Smart⁸ Input Sensor

User Guide

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1. Important Information

Intended Audience

This manual is intended for use by qualified technology experts and includes references to industry standard terminology and practices. Every effort has been made to ensure the information in this manual is accurate, however due to constant product improvement, specifications and information contained in this document is subject to change without notice. For the most up to date information on this product you can visit www.fiberopticlink.com.

Conventions

Symbols for notes, attention, and caution are used throughout this manual to provide readers with additional information, advice when special attention is needed, and caution to prevent injury or equipment damage.

 Notes: Helpful information to assist in installation or operation.

 Attention: information essential to installation or operation.

 Caution: Important information that may result in equipment damage or injury if ignored.

General Safety Practices

RLH recommends that installation and service personnel be familiar with the correct handling and use of electrical and network equipment prior to use. RLH also recommends that installation and service personnel follow all safety precautions including the use of protective personal equipment as required.

Caution - Severe Shock Hazard

• Always remove source voltage using proper lockout procedures prior to installation and service.

• Never wire any wet inputs without removing source voltage first.

• Remove the terminal block when wiring.

• Check that all equipment has been properly locked out before restarting or configuring the device.

2. Introduction

Product Description

Ethernet I/O

The Smart Input Sensor is an Ethernet device with 8 integrated digital inputs. The device allows for web based monitoring of the inputs and may be integrated into distributed control and network management systems to allow those systems to alarm and monitor field devices. Each of the Inputs can be individually configured to send customized emails and notifications when an event is recorded. The device supports a wide variety of protocols it is compatible with over Ethernet. Integration options are: SNMPv1,2c,3, SNMP Traps (SNMP 1, 2vc), Modbus TCP featuring addressable registers, and DNPv3 TCP for integration with utility and other automation control systems.

Contact Closure Over Ethernet

The Smart Input Sensor may be paired with a Smart Relay Output. When using RLH's System Link feature, the two devices become linked establishing a tunnel over an Ethernet network and will transport a digital outputs being received by the Input Sensor through the Ethernet tunnel to the linked Relay Output device. The System Link feature can be set up via: One to One, Many to One, and One to Many allowing for event distribution and consolidation as needed.

Standard Features

- ▶ Rugged Design - Operating temp. -40°C ~ 70°C
- ▶ Intuitive embedded web interface for configuration
- ▶ 8 Inputs for multiple device monitoring
- ▶ System Link - Pair with a Output Device for Alarm Transportation over Ethernet
- ▶ IGMP V2 supported to enable multicast routing in one to many configurations
- ▶ Custom email notifications for individual inputs
- ▶ Advanced SMTP integration allowing for SSL and TLS based authentication
- ▶ Integration options include: SNMPv1, 2c, 3, SNMPv1,2c Traps, Modbus TCP, and DNPv3 TCP
- ▶ Input event log with time stamps
- ▶ Each input is optically isolated
- ▶ Includes both DIN clip and wall mount ears for easy installation
- ▶ System power ranges available: 24-48VDC, 125VDC, & 12VDC
- ▶ 10/100 Fast Ethernet Port
- ▶ Limited Lifetime Warranty
- ▶ **Made in the U.S.A.**

Panel Layout

Front Panel

The front panel contains all the input terminals, LED's, and the Ethernet port.
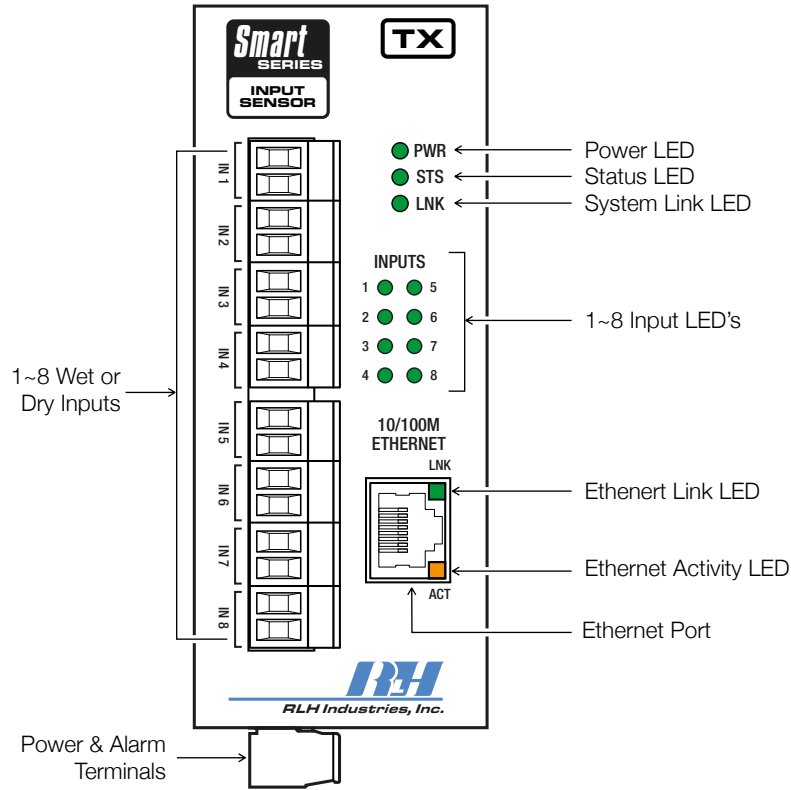
Front Panel Features

LED Identification

LED	Name	Color	Status	Condition
Inputs 1-8	Input Status	Green	ON	Input ON
			OFF	Input OFF
PWR	Power Failure	Green	ON	DC Input Power OK
			OFF	DC Input Power failed
STS	CPU Failure	Green	Blinking	CPU Operating Normally
			Solid (On or Off)	CPU Failure
LNK	System Link	Green	ON	Paired via TCP connection
			OFF	Not paired with output unit
LNK	Ethernet Link Down	Green	ON	Ethernet Link is Present
			OFF	No Ethernet link present
ACT	Ethernet Activity	Orange	Blinking	Ethernet is active
			OFF	Ethernet is not active

System Alarm Contacts

- Alarms on power failure.
- Alarms when Ethernet Link Down.

Bottom Panel

The bottom panel contains the power and alarm terminals.
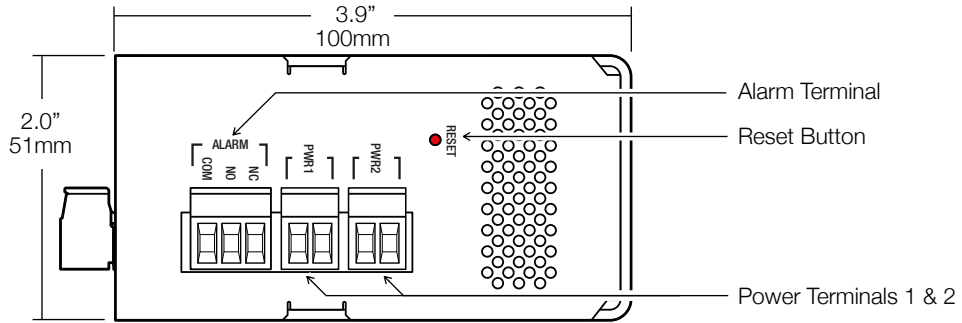
Bottom Panel Features

Rear Panel

The DIN clip for mounting the system is mounted onto the rear panel. Insert a flat head screwdriver into the release slot at the bottom of the DIN clip and pull down to remove the system from the DIN rail.
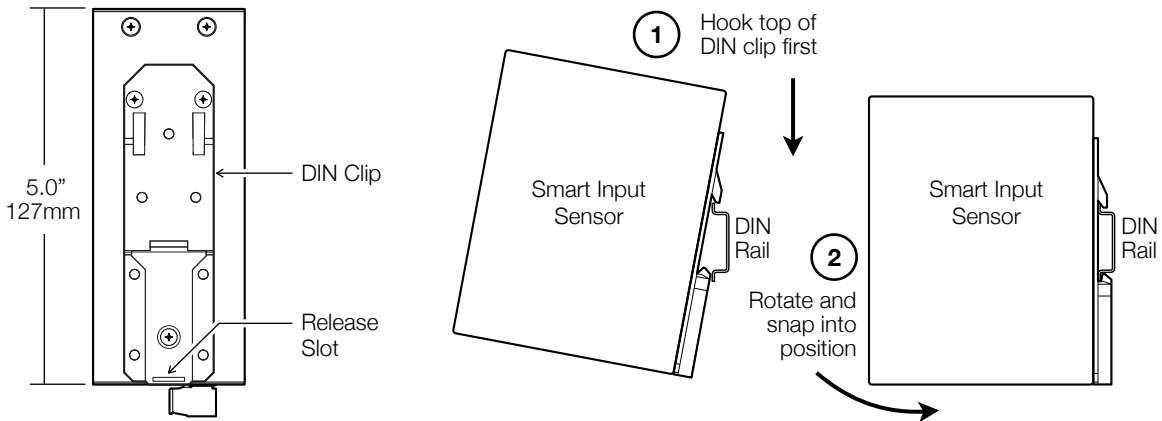
Rear Panel Features

DIN Rail Mounting

3. Before Installing

Prepare for Installation

Check for shipping damage

Carefully unpack and inspect the device. Contact RLH immediately if any components are damaged or missing.

Verify system contents

- Smart Input Sensor device
- DIN clip and wall mount ears
- Correct model type for intended installation

Site Requirements

Site selection

Locate the Smart Input Sensor to allow easy access to the equipment. Leave at least 3 inches (7.62 cm) clearance in the front. The device is temperature hardened, but must be mounted indoors or inside an outdoor rated enclosure.

Typical installation environments

- NEMA 4X enclosures
- RLH 19" rack mount DIN rail brackets
- Control cabinets
- T-35 DIN Rail

Required power sources

The Standard RLH Smart Input Sensor system accepts 24~56VDC. RLH also offers optional power compatibility to both Low DC (12 Volts) and High DC Power (125 Volts) for enhanced compatibility with solar and utility battery systems.

4. Installation

Getting Started

Before starting

- Review the safety information in section **1. Important Information**
- Familiarize yourself with the Smart Input Sensor as described in section **2. Introduction**
- Have a suitable installation environment with the correct source voltage.

Install the Smart Input Sensor

- Mount the Smart Input Sensor to a T-35 DIN rail.

Connect wiring to input terminals

Connect the wire pair to the green screw-down terminals on the front.
DO NOT APPLY VOLTAGE to the contact terminals without verifying that you have the Wet input model or the system maybe damaged.

- The pluggable contact terminals may be removed and accept wire sizes 16~26 AWG.
- Fully seat the terminal block back into the connector socket before operating the system

Dry Input Models
- Sourcing Input - Each input will provide a small amount of current to enable sensing of a dry contact closure.
- Check to ensure the copper pairs being used do not exceed 100 Ohms.
- Do not apply voltage to Dry Input terminals as the system may be damaged.

Wet Input Models
- Sinking Inputs - Each input is passive and is expecting to receive a voltage signal to indicate ON status.
- Ensure the DC signals voltage is within the models accepted range.
- Remove all voltage when wiring inputs.
- Wet inputs are NOT polarity sensitive. Connect + and - wire pair in any order.

Connect Ethernet cable

- Connect the Ethernet cable to the RJ-45 Ethernet port located on the front panel of the Smart Input Sensor. Verify the link LED indicators are ON to ensure you have connectivity to your network.

Connect power

The Smart Input Sensor has redundant power terminals to accommodate a backup power supply in the event of an outage. Follow these steps when attaching wires to power terminals located on the bottom of the module.

- Check that DC power source voltage matches the accepted voltage range of the device.
- Remove power from the DC power source prior to connecting to the Smart Input Sensor.
- Connect the DC power cables to the terminal pairs. Power terminals are not polarity sensitive.
- Energize the power source. The PWR LED will be ON indicating that the system has power.

System alarm wiring

Connect alarm relay monitoring equipment wire pair to the alarm contact on the bottom of the device.

- Use the NO or NC contact positions as required.
- The alarm terminal block may be removed and accept wire sizes 16~26 AWG.
- Fully seat the terminal block back into the connector before operating the system.

Start the system

Once a local power source is connected and turned on the PWR LED will turn ON. The STS LED will be blinking to let you know the device is operating normally.

5. Establishing Connection to Device

General Connection

To initially connect to the RLH Smart Input Sensor you must access the device by its default IP address as listed below:

Default Settings

```
IP Address: 192.168.2.16          Username: admin
Subnet: 255.255.255.0             Password: admin
```

Default IP Address   **Default Username/Password**

In most cases you will need to assign a temporary static IP to your workstation to initially access the RLH Smart Input Sensor web page. The assigned temporary address should be within the same subnet as the default address.

Example Client Device Address:

- IP: 192.168.2.10
- Subnet: 255.255.255.0

Now access the device via: http://192.168.2.16
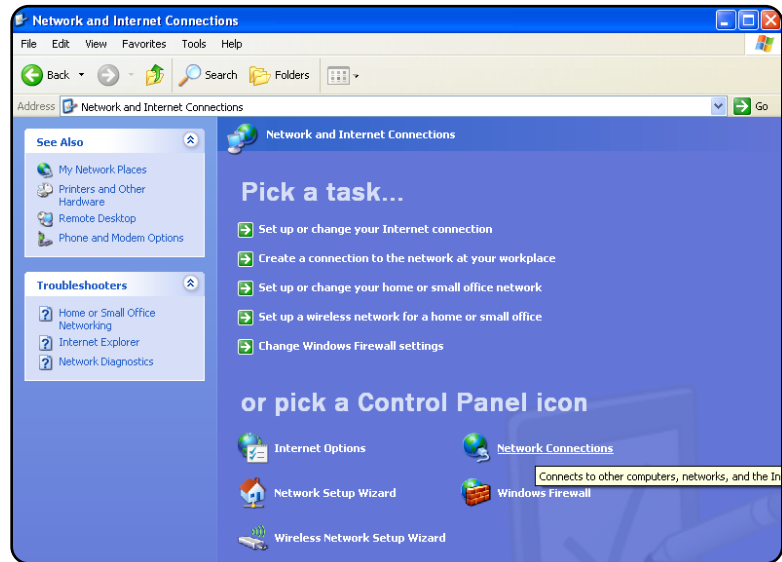
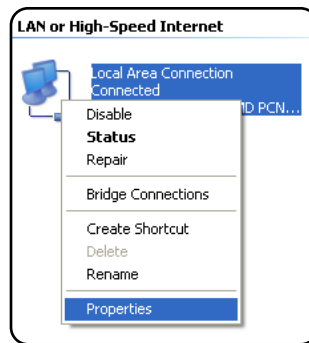## Assigning a Static IP Address

Steps for Window XP

First: Go to windows XP control panel and select `Network and Internet Connections`.
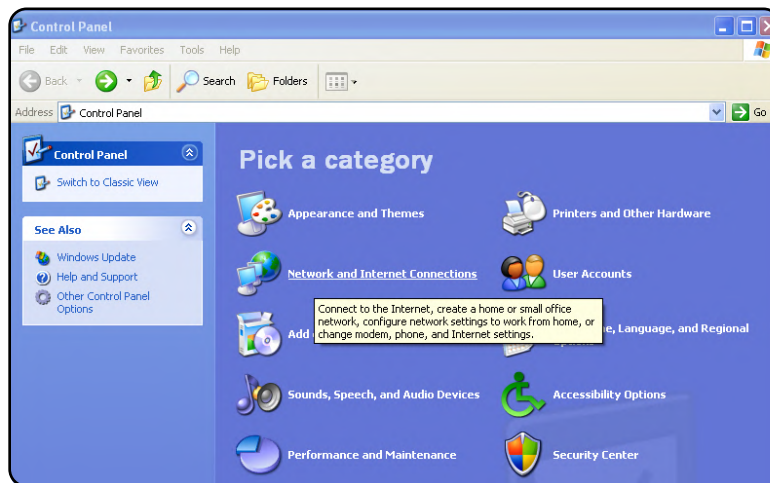
Next: Select `Network Connections`

Next: Right-click on the adapter you want to set the IP for and select `Properties`.

Next: Highlight Internet Protocol (TCP/IP) and click the `Properties` button.
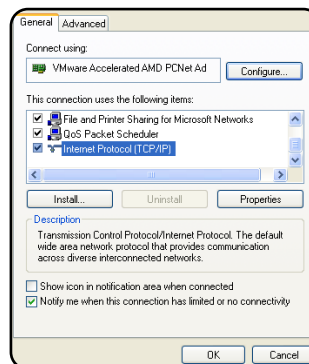
Next: Change the IP, Subnet mask, Default Gateway, and DNS Server Addresses. When you are finished click **OK**.
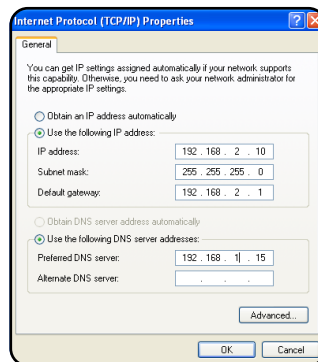
Note: You will need to close out of the Network Connection Properties screen before the changes go into effect.

Finally: Verify IP Address:

- In the Run box type in cmd and click **OK**.
- Then at the prompt type in ipconfig and hit Enter. This will show the IP address for the network adapter you changed.

Steps for Windows 7

First: To a static IP address in Windows 7, type network and sharing into the Search box in the Start Menu and select **Network and Sharing Center** when it comes up.
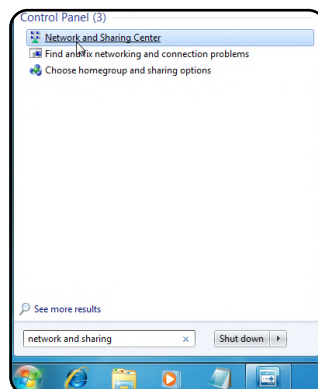
Next: When the Network and Sharing Center opens, click on `Change adapter settings`.
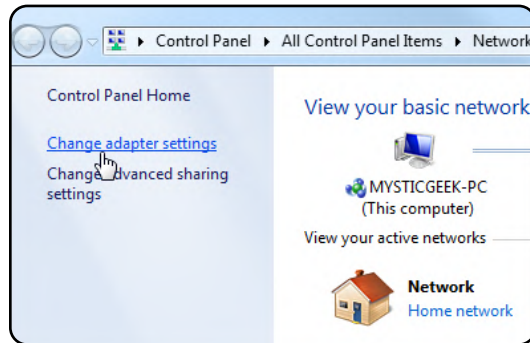
Next: Right-click on your local adapter and select `Properties`.
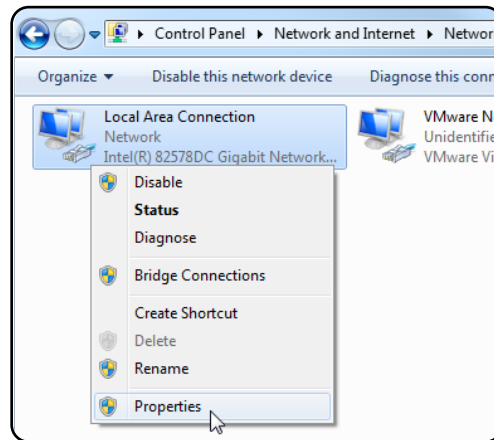
Next: In the Local Area Connection Properties window highlight Internet Protocol Version 4 (TCP/IPv4) then click the `Properties` button.
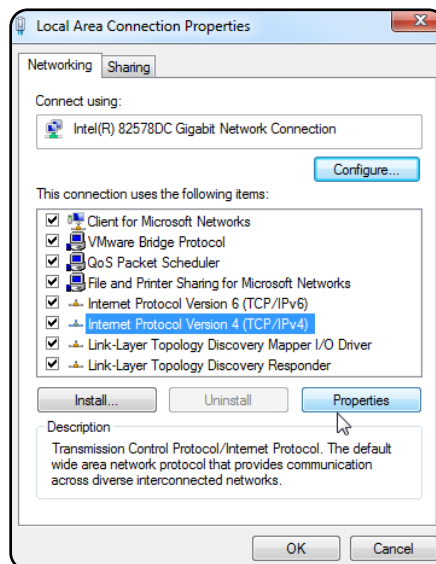
Finally: Now select the radio button `Use the following IP address` and enter in the correct IP, Subnet mask, and Default gateway that corresponds with your network setup. When you're finished click **OK**.
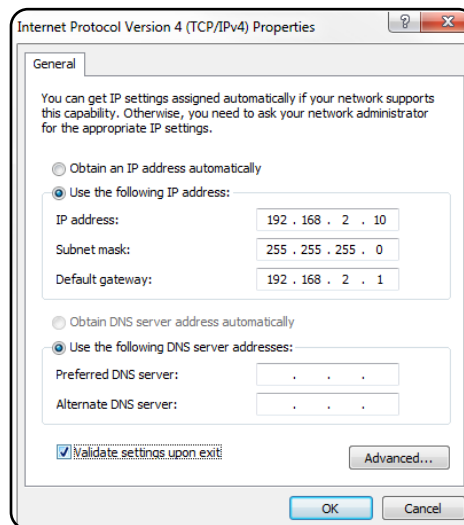
Note: Now you can open the command prompt and do an ipconfig to see the network adapter settings have been successfully changed.

6. Device Configuration

Network Address Configuration
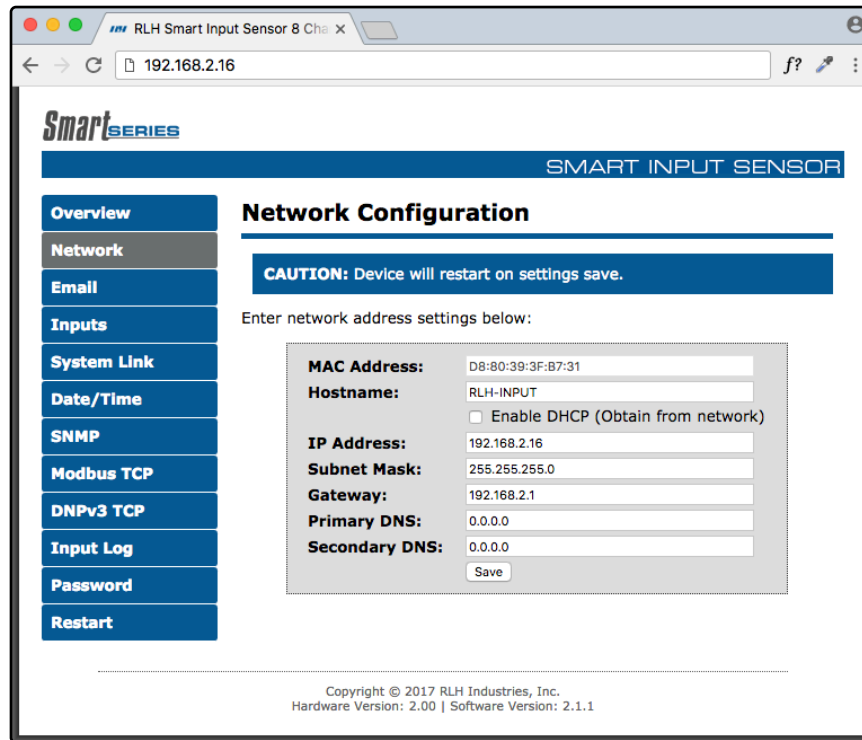
Network Address Configuration Screen

Settings	Description
Mac Address	Read only field will display the mac-address of your device.
Hostname	Enter the hostname which your DNS server will register your device as.
Enable DHCP	If checked, this option allows you to automatically obtain addressing information from your networks DHCP server.
IP Address	Set a static IP address for which you wish to assign to the device.
Subnet Mask	Set subnet mask you wish to use.
Gateway	Set the default gateway the device will use.
Primary DNS	This will be the first server your device connects to for translating URLs and Fully Qualified Domain Names (FQDNs).
Secondary DNS	In case of an outage in the primary DNS server the device will attempt to use the secondary DNS as a backup.

Note: If unsure of the address to assign your device you may wish to consult your network administrator for the correct addressing information for your network

SMTP / Email Server Configuration
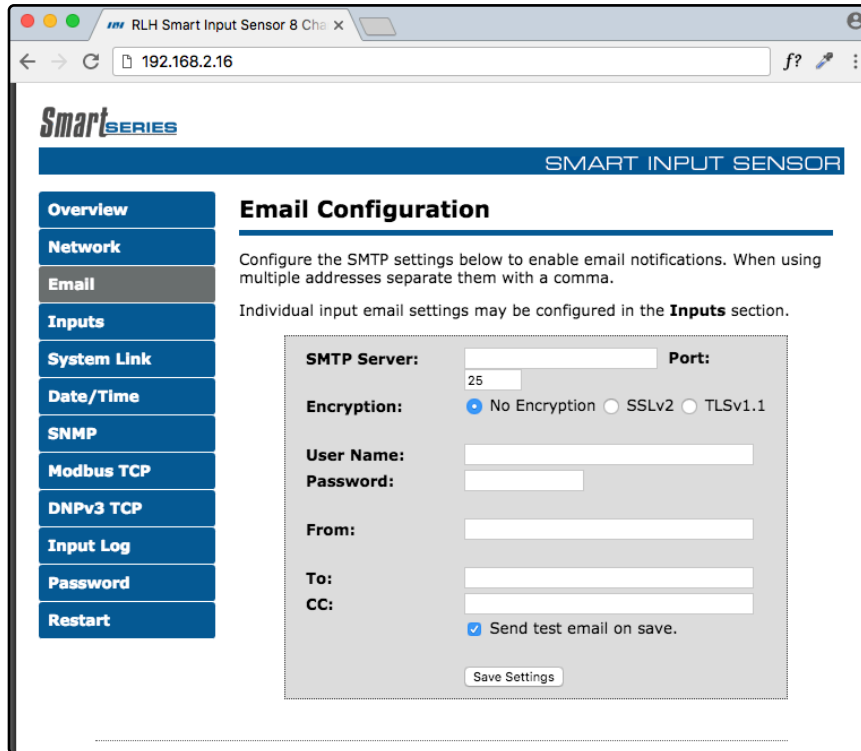
SMTP/Email Configuration Screen

Settings	Description
SMTP Server	Enter the FQDN or the IP address of the email server you wish to use.
Port	Set to 25 by default.
Encryption	None - No encryption will be used when communicating with SMTP server
	SSL (V2) - Encryption will be used when communicating with SMTP server
	TLS (V1.1) - Encryption will be used when communicating with the SMTP server
Username	Enter in your SMTP server username.
Password	Enter your SMTP server password.
From	This will be the from address the device uses in email notifications.
To	Email Address for the To field for SMTP notifications.
CC	Email Address for the CC field for SMTP notifications.
Checkbox (Send Test Email)	If checked the device will send a test email after the settings are saved.

Note: SSL connections will support up to 1024 Bit certificates.

Input Configuration
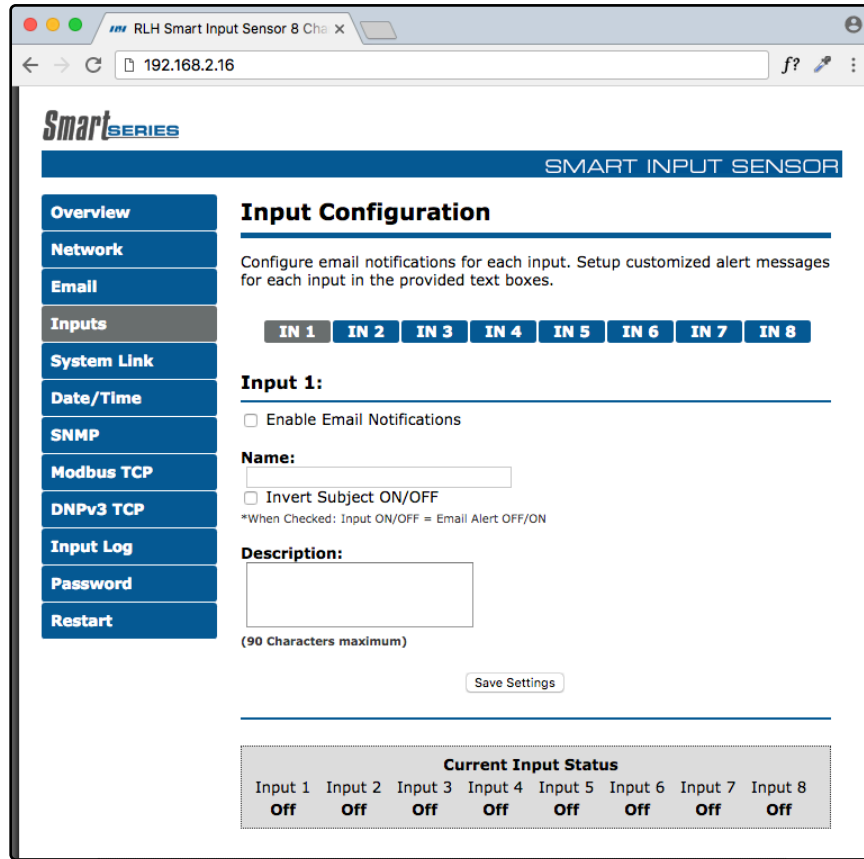
Input Configuration Screen

Settings	Description
Enable Email Notifications	When checked notifications are sent when the input changes state. Email Notifications will include: Input Name, Input Description, Input Status, Hostname of the Device, Time and Date (if enabled).
Name	This field provides a name for the individual input. The entered name will be present in the subject line of all email notifications for this input. *Example: Main Entry Door Alarm -* **ON**
Reverse Subject ON/OFF	When enabled the email notification will state the alarm is ON when the input turns OFF, and that the alarm is OFF when the input turns ON.
Description	This field allows the user to enter a custom message that is included in the body of the email notification. *Example: Generator Output Alarm has turned ON! Please contact On-Call electrician immediately upon receipt of this email (714) 777-7777.*
Current Input Status	This display shows the current **On/Off** status of each input.

System Link Configuration
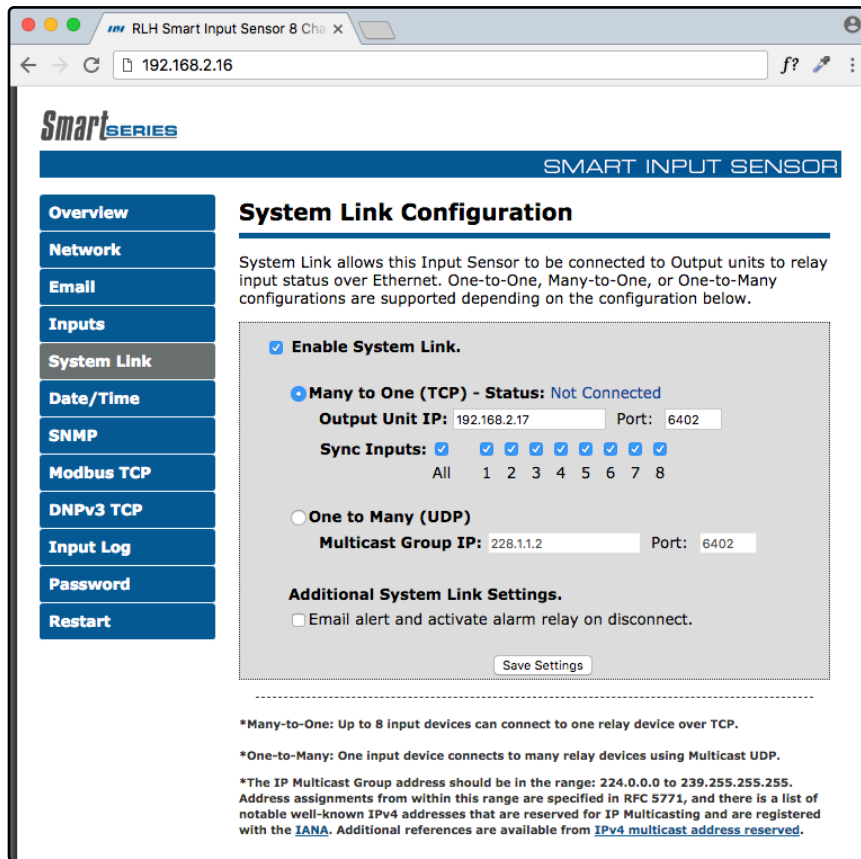
System Link Screen

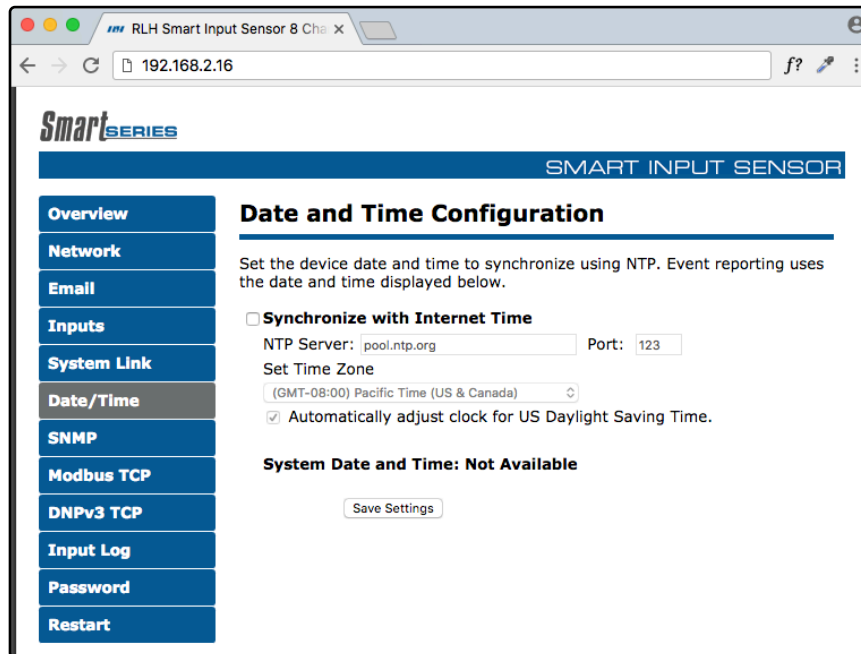| Settings	Description
Enable System Link	When checked this unit will synchronize with the output device(s) as configured below.
Many to One (TCP)	When selected the device will use TCP to link up with the paired output device(s). The current connection status is shown here.
	Output Unit IP — Enter the address of the output device you wish to link to. *The address 192.168.2.17 port: 6402 is the default address of the output device.*
	Port — Enter which port number you wish to use for TCP communication.
	Sync Inputs — Select which inputs you wish to link to the output device. *Refer to the Event Consolidation diagram in the Configuration Example section for more details on how to configure multiple input devices with one output device.*
	Note: When using multiple inputs units with one output unit make sure none of the inputs are synchronizing the same input number. This can cause a conflict with the output device and result with the intended output relay not operating as expected.

Note: System Link Configuration settings chart is continued on the next page.

(continued)

Settings	Description
One to Many (UDP)	When selected the device will use Multicast UDP to broadcast the ON/OFF events to all output devices.
	Multicast Group IP — Enter the address of the multicast group you wish to link this input unit to. *The address: 228.1.1.2 port: 6402 is the default multicast address & port for both the Input and Output devices.* **Caution** – *Only 1 input device should be joined to a multicast group. The address entered must be within the IANA multicast address range.*
	Port — Enter which port number you wish to use for UDP communication.
	Notes: (1) Choose this option for linking the input devices to multiple output units on the same network. (2) IGMP v2 is supported by Smart Series Input/Output devices to allow multicast routing.
Additional Settings Check Box	When selected email notifications and the alarm relay will activate on system link connection /disconnection.

Date/Time – NTP vs Local Time

Ensuring that your device has the correct time values is necessary to have the correct time stamp for each event. This portion of the configuration allows you to configure the device to synchronize it's time with a network time server.

Date and Time Configuration Screen

Configuring NTP Time

Settings	Description
NTP Server	Enter the NTP Server IP or URL you wish to use.
Port	Default NTP Port is 123
Time Zone	Select your time zone
Adjust Daylight Savings Time	Check this box to enable DST time corrections for your time zone.

SNMP Community Configuration

RLH Smart Series devices are compatible with SNMP Polling, versions 1, 2c, & 3. They also support SNMP Traps, versions 1 and 2. The latest MIB table is available online at www.fiberopticlink.com
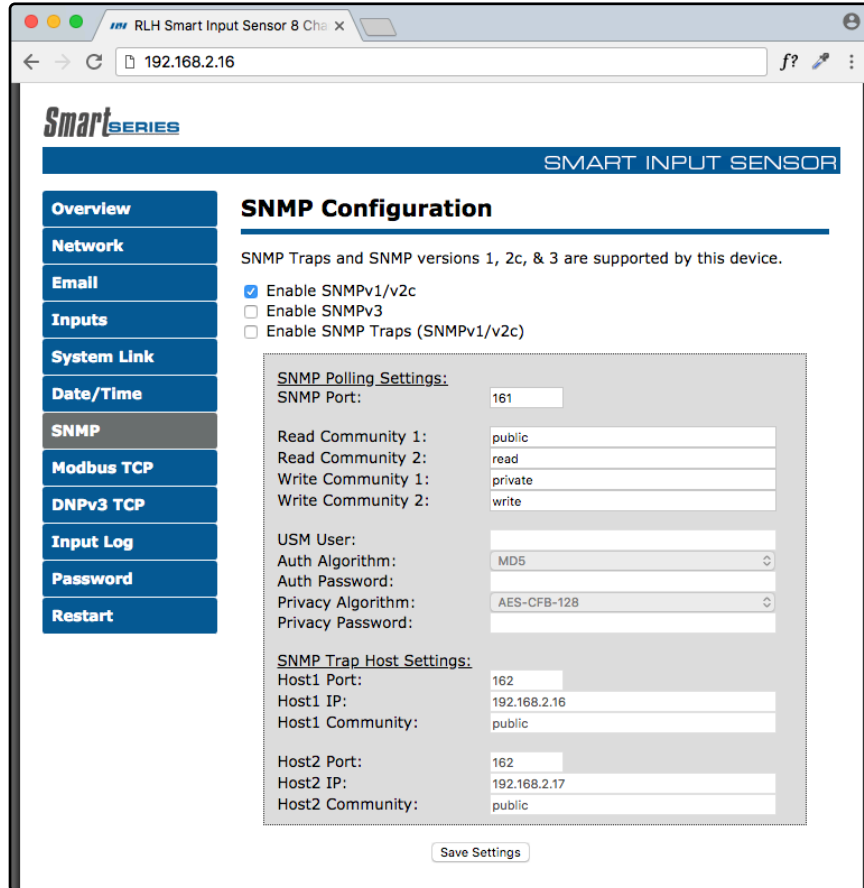
SNMP Community Configuration Screen

Settings		Description
SNMPv3 Options	USM User	Enter in the desired username
	Auth Algorithm	Select MD5, SHA1, or No_Auth
	Privacy Algorithm	Select AES-CFB-128 or No Priv
SNMP Trap Host Settings (Host1 / Host2)	Host Port	Select the SNMP port the device will use to send SNMP Traps, Default is 162.
	Host IP	Enter the IP address of the Host that will receive the SNMP Traps.
	Host Community	Enter the community name to associate with the SNMP traps sent from this device.
	Note: SNMP Traps currently only support SNMP versions 1 & 2.	

ModBus TCP

The RLH Smart Input Sensor acts as a Modbus TCP slave and supports 1 connection.
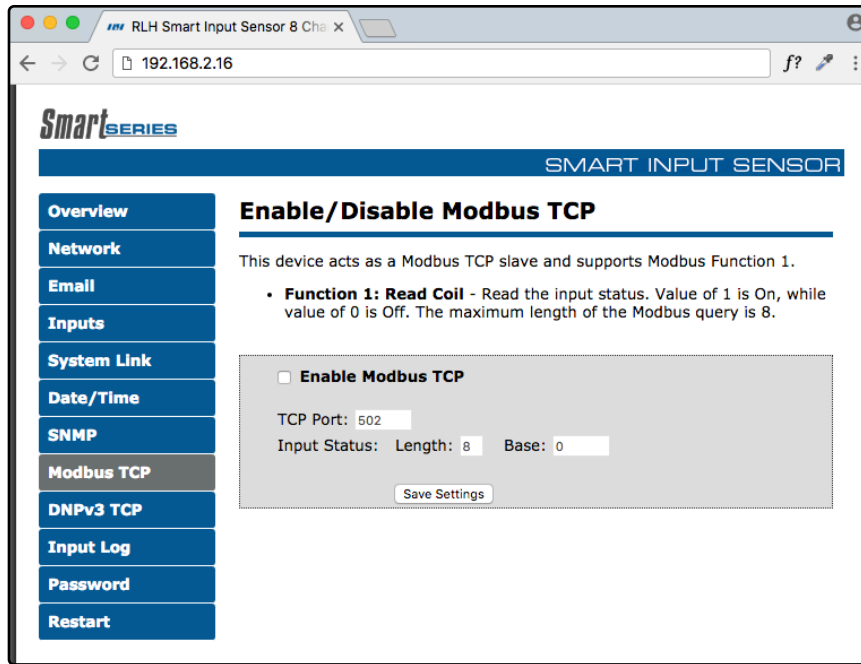
Enable/Disable Modbus TCP Screen

Settings	Description
TCP Port	Set desired TCP Port for use with Modbus TCP (Default Port is 502)
Input Status	Associated fields will allow function 1 queries to the configured Length and Base addressing.
Length	The amount of registers the Modbus Query will attempt to read starting from the configured base address.
Base	The register value that will store Input 1 Status, Inputs 2, 3, and 4 will be sequentially stored counting up from the configured base address.

Function 1: Read Coil

Read the current state of the Input. Maximum address length of the query should be set to 8.

The Value 1 = On (Input Active)

The Value 0 = Off

Example using default configuration

Address	Value Range		Note
00001	0 – OFF	1 - ON	Input 1 status
00002	0 – OFF	1 - ON	Input 2 status
00003	0 – OFF	1 - ON	Input 3 status
00004	0 – OFF	1 - ON	Input 4 status
00005	0 – OFF	1 - ON	Input 5 status
00006	0 – OFF	1 - ON	Input 6 status
00007	0 – OFF	1 - ON	Input 7 status
00008	0 – OFF	1 - ON	Input 8 status

DNPv3 TCP

The RLH Smart Input Sensor acts as a Outstation Device. Either responding to request from a Master Station or sending unsolicited updates to a Master Station.
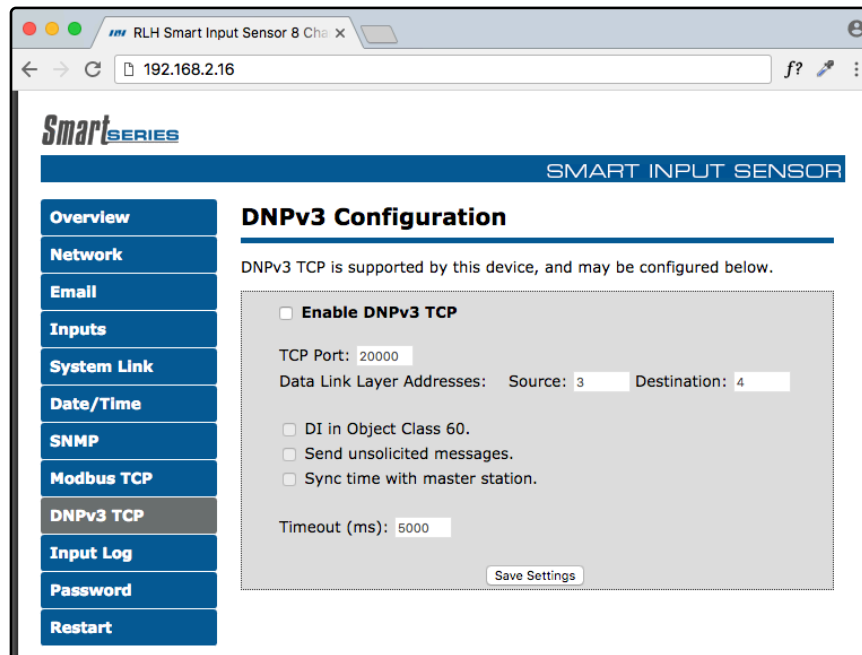
Enable/Disable DNPv3 TCP Screen

Note: DNPv3 Settings table and description can be found on the following page.

Settings	Description
`TCP Port`	TCP Port for use with DNPv3 TCP (Default Port is 20000)
`Data Link Layer Addresses`	Configure link layer addressing
`Source`	This is the Link Layer address of this outstation device
`Destination`	Link layer address of the remote master station.
`DI in Object Class 60`	Must be enabled for Integrity Data Polling - Class 0123
`Send unsolicited messages`	Digital Inputs initiate message to master state on state change.
`Sync time with master station`	Syncs system clock with Master station time.
`Timeout (ms)`	Period in milliseconds the device will wait for a response.

Note: DNPv3 TCP function code descriptions are continued on the next page.

DNPv3 Device Profile

The RLH Smart Input Sensor is classified as an Outstation Device with the following characteristics.

DNPv3 Characteristics	
DNP Timeout is configurable and applies to:	Application Confirm
	Complete Application Response
Responds to Read Data Function:	Binary Inputs = 0, 1, 2, 3, 4, 5, 6, 7
	Binary Input OFF = 0x01
	Binary Input ON = 0x81
Responds to Function Code:	15: Initialize data
	16: Initialize application, which will restore the device to its factory default settings.
Master Station:	Expects binary input change events as configured in the scan settings, unless configured as unsolicited.

Note: DNP Implementation Table is continued on the next page.

DNPv3 Implementation Object Table

This DNPv3 Implementation Object table describes the objects, function codes and qualifiers used in this device.

Object			Request (Slave Must Parse)		Response (Master Must Parse)	
Object	Variation	Description	Func. Code	Qualifier (Hex)	Func. Code	Qualifier (Hex)
1	1	Binary Inputs – *Packed Format without Status*	1	0x06 - All Points 0x00 – 8 Bit Start/Stop 0x01 – 16 Start/Stop 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x07
1	2	Binary Inputs – *With Status*	1	0x06 - All Points 0x00 – 8 Bit Start/Stop 0x01 – 16 Start/Stop 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x00
2	1	Binary Input Change Event – *Without Time*	1	0x06 - All Points 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x17
2	2	Binary Input Event – *With Time*	1	0x06 - All Points 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x17
50	01	Synchronize Time and Date – *Absolute Time*		0x07		
60	01	Class 0 Data		0x06 - All Points 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x00
60	02	Class 1 Data		0x06 - All Points 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x00
60	03	Class 2 Data		0x06 - All Points 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x00
60	04	Class 3 Data		0x06 - All Points 0x07 – 8 Bit Single Field 0x08 – 16 Bit Single Field	129 (0x81)	0x00

Input Log

The input log page lists the last 10 On/Off events. Each event is time stamped with the time and date each event occurred. The log page also displays the description information entered for each input.

Input Log Screen

Administration Tasks

Change Password

To change the default administration password you will need to enter your current password and your new password twice. Ensure that you use a memorable password as the only way to recover a lost password is by resetting the device to its factory defaults.
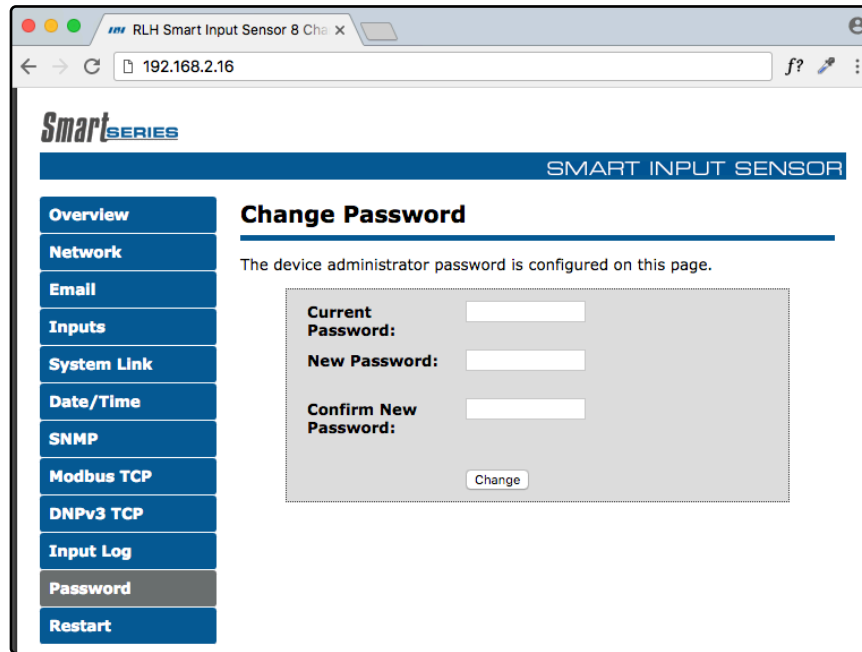

Change Password Screen

Rebooting

Navigate to the "reset" tab. Here you will need to enter the administrative password to restart the device.

Set to Factory Defaults

To set the device to factory defaults you have two options. Hard reset or software factory reset through the web browser.

Hard Reset

- On the underside of the device next to the power terminals and system alarm contact you will see an opening labeled reset.
- **Warning**: This next step will clear all current configurations and restart the device.
- Insert a non-conductive object into the reset hole and depress the button for 5 seconds.
- The device will then restart to indicate it has gone through the factory default reset process.
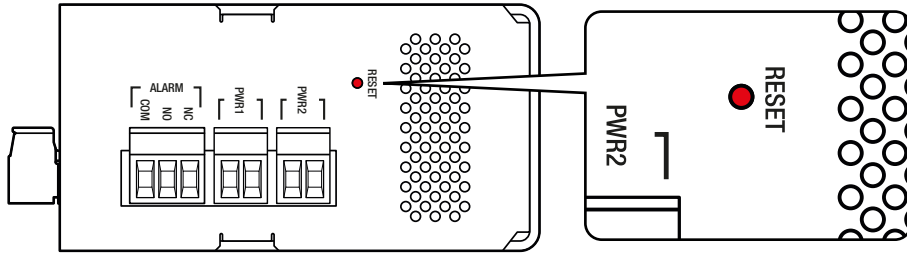
Reset Button on Bottom

Software Factory Reset

- Login to the web browser and view the reset page.
- On the bottom right of the reset page you will see, in smaller font, a `Set to default` option (highlighted in red below). Click on the link.
- **Warning**: This next step will clear all current configurations and restart the device.
- On the next screen you will need to click the `Restore` button.
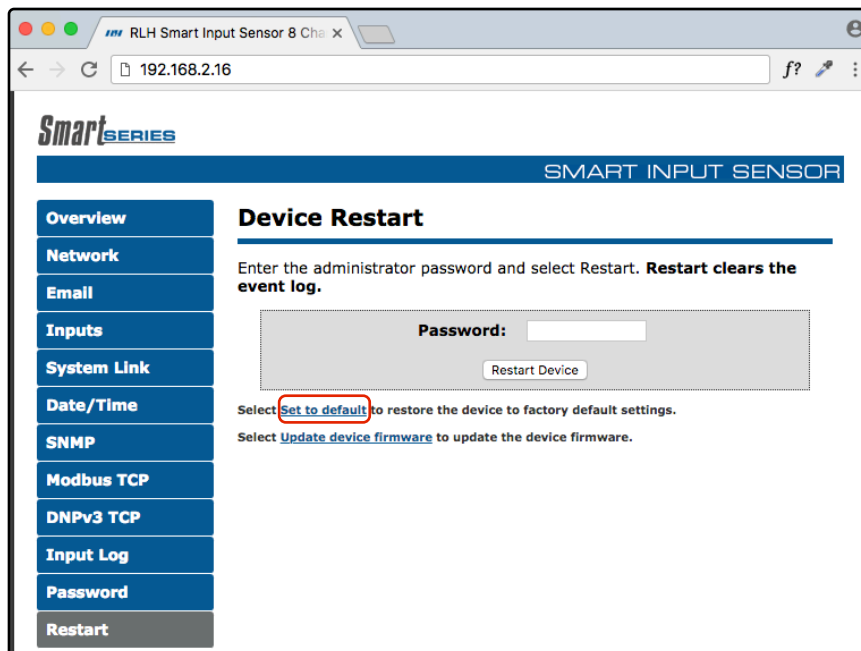
Restart the Device Screen

7. Configuration Examples

Event Consolidation - Many Inputs to One Output

Input Sensor Device (A) - IP:

Input Sensor Device (B) - IP:
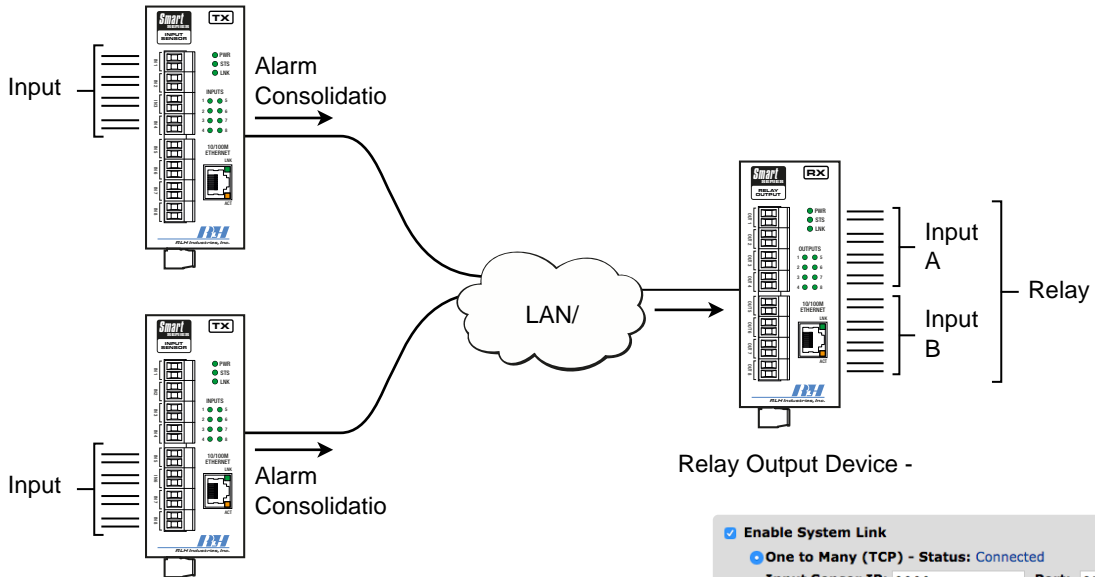
Many Inputs to One Output Example

8. Application Examples

Contact Closure over Ethernet - One to One (TCP)
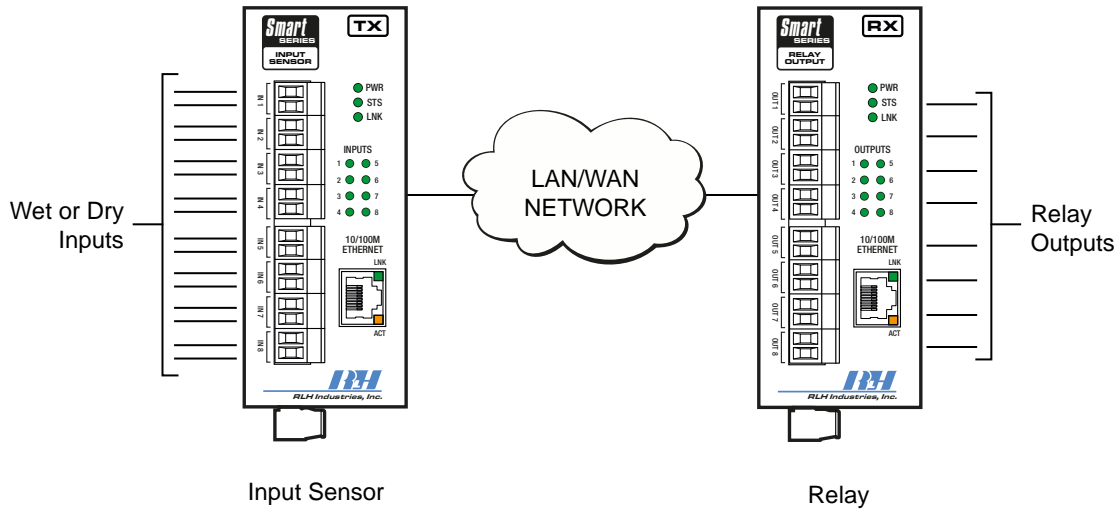
One to One (TCP) Example

Contact Closure over Ethernet - One to Many (UDP)
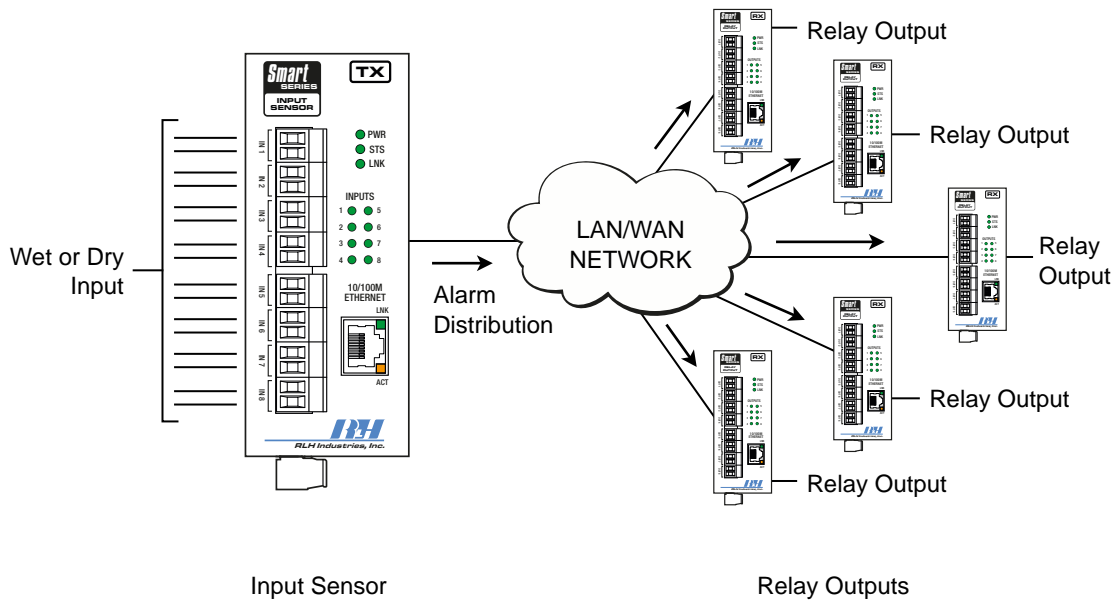
One to Many (UDP) Example

Event Consolidation - Many Inputs to One Output

Input Sensor

Switch or

IN 1
IN 2
IN 3
IN 4
IN 5
IN 6
IN 7
IN 8

Ethernet

Relay

Alarm or relay output

Out 1
Out 2
Out 3
Out 4
Out 5
Out 6
Out 7
Out 8

Each output relay can only be controlled by one input
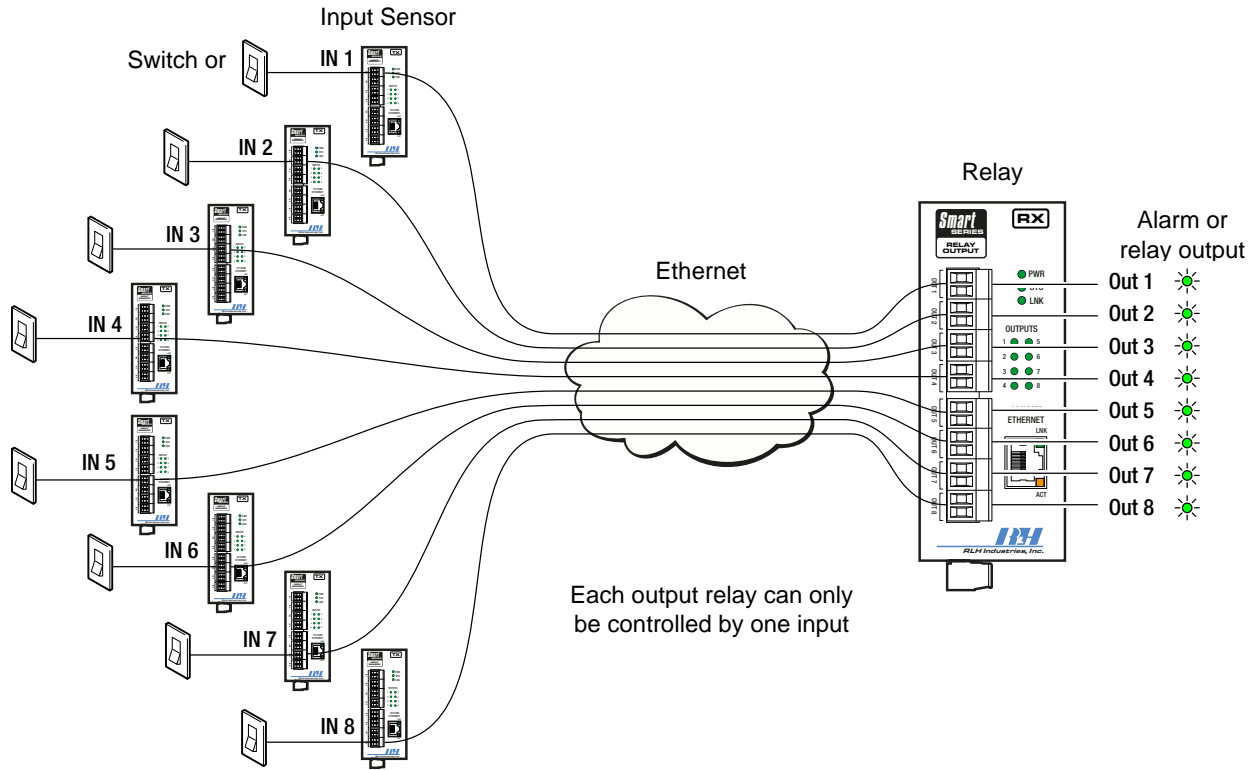
Many Inputs to One Output Example

Dry Contact

Dry Contact

LAN/WAN NETWORK

Dry Relay Outputs

Input Sensor

Relay
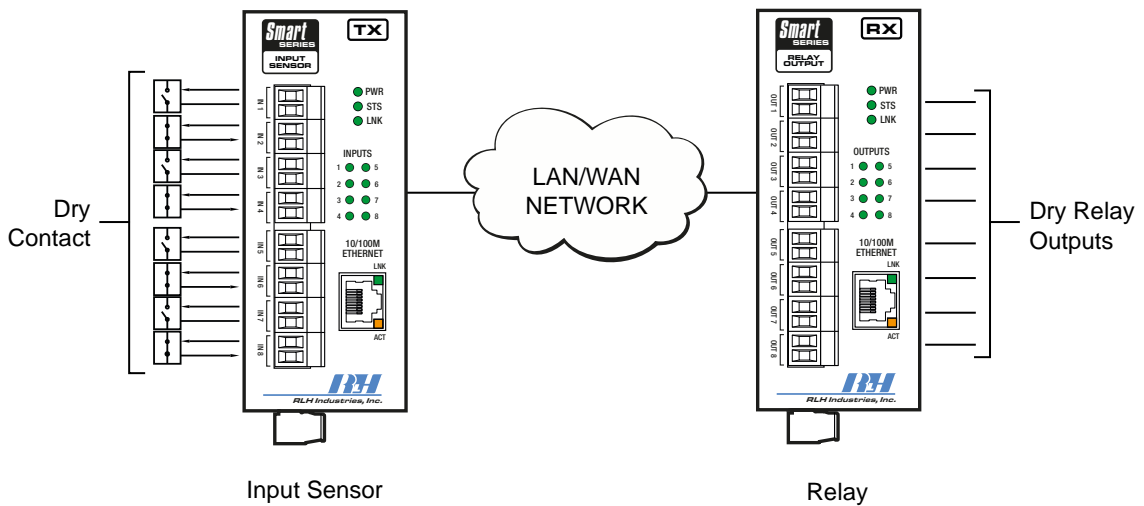
Dry Contact Example

Wet Contact

Wet Contact Inputs
12-24VDC or

Input Sensor

Modbus — PLC / DCS

SMTP — Email Text via Email

DNP 3.0 — Control Systems

SNMP — Network Management System

Relay Output — IO / RTU

LAN/WAN NETWORK
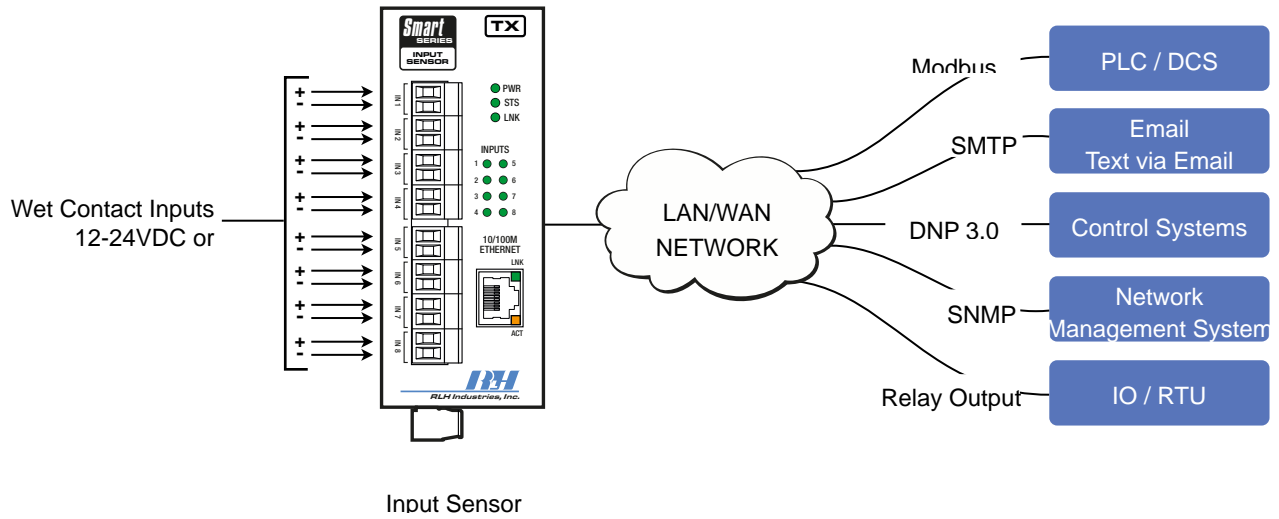
Wet Contact Example

9. Specifications

Powering Voltage	Standard Model	24~48VDC	
	-A Model	125VDC	
	-B Model	12VDC	
Power Consumption	6 Watts (Maximum)		
Wire Connectors	Screw down terminal block, 16~26AWG		
Inputs 1~4 Polarity Insensitive	**SM-INPUT-DR-2**	Dry (0-100 ohms)	Optical isolation 3.5kV
	SM-INPUT-24-2	Wet (8~27VDC / 5mA)	Optical isolation 3.5kV
	SM-INPUT-48-2	Wet (20~52VDC / 5mA)	Optical isolation 3.5kV
System Status Alarm	Normally Open/Closed Relay (SPDT)		
System Link Response Time*	One-To-One (TCP)	Typical 8ms, Maximum 45ms	
	One-To-Many (UDP)	< 15ms	
	Many-To-One (TCP)	< 250ms	
	* Specifications listed are based on direct connections. Network overhead should be considered when calculating overall system response times.		
Data Interface	Ethernet (RJ-45)		
Data Rate	10/100Mbps IEEE 802.3 Compliant		
Surge Protection	Varistor (MOVs) and automatic resettable fuse (PTC Thermistor)		
DC Input Isolation	1.5kV		
Construction	Powder coated steel and aluminum alloy		
Physical Dimensions	H 4.93" x W 2.0" x D 3.93" (125mm x 51mm x 100mm) Not including connectors or DIN clip		
Mounting Style	Standard DIN rail (T-35)		
Operating Temperature	-40℉ to +158℉ (-40℃ to +70℃)		
Humidity	95%		
MTBF	175,000 Hrs. (Circuit Board level)		
Warranty	Limited Lifetime		

10. Ordering Information

System Models

Part Number	Description	Dimensions
SM-INPUT-48-2	Smart Series 8 Channel Input Sensor Wet Input (24-48VDC)	H 5.0 in. x W 2.0 in. x D 3.9 in. (127mm x 51mm x 100mm)
SM-INPUT-24-2	Smart Series 8 Channel Input Sensor Wet Input (12-24VDC)	H 5.0 in. x W 2.0 in. x D 3.9 in. (127mm x 51mm x 100mm)
SM-INPUT-DR-2	Smart Series 8 Channel Input Sensor Dry Input	H 5.0 in. x W 2.0 in. x D 3.9 in. (127mm x 51mm x 100mm)

▶ Please contact your RLH sales representative for pricing and delivery information.

▶ Add **-A** to the end of the part number for 125VDC input power option.

▶ Add **-B** to the end of the part number for 12VDC input power option.

11. Support

Technical Support

Email:	support@fiberopticlink.com
24/7 technical support:	Toll Free 1-855-RLH-24X7 Toll Free 1-855-754-2497

Contact Information

Corporate Headquarters:	RLH Industries, Inc. 936 N. Main Street Orange, CA 92867 USA
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Specifications subject to change without notice.