



Operation Manual

PRODUCT NAME

Ethernet ITV – Ethernet/IP™

MODEL / Series / Product Number

ITVXXXX-SEN-XX-DUX02357-XXXX

SMC Corporation

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1. Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage.

These instructions indicate the level of potential hazard with the labels of "Caution", "Warning" or "Danger". They are all important notes for safety and must be followed in addition to International standards (ISO/IEC), and other safety regulations.

ISO 4414: Pneumatic fluid power -- General rules relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines. (Part 1: General requirements)

ISO 10218-1992: Manipulating industrial robots -- Safety.

Etc.



Caution: CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



Warning: WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Danger: DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

- The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
- When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
- Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

- Conditions and environments outside of the given specifications or use outdoors or in a place exposed to direct sunlight.
- Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
- An application which could have negative effects on people, property, or animals requiring special safety analysis.
- 4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered. *1)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the products.

*1) Vacuum pads are excluded from this 1-year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

Operator

- This operation manual has been written for those who have knowledge of machinery and apparatus that use pneumatic equipment and have full knowledge of assembly, operation and maintenance of such equipment.
- Please read this operation manual carefully and understand it before assembling, operating or providing maintenance to the product.

Precautions

Warning

Do not disassemble, modify (including changing the printed circuit board) or repair.
An injury or failure can result.

Do not operate the product outside of the specifications.
Do not use for flammable or harmful fluids.
Fire, malfunction, or damage to the product can result.
Verify the specifications before use.

Do not operate in an atmosphere containing flammable or explosive gases.
Fire or an explosion can result.
This product is not designed to be explosion proof.

If using the product in an interlocking circuit:
Provide a double interlocking system, for example a mechanical system.
Check the product regularly for proper operation.
Otherwise malfunction can result, causing an accident.

The following instructions must be followed during maintenance:
Turn off the power supply.
Stop the air supply, exhaust the residual pressure and verify that the air is released before performing maintenance.
Otherwise an injury can result.

Caution

After maintenance is complete, perform appropriate functional inspections.
Stop operation if the equipment does not function properly.
Safety cannot be assured in the case of unexpected malfunction.

Provide grounding to assure the safety and noise resistance of the Serial System.
Individual grounding should be provided close to the product with a short cable.

• NOTE

- Follow the instructions given below when designing, selecting and handling the product.
- The instructions on design and selection (installation, wiring, environment, adjustment, operation, maintenance, etc.) described below must also be followed.
- **Product specifications**
 - When conformity to UL is necessary the Serial Interface unit must be used with a UL1310 Class2 power supply.
 - The unit is an  approved product only if they have a  mark on the body.
 - Use the specified voltage. Otherwise failure or malfunction can result.
 - Reserve a space for maintenance.
 - Allow sufficient space for maintenance when designing the system.
 - Do not remove any nameplates or labels.
 - This can lead to incorrect maintenance, or misreading of the operation manual, which could cause damage or malfunction to the product.
 - It may also result in non-conformity to safety standards.

• Product handling

○ Installation

- Do not drop, hit or apply excessive shock to the Ethernet ITV system. Otherwise damage to the product can result, causing malfunction.
- Tighten to the specified tightening torque. If the tightening torque is exceeded the mounting screws may be broken.
- IP65 protection cannot be guaranteed if the screws are not tightened to the specified torque.
- Never mount a product in a location that will be used as a foothold.
- The product may be damaged if excessive force is applied by stepping or climbing onto it.

○ Wiring

- Avoid repeatedly bending or stretching the cables or placing heavy load on them.
- Repetitive bending stress or tensile stress can cause breakage of the cable.
- Wire correctly.
- Incorrect wiring can break the product.
- Do not perform wiring while the power is on. Otherwise damage to the fieldbus system and/or I/O device can result, causing malfunction.
- Do not route wires and cables together with power or high voltage cables. Otherwise the fieldbus system and/or I/O device can malfunction due to interference of noise and surge voltage from power and high voltage cables to the signal line.
- Confirm proper insulation of wiring.
- Poor insulation (interference from another circuit, poor insulation between terminals, etc.) can lead to excess voltage or current being applied to the product, causing damage.
- Take appropriate measures against noise, such as using a noise filter, when the fieldbus system is incorporated into equipment. Otherwise noise can cause malfunction.

• Environment

- Select the proper type of protection according to the operating environment.
- IP65 protection is achieved when the following conditions are met. The units are connected properly with fieldbus cable with M12 connector and power cable with M12 connector. All unused connectors are closed with a properly installed seal cap.
- If using in an environment that is exposed to water splashes, please take measures such as using a cover.
- Do not use in a place where the product could be splashed by oil or chemicals.
- If the product is to be used in an environment containing oils or chemicals such as coolant or cleaning solvent, even for a short time, it may be adversely affected (damage, malfunction etc.).
- Do not use the product in an environment where corrosive gases or fluids could be splashed. Otherwise damage to the product and malfunction can result.
- Do not use in an area where surges are generated.
- If there is equipment which generates a large amount of surge (solenoid type lifter, high frequency induction furnace, motor, etc.) close to the fieldbus system, this may cause deterioration or breakage of the internal circuit of the fieldbus system. Avoid sources of surge generation and crossed lines.
- When a surge-generating load such as a relay or solenoid is driven directly, use a fieldbus system with a built-in surge absorbing element.
- Direct drive of a load generating surge voltage can damage the fieldbus system.
- The product is **NOT** immune to lightning strikes. Take measures against lightning strikes in the system.
- Prevent foreign matter such as remnant of wires from entering the fieldbus system to avoid failure and malfunction.
- Mount the product in a place that is not exposed to vibration or impact.
 - Failure or malfunction can result.
- Do not expose the product to direct sunlight.
- If using in a location directly exposed to sunlight, shade the product from the sunlight. Failure or malfunction can result.
- Keep within the specified operating temperature range.
 - Malfunction can result.
- Do not operate close to a heat source, or in a location exposed to radiant heat.
 - Malfunction can result.

• Adjustment and Operation

- Perform settings suitable for the operating conditions.
 - Incorrect setting can cause operation failure.
- Please refer to the PLC manufacturer's manual etc. for details of programming and addresses.
 - For the PLC protocol and programming refer to the relevant manufacturer's documentation.

• Maintenance

- Turn off the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.
 - There is a risk of unexpected malfunction.
- Perform regular maintenance and inspections.
 - There is a risk of unexpected malfunction.
- After maintenance is complete, perform appropriate functional inspections.

- Stop operation if the equipment does not function properly.
- Otherwise safety is not assured due to an unexpected malfunction or incorrect operation.
- Do not use solvents such as benzene, thinner etc. to clean the unit.
 - They could damage the surface of the body and erase the markings on the body. Use a soft cloth to remove stains. For heavy stains, use a cloth soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

2. About this Manual

The purpose of this manual is to provide the user with necessary information to install, configure, and use the ITV####-SEN-##-DUX02357-#### also known as the Ethernet ITV.

The ITV is typically operated under the control of a master device (usually a PLC). The ITV may also be operated under the control of explicit messaging program Ex: LabVIEW™ software. Finally, the ITV may be operated using the built-in ITV web interface. Examples for each of these conditions are documented in this manual.

This manual provides information for ITV setup and configuration, examples of the web interface, a LabVIEW™ software program, and a brief overview of the Rockwell Automation® RSLogix 5000® software. Please see the manufacturer's documentation for detailed instructions on the setup and use of your Rockwell Automation® or other PLCs. Please see the LabVIEW™ software documentation for more information on using LabVIEW™ software.

3. Terminology

	Terms	Meaning
A	Auto negotiation	The function that automatically optimizes the common communication parameters such as speed, duplex mode, and flow control between Ethernet devices.
B	Bus In / Bus Out	M12 Ethernet communication connectors located on top of the ITV.
C	Counts	The ITV controls and reports pressure or vacuum internally in Counts . The counts are used by hardware devices to control and measure the pressure or vacuum regulated by the ITV.
	Current consumption	The current necessary to operate each unit or device using a 24 VDC.

D	DHCP	DHCP (Dynamic Host Configuration Protocol) allows the ITV IP address to be set using an external DHCP server. DHCP may be used if desired but is not required.
	Downstream	Relative to your ITV, a downstream device receives power and/or communication signals which originate <i>from</i> or are <i>passed through</i> your ITV. This also refers to pneumatic devices controlled by the ITV.
	DLR	DLR (Device Level Ring) is supported by Rockwell Automation® PLCs for Ring networks. If your ITVs are configured using a ring topology, DLR provides redundancy if a problem (such as a line break or device failure) occurs within a Ring network. DLR allows communication and control of devices in the network to continue in the event of a single communication failure.
E	Electronic Data Sheet (EDS)	EDS is a file containing settable attribute information for a device (each parameter's object address, etc.). Used by Rockwell Automation® PLC RSLogix 5000® or Logix Designer™ software to permit faster, more consistent PLC setup.
	Ethernet/IP™ (EIP)	The specific Fieldbus (network) communication protocol used by the ITV to communicate with the PLC, and any other connected devices. EIP is a well-documented, standard communications protocol.
F	Fieldbus	The protocol that uses digital communication to exchange signals between field equipment (instruments and actuators).
	Full duplex	Communication system that can send and receive data at the same time bi-directionally (similar to standard telephone).
H	Half duplex	Communication system that sends and receives data in one direction at a time (similar to two-way radio).
	Host Address	The final (4 th) octet of an IP Address.
I	IP address	A 32-bit digit sequence which is assigned to identify devices which are connected to the network. This address must be unique for each device to ensure proper operation of the network.
	IPxy	International Ingress Protection standard. xy indicates the level of protection from external objects (hands, steel balls, steel wire, dust, water, etc.) applied to the product.
M	MAC address	A unique number inherent to all devices which are connected to Ethernet.
	Master	The master is the device which controls the ITV. Typically, a master is a PLC. It may also be a PC (using the ITV web pages or a LabVIEW™ software program) or it may be another device capable of controlling the ITV.
	MS	Module Status.
N	NS	Network Status
P	PC	Personal Computer.
	PLC	Abbreviation for Programmable Logic Controller. A digital computer/controller used for automation of electromechanical processes.
	Power Cycle	A Power Cycle involves briefly removing power from the ITV and then restoring power.
S	Setpoint	The specified pressure or vacuum value which the ITV has been directed to maintain.
	Serial Interface (SI)	A communication interface between two digital systems that transmits data as a series of voltage pulses down a wire. Each pulse represents a single bit of data.
	SI unit	Abbreviation for Serial Interface unit. A unit connected to a device to communicate input and output data. The ITV connection to another device is a Serial Interface Unit (SI Unit).
	Subnet Address	The 3 rd octet of an IP Address. Also called Subnet.
T	Topology	Connection configuration of the network.
U	Upstream	Relative to your ITV, an upstream device provides power and/or communication signals <i>to</i> your ITV.

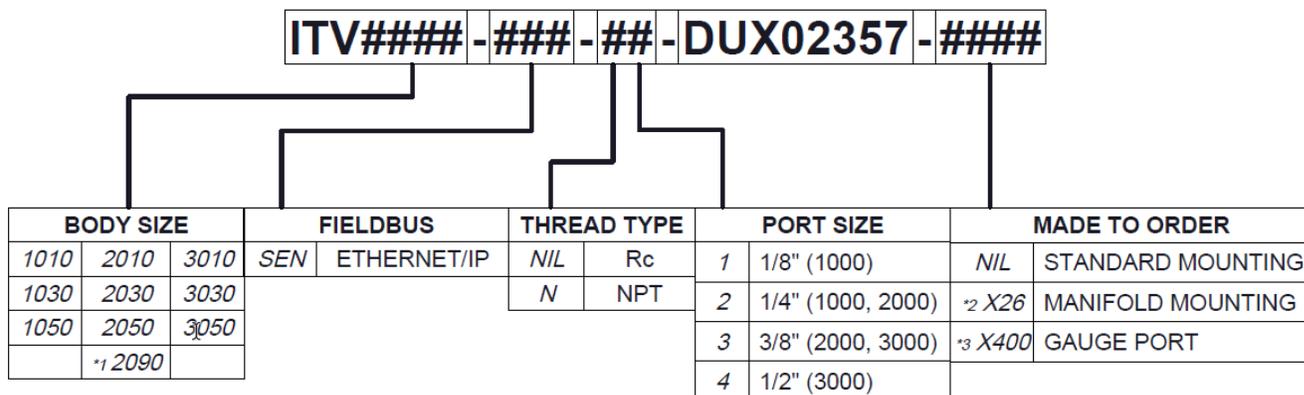
Figure 1 - Definitions and Terminology

4. Product Summary

The Ethernet ITV is a pressure/vacuum regulator which is controlled over a standard ethernet interface. Pressure ITVs (ITVX010, ITVX030, and ITVX050) and Vacuum ITVs (ITV2090) regulate supplied air pressure or vacuum to an output pressure or vacuum specified by the user. The user can set the ITV pressure or vacuum and monitor the ITV operating status using the built-in webserver, PLC, or explicit messaging.

5. How to Order

Single ITV Options

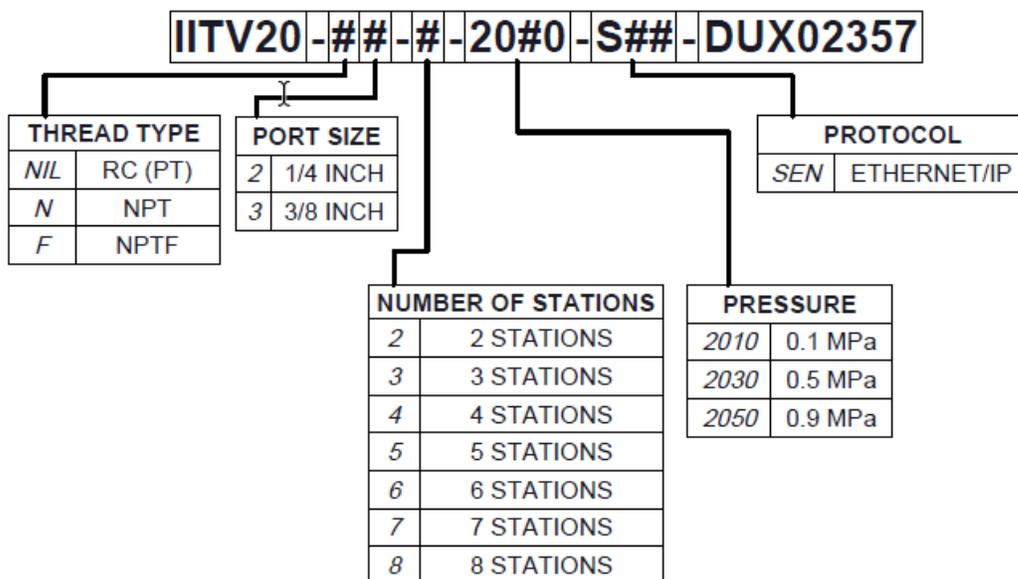


HOW TO ORDER EXCEPTIONS:

1. ITV2090 AVAILABLE WITH 1/4" Rc AND NPT PORTS ONLY.
2. X26 OPTION AVAILABLE IN 2010, 2030 AND 2050 WITH 1/4" Rc PORTS ONLY. ORDER MATING MANIFOLD WITH DESIRED PORT TYPE.
3. X400 AVAILABLE IN 2030 AND 2050 ONLY WITH 3/8" Rc PORTS.

*ALSO SEE INDIVIDUAL SERIES VIEWS ON SUBSEQUENT PAGES FOR ADDITIONAL HOW TO ORDER RESTRICTIONS

Assembled Manifold Mounted Options



6. Accessories

Connector cables (recommended – not included with ITV)

ITV unit connection	Description	Compatible cable		
		Part number	Len	Specifications
Fieldbus interface	Cables	EX9-AC010EN-PSRJ	1m	One end: molded M12 straight connector. Other end: RJ45 connector (Ethernet).
		EX9-AC020EN-PSRJ	2m	
		EX9-AC030EN-PSRJ	3m	
		EX9-AC050EN-PSRJ	5m	
		EX9-AC100EN-PSRJ	10m	One end: molded M12 right angle connector. Other end: flying leads.
		PCA-1446566	5m	
		EX9-AC005EN-M12M12	0.5m	
		EX9-AC050EN-M12M12	5m	Both ends: molded M12 straight connectors.
Field wireable Connector	PCA-1446553	--	Connector: M12 straight plug connector. Use with PCA-1446566 to make a cable of desired length.	
Power supply	Cables	EX500-AP010-SE	1m	One end: molded M12 straight connector. Other end: flying leads.
		EX500-AP050-S	5m	
		EX500-AP010-A	1m	One end: molded M12 right angle connector. Other end: flying leads.
		EX500-AP050-A	5m	
	Cable with Speedcon connector	PCA-1401804	1.5m	One end: molded M12 straight connector. Other end: flying leads.
		PCA-1401805	3m	
		PCA-1401806	5m	

Figure 2 - Recommended Cables

Note: More options are available. Contact SMC for information on these options.

Seal cap

Seal caps are used to protect the M12 size connector openings. It is recommended that seal caps be used on all unused M12 connector openings. Use of seal caps is required for all unused connections for IP65 rating.



(One Ethernet and one Power seal cap are attached to the ITV when shipped from factory.)

Description	Part No.	Specification	
Seal cap	EX9-AWTS	For M12 connector socket: 10pcs.	Bus Port
Seal cap	P5033-88	For M12 connector socket: 1pcs.	Bus Port
Seal cap	UIUSP-A05-DUQ00833	Cap and Gasket for M12 Female Connector 1 pcs.	Power Port

Figure 3 - Seal Cap Part Numbers

7. Summary of Product Elements

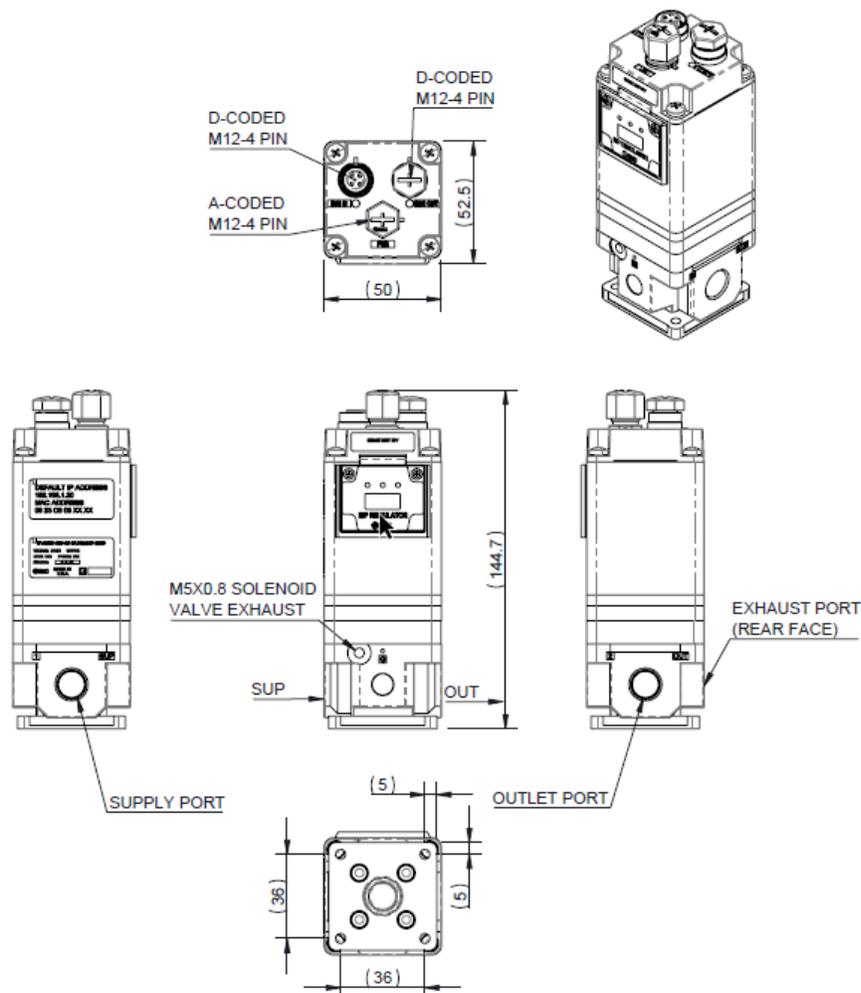


Figure 4 - ITV20XX Drawing

Element	Description
Supply Port Connection	Input Pressure Line Connection (X010, X030, X050) / Atmosphere Pressure (2090) *1
Outlet Port Connection	Output Pressure Line Connection (X010, X030, X050) / Application Vacuum Line Connection (2090) *1
Exhaust / Vacuum Port	Exhaust Port (X010, X030, X050) / Vacuum Line Connection (2090) *1
LED Display window	Network and operating status LEDs *2
Fieldbus interface connector (Bus In)	Ethernet connection (M12, 4-pin socket, D-coded) *3
Fieldbus interface connector (Bus Out)	Ethernet connection (M12, 4-pin socket, D-coded) *3
Power supply connector	24 Volt DC input power supply *3
Seal Cap (Accessory)	Seal cap for unused Fieldbus interface connector (Bus Out); Seal cap for unused power supply connector *3

*1: X is 1, 2, or 3 and designates the body type for the ITV. (See How to Order for more information)

*2: See LED Indicators for the LED indication.

*3: See Accessories for connecting cables and seal caps part numbers.

8. Quick Start

8.1. Network

1. Using the suggested M12 D-coded cable, connect one of the network ports to the network.

8.2. Power Connection

1. Connect common to pin 3 the blue wire typically of the M12 Cable.
2. Connect 24 VDC to pin one the brown wire typically of the M12 Cable.
3. Pins to 2 and 4 are “no connect” - black and white wires typically.
4. Connect the cable to the power connector of the ITV.
5. Turn on the power if you haven’t already
6. You should have two solid green LEDs and one flashing green LED on the front.
7. On top you should have one solid green LED and possibly a flashing yellow.

8.3. Set IP address

1. The default IP address is 192.168.1.20
2. The PC used to connect to the ITV must be on the same subnet “192.168.1.X” but not the same IP address
3. You can modify the IP address using the built-in webserver by entering that IP address into the address bar of a computer that is connected to the same network and on the same subnet.
4. Login as “user” password “user” then select network tab to change the IP address
5. There are other ways to set the IP address that can be found here IP Address

8.4. PLC setup

1. Install the EDS file which can be found on smcusa.com for the latest.
2. Add a new module to your Ethernet network.
3. Search for “ITV” in the new module window. Select the ITVXXXX-SEN-XX-DUX02357 from the list.
4. Select Change in the Module Properties window.
5. Change the size to INT to simplify calculating the setpoint and feedback.
6. You will have to set the name and IP address too as you would for any other Ethernet/IP device.
7. Download to your PLC and the ITV should connect.

8.5. Setpoint and Feedback

1. The setpoint and feedback are scaled across 12bits full scale.

8.6. Plumbing and mounting

1. Plumb supply pressure as appropriate
2. Plumb Outlet to device to be controlled
3. Turn on the supply pressure and check for leak

9. IP Address

The IP address is set to (192.168.1.20) at the factory. The IP address can be set using the built in ITV web server (See_Network Tab) “suggested way”, using the dip switches, Bootp/DHCP, or explicit messaging per CIP specification.

9.1. Dip Switches

- Dip switches set last octet of IP address - Default is 192.168.1.XXX
- Left most switch is 1 and the right most is 128
- The value of the dip switches is read at power up
- Numbers 1-254 are valid IP values
- Number 255 does nothing - Whatever value or mode the device is in it will stay that way on power up.
- Factory Default is 255 all switches on.
- Switch value zero will reset the IP address to it default value. - 192.168.1.20
 - a. The subnet mask should also be set to default value - 255.255.0.0
 - b. The Gateway should also be reset to default value - 0.0.0.0
- DHCP
 - a. Dip switches must be in 255 for DHCP to work

10. Mounting and Plumbing

For standard mounting, properly install pneumatic fittings in the threaded ports of the ITV base. For additional details see *SMC Best Pneumatics* version 5 (or later), volume 5, ITV Section Series ITV0000/1000/2000/3000. For information about SMC fittings see <http://www.smcusa.com/top-navigation/cad-models.aspx/87051>. See Figure 4 - ITV20XX Drawing for the description of fittings. Torque the fittings as indicated:

Connection thread	1/8	1/4	3/8	1/2
Torque (N•m)	7 to 9	12 to 14	22 to 24	28 to 30

Figure 5 - Recommended proper connection torque: N•m

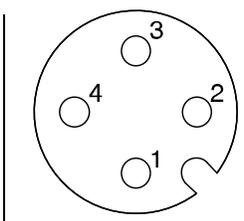
10.1. Install pneumatic tubing.

When installing this tubing, be sure that the air pressure or vacuum source is **LOCKED OFF** at the closest shutoff valve before the ITV. There must be **NO AIR PRESSURE OR VACUUM** in the pneumatic line until all connections are complete.

 Caution
<p>DO NOT enable air pressure or vacuum until ALL pneumatic lines in the circuit have been properly connected and the connections have been verified to be correct. Failure to follow this requirement can result in injury or equipment damage.</p>
<p>Be SURE you understand the location and function of the ports BEFORE connecting the ITV to an air or vacuum line. VERIFY that these lines are properly connected BEFORE enabling pneumatic pressure or vacuum and BEFORE powering the ITV.</p>

11. Power Connection

Power supply connector layout - PWR: M12 4-pin Plug A-coded connector



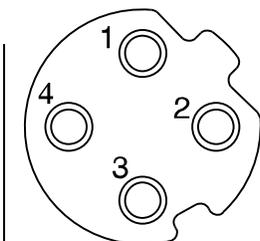
No.	Designation	Description
1	24 VDC	Power (Brown Wire +24 VDC + terminal)
2	-	Do Not Connect
3	0 VDC	Common (Blue Wire -Common -terminal)
4	-	Do Not Connect

Figure 6 - ITV Power Cable Pin Connections

(Note: The wire colors above are for a standard SMC power cable. Power cables from other sources may use different colors.) For Power Cable selection, see [Accessories \(Section 6\)](#).

12. Networking

Network Bus In and Bus Out: M12 4-pin socket D-coded connectors



No.	Designation	Description
1	TD+	Transmit Data +
2	RD+	Receive Data +
3	TD-	Transmit Data -
4	RD-	Receive Data -

Figure 7 - ITV Ethernet Cable Pin Signals

Use a standard industrial Ethernet cable. For cable selection see [Accessories](#).

Connect one connector ("Bus In" or "Bus Out") to the upstream device and connect the other connector ("Bus Out" or "Bus In") to the downstream device. For cable selection see [Accessories](#).

If Power Over Ethernet (POE) is **NOT** in use, either communications port can be used for input or output. It is recommended that "Bus In" be used for the input (upstream) connection to the ITV and "Bus Out" be used for the output (downstream) connection from the ITV. It is also recommended that unused connectors be capped with a seal cap to meet IP65 environmental rating. For more information see [Accessories](#).

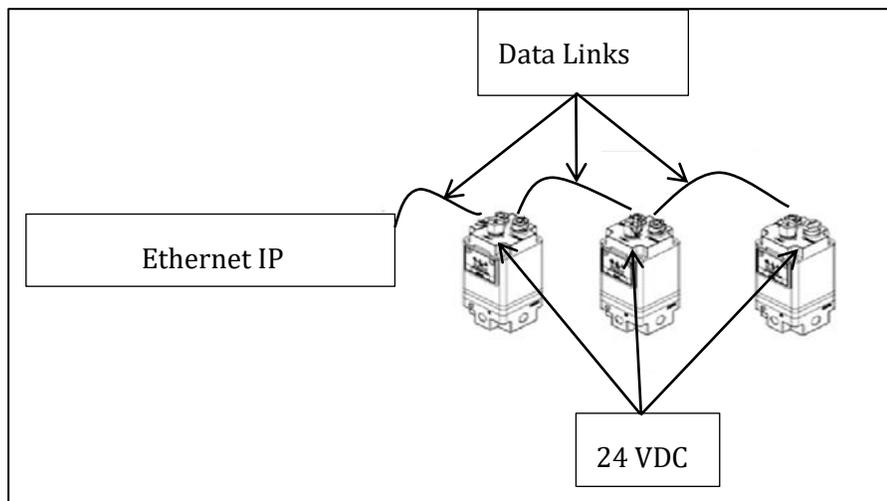


Figure 8 - Example (non-POE) ITV Data and Power Connections

12.1. SMC ITV POE Summary

The Power Over Ethernet (POE) feature is an *optional* way to power ITV units eliminating the need to run a power cable to all ITVs. When POE is enabled, power is provided to the ITV by the “**Bus In**” cable. The ITV factory *default* condition is **POE disabled**.

⚠ Caution

The POE on the ITV does not use the PoE 802.3 standard and therefore is not compatible with these devices. The ITV Power Over Ethernet (POE) implementation is unique to the SMC ITV. Do **NOT** operate other devices using the ITV POE. Do **NOT** use POE from other devices to operate the ITV. By default, POE is **DISABLED**. Be sure that you **FULLY** understand this section **BEFORE** enabling POE on your ITV network.

12.2. Configuring POE

POE is enabled or disabled using the “Enable POE” checkbox on the network tab. Login to the ITV and press the “Network” menu item. The “Enable POE” check box is highlighted in the example below.

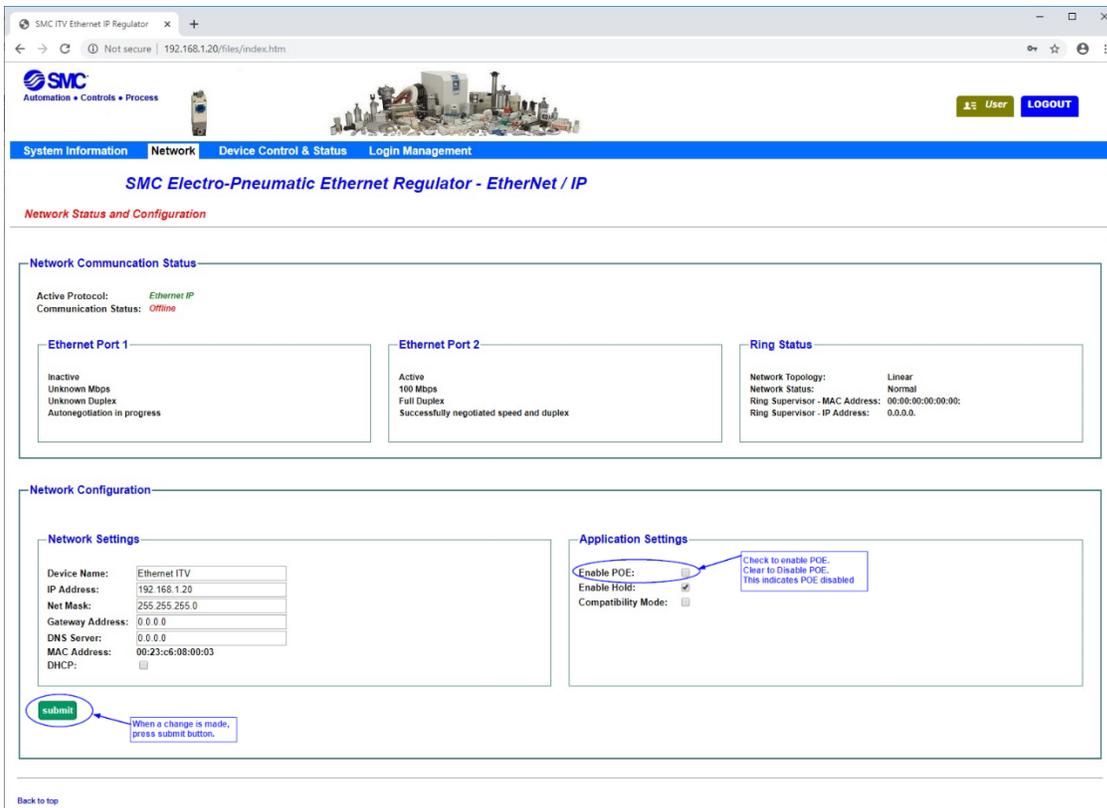


Figure 9 ITV in POE Mode

To change the POE state of an ITV, press “**Submit**”, or the keyboard **Enter** key. The ITV will turn on POE and store this state. The ITV now has the “**Bus Out**” connection changed to the POE state indicated by the “Enable POE” checkbox: **enabled** – 24 VDC **on** (checked) or **disabled** – 24 VDC **off** (unchecked).

12.3. Connecting ITVs for a POE Group

The cable connections are critical for proper operation of POE. The following is an example of proper POE cable connections.

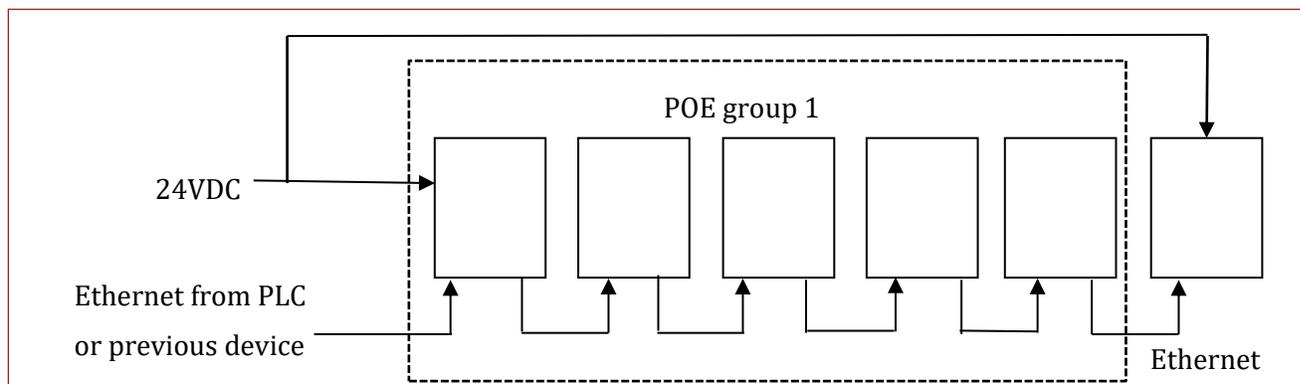


Figure 10 - ITV POE Group Ethernet Connections

The diagram illustrates the Ethernet communication and 24 VDC power cable connections required to support 6 ITVs when Power Over Ethernet (POE) is in use. The ITVs in the dashed box form a single POE group. Note that POE supports a **maximum** of five (5) ITVs in one POE group.

The following rules **MUST** be followed for proper operation of POE:

- 1) Ethernet cable from the PLC or other device (source) must be connected to the “**Bus In**” on the first ITV in a POE group.
- 2) Ethernet cable between the ITVs within the POE group must be connected between the “**Bus Out**” port of the **upstream** ITV and the “**Bus In**” port of the **downstream** ITV for **ALL** ITVs.

Caution

NEVER connect “**Bus Out**” of an ITV which has POE Enabled to **ANYTHING** other than “**Bus In**” of another ITV. “**Bus Out**” of a POE Enabled ITV provides a 24 VDC power source for the next ITV. Failure to follow this precaution can result in equipment damage.

- 3) A maximum of 5 ITVs is allowed in each POE group.
- 4) The “**Bus Out**” port on the last ITV (**POE disabled**) in the group may be connected as the **communication source** to a downstream device.
- 5) The first ITV within a POE group **must** have a power connection to a 24 VDC power supply. The first ITV is the **ONLY** ITV in the group with a connection to the 24 VDC power supply.
- 6) Every ITV in the group (**EXCEPT THE FINAL ITV**) **MUST** have POE **ENABLED**. The **FINAL** ITV **MUST** have POE **DISABLED**.

Caution

POE for the FINAL ITV in a ITV POE group **must be** disabled for proper operation.

- 7) A power supply connection is **required** for the first ITV following a POE group.
- 8) Multiple POE groups can be connected together, and the number of ITVs in each POE group can vary as necessary (maximum of 5 ITVs per group).

13. **Hold on Connection Loss**

Hold on Connection Loss - checkbox is used to control ITV behavior in the event Ethernet communication is lost to the PLC. If Ethernet communication is lost when checked and the ITV is powered, the ITV will continue to actively regulate to the previous pressure setpoint. If Ethernet communication is lost with unchecked and the ITV is powered, the ITV will set the pressure setpoint to 0 and the output pressure will be immediately exhausted. **Note: If power is lost, the ITV will stop actively regulating to the setpoint. This does not mean the pressure will drop to zero.**

14. **Compatibility Mode**

Compatibility Mode - checkbox is checked, it will allow for the DUX02357 ITV to simulate the DUQ00833 v2.2 configuration. This allows the DUX02357 to be used on a machine that was originally programmed for the DUQ00833 ITV without having to be reprogrammed. Basically, you can retrofit a DUX in for a DUQ. **Note: If compatibility mode is selected the ITV will not work with the DUX EDS file.** When the compatibility checkbox is changed, press “submit”, or the keyboard

Enter key and the ITV will automatically reboot. Note: Pressure or vacuum control will be interrupted during the rebooting process. Other changes to network configuration may not be stored at the same time as changing to or from compatibility mode.

15. Setpoint and Feedback

Standard PLC Output Control Signal formatting (Setpoint)															
INT 0															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Byte 0 - SINT								Byte 1 - SINT							
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
LSb	Control Signal										MSb	Ext	X	X	X

Note: "Ext" Used for extending the pressure range above 100% full scale

Standard PLC Input Control Signal formatting (Feedback)																															
INT 0																INT 1															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Byte 0 - SINT								Byte 1 - SINT								Byte 2 - SINT								Byte 3 - SINT							
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
L	Feedback								M	E	X	X	X	Diagnostics																	

Note: "E" Allows for to showing pressure greater than 100% full scale

16. Byte Swap

Byte Swap – This is a legacy feature to match byte swap feature on the DUQ version of the ITV. When box is checked, it will byte swap input and output into the ITV. Table below shows how this works.

	No Byte Swap - Little Endian						Byte Swapped - Big Endian								
Output	Byte	0	1				Byte	1	0						
Input	Byte	0	1	2	3		Byte	1	0	3	2				

17. *Pressure In-range Window Diagnostic*

This diagnostic will monitor the pressure feedback and determine if it is outside of a window pressure range for a specified elapsed time. If it is, then an error flag is set called Window Error, else the Window Error flag is cleared as the pressure is within the in-range pressure window. This is a useful feature to test if you achieved or are maintaining the setpoint.

17.1. **Configuring the in-range window**

In-range diagnostic is an always enabled feature. The defaults are already set at the factory and only need to be changed if a different response is desired. The in-range window is configured by adjusting the User Gain and User Sensitivity values on the Device Control & Status web page (also via explicit messaging). Note: Changing the Gain and Sensitivity will also change the responsiveness of the ITV.

For User Gain: Default is 8 which is a timeout of about 5 seconds

User Gain = 0 is a 10 second timeout.

User Gain = 15 is a 1 second timeout.

The timeout time is linear between the User Gain values of 0 to 15.

For User Sensitivity: Default is 2 which is about 2%

User Sensitivity = 0 is 1% of full scale.

User Sensitivity = 7 is 5% of full scale.

The percentages are linear between the User Sensitivity values of 0 to 7.

18. *Setpoint and Feedback*

Setpoint is the requested value for the ITV's regulated pressure or vacuum output. An external master (typically a PLC) sends the setpoint value to the ITV, either in counts or engineering units. Counts is the default of the ITV. The full-scale pressure range of the ITV is scaled across 12bit (0-4095). Example: Mid pressure for an ITV would be 2048. During machine start up or troubleshooting, the ITV web page can be used to enter a setpoint values.

This version of the ITV supports not only counts but also various types of engineering units as pressure set point and pressure feedback values. This ITV supports Counts, kg/cm², BAR, PSI, kPa and, MPa as acceptable pressure set point units. Caution - Changing unit type should be done when setpoint is zero as current setpoint will be interpreted as the new unit type. This could cause the pressure to go to max pressure.

18.1. **Counts as Setpoint**

Counts can be used to control the ITV pressure. The master device sends counts to the ITV for the desired pressure. The ITV will then report the current pressure feedback value to the master device in counts. The count range is 0 to 4095 (12 bits). The count range is the same for all ITVs. The maximum pressure or vacuum corresponds to 4095 counts. For example, an X010 ITV body size has a pressure range from 0 to 0.1 MPa. The maximum pressure would correspond to 4095 counts.

A 16-bit value must be sent to the ITV. The lower or least significant 12 bits represent the count value. Counts sent to the ITV for a desired pressure or vacuum output must be scaled to an integer value between 0 and 4095.

The “Maximum Pressure Scaling Formula” for converting pressure to counts is:

$$\text{Counts} = \left(\frac{\text{desired pressure}}{\text{maximum pressure}} \right) \times 4095$$

Some of the typical pressure unit types are precalculated below in the table. If another type is need counts can also be determined by using the “Scale Factor Formula”:

$$\text{Counts} = \text{desired pressure} \times \text{scale factor}$$

The following table shows some precalculated the scale factors for the ITV body types and pressure units

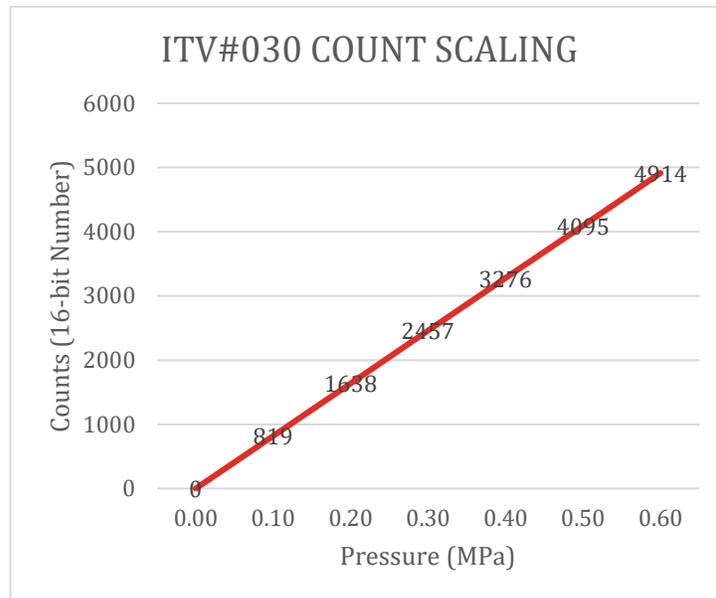
Pressure Body Type	MPa	kg/cm2	Bar	PSI	KPa
X010	40950.0	4014.70	4095.0	282.33	40.95
X030	8190.0	802.94	819.0	56.46	8.19
X050	4550.0	446.07	455.0	31.37	4.55
2090 (Vacuum)	-51187.5	-4993.90	-5118.75	-352.92	-51.18

Figure 11 - ITV Scale Factors

For example: The desired output pressure is 10 PSI for an X030 ITV. From the table, the scale factor for this body type is 56.46. Use the “Scale Factor” formula to obtain the count value.

$$\text{Counts} = 10 \times 56.46 = 564.6 \cong 565 = 0x0235$$

The calculated count value must be rounded if necessary and converted to hexadecimal.



18.2. Counts as Feedback

A 16-bit value is received from the ITV. The upper 4 bits are 0. The lower 12 bits represent the count value. The count value indicates the current pressure output of the ITV. The inverse of the setpoint scaling factor is used to determine the feedback in the unit type selected. The count value can be converted to pressure units using the following formulas:

“Maximum Pressure Scaling Formula” (using ITV Scale Factors):

$$\text{Feedback Pressure} = \left(\frac{\text{counts} \times \text{maximum pressure}}{4095} \right)$$

“Scale Factor Table Formula” (using ITV Scale Factors):

$$\text{Feedback Pressure} = \frac{\text{counts}}{\text{scale factor}}$$

18.3. Using engineering units

Engineering units can be selected from either the webpage or explicit messaging. Below is how to set the ITV to engineering unit mode using the webpage. Refer to Explicit Messaging to config from the PLC. Note: Changing to and from engineering mode should be done without a setpoint command.

1. Select Engineering Unit Mode from the Device Control and Status web page
2. Select the engineering unit desired by selecting the radio button corresponding to the desired unit type.
3. Check Engineering Unit Check Box
4. Click Submit – Changes will be made immediately. The selected engineering unit will be stored in internal memory and will be retained permanently, even if power is cycled, until a different unit is selected using procedure 1-3 above.

18.4. Scaling the engineering units

The engineering units are scaled to use integer math and as a result require a multiplier to be used when sending the pressure set point of the desired engineering unit type. The multiplier used depends on what type of ITV unit is being communicated with and what type of engineering unit is selected. Please see the tables below for a full description with an example following –

ITV Unit Type - 0.1 MPa						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
Multiplier	100000	10000	10000	1000	100	See Section 18.1

ITV Unit Type - 0.5 MPa						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
Multiplier	100000	10000	10000	100	100	See Section 18.1

ITV Unit Type - 0.9 MPa						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
Multiplier	10000	1000	1000	100	10	See Section 18.1

ITV Unit Type - -80 kPa (vacuum unit)						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
Multiplier	100000	10000	10000	1000	100	See Section 18.1

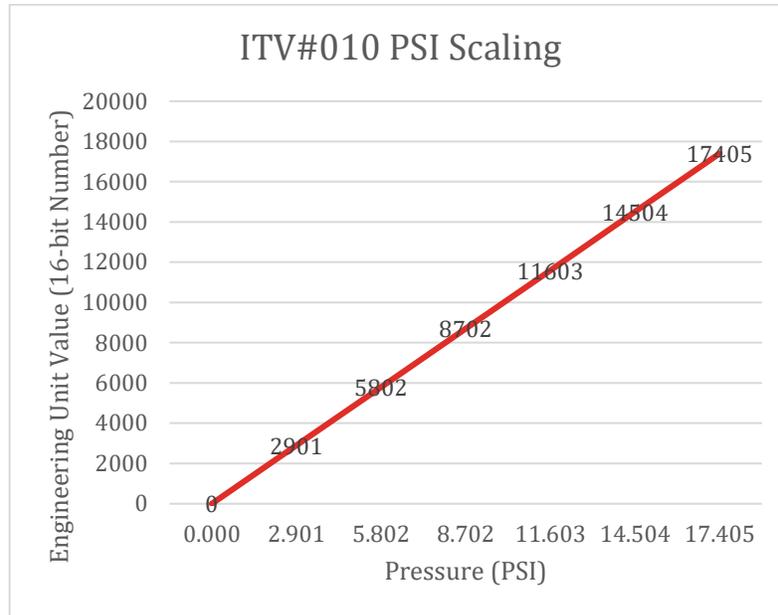


Figure 12 – PSI Engineering Unit Scaling Example for 0.1MPa Range ITV

Example: Suppose you have a 0.9 MPa ITV unit and you want to use PSI engineering units. The range of the unit in PSI is 0.03 PSI to 130.53 PSI. Making sure the engineering units are enabled with PSI selected, then if you wish to send 82.4 PSI refer to the table above for 0.9 MPa unit noting the multiplier for PSI - as you can see, it is 100; so multiply 82.4 by 100 and you get 8240. Set the setpoint to 8240 (0x2030). Remember, you need to know what to multiply the set point by for engineering units and that is determined by what ITV unit type you're using and what engineering units you wish to send.

18.5. Engineering Units as Feedback

When an engineering unit is selected as outlined above, the unit type that was selected will be the units used for the pressure feedback. As with the pressure set point multiplier that was needed to be applied, the same multiplier will need to be applied on the pressure feedback. Example: if the ITV unit is a 0.5 MPa unit and the units selected is kPa, then the multiplier is 100. So, if the feedback value is 3825, then the pressure feedback is $3825/100$ or 38.25 kPa.

18.6. 120% for Full-Scale

The calibrated range of the ITV is the full-scale value/marked value. This ITV's range can extend beyond the 100% mark all the way to 120% of full scale. Therefore, this ITV can deliver pressures well beyond the calculated 100% of full-scale mark. Please note, the accuracy is not guaranteed beyond the full-scale value. An example of where this could be useful is a process valve rate for 15PSI. Normally a 0.5Mpa ITV would be needed to meet the 15 PSI max pressure of the process valve. Now a 0.1Mpa ITV could be used gaining 5 times better precision control of the process valve. Please see table below for the overall values that can be set and measured for this ITV (all values between 100% to 120% are linear) – Note 120% of the vacuum regulator is an impossibility as there is not enough difference in the vacuum pressure for the ITV to function correctly.

ITV Unit Type – 0.1 MPa						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
100%	0.1	1.0197	1	14.5038	100	4095
120%	0.12	1.2236	1.2	17.4046	120	4914
TV Unit Type – 0.5 MPa						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
100%	0.5	5.0986	5	72.5189	500	4095
120%	0.6	6.1183	6	87.0227	600	4914
ITV Unit Type – 0.9 MPa						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
100%	0.9	9.1775	9	130.534	900	4095
120%	1.08	11.013	10.8	156.6408	1080	4914
ITV Unit Type – -80 kPa (vacuum unit)						
Engineering Units	MPa	Kg/cm ²	BAR	PSI	kPa	Counts
100%	0.08	0.8158	0.8	11.603	80	4095
120%	0.096	0.9790	0.96	13.9236	96	4914

19. Sensitivity and Gain

These parameters can be found on the Device Control & Status webpage. They can also be set via explicit messaging.

19.1. User Sensitivity

Sensitivity is a relative measure of response to changes in a control system. In this case it controls how sensitive the ITV will be to pressure changes. The valid range for sensitivity is 0-7, where 0 is the most sensitive and 7 is the least sensitive. The default sensitivity is 2. Changing the sensitivity will change the pressure correction operation near the set pressure point. The lower the sensitivity number, the more precise the ITV will try to maintain the setpoint. Sometimes lowering the sensitivity number too much can cause the ITV to hunt and be less precise. The larger the sensitivity number, the less likely hunting will occur, but the precision will be reduced.

19.2. User Gain

Gain is a measure of how quickly the unit will respond for a given change in pressure. The valid range for gain is 0-15, where 0 is no gain and 15 is the most gain possible. The default gain is 8. Increasing the gain will decrease response time but increase the possibility of overshoot to pressure changes. Excessive gain can lead to oscillating corrections in pressure, resulting in unstable pressure control. Decreasing the gain can ensure damped response to pressure changes but increases the response time.

20. LED Indicators

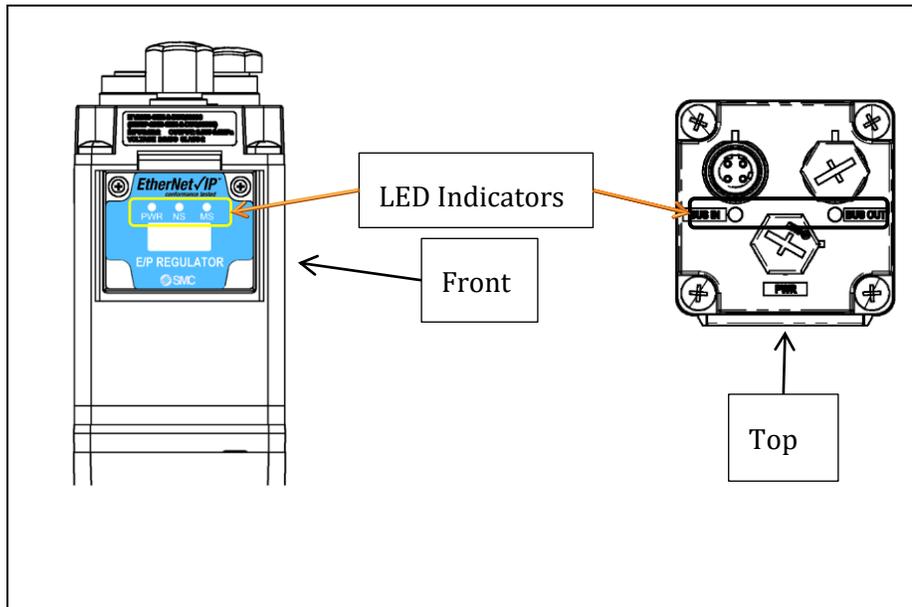
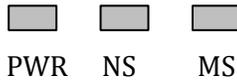


Figure 13 - ITV LED Placement

Front LED Indicators



LED	LED Status	Description
PWR	 OFF	Load voltage for the ITV is not supplied.
	 Green ON	Load voltage for the ITV is supplied.
	 Red ON	Load voltage for the ITV is outside the tolerance range (24 VDC \pm 10%).
NS	 OFF	The ITV operating voltage is not supplied, or the ITV is in DHCP mode with NO valid IP address set.
	 Green ON	Communication established.
	 Green flashing	Idle link.
	 Red flashing	Communication time out.
	 Red ON	IP address duplicated.
MS	 OFF	The ITV operating voltage is not supplied.
	 Green ON	Operating normally – communication in progress.
	 Green flashing	Operating normally – idle link.
	 Red flashing	Recoverable error.
	 Red ON	Unrecoverable error.

Figure 14 - ITV Front LED Indicator Status Key

Top LED Indicators

BUS IN BUS OUT



LED		LED Status	Description
Bus In / Bus Out		Off	Load voltage not supplied, terminal is not connected to another operating device, or terminal failed
Bus In / Bus Out		Green ON	Terminal is connected to another operating device
Bus In / Bus Out		Yellow Flashing	Intermittently blink yellow - data transfer in progress

Figure 15 - ITV Top Bus Connection LED Indicator Status Key

21. Built in Web Server

The built-in webserver can provide useful information about the ITV along with allowing for simple configuration of the ITV's features. The webpage is also a great debugging tool for checking the status of the ITV along with being able to command the ITV directly. The webpages are password protected to prevent accidentally changing the settings. The default login information is username "user" and password "user". All the webpages are dynamic and update every second with the latest information.

21.1. System Information Tab

Enter the IP address of the ITV into your internet browser as shown below (Default address is 192.168.1.20).

The "System Information" page will open. Select and press "**Login**" button at the upper-right corner to open the login web page. Enter "**user**" for both the Username and the Password and then press "**Submit**" button. Logging in with user privileges allows the user to change the network configuration and control the ITV. After User has logged in successfully, the System Information web page will be displayed, as shown below. Note that the Login Management web page is now accessible. The Device Status web page are changed to Device Control & Status web page to allow the user to control the ITV. The Network web page now allows the user to change the network configuration.

System Information Network Device Control & Status Login Management

SMC Electro-Pneumatic Ethernet Regulator - EtherNet / IP

System General Information

Network

Protocol:	Ethernet IP
Device Name:	Ethernet ITV
IP Address:	192.168.1.20
Net Mask:	255.255.255.0
Gateway Address:	0.0.0.0
DNS Server:	0.0.0.0
MAC Address:	00:23:c6:08:00:01
DHCP Active:	No

Manufacturing Information

Firmware Version:	3.200
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Contact

<p>Production Information</p> <p><i>For more information about SMC production, please contact:</i></p> <p>Phone: 1.800.SMC.SMC1 Email: insidesupport@smcusa.com Webpage: www.smcusa.com</p>	<p>Technical Support</p> <p><i>If you need technical support, please contact:</i></p> <p>Phone: 1.800.SMC.SMC1 Email: aeg@smcusa.com</p>
--	--

Figure 16 - ITV System Information web page

The **“Network”** section displays the current ITV network communication settings. Some of these settings can be changed by logging into the ITV. See the instructions on the Network Page.

The **“Manufacturing Information”** display the version of SMC firmware. Please make note of this information if contacting SMC for technical support.

21.2. Network Tab

When **Network** is selected, the Network page will be displayed to show the communication and connection status of the ITV. On this page login, network configuration and operating parameters can be changed.

System Information | **Network** | Device Control & Status | Login Management

SMC Electro-Pneumatic Ethernet Regulator - EtherNet / IP

Network Status and Configuration

Ethernet Port 1

Active
100 Mbps
Full Duplex
Successfully negotiated speed and duplex

Ethernet Port 2

Active
100 Mbps
Full Duplex
Successfully negotiated speed and duplex

Ring Status

Network Topology: Linear
Network Status: Normal
Ring Supervisor - MAC Address: 00:00:00:00:00:00
Ring Supervisor - IP Address: 0.0.0.0

Network Configuration

Network Settings

Device Name:

IP Address:

Net Mask:

Gateway Address:

DNS Server:

MAC Address:

DHCP:

Application Settings

Enable POE:

Enable Hold:

Compatibility Mode:

Byte Swap:

Please submit the changes.

Figure 17 - ITV Network web page

Network Communication Status - displays connection information for Ethernet Port 1, Ethernet Port 2 and Ring Status. From Figure 17 - ITV Network web page you can see Ethernet Port 1 is active at 100Mbps.

Network Configuration - area allows you to configure the following network related Items. When all items are modified, press **“submit”**, or the **Enter** key for the changes to take effect. These changes will take effect immediately.

Device Name - This is a nice electronic way to label the ITVs location on the machine.

IP Address - The default is 192.168.1.20. You can set IP Address for the ITV here. It must be unique on a network or subnet. A new IP Address will take effect immediately when you press "Submit" or the keyboard Enter key. Make sure to update the address in the browser to match the new IP address if you want to continue using the webserver.

Netmask - The default is 255.255.255.0. The netmask limits the traffic the ITV must process. Good networking practices should be followed.

Gateway Server - The default Gateway address is 0.0.0.0. If the ITV is not connected to a Gateway Server, the Gateway Server should be left as 0.0.0.0. If another address is specified, the ITV will attempt to use the indicated Gateway Server to manage network communication.

DHCP - The default setting is disabled. Enable to use a DHCP server to set the network configuration for the ITV.

DNS Server - If the ITV is not connected to a DNS (Domain Name System) Server, the DNS Server should be left as 0.0.0.0. If another address is specified, the ITV will attempt to use the indicated DNS Server to manage network communication.

Application Settings - area allows you to configure the following network related Items.

Enable POE - checkbox is used to control Power Over Ethernet feature. When the checkbox is checked, POE is enabled. When the checkbox is unchecked, POE is disabled. Follow the instructions in_SMC ITV POE Summary. If the instructions are not properly followed, changing the state of POE may result in undesired performance, abnormal equipment operation, or product damage.

Hold on Connection Loss - checkbox is used to control ITV behavior in the event Ethernet communication is lost to the PLC. If Ethernet communication is lost when checked and the ITV is powered, the ITV will continue to actively regulate to the pervious pressure setpoint. If Ethernet communication is lost with unchecked and the ITV is powered, the ITV will set the pressure setpoint to 0 and the output pressure will be immediately exhausted.

Note: If power is lost, the ITV will stop actively regulating to the setpoint. This does not mean the pressure will drop to zero.

Compatibility Mode - checkbox is checked, it will allow for the DUX02357 ITV to simulate the DUQ00833 v2.2 configuration. This allows the DUX02357 to be used on a machine that was originally programmed for the DUQ00833 ITV without having to be reprogrammed. Basically, you can retrofit a DUX in for a DUQ. **Note: If compatibility mode is selected the ITV will not work with the DUX EDS file.** When the compatibility checkbox is changed, press "submit", or the keyboard Enter key and the ITV will automatically reboot. Note: Pressure or vacuum control will be interrupted during the rebooting process. Other changes to network configuration may not be stored at the same time as changing to or from compatibility mode.

Byte Swap - This is a legacy feature to match byte swap feature on the DUQ version of the ITV. When box is checked, it will byte swap input and output into the ITV. Table below shows how this works.

21.3. Device Control and Status Tab

When Device Status (without login) or Device Control & Status (with login) on the menu is selected, Device Status / Device Control & Status web page will be displayed.

System Information	Network	Device Control & Status	Login Management
SMC Electro-Pneumatic Ethernet Regulator - EtherNet / IP			
<i>Device Control Parameter Setup and Status</i>			
ITV Regulator Control Parameter Setup (Vacuum)			
Pressure Unit:	<input checked="" type="radio"/> MPa	<input type="radio"/> Kg/cm ²	<input type="radio"/> Bar
	<input type="radio"/> PSI	<input type="radio"/> KPa	<input checked="" type="radio"/> Count
Current Pressure:	3000 Counts		
Pressure Setpoint:	<input type="text" value="3000"/> Counts		
Override PLC Control :	<input type="checkbox"/>		
Engineering Unit Mode :	<input type="checkbox"/>		
<input type="button" value="submit"/>			
ITV System Status			
System Fault:	<input checked="" type="checkbox"/>		
Bus Fault:	<input checked="" type="checkbox"/>		
Voltage Out of Range:	<input checked="" type="checkbox"/>		
Pressure Error:	<input checked="" type="checkbox"/>		
Input Signal Error:	<input checked="" type="checkbox"/>		

Figure 18 - ITV Device Control and Status web page

On this web page, the current ITV pressure or vacuum value will be displayed dynamically based on the pressure unit selected. The page also shows ITV system status and ITV supply voltage dynamically. This page allows the user to override PLC control, change pressure units, enable or disable the pressure engineering unit mode, and change user gain and user sensitivity:

Pressure Unit – Used to display the pressure in counts or the engineering unit desired. If Engineering Unit Mode enable this will also select the engineering unit type.

Current Pressure – This is the current feedback pressure from the ITV in the unit type selected above.

Pressure Setpoint – Shows the current setpoint set via the PLC unless the Override PLC Control is enabled. If the pressure setpoint value entered is legitimate, the ITV will regulate to this new pressure or vacuum. The pressure displayed on the Current Pressure box will change to the new regulated pressure value.

If the pressure setpoint value is out of range, the entered data and the title of “**Pressure Setpoint**” will be displayed in red and a note in red on the right side of the data entry will be displayed to indicate the data of the legitimate range. When the pressure setpoint value is out of range, the user cannot submit the pressure setpoint and will get an error message “*Parameter setup error. Please correct the error and submit it again*” on the web page.

Override PLC Control - If the checkbox is unchecked, the ITV is controlled externally (typically from a PLC). When the ITV is externally controlled, the user cannot set the ITV pressure or change the pressure units from the web page. When the Override PLC Control checkbox is changed, press “**submit**” button for the change to take effect. When the Override PLC Control checkbox is changed, press “**submit**” button for the change to take effect.

Changing ITV control from the master to the web page (checking the Override PLC Control checkbox) gives the user control of the ITV. There is no pressure change until the user enters a pressure setpoint in the Pressure Setpoint box.

Changing ITV control from the web page to the master (clearing the Override PLC Control checkbox) gives the master device control of the ITV. There may be an immediate pressure change to the pressure setpoint sent from the master device.

Note: Override PLC Control will be disabled when the user exits this page.

Engineering Unit Mode - This is a checkbox to allow the user to change pressure engineering unit configuration of ITV from the web page. If this checkbox is checked, the user can change the engineering unit from the web page by selecting a pressure unit for the set of radio buttons of Pressure Unit. If this checkbox is unchecked, the user cannot change the engineering unit from the web page.

User Gain. This is a data entry box for entering the user gain. When the value of the user gain is changed, press “**submit**” button for the change to take effect.

If the user gain value entered is legitimate, the user gain will be submitted to the ITV for pressure or vacuum regulation.

If the user gain value is out of range, the entered data and the title of “**User Gain**” will be displayed in red and a note in red on the right side of the data entry will be displayed to indicate the data legitimate range. When the user gain value is out of range, the user cannot submit the pressure setpoint and will get an error message “*Parameter setup error. Please correct the error and submit it again*” on the web page.

User Sensitivity. This is a data entry box for entering the user sensitivity. When the value of the user sensitivity is changed, press “**submit**” button for the change to take effect.

If the user sensitivity value entered is legitimate, the user sensitivity will be submitted to the ITV for pressure or vacuum regulation.

If the user sensitivity value is out of range, the entered data and the title of “**User Sensitivity**” will be displayed in red and a note in red on the right side of the data entry will be displayed to indicate the data legitimate range. When the user sensitivity value is out of range, the user cannot submit the user sensitivity and will get an error message “*Parameter setup error. Please correct the error and submit it again*” on the web page.

21.4. Login Management Tab

When Login Management on the menu is selected, Login Management web page will be displayed. With this web page, the user can change Username and Password. Username and password should be 1-15 alpha-numeric characters. When username or password is changed, press “**Update**” button for the change to take effect.



Figure 29 - ITV Login Management web page

22. Basic PLC Configuration

Configure the PLC for use with the ITV using RSLogix 5000® or Logix Designer™ (version 20 or higher)

When connecting the ITV, using RSLogix 5000® or Logix Designer™ software by Rockwell Automation®, refer to Rockwell Automation® manuals for detailed operation.

1. Example of configuring with EDS file

Select [EDS Hardware Installation Tool] from the [Tools] menu.

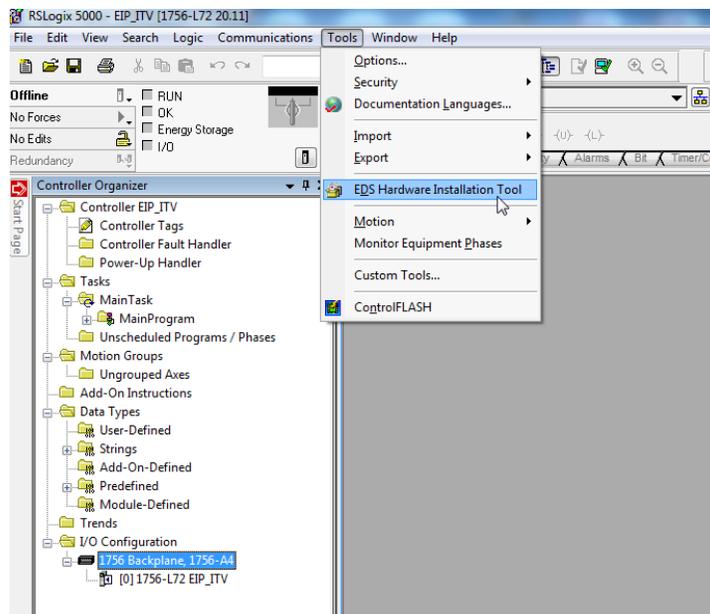


Figure 19 - EDS Hardware Installation Tool

Select [Register an EDS file(s)] from the [Options] menu. Then select [Next].



Figure 20 - EDS Options Menu

Select the EDS file to be installed and select [Next].

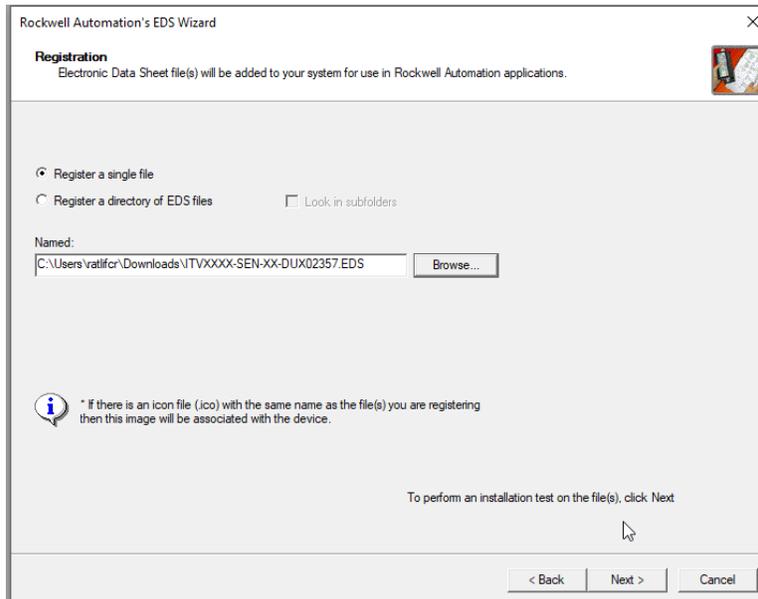


Figure 21 - Select EDS File to Install

Right click on the selection [Ethernet] in the [I/O Configuration] folder and select [New Module].

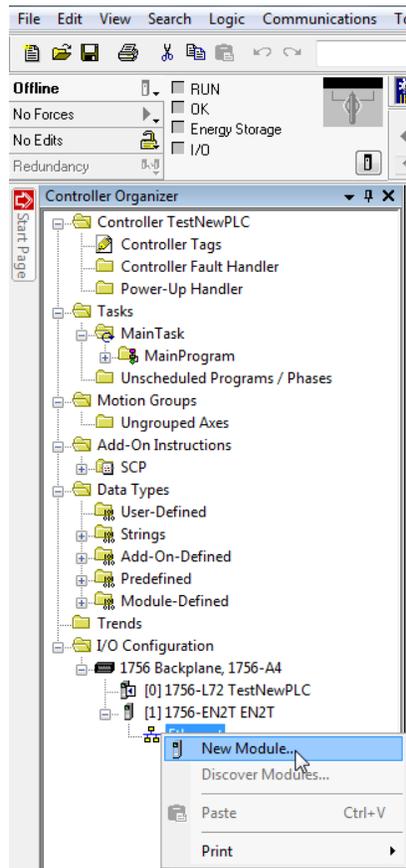


Figure 22 - New Module Selection

The [Select Module Type] screen is displayed. Select [ITVXXXX-SEN-XX-DUX02357] and select [Create].

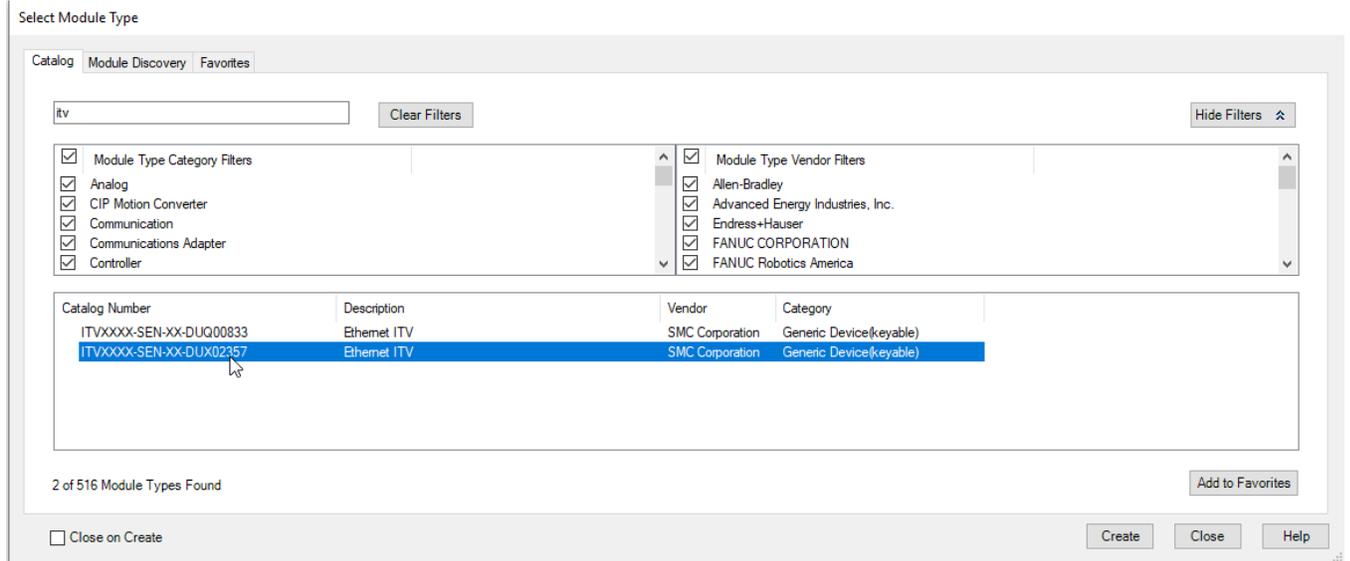


Figure 23 - Select Module Type Screen

When the [New Module] screen is displayed, input the information below.

- (1) Name: Enter the required unit name.
- (2) IP Address: The IP address setting for the unit.
- (3) Change Module Definition
- (4) Set size to "INT"

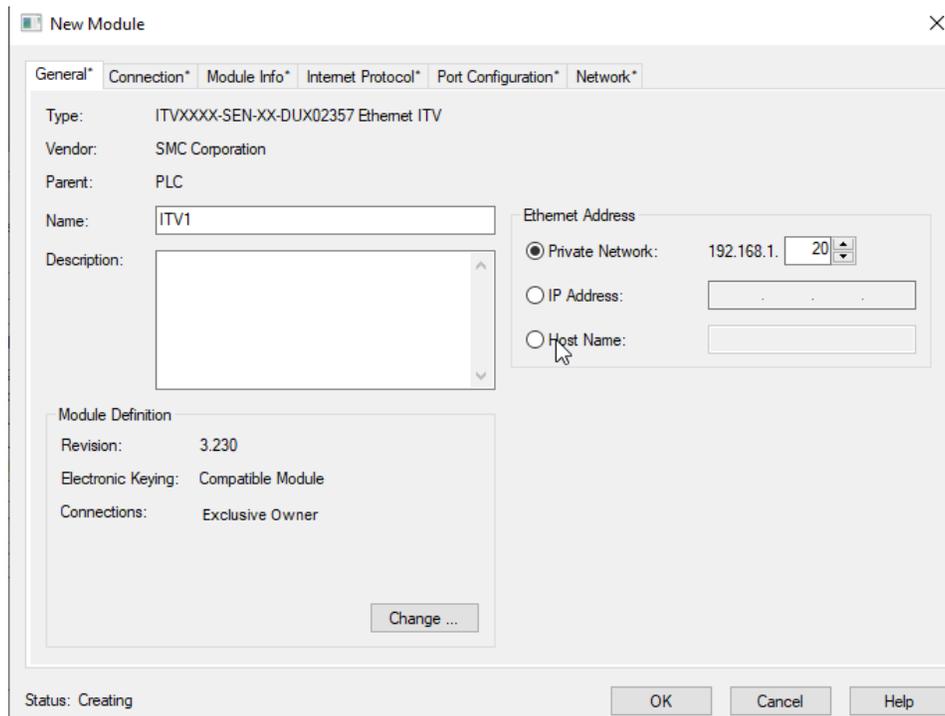


Figure 24 - New Module Screen

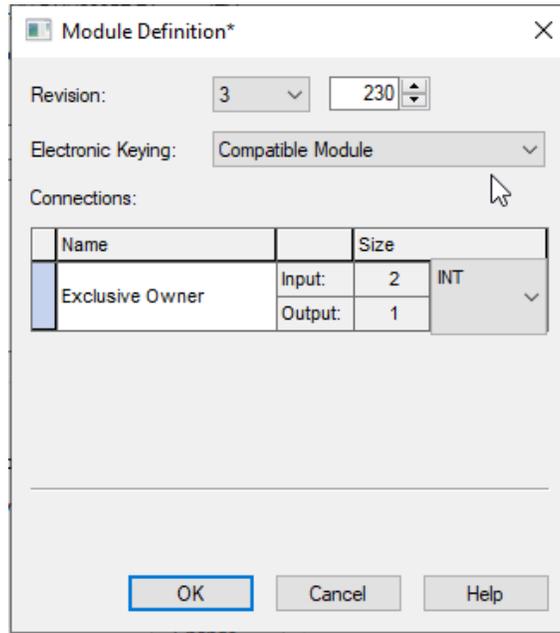


Figure 25 – Module Definition Screen

2. Example of setting using the Generic Ethernet Module

Right-click on the selection [Ethernet] in the [I/O Configuration] folder and select [New Module]. The [Select Module Type] screen is displayed. Select [Generic Ethernet Module] and select [Create]

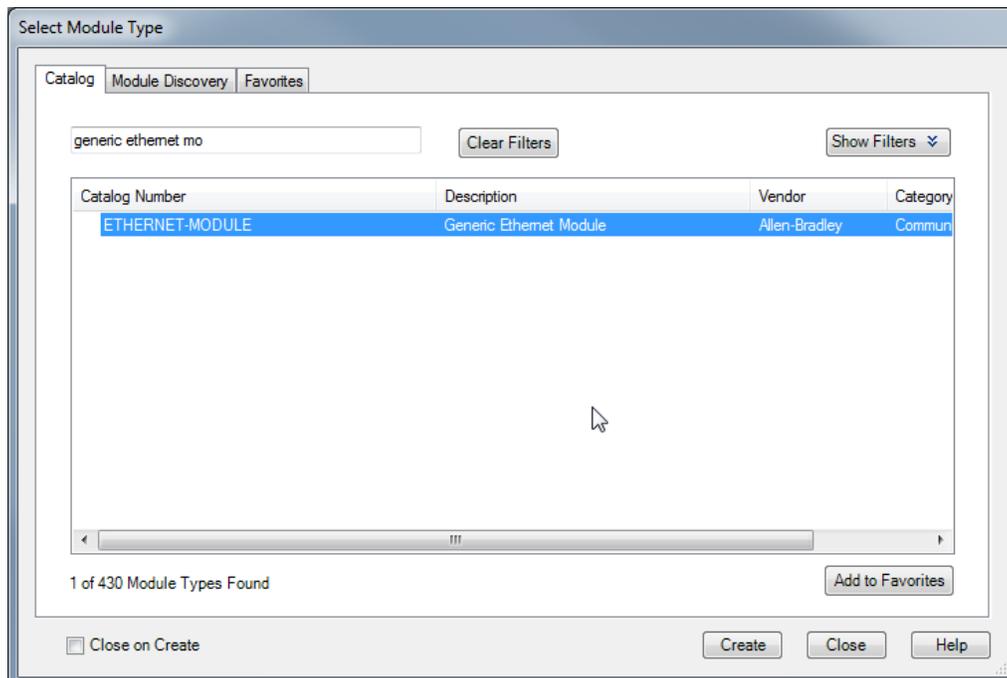


Figure 26 - Select (Register) Module Type

The [Module Properties] screen is displayed, to perform setup.

- (1) Name: Enter the required unit name.
- (2) Select the data format of Comm: Connection Parameters.
- (3) IP Address: Enter the IP address setting for the SI unit.
- (4) Assembly Instance: Perform setting as shown below.

Description	Decimal
Input	150
Output	100
Configuration	105

- (5) Size: Perform setting as shown below.

Description	Decimal	
Common Format	"Data-INT"	"Data-SINT"
Input	2	4
Output	1	2
Configuration	4	4

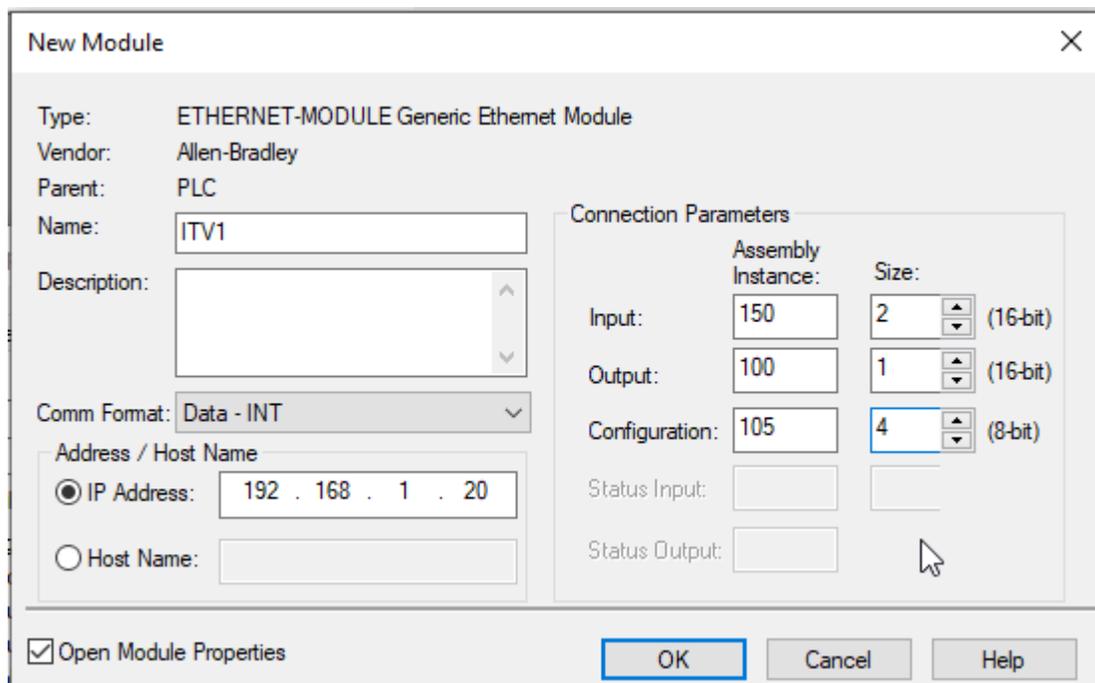


Figure 27 - Module Properties

23. Explicit Messaging

The Ethernet ITV has these explicit messages available. These are useful for programmatically configuring the ITV settings. These options are also useful if using LabVIEW™ software or another programming language that may not have real time implicit libraries readily available. Also, some PLCs do not have implicit messaging. These are additional to all the Ethernet/IPs required default explicit message requirements.

TYPE	Class	Instance	Attribute	Size	Description
Output	100	100	3	2 bytes	Pressure set-point
Input	150	150	3	4 bytes	2 bytes measured position, 2 bytes diagnostics
Output	101	101	3	1 byte	User gain – Refer to User Gain Section
Output	101	102	3	1 byte	User sensitivity – Refer to User Sensitivity section
Output	101	108	3	2 bytes	Configuration
Input	101	109	3	2 bytes	Supply Voltage Engineering units 10x volts (xx.x) Ex. 24.2v equal 242)

Figure 28 Available Explicit Messages

23.1. Diagnostics

Bit	Description	Extended Description	Persistent
0	Setpoint signal error	Setpoint Values out of range - If Setpoint greater than 120% full scale	No
1	Clear zero error	Not going zero within a timely manner	No
2	Pressure error	Output Pressure Greater the 120% full scale	No
3	Non-violate Data Error	Had to restore default as the configuration data was corrupt	Yes
4	Window Error	Not within setpoint and sensitivity in timely manner	No
5	Initializing Status	Set when initializing is occurring	No
6	Integrity Error	Memory Corruption Check	No
7	Not Used	Not currently used	No
8	System Fault	System Fault	No
9	Bus Fault	Network Error	No
10	Voltage Fault	Voltage out of range	No
11	Watchdog Fault	Recovered from watchdog fault	Yes
12-15	Not Used	Not Used	No

Figure 29 Instance 150 Diagnostics

23.2. Configuration

Bit	Description
bit 0	Hold on connection loss
bit 1	POE Enable
bit 2	Enable Engineering units
bit 3	Auto clear faults
bits 7-4	Engineering Units

Figure 30 Config - Class 101 Instance 108 explanation

TYPE	Hex	Bits 7 - 4
Mpa	0x0	0000
kg/cm	0x1	0001
BAR	0x2	0010
PSI	0x3	0011
Kpa	0x4	0100
Counts	0x5	0101

Figure 31 - Config engineering unit types

23.3. Initial Configuration Parameters

Item	Value
IP address	192.168.1.20
Subnet	255:255:255:0
DHCP	Off
Enable POE	Off
Enable Hold	Off
Byte Swap	Off
Pressure Unit	Counts
Engineering Unit	Counts
User Gain	8
User Sensitivity	2
Webpage ID	user
Webpage Password	user

Figure 32 - ITV Initial Configuration

Appendix

24. Explicit Message Example using LabVIEW™ software

It is possible to control the ITV with a LabVIEW™ software program.

The following is a simple example of a LabVIEW™ software block diagram. The program can send a pressure or vacuum setpoint value to the ITV and will read the ITV pressure and status.

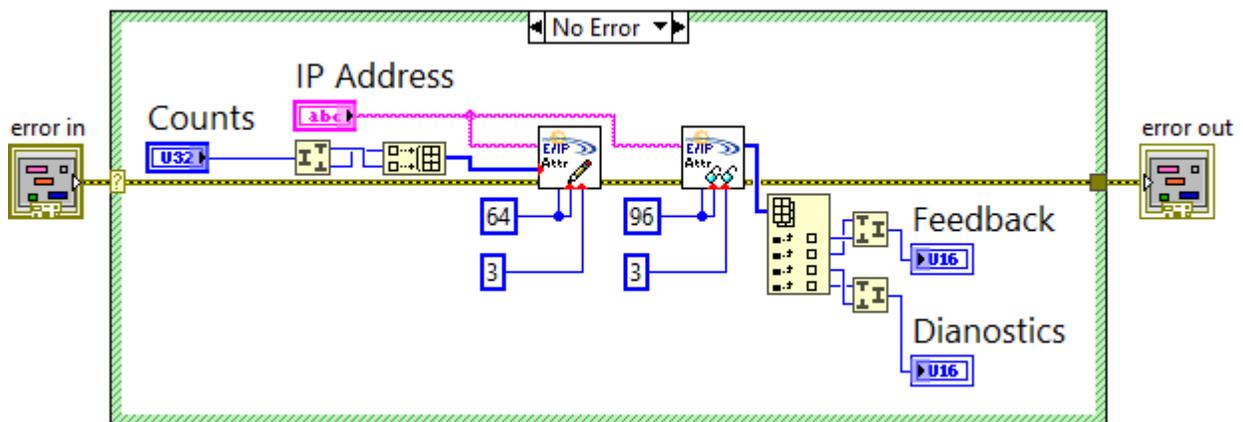


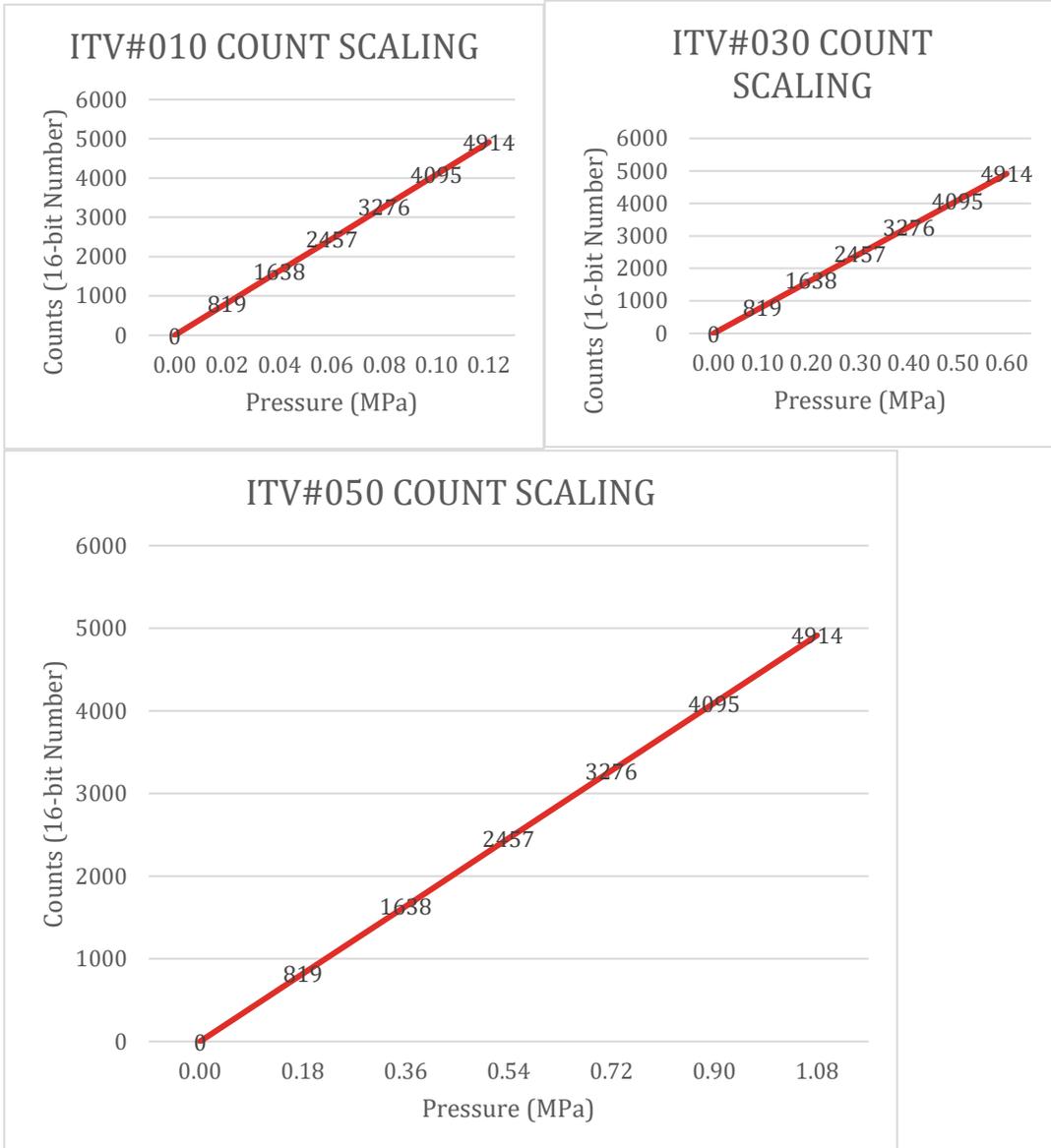
Figure 33 - Sample LabVIEW™ software Block Diagram

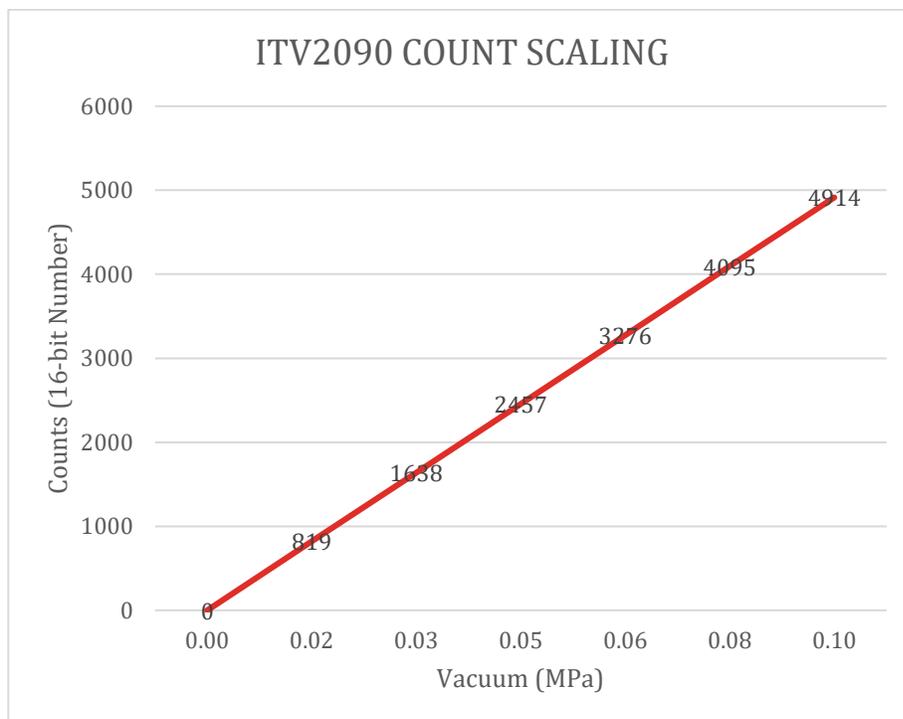
The LabVIEW™ software Industrial Communications library is used to set and get explicit messages to and from the ITV.

25. *Scaling*

Here are some example graphs to help with understanding how to scale the input and output to and from the PLC.

25.1. Counts





26. Troubleshooting

This is a brief set of troubleshooting tools for the SMC Ethernet ITV. The intent of this section is to provide steps that a user can follow to diagnose and correct common issues. This set is by no means exhaustive.

26.1. ITV Does Not Power Up

1. Check power supply. Be sure it is providing 24 VDC \pm 10%. Check the output voltage provided by the power supply using a calibrated voltage meter.
2. Check the power cable. Be sure 24 VDC is available at the ITV connector on the cable pins indicated in the power cable pin-out. Ensure the power cable is securely connected to the ITV. Be sure there are no breaks or cuts in the power cable.
3. If the ITV is being powered using POE, be sure that the requirements of POE are met. In particular, ensure that the upstream ITV has POE enabled and that the Ethernet cable is properly connected to the upstream ITV "Bus Out" connector and the "Bus In" connector of the ITV that doesn't power up.
4. If POE is being used to power the ITV that is not powering up, connect a 24 VDC power supply with a properly configured power cable to the power connector of the ITV. If the ITV powers up, verify POE setting and communication cable from the upstream ITV.
5. If the problem persists, contact SMC Technical Support

26.2. One LED is Red

1. Solid Red **NS LED** indicates a **duplicate** IP address has been detected. The ITV displaying the red NS LED has the same IP address as another device on the network.
2. Solid Red **MS LED** indicates an **unrecoverable error**. Power cycle the ITV.
3. If the problem persists, contact SMC Technical Support.

26.3. Possible Cause: Power LED is Green and NS and/or MS LEDs are flashing Red

1. Flashing Red **NS LED** indicates loss of communication with the master device. Check the LED on top of the ITV (Bus Connector LED).
 - 1.1. If the **Bus Connector LED is OFF**, the physical connection with the master device has been lost. Verify the communication cable connections. Verify that the master device is operating.
 - 1.2. If the **Bus Connector LED is GREEN**, the physical connection is operational. The master device has stopped responding to the ITV. Verify the state of the master device.
2. Flashing Red **MS LED** indicates a recoverable error.
3. If the problem persists, contact SMC Technical Support.

26.4. Possible Cause: Power LED is Red

1. A solid Red **MS LED** indicates a low voltage condition. The voltage is high enough for the ITV to power up but may not be high enough for the ITV to operate properly. Verify the ITV power is within specification.

26.5. Problem: Unable to Communicate with ITV

Symptom: LEDs are Green

ITV does not respond to commands. Power LED is green, NS flashing green, the LED on top of the ITV for the incoming signal is green

Possible Cause: Incorrect IP address

1. Verify that the master device is using the correct IP address for the ITV.
2. If the ITV IP Address is unknown, use the procedure to attempt to determine the IP address of the ITV. Use that IP address to communicate with the ITV.
3. If the problem persists, contact SMC Technical Support for assistance

Symptom: NS LED OFF 1+ Minutes After Power Cycle

ITV does not respond to commands. Power LED is green, NS OFF 1+ minutes after power cycle, LED on top of the ITV for the incoming signal is green

Possible Cause: ITV is in DHCP Mode

1. Verify the ITV is in DHCP mode. Power cycle the ITV. Just after the power cycle, verify NS LED is flashing green. If the **NS LED** turns **off** after about one minute, the ITV is in **DHCP** mode. Follow the instructions in to connect to the ITV.
2. If the problem persists, contact SMC Technical Support for assistance

Symptom: Power is green; LED on top of the ITV for the incoming signal is off.

Note: It is **normal** for a connector LED to be **OFF** if there is no physical connection to another device.

Possible Cause: Connector Not Connected or Not Powered

1. If a communication cable is not connected to the connector associated with the LED, the LED will be off. If this connection is not required, putting a seal cap on the connector is recommended.
2. The cable is not connected to another operating device. Verify the communication cable is properly connected between the other device and the ITV. Also, verify the other device is operational.
3. If the problem persists, contact SMC Technical Support for assistance

26.6. Problem: ITV Web Page Pressure Value Differs from Master Calculated Value

Note: The master device reported pressure is calculated from the pressure count value received by the master from the ITV.

Possible Cause: ITV and Master Pressure Units Differ

The selected pressure unit **displayed on the ITV web page** is **different** from the pressure unit used to **calculate** the pressure value from the counts sent to the **master device**.

1. Confirm the pressure unit displayed on the ITV web page matches the pressure unit used to calculate the pressure value from the counts sent to the master. Also refer to the conversions in [Basic PLC Configuration](#).

Possible Cause: Incorrect Count Calculation

1. Verify the correct formula for calculating pressure is used for determining pressure value. (See the conversions in [Basic PLC Configuration](#)).

Possible Cause: Pressure Change in Progress

1. If the master requested a pressure value change and the ITV has not settled to the new pressure value, the web page may display a different pressure value than the calculated value. Check the pressure value once the ITV has settled to the new pressure value.

Possible Cause: ITV and PLC Use Different Byte Order for Data Transfer

1. Confirm the setting of the “Swap PLC Data Bytes” checkbox on the Network Webpage. Verify the setting matches the master device. The “Swap PLC Data Bytes” checkbox can be changed to see if this corrects the problem.
2. If there is still a problem, contact SMC Technical Support for assistance.

26.7. Problem: ITV Does Not Reach Set Pressure

Symptom: ITV “Buzzes” When Directed to Set a Pressure

Possible Cause: In Inadequate Supply Pressure

1. Verify that supply pressure is at least set at Minimum Pressure (**Set pressure + 0.1 MPa - or Set Pressure - 13.3 kPa** for ITV2090 Vacuum ITVs).
2. If the problem persists, contact SMC Technical Support for assistance.

Symptom: ITV Makes “Hissing” Sound when Operated at Pressure

Possible Cause: Air or Vacuum Leak

1. Verify that fittings are properly installed in the correct ports.
2. Verify that air lines are properly installed.
3. Verify that the air lines are not cut or punctured.

4. Verify that air is not being unexpectedly exhausted from the ITV exhaust port.
5. If the problem persists, contact SMC Technical Support for assistance.

This is not an exhaustive troubleshooting guide. SMC Technical Support may request that you check additional things, depending on the problem experienced.

26.8. Recovering the IP address of the Ethernet ITV

Note: ITVs have a factory preconfigured static IP address (192.168.1.20). Use this procedure when the current IP address of an ITV is unknown.

Power off the ITV

Set all the dip switches down or off or 0.

Power on the ITV

Wait for the MS LED to start to flash green

Power off the ITV

Set the dip switches to all up or On or 1

ITV should now be back to default IP address of 192.168.1.20

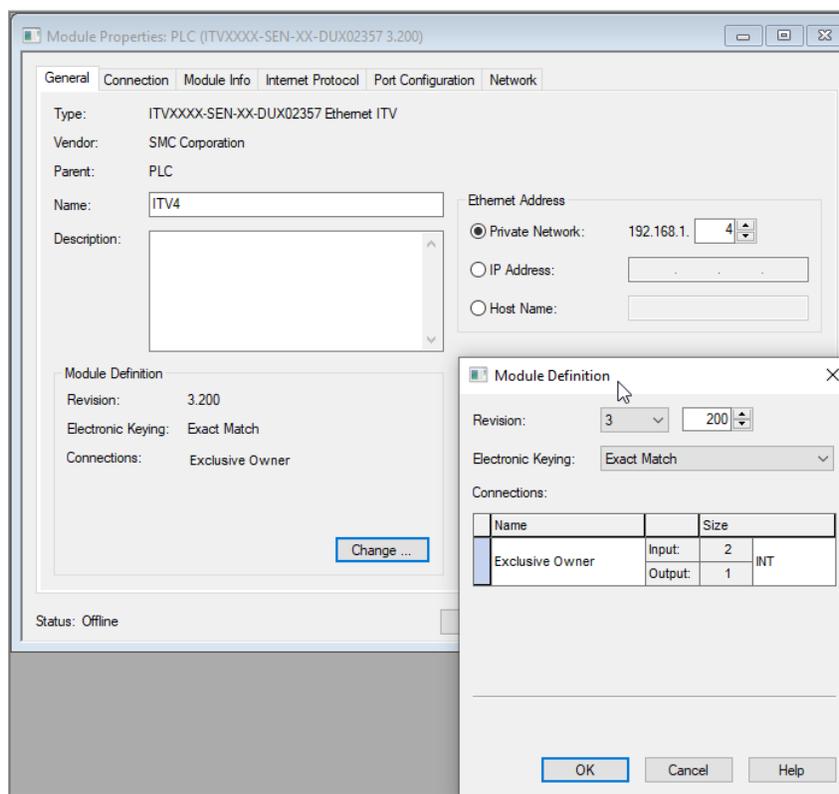


Figure 54:

26.9. Initial Power-up

The ITV web page is the mechanism used to configure an ITV and prepare it for installation. The ITV web page may also be used to operate and control the ITV.

New ITVs come from the factory preconfigured with a unique MAC address which matches the MAC address printed on the label of the ITV. New ITVs have a preset static IP address of 192.168.1.20. Use this IP address initially to access the ITV web page.

Both MAC addresses and IP addresses must be unique on a network. The factory sets the same static IP address for *all* ITVs; therefore, the IP address *may need to be changed* as part of the setup process. The IP address change procedure is discussed in this section.

Connection and Power Up

In order to initially access the ITV web page, you will need the following items

1. One (1) power cable (with a 5-pin female M12 A-Coded connector).
2. One (1) Ethernet cable (with a 4-pin male M12 D-Coded connector on one end and a standard LAN Ethernet cable plugin connector (RJ45) on the other end).
3. A PC with a LAN port. The PC is either directly connected to the ITV using the Ethernet cable in item 2, or it may be connected to the ITV via a separate cable and switch.
4. Web browser installed on the PC. Internet Explorer (IE 9 or later), Chrome, or Firefox are supported.

Connect the Ethernet cable to the “Bus In” port of the ITV. Connect the LAN connector to your PC LAN port or switch.

Turn on the PC (and switch, if used).

Connect the power cable to a 24 VDC power supply and to the ITV

Turn on the 24 VDC power supply.

The ITV should power up, the Power LED should be solid green, and the MS LED should be flashing green. If this does not occur, turn off the 24 VDC power supply or disconnect the ITV power cable. Verify all connections.

26.10. Configuring the PC

As noted, the IP address is initially set statically in the factory to 192.168.1.20. This is an address on subnet 1.

In order to access the ITV web page, the PC must also be configured to use subnet 1. The following steps (using Windows 7 – other versions of Windows may differ) describe how to set the PC to subnet 1. Note: If the PC is already configured to use subnet 1, you may skip this section.

This procedure assumes that you have appropriate access privileges on your PC. If not, please consult your PC Administrator.

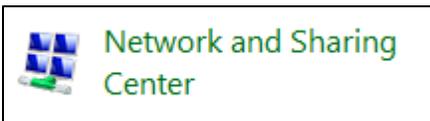
Bring up the Network and Sharing Center using the Control Panel from the Start menu:



First, select the **Start** button on your PC toolbar



Next, select Control Panel on the Start Menu



Finally select Network and Sharing Center on the Control Panel menu.

Your **Network and Sharing Center** will depict the specific network configuration for your PC and its network(s). As a result, your view may be somewhat different from the following window. If you have questions, please review the documentation for your PC. If you have additional questions, please consult your PC or Network Administrator for information and assistance.

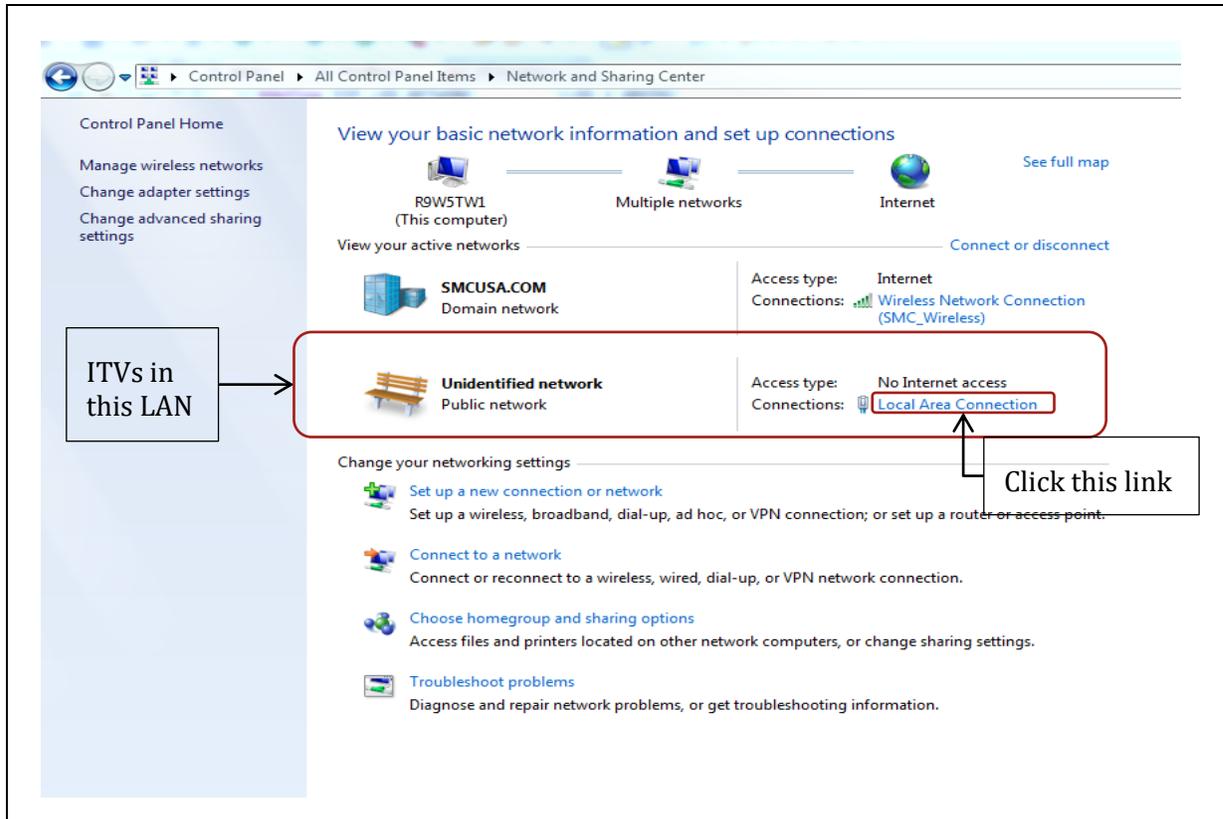


Figure 34 - Windows Network and Sharing Center

Press the **“Local Area Connection”** link (in [Figure 34 - Windows Network and Sharing Center](#)) and the **Local Area Connection Status** window will appear. Then press the **“Properties”** button and the **Local Area Connection Properties** window will appear:

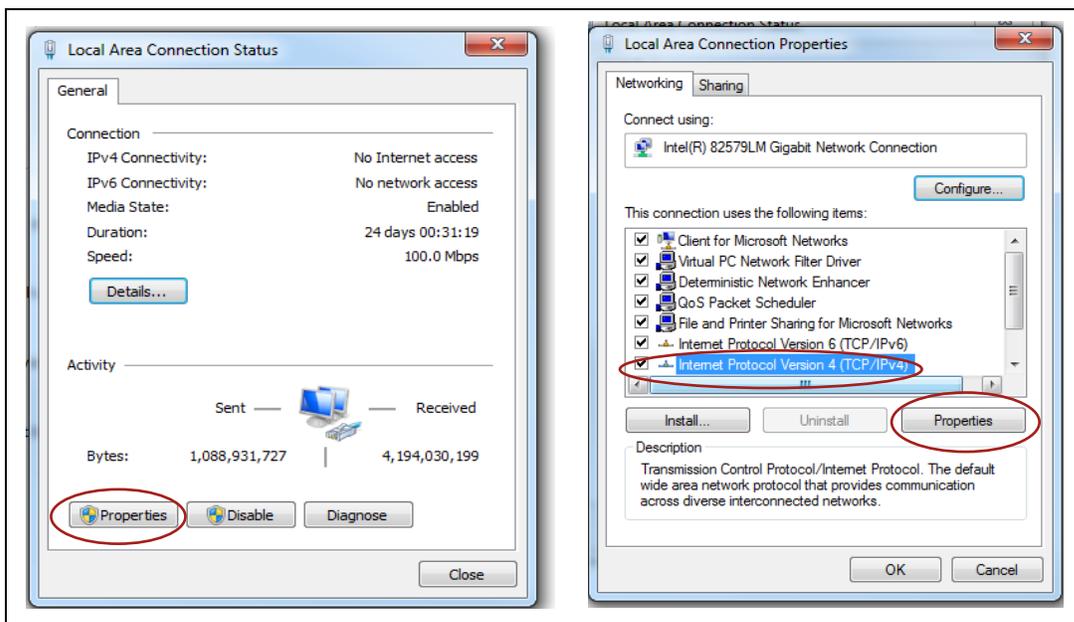


Figure 35 - Windows Local Area Connection and Local Area Connection Properties

Next select **Internet Protocol Version 4 (TCP/IPv4)** and press the **Properties** button. The **Internet Protocol Version 4 (TCP/IPv4) Properties** window will appear:

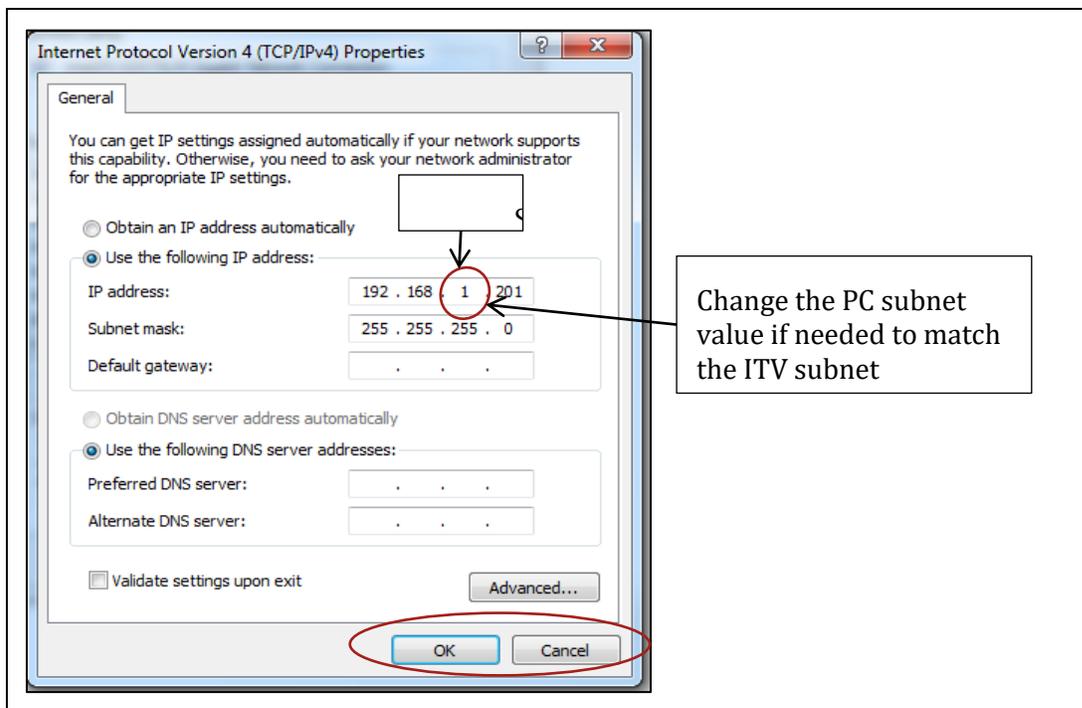


Figure 36 - Windows Internet Protocol - IPv4 - Properties

The **Subnet** field is circled ([Figure 36](#) - Windows Internet Protocol - IPv4 – Properties). Verify that the PC Subnet value matches the Subnet in use on your ITV. Note: The PC and ITV **must** have different IP addresses.

DO NOT MODIFY ANY OTHER FIELD IN THE IPv4 PROPERTIES WINDOW.

If the Subnet field must be changed, **double click** the Subnet field entry (circled in [Figure 36](#) - Windows Internet Protocol - IPv4 – Properties) and type the new value. Do **NOT** hit the keyboard “Enter” key. That has the effect of pressing the OK button but does not give you the opportunity to review your Subnet change to ensure it is correct before you accept it.

Verify that the **ONLY** change is the Subnet field. If **ANYTHING**, other than the Subnet field has changed, restore the initial value **BEFORE** you press OK.

Once you have verified the values in the *IPv4 Properties* window, press the OK button to complete the PC subnet change. This will close the IPv4 Properties window.

Next, continue to Connecting to the ITV Web Page.

26.11. Connecting to the ITV Web Page

After you have confirmed that the PC and ITV are on the same Subnet, launch your preferred browser. The following examples use Google Chrome. Firefox and IE are similar.

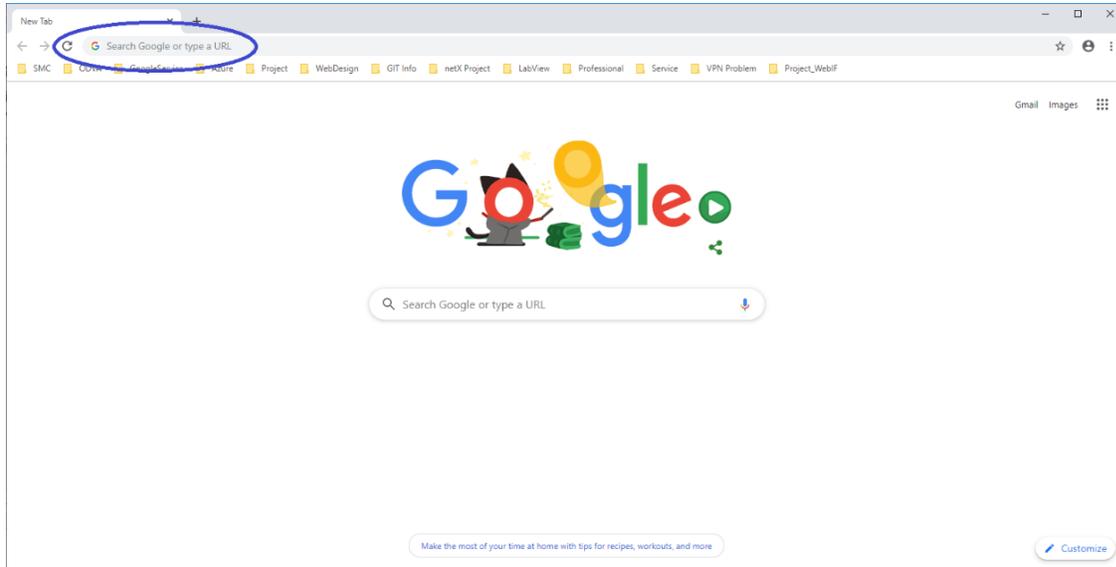


Figure 37 - Chrome Browser Homepage

In order to bring up the ITV web page, type the ITV IP address on the browser URL line. The "System Information" page should appear.

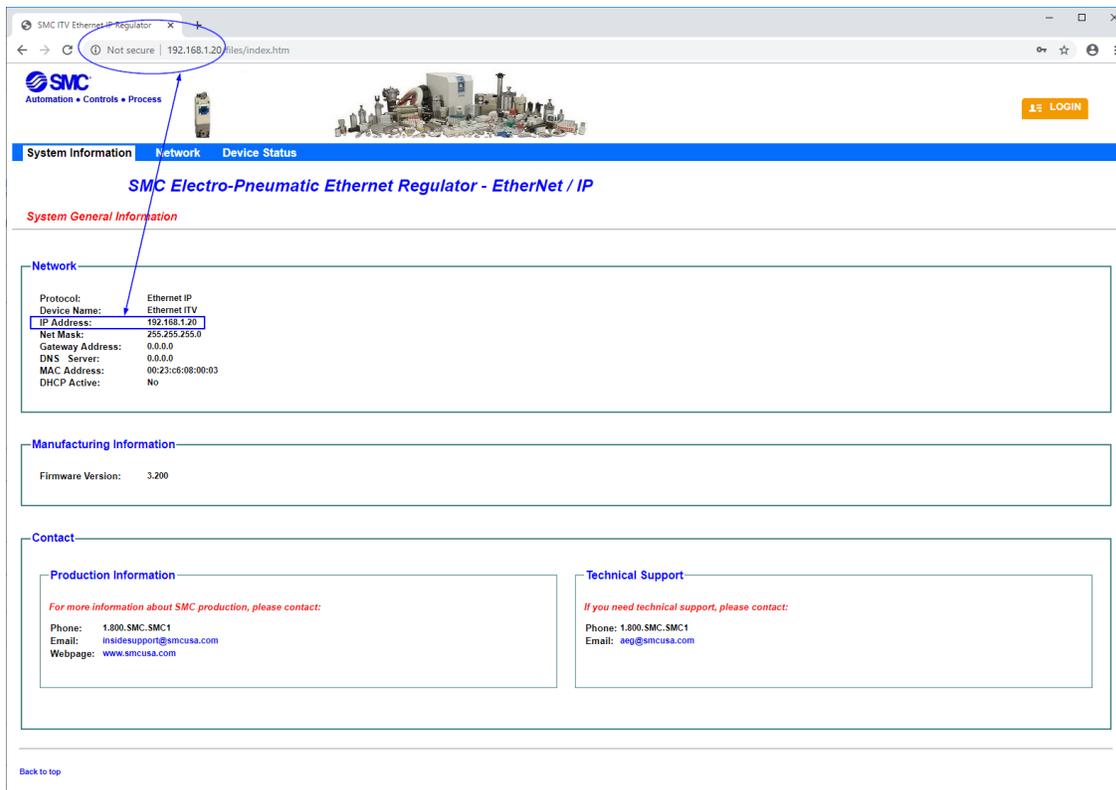


Figure 38 - ITV "System Information" Page with Factory Default IP Address

If the System Information page does **NOT** appear please see the following subsections

- ITV Does Not Power Up
- One LED is Red

If necessary, contact SMC Technical Support for assistance.

Note: To change the ITV IP address, follow the instructions in IP Address

Revision History		
Revision	Description	Date
2	Added How to order for IITV	09/02/2020
1	Updates for DUX	08/01/2020
0	Initial release for EthernetIP™ ITV.	10/30/2019

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