118 ITM

Intelligent Transformer Monitor for Dry Transformers

Instruction Manual

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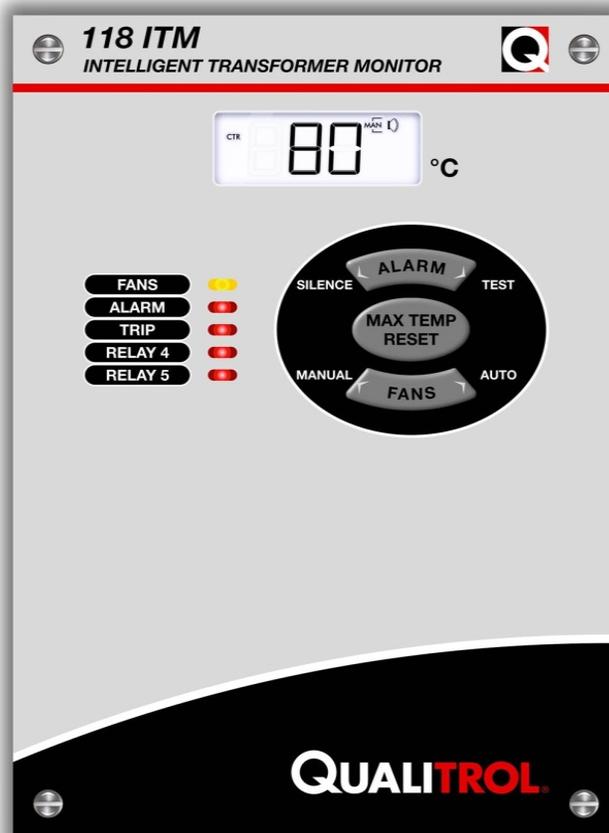
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Contents

Overview

1.1.   QUALITROL Intelligent Transformer Monitor

The Model 118 ITM Intelligent Transformer Monitor (ITM) can monitor up to three thermocouples in ventilated dry-type transformer windings, display the current winding temperatures, and operate relays by comparing the highest of the three winding temperatures to stored set point temperatures.

The ITM provides the following standard features:

- Monitors three, type K thermocouples.

- Displays each of the three thermocouple temperatures as well as the maximum temperature stored.

- Displays the channel that caused the stored maximum temperature.

- Operates high-contact rating SPST relays with fuse-protected contacts to control cooling FANs.

- A Manual Fan Control provides the capability to force the FANs to turn ON.

- A yellow LED indicates that the FANs are ON.

- A Fan Exerciser Circuit turns the FANs ON for a short time at periodic intervals (ON time and intervals are programmable).

- Operates a relay with an SPDT contact when one of the inputs exceeds the ALARM setting.

- A red LED indicates that the ALARM is ON.

- An internal audible device (buzzer) sounds when the ALARM is ON. The audible device can be silenced by the Front Panel Silence button without changing the state of the ALARM relay.

- The ALARM relay default state is normally energized so that the ALARM is initiated upon power failure (failsafe). All other relay default states are normally de-energized (non-failsafe). The normal state of all relays, except for the Fan Control Relays, may be changed via the USB port and software, allowing for customer configuration.

- RELAY 4 and RELAY 5 are available for use depending on application. The normal state of these relays may be set by the user software. A red LED indicates the status RELAY 4 and 5

- If a thermocouple goes open circuit, it is detected, the ALARM operates, and the faulty channel displays "- - -". A failed thermocouple will not cause a TRIP.

- Operates a relay with an SPDT contact when one of the inputs exceeds the TRIP setting.

- A red LED indicates that the TRIP relay is ON

- A TEST function shows the stored set points, shows the internal temperature of the ITM, and tests the LCD display, relay status LEDs, and the buzzer.

An analog output is provided that is proportional to the highest of the three input temperatures. The output can be configured to be 0–1 mA, 0–10 mA, 0–20 mA, 4–20 mA, or 0–5 V

A USB data line is used to set up the programmable parameters of the unit.

Power to the unit is via a Universal Power Supply that can accept as Prime Power 80–300 VAC 50/60 Hz or 40–280 VDC.

The 118 ITM is a panel mounted through a cutout.

RS-485 data link with Modbus protocol is available as an option that must be specified at the time of the order.

1.2. QUALITROL

QUALITROL has been a leader in supplying pressure, liquid-level, and temperature controls since 1945. As an ISO 9001 system-certified company, we are committed to providing you with quality and reliability, both in our products and in our service.

1.3. About This Manual

This manual provides all the information you will need to install, set up, and operate your QUALITROL Intelligent Transformer Monitor. It is organized into the following sections:

Installation – Step-by-step, illustrated instructions to guide you through mounting, supplying power to, and wiring your Transformer Monitor.

Operation – A description of use during transformer operation, as well as easy instructions on how to perform a system test while the transformer is in service.

Functional Specification – A detailed functional specification of the unit.

Setup Software – Step-by-step instructions to guide you through configuration of the Transformer Monitor to meet your specific needs.

Appendix A – Step-by-step instructions to guide you through the manual adjustment of set points of the Transformer Monitor.

Appendix B – Guides you through the installation considerations and the method of testing a thermocouple-equipped ITM for accuracy.

Appendix C – Guides you through the possible error codes that may be displayed, the conditions that resulted in the error codes, and the situations' effects on the Transformer Monitor.

Appendix D – Guides you through special requirements in order to use the Transformer Monitor in the European community.

Appendix E – Step-by-step instructions to guide you through set up of the Transformer Monitor for use with Modbus communications.

Installation and Wiring

2.1. Mounting of the Transformer Monitor

The 118 ITM mounts in a rectangular cutout for a panel or a hinge mount, which is secured by four ¼" bolts. See Figure 1; 118 ITM Dimensions.
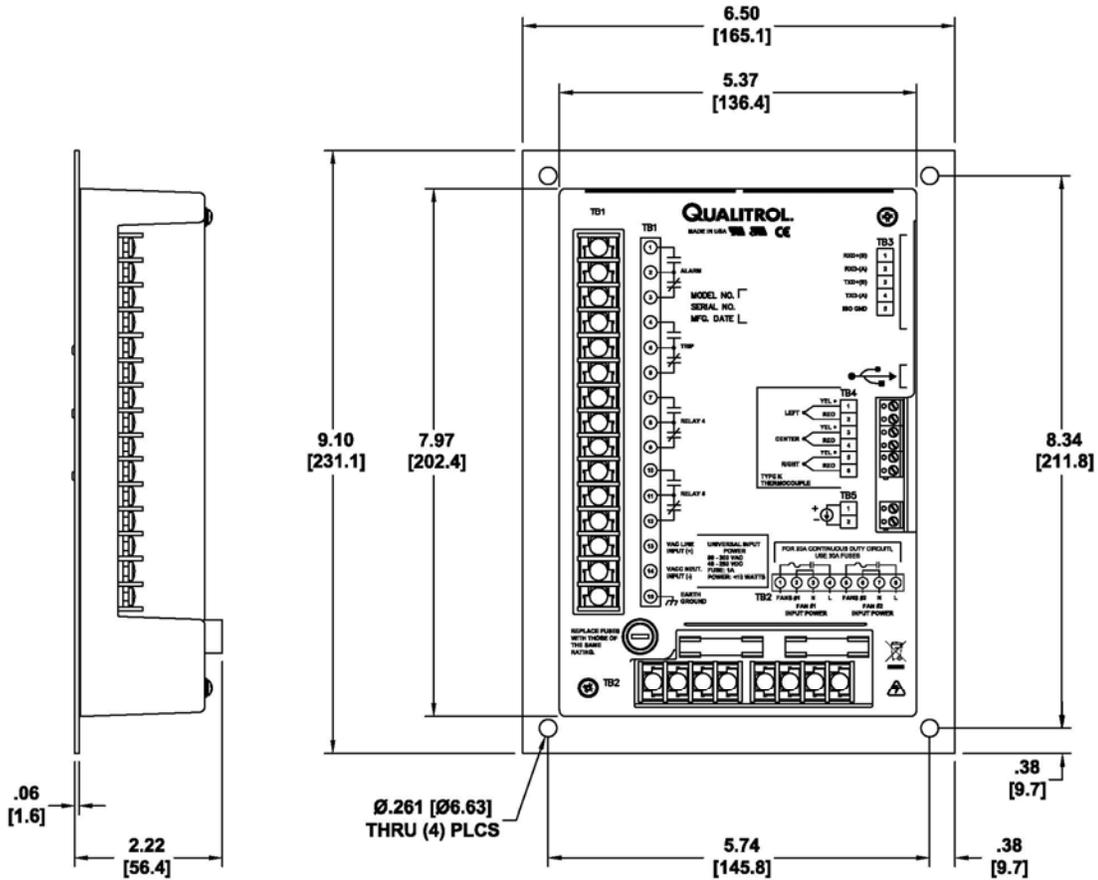
Figure 1a – 118 ITM-P Dimensions
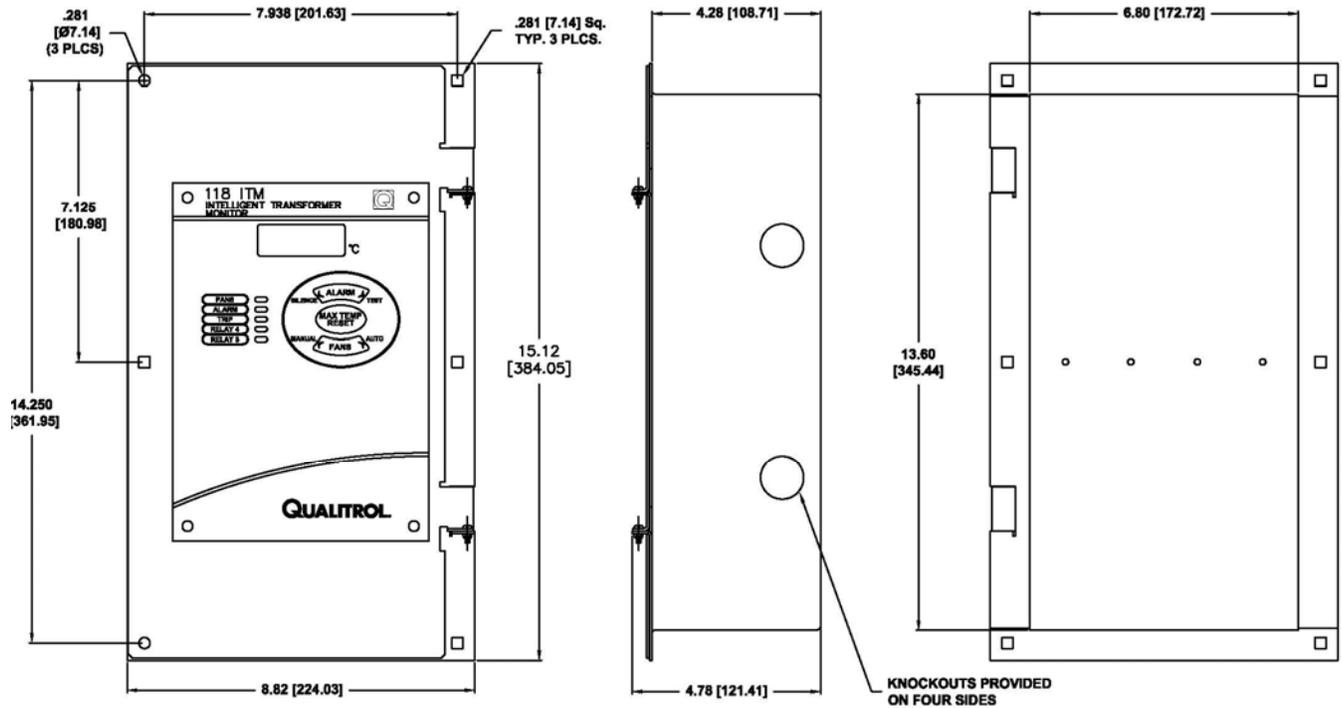
Figure 1b – 118 ITM-H Dimensions
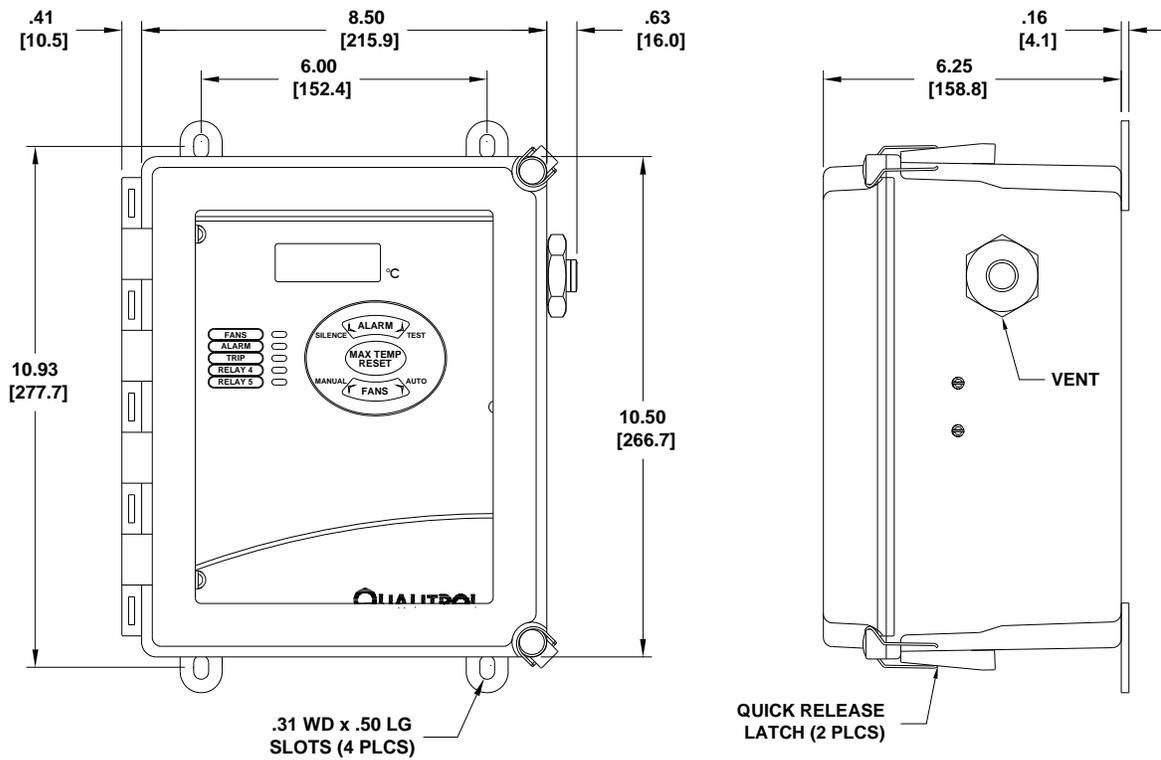
Figure 1c – 118 ITM-E Dimensions

2.2. Primary Power

Primary Power is connected to TB1-13 and TB1-14 with an Earth Ground connection to TB1-15. This connection provides power to the 118 ITM. Power can be 80 to 300Vac or 40 to 280Vdc.

2.3. Sensors

The three thermocouple sensors are connected to TB4-1(+), 2(−); TB4-3(+), 4(−), and TB4-5(+), 6(−). See Figure 2; Wiring Diagram.

To connect the Type K thermocouples, the YELLOW lead is connected to the positive terminal (1, 3, or 5), and the RED lead is connected to the negative terminal (2, 4, or 6).

If no thermocouple is connected to an input, those input terminals must be shorted together. This will prevent the ITM from reporting an alarm condition, due to a failed input, and will cause that channel to show the internal temperature of the ITM. If the channel is not used, it can be turned OFF using the setup software, **but the terminals still must be shorted together**.
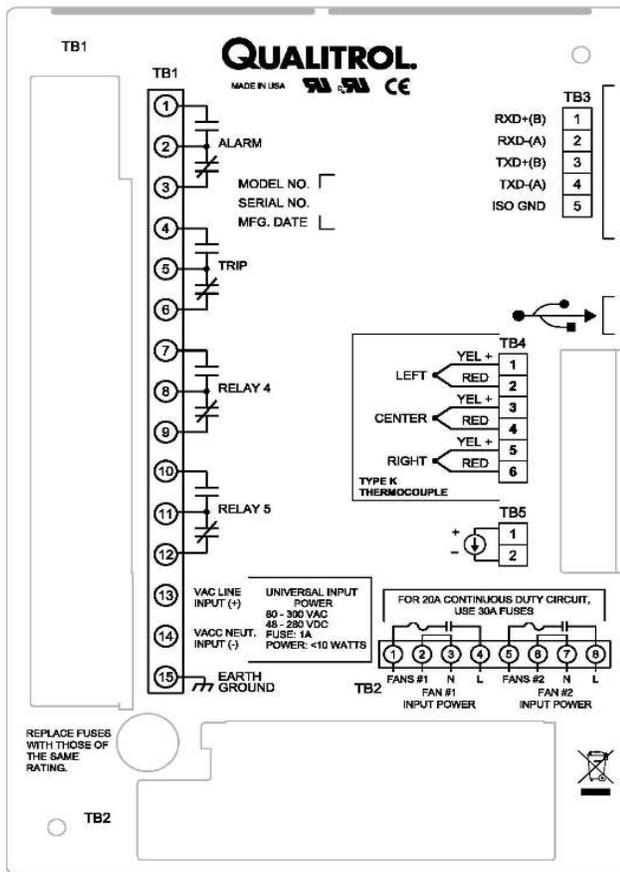
Figure 2 – Wiring Diagram

2.3.1. Relay Contacts

FAN #1 – Power for Fan #1 is connected to TB2-3 (N) and TB2-4 (L). Fan #1 is connected to TB2-1 and TB2-2. There is a 30 A fuse in series with TB2-1.

FAN #2 – Power for Fan #2 is connected to TB2-7 (N) and TB2-8 (L). Fan #2 is connected to TB2-5 and TB2-6. There is a 30 A fuse in series with TB2-5. Note that the Fan #2 circuit is electrically separate from Fan #1.

ALARM – SPDT (form C) contacts are provided at TB1-1, -2, and -3 to indicate an alarm condition. This relay is usually set to be energized in the normal state so that the power OFF state will cause an alarm (failsafe). The normal state can be changed by the User Configuration software via the USB port.

NOTE: Under failsafe conditions below set point, TB1-1 and -2 are closed, and TB1-2 and -3 are open. Under failsafe alarm conditions, TB1-1 and -2 will open, and TB1-2 and -3 will close. The operation of this relay can be changed to be non-failsafe, the opposite of that described above, through the software configuration.

TRIP – SPDT (form C) contacts are provided at TB1-4, -5, and -6 to indicate that the temperature being monitored has reached the trip state. This relay is usually set to be de-energized n the normal (non-failsafe) state. The normal state of the relay can be changed by the User Configuration software via the USB port.

NOTE: Under non-failsafe conditions below the set point, TB1-4 and -5 are open, and TB1-5 and -6 are closed. Under non-failsafe trip conditions, TB1-4 and -5 will close, and TBI-5 and -6 will open The operation of this relay can be changed to be failsafe, the opposite of that described above, through the software configuration.

RELAY 4 (form C) contacts are provided at TB1-7, -8, and -9 to indicate that the temperature being monitored has exceeded the set point. This AUX relay is usually set to be de-energized in the normal (non-failsafe) state. The normal state of the relay can be changed by the User Configuration software via the USB port.

NOTE: Under non-failsafe conditions below the set point, TB1-7 and -8 are open, and TB1-8 and -9 are closed. When the set point is exceeded, TB1-7 and -8 will close, and TBI-8 and -9 will open. The operation of this AUX relay can be changed to be failsafe, the opposite of that described above, through the software configuration.

RELAY 5 (form C) contacts are provided at TB1-10, -11, and -12 to indicate that the temperature being monitored has exceeded the set point. This AUX relay is usually set to be de-energized in the normal (non-failsafe) state. The normal state of the relay can be changed by the User Configuration software via the USB port.

NOTE: Under non-failsafe conditions below the set point, TB1-10 and -11 are open, and TB1-11 and -12 are closed. When the set point is exceeded, TB1-10 and -11 will close, and TBI-11 and -12 will open. The operation of this AUX relay can be changed to be failsafe, the opposite of that described above, through the software configuration.

2.3.2. Analog Output

An analog output is available at TB5-1(+) and TB5-2(–) that provides an analog signal proportional to the highest temperature. The analog signal can be selected by the User Configuration software to be 0–1 mA, 0–10 mA, 0–20 mA, 4–20 mA, or 0–5 V.

2.3.3. USB Link

A USB data link is provided for setting up the 118 ITM. A USB plug is provided for this link. Refer to the Setup Software section of this manual for more detailed information.

NOTE: The USB cable should only be connected when a configuration update is required. No permanent wires should be connected to this connector.

2.3.4. RS-485 Link (Optional)

The optional RS-485 data link is accessed through a terminal block connector on the back of the unit. This provides a method of communicating with a remote master station using Modbus RTU protocol. Convert to a two-wire RS-485 connection jumper TB3-1 (RXD+ (B)) with TB3-3 (TXD+(B)) and jumper TB3-2 (RXD-(A)) with TB3-4 (TXD-(A)) for half duplex operation. Refer to Appendix E of this manual for additional information.

Operation

3.1. Temperature Display

The temperature display consists of a three-digit, seven-segment, back-lit LCD display that can show temperatures from 0°C to 250°C, and three individual icons that identify the temperature being displayed. The display shows each reading for approximately one second and then automatically steps to the next reading.

The display shows the three winding temperatures and then the maximum stored temperature. While the maximum stored temperature is displayed, both the MAX icon and the icon representing the winding that caused the maximum reading turn ON.

3.2. Status Lamps

Five LEDs are provided that indicate the status of the output relays. Refer to Figure 3; Front Panel.

A yellow FAN LED indicates that the FAN relay is activated.

A red ALARM LED indicates that the ALARM relay is in the ALARM state.

A red TRIP LED indicates that the TRIP relay is in the TRIP state.

A red fourth-relay LED indicates that RELAY 4 is in the active state.

A red fifth-relay LED indicates that RELAY 5 is in the active state.

3.3. Audible Alarm

An internal buzzer sounds each time the ALARM becomes active. The buzzer can be silenced by pressing the SILENCE/TEST push-button. The buzzer will then turn OFF and remain OFF until a new ALARM occurs.

3.4. Push Buttons

Pressing the MANUAL/AUTO FAN button will force the FAN relay to activate. The FANs will stay ON until the button is pressed again. A MAN icon on the LCD display indicates whether the manual FAN ON function is active. Pressing the button to release the MANUAL FAN function, while the temperature is above the FAN ON set point, will turn OFF the MANUAL FAN icon on the LCD but will NOT turn OFF the FANs. Thus, the MANUAL FAN button can force the FANs ON but cannot force the FANs OFF.

Pressing the SILENCE/TEST button while the buzzer is sounding will silence the buzzer until the next new alarm condition occurs.

Pressing the SILENCE/TEST button while the buzzer is not sounding will start a TEST sequence. The TEST sequence does the following at two-second intervals:

Displays the FAN ON temperature set point and lights the FAN LED.

Displays the ALARM temperature set point and lights the ALARM LED.

Displays the TRIP temperature set point and lights the TRIP LED.

Displays the RELAY 4 temperature set point and lights the RELAY 4 LED.

Displays the RELAY 5 temperature set point and lights the RELAY 5 LED.

Displays the ambient temperature inside the ITM.

Displays 888 on the temperature display, turns on all icons on the display, turns on all relay status LEDs, and turns on the buzzer.

Pressing the MAX TEMP RESET button will clear the memory of the maximum stored temperature causing the current winding temperatures to become the new maximum stored temperature for each channel.
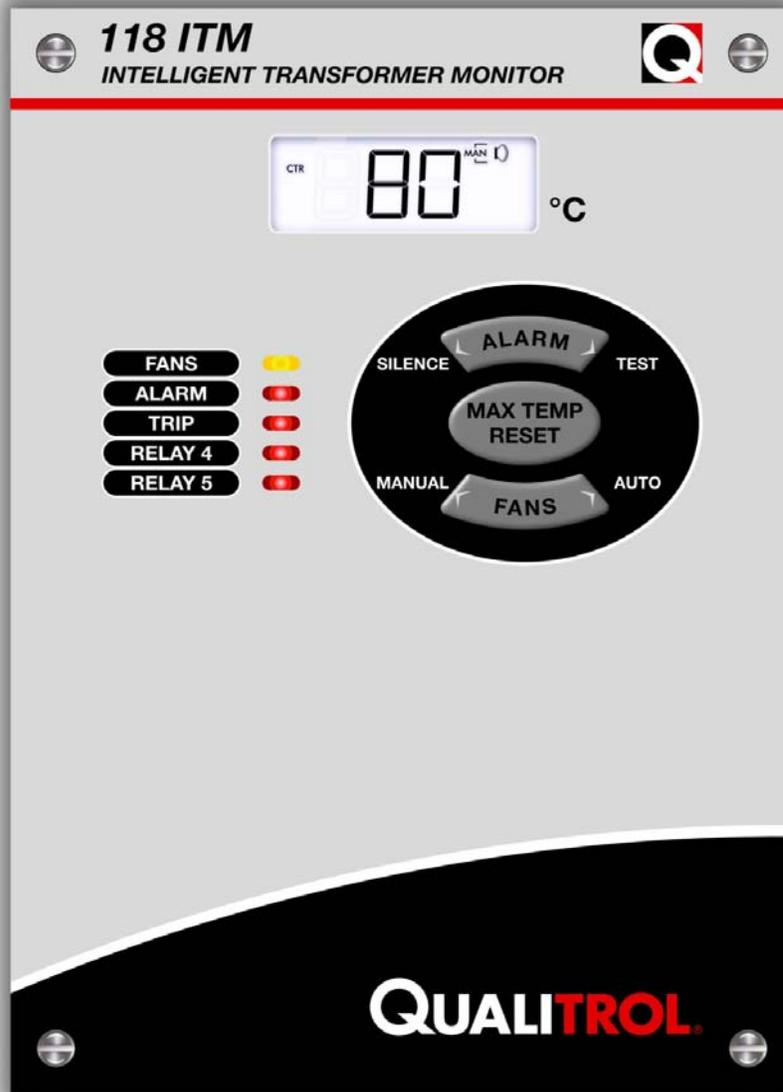
Figure 3 – Front Panel

3.5. Fan Exerciser

The unit has a built-in Fan Exerciser function that can turn the FANs on for a short period of time at periodic intervals. The default setting is for one minute every seven days.

The Fan Exerciser can be configured to be active or inactive. When inactive, it will never turn the FANs ON.

If the Fan Exerciser is active, it will start timing with a FAN run period when the unit is powered up. Thus, if the Fan Exerciser run time is one minute, the FANs will turn ON for one minute after power up. If the Fan Exerciser run time is set for 15 minutes, the FANs will turn ON and run for 15 minutes after power up.

Functional Specifications

Performance:	Input Power:	80 to 300 VAC 50/60 Hz ; 40 to 280 VDC Universal Power Supply
	Power Consumption:	<10Watts
	Measurement Range:	0°C–250°C
	Display Resolution:	1°C increments
	Input Measurement Accuracy:	±3°C
	Memory Retention:	40 years (with power OFF)
	Contact Ratings Fans: Alarm & Trip: Fan Circuit Rating:	<u>Volts</u> <u>Resistive</u> <u>Horsepower</u> 120 VAC 30 A 1 Hp 240 VAC 30 A 2 Hp 120 VAC 10 A - - - - - - - 240 VAC 8 A - - - - - - - UL Rated for 20A
	Remote Output Current Loop: Accuracy:	0 to 1 mA = into 10,000Ω max. load 0 to 10 mA = into a 1000 Ω max. load 0 to 20 mA = into 500Ω max. load 4 to 20 mA = into 500Ω max. load 0 to 5 V ±3°C
	Fan Exerciser	Fan Run Time – 1 to 120 minutes Fan Cycle Time – 0.01 to 30.0 days Time starts at power up.
	Optional Modbus Communications	Via electrically isolated 2- or 4-wire RS-485 link
Environment:	Operating Temperature:	−30°C to +72°C
	Storage Temperature:	−50°C to +72°C
	Relative Humidity:	10 to 90% non-condensing
	Hi-pot:	1500 VAC 50/60 Hz for 1 minute; relay contacts and power input to all other terminals and earth ground
	Vibration:	50/180 Hz @ .004"displacement
	Shock:	10 G's in 3 orthogonal planes
	Transient Suppression:	Per ANSI 37.90a-1989 oscillatory waveform test This device is protected against Radio Frequency Interference.

Mechanical: (Panel Mount Unit)	Front Panel:	6.5"[165.1mm]Wide x 9.10"[231.1mm]HighGraphic overlay UV resistant for outdoor use.
	Mounting:	Panel mount through 5.37" [136.4 mm] wide x 7.97" [202.4 mm] high cutout. Ø.261[6.63mm]
	Depth:	2.22" [56.4 mm]
	Weight:	3lbs[1.4kg
	Terminals:	Screw terminal; maximum 12-gauge wire
Mechanical (Hinge Mount)	Mounting	Hinge mount through 8.82" [224.03mm] wide x 15.12" [384.05 mm] high cutout. Mounting Holes 7.94"[201.63mm]Wide x 14.25"[361.95mm]High, Ø.261[6.63mm] x (4)
	Depth	4.28"[108.71mm]
	Weight	5lbs[2.3kg]
	Terminals:	Screw terminal; maximum 12-gauge wire
Mechanical (Wall Mount Weatherproof Box)	Mounting	Height = 10.5" [267mm] Width = 8.9" [226mm] Depth = 6.38" [162mm]
	Weight	6.5lbs [2.9kg]
	Mounting	(4) #1/4 screws on a 10.94" [277.8mm] x 6.00" [152.4mm] pattern.
	Terminals:	Screw terminal; maximum 12-gauge wire
Approvals:		Registered per UL standard 873. Registered per Canadian Standard C22.2 No. 24 Declaration of Conformance CE.

Setup Software

> **Note:** **The software is NOT supplied with every unit – it can be ordered as a separate item with USB cable Item number: KIT-207-1**

The ITM Configuration software is a Windows-based program that allows the user to set up parameters in the QUALITROL Model 118 ITM Intelligent Transformer Monitors via the USB port.

5.1. Installation for Window XP *For Win7 refer to Appendix F*

Run ITM Setup.exe from the software CD, this will create a directory C:\Program Files\QUALITROL\ITM118 on the hard drive, and it will install the program and default configuration files in that directory. It will also put an icon on the desktop to start the program.

Before you can configure the 118 ITM a driver must be installed to allow the configuration software to talk to a USB port. Do the following to install the USB driver:

Turn ON the ITM and connect to the computer with a USB printer cable (USB male A to USB Male B) The ITM will display USB

The computer will show "Welcome to the Found New Hardware Wizard" select "Install from a list or specific location" and click Next (see Figure 4)

Figure 4

Check "Include this location in search" and type C:\Program Files\Qualitrol\118ITM in the text box then click Next. (See Figure 5)
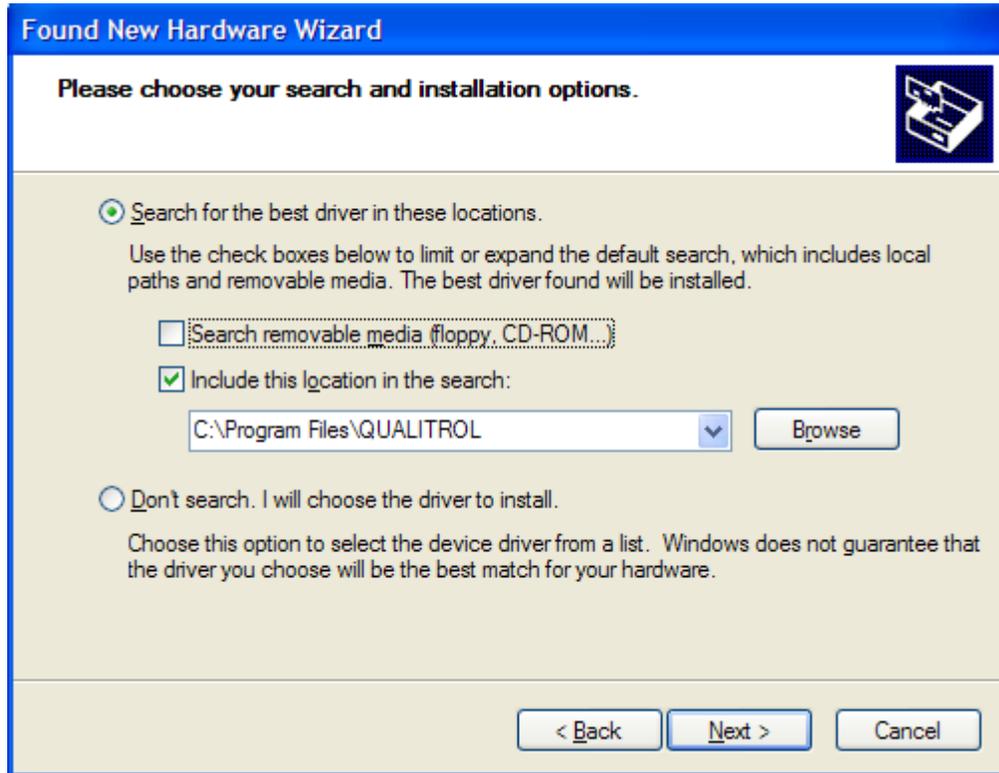
Figure 5

You will get a warning message – click "continue anyway". (See Figure 6)

Figure 6

Click "Finish" on the next screen completing the driver installation. Figure 7
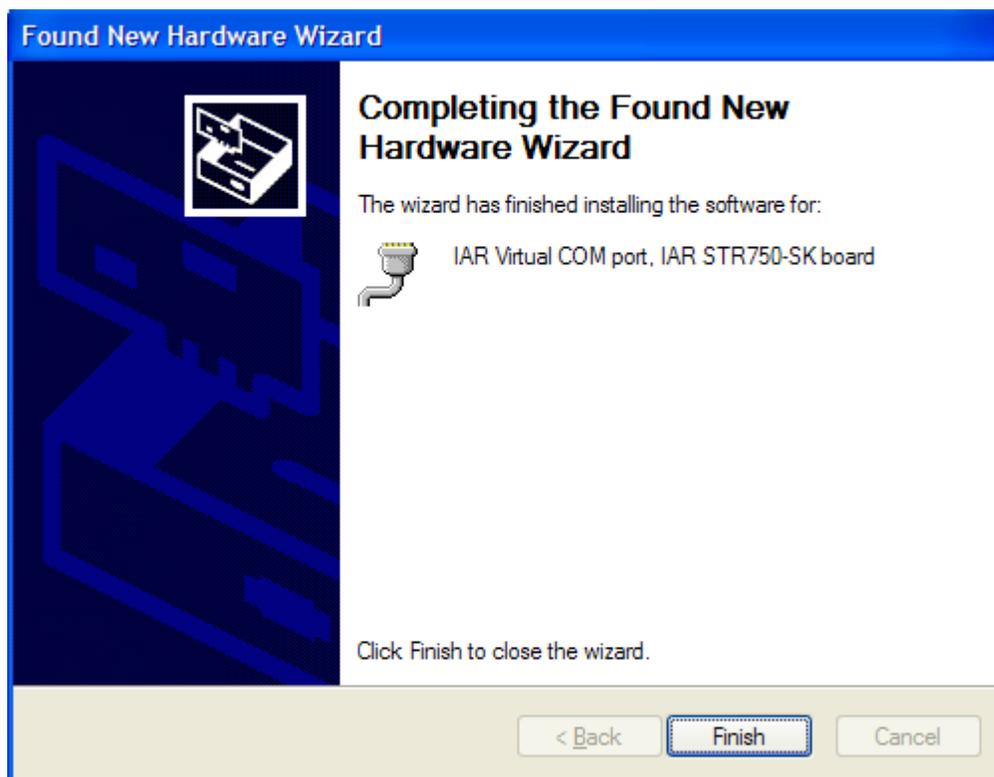
Figure 7

The windows file usbser.sys needs to be in the Windows\System32\Drivers folder (it usually is) in order to install the USB drive. If the install program says it can't find the driver file, you will need to search the computer to find it and copy it to Windows\System32\Driver folder and repeat the process above.

Once the driver is successfully installed you must find what communication port number was assigned so that when you start the ITM Configuration program you can enter the correct communication port number.

In a Windows XP machine do the following: Click Start button – Control Panel – System. (See Figure 8)
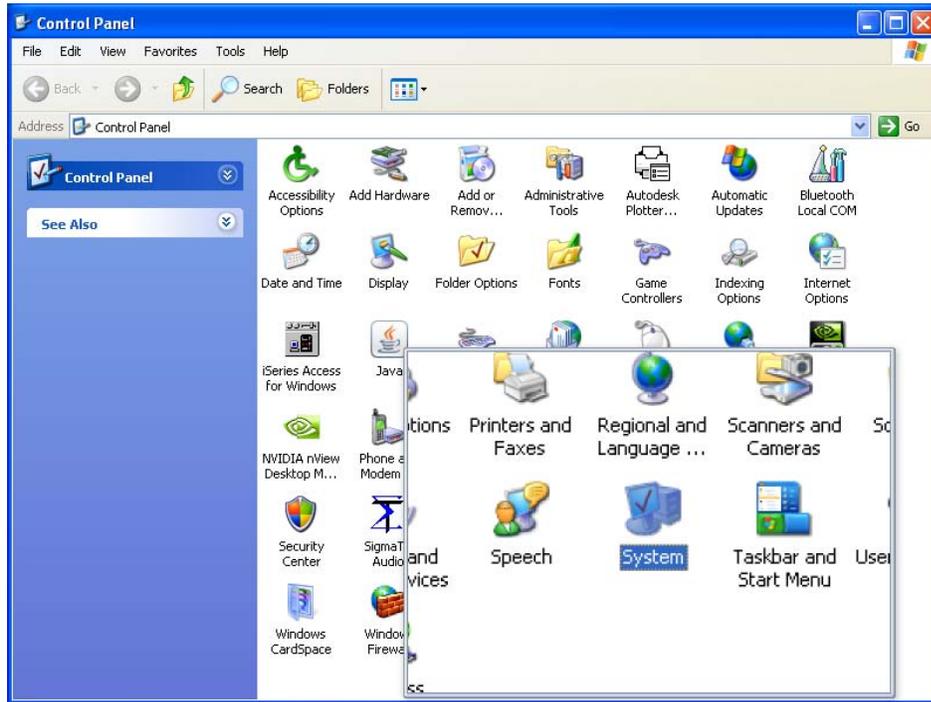
Figure 8

In the System Screen click the Hardware tab then click Device manager. (See Figure 9)
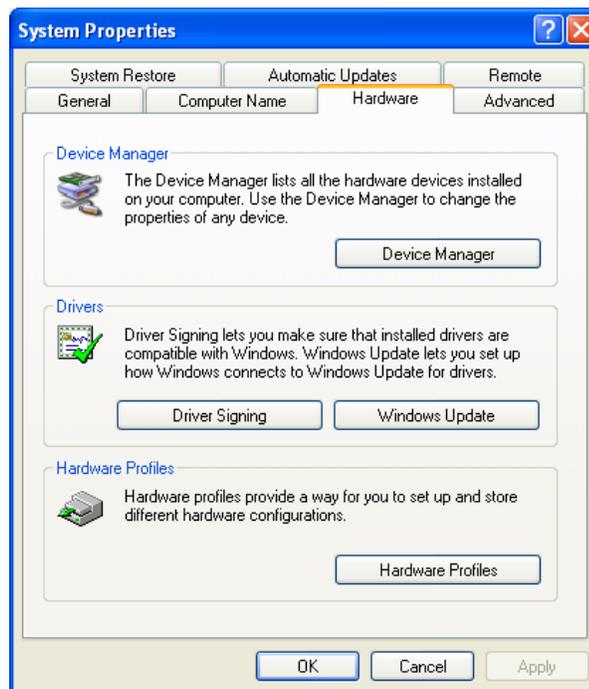
Figure 9

Click the + sign next to ports and it will show the communication port number next to "IAR virtual COM port". For example (COM7) means the communication port number is 7. (See Figure 10)
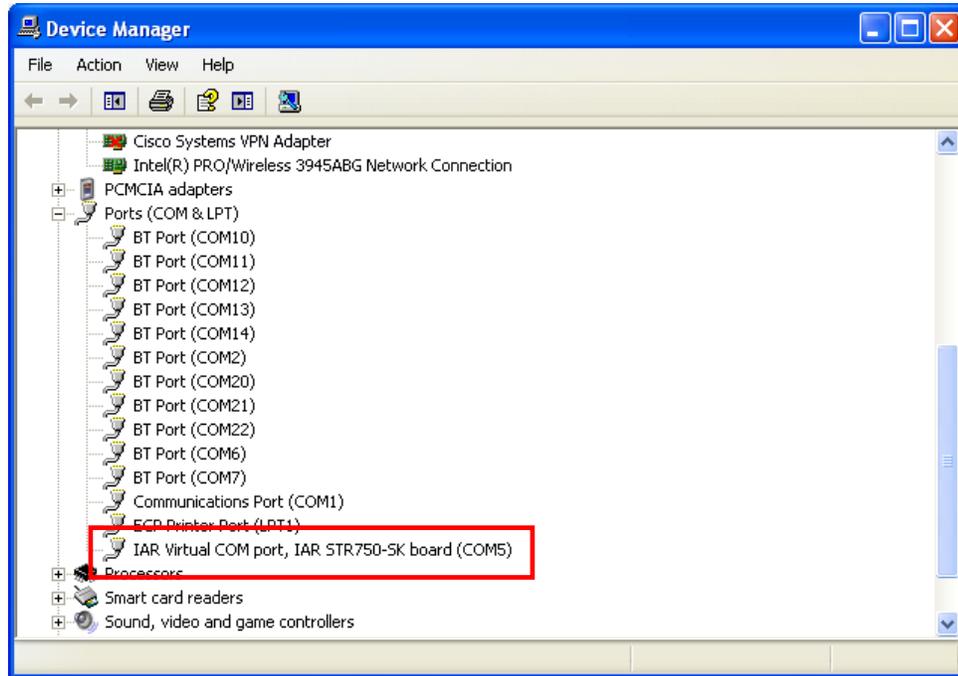
Figure 10

In a Windows 7 machine do the following: Click Start button – Control Panel – System and Security. Under System click Device Manager. Click the triangle sign next to Ports and it will show the communication port number next to "IAR virtual COM port". For example (COM7) means the communication port number is 7.

5.2. Files

The first time you start the program, you must select the proper communication port to be used with the program. When you close the program, the communication port is remembered, so that the next time you use the program, it uses the correct communication Port without having to select it each time. When the program starts, you must either select an existing configuration file or start a new configuration file. Until a file is assigned or selected, the other menu items are not available. See figure 11 for 118 ITM Configuration Menu.

NEW – Use the "Make New Configuration" button to start a new configuration. The program will ask what Model you are going to configure and then will use the standard Windows screen to allow you to assign a file name to the configuration file.

OPEN – Use the OPEN button, Open Existing Configuration File to select an existing configuration file. The configuration file contains the type ITM being configured. If the default file is chosen, the values can be changed and stored as the new default values, or they can be stored as a different configuration name.

Select Communication Port – Selects the computer communication port to use to communicate with the ITM.

Print Configuration – Prints the configuration screen.

Exit – Exits the program.
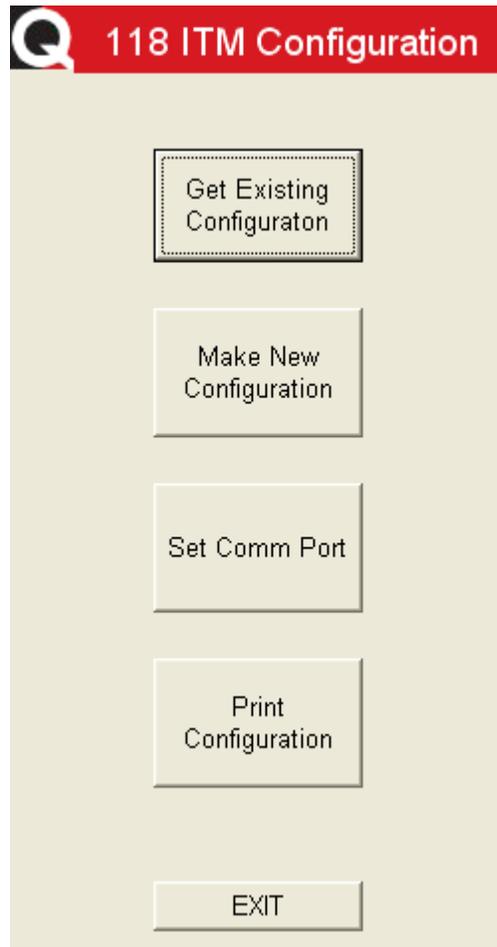
Figure 11

5.3. Configuration

User can select "Get Existing Configuration" or "Make New Configuration" to view configuration or change configuration offline, selecting one of these options will allow you to open an existing or new file allowing you to make the changes on the 118 ITM Configuration screen (See Figure 11).You can then download the configuration to an ITM and/or save it to a configuration file. It is also possible to upload the existing configuration from the ITM to the Configuration screen. To change the configuration you must connect the ITM to the computer via a USB cable. The ITM display will show USB.

The configuration software allows the user to set up the following parameters of the ITM:

> **Active Channels** – Any one or two of the three input channels can be turned OFF, if they are not being used in an application.

> **Fan / Alarm / Trip / Fourth Relay / Fifth Relay** set point and switching differential (hysteresis) can be set to determine at what temperature the relays turn ON and OFF.

> **Alarm / Trip / Fourth Relay / Fifth Relay** can be set to failsafe (normally energized) or not failsafe (normally de-energized).

> **Fan Exerciser** – The Fan Exerciser function can be turned ON or OFF. When it is ON, the time between turning the FANs ON, and the run time can be set.

> **Analog Output** – Can be set to operate from the hottest phase or only the center phase. The type of analog output can be set to be 0–1 mA, 0–10 mA, 0–20 mA, 4–20 mA or 0–5 V.

> **Reverse thermocouple sense** – This feature can be activated or de-activated. This allows an inadvertent sensor-wiring problem to be detected quickly. If the thermocouple is connected incorrectly, as the temperature goes up, the display temperature goes down. If the reverse thermocouple feature is activated, when the thermocouple reaches 30°C below the (internal) ambient temperature chip, the unit will go into "fault" mode. In some instances, a sudden increase in ambient, such as early morning sun shining on a unit where the transformer is still cold, may cause the same result. In this case, the reverse thermocouple feature can be de-activated, and the unit will require a 70°C difference between the thermocouple and ambient to go into "fault" mode.

> The **communications parameters** for the optional RS-485 output can be set.

> **Send configuration data to ITM** – This will cause the displayed configuration data to be written to the ITM. After the data is changed in the ITM memory, the ITM will reset to activate the new values. If you wish to communicate over the USB port again you must unplug the USB cable and plug it back in

> **Get configuration data from ITM** – This reads the configuration currently in the ITM and displays that data on the screen.

> **Save** – This saves the current configuration to the current open file (if it is the default file, it overwrites it).

> **Save As** – Allows the current configuration to be saved to a new file name or different path.

> **Exit** – Exits this window.

Figure 12

'ORDER CONFIGURATION

This unit is configured as follows:

118ITM -__ - __- __

Communication
M – Modbus

Remote Output Loop
0- 0-1mA
10- 0-10mA
20- 0-20mA
5- 0-5 Vdc
4- 4-20mA

Package
P – Panel mounting plate
H – Box with hinged front cover
E – Weatherproof Enclosure Box
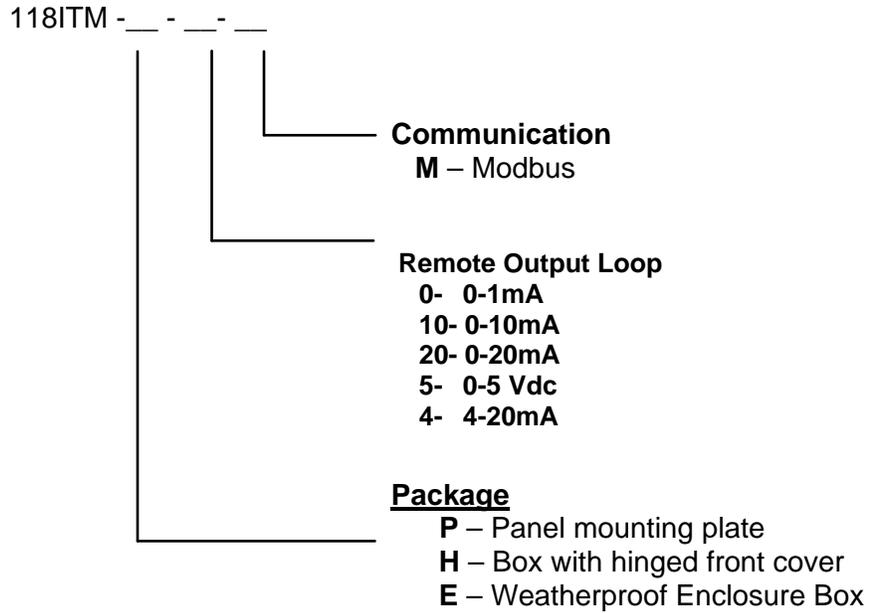
FAN   turns ON at _____°C and OFF at _____°C

ALARM   turns ON at _____°C and OFF at _____°C

TRIP   turns ON at _____°C and OFF at _____°C

RELAY 4 turns ON at _____°C and OFF at _____°C

RELAY 5 turns ON at _____°C and OFF at _____°C

FAN EXERCISER - ON for _____ Min. EVERY _____ Days

Appendix A – Manual Set Point Adjustment

Although the preferred method of changing the unit setup is to use a computer connected to the USB port, there may be cases where it is desired to change a set point in the field when there is no computer available. The model 118 ITM has this capability by using the following procedure:

- Push and hold the MAX TEMP RESET button for 5 seconds. The unit will stop scrolling, the FAN light will be ON and the display will show the FAN icon along with the FAN set point **(This will also reset the MAX MEMORY).**

- Use the ALARM SILENCE/TEST and FANS MANUAL/AUTO buttons to step the FAN set point UP or DOWN.

- Push the MAX TEMP RESET button. It will then scroll to the next set point, the ALARM light will be ON, and the Display will show the ALARM set point.

- Use the ALARM SILENCE/TEST and FANS MANUAL/AUTO buttons to step the ALARM set point UP or DOWN.

- Push the MAX TEMP RESET button, the TRIP light will be ON and the display will now show the TRIP set point.

- Use the ALARM SILENCE/TEST and FANS MANUAL/AUTO buttons to step the TRIP set point UP or DOWN.

- Push the MAX TEMP RESET button, the RELAY 4 light will be ON and the display will show the RELAY 4 set point.

- Use the ALARM SILENCE/TEST and FANS MANUAL/AUTO buttons to step the ALARM set point UP or DOWN.

- Push the MAX TEMP RESET button, the RELAY 5 light will be ON and the display will show the RELAY 5 set point.

- Push the MAX TEMP RESET button. The display will indicate whether the reverse thermocouple function is active (rS) or inactive (nrS). Use the ALARM SILENCE/TEST and FANS MANUAL/AUTO buttons to toggle between rS and nrS.

- Push the MAX TEMP RESET button. The new settings are saved, and the unit returns to normal operation.

If during the above process no button is pushed within 30 seconds, the unit returns to normal operation.

When the set point is changed using the above technique, the switching differential is preserved. Thus, if the original FAN set point were 190°C with a 10°C switching differential, the FANs would come ON at 190°C and turn OFF at 180°C. If the above method is used to change the set point to 175°C, then the FANs will turn ON at 175°C and OFF at 165°C.

Appendix B – Thermocouple Accuracy

In order to ensure accurate results when using thermocouple-based devices, certain installation and testing procedures should be observed. This appendix addresses the installation of the Model 118 ITM Intelligent Transformer Monitor (ITM) and techniques required to test its accuracy in a laboratory setting.

7.1. Installation Considerations

The temperature sensed by a thermocouple device is a function of the temperature differential between the thermocouple (TC) and its point of connection to the ITM. Thus *sudden* changes in the ambient temperature surrounding the ITM can change the terminal block temperature faster than the internal ITM temperature can stabilize. For this reason the point of connection needs to be protected from moving air.

The most common method of installation for the ITM is to mount it in some type of enclosure that will protect the unit from air currents such as those caused when the FANs turn ON. If the unit is installed in an enclosure, no further protection is required.

If the unit is mounted without being installed in an enclosure, to maintain the rated accuracy, some form of covering is needed over the TC connection terminals to protect them from stray air currents.

7.2. Method for Testing ITM Accuracy

To test the accuracy of an ITM, a millivolt signal must be applied that is the millivolt equivalent of the temperature between the terminal block and the TC. Since the precise temperature of the terminal block is not known, a common method is to use a TC immersed in an ice bath as a reference (0°C) and then add the millivolt equivalent of the degrees above zero C that are desired as the input to the ITM.

The sketch below indicates one method of doing this. Note that, again, the terminals on the ITM must be protected from air currents, and the ITM must be given time for the internal temperatures to stabilize before accuracy testing is performed. The best way to do this testing is with the ITM mounted in the enclosure that will be used in the final installation.
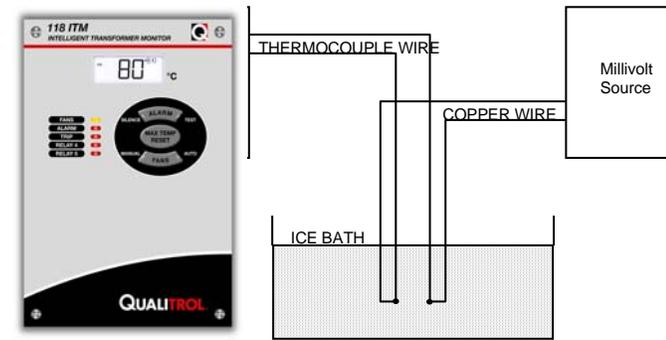
Figure 13 – Test setup for applying simulated thermocouple readings to the ITM

Appendix C – Error Codes

During normal operation, the system is constantly checking itself for proper operation. If a failure is detected, the FANs are turned ON, and the unit is put into the ALARM state. The unit will then operate as follows:

Failed Sensor

- Shows "- - -" on the display during the time when that sensor value would be displayed
- Shows which sensor is bad
- System continues to function using the remaining input channels

Failed A/D Converter

- Shows "E11" on all channels

Failed Ambient Temperature Sensor

- Shows "E22" on all channels
- Set ambient temperature at 30°C
- Continue to operate using 30°C ambient

Failed EEROM After Initial Start Up

- Shows "E33" on all channels
- Continues to operate

Failed EEROM at Power Up

- Shows "E33" on all channels

Failed Display Driver

- Continues to operate

Intermittent Sensor Connection

- If there is an intermittent sensor, the ALARM and FAN relays will latch ON. During the time the sensor is open, the display will show "- - -" . During the time the sensor is closed, it will show b – C (bad connection). Once the problem is resolved, push the SILENCE button to unlatch the ALARM and FAN relays.

Reversed Thermocouple

- If a thermocouple is installed with the wires reversed, the temperature reading will go down as the temperature of the thermocouple goes up. If the thermocouple temperature is 30°C colder than the temperature inside the unit, the unit will operate the ALARM and the FAN relay contacts, and the display will show "- - -".
- There may be cases where this feature will cause a false alarm. The reversed thermocouple detection can be turned OFF, as described in Appendix A.

Appendix D – Using the Model 118 ITM in the European Community

9.1. Installation

The Model 118 ITM is intended to mount inside the customer's panel, enclosure, or to be otherwise protected so that only the face of the instrument is accessible to the operator. There are potentially hazardous voltages (mains) on the rear terminals of the unit.

The mains supply power to both the Model 118 ITM and the cooling FANs for the customer's transformer. The wire size required for mains wiring is dependent on the FAN current and must be determined by the customer.

The user must supply appropriate anchorage for the mains wiring.

The Model 118 ITM is designed to be installed in Installation Category III per EN 61010-1 (low voltage directive).

A terminal connected to the Model 118 ITM chassis is provided as TB1-11. This provides the means to connect the Model 118 ITM front panel to the grounding system of the cabinet or enclosure.

To meet the requirements of the EN 61010-1 paragraph 6.12.2.1:

A switch or circuit breaker must be provided to control power to the unit.

It shall be in close proximity to the unit and within easy reach of the operator.

It shall be marked as the disconnecting device for the equipment.

Radio Frequency interference above Level 1 of EN 61000-4-6 *conducted* on the mains wiring may affect the reading of the Model 118 ITM. This is a very unlikely type of interference in the usual environment of the Model 118 ITM. In the event that this type of interference is present, an RF filter needs to be applied to the mains wiring external to the Model 118 ITM.

The Model 118 ITM is immune to *radiated* Radio Frequency interference such as that caused by hand-held radio transmitters or cellular telephones.

9.2. Fuses

There are two types of fuses used in the unit. Neither fuse is operator replaceable.

30 A fuse 0.25 in. x 1.25 in. Type F, two per unit
1 A fuse 5mm x 20mm Slow Blow, one per unit

The 30 A fuses monitors the Fan Current (30 Amp fuse required for UL 20 Amp FANS requirement). If one of the fuses fully opens, properly trained maintenance personnel must determine the cause of the problem and, with the power turned OFF to the Model 118 ITM, change the fuse. These fuses are located at the rear of the unit (see Figure 14) and are only accessible by the use of a tool to gain access to the fuses.

The 1 A fuse monitors the current going into the Model 118 ITM electronic section. It is located at the rear of the unit, please see Figure 14. In order to access the fuse you'll need to use a flathead screw driver, insert the screw driver into the slot and turn counterclockwise to open the fuse housing for replacement. The 1 A fuse will only open if there has been a failure inside the Model 118 ITM. If the 1 A fuse opens, the Model 118 ITM must be removed from service and returned to the factory for repair.
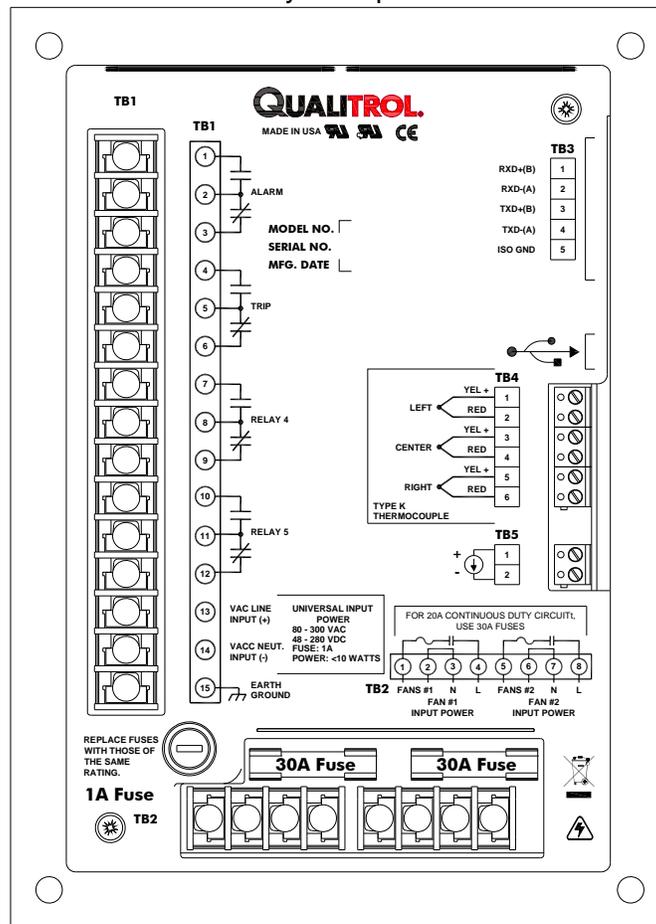
Figure 14 – Fuse location

Appendix F – Installing Configuration Software on Win7

Windows 7 Software installation:

Run ITM Setup.exe **Qualitrol 118 ITM Installer** *from the software CD, this will create a directory C:\Program Files\QUALITROL\ITM118 on the hard drive, and it will install the program and default configuration files in that directory. It will also put an icon on the desktop to start the program.*

1. Once the executable is running it will prompt the user with the following window:
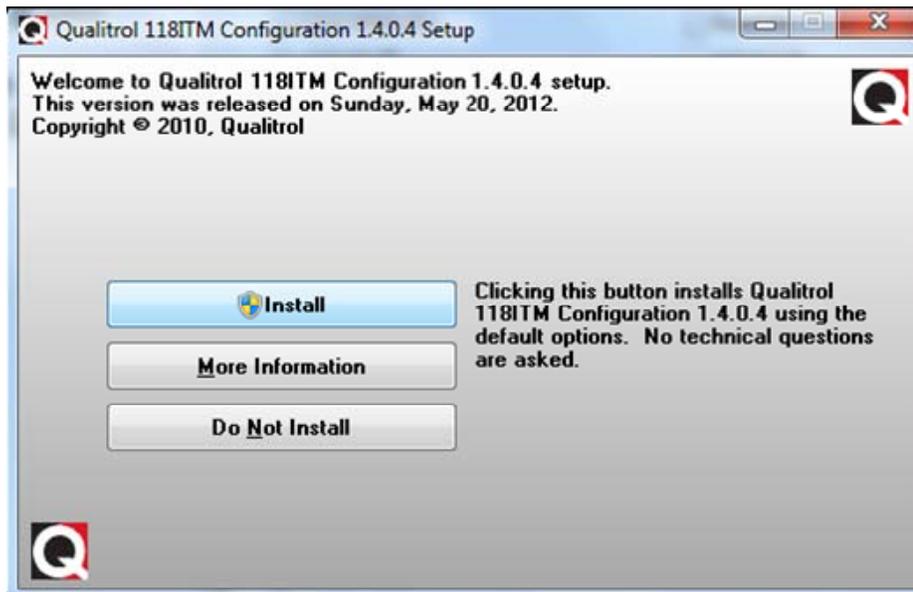
Figure 15 Install Window

2. Please click the "Install" button (figure 15)

3. Then select, "Yes, I do", for accepting Qualitrol terms, if "No, I do not" is selected then it will cancel the install.

Figure 16 Terms and Condition Agreement

4. Once the terms are agreed to it will then prompt the user with the "Welcome" screen:
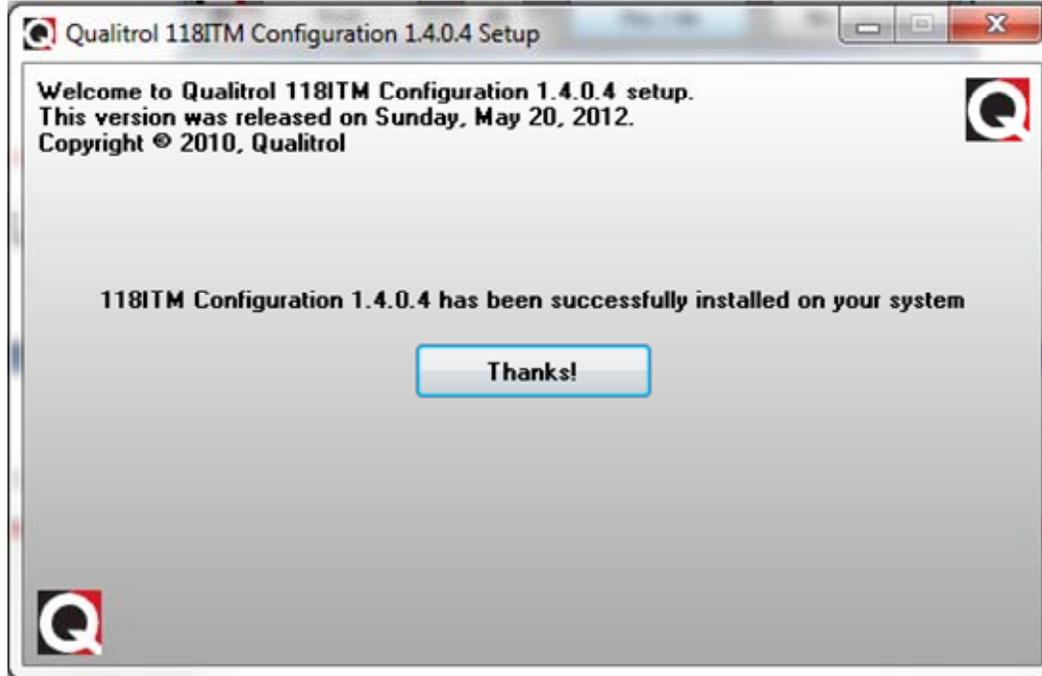
Figure 17 Final Install Window

5. Clicking on the "Thanks!" button, shown in figure 17, will complete the software installation and bring up the **"C:\Program Files\QUALITROL\TM118 "**directory (figure 18). Here the user will find the 118ITM shortcut and software uninstall option.
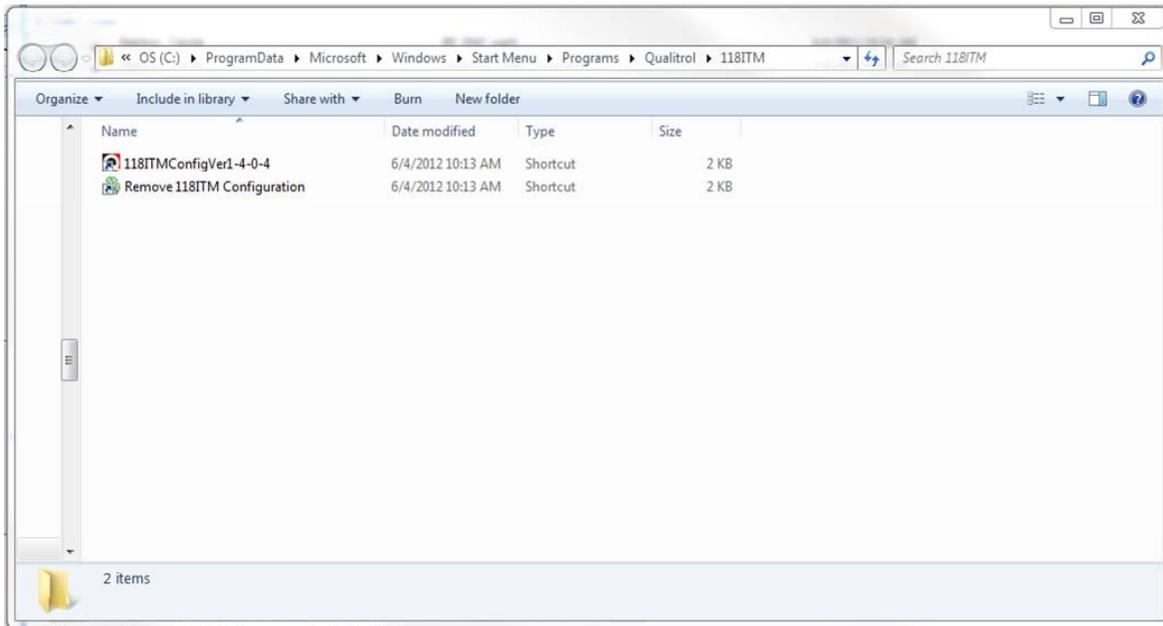
Figure 18 118ITM Qualitrol Folder

6. Now click on the launch icon . By launching the software application Windows, it will prompt the user with a Run-Time error, as seen in figure 19, this is expected, click OK.
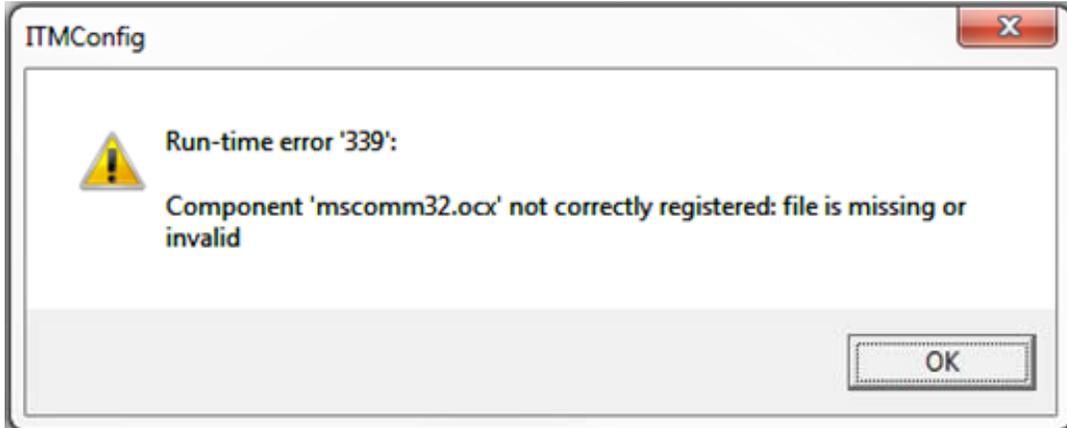
Figure 19 Windows 7 Error

7. While placing the pointer over the 118ITM shortcut , right click and select "Run as administrator", refer to figure 20 for illustration.
   If this option is not available please contact your I.T department for assistance.
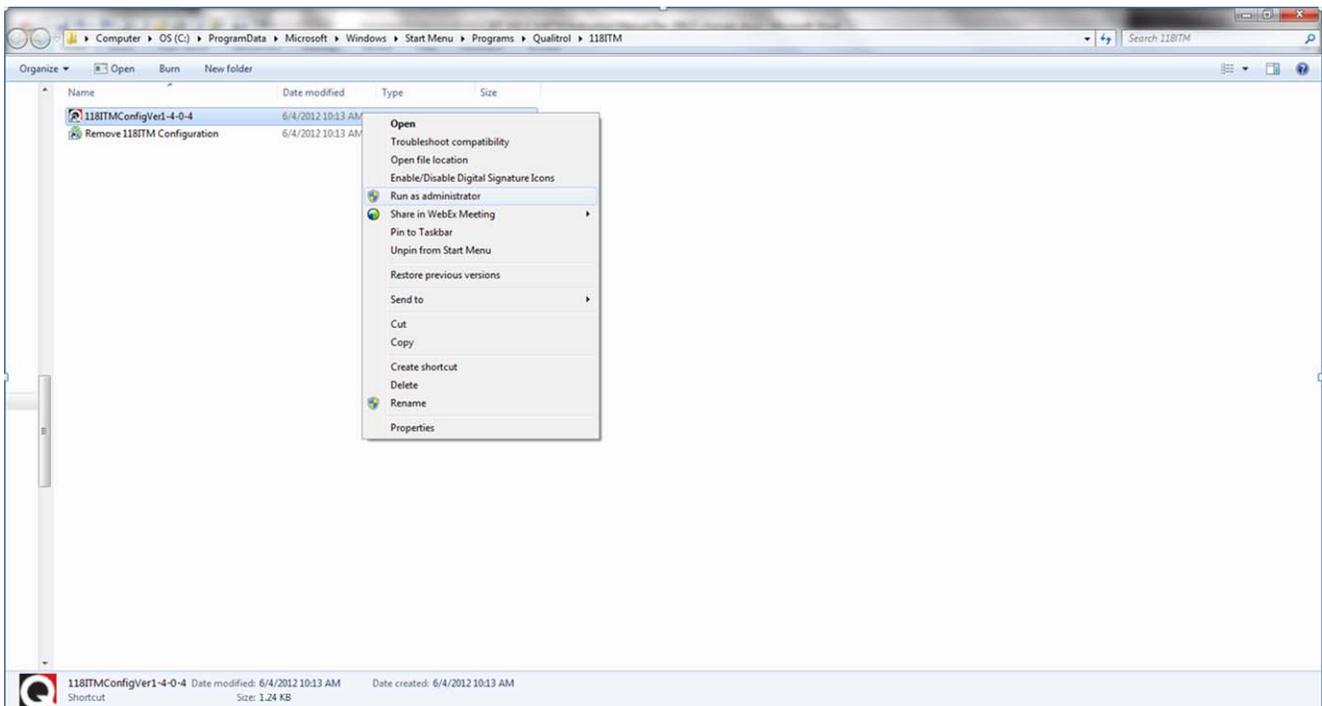
Figure 20 Run as Administration

8. After you select "Run as administration", it will then launch the 118ITM configuration software. Once this step is completed the user will not have to run through this process again.

   Now the user should be able to just click on the shortcut , which will launch the configuration software. For configuration instructions please refer to section "4.3 Configuration".

Appendix G – Modbus Communications

If the Model 118 ITM is equipped with the optional RS-485 port, the unit can communicate with a Modbus master station.

The RS-485 port is located on the side of the Model 118 ITM and is provided with a plug-in terminal block connector. The connector is wired as follows:

Terminal – TB4	Function
1	+Receive
2	–Receive
3	+Transmit
4	–Transmit
5	Shield Ground

Terminals 1 and 3 and terminals 2 and 4 can be connected together if a two-wire RS-485 data link is desired.

The data communicated on the RS-485 link is in Modbus RTU format. The table included shows the data and Modbus register addresses used. Modbus functions 03, 06, and 16 are supported.

The Modbus Data Link parameters can either be set using the User Setup software or they can be set up by the following procedure using the front panel switches:

1. Depress and hold all three switches until the unit stops cycling through the readings (approximately 10 seconds). The unit will then be displaying the current baud rate:
   - 12 = 1200 bits per second (bps)
   - 24 = 2400 bps
   - 48 = 4800 bps
   - 96 = 9600 bps
   - 192 = 19200 bps

   Pressing the ALARM (Top) button will step the display UP through the above choices. Pushing the FAN (bottom) button will step the display DOWN through the above choices.

2. When the desired baud rate is displayed, press the MAX TEMP RESET (Middle) button. This will show the current parity setting.
   PE = Even Parity (standard)
   PO = Odd Parity
   P-- = No Parity

3. When the desired parity is displayed, press the MAX TEMP RESET (Middle) button. This will show the current stop-bit setting. If parity is even or odd, the display will show S1 and will not be able to be changed.

If No Parity has been selected, the number of stop bits can be set to 1 or 2 (S1 or S2). S1 is used if the unit is communicating through a modem; otherwise, S2 is the standard.

4. When the desired Protocol is displayed, press the MAX TEMP RESET (Middle) button. This will show the current Address setting.

   Pressing the ALARM (Top) button will step the display UP through the addresses.

   Pushing the FANS (bottom) button will step the display DOWN through the addresses.

   Note: Legal addresses in Modbus mode are 1–255.

   Pressing the MAX TEMP RESET (top) button will return the unit to normal operation and save the settings.

   If no button is pushed for 30 seconds, the unit will automatically return to normal operation with the communications setup unchanged.

Modbus Register	Data Returned When Register Is Addressed		Comments
40001	Temperature Left Phase		Normal temperature range is 0 - 255D in low byte
40002	Temperature Center Phase		A value of 8000H indicates invalid data
40003	Temperature Right Phase		
40004	ITM Status		
		Bit 0	"1" = Some other bit is '1'
		Bit 1	"1" = ON, Fan State
		Bit 2	"1" = ON, Alarm State
		Bit 3	"1" = ON, Trip State
		Bit 4	"1" = ON, Buzzer State
		Bit 5	"1" = ON, Manual Fan State
		Bit 6	"1" = ON, Aux Relay 4 State
		Bit 7	"1" = ON, Aux Relay 5 State
40005	Maximum Stored Temperature		Normal temperature range is 0 - 255D in low byte
40006	Phase with Max Stored Temperature		
		Bit 0	Always a "1"
		Bit 1	A "1" indicates max stored temp was left phase
		Bit 2	A "1" indicates max stored temp was center phase
		Bit 3	A "1" indicates max stored temp was right phase
	NOTE: There will always be only a single "1" in bits 1, 2, or 3		
40007	Temperature at Unit's Terminal Block		The low byte indicates the temperature at the instrument terminal block in degrees C. Temperatures below zero will show as zero
40008	Diagnostic Status		
		Bit 0	"1" = Some other bit is '1'
		Bit 1	"1" = Failed A/D Converter
		Bit 2	"1" = Failed Terminal Block Temperature Sensor
		Bit 3	"1" = Failed EEROM

		Bit 4	"1" = Failed Display Driver
40009	Phase Status		
		Bit 0	"1" = Some other bit is '1'
		Bit 1	"1" = Left phase disabled
		Bit 2	"1" = Center phase disabled
		Bit 3	"1" = Right phase disabled
		Bit 4	"1" = Left phase has a Failed Sensor
		Bit 5	"1" = Center phase has a Failed Sensor
		Bit 6	"1" = Right phase has a Failed Sensor
		Bit 7	"1" = Fan Exerciser is disabled
	NOTE: Since all sensors are normally enabled, This register will normally be 0000H.		
40010	Fan set point		
40011	Alarm set point		
40012	Trip set point		Setpoints and switching differentials are 8-bit data in the low-order byte.
40013	Fan switching differential (hysteresis)		
40014	Alarm switching differential (hysteresis)		
40015	Trip Switching differential (hysteresis)		
40016	Fan Exerciser interval		1 to 720 hours (up to 30 Days)
40017	Fan Exerciser run time		1 to 120 minutes
40018	Time since last Fan Exercise		1 to 720 hours (up to 30 Days)
40019	Firmware Version		
40020	Auxiliary Relay 4 set point		
40021	Auxiliary Relay 5 set point		Setpoints and switching differentials are 8-bit data in the low-order byte.
40022	Auxiliary Relay 4 switching differential (hysteresis)		
40023	Auxiliary Relay 5 switching differential (hysteresis)		
48188	Device I.D.		15060D (15060 - 15069 reserved for ITM

Modbus Register	Data Sent To Addressed Register	Comments
40050	Set Manual Fan Function ON/OFF	0001 turns Fan ON, 0000 sets Fan to AUTO
40051	Reset Max stored temperature	0001 sets max temp stored to current max temp.
40052	Reset Unit	0001 resets the unit.
40053	Buzzer Control	0001 turns ON Buzzer, 0000 turns Buzzer OFF