Thermo Scientific AquaSensors<sup>™</sup> AV38 and DataStick<sup>™</sup> Ethernet Communications User Guide





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This publication supersedes all previous publications on this subject.

# **Table of Contents**

1	Quick Sta	art	6
2	Introduct	ion	7
3	Hardware	e Setup	9
	3.1 Ethe	ernet Communications Adapter	10
	3.1.1	Operating Temperature	11
	3.1.2	Electrical Connections	12
	3.1.3	Location of Adapter's MAC Address	12
	3.1.4	LED Indicators	13
	3.1.5	Restoring Default IP Address, Subnet Mask, Gateway Address	14
	3.2 AV3	38 Local Display with Ethernet Option	15
	3.2.1	Electrical Connections	15
	3.2.2	Location of AV38's MAC Address	15
	3.2.3	Restoring Default IP Address, Subnet Mask, Gateway Address	16
4	Configura	ation Procedures	17
	4.1 For	Evaluation/Demonstration Purposes	19
	4.1.1	Advanced Configuration	23
	4.2 Con	missioning an Ethernet Product for Service	25
5	Web Serv	ver	37
	5.1 Hon	ne Page	37
	5.2 Cali	bration Page	38
	5.3 Con	figuration Page	39
	5.4 Con	nmunications Settings Page	41
	5.4.1	Viewing/Changing the Communications Settings	41
	5.4.2	Viewing/Clearing the Internal Counters	41
	5.4.3	Upgrading the Firmware	42
6	EtherNet	/IP	43
	6.1 Elec	tronic Data Sheet (EDS)	43
	6.2 Defi	nitions	43
	6.3 Refe	erence Documents	43
	6.4 Ope	n DeviceNet Vendor Association, Inc. (ODVA)	44
	6.5 Obje	ect Model	44
	6.5.1	Configuration	44
	6.5.2	Identity Object (01 <sub>HEX</sub> – 1 Instance)	44
	6.5.3	Message Router Object (02 <sub>HEX</sub> – 0 Instances)	45
	6.5.4	Assembly Object (04 <sub>HEX</sub> – 2 Instances)	45
	6.5.5	Connection Manager Object (06 <sub>HEX</sub> )	46
	6.5.6	TCP Object (F5 <sub>HEX</sub> – 1 Instance)	46
	6.5.7	Ethernet Link Object (F6 <sub>HEX</sub> – 1 Instance)	47
	6.5.8	System Status Object (64 <sub>HEX</sub> – 1 Instance)	48
	6.5.9	Sensor Installation Object (65 <sub>HEX</sub> – 1 Instance)	49
	6.5.10	Sensor Value Object (66 <sub>HEX</sub> – 1 Instance)	50
	6.5.11	User Configuration Object (67 <sub>HEX</sub> – 1 Instance)	50
	6.5.12	Generic Sensor Calibration Object (68 <sub>HEX</sub> – 1 Instance)	51

	6.5.13	Conductivity Sensor Calibration Object (69 <sub>HEX</sub> – 1 Instance)	52
	6.5.14	Mode Configuration Object (75 <sub>HEX</sub> – 1 Instance)	53
6.	6 Ethe	erNet/IP Reference	53
7	Modbus	TCP and PCCC	54
7.	1 Mo	dbus TCP	54
	7.1.1	Modbus TCP Reference	55
7.	2 Prog	grammable Controller Communication Commands (PCCC)	55
	7.2.1	SLC 5/03 and SLC 5/04 PLCs	56
	7.2.2	Example SLC 5/03 Ladder Logic Programs	58
	7.2.3	SLC 5/05 PLC	68
	7.2.4	Example SLC 5/05 Ladder Logic Programs	69
	7.2.5	PCCC References	70
7.	3 Moo	dbus TCP and PCCC Register Map	71
8	Certifica	tions	82
9	General	References	82
10	Limite	ed Warranty	83
11	Terms	and Conditions	84

# **Table of Figures**

Figure 1: A diagram of an isolated Ethernet DataStick network	. 6
Figure 2: A diagram of an isolated AV38 network	. 6
Figure 3: The Ethernet Communications Adapter.	. 7
Figure 4: The Ethernet option in the AV38 Local Display (front and rear views)	. 7
Figure 5: Dimensions of the Adapter	. 8
Figure 6: Ethernet Communications Adapter shown detached from a DataStick with a	
toroidal Sensor Head	. 8
Figure 7: Endpoint power sourcing equipment, Mode A. The product is the Powered	
End Station	. 9
Figure 8: Endpoint power sourcing equipment, Mode B. The product is the Powered	
End Station	10
Figure 9: The three parts of the DataStick measurement system	10
Figure 10: The elements of the DataStick Measurement System.	11
Figure 11: The different parts of the Adapter	11
Figure 12: RJ45 plug pin positions	12
Figure 13: LED indicators on the Adapter. Note that the Heartbeat LED is recessed	
while the Link/Activity LED is not.	13
Figure 14: Pin numbering and LED locations.	14
Figure 15: The AV38's MAC address is in the lower right-hand corner of the overlay	15
Figure 16: Restoring default communications settings of an Adapter embedded inside a	n
AV38	16
Figure 17: A power injector.	19
Figure 18: An Ethernet DataStick network for evaluation or demonstration purposes	19
Figure 19: An AV38 network for evaluation or demonstration purposes.	20
Figure 20: Network Connections window.	20
Figure 21: Local Area Connection Properties.	21
Figure 22: The Internet Protocol (TCP/IP) Properties window	21
Figure 23: Giving the laptop a static IP address.	22
Figure 24: The Ethernet DataStick's Home Page	23
Figure 25: Obtaining an IP address automatically	24
Figure 26: The alternate configuration settings.	24
Figure 27: The output of the ipconfig command.	25
Figure 28: An Ethernet DataStick network constructed with a power injector and a cros	s-
over cable	26
Figure 29: An AV38 network constructed with a power injector and a cross-over cable.	
	26
Figure 30: An Ethernet DataStick network constructed with an Ethernet switch and pat	ch
cables	27
Figure 31: An AV38 network constructed with an Ethernet switch and patch cables	27
Figure 32: An Ethernet DataStick network constructed with a PoE switch and a patch	_
cable	28
Figure 33: An AV38 network constructed with a PoE switch and patch cables	28
Figure 34: Network Connections window.	29

Figure 35:	Local Area Connection Properties.	29
Figure 36:	The Internet Protocol (TCP/IP) Properties window.	30
Figure 37:	Giving the computer a static IP address.	30
Figure 38:	Verifying that no device is present using the ping command	31
Figure 39:	The Ethernet DataStick's Home Page	32
Figure 40:	The product's IP Setup Page	33
Figure 41:	Entering the username and password in the IP Setup Page	34
Figure 42:	The IP address, subnet mask and gateway address edited as desired	35
Figure 43:	The Home Page as seen from the Product's new IP address.	36
Figure 44:	The DataStick Measurement System Home Page	37
Figure 45:	Accessing the Calibration Page	38
Figure 46:	The DataStick Measurement System Calibration Page	38
Figure 47:	Accessing the Configuration Edit Page	39
Figure 48:	The Configuration Edit Page	40
Figure 49:	The Communications Settings Page	41
Figure 50:	SLC 5/03 PLC connected to Ethernet network via a 1761-NET-ENI	56
Figure 51:	The ENI Configuration Utility.	57
Figure 52:	The Com Port Redirector.	58
Figure 53:	The Message Routing tab of the ENI Configuration Utility	59
Figure 54:	Part 1 of 3 of a ladder logic program that reads the Sensor Value from	
N20:01		60
Figure 55:	Part 2 of 3 of a ladder logic program that reads the Sensor Value from	
N20:01		61
Figure 56:	Part 3 of 3 of a ladder logic program that reads the Sensor Value from	
N20:01		62
Figure 57:	The Setup screen for a MSG instruction in a SLC 5/03	62
Figure 58:	The Sensor Value in F8:0.	63
Figure 59:	Part 1 of 3 of a ladder logic program to read and write the Sensor Filter value	ıe
at N30:18.		64
Figure 60:	Part 2 of 3 of a ladder logic program to read and write the Sensor Filter value	ıe
at N30:18.		65
Figure 61:	Part 3 of 3 of a ladder logic program to read and write the Sensor Filter value	ıe
at N30:18.		66
Figure 62:	The Setup screen for a MSG instruction in a SLC 5/03	67
Figure 63:	The N7 register showing the Sensor Filter value and the new Sensor Filter	
value		68
Figure 64:	SLC 5/05 PLC connected directly to an Ethernet network.	68
Figure 65:	The Setup screen for a MSG instruction in a SLC 5/05 PLC	69
Figure 66:	Specifying the IP address of the Ethernet product on the Setup screen of the	
SLC 5/05 N	MSG instruction.	70
Figure 67:	The top entry is the Modbus TCP register and the bottom entry is the PCCC	
register		71

## **Table of Tables**

Table 1:	RJ45 connector pin assignment	12
Table 2:	RJ45 jack signal names and functions	15
Table 3:	These objects are identical in the Ethernet products and DeviceNet Adapter	
object m	odels	44
Table 4:	Uptime registers	71
Table 5:	Register bank 1000; status registers.	72
Table 6:	Register bank 2000; floating-point registers	72
Table 7:	Register bank 3000; integer registers.	74
Table 8:	Register bank 4000; integer scale-factor registers	77
Table 9:	Register bank 5000; information registers	80
Table 10	: Register bank 6000; AV38 configuration register	81

#### **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 <u>www.thermo.com/processwater</u>

#### 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<sup>TM</sup> 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





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 co	onnector pin assignment	
<b>Pin Position</b>	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.

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-

Table 2: RJ45 jack signal names and functions

#### 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.

A NO A NO A NO A NO A NO A A A A A A A A A A A A A A A A A A A	Nodel: AV38	-
H     NC     Retay     must be made to a point compliant device       G     COM     Point     Point       F     NO     NO     Point       D     Loop 2 (-)     Point     Point       B     COM     Point     Point       B     COM     Point     Point       C     NC     Retay     Point       C     NC     Point     Point       C     NC     Point     Point       D     Loop 1 (-)     Black     12	Ax Operating	
G     COM     Bay B     V+     Red     6       F     NO     B     Ground     Black     7       E     Loop 2 (-)     A     A     Comms (-)     Blue     9       C     NC     Relay A     Shield     Clear 10     1       B     COM     A     0     2-4     Loop 1 (-)     Black     12	H NC 2 must be made to a POE compliant device	
F     NO     B       E     Loop 2 (+)     A       D     Loop 2 (+)       A     NO         B     COM       B     COM       B     COM       A     NO         F     NO         Ground     Black       Ground     Black       C     NC       Red B     COM       Q     Loop 1 (+)       Black     12	G COM Bay V+ Red 6	
E         Loop 2 (*)         m A20         Comms (*)         White         8           D         Loop 2 (*)         m A20         Comms (*)         Blue         9           C         NC         Reiav         Shield         Clear         10           B         COM         V         V         Loop 1 (*)         Black         11           A         NO         V         V         Loop 1 (*)         Black         12	F NO Ground Black 7	
D     Loop 2 (-)     Comms (-)     Blue     9       C     NC     Rei     Shield     Clear     10       B     COM     YA     A     NO     Loop 1 (-)     Black     12	E Loop 2 (+) mA 20 S Comms (+) White 8	
C     NC     Region     Shield     Ciear     10       B     COM     A	D Loop 2 (-) Comms (-) Blue 9	
A NO A VA	C NC Re Shield Clear 10	
A NO A E Loop 1 (-) Black 12	B COM Red 11	
	A NO 4 E Loop 1 (-) Black 12	

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.

Connect using: Realtek RTL8139 Family PCI Fast Ethernet NIC Configure This connection uses the following items: Client for Microsoft Networks Client f	Ithentication Advanced	
<ul> <li>Realtek RTL8139 Family PCI Fast Ethernet NIC</li> <li>Configure</li> <li>file connection uses the following items:</li> <li>Client for Microsoft Networks</li> <li>Client for Microsoft Networks</li> <li>File and Printer Sharing for Microsoft Networks</li> <li>GoS Packet Scheduler</li> <li>Internet Protocol (TCP/IP)</li> <li>Install</li> <li>Uninstall</li> <li>Properties</li> <li>Description</li> <li>Transmission Control Protocol/Internet Protocol. The defaul wide area network protocol that provides communication across diverse interconnected networks.</li> </ul>	ing:	
Configure         his connection uses the following items:         Image: Client for Microsoft Networks         Image: Client for Microsoft Networks <td>tek RTL8139 Family PCI Fast Ethernet I</td> <td>NIC</td>	tek RTL8139 Family PCI Fast Ethernet I	NIC
	ction uses the following items:	<u>C</u> onfigure
Description Transmission Control Protocol/Internet Protocol. The defaul wide area network protocol that provides communication across diverse interconnected networks.	oS Packet Scheduler ternet Protocol (TCP/IP)	Properties
Transmission Control Protocol/Internet Protocol. The defaul wide area network protocol that provides communication across diverse interconnected networks.		T jopenes
	sion Control Protocol/Internet Protocol. a network protocol that provides commu iverse interconnected networks.	The default unication
Show icon in notification area when connected	on in notification area when connected	

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.

eneral Alternate Configuration	
You can get IP settings assigne this capability. Otherwise, you no the appropriate IP settings.	d automatically if your network supports eed to ask your network administrator for
⊙ @btain an IP address autor	matically
OUse the following IP addre	\$\$:
IP address:	
Sybnet mask:	and the second sec
Default gateway:	
O Dbtain DNS server addres	s automaticallu
O Use the following DNS ser	ver addresses:
Preferred DNS server:	
Alternate DNS server:	
	Advanced

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.

/ou can get IP settings assigned his capability. Otherwise, you ne he appropriate IP settings.	l automatically if your network supports ed to ask your network administrator for			
O Dotain an IP address autor O Use the following IP address	natically s			
IP address:	. 191.168.0.1			
S <u>u</u> bnet mask:	255 . 255 . 255 . 0			
Default gateway:	192.168.0.1			
<ul> <li>Obtain DNS server address</li> <li>Use the following DNS server</li> <li>Preferred DNS server:</li> </ul>	automatically ver addresses:			

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.

DataStick - I/O Sta	tus - Micros	oft Inte	rnet Explorer				
e <u>E</u> dit <u>V</u> iew F <u>a</u> vo	orites <u>T</u> ools	Help					
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dress 🕘 http://192.16	8.0.100/						🖌 🛃 Go 🛛 Línks 🎽 🍕
AquaS	enso	rs	Datas I/O	Stick     	Veas Home ок	urement Sys e Page	tem
Measurement	Value	Units	Configuration	Value	Units	Diagnostic	Value
Sensor	7.0000	pН	Sensor Filter	1	sec	Firmware Version	D3.17
Temperature	25.2000	°C	Temperature Filter	1	sec	Serial Number	1234
SensorType	pН		pH Buffer Standard	4,7,10		Sensor Memory Status	Valid
	-		DO Pressure	760.000	mmHg	Config. Memory Status	Valid
CommSettings			DO Salinity	0.0000	mS/cm	Cal Memory Status	Valid
	_		Comp. Slope	0.0000	%/°C	Run Status	System OK
Aqua Web Site			Cond. Ref. Temp.	25.0000	°C	Last Cal. Type	No Sensor Cal
	_		Cell Constant			Calibration Status	No Sensor Cal
			This page automatic	ally reloads	every 20 :	seconds.	
	DataStick	Measur	ement System, Vers	ion 1.01.01	(syste	m uptime 00Days 00:02:	40)
Done							🧼 Internet

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.

ou can get IP settings assigned au is capability. Otherwise, you need ie appropriate IP settings.	itomatically if your network supports to ask your network administrator for
Obtain an IP address automating	cally
OUse the following IP address:	
IP address:	
Sybnet mask;	· · · · · · · · · · · · · · · · · · ·
Default gateway:	
O Detain DNS server address au O Use the following DNS server Preferred DNS server: Alternate DNS server:	itomatically addresses:

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.

Internet	Protocol (TCP/IP) Pr	roperties ? 🔀
General	Alternate Configuration	
If this c settings	omputer is used on more th : below.	nan one network, enter the alternate IP
OA	utomatic private IP addres	s
_⊙L	lser configured	
<u>I</u> P a	ddress:	192.168.0.1
Sub	net mask:	255 . 255 . 255 . 0
<u>D</u> ef	ault gateway:	192.168.0.1
Pref	erred DNS server:	
<u>A</u> lte	mate DNS server:	
Prel	erred <u>W</u> INS server:	
Alte	rnate WI <u>N</u> S server:	
		OK Cancel

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.

ieneral	Authentication	Advanced		
Connec	st using:			
H C	Realtek RTL8139	Family PCI Fast	Ethernet I	NIC
			ſ	Configure
This c <u>c</u>	nnection uses the	following items:		
	Client for Micros	oft Networks		
		entrettente		
	File and Printer 9	Sharing for Micro	soft Netw	vorks
	File and Printer 9 QoS Packet Scl	Sharing for Micro heduler	osoft Netw	vorks
	File and Printer S QoS Packet Sch Internet Protoco	Sharing for Micro heduler I (TCP/IP)	osoft Netw	vorks
	File and Printer S QoS Packet Sci Internet Protoco	Sharing for Micro heduler I (TCP/IP)	osoft Netw	vorks
	File and Printer S QoS Packet Scl Internet Protoco	Sharing for Micro heduler I (TCP/IP) Uninstall	osoft Netw	vorks P <u>r</u> operties
	File and Printer S QoS Packet Sci Internet Protoco <u>n</u> stall	Sharing for Micro heduler I(TCP/IP) Uninstall	osoft Netw	P <u>r</u> operties
	File and Printer S QoS Packet Scl Internet Protoco nstall iption smission Control P	Sharing for Micro heduler I (TCP/IP) Uninstall Protocol/Internet	Protocol.	Properties
Desc Trar wide	File and Printer S QoS Packet Scl Internet Protoco Install ription smission Control P area network pro	Sharing for Micro heduler I(TCP/IP) Uninstall Protocol/Internet tocol that provid	Protocol. les commu	Properties The default unication
Desc Trar wide acro	File and Printer S QOS Packet Sch Internet Protoco nstall ription smission Control P area network pro ss diverse intercor	Sharing for Micro heduler I(TCP/IP) Uninstall Irotocol/Internet tocol that provid nnected network	Protocol. les commu	Properties The default unication
Desc Tranwide acro	File and Printer S QOS Packet Scl Internet Protoco install ription smission Control P area network pro ss diverse intercor	Sharing for Micro heduler I(TCP/IP) Uninstall Protocol/Internet tocol that provid nnected network	Protocol. les commu	Properties The default unication
Desc Trar wide acro	File and Printer S QoS Packet Sch Internet Protoco Install iption smission Control P area network pro ss diverse intercor w icon in notificati	Sharing for Micro heduler I (TCP/IP) Uninstall Protocol/Internet tocol that provid nnected network	Protocol. les commu cs.	Properties Properties The default unication

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.

reneral	Alternate Configuration				
You ca this cap the app	n get IP settings assigned au bability. Otherwise, you need ropriate IP settings.	tomatically if ; to ask your n	your ne etwork	twork supj administra	oorts tor for
0	otain an IP address automati	cally			
OU	se the following IP address:				
<u>I</u> P ad	ddress:		÷:	-	
Sybr	net mask:		10	- 60	
<u>D</u> efa	ult gateway:		- 81	10	
00	otain DNS server address au	tomatically			
0 U:	se the following DNS server (	addresses: —			
<u>P</u> refe	erred DNS server:				
Alter	nate DNS server:		<b>.</b>		
				Advar	ced

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.

ieneral	
You can get IP settings assi this capability. Otherwise, yo the appropriate IP settings.	gned automatically if your network supports u need to ask your network administrator for
<u>○ O</u> btain an IP address a	outomatically
Use the following IP ac	Idress:
IP address:	191.168.0.1
S <u>u</u> bnet mask:	255 . 255 . 255 . 0
Default gateway:	192.168.0.1
<ul> <li>Obtain DNS server add</li> <li>Use the following DNS</li> <li>Preferred DNS server:</li> <li>Alternate DNS server:</li> </ul>	dress automatically server addresses:
	Advanced

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.

Back • 🕥 • 💽 😭 🏠 🔎 Search 👷 Favorites 🤣 😥 • 🌺 👿 • 🛄 🍇	
iress 🕘 http://192.168.0.100/	🕑 🛃 Go 🛛 Links 🂙
AquaSensors DataStick Measurement Home Page	System
I/O Status ок	
Measurement Value Units Configuration Value Units Diagnosti	ic Value
Sensor 7.0000 pH Sensor Filter 1 sec Firmware Version	D3.17
Temperature 25.2000 °C Temperature Filter 1 sec Serial Number	1234
SensorType pH pH Buffer Standard 4.7.10 Sensor Memory St	tatus Valid
	TT-1:1
DO Pressure 760.000 mmHg Config. Memory St	tatus vand
DO Pressure         760.000         mmHg         Config. Memory St           CommSettings         DO Salinity         0.0000         mS/cm         Cal Memory Status	s Valid
DO Pressure         760.000         mmHg         Config. Memory St           CommSettings         DO Salinity         0.0000         mS/cm         Cal Memory Status           Comp. Slope         0.0000         % / °C         Run Status	s Valid s Valid System OK
DO Pressure     760.000     mmHg     Config. Memory St       CommSettings     DO Salinity     0.0000     mS/cm     Cal Memory Status       Comp. Slope     0.0000     % / °C     Run Status       Aqua Web Site     Cond. Ref. Temp.     25.0000     °C     Last Cal. Type	s Valid s Valid System OK No Sensor Cal
DO Pressure     760.000     mmHg     Config. Memory St       CommSettings     DO Salinity     0.0000     mS/cm     Cal Memory Status       Comp. Slope     0.0000     % / °C     Run Status       Aqua Web Site     Cond. Ref. Temp.     25.0000     °C     Last Cal. Type       Cell Constant      Calibration Status	s Valid System OK No Sensor Cal No Sensor Cal

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.

e Edit View Favo	rus - Micros prites Tools	Help	rnet Explorer				
Back . A.		10	Search A		0. 🔍 🖬 . 🗆 🕺		
dress 🙋 http://192.16	8.0.100/						Go Links "
AquaS	enso	rs	D	Connect to 19	2.168.0.100	<b>y</b> s	stem
Measurement	Value	Units	Configu	AQUA 282E		-	Value
Sensor	7.0000	pH	Sensor Filter	User name:	🖸 aga		D3.17
Temperature	25.2000	°C	Temperature	-			1234
SensorType	pH		pH Buffer St	Password:	•••	15	Valid
			DO Pressure		Remember my password	us	Valid
CommSettings			DO Salinity				Valid
			Comp. Slope				System OK
Aqua Web Site			Cond. Ref. 7		OK Cancel		No Sensor Cal
			Cell Constan	-	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		No Sensor Cal
			This page :	automatically re	loads every 20 seconds.		
	DataStick	Measur	ement Syste	m, Version 1.	01.01   (system uptime 00Days	00:06:	07)

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.

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; Edit ⊻iew Fav	orites <u>T</u> ools	: <u>H</u> elp					
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iress 🕘 http://192.1	68.10.200/						🔽 🛃 Go 🛛 Links 🂙
AquaS	enso	rs	DataS	itick   	Meas Home	urement Sys e Page	tem
			I/O	Status	ок		
Measurement	Value	Units	Configuration	Value	Units	Diagnostic	Value
<b>Measurement</b> Sensor	<b>Value</b> 7.0000	<b>Units</b>	Configuration Sensor Filter	<b>Value</b> 1	Units sec	Diagnostic Firmware Version	Value D3.17
<b>Measurement</b> Sensor Femperature	Value 7.0000 25.2000	Units pH °C	Configuration Sensor Filter Temperature Filter	Value           1           1	Units sec sec	Diagnostic Firmware Version Serial Number	Value D3.17 1234
<b>Measurement</b> Sensor Temperature SensorType	Value 7.0000 25.2000 pH	Units pH °C	Configuration Sensor Filter Temperature Filter pH Buffer Standard	Value 1 1 4,7,10	Units sec sec	Diagnostic Firmware Version Serial Number Sensor Memory Status	Value D3.17 1234 Valid
<b>Measurement</b> Sensor Temperature SensorType	Value 7.0000 25.2000 pH	Units pH °C	Configuration Sensor Filter Temperature Filter pH Buffer Standard DO Pressure	Value 1 1 4,7,10 760.000	Units sec sec mmHg	Diagnostic Firmware Version Serial Number Sensor Memory Status Config. Memory Status	Value D3.17 1234 Valid Valid
Measurement Sensor Temperature SensorType CommSettings	Value 7.0000 25.2000 pH	Units pH °C	Configuration Sensor Filter Temperature Filter pH Buffer Standard DO Pressure DO Salinity	Value 1 1 4,7,10 760.000 0.0000	Units sec sec mmHg mS/cm	Diagnostic Firmware Version Serial Number Sensor Memory Status Config. Memory Status Cal Memory Status	Value D3.17 1234 Valid Valid Valid Valid
Measurement Sensor Temperature SensorType CommSettings	Value 7.0000 25.2000 pH	Units pH °C	Configuration Sensor Filter Temperature Filter pH Buffer Standard DO Pressure DO Salinity Comp. Slope	Value 1 1 4,7,10 760.000 0.0000 0.0000	Units sec sec mmHg mS/cm % / °C	Diagnostic Firmware Version Serial Number Sensor Memory Status Config. Memory Status Cal Memory Status Run Status	Value D3.17 1234 Valid Valid Valid System OK
Measurement Sensor Temperature SensorType CommSettings Aqua Web Site	Value 7.0000 25.2000 pH	Units pH °C	Configuration Sensor Filter Temperature Filter pH Buffer Standard DO Pressure DO Salinity Comp. Slope Cond. Ref. Temp.	Value 1 1 4,7,10 760.000 0.0000 0.0000 25.0000	Units sec sec mmHg mS/cm % / °C	Diagnostic Firmware Version Serial Number Sensor Memory Status Config. Memory Status Cal Memory Status Run Status Last Cal Type	Value D3.17 1234 Valid Valid Valid System OK No Sensor Cal
Measurement Sensor Temperature SensorType CommSettings Aqua Web Site	Value 7.0000 25.2000 pH	Units pH °C	Configuration Sensor Filter Temperature Filter pH Buffer Standard DO Pressure DO Salinity Comp. Slope Cond. Ref. Temp. Cell Constant	Value 1 1 4,7,10 760.000 0.0000 0.0000 25.0000	Units sec sec mmHg mS/cm % / °C °C	Diagnostic Firmware Version Senial Number Sensor Memory Status Config. Memory Status Cal Memory Status Run Status Last Cal. Type Calibration Status	Value D3.17 1234 Valid Valid Valid System OK No Sensor Cal No Sensor Cal
Measurement Sensor Temperature SensorType CommSettings Aqua Web Site	Value 7.0000 25.2000 pH	Units pH ℃	Configuration Sensor Filter Temperature Filter pH Buffer Standard DO Pressure DO Salinity Comp. Slope Cond. Ref. Temp. Cell Constant This page automatic	Value 1 1 4,7,10 760.000 0.0000 0.0000 25.0000 ally reloads	Units sec sec mmHg mS/cm % / °C °C every 20	Diagnostic Firmware Version Senial Number Sensor Memory Status Config. Memory Status Cal Memory Status Run Status Last Cal Type Calibration Status seconds.	Value D3.17 1234 Valid Valid Valid System OK No Sensor Cal No Sensor Cal

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.

le Edit View Favorites Iools Help Back  →  →  →  →  →  →  →  →  →  →  →  →  →						rnet Explorer	oft Inter	us - Micros	DataStick - I/O Stat
Back       Image: Constant       Image: Constant <thimage: constant<="" th="">       Image: Const</thimage:>	1						Help	rites <u>T</u> ools	e <u>E</u> dit <u>V</u> iew F <u>a</u> vo
Image: Terms and the series of the series			• 🔜 🔏	è 🛛	Ø <b>⊘</b> ∙	Search 👷 Favorites	6	× 2 (	Back 🔹 🕥 🐇
Aqua Web SiteDataStick Measurement System Home PageI/O Status okI/O Status okMeasurementValueUnitsConfigurationValueUnitsDiagnosticValueSensor7.0000pHSensor Filter1secFirmware VersionD3.17Temperature25.2000°CTemperature Filter1secSensor Memory StatusValidDO Pressure760.000mmHgConfig Memory StatusValidDo Pressure760.000mS/cmCal Memory StatusValidCommSettingsDO Salinity0.0000% / °CRun StatusSystem OKAqua Web SiteCond. Ref. Temp.25.0000°CLast Cal. TypeNo Sensor Condition Status	nks » 🍯	🖌 🄁 Co						3.0.100/	iress 🕘 http://192.16
I/O Status     OK       Measurement     Value     Units     Diagnostic     Value       Sensor     7.0000     pH     Sensor Filter     1     sec     Firmware Version     D3.17       Temperature     25.2000     °C     Temperature Filter     1     sec     Sensor Memory Status     Valid       SensorType     pH     pH Buffer Standard     4,7,10     Sensor Memory Status     Valid       CommSettings     DO Pressure     760.000     mmHg     Config. Memory Status     Valid       CommSettings     DO Salinity     0.0000     mS/cm     Cal Memory Status     Valid       Aqua Web Site     Cond. Ref. Temp.     25.0000     °C     Last Cal. Type     No Sensor C       Cell Constant      Calibration Status     No Sensor C		tem	urement Sys Page	Neas Iome	itick I F	DataS	rs	enso	AquaS
Measurement         Value         Units         Configuration         Value         Units         Diagnostic         Value           Sensor         7.0000         pH         Sensor Filter         1         sec         Firmware Version         D3.17           Temperature         25.2000         °C         Temperature Filter         1         sec         Serial Number         1234           SensorType         pH         pH Buffer Standard         4,7,10         Sensor Memory Status         Valid           CommSettings         DO Pressure         760.000         mmHg         Config. Memory Status         Valid           CommSettings         DO Salinity         0.0000         mS/cm         Cal Memory Status         Valid           Aqua Web Site         Cond. Ref. Temp.         25.0000         %C         Last Cal. Type         No Sensor C           Cell Constant          Calibration Status         No Sensor C         Sensor C				OK	Status	I/O			
Sensor     7.0000     pH     Sensor Filter     1     sec     Firmware Version     D3.17       Temperature     25.2000     °C     Temperature Filter     1     sec     Serial Number     1234       SensorType     pH     pH Buffer Standard     4,7,10     Sensor Memory Status     Valid       DO Pressure     760.000     mmHg     Config. Memory Status     Valid       CommSettings     DO Salinity     0.0000     mS/cm     Cal Memory Status     Valid       Comp. Slope     0.0000     % / °C     Run Status     System OK       Aqua Web Site     Cell Constant      Calibration Status     No Sensor Constant		Valu	Diagnostic	Units	Value	Configuration	Units	Value	Measurement
Temperature       25.2000       °C       Temperature Filter       1       sec       Serial Number       1234         SensorType       pH       pH Buffer Standard       4,7,10       Sensor Memory Status       Valid         DO Pressure       760.000       mmHg       Config. Memory Status       Valid         CommSettings       DO Salinity       0.0000       mS/cm       Cal Memory Status       Valid         Aqua Web Site       Cond. Ref. Temp.       25.0000       °C       Last Cal. Type       No Sensor C         Cell Constant        Calibration Status       No Sensor C		D3.17	Firmware Version	sec	1	Sensor Filter	pH	7.0000	Sensor
SensorType     pH     pH Buffer Standard     4,7,10     Sensor Memory Status     Valid       DO Pressure     760.000     mmHg     Config. Memory Status     Valid       CommSettings     DO Salinity     0.0000     mS/cm     Cal Memory Status     Valid       Comp. Slope     0.0000     % / °C     Run Status     System OK       Aqua Web Site     Cond. Ref. Temp.     25.0000     °C     Last Cal. Type     No Sensor C       Cell Constant      Calibration Status     No Sensor C		1234	Serial Number	sec	1	Temperature Filter	°C	25.2000	Temperature
DO Pressure         760.000         mmHg         Config. Memory Status         Valid           CommSettings         DO Salinity         0.0000         mS/cm         Cal Memory Status         Valid           Comp. Slope         0.0000         % / °C         Run Status         System OK           Aqua Web Site         Cond. Ref. Temp.         25.0000         °C         Last Cal. Type         No Sensor OC           Cell Constant          Calibration Status         No Sensor OC		Valid	Sensor Memory Status		4,7,10	pH Buffer Standard		pН	SensorType
CommSettings         DO Salinity         0.0000         mS/cm         Cal Memory Status         Valid           Comp. Slope         0.0000         % / °C         Run Status         System OK           Aqua Web Site         Cond. Ref. Temp.         25.0000         °C         Last Cal. Type         No Sensor C           Cell Constant          Calibration Status         No Sensor C		Valid	Config. Memory Status	mmHg	760.000	DO Pressure			
Comp. Slope         0.0000         % / °C         Run Status         System OK           Aqua Web Site         Cond. Ref. Temp.         25.0000         °C         Last Cal. Type         No Sensor C           Cell Constant          Calibration Status         No Sensor C		Valid	Cal Memory Status	mS/cm	0.0000	DO Salinity			CommSettings
Aqua Web Site         Cond. Ref. Temp.         25.0000         PC         Last Cal. Type         No Sensor C           Cell Constant          Calibration Status         No Sensor C		System OF	Run Status	%/°C	0.0000	Comp. Slope		_	
Cell Constant Calibration Status No Sensor C	Cal	No Sensor	Last Cal. Type	°C	25.0000	Cond. Ref. Temp.			Aqua Web Site
	Cal	No Sensor	Calibration Status			Cell Constant		_	<u> </u>
This page automatically reloads every 20 seconds.	_		seconds.	every 20 s	ally reloads	This page automatic			
DataStick Measurement System, Version 1.01.01   (system uptime 00Days 00:02:40)		10)	m uptime 00Days 00:02:	(syster	on 1.01.01	ement System, Versi	Measur	DataStick	

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.

DataStick - I/O Status - Microsoft Internet File Edit View Favorites Tools Help     Back      O      Edit View Favorites     Co      Se Address     Address     Attp://192.168.0.100/	
AquaSensors	Click on the Sensor or Temperature Value to access the Calibration Page
MeasurementValueUnitsSensor7.0000pHSeTemperature25.2000°CTeSensorTypepHpHDC	

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.

DataStick Measurement System - Ca	libration - Microsoft Internet Explorer	
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorites <u>T</u> ools <u>H</u> elp		
🔇 Back 👻 🔘 - 💌 🗟 🏠 🔎	🔎 Search 👷 Favorites 🚱 🔗 - چ 👿 - 🗔 🖄	8
Address 🗃 http://192.168.0.100/cal.htm?calid	x=1	💽 🔂 Go 🛛 Links 🌺 🕈
AquaSensors	DataStick Measureme Calibration Pa	ent System age
	1-Point Sample Calibration	
	Set Sensor 7.0000 pH	
Home	Set Temperature 25.2000 °C	
Aqua Web Site DataStick Measu	Cancel	0Days 00:10:14)
ど Done		🔮 Internet

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.

) Back 🔹 🕥 🕤 💽 🛃	🔎 Search	📩 Favorites 🤣	8· 🎍	W	l • 🗔 🦓		
ress 🗃 http://192.168.0.100/cfg.htm?cfi	idx=2					💌 🛃 Go	Links » 🧯
<b>AquaSensors</b>		DataStic	k Mea 	as	urement	System	
		Conf	igura	tie	on Edit Pa	age	
		Configuration	. Cottin				
	(Carl	Comguiauo		lgs			
	Set	Sensor Units		-			
	Set	Temperature Units		_			
	Set	Sensor Filter		_	sec		
	Set	Temperature Filter		1000	sec		
	Set	pH Buffer Standard	4,7,10	~			
	Set	DO Pressure	760.000		mmHg		
	Set	DO Salinity	0.0000		mS/cm		
	Set	Comp Slope	0.0000		% / °C		
	Set	Cond Ref Temp	25.0000		°C		
	Set	Cell Constant	0				
Home	Set						
		Cancel	<u>,                                    </u>				
Aqua Web Site			_				

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<sup>TM</sup> 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<sub>HEX</sub> – 1 Instance)

6.5.2.1 Class Attributes

Attribute ID	Name	EtherNet/I P 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 <sub>DEC</sub>	Get
2	Device Type	UINT	0	Get
3	Product Code Number	UINT	11605 <sub>DEC</sub>	Get
4	Product Major Revision	USINT	01	Get
	Product Minor Revision	USINT	01	
5	Status	WORD	See Below	Get
6	Serial Number	UDINT	Unique	Get
			32 Bit Value	
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	Impleme	Service Name	
	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get_Attribute_Single
05 <sub>HEX</sub>	No	Yes	Reset

### 6.5.3 Message Router Object (02<sub>HEX</sub> – 0 Instances)

No attributes or services supported.

### 6.5.4 Assembly Object (04<sub>HEX</sub> – 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	Implemented for		Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get_Attribute_Single
10 <sub>HEX</sub>	No	Yes	Set_Attribute_Single

### 6.5.5 Connection Manager Object (06<sub>HEX</sub>)

This object has no attributes.

### 6.5.6 TCP Object (F5<sub>HEX</sub> – 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 <sup>1</sup>	DWORD	1	Get
2	Configuration Capability <sup>2</sup>	DWORD	0	Get
3	Configuration Control <sup>3</sup>	DWORD	0	Get
4	Physical Link Object <sup>4</sup>			Get
	Structure of:			
	Path Size	UINT	2	
	Path	Array Of WORD	0x20F6	
			0x2401	
5	Interface Configuration <sup>5</sup>			Get
	Structure of:			
	IP Address	UDINT	0	
	Network Mask	UDINT	0	
	Gateway Address	UDINT	0	
	Name Server	UDINT	0	
	Name Server 2	UDINT	0	
	Domain Name Size	UINT	0	
	Domain Name	STRING	0	
6	Host Name <sup>6</sup>			Get
	Structure of:			
	Host Name Size	UINT	0	
	Host Name	STRING	0	

### 6.5.6.3 Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get_Attribute_Single
10 <sub>HEX</sub>	No	Yes	Set_Attribute_Single

### 6.5.7 Ethernet Link Object (F6<sub>HEX</sub> – 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	UDINT	10	Get
2	Interface Flags <sup>8</sup>	DWORD	3	Get
3	Physical Address <sup>9</sup>	USINT Array[6]	0	Get

<sup>&</sup>lt;sup>1</sup> See section 5-3.2.2.1 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.

 <sup>&</sup>lt;sup>2</sup> See section 5-3.2.2.2 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
 <sup>3</sup> See section 5-3.2.2.3 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
 <sup>4</sup> See section 5-3.2.2.4 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.

<sup>&</sup>lt;sup>5</sup> See section 5-3.2.2.5 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.

 <sup>&</sup>lt;sup>6</sup> See section 5-3.2.2.6 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
 <sup>7</sup> See section 5-4.2.2.1 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.
 <sup>8</sup> See section 5-4.2.2.2 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on this attribute.

<sup>&</sup>lt;sup>9</sup> 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 <sub>HEX</sub>	Yes	Yes	Get_Attribute_Single

### 6.5.8 System Status Object (64<sub>HEX</sub> – 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/I P 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/I P 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 <sup>10</sup>
103	Write Error Count	N/A	N/A	UINT	0	Get / Set <sup>10</sup>
104	Timeout Count	N/A	N/A	UINT	0	Get / Set <sup>10</sup>

#### 6.5.8.3 Common Services

Service	Implemented for		Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get Attribute Single

# 6.5.9 Sensor Installation Object (65<sub>HEX</sub> – 1 Instance)

#### 6.5.9.1 Class Attributes

Attribute ID	Name	EtherNet/I P 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

<sup>&</sup>lt;sup>10</sup> Writing this attribute clears the count to 0.

#### 6.5.9.3 Common Services

Service	ervice Implemented for		Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get Attribute Single

# 6.5.10 Sensor Value Object (66<sub>HEX</sub> – 1 Instance)

#### 6.5.10.1 Class Attributes

Attribute ID	Name	EtherNet/I P 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	Implemented for		Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get Attribute Single

# 6.5.11 User Configuration Object (67<sub>HEX</sub> – 1 Instance)

#### 6.5.11.1 Class Attributes

Attribute ID	Name	EtherNet/I P 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_ST RING	0	Get / Set
2	Code Version	GCVSN	0	SHORT_ST RING	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	Implemented for		Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get Attribute Single
10 <sub>HEX</sub>	No	Yes	Set Attribute Single

# 6.5.12 Generic Sensor Calibration Object (68<sub>HEX</sub> – 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/I P Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

#### 6.5.12.2 Instance Attributes

Attribu te ID	Name	Thermo Scientific	Thermo Scientific	EtherNet/IP Data Type	Default Data	Access Rule
		AquaSensors Command	AquaSensors Offset		Value	
1	Calibrate Sensor Zero	CALSZERO		None	0	Get / Set <sup>11</sup>
2	Calibrate 1-Point Sample	CALS1PS, data		REAL	NAN	Get / Set <sup>11</sup>
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 <sup>11</sup>
5	Calibrate Sensor 1-Point Buffer	CALS1PB		None		Get / Set <sup>11</sup>
6	Calibrate Sensor 2-Point Buffer	CALS2PB, data		UINT	0	Get / Set <sup>11</sup>
7	Calibrate Sensor in Air	CALSAIR		None		Get / Set <sup>11</sup>
8	Calibrate Sensor Temperature 1- Point Sample	CALST1PS		REAL	NAN	Get / Set <sup>11</sup>
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 <sup>11</sup>

#### 6.5.12.3 Common Services

Service	Implemented for		Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	No	Get Attribute Single
10 <sub>HEX</sub>	No	Yes	Set Attribute Single

### 6.5.13 Conductivity Sensor Calibration Object (69<sub>HEX</sub> – 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	Implen	nented for	Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get Attribute Single
10 <sub>HEX</sub>	No	Yes	Set Attribute Single

<sup>&</sup>lt;sup>11</sup> Always reads as "0" since the parameter is write only.

### 6.5.14 Mode Configuration Object (75<sub>HEX</sub> – 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	Туре
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	Implen	nented for	Service Name
Code	Class Level	Instance Level	
0E <sub>HEX</sub>	Yes	Yes	Get Attribute Single
10 <sub>HEX</sub>	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<sup>™</sup> 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 <a href="http://www.ab.com/programmablecontrol/plc/micrologix1000/get/ENIutility.exe">http://www.ab.com/programmablecontrol/plc/micrologix1000/get/ENIutility.exe</a>.

ENI / ENIW Utility				×
NI IP Addr   Message Routin	g Email Reset Utili	ty Settings   Web Config   Web Data Desc	He	lp
ENI Series 🗛 💌	232 Baud Rate Auto	💽 CompactLogix Plouting 🗖	Load From	Save To-
Obtain via BootP_🔽	ENI IP Address	000.000.000.000	EVII	EMI DAM
Always I	Subnet Mask	000.000.000.000		
Obtain via DHCP	Gateway	000.000.000.000	Defaults	ENI ROM
Ethernet Speed/Duplex	Security Mask 1	000.000.000.000	Iext	Te <u>x</u> t
Auto Negotiate 🛛 💌	Security Mask 2	000.000.000	Default Value	20

Figure 51: The ENI Configuration Utility.

See the 1761-NET-ENI MicroLogix<sup>TM</sup> 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.

Advanced	Redirect <b>DOMS2 T</b> o:	Move Up
C <u>o</u> m Setup	[IP] 192.168.10.60.10001	Move Do <u>w</u> n
<u>S</u> ilent Mode		
	Port Settings	
		<u>R</u> emove
Status: Idle		

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.

ENI IP Addr	Messag	e Routing E	mail Reset Utility Settings W	eb Config   Web Data Desc	<u>H</u> e	lp
	Destn	Config	IP Address	<u> </u>	Load From	-Save To
	9	109	192,168.010.201		File Load	File <u>S</u> av
	10	110	000.000.000.000		ENI	ENI RAM
	11	111	000.000.000.000			
	12	112	000.000.000.000		Defaults	
	13	113	000.000.000.000		<u>⊺</u> ext	Te <u>x</u> t
	14	114	000.000.000.000	-		1.
	1.46	4.40	000,000,000,000		Device Value	IS .

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.

s Controller Communication Command: PLC5 Read Data Table Address: N7:0 Size in Elements: 2 Channel: 0 rget Device Message Timeout : 23 Data Table Address: N20:1 Local Node Addr (dec): 9 Local / Remote : Local	Control Bits Ignore if timed out (TO): ① To be retried (NR): ② Awaiting Execution (EW): ③ Continuous Run (CO): ③ Error (ER): ③ Message done (DN): ③ Message done (DN): ③ Message Transmitting (ST): ③ Message Enabled (EN): ③ Waiting for Queue Space : ④ Error Error Code(Hex): ④
or Description	

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.

🖉 Data File F8 🕂	FLOAT				_ 🗆 🗵
Offset	0	1	2	3	4
F8:0	7				
 					• <b>-</b>
 F8:0				Redix:	*
Symbol: SENSOR V	ALUE			Colu	mns: 5 💌
Desc:					
F8	Properties			Help	

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.

Local Node Addr (dec):       9       (octal):       11       Waiting for Queue Space :       0         Local / Remote :       Local       Error       Error Code(Hex):       0
--

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.

🖉 Data File	N7 (dec)	INTEGE	R							
Offset	0	1	2	3	4	5	6	7	8	9
N7:0	1	0	0	0	0	0	0	0	0	0
N7:10	1	0	0	0	0	0	0	0	0	0
N7:20	0	0	0	0	0	0	0	0	0	0
N7:30	0	0	0	0	0	0	0	0	0	0
N7:40	0	0	0	0	0	0	0	0	0	0
N7:50	0	0	0	0	0	0	0	0	0	0
N7:60	O	0	0	ο	0	0	0	0	0	0
N7:70	0	0	0	0	0	0	0	0	0	0
N7:80	0	0	0	0	0	0	0	0	0	0
N7:90	O	0	0	0	0	0	0	0	0	O
N7:100	700	0								
•										) -
N7:	0							Radi	<sub>x:</sub> Decima	il 💌
Symbol: SEN	ISOR FILTE	R							Colum	ns: 10 🔻
Desc:										
N7 -		Proper	ties		Usa	ge		Hel	P	

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.

s Controller Communication Command: <u>PLC5 Read</u> Data Table Address: N15:0	Control Bits Ignore if timed out (TO): 0 To be retried (NR): 0
Size in Elements: 100	Awaiting Execution (EW):
	Error (ER): 1
Message Timeout : 1	Message done (DN): 0
Data Table Address: N7:0	Message Transmitting (ST): 0 Message Enabled (EN): 0
Local / Remote : Local MultiHop: Yes	Waiting for Queue Space : 0
	Error
	Error Code(Hex): d8
r Description	
Connection was broken	

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.

		Del = Remove Hop						
From Device	From Port	To Address Type	To Address					
This SEC500	1	EtherNet IP Device (str.)	192.168.0.200					

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<sup>™</sup> Ethernet Interface User Manual, Publication 1761-UM006E-EN-P,
   <u>http://literature.rockwellautomation.com/idc/groups/literature/documents/um/176</u> <u>1-um006\_-en-p.pdf</u>
- RSLogix 500 Instruction Help System
- Communicating with RA Products Using EtherNet/IP Explicit Messaging, <u>http://www.rockwellautomation.com/enabled/pdf/eipexp1\_2.pdf</u>
## 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.

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

#### Table 4: Uptime 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

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

 Table 5: Register bank 1000; status registers.

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).

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	II						
42,005 N20:05	Calibrate Sensor 1- Point Sample Value	float	R/W	CALS1PS		7.02	Calibration
42,006 N20:06	11						
42,007 N20:07	Calibrate Sensor 2- Point Sample Value	float	R/W	CALS2PS		10.04	Calibration
42,008 N20:08	n						
42,009 N20:09	Calibrate Temperature 1-Point	float	R/W	CALST1PS		25.3	Calibration

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

Register Number	Description	Data Type	Access	DataStick Command	Comment	Example Value	Variable Class
	Sample Value						
42,010	"						
N20:10							
42,011							
42 012							
N20:12							
42,013							
N20:13							
42,014							
12 0.14							
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	U.						
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.

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

Table 7: Register bank 3000; integer registers.

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  $7.04 \times 100 = 704$ .

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.

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							

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

Register	Description	Data	Access	DataStick	Comment	Example Value	Variable
Number		Туре		Command			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.

Register	Description	Data	Access	DataStick	Comment	Example	Variable
Number		Туре		Command		Value	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	II		"03"	Information
45,004 N50:04	Main Serial Number04	ASCII[2]	R/W	II		"79"	Information
45,005 N50:05	Main Serial Number05	ASCII[2]	R/W	II		<null><null></null></null>	Information
45,006 N50:06	Main Serial Number06	ASCII[2]	R/W	II		<null><null></null></null>	Information
45,007 N50:07	Main Serial Number07	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,008 N50:08	Main Serial Number08	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,009 N50:09	Main Serial Number09	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,010 N50:10	Main Serial Number10	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,011 N50:11	Main Serial Number11	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,012 N50:12	Main Serial Number12	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,013 N50:13	Main Serial Number13	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,014 N50:14	Main Serial Number14	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,015 N50:15	Main Serial Number15	ASCII[2]	R/W	"		<null><null></null></null>	Information
45,016 N50:16	Main Serial Number16	ASCII[2]	R/W	"		<null><null></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	11		".5"	Information
45,019 N50:19	DataStick Code Version03	ASCII[2]	R	11		"1" <null></null>	Information
45,020 N50:20	DataStick Code Version04	ASCII[2]	R	11		<null><null></null></null>	Information
45,021 N50:21	Node Address	integer	R/W	GADDR/ SADDR	Chars: 3	321	Information

Table 9: Register bank 5000; information registers.

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, <u>http://standards.ieee.org/getieee802/index.html</u>
- TIA/EIA-568-B, Commercial Building Telecommunications Cabling Standard, <a href="http://www.tiaonline.org/">http://www.tiaonline.org/</a>
- 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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