

Electronic Cooling Monitor
for Liquid-Filled
Transformers

509-200

Operations Manual
IST-072-2

QualiTROL

Electronic Cooling Monitor for Liquid-

Filled Transformers

Operations Manual

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QualiTROL

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OVERVIEW

QualiTROL Electronic Cooling Monitor

The QualiTROL Electronic Cooling Monitor (ETM) for Liquid-Filled Transformers (Model #509-200 Series) is an Intelligent Electronic Device (IED). Combining microprocessor technology and advanced digital signal processing, to accurately assess the health, and performance of three phase or autotransformers.

The 509 can be tailored to suit the application. The ETM can monitor up to eight total parameters. Requiring inputs from Resistance Temperature Detectors (RTD's), Current Transformers, AC Voltage (0-140 or 0 –320 VAC), Current loops (0-1 or 4-20 ma DC), DC Voltage (0-100 mv or 0-10V), or Switch Contact Closure, this complete transformer monitoring system can monitor parameters such as: Liquid Temperatures (Main Tank Top or Bottom, Load Tap Changer), Winding Temperatures, Ambient Temperatures, Winding Current, Cooling Bank Currents, and a variety of parameters from transducers such as Tank Pressure, or Dissolved Gas in Oil analysis. The 509 Transformer Monitor offers:

- Advanced thermal modeling of winding temperatures
- Superior temperature control for higher loads
- Integrated Load Tap Changer temperature monitoring
- Stand alone or networked substation monitoring
- Diagnostic tool for condition based maintenance
- Eight (8) form C adjustable relays to operate cooling equipment, signal alarms, and provide trip functions, depending on transformer conditions
- Up to four (4) 0-1 or 4-20 ma DC loops for use with SCADA systems
- Digital communication ports RS-232, RS-485

The device is extremely easy to install and use. It is designed to be mounted outdoors (heater available inside enclosure), in the transformer control cabinet or in a 19 inch control rack and is powered by a universal power supply of 90-264 VAC 47-63 Hz single phase power or 40-290 VDC. It comes with user-friendly

computer aided setup software, and can be supplied with non-intrusive, easy to retrofit sensors.

QualiTROL

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

About This Manual

This manual provides all the information you will need to configure, install, and operate your QualiTROL Electronic Transformer Monitor. It is organized into the following sections:

Controls, Indicators, and Modules — Diagrams and brief descriptions to help you locate and understand basic functions of each of the controls, indicators, and modules that make up the QualiTROL ETM.

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

Operation — A description of automatic operation, as well as easy instructions on how to view parameters, and set points, reset memories, program the ETM using the *Keypad*, and test the system.

Functional Specification — A detailed functional specification of the unit.

Appendix — A functional wiring diagram for your reference, an example of the front panel menu diagram, a rear cover view and a Configuration Table in which to record settings and connections to the ETM.

CONTROLS, INDICATORS, AND MODULES

Front Panel

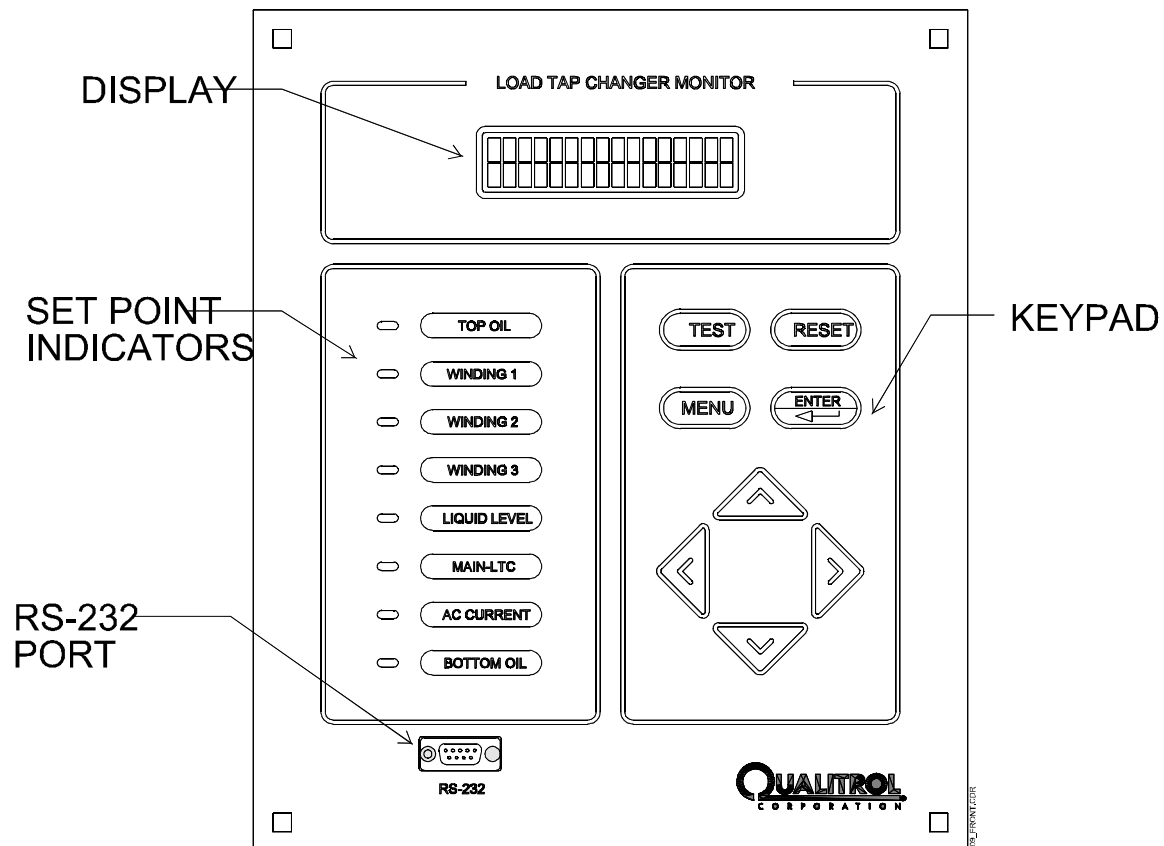
The functions of the display and the keypad on the Front Panel are described below. For operating instructions, refer to the “Operation” section.

DISPLAY — Automatically scrolls through the channels and displays the channel name and the value of the parameter every 2 seconds. Also used to display the selected indications of the keypad control.

Keypad — The *ENTER* key is used to change menu modes or accept changes to values, the *TEST* key displays the setpoint source and value on the DISPLAY, the *MENU* key is used to access the programming menu, The *RESET* key is used to reset the maximum and minimum values (while in the program menu) The *ARROWS* keys are used to move around in the various menus. For a full operation description, refer to the “Operation” section.

Set Point Indicators — A red LED illuminates to indicate that the set point for the relay indicated on the overlay has been exceeded.

RS-232 Port — When used with the QualiTROL software, this port allows for the setup of all of the parameters of the Transformer Monitor. See Software Manual for a full description of this set up procedure.



Modules

The modules comprising the QualiTROL ETM include:

- 509-RTD Input Module
- 509-CT Input Module
- 509-AC Voltage Input Module
- 509-Potentiometer Input Module
- 509-DC Voltage Input Module
- 509 Current Input Module
- 509-Dry Contact Closure Module
- 509-Powered Contact Closure Module

This section describes the function and key components of each of these modules.

509-RTD Input Module

RTD Input Modules are provided for monitoring Liquid, Ambient or if used in a heated well, winding temperatures. The input to the module is either a 10 ohm copper or a 100 ohm platinum RTD(factory configured).

For measuring Liquid or Ambient temperatures the Module is scaled over the range of -40°C to 120°C . If it is used in a heated well then the scale is -40° to 200°C . This needs to be specified when ordering the 509 unit from the factory.

509-CT Input Module

The CT Input Module is provided for monitoring Winding Temperatures, Winding Currents, Motor Currents of LTC's or fan currents. The inputs to the module is a clamp on CT provided by QualiTROL, that have an input range of 0-5A, 0-10A, or 0-20A(other ranges available), and have an output of 0-0.333VAC(to be used as the input to the CT Input Module).

If this Module is used for temperatures, the scaling is in the range of -40°C to 200°C ; for anything other than temperature, the range is scalable to a maximum of 99999.9.

509-AC Voltage Input Module

The AC Voltage Input Module is used to monitor any AC Voltages under 320 VAC. The Input Module works in conjunction with the Qualitrol Voltage Sensor (TRA-600-1) and measures ranges of either 0 to 140 VAC or 0 to 320 VAC.

The range is scalable to a maximum of 99999.9.

509-Potentiometer Input Module

The Potentiometer Input Module is provided for monitoring Liquid Level, Flow Gauges, or Gas Accumulation. The input to the module is a potentiometer (typically supplied by QualiTROL). The range of the potentiometer input is up

to 15000 ohms. Typically, the 25° mark on a liquid level dial is set to the center of the potentiometer range, and the high and low readings are simply ratios of the angular deflections from the “normal”(QualiTROL gauges use a 340 angular degree potentiometer on a 2:1 gear ratio from the dial travel to the potentiometer travel). The Potentiometer module must be calibrated on site. See the calibration section in the software manual for instructions on how to do this.

The Scaling of the ETM is 0 to 100 percent for this module.

509-DC Voltage Input Module

The Voltage Input Module is provided for Monitoring Transducer outputs with an output signal in either the 0-100 mV DC or 0-10VDC volt range.

The range is scalable to a Maximum of 99999.9 for this module.

509-Current Input Module

The Current Input Module is provided for Monitoring Transducer outputs with an output signal in either the 0-1 ma DC or 4-20 ma DC range. These could be devices such as pressure transducers for measuring main tank pressure, bushing pressure, or dissolved gas in oil transducers.

The input module can be configured to operate with either two wire loop transducers (powered by the module), or three wire transducers, either powered by the module, or powered from the transducer.

The range is scalable to a Maximum of 9999.99 for this module.

509-Dry Contact Closure Module

The Contact Closure Module is provided for monitoring a contact and simply indicating on the display whether it is open or closed. An open means there is no connection between the contacts while closed signifies a shorted connection across the contacts. This can be used to ensure or monitor pumps or fans for example. The system internal treats closed and open as either a 0 or 100. Therefore if the module is used to control a relay the relay setpoint should be set midrange (e.g. 50).

This Module can monitor a non-powered (dry) contact.

509-Powered Contact Closure Module

The Powered Contact Closure Module is provided for monitoring a powered contact and simply indicating on the display whether it is open or closed. An open means there is no connection between the contacts while closed signifies a shorted connection across the contacts. This can be used to monitor alarms or active fans for example. The system internal treats closed and open as either a 0 or 100. Therefore if the module is used to control a relay the relay setpoint should be set midrange (e.g. 50).

This Module can monitor a powered contact (>80V AC or DC).

INSTALLATION

Location and Mounting

Enclosure Style

The QualiTROL Electronic Transformer Monitor is 3R enclosure style designed to be back-mounted on any smooth surface. Four 0.31 by 0.50 oval slots are provided for use with suitable fasteners. The Transformer Monitor requires an approximate area of 13" wide by 16" high and is 8 1/2" deep. Additional area below the Temperature Monitor should be allotted for wiring harness. See *Figure 1* for mounting centers and dimensions.

Panel Mount Style

The QualiTROL Electronic Transformer Monitor is designed to be flush-mounted inside a transformer control cabinet on any smooth surface. Four 0.28" square holes are provided for use of 1/4" diameter fasteners (suitable for 0.25" carriage bolts). The Transformer Monitor requires an approximate area of 11" wide by 13" high and is 3" deep. Additional area below the Transformer Monitor should be allotted for wiring harness. See *Figure 1*.

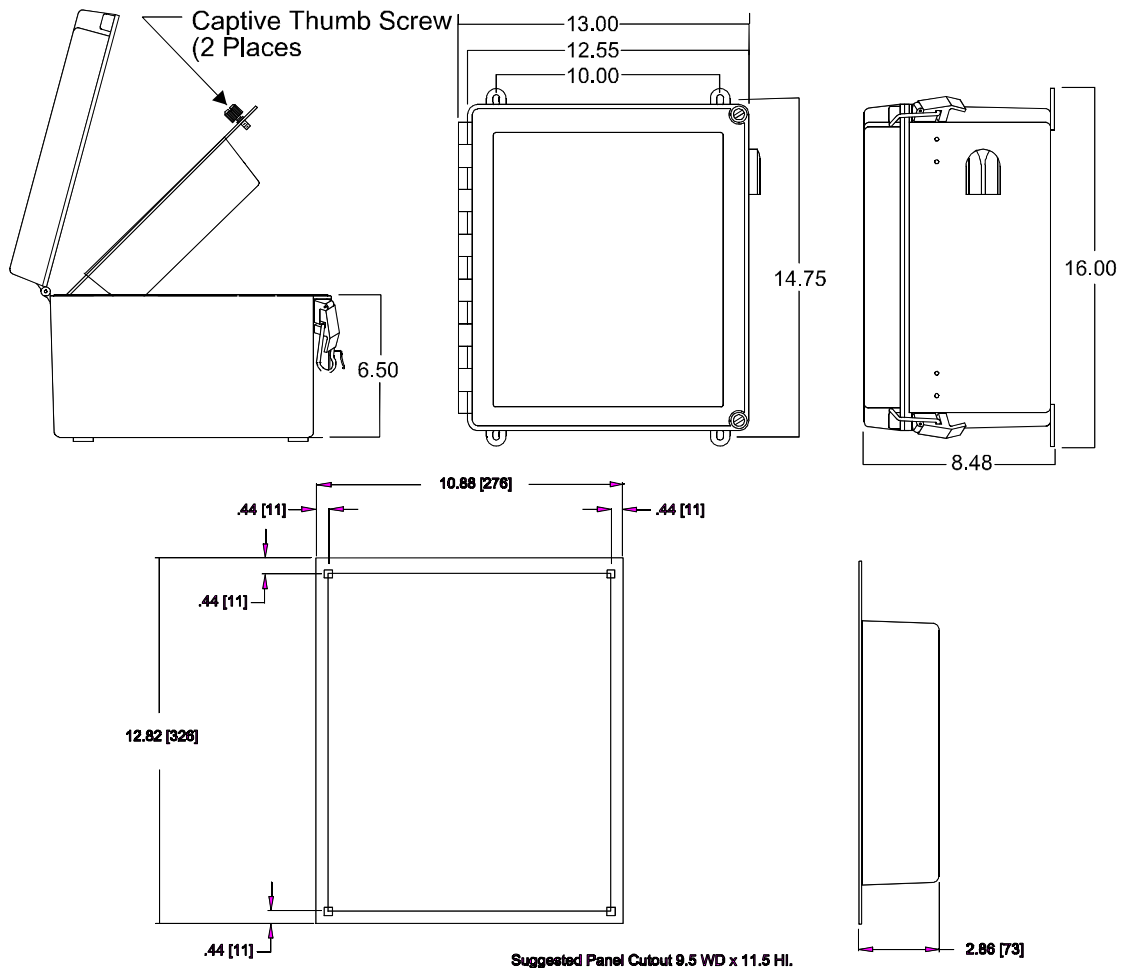


Figure 1. Mounting

Rack Mount Style

The QualiTROL Electronic Transformer Monitor is also designed to be rack mounted in a 19-inch transformer control cabinet. The Transformer Monitor is 3U high, approximately 10.5" deep and requires four screws to mount it in the control rack. Additional area behind the Temperature Monitor should be allotted for the wiring harness. See *Figure 1a* for the mounting centers and dimensions.

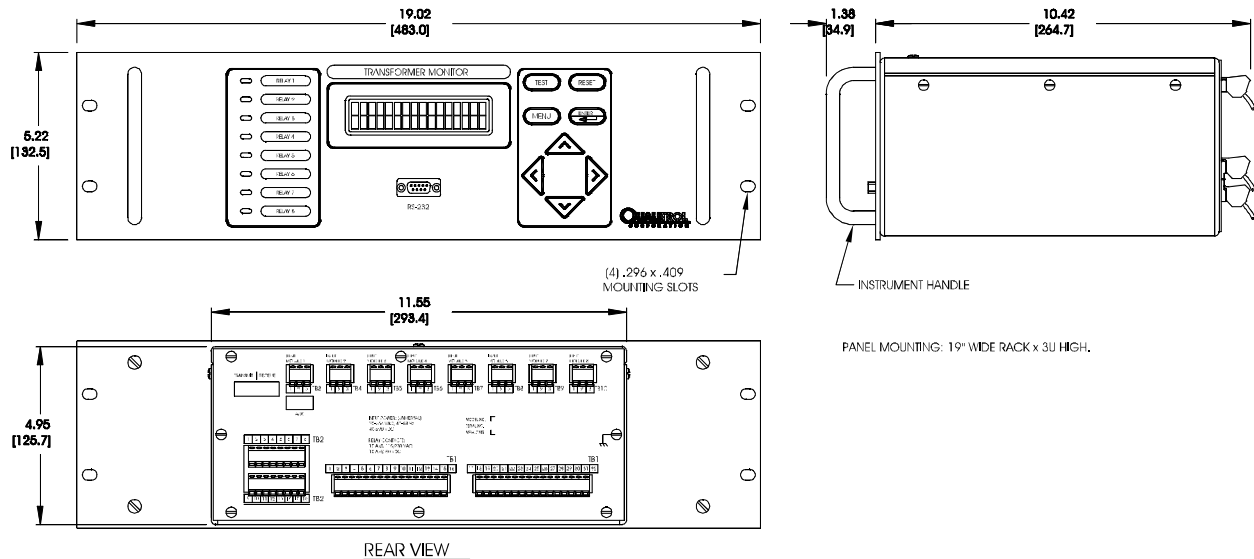


Figure 1a. Mounting – 19" Rack Mount

Power Supply

Supply power is applied to Terminal Block TB1 terminals 14 and 15. For DC inputs positive voltage is applied to terminal 14 and ground or negative voltage is applied to terminal 15. Chassis ground is applied to terminal number 16 as shown in *Figure 2*. This non-metallic enclosure does not automatically provide a common grounding lug. Grounding must be provided as part of the installation, and must be in accordance with the requirements of the National Electrical Code.

For the 5KV impulse unit supply power is applied to Terminal Block TB12 terminals 1, 3 and 5 as shown in *Figure 2a*.

For the Rack Mount Unit supply power is applied to Terminal Block TB1 terminals 30, 31 and 32 as shown in *Figure 2b*.

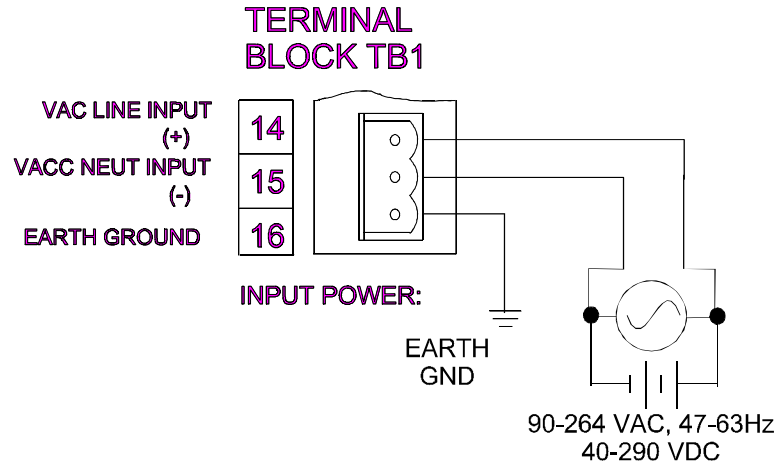


Figure 2. Power Supply Connection

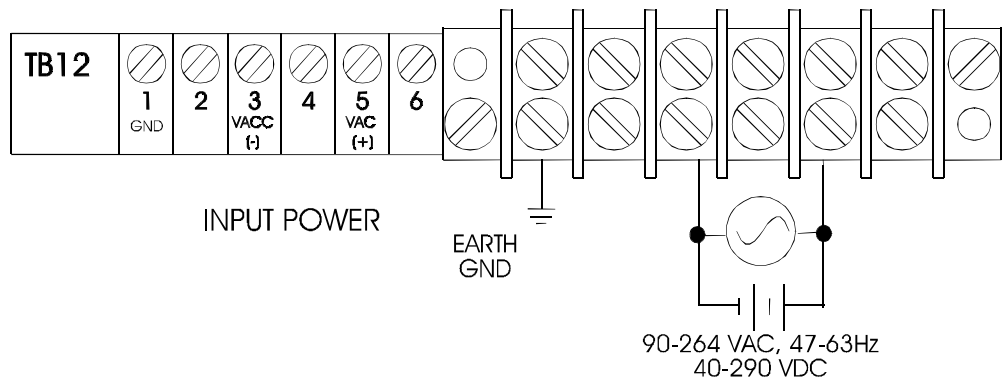


Figure 2a. Power Supply Connection for 5 KV impulse unit

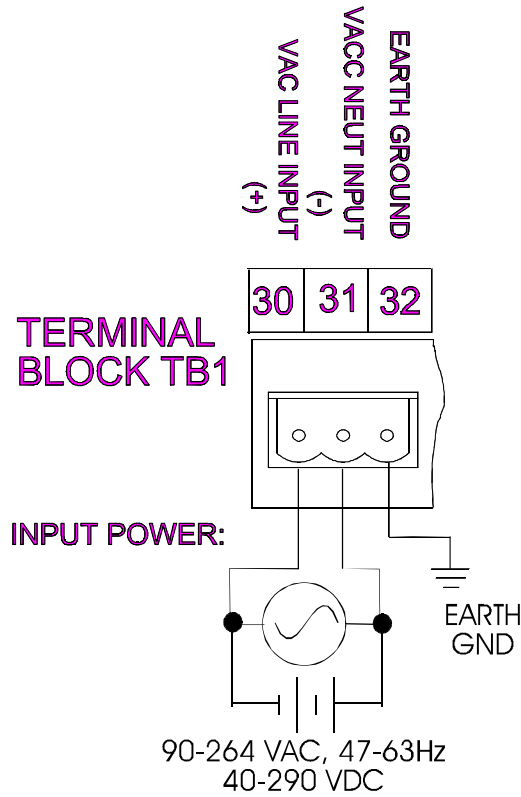


Figure 2b. Power Supply Connection for 19" Rack Mount unit

The power supply has an internal removable fuse. If it becomes necessary to replace this fuse, it must be replaced with the same type and rating. Failure to do so may impact warranty issues.

Heater Option

If the Enclosure or Panel Mount unit is supplied with Heater Option, the supply power (120 or 240 VAC as specified by option) is applied to Terminal Block TB1 terminals 1 and 17 as shown in *Figure 3*:

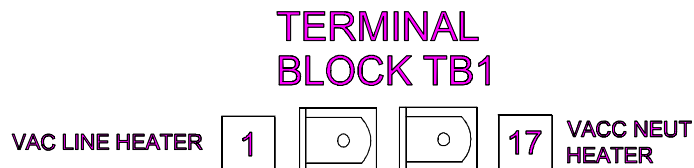


Figure 3. Heater option connection

If the Rack Mount unit is supplied with the Heater Option, the supply power (120 or 240 VAC as specified by the option) is applied to Terminal Block TB1 at terminals 16 and 17 as shown in *Figure 3a*.



Figure 3a. Heater option connection for 19" Rack Mount unit

It is recommended that the heater circuit be fused for safety and protection purposes. This fuse is the responsibility of the installer. The rating of the heater is 120 volts AC and 100 watts. A 240 volt AC heater uses 2 of these heaters in series (a total of 200 watts). Qualitrol recommends a slow blow fuse rated at 1.25 or 1.5 Amps (600V).

RTD Input Module

Each RTD input module is specifically built to function with **only** a 10 ohm copper RTD or **only** a 100 ohm Platinum RTD. For each RTD input module one standard 10 Ω RTD or 100 Ω RTD (as specified), with a three conductor shielded cable is required to measure liquid temperature, ambient temperature or if in a heated well, winding temperature. The three conductors and the shield drain lead are connected to the Transformer Monitor as shown in *Figure 4*.

NOTE: RTD WIRING TO BE CONTINUOUS AND SHIELD DRAIN LEAD MUST BE GROUNDED ONLY AT INSTRUMENT.

The Transformer Monitor provides a compensation scheme for the RTD cable connection. The three-wire connection compensates for the resistance of the connecting wires.

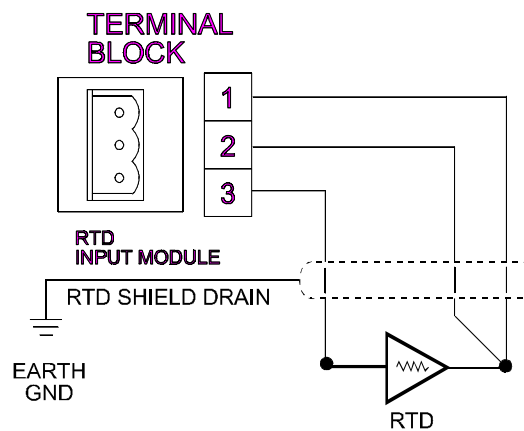


Figure 4. RTD Input Wiring Connections

If you are retrofitting an existing Qualitrol device, or if the RTD you have installed is a four wire RTD, **DO NOT** connect the fourth wire in parallel with the third wire, this will adversely affect the compensation scheme. **IF YOU HAVE A FOURTH WIRE ON THE RTD CONNECTION, CUT THE FOURTH WIRE FLUSH TO THE JACKET.**

NOTE: Due to dimensional and mounting variations, the RTD, well, and connector must be ordered separately.

CT input Module

For each CT input module one standard Clamp on CT (input current range as specified), is required to measure Winding Temperature, or Currents.

Pull the supplied CT Sensor apart and place the wire which carries the current to be sensed into the CT opening, and push the CT sensor back together, making sure it is fully engaged. Connect output wires of Clamp on CT to Terminal board as shown in *Figure 5*.

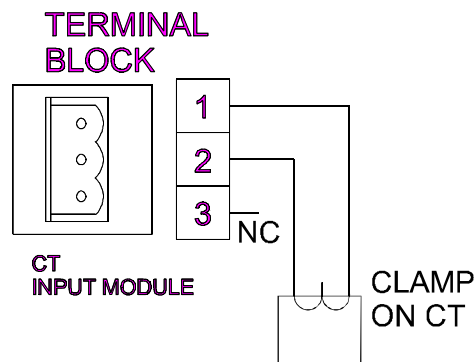


Figure 5. CT Input Connections

AC Voltage Input Module

For each AC Voltage Input Module one AC Voltage Sensor (TRA-600-1) is required to measure AC Voltage. The Module can measure either 0 – 140 VAC or 0 – 320 VAC, 50/60 Hz; as specified at the factory. Connect the voltage to be measured to the Sensor input terminal block TB1 of the Voltage Sensor. Then connect the Sensor output to the terminal block of the AC Voltage Input Module as shown; see *Figure 6*.

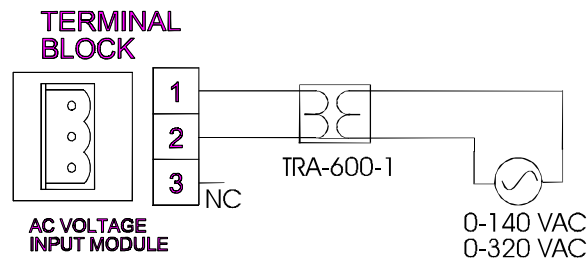


Figure 6. AC Voltage Input Connections

Potentiometer Input Module

For each Potentiometer input module one standard potentiometer in the range of 0 to 15000 ohms (as supplied by various QualiTROL case assemblies) is required to measure Liquid Level, Flow, or Gas Accumulation. The Potentiometer input

module must be calibrated on site. See the calibration section in the software manual for instructions on how to do this.

The three conductors and the shield drain lead are connected to the Transformer Monitor as shown in *Figure 7*.

NOTE: WIRING TO BE CONTINUOUS AND SHIELD DRAIN LEAD MUST BE GROUNDED ONLY AT INSTRUMENT.

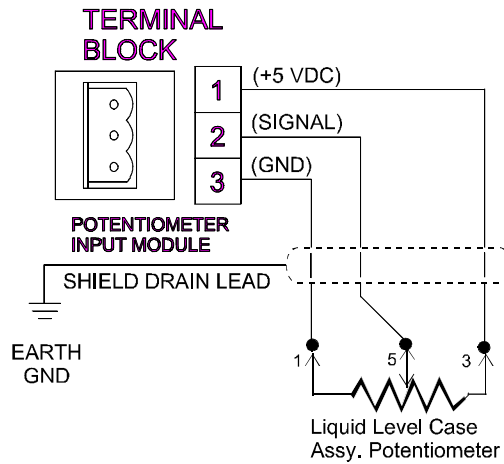


Figure 7. Potentiometer Input Connections

DC Voltage Input Module

For each Voltage input module one voltage transducer (0-100mV DC or 0-10 VDC as specified), is required.

Connect output wires of Transducer to Terminal Block as shown in *Figure 8*.

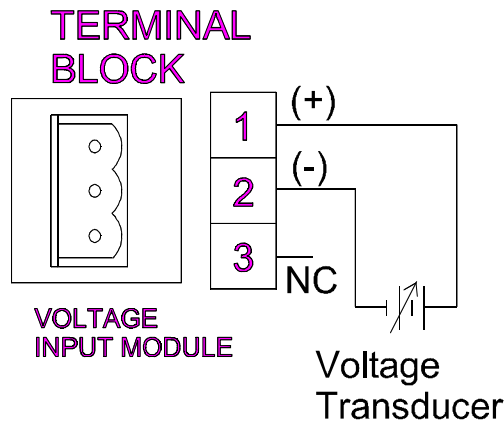


Figure 8. Voltage Input Wiring

Current Input Module

The Current input Module is configurable to accept either a 0-1 ma DC or a 4-20 ma DC (SCADA type) signal. Either of these options can be a transducer that is:

1. 2 wire (self powered from the transducer)
2. 2 wire (powered from the input module)
3. 3 wire (powered from the input module)

For each Current input module one current transducer (0-1ma DC or 4-20 ma DC), is required.

Connect output wires of Transducer to Terminal Block as shown in *Figure 9*.

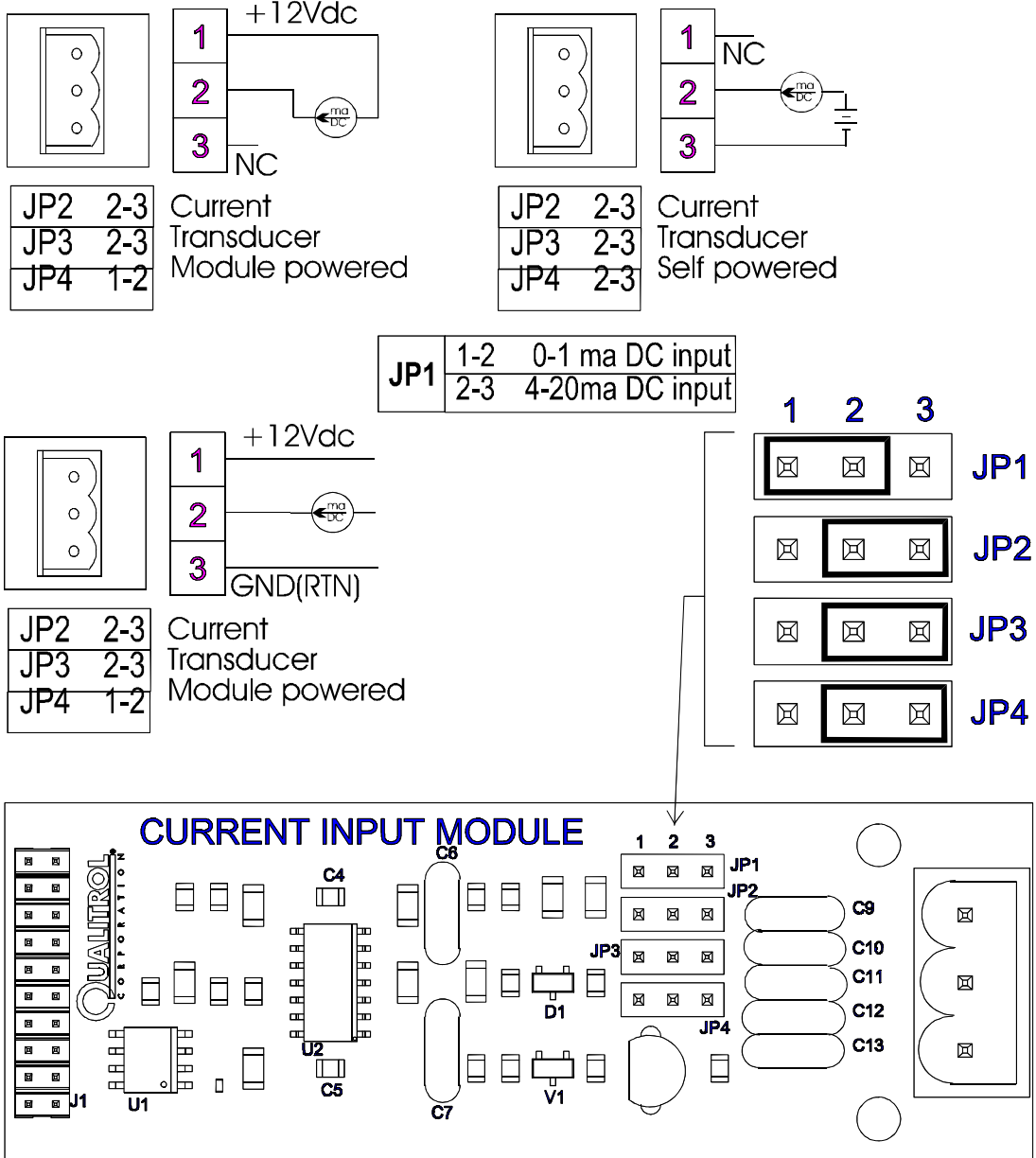


Figure 9. Current Input Wiring

Dry Contact Closure Input Module

The Dry Contact (Switch) Closure Input Module is designed to detect the actuation or de-actuation of one dry (non-powered) switch contact. The system internally treats closed and open contacts as either 0 or 100. Therefore if the module is used to control a relay the relay setpoint should be set midrange (e.g. 50).

See *Figure 10* for proper circuit wiring.

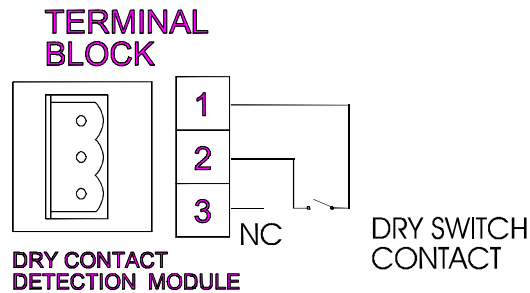


Figure 10. Contact Closure Wiring

Powered Contact Closure Input Module

The Powered Contact (Switch) Closure Input Module is designed to detect the actuation or de-actuation of a powered switch contact. This is accomplished by measuring a potential across the switch contact of 0 volts as closed and a potential greater than 80 volts AC/DC as being an open contact. For applications where a higher potential is being measured (e.g. 240 VAC, 250 VDC) there is a jumper on the board that can be moved that will raise the sense voltage to 130 volts if required. The system internally treats closed and open contacts as either a 0 or 100 numeric value. Therefore if the module is used to control a relay the relay setpoint should be set midrange (e.g. 50).

See *Figure 11* for proper circuit wiring.

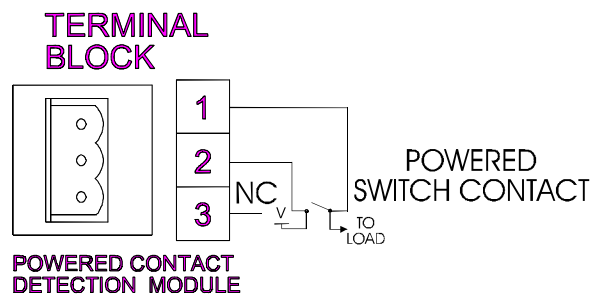


Figure 11. Powered Contact Wiring

Output Contacts

Nine isolated sets of normally open/normally closed output contacts (for Output Relays 1-8 and the System State Output Relay) are provided for controlling cooling equipment, sounding an alarm, or operating remote breaker coils. Each set is capable of switching 115/230 VAC, 30 VDC @ 10 Amps and are accessed

on Terminal Block TB1 see *Figure 12* for the Enclosure and Panel Mount Units and see *Figure 12a* for the Rack Mount Unit.

Refer to the software instruction manual (IST-073-3) for configuring the relays controlling signal, as failsafe/non-failsafe, time delay and other features.

Refer to the Meter Panel for configuration and identification of the output contacts for each relay. Note that each relay is shown in the non-powered state.

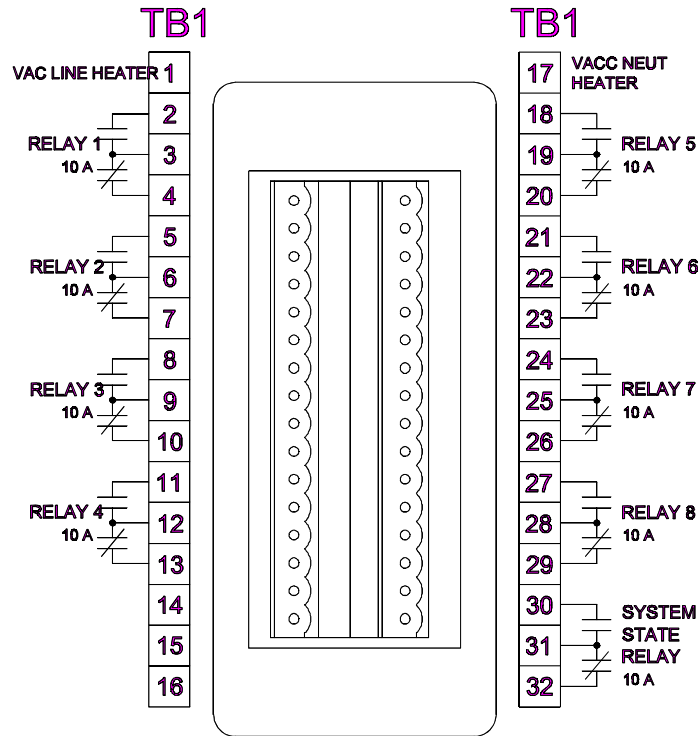


Figure 12. Relay Wiring

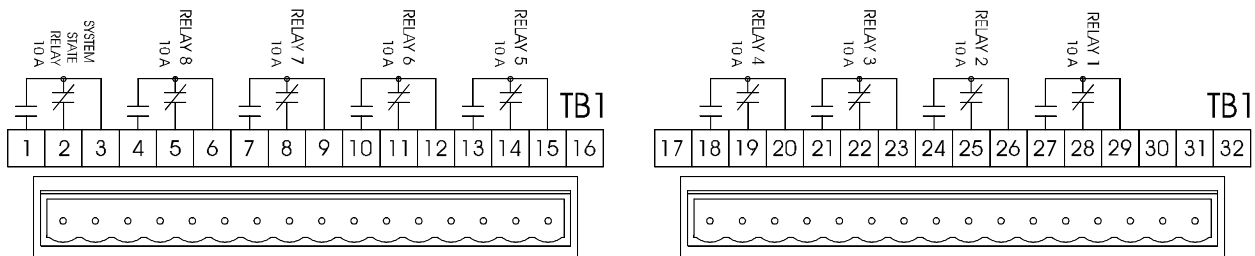


Figure 12a. Relay Wiring for 19" Rack Mount unit

Remote Output Signals

The Transformer Monitor is configured to supply four ma current outputs for remote indication or use with SCADA devices. This output is proportional to full scale of the parameter selected in the configuration (Refer to "Functional Specification," later on in the manual for maximum load.)

The output signals are accessed on Terminal Block TB2 terminals 1 through 8 for the Enclosure and Panel Mount Units (see *Figure 13*) and TB2 terminals 9 through 16 for the Rack Mount Unit (see *Figure 13a*).

NOTE: ALL REMOTE OUTPUT SIGNALS ARE INDEPENDENT, VARIABLE CURRENT LOOPS, DRIVEN BY SYSTEM POWER AND DESIGNED TO DRIVE A RESISTIVE LOAD (I.E., CURRENT METER). **THEY CANNOT BE GROUNDED OR TIED TOGETHER.**

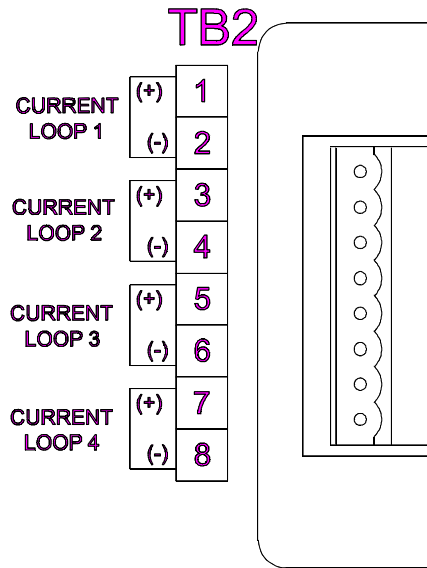


Figure 13. Remote Output Signal Terminals

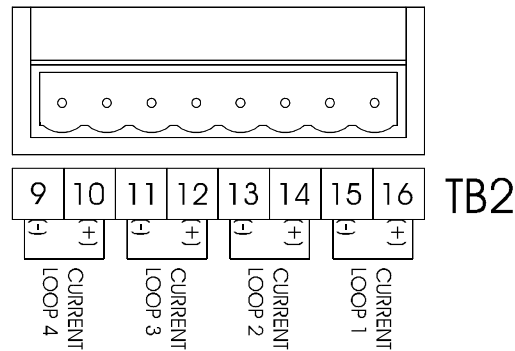


Figure 13a. Remote Output Signal Terminals for 19" Rack Mount unit

Communications

The transformer Monitor comes Equipped with digital communication capabilities. A four wire RS-485 connection is located on the back of the unit see *Figures 14, 14a*. If the operator is using a two wire RS-485 connection with the 509, short TXD+(B) with RXD+(B) and TXD-(A) with RXD-(A). Now connect the two wire RS-485 as an A/B system. There is also a fiber optic connection option. See *Figure 15, 15a* for the connection to this option. This option has been tested using both the Black Box fiber optic modem line driver #ME540A-ST and the Dymec line/repeater #5846-F-ST. The RS-485 connection may be

used with the Qualitrol Remote Software Package and other available protocols. Refer to the 509 Software Manual (IST-073-3) and the 509 communications manual (IST-073-2) for a complete description of these features. For specific and/or special communications protocol options contact Qualitrol, or our authorized representative.

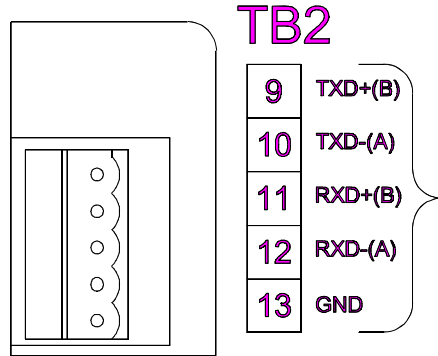


Figure 14. Four Wire RS-485 Connection

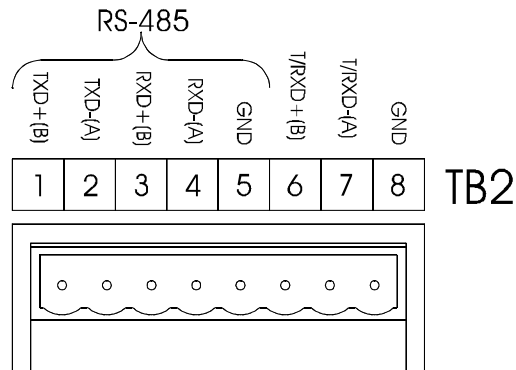


Figure 14a. Four Wire RS-485 Connection for 19" Rack Mount unit

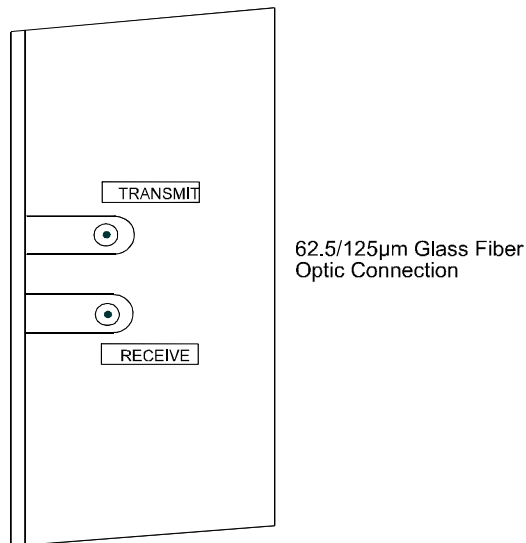


Figure 15. Optional Fiber Optic Connection

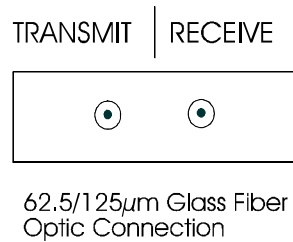


Figure 15a. Optional Fiber Optic Connection for 19" Rack Mount unit

OPERATION

Automatic Operation

Viewing Channels (*Viewing Mode Scrolling*)

Power up, <enter>

The QualiTROL Electronic Transformer Monitor upon power being applied automatically begins to monitor the inputs and controls outputs based on the factory configuration specified by the customer. The display however, shows only time/date. It will remain in this state until the *ENTER* key is depressed, at which time the display will go into *Viewing Mode scrolling* and will *Auto Scroll* all of the parameters being monitored at a frequency of two seconds.

Menu Mode

Viewing Relay Actuation Description (*Viewing Mode*)

(See the appendix for an example of the Menu structure.)

View Mode Scrolling, Menu

Pressing the *Menu* button moves the display out of *Auto Scroll* and into *Viewing Mode*. The *Up* and *Down Arrows* (or *Enter*) will move you through each activated relay description (if there is any). If no button activity takes place for 60 seconds the ETM automatically reverts to *Auto Scroll*, **or** pressing the *Menu* button again reverts back to *Viewing Mode scrolling*.

Viewing Channels

View Mode Scrolling, Menu, Right Arrow

From *Viewing Mode*, Press the *Right Arrow Key*. The *Up* and *Down Arrows* (or *Enter*) will move you through each parameter being monitored individually. If no button activity takes place for 60 seconds the ETM automatically reverts to *Auto Scroll*, **or** pressing the *Menu* button again reverts back to *Viewing Mode scrolling*.

Viewing Max Readings

View Mode Scrolling, Menu, Right Arrow, Right Arrow

From *Viewing Mode*, press the *Right Arrow* key twice. The *Up* and *Down Arrows* (or *Enter*) will move you through the Maximum values, as well as the time and date of each parameter being monitored. Pressing the *Reset* key will reset **all** of the Maximum readings. If no button activity takes place for 60 seconds the ETM automatically reverts to *Auto Scroll*, **or** pressing the *Menu* button again reverts back to *Viewing Mode scrolling*.

Qualitrol recommends resetting the maximum values immediately after setting up the unit to avoid any erroneous readings caused by the installation.

Viewing Min Readings

View Mode Scrolling, Menu, Right Arrow, Right Arrow, Right Arrow

From *Viewing Mode*, press the *Right Arrow* key three times. The *Up* and *Down Arrows* (or *Enter*) will move you through the Minimum values, as well as the time and date of each parameter being monitored. Pressing the *Reset* key will reset **all** of the Minimum readings. If no button activity takes place for 60 seconds the ETM automatically reverts to *Auto Scroll*, **or** pressing the *Menu* button again reverts back to *Viewing Mode scrolling*.

Qualitrol recommends resetting the minimum values immediately after setting up the unit to avoid any erroneous readings caused by the installation.

Viewing Set Points

View Mode Scrolling, Menu, Rt. Arrow, Rt. Arrow, Rt. Arrow, Rt. Arrow

From *Viewing Mode*, press the *Right Arrow* key four times. The *Up* and *Down Arrows* (or *Enter*) will move you through the Set Point values, as well as the Relay number of each relay. If no button activity takes place for 60 seconds the ETM automatically reverts to *Auto Scroll*, **or** pressing the *Menu* button again reverts back to *Viewing Mode scrolling*.

Viewing Cooling Monitor Readings

View Mode Scrolling, Menu, Rt. Arr, Rt. Arr, Rt. Arr, Rt. Arr, Rt. Arr

From *Viewing Mode*, press the *Right Arrow* key five times. The display will read Cooling Monitor Inactive. Depressing the *Up* or *Down Arrows* (or *Enter*) will move you through the Cooling Monitor values for all active systems. If no button activity takes place for 60 seconds the ETM automatically reverts to *Auto Scroll*, **or** pressing the *Menu* button again reverts the system back to *Viewing Mode Scrolling*.

See the section on the Cooling Monitor in this manual and the section on Cooling Monitor in the Software Manual for more information of this operation.

Program Mode

View Mode Scrolling, Menu, Rt. Arr, Rt. Arr, Rt. Arr, Rt. Arr, Rt. Arr, Rt. Arr

From *Viewing Mode*, press the *Right Arrow* key six times. Hitting the *Enter* Button will place you into *Menu Mode*. This is where you can change the settings of the ETM. This mode is protected. Before you are allowed to change any parameters, you must first enter a program user ID#. (This is the same 'password' that is used to enter the Customer Configuration section of the Qualitrol Remote Software Package; see manual IST-073-3). If you are not authorized to change these settings, press the *Menu* key to go back to *Viewing Mode scrolling*. The *Up*, and *Down Arrows* will allow you to change the value of the character highlighted by the display, while the *Right, and left Arrows* will move the highlighted character. Hitting the *Enter* key moves you to the next setting. At the end of the *Program Mode* menu, hitting *Enter* reboots the system. If no activity takes place for 60 seconds, the ETM automatically reverts to *Auto Scroll* and discards any changes that were made **or** Pressing the *Menu* button again reverts back to *Viewing Mode scrolling*.

COOLING SYSTEM MONITOR

There are two parts to the Cooling System Monitor. The first is the setup described in the Software Manual under the Cooling Monitor Configuration and Initialization. Make sure you have familiarized yourself with these sections before using the Cooling Monitor feature. The second part of the monitor is the normal operations of the Cooling System. Once the Cooling feature has been initialized and configured, the 509 will begin monitoring the cooling system. The automatic scrolling display will show the current of the cooling fan/pump, the status of the flow gauge (if there is one) and the temperature of both the RTD inputs and their differential value (if selected). When the cooling system is inactive the operator will notice a zero value for the measured current. This will not cause the cooling alarm relay to actuate since the cooling system only uses the active inrush and steady state current values for comparing against high and low setpoint values. To be able to view the active values and their maximum and minimum values the operator needs to depress the *Menu* button and enter the menu mode. Upon entering the menu mode (see the appendix for a visual overview of the menu mode) the operator may head to the cooling monitor column. If the header of the column states that the cooling monitor is inactive then the cooling monitor has either not been installed or the user did not make it active. (See the software manual for making a cooling bank active). If it is active the operator can travel up and down the column to view the present active values, maximum and minimum values, setpoints, actuation counts, total run time and the differential setpoint amount. Upon viewing the maximum and minimum values the user can reset them by depressing the *Reset* button when they are in the cooling mode column. NOTE: IF THERE ARE MORE THAN ONE COOLING MODES ACTIVE, THE USER SHOULD VIEW ALL THE VALUES BEFORE RESETTING THEM SINCE THE *RESET* BUTTON WILL CLEAR ALL THE MAXIMUM AND MINIMUM CURRENT VALUES ONCE IT IS DEPRESSED. Since the alarm is activated by the active current values (if enabled), should a current value cause an alarm it is possible to enter the menu mode and reset the active current values to their average learned value. When

traveling down the cooling mode column, the operator will view a window for each active cooling bank which reads: “COOLING CURRENT CMX <RESET>”. While viewing that window, depressing the *Reset* button will cause the Inrush current value and the Running current value of just this particular cooling bank to restore their average values as present values. This feature is in case the operator knows what the failure is or has fixed the failure and wishes to stop the alarm until the cooling system can engage again measuring new values. By depressing the *Menu* button the operator will now leave the menu mode.

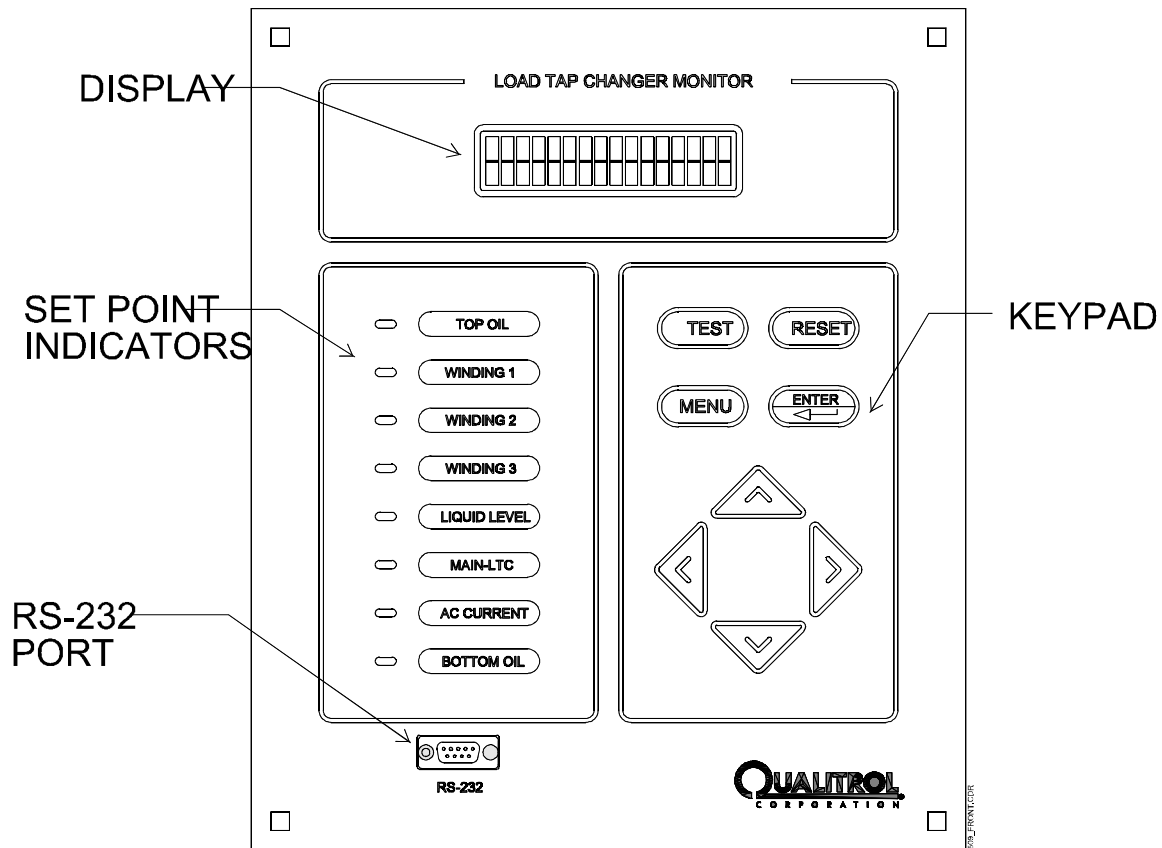


Figure 16. Front Panel Control

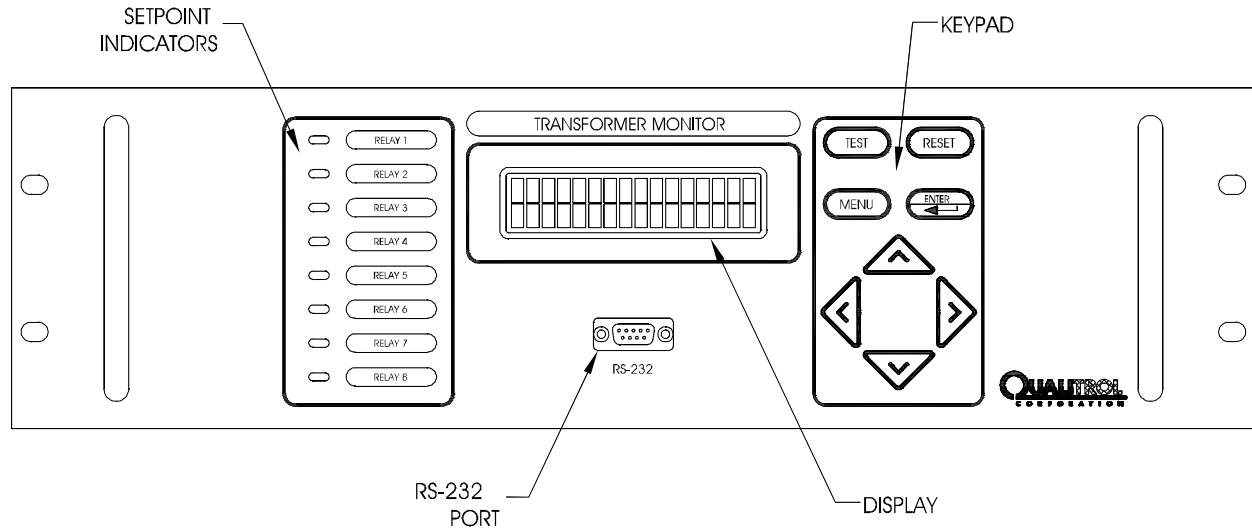


Figure 16a. Front Panel Control for 19" Rack Mount unit

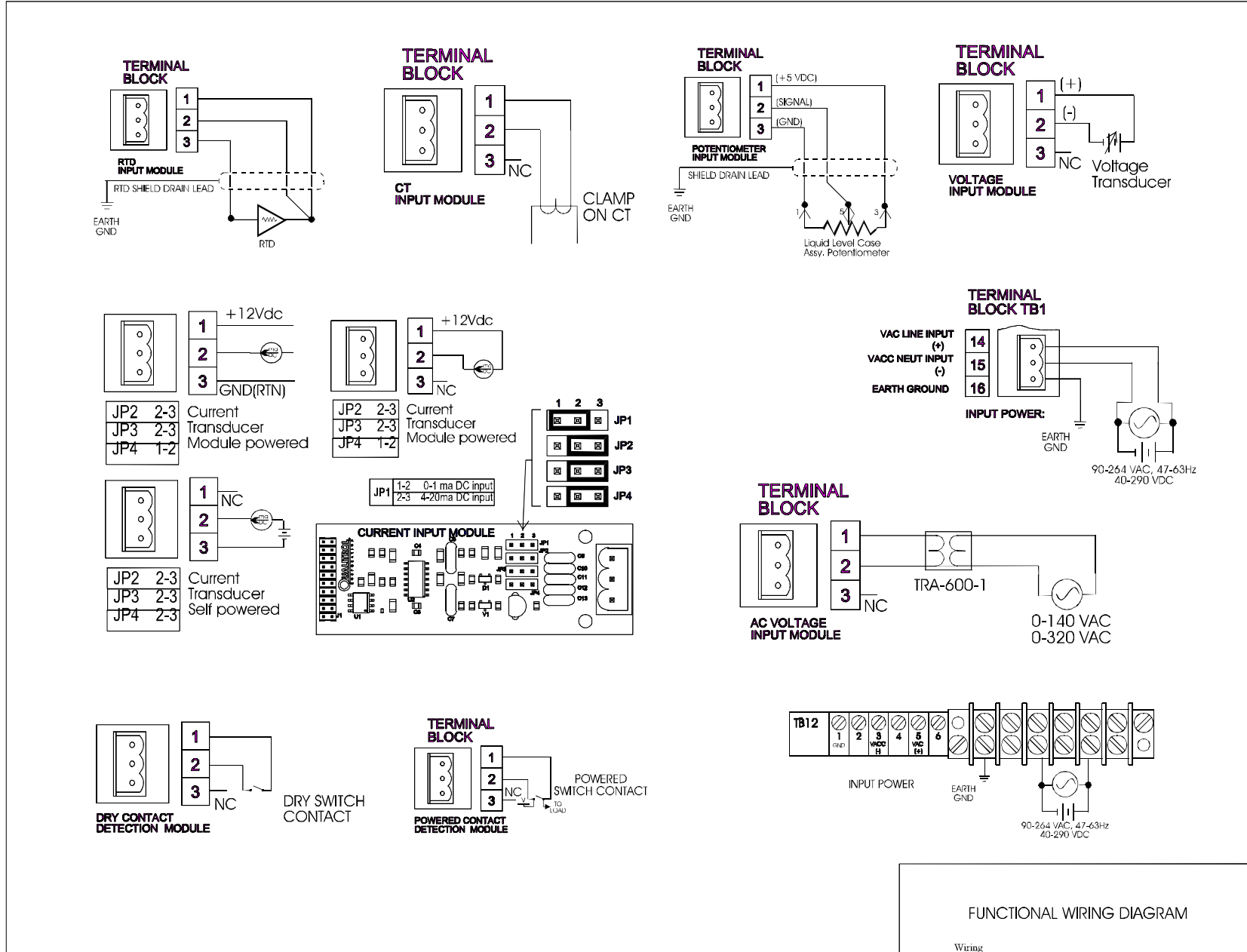
Testing the System

To perform a system confidence test, press and hold the *TEST* Button. Pressing the *TEST* key displays the setpoint source and value on the *DISPLAY* in one-second intervals.

FUNCTIONAL SPECIFICATION

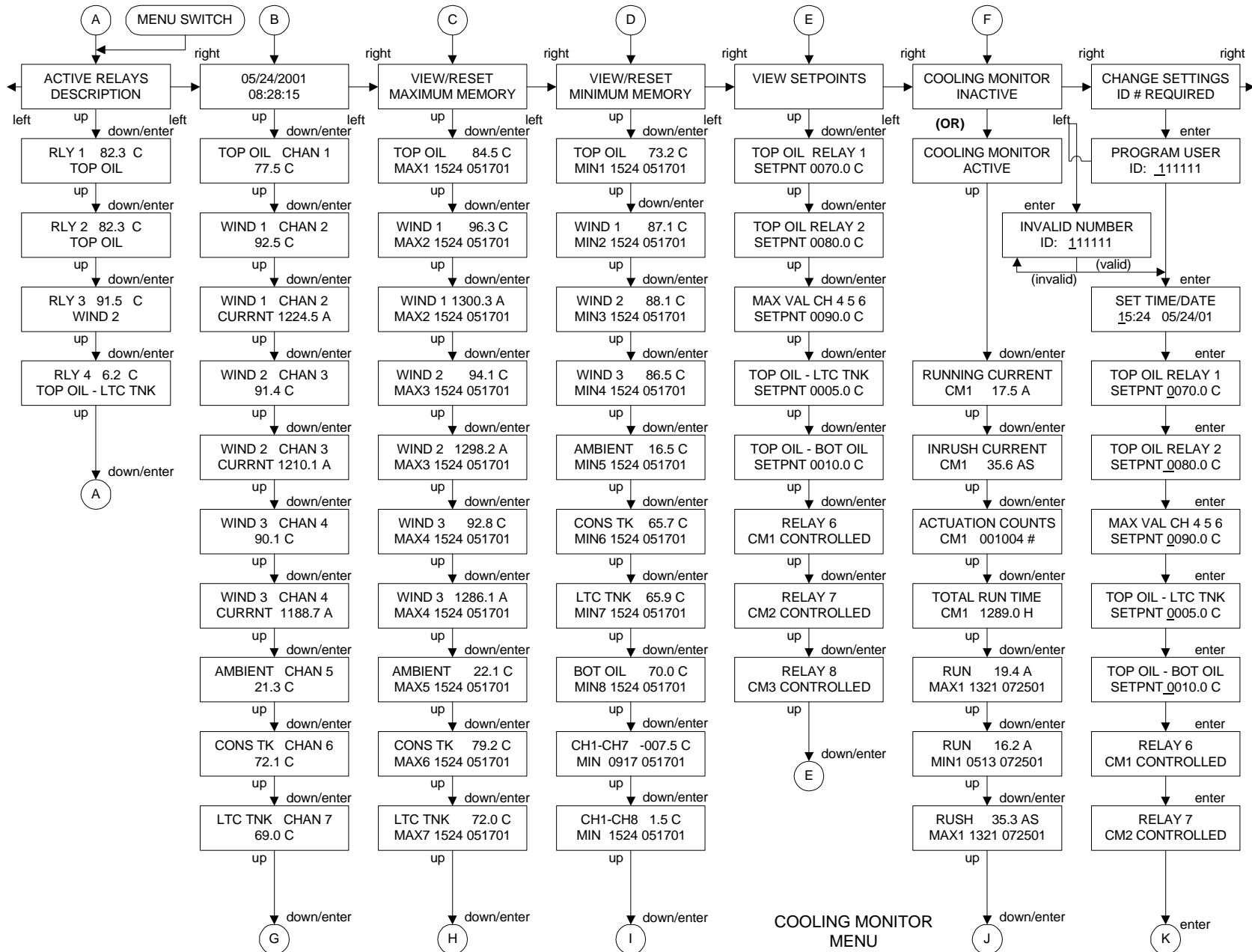
Power Supply:		Universal, 90-264 VAC, 47-63 Hz and 40-290 VDC; (< 18 watts)
Front Panel and Interface	Display:	Type: 1 Easy to read 2-line, 16 character alphanumeric Liquid Crystal Display (LCD) Character size: 0.38" (9.66 mm) high x 0.19" (4.84 mm) wide per line Backlight: Optional
	Status Indicators:	8, Light Emitting Diode (LED)
	Controls:	8 Large keys for programable settings and user interaction
	Front Panel Membrane:	UV stabilized polyester
Input Parameters:	Accuracy:	+/-0.5% full scale input range
	Temperature:	100 ohm platinum (Pt100) or 10 ohm copper (Cu10) RTD sensors;-40 to 120°C or -40 to 200°C range
	Current:	Clamp on CT 0-5A, 0-10A, 0-20A and others available
	Current loop:	0-1 or 4-20 ma DC
	AC Voltage:	0-140 VAC or 0-320 VAC; 50/60 Hz.
	Potentiometer:	1500 to 15,000 ohms
	Switch Contact Closure (isolated dry):	Open/Closed
	Switch Contact Closure (powered) (powered, low current)	>80 Volts AC/DC open, 0 volts closed; optically isolated >130 Volts AC/DC open, 0 volts closed; optically isolated
Outputs	Control/Alarm Contacts:	8 form C (changeover) relay contacts for cooling control, alarms, trip, etc.
	Diagnostics Alarm:	1 relay for sensors, power and internal instrument circuitry diagnostics
	Heater control:	1 relay
	Contact Rating:	10A @ 115/230 VAC, 10A @ 30VDC
	Remote (SCADA) Output:	0-1 ma, 4-20 ma, (other options available) maximum allowable load resistance: 10,000 ohms for 0-1 ma, 450 ohms for 4-20 ma
	Data Communication:	RS-232, RS-485 (optically isolated), optional fiber optic interface uses ST connector; 820 nm wavelength; max distance 1500 meters
Immunity	Dielectric Isolation (hi pot):	2500 VAC, 60 seconds to ground
	Surge Withstand Capability:	IEEE C37.90.1
	Conducted/Radiated Emissions:	IEC 61000-6-1
	Conducted/Radiated Radio Frequency Immunity:	IEC 61000-6-2
	Safety:	IEC 61010-1
	Agency Approval:	CE
Environment:	Temperature Range:	-40°C to +72°C
	Storage Temperature:	-50°C to +80°C
	Humidity:	90% non-condensing
	Vibration:	60/120 Hz @ .004 inch displacement.
	Shock:	10 G's half-sine, in three orthogonal planes
	Weatherproof Enc. Weight Approx:	NEMA #3R (vented), UV stabilized, Corrosion proof fiberglass Weatherproof enclosure version 11.5 lb. (5.2 kg) Panel Mount version: 4.5 lb. (2 kg) Rack Mount version 6.5 lb. (3 kg)
All Terminal Connections:		Accepts wire sizes from 24 to 12 AWG

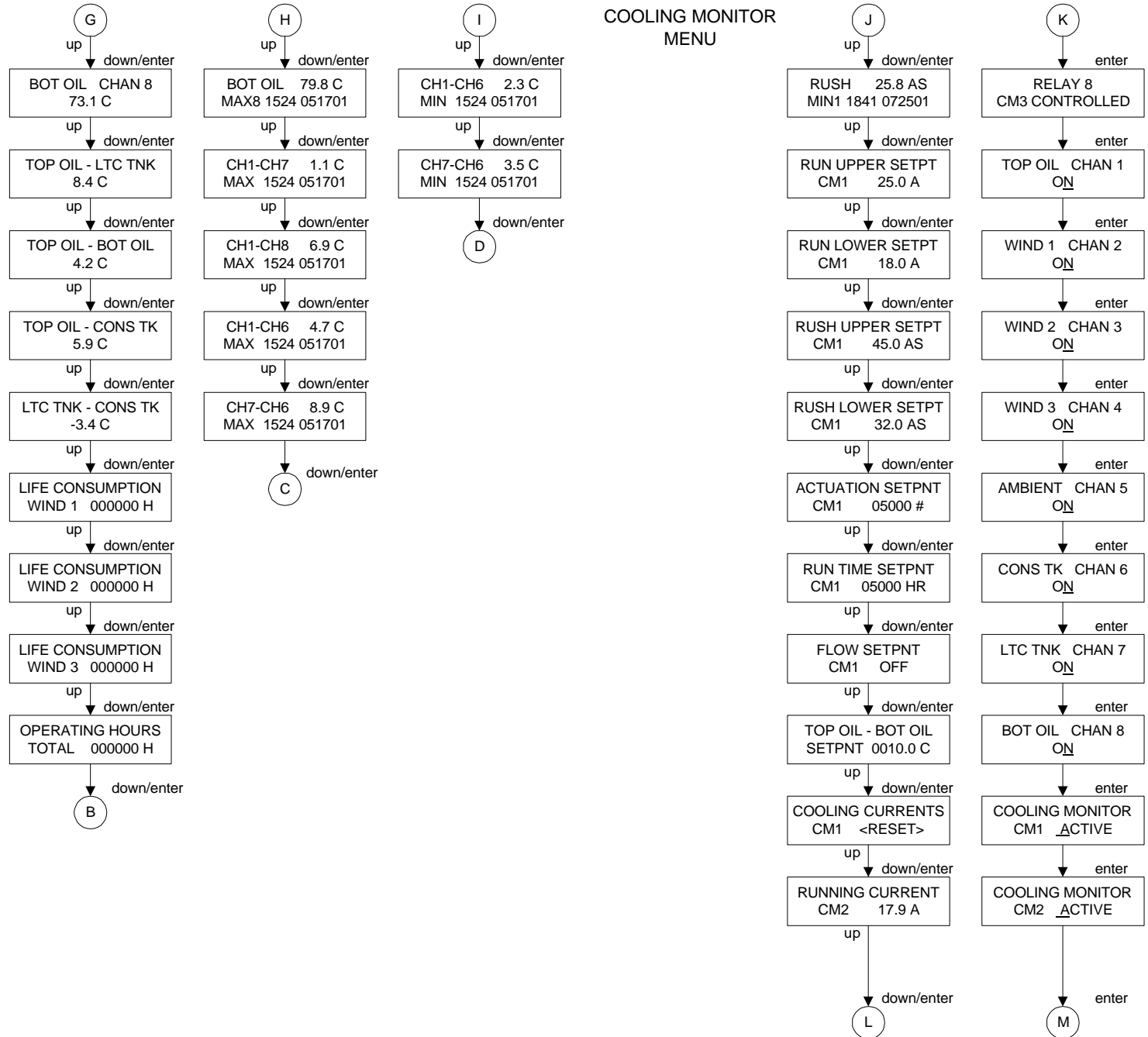
APPENDIX

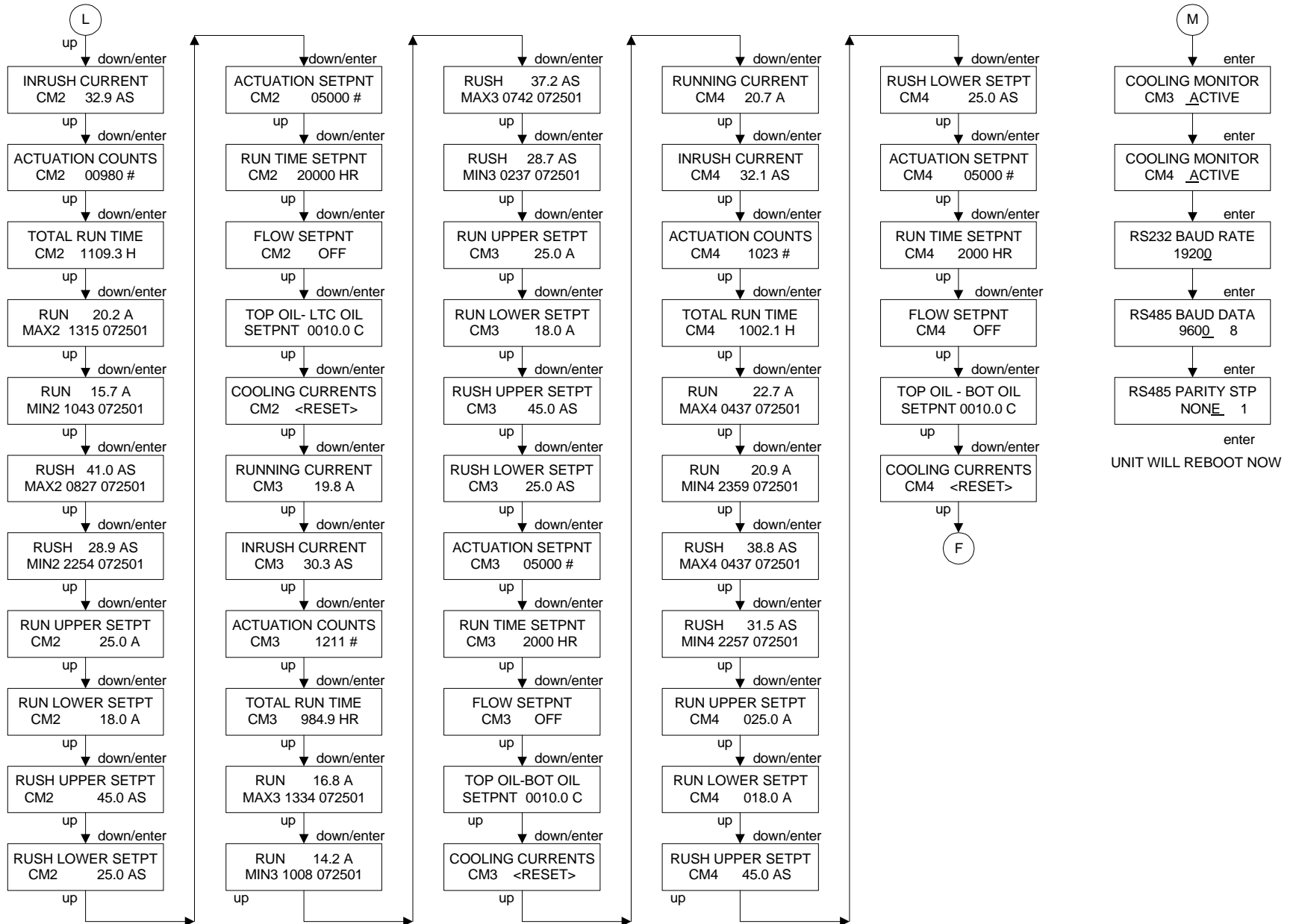


FUNCTIONAL WIRING DIAGRAM

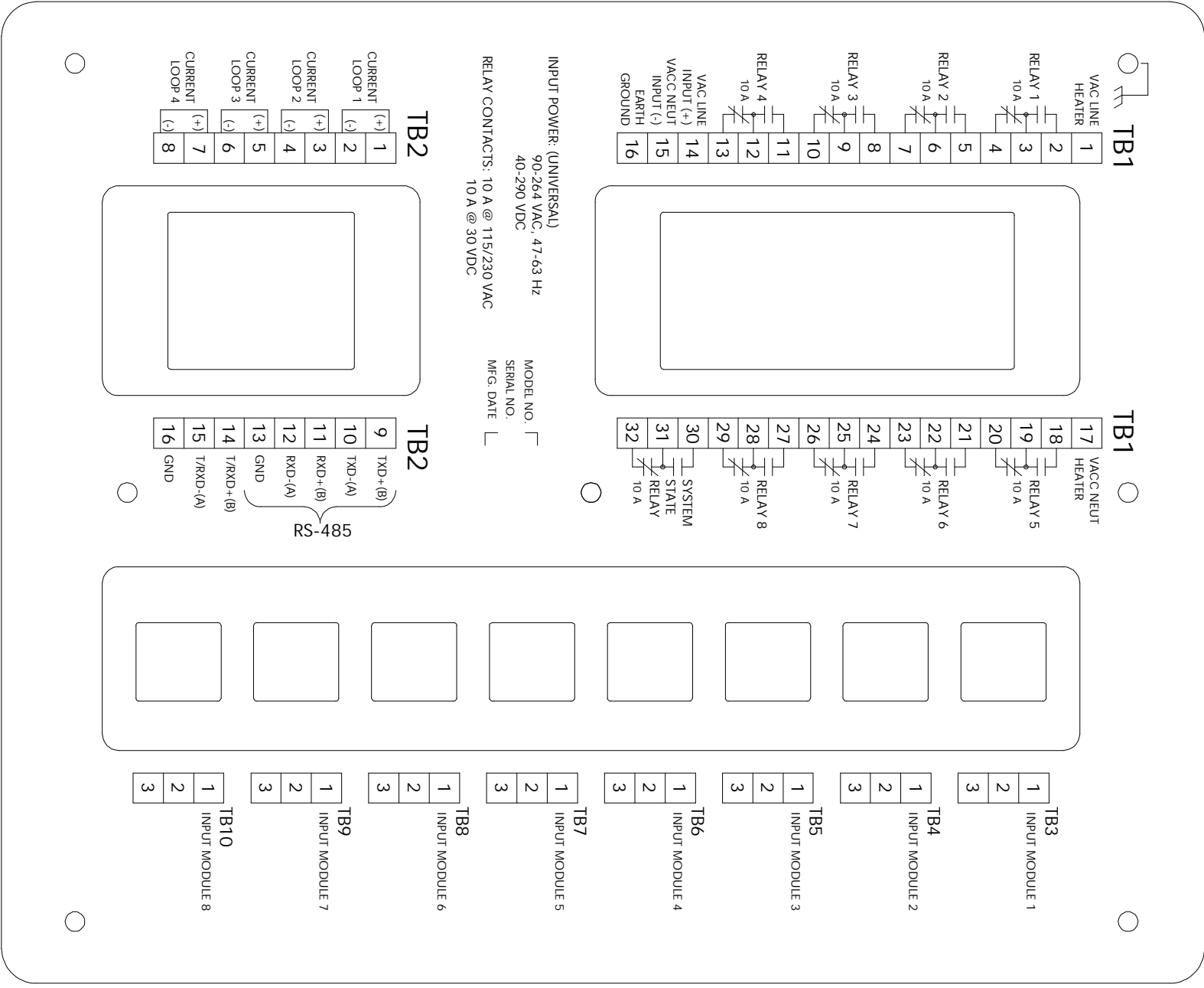
Wiring

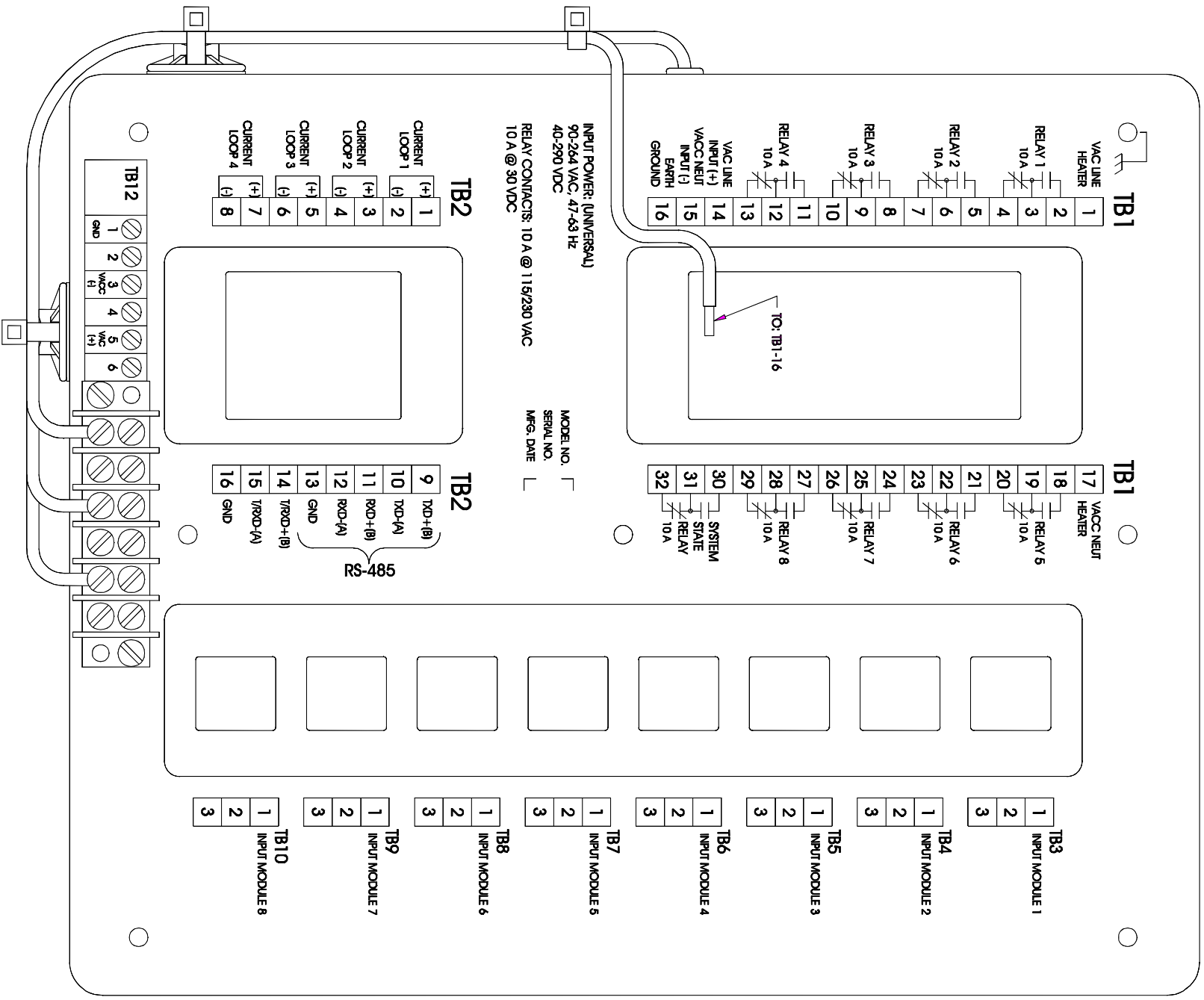




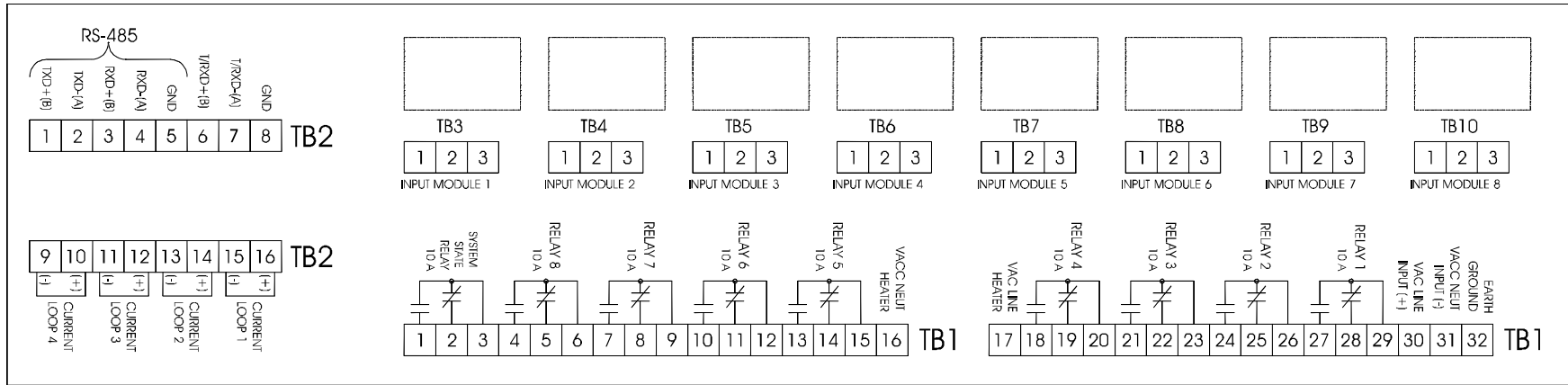


COOLING MONITOR
MENU

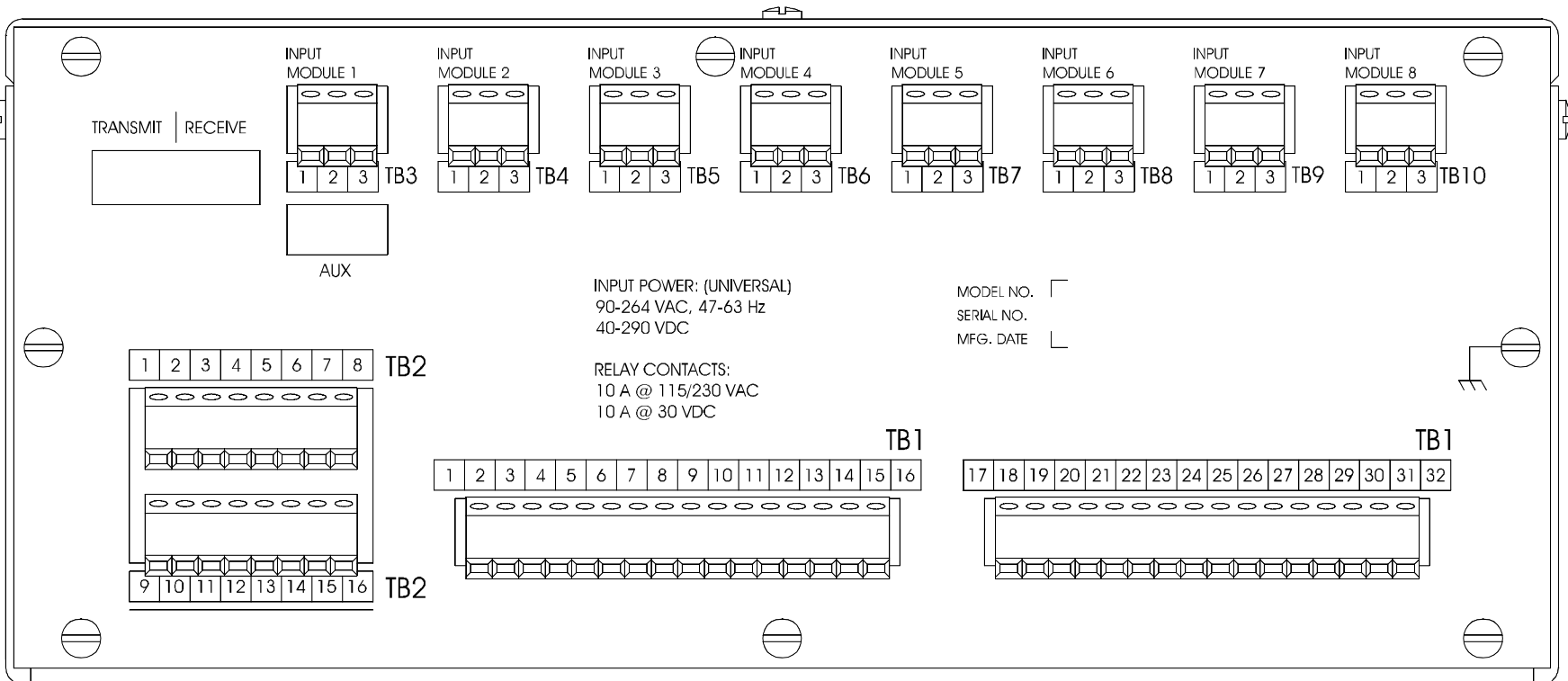




Wiring Label (below)



Rear Cover (below)



CONFIGURATION RECORDS

Parameter Name	Comments/Range	Parameter Name	Set Point
Input Module 1: _____	_____	Relay 1: _____	_____
Input Module 2: _____	_____	Relay 2: _____	_____
Input Module 3: _____	_____	Relay 3: _____	_____
Input Module 4: _____	_____	Relay 4: _____	_____
Input Module 5: _____	_____	Relay 5: _____	_____
Input Module 6: _____	_____	Relay 6: _____	_____
Input Module 7: _____	_____	Relay 7: _____	_____
Input Module 8: _____	_____	Relay 8: _____	_____
Differential 1: _____	_____	Thermostat: _____	
Differential 2: _____	_____	RS-232 Baud Rate: _____	
Differential 3: _____	_____	RS-485 Baud Rate: _____	
Differential 4: _____	_____	RS-485 Parity/stop Bit: _____	
		RS-485 Active Protocol: _____	

AUXILIARY MODEM:

For remote communications Qualitrol offers a 33.6K modem that interfaces directly with the auxiliary port of the 509. When used with the Qualitrol Remote Software package the user is capable of operating the 509 as if they were connected locally.

Wiring Specifications:

Input Power:	Universal; 90 – 264 VAC; 47 – 63 Hz; or 40 – 290 VDC
TB1-1	Line or (+)
TB1-2	Neutral or (-)
TB1-3	Earth Ground
Telephone Line:	Use a normal modem cable (not a null)
J1	Modular Telephone Jack

Software Configuration: See the 509 Software Manual; IST-073-X

Mechanical Dimensions: Length: 7.33 in; Width: 3.71 in; Height: 1.21 in; Weight 12 oz.

Modem Features:

- V.90/56K maximum data speed
- V.17 FAX Class 2
- V.17 FAX Class 1
- V.42 error correction
- V.42bis data compression