Instruction Manual IM02602008E - Rev. D

Transformer Temperature Controllers



Powering Business Worldwide

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TABLE OF CONTENTS

1. INTRODUCTION 1
1.1 Product Overview 1
1.2 Barrier Cabinet Version 2
1.3 Bezel-Mounted Version 2
1.4 Safety Precautions 3
1.4.1 Types of Safety Precautions 3
1.4.2 General Safety Precautions 3
1.5 Ordering Information 4
1.6 Product Labels 4
1.6.1 TC Barrier Cabinet Version 4
1.6.2 TC Barrier Cabinet With Controller Version 4
1.6.3 TC Controller Unit 5
1.6.4 Equipment Testing 5

2 INSTALLATION 5
2.1 Preparation for Installation 5
2.1.1 General 5
2.2 Barrier Cabinet Version 6
2.3 Bezel-Mounted Version 7
2.4 Wiring the TC Temperature Controller 8
2.4.1 General 8
2.4.2 Wiring Procedures 8

3 OPERATING FUNCTIONS 13
3.1 Monitoring 13
3.2 Programming 13
3.3 Reporting (TC-100 Only) 13
3.4 Testing 13

4. OPERATING PROCEDURES 14
4.1 Manual Operation 14
4.1.1 Control Functions 14
4.1.2 Operating the TC-100 Manually 18
4.2 Local Operation 34
4.2.1 Main Menu 34
4.2.2 Navigating The Function Bar 35
4.2.3 Navigating the Options Bars 35
4.2.4 Configuration 36
4.2.5 Device 53
4.2.6 Reports (TC-100 Only) 57

4.2.7 Calibration 66
4.2.8 Help 67
4.2.9 Exit 70
4.3 Remote Operation 71
4.3.1 Introduction 71
4.3.2 Features 71
4.3.3 Hardware Installation 71
4.3.4 Connectors **71**
4.3.5 Modbus Troubleshooting 72

5. POWER UP FOR TESTING 72
5.1 General 72

6. MAINTENANCE AND REPAIR 73
6.1 Preventive Maintenance 73
6.2 Repair 73
6.3 Controller Replacement 73

7. TROUBLESHOOTING 74

8 SPECIFICATIONS 75

APPENDIX A - PROGRAMMING QUICK REFERENCE GUIDE 77

APPENDIX B - MODBUS REGISTERS 80

1. Introduction

The content of this manual is organized into seven sections, and three appendixes, as follows:

- Introduction
- Installation
- Operating Functions
- Operating Procedures
- Maintenance and Repair
- Troubleshooting
- Specifications
- Appendix A - Programming Quick Reference Guide
- Appendix B - Modbus Registers

1.1 Product Overview

Eaton® Transformer Temperature Controllers monitor the temperature of up to three ventilated, dry-type transformer windings. They also monitor the ambient temperature within the cabinet in which the transformer is installed.

These temperatures are detected by thermocouples placed within the transformer windings and inside the cabinet.

If winding temperatures exceed a preset limit (setpoint) relays are tripped to start cooling fans to reduce temperatures and prevent equipment damage. If higher trip and alarm winding temperature setpoints are reached, Form C contacts may be used to trip a remote alarm and ultimately trip the transformer offline.

Three models of the transformer temperature controller (TC) are available; the **TC-50**, the **TC-50 Modbus**, and the **TC-100**. The TC-100 includes Modbus and has advanced features for discrete inputs, monitoring, and data logging.

All models have a common appearance but vary in functionality. The functionality described in Section 4.1.2 -Operating the TC Manually, and Section 4.2 -Local Operation, apply to all models unless otherwise noted in a heading or the text.

All TC models have a front panel that provides a communications interface between the controller and an operator. The panel consists of an 9-character LED display, 9 discrete LEDs, and 9 pushbuttons. Communication is also possible using a laptop computer connected to a front USB port, or through Modbus (on the TC-50 Modbus, and the TC-100 models

A sealed controller unit processes all data received.

All TC models are available in two versions: a barrier cabinet version (Section 1.2) or a flush, bezel-mounted version (Section 1.3).

The features of each model are described below.

All models **(TC-50, TC-50 Modbus, and TC-100)** have these standard features:

- Operates on 100 to 240 Vac, 50 or 60 Hz power.
- LED display shows conditions and values
- Panel LEDs indicate system status.
- Cooling fans turn on automatically when temperatures exceed a setpoint, or a trip relay shuts down the transformer.
- Setpoints can be used to turn on either fan, or turn on an Alarm or Trip relay for a high temperature condition.
- Alarm and trip relays can function as fail-safe relays (normally energized when the TC is powered up).
- Alarm buzzer sounds but can be silenced without canceling the alarm.
- Certifications include Underwriter's Laboratories (UL®), to Standard 873, CSA C22.2 No. 24-93.
- Provides 4-20 mA analog signal for remote indication or use with SCADA systems.
- Unit can be used for single-phase transformers, or other devices, by selecting or deselecting individual elements.
- Fans can be operated automatically for short periods to prevent motor seizing.

The **TC-50 Modbus** model has all of the standard features, plus:

- RS-485 connection for Modbus communications.

The **TC-100** model has all of the standard features, plus these additional features:

- RS-485 connection for Modbus communications.
- Monitors two discrete inputs, such as opening or closing fan louvers or doors.
- Provides automatic monitoring and logging functions, and temperature trending, to analyze operation and achieve faster restoration.

1.2 Barrier Cabinet Version

The barrier cabinet version of the TC models has three major components: the barrier cabinet, the controller and a hinged panel, as shown in Figure 1, TC Barrier Cabinet Version.

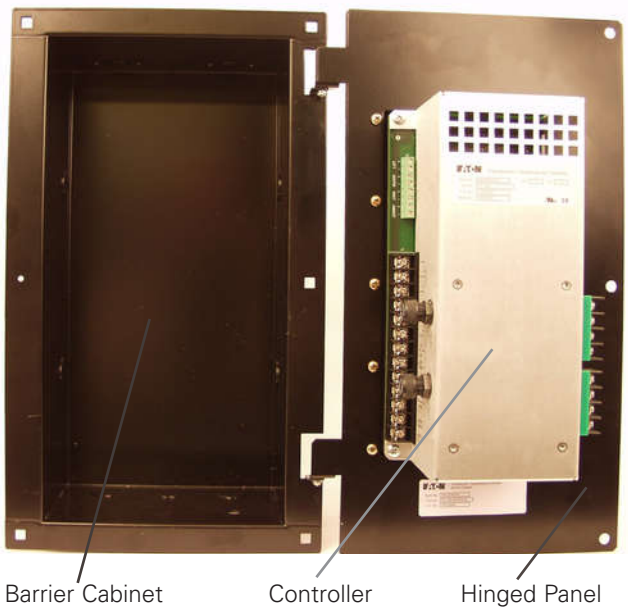


Figure 1, TC Barrier Cabinet Version

With the barrier cabinet version, the barrier cabinet recesses into a cutout in the transformer cabinet at the time of installation. This provides a barrier that prevents user exposure to high voltages inside the transformer cabinet while the TC is being installed, wired or serviced.

The controller unit mounts to the back of the hinged panel. With the hinged panel open, terminal points on the controller are readily available for wiring the unit. The barrier cabinet prevents any physical entry into the transformer cabinet.

Once wired, the controller performs the monitoring, programming, reporting and testing functions. When the hinged panel is closed, the controller moves back into the barrier cabinet and the front panel (mounted to the door of the enclosure) is exposed.

The front panel of the TC is shown in Figure 2, TC Front Panel. This front panel provides the user interface to monitor, program, and report the TC functions.

The barrier cabinet version mounts with 6 screws. Removing the three screws opposite the hinges allows the hinged panel to open and expose the controller unit and the inside the barrier cabinet,



Figure 2, TC - Front Panel

1.3 Bezel-Mounted Version

The bezel mounted version of the TC mounts flush against the transformer cabinet.

The controller unit is attached to the rear of the front panel, and recesses into a hole cut into the cabinet prior to installation. Following installation, the bezel around the front panel sets securely against the cabinet, as shown in Figure 3, TC Bezel-Mounted Version.

Once wired, the controller performs the monitoring, programming, reporting and testing functions of the TC. However, accessing the bezel-mounted controller, to wire it or replace fan fuses, requires working inside the transformer cabinet. This exposes the installer to any high voltages that may be present inside the cabinet.

The bezel-mounted version is mounts from within the transformer cabinet with 10 screws.



Figure 3, TC - Bezel-Mounted Version

1.4 Safety Precautions

A licensed/qualified electrician must complete all instructions in this manual in accordance with the National Electric Code (NEC), state and local codes, or other applicable country codes. All applicable local electric codes supersede these instructions.

1.4.1 Types of Safety Precautions

Safety precautions cited in this manual, by category and meaning, are as described below

⚠WARNING

THIS WARNING SYMBOL RELATES TO THE PRESENCE OF HIGH VOLTAGES THAT COULD CAUSE DEATH, INJURY OR EQUIPMENT DAMAGE.

⚠WARNING

THIS WARNING SYMBOL RELATES TO CONDITIONS THAT COULD CAUSE PERSONAL INJURY OR DEATH.

⚠CAUTION

THIS CAUTION SYMBOL RELATES TO CONDITIONS THAT COULD CAUSE EQUIPMENT DAMAGE.

⚠IMPORTANT

THIS SYMBOL RELATES TO INFORMATION THAT IS IMPORTANT TO THE READER, BUT IS NOT CLASSIFIED AS A VOLTAGE WARNING, A GENERAL WARNING, OR A CAUTION.

1.4.2 General Safety Precautions

⚠WARNING

WARNING HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE TRANSFORMER ENCLOSURE AND THE TEMPERATURE CONTROLLER HOUSING. FOLLOW ALL SAFE WORK PRACTICES TO AVOID ELECTRICAL SHOCK THAT COULD CAUSE DEATH OR SERIOUS INJURY

⚠WARNING

IMPROPER INSTALLATION COULD CAUSE DEATH, INJURY OR EQUIPMENT DAMAGE. FOLLOW ALL WARNINGS AND CAUTIONS. READ AND COMPLETELY UNDERSTAND THE INFORMATION IN THIS INSTRUCTION MANUAL BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS CONTROLLER.

⚠WARNING

IMPROPER WIRING COULD CAUSE DEATH, INJURY OR EQUIPMENT DAMAGE. ONLY LICENSED/ QUALIFIED ELECTRICIANS WHO ARE TRAINED IN THE INSTALLATION AND SERVICE OF ELECTRICAL EQUIPMENT ARE TO INSTALL OR SERVICE THIS CONTROLLER.

⚠WARNING

ARC FLASH DURING INSTALLATION COULD CAUSE INJURY. USE APPROPRIATE SAFETY PRECAUTIONS AND EQUIPMENT FOR ARC FLASH PROTECTION.

1.5 Ordering Information

Each TC is identified by a different catalog number, as shown in Table 1, TC- Ordering Information.

Table 1 - TC Ordering Information

Description	Catalog Number
Controller Only (Semi-Flush Mounting), No Communication, Blank Overlay	TC-50-Blank
Controller with Barrier Cabinet (Hinged Front Panel), No Communication, Blank Overlay	TC-51-Blank
Controller Only (Semi-Flush Mounting), Modbus-RTU Communication, Blank Overlay	TC-50-Blank-Mod
Controller with Barrier Cabinet (Hinged Front Panel), Modbus-RTU Communication, Blank Overlay	TC-51-Blank-Mod
Controller Only (Semi-Flush Mounting), No Communication	TC-50
Controller with Barrier Cabinet (Hinged Front Panel), No Communication	TC-51
Controller Only (Semi-Flush Mounting), Modbus-RTU Communication	TC-50-Mod
Controller with BarrierCabinet (Hinged Front Panel), Modbus-RTU Communication	TC-51-Mod
Controller Only (Semi-Flush Mounting)	TC-100
Controller with Barrier Cabinet (Hinged Front Panel)	TC-101
Cabinet Door forTC-50 or TC-100 Retrofit Applications	TC-Door
Barrier Cabinet	TC-Barrier

1.6 Product Labels

Every TC product has an identification label. This includes the barrier cabinet version, the bezel-mounted version, and the controller.

Product labels identify a specific product type, model number, rating, date of manufacture and serial number. The product label will confirm that the TC product type is right for the application.

Each product type has a different product label. And the label for each product type appears in a different location.

1.6.1 TC Barrier Cabinet Version

The product Label for the TC barrier cabinet version is located on the rear of the hinged panel, next to the controller, as shown in Figure 4, TC Barrier Cabinet Product Label.

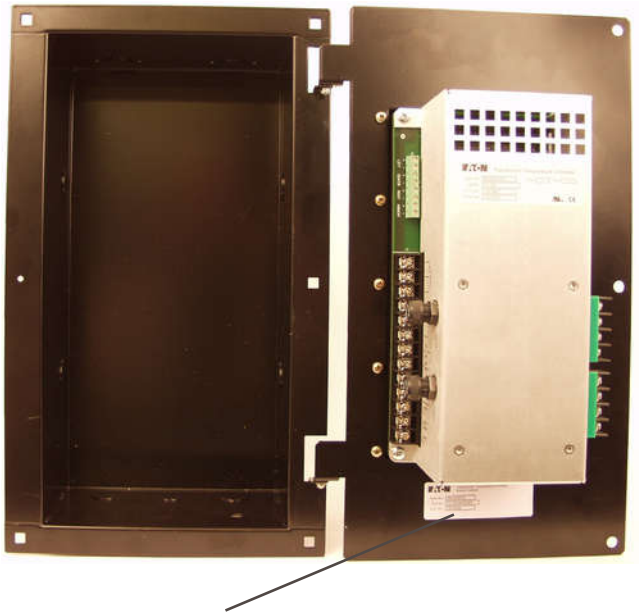


Figure 4, TC - Barrier Cabinet Product Label

1.6.2 TC Barrier Cabinet With Controller Version

The product label for the barrier cabinet with controller, is located on the side of the cabinet, as shown in Figure 5, TC Barrier Cabinet With Controller Product Label.



Figure 5, TC Barrier Cabinet With Controller Product Label

1.6.3 TC Controller Unit

The product label for the TC controller is located on the controller itself, as shown in Figure 6, TC Controller Product Label.



Figure 6, TC Controller Product Label

1.6.4 Equipment Testing

⚠CAUTION

NEVER PERFORM DIELECTRIC, MEGGER OR HIGH-POTENTIAL TESTING ON TRANSFORMERS WHILE A TC CONTROLLER UNIT IS CONNECTED. SUCH TESTING MAY CAUSE INTERNAL DAMAGE TO THE CONTROLLER. DISCONNECT THE TC CONTROLLER UNIT BEFORE CONDUCTING DIELECTRIC, MEGGER, OR HI-POT TESTS..

Every Eaton TC model is tested at the factory. There is no need for further testing of the TC.

If you prefer to test the transformer being monitored by the TC, by performing dielectric, megger or hi-potential tests, the TC controller unit must be disconnected before testing to avoid damaging it.

Follow this procedure to disconnect the TC controller unit:

1. Disconnect the incoming power to the transformer being monitored by the TC.

Note: Wiring for the power input must be 12-22 AWG. Fusing at the source should be appropriate for the selected wire.

2. Lock out and Tagout the disconnected circuit.
3. Access the controller by opening the hinged panel (barrier cabinet version) or from within the transformer cabinet (bezel-mounted version).
4. Disconnect the wiring to the controller. See Section 2.4, Wiring the TC, for locations.

2. Installation

⚠WARNING

INSTALLING A TC TRANSFORMER TEMPERATURE CONTROLLER THAT IS IMPROPERLY RATED FOR THE ELECTRICAL SYSTEM VOLTAGE COULD CREATE A POTENTIALLY HAZARDOUS CONDITION, RESULTING IN INJURY OR EQUIPMENT DAMAGE.

2.1 Preparation for Installation

⚠CAUTION

EATON TC PRODUCTS MUST BE INSTALLED OR REPLACED BY A QUALIFIED ELECTRICIAN TO AVOID INJURY OR EQUIPMENT DAMAGE.

2.1.1 General

Installation preparation is the same for both the barrier cabinet version and the bezel-mounted version. There are slight differences in the mounting procedures.

Before installing an Eaton TC, do the following:

- Verify that the area is clear of any dirt, debris, or clutter that may hamper the installation process.
- Verify that there is enough space in the transformer cabinet to install and wire the TC unit. See Section 8, Specifications, for dimensions.
- Confirm that all tools and equipment needed for the installation are available.
- Confirm that output wiring from the four thermocouples is long enough to reach the installed TC unit.
- Confirm that the incoming power source for the TC unit is available, as 100 to 240 Vac, and that the wires are long enough to reach the installed TC unit. Wiring for the power supply must be 12 to 22 AWG, and fitted with a fuse at the end appropriate for the selected wire.
- Confirm that 4-20mA output wiring is long enough to reach the TC controller component.
- Confirm that the Modbus RS485 cable is long enough to reach the TC unit.
- Confirm that external alarm indicators, trip actuators, discrete input devices, and/or SCADA systems are installed.

2.2 Barrier Cabinet Version

⚠WARNING

TURN OFF AND LOCK OUT THE POWER SUPPLY BEFORE WORKING IN ANY ELECTRICAL OR TRANSFORMER CABINET. FAILURE TO DO SO COULD RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK.

Prepare the transformer cabinet for mounting the TC barrier cabinet version, as follows:

1. Cut a hole in the transformer cabinet to receive the TC Barrier Cabinet. See Figure 7, TC Barrier Cabinet Cutout and Drill Dimensions, for dimensions.
2. Drill six holes in the transformer cabinet to mount the TC barrier cabinet. See Figure 7, TC - Barrier Cabinet Cutout and Drill Dimensions, for dimensions.
3. Open the hinged panel on the TC to expose the barrier cabinet.
4. Remove knock-outs in the barrier cabinet, as required, and install cable clamps or grommets to secure and protect the wiring.
5. Feed wiring into the barrier cabinet as it is being installed. This includes wiring for the four thermocouples, two fans, external alarm (if provided), controller power supply, 4-20mA output wiring and RS-485 cable for Modbus. Feed wires through the clamps and/or grommet protected holes created by removing the knock-outs.
6. Install the TC barrier cabinet into the hole cut into the transformer cabinet. Pull the wires into the barrier cabinet.
7. Secure the TC barrier cabinet to the transformer cabinet with the six screws provided. Draw them snug but do not overtighten them.

The TC is now ready to be wired from outside the transformer housing.

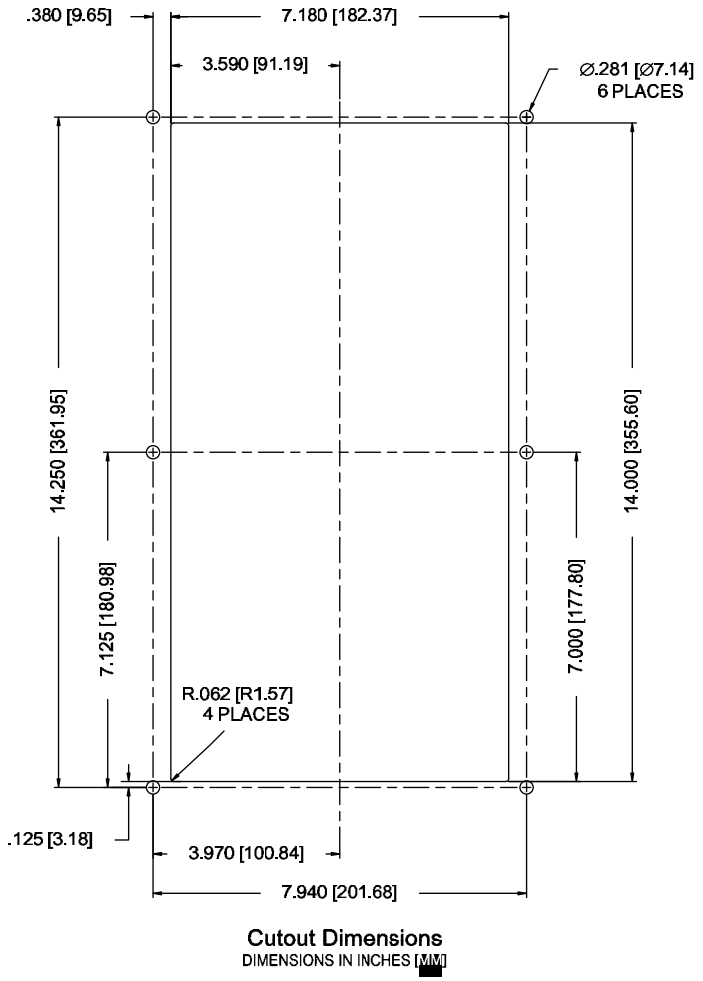


Figure 7, TC Barrier Cabinet Cutout and Drill Dimensions

2.3 Bezel-Mounted Version

⚠WARNING

TURN OFF AND LOCK OUT THE POWER SUPPLY BEFORE WORKING IN ANY ELECTRICAL CABINET OR TRANSFORMER CABINET. FAILURE TO DO SO COULD RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK.

Prepare the transformer cabinet to receive the bezel-mounted version, as follows:

1. Cut a hole in the transformer cabinet to receive the TC bezel-mounted version. See Figure 8, TC Bezel-Mounted Cutout and Drill Dimensions, for dimensions.
2. Drill ten holes in the transformer cabinet to mount the TC bezel-mounted version. See Figure 8, TC Bezel-Mounted Cutout and Drill Dimensions, for dimensions.
3. Install the TC- bezel-mounted version into the cutout hole, from the front.
4. Secure the TC unit to the transformer cabinet with the 10 screws provided. Use moderate torque - 8 inch pounds. Do not attempt to tap the holes. Do not use machine screws.
5. The TC unit is now ready to be wired, from inside the transformer cabinet.

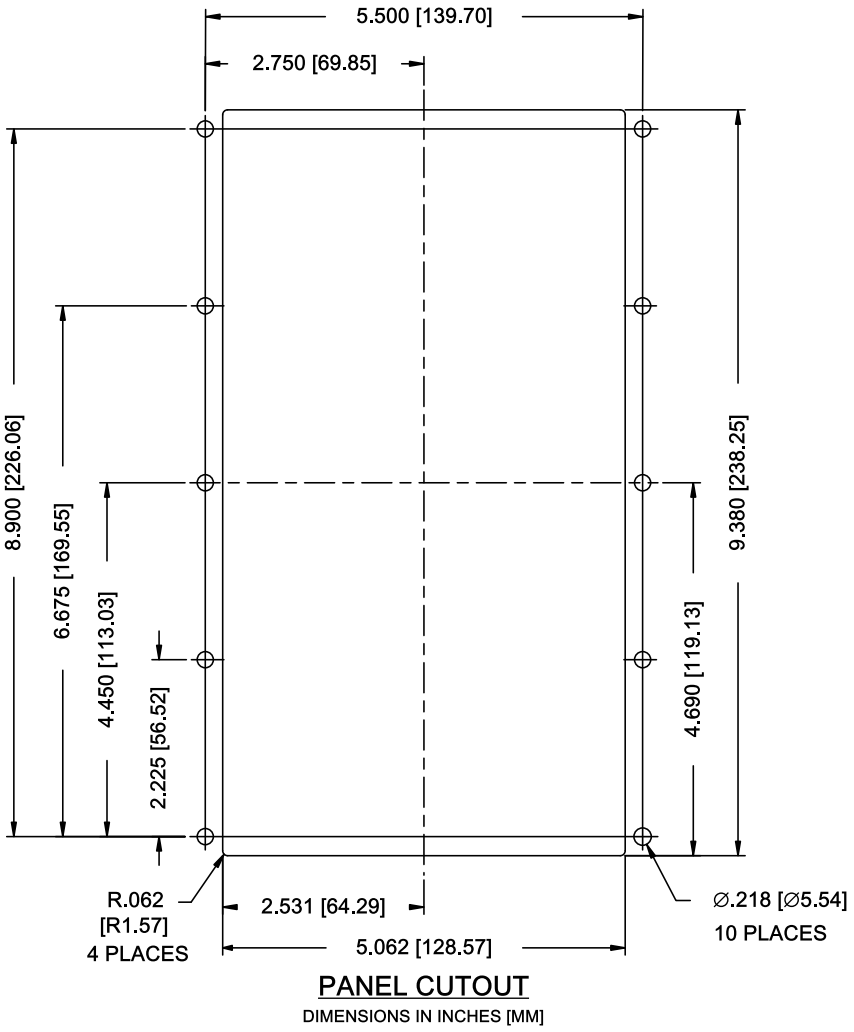


Figure 8, TC - Bezel-Mounted Cutout and Drill Dimensions

2.4 Wiring the TC Temperature Controller

⚠WARNING

TURN OFF AND LOCK OUT THE POWER SUPPLY BEFORE WORKING IN ANY TRANSFORMER CABINET. FAILURE TO DO SO COULD RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK.

⚠WARNING

WIRING MUST BE PERFORMED ONLY BY LICENSED/ QUALIFIED ELECTRICIANS WHO ARE TRAINED IN THE INSTALLATION AND SERVICING OF ELECTRICAL EQUIPMENT.

NOTICE

WIRING IS THE SAME FOR ALL MODELS, UNLESS OTHERWISE STATED IN A SUBJECT HEADING OR TEXT.

2.4.1 General

Both the barrier cabinet version and the bezel-mounted version are wired the same. However, the barrier cabinet version is wired from outside the transformer cabinet. The bezel-mounted version is wired from within the transformer cabinet.

Wire size and type will vary depending on the specific application. For direct connection to the terminal blocks, the wire size must fall within the limits shown in Table 2:

Table 2 - Recommended Wire Sizes

	Application	Wire Size
J1	Main power, Alarm, and Trip connections	12-22 AWG*
J2, J7, J8	Thermocouple inputs, 4-20mA Output, and Modbus network interface	14-28 AWG
J9, J10	Fan power	12-22 AWG*
* For J1, J9 and J10, if wiring outside this range is required it may be accommodated with a properly sized ring terminal.		

Figure 9, TC -Typical External Wiring Diagram, shows a typical wiring arrangement for all models.

Figure 10, TC - Detailed Drawing, shows a detailed description of mechanical connections for all models..

Figure 11, TC - Power and Discrete Input Wiring, shows alternative approaches for discrete input wiring (TC-100 only).

2.4.2 Wiring Procedures

Follow these procedures to wire all TC models.

2.4.2.1 Thermocouples

1. Connect the thermocouple wires to terminal block J2, shown in Figure 10, TC - Detailed Drawing, as follows:

   a. Connect Left Phase (A) (+) to terminal 1 and (-) to terminal 2.

   b. Connect Center Phase (B) (+) to terminal 3 and (-) to terminal 4.

   c. Connect Right Phase (C) (+) to terminal 5 and (-) to terminal 6

   d. Connect Ambient (+) to terminal 7 and (-) to terminal 8

Note: The standard color code for K type thermocouple wire is yellow insulation for the positive (+) lead and red insulation for the negative (-) lead. For E type thermocouple wire the standard is purple insulation for the positive (+) lead and red insulation for the negative (-) lead.

2.4.2.2 Trip Relay

1. Connect the trip contactor or coil to be controlled by trip relays to terminal block J1, shown in Figure 10, as follows:

   a. Connect the trip relay Normally Closed (NC) contact to terminal #1.

   b. Connect trip relay Common (COM) contact to terminal #2.

   c. Connect the trip relay Normally Open (NO) contact to terminal #3.

Note: The fail-safe setting for the trip relay will determine the state of the NO and NC contacts. When fail-safe mode is Off, the NO contact is open when no trip condition is present or latched, and closes to NC when a trip condition occurs. This is reversed when fail-safe mode is On.

2.4.2.3 Alarm Relay

1. Connect remote alarm equipment to be controlled by the alarm relay to terminal block J1, shown in Figure 10, TC - Detailed Drawing, as follows:

   a. Connect equipment to the alarm relay Normally Closed contact (NC) to terminal #4.

   b. Connect the alarm relay Common contact (COM) to terminal #5.

   c. Connect the alarm relay Normally Open contact (NO) to terminal #6.

Note: The fail-safe setting for the alarm relay will determine the state of the NO and NC contacts. When fail-safe mode is Off, the NO contact is open when no alarm condition is present or latched, and closes to NC when an alarm condition occurs. This is reversed when fail-safe mode is On.

2.4.2.4 Earth Ground

1. Connect terminal #8 of terminal block J1, shown in Figure 10, to the closest solid electrical-safety grounding point with a heavy wire or braid (#14 AWG or larger). Do not use a current-carrying or neutral conductor for this grounding. Also, do not tie terminal #8 to neutral terminal #10 of terminal block J1.

2.4.2.5 100 Vac to 240 Vac Input Power

1. Connect terminals #7 and #10 of terminal block J1, shown in Figure 10, to a source of control power rated at 100 - 240 Vac.

   a. Connect LINE to terminal #7

   b. Connect NEUTRAL (120V) or Line 2 (240V) to terminal #10.

2.4.2.6 Discrete Input Power (TC-100 Only)

The discrete inputs are used for sensing contacts on remote relays or sensor switches for the purpose of generating alarm or trip conditions or controlling the fan(s) on the TC-100. Note that programming of the discrete inputs allows connection to either normally open (NO) or normally closed (NC) contacts.

The Discrete Input circuits are isolated from the other circuits in the TC and have their own common connection, Terminal 12. The contact signals are connected to Terminals 11 and 13.

Two methods of powering and connecting the customer contacts are shown in Figure 11, "TC - Discrete Input Power Wiring".

1. Connect external contacts to the TC-100 discrete inputs on terminal block J1, shown in Figure 10, as follows:

   a. Connect a remote contact wetting source to one side of the remote contact.

   b. Connect the other side of the remote contact to terminal 11 or 13.

   c. Connect terminal 12 to the neutral or line 2 of that remote source.

⚠CAUTION

FOR NOISE IMMUNITY AND SAFETY, DO NOT CONNECT THE DISCRETE COMMON TERMINAL 12 TO TERMINAL 10 OR ANY OTHER NEARBY NEUTRAL IF A REMOTE WETTING SOURCE IS IN USE.

⚠CAUTION

BEWARE OF LARGE SHUNT CAPACITANCE ACROSS CONTACTS OR IN SOLID-STATE RELAYS CONNECTED TO THE TC-100 DISCRETE INPUTS. CHARGING CURRENT THROUGH THE CAPACITOR COULD CAUSE A FALSE INDICATION OF A CLOSED CONTACT. KEEP TOTAL CAPACITANCE BELOW 0.05 MICROFARADS.

2.4.2.7 Modbus Network (TC-50 Modbus and TC-100 only)

1. Connect the Modbus network to terminal block J8, shown in Figure 9, TC - Typical External Wring Diagram, as follows:

   a. Connect (A) to terminal #4, and B to terminal #3.

   b. Connect the (COM) to terminal #2.

   c. Connect the Shield to terminal #1.

2.4.2.8 4-20mA Output

1. Connect the remote meter or SCADA system to the 4-20mA Output on terminal block J7, shown in Figure 9, TC- Typical External Wiring Diagram, as follows:

   a. Connect (+) to terminal #2.

   b. Connect (-) to terminal #1.

2.4.2.9 Fan Power

⚠WARNING

POWER TO THE FAN(S) MUST BE FUSED AT THE SOURCE AT A LEVEL APPROPRIATE FOR THE SELECTED WIRING.

1. Connect input power (line or +) for the fan(s) to terminal #1, shown in Figure 9, TC - Typical External Wiring Diagram.
2. Connect input power (line2, neutral, or -) for the fan(s) to terminal #2.
3. Connect the passed-through output power (line2, neutral or -) to the fan(s) to terminal #3.
4. Connect the fused, switched output power to the fan(s) to terminal #4.

Note: The fuses built into the TC-100 are standard 1/4" x 1-1/4", 250 Vac, 20 Amps maximum rating. Lower ratings may be used, as required, based upon the application's power supply, wire size, and fan(s).

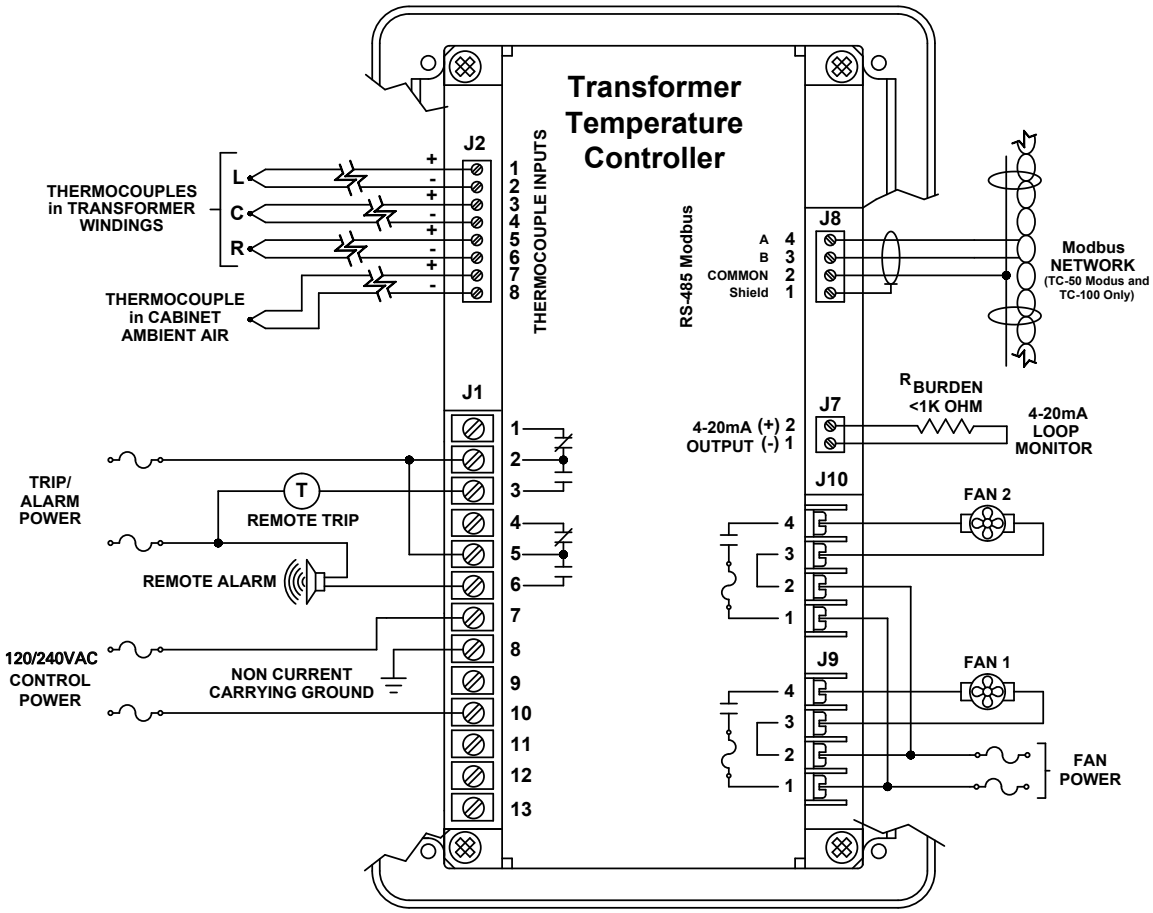


Figure 9, TC - Typical External Wiring Diagram

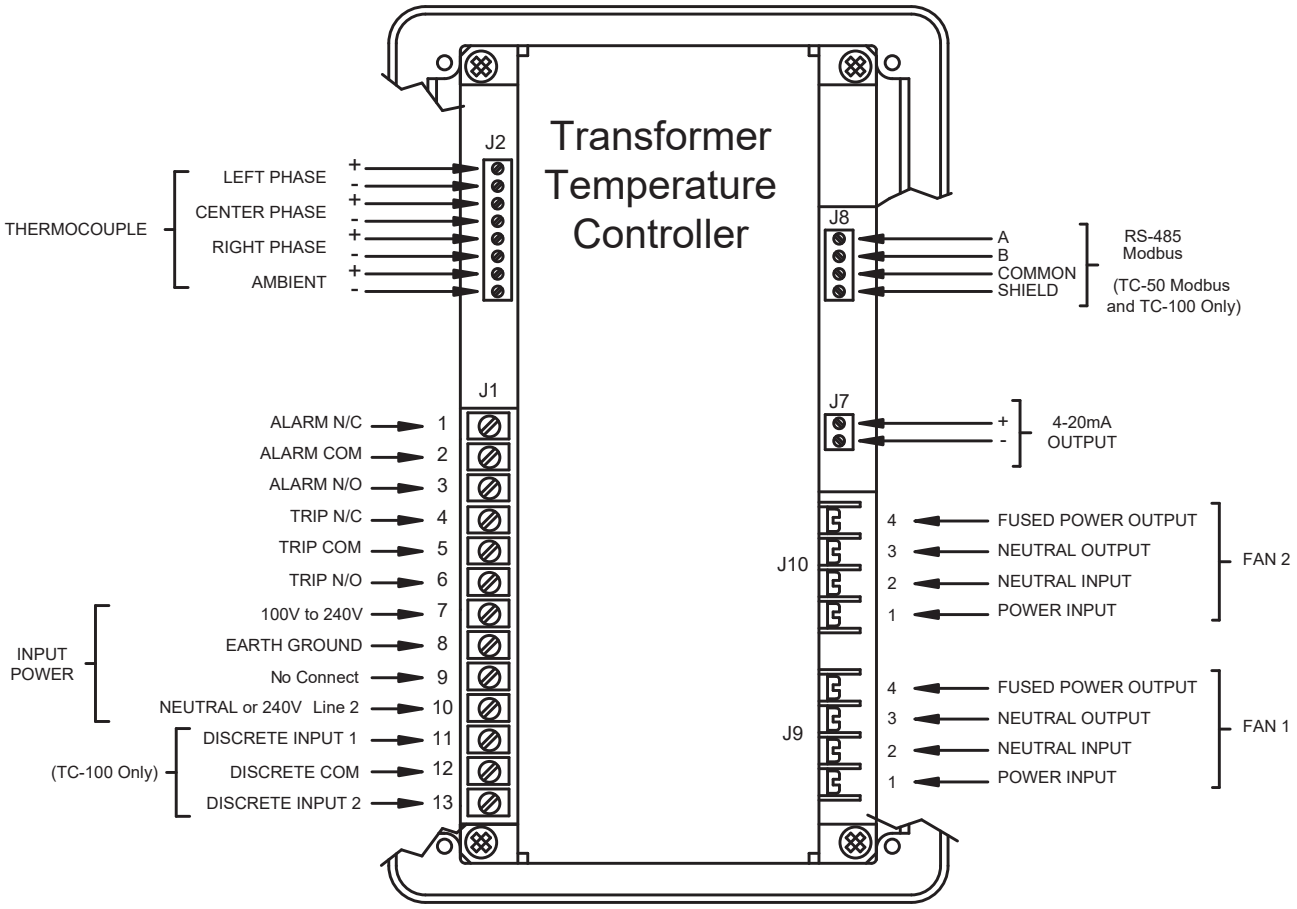


Figure 10, TC- Detailed Drawing

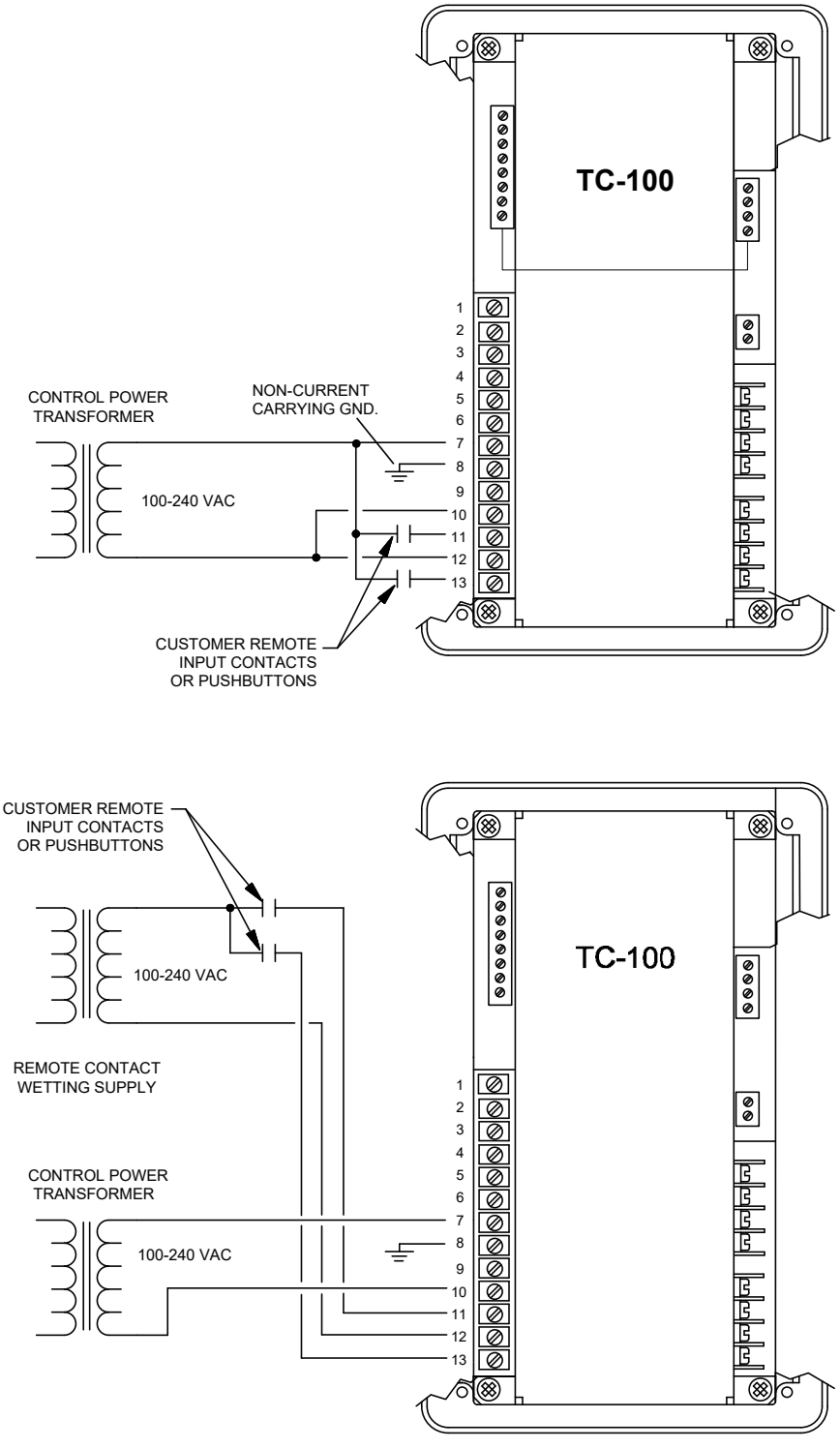


Figure 11, TC - 100 Discrete Input Power Wiring

3. Operating Functions

NOTICE

FUNCTIONS DESCRIBED IN THIS SECTION ARE THE SAME FOR ALL MODELS, UNLESS OTHERWISE STATED IN A SUBJECT HEADING.

TC models boast a variety of functions. Some of them were mentioned in the Introduction, but not explained in detail.

This section describes the Operating Functions of all TC models in an organized manner. How you set up, program and control each TC model to implement these functions is explained in Section 4, Operating Procedures.

Operating functions of the TC models are organized into four categories, as described below.

3.1 Monitoring

The TC models monitor and display the temperature of each of the four thermocouples (Left, Center and Right Phases, and the ambient temperature) on a continuing basis.

In the **Scroll** mode, the temperatures are displayed sequentially on the LED display on the front panel, at 3 second intervals. The display alternates between Left, Center, Right, Ambient, Maximum Winding, and Average Winding temperatures and shows the temperature of that thermocouple in °C or °F. The value (°C or °F) is programmable.

In the **Max** mode, the highest of the three winding temperatures, alternating with the average of the winding temperatures, will be displayed on a continuous basis.

The **Scroll** or **Max** mode is programmable.

3.2 Programming

Many control functions can be selected or changed by the operator. This includes changing temperature setpoints to modify fan turn-on, alarm and trip conditions, setting parameters for gathering report information, and controlling various functions on a (programmable) timed basis. The TC models can also be programmed to operate (exercise) the fans for short intervals to prevent seizing.

Programming the TC models Manually is done from the front panel, using a variety of pushbuttons.

Entering the Program mode, using the **Prog** button, presents a list of options from which you may select. You can navigate through this list using the ▲ and ▼ arrows (Up and Down arrows) until you find the option desired. Pressing the **Select** button selects that option.

Sometimes, pressing **Select** will present another list of options from which to choose. Navigate that list the same as before, using the ▲ and ▼ arrows, then press the **Select** button to select (enter) that option.

How to set specific parameters is covered in sections 4.1.2, Programming the TC Manually, and 4.1.2.2 Configuration Parameters.

3.3 Reporting (TC-100 Only)

The TC models can automatically collect and store report (log) data.

Typical reports (logs) include:

- Temperature Trend Data
- Alarm Log
- Trip Log
- Fan Wear History

Up to 100 points of Temperature Trend Data and 25 entries each for Alarm and Trip Logs can be stored .

Individual logs are stored on a First In First Out (FIFO) basis, where the oldest log is replaced by the newest.

Individual logs are displayed on a Last In First Out (LIFO) basis, where the newest log is always displayed.

3.4 Testing

The TC allows the user to test various functions to assure they are operating correctly. These include testing the following:

- Alarm and Trip relays
- Internal temperature of the TC
- LED display
- Individual LEDs
- Operation of buttons on the front panel.

4. Operating Procedures

NOTICE

FUNCTIONS DESCRIBED IN THIS SECTION ARE THE SAME FOR ALL MODELS, UNLESS OTHERWISE STATED IN A SUBJECT HEADING.

TC models can be operated/programmed three different ways::

- **Manual Operation,** using the front panel controls (all models)
- **Local Operation,** using a laptop computer connected to the TC USB port (all models**)**
- **Remote Operation,** using a standard Modbus communications network (TC-50 Modbus and TC-100 only).

Regardless of the operating method selected, each TC must be set up or programmed to best suit the needs/desires of the user.

The Reset and Test functions are only available in Manual Operation using the front panel controls.

The programming functions of all TC models are the same, regardless of the operating method used.

However, each operating method varies in its execution. For this reason, each is described in a separate section, below.

4.1 Manual Operation

Operating the TC models manually, at the front panel, requires a thorough understanding of the controls and how they are used to set up/program the controller. These controls are used to set up various operating parameters, change setpoints, reset alarm and trip relays, and clear data logs used for reports.

Some functions of the TC can be controlled manually by the operator, such as turning the cooling fans On or Off, silencing alarms, and performing various test routines.

The content of this section is organized into four functional areas:

- Control Functions
- Reset Functions
- Programming Functions
- Test Functions.

4.1.1 Control Functions

The front panel contains one 8-charcter LED display, nine discrete LEDs, and nine pushbutton membrane switches. Using the front panel controls, the user can set the TC for automatic operation, establish setpoints, configure the system, and set operating parameters.

The bottom of the front panel also contains one flip-up door, which can be sealed with a locking wire, that covers a USB 2.0 port. The USB port is used to connect a laptop computer to the TC to operate it **Locally**.

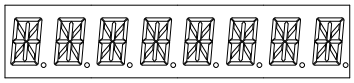
The front control panel layout is shown below, in Figure 12, TC - Front Panel Controls.

The function of each front panel control is explained on the following pages.



Figure 12, TC- Front Panel Controls

4.1.1.1 LED Display:



The 8-character LED panel, shown above, displays a variety of messages, including average and maximum temperatures, setpoint values, status, and program menu items.

Specific messages that will be displayed are mentioned throughout this manual, and notably in Section 4.1.2, Operating the TC Manually.

The display can be set to operate in either of two modes:

- **Scroll** Mode: Displays each winding (and ambient) temperature sequentially, allowing a few seconds to read each value. Typical **Scroll** displays show the winding temperature of Phase A, B, and C, then, the ambient temperature, followed by the maximum measured winding temperature, and finally the average of the measured winding temperatures. The sequence is then repeated. At the same time, the corresponding temperature LED indicator illuminates (as described in Section 4.1.1.2, LED Indicators), for Phase A. B, C and Ambient. If one or more alarms are present and alarm display is enabled, an abbreviated alarm description will also be displayed.
- **Max** Mode: Displays the value of the highest winding temperature and the average of the winding temperatures. The Temperature LED Indicator corresponding to the winding with the maximum temperature illuminates when the max temperature is displayed. If one or more alarms are present and alarm display is enabled, an abbreviated alarm description will also display.

While in the **Max** mode, you can scroll through the phase winding temperatures using the ▲ and ▼ arrows on the front panel. After a 60 second time-out, the system returns to the **Max** mode.

4.1.1.2 LED Indicators

4.1.1.2.1 Fan LED



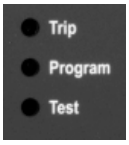
A **yellow** LED Illuminates when one or both fan relays are **On.**

4.1.1.2.2 Alarm LED



A **red** LED illuminates when the alarm relay is active due to an over-temperature condition from any of the four thermocouples, if there is a thermocouple failure, or an internal failure of the TC.

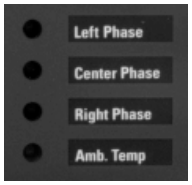
4.1.1.2.3 Status LEDs



Red LEDs Indicate the operating status of the TC as follows:

- **Trip** LED: Illuminates when the trip relay is active.
- **Program** LED: Illuminates when the TC is in the manual program mode, via the **Prog** button on the front panel.
- **Test** LED: Illuminates when the TC is in the test mode, via the **Test** button on the front panel.

4.1.1.2.4 Temperature LEDs



Green LEDs Illuminate when the temperature of one of the thermocouples is displayed on the LED screen, as follows:

- **Left Phase:** Indicates the temperature for this channel is being displayed, in either °C or °F.
- **Center Phase:** Indicates the temperature for this channel is being displayed, in either °C or °F.
- **Right Phase:** Indicates the temperature for this channel is being displayed, in either °C or °F.
- **Ambient:** Indicates the temperature for this channel is being displayed, in either °C or °F.

Note: Displaying the temperatures in either °C or °F is programmable.

Note: The label beside the Temperature LED Indicators may be removed and turned over to provide a place for the user to write their own description. The best way to remove the label is to slide a sticky note, sticky side facing up, under the label and then carefully remove the label with the sticky note.

4.1.1.3 Pushbutton Controls:

4.1.1.3.1 Password Protection

Three pushbuttons are password protected: **Reset**, **Prog**, and **Test**. A valid four character, alpha-numeric password must be entered for these pushbuttons to function.

The TC models are shipped with the default password of "0000". When a password protected button is pressed, the LED display shows **PWD**.**** prompting you to enter your password.

Changing the password is optional.

If the default password **has not** been changed, simply press **Select** to enter the Reset, Program, and Test programs.

If the default password **has** been changed, the new password must be entered to access the program.

Enter the password as follows:

1. Press the ▼ arrow to change the individual password character; (**0** through **9** and **A** through **F**). Press the ▲ arrow to move to the next character in the display.
2. Press **Select** to enter the password.
3. If the password is correct, the LED display will show the first item in the **Reset, Program**, or **Test** sub- menu depending on the function being accessed.

4.1.1.3.2 Reset



Note: The **Reset** button is password protected. See Section 4.1.1.3.1 Password Protection.

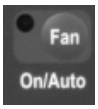
The **Reset** button is located at the very top of the front panel, to the right. This button allows the user to:

- Reset alarm and trip relays that are latched.
- Clear trend, alarm, trip or fan wear data logs (TC-100 Only).

The various reset functions are described in Section 4.1.2.1, Reset Functions, and shown in Appendix B, Programming Quick Reference Guide, Table 1.

Note: The **Reset** button is password protected. See Section 4.1.1.3.1, Password Protection.

4.1.1.3.3 Fan



The **Fan** button turns the fans On or Off, if manual operation is enabled, but has no effect if manual operation is disabled.

In the **Auto/Manual** mode, **Fan** turns the fans On, but will not turn the fans Off if the thermocouple temperatures are above the programmed setpoint.

4.1.1.3.4 Alarm



The **Alarm** button silences the audible alarm (if enabled) when an alarm is present. **Alarm** has no effect if audible alarm is disabled.

If there is no alarm condition, pressing **Alarm** tests the alarm and cause it to sound. Pressing **Alarm** again silences the alarm.

Alarms can be set to be latched or unlatched, (Latched means that even if you correct the alarm condition, the alarm will remain until manually reset).

If an alarm is initiated, the TC-100 creates a data log by collecting data about the type of alarm, the time and date of the alarm, and the temperature of each thermocouple at the time of the alarm. The TC-100 stores such alarm data for up to 25 alarms.

Alarm **conditions** include:

- Temperature not decreasing
- Thermocouple Reverse Connection
- Thermocouple Open Circuit.
- Winding over-temperature
- Air flow not detected
- Fan wear limit time exceeded
- Maximum fan on time exceeded

Alarm **Internal Controller Failures** include:

- EEPROM Failure
- FRAM Failure
- Isothermal Block out of range

4.1.1.3.5

Up and Down Arrows 

The ▲ and ▼ arrows are used to:

- Change your password
- Increase or decrease values
- Scroll (up or down) through the temperature channels while in the **Max** display mode
- Scroll through the various menu options while in the **Program**, **Reset**, or **Test** modes.

The ▲ moves **Up** one level. The ▼ moves **Down** one level.

4.1.1.3.6 Back 

The **Back** button returns to the previous menu item, when in the **Program**, **Reset**, or **Test** modes. When in the **Max** mode and manually scrolling through temperatures, **Back** returns to the **Max** mode.

4.1.1.3.7 Select 

The **Select** button accesses historical (log) data stored in the TC, while in the **Scroll** or **Max** modes, during Manual operation,

Selections are made using the ▲ and ▼ arrows and entered by pressing **Select**.

Available log data includes:

- **Trip Log** data (TC-100 only), including the time and date of the trip, the reason for the trip, and the temperature for each thermocouple at the time of the trip. The TC stores data for up to 25 trips.
- **Alarm Log** data (TC-100 only), including the type of alarm, the time and date of the alarm, and the temperature for each thermocouple at the time of the alarm. The TC stores data for up to 25 alarms.
- **Temperature Trend** data (TC-100 only) includes temperatures at selected, programmable times. There are 100 points of trend data available, on a First In First Out (FIFO) basis.
- **Maximum Temperature** data (all models) includes the maximum temperature measured on each channel since the last time this data was manually reset.
- **Fan Wear** data includes how many hours each fan has run. It also displays the maximum, continuous On time for each fan.
- **Current Date,** time and firmware version number (all models).

Select is also used to select the next menu item or enter a configuration setting while in the **Program**, **Reset**, or **Test** modes.

4.1.1.3.8 Program 

Note: The program function is password protected. See Section 4.1.1.3.1, Password Protection.

The **Prog** button enters the **Program Configuratio**n mode. The configuration parameters are described in Section 4.1.2.2, Configuration Parameters, and shown in Appendix A, Programming Quick Reference Guide, Table 2.

4.1.1.3.9 Test 

Note: The **Test** button is password protected. See Section 4.1.1.3.1 Password Protection.

The **Test** button enters the Test mode. The various test functions are described in Section 4.1.2.3, Test Functions, and shown in Appendix A, Programming Quick Reference Guide, Table 3.

4.1.1.3.10 USB Port

The 2.0 USB Port is located behind a hinged (flip-up) cover, shown below, that can be secured with locking wire for security purposes.



When the cover is opened, a USB port is exposed, as shown below.



The USB port allows you to connect a laptop computer to the TC using a USB cable, then operate and/or control the TC-100 from the laptop. (These procedures are discussed in Section 4.2, Local Operation).

4.1.2 Operating the TC Manually

With manual operation, the TC is programmed and controlled from the front panel.

There are three basic aspects to manually operating the TC:

- Reset Functions
- Configuration Parameters
- Test Functions.

Each is discussed in detail, below, and shown in tabular form in Appendix A, Programming Quick Reference Guide, Tables 1, 2, and 3.

4.1.2.1 Reset Functions

Note: The **Reset** button is password protected. See Section 4.1.1.3.1 Password Protection.

The **Reset** functions include resetting alarm and trip relays; trend, alarm and trip log data; and transformer fan wear history. These are described below.

Resetting these items involves the **Back**, **Reset** and **Select** buttons and the ▲ and ▼ arrows on the front panel. The associated process messages are displayed on the LED display screen.

Navigate to the function to be reset by scrolling through the functions shown using the ▲ and ▼ arrows until the desired function is displayed.

Then, press **Reset**. The function will be reset. The LED Display will show **RST-COMP**.

Press **Reset** to return to normal operation. Press **Back** once to return to the Reset menu, and twice to exit the program.

4.1.2.1.1 Trend Reset (TC-100 Only)

Resets the trend log data.

Note: This will delete all trend data from the TC. If this data is important it should be uploaded through the local USB port or remote RS-485 Modbus port prior to resetting.

1. Press **Reset** and enter password. A sub-menu will display.
2. Scroll to **R-TREND** using the ▲ and ▼ arrows.
3. Press **Select** to reset the trend log data. The LED Display will then show **RST-COMP**.
4. Press **Back** once to return to the Reset menu, and twice to exit the program.

4.1.2.1.2 Alarm Reset

Resets a latched alarm condition including the Alarm relay LED and the audible alarm.

1. Press **Reset** and enter password. A sub-menu displays.
2. Scroll to **R-ALARM** using the ▲ and ▼ arrows.
3. Press **Select** to reset the latched alarm. The LED Display shows **RST-COMP**.
4. Press **Back** once to return to the Reset menu, and twice to exit the program.

Note: This function will not reset unless the alarm condition is cleared.

Note: Alarms can be set to be **Latched** or **Unlatched**, (Latched means that even if you correct the alarm condition, the alarm will remain until manually reset).

4.1.2.1.3 Trip Reset

Resets the latched trip relay.

1. Clear the trip condition.
2. Press **Reset** and enter password. A sub-menu displays.
3. Scroll to **R-TRIP** using the ▲ and ▼ arrows.
4. Press **Select** to reset the latched trip relay. The LED Display will then show **RST-COMP**.
5. Press **Back** once to return to the Reset menu, and twice to exit the Reset program.

Note: This function will not reset unless the trip condition is cleared.

Note: Trip events can be set to be **Latched** or **Unlatched**, (Latched means that even if you correct the trip condition, the trip will remain until manually reset).

4.1.2.1.4 Reset Alarm Log (TC-100 Only)

Resets the alarm log data.

Note: This will delete all historical alarm event data from the TC. If this data is important it should be uploaded through the local USB port or remote RS-485 Modbus port prior to resetting.

1. Press **Reset** and enter password. A sub-menu displays.
2. Scroll to **R-ALMLOG** using the ▲ and ▼ arrows.
3. Press **Select** to reset the alarm log data. The LED Display shows **RST-COMP**.
4. Press **Back** once to return to the Reset menu, and twice to exit the program.

4.1.2.1.5 Reset Trip Log (TC-100 Only)

Resets the trip log data.

Note: This will delete all historical trip event data from the TC. If this data is important it should be uploaded through the local USB port or remote RS-485 Modbus port prior to resetting.

1. Press **Reset** and enter password. A sub-menu displays.
2. Scroll to **R-TRPLOG** using the ▲ and ▼ arrows.
3. Press **Select** to reset the trip log data. The LED Display shows **RST-COMP**.
4. Press **Back** once to return to the Reset menu, and twice to exit the program.

4.1.2.1.6 Reset Maximum Temperature Log

Resets the maximum temperature recorded for each winding and the ambient temperature since the last reset of this log.

1. Press **Reset** and enter password. A sub-menu displays.
2. Scroll to **R-MAXLOG** using the ▲ and ▼ arrows.
3. Press **Select** to reset the trip log data. The LED Display shows **RST-COMP**.
4. Press **Back** once to return to the Reset menu, and twice to exit program.

4.1.2.1.7 Reset All Logs

Resets all Trend, Alarm, and Trip log data.

Note: This will delete all historical log data from the TC. If this data is important it should be uploaded through the local USB port or remote RS-485 Modbus port prior to resetting.

1. Press **Reset** and enter password. A sub-menu displays.
2. Scroll to R-LOGS using the ▲ and ▼ arrows.
3. Press **Select** to reset the Alarm, Trend, and Trip log data. The LED Display shows **RST-COMP**.
4. Press **Back** once to return to the Reset menu, and twice to exit the program.

4.1.2.1.8 Reset Fan Wear History (TC-100 Only)

Resets the transformer fan wear history. This is useful after replacing or performing periodic maintenance on a fan.

1. Press **Reset** and enter password. A sub-menu displays.
2. Scroll to **R-FWEAR** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **TOTAL ON** or **CONT, ON** using the ▲ and ▼ arrows.

Note: TOTAL ON indicates the total time a fan has run. CONT. ON indicates how long the fan has run continuously.

5. Press **Select**. A sub-menu displays.
6. Scroll to **FAN1** or **FAN 2**.
7. Press **Select** to reset the type of fan wear history selected for the fan selected. The LED Display shows **RST-COMP**.
8. Press **Back** one, two or three times to return to the Reset menus (and make another selection) or four times to exit the program.

4.1.2.2 Configuration Parameters

There are many parameters that must be set when programming the TC to customize it to a particular installation.

The format for each parameter described below is:

4.1.2.2.1 Name (Display Menu Name)

Followed by a short description of the parameter, range of possible values, and default value. If no new value is set for a parameter, the default value will be used.

Each parameter is described below, including its screen display name, default setting, range for selection, and function.

Press **Prog** to enter the **Program** mode. This button is password protected. See Section 4.1.1.3.1, Password Protection.

Navigate to the selection desired (as shown below) using the ▲ and ▼ arrows. Press **Select** to enter your selection.

In many cases there are sub-menus that must be navigated following this same procedure of using the ▲ and ▼ arrows and **Select** button until the actual parameter to be changed is displayed.

Once the parameter to be changed is displayed use the ▲ and ▼ arrows to scroll to the desired value.

Press **Select** to store the desired value and return to the previous menu, or **Back** to return to the previous menu without storing the change.

Repeat this Select, Modify, and Store process until all desired changes are completed, and then press **Prog** to return to normal operation.

4.1.2.2.2 Display Mode (DISPMODE)

Controls how the front panel displays individual winding and ambient temperature readings; either **Scroll** or **Max**. The default is **Scroll**.

Scroll: Displays individual winding and ambient temperature readings sequentially, followed by the maximum and average winding temperatures.

Max: Displays the maximum (highest) winding temperature.

1. Press **Prog** and enter password. A sub-menu displays.
2. Scroll to **DISPMODE** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **SCROLL** or **MAX** using the ▲ and ▼ arrows.
5. Press **Select** to enter your choice. **DISPMODE** displays.
6. Press **Back** to exit the program.

4.1.2.2.3 Temperature Display Unit (TEMP C/F)

Selects the unit of measure to display temperatures; Celsius **(DEGREE C)** or Fahrenheit **(DEGREE F)**. Default is **DEGREE C**.

1. Press **Prog** and enter your password. A sub-menu will display.
2. Scroll to **TEMP -C/F** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **DEGREE - C**, or **DEGREE - F** using the ▲ and ▼ arrows.
5. Press **Select** to enter your choice, **TEMP- C/F** displays.
6. Press **Back** to exit the program.

4.1.2.2.4 Transformer Type (XFORMER)

Selects the type of transformer being monitored, either **Dry** or **CASTCOIL**. Default is **Dry**.

Note: This setting is for information purposes only. It does not affect operation of the fan, alarm, or trip setpoints.

1. Press **Prog** and enter your password. A sub-menu will display.
2. Scroll to **XFORMER** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **DRY**, or **CASTCOIL** using the ▲ and ▼ arrows.
5. Press **Select** to enter your choice. **XFORMER** displays.
6. Press **Back** to exit the pogram.

4.1.2.2.5 Modbus Parameters (MODBUS) (TC-50 Modbus and TC-100)

This is the top level menu for setting the various Modbus parameters. Pressing **Select** at this menu item provides a set of sub-menus to navigate through the individual parameters.

4.1.2.2.5.1 Baud Rate (MODBUS/BUDRATE) (TC-50 Modbus and TC-100)

Selects the Modbus communications rate desired. Options are: **9.6K, 19.2K,** or **38.4K**. Default is **9.6K**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **MODBUS** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **BAUDRATE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **9.6K**, **19.2K** or **38.4K** , using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **BAUDRATE** displays.
8. Press **Back** once to return to the Modbus menu or twice to exit the program.

4.1.2.2.5.2 Parity (MODBUS/PARITY) (TC-50 Modbus and TC-100)

Selects Modbus parity, between **ODD**, **EVEN,** or **NONE.** The default is **NONE**.

1. Press **Prog** and enter your password. A sub-menu displays.

2. Scroll to **MODBUS** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **PARITY** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **ODD**, **EVEN**, or **NONE**, using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **PARITY** displays.
8. Press **Back** once to return to the Modbus menu or twice to exit the program.

4.1.2.2.5.3 Stopbits (MODBUS/STOP-BIT) (TC-50 Modbus and TC-100)

Selects Modbus stopbit desired, between **One** or **Two**. The default is **Two**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **MODBUS** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **STOP-BIT** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **ONE** or **TWO**, Using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **STOP-BIT** displays.
8. Press **Back** once to return to the Modbus menu or twice to exit the program.

4.1.2.2.5.4 Modbus Address (MODBUS MB-ADDRS) (TC-50 Modbus and TC-100)

Selects the Modbus address desired, between **1** and **247**. The default is **1**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **MODBUS** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **MB-ADDRESS** using the ▲ and ▼ arrows.
5. Press **Select**.
6. Scroll to the address desired, from 1 to 247, using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **MB-ADDRESS** displays.
8. Press **Back** once to return to the Modbus menu or twice to exit the program.

4.1.2.2.6 Input Channel Parameters (INPUT-CH)

This is the top level menu for setting the various thermocouple input channel parameters. Pressing **Select** at this menu item to view a set of sub-menus to navigate through the individual parameters..

4.1.2.2.6.1 Channel Display (INPUT-CH-DISPLAY)

Selects the channel identifier for display, from **ABC**, **123**, or **UVW**. The default is **ABC**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **INPUT-CH** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **CH-DISPL** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu will display.
6. Scroll to **A-B-C**, **1-2-3**, or **U,V,W** using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **CH-DISPL** displays.
8. Press **Back** once to return to the Channel Display menu or twice to exit the program.

4.1.2.2.6.2 Input Channel-ON/OFF Control (INPUT-CH/CH-ON,OFF)

This is the 1st sub-level menu for setting the On/Off status of thermocouple input channels. Pressing **Select** at this sub-menu item provides another set of sub-menus to navigate through the four channels. This is the first sub-level menu for setting the On/Off status of thermocouple input channels. Pressing **Select** at this sub-menu item provides another set of sub-menus to navigate through the four channels.

4.1.2.2.6.3 Input 1(INPUT-CH/CH-ON or OFF/INPUT1)

Sets thermocouple On/Off control for input 1 to **ON** or **OFF**. The default is **ON**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **INPUT-CH** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **CH-ON.OFF** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **INPUT 1** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.

8. Scroll to **ON** or **OFF** using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. INPUT 1 displays.
10. Press **Back** once or twice to return to the sub-menus, or three times to exit the program.

4.1.2.2.6.4 Input 2 (INPUT-CH/CH-ON or OFF/INPUT2)

Sets thermocouple On/Off control for input to **ON** or **OFF**. The default is **ON**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to I**NPUT-CH** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **CH-ON.OFF** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **INPUT 2** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Scroll to **ON** or **OFF** using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **INPUT 2** displays.
10. Press **Back** once or twice to return to the sub-menus, or three times to exit the program.

4.1.2.2.6.5 Input 3 (INPUT-CH/CH-ON or OFF/INPUT3)

Sets thermocouple On/Off control for input to **ON** or **OFF**. The default is **ON**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **INPUT-CH** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **CH-ON.OFF** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **INPUT 3** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Scroll to **ON** or **OFF** using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **INPUT 3** displays.
10. Press **Back** once or twice to to return to the sub-menus, or three times to exit the program.

4.1.2.2.6.6 Input 4 (INPUT-CH/CH-ON or OFF/INPUT4)

Sets thermocouple On/Off control for input to **ON** or **OFF**. The default is **ON**.

Press **Prog** and enter your password. A sub-menu displays.

1. Scroll to **INPUT-CH** using the ▲ and ▼ arrows.
2. Press **Select**. A sub-menu displays.
3. Scroll to **CH-ON.OFF** using the ▲ and ▼ arrows.
4. Press **Select**. A sub-menu displays
5. Scroll to **INPUT 4** using the ▲ and ▼ arrows.
6. Press **Select**. A sub-menu displays.
7. Scroll to **ON** or **OFF** using the ▲ and ▼ arrows.
8. Press **Select** to enter your choice. **INPUT 4** displays.
9. Press **Back** once or twice to return to the sub-menus, or three times to exit the program.

4.1.2.2.7 Input Channel Thermocouple Settings (INPUT-CH/CH-THERM)

This is the first sub-level menu for setting the thermocouple properties for all input channels. Pressing **Select** at this sub-menu item provides another set of sub-menus to navigate through the individual thermocouple parameters.

4.1.2.2.7.1 Thermocouple Type (INPUT-CH/CH-THERM/TYPE)

Selects the thermocouple type, between **K-Type** or **E-Type.** Default is **K-Type**.

Note: All four channels must use the same thermocouple type.

⚠CAUTION

SELECTING THE WRONG THERMOCOUPLE TYPE WILL RESULT IN INCORRECT TEMPERATURE READINGS, POSSIBLY ALLOWING THE TRANSFORMER TO OVERHEAT.

1. Press **Prog** and enter your password. A sub-menu will display.
2. Scroll to **INPUT-CH** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays
4. Scroll to **CH-THERM** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **TYPE** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu display.
8. Scroll to **K-TYPE** or **E-TYPE** using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **TYPE** displays.
10. Press **Back** once or twice to return to the sub-menus, or three times to exit the program.

4.1.2.2.7.2 Reverse Detection (INPUT-CH/CH-THERM/RVRS-DET)

Enables/Disables the reverse thermocouple detection alarm. When enabled, this alarm activates when transformer thermocouple Channel 1, 2, or 3 is more than 30° C (54° F) below the ambient thermocouple (channel 4).

Select between **ON** or **OFF**. Default is **ON**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **INPUT-CH** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **CH-THERM** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **RVRS-DET** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Scroll to **ON** or **OFF** using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **RVRS-DE**T displays.
10. Press **Back** once or twice to return to the sub-menus, or three times to exit the program.

4.1.2.2.8 Fan Control Parameters (FAN)

This is the top level menu for setting the various fan control parameters. Pressing **Select** at this menu item provides a set of sub-menus to navigate through the individual parameters.

4.1.2.2.8.1 Fan 1 Setpoint (FAN/F-SETPNT/FAN1)

This is the first sub-level menu for setting the fan turn-on temperature setpoints. Pressing **Select** at this sub-menu item provides another sub-menu to select which fan setpoint to change.

Selects the setpoint where Fan 1 turns **ON** or is disabled, from 0-250°C , or turns **OFF**. Default is **180 DEGREES C**.

OFF is reached by continuing below 0 or above 250° C, and ensures the fan relay never turns On, regardless of measured temperature.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **F--SETPNT** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **FAN 1 STP** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Enter the temperature desired using the ▲ and ▼ ▼ arrows.
9. Press **Select** to enter your choice. **FAN 1 STP** displays.
10. Press **Back** once or twice to return to the sub-menus, or three times to exit the Program.

4.1.2.2.8.2 Fan 2 Setpoint (FAN/F-SETPNT/FAN2)

Selects the setpoint where Fan 2 turns **ON** or is disabled, from 0-250 °C , or turns **OFF**. Default is **190 DEGREES C**.

OFF is reached by continuing below 0 or above 250° C and ensures the fan relay never turns On, regardless of measured temperature.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** Using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **F--SETPNT** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **FAN 2 STP** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Enter the temperature desired using the ▲ and ▼ ▼ arrows.
9. Press **Select** to enter your choice. **FAN 2 STP** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

Note: The Fan 2 setpoint is, by default, 10 degrees higher than the setpoint for Fan 1 to control a second fan (or set of fans) that turn on if the first fan(s) are not able to cool the transformer. In installations where it is desirable for all fans to turn on at the same time for maximum cooling, this setpoint should be changed to match the fan1 setpoint.

4.1.2.2.8.3 Fan Dead Band (FAN/F-BAND)

Sets hysteresis for turning the fans **OFF.** The dead band setting applies to both fans. Range is from **5-50° C** to **OFF**. Default is **10° C**.

1. Press **Prog** and enter your password. A sub-menu will display.
2. Scroll to **FAN** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **F--DBAND** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Enter the temperature desired using the ▲ and ▼ ▼ arrows.
7. Press **Select** to enter your choice. **F-- DBAND** displays.

8. Press **Back** once to to return to the sub-menu, or twice to exit the program.

4.1.2.2.9 Fan Activation (FAN/F-ACT)

This is the first sub-level menu for setting the fan activation. Pressing **Select** at this sub-menu item provides another sub-menu to select which fan activation to change.

4.1.2.2.9.1 Number to Activate Fan 1 (FAN/F-ACT)

Selects number of temperature channels that must be above setpoint before Fan 1 turns On. Selections are **ANY1, ANY2,** or **ALL**. The default is **ANY1**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--ACT** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **FAN 1 ACT** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Select **ANY1**, **ANY2**, or **ALL** using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **FAN 1 ACT** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.9.2 Number to Activate Fan 2 (FAN/F-ACT)

Selects number of temperature channels that must be above setpoint before Fan 1 turns On. Selections are **ANY1, ANY2,** or **ALL**. The default is **ANY1**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** Using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--ACT** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **FAN 2 ACT** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Select ANY1, ANY2, or ALL using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **FAN 2 ACT** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.10 Fan Wear Limit Settings (FAN/FAN-WEAR) (TC-100 Only)

This is the first sub-level menu for the fan wear limit setting. Pressing **Select** at this sub-menu item provides another sub-menu to select which fan wear setting to change.

4.1.2.2.10.1 Fan 1 Wear Limit Setting (FAN/FAN-WEAR/FAN1 WS) (TC-100 Only)

Selects the number of hours Fan 1 runs before the fan wear limit alarm activates, from **1-65000** hours. The default is **8760** hours. Due to the large range of possible values, the fan wear limit entry differs from other parameters. The ▲ changes between digits (as indicated by the flashing digit) and the ▼ increments the value of the selected digit, from **1** to **0**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** Using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--WEAR** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **FAN 2 WS** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Enter the setting desired using the ▲ and ▼ arrows. The ▲ moves the number one digit to the left. The ▼ arrow increase the number by one digit, from 1 to 0.
9. Press **Select** to enter your choice. **FAN 2 WS** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.10.2 Fan 2 Wear Limit Setting (FAN/FAN-WEAR/FAN2 WS) (TC-100 Only)

Fan 2 Wear Setting (FAN/FAN-WEAR/FAN2 WS):

Selects the number of hours Fan 2 runs before fan indicator alarm activates, from **1-65000** hours. The default is **8760** hours.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--WEAR** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **FAN 1 WS** using the ▲ and ▼ arrows.

7. Press **Select**. A sub-menu displays.
8. Enter the setting desired using the ▲ and ▼ arrows. The ▲ moves the number one digit to the left. The ▼ arrow increments the number by one digit, from 1 to 0.
9. Press **Select** to enter your choice. **FAN 1 WS** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.11 Fan Mode Control (FAN/FAN-MODE)

Selects fan control mode. **AUTO** mode controls the fans via setpoints only. **AUTO-MAN** mode controls the fans with either the front panel **Fan** button or temperature setpoint, however the **Fan** button cannot be used to turn the fans Off if they are On due to an over-temperature condition. **MANUAL** mode controls the fans via front panel **Fan** button only and is useful during testing or maintenance to keep the fans from turning On due to over-temperature conditions. **AUTO-MAN** is both. The default is **AUTO-MAN**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to FAN using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--MODE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **AUTO--MAN**, **MAN**, or **AUTO** using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **FAN--MODE** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.12 Fan Exercise Setting (FAN/FAN-EXER)

This is the first sub-level menu for the fan exercise settings. Pressing **Select** at this sub-menu item provides another sub-menu to select which fan exercise setting to change.

4.1.2.2.12.1 Fan Exercise Off (FAN/FAN-EXER/OFF)

When selected, turns the fan exercise feature **OFF**, which is the default fan exercise setting. To turn the fan exercise feature **ON** set a value for the Fan Exercise Cycle Time (INTERVAL) as described in Section 4.1.2.2.11.3, Fan Exercise Run Time.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--OFF** using the ▲ and ▼ arrows.
5. Press **Select**. **FAN--XER** displays.
6. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.12.2 Fan Exercise Cycle Time)FAN/INTERVAL)

Selects fan exercise interval (time between fan turn on), from off to **0.01-30** days. On initial entry when the fan exercise feature is **OFF** this value is set to 0.01 days (approximately 15 minutes). Due to the large range of possible values, the fan exercise interval entry differs from other parameters. The ▲ changes between digits (as indicated by the flashing digit) and the ▼ increments the value of the selected digit, from 1 to 0. Pressing **Select** turns the fan exercise feature **ON** with the selected interval.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--EXER** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **INTERVAL** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Enter the setting desired using the ▲ and ▼ arrows. The ▲ moves the number one digit to the left. The ▼ arrow increase the number by one digit, from 1 to 0.
9. Press **Select** to enter your choice. **INTERVAL** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.12.3 Fan Exercise Run Time (FAN/FAN-EXER/RUN-TIME)

Selects fan exercise run time (how long the fan will run to **exercise**), from **1-20** minutes. The default is **1**.

Note: This setting will have no effect until the fan exercise cycle time is set to turn the fan exercise feature On. See Section 4.2.2.11.2, Fan Exercise Cycle Time.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **FAN** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN--EXER** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **RUN--TIME** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Enter the setting desired using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **RUN TIME** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.13 Alarm Parameters (ALARM)

This is the top level menu for setting the various alarm parameters. Pressing **Select** at this menu item provides a set of sub-menus to navigate through the individual parameters.

4.1.2.2.13.1 Alarm Setpoint (ALARM)

Selects the setpoint where the Alarm activates due to an over-temperature condition, or disables the Alarm for over-temperature. Range is from **0-250° C** or **OFF**. The default is **200° C**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **ALARM** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **A--SETPNT** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **INTERVAL** using the ▲ and ▼ arrows.
7. Press **Select**. A sub-menu displays.
8. Enter the setpoint temperature setting desired using the ▲ and ▼ arrows.
9. Press **Select** to enter your choice. **A--SETPNT** displays.
10. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.13.2 Alarm Dead Band (ALARM/A-BAND)

Sets hysteresis for Alarm deactivation on return from an over-temperature condition, from **5-20° C**. The default is **5° C.**

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **ALARM** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **D--BAND** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Enter the dead band temperature setting desired using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **A--D BAND** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.13.3 Alarm Fail Safe (ALARM/A-FSAFE)

Selects the Alarm Relay Fail Safe mode, between **ON** and **OFF**. On means Alarm Relay is powered when no alarms are active. Off means Alarm Relay is not active. The default is **OFF**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **ALARM** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **A--F SAFE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **OFF** or **ON** using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **A--F SAFE** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.13.4 Alarm Latch (ALARM/A-LATCH)

Selects the alarm latch mode, between **ON** or **OFF**. Default is **ON**. On means the Alarm state remains active even after the condition(s) that caused the alarm are cleared. The Alarm state must be manually cleared using the front panel button.

Note: The **ON** condition requires an Alarm Reset after the alarm condition is corrected in order to cancel the alarm.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **ALARM** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **A--LATCH** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **OFF** or **ON** using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **A--LATCH** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.13.5 Alarm Display (ALARM/A-DISP)

Selects the alarm display mode, between **ON** or **OFF**. The default is **ON**. ON allows a brief description of all alarm conditions to be displayed on the front panel LED display.

Note: The red LED beside the Alarm button illuminates when an alarm condition is present/latched, regardless of this configuration.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **ALARM** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **A--DISP** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.

6. Scroll to **OFF** or **ON** using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **A--DISP** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.14 Buzzer Parameters (BUZZER)

This is the top level menu for setting the various buzzer (audible alarm) parameters. Pressing **Select** at this menu item provides a set of sub-menus to navigate through the individual parameters.

4.1.2.2.14.1 Buzzer (BUZZER/B-ON/OFF)

Selects how the buzzer (audible alarm) is activated. Selections are **OFF**, **ON ALARM**, **ON TRIP**, **ON ANY**. The default is **OFF**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **BUZZER** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **B--ON/OFF** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to the selection desired, **OFF**, **ON ALARM**, **ON TRIP**, or **ON ANY**, using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **B--ON/OFF** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.14.2 Buzzer Tone (BUZZER-TONE)

Selects whether the buzzer tone is **INTERMITTENT** or **STEADY**. The default is **INTERMITTENT**, which is more likely to be heard in noisy environments.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **BUZZER** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **B--TONE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to the selection desired, **STEADY** or **INTRMTNT**, using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **B--TONE** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.15 Trip Parameters (TRIP)

This is the top level menu for setting the various trip parameters. Pressing **Select** at this menu item provides a set of sub-menus to navigate through the individual parameters.

4.1.2.2.15.1 Trip Setpoint (TRIP/T-SETPNT)

Selects the setpoint where the Trip activates due to an over-temperature condition, or disables the Trip for over-temperature. The range is **0-250° C**. The default is **210° C**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TRIP** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **T--SETPNT** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Enter the trip setpoint temperature desired, using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **T--SETPNT** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.15.2 Trip Dead Band (TRIP/D-BAND)

Sets hysteresis for Trip Relay deactivation on return from an over-temperature condition. The range is **5-20° C**. The default is **5° C**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TRIP** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **T--DBAND** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Enter the trip dead band value desired, using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. T**--DBAND** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.15.3 Trip Fail Safe (TRIP/T-FSAFE)

Sets the Tip Relay Fail Safe mode to **ON** or **OFF**. Default is **OFF**. **ON** means the Trip Relay is powered when no trip condition is present. **OFF** means the Trip Relay is powered when one or more trip conditions are present.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TRIP** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **T--FSAFE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **OFF** or **ON** using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **T--FSAFE** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.15.4 Trip Latch (TRIP/T-LATCH)

Selects the Trip latch mode, between **ON** or **OFF**. The default is **ON**. On means the trip state remains active even after the condition(s) that caused the trip are cleared. The Trip state must be manually cleared using the front panel Reset button.

Note: An On condition requires a Trip Reset after the trip condition is corrected in order to cancel the trip.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TRIP** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **T--LATCH** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **OFF** or **ON** using the ▲ and ▼ arrows.
7. Press **Select** to enter your choice. **T--LATCH** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.16 Trend Time Setting (TREND) (TC-100 Only)

This is the top level menu for selecting the time interval for logging trend data or disabling the logging of trend data. Pressing **Select** at this menu item provides a set of choices for setting the time interval including **MINUTES**, **HOUR**, **DAY**, or **OFF**. The default is **HOUR**.

Note: Only one time increment can be selected. For example you can select an interval of 30 minutes or 1 hour, but not 1 hour and 30 minutes.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TREND** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to the time period desired, **MINUTES**, **HOUR**, **DAY**, or **OFF**, using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Enter the number desired for the previous selection, **MINUTES**, **HOUR** or **DAY**, using the ▲ and ▼ arrows. No number is required for **OFF**.
7. Press **Select** to enter your choice. **MINUTES**, **HOUR**, **DAY**, or **OFF** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.16.1 Trend Data Logging Off (TREND OFF) (TC-100 Only)

When selected turns the trend data logging feature **OFF**. This may be used to avoid spurious data during periods of testing or maintenance. To turn the trend data logging feature **ON** set a value for the Trend Time Increment in **MINUTES**, **HOURS** or **DAYS** as described next.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TREND** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **OFF** using the ▲ and ▼ arrows.
5. Press **Select**. **TREND** displays.
6. Press **Back** once to exit the program.

4.1.2.2.16.2 Trend Time Minute Increment Setting (TREND/MINUTES) (TC-100 Only)

Selects the time interval for logging trend data in **MINUTES**. The range is **1-60 MINS**. The default is **12 MINS**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TREND** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **MINUTES** using the ▲ and ▼ arrows.
5. Press **Select**. **XMINS** displays.
6. Enter the number of hours desired using the ▲ and ▼ arrows.
7. Press **Select**. **MINUTES** displays.

4.1.2.2.16.3 Trend Time Hour Increment Setting (TREND/HOUR) (TC-100 Only)

Selects the time interval for logging trend data in **HOURS**. The range is **1-24 HOURS**. The default is **12 HOURS**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TREND** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **HOURS** using the ▲ and ▼ arrows.
5. Press **Select**. **X HOUR** displays
6. Enter the number of hours desired using the ▲ and ▼ arrows.
7. Press **Select**. **HOUR** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.16.4 Trend Time Day Increment Setting (TREND/DAY) (TC-100 Only)

Selects the time interval for logging trend data in **DAYS**. The range is **1-30 DAYS**. The default is **12 DAYS**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TREND** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **DAY** using the ▲ and ▼ arrows.
5. Press **Select**. **X DAYS** displays.
6. Enter the number of days desired using the ▲ and ▼ arrows.
7. Press **Select**. **DAY** displays.
8. Press **Back** once to return to the sub-menu or twice to exit the program.

4.1.2.2.17 Discrete Input 1 Selection (D-Input1) (TC-100 Only)

This is the top level menu for configuring the use of discrete input 1. The options are **NOT USED**, **FAN FAIL**, and **USER DEF** (user defined). The default is **NOT USED**. When **FAN FAIL** or **USER DEF** is selected further sub-menus are provided to complete the configuration as shown in the following sections.

4.1.2.2.17.1 Discrete Input 1 Selection (D-INPUT1/NOT USED) (TC-100 Only)

When selected, this turns off all responses to discrete input 1. This is the default operating condition. To utilize discrete input 1, configure it as **FAN FAIL** or **USER DEF** as defined in the following sections.

4.1.2.2.17.2 Discrete Input 1 Fan Fail Selection (D-IPUT1/FAN FAIL) (TC-100 Only)

Configures discrete input 1 for use as a fan fail detector. This may be used with an airflow sensor or micro switch connected to ventilation louvers to indicate when the fan is operating properly.

When selected, two options are given for the input state that indicates a fan failure. The options are **OPEN** or **CLOSED** to allow connection to either NC or NO contacts. The default is **OPEN**.

After the input state is selected two more options are given for the effect to occur when a fan failure is detected. The options are **ALM ONLY** (alarm only) or **ALM+FAN2** (alarm and turn on Fan 2). The default is **ALM ONLY**.

Selecting either option will activate an alarm condition when a fan failure is detected, activating the alarm relay and front panel LED, and if enabled, displaying **A. AIR-ND** (airflow not detected). The second option can be used to configure Fan 2 as a backup to come on if FAN 1 fails.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **D--INPUT 1** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN FAIL** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **OPEN** or **CLOSED** using the ▲ and ▼ arrows.
7. Press **Select** to enter your selection. A sub-menu displays.
8. Scroll to **ALM ONLY** or **ALM + FAN 2** using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **OPEN** or **CLOSED** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.17.3 Discrete Input 1 User Defined (D-IPUT1/USER DEF) (TC-100 Only)

Configures discrete input 1 as a user defined function. This may be used with a wider array of external sensors or switches to generate an alarm or trip condition, control the fans, or even control other equipment using the Fan2 relay.

When selected, two options are given to define the relationship between the input state and output state. The options are **DIRECT**, which means a closure on the input results in a closure on the output, or **INVERT** which means an open on the input causes a closure on the output. This allows the use of NO or NC contacts on the input. The default is **DIRECT**.

After the input state is selected five options are given for the effect to occur when the input state occurs. The options are **ALARM**, **TRIP**, **FAN2**, **FANS ON**, and **FANS OFF**. The default is **ALARM**. The **FANS ON** and **FANS OFF** control both fans and override temperature setpoints, thus they can be used to always force fans On or Off.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **D-INPUT 1** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **USER DEF** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **DIRECT** or **INVERT** using the ▲ and ▼ arrows.
7. Press **Select** to enter your selection. A sub-menu displays.
8. Scroll to **ALARM**, **FANS OFF**, **FANS ON**, **FAN 2**, or **TRIP** using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **DIRECT** or **INVERT** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.17.4 Discrete Input 2 Fan Fail Selection (D-IPUT1/FAN FAIL) (TC-100 Only)

Configures discrete input 2 as a user defined function. This may be used with a wider array of external sensors or switches to generate an alarm or trip condition, control the fans, or even control other equipment using the Fan2 relay.

When selected, two options are given to define the relationship between the input state and output state. The options are **DIRECT**, which means a closure on the input results in a closure on the output, or **INVERT** which means an open on the input causes a closure on the output. This allows the use of normally open or normally closed contacts on the input. The default is **DIRECT**.

After the input state is selected five options are given for the effect to occur when the input state occurs. The options are **ALARM ONLY**, or **ALM+FAN1**. The default is **ALARM ONLY**. The **FANS ON** and **FANS OFF** control both fans and override temperature setpoints, thus they can be used to always force fans On or Off.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **D--INPUT 2** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **FAN FAIL** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **OPEN** or **CLOSED** using the ▲ and ▼ arrows.
7. Press **Select** to enter your selection. A sub-menu displays
8. Scroll to **ALARM ONLY** or **ALM+FAN 1** using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **OPEN** or **CLOSED** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.17.5 Discrete Input 2 User Defined (D-IPUT2/USER DEF) (TC-100 Only)

Configures discrete input 2 as a user defined function. This may be used with a wider array of external sensors or switches to generate an alarm or trip condition, control the fans, or even control other equipment using the Fan2 relay.

When selected, two options are given to define the relationship between the input state and output state. The options are **DIRECT**, which means a closure on the input results in a closure on the output, or **INVERT** which means an open on the input causes a closure on the output. This allows the use of NO or NC contacts on the input. The default is **DIRECT**.

After the input state is selected five options are given for the effect to occur when the input state occurs. The options are **ALARM**, **TRIP**, **FAN2**, **FANS ON**, and **FANS OFF**. The default is **ALARM**. The **FANS ON** and **FANS OFF** control both fans and override temperature setpoints, thus they can be used to always force fans On or Off.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **D-INPUT 2** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **USER DEF** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **DIRECT** or **INVERT** using the ▲ and ▼ arrows.
7. Press **Select** to enter your selection. A sub-menu displays.
8. Scroll to **ALARM**, **FANS OFF**, **FANS ON**, **FAN 2**, or **TRIP** using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **DIRECT** or **INVERT** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.18 Set Time and Date (TIME.DATE)

This is the top level menu for setting the current time and date, which is used for time-stamping entries in the trend data and history logs. Pressing **Select** at this menu item provides two options, **DATE** and **TIME**.

4.1.2.2.18.1 Date (TIME.DATE/DATE)

This is the second level menu for setting the time and date, specifically for setting the date. Pressing **Select** at this menu item provides three options, **DAY**, **MONTH**, and **YEAR**.

4.1.2.2.18.2 Day (TIME.DATE/DATE/DAY)

Selects the **DAY** of the month for alarm and trip history and trend logging. The range is **1-31**. Default is **1**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TIME.DATE** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **DATE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **DAY** using the ▲ and ▼ arrows.
7. Press **Select**. **XX D** displays for the day currently selected.
8. Enter the day of the month desired using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **DAY** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.18.3 Month (TIME.DATE/DATE/MONTH)

Selects the month of the year for alarm and trip history and trend logging. The range is **1-12**. Default is **1**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TIME.DATE** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **DATE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **MONTH** using the ▲ and ▼ arrows.
7. Press **Select**. **XX M** displays for the day currently selected.
8. Enter the month of the year desired using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **MONTH** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.18.4 Year (TIME.DATE/DATE/YEAR)

Selects the year for alarm and trip history and trend logging. The range is from **2000-3000**, Default is **2010**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TIME.DATE** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **DATE** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **YEAR** using the ▲ and ▼ arrows.
7. Press **Select**. **XXXX Y** displays for the year currently selected.
8. Enter the year desired using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **YEAR** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.18.5 Time (TIME.DATE/TIME)

This is the second level menu for setting the time and date, specifically for setting the time. Pressing **Select** at this menu item provides two options, **HOUR** and **MINUTES**.

4.1.2.2.18.1 Minutes (TIME.DATE/TIME/MINUTES)

Selects the minute of the hour for alarm and trip history and trend logging. The range is **1-60**. Default is **1**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TIME.DATE** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **TIME** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **MINUTES** using the ▲ and ▼ arrows.
7. Press **Select**. **XX MN** displays for the minutes currently selected.
8. Enter the minutes of the hour desired using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **MINUTES** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.18.2 Hours (TIME.DATE/TIME/HOUR)

Selects the current hour for alarm and trip history and trend logging. The range is **1-24**. Default is **1**.

1. Press **Prog** and enter your password. A sub-menu displays.
2. Scroll to **TIME.DATE** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.
4. Scroll to **TIME** using the ▲ and ▼ arrows.
5. Press **Select**. A sub-menu displays.
6. Scroll to **HOUR** using the ▲ and ▼ arrows.
7. Press **Select**. **XX HR** displays for the hour currently selected.
8. Enter the hour of the day desired using the ▲ and ▼ arrows.
9. Press **Select** to enter your selection. **HOUR** displays.
10. Press **Back** once or twice to return to the sub-menus or three times to exit the program.

4.1.2.2.19 Change Password (CHW-PWD)

Allows entry of a new password. The range is **0000-ZZZZ**. Default is **0000**.

Three pushbuttons are password protected: **Reset**, **Prog**, and **Test**. A valid four character, alpha-numeric password must be entered for these pushbuttons to function. See Section 4.1.1.3.1, Password Protection.

If the password has been previously changed the display shows **OLD PWD**, prompting for entry of the old password. Press **Select** to enter the old password. If the password has not been changed from the default, or after the old password has been entered correctly the display shows **NEW PWD**, prompting for entry of the new password. Press **Select** to enter the new password in the same manner as normal password entry.

Changing the password is optional.

If the default password **has not** been changed, simply press **Select** to enter the Reset, Program, and Test programs.

If the default password **has** been changed, the new password must be entered to access the program.

Enter the password as follows:

1. Press the ▼ arrow to change the individual password character; (**0** through **9** and **A** through **Z**). Press the ▲ arrow to move to the next character in the display.
2. Press **Select** to enter the password.
3. If the password is correct, the LED display shows the first item in the Reset**,** Program, or Test sub- menu depending on the function being accessed.

4.1.2.3 Test Functions

Press **Test** to enter the Test mode. This button is password protected. See Section 4.1.1.3.1, Password Protection.

The Test functions include testing the relays, the internal temperature, the LED display, the Test buttons, and the LEDs.

Note: The TC-100 should be in the normal operating mode with no active alarm or trip condition and both fans Off prior to entering the test mode. If alarm or trip conditions are present or occur while executing test functions they will take priority over the test function.

Testing these functions involves the ▲ and ▼ arrows, and the **Select** and **Back** buttons on the front panel. The associated process messages are displayed on the LED display screen.

Select the function to be tested by scrolling to the function desired using the ▲ and ▼ arrows, and then pressing **Select**.

Depending on the function to be tested the test will be initiated or more options will be displayed. When the test is complete the LED display will show **TEST OVER**.

4.1.2.3.1 Test Relays

This tests the **FAN 1**, **FAN 2**, **ALARM** and **TRIP** relays by simulating an over-temperature condition.

1. Press **Test** and enter password. The Test sub-menu displays.
2. Scroll to **T-RELAY** using the ▲ and ▼ arrows.
3. Press **Select**. A sub-menu displays.

Note: All four of these relays may be tested individually, as described below. The procedure is the same for all relays.

4. Scroll to the relay you want to test. The options are **FAN 1**, **FAN 2**, and **TRIP**. The **ALARM** relay is blocked.
5. Press **Select**. The simulated temperature for that relay, about 10° C below the setpoint, displays.
6. Press the ▼ arrow, repeatedly, to raise the simulated temperature. When the simulated temperature reaches the setpoint, the relay should switch to the active state. Note that this state depends on the status of the Fail Safe configuration for the Alarm and Trip relays.
7. Press the ▲ arrow to lower the simulated temperature below the setpoint. The relay should return to the non-active state.
8. Press **Back** once to select another relay to test, from the **T-RELAY** sub-menu.
9. Repeat Steps 4, through 8 until all relay testing desired is completed.
10. Press **Back** twice or press **Test** to exit the program.

4.1.2.3.2 Internal Temperature

This test displays the temperature inside the TC-100 controller unit.

1. Press **Test** and enter password. The Test sub-menu displays.
2. Scroll to **T--INT** using the ▲ and ▼ arrows.
3. Press **Select**. The internal temperature of the controller displays.
4. Press **Back** once to select another item from the Test sub-menu.
5. Press **Back** again, or press **Test** to exit the program.

4.1.2.3.3 Test Display

This test lights up all segments of the 8-character LED display.

1. Press **Test** and enter password. The Test sub-menu will be displayed.
2. Scroll to **T-DISP** using the ▲ and ▼ arrows.
3. Press **Select**. Each of the 8 characters of the LED illuminate, sequentially. When completed, **TEST OVER** displays
4. Press **Back** once to select another item from the Test sub-menu.
5. Press **Back** again, or press **Test** to exit the program.

4.1.2.3.4 Test Buttons

This test verifies that all front panel interface buttons operate properly.

1. Press **Test** and enter password. The Test sub-menu displays.
2. Scroll to **T-BUTTON** using the ▲ and ▼ arrows and the **Back** button.
3. Press **Select**. The message **PRESS KEY** displays
4. Press the pushbutton you want to check. The name of that button (key) will be displayed on the LED display if it is functioning properly.
5. Press **Test** once to return to the Test sub-menu, or twice to exit the program.

4.1.2.3.5 Test LEDs

This test lights up all LEDs.

1. Press **Test** and enter password The Test sub-menu displays
2. Scroll to **T-LED** using the ▲ and ▼ arrows.
3. Press **Select**. All nine LEDs will illuminate. The message **TEST OVER** will be displayed if the LEDs are functioning properly.
4. Press **Back** once to return to the Test menu and select another test function.
5. Press **Back** again or press **Test** to exit the program.

4.2 Local Operation

Operating the TC device locally requires that a laptop computer (with the TC Series software) be connected to the TC device via a USB cable. The cable plugs into the USB port, accessible when the securing wire is removed from the hinged cover and the USB port is exposed.

This allows the operator to program and control the TC device from the laptop instead of using buttons on the front panel. The programming functions are (essentially) the same. The biggest difference is that a series of menus are displayed on the laptop instead of alpha-numeric data being displayed on the LED screen of the TC device.

Some functions, such as testing the TC device, can be performed only during manual operation, using the pushbuttons on the front panel. These procedures are described in Section 4.1, Manual Operation. This section should be read and understood by all operators.

Operating in the Local mode involves a series of menus, used to select a variety of functions and options. Successfully navigating this system requires an understanding of how the system is organized and how commands are entered.

To open the TC Series software program, click the TC Series icon on the desktop, or click **All Programs** then select the TC Series Transformer Wellness program from list, and double click to open it.

4.2.1 Main Menu

When you open the TC Series software, the main menu appears, as shown in Figure 13, below.

The upper portion of the menu is called the Function Bar. It displays the six different functions available to the operator.

The lower portion of the menu is called the Options Bar. It displays the options available for each function.

When you click an icon in the Function Bar (Configuration, Device, Reports, or Calibration) that icon is highlighted and the Options Bar for that function becomes active. The option bar is different for each function. (The Options Bar for the Configuration Function is shown in Figure 13).

Click Help to display a navigational aid.

Click Exit to exit the program.

When you click an icon on the Options bar, other menus or a dialog boxes appears. These allow you to enter new configuration data, open and save existing configuration files, write files to the TC device, graph report and log data, review fan wear data, or delete trend, alarm, or trip log data history.

Each of these Functions and Options are described fully on the following pages.

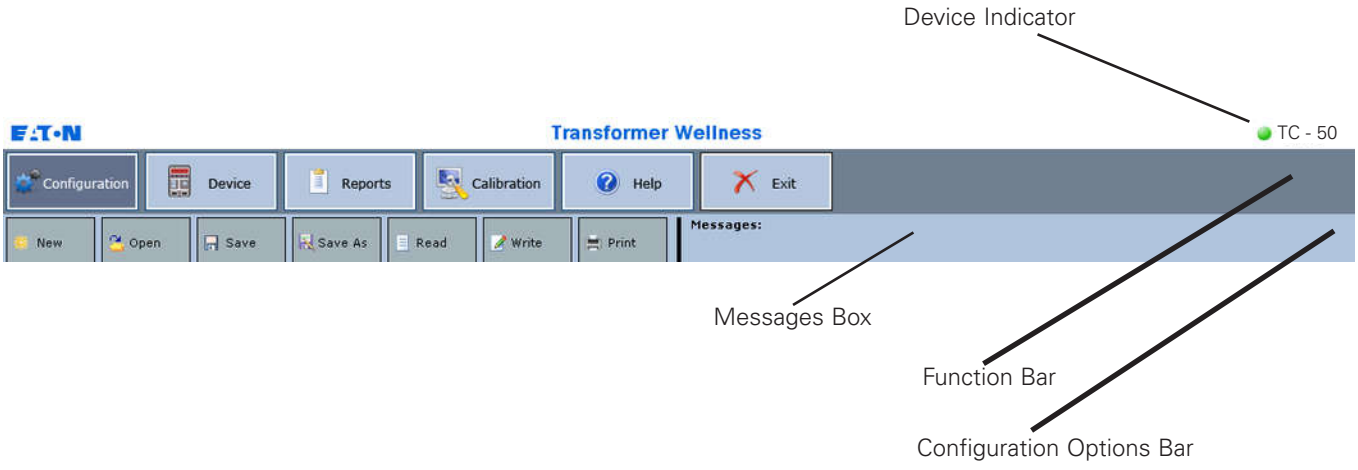


Figure 13, Main Menu

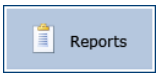
4.2.2 Navigating The Function Bar

The Function Bar is shown in Figure 13, across the top of the main menu.

There are six different functions available, as described below.

- 

- Allows you to configure the TC device.
- 

-Allows you to collect trend/log data, upgrade firmware,, upgrade the device type (depending upon the model), or change the pass word.
- 

- Allows you to display trend data and graphs, trip and alarm logs, fan wear indications, and delete log history (TC-100 only).
- 

- User calibration is not provided at this time. Factory Use only
- 

- Allows display of navigation graphic.
- 

- Exits the TC Series program.

Click the icon for the function desired. This will display the options bar for that function.

The Options Bar display is different for each function, as described in Section 4.2.3, Navigating the Options Bars.

4.2.2.1 Model Indicator

The upper right-hand corner of the screen, shown in Figure 13, shows what model is plugged in (TC-50, TC-50 Modbus, or TC-100) or offline if no TC device is connected.

4.2.2.2 Messages Box

The Messages box is shown in figure 13 on the right side of the Options Bar, and under the Function bar. Messages pertaining to communications with a connected TC device, as well as operation of various software features, will be displayed in this box.

4.2.3 Navigating the Options Bars

The Options Bar appears under the Function bar. A typical Options Bar (this one for configuration) is shown in Figure 13.

While the Options Bar is different for each function, there are only a few types of displays used. These include drop down menus, option sub-menus, pull down lists, and dialog boxes. An example of each menu and each dialog box is shown below as well as hints on how to navigate them.

Understanding how to navigate these menus and dialog boxes will make it easy to perform the functions desired.

4.2.4 Configuration

The **Configuration** function allows you to set/change the TC device parameters.

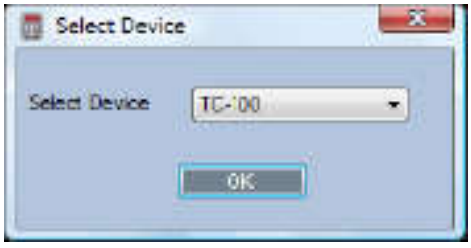
Select **Configuration** on the function bar to display the configuration options bar, shown in Figure 13, across the bottom of the main menu.

The options available are:

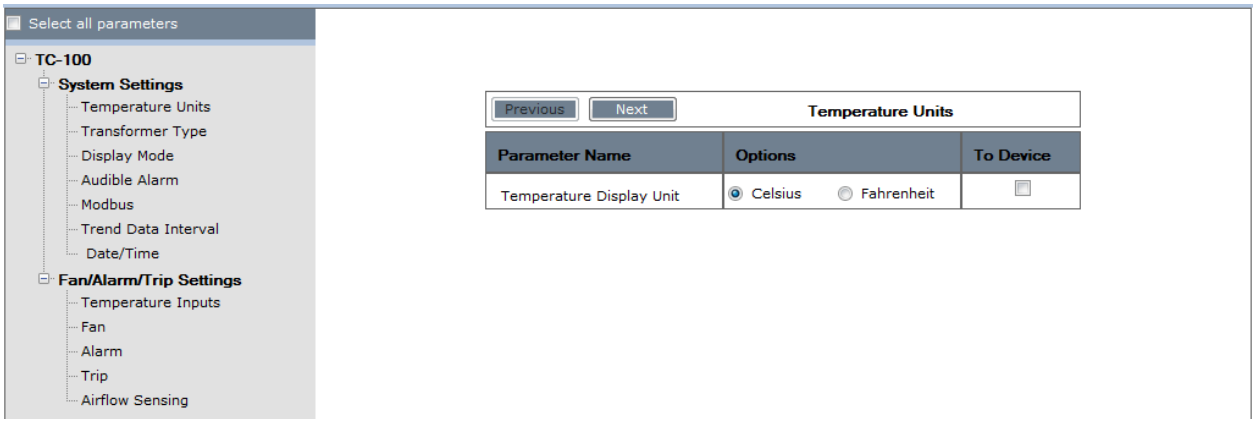
- **New** - Creates a new configuration starting from a default setup.
- **Open** - Opens an existing configuration file from PC memory.
- **Save** - Saves the current configuration file to PC memory.
- **Save As** - Saves the current configuration file to a PC file whose name and location is specified by the user.
- **Read** - Reads the configuration parameters from a connected TC device.
- **Write** - Writes the selected configuration parameters to the TC device.
- **Print** - Prints the configuration parameters.

4.2.4.1 Creating New Configuration Files

Select **Configuration** then **New** to create a new configuration starting from a default set of parameters. The Select Device pop up menu appears, as shown below.



Select the TC device desired (TC-50, TC-50 Modbus, or TC-100) then click OK. The Select All Parameters menu appears. The menu shown is for the TC-100, but is the same for the TC-50 Modbus and TC-50 except that Trend Data Interval and Airflow Sensing parameters will not appear.



This menu organizes the configuration parameters that can be set locally into two main groups and 12 more specific categories. The first category, Temperature Units, is highlighted and appears first by default. The corresponding configuration parameter(s) appears to the right.

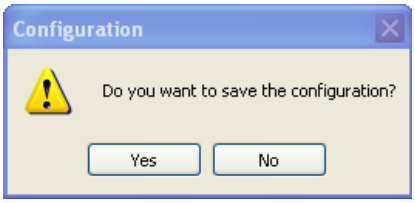
The configuration parameters will change for each category selected. However, navigating the configuration parameters involves the same procedures. For example, to set the Temperature Display Unit do the following:

1. Click/Select the temperature unit to display a sub-menu. (In this **Temperature Units** example, there are only two choices; **Celsius** and **Fahrenheit**).
2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.

Note: To write all parameters to the TC device at one time, click the **Select All Parameters** check box above the drop down menu, then click the **Write** icon. (Parameters not changed will be written as well).

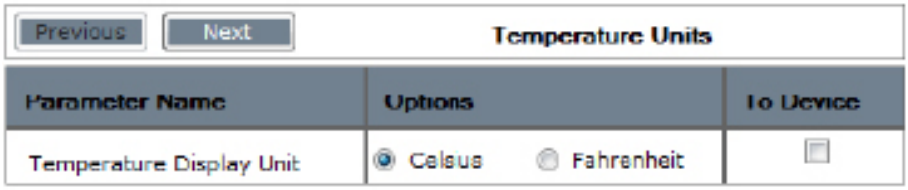
3. Click **Next** or **Previous** to select the next or previous parameter category. Each click moves one item on the category menu on the left. As an alternative, use the mouse to select the desired configuration category on left, side menu.
4. Click **Save** to save the new configuration file after all new parameters have been entered and written to the TC device. See Section 4.2.3.1.3, Save, for details.

Note: If you select another function in the function bar, before saving the new configuration file, the file data will not be saved automatically. The following dialog box will ask if you want to save the configuration.



4.2.4.1.1 Temperature Units

Select **Temperature Units**. The Temperature Units configuration parameters will appear.



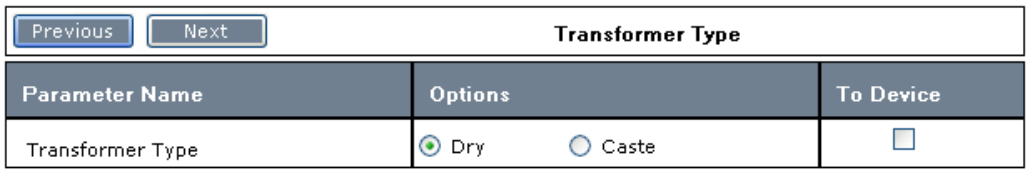
1. Select the temperature display unit desired. The options are **Celsius** and Fahrenheit. The default is **Celsius**.

Note: This setting affects the normal temperature measurement display as well as the configuration parameters on both the front panel and the PC software.

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.2 Transformer Type

Select **Transformer Type**. The Transformer Type configuration parameters will appear.



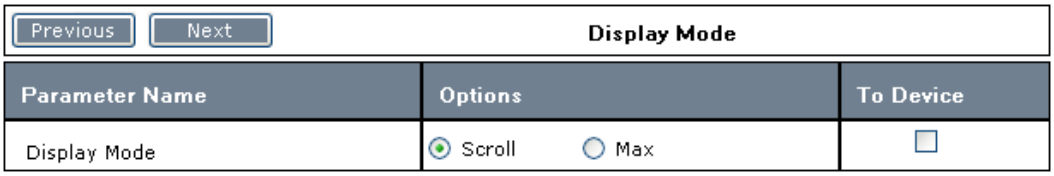
1. Select the transformer type desired. The options are **Dry** or **Caste**. The default is **Dry**.

Note: This option is for reference only. It does not change any fan, alarm, or trip setpoint, or in any way alter operation of the TC device

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.3 Display Mode

Display Mode. The Display Mode configuration parameters will appear.



1. Select the display mode desired. The options are **Scroll** or **Max**. The default is **Scroll**.

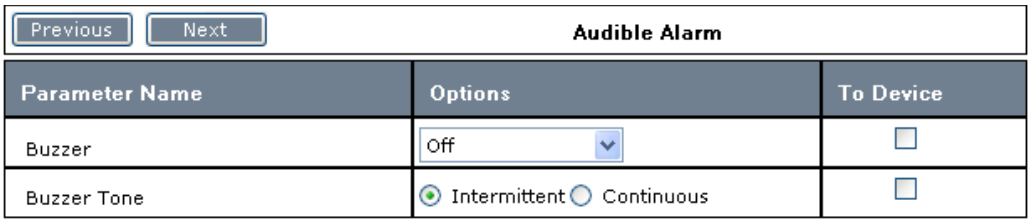
   Scroll displays individual thermocouple temperatures sequentially, every three seconds.

   Max displays only the highest (maximum) thermocouple temperature

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.4 Audible Alarm

Select **Audible Alarm**. The Audible Alarm configuration parameters will appear.



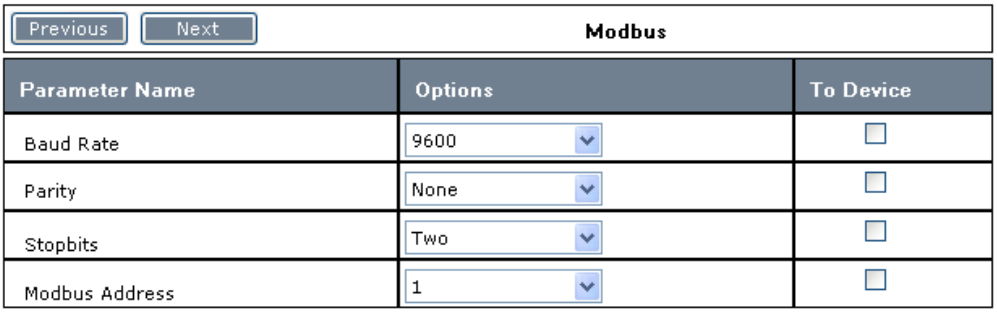
1. Select the audible alarm options desired. The options relate to the audible alarm activation and tone.

   Buzzer defines when the audible alarm comes On. The options are: **Off**, **Trigger on Alarm**, **Trigger on Trip**, or **Any**. The default is **Any**.

   Buzzer Tone sets the audible alarm tone. The options are **Intermittent** or **Continuous**. The default is **Intermittent**.
2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TTC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.5 Modbus (TC-50 Modbus and TC-100 Only)

Select **Modbus**. The Modbus configuration parameters will appear.



1. Select the Modbus parameters desired, as follows:

   Baud Rate sets the baud rate desired. The options are **9600**, **19200**, or **38400**. The default is **9600**.

   Parity sets the parity desired. The options are **Odd**, **Even** and **None**. The default is **None**.

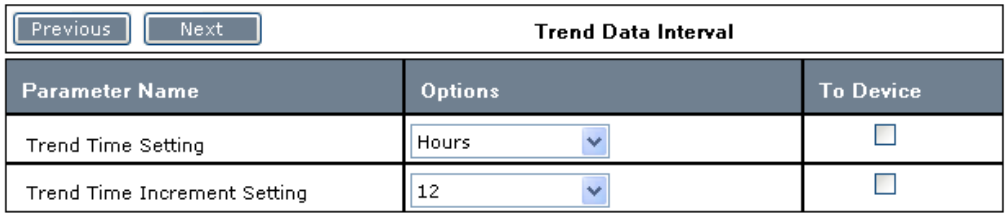
   Stopbits sets the stopbit desired. The options are **One** or **Two**. The default is **Two**.

   Modbus Address sets the Modbus address desired, from **1- 247**. The default is **1**.

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.6 Trend Data Interval (TC-100 Only)

Select **Trend Data Interval**. The Trend Data Interval configuration parameters will appear.



1. Select the Trend time interval for logging trend data or disabling the logging of data, as follows.

   Trend Time Setting sets the time period desired. The options are **Off**, **Minutes**, **Hours**, or **Days**. The default is **Hours**.

   Trend Time Increment Settings sets the tie interval desired for logging trend data. The options range and default change based on the previous Trend Time Setting.

   For **Minutes**, the range is **1-60** and the default is **30**.

   For **Hours** the range is **1-24** and the default is **12**.

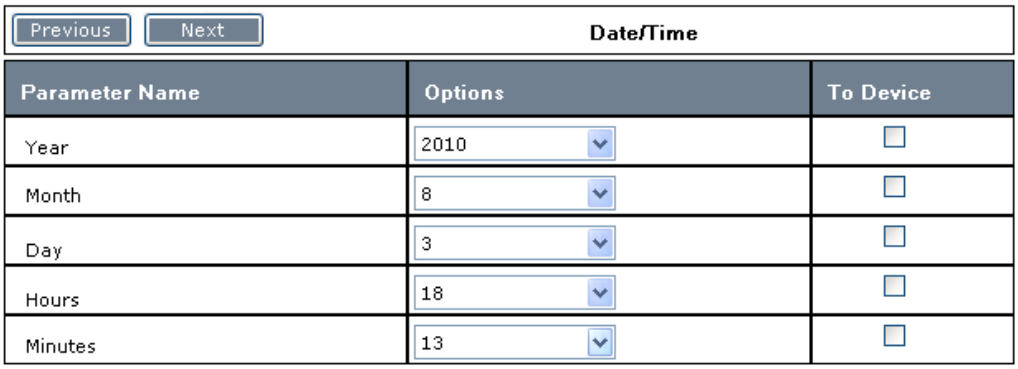
   For **Days** the range is **1-30** and the default is **1**.

   If the Trend Time Setting is **Off**, no trend data will be recorded and there will be no option for Trend Time Increment Settings. are **1-60**. The default is **12** (Hours).

2. Click the **To Device** check box to save this setting to the TC-100 when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC-100, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.7 Date/Time

Select **Date/Time**. The Date/Time configuration parameters will appear.



1. Select the date and time for the system clock, as follows.

   Year sets the year desired, from **2000-3000**.

   Month sets the month desired, from **1-12**.

   Day sets the day of the month, from **1-31**.

   Hours sets the the hour desired, from **0-23**.

   Minutes sets the the minutes desired, from **0-59**.

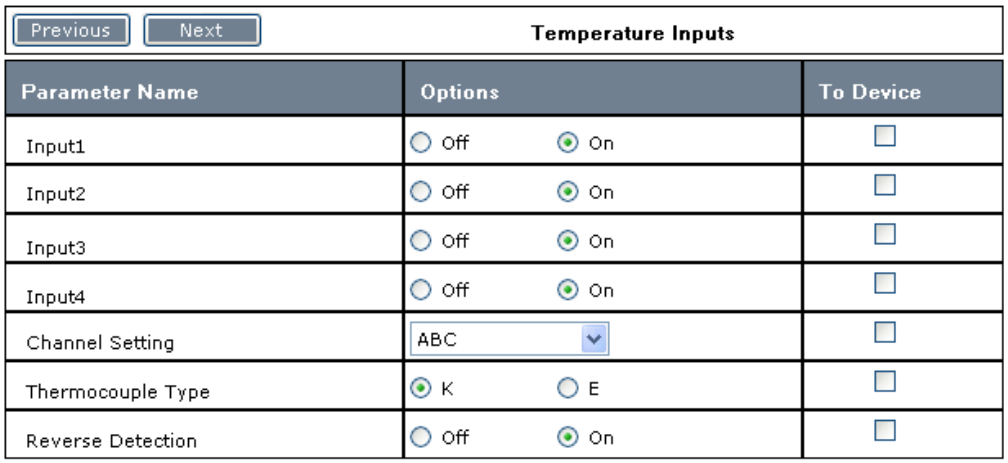
Note: The **Date and Time** displayed when entering this screen depends on the options menu used to get here. If **New** is selected, this is the date and time taken from the laptop clock when the New button was clicked. When **Open** is selected this is the date and time that was selected when the configuration file was saved. When **Read** is selected this is the date and time read from the TC device when the Read button was clicked.

Note: The **Set Current Date/Time** option is available when an existing configuration is **Open** from a laptop file or when the configuration is **Read** from a connected device. Selecting this option populates the date and time parameters from the laptop clock. If the **Write** option is used after selection of this option, the current date/time is re-read from the laptop clock and sent to the TC device to ensure synchronization with the laptop clock. Although this option is not present when a **New** configuration is selected, it is the default configuration for date/time.

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.8 Temperature Units

Select **Temperature Inputs**. The Temperature Inputs configuration parameters will be displayed.



1. Select the input data for the thermocouples, as follows:

   Input1 turns thermocouple one **On** or **Off**. The default is **On**.

   Input2 turns thermocouple two **On** or **Off**. The default is **On**.

   Input3 turns thermocouple three **On** or **Off**. The default is **On**.

   Input4 turns thermocouple four **On** or **Off**. The default is **On**.

   Channel Setting selects the channel identifier for display. The options are **ABC**,

   Thermocouple Type selects the thermocouple type being used. The options are **K** and **E**. The default is **K**.

   Reverse Detection enables or disables the reverse thermocouple detection alarm. The options are **On** or **Off**. This alarm activates when a transformer thermocouple temperature (Inputs 1, 2, or 3) is more than 30° C (54° F. below the internal controller temperature.

Note: In some installations this alarm may activate falsely, such as in cold environments where the controller may be heated due to exposure to sunlight while the transformer is Off. In this case the alarm should be disabled. Note that even when disabled the alarm will activate if a measured transformer winding temperature is more than 70° C (126° F) below the internal controller temperature.

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.9 Fan

Select **Fan**. The Fan configuration parameters will appear.

Previous Next **Fan**

Parameter Name	Options	To Device
Fan 1 Setpoint	180 C	☐
Fan 2 Setpoint	190 C	☐
Fan Dead Band	10 C	☐
Number to activate Fan 1	Any 1	☐
Number to activate Fan 2	Any 1	☐
Fan 1 Wear Setting	8760	☐
Fan 2 Wear Setting	8760	☐
Fan Mode Control	Auto - Manual	☐
FAN Exercise Cycle Time	Off Days	☐
FAN Exercise Run Time	1 Min	☐

1. Select the fan setting desired, as follows:

   Fan1 Setpoint determines at what temperature Fan 1 will turn **On**. The range is from **0-250° C (0-482° F)**, of **Off**. The default is **180° C (356° F)**.

   Fan2 Setpoint determines at what temperature Fan 2 will turn **On**. The range is from **0-250° C (0-482° F)**, or **Off**. The default is **190° C (374° F)**.

   Fan Dead Band sets the hysteresis (amount the temperature must drop below the setpoint) for turning the fans **Off**. The Dead Band setting affects both fans. The range is from **5-50 °C (9-90° F)**. The default is **10 °C (18° F)**.

   Number to Activate Fan 1 selects the number of temperature inputs that must be above the setpoint before Fan 1 turns **On**. The options are **Any 1**, **Any 2**, or **All**, The default is **Any 1**.

   Number to Activate Fan 2 selects the number of temperature inputs that must be above the setpoint before Fan 2 turns **On**. The options are **Any 1**, **Any 2**, or **All**, The default is **Any 1**.

   FAN 1 Wear Setting (TC-100 only) selects the number of hours Fan 1 must run before the Fan Wear alarm activates. The range is **1-65,000** hours. The default is **8,760** hours.

   FAN 2 Wear Setting (TC-100 only) selects the number of hours Fan 2 must run before the Fan Wear alarm activates. The range is **1-65,000** hours. The default is **8,760** hours.

   Fan Mode Control selects the fan control mode. **Auto** is via the setpoints only. **Man** is via the front panel FAN button only. **Auto-Man** is both. The default is **Auto-Man**.

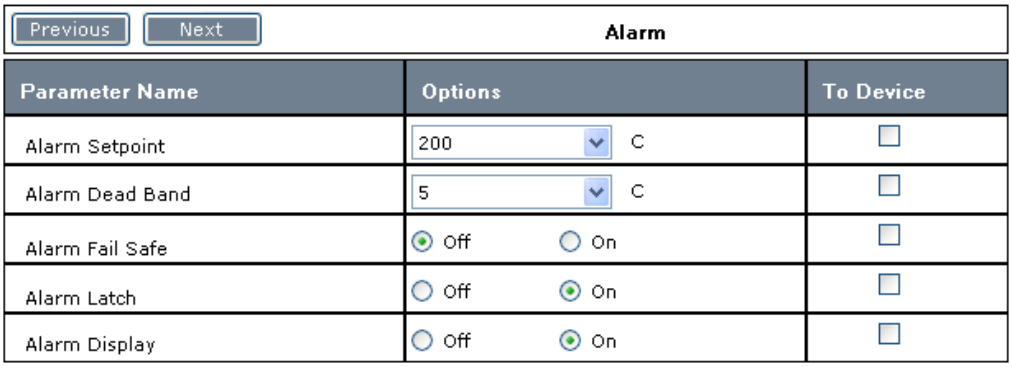
   Fan Exercise Cycle Time selects the fan exercise interval (time between exercise periods). The options are **0.01-30** days, or **Off**. The default is **Off**.

Fan Exercise Run Time selects the fan exercise run time (how long the fans will run to exercise). The range is **1-120** minutes. The default is **one** minute.

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.10 Alarm

Select **Alarm**. The Alarm configuration parameters will appear.



1. Select the alarm setting desired, as follows:

   Alarm Setpoint determines at what temperature the Alarm activates due to an over-temperature condition, or disables the Alarm for over-temperature. The range is from **0-250° C (482° F)**, or **Off**. The default is **200° C (392° F)**.

   Alarm Dead Band sets the hysteresis (amount the temperature must drop below the setpoint) for the alarm deactivation on return from an over-temperature condition. The range is from **5-20° C (9-36° F)**. The default is **5° C (9° F)**.

   Alarm Fail Safe sets the Alarm Relay Fail Safe mode. The options are **On** or **Off**. **On** means the Alarm Relay is powered when no alarms are active. **Off** means the Alarm Relay is powered when one or more alarms are active. The default is **On**.

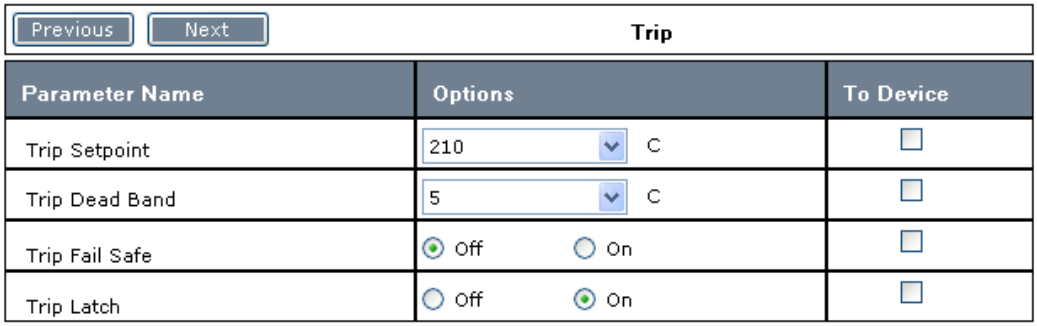
   Alarm Latch selects the Alarm Relay Latch mode, between **On** or **Off**. **On** means the Alarm state remains active even after the condition(s) that caused the alarm are cleared. **Off** means the Alarm state clears when the cause of the alarm is cleared. The Alarm state must be manually cleared with the front panel Reset. The default is **On**.

   Alarm Display selects the alarm display mode. The options are **On** or **Off**. The default is **On**.

2. Click the **To Device** check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.11 Trip

Select **Trip**. The Trip configuration parameters will appear.



1. Select the trip settings desired, as follows:

   Trip Setpoint determines at what temperature the Trip activates due to an over-temperature condition, or disables the Trip for over-temperature. The range is from **0-250 °C (0-482° F)**, or **Off**. The default is **210 °C (410° F)**.

   Trip Dead Band sets the hysteresis (amount the temperature must drop below the setpoint) for the trip deactivation on return from an over-temperature condition. The range is from **5-20 °C (9-36° F)**. The default is **5 °C (9° F)**.

   Trip Fail Safe sets the trip relay Fail Safe mode. The options are **On** or **Off**. **On** means the Trip Relay is powered when no trip condition is present. **Off** means the Trip Relay is powered when one or more trip conditions are present. The default is **On**.

   Trip Latch selects the trip relay latch mode, between **On** or **Off**. **On** means the Trip state remains active even after the condition(s) that caused the Trip are cleared. **Off** means the Trip state clears when the cause of the trip is cleared. The Trip state must be manually cleared with the front panel Reset. The default is **On**.

   Alarm Display selects the alarm display mode. The options are **On** or **Off**. The default is **On**.

2. Click the To Device check box to save this setting to the TC device when the **Write** function is selected.
3. Click **Next** or **Previous**, or use the mouse, to select another configuration category.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC device, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.1.12 Air Flow Sensing (TC-100 Only)

Select **Air Flow Sensing**. The Air Flow Sensing configuration parameters will appear.

Previous | Next | **Airflow Sensing**

Parameter Name	Options	To Device
Discrete Input 1 Selection	Not Used	☐
Discrete Input 1 Edge	Not Applicable	☐
Discrete Input 1 Effect	Not Applicable	☐
Discrete Input 2 Selection	Not Used	☐
Discrete Input 2 Edge	Not Applicable	☐
Discrete Input 2 Effect	Not Applicable	☐

1. Select the air flow settings desired, as follows:

   Discrete Input 1 Selection: Configures the use of Discrete Input 1. The options are **Not Used**, **Fan Fail**, and **User Defined**. Fan Fail may be used with an airflow sensor or micro switch connected to ventilation louvers to indicate when the fan is operating properly. User Defined may be used with a wider array of external sensors or switches to generate an alarm or trip condition, control the fans, or even control other equipment using the Fan2 relay Default is **Not Used**.

   Discrete Input 1 Edge: This option should only be set after the Discrete Input 1 Selection is changed from **Not Used**. The options differ depending on the Discrete Input 1 Selection.

   For **Fan Fail** the options are **Open** or **Closed** and configure the input state that indicates a fan failure. This allows connection to either normally closed or normally open contacts. The default is **Open**.

   For **User Defined** two options are given to define the relationship between the input state and output state. The options are **Direct**, which means a closure on the input results in a closure on the output, or **Invert** which means an open on the input causes a closure on the output. This allows the use of normally open or normally closed contacts on the input. The default is **Direct**.

   Discrete Input 1 Effect: This option should only be set after the Discrete Input 1 Selection is changed from **Not Used**. The options differ depending on the Discrete Input 1 Selection.

   For **Fan Fail** the options are **Alarm Only** or **Alarm + Fan 2**. The default is **Alarm Only**. Selecting either option will activate an alarm condition when a fan failure is detected, activating the alarm relay and front panel LED, and if enabled, displaying **A. AIR-ND** (airflow not detected). The second option can be used to configure Fan 2 as a backup to come on if FAN 1 fails.

   For **User Defined** the options are **Alarm**, **Trip**, **Fan2**, **Fans ON**, and **Fans OFF**. The default is **Alarm**. The **Fans ON** and Fans **OFF** control both fans and override temperature setpoints, thus they can be used to always force fans On or Off.

Discrete Input 2 Selection: Configures the use of Discrete Input 2. The options are **Not Used**, **Fan Fail**, and User **Defined**.

Fan Fail may be used with an airflow sensor or micro switch connected to ventilation louvers to indicate when the fan is operating properly.

User Defined may be used with a wider array of external sensors or switches to generate an alarm or trip condition, control the fans, or even control other equipment using the Fan2 relay

Default is **Not Used**.

Discrete Input 2 Edge: This option should only be set after the Discrete Input 2 Selection is changed from **Not Used**. The options differ depending on the Discrete Input 2 Selection.

For **Fan Fail** the options are **Open** or **Closed** and configure the input state that indicates a fan failure. This allows connection to either normally closed or normally open contacts. The default is **Open**.

For **User Defined** two options are given to define the relationship between the input state and output state. The options are **Direct**, which means a closure on the input results in a closure on the output, or **Invert** which means an open on the input causes a closure on the output. This allows the use of normally open or normally closed contacts on the input. The default is **Direct**.

Discrete Input 2 Effect: This option should only be set after the Discrete Input 2 Selection is changed from **Not Used**. The options differ depending on the Discrete Input 2 Selection.

For **Fan Fail** the options are **Alarm Only** or **Alarm + Fan 1**. The default is **Alarm Only**. Selecting either option will activate an alarm condition when a fan failure is detected, activating the alarm relay and front panel LED, and if enabled displaying **A. AIR-ND** (airflow not detected). The second option can be used to configure Fan 2 as a backup to come on if FAN 1 fails.

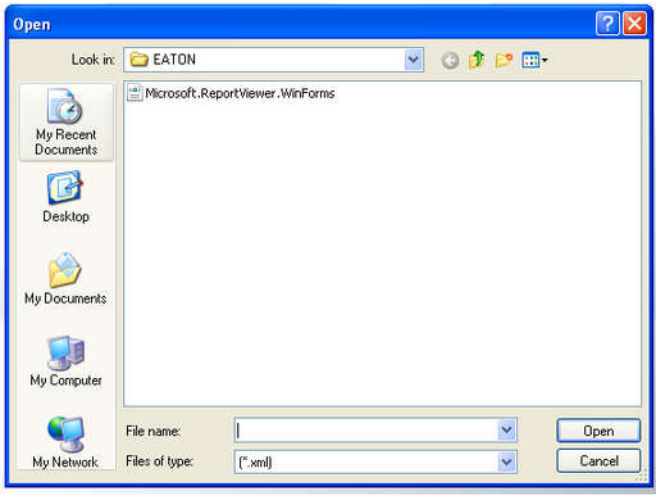
For **User Defined** the options are **Alarm**, **Trip**, **Fan2**, **Fans ON**, and **Fans OFF**. The default is **Alarm**. The Fans ON and Fans OFF control both fans and override temperature setpoints, thus they can be used to always force fans On or Off.

2. Click the **To Device** check box to save this setting to the TC-100 when the **Write** function is selected. change.
3. Click **Next** or **Previous**, or use the mouse, to select another parameter.
4. When all configuration parameters have been changed/selected click **Write** to save all selected parameters to the TC-100, or click **Save** or **Save As** to store this configuration as a file on the laptop for later use.

4.2.4.2 Open

The **Open** option allows you to open existing configuration files.

Select Open on the options bar to display the **Open** dialog box.



1. Enter/check the path to where the configuration files are stored. The default path is "My Documents\TCSeries.
2. Select the configuration file to open from the list of saved files.
3. Click **Open** to open the file.

Note: **Microsoft Report Viewer .WinForms** is not a configuration file. If you try to open this directory an **Error** message will appear in the **Messages Box**.

4. Click **Cancel** to cancel the operation.

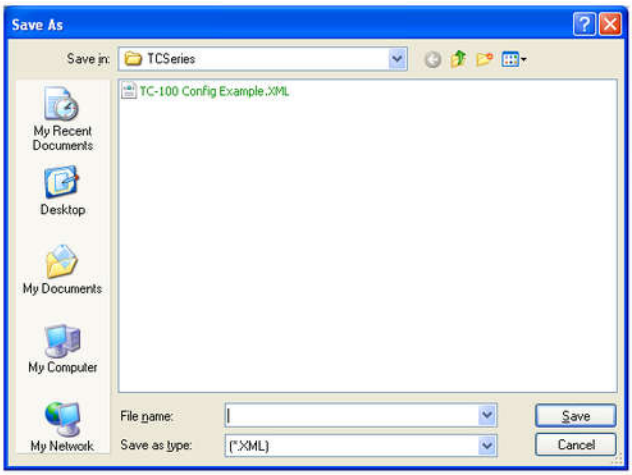
4.2.4.3 Save

The **Save** option allows you to save the current configuration to a file on the PC or network.

Note: If the current configuration was created from an existing configuration file by first using the Open option, selecting **Save** will overwrite that file with the current configuration with no further prompts.

If the current configuration was created starting with the New or Read option, selecting Save will open a **Save As** dialog box, which prompts you to enter a file name to save the configuration.

Select **Save** on the options bar to display the **Save** dialog box.

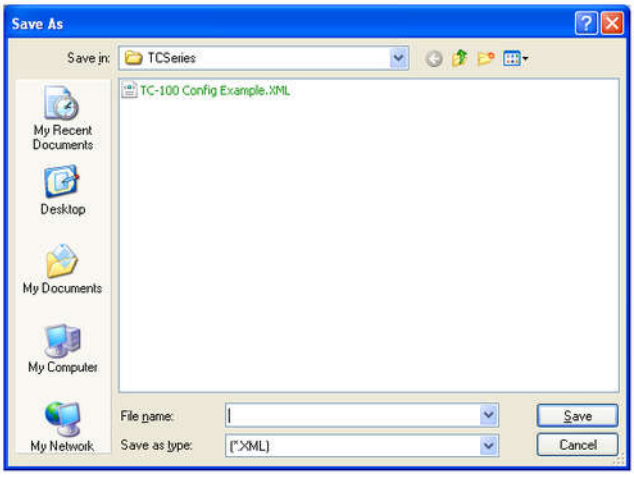


1. Enter/check the path where you want to save the file. Normally this is where the configuration files are stored. The default path is "My Documents\TCSeries"
2. Click **Save** to save the file.
3. Click **Cancel** to cancel the operation.

4.2.4.4 Save As

The **Save As** function allows you to save the current configuration to a file on the PC or network with the name and location specified by the user.

Select **Save As** on the options bar to display the **Save As** dialog box.



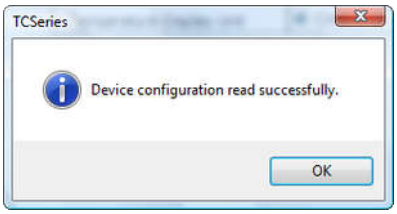
1. Enter/check the path where the configuration files are stored. The default path is you want to save the file. Normally this is files were installed, which is by default "My Documents\TCSeries". Enter the new name of the file. The only file type allowed is *\XML.
2. Click **Save** to save the file.
3. Click **Cancel** to cancel the operation.

4.2.4.5 Read

The **Read** option allows you to read the configuration parameters from a connected TC device.

Note: Prior to selecting the Read option ensure that the TC device is properly connected to the laptop with a USB cable and the Online indication in the upper right corner of the TC-Series Transformer Wellness software screen has a valid identification and is not Offline.

1. **Select Read** on the options bar. When completed, a **Configuration Read Successfully** message appears.



2. Click OK.

4.2.4.6 Write

The **Write** option allows you to write the selected parameters from the current configuration to a connected TC device. There is no associated sub-menu.

Note: Prior to selecting the Write option ensure that the TC-device is properly connected to the laptop with a USB cable and the Online indication in the upper right corner of the TC-Series Transformer Wellness software screen has a valid identification and is not Offline.

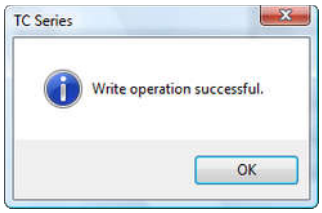
1. Open a configuration. Refer to Sections 4.2.4.1 Creating New Configuration Files, 4.2.4.2 Open an Existing Configuration File, and 4.2.4.5 Reading an Existing Configuration File.





2. Select the items you want to write to the device. Click **Select All Parameters** to write all parameters to the device. All boxes in the **To Device** column will become checked. To select specific items to write, click on a parameter (such as Date/Time) and make your changes. The **To Device** box for those items will become checked. Items will not be written unless checked.

3. Click **Write** on the options bar. The **Write Operation Successful** message appears.

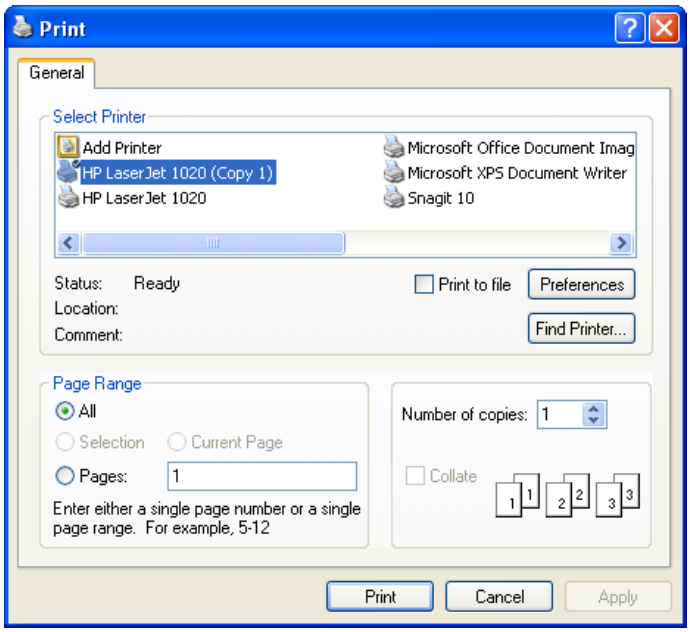


4.2.4.7 Print

The **Print** option allows you to print the current configuration or export the configuration in spreadsheet (*.xls) or PDF format.

Select **Print** on the options bar to display the **Print** dialog box.

The open configuration file will be displayed behind the dialog box, as shown at the end of this section.



To print the current configuration:

1. Select the printer desired, if more than one printer is available.
2. Select the number of copies and any printing preferences desired.
3. Click **Print** to print the file.

Note: To store the configuration in a tabular format, click **Cancel** on the Print dialog box to access the **Print Configuration dialog box**. Click the **Export** option and select **Excel** or **PDF** format. A **Save As** dialog box will appear to specify the location and file name. Click **Cancel** to cancel the operation.



Configuration Parameters of TC100		
Sl No.	Parameter Name	Value
1	Display Mode	Scroll
2	Temperature Display Unit	Centigrade
3	Transformer Type	Dry
4	Baud Rate	9600
5	Parity	None
6	Stopbits	One
7	Modbus Address	1
8	Input1	Off
9	Input2	Off
10	Input3	Off
11	Input4	Off
12	Channel Setting	123
13	Thermocouple Type	E
14	Reverse Detection	On
15	Fan 1 Setpoint	180
16	Fan 2 Setpoint	190
17	Fan Dead Band	10
18	Number to activate Fan 1	Any 1
19	Number to activate Fan 2	Any 1
20	Fan 1 Wear Setting	36
21	Fan 2 Wear Setting	1
22	Fan Mode Control	Auto
23	FAN Exercise Cycle Time	Off
24	FAN Exercise Run Time	1
25	Alarm Setpoint	200
26	Alarm Dead Band	5
27	Alarm Fail Safe	On
28	Alarm Latch	On
29	Alarm Display	On
30	Trip Setpoint	210
31	Trip Dead Band	5
32	Trip Fail Safe	On
33	Trip Latch	On
34	Buzzer	Off
35	Buzzer Tone	Intermittent

4.2.5 Device

Select **Device** on the function bar to display the device options bar, shown below.



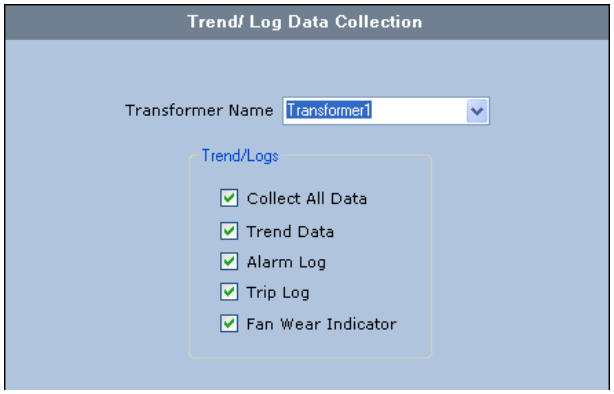
The options available are:

- **Trend/Log Data** - Collects Trend, Alarm and Trip log and Fan Wear Indicator data (TC-100 only).
- **Upgrade Firmware** - Transfers firmware files to the TC device.
- **Change Password** - Changes/resets the password.
- **Upgrade Device** - Provides feature upgrade capability for the TC-50 and TC-50 Modbus devices. This option is not displayed on for the TC-100 because no feature upgrades are possible for this device.

4.2.5.1 Trend/Log Data (TC-100 Only)

The **Trend/Log Data** option allows you to select the type of trend and log data desired and collect that data from the TC-100.

Select **Trend/Log Data** on the options bar to display the **Trend Log Data Collection** dialog box.



IMPORTANT

NOTE THAT THERE IS NO AUTOMATIC CORRELATION BETWEEN CONNECTED TC-100 DEVICES AND TRANSFORMER NAME. ENSURE THAT THE CORRECT TRANSFORMER NAME IS SELECTED TO AVOID SAVING THE NEW DATA INTO THE WRONG TRANSFORMER HISTORY.

1. Select the transformer desired from the **Transformer Name** pull down list, or if you are collecting data from a TC device for the first time type a new name into the **Transformer Name box**.

Note: Use care when entering a new Transformer Name because there is no way to modify it after entry.

2. Check the C**ollect All Data** check box to collect all the available data. This will check all other checked boxes.
3. Check individual check boxes to collect only specific data (Trend Log, Alarm Log, Trip Log, or Fan Wear Indicator). Only the data checked will be collected.

Note: Prior to clicking Collect Date ensure that the TC-100 device is properly connected to the PC with a USB cable and the Online indication in the upper right corner of the TC-100 Transformer Wellness software screen application is On.

4. Click **Collect Data** to collect the data specified from the TC-100. The Messages box will display each data item as it is collected. The data is read very quickly so typically only the last data type message is seen.

4.2.5.2 Upgrade Firmware

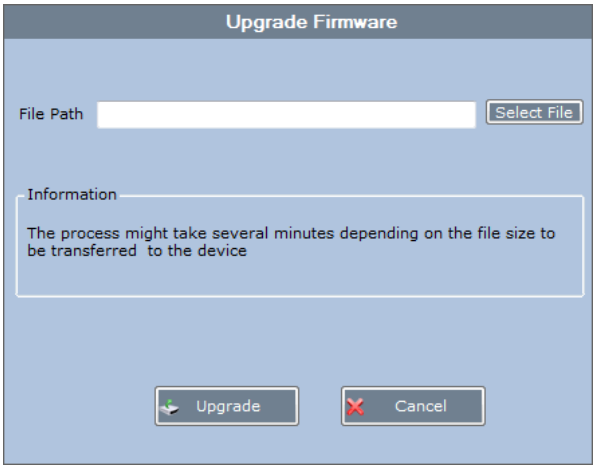
The **Upgrade Firmware** option allows you to download a file to upgrade the firmware of a connected TC device.

CAUTION

THE FIRMWARE FILE MUST BE IN HEXADECIMAL (*.HEX) FORMAT AND OBTAINED FROM EATON CUSTOMER SUPPORT OR WEB SITE SPECIFICALLY FOR THIS PRODUCT. UPGRADING WITH AN IMPROPER FILE COULD RESULT IN LOSS OF PRODUCT FUNCTIONALITY AND/OR DAMAGE TO THE TC-100 OR THE EQUIPMENT IT IS CONNECTED TO.

PLEASE CAREFULLY READ ANY INSTRUCTIONS INCLUDED WITH THE UPGRADE FILE PERTAINING TO CONFIGURATION AND TREND/LOG DATA PRIOR TO UPGRADING.

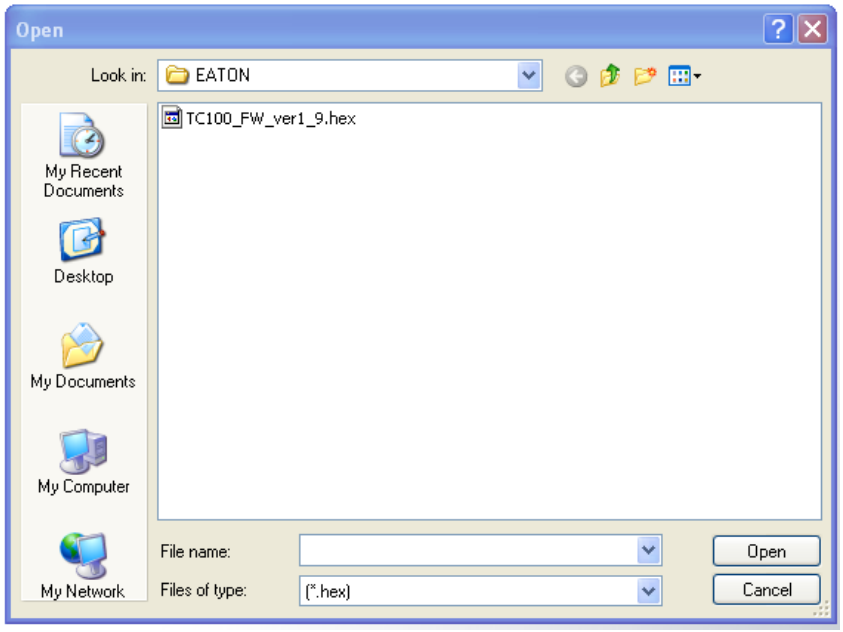
Select Upgrade Firmware To display the **Upgrade Firmware** dialog box.



Note: You can select a file by entering its file name or selecting it from a list.

1. Enter the firmware file to download, by entering the path and file name in the **File Path** window.
2. Or select a file from a list by clicking **Select File**.
3. Check the path to where the firmware files are stored. Normally, this is the "My Documents\TCSeries" directory. Select the firmware file desired from the list displayed.
4. Click **Open** to open the selected file.
5. Click **Upgrade** to download the file. The complete upgrade process should take less than 1 minute. During the upgrade the front panel of the TC device will go blank until the new firmware is loaded, and then it will go through a normal power-up sequence. Carefully observe the firmware version displayed on the TC device character display during this sequence to verify a successful upgrade. After a successful upgrade the message **Upgrade Firmware complete** should appear in the messages box of the TC-Series Transformer Wellness software screen.
6. In the event of a failure during the upgrade the messages box will display appropriate diagnostic messages. The TC device upgrade process is designed to be fail-safe, and the unit should revert to it's previous version of firmware and continue normal operation.

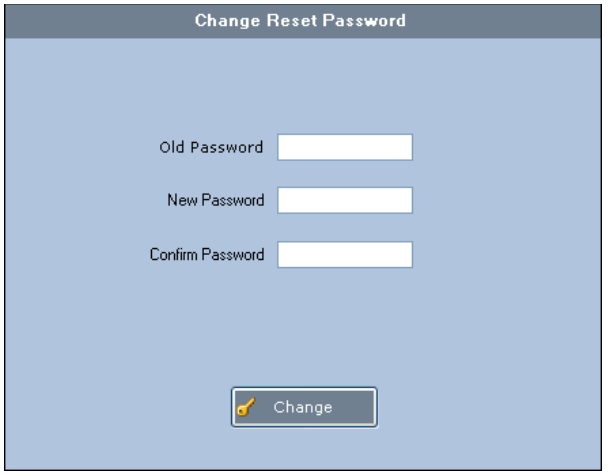
Note: Prior to clicking Upgrade ensure the TC device is properly connected to the laptop with a USB cable and the Online indication in the upper right corner of the TC-Series Transformer Wellness software screen is On.



4.2.5.3 Change/Reset Password

The **Change Password** option allows you to change the current password on the connected TC device, or reset the password to the default (0000).

Select **Change Password** to display the **Change or Reset Password** dialog box.



Note: Four alpha-numeric characters (0-9, A-Z) are required. All three fields must be entered.

1. Enter the old password.
2. Enter the new password.
3. Confirm the new password by entering it again.

Note: Prior to clicking Change ensure the TC device is properly connected to the laptop with a USB cable and the Online indication in the upper right corner of the TC device Transformer Wellness software screen is On.

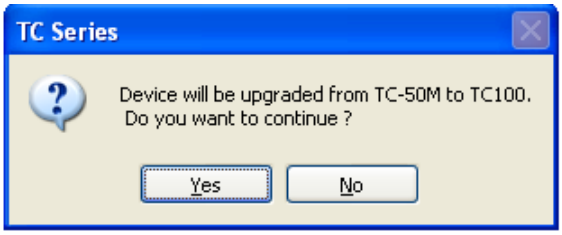
4. Click the **Change** box to execute the change. After a successful changing the password, the message **The reset password is changed successfully** should appear in the messages box.

4.2.5.4 Upgrade Device

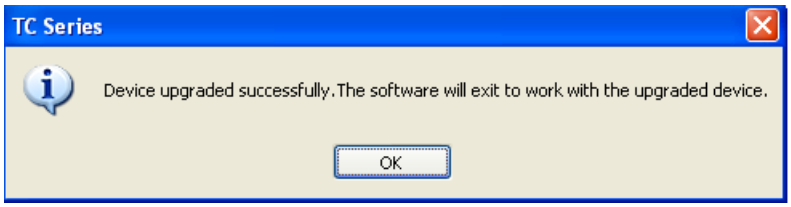
When Upgrade Device is selected on the Device Options Bar, the following screen appears. This displays the device manufacturing date and serial number. You will need these numbers to upgrade the TC-50 or TC-50 Modbus.



1. Contact your Eaton sales representative to order a product upgrade. You will be given a upgrade code (key file). Save this code on the computer that will be used to upgrade the TC-50 or TC-50 Modbus, preferable to the My Documents\TC Series folder.
2. Click Read File to find, open and display the upgrade code in the Code window. If the upgrade code displayed is correct, continue. If incorrect, go back to Step 1.
3. Click Upgrade Device. The following dialog box appears.



4. Click **Yes** to upgrade your device. The following confirmation appears.



5. Click OK to close the program.
6. Restart the program to view your newly upgraded device. The new device number will appear for the Device Indicator on the Main Menu.

4.2.6 Reports (TC-100 Only)

Select **Reports** on the function bar to display the **Reports** sub-menu, shown below.



The options available are:

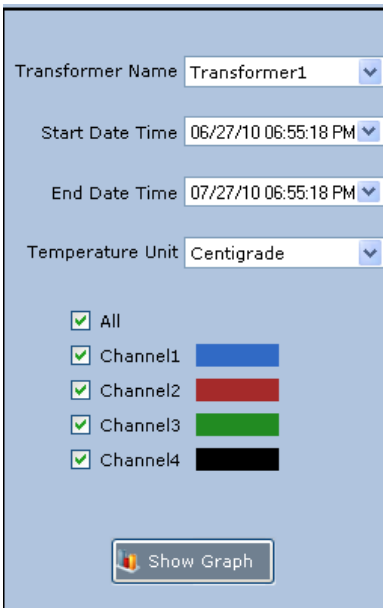
- **Trend Graph** - View trend data in the form of a graph.
- **Trend Data** - View trend data in the form of a report.
- **Trip Log** - View trend data in the form of a report.
- **Alarm Log** - View Alarm event history as a report.
- **Fan Wear Indicator** - View fan wear data as a report.
- **Delete History** - Deletes selected data from the data base.

Note: Because these reports are available only for TC-100 devices a TC-100 device must be properly connected to the computer with a USB cable or a TC-100 configuration must be opened before selecting the Reports option. Refer to Section 4.2.4.1 Creating Configuration Files or 4.2.4.2 Open an Existing Configuration to open a TC-100 configuration. All reports are generated from data that was previously downloaded from TC-100 units connected to the laptop. For the most up-to-date reports, connect to the desired TC-100 unit(s) and collect the latest data using the Trend/Log Data option of the Device functions prior to accessing the Reports options. See section 4.2.5.1, Trend/Log Data..

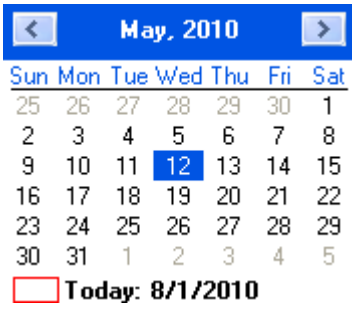
4.2.6.1 Trend Graph

The **Trend Graph** option allows you to select the trend data desired and display a graph of that data.

Select **Trend Graph** on the reports options bar to display the set-up menu.



1. Select the transformer desired from the pull down menu.
2. Specify the starting date and time for the desired trend data by directly entering the **Start Date Time**, or click on the pull down menu to display a calendar, as shown below.



3. Select the month for the start date desired by clicking the **<** and **>** arrows on the calendar.
4. Click the day of the month to select the start day.

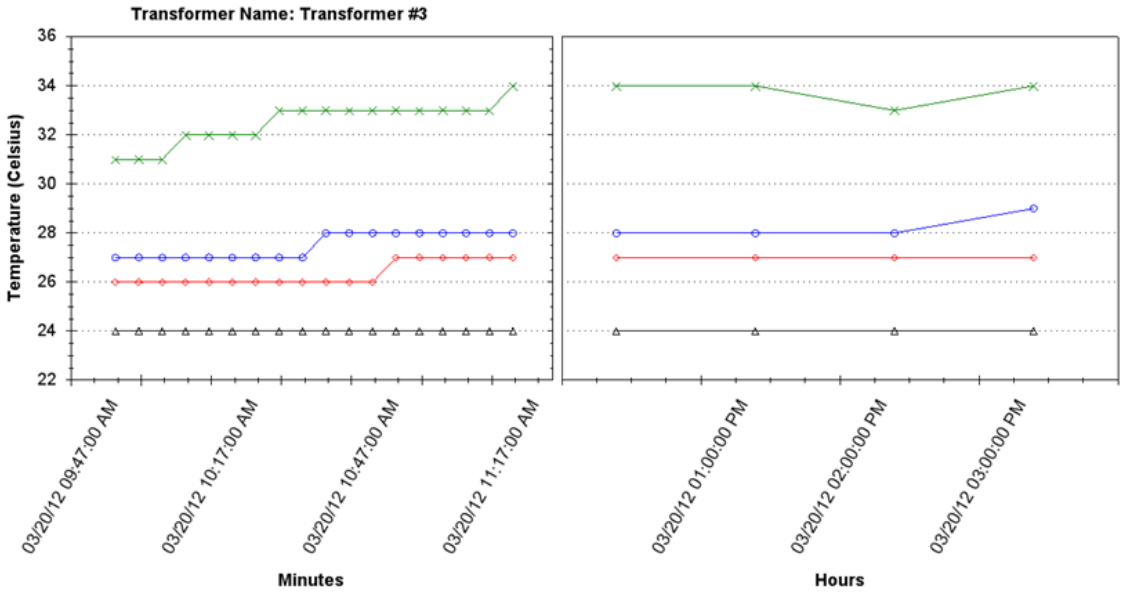
Note: The **Start** date must always be less than the **End** date.

5. Specify the ending date and time for the desired trend data by directly entering the **End Date Time**, or click on the pull down menu to display a calendar, as shown above.
6. Follow the same procedure to specify the ending date and time for the desired trend data.
7. Select the month for the end date desired by clicking the **<** and **>** arrows on the calendar.
8. Click the day of the month for the end date to select the end day.
9. Click the **Temperature Unit** pull down menu to select the temperature unit for display. The options are Celsius and Fahrenheit.
10. Select the individual **Channel(s)** you want to include in the graph, or **All Channels** to select all.

Note: Selecting **All Channels** provides a quick view of all available temperature data. By enabling only particular channels it may be easier to concentrate on specific points of interest with the graph.

11. Click **Show Graph** to display the graph.
12. The graph will be plotted in different panels if the trend data interval changes with the time period selected as shown in the following sample graph. If the trend data interval is constant over the time period selected all data will be plotted in one panel.

A typical Trend graph is shown below.



Navigate the graph to find specific values, as follows:

1. **Data Point Date and Time**. Right click the graph, then select **Show Point Values**. Hover over the data point with the mouse to display the date and time of that data point.
2. **Zoom In to a section:** Double click the graph. The graphic will change slightly in appearance. Click and hold the left mouse button then drag it to one side or another. Two vertical dotted lines will appear. This is the area that will be enlarged when you release the mouse.

Note: To **return to the normal view**, click the curved arrow in the upper left-hand corner of the screen. (If you hover the mouse pointer over this arrow the message will be **Click here to go back to original view**).

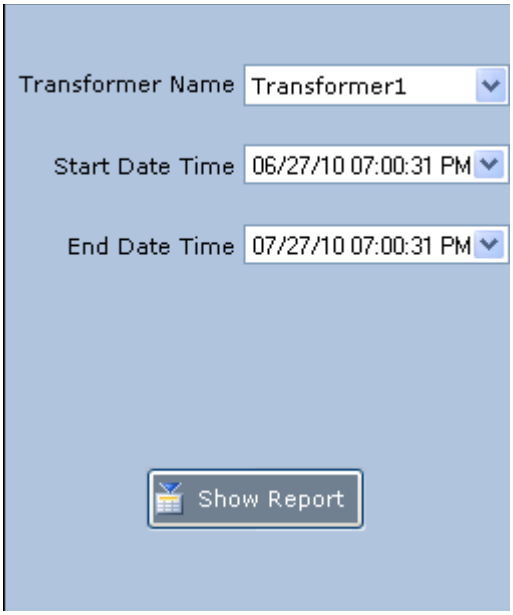
3. **Move to other areas:** Move to other areas of the graph (at the zoomed-in resolution) using the Keyboard arrow keys,
4. **Zoom Out from a section:** Right click then click **Un-zoom** or **Undo all zoom/pan**.

Note: To modify the graph contents, change the **Transformer Name**, **Start Date Time**, **End Date Time**, **Temperature Unit**, and/or channels to view and click **Show Graph** again to update the graph with the new selections.

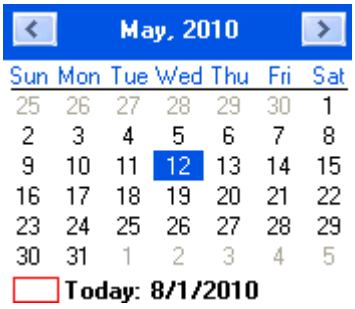
4.2.6.2 Trend Data

The **Trend Data** option allows you to select the trend data desired and display it as a spreadsheet/tabular report.

Select **Trend Data** on the reports options bar to display the set up menu.



1. Select the transformer desired from the pull down menu.
2. Click the **Start Date Time** menu to display a calendar, as shown below.



3. Select the month for the start date desired by clicking the **<** and **>** arrows on the calendar.
4. Click the day of the month to select the start day.

Note: The **Start** date must always be less than the **End** date.

5. Click the **End Date Time** menu to display a calendar, as shown above.
6. Select the month for the end date desired by clicking the **<** and **>** arrows on the calendar.
7. Click the day of the month for the end date to select the end day.
8. Click **Show Report** to display the report.

A sample Trend report is shown below.

1 of 3 100% Find | Next

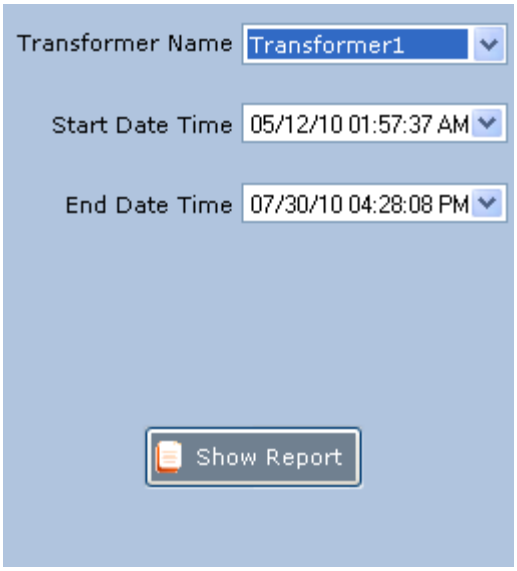
Transformer Name: Mark's desk						
From: 7/29/2010 12:51:37 PM To: 8/11/2010 2:43:37 AM						
Record #	Channel1 Temperature	Channel2 Temperature	Channel3 Temperature	Channel4 Temperature	Units	Trend Date & Time
8	37	27	25	26	C	7/29/2010 8:38:37 PM
9	37	26	25	25	C	7/29/2010 9:38:37 PM
10	37	26	25	25	C	7/29/2010 10:38:37 PM
11	36	26	25	25	C	7/29/2010 11:38:37 PM
12	36	26	25	25	C	7/30/2010 12:38:37 AM
13	36	26	25	25	C	7/30/2010 1:38:37 AM
14	36	26	24	24	C	7/30/2010 2:38:37 AM
15	36	25	24	24	C	7/30/2010 3:38:37 AM
16	36	23	22	23	C	7/30/2010 4:38:37 AM

Note: The report tool bar allows you to view which page (of several) you desire to view, using the left and right arrow icons, or you can scroll to the page desired using the scroll bar. The report can be printed by clicking the **Print** icon, or exported to Excel for more detailed analysis or as an Acrobat (PDF) file by clicking the **Export** icon.

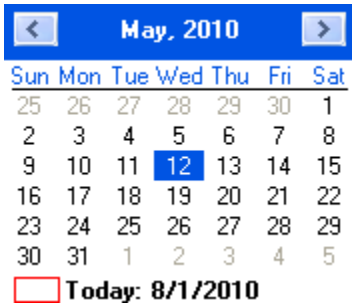
4.2.6.3 Trip Log

The **Trip Log** option allows you to select the desired trip log data and show it as a report.

Select Trip Log on the reports options bar to display the set up menu.



1. Select the transformer desired from the pull down menu.
2. Click the **Start Date Time** menu to display a calendar, as shown below.

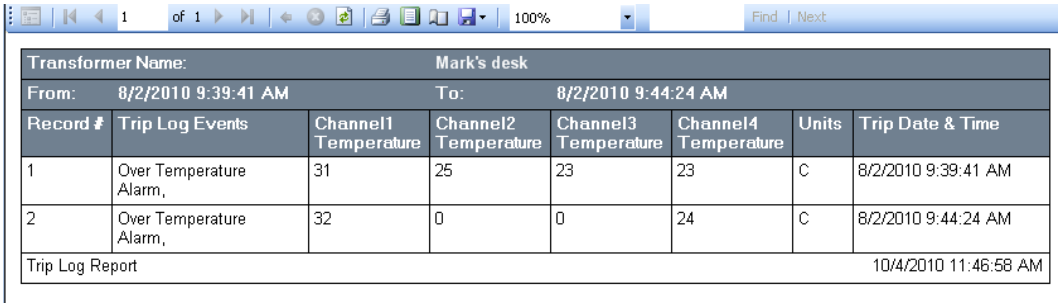


3. Select the month for the start date desired by clicking the **<** and **>** arrows on the calendar.
4. Click the day of the month to select the start day.

Note: The **Start** date must always be less than the **End** date.

5. Click the **End Date Time** menu to display a calendar, as shown above.
6. Select the month for the end date desired by clicking the **<** and **>** arrows on the calendar.
7. Click the day of the month for the end date to select the end day.
8. Click **Show Report** to display the report.

A sample Trip report is shown below.



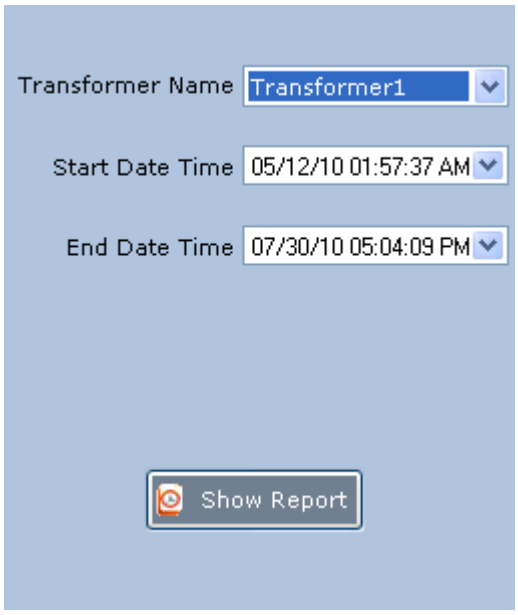
Transformer Name:			Mark's desk				
From:	8/2/2010 9:39:41 AM		To:	8/2/2010 9:44:24 AM			
Record #	Trip Log Events	Channel1 Temperature	Channel2 Temperature	Channel3 Temperature	Channel4 Temperature	Units	Trip Date & Time
1	Over Temperature Alarm,	31	25	23	23	C	8/2/2010 9:39:41 AM
2	Over Temperature Alarm,	32	0	0	24	C	8/2/2010 9:44:24 AM
Trip Log Report							10/4/2010 11:46:58 AM

Note: The report tool bar allows you to view which page (if several) you desire to view, using the left and right arrow icons, or you can scroll to the page desired using the scroll bar. The report can be printed by clicking the **Print** icon, or exported to Excel, for more detailed analysis, or as an Acrobat (PDF) file by clicking the **Export** icon.

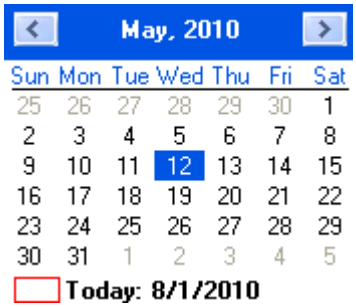
4.2.6.4 Alarm Log

The **Alarm Log** option allows you to select the desired Alarm log data and show it as a report.

Select **Alarm Log** on the reports options bar to display the alarm log menu.



1. Select the transformer desired from the pull down menu.
2. Click the **Start Date Time** menu to display a calendar, as shown below.

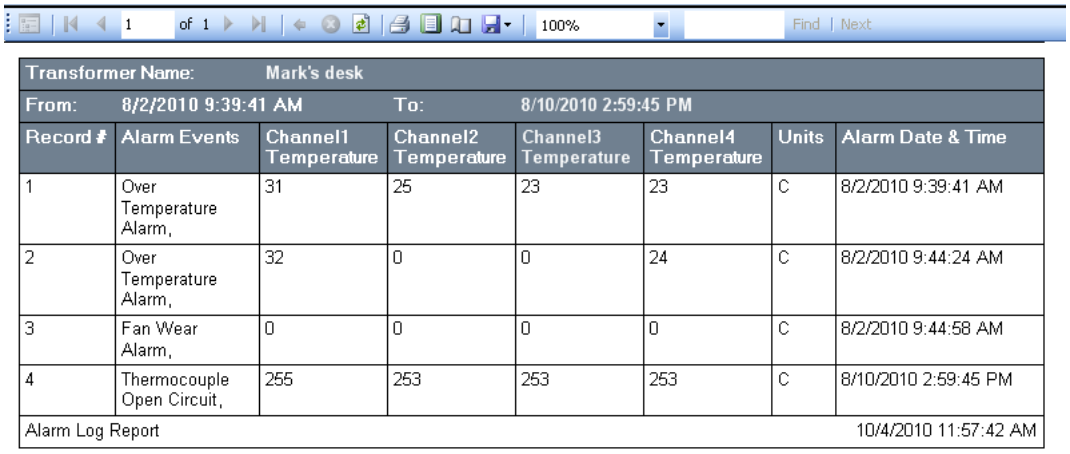


3. Select the month for the start date desired by clicking the **<** and **>** arrows on the calendar.
4. Click the day of the month to select the start day.

Note: The **Start** date must always be less than the **End** date.

5. Select the month for the end date, as described above.
6. Click the day of the month for the end date to select the end day.
7. Click **Show Report** to display the report.

A sample Alarm report is shown below.



1 of 1 100% Find | Next

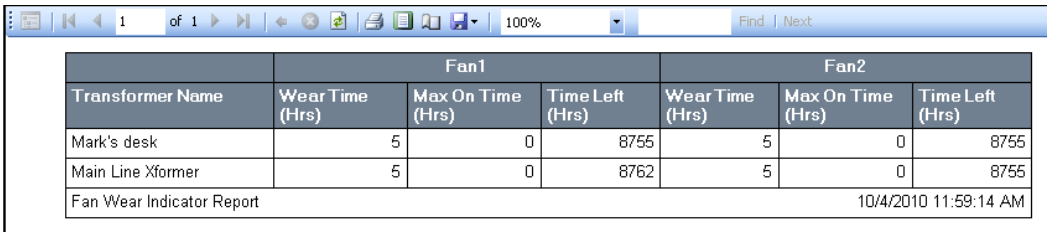
Transformer Name:	Mark's desk						
From:	8/2/2010 9:39:41 AM		To:	8/10/2010 2:59:45 PM			
Record #	Alarm Events	Channel1 Temperature	Channel2 Temperature	Channel3 Temperature	Channel4 Temperature	Units	Alarm Date & Time
1	Over Temperature Alarm,	31	25	23	23	C	8/2/2010 9:39:41 AM
2	Over Temperature Alarm,	32	0	0	24	C	8/2/2010 9:44:24 AM
3	Fan Wear Alarm,	0	0	0	0	C	8/2/2010 9:44:58 AM
4	Thermocouple Open Circuit,	255	253	253	253	C	8/10/2010 2:59:45 PM
Alarm Log Report							10/4/2010 11:57:42 AM

Note: The report tool bar allows you to view which page (if several) you desire to view, using the left and right arrow icons, or you can scroll to the page desired using the scroll bar. The report can be printed by clicking the **Print** icon, or exported to Excel for more detailed analysis, or as an Acrobat (PDF) file by clicking the **Export** icon.

4.2.6.5 Fan Wear Indicator

The **Fan Wear Indicator** option allows you to view a report of the currently available fan wear data for all TC devices that have been queried in the database.

Select Fan Wear Indicator on the reports options bar to display the current fan wear report. A sample report is shown below.



	Fan1			Fan2		
Transformer Name	Wear Time (Hrs)	Max On Time (Hrs)	Time Left (Hrs)	Wear Time (Hrs)	Max On Time (Hrs)	Time Left (Hrs)
Mark's desk	5	0	8755	5	0	8755
Main Line Xformer	5	0	8762	5	0	8755
Fan Wear Indicator Report						10/4/2010 11:59:14 AM

Note: The report tool bar allows you to view which page (of several) you desire to view, using the left and right arrow icons, or you can scroll to the page desired using the scroll bar. The report can be printed by clicking the **Print** icon, or exported to Excel for more detailed analysis, or as an Acrobat (PDF) file by clicking the **Export** icon.

4.2.6.6 Delete History

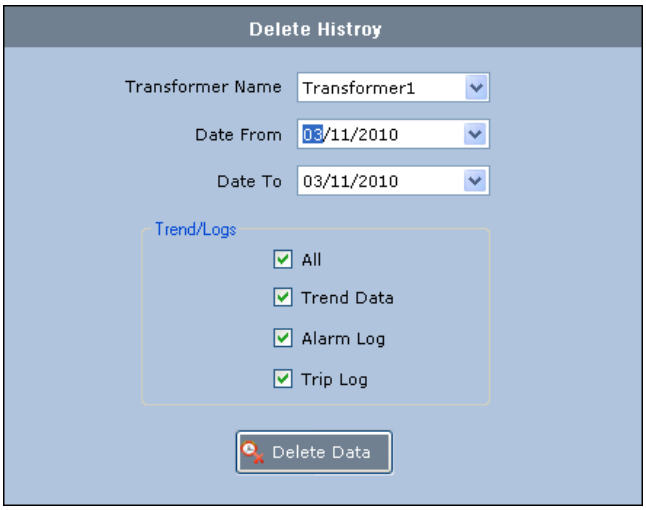
The **Delete History** option allows you to select the type of data to be deleted, for what transformer, and for what period of time desired.

Note: Delete History only deletes data from the PC database. To delete history data from the TC device use the **Reset** button on the front panel interface as described in Section 4.1.2.1 Reset Functions.

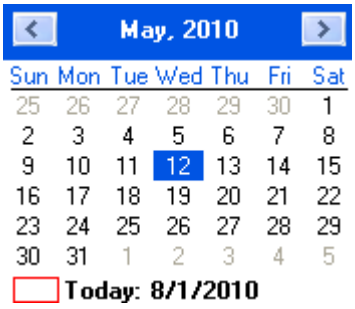
Select Delete History on the reports option bar to display the Delete History menu.

⚠ IMPORTANT

HISTORICAL DATA DELETED CANNOT BE RECOVERED.



1. Select the transformer desired from the pull down menu.
2. Click the **Date From** menu to display a calendar, as shown below.



3. Select the month for the **Date From** date desired by clicking the **<** and **>** arrows on the calendar.
4. Click the day of the month to select the **Date From** day.

Note: The **Date From** date must always be less than the **Date To** date.

5. Select the month for the **Date To** date, as described above.
6. Click the day of the month to select the **Date To** day.
7. Click the check box for the type of **Tend/Logs** data you want to delete, for the time period selected.
   * All = Deletes the **Trend Data**, **Alarm Log** and **Trip Log**.

Note: Deleting all data for a particular transformer will also delete that Transformer name from the database. This is useful if a transformer/TC device is taken out of service.

   * Trend Data = Deletes the **Trend Data** for the time period selected.
   * Alarm Log = Deletes the **Alarm Log** for the time period selected.
   * Trip Log = Deletes the **Trip Log** for the time period selected.

8. Click the **Delete Data** box to delete the data selected.

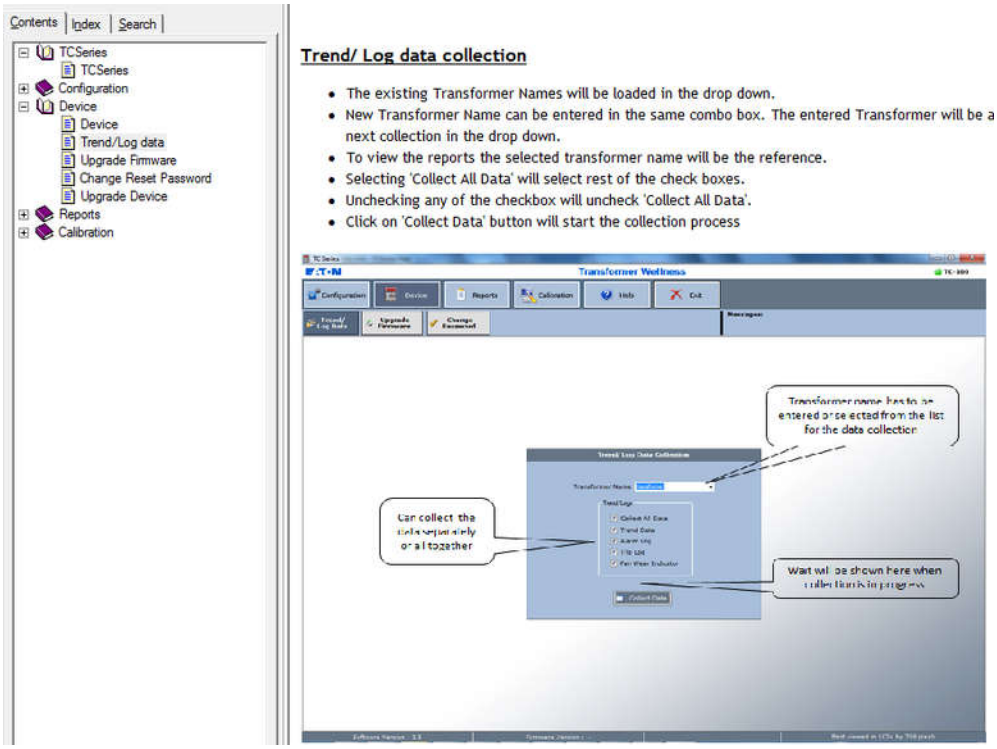
4.2.7 Calibration

Selecting **Calibration**, on the function bar allows access by manufacturing operations ONLY to calibrate the TC device. This device cannot be calibrated by end users. This access for calibration is password protected.

4.2.8 Help

The **Help** option provides help in understanding and navigating the TC-Series functions and options.

1. **Select** **Help** on the function bar to display help menus. The opening Help menu is shown below. The Configuration Menu appears by default, as shown below. The broad categories where help is available are shown in the left pane. They include TC Series, Configuration, Device, Reports, and Calibration.
2. Click the plus sign (+) for the help category desired to display an expanded list of subjects, such as for the Device category.
3. From that expanded list select a subject, such as Trend/Log data, by clicking it. A help screen for that subject appears, as shown below.



4. Review the help information.
5. Click the minus sign (-) to collapse the list of subjects.

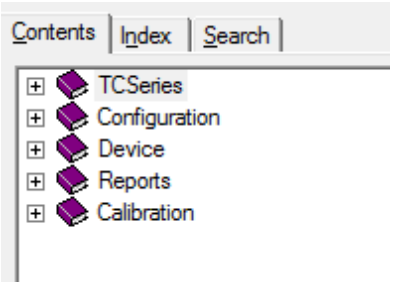
Note: The information messages and error messages will be displayed in the message bar in the Help Screen.

Note: This routine is the same for all help subjects.

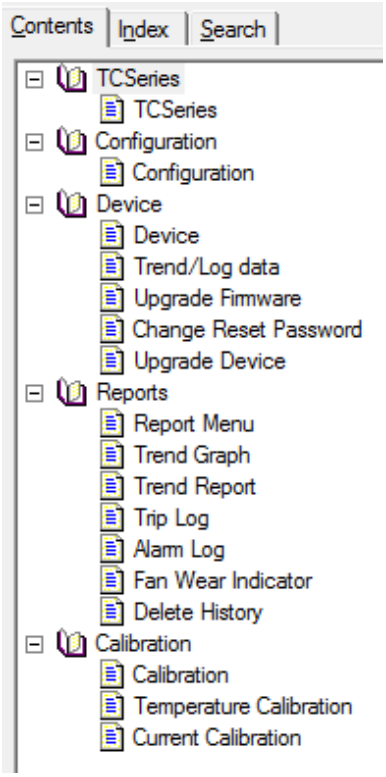
4.2.8.1 Contents Tab

The **Contents** tab option displays the subjects overed on the function bar.

Click **Contents** to display the subjects covered on the function bar. This menu is shown in the **collapsed** view, noted by the **+** (plus sign) to the left of each topic.



Click the **+** (plus sign) to **expand** the list of subjects for each topic. (Click the **-** (minus sign) to **collapse** the list). The following menu shows all subjects in each topic expanded.

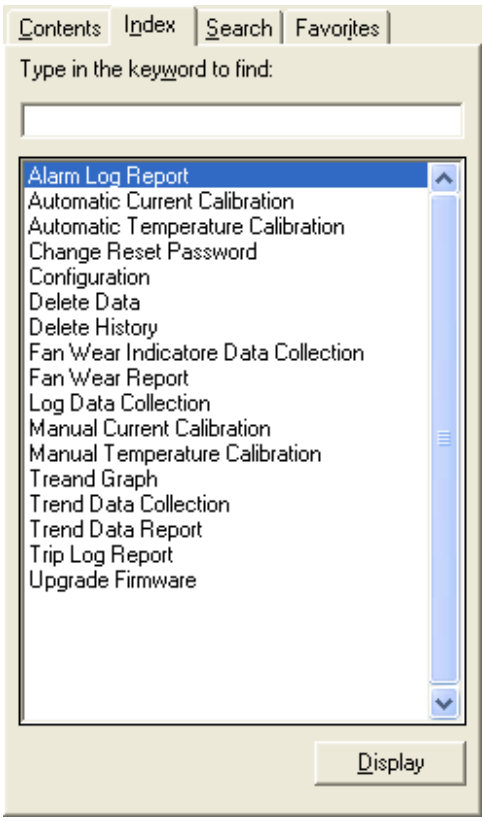


4.2.8.2 Index Tab

The **Index** tab option lists all parameters in alphabetical order.

Click **Index** to display all parameters,

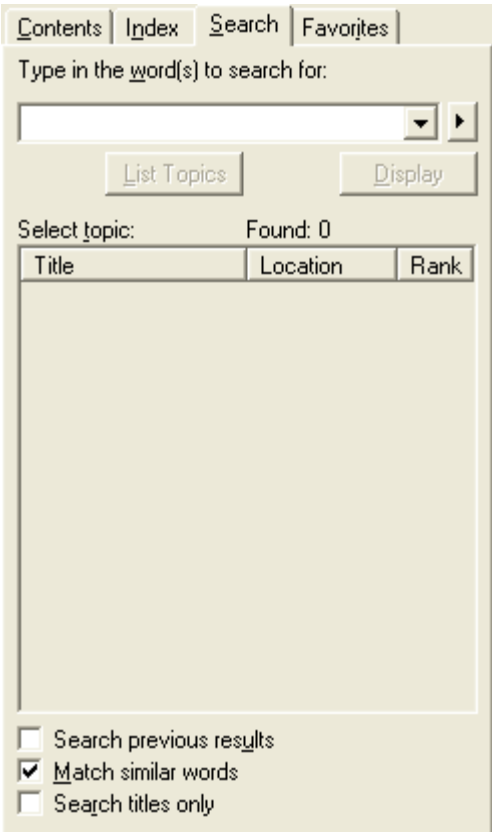
Click a subject to obtain a detailed explanation and a graphic of that subject.



4.2.8.3 Search Tab

The **Search** tab allows you to search for a file by name.

Click **Search** to display the **Search** dialog box.



1. Enter the topic desired in the **Display Topic** window, or select the topic from a list by clicking the pull down menu arrow.
2. Click **Display** to retrieve the file selected.

4.2.9 Exit

The **Exit** option allows you to exit the TC Series program.

Click **Exit** to exit the TC Series program.

4.3 Remote Operation

Operating the TC-50 Modbus and TC-100 models remotely requires a standard Modbus communications network.

This arrangement allows the user to monitor current operating conditions of the transformer and controller, such as winding temperatures, active alarms, and status of the fan, alarm, and trip relays. It also allows the user to monitor ongoing statistics for the winding temperatures and fans as well as download alarm and trip event logs and trend data.

Finally, the user can make configuration changes which can be useful, for example, to change the trend data logging interval to troubleshoot possible problems.

4.3.1 Introduction

The TC-50 Modbus and TC-100 models communicate over an RS-485 network using standard Modbus RTU protocol. A 4-pin connector is provided for wiring to the RS-485 network. TX and RX LEDs illuminate when when data is transmitted or received, aiding in network troubleshooting. Communications settings for baud rate, parity, number of stop bits, and Modbus address are programmable through the front panel keypad or via the USB interface to a local computer running the TC-50 Modbus and TC-100 PC software.

A register map detailing available data can be found in Appendix C-Modbus Registers.

4.3.2 Features

The TC-50 Modbus and TC-100 models have the following features:

- A means of communicating using the standard Modbus RTU protocol over an RS-485 network connection.
- Supports baud rates of 9600, 19200, and 38400, selectable via the front panel keypad for networking flexibility.
- Selectable addresses 1-247 via the front panel keypad.
- Data in fixed-point formats.
- RS-485 TX/RX indicators.
- Termination resistor is dip-switch selectable.

4.3.3 Hardware Installation

4.3.3.1 Simplified Wiring Rules

The TC-50 Modbus and TC-100 models provide a half-duplex, EIA/RS-485 network connection. EIA/RS-485 is a multi-drop, industrial-grade communications standard.

It is a "balanced differential" signal that feeds over a twisted-pair containing A and B signals and a common. For this reason, it is very important to carry all three conductors to ensure a high quality communications network.

4.3.3.2 Signal Polarity

The data is considered a binary 1 when the voltage level of the **A** signal is less than the voltage level of the **B** signal. A binary 1 is considered a Mark or Off whereas a binary 0 is a Space or On.

4.3.3.3 Cabling

The recommended cable for maximum performance of the RS-485 network is a twisted pair with 22-AWG stranded 7 x 30 conductors with PVC insulation under aluminum foil polyester tape, a single 24-AWG stranded 7 x 32 conductor with PVC insulation and aluminum foil polyester tape, and an all-over braided shield (Belden 3106A). Cables with similar shielding and smaller wire sizes (24-AWG) can be used for easier wiring. The cable characteristic impedance should be 120 ohms.

4.3.3.4 RS-485 Bus Termination

Assuming the characteristic impedance of the cable is 120 ohms, each segment of the RS-485 network should be terminated with an end-of-line terminating resistor. A resistor value of 120 ohm should be used at the Master end of the network as well as at the end of the line. This terminating resistor is mounted at the factory and can be switched in by changing the SW1 on (**1**). SW1 is set to the **Off** position. SW1 and SW4 are set to the **Off** position at the factory, and in most installations, the SW1 terminating resistor does not need to be set to the **On** position.

4.3.4 Connectors

4.3.4.1 RS-485 Connector

Figure 14, Modbus Board Wiriing, shows a typical Modbus network where the TV-50 Modbus or TC-100 (slave) and host devices are connected to the RS-485 Modbus Master..

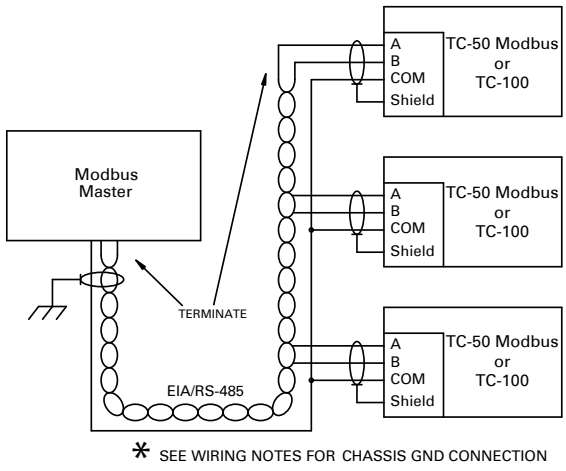


Figure 14, Modbus Board Wiring

Table 2, below, shows the 5-pin connector pin-out assignment.

Table 2 - Modbus Pin-Out Assignment

Pin	Signal
1	A (-)
2	B (+)
3	Common
4	Shield

4.3.4.2 Wiring Notes

For maximum noise immunity, the shield of the RS-485 cable should be daisy-chained from one slave device to another and terminated to chassis ground at the Modbus master-end of the network (single-point ground).

4.3.4.3 System Capacity

The address of the TC-50 Modbus or TC-100 can be set between 1 and 247 (decimal) allowing to operate on networks containing up to 247 TC-50 Modbus or TC-100 units or other slave devices.

4.3.4.4 LEDs

4.3.4.4.1 Red RS-485 Transmit LED (TX) Indicator

The RX LED on the TC-100 or TC-50 Modbus controller turns on when the TC-100 is responding to a request. The TC-50 Modbus and TC-100 models only respond to requests to its address.

4.3.4.4.2 Red RS-485 Receive LED (RX) Indicator

The RX LED flashes when the TC-100 or TC-50-Modbus detects that a signal is being received. The LED flashes even if the signal is at the wrong baud rate, to a different adddress, etc.

4.3.5 Modbus Troubleshooting

The most common issues experienced with the operation of the TC-50 Modbus and TC-100 on a Modbus network are addresssed as follows:

- Modbus RX LED and TX LED do not light:
  - * Verify that the communication cable is connected correctly from the master to the Modbus slave device.
- Modbus RX LED is flashing, but the TC-50 Modbus or TC-100 does not respond to master command requests.
  - * Verify that the baud rate, parity, number of stop bits, and address are correctly set using the front panel keypad (see Section 4.1.2.2.4.2, Parity) or with the PC software (Section 4.2.4.1.5, Modbus).
  - * Verify that the communication cable is connected correctly from the master to the Modbus slave device.
  - * Verify that the network is terminated properly.
- Modbus RX LED and TX LED are flashing, but the TC-50 Modbus or TC-100 responds with error codes to master command requests.
  - * Verify that the function code, register address, and data value in the command from the master are valid per the register map in Appendix B.
  - * If the command request is valid, verify that the TC-50 Modbus or TC-100 is properly connected to chassis ground, that the cable shield is connected to chassis ground only at the master, and that the network is terminated properly.

If you have any questions or need further information or instructions, contact the Eaton Technical Support Center at 1-800-809-2772.

5. Power Up for Testing

5.1 General

After the TC has be installed, wired properly, and programmed, it must be tested prior to placing it in service.

Test the TC models as follows:

- Ensure all control power and fan power wiring is sized and fused properly. Ensure all signal and control wiring is properly segregated from power wiring within the transformer cabinet. Ensure all wiring within the barrier cabinet is secured to avoid excessive strain when the frontcover is closed..
- Apply control power to the unit and verify the power-on self test completes and the unit displays proper temperatures for the connected thermocouples.
- Use the front panel **Prog** button or PC Application to configure any necessary parameters. At the very least the current date/time should be verified/set. If the Modbus interface is to be used its configuration should also be verified/set.
- Use the front panel Test button to enter test mode and turn on the individual relays to verify their wiring. Also verify that all of the buttons and LEDs operate properly and verify that the internal temperature is correct.
- If discrete inputs are used verify that open/closed contacts provide the desired response.
- If the 4-20mA output is used, verify that the remote monitor is indicating the correct maximum winding temperature.

6. Maintenance and Repair

6.1 Preventive Maintenance

There is no routine preventive maintenance required for any of the TC models.

However, if cleaning is desired, NEVER clean the TC with system or power On. Clean the TC using **ONLY** a clean, dry cloth. **DO NOT** use water or solvents of any kind.

6.2 Repair

The TC Controller is a sealed unit. There are no serviceable parts. If there is a failure in the controller, the entire unit must be replaced.

6.3 Controller Replacement

Remove and replace the TC controller, as follows:

1. Lock Out and Tagout the transformer and the TC unit serving it.
2. Access the controller by opening the hinged panel (barrier cabinet version) or from within the transformer cabinet (bezel-mounted version).
3. Disconnect the wiring to the controller. See Section 2.4, Wiring the TC
4. Remove the 10 screws used to mount the controller.
5. Install the new TC controller unit and secure it with the 10 mounting screws.
6. Wire the controller, as described. See Section 2.4, Wiring the TC.
7. Close the hinged panel (barrier cabinet version) and secure it.
8. Restore electrical power to the transformer and the TC.
9. Test the TC operation, as described in Section 5, Power Up for Testing.

7. Troubleshooting

The TC models are very reliable if installed and operated properly.

If, for some reason, your TC does not function properly, first confirm that it is installed properly. See Section 2, Installation.

If the TC malfunctions after it has been operating routinely, refer to Table 4, Troubleshooting Chart.

This Troubleshooting Chart identifies causes and solutions to the malfunction. For further assistance contact the Customer Integrity Team at MRsupport@eaton.com or calling 1-844-435-8982.

Table 4 - Troubleshooting

Condition	Probable Cause	Solution
Electrical		
Display shows A.TMP-ND	No winding temperature decrease within five (5) minutes of Fan(s) turn on	Verify proper fan operation.
Display shows A.T-R-CON	Thermocouple wired reverse polarity	Verify proper polarity of thermocouple connections.
Display shows A.T-O-CKT	Thermocouple Open Circuit Winding temperature (s) colder than internal controller temperature	Verify thermocouple is connected properly. Replace thermocouple if broken. If this is a typical operating condition, disable reverse thermocouple detection
Display shows A.OVRTMP	Winding temperature(s) exceed Alarm threshold	Verify proper alarm setpoint and if correct troubleshoot and repair any transformer overloading, fan failure, airflow blockage, etc.
Display shows A.AIR-ND (TC-100 only)	Discrete Input Activation	Troubleshoot reason for discrete input activation and make any necessary repairs
Display shows A.FANWEAR (TCC-100 only)	Total fan operating time has exceeded the programmed threshold	Perform any required fan maintenance based on this operating time and Reset the FANWEAR hours via the front panel Reset menu
Display shows A.FAN ONT (TC-100 only)	Fan has been operating continuously for at least 24 hours	Troubleshoot and repair any potential transformer overloading, fan failure, airflow blockage, etc. Note: This may be a normal operating condition during periods of high ambient temperature and heavy transformer loading
Display shows A.FRAM or A.EEPROM or A.ISO-OR	Internal Controller Failure	Return controller for repair.
Fan(s) not turning on	Improper programming Open Fuse Bad wiring/fan	Verify proper programming of fan mode and setpoints Determine/repair cause of fuse opening. Replace fuse Rewire/replace fan, as required

8. Specifications

Description	Specification
Control Power	
Nominal rating	100Vac to 240 Vac (+/-10%)
Frequency	50/60 Hz
Power Use	18 VA maximum
Ride-through time	20 cycles at nominal Vac
Environmental	
Operating Temperature	-30° to + 72° C (-22° to 162° F)
Storage Temperature	-50° to +85° C (-58° to 185° F)
Relative Humidity	0% to 90% non-condensing
Temperature Measurement	
Measuring Range	0° C - 250° C (32° F - 482 ° F)
Display Resolution	1° C
Accuracy	±1° C ± one count under normal conditions ±2° C ± one count under extreme conditions. Extreme conditions are: Ambient temperature colder than -10° C Winding to unit temperature greater than 210° C
Discrete Inputs	
Number of Inputs †	Two (2) programmable
Rating †	<0.2 VA at 120 Vac On Voltage: 100-240VAC Off Voltage: 0V
Outputs	
Fan Control Outputs	Two (2) individually configurable SPST contacts rated 1 HP @ 120 Vac, 2 HP @ 240 Vac for each contact
Alarm Output	One (1) SPDT contact rated 10 Amps @ 120Vac, 8 Amps @ 240 VAC (resistive) Configurable for normal or fail-safe operations
Trip Output	One (1) SPDT contact rated 10 Amps @ 120Vac, 8 Amps @ 240 VAC (resistive) Configurable for normal or fail-safe operations
Remote Analog Output	4-20 mA into a load of up to 1000 ohms max. Proportional to hottest winding temperature ±1% (0° C => 4mA. 250° => 20mA)
† = TC-100 Only	

Description	Specification
EMC	
Immunity	- ANSI/IEEE C37.90.1-2002 - Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems - ANSI/IEEE C37.90.2-2004, Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers. - EN 61000-4-2 ESD - EN 61000-4-3 RF Radiated Immunity - EN 61000-4-4 EFT/Burst Immunity - EN 61000-4-5 Surge Immunity - EN 61000-4-6 RF Conducted Immunity - EN 61000-4-8 Power Frequency Magnetic Field Immunity - EN 61000-4-11 Voltage Variation Immunity
Emissions	- EN 50011 CISPR-11, Class A - CFR 47 FCC Part 15 Subpart B Class A
Clock	
Accuracy	+/- 1 minute/month @ 25° C
Backup	30 days with no control power
Logging	
Trend Data †	100 entries, logging interval programmable from 1 minute to 30 days
Alarm Events †	Last 25 alarm events
Trip Events †	Last 25 trip events
Maximum Temperature (All models)	Maximum instantaneous temperature stored for each channel (resettable from front panel)
Fan Wear †	Total Hours ON, Maximum Continuous Hours ON for each Fan Output. (resettable from front panel)
Memory Retention (All models)	40 years (with no power)
Mechanical (in Barrier Cabinet)	
Dimensions (HxWxD)	38.4 cm x 22.4 cm x 10.9 cm (15.12" x 8.82" x 4.28")
Weight	9.7 lbs.
Approvals	
Underwriters Laboratories	UL-873 Temperature-Indicating and Regulating Equipment
Canadian Standards Association	C22.2 No. 24-93 Temperature-Indicating and Regulating Equipment
† = TC-100 Only	

Appendix A - Programming Quick Reference Guide

Programming Table 1 - Reset Functions

Parameter Name	Front Panel Display Name	Description
Trend †	R-TREND	Resets the Trend log data
Alarm	R-ALARM	Resets the latched alarm relay (will not function if alarm condition(s) still exist)
Trip	R-Trip	Resets the latched trip relay (will not function if trip condition still exists)
Alarm Log †	R-ALMLOG	Resets the Alarm log data
Trip Log †	R-TRPLOG	Resets the Trip log data
Max Temperature Log	R-MAXLOG	Resets the maximum temperature recorded for each temperature channel.
All Logs	R-LOGS	Resets the Alarm, Tend, and Trip log data.
Fan Wear History †	R-FWEAR	Resets the transformer wear history. Sub-menus choose total on time and continuous on time for fan 1 and fan 2 individually.
† = TC-100 Only		

Programming Table 2 – Configuration Parameters

Parameter Name	Front Panel Display Name	Default Value	Range	Description
Display Mode	DISPMODE	Scroll	Scroll/Max	Controls front panel display to scroll through all measurements or always display the maximum temperature.
Temperature Display Unit	TEMP-C/F	Celsius	°C/°F	Display and set point units
Transformer Type	XFORMER	Dry	Dry/Cast	Informational only
Baud Rate ‡	MODBUS/BAUDRATE	9600	9600/19.2K/38.4K	Modbus communications rate
Parity ‡	MODBUS/PARITY	None	Odd/Even/None	Modbus parity setting
Stopbits‡	MODBUS/STOP-BIT	Two	One/Two	Modbus stop bit setting
Modbus Address ‡	MODBUSMB-ADDRS	1	1-249	Modbus address setting
Channel Setting	INPUT-CH/CH-DISPL	ABC	ABC/123/UVW	Channel identifier for display
Input1	INPUT-CH/CH-ON.OFF/INPUT1	On	On/Off	Thermocouple 1 on/off control
Input2	INPUT-CH/CH-ON.OFF/INPUT2	On	On/Off	Thermocouple 2 on/off control
Input3	INPUT-CH/CH-ON.OFF/INPUT3	On	On/Off	Thermocouple 3 on/off control
Input4	INPUT-CH/CH-ON.OFF/INPUT4	On	On/Off	Thermocouple 4 on/off control
Thermocouple Type	INPUT-CH/CH-THERM/TYPE	K-Type	K-Type/E-Type	Selects thermocouple type (all the same)

Parameter Name	Front Panel Display Name	Default Value	Range	Description
Reverse Detection	INPUT-CH/CH-THERM/RVRS-DET	On	On/Off	Enable/Disable the reverse thermocouple detection alarm. Alarm occurs when transformer thermocouple (channel 1, 2, and/or 3) is less than ambient (channel 4).
Fan 1 Setpoint	FAN/F-SETPNT/FAN1 STP	180(°C)	0-250(°C)/Off	Setpoint where Fan 1 turns on, or disable fan 1
Fan 2 Setpoint	FAN/F-SETPNT/FAN2 STP	190(°C)	0-250(°C)/Off	Setpoint where Fan 2 turns on, or disable fan 2
Fan Dead Band	FAN/F-DBAND	10(°C)	5-50(°C)	Hysteresis for fan turn off.
Number to activate Fan 1	FAN/ACT/FAN1 ACT	Any 1	Any 1/Any 2/All	Number of temperature channels required above the setpoint before fan 1 turns on
Number to activate Fan 2	FAN/ACT/FAN1 ACT	Any 1	Any 1/Any 2/All	Number of temperature channels required above the setpoint before fan 2 turns on
Fan 1 Wear Setting ‡	FAN/FAN-WEAR/FAN1 WS	8760	1-65000 (hours)	Number of hours fan 1 runs before fan wear indicator alarm activates.
Fan 2 Wear Setting ‡	FAN/FAN-WEAR/FAN2 WS	8760	1-65000 (hours)	Number of hours fan 2 runs before fan wear indicator alarm activates.
Fan Mode Control	FAN/FAN-MODE	Auto - Man	Auto/Manual/Auto-Man	Fan control mode: Auto is via setpoints only, Manual is via front panel FAN button only, Auto-Man is both.
FAN Exercise Cycle Time	FAN/INTERVAL	Off	Off/0.01-30 (days)	Fan exercise interval (time between fan turn-on)
FAN Exercise Run Time	FAN/RUN-TIME	1	1-120 (minutes)	Fan exercise run time.
Alarm Setpoint	ALARM/A-SETPNT	200(°C)	0-250(°C)/Off	Setpoint where Alarm Relay turns on, or disable Alarm Relay
Alarm Dead Band	ALARM/A-DBAND	5(°C)	5-20(°C)	Hysteresis for Alarm Relay turn off.
Alarm Fail Safe	ALARM/A-FSAFE	Off	On/Off	Alarm Relay Fail Safe mode. On means Alarm Relay is powered when no alarms are active.
Alarm Latch	ALARM/A-LATCH	On	On/Off	Alarm Relay Latch mode. On requires Reset after alarm condition goes away to retire the alarm.
Alarm Display	ALARM/A-DISP	On	On/Off	Alarm Display Mode. On allows all alarm conditions to be displayed on the front panel.
Buzzer	BUZZER/B-ON/OFF	Off	On/Off	Controls whether the audible alarm will activate if an alarm occurs or the front panel switch is pressed.
Buzzer Tone	BUZZER/B-TONE	Intermittent	Intermittent/Steady	Controls the audible alarm tone.
Trip Setpoint	TRIP/T-SETPNT	210(°C)	0-250(°C)	Setpoint where Trip Relay turns on, or disable Trip Relay
Trip Dead Band	TRIP/T-DBAND	5(°C)	5-20(°C)	Hysteresis for Trip Relay turn off.
Trip Fail Safe	TRIP/T-FSAFE	Off	On/Off	Trip Relay Fail Safe mode. On means Trip Relay is powered when the temperature is below the trip setpoint.
Trip Latch	TRIP/T-LATCH	On	On/Off	Trip Relay Latch mode. On requires Reset after trip condition goes away to change the trip relay state.
Trend Time Setting †	TREND	Hours	Minutes/Hours/Days/Off	Controls the time interval units for logging trend data, or disabling logging of trend data.

Parameter Name	Front Panel Display Name	Default Value	Range	Description
Trend Time Increment Setting †	TREND/HOUR (MINUTES or DAY)	12	1-60(minutes)1-24(hours)1-30(days)	Sets the time interval for logging trend data.
Discrete Input 1 Selection †	D-INPUT1/	Not Used	Not Used/Fan Fail/User Defined	Configures use of discrete input 1
Discrete Input 1 Edge †	D-INPUT1/	Not Applicable		Varies with use, needs further explanation
Discrete Input 1 Effect †	D-INPUT1/	Not Applicable		Varies with use, needs further explanation
Discrete Input 2 Selection †	D-INPUT2/	Not Used	Not Used/Fan Fail/User Defined	Configures use of discrete input 2
Discrete Input 2 Edge †	D-INPUT2/	Not Applicable		Varies with use, needs further explanation
Discrete Input 2 Effect †	D-INPUT2/	Not Applicable		Varies with use, needs further explanation
Year	TIME.DATE/DATE/YEAR	2009	2000-3000	Set the current year for alarm and trip history and trend logging.
Month	TIME.DATE/DATE/MONTH	1	1-12	Set the current month for alarm and trip history and trend logging.
Day	TIME.DATE/DATE/DAY	1	1-31	Set the current day for alarm and trip history and trend logging.
Hours	TIME.DATE/TIME/HOUR	1	1-24	Set the current hour for alarm and trip history and trend logging.
Minutes	TIME.DATE/TIME/MINUTES	1	1-60	Set the current minute for alarm and trip history and trend logging.
Change Password	CHW-PWD	0000	0000-FFFF	Change the password.
† = TC-100 Only ‡ = TC-50 Modbus and TC-100				

Programming Table 3 – Test functions.

Parameter Name	Front Panel Display Name	Description
Test Relays	T-RELAY	Tests the two fan relays and the alarm and trip relays by allowing the user to raise the temperature above the programmed setpoint. Press Back to return to the previous menu.
Internal Temperature	T-INT	Displays the internal unit temperature. Press Back to return to the Test menu.
Test Display	T-DISP	Lights up all segments of the 8-character display. Displays TEST OVR when done. Press Back to return to the Test menu.
Test Buttons	T-BUTTON	Displays the button name of each button pressed. Press Test button again to return to the test menu.
Test LEDs	T-LED	Lights all LEDs for several seconds. Displays TEST OVR when done. Press Back to return to the Test menu.

Appendix B - Modbus Registers

Table 1 - Modbus Read Only Parameters

Function Code	Register Address (Decimal)	Register Address (Hex)	Register Type	Parameter Description	Data Range (Units)	Number of Bytes
3	40001	1	Read Only	FAN1 Wear Time	0 – 65000 (hours)	2
3	40002	2	Read Only	FAN2 Wear Time	0 – 65000 (hours)	2
3	40003	3	Read Only	FAN1 Max On Time	0 – 3600 (hours)	2
3	40004	4	Read Only	FAN2 Max On Time	0 – 3600 (hours)	2
3	40005	5	Read Only	Firmware Version	1 to 100	2
3	40006	6	Read Only	Hardware Version	1 to 100	2
3	40007	7	Read Only	Winding 1 Temperature	0 – 255 (°C or °F *)	2
3	40008	8	Read Only	Winding 2 Temperature	0 – 255 (°C or °F *)	2
3	40009	9	Read Only	Winding 3 Temperature	0 – 255 (°C or °F *)	2
3	40010	A	Read Only	Ambient Temperature	0 – 255 (°C or °F *)	2
3	40011	B	Read Only	Max Temperature	0 – 255 (°C or °F *)	2
3	40012	C	Read Only	Average Temperature	0 – 255 (°C or °F *)	2
3	40013	D	Read Only	Winding 1 Max Temperature	0 – 255 (°C or °F *)	2
3	40014	E	Read Only	Winding 2 Max Temperature	0 – 255 (°C or °F *)	2
3	40015	F	Read Only	Winding 3 Max Temperature	0 – 255 (°C or °F *)	2
3	40016	10	Read Only	Ambient Max Temperature	0 – 255 (°C or °F *)	2
3	40017	11	Read Only	Phase With Maximum Temperature	bit 0 is always a 1 bit 1 = 1 = Winding 1 bit 2 = 1 = Winding 2 bit 3 = 1 = Winding 3	2
3	40018	12	Read Only	Diagnostic Status	bit 0 = 1 = Some other bit is 1 bit 1 = 1 = Over bit 2 = 1 = Air Flow not Detected bit 3 = 1 = Temperature Decrease not Detected bit 4 = 1 = EEPROM Failure bit 5 = 1 = Isothermal block Out of Range bit 6 = 1 = Fan WearOut bit 7 = 1 = Max Fan On Time bit 8 = 1 = Open Circuit Alarm bit 9 = 1 = Reverse Circuit Alarm bit 10 = 1 = FRAM Alarm	2

Modbus Table 1 - Modbus Read Only Parameters (Cont'd)						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range (Units)**	**Number of Bytes**
3	40019	13	Read Only	Relay Status	bit 0 = 1 = Some other bit is 1 bit 1 = 1 = ON,FAN1 Relay state bit 2 = 1 = ON,FAN2 Relay state bit 3 = 1 = ON,Alarm Relay state bit 4 = 1 = ON,Trip Relay state bit 5 = 1 = ON, Buzzer State	2
3	40020	14	Read Only	Serial Number	1 to 65535	2
3	40021	14	Read Only	Data Code	packed BCD yyyymmddy	4
3	40023	17	Read Only	Device Type	1 - TC-100 2 - TC-50 Modbus TC - 50	2
† = TC-100 Only						

Modbus Table 2 - Modbus Write Only Parameters						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range**	**Number of Bytes**
6/16	40033	21	Write Only	FAN Control	1 - toggles ON/OFF	2
6/16	40034	22	Write Only	Buzzer Control	1 - toggles ON/OFF	2

Modbus Table 3 - Modbus Read/Write Parameters						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range**	**Number of Bytes**
Code	40071	47	Read/Write	Reset Menu Password Change	4 digits, 0-9 and A-F	4

Modbus Table 4 - Modbus Configurations						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range**	**Number of Bytes**
3/6/16	40101	65	Read/Write	Display Mode	0 – Scroll 1 – Max	2
3/6/16	40102	66	Read/Write	Temp Display Unit	0 – C 1 – F	2
3/6/16	40103	67	Read/Write	Transformer Type	0 – Dry 1 – Caste	2
3/6/16	40104	68	Read/Write	Modbus Baudrate	0 = 9600 1 = 19.2k 2 = 38.4k	2

Modbus Table 4 - Modbus Configurations (Cont'd)						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range**	**Number of Bytes**
3/6/16	40105 ‡	69	Read/Write	Modbus Parity	0 – None 1 – Even 2 – Odd	2
3/6/16	40106 ‡	6A	Read/Write	Modbus Stop Bits	1 – One 2 – Two	2
3/6/16	40107 ‡	6B	Read/Write	Modbus Address	1 – 247	2
3/6/16	40108	6C	Read/Write	Active Channels	bit 0 = 1 = Activate Input 1 bit 1 = 1 = Activate Input 2 bit 2 = 1 = Activate Input 3 bit 3 = 1 = Activate Input 4	2
3/6/16	40109	6D	Read/Write	Channel Display Setting	0 – ABC 1 – UVW 2 – 123	2
3/6/16	40110	6E	Read/Write	Thermocouple Type	0 – K 1 – E	2
3/6/16	40111	6F	Read/Write	Reverse Detection	0 – OFF 1 – ON	2
3/6/16	40112	70	Read/Write	FAN 1 Setpoint in Fahrenheit	32 – 482, OFF(0x0FFF)	2
3/6/16	40113	71	Read/Write	FAN 2 Setpoint in Fahrenheit	32 – 482, OFF(0x0FFF)	2
3/6/16	40114	72	Read/Write	FAN DeadBand in Fahrenheit	41 – 122	2
3/6/16	40115	73	Read/Write	Number to activate Fan 1	1-Any 1, 2-Any 2, 3-All	2
3/6/16	40116	74	Read/Write	Number to activate Fan 2	1-Any 1, 2-Any 2, 3-All	2
3/6/16	40117	75	Read/Write	FAN 1 Wear Setting	1-65000 †	2
3/6/16	40118	76	Read/Write	FAN 2 Wear Setting	1-65000 †	2
3/6/16	40119	77	Read/Write	FAN Mode Control	1 = Auto 2 = Manual 3 = Auto-Manual	2
3/6/16	40120	78	Read/Write	FAN Exercise Cycle Time	(0.01-30)*100, OFF(0x0FFF)	2
3/6/16	40121	79	Read/Write	FAN Exercise Run Time	1-120	2
3/6/16	40122	7A	Read/Write	Alarm Setpoint in Fahrenheit	32 – 482, OFF(0x0FFF)	2
3/6/16	40123	7B	Read/Write	Alarm DeadBand in Fahrenheit	41 – 68	2

Modbus Table 4 - Modbus Configurations (Cont'd)						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range**	**Number of Bytes**
3/6/16	40124	7C	Read/Write	Alarm Fail Safe	0 = OFF 1 = ON	2
3/6/16	40125	7D	Read/Write	Alarm Latch	0 = OFF 1 = ON	2
3/6/16	40126	7E	Read/Write	Alarm Display	0 = OFF 1 = ON	2
3/6/16	40127	7F	Read/Write	Trip Setpoint in Fahrenheit	32 – 482, OFF(0x0FFF)	2
3/6/16	40128	80	Read/Write	Trip DeadBand in Fahrenheit	41 – 68	2
3/6/16	40129	81	Read/Write	Trip Fail Safe	0 = OFF 1 = ON	2
3/6/16	40130	82	Read/Write	Trip Latch	0 = OFF 1 = ON	2
3/6/16	40131	83	Read/Write	Buzzer	0 = OFF 1 = Trigger on Alarm 2 = Trigger on Trip 3 = Any	2
3/6/16	40132	84	Read/Write	Buzzer Tone	0 – Intermittent 1 = Continuous	2
3/6/16	40133	85	Read/Write	Trend Time Unit	0 – Off † 1 – Minutes † 2 – Hours † 3 – Days †	2
3/6/16	40134	86	Read/Write	Trend time Value	0-60 †	2
3/6/16	40135	87	Read/Write	Discrete Input 1 Selection	0 – Not Used † 1 – Fan Fail † 2 – User Defined †	2
3/6/16	40136	88	Read/Write	Discrete Input 1 Edge	0 – Not Applicable † 1 – Open † 2 – Close † 3 – Direct4 – Invert †	2
3/6/16	40137	89	Read/Write	Discrete Input 1 Effect	0 – Not Applicable † 1 – Alarm Only † 2 – Alarm + Fan1 † 3 – Alarm + Fan2 † 4 – Alarm † 5 – Trip † 6 – Fan2 † 7 – Fans ON † 8 – Fans OFF †	2

Modus Table 4 - Modbus Configurations (Cont'd)						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range**	**Number of Bytes**
3/6/16	40138	8A	Read/Write	Discrete Input 2 Selection	0 – Not Used † 1 – Fan Fail, † 2 – User Defined †	
3/6/16	40139	8B	Read/Write	Discrete Input 2 Edge	0 – Not Applicable † 1 – Open, † 2 – Closed, † 3 – Direct, † 4 – Invert †	
3/6/16	40140	8C	Read/Write	Discrete Input 2 Effect	0 – Not Applicable † 1 – Alarm Only † 2 – Alarm + Fan1 † 3 – Alarm + Fan2 † 4 – Alarm † 5 – Trip † 6 – Fan2 † 7 – Fans ON † 8 – Fans OFF †	2
3/6/16	40141	8D	Read/Write	RTC_Year	2000 – 3000	2
3/6/16	40142	8E	Read/Write	RTC_Month	1 – 12	2
3/6/16	40143	8F	Read/Write	RTC_Day	1 – 31	2
3/6/16	40144	90	Read/Write	RTC_Hour	0 – 23	2
3/6/16	40145	91	Read/Write	RTC_Minute	0 – 59	2
3/6/16	40146	92	Read/Write	FAN 1 Setpoint in Celsius	0 – 250, OFF(0x0FFF)	2
3/6/16	40147	93	Read/Write	FAN 2 Setpoint in Celsius	0 – 250, OFF(0x0FFF)	2
3/6/16	40148	94	Read/Write	FAN DeadBand in Celsius	5 to 50	2
3/6/16	40149	95	Read/Write	Alarm Setpoint in Celsius	0 – 250, OFF(0x0FFF)	2
3/6/16	40150	96	Read/Write	Alarm DeadBand in Celsius	5 to 20	2
3/6/16	40151	97	Read/Write	Trip Setpoint in Celsius	0 – 250, OFF(0x0FFF)	2
3/6/16	40152	98	Read/Write	Trip DeadBand in Celsius	5 to 20	2
† = TC-100 Only ‡ = TC-50 Modbus and TC-100						

Modbus Table 5 - Modbus Logs						
Function Code	**Register Address (Decimal)**	**Register Address (Hex)**	**Register Type**	**Parameter Description**	**Data Range (Units)**	**Number of Bytes**
3	40201 - 40207, † 40208 - 40214, ... 40894 - 40900	C9 – CF D0 - D6, ... 37E – 384	Read Only	Trend Log	The data format for this log is detailed below.	14 Bytes (7 Registers) Per Each Record 100 Records Max.
3	40901 - 40908, † 40909 - 40916, ... 41093 - 41100	385 – 38C 38D – 394, ... 445 – 44C	Read Only	Trip Log	The data format for this log is detailed below.	16 Bytes (8 Registers) Per Each Record, 25 Records Max.
3	41101 – 41108 † 41109 - 41116 . . . . 41293 - 41300	44D – 454, 455 – 45C 50D – 514	Read Only	Alarm Log	Alarm Log	16 Bytes (8 Registers) Per Each Record 25 Records Max.
† = TC-100 Only						

The data format for each log is detailed below.

Trend Log Format (14 Bytes)		
Byte Number	**Description**	**Data Range**
1	Series Number	1-100
2	Winding 1 Temperature	0-255 °C
3	Winding 2 Temperature	0-255 °C
4	Winding 3 Temperature	0-255 °C
5	Ambient Temperature	0-255 °C
6	Temperature Unit Setting at Time of Log Entry	0= °C, 1= °F
7	Time Stamp – Hour	0-23
8	Time Stamp – Minute	0-59
9	Time Stamp – Second	0-59
10	Time Stamp – Month	1-12
11	Time Stamp – Day	1-31
12-13	Time Stamp – Year	2000-3000
14	Record Separator	255

Trip Log Format		
Byte Number	**Description**	**Data Range**
1	Series Number	1-25
2-3	Trip Event	Bit 0 = 1 - Airflow Not Detected (TC-100 Only) Bit 1 = 1 - Over Temperature
4	Winding 1 Temperature	0-255 °C
5	Winding 2 Temperature	0-255 °C
6	Winding 3 Temperature	0-255 °C
7	Ambient Temperature	0-255 °C
8	Temperature Unit Setting at Time of Log Entry	0= °C, 1= °F
9	Time Stamp – Hour	0-23
10	Time Stamp – Minute	0-59
11	Time Stamp – Second	0-59
12	Time Stamp – Month	1-12
13	Time Stamp – Day	1-31
14-15	Time Stamp – Year	2000-3000
16	Record Separator	255

Alarm Log Format		
Byte Number	**Description**	**Data Range**
1	Series Number	1-25
2-3	Alarm Event	bit 0 = 1 - Over Temperature
		bit 1 = 1 - Air Flow not Detected (TC-100 only)
		bit 2 = 1 - Temperature Decrease not Detected
		bit 3 = 1 - EEPROM Failure
		bit 4 = 1 - Isothermal Block Out of Range
		bit 5 = 1 - Fan Wear Out (TC-100 only)
		bit 6 = 1 - Max Fan On Time (TC-100 only)
		bit 7 = 1 - Open Circuit Alarm
		bit 8 = 1 - Reverse Circuit Alarm
		bit 9 = 1 - FRAM Alarm
4	Winding 1 Temperature	0-255 °C
5	Winding 2 Temperature	0-255 °C
6	Winding 3 Temperature	0-255 °C
7	Ambient Temperature	0-255 °C
8	Temperature Unit Setting at Time of Log Entry	0= °C 1= °F
9	Time Stamp – Hour	0-23
10	Time Stamp – Minute	0-59
11	Time Stamp – Second	0-59
12	Time Stamp – Month	1-12
13	Time Stamp – Day	1-31
14-15	Time Stamp – Year	2000-3000
16	Record Separator	255

Notes:

Instruction Manual IM02602008E - Rev. D

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Printed in USA
Publication No. IM02602008E - Rev. D
Style No. 66A2454H01 TBG 001453
May 2019

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