

# IntelliSense®

**SOFTWARE VERSION: 1.4.5**

**FIRMWARE VERSION: R104**

User Manual

Engineering  
GREAT Solutions



## **SCOPE OF THIS MANUAL**

This instruction manual supports IMI Norgren standard components only. If special components, including but not limited to serial hubs, power supplies, and drivers, are included based on a customer's specifications or special request, it is the Customer's responsibility to consult support materials and technical support specific to these special components provided by the third party manufacturers. IMI Norgren assumes no liability for misuse, misapplication, or support for components that are not the IMI Norgren brand.

## **WARNING**

Using the equipment in a manner not specified in this manual can impair the safety of the equipment.

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## OPERATING MODES

The IntelliSense® Sensor Interface Module (SIM) can be operated in three modes: Cylinder Monitoring, Pressure/Temperature Monitoring or Vacuum Pump Monitoring. The general installation and setup for these modes is the same. The modes differ in the status information that is displayed in the software and on the SIM. Figure 1 (shown below) provides a list of operating modes for each mode that is available for IntelliSense®.

### CYLINDER MONITORING

Cylinder Monitoring mode is used to measure and analyse the performance of pneumatic cylinders.

### PRESSURE/TEMPERATURE MONITORING

Pressure / Temperature Monitoring mode is used in system monitoring to establish alerts based on pressure and temperature limits.

### VACUUM PUMP MONITORING

Vacuum Pump Monitoring mode is used to measure and analyse the performance of venturi Vacuum pumps.

*Figure 1: Information available on IntelliSense® Operating Modes*

| CYLINDER MONITORING MODE |                      |                      |                   |
|--------------------------|----------------------|----------------------|-------------------|
| ESTIMATED VALUES         | MEASURED VALUES      | CALCULATED VALUES    | CONDITION STATUS  |
| Days Remaining           | Sensor 1 Pressure    | Cycle Count          | Front Piston Seal |
| Cycles Remaining         | Sensor 2 Pressure    | Average Daily Cycles | Rear Piston Seal  |
| Cylinder Life Remaining  | Sensor 1 Temperature | Extend Time          | Rod Seal          |
|                          | Sensor 2 Temperature | Retract Time         | Sensor Status     |
|                          |                      | Line Pressure        | SIM Status        |
|                          |                      | Ambient Pressure     |                   |
|                          |                      | Cycle Time           |                   |
|                          |                      | Dwell Time           |                   |

| PRESSURE/TEMPERATURE MONITORING MODE |                  |
|--------------------------------------|------------------|
| MEASURE VALUES                       | CONDITION STATUS |
| Sensor 1 Pressure                    | Sensor Status    |
| Sensor 2 Pressure                    | SIM Status       |
| Sensor 1 Temperature                 |                  |
| Sensor 2 Temperature                 |                  |

| VACUUM PUMP MONITORING MODE |                      |                  |
|-----------------------------|----------------------|------------------|
| MEASURED VALUES             | CALCULATED VALUES    | CONDITION STATUS |
| Sensor 1 Temp               | Cycle Count          | Part Present     |
| Sensor 2 Temp               | Average Daily Cycles | Vacuum Lock      |
| Sensor 1 Vacuum             | Ambient Pressure     | Sensor Status    |
| Sensor 2 Pressure           |                      | SIM Status       |



## INTELLISENSE® ARCHITECTURE

IntelliSense® is designed to be scalable in its implementation. It is easy to go from a single standalone SIM to multiple SIMs on a MODBUS RTU network with remote access using an IntelliSense® Data Gateway. The development of an IntelliSense® installation requires merging of four traditionally disparate sub-systems, Pneumatic, Data, Controls, and Power.

## PNEUMATIC ARCHITECTURE

IntelliSense® is intended for use with a variety of pneumatic components including actuators, Vacuum pumps, filters, and more. One IntelliSense® Sensor Interface Module (SIM) and two sensors are required for each component to be monitored. No other pneumatic devices should be located between the device being monitored and the sensor fitting. For more details on mounting location and orientation, see the Sensor Installation section in this manual.

IntelliSense® is designed to be easily fitted into new and existing applications. Each IntelliSense® kit is sized based on the included pneumatic fittings. IntelliSense® kits include two in-line push to connect fittings designed for use with Nylon, Polyethylene, or 95-D Polyurethane tubing. Six fittings sizes are available: 5/32" or 4 mm, 6 mm, 1/4", 5/16" or 8 mm, 10 mm, and 3/8" outer diameter tubing. Custom fittings may also be used. The port on the IntelliSense® sensors is a 10-32 thread.

## DATA ARCHITECTURE

The Data sub-system is used to provide detailed system information to monitor and diagnose the connected pneumatics. In addition, the data network is used to configure the alerts and events that define the operation of the SIM. There are two ways to access the data provided by the SIM via a direct connection to a Windows PC or by using an IntelliSense® Data Gateway to connect remotely.

### PC

To connect an IntelliSense® Sensor Interface Module to a PC, use the IntelliSense® Programming Cable (NCBL-IS-RU-1.8). This cable provides a RJ45 to USB Serial connection between the PC and the IntelliSense® SIM. This configuration is ideal for setting up a standalone system, checking on the status of a cylinder after the SIM has sent an alert to a PLC, or after a SIM status light change.

### Intellisense Data Gateway

The addition of an IntelliSense® Data Gateway greatly enhances the data gathering capabilities of an IntelliSense® installation. The IntelliSense® Data Gateway is capable of connecting 1-12 SIMs to a LAN or the internet to access insights and configure the SIM. The datagateway is also capable of being configured to send emails when an alert occurs. In addition the IntelliSense® Data Gateway also has the ability to store 100+ Gb of performance data.

### Single SIM

Adding a single SIM to the IntelliSense® Data Gateway requires an IntelliSense® Programming Cable (NCBL-IS-RU-1.8).

### Multiple SIM

The IntelliSense® Data Gateway has three available USB ports that can be used to connect IntelliSense® SIMs either using an IntelliSense® Programming Cable or a 4 Port R422 to USB Hub (NISH-D04). The 4 Port R422 to USB Hub (ISH-D04) can be connected to a SIM's PC port using a DB9 to RJ45 Cable (NCBL-IS-RD-0.5 or NCBL-IS-RD-0.5). See the **Cable Pin Out** section of the appendix for details on the DB9 to RJ45 cable.

## CONTROLS ARCHITECTURE

The IntelliSense® Sensor Interface Module has the ability to be a slave device on a MODBUS RTU network.

More information can be found in the **Using IntelliSense® with MODBUS RTU Networks** section.

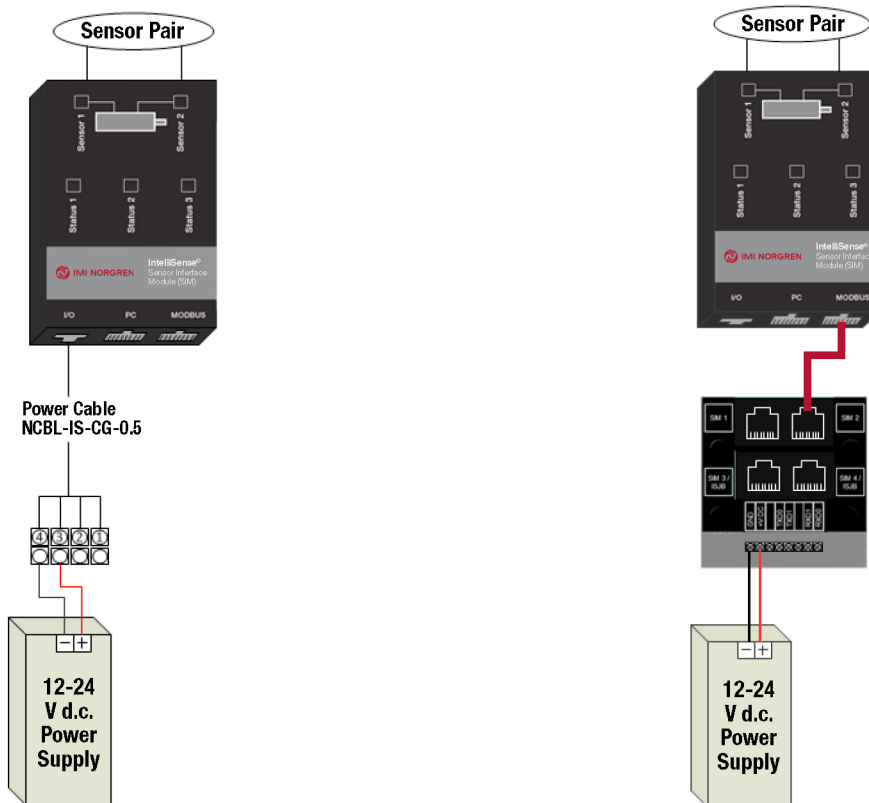
## POWER ARCHITECTURE

The IntelliSense® SIM should be connected to a Class 2, limited power source or limited-energy power source. The power supply may supply 11~24 V d.c.. There are two ways to connect power to the IntelliSense® SIM.

Power can be supplied:

- over pin 3 (+) and pin 4 (-) of the 4-pin connector
- using pin 7 (+) and pin 8 (-) of the MODBUS port

Using the IntelliSense® Junction Block (NISH-R04) is the preferred method of enabling power for option b.



## Choosing How to Power the Sim

The system architecture will dictate which power option is available for your installation. The determining factor is the use of the outputs. If the installation calls for the use of the outputs, option b becomes the only power option available and DIP switch 9 must be switched to OFF (default setting is ON).

## ARCHITECTURE EXAMPLES

IntelliSense® has a variety of hardware configurations to meet the customers' needs.

- Basic Monitoring / and PLC discrete inputs
- Basic Data Logging and Remote Monitoring / with PLC discrete inputs
- Basic Monitoring with MODBUS RTU Network / and PLC discrete inputs
- Data Logging, Online Monitoring, and MODBUS RTU Network / and PLC discrete inputs

All of these setups can support multiple SIM unit setups.

## Basic Monitoring / and PLC Discrete Inputs (appendix drawing 1 and 2)

This setup consists of a single SIM unit, power source, and user PC device. Both power options are available. With this setup, the user may connect to the SIM through PC port and visually monitor the current status of the SIM unit and attached pressure system. This setup can also remain connected to the pneumatic component to act as a stand-alone SIM and sensor set to monitor the actuator.

### Functionality

- Pneumatic component monitoring through status indicators on SIM
- Prognostic data including cycle count, cylinder life, cycle time, and Vacuum level
- Real time condition monitoring based on status LEDs on SIM unit pressure and temperature data
- User PC only connected for initial configuration
- Use of outputs with PLC installation and use of power option b
- Configure SIM

## List of Required Components

### Required IMI Norgren Products

- 1 - IntelliSense® Basic Kit- [NISK-BMA-xxx]
  - » 1 - IntelliSense® Sensor Interface Module (SIM) [NISM-S1-BA1-5P]
  - » 2 - IntelliSense® Pressure / Temperature Sensor [NISS-1A-7SS]
  - » 2 - IntelliSense® Tee fittings [NISF-T1-xxx]
- 2 - IntelliSense® Sensor Cable [NCBL-IS-M8-x]
- 1 - IntelliSense® 0.5 meter IO Cable [NCBL-IS-CF-0.5]
- 1 - IntelliSense® USB Programming Cable [NCBL-IS-RU-1.8]

### Optional IMI Norgren Products

- 1 – 24 V d.c. Power supply [NPWR-024A24-DIN] (if not supplied by user)
- 1 - IntelliSense® 0.5 meter IO Cable [NCBL-IS-CF-0.5] (for discrete outputs or power option a)
  - » The above products are available as a kit in the IntelliSense® Starter Kit [NISK-BMA-xxx]
- 1 – IntelliSense® Junction Block [NISH-R04] (for power option b)

### User Supplied

- 12-24 V d.c. Cable for 120 V a.c. power source (if not using IMI Norgren option) to 24 V Power Supply
- Computer for setup of IntelliSense® SIM

### Optional

- PLC that will accept a NPN (sinking) sensor (for discrete outputs)

## **Data Logging and Remote Monitoring / with PLC Discrete Input (appendix drawing 3 and 4)**

With this setup the user may connect to the SIM unit through the Data Gateway and visually monitor the current status of the SIM unit and attached pressure system. This setup also allows for data logging to be performed and stored in the Data Gateway unit, regardless of a user PC connection. If using the discrete outputs, the SIM must be powered using option b.

### **Functionality**

- Device monitoring based on status LEDs on SIM unit
- Data Gateway remains connected for data logging
- User PC connects to Data Gateway for initial configuration and/or real time monitoring of the SIM unit and attached pressure system
- Use of outputs with PLC installation and use of power option b

## **List of Required Components**

### **Required IMI Norgren Products**

- IntelliSense® Basic Kit- [NISK-BMA-xxx]
  - » 1 - IntelliSense® Sensor Interface Module (SIM) [NISM-S1-BA1-5P]
  - » 2 - IntelliSense® pressure / temperature sensor [NISS-1A-7SS]
  - » 2 - IntelliSense® Tee fittings [NISF-T1-xxx]
- 2 - IntelliSense® sensor cable [NCBL-IS-M8-x]
- 1 - USB programming cable [NCBL-IS-RU-1.8]
- 1 - IntelliSense® Data Gateway [NISG-01]

### **Optional IMI Norgren Products**

- 1 – 24 V d.c. Power supply [NPWR-024A24-DIN] (if not supplied by user)
- 1 - IntelliSense® 0.5 meter IO cable [NCBL-IS-CF-0.5] (for discrete outputs or power option a)
- 1 – IntelliSense® Junction Block [NISH-R04] (for power option b)

### **User Supplied**

- 12-24 V d.c. power source (if not using IMI Norgren option)
- Computer for setup of IntelliSense® SIM

### **Optional**

- PLC that will accept a NPN (sinking) sensor (for discrete outputs)

## **Basic Monitoring with MODBUS RTU Network / with PLC Discrete Inputs (appendix drawing 5 and 6)**

With this setup the user may connect to the SIM through PC port and visually monitor the current status of the SIM unit and attached pressure system. By configuring a Modbus RTU network between the user's PLC (Master Device) and the SIM unit(s) (Slave Device) the user can retrieve desired status values and alerts. If using the discrete outputs, the SIM must be powered using option b.

### **Functionality**

- Device monitoring based on status LEDs on SIM unit
- By configuring a MODBUS RTU network between the users' PLC/HMI (Master Device) and the SIM unit(s) (Slave Device), the user can retrieve desired status values and alerts
- User PC connects to SIM for initial configuration and/or real time monitoring of the SIM unit and attached pressure system
- Use of outputs with PLC installation and use of power option b

## List of Required Components

### Required Products

- IntelliSense® Basic Kit- [NISK-BMA-x]
  - » 1 - IntelliSense® Sensor Interface Module (SIM) [NISM-S1-BA1-5P]
  - » 2 - IntelliSense® pressure / temperature sensor [NISS-1A-7SS]
  - » 2 - IntelliSense® Tee fittings [NISF-T1-xxx]
- 2 - IntelliSense® sensor cable [NCBL-IS-M8-x]
- 1 - IntelliSense® USB programming cable [NCBL-IS-RU-1.8]
- 1 - IntelliSense® Data Gateway [NISG-01]

### Optional Products

- 1 – 24 V d.c. Power supply [NPWR-024A24-DIN] (if not supplied by user)
- 1 - IntelliSense® 0.5 meter IO cable [NCBL-IS-CF-0.5] (for discrete outputs or power option a)
- 1 – IntelliSense® Junction Block [NISH-R04] (for connection to MODBUS network and power option b)

### User Supplied

- 12-24 V d.c. Power source (if not using IMI Norgren option)
- PLC with MODBUS RTU network compatibility
- Interface cable to connect RS-485 to PLC
- Computer for setup of IntelliSense® SIM
- PLC that will accept a NPN (sinking) sensor (for discrete outputs)

## Data Logging, Remote Monitoring, and MODBUS RTU Network / with PLC Discrete Input (appendix drawing 7 and 8)

With this setup the user may connect to the SIM unit through the Data Gateway and visually monitor the current status of the SIM unit and attached pressure system. This setup also allows for data logging to be performed and stored in the Data Gateway unit, regardless of a user PC connection. By configuring a Modbus RTU network between the user's PLC (Master Device) and the SIM unit(s) (Slave Device) the user can retrieve desired status values and alerts. If using the discrete outputs, the SIM must be powered using option b.

### Functionality

- Device monitoring based on status LEDs on SIM unit
- By configuring a MODBUS RTU network between the users' PLC/HMI (Master Device) and the SIM unit(s) (Slave Device), the user can retrieve desired status values and alerts
- Data Gateway remains connected for data logging
- User PC connects to Data Gateway for initial configuration and/or real time monitoring of the SIM unit and attached pressure system
- Use of outputs with PLC installation and use of power option b)

## List of Required Components

### Required IMI Norgren Products

- IntelliSense® Basic Kit- [NISK-BMA-x]
  - » 1 - IntelliSense® Sensor Interface Module (SIM) [NISM-S1-BA1-5P]
  - » 2 - IntelliSense® pressure / temperature sensor [NISS-1A-7SS]
  - » 2 - IntelliSense® Tee fittings [NISF-T1-xxx]
- 2 - IntelliSense® sensor cable [NCBL-IS-M8-x]
- 1 - IntelliSense® USB programming cable [NCBL-IS-RU-1.8]

### Optional IMI Norgren Products

- 1 - 24 V d.c. Power supply [NPWR-024A24-DIN] (if not supplied by user)
- 1 - IntelliSense® 0.5 meter IO cable [NCBL-IS-CF-0.5] (for discrete outputs or power option a)
- 1 – IntelliSense® Junction Block [NISH-R04] (for connection to MODBUS network and power option b)

### User Supplied

- 12-24 V d.c. power source (if not using IMI Norgren option)
- PLC with MODBUS RTU network compatibility
- Interface cable to connect RS-485 to PLC
- Computer for setup of IntelliSense® SIM
- PLC that will accepts a NPN (sinking) sensor (for discrete outputs)

## SENSOR INSTALLATION

### MEDIA COMPATIBILITY

The IntelliSense® pressure sensor is designed to be used with clean dry air. A 5 micron filter should be used. If the sensor is used with other media, it is the user's responsibility to confirm that it is compatible with the wetted materials in the sensor.

*Table 1: Wetted Materials*

| COMPONENT                        | MATERIAL            |
|----------------------------------|---------------------|
| O-ring Seals                     | Buna-N              |
| Sensor Cap                       | 304 Stainless Steel |
| Sensor Element Isolation Barrier | Silicone Based Gel  |
| Port                             | 303 Stainless Steel |

## SENSOR MOUNTING

### Mounting Location

#### Cylinder Mounting Mode

It is recommended that the sensor be placed between 2" (50.8 mm) and 6" (152.4 mm) of the cylinder. To avoid damage to the sensor, do not directly mount the sensor to the cylinder. The maximum distance from the cylinder to the sensor assembly is 4' (1219 mm). Responsiveness of the sensor may be reduced due to longer tube lengths. The sensor should be mounted so that it is part of the cylinder volume. Pneumatic accessories such as flow controls and quick exhaust valves should not be located between the sensor and the cylinder. The sensor assembly should be retained to minimise stress on the pneumatic connection and sensor cable.

#### Vacuum Pump Monitoring Mode

In Vacuum Pump Monitoring Mode Sensor 1 is used to monitor the Vacuum level generated by the venturi. The sensor can be mounted directly to a venturi body or anywhere along the Vacuum line that is convenient. If a Vacuum filter is used the sensor should be placed between the Vacuum cup and the filter. Sensor 2 is used to measure the supply pressure to the venturi to ensure the pump is operating at the optimal pressure. This sensor should be placed as close to the pump inlet as possible for the application.

### Sensor Orientation

The sensor should be oriented with the port pointed down. This will minimise the chance of debris clogging the port. The pressure sensor is a dead-end device and cannot be cleaned. If the port becomes clogged, a new sensor should be installed.

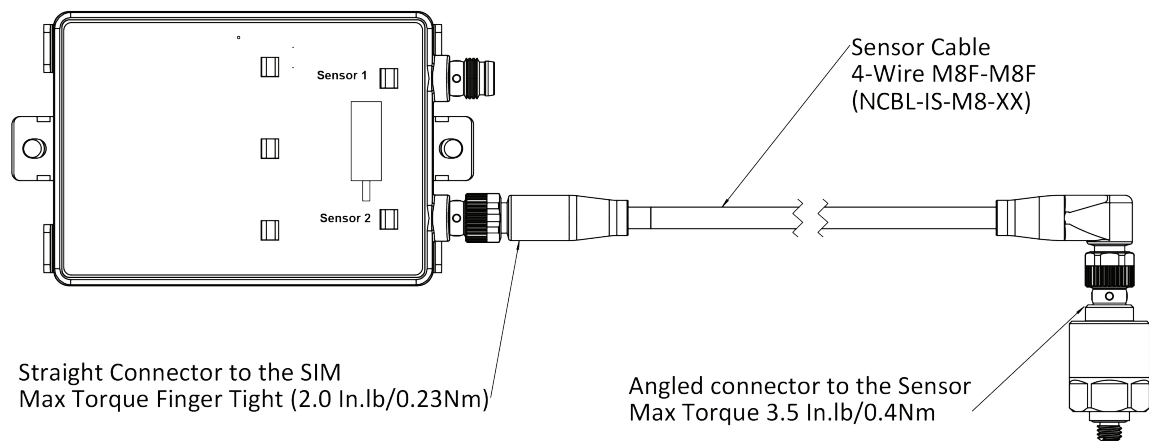
### Assembly Torque

The sensors included with an IntelliSense® kit come pre-assembled to a pneumatic fitting. A situation may arise where a different fitting is required. The port on the sensor is a 10-32 UNF thread. The maximum torque for the sensor is 10 in-lb [1.13 N-m].

### Sensor Cable

The SIM connects to each sensor with a four-wire Female M8 to Female M8 cable (part number NCBL-IS-M8-XXX). The maximum length of this cable is 325 feet (100 Meters). Care should be taken to not over tighten the connection to the SIM.

The sensor connected to the port labeled Sensor 1 should be installed at the cap or rear of the cylinder. The sensor connected to the port labeled Sensor 2 should be connected to the head or rod side of the cylinder.



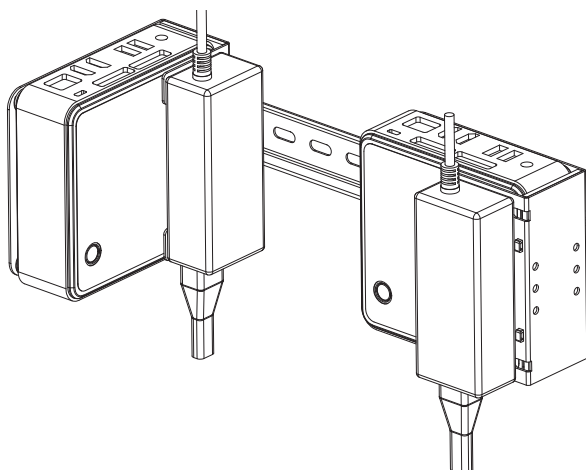


## INTELLISENSE® DATA GATEWAY INSTALLATION (OPTIONAL)

### MOUNTING THE INTELLISENSE® DATA GATEWAY

The IntelliSense® Gateway is provided with a bracket and clips for mounting to a 35 mm DIN rail. The DIN bracket clips can be attached to the bracket so that the Gateway can be mounted edgewise if panel space does not allow the width of the Gateway. Refer to the specifications section for mounted dimensions.

*Figure 6: Two options for mounting the gateway to a DIN rail.*



### CONNECTING TO THE INTELLISENSE® DATA GATEWAY

By default, the Data Gateway is set up with a static IP address on the Ethernet port and can be configured for the end user's network.

Default Ethernet IP settings for the Data gateway:

IP Address: 10.10.10.20

Subnet mask: 255.255.255.0

With a computer or other web enabled device with an Ethernet port, it is possible to connect directly or via a switch to the Data Gateway. To access the user interface of the Data Gateway, enter the following address into an approved web browser (Internet Explorer 10 or Google Chrome):

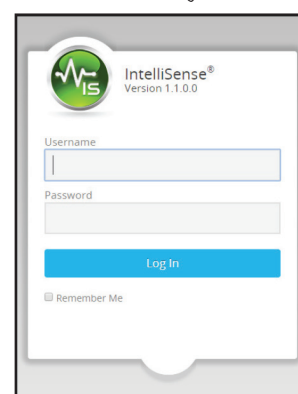
<http://10.10.10.20:3000/>

A login screen will show. The default administrator login with full access is:

Username: admin

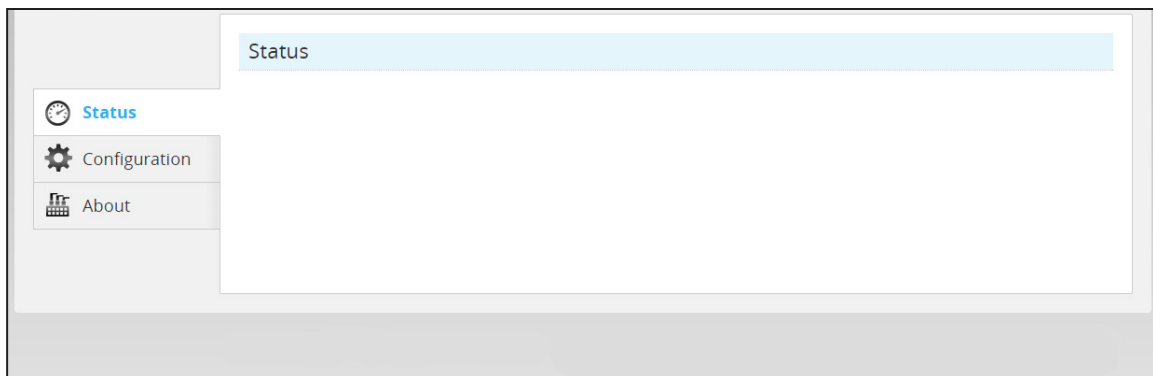
Password: admin

*Figure 7:  
IntelliSense® log in screen*



The following user interface will then appear:

*Figure 8: Multi-SIM Monitoring Screen*



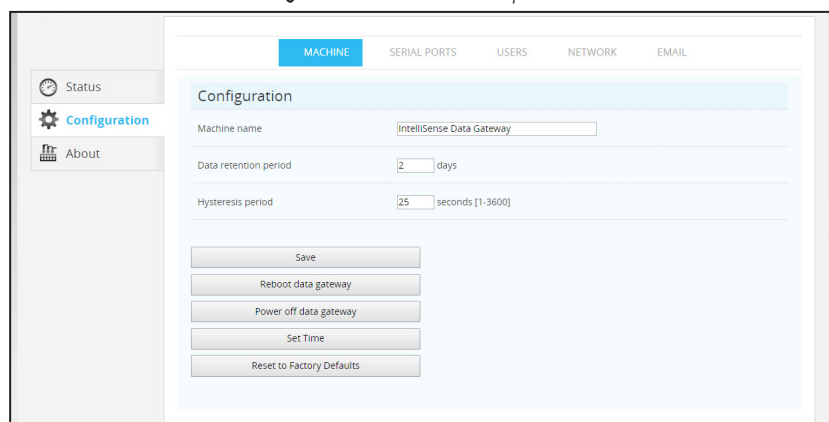
## CONFIGURE THE INTELLISENSE® DATA GATEWAY

### Data Gateway Machine Settings

Select the Configuration tab on the left of the screen, then the Machine tab on the top. On this page, the following parameters can be entered:

|                            |   |
|----------------------------|---|
| Machine name:              | A name for the gateway  |
| Data retention period:     | The number of days that recorded temperature and pressure should be kept for, disk size permitting. |
| Hysteresis period:         | The number of seconds a cylinder must be in an alert state before an alert is issued.               |
| Save:                      | All changes are lost if not saved.  |
| Power off gateway:         | Allows the gateway to be shut down without the risk of data loss or file corruption.                |
| Reset to Factory Defaults: | Clears any user-entered changes and resets the Data Gateway to factory default values.              |

*Figure 9: Machine Setup*



## Data Gateway Cylinders / SIMs

This page is for adding connections to SIMs that the Data Gateway will monitor. For more information, refer to the following section in this document: Add or Configure a SIM on the PC or Gateway.

## Data Gateway User Administration

The Data Gateway has user access control and multiple users can be set up with three levels of access privileges.

The three user levels are:

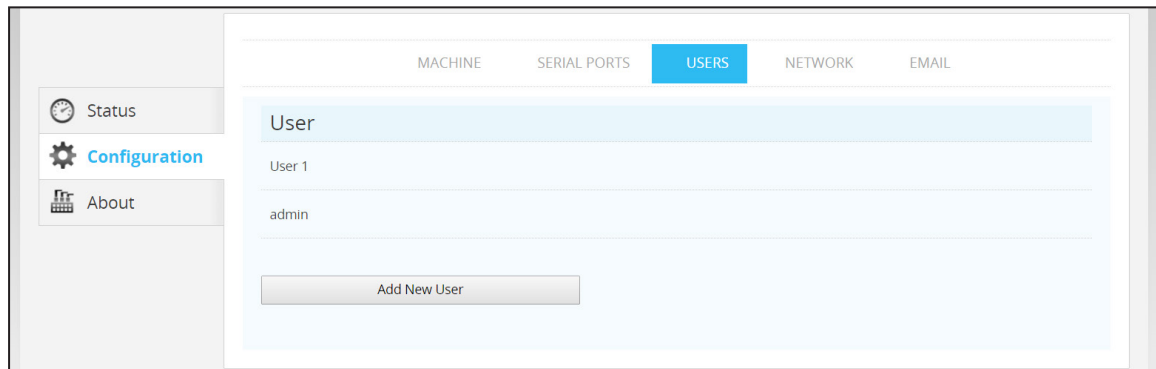
Read                      All users have read access

Modify SIM                      The user is able to modify the SIM parameters

Modify Gateway                      The user is able to modify the Gateway parameters

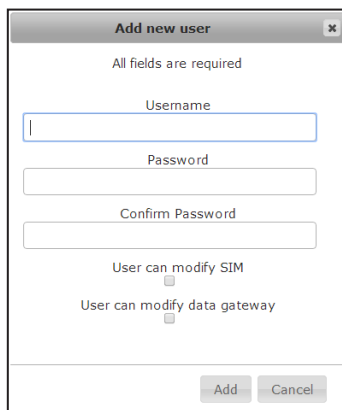
To get to the user setup screen, select the Configuration tab on the left of the screen and the Users tab at the top of the screen. A list of names for the currently set up users will show.

*Figure 10: User Account Management*



To edit any user, select the name in the list. To add a new user, select the "Add New User" command. In both cases, the edit user window will show. The following can be entered or changed:

*Figure 11: User Setup*



|                                      |   |
|--------------------------------------|---|
| <b>Username:</b>                     | Case sensitive. 3 characters minimum. (Do not use email addresses as usernames) |
| <b>Password:</b>                     | Case sensitive. 5 characters minimum.   |
| <b>User can modify SIM:</b>          | The user is able to modify the SIM parameters.                                  |
| <b>User can modify Data Gateway:</b> | The user is able to modify Gateway parameters.                                  |
| <b>Add/Save:</b>                     | Saves the entered changes.  |
| <b>Cancel:</b>                       | None of the entered changes are saved.  |
| <b>Delete:</b>                       | To delete an existing user.   |

## DATA GATEWAY NETWORK SETTINGS

The Data Gateway is a TCP/IP v4 device and following network settings can be made to enable communication:

### Global Server Settings

Figure 12: Global network settings

The screenshot shows the 'Global Server Settings' page. The left sidebar has 'Status', 'Configuration' (selected), and 'About'. The top navigation bar has 'MACHINE', 'SERIAL PORTS', 'USERS', 'NETWORK' (selected), and 'EMAIL'. Below this, there are tabs for 'GLOBAL' (selected), 'WIRED ETHERNET', and 'WIFI'. The main content area is titled 'GLOBAL SERVER SETTINGS' and contains a table of settings:

|                                     |                          |
|-------------------------------------|--------------------------|
| Web port                            | 3000                     |
| SSL encryption enabled ( https:// ) | <input type="checkbox"/> |
| Base URL:                           | http://10.10.10.20:3000  |
| Wired IP Address                    | 10.10.10.20              |
| Wired MAC Address                   | c0:3f:d5:6e:ad:e6        |
| WiFi IP Address                     | 192.168.1.244            |
| WiFi MAC Address                    | cc:e1:d5:15:b5:13        |

At the bottom of the settings table is a 'Save' button.

|                                    |  |
|------------------------------------|--|
| Web Port:                          | This defines the TCP port for connecting to IntelliSense®. Unless needed to avoid conflicts, keep the default value. See your system administrator for more information. |
| SSL encryption enabled (https://): | Checkbox enables SSL encryption for communication with IntelliSense® Data Gateway.   |
| Base URL:                          | For reference, gives the full URL, including port number, to access the current server.  |
| Wired IP Address:                  | The IP address assigned to the wired Ethernet port if enabled.   |
| Wired MAC Address:                 | The MAC address of the wired Ethernet port if enabled.   |
| WiFi IP Address:                   | The IP address assigned to the WiFi connection if enabled.   |
| WiFi Mac Address:                  | The MAC address of the WiFi connection if enabled.   |
| Save:                              | All changes must be saved to become effective.   |

## ENABLE SSL ENCRYPTION

Figure 13: Enable SSL Encryption

The screenshot shows the 'Global Server Settings' page with SSL encryption enabled. The 'SSL encryption enabled ( https:// )' checkbox is checked. The 'SSL Certificate' and 'SSL Key' fields show 'Choose File' buttons and 'No file chosen' text. The 'SSL Credential Status' field shows 'SSL Cert-Key Pair matched (10.1.251.130.crt and 10.1.251.130.key)'. The 'Base URL' is 'https://10.1.251.130:3000'. The 'Wired IP Address' is '10.1.251.130' and the 'Wired MAC Address' is 'c0:3f:d5:61:fc:d7'. At the bottom, there are 'Save' and 'Remove SSL Certificate and key' buttons.

After selecting the SSL encryption enabled (https://) check box, the following options are available.

SSL Certificate: Upload Certification file to Data Gateway

- Select Choose File
- Locate SSL Certificate on your computer
- Select open

SSL Key: Upload Key file to Data Gateway

- Select Choose File
- Locate SSL KEY on your computer
- Select open

SSL Credential Status: Confirms that the Certification and key files match and displays the name of each file.

After uploading the Certification and Key File and confirming they are correctly paired, select save to enable SSL security. If SSL encryption is disabled, the certification and key files will remain on the data gateway allowing SSL to be enabled again at any time.

Remove SSL Certificate and Key: Deletes the SSL certificate and Key from the Data Gateway.

## IP ADDRESS ASSIGNMENT

|           |   |
|-----------|---|
| DHCP:     | Configures the Gateway to receive TCP/IP settings from a DHCP server.                       |
| Static:   | Allows the user to manually enter the TCP/IP address, subnet mask, gateway and DNS servers. |
| Disabled: | Disables the WiFi adapter.  |

## WIRED ETHERNET

The following settings are for the wired RJ-45 Ethernet port on the Data Gateway. Press the save button to make the changes effective.

|              |  |
|--------------|--|
| ESSID:       | Select the Access Point name from the drop down list. Select the Re-scan button to refresh the list. |
| Key:         | The password key for the access point.   |
| IP Settings: | When in DHCP mode, displays the assigned parameters. In static mode, values can be entered here.     |
| MAC Address: | The MAC address of the wired Ethernet connection.  |

Figure 14: Wireless Network Settings

## WIFI

When the included wireless adapter is connected to the Data Gateway, the following wireless settings can be entered. Press the save button to make any changes effective.

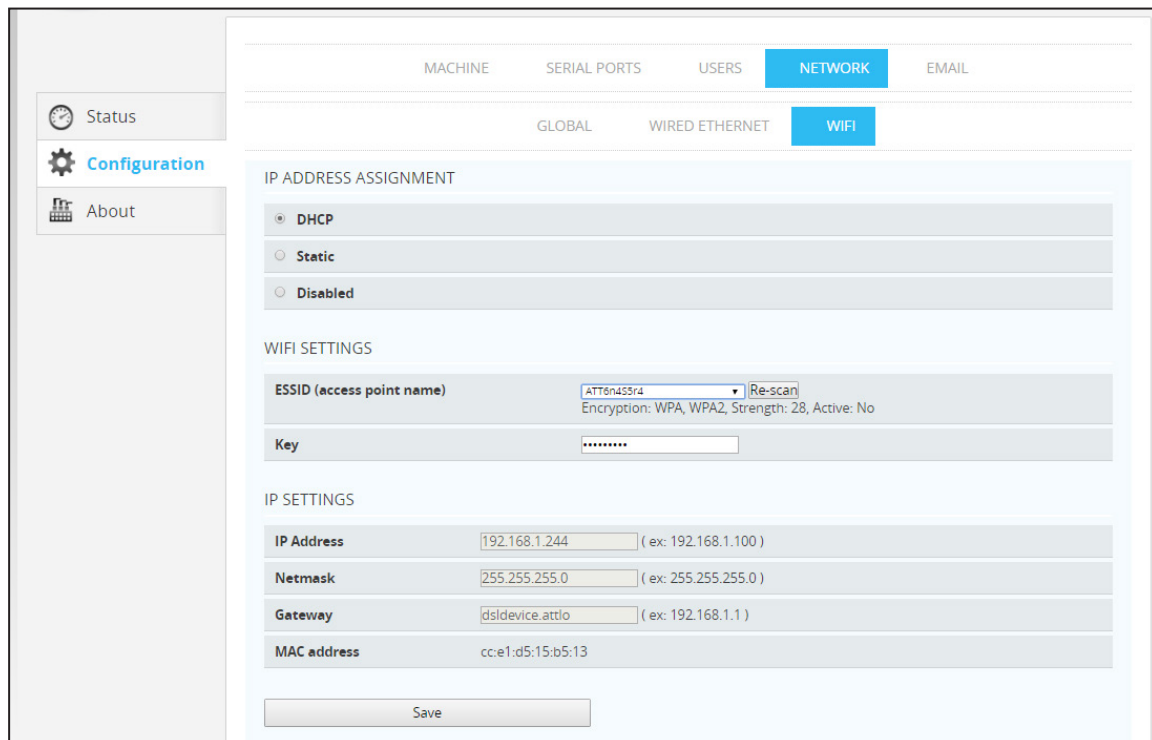
### IP Address Assignment

|           |   |
|-----------|---|
| DHCP:     | Configures the Gateway to receive TCP/IP settings from a DHCP server.                       |
| Static:   | Allows the user to manually enter the TCP/IP address, subnet mask, gateway and DNS servers. |
| Disabled: | Disables the WiFi adapter.  |

### WiFi Settings

|              |  |
|--------------|--|
| ESSID:       | Select the Access Point name from the drop down list. Select the Re-scan button to refresh the list. |
| Key:         | The password key for the access point.   |
| IP Settings: | When in DHCP mode, displays the assigned parameters. In static mode, values can be entered here.     |
| MAC Address: | The MAC address of the WiFi Ethernet connection.   |

*Figure 15: WiFi Network Settings*



## EMAIL ALERTS

Beginning with version 1.2.0 of the IntelliSense® data gateway software, the data gateway is capable of sending basic email alerts to select email address. Emails are sent when an alert becomes active and when it becomes inactive. No reminder emails or escalation emails are sent. For an email to be sent, the change in condition from inactive to active or active to inactive must exist for greater than the value set in the Hysteresis period in the Global settings tab.

To enable the enable alerts, select the EMAIL tab under the Configuration screen. Contact your email server administrator for assistance with the proper settings.

Figure 16: Email settings

## Email Server Settings

|                 |  |
|-----------------|--|
| Email server:   | Enter the IP address of the outbound email server.                                   |
| Port:           | Enter the port required to send email from the server.                               |
| SSL encryption: | Choose the required encryption for your server, disabled, SMTPS, or TTLS.            |
| Username:       | If required, enter the user name you would like the Data Gateway to send email from. |
| Password:       | Enter the password for the chosen username.  |

## Email Template Settings

|                             |   |
|-----------------------------|---|
| Sender (Reply to):          | The email address that will be entered into the From field is allowed by email server.  |
| Subject:                    | The subject line of the alert email.  |
| Email encoding:             | Choose between HTML and Text formatting for the email alert.  |
| Email template:             | Functions related to managing custom email templates. See section "Email Templates: for details on developing customer templates.   |
| Email branding image:       | Upload new image file to be included in the alert email.  |
| Base URL included in email: | Email notifications can include links back to the IntelliSense® Data Gateway. Enter the base URL from either the Ethernet or WiFi settings screens depending on which address the user should use to access the Data Gateway. |

## Email Alert Settings

|                  |  |
|------------------|--|
| Email alerts:    | Check box enables or disables the email alert function.  |
| Alert period:    | How frequently the email clients check for alerts.   |
| Address list:    | Enter the email address to send alert emails. Multiple addresses should be separated by either a comma or a semicolon.                 |
| Save:            | All changes must be saved before exiting the email settings screen.  |
| Send Test Email: | Sends test email to all email address listed in the Address list, confirming the Gateway has been configured correctly to send emails. |



## Email Alerts Templates

The IntelliSense® email alert functionality allows for user created templates to be used. The email template should be constructed in HTML format. Within the email configuration screen there are three possible buttons to help you manage your email template shown in Figure 17.

*Figure 17: Email Settings*

|                |                      |                        |                 |
|----------------|----------------------|------------------------|-----------------|
| Email template | Upload Template File | Download Template File | Restore Default |
|----------------|----------------------|------------------------|-----------------|

- |                         |   |
|-------------------------|---|
| Upload Template File:   | Upload a new template file in plain text .html, .htm or .tpl format.  |
| Download Template File: | Download the email template currently being used by the data gateway.   |
| Restore Default:        | Only available when a custom template has been loaded. This button restores the factory default email template. |

## Setting the Date and Time Format

The first line of the template is used to set the date and time format. It should read [% USE date(format = '...') %]. The three dots should be replaced with any of the specifiers shown in Table 3. Any text include between ' ' will be included in the date and time output.

For example:

The line [% USE date(format = '%Y-%m-%d, %l:%M:%S %p') %] set the date in the following format 2015-12-23, 10:28:40 AM.

Or

The line [% USE date(format = '%A, %B %-d : %X') %] set the date in the following format Wednesday, December 23 : 11:26:43 AM

Any leading zeros may be removed from any field by using the hyphen character. (e.g. The display of the time, if the time is eight o'clock, using %l to represent the hour '08:00', and using %-l for the hour '8:00').

*Table 3: Date format specifiers*

| SPECIFIER        | MEANING  |
|------------------|--|
| %a               | The abbreviated weekday name ("Sun")                                     |
| %A               | The full weekday name ("Sunday")   |
| %b               | The abbreviated month name ("Jan")                                       |
| %B               | The full month name ("January")  |
| %c               | The preferred local date and time representation (\$a %e %b %Y %r %p %Z) |
| %C               | The century (20 from 2015)   |
| %d               | The day of the month (01..31)  |
| %D               | The date string (%m/%d/%y)   |
| %e               | The day of the month, space padded ( 1..31)                              |
| %F               | The day string (%Y-%m-%d) (the ISO 8601 date format)                     |
| %H               | The hour of the day, 24-hour clock (00..23)                              |
| %l (uppercase i) | The hour of the day, 12-hour clock (01..12)                              |

| SPECIFIER        | MEANING   |
|------------------|---|
| %j               | The day of the year (001..366)  |
| %k               | The hour of the day, 24-hour clock, space padded ( 0..23)   |
| %l (uppercase L) | The hour of the day, 12-hour clock, space padded ( 1..12)   |
| %m               | The month of the year (01..12)  |
| %M               | The minute of the hour (00..59)   |
| %p               | The meridian indicator, uppercase ("AM" or "PM")  |
| %P               | The meridian indicator, lowercase ("am" or "pm")  |
| %r               | The time string, 12-hour clock (%l:%M%S %p)   |
| %s               | The number of seconds since 1970-01-01 00:00:00 UTC   |
| %S               | The seconds of the minute (00..60)  |
| %T               | The time string, 24-hour clock (%H:%M:%S)   |
| %u               | The day of the week as a decimal, with Monday being 1 (1..7)  |
| %U               | The week number of the year, starting with the first Sunday as the first day of the first week (00..53) |
| %V               | The week number of the year according to ISO 8601 (01..53)  |
| %w               | The day of the week, Sunday is 0 (0..6)   |
| %W               | The week number of the year, starting with the first Monday as the first day of the first week (00..53) |
| %x               | Preferred representation for the date alone, no time (%m/%d/%Y)   |
| %X               | Preferred representation for the time alone, no date (%l:%M%S %p)                                       |
| %y               | The year without the century (00..99)   |
| %Y               | The year with the century   |
| %Z               | The time zone name  |

## Displaying SIM Status

The keywords shown in Table 4 are used to display information related to the alert. These keywords must be used with in the following code block in the template.

```
[% FOREACH event IN Events %]  
[% END %]
```

Any formatting in the code block will be applied to each alert status when multiple Alerts are active. For example, a data gateway has two SIMs attached and the following line is included in the code block in the email template.

```
[% FOREACH event IN Events %]  
[%EventName %],[% EventAlert %], [% EventTime %], [% EventStatus %]<BR>  
[% END %]
```

If both SIMS have an alert condition, the email would contain:

SIM 1, Sensor 2 Temperature High, Wednesday, December 23 : 01:40:05 PM, active  
SIM 2, Sensor 1 Temperature Low, Wednesday, December 23 : 01:40:05 PM, active

*Table 4: Template SIM status keywords*

| KEYWORD          | DESCRIPTION                                  |
|------------------|--|
| [% EventName %]  | The name of the SIM                          |
| [% EventAlert %] | The event description                        |
| [% EventTime %]  | The time of the event                        |
| [% EventTime %]  | The status of the event (active or inactive) |
| [% loop.count %] | Event ID number                              |
| [% loop.size %]  | Total number of event in email               |

## Display data gateway name and URL

There are two more keywords available for use in the email template. These keywords make it easier to access the data gateway that sent the email alert. These keywords are shown in Table 5.

It is recommended that these two key words are used together to create a hyperlink to the SIM status screen that can be accessed from the alert email. For example:

```
<a href="[% URL %]">[% MachineName %]</a>
```

In this example, the hyper link references the [% URL %] keyword and applies the link to the result of the [% MachineName %] keyword.

*Table 5: Template machine identification keywords*

| KEYWORD           | DESCRIPTION                                   |
|-------------------|---|
| [% MachineName %] | The machine name assigned to the data gateway |
| [% URL %]         | The URL of the SIM status screen              |

## Using a Branding Image

One image file can be added to the email template to help brand alert emails. To reference the branding image, use keyword [% BrandingImageSrc %]. For example:

```

```

In this example, the image tag calls uses [% BrandingImageSrc %] as the image file.

Here is a simple example of a complete template that could be uses.

```
[% USE date(format= '%F, %r') %]
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<body style="margin: 0; padding: 0;">
  <table align="left" cellpadding="0" cellspacing="0" style="border-collapse:
collapse;">
    <tr><td>
      The IntelliSense Data Gateway, <a href="[% URL %]">[% MachineName
%]</a>, has detected change(s) in alert status<br><br>
      [% FOREACH event IN Events %]
        Event [% loop.count %] of [% loop.size %]:<br>
        &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&Cylinder: [% EventName %]<br>
        &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&&nbsp;&nbsp;&Alert: [% EventAlert %]<br>
        &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&&nbsp;&nbsp;&Time: [% EventTime %]<br>
        &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&&nbsp;&nbsp;&Status: [% EventStatus %]<br><br>
      [% END %]
    </td>
  </tr>
</table>
</body></html>
```

This template example generates the following email:

```
The IntelliSense Data Gateway, Machine 1, has detected change(s) in alert
status

Event 1 of 2:
  Cylinder: ID 1 not specified.
    Alert: Sensor 1 Temperature High
    Time: 2015-12-01, 09:01:30 AM
    Status: active

Event 2 of 2:
  Cylinder: ID 1 not specified.
    Alert: Sensor 2 Temperature High
    Time: 2015-12-01, 09:01:24 AM
    Status: inactive
```

## Update Gateway Software

If connected to the internet, it is possible to update the software on the Data Gateway and download the latest SIM firmware.

1. Select the “About” tab on the left of the screen, then the “Software” tab.
2. Under the Component column, IntelliSense® indicates the Gateway software. The remaining items are for the SIM and sensor firmware.
3. The Installed column has the version number of the installed software and Update shows the version available for download. If they are different, a command button under Action will appear to prompt updating the software.

If not connected to the internet, it is possible to update the software on the Data Gateway via a USB drive.

For Data Gateway software versions 1.1.0 and older, the IntelliSense® Patch 1.1 must be installed before the Data Gateway can be updated via USB drive.

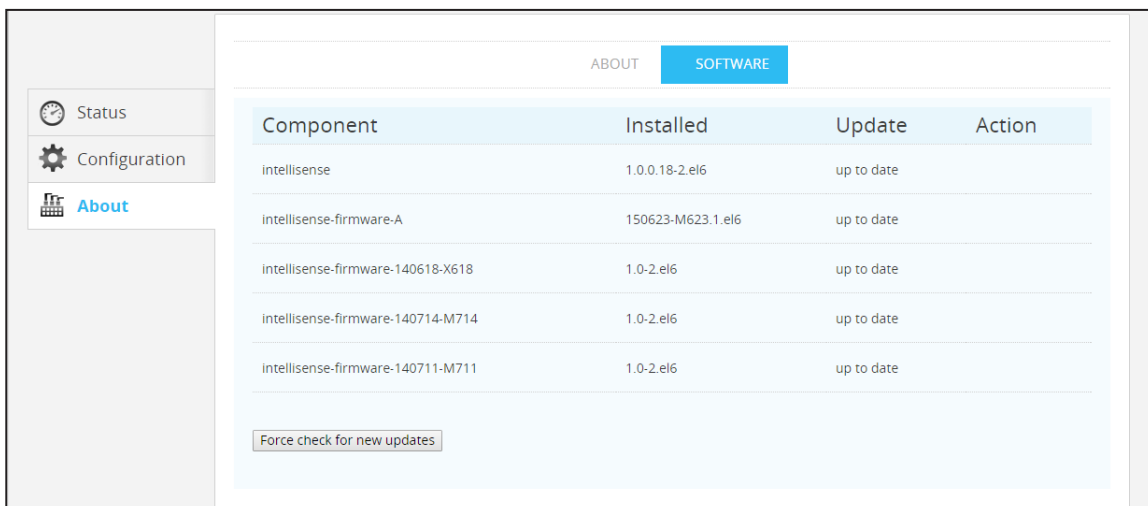
1. Download the IntelliSense® Patch file from [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics)
2. From a PC with access to the Data Gateway, run IntelliSense®\_Patch\_1\_1.exe.
3. Enter the IP address of the Data Gateway and click Install.
4. After installation is complete, click close.

For Data Gateways with version 1.1.1 or later or that have had the IntelliSense® Patch 1.1 installed, the Data Gateway software can be updated with a USB drive.

1. Download IntelliSense® USB software from [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics).
2. Copy the contents of the .zip file to the root directory of a USB drive.
3. Plug the USB into one of the USB ports on the Data Gateway and allow it to be recognized.
4. From the “Software” tab, click “Force check for new updates.”
5. Click the update button just as you would if connected directly to the internet.

To download the available SIM firmware, select the Install button in the Action column to the right of the desired firmware version. This will download the latest firmware for storing on the Gateway, and does not update the attached SIMs. Refer to the following section in this manual to apply the SIM update: Update SIM Firmware.

*Figure 18: IntelliSense® Data Gateway Software Update*



| Component                         | Installed         | Update     | Action |
|-----------------------------------|-------------------|------------|--------|
| intellisense                      | 1.0.0.18-2.el6    | up to date |        |
| intellisense-firmware-A           | 150623-M623.1.el6 | up to date |        |
| intellisense-firmware-140618-X618 | 1.0-2.el6         | up to date |        |
| intellisense-firmware-140714-M714 | 1.0-2.el6         | up to date |        |
| intellisense-firmware-140711-M711 | 1.0-2.el6         | up to date |        |

Force check for new updates

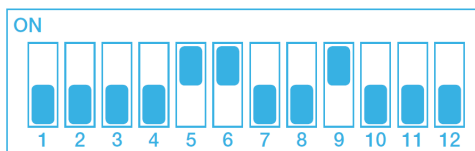
## SIM INSTALLATION

### DIP SWITCH SETTINGS

The IntelliSense® SIM module has a bank of DIP switches that allow for a variety of different architectural configurations. The DIP switch bank is located under the rear cover of the SIM unit. Before mounting your SIM unit, it is important that the DIP switches are configured to match the installation type being used. The SIM unit's DIP switch setting can be grouped in two categories:

- Power Source/Discrete Output
- Network Configuration/MODBUS Settings

*Figure 19: Default DIP switch settings*



*Table 6: IntelliSense® Sensor Interface Module Dip Switch Settings*

| DIP SWITCH  | PORT          | OFF-0  | ON-1  | DEFAULT |
|-------------|---------------|--|---|---------|
| 1, 2, 3, 4* | Both          | Communication ports unlinked                               | Communication ports linked  | 0,0,0,0 |
| 5, 6*       | Modbus**      | 4-wire RS-422 or RS-485                                    | 2-wire RS-485   | 1,1     |
| 7           | Modbus        | 150 ohm terminating resistor unconnected                   | 150 ohm terminating resistor connected                                    | 0       |
| 8           | N/A           | This switch should remain off for all configurations       | Not Used  | 0       |
| 9           | I/O Connector | Isolates Pin 4 from ground to allow for outputs to be used | Connects Pin 4 to ground to allow for SIM to be powered via I/O connector | 1       |
| 10          | Modbus**      | Unties Channel A from +5V                                  | Ties Channel A to +5V via 680 $\Omega$ resistor                           | 0       |
| 11          | Modbus**      | Unties Channel B from ground                               | Ties Channel B to ground via 680 $\Omega$ resistor                        | 0       |
| 12          | N/A           | Not Used   | Not Used  | N/A     |

\*Switches should be changed together

\*\*Affects both ports if they are linked (DIP 1-4 ON)

### Power Source and Discrete Output Settings

By setting DIP switch 9 to ON, the SIM unit may be powered using 4 pin I/O connector. See Using IntelliSense® I/O Connector for information on wiring. This is the default setting.

When DIP switch 9 is OFF, the user may use the outputs of the 4 pin I/O connector. See Using IntelliSense® I/O Connector for information on wiring.

## Network Configuration/MODBUS Settings

DIP switches 1-4 should be treated as one switch, either all ON or all OFF. When this set is turned ON, the MODBUS Port and PC Port are internally connected to allow for a daisy chain layout. When OFF (default), the ports are not internally connected.

DIP switches 5 and 6 should be treated as one switch, either both ON or both OFF. When this set is turned ON (default), the MODBUS Port is configured for 2-wire RS485. When OFF, the port is configured for 4-wire RS485.

When DIP switch 7 is set ON, it connects a 150 ohm terminating resistor across channels D0 and D1 of the MODBUS Port. Default is OFF. See Using IntelliSense® with MODBUS RTU Network for more information.

DIP switch 8 is not used for any valid IntelliSense® configuration. The default value is OFF. This switch should remain in this position.

When DIP switch 10 is set ON, it connects channel A of the MODBUS Port to +5V via a 680 ohm resistor for line polarization. When using the IntelliSense® in a multiple-slave MODBUS network, only one SIM unit should have this switch in the ON position. All other slave SIM units should be in the OFF position. Default position is OFF.

When DIP switch 11 is set ON, it connects channel B of the MODBUS Port to Ground via a 680 ohm resistor for line polarization. When using the IntelliSense® in a multiple-slave MODBUS network, only one SIM unit should have this switch in the ON position. All other slave SIM units should be in the OFF position. Default position is OFF.

DIP switch 12 is not used.

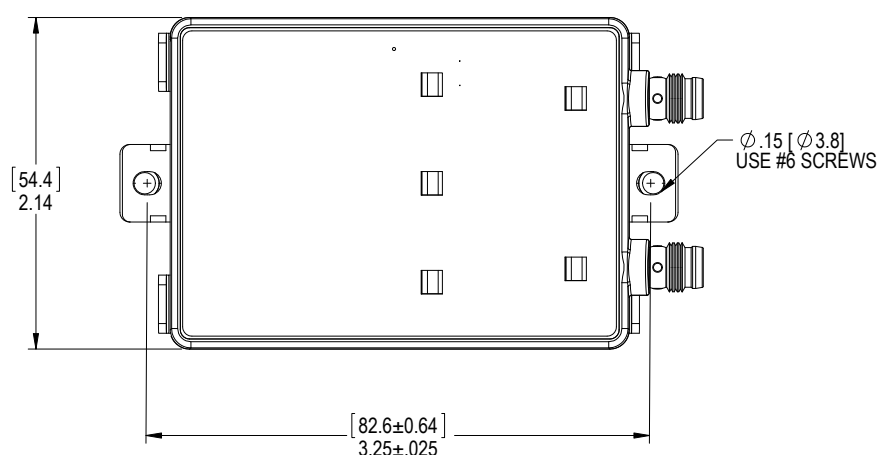
## LOCATING THE SIM

### Mounting the SIM

The SIM is recommended to be mounted in an electrical enclosure or another clean dry environment. It is not intended to be placed in dirty, damp, or hazardous environments.

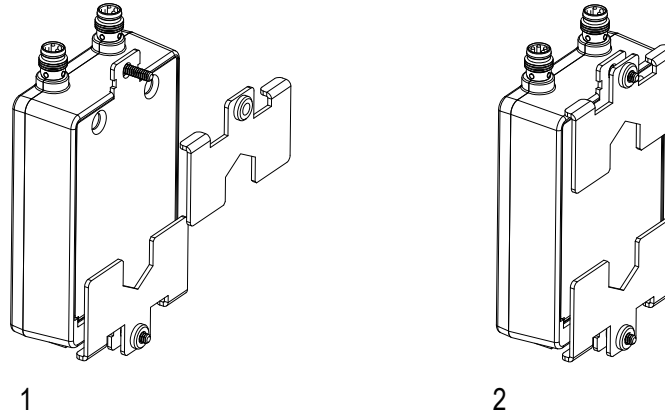
*Panel Mount:* The SIM will mount to a flat panel with two #6 size screws. The figure below shows the hole spacing for the SIM back plate.

*Figure 20: SIM Panel Mount Dimensions*



DIN Rail Mount: included with the SIM are clips for mounting to 35 mm DIN rail. The clips attach to the rear of the SIM back plate with the included #6 screws. When the screws are tightened down, the clips will grip onto the flanges of the DIN rail. The SIM may still slide laterally on the rail even when screws are tightened.

*Figure 21: SIM DIN Rail Mount*



## CONFIGURING THE SIM

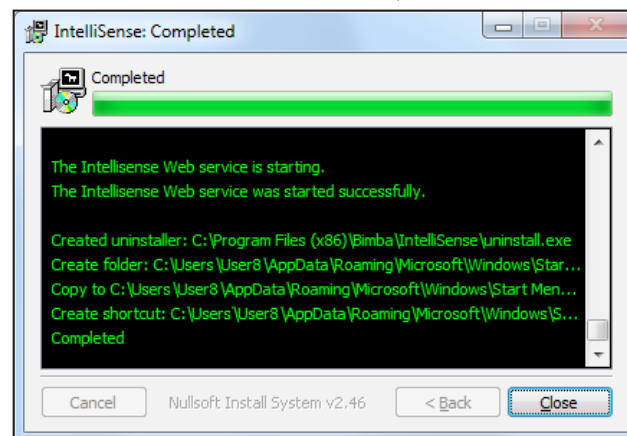
An IntelliSense® SIM can be configured either through a PC or an IntelliSense® Data Gateway.

To configure IntelliSense® using a PC, you must first install the IntelliSense® PC Software.

### PC Software Installation

Download the installation executable to a location on your computer and run. Accept the pop-up windows for Windows User Access Control and follow the instructions for selecting the installation location, if the default needs to be changed. The software will copy all files and install. When installation is complete, the following window will appear. Select Close to exit and then restart your computer.

*Figure 22: Installation complete window*



Launch the software by running **IntelliSense®** from the start menu under the Bimba folder.

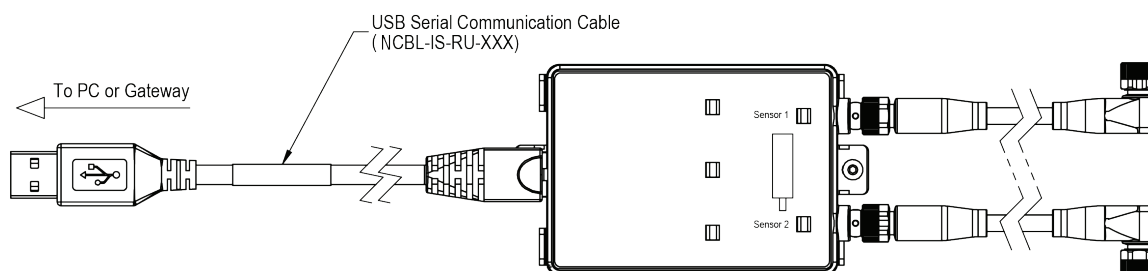


## Connecting to the SIM

The SIM connects to the USB port of a PC or Data Gateway with the USB programming cable or through a USB serial hub.

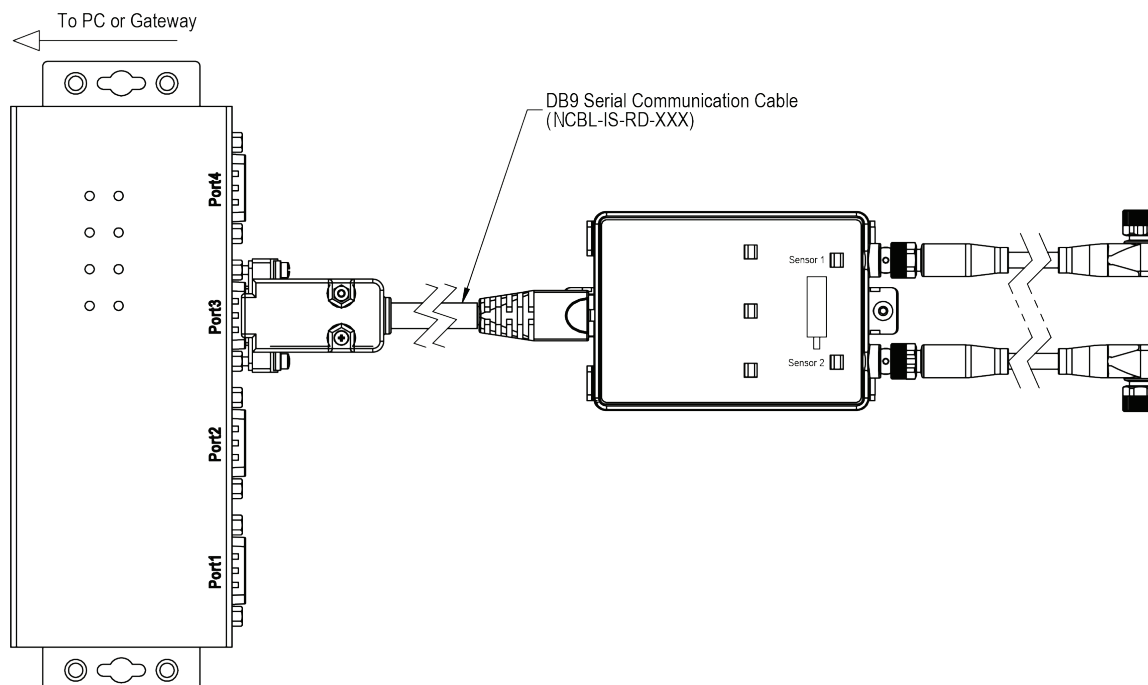
Direct connection: Connect the RJ-45 connector of the programming cable (NCBL-IS-RU-1.8) to the port labeled “PC” on the SIM and the other end to a free USB port on the PC or Data Gateway. With everything powered on, the USB connector will turn a solid green when connected to a properly working SIM and two sensors.

*Figure 23: SIM Direct Connect*



Through Serial Hub: Connect the RJ-45 connector of the serial cable (NCBL-IS-RD-XX) to the PC port on the SIM, and the DB9 connector to one of the free ports on the serial (NISH-D04). The hub is then connected to a free USB port on the PC or data gateway. With the serial hub, it is possible to connect up to four SIMs to a single USB port. See Page 75 for DB9 to RJ45 cable pin-outs.

*Figure 24: SIM serial hub connection*

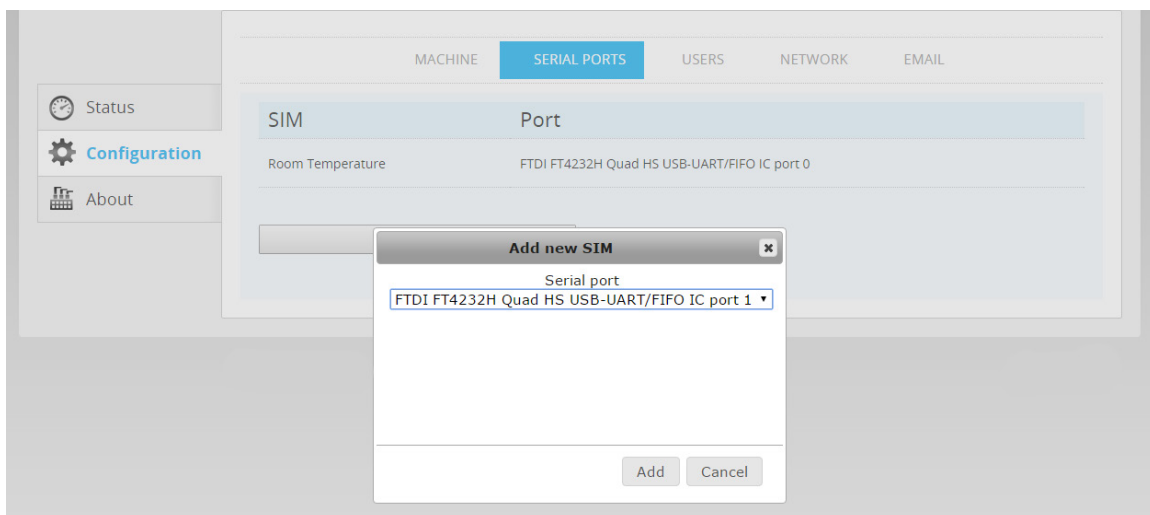


## Add or Configure a SIM on the PC or Gateway

Ensuring that the SIM has two sensors connected, with a SIM connected to a gateway using a programming cable or through a serial hub, the software has to be set up to recognize the SIM. The following steps illustrate how to do this:

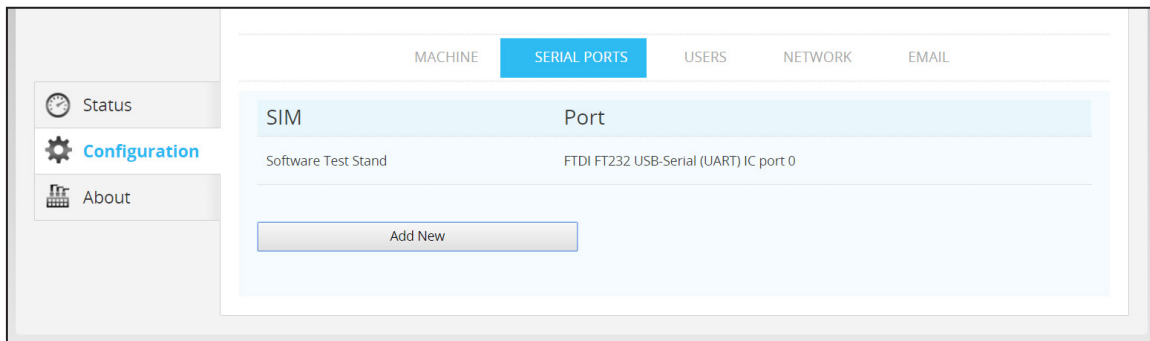
1. On a PC, launch the IntelliSense® software using a web browser connected to the IntelliSense® Data Gateway that the SIM is connected to. The default address is `http:\\10.10.20:3000`.
2. Select the Configuration button on the left side of the window.
3. Select the “Serial Ports” tab in the middle of the top row.
4. Click the “Add New” button to bring up a pop-up window of all SIMs connected to serial ports on the PC or Gateway that have not been registered in the software.
5. From the drop down box, select the port address of the serial connection for the SIM that will be registered on the computer.
6. Press the “Add” button to register the device.

*Figure 25: Add new Cylinder*



- The software will show a message indicating success and the SIM will appear in the SIM list as “unknown” and the full port address that was previously selected.

*Figure 26: Unknown cylinder*

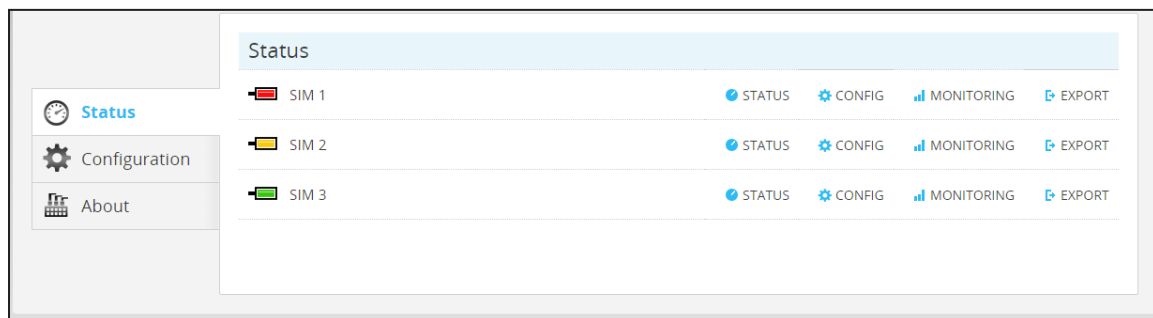


- Select the “Status” tab on the left of the screen. The cylinder status list will show, and the newly registered SIM will have a status of “ID X not specified”.

## Multiple SIMs

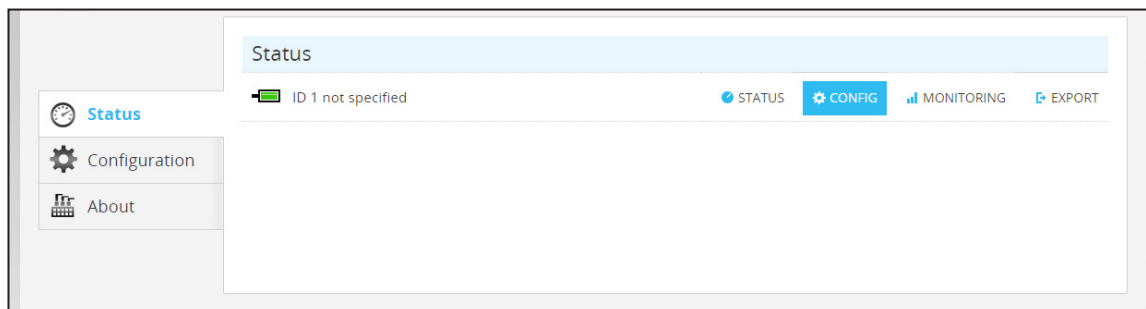
Multiple SIMS can be added to a Data Gateway by following the steps to add a single SIM. The PC software only support one SIM at a time. It is recommended that each SIM is connected to the Data Gateway individually and given a distinguishing name (see editing SIM configuration) and then adding the remaining SIMs. The figure below shows a Gateway with three SIMS connected.

*Figure 27: Multi-SIM Dashboard*



## Editing SIM Configuration

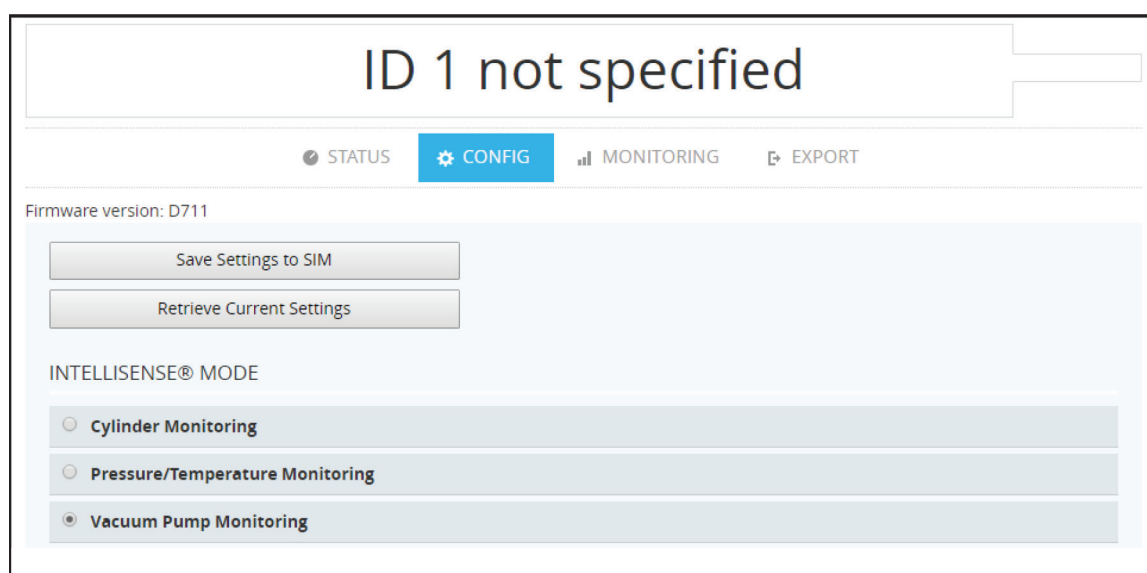
Figure 28: Cylinder Config button



Any SIM in the main list can be configured by selecting the “Config” button to the right of the SIM entry on the status screen. The following configuration page will show. Click the button marked Retrieve Current Settings to bring all of the current parameter values from the SIM memory into the web browser, including the SIM version, set-up and communication parameters.

To save any changed values to the SIM memory, click the button Save Settings to SIM.

Figure 29: Save and retrieve Settings to and from the SIM



## BASIC SIM SETTINGS

### IntelliSense® Modes

IntelliSense® can be set up to monitor a variety of pneumatic components by selecting one of three modes, Cylinder Monitoring, Pressure Temperature Monitoring or Vacuum Pump Monitoring. In Cylinder Monitoring mode, IntelliSense® will monitor cylinder performance, including stroke time and leakage, and allow alarms to be set. These alarms are triggered when the set thresholds are crossed. In Pressure Monitoring mode, IntelliSense® will measure pressure and temperature and alert you when the set-points are reached or crossed. The mode can be set by selecting the appropriate option button shown in the figure on the next page. Vacuum Pump Monitoring, this mode is designed to monitoring venturi Vacuum pumps to ensure proper Vacuum levels are reached and warn before failure occurs.

*Figure 30: IntelliSense® Mode Selection*

| INTELLISENSE MODE                |                                 |
|----------------------------------|---------------------------------|
| <input type="radio"/>            | Cylinder Monitoring             |
| <input type="radio"/>            | Pressure/Temperature Monitoring |
| <input checked="" type="radio"/> | Vacuum Pump Monitoring          |

## Identification

When in Cylinder Monitoring or Vacuum Pump modes, three pieces of information can be entered for identifying the SIM. The first ID is the SIM name (60 characters max), the second is the cylinder location (40 characters) and the third is the cylinder part number (32 characters).

*Figure 31: Cylinder mode Identification*

| IDENTIFICATION     |   |
|--------------------|---|
| <b>Name</b>        | <input type="text"/> 59 characters remaining. |
| <b>Location</b>    | <input type="text"/> 39 characters remaining. |
| <b>Part Number</b> | <input type="text"/> 31 characters remaining. |

In Pressure Monitoring mode, the first ID is the SIM name (60 characters max), the second is the location of sensor one (40 characters) and the third is the location of sensor two (32 characters).

*Figure 32: Pressure / Temperature Monitoring mode Identification*

| IDENTIFICATION           |   |
|--------------------------|---|
| <b>Name</b>              | <input type="text"/> 59 characters remaining. |
| <b>Sensor 1 location</b> | <input type="text"/> 39 characters remaining. |
| <b>Sensor 2 location</b> | <input type="text"/> 31 characters remaining. |

## Commissioning

The commission buttons are used to setup a new SIM or reset a SIM after a device is replaced. The buttons available will change based on the mode you have chosen.

- In Service Day : User defined date the device being monitored is put into service (All modes)
- Update SIM Firmware : Update SIM to latest Firmware (All modes)
- Blink LEDs for identification : Blink LED's on SIM (All modes)
- Set Sensor(s) As Recognized : Sync sensor id to SIM to identify if a sensor is moved or changed (All modes)
- Set Time : Set the time on the SIM real time clock to match Data Gateway or laptop (All modes)
- Reset cycles per day : Sets Average Daily Cycles to zero (Cylinder and Vacuum modes)
- Reset cycle count to zero : Sets Cycle count to zero (Cylinder and Vacuum modes)
- Reset predictive data and history : Clear SIM memory and revert to cycle count mode (Cylinder Mode)
- Take Baseline of current performance : Generates the average value for the Alert Condition variables to be used as a basis for setting limits. (All Modes)

Figure 33: Commissioning Buttons for Cylinder Monitoring Mode

|  |            |
|--|------------|
| In Service Day   | 08/05/2015 |
| <div>Update SIM Firmware</div> <div>Blink LEDs for identification</div> <div>Set Sensor(s) As Recognized</div> <div>Set Time</div> <div>Reset cycles per day</div> <div>Reset cycle count to zero</div> <div>Reset predictive data and history</div> <div>Take baseline of current performance</div> |            |

## Update SIM Firmware

If it is necessary to update the SIM firmware, this can be performed with a file downloaded to the user's machine or one that resides on the data gateway.

Select the Update SIM firmware command to launch the pop up window:

Figure 34: SIM Firmware update

SIM MAINTENANCE FUNCTIONS

Restart SIM
Set Time
Backup Settings
Restore Settings from Backup
Restore SIM to Factory Settings
Reset predictive data and history
Reset cycles per day
Update SIM Firmware
Blink LEDs for identification

Update Firmware

Select firmware file

140618-X618
140711-M711
140714-M714

OR

Upload other firmware file

Choose File
No file chosen

PC update:

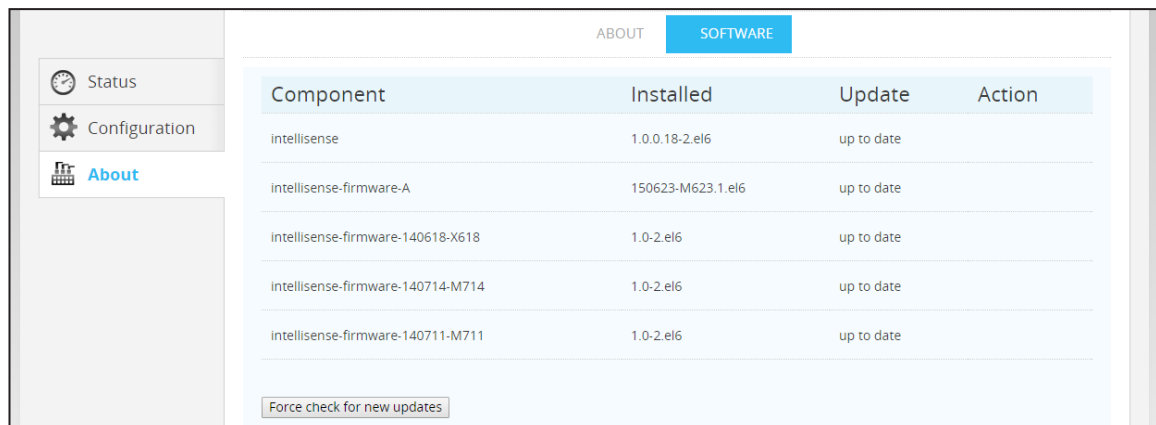
1. Download the latest SIM firmware to a location accessible from your computer.
2. Select the "Choose File" command.
3. With the file explorer in your browser, select the firmware update.
4. The update will be applied.

#### Data Gateway updates:

This option requires that the gateway is connected to the internet.

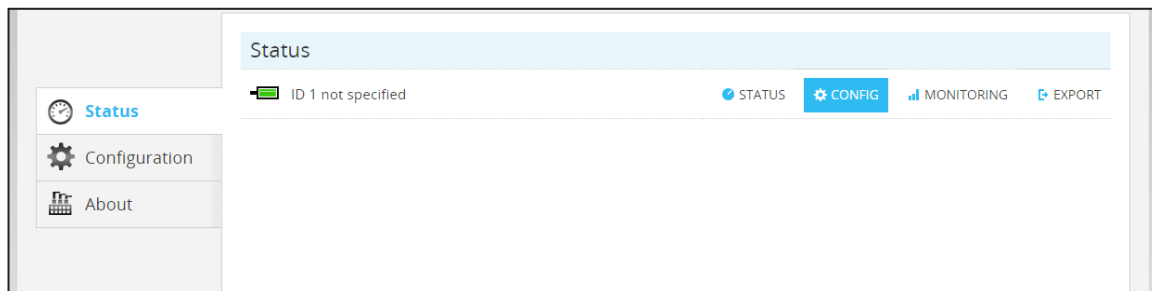
1. The pop-up list box displays firmware files that reside on the gateway.
2. To check if there are any newer files available, select the “About” tab in the left column of the screen, and then select the “Software” tab.
3. The software list will show the current firmware version residing on the data gateway. If there is a newer version available, a command button will show allowing it to be downloaded to the Data Gateway. If the firmware version is the latest available, the message “Up To Date” will show.

*Figure 35: IntelliSense® Data Gateway check for new firmware*



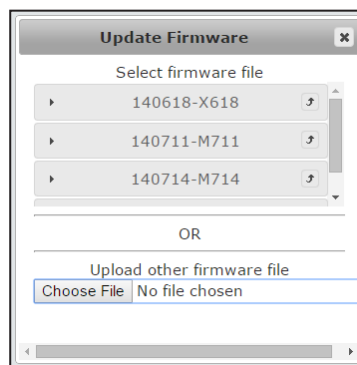
4. Return to the SIM “Config” screen

*Figure 36: Return to Cylinder Config Screen*



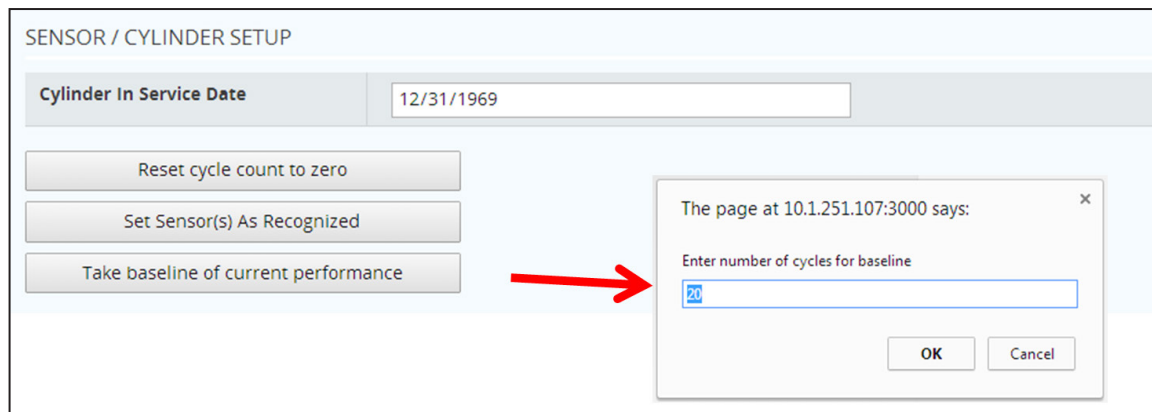
5. Select the “Update SIM Firmware” command and select the upload icon to the right of the firmware file name to load it to the selected SIM.

*Figure 37: Update from Data Gateway*



6. The updated firmware will be applied to the SIM.

Figure 38: Baseline cycle count



## Alert Detection

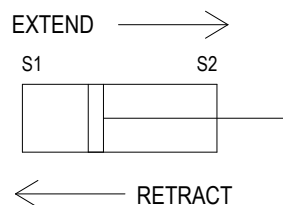
In the alert detection section, the user enters the limits that define failure for the current mode.

## Cylinder Mode Alert Detection

Cylinder alerts indicate allowable ranges for cylinder performance and system parameters.

Extend time is the time required for the cylinder to extend outwards until the end of stroke or an obstacle causes end of travel. Retract time is the time for the cylinder to retract. The direction of extend and retract is denoted by the default location of the sensors with S1 on the cap side of the cylinder and S2 on the rod side.

Figure 39: Cylinder Mode sensor position



To aid in determining the parameter limits for the alerts, the values from the baseline of the cylinder are displayed for reference.



*Figure 40: Alert detection settings Cylinder Mode*

| ALERT DETECTION         |   |          |  |                         |
|-------------------------|---|----------|--|-------------------------|
| Threshold               |   | Baseline |  |                         |
| Extend time (S1 to S2)  | Min: <input type="text" value="20"/>    | [211]    | Max: <input type="text" value="400"/>    | Milliseconds            |
| Retract time (S2 to S1) | Min: <input type="text" value="20"/>    | [228]    | Max: <input type="text" value="400"/>    | Milliseconds            |
| Rod seal failure        | Min: <input type="text" value="0"/>     | [0.00]   | Max: <input type="text" value="3"/>      | % Line Pressure Leaking |
| Piston seal failure     | Min: <input type="text" value="0"/>     | [0.44]   | Max: <input type="text" value="3"/>      | % Line Pressure Leaking |
| Line pressure           | Min: <input type="text" value="87.02"/> | [103.00] | Max: <input type="text" value="116.03"/> | psia                    |
| Sensor 1 Temperature    | Min: <input type="text" value="59.00"/> | [80.56]  | Max: <input type="text" value="100.00"/> | °F                      |
| Sensor 2 Temperature    | Min: <input type="text" value="59.00"/> | [80.47]  | Max: <input type="text" value="100.00"/> | °F                      |

## Pressure/Temperature Mode Alert Detection

In pressure / temperature mode, there are eight alert values that can be set for each sensor, Min. Pressure warning, Min. Pressure Alert, Max. Pressure Warning, Max. Pressure Alert, Min. Temperature warning, Min. Temperature Alert, Max. Temperature Warning, and Max. Temperature Alert. The min. warning value should always be higher than the min. alert value and the max. warning value should always be lower than the max. alert value. The SIM will alert the users when the detected variable is outside of the defined range.

*Figure 41: Alert detection Pressure / Temperature Mode*

| Threshold                  |   | Baseline |  |      |
|----------------------------|---|----------|--|------|
| Sensor 1 Pressure Warn     | Min: <input type="text" value="0.00"/>  | [51.48]  | Max: <input type="text" value="40.00"/>  | psia |
| Sensor 1 Pressure Alert    | Min: <input type="text" value="0.00"/>  | [51.48]  | Max: <input type="text" value="116.03"/> | psia |
| Sensor 2 Pressure Warn     | Min: <input type="text" value="0.00"/>  | [34.58]  | Max: <input type="text" value="40.00"/>  | psia |
| Sensor 2 Pressure Alert    | Min: <input type="text" value="0.00"/>  | [34.58]  | Max: <input type="text" value="116.03"/> | psia |
| Sensor 1 Temperature Warn  | Min: <input type="text" value="60.01"/> | [77.36]  | Max: <input type="text" value="64.98"/>  | °F   |
| Sensor 1 Temperature Alert | Min: <input type="text" value="59.00"/> | [77.36]  | Max: <input type="text" value="90.00"/>  | °F   |
| Sensor 2 Temperature Warn  | Min: <input type="text" value="60.01"/> | [74.57]  | Max: <input type="text" value="80.01"/>  | °F   |
| Sensor 2 Temperature Alert | Min: <input type="text" value="59.00"/> | [74.57]  | Max: <input type="text" value="81.90"/>  | °F   |

## Vacuum Pump Mode Alert Detection

In Vacuum Pump Monitoring mode you can set an alert or warning based on the Vacuum level reached during the corking portion of the cycle, the supply pressure, temperature at Sensor 1 and Sensors 2, If a part has been picked by not released (Vacuum Lock), and if the pump is on but has not picked up a part (No Vacuum).

Vacuum level is only measure when the pump is on. This is measured by the presence of supply pressure. While the supply pressure is on IntelliSense® will check that that Vacuum level is within the limits set. The Max. Vacuum Warning should be set just below the expected Vacuum level for the application. This allows IntelliSense® to act as a part present sensor. The Min. V a.c. warning should be set above the Min Vacuum Alert level providing a warning to order replacement parts before the system begins to fail.

The Max. Vacuum Alert should be set to the maximum Vacuum allowable with out damaging the work piece. The Min Vacuum Alert should be set above the minimum Vacuum required for the application.

The Pressure warning Min. should be set just below the optimal pressure for the Vacuum pump. The Max should be set just above. By knowing the supply pressure is in range when a Vacuum alert is given it can be assumed the drop in Vacuum level is due to leakage.

The temperature alerts and warning are directional guides.

Vacuum Lock is indicated when the Line pressure is below the set level and the Vacuum level is above the set level.

No Vacuum is indicated when the Line pressure is above the set level and the Vacuum level is below the set value, indicating the pump is being supplied air but the proper Vacuum level is not achieved.

*Figure 42: Vacuum Pump Monitoring Alert Setting*

| ALERT DETECTION            |  |          |   |
|----------------------------|--|----------|---|
| Threshold                  |  | Baseline |   |
| Sensor 1 Vacuum Warn       | Min: <input type="text" value="558.80"/>       | [684.36] | Max: <input type="text" value="685.56"/> mmHg   |
| Sensor 1 Vacuum Alert      | Min: <input type="text" value="406.53"/>       | [684.36] | Max: <input type="text" value="711.06"/> mmHg   |
| Sensor 2 Pressure Warn     | Min: <input type="text" value="200"/>          | [5452.5] | Max: <input type="text" value="7800"/> mBar(a)  |
| Sensor 2 Pressure Alert    | Min: <input type="text" value="0"/>            | [5452.5] | Max: <input type="text" value="8000"/> mBar(a)  |
| Sensor 1 Temperature Warn  | Min: <input type="text" value="17"/>           | [22.58]  | Max: <input type="text" value="26.67"/> °C      |
| Sensor 1 Temperature Alert | Min: <input type="text" value="15"/>           | [22.58]  | Max: <input type="text" value="29.44"/> °C      |
| Sensor 2 Temperature Warn  | Min: <input type="text" value="17"/>           | [22.84]  | Max: <input type="text" value="26.67"/> °C      |
| Sensor 2 Temperature Alert | Min: <input type="text" value="15"/>           | [22.84]  | Max: <input type="text" value="29.44"/> °C      |
| Vacuum Lock                | Line: <input type="text" value="689"/> mBar(a) | [--]     | Vac: <input type="text" value="126.76"/> mmHg   |
| No Vacuum                  | Vac: <input type="text" value="126.76"/> mmHg  | [--]     | Line: <input type="text" value="5171"/> mBar(a) |

## Event Detection

*Figure 43: Event detection settings*

| EVENT DETECTION     |   |
|---------------------|---|
| Cycle count limit   | 31680000 cycles                                     |
| Sampling window     | 500 cycles  |
| Trigger Event       | Change  |
| Extend/Retract time | <input checked="" type="checkbox"/> 20 Milliseconds |
| Cylinder leak       | <input type="checkbox"/> 2.5 %                      |

Event detection is only used in cylinder monitoring mode. The parameters define how often an estimate for the remaining cylinder life is made based on the observed change in cylinder performance. The following criteria can be entered:

- Cycle count limit:** Number of cycles that define the life of the cylinder without taking into account any observed drop in performance. This can be entered for an existing application where the typical life of the cylinder and the average number of daily cycles are both known. Use the following formula to calculate the number of cycles:
- $$\text{Cycle count limit} = M \times W \times 30 \div 7$$
- Where, M = number of months between cylinder change  
W = number of cycles cylinder is run per week
- Sampling Window:** This is the sensitivity of detection for leakage and stroke time, and defines how long a detected change in performance has to be maintained for it to be recognized. Start with the default value and if too many system snapshots are being taken, particularly ones that alternate, showing an increase and decrease in cylinder life, this value should be increased to reduce the sensitivity to transient changes.
- System Snapshots:** A system snapshot is taken every time a change is detected between the current system and the previous system snapshot. The size of the change to be detected is defined in the Trigger Event section.
- Trigger Event:** Select the cylinder performance that you would like to monitor for a change. The events that can be monitored for are:
- Change in stroke time
  - Change in cylinder leakage
  - Change in cycles completed
- To activate the trigger, select the check box beside it and enter the quantity that defines a change that will trigger a snapshot to be taken. When a change in the monitored parameters occurs that is equal to or greater than the entered change amounts, a snapshot is taken.
- The SIM monitors the given parameters and tracks the rate of change.

## Status Light Activation Threshold

Enter for the percentage of estimated life that the amber (status 2) and red (status 3) warning lights on the SIM and on the software status screen will correspond to.

The estimate for remaining life on cylinder performance is the estimated time for the cylinder performance to reach either the high or low limits for cylinder leakage and stroke time, or the user entered cycle count limit entered in the Alert and Event Detections section.

*Figure 44: Status light activation threshold settings*

| STATUS LIGHT ACTIVATION THRESHOLD     |                     |
|---------------------------------------|---------------------|
| Status 2 (order replacement cylinder) | 25 % Life Remaining |
| Status 3 (imminent failure)           | 10 % Life Remaining |

## MODBUS Settings

Enter the MODBUS parameters used on the network.

Figure 45: MODBUS settings

- Slave address: enter the node or slave address for the SIM (see the manual section: Using IntelliSense® with MODBUS RTU Networks)
- Select the appropriate serial parameters (table 3)
- Select the line baud rate between 4,800 and 115,200 bps

Table 7: MODBUS parameters

| DATA BITS | PARITY | STOP BIT |
|-----------|--------|----------|
| 8         | None   | 1        |
| 8         | Even   | 1        |
| 8         | Odd    | 1        |
| 8         | None   | 2        |
| 8         | Even   | 2        |
| 8         | Odd    | 2        |

## SIM Maintenance Functions

The following commands are available:

Figure 46: SIM Configuration commands

Restart SIM: Cycles power to the SIM.

Backup Settings: The current SIM settings are downloaded to an XML file on the user's machine.

Restore Settings from Backup: The user can upload SIM settings from a previously saved XML file backup.

Restore SIM to Factory Settings: Removes all user changes, and restores the SIM to default settings.

## Units

Data can be displayed in the following units:

|             | Non-metric | Metric |
|-------------|------------|--------|
| Pressure    | psi        | mbar   |
| Temperature | °F         | °C     |

To change the display units, select the "USER" menu at the top of the screen and then select the option to switch either the temperature or pressure units. The change is immediately applied.

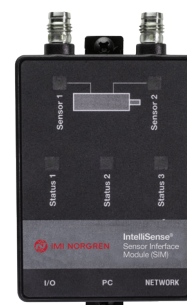
Figure 47: Change Units

## USING INTELLISENSE®

### SENSOR INTERFACE MODULE LIGHTS

#### Boot load mode

If the SIM is connected to a Data Gateway or a PC running the IntelliSense® software when it enters Boot load mode, the SIM will check if firmware update is available on the Gateway or PC. While the SIM is checking for the latest firmware, Status 1 and Status 2 will be lit. After the firmware update, the SIM will check that the installed firmware is valid. During this time, Status 1 will be lit. If the firmware fails, the check it will automatically restart the boot load process. If the firmware fails a second time, Status 1, Status 2, and Status 3 will be lit. Go to [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics) for the latest firmware. When the check is successful, the SIM will enter Application mode.



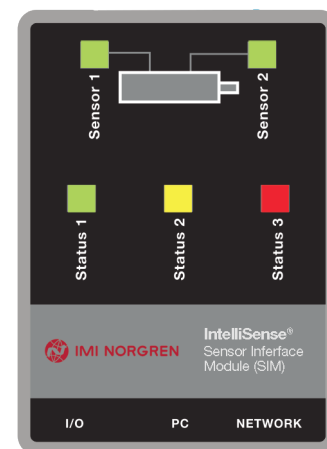
#### Application Mode

Figure 48: Operation of Status Lights in Cylinder Monitoring Mode

| INTELLISENSE® CYLINDER MONITORING                   |          |          |          |          |          |
|---|----------|----------|----------|----------|----------|
| Process   | Status 1 | Status 2 | Status 3 | Sensor 1 | Sensor 2 |
| <b>Boot lead</b>                                    |          |          |          |          |          |
| Firmware update                                     | ON       | ON       |          |          |          |
| Firmware check                                      | ON       | OFF      | OFF      | OFF      | OFF      |
| Firmware check failed                               | ON       | ON       | ON       | OFF      | OFF      |
| <b>Cylinder Monitoring Mode</b>                     |          |          |          |          |          |
| <b>Sensor Communication</b>                         |          |          |          |          |          |
| Sensor 1 not detected                               | OFF      | OFF      | ON       | S        |          |
| Sensor 2 not detected                               | OFF      | OFF      | ON       |          | S        |
| Sensor 1 and 2 not detected                         | OFF      | OFF      | ON       | S        | S        |
| <b>End of travel (EOT) detected</b>                 |          |          |          |          |          |
| Sensor 1  |          |          |          | ON       |          |
| Sensor 2  |          |          |          |          | ON       |
| <b>% Life remaining above specification</b>         |          |          |          |          |          |
| Cycle Count Mode                                    | ON       | OFF      | OFF      | EOT      | EOT      |
| Predictive Mode                                     | S        | OFF      | OFF      | EOT      | EOT      |
| Alert Active  | F        | OFF      | OFF      | EOT      | EOT      |
| <b>% Life remaining approaching critical level*</b> |          |          |          |          |          |
| Cycle Count Mode                                    | OFF      | ON       | OFF      | EOT      | EOT      |
| Predictive Mode                                     | OFF      | S        | OFF      | EOT      | EOT      |
| Alert Active  | OFF      | F        | OFF      | EOT      | EOT      |
| <b>% Life remaining below critical level*</b>       |          |          |          |          |          |
| Cycle Count Mode                                    | OFF      | OFF      | ON       | EOT      | EOT      |
| Predictive Mode                                     | OFF      | OFF      | S        | EOT      | EOT      |
| Alert Active  | OFF      | OFF      | F        | EOT      | EOT      |

\*% Life remaining specifications defined by user

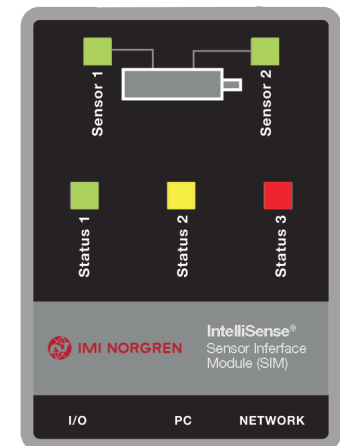
|                                  |    |     |              |              |
|----------------------------------|----|-----|--------------|--------------|
| <b>KEY</b>                       | ON | OFF | S SLOW FLASH | F FAST FLASH |
| EOT = SEE END OF TRAVEL DETECTED |    |     |              |              |



*Figure 49: Operation of Status Lights in Pressure/Temperature Monitoring Mode & Vacuum Pump Monitoring Mode*

| INTELLISENSE® PRESSURE TEMPERATURE MONITORING      |          |          |          |          |          |
|--|----------|----------|----------|----------|----------|
| Process  | Status 1 | Status 2 | Status 3 | Sensor 1 | Sensor 2 |
| <b>Boot lead</b>                                   |          |          |          |          |          |
| Firmware update                                    | ■        | ■        | ■        | ■        | ■        |
| Firmware check                                     | ■        | ■        | ■        | ■        | ■        |
| Firmware check failed                              | ■        | ■        | ■        | ■        | ■        |
| <b>Cylinder Monitoring Mode</b>                    |          |          |          |          |          |
| <b>Sensor Communication</b>                        |          |          |          |          |          |
| Sensor 1 not detected                              | ■        | ■        | ■        | S        | ■        |
| Sensor 2 not detected                              | ■        | ■        | ■        | ■        | S        |
| Sensor 1 and 2 not detected                        | ■        | ■        | ■        | S        | S        |
| <b>Alert Indication (AI)</b>                       |          |          |          |          |          |
| Sensor 1 normal: Sensor 2 normal                   |          |          |          | ■        | ■        |
| Sensor 1 normal: Sensor 2 detects alert            |          |          |          | ■        | ■        |
| Sensor 1 detects alert: Sensor 2 normal            |          |          |          | ■        | ■        |
| Sensor 1 detects alert: Sensor 2 detects alert     |          |          |          | ■        | ■        |
| <b>Status</b>                                      |          |          |          |          |          |
| Pressure and temperature within limits             | ■        | ■        | ■        | ■        | ■        |
| Pressure or temperature is approaching upper limit | ■        | F        | ■        | AI       | AI       |
| Pressure or temperature is approaching lower limit | ■        | S        | ■        | AI       | AI       |
| Pressure or temperature exceeded upper limit       | ■        | ■        | F        | AI       | AI       |
| Pressure or temperature below lower limit          | ■        | ■        | S        | AI       | AI       |

\*% Life remaining specifications defined by user



**KEY** ■ ON ■ OFF S SLOW FLASH F FAST FLASH  
AI = SEE ALERT INDICATION SECTION

## USING INTELLISENSE® WITH A PC OR DATA GATEWAY

### Top Menu Bar

The Top Menu bar is located in the top right corner of the screen and is accessible from any window in IntelliSense® and has the following functions:

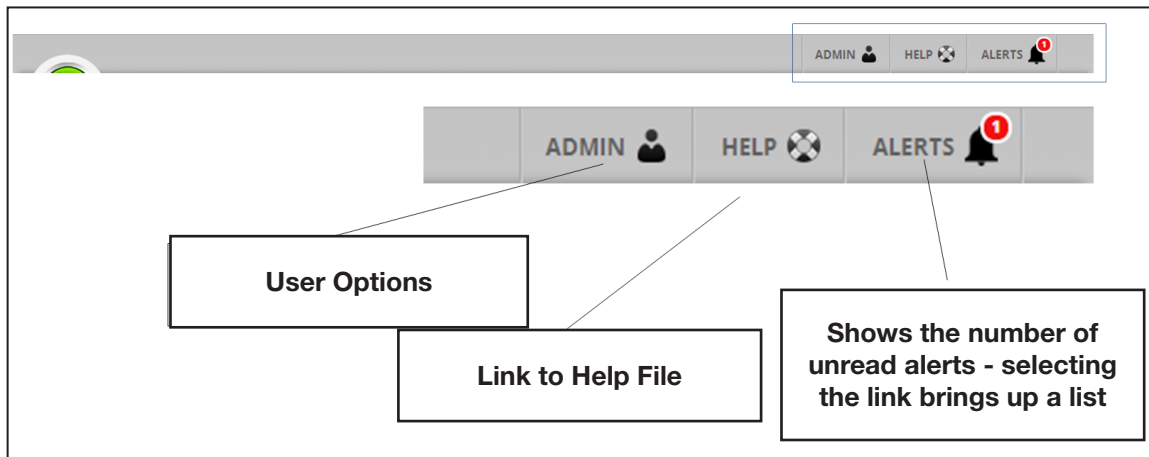
User Options:

|                             |  |
|-----------------------------|--|
| Logout:                     | Allows the current user to log off the system              |
| Change Password:            | Allows the current user to change their password           |
| Switch to °C/°F:            | Toggles the temperature units used to display measurements |
| Switch to mBar(a)/psia:     | Toggles the pressure units used to display measurements    |
| Show/Hide tips:             | Shows/hides the command and field tips                     |
| Mute/Unmute Alerts:         | Enables or disables audible alerts in the browser.         |
| Available Language Include: | English, French, German, Italian, Spanish and Chinese      |

Help: Provides a link to the software help file

Alerts: Provides real-time feedback if there are any alerts in the system. Selecting the tab brings a drop-down list with the detail of each alert.

*Figure 50: Menu Bar*



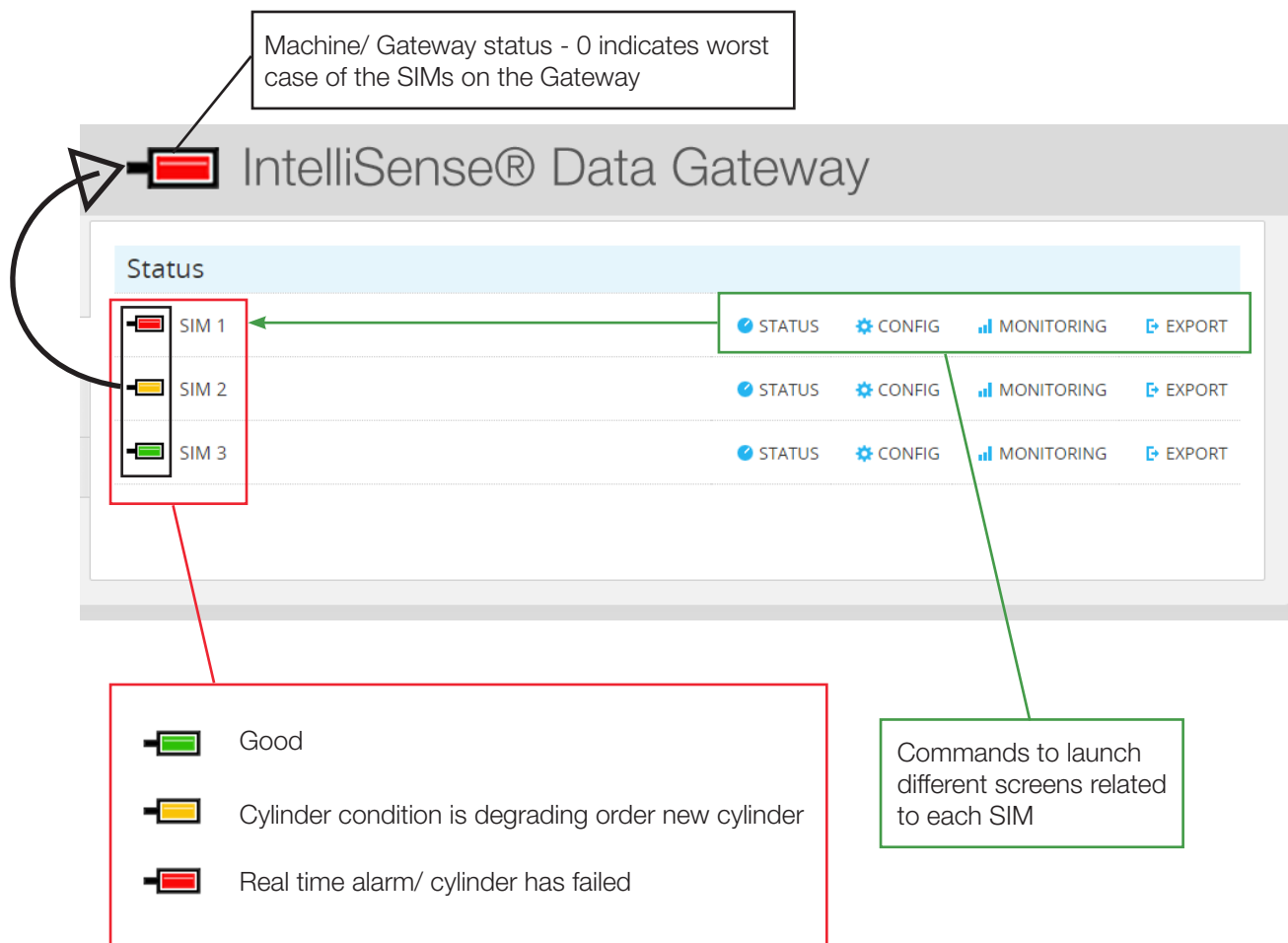
### Dashboard

The IntelliSense® dashboard is the program homepage and provides a summary of all of the SIMs connected to the computer or gateway. It is the first page that is shown after logging in to the computer or gateway and can be accessed from any other window by selecting the Status tab on the left.

The IntelliSense® dashboard has a list of all of the SIMs displayed along with the current status. From this page, it is possible to select a SIM individually to view detailed status and real time monitoring information (see SIM Status and SIM monitoring sections), change SIM settings (SIM Configuration) and export logged data.

The cylinder icon next to the SIM name indicates the status of the cylinder. The cylinder icon at the top of the window indicates the status of the machine that the gateway is monitoring, and is the worst case of all of the cylinders in the list.

Figure 51: Multi-SIM Status



## SIM Status

The SIM status screen shows the current state of the SIM and connected cylinder, and gives a summary of all of the measured parameters and an overall health rating for the cylinder.

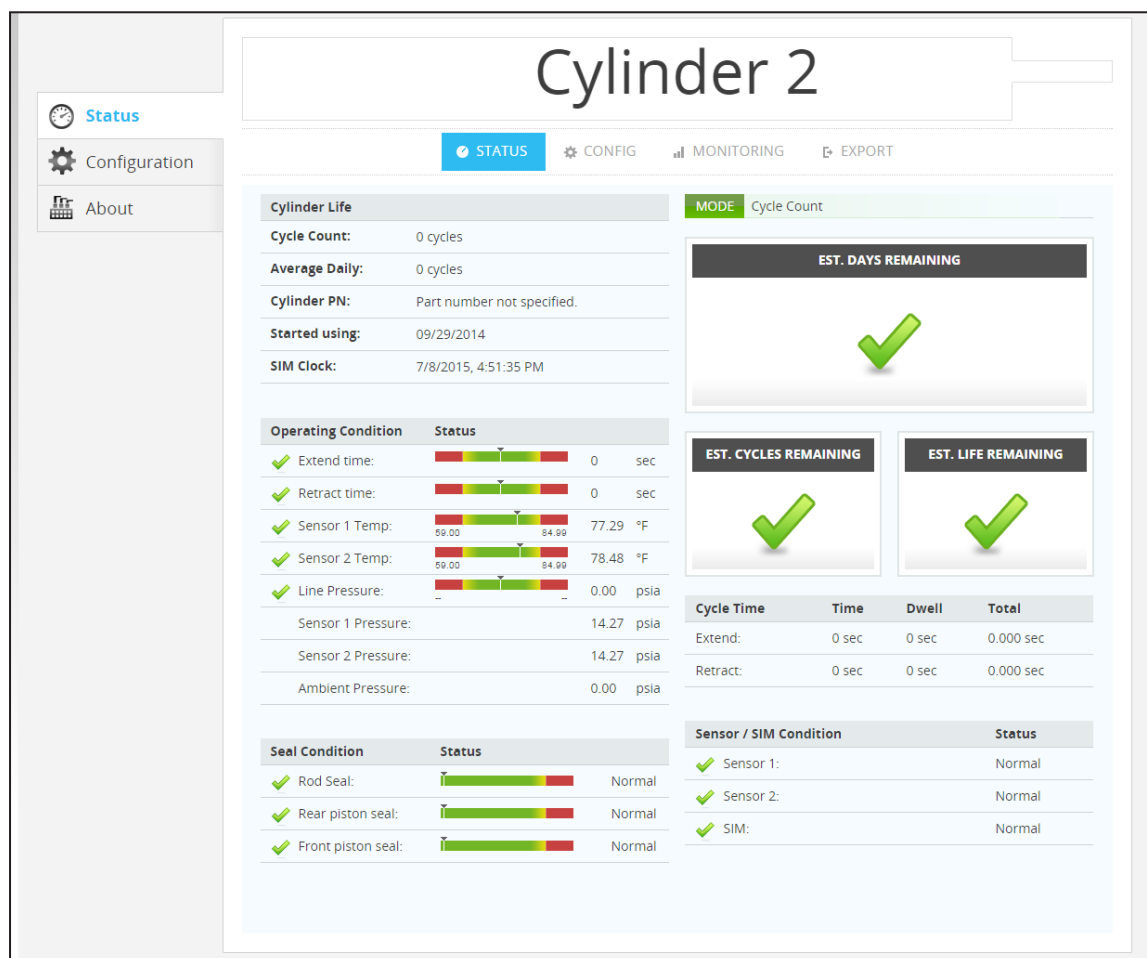
The status screen has the following sections:

|               |                |   |
|---------------|----------------|---|
| Cylinder Life | Cycle Count:   | Total number of cycles that the cylinder has run since last set up                                    |
|               | Average Daily: | Average number of cycles that the cylinder has run per day  |
|               | Cylinder PN:   | Cylinder part number, as entered in the Config screen   |
|               | Started Using: | Date that the cylinder started being in service, as entered in the Config screen                      |
|               | SIM Clock:     | Current time and date taken from the SIM clock. If incorrect, this needs to be set on the Config page |



|                       |                             |   |
|-----------------------|-----------------------------|---|
| Operating Condition   | Extend Time:                | Current measured time for the cylinder to extend                    |
|                       | Retract Time:               | Current measured time for the cylinder to retract                   |
|                       | Sensor 1 Temp:              | Current measured temperature of sensor 1                            |
|                       | Sensor 2 Temp:              | Current measured temperature of sensor 2                            |
|                       | Line Pressure:              | Current high line pressure detected by the cylinder                 |
|                       | Sensor 1 Pressure:          | Current measured pressure of sensor 1                               |
|                       | Sensor 2 Pressure:          | Current measured pressure of sensor 2                               |
|                       | Ambient Pressure:           | Current measured atmospheric pressure                               |
| Seal Condition        | Rod Seal:                   | Status of each seal   |
|                       | Rear Piston Seal:           |   |
|                       | Front Piston Seal:          |   |
| Mode                  |                             | Shows which mode the SIM is in:                                     |
|                       |                             | Cylinder or Pressure/Temperature Monitoring Mode                    |
| Life Remaining        | Estimated Days Remaining:   | Estimated cycles remaining divide by average daily cycles           |
|                       | Estimated Life Remaining:   | Estimated cycles remaining divide by total number of cycles         |
|                       | Estimated Cycles Remaining: | Cycle count mode: Cycle count limit - current cycle count           |
|                       |                             | Predictive mode: Estimated number cycles at time of prediction*     |
|                       |                             | *Impredictive mode: values only update when an event occurs         |
| Cycle Time            |                             | Gives the stroke, dwell and total cycle time for extend and retract |
| Sensor /SIM Condition |                             | Connection status to the SIM and sensors                            |

Figure 52: Cylinder Status Screen



## SIM Configuration

All of the parameters for the selected SIM can be reviewed and edited on this page. Please refer to the section in this manual on for more details.

## SIM Monitoring

On the monitoring screen the user is able to see the pressure and temperature measurements from the SIM in real time as they are made. The pressure measurements are updated up to 1000 times per second (1 kHz) and the temperatures about every second (1 Hz).

The SIM monitoring screen has the following features:

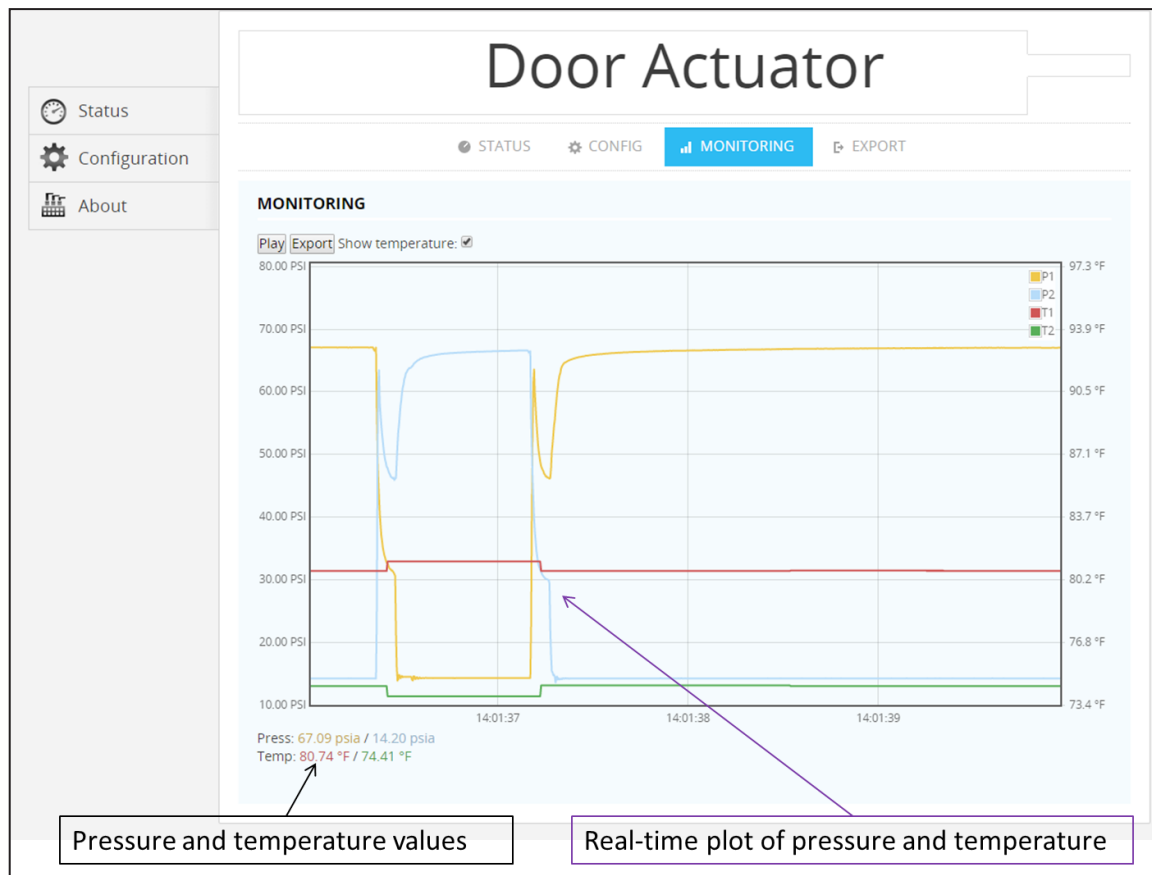
Play/Pause real-time Pressure/  
Temperature plot:

Displays real time plot of Pressure/Temperature against time for approximately four seconds of data.

Export:

After the real-time plot is paused, it is possible to export the visible pressure and temperature data for further analysis.

Figure 53: Cylinder Monitoring Screen



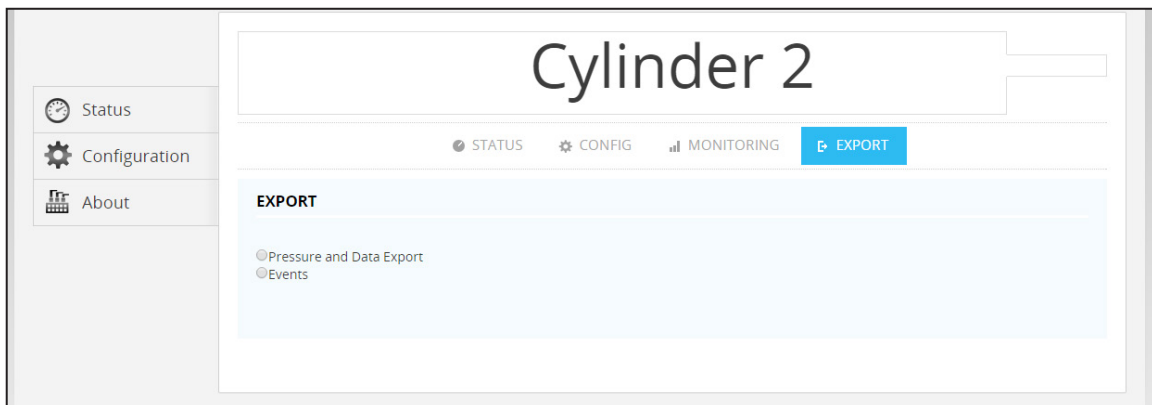
## Export

From the export page, it is possible to download data logged to the Data Gateway. The two main categories are:

- |                    |   |
|--------------------|---|
| Pressure and Data: | Logged pressure, temperature and cylinder alert and performance data. This data is only available when accessing IntelliSense® via an IntelliSense® Data Gateway. |
| Events:            | Monitored changes in the cylinder performance are logged as events and these events can be viewed or exported to the user's machine for further analysis.         |

Select the Export tab for the desired SIM, and on the export screen select the category of data to export.

Figure 54: Data Export Screen



## Pressure and Data Export

Logged data can be exported to the user's local machine for further analysis. The format is comma separated text file (CSV) which can be easily opened and edited with spreadsheet or database program.

The following data is available for export in Cylinder Monitoring Mode. Note that time is exported by default and cannot be selected by the user.

## Measured Data

|                       |  |
|-----------------------|--|
| Time:                 | Time and date of measurement – not user selectable           |
| Pressure 1:           | Sensor 1 absolute pressure measurement – not user selectable |
| Pressure 2:           | Sensor 2 absolute pressure measurement – not user selectable |
| Sensor 1 Temperature: | Sensor 1 temperature   |
| Sensor 2 Temperature: | Sensor 2 temperature   |
| Line Pressure:        | Absolute line pressure for the cycle                         |
| Ambient Pressure:     | Ambient/atmospheric absolute pressure                        |
| Extend Time:          | Extend time for the stroke in seconds                        |
| Retract Time:         | Retract time for the stroke in seconds                       |
| Dwell Time - Extend:  | Dwell time after extending in seconds                        |
| Dwell Time - Retract: | Dwell time after retracting in seconds                       |
| Cycle Count:          | Current cycle count  |
| Average Daily Cycles: | The average daily cycles at the time of measurement          |

## Alert Data

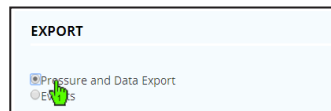
The following will output the state of the alarm at the time of the measurement. A value of 1 indicates that the alert was active, and 0 indicates that the alert was off.

|                     |                    |                     |
|---------------------|--------------------|---------------------|
| Line Pressure High  | Line Pressure Low  | Sensor 1 Press High |
| Sensor 2 Press High | Sensor 1 Press Low | Sensor 2 Press Low  |
| Sensor 1 Temp High  | Sensor 1 Temp Low  | Sensor 2 Temp High  |
| Sensor 2 Temp Low   | Extend Time Low    | Extend Time High    |
| Retract Time Low    | Retract Time High  | Rear Seal Failure   |
| Front Seal Failure  | Rod Seal Failure   |                     |

To export the logged data:

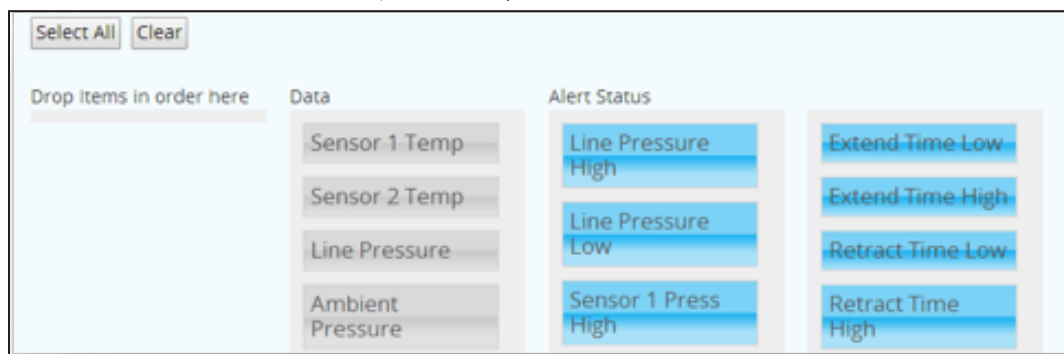
1. Select the Pressure and Date Export option button

*Figure 55: Export option*



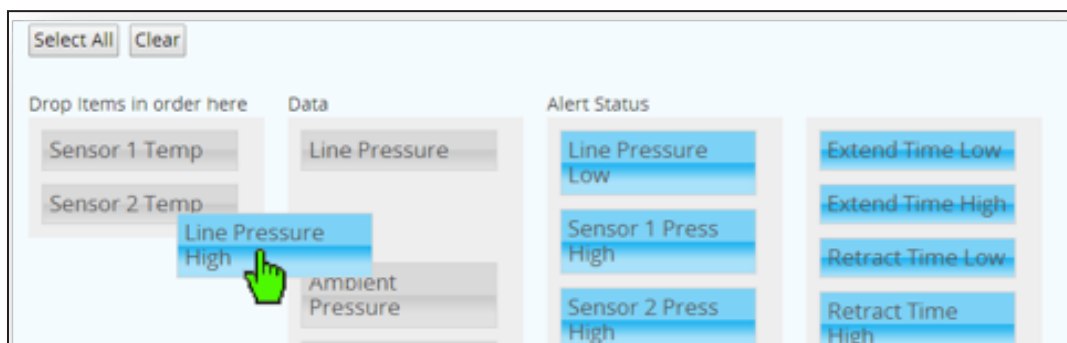
2. The field selector will appear. On the right is a list of all of the available pieces of data. On the left is a grey area where the desired fields can be dragged.

*Figure 56: Export field selector*



3. By default, the export file will contain the measurement time and the two pressure measurements, P1 and P2. To add any of the available fields/columns to the exported file, press the left button over the required field and drag it to the space to the left. The "Select All" command moves all of the column names to the left column, adding them to the export report, and the "Clear" command clears any selected column names.

*Figure 57: Select variable to export*



4. Items in the list can be rearranged to represent the column order in the exported file from left to right.
5. The date and time range for the exported data can be entered as an interval between two points in time, defined as a date and time, or as a period of seconds going back from the current time. Above the time period selection, the date and time when the gateway started logging data for the SIM is shown for reference.

It should be noted that pressure data is recorded every millisecond, giving a thousand lines of information for each second of time. The data file can be very large and unmanageable for large periods of time.

a. Download by interval

Select the Download by Interval option and enter the dates and times in the past that define the beginning and end of the time interval. Upon entering the dates and times, select the download button to save a file to the local machine.

Figure 58: Export interval

**Download Method**

Data starts at Wed, 02 Jul 2014 22:48:15 GMT --- (1357835 seconds ago)

☒ Download by interval  
☐ Download by seconds in the past

Start at  and end at  **Download data by interval**

Calendar: July 2014

| Su | Mo | Tu | We | Th | Fr | Sa |
|----|----|----|----|----|----|----|
|    |    | 1  | 2  | 3  | 4  | 5  |
| 6  | 7  | 8  | 9  | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 |    |    |

Time: 00:00  
Hour:   
Minute:   
Now Done

b. Download by last number of seconds

Enter the number of seconds to go back from the current time and select the download button. A file will be created for the entered period of seconds ending at the moment the Download button is selected.

Figure 59: Export seconds in the past

**Download Method**

Data starts at Fri, 04 Jul 2014 15:56:04 GMT --- (1134607 seconds ago)

☐ Download by interval  
☒ Download by seconds in the past

Begin data export at  seconds ago. **Download data by seconds**

## Events Export

In Cylinder Monitoring Mode Selecting the events export option displays a table containing all of the snapshot history taken for the cylinder being monitored by the SIM. In other modes, the event selection show the baseline performance. The snapshots can be reviewed in the browser to see how often changes in performance are detected. The SIM can store 31 snapshots in addition to the original snapshot taken as the cylinder baseline. If numerous snapshots are being taken within short periods of time that show an oscillation of performance, i.e. a decrease in the performance parameter followed by an increase, the sample size should be increased to reduce this fluctuation. For more details on setting up event detection, refer to the next section in this manual:

The legend below, the table of data, explains each of the column names with units.

Selecting the Download Events button downloads all of the event snapshot data in a comma-separated value file (CSV) for further analysis in a spreadsheet or database program.

*Figure 60: Event log*

| Download Event(s)     |                     |             |                  |               |         |             |              |      |      |       |      |  |
|-----------------------|---------------------|-------------|------------------|---------------|---------|-------------|--------------|------|------|-------|------|--|
| Time taken            | Sample size(cycles) | Cycle count | Ambient pressure | Line pressure | Failure | Extend time | Retract time | RLTF | FSFR | FLTS  | RSFF |  |
| 7/14/2014 2:52:30 AM  | 25                  | 1352091     | 977.9            | 4673.6        | 0       | 220         | 110          | 0.0  | 0.0  | 338.5 | 38.3 |  |
| 7/17/2014 11:46:30 AM | 20                  | 1412390     | 986.7            | 4677.6        | 0       | 101         | 134          | 0.0  | 0.0  | 342.6 | 43.0 |  |
| 7/15/2014 2:51:03 AM  | 25                  | 1369996     | 975.8            | 4671.9        | 0       | 101         | 131          | 0.0  | 0.0  | 350.0 | 41.4 |  |
| 7/14/2014 2:38:43 PM  | 25                  | 1360903     | 974.8            | 4670.0        | 0       | 101         | 105          | 0.0  | 0.0  | 332.5 | 39.4 |  |
| 7/14/2014 2:06:04 PM  | 25                  | 1360499     | 974.8            | 4674.4        | 0       | 101         | 131          | 0.0  | 0.0  | 334.6 | 40.3 |  |

*Figure 61: Event log legend*

| Legend           |   |
|------------------|---|
| Item             | Definition  |
| Index            | Event Number  |
| Time Taken       | Date that the event happened                                |
| Sample Size      | The number of cycles captured for the event                 |
| Cycle Count      | Cycle count at time of event                                |
| Ambient Pressure | Calculated ambient pressure while the event was being taken |
| Line Pressure    | Calculated line pressure while the event was being taken    |
| Reason           | Reason code   |
| Failure          | Failure Type  |
| Extend Time      | Average calculated time taken to extend the rod (ms)        |
| Retract Time     | Average calculated time taken to retract the rod (ms)       |
| RLTF             | Rear Leakage To Front                                       |
| FSFR             | Front Seepage From Rear                                     |
| FLTS             | Front Leakage To Somewhere                                  |
| RSFF             | Rear Seepage From Front                                     |

## Events Reason

When an Event is logged by the SIM unit it records the Reason the event was triggered. These events are coded as follows.

- A value of 0 can mean three things.
  - » This is the initial event snapshot.
  - » Was a user commanded "Baseline" snapshot. It's recommended to take "Baseline" snapshot using a cycle count different then the "Sampling Window" so it can be easily identified.
  - » The event was triggered by the improvements of the tracked parameters.
- A value of 4 means the event was triggered by the extend time window changing in the positive direction equal or greater than the value of the "Extend/Retract time" change parameter.
- A value of 8 means the event was triggered by the extend time window changing in the negative direction equal or greater than the value of the "Extend/Retract time" change parameter.

- A value of 16 means the event was triggered by the retract time window changing in the positive direction equal or greater than the value of the “Extend/Retract time” change parameter.
- A value of 32 means the event was triggered by the retract time window changing in the negative direction equal or greater than the value of the “Extend/Retract time” change parameter.
- A value of 64 means the event was triggered by an increase in detected rod seal leakage, in percentage, equal to or greater than the value of the “Cylinder leak” change parameter.
- A value of 256 means the event was triggered by an increase in detected front piston seal leakage, in percentage, equal to or greater than the value of the “Cylinder leak” change parameter.
- A value of 1024 means the event was triggered by an increase in detected rear piston seal leakage, in percentage, equal to or greater than the value of the “Cylinder leak” change parameter.

## Events Failures

When an event is logged by the SIM unit, it records any active failures. These failures are coded as binary numbers as follows:

*Table 8: Event failure codes*

|      |                                     |
|------|-------------------------------------|
| 4096 | Retract time was above limit        |
| 2048 | Retract time was below limit        |
| 1024 | Extend time was above limit         |
| 512  | Extend time was below limit         |
| 256  | Sensor 2 Temperature is below limit |
| 128  | Sensor 1 Temperature is below limit |
| 64   | Sensor 2 Temperature is above limit |
| 32   | Sensor 1 Temperature is above limit |
| 16   | Rod Seal Failure Present            |
| 8    | Front Piston Seal Failure Present   |
| 4    | Rear Piston Seal Failure Present    |
| 2    | Line pressure above limit           |
| 1    | Line pressure below limit           |

Following this table, a failure code for “Extend time was above limit” would be a 1024. Likewise, an event with multiple failures, such as a “Extend time was above limit” and “Line pressure above limit” would be a 1026.



## USING INTELLISENSE® WITH MODBUS RTU NETWORKS

The IntelliSense® SIM unit has a dedicated port labeled MODBUS. This port is designed to allow the SIM to communicate over a MODBUS RTU serial network. This port can be configured either as 2-wire (default) or 4-wire RS-485. (See Setting the DIP Switch for more information.) The IntelliSense® SIM only utilises READ request to its internal Holding Registers. For pin out and wiring diagrams, consult the Wiring Diagram section.

### Configurable Elements:

|                |  |
|----------------|--|
| Slave Address: | Values 1-247 are valid. Default value is 1. MODBUS RTU networks of more than 31 IntelliSense® SIM units are not recommended. |
| Baud Rate:     | Values of 4,800, 9,600, 19,200 (default), 38,400, 57,600, and 115,200 bps.   |
| Bit Parity:    | Supports Even (default), Odd, or None parity.  |
| Stop Bit:      | The IntelliSense® SIM may uses 1 stop bit or 2 stop bits.  |

### Static Elements:

|            |  |
|------------|--|
| Bit Count: | The IntelliSense® SIM uses an 8-bit formatted message. |
|------------|--|

## MODBUS Registries

The integer data values stored in the IntelliSense® SIM Holding Registers can be accessed using the appropriate address found in the following table:

*Table 9: MODBUS registry for Cylinder Monitoring Mode*

| Register | Description   | Size    |
|----------|---|---------|
| 40001    | Pressure of port 1 in absolute tenths of PSia   | 2 Bytes |
| 40002    | Pressure of port 2 in absolute tenths of PSia   | 2 Bytes |
| 40003    | Ambient pressure in absolute tenths of PSia   | 2 Bytes |
| 40004    | Pressure of port 1 in absolute tenths of mBar   | 2 Bytes |
| 40005    | Pressure of port 2 in absolute tenths of mBar   | 2 Bytes |
| 40006    | Ambient pressure in absolute tenths of mBar   | 2 Bytes |
| 40007    | Line pressure in absolute tenths of PSia  | 2 Bytes |
| 40008    | Line pressure in absolute tenths of mBar  | 2 Bytes |
| 40009    | Rod Position  | 2 Bytes |
|          | Bit 0 - Extended<br>Bit 1 - Retracted<br>Bit 3 - Extending<br>Bit 4 - Retracting  |         |
| 40010    | Time in ms for last extension event.  | 2 Bytes |
| 40011    | Time in ms for last retraction event.   | 2 Bytes |
| 40012    | Temperature of port 1 in hundredths of a degree F   | 2 Bytes |
| 40013    | Temperature of port 2 in hundredths of a degree F   | 2 Bytes |
| 40014    | Temperature of port 1 in hundredths of a degree C   | 2 Bytes |
| 40015    | Temperature of port 2 in hundredths of a degree C   | 2 Bytes |
| 40016    | Cycle count, low word.  | 2 Bytes |
| 40017    | Cycle count, high word.   | 2 Bytes |
| 40018    | Cycle count limit, low word.  | 2 Bytes |
| 40019    | Cycle count limit, high word.   | 2 Bytes |
| 40020    | First two bytes of SIM revision   | 2 Bytes |
| 40021    | Second two bytes of SIM revision  | 2 Bytes |
| 40022    | Sensor Status   | 2 Bytes |
|          | Bit 0 - 1 Streaming<br>Bit 1 - 2 Streaming<br>Bit 3 - 1 Recognized<br>Bit 4 - 2 Recognized  |         |
| 40023    | Pressure Failure  | 2 Bytes |
|          | Bit 0 - Line Pressure High<br>Bit 1 - Line Pressure Low<br>Bit 2 - Sensor 1 Pressure High<br>Bit 3 - Sensor 1 Pressure Low<br>Bit 4 - Sensor 2 Pressure High<br>Bit 5 - Sensor 2 Pressure Low<br>Bit 6 - Sensor 1 Pressure High Warn<br>Bit 7 - Sensor 1 Pressure Low Warn<br>Bit 8 - Sensor 2 Pressure High Warn<br>Bit 9 - Sensor 2 Pressure Low Warn |         |
| 40024    | Leakage Failure   | 2 Bytes |
|          | Bit 0 - Rear Piston Seal<br>Bit 1 - Front Piston Seal<br>Bit 2 - Rod Seal   |         |
| 40025    | Temperature Failure   | 2 Bytes |
|          | Bit 0 - 1 Temp High<br>Bit 1 - 1 Temp Low<br>Bit 2 - 2 Temp High<br>Bit 3 - 2 Temp Low<br>Bit 4 - 1 Temp High Warn<br>Bit 5 - 1 Temp Low Warn<br>Bit 6 - 2 Temp High Warn<br>Bit 7 - 2 Temp Low Warn  |         |
| 40026    | Extent Failure  | 2 Bytes |
|          | Bit 0 - Extent Time High<br>Bit 1 - Extend Time Low<br>Bit 2 - Retract Time High<br>Bit 3 - Retract Time Low  |         |
| 40027    | Estimated Life Remaining  | 2 Bytes |
|          | Bit 0 - above 90%<br>Bit 1 - below 10%  |         |
| 40028    | Estimated Life Remaining Percentage, in 100ths  | 2 Bytes |
| 40029    | Cylinder Status   | 2 Bytes |
|          | Bit 0 - Yellow Light Status<br>Bit 1 - Red Light Status   |         |
| 40030    | Estimated Cycles remaining, low word  | 2 Bytes |
| 40031    | Estimated Cycles remaining, high word   | 2 Bytes |
| 40032    | Estimated Days Remaining  | 2 Bytes |
| 40033    | Time in ms for last dwell after extend.   | 2 Bytes |
| 40034    | Time in ms for last dwell after retract.  | 2 Bytes |

The IntelliSense® SIM also stores the Real Time Clock Data and Identification labels, configured by the user, as ASCII data in the following registers:

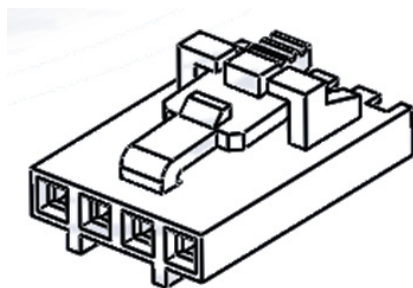
*Table 10: ASCII MODBUS Registries*

| REGISTER | DESCRIPTION              | SIZE     |
|----------|--------------------------|----------|
| 40501    | RTC Seconds              | 2 bytes  |
| 40502    | RTC minutes              | 2 bytes  |
| 40503    | RTC hours (24hr)         | 2 bytes  |
| 40504    | RTC hours (12hr)         | 2 bytes  |
| 40505    | RTC AM/PM                | 2 bytes  |
| 40506    | RTC day                  | 2 bytes  |
| 40507    | RTC month                | 2 bytes  |
| 40508    | RTC year (last 2 digits) | 2 bytes  |
| 40510    | ID 1 string              | 60 bytes |
| 40540    | ID 2 string              | 40 bytes |
| 40560    | Part number              | 30 bytes |

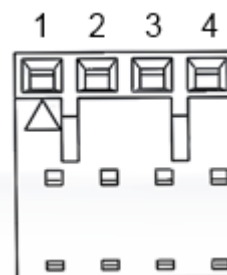
## USING INTELLISENSE® I/O CONNECTOR

The IntelliSense® SIM unit's I/O connector can be used to power the SIM or to utilise the two 3-wire NPN transistor outputs. These outputs are configured by the user. Cable part number NCBL-IS-CF-0.5 is used to connect to the I/O connector. This cable is 0.5 meter in length, has flying leads on one end, and a 4 pin connector on the other (Figure 60: Molex 50-57-9409 connector). The underside of this connector has an arrow to indicate the location of pin 1 (Figure 61: Underside of Molex connector with Pin 1 Indicator).

*Figure 62: Molex 50-57-9409 connector*



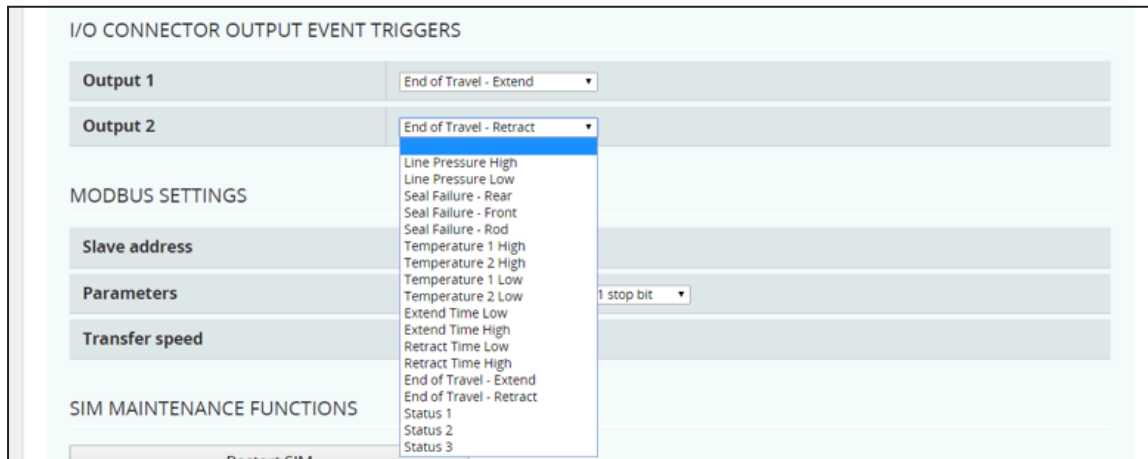
*Figure 63: Underside of Molex connector with Pin 1 Indicator*



## Configure user selectable outputs

In the SIM configuration screen, there are two pull downs in the I/O Connector Output Event Triggers section. Each pull down can be set to one of the available outputs. There are 18 possible outputs in cylinder monitoring mode and 19 possible outputs in pressure temperature monitoring mode. These outputs trigger whenever the event condition for the selected option is active. For example, if output 1 is set to Line Pressure High the output will be active whenever the line pressure value exceeds the Line Pressure upper limit. If the line pressure falls back below this limit the output turns off.

*Figure 64: User selectable outputs Cylinder monitoring mode*

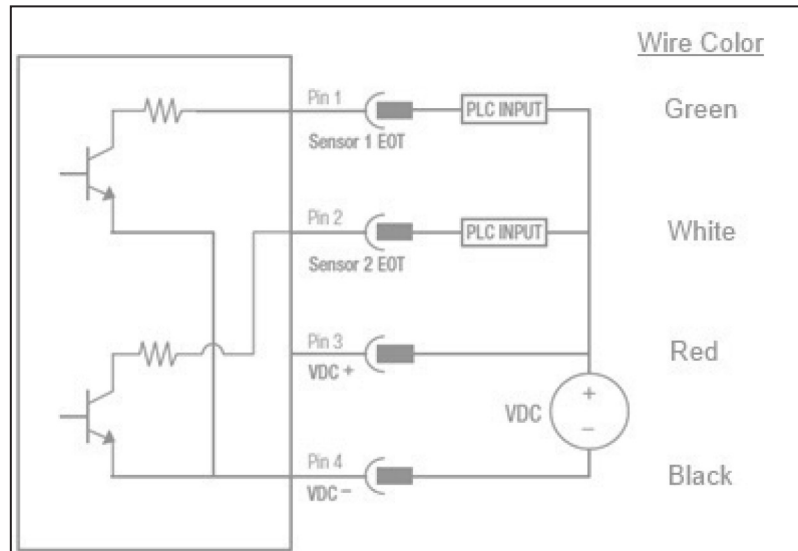


The possible settings for the outputs in Cylinder monitoring mode are listed below.

|                          |   |
|--------------------------|---|
| Line Pressure High:      | Line pressure exceeded upper limit                          |
| Line Pressure Low:       | Line pressure is below lower limit                          |
| Seal Failure - Rear:     | Air leakage across the rear piston seal exceeds limit       |
| Seal Failure - Front:    | Air leakage across the front piston seal exceeds limit      |
| Seal Failure - Rod:      | Air leakage across the rod seal exceeds limit               |
| Temperature 1 High:      | The temperature at Sensor 1 exceeds the upper limit         |
| Temperature 2 High:      | The temperature at Sensor 2 exceeds the upper limit         |
| Temperature 1 Low:       | The temperature at Sensor 1 is below the lower limit        |
| Temperature 2 Low:       | The temperature at Sensor 2 is below the lower limit        |
| Extend Time Low:         | The cylinder extended faster than the minimum extend time   |
| Extend Time High:        | The cylinder extended slower than the maximum extend time   |
| Retract Time Low:        | The cylinder retracted faster than the minimum retract time |
| Retract Time High:       | The cylinder extended slower than the maximum retract time  |
| End of travel - Extend:  | The cylinder has stopped moving from S1 to S2               |
| End of travel - Retract: | The cylinder has stopped moving from S2 to S1               |
| Status 1:                | Status light 1 is active                                    |
| Status 2:                | Status light 2 is active                                    |
| Status 3:                | Status light 3 is active                                    |

To use the outputs of the IntelliSense® SIM unit, confirm DIP switch 9 is OFF and use the following the diagram:

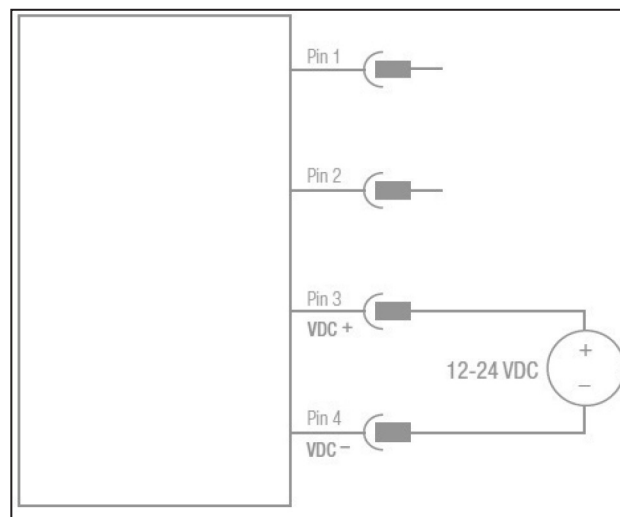
*Figure 65: I/O connector output wiring diagram with wire colours for cable CBL-IS-CF-0.5*



Note: PLC input needs to accept sinking (NPN) sensors.

To use the I/O Connector to power SIM, confirm DIP switch 9 is ON and follow the diagram below.

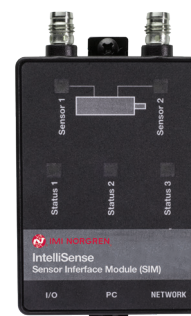
*Figure 66: I/O connector SIM power wiring diagram*



## TECHNICAL SPECIFICATIONS

### INTELLISENSE® SENSOR INTERFACE MODULE NISM-S1-BA1-5P

- > Five LEDs indicate the status of the item being monitored
- > 2 Male four pin micro M8 connectors for sensor communication
- > RJ45 connector for Modbus RTU communication
- > IP50 Rated
- > RJ45 connector for Serial RS422 communication



#### Technical features

**IP rating:**

IP50

**Vibration:**

 5G @ 15Hz - 500Hz -1hr  
 - Random @ 0°C & 55°C  
 (Operating)

**Shock:**

 30G 10,000 times each axis  
 and direction

**Mounting options:**

 35 mm DIN Rail using Brackets  
 Flush mounted using Screw Hole

**Certifications:**

 UL EN61326-1 (Industrial), UL  
 EN61000-3-2, UL EN61000-3-3,  
 CE

**Operating Temperature:**

0°C...55°C (-32°F...131°F)

**Materials:**

Housing:

ABS

Back plate:

 18-Gauge Mild Steel,  
 Black Electro-Coat

DIN Rail Brackets:

 18-Gauge Mild Steel,  
 Black Electro-Coat

#### Connectors

|               |  |
|---------------|--|
| <b>Sensor</b> | 2 - Male 4 Pin M8                      |
| <b>IO</b>     | 1 - 4 Pin Molex SLTM Modular Connector |
| <b>PC</b>     | 1 - RJ-45/ RS-422 Serial               |
| <b>Modbus</b> | 1 - RJ-45/ RS-485 - Modbus RTU         |

#### Software requirements

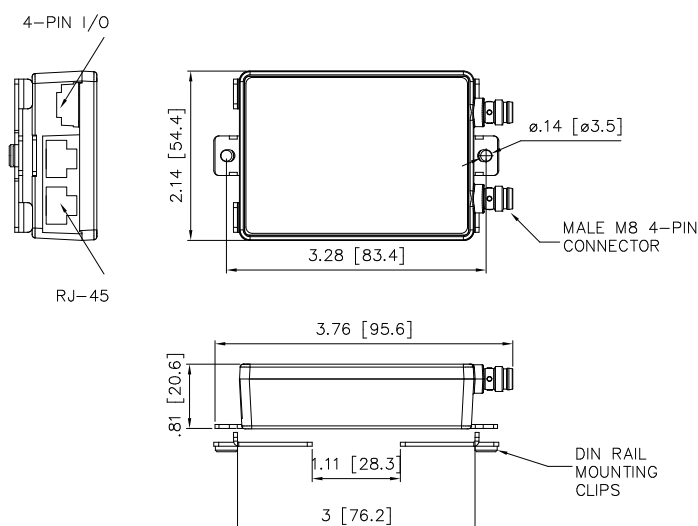
- PC with an available USB Port
- Windows 8 (32-/64-bit)/ 7 (32-/64-bit)/ Vista (32-/64-bit), XP (32-/64-bit)/ Server 2003 and 2008 (32/64-bit)/ Server 2008 R2

#### Electrical & EMS Specifications

|   |  |
|---|--|
| <b>Input voltage</b>                      | 11 to 24 V d.c. Regulated  |
| <b>Current draw (SIM and 2 Sensors)</b>   | <100 mA @ 12 V d.c.  |
| <b>EMC rating</b>                         | Emissions & immunity to EN 61326:2013  |
| <b>Electro static discharge</b>           | 4 kV Contact 8 kV Air, 4 kV Indirect   |
| <b>Radiated immunity</b>                  | 10 V/m from 80 - 1000 MHz,<br>3 V/m from 1.4 to 2.0 GHz,<br>3 V/m from 2.0 to 2.7 GHz,<br>Amplitude modulated with a 1 kHz sine wave to a depth of 80% |
| <b>Fast transient burst</b>               | ±0.5 kV on all ports (±1kV on AC Power)  |
| <b>Immunity to conducted disturbances</b> | 3V rms 0.15-80 MHz, 80% AM Modulation, @ 1 kHz   |

#### Dimensions

Inches [mm]



## TECHNICAL SPECIFICATIONS

### INTELLISENSE® PRESSURE/TEMPERATURE SENSOR NISS-1A-7SS

- > **Proprietary communication protocol for use with an IntelliSense® SIM**
- > **IP69K rated when used with appropriate cables**
- > **10-32 thread SS pressure port**



#### Technical features

##### IP rating:

Up to IP69K based on cables used

##### Vibration:

18-20G @ 80-2000Hz - 1hr -

Random

##### Shock:

30G 10,000 times each axis and direction

##### Mounting options:

35 mm DIN Rail using Brackets

Flush mounted using Screw Hole

##### Operating Temperature Range:

-40°C...176°C (-40°F...176°F)

##### Materials

Housing:

303 Stainless steel

Port:

303 Stainless steel

Sensor Isolation Barrier

Retaining Ring:

304 Stainless Steel

Sensor Isolation Barrier:

Silicone Gel

O-Ring Seal:

Buna-N

#### Pressure sensing performance specifications

| Model       | Operating Pressure                            | Overpressure Rating           | Burst Pressure                | Resolution              | Accuracy*                                    | Response Time | Long Term Stability               |
|-------------|---|-------------------------------|-------------------------------|-------------------------|--|---------------|-----------------------------------|
| NISS-1A-7SS | 0 bar(a) to 14 bar(a)<br>(0 psia to 200 psia) | 2X maximum operating pressure | 5X maximum operating pressure | 0.001 bar<br>(0.01 psi) | ±0.29 psi (±20 mbar)<br>±0.58 psi (±40 mbar) | 1 ms          | -0.29 psi/year<br>(-20 mbar/year) |

\*Accuracy 0 bar to 6 bar (0 psi to 87 psi), 0°C to 40°C (-32°F to 40°C), -40°C to 85°C (-40°F to 85°C)

#### Electrical & EMS Specifications

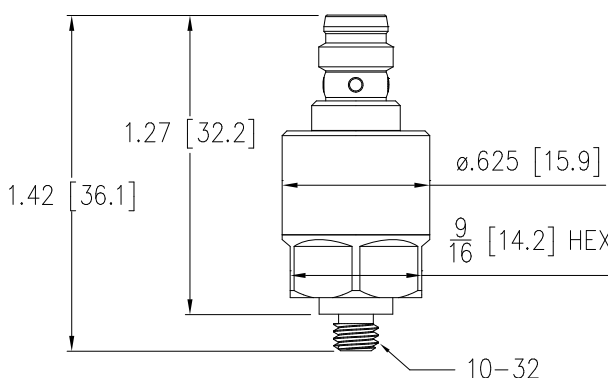
|   |  |
|---|--|
| <b>Power</b>                              | Supplied by SIM via Sensor Cable   |
| <b>EMC Rating</b>                         | Emissions and Immunity to EN 61326:2013  |
| <b>Electro Static Discharge</b>           | 4 kV Contact, 8 kV Air, 4 kV Indirect  |
| <b>Radiated Immunity</b>                  | "10 V/m from 80 - 1000 MHz,  |
| <b>3 V/m from 1.4 to 2.7 GHz</b>          | 10 V/m from 80 - 1000 MHz,<br>3 V/m from 1.4 to 2.0 GHz,<br>3 V/m from 2.0 to 2.7 GHz,<br>Amplitude modulated with a 1 kHz sine wave to a depth of 80% |
| <b>Fast Transient Burst</b>               | ±0.5 KV  |
| <b>Immunity to Conducted Disturbances</b> | 3V rms 0.15-80 MHz, 80% AM Modulation @ 1 kHz  |

#### Temperature Sensing Performance Specifications

|                          |                               |
|--------------------------|-------------------------------|
| <b>Temperature range</b> | -15°C to 60°C (-9°F to 127°F) |
| <b>Resolution</b>        | 0.01°C (<0.02°F)              |
| <b>Accuracy</b>          | 10°C (±18°F)                  |

#### Dimensions

Inches [mm]



## TECHNICAL SPECIFICATIONS

### INTELLISENSE® DATA GATEWAY NISG-01

- > Remote monitoring for up to 12 SIMs
- > Ethernet and wireless connectivity
- > Data logging capabilities with 100+ GB of storage
- > Includes IntelliSense® Data Gateway DIN rail bracket



#### Technical features

##### Relative humidity:

5-95% Non-condensing

##### Mounting options:

35 mm DIN Rail using Brackets

Flush Mounted using Screw Hole

##### Certifications:

UL60950: Information Technology

- Equipment - Safety -

Part 1: General Requirements

##### Operating temperature range:

0°C to 55°C

(32°F to 131°F)

##### Materials

Housing:

Plastic and aluminium

Bracket:

18-Gauge mild steel,

Black Electro-coat

#### Electrical & EMS Specifications

|                      |                     |
|----------------------|---------------------|
| <b>Input voltage</b> | 19 V d.c., 65 W     |
| <b>Power supply</b>  | 100-240 V a.c./1.5A |

#### Connectors

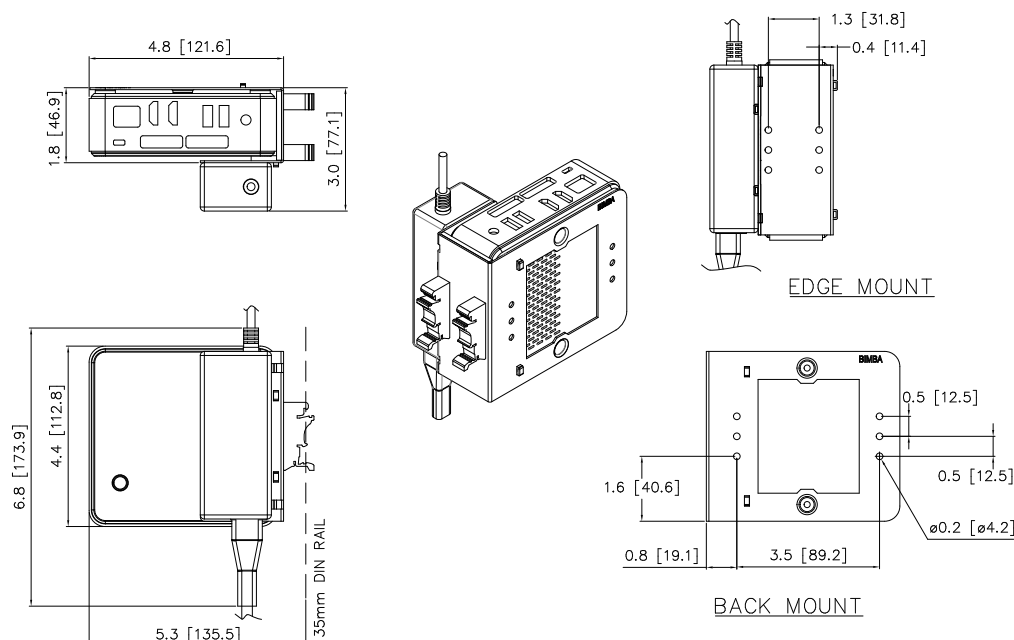
|                                    |            |
|------------------------------------|------------|
| <b>USB 2.0</b>                     | Quantity 3 |
| <b>Gigabit Internet</b>            | Quantity 1 |
| <b>19V, 65W DC Power Connector</b> | Quantity 3 |

#### Included accessories

- IntelliSense® Remote Monitoring & Configuring Software
- USB Wi-fi Adaptor
- USB Extension Cable 3' (0.9m)
- IntelliSense® Data Gateway Mounting Bracket
- 100-240 V a.c. 10 19V DC Power Supply

#### Dimensions

Inches [mm]



## TECHNICAL SPECIFICATIONS

### INTELLISENSE® FITTING

**NISF-T1 4 mm, 6 mm, 8 mm, 10 mm, 5/32", 1/4", 5/16", 3/8"**

**In-line push to connect fitting**

> For use with PE, PA, and 95-D Polyurethane tubing

> Metric and imperial sizes  
4 mm, 6 mm, 8 mm,  
10 mm, 5/32", 1/4", 5/16",  
3/8"

> #10-32 thread port  
> Nickel plated brass  
> Buna-N seals



### Technical features

**Operating pressure range:**

1 bar...11.4 bar  
(14.7 psia...164.7 psia)

**Overpressure minimum rating:**

18.3 bar (264.7 psia)

**Operating temperature range:**

0°C...60°C (32°F...140°F)

**Materials**

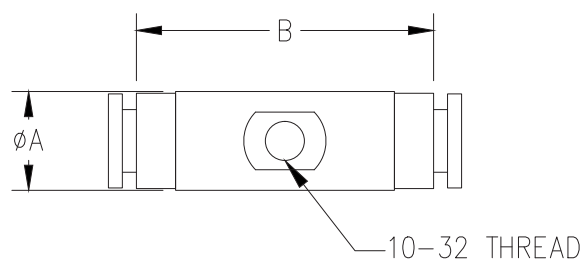
Body:  
Nickel Plated Brass  
Collet:  
Stainless Steel  
O-Ring Seal:  
Buna-Na

### Recommended tubing

- Nylon
- PE
- 95-D Polyurethane

### Dimensions

Inches [mm]



| Model       | Tube Size     | $\phi A$     | B            |
|-------------|---------------|--------------|--------------|
| NISF-T1-006 | 6 mm          | 1.42 [36.07] | 0.47 [11.94] |
| NISF-T1-010 | 10 mm         | 1.62 [41.15] | 0.63 [16.00] |
| NISF-T1-156 | 5/32" or 4 mm | 1.26 [32.00] | 0.47 [11.94] |
| NISF-T1-250 | 1/4"          | 1.42 [36.07] | 0.47 [11.94] |
| NISF-T1-313 | 5/16" or 8 mm | 1.54 [39.12] | 0.55 [13.97] |
| NISF-T1-375 | 3/8"          | 1.62 [41.15] | 0.63 [16.00] |



## TECHNICAL SPECIFICATIONS

### STAINLESS STEEL FITTING NISP-S1 1/8" ... 1 1/2"

- > 10-32 thread port
- > Stainless Steel
- > Replace standard push-to-connect fittings



#### Technical features

**Operating pressure range:**

0 bar (a) to 14 bar (a)  
 (0 psia to 200 psia)

**Overpressure minimum rating:**

70 bar (1015 psia)

**Operating temperature range:**

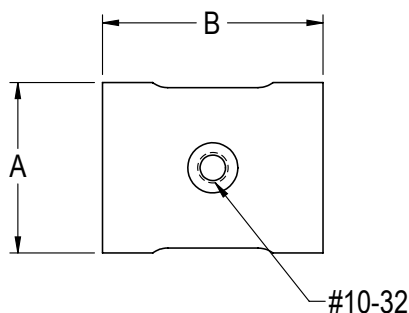
-40°C to 80°C (-40°F to 176°F)

**Materials:**

Body:  
 Stainless steel

#### Dimensions

Inches [mm]



| Model        | NPT Thread | ø A          | ø B          |
|--------------|------------|--------------|--------------|
| NISF-S1-125  | 1/8"       | 0.63 [16.00] | 1.00 [25.40] |
| NISF-S1-250  | 1/4"       | 0.75 [19.05] | 1.13 [28.70] |
| NISF-S1-375  | 3/8"       | 0.88 [22.35] | 1.13 [28.70] |
| NISF-S1-500  | 1/2"       | 1.06 [26.92] | 1.38 [35.05] |
| NISF-S1-750  | 3/4"       | 1.31 [33.27] | 1.50 [38.10] |
| NISF-S1-1000 | 1"         | 1.63 [41.40] | 1.75 [44.45] |
| NISF-S1-1500 | 1-1/2"     | 2.25 [57.15] | 2.13 [54.10] |

## AVAILABLE ACCESSORIES

| ACCESSORIES                                      | PART NUMBER      |
|--|------------------|
| IntelliSense® Data Gateway                       | NISG-01          |
| IntelliSense® Junction Block                     | NISH-R04         |
| IntelliSense® 2.0 Meter Sensor Cable             | NCBL-IS-M8-2     |
| IntelliSense® 5.0 Meter Sensor Cable             | NCBL-IS-M8-5     |
| IntelliSense® 2.0 Meter IP69K Sensor Cable       | NCBL-IS-M8-2-69K |
| IntelliSense® 5.0 Meter IP69K Sensor Cable       | NCBL-IS-M8-5-69K |
| IntelliSense® 0.5 Meter IO Cable                 | NCBL-IS-CF-0.5   |
| IntelliSense® 1.8 Meter USB Programming Cable    | NCBL-IS-RU-1.8   |
| IntelliSense® 2.0 Meter DB9 to RJ45 Serial Cable | NCBL-IS-RD-2     |
| IntelliSense® 0.5 Meter DB9 to RJ45 Serial Cable | NCBL-IS-RD-0.5   |
| RS422 to USB HUB                                 | NISH-D04         |
| 24V Power Supply                                 | NPWR-020A24-DIN  |
| IntelliSense® Stainless Steel Fitting 1/8" NPT   | NSF-S1-125       |
| IntelliSense® Stainless Steel Fitting 1/4" NPT   | NSF-S1-250       |
| IntelliSense® Stainless Steel Fitting 3/8" NPT   | NSF-S1-375       |
| IntelliSense® Stainless Steel Fitting 1/2" NPT   | NSF-S1-500       |
| IntelliSense® Stainless Steel Fitting 3/4" NPT   | NSF-S1-750       |
| IntelliSense® Stainless Steel Fitting 1" NPT     | NSF-S1-1000      |
| IntelliSense® Stainless Steel Fitting 1-1/2" NPT | NISF-S1-1500     |
| SERVICE PARTS                                    | PART NUMBER      |
| IntelliSense® Pressure/Temperature Sensor        | NISS-1A-7SS      |
| IntelliSense® Sensor Interface Module (SIM)      | NISM-S1-BA1-5P   |
| IntelliSense® Fitting, 6mm OD Tubing             | NISF-T1-006      |
| IntelliSense® Fitting, 10mm OD Tubing            | NISF-T1-010      |
| IntelliSense® Fitting, 5/32" OD or 4mm OD Tubing | NISF-T1-156      |
| IntelliSense® Fitting, 1/4" OD Tubing            | NISF-T1-250      |
| IntelliSense® Fitting, 5/16" OD or 8mm OD Tubing | NISF-T1-313      |
| IntelliSense® Fitting, 3/8" OD Tubing            | NISF-T1-375      |
| IntelliSense® Data Gateway DIN Rail Bracket      | NISG-BRKT        |

## **INTELLISENSE® TROUBLESHOOTING**

### **FAQ**

#### **Application**

**Q: Can I use the IntelliSense® for single acting or reverse acting actuators?**

A: Not at this time.

**Q: Can I use IntelliSense® with SPCS valves?**

A: Not at this time.

**Q: Can I use a non-IMI Norgren Actuator?**

A: IntelliSense® was developed using IMI Norgren actuators. Double acting cylinders from other manufacturers should work. Contact your local IMI Norgren distributor for help with non-IMI Norgren actuators.

**Q: What IMI Norgren products is IntelliSense® compatible with?**

A: IntelliSense® is compatible with most single-rod and double-acting cylinders. For compatibility with other IMI Norgren cylinders, please contact your local Sales Team.

**Q: Can I use the IntelliSense® on a double end rod (DE option) actuator?**

A: IntelliSense® is currently only configured for use with single rod end cylinders.

**Q: How are the baseline numbers established?**

A: The base line looks at the values over the specified number of cycles and reports back the observed averages.

**Q: Is the use of cushions compatible with IntelliSense®?**

A: Yes, the IntelliSense® is compatible with cushion applications.

**Q: How does the IntelliSense® install on a cylinder?**

A: The IntelliSense® Pressure and Temperature sensors are designed to be attached to pneumatic tubing using the in line fittings provided in each IntelliSense® Kit. The fitting is intended to be mounted 2-6 inches from the cylinder's ports. There should be no other devices between the cylinder and the sensor. The IntelliSense® sensors should not be mounted directly to a cylinder.

**Q: Can I use IntelliSense® with a quick exhaust valve?**

A: Yes. IntelliSense® works with quick exhaust valves as long as the valve is not located between the cylinder and the IntelliSense® sensor.

**Q: Can I use IntelliSense® with flow controls?**

A: Yes. IntelliSense® works with flow controls as long as the control is not located between the cylinder and the IntelliSense® sensor.

**Q: Can IntelliSense® be used on a lubricated system?**

A: Yes, IntelliSense® may be installed in a lubricated system. IMI Norgren's installation recommendations should be followed when installing the IntelliSense® system.

**Q: What is the maximum cylinder frequency that can be detected?**

A: IntelliSense® is designed to detect most cycle profiles without additional tuning of the software. If IntelliSense® is not detecting cycles after 5~10 cycles contact your local Sales Team for assistance with advanced tuning options.

**Q: Can IntelliSense® be used with a multi-position cylinder?**

A: No, IntelliSense® does not support use with multi-position cylinders.

**Q: Can I use IntelliSense® to only offer alarms when there are changes in temperature and/or pressure?**

A: IntelliSense® offers configurable alarm thresholds for temperature, pressure, extend and retract times. These values are utilised by the IntelliSense® SIM unit in the predictive algorithm. These values are also stored in the SIM's MODBUS RTU Holding Registers and can be accessed by a controls system to create alarms or drive actions based on user programmed conditions.

**Q: How often do I need to calibrate the IntelliSense® system?**

A: The IntelliSense® system requires only the initial installation period to calibrate the SIM and sensor pair to the users' system.

**Q: When/why do I need to reset the IntelliSense® system?**

A: It is recommend that after you replace a failed actuator being monitored by IntelliSense®, the cycle count on the SIM unit be reset. However, due to the predictive functionality of the system, the life expectancy will begin to trend upward and continue to track the system's remaining life.

**Q: How many cylinders can I view on a single dash board?**

A: The IntelliSense® dash board shows the basic status of Green (healthy), Yellow (Alerted), and Red (Failed) for all the SIM units attached to the Data Gateway. The limit of SIMs that can be attached to the Data Gateway is set at 12 units.

**Q: How many cylinders can I use with a single data gateway?**

A: Due to the 100 GB capacity of the Data Gateway we recommend no more than 12 SIM units are attached. Please keep in mind the more SIM units being logged on a Data Gateway, the shorter the time frame in which data can be logged.

**Q: Who can I contact to discuss if IntelliSense® is right for my application?**

A: You may contact your local IMI Precision Engineering sales team for more details.

**Q: Do I need a PLC for IntelliSense®?**

A: IntelliSense® is a standalone product offering monitoring of a system's performance, current status, and predicted life expectancy. The system offers a MODBUS RTU network connection so that users can interface the system with their choice MODBUS RTU master device. A PLC is not required with an IntelliSense® application.

**Q: Can I use IntelliSense® on hydraulic cylinders?**

A: At this time IntelliSense® is not supported for use with hydraulic cylinders.

**Q: Do you need switches on the cylinder?**

A: Limit switches have no effect on an IntelliSense® installation.

**Q: Can IntelliSense® be used to monitor a valve?**

A: IntelliSense® Pressure and Temperature Monitoring mode can be used to monitor the supply and output pressure of a valve. IntelliSense® does not have a predictive model for valves.

## Hardware

### IntelliSense® Pressure / Temperature Sensor

**Q: Does the location of the sensors matter in relation to the actuators pressure ports? (Does Sensor 1 have to go with the extend port? Does Sensor 2 have to go with the retract port?)**

A: Yes. While the sensors themselves are interchangeable, when installed the sensor connected to the “Sensor 1” connection of the IntelliSense® SIM unit needs to be installed in-line with the end cap port (extend). Conversely, the sensor connected to the “Sensor 2” connection of the IntelliSense® SIM unit needs to be installed in-line with the rod guide port (retract).

**Q: How far away from the actuator can I install the IntelliSense® sensors?**

A: The recommended installation distance for the IntelliSense® sensor and tee fitting is 2 - 6 inches away from either port.

**Q: What port sizes are offered?**

A: The sensor port is 10-32. It is not recommended to mount the sensor directly to a cylinder. IMI Norgren offers sensor fittings designed for 5/32” (4 mm), 1/4”, 6 mm, 5/16” (8 mm), 3/8”, and 10 mm OD Tubing. More information regarding dimensions and part numbers can be found at [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics).

**Q: Are shielded cables required?**

A: Shielded cables are not required for an IntelliSense® installation. Shielded cables are recommended to prevent unwanted signal interference. IMI Norgren offers shielded cables in lengths of 2 and 5 meters. Information on these cables and the pin configuration of the cables can be found in the IntelliSense® User’s Manual which can be downloaded from [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics).

**Q: What is the IP rating of the IntelliSense® hardware?**

A: The IntelliSense® sensing unit are rated IP69K. The IntelliSense® SIM module is rated IP50. The Data Gateway has no rating.

**Q: What is the standard BOM of part needed to set up a basic IntelliSense® system?**

A: IMI Norgren offers three kit options for IntelliSense®. These kits give users flexibility when it comes to upgrading their installation based on functional needs. Kit information can be found in the IntelliSense® Catalogue.

**Q: What is the warranty on IntelliSense®?**

A: The IntelliSense® system comes with a one year hardware warranty.

**Q: Are the sensors wash-down compatible?**

A: The IntelliSense® sensor units are wash-down compatible with an IP69K rating. The sensors would need to be connected using wash-down rated cables supplied from a 3<sup>rd</sup> party.

**Q: What are the temperature ratings on the sensors?**

A: The IntelliSense® sensors have an operating range of -40° C to 80° C (-40° F to 176° F).

**Q: Can IntelliSense® be used to monitor temperature parameters?**

A: Temperature values can be tracked using the MODBUS RTU holding registers of the IntelliSense® SIM. These values are updated at a 1 second refresh rate.

**Q: What is the maximum cable distance from sensor to SIM?**

A: The recommend sensor maximum cable distance is 100 metres [325'].

**Q: Is IntelliSense® compatible with Hydrogen Peroxide?**

A: No, the wetted material in the IntelliSense® sensor and fitting include Buna-N seals which are not compatible with high concentration of Hydrogen Peroxide.

**Q: What is the recommended filtration for the sensors?**

A: It is recommended that IntelliSense® be installed with a Class 3 ISO-8573-1/5 micron filter.

**Q: What is the maximum pressure rating for IntelliSense®?**

A: The operation pressure rating for the IntelliSense® sensors is 0 bar (a) to 14 bar (a) (0 psia to 200 psia).

**Q: What type of technology does the sensor utilise?**

A: The IntelliSense® sensors use a silicone gel coated MEMS pressure sensor element.

**Q: Where do I find and download the manuals and required Software?**

A: Manual and required software can be downloaded from [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics).

**Q: Can IntelliSense® be programmed and monitored with an HMI?**

A: When using IntelliSense® on a MODBUS RTU network it is possible to display data observed onto a HMI unit. If the HMI is capable of serving as a MODBUS Master device no PLC is needed. However, the SIM is a read-only device and setting cannot be made outside of the IntelliSense® configuration software.

## **IntelliSense® Sensor Interface Module (SIM)**

**Q: Are there any discrete signals included with IntelliSense®?**

A: The IntelliSense® SIM unit offers two discrete outputs in the form of sinking (NPN) transistors. The triggering event for these outputs can be selected by the user in the config screen.

## **MODBUS Network**

**Q: What wiring standard does the MODBUS port of the IntelliSense® SIM permit?**

A: The MODBUS port on the IntelliSense® SIM conforms to 2-wire or 4-wire RS-485. For more information on connecting IntelliSense® to a MODBUS RTU network please consult the IntelliSense® User Manual located at [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics).

**Q: What MODBUS network standards does IntelliSense® support?**

A: IntelliSense® supports MODBUS RTU.

## **DATA Network**

**Q: Do I need to purchase a Data Gateway to use the data logging function of IntelliSense®?**

A: Yes, at this time the IntelliSense® SIM unit does not support data logging on its own.

**Q: Is it possible to connect multiple IntelliSense® SIM units on a single PC or Data Gateway network?**

A: Yes, multiple IntelliSense® SIM units can be connected to a single Data Gateway or PC using the IntelliSense® Communication Hub (NISH-DB9-04). This hub allows for a single USB port to connect up to 4 IntelliSense® SIM units.

**Q: Do I need to order anything more than the IntelliSense® Basic Kit to use IntelliSense®?**

A: Yes. The IntelliSense® basic kit does not include any cabling. The user will need an IntelliSense® USB programming cable (NCBL-IS-RU-1.8) to configure the IntelliSense® SIM unit. However, this cable does not need to remain connected if online monitoring or data logging, via Data Gateway, is not desired in the application. Also needed are the cables to connect the two sensing units back to the SIM. These cables need to be straight through 4 pin, with female M8 connectors on both ends. IMI Norgren offers 2m and 5m, shield versions (NCBL-IS-M8-2, NCBL-IS-M8-5).

## Power

**Q: What options to I have for providing power to my IntelliSense® SIM unit?**

A: The IntelliSense® SIM unit requires a 11-24 V d.c. power source. That can be connected via the unit's I/O Connector port or the MODBUS connector port. For more detailed information please refer to the IntelliSense® User Manual. The manual can be found at [www.imi-precision.com/list/intelligent-pneumatics](http://www.imi-precision.com/list/intelligent-pneumatics).

## Software

**Q: Why does the Estimated Days Remaining, Estimated Cycles Remaining, and Estimated Life Remaining show a green check mark?**

A: This is an indication that the cylinder is operating normally and performance has not changed from the initial installation. When IntelliSense® predicts 90% of life remaining it will begin to display values for these fields.

**Q: Why does the Estimated Days Remaining, Estimated Cycles Remaining, and Estimated Life Remaining show a red circle with an exclamation point?**

A: This is an indication that the cylinder's performance is critical and action is required. Action may include replacing the cylinder or verifying the IntelliSense® configuration. If not setup correctly the SIM may predict premature failure of a cylinder.

**Q: How does IntelliSense® calculate estimated days remaining?**

A: The estimated days remaining is calculated by dividing the Estimated Cycles Remaining by the Average Daily Cycles.

**Q: How does IntelliSense® calculate Average Daily Cycles?**

A: IntelliSense® uses a seven-day rolling average to calculate the Average Daily Cycles.

**Q: My cylinder is cycling but the estimate cycles remaining is not changing.**

A: This is how IntelliSense® is designed to operate in predictive mode. The Estimated Cycles Remaining is only updated when an event occurs.

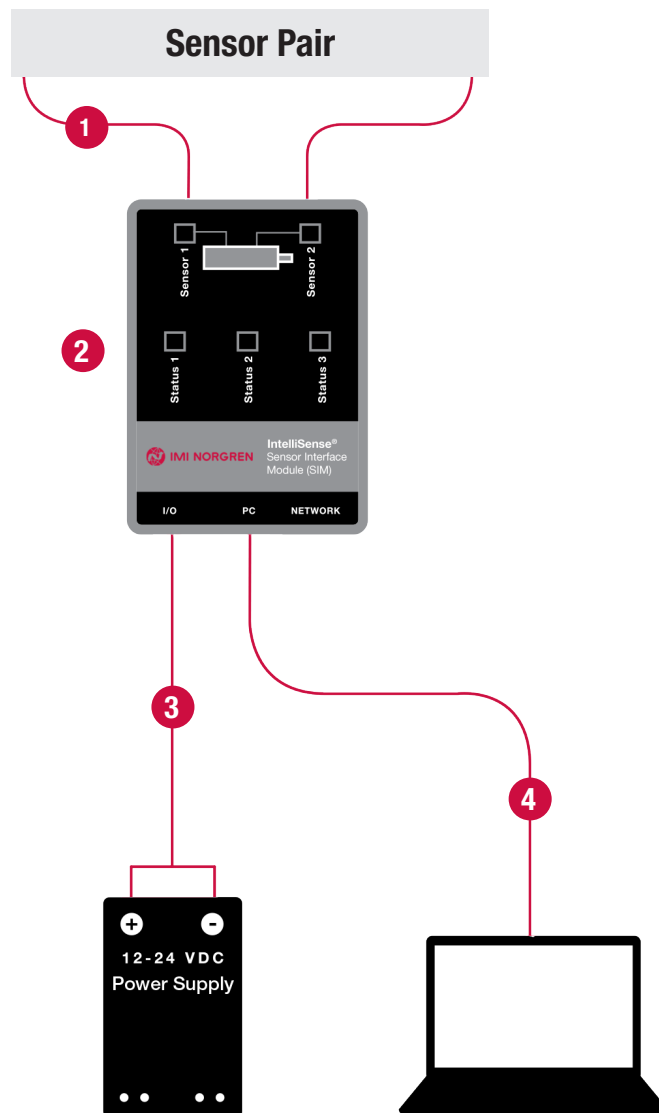
**Q: How is Est. Life Remaining calculated?**

A: Estimated Life Remaining is calculated by dividing Estimated Cycles Remaining by the expected life of the Cylinder.

## APPENDIX

### NETWORK DRAWINGS

#### Drawing 1: Basic Monitoring



**1** IntelliSense® Sensor Cables:  
NCBL-IS-M8-X

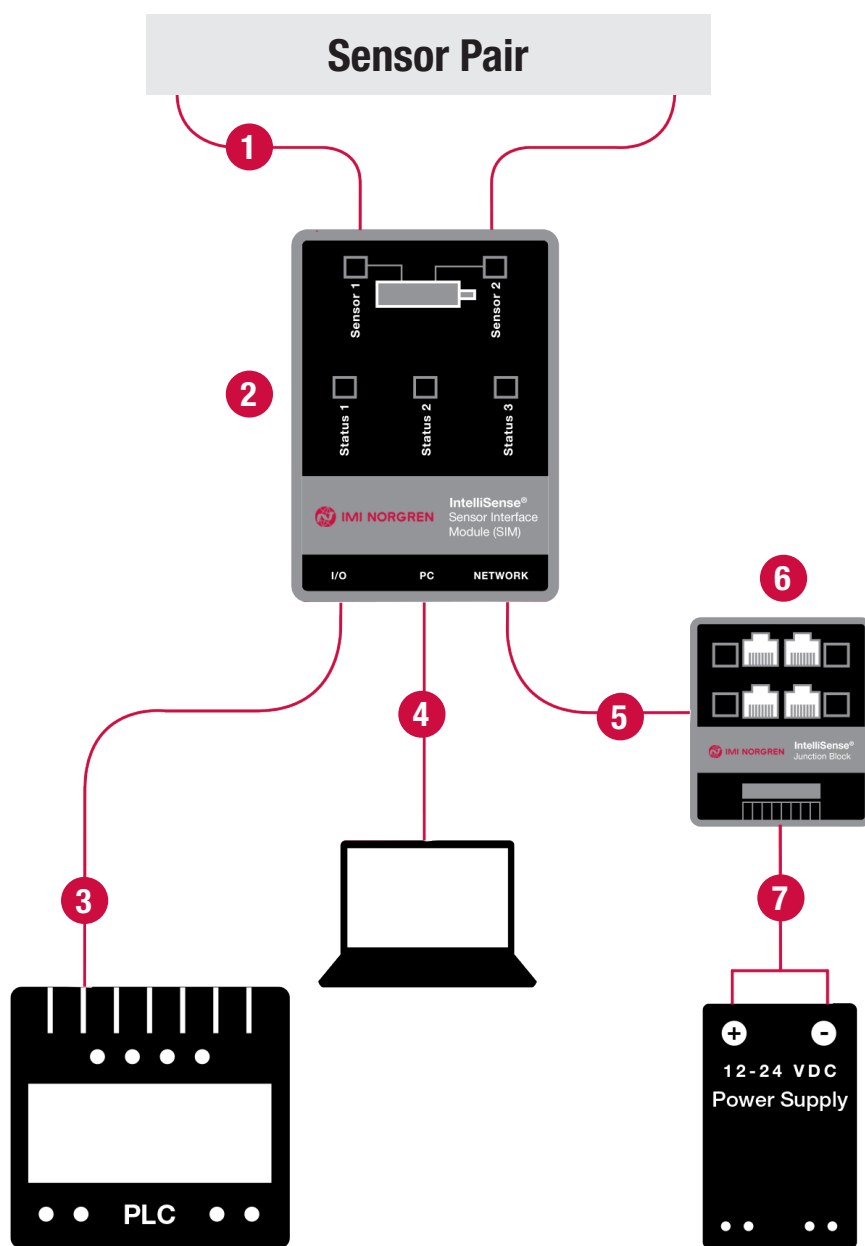
**2** IntelliSense® Basic Kit Sensor  
Interface Module and Sensor  
Pair: NISK-BMA-XXX

**3** IntelliSense® IO Cable:  
NCBL-IS-CF-0.5

**4** IntelliSense® USB  
Programming Cable: NCBL-  
IS-RU-1.8



Drawing 2: Basic Monitoring with PLC Discrete Input



1 IntelliSense® Sensor Cables:  
NCBL-IS-M8-X

2 IntelliSense® Basic Kit Sensor Interface  
Module and Sensor Pair: NISK-BMA-XXX

3 IntelliSense® IO Cable:  
NCBL-IS-CF-0.5

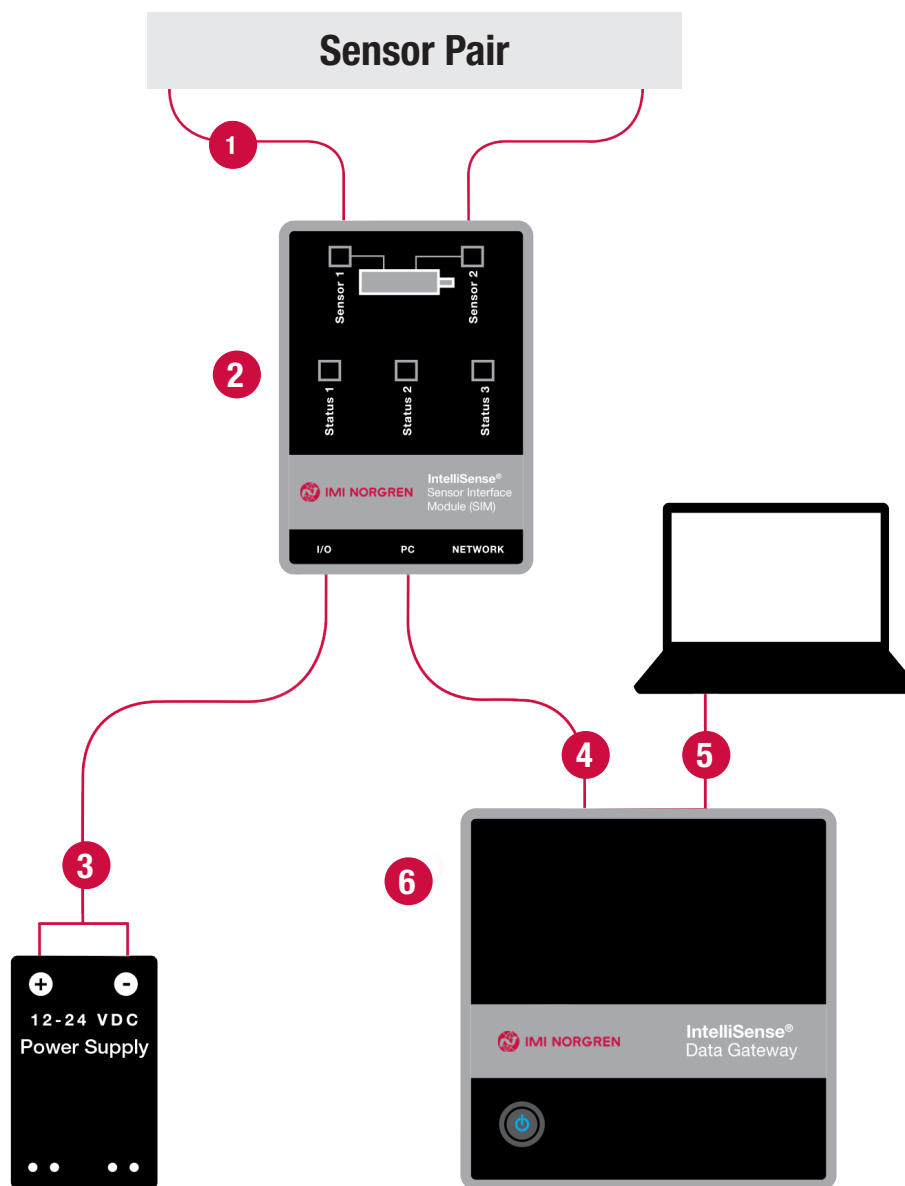
4 IntelliSense® USB  
Programming Cable: NCBL-  
IS-RU-1.8

5 RJ45-RJ45 (User supplied)

6 IntelliSense® Junction Block: NISH-R04

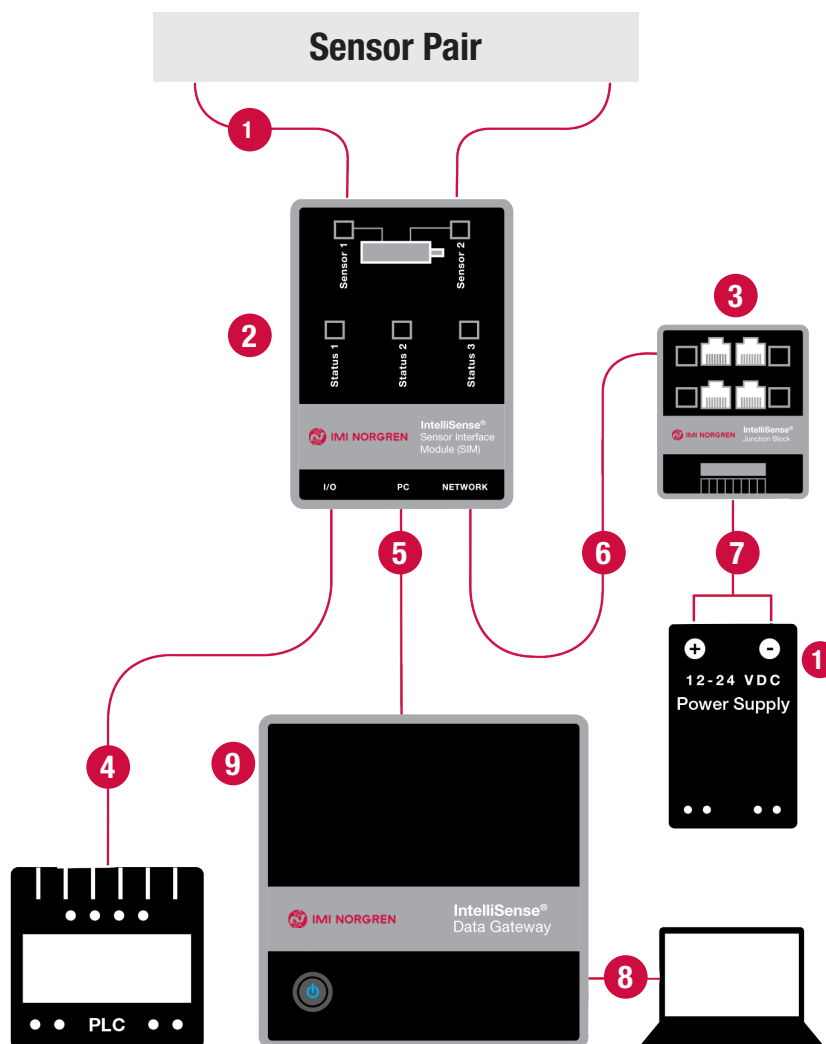
7 Power Cable (User Supplied)

Drawing 3: Basic Data Logging and Remote Monitoring



- |   |  |
|---|--|
| 1 IntelliSense® Sensor Cables:<br>NCBL-IS-M8-X  | 4 IntelliSense® USB<br>Programming Cable: NCBL-<br>IS-RU-1.8 |
| 2 IntelliSense® Basic Kit Sensor<br>Interface Module and Sensor<br>Pair: NISK-BMA-XXX | 5 Wireless or Wired Ethernet<br>Network (User Supplied)      |
| 3 IntelliSense® IO Cable:<br>NCBL-IS-CF-0.5   | 6 IntelliSense® Junction Block:<br>NISH-R04                  |

Drawing 4: Basic Data Logging and Remote Monitoring with PLC Discrete Input



**1** IntelliSense® Sensor Cables:  
NCBL-IS-M8-X

**2** IntelliSense® Basic Kit Sensor  
Interface Module and Sensor  
Pair: NISK-BMA-XXX

**3** IntelliSense® Junction Block:  
NISH-R04

**4** IntelliSense® IO Cable:  
NCBL-IS-CF-0.5

**5** IntelliSense® USB  
Programming Cable: NCBL-  
IS-RU-1.8

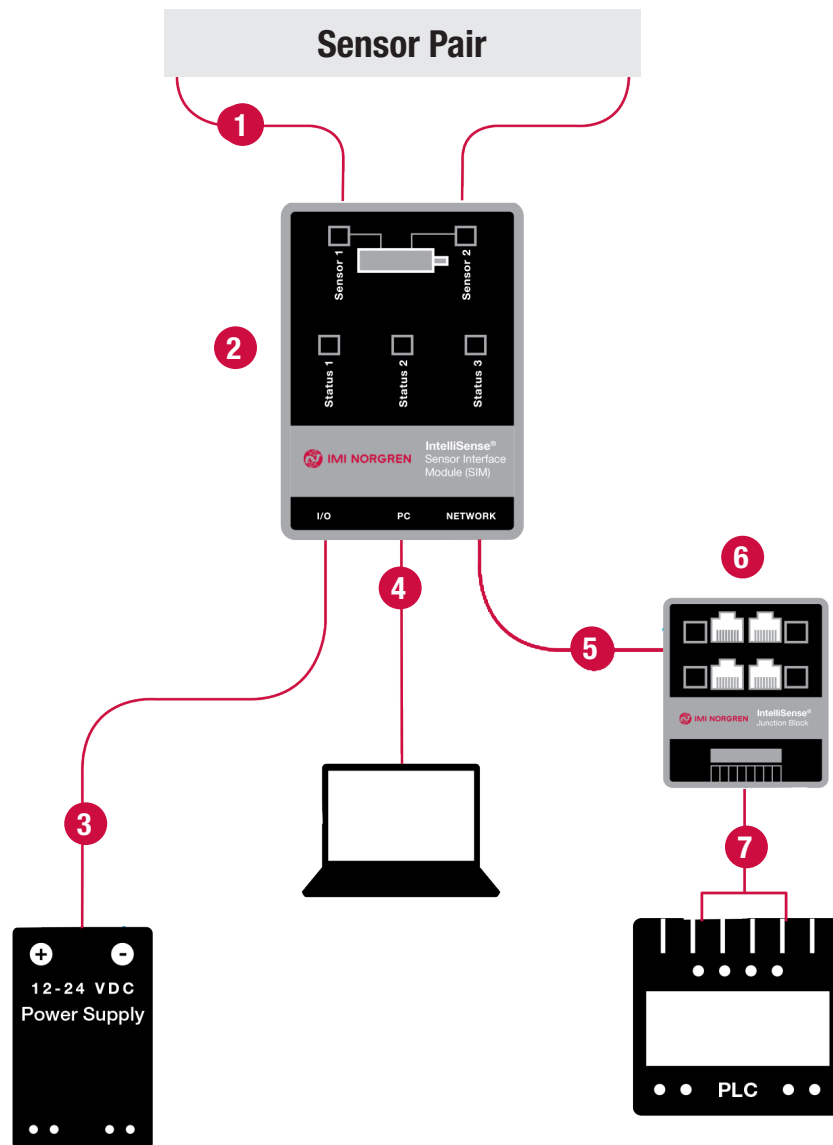
**6** RJ45-RJ45 (User Supplied)

**7** Power Cable (User Supplied)

**8** Wireless or Wired Ethernet  
Network (User Supplied)

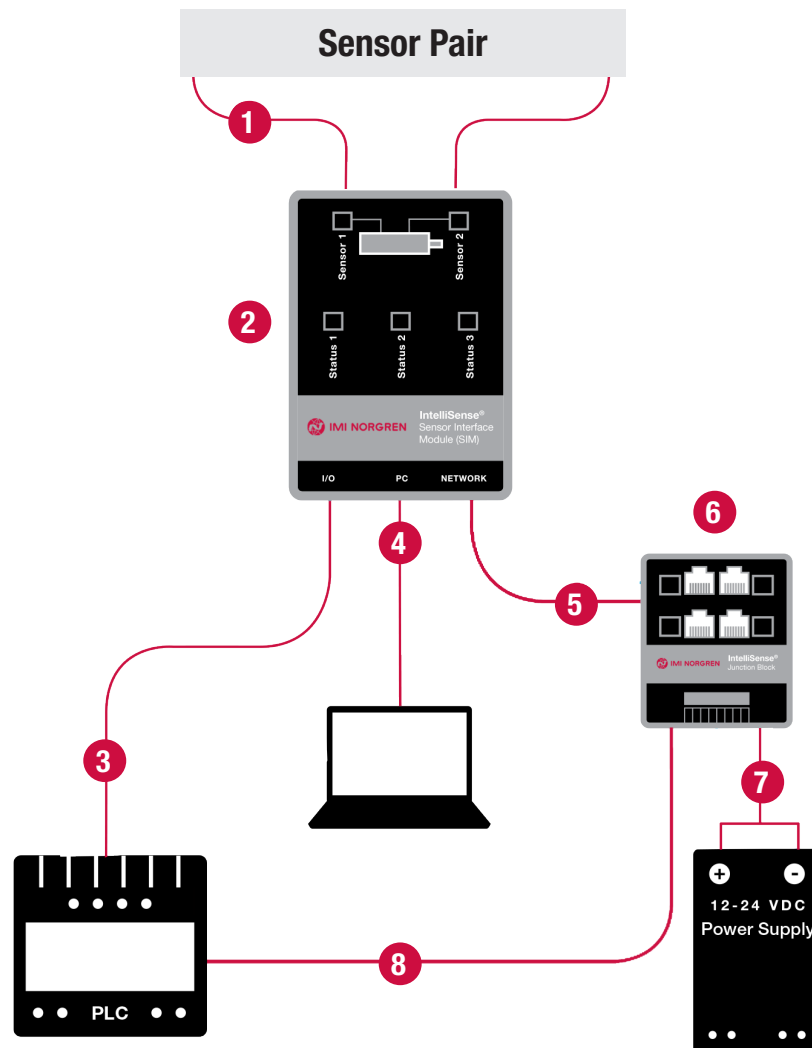
**9** IntelliSense® Data Gateway:  
NISG-01

Drawing 5: Basic Monitoring and MODBUS RTU Network



- |  |   |  |
|--|---|--|
| <b>1</b> IntelliSense® Sensor Cables:<br>NCBL-IS-M8-X  | <b>4</b> IntelliSense® USB Programming<br>Cable: NCBL-IS-RU-1.8 | <b>7</b> Modbus Interface Cable<br>(User supplied) |
| <b>2</b> IntelliSense® Basic Kit Sensor<br>Interface Module and Sensor<br>Pair: NISK-BMA-XXX | <b>5</b> RJ45-RJ45 (User Supplied)                              |  |
| <b>3</b> IntelliSense® IO Cable:<br>NCBL-IS-CF-0.5   | <b>6</b> IntelliSense® Junction Block:<br>NISH-R04              |  |

Drawing 6: Basic Monitoring and MODBUS RTU Network with PLC Discrete Input



**1** IntelliSense® Sensor Cables:  
NCBL-IS-M8-X

**2** IntelliSense® Basic Kit Sensor  
Interface Module and Sensor  
Pair: NISK-BMA-XXX

**3** IntelliSense® IO Cable:  
NCBL-IS-CF-0.5

**4** IntelliSense® USB  
Programming Cable: NCBL-

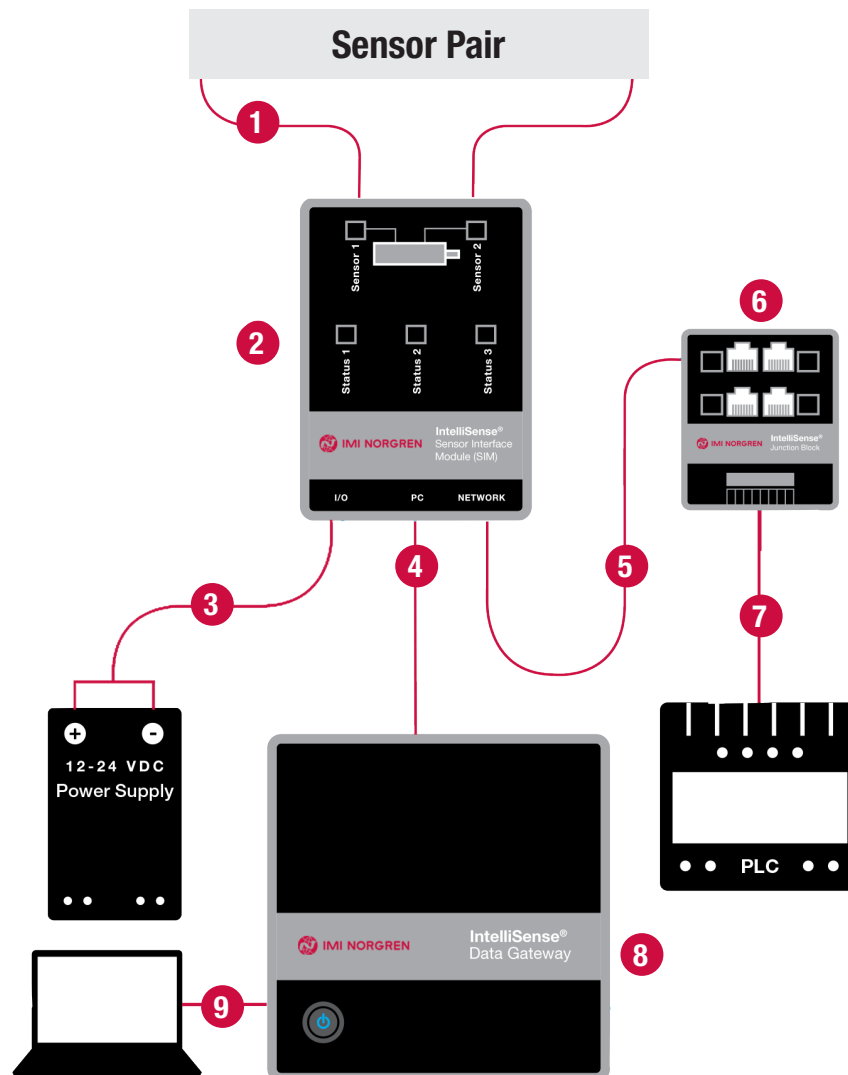
**5** RJ45-RJ45 (User Supplied)

**6** IntelliSense® Junction Block:  
NISH-R04

**7** Modbus Interface Cable  
(User supplied)

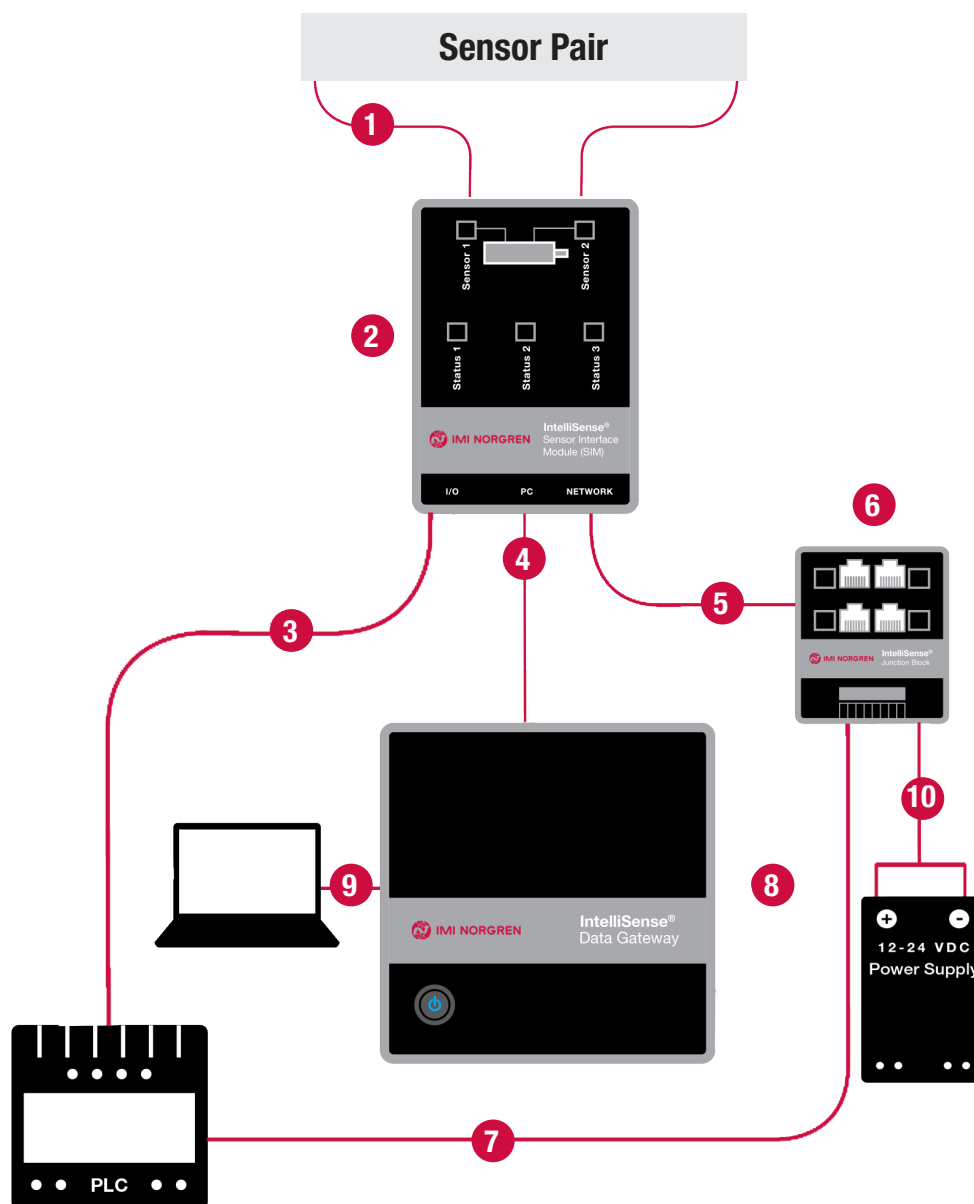
**8** Power Cable (User Supplied)

Drawing 7: Data Logging Remote Monitoring and MODBUS RTU Network



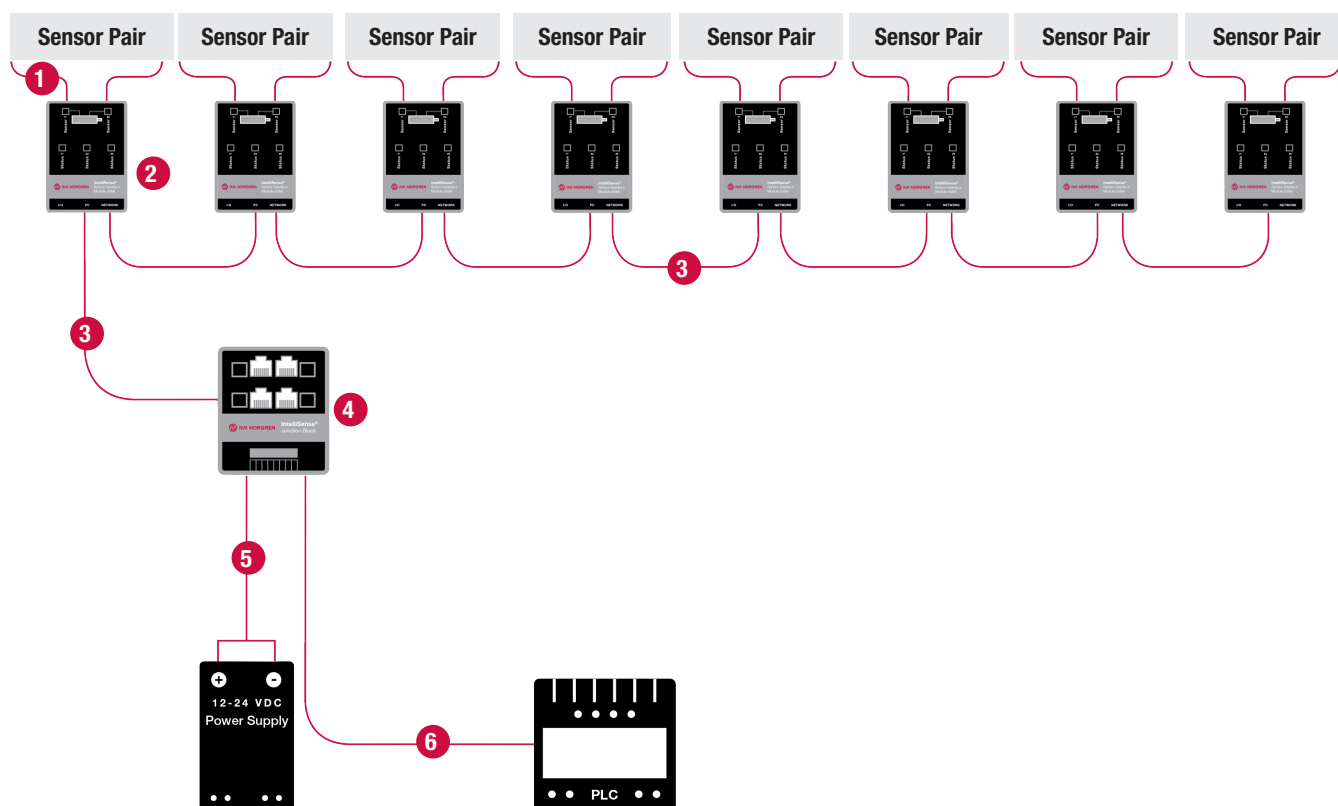
- |   |  |   |
|---|--|---|
| 1 IntelliSense® Sensor Cables:<br>NCBL-IS-M8-X  | 4 IntelliSense® USB<br>Programming Cable: NCBL-<br>IS-RU-1.8 | 7 Modbus Interface Cable<br>(User supplied)             |
| 2 IntelliSense® Basic Kit Sensor<br>Interface Module and Sensor<br>Pair: NISK-BMA-XXX | 5 RJ45-RJ45 (User Supplied)                                  | 8 IntelliSense® Data Gateway: NISG-01                   |
| 3 IntelliSense® IO Cable:<br>NCBL-IS-CF-0.5   | 6 IntelliSense® Junction Block:<br>NISH-R04                  | 9 Wireless or Wired Ethernet<br>Network (User Supplied) |

Drawing 8: Data Logging, Remote Monitoring, and MODBUS RTU Network with PLC Discrete Input



- |  |  |  |                                       |
|--|--|--|---------------------------------------|
| <b>1</b> IntelliSense® Sensor Cables:<br>NCBL-IS-M8-X  | <b>4</b> IntelliSense® USB<br>Programming Cable:<br>NCBL-IS-RU-1.8 | <b>7</b> Modbus Interface Cable (User<br>Supplied)             | <b>10</b> Power Cable (User Supplied) |
| <b>2</b> IntelliSense® Basic Kit Sensor<br>Interface Module and Sensor<br>Pair: NISK-BMA-XXX | <b>5</b> RJ45-RJ45 (User Supplied)                                 | <b>8</b> IntelliSense® Data Gateway:<br>NISG-01                |                                       |
| <b>3</b> IntelliSense® IO Cable:<br>NCBL-IS-CF-0.5   | <b>6</b> IntelliSense® Junction Block:<br>NISH-R04                 | <b>9</b> Wireless or Wired Ethernet<br>Network (User Supplied) |                                       |

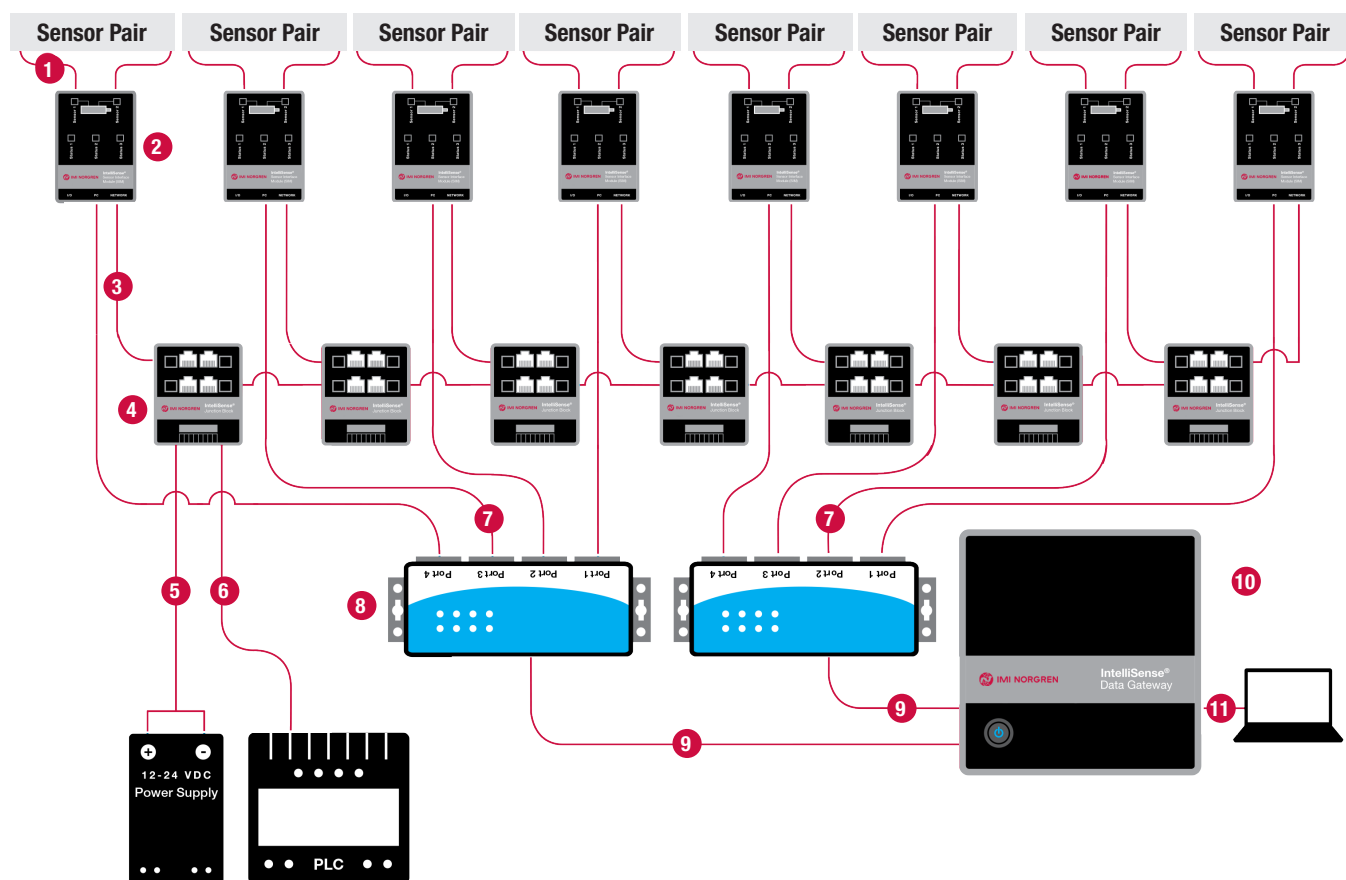
Drawing 9: Daisy Chained MODBUS RTU Network with Multiple SIM



- |  |  |
|--|--|
| <b>1</b> IntelliSense® Sensor Cables:<br>NCBL-IS-M8-X  | <b>4</b> IntelliSense® Junction Block:<br>NISH-R04 |
| <b>2</b> IntelliSense® Basic Kit Sensor<br>Interface Module and Sensor<br>Pair: NISK-BMA-XXX | <b>5</b> Power Cable (User Supplied)               |
| <b>3</b> RJ45-RJ45 (User Supplied)   | <b>6</b> Modbus Interface Cable<br>(User Supplied) |



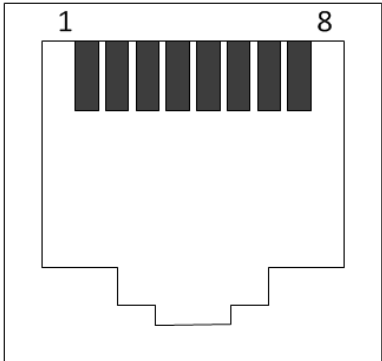
Drawing 10: Data Logging, Remote Monitoring, and MODBUS RTU Network with Multiple SIM



- |  |  |  |   |
|--|--|--|---|
| <b>1</b> IntelliSense® Sensor Cables:<br>NCBL-IS-M8-X  | <b>4</b> IntelliSense® Junction Block:<br>NISH-R04 | <b>7</b> IntelliSense® D89 to RJ45<br>Cable: NCBL-IS-RD-XX | <b>10</b> IntelliSense® Data Gateway:<br>NISG-01                |
| <b>2</b> IntelliSense® Basic Kit Sensor<br>Interface Module and Sensor<br>Pair: NISK-BMA-XXX | <b>5</b> Power Cable (User Supplied)               | <b>8</b> RS422 to USB Hub: NISH-004                        | <b>11</b> Wireless or Wired Ethernet<br>Network (User Supplied) |
| <b>3</b> RJ45-RJ45 (User Supplied)   | <b>6</b> Modbus Interface Cable (User<br>Supplied) | <b>9</b> USB Cable: (Supplied with<br>NISH-D04)            |   |

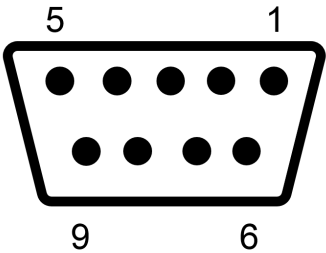
# CABLE PIN OUTS

MODBUS Port Pin Out



| PIN ON RJ45 | SIGNAL    |
|-------------|-----------|
| 1           | IRXD0     |
| 2           | RXD1      |
| 3           | NA        |
| 4           | TXD1      |
| 5           | TXD0      |
| 6           | NA        |
| 7           | Option V+ |
| 8           | Common    |

DB9 to RJ45 Cable Pin Out



| PIN ON DB9 | PIN ON RJ45 | SIGNAL |
|------------|-------------|--------|
| 1          | 1           | IRXD0  |
| 2          | 2           | RXD1   |
| 3          | 4           | TXD1   |
| 4          | 5           | TXD0   |
| 5          | 8           | GND    |
| 6          | NC          | -      |
| 7          | NC          | -      |
| 8          | NC          | -      |
| 9          | NC          | -      |

## TECHNICAL DOCUMENTS

Visit our website for additional models, drawings, and further documentation.

[www.imi-precision.com/list/intelligent-pneumatics.](http://www.imi-precision.com/list/intelligent-pneumatics)