GE
Measurement & Control Solutions

Flow

Communications Options

User's Guide

imagination at work

916-115 Rev. C
May 2011

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Information Paragraphs

- **Note** paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.
- **Important** paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.
- **Caution!** paragraphs provide information that alerts the operator to a hazardous situation that can cause damage to property or equipment.
- **Warning!** paragraphs provide information that alerts the operator to a hazardous situation that can cause injury to personnel. Cautionary information is also included, when applicable.

Safety Issues

WARNING! It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.

WARNING! Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on the equipment.

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Purpose for User's Guide

This guide is a separate document that is meant to complement product manuals for various GE Sensing ultrasonic flowmeters that have digitial communications options. Due to the varied nature of digital I/O on GE Sensing ultrasonic flowmeters, this separate guide provides more detailed information around setup, programming, verification, and trouble-shooting of digital communications options. In particular, this guide addresses digital communications options for the following instruments:

- DF868 Liquid Ultrasonic Flowmeters
- Gx868 Gas Ultrasonic Flowmeters (GC868, GF868, GS868, GM868)
- XMT868 & XMT868i Liquid Ultrasonic Flowmeters
- XGx868 & XGx868i Gas Ultrasonic Flwometers (XGS868, XGM868, XGS868i, XGM868i)

Note: *This guide supercedes previously published information on digital communications for GE Sensing ultrasonic flowmeters published in various instrument manuals.*

To find the communications options available for your instrument, see the specifications section of your user's manual or product datasheet, or contact GE.

Chapter 1. Modbus Communications

Chapter 2. Modbus Over Ethernet Communications 1

Chapter 3. Modbus Over Ethernet Communications 2

Chapter 4. Ethernet Only Communications

Chapter 5. Modbus Over WI-FI Communications

Chapter 6. WI-FI Only Communications

Chapter 7. Foundation Fieldbus Communications

Chapter 8. HART Communications

Chapter 9. BACNet/IP (BACNet Over Ethernet)

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Chapter 1. Modbus Communications

1.1 Introduction

Your flowmeter hardware and software (GC3E.MBS) have been modified to provide improved MODBUS communications. The MODBUS option card provides an RS485 interface with a host system, while the main circuit board continues to support RS232 communications for use with a PC running PanaView™ software.

Note: *PanaView™ does not support Modbus.*

To properly set up the instrument, use this addendum along with the standard flowmeter *User's Manual*. This document shows how to install the MODBUS option card and how to program the modified flowmeter to access this special feature.

When equipped with the optional MODBUS output card, the flow transmitter can send flow data and diagnostic information to a flow computer (or SCADA) serially, using a Gould-type RTU protocol. In this case, only the MODBUS function command, 3 (read multiple registers), 6 (write multiple registers) is valid. The format for the data exchange is as follows:

- The **send** command (initiated by the host flow computer or controller) comes in the form:
  [time delimiter]<Addr><3><First Register MSB>
  <First Register LSB><Register Count MSB>
  <Register Count LSB><CRC Low><CRC High>[time delimiter]
- The response (initiated by the host flow computer or controller) comes in the form:
  [time delimiter]<Addr><3><Byte count><Data.....>
  <CRC Low><CRC High>[time delimiter]

The format for the returned data types is as follows:

- Integer (16 bit Integer) <MSB><LSB>
  1 Register - 16 bit integer
- Integer (32 bit IntegerI) <MSB><LSB><LSB><LSB>
  2 Registers - 32 bit long integer
- Floating Point (FP) <EXP><MAN><MAN><MAN>
  2 Registers - 32 bit IEEE floating point number

1.2 Installing the MODBUS Option Card

IMPORTANT: *The installation information presented here supersedes the information in the standard flowmeter* User's Manual.

The modified flowmeter uses the RS485 standard for MODBUS communications. This standard allows up to 32 nodes (drivers and receivers) on one multidrop network, at distances up to 4,000 ft (1,200 m). To connect the instrument(s) to the host system, GE Sensing recommends using a 24-gauge (24 AWG) twisted-pair cable with a characteristic impedance of 120 ohms and a 120-ohm termination at each end of the communications line.

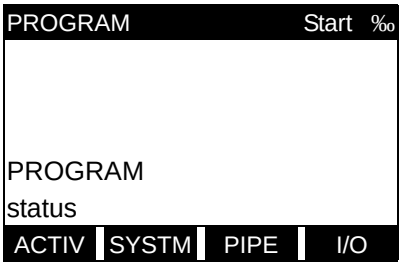
The MODBUS option card must be plugged into either slot 5 or slot 6 of the flowmeter. On the option card, pin 1 is the [TMT-] inverting or negative connection and pin 2 is the [TMT+] non-inverting or positive connection. To link the flowmeter to the control system, connect the two wires of the twisted-pair cable from these terminals to the corresponding terminals at the control system.

Note: *If two MODBUS option cards are installed in the flowmeter, only the card in slot 5 is activated.*

1.3 Setting Up MODBUS Communications

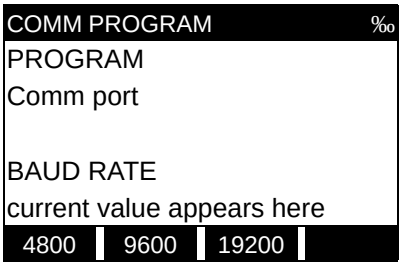
To set up MODBUS communications, enter the *User Program* as described in your *Programming Manual*. Then, refer to the *menu map* in Figure 2 on page 22 and complete the following steps:

Note: *Any time the following settings are changed, the flowmeter must be rebooted to load the new settings into the option card.*



Press the [∅] key and then the [F3] key to select the *COMM* submenu. (On a two-channel flowmeter, pressing the [∅] key and the [F3] key accesses the *GLOBL* menu. Then press [F4] to select the *COMM* submenu.)

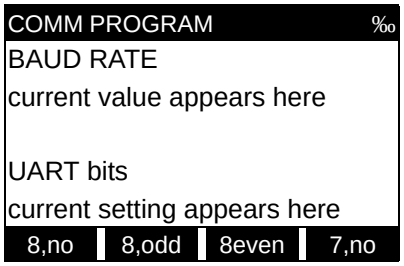
IMPORTANT: *The serial port settings of the flowmeter must match those of the MODBUS control system.*



[This baud rate applies only to the RS232 serial port.] Press the [∅] until the desired RS232 baud rate appears on the option bar and press the appropriate [Fx] function key to select it.

The available RS232 baud rates are 300, 600, 1200, 2400, 4800, 9600, and 19200.

1.3 Setting Up MODBUS Communications (cont.)

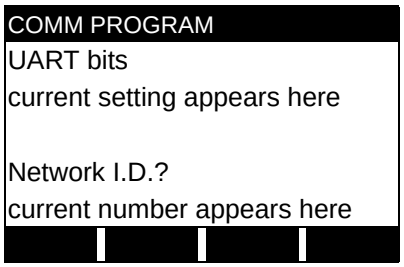


[The UART bits setting applies only to the RS232 serial port.] Press the [∅] until the desired RS232 UART bits setting appears on the option bar and then press the appropriate [Fx] function key to select it.

See Table 1 for a description of the options available at the above prompt.

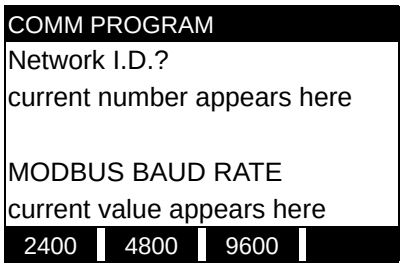
Table 1: UART Bits Options

Option Bar	# Data Bits	# Stop Bits	Parity
8,no	8	0	None
8,odd	8	0	Odd
8even	8	0	Even
7,odd	7	1	Odd
7even	7	1	Even

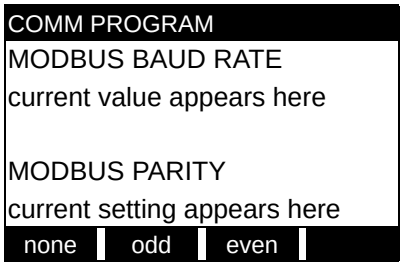


[The Network ID number is used by the IDM software only.] Enter a Network ID number between 1 and 254 and then press [ENT]. The default ID number is 1.

Note: *If more than one meter is connected to a network, each meter must have a unique* Network I.D.

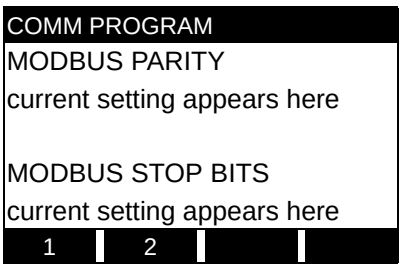


Press the appropriate [Fx] function key to select [2400], [4800], or [9600] for the MODBUS baud rate.

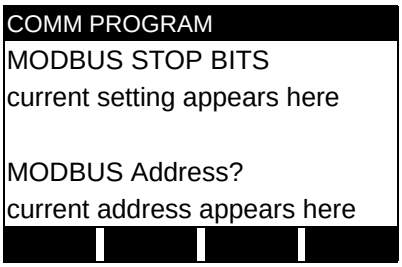


Press the appropriate [Fx] function key to select [NONE], [ODD], or [EVEN] for the MODBUS parity setting.

1.3 Setting Up MODBUS Communications (cont.)



Press the appropriate [Fx] function key to select [1] or [2] for the MODBUS stop bits setting.



Enter a MODBUS Address number between 1 and 247. Then, press [ENT].

Press [EXIT] until you return to RUN mode and the screen resumes the display of data measurements. Then reboot the meter to load the new settings into memory.

1.4 MODBUS Register Map

To request specific parameters from the flowmeter using MODBUS, the control system must enter the appropriate register number. Only registers 1 through 90 are available for MODBUS communications, while registers 508 through 512 are used by the flowmeter to store the MODBUS parameters. For details, see:

Table 2 on page 5 for a 1-Channel gas flowmeter (GC868, GF868, GM868, GN868, GS868, XGM878, XGS878)
Table 3 on page 6 for a 2-Channel gas flowmeter (GC868, GF868, GM868, GN868, GS868, XGM878, XGS878)
Table 4 on page 9 for a 1-Channel liquid flowmeter (DF868, XMT868i)
Table 5 on page 11 for a 2-Channel liquid flowmeter (DF868)
Table 6 on page 14 for a Sentinel flowmeter.

Refer to **Notes** on page 8, page 13, or page 16 for information about the numerical references.

Note: *Depending on the type of flowmeter being programmed, some MODBUS register numbers may have zero readings. If this is the case, those register types are not available for that flowmeter.*

Note: *If you request Ch2 or AVE data from a 1-Channel meter, the values will all be zero.*

Table 2: MODBUS Registers for a 1-Channel Gas Flowmeter

MODBUS Reg #	Description	Scaling (decimal places)	Size in Bytes
1	[1]"Clear Ch1 Totalizers"	--	2 (16 bit signed int)
2	Not Used	--	2 (16 bit signed int)
3, 4**	Velocity	2	4 (32 bit Long Integer)
5, 6*	[2]Act Volumetric	--	4 (IEEE 32 bit Float)
7, 8*	[2]Std Volumetric	--	4 (IEEE 32 bit Float)
9, 10**	[3]Fwd Totals	Register 13	4 (32 bit Long Integer)
11, 12**	[3]Rev Totals	Register 13	4 (32 bit Long Integer)
13	#Tot Digits	0	2
14, 15*	[2]Mass Flow	--	4 (IEEE 32 bit Float)
16, 17**	[4]Fwd Mass Totals	Register 20	4 (32 bit Long Integer)
18, 19**	[4]Rev Mass Totals	Register 20	4 (32 bit Long Integer)
20	#MT DIGITS (Mass Tot Digits)	0	2
21, 22**	Timer	2	4 (32 bit Long Integer)
23	[9]Error Code	0	2
24, 25**	Sound Speed	3	4 (32 bit Long Integer)
26, 27**	[10]Density	4	4 (32 bit Long Integer)
28, 29**	Signal Strength Upstream	1	4 (32 bit Long Integer)
30, 31**	Signal Strength Downstream	1	4 (32 bit Long Integer)
32, 33**	Temperature	2	4 (32 bit Long Integer)
34, 35**	Pressure	3	4 (32 bit Long Integer)
92, 93 (36, 37)*	Signal Quality Up	--	4 (IEEE 32 bit Float)
94, 95 (38, 39)*	Signal Quality Down	--	4 (IEEE 32 bit Float)
96, 97 (40, 41)*	Amp Discriminator Up	--	4 (IEEE 32 bit Float)
98, 99 (42, 43)*	Amp Discriminator Down	--	4 (IEEE 32 bit Float)
100, 101 (44, 45)*	SNR Up	--	4 (IEEE 32 bit Float)
102, 103 (46, 47)*	SNR Down	--	4 (IEEE 32 bit Float)
508	[6]MODBUS baud rate	0	2
509	[7]MODBUS parity	0	2
510	[8]MODBUS stop bits	0	2
511	MODBUS meter addr	0	2
512	RESERVED	---	---

*The complete floating point value is constructed by combining readings from the first register with a second register. An eight Hex digits number will represent the IEEE-754 hexadecimal floating point value. 32-bit Hexadecimal Representation To Decimal Floating-Point conversion can be performed if needed.

Example: Reg 14 reading is 44d7, Reg 15 reading is 4000, Mass Flow is 44d74000, which corresponds to 1722.

**The complete Long integer value is constructed by combining readings from the first register with the second register. Eight Hex digits will represent the Long interger value.

Example: Reg 24 is 0019, Reg 25 is ED30, Hexadecimal Sound Speed is 0019ED30, which is converted to 1699120 decimal. Taking into account that Sound Speed has 3 decimal places (from the map), it corresponds to a value of 1699.120.

Table 3: MODBUS Registers for a 2-Channel Gas Flowmeter

MODBUS Reg #	Description	Scaling (decimal places)	Size in Bytes
1	[1]"Clear Ch1 Totalizers"	--	2 (16 bit signed int)
2	[1]"Clear Ch2 Totalizers"	--	2 (16 bit signed int)
3, 4**	Ch1 Velocity	2	4 (32 bit Long Integer)
5, 6*	[2]Ch1 Act Volumetric	--	4 (IEEE 32 bit Float)
7, 8*	[2]Ch1 Std Volumetric	--	4 (IEEE 32 bit Float)
9, 10**	[3]Ch1 Fwd Totals	Register 13	4 (32 bit Long Integer)
11, 12**	[3]Ch1 Rev Totals	Register 13	4 (32 bit Long Integer)
13	Ch1 #Tot Digits	0	2
14, 15*	[2]Ch1 Mass Flow	--	4 (IEEE 32 bit Float)
16, 17**	[4]Ch1 Fwd Mass Totals	Register 20	4 (32 bit Long Integer)
18, 19**	[4]Ch1 Rev Mass Totals	Register 20	4 (32 bit Long Integer)
20	Ch1 #MT DIGITS (Mass Tot Digits)	0	2
21, 22**	Ch1 Timer	2	4 (32 bit Long Integer)
23	[9]Ch1 Error Code	0	2
24, 25**	Ch1 Sound Speed	3	4 (32 bit Long Integer)
26, 27**	[10]Ch1 Density	4	4 (32 bit Long Integer)
28, 29**	Ch1 Sig Strength Upstream	1	4 (32 bit Long Integer)
30, 31**	Ch1 Sig Strength Downstream	1	4 (32 bit Long Integer)
32, 33**	Ch1 Temperature	2	4 (32 bit Long Integer)
34, 35**	Ch1 Pressure	3	4 (32 bit Long Integer)
36, 37**	Ch2 Velocity	2	4 (32 bit Long Integer)
38, 39*	Ch2 Act Volumetric	--	4 (IEEE 32 bit Float)
40, 41*	Ch2 Std Volumetric	--	4 (IEEE 32 bit Float)
42, 43**	Ch2 Fwd Totals	Register 46	4 (32 bit Long Integer)
44, 45**	Ch2 Rev Totals	Register 46	4 (32 bit Long Integer)
46	Ch2 #Tot Digits	0	2
47, 48*	Ch2 Mass Flow	--	4 (IEEE 32 bit Float)
49, 50**	Ch2 Fwd Mass Totals	Register 53	4 (32 bit Long Integer)
51, 52**	Ch2 Rev Mass Totals	Register 53	4 (32 bit Long Integer)
53	Ch2 #Mass Tot Digits	0	2
54, 55**	Ch2 Timer	2	4 (32 bit Long Integer)
56	[9]Ch2 Error Code	0	2
57, 58**	Ch2 Sound Speed	3	4 (32 bit Long Integer)
59, 60**	[10]Ch2 Density	4	4 (32 bit Long Integer)
61, 62**	Ch2 Sig Strength Upstream	1	4 (32 bit Long Integer)
63, 64**	Ch2 Sig Strength Downstream	1	4 (32 bit Long Integer)
65, 66**	Ch2 Temperature	2	4 (32 bit Long Integer)
67, 68**	Ch2 Pressure	3	4 (32 bit Long Integer)

Table 3: MODBUS Registers for a 2-Channel Gas Flowmeter (cont.)

MODBUS Reg #	Description	Scaling (decimal places)	Size in Bytes
69, 70**	Avg Velocity	2	4 (32 bit Long Integer)
71, 72*	Avg Act Volumetric	--	4 (IEEE 32 bit Float)
73, 74*	Avg Std Volumetric	--	4 (IEEE 32 bit Float)
75, 76**	Avg Fwd Totals	Register 79	4 (32 bit Long Integer)
77, 78**	Avg Rev Totals	Register 79	4 (32 bit Long Integer)
79	Avg #Tot Digits	0	2
80, 81*	Avg Mass Flow	--	4 (IEEE 32 bit Float)
82, 83**	Avg Fwd Mass Totals	Register 86	4 (32 bit Long Integer)
84, 85**	Avg Rev Mass Totals	Register 86	4 (32 bit Long Integer)
86	Avg #Mass Tot Digits	0	2
87, 88**	Avg Timer	2	4 (32 bit Long Integer)
89	[5]Avg Error Code	0	2
90, 91**	Avg Sound Speed	3	4 (32 bit Long Integer)
92, 93*	CH1 Signal Quality Up	--	4 (IEEE 32 bit Float)
94, 95*	CH1 Signal Quality Down	--	4 (IEEE 32 bit Float)
96, 97*	CH1 Amp Discriminator Up	--	4 (IEEE 32 bit Float)
98, 99*	CH1 Amp Discriminator Down	--	4 (IEEE 32 bit Float)
100, 101*	CH1 SNR Up	--	4 (IEEE 32 bit Float)
102, 103*	CH1 SNR Down	--	4 (IEEE 32 bit Float)
104, 105*	CH2 Signal Quality Up	--	4 (IEEE 32 bit Float)
106, 107*	CH2 Signal Quality Down	--	4 (IEEE 32 bit Float)
108, 109*	CH2 Amp Discriminator Up	--	4 (IEEE 32 bit Float)
110, 111*	CH2 Amp Discriminator Down	--	4 (IEEE 32 bit Float)
112, 113*	CH2 SNR Up	--	4 (IEEE 32 bit Float)
114, 115*	CH2 SNR Down	--	4 (IEEE 32 bit Float)
508	[6]MODBUS baud rate	0	2
509	[7]MODBUS parity	0	2
510	[8]MODBUS stop bits	0	2
511	MODBUS meter addr	0	2
512	RESERVED	---	---

*The complete floating point value is constructed by combining readings from the first register with a second register. An eight Hex digits number will represent the IEEE-754 hexadecimal floating point value. 32-bit Hexadecimal Representation To Decimal Floating-Point conversion can be performed if needed.

Example: Reg 14 reading is 44d7, Reg 15 reading is 4000, Mass Flow is 44d74000, which corresponds to 1722.

**The complete Long integer value is constructed by combining readings from the first register with the second register. Eight Hex digits will represent the Long interger value.

Example: Reg 24 is 0019, Reg 25 is ED30, Hexadecimal Sound Speed is 0019ED30, which is converted to 1699120 decimal. Taking into account that Sound Speed has 3 decimal places (from the map), it corresponds to a value of 1699.120.

1.4.1 Notes for a Gas Flowmeter:

1. **Clear Totalizers:**
   Write 1 to Reg 1 to clear Channel 1 totalizers.
   Write 1 to Reg 2 to clear Channel 2 totalizers.
2. **Values in these registers are floating point numbers and require no scaling. The number of decimal digits is set in meter programming.**
3. **Require scaling by value in register 13.**
4. **Require scaling by value in register 20.**
5. **AVG Error Code:**
   0=Both Ch1 and Ch2 are in error.
   1=Ch1 only is in error
   2=Ch2 only is in error
   3=Both channels are error free
6. **MODBUS baud rate:**
   5 = 2400, 6 = 4800, 7 = 9600
7. **MODBUS parity:**
   0 = none, 1 = odd, 2 = even
8. **MODBUS stop bits:**
   1 = 1 stop bit, 2 = 2 stop bits
9. **Error Code:**
   Highest single number, or combination of error numbers, listed without an "E". Error codes should be explained in the user's manual or guide.

IMPORTANT: *If the unit is reading over range, an error condition will occur and output* 20mA *(for a 0-20mA range) or* 21.10mA *(for a 4-20mA range).*

10. **Descriptions:**
    For the GF868, register numbers 26, 27 and 59, 60 have the description Molecular Weight.
    For the GN868, register numbers 26, 27 and 59, 60 have the description Fpv.

Table 4: MODBUS Registers for a 1-Channel Liquid Flowmeter

MODBUS Reg #	Description	Scaling (decimal places)	Size in Bytes
1	[1]Clear Totalizers		2 (16 bit signed int)
2, 3**	Velocity	2	4 (32 bit Long Integer)
4, 5*	Volumetric	--	4 (IEEE 32 bit Float)
6, 7**	+Totals	Register 10	4 (32 bit Long Integer)
8, 9**	–Totals	Register 10	4 (32 bit Long Integer)
10	#T Digits	0	2 (16 bit signed int)
11, 12**	Totalizer Time	2	4 (32 bit Long Integer)
13	[2]Error Value	0	2 (16 bit signed int)
14, 15**	SSUP	1	4 (32 bit Long Integer)
16, 17**	SSDN	1	4 (32 bit Long Integer)
18, 19**	SNDSP	0	4 (32 bit Long Integer)
56, 57*	Power	--	4 (IEEE 32 bit Float)
58, 59**	+Energy	Register 62	4 (32 bit Long Integer)
60, 61**	–Energy	Register 62	4 (32 bit Long Integer)
62	# Energy Digits	0	2 (16 bit signed int)
63, 64**	TempS	2	4 (32 bit Long Integer)
65, 66**	TempR	2	4 (32 bit Long Integer)
67, 68**	TS-TR	2	4 (32 bit Long Integer)
69, 70**	DELTH	2	4 (32 bit Long Integer)
86, 87*	[5]Slot 1 Input A		4 (IEEE 32 bit Float)
88, 89*	[5]Slot 1 Input B		4 (IEEE 32 bit Float)
90, 91*	Slot 2 Input A		4 (IEEE 32 bit Float)
92, 93*	Slot 2 Input B		4 (IEEE 32 bit Float)
94, 95*	Slot 3 Input A		4 (IEEE 32 bit Float)
96, 97*	Slot 3 Input B		4 (IEEE 32 bit Float)
98, 99*	Slot 4 Input A		4 (IEEE 32 bit Float)
100, 101*	Slot 4 Input B		4 (IEEE 32 bit Float)
102, 103*	Slot 5 Input A		4 (IEEE 32 bit Float)
104, 105*	Slot 5 Input B		4 (IEEE 32 bit Float)
106, 107*	Slot 6 Input A		4 (IEEE 32 bit Float)
108, 109*	Slot 6 Input B		4 (IEEE 32 bit Float)
508	[6]MODBUS baud rate	0	2 (16 bit signed int)
509	[7]MODBUS parity	0	2 (16 bit signed int)
510	[8]MODBUS stop bits	0	2 (16 bit signed int)
511	MODBUS meter address	0	2 (16 bit signed int)
512	RESERVED	--	--

Table 4: MODBUS Registers for a 1-Channel Liquid Flowmeter (cont.)

*The complete floating point value is constructed by combining readings from the first register with a second register. An eight Hex digits number will represent the IEEE-754 hexadecimal floating point value. 32-bit Hexadecimal Representation To Decimal Floating-Point conversion can be performed if needed.

Example: Reg 4 reading is 44d7, Reg 5 reading is 4000, Volumetric is 44d74000, which corresponds to 1722.

**The complete Long integer value is constructed by combining readings from the first register with the second register. Eight Hex digits will represent the Long interger value.

Example: Reg 2 is 0019, Reg 3 is ED30, Hexadecimal Velocity is 0019ED30, which corresponds to 1699120 decimal. Taking into account that Velocity has 2 decimal places (from the map), it corresponds to a value of 16991.20.

Table 5: MODBUS Registers for a 2-Channel Liquid Flowmeter

MODBUS Reg #	Description	Scaling (decimal places)	Size in Bytes
1	[1]Clear Totalizers		2 (16 bit signed int)
2, 3**	CH 1 Velocity	2	4 (32 bit Long Integer)
4, 5*	CH 1 Volumetric	--	4 (IEEE 32 bit Float)
6, 7**	CH 1 +Totals	Register 10	4 (32 bit Long Integer)
8, 9**	CH 1 -Totals	Register 10	4 (32 bit Long Integer)
10	CH 1 #T Digits	0	2 (16 bit signed int)
11, 12**	CH 1 Totalizer Time	2	4 (32 bit Long Integer)
13	[2]CH 1 Error Value	0	2 (16 bit signed int)
14, 15**	CH 1 SSUP	1	4 (32 bit Long Integer)
16, 17**	CH 1 SSDN	1	4 (32 bit Long Integer)
18, 19**	CH 1 SNDSP	0	4 (32 bit Long Integer)
20, 21**	CH 2 Velocity	2	4 (32 bit Long Integer)
22, 23*	CH 2 Volumetric	--	4 (IEEE 32 bit Float)
24, 25**	CH 2 + Totals	Register 28	4 (32 bit Long Integer)
26, 27**	CH 2 - Totals	Register 28	4 (32 bit Long Integer)
28	CH 2 # T Digits	0	2 (16 bit signed int)
29, 30**	CH 2 Totalizer Time	2	4 (32 bit Long Integer)
31	[2]CH 2 Error Value	0	2 (16 bit signed int)
32, 33**	CH 2 SSUP	1	4 (32 bit Long Integer)
34, 35**	CH 2 SSDN	1	4 (32 bit Long Integer)
36, 37**	CH 2 SNDSP	0	4 (32 bit Long Integer)
38, 39**	[3]AVG Velocity	2	4 (32 bit Long Integer)
40, 41*	[3]AVG Volumetric	--	4 (IEEE 32 bit Float)
42, 43**	[3]AVG + Totals	Register 46	4 (32 bit Long Integer)
44, 45**	[3]AVG - Totals	Register 46	4 (32 bit Long Integer)
46	AVG #T Digits	0	2 (16 bit signed int)
47, 48**	[3]AVG Totalizer Time	2	4 (32 bit Long Integer)
49	[4]AVG Error Value	0	2 (16 bit signed int)
50, 51**	[3]AVG SSUP	1	4 (32 bit Long Integer)
52, 53**	[3]AVG SSDN	1	4 (32 bit Long Integer)
54, 55**	[3]AVG SNDSP	0	4 (32 bit Long Integer)
56, 57*	CH 1 Power	--	4 (IEEE 32 bit Float)
58, 59**	CH 1 +Energy	Register 62	4 (32 bit Long Integer)
60, 61**	CH 1 -Energy	Register 62	4 (32 bit Long Integer)
62	CH 1 # Energy Digits	0	2 (16 bit signed int)
63, 64**	CH 1 TempS	2	4 (32 bit Long Integer)
65, 66**	CH 1 TempR	2	4 (32 bit Long Integer)
67, 68**	CH 1 TS-TR	2	4 (32 bit Long Integer)

Table 5: MODBUS Registers for a 2-Channel Liquid Flowmeter (cont.)

MODBUS Reg #	Description	Scaling (decimal places)	Size in Bytes
69, 70**	CH 1 DELTH	2	4 (32 bit Long Integer)
71, 72*	CH 2 Power	--	4 (IEEE 32 bit Float)
73, 74**	CH 2 +Energy	Register 77	4 (32 bit Long Integer)
75, 76**	CH 2 -Energy	Register 77	4 (32 bit Long Integer)
77	CH 2 # Energy Digits	0	2 (16 bit signed int)
78, 79**	CH 2 TempS	2	4 (32 bit Long Integer)
80, 81**	CH 2 TempR	2	4 (32 bit Long Integer)
82, 83**	CH 2 TS-TR	2	4 (32 bit Long Integer)
84, 85**	CH 2 DELTH	2	4 (32 bit Long Integer)
86, 87*	[5]Slot 1 Input A		4 (IEEE 32 bit Float)
88, 89*	[5]Slot 1 Input B		4 (IEEE 32 bit Float)
90, 91*	Slot 2 Input A		4 (IEEE 32 bit Float)
92, 93*	Slot 2 Input B		4 (IEEE 32 bit Float)
94, 95*	Slot 3 Input A		4 (IEEE 32 bit Float)
96, 97*	Slot 3 Input B		4 (IEEE 32 bit Float)
98, 99*	Slot 4 Input A		4 (IEEE 32 bit Float)
100, 101*	Slot 4 Input B		4 (IEEE 32 bit Float)
102, 103*	Slot 5 Input A		4 (IEEE 32 bit Float)
104, 105*	Slot 5 Input B		4 (IEEE 32 bit Float)
106, 107*	Slot 6 Input A		4 (IEEE 32 bit Float)
108, 109*	Slot 6 Input B		4 (IEEE 32 bit Float)
508	[6]MODBUS baud rate	0	2 (16 bit signed int)
509	[7]MODBUS parity	0	2 (16 bit signed int)
510	[8]MODBUS stop bits	0	2 (16 bit signed int)
511	MODBUS meter addr	0	2 (16 bit signed int)
512	RESERVED	--	--

*The complete floating point value is constructed by combining readings from the first register with a second register. An eight Hex digits number will represent the IEEE-754 hexadecimal floating point value. 32-bit Hexadecimal Representation To Decimal Floating-Point conversion can be performed if needed.

Example: Reg 4 reading is 44d7, Reg 5 reading is 4000, Volumetric is 44d74000, which corresponds to 1722.

**The complete Long integer value is constructed by combining readings from the first register with the second register. Eight Hex digits will represent the Long interger value.

Example: Reg 2 is 0019, Reg 3 is ED30, Hexadecimal Velocity is 0019ED30, which is converted to 1699120 decimal. Taking into account that Velocity has 2 decimal places (from the map), it corresponds to a value of 16991.20.

1.4.2 Notes for a Liquid Flowmeter:

1. **Clear Totalizers:** Write 1 to Reg 1 to clear Channel 1 and Channel 2 totalizers.
2. **Error Value:** see table in DF868 manual for error codes
3. **Average:**
   average of channel 1 and channel 2 if both channels out of error,
   channel 1 value if channel 2 is in error,
   channel 2 value if channel 1 is in error,
   zero if both channels are in error.
4. **Average Error Status:**
   0 = both in error
   1 = chan 2 in error,
   2 = chan 1 in error,
   3 = both ok
5. **MODBUS baud rate:**
   5 = 2400, 6 = 4800, 7 = 9600
6. **MODBUS parity:**
   0 = none, 1 = odd, 2 = even
7. **MODBUS stop bits:**
   1 = 1 stop bit, 2 = 2 stop bits
8. **General:**
   Registers are written if corresponding functions are actuated by the user. Registers for unactuated functions are initialized to zero at startup.
9. **Error Code:**
   Highest number (single or combination of errors) listed, without an “E”. Error codes should be explained in the user’s manual.

Table 6: MODBUS Registers for a Sentinel Flowmeter

MODBUS Reg #	Description	Default	Unit	Refresh	Size in Bytes
1, 2*	Actual Volumetric Flow	0	am^3/hr	1s	4 (IEEE 32 bit Float)
3, 4*	Soundspeed	0	m/s	1s	4 (IEEE 32 bit Float)
5	Measurement Status	0		1s	2 (16 bit Int)
6, 7*	Area Average Velocity	0	m/s	1s	4 (IEEE 32 bit Float)
8, 9*	Normal Volumetirc Flow	0	sm^3/hr	1s	4 (IEEE 32 bit Float)
10, 11, 12, 13**	Actual Volume Forward Total	0	am^3	2s	8 (64 bit double precision)
14, 15, 16, 17**	Actual Volume Reverse Total	0	am^3	2s	8 (64 bit double precision)
18, 19, 20, 21**	Normal Volume Forward Total	0	sm^3	2s	8 (64 bit double precision)
22, 23, 24, 25**	Normal Volume Reverse Total	0	sm^3	2s	8 (64 bit double precision)
26, 27*	Mass Flow	0	kg/hr	2s*	4 (IEEE 32 bit Float)
28, 29*	Forward Mass Total	0	kg	2s*	4 (IEEE 32 bit Float)
30, 31*	Reverse Mass Total	0	kg	2s*	4 (IEEE 32 bit Float)
32, 33*	Energy Flow	0	J/hr	5s*	4 (IEEE 32 bit Float)
34, 35*	Forward Energy Total	0	J	5s*	4 (IEEE 32 bit Float)
36, 37*	Reverse Energy Total	0	J	5s*	4 (IEEE 32 bit Float)
38, 39*	Pressure	10^5	Pa	10s/Fixed	4 (IEEE 32 bit Float)
40, 41*	Temperature	20	C	10s/Fixed	4 (IEEE 32 bit Float)
42	Super Compressibility Factor x 1000	1000		10s/Fixed	2 (16 bit Int)
43	Density x 1000	1000	lb/ft^3	10s/Fixed	2 (16 bit Int)
44	Kinematic Viscosity x 10^8	1000	m^2/s	10s/Fixed*	2 (16 bit Int)
45	Heating Value	25000	kJ/m^3	10s/Fixed*	2 (16 bit Int)
46	Path A Velocity	0	m/s x 1000	10s	2 (16 bit Int)
47	Path A Sound Speed	0	m/s x 10	10s	2 (16 bit Int)
48	Path A % Readings in Error	0		10s	2 (16 bit Int)
49	Path A Last Error	0		10s*	2 (16 bit Int)
50	Path B Velocity	0	m/s x 1000	10s	2 (16 bit Int)
51	Path B Sound Speed	0	m/s x 10	10s	2 (16 bit Int)
52	Path B % Readings in Error	0		10s	2 (16 bit Int)
53	Path B Last Error	0		10s*	2 (16 bit Int)
54	Path C Velocity	0	m/s x 1000	10s	2 (16 bit Int)
55	Path C Sound Speed	0	m/s x 10	10s	2 (16 bit Int)
56	Path C % Readings in Error	0		10s	2 (16 bit Int)
57	Path C Last Error	0		10s*	2 (16 bit Int)
58	Path D Velocity	0	m/s x 1000	10s	2 (16 bit Int)
59	Path D Sound Speed	0	m/s x 10	10s	2 (16 bit Int)
60	Path D % Readings in Error	0		10s	2 (16 bit Int)
61	Path D Last Error	0		10s*	2 (16 bit Int)
62	Path E Velocity	0	m/s x 1000	10s	2 (16 bit Int)
63	Path E Sound Speed	0	m/s x 10	10s	2 (16 bit Int)

Table 6: MODBUS Registers for a Sentinel Flowmeter (cont.)

MODBUS Reg #	Description	Default	Unit	Refresh	Size in Bytes
64	Path E % Readings in Error	0		10s	2 (16 bit Int)
65	Path E Last Error	0		10s*	2 (16 bit Int)
66	Path F Velocity	0	m/s x 1000	10s	2 (16 bit Int)
67	Path F Sound Speed	0	m/s x 10	10s	2 (16 bit Int)
68	Path F % Readings in Error	0		10s	2 (16 bit Int)
69	Path F Last Error	0		10s*	2 (16 bit Int)
70	Internal Update Rate	10	Hz	On Init.	2 (16 bit Int)
71	Sound Speed Low Limit	300	m/s	On Init.	2 (16 bit Int)
72	Sound Speed High Limit	500	m/s	On Init.	2 (16 bit Int)
73	Velocity High Limit	40	m/s	On Init.	2 (16 bit Int)
74	Velocity Low Limit	–40	m/s	On Init.	2 (16 bit Int)
75	Signal Strength High Limit	100	dB	On Init.	2 (16 bit Int)
76	Signal Strength Low Limit	20	dB	On Init.	2 (16 bit Int)
77	Amplitude High Limit	95		On Init.	2 (16 bit Int)
78	Amplitude Low Limit	35		On Init.	2 (16 bit Int)
79	Number in Average	32		On Init.	2 (16 bit Int)
80	Software Version	(2 ASCII)		On Init.	2 (16 bit Int)
81	Checksum			On Init.	2 (16 bit Int)
82	Number of Paths	4		On Init.	2 (16 bit Int)
83	Modbus Address	32		On Init.	2 (16 bit Int)

*The complete floating point value is constructed by combining readings from the first register with a second register. An eight Hex digits number will represent the IEEE-754 hexadecimal floating point value. 32-bit Hexadecimal Representation To Decimal Floating-Point conversion can be performed if needed.

Example: Reg 1 reading is 44d7, Reg 2 reading is 4000, Actual Volumetric Flow is 44d74000, which corresponds to 1722.

**The complete double precision floating point value is constructed by combining readings from all four registers according to IEEE-754 for double precision.

1.4.3 Notes for a Sentinel Flowmeter

The **Sentinel Flowmeter**, when equipped with the optional Modbus output card, can transmit flow data and diagnostic information to a flow computer or SCADA, serially, using a Gould-type RTU protocol. For security and audit-trail purposes, the unit must be programmed through the PanaView interface. This means that only the Modbus function command 3 (read multiple registers), is valid.

Communication parameters: 9600, n, 8, 1

The format for the data exchange is as follows:

- The ***send*** command (initiated by host flow computer or controller) is of the form:

<time delimiter> <Addr> <3> <First Register MSB>
<First Register LSB> <Register Count MSB>
<Register Count LSB> <CRC Low> <CRC High> <time delimiter>

- The ***response*** (initiated by host flow computer or controller) is of the form:

[time delimiter] <Addr> <3> <Byte count> < Data …… >
<CRC Low> <CRC High> <time delimiter>

Table 6 on page 14 is the data map for the **IGM878** and **Sentinel**. The refresh rate indicates how often the central controller updates the memory map, available using the ModBus port. The most time-critical information is stored at the top of the register. This limits how deep the user has to go into the resister stack to gather the real-time information. All values are IEEE format MSB first (big-endian).

The **Sentinel LCT** and **Sentinel LNG** support digital communications using the MODBUS/RTU protocol, with 2-wire RS-485 or 3-wire RS-232C as the physical layer. Data rate can be specified from 4800 to 19,200 bits per second (bps), with selectable parity.

Note: *Regarding meter status, each bit field indicates the error number from LSB corresponding to E1, and from MSB corresponding to E32.*

Note: *Writing any non-zero value will clear the totals (unless they are locked using TOT LOCK/KEY LOCK switches on the front panel - per MID requirements).*

Note: *Writing to COMP will clear all channels.*

Note: Modbus Registers for the **Sentinel LCT** or **Sentinel LNG** Flowmeter, *Table 7 on page 17, has some fields with a grey background. These are currently not supported and will return a value of –1.0.*

Table 7: Modbus Registers for the Sentinel LCT or Sentinel LNG Flowmeter

Category	Measurement	Type	Size Format	Composite Register Address	Channel 1 Register Address	Channel 2 Register Address	Channel 3 Register Address	Channel 4 Register Address
Primary Measurand	Velocity	F	2 LSW float	1 0x0000	1025 0x0400	2049 0x0800	3073 0x0C00	4097 0x1000
	Volumetric	F	2 LSW float	3 0x0002	1027 0x0402	2051 0x0802	3075 0x0C02	4099 0x1002
	Std Volumetric	F	2 LSW float	5 0x0004	1029 0x0404	2053 0x0804	3077 0x0C04	4101 0x1004
	Mass Flow	F	2 LSW float	7 0x0006	1031 0x0406	2055 0x0806	3079 0x0C06	4103 0x1006
	Energy Rate	F	2 LSW float	9 0x0008	1033 0x0408	2057 0x0808	3081 0x0C08	4105 0x1008
Transit Time	Soundspeed	F	2 LSW float	11 0x000A	1035 0x040A	2059 0x080A	3083 0x0C0A	4107 0x100A
	Up Transit	F	2 LSW float	13 0x000C	1037 0x040C	2061 0x080C	3085 0x0C0C	4109 0x100C
	Dn Transit	F	2 LSW float	15 0x000E	1039 0x040E	2063 0x080E	3087 0x0C0E	4111 0x100E
	DeltaT	F	2 LSW float	17 0x0010	1041 0x0410	2065 0x0810	3089 0x0C10	4113 0x1010
Receiver Diagnostics	UP Sig Strength	F	2 LSW float	19 0x0012	1043 0x0412	2067 0x0812	3091 0x0C12	4115 0x1012
	DN Sig Strength	F	2 LSW float	21 0x0014	1045 0x0414	2069 0x0814	3093 0x0C14	4117 0x1014
	Gain Up[dB]	F	2 LSW float	23 0x0016	1047 0x0416	2071 0x0816	3095 0x0C16	4119 0x1016
	Gain Dn[dB]	F	2 LSW float	25 0x0018	1049 0x0418	2073 0x0818	3097 0x0C18	4121 0x1018
	UP DAC	U	2 Unsigned integer	27 0x001A	1051 0x041A	2075 0x081A	3099 0x0C1A	4123 0x101A
	DN DAC	U	2 Unsigned integer	29 0x001C	1053 0x041C	2077 0x081C	3101 0x0C1C	4125 0x101C
	UP Amp Discrim	F	2 LSW float	31 0x001E	1055 0x041E	2079 0x081E	3103 0x0C1E	4127 0x101E
	DN Amp Discrim	F	2 LSW float	33 0x0020	1057 0x0420	2081 0x0820	3105 0x0C20	4129 0x1020
Signal Processing Diagnostics	PEAK%	F	2 LSW float	35 0x0022	1059 0x0422	2083 0x0822	3107 0x0C22	4131 0x1022
	UP Signal Q	F	2 LSW float	37 0x0024	1061 0x0424	2085 0x0824	3109 0x0C24	4133 0x1024
	DN Signal Q	F	2 LSW float	39 0x0026	1063 0x0426	2087 0x0826	3111 0x0C26	4135 0x1026
	UP +– Peak	F	2 LSW float	41 0x0028	1065 0x0428	2089 0x0828	3113 0x0C28	4137 0x1028
	DN +– Peak	F	2 LSW float	43 0x002A	1067 0x042A	2091 0x082A	3115 0x0C2A	4139 0x102A
	UP Norm Factor	F	2 LSW float	45 0x002C	1069 0x042C	2093 0x082C	3117 0x0C2C	4141 0x102C
	DN Norm Factor	F	2 LSW float	47 0x002E	1071 0x042E	2095 0x082E	3119 0x0C2E	4143 0x102E
	Theta 3	F	2 LSW float	49 0x0030	1073 0x0430	2097 0x0830	3121 0x0C30	4145 0x1030
	CEE1	F	2 LSW float	51 0x0032	1075 0x0432	2099 0x0832	3123 0x0C32	4147 0x1032
Correction Factors	Reynolds #	F	2 LSW float	53 0x0034	1077 0x0434	2101 0x0834	3125 0x0C34	4149 0x1034
	K(RE)	F	2 LSW float	55 0x0036	1079 0x0436	2103 0x0836	3127 0x0C36	4151 0x1036
	CTL[1]	F	2 LSW float	57 0x0038	1081 0x0438	2105 0x0838	3129 0x0C38	4153 0x1038
	CPL[2]	F	2 LSW float	59 0x003A	1083 0x043A	2107 0x083A	3131 0x0C3A	4155 0x103A
	CTPL[3]	F	2 LSW float	61 0x003C	1085 0x043C	2109 0x083C	3133 0x0C3C	4157 0x103C

[1]Correction factor for the effect of Temperature on the Liquid.

[2]Correction factor for the effect of Pressure on the Liquid.

[3]Correction factor for the effects of Temperature and Pressure on the Liquid, a.k.a. “full VCF,” is product of CTL and CPL.

Table 7: Modbus Registers for the Sentinel LCT or Sentinel LNG Flowmeter

Category	Measurement	Type	Size Format	Composite Register Address	Channel 1 Register Address	Channel 2 Register Address	Channel 3 Register Address	Channel 4 Register Address
Temperature Inputs	Supply Temp	F	2 LSW float	63 0x003E	1087 0x043E	2111 0x083E	3135 0x0C3E	4159 0x103E
	Return Temp	F	2 LSW float	65 0x0040	1089 0x0440	2113 0x0840	3137 0x0C40	4161 0x1040
	Supply-Rtn	F	2 LSW float	67 0x0042	1091 0x0442	2115 0x0842	3139 0x0C42	4163 0x1042
	Supply Dens	F	2 LSW float	69 0x0044	1093 0x0444	2117 0x0844	3141 0x0C44	4165 0x1044
	Return Dens	F	2 LSW float	71 0x0046	1095 0x0446	2119 0x0846	3143 0x0C46	4167 0x1046
	Delta h	F	2 LSW float	73 0x0048	1097 0x0448	2121 0x0848	3145 0x0C48	4169 0x1048
Pressure Inputs	Pressure Input	F	2 LSW float	75 0x004A	1099 0x044E	2123 0x084A	3147 0x0C4A	4171 0x104A
Special Inputs	Special Input 1	F	2 LSW float	77 0x004C	1101 0x044C	2125 0x084C	3149 0x0C4C	4173 0x104C
	Special Input 2	F	2 LSW float	79 0x004E	1103 0x044E	2127 0x084E	3151 0x0C4E	4175 0x104E
	Special Input 3	F	2 LSW float	81 0x0050	1105 0x0450	2129 0x0850	3153 0x0C50	4177 0x1050
	Special Input 4	F	2 LSW float	83 0x0052	1107 0x0452	2131 0x0852	3155 0x0C52	4179 0x1052
Flow Totals	FWD Total	D	4 LSW double	129 0x0080	1153 0X0480	2177 0X0880	3201 0X0C80	4225 0X1080
	REV Total	D	4 LSW double	133 0x0084	1157 0X0484	2181 0X0884	3205 0X0C84	4229 0X1084
	FWD Mass	D	4 LSW double	137 0x0088	1161 0X0488	2185 0X0888	3209 0X0C88	4233 0X1088
	REV Mass	D	4 LSW double	141 0x008C	1165 0X048C	2189 0X088C	3213 0X0C8C	4237 0X108C
	FWD Energy	D	4 LSW double	145 0x0090	1169 0X0490	2193 0X0890	3217 0X0C90	4241 0X1090
	REV Energy	D	4 LSW double	149 0x0094	1173 0X0494	2197 0X0894	3221 0X0C94	4245 0X1094
	Totl. Time	D	4 LSW double	153 0x0098	1177 0X0498	2201 0X0898	3225 0X0C98	4249 0X1098
	STD FWD Total	D	4 LSW double	157 0x009C	1181 0X049C	2205 0X089C	3229 0X0C9C	4253 0X109C
	STD REV Total	D	4 LSW double	161 0x00A0	1185 0X04A0	2209 0X08A0	3233 0X0CA0	4257 0X10A0
	STD Totl. Time	D	4 LSW double	165 0x00A4	1189 0X04A4	2213 0X08A4	3237 0X0CA4	4261 0X10A4
Flow Totals (scientific notation)	FWD Total Register 0	L	2 LSW float	257 0x0100	1281 0X0500	2305 0X0900	3329 0X0D00	4353 0X1100
	FWD Total Register 1	L	2 LSW float	259 0x0102	1283 0X0502	2307 0X0902	3331 0X0D02	4355 0X1102
	FWD Total Register 2	L	2 LSW float	261 0x0104	1285 0X0504	2309 0X0904	3333 0X0D04	4357 0X1104
	REV Total Register 0	L	2 LSW float	263 0x0106	1287 0X0506	2311 0X0906	3335 0X0D06	4359 0X1106
	REV Total Register 1	L	2 LSW float	265 0x0108	1289 0X0508	2313 0X0908	3337 0X0D08	4361 0X1108
	REV Total Register 2	L	2 LSW float	267 0x010A	1291 0X050A	2315 0X090A	3339 0X0D0A	4363 0X110A
	FWD Mass Register 0	L	2 LSW float	269 0x010C	1293 0X050C	2317 0X090C	3341 0X0D0C	4365 0X110C
	FWD Mass Register 1	L	2 LSW float	271 0x010E	1295 0X050E	2319 0X090E	3343 0X0D0E	4367 0X110E

Table 7: Modbus Registers for the Sentinel LCT or Sentinel LNG Flowmeter

Category	Measurement	Type	Size Format	Composite Register Address	Channel 1 Register Address	Channel 2 Register Address	Channel 3 Register Address	Channel 4 Register Address
Flow Totals (scientific notation)	FWD Mass Register 2	L	2 LSW float	273 0x0110	1297 0X0510	2321 0X0910	3345 0X0D10	4369 0X1110
	REV Mass Register 0	L	2 LSW float	275 0x0112	1299 0x0512	2323 0x0912	3347 0x0D12	4371 0X1112
	REV Mass Register 1	L	2 LSW float	277 0x0114	1301 0x0514	2325 0x0914	3349 0x0D14	4373 0X1114
	REV Mass Register 2	L	2 LSW float	279 0x0116	1303 0x0516	2327 0x0916	3351 0x0D16	4375 0X1116
	FWD Energy Register 0	L	2 LSW float	281 0x0118	1305 0x0518	2329 0x0918	3353 0x0D18	4377 0X1118
	FWD Energy Register 1	L	2 LSW float	283 0x011A	1307 0x051A	2331 0x091A	3355 0x0D1A	4379 0X111A
	FWD Energy Register 2	L	2 LSW float	285 0x011C	1309 0x051C	2333 0x091C	3357 0x0D1C	4381 0X111C
	REV Energy Register 0	L	2 LSW float	287 0x011E	1311 0x051E	2335 0x091E	3359 0x0D1E	4383 0X111E
	REV Energy Register 1	L	2 LSW float	289 0x0120	1313 0x0520	2337 0x0920	3361 0x0D20	4385 0X1120
	REV Energy Register 2	L	2 LSW float	291 0x0122	1315 0x0522	2339 0x0922	3363 0x0D22	4387 0X1122
	Totl. Time days[4]	L	2 LSW float	293 0x0124	1317 0x0524	2341 0x0924	3365 0x0D24	4389 0X1124
	Totl. Time seconds	L	2 LSW float	295 0x0126	1319 0x0526	2343 0x0926	3367 0x0D26	4391 0X1126
	STD FWD Total Register 0	L	2 LSW float	297 0x0128	1321 0x0528	2345 0x0928	3369 0x0D28	4393 0X1128
	STD FWD Total Register 1	L	2 LSW float	299 0x012A	1323 0x052A	2347 0x092A	3371 0x0D2A	4395 0X112A
	STD FWD Total Register 2	L	2 LSW float	301 0x012C	1325 0x052C	2349 0x092C	3373 0x0D2C	4397 0X112C
	STD REV Total Register 0	L	2 LSW float	303 0x012E	1327 0x052E	2351 0x092E	3375 0x0D2E	4399 0X112E
	STD REV Total Register 1	L	2 LSW float	305 0x0130	1329 0x0530	2353 0x0930	3377 0x0D30	4401 0X1130
	STD REV Total Register 2	L	2 LSW float	307 0x0132	1331 0x0532	2355 0x0932	3379 0x0D32	4403 0X1132
	Std Totl. Time days[4]	L	2 LSW double	309 0x0134	1333 0x0534	2357 0x0934	3381 0x0D34	4405 0X1134
	Std Totl. Time seconds	L	2 LSW double	311 0x0136	1335 0x0536	2359 0x0936	3383 0x0D36	4407 0X1136

[4] 1 day = 86,400 seconds

Table 7: Modbus Registers for the Sentinel LCT or Sentinel LNG Flowmeter

Category	Measurement	Type	Size Format	Composite Register Address	Channel 1 Register Address	Channel 2 Register Address	Channel 3 Register Address	Channel 4 Register Address
Meter Status	Error Code[5]	B	2 LSW unsigned long integer	385 0x0180	1409 0x0580	2433 0x0980	3457 0x0D80	4481 0x1180
Meter Control	Reset Totals[6]	I	1 Unsigned integer	513 0x0200	1537 0x0600	2561 0x0A00	3585 0x0E00	4609 0x1200
	Reset Batch Total	I	1 Unsigned integer	514 0x0201	1538 0x0601	2562 0x0A01	3586 0x0E01	4610 0x1201
	Error Code[7]	I	1 Unsigned integer	515 0x0202	1539 0x0602	2563 0x0A02	3587 0x0E02	4611 0x1202
Comm Settings	Word Order	I	1 Unsigned integer	5121 0x1400				
	Baud Rate	I	1 Unsigned integer	5122 0x1401				
	Parity	I	1 Unsigned integer	5123 0x1402				
	Stop Bits	I	1 Unsigned integer	5124 0x1403				
	Meter Address	I	1 Unsigned integer	5125 0x1404				
	All Ones	I	1 Unsigned integer	5126 0x1405				

[5]Each of the 32 bits represents an error type.

[6]Writing any non-zero value will clear totals (unless locked per MID requirements).

[7]Represented as integer value (i.e. E1, E2, E3, etc.)

Table 8: Data Type/Symbol for the Sentinel LCT or Sentinel LNG Flowmeter

Symbol	Numeric Type	Size Register Sequence				Comments*
		1	2	3	4	
I	Integer	1W				Single, signed 16-bit word
L	Long integer	2LSW	MSW			32-bit signed integer may be listed as double word on some types of programmable logic controller (PLC).
U	Unsigned long integer	2LSW	MSW			32-bit signed unsigned integer may be listed as double word on some types of programmable logic controller (PLC).
F	Floating point	2LSW	MSW			Single-precision floating point number specified in IEEE Standard for Binary Floating-Point Arithmetic (ANSI/IEEE Std 754-1985), also known as IEC 60559:1989, Binary floating-point arithmetic for microprocessor systems.
D	Double-precision floating point	4LSW	W	W	MSW	Double-precision IEEE 754 floating point number is not supported by many PLCs.
B	Bit field	2LSW	MSW			32-bit bit field where each field represents a particular status (i.e. 0=off/inactive and 1=on/active)"

*For data stored in multiple 16-bit registers, the Least Significant Word is usually transmitted first. The sequence can be inverted, i.e.: the Most Significant Word is sent first and the LSW last, by toggling a global meter setting. Within each two-byte register, the most significant byte must always be sent first.

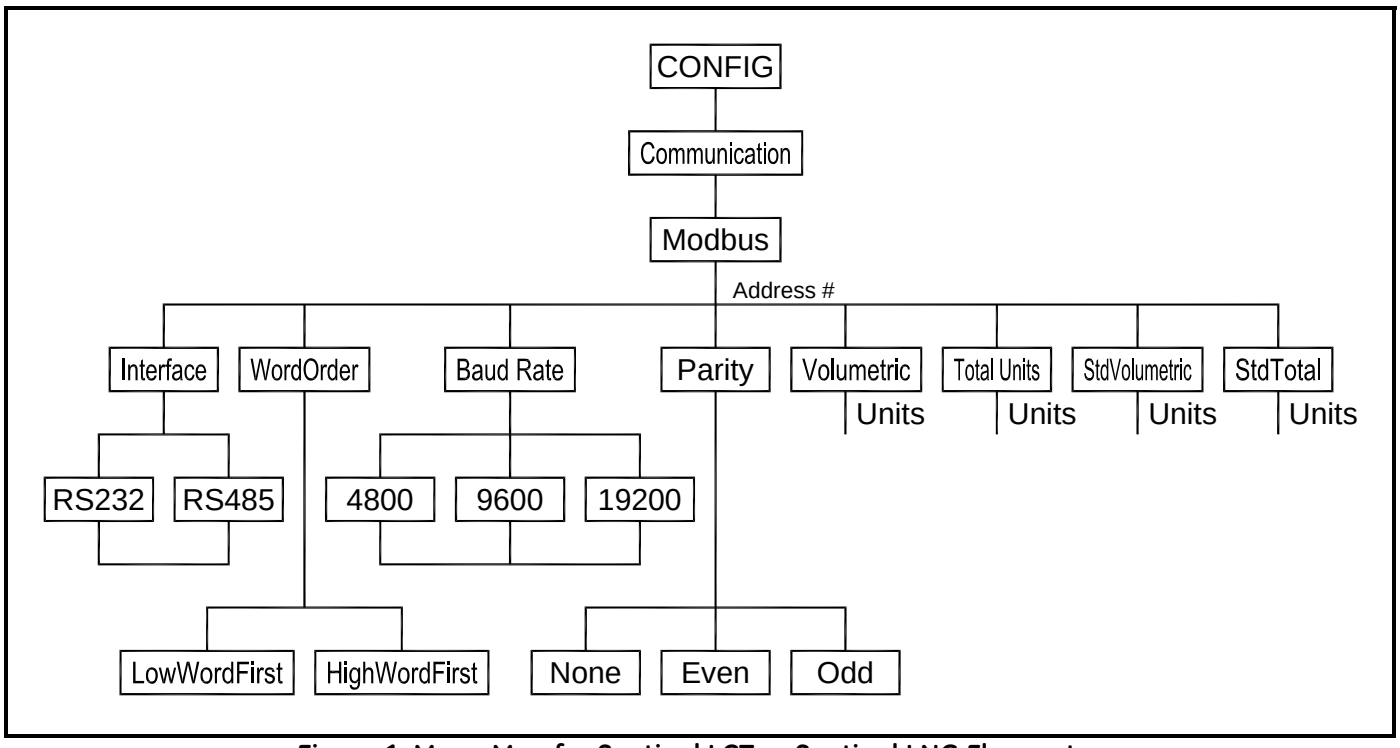


Figure 1: Menu Map for Sentinel LCT or Sentinel LNG Flowmeter

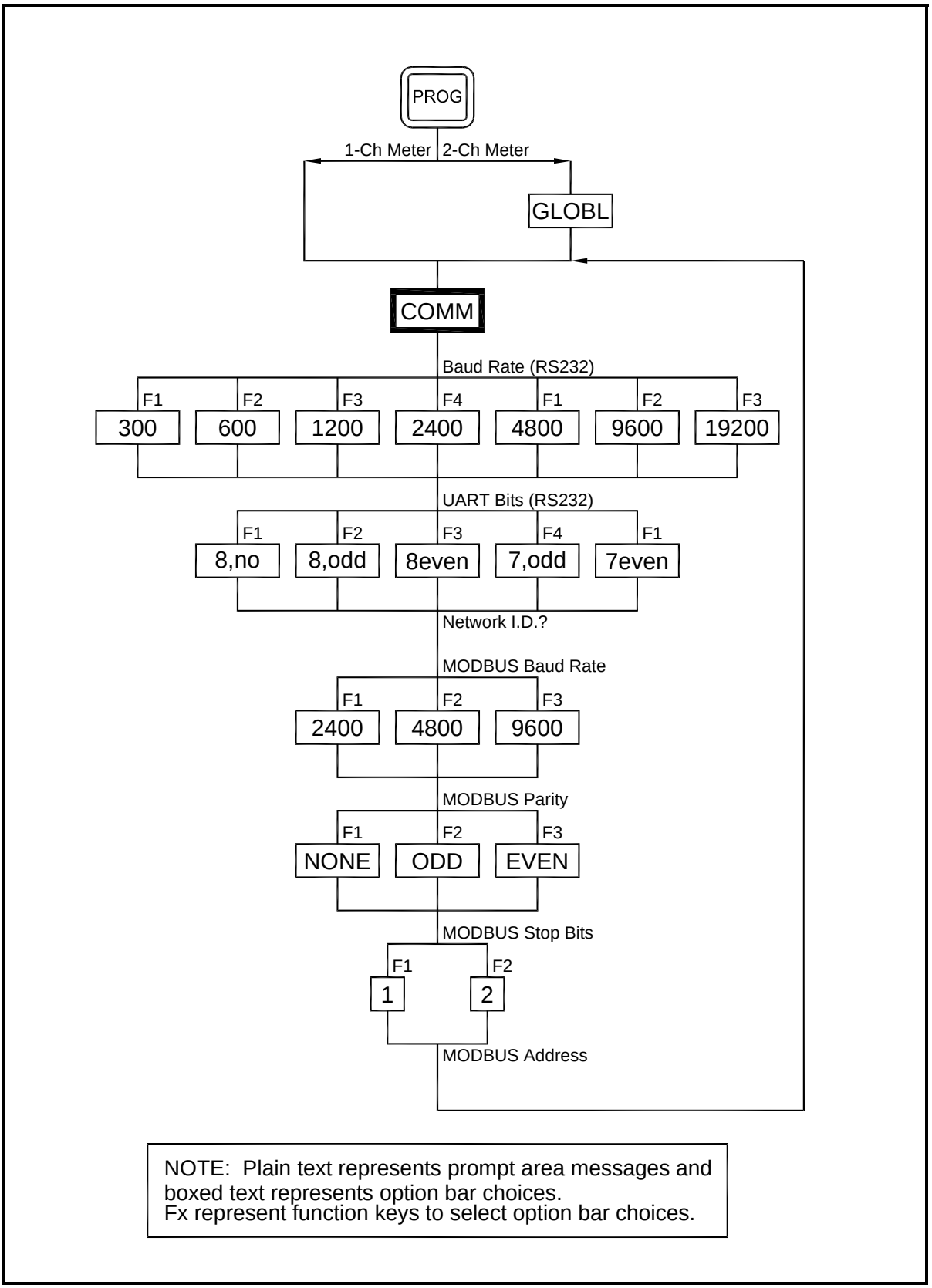


Figure 2: MODBUS Menu Map for 868 Meters

1.5 Swapping the Floating Point

To represent a correct floating point value, you may need to swap the reading from two registers. Some applications allow you to swap the registers. Some do not.

When using the Modscan32 utility in order to monitor register values, you need to select **03: HOLDING REGISTER** (see Figure 3), select the corresponding communications parameters in the menu item **Connection-Connect**, and hit **OK** to make a connection.

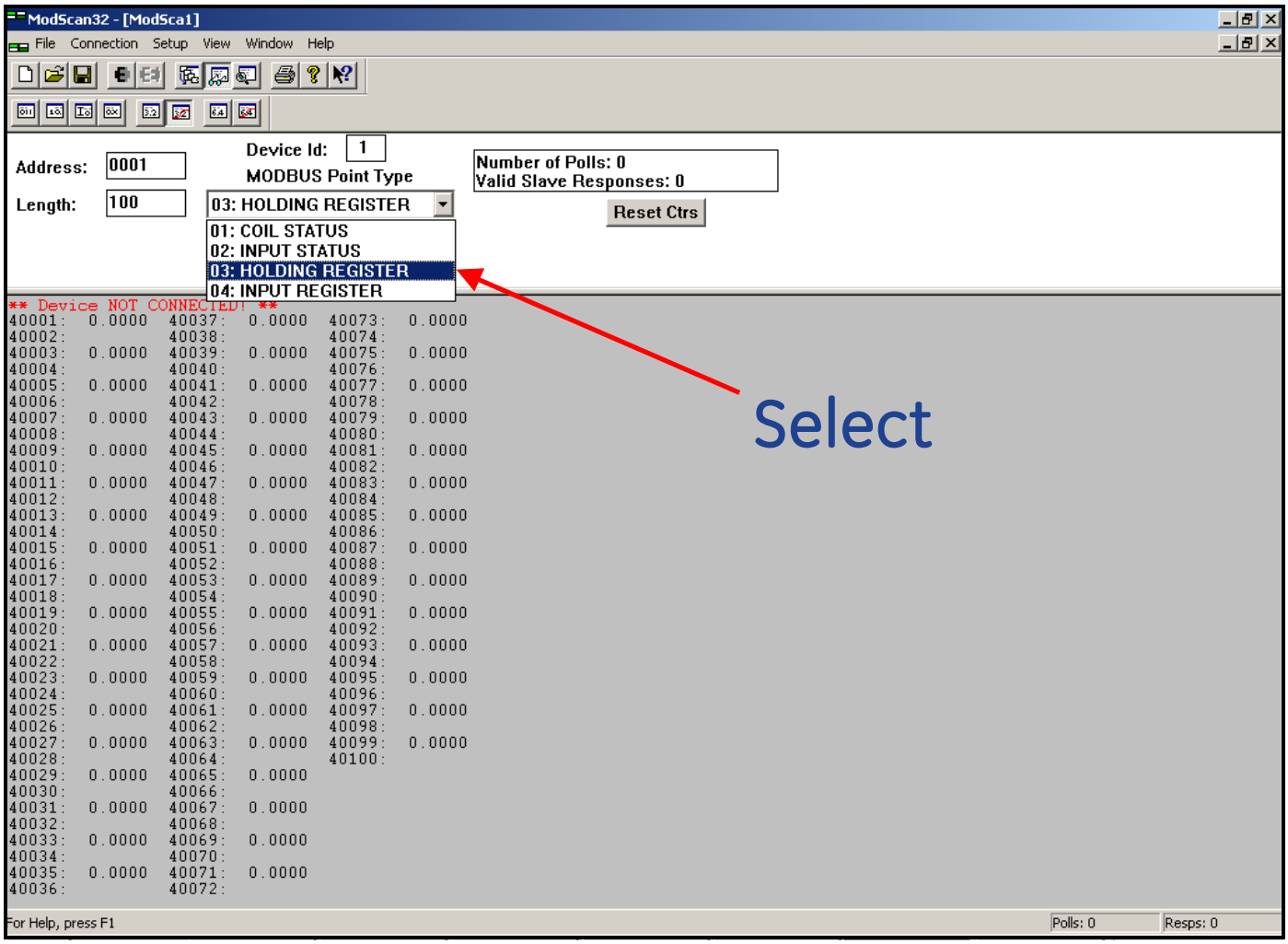


Figure 3: Selecting the Holding Register

1.5 Swapping the Floating Point (cont.)

To see all the register readings in Hexadecimal form, select **Menu-Setup-Display Options-Hex** (see Figure 4).

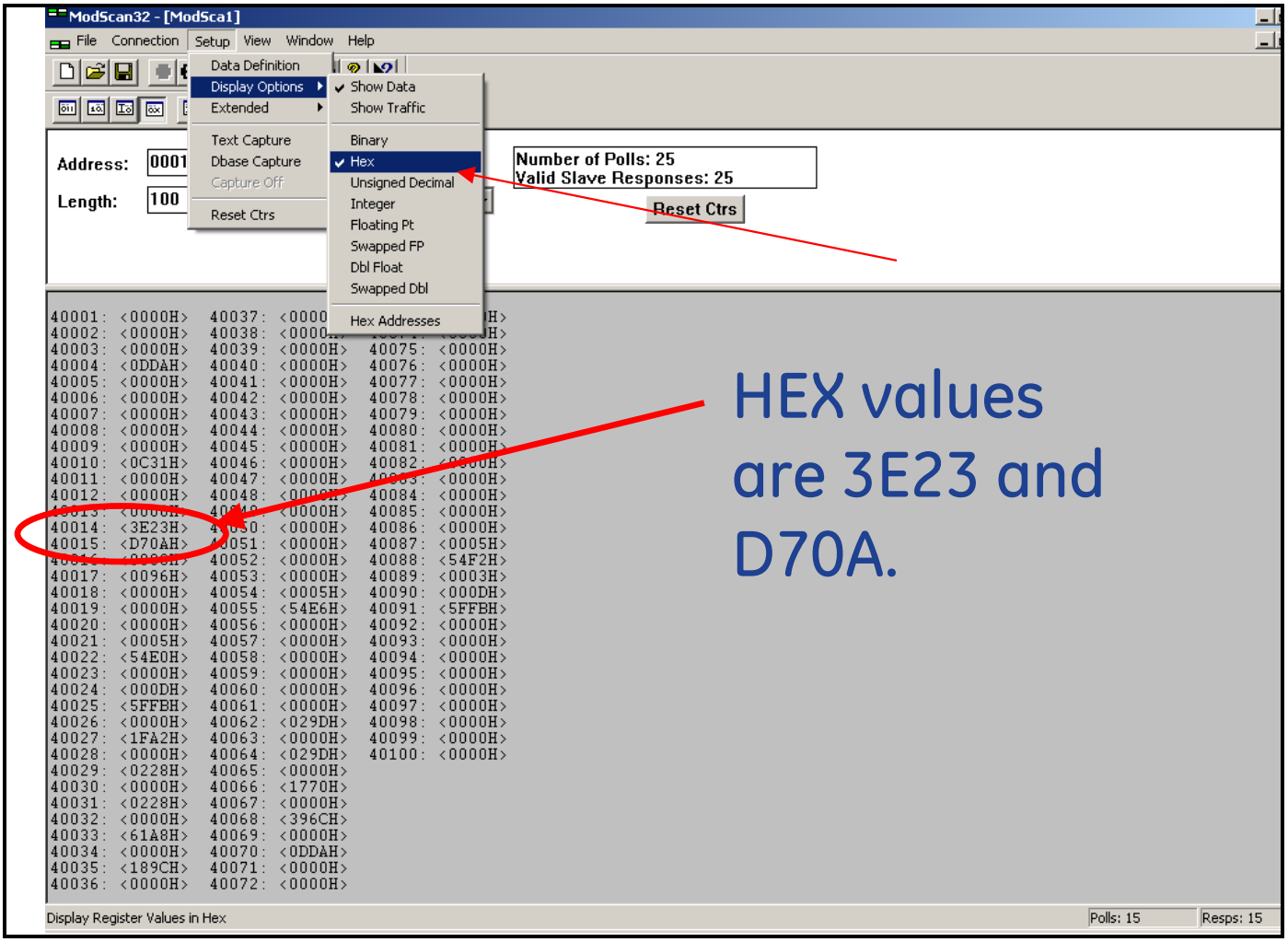


Figure 4: Finding the Hex Values

1.5 Swapping Floating Point (cont.)

To monitor the floating point variable, enter the first register of the variable in the Address (see Figure 5), and set the Length to "**2**".

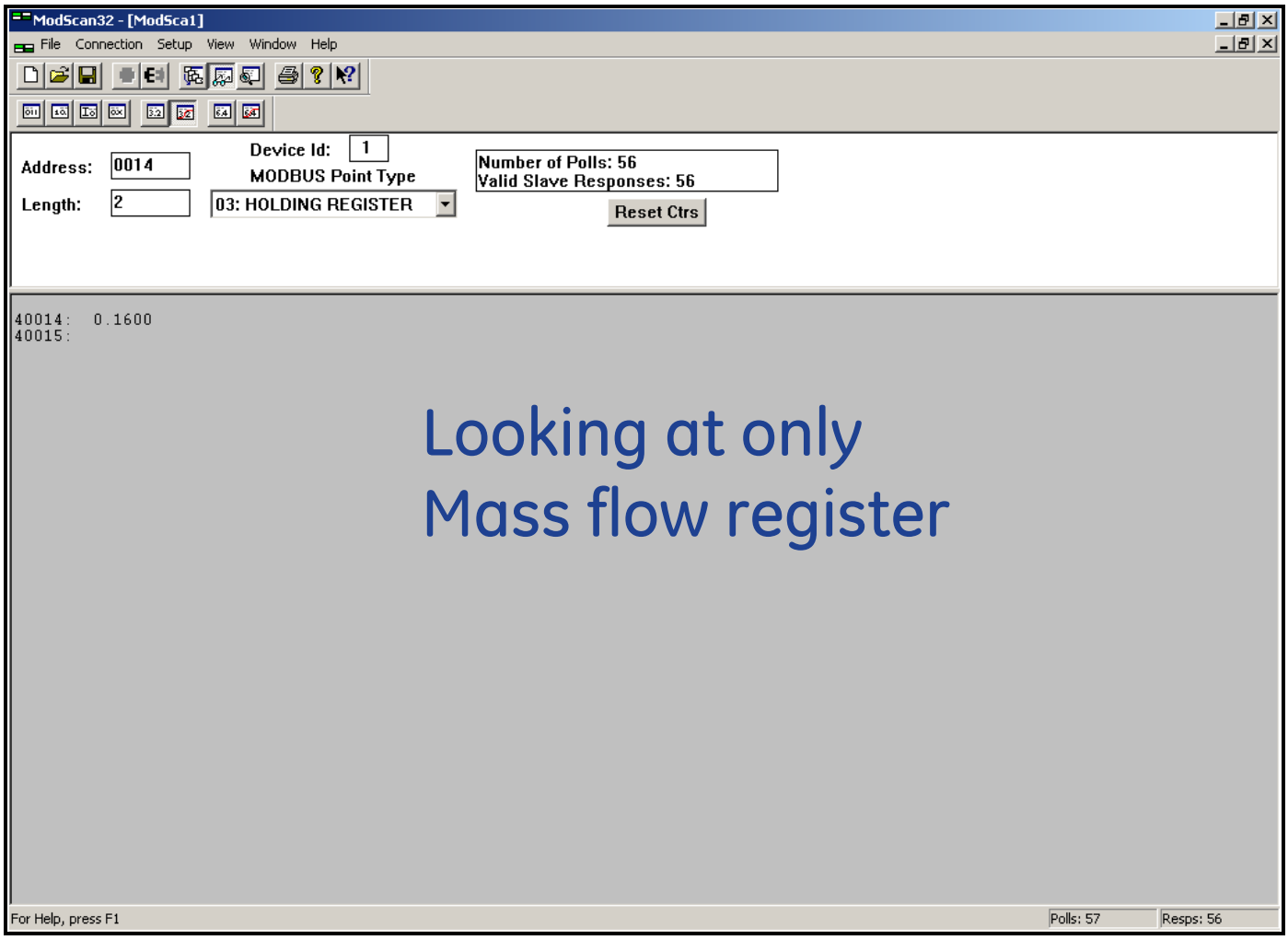


Figure 5: The Mass Flow Register

1.5 Swapping the Floating Point (cont.)

Then select **Menu-Setup-Display Options-Swapped FP** (see Figure 6). Modscan32 will swap the register and display the floating point variable correctly.

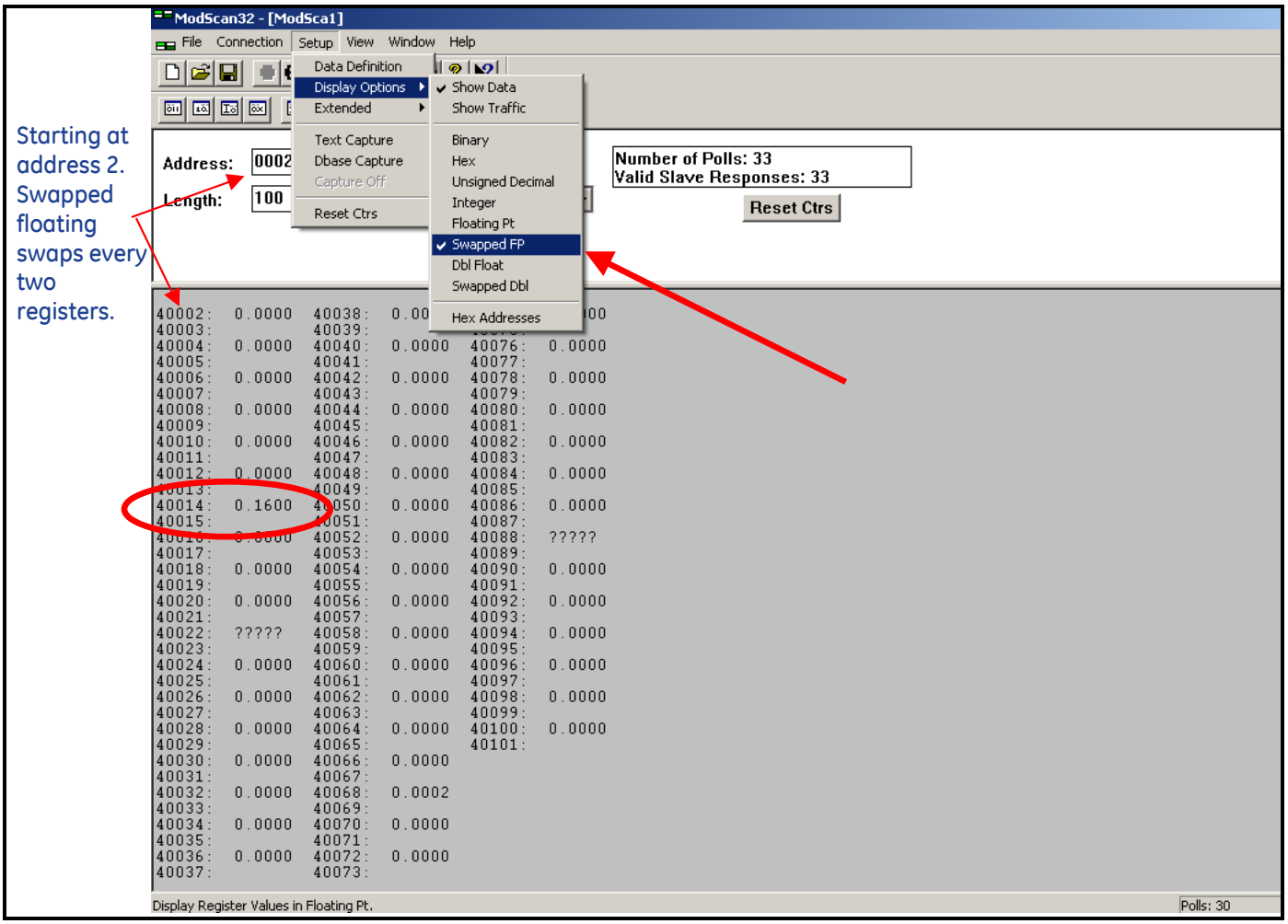


Figure 6: Swapped Floating Point

1.5 Swapping the Floating Point (cont.)

Web utilities can also be used to convert hexadecimal register readings into floating point values (see Figure 7).

Note: *How to construct an 8-digit hexadecimal value from two registers is explained at the bottom of the* Modbus Register *tables, Table 2 on page 5 for 1-Channel flowmeters and Table 3 on page 6 for 2-Channel flowmeters.*

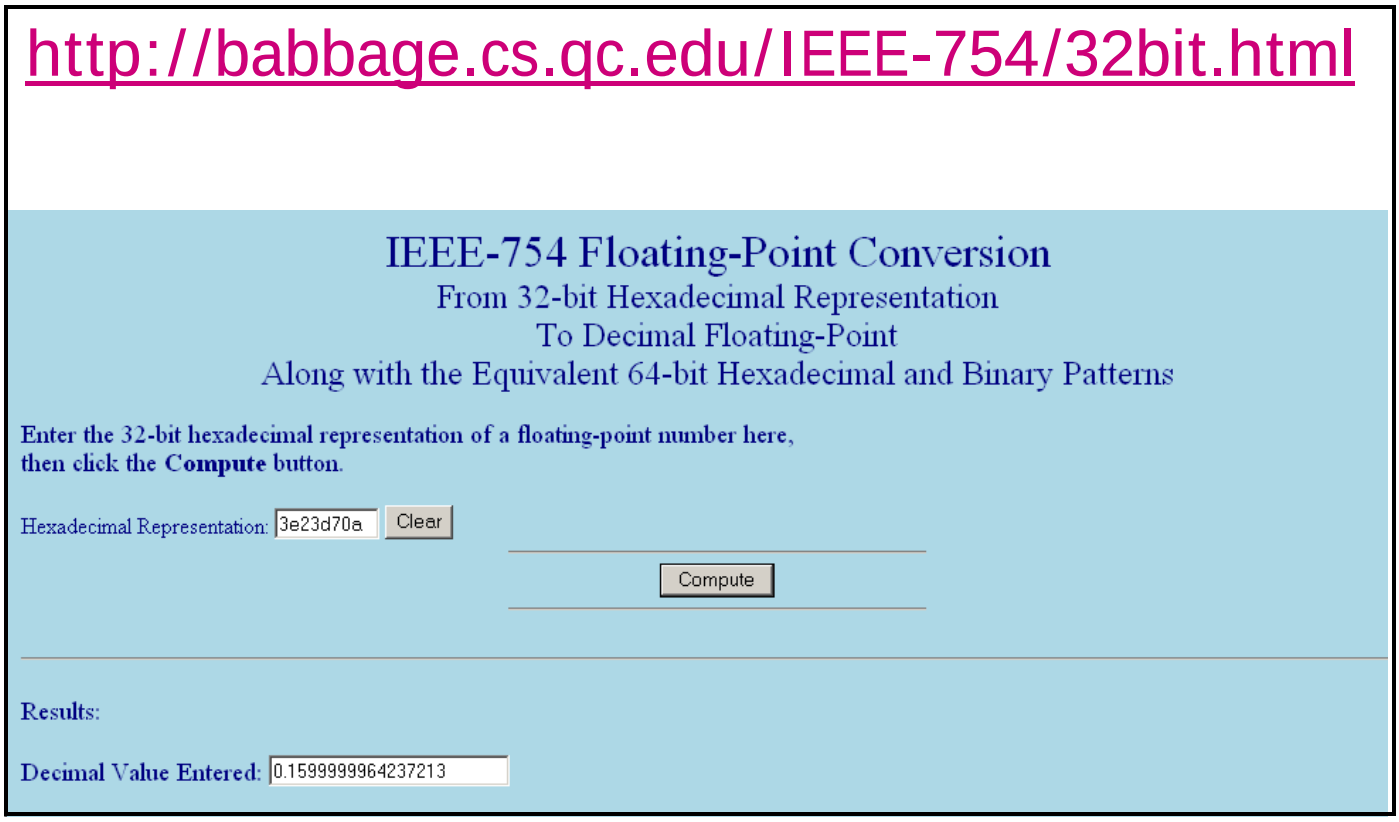


Figure 7: Converting Hexadecimal Register Readings into Floating Point Values

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Chapter 2. Modbus Over Ethernet Communications 1

IMPORTANT: *These setup instructions apply only when using option card* 703-1476-05, rev. A, *or option card* 703-1477-03, rev. C *and* lower.

2.1 Introduction

This document provides instructions for setting up a flowmeter equipped with *Modbus Over Ethernet* (Modbus/TCP) communications. To apply these procedures, the flowmeter must have the option card installed. The option card, based on the features that were ordered, will have many components. (See the examples in Figure 8 and Figure 9).

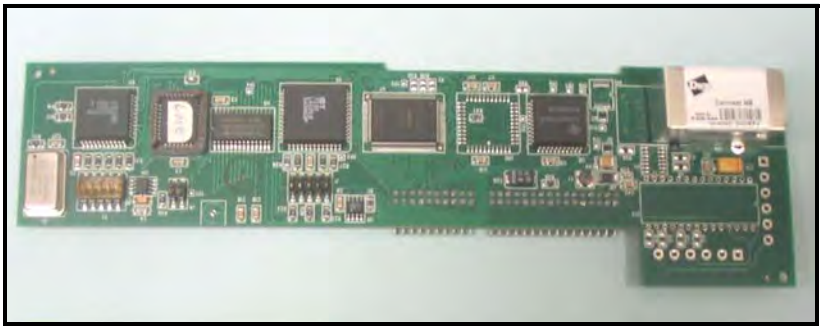

Figure 8: DF/GX Ethernet Option Card

Figure 9: XMT Ethernet Option Card

Note: *To install an option card, consult the user's manual(s) which apply to your instrument.*

2.2 Setup

The default IP address in setting up the Ethernet option card is Dynamic (DHCP). If it has to be changed to a static IP address, the instrument must first be connected to the DHCP network.

Note: *The following are setup procedure examples.*

2.2.1 Finding the Assigned IP Address

Example:
Find the IP address of a module with Media Access Control (MAC) address 00409d25da0b.

1. Open a DOS command prompt. Go to the directory containing the executable *ruiping.exe.*
2. Type `ruiping -e` and hit **Enter**.

Note: *Once the module containing the MAC address has been found, it will be displayed along with the assigned IP address (see Figure 10). In this example the assigned address is 3.112.161.79.*

3. Stop the process by hitting the **Esc** key.

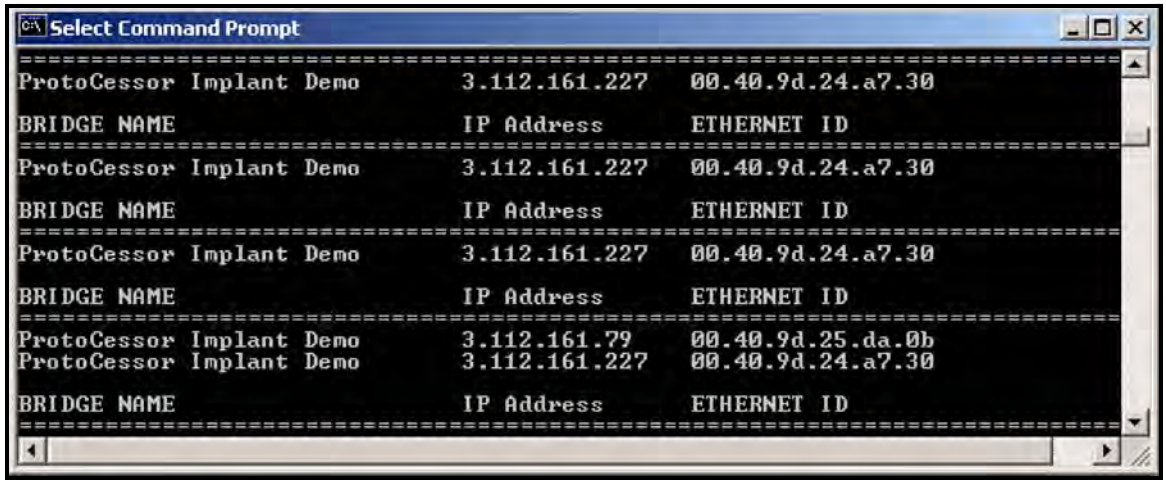

Figure 10: Finding the Assigned IP Address

2.2.2 Changing the Password

Example:
Change the Password for the module with IP address 3.112.161.79 (see Figure 11).

1. Open a DOS command prompt.
2. Type `telnet 3.112.161.79 10000` and hit **Enter**.
3. Enter the current Login and Password. The factory defaults are *root* and *Netsilicon*.

Note: *The Login and Password are case sensitive.*

4. Enter Selection number 2.
5. Enter the current Password and the new Password when prompted.

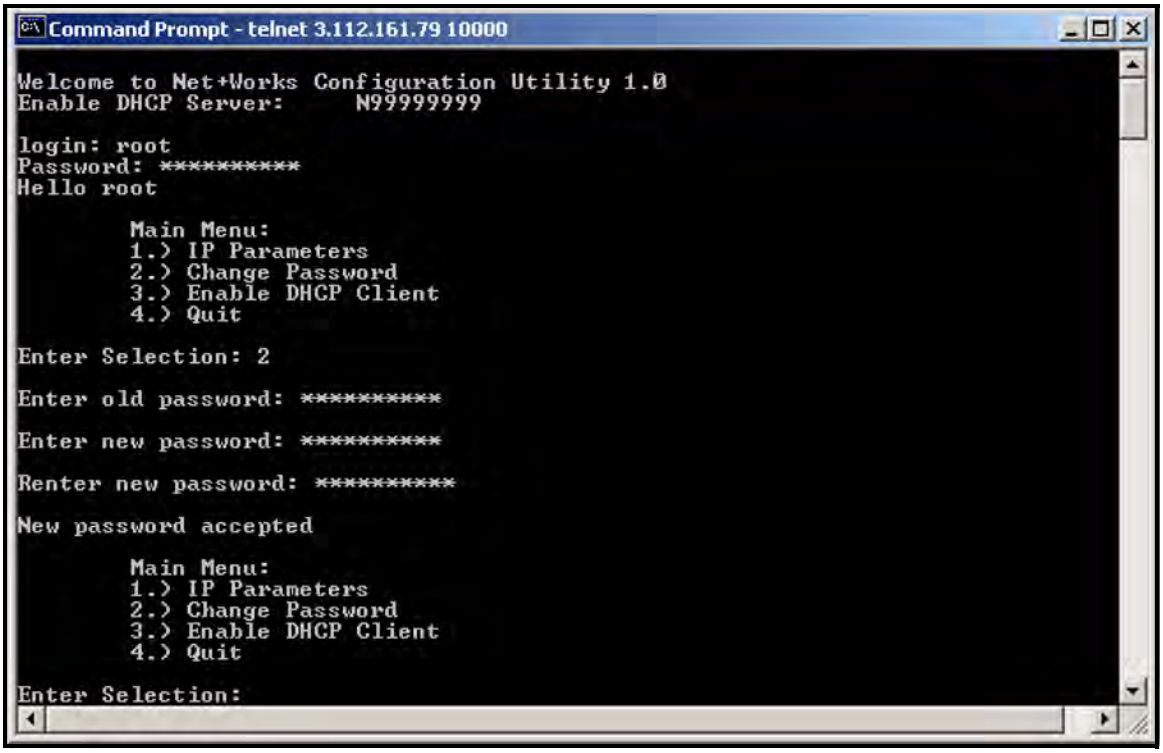

Figure 11: Changing the Password

2.2.3 Changing IP Parameters

Example:
Change the DHCP-assigned IP address to static address 192.168.2.225 and disable DHCP for the module with IP-assigned address 3.112.161.79 (see Figure 12 on page 27 and Figure 13 on page 28).

1. Open a DOS command prompt.

2. Type `telnet 3.112.161.79 10000` and hit **Enter**.

3. Enter the current Login and Password.

Note: *The Login and Password are case sensitive.*

4. From the Main Menu select *1. IP Parameters*.

5. From the IP Parameters menu select *1. IP Address*.

6. Enter the new static IP address `192.168.2.225`.

Note: *If necessary, change the Subnet Main and a default Gateway by entering 2 and 3 in the IP parameters menu.*

7. Select 4 to return to the Main Menu.

8. From the Main Menu select 3. *Enable DHCP Client.*

9. Enter 2 to disable the DHCP. Once the update has taken place, the new IP address will be shown.

10. Select 4. *Main Menu* and Quit.

11. Cycle the power on the unit.

2.2.3 Changing IP Parameters (cont.)

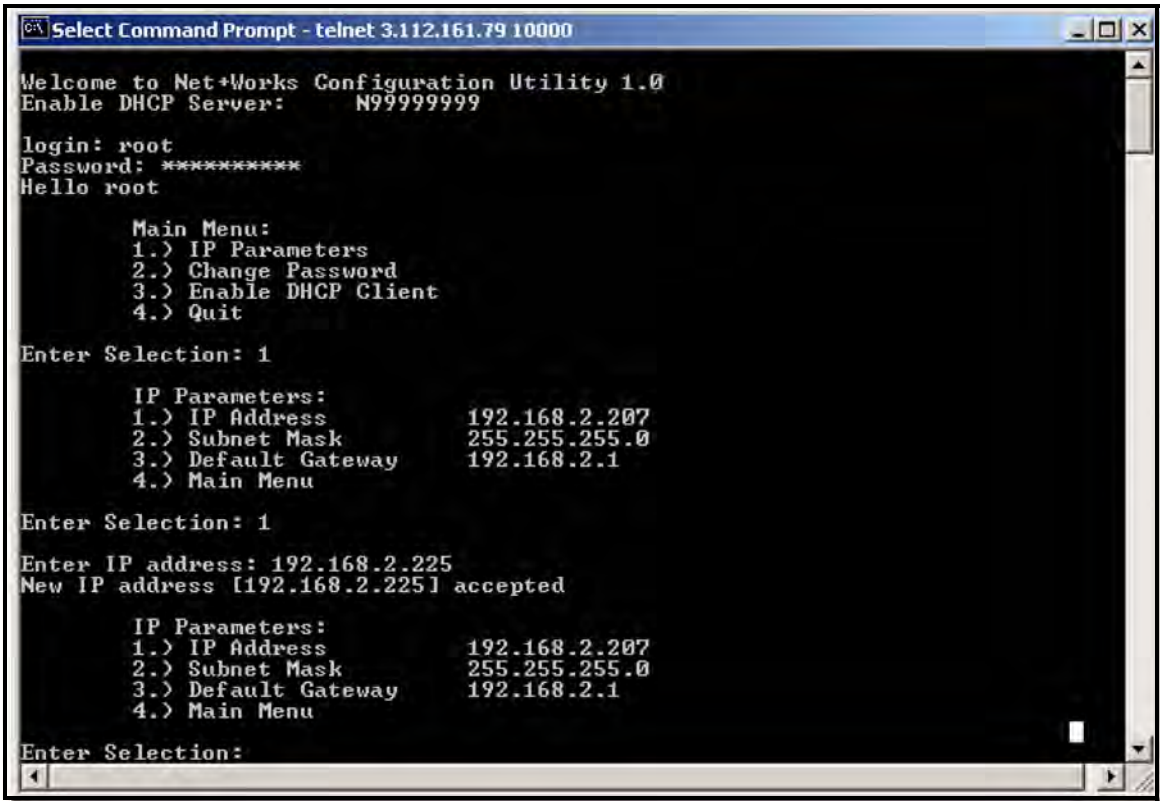

Figure 12: Changing IP Parameters - 1

2.2.3 Changing IP Parameters (cont.)

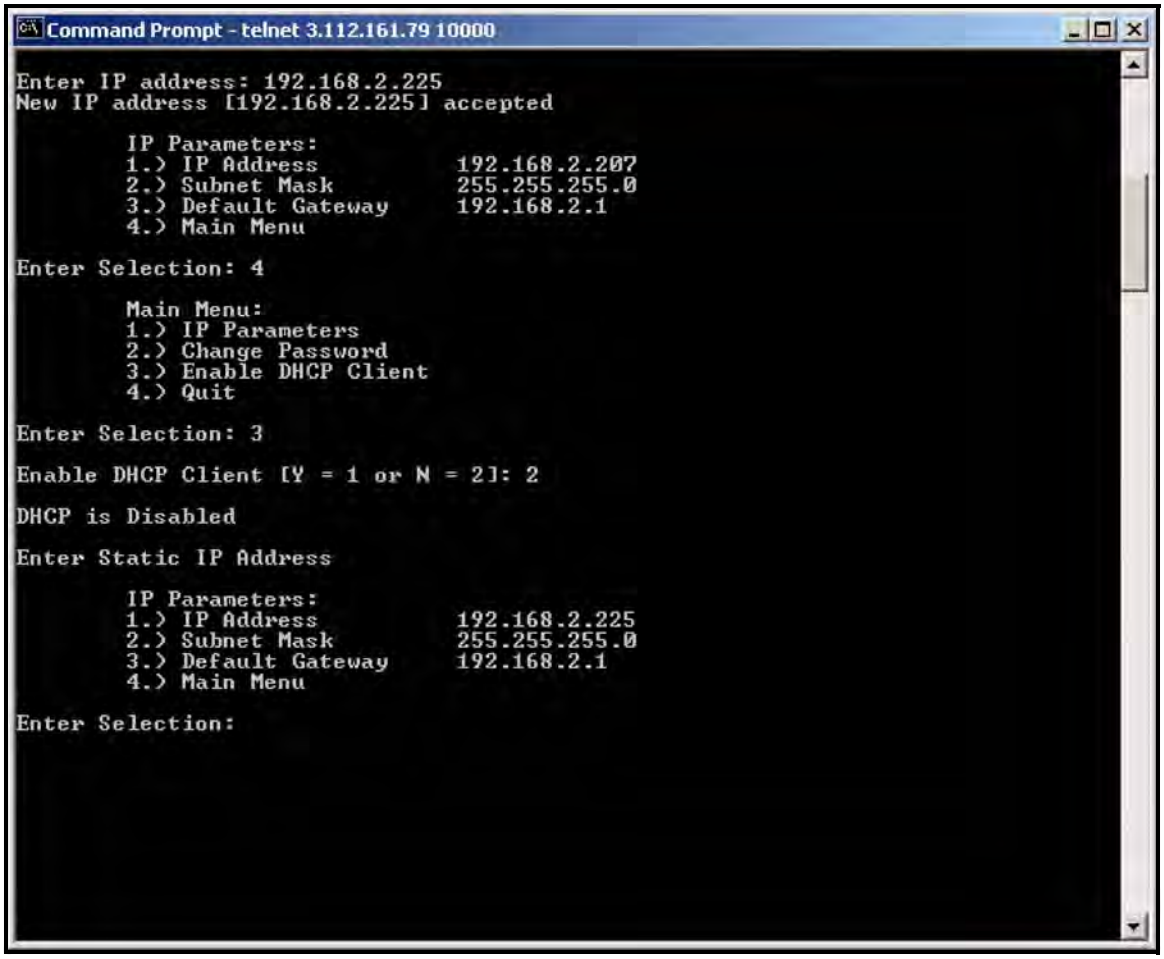

Figure 13: Changing IP Parameters - 2

Chapter 3. Modbus Over Ethernet Communications 2

IMPORTANT: ***These setup instructions apply only when using option card*** **703-1476-05, rev. B** ***and*** **higher,** ***or option card*** **703-1477-03, rev. D** ***and*** **higher.**

3.1 Introduction

This document provides instructions for setting up a flowmeter equipped with *Modbus Over Ethernet* (Modbus/TCP) communications. To apply these procedures, the flowmeter must have the option card installed. See the option card examples in Figure 14 and Figure 15.

Note: *To install an option card, consult the user's manual(s) which apply to your instrument.*

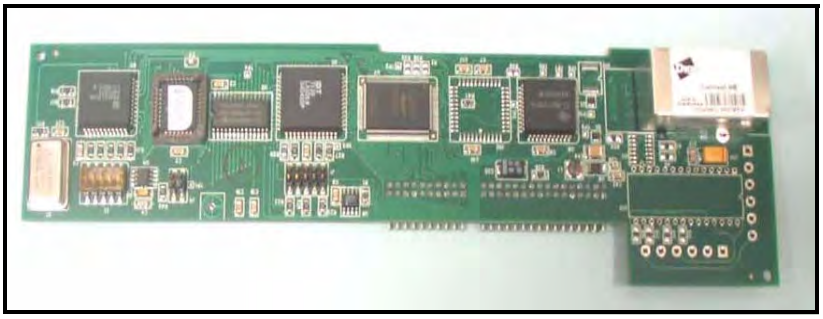

Figure 14: DF Modbus Over Ethernet Option Card

Figure 15: XMT Modbus Over Ethernet Option Card

3.2 Setup

The *Digi Device Discovery Program* is required to set up Ethernet parameters. To download the program, proceed with the following steps:

3.2.1 Downloading the Digi Device Discovery Program

1. Go to www.digi.com on the internet.
2. Move the cursor to the SUPPORT button and select *Diagnostics, Utilities and MIBs* from the menu.
3. Open the Select Your Product for Support menu and select *Digi Connect ME*. Then click on Submit.
4. From the OS Specific Diagnostics, Utilities and MIBs menu select *Microsoft Windows NT 4.0, 2000* or *XP*. Then, under the window, select *Device Discovery Utility for Windows*, and the File Download window appears.
5. Select Save this file to a disk, click on OK, and save the file to your computer.
6. Install the program from the downloaded file.

3.2.2 Module LED Behaviors

- **Yellow ON:** a link has been detected
- **Yellow OFF:** no link has been detected

3.2.3 Default Parameters

- **Baud Rate:** 9600 bps
- **Data Bits:** 8
- **Parity:** None
- **Stop Bits:** 1
- **Flow Control:** None
- **TCP/UDP Port:** 502

IMPORTANT: *The option card is shipped with DHCP (not static) IP addressing which may not work in your LAN network. If your network requires static IP, you must follow the procedure on page 4. Otherwise, this card will not be operational.*

3.2.4 Finding the Assigned IP Address

Note: *The following are setup procedure examples.*

Example:
Find the IP address of the module with Media Access Control (MAC) address 00409d24ded5.

1. Run the *Digi Device Discovery Program* (see Figure 16).

Note: *To access the* Digi Device Discovery Program, *see page 30.*

Note: *The MAC address of all found units and the assigned IP address will be displayed. In this example the assigned address is 3.112.162.129.*

Note: *Refresh the display to find the MAC address of all units.*

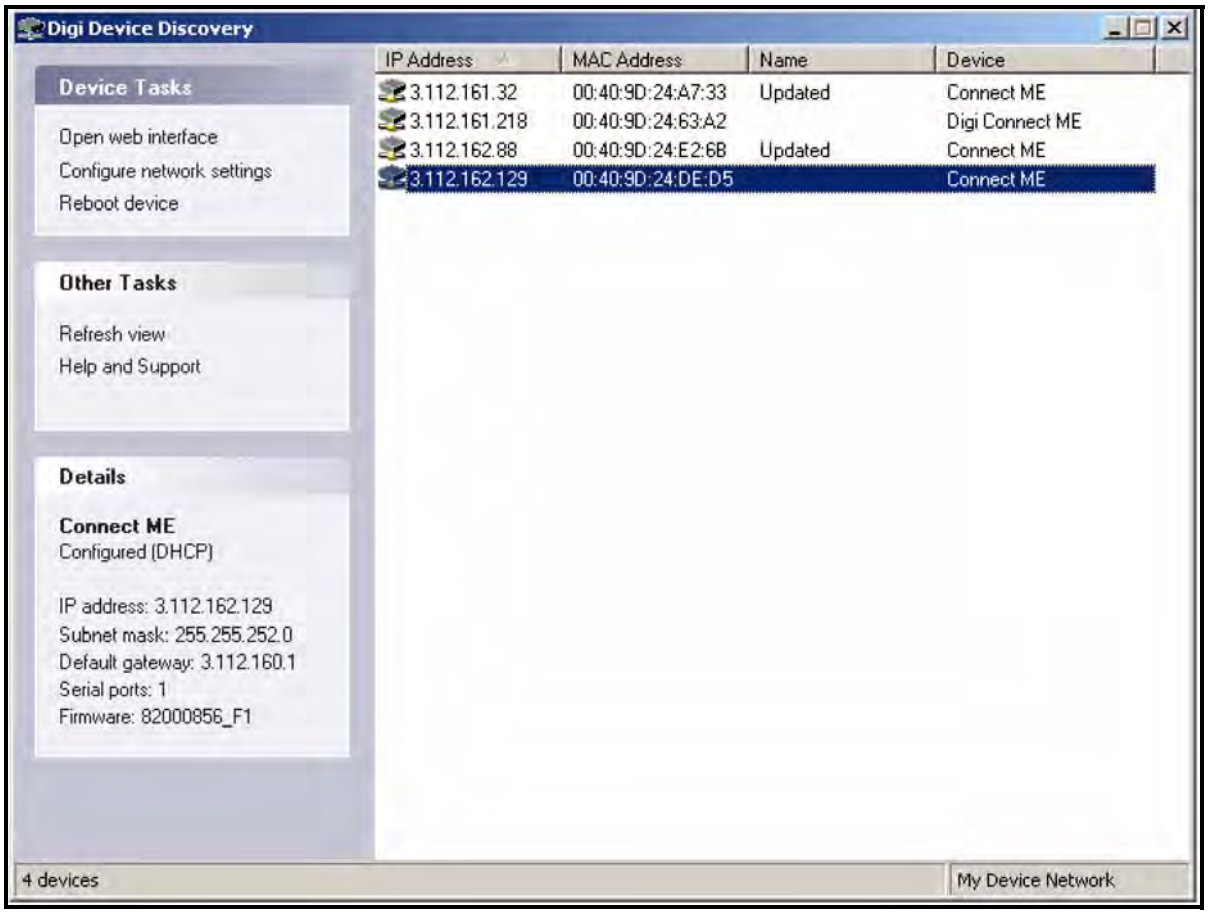

Figure 16: Finding the Assigned IP Address

3.2.5 Changing IP Parameters

Example: (to change the dynamic DHCP IP address to static).
Change the DHCP-assigned IP address to static address 192.168.2.207 and disable DHCP for the unit with IP assigned address 3.112.162.129 (see Figure 17).

1. Plug the option card into the DHCP network. The DHCP network server has to assign an IP address to this card.
2. Under Device Task at Digi Device Discovery Program (page 31), highlight the corresponding device and select *Open web interface*.
3. Enter Username and Password. Factory defaults are *root* and *dbps.*

Note: *The username and password are case sensitive.*

4. Click on **Login**.
5. Select *Configuration* / *Network*.
6. Select *Use the following IP address:* and enter IP address `192.168.2.207`.
7. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to complete.

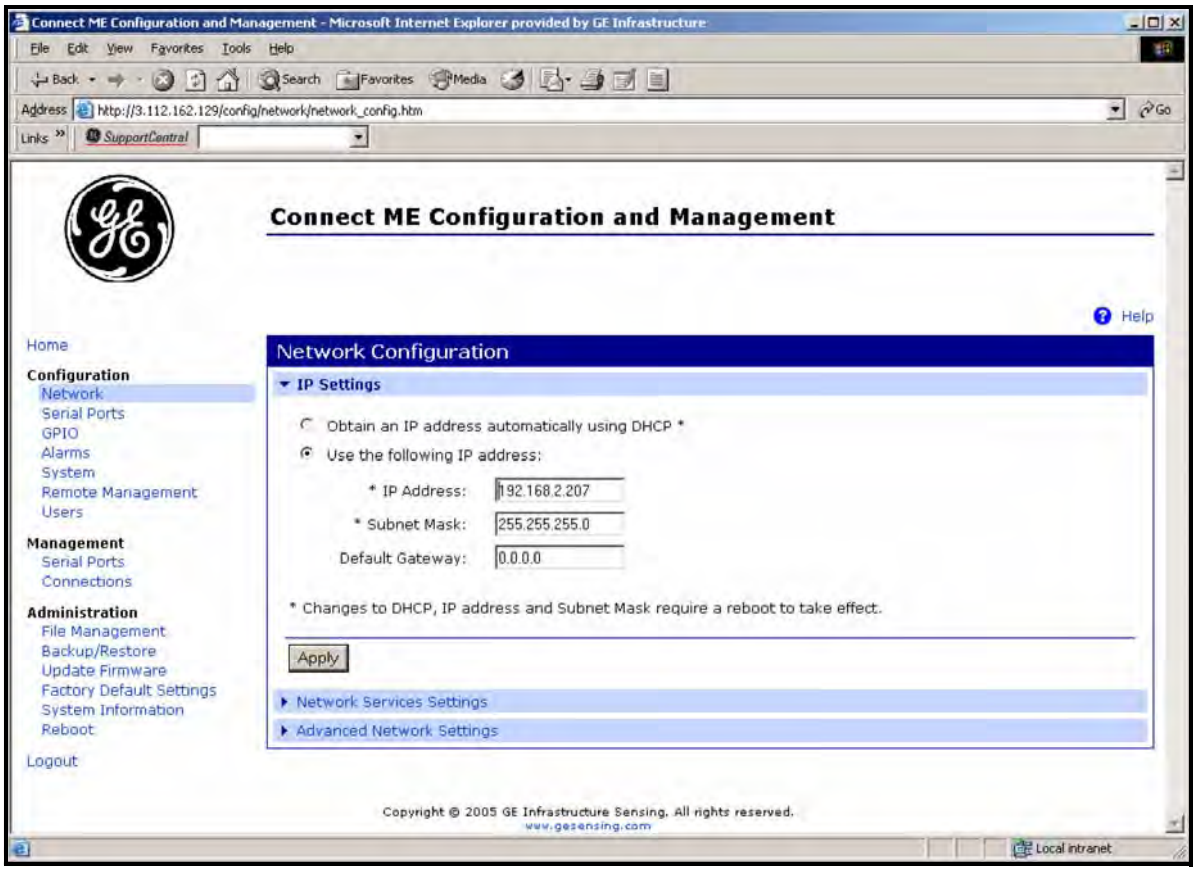

Figure 17: Changing IP Parameters

3.2.6 Changing Modbus/TCP Network Parameters

1. Select Configuration → Serial Ports → Port 1 → Modbus/TCP Network Setting
2. Accept incoming Modbus/TCP connection: TCP Port: XXX
3. Accept incoming Modbus/TCP in UDP/IP: UDP Port: XXX
4. → Apply

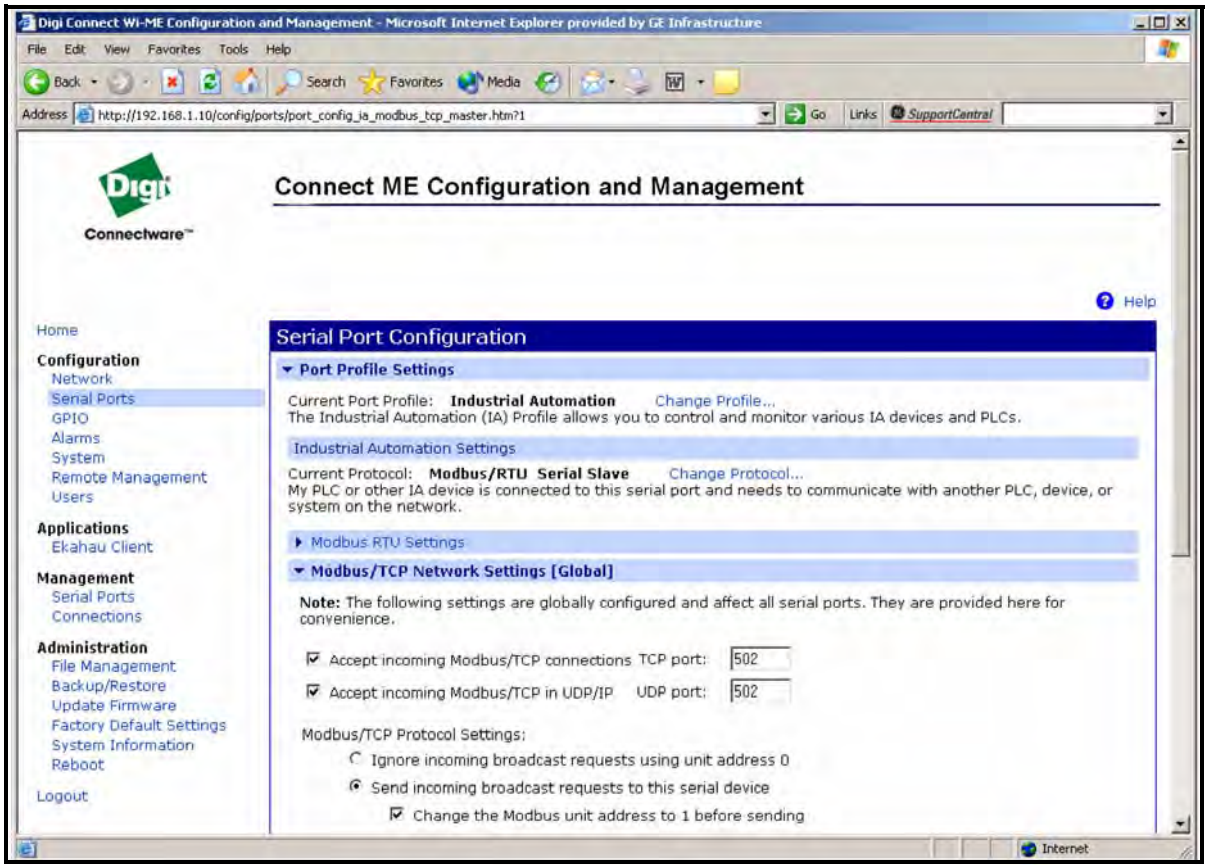

Figure 18: Changing Modbus/TCP Port

3.2.7 Changing User's Information

To change the user name and/or password:

1. Under Device Task select *Open web interface*.
2. Enter the Username and Password. The factory defaults are *root* and *dbps.*

Note: *The username and password are case sensitive.*

3. Click on **Login**. Figure 19 appears.
4. Select *Configuration* / *Users*.
5. Click on **New...**. Figure 20 on page 35 appears.

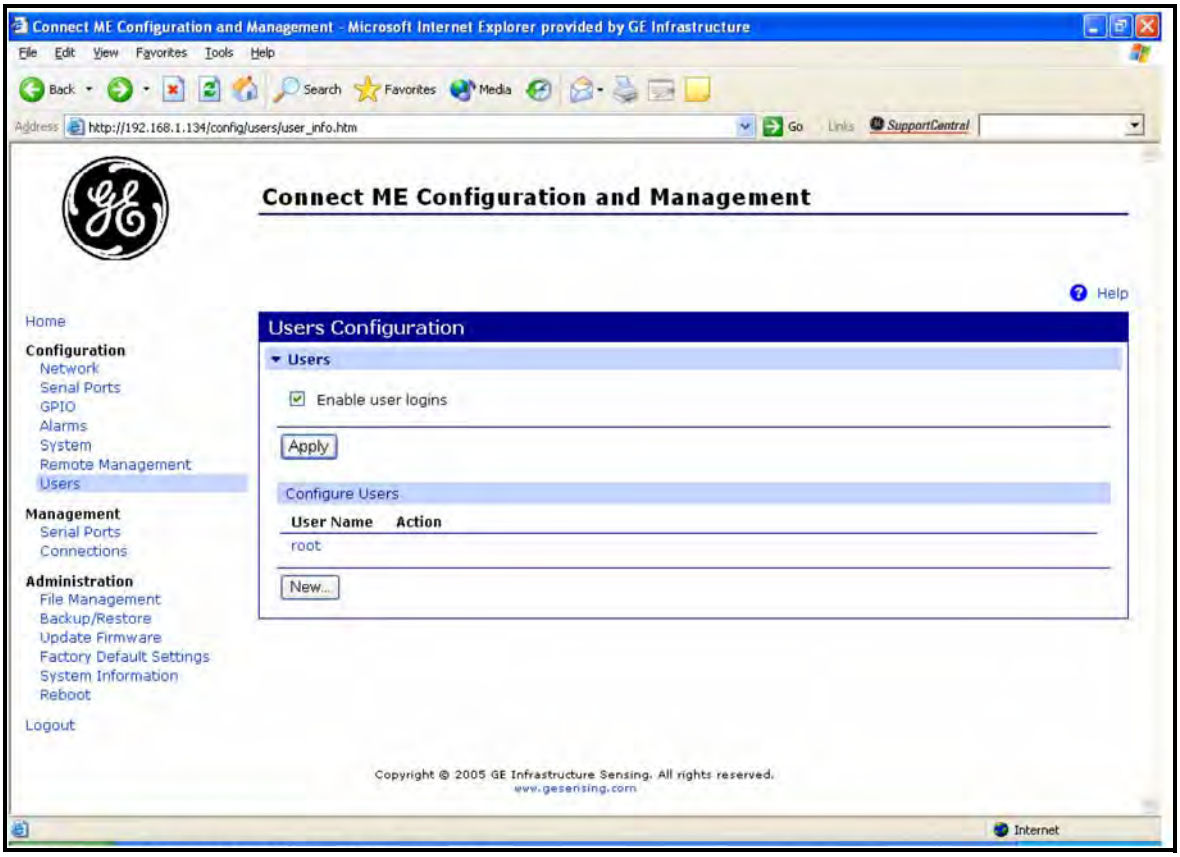

Figure 19: User's Configuration Menu

3.2.7 Changing User's Information (cont.)

6. To change the User Name, click in the box, delete the current name, and type in the new name.

7. To create a New Password, click in the box, delete the current password, and type in the new password.

8. To Confirm the new Password, click in the box, delete the current password and type in the new password.

Note: *For the password to be changed, the New Password and Confirm Password must be identical.*

9. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to be completed.

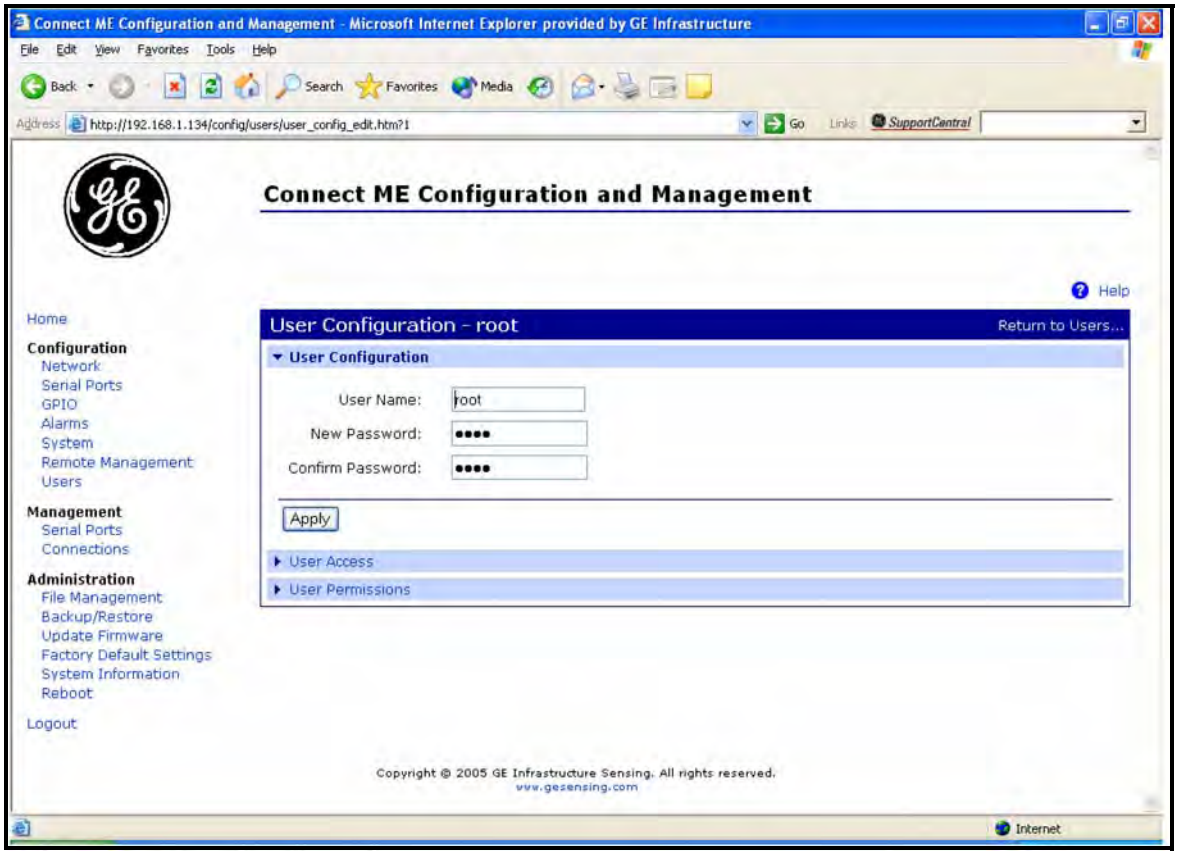

Figure 20: Changing the User Name and/or Password

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Chapter 4. Ethernet Only Communications

4.1 Introduction

This document provides instructions for setting up a flowmeter equipped with *Ethernet Only* communications. To apply these procedures, the flowmeter must have the option card installed. See the option card examples in Figure 21 and Figure 22.

Note: *To install an option card, consult the user's manual(s) which apply to your instrument.*

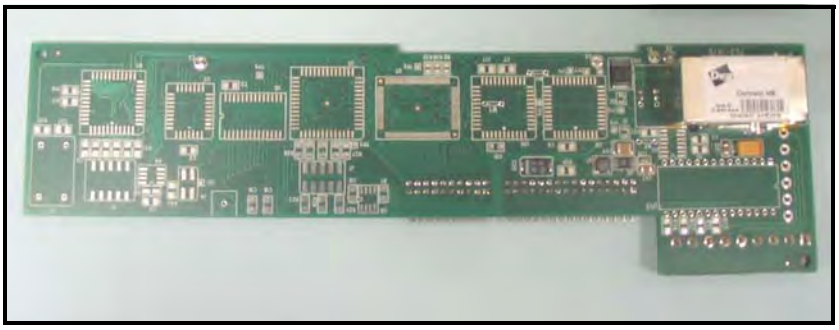


Figure 21: DF/GX Ethernet Only Option Card

Figure 22: XMT Ethernet Only Option Card

4.2 Setup

The *Digi Device Discovery Program* is required to set up Ethernet parameters for the *Ethernet Only* board. To download the program, proceed with the following steps:

4.2.1 Downloading the Digi Device Discovery Program

1. Go to www.digi.com on the internet.
2. Move the cursor to the SUPPORT button and select *Diagnostics, Utilities and MIBs* from the menu.
3. Open the Select Your Product for Support menu and select *Digi Connect ME*. Then click on Submit.
4. From the OS Specific Diagnostics, Utilities and MIBs menu select *Microsoft Windows NT 4.0, 2000* or *XP*. Then, under the window, select *Device Discovery Utility for Windows*, and the File Download window appears.
5. Select Save this file to a disk, click on OK, and save the file to your computer.
6. Install the program from the downloaded file.

4.2.2 Module LED Behaviors

- **Yellow ON:** a link has been detected
- **Yellow OFF:** no link has been detected

4.2.3 Default Parameters

- **Baud Rate:** 9600 bps
- **Data Bits:** 8
- **Parity:** None
- **Stop Bits:** 1
- **Flow Control:** None

4.2.4 Finding the Assigned IP Address

Note: *The following are setup procedure examples.*

Example:
Find the IP address of the module with Media Access Control (MAC) address 00409d24ded5.

1. Run the *Digi Device Discovery Program* (see Figure 23).

Note: *To access the* Digi Device Discovery Program, *refer to page 38.*

Note: *The MAC address of all found units and the assigned IP address will be displayed. In this example the assigned address is 3.112.162.129.*

Note: *Refresh the display to find the MAC address of all units.*

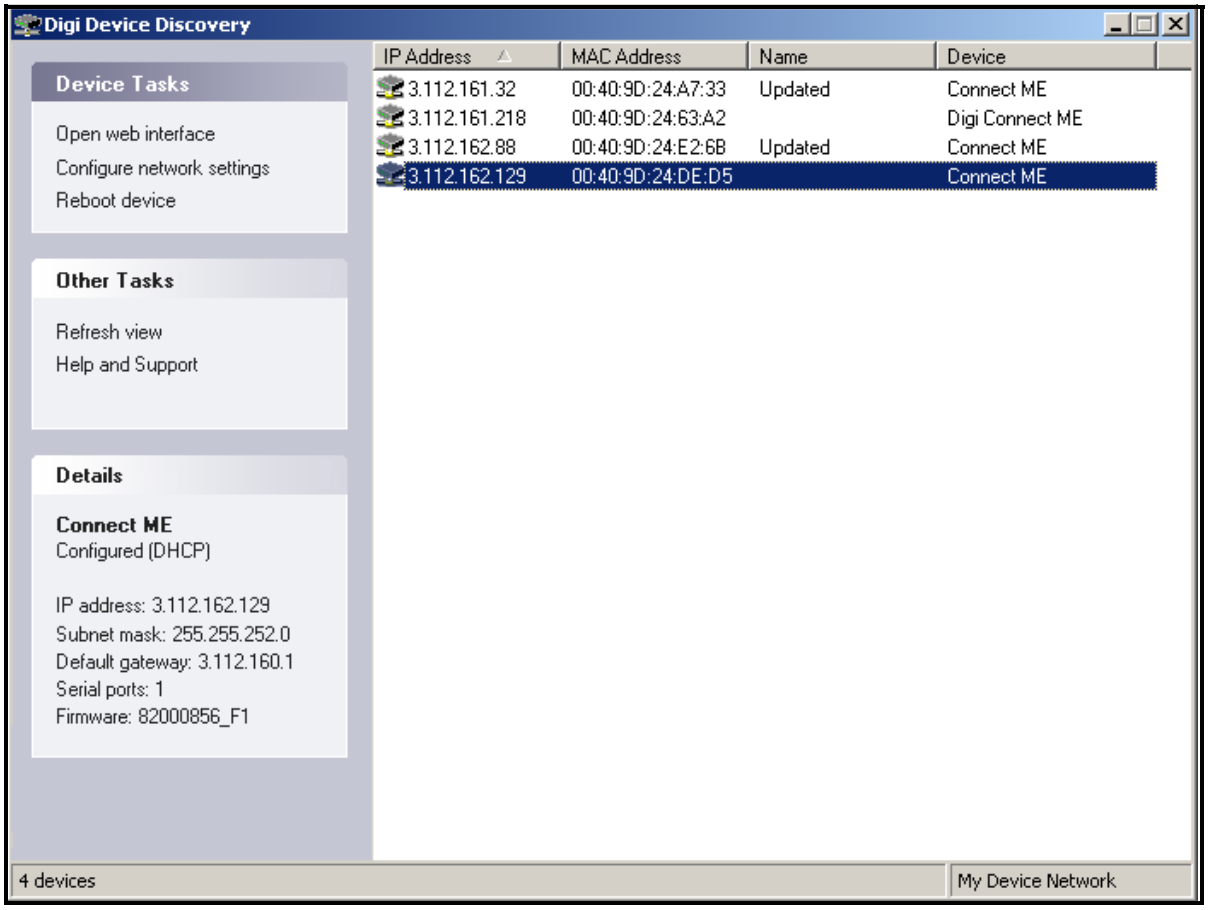


Figure 23: Finding the Assigned IP Address

4.2.5 Changing IP Parameters

Example:
Change the DHCP-assigned IP address to static address 192.168.2.207 and disable DHCP for the unit with IP assigned address 3.112.162.129 (see Figure 24).

1. Under Device Task select *Open web interface*.
2. Enter the Username and Password. The factory defaults are *root* and *dbps.*

Note: *The username and password are case sensitive.*

3. Click on **Login**.
4. Select *Configuration* / *Network.*
5. Select *Use the following IP address:* and enter IP address `192.168.2.207`.
6. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to complete.

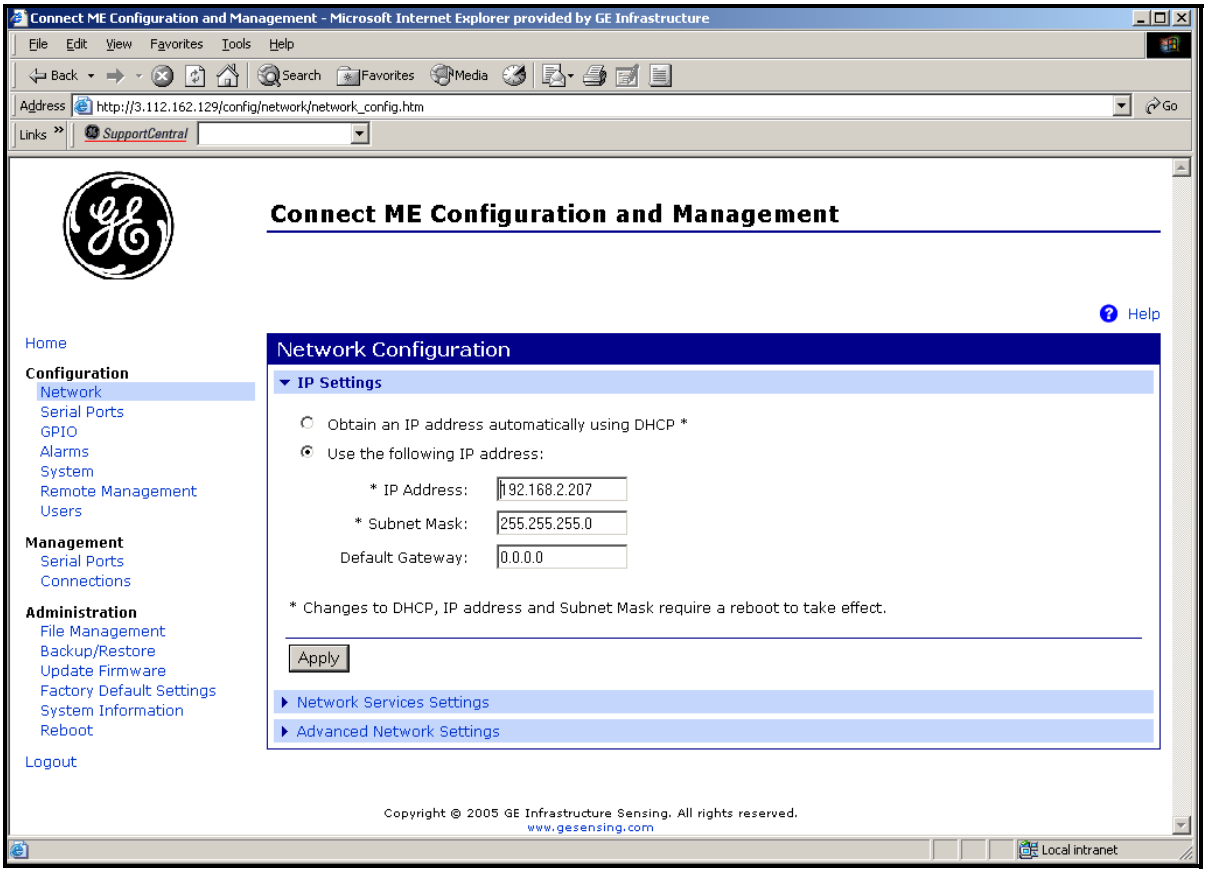


Figure 24: Changing IP Parameters

4.2.6 Changing User's Information

To change the user name and/or password:

1. Under Device Task select *Open web interface*.
2. Enter the Username and Password. The factory defaults are *root* and *dbps*.

Note: *The username and password are case sensitive.*

3. Click on **Login**. Figure 25 appears.
4. Select *Configuration* / *Users*.
5. Click on **New...**. Figure 26 on page 42 appears.

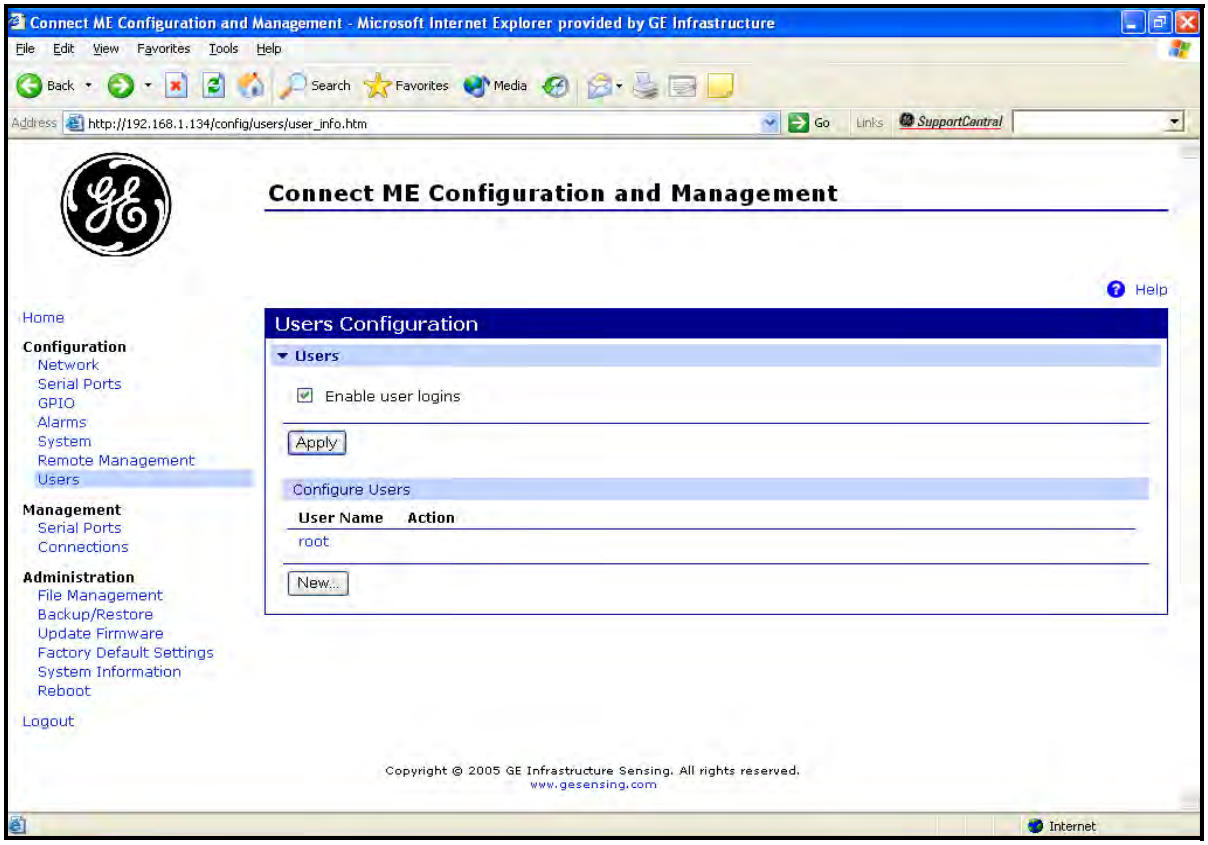


Figure 25: User's Configuration Menu

4.2.6 Changing User's Information (cont.)

6. To change the User Name, click in the box, delete the current name, and type in the new name.

7. To create a New Password, click in the box, delete the current password, and type in the new password.

8. To Confirm the new Password, click in the box, delete the current password and type in the new password.

Note: *For the password to be changed, the New Password and Confirm Password must be identical.*

9. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to be completed.

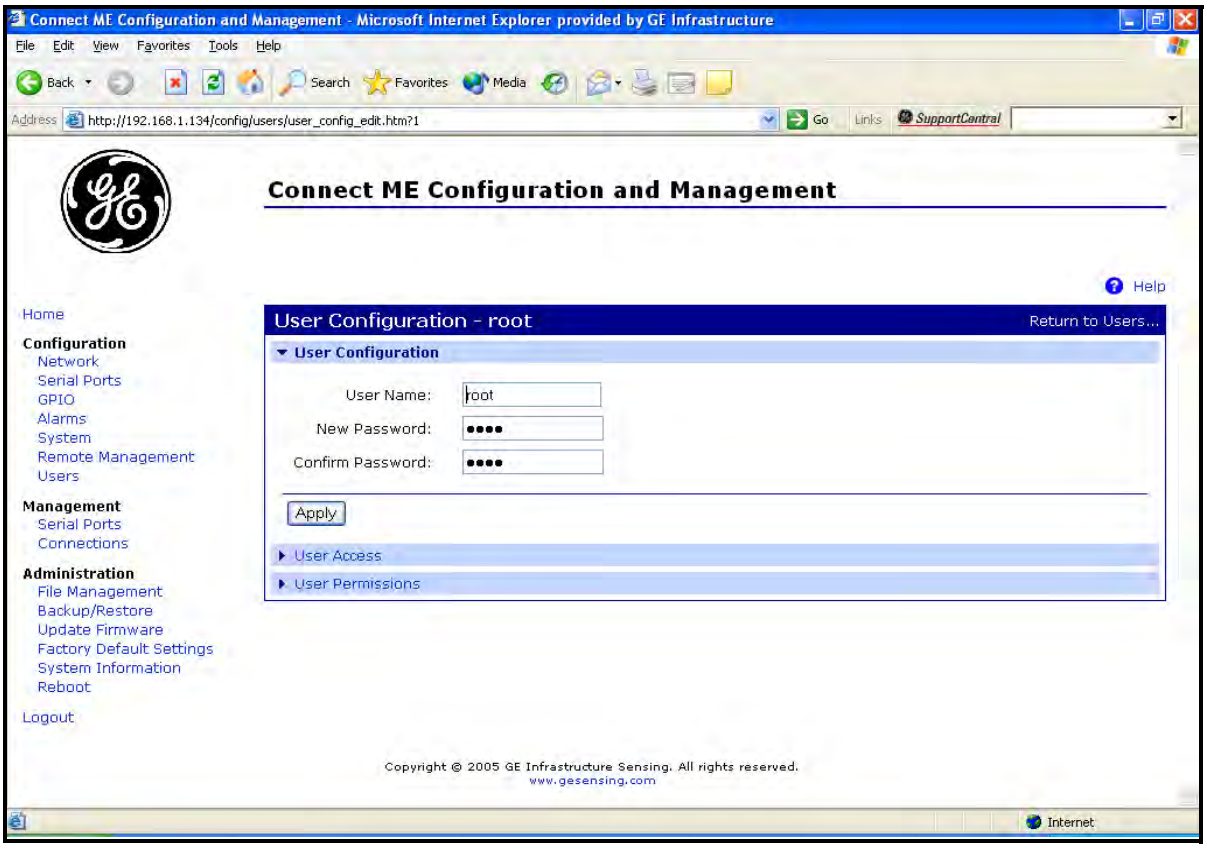


Figure 26: Changing the User Name and/or Password

Chapter 5. Modbus Over WI-FI Communications

5.1 Introduction

This document provides instructions for setting up a flowmeter equipped with *Modbus Over WI-FI* communications. To apply these procedures, the flowmeter must have the option card installed (see the example in Figure 27) and connected to a WI-FI antenna.

Note: *To install an option card, consult the user's manual(s) which apply to your instrument.*

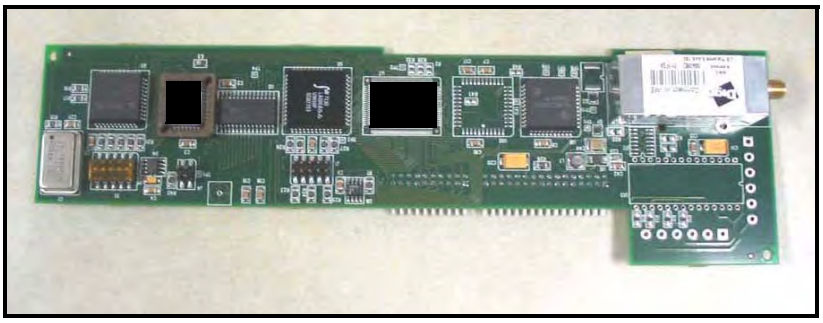


Figure 27: Modbus Over WI-FI Option Card

5.2 WI-FI Components

The WI-FI antenna should be mounted on top of the flowmeter enclosure (see Figure 28) and connected to the *Modbus Over WI-FI* option card as shown in Figure 29 and Figure 30 on page 44.

Figure 28: WI-FI Antenna

5.2 WI-FI Components (cont.)

Figure 29: WI-FI Cable Antenna Connection

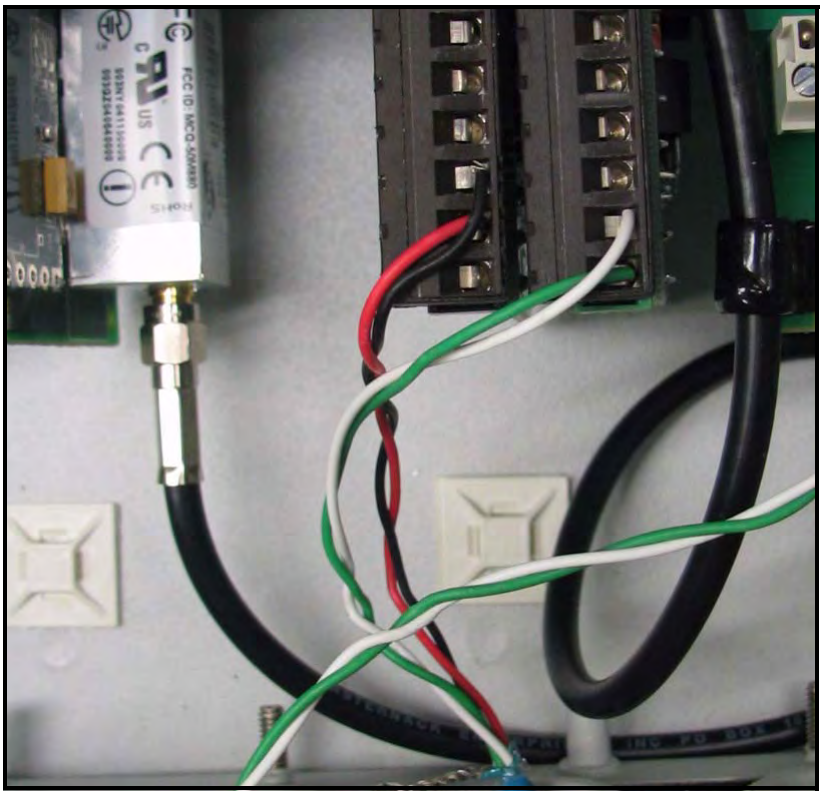


Figure 30: WI-FI Cable PC Board Connection

5.3 Setup

The default IP address in setting up the Modbus Over WI-FI option card is Dynamic (DHCP). If it has to be changed to a static IP address, the instrument must first be linked to the DHCP network.

Note: *The following are setup procedure examples.*

The *Digi Device Discovery Program* is required to set up WI-FI parameters. To download the program, proceed with the following steps:

5.3.1 Downloading the Digi Device Discovery Program

1. Go to www.digi.com on the internet.
2. Move the cursor to the SUPPORT button and select *Diagnostics, Utilities and MIBs* from the menu.
3. Open the Select Your Product for Support menu and select *Digi Connect ME*. Then click on Submit.
4. From the OS Specific Diagnostics, Utilities and MIBs menu select *Microsoft Windows NT 4.0, 2000* or *XP*. Then, under the window, select *Device Discovery Utility for Windows*, and the File Download window appears.
5. Select Save this file to a disk, click on OK, and save the file to your computer.
6. Install the program from the downloaded file.

5.3.2 Module LED Behaviors

- **Yellow ON:** Associated with Access Point
- **Yellow Blinking Slowly:** Ad hoc mode
- **Yellow Blinking Quickly:** Scanning for a network

5.3.3 Default Parameters

- **Baud Rate:** 9600 bps
- **Data Bits:** 8
- **Parity:** None
- **Stop Bits:** 1
- **Flow Control:** None
- **TCP/UDP Port:** 502

IMPORTANT: *This Modbus over WI-FI option card is shipped with DHCP IP addressing, and all the security options disabled. If your wireless LAN has any security set, it should be disabled to have this card join your wireless network. A solid yellow LED on the card indicates the card is joined to the wireless network.*

5.3.4 Finding the Assigned IP Address

Note: *The following are setup procedure examples.*

Example:
Find the IP address of the module with Media Access Control (MAC) address 00409d24ded5.

1. Run the *Digi Device Discovery Program* (see Figure 31).

Note: *To access the* Digi Device Discovery Program, *see page 45.*

Note: *The MAC address of all found units and the assigned IP address will be displayed. In this example the assigned address is 3.112.162.129.*

Note: *Refresh the display to find the MAC address of all units.*

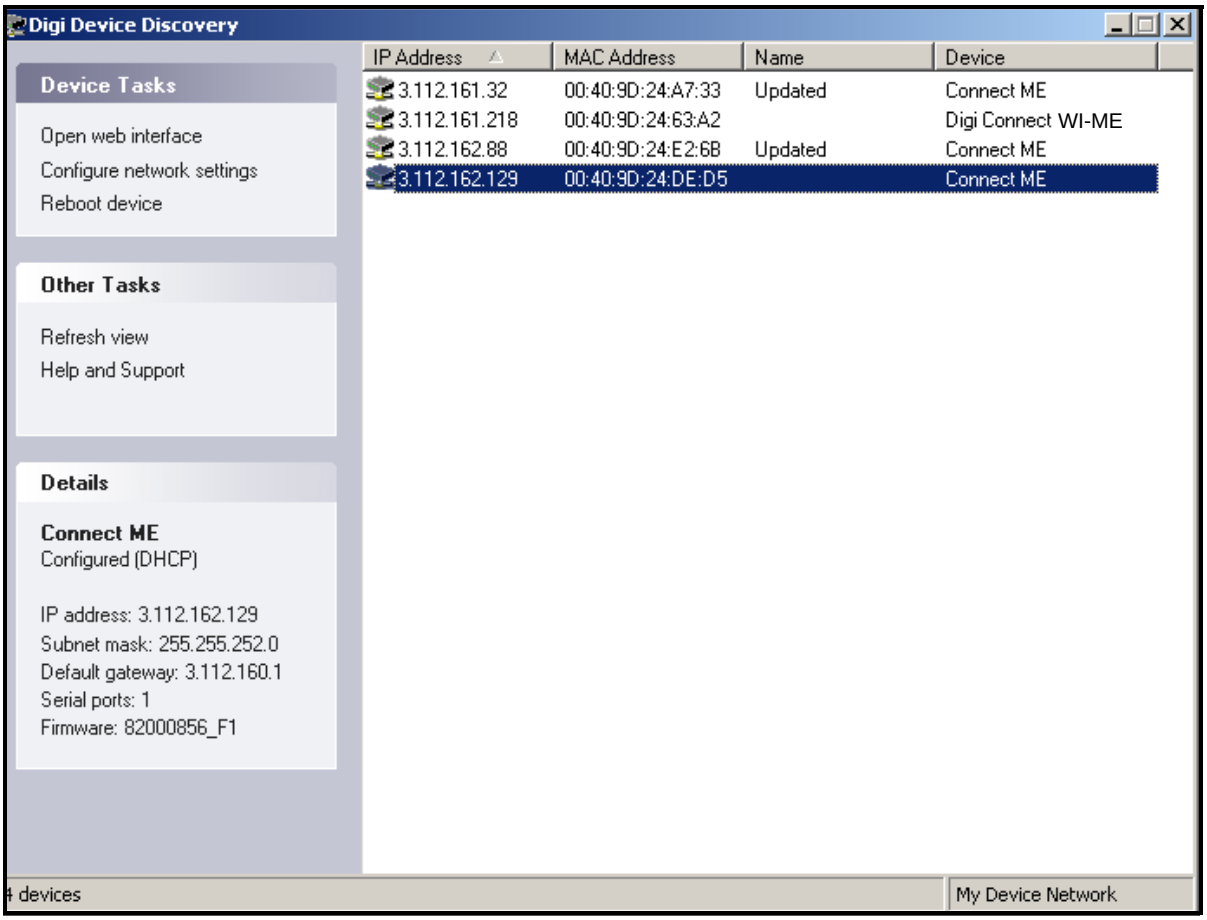


Figure 31: Finding the Assigned IP Address

5.3.5 Changing IP Parameters

Example:
Change the DHCP-assigned IP address to static address 192.168.2.207 and disable DHCP for the unit with IP assigned address 3.112.162.129 (see Figure 32).

1. Have your option card joined to the wireless network.
2. Under Device Task select *Open web interface*.
3. Enter Username and Password. Factory defaults are *root* and *dbps*.

Note: *The username and password are case sensitive.*

4. Click on **Login**.
5. Select *Configuration* / *Network.*
6. Select *Use the following IP address:* and enter IP address `192.168.2.207`.
7. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to be completed.

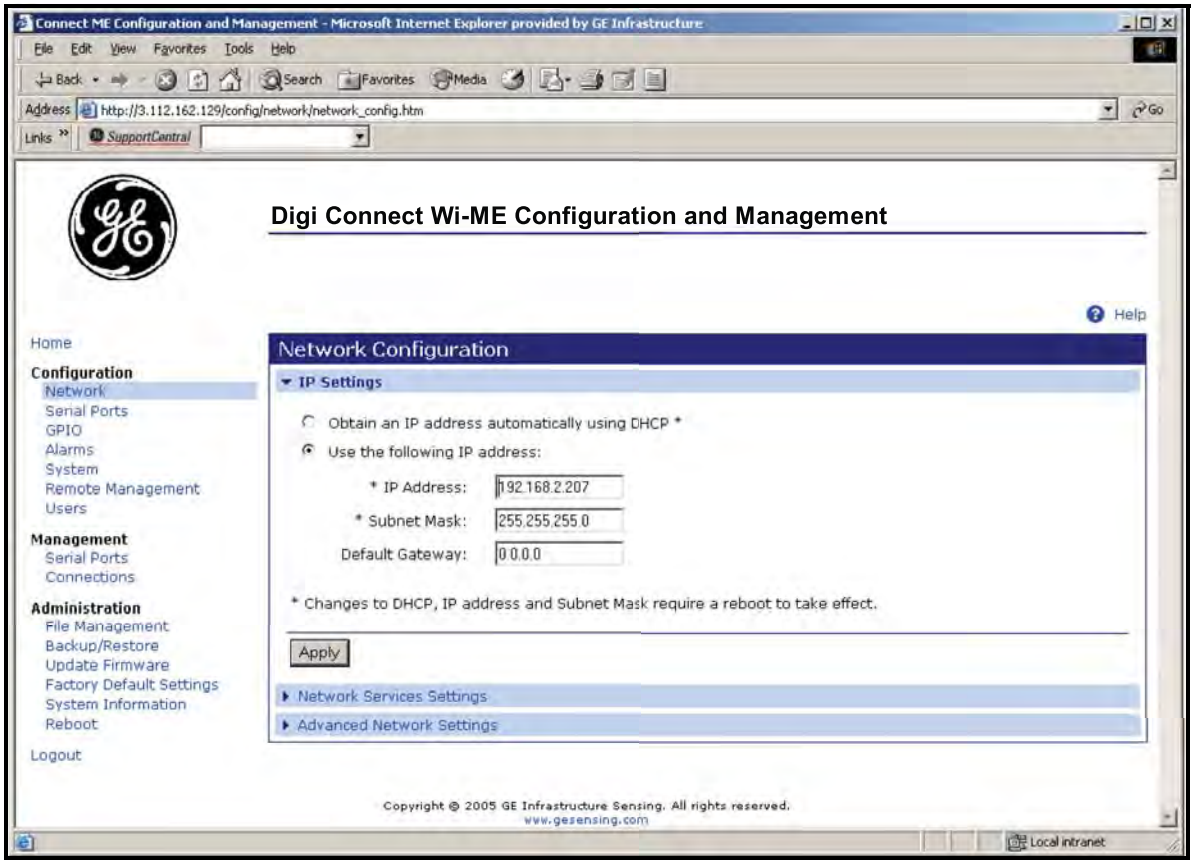


Figure 32: Changing IP Parameters

5.3.6 Changing Modbus/TCP Network Parameters

1. Select Configuration → Serial Ports → Port 1 → Modbus/TCP Network Setting
2. Accept incoming Modbus/TCP connection: TCP Port: XXX
3. Accept incoming Modbus/TCP in UDP/IP: UDP Port: XXX
4. → Apply

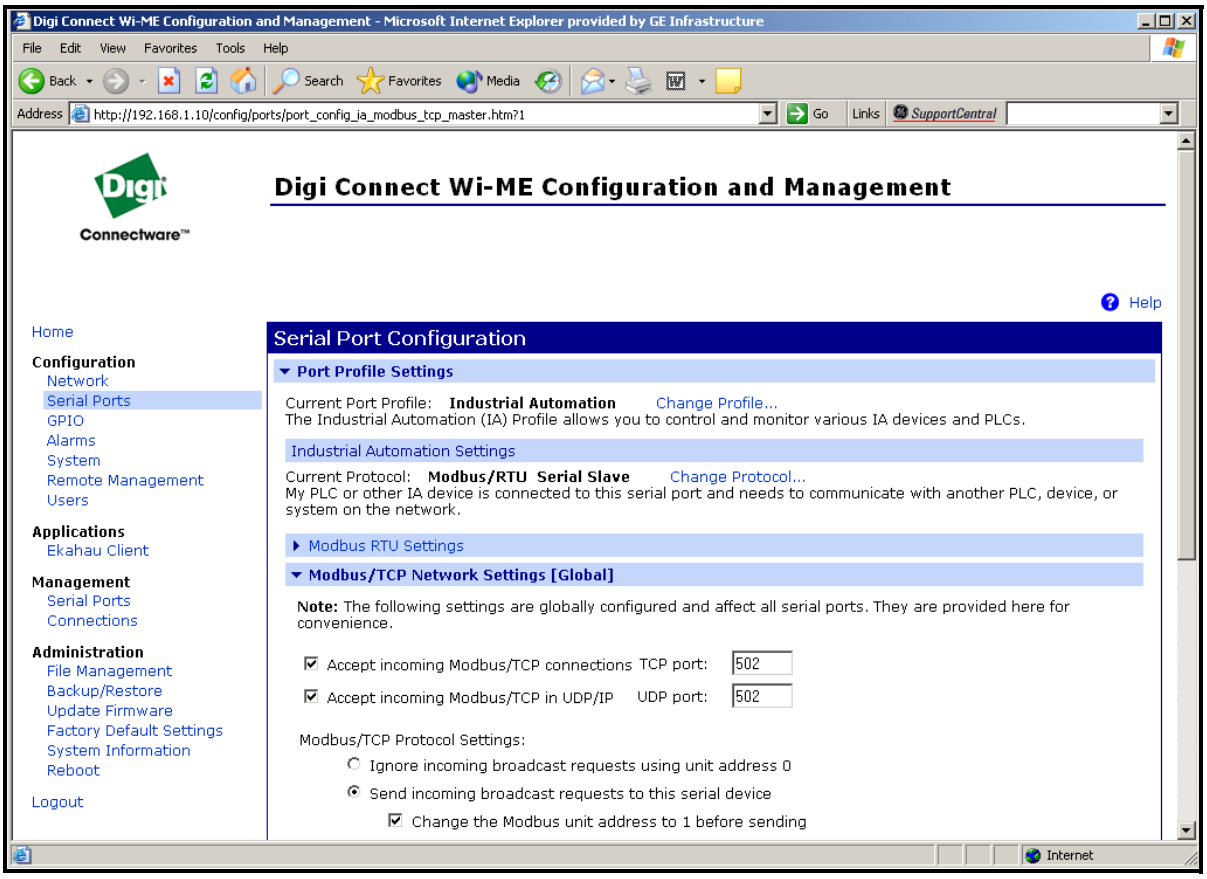


Figure 33: Changing Modbus/TCP Port

5.3.7 Changing User's Information

To change the user name and/or password:

1. Under Device Task select *Open web interface*.
2. Enter the Username and Password. The factory defaults are *root* and *dbps.*

Note: *The username and password are case sensitive.*

3. Click on **Login**. Figure 34 appears.
4. Select *Configuration* / *Users*.
5. Click on **New...**. Figure 35 on page 50 appears.

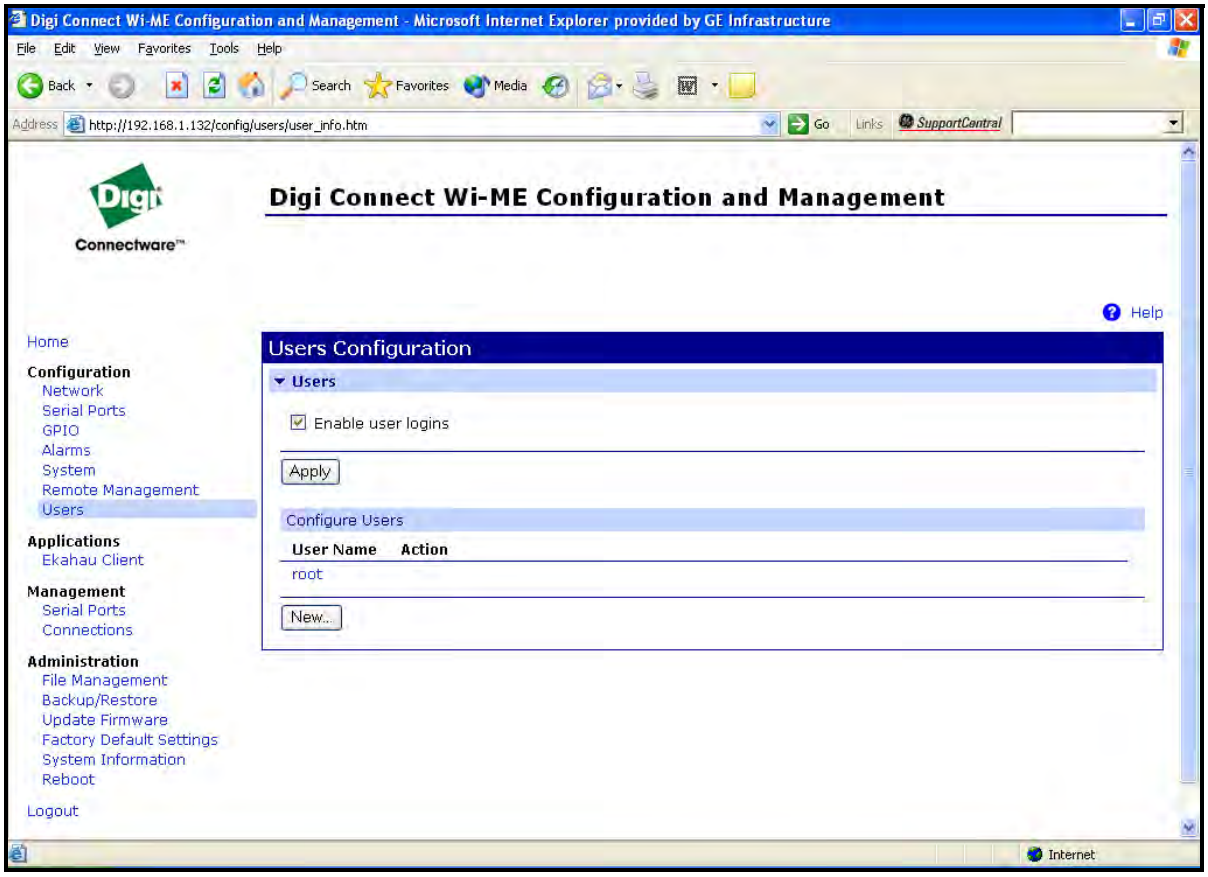


Figure 34: User's Configuration Menu

5.3.7 Changing User's Information (cont.)

6. To change the User Name, click in the box, delete the current name, and type in the new name.

7. To create a New Password, click in the box, delete the current password, and type in the new password.

8. To Confirm the new Password, click in the box, delete the current password and type in the new password.

Note: *For the password to be changed, the New Password and Confirm Password must be identical.*

9. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to be completed.

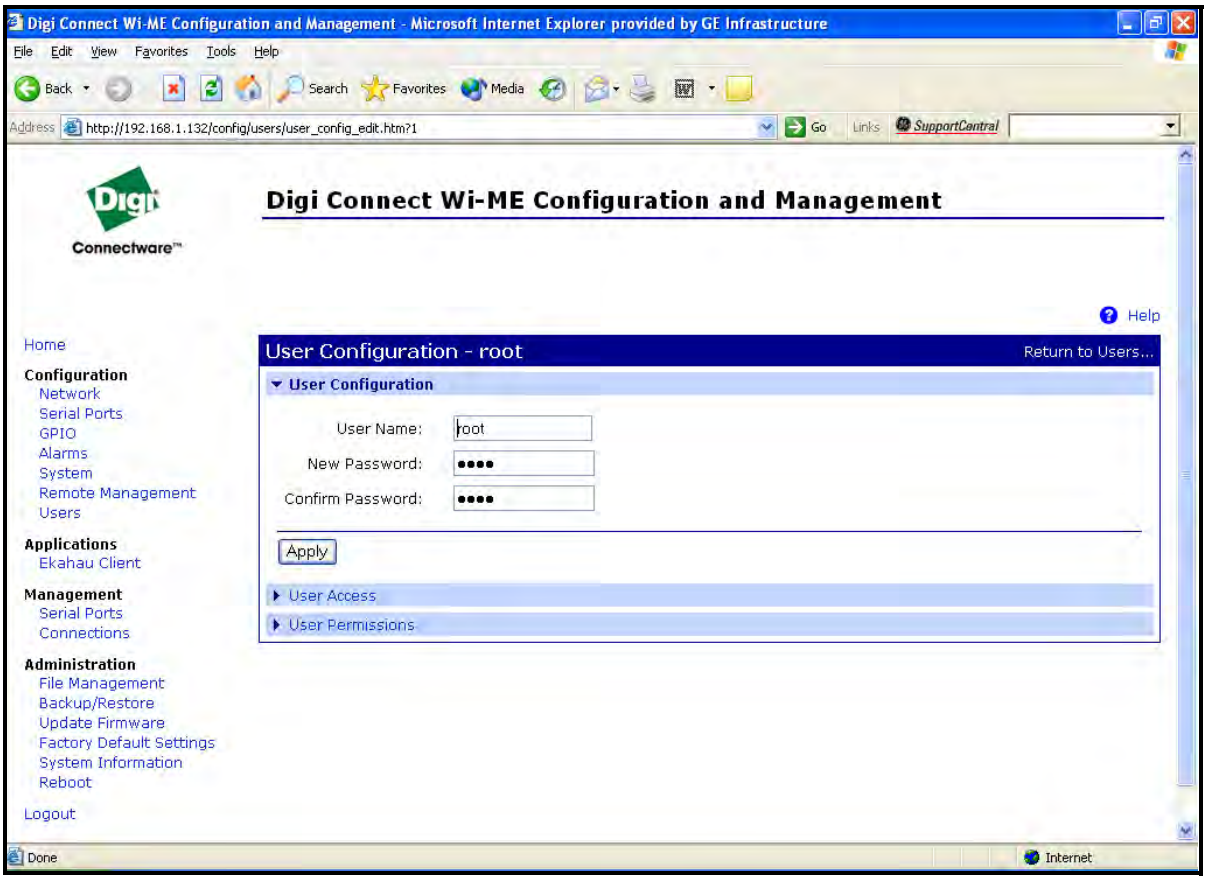


Figure 35: Changing the User Name and/or Password

5.4 Tips for Improving Wireless Data Communications

A suitable installation site should locate the antenna in a transmission path as unobstructed as possible; in the direction of the associated router.

When a wireless transducer is linked to a router, a yellow LED on the WI-FI option board remains on. Received Signal Strength Indication (RSSI) is an important indicator of wireless link quality. The higher the RSSI, the stronger the performance a wireless system can provide. Signal Strength is calculated by a wireless transceiver and can be viewed on Administration-System Information - WI-FI LAN - Active Settings of the device home page (see Figure 37 on page 51).

If constant interference is present in a particular frequency zone, it might be necessary to change the operational channel in the WI-FI network. If interference problems persist, try reducing the length of data streams by reading less registers in one request. Groups of short data streams have a better chance of getting through in the presence of interference than do long streams.

Figure 36: Installation Site

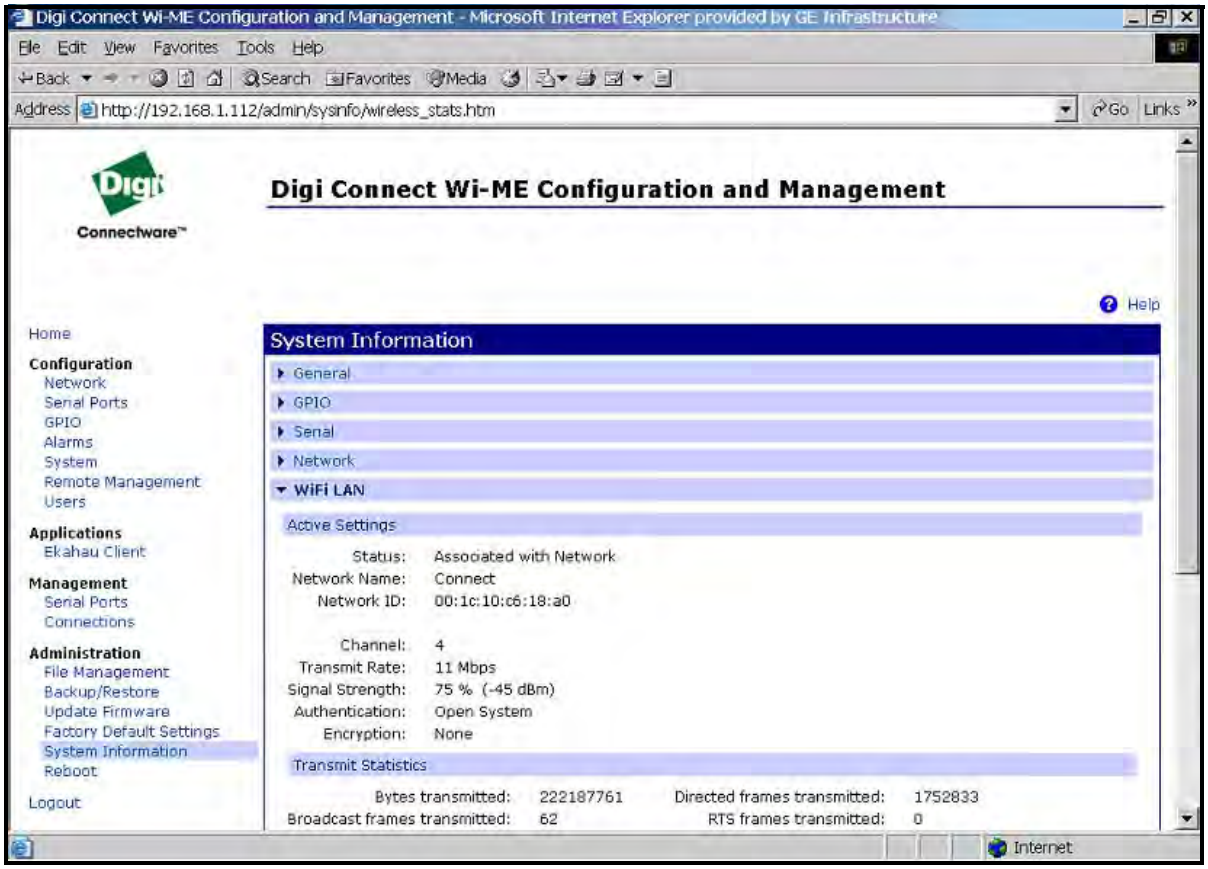


Figure 37: System Information Menu - WI-FI Lan

[no content intended for this page]

Chapter 6. WI-FI Only Communications

6.1 Introduction

This document provides instructions for setting up a flowmeter equipped with *WI-FI Only* communications. To apply these procedures, the flowmeter must have the option card installed (see the example in Figure 38) and connected to a WI-FI antenna.

Note: *To install an option card, consult the user's manual(s) which apply to your instrument.*

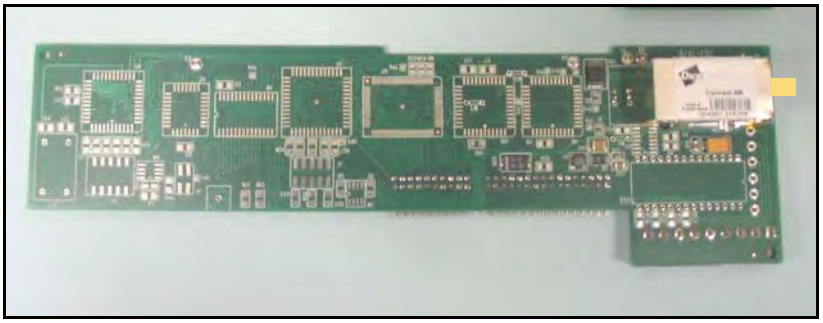


Figure 38: WI-FI Only Option Card

6.2 WI-FI Components

The WI-FI antenna should be mounted on top of the flowmeter enclosure (see Figure 39) and connected to the *WI-FI Only* option card as shown in Figure 40 and Figure 41 on page 54.

Figure 39: WI-FI Antenna

6.2 WI-FI Components (cont.)

Figure 40: WI-FI Cable Antenna Connection

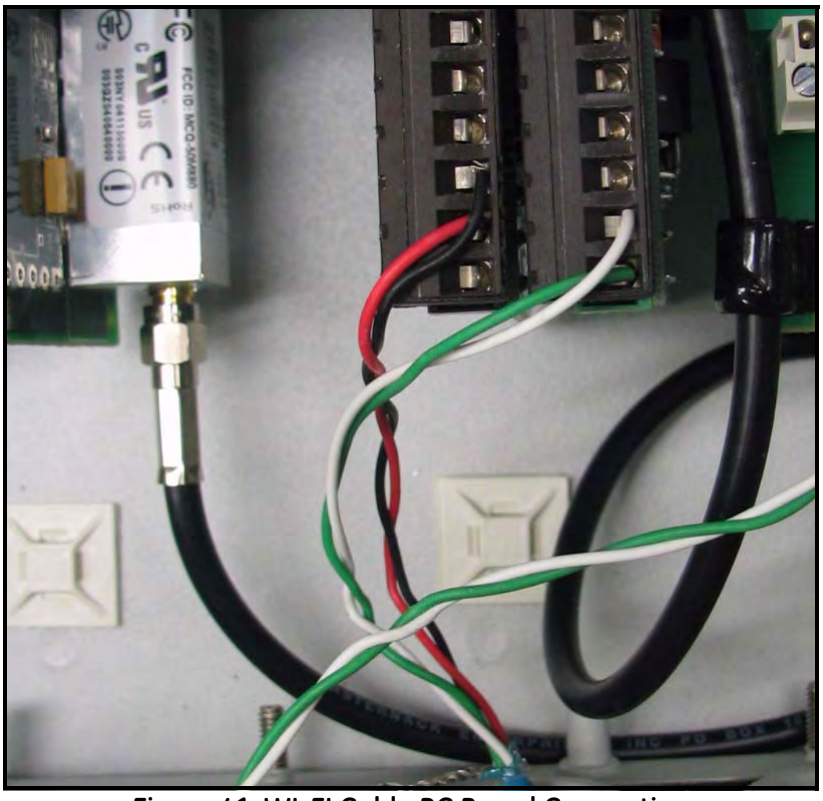


Figure 41: WI-FI Cable PC Board Connection

6.3 Setup

The default IP address in setting up the WI-FI Only option card is Dynamic (DHCP). If it has to be changed to a static IP address, the instrument must first be wirelessly linked to the DHCP network. You may need a WI-FI router in order to activate that.

Note: *The following are setup procedure examples.*

The *Digi Device Discovery Program* is required to change communications parameters if needed. To download the program, proceed with the following steps:

6.3.1 Downloading the Digi Device Discovery Program

1. Go to www.digi.com on the internet.
2. Move the cursor to the SUPPORT button and select *Diagnostics, Utilities and MIBs* from the menu.
3. Open the Select Your Product for Support menu and select *Digi Connect ME*. Then click on Submit.
4. From the OS Specific Diagnostics, Utilities and MIBs menu select *Microsoft Windows NT 4.0, 2000* or *XP*. Then, under the window, select *Device Discovery Utility for Windows*, and the File Download window appears.
5. Select Save this file to a disk, click on OK, and save the file to your computer.
6. Install the program from the downloaded file.

6.3.2 Module LED Behaviors

- **Yellow ON:** Associated with Access Point
- **Yellow Blinking Slowly:** Ad hoc mode
- **Yellow Blinking Quickly:** Scanning for a network

6.3.3 Default Parameters

- **Baud Rate:** 9600 bps
- **Data Bits:** 8
- **Parity:** None
- **Stop Bits:** 1
- **Flow Control:** None

IMPORTANT: *This WI-FI Only option card is shipped with DHCP IP addressing, and all the security options disabled. If your wireless LAN has any security set, it should be disabled to have this card join your wireless network. A solid yellow LED on the card indicates the card is joined to the wireless network.*

6.3.4 Finding the Assigned IP Address

Note: *The following are setup procedure examples.*

Example:
Find the IP address of the module with Media Access Control (MAC) address 00409d24ded5.

1. Run the *Digi Device Discovery Program* (see Figure 42).

Note: *To access the* Digi Device Discovery Program, *see page 55.*

Note: *The MAC address of all found units and the assigned IP address will be displayed. In this example the assigned address is 3.112.162.129.*

Note: *Refresh the display to find the MAC address of all units.*

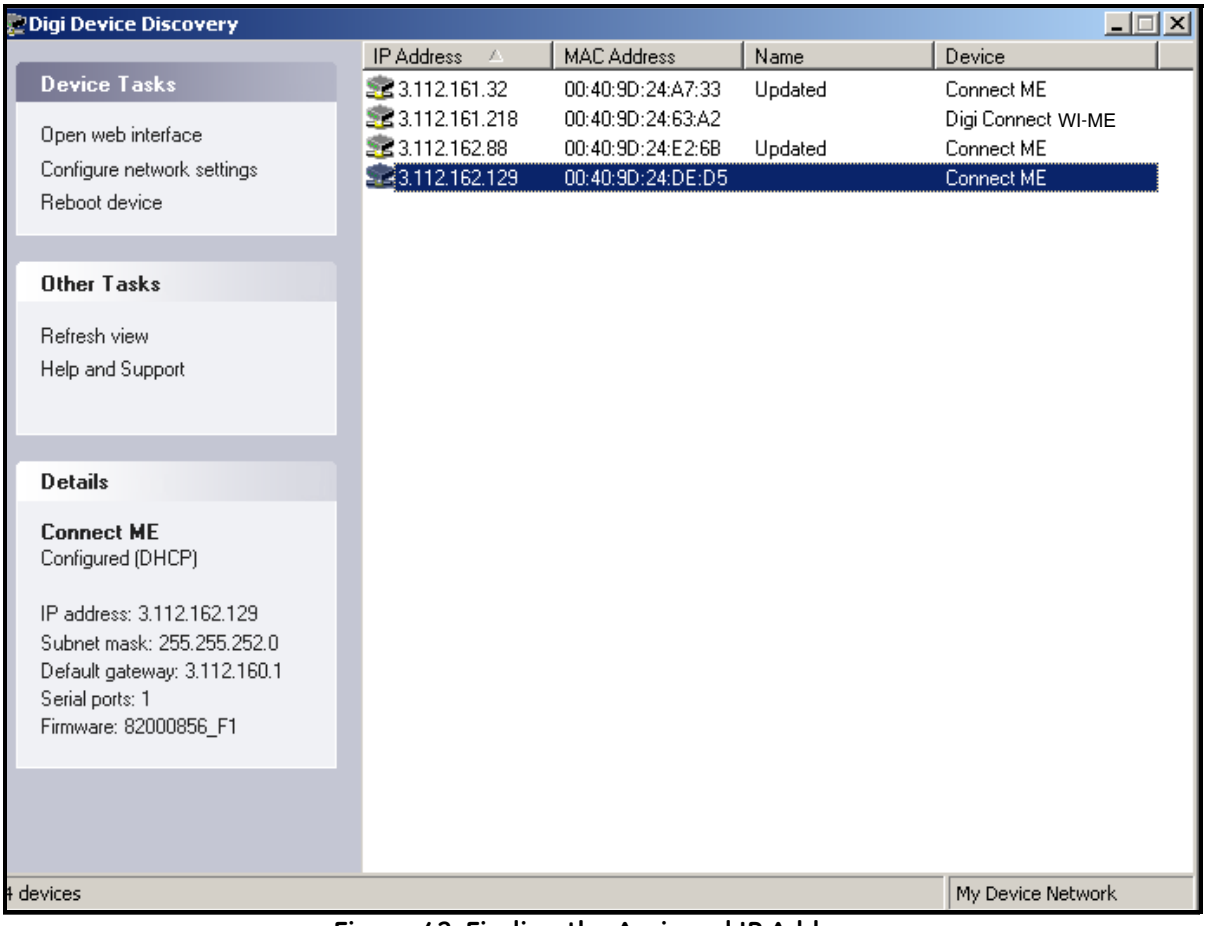


Figure 42: Finding the Assigned IP Address

6.3.5 Changing IP Parameters

Example:
Change the DHCP-assigned IP address to static address 192.168.2.207 and disable DHCP for the unit with IP assigned address 3.112.162.129 (see Figure 43).

1. Have your option card joined to the wireless network.
2. Under Device Task select *Open web interface*.
3. Enter Username and Password. Factory defaults are *root* and *dbps*.

Note: *The username and password are case sensitive.*

4. Click on **Login**.
5. Select *Configuration* / *Network*.
6. Select *Use the following IP address:* and enter IP address `192.168.2.207`.
7. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to be completed.

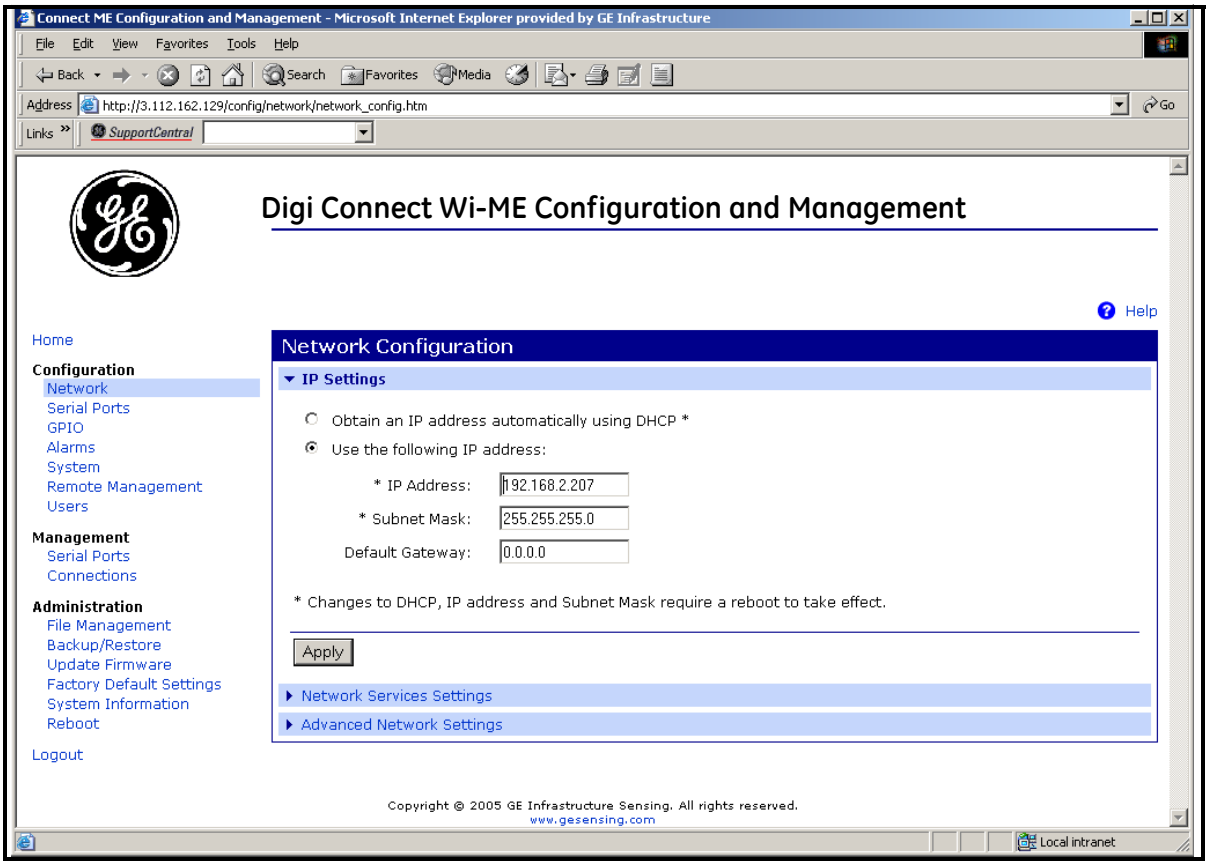


Figure 43: Changing IP Parameters

6.3.6 Changing User's Information

To change the user name and/or password:

1. Under Device Task select *Open web interface*.
2. Enter the Username and Password. The factory defaults are *root* and *dbps.*

Note: *The username and password are case sensitive.*

3. Click on **Login**. Figure 44 appears.
4. Select *Configuration* / *Users*.
5. Click on **New...**. Figure 45 on page 59 appears.

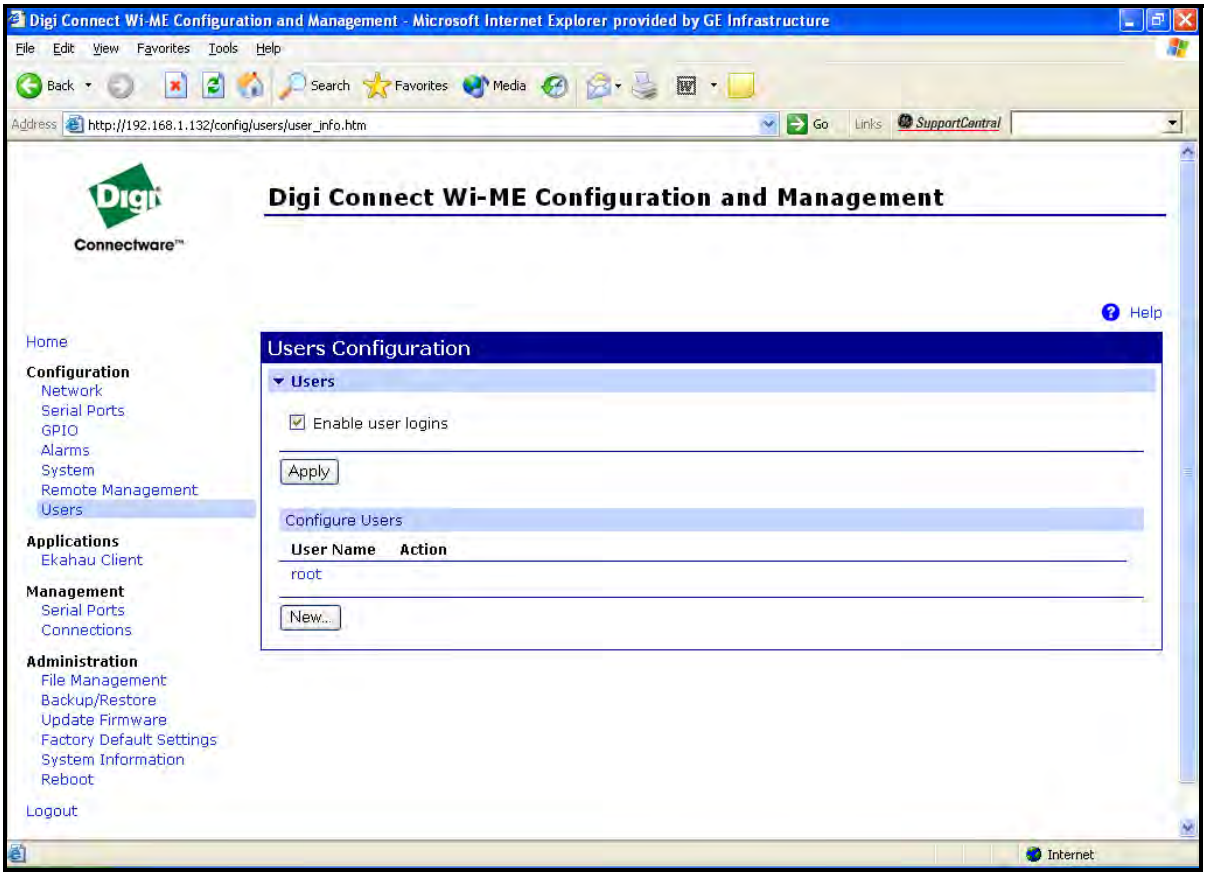


Figure 44: User's Configuration Menu

6.3.6 Changing User's Information (cont.)

6. To change the User Name, click in the box, delete the current name, and type in the new name.

7. To create a New Password, click in the box, delete the current password, and type in the new password.

8. To Confirm the new Password, click in the box, delete the current password and type in the new password.

Note: *For the password to be changed, the New Password and Confirm Password must be identical.*

9. Click on **Apply**.

Note: *Changes will require a reboot to take effect.*

Select *Administration / Reboot*, then wait for the reboot to be completed.

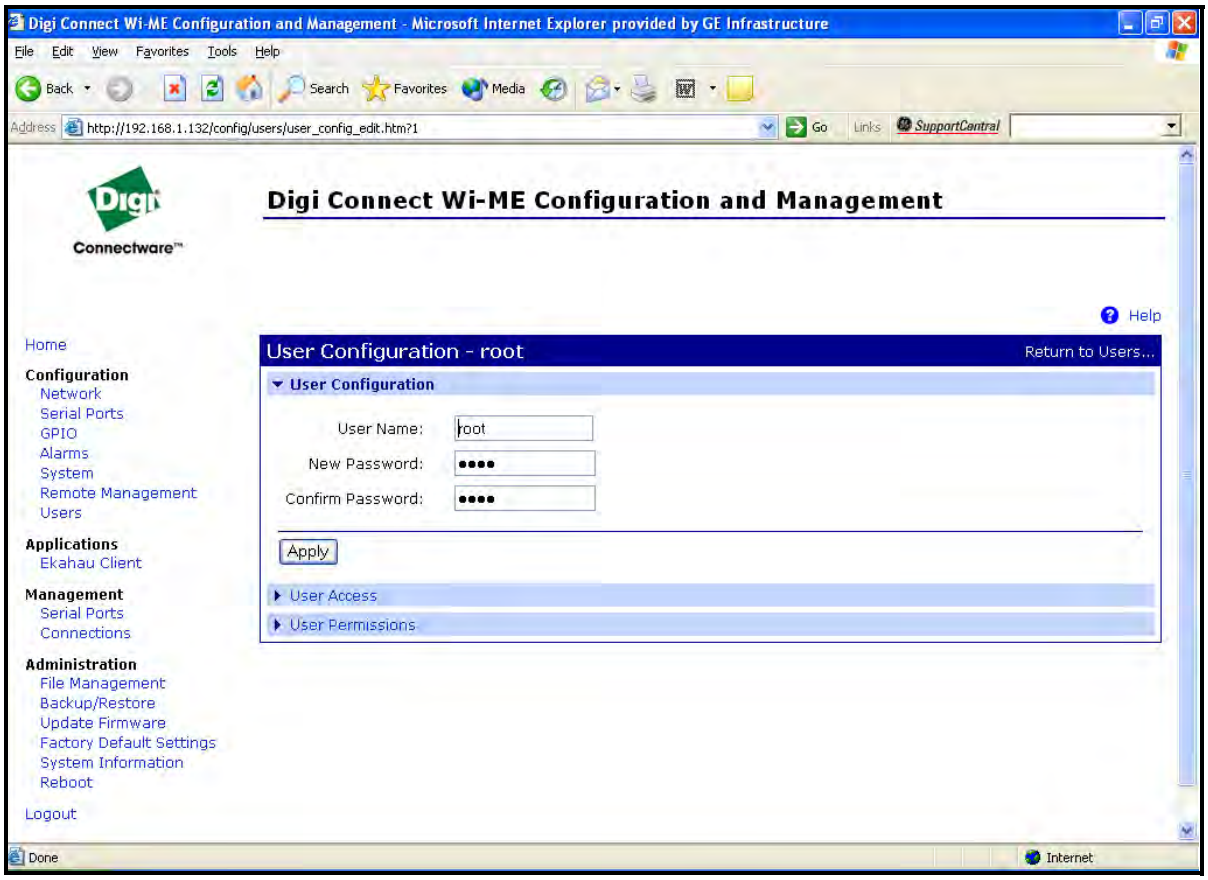


Figure 45: Changing the User Name and/or Password

6.4 Tips for Improving Wireless Data Communications

Figure 46: Installation Site

A suitable installation site should locate the antenna in a transmission path as unobstructed as possible; in the direction of the associated router.

When a wireless transducer is linked to a router, a yellow LED on the WI-FI option board remains on. Received Signal Strength Indication (RSSI) is an important indicator of wireless link quality. The higher the RSSI, the stronger the performance a wireless system can provide. Signal Strength is calculated by a wireless transceiver and can be viewed on Administration-System Information - WI-FI LAN - Active Settings of the device home page (see Figure 47).

If constant interference is present in a particular frequency zone, it might be necessary to change the operational channel in the WI-FI network. If interference problems persist, try reducing the length of data streams. Groups of short data streams have a better chance of getting through in the presence of interference than do long streams.

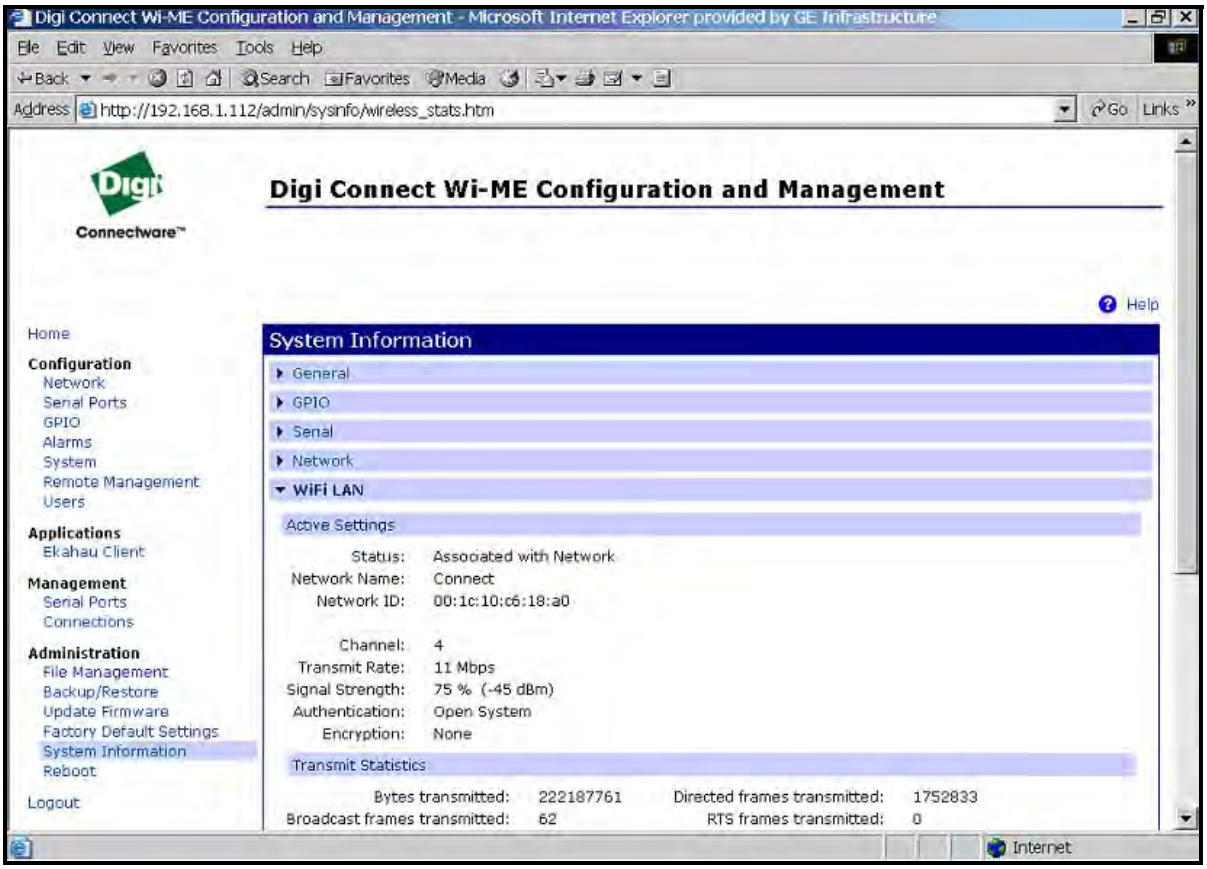


Figure 47: System Information Menu - WI-FI Lan

Chapter 7. Foundation Fieldbus Communications

7.1 Optional Measurements

Foundation Fieldbus provides a means of communicating with the flowmeter. The patent numbers which apply are 5,909,363 and 6,424,872.

This Foundation Fieldbus device supports 2 Analog Input (AI) blocks, which can be configured to supply the following measurements on the network (see Table 9).

Table 9: Available Measurements for the DF868

Channel 1	Units	Channel 2	Units	Average	Units
Ch1 Velocity	ft/s or m/s*	Ch2 Velocity	ft/s or m/s*	Avg Velocity	ft/s or m/s*
Ch1 Act Volumetric	VOL_U	Ch2 Act Volumetric	VOL_U	Avg Act Volumetric	VOL_U
Ch1 Std Volumetric	VOL_U	Ch2 Std Volumetric	VOL_U	Avg Std Volumetric	VOL_U
Ch1 Fwd Totals	TOT_U	Ch2 Fwd Totals	TOT_U	Avg Fwd Totals	TOT_U
Ch1 Rev Totals	TOT_U	Ch2 Rev Totals	TOT_U	Avg Rev Totals	TOT_U
Ch1 #Tot Digits**	none	Ch2 #Tot Digits**	none	Avg #Tot Digits	none
Ch1 Mass Flow	MASS_U	Ch2 Mass Flow	MASS_U	Avg Mass Flow	MASS_U
Ch1 Fwd Mass Totals	MTOT_U	Ch2 Fwd Mass Totals	MTOT_U	Avg Fwd Mass Totals	MTOT_U
Ch1 Rev Mass Totals	MTOT_U	Ch2 Rev Mass Totals	MTOT_U	Avg Rev Mass Totals	MTOT_U
Ch1 #Mass Tot Digits	none	Ch2 #Mass Tot Digits	none	Avg #Mass Tot Digits	none
Ch1 Timer	sec	Ch2 Timer	sec	Avg Timer	sec
Ch1 Error Code	none	Ch2 Error Code	none	Avg Error Code	none
Ch1 SSUP	none	Ch2 SSUP	none	Avg SSUP	none
Ch1 SSDN	none	Ch2 SSDN	none	Avg SSDN	none
Ch1 Sound Speed	ft/s or m/s*	Ch2 Sound Speed	ft/s or m/s*	Avg Sound Speed	ft/s or m/s*
Ch1 Density***	see note	Ch2 Density***	see note		
Ch1 Temperature	Deg F or C*	Ch2 Temperature	Deg F or C*		
Ch1 Pressure	PRESS_U	Ch2 Pressure	PRESS_U		

*Metric or English units are determined by the setup of the flowmeter.

**Totalizer digits are available for informational purposes only. Respective totals are automatically scaled by the Tot Digits value selected in the flowmeter setup.

***If the meter is outputting Mole Weight, the unit is “mw”, otherwise it is the programmed pressure unit.

VOL_U, TOT_U, MASS_U, MTOT_U and PRESS_U are determined by the units chosen for these measurements in the flowmeter setup. See the instrument User's Manual for the setup of these parameters.

7.2 Configuration Utility Setup

The following is an example setup using National Instruments Configuration Utility v3.1.

Figure 48 shows the Configuration Utility with a flowmeter on the network (GE Flow-XMT).

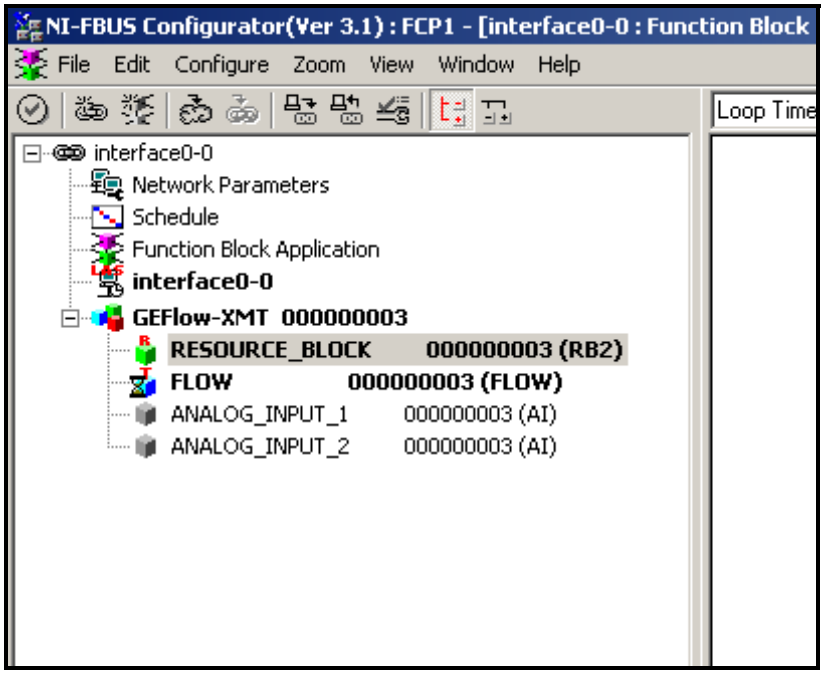


Figure 48: Configuration Utility Setup Example

Note: *The following procedures assume that the device has been placed in the OOS (out-of-service) mode before executing.*

7.3 Selecting the Desired Measurements

To set the measurement unit for each AI:

1. Double click on the FLOW Transducer Block (in the tree under GEFlow-XMT).
2. Select the **Others** tab and open the drop down list for the PRIMARY_SELECTOR and SECONDARY_SELECTOR (refer to Figure 49 on page 63).
3. Choose the unit from the list (see Figure 49 on page 63).

This unit will correspond to the unit that is available in the AI block for network connection. The PRIMARY_SELECTOR unit will correspond to ANALOG_INPUT_1 and the SECONDARY_SELECTOR will correspond to ANALOG_INPUT_2.

7.3 Selecting the Desired Measurements (cont.)

4. After the desired measurements have been selected for the PRIMARY and SECONDARY SELECTOR, choose the unit system (UNIT_SELECTOR above the PRIMARY_SELECTOR) that has been programmed in the flowmeter (English or SI).

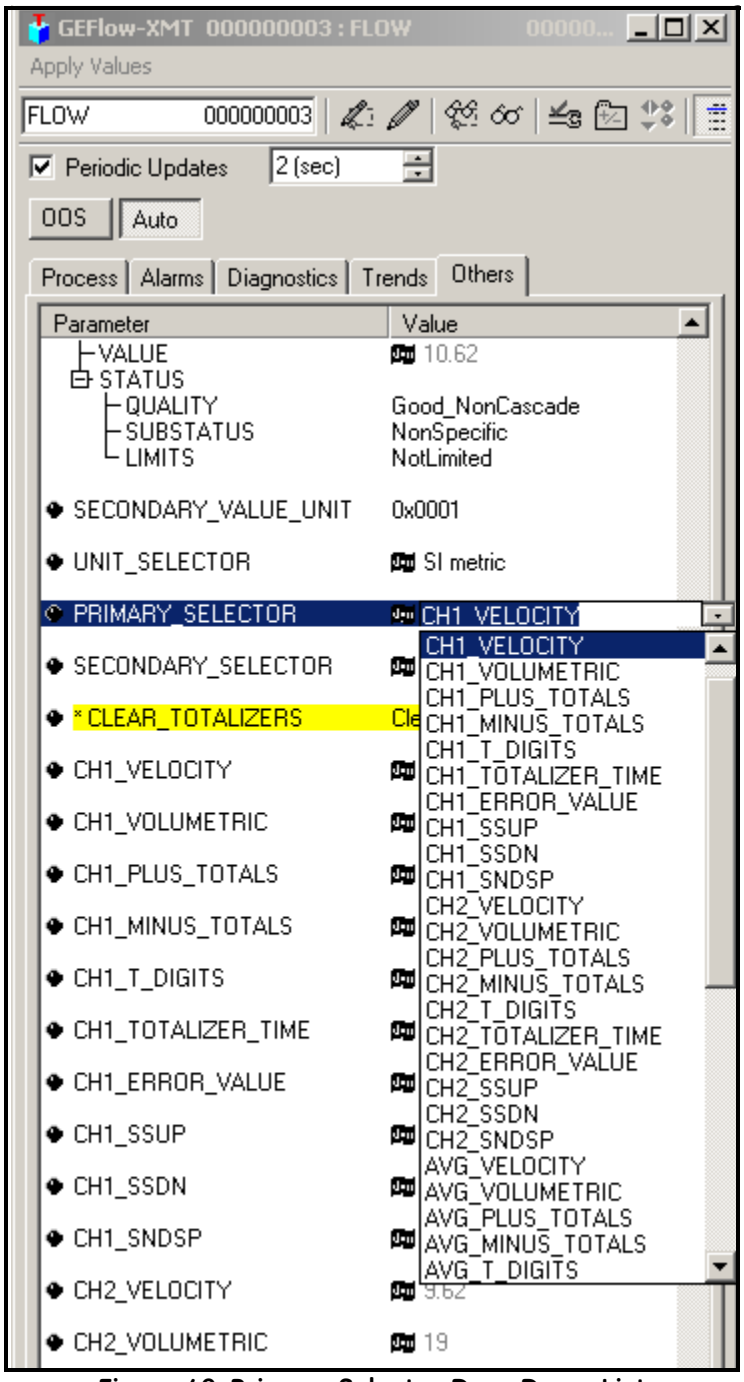


Figure 49: Primary Selector Drop Down List

7.4 Selecting Units for AI Blocks

To select the units for the individual AI blocks:

1. Double click on the AI block for which you wish to set the units (ANALOG_INPUT_1 or ANALOG_INPUT_2 in the tree under GEFlow-XMT; see Figure 48 on page 62).
2. Select the **Scaling** tab and set the unit for the measurement based on the flowmeter settings.

For example, if the flowmeter was set to use the metric unit system and the PRIMARY_SELECTOR was set to use VELOCITY you would choose **m/s** for the unit as shown in Figure 50.

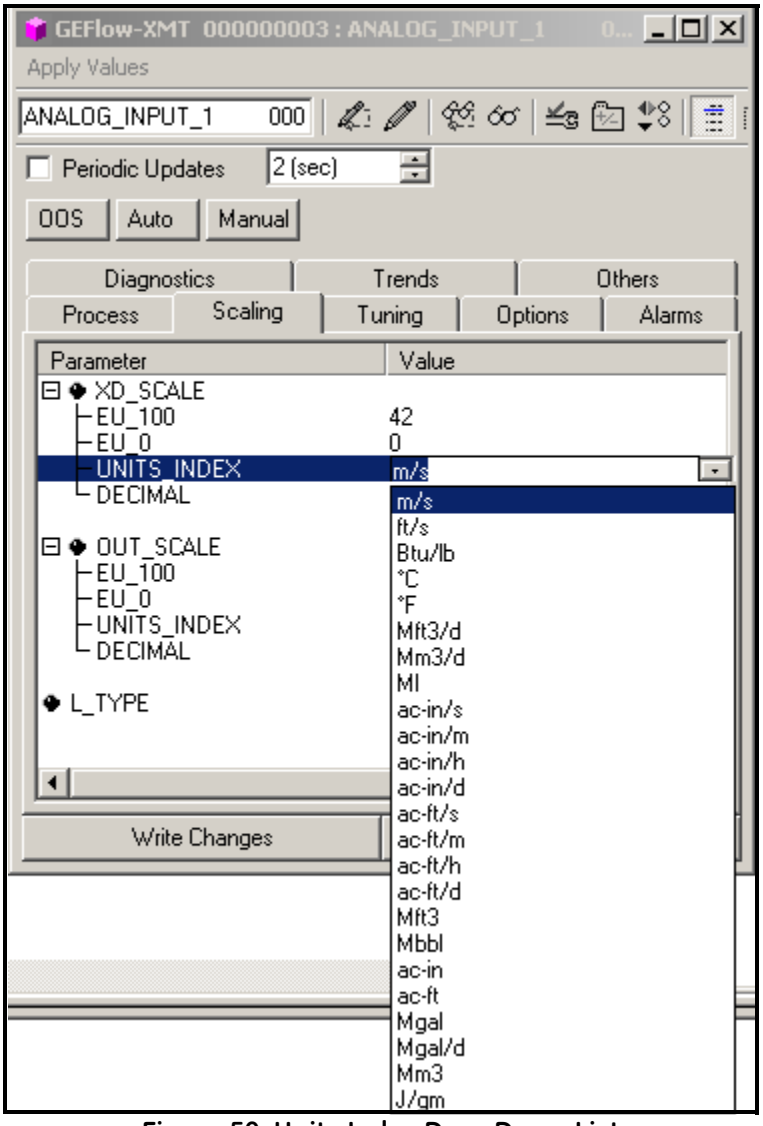


Figure 50: Units Index Drop Down List

7.5 Resetting Instrument Totalizers

To reset the instrument totalizers:

1. Double click on the FLOW transducer block (in the tree under GEFlow-XMT; see Figure 48 on page 62).
2. Select the **Others** tab and scroll down to the CLEAR_TOTALIZERS listing.
3. Select **Clear** from the drop down list box (see Figure 51).
4. After the totals have been reset, select **Normal** from the drop down list box to resume total accumulation.

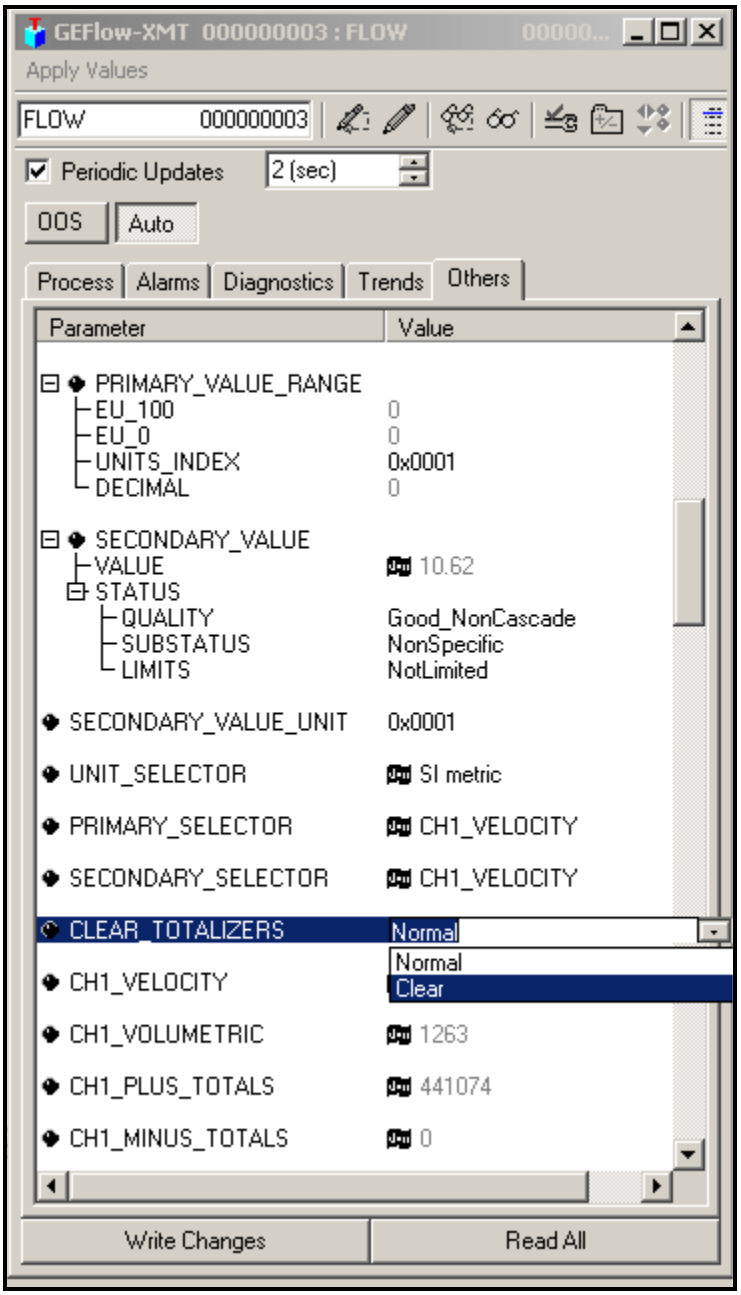


Figure 51: Clear Totalizers Drop Down List

7.6 Function Block Application

Figure 52 is an example setup using the Function Block Application editor. The flowmeter AI blocks, along with the AO and PID of another device on the network, are displayed. We have connected the AI_1 OUT of the flowmeter to the CAS IN of the AO block. We have also connected the AI_2 OUT of the flowmeter to the CAS IN of the PID block.

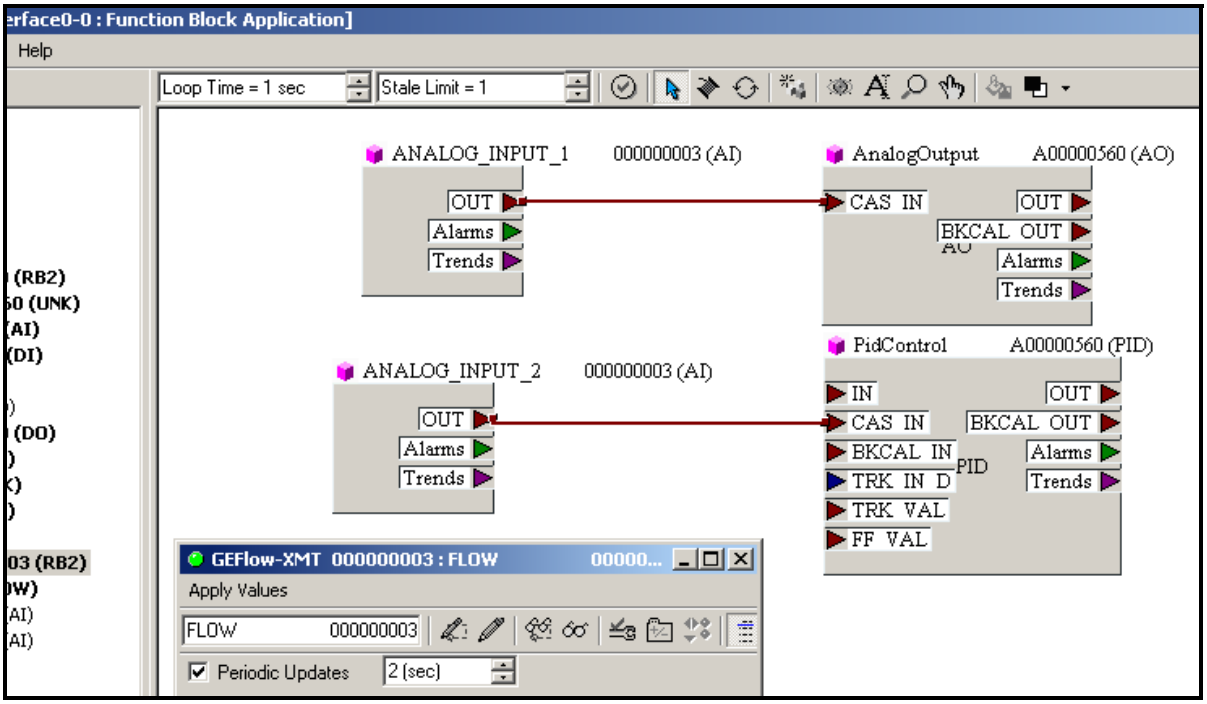


Figure 52: Function Block Application

Chapter 8. HART Communications

8.1 Introduction

GE Panametrics GF868, XGM868, XGS868 and XMT868 ultrasonic flowmeters may be modified to permit two-way communication with a HART communication device. This requires the installation of a HART option card in the flowmeter. The option card generates a 4-20 mA analog output signal that can be read by the HART device. Proceed to the appropriate section for detailed instructions on installing and using the HART option card.

8.2 Installing the HART Option Card

To install a HART option card in your flowmeter, complete the following steps:

WARNING! This procedure should be performed only by qualified service personnel.

1. Disconnect the main power from the flowmeter.

WARNING! Failure to disconnect the power before proceeding may result in serious injury.

2. Refer to your *User's Manual* for step-by-step instructions, and install the HART option card in **Slot 6** for a GF868 flowmeter or in **Slot 2** for an XGM868, XGS868 or XMT868 flowmeter.

IMPORTANT: *If a* **MODBUS** *option card is installed in Slot 5 of a GF868 flowmeter, the* **HART** *option card in Slot 6 will be ignored.*

3. Interconnect the HART option card and the HART device as shown in Figure 53.

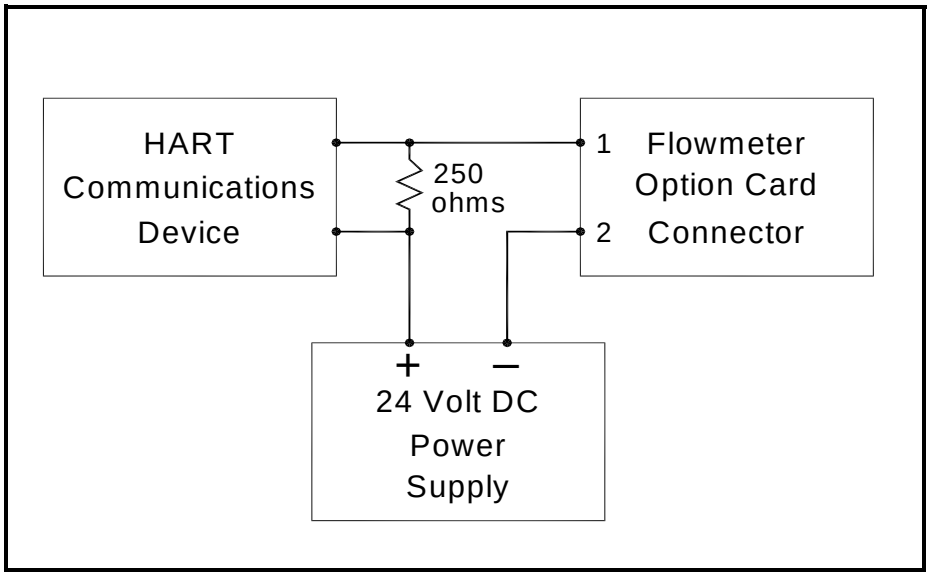


Figure 53: Option Card Wiring

8.2 Installing the HART Option Card (cont.)

For a GF868 flowmeter, the option card connector is mounted on the card, and the HART device leads should go to pins 1 and 2 of this connector. As for other option cards installed in the same meter as the HART option card, the HART device will not recognize any option card installed in Slots 3-5 and it will only recognize option cards installed in Slots 1-2 if they are Analog Input, Analog Output, or RTD option cards.

For XGM868, XGS868 and XMT868 flowmeters, the HART device connections must be made to pins 1 and 2 of the 12-pin terminal block J2 on the terminal board. Therefore, you must make sure that any option card installed in Slot 1 does not use these terminals.

Note: *Refer to your* User's Manual *for a complete description of the available Slot 1 option cards and their terminal usage.*

8.3 Flowmeter Software Setup

GE Panametrics flowmeters that are shipped with a factory-installed HART option card require no special setup procedures by the user. The meter automatically configures itself for HART communication on startup. However, for field-installation of a HART option card, the card must be configured in the factory test menu before it will be recognized by the meter. Thereafter, the initialization will be automatic on startup. Contact the factory for specific instructions.

In addition to setting up the HART option card so that it is recognized by the meter, the analog output of the option card may be configured using any of the following methods (if available):

- the flowmeter keypad
- Instrument Data Manager (IDM™) software
- PanaView™ graphical user interface software
- the HART device

To configure your HART option card analog output using any of the first three methods, follow the instructions in the appropriate *User's Manual*. During configuration, the choice of parameter must be limited to those listed in Table 10 on page 69. To use the HART device for configuration of the analog output, refer to the instructions that came with that device.

Note: *Because HART communication is unreliable at analog outputs below 4 mA, the flowmeter automatically changes a HART option card analog output configuration of* 0-20 mA *or* OFF *to a* 4-20 mA *configuration upon startup. Check to make sure that the analog output configuration is set to 4-20mA. If for some reason, it has not been automatically changed, set it to 4-20mA from the front panel.*

8.3 Flowmeter Software Setup (cont.)

Some flowmeter parameters can only be read by the HART device during startup. Therefore, it is recommended that both the flowmeter and the HART device be rebooted after any reprogramming of the HART option card analog output. Failure to do so may result in erroneous information or a communication failure between the flowmeter and the HART device.

Table 10: Valid HART Parameters and Units

Parameter	English Units	Metric Units
Velocity	ft/sec	m/s
Volumetric (liquid)	gal/s, gal/m, gal/h, mgal/day, cuf/s, cuf/m, cuf/h, mcf/day, bbls/s, bbl/m, bbl/h, mbl/d, acre-inch/day	l/s, l/m, l/h, ml/d, cum/s, cum/m, cum/h, mcm/d, bbl/s, bbl/m, bbl/h, mbl/d
Volumetric (gas)	acf/m, acf/h, scf/m, scf/h	acm/h, scm/h, scm/d
+Tot, -Tot (liquid)	gal, cuf,bbl, acre-in, acre-ft	liter, cum, bbl
+Tot, -Tot (gas)	acf, scf	acm, scm
Mass Flow	lb/s, lb/m, lb/h, mlb/d, ton/m, ton/h, mton/d	kg/s, kg/h, mkg/d, tne/m, tne/h, tne/d
+Mass, -Mass	lb, ton	kg, tne
Power	kbtu/h, kw	mcal/h, kw
+Energy, -Energy	btu, kw-hr	mcal, kw-hr
Temperature	°F	°C
Pressure	psia	bar, bara
Mol Weight	none	none
NOTE: “acf” is reported as “normal cubic feet” in HART. Also, “Mega” units (i.e. mgal/day, mcf/day, etc.) are reported as standard units x 10^6 in HART. For example, 1 mgal is 1x10^6 gal in HART.		

8.4 Using the HART Interface

The HART communications option card installed in GE Panametrics flowmeters has been successfully tested with the **Rosemount 275 Hand-Held Communicator** and the **Rosemount AMS Computer-Based Communications Software**. Although some flowmeter functions may be performed using the HART device, many other functions (i.e. data logging, site file uploading, site file downloading, printing, etc.) must still be programmed by the methods described in the flowmeter *User’s Manual*. This is because the HART protocol was developed for use with simple transmitters and it cannot handle the multitude of sophisticated functions built into the GE Panametrics flowmeters.

8.4.1 Unit Types

Due to limitations of the HART protocol, only those unit types listed in Table 10 are acceptable. If a meter parameter is set to any other measurement units, the HART device displays an *“Unknown Enumerator, Can not resolve”* error message and may terminate communications entirely. In some cases, both the Hart device and the flowmeter may have to be rebooted to clear the error. To address this potential problem, the flowmeter has been programmed to force all measurement units to HART compliant units if a HART option card is detected upon startup.

8.4.2 HART Functions

After HART communications has been properly set up, the following flowmeter functions may be accessed using the HART device:

- static temperature and static pressure

Note: *To view the static temperature or pressure for a channel using the HART device, the fixed value for that parameter must be assigned to that channel at the flowmeter. See your* User's Manual *for instructions.*

- tracking windows (XMT868 only)
- minimum and maximum soundspeed (XMT868 only)
- 2-path error handling
- velocity averaging response time
- static density
- error handling
- mA error level (if selected)
- clear totals

Note: *Refer to your* User's Manual *for a complete description of each of the above functions.*

When information is viewed through the HART device, the input variable always appears as either *Channel 1 Temperature* or *Channel 1 Pressure*. Although these inputs are not necessarily assigned to Channel 1, the HART protocol labels all inputs as channel-specific. For example, a Slot 1 analog input that is programmed at the meter as a temperature input assigned to Channel 1, Channel 2, Both, or Neither is always reported by the HART device as a *Channel 1* Temperature input.

Note: *Inputs cannot be assigned using the HART device. Also, any input assigned as* "Special" *is always reported as a Channel 1 Temperature input by the HART device*

In addition to the functions listed on the previous page, the following procedures may be performed through the HART device:

- calibration and setup of the HART option card analog output
- calibration and some programming of analog inputs, analog outputs, and RTD inputs on option cards installed in Slots 0 (all), 1 (all), and 2 (GF868 only)
- viewing some of the flowmeter's diagnostic parameters

8.5 List of Programmable Variables

For convenient reference, all of the programmable variables for the four flowmeter models are listed in Table 11 on page 71.

Table 11: Programmable Variables

Description	Format*	R/W/B*	XMT868	XGS868	XGM868	GF868
Channel Process Variables						
Ch1, Ch2, or Ave vel	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave vol	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave mdot	f.p.	R	Y	Y	if mass	Y
Ch1, Ch2, or Ave power	f.p.	R	if energy	N	N	N
Ch1, Ch2, or Ave Temper	f.p.	R	N	Y	Y	Y
Ch1, Ch2, or Ave Pressure	f.p.	R	N	Y	Y	Y
Ch1, Ch2, or Ave Mw	f.p.	R	N	N	N	Y
Ch1, Ch2, or Ave +tot	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave -tot	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave +mass	f.p.	R	Y	Y	if mass	Y
Ch1, Ch2, or Ave -mass	f.p.	R	Y	Y	if mass	Y
Ch1, Ch2, or Ave +energy	f.p.	R	if energy	N	N	N
Ch1, Ch2, or Ave -energy	f.p.	R	if energy	N	N	N
Ch1 or Ch2 Ssup	f.p.	R	Y	Y	Y	Y
Ch1 or Ch2 ssDO	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave tUP	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave tDO	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave deltaT	f.p.	R	Y	Y	Y	Y
Ch1 or Ch2 peak%	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave DeltaT(s)	f.p.	R	N	if meas	if meas	if meas
Ch1, Ch2, or Ave DeltaT(M)	f.p.	R	N	if meas	if meas	if meas
Ch1 or Ch2 qUP	f.p.	R	Y	Y	Y	Y
Ch1 or Ch2 qDOWN	f.p.	R	Y	Y	Y	Y
Ch1 or Ch2 ampUP	f.p.	R	Y	Y	Y	Y
Ch1 or Ch2 ampDOWN	f.p.	R	Y	Y	Y	Y
Ch1 or Ch2 peak#UP	f.p.	R	Y	Y	Y	Y
Ch1 or Ch2 peak#DOWN	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave t.S	f.p.	R	if energy	N	N	N
Ch1, Ch2, or Ave t.R	f.p.	R	if energy	N	N	N
Ch1, Ch2, or Ave t.S-t.R	f.p.	R	if energy	N	N	N
Ch1 or Ch2 inco1	f.p.	R	if transfl.	N	N	N
Ch1 or Ch2 onco2	f.p.	R	if transfl.	N	N	N
Ch1 or Ch2 Rpowr	f.p.	R	if transfl.	N	N	N
Ch1 or Ch2 Rqual	f.p.	R	if transfl.	N	N	N
Ch1 or Ch2 Repp	f.p.	R	if transfl.	N	N	N
Ch1, Ch2, or Ave c3	f.p.	R	Y	Y	Y	Y
Ch1, Ch2, or Ave Temp_super	f.p.	R	N	Y	N	N
Ch1, Ch2, or Ave Rho	f.p.	R	N	Y	N	N
Ch1 or Ch2 Err code	int	R	Y	Y	Y	Y
Ch1 or Ch2 re#	f.p.	R	Y	N	N	N

Table 11: Programmable Variables (cont.)

Description	Format*	R/W/B*	XMT868	XGS868	XGM868	GF868
Global Meter Information						
MeterType (Model)	int	R	Y	Y	Y	Y
#Channels	int	R	Y	N	N	N
2-Path?	int	B	Y	N	N	N
Resp_time	int	B	Y	Y	Y	Y
Static Density?	int	B	Y	Y	Y	Y
Static Density Value	f.p.	B	Y	Y	Y	Y
Error Mode	int	B	Y	Y	Y	Y
Aout Error Level	f.p.	B	Y	Y	Y	Y
Meter Units (Eng. or Metric)	uchar	B	Y	Y	Y	Y
EnergyMeter?	uchar	R	Y	N	N	N
Clear-totals?	int	W	Y	Y	Y	Y
CH1 Information						
Ch1 Fixed Temp	f.p.	B	N	Y	Y	Y
Ch1 Fixed Press	f.p.	B	N	Y	Y	Y
Ch1 Tracking?	int	B	Y	N	N	
Ch1 Min Sound Spd	f.p.	B	Y	N	N	N
Ch1 Max Sound Spd	f.p.	B	Y	N	N	N
CH2 Information (if applicable)						
Ch2 Fixed Temp	f.p.	B	N	Y	Y	Y
Ch2 Fixed Press	f.p.	B	N	Y	Y	Y
Ch2 Tracking?	int	B	Y	N	N	
Ch2 Min Sound Spd	f.p.	B	Y	N	N	N
Ch2 Max Sound Spd	f.p.	B	Y	N	N	N
Slot Information						
Slot 0 A or B Device	uchar	R	Y	Y	Y	Y
Slot 0 A or B Type	uchar	B	Y	Y	Y	Y
Slot 0 A or B Chan	uchar	B	if 2-Ch	if 2-Ch	if 2-Ch	if 2-Ch
Slot Information (cont.)						
Slot 0 A or B Variable	uchar	B	Y	Y	Y	Y
Slot 0 A or B Units	uchar	R	Y	Y	Y	Y
Slot 0 A or B Zero	f.p.	B	Y	Y	Y	Y
Slot 0 A or B Span	f.p.	B	Y	Y	Y	Y
Slot 1 or 2 Active	int	R	Y	Y	Y	Y
Slot 1 or 2 A, B, C, or D Device	uchar	R	if active	if active	if active	if active
Slot 1 or 2 A, B, C, or D Type	uchar	B	if active	if active	if active	if active
Slot 1 or 2 A, B, C, or D Chan	uchar	B	if active	if active	if active	if active
Slot 1 or 2 A, B, C, or D Variable	uchar	B	if active	if active	if active	if active
Slot 1 or 2 A, B, C, or D Units	uchar	R	if active	if active	if active	if active
Slot 1 or 2 A, B, C, or D Zero	f.p.	B	if active	if active	if active	if active
Slot 1 or 2 A, B, C, or D Span	f.p.	B	if active	if active	if active	if active

Table 11: Programmable Variables (cont.)

Description	Format*	R/W/B*	XMT868	XGS868	XGM868	GF868
HART Variables						
Universal Rev	uchar	R	Y	Y	Y	Y
Software Rev	uchar	R	Y	Y	Y	Y
Transmitter Rev	uchar	R	Y	Y	Y	Y
Hardware Rev	uchar	R	Y	Y	Y	Y
Device ID	uchar	R	Y	Y	Y	Y
PollAddress	uchar	B	Y	Y	Y	Y
Message	uchar24	B	Y	Y	Y	Y
Tag	uchar6	B	Y	Y	Y	Y
Descriptor	uchar12	B	Y	Y	Y	Y
Date	uchar3	B	Y	Y	Y	Y
Final Assy No	uchar3	B	Y	Y	Y	Y
Derial No.	uchar3	R	Y	Y	Y	Y
Pvt. Label Dist	uchar	R	Y	Y	Y	Y
Pri Var Code	uchar	R	Y	Y	Y	Y
Alarm Select	f.p.	B	Y	Y	Y	Y
Write Protect Code	uchar	B	Y	Y	Y	Y
Config Chgd Flag	uchar	B	Y	Y	Y	Y
Response Preambles	uchar	B	Y	Y	Y	Y
HART Device	uchar	R	Y	Y	Y	Y
HART Type	uchar	B	Y	Y	Y	Y
HART Channel	uchar	B	Y	Y	Y	Y
HART Variable	uchar	B	Y	Y	Y	Y
HART Units	uchar	R	Y	Y	Y	Y
HART Zero	f.p.	B	Y	Y	Y	Y
HART Span	f.p.	B	Y	Y	Y	Y

*** Format** - f.p. = IEEE floating point, int = integer, uchar = unsigned character ucharX = X bytes of unsigned characters. **R/W/B** - R = read only, W = write only, B = read or write using HART

[no content intended for this page]

Chapter 9. BACNet/IP (BACNet Over Ethernet)

9.1 Introduction

This chapter provides instructions for setting up a flowmeter equipped with *BACNet Over Ethernet* communications. To apply these procedures, the flowmeter must have the option card installed. The option card, based on the features that were ordered, will have many components (see Figure 54 and Figure 55).

Note: *To install an option card, consult the user's manual(s) which apply to your instrument.*

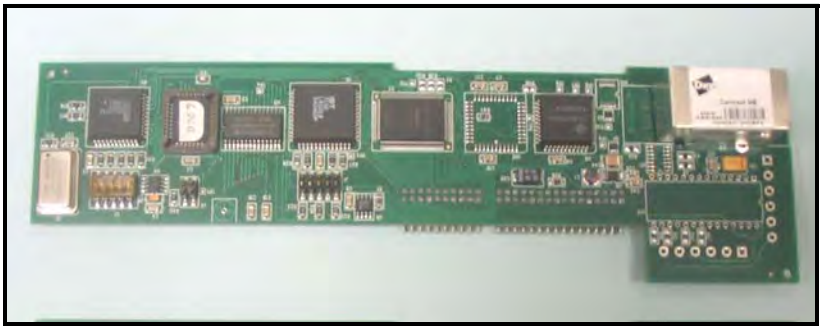


Figure 54: DF/GX BACNet/IP Option Card

Figure 55: XMT BACNet/IP Option Card

9.2 Setup

Using an Ethernet Crossover Cable, connect the flowmeter to a computer as shown in Figure 56. You must set up the computer's IP parameters according to Figure 56.

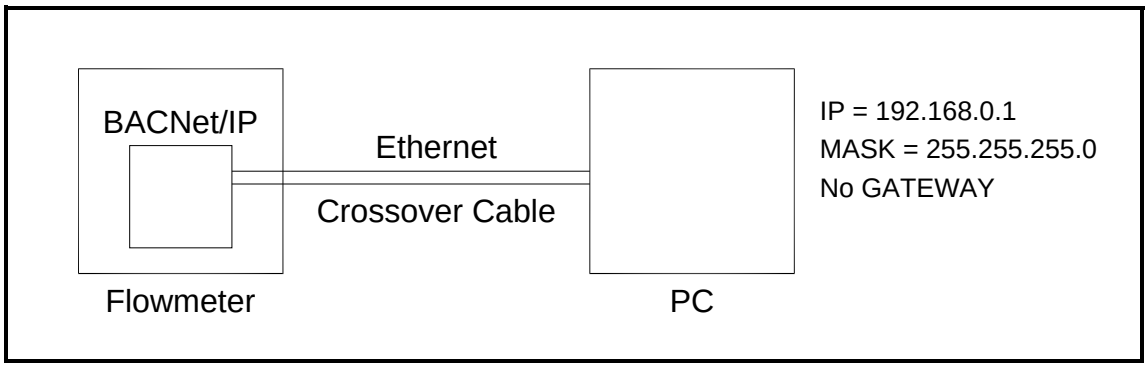


Figure 56: Computer Cable Connection

To set up the BACNet/IP parameters, enter "192.168.0.100" (the default static IP of the board) on your internet browser, and a screen similar to Figure 57 on page 77 appears.

9.2 Setup (cont.)

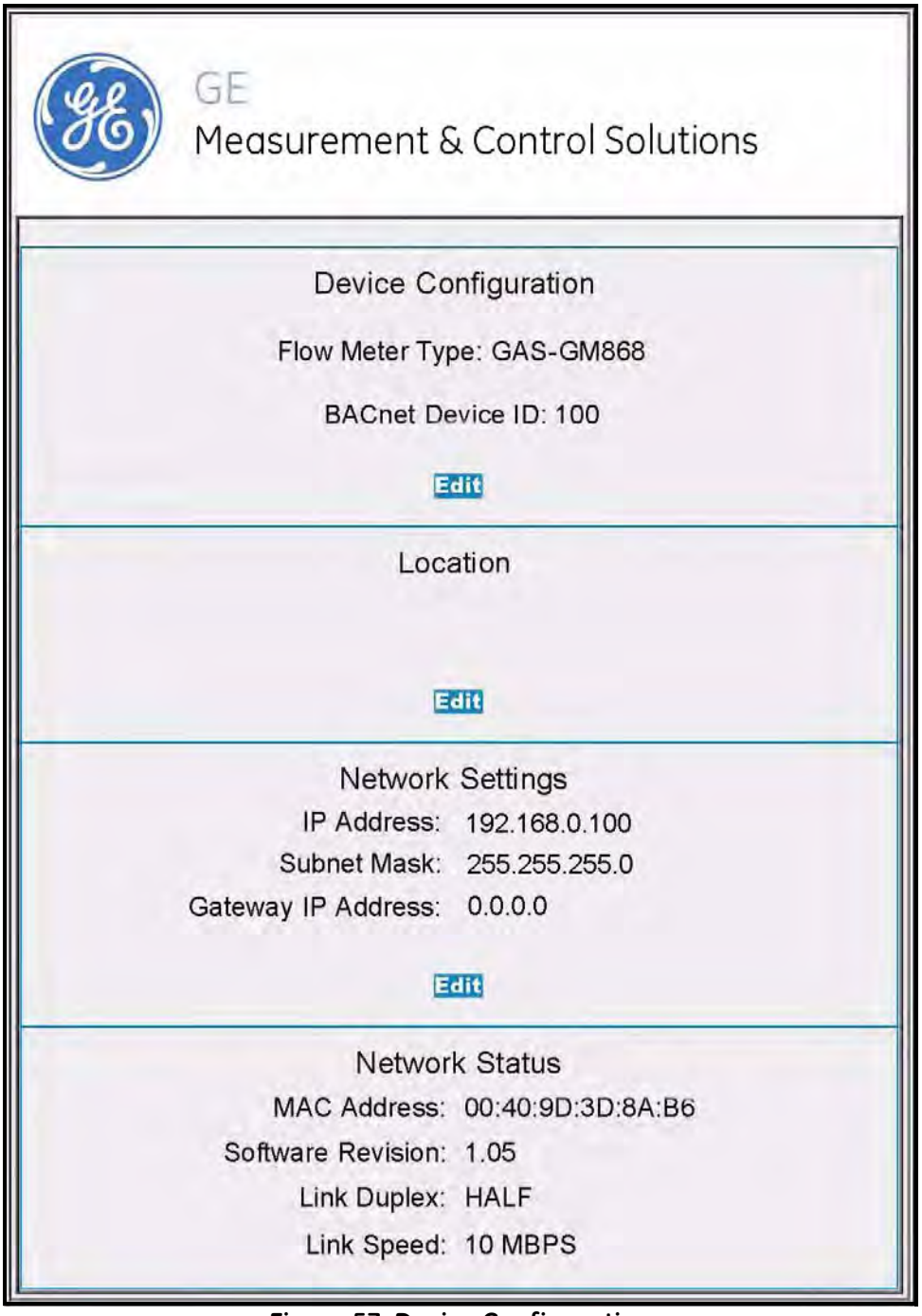


Figure 57: Device Configuration

9.2 Setup (cont.)

To change the BACNet Device ID (see Figure 57), under Device Configuration, click on Edit and a screen similar to Figure 58 appears. Enter the flow meter type and/or the device ID and click on “Save Settings” to save the change or “Cancel Changes” to return to the previous value. Click on Main Page to return to the main page.

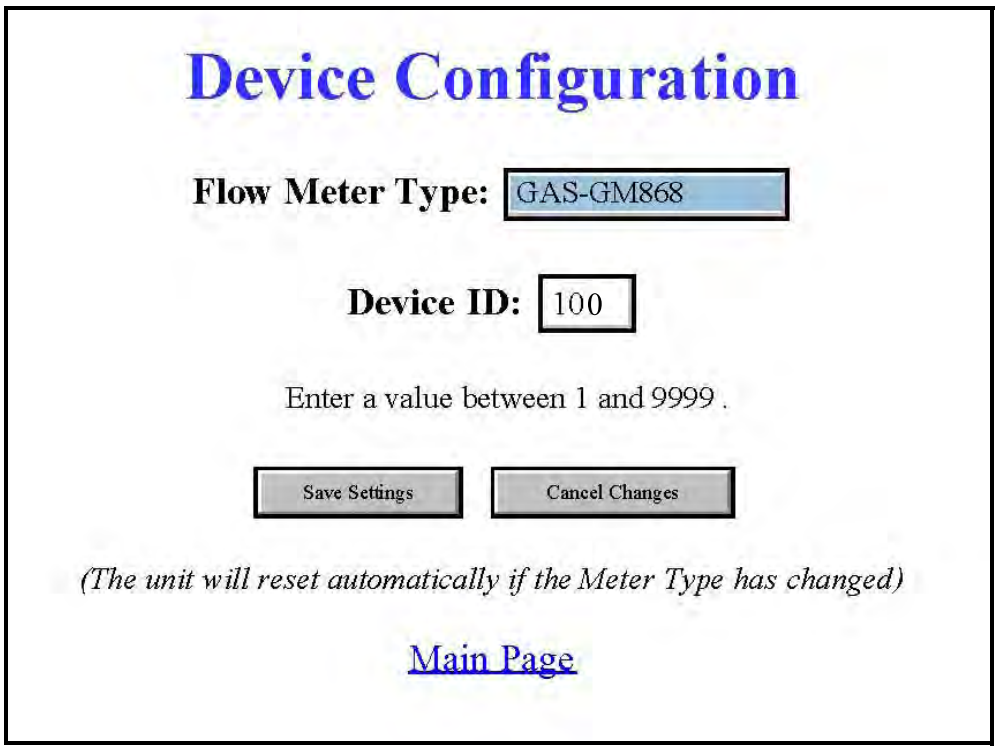


Figure 58: Device Configuration

9.2 Setup (cont.)

To change the IP address, under Network Settings, click on Edit and a screen similar to the following appears. Enter the new address and click on “Save Settings” to save the change, or “Cancel Changes” to return to the previous setting. You must type the new IP in the browser to return to the main page.

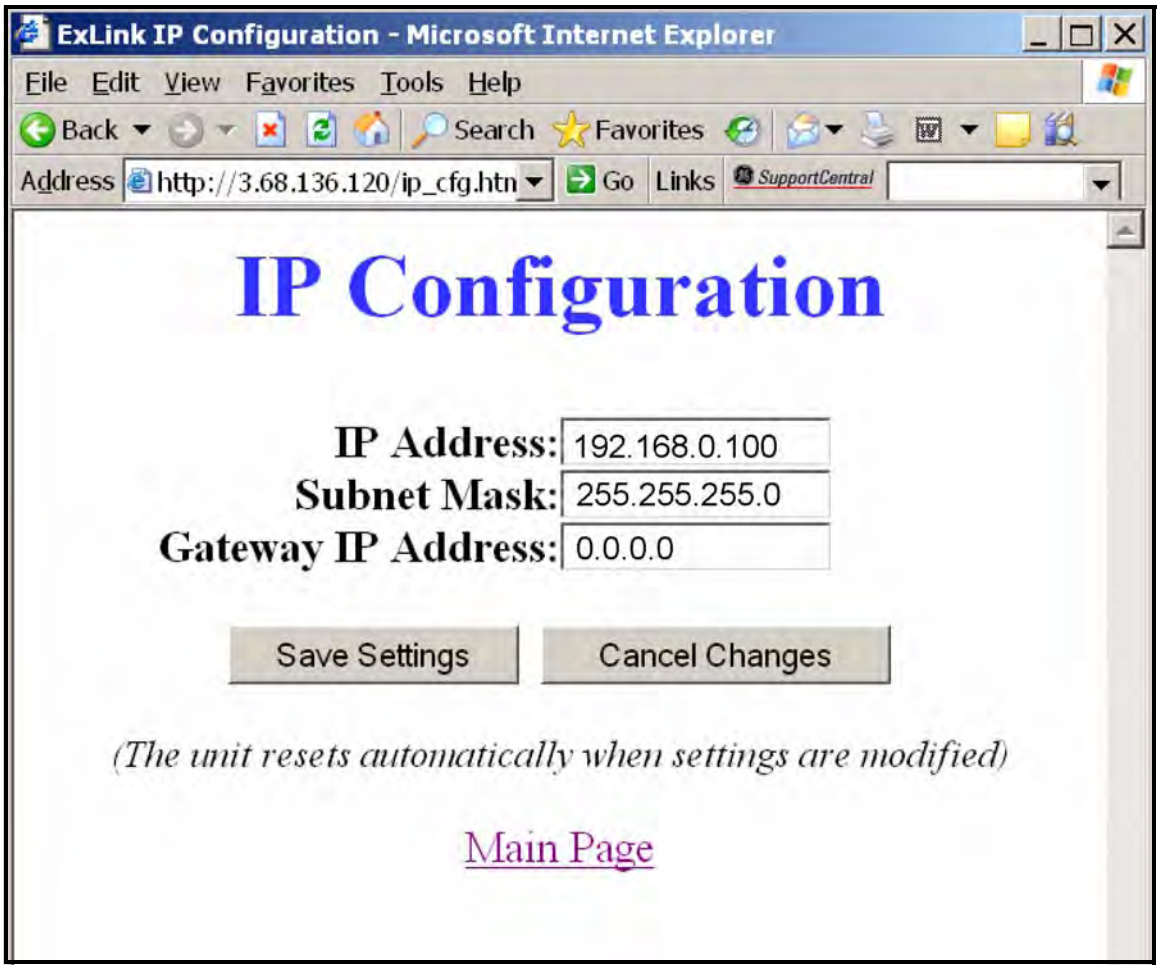
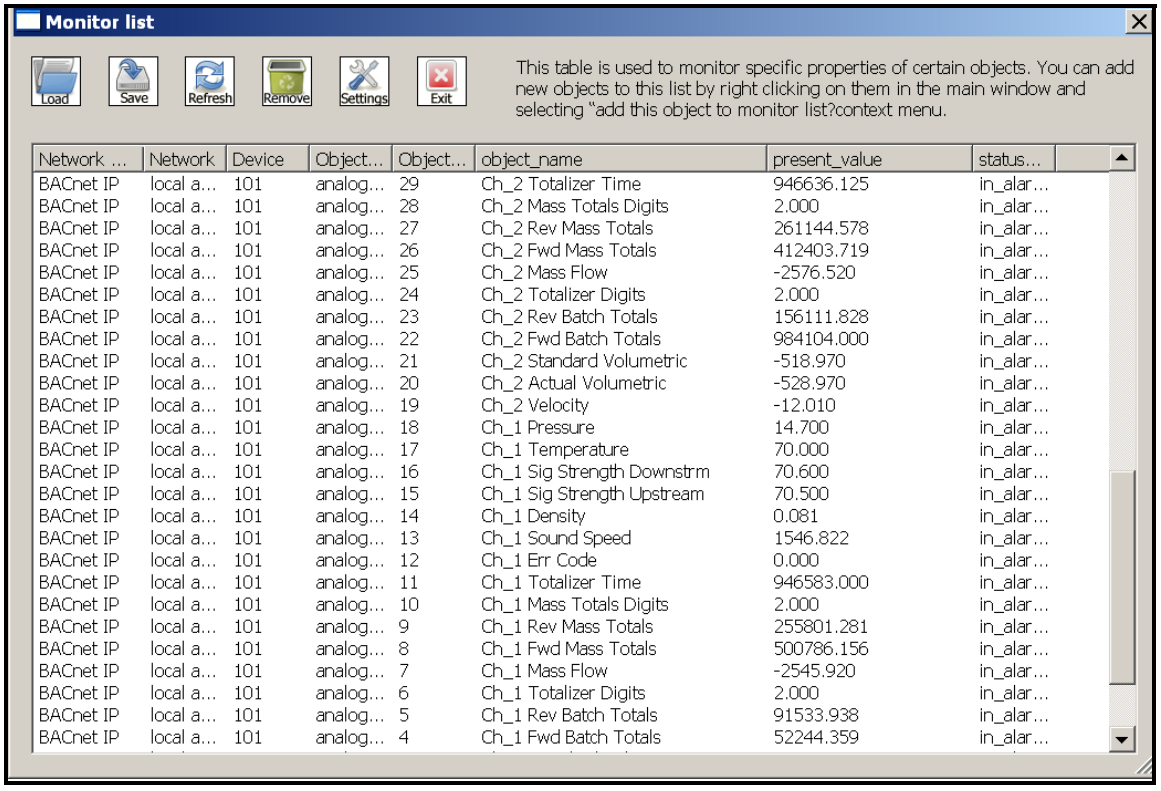


Figure 59: IP Configuration

9.3 Adding Information to the Monitor List

To test connectivity and view data, use any BACNet monitoring software.

The table shown in Figure 60 is used to monitor specific properties of certain objects on the CAS BACNet Explorer. To add new objects to this list, right click on the BACNet device in the main window and select “add this device’s object to monitor list” context menu.



Network ...	Network	Device	Object...	Object...	object_name	present_value	status...
BACnet IP	local a...	101	analog...	29	Ch_2 Totalizer Time	946636.125	in_alar...
BACnet IP	local a...	101	analog...	28	Ch_2 Mass Totals Digits	2.000	in_alar...
BACnet IP	local a...	101	analog...	27	Ch_2 Rev Mass Totals	261144.578	in_alar...
BACnet IP	local a...	101	analog...	26	Ch_2 Fwd Mass Totals	412403.719	in_alar...
BACnet IP	local a...	101	analog...	25	Ch_2 Mass Flow	-2576.520	in_alar...
BACnet IP	local a...	101	analog...	24	Ch_2 Totalizer Digits	2.000	in_alar...
BACnet IP	local a...	101	analog...	23	Ch_2 Rev Batch Totals	156111.828	in_alar...
BACnet IP	local a...	101	analog...	22	Ch_2 Fwd Batch Totals	984104.000	in_alar...
BACnet IP	local a...	101	analog...	21	Ch_2 Standard Volumetric	-518.970	in_alar...
BACnet IP	local a...	101	analog...	20	Ch_2 Actual Volumetric	-528.970	in_alar...
BACnet IP	local a...	101	analog...	19	Ch_2 Velocity	-12.010	in_alar...
BACnet IP	local a...	101	analog...	18	Ch_1 Pressure	14.700	in_alar...
BACnet IP	local a...	101	analog...	17	Ch_1 Temperature	70.000	in_alar...
BACnet IP	local a...	101	analog...	16	Ch_1 Sig Strength Downstrm	70.600	in_alar...
BACnet IP	local a...	101	analog...	15	Ch_1 Sig Strength Upstream	70.500	in_alar...
BACnet IP	local a...	101	analog...	14	Ch_1 Density	0.081	in_alar...
BACnet IP	local a...	101	analog...	13	Ch_1 Sound Speed	1546.822	in_alar...
BACnet IP	local a...	101	analog...	12	Ch_1 Err Code	0.000	in_alar...
BACnet IP	local a...	101	analog...	11	Ch_1 Totalizer Time	946583.000	in_alar...
BACnet IP	local a...	101	analog...	10	Ch_1 Mass Totals Digits	2.000	in_alar...
BACnet IP	local a...	101	analog...	9	Ch_1 Rev Mass Totals	255801.281	in_alar...
BACnet IP	local a...	101	analog...	8	Ch_1 Fwd Mass Totals	500786.156	in_alar...
BACnet IP	local a...	101	analog...	7	Ch_1 Mass Flow	-2545.920	in_alar...
BACnet IP	local a...	101	analog...	6	Ch_1 Totalizer Digits	2.000	in_alar...
BACnet IP	local a...	101	analog...	5	Ch_1 Rev Batch Totals	91533.938	in_alar...
BACnet IP	local a...	101	analog...	4	Ch_1 Fwd Batch Totals	52244.359	in_alar...

Figure 60: Monitor List Context Menu

Warranty

Each instrument manufactured by GE Sensing is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of GE Sensing. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If GE Sensing determines that the equipment was defective, the warranty period is:

- one year from delivery for electronic or mechanical failures
- one year from delivery for sensor shelf life

If GE Sensing determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by GE Sensing, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a GE Sensing instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify GE Sensing, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, GE Sensing will issue a RETURN AUTHORIZATION NUMBER (RAN), and shipping instructions for the return of the instrument to a service center will be provided.
2. If GE Sensing instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, GE Sensing will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If GE Sensing determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

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Customer Support Centers

U.S.A.

The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: sensing@ge.com

Ireland

Sensing House
Shannon Free Zone East
Shannon, County Clare
Ireland
Tel: +353 61 61470291
E-mail: gesensingsnnservices@ge.com

An ISO 9001:2008 Certified Company

www.ge-mcs.com/en/about-us/quality.html

www.ge-mcs.com

916-115 Rev. C