MOX IONITY System User Guide

0742-606-2301-003

Preface

Scope of the User Guide

This MOX IONITY System User Guide contains information on the hardware installation, software configuration and operation for the following products:

Part Number	Description
MX603-9001	MOX 603 PSU module
MX606-5002-01	MOX IoNix processor
MX606-5102	The base for IoNix processor MX606-5002-01
MX606-5002-02	MOX IoNix processor
MX606-5103	The base for IoNix processor MX606-5002-02

This guide has been organized for the installer and operator, and it is expected that the user is an engineer or similar with an understanding of the operating and programming requirements of similar field control products.

Related Documents

All MOX network architectures contain a collection of MOX equipment and several software packages. For this reason, a number of related documents should be read in conjunction with this user guide.

The related documents are noted below:

- MOXIDE User Guide
- MOXGRAF User Guide
- MOX IONITY 603 Rack Base IO User Guide

Conventions Used

	*When you see the "exclamation mark" icon in the left-hand margin, the text to its immediate right will be a special note. Please ensure that you read this information to increase your understanding of the systems operation.*

	*When you see the "stop sign" icon in the left-hand margin, the text to its immediate right will be a warning. This information could prevent injury loss of property or even death (in extreme cases). It is very important that you stop and read this information and ensure that you have complete understanding before continuing with the procedures.*

Contents

Figures

Tables

1 Overview

MOX IONITY is a leading edge control system with enhanced Remote Terminal Unit capabilities for use in SCADA, telemetry and remote data monitoring applications. It consists of a MOX IoNix processor, a Power Supply Unit (PSU) and any suitable combination of MOX IONITY 603 Rack Base I/O. A maximum of ten I/O modules are recommended to be connected.

The MOX IONITY system offers excellent performance in different applications with the help of the following features.

- Modular and open design architecture
- Scalable I/O architecture via MOX IONITY 603 I/O modules
- RS232/RS485 Serial connections
- Ethernet connection
- Built-in DI and DO
- Integrated and transportable IEC61131-3 control software
- Standard DNP3 communications
- Standard TCP/IP communications
- MODBUS Master/Slave

Figure 1 Typical MOX IONITY System

2 Familiarization

2.1 MX606-5002-01 IoNix Processor and MX606-5102 Base

Figure 2 MOX IoNix Processor MX606-5002-01 and Base MX606-5102

The processor provides following features.

- One 10/100Mbps Ethernet port
- Two 3-wire RS232 serial ports
- Two isolated RS485 serial ports
- Two DO channels, at least 100mA drive capacity per channel, one group with a COM terminal
- Six DI channels, one group with a COM terminal
- Cascaded directly with the MOX 603 Rack Base I/O modules

2.1.1 Datasheet

The following tables give the detailed information for processor module MX606-5002-01.

Power Specifications	
Power Dissipation within Module	5.5W (Max)
CPU Specifications	
Processor	ARM
Clock Speed	400MHz
RAM	64MBytes
Flash	128MBytes
Communication Specifications	
Serial	2 x RS232, 2 x RS485
Ethernet	1 x 10/100Mbps Ethernet, RJ45
Isolation Voltage	
Ethernet Port to System	1500Vrms
Serial Ports to System	RS485: 2500Vrms RS232: None
Built-in DO Channels to System	5000Vrms
Built-in DI Channels to System	5000Vrms
Environmental Conditions	
Operating Temperature	-20~70 °C
Storage Temperature	-40~85 °C
Humidity	5~95% non-condensing
Hazardous location	IEC Zone 2 (IEC60079-15 “nA”)

Table 1 MOX IoNix Processor MX606-5002-01 Datasheet

The following tables give the detailed information for the base MX606-5102.

Environmental Conditions	
Operating Temperature	-20~70 °C
Storage Temperature	-40~85 °C
Humidity	5~95% non-condensing
Hazardous location	IEC Zone 2 (IEC60079-15 “nA”)

Table 2 MOX Base MX606-5102 Datasheet

2.1.2 LED Indicator

LED	Color	State	Description
PWR	Green	ON	The controller is powered up
		OFF	The controller is powered down
RUN	Green	Flashing in 5 Hz	CPU is running normally
		OFF	System not started
		Flashing in 0.5 Hz	There is no MOXGRAF code (control code) present
		ON	Reserved
ERR	Red	ON	MOX I/O communication error. (Allocated I/O in the control code is not replying to communication requests)
		OFF	MOX I/O communication OK
ACT	Green	OFF	This LED is always OFF
ETH1	Green	ON	A physical connection is established
		Flash	Communication is taking place with the host controller
ETH2	Green	ON	A physical connection is established
		Flash	Communication is taking place with the host controller

Table 3 MOX IoNix Processor MX606-5002-01 LED State Description

The following table shows all combinations of RUN, ERR and ACT LED states and the operational status of each combination.

LED	State	Description
RUN	Flashing in 5 Hz	CPU is running normally
ERR	OFF	
ACT	OFF	
RUN	Flashing in 0.5 Hz	There is no MOXGRAF code present
ERR	OFF	
ACT	OFF	
RUN	Flashing in 5 Hz	This CPU is running, but with I/O communication error
ERR	ON	
ACT	OFF	

Table 4 MOX IoNix Processor MX606-5002-01 LED State Trouble Shooting

2.1.3 Serial Ports

The IONIX processor module provides two 3-wire RS232 serial ports and two RS485 serial ports. COM1 and COM3 are RS485 serial ports. They are 2500V isolated to the system. COM2 and COM4 are RS232 serial ports. The wire terminals of the serial ports locate at the front of the processor base.

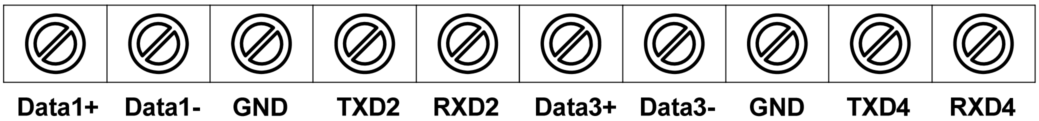


Figure 3 Pin Assignment for the Serial Ports Terminal

COM#	Terminals	Type	Baud Rate
COM1	Data1+, Data1-	RS485	1200~115200bps
COM2	TXD2, RXD2, GND	RS232	1200~115200bps
COM3	Data3+, Data3-	RS485	1200~115200bps
COM4	TXD4, RXD4, GND	RS232	1200~115200bps

Table 5 Serial Ports Definition

The table below shows the signal description of COM1 and COM3.

Symbol	Description
COM1+	Non invert receiver input and non invert driver output of COM1
COM1-	Invert receiver input and invert driver output of COM1
COM3+	Non invert receiver input and non invert driver output of COM3
COM3-	Invert receiver input and invert driver output of COM3

Table 6 Signal Description of COM1 and COM3

COM2 and COM4 are 3-wire RS232 serial ports. Each of them consists of three signals: TXD, RXD and GND. The baud rate of the two ports can be programmed by software.

The input and output signals' voltage of COM2 and COM4 meets EIA/TIA-232E specification. The output signals' logic voltage is ±5V. The input signals can endure ±15V logic voltage.

The table below shows the signal description of COM2 and COM4.

Symbol	Description
TXD2	Data transfer of COM2
RXD2	Data receive of COM2
GND	GND of COM2
TXD4	Data transfer of COM4
RXD4	Data receive of COM4
GND	GND of COM4

Table 7 Signal Description of COM2 and COM4

2.1.4 Ethernet Ports

The MX606-5002-01 processor supports only one 10/100Mbps Ethernet connection. The RJ45 connector locates on the front panel of the module. The Ethernet port is 1500V isolated to the system.

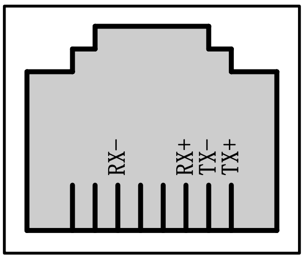


Figure 4 Pin-out of the RJ45 Connectors

The factory default IP address of the MX606-5002-01 Ethernet port is ***192.168.1.32****.*

2.1.5 Built-in DI/DO

The MOX IONIX processor offers 6 DI channels and 2 DO channels. The DI channels are combined to one group with a common GND connection. The DO channels are combined to one group with a common GND connection. Each DO channel can output 100mA current, which is good enough to drive relays.

The DI and DO channels are 5000V isolated to the system.

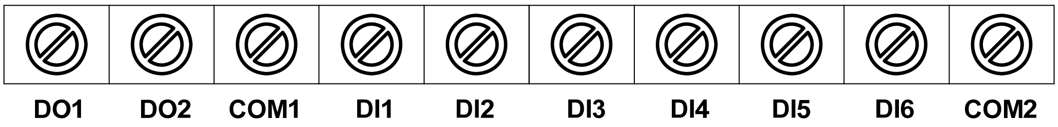


Figure 5 Pin Assignment for DI/DO Channels

The following figures show the equivalent circuit of DI and DO.

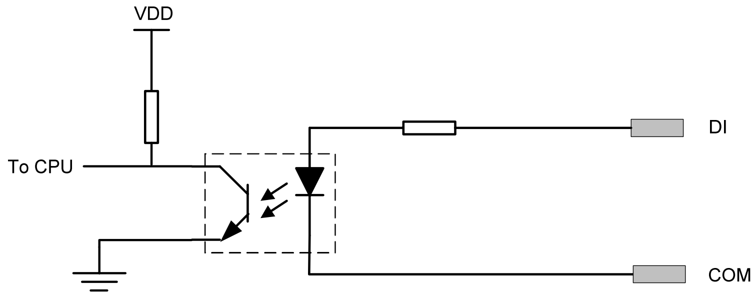


Figure 6 Equivalent Circuit of the DI

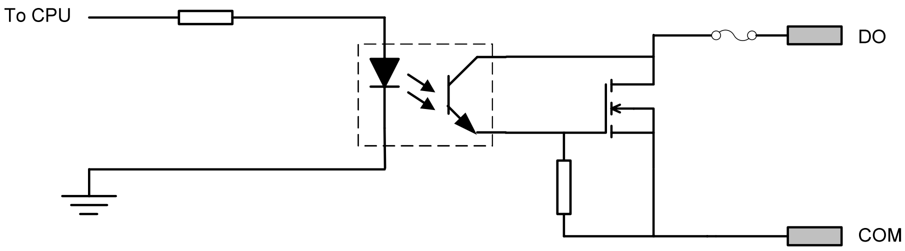


Figure 7 Equivalent Circuit of the DO

Refer to the following figure for the typical wiring of the DI/DO channels.

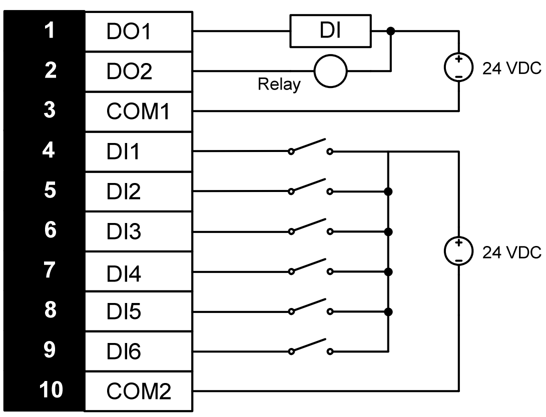


Figure 8 Typical Wiring of DI/DO Channels

2.2 MX606-5002-02 IoNix Processor and MX606-5103 Base

Figure 9 MOX IoNix Processor MX606-5002-02 and Base MX606-5103

The processor provides following features.

- Two 10/100Mbps Ethernet port
- Two 3-wire RS232 serial ports
- Two isolated RS485 serial ports
- Two DO channels, at least 100mA drive capacity per channel, one group with a COM terminal
- Six DI channels, one group with a COM terminal
- Cascaded directly with the MOX 603 Rack Base I/O modules

2.2.1 Datasheet

The following tables give the detailed information for processor module MX606-5002-02.

Power Specifications	
Power Dissipation within Module	5.5W (Max)
CPU Specifications	
Processor	ARM
Clock Speed	400MHz
RAM	64MBytes
Flash	128MBytes

Communication Specifications	
Serial	2 x RS232, 2 x RS485
Ethernet	2 x 10/100Mbps Ethernet, RJ45
Isolation Voltage	
Ethernet Port to System	1500Vrms
Serial Ports to System	RS485: 2500Vrms RS232: None
Built-in DO Channels to System	5000Vrms
Built-in DI Channels to System	5000Vrms
Environmental Conditions	
Operating Temperature	-20~70 °C
Storage Temperature	-40~85 °C
Humidity	5~95% non-condensing
Hazardous location	IEC Zone 2 (IEC60079-15 “nA”)

Table 8 MOX IONIX Processor MX606-5002- 02 Datasheet

The following tables give the detailed information for the base MX606-5103.

Environmental Conditions	
Operating Temperature	-20~70 °C
Storage Temperature	-40~85 °C
Humidity	5~95% non-condensing
Hazardous location	IEC Zone 2 (IEC60079-15 “nA”)

Table 9 MOX Base MX606-5103 Datasheet

2.2.2 LED Indicator

LED	Color	State	Description
PWR	Green	ON	The controller is powered up
		OFF	The controller is powered down
RUN	Green	Flashing in 5 Hz	CPU is running normally
		OFF	System not started
		Flashing in 0.5 Hz	There is no MOXGRAF code (control code) present
		ON	Reserved
ERR	Red	ON	MOX I/O communication error. (Allocated I/O in the control code is not replying to communication requests)
		OFF	MOX I/O communication OK
ACT	Green	OFF	This LED is always OFF
ETH1	Green	ON	A physical connection is established
		Flash	Communication is taking place with the host controller
ETH2	Green	ON	A physical connection is established
		Flash	Communication is taking place with the host controller

Table 10 MOX IoNix Processor MX606-5002-02 LED State Description

The following table shows all combinations of RUN, ERR and ACT LED states and the operational status of each combination.

LED	State	Description
RUN	Flashing in 5 Hz	CPU is running normally
ERR	OFF	
ACT	OFF	
RUN	Flashing in 0.5 Hz	There is no MOXGRAF code present
ERR	OFF	
ACT	OFF	
RUN	Flashing in 5 Hz	This CPU is running, but with I/O communication error
ERR	ON	
ACT	OFF	

Table 11 MOX IoNix Processor MX606-5002-02 LED State Trouble Shooting

2.2.3 Serial Ports

The IONIX processor module provides two 3-wire RS232 serial ports and two RS485 serial ports. COM1 and COM3 are RS485 serial ports. They are 2500V isolated to the system. COM2 and COM4 are RS232 serial ports. The wire terminals of the serial ports locate at the front of the processor base.

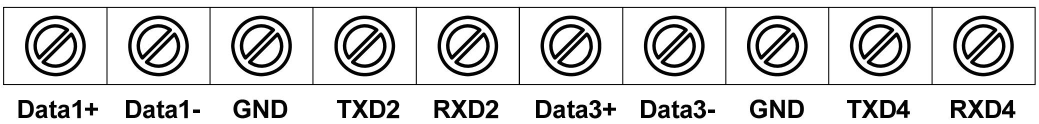


Figure 10 Pin Assignment for the Serial Ports Terminal

COM#	Terminals	Type	Baud Rate
COM1	Data1+, Data1-	RS485	1200~115200bps
COM2	TXD2, RXD2, GND	RS232	1200~115200bps
COM3	Data3+, Data3-	RS485	1200~115200bps
COM4	TXD4, RXD4, GND	RS232	1200~115200bps

Table 12 Serial Ports Definition

The table below shows the signal description of COM1 and COM3.

Symbol	Description
COM1+	Non invert receiver input and non invert driver output of COM1
COM1-	Invert receiver input and invert driver output of COM1
COM3+	Non invert receiver input and non invert driver output of COM3
COM3-	Invert receiver input and invert driver output of COM3

Table 13 Signal Description of COM1 and COM3

COM2 and COM4 are 3-wire RS232 serial ports. Each of them consists of three signals: TXD, RXD and GND. The baud rate of the two ports can be programmed by software.

The input and output signals' voltage of COM2 and COM4 meets EIA/TIA-232E specification. The output signals' logic voltage is ±5V. The input signals can endure ±15V logic voltage.

The table below shows the signal description of COM2 and COM4.

Symbol	Description
TXD2	Data transfer of COM2
RXD2	Data receive of COM2
GND	GND of COM2
TXD4	Data transfer of COM4
RXD4	Data receive of COM4
GND	GND of COM4

Table 14 Signal Description of COM2 and COM4

2.2.4 Ethernet Ports

The MX606-5002-02 processor supports two 10/100Mbps Ethernet connection. One of the RJ45 connectors locates on the front panel of the module, the other one locates on the base module. The Ethernet ports are 1500V isolated to the system.

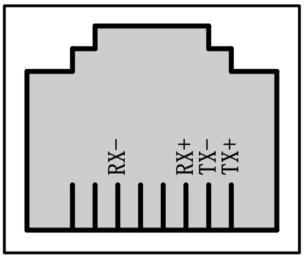


Figure 11 Pin-out of the RJ45 Connectors

> *The factory default IP address of the MX606-5002-02's ETH1 (on the module) is **192.168.1.32**.*
>
> *The factory default IP address of the MX606-5002-02's ETH2 (on the base) is **192.168.0.32**.*

2.2.5 Built-in DI/DO

The MOX IONIX processor offers 6 DI channels and 2 DO channels. The DI channels are combined to one group with a common GND connection. The DO channels are combined to one group with a common GND connection. Each DO channel can output 100mA current, which is good enough to drive relays.

The DI and DO channels are 5000V isolated to the system.

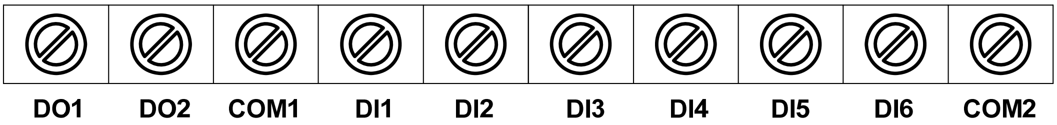


Figure 12 Pin Assignment for DI/DO Channels

The following figures show the equivalent circuit of DI and DO.

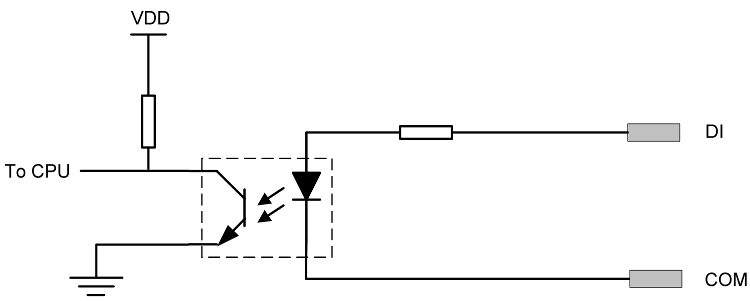


Figure 13 Equivalent Circuit of the DI

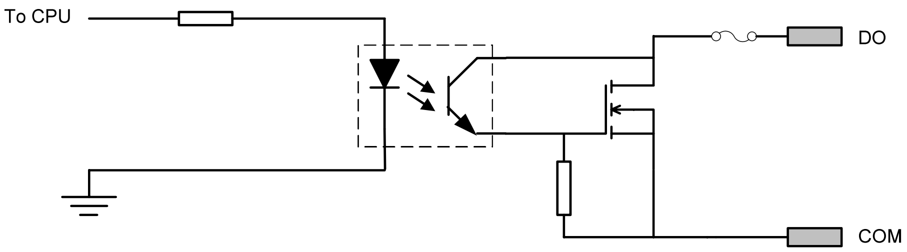


Figure 14 Equivalent Circuit of the DO

Refer to the following figure for the typical wiring of the DI/DO channels.

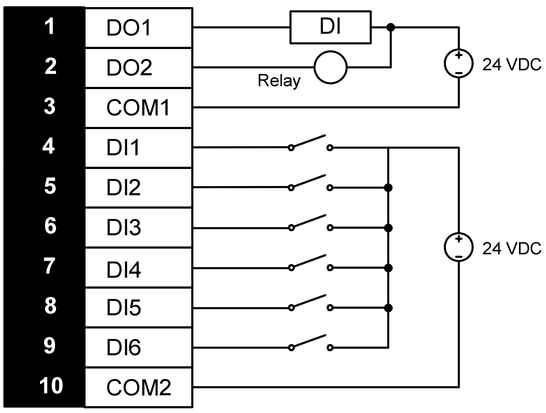


Figure 15 Typical Wiring of DI/DO Channels

2.3 Power Supply Unit

Both MOX IoNix processor module draws 5V power from the base. The power is generated with the MOX 603 PSU module MX603-9001 located on the left side of the processor.

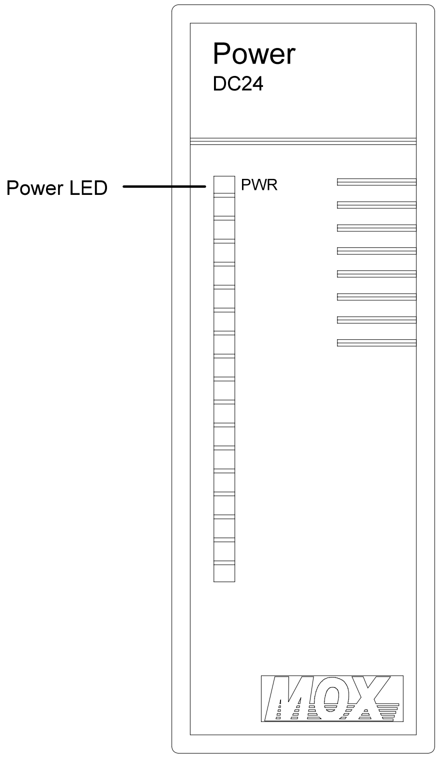


Figure 16 MOX 603 PSU Module Familiarization

The following table gives the detailed information for MOX 603 PSU Module MX603-9001.

Characteristics	
Rated input voltage	24VDC
Operating voltage range	20~30VDC
Rated output current	8A@5V
Ripple voltage	80mV
Reverse input protection	Yes
Efficiency	83% (Max.)
Environmental Conditions	
Operating Temperature	-20~70 °C
Storage Temperature	-40~85 °C
Humidity	5~95% non-condensing
Hazardous location	IEC Zone 2 (IEC60079-15 “nA”)

Table 15 MOX 603 PSU Module MX603-9001 Datasheet

2.4 IONITY 603 Rack Base I/O Modules

Figure 17 IONITY 603 Rack Base I/O Modules Connected to MOX IoNix Processor

⚠	*It is recommended that a maximum of 10 MOX IONITY 603 Rack Base I/O modules be connected.*

Configuration details for MOX IONITY 603 Rack Base I/O can be completed using the MOXIDE configuration software.

Detailed information on the MOX IONITY 603 I/O modules may be found in the MOX IONITY 603 Rack Base I/O User Guide.

2.5 Software Tools

The MOX IoNix Processor must be configured and programmed using both MOXIDE and MOXGRAF.

MOXIDE (MOX Integrated Development Environment) is a powerful network configuration interface that allows the user to upload, download and monitor device information. MOXIDE can be used to configure a communications network, alter configurations on the fly, monitor all device operations and change operational parameters of individual devices.

MOXGRAF is a development environment for designing applications without knowledge of complex, high-level computer languages. Using IEC 61131-3 programming standards, intuitive graphical and textual editors, results in robust applications developed with simplicity and in the shortest possible timeframe.

The extensive hypertext based online help system includes a thorough cross-reference explanation of the IEC 61131-3 standard. MOXGRAF also features a powerful self-documenting capability. The document generator builds a complete, coherently grouped printed document of all project items and provides a history of their modification. Both graphical and textual programs may be included in the final documentation, as can the overall project architecture, I/O wiring lists, dictionaries, cross-references and more.

3 Installation

Within this chapter are detailed instructions on mounting, installation and cabling of the MOX IONITY system.

3.1 Handling Considerations

3.1.1 Hazardous Location Information

The MOX IONITY system is allowed to use in Zone2 (IEC) hazardous locations. Products in the system are marked 'Ex nA II T4 Gc'. The Products that can be used in IONITY system excluding IONITY 603 Rack Base IO are listed in the following table. MOX IONITY 603 I/O module list may be found in the MOX IONITY 603 Rack Base I/O User Guide.

Part Number	Description
MX603-9001	MOX 603 PSU module
MX606-5002-01	MOX IoNix processor
MX606-5102	The base for IoNix processor MX606-5002-01
MX606-5002-02	MOX IoNix processor
MX606-5103	The base for IoNix processor MX606-5002-02

- *In hazardous area, the power consumption for each rack of I/O modules must be under 20W.*
- *Do not connect or disconnect equipment (no hot-swap) unless power has been removed or the area is known to be non-hazardous.*
- *Do not connect or disconnect connections to this equipment unless power has been removed or the area is known to be non-hazardous.*
- *Do not operate the rotary switch located on the front of the I/O module unless power has been removed or the area is known to be non-hazardous.*
- *Substitution of components may impair suitability for Zone2 (IEC).*
- *Modules must be installed in an adequate housing to provide IP 54 degree of protection (according to IEC60529) as a minimum. And the following warnings should be stated on the enclosure:*

  - DO NOT OPERATE ANY INNER SWITCHES WHEN ENERGIZED.

  - DO NOT SEPARATE ANY CONNECTORS WHEN ENERGIZED.
- *The RTC backup battery can only be replaced by the manufacturer.*
- *In hazardous area, provisions shall be made to prevent the rated voltage from being exceeded by the transient disturbances of more than 40%.*

3.1.2 Electrostatic Discharge

Integrated circuits or semiconductors may be severely damaged by electrostatic discharge. This may be caused if the terminal connector pins come in contact with an electro statically charged object such as hands or clothing. Follow these guidelines when you handle the module.

- Touch a grounded object to discharge static potential.
- Do not touch the terminal connector pins.
- Do not touch circuit components inside the unit.
- Always work with the unit on a grounded surface

3.1.3 Environmental Precautions

To extend the life of the MOX IONITY system, take the following precautions:

- Avoid storing or operating the device where it could be exposed to a corrosive atmosphere.
- Protect from moisture and direct sunlight.

The MOX IONITY system has been designed for use in an industrial environment when installed in accordance with these instructions. Within this environment, the equipment is still intended for installation in a clean and dry location.

3.2 Mounting the MOX IoNix Processor and Associated Components

Correct placement of the MOX IoNix Processor is necessary to avoid overheating due to lack of ventilation. Placement errors should be avoided by using the dimensional specifications provided. Adequate ventilation should be provided to avoid overheating and spacing between components should allow for a suitable working environment.

3.2.1 Installation Considerations

The MOX IoNix processor is installed on a pre-mounted DIN rail, and is secured using two locating clips found on the IoNix processor's base.

Ensure the DIN rail matches the dimensions of DIN EN 50022 provided as follows.

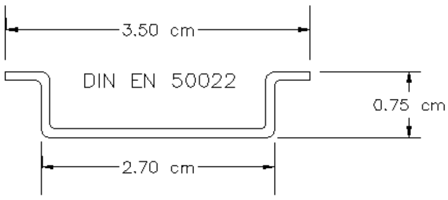


Figure 18 DIN Rail EN 50022

The enclosure may also contain an AC power supply, expansion MOX IONITY 603 I/O modules, terminal strips, circuit breakers and other equipment required in the installation. All items should be appropriately mounted and spaced to ensure good ventilation.

The MOX IoNix processor and connected MOX IONITY 603 I/O modules must be installed horizontally to avoid movement on the DIN rail. Connected MOX IONITY 603 I/O modules are installed beside one another. End clamps are recommended to restrict side-to-side movement.

STOP	*End brackets are required for each end of DIN rail, to eliminate sparks caused by loose connection between rack bases of I/O.*

3.2.2 Preventing Excessive Heat

For most applications, normal convective cooling keeps the controller within the specified operating range. The following should be considered to ensure that the specified operating range is maintained.

- Recommended spacing between the adjacent racks of modules is 200mm minimum. This prevents much heat influence between the racks, and allows room for wire ducting to be installed without obstructing field wiring installation.
- Recommended spacing between the adjacent racks of I/O modules is 200mm minimum. This prevents much heat influence between the racks, and allows room for wire ducting to be installed without obstructing field wiring installation.

- If particularly high or low ambient temperatures occur, additional cooling or heating provisions should be provided.
- In some applications, a substantial amount of heat is produced by other equipment inside or outside the enclosure. In this case, place blower fans inside the enclosure to assist in air circulation and to reduce "hot spots" near the controller.
- Do not bring unfiltered outside air into the enclosure. Place the controller in an enclosure to protect it from a corrosive atmosphere. Harmful contaminants or dirt could cause improper operation or damage to components.

3.2.3 Installation Cleanliness

During installation and placement of items within the cabinet, do not install any components until all drilling is complete. Also, strip and trim cables well away from the MOX IONITY system. Be sure that debris (metal chips, wire strands, etc.) does not fall onto the MOX IONITY system's terminal connections. Such debris could cause damage on power-up. Once wiring is complete, ensure that the unit is free of all metal fragments and other objects that may interfere with correct operation.

3.2.4 Typical MOX IONITY System Dimensions

Core parts of the MOX IONITY system have the following dimensions although the addition of extended communication options will differ from those displayed.

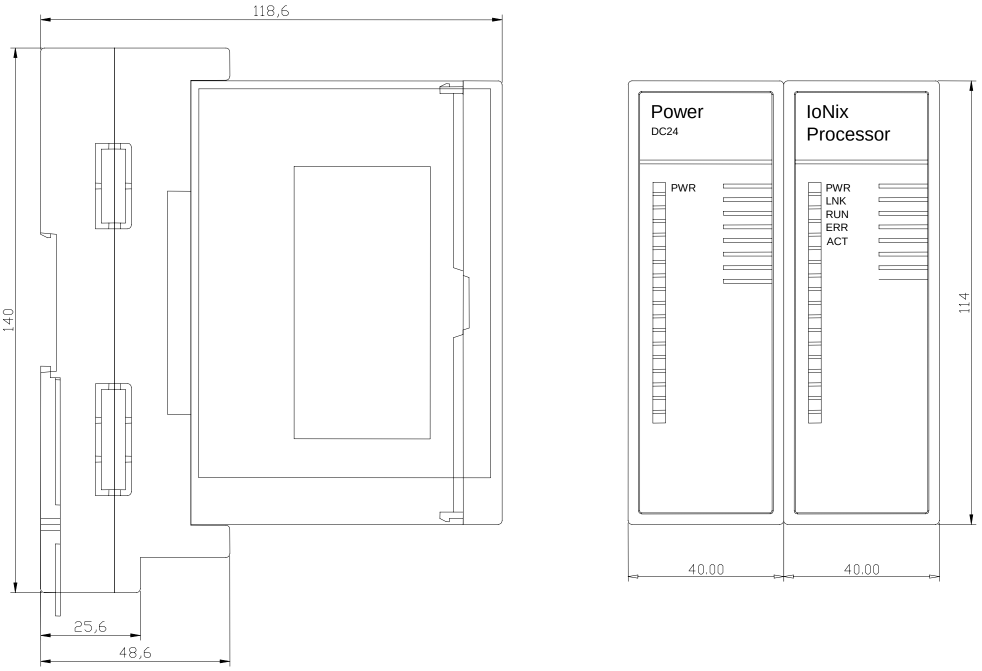


Figure 19 Typical MOX IONITY System Dimensions

3.2.5 Power Isolation

When removing power from the device, interruption of the DC side of the power supply is preferred. This avoids the additional discharge delay of the power supply if the AC line is connected.

Always fuse the AC line of the power supply and place the main power isolation switch where operators and maintenance personnel have quick and easy access to it. If you mount an isolation switch inside the controller enclosure, place a handle on the outside of the enclosure to switch the isolator, so that you can disconnect power without opening the enclosure.

3.2.6 Terminal Connector

Ensure all power sources, including MOX IoNix processor supply and field I/O supply, are isolated from the terminal connector before removing or inserting the terminal connector.

 STOP	*Always isolate the supply power before removal or insertion of connectors. When you remove or insert the connectors with power applied, an electrical arc may occur.*

An electrical arc can cause personal injury or damage to property by:

- Sending an erroneous or excessive signal to your system's field devices
- Causing damage to the product through line spikes
- Cause excessive wear on module contacts due to the electrical arcing

- Create electrical resistance from worn contacts

3.2.7 Grounding Considerations

In solid-state control systems, grounding helps limit the effects of noise due to electromagnetic interference (EMI). Run a ground connection from any mounting point of the controller to the ground connection point of the cabinet.

3.3 Cable Path Considerations

When installing communications cables, the path of the cables should be planned to avoid electrical interference. Follow these guidelines to reduce electrical interference:

- Keep the communication cable at least 1.52 m from any electric motors, transformers, rectifiers, generators, arc welders, induction furnaces, or sources of microwave radiation.
- If you must run the cable across power feed lines, run the cable at right angles to the lines.
- If you do not run the cable through a contiguous metallic wire way or conduit, keep the communication cable at least 150mm from AC power lines of less than 20A, 300mm from lines greater than 20A (but only up to 100kVA), and 600mm from lines of 100kVA or more.
- If you run the cable through a contiguous metallic wire way or conduit, keep the communication cable at least 80mm from AC power lines of less than 20A, 150mm from lines greater than 20A (but only up to 100kVA), and 300mm from lines of 100kVA or more.

Running the communication cable through conduit provides extra protection from physical damage and electrical interference. If you route the cable through conduit, follow these additional recommendations:

- Use ferromagnetic conduit near critical sources of electrical interference. You can use aluminum conduit in non-critical areas.
- Use plastic connectors to couple between aluminum and ferromagnetic conduit. Make an electrical connection around the plastic connector (use pipe clamps and the heavy gauge wire or wire braid) to hold both sections at the same potential.
- Ground the entire length of conduit by attaching it to the building earth ground.
- Do not let the conduit touch the plug on the cable.
- Arrange the cables loosely within the conduit. The conduit should contain only serial communication cables.
- Install the conduit so that it meets all applicable codes and environmental specifications.

3.3.1 Minimizing Electrical Noise on Analog Signal Lines

Analog input channels employ digital high frequency filters that significantly reduce the effects of electrical noise on input signals. However, because of the variety of applications and environments where analog controllers are installed and operating, it is impossible to ensure that the input filters will remove all environmental noise. Several specific steps can be taken to help reduce the effects of environmental noise on analog signals:

- Install the MOX IoNix processor and its associated components in a properly rated (i.e. NEMA) enclosure.
- Make sure that the MOX IoNix processor and its associated components are properly grounded.
- Use Belden cable #8761 for wiring the analog channels making sure that the drain wire and foil shield are properly earth grounded at one end of the cable.
- Route the Belden cable separate from any other wiring. Additional noise elimination can be obtained by routing the cables in grounded conduit.

- Periodically check the system operation, particularly when new machinery or other noise sources are installed near the system.

3.3.2 Analog Signal Cable Grounding

Use shielded communication cable (Belden #8761). The Belden cable has two signal wires (black and clear), one drain wire and a foil shield. The drain wire and foil shield must be grounded at one end of the cable. We recommend grounding the shield to the case of the signal source, so energy coupled to the shield will not be delivered to signal source's electronics.

STOP	*Do not ground the drain wire and foil shield at both ends of the cable.*

3.4 Power Wiring

3.4.1 Power Requirement

The MOX IONITY PSU module requires 20-30VDC from an external 12W (min) DC power module. This recommendation is for a single MOX IoNix processor module.

3.4.2 Power Consumption Calculations

To calculate the current requirements, add the wattage required for the MOX IoNix processor and I/O modules in use, then divide the total wattage by the DC power source voltage. Then add any current needed for user instrumentation loops. Ensure your power supply is sufficiently sized to suit the power requirements of your system.

The following power consumption calculations only involve the relevant MOX IONITY system module options. For an all incorporated system power consumption calculation, please see the relevant guides for power consumption information.

Determine Power Consumption

In estimating total I/O power requirements, the 'duty cycle' of each I/O channel must be estimated. For a non-analog I/O channel, the duty cycle is essentially the percentage of time that the I/O channel is active (maximum power consumption). For example, if a discrete output is active for 15 seconds out of every 60 seconds, the duty cycle is:

Duty Cycle = Active time/ (Active time + Inactive time) = 15 sec/60 sec =0.25

For an analog I/O channel, the duty cycle is approximated by estimating the percentage of the time the channel spends in the upper half of its range (span) of operation. For example, if an analog input wired to a current loop (4-20mA) device operates in the upper half of its range 75% of the time, then 0.75 would be used as the duty cycle. If the analog channel generally operates around the midpoint of its span, use 0.5 as the duty cycle.

To calculate the total power consumed by an I/O channel, read the minimum (Pmin) and (Pmax) power consumption value from the table for the desired I/O channel. Use the following equation to calculate the power consumption for a channel with the duty cycle taken into account:

Power = (Pmax x Duty Cycle) + [Pmin x (1 – Duty Cycle)]

Multiply this value by the quantity (QTY) of I/O channels with the same duty cycle to give a subtotal. Repeat the procedure for all the other I/O channels used. Finally total all subtotals.

Total Power Requirements

To adequately meet the needs of the system, it is important to determine the total power consumption and battery backup requirements accordingly. For total power consumption, add all system device power consumption values together, be sure to add the power consumption (in mW) of any non MOX devices used in the same power system.

Convert the total value (in mW) to Watts by dividing it by 1000.

mW / 1000 = Watts

For selecting an adequate power supply, use a safety factor (SF) of 1.25 to account for losses and other variables not factored into the power consumption calculations. To incorporate the safety factor, multiply the total power consumption (P) by 1.25.

$$P_{SF} = P \times 1.25 = \qquad \text{Watts}$$

To convert PSF to current consumption in amps (I_{SF}), divide P_{SF} by the system voltage (V) of 24VDC.

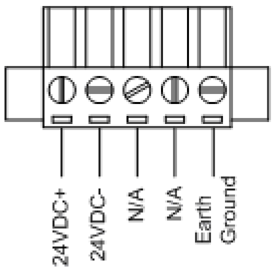
$$I_{SF} = P_{SF} / V = \qquad \text{Amps}$$

3.4.3 DC Power Wiring (User DC Source)

The MOX IoNix processor and user instrumentation loops may be powered from a single, user supplied, 24VDC source. Ensure correct wiring to the lower terminal, before powering up the MOX IoNix processor.

	*To avoid electric shock or damage, power should only be applied after all wiring terminations are complete.*

Make sure a good wiring (minimum AWG18) is connected to the '24VDC+', '24VDC-' and 'Earth Ground' terminals on the PSU base.



In hazardous area, provisions shall be made to prevent the rated voltage from being exceeded by the transient disturbances of more than 40%.

After all field wiring is installed, power up the controller and related peripherals. Observe the status LEDs on the controller and each I/O module. Normal startup conditions for the MOX IoNix processor will result in the following final conditions.

1) On power up the PWR LED will display and will remain on continually. If the PWR LED is not displayed remove power from the controller and double check your wiring. If your wiring is correct confirm that the user supplied 24VDC power source is supplying the system with the correct voltage and at the correct polarity.
2) About 60 seconds after power has been supplied to the MOX IoNix processor, the RUN LED will be illuminated.

a. If an application program is not loaded, the RUN LED will start flashing in 0.5 Hz.

b. If there is an application program loaded, the RUN LED will start flashing in 5 Hz.

	*The MOX IoNix processor will always startup in run mode once power is applied. The currently installed application will be run on power-up. This is a safety and reliability feature.*

4 MOX IoNix Processor Configuration

The configuration to MOX IoNix processor is implemented through MOXIDE. The MOXIDE software provides the following functions to manage MOX devices, configuration, monitoring and diagnosis. Open MOXIDE and create a new project for the connected MOX IoNix processor.

To create a new project, select **File | New Project** from within the MOXIDE Projects Management windows.

Enter a name for the new project you wish to create. The name must be less than 32 characters and consist only of alphanumeric characters. A meaningful project name and one that follows a naming standard could help on organizing your projects.

	*You must select the **Connect via IoNix to I/O** network architecture template before you can continue with configuration.*

Upon creation of this new project, a directory entitled the same as the project title will be created and placed under the MOXIDE directory structure where it can be easily accessed.

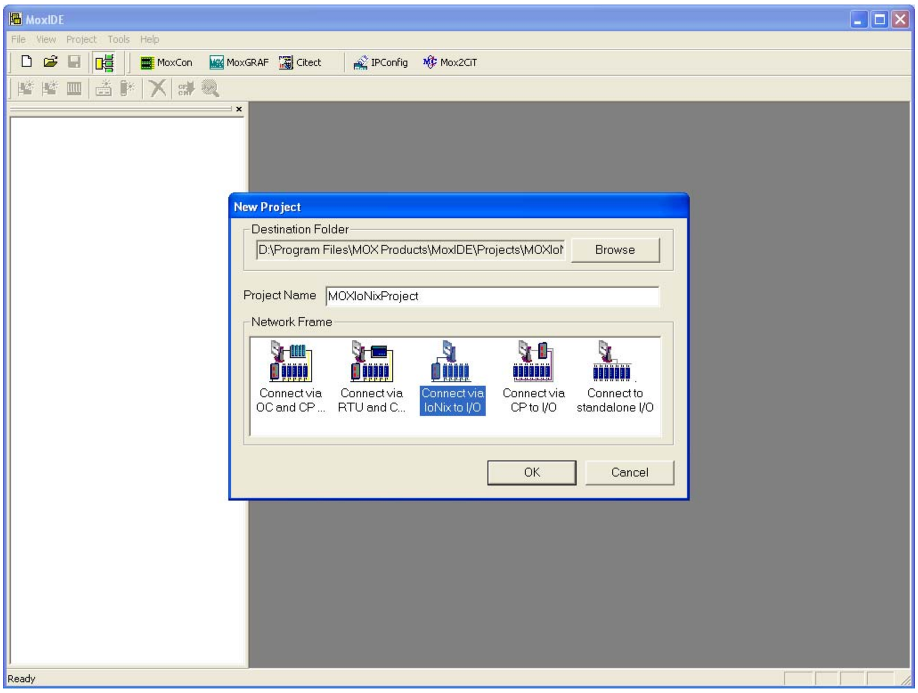


Figure 20 MOXIDE Project Creation Screen

For further information on the functionality and operational abilities of the MOXIDE software refer to MOXIDE User Guide or MOXIDE online help system.

4.1 Communication Ports

All MOX IoNix processors are supplied with four serial ports and one RJ45 Ethernet port.

The baud rate and other communication parameters for all ports are assigned in the MOXIDE software.

4.1.1 Serial Ports

To alter serial communication port parameters, click on the controller in the visual network tree. Select the **“Ports”** tab on the Module Description Window to display the port information.

To find out what the connected MOX IoNix processor’s serial port configuration is, click on the **“Online”** tab. Select the **“Online”** button to create a communication link with the controller via its Ethernet connection.

Once connection has been established the MOX IoNix processor’s onboard information will be displayed on the screen. This is an indication that the communication link has been established. Click on the **“<< Upload”** button and select the **“General Information”** option to upload all port information to MOXIDE. Return to the **“Ports”** tab to view the current serial port parameters.

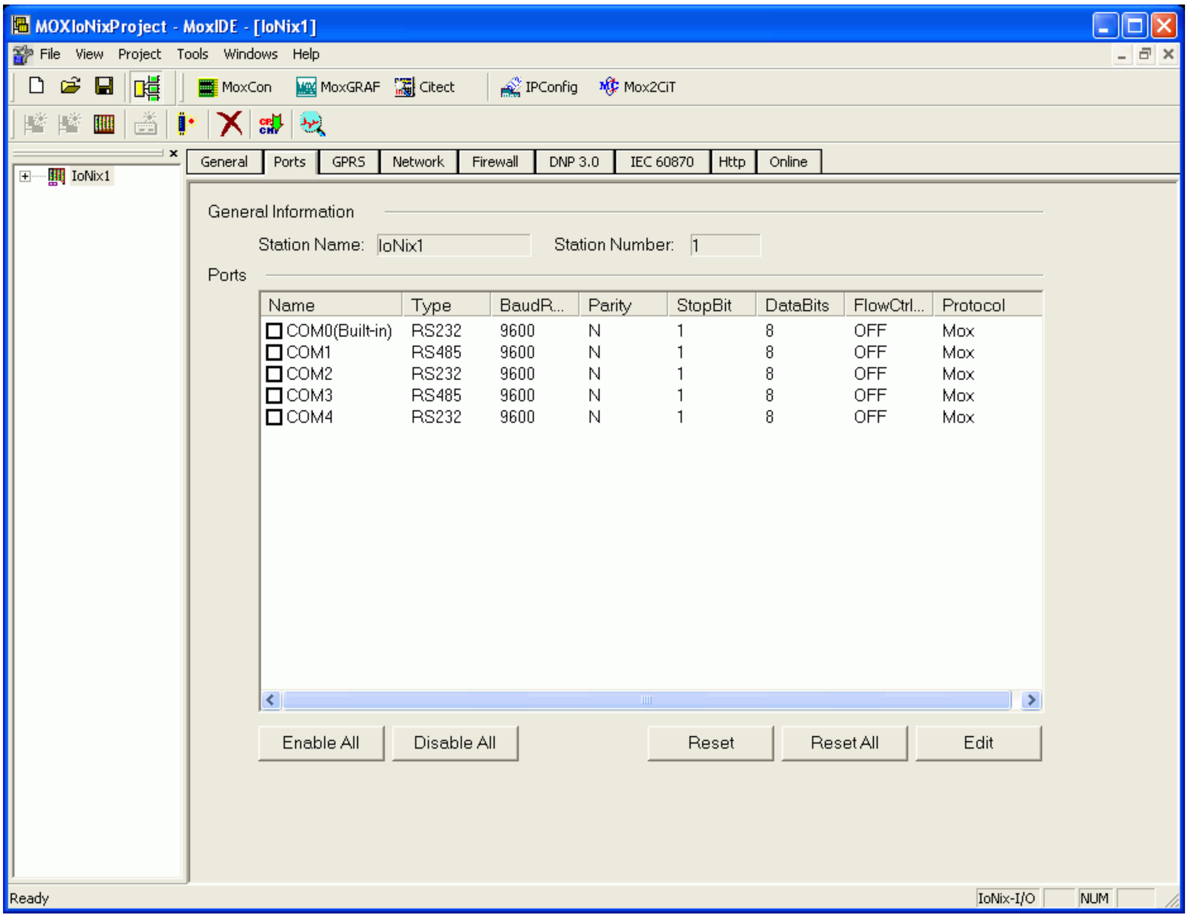


Figure 21 Serial Port Configuration

Select a serial port and double click on it to open its communication parameters.

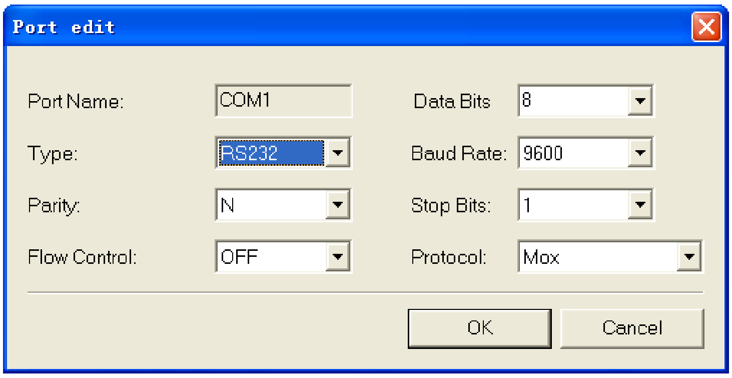


Figure 22 Serial Port Configuration

Once all the desired serial ports have been configured return to the **"Online"** tab. The new port information will update automatically within MOXIDE on leaving **Ports** page. Select the **"Online"** button to establish connection with the controller. Click on the **"Download >>"** button and select the **"General Information"** option to download all port information to desired controller. This will display a progress window. When download process is completed, close the progress window and click the **"Offline"** button to disconnect with the controller.

STOP	*After successful download of the new serial port configuration perform a full reboot of the MOX IoNix processor is required before the new serial port configuration will take effect.*

There are a number of selectable protocols that the user can choose from when setting serial port communication parameters. The following is a description of each protocol and its intended use:

Protocol	Definition	Description
mox	MODBUS Slave	Communication with a MODBUS Master device.
MODBUS Master	MODBUS Master	Communication with MODBUS slave devices.
MODBUSa Master	MODBUS ASCII Master	Communication with a visual slave device, e.g. LCD screen.
MODBUSa Slave	MODBUS ASCII Slave	Communication with MODBUS ASCII slave, such as touch screen device.
Transparent		Ethernet to Serial communication between two MOX IoNix processor devices.
MODNET	MODBUS TCP/IP	Convert MODBUS TCP/IP protocol from Ethernet to Serial port format.
DNP	DNP 3.0	*Distributed Network Protocol* (Master and Slave communications are supported)

Table 16 Serial Communication Protocol Definitions

4.1.2 Ethernet Ports

The MOX IoNix processor contains one 10/100Mbps Ethernet port. Communications are accessible through the onboard RJ45 connector port. Programming of the MOX IoNix processor with MOXGRAF may be conducted via Ethernet.

⚠	*All Ethernet implementations must follow standard IEEE802.3 Ethernet rules.*

SCADA/HMI interfaces that support the MODBUS TCP/IP protocol and DNP3.0 can communicate to the MOX IoNix processor.

To alter Ethernet communication port IP address, select **Tools | IPConfig** within MOXIDE to open the IP configuration application, please refer to Figure 23.

If you are unsure what the current IP address of the controller is you are able to scan all connected MOX controllers using this tool. IPConfig application provides two scanning methods, **"By Range"** and **"Blind"**.

By Range: The **"From"** field specifies the sub network and the starting host. The **"Count"** field specified the scanning range. For example, fill the **"From"** field with **"192.168.1.1"** and **"Count"** field with **"254"**, then click the **"Scan"** button to scan the host from 192.168.1.1 to 192.168.1.254. If any controller is detected, its IP address will be displayed in the list window at the upper left corner.

"Blind" method takes no parameters. Simply select **"Blind"** and click on the **"Scan"** button to scan all the controllers in the same network.

If the controller's IP is found it will be displayed in the **Target List** window. Double click on the displayed IP and select **"Upload"** to display all IP information of that IoNix processor.

If you know the IP address, simply type it into the **Target IP** Address prompt and select "**Upload**".

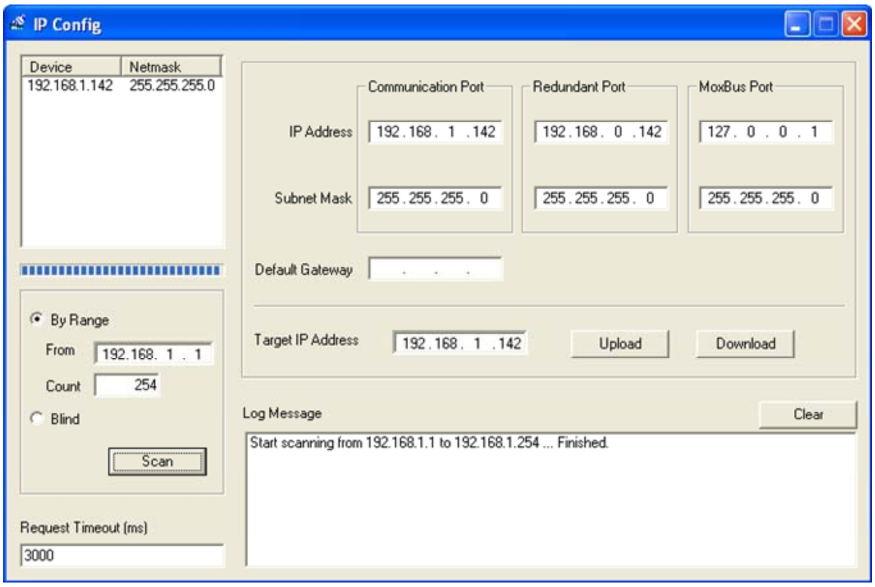


Figure 23 IP Configuration Application

To change the 10/100Mbps Ethernet port's IP address, change the IP information found within the **Communication Port** box.

The Redundant Port IP address must be set as default value.
*The MoxBUS Port IP address must be set to **127.0.0.1**.*

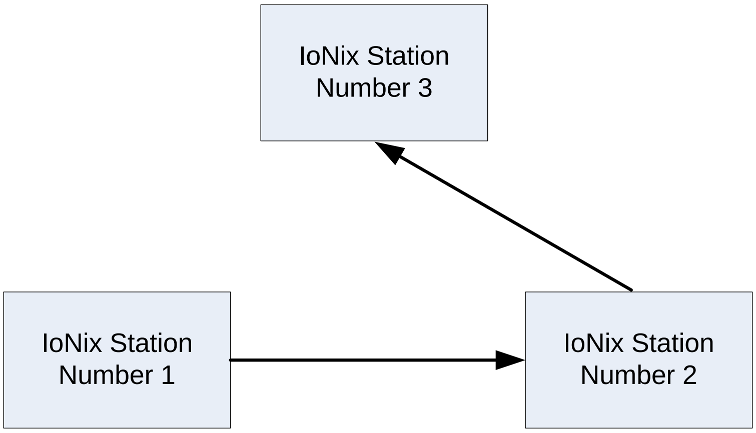
If alteration of the IP address is required ensure that a valid IP address is allocated. Allocating an illegal IP address, e.g. 192.168.0.0, will result in system failure.

Once you have changed the Ethernet port addresses to the desired IP, select **"Download"**. And reboot IoNix processor using software to make the IP address take effect. The request timeout may need to be altered depending on the size of the connect network architecture.

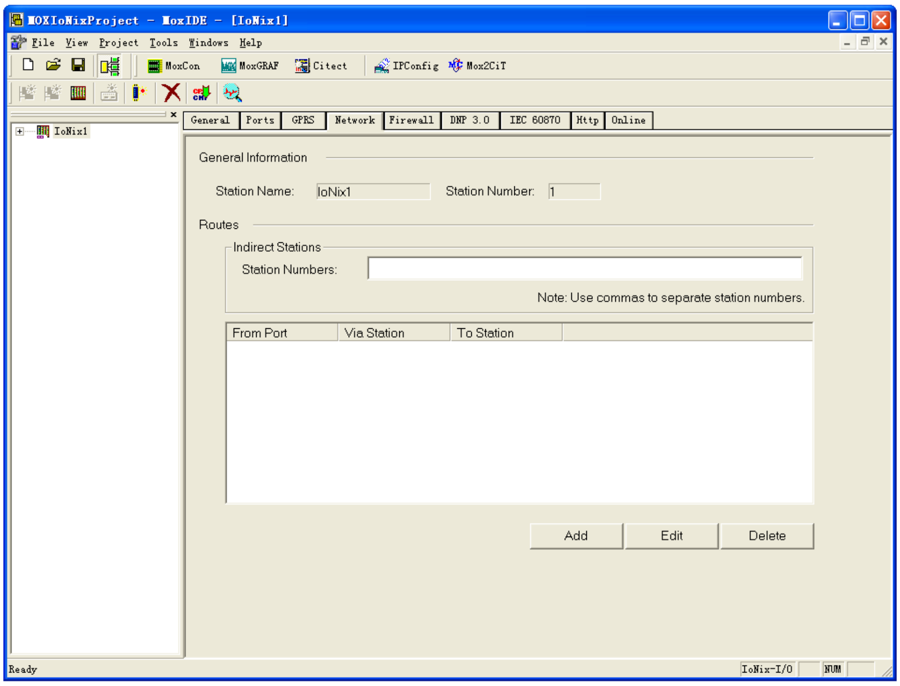
4.2 Transparent Networking

The MOX IoNix processor has the ability to communicate peer-to-peer via connected MOX IoNix processors. If direct communication with a connected MOX IoNix processor is not possible, the Master IoNix processor can communicate via a set network path to the desired controller. Configuring the MOX IoNix processor network is performed within the “Network” tab of MOXIDE. The MOX Function Block **“MoxRxTX”** within MOXGRAF must be used in conjunction with the network configuration information for communication to work correctly.

For this exercise we will use the network displayed below:

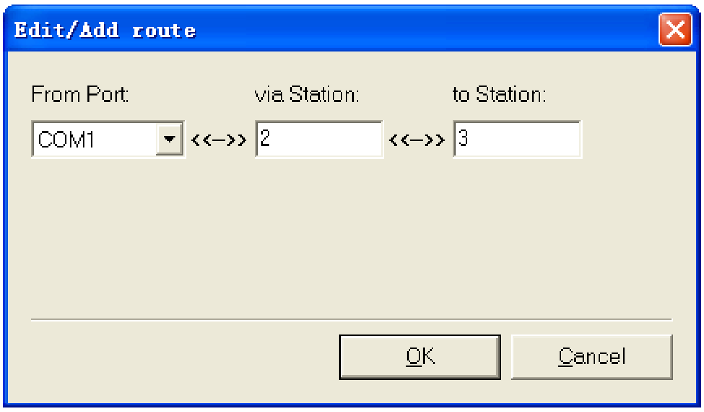


1) Select the desired MOX IoNix processor in the visual network tree and click on the **“Network”** tab. IoNix processor Station Number 1 is taken as an example for the following description.

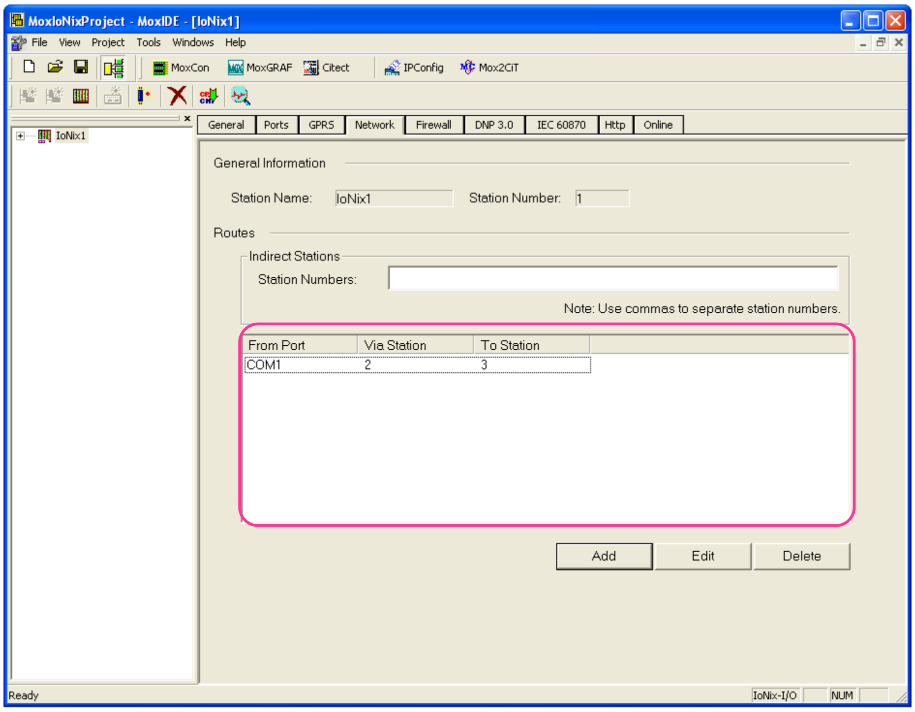


2) Select **"Add"** to insert a new communication route to the network.

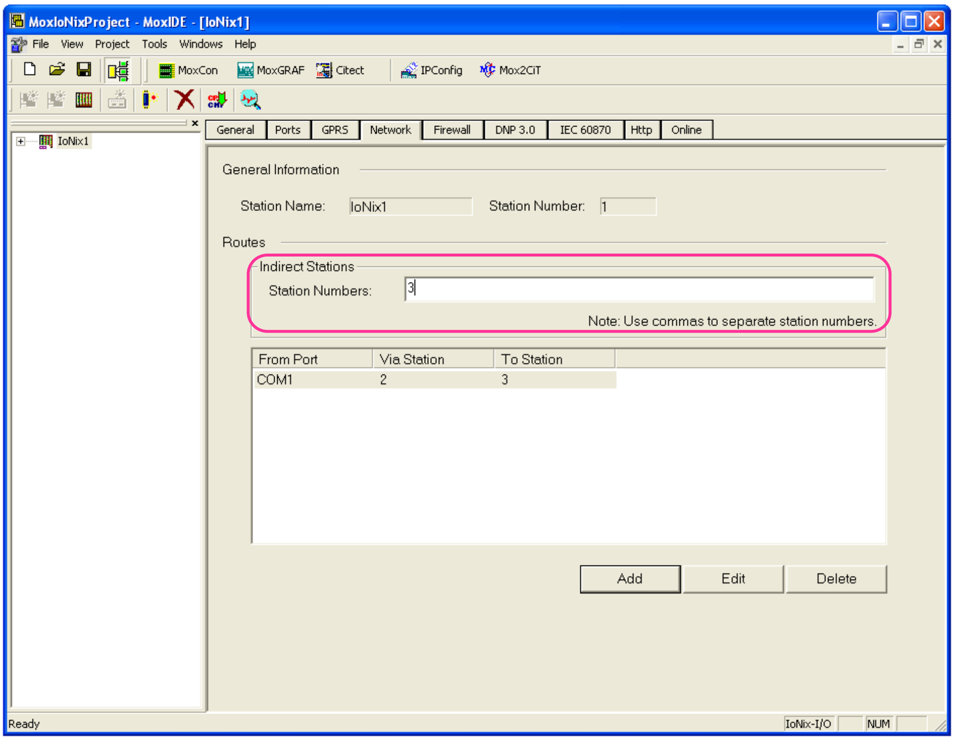
3) Enter the serial port that is connected to the network. Using the above example network, for MOX IoNix processor 1 to be able to communicate with MOX IoNix processor 3, it has to go via IoNix processor 2. Enter the "via Station" number 2. In the example the destination MOX IoNix processor is number 3. Enter the "to Station" number 3. Select the **"OK"** button.



4) The network route window should now look identical to this:



5) The “Indirect Stations” include the MOX IoNix processors that are not directly connected to the Master in the network. Using the example above the controllers, MOX IoNix processor 3 is not directly connected. Enter “3” into the network configuration.



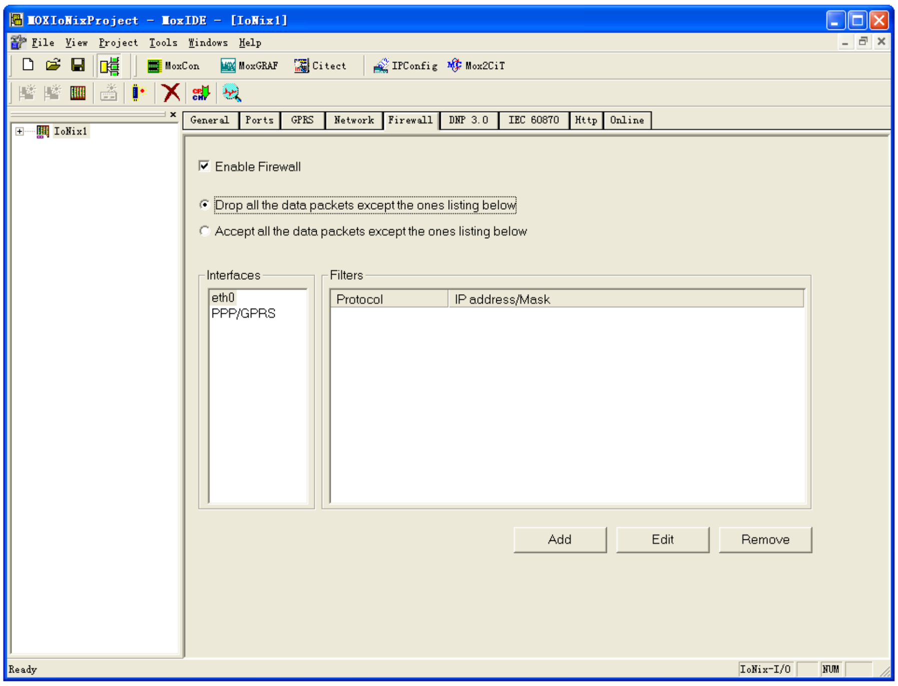
6) When MOX IoNix processor 1 is successfully configured, IoNix processor 2 and IoNix processor 3 should also to be configured to make the communication link complete. For

MOX IoNix processor 2, the Routes must be **“Via Station 1 to Station 1”** and **“Via Station 3 to Station 3”**. The “Indirect Stations” can be left blank. For MOX IoNix processor 3, the Routes must be **“Via Station 2 to Station 1”** and the “Indirect Stations” should be **“1”**.

⚠	*The new Network information will automatically update within MOXIDE on leaving the Network page.*

4.3 Firewall

The MOX IoNix processor has the ability to block out all unauthorised access. This is done by configuring an onboard firewall of the MOX IoNix processor. To configure the firewall select the **"Firewall"** tab.



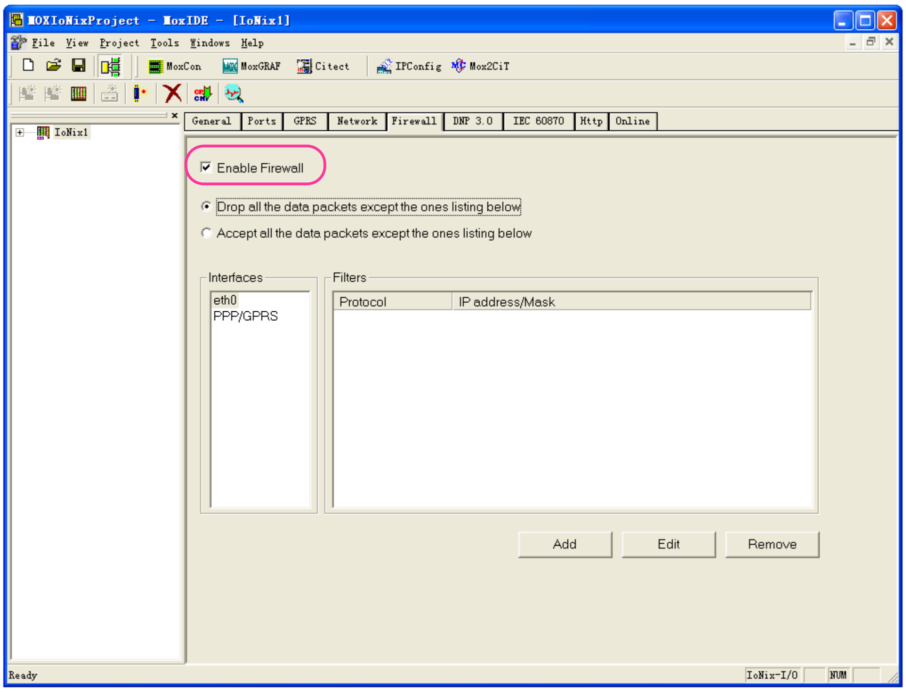
There are two approaches that can be taken when configuring the firewall. The first is to drop all information that is not sent by known "secure" devices/addresses. This is considered the safest method of security.

The second method is to allow all information sent by devices/addresses except those specified.

This guide will focus on the recommended method, to drop all information sent by unknown devices/addresses.

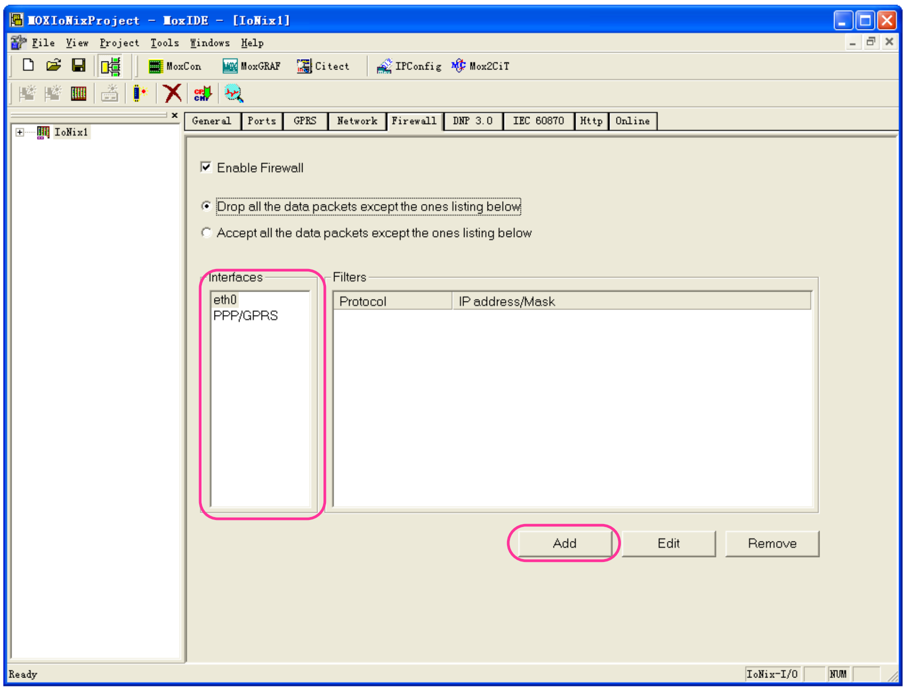
1) Firewall Configuration: Select the desired MOX IoNix processor in the visual network tree and click on the **"Firewall"** tab.

2) Enable Firewall configuration.

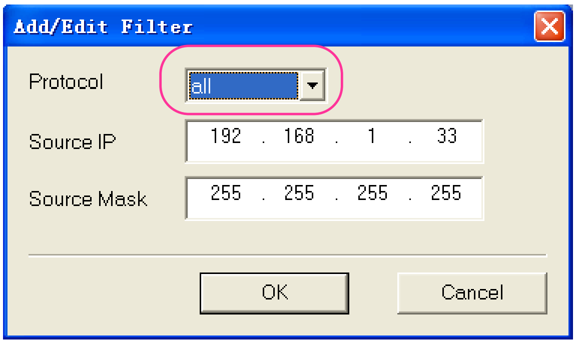


3) Select the communication interface that the firewall is to protect.

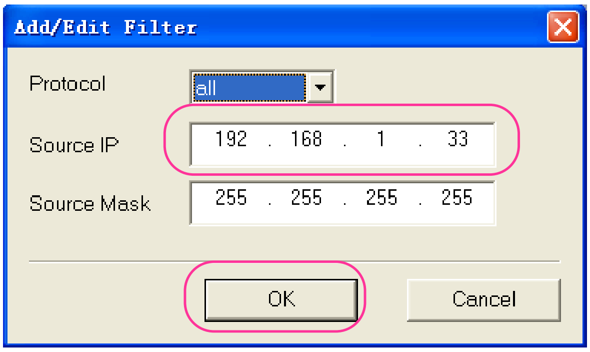
4) Select the **"Add"** button to insert a secure IP address.



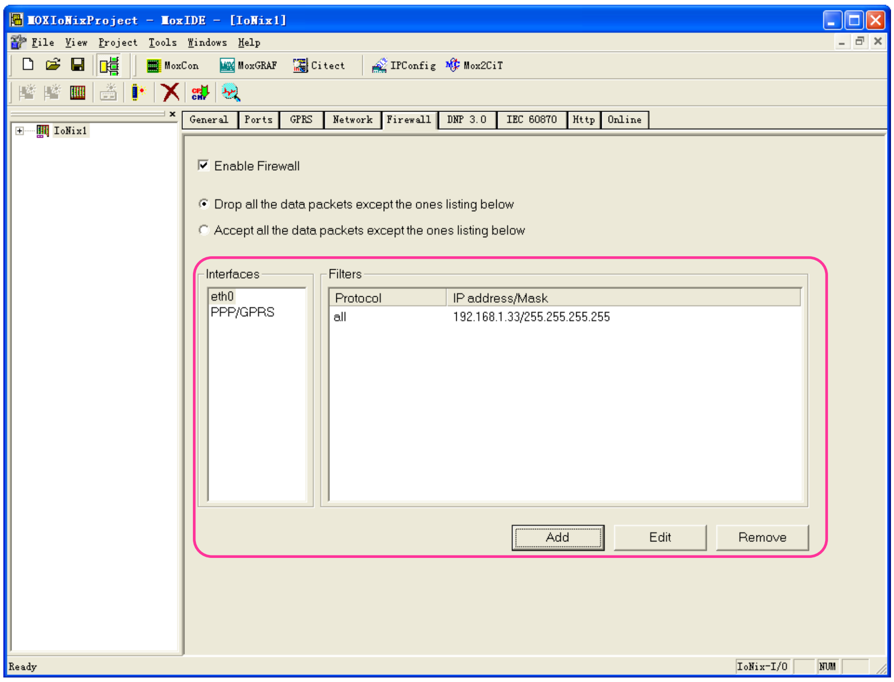
5) Select the **"Protocol"** of the IP that is to be accepted. For this example select all.



6) Enter the accepted **“Source IP”** address and select **“OK”**.



7) The filters window should now look like this:

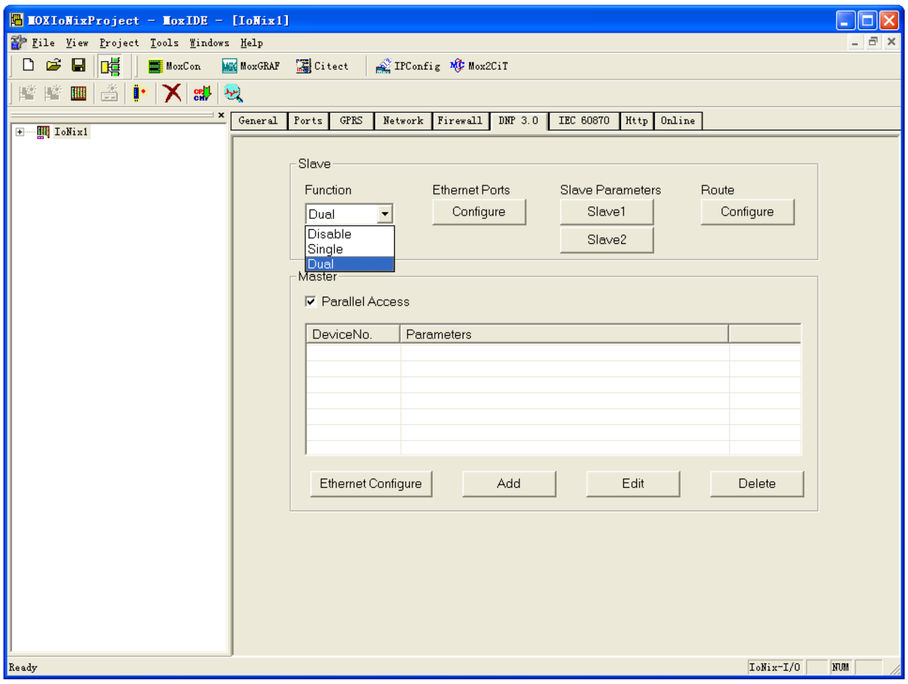


The new Firewall information will automatically update within MOXIDE when the Firewall page has lost focus.

4.4 DNP 3.0

4.4.1 MOXIDE Settings

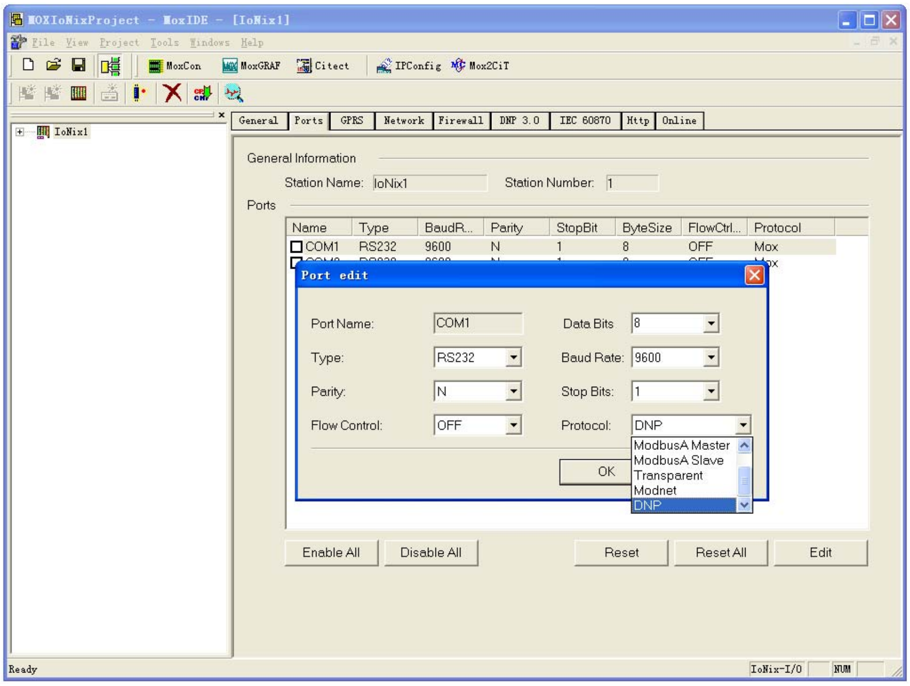
DNP 3.0 is one of the communication functionalities of MOX IoNix processor. A MOX IoNix processor can be set as master or slave. The **"DNP 3.0"** tab enables master and slave configuration of DNP 3.0 communication protocol. Please read the related document *DNP3 Configuration Guide* for DNP 3.0 communication protocol configuration in details.



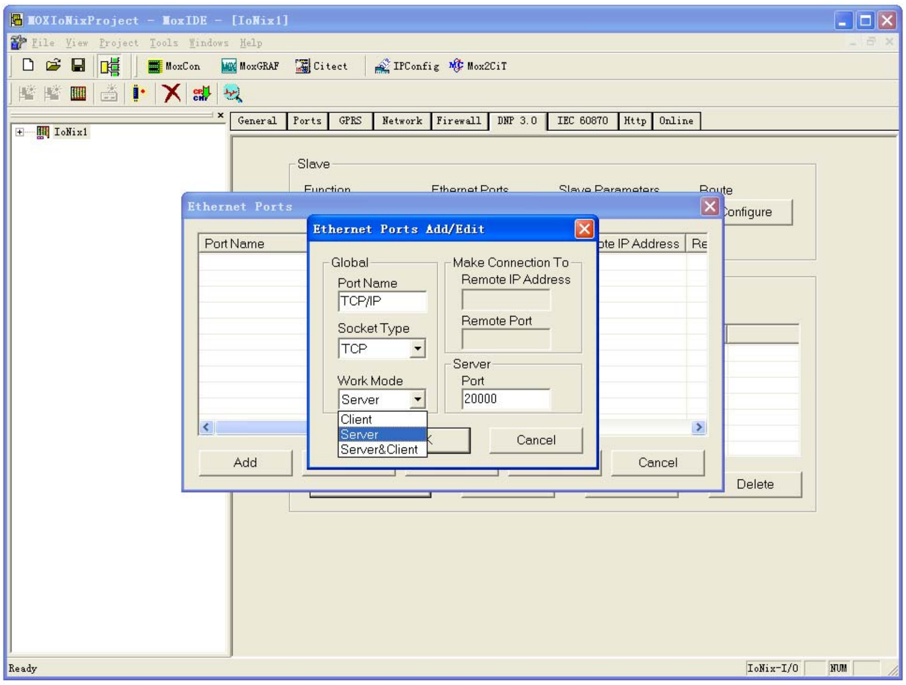
From this tab, the user is able to:

- Disable DNP3 protocol support for the product
- Enable a single DNP3 slave protocol support
- Enable dual DNP3 slave protocol support for two (slave addresses must be different)
- Configure Ethernet ports for required DNP communications
- Configure DNP3 protocol specific slave communications parameters
- Configure DNP3 protocol specific master communication parameters
- Configure DNP3 network node specific routing paths

Assign DNP 3.0 protocol to one of the serial ports before configuring DNP 3.0 settings.



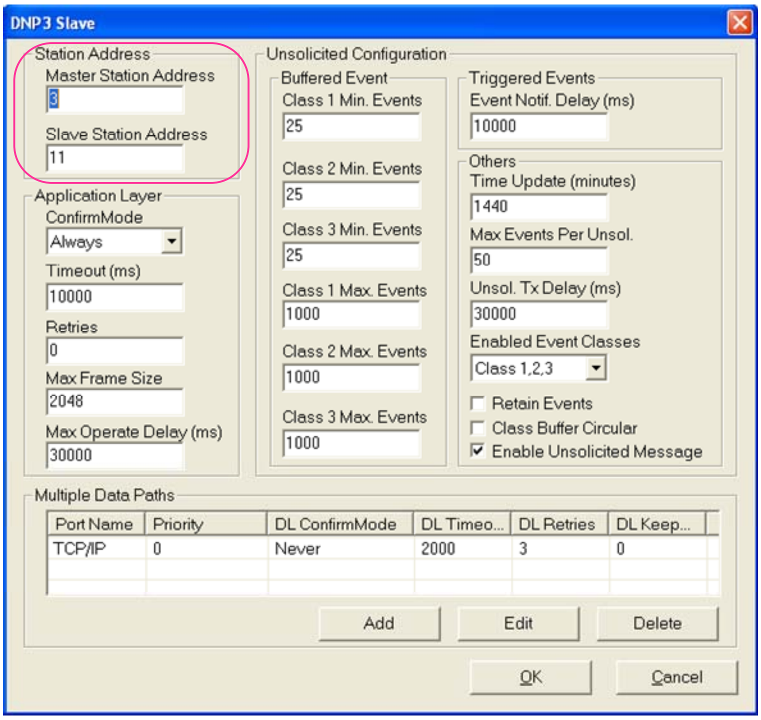
The DNP3 slave configuration dialog allows the user to configure the Ethernet port DNP communications characteristics.



The DNP3 Slave configuration dialog allows the user to individually configure the protocol specific communication parameters for each DNP network node.

For each individual DNP3 network node, the user is able to configure the following:

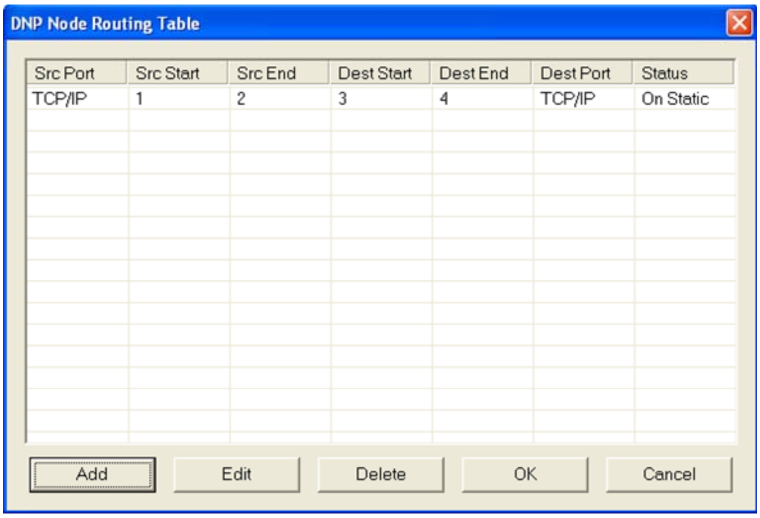
- Master and Slave DNP3 addresses
- Communications media type (Serial or TCP/P) to be used for the node
- The Data Link layer setup
- The Application layer setup
- Unsolicited data configuration.



MOX controllers are capable of routing DNP3 protocol packets between different sections of a communications network. This is achieved by using a routing table. Each controller in the communications network can be configured to use a routing table.

Each DNP3 data-link layer frame contains both a source and destination DNP node address. This addressing method allows for peer-to-peer controller communication, and allows DNP3 data-link layer frames to be routed.

The routing table is shown below:



4.4.2 MOXGRAF Settings

MOXGRAF is used to configure the DNP3 protocol addressing structures, and is used as the programming interface for the MOX IoNix processor.

The procedures for DNP3 Master Address settings are:

- Run MOXGRAF
- Open project
- Open the link architecture page
- Right click Resource 1 page
- Select DNP3 master setting

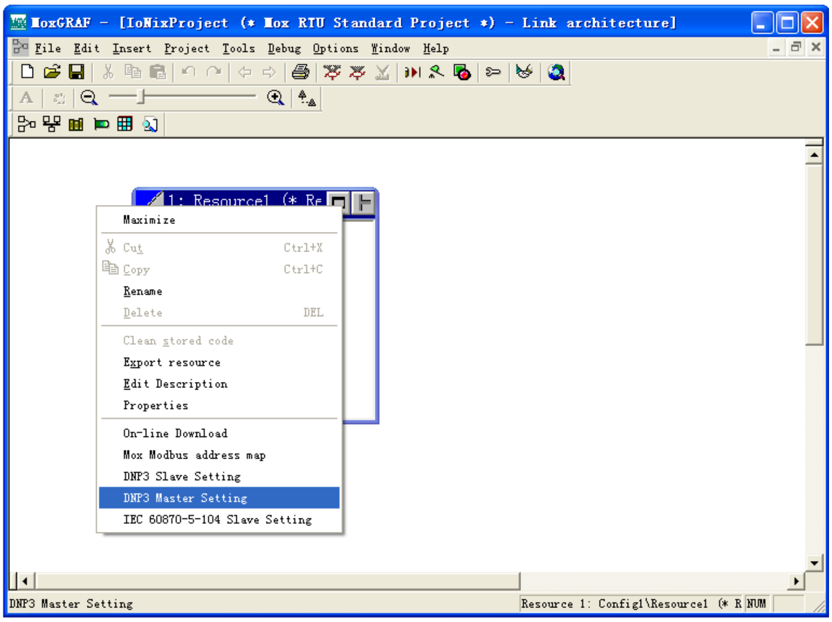


Figure 24 DNP3 Master Setting

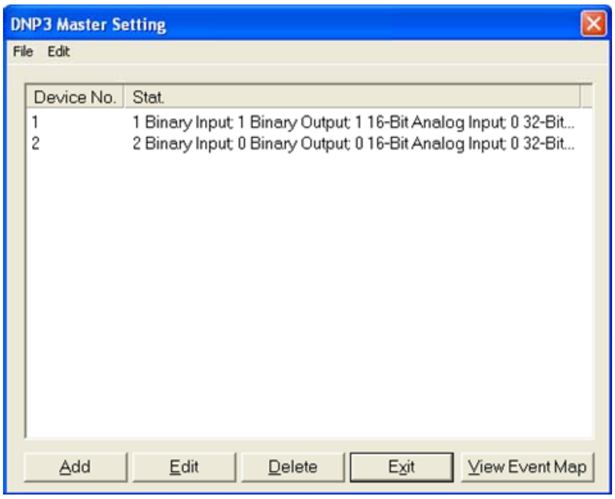


Figure 25 DNP3 Master Devices Summary

To configure the MOX IoNix processor DNP3 slave addressing, these are the required configuration steps to be completed in MOXGRAF:

- Assign MOXGRAF internal variables to DNP3 index
- Assign data Classes to the individual DNP3 index
- Configure individual DNP3 address object and variation specifics and Event characteristics
- Build the project database and download the compiled project configuration to the MOX IoNix processor.

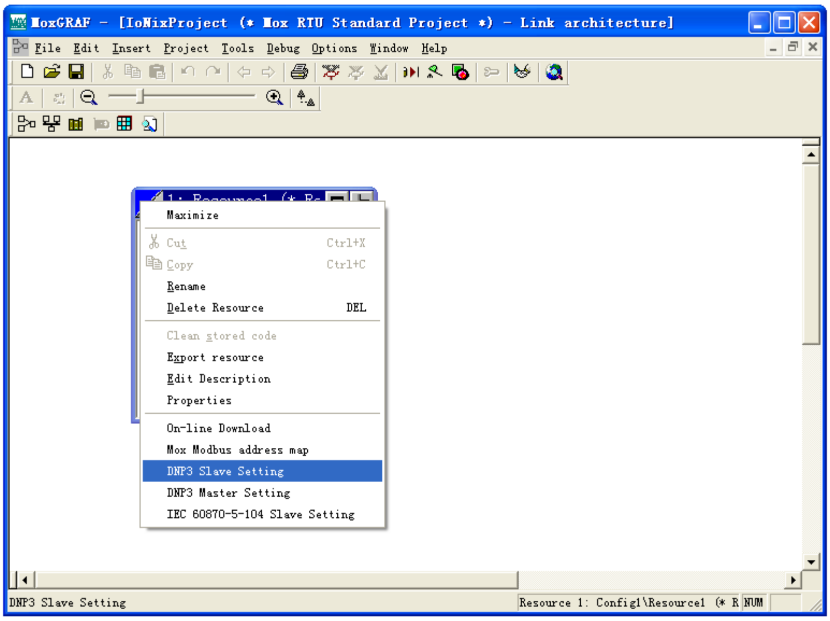
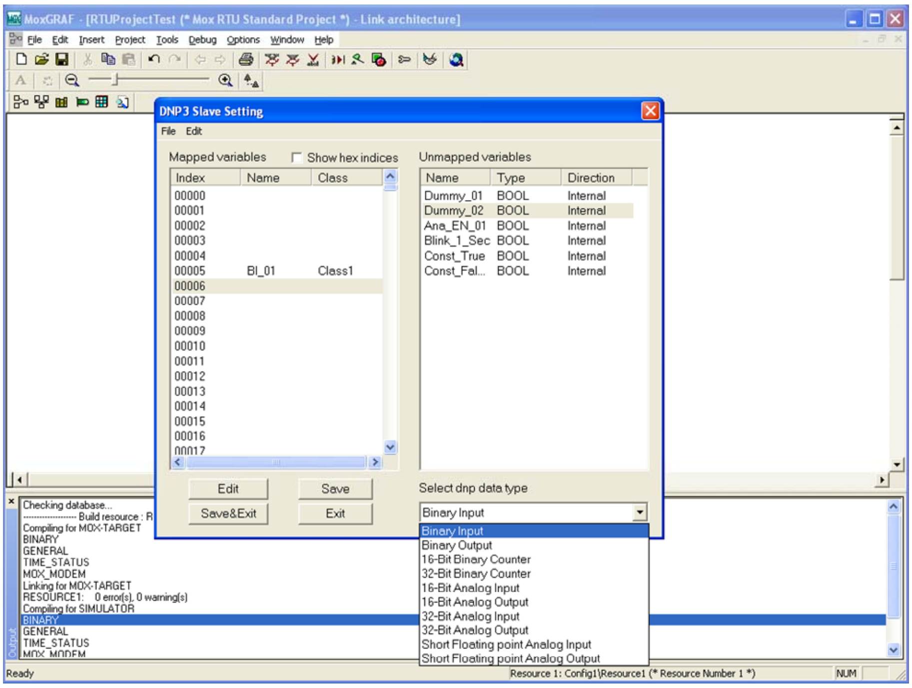


Figure 26 DNP3 Slave Setting

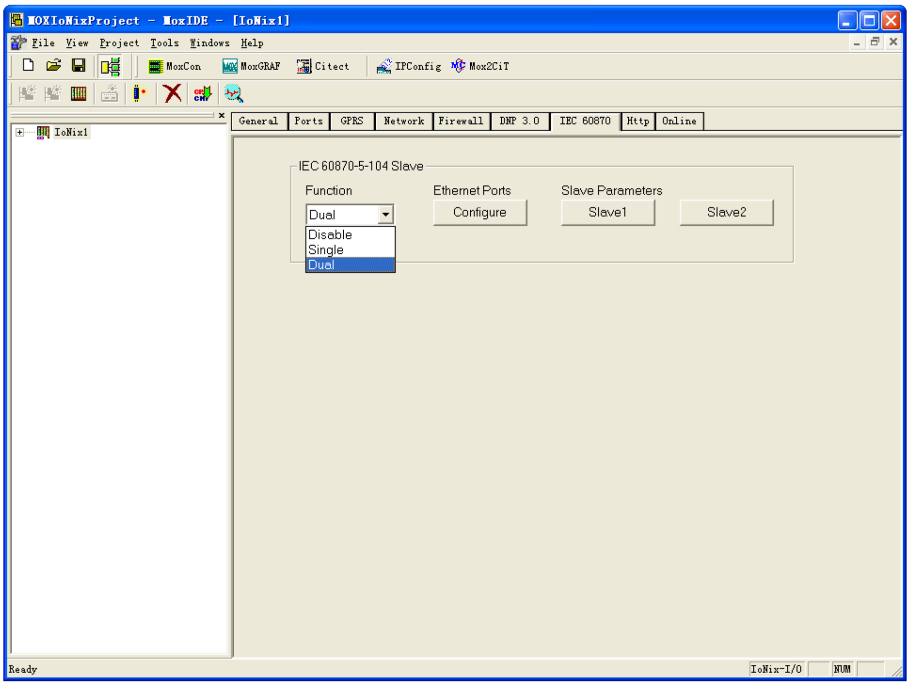

MoxGRAF - [RTUProjectTest (* Mox RTU Standard Project *) - Link architecture]
File Edit Insert Project Tools Debug Options Window Help
DNP3 Slave Setting
File Edit
Mapped variables
Show hex indices
Index Name Class
00005 BI_01 Class1
Unmapped variables
Name Type Direction
Dummy_01 BOOL Internal
Dummy_02 BOOL Internal
Ana_EN_01 BOOL Internal
Blink_1_Sec BOOL Internal
Const_True BOOL Internal
Const_Fal... BOOL Internal
Edit
Save
Save&Exit
Exit
Select dnp data type
Binary Input
Binary Output
16-Bit Binary Counter
32-Bit Binary Counter
16-Bit Analog Input
16-Bit Analog Output
32-Bit Analog Input
32-Bit Analog Output
Short Floating point Analog Input
Short Floating point Analog Output
Checking database...
Compiling for MOX-TARGET
RESOURCE1: 0 error(s), 0 warning(s)
Compiling for SIMULATOR
Ready
Resource 1: Config1\Resource1 (* Resource Number 1 *)
NUM

4.5 IEC 60870

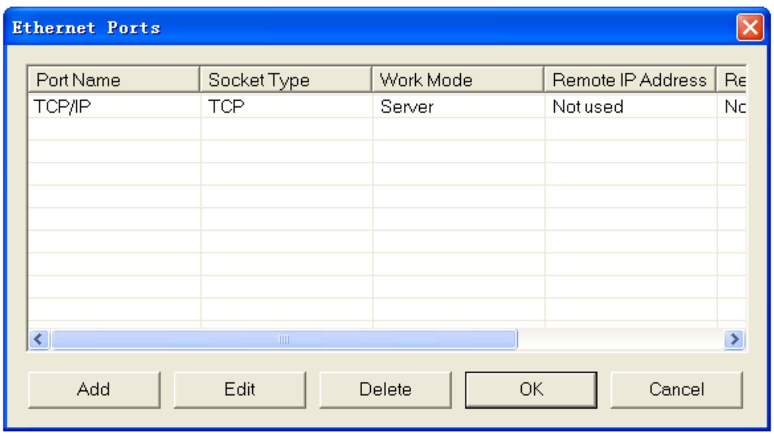
4.5.1 MOXIDE Settings

IEC 60870-5 is a series of transport protocol standards, applying to telecontrol, teleprotection, and associated telecommunications for electric power systems.

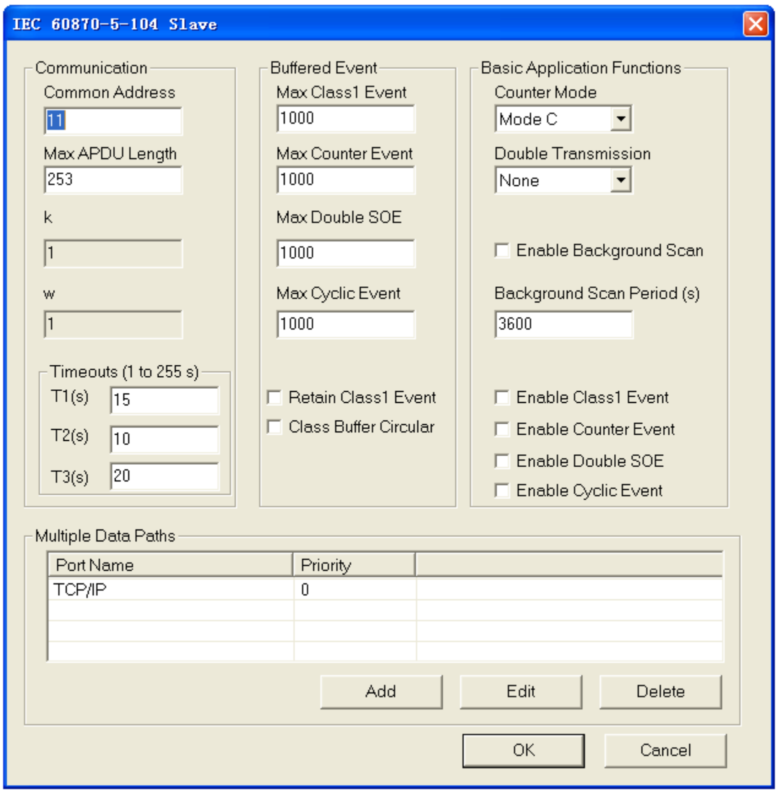
The **"IEC 60870"** tab allows the user to configure IEC 60870 - 104 Slaves. There are three options in IEC 60870 - 104 Slave Function: Disable, Single, and Dual.



To configure Ethernet Ports information, click the "**Configure**" button under "**Ethernet Ports**" label.



To configure IEC 60870 - 104 Slave information, click the **"Slave1"** or **"Slave2"** button under **"Slave Parameters"** label.



The new IEC870 information will update automatically within the MOXIDE project on leaving this tab.

4.5.2 MOXGRAF Settings

MOXGRAF is used to configure the map between IEC 60870 variables and MOX variables, assign IEC 60870 objects to a group as well as select the transmission mode and time tag.

To enter the IEC 60870 setting dialog, run MOXGRAF and open a project, and then go to the Link architecture page. Right click Resource 1 page, select IEC 60870-5-104 setting menu, the IEC 60870 setting dialog will pop up. Or simply select the **Tools | IEC 60870-5-104 Slave Setting** to get the pop-up IEC 60870-5-104 setting window.

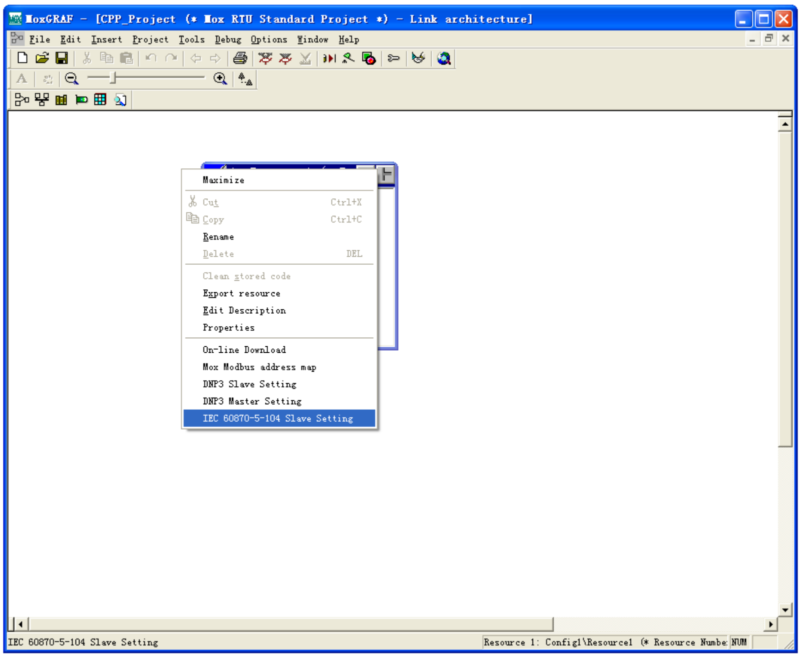


Figure 27 Enter IEC 60870 Setting Dialog

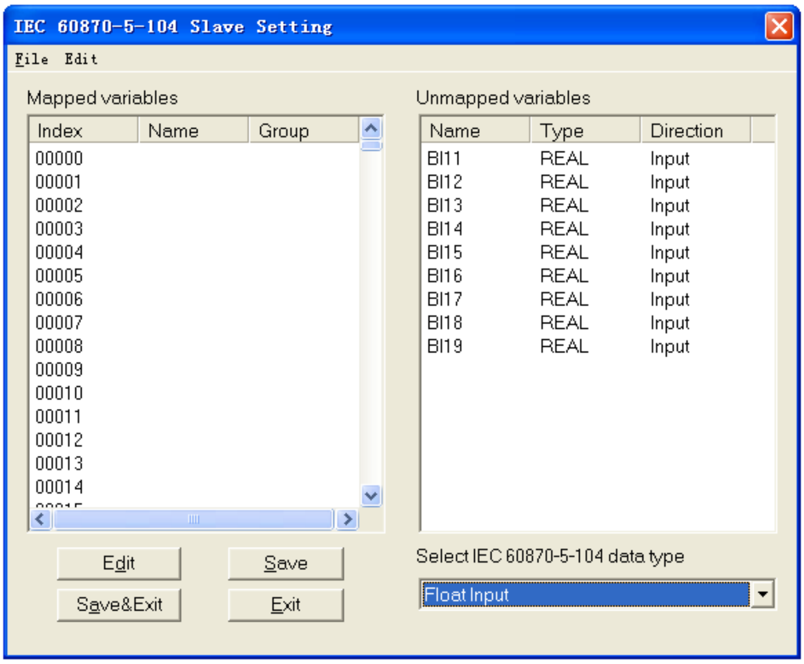


Figure 28 IEC 60870 Slave Setting Window

Select an index from the **Mapped variables** list on the left, and then double click a variable you want to map to the selected index from **Unmapped variables** list on the right. This variable will go to left list immediately. In order to map more variables, just repeat this procedure. Click the **"Save"** or **"Save&Exit"** button to save the changes.

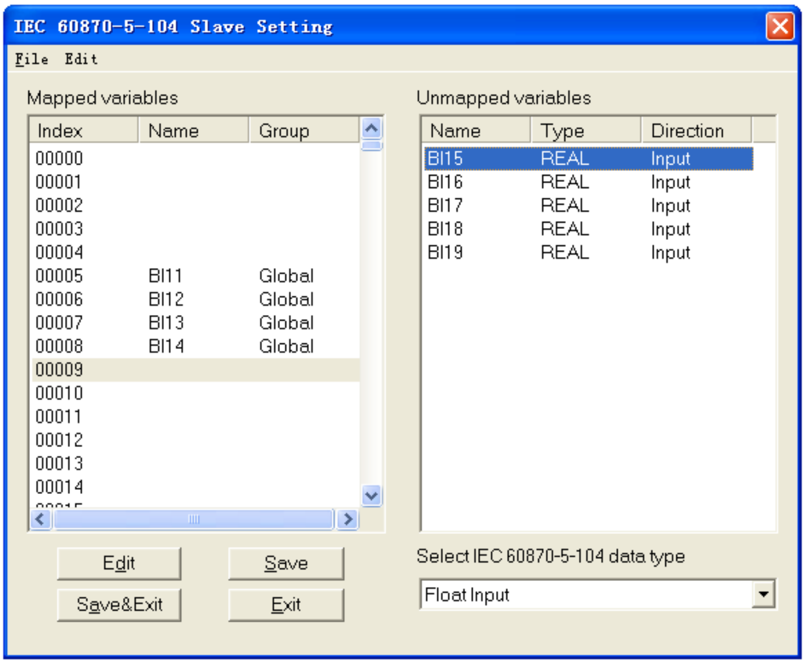


Figure 29 Map IEC 60870 Variables

In the **Mapped variables** list, double click the row that needs to be unmapped. To unmap more variables, just repeat the procedure. Click the **"Save"** or **"Save&Exit"** button to save the changes.

In the **Mapped variables** list, select the row you want to edit and click the **"Edit"** button, edit dialog will pop up. Change Group and other settings according to your requirements, then click the **"OK"** button to close the dialog and click the **"Save"** button on the IEC 60870 Slave Setting window.

In MOXGRAF toolbar, select **Project | Build Project/Library** to build the data map configuration file.

For more information about IEC 60870, please refer to the IEC 60870 Configuration Guide.

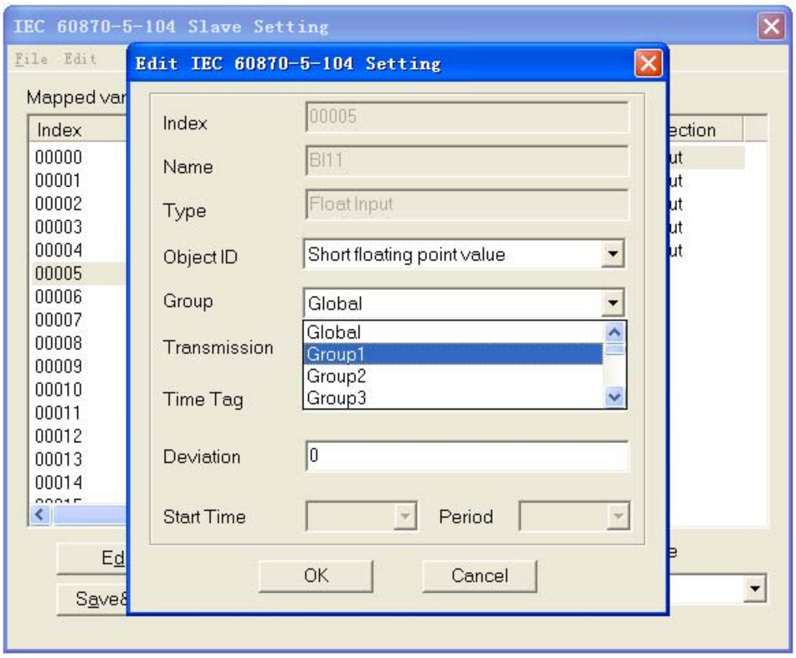


Figure 30 IEC 60870 Group Setting

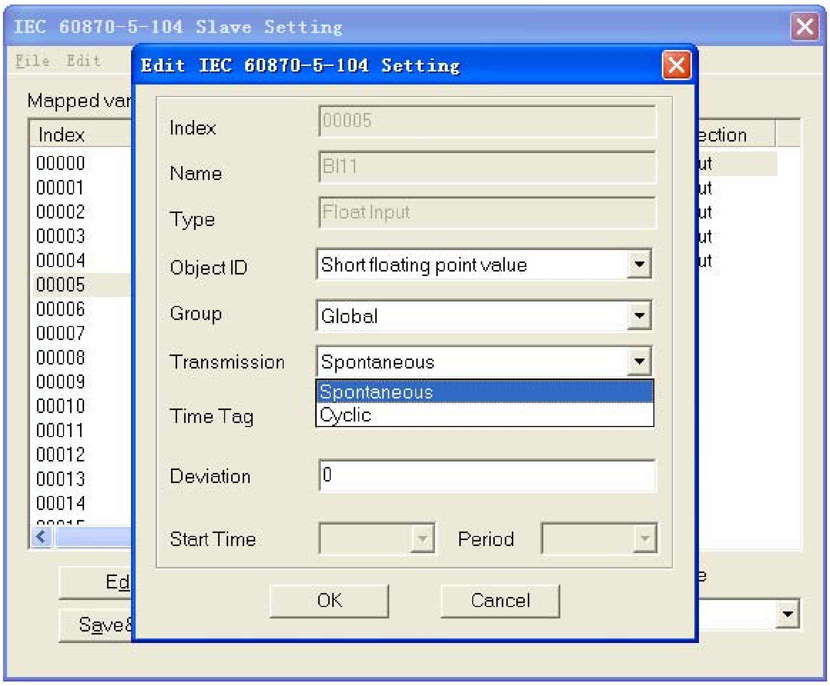


Figure 31 IEC 60870 Transmission Setting

4.6 HTTP Server

The MOX IoNix processor is provided with a HTTP server with XML support. This gives the flexibility to browse controller specific web pages or to simply browse/download files with the web client.

The MOX IoNix processor HTTP server provides a platform to build web sites specifically for managing the controller. The web pages are first built and then uploaded to the HTTP server, using File Transfer Protocol (FTP). Once all pages are uploaded to the HTTP server, they can be viewed using a web client. It is important to understand that these are user data files, not configuration files.

FTP account information as follow:

- Username = Guest
- Password = *No Password*
- Port Number = 21

	FTP username is case sensitive.

Both HTML and XML are supported, however if no default page exists, such as index.html, index.htm, index.html, default.htm, current user directory will be displayed. Use the controller's IP address to access HTTP server directly since MOX IoNix processor has no name of itself, e.g. http://192.168.0.32.

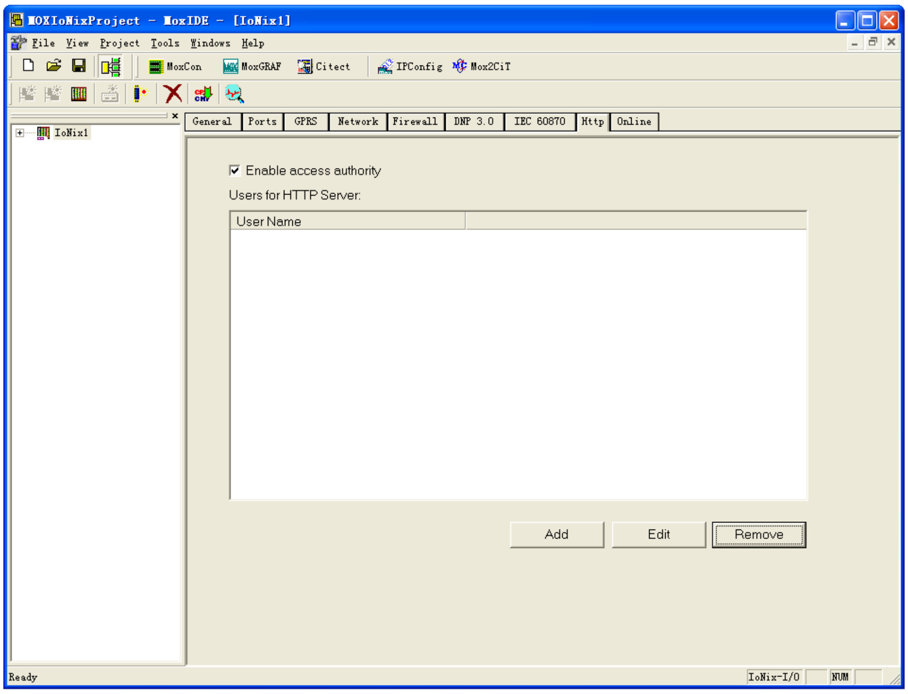
4.6.1 Basic HTTP Authentication

Basic HTTP authentication is provided, and illegal IP access will be prohibited as a system security mechanism. If the HTTP authentication is not configured in MOXIDE, no security features will be operational and all access to the user directory of the controller will be possible.

The detailed procedures for HTTP authentication configuration are shown below:

1) Prerequisite:

- Run MOXIDE
- Create a project using the "Connect via IoNix to I/O" network architecture option.
- Create a new IoNix processor station.
- Once the new IoNix processor station is created, go to the **HTTP** page.
- Enable HTTP function by giving a check on the respective checkbox and begin to edit the basic authentication configuration.



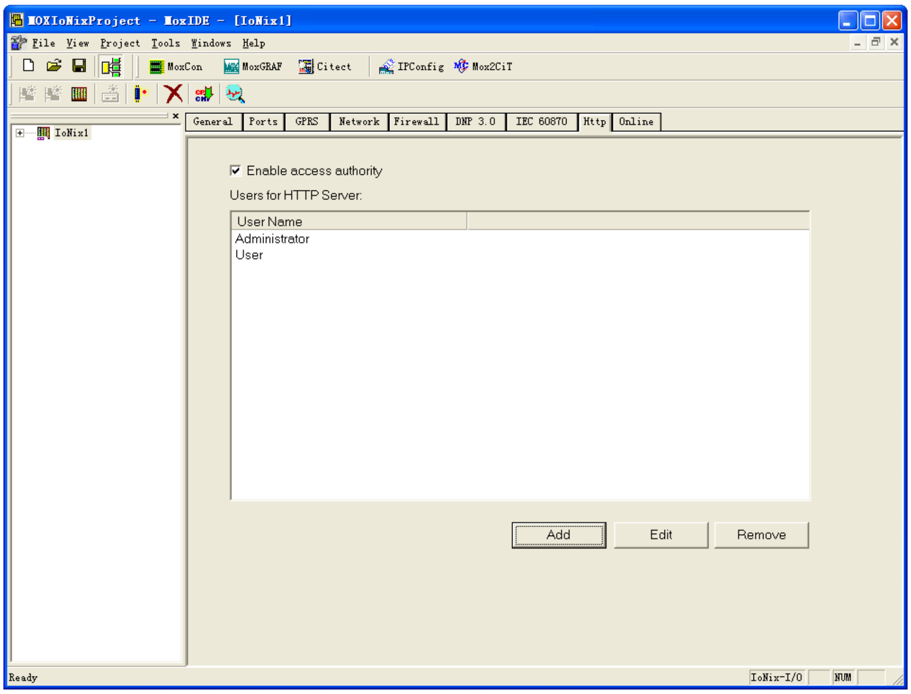
2) Add a new user:

- Add users for HTTP server by selecting the **“Add”** button.
- Enter in the **“Username”** of the new user for using the HTTP server.
- Finally give this user a “Password” for accessing the IoNix processor’s web pages.
- Click the **“OK”** button to save configuration or click the **“Cancel”** button to discard configuration.
- Remove all HTTP users to cancel basic HTTP authentication.

3) Edit an existing user:

- Edit an existing user by selecting the desired user and click the **“Edit”** button.
- Modify the **“Username”** of the selected user (optional)
- Finally give this user a **“Password”** for accessing the IoNix processor’s web pages.
- Click the **“OK”** button to save modification or click the **“Cancel”** button to discard the alteration.

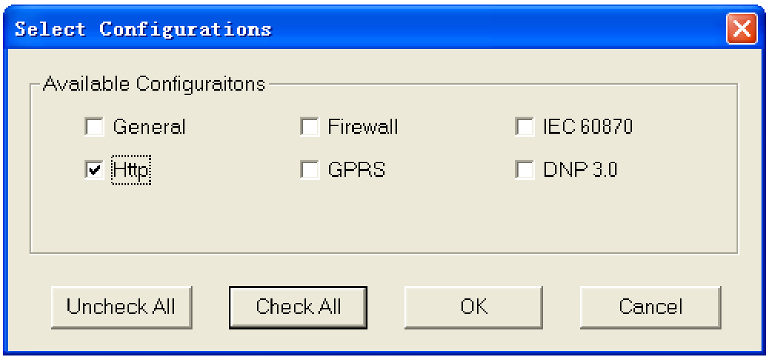
	*When Http is enabled but with no user defined, no one can access the IoNix processor via http.* *A valid username cannot be started or finished with a white space.*



Once you have altered the authentication parameters to match your requirements, save the current project (Select **File | Save Project** or click on the save project icon) then proceed to download them to the MOX IoNix processor.

Select the **"Online"** page and click the **"Online"** button. If MOX IoNix processor onboard information has been successfully uploaded and displayed on the screen, it indicates that MOXIDE is connected to the selected IoNix processor. Both **"Upload <<"** and **"Download >>"** buttons will be enabled.

Next click the **"Download >>"** button and select the **"Http User"** option to download the configuration to the controller.



Three real MODBUS data access examples are provided on HTTP server:

1) Basic read and write: manual MODBUS reading and writing online
2) HTML with MODBUS: user building HTML pages related with MODBUS variables

3) XML with MODBUS: user building XML files related with MODBUS variables

To view these pages open your desired Internet Web Explorer and type in the IP address of the connected controller into the “Address” field. This will bring up the index.htm page from which you can select to open any of the above examples.

The basic operations of reading and writing a MODBUS address while online is performed via two simple request pages:

- moxread.htm: reading a group of MODBUS variables
- moxwrite.htm: writing a single MODBUS variable;

Select the moxread.htm example from the index page.

Enter the MODBUS start address from where you wish to read variables.

Enter the number of data points (registers) that you wish to read. If you wish to read three DINT variables then it will be six data point as each variable uses two registers.

Select the data type (format) of the desired variables and the refresh time.

Select the submit button. If there is no error in the information that you have selected to read the moxonline.htm web page will be returned displaying the data.

If refresh time is defined, the moxonline.htm web page will refresh automatically at the set intervals.

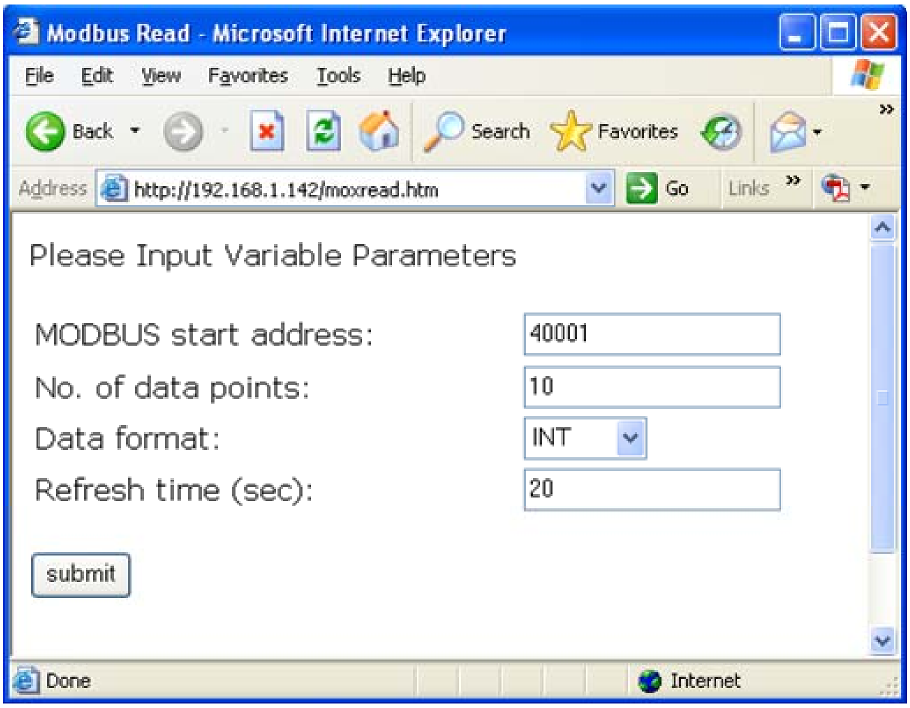


Figure 32 MODBUS Read Request Page

Here are the details of input parameters on this page.

MODBUSAddr: MODBUS address of the source variable

- Coil status: 00001-9999
- Input status: 10001-19999
- Input register: 30001-39999
- Holding register: 40001-49999

DataPoint: Data points to read in http server station, for MODBUS write, only one variable is allowed.

- Range: 1~100

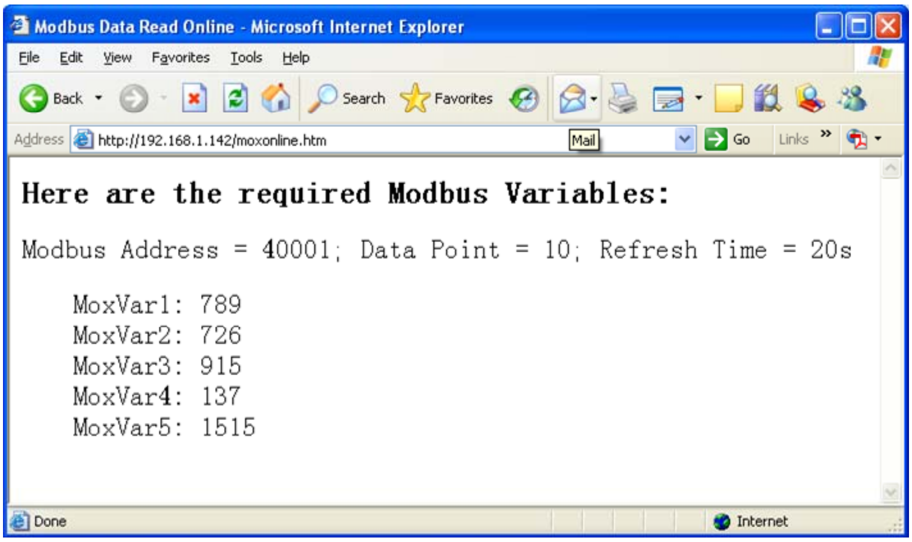
DataFormat: Data format

- Boollean: BOOL, TRUE or FALSE
- Int: DINT
- Float: REAL

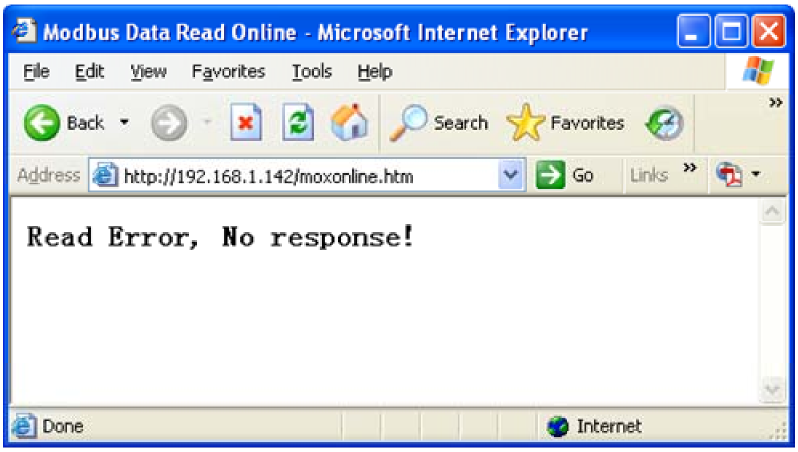
Data: The data value for writing.

Refresh: Variables refresh time in second for MODBUS read

If the MODBUS read is successful, the following page will be displayed:



If the MODBUS read is unsuccessful, the following page will be displayed:



Select the moxwrite.htm example from the index menu.

Enter the MODBUS start address from the variable you wish to write to.

Enter the number of data points (registers) that the variable uses. For example a FLOAT (REAL) uses 4 registers within the MOX IoNix processor.

Select the data type (format) of the desired variables and the data value.

Select the submit button. If there is no error in the information that you have selected to write the moxonline.htm web page will be returned displaying a success message.

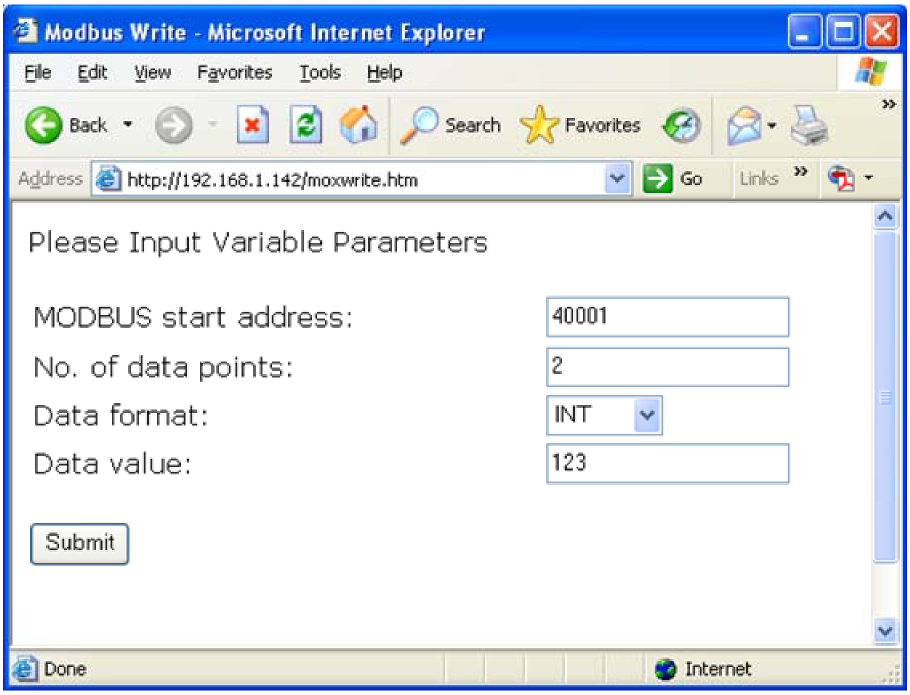


Figure 33 MODBUS Variable Write Request Page

The following page will be displayed if the MODBUS write request is successful:

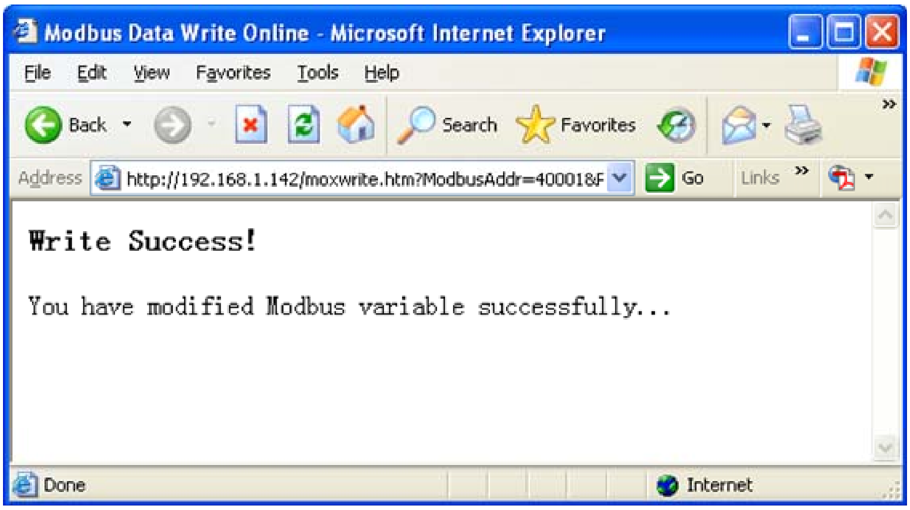


Figure 34 Basic Write Success

The following page will be displayed if the MODBUS write request is unsuccessful:

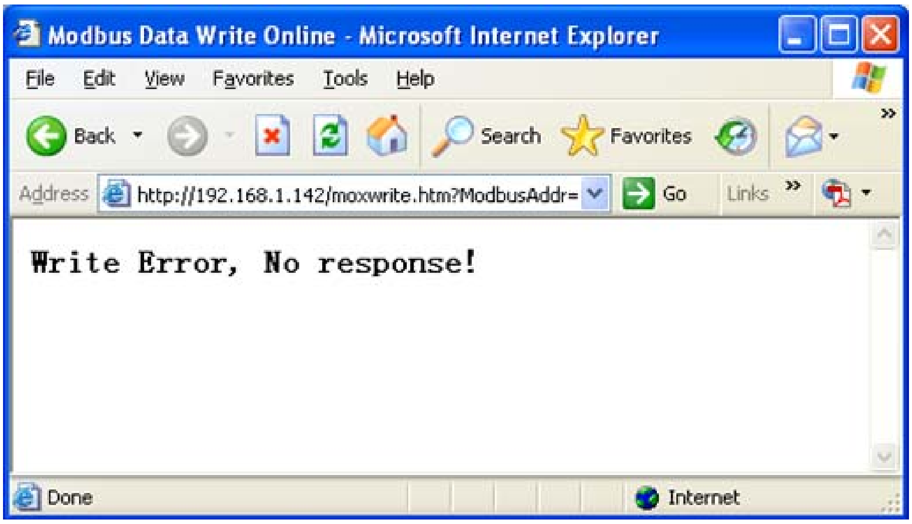


Figure 35 Basic Write Error

HTML with MODBUS enables the user to view variables on a web page without having to request them, as displayed in the previous read operation.

One MODBUS variable tag represents one MODBUS variable.

All HTML pages related with MODBUS variables should be named as mox*.htm. MODBUS variable tags use the combination of type and MODBUS address. Each tag occupies 10 characters, defined as followed:

#BOOL00001, #BOOL10001, #DINT40001, #REAL40003, ……

All these tags will be replaced with the true data directly when user browse them. User should pre-build such HTML pages and put them to HTTP server before browsing.

If user define mox*.htm with no MODBUS variable tags, there is no problem. If there are many such pages, it will affect the performance of http server. If user put MODBUS variable tags on other pages, there is no process for MODBUS variable tags when browsing.

Here is a source code of moxdata.htm. Three MODBUS variable tags are used as #BOOL00001, #DINT40001 and #REAL40021. Be sure the combination of type and address is correct and upload this page to http server.

```
<html>
<head>
<meta http-equiv="Content-Type" content="text/html; charset=gb2312">
<title>An example of MODBUS variables related html page</title>
</head>

<body>
        <p>Here are the required MODBUS Variables:</p>
        <p>A BOOL variable at address 00001: #BOOL00001<br>
         A DINT variable at address 40001: #DINT40001<br>
         A REAL variable at address 40021: #REAL40021</p>
</body>
</html>
```

Select the moxdata.htm example from the index.htm page.

The following page will be displayed if the dynamic read operation is successful:

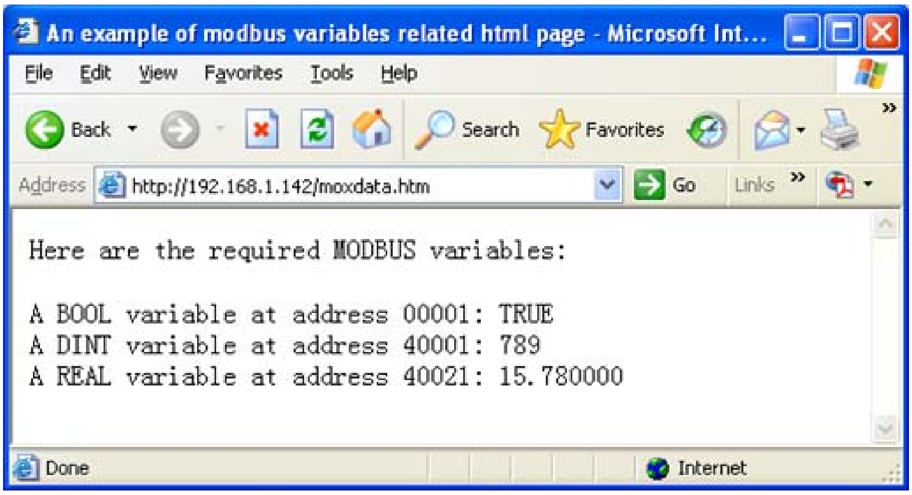


Figure 36 Read MODBUS Variables Success

If the controller is unable to read the MODBUS addresses defined in the HTML page the following screen will be displayed:

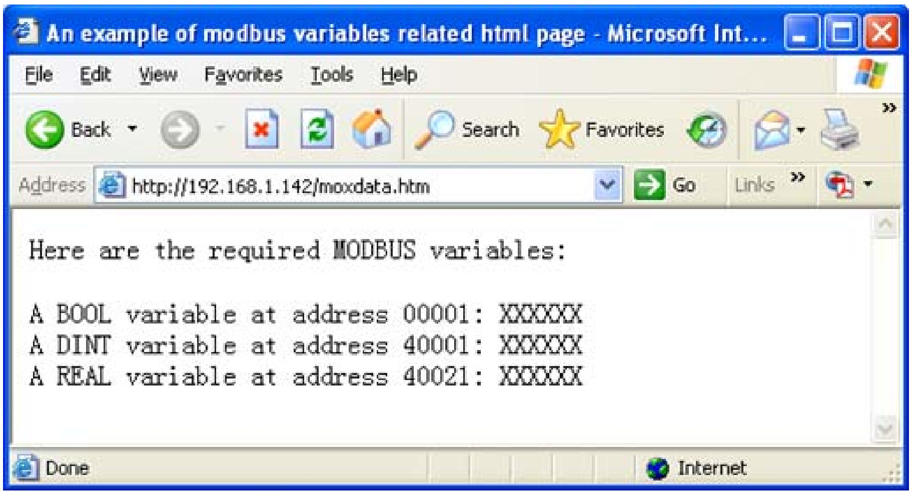


Figure 37 MODBUS Variable Read Error

A MODBUS variable group tags and attributes method is used to require a group of MODBUS variables. All XML files related with MODBUS variables should be named as mox*.xml. There is no process for other XML files on HTTP server. All MODBUS variable group tags should begin with MoxVar and the attribute of MoxVar should be defined correctly. Sub tags will be returned after MODBUS variable group tag as MoxVar1, MoxVar2, and so on.

Here is a source code of moxdata.xml. Three MODBUS variable group tags are used as MoxVarGroup1, MoxVarGroup2 and MoxVarGroup3. For each tag, there are three attributes displayed in bold font: **MODBUSAddr, Point and Format**.

Set all parameter correctly and upload this page to http server.

```
<?xml version="1.0" encoding="gb2312"?>
<!—an Example to access Mox variables-->
<MoxDataDisplay>
   < MoxVarGroup1 MODBUSAddr="1" Point="2" Format="Boollean"></ MoxVarGroup1>
   < MoxVarGroup2 MODBUSAddr="40001" Point="4" Format="Int"></ MoxVarGroup2>
   < MoxVarGroup3 MODBUSAddr="40021" Point="4" Format="Float"></ MoxVarGroup3>
</ MoxDataDisplay>
```

Open moxdata.xml on http server.

If success:

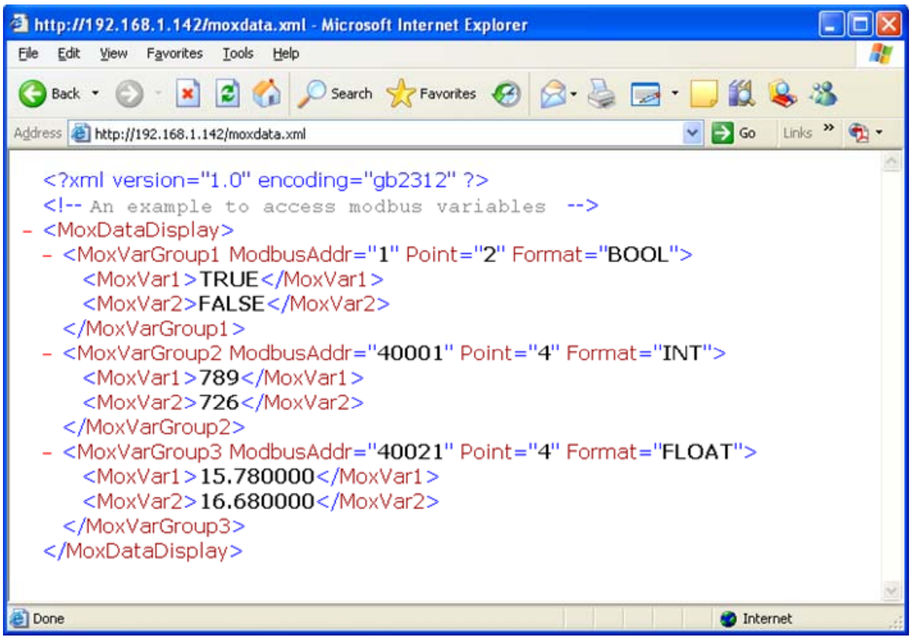


Figure 38 Read moxdata.xml success

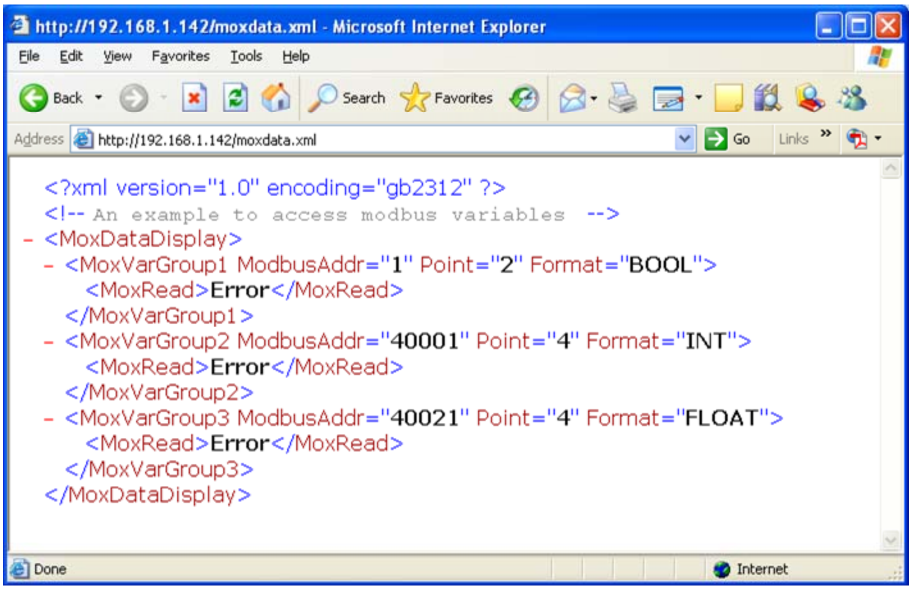
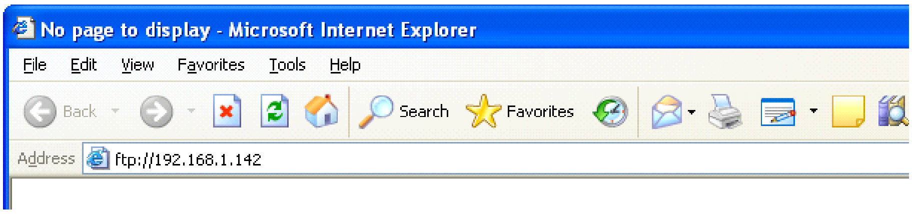


Figure 39 Read moxdata.xml error

4.6.2 Downloading User Web Pages

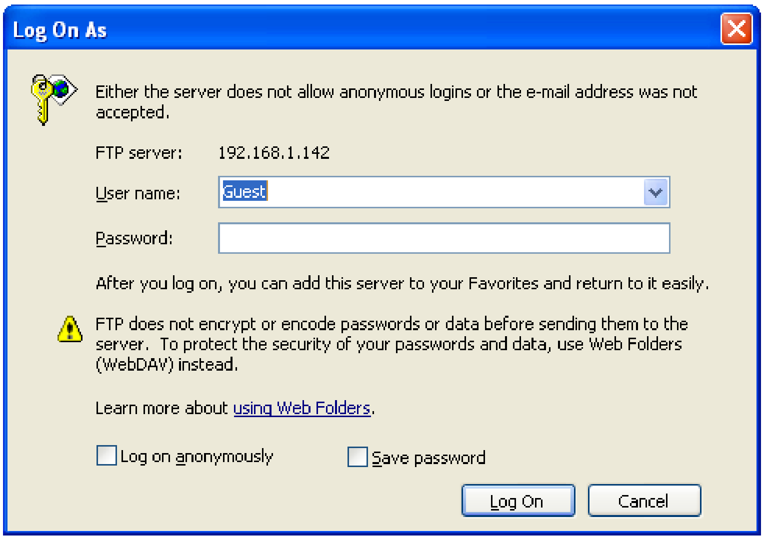
All user web pages and stored data are held in the user specified space on the MOX IoNix processor. Web pages are held within the web folder in this space. Images on the user web pages should be placed in the images folder within the web folder to keep structure and organization for web page trouble shooting.

To download user web pages to the IoNix processor, open Internet Explorer and use the ftp tool, e.g. ftp://192.168.1.142. It is also possible to use a ftp GUI client, such as Cuteftp or leechftp to perform this operation.

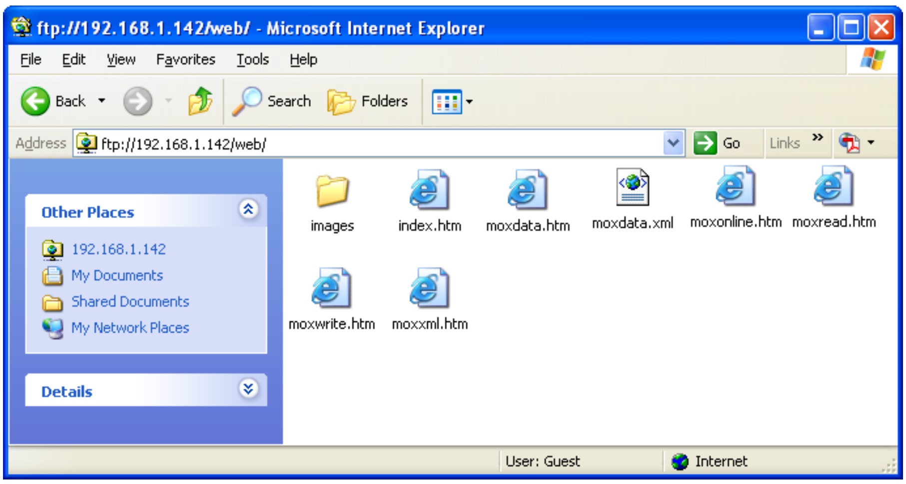


The user will then be prompted to login into the IoNix processor's user space.

- Username: Guest
- Password:



Once logged into the MOX IoNix processor user space, data can be manipulated to meet the desired requirements.



Note: The 'web' and 'images' folders cannot be removed from the system.

5 Create MOXGRAF Project

The MOXGRAF software is used to create program code for MOX Controllers. Open MOXGRAF and create a new project for the connected MOX IoNix processor. Select **File | New** from the MOXGRAF Projects Management window. Enter a name for the new project you wish to create. The name must be less than 32 characters and consist only of alphanumeric characters. It is also recommended you use a meaningful name and one that follows a naming standard.

You must select the ***MoxRTUStandardPrj*** *Template before you can continue with programming. Ensure that you have changed to the correct template before selecting* ***OK****.*

Upon creation of this new project, a directory entitled the same as the project title will be created and placed under the MOXGRAF directory structure where it can be easily accessed.

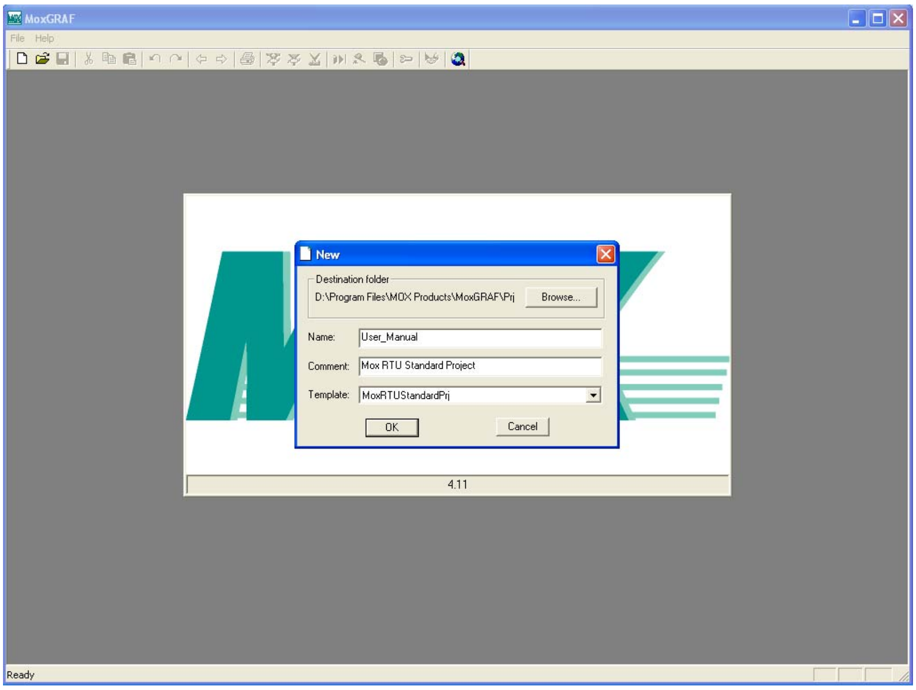
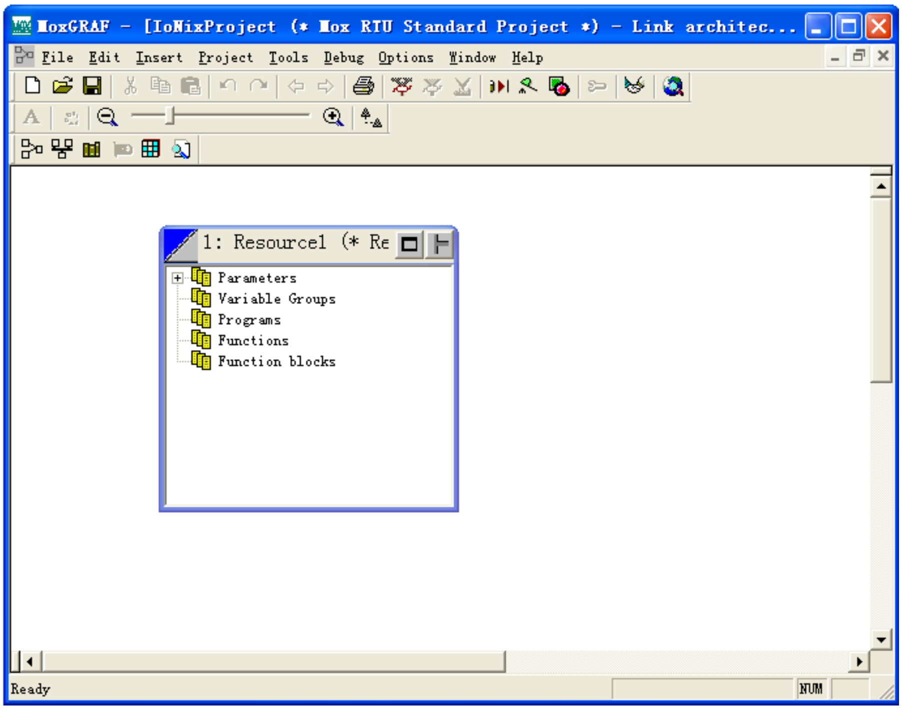


Figure 40 MOXGRAF Project Creation Screen

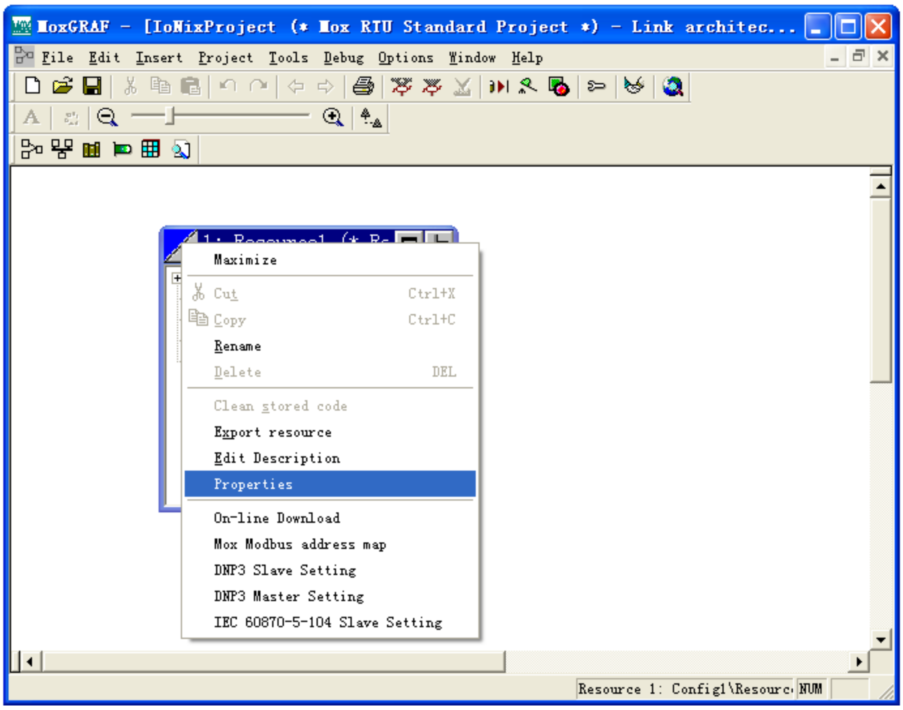
A MOXGRAF project is a collection of programs (programs, functions, function blocks etc.) used to control a process. A project corresponds to one complete process run on a target MOX controller.

At present, IoNix processor does not support redundancy, so for configuration in MOXGRAF concerning redundancy, please follow the instructions below:

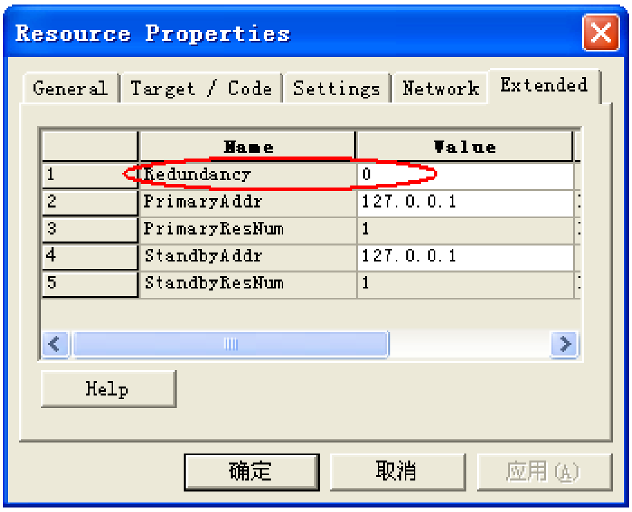
1) Open the MOXGRAF project and open the **Link Architecture** view.



2) Right click on the Header of the **Resource 1** window. This will display a list of options. Select the **Properties** option.



3) A new window will appear, **Resource Properties**. Select the **Extended** option.



Within this configuration window, keep **“Redundancy”** to its default value **“0”.**

For further information on the functionality, operational abilities and programming principles of the MOXGRAF software please refer to *MOXGRAF User Guide*.

6 Complex System

6.1 MOX IoNix Processor to MOX IONITY 603 Rack Base I/O Modules

The typical way to connect MOX IONITY 603 I/O modules to the MOX IoNix processor is directly using the MOX IoNix processor communication bus.

MOX IoNix processor communication bus locates at the right side of the system base. In this configuration no cabling is required as the I/O modules can be simply connected to the right hand end of the MOX IoNix processor. The communication bus is continued on through each connected I/O module.

The MOX IoNix processor has its own Built-in CP, as a result of this it requires configuration of all connected I/O modules via MOXIDE configuration software.

To configure the MOX IoNix processor for extended MOX IONITY 603 I/O communications, the “MoxBUS port” within IP Config must be set to 127.0.0.1. This will tell the MOX IoNix processor to scan for the virtual communications processor within itself.

This network configuration will ensure fewer communication clashes, caused by multiple connections with other MOX devices on the same Ethernet port.

MOXIDE is required when configuring a communication network. There are two methods of configuring your network architecture:

1) Connect your network hardware. Use MOXIDE to scan the network architecture for an automatic software configuration.
2) Create the software configuration in MOXIDE. Connect your network hardware identical to the software-configured architecture.

To scan your physically connected MOX I/O network, select the controller displayed in the network tree. Select the **“Scan Device”** icon to start the scan process. A window will be displayed to give feedback on the modules that have been successfully identified.

When the scan function has finished a prompt will appear querying if you wish to upload all found modules and their information to MOXIDE. Select the **“Accept”** if you want the information uploaded otherwise select the **“Cancel”**.

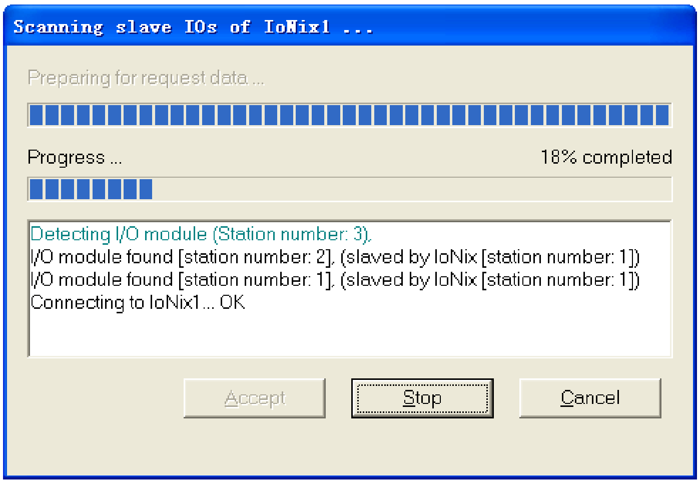


Figure 41 Scanning MOX I/O modules

The displayed network tree is not unalterable, refer to the figure below. The information can be changed manually and updated to suit user needs. If required change module information and download it to the working device. If at any time the network architecture changes simply use the scan function again to upload the new configuration.

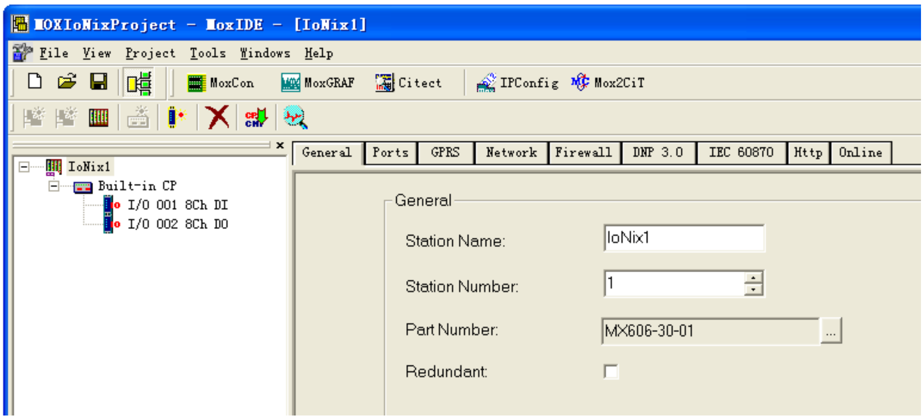


Figure 42 Uploaded Network Tree

Once the required architecture is reached and all physically connected MOX I/O modules have been recognized and uploaded into the network tree, make sure that each individual MOX I/O module is configured to meet its operational requirements.

The next step is to download all I/O rack network information into the Built-in CP within the MOX IoNix processor. Select the MOX IoNix processor Built-in CP Configuration page then click on the **"Download CPCONF"** icon to download the connected I/O module configuration to it. Once MOX IoNix processor Built-in CP has its network configurations downloaded, the network architecture can be exported into MOXGRAF.

Under the **"General"** Tab there is a section dedicated to MOXGRAF. Select the **"Browse"** button and search for the *.mdb file of the MOXGRAF program that you have previously created.

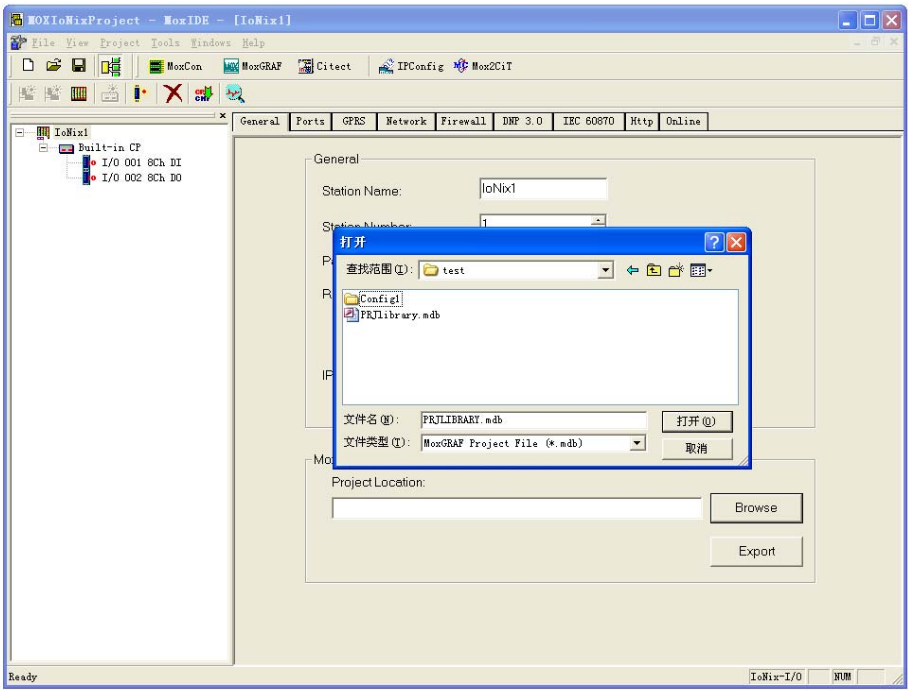


Figure 43 MOXGRAF to MOXIDE Link

When the filename of the MOXGRAF project is opened, click on the **"Export"** button to export the network architecture. Ensure that the MOXGRAF project **I/O Wiring** page is closed before performing this operation.

Once complete a successful result will be displayed. Open the **I/O Wiring** page in MOXGRAF and view the newly imported I/O device.

Connect all variables to their required device channels, compile and download the program to the MOX IoNix processor.

6.2 MOX IoNix Processor to MOX IoNix Processor Ethernet Communication

Using MODBUS TCP/IP communications, the **"MODNETM"** function block can be used to retrieve information from the connected MOX IoNix processor device. Using this function block the MOX IoNix processor can act as both a slave and a master to send and receive information. For more detailed information about "MODNETM" function block, please refer to *Special Function Block Programming Guide*.

Figure 44 MOX IoNix Processor to MOX IoNix Processor Ethernet Communications

6.3 MOX IoNix Processor to HMI Communications

The MOX IoNix processor has to ability to communicate with higher-level HMI (Human Machine Interface) software packages. There are numerous HMI software packages widely used for Supervisory Control and Data Acquisition (SCADA) of industrial processes. These SCADA packages enable the user to visualize graphically what the process controller (MOX IoNix processor) is controlling and its current operational state. This includes the ability to read from and write data to the MOX IoNix processor in real time, altering the system at its source.

The preference over one HMI for another is purely dependent on the user. The MOX IoNix processor can be used in conjunction with any HMI that supports the required communication protocols:

- MODBUS (RTU & ASCII) - common industry communications protocol
- MODBUS TCP/IP - common industry communications protocol
- DNP3

Appendix A Updating the Target

As the MOX IoNix processor's onboard Operating System (OS) is updated with software nonconformance corrections or extended functionality new "*target*" (OS) updates become available. The following chapter details the procedure required to perform the update to your MOX IoNix processor.

1) In your MOXIDE project select the desired MOX IoNix processor in the network tree and go to its **General** page. This will display the IoNix processor's station information.

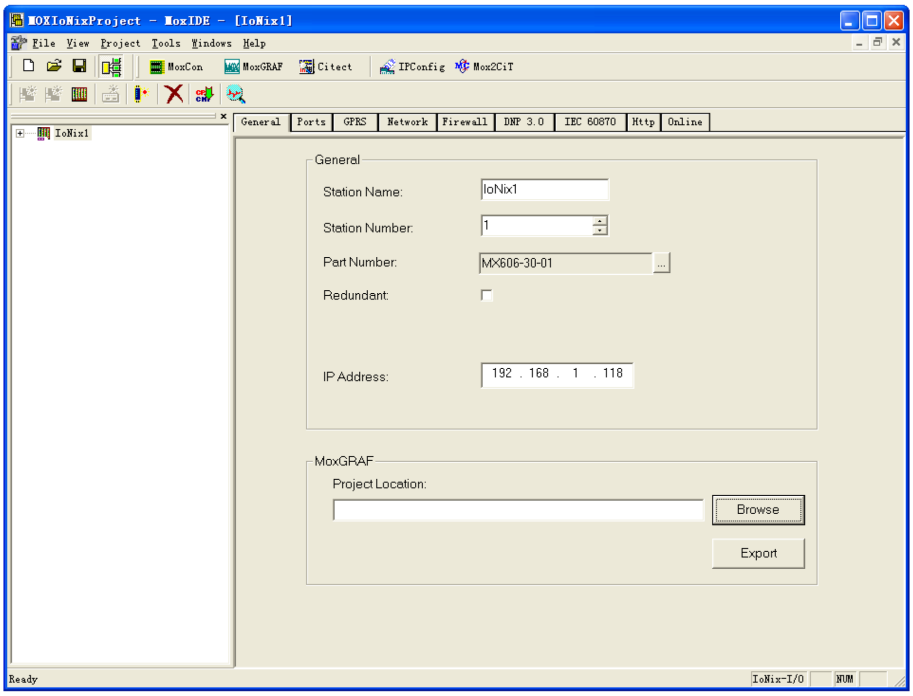


Figure 45 MOX IoNix Processor Selection

2) Select the **"Online"** tab and click the **"Online"** button to connect the MOX IoNix processor. This will read and display all of its target information on the **"Online"** page.

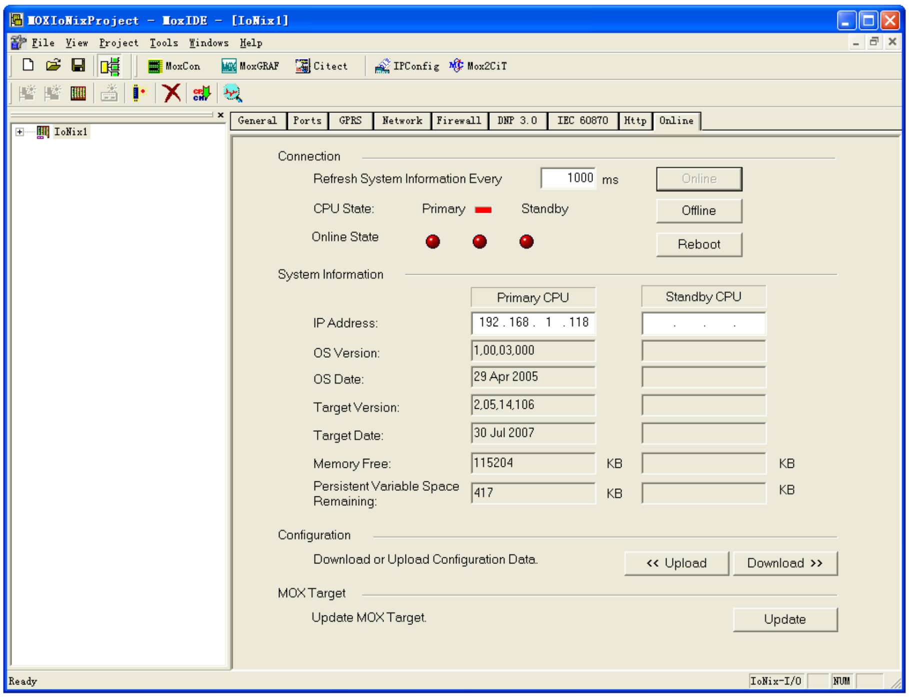


Figure 46 MOX IoNix Processor Online Information

3) Select the **"Update"** button, this will start the guide of target update.

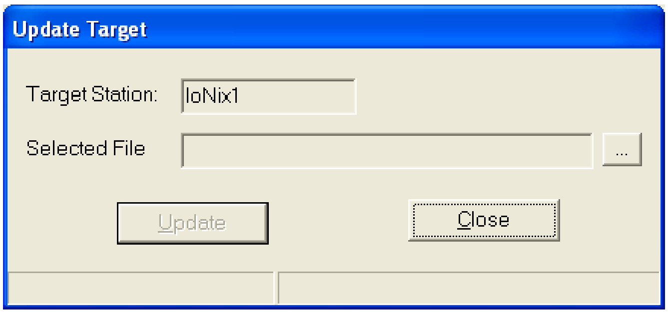


Figure 47 Opening the Update Target File

4) Select the **"…"** button next to the **"Selected File"** text field. This will open a window that will allow you to search for the required file.

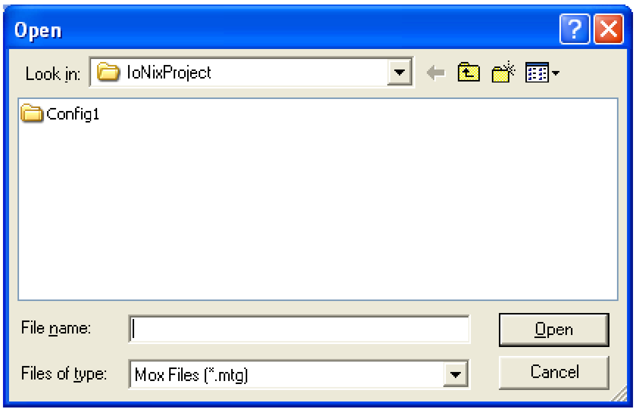


Figure 48 Selecting Update Target File

5) Select the desired file, ensuring that it is the correct target update for the MOX IoNix processor and select the **"Open"** to return to the previous window.

6) The **"Update"** button will now be useable. Select the **"Update"** button and wait until confirmation that the MOX IoNix processor target has been updated.

The update tool will not reset the MOX IoNix processor so you will have to perform a hardware reboot. This is done by power cycling the IoNix processor and waiting until it comes back online before any operations can be performed.

Appendix B Product Support

Warranty Information

All MOX manufactured products are warranted to be free from defects in material and workmanship. Our obligation under this warranty will be limited to repairing or replacing, at our option, the defective parts within 1 year of the date of installation, or within 18 months of the date of shipment from the point of manufacture, whichever is sooner. Products may only be returned under authorization. The purchaser will prepay all freight charges to return any products with a valid return authorization number to the designated repair facility.

This limited warranty does not cover loss or damage that may occur in shipment of the goods or due to improper installation, maintenance, misuse, neglect or any cause other than ordinary commercial or industrial use. This limited warranty is in lieu of all other warranties whether oral or written, expressed or implied.

Liability associated with all MOX products shall not exceed the price of the individual unit that is the basis of the claim. In no event will there be liability for any loss of profits, loss of use of facilities or equipment or other indirect, incidental or consequential damages.

Contact Details

To obtain support for MOX products, please contact MOX Group or your designated support provider and ask for MOX Support.

E-mail addresses

support@mox.com.au

sales@mox.com.au

Visit our web page at

http://www.mox.com.au

Service Information

If you require service, contact your local MOX Group representative. A trained specialist will help you to quickly determine the source of the problem. Many problems are easily resolved with a single phone call. If it is necessary to return a unit, an RMA (Return Material Authorization) number will be provided.

All returned materials are tracked with our RMA system to ensure speedy service. You must include this RMA number on the outside of the box so that your return can be processed immediately.

Your MOX Group authorized applications engineer will complete an RMA request for you. If the unit has a serial number, we will not need detailed financial information. Otherwise, be sure to have your original purchase order number and date purchased available.

We suggest that you provide a repair purchase order number in case the repair is not covered under our warranty. You will not be billed if the repair is covered under warranty.

Please supply us with as many details about the problem as you can. The information you supply will be written on the RMA form and supplied to the repair department before your unit arrives. This helps us to provide you with the best service, in the fastest manner. Most repairs are completed within two days. During busy periods, there may be a longer delay.

If you need a quicker turnaround, ship the unit to us by airfreight. We give priority service to equipment that arrives by overnight delivery. Many repairs received by midmorning (typical overnight delivery) can be finished the same day and returned immediately.

We apologize for any inconvenience that the need for repair may cause you. We hope that our rapid service meets your needs. If you have any suggestions to help us improve our service, please give us a call. We appreciate your ideas and will respond to them.

For Your Convenience

Please fill in the following information and keep this manual with your MOX system for future reference:

P.O. #: ___________________ Date Purchased: ____________________

Purchased From: ____

MOX Group
Web: www.mox.com.au
Email: info@mox.com.au