Thermo Scientific AquaSensors™ AV38 and DataStick™ Ethernet Communications

User Guide

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Contact Information

To contact Thermo Scientific AquaSensors Technical Support:
Within the United States call 1.800.225.1480 or fax 978-232-6015.
Outside the United States call 978.232.6000 or fax 978.232.6031.
In Europe, the Middle East and Africa, contact your local authorized dealer.
Visit us on the web at www.thermo.com/processwater

Ethernet Communications Adapter Part Numbers (for use with the DataStick)

- CA17R: 316 Stainless Steel Housing
- CA27R: CPVC Housing
- CA37R: PEEK® Housing

AV38 with Ethernet Part Number

AV38WX7Z: The variables W, X and Z are for specifying current output, relay and mounting options. The number 7 indicates that the Ethernet option is present.

1 Quick Start

If you're familiar with setting a computer's IP address and have a cross-over cable and a power injector, the quickest way to establish communications with a Thermo Scientific AquaSensors Ethernet product is to:

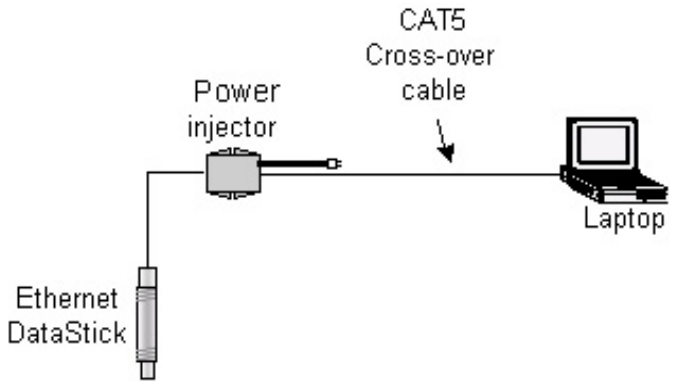

Figure 1: A diagram of an isolated Ethernet DataStick network.

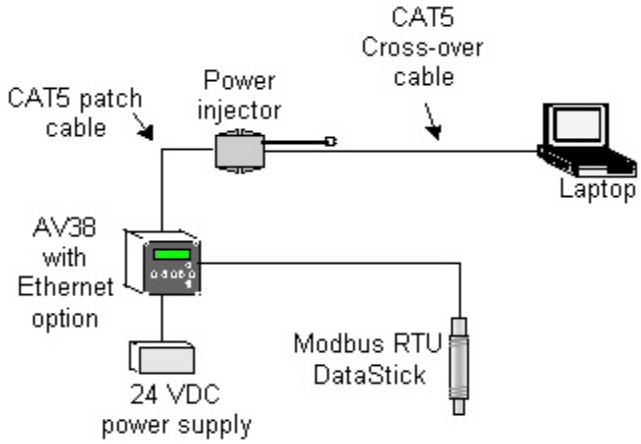

Figure 2: A diagram of an isolated AV38 network.

1. Change the computer's IP address to 192.168.0.1.
2. Plug the product into the PoE-side of the power injector.
3. Connect the power injector to the computer using a CAT5 cross-over cable.
4. Point your Web browser at 192.168.0.100 to see the Home Page.

The Home Page will show the product's measurement values, configuration and diagnostic information. From there, the product's IP address can be changed if desired by clicking on the CommSettings button.

If you're not familiar with setting a computer's IP address, see Section 3 for a detailed description of the configuration procedure.

2 Introduction

This document describes the configuration and operation of the Thermo Scientific AquaSensors Ethernet Communications product. It applies to V1.02.00 firmware or later.

The product is offered in two forms. The first form is as a Communications Adapter as shown in Figure 3 that is plugged into the DataStick Body.

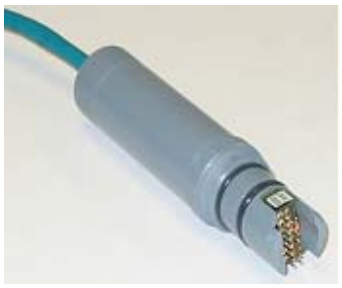

Figure 3: The Ethernet Communications Adapter.

The second form is as an option in the AV38 Local Display as shown in Figure 4.

Figure 4: The Ethernet option in the AV38 Local Display (front and rear views).

The product provides full-featured measurement, configuration, calibration and diagnostics of any DataStick™ measurement system from any Ethernet-enabled device via resident Web pages, EtherNet/IP, Modbus TCP, or Programmable Controller Communication Commands (PCCC). An intermediate analyzer is not required.

In either form, the product supports the following protocols:

- EtherNet/IP
- Modbus TCP
- Programmable Controller Communication Commands (PCCC)
- TCP/IP (IPv4)
- UDP
- ICMP (for ping response)
- TFTP (for upgrading firmware)

The Ethernet Communications Adapter (Adapter) has a diameter of about 1 inch, a length of about 4.5 inches, and it protrudes from the end of the DataStick Body by about 3.1 inches as shown in Figure 5.

Figure 5: Dimensions of the Adapter.

It has an integral CAT5 industrial Ethernet cable with an RJ45 connector on one end that can be plugged in to any PoE switch or power injector. On the other end of the Adapter is a keyed O-ring-sealed connector that can be plugged into any Thermo Scientific AquaSensors DataStick. There are red and green LED indicators on this end of the Adapter that make it easy to know when the Ethernet link is active. The cable can be up to 100 meters (328 feet) long although we recommend that the Adapter be ordered with 10–30 feet of cable to reduce cost.

When plugged into a DataStick sensor system the Adapter becomes an integral part of the measurement system and the system can be mounted as any industrial sensor would be mounted for continuous use in process applications. Figure 6 shows an Adapter detached from a DataStick with a toroidal Sensor Head.

Figure 6: Ethernet Communications Adapter shown detached from a DataStick with a toroidal Sensor Head.

The Adapter can be used for direct access to DataStick measure, calibrate, configure and diagnose information, even when the Sensor Head is changed from one type of analytical measurement to another with power applied. The DataStick automatically supports multiple measurement types and all Sensor Heads are automatically supported.

Refer to the DataStick Manual for detailed information on installation, maintenance and operation of sensors.

The Ethernet option in the AV38 Local Display provides an RJ45 jack for connection to a power injector or 802.3af-compliant (PoE) Ethernet hub or switch as shown on the right side of Figure 4. It allows network access to the Modbus RTU DataStick connected to the AV38.

In this form, power for the Ethernet option is provided by a Power-Over-Ethernet device, and power for the AV38 Local Display is provided by an external 24 VDC power supply.

This manual includes only the Ethernet option in the AV38. For information about the rest of the AV38, please see the AV38 User's Manual.

3 Hardware Setup

Both forms of the product possess the same default communications settings. They are as follows:

IP Address:	192.168.0.100
Subnet Mask:	255.255.255.0
Gateway Address:	192.168.0.1

Both forms support a data rate of 10 Mbps (10Base-T).

Both forms comply with the IEEE 802.3af Power Over Ethernet standard and, as such, are termed powered devices (PD). This means that they receive their power via the Ethernet network.

Power Classification:	Class 1
Supply Voltage:	44–57 VDC, 48 VDC nominal
Supply Current:	25 mA @ 48 VDC

They are insensitive to the polarity of the power supply and are capable of operating in either Mode A or Mode B as shown in Figure 7 and Figure 8, respectively.

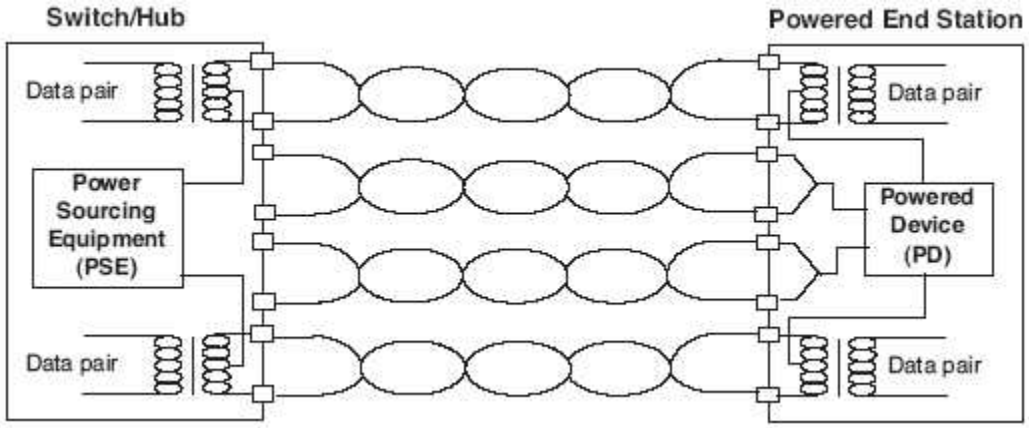

Figure 7: Endpoint power sourcing equipment, Mode A. The product is the Powered End Station.

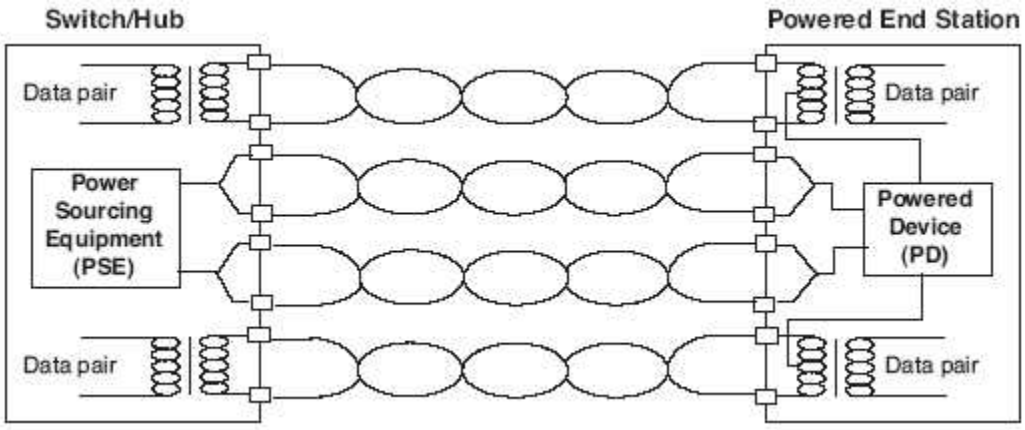

Figure 8: Endpoint power sourcing equipment, Mode B. The product is the Powered End Station.

The rest of this section describes the hardware setup of each form of the product.

3.1 Ethernet Communications Adapter

The DataStick measurement system consists of three parts as shown in Figure 9 that are assembled at Thermo Fisher Scientific.

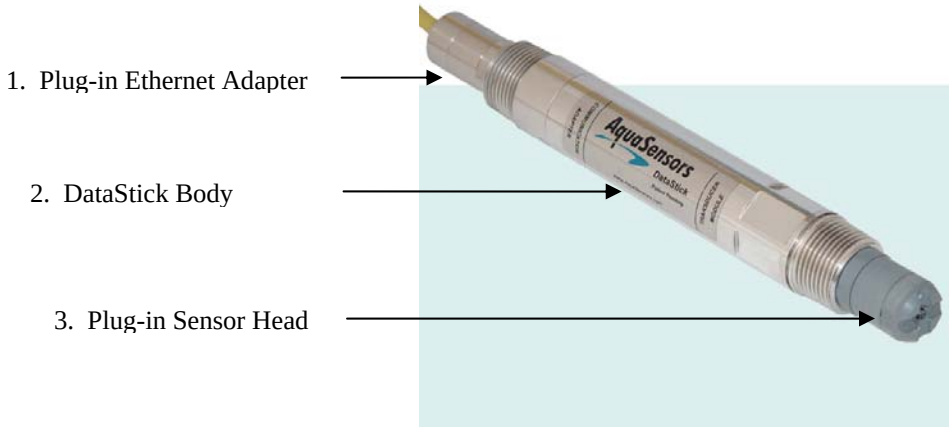

Figure 9: The three parts of the DataStick measurement system.

The Adapter can be removed and replaced in the field. This may be desirable for any number of reasons, some of which are:

- Ethernet Diagnostics: Observe the Link/Activity LED to confirm the communications link
- DataStick Diagnostics: Temporarily plug in a USB Communications Adapter for PC diagnostics
- Repair: Replace a damaged DataStick assembly without rewiring
- Change Measurement: Quickly swap the Sensor Head with a spare that's been calibrated in the laboratory

The Adapter is keyed and plugs into the end of the DataStick Body that's marked "Communications Adapter" as shown in Figure 10.

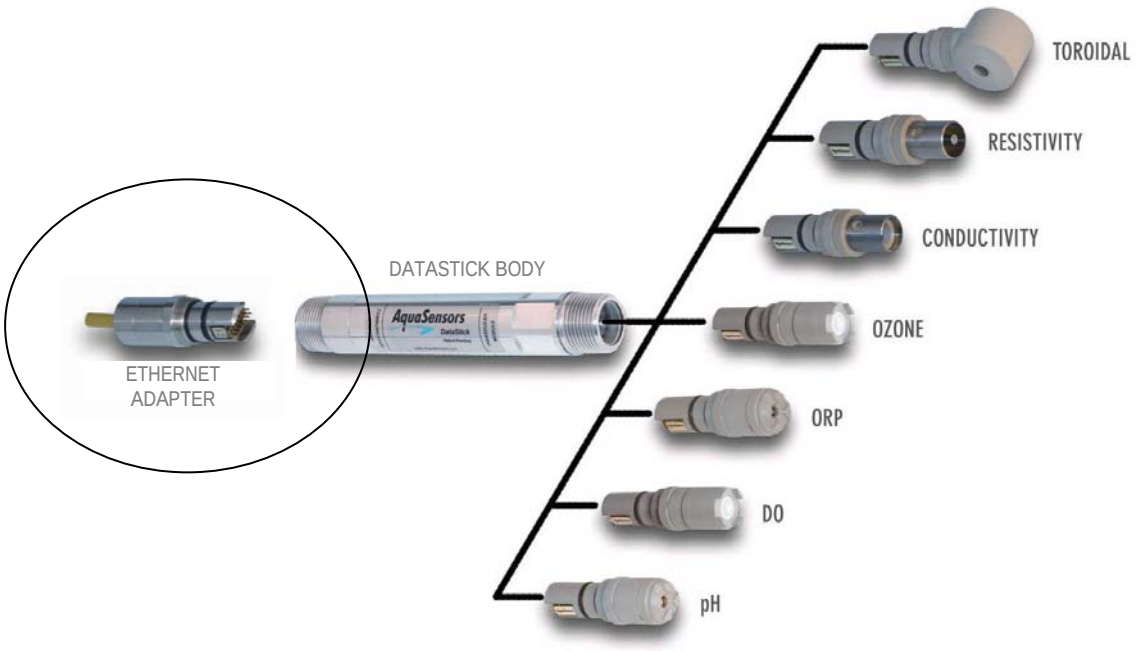

Figure 10: The elements of the DataStick Measurement System.

Insert the Adapter into the DataStick Body until it bottoms out. Rotate the Adapter until it engages with the connector. Push the adapter in gently, and then tighten the retaining ring with a 15/16-inch wrench. It is very important to tighten the retaining ring to ensure a reliable connection. The different parts of the Adapter are shown in Figure 11.

Figure 11: The different parts of the Adapter.

3.1.1 Operating Temperature

While operating at room temperature (~22 °C or ~72 °F), the Adapter runs at around body temperature (~37 °C or ~99 °F). This is normal.

3.1.2 Electrical Connections

The Adapter is supplied with an 8-conductor integral industrial CAT5 Ethernet cable that is terminated with an RJ45 plug. The pin positions of the plug are shown in Figure 12 and the signal names and functions are defined in Table 1.

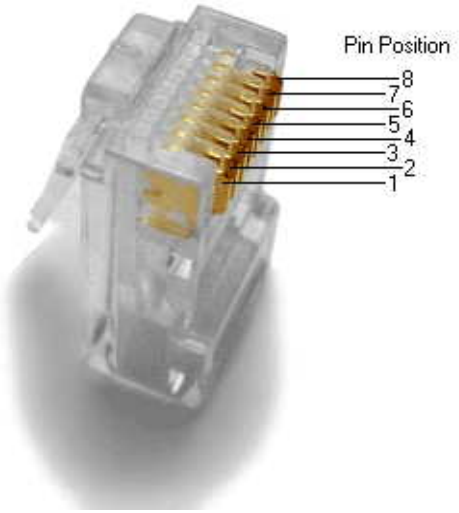

Figure 12: RJ45 plug pin positions

Table 1: RJ45 connector pin assignment

Pin Position	Signal Name/Function Mode A	Signal Name/Function Mode B
1	Tx+ (Transmit)/DC+	Tx+ (Transmit)
2	Tx– (Transmit)/DC+	Tx– (Transmit)
3	Rx+ (Receive)/DC–	Rx+ (Receive)
4	Not used	DC+
5	Not used	DC+
6	Rx– (Receive)/DC–	Rx– (Receive)
7	Not used	DC–
8	Not used	DC–

3.1.3 Location of Adapter's MAC Address

The Adapter's Media Access Control (MAC) Address is printed on a label that is affixed to the integral Ethernet cable. The MAC Address can also be read electronically using the supported EtherNet/IP or Modbus TCP protocols, or by browsing to the Adapter's CommSettings Web page.

3.1.4 LED Indicators

There are two bi-color LED indicators visible from the DataStick-end of the Adapter as shown in Figure 13.

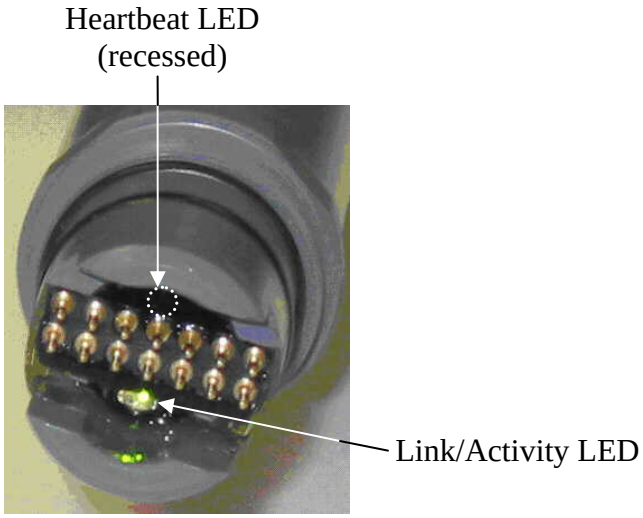

Figure 13: LED indicators on the Adapter. Note that the Heartbeat LED is recessed while the Link/Activity LED is not.

The Link/Activity LED glows green when there is a link between the Adapter and another network device, and it glows red when there is network activity.

The Heartbeat LED is recessed within the body of the Adapter. It blinks green at a rate of 1 Hz while the Adapter is operating normally. It blinks red and green to indicate that the IP Address, Subnet Mask, and Gateway Address have been restored to default values. See Section 3.1.5 for more information about restoring the communications settings to default values.

3.1.5 Restoring Default IP Address, Subnet Mask, Gateway Address

In the event that the IP address of an Adapter is unknown, its communications settings can be restored to factory default values by following the procedure below:

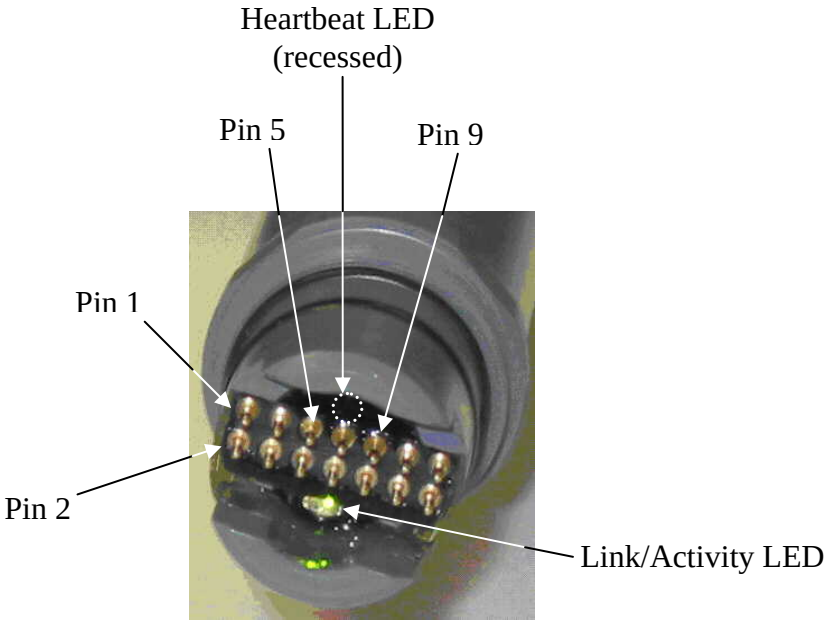

Figure 14: Pin numbering and LED locations.

1. Disconnect the Adapter from the network. **Attention: Determine how your control system will respond before disconnecting an Adapter from the network.**
2. Detach the Adapter from the DataStick.
3. Make an electrical connection between pins 5 and 9 on the DataStick-side of the Adapter using a clip lead or equivalent as shown in Figure 14. Be careful to make the connection only between pins 5 and 9.
4. Apply power to the Adapter and watch the Heartbeat LED shown in Figure 14. After approximately 5 seconds, the Heartbeat LED will blink red and green at a rate of 2 Hz. This indicates that the Adapter has detected the connection between pins 5 and 9 and restored the communications settings to their factory default values.
5. Disconnect the power from the Adapter and remove the electrical connection between pins 5 and 9. Re-attach the Adapter to the DataStick.
6. Establish communications with the Adapter as described in Section 4.

3.2 AV38 Local Display with Ethernet Option

3.2.1 Electrical Connections

The option is supplied with an 8-conductor integral RJ45 jack as shown in Figure 15. The signal names and functions of the jack are defined in Table 2.

Table 2: RJ45 jack signal names and functions

Position	Signal Name/Function Mode A	Signal Name/Function Mode B
1	Tx+ (Transmit)/DC+	Tx+ (Transmit)
2	Tx– (Transmit)/DC+	Tx– (Transmit)
3	Rx+ (Receive)/DC–	Rx+ (Receive)
4	Not used	DC+
5	Not used	DC+
6	Rx– (Receive)/DC–	Rx– (Receive)
7	Not used	DC–
8	Not used	DC–

3.2.2 Location of AV38's MAC Address

The AV38's Media Access Control (MAC) Address is printed on a label that is affixed to the terminal block overlay inside the AV38 as shown in Figure 15.

Figure 15: The AV38's MAC address is in the lower right-hand corner of the overlay.

3.2.3 Restoring Default IP Address, Subnet Mask, Gateway Address

The communications settings of the option can be restored to factory default values by following the procedure below.

Note: The AV38 must be powered-on during this procedure (24 VDC applied to Terminal Block pins 1 [+] and 2 [–]).

Figure 16: Restoring default communications settings of an Adapter embedded inside an AV38.

1. Disconnect the AV38 from the Ethernet network. **Attention: Determine how your control system will respond before disconnecting an AV38.**
2. Remove the terminal-block overlay.
3. Make an electrical connection between the two test points on the terminal board of the AV38 using a clip lead or equivalent. The test points are circled in white in Figure 16.
4. Reconnect the AV38 to the Ethernet network and wait at least 60 seconds for the communications settings to be restored to their factory default values.
5. Disconnect the AV38 from the Ethernet network and remove the electrical connection between the two test points. Replace the terminal-block overlay.
6. Establish communications with the AV38 as described in Section 4, Configuration Procedures.

4 Configuration Procedures

The product is shipped from Thermo Fisher Scientific with a static IP address, subnet mask and default gateway that can be changed by the user to conform to specific networking requirements. These changes can be made from the resident Web page.

The product stores communications settings and other information in its own non-volatile memory. You must, therefore, access the product to view and edit these parameters.

Changes to the IP Address, Subnet Mask, and Gateway Address require that you reset the product before the new settings take effect. You can reset the product by cycling its power.

Please contact Thermo Fisher Scientific for a list of networking infrastructure hardware that includes manufacturers of power injectors as well as 802.3af-compliant industrial and home/office Ethernet switches.

> **Note: When the Ethernet product's cable is moved from one port on an Ethernet switch to another, communication with that product will not be possible until the tables inside the switch are rebuilt by cycling the switch's power.**

Optionally, a virtual private network (VPN) can be established between Thermo Fisher Scientific and the customer's site to allow Thermo Fisher Scientific to configure and diagnose Ethernet communications products and upgrade them if necessary.

The default static IP address for Thermo Scientific AquaSensors Ethernet products is provided on a paper tag for initial access and setup. When connecting to a network, be sure to configure an IP address that will not be in conflict with other devices or DHCP servers on the network. If there is an IP address conflict, several devices on the network may not communicate.

> **Note: It is important to tag Thermo Scientific AquaSensors Ethernet communications products with currently configured IP address information so that they can always be accessed.**

Thermo Fisher Scientific ships Ethernet communications products with a paper tag that gives currently configured IP address information along with a permanent tag that gives the MAC address. For customers that order a preconfigured IP address, a permanent IP address label can be provided.

In the event that the IP address for a Thermo Scientific AquaSensors Ethernet product is lost, there are two ways to regain communications. The first involves a Discovery Utility provided by Thermo Fisher Scientific that will find all Thermo Scientific AquaSensors Ethernet communications products on a network and allow their IP addresses, subnet masks and default gateways to be changed. The second involves restoring the settings to default values as described in Section 3.

Configuration procedures in this section are explained using the Windows xp operating system. When other operating systems are used, procedures may be slightly different.

When possible, obtain an IP address, subnet mask and default gateway from a network administrator.

There are many situations that may necessitate changing the configuration of the product. This section describes two: The first involves evaluating or demonstrating an Ethernet DataStick and the second involves configuring a product that's to be put into service.

There are many ways to connect a product to a computer so that it can be configured. This section describes three:

1. Using a power injector and a CAT5 cross-over cable
2. Using an Ethernet hub or switch and a CAT5 patch cable
3. Using an 802.3af-compliant (PoE) Ethernet hub or switch and a CAT5 patch cable

Choose the way that is most convenient for you.

> **Attention: Determine how your control system will respond before disconnecting a product from the network.**

4.1 For Evaluation/Demonstration Purposes

A Thermo Scientific AquaSensors Ethernet product can be connected to a computer using a power injector and a CAT5 cross-over cable. This "point-to-point" connection is convenient for initial setup because it avoids the possibility of an IP address conflict. This connection method is also convenient for evaluating or demonstrating a DataStick measurement system.

To set up the network, you will need the following:

- a computer with a Web browser and an Ethernet port
- an Ethernet DataStick or an AV38 with Ethernet option
- a CAT5 cross-over cable
- a power injector such as the one shown in Figure 17

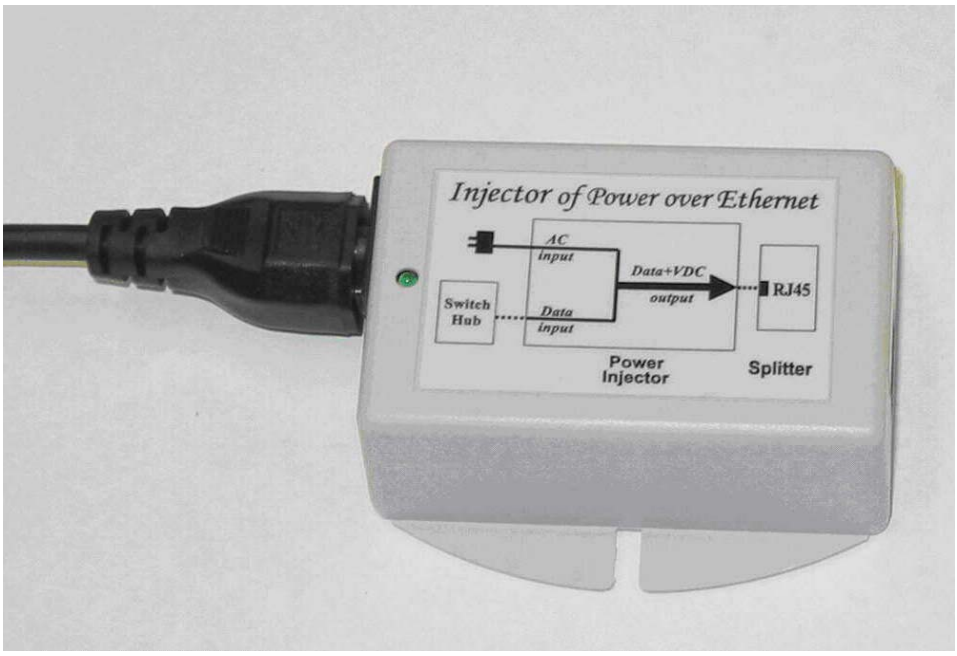

Figure 17: A power injector.

An Ethernet DataStick network is shown diagrammatically in Figure 18 and an AV38 network is shown in Figure 19.

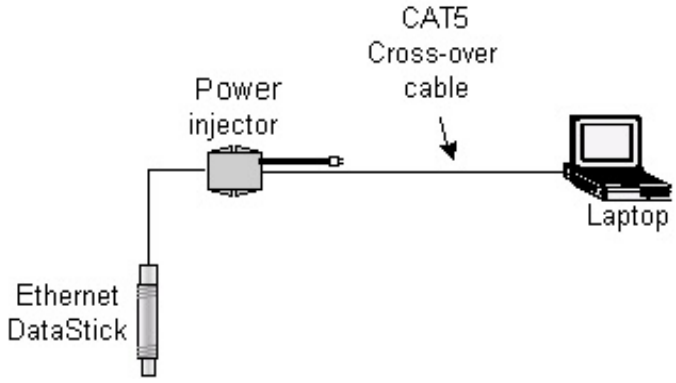

Figure 18: An Ethernet DataStick network for evaluation or demonstration purposes.

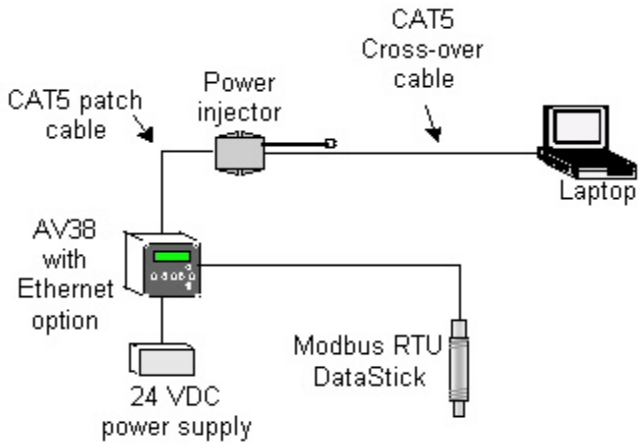

Figure 19: An AV38 network for evaluation or demonstration purposes.

The first step is to restore the product's communications settings to default values. This will guarantee that the product's IP address is known. Follow the appropriate procedure in Section 3 to accomplish this. If you're sure that the communications settings haven't been changed since the product was received from Thermo Fisher Scientific, then this step can be skipped.

The next step is to change the IP address of the laptop to 192.168.0.1 so that it can communicate with the product. Follow the procedure below to accomplish this.

> **Attention: If the laptop is connected to a network, disconnect the laptop before continuing. This will avoid any potential conflicts during the configuration procedure.**

Go to the Network Connections window shown in Figure 20 by clicking Start | Control Panel | Network Connections.

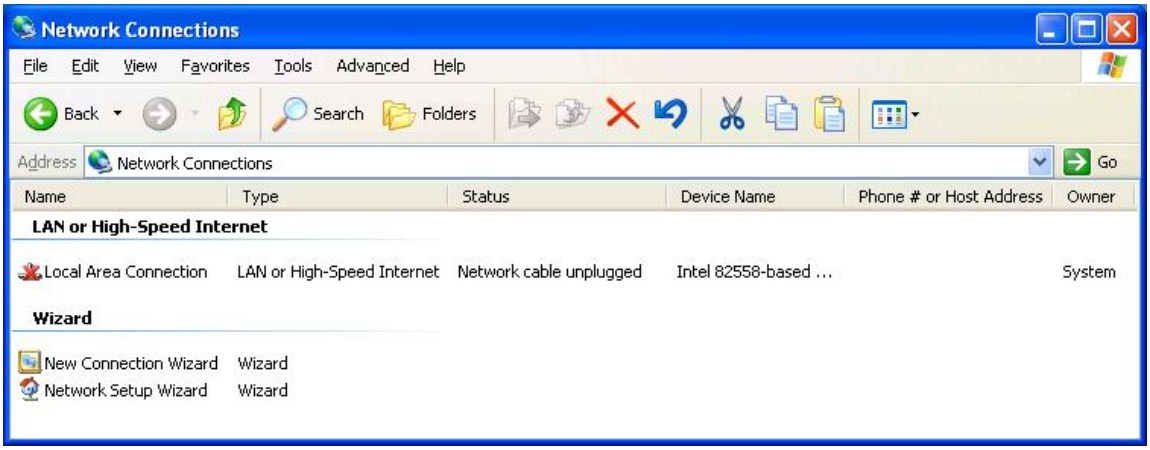

Figure 20: Network Connections window.

Right-click on Local Area Connection and select Properties. This will bring up the Local Area Connection Properties as shown in Figure 21.

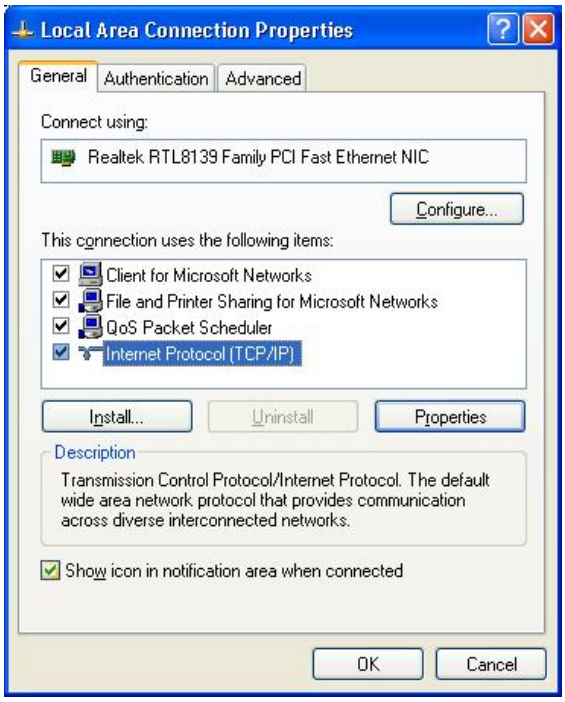

Figure 21: Local Area Connection Properties.

Highlight Internet Protocol (TCP/IP) and click the Properties button.

This will bring up the Internet Protocol (TCP/IP) Properties window as shown in Figure 22.

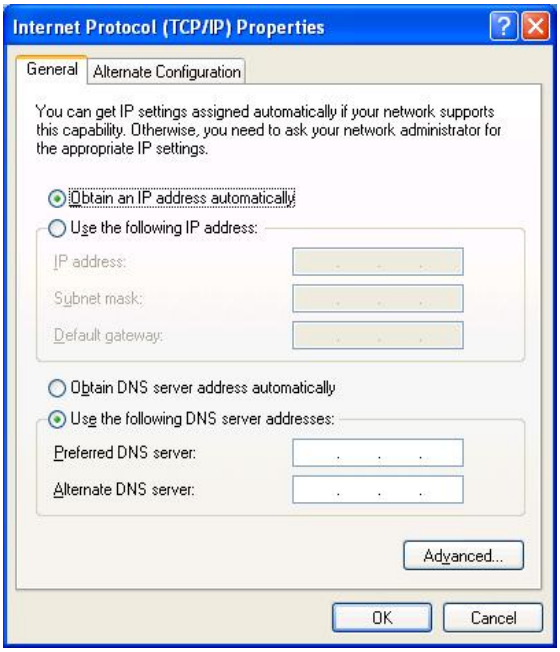

Figure 22: The Internet Protocol (TCP/IP) Properties window.

Click the “Use the following IP address” radio button and enter the IP address, Subnet mask and Default gateway values as shown in Figure 23.

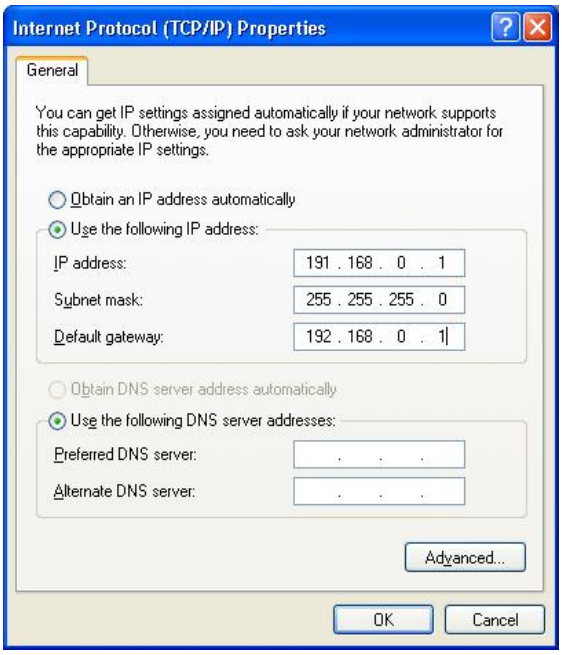

Figure 23: Giving the laptop a static IP address.

Click OK until you return to the Network Connections window.

The laptop now has a static IP address of 192.168.0.1 and its subnet is 192.168.0.0.

The next step is to connect the Ethernet DataStick to the laptop. Follow the procedure below to accomplish this.

Connect the power injector to the laptop using the CAT5 cross-over cable. Be careful not to plug the cross-over cable into the jack that has the DC power on it. This jack is typically identified with a warning sticker that says “Connect to PoE device only!”

Connect the Ethernet DataStick to the power injector by plugging the Ethernet DataStick’s integral CAT5 cable to the PoE jack.

Plug the power injector into an AC outlet and verify that the Link LED on the laptop lights.

Start a Web browser on the laptop and enter the Ethernet DataStick’s IP address in the Address field. This will bring up the DataStick’s Home Page as shown in Figure 24.

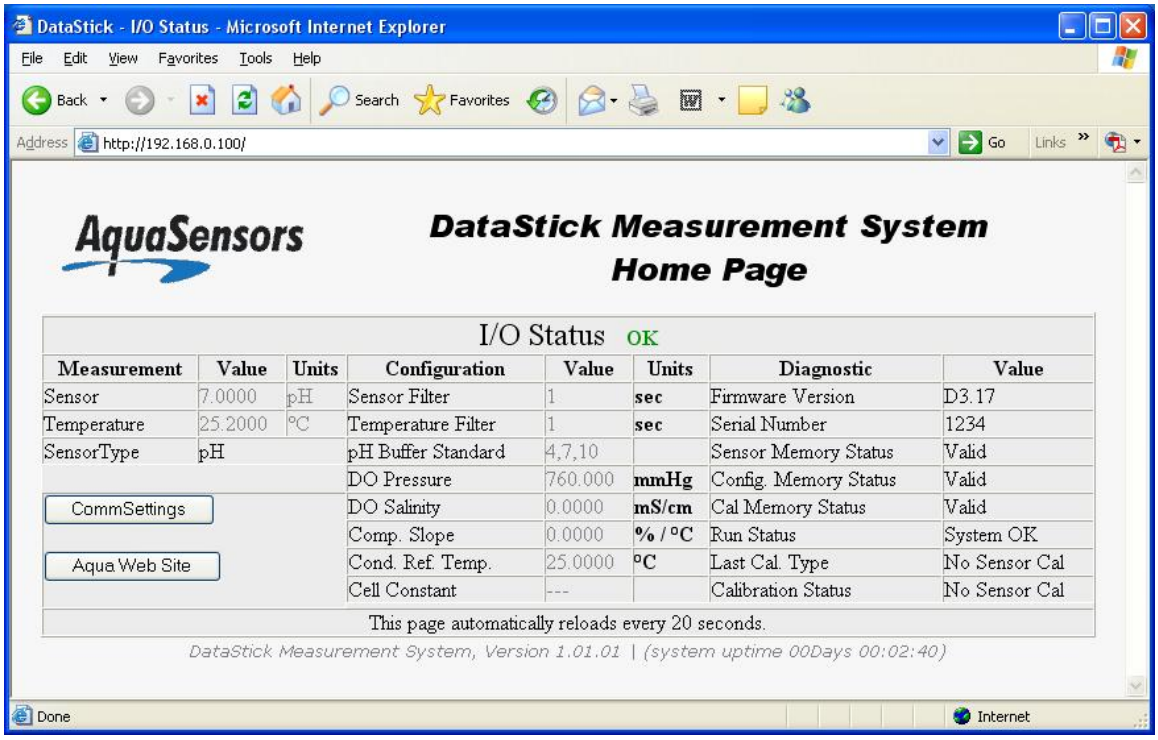

Figure 24: The Ethernet DataStick's Home Page.

This completes the configuration process. The system can now be used for evaluation or demonstration purposes.

4.1.1 Advanced Configuration

If the Internet Protocol (TCP/IP) Properties window has an Alternate Configuration tab as shown in Figure 25, then the laptop can be configured so that it will obtain an IP address automatically when one is available, or it will use a static IP address when one is not. This advanced configuration makes moving from a home/office network environment to an isolated network environment a little easier.

On the General tab of the Internet Protocol (TCP/IP) Properties window, click the "Obtain IP address automatically" radio button as shown in Figure 25.

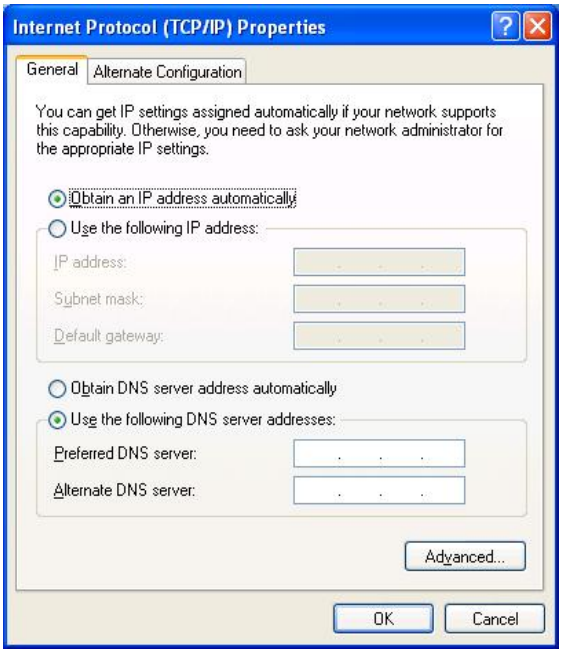

Figure 25: Obtaining an IP address automatically.

On the Alternate Configuration tab, click the "User configured" radio button and enter the values shown in Figure 26.

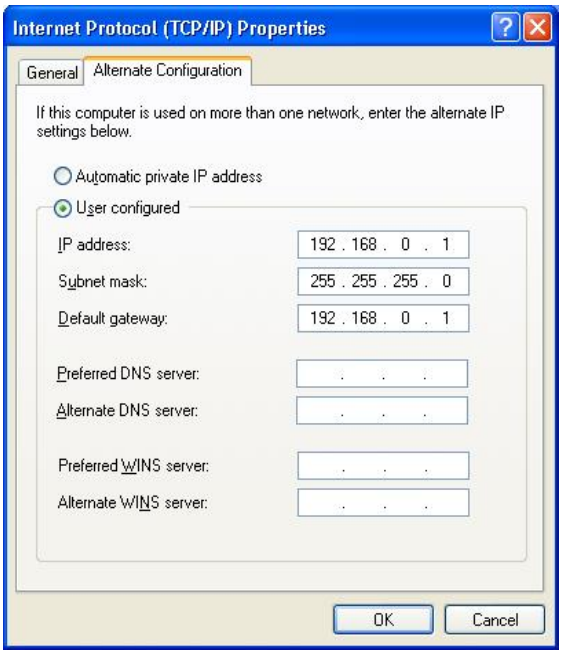

Figure 26: The alternate configuration settings.

Click OK until you return to the Network Connections window.

The laptop can now be connected to a home/office network where it will obtain an IP address automatically or to an Ethernet DataStick where it will use a static IP address.

4.2 Commissioning an Ethernet Product for Service

This section describes how to configure an Ethernet product so that it can be connected to an existing network.

First, the network's subnet must be determined.

> **Note: If a network administrator has provided you with an IP address, subnet mask and default gateway, then this step can be skipped.**

This can be done using the `ipconfig` command in a Command Prompt on a Windows xp computer that's connected to the destination network as shown in Figure 27. To open a Command Prompt, click Start | Run, and type `cmd` in the Open field.

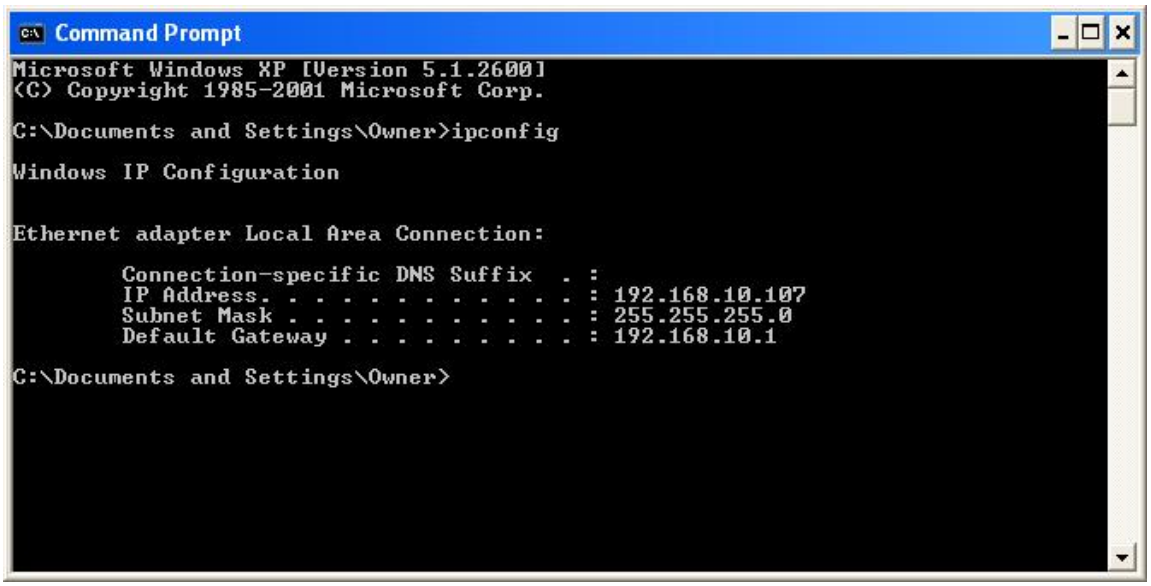

Figure 27: The output of the `ipconfig` command.

To determine the network's subnet, bitwise-AND the IP address with the subnet mask. In the example of Figure 27, the IP address is 192.168.10.107 and the subnet mask is 255.255.255.0:

```
    192.168.010.107
AND 255.255.255.000
    ---------------
    192.168.010.000
```

192.168.10.107 bitwise-ANDed with 255.255.255.0 yields 192.168.10.0—this is the network's subnet. It means that the Ethernet DataStick to be added must be given an IP address between 192.168.10.1 and 192.168.10.254 in order to be accessible by other devices on the network.

Next, the product's communications settings must be restored to default values. This will guarantee that its IP address is known. Follow the procedure described in Section 3 to accomplish this. If you're sure that the communications settings haven't been changed since the product was received from Thermo Fisher Scientific, then this step can be skipped.

Next, an isolated network must be set up consisting of a computer and an Ethernet DataStick, and the IP address of the computer must be changed so it can communicate with the DataStick. Follow the procedure below to accomplish this. Windows xp is used, but Windows 2000 and Vista, as well as other operating systems, will also work.

An isolated network can be constructed in several different ways depending upon the equipment that's available.

If you have the following equipment:

- power injector
- CAT5 cross-over cable

then a network like the one shown in Figure 28 or Figure 29 can be constructed.

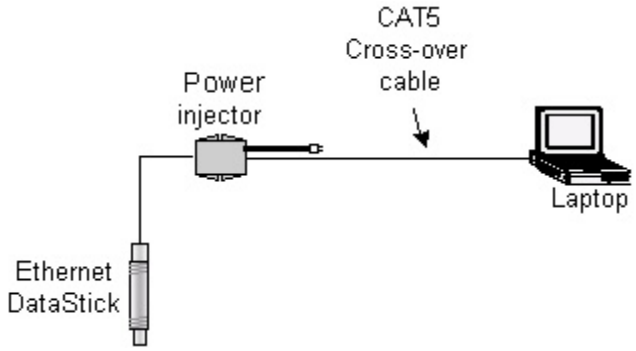

Figure 28: An Ethernet DataStick network constructed with a power injector and a cross-over cable.

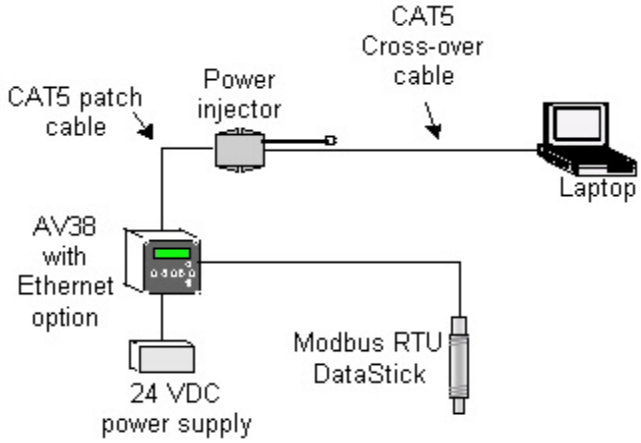

Figure 29: An AV38 network constructed with a power injector and a cross-over cable.

If you have the following equipment:

- Ethernet hub or switch
- CAT5 patch cable

then a network like the one shown in Figure 30 or Figure 31 can be constructed.

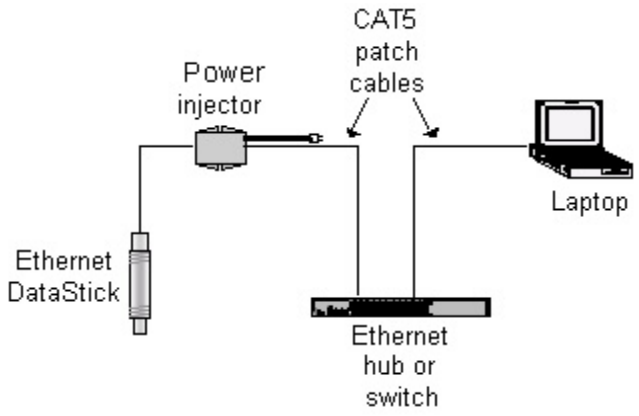

Figure 30: An Ethernet DataStick network constructed with an Ethernet switch and patch cables.

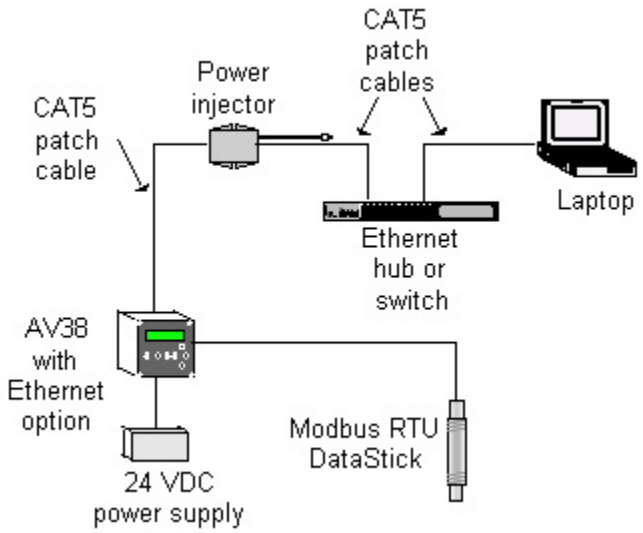

Figure 31: An AV38 network constructed with an Ethernet switch and patch cables.

If you have the following equipment:

- 802.3af-compliant (PoE) Ethernet hub or switch
- CAT5 patch cable

then a network like the one shown in Figure 32 or Figure 33 can be constructed.

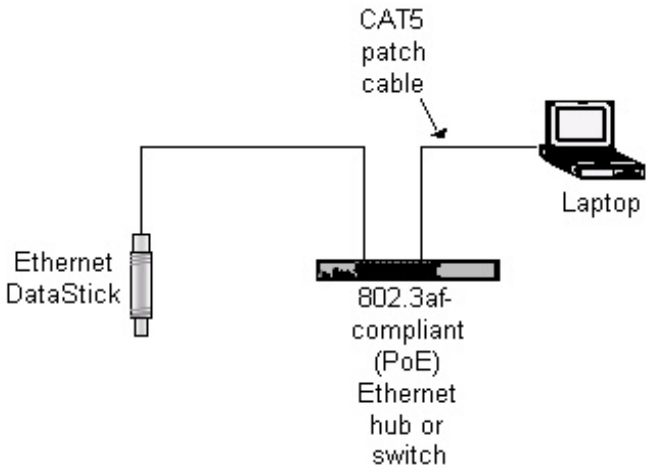

Figure 32: An Ethernet DataStick network constructed with a PoE switch and a patch cable.

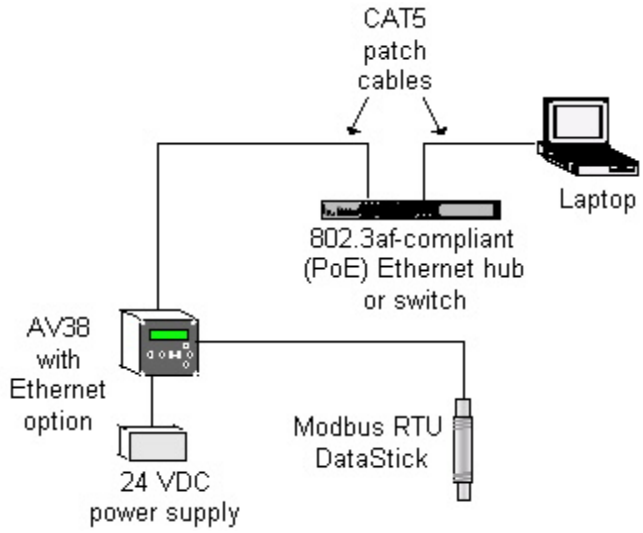

Figure 33: An AV38 network constructed with a PoE switch and patch cables.

Now that an isolated network has been constructed, it's time to change the IP address of the computer so that it can communicate with the DataStick.

Go to the Network Connections window shown in Figure 34 by clicking Start | Control Panel | Network Connections.

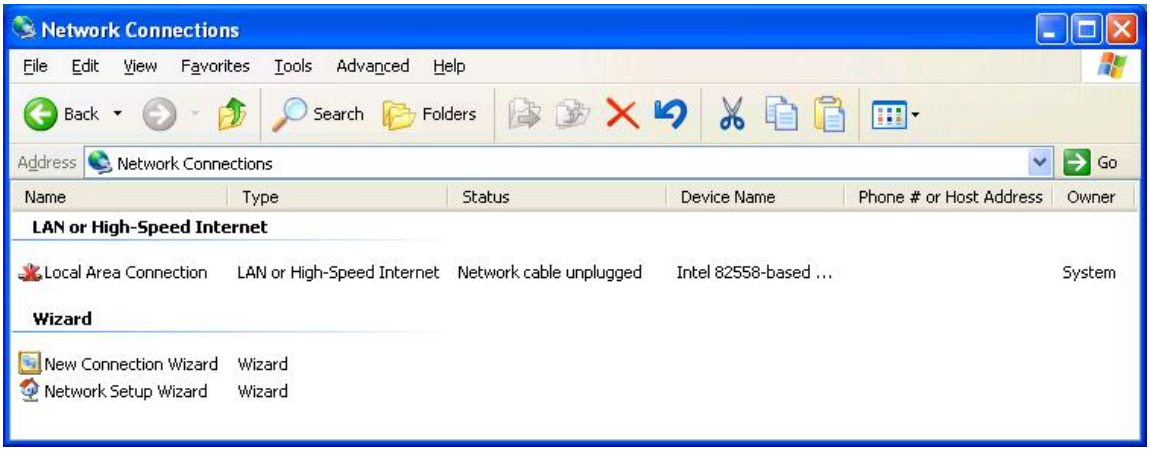

Figure 34: Network Connections window.

Right-click on Local Area Connection and select Properties.

This will bring up the Local Area Connection Properties window as shown in Figure 35.

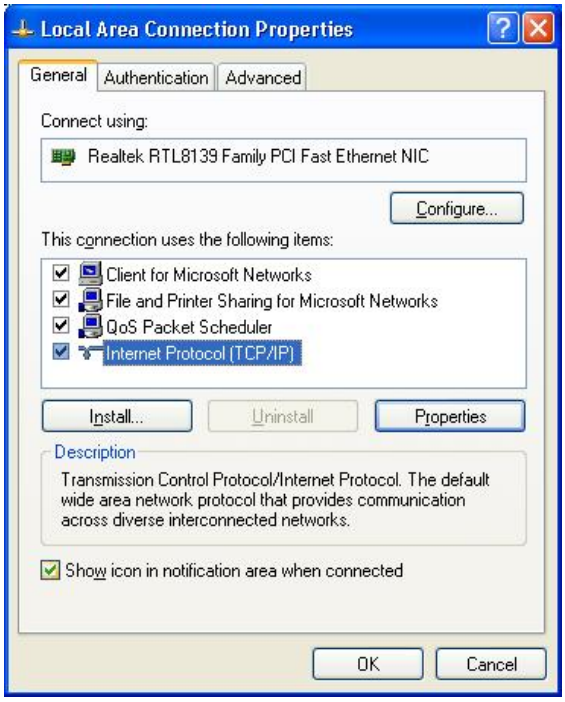

Figure 35: Local Area Connection Properties.

Highlight Internet Protocol (TCP/IP) and click the Properties button.

This will bring up the Internet Protocol (TCP/IP) Properties window as shown in Figure 36.

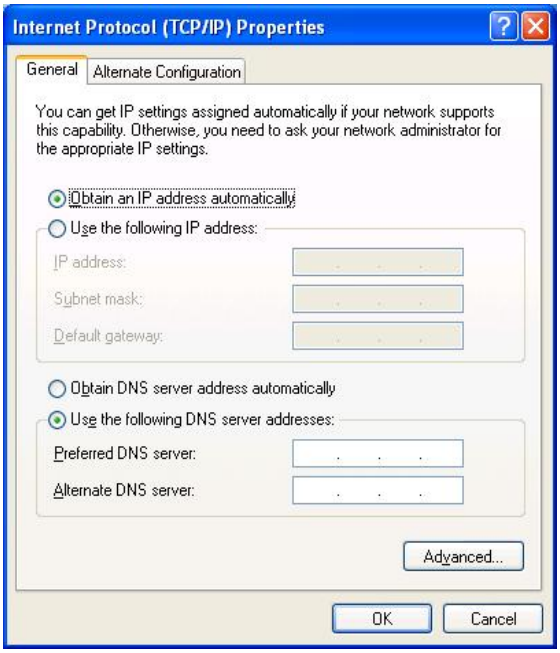

Figure 36: The Internet Protocol (TCP/IP) Properties window.

Click the "Use the following IP address" radio button and enter the IP address, Subnet mask and Default gateway values as shown in Figure 37.

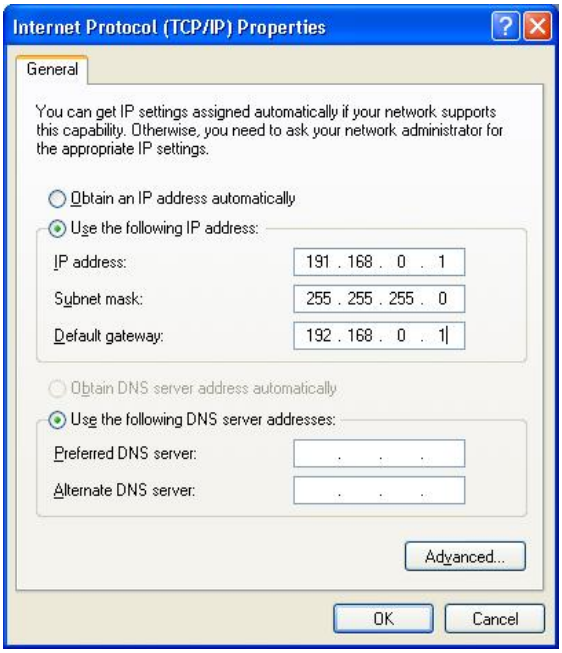

Figure 37: Giving the computer a static IP address.

Click OK until you return to the Network Connections window.

The computer now has a static IP address of 192.168.0.1 and its subnet is 192.168.0.0.

The next step is to change the IP address of the Ethernet DataStick. Follow the procedure below to accomplish this.

When an Ethernet DataStick is connected to a network with a DHCP server we recommend that the candidate address be chosen so that it's below the range of IP addresses controlled by the DHCP server. This will avoid potential conflicts between the Ethernet DataStick and any devices that might be added to the network at a later time. Before settling on the candidate address for the Ethernet DataStick, use the ping utility to verify that there is not already a device at that address. Figure 38 shows the output of the `ping` command that was run on a computer connected to the network to which the Ethernet DataStick will be connected.

Figure 38: Verifying that no device is present using the `ping` command.

Start a Web browser on the computer and enter 192.168.0.100 in the Address field. This will bring up the DataStick's Home Page as shown in Figure 39.

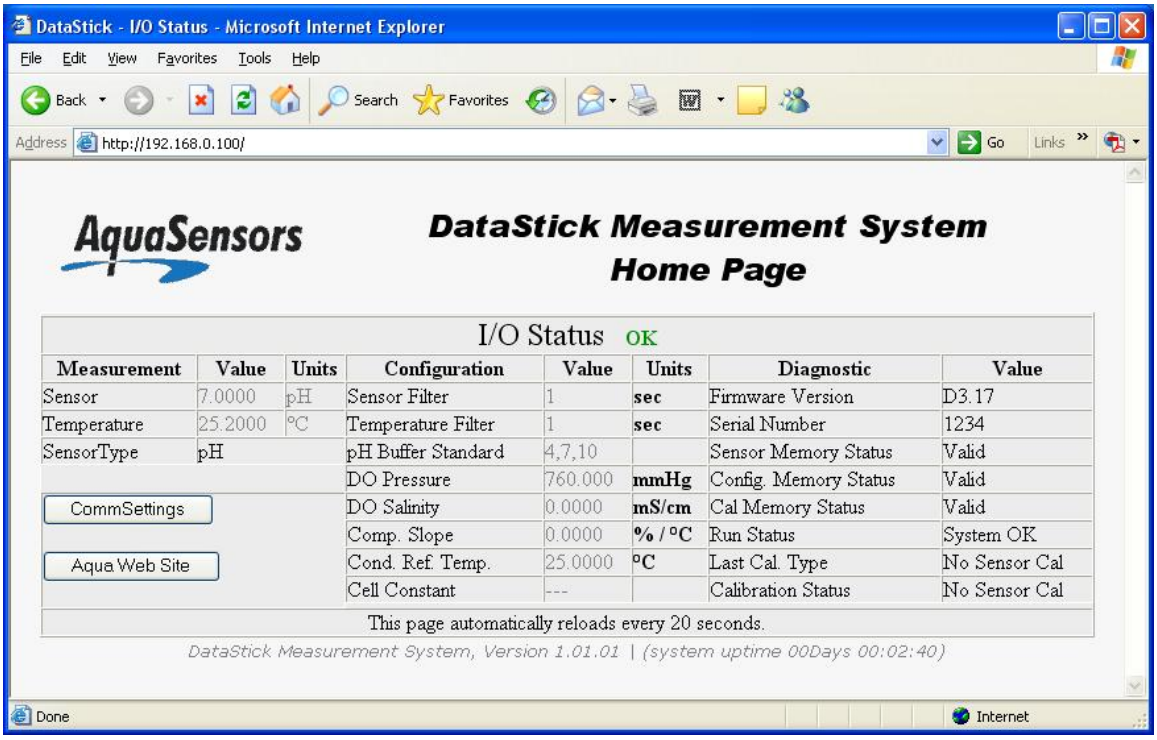

Figure 39: The Ethernet DataStick's Home Page.

Click on the CommSettings button to access the communications settings. The IP Setup Page will appear as shown in Figure 40.

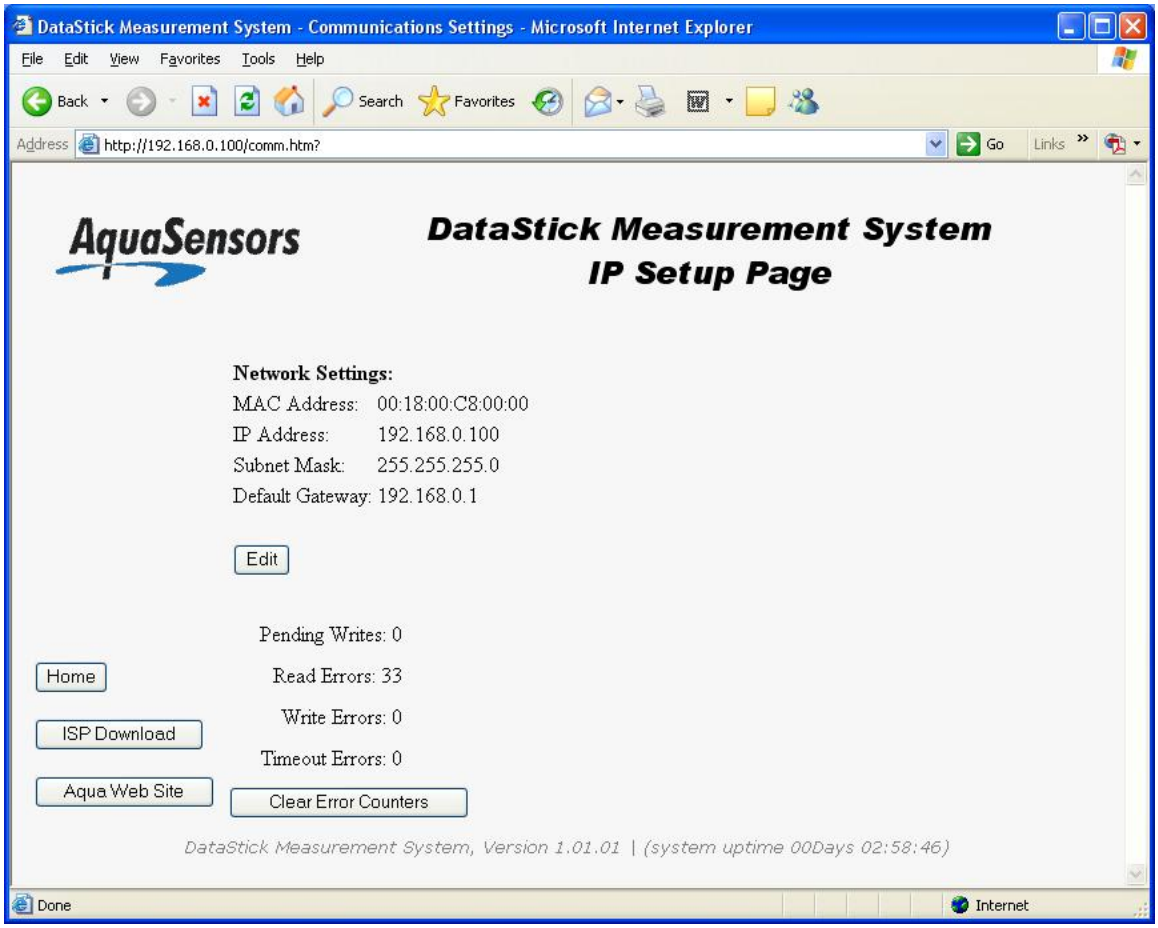

Figure 40: The product's IP Setup Page.

Click the Edit button and enter the following information:

- User name: aqa
- Password: aqa

as shown in Figure 41.

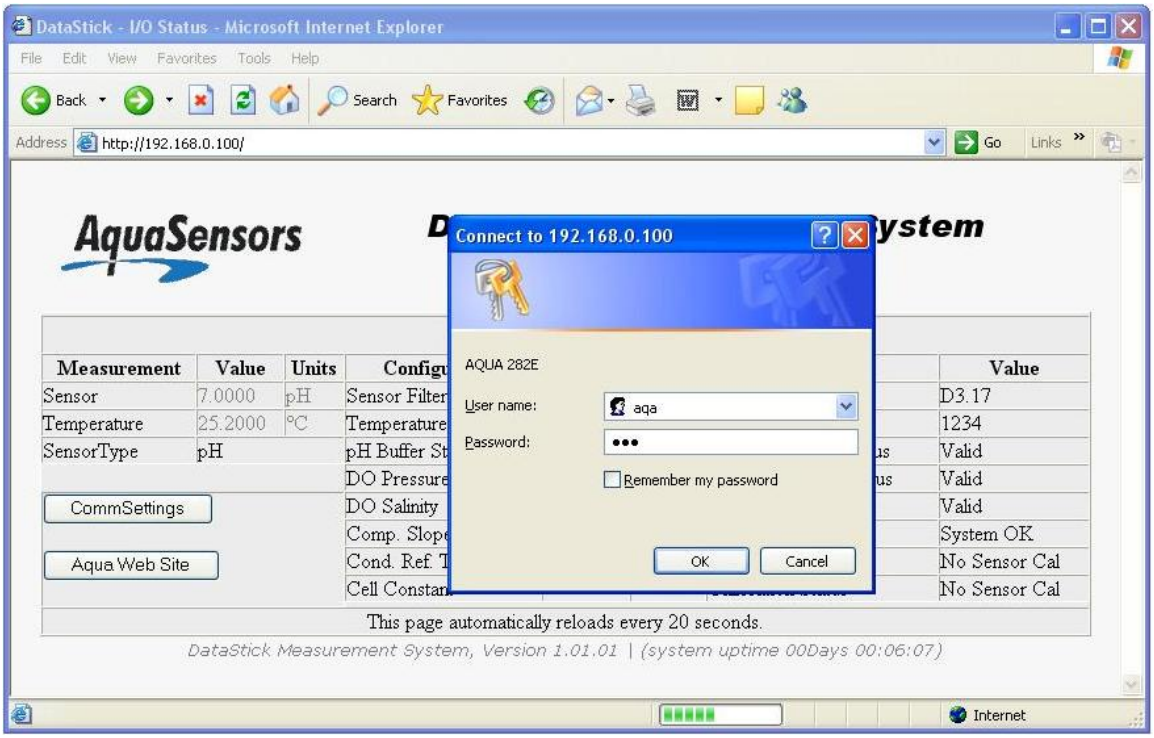

Figure 41: Entering the username and password in the IP Setup Page.

Edit the IP Address, Subnet Mask and Gateway Address as desired. For this example, the desired IP address is 192.168.10.200 as shown in Figure 42.

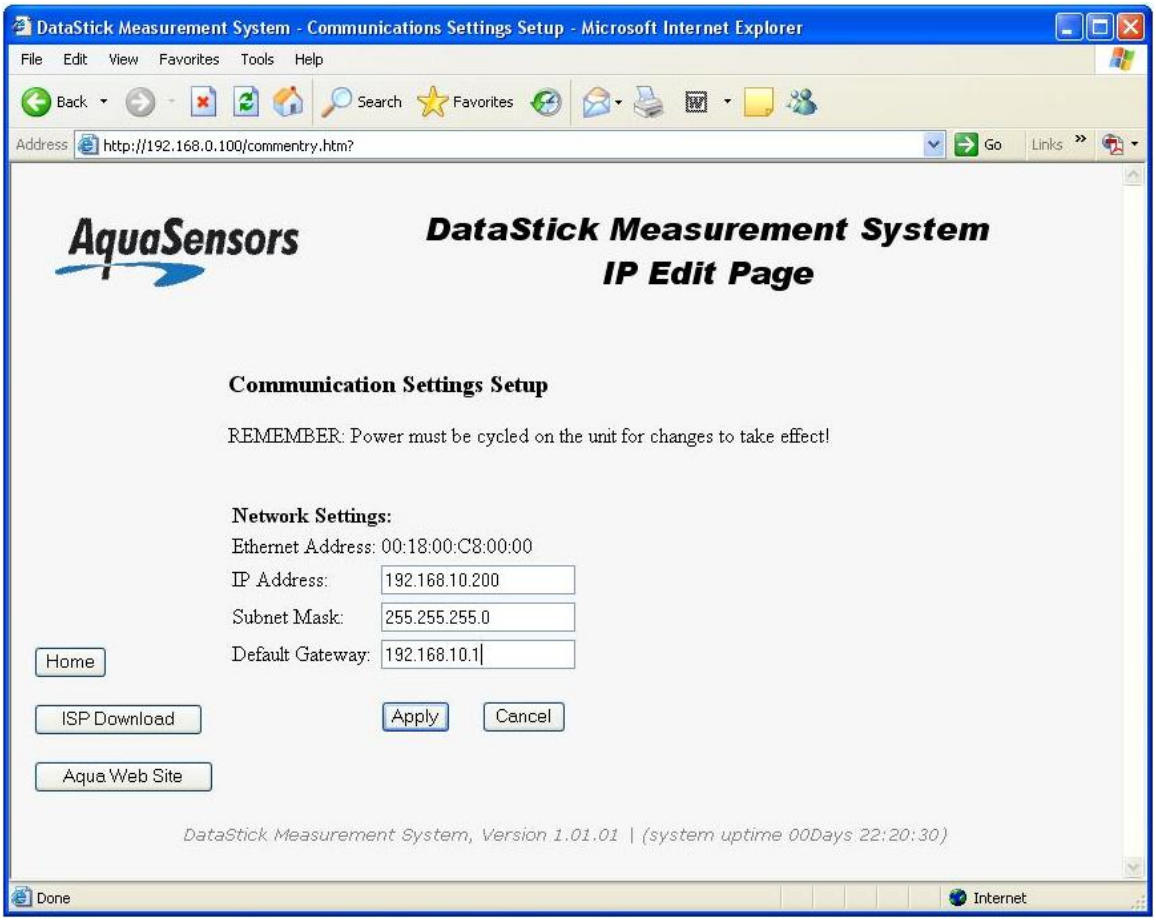

Figure 42: The IP address, subnet mask and gateway address edited as desired.

After the values have been edited as desired, click the Apply button.

To abort this step, click the Cancel button. The IP Address, Subnet Mask and Default Gateway will be returned to their previous values.

Now the power to the product must be cycled so that the new communications settings will take effect. Cycle the power by disconnecting and reconnecting the product's Ethernet connection.

Enter the product's new IP address in the Address field of the Web browser to bring up the Home Page as shown in Figure 43.

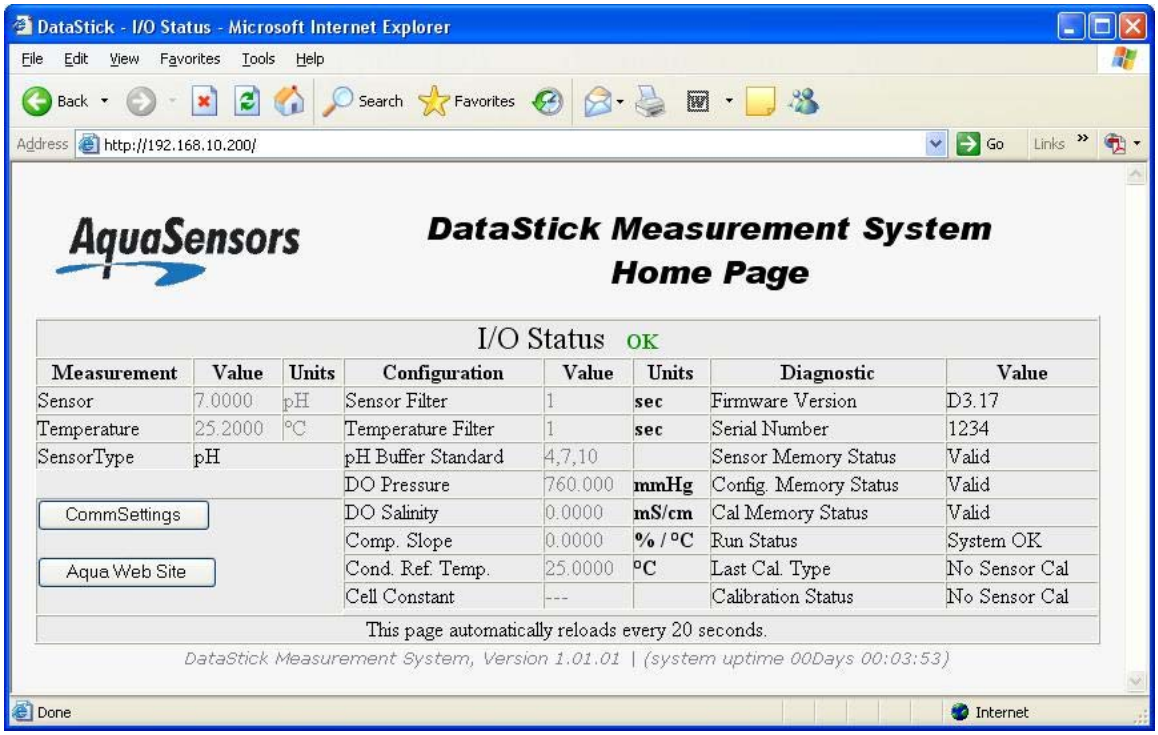

Figure 43: The Home Page as seen from the Product's new IP address.

The Ethernet DataStick's communications settings have now been set as desired and it can be connected to the desired network.

This completes the configuration procedure.

5 Web Server

The Ethernet product contains a Web server whose pages can be viewed by any device on the network. Simply start a Web browser and type in the IP address of the product.

5.1 Home Page

Entering the IP address of a product into a Web browser will bring up the DataStick Measurement System Home Page as shown in Figure 44.

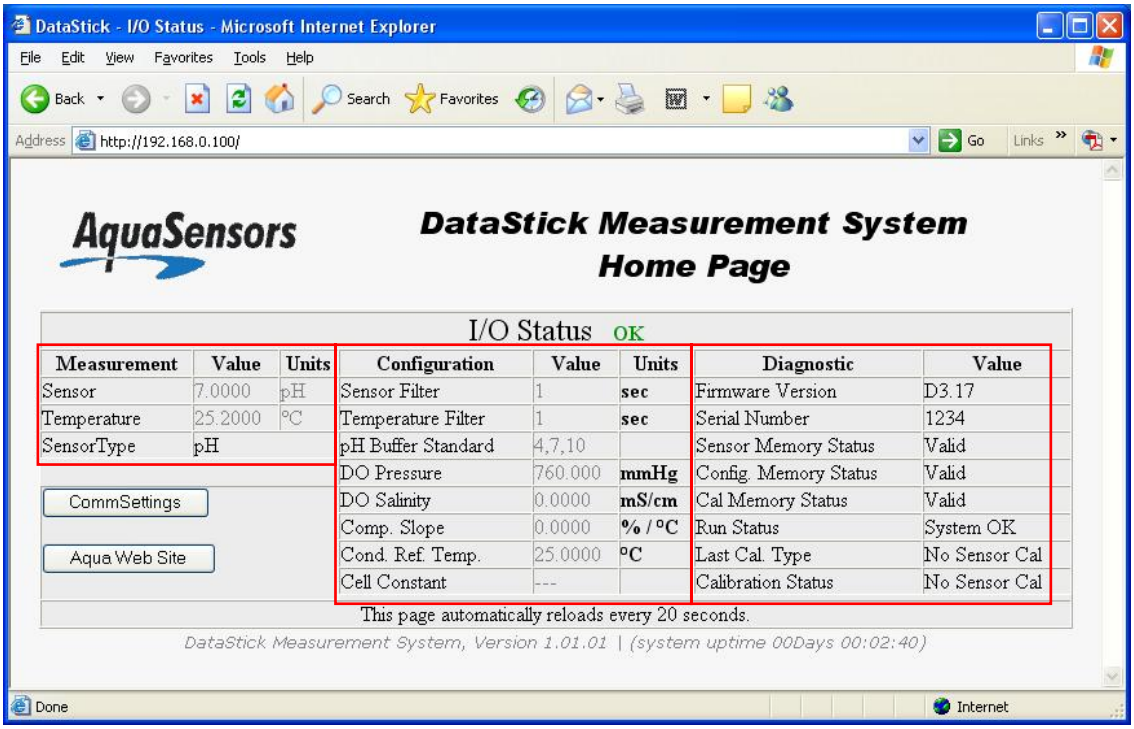

Figure 44: The DataStick Measurement System Home Page.

The Home Page shows measurement values in the left column, configuration settings for all measurement types in the center column and diagnostic information in the right column. It is updated automatically every 20 seconds and can be refreshed manually at any time. In the lower-left corner are buttons for viewing/changing the communications settings and a link to the Thermo Fisher Scientific Website.

The I/O Status field is an indication of the status of the communications between the product and the DataStick Body:

- **OK** – this status will appear when the communications between the product and the DataStick Body are good
- **Communications Errors Exist** – this status will appear when the communications between the product and the DataStick Body are not good but the Product has yet to determine that the DataStick Body is absent

- **No DataStick Communications** – this status will appear when the product has been detached from the DataStick Body

If the Sensor Head is removed from the DataStick Body, then the Sensor Type field will indicate “No Sensor”.

5.2 Calibration Page

The calibration page can be accessed by clicking on the Sensor or Temperature Value on the Home Page as shown in Figure 45.

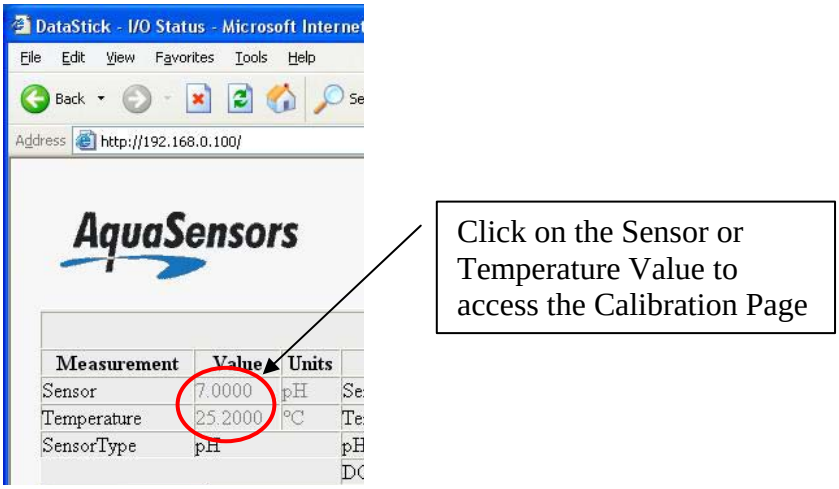

Figure 45: Accessing the Calibration Page.

The calibration page as shown in Figure 46 allows a 1-point sample calibration to be done on the DataStick.

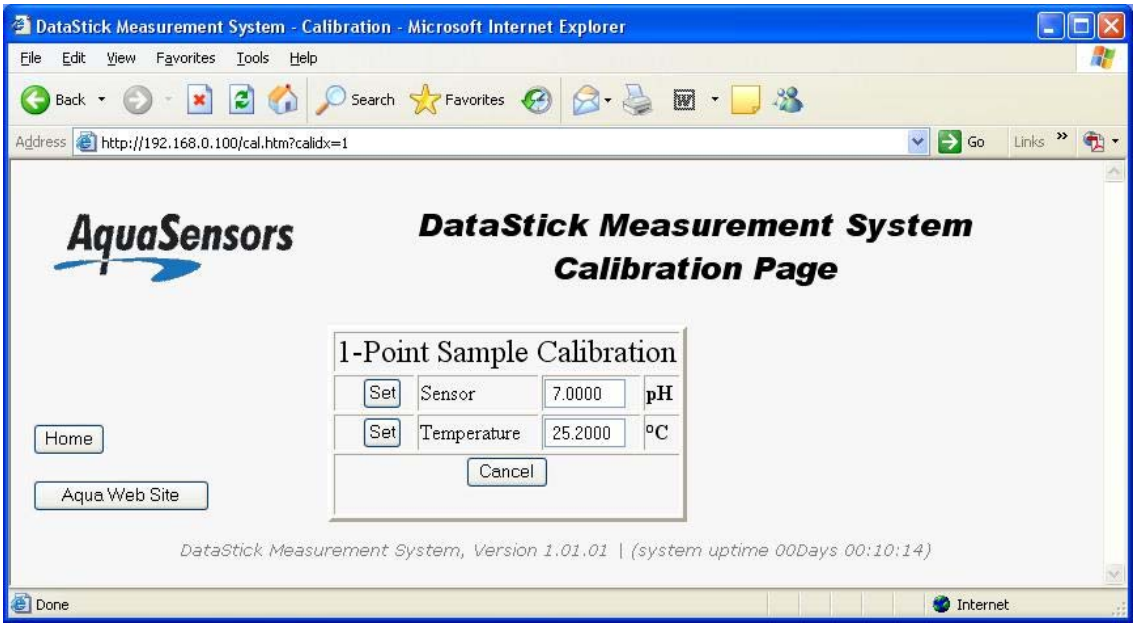

Figure 46: The DataStick Measurement System Calibration Page.

To perform a 1-point sample calibration on the Sensor or the Temperature measurement, enter the desired value in the Sensor or Temperature field and click the corresponding Set button. The calibration procedure can be monitored by returning to the Home Page and observing the Sensor or Temperature Value, and the Last Cal Type and Calibration Status fields. Calibration Status will indicate Cal OK if the procedure completed successfully.

Clicking the Cancel button instead of the Set button will return the 1-Point Sample Calibration value to its previous value.

5.3 Configuration Page

The configuration edit page can be accessed by clicking on any of the Measurement Units or Configuration Values on the Home Page as shown in Figure 47.

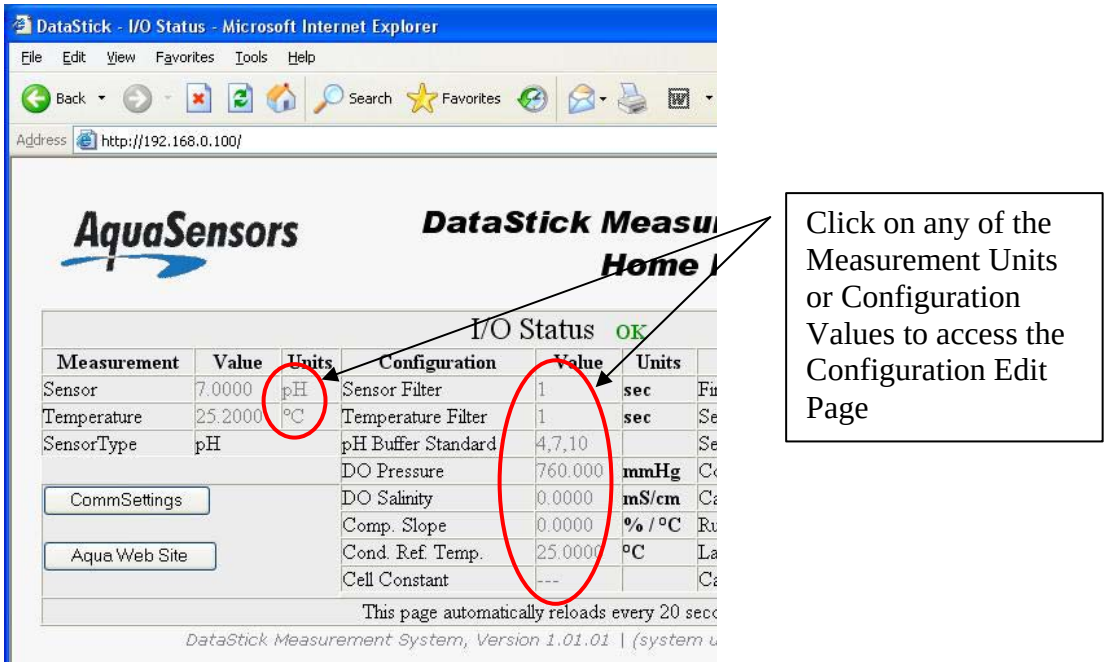

Figure 47: Accessing the Configuration Edit Page.

The configuration page as shown in Figure 48 allows the DataStick to be re-configured.

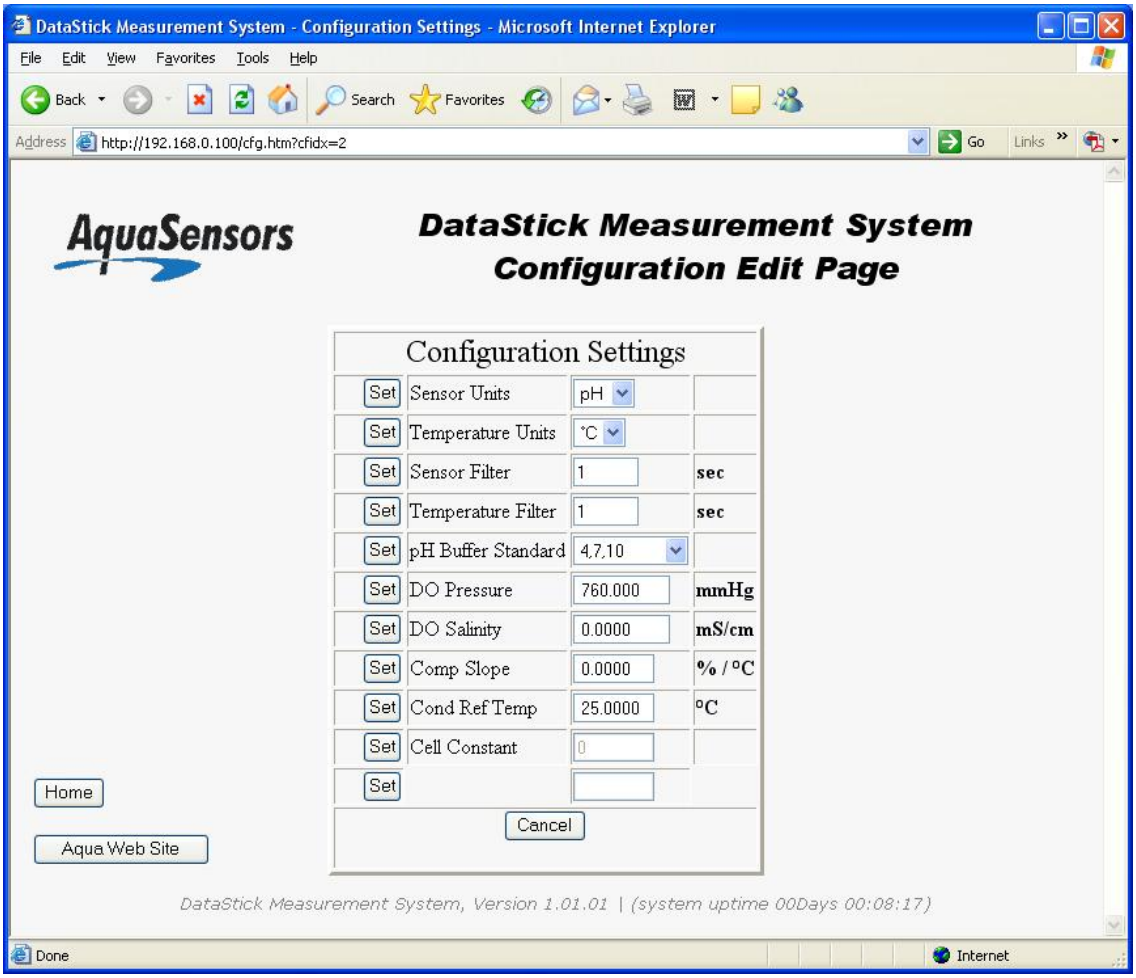

Figure 48: The Configuration Edit Page.

To change the configuration of the DataStick, enter the desired value in the editable field and click on the corresponding Set button. For more information about re-configuring a DataStick, see the DataStick Manual.

Clicking the Cancel button instead of the Set button will return the Configuration Setting to its previous value.

5.4 Communications Settings Page

The communications settings page as shown in Figure 49 can be accessed by clicking the CommSettings button on the Home Page.

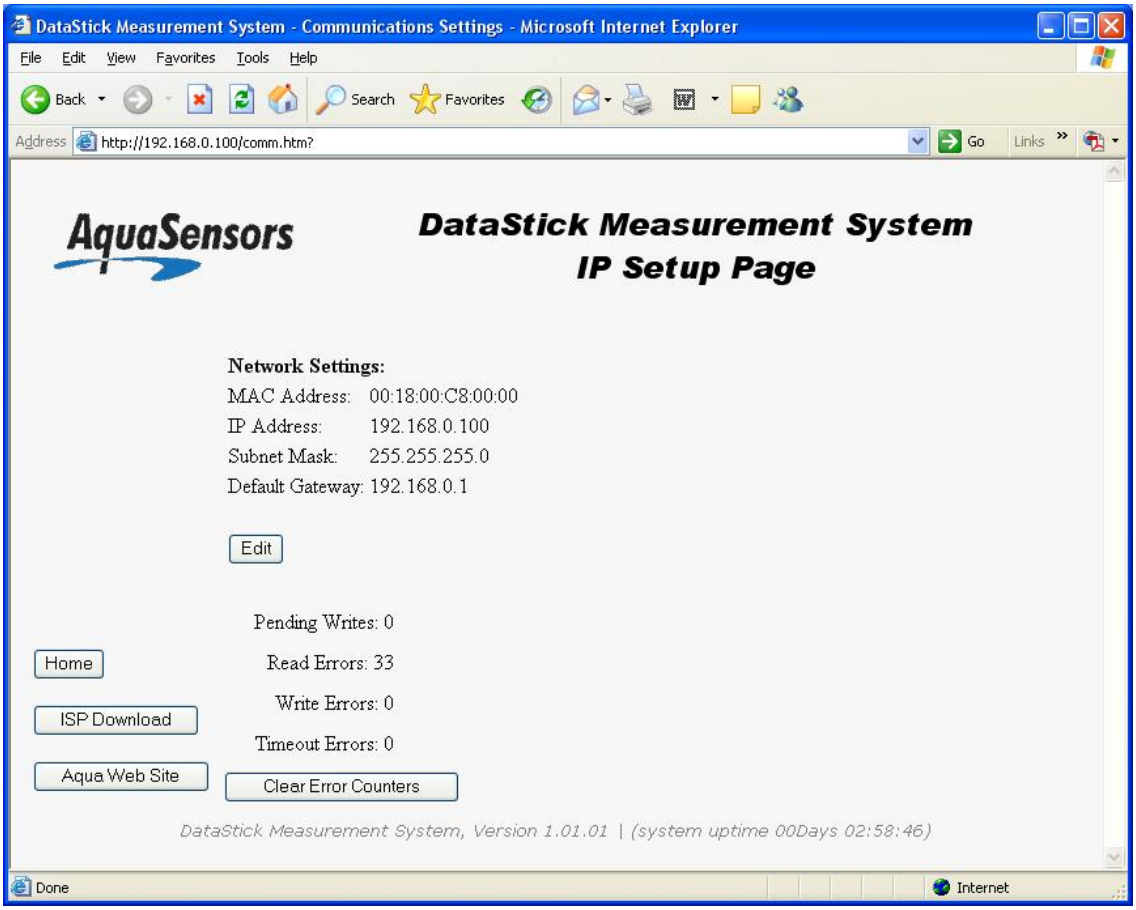

Figure 49: The Communications Settings Page.

The communications settings page allows:

- the network settings to be viewed/changed
- some counters internal to the Ethernet product to be viewed/cleared
- the firmware in the Ethernet product to be upgraded

5.4.1 Viewing/Changing the Communications Settings

See Section 4, Configuration Procedures, for more information about changing the communications settings.

5.4.2 Viewing/Clearing the Internal Counters

There are four counters internal to the Ethernet product that can be viewed. Three of them can be cleared.

The Pending Writes counter is incremented every time the Ethernet product has been asked to write to the DataStick but has not yet completed the operation. The counter is decremented each time a write completes.

The Read Errors counter is incremented every time the Ethernet product receives an error while trying to read from the DataStick. It is a count of the total number of read errors for all of the protocols supported. Some configuration data might not be available depending on the type of Sensor Head installed in the DataStick Body. When the Ethernet product tries to read this unavailable data the DataStick will respond with an error and this will cause the Read Errors counter to be incremented. The Ethernet product will realize that this data is unavailable and stop requesting it.

The Write Errors counter is incremented every time the Ethernet product receives an error while trying to write to the DataStick. It is a count of the total number of write errors for all of the protocols supported. For instance, if an attempt is made to change the Sensor Filter value to 200 using the Web Server's Configuration Page, the DataStick will respond with an error because the largest acceptable value is 100 and this will cause the Write Errors counter to be incremented.

The Timeout Errors counter is incremented every time the Ethernet product fails to receive a response from the DataStick in a reasonable amount of time. It is a count of the total number of write errors for all of the protocols supported.

The error counters can be cleared to 0 by clicking the Clear Error Counters button.

5.4.3 Upgrading the Firmware

The firmware in the Ethernet product can be upgraded by clicking on the ISP Download button. Thermo Fisher Scientific will provide you with further instructions in the event that a firmware upgrade becomes necessary.

6 EtherNet/IP

The product supports all measure, calibrate, configure and diagnose features of the DataStick via EtherNet/IP.

EtherNet/IP™ is a low-cost open industrial network that links industrial devices (such as limit switches, photoelectric sensors and motor starters) to machine controllers over Ethernet.

This section describes the EtherNet/IP Network Object Model which completely describes the interface from the EtherNet/IP network point of view. It also describes the unit configuration, unit initialization and the EtherNet/IP Network Model.

6.1 Electronic Data Sheet (EDS)

The EtherNet/IP Electronic Data Sheet (EDS) is called 282EEIP.eds and can be found on the Ethernet Files CD that is supplied with the Ethernet product. Be sure to register the EDS file with the configuration tool that you will be using.

6.2 Definitions

Network Client	The EtherNet/IP network host (commonly a scanner module in a programmable logic controller)
Network Server	An EtherNet/IP device that implements server functionality in an EtherNet/IP system
Programmable Logic Controller	PLC refers to the EtherNet/IP network host
BYTE	An unsigned 8-bit value
USINT	Unsigned Short Integer, see BYTE
UINT	Unsigned Integer, a 16-bit unsigned value
WORD	See UINT
BOOL	A logical type (TRUE or FALSE) which may be represented by a single bit
REAL	Floating point, specifically IEEE 32-bit single precision
UDINT	Unsigned Double Integer, a 32-bit unsigned value
SHORT_STRING	A string of bytes in which the first byte contains the length
NAN	Not A Number, a specific value for IEEE floating-point to indicate NO-DATA

6.3 Reference Documents

- ODVA Volume 1: CIP Common Specification, Edition 3.1 ©2006 ODVA
- ODVA Volume 2: EtherNet/IP Adaptation of CIP, Edition 1.3 ©2006 ODVA

6.4 Open DeviceNet Vendor Association, Inc. (ODVA)

ODVA is an independent supplier organization that manages the EtherNet/IP specification and supports the worldwide growth of EtherNet/IP.

6.5 Object Model

The product's EtherNet/IP object model is fashioned after the object model for the Thermo Scientific AquaSensors DeviceNet Communications Product (CA-b-5R or AV38-W-X-5). As a result, the objects shown in Table 3 are identical. This reduces the impact of changing the communications protocol after the application has been created.

Table 3: These objects are identical in the Ethernet products and DeviceNet Adapter object models.

Object Name
System Status
Sensor Installation
Sensor Value
User Configuration
Generic Sensor Calibration
Conductivity Sensor Calibration
Mode Configuration

For a detailed explanation of the Instance Attributes, please see the description of the associated Thermo Scientific AquaSensors Command in the DataStick Measurement System Instruction Manual.

6.5.1 Configuration

The product supports Thermo Scientific AquaSensors "factory" configuration parameters and user configuration parameters. All configuration data is stored in non-volatile memory.

6.5.2 Identity Object (01_{HEX} – 1 Instance)

6.5.2.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.2.2 Instance Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Vendor Number	UINT	995_{DEC}	Get
2	Device Type	UINT	0	Get
3	Product Code Number	UINT	11605_{DEC}	Get
4	Product Major Revision Product Minor Revision	USINT USINT	01 01	Get
5	Status	WORD	See Below	Get
6	Serial Number	UDINT	Unique 32 Bit Value	Get
7	Product Name	SHORT_STRING	DataStick	Get

6.5.2.3 Status Word

Bit	Bit = 0	Bit = 1
0	Not Owned	Owned (I/O Connection Allocated)
1 – 7	Unused	Unused
8	Serial Comms OK	Serial Timeout
9 – 15	Unused	Unused

6.5.2.4 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
05_{HEX}	No	Yes	Reset

6.5.3 Message Router Object (02_{HEX} – 0 Instances)

No attributes or services supported.

6.5.4 Assembly Object (04_{HEX} – 2 Instances)

6.5.4.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	2	Get
2	Max Instance	UINT	130	Get

6.5.4.2 Instance 100 (64 hex) Attributes (Input Instance)

Attribute ID	Name	EtherNet/IP Data Type	Default Data Value	Access Rule
3	Input Data - Sensor Value - Sensor Temperature	REAL[2]	NAN	Get

6.5.4.3 Output Instance 128 – (Heartbeat Instance – Input Only)

This instance allows clients to monitor input data without providing output data.

6.5.4.4 Output Instance 129 – (Heartbeat Instance – Listen Only)

This instance allows clients to monitor input data without providing output data. To utilize this connection type, an owning connection must exist from a second Client and the configuration of the connection must match exactly.

6.5.4.5 Output Instance 130 – (Configuration Instance)

This instance allows clients to download necessary configuration information to the ExLink when the I/O connection is opened. The Configuration Instance supports 0-400 bytes of data. If no configuration data is needed this instance may be omitted.

6.5.4.6 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single

6.5.5 Connection Manager Object (06_{HEX})

This object has no attributes.

6.5.6 TCP Object ($F5_{HEX}$ – 1 Instance)

6.5.6.1 Class Attributes

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.6.2 Instance Attributes

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Status[1]	DWORD	1	Get
2	Configuration Capability[2]	DWORD	0	Get
3	Configuration Control[3]	DWORD	0	Get
4	Physical Link Object[4] **Structure of:** Path Size Path	 UINT Array Of WORD	 2 0x20F6 0x2401	Get
5	Interface Configuration[5] **Structure of:** IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name Size Domain Name	 UDINT UDINT UDINT UDINT UDINT UINT STRING	 0 0 0 0 0 0 0	Get
6	Host Name[6] **Structure of:** Host Name Size Host Name	 UINT STRING	 0 0	Get

6.5.6.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single
10_{HEX}	No	Yes	Set_Attribute_Single

6.5.7 Ethernet Link Object ($F6_{HEX}$ – 1 Instance)

6.5.7.1 Class Attributes

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.7.2 Instance Attributes

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Interface Speed[7]	UDINT	10	Get
2	Interface Flags[8]	DWORD	3	Get
3	Physical Address[9]	USINT Array[6]	0	Get

[1] See section 5-3.2.2.1 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[2] See section 5-3.2.2.2 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[3] See section 5-3.2.2.3 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[4] See section 5-3.2.2.4 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[5] See section 5-3.2.2.5 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[6] See section 5-3.2.2.6 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[7] See section 5-4.2.2.1 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[8] See section 5-4.2.2.2 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
[9] See section 5-4.2.2.3 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.

6.5.7.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get_Attribute_Single

6.5.8 System Status Object (64_{HEX} – 1 Instance)

When power is applied to the Ethernet product, it takes a short amount of time for it to update its local copy of the data stored in the DataStick Body. The Data Valid attribute can be used to determine when this operation is complete. It changes from 0 to 1 when the local copy of the data has been completely updated.

The Ethernet product provides access to data stored in the product itself as well as data stored in the Data Stick Body. When data stored in the product itself is accessed, the success or failure of the operation is indicated immediately. When data stored in the DataStick Body is accessed, the immediate indication is success even though the overall operation may have failed. This is because the protocol being used doesn't tolerate the kind of delays necessary to accomplish an access of this type. To assist the programmer in determining the overall success or failure of accessing DataStick Body data, four counter attributes are available:

1. Writes Pending
2. Read Error Count
3. Write Error Count
4. Timeout Count

The Writes Pending is incremented every time the Ethernet product has been asked to write to the DataStick but has not yet completed the operation. The count is decremented each time a write completes.

The Read Error Count is incremented every time the Ethernet product receives an error while trying to read from the DataStick Body. It is a count of the total number of read errors for all of the protocols supported. Some DataStick Body data might not be available depending on the type of Sensor Head installed. When the Ethernet product tries to read this unavailable data the DataStick will respond with an error and this will cause the Read Error Count to be incremented. The Ethernet product will realize that this data is unavailable and stop requesting it.

The Write Error Count is incremented every time the Ethernet product receives an error while trying to write to the DataStick. It is a count of the total number of write errors for all of the protocols supported. For instance, if an attempt is made to change the Sensor Filter value to 200, the DataStick will respond with an error because the largest acceptable value is 100 and this will cause the Write Error Counter to be incremented.

The Timeout Count is incremented every time the Ethernet product fails to receive a response from the DataStick in a reasonable amount of time. It is a count of the total number of write errors for all of the protocols supported.

The counters can be cleared to 0 by setting them to 0.

6.5.8.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.8.2 Instance Attributes

Attribute ID	Name	Thermo Scientific AquaSensors Command	Thermo Scientific AquaSensors Offset	EtherNet/IP Data Type	Default Data Value	Access Rule
1	Sensor Memory Status	GSTATUS	0	USINT	0	Get
2	Configuration Memory Status	GSTATUS	2	USINT	0	Get
3	Calibration memory Status	GSTATUS	4	USINT	0	Get
4	Run Status	GSTATUS	6	USINT	0	Get
100	Data Valid	N/A	N/A	UINT	0	Get
101	Writes Pending	N/A	N/A	UINT	0	Get
102	Read Error Count	N/A	N/A	UINT	0	Get / Set[10]
103	Write Error Count	N/A	N/A	UINT	0	Get / Set[10]
104	Timeout Count	N/A	N/A	UINT	0	Get / Set[10]

6.5.8.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single

6.5.9 Sensor Installation Object (65_{HEX} – 1 Instance)

6.5.9.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.9.2 Instance Attributes

Attribute ID	Name	Thermo Scientific AquaSensors Command	Thermo Scientific AquaSensors Offset	EtherNet/IP Data Type	Default Data Value	Access Rule
3	Sensor Type	GSTYPE	0	UINT	0	Get
4	Sensor Category	GSCAT	0	UINT	0	Get

[10] Writing this attribute clears the count to 0.

6.5.9.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single

6.5.10 Sensor Value Object (66_{HEX} – 1 Instance)

6.5.10.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.10.2 Instance Attributes

Attribute ID	Name	Thermo Scientific AquaSensors Command	Thermo Scientific AquaSensors Offset	EtherNet/IP Data Type	Default Data Value	Access Rule
1	Sensor Value	GSNSR	0	REAL	NAN	Get
2	Temperature Value	GTEMP	0	REAL	NAN	Get

6.5.10.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single

6.5.11 User Configuration Object (67_{HEX} – 1 Instance)

6.5.11.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.11.2 Instance Attributes

Attribute ID	Name	Thermo Scientific AquaSensors Command	Thermo Scientific AquaSensors Offset	EtherNet/IP Data Type	Default Data Value	Access Rule
1	Main Serial Number	GMSNO/ SMSNO	0	SHORT_STRING	0	Get / Set
2	Code Version	GCVSN	0	SHORT_STRING	0	Get
3	Sensor Units	GSUNITS / SSUNITS	0	UINT	0	Get / Set
4	Temperature Units	GTUNITS / STUNITS	0	UINT	0	Get / Set
5	Sensor Filter	GSFIL / SSFIL	0	UINT	0	Get / Set
6	Temperature Filter	GTFIL / STFIL	0	UINT	0	Get / Set
7	pH Buffer Type	GPHBUF / SPHBUF	0	UINT	0	Get / Set
8	DO Salinity	GSALT / SSALT	0	REAL	NAN	Get / Set
9	DO Pressure	GPRESS / SPRESS	0	REAL	NAN	Get / Set
10	Conductivity Reference Temperature	GCRTEMP / SCRTEMP	0	REAL	NAN	Get / Set
11	Conductivity Compensation Slope	GCCSLOPE / SCCSLOPE	0	REAL	NAN	Get / Set
12	Node Address	GADDR / SADDR	0	USINT	0	Get / Set
13	DataStick Address	GDSA / SDSA	0	UINT	0	Get / Set
14	DataStick Timeout (2 to 200) 10 msec. tick	NA	NA	UINT	0	Get / Set
15	TDS Conversion Factor	GTDSF/STDSF	0	REAL	NAN	Get/Set

6.5.11.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single
10_{HEX}	No	Yes	Set Attribute Single

6.5.12 Generic Sensor Calibration Object (68_{HEX} – 1 Instance)

When calibrating the DataStick system, use the primary units of measure, e.g., calibrate pH in pH, not mV.

6.5.12.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.12.2 Instance Attributes

Attribute ID	Name	Thermo Scientific AquaSensors Command	Thermo Scientific AquaSensors Offset	EtherNet/IP Data Type	Default Data Value	Access Rule
1	Calibrate Sensor Zero	CALSZERO		None	0	Get / Set[11]
2	Calibrate 1-Point Sample	CALS1PS, data		REAL	NAN	Get / Set[11]
3	Calibrate Sensor 2-Point Sample Point	N/A		UINT	0	Get / Set
4	Calibrate Sensor 2-Point Sample Value	CALS2PS, data1, data2		REAL	NAN	Get / Set[11]
5	Calibrate Sensor 1-Point Buffer	CALS1PB		None		Get / Set[11]
6	Calibrate Sensor 2-Point Buffer	CALS2PB, data		UINT	0	Get / Set[11]
7	Calibrate Sensor in Air	CALSAIR		None		Get / Set[11]
8	Calibrate Sensor Temperature 1-Point Sample	CALST1PS		REAL	NAN	Get / Set[11]
9	Calibration Type	CALSTATUS	3	UINT	0	Get
10	Calibration Status	CALSTATUS	6	UINT	0	Get
11	Calibration Abort	CALABORT	N/A	None	0	Get / Set[11]

6.5.12.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	No	Get Attribute Single
10_{HEX}	No	Yes	Set Attribute Single

6.5.13 Conductivity Sensor Calibration Object (69_{HEX} – 1 Instance)

6.5.13.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.13.2 Instance Attributes

Attribute ID	Name	Thermo Scientific AquaSensors Command	Thermo Scientific AquaSensors Offset	EtherNet/IP Data Type	Default Data Value	Access Rule
1	Cell Constant	GCELL / SCELL	0	REAL	NAN	Get/Set

6.5.13.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single
10_{HEX}	No	Yes	Set Attribute Single

[11] Always reads as "0" since the parameter is write only.

6.5.14 Mode Configuration Object (75_{HEX} – 1 Instance)

6.5.14.1 Class Attributes

Attribute ID	Name	EtherNet/IP Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

6.5.14.2 Instance Attributes

Attribute ID	Name	Thermo Scientific AquaSensors Command	Thermo Scientific AquaSensors Offset	EtherNet/IP Data Type	Default Data Value	Access Rule
2	PLC Data Type (format of Implicit data object)	N/A	N/A	USINT	0	Get/Set

6.5.14.3 PLC Data Type

Value	Type
0	Little Endian - ControlLogix
1	Little Endian Word Swap - SLC
2	Big Endian
3	Big Endian Word Swap

6.5.14.4 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
$0E_{HEX}$	Yes	Yes	Get Attribute Single
10_{HEX}	No	Yes	Set Attribute Single

Please note that the PLC Data Type in the Mode Configuration Object affects only the implicit I/O of the EtherNet/IP; it has no effect on the Modbus TCP.

6.6 EtherNet/IP Reference

Open DeviceNet Vendor Association (ODVA), http://www.odva.org/

7 Modbus TCP and PCCC

This section describes the Modbus TCP and Programmable Controller Communication Commands (PCCC).

7.1 Modbus TCP

The product supports all measure, calibrate, configure and diagnose features of the DataStick via Modbus TCP.

According to the Modbus-IDA Website:

> The Modbus Protocol is a messaging structure developed by Modicon in 1979. It is used to establish master-slave/client-server communications between intelligent devices. It is a de facto standard, truly open and the most widely used network protocol in the industrial manufacturing environment. It has been implemented by hundreds of vendors on thousands of different devices to transfer discrete/analog I/O and register data between control devices. It's a lingua franca or common denominator between different manufacturers.
>
> TCP/IP is the common transport protocol of the Internet and is actually a set of layered protocols, providing a reliable data transport mechanism between machines. Ethernet has become the de facto standard of corporate enterprise systems, so it comes as no surprise that it has also become the de facto standard for factory networking. Ethernet is not a new technology. It has matured to the point that the cost of implementing this network solution has been dropping to where its cost is commensurate with those of today's field-buses.
>
> Using Ethernet TCP/IP in the factory allows true integration with the corporate intranet and MES systems that support the factory. To move Modbus into the 21st century, an open Modbus TCP/IP specification was developed in 1999. The protocol specification and implementation guide are available for download (www.modbus-ida.org/specs).
>
> Combining a versatile, scaleable, and ubiquitous physical network (Ethernet) with a universal networking standard (TCP/IP) and a vendor-neutral data representation, Modbus gives a truly open, accessible network for exchange of process data.

The Modbus TCP registers are defined in the tables in Section 7.3,

Modbus TCP and PCCC Register Map. For a detailed explanation of the register contents, please see the description of the associated DataStick Command in the DataStick Measurement System Instruction Manual, Catalog Number MAN011DS-4.

7.1.1 Modbus TCP Reference

Modbus-IDA, http://www.modbus-ida.org/

7.2 Programmable Controller Communication Commands (PCCC)

This section describes how to communicate with an Ethernet product using an Allen-Bradley SLC 5/03, SLC 5/04 or SLC 5/05 PLC using Programmable Controller Communication Commands (PCCC).

The Ethernet product (server) mimics the behavior of a PLC5 in order to enable communications with a PLC5, SLC 5/03, SLC 5/04 or SLC 5/05 PLC (client). The PCCC object in the Ethernet product is accessed remotely using explicit messaging via EtherNet/IP. In order to read registers in the Ethernet product, the PLC must issue a Peer-To-Peer Read command to the Ethernet product. In order to write registers in the Ethernet product, the PLC must issue a Peer-To-Peer Write Command to the Ethernet product.

The PCCC Register numbers are shown in the tables in Section 7.3,

Modbus TCP and PCCC Register Map. They are determined from the corresponding Modbus TCP registers as follows:

> Take the Modbus TCP register of interest, ignore the leading 4 and divide by 100. The quotient is the register file (prefixed with N) and the remainder is the register number.

For example, to read Modbus TCP register 42,001 (Sensor Value), ignore the leading 4 to obtain 2,001, and divide 2,001 by 100 to obtain 20 with a remainder of 1. The register file, then, is N20 and the register is 1, or N20:01.

Keep in mind that there is no type checking; if you access only N20:01 instead of N20:01 and N20:02 you will receive a strange number because N20:01 is only half of the data for a floating-point value.

Please note that PLC Data Type (N30:25) has no effect on the order of the bytes or words transferred using PCCC.

For a detailed explanation of the PCCC register contents, please see the description of the associated DataStick Command in the DataStick Measurement System Instruction Manual, Catalog Number MAN011DS-4.

7.2.1 SLC 5/03 and SLC 5/04 PLCs

If you have an Allen-Bradley SLC 5/03 or SLC 5/04 PLC and wish to communicate with an Ethernet Communications product you'll need a 1761-NET-ENI MicroLogix™ Ethernet Interface (ENI) and a 1761-PM02-CBL Communications Cable (Catalog No. 2707-NC8) to add Ethernet connectivity to the SLC. Figure 50 shows a SLC 5/03 connected to an Ethernet network via a 1761-NET-ENI.

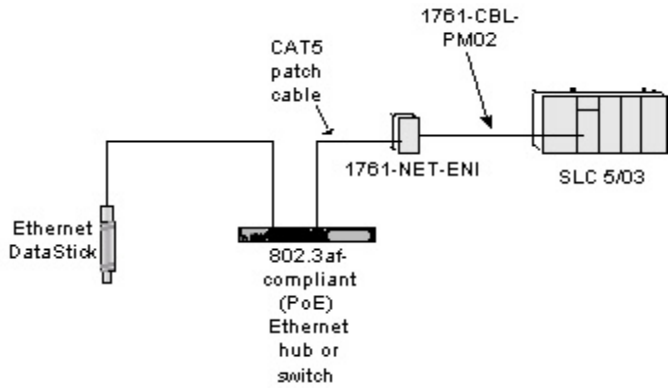

Figure 50: SLC 5/03 PLC connected to Ethernet network via a 1761-NET-ENI.

The SLC communicates with the ENI using DF1 full-duplex over RS-232 and the ENI translates the communications into EtherNet/IP and sends them out on the Ethernet network.

7.2.1.1 Configuring the NET-ENI

The 1761-NET-ENI (ENI) must be configured to forward messages from the SLC to the Ethernet Communications product before you can accomplish any communications. This

is done using the ENI Configuration Utility shown in Figure 51. It can be downloaded from http://www.ab.com/programmablecontrol/plc/micrologix1000/get/ENIutility.exe.

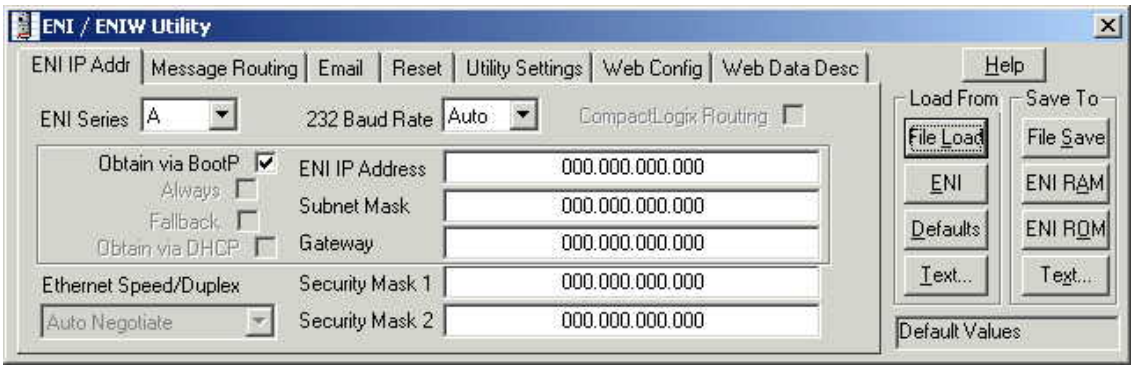

Figure 51: The ENI Configuration Utility.

See the 1761-NET-ENI MicroLogix™ Ethernet Interface User Manual for a complete description of how to configure the ENI.

7.2.1.2 Com Port Redirector Software

If you have a Series D 1761-NET-ENI (ENI), then it's possible to configure the ENI via Ethernet using a software program called Com Port Redirector. This can be beneficial because the ENI can be re-configured without disconnecting it from the SLC. Com Port Redirector can be downloaded from http://www.ab.com/programmablecontrol/plc/micrologix1000/get/comredir.zip.

Figure 52 shows the Com Port Redirector configured to redirect COM32 on the computer to the ENI at IP address 192.168.10.60, port 10,001. The ENI Utility is configured to communicate with the ENI via COM32.

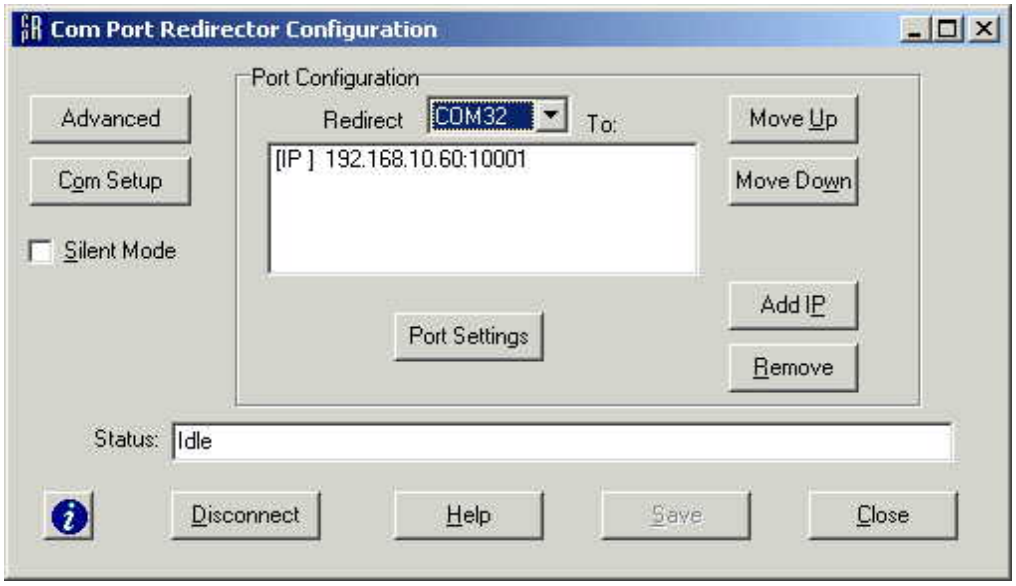

Figure 52: The Com Port Redirector.

Com Port Redirector creates a virtual COM port at COM32 and redirects any communications with COM32 to IP address 192.168.10.60, port 10,001.

7.2.2 Example SLC 5/03 Ladder Logic Programs

The Message (MSG) instruction is used to communicate with the Ethernet product. It has a DN (Message done) bit that can be used to trigger the next operation. It also has an ER (Error) bit that can be used to handle communications errors. See the RSLogix 500 Instruction Help for more information.

The example ladder logic programs in this section communicate with an Ethernet product through an ENI configured as shown in Figure 53.

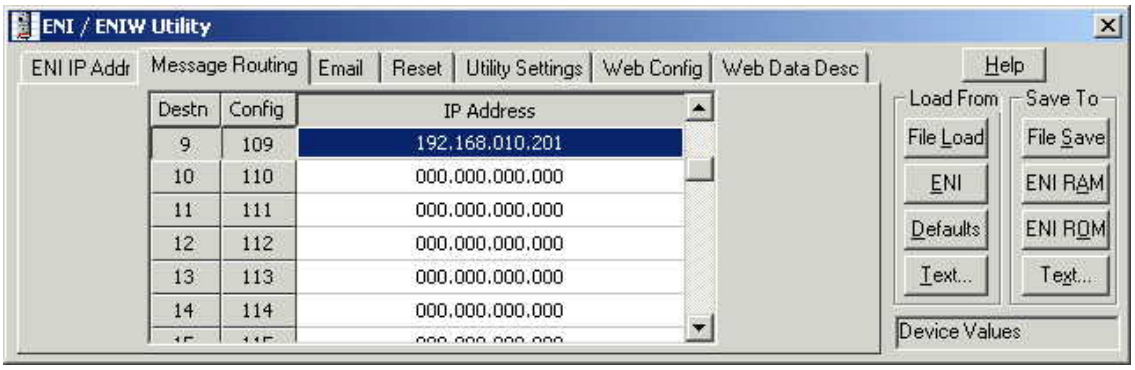

Figure 53: The Message Routing tab of the ENI Configuration Utility.

When a MSG instruction from the PLC with a Local Node Address (Destn) of 9 arrives at the RS-232 port on the ENI, the ENI routes it to the Ethernet product at IP address 192.168.10.201.

7.2.2.1 Reading the Sensor Value

The ladder logic program shown in Figure 54, Figure 55 and Figure 56 continuously reads the Sensor Value from register N20:01 in the Ethernet product at IP address 192.168.10.201 using a Message (MSG) instruction and stores it in F8:0 in the PLC. Note that, on rung 3, the two words that make up the floating-point Sensor Value are swapped before they're copied to the F8 file. The program is event-driven in that the completion of a MSG instruction triggers the transmission of another one. A count of the messages sent is kept as well as a count of any errors that may have occurred.

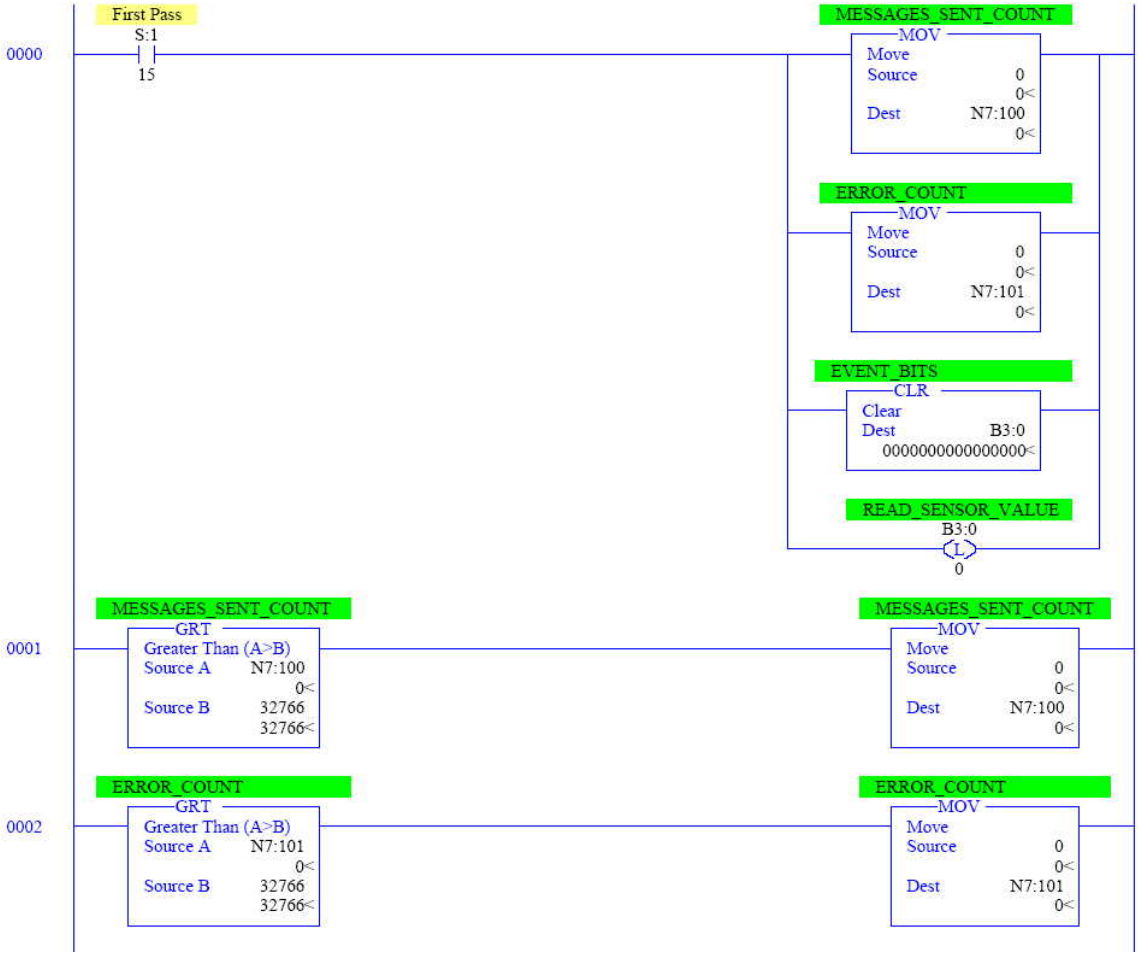

Figure 54: Part 1 of 3 of a ladder logic program that reads the Sensor Value from N20:01.

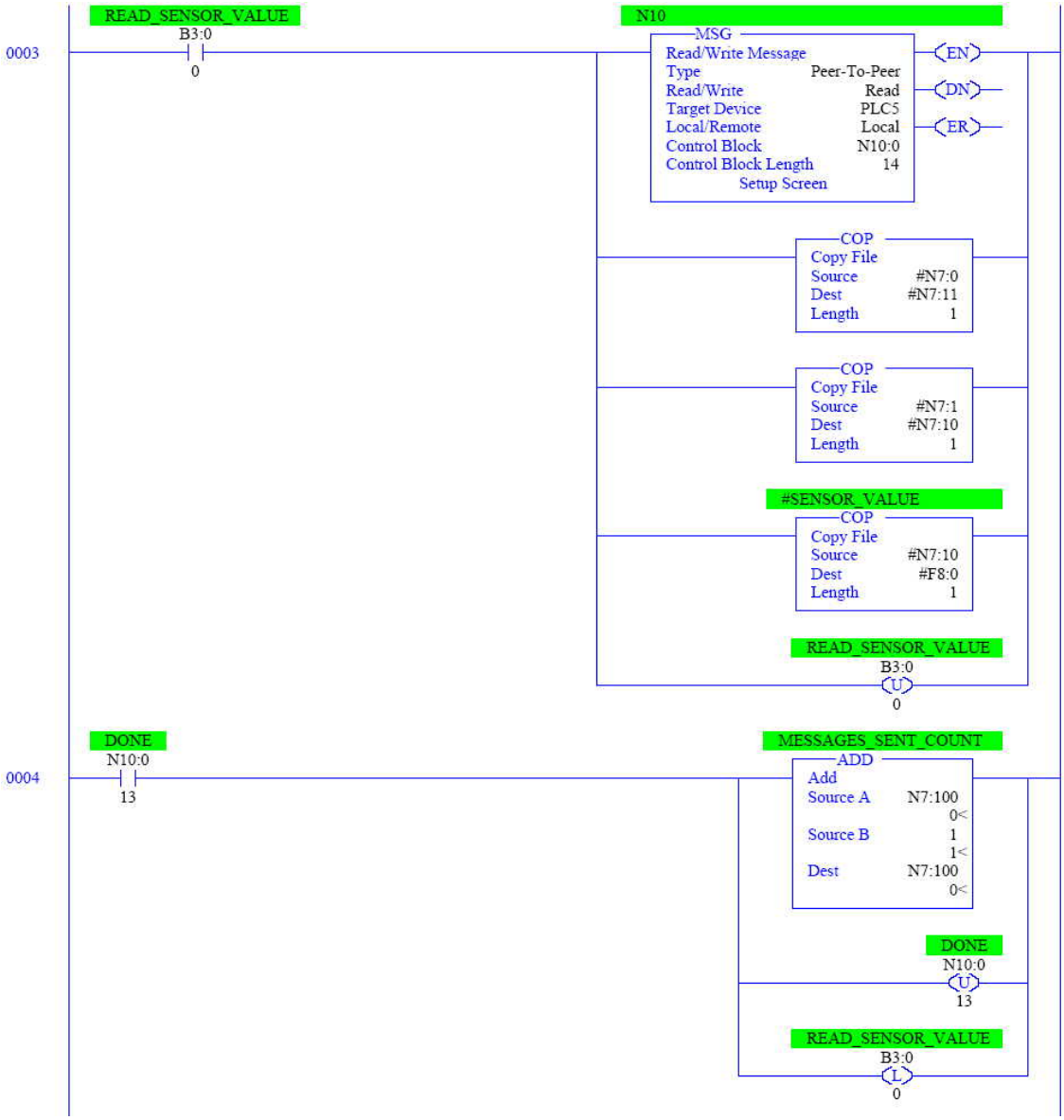

Figure 55: Part 2 of 3 of a ladder logic program that reads the Sensor Value from N20:01.

In the MSG instruction on rung 3, note that the Type is Peer-to-Peer and that it is a Read instruction. The "Target Device" must be set to PLC5.

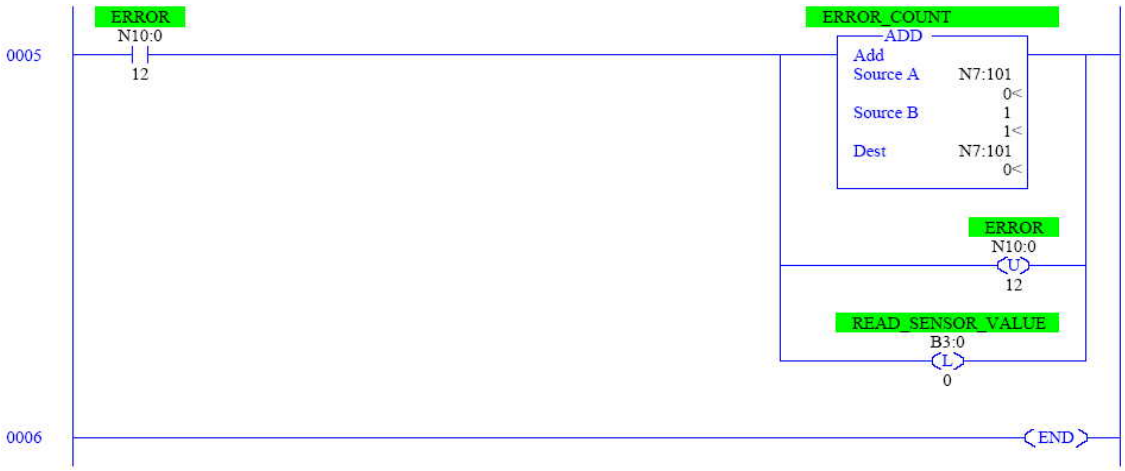

Figure 56: Part 3 of 3 of a ladder logic program that reads the Sensor Value from N20:01.

This program can be easily expanded to read the Temperature Value from N20:03 and N20:04.

Figure 57 shows the Setup screen for the MSG instruction on rung 3. The destination information is contained in the "This Controller" field. The "Data Table Address" is the register in the PLC where the Sensor Value is to be stored. Note that the "Size in Elements" is 2 because Sensor Value is a floating-point data type that occupies registers N20:01 and N20:02 in the Ethernet product. The Channel is 0 because this is the RS-232 port on the SLC to which the ENI is connected.

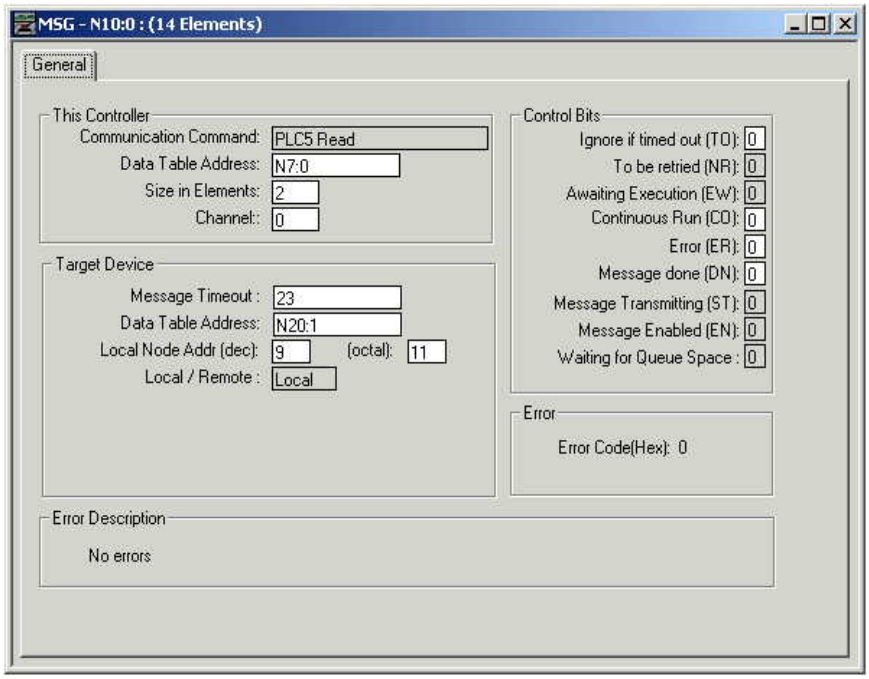

Figure 57: The Setup screen for a MSG instruction in a SLC 5/03.

The source information is shown in the "Target Device" field. The Message Timeout specifies the amount of time that the MSG instruction will wait for the Ethernet product to respond. Because of the way the ENI has been configured, a Local Node Address of 9 corresponds to IP address 192.168.10.201.

Figure 58 shows the Sensor Value (7 pH) that was read from N20:01 and stored in F8:0.

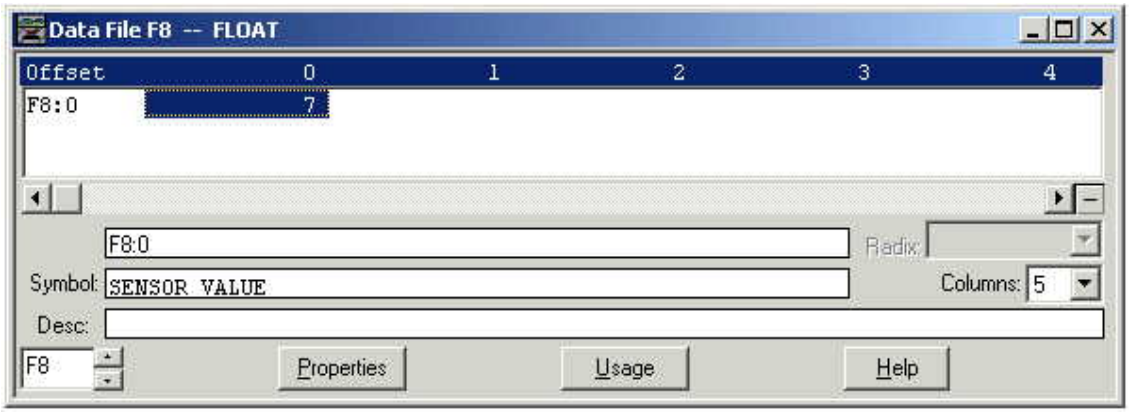

Figure 58: The Sensor Value in F8:0.

7.2.2.2 Reading and Writing a Configuration Value

The ladder logic program in Figure 59, Figure 60 and Figure 61 continuously reads the Sensor Filter value from register N30:18 in the Ethernet product at IP address 192.168.10.201 using a Message (MSG) instruction and stores it in N7:0 in the PLC. It also writes the value in N7:10 in the PLC to N30:18 in the Ethernet product when bit B3:0/1 is toggled. The program is event-driven in that the completion of a MSG instruction triggers the transmission of another one. A count of the messages sent is kept as well as a count of any errors that may have occurred.

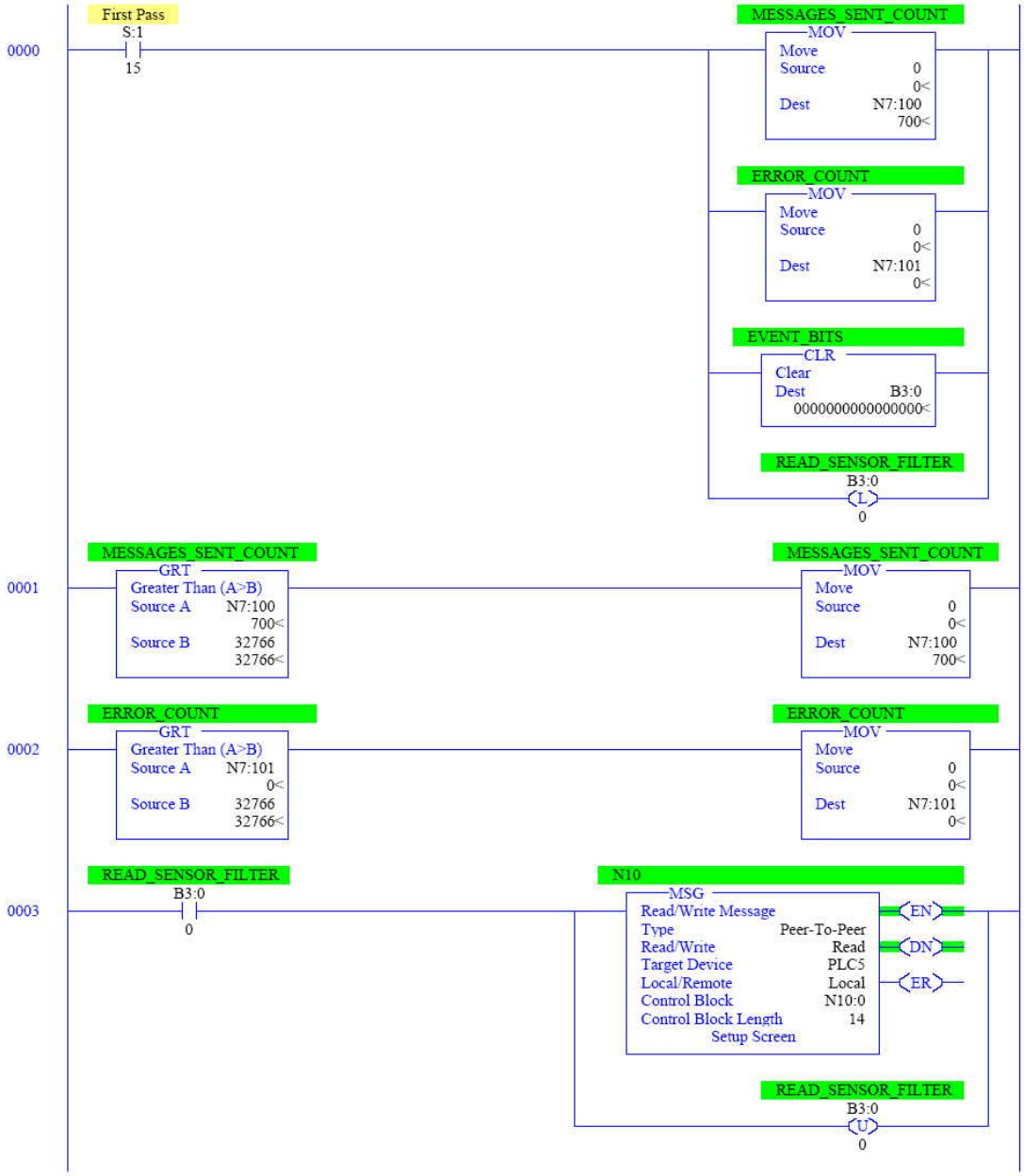

Figure 59: Part 1 of 3 of a ladder logic program to read and write the Sensor Filter value at N30:18.

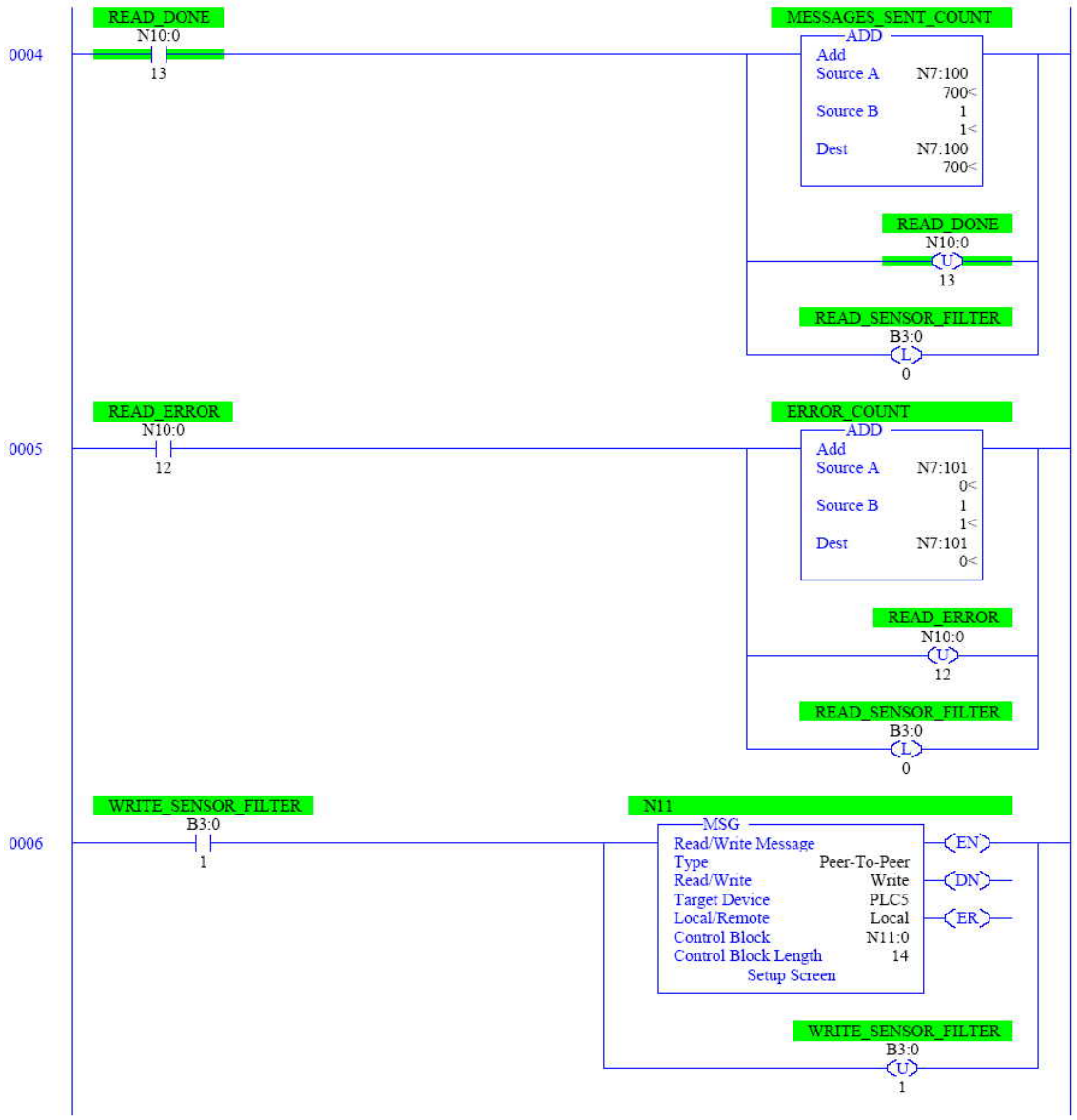

Figure 60: Part 2 of 3 of a ladder logic program to read and write the Sensor Filter value at N30:18.

Note that the type of the MSG instruction on rung 6 is Write.

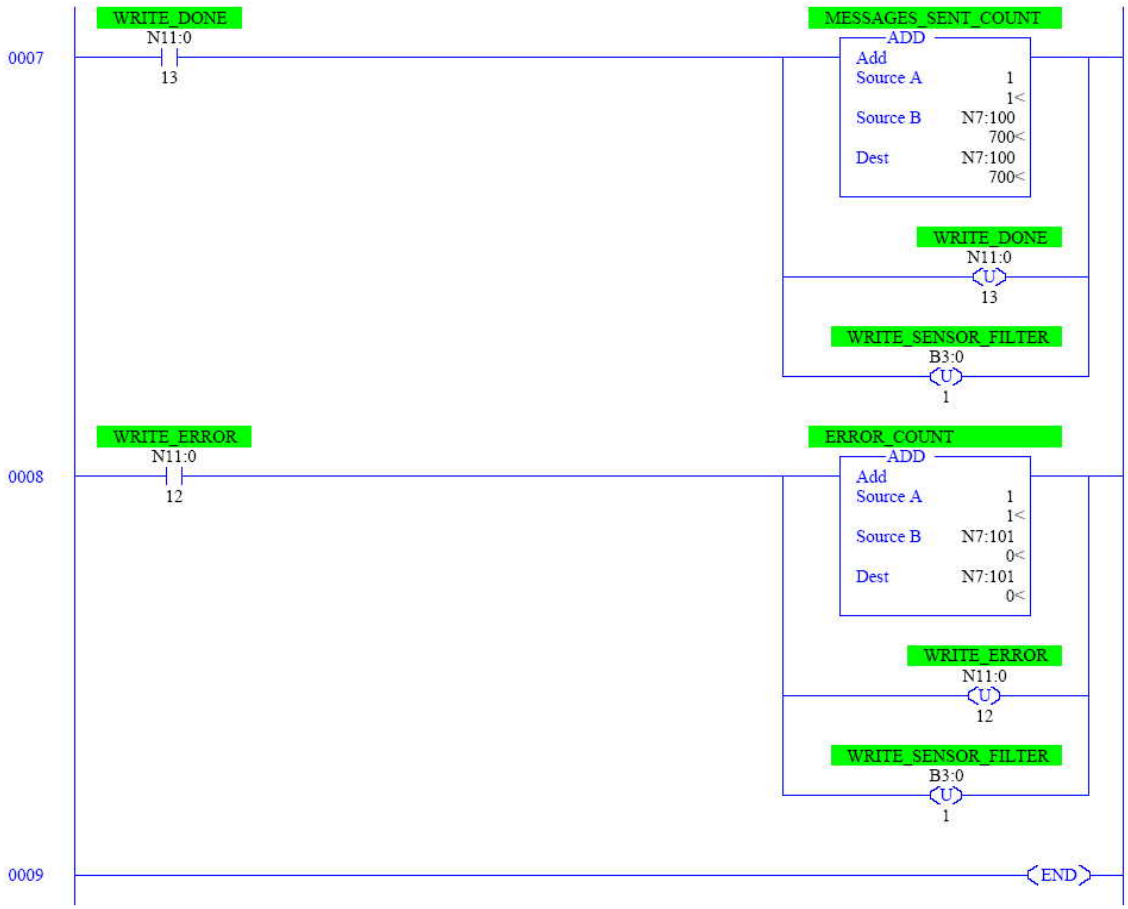

Figure 61: Part 3 of 3 of a ladder logic program to read and write the Sensor Filter value at N30:18.

This program can easily be extended to read and write other configuration values.

Figure 62 shows the Setup screen for the MSG instruction on rung 6. The source information is contained in the "This Controller" field. The "Data Table Address" is the register in the PLC where the new value is to be obtained. Note that the "Size in Elements" is 1 because the Sensor Filter value is an integer data type that occupies register N30:18 in the Ethernet product. The Channel is 0 because this is the RS-232 port on the SLC to which the ENI is connected.

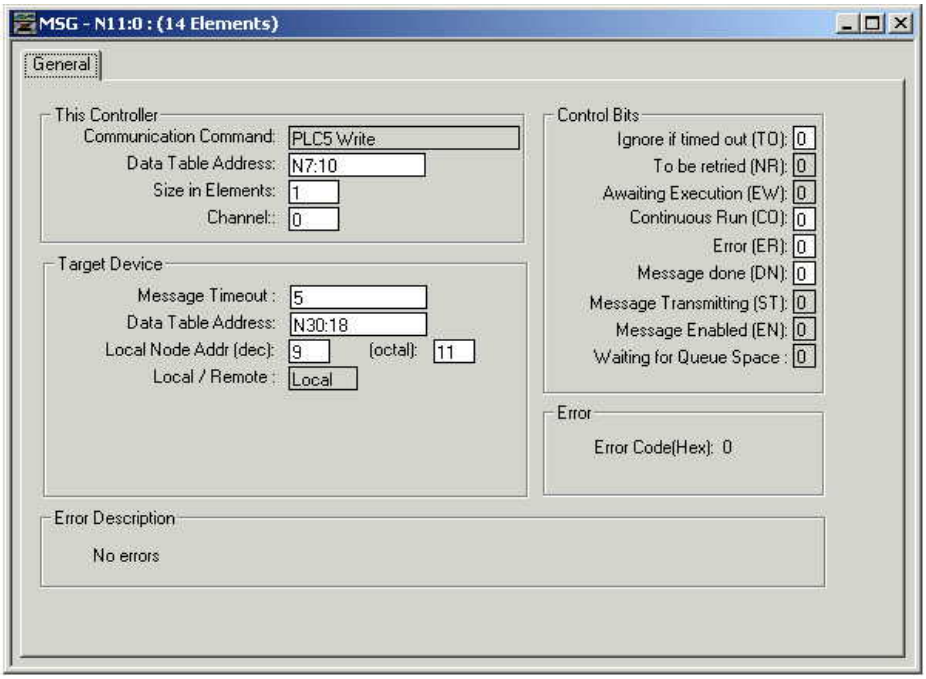

Figure 62: The Setup screen for a MSG instruction in a SLC 5/03.

The destination information is shown in the "Target Device" field. The Message Timeout specifies the amount of time that the MSG instruction will wait for the Ethernet product to respond. Because of the way the ENI has been configured, a Local Node Address of 9 corresponds to IP address 192.168.10.201.

Figure 63 shows the Sensor Filter value that was read from N30:18 and stored in N7:0. The value to be written is in N7:10. In this example the Sensor Filter value was changed to 1. The figure also shows the MESSAGES_SENT_COUNT in N7:100 and the ERROR_COUNT in N7:101.

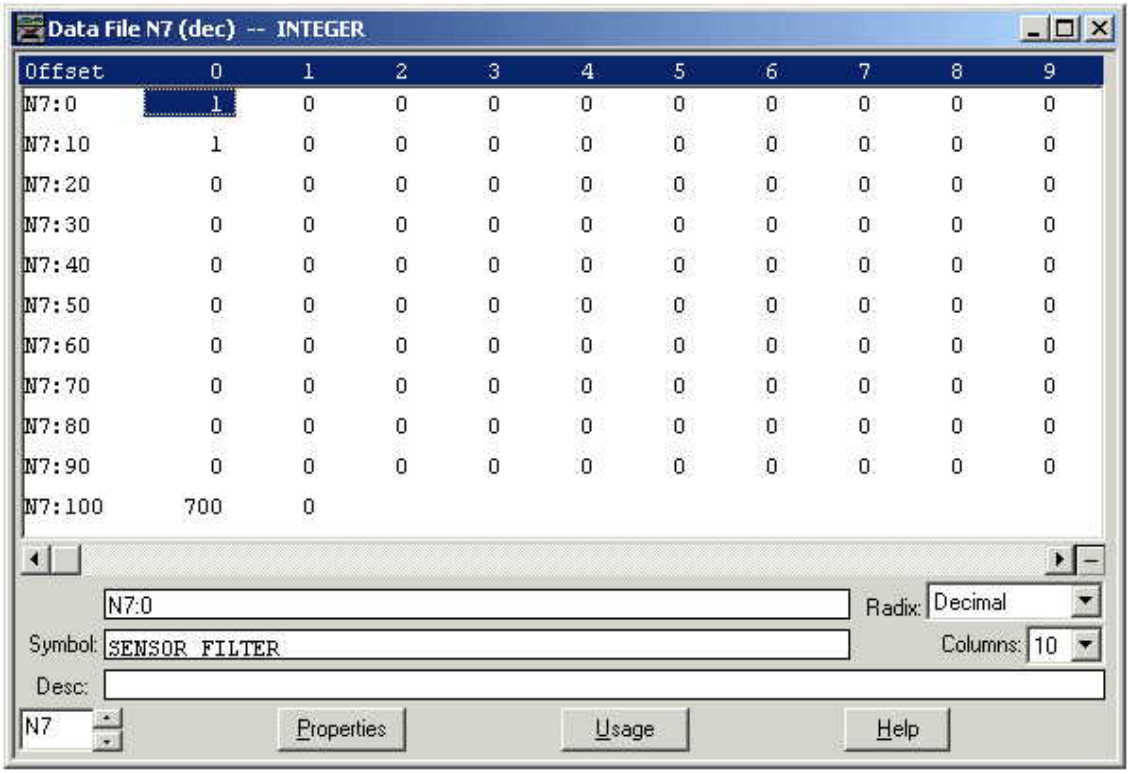

Figure 63: The N7 register showing the Sensor Filter value and the new Sensor Filter value.

7.2.3 SLC 5/05 PLC

A SLC 5/05 PLC can be connected directly to an Ethernet network; no intermediate equipment is required. Figure 64 shows a SLC 5/05 connected directly to an Ethernet network.

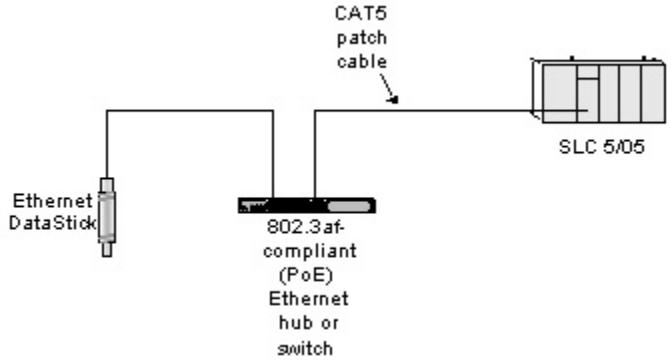

Figure 64: SLC 5/05 PLC connected directly to an Ethernet network.

7.2.4 Example SLC 5/05 Ladder Logic Programs

The ladder logic programs for a SLC 5/05 are very similar to the ladder logic programs shown in Section 7.2.2, Example SLC 5/03 Ladder Logic Programs. The main difference is in the Setup screen for the MSG instruction as shown in Figure 65.

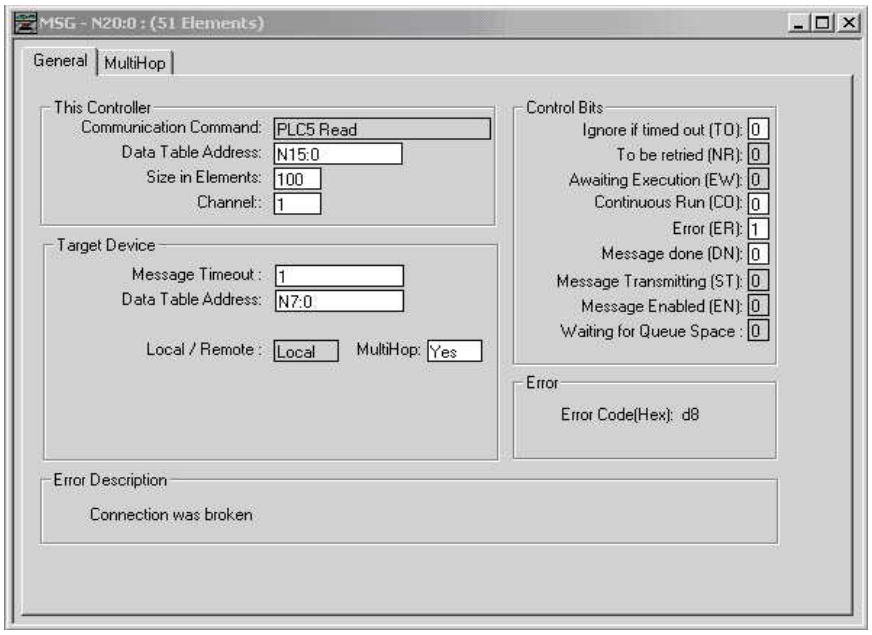

Figure 65: The Setup screen for a MSG instruction in a SLC 5/05 PLC.

Since the SLC 5/05 is connected directly to the Ethernet network, there's no Local Node Address field in the "Target Device" section of the MSG Setup screen. Instead, if the MultiHop field is set to Yes, the IP address of the Ethernet product can be specified directly on the MultiHop tab as shown in Figure 66.

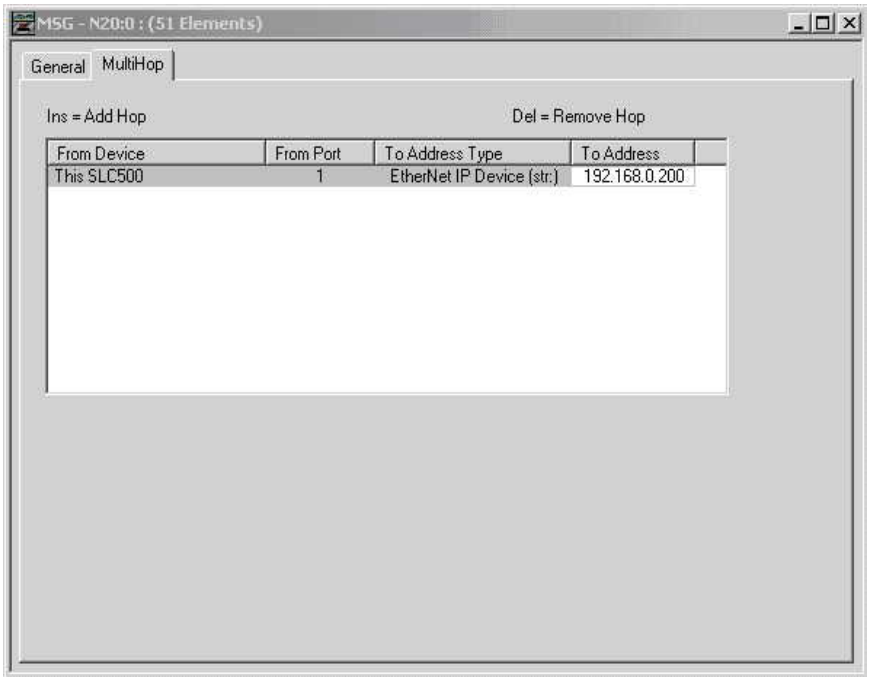

Figure 66: Specifying the IP address of the Ethernet product on the Setup screen of the SLC 5/05 MSG instruction.

Also, the Channel must be set to 1 instead of 0 so that the MSG instruction will be sent out the Ethernet port instead of the RS-232 port.

7.2.5 PCCC References

- 1761-NET-ENI MicroLogix™ Ethernet Interface User Manual, Publication 1761-UM006E-EN-P, http://literature.rockwellautomation.com/idc/groups/literature/documents/um/1761-um006_-en-p.pdf
- RSLogix 500 Instruction Help System
- Communicating with RA Products Using EtherNet/IP Explicit Messaging, http://www.rockwellautomation.com/enabled/pdf/eipexp1_2.pdf

7.3 Modbus TCP and PCCC Register Map

This section shows the register map for the Modbus TCP and the PCCC.

The PCCC registers are determined from the corresponding Modbus TCP registers as follows:

> Take the Modbus TCP register number of interest, ignore the leading 4 and divide by 100. The quotient is the register file (prefixed with N) and the remainder is the register number.

For example, to read Modbus TCP register 42,001 (Sensor Value), ignore the leading 4 to obtain 2,001, and divide 2,001 by 100 to obtain 20 with a remainder of 1. The register file, then, is N20 and the register is 1, or N20:01.

In the tables in this section, each row contains two entries in the Register Number column; the top entry is the Modbus TCP register and the bottom entry is the PCCC register as shown in Figure 67. Both represent the same register in the Ethernet product.

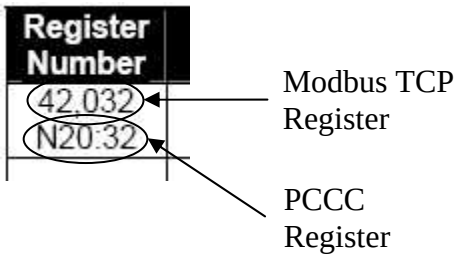

Figure 67: The top entry is the Modbus TCP register and the bottom entry is the PCCC register.

The Uptime registers shown in Table 4 indicate the elapsed time since the power was applied to the product.

Table 4: Uptime registers.

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
410,000 N100:00	Uptime in days	integer	R	N/A	Elapsed time…	3	Information
410,001 N100:01	Uptime in hours	integer	R	N/A	since last reset…	22	Information
410,002 N100:02	Uptime in minutes	integer	R	N/A	or application…	47	Information
410,003 N100:03	Uptime in seconds	integer	R	N/A	of power.	16	Information

Bank 1000 contains registers that are used for informational purposes only.

Table 5: Register bank 1000; status registers.

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
41,001 N10:01	Communications Status	integer	R	N/A			Status
41,002 N10:02	Calibration Status	integer	R	CALSTATUS	Chars: 2; Offset: 6	1	Status
41,003 N10:03	Sensor Memory Status	integer	R	GSTATUS	Chars: 1; Offset: 0	1	Status
41,004 N10:04	Configuration Memory Status	integer	R	GSTATUS	Chars: 1; Offset: 2	1	Status
41,005 N10:05	Calibration Memory Status	integer	R	GSTATUS	Chars: 1; Offset: 4	1	Status
41,006 N10:06	Run Status	integer	R	GSTATUS	Chars: 1; Offset: 6	1	Status

All of the registers in Bank 2000 contain floating-point values. Use these registers if the other devices on the network support floating-point values. If the other devices on the network do not support floating-point values, corresponding integer values can be found in Bank 3000.

If the product is not attached to a DataStick body, the Sensor Value (float) and the Temperature Value (float) shown in Table 6 will read "Not a Number" (NaN).

Table 6: Register bank 2000; floating-point registers.

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
42,001 N20:01	Sensor Value	float	R	GSNSR		7.04	Process Value
42,002 N20:02	"						
42,003 N20:03	Temperature Value	float	R	GTEMP		25.1	Process Value
42,004 N20:04	"						
42,005 N20:05	Calibrate Sensor 1-Point Sample Value	float	R/W	CALS1PS		7.02	Calibration
42,006 N20:06	"						
42,007 N20:07	Calibrate Sensor 2-Point Sample Value	float	R/W	CALS2PS		10.04	Calibration
42,008 N20:08	"						
42,009 N20:09	Calibrate Temperature 1-Point	float	R/W	CALST1PS		25.3	Calibration

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
	Sample Value						
42,010 N20:10	"						
42,011 N20:11							
42,012 N20:12							
42,013 N20:13							
42,014 N20:14							
42,015 N20:15							
42,016 N20:16							
42,017 N20:17							
42,018 N20:18							
42,019 N20:19							
42,020 N20:20							
42,021 N20:21							
42,022 N20:22							
42,023 N20:23	DO Salinity	float	R/W	GSALT/ SSALT		232.1	Configuration
42,024 N20:24	"						
42,025 N20:25	DO Pressure	float	R/W	GPRESS/ SPRESS		764.2	Configuration
42,026 N20:26	"						
42,027 N20:27	Conductivity Reference Temperature	float	R/W	GCRTEMP/ SCRTEMP		25.1	Configuration
42,028 N20:28	"						
42,029 N20:29	Conductivity Compensation Slope	float	R/W	GCCSLOPE/ SCCSLOPE		2.01	Configuration
42,030 N20:30	"						

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
42,031 N20:31	Cell Constant	float	R/W	GCELL/ SCELL		1.001	Configuration
42,032 N20:32	"						
42,033 N20:33	TDS Conversion Factor	float	R/W	GTDSF/ STDSF		0.492	Configuration
42,034 N20:34	“						
42,035 N20:35							
42,036 N20:36	“						

All of the registers in Bank 3000 contain integer values. Some of the values in these registers are available in floating-point format in Bank 2000. Use the floating-point representation if the other devices on the network support the format.

Some values provided by the DataStick can exceed an integer register's ability to represent them. In such cases, the value is limited to 32,767 or –32,768 as appropriate. For example, if the Sensor Type is pH and the Sensor Units are mV, the Sensor Value can exceed 400.00 mV. At a resolution of 0.01 mV the corresponding integer value would be 400,000 which would exceed the register's ability to represent it. In this case the resolution is decreased to 0.1 mV, the corresponding scale factor becomes 10, and the integer value becomes 4,000 which is representable.

When calibrating the DataStick system, use the primary units of measure, e.g., calibrate pH in pH, not in mV.

Please note that the PLC Data Type affects only the Modbus TCP; it has no effect on the EtherNet/IP.

Table 7: Register bank 3000; integer registers.

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
43,001 N30:01	Sensor Value	integer	R	GSNSR		704	Process Value
43,002 N30:02	Temperature Value	integer	R	GTEMP		251	Process Value
43,003 N30:03	Calibrate Sensor 1-Point Sample Value	integer	R/W	CALS1PS	One DS arg: 3003	702	Calibration
43,004 N30:04	Calibrate Sensor 2-Point Sample Value	integer	R/W	CALS2PS	Two DS args: 3008 3004	0 1004	Calibration
43,005 N30:05	Calibrate Temperature 1-Point	integer	R/W	CALST1PS	One DS arg: 3005	253	Calibration

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
	Sample Value						
43,006 N30:06	Calibrate Sensor 1-Point Buffer	integer	R/W	CALS1PB	No DS arguments	N/A	Calibration
43,007 N30:07	Calibrate Sensor 2-Point Buffer	integer	R/W	CALS2PB	One DS arg: 3007	0	Calibration
43,003 N30:08	Calibrate Sensor 2-Point Sample Point	integer	R/W	N/A		0	Calibration
43,009 N30:09	Calibrate Sensor in Air	integer	R/W	CALSAIR	No DS arguments	N/A	Calibration
43,010 N30:10	Calibrate Sensor Zero	integer	R/W	CALSZERO	No DS arguments	N/A	Calibration
43,011 N30:11	Calibration Abort	integer	R/W	CALABORT	No DS arguments	N/A	Calibration
43,012 N30:12	DO Salinity	integer	R/W	GSALT/ SSALT		2321	Configuration
43,013 N30:13	DO Pressure	integer	R/W	GPRESS/ SPRESS		7642	Configuration
43,014 N30:14	Conductivity Reference Temperature	integer	R/W	GCRTEMP/ SCRTEMP		251	Configuration
43,015 N30:15	Conductivity Compensation Slope	integer	R/W	GCCSLOPE/ SCCSLOPE		201	Configuration
43,016 N30:16	Cell Constant	integer	R/W	GCELL/ SCELL		1001	Configuration
43,017 N30:17	Sensor Units	integer	R/W	GSUNITS/ SSUNITS	Sensor Head-dependent	0	Configuration
43,018 N30:18	Sensor Filter	integer	R/W	GSFIL/ SSFIL		1	Configuration
43,019 N30:19	Temperature Units	integer	R/W	GTUNITS/ STUNITS		0	Configuration
43,020 N30:20	Temperature Filter	integer	R/W	GTFIL/ STFIL		1	Configuration
43,021 N30:21	pH Buffer Type	integer	R/W	GPHBUF/ SPHBUF		0	Configuration
43,022 N30:22							
43,032 N30:23							
43,024 N30:24							

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
43,025 N30:25	PLC Data Type	integer	R/W	N/A	Big Endian	1	Configuration
43,026 N30:26	Timeout	integer	R/W	N/A	ms	500	Configuration
43,027 N30:27							
43,028 N30:28	TDS Conversion Factor	integer	R/W	GTDSF/ STDSF		49	Configuration
43,029 N30:29							
43,030 N30:30	MAC Address	integer	R/W	N/A	Writable only...		Configuration
43,031 N30:31	“	integer	R/W	N/A	if 0.		Configuration
43,032 N30:32	“	integer	R/W	N/A			Configuration

Not all devices support floating-point math. For this reason all values of type float are also available as type integer.

Integer data types include a corresponding Scale Factor that defines the relationship between the integer type of the value and the float type. See Table 8 for a list of the available Scale Factors.

The product calculates the integer type of the value from the float type by multiplying the float type by the scale factor. For example, for a Sensor Type of pH, the Scale Factor for the Sensor Value is 100. If the float Sensor Value is 7.04, then the integer Sensor Value is 7.04 x 100 = 704.

Most Scale Factors are fixed, e.g., the Cell Constant Scale Factor is fixed at 1000, but some depend on the type of Sensor Head installed in the DataStick. The Sensor Value Scale Factor is one of these. For example, when the installed Sensor Head is pH, the Sensor Value Scale Factor is 100, but when the installed Sensor Head is ORP, the Sensor Value Scale Factor is 1.

Table 8: Register bank 4000; integer scale-factor registers.

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
44,001 N40:01	Sensor Value S.F.	integer	R	N/A	Sensor Units-dependent	100	Scale Factor
44,002 N40:02	Temperature Value S.F.	integer	R	N/A	fixed	10	Scale Factor
44,003 N40:03	Calibrate Sensor 1-Point Sample Value S.F.	integer	R	N/A	Sensor Head-dependent	100	Scale Factor
44,004 N40:04	Calibrate Sensor 2-Point Sample Value S.F.	integer	R	N/A	Sensor Head-dependent	100	Scale Factor
44,005 N40:05	Calibrate Temperature 1-Point Sample Value S.F.	integer	R	N/A	fixed	10	Scale Factor
44,006 N40:06							
44,007 N40:07							
44,008 N40:08							
44,009 N40:09							
44,010 N40:10							
44,011 N40:11							

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
44,012 N40:12	DO Salinity S.F.	integer	R	N/A	fixed	10	Scale Factor
44,013 N40:13	DO Pressure S.F.	integer	R	N/A	fixed	10	Scale Factor
44,014 N40:14	Conductivity Reference Temperature S.F.	integer	R	N/A	fixed	10	Scale Factor
44,015 N40:15	Conductivity Compensation Slope S.F.	integer	R	N/A	fixed	100	Scale Factor
44,016 N40:16	Cell Constant S.F.	integer	R	N/A	fixed	1000	Scale Factor
44,017 N40:17							
44,018 N40:18							
44,019 N40:19							
44,020 N40:20							
44,021 N40:21							
44,022 N40:22							
44,023 N40:23							
44,024 N40:24							
44,025 N40:25							
44,026 N40:26							
44,027 N40:27							
44,028 N40:28	TDS Conversion Factor S.F.	integer	R	N/A	fixed	100	Scale Factor
44,029 N40:29							

When power is applied to the Ethernet product, it takes a short amount of time for it to update its local copy of the data stored in the DataStick Body. The Data Valid register can be used to determine when this operation is complete. It changes from 0 to 1 when the local copy of the data has been completely updated.

The Ethernet product provides access to data stored in the product itself as well as data stored in the Data Stick Body. When data stored in the product itself is accessed, the

success or failure of the operation is indicated immediately. When data stored in the DataStick Body is accessed, the immediate indication is success even though the overall operation may have failed. This is because the protocol being used doesn't tolerate the kind of delays necessary to accomplish an access of this type. To assist the programmer in determining the overall success or failure of accessing DataStick Body data, four counter registers are available:

5. Pending Writes
6. Read Error Count
7. Write Error Count
8. Timeout Count

The Pending Writes is incremented every time the Ethernet product has been asked to write to the DataStick but has not yet completed the operation. The count is decremented each time a write completes.

The Read Error Count is incremented every time the Ethernet product receives an error while trying to read from the DataStick Body. It is a count of the total number of read errors for all of the protocols supported. Some DataStick Body data might not be available depending on the type of Sensor Head installed. When the Ethernet product tries to read this unavailable data the DataStick will respond with an error and this will cause the Read Error Count to be incremented. The Ethernet product will realize that this data is unavailable and stop requesting it.

The Write Error Count is incremented every time the Ethernet product receives an error while trying to write to the DataStick. It is a count of the total number of write errors for all of the protocols supported. For instance, if an attempt is made to change the Sensor Filter value to 200, the DataStick will respond with an error because the largest acceptable value is 100 and this will cause the Write Error Counter to be incremented.

The Timeout Count is incremented every time the Ethernet product fails to receive a response from the DataStick in a reasonable amount of time. It is a count of the total number of write errors for all of the protocols supported.

The counters can be cleared to 0 by writing to them.

Table 9: Register bank 5000; information registers.

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
45,001 N50:01	Main Serial Number01	ASCII[2]	R/W	GMSNO/ SMSNO		"00"	Information
45,002 N50:02	Main Serial Number02	ASCII[2]	R/W	"		"00"	Information
45,003 N50:03	Main Serial Number03	ASCII[2]	R/W	"		"03"	Information
45,004 N50:04	Main Serial Number04	ASCII[2]	R/W	"		"79"	Information
45,005 N50:05	Main Serial Number05	ASCII[2]	R/W	"		<Null><Null>	Information
45,006 N50:06	Main Serial Number06	ASCII[2]	R/W	"		<Null><Null>	Information
45,007 N50:07	Main Serial Number07	ASCII[2]	R/W	"		<Null><Null>	Information
45,008 N50:08	Main Serial Number08	ASCII[2]	R/W	"		<Null><Null>	Information
45,009 N50:09	Main Serial Number09	ASCII[2]	R/W	"		<Null><Null>	Information
45,010 N50:10	Main Serial Number10	ASCII[2]	R/W	"		<Null><Null>	Information
45,011 N50:11	Main Serial Number11	ASCII[2]	R/W	"		<Null><Null>	Information
45,012 N50:12	Main Serial Number12	ASCII[2]	R/W	"		<Null><Null>	Information
45,013 N50:13	Main Serial Number13	ASCII[2]	R/W	"		<Null><Null>	Information
45,014 N50:14	Main Serial Number14	ASCII[2]	R/W	"		<Null><Null>	Information
45,015 N50:15	Main Serial Number15	ASCII[2]	R/W	"		<Null><Null>	Information
45,016 N50:16	Main Serial Number16	ASCII[2]	R/W	"		<Null><Null>	Information
45,017 N50:17	DataStick Code Version01	ASCII[2]	R	GCVSN		"D2"	Information
45,018 N50:18	DataStick Code Version02	ASCII[2]	R	"		".5"	Information
45,019 N50:19	DataStick Code Version03	ASCII[2]	R	"		"1"<Null>	Information
45,020 N50:20	DataStick Code Version04	ASCII[2]	R	"		<Null><Null>	Information
45,021 N50:21	Node Address	integer	R/W	GADDR/ SADDR	Chars: 3	321	Information

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
45,022 N50:22	Sensor Type	integer	R	GSTYPE	Chars: 2	1	Information
45,023 N50:23	Calibration Type	integer	R	CALSTATUS	Chars: 2; Offset: 3	4	Information
45,024 N50:24	Comms Adapter Code Version	integer	R	N/A	V3.03	0x0303	Information
45,025 N50:25							
45,026 N50:26	Location01	ASCII[2]	R/W	N/A	Also...	"TA"	Information
45,027 N50:27	Location02	ASCII[2]	R/W	N/A	readable…	"NK"	Information
45,028 N50:28	Location03	ASCII[2]	R/W	N/A	by…	"#3"	Information
45,029 N50:29	Location04	ASCII[2]	R/W	N/A	Discovery…	"BL"	Information
45,030 N50:30	Location05	ASCII[2]	R/W	N/A	Tool.	"DG"	Information
45,031 N50:31	Location06	ASCII[2]	R/W	N/A	“	"#8"	Information
45,032 N50:32	Location07	ASCII[2]	R/W	N/A	“		Information
45,033 N50:33	Location08	ASCII[2]	R/W	N/A	“		Information
45,034 N50:34	Data Valid	integer	R	N/A			Information
45,035 N50:35	Pending Writes	integer	R	N/A			Information
45,036 N50:36	Read Error Count	integer	R/W	N/A	Resets to 0 on write		Information
45,037 N50:37	Write Error Count	integer	R/W	N/A	Resets to 0 on write		Information
45,038 N50:38	Timeout Count	integer	R/W	N/A	Resets to 0 on write		Information

When the Ethernet option is present in the AV38 Local Display, the register in Table 10 can be used to change the address of the DataStick with which the AV38 is communicating. In this way, a device on the Ethernet network can access a DataStick that’s connected to the AV38.

Table 10: Register bank 6000; AV38 configuration register.

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
46,001 N60:01	DataStick Slave Address	integer	R/W	GDSA/ SDSA		123	AV38 Configuration

8 Certifications

The products are designed to pass:

- the ODVA-approved conformance tests for an EtherNet/IP Node Device
- the Modbus-IDA Conformance Test Program

9 General References

- IEEE Standard 802.3, 10Base-T Ethernet, http://standards.ieee.org/getieee802/index.html
- IEEE Standard 802.3af, Power Over Ethernet, http://standards.ieee.org/getieee802/index.html
- TIA/EIA-568-B, Commercial Building Telecommunications Cabling Standard, http://www.tiaonline.org/
- DataStick Measurement System Instruction Manual

10 Limited Warranty

WARRANTY/REPLACEMENT PLAN

Thermo Fisher Scientific warrants its Smart Communications Adapters against material and workmanship defect for a period of one year from the date of shipment.

In the event that a defect is discovered during the warranty period, Thermo Fisher Scientific agrees, at its option, to repair or replace the defective product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

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Products may not be returned without authorization from Thermo Fisher Scientific. To obtain authorization, please call Thermo Fisher Scientific for a return material authorization number.

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2. Damage caused by any repair or attempted repair not authorized by Thermo Fisher Scientific.
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11 Terms and Conditions

Terms and Conditions of Sale

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Any standard or boilerplate terms and conditions supplied with a written purchase order will not be applicable unless accepted in writing by both parties.

Quotations: All quotations shall be in writing. Written quotations shall be valid for 30 days from the date issued. Verbal quotations or price lists are not valid.

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