MAC VALVES, INC.

DOCUMENT NUMBER
UI-180

TITLE: Control Manual for MAC ProfiNet MI/O-67 Manifold

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B	11/8/18	Communications Fault Handling Added	30726		TRJ
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D	1/24/20	Configurable Analog Module Info Added	31656		TRJ
E	4/1/20	CE Info, 4 Pin Power, and IP Config Info Added	31794		TRJ

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Control Manual
For
MAC Valves ProfiNet
MI/O-67 Serial Manifold

10/2/2018

1. System Overview

ProfiNet is an open protocol, which is the Siemens version of the EtherNet family of control protocols. It is supported by the Profibus Trade Organization.

The protocol itself consists of one or more master devices and multiple slave devices. Because it is an open network, the system will consist of products from a wide variety of vendors. It is important to note that even though ProfiNet is an Ethernet family member, it is different than the commonly known Ethernet.

The master (a PC or PLC with its network scanner) and slave devices are connected via a standard D-coded M12 connector on a ProfiNet cable. The valve and electronics 24VDC will have to be supplied to the MI/O-67 manifold via an additional cable.

A. MAC Valves MI/O-67 Serial Manifold

The MAC MI/O-67 Serial Manifold is a slave device within the ProfiNet network. Thus, it will respond to all of the commands associated with the network like any other node of its type.

Each manifold occupies a single node on the network. The output portion consumes 210 bytes, the input portion produces 210 bytes, and the configuration occupies 190 bytes. The system is highly configurable and can have a large variety of Digital Input/Output, Analog Input/Output (voltage or current), and Power Plus modules. You can have up to twelve modules on the stack in any combination. It all starts with the Communications Module and a valve stack.

A typical valve manifold is shown in **Figure 1**. Note the functional module shown is for reference only. More about these modules later in this document.

The main communications module is call the Comms Module. Its functions are to provide front-end interfacing to the ProfiNet line, operate 32 valve drivers for the stack valves, route power for the stack valves and electronics, and control the CAN bus backplane which interfaces the functional modules.

The stack will come fully assembled. However, if a need arises to add or subtract modules**, turn off all power and air prior to changing the module configuration.**

The valve stack can operate up to 32 solenoids in any combination of double and single solenoid valves. It is set up for 24VDC valves.

Figure 1 Typical Valve Stack

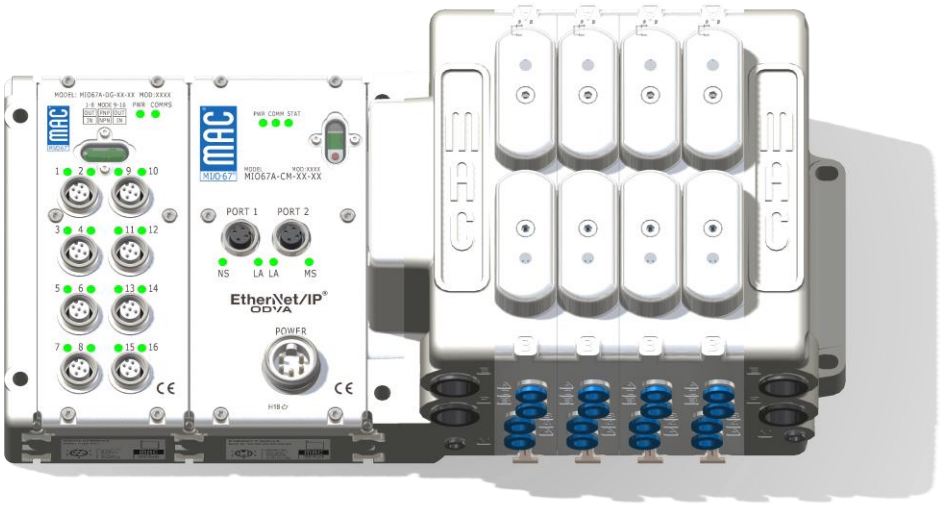


Figure 2 ProfiNet Comms Module, 5 Pin Power Connector

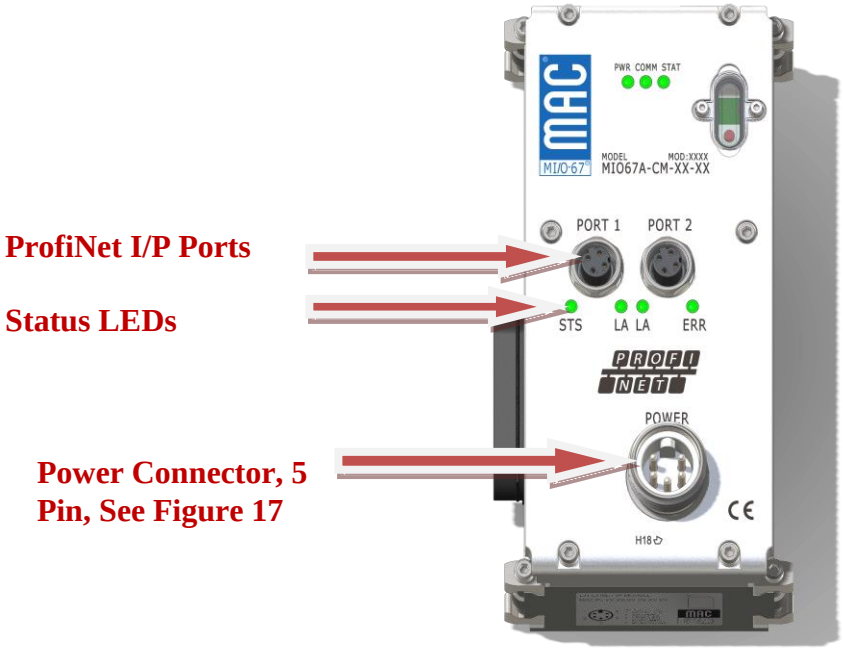
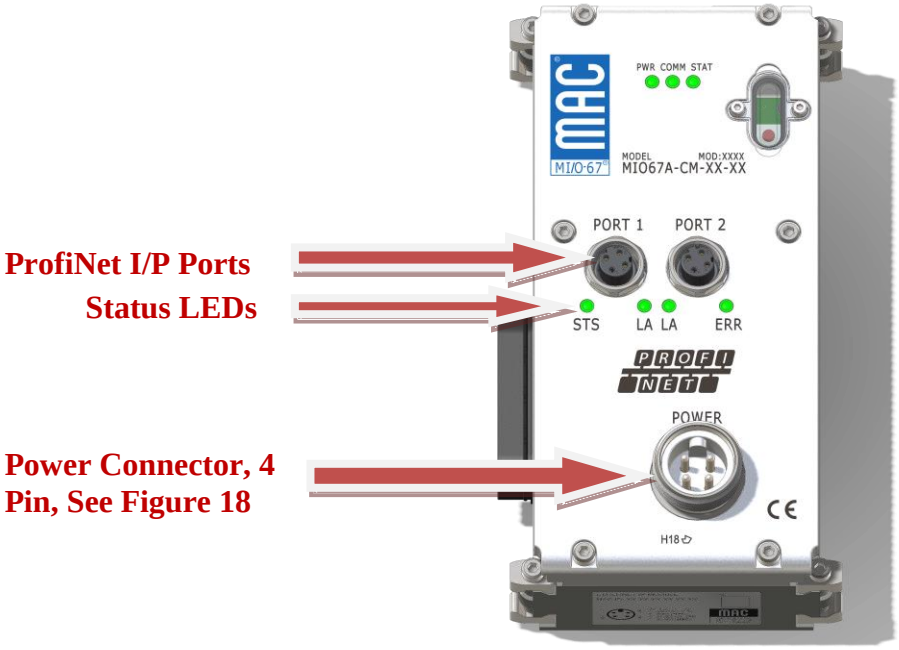


Figure 3 ProfiNet Comms Module, 4 Pin Power Connector



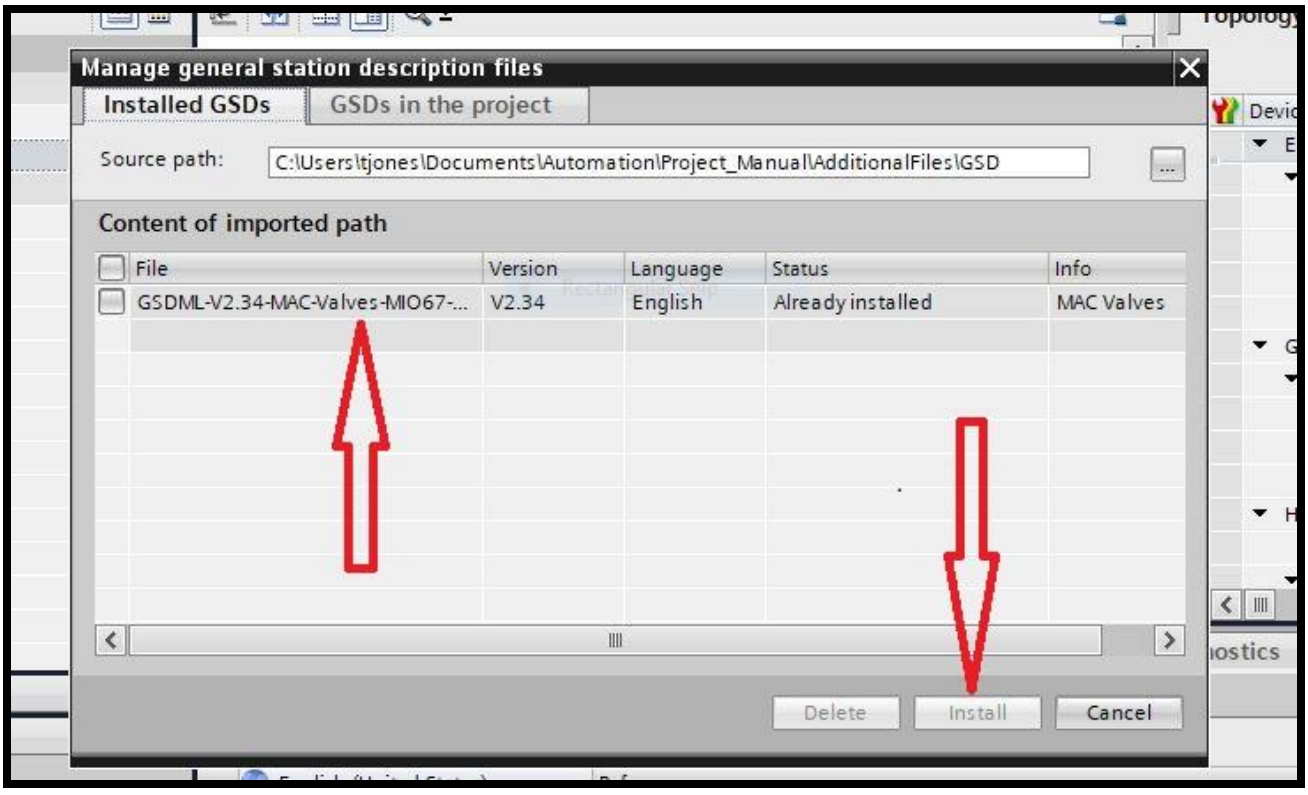
B. GSD File

The basic start up properties are enabled in a GSD (General Station Description) supplied by MAC. It must be loaded into the master controller prior to continuing. Consult the controller manual for directions to that end. However, here are the basics using Siemens TIA V15 software and an ET200 controller:

First, load the file "GSDML-V2.34-MAC-Valves-MIO67-20180731" into the computer that has the software for the controller. It is important to use the latest GSD file. If there is a mismatch, the controller will not connect correctly.

Next, inside the PLC software, select "Options" located along the top menu. A menu will come down. Select "Manage General Station Description Files (GSD). As shown in **Figure 4**. From that menu, select the file and hit the "Install" button on the bottom. The software will respond back when it is completed.

Figure 4 Loading GSD Files



C. Network Creation

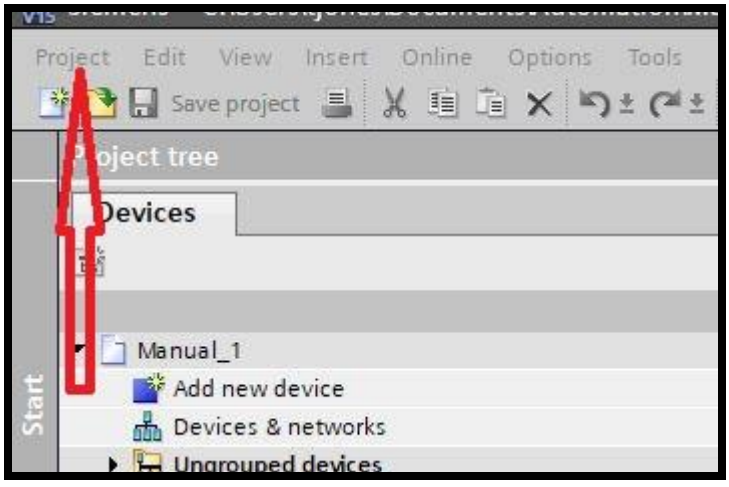
Once the GSD file is loaded into the controller, it will become part of the catalog and thus can be used again for additional nodes on the network.

The description here begins with a new network. If the network is already created, then the MIO-67 can be added as needed.

To begin the process, start a new project and added the various devices which will reside on the network. Here, a new network will be created which has the controller, three cards on the controller, an HMI, and the MIO-67.

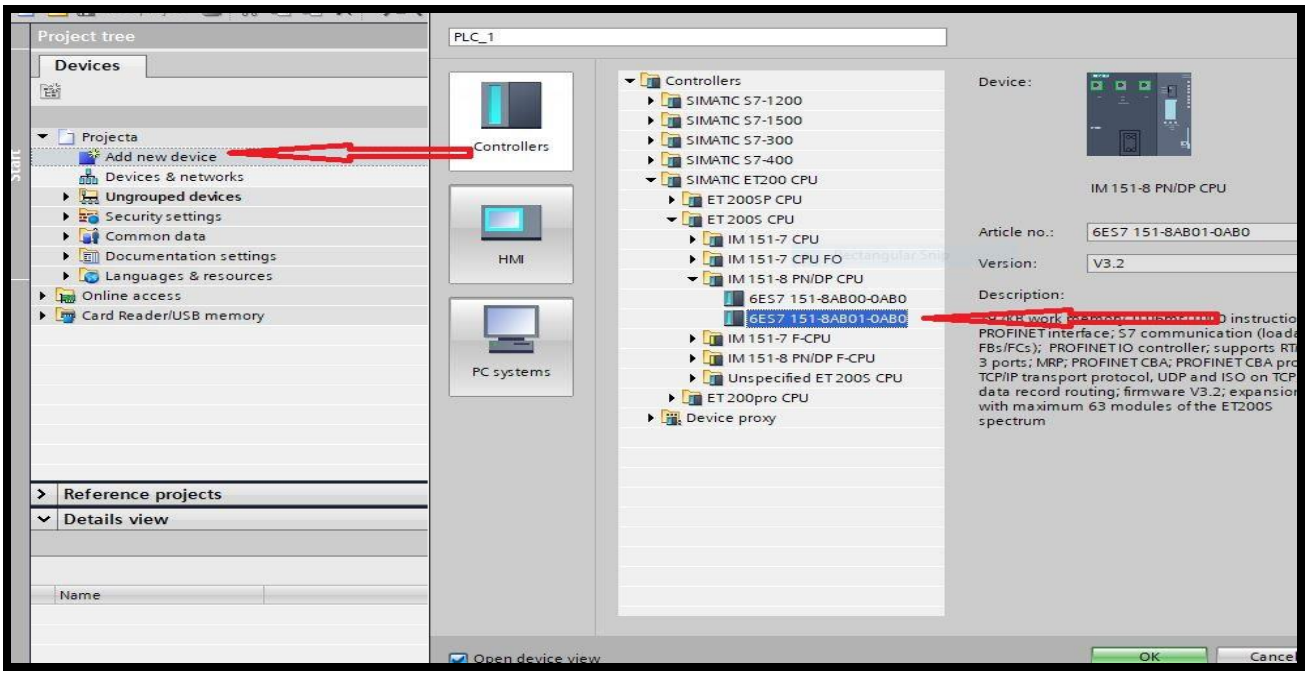
To start with, select "New Project" and create a name.

Figure 5 Project Starting Point



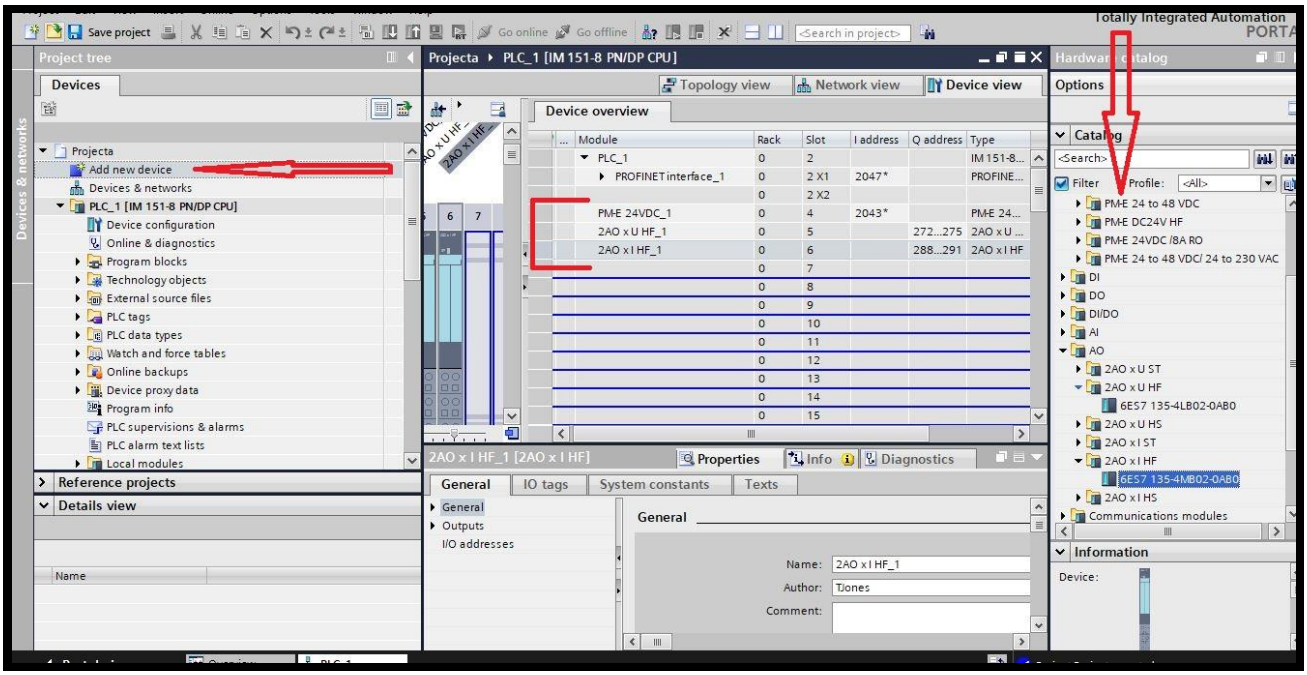
The next item is to add the controller. From the "Add new device" command on the left hand tree, select "Controllers" and the type which will be operated. This example is using an ET200 CPU p/n ^ES7 151-8AB01-0AB0. See **Figure 6** below.

Figure 6 Loading CPU



Next, add the other cards on the controller stack as required. Here, a power supply and two types of Analog Output cards will be added.

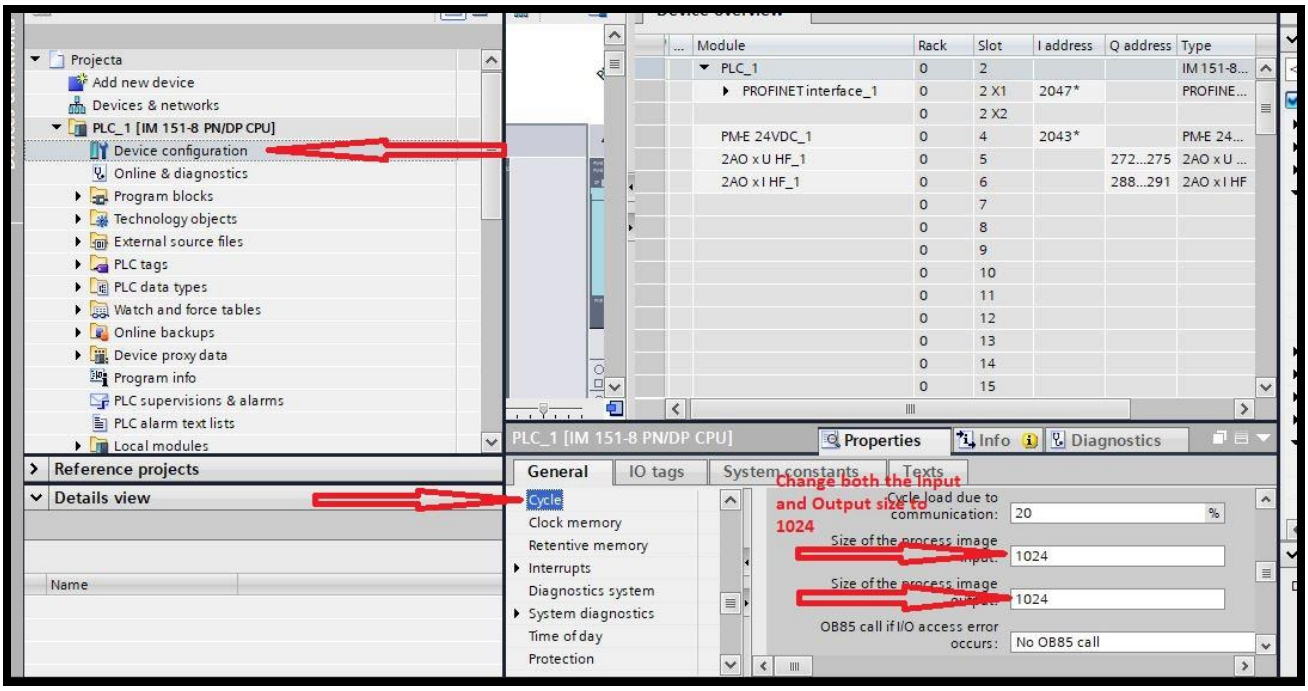
Figure 7 Adding Controller Stack Cards



The power supply is a PM24V power supply p/n 6ES7 138 4CA01-0AA0, a 2AO x U HF card p/n 6ES7 135 4LB02-0AB0, and a 2AO x I HF card p/n 6ES7 135 4MB02-0AB0.

In setting up the controller, it is important to set the size for the Input and Output memory. To do this, go to the controller tree in the left hand menu. Select “Device Configuration” and go to the “Cycle” area. Inside there, both Input and Output sizes will appear. The default is 128. Change both of these to 1024.

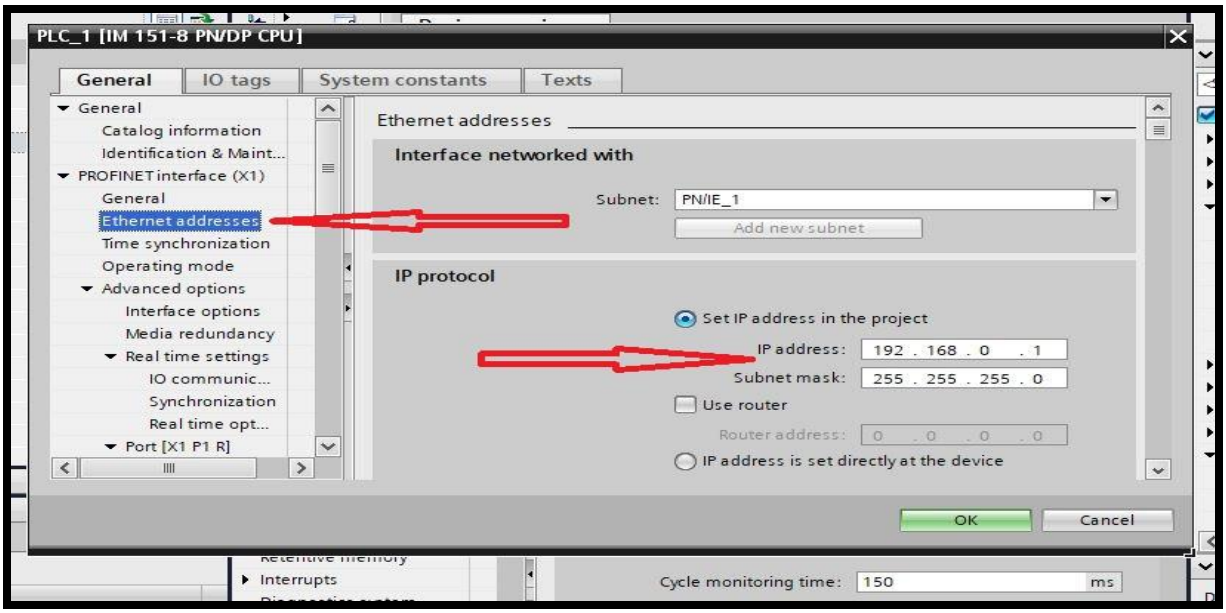
Figure 8 Updating Input/Output Memory Sizes



Next, the IP address must be added to the controller. In our example, we are using IP Address 192-168-0-1 and subnet mask 255-255-255-0. For sake of connectivity, the computer which has the controller software must also be on the same subnet and have a unique IP Address (not 192-168-0-1 in our example). There are a few other reserved addresses so we are using 192-168-0-75 for the computer. There is nothing special about the IP Addresses selected and can be set up using a large variety of addresses so long as they are on the same subnet, the masking is the same, and the addresses are not reserved by the computer or the protocol.

See below for setting the PLC IP address in **Figure 9**.

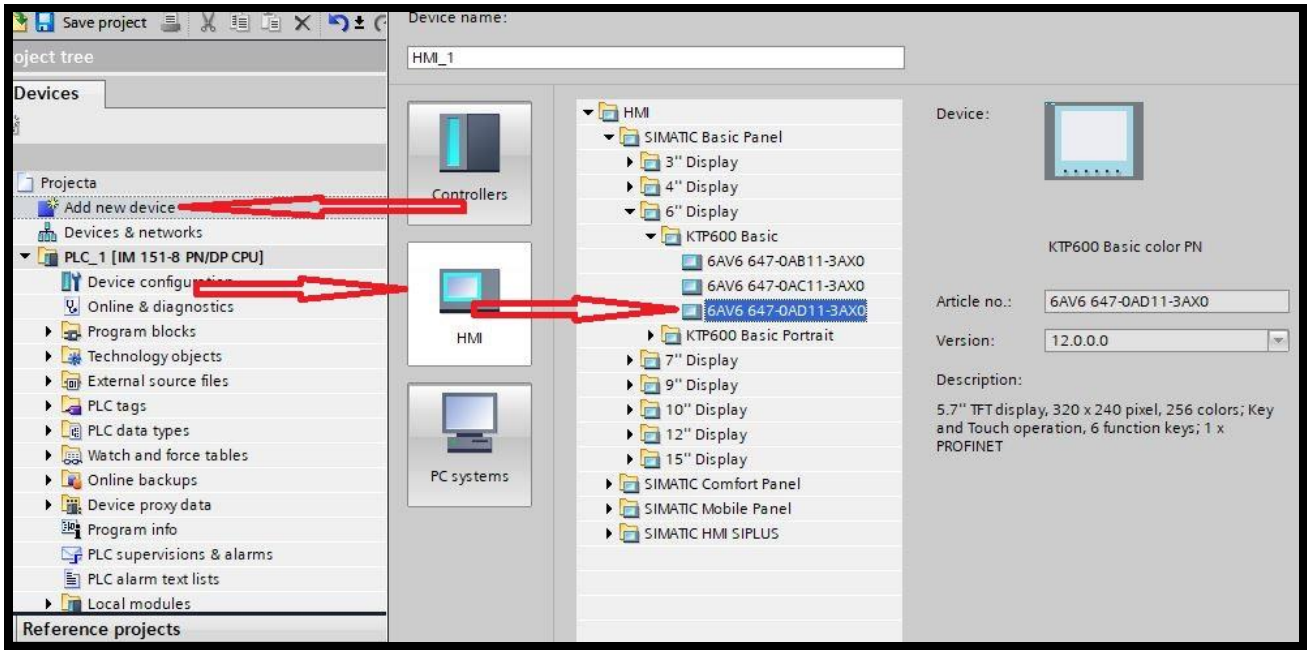
Figure 9 Setting IP Address



Next, add a HMI, configure it, and set its IP Address. The display is a 6” module. The IP Address will be 192.168.0.2.

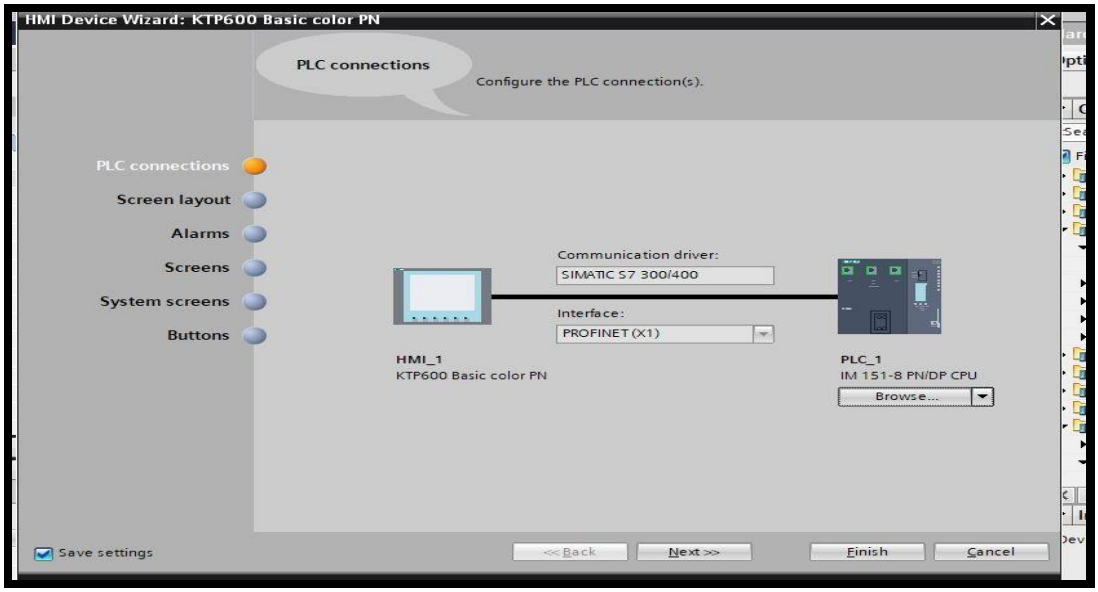
The process is the same as adding the PLC above.

Figure 10 Adding HMI



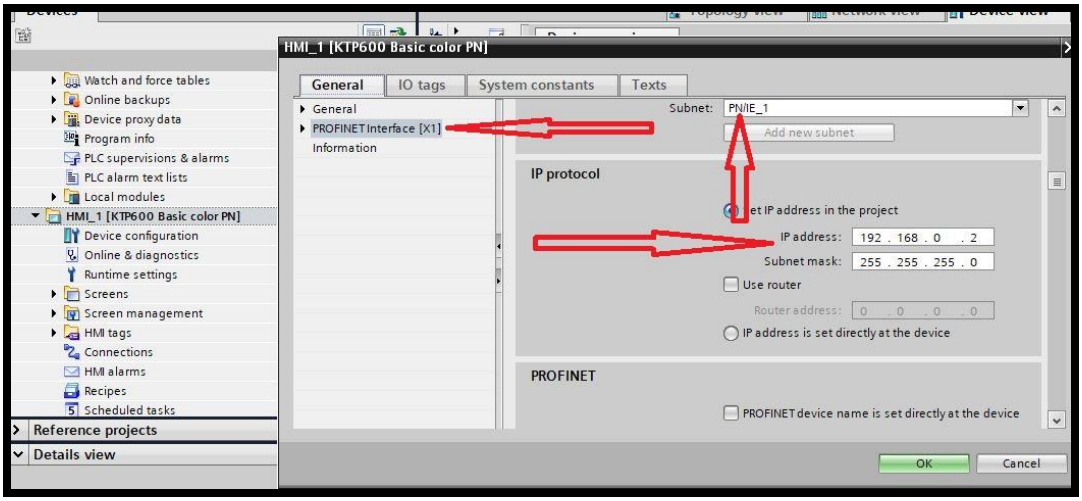
After selecting the type of HMI, another menu will pop up with the configuration information on it.

Figure 11 Configuring the HMI



Finally, add the IP Address for the network.

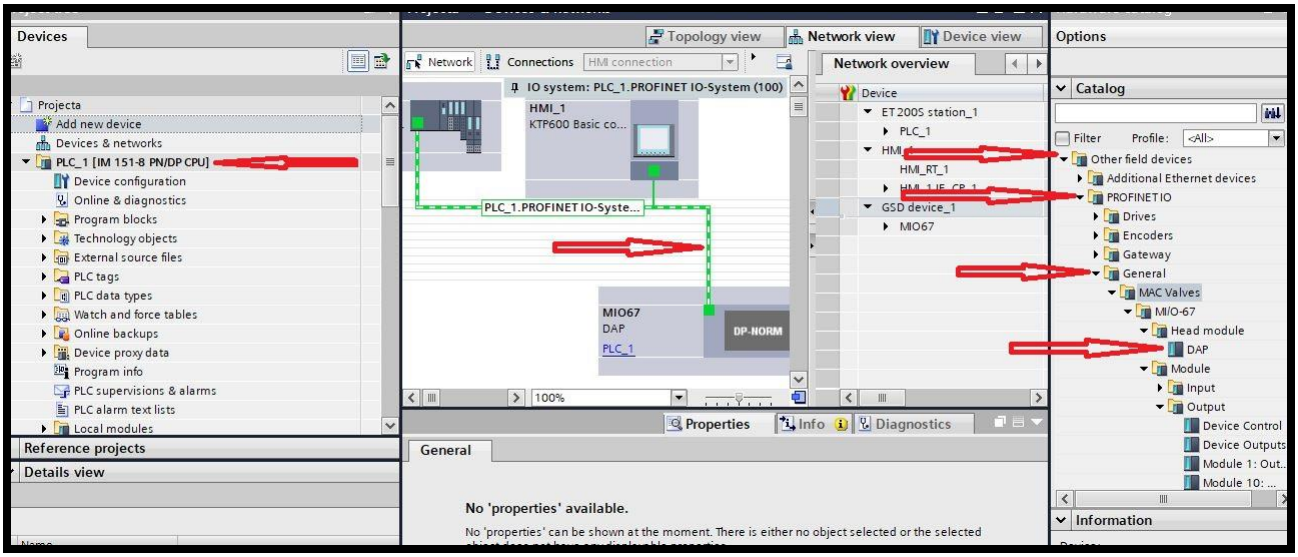
Figure 12 HMI IP Address



The next step is to add the MIO-67. This time, select the PLC in the command tree on the left. From there, the catalog will appear. Go down to “Other Field Devices”, “ProfiNet IO”, “General”, “MAC Valves”, “MIO-67” and double click on DAP.

The icon will appear on the network. From there, click on the port area on the DP-Norm part of the icon. Drag the line to the controller network. Insure the unit says the controller name on it (PLC_1).

Figure 13 Adding MIO-67



Next, select the MIO67 and go to Device View as shown in **Figure 13**.

Figure 14 Adding MIO Modules, Device View

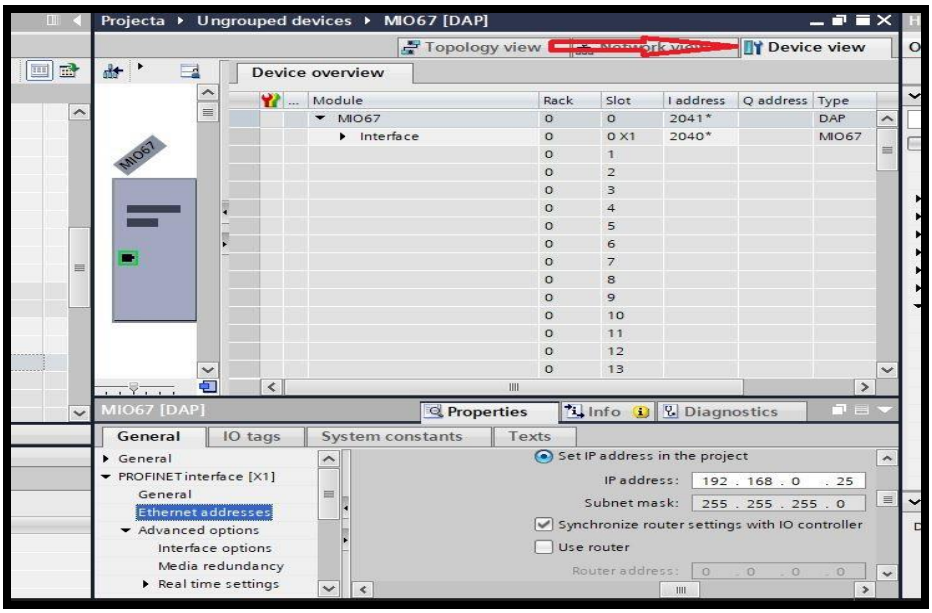
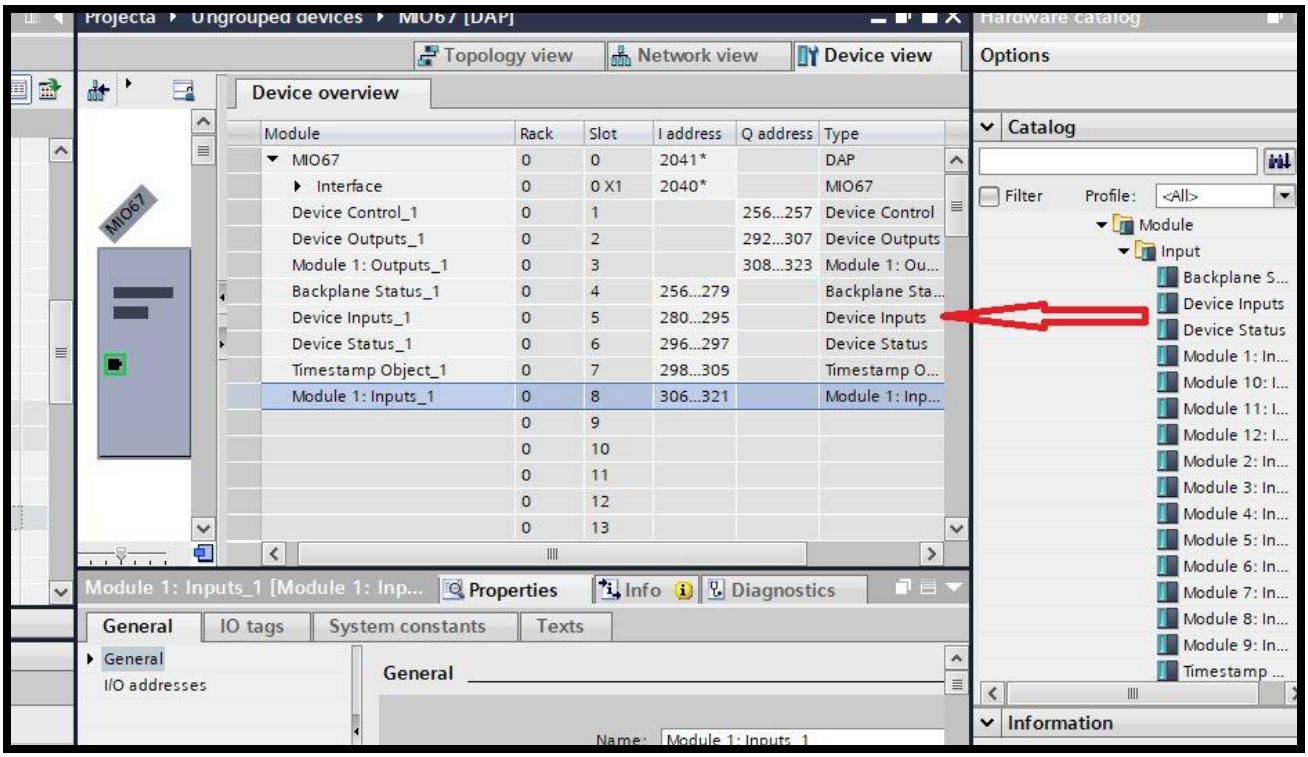


Figure 15 Dragging Modules into Device



When building a MIO stack, at minimum each module input and output device has to be dragged into the device as shown in **Figure 15** above. The default addresses are then loaded into the device. These can be changed as needed. In the controller, "I" addresses are for inputs, "Q" addresses are for outputs. Also note in **Figure 15**

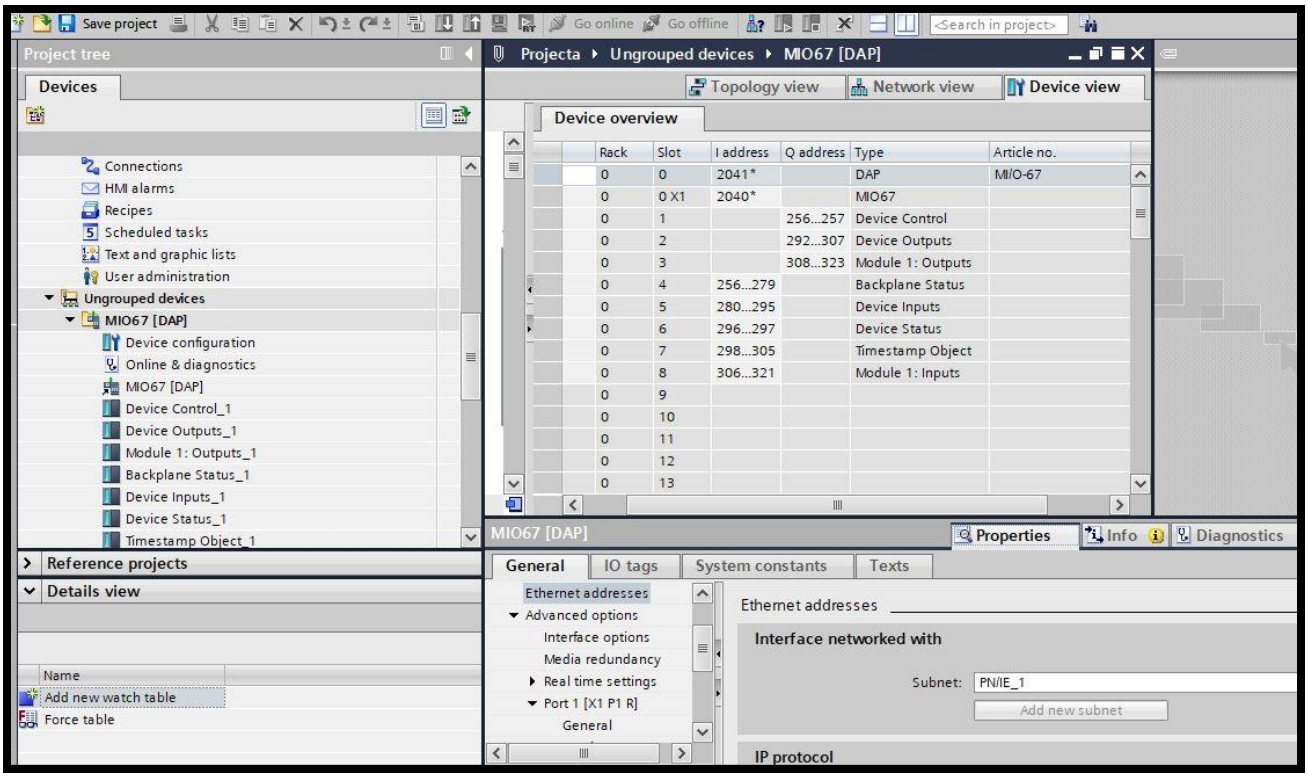
, the valves on the stack can be operated by using (Module Name) Device_Outputs_1 starting at address QW292.

A side note about addressing. All of the addresses are set up in Word format. The range is given in byte format.

Table 1 Module Default Addresses

Module Number	I Starting	I Ending	Q Starting	Q Ending
Module _1 Input	272	287		
Module_1 Output			512	527
Module _2 Input	288	303		
Module_2 Output			528	543
Module _3 Input	304	319		
Module_3 Output			544	559
Module _4 Input	320	335		
Module_4 Output			560	575
Module _5 Input	336	351		
Module_5 Output			576	591
Module _6 Input	352	367		
Module_6 Output			592	607
Module _7 Input	368	383		
Module_7 Output			608	623
Module _8 Input	384	399		
Module_8 Output			624	639
Module _9 Input	400	415		
Module_9 Output			640	655
Module _10 Input	416	431		
Module_10 Output			656	671
Module _11 Input	432	446		
Module_11 Output			672	678
Module _12 Input	447	462		
Module_12 Output			688	703

Figure 16 Typical I/O Address Mapping



2. System Structure

A. Applicable MAC Valves Series for the MI/O-67

Following are the valves, which can be used with the MI/O-67 Valve Manifold:

92 Series	36 Series
42 Series	46 Series

For other valve types, please consult the factory

The maximum wattage per channel is 12.0W, which corresponds to 500mA at 24VDC. The Comms Module uses 400mA from the valve current so the maximum total load is 7.6A. Please refer to the individual valve series and power calculator for further explanation of maximum wattage and current limits.

An example of a valve stack is shown in **Figure 1**. The stack consists of one Digital I/O Module and one Comms Module, and 1 single solenoid valves for reference.

3. Power Wiring and Connectors

A. Connectors - Power

The power connector located on the top of the MI/O-67 is shown in **Figure 1,2, and e 3**. The power assignment for the 5 pin option is illustrated in **Figure 17**. The pin-out for the 4 pin option is shown in **Figure 18**.

If it is desired to add or subtract modules from the stack, it is very important to remove all the power prior to connecting or discounting the modules. Failure to do this could result in module damage.

The power connector has two separate power channels on it. The first is the +24VDC required for the valves. The largest current a single valve can consume is 500mA. If all 32 channels need to be operated simultaneously, each valve is limited to 225mA (8A total – 0.4A Comms Module Consumption = 7.6A….7.6A/32 Valve Channels = 0.238A/Channel….rounding down to 5.4W @24VDC =0.225A). Also, it is possible to run the electronics independent of the valves. If it is desirable to keep the electronics "awake," while the valve power is off, then two separate power supplies will be necessary. By disconnecting the valve power supply and keeping the electronics supply active, the node will stay online but the valves will not operate. Please note that it is also important to make a connection to the Earth (PE).

As far as the Electronics and I/O power is concerned; it depends on the number of modules and the load on each module. For starters, each module except the Comms Module will draw about 100mA without a load (sensor, analog load, etc.). The Comms Module (electronics side) draws 140mA. The maximum capacity for this line is also 8.0A. Refer to the Power Handling Section (9) for the load calculations.

Figure 17 Power Connector, 5 Pin, Pin-Out

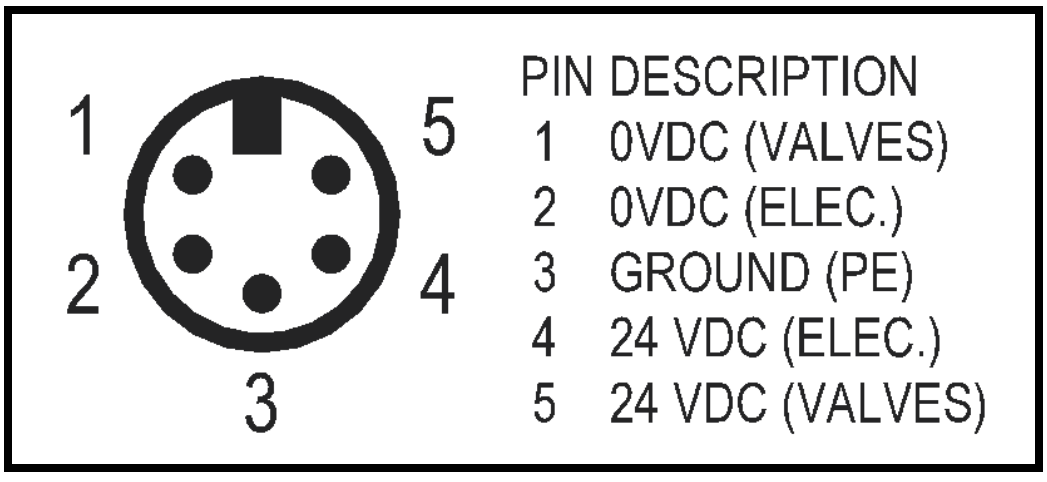
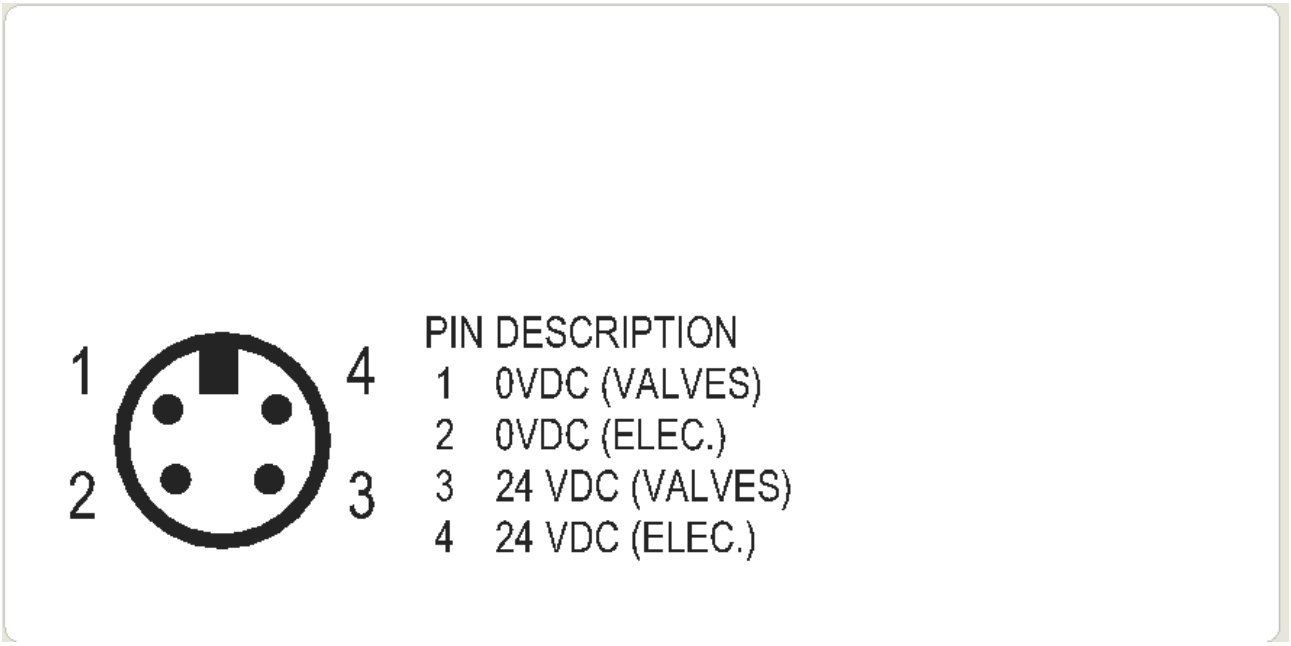


Figure 18 Power Connector, 4 Pin, Pin-Out



4. Analog Module Wiring and Connectors, Configurable Type

A. Connectors

The four connectors for these modules on the top of the MI/O-67 are shown in **Figure 19**. The pin outs can be found in **Figure 20**.

The pin out for each connector is dependent on whether it is configured as an Output or Input.

Each module has four channels on four different connectors. The modules themselves are either 0-10V I/O or 4-20mA I/O.

Figure 19 Analog I/O Module, Configurable Type

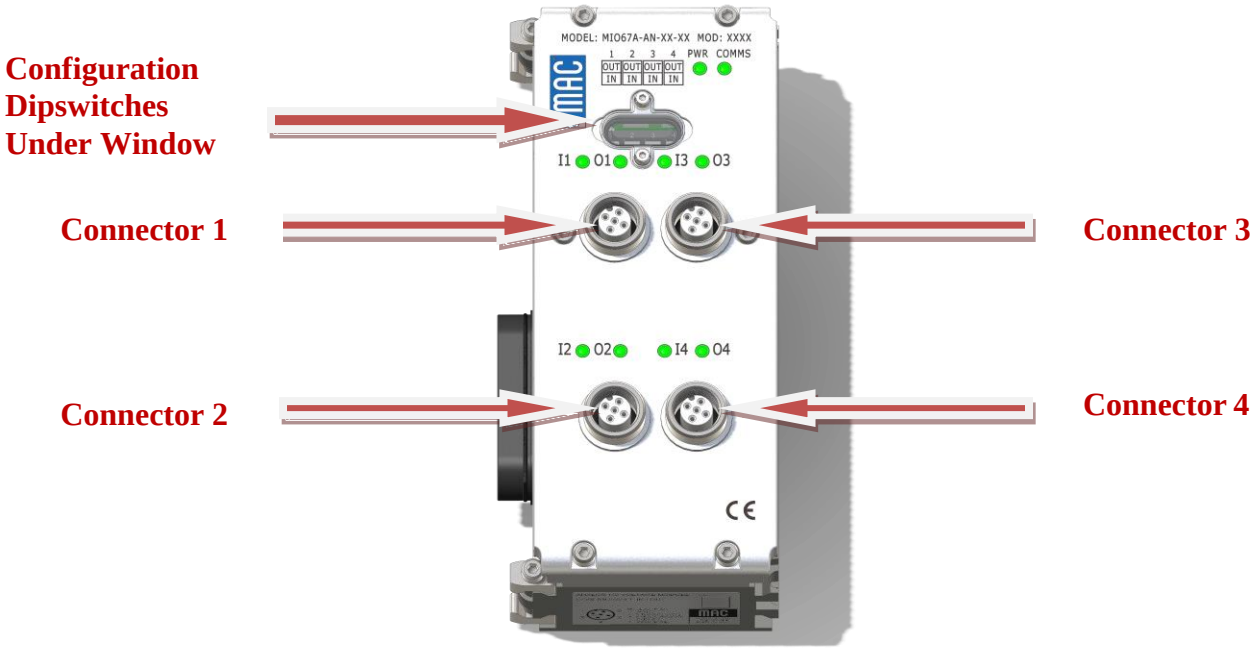
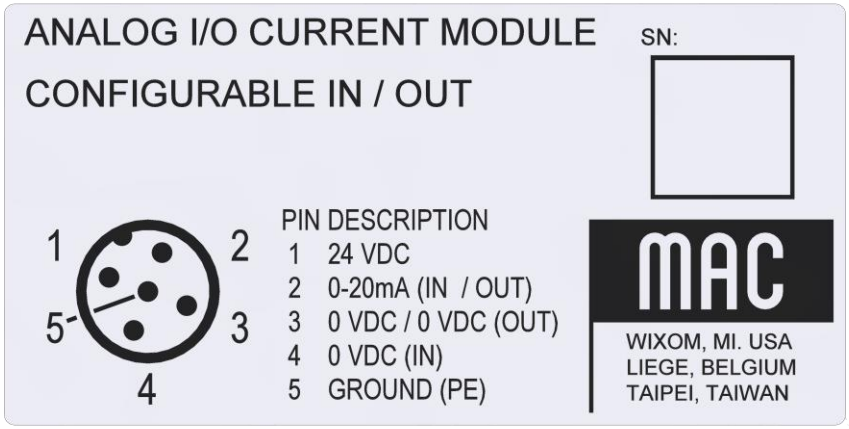
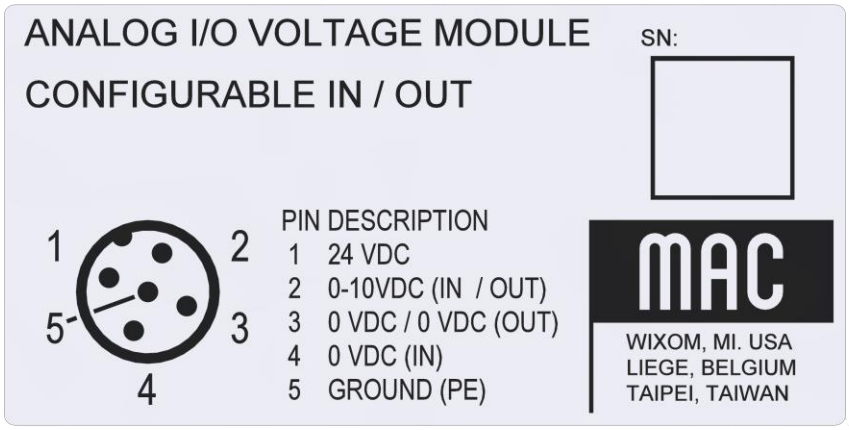


Figure 20 Analog Module (Configurable) Pin-Out





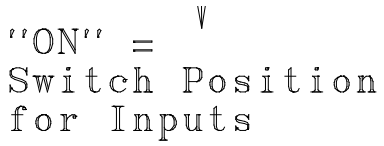
As shown in **Figure 20**, depending on how the connectors are configured sets the pin-out for that connector. For example, if you have a 0-10V module and you configure a connector to act as an output, then Pin 2 is the Positive output and Pin 3 is the Negative Output along with the common for the 24VDC. If you have a 4-20mA module and you configure a connector to act as an Input, then Pin 2 is the Positive input and Pin 4 is the Negative Input.

B. Module Configuration

Each connector on the module can be configured as an Analog Output or an Analog Input. The type depends on whether you have an Analog Current Module, an Analog Voltage Module.

The configuration is done by way of the four dipswitches under the window on the module near the top as shown in **Figure 21**.

Figure 21 Dipswitch Configuration



The controller will handle this in the same way as the non-configurable module. See section 5, Analog Non-Configurable subsection D Memory Mapping.

C. Indicator LEDs

Each connector has two LEDs near them. The LEDs are solid green when the everything is running normally. They will change to red when there is either an overvoltage (for the current module) or overcurrent (for the voltage module) fault.

5. Analog Module Wiring and Connectors, Non-Configurable Type

A. Connectors

The four connectors for these modules on the top of the MI/O-67 are shown in **Figure 22**. The pin outs can be found in **Figure 23**.

Each module has four channels on four different connectors. The modules themselves are either 0-10V I/O or 4-20mA I/O.

Figure 22 Analog I/O Module, Non-Configurable Type

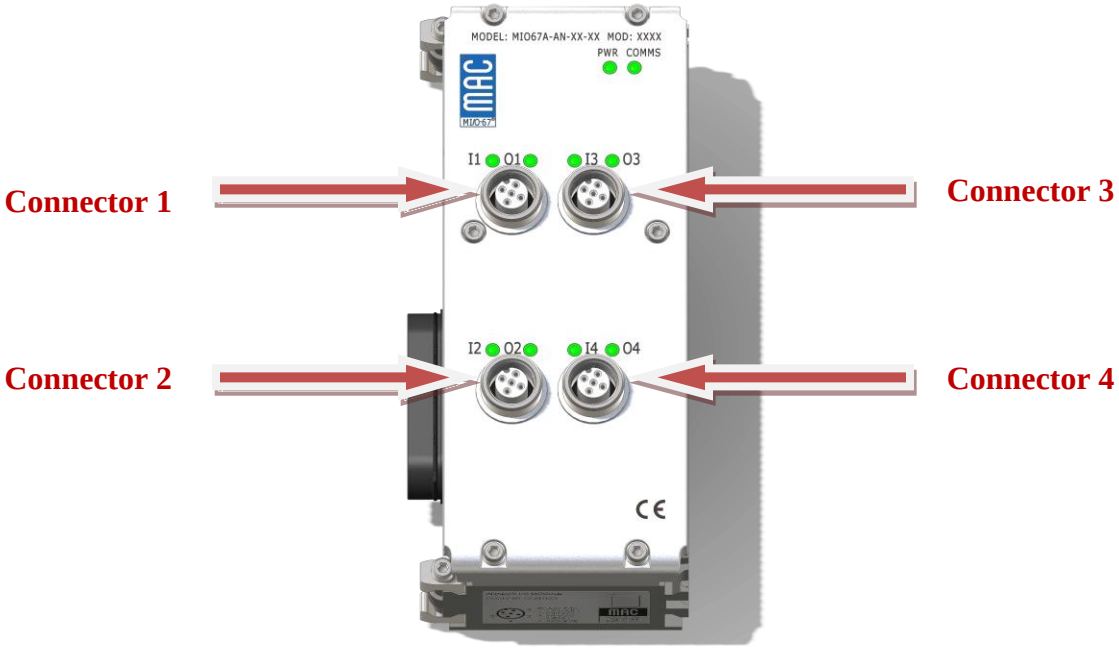
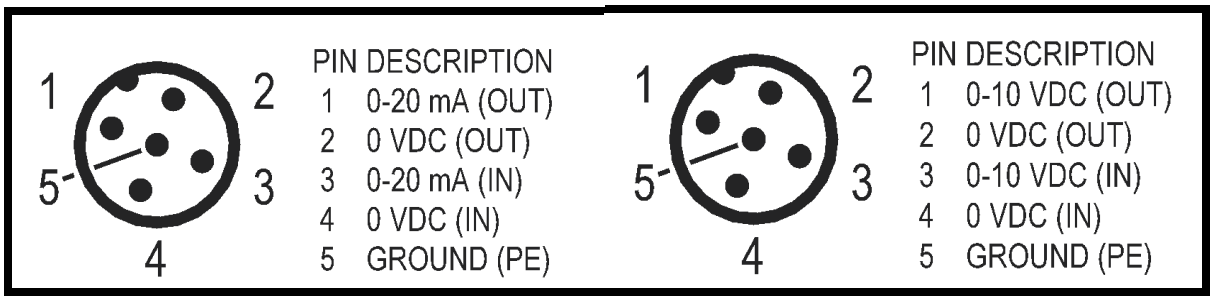


Figure 23 Analog I/O Pin-Out



B. Module Configuration

The controller will map the inputs and outputs in order of where the module is on the stack.

\

C. Indicator LEDs

Each connector has two LEDs near them. The LEDs are solid green when the everything is running normally. They will change to red when there is either an overvoltage (for the current module) or overcurrent (for the voltage module) fault.

D. Memory Mapping

The table below gives an example for the mapping for the connectors using input address starting with IW306 and output address starting with QW308 for example. The modules have 12 bit resolution.

Table 2 Analog I/O Module Memory Mapping

Connector		Input (IWxxx)	Output (QWxxx)
1			
	Input 1	306	
	Output 1		308
2			
	Input 2	308	
	Output 2		310
3			
	Input 3	310	
	Output 3		312
4			
	Input 4	312	
	Output 4		314

E. Scaling

The table below gives approximate values for the given signals for either the 0-10V or 0-20mA inputs or outputs. These will vary slightly in the lower bits from module to module.

Table 3 Analog Scaling

Analog Value	Digital Equiv. (hex)
0V	16#0000
2.5V	16#0400
5.0V	16#0800
7.5V	16#0c00
10.0V	16#0fff
0mA	16#0000
4mA	16#02ae
8mA	16#055d
12mA	16#0800
16mA	16#0ab7
20mA	16#0d5d

6. Digital I/O Module Connectors and Configuration

A. Connectors

The eight connectors for these modules on the top of the MI/O-67 are shown in **Figure 24**. The pin outs can be found in **Figure 25**.

Each module has sixteen channels on the eight different connectors. The module can be configured for sixteen inputs, sixteen outputs, or eight inputs and eight outputs.

Also shown in **Figure 24** is the window for access to the mode selector dipswitches. More about that later.

Figure 24 Digital I/O Module

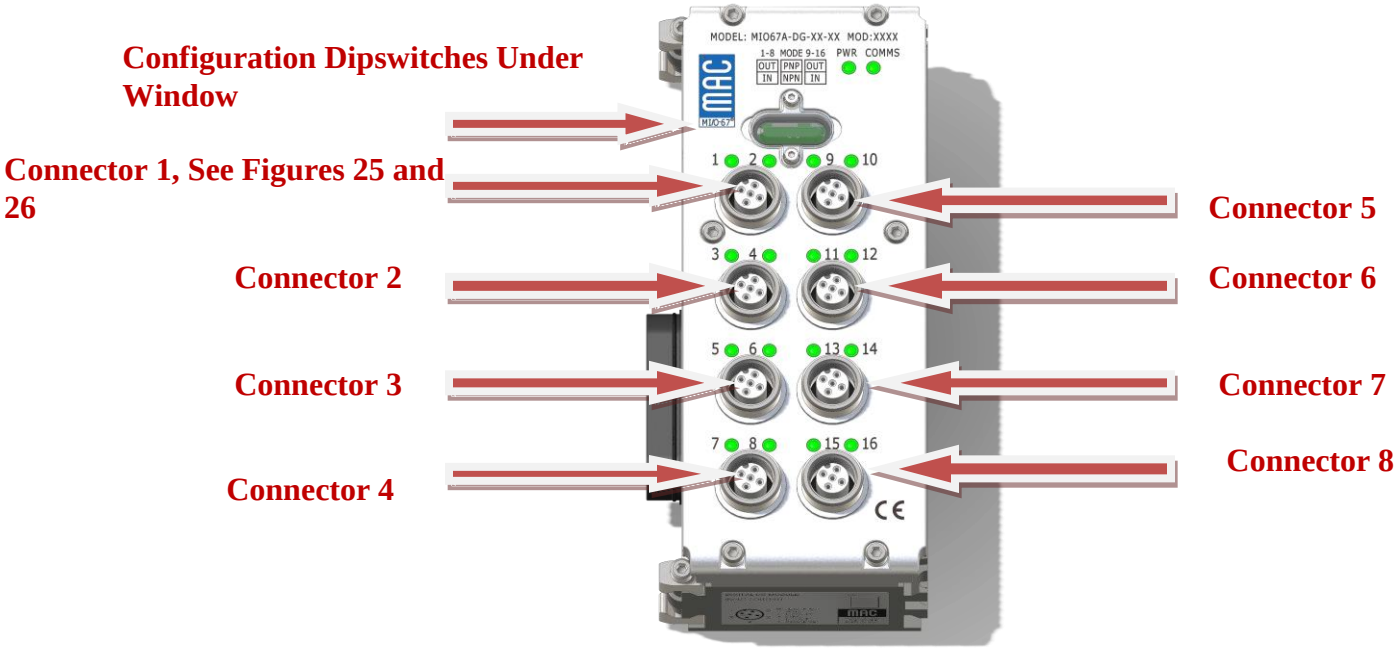


Figure 25 I/O Connectors Pin-Out

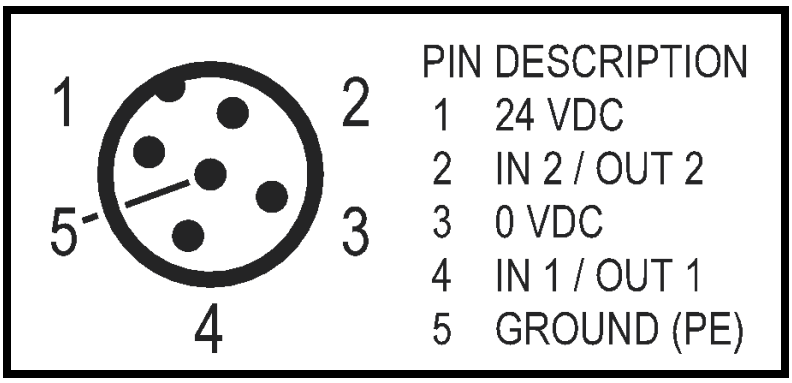
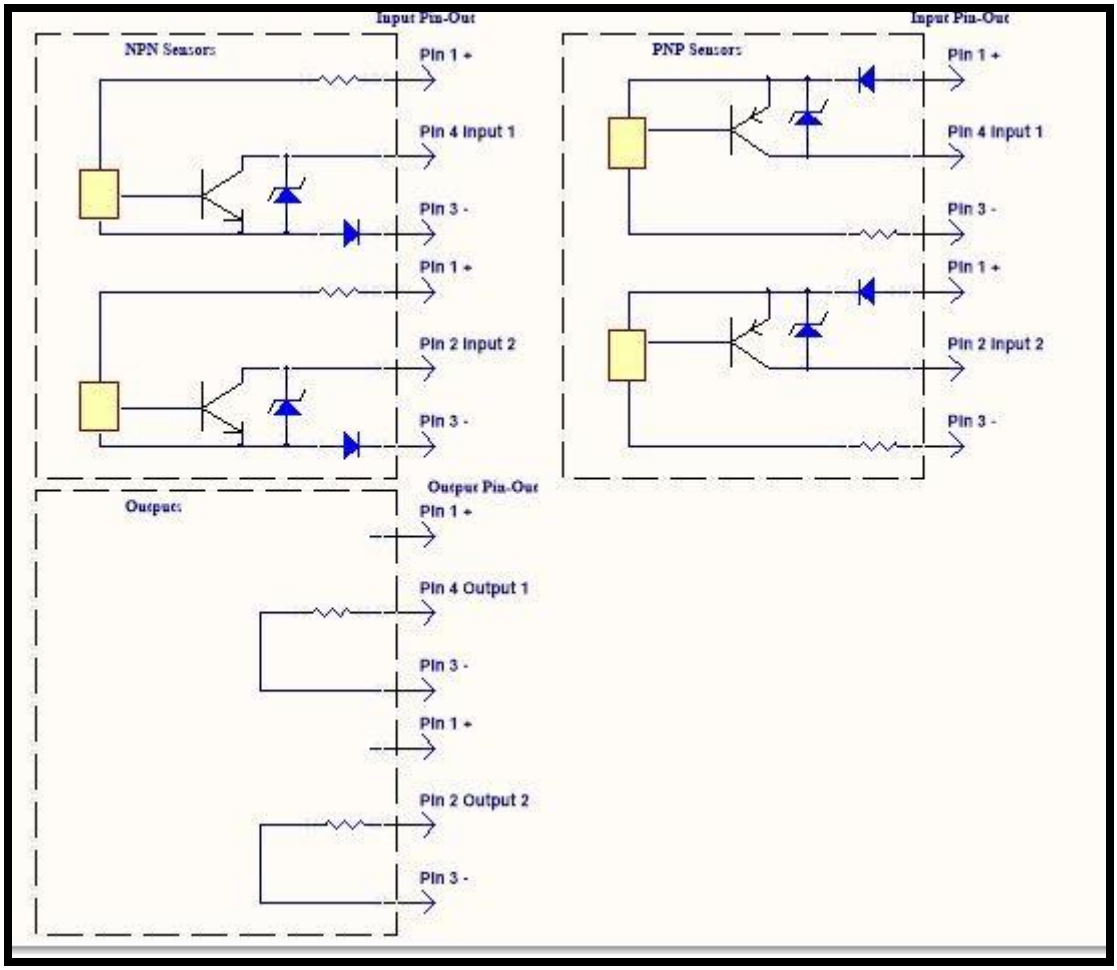


Figure 26 Sensor/Load Wiring



B. Dipswitch Configuration

The module is broken down into two banks of 8 points. The left 4 connectors are considered Bank A and the right 4 connectors are considered Bank B. The dipswitches shown in **Figure 24** will set the bank function of being either input or output connectors for these modules. The pin outs can be found in **Figure 25**. The wiring for each is shown in **Figure 26**.

As stated above, each module has sixteen channels on the eight different connectors. The module can be configured for sixteen inputs, sixteen outputs, or eight inputs and eight outputs. For the inputs, along with setting the banks, you can also set whether they are for npn or pnp sensors. The table below shows the dipswitch settings.

Left to Right as shown in **Table 4**, where 0 = off position (dipswitch position away from top edge of board) and 1 = on position (dipswitch position is closer to top edge of board) for the switches:

Table 4 Digital I/O Dipswitch Functions

Dipswitch			Bank A	Bank B
A	B	C		
0	0	0	Input/NPN	Input/NPN
0	0	1	Input/NPN	Output
0	1	0	Input/PNP	Input/PNP
0	1	1	Input/PNP	Output
1	0	0	Output	Input/NPN
1	0	1	Output	Output
1	1	0	Output	Input/PNP
1	1	1	Output	Output

C. Indicator LEDs

Each connector has two LEDs near them. The LEDs are solid green when the change is active (driving an output load or sensing an input).

D. Memory Mapping

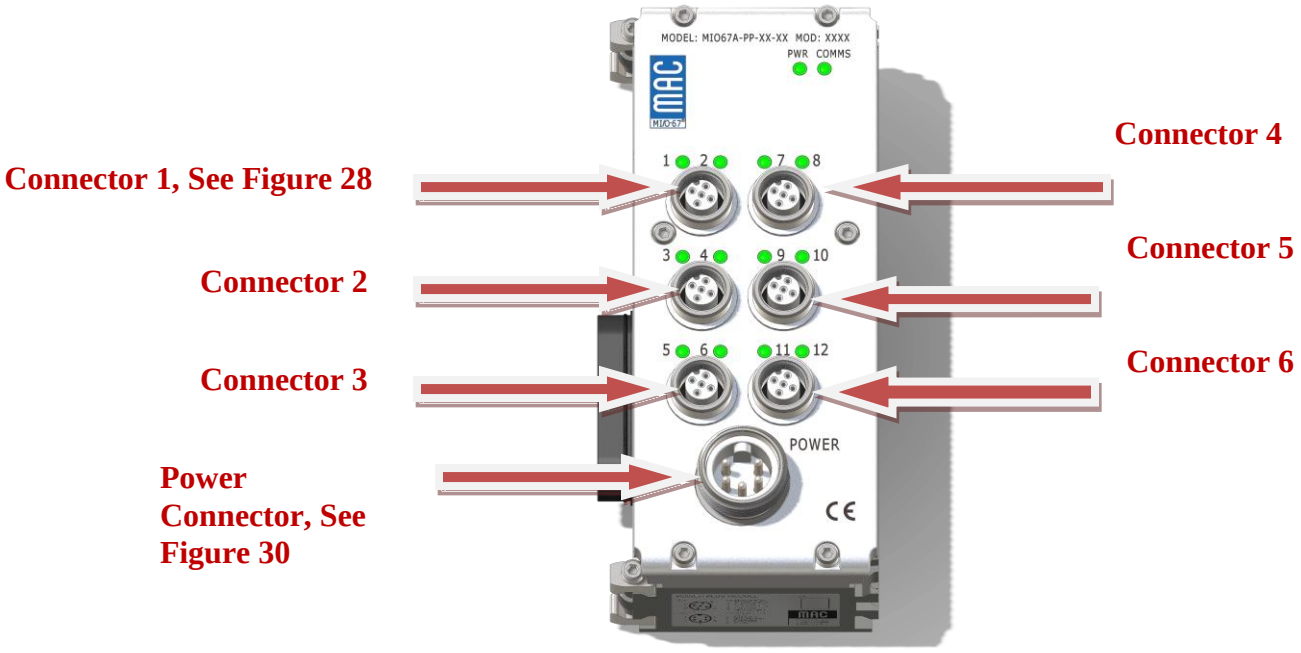
Below are the memory locations for the module using IW306 and QW308 as addresses. In Table 5 below, for example, 306.0 (Input) would be the first bit in Input Word 306. The addresses can be set to other locations. These are for example only. The toggles associated with either the inputs or outputs are BOOL.

Table 5 Digital I/O Memory Mapping

Connector	Input Location	Output Location
1	Input 1	306.0
	Input 2	306.1
	Output 1	308.0
	Output 2	308.1
2 `	Input 3	306.2
	Input 4	306.3
	Output 3	308.2
	Output 4	308.3
3	Input 5	306.4
	Input 6	306.5
	Output 5	308.4
	Output 6	308.5
4	Input 7	306.6
	Input 8	306.7
	Output 7	308.6
	Output 8	308.7
5	Input 9	306.8
	Input 10	306.9
	Output 9	308.8
	Output 10	308.9
6	Input 11	306.10
	Input 12	306.11
	Output 11	308.10
	Output 12	308.11
7	Input 13	306.12
	Input 14	306.13
	Output 13	308.12
	Output 14	308.13
8	Input 15	306.14
	Input 16	306.15
	Output 15	308.14
	Output 16	308.15

7. Power Plus Module

Figure 27 Power Plus Module



A. Connectors

This module will have six connectors (twelve outputs total, two outputs per connectors) for external valve operation plus an external power connection.

B. Wiring

Shown below in **Figure 29** are the load connections to drive a valve or other 12W or less loads on the Power Plus Module. Note; each connector has two outputs. The wiring for these connectors is show in **Figure 28**.

The power to operate the electronics of the module comes from the Comms Module Electronics power. The load power comes from the mini connector on the module and is wired according to **Figure 30**. The outputs cannot be operated without power from the mini connector. If this power is absent, the channel leds will be solid red and an error message will be sent to the PLC.

Figure 28 Pin-Outs, Power Plus Module

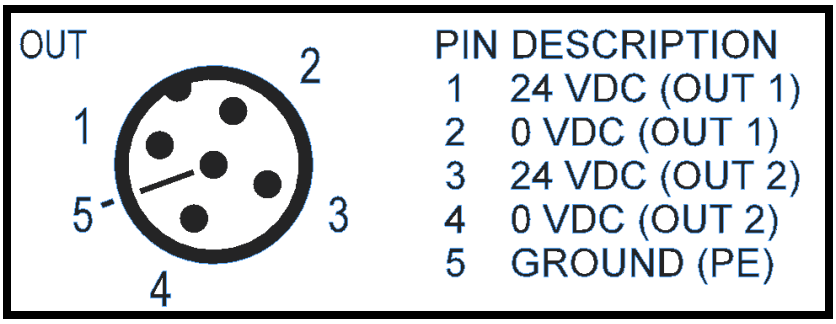


Figure 29 M12 Load Connections

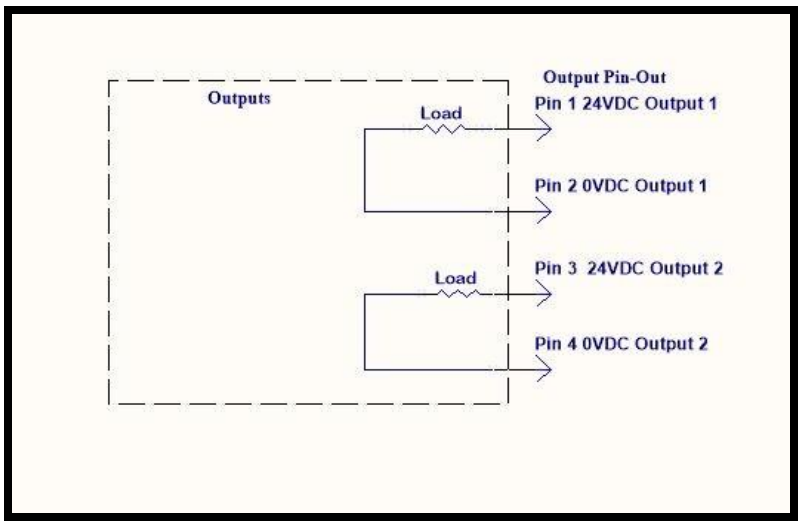
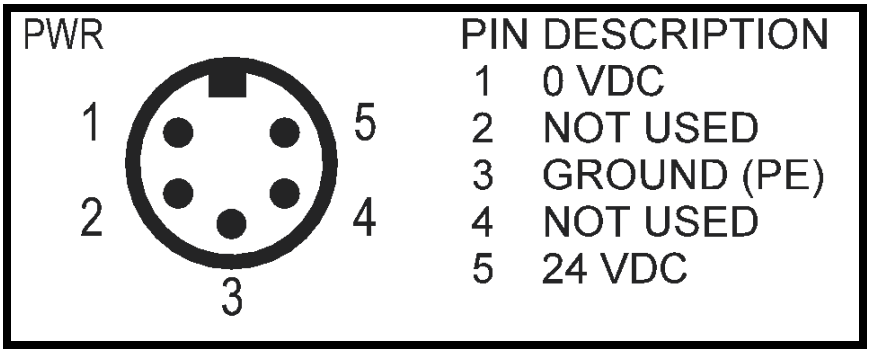


Figure 30 Mini Power Connector



C. Indicator LEDs

Each connector has two LEDs near them. The LEDs are solid green when the change is active (driving an output load). If there is no output power to the module, the LEDs will be solid red.

D. Memory Mapping

The memory mapping for the module is given in the table below. It uses address QW308 (bits 0-11) for example. The signals themselves are BOOL.

Table 6 Power Plus Memory Mapping

Connector	Output
1	
Output 1	308.0
Output 2	308.1
2	
Output 3	308.2
Output 4	308.3
3	
Output 5	308.4
Output 6	308.5
4	
Output 7	308.6
Output 8	308.7
5	
Output 9	308.8
Output 10	308.9
6	
Output 11	308.10
Output 12	308.11

8. Network Connection

A. Connectors – ProfiNet

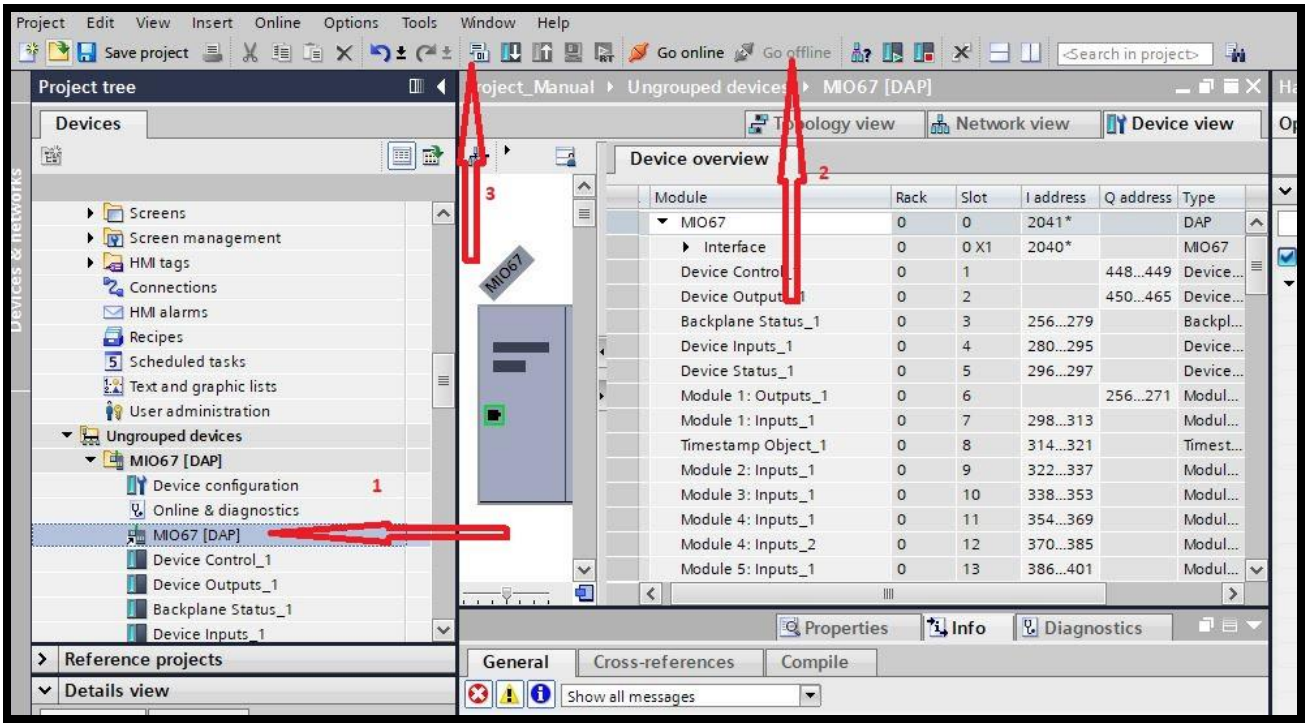
There are two ProfiNet connectors shown in **Figure 1 and Figure 2**. The one on the left is Port 1; the one on the right is Port 2. If you are connecting this in a standard "drop" type configuration where one port is used, either Port 1 or Port 2 can be connected without any other configuration. The software for the controller will have to be set for which port is connected to the MIO but either can be used.

B. Module Configuration

In order for the controller to recognize the module during an initial startup, a sequence must be followed. This is true whether it is the first time for the network or some change to the MIO as occurred (i.e. a new module place on the stack).

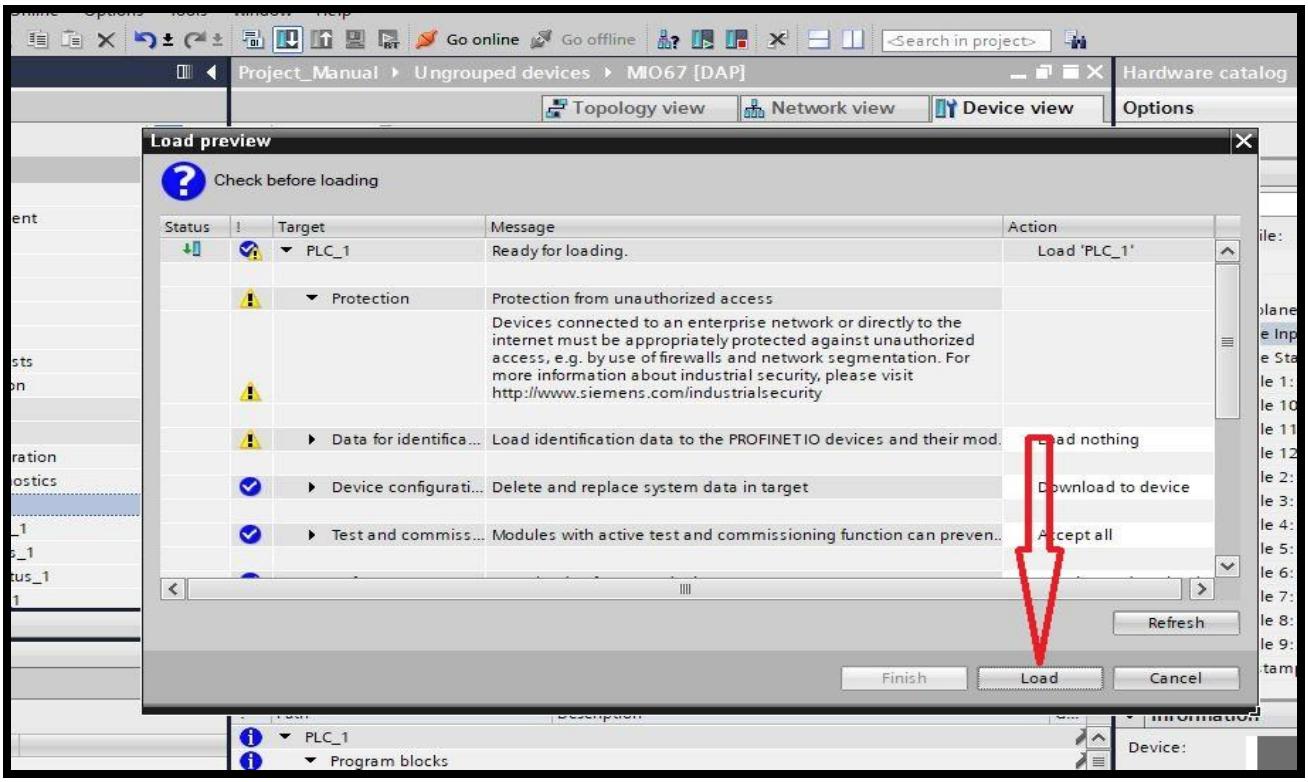
First, select the DAP in the tree (1 in the **Figure 29**), next go off line (2), then select Compile (3).

Figure 31 Compiling MIO



Next, select Load and Finish.

Figure 32 Loading Configuration



When completed, bring the software online and start the CPU.

C. Communications Fault Handling

In the case where the ProfiNet communications has faulted, (IOPS = Bad), then the state change for the communications interface for the MI/O-67 will shift to IDLE. The network is then informed that the I/O data from the submodules are all cleared (substituted to zeroes) and no read process data is updated in the host interface.

If there is a fault due to a connection being aborted, then the state is changed to WAIT_PROCESS. The network is then informed that the I/O data from the submodules are all cleared (substituted to zeroes) and no process data is updated in the host interface.

During power on, the outputs are all cleared (substituted to zeroes) and no process data is updated to the host interface.

9. Comms Module Diagnostics

The Comms Module has system diagnostics which can be read from the PLC.

A. Back Plane Status Word

Bit	Description
0-7	Heartbeat Values 0x00 = Bootup Message 0x04 = Stopped 0x05 = Operational 0x7f = Pre-operational
8	Heartbeat Producer Timeout 1 = Slave – Master Timeout 0 = No error
9	Heartbeat Consumer Timeout 1 = Master – Slave Timeout 0 = No error
10	Non-Volatile CRC Error 1 = Non-Volatile Memory Corruption 0 = No error
11	CAN Error Passive 1 = CAN controller is in 'Error Passive' state. The module is not permitted to add errors to the CAN warning registers. Thus, the backplane is offline. 0 = No error
12	CAN Receive Overrun Error 1 = Data was lost 0 = No error
13	CAN Transmit Overrun Error 1 = Data was lost 0 = No error
14	CAN Bus-Off Error 1 = Device will auto-recover from this failure once the failure condition has been removed. 0 = No error
15	External I/O Error 1 = Module Fault Power Plus Module short or over temperature Power Plus Module open-load detection Power Plus Module driver chip fault Analog Module, Voltage output shorted Analog Module, Voltage output over-temperature Analog Module, Voltage input over-voltage Analog Module, Current input under-current

Analog Module, Current input over-current
Analog Module, Current output open-load
0 = No error

10. Power Handling

The MI/O-67 system has two power paths for the valves and the modules as shown in **Figure 1** in Section 3.1. In addition to that, the Power Plus Module uses an external power connector to operate the valves connected to that module.

A. Valve Power

The first power system is for the valves on the stack. It is isolated from the electronics power and thus can be separately disconnected of desired. It can pass up to 8A at 24VDC maximum. To calculate the total power for the valve line, use the following formula:

Total Current (Amps) = Number of Valves x (Valve Wattage/24) +0.4A $\leq$ 8 Amps.

If there are valves of different wattages on the stack then each group of wattages must be added up separately. Thus:

Total Current (Amps) = [Number of Valves (Wattage1) x (Valve Wattage1/24)] + [Number of Valves (Wattage2) x (Valve Wattage2/24] + [Number of Valves (Wattage3) x (Valve Wattage3/24] + [Number of Valves (Wattage4) x (Valve Wattage4/24)] …..etc.

Note: Valve wattage must be $\leq$ 12 watts per channel at 24VDC.

B. Electronics Power

There is an isolated power line which also can handle up to 8 Amps at 24VDC. This line is used for the EtherNet electronics, module electronics, and the electronics (but not the outputs) of the Power Plus Module.

In general, the power consumed by the modules by themselves (excluding the Comms Module) will be between 50-130mA depending on the module type. This number does not include the loads on the module from sensors, analog outputs, and outputs from the Digital I/O Module.

C. Comms Module

The Comms Module will consume 140mA from the 8A total. Thus, for additional modules, and assuming there is 8A available at the connector, the first module will have 7.86A maximum to work with.

D. Analog Module, Current (Both Types)

The Analog Module can operate 4 channels of 4-20mA outputs at the same time. If all the channels are running at maximum output the module will consume 130mA from the electronics power allotment per module.

E. Analog Module, Voltage (Both Types)

Like the Analog Current Module above, the Analog Voltage Module has four channels which can output 10V at a maximum of 16mA per channel. This module will consume, at maximum output, 50mA per module from the electronics power allotment.

F. Digital I/O Module

The modes of the Digital I/O Module must be considered when calculating the module's current draw.

If the module is run completely as an output unit, then the total current draw will be 60mA (for the module) + (number of channels used up to 16 x current load of the outputs). For example, if there are 16 250mA loads on the device, then the current draw will be 60mA + (16 x 250mA) = 4.04A. Care must be taken with this module because the individual channel maximum outputs are 0.5A and if the unit is loaded down to the maximum (16 x 0.5A) it is possible to completely load the entire stack and take the ProfiNet off line.

If the module is used only as an input unit, then the draw of the sensors must be taken into account. This works out as 60mA for the module and then the current draw of each sensor x the number of sensors on the module. For example, if there are 16 Hall Effect proximity sensors on the module and each sensor draws 2mA, then the total current draw for the module will be 60mA + (16 x 2mA) = 92mA total.

Using the module as a combination input/output module will require using input and output current calculations plus the module current draw (60mA).

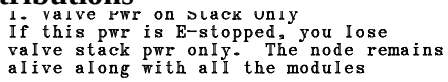
G. Power Plus Module

The Power Plus Module can operate up to 12 0.5A loads (valves, outputs, etc.). However, this power does not come from the electronics total. The module itself draws 50mA.

11. Power Distribution

The stack's power distribution is shown in **Figure 33**. Note, the Electronics power handles all the module electronics plus the I/O electronics for the Digital and Analog I/O Modules. This is routed through the backplane along with the CAN control signals. The stack valve power comes from the Comms Module power. The Power Plus Module has a separate source for its loads.

Figure 33 Stack Power Distributions



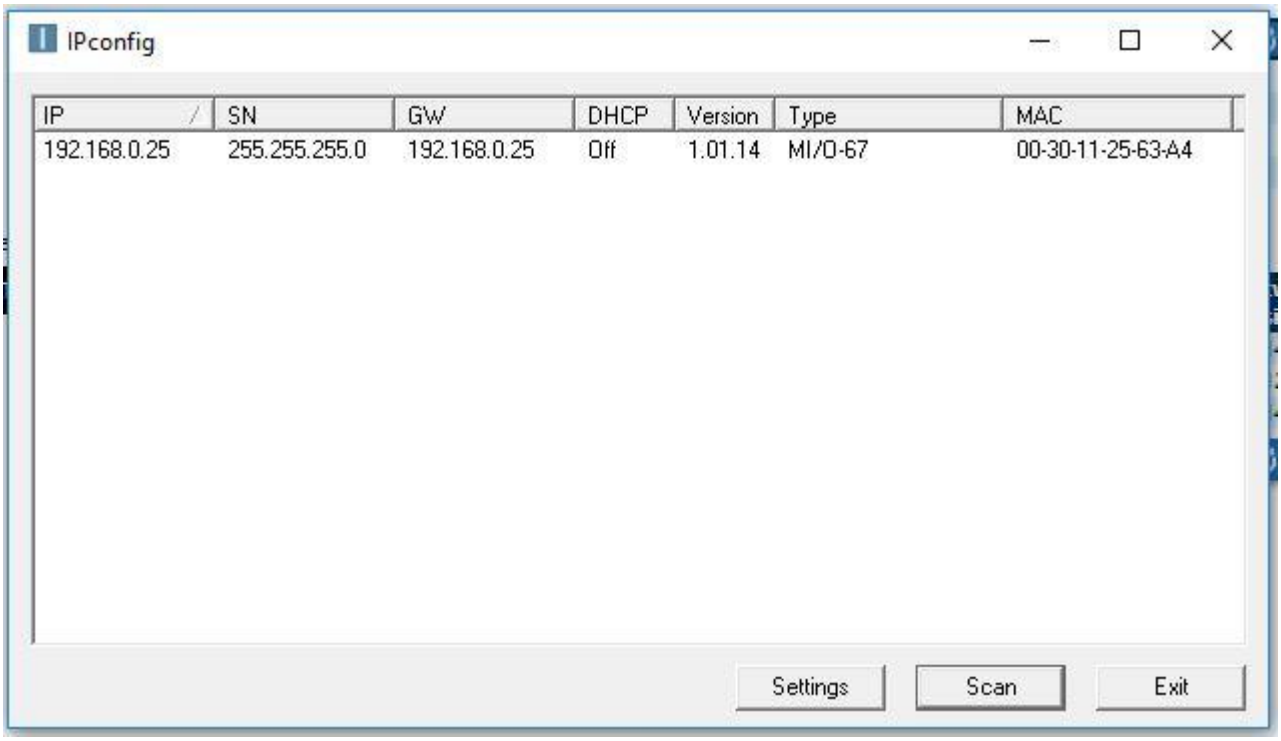
12. Configuration Using the IP Config and Web Config Tools (See UI-174 for more detailed instructions)

The IP Address comes as the factory default as 192-168.1.25. However, if the address is not known or needs to be verified, then the IP Config tool is the easiest way to accomplish this.

The steps are:

1. Connect the unit to a ProfiNet line and host computer.
2. Connect power to the stack.
3. Start the IP Config Tool (must be preloaded onto the host computer).

Figure 34 IP Config Main Screen



4. A screen will appear showing the stack, IP Address, MAC ID, etc.
5. To re-set the IP Address, select the stack on the list (double click). A second menu will appear, load the desired IP Address, Subnet Mask…etc. Exit menu.
6. The first menu will appear. Scan the network and the new information regarding the stack will appear.

To use the Web Config Tool:

1. Connect the unit to a ProfiNet line and host computer.
2. Connect power to the stack.
3. Launch the web browser (i.e. Google Chrome, Mozilla Firefox, etc.)
4. Browse to http://192.168.1.25 (or whatever the IP Address has been set

into the Comms Module)

5. A screen will appear that looks like below.
6. On the left-hand menu bar, go to “1. Network”.
7. Type in the desired IP Address in the space and hit “Save Settings”.
8. Power cycle the Comms Module for the new address to take effect.
9. Also using this tool, you can see the complete device using the various menu items.

Figure 35 WebConfig Main Page

13. GSD, Adding IRD to "Configured Module List"

The Comms Module is a general device in the ProfiNet world. The module ID list auto-synchronize to the detected module ID list. Thus, additional configuration is not necessary. However, if a noun table listing of the modules for the properties of the DAP (MIO-67), then the following can be added to the GSDML file:

The following entry can be added to the GSDML's DAP following the <IOData /> element:

```
<RecordDataList>
  <ParameterRecordDataItem Index="1552" Length="48" TransferSequence="1">
    <Name TextId="T_ID_CFG_MOD_ID_LIST"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="0" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_1"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="4" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_2"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="8" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_3"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="12" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_4"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="16" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_5"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="20" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_6"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="24" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_7"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="28" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_8"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="32" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_9"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="36" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_10"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="40" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_11"/>
    <Ref ValueItemTarget="V_ID_ModuleID" DataType="Unsigned32" ByteOffset="44" DefaultValue="0"
TextId="T_ID_CFG_MOD_ID_12"/>
```

```
  </ParameterRecordDataItem>
</RecordDataList>
```

The entry above provides a list of 32-bit values to assign to the index 1552 which contains the "Configured Module Ident List".

ValueList

The following entry can be added following the GSDML's </ModuleList> element:

```
<ValueList>
  <ValueItem ID="V_ID_ModuleID">
    <Assignments>
      <Assign Content="0" TextId="T_ID_ASSIGN_NONE"/>
      <Assign Content="1879245201" TextId="T_ID_ASSIGN_DIGIO_0"/>
      <Assign Content="1896022417" TextId="T_ID_ASSIGN_DIGIO_1"/>
      <Assign Content="1912799633" TextId="T_ID_ASSIGN_DIGIO_2"/>
      <Assign Content="1929576849" TextId="T_ID_ASSIGN_DIGIO_3"/>
      <Assign Content="1946354065" TextId="T_ID_ASSIGN_DIGIO_4"/>
      <Assign Content="1963131281" TextId="T_ID_ASSIGN_DIGIO_5"/>
      <Assign Content="1979908497" TextId="T_ID_ASSIGN_DIGIO_6"/>
      <Assign Content="1996685713" TextId="T_ID_ASSIGN_DIGIO_7"/>
      <Assign Content="2165047697" TextId="T_ID_ASSIGN_ANAIOCV"/>
      <Assign Content="2181824913" TextId="T_ID_ASSIGN_ANAIOCC"/>
      <Assign Content="2198012305" TextId="T_ID_ASSIGN_VALVE"/>
      <Assign Content="2214789521" TextId="T_ID_ASSIGN_VALVE_PI"/>
    </Assignments>
  </ValueItem>
</ValueList>
```

The above entry provides the list of enumerated values that can be assigned to the configured module ID list.

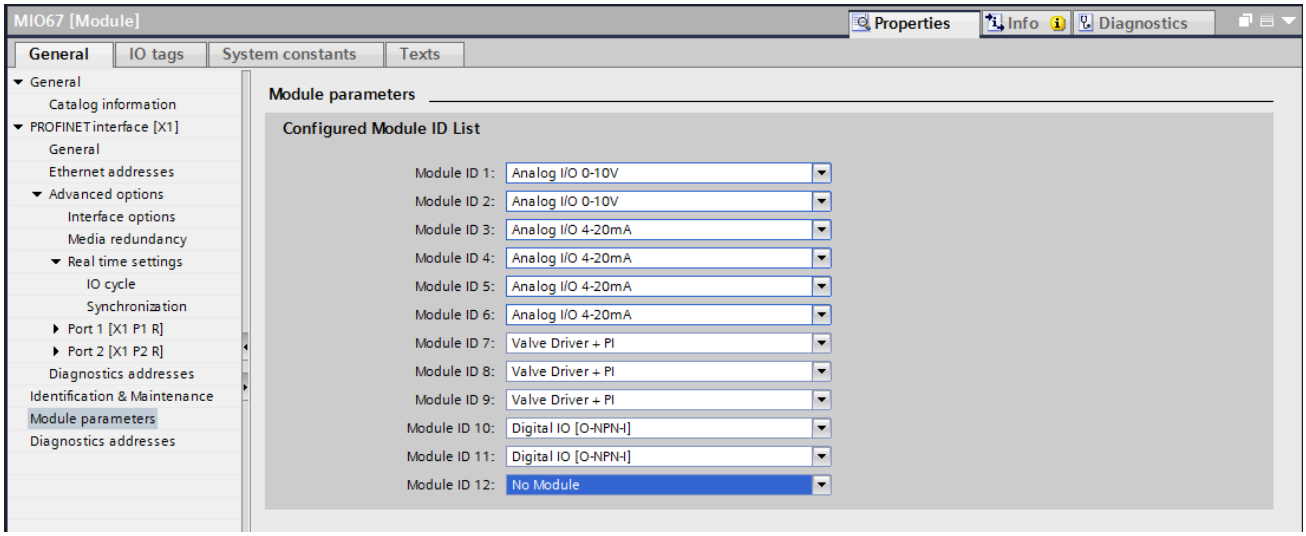
ExternalTextList

The following entries can be appended to the already existing <ExternalTextList><PrimaryLanguage> list of <Text> elements:

```
<Text TextId="T_ID_CFG_MOD_ID_LIST" Value="Configured Module ID List"/>
<Text TextId="T_ID_CFG_MOD_ID_1" Value="Module ID 1"/>
<Text TextId="T_ID_CFG_MOD_ID_2" Value="Module ID 2"/>
<Text TextId="T_ID_CFG_MOD_ID_3" Value="Module ID 3"/>
<Text TextId="T_ID_CFG_MOD_ID_4" Value="Module ID 4"/>
<Text TextId="T_ID_CFG_MOD_ID_5" Value="Module ID 5"/>
<Text TextId="T_ID_CFG_MOD_ID_6" Value="Module ID 6"/>
<Text TextId="T_ID_CFG_MOD_ID_7" Value="Module ID 7"/>
<Text TextId="T_ID_CFG_MOD_ID_8" Value="Module ID 8"/>
<Text TextId="T_ID_CFG_MOD_ID_9" Value="Module ID 9"/>
<Text TextId="T_ID_CFG_MOD_ID_10" Value="Module ID 10"/>
<Text TextId="T_ID_CFG_MOD_ID_11" Value="Module ID 11"/>
<Text TextId="T_ID_CFG_MOD_ID_12" Value="Module ID 12"/>
<Text TextId="T_ID_ASSIGN_NONE" Value="No Module"/>
<Text TextId="T_ID_ASSIGN_DIGIO_0" Value="Digital IO [I-NPN-I]"/>
<Text TextId="T_ID_ASSIGN_DIGIO_1" Value="Digital IO [I-NPN-O]"/>
<Text TextId="T_ID_ASSIGN_DIGIO_2" Value="Digital IO [I-PNP-I]"/>
<Text TextId="T_ID_ASSIGN_DIGIO_3" Value="Digital IO [I-PNP-O]"/>
<Text TextId="T_ID _ASSIGN_DIGIO_4" Value="Digital IO [O-NPN-I]"/>
<Text TextId="T_ID_ASSIGN_DIGIO_5" Value="Digital IO [O-NPN-O]"/>
<Text TextId="T_ID_ASSIGN_DIGIO_6" Value="Digital IO [O-PNP-I]"/>
<Text TextId="T_ID_ASSIGN_DIGIO_7" Value="Digital IO [O-PNP-O]"/>
<Text TextId="T_ID_ASSIGN_ANAIOCV" Value="Analog I/O 0-10V"/>
<Text TextId="T_ID_ASSIGN_ANAIOCC" Value="Analog I/O 4-20mA"/>
<Text TextId="T_ID_ASSIGN_VALVE" Value="Valve Driver"/>
<Text TextId="T_ID_ASSIGN_VALVE_PI" Value="Valve Driver + PI"/>
```

The above entries provide human readable text references that are used in the previous entries mentioned above.

The end result of these changes above when using tools like TIA Portal, is that there will be new configuration options presented to the user for specifying the module ID list. Below is a screenshot from TIA Portal showing this configuration entry when selecting the MI/O-67 device properties “Module parameters” section.



14. Specifications

General Specifications

Item	Specifications
Operating ambient temperature	0~+50°C (consult the factory for higher temperature operation)
Operating ambient humidity	10~90% RH (no condensation)
Vibrating resistance	5G (10~55 Hz, 0.5mm)
Impact resistance	10G
Dielectric strength	500VAC 60 Hz for 1 sec. (between external terminal and case)
Insulation resistance	10Mohm
Operating atmosphere	No corrosive gases

ProfiNet Performance Specifications

Item	Specification
Transmission Speed	10Mbit/100Mbit
Transmission Distance	100m
Transmission Media	CAT-5 ProfiNet cable
Protocols	ProfiNet

CE EMC Directive Certification

Item	Specification
Radiated Emissions	CISPR 16-2-3 Ed 4.1(2019-09)
AC Mains Conducted Emissions	CISPR 16-2-1 Ed 3.1(2017-06)
Electro-Static discharge Immunity	IEC61000-4-2 Ed 2.0(2008-12)
Radiated, Radio Frequency Electromagnetic Immunity	IEC61000-4-3 Ed 3.2(2010-04)
Electrical Fast Transcient/Burst Immunity	IEC61000-4-4 Ed 3.0(2012-04)
Immunity to Surges	IEC61000-4-5 Ed 3.1(2017-08)
Conducted, Radio Frequency Electromagnetic Immunity	IEC61000-4-6 Ed 4.0(2013-10)
Power Frequency Magnetic Field Immunity	IEC61000-4-8 Ed 2.0(2009-09)

2. Troubleshooting Guide

In the event of difficulties in either operation or installation of the MI/O-67, there are number of fault detection tools available. Along with the short/open detection mentioned above, each module has groups of LEDs which can help to get the manifold online in the event of problems.

A. Comms Module

Below the ProfiNet Ports, there are four LEDs. In addition to the four LEDs near the communications connectors, there are three more LEDs along the top of the Comms Module for further diagnostics.

For STS (Network Status):

State	Description
Off	No Power, No controller connection
Green	Online, 1 or more connections established
Green 1 Flash	Online, controller in STOP state
Green 3 Flashes	Identify flashing with slave
Green, Con Flashes	Connection established, controller in STOP state
Red	Fatal Error
Red 1 Flash	Station name error
Red 2 Flashes	IP address error, address not set
Red 3 Flashes	Configuration error, expected ID differs from Real ID

For ERR (Module Status):

State	Description
Off	No power or module in SETUP or INIT state
Green	Controlled by a scanner in run mode
Green 1 Flash	Diagnostic event present
Green Con Flashes	Slave ID
Red	Fatal Error

For LA (Link/Activity)

State	Description
Off	No Link/No Activity
Green	Link established, 100mb
Green Flickering	Activity, 100mb
Yellow	Link established, 10mb
Yellow Flickering	Activity, 10mb

For Power:

State	Description
Off	No Power
Green	Power OK

For Comm (Backplane Communications):

State	Description
Off	No power
Green	OK
Green Flashing	Not configured or scanner in idle mode
Red	Fatal Error
Red Flashing	Recoverable fault

For Stat (Backplane Status)

State	Description
Off	No Link/No Activity
Green	Run Mode
Green Flashing	Standby Mode

B. Digital I/O Module

Leds on top right of module

Com Led-- Red: (CANopen Status, Error Led)

State	Description
Off	No error
Single Flash	Warning limit reached (error passive)
Flickering	LSS Config Mode
On	Bus Off/fatal error
Double Flash	Heartbeat timeout error

Com Led-- Green: (CANopen Status, Run Led)

State	Description
Single Flash	CANopen stopped state
Flickering	LSS Config Mode
On	CANopen operational state
Blinking	CANopen pre-operational state

PWR Led:

State	Description
Green	Power/Application loaded
Green w/Red Single Flash	IO Comm failure

Flickering between
Green and RedDip switch state changed
Red Fatal error in application

IO Led near each M12 connector, 2 ea.:
Input Mode

State	Description
Green	NPN-connection is sinking current, PNP-connection is sourcing current.
Red	Fault on channel
Off	Channel off

Output Mode

Green	Output on
Red	Fault on channel
Off	Channel off

During start up, PWR, IO, and Com Leds will be 0.25sec Green, 0.25sec Red.

C. Power Plus Module

Leds on top right of module

Com Led-- Red: (CANopen Status, Error Led)

State	Description
Off	No error
Single Flash	Warning limit reached (error passive)
Flickering	LSS Config Mode
On	Bus Off/fatal error
Double Flash	Heartbeat timeout error

Com Led-- Green: (CANopen Status, Run Led)

State	Description
Single Flash	CANopen stopped state
Flickering	LSS Config Mode
On	CANopen operational state
Blinking	CANopen pre-operational state

PWR Led:

State	Description
Green	Power/Application loaded
Green w/Red Single Flash	IO Comm failure
Flickering between	

Green and RedDip switch state changed
Red Fatal error in application

Output Led near each M12 connector, 2 ea:

State	Description
Green	Output on
Red	Fault (output power not present)
Off	Output off

During start up, PWR, Output, and Com Leds will be 0.25sec Green, 0.25sec Red.

D. Analog I/O Module (Voltage and Current)

Leds on top right of module

Com Led-- Red: (CANopen Status, Error Led)

State	Description
Off	No error
Single Flash	Warning limit reached (error passive)
Flickering	LSS Config Mode
On	Bus Off/fatal error
Double Flash	Heartbeat timeout error

Com Led-- Green: (CANopen Status, Run Led)

State	Description
Single Flash	CANopen stopped state
Flickering	LSS Config Mode
On	CANopen operational state
Blinking	CANopen pre-operational state

PWR Led:

State	Description
Green	Power/Application loaded
Green w/Red	
Single Flash	IO Comm failure
Flickering between	
Green and RedDip switch state changed	
Red	Fatal error in application

During start up, PWR, IO, and Com Leds will be 0.25sec Green, 0.25sec Red.

3. Troubleshooting Chart

Fault	**Description**
Do valves operate?	
No	Check power to Comms Module
	Check network wiring
	Check network indicator LEDs on Comms Module
	Check network IP Address and Configuration
	Check for correct Bytes to operate valves in PLC Output Table
Do modules operate?	
No	Check configuration in PLC
	If using a Digital I/O Module, check dipswitches on module
	If using a Power Plus Module, check external power
	Check all module for wiring (sensors, loads, etc)
Are you getting faults on Comms Module?	Check the Open Load Diagnostics in PLC and valve set up
Is unit coming online in the PLC network?	
No	Check the IP address and whether the EDS file is loaded

Appendix A IP Config Tool Settings

The IP Config Tool has the ability to set a password into the node in order to lock in the IP Address, Subnet Mask, and DHCP status.

To set this feature, first select the node that the password is to be set on as shown in **Figure 66**.

Next, in the second screen, select "Change Password". Type a password into the Password and New Password lines. Hit "Set" as shown in **Figure 67**.

If you try to change the IP Address with the wrong password after setting it, then the error message will appear as shown **in Figure 68**.

Care must be taken in save guarding the password. If it is forgotten, then a firmware reloading will be necessary.

Figure 36 IP Config Tool

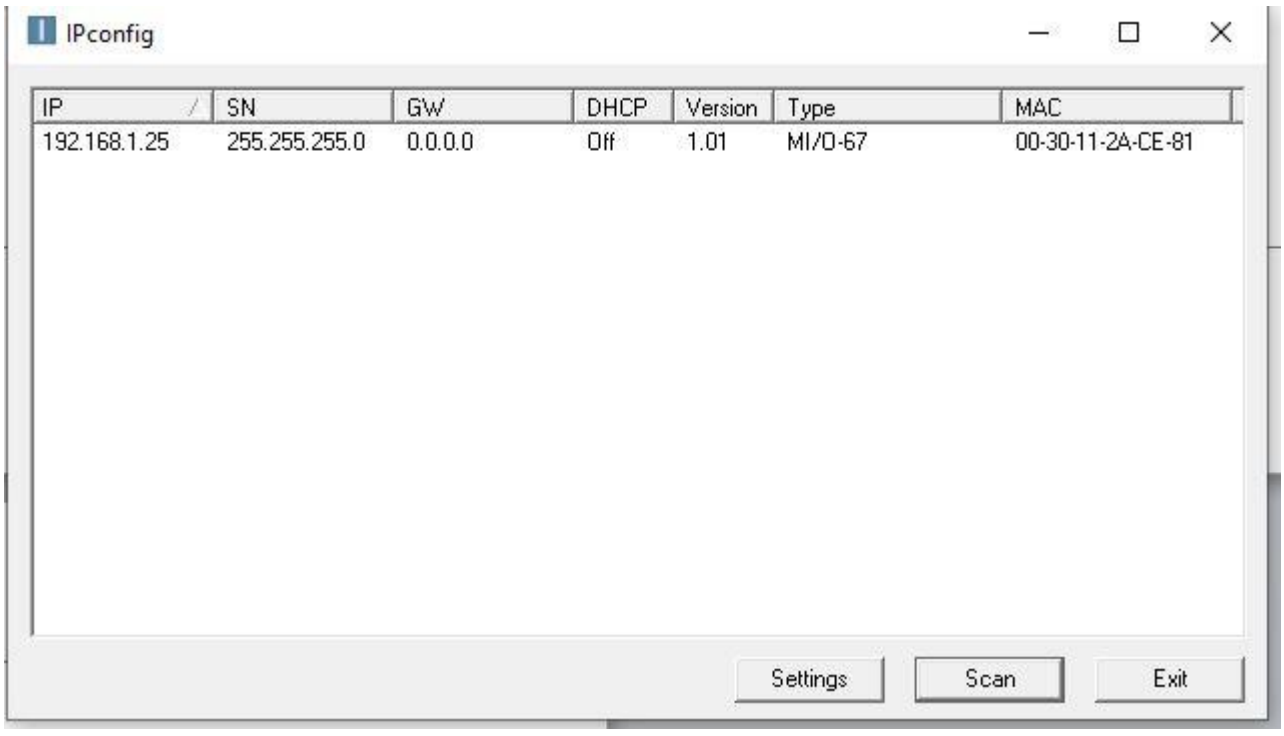


Figure 37 Password Setting

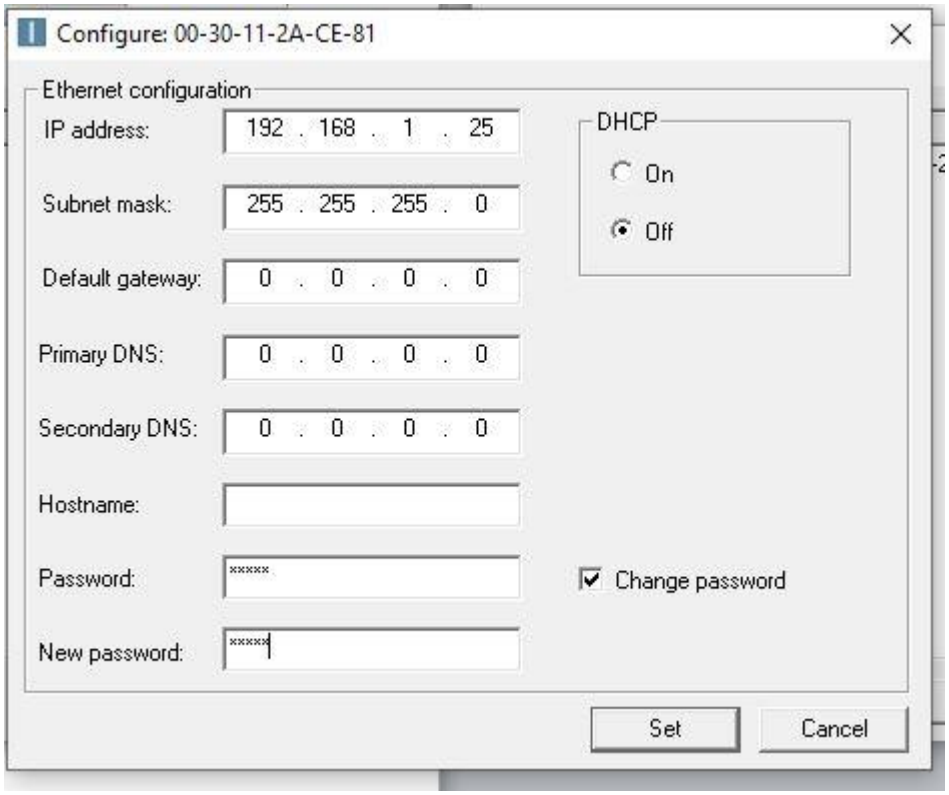
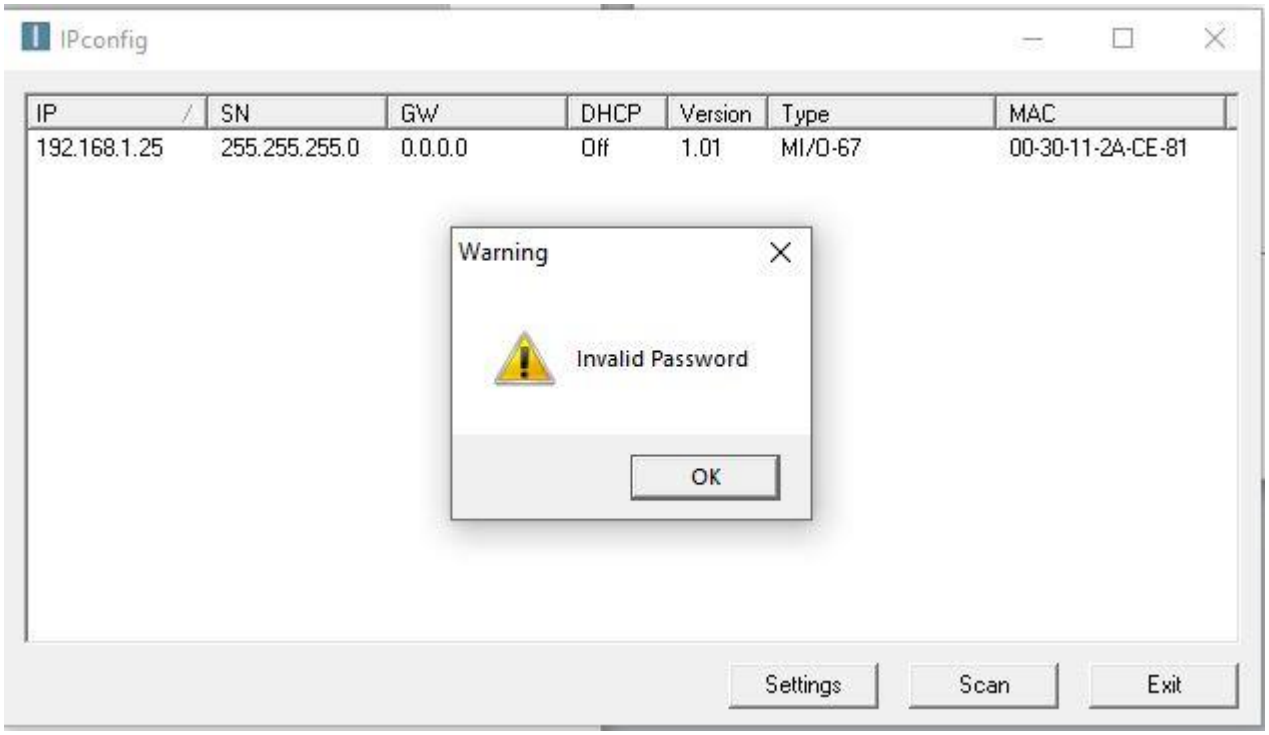


Figure 38 IP Config Error Message



Warning:

Under no circumstances are MAC Valves to be used in any application or system where failure of the valves or related components to operate as intended could result in injury to the operator or any other person.

- Do not operate outside of prescribed pressure or temperature ranges.
- Air supply must be clean. Contamination of valve can affect proper operation.
- Before attempting to perform any service on valve, consult catalog, P & O sheet, or factory for proper maintenance procedures. Never attempt service with air pressure to valve.
- If air line lubrication is used, consult catalog, P & O sheet, or factory for recommended lubricants.
- Before interfacing the product to any bus or serial system, consult the controller and bus manuals for proper usage.