



# NIR-6000 Series Analyzer

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## Technical Manual



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## Preface

### About The Manual

This manual is intended to provide a technical reference for configuring and operating the newest Sensortech Near Infrared Reflectance (NIR) series of Analyzers and software. New and experienced users will benefit from the detailed technical information and operating instructions for Sensortech hardware and software options and accessories.

In this manual, the NIR Series Analyzers are also referred to by the general term "Gauge".

Hardware Revisions and Software Versions covered by this manual:

Analyzer Hardware Revision: C (and above)

Analyzer Firmware Version: 1.000 (and above)

Analyzer Configuration Software Version: 1.000 (and above)

The manual is organized as follows:

1. Quick Start Guide
2. Sensortech Analyzer and hardware installation information.
3. Sensortech software installation and PC requirements.
4. Overview of the Sensortech Analyzer and software configuration.
5. Overview of Product Calibration using the Sensortech Analyzer.
6. Upgrading Analyzer Firmware
7. APPENDIX.



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## Quick Start Guide

Follow these helpful hints to quickly get your Analyzer set up and ready for use.

## Installation

Select a location that has a continuous flow of material, and install the Analyzer above the material to be measured approximately 4 to 16 inches (10.2 to 40.6 cm) from the Viewing Window to the top of the average material height. Mount the Analyzer on-line using a 1 to 1.3 inch (25 to 32 mm) diameter metal pipe that is floor mounted or welded to a structure free from vibration.

### Communication

- a. Load the CD containing the Configuration Software and install the program onto your PC.
- b. Configure your computer's IP address: 192.168.0.200 Subnet Mask: 255.255.255.0 and connect with the Ethernet cable that was provided with the Analyzer.
- c. Start the Configuration Software and click the 'Find Networked Gauges' button.
- d. Double-click 'DefaultID' and press the 'Connect' button.
- e. Log in with the Engineering password "engpass" to change parameters and perform Analyzer calibration if necessary. By default operator level control is available when no password is entered. Note: Log out each time you are finished to prevent unauthorized access to the Analyzer's configuration settings.

### Calibration

In most cases, the Analyzer has been statically calibrated at our factory for your application. Once the Analyzer has been installed on-line, a single sample comparison with the measurement value will determine if an offset is necessary.

- a. Select Calibration Method – Offset Method
- b. While material is flowing under the Analyzer, press the 'Start' button and wait until the measured value is displayed.
- c. Press the 'Stop' button and immediately collect a sample from the line at the Analyzer and place it in an airtight container or plastic bag. Completely fill the container and remove any excess air.
- d. Press 'Store Sample' to record the reading in the Calibration page data table.
- e. Perform a lab analysis on your sample (for moisture this is typically a weight loss oven test), then enter the lab analysis value into the data table under the 'Lab' column.
- f. Press 'Recalculate Coefficients' and note that the 'C' coefficient value has been corrected.
- g. Press 'Send Coefficients' to conclude the calibration procedure.



## Getting Started

### Introduction

Thank you for choosing Sensortech Analyzers for your moisture measurement and analysis. The Sensortech NIR-6000 Series Analyzers are designed for use in industrial environments and provide the most sophisticated on-line Analyzers available, offering unmatched accuracy and reliability.

The NIR-6000 Series Analyzer is a complete measurement and interface system where all signal processing and control functions are self-contained. It features multiple interface protocols including three isolated 4-20mA outputs, an RS-232/485 serial communication port and Ethernet (TCP/IP & UDP) port. Optional communications protocols include OI-6000 Operator Interface, DeviceNet, PROFIBUS, PROFINET and EtherNet/IP as well as digital input and output for external sample gating and control.

The Analyzers are shipped with all the accessories and custom options ordered. Please compare the contents with the packing list to ensure all items are accounted for. If any items are missing or damaged, please contact Sensortech immediately for further assistance.

### Physical Installation

A typical installation location has a continuous flow of material where the Analyzer experiences low vibration and the minimum and maximum air temperature is +0 to +50 degrees C; install the Analyzer above the material to be measured approximately 4 to 16 inches (10.2 to 40.6 cm) from the Viewing Window to the top of the average material height. The most important mounting consideration is the distance from product to Viewing Window. Although the Analyzer will operate effectively in many applications at distances of 4" – 24" (100mm – 600mm), the optimum distance for most applications is 6" – 10" (150mm – 250mm). Highly reflective products, such as glossy paper, produce first surface reflections detrimental to measurement. Setting the Analyzer at a slight angle from vertical may easily eliminate these reflections. Typically an angle of 15° - 20° from vertical is recommended.

Install the Analyzer in an environment where the external Analyzer temperature does not exceed 0 to 50 degrees Celsius. If higher temperatures are experienced, an Analyzer with Cooling Option (air vortex or liquid coolant) should be used. If lower temperatures are experienced, an Analyzer with internal Heater Option should be used.

Ensure the Analyzer is mounted on a metal post installed on a cement floor or other stable, low vibration mounting. The Analyzer includes two removable mounting brackets. These brackets provide a rear end vertical pole or top side horizontal pole mount configuration with the two mounting clamps positioned on the rear connector-end or top side of the Analyzer. Figure 1, 2 and 3 illustrates these mounting configurations.

The Analyzer mounting brackets are designed to clamp onto a metal bar with a diameter of 1.0" – 1.3" (25.4 to 33.3mm).



The metal Viewing Window Light Tube contains a stainless steel fitting for a 0.25 inch (6.35 mm) diameter compressed air line to provide positive air pressure to prevent contamination of the glass Viewing Window. The standard Viewing Window Light Tube contains a bronze mesh insert which distributes the incoming air to create an air current that pushes contaminants away from the entrance of the Viewing Window Light Tube. Adjust the incoming air flow until all particles and dust from the production environment remain outside of the Viewing Window Light Tube. Check and clean the Viewing Window periodically to prevent obstruction of the NIR light source thru the Viewing Window.

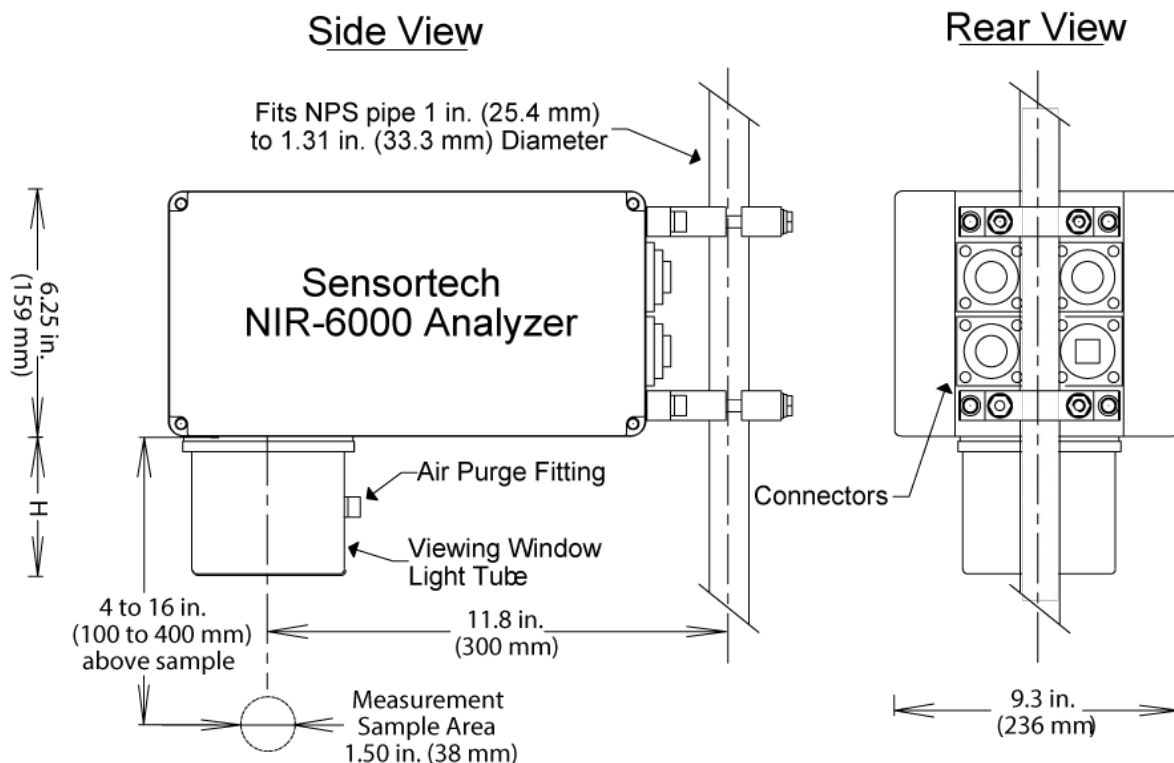


Figure 1: Vertical Pole Mount to Rear of Analyzer

Viewing Window Light Tube Height:

No Viewing Window Light Tube = 0.25 inches (6.35 mm)

Standard = 3.6 inches (9.1 cm)

Extended = 5 inches (12.7 cm)

Note: Viewing Window Light Tube height may vary with application.

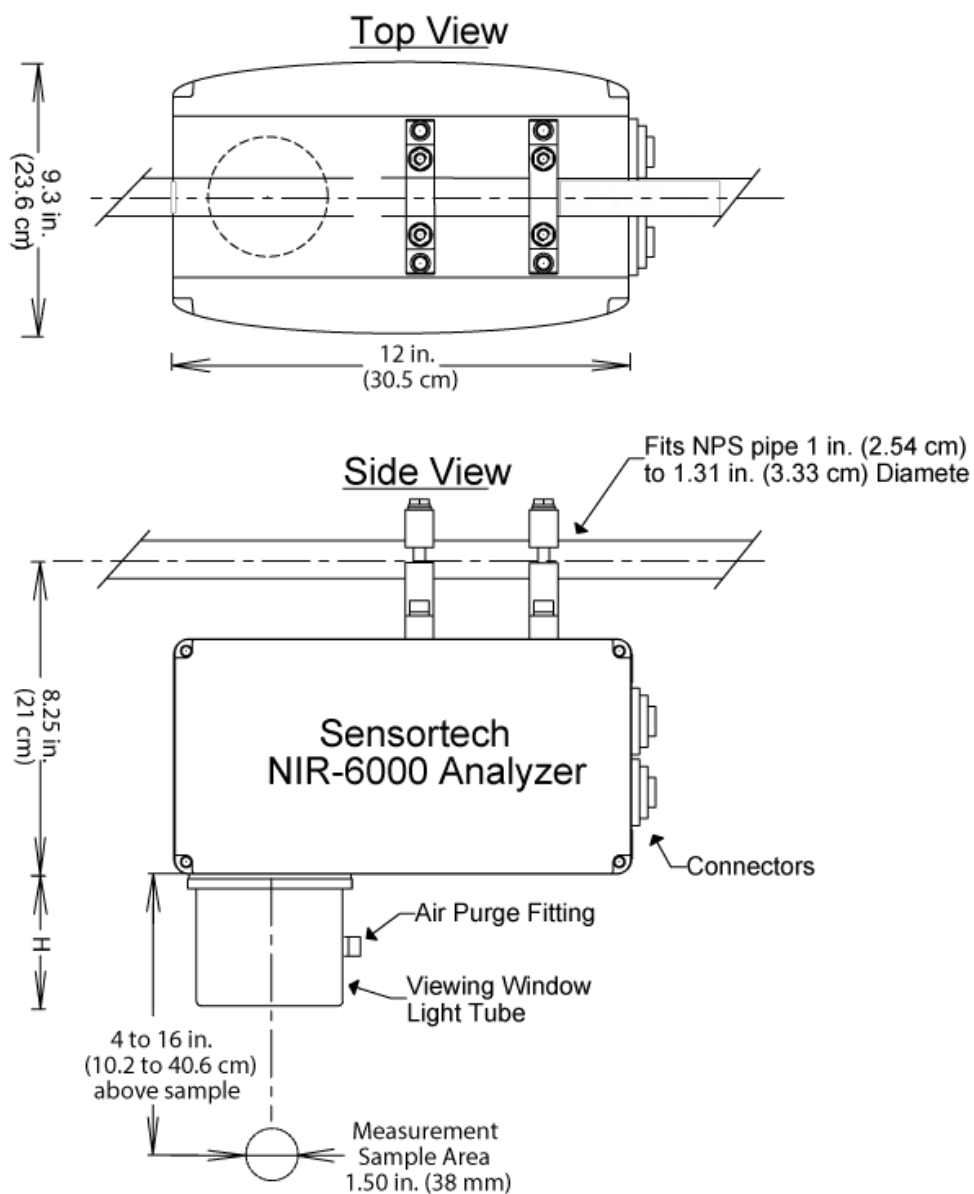


Figure 2: In-Line Horizontal Pole Mount to Top of Analyzer

Viewing Window Light Tube Height:

No Viewing Window Light Tube = 0.25 inches (6.35 mm)

Standard = 3.6 inches (9.1 cm)

Extended = 5 inches (12.7 cm)

Note: Viewing Window Light Tube height may vary with application.

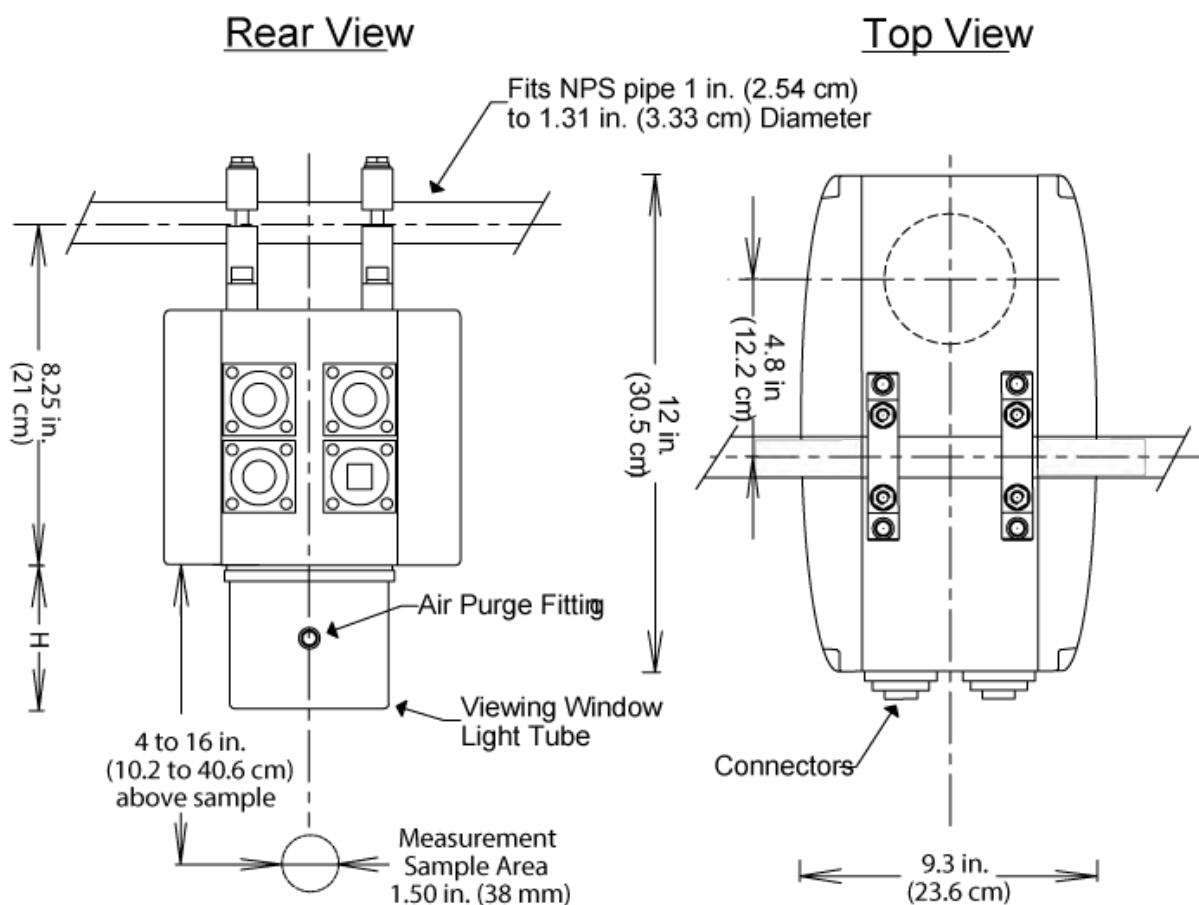


Figure 3: Cross Horizontal Pole Mount to Top of Analyzer

Viewing Window Light Tube Height:

No Viewing Window Light Tube = 0.25 inches (6.35 mm)

Standard = 3.6 inches (9.1 cm)

Extended = 5 inches (12.7 cm)

Note: Viewing Window Light Tube height may vary with application.

## Electrical Connections

In Figure 4, the rear connector panel of the Analyzer is shown. The standard connectors provided are Bulgin Buccaneer Low Profile Flange Mounting type for water and dust protection to NEMA4 specifications when mated to a Bulgin Flex Cable connector or Cover Cap.

**Important:** All connectors on the rear of the Analyzer must have either a Bulgin Cover Cap (p/n: PX0733 supplied with all new Analyzers) on the connector or a Bulgin Flex Cable Connector plug to seal the Analyzer and maintain the NEMA4 rating. (Analyzer options using a DB-9 or other custom configurations may require special NEMA4 rated connectors, compression fittings and/or cover caps installed to maintain the NEMA rating.)

### Rear Panel View

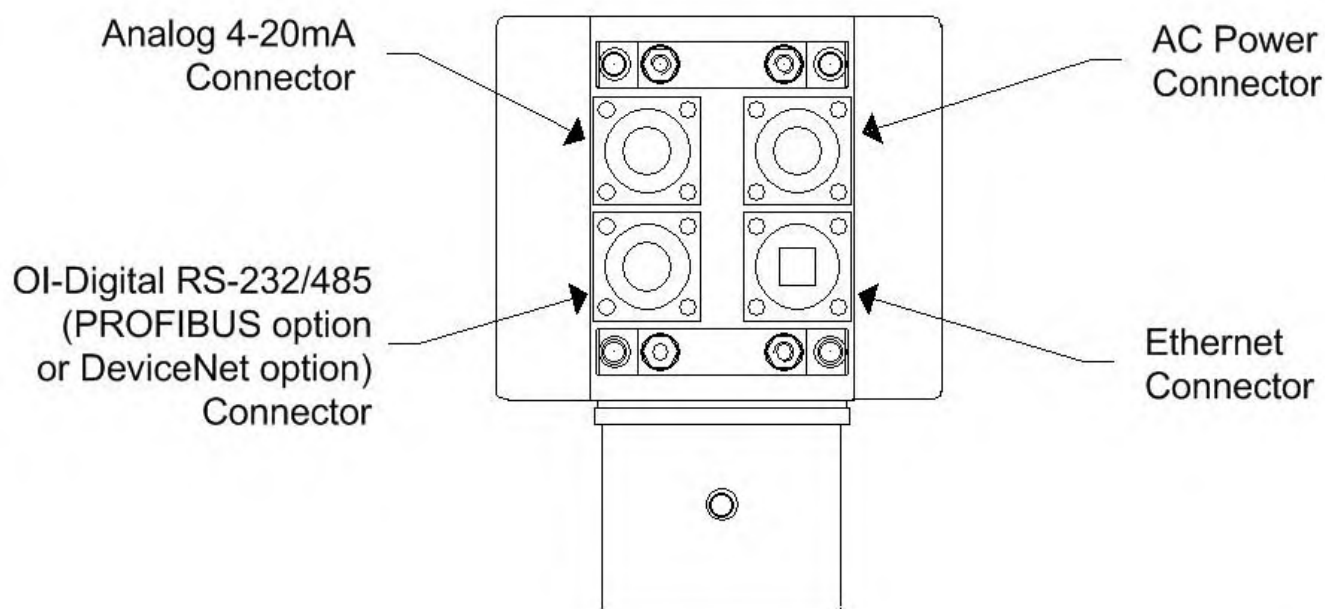


Figure 4: Electrical Connections on rear panel of Analyzer

See APPENDIX for connector pinout information.



## Description of Electrical Connections

**AC Power** – the power connector in the upper right provides either 90VAC-240VAC 50/60Hz or optional +24VDC power input per the Analyzer configuration ordered. The default power input configuration is for 90VAC-240VAC 50/60Hz via a power cord, which is supplied with the Analyzer. The 8-foot (2.5m) power cord comes with a power plug appropriate to the country of operation. Longer power cables may be used to provide the live (L), neutral (N) and safety ground (GND) connections. Power options include ATEX and DC power where only the Bulgin Flex Cable connector plug may be supplied to allow for a custom power cable installation.

Mates with Bulgin Flex Cable connectors PX0731/S (AC power), PX0731/P (DC power) or Cover Cap PX0733.

**Ethernet** – the connector in the lower right provides a Cat5e compliant 10/100 Ethernet Crossover connection. The Ethernet receptacle accepts RJ-45 connectors with the cable wired to the T-568A standard wiring configuration to communicate with the Analyzer. The TCP/IP Ethernet connection may be point to point or over a local network and can be factory configured to provide either a PROFINET or an EtherNet/IP communications protocol.

Mates with Bulgin Flex Cable connectors PX0836, PX0834 or Cover Cap PX0733.

**Analog 4-20mA** – in the upper left, three self-powered, isolated analog 4-20mA output signals are provided at the connector. The three outputs are identified as Port1 (Loop1), Port2 (Loop2) and Port3 (Loop3). Each of the three Ports is software configurable to provide moisture, product temperature and additional measured values. The analog 4-20mA output is commonly used by process control systems such as a PLC, DCS or SCADA, for cost-effective continuous monitoring. A Sensortech digital panel meter can be used which provides 3 ½ or 4 ½ digit LCD or LED displays with a Bulgin Flex Cable connector to the analog 4-20mA connector. If a third party analog 4-20mA display or control system is used, ensure that the correct Bulgin Flex Cable connector is used to connect to the Analyzer to maintain the NEMA rating.

Mates with Bulgin Flex Cable connector PX0739/P or Cover Cap PX0733.

**OI-Digital RS-232/485** – the connector in the lower left provides the factory default 7 pin RS-232 and RS-485 serial interface connector or the optional OI-6000 Operator Interface. The Digital RS-232/485 connector can also be factory configured to provide hardware and software support for OI-6000 Operator Interface and half or full duplex RS-232/422/485, DeviceNet, PROFIBUS, additional Analog 4-20mA output(s), as well as voltage input and voltage output control for external gating options. The Digital RS-232/485 connector is either modified or replaced as needed to support these interface options.

For standard serial interface, mates with 7 pin Bulgin Flex Cable connector PX0745/S or Cover Cap PX0733.

For OI-6000 interface, mates with 9 pin Bulgin Flex Cable connector PX0728/P or Cover Cap PX0733.

See APPENDIX for connector pinout information.

## Software

### Host Computer requirements

A compact disc is included with the Analyzer. This CD contains software to perform Analyzer configuration and display results.

#### Minimum Host PC Requirements

- IBM PC compatible computer
- Windows XP, 7 or 8.1
- Pentium 4 / 3.00 GHz. or better processor
- 1280 X 1024 pixel resolution, 16-bit color
- 2GB System RAM
- 128MB Video RAM
- 1MB disk space
- 10/100 MB or faster Ethernet card

#### Software installation

Run Setup.msi and follow the installation instructions.

If earlier versions of Sensortech software are installed, they should be detected during the setup procedure and may be removed. It is recommended to back-up and remove any earlier known versions prior to installing the software.

#### *Starting the software*

At the completion of software installation, an icon will appear on the desktop of the host PC.



Figure 5: Sensortech Analyzer Configuration Program Icon

Double clicking the icon above will start the configuration program and display the Page shown in Figure 8.

**Note:** The Sensortech Analyzer Configuration program is used to perform Analyzer configuration. It is not intended as an HMI or logging program. For continuous monitoring of the Analyzer(s), Sensortech provides Analyzer-monitoring software for continuous monitoring using a host PC. An Operator Interface unit or process controller may also be connected to the Analyzer instead of a host PC for Analyzer configuration and monitoring measurements.

## Connecting to a Analyzer using Ethernet TCP/IP

The standard Analyzer configuration provides two interface ports for digital communications via Ethernet (TCP/IP & UDP) and RS-232/422/485 serial communications.

Optional communications protocols may be configured using the Ethernet port on an Analyzer to provide PROFINET or EtherNet/IP protocol interface for digital communications. See the Analyzer Configuration Detail sheet provided with the Analyzer to determine if a custom PROFINET or EtherNet/IP protocol interface option was installed.

### Ethernet TCP/IP Communication - Host PC to Analyzer

The starting point for Analyzer configuration is to connect the Analyzer to a host PC using the 10 ft. (3m) long Ethernet cable provided by Sensortech. The Ethernet connector on the rear of the NIR-6000 Analyzer is wired in the Crossover configuration (T-568B) for direct connection to a host PC such as a laptop, using a standard Ethernet cable (wired for T-568A). If a longer Ethernet cable is required, the user may wire a standard Ethernet cable (wired to T-568A) using the spare Ethernet Flex Connector Plug provided with the Analyzer to connect to the user network or host PC.

Set-up the host PC Ethernet TCP/IP port (v.4) settings for the factory default settings below:

	Host PC	Analyzer
<b>IP Address</b>	192.168.0.200 <sup>1</sup>	192.168.0.100
<b>Subnet Mask</b>	255.255.255.0	255.255.255.0
<b>Default Gateway</b>	192.168.0.1	192.168.0.1
<b>DNS Server</b>	192.168.0.1	192.168.0.1

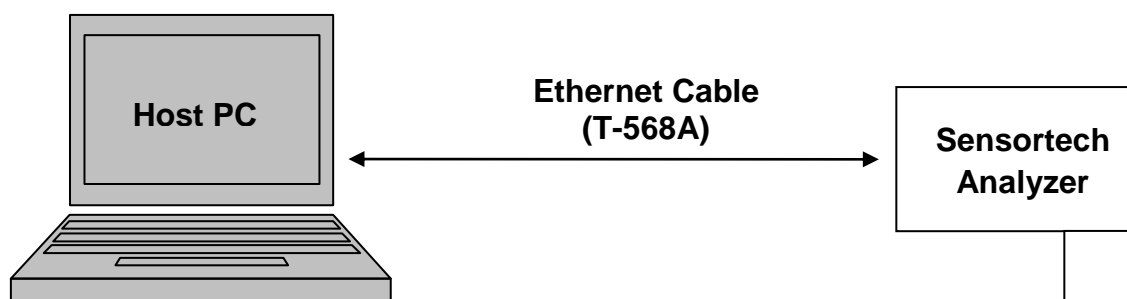


Figure 6: Ethernet TCP/IP Interface Connection

<sup>1</sup> IP Address 192.168.0.200 may be any address from 192.168.0.0 thru 192.168.0.255 excluding the default Analyzer address of 192.168.0.100

The following sections describe using the Sensortech Configuration Program to connect to the Analyzer at start-up. Changes to the Ethernet settings for your network are described in the Ethernet Configuration Page section.

See the APPENDIX for Ethernet wiring and connector information.

## Connecting to an Analyzer using RS-232 or RS-485

The default Analyzer configuration provides for serial communication via the Digital RS-232/485 port on the rear of the Analyzer. Optional communication protocols may be added to an Analyzer to provide DeviceNet, PROFIBUS, or RS-422 interface for digital communications. The RS-232/485 interface port may be modified or replaced to support optional External Gate Control, DeviceNet or PROFIBUS interface configurations. See the Analyzer Configuration Detail sheet provided with the Analyzer to determine if a custom option was installed.

### RS-232 or RS-485 Serial Communication - Host PC to Analyzer

On standard Analyzers, an alternative to using the Ethernet TCP/IP communication link is to connect using the RS-232/485 serial port. The starting point for Analyzer configuration would be to connect the Analyzer to a host PC using the serial interface. The user would need to provide or create a serial cable, for either RS-232 or RS-485 communication, using the Bulgin Flex Cable Connector Plug provided with the Analyzer. A typical RS-232 connection can be made using the DB-9 port (or to an optional USB to RS-232 / 485 converter) on the host PC to connect to the Digital RS-232 / 485 port on the Analyzer.

After creating the serial cable, connect the host PC to the Analyzer using the factory default settings below:

	Host PC	Analyzer
<b>Baud Rate</b>	19200	19200
<b>Protocol</b>	N/A	Modbus
<b>Stop Bits</b>	1	1
<b>Data Bits</b>	8	8
<b>Parity</b>	None	None
<b>Flow Control</b>	None	None

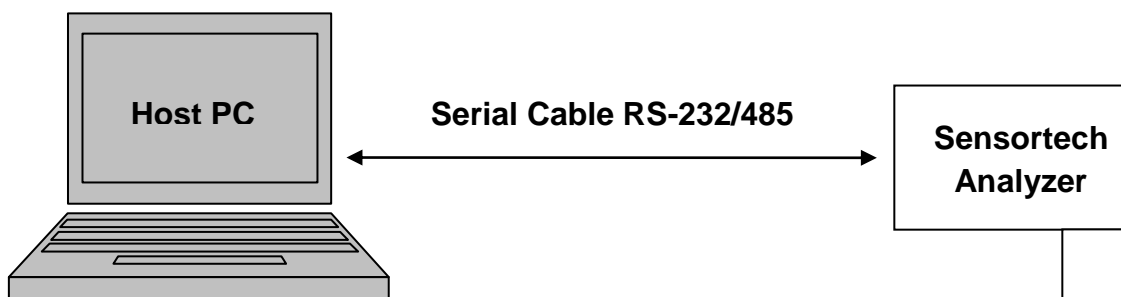


Figure 7: Digital RS-232/422/485 Serial Interface Connection

Changes to the serial interface settings are described in the Serial/4-20mA Configuration Page section.

See the APPENDIX for Digital RS-232/485 Connector wiring and connector information.



## Connecting Analyzer to the OI-6000 Operator Interface

An Analyzer configuration option replaces the 7 pin Digital RS-232/485 connector with a 9 pin OI-6000 Interface connector. This option allows the user to connect the OI-6000 to an OI-Digital RS-232/485 port on the rear of the Analyzer. See the Analyzer Configuration Detail sheet provided with the Analyzer to determine if a custom option was installed.

### OI-6000 Interface – OI-6000 Operator Interface to Analyzer

On standard Analyzers, an alternative to using the Ethernet TCP/IP communication link is to connect using the OI-6000 Operator Interface. The OI-6000 cable is connected to the 9 pin OI-Digital connector on the rear of the Analyzer.

Connect the OI-6000 Operator Interface to the Analyzer using the settings below:

	OI-6000	Analyzer
<b>Baud Rate</b>	19200	19200
<b>Protocol</b>	N/A	Modbus
<b>Stop Bits</b>	1	1
<b>Data Bits</b>	8	8
<b>Parity</b>	None	None
<b>Flow Control</b>	None	None

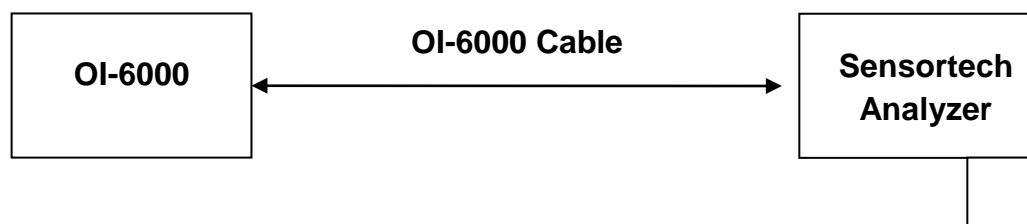


Figure 8: OI-6000 Interface Connection

Changes to the serial interface settings are described in the Serial/4-20mA Configuration Page section.

See the APPENDIX for OI-Digital RS-232/485 Connector wiring and connector information.

## Analyzer Configuration

### Main Page – at Startup

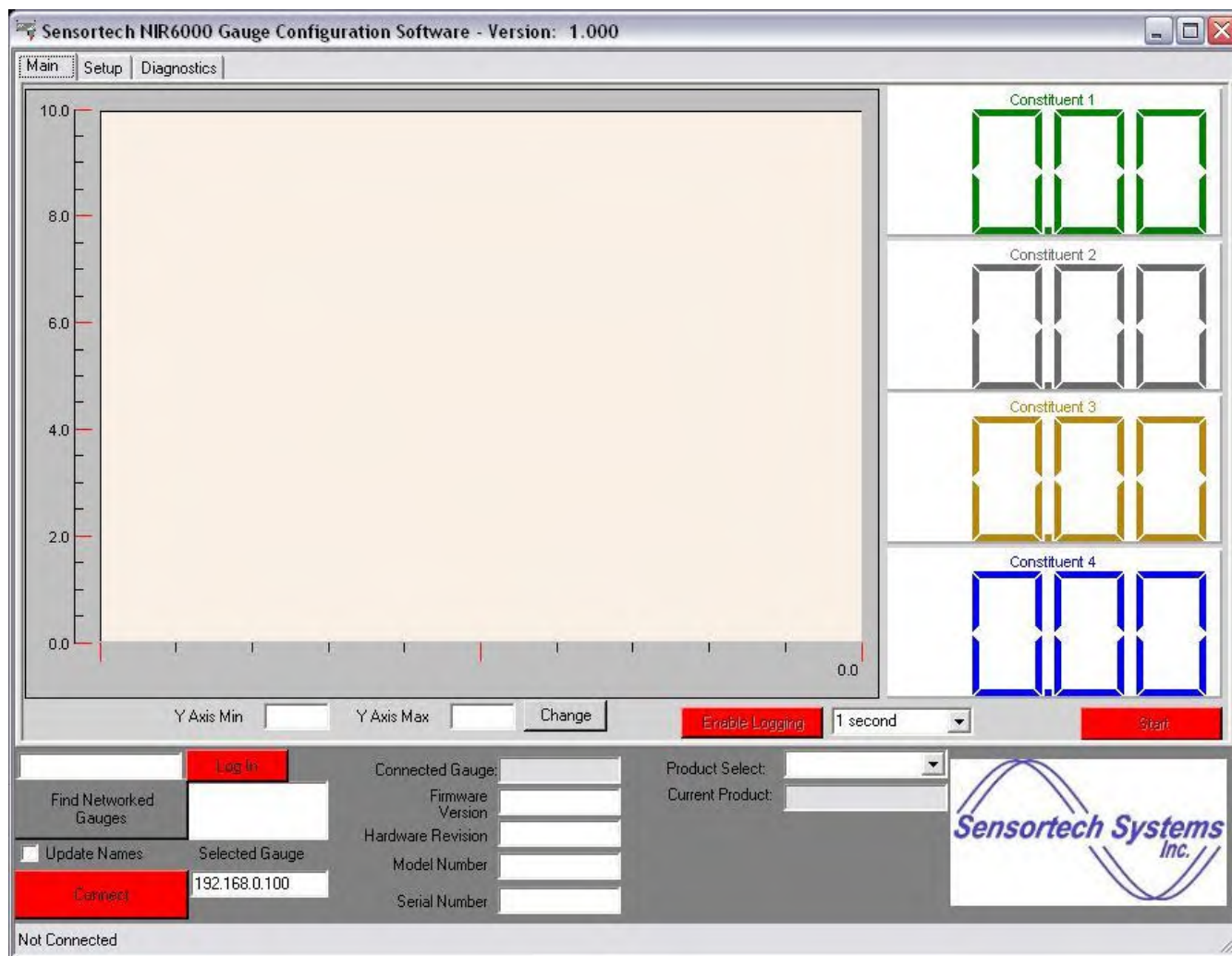


Figure 9: Main Page at Startup - Not Connected to an Analyzer

To initiate connection between the host PC and an Analyzer click on "Find Networked Gauges" button on the lower left of the Main Page. All Analyzers connected to the host PC will be displayed in the "Gauge List" box located in the lower left.

For Ethernet TCP/IP, connect to a specific Analyzer using Ethernet TCP/IP, highlight that Analyzer by double-clicking on the 'DefaultID' listed in the "Gauge List" box and the selected 'DefaultID' will appear in the "Selected Gauge" field above the "Gauge List".

For Serial RS-232 or RS-485, connect to a Analyzer using the serial interface COMx (where x = 1 - 9), highlight the COMx by double-clicking on the COMx listed in the "Gauge List" box and the selected COMx port will appear in the "Selected Gauge" field above the "Gauge List".

Press the red "Connect" button at the lower left. When an Analyzer is connected, the "Connect" button will change color from red to green and the information fields to the right of the "Connect" button will display the data read from the connected Analyzer.

## Main Page – Analyzer Connected

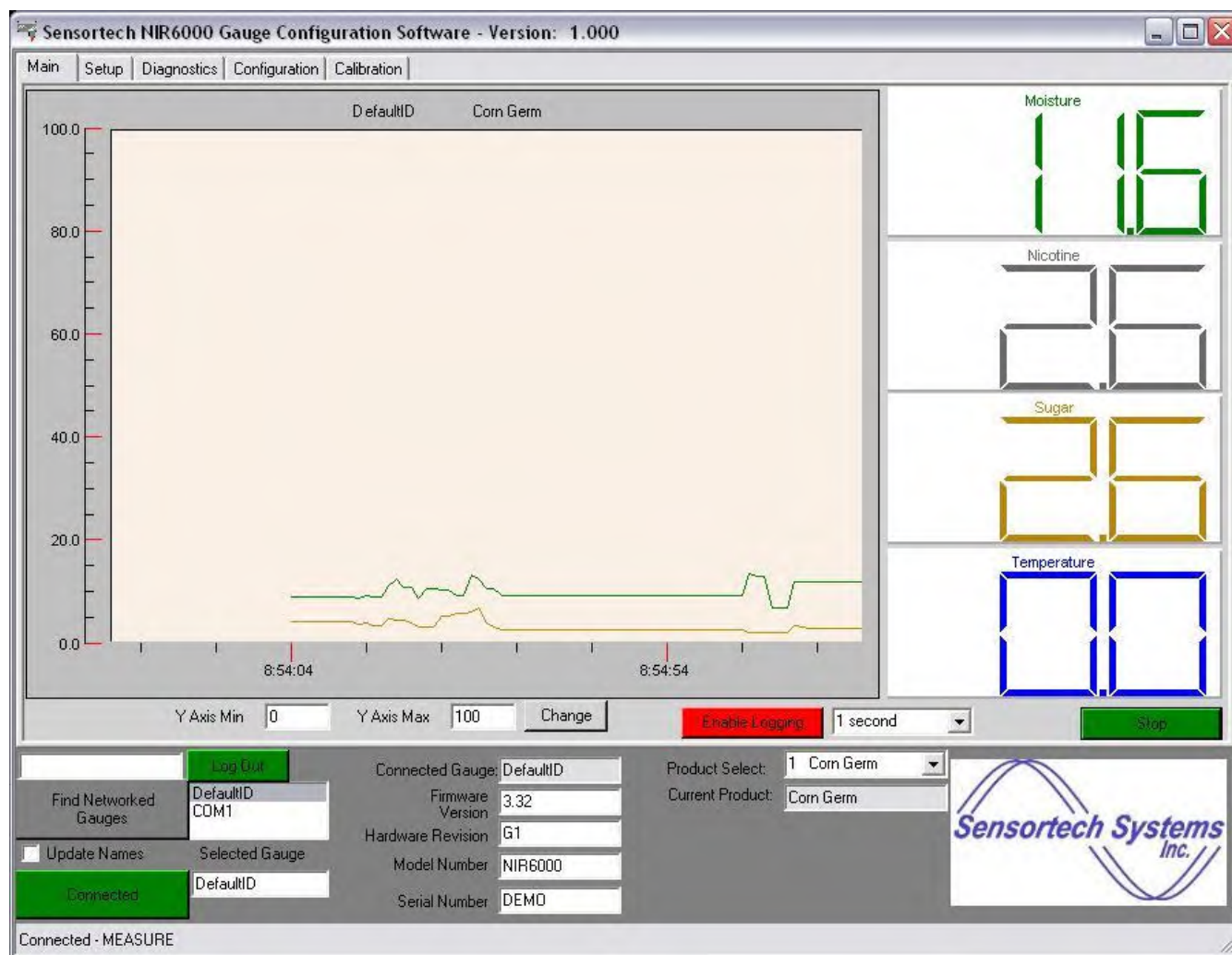


Figure 10: Main Page with an Analyzer Connected

To display moisture and commence a time plot, press the "Start" button after the "Connect" button has turned green. When a measurement has started, the "Start" button will change color from red to green and the displays on the upper right will indicate the measured value selected and the trend plot in the upper left will begin to display the measured value and time plot as in Figure 9.

The Main Page above is shown after an Analyzer is connected to the host PC, the user has logged in using the factory default password and a moisture measurement has started.



The Main Page configuration and field descriptions are as follows (beginning at upper left of Page):

1. Sensortech Configuration Software Version is displayed in upper bar.
2. At startup, the Main Page shows three tabs in the upper left, namely: **Main**, **Setup** and **Diagnostics**. The Analyzer configuration functions are password protected for security. Entering the appropriate password enables more tabs at the top of Page for access to additional Analyzer functions: **Configuration** and **Calibration**. Select the Tab for each of the **Setup**, **Diagnostics Configuration** and **Calibration** Pages to select the Analyzer configuration desired.
3. Trend Chart Display of time vs. measured value plot of all selected constituents to be measured and displayed.
4. Digital Display of Measurement Values for selected constituents.
5. Y Axis Min: Minimum value of lowest measured value to display. User defined.
6. Y Axis Max: Maximum value of highest measured value to display. User defined.
7. Change button: sends the new 'Y Axis Min' and 'Y Axis Max' values to configure the plot display.
8. Enable/Disable Logging button: starts or stops the data log, which stores measurement data directly into a file that can be viewed by Microsoft Excel or similar program. Pressing the red "Enable Logging" button will open a window where you can create and name the file. Once the file is named, press 'Open' to activate this function. Press the Start/Stop button to begin data logging. The measurements will be stored in the data log file until the user presses "Disable Logging" button or the Configuration program is closed.
9. Drop-down menu (1 second) selects the time interval for updating the displays for each constituent and the sample rate used for data log of measurements.
10. Start/Stop button: begins the display and plot of a measurement on the Main Page. It also starts and stops the data log of measurements.
11. Password entry field and Login/Log Out button: Press the Login button after entering the Engineering password "engpass" and the button changes from red to green. The default is operator level control when no password is entered. Note: Log out each time you are finished to prevent unauthorized access to Analyzer configuration settings.
12. Find Networked Gauges button: Queries all of the Analyzers connected to the host PC and displays a list of Analyzers that are detected and can be connected to the host PC using the Configuration program.
13. Gauge List field: Displays a list of the GaugeID names for all Analyzers currently available that can be selected to connect to the Configuration program. Only one Analyzer may be connected at a time to the Configuration program.
14. Update Names: Checkbox selects all Product specific data stored in the Analyzer to be read by the Configuration program and over-writes all product data in the Configuration program.
15. Connect button: initiates the data connection between the host PC and Analyzer. The button is red when not connected to an Analyzer and changes to green when an Analyzer is connected.
16. Selected Gauge: Displays the GaugeID name of the Analyzer currently connected to the host PC using the Configuration program.
17. Fields displaying information of Connected Gauge, Firmware Version, Hardware Revision, Model Number and Serial Number for the Analyzer.
18. Product Select: Drop-down menu (1 Corn Germ) to select the Product configuration to be used for the current measurement.

19. Current Product: Displays the Product name of the currently active product configuration.
20. Lower status display bar is updated with current Analyzer and measurement status. See Table 2 for Analyzer status and error messages.

## Setup Page

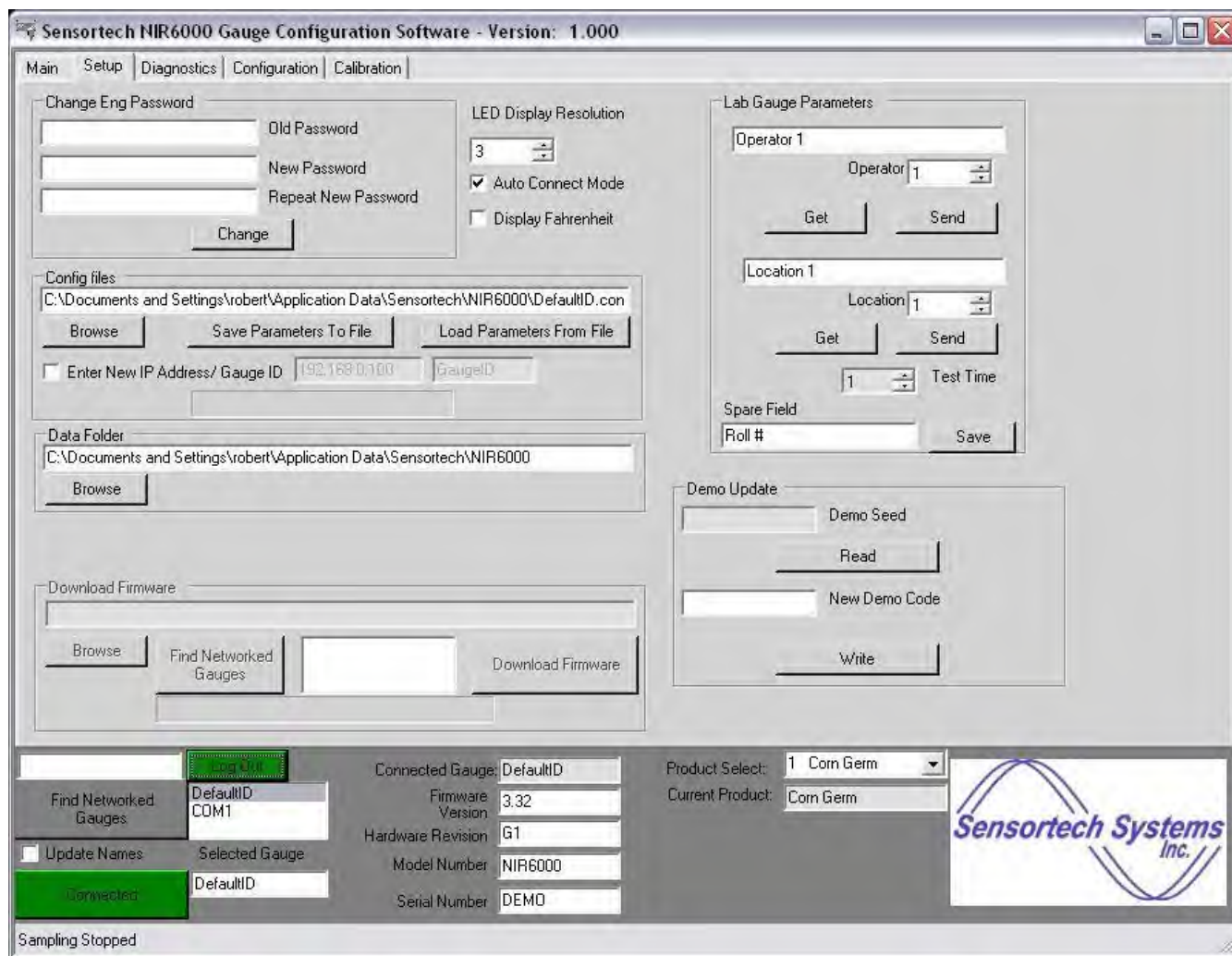


Figure 11: Setup Page

The Setup Page is shown in Figure 10 above. From this Page it is possible to create new user passwords, which will change the factory default. Changes to Setup Page configurations will take place when a new field is entered or a button is pressed.

The Setup Page descriptions are as follows (from upper left of Page):

Change Eng Password Box - allows you to change your password for access to the Calibration and the Configuration Pages

1. Old Password: Enter the factory default or a previously entered user defined password.





2. New Password: Enter a new user defined password (alphanumeric characters).
3. Repeat New Password: Re-enter new user defined password.
4. Change button: Sends and stores the new password entered.
5. LED Display Resolution: The display resolution can be changed from 0, 1, 2, 3, and 4 to display from zero to four decimal places to obtain the desired resolution. This setting controls the number of decimal places displayed on all measurement display Pages.
6. Auto Connect Mode checkbox: When selected, will automatically connect to Ethernet TCP/IP devices connected to the Ethernet port such as an Operator Interface unit.
7. Display Fahrenheit checkbox: Allows the user to display the temperature readings either in Celsius that is the default setting or by selecting the checkbox to obtain the temperature in Fahrenheit.
8. Save Parameters To File button: Allows the user to save the current Analyzer configuration and parameters to a file specified in the "C:\pathname\filename" field above the button.
9. Load Parameters From File button: Allows the user to load a previously saved Analyzer configuration and parameters from the file specified in the "C:\pathname\filename" field above the
10. Enter New Gauge IP Address / GaugeID checkbox: Allows the user to change the current IP address for the Analyzer and/or the GaugeID name. New IP address or GaugeID may be entered in the fields above the checkbox.
11. Data Folder: specifies the pathname where all gauge data will be stored.
12. Download Firmware: The internal processor can be programmed by using this function.
13. Find Networked Gauges: Press this button to query the Analyzers connected to the host PC and display a list of available Analyzers that may be connected to the host PC using the Configuration program.

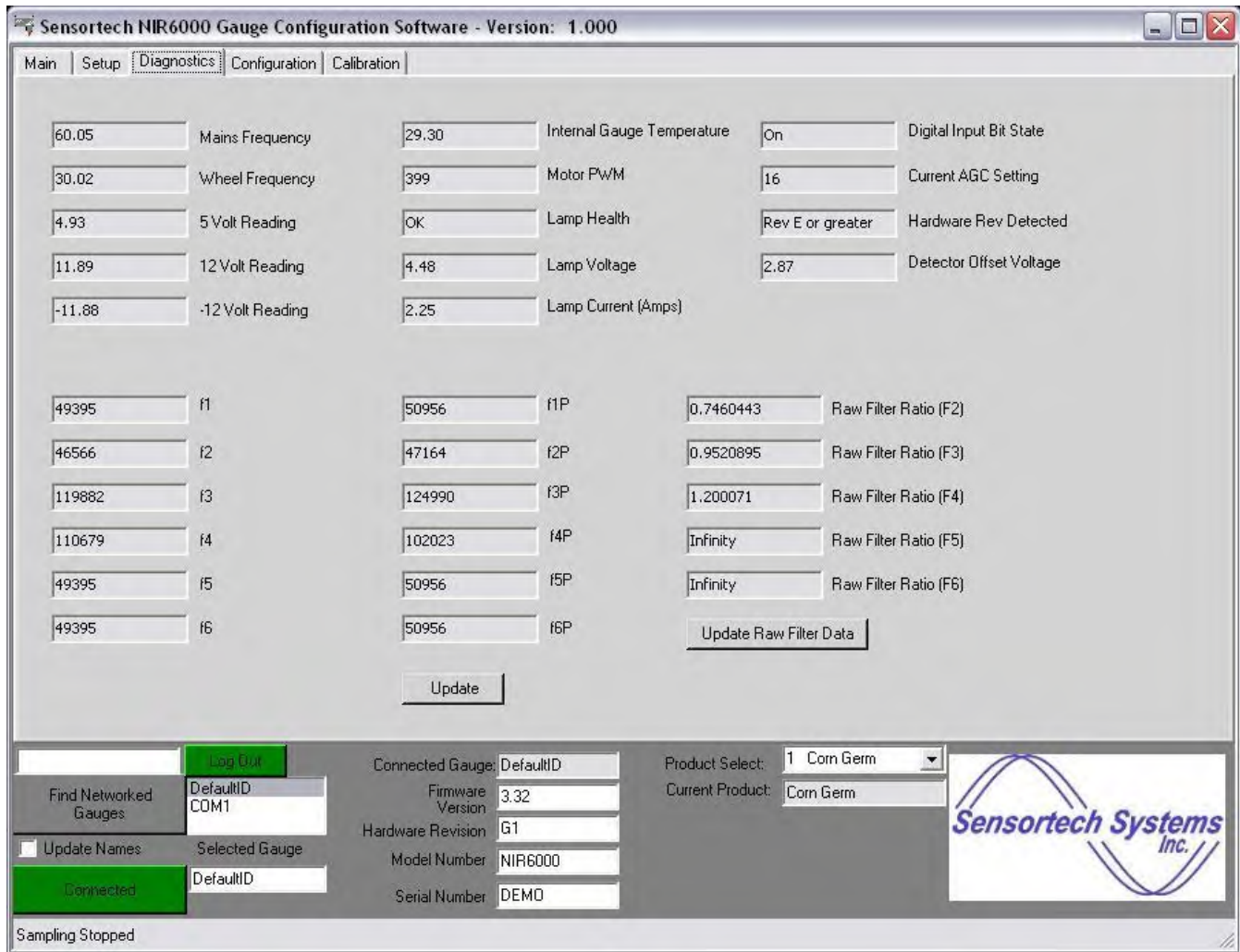
*Lab Gauge Parameters Box* – Allows configuration of Lab Analyzer parameters.

14. Operator: Operator Name text is entered into field and selected by the number selector.
15. Location: Location Name text is entered into field and selected by the number selector.
16. Test Time: Number of seconds to make a single measurement.
17. Spare Field: (for factory use only)

*Demo Update Box* – (for factory use only).

18. Demo Seed: (for factory use only)
19. New Demo Code: (for factory use only)

## Diagnostics Page



**Sensortech NIR6000 Gauge Configuration Software - Version: 1.000**

Main | Setup | **Diagnostics** | Configuration | Calibration


60.05	Mains Frequency	29.30	Internal Gauge Temperature	On	Digital Input Bit State
30.02	Wheel Frequency	399	Motor PWM	16	Current AGC Setting
4.93	5 Volt Reading	OK	Lamp Health	Rev E or greater	Hardware Rev Detected
11.89	12 Volt Reading	4.48	Lamp Voltage	2.87	Detector Offset Voltage
-11.88	-12 Volt Reading	2.25	Lamp Current (Amps)		

49395	f1	50956	f1P	0.7460443	Raw Filter Ratio (F2)
46566	f2	47164	f2P	0.9520895	Raw Filter Ratio (F3)
119882	f3	124990	f3P	1.200071	Raw Filter Ratio (F4)
110679	f4	102023	f4P	Infinity	Raw Filter Ratio (F5)
49395	f5	50956	f5P	Infinity	Raw Filter Ratio (F6)
49395	f6	50956	f6P		

Connected Gauge: DefaultID  
Firmware Version: 3.32  
Hardware Revision: G1  
Model Number: NIR6000  
Serial Number: DEMO

Product Select: 1 Corn Germ  
Current Product: Corn Germ



Sampling Stopped

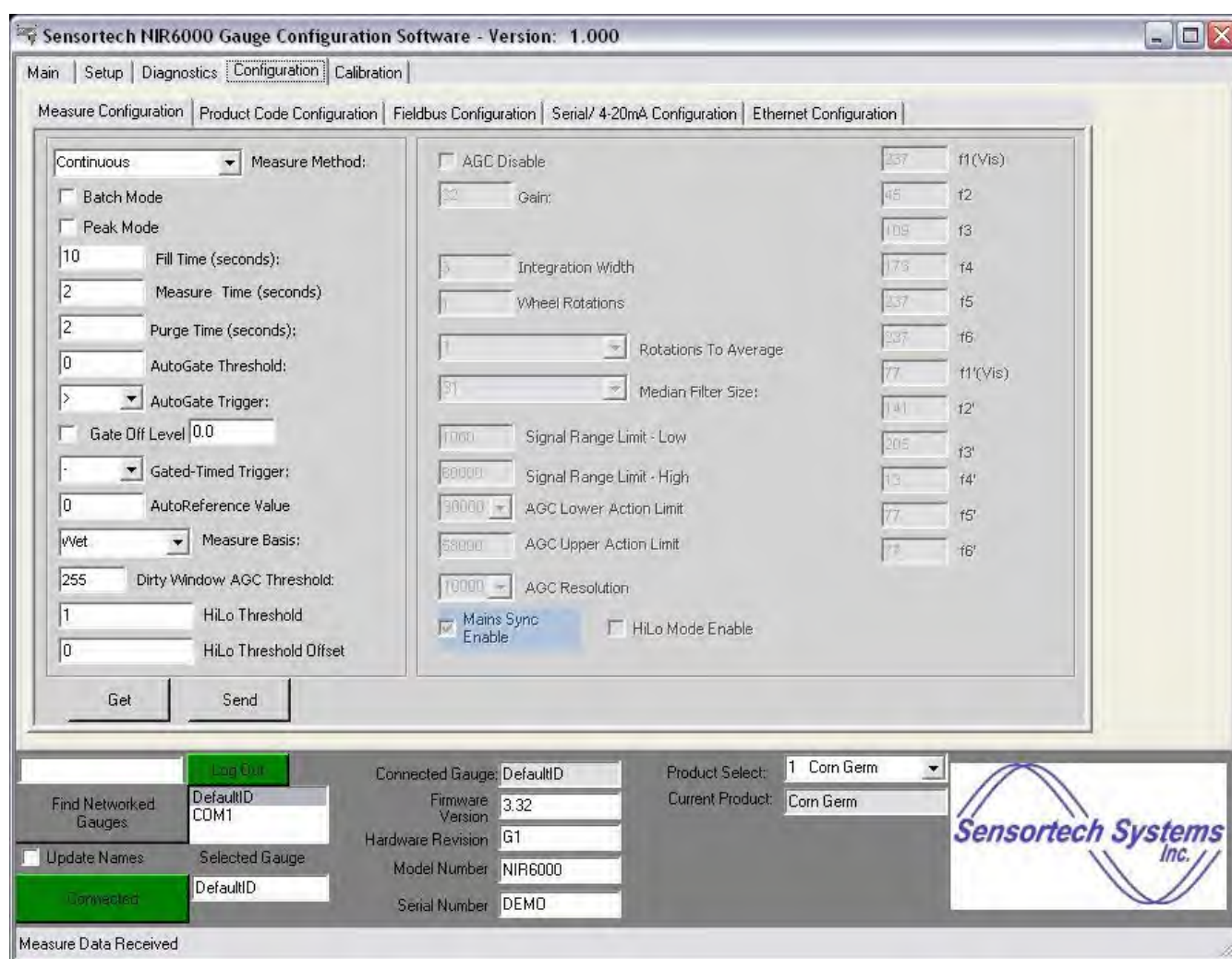
Figure 12: Diagnostics Page

The Diagnostics Page is shown in Figure 11 above. The Diagnostic values are loaded when the “Update” button is pressed and the current Analyzer information will be displayed. The Diagnostics Page field descriptions are as follows (from upper left of Page):

1. Mains Frequency: Displays 50Hz or 60Hz mains frequency supplied to Analyzer.
2. Wheel Frequency: Displays Analyzer filter wheel rotation frequency in rotations per second.
3. 5 Volt Reading: Displays internal +5V power supply voltage monitor.
4. 12 Volt Reading: Displays internal +12V power supply voltage monitor.
5. -12 Volt Reading: Displays internal -12V power supply voltage monitor.
6. Internal Gauge Temperature: displays Analyzer internal temperature.
7. Motor PWM: Displays pulse width modulation of the filter motor.
8. Lamp Health: Displays the condition of the Lamp. "OK" is displayed on a working Lamp.

9. Lamp Voltage: Displays voltage at which the Lamp is biased.
10. Lamp Current (Amps): Displays DC current provided to the Lamp.
11. Digital Input Bit State: Displays the state of the digital input whether ON or OFF.
12. Current AGC Setting: Displays the signal gain set by the Automatic Gain Control.
13. Hardware REV Detected: Automatically detects and displays the Hardware Revision of the Main PCB installed in the Analyzer.
14. Detector Offset Voltage: Displays the offset voltage of the detector.
15. f1-f6, f1P-f6P, Raw Filter Ratio (F2-F6): Internal Analyzer signals (for factory use only)

## Measure Configuration Page



Sensortech NIR6000 Gauge Configuration Software - Version: 1.000

Main | Setup | Diagnostics | **Configuration** | Calibration

Measure Configuration | Product Code Configuration | Fieldbus Configuration | Serial/ 4-20mA Configuration | Ethernet Configuration

Continuous  Measure Method:

☐ Batch Mode

☐ Peak Mode

10 Fill Time (seconds):

2 Measure Time (seconds):

2 Purge Time (seconds):

0 AutoGate Threshold:

> AutoGate Trigger:

☐ Gate Off Level 0.0

☐ Gated-Timed Trigger:

0 AutoReference Value

Wet Measure Basis:

255 Dirty Window AGC Threshold:

1 HiLo Threshold

0 HiLo Threshold Offset

☐ AGC Disable

32 Gain:

5 Integration Width

1 Wheel Rotations

1 Rotations To Average

31 Median Filter Size:

1000 Signal Range Limit - Low

80000 Signal Range Limit - High

30000 AGC Lower Action Limit

58000 AGC Upper Action Limit

10000 AGC Resolution

☒ Mains Sync Enable ☐ HiLo Mode Enable

437 f1(Vis)

46 f2

105 f3

175 f4

437 f5

837 f6

77 f1'(Vis)

141 f2'

305 f3'

13 f4'

77 f5'

75 f6'

Get Send

Find Networked Gauges

DefaultID COM1

Update Names

Selected Gauge

DefaultID

Connected

Measure Data Received

Connected Gauge: DefaultID

Firmware Version: 3.32

Hardware Revision: G1

Model Number: NIR6000

Serial Number: DEMO

Product Select: 1 Corn Germ

Current Product: Corn Germ

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Figure 13: Measure Configuration Page

After entering the password, click on the 'Configuration' tab, the Measure Configuration Page shown in Figure 12 will be displayed. The Page allows the user to select the mode of measurement and to set various parameters associated with this mode.



The user may change Analyzer measure configuration and data field values on the left side of the Page. Factory preset Analyzer configuration and data fields on the right side of the Page are not user configurable.

The Measure Configuration Page descriptions are as follows (from upper left of Page):

1. Measure Method: drop-down menu selects the measurement mode of the Analyzer. An Analyzer can be configured to operate in one of 5 different measurement modes as described in Table 1.

MEASUREMENT MODE	DESCRIPTION
<b>Continuous</b>	Measures continuously
<b>Signal Gated</b>	An external input signal is provided to the Analyzer, which enables a measurement sample for a true logic input voltage. A false logic input voltage disables measurement and the last measurement is held.
<b>Auto Gated</b>	Similar to signal gated, but gating is enabled by using the measured moisture level. A moisture level threshold is programmed in Gate Off Level and the Auto Gate Trigger is selectable for less than or greater than the Gate Off Level threshold.
<b>Timed Sample</b>	This is used when a sampling device is attached to the Analyzer such as a Snorkel Sampler, which collects a material sample for measurement, performs a measurement then purges the sample container to begin a new measurement. Programmable functions for this mode include Fill Time, Measure Time and Purge Time.
<b>Gate Timed</b>	An external input signal is provided to the Analyzer, which enables measurement sample for a timed interval for a true logic input voltage. The Measure Time interval is programmable.
<b>Auto Reference</b>	A measurement is made on an uncoated web as a reference for zero coating. This value is stored and sets the zero value offset for additional coating measurements. This accounts for basis weight changes.

Table 1: Modes of Operation

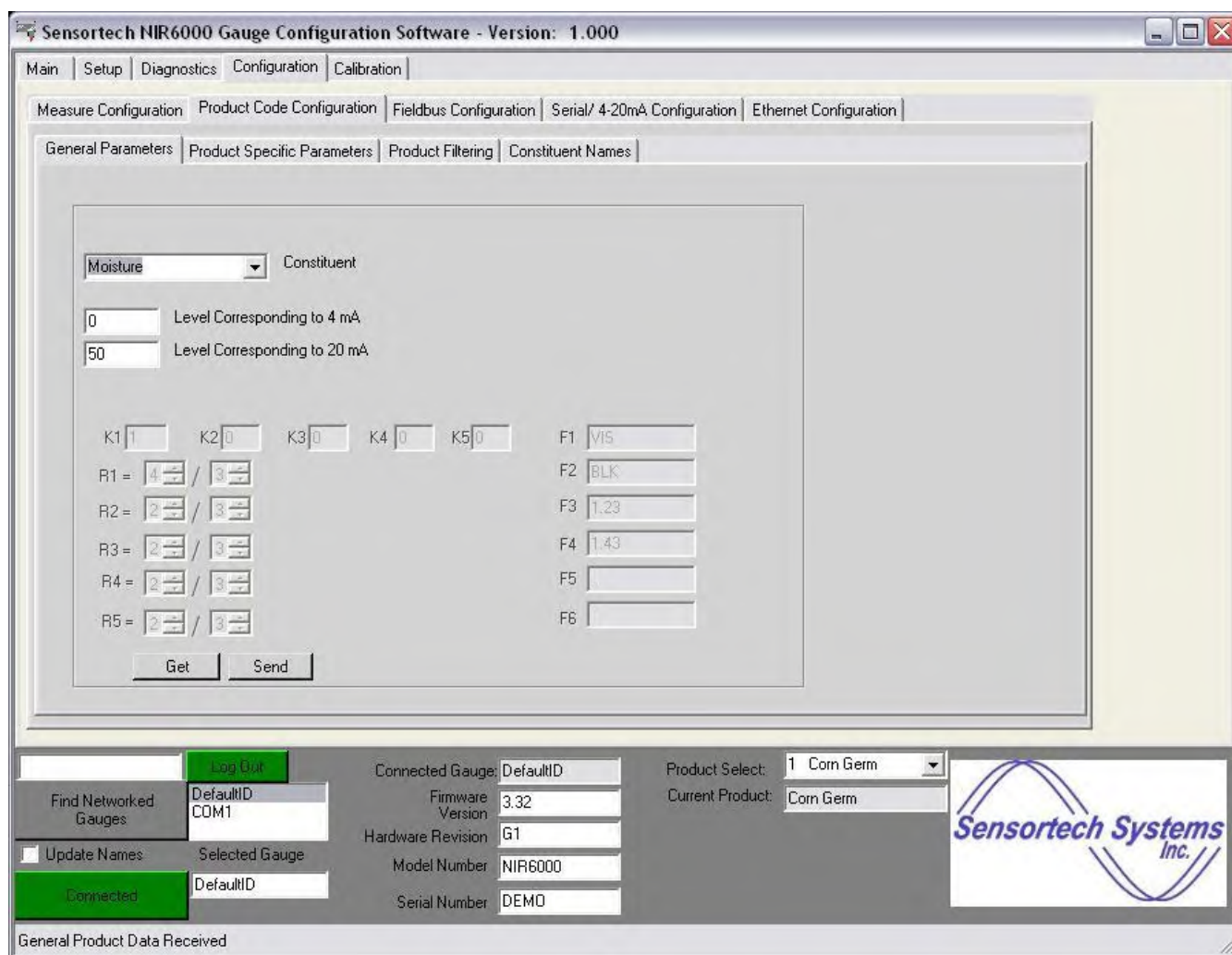
2. Batch Mode checkbox: This can be applied to all measurement modes except for Continuous. The measurement will be averaged during the period that the “gate” is active. The average of the measured values will be displayed when the gate is inactive.
3. Peak Mode checkbox: This can be applied to all measurement modes. Only the peak (highest) value measured is displayed instead of the average.
4. Fill Time (seconds): Used in Timed Sample mode to define the period (in seconds) to collect a material sample for measurement. No measurements are made during this period.
5. Measure Time (seconds): Used in Timed Sample mode to define the period (in seconds) to measure a sample.
6. Purge Time (seconds): Used in Timed Sample mode to define the period (in seconds) to purge a material sample collected for measurement. No measurements are made during this period.
7. AutoGate Threshold: Drop-down menu used in Auto Gate mode to set the measured value required to begin measurements.

8. AutoGate Trigger: Drop-down menu used in Auto Gate mode to set the direction of change in moisture measurement to trigger a valid measurement. When "<" or ">" is selected a measured value less than or greater than the Auto Gate Off Level triggers a valid measurement.
9. Gate Off Level checkbox: Selecting the checkbox enables Auto Gate mode and the level is entered in to the adjacent field to set the measured value required to stop measurements.
10. Gated-Timed Trigger: Used in Gate Timed mode to define an interval (in seconds) to perform measurements after an external gate signal switches from logic low to logic high.
11. AutoReference Value: Used in Auto Reference mode to provide an offset value as the new zero level for subsequent measurements.
12. Measure Basis: Used by all modes to set the 'Wet' or 'Dry' measurement basis. Note: Calibration always uses 'Wet' basis.
13. Dirty Window AGC Threshold: Used by all modes to set the maximum gain threshold for Analyzer automatic gain control (AGC) operation. When the Analyzer AGC exceeds the threshold, an error message is displayed to the user and may be monitored by a PLC control system to indicate the viewing window is obscured and cleaning / maintenance is required.
14. HiLo Threshold: This mode is factory configured and requires a HiLo filter wheel option. It is used when HiLo Mode is enabled to set the measured moisture threshold to switch the Analyzer from a low moisture range measurement to a high moisture range measurement. The low moisture range is selected automatically when the measurement is below the HiLo Threshold minus HiLo Threshold Offset values.
15. HiLo Threshold Offset: Used when HiLo Mode is enabled to set the measured moisture offset to switch the Analyzer from a high moisture range measurement to a low moisture range measurement.

The "Get" button loads information from the Analyzer and the "Send" button writes to the Analyzer.

Note: Every Analyzer is set at the factory for the Analyzer configuration ordered and predefined values have been set according to the product and measurement requirements specified. Care should be taken when changing any factory configuration or preset values to ensure that the Analyzer will perform the measurement in the mode desired.

## Product Code Configuration – General Parameters Page



Sensortech NIR6000 Gauge Configuration Software - Version: 1.000

Main | Setup | Diagnostics | Configuration | Calibration

Measure Configuration | Product Code Configuration | Fieldbus Configuration | Serial/ 4-20mA Configuration | Ethernet Configuration

General Parameters | Product Specific Parameters | Product Filtering | Constituent Names

Moisture Constituent

0 Level Corresponding to 4 mA

50 Level Corresponding to 20 mA

K1 1 K2 0 K3 0 K4 0 K5 0

R1 = 4 / 3

R2 = 2 / 3

R3 = 2 / 3

R4 = 2 / 3

R5 = 2 / 3

F1 VIS

F2 BLK

F3 1.23

F4 1.43

F5

F6

Get Send

Log Out

Find Networked Gauges DefaultID COM1

Update Names Selected Gauge

Connected DefaultID

General Product Data Received

Connected Gauge: DefaultID

Firmware Version: 3.32

Hardware Revision: G1

Model Number: NIR6000

Serial Number: DEMO

Product Select: 1 Corn Germ

Current Product: Corn Germ

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Figure 14: Product Code Configuration - General Parameters Page

The General Parameters Page allows the user to define the Analog / 4-20mA output range for each Constituent being measured.

The General Parameters Page descriptions are as follows (from upper left of Page):

1. Constituent: drop-down menu to select a Constituent to be configured.
2. Level Corresponding to 4 mA: measurement value that will produce an output of 4mA.
3. Level Corresponding to 20 mA: measurement value that will produce an output of 20mA.

The remaining fields contain factory preset Analyzer configuration and data fields, which are “grayed” out in the lower half of the Page, are not user configurable.

The “Get” button loads information from the Analyzer and the “Send” button writes to the Analyzer.

## Product Code Configuration – Product Specific Parameters Page

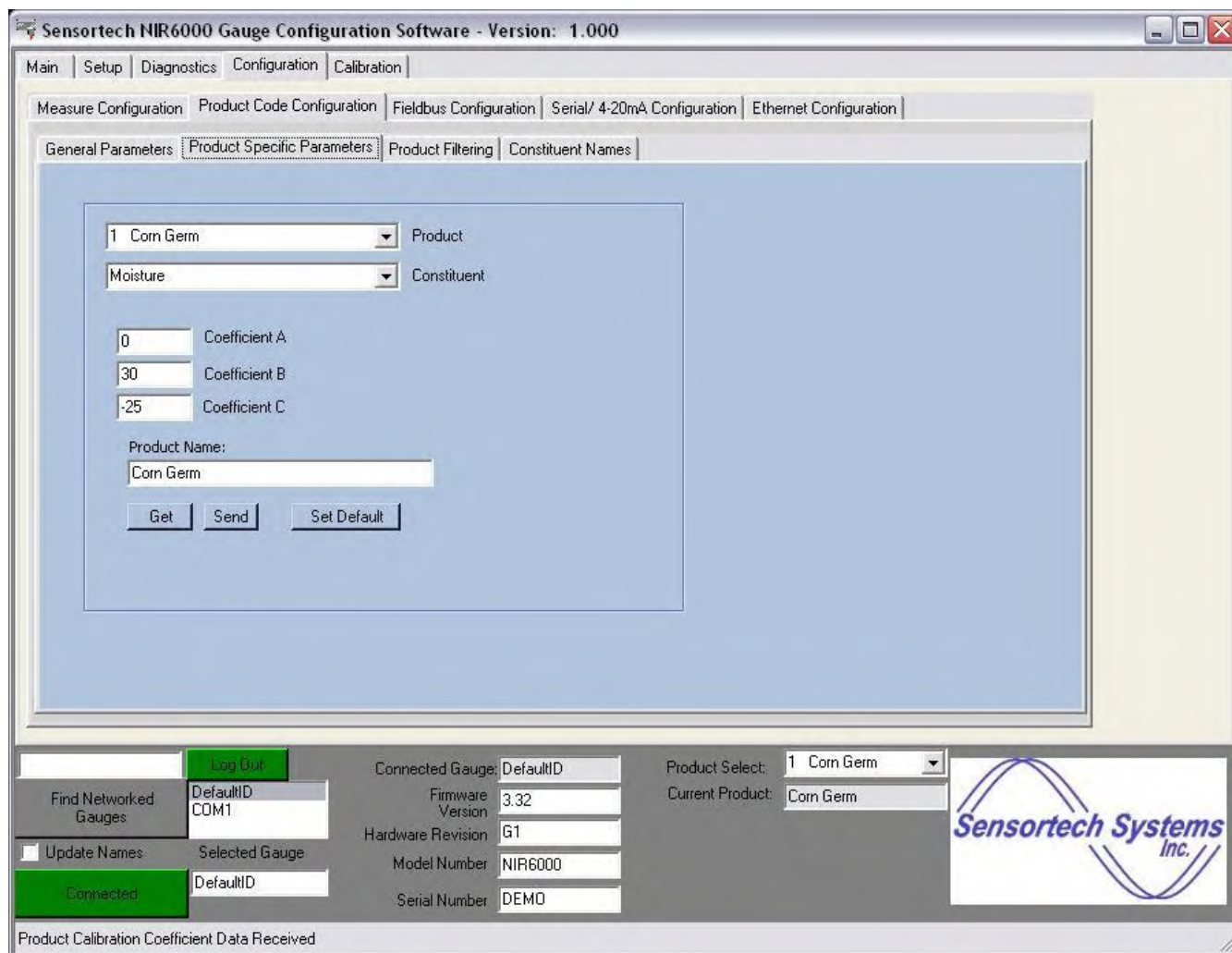


Figure 15: Product Specific Parameters Page

The Product Specific Parameters Page allows the user to enter up to 50 Product Names and configure the Analyzer coefficients for each Constituent measured for each Product. The Analyzer stores the configuration information for 50 product codes within the on-board flash memory.

Product Specific Parameters Page descriptions are as follows (from upper left of Page):

1. Product: drop-down menu that allows the user to select the Product information to be displayed. A Product name can be set by entering the name of the product in Product Name field.
2. Constituent: drop-down menu that allows the user to select the Constituent information to be displayed.
3. Coefficient A: always zero unless a quadratic curve fit is used. This is for more advanced users and is not covered in the technical manual.



4. Coefficient B: user programmable positive value that defines the measurement slope. A higher 'B' value increases Analyzer sensitivity.
5. Coefficient C: user programmable positive or negative value that defines the measurement offset.
6. Product Name: user defined name composed of alphanumeric characters.

The "Get" button loads information from the Analyzer and the "Send" button writes to the Analyzer.

The "Set Default" button is a shortcut that loads the default coefficient values into the fields. The default coefficient values are  $A = 0$ ,  $B = 30$  and  $C = -25$  and may be changed by the user by entering values into the appropriate fields on this Page or by using the Calibration procedure described in this manual.

Note: When specified, an Analyzer will be pre-calibrated prior to shipping and a suitable Coefficient values for A, B and C will be preset at the factory. Samples may need to be supplied to Sensortech to ensure the calibration is performed on the materials being measured.

## Product Code Configuration – Product Filtering Page

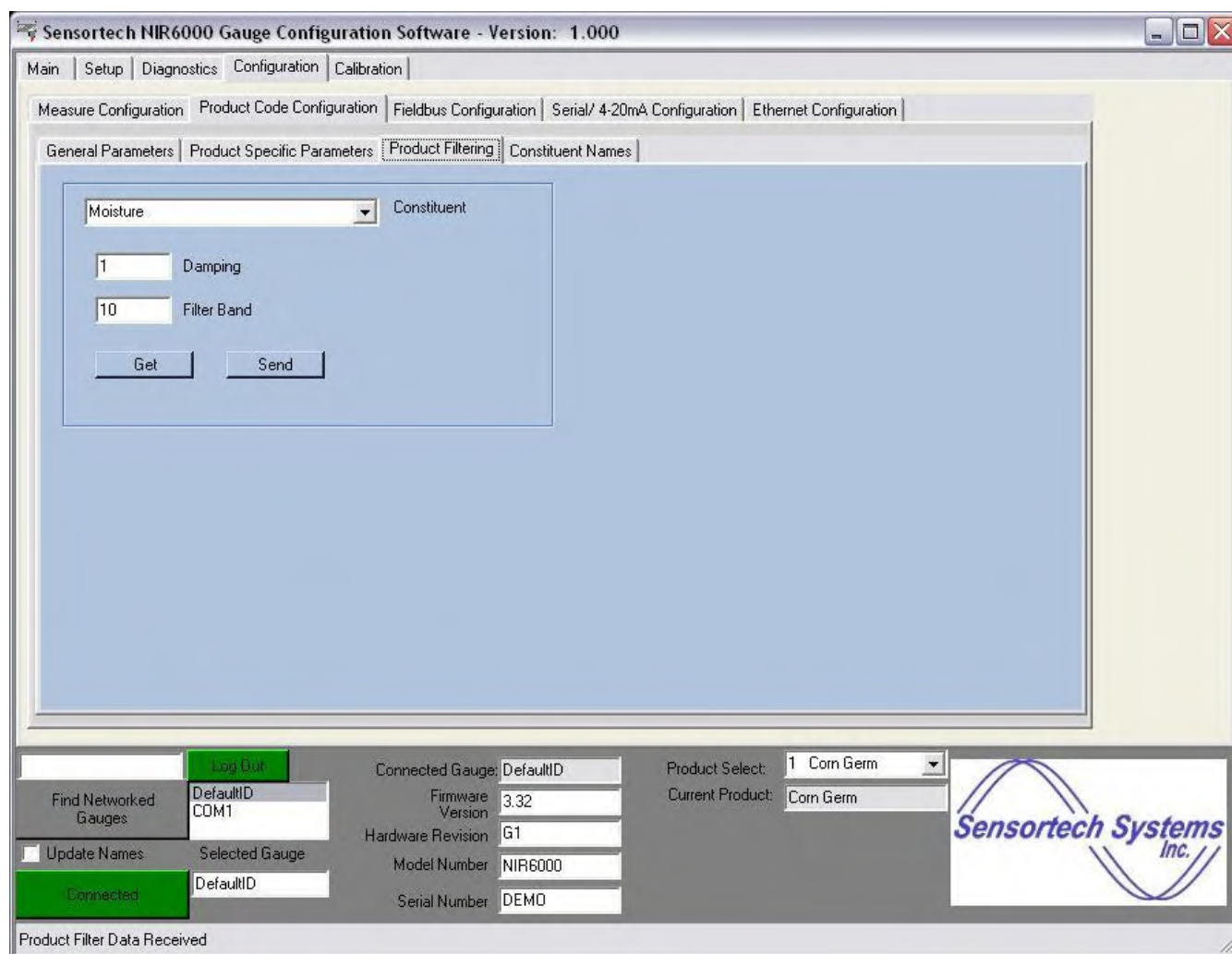


Figure 16: Product Filtering Page

The Product Filtering Page allows the user to configure the Damping and Filter Band values. The Product Filtering Page descriptions are as follows (from upper left of Page):

1. Constituent: Drop-down menu that allows the user to select the Constituent information to be displayed.
2. Damping: Number of measurement samples to display as a moving average. For example, if a Damping value of 10 is entered, then the average of the last 10 measurement samples is displayed. Damping has a smoothing effect on the Analyzer response to measurement changes. A large Damping value will delay the response to measurement changes. The measurement sample update rate is not affected by the Damping value.
3. Filter Band: The Analyzer also contains a programmable Filter Band where any measurement changes within this band will have damping applied. However, measurement changes exceeding the Filter Band value bypass the Damping function. In this way, small, steady state fluctuations are smoothed by damping, but changes greater than the Filter Band value are immediately displayed.



The “Get” button loads information from the Analyzer and the “Send” button writes to the Analyzer.

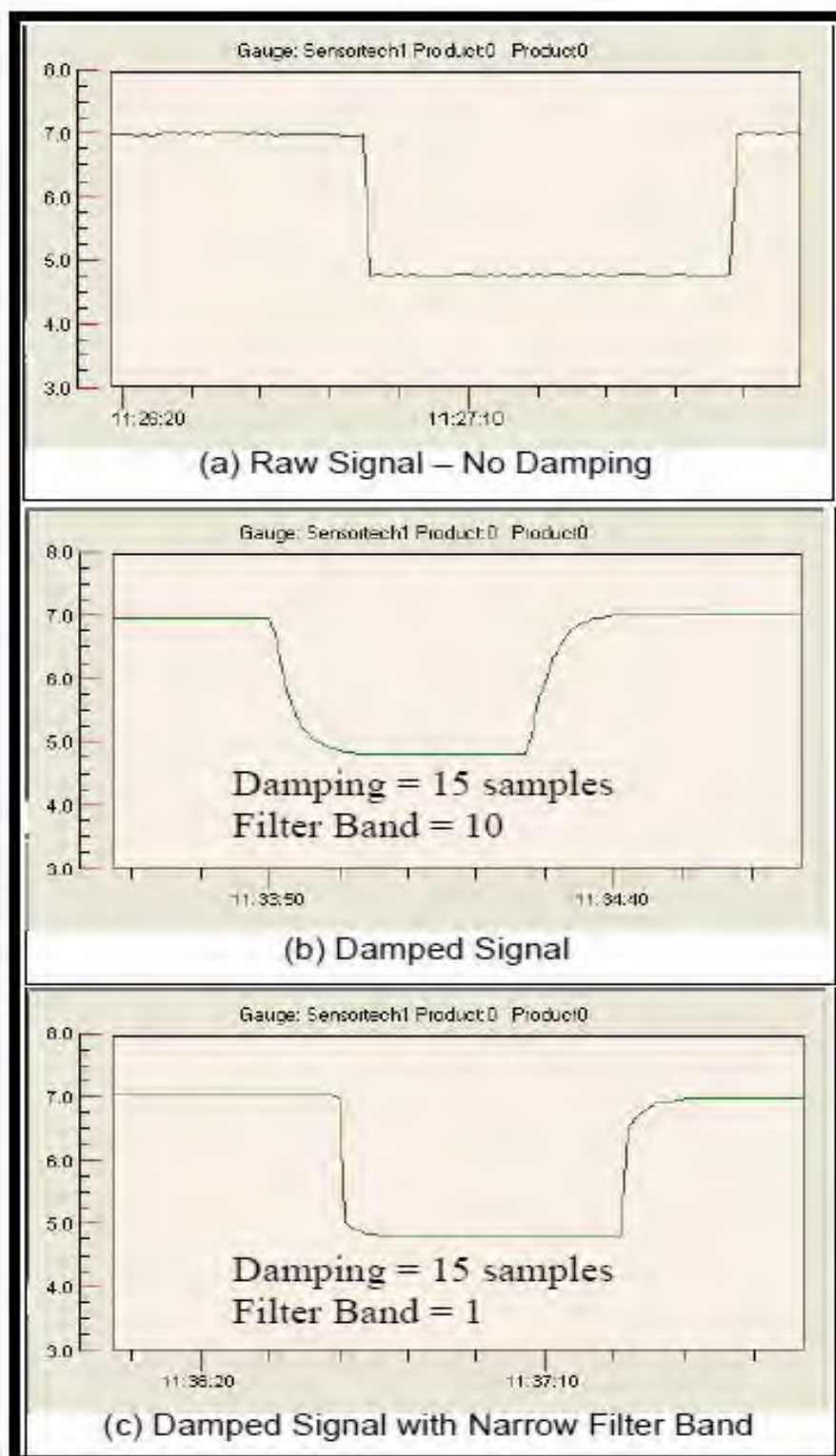


Figure 17: Effect of Damping and Filtering on Measurements

## Product Code Configuration – Constituent Names Page

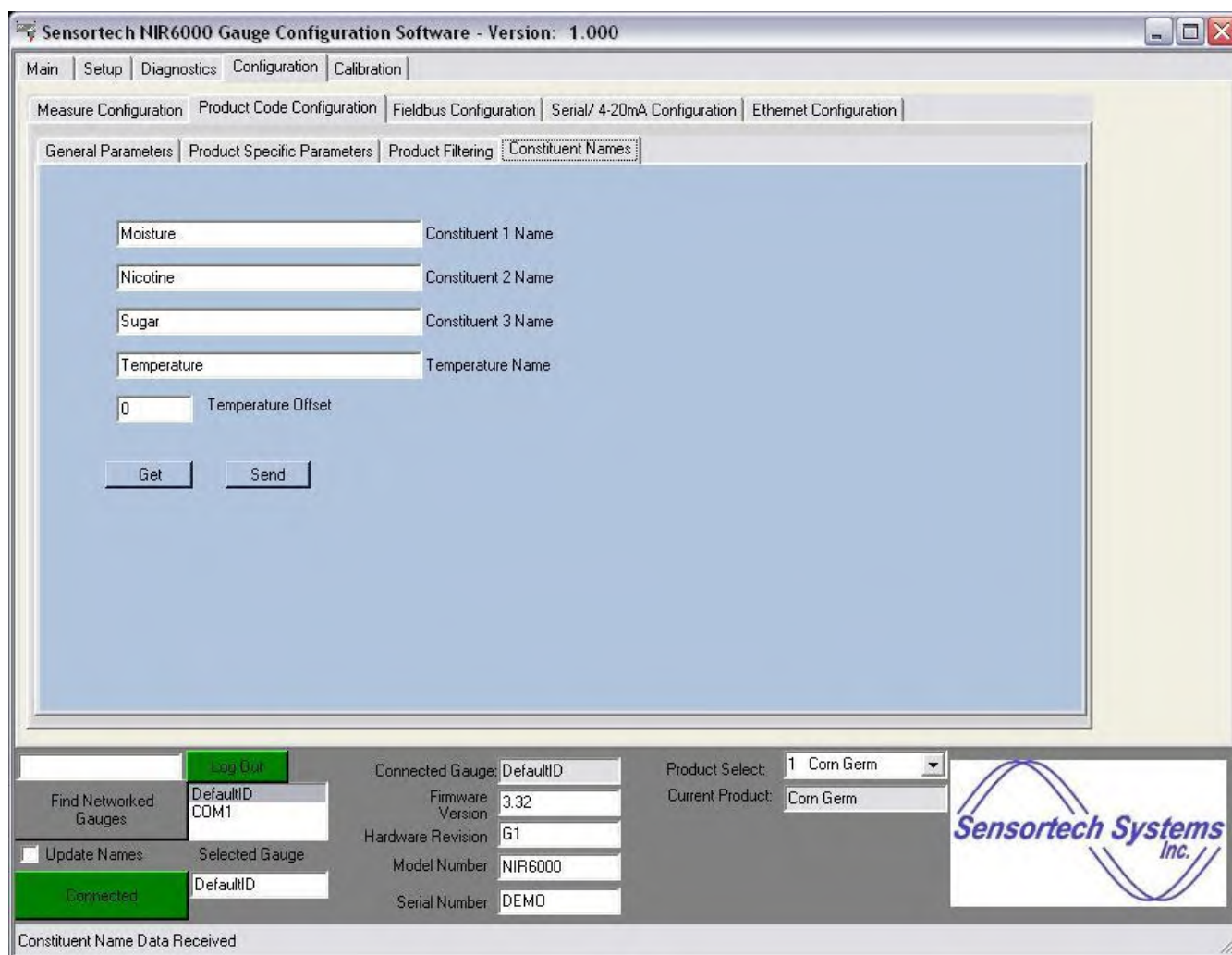


Figure 18: Constituent Names Page

The user may enter a name desired for each Constituent and Temperature in each field. These names will appear on all Drop-down menus in all Pages. Typical Constituent Names are Moisture, Nicotine, Fat, Protein, Sugar, Clarity, etc.

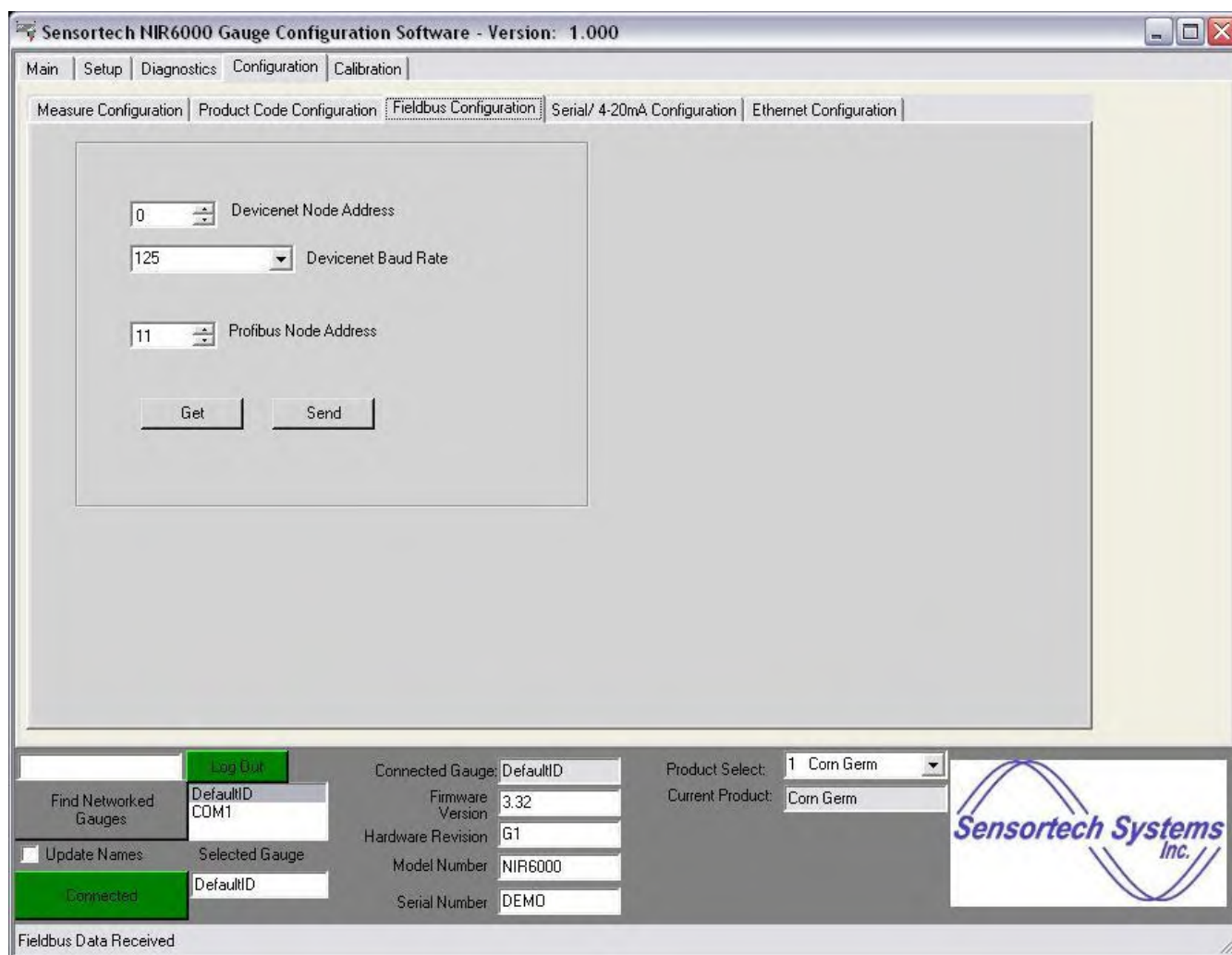
The Constituent Names Page descriptions are as follows (from upper left of Page):

1. Constituent 1 Name: User defined name composed of alphanumeric characters.
2. Constituent 2 Name: User defined name composed of alphanumeric characters.
3. Constituent 3 Name: User defined name composed of alphanumeric characters.
4. Temperature Name: User defined name composed of alphanumeric characters.
5. Temperature Offset: User defined offset to apply to product temperature measurement.

The “Get” button loads information from the Analyzer and the “Send” button writes to the Analyzer.



## Fieldbus Configuration Page



Sensortech NIR6000 Gauge Configuration Software - Version: 1.000

Main | Setup | Diagnostics | Configuration | Calibration

Measure Configuration | Product Code Configuration | **Fieldbus Configuration** | Serial/ 4-20mA Configuration | Ethernet Configuration

0 DeviceNet Node Address

125 DeviceNet Baud Rate

11 Profibus Node Address

Get Send

Find Networked Gauges DefaultID COM1

Update Names Selected Gauge

Connected DefaultID

Fieldbus Data Received

Connected Gauge: DefaultID

Firmware Version: 3.32

Hardware Revision: G1

Model Number: NIR6000

Serial Number: DEMO

Product Select: 1 Corn Germ

Current Product: Corn Germ

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Figure 19: Fieldbus Configuration Page

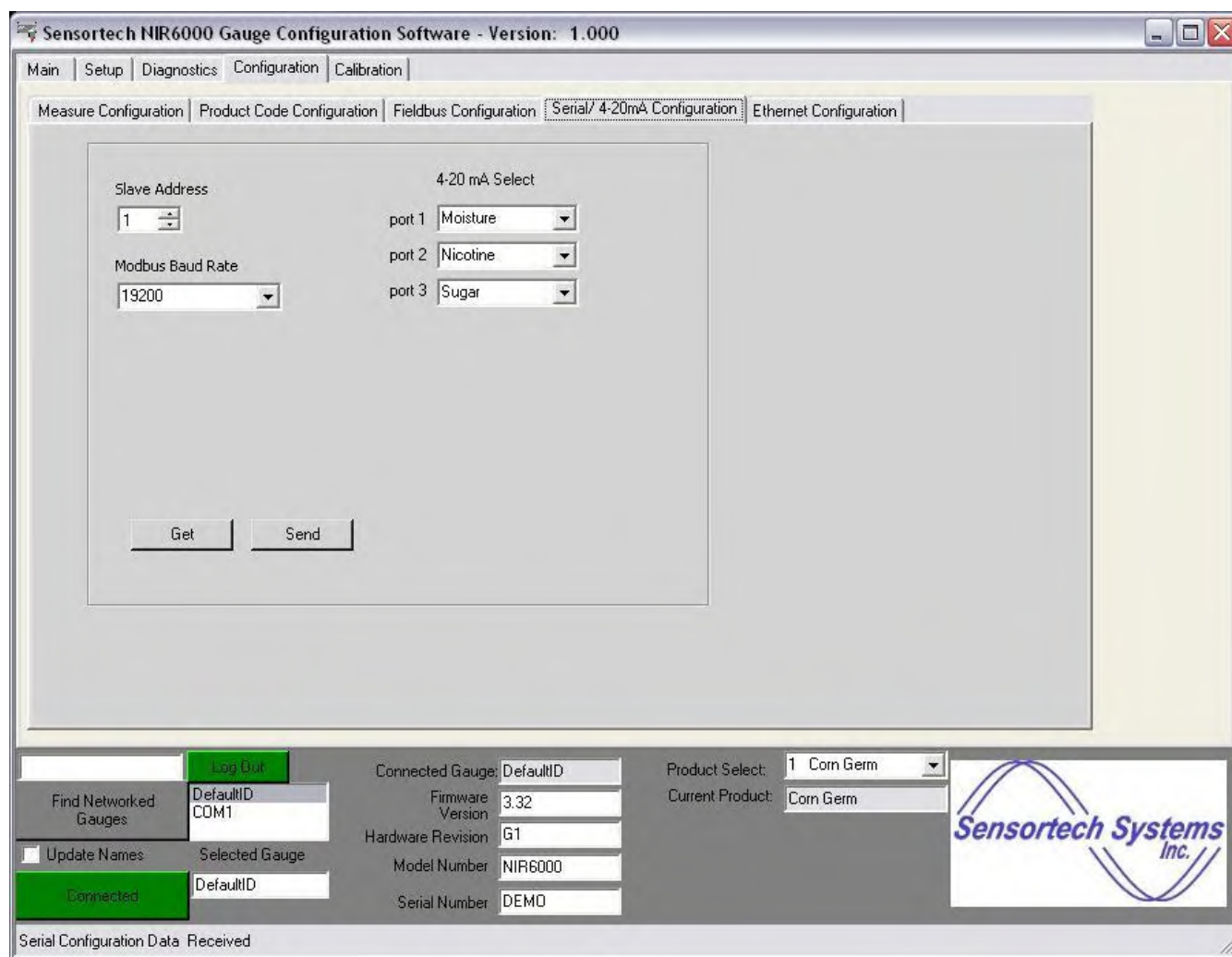
The Fieldbus Configuration Page allows the user to configure the Analyzer to communicate with a DeviceNet or PROFIBUS network. The Analyzer must be configured at the factory for the hardware, connectors and software required to support DeviceNet or PROFIBUS communications.

The Fieldbus Configuration Page descriptions are as follows (from upper left of Page):

1. DeviceNet Node Address: User selectable value for DeviceNet node address when interfacing with a DeviceNet network.
2. DeviceNet Baud Rate: Drop-down menu for DeviceNet baud rate when interfacing with a DeviceNet network.
3. PROFIBUS Node Address: User selectable value for PROFIBUS node address when interfacing with a PROFIBUS network. Some implementations of PROFIBUS support automatic node assignment in which case this parameter is not used.

The “Get” button loads information from the Analyzer and the “Send” button writes to the Analyzer

## Serial/4-20mA Configuration Page



Sensortech NIR6000 Gauge Configuration Software - Version: 1.000

Main | Setup | Diagnostics | Configuration | Calibration

Measure Configuration | Product Code Configuration | Fieldbus Configuration | **Serial/ 4-20mA Configuration** | Ethernet Configuration

Slave Address: 1

Modbus Baud Rate: 19200

4-20 mA Select

port 1: Moisture

port 2: Nicotine

port 3: Sugar

Get Send

Log Out

Find Networked Gauges

Update Names

Connected

DefaultID COM1

Selected Gauge

DefaultID

Connected Gauge: DefaultID

Firmware Version: 3.32

Hardware Revision: G1

Model Number: NIR6000

Serial Number: DEMO

Product Select: 1 Corn Germ

Current Product: Corn Germ

Serial Configuration Data Received

Figure 20: Serial/4-20mA Configuration Page

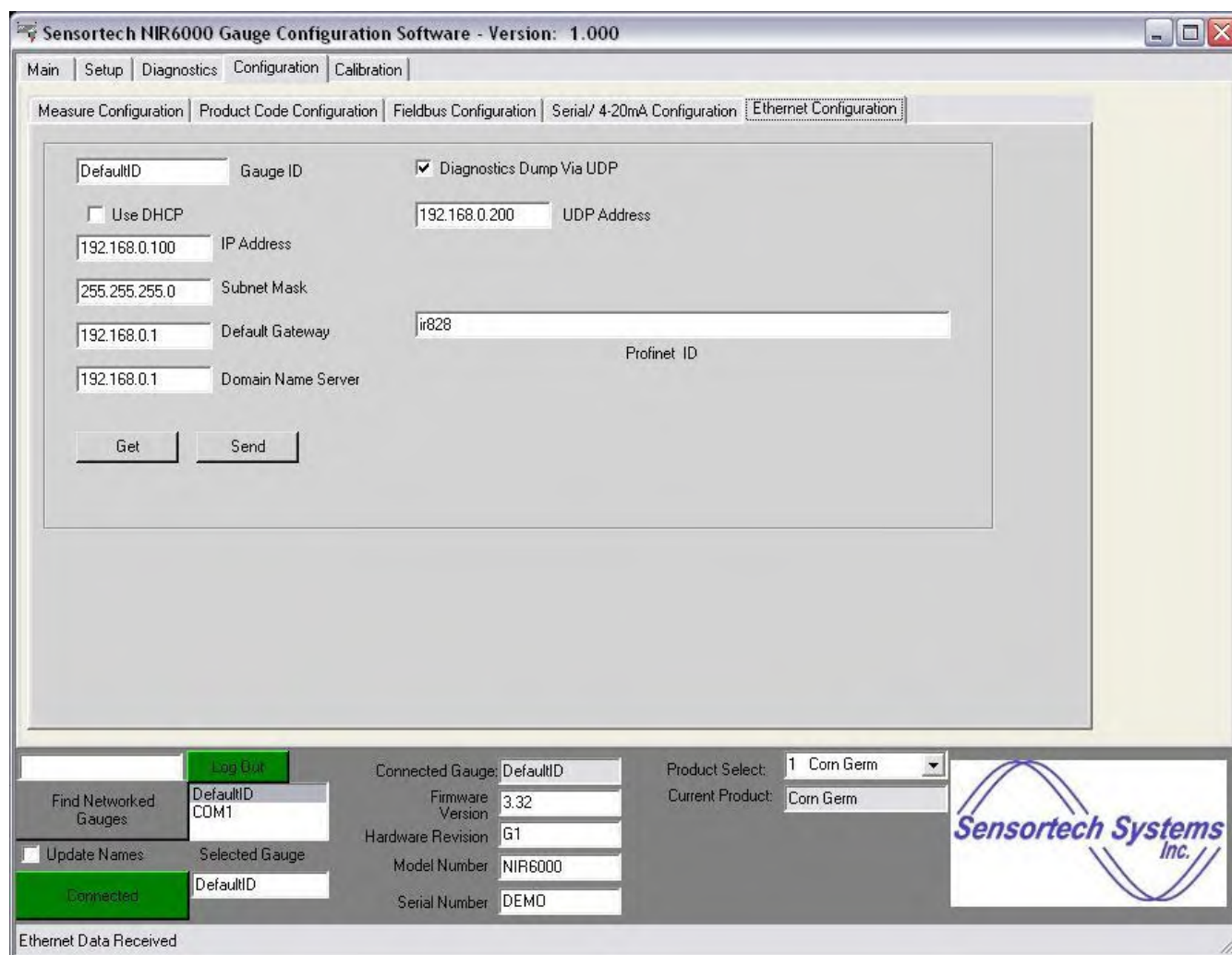
The Serial/4-20mA Configuration Page allows the user to configure the Analyzer to communicate via the RS-232/485 serial interface and select the 4-20mA ports associated with each Constituent. The serial interface format uses standard Modbus/RTU protocol.

The Serial/4-20mA Configuration Page descriptions are as follows (from upper left of Page):

1. Slave Address: User selectable slave device address. Default value is 1.
2. Modbus Baud Rate: Drop-down menu to select baud rates of 9600, 19200 or 38400. Default value is 19200.
3. 4-20 mA Select: Drop-down menus to associate a constituent to an Analog 4-20mA port (loop) output located on the rear of the Analyzer.

The “Get” button loads information from the Analyzer and the “Send” button writes to the Analyzer.

## Ethernet Configuration Page



Sensortech NIR6000 Gauge Configuration Software - Version: 1.000

Main | Setup | Diagnostics | Configuration | Calibration

Measure Configuration | Product Code Configuration | Fieldbus Configuration | Serial/ 4-20mA Configuration | Ethernet Configuration

DefaultID Gauge ID ☒ Diagnostics Dump Via UDP

☐ Use DHCP 192.168.0.200 UDP Address

192.168.0.100 IP Address

255.255.255.0 Subnet Mask

192.168.0.1 Default Gateway ir828

192.168.0.1 Domain Name Server Profinet ID

Get Send

Log Out

Find Networked Gauges DefaultID COM1

☐ Update Names Selected Gauge

Connected DefaultID

Ethernet Data Received

Connected Gauge: DefaultID

Firmware Version: 3.32

Hardware Revision: G1

Model Number: NIR6000

Serial Number: DEMO

Product Select: 1 Corn Germ

Current Product: Corn Germ

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Figure 21: Ethernet Configuration Page

The most commonly used interface is the TCP/IP Ethernet port on the rear of the Analyzer. The Ethernet connector on the rear of the NIR-6000 Analyzer is wired in the Ethernet Crossover configuration (T-568B) for direct connection to a host PC such as a laptop using a standard Ethernet cable (wired for T-568A). The 10/100 Ethernet Crossover port is standard on all NIR Series products and provides the highest data speed with the most comprehensive data access. The factory default settings are a fixed IP address of 192.168.0.100 and Subnet Mask address of 255.255.255.0. The user may also select the DHCP mode or enter other IP addresses and settings for the Analyzer.

The 'Use DHCP' checkbox should be selected when the Analyzer is connected to a DHCP server-based network. Dynamic Host Configuration Protocol (DHCP) then assigns suitable IP addresses to all devices on the network at time of Analyzer start up.

Note: The 'Diagnostics Dump Via UDP' checkbox is normally not selected by a user. The default is to leave it unchecked. The default UDP address is the same as the Host PC address 192.168.0. The PROFINET ID field is used for identification when connected to a PROFINET network.

The "Get" button loads information from the Analyzer and the "Send" button writes to the Analyzer.

## Calibration Program

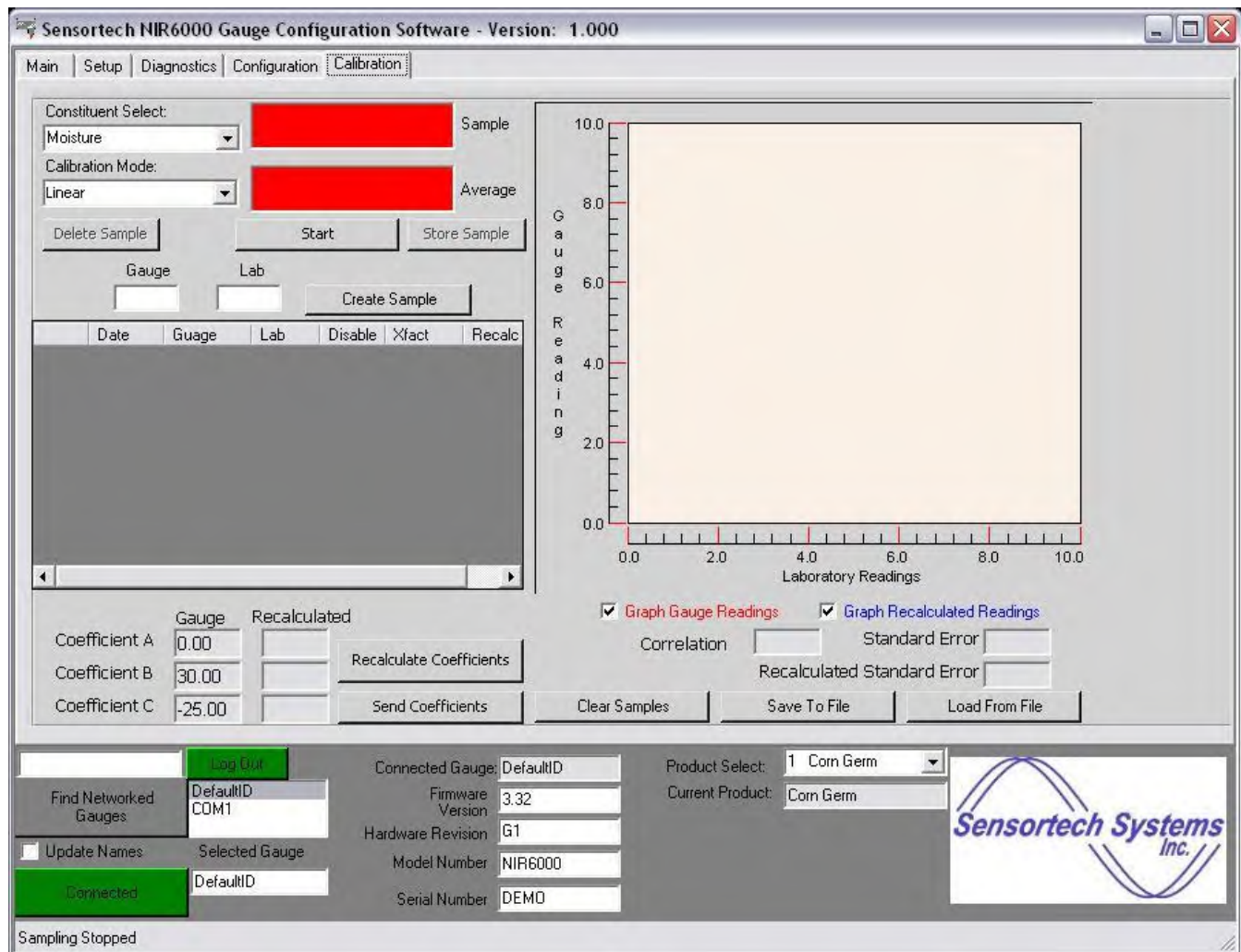


Figure 22: Calibration Page

The Calibration program enables the user to recalibrate the instrument by recording measurements of physical samples and comparing them to a laboratory analysis.

The page descriptions are as follows (from upper left of Page):

1. Constituent Select: One constituent at a time is selected for Analyzer calibration. (i.e. Moisture)
2. Calibration Mode: There are two modes which can be employed: Linear and Offset. Each method is outlined later in this chapter.
3. Delete Sample: Deletes any previous sample measurement.
4. Sample: This field displays the real-time measurement.
5. Average: This field displays the average between start and stop of the measurement.
6. Start / Stop button: By pressing the 'Start' button, the calibration measurement is initiated. The button toggles to 'Stop', which will complete the sample measurement when pressed.
7. Store Sample: This button stores the average value obtained during the sample period into the data table.
8. Create Sample: This is used for manual entry of values in the Gauge and corresponding Lab field.
9. Recalculate Coefficients: Recalculates coefficients A, B and C after all of the sample measurement and corresponding lab data has been collected.
10. Send Coefficients: Using this function, the recalculated coefficients are stored in the sensor, completing the calibration procedure.
11. Correlation: This shows the quality data fit between the analyzer and Lab data. The optimum value for correlation is 1.
12. Standard Error: The standard deviation before recalculation.
13. Recalculated Standard Error: The standard error resulting from the new values determined for coefficients A, B and C after recalculation.
14. Clear Samples: This function will clear the data relating to the current Calibration. Note: All data will be lost unless saved to file.
15. Save To File: After performing the calibration, the coefficient values can be saved in the host PC for future use.
16. Load from File: This function is used to load previously saved calibrations.



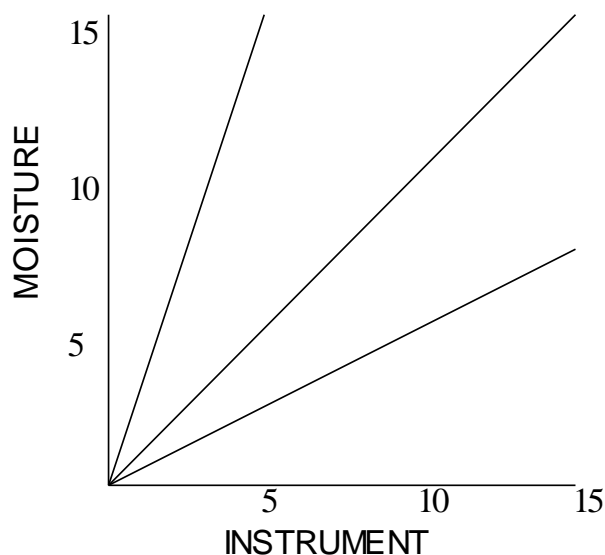


Figure 23: Effect of Coefficient B on Slope

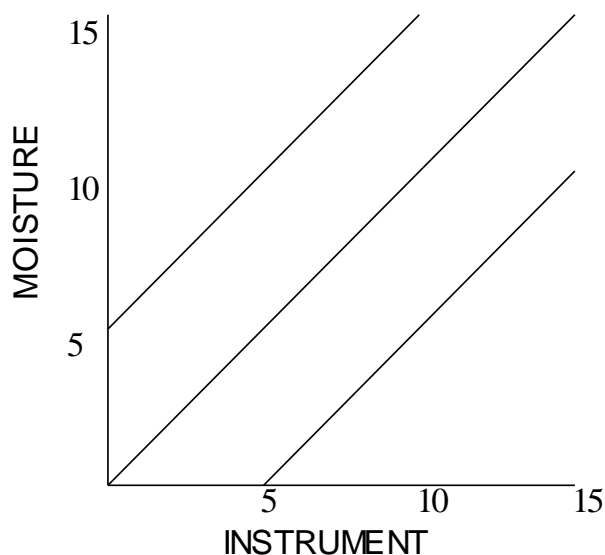


Figure 24: Effect of Coefficient C on Offset

### Offset Mode

The simplest mode of calibration is the 'Offset' method. This method assumes that the Analyzer has been previously calibrated and the slope (Coefficient B) has already been established. It is primarily intended for online calibration to compensate for process variables such as product height, flow speed, angle of installation, etc.

In most cases, the Analyzer has been statically calibrated in our factory for your application. Once the Analyzer has been installed on-line, a single sample comparison with the measurement value will determine if an offset is necessary.

1. Select Calibration Method – Offset Method
2. While material is flowing under the Analyzer, press the 'Start' button and wait until the measured value is displayed.
3. Press the 'Stop' button and immediately collect a sample from the line at the Analyzer and place it in an airtight container or plastic bag. Completely fill the container and remove any excess air.
4. Press 'Store Sample' to record the reading in the Calibration page data table.
5. Perform a lab analysis on your sample (for moisture this is typically a weight loss oven test), then enter the lab analysis value into the data table under the 'Lab' column.
6. Press 'Recalculate Coefficients' and note that the 'C' coefficient value has been corrected.
7. Press 'Send Coefficients' to conclude the calibration procedure

### Linear Mode

Linear regression establishes the direct correlation between two data series. A correlation coefficient indicates the quality of correlation. This value is between 0 and 1, with 1 being perfect.

In addition to determining the quality of fit, the regression function calculates the slope and intercept of the calibration line. These two values are the 'B' and 'C' coefficients, respectively.

Linear mode should only be used with an adequate range and moisture levels

The following steps will provide an example of how to perform a Product Calibration:

1. Select the Calibration page tab.
2. Select the constituent to calibrate using the 'Constituent Select' drop-down menu.
3. Select the calibration mode using the 'Calibration Mode' drop-down menu.
4. Place the sample material to be calibrated under the Analyzer Light Tube / Viewing Window.
5. Press the 'Start' button. The 'Sample' and 'Average' fields will change color to green and the current measured value is displayed. The 'Start' button changes to 'Stop' during the measurement.
6. Press the 'Stop' button. The 'Sample' and 'Average' displays will change color to red and the average of all the readings, obtained during the sample period, is displayed in the 'Average' field. The 'Sample' field will be cleared. Press 'Store Sample' button. The sample measurement is stored to the table.
7. Repeat this procedure to get at least 3 sample measurement readings. A minimum of six sample measurements is recommended for good calibration data sample set. Samples should be reasonably distributed through the calibration range.
8. The stored samples will be displayed with time and date information in the table fields as shown in Figure 27.
9. Initially, the 'Gauge' value is entered into the 'Lab' field also. The actual 'Lab' value is manually entered following the laboratory analysis. Position cursor over desired 'Lab' value in table and click field. A data entry window will open to allow entry of the actual 'Lab' value.
10. Press the 'Recalculate Coefficients' button. The 'Gauge' values and the 'Lab' values will be used to recalculate the coefficient values to find the best fit. The new 'Gauge' coefficient values appear in the 'Recalculated' fields.
11. To complete the Product Calibration click on the 'Send Coefficients' button. The new coefficient values will be sent to the Analyzer and overwrite the previous coefficient values stored in the Analyzer.

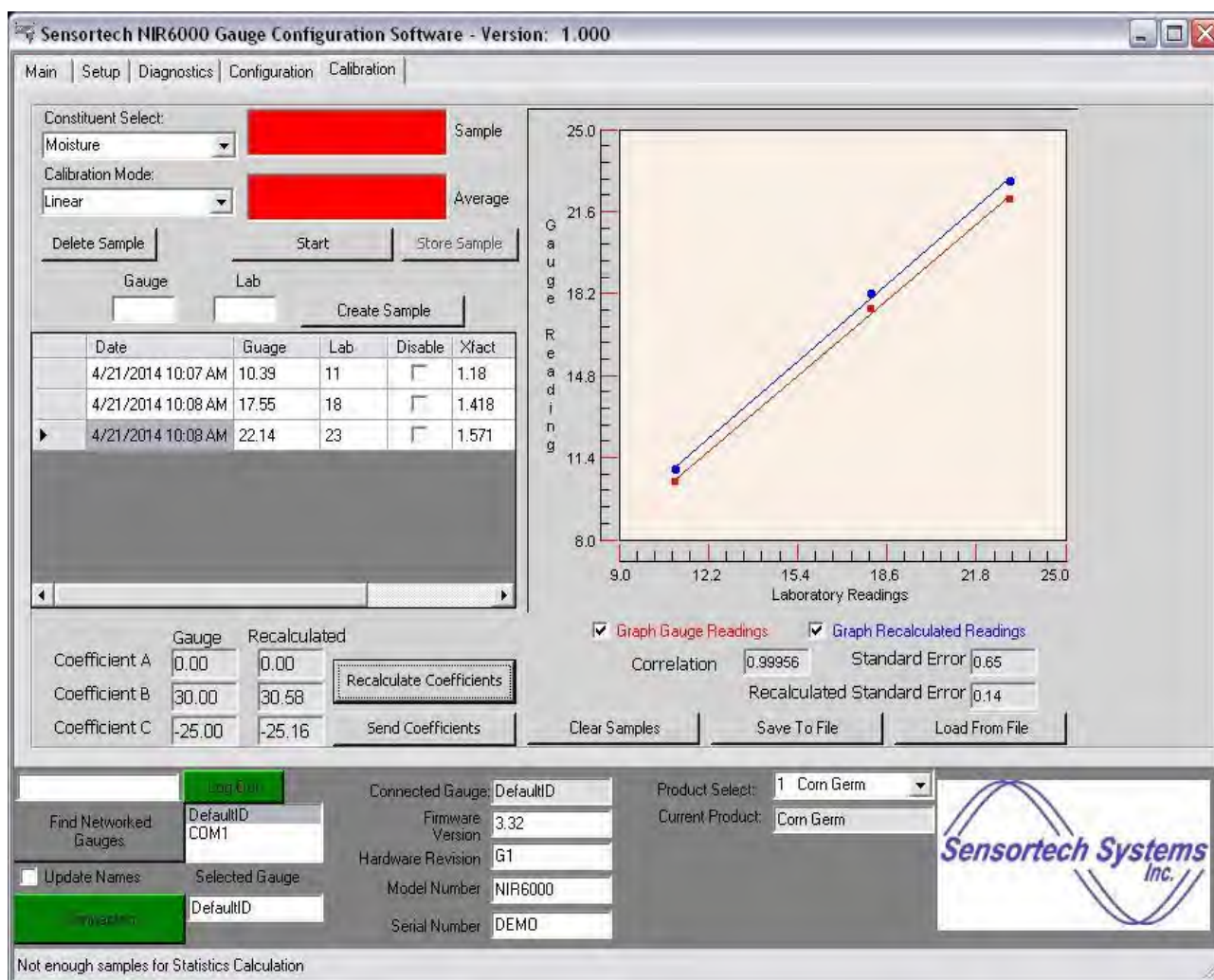


Figure 25: Performed Calibration

The graphical representation is useful in selecting bad data points. If a data point appears to be an outlier it may be temporarily disabled by clicking on the appropriate checkbox in the table. Press 'Recalculate Coefficients' button to check if correlation value is significantly improved. If not, uncheck the disable checkbox. If disabling a data point significantly improves correlation then that data point may be permanently removed by highlighting the row in the table and pressing the 'Delete Sample' button.

## Upgrading Analyzer Firmware

Perform the following steps to save the existing (old) Analyzer configuration:

1. Start the Configuration program.
2. Connect to the Analyzer to be upgraded.
3. Login using the engineering password.





4. Go to the 'Setup' Page.
5. Press 'Save Parameters To File' button to save the current Analyzer configuration and parameters to the file specified in the "C:\pathname\filename" field above the button.
6. Close the Configuration program.

Perform the following steps to upgrade the Analyzer firmware:

1. Load the new Configuration program.
2. Start the new Configuration program.
3. Login using the engineering password.
4. Go to the 'Setup' Page.
5. Press 'Find Networked Gauges' button to find the Analyzer connected to the host PC to be upgraded.
6. Use the cursor to highlight the Analyzer in the Analyzer display list.
7. Press 'Download Firmware' button to load the internal processor with the new firmware.

Perform the following steps to load the saved Analyzer configuration:

1. Start the new Configuration program.
2. Connect to the Analyzer to be upgraded.
3. Login using the engineering password.
4. Go to the 'Setup' Page.
5. Press 'Parameters From File' button to load a previously saved Analyzer configuration and parameters from the file specified in the "C:\pathname\filename" field above the button.

## Accessories

### Calibration Check Reference Standards

The Calibration Check Reference Standards are useful for verifying if your analyzer's calibration has drifted. Each kit includes a high and low reference standard that locks on to the Air-Purge Light Tube. After you install your analyzer, perform the final online calibration and record the high/low reference readings:

First, secure the Low Reference Standard to the Air-Purge Light Tube, allow the analyzer to stabilize, and record the reading. Do the same with the High Reference Standard and keep the data stored with your analyzer's history file.

We recommend doing this every 6 months or any time you suspect the calibration may be out of spec. If the readings are not the same as the original ones that were recorded, take the following action:

1. Ensure the window is clean. Repeat the procedure and see if the readings have returned to their original values.
2. If the window is clean and the readings are still out of spec, re-calibrate the analyzer using the Online Method described in the manual. After re-calibration, record the new reference numbers for future verification.

The most likely cause of drift is build up of material on the analyzer's light path window and can be easily prevented by proper use of the Air-Purge System. For best results, apply 5psi of filtered compressed air to create a positive pressure inside the analyzer's Air Purge Light Tube. Too much air will hinder the nozzle's ability to keep the window clean by creating a vortex inside the tube.

Even with the use of the Air-Purge System, it's still possible for dust or debris to slowly build up over time. The best way to deal with this is regular preventive maintenance. A clean, dry cloth is usually sufficient; but in harsher environments a cleaning solution or mild solvent may be the best choice for cleaning. The most important thing to ensure is that the glass is completely free of streaks and residue after cleaning has been done.

Keep your Reference Standards stored in their original case provided by the manufacturer. Before each use, make sure they are free from dust and debris and if cleaning is required use only a dry lint free cloth.

## Options

### Air Vortex Cooling Side Panel Installation

The user may connect a compressed air line to the Air Vortex Tube to reduce internal Analyzer temperature to the +5 to +55 degrees C operating specification when the external Analyzer temperature is at maximum external temperature of up to +85 degrees C. The air supply temperature is controlled by the compressed air pressure and flow rate into the Air Vortex Tube as well as the Air Vortex Tube adjustment screw. The Air Vortex Tube and Exhaust Muffler are installed on the side panel of the Analyzer to supply cold air to the internal heat exchanger.



Figure 26: Air Vortex Tube & Exhaust Muffler



Figure 27: Air Vortex Tube and Muffler Installed



Air Vortex Cooling Hardware Installation:

1. The Air Vortex Cooling hardware is listed below:
  - a. 1 each – Cooling Side Panel
  - b. 2 each – Female Tube Adapter, ¼ in. Tube OD x ¼ in. Female NPT
  - c. 1 each – Male Elbow, ⅜ in. Male NPT
  - d. 1 each – Air Vortex Tube
  - e. 1 each – Muffler, Hex Style ⅜ in. Male NPT, 175 SCFM Max.
2. Install one end of the Male Elbow into the bottom of the Air Vortex Tube. Use Teflon tape to seal threads on fittings.
3. Install the completed Air Vortex Tube assembly and the Muffler assembly into the two ¼ inch compression fittings on the side panel. Use Teflon tape to seal threads on fittings.
4. Install the analyzer on-line and connect to air source of up to 15 SCFM at 100 PSIG (6.9 BAR).
5. Connect the analyzer to the host computer via Ethernet or serial port.
6. Start the analyzer Configuration Software and connect to the analyzer.
7. Using the Configuration Software, go to the Diagnostics screen and monitor the Internal Gauge temperature.
8. Adjust the Air Vortex Tube air flow until the Internal Gauge temperature remains above +5 and below +55 degrees C at maximum and minimum external environmental temperature( +0 to +85 degrees C unless otherwise specified).

## Appendix

### Analyzer Status and Error Messages

Configuration Program Message Displayed	7 Segment LED (inside Analyzer)	Message Description
<b>Connected – Measure</b>	0	Analyzer operating normally. Sample measurement in range.
<b>Sampling Stopped</b>	0	Analyzer operating normally. Hold last sample measurement or measurement not Started on Main Page.
<b>Not Connected</b>	0	Configuration program not connected to the Analyzer.
<b>Measure Data Received</b>	0	Page update data received by Analyzer from the Host PC. The Analyzer is operating normally.
<b>Measure Data Sent</b>	0	Page update data sent to Host PC from the Analyzer. The Analyzer is operating normally.
<b>Measure Data Error</b>	0	Page update data not sent or received from Analyzer. The Analyzer is operating normally but data may need to be re-sent or re-read.
<b>Connected - No Lock</b>	1	Analyzer is unable to make a measurement and unable to lock the filter wheel to AC mains frequency or preset AC mains value due to excessive vibration on Analyzer mounting or Analyzer hardware fault.
<b>Connected - AZC</b>	2	Measurement signal too large and the Analyzer is unable to make a measurement. The Analyzer is unable to reduce AGC gain due to highly reflective material or debris build-up on Analyzer Viewing Window.
<b>Connected - AGC</b>	3	Warning that Measurement signal is too large. The Analyzer is unable to reduce AGC to preset AGC threshold due to highly reflective material or debris build-up on Analyzer Viewing Window.
<b>TIMED_MODE_FILL</b>	4	In Timed Sample Mode. Holding last sample measurement while sample cup is being filled.
<b>TIMED_MODE_PURGE</b>	6	In Timed Sample mode. Purging last sample from sample cup.
<b>Connected – NO_GATE</b>	7	In Signal Gated or Auto Gated sample mode. Holding last sample measurement until signal gate level goes high or measurement threshold is exceeded.
<b>Connected – Max AGC</b>	c	Measurement signal is too small. Analyzer is unable to increase AGC gain range due to dark or low reflective material or debris build-up on the Analyzer Viewing Window.

Table 2: Analyzer Status and Error Messages

## Main Power Connector – 90-240VAC (default power configuration)

Signal Name	Bulgin Flange Mount Connector Pin (PX0765/P on Analyzer)	Bulgin Flex Connector Pin (PX0731/S on cable)
Line (110/220VAC)	L	L
Neutral (110/220VAC)	N	N
Safety Ground	GND	GND

Table 3: AC Main Power Pin Out

## Main Power Connector – 24VDC (optional power configuration)

Signal Name	Bulgin Flange Mount Connector Pin (PX0765/S on Analyzer)	Bulgin Flex Connector Pin (PX0731/P on cable)
24VDC Positive	L	L
24VDC Negative	N	N
Safety Ground	GND	GND

Table 4: DC Main Power Pin Out

Note: Use 18 AWG or larger wires on cable used to provide external 24VDC power to the NIR-6000 using the 3 pin Bulgin Plug provided.

## Analog 4-20mA Connector

Signal Name	Bulgin Flange Mount Connector Pin (PX0767/S on Analyzer)	Bulgin Flex Connector Pin (PX0739/P on cable)
Port 1 Positive (Loop 1+)	1	1
Port 1 Negative (Loop 1-)	2	2
Port 2 Positive (Loop 2+)	3	3
Port 2 Negative (Loop 2-)	4	4
Port 3 Positive (Loop 3+)	5	5
Port 3 Negative (Loop 3-)	6	6

Table 5: Analog 4-20mA Pin Out



## Ethernet Connector

The Ethernet connector on the rear of the NIR-6000 Analyzer is wired in the Crossover configuration (T-568B) for direct connection to a host PC such as a laptop using a standard Ethernet cable (wired for T-568A). Sensortech supplies a standard, IP68 RJ Buccaneer to Shielded RJ45 Ethernet cable for use with the Analyzer which is 10 ft (3m) long (wired to T-568A). This Ethernet cable provided may be used to configure and operate the Analyzer. If a longer Ethernet cable is required, the user may wire a standard Ethernet cable (wired to T-568A) using the spare Ethernet Flex Connector Plug provided with the Analyzer to connect to the user network or host PC.

The Ethernet signals are shown in the table below:

Signal Name	Bulgin Flange Mount Connector Pin (T-568B) (PX0870 on Analyzer)	Bulgin Flex Connector Pin (T-568A) (PX0834/A on cable)
<b>g</b>	3	1
<b>G</b>	6	2
<b>o</b>	1	3
<b>B</b>	4	4
<b>b</b>	5	5
<b>O</b>	2	6
<b>br</b>	7	7
<b>BR</b>	8	8

Table 6: Ethernet Pin Out

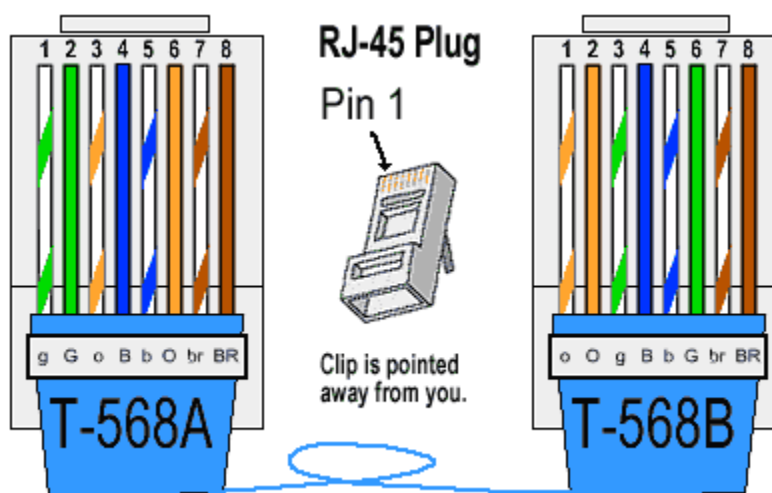


Figure 28: Ethernet Crossover Cable Wiring

## Digital RS-232/485 Connector (7 pin)

The Digital RS-232/485 serial interfaces provided on the Analyzer supports RS-232 and RS-485 (Full Duplex) as the factory default configuration. Other serial interface options require the Analyzer to be custom configured at the factory for RS-422 Full or Half Duplex or RS-485 Half Duplex as shown in the table below. The RS-232 serial interface operates independently from the RS-422 and RS-485 serial interface. Only one type of serial interface should be selected and used on an Analyzer at the same time.

The Digital RS-232/485 pin out is the same for all serial interfaces and the Bulgin Flex Connector Plug provided with the Analyzer can be wired to connect to the RS-232, RS-422 or RS-485 signals as shown in the table below:

	RS-232	EIA RS-485	EIA RS-422
<b>Mode of Operation</b>	Single-Ended	Differential	Differential
<b>Baud Rate</b>	9600, 19200, 38400	9600, 19200, 38400	9600, 19200, 38400
<b>Available Signals</b>	Pins 5, 6 and 7	Pins 1, 2, 3, 4 and 7 (Full or Half Duplex)	Pins 1, 2, 3, 4 and 7 (Full or Half Duplex)

Table 7: Digital RS-232/422/485 Interface Options

Signal Name	Bulgin Flange Mount Connector Pin (PX0768/P on Analyzer)	Bulgin Flex Connector Pin (PX0745/S on cable)
<b>INPUT+ (RS-422/485)</b>	1	1
<b>INPUT - (RS-422/485)</b>	2	2
<b>OUTPUT + (RS-422/485)</b>	3	3
<b>OUTPUT - (RS-422/485)</b>	4	4
<b>RxD (RS-232)</b>	5	6*
<b>TxD (RS-232)</b>	6	5*
<b>GROUND (RS-232/422/485)</b>	7	7

Table 8: Digital RS-232/422/485 Pin Out

Note: \* Input/Output signals reversed on opposite end of RS-232 serial interface cable. RS-232 and RS-485 (Full Duplex) is the factory default configuration.

## OI-Digital RS-232/485 Interface Connector (9 pin)

An option on the NIR-6000 Series replaces the 7 pin connector with a 9 pin connector for interfacing the Analyzer to the OI-6000 Operator Interface. The same Digital RS-232/485 serial interfaces provided on the Analyzer are available when there is no OI-6000 connected to the gauge as shown in the pinout table below. When the OI-6000 is connected to the analyzer, the 9 pin connector is dedicated to OI-6000 power and interface and the RS-232, 422 or RS-485 serial interfaces are not available by the user. Only one type of serial interface, the OI-6000 interface, RS-232, RS-422 or RS-485 **can** be selected and used on an Analyzer at the same time.

The OI-Digital RS-232/485 pin out is the same for all serial interfaces and the Bulgin Flex Connector Plug provided with the Analyzer can be wired to connect to the RS-232, RS-422 or RS-485 signals as shown in the table below:

	RS-232	EIA RS-485	EIA RS-422
<b>Mode of Operation</b>	Single-Ended	Differential	Differential
<b>Baud Rate</b>	9600, 19200, 38400	9600, 19200, 38400	9600, 19200, 38400
<b>Available Signals</b>	Pins 7, 8 and 9	Pins 3, 4, 5, 6 and 9 (Full or Half Duplex)	Pins 3, 4, 5, 6 and 9 (Full or Half Duplex)

Table 9: Digital RS-232/422/485 Interface Options

Signal Name	Bulgin Flange Mount Connector Pin (PX0769/S on Analyzer)	Bulgin Flex Connector Pin (PX0728/P on cable)
<b>POS (OI-6000 Operator Interface)</b>	1	1
<b>NEG (OI-6000 Operator Interface)</b>	2	2
<b>INPUT+ (RS-422/485)</b>	3	3
<b>INPUT - (RS-422/485)</b>	4	4
<b>OUTPUT + (RS-422/485)</b>	5	5
<b>OUTPUT - (RS-422/485)</b>	6	6
<b>RxD (RS-232)</b>	7	8*
<b>TxD (RS-232)</b>	8	7*
<b>GROUND (RS-232/422/485)</b>	9	9

Table 10: OI-Digital RS-232/422/485 Pin Out

Note: \* Input/Output signals reversed on opposite end of RS-232 serial interface cable. RS-232 and RS-485 (Full Duplex) is the factory default configuration.

## DeviceNet Connector (optional DeviceNet interface)

The DeviceNet interface is a factory configured software and hardware option for the Analyzer. The DeviceNet Bulgin Connector replaces the Digital RS-232/485 Bulgin Connector on the rear of the Analyzer. A Bulgin Flex Connector Plug is provided with the Analyzer that can be wired to connect the Analyzer to the DeviceNet cable. The DeviceNet Connector signals are shown in the table below:

Signal Name	Bulgin Flange Mount Connector Pin (PX0767/P on Analyzer)	Bulgin Flex Connector Pin (PX0739/S on cable)
V-	1	1
CAN_L	2	2
SHIELD (Drain)	3	3
CAN_H	4	4
V+	5	5
(not used)	6	6

Table 11: DeviceNet Bulgin Connector Pin Out

## PROFIBUS Connector (optional PROFIBUS interface)

The PROFIBUS interface is a factory configured software and hardware option for the Analyzer. A 9-pin Sub-D Female Connector replaces the Digital RS-232/485 Bulgin Connector on the rear of the Analyzer. The user provides the 9-pin Sub-D Male Connector and cable to connect the Analyzer to the PROFIBUS network. The PROFIBUS 9-pin Sub-D Connector signals are shown in the table below:

Signal Name	9-pin Sub-D Female Connector Pin (on Analyzer)	9-pin Sub-D Male Connector Pin (on cable)
(not used)	1	1
(not used)	2	2
B-Line, Positive RS485 RxD/TxD	3	3
RTS, Request to Send	4	4
GND BUS	5	5
+5V BUS	6	6
(not used)	7	7
A-Line, Negative RS485 RxD/TxD	8	8
(not used)	9	9

Table 12: PROFIBUS Connector Pin Out

Note: The 9-pin Sub-D Female Connector shell is connected to GND (on Analyzer)