3000 Series

MoistTech Corp.

TECHNICAL MANUAL
NEAR INFRARED SENSOR

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Preface

About The Manual

This manual is intended to provide a technical reference for configuring and operating the newest MoistTech 3000 series of hardware and software. New and experienced users will benefit from the detailed technical information and operating instructions for MoistTech hardware and software options and accessories.

In this manual, the 3000 Series sensors are referred to by the general term “gauge”.

Hardware Revisions and Software Versions covered by this manual:

Gauge Hardware Revision: C (and above)

Gauge Firmware Version: 3.21 (and above)

Configuration Software Version: 3.027 (and above)

The manual is organized as follows:

1. Quick Start Guide
2. MoistTech gauge and hardware installation information.
3. MoistTech software installation and PC requirements.
4. Overview of the MoistTech gauge and software configuration.
5. Overview of Product Calibration using the MoistTech gauge.
6. APPENDIX.

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Quick Start Guide

To begin, follow these helpful hints for quickly getting your gauge set up and ready for use. Please refer to the detailed information in this manual to set-up the gauge and use the Configuration Software.

1. Gauge Installation

Select a location that has a continuous flow of material, and install the gauge above the material to be measured approximately 4-6 inches (100-150 mm) from the bottom of the light tube to the top of the average material height. Mount the gauge on-line using a 1 to 1.3-inch (25 to 32 mm) diameter vertical or horizontal pipe that is floor mounted or welded to a structure free from vibration.

2. Gauge Communication

a. Install the CD containing the Configuration Software onto your host PC.

b. Configure the IP address on the host PC per the manual and connect the ethernet cross-over cable to the host PC and the gauge.

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 Engineer's password "**engpass**" to change parameters and perform gauge calibration.

Note: Log out each time you are finished to prevent unauthorized access to gauge settings.

3. Product Calibration

Each gauge has been statically pre-calibrated at the factory for your application. Once the gauge has been installed on-line, a simple offset calibration is required to zero in on the measurement target for each constituent. Go to the Calibration screen and use the following procedure:

a. Select Calibration Method – Offset Method

b. While the material is flowing under the gauge, press the 'Start' button and wait until a measurement value is displayed.

c. Press 'Stop' button and immediately collect a sample from the line where it was measured and place it in an airtight container or plastic bag.

d. Press 'Store Sample' to record the reading in the data table.

e. Perform an analysis of your sample in a lab (for moisture perform an oven test), then enter the lab analysis value into the data table under the Lab column.

f. Press the 'Recalculate Coefficients' button and note that the 'C' coefficient value has changed.

g. Press 'Send Coefficients' to conclude the offset Product Calibration procedure.

Getting Started

Introduction

The 3000© products are the most sophisticated on-line NIR sensors available, offering unmatched accuracy and reliability at a very affordable cost.

The 3000 is a "smart" sensor with all measurement, signal processing and control functions 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 Devicenet®, Profibus®, Profinet®, EthernetIP and Modbus.

The 3000 series gauges 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 MoistTech immediately for further assistance.

Physical Installation

Select a location that has a continuous flow of material, and install the gauge above the material to be measured approximately 4-6 inches (100-150 mm) from the bottom of the light tube to the top of the average material height.

Install the gauge in an environment where the external gauge temperature does not exceed 50 degrees Celsius. If higher temperatures are experienced, an optional air or water-cooling panel should be used.

Ensure the gauge is mounted on a metal post installed on a cement floor or other stable, low vibration mounting.

The 3000 series gauges include two removable mounting brackets. These brackets may be installed to provide flexible mounting options. The most common configuration, the one provided from the factory, is a vertical mounting with the two mounting clamps positioned on the rear connector-end of the gauge. Figure 1 illustrates the rear mounting configuration.

The gauge mounting brackets are designed to clamp onto a metal bar with a diameter of 1.0" – 1.3" (25mm to 32mm). Due to the many variables associated with any process environment, it may be more convenient to use a horizontal mounting bar. In this case, the mounting clamps may be relocated using the four mounting holes on the top of the gauge.

The four holes form a square pattern, allowing clamps to be mounted in either of two positions, at 90° orientation. Figure 2 and Figure 3 show top mounting configuration options.

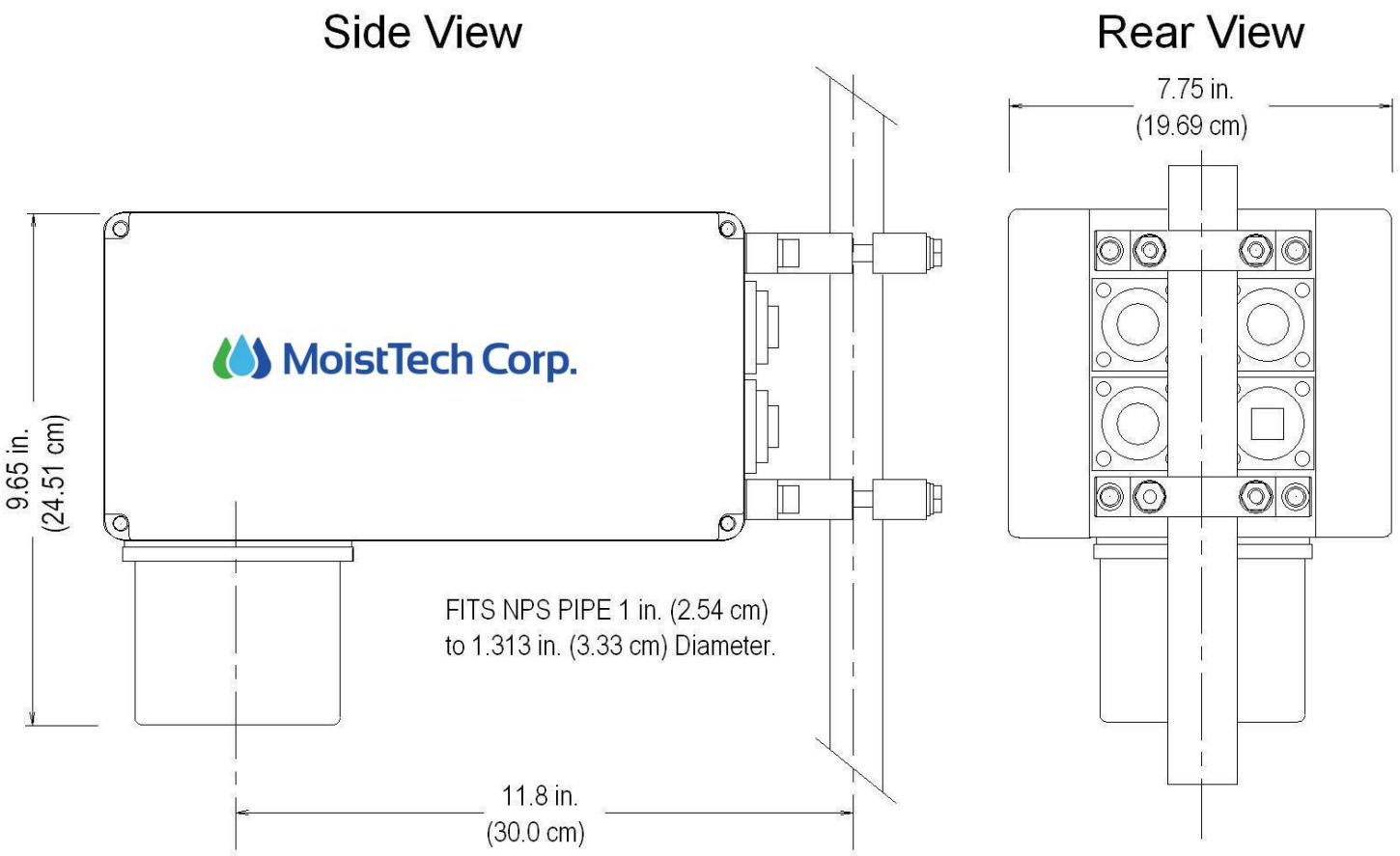

Figure 1. Pole Mount to Rear of Gauge

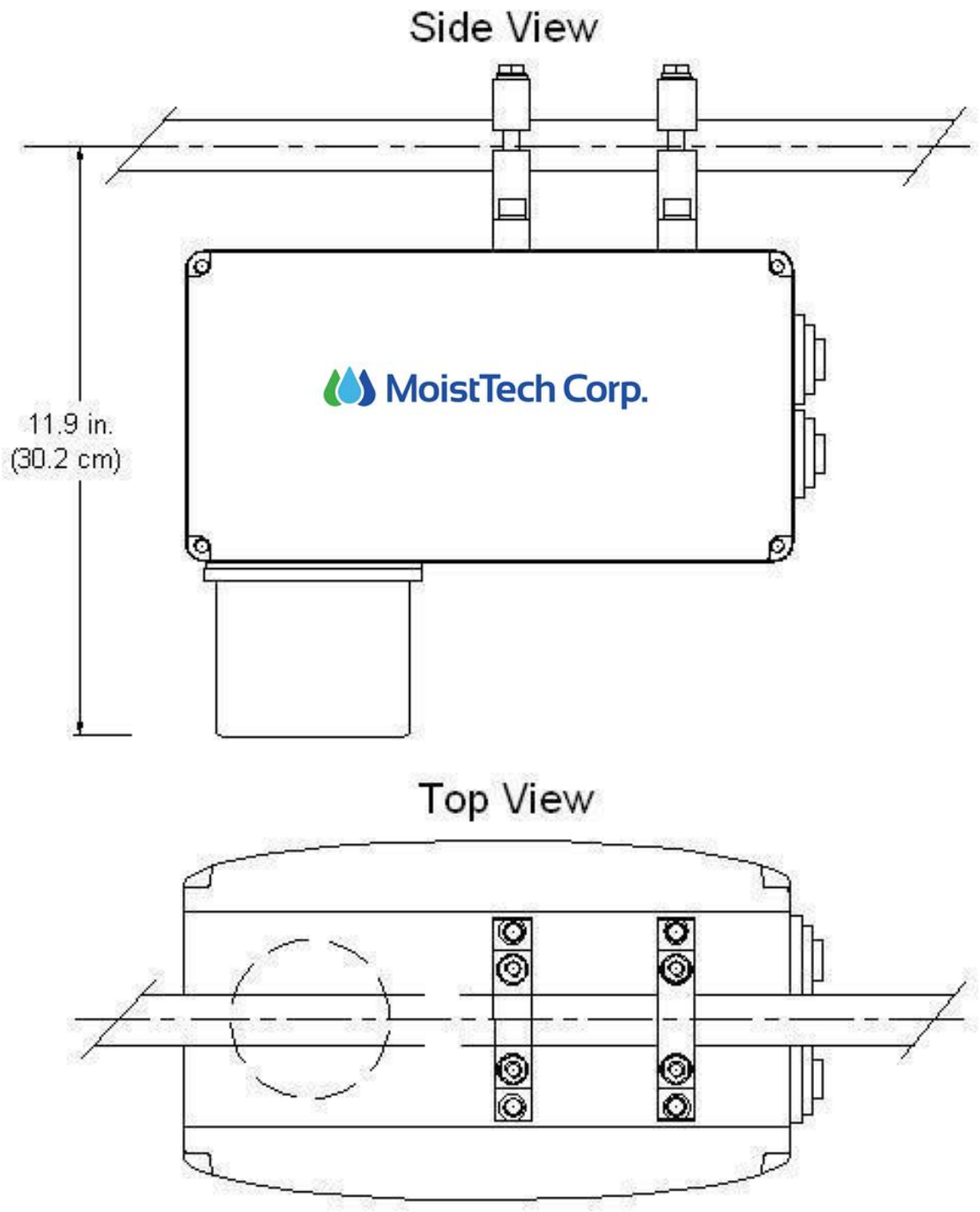

Figure 2. Pole Mount to Top of Gauge – option 1

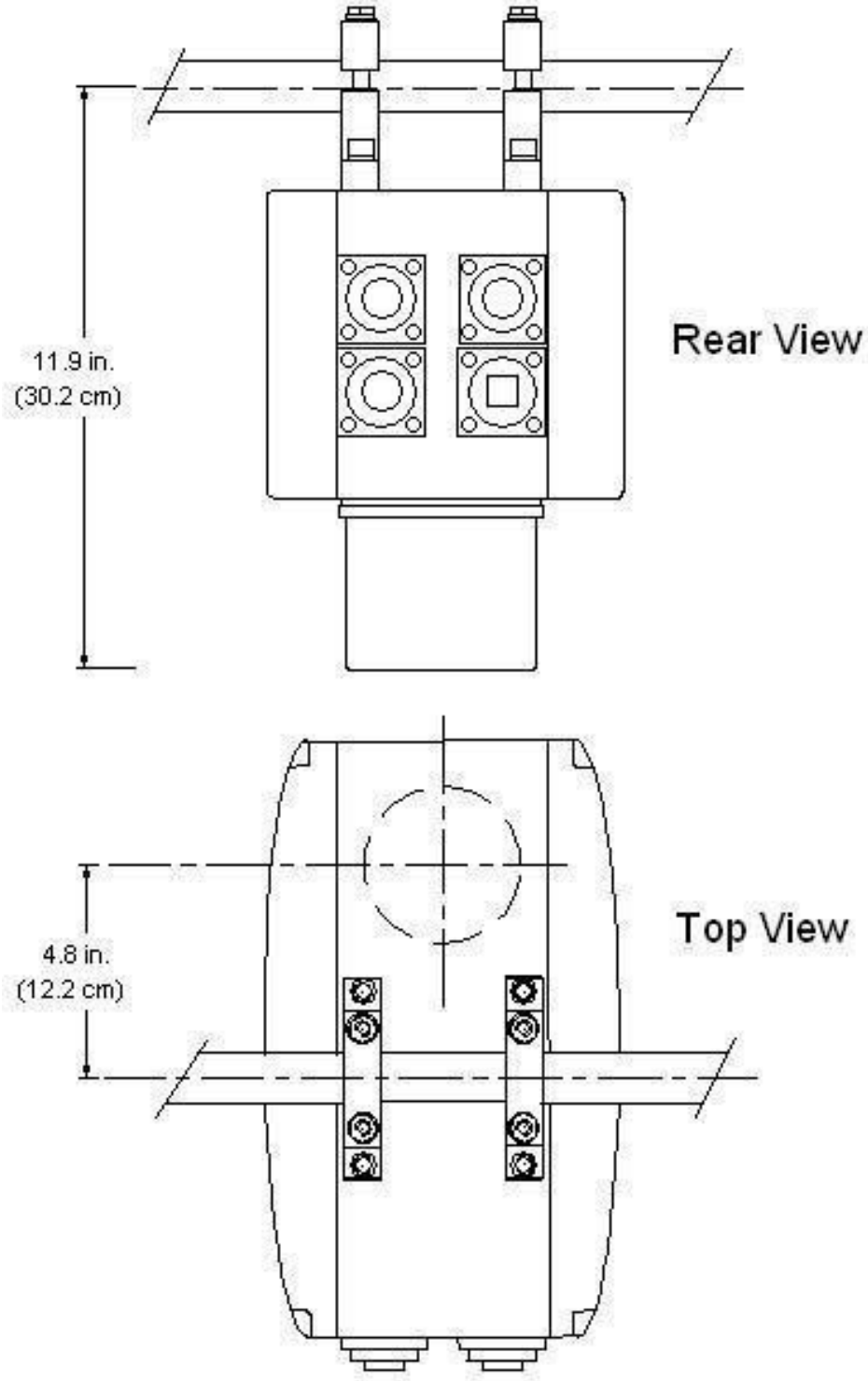

Figure 3. Pole Mount to Top of Gauge – option 2

Electrical Connections

In Figure 4, the rear connector panel of the gauge 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 gauge must have either a Bulgin Cover Cap (p/n: PX0734 supplied with all new gauges) on the connector or a Bulgin Flex Cable Connector plug to seal the gauge and maintain the NEMA4 rating. (Gauge options using a DB-9 or other custom configurations may require special NEMA4 rated connectors, compression fittings and/or cover caps.)

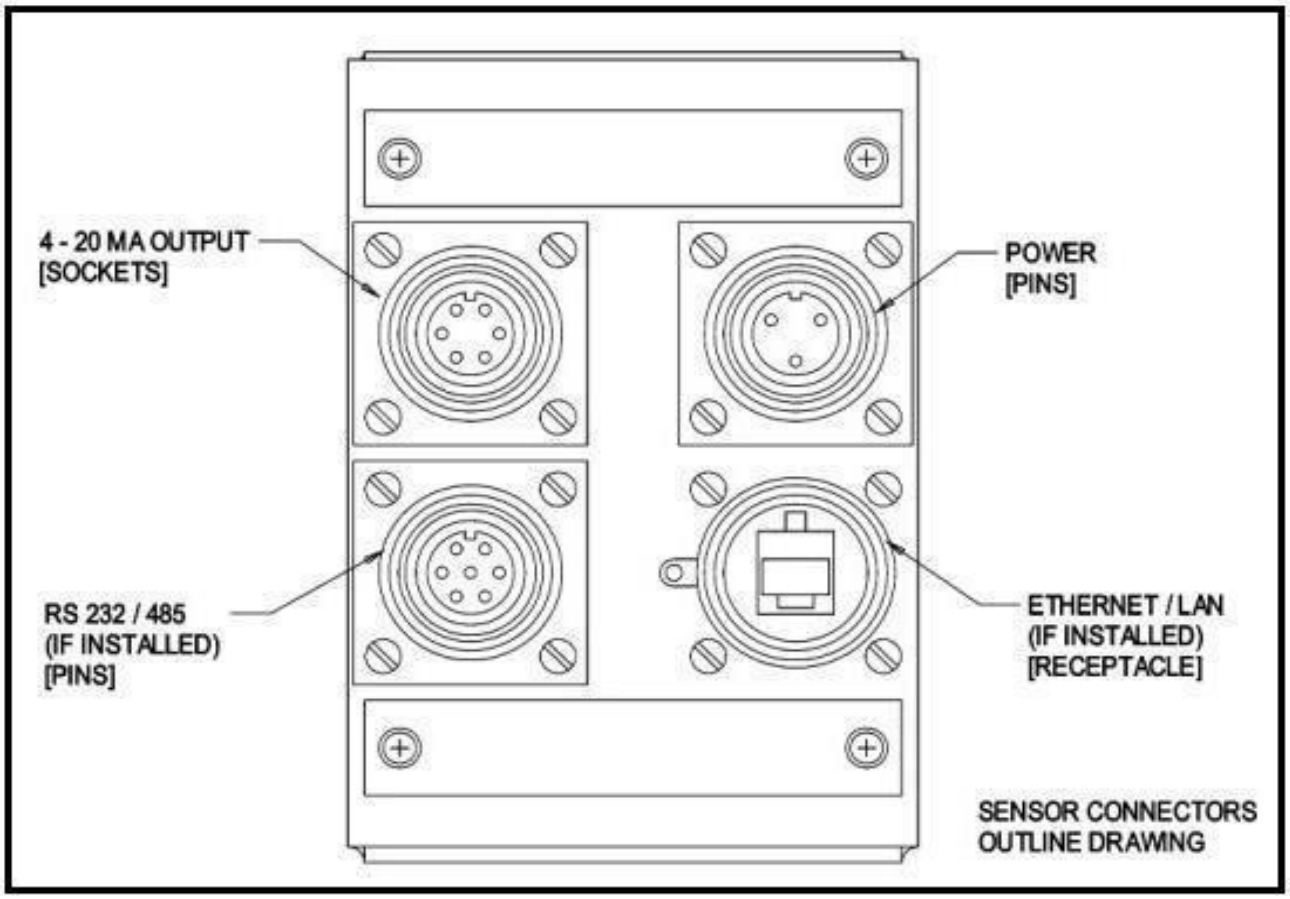

Figure 4. Electrical Connections on Rear of Gauge

See APPENDIX for connector pinout information.

Description of Electrical Connections

POWER - the power connector in the upper right provides either AC or optional DC power input per the gauge configuration ordered. The default power input configuration is for 90VAC-250VAC 50/60Hz via a power cord, which is supplied with the gauge. The 10-foot (3m) 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 PX0734.

Ethernet / LAN – the connector in the lower right provides a Cat5e compliant 10/100 Ethernet crossover connection. The Ethernet receptacle accepts RJ-45 connectors with the T568B standard wiring configuration to communicate with the gauge. The TCP/IP Ethernet connection may be point to point or over a local network and can be factory configured to provide Profinet® and EthernetIP communications protocol. Mates with Bulgin Flex Cable connectors PX0836, PX0834 or Cover Cap PX0734.

Analog 4 - 20 MA OUTPUT – three self-powered, isolated analog 4-20mA output signals are provided at the connector in the upper left. The three outputs are identified as Port1 (Loop1), Port2 (Loop2) and Port3 (Loop3). Each of the three Ports is software configurable to provide moisture, temperature and other 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 MoistTech 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 plug is used to connect to the gauge. Mates with Bulgin Flex Cable connector PX0739/P or Cover Cap PX0734.

Digital RS 232 / 485 – the connector in the lower left provides the factory default RS-232 and RS-485 serial interface. The Digital RS 232 / 485 connector can also be factory configured to provide hardware and software support for half or full duplex RS-422/485, Devicenet®, Profibus®, a second Analog 4 – 20MA OUTPUT, 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. Mates with Bulgin Flex Cable connector PX0745/S or Cover Cap PX0734.

Important: All connectors on the rear of the gauge must have either a Bulgin Cover Cap on the connector or a Bulgin Flex Cable Connector plug on each rear connector to seal the gauge and maintain the NEMA4 rating. (Gauge options using a DB-9 connector or other custom configurations may require special NEMA4 rated connectors, compression fittings and/or cover caps.)

See APPENDIX for connector pinout information.

Software

Personal Computer requirements and software installation

A compact disc is included with the gauge. This CD contains software to perform sensor configuration and display results. PC configuration software is contained in a folder labeled 'IR3000 Configuration'.

Minimum PC Requirements

IBM PC compatible computer

Windows XP or newer

Pentium 4/3.00 GHz. or better processor.

1280 X 1024-pixel resolution, 16-bit color

512MB System RAM

128MB Video RAM

15MB disk space

10/100 MB or faster Ethernet card (2 Ethernet ports recommended)

From the folder labeled IR 3000 Configuration, run Setup.exe and follow the installation instructions.

If earlier versions of MoistTech 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 setup.

Starting the software

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

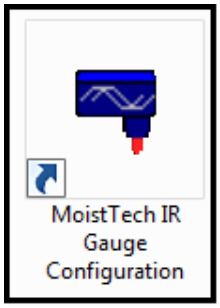

Figure 5. MoistTech IR Gauge Configuration Program Icon

Double clicking the above icon will start the configuration program.

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

Connecting to a Gauge using Ethernet TCP/IP

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

Optional communications protocols may be configured using the Ethernet / LAN port on a gauge to provide Profinet® or EthernetIP protocol interface for digital communications. See the Instrument Configuration Detail sheet provided with the gauge to determine if a custom Ethernet / LAN port option was installed.

Ethernet TCP/IP Communication - Host PC to Gauge

The starting point for gauge configuration is to connect the gauge to a host PC using the Ethernet crossover cable provided by MoistTech. Set-up the host PC Ethernet TCP/IP port (v.4) LAN settings for the factory default settings below:

	Host PC	Gauge
IP Address	192.168.0.94	192.168.0.100
Subnet Mask	255.255.255.0	255.255.255.0
Default Gateway	192.168.0.1	192.168.0.1
DNS Server	192.168.0.1	192.168.0.1

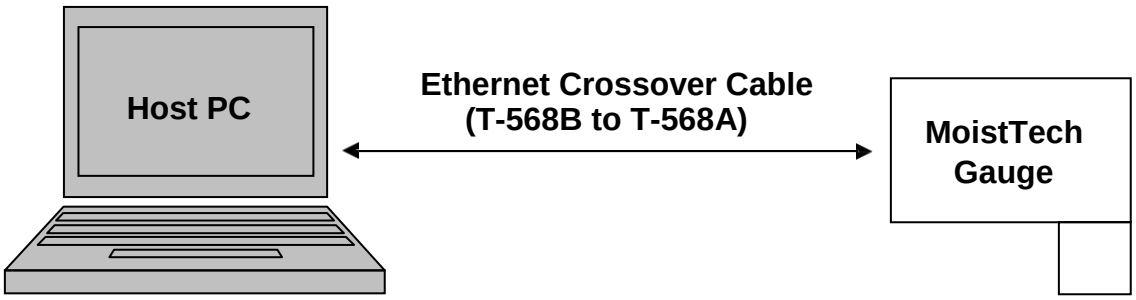

Figure 6. Ethernet TCP/IP Interface Connection using Crossover Cable

Configuring the gauge Ethernet interface for your network is covered in the Ethernet Configuration Screen section.

See the APPENDIX for Ethernet / LAN wiring and connector information.

Connecting to a Gauge using RS-232 or RS-485

The default gauge configuration provides for serial communication via the Digital RS 232 / 485 port on the rear of the gauge. Optional communication protocols may be added to a gauge 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 Instrument Configuration Detail sheet provided with the gauge to determine if a custom option was installed.

RS-232 or RS-485 Serial Communication - Host PC to Gauge

On standard gauges, an alternative to using the Ethernet TCP/IP communication link is to connect with the RS 232 / 485 serial port. The starting point for gauge configuration would be to connect the gauge 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 gauge. 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 gauge.

Connect the host PC to the gauge using the factory default settings below:

	Host PC	Gauge
Baud Rate (Bits per second)	19200	19200
Data bits	8	8
Parity	None	None
Stop Bits	1	1
Flow control	None	None

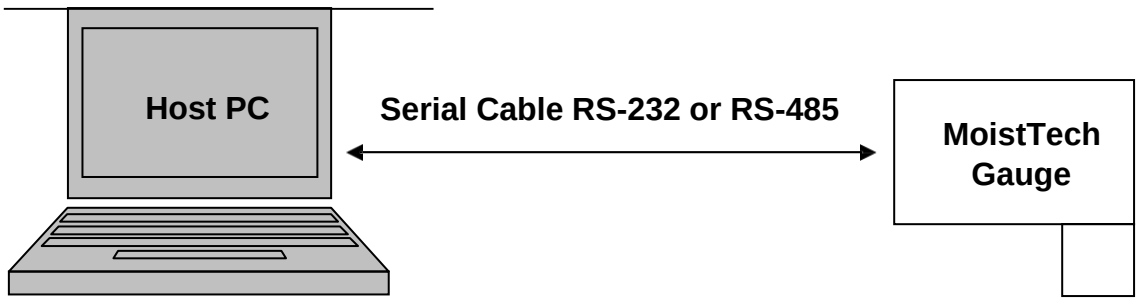

Figure 7. Digital RS 232 / 485 Serial Interface Connection

Configuring the gauge serial interface is covered in the Serial/4-20 mA Configuration Screen section.

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

Main Screen – at Start-up

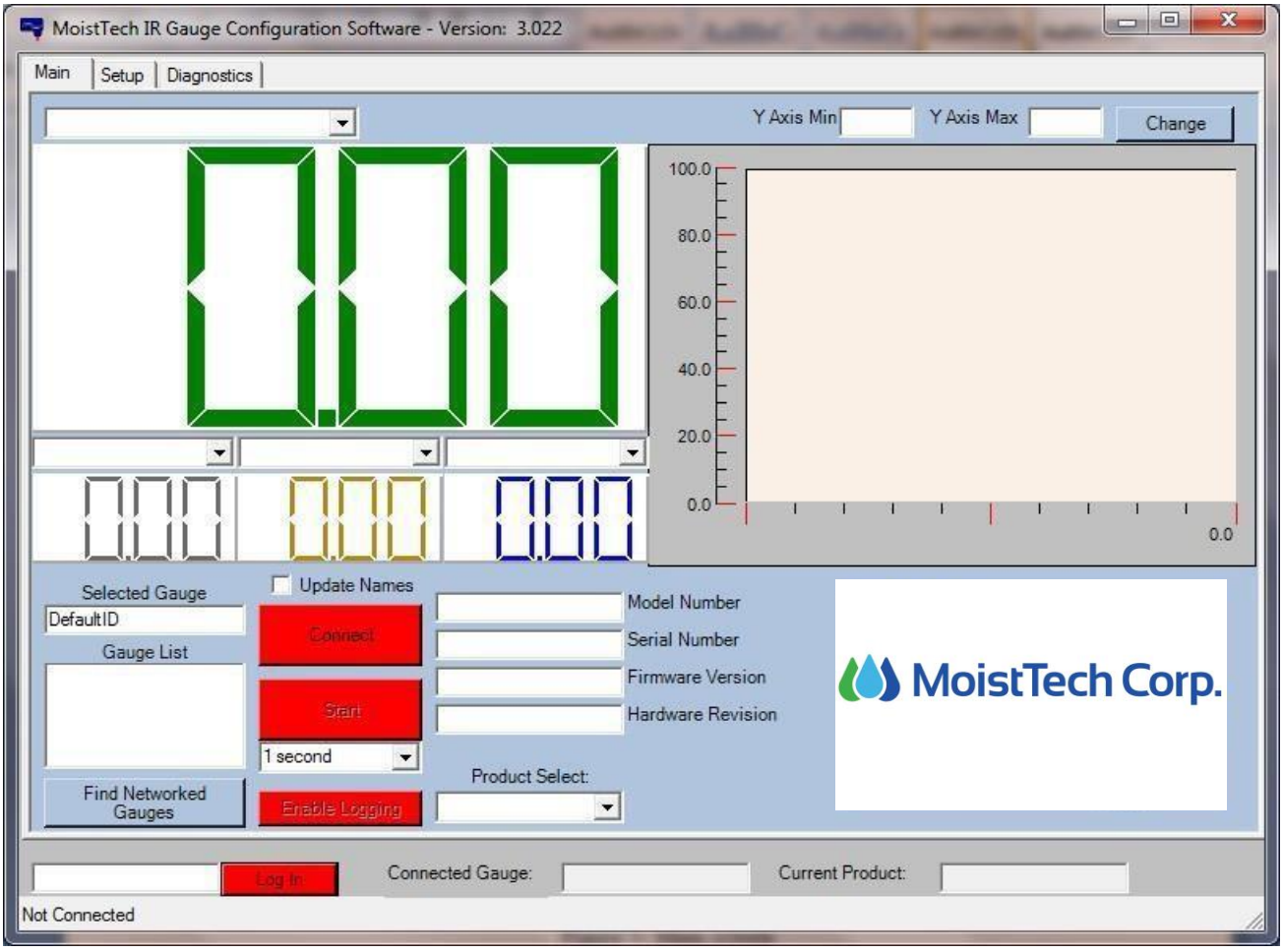

Figure 8. Main Screen at Start-up – Not Connected to a Gauge

To initiate connection between the host PC and a gauge click on "Find Networked Gauges" button on the lower left of the Main screen. All gauges 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 gauge using Ethernet TCP/IP, highlight that gauge 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 gauge 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 "Connect" button to the right. When a gauge 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 gauge.

Main Screen – Gauge Connected

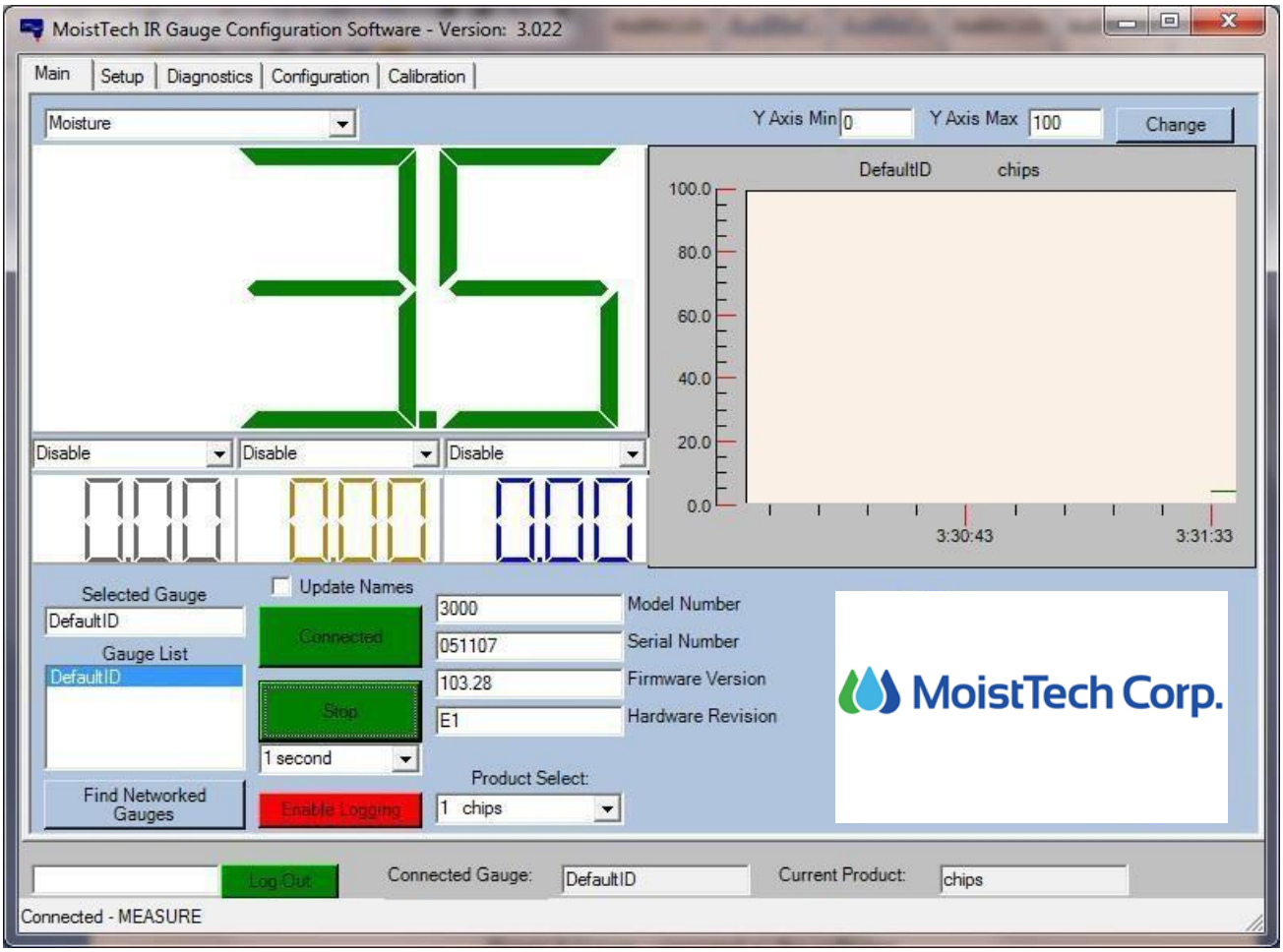

Figure 9. Main Screen with a Gauge Connected

To display the measured value 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 above the “Start” button will indicate the measured value selected and the trend plot in the upper right will begin to display the measured value and time plot as shown above.

The Main Screen above is shown after a gauge is connected to the host PC, the user has logged in using the factory default password and a measurement has started. **User default password is: engpass**

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

1. MoistTech Software Version is displayed in upper bar.
2. At startup, the Main screen shows three tabs in the upper left, namely: ***Main***, ***Setup*** and ***Diagnostics***. The gauge configuration functions are password protected for security. Entering the appropriate password enables more tabs at the top of screen for access to additional gauge functions: ***Configuration*** and ***Calibration***. Select the Tab for each of the ***Setup***, ***Diagnostics Configuration*** and ***Calibration*** screens to select the gauge configuration desired.

3. Drop-down menu to select the constituent (Moisture) to be displayed in the upper display box.
4. Drop-down menus to select the constituents (Disable) to be displayed in each of the lower displays. Up to three different constituents and/or product temperature can be displayed at the same time.
5. Selected Gauge: Displays the Gauge ID name of the gauge currently connected to the host PC using the Configuration program.
6. Gauge List: Displays a list of the Gauge ID names for all gauges currently available that can be selected to connect to the Configuration program. Only one gauge may be connected at a time to the Configuration program.
7. Find Networked Gauges button: Queries all of the gauges connected to the host PC and displays a list of gauges that may be connected to the host PC using the Configuration program.
8. Password entry field and Login / Log Out button: Press the Login button after entering the appropriate password and the button changes from red to green. The default is operator level control when no password is entered.
9. Gauge status display bar is updated with current gauge and measurement status. See Table 2 for gauge status and error messages.
10. Update Names: Checkbox selects all Product specific data stored in the gauge to be read by the Configuration program and over-writes all product data in the Configuration program.
11. Connect button: initiates the data connection between the host PC and gauge. The button is red when not connected to a gauge and changes to green when a gauge is connected.
12. Start/Stop button: begins the display and plot of a measurement on the Main screen. It also starts and stops the data log of measurements.
13. Drop-down menu (1 second) to select the time interval in seconds for updating the displays for each constituent and the sample frequency used for data log of measurements.
14. 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 (see 11) 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.
15. Fields displaying the connected gauge information for gauge model number, gauge serial number, gauge Firmware Version and gauge Hardware Revision.
16. Drop-down menu (1 chips) to select the Product configuration to be used for the current measurement.
17. Connected Gauge: Displays the Gauge ID for the currently connected gauge.
18. Current Product: Displays the currently selected Product configuration.
19. Y Axis Min: Value of lowest measured value to display.
20. Y Axis Max: Value of highest measured value to display.

21. Change button: sends the new ‘Y Axis Min’ and ‘Y Axis Max’ values to configure the plot display.
22. Display time vs. measured value plot of all selected constituents to be measured and displayed and when enabled the measured values to be data logged.

Setup Screen

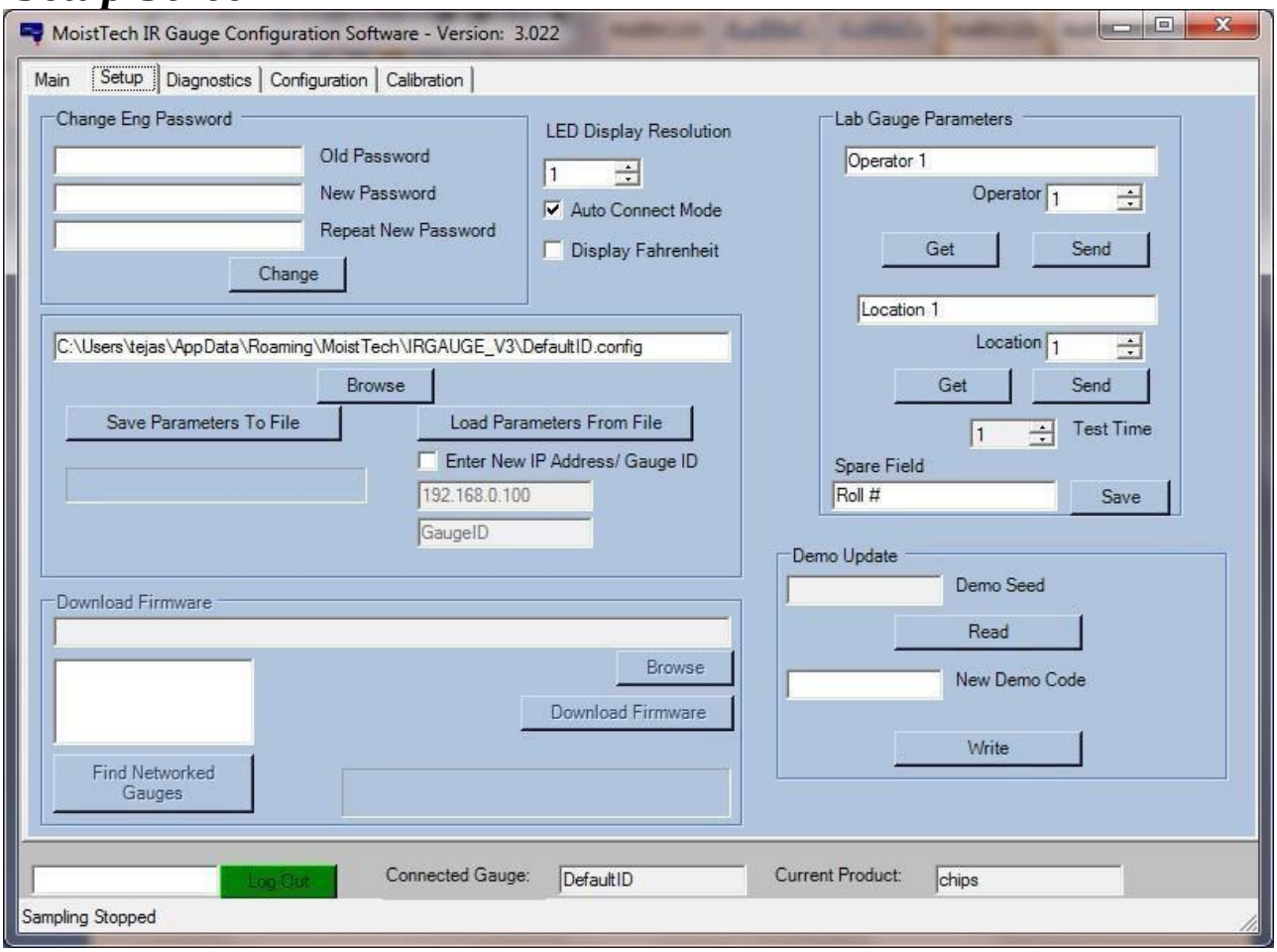

Figure 10. Setup Screen

From the Setup screen shown above, it is possible to create new user passwords, but the factory default will always work. Changes to Setup screen configurations will take place when a new field is entered, or a button is pressed.

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

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

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: 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 screens.
6. Auto Connect Mode checkbox: when selected, will automatically connect to Ethernet TCP/IP devices connected to the Ethernet LAN port such as an Operator Interface unit.
7. Display Fahrenheit checkbox: allows the user to display the temperature readings either in the Celsius setting (default) or by selecting the checkbox to display the temperature in Fahrenheit.
8. Save Parameters To File button: allows the user to save the current gauge 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 gauge configuration and parameters from the file specified in the "C:\pathname\filename" field above.
10. Enter New Gauge IP Address / Gauge ID: allows the user to change the current IP address for the gauge and/or the GaugeID name. New IP address or GaugeID may be entered in the fields above the checkbox.
11. Download Firmware: the internal processor (Rabbit) can be programmed by using this function.
12. Find Networked Gauges: press this button to query the gauges connected to the host PC and display a list of available gauges that may be connected to the host PC using the Configuration program.

Lab Gauge Parameters Box – Allows configuration of IR858 Lab Gauge parameters.

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

Demo Update Box – (for factory use only).

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

Diagnostics Screen

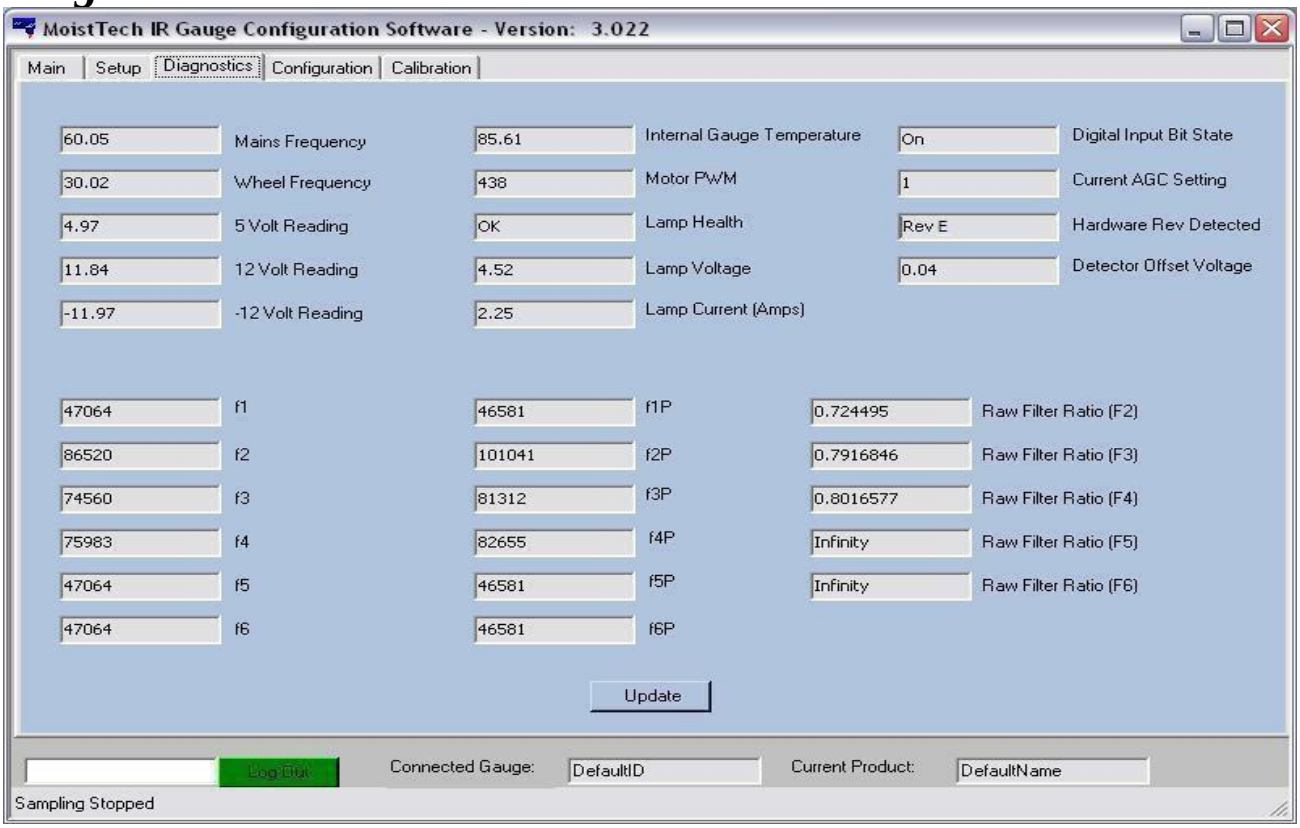

Figure 11. Diagnostics Screen

The Diagnostics screen is shown above. The Diagnostic values are loaded when the "Update" button is pressed, and the current gauge information will be displayed. The Diagnostics screen field descriptions are as follows (from upper left of screen):

1. Mains Frequency: displays 50Hz or 60Hz mains frequency supplied to gauge.
2. Wheel Frequency: displays gauge 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 gauge internal temperature.
7. Motor PWM: displays pulse width modulation of the filter motor.
8. Lamp Health: displays the condition of the Lamp. "OK" will be displayed on a working gauge.
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 gauge.
14. Detector Offset Voltage: displays the offset voltage of the detector.
15. f1-f6, f1P-f6P, Raw Filter Ratio (F2-F6): Internal gauge signals (for factory use only)

Measure Configuration Screen

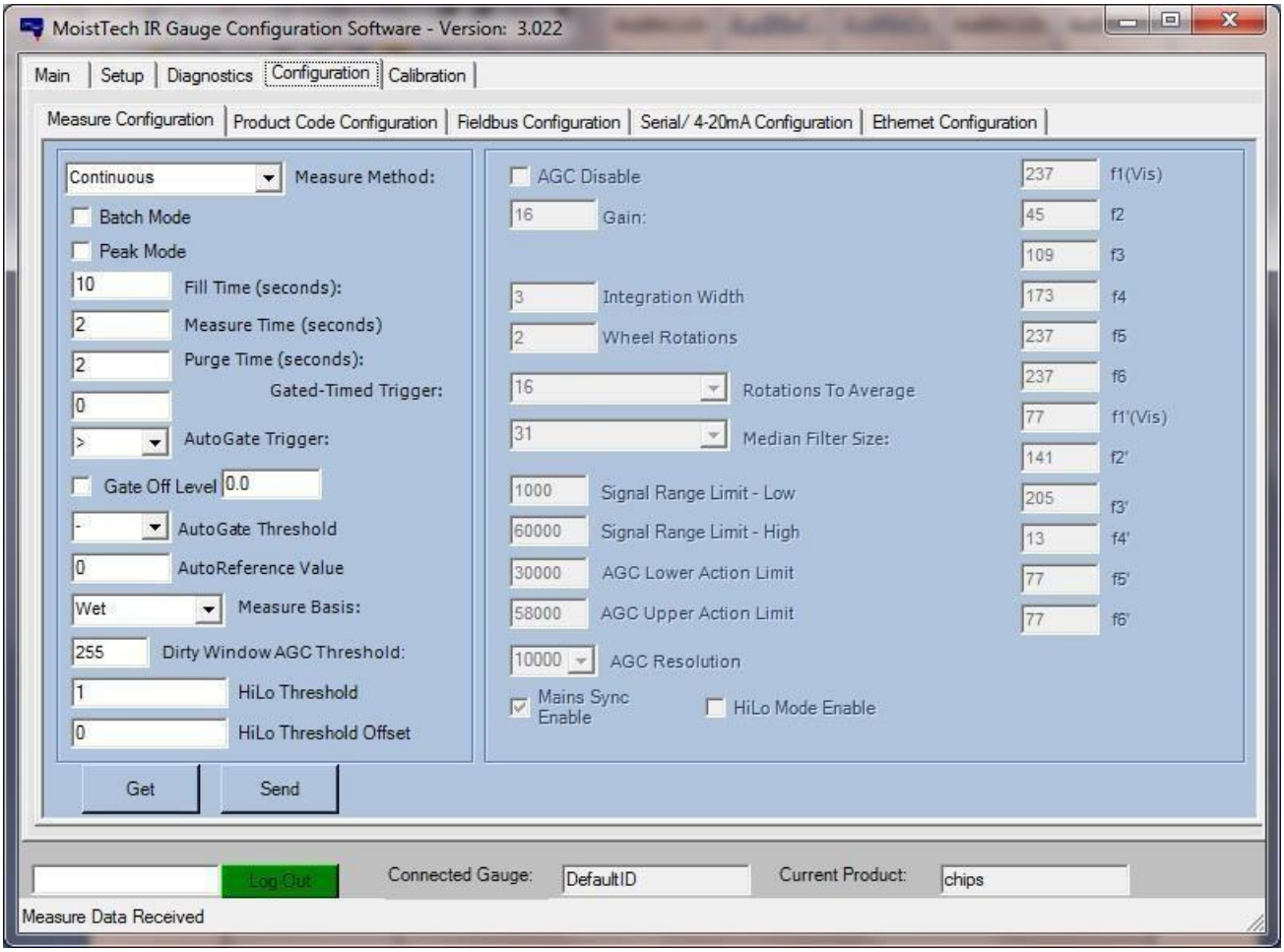

Figure 12. Measure Configuration Screen

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

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

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

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

Continuous	Measures continuously
Signal Gated	An external input signal is provided to the gauge, which enables a measurement sample for a true logic input voltage. A false logic input voltage disables measurement and the last measurement is held.
Auto Gated	Similar to signal gated, but gating is enabled by using the measurement level threshold. A measurement 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.
Timed Sample	Used when a sampling device is attached to the gauge 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.
Gate Timed	An external input signal is provided to the gauge, which enables a measurement sample for a timed interval for an externally provided true logic input voltage to the gauge. The Measure Time interval is programmable.
Auto Reference	A measurement is made on a sample (uncoated web) as a zero reference (for zero coating). This value is stored and sets the zero-value offset for additional coating measurements. This accounts for sample (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. 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.

8. AutoGate Trigger: drop-down menu used in Auto Gate mode to set the direction of change in measurement value 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. AutoGate Threshold: drop-down menu used in Auto Gate mode to set the measured value required to begin measurements.
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 gauge AGC operation. When the gauge 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: used when HiLo Mode is enabled to set the measurement threshold to switch the gauge from a low measurement range measurement to a high measurement range measurement. The low measurement range is selected automatically when the measurement is below the HiLo Threshold minus HiLo Threshold Offset values. This mode is factory configured and requires a HiLo filter wheel.
15. HiLo Threshold Offset: used when HiLo Mode is enabled to set the measurement offset to switch the gauge from a high measurement range measurement to a low measurement range measurement.

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

Note: Every gauge is set at the factory for the gauge 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 gauge will perform the measurement in the mode desired.

Product Code Configuration – General Parameters Screen

The Product Code Configuration screen contains four sub-screens: General Parameters, Product Specific Parameters, Product Filtering and Constituent Names as described in the following sections.

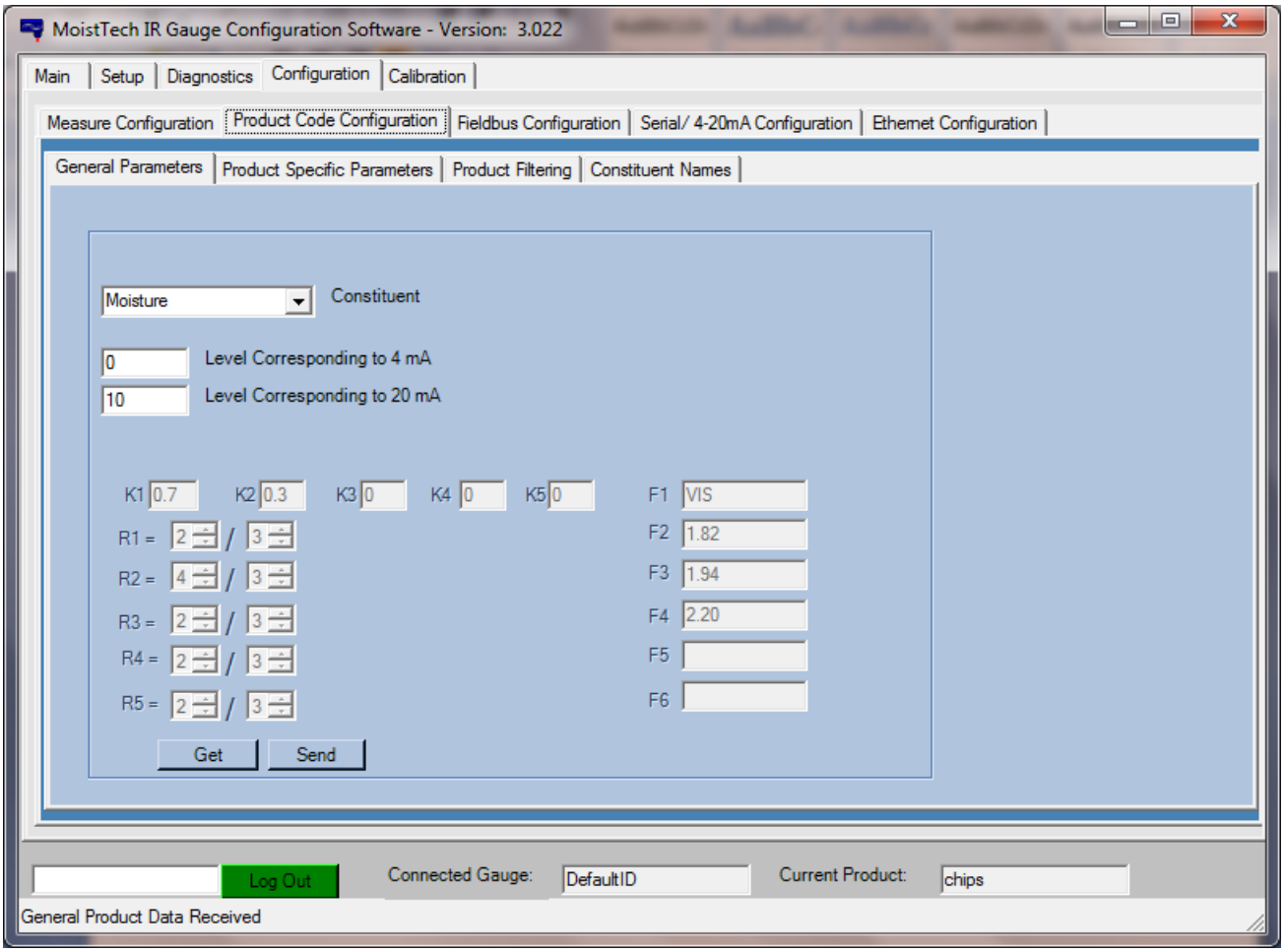

Figure 13. Product Code Configuration- General Parameters Screen

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

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

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 gauge configuration and data fields, which are “grayed” out in the lower half of the screen, are not user configurable.

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

Note: The 4mA and 20mA values are typically preset at the factory to application requirements and will match the display values, which have been preset when a MoistTech Digital Panel Meter is provided.

Product Code Configuration – Product Specific Parameters Screen

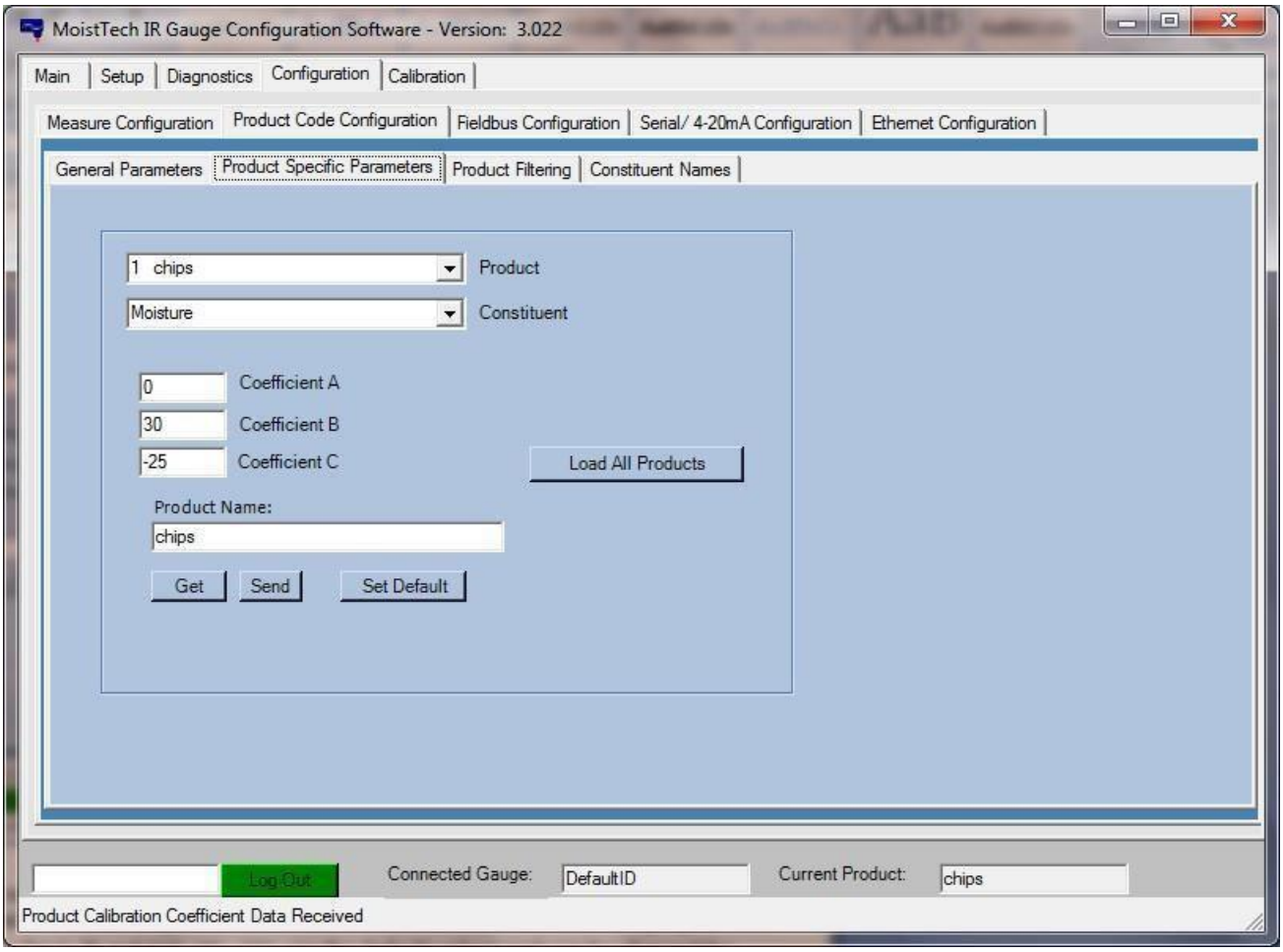

Figure 14. Product Specific Parameters Screen

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

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

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 instrument 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 gauge and the “Send” button writes to the gauge.

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 screen or by using the Calibration procedure described in this manual.

Note: When specified, a gauge 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 MoistTech to ensure the calibration is performed on the materials being measured.

Product Code Configuration – Product Filtering Screen

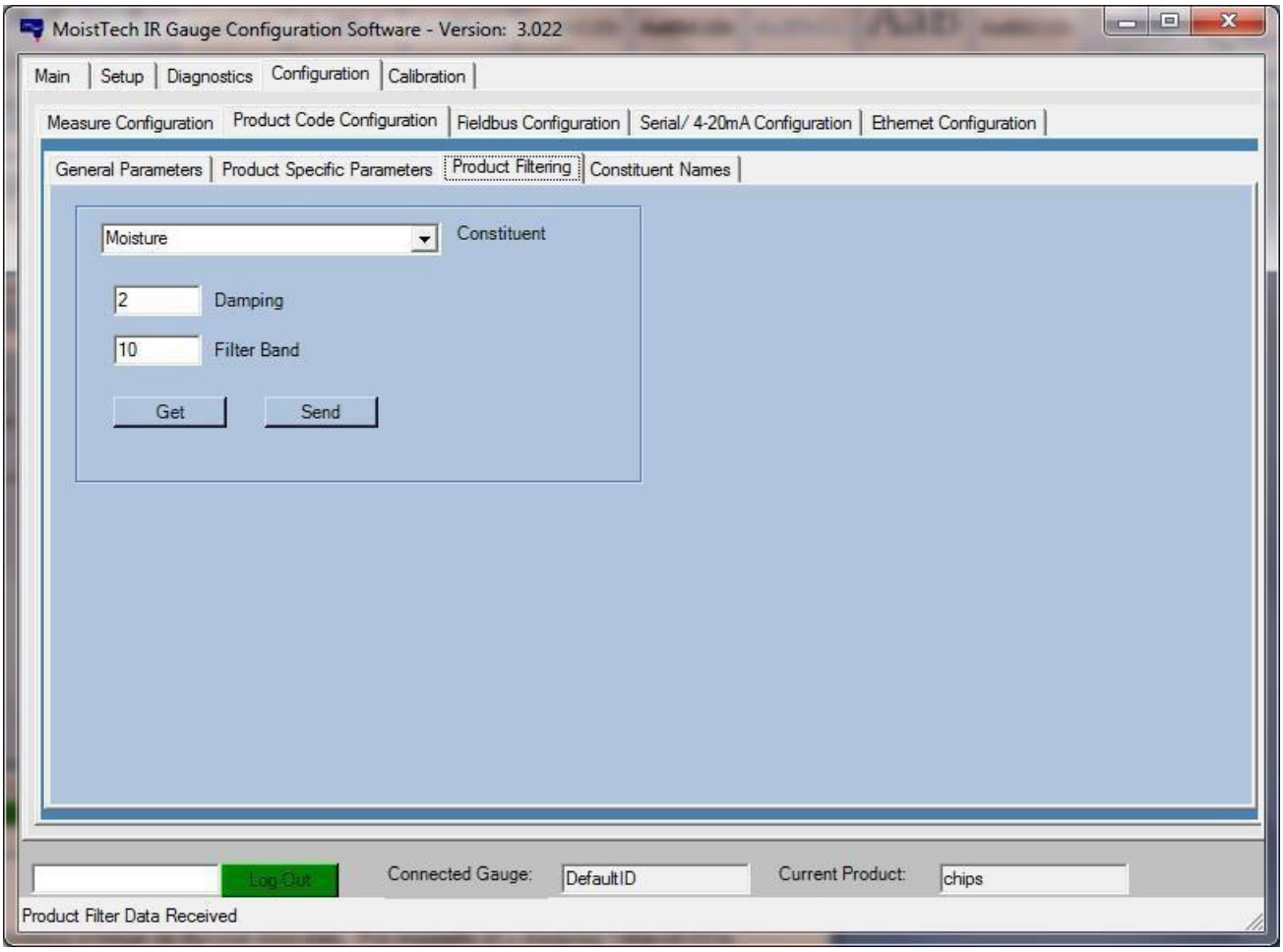

Figure 15. Product Filtering Screen

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

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 gauge 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 gauge 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 gauge and the “Send” button writes to the gauge.

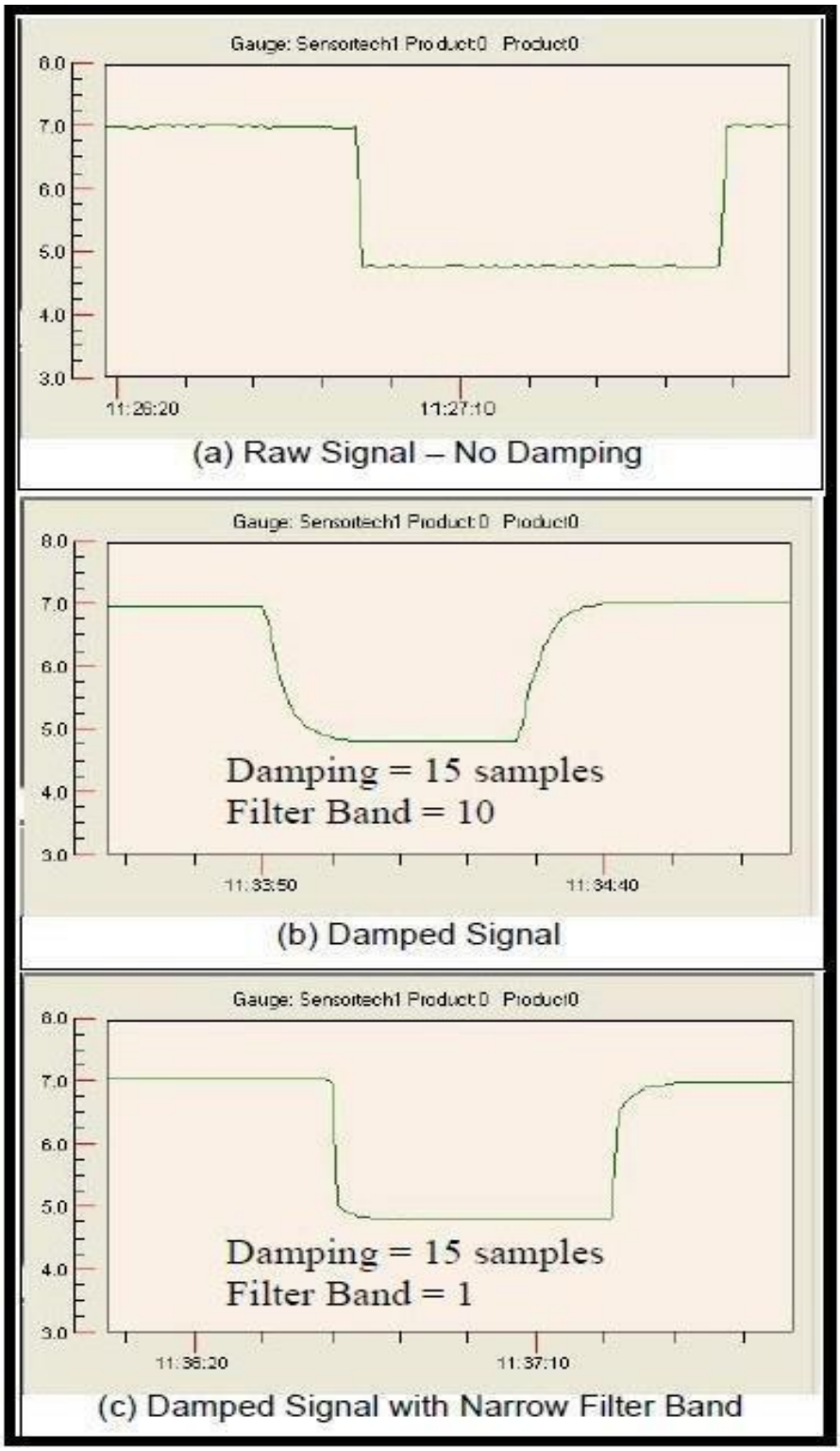

Figure 16. Effect of Damping and Filtering on Measurements

Product Code Configuration – Constituent Names Screen

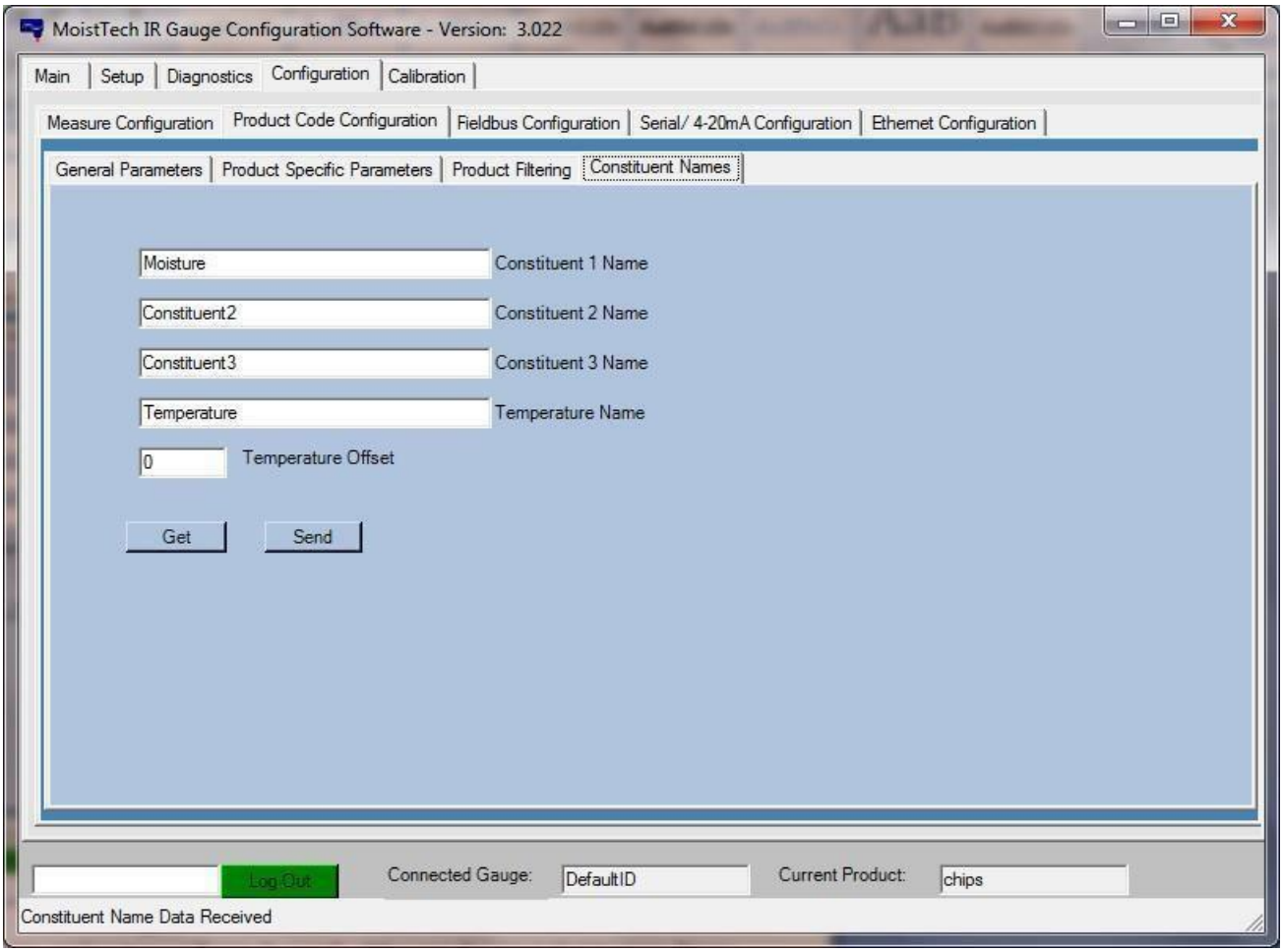

Figure 17. Constituent Names Screen

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 screens. Typical Constituent Names are Moisture, Fat, Protein, Sugar, Clarity, Nicotine, etc.

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

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 gauge and the "Send" button writes to the gauge.

Fieldbus Configuration Screen

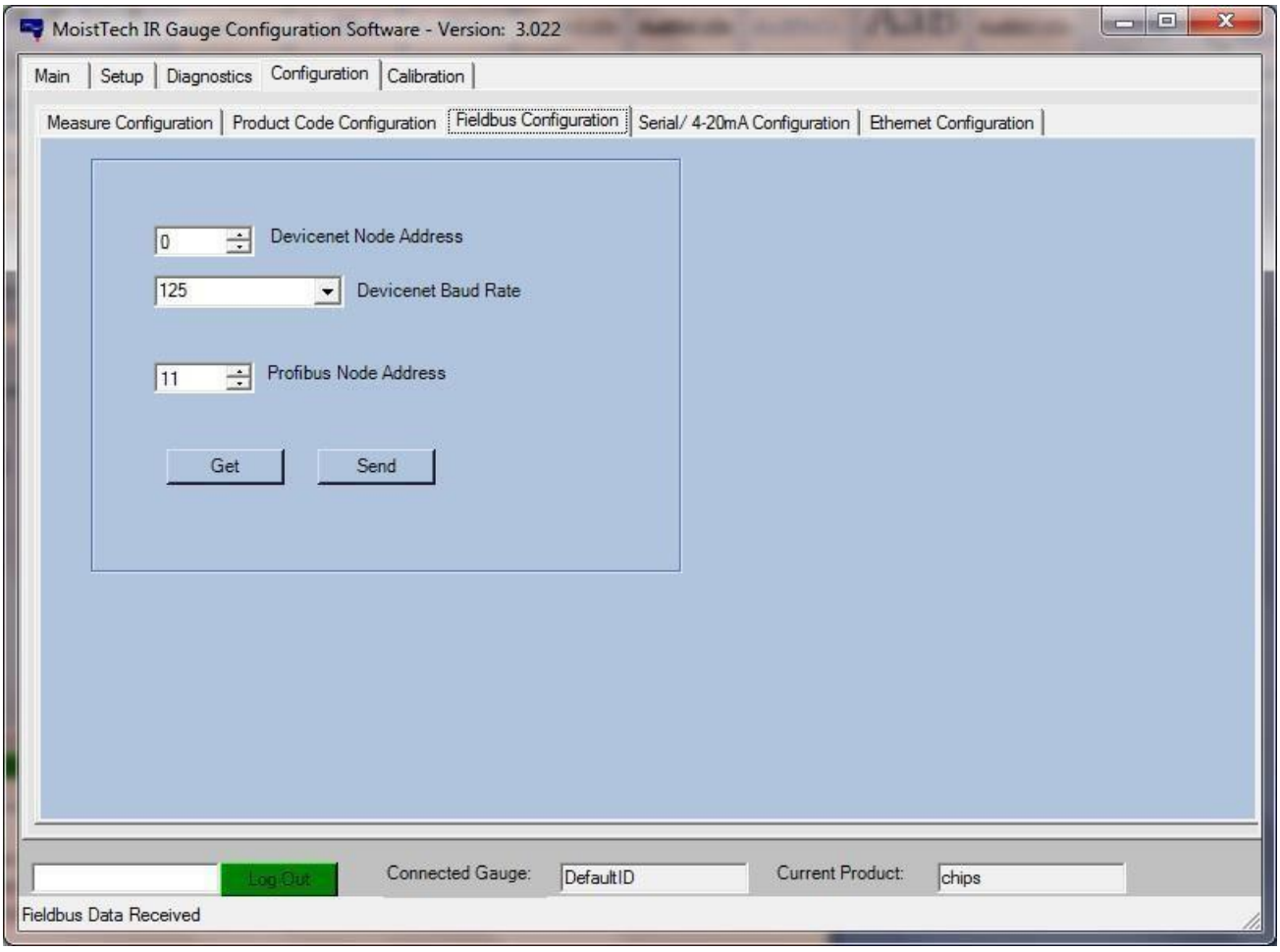

Figure 18. Fieldbus Configuration Screen

The Fieldbus Configuration screen allows the user to configure the gauge to communicate with a Devicenet® or Profibus® network. The gauge must be configured at the factory for the hardware, connectors and software required to support Devicenet® or Profibus® communications.

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

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 gauge and the "Send" button writes to the gauge.

Serial/ 4-20 mA Configuration Screen

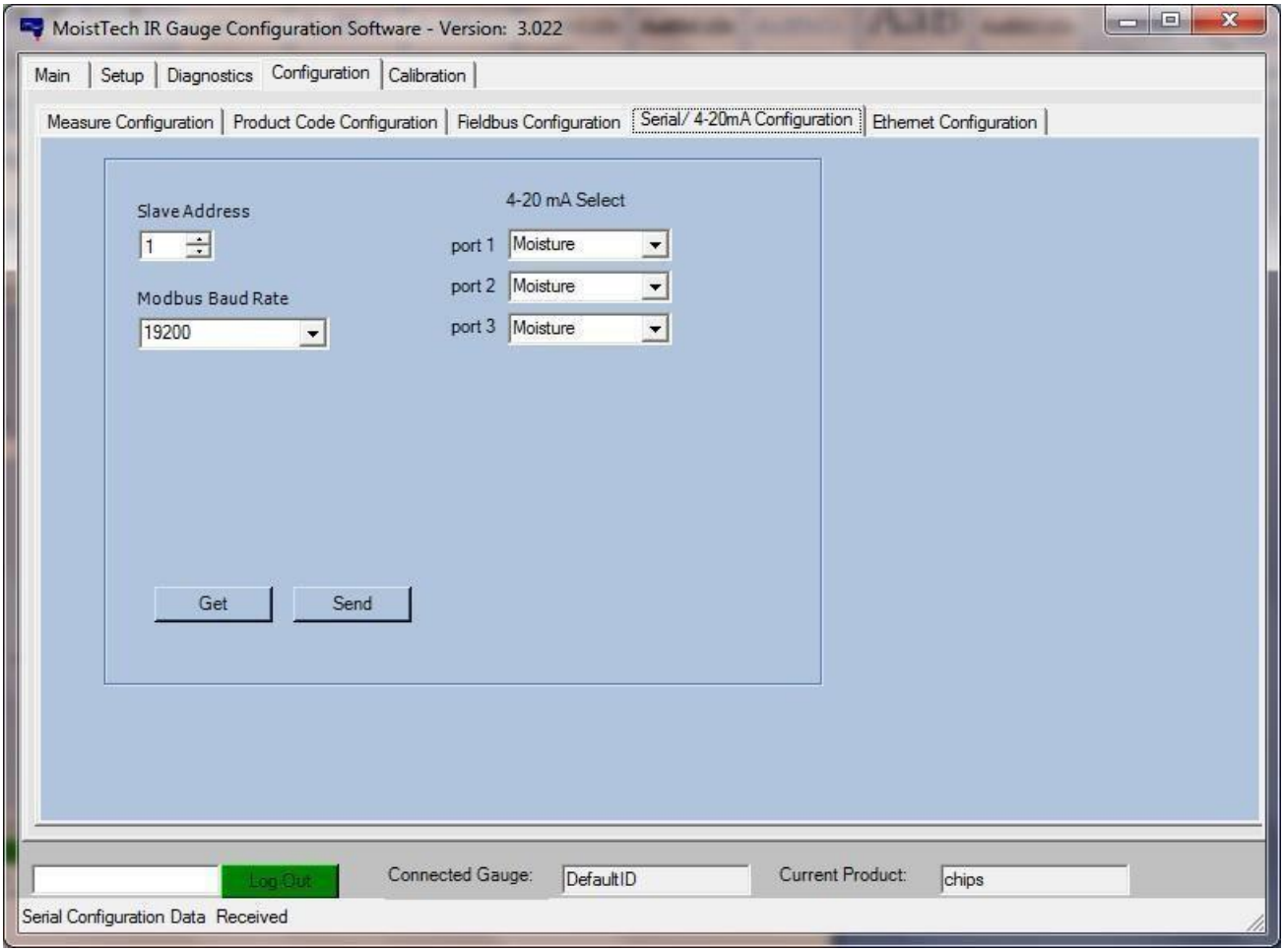

Figure 19. Serial / 4-20 mA Configuration Screen

The Serial/4-20 mA Configuration screen allows the user to configure the gauge 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/4-20 mA Configuration screen descriptions are as follows (from upper left of screen):

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 gauge.

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

Ethernet Configuration Screen

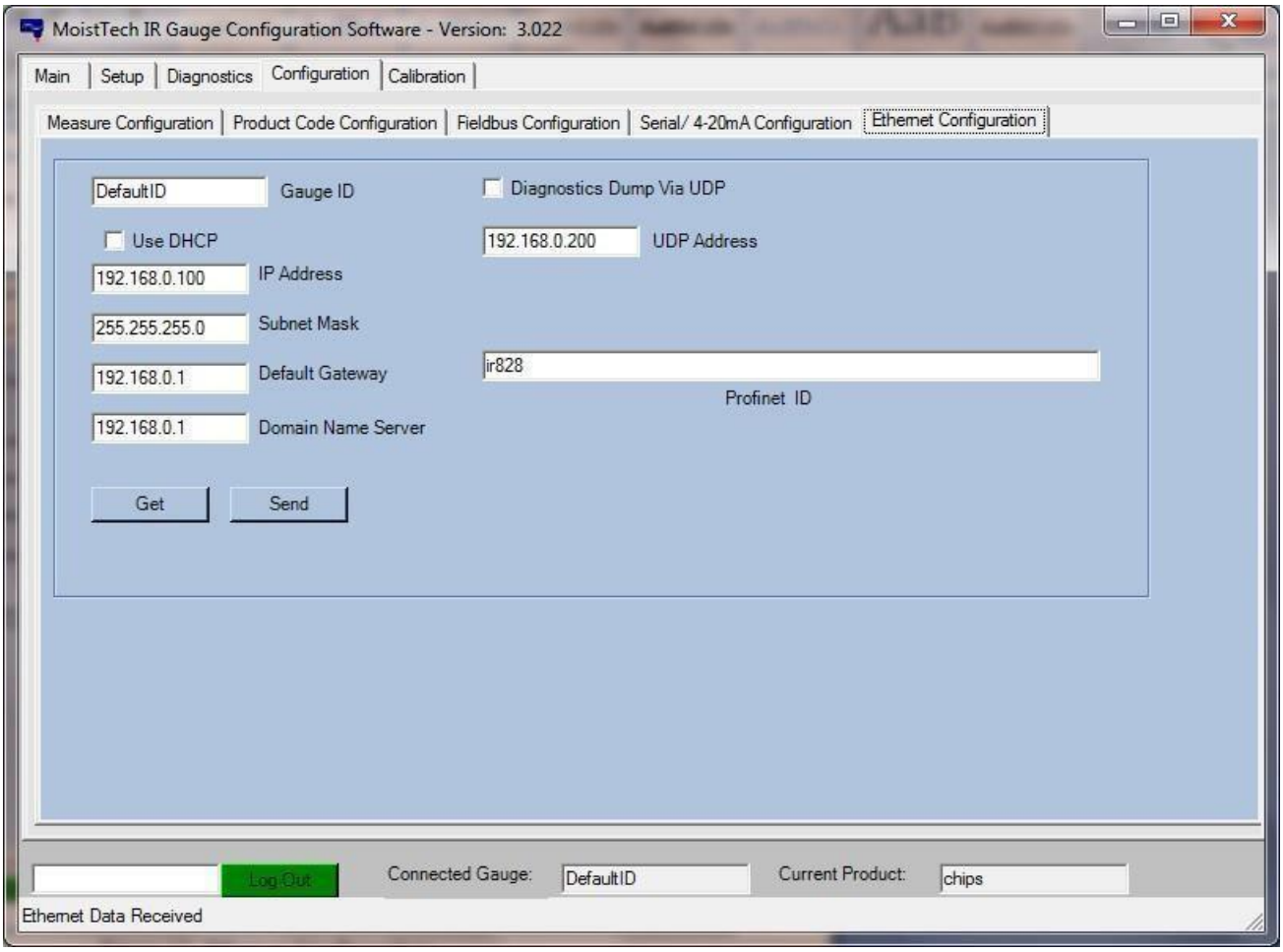

Figure 20. Ethernet Configuration Screen

The most commonly used gauge interface is the TCP/IP Ethernet port. The 10/100 Ethernet port is standard on all IR-3000 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 a gauge.

The 'Use DHCP' checkbox should be selected when a gauge 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 gauge start up.

Note: The 'Diagnostics Dump Via UDP' checkbox is normally not selected by a user. The default is to leave it unchecked. The UDP address has been updated as 192.168.0.200 from previous default value of 192.168.0.94. The Profinet ID field is used for identification on a Profinet® network.

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

Calibration Screen

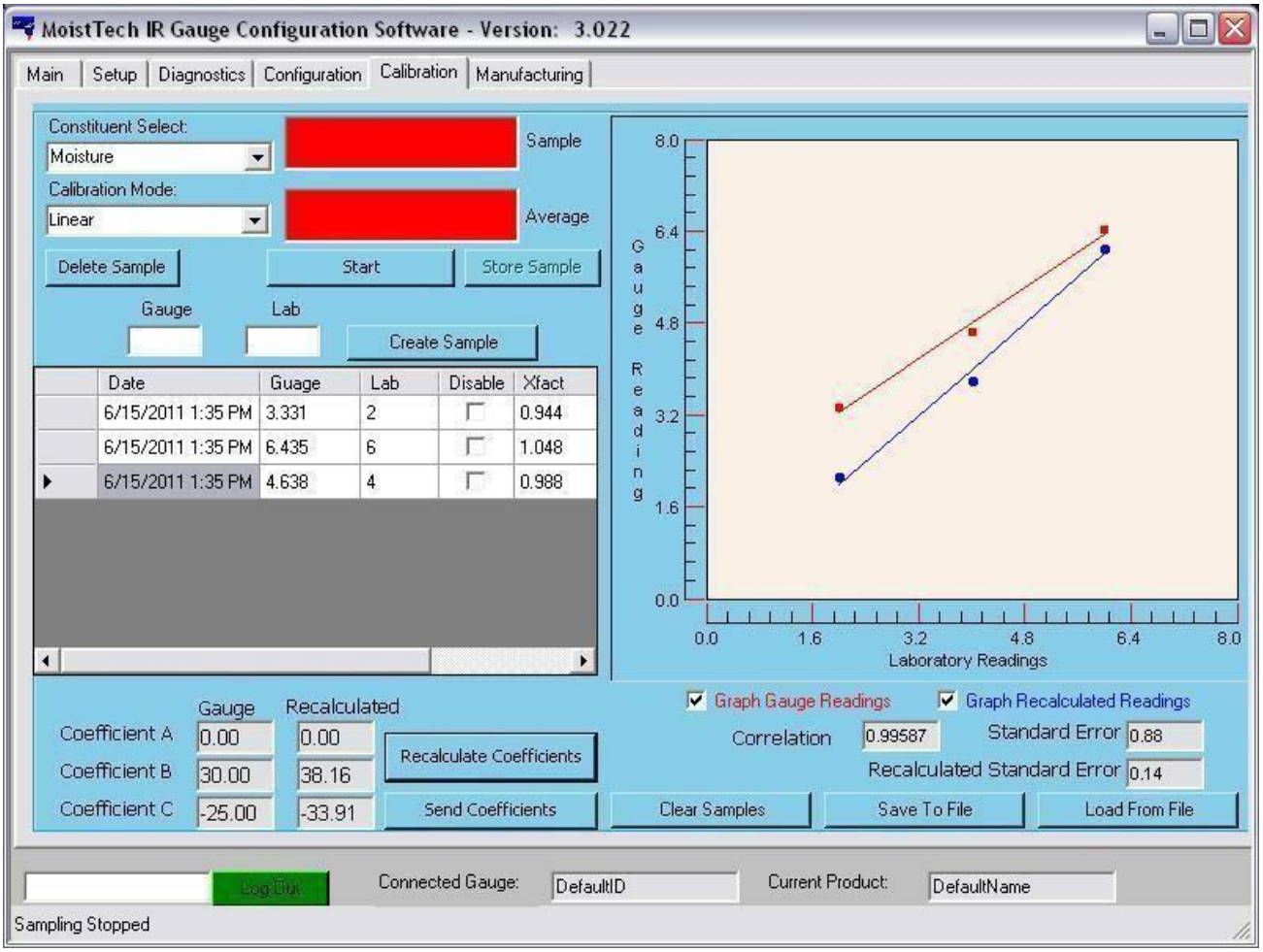

Figure 21. Calibration Screen

The Calibration screen allows the user to acquire sample measurements from physical samples taken for laboratory analysis. The laboratory analysis results and the gauge sample measurements are entered into the Calibration screen to determine the gauge calibration coefficients and laboratory value vs. gauge measurement correlation as well as the standard error.

The Calibration screen descriptions are as follows (from upper left of screen):

1. Constituent Select: Drop-down menu One constituent at a time may be selected for the sample calibration. It can be selected from the drop-down menu available. It can be a single constituent such as Moisture, Protein or Nicotine.
2. Calibration Mode: There are two modes which can be employed for Calibration purposes: Linear and Offset. Appropriate selection of the Calibration Mode can be selected using the drop-down menu.
3. Delete Sample button: Deletes a previous sample measurement.
4. Sample: The Sample field will display the current sample measurement.

5. Average: The Average field will display the average of the sample measurements between start and stop of the sample measurement.
6. Start / Stop button: By pressing the 'Start' button, the calibration measurement is initiated. The button changes to a 'Stop' button, which stops sample measurement.
7. Store Sample button: This button stores the average value obtained during sample period into the Gauge value in Table. The Gauge value is also stored in the Lab value column in Table to be changed subsequent to laboratory analysis.
8. Create Sample button: This function allows manual entry of a value in the Gauge field and a corresponding value in the Lab field.
9. Recalculate Coefficients button: The values of coefficients A, B and C would be recalculated after using this function.
10. Send Coefficients button: On using this function, the recalculated values would be sent to the gauge, which would replace the previous stored values.
11. Correlation: This shows the quality data fit between the Gauge and Lab data. The optimum value for a correlation is 1.
12. Standard Error: The standard error is the average of the square root of the squares of the sum of all errors. This error is calculated using the Gauge and the Lab values.
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 values from the Calibration screen related to the current Calibration. Note: All data will be lost unless a 'Save to File' is performed.
15. Save To File button: After performing the calibration, the coefficient values can be stored to a file in the host PC for future use.
16. Load From File button: This function can be used to load any previous calibration measurements performed to the Calibration screen.

Performing a Product Calibration

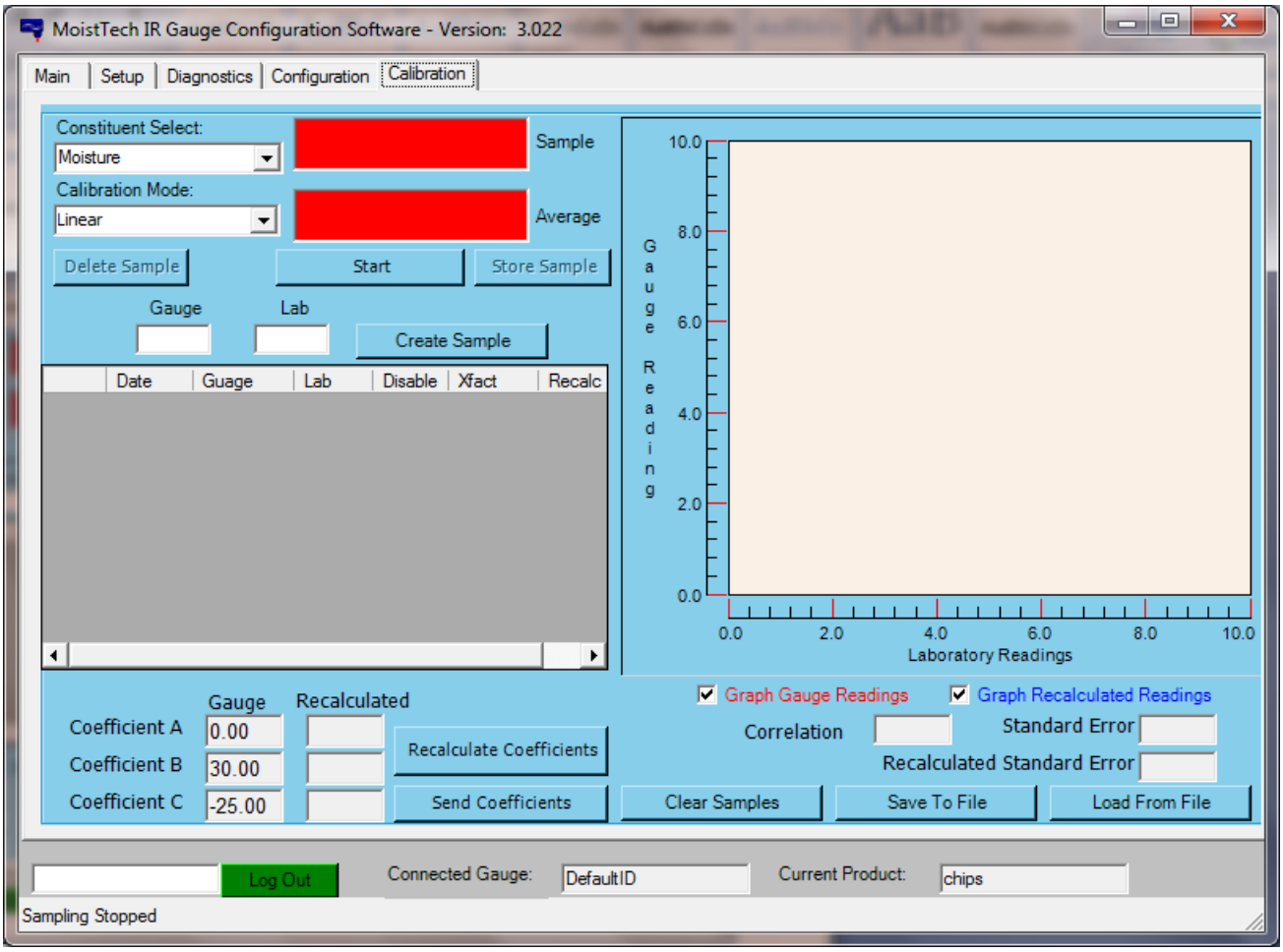

Figure 22. Calibration Screen at Beginning of Product Calibration

A useful tool provided in the Configuration program is the Product Calibration function. This function provides the user with the capability of grabbing a physical sample from the process of the same material that the gauge is measuring. Alternately, a laboratory analysis physical sample may be used.

The Product Calibration procedure is comprised of taking a sample from the process in close proximity to the gauge, and then pressing the 'Start' sampling button. Each time this button is pressed, it will toggle between 'Start' and 'Stop'. After taking a sample, the 'Store Sample' button will be hi-lighted and the 'Average' measurement between start and stop sampling is displayed. Pressing 'Store Sample' button will store this value in the calibration table. Each sample has an associated time and date stamp to facilitate sample matching.

Previously stored Product Calibration data may also be used by loading a previously saved data file (from an earlier Product Calibration), amending it with current data and then recalculating the coefficients using the entire range of data.

Highlighting the sample data row and pressing the ‘Sample Delete’ button allows the user to delete invalid samples. **Caution:** Deleted samples are not recoverable. It is recommended to save the data to a file prior to editing.

Two modes can be employed for Product Calibration: Linear and Offset. The ‘Calibration Mode’ can be selected using the drop-down menu to select the Linear or Offset mode. Both modes are described in the following sections.

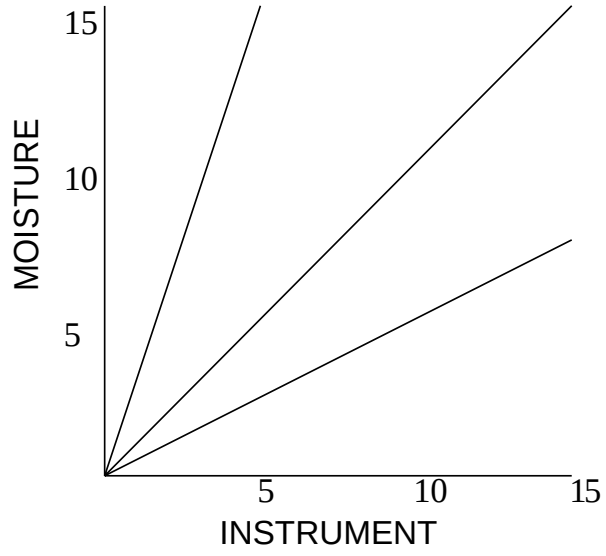

Figure 23. Effect of Coefficient B on slope.

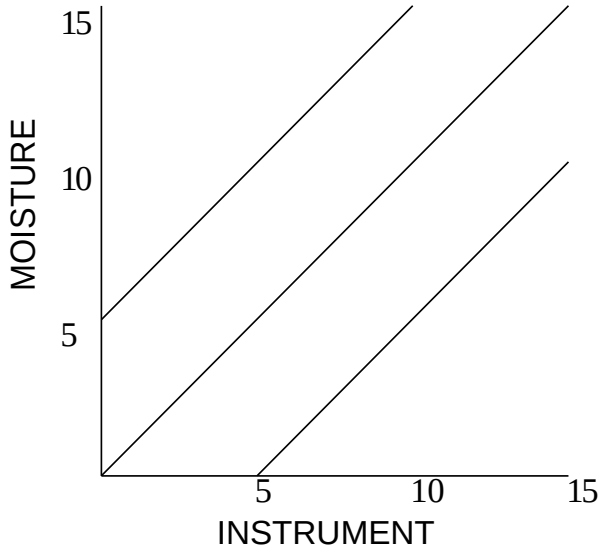

Figure 24. Effect of Coefficient C on offset.

Offset Mode:

The simplest calibration is the ‘Offset’ method. This method assumes that the gauge has been previously calibrated and the calibration slope (Coefficient B) is approximately right. Sampling is performed using the calibration procedure exactly as in the previously described method. Pressing the ‘Recalculate Coefficients’ button calculates the mean gauge error. Coefficient ‘C’ is adjusted to make mean error zero. New coefficients are sent to the gauge by pressing the ‘Send Coefficients’ button.

Linear Mode:

Linear regression is a statistical program that 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 a perfect correlation.

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.

After entering the sample measurements to the calibration table and having performed a laboratory analysis on the corresponding samples, the laboratory analysis values may be entered into the calibration table. Double click on the appropriate ‘Lab’ value field and enter the new lab value into the pop-up window that appears. Repeat until all lab values have been entered into the calibration table then press the ‘Recalculate Coefficients’ button. The sample measurements and the ‘Lab’ values are used to calculate new coefficients according to the average error between the values. New coefficients are sent to the gauge by pressing the ‘Send Coefficients’button.

A linear regression should only be performed on data with an adequate range.

Running a linear regression on static physical samples is often a good way of establishing a slope. When the gauge is then placed on-line, the offset method may be used to offset the measurements to the correct range.

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

1. Select the Calibration screen 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 gauge-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.

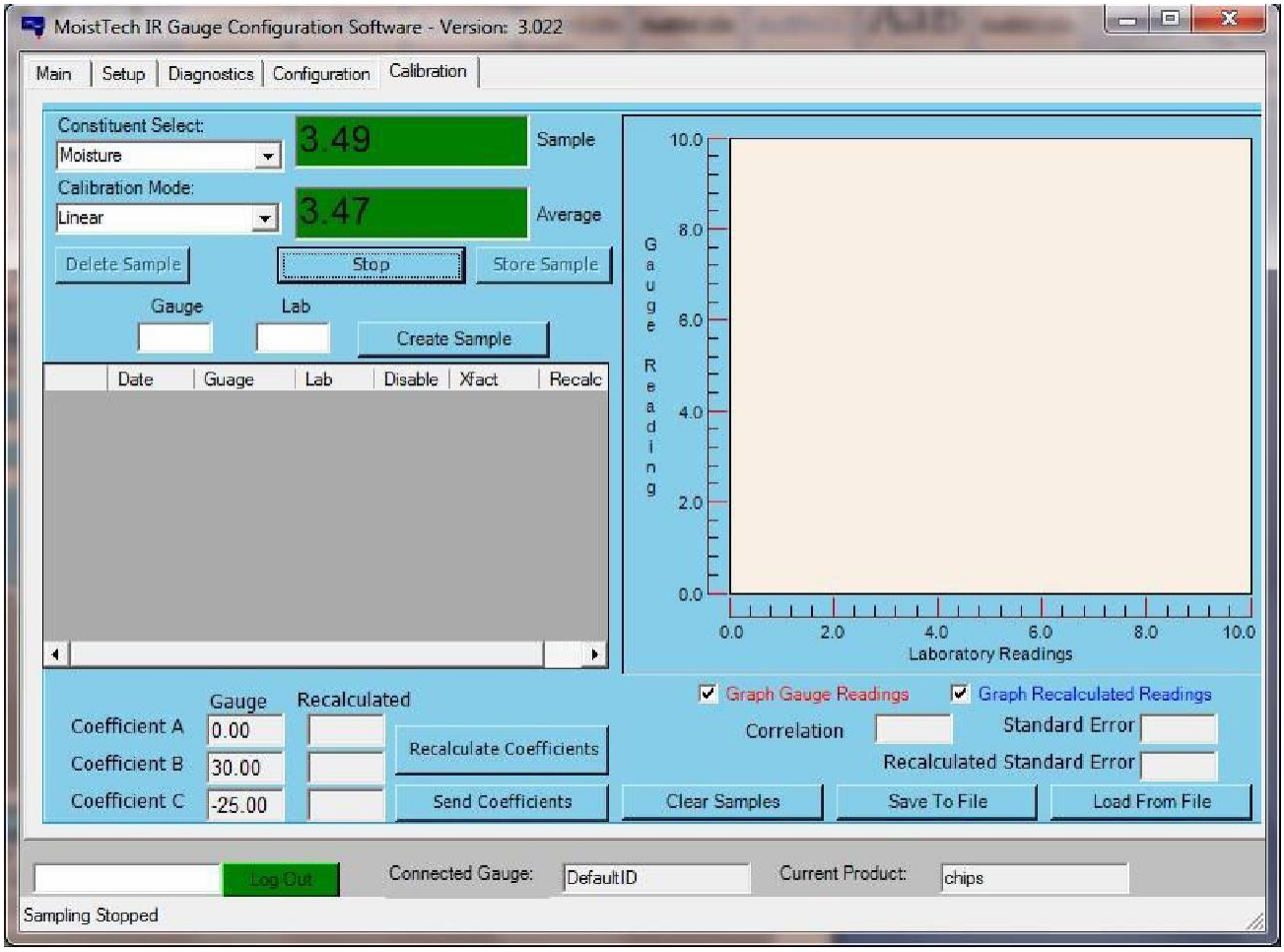

Figure 25. Calibration Screen While Making a Measurement

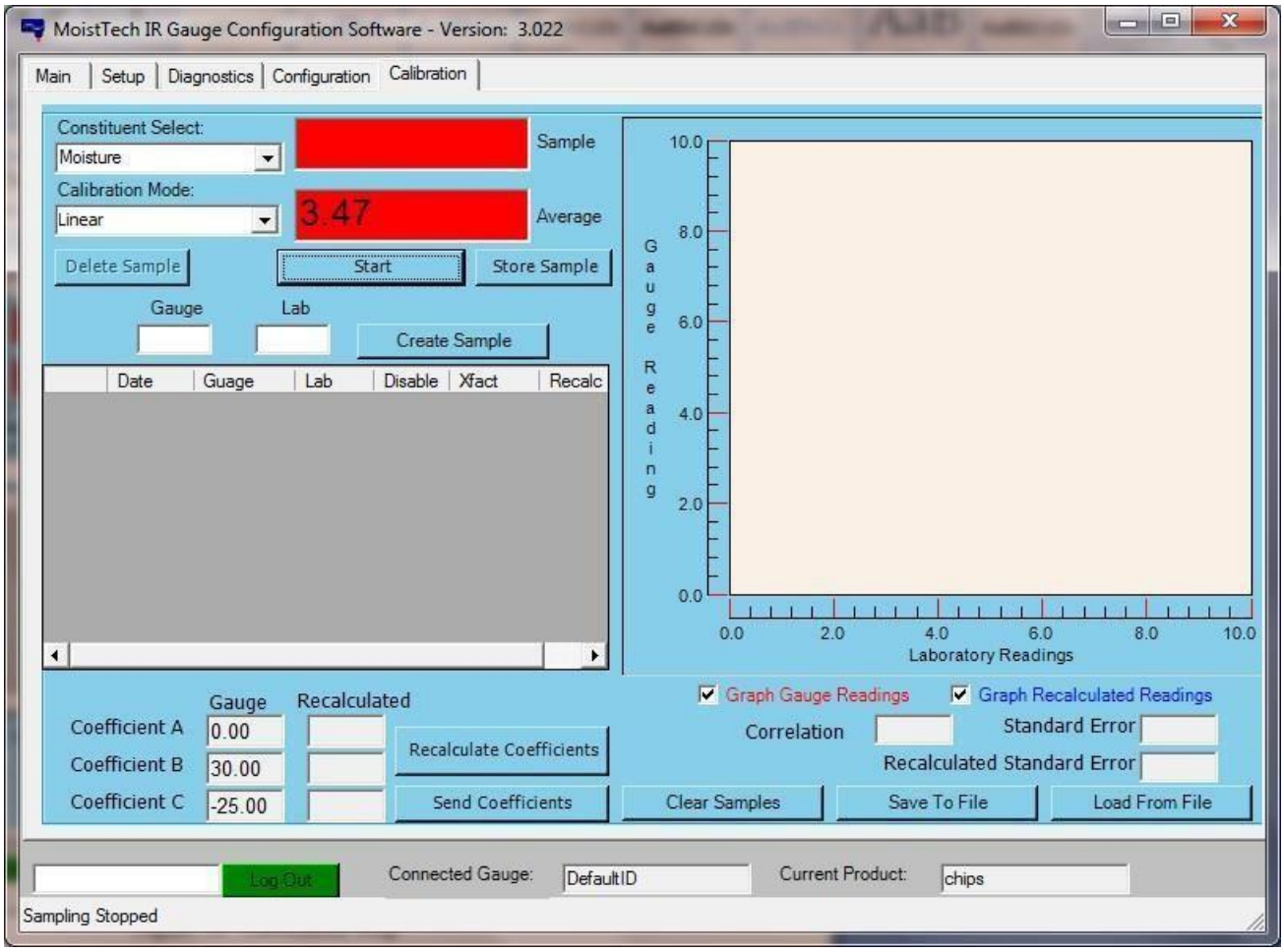

Figure 26. Calibration Screen After Sample Measurement Stop

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.

7. Press ‘Store Sample’ button. The sample measurement is stored to the table.
8. 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 calibrationrange.

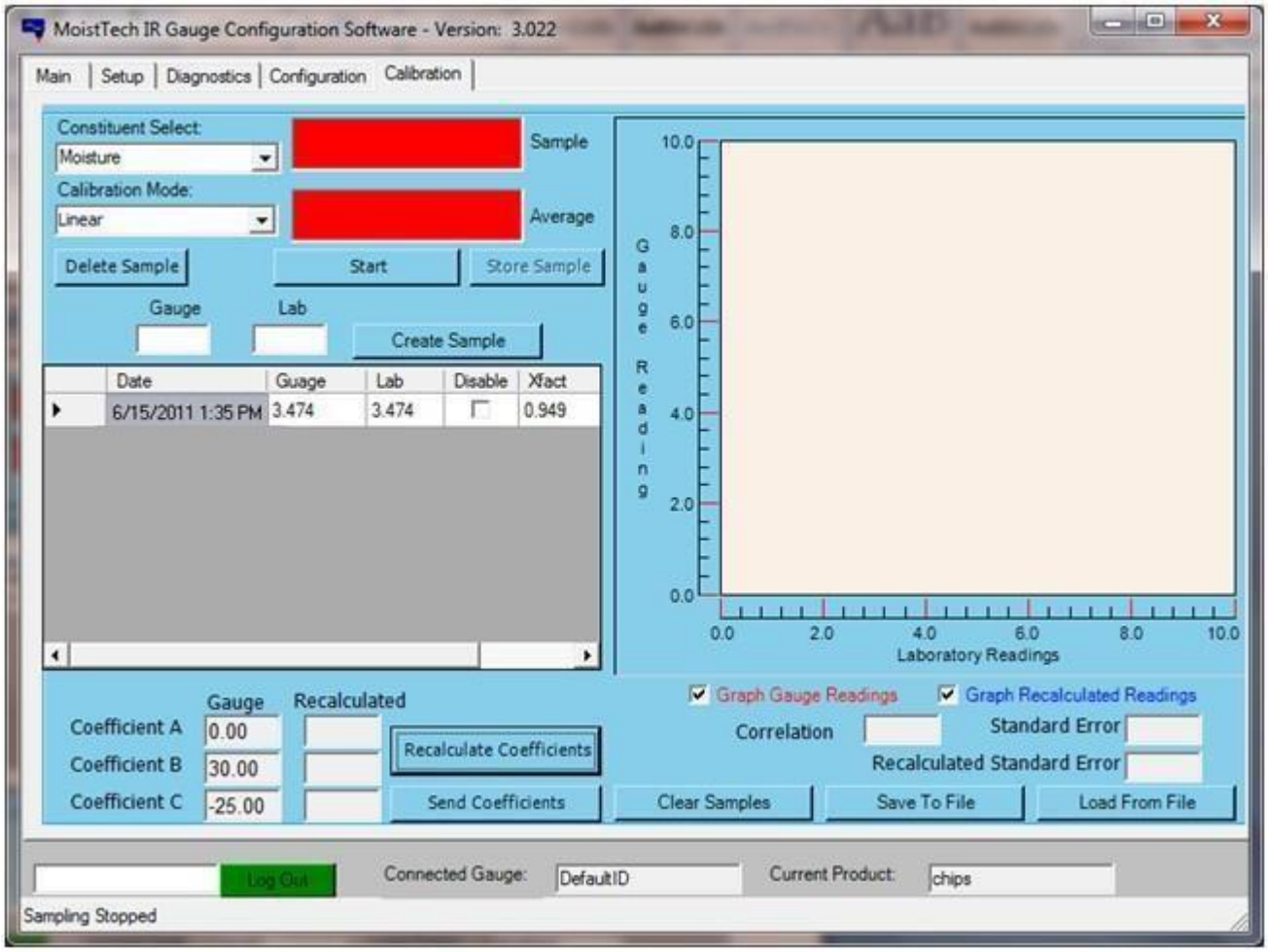

Figure 27. Calibration Values Stored in the Table

9. The stored samples will be displayed with time and date information in the table fields as shown above.
10. 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.

11. 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.

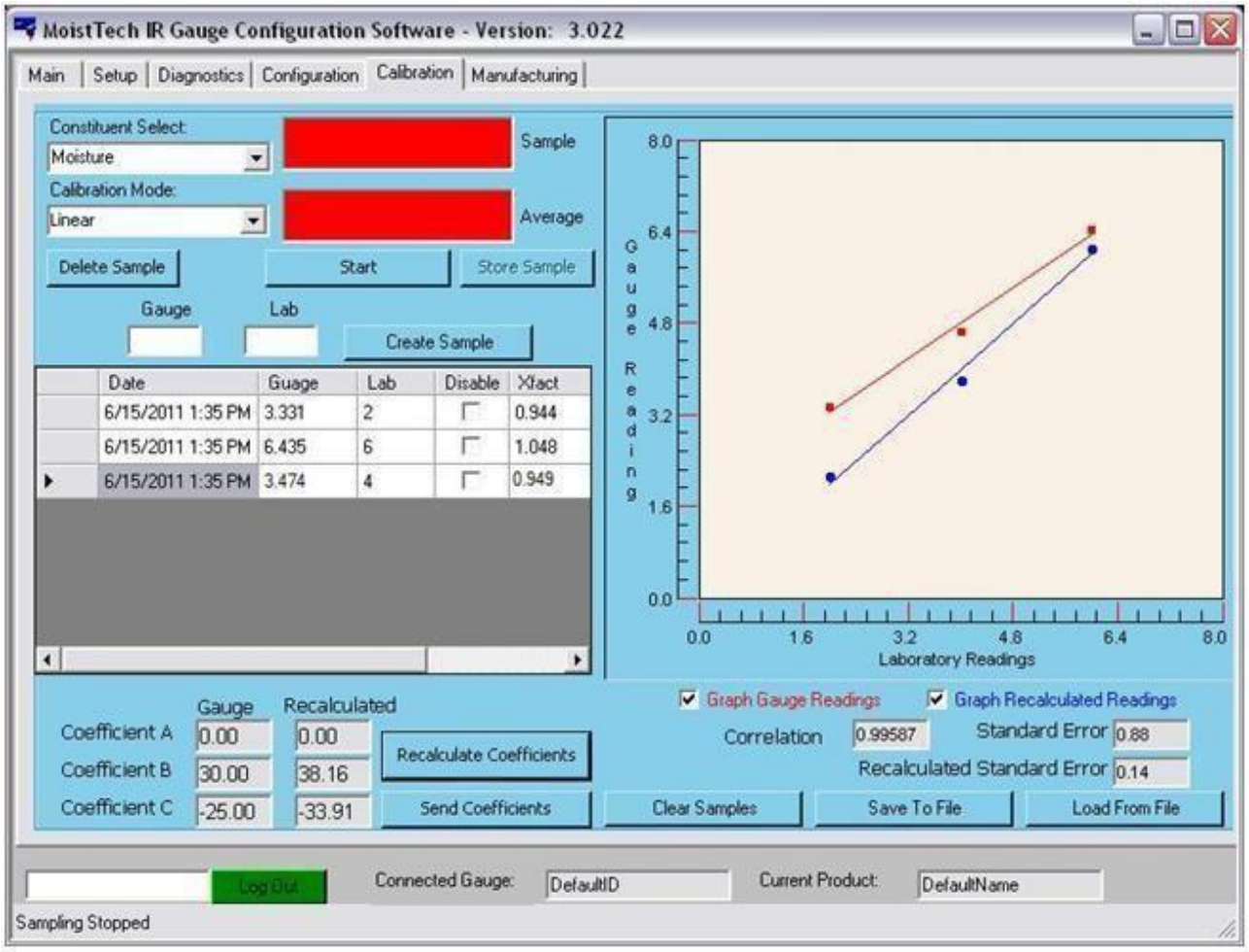

Figure 28. Calibration Table with Gauge and Laboratory Values

12. 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 clicking on the row in the table and pressing the 'Delete Sample' button.
13. To complete the Product Calibration, click on the 'Send Coefficients' button. The new coefficient values will be sent to the gauge and overwrite the previous coefficient values stored in the gauge.
14. Press 'Save to File' button to save the coefficient values for future reference.

Select another constituent and repeat the procedure for each constituent measured for this product.

To perform a Product Calibration on additional products, select the ‘Main’ tab to select the product name and repeat the Product Calibration procedure for each product.

APPENDIX

Upgrading Gauge Firmware

Perform the following steps to save the existing gauge configuration:

1. Start the Configuration program.
2. Connect to the gauge to be upgraded.
3. Login using the engineering password.
4. Go to the Setup screen.
5. Press 'Save Parameters To File' button to save the current gauge 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 gauge firmware:

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

Perform the following steps to load the saved gauge configuration:

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

Gauge Status and Error Messages

Message Displayed	Message Description
Connected – Measure	Gauge operating normally. Sample measurement in range.
Not Connected	Configuration program not connected to a gauge.
Measure Data Received	Screen update data received from gauge. Gauge operating normally.
Measure Data Error	Screen update data not sent or received from gauge. Gauge operating normally but data may need to be re-sent or re-read.
AZC	Measurement signal too large and gauge is unable to make a measurement. Gauge is unable to reduce AGC gain due to highly reflective material or debris build-up on gauge window.
Min – AGC	Measurement signal is too large. Gauge is able to make a measurement but unable to reduce AGC gain to preset minimum gain range due to highly reflective material or debris build-up on gauge window.
Max – AGC	Measurement signal is too small. Gauge is able to make a measurement but unable to reduce AGC gain to preset maximum gain range due to dark or low reflective material or debris build-up on gauge window.
Wheel Lock	Gauge is unable to make a measurement. Gauge is unable to lock the filter wheel to mains frequency or preset mains value due to excessive vibration on gauge or gauge hardware fault.

Table 2. Gauge Status and Error Messages

Main Power Connector – 90-250VAC (default power configuration)

Signal Name	Bulgin Flange Mount Connector Pin (PX0765/P on gauge)	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 gauge)	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

Analog 4-20mA Connector

Signal Name	Bulgin Flange Mount Connector Pin (PX0767/S on gauge)	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 / LAN Connector

The Ethernet / LAN Pin Out is the same for Ethernet TCP/IP, Ethernet UDP, Profinet® or EthernetIP protocol interface for digital communications. The crossover cable provided by MoistTech may be used to configure and operate the gauge. A user may wire a crossover cable with the Bulgin Flex Connector Plug provided with the gauge to connect to the network. The ethernet crossover signals are shown in the table below:

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

Table 6. Ethernet LAN Pin Out

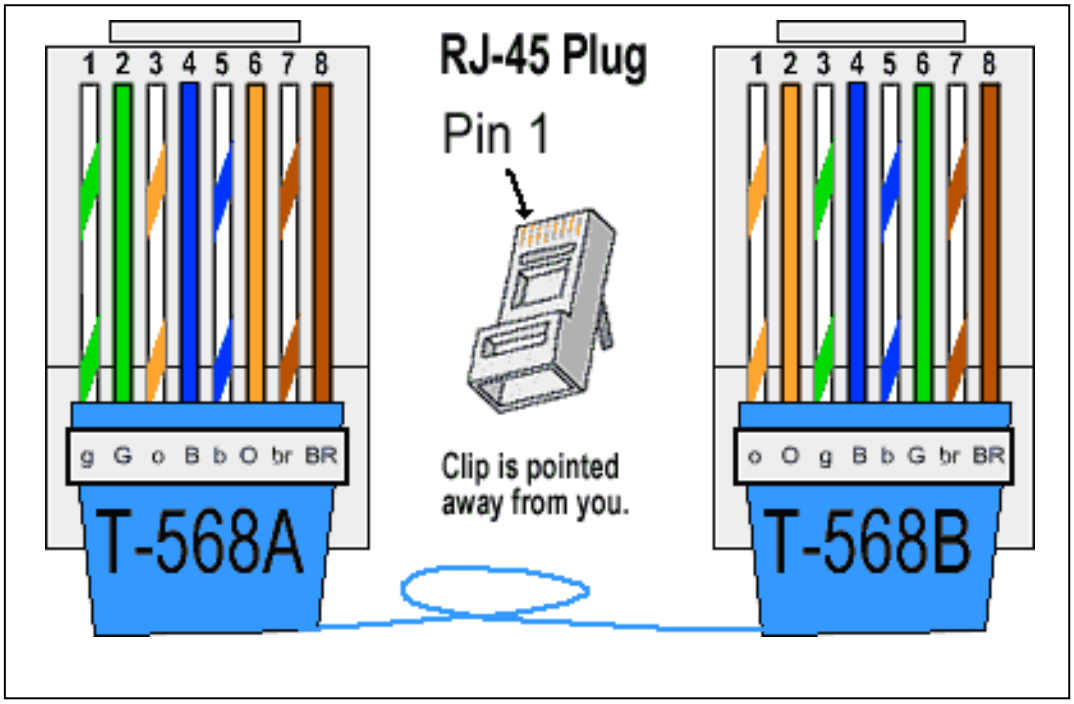

Figure 29. Ethernet LAN Crossover Cable Wiring

Digital RS 232 / 485 Connector

The Digital RS 232 / 485 serial interface provided on the gauge supports RS-232 and RS-485 (Full Duplex) as the factory default configuration. Other serial interface options require the gauge 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 a gauge 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 gauge can be wired to connect to the RS-232, RS-422 or RS-485 signals as shown in the table below:

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

Table 7. Digital RS 232 / 485 Interface Options

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

Table 8. Digital RS 232 / 485 Pin Out

Note: * Input / Output signals reversed on opposite end of 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 gauge. The Devicenet ® Bulgin Connector replaces the Digital RS 232 / 485 Bulgin Connector on the rear of the gauge. A Bulgin Flex Connector Plug is provided with the gauge that can be wired to connect the gauge to the Devicenet ® cable. The Devicenet ® Connector signals are shown in the table below:

Signal Name	Bulgin Flange Mount Connector Pin (PX0767/P on gauge)	Bulgin Flex Connector Pin (PX0739/S on cable)
V-	1	1
CAN_L	2	2
SHIELD	3	3
CAN_H	4	4
V+	5	5
-	6	6

Table 9. Devicenet ® Bulgin Connector Pin Out

Profibus® Connector (optional Profibus® interface)

The Profibus® interface is a factory configured software and hardware option for the gauge. A 9-pin Sub-D Female Connector replaces the Digital RS 232 / 485 Bulgin Connector on the rear of the gauge. The user provides the 9-pin Sub-D Male Connector and cable to connect the gauge 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 gauge)	9-pin Sub-D Male Connector Pin (on cable)
-	1	1
-	2	2
B-Line, Positive RS485 RxD/TxD	3	3
RTS, Request to Send	4	4
GND BUS	5	5
+5V BUS	6	6
-	7	7
A-Line, Negative RS485 RxD/TxD	8	8
-	9	9

Table 10. Profibus® Connector Pin Out

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