

**CAUTION:** The ETM-40US universal temperature scanner is suitable for use in Class I, Groups C & D, Division 2 hazardous locations when installed in accordance with these instructions.

The thermocouple leads connected to this device operate at a very low voltage and power level and **MUST NOT CONTACT** any external voltage source. Damage to the system will result from connection between the thermocouple and the ignition system or any AC or DC power source.

**WARNING: DEVIATION FROM THESE INSTALLATION INSTRUCTIONS MAY LEAD TO IMPROPER OPERATION OF THE MONITORED MACHINE WHICH COULD CAUSE PERSONAL INJURY TO OPERATORS OR OTHER NEARBY PERSONNEL.**

## **1.0 DESCRIPTION**

- 1.1 The Altronic ETM-40US universal temperature scanner is an electronic instrument designed to monitor temperatures using industry standard type J or K thermocouples. Automatic cold junction compensation is built-in. The ETM-40US can monitor up to forty temperature inputs. The universal temperature scanner uses a microcontroller to process the input signal and a nonvolatile memory to store the setup and setpoint values. A 4x20 character LCD displays the absolute temperature value of each channel and the average temperature value for each group in °F or °C. In addition, each groups setpoint status information along with temperature bargraphs are displayed. A front mounted keypad serves as the user interface. The instrument can read type J thermocouples between -76°F and 1382°F (-60°C and 750°C) and type K thermocouples between -76°F and +1472°F (-60°C and 800°C).
- 1.2 The 40 inputs are grouped into seven individual groups. Group 1 can have up to 16 inputs, with the balance to group 1A; groups 2 and 3 have up to two inputs each; group 4 can have up to 16 inputs, with the balance to group 5; and group 6 has up to 4 inputs. Each of these groups has low, high and differential setpoints for alarm and shutdown. All of the temperature setpoints can be adjusted using the keypad. There are four configurable output solid state relays. When the temperature has exceeded its setpoint value, a solid state relay output module turns on/off, and a fault indication is displayed on the LCD. All setpoint changes are performed through the keypad or through RS-485 communications.
- 1.3 The ETM-40US universal temperature scanner is designed to be versatile and simple to use. Type J or K thermocouples and °F or °C units can be selected via the keypad. Either automatic or manual scan functions can be selected. A fault log is available for the sixteen most current faults for each group. RS-485 serial communications allows data and fault status to be communicated to other devices via ModBus RTU protocol. An escape key is provided to permit the user to exit any setup function and return to the normal display. A programmable software filter is also provided which can be used to stabilize readings where the thermocouple signal is fluctuating. Calibration can be performed using the keypad. Factory default configurations, including factory calibration settings, can be recalled for easy setup.

- 1.4 The power requirement for the universal temperature scanner is 10 to 36 Vdc, 4 watts max. or 100 to 250 Vac, 10 watts max.
- 1.5 For proper operation, these installation/operation instructions must be adhered to strictly.

## **2.0 THERMOCOUPLES**

- 2.1 The ETM-40US universal temperature scanner is designed to operate with industry standard, grounded or ungrounded, type J or K thermocouples. Ungrounded thermocouples are recommended where possible. The mixing of ungrounded and grounded thermocouples is not recommended.

## **3.0 MOUNTING**

- 3.1 Mount the universal temperature scanner inside a control panel or to a suitable flat surface so that the display is at a convenient viewing height. NOTE: Avoid mounting the ETM scanner with the LCD display facing direct sunlight. The display temperature range is -4°F to +158°F (-20°C to +70°C).

## **4.0 WIRING (SEE WIRING DIAGRAMS)**

- 4.1 POWER WIRING - The ETM-40US will operate from either 10-36Vdc, 24 volts nominal or 100-250Vac, 120 volts nominal.

DC Power - Connect the power input wires, plus to terminal 10-36Vdc + and minus to -; power requirement is 10 to 36 Vdc 4 watts max. Connect the minus terminal (-) to panel ground which should be the same as engine ground. DO NOT ground this device directly to the ignition system common coil ground.

AC Power - Connect the power input wires, HOT to terminal 100-250Vac "H", NEUTRAL to "N", and GROUND to the ground terminal. The ground terminal is the same electrically as the enclosure. DO NOT ground this device directly to the ignition system common coil ground.

- 4.2 THERMOCOUPLES AND THERMOCOUPLE EXTENSION WIRE - Grounded or ungrounded type J or K thermocouples may be used. Use thermocouple extension wire of the same type as the thermocouple probe to connect the thermocouple to the universal temperature scanner. Use stranded thermocouple wire having a good moisture-resistant insulation such as PVC; for higher ambient temperatures, Teflon or B-fibre insulated thermocouple wire is recommended. To insure an accurate signal is transmitted to the instrument, avoid any added junctions, splices and contact with other metals. Take care not to damage the insulation when installing and take precautions against later damage from vibration, abrasion, or liquids in conduits. In addition, it is essential that the following practices be adhered to:
  - A. Never run thermocouple wires in the same conduit with ignition wiring or other high energy wiring such as AC line power.
  - B. Keep secondary wires to spark plugs and other high voltage wiring at least eight inches (200mm) away from thermocouples and extension wiring.

- 4.3 SOLID STATE OUTPUT MODULE WIRING - An alarm or fault condition occurs when the temperature of a point reaches or violates one of the setpoint values. This will cause one of the solid state output modules to turn ON or OFF (software configurable) from DIG. OUT + (plus) to - (minus). Each output module is optically isolated from all other terminals. Each module has an LED and a 3 amp fuse associated with it. When an output module is conducting or active, the LED will light. These solid state modules can be wired to an Altronic annunciator system or to pilot duty relays as shown in the wiring diagrams. See module selections and ratings in section 15 of this manual.
- 4.4 SOLID STATE INPUT MODULE WIRING - The input module is used for remote system reset. It has a LED and a 3 amp fuse associated with it. A voltage within the rating of the module is required to induce a reset (see module ratings in section 15 of this manual). A reset can also be performed using the keypad reset key or serial communications.
- 4.5 RS-485 COMMUNICATIONS WIRING - The ETM-40US universal temperature scanner can communicate to other instruments, PC's or PLC's via the two serial RS-485 communication wires. Use a two conductor shielded cable of fine gauge stranded wire and connect the wires to the terminals marked RS-485 "A" and RS-485 "B". Connect to the other communication device "A" to "A"(-) and "B" to "B"(+). Connect the shield wire to the master device only.
- 4.6 HAZARDOUS AREA OPERATION - The ETM-40US universal temperature scanner is CSA certified for CLASS I, DIVISION 2, GROUPS C & D areas. Model ETM-40US is certified as a component only and is required to be installed in a suitable enclosure where the suitability of the combination is subject to the local inspection authority having jurisdiction. The power connections to the ETM-40US must be in accordance with the National Electrical Code and in Canada, the Canadian Electrical Code. In addition, the following requirements must be met:
1. Run the thermocouple extension wires leaving the panel in a separate conduit from all other wiring and keep them separate throughout the installation.
  2. Power wiring and wiring to the modules must have a grade of insulation capable of withstanding an AC voltage of 500 volts RMS.
  3. In general, run wires in separate conduits and junction boxes from high voltage wires such as ignition, fuel valve, and other high voltage wiring.

**WARNING: EXPLOSION HAZARD - DO NOT REPLACE FUSES OR I/O MODULES UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.**

**DO NOT DISCONNECT EQUIPMENT IN DIV. 2 ENVIRONMENT UNLESS POWER IS SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS**

- 4.7 TESTING THERMOCOUPLE LEADS - If it becomes necessary to check thermocouple to terminal strip wiring with an ohmmeter or other checker, first unplug the thermocouple connectors from the universal temperature scanner. This will prevent possible damage to the device's sensitive low voltage detection circuitry.

## **5.0 GROUPS AND CONFIGURATION**

- 5.1 The ETM-40US universal temperature scanner is grouped into seven groups. The groups are described below.

Each group can be set for COMMON SETPOINTS or INDIVIDUAL SETPOINTS.

COMMON SETPOINTS - When a group is set for common setpoints, all channels in the group will have a common low 1, high 1, and differential 1; and a common low 2, high 2, and differential 2. Setpoints 1 trip output 1 (3 in group 6), setpoints 2 trip output 2 (4 in group 6).

INDIVIDUAL SETPOINTS - When a group is set for individual setpoints, each channel has 4 individual setpoints; a low and a high for output 1 (output 3 in group 6) and a low and a high for output 2 (output 4 in group 6).

The seven groups are as follows:

GROUP 1 - Contains up to 16 channels (01-16) intended for exhaust cylinders. Group 1 can be configured for any number of channels from 1 to 16 with the default at 16; the balance are available for group 1A. Setpoints can be configured for either common or individual. Setpoints 1 trip output 1, setpoints 2 trip output 2.

GROUP 1A - Contains up to 16 channels (01-16) intended for the remaining points not used for exhaust cylinder temperatures in group 1. Setpoints can be configured for either common or individual. Setpoints 1 trip output 1, setpoints 2 trip output 2.

GROUP 2 - Contains up to 2 channels (17,18) intended for common exhaust, turbo's or catalytic converters. Setpoints can be configured for either common or individual. Setpoints 1 trip output 1, setpoints 2 trip output 2.

GROUP 3 - Contains up to 2 channels (19,20) intended for common exhaust, turbo's or catalytic converters. Setpoints can be configured for either common or individual. Setpoints 1 trip output 1, setpoints 2 trip output 2.

GROUP 4 - Contains up to 16 channels (21-36) intended for engine or compressor main or rod bearings. Group 4 can be configured for any number of channels from 0 to 16 with the default at 9; the balance are available for group 5. Setpoints can be configured for either common or individual. Setpoints 1 trip output 1, setpoints 2 trip output 2.

GROUP 5 - Contains up to 16 channels (21-36) intended for engine or compressor main or rod bearings. Group 5 can be configured for any number of channels from 0 to 16 with the default at 7; the balance not selected for group 4 are available for group 5. Setpoints can be configured for either common or individual. Setpoints 1 trip output 1, setpoints 2 trip output 2.

GROUP 6 - Contains up to 4 channels (37-40) intended for miscellaneous engine or compressor temperatures. Setpoints can be configured for either common or individual. Setpoints 1 trip output 3, setpoints 2 trip output 4.

**ETM-40US GROUP/SETPOINT MATRIX**

<b>GROUP</b>	<b>CHANNEL NUMBERS</b>	<b>COMMON SETPOINTS</b>	<b>INDIVIDUAL SETPOINTS</b>	<b>OUTPUTS</b>
1	01-XX	L1, H1, D1 L2, H2, D2	L1, H1 L2, H2	1 2
1A	XX-16	L1, H1, D1 L2, H2, D2	L1, H1 L2, H2	1 2
2	17-18	L1, H1, D1 L2, H2, D2	L1, H1 L2, H2	1 2
3	19-20	L1, H1, D1 L2, H2, D2	L1, H1 L2, H2	1 2
4	21-XX	L1, H1, D1 L2, H2, D2	L1, H1 L2, H2	1 2
5	XX-36	L1, H1, D1 L2, H2, D2	L1, H1 L2, H2	1 2
6	37-40	L1, H1, D1 L2, H2, D2	L1, H1 L2, H2	3 4

Table 1

**NOTES:**

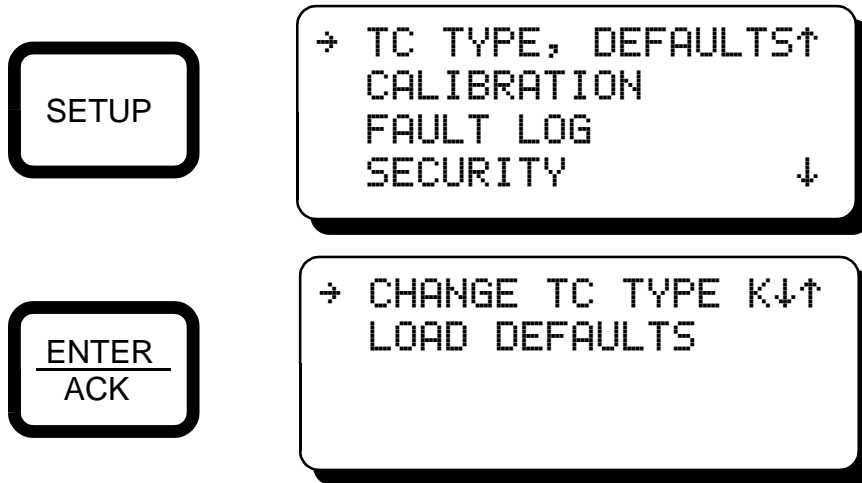
Groups 1 and 1A - Select the required number of points for Group 1, from 0 to 16; the balance are available for group 1A. (EX: Group 1 = 6; 10 available for Group 1A).

Groups 4 and 5 - Select the required number of points for Group 4, from 0 to 16; the balance are available for group 5. (EX: Group 4 = 12; 4 available for Group 5).

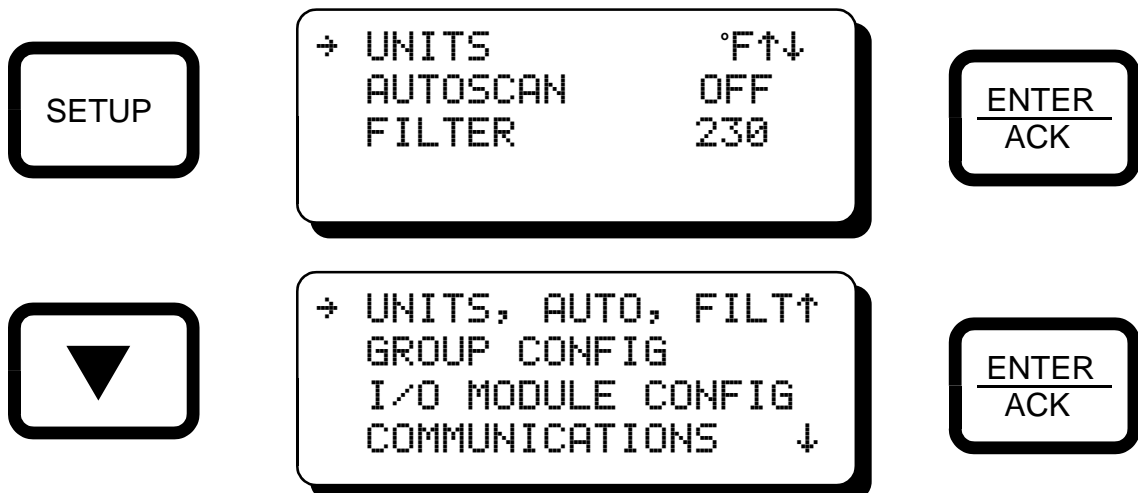
The shading indicates the default selection as the device is shipped.

## 6.0 INITIAL OPERATION

- 6.1 This section allows for quick setup and installation of the ETM-40US universal temperature scanner. Mount and wire the device as described in sections 3.0 and 4.0. Upon initial power up, press the SETUP key; the unit will be in the configuration mode. Press the SETUP key until the display reads "TC TYPE, DEFAULTS" and press the ENTER/ACK key. Press the ▲ or ▼ (up or down arrow key) to view the thermocouple options (either type "J" or "K"). Press ENTER/ACK when the appropriate thermocouple type is displayed to load the selected thermocouple type.

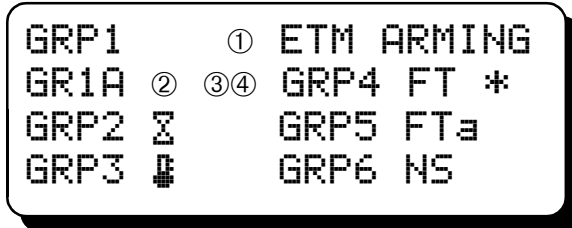


Next, press SETUP to enter the configuration mode, select "UNITS, AUTO, FILT", press ENTER/ACK, the display will read UNITS °F or °C, press the ▲ or ▼ (up or down arrow key) to select °F or °C and press ENTER/ACK to accept the desired units choice. The device is now ready to accurately read temperatures.



## 7.0 GLOBAL STATUS AND CHANNEL SCREEN DESCRIPTION

7.1 GLOBAL STATUS SCREEN - The global status screen displays global information on the condition of each group on a single screen. It displays the condition of the setpoints, timers and if a setpoint has been acknowledged or disabled. The global status screen is shown after a reset and can be displayed at any time by using the up or down arrow keys. It is located previous to channel 01 and after the last channel used.



① The right side of the top line of the display indicates the global status of the system:

- ETM RESET - RESET will be shown when either the "RESET" key is pressed or the remote reset is activated.
- ETM ARMING - ARMING will be shown when any group's timer is active or the average temperature has not been met.
- ETM ARMED - ARMED will be shown when all timers expire and all average temperatures are met. The scanner is then actively scanning all points.
- ETM FAULT - FAULT indicates at least one group has a faulted channel.

② First two positions for each group indicate the arming condition of each group:

OK All points in this group are being monitored

⌘ The timer for this group is active

⚡ The average temperature for this group has not been reached

FT A fault has occurred on a channel in the group

OFF The group has been turned off, no temperatures for that group will be displayed

NS No Setpoints are being monitored in that group, all are locked out or turned off

③ Third position of each group indicate if a point in the group has been acknowledged:

a A point in the group has been acknowledged

④ Fourth position of each group indicate if a point in the group has been disabled:

\* A point in the group has been disabled

7.2 INDIVIDUAL CHANNEL DISPLAY SCREENS - The display screens for channels 01 through 40 displays the channel description, channel number, and temperature in °F or °C on the first line. The individual group's status and average or differential temperature on the second line. The bargraph for setpoint one is on the third line and the bargraph for setpoint two is on the fourth line.



**LINE 1:** Channel description - The channel description describes the channel being monitored. Standard selections from the ETM setup menu are: "CHANNEL", "CYLINDER", BEARING", "EXHAUST", CATALYST", COMPRESSOR", TURBO", ENGINE", and a custom label can be created and downloaded through modbus RTU (see section 13)

Channel number - 01 through 40.  
Channel temperature

**LINE 2:** Group status line - Groups 1 through 6

- ① OK All points in this group are being monitored
  - ⌘ The timer for this group is active
  - ⚡ The average temperature for this group has not been reached
  - FT A fault has occurred on a channel in the group
  - NS No Setpoints are being monitored in that group, all are locked out
  - ② Ⓜ A point in the group has been acknowledged
  - ③ \* A point in the group has been disabled
- Average group temperature

**LINE 3:** Bargraph for setpoint 1, between the high and low setpoints

**LINE 4:** Bargraph for setpoint 2, between the high and low setpoints

Press ESCAPE to display the bargraph showing differential of viewed channel from average.



**LINE 1:** Same as above

**LINE 2:** Same as above

**LINE 3:** Bargraph for setpoint 1, differential of viewed channel from average

**LINE 4:** Bargraph for setpoint 2, differential of viewed channel from average





After reset, the global status screen will show "ETM ARMING" to indicate that one or more groups have a start-up timer active and/or the average arm temperature has not been met. All start-up timers can be cancelled by pressing the ENTER/ACK key when in the global status screen. Note: Cancel timers works in the global status screen only.

The screen shown below is showing that setpoints for groups 1,1A, and 4 are being monitored (OK); Group 2 start-up timer is active (Σ); Group 3 temperature has not yet been met (⚡); Group 5 has been turned off in the setup menu (OFF), and the setpoints of Group 6 have been turned off in the setpoints menu (NS).

```
GRP1 OK    ETM ARMING
GR1A OK    GRP4 OK
GRP2 Σ     GRP5 OFF
GRP3 ⚡     GRP6 NS
```

Pressing the ESCAPE key when viewing the global status screen will change the display to the global status start-up timer screen which displays the time left for each groups' arm time. The last minute for each group will count down from 60 seconds. If the start-up timer is not configured for a group, "0s" will display. Press escape again to return to the global status screen.



```
GRP1 0s    ETM ARMING
GR1A 0s    GRP4 0s
GRP2 59s   GRP5 OFF
GRP3 10m   GRP6 99m
```

"ETM ARMED" is displayed when all of the configured setpoints are armed and are being monitored.

```
GRP1 OK    ETM ARMED
GR1A OK    GRP4 OK
GRP2 OK    GRP5 OFF
GRP3 OK    GRP6 NS
```

8.2 INDIVIDUAL CHANNEL STATUS SCREENS - When viewing each individual channel, the ETM-40US universal temperature scanner displays the channel description, channel number, and temperature in °F or °C on the first line. The individual group's status and average or differential temperature on the second line. Each channel displays a bargraph between setpoints L1 and H1 and L2 and H2. The bargraph for setpoint 1 is on the third line and the bargraph for setpoint 2 is on the fourth line.

```

CHANNEL      01  950°F
GRP1 OK     AVG  943°F
1 L>|||||
2 L>|||||
  
```

An additional set of bargraphs showing the differential of the viewed channel from the average of the group are available for groups set to common setpoints. Press the ESCAPE key to toggle between the two bargraphs.



```

CHANNEL      01  950°F
GRP1 OK     DIF   7°F
1 D>      |||||
2 D>      ||||
  
```

Use the ▲ or ▼ (up or down arrow key) to advance to contiguous channels. Continue to use the up or down arrow keys to view the remaining channels.



```

CHANNEL      17 1010°F
GRP2 OK     AVG 1000°F
1 L>|||||
2 L>|||||
  
```

Press the ESCAPE key to display the differential bargraphs of setpoints one and two. Channels 17 and 18 (group 2) and channels 19 and 20 (group 3) display, on line 2, the absolute differential temperature value between each channel of the corresponding group.



```

CHANNEL      17 1010°F
GRP3 OK     DIF  10°F
1 D>|||||
2 D>|||||
  
```

8.3 BARGRAPHS - There are four bargraphs available for each channel for groups set to common setpoints and two for groups set to individual setpoints. The first two bargraphs show the temperature for each channel between setpoints L1 and H1 (third line) and L2 and H2 (fourth line). The low setpoint value is on the left, and the high value on the right. As the temperature for the displayed channel increases, so does the bar until it reaches the high setpoint, and conversely decreases until reaching the low setpoint. When a setpoint is reached the fault description replaces the bargraph for the respective bargraph.

```

CHANNEL      01 1015°F
GRP1 OK      AVG  965°F
FAULT1: HI DIF
2 L>||||||||||||||||||||||||||| <H

```

For groups set for common setpoints, a bargraph representing the differential of the viewed channel from the average of the group is shown for each differential setpoint. Press the ESCAPE key to access these. The center of the graph is the average temperature of the group, the two endpoints are the setpoint value below and above the average. For example, if the differential from average setpoint is 100°F and the current average temperature is 965°F, then the end points will be 865°F and 1065°F. The endpoints change with the changing of the average temperature. If the viewed channel's temperature is above the group average, the bars will be to the right of the center post, and conversely to the left for temperatures below the average temperature for the group. This bargraph gives a quick visual indication of how close any channel is to the average temperature of its group and the proximity to the trip point.

```

[ ESCAPE ]
CHANNEL      01 1015°F
GRP1 OK      DIF   50°F
1 D>          ||||||||    <
2 D>          ||||||     <

```

Channels 17 and 18 (group 2) and channels 19 and 20 (group 3) when configured for common setpoints, display the absolute differential temperature value between each channel of the corresponding group. The differential bargraphs show the percentage of the absolute difference from the setpoint. To access the differential bargraphs, press the ESCAPE key. The two endpoints are channels 17 left and 18 right (group 2) and channels 19 left and 20 right (group 3). When the difference between the channels in the group increases, the bars increase and conversely when the difference decreases, the bars decrease. This bargraph is typically used to give a quick visual indication of how close an input temperature is from an output temperature of a monitored item.



```
CHANNEL      19  950°F  
GRP3 OK     DIF   23°F  
1 D>||||| <  
2 D>||||| <
```

Note: If a setpoint is turned off, "NA" (not available) will display along with a left arrow indicating the low setpoint is off and a right arrow indicating the high setpoint is off.

**9.0 FAULT CONDITIONS**

9.1 Upon a fault condition the global status screen will read "ETM FAULT". The associated output module will change states, the associated output LED will light, and the fault indicator on the front panel will light. The first-out fault indication will remain until either the fault clears (output set to nonlatching) or a reset is performed. When the captured fault goes away and if an additional fault is occurring in the system, it will be replaced with the next fault in the scan cycle.

```
GRP1 FT     ETM FAULT  
GR1A OK     GRP4 OK  
GRP2 OK     GRP5 OFF  
GRP3 OK     GRP6 NS
```

The individual channel with the fault occurring will show all of the faults occurring (HI, LO, and DIF) on that channel. The group status will read "FT" (fault). Setpoint 1's fault will be shown on line 3, setpoint 2's fault will be shown on line 4. When a fault is displayed, it replaces the bargraph on that line.

```
CHANNEL      02 1123°F  
GRP1 FT     AVG   943°F  
FAULT1: HI DIF  
2 L>||||| <H
```

The groups with no faults will not display the "FT" on the group status line (line 2). Note: Press the ESCAPE key to view the first-out fault in the system if not displayed (bargraphs displaying). Pressing the ESCAPE key toggles between the first-out fault and bargraphs.

ESCAPE

```

CHANNEL      19 1003°F
GRP3 OK      AUG  995°F
1 L>|||||<H
2 L>|||||<H
      
```

ESCAPE

```

CHANNEL      19 1003°F
GRP3 OK      AUG  995°F

FAULT: CH.02 HI1
      
```

9.2 ACKNOWLEDGE A FAULT - To acknowledge a fault, display the faulted channel and press the ENTER/ACK key, the display will momentarily display "ACKNOWLEDGE" on the top line. A lowercase "a" will be displayed on the group status line and in front of each fault. All faults occurring on both setpoints will be acknowledged. When acknowledging a channel, if no other channels are faulted, the output module will normalize. The acknowledgment will clear when the fault clears by temperature change (set to non latching) or by a reset condition.

ENTER  


---

 ACK

```

CHANNEL      02 1123°F
GRP1 FTa    AUG  943°F
FAULT1: aHI aDIF
2 L>|||||<H
      
```

9.3 DISABLE A CHANNEL - To disable a channel, display the desired channel. Press and hold the ENTER/ACK key and press the ESCAPE key - the display will momentarily show "DISABLE". An asterisk will appear next to the channel number on the first line and in the group status on line 2. The word "DISABLED" will appear on the fourth line. The group status indicates at least one channel in that group has been disabled. When disabling a channel, if no other points are faulted, the output module will normalize. To re-enable the channel, display the channel, press and hold the ENTER/ACK key and press the ESCAPE key; the display will momentarily show "ENABLE", the asterisk will be removed, and the setpoints will become active.

ENTER  


---

 ACK

ESCAPE

```

CHANNEL      02*1123°F
GRP1 OK *    AUG  943°F

DISABLED
      
```

- 9.4 LO OUT OF RANGE, HI OUT OF RANGE and OPEN THERMOCOUPLE indication - If a monitored thermocouple temperature falls below the minimum range of the instrument (-76°F or -60°C), the display will read "LO OOR" (Low Out Of Range) in place of the temperature reading to identify this condition. If the channel is configured for a low setpoint, the associated output module will activate. If the thermocouple temperature exceeds the maximum range of the instrument (1382°F or 750°C for type J, 1472°F or 800°C for type K) the display will read "HI OOR" (High Out Of Range) in place of the temperature reading to identify this condition. If the channel number is configured for a high setpoint, the associated output switch will activate.

```
CHANNEL    01 HI OOR
GRP1 FT    AVG 1175°F
FAULT1:    HI DIF
FAULT2:    HI DIF
```

If a thermocouple or its wiring becomes open or disconnected from the universal temperature scanner, the display will read "OPEN" (thermocouple open) in place of the temperature reading on that channel and if configured for a high setpoint, its output switch will activate. All configured unused thermocouple inputs must be shunted to prevent this condition in normal operation. NOTE: Even if the channel is turned off in the configuration menu, the unused inputs must be shunted on the thermocouple input terminal block.

```
CHANNEL    01 OPEN
GRP1 FT    F AVG 1055°F
FAULT1:    HI DIF
FAULT2:    HI DIF
```

## 10.0 FAULT LOGS

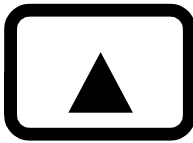
- 10.1 The VIEW ALARMS key allows the user to display the channels which in the past have exceeded their setpoints (up to the first 16 faults for each group) in the order they occurred after a reset has been performed. This is helpful in determining which thermocouple is responsible for causing an alarm, especially if a fault is set for non-latching and has cleared itself. Pressing VIEW ALARMS, first display is a group select menu. Use the ▲ or ▼ arrow key to select the desired group and press ENTER/ACK.

VIEW  
ALARMS

```
→GROUP 1 CH's 01-16
GROUP 2 CH's 17-18
GROUP 3 CH's 19-20
GROUPs 4, 5, & 6
```

ENTER  
ACK

Use the ▲ or ▼ arrow key to scroll through the log in the order in which the measured temperature has violated the setpoint values. The first fault will be displayed first along with the channel description, channel number and one of the fault indicators, "HI1", "HI2", "LO1", "LO2", "DIF1", "DIF2", "DIF1" or "DIF2". All other channels that have had a fault condition in that group after the first one will be displayed in the order that they occurred. The first 16 occurring faults will be logged for each group. If a channel faults, then clears, and faults again, it will be logged a second time. Each fault that occurs will be logged until the log is full. Any channel that has not violated its setpoint value will not be logged. If configured, performing a global reset will clear all logs. See "FAULT LOG" description in the setup section (section 13) of this manual.



```

FAULT LOG FOR GRP 1
FAULT 01↓↑
                CYLINDER
                CH.01 HI1
    
```

After displaying all faults (up to 16 maximum) that have violated their setpoints, the display will show "END OF FAULT LOG".

```

FAULT LOG FOR GRP1

                END OF FAULT LOG
                PRESS ENTER TO CLEAR
    
```

Press the ESCAPE key twice to return to the normal screen to retain the current logs. To clear the fault logs in the group displayed, press the ENTER/ACK key, when the display asks "CLEAR FAULT LOG FOR GROUP X?" press the ENTER/ACK key to clear the log; the fault log will clear, the display will read "FAULT LOG EMPTY". Press the ESCAPE key twice to return to the "normal" display and retain the logs. If no faults are logged in the selected group, the display will show "FAULT LOG EMPTY".



```

CLEAR FAULT LOG FOR
GROUP 1?

[ENTER]=YES [ESC]=NO
    
```



```

FAULT LOG FOR GRP1

                FAULT LOG EMPTY
    
```



- 10.2 FAULT LOG RETENTION - The fault log can be configured using the setup menu to either retain or clear all logs on power-down/power-up, by pressing the RESET key, or by activating the remote reset. See section 13 , the setup section, to configure the fault log.

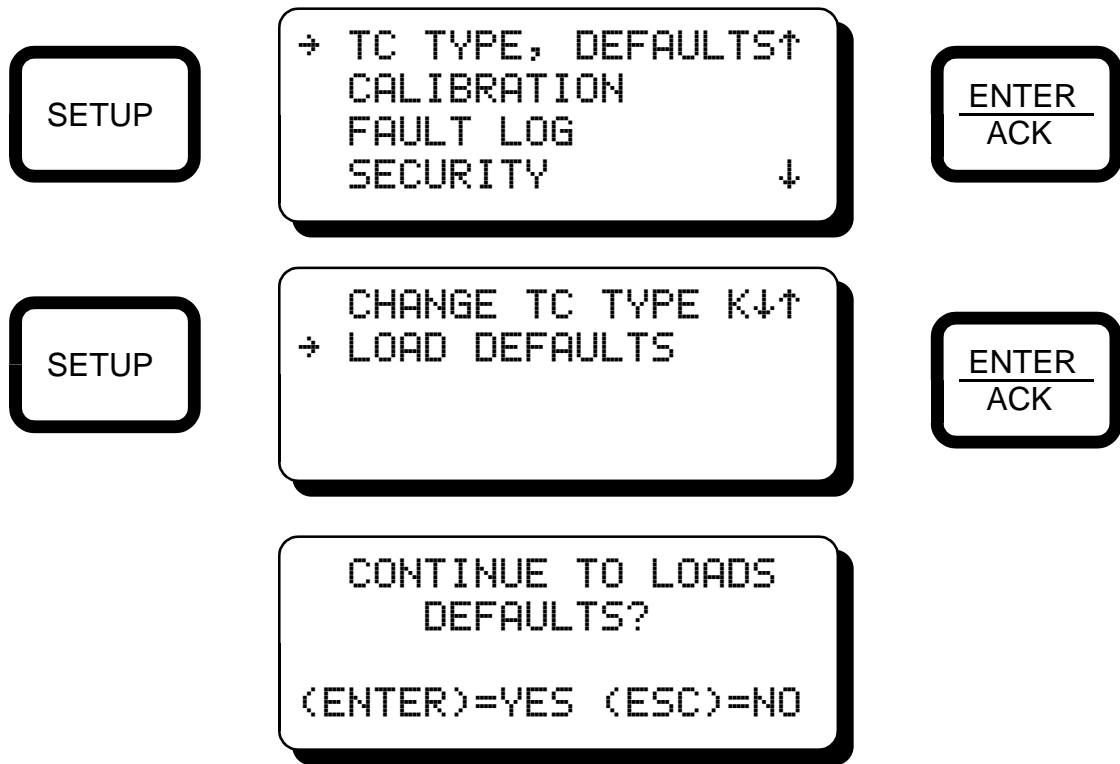
## **11.0 KEYPAD DESCRIPTION**

- 11.1 The ETM-40US universal temperature scanner contains an eight-key front keypad which is used to view or change the setpoint values and to configure and calibrate the scanner. The eight front panel keys are VIEW ALARMS, RESET, SETUP, ENTER/ACK, SETPTS, ESCAPE, and ▲, ▼ (up and down arrow keys).
- 11.2 VIEW ALARMS - The VIEW ALARMS key allows the user to display the channels which in the past have exceeded their setpoints (up to the first 16 faults for each group) in the order they occurred after a reset has been performed. This is helpful in determining which thermocouple is responsible for causing a fault.
- 11.3 RESET - The RESET key is used to clear the faults, the fault logs and the output switch if set to latching mode. See section 16 for more information on reset.
- 11.4 SETUP - The SETUP key is used to configure the scanner.
- 11.5 ENTER/ACK - The ENTER/ACK key is used to save new data or a new configuration in nonvolatile memory. The ENTER/ACK is also used to acknowledge a fault.
- 11.6 SETPTS - The SETPTS (setpoints) key is used to view or change the setpoint values. Refer to section 14 for more information. NOTE: The setpoints cannot be changed if security is set to "On".
- 11.7 ESCAPE - The ESCAPE key can be used at any time during the setup, setpoint or view alarms modes to return to the normal mode. When the ESCAPE key is pressed in any configuration mode, the display returns to the previous screen; multiple presses of the ESCAPE key may be required to return to the normal or channel screens.
- 11.8 ▲ ▼ - The up and down arrow keys are used to increment or decrement the displayed channel and corresponding temperature value. Each press of the up arrow key increments the channel one number while each press of the down arrow key decrements by one channel. These keys are also used to scroll through the selections and to increase or decrease values in the setup and setpoints menus.

## **12.0 FACTORY DEFAULT SETTINGS**

- 12.1 The ETM-40US universal temperature scanner contains default settings that are available to the user anytime during the life of the instrument. Upon receipt, the universal temperature scanner is set to these settings.

12.2 SELECTING THE DEFAULT SETTINGS - From the normal mode, press the SETUP key until the display reads "TC TYPE, DEFAULTS" and press the ENTER/ACK key. The display will read "CHANGE TC TYPE J or K" on the first line and "LOAD DEFAULTS" on the second line. Press the SETUP key so that the selection arrow points to "LOAD DEFAULTS" and press ENTER/ACK. The display will read "CONTINUE TO LOAD DEFAULTS?" - (ENTER)=YES and (ESC)=NO. Press ENTER to load defaults, the display will show "SAVED". All of the configuration parameters as well as the calibration values will automatically be set to the factory settings.



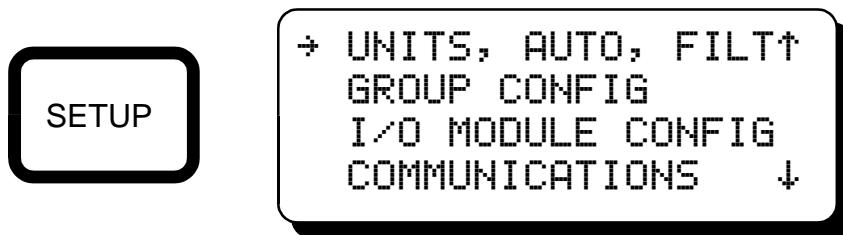
12.3 DEFAULT SETTINGS - Listed below are the factory default settings stored in permanent memory.

UNITS:	Degrees F (°F) or Degrees C (°C)
DISPLAY SCAN:	Manual
DISPLAY FILTER:	230 out of 255
NUMBER OF CHANNELS:	40 channels
PROTECTION STATUS:	Protection is OFF (Allow setpoints to be changed.)
NODE NUMBER:	01
SERIAL COMMUNICATIONS:	9600 baud
OUTPUT MODULES:	Shelf state, non-latching
SETPOINT VALUES:	HI -1000 °F, LO - 0 °F, DIF - 100 °F
STARTUP TIMER :	All timers = 0 minutes

**WARNING: UNIT MUST BE PROPERLY CONFIGURED FOR EACH APPLICATION PRIOR TO USE.**

## 13.0 SETUP / CONFIGURATION

- 13.1 The following are the configuration headings of the universal temperature scanner. From the normal display mode, press the SETUP key to enter the setup or configuration mode. Once in the setup mode, press the SETUP key or the ▲ or ▼ (up or down arrow key) to reach any of these configuration headings. Make a selection and press the ENTER/ACK key. Use the up or down arrow keys to navigate each menu. An arrow (→) will point to the active item. Use the ▲ or ▼ (up or down arrow keys) when (↑↓) are displayed next to an item to increase or decrease a value or to change the selection. Use the SETUP key to advance to the next item in each screen. Each line of data in each screen is changed and saved individually. Press the ENTER/ACK key to save the change, the display will read "SAVED" on the line of the changed item. The new data on that line is saved at this time. Data is saved line by line in each screen. The ESCAPE or SETUP key can be used before pressing the ENTER/ACK key to abort an unintended change. The SETUP key advances to the next item in the current screen and the ESCAPE key reverts back one screen. During configuration, the unit allows 30 seconds for first level and 60 seconds for other levels between keystrokes to change or save a new configuration. If the time lapses without a keystroke, the device will automatically return to the normal mode without making any changes. The new information is saved only if the ENTER/ACK key is pressed and the display reads "SAVED". A flowchart is provided that shows step-by-step progression through the configuration procedure.



Press the SETUP key or ▼ down arrow key until the next menu appears.



- 13.2 "UNITS, AUTO, FILT" - Press the SETUP or ▼ down arrow key to select "UNITS", "AUTOSCAN", or "FILTER" and press ENTER/ACK.



"UNITS °F or °C" - The available temperature units are °F and °C. When changing temperature units, the displayed temperature is automatically converted to the new unit value. To change the units, use the ▲ or ▼ arrow key to select either °F or °C, and press ENTER/ACK to accept and save the change. The top line of the display will read "SAVED", press ESCAPE twice to return to the normal mode displaying the new units selected and the numeric value converted to the selected units.

"AUTOSCAN 1-30s / OFF" - Autoscan allows the user to display automatically or manually the selected number of channels. The scan starts with the global status screen then channel 01 and progresses in numerical order to the last channel selected in each group. In manual scan (AUTOSCAN set to OFF), the scanner continually displays the temperature value of one channel at a time. The next channel or previous channel and corresponding temperature value is displayed with each press of the ▲ or ▼ arrow key. Autoscan can be set from 1 second to 30 seconds. In auto scan the device will display each channel number and temperature value for the selected time before automatically switching to the next channel. The ▲ or ▼ arrow keys can be used in autoscan to quickly advance or descend to other channels. Any channels or groups not used will not display.

"FILTER / 1-255" - The display filter can be used to stabilize the display reading of a changing input. Filtering is done in both hardware and software. The software filter is an adjustable filter; the rate of change is less for large values. The filter value is read-out in a number from 1 to 255, 1 being minimum filter value and 255 being maximum filter value. Below are some typical filter values and their effect on the display reading. Settling values are approximate times in seconds to reach 90% of new reading. Use the ▲ or ▼ arrow keys to increase or decrease the filter value and press ENTER/ACK to save the new filter value.

FILTER VALUE	1	128	200	210	220	230	240	250	253	255
SETTLING, SEC.	2	3.0	5.0	6.0	7.0	10	14	39	78	232

- 13.3 "GROUP CONFIG" - Group Configure allows the user to select the number of channels to be monitored in each group, set each group for common or individual setpoints, select a number of standard channel labels, set the group arm temperature and set the group arm time. Press the SETUP or ▼ down arrow key to select "GROUP CONFIG" and press ENTER/ACK.

SETUP

```
UNITS, AUTO, FILT↑  
→ GROUP CONFIG  
I/O MODULE CONFIG  
COMMUNICATIONS ↓
```

ENTER  
ACK

```
→GROUP 1 CH's 01-16  
GROUP 2 CH's 17-18  
GROUP 3 CH's 19-20  
GROUPs 4, 5, & 6
```

To access groups 4, 5, and 6, press the SETUP or ▼ arrow key until the → is pointing to "GROUPs 4, 5, & 6" and press ENTER/ACK.

The point assignment for groups 1 and 1A and groups 4 and 5 are linked together. The user can select any number of points from 0 to 16 for group 1 and the balance of points will be available for use in group 1A. Groups 4 and 5 work the same way with a total of 16 points that can be divided between the two groups. The configuration screens for groups 1 and 1A and 4 and 5 are similar and are described below. Point to group 1 and press ENTER/ACK.

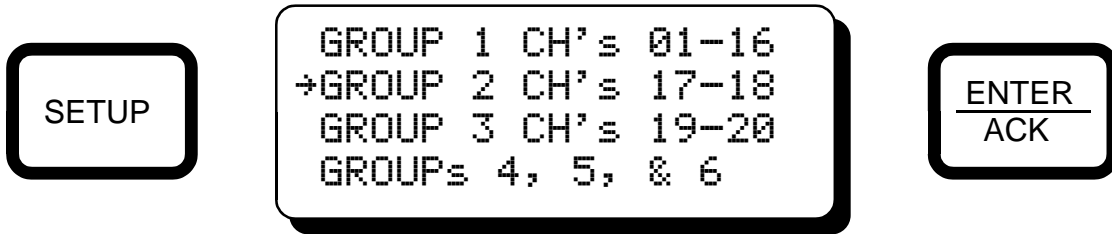
```
→GROUP 1 CH's 01-16  
GROUP 2 CH's 17-18  
GROUP 3 CH's 19-20  
GROUPs 4, 5, & 6
```

ENTER  
ACK

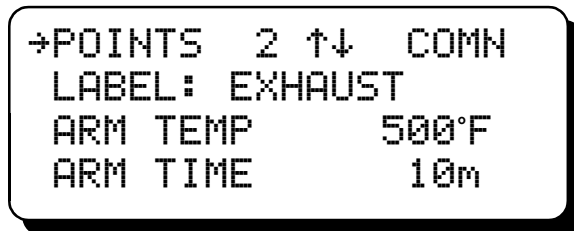
```
→GROUP 1 PTS 16↑↓  
GROUP 1A PTS 0  
GROUP 1 CONFIG  
GROUP 1A CONFIG
```

Use the ▲ or ▼ arrow keys to select the desired number of points for GROUP 1 and press ENTER/ACK to save. Use the SETUP key to point to GROUP 1A and select the desired number of points. The maximum number of points for both groups 1 and 1A are 16. So for example if 12 points are selected for group 1, then 4 points will be available for GROUP 1A. Both groups do not need to be used, either group can be set to zero points used. Use the SETUP key to point to GROUP 1 CONFIG and press ENTER/ACK to continue configuration. NOTE: The first channel in each group will be used first and the rest of the channels used follow in numeric order.

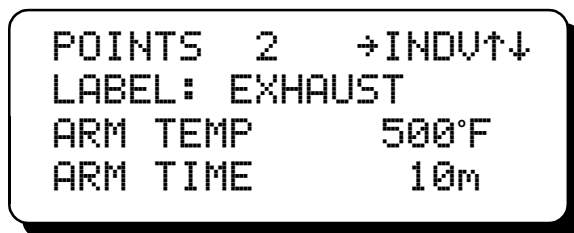
Groups 2, 3, and 6 configurations are similar. These groups are not linked to other groups as are groups 1, 1A and 4, 5. Once the number of points are selected, the rest of the configuration is the same for all groups. Press the ENTER/ACK key to configure.



“POINTS” - Allows the user to select the number of points to be monitored in each group. Use the ▲ or ▼ arrow keys to select the desired number of points and press ENTER/ACK to save. Channels or groups not selected will not display and will have no effect on the output module. NOTE: The first channel in each group will be used first and the rest of the channels used follow in numeric order.



“COMN / INDIV” - Any group’s setpoints can be set to common or individual. Selecting common setpoints would provide the six common setpoints for the selected group, two low’s, two high’s and two differential from average setpoints (L1, L2, H1, H2, D1, D2). Selecting individual setpoints would allow each channel for the selected group to have two individual low setpoints and two individual high setpoints (L1, L2, H1, H2). See Table 1 (Group Configuration) in this manual for a group summary.



"LABEL" - The group channel label can be changed to better identify the temperature type that the group is monitoring. This label will appear on each groups' individual channel screens in place of the standard "CHANNEL" label; the choices are: CHANNEL, CYLINDER, BEARING, EXHAUST, CATALYST, COMPRESSOR, TURBO, ENGINE, \*CUSTOM\*. A custom label can be downloaded from a P.C. to the ETM-40 via the RS-485 serial port using the ETM-40 custom channel label program (ETM40LblProg.exe) supplied on the CD with the unit. With the "\*CUSTOM\*" label selected in a group, each channel in that group can have its own individual label. Select "\*CUSTOM\*" and follow the instructions included with the custom channel label program.

```
POINTS 12   INDV
→LABEL: * CUSTOM *↑↓
ARM TEMP    100°F
ARM TIME    10m
```

ARM TEMPERATURE - The arm temperature and arm timer functions lock out the setpoints of each group from causing a fault condition and tripping an output module. Each group contains its own separate arm temperature and arm timer that arms the entire group. Upon a reset condition, the system waits for the average arm temperature to reach the group average temperature. After the arm temperature is met, the arm timer starts to count down. The engine arm temperature can be set anywhere within the range of the scanner. Use the ▲ or ▼ arrow keys to increase or decrease the selected group arm temperature and press ENTER/ACK to save. To effectively turn the arm temperature off for any group, set the arm temp to a value below what would normally be seen by the average group temperature.

```
POINTS 12   INDV
LABEL: * CUSTOM *
→ARM TEMP    100°F↑↓
ARM TIME    10m
```

ARM TIMER - Each group has an individual adjustable arm timer. Each arm timer starts when the average group temperature is met. For each group, if at any time when the timer is active the average temperature goes below the configured arm temperature, the timer will start over. The setpoints for that group do not become active until the average group temperature stays above the configured group arm temperature continuously for the entire entered time period. All start-up timers can be canceled by displaying the global status screen and pressing the ENTER/ACK key. When each group's start-up timer expires, all setpoints in that group are active as well as the output modules. Pressing the ESCAPE key when displaying the global status screen will display the time left for each group's arm time. The last minute for each group will count down from 60 seconds. Pressing the ESC key again will return to the start-up timer screen. If no setpoint is configured to use the timer, it will not display during start-up.

```
POINTS 12   INDV
LABEL: * CUSTOM *
ARM TEMP    100°F
→ARM TIME   10m↑↓
```

13.4 "I/O MODULE CONFIG" - I/O Module Config is used to set the input and output modules to fail safe or shelf state, and latching or non-latching. Note: For the input module, fail safe or shelf state only. Shelf state is when the outputs are in the same condition with no faults as when unpowered; fail-safe is when they are opposite. In non-latching mode, the output switch changes state when the setpoints come out of violation; in latching mode, a reset event is required to clear from the tripped state. Press the SETUP or ▼ down arrow key to select "I/O MODULE CONFIG" and press ENTER/ACK.

SETUP

```
UNITS, AUTO, FILT↑
GROUP CONFIG
→ I/O MODULE CONFIG
COMMUNICATIONS ↓
```

Use the ▲ or ▼ arrow key to select the desired input or output module and press ENTER/ACK

```
INPUT
→OUTPUT 1   OUTPUT 3
   OUTPUT 2   OUTPUT 4
```

Use the ▲ or ▼ arrow key to select between "SHELF" and "FAIL SAFE"; press ENTER/ACK to save.

```
→STATE      SHELF   ↑↓
   TYPE      NON LATCH
```



Use the SETUP key to select type. Use the ▲ or ▼ arrow key to select between “LATCH” and “NON LATCH”; press ENTER/ACK to save.



```
OUTPUT 1
STATE    SHELF
→TYPE    NON LATCH ↑↓
```

13.5 “COMMUNICATIONS” - Use the communications menu to select the node number and the baud rate. Press the SETUP or ▼ down arrow key to select “COMMUNICATIONS” and press ENTER/ACK.



```
UNITS, AUTO, FILT↑
GROUP CONFIG
I/O MODULE CONFIG
→ COMMUNICATIONS ↓
```

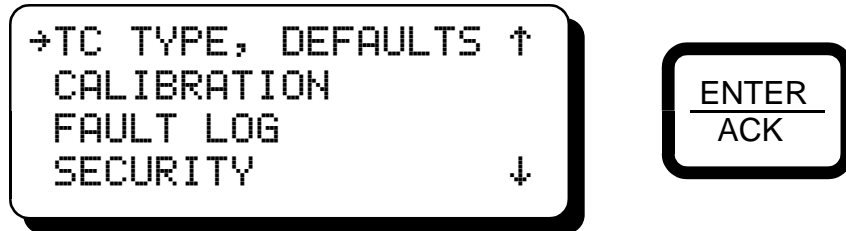
“NODE NO.” - For RS-485 serial communications, each unit must be assigned a node or identification number so that the ETM-40 scanner can be identified by the device communicating with it. Any unique number from 1 to 99 may be used.

```
COMMUNICATIONS
→NODE NO.      01↑↓
BAUD RATE      9600
```

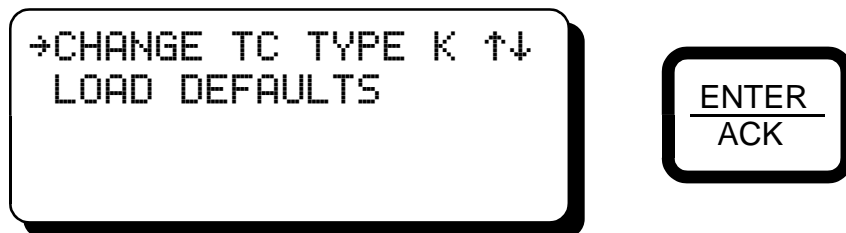
“BAUD RATE” - Press the SETUP key to set the communications baud rate. The default is 9600. The speed selections are 300, 600, 1200, 2400, 4800, 9600, 19.2K, 38.4K, and 57.6K. The connection preferences are N 8 1 (8 data bits, no parity and 1 stop bit).

```
COMMUNICATIONS
NODE NO.      01
→BAUD RATE    9600↑↓
```

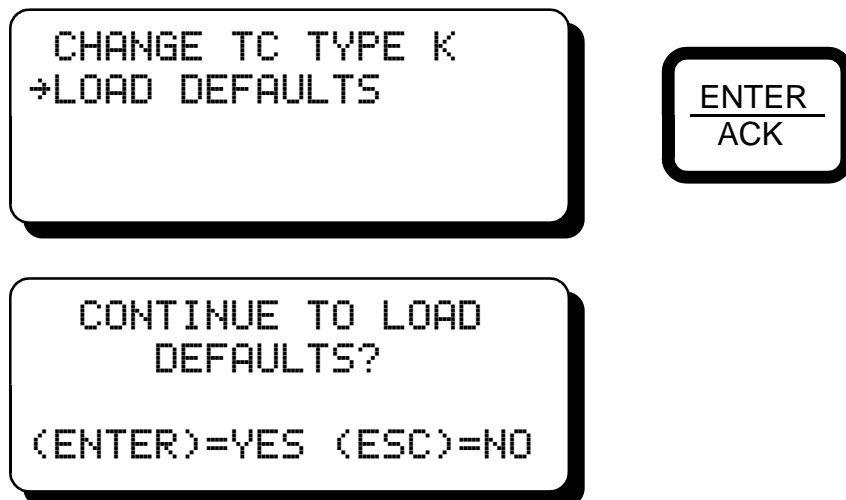
- 13.6 "THERMOCOUPLE TYPE" J or K or LOAD FACTORY DEFAULTS - The ETM-40 can read either type J or K thermocouples. All of the inputs must be of the same type, either "J" or "K"; the inputs cannot be mixed. Use the ▲ or ▼ arrow key or the SETUP key to select "TC TYPE, DEFAULTS" and press ENTER/ACK.



With the arrow pointing to "CHANGE TC TYPE", use the ▲ or ▼ arrow key to select either type "K" or "J" thermocouple type and press ENTER/ACK to save the new thermocouple type.

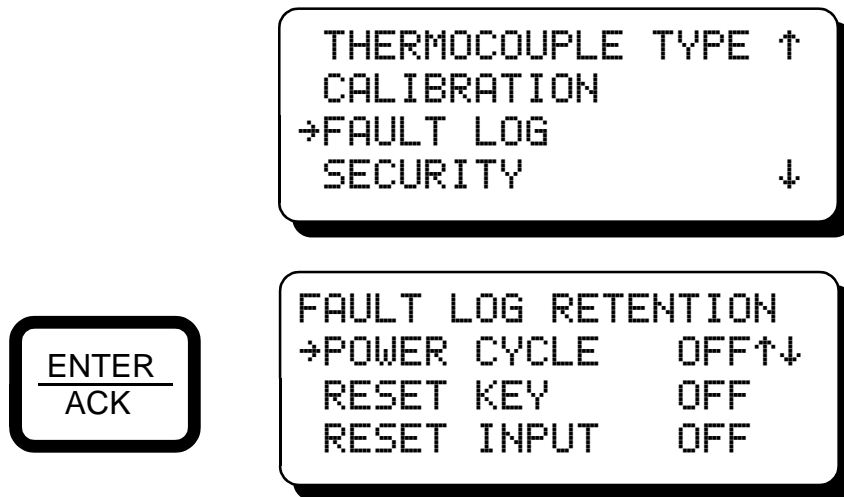


To load the factory defaults, use the SETUP key to select "LOAD DEFAULTS" and press ENTER/ACK. To load the factory defaults press ENTER/ACK or to keep the current configuration, press ESCAPE.

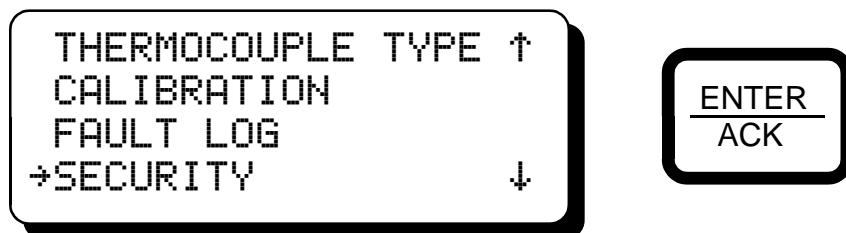


**NOTE:** Pressing ENTER/ACK will return all of the adjustable parameters, including the setpoint switch values, to factory default values. Press ESC to exit without reloading default values.

- 13.7 "CALIBRATION" - For calibration procedures, see Section 17.0.
- 13.8 "FAULT LOG" - The fault log retention configuration menu allows the fault logs to be retained on a power-off/power-on cycle, the pressing of the RESET key, or by a system reset using the input module (remote reset). When set to "ON", fault retention will occur; if set to "OFF", the logs will be cleared for each reset method. Regardless as to how these are set, each individual groups fault logs can be cleared in the fault log screen. See section 10.0 FAULT LOGS in this manual.



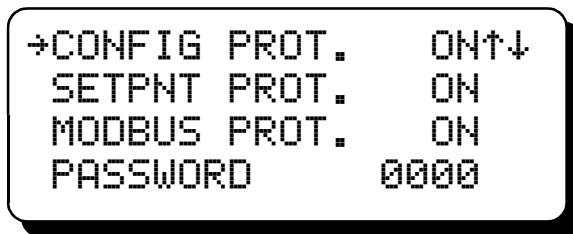
- 13.9 "SECURITY" - This feature allows for protection from data being inadvertently being changed. There are several menus that can be protected as well as two layers of protection. The menus that can be protected are the CONFIGURATION SETTINGS, the SETPOINT VALUES, and the ability to make changes via MODBUS communications. When protection is ON, the user is able to view the values but is not able to change any of them. If an attempt is made to change the values and the ENTER/ACK key is pressed when protection is on, the display will read "LOCKED" and advance to the next item in that screen. Select 'SECURITY' and press ENTER/ACK.



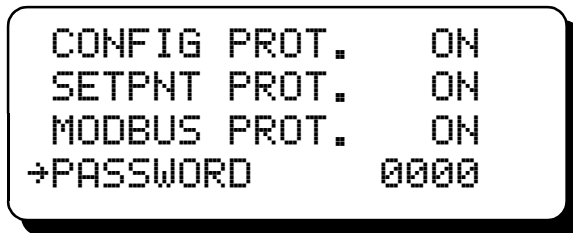
CONFIGURATION PROTECTION, when set to "ON", prevents the user from changing items in GROUP CONFIG, OPTO CONFIG, COMMUNICATIONS, THERMOCOUPLE TYPE, CALIBRATION, and configuring the fault log retention. Select "CONFIG PROT." and use the ▲ or ▼ to set to "ON" and press ENTER/ACK to save. Note: Units, auto scan and filter values are not locked out when configuration protection is on.

SETPOINT PROTECTION, when set to "ON", prevents the user from changing the setpoint values. All setpoint values can be read but not changed. Select "SETPT PROT." and use the ▲ or ▼ to set to "ON" and press ENTER/ACK to save.

MODBUS PROTECTION when set to "ON" prevents the user from changing the above listed items via the MODBUS serial communications. The user can read data but not write data via Modbus when Modbus protection is on. If the user attempts to do a write, the error message "INVALID FUNCTION CODE" will be sent.



PASSWORD is the second level of protection. When password is selected, the user will be prompted to enter a 4 digit password. The top four keys are numbers 1 through 4 respectively. Use these four keys in any combination to enter a password and press ENTER/ACK.



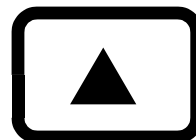
1



2



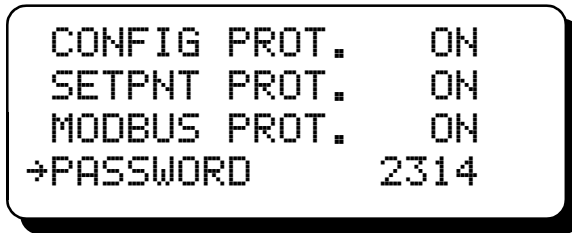
3



4

The next time the security screen is accessed, the message “ENTER PASSWORD will appear. If the proper password is entered, the display will allow changes to be made. To gain access to the protected menu's, turn protection OFF. If the incorrect password is entered, the display will show “PASSWORD INVALID” and return to a home screen and continue to deny access to the protected menu's.

If the password is forgotten, it can be displayed by moving jumper JMP1 to pins 1 and 2, then enter the security screen and the password will be displayed. When done, place the jumper back to pins 2 and 3. To remove the password, us the SETUP key to point to “PASSWORD”, press ENTER/ACK and then the ▼ arrow key, the password will reset to 0000 (no password).



## 14.0 SETPOINTS

- 14.1 The ETM-40US temperature scanner has seven groups. Each group can be independently set to have either common setpoints for the whole group or individual setpoints for each channel in the group.

COMMON SETPOINTS - When a group is set for common setpoints, there are six setpoints available for the group. The common setpoints are low 1 and 2 (L1, L2), high 1 and 2 (H1, H2), and differential 1 and 2 (D1, D2). Differential is taken from the average of the other points in the group.

INDIVIDUAL SETPOINTS - When a group is set for individual setpoints, there are 4 individual setpoints for each channel - a low and a high (L1, H1) for output 1 and a low and a high (L2, H2) for output 2.

For groups 1 through 5, setpoints L1, H1, and D1 trip output module 1. For group 6, setpoints L1, H1, and D1 trip output module 3.

For groups 1 through 5, setpoints L2, H2, and D2 trip output module 2. For group 6, setpoints L2, H2, and D2 trip output module 4.

A group/setpoint matrix summary is shown in table 1 on page 5.

All of the temperature setpoints can be set anywhere within the range of the scanner or OFF. To view or change the setpoint values, press the SETPTS key. Use the SETUP key to select a group, and press ENTER/ACK. Note that group 1 and 1A have an intermediate menu to select group 1 or 1A to configure their setpoints.



```

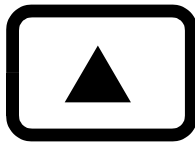
→GROUP 1 CH's 01-16
GROUP 2 CH's 17-18
GROUP 3 CH's 19-20
GROUPs 4, 5, & 6

```



Use the ▲ or ▼ arrow key to select output 1 or 2 (for group 6, output 3 or 4) and press SETUP to adjust the high, low and differential setpoints. The → arrow key will point to the setpoint to be changed. To adjust the displayed value, press the ▲ or ▼ arrow key to increase or decrease the value until the desired trip-point is reached. Press ENTER/ACK to accept and save the new value. The new setpoint value will change only if the ENTER/ACK key is pressed. Press the ESCAPE key to return to the group select menu. To set the selected setpoint off (no fault display or output module action), display the adjust setpoints screen, point to the desired setpoint and press the SETPTS key; the display will show "OFF", press ENTER/ACK to save. To turn it back on, again press the SETPTS or the ▲ or ▼ key and then ENTER/ACK key.

NOTE: When in the setpoints mode, the previous setpoint values are monitored, and the new value is monitored only after the ENTER/ACK key is pressed and the display says "SAVED". If no key is pressed for 30 seconds, the display will return to the normal mode and the configuration will revert back to the previous parameters.



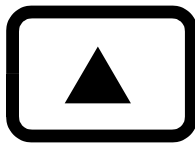
```

GRP1      OUT 1
→HIGH 1   1000°F↑↓
LOW 1     50°F
DIF 1     100°F

```



When a group is configured for individual setpoints, each channel in the respective group can have two low setpoints and two high setpoints. Setpoints low 1 and high 1 will trip output 1, (output 3 for group 6) setpoints low 2 and high 2 will trip output 2 (output 4 for group 6). Use the ▲ or ▼ key to select the desired channel. Use the SETUP and the ▲ or ▼ keys as described above to select output 1 or 2, (3 or 4) and adjust each setpoint value. Press ENTER/ACK to accept the change.



```

→CH.21↑↓  OUT 1
HIGH 1    650°F
LOW 1     65°F

```



## **15.0 INPUT/OUTPUT MODULES**

- 15.1 OUTPUT MODULES - The output modules are standard 0.6 inch plug-in digital output modules. There is a wide offering of 0.6 inch output modules available from many suppliers with different voltage and current ratings. All modules are optically isolated and come in both AC and DC versions. Listed below are the modules available from Altronic. Each module has a 3-amp board mounted plug-in fuse in the output circuitry above each module. Each module has an LED indicator mounted above each module; the LED is on when activated. See figure 4, GENERAL ELECTRICAL CONNECTIONS, for position of each module. NOTE: CSA certified input/output modules must be used in Class I, Groups C & D hazardous locations.

<u>Altronic P/N</u>	<u>Manuf. P/N</u>	<u>Voltage</u>	<u>Current</u>	<u>Case color</u>
691056	ODC5	5-60 Vdc	2A	RED
691066	ODC5A	5-200 Vdc	0.67A	RED
691065	OAC5A	24-280Vac	2A	BLACK

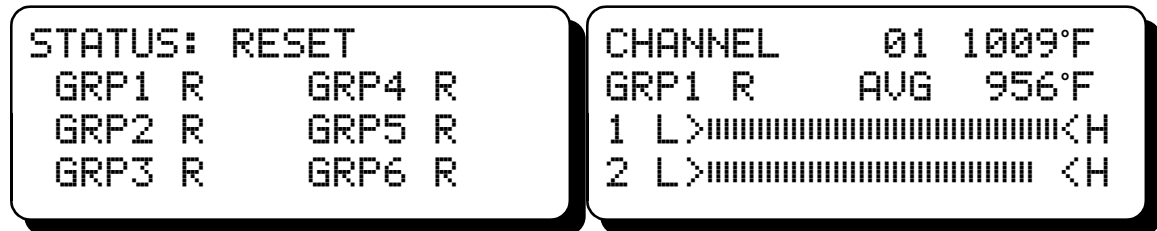
Each module can be actively configured with the keypad to be either open or closed and latching or nonlatching. See table 1 for the mapping of channels, setpoints and output modules. The output module will make an electrical connection within two seconds (see note below) of a setpoint violation. A hysteresis of 10°F or 5°C is used on all setpoints to prevent the output from rapidly turning on and off near a setpoint. The output module, if set to non-latching, will clear when the temperature values of all configured channels are 10°F / 5°C different than any setpoint. For example, if a high 2 setpoint value is set to 900°F, the output module will trip when the monitored temperature reaches 900°F and will not clear until the input temperature is less than or equal to 890°F. If the output module is set to LATCHING, the output module will remain tripped until reset is initiated.

**NOTE: The output switch reaction time is tied to the filter value with two seconds being the minimum. For other reaction times see section 13.2.**

- 15.2 INPUT MODULE - The input module is a standard 0.6 inch plug-in digital input module. There is a wide offering of 0.6 inch input modules available from many suppliers with different voltage and current ratings. All modules are optically isolated and come in both AC and DC versions. Listed below are the modules available from Altronic. The input module has a 3-amp board mounted plug-in fuse in the input circuitry above the module. The input module has an LED indicator mounted above it; the LED is on when activated. See figure 4, GENERAL ELECTRICAL CONNECTIONS, for position of the input module. The input module can be actively configured with the keypad to be either open or closed.

<u>Altronic p/n</u>	<u>Man. P/N</u>	<u>Voltage</u>	<u>Case color</u>
691057	IDC5	10-32 Vdc	RED
691064	IAC5	90-140Vac/Vdc	BLACK

All setpoints and outputs can be controlled during start-up by using the input module. With the input module active, all the setpoints and outputs will be inactive, (will not trip). The front panel fault indicator will not light, and the status line of the global status screen will display "RESET". Each configured channel screen will display an "R" (in reset) for the group status indication. All channels' temperature readings and bargraphs will operate normally.



## **16.0 RESET**

- 16.1 RESET OPERATION - Reset can be initiated in one of three ways: by pressing the RESET key, by activating the input module, or by sending a reset command via the RS-485 Modbus communications. A reset operation clears the view alarms and start-up timers and places the output switches in the non-tripped condition. Reset can be held active by either activating the input module on the input/output terminal board assembly of the unit or by pressing and holding the reset button on the front keypad. When reset is kept active, the output modules will stay in the non-faulted condition and the display will show "RESET" to inform the operator. When the RESET key is pressed, the global status screen is displayed. With the input module active, all the setpoints and outputs will be inactive (will not trip). The front panel fault indicator will not light, and the status line of the global status screen will display "RESET". Each configured channel screen will display an "R" (in reset) for the group status indication. All channels' temperature readings and bargraphs will operate normally.



## **17.0 CALIBRATION**

- 17.1 The instrument is calibrated at the factory and should not require additional calibration. However, calibration can be performed in the field many times over the life of the device. The calibration mode is used to calibrate the zero and span values. Calibration can be performed from the front keypad. A thermocouple calibrator or simulator is required to provide a calibration reference.

NOTE: During calibration, the unit allows 60 seconds between keystrokes to change or save a new calibration. If 60 seconds lapse without a keystroke, the device will automatically return to the normal mode with the previous values. The new calibration information is saved only if the ENTER/ACK key is pressed and the display reads "SAVED".

- 17.2 CALIBRATION PROCEDURE - Connect the appropriate thermocouple simulator (either type J or K) using proper thermocouple extension wire to the universal temperature scanner thermocouple input channel 01. The ETM-40US universal temperature scanner MUST be calibrated on channel 01 only. The calibration performed on channel 01 applies to all channels. NOTE: Calibration is performed on channel 01 even if group 1 is turned off.

To calibrate the universal temperature scanner, press the SETUP key until the display reads "CALIBRATION" and press ENTER/ACK. The display will read "SET LO POINT". Adjust the simulator for a very low reading (0°F) and press ENTER/ACK; the display will show "SAMPLING", then "ADJUST LO POINT". Use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the setting of the simulator and press ENTER/ACK. The display will now read "SET HI POINT". Adjust the simulator for a very high reading (1000°F) and press ENTER/ACK; the display will show "SAMPLING", then "ADJUST HI POINT". Again use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the simulator and press ENTER/ACK. The display will read "SAVED". Press ESCAPE to return to the normal reading with the new calibration values stored in permanent memory. NOTE: Be sure that the thermocouple type and the units (°F or °C) of the calibrator match the units of the instrument before performing a calibration.

- 17.3 The ETM-40US universal temperature scanner has a feature that allows a slight adjustment of either the zero or span values individually. This type of calibration can be used to "tweak" the readout to match that of a known value without actually performing a formal calibration procedure. This adjustment must be performed only on channel 01. NOTE: This type of adjustment will invalidate calibration settings from the procedures in section 17.2.

A. ZERO ADJUSTMENT ONLY - To make a small adjustment on the zero calibration value of the universal temperature scanner, enter the calibration mode by pressing the SETUP key until the display reads "CALIBRATION" and press ENTER/ACK; the display will read "SET LO POINT". With the standard at or near zero, press ENTER/ACK and use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the standard and press ENTER/ACK. The display will read "SET HI POINT"; press the SETUP key and the display will read "SAVED". Press ESCAPE to return to the normal reading with the new zero calibration value stored in permanent memory.

B. SPAN ADJUSTMENT ONLY - To make a small adjustment on the span point of the universal temperature scanner, enter the calibration mode by pressing the SETUP key until the display reads "CALIBRATION" and press ENTER/ACK; the display will read "SET LO POINT". Press the SETUP key and the display will read "SET HI POINT". With the standard at or near the desired span value, press ENTER/ACK and use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the standard and press ENTER/ACK. The display will read "SAVED". Press ESCAPE to return to the normal reading with the new span calibration value stored in permanent memory.

17.4 SELECTING THE DEFAULT CALIBRATION -- The user can at any time during the life of the scanner return to the factory calibration values. Press the SETUP key until the display reads "THERMOCOUPLE TYPE"; press ENTER/ACK, the display will read "CHANGING TC TYPE LOADS DEFAULTS". Use the ▲ or ▼ arrow key to select either type "J" or "K" thermocouple type and press ENTER/ACK. The display will say "SAVED" and the factory default calibration values will be used. NOTE: All the setup parameters will return to the factory default values; the user must configure the scanner before use on an engine.

## **18.0 RS-485 COMMUNICATIONS**

18.1 The ETM-40US universal temperature scanner is part of a system that has been carefully designed to easily interface to popular computers, terminals, programmable controllers and future Altronic instruments. The serial communications is compliant to the Modicon Modbus RTU standard and uses RS-485 for its hardware communication format.

18.2 MASTER/SLAVE OPERATION - The ETM-40 temperature scanner's RS-485 communication system is designed as a master/slave system; that is, each unit responds to its own unique address (node number) only after it is interrogated by the master (computer). One master and up to 32 slaves can communicate in the system. The units communicate with the master via a polling system. The master sends a command and only the polled slave responds. The slave modules can never initiate a communications sequence. A simple command/ response protocol must be strictly observed.

18.3 NODE NUMBER - The node number is used in the system to identify the desired slave unit being polled. The node number can be any numeric value from 1 to 99 although only 32 devices can be served on a single communications port. This number range (1 to 99) is allowed so that if device grouping by function or application is desired, it can be implemented using the first digit as the group or engine number and the second as the unit number. For example, 53 could be used to identify the number 3 slave unit mounted on engine number 5.

18.4 HALF-DUPLEX OPERATION - The RS-485 system employed uses two wires for communication and cannot send and receive data at the same time over the same two wires making it a half-duplex system. When the master is in the transmit mode, the slave is in the receive mode and visa-versa.

- 18.5 ELECTRICAL OPERATING RANGE - RS-485 is a communications standard to satisfy the need for multi-dropped systems that can operate at high speeds over long distances. RS-485 uses a balanced differential pair of wires switching from 0 to 5 volts to communicate data. RS-485 drivers can handle common mode voltages from -7 to +12 volts without loss of data, making them an excellent choice for industrial environments.
- 18.6 COMMUNICATIONS PARAMETERS - The following must be set by the master to communicate with the slaves:
- Baud Rate: 9600 (DEFAULT others available, see section 13.5)
  - Data Bits: 8
  - Stop Bits: 1
  - Parity: None
- 18.7 COMMUNICATIONS WIRING - The RS-485 wiring diagram illustrates the wiring required for multiple slave unit hookup. Note that every slave unit has a direct connection to the master. This allows any one slave unit to be removed from service without affecting the operation of the other units. Every unit must be programmed with a unique address or node number, but the addition of new units or nodes can be in any order. To minimize unwanted reflections on the transmission line, the bus should be arranged as a trunk line going from one module to the next. Random structures of the transmission line should be avoided. Special care must be taken with long busses (500 feet or more) to ensure error-free operation. Long busses must be terminated with a 120 ohm resistor between the terminals marked RS-485 "A" and RS-485 "B" at the master only. The use of twisted pair shielded cable will enhance signal fidelity and is recommended. To prevent ground loops the shield should be connected to the shield terminal at the master only.
- 18.8 RX, TX INDICATORS - An RX and TX (receive and transmit) LED is visible on the door-mounted circuit board of the ETM-40US unit to indicate when the unit is either receiving or transmitting data.
- 18.9 CONNECTING TO A PC - When connecting the ETM-40US universal temperature scanner to the RS-232 port on a PC, an RS-232 to RS-485 converter must be used for the communication interface. See wiring diagram for details.
- 18.10 LOADING - RS-485 uses a balanced differential pair of wires switching from 0 to 5 volts to communicate data. In situations where many units (32 max.) are connected together on a long run, voltage drop on the communications leads becomes a major problem. Voltage drops on the RS-485 minus lead appear as a common mode voltage to the receivers. While the receivers are rated to a maximum voltage difference of +/-7 volts, -7V to +12V, a practical system should not have a voltage difference exceeding +/- 3 volts under normal conditions. The wire gauge used for the connections therefore limits the maximum number of units or the maximum length of wire between units in each application. The following formula can be used as a guideline to select the appropriate wire gauge.
- For 18 AWG wire No. of units = (4000) / (ft. of wire used)
  - For 20 AWG wire No. of units = (2500) / (ft. of wire used)
  - For 22 AWG wire No. of units = (1600) / (ft. of wire used)
- NOTE: The maximum number of units connected together in a system is 32.

18.11 MODBUS REGISTER LISTS - The maximum number of registers that can be read at one time is limited to 32. The maximum number of booleans that can be read at one time is limited to 256. All communications are at 9600 baud (default value, see section 13.5 for other speeds), 8 Data bits, No Parity, 1 Stop bit (9600 8N1). The MODBUS address list is as follows.

**Revised ETM-40 Modbus RTU Register List (for firmware version 2.0 dated 02/13/2003)**

**Note: All temperatures are stated in 0.1 Deg. Kelvin ( for universal compatibility ).  
Therefore a register value of 2730 is 273.0K, which is 0C, or 32F.**

COILS (FUNCTION CODE 1)	
ADDRESS	DESCRIPTION OF FUNCTION
00001	UNITS DEG. C or F (1=C)
00002	TC TYPE J or K (1=K)
00003	AUTOSCAN ON/OFF (1=ON)
00004	RETAIN FAULTS ON POWER CYCLE
00005	RETAIN FAULTS ON RESET KEY
00006	RETAIN FAULTS ON RESET MODULE
00007	RESERVED
00008	INPUT MOD STATE (1=FAILSAFE)
00009	OUT MOD #1 TYPE (1=LATCHING)
00010	OUT MOD #1 STATE (1=FAILSAFE)
00011	OUT MOD #2 TYPE (1=LATCHING)
00012	OUT MOD #2 STATE (1=FAILSAFE)
00013	OUT MOD #3 TYPE (1=LATCHING)
00014	OUT MOD #3 STATE (1=FAILSAFE)
00015	OUT MOD #4 TYPE (1=LATCHING)
00016	OUT MOD #4 STATE (1=FAILSAFE)
00017	GROUP 1 SETPT: HI 1 (1=ON)
00018	GROUP 1 SETPT: LO 1 (1=ON)
00019	GROUP 1 SETPT: DIF 1 (1=ON)
00020	GROUP 1 SETPT: HI 2 (1=ON)
00021	GROUP 1 SETPT: LO 2 (1=ON)
00022	GROUP 1 SETPT: DIF 2 (1=ON)
00023	RESERVED
00024	RESERVED
00025	GROUP 1A SETPT: HI 1 (1=ON)
00026	GROUP 1A SETPT: LO 1 (1=ON)
00027	GROUP 1A SETPT: DIF 1 (1=ON)
00028	GROUP 1A SETPT: HI 2 (1=ON)
00029	GROUP 1A SETPT: LO 2 (1=ON)
00030	GROUP 1A SETPT: DIF 2 (1=ON)
00031	RESERVED
00032	RESERVED

00033	GROUP 2 SETPT: HI 1 (1=ON)
00034	GROUP 2 SETPT: LO 1 (1=ON)
00035	GROUP 2 SETPT: DIF 1 (1=ON)
00036	GROUP 2 SETPT: HI 2 (1=ON)
00037	GROUP 2 SETPT: LO 2 (1=ON)
00038	GROUP 2 SETPT: DIF 2 (1=ON)
00039	RESERVED
00040	RESERVED
00041	GROUP 3 SETPT: HI 1 (1=ON)
00042	GROUP 3 SETPT: LO 1 (1=ON)
00043	GROUP 3 SETPT: DIF 1 (1=ON)
00044	GROUP 3 SETPT: HI 2 (1=ON)
00045	GROUP 3 SETPT: LO 2 (1=ON)
00046	GROUP 3 SETPT: DIF 2 (1=ON)
00047	RESERVED
00048	RESERVED
00049	GROUP 4 SETPT: HI 1 (1=ON)
00050	GROUP 4 SETPT: LO 1 (1=ON)
00051	GROUP 4 SETPT: DIF 1 (1=ON)
00052	GROUP 4 SETPT: HI 2 (1=ON)
00053	GROUP 4 SETPT: LO 2 (1=ON)
00054	GROUP 4 SETPT: DIF 2 (1=ON)
00055	RESERVED
00056	RESERVED
00057	GROUP 5 SETPT: HI 1 (1=ON)
00058	GROUP 5 SETPT: LO 1 (1=ON)
00059	GROUP 5 SETPT: DIF 1 (1=ON)
00060	GROUP 5 SETPT: HI 2 (1=ON)
00061	GROUP 5 SETPT: LO 2 (1=ON)
00062	GROUP 5 SETPT: DIF 2 (1=ON)
00063	RESERVED
00064	RESERVED
00065	GROUP 6 SETPT: HI 3 (1=ON)
00066	GROUP 6 SETPT: LO 3 (1=ON)
00067	GROUP 6 SETPT: DIF 3 (1=ON)
00068	GROUP 6 SETPT: HI 4 (1=ON)
00069	GROUP 6 SETPT: LO 4 (1=ON)
00070	GROUP 6 SETPT: DIF 4 (1=ON)
00071	RESERVED
00072	RESERVED
00073	CHANNEL 01 SETPT: HI 1 (1=ON)
00074	CHANNEL 01 SETPT: LO 1 (1=ON)
00075	RESERVED

00076	CHANNEL 01 SETPT: HI 2 (1=ON)
00077	CHANNEL 01 SETPT: LO 2 (1=ON)
00078	RESERVED
00079	RESERVED
00080	RESERVED
00081	CHANNEL 02 SETPT: HI 1 (1=ON)
00082	CHANNEL 02 SETPT: LO 1 (1=ON)
00083	RESERVED
00084	CHANNEL 02 SETPT: HI 2 (1=ON)
00085	CHANNEL 02 SETPT: LO 2 (1=ON)
00086	RESERVED
00087	RESERVED
00088	RESERVED
00089	CHANNEL 03 SETPT: HI 1 (1=ON)
00090	CHANNEL 03 SETPT: LO 1 (1=ON)
00091	RESERVED
00092	CHANNEL 03 SETPT: HI 2 (1=ON)
00093	CHANNEL 03 SETPT: LO 2 (1=ON)
:	:
:	:
00366	RESERVED
00367	RESERVED
00368	RESERVED
00369	CHANNEL 38 SETPT: HI 3 (1=ON)
00370	CHANNEL 38 SETPT: LO 3 (1=ON)
00371	RESERVED
00372	CHANNEL 38 SETPT: HI 4 (1=ON)
00373	CHANNEL 38 SETPT: LO 4 (1=ON)
00374	RESERVED
00375	RESERVED
00376	RESERVED
00377	CHANNEL 39 SETPT: HI 3 (1=ON)
00378	CHANNEL 39 SETPT: LO 3 (1=ON)
00379	RESERVED
00380	CHANNEL 39 SETPT: HI 4 (1=ON)
00381	CHANNEL 39 SETPT: LO 4 (1=ON)
00382	RESERVED
00383	RESERVED
00384	RESERVED
00385	CHANNEL 40 SETPT: HI 3 (1=ON)
00386	CHANNEL 40 SETPT: LO 3 (1=ON)
00387	RESERVED
00388	CHANNEL 40 SETPT: HI 4 (1=ON)

00389	CHANNEL 40 SETPT: LO 4 (1=ON)
00390	RESERVED
00391	RESERVED
00392	RESERVED

**INPUT STATUS (FUNCTION CODE 2)**

ADDRESS	DESCRIPTION OF FUNCTION
10001	FAULT SWITCH 1 (1 = FAULT)
10002	FAULT SWITCH 2 (1 = FAULT)
10003	FAULT SWITCH 3 (1 = FAULT)
10004	FAULT SWITCH 4 (1 = FAULT)
10005	GLOBAL FAULT BIT (1 = FAULT)
10006	RESET INPUT TERM. (1 = RESET)
10007	RESET KEY (1 = RESET)
10008	GLOBAL RESET BIT (1 = RESET)
10009	GROUP 1 ARMED (1 = ARMED)
10010	GROUP 1A ARMED (1 = ARMED)
10011	GROUP 2 ARMED (1 = ARMED)
10012	GROUP 3 ARMED (1 = ARMED)
10013	GROUP 4 ARMED (1 = ARMED)
10014	GROUP 5 ARMED (1 = ARMED)
10015	GROUP 6 ARMED (1 = ARMED)
10016	GLOBAL ARMED BIT (1 = ARMED)
10017	CH.01 HI 1 (1 = TRIP)
10018	CH.01 LO 1 (1 = TRIP)
10019	CH.01 DIF 1 (1 = TRIP)
10020	CH.01 HI 2 (1 = TRIP)
10021	CH.01 LO 2 (1 = TRIP)
10022	CH.01 DIF 2 (1 = TRIP)
10023	RESERVED
10024	RESERVED
10025	CH.02 HI 1 (1 = TRIP)
10026	CH.02 LO 1 (1 = TRIP)
10027	CH.02 DIF 1 (1 = TRIP)
10028	CH.02 HI 2 (1 = TRIP)
10029	CH.02 LO 2 (1 = TRIP)
10030	CH.02 DIF 2 (1 = TRIP)
10031	RESERVED
10032	RESERVED
10033	CH.03 HI 1 (1 = TRIP)
10034	CH.03 LO 1 (1 = TRIP)
10035	CH.03 DIF 1 (1 = TRIP)
10036	CH.03 HI 2 (1 = TRIP)

10037	CH.03 LO 2 (1 = TRIP)
10038	CH.03 DIF 2 (1 = TRIP)
:	:
:	:
10311	RESERVED
10312	RESERVED
10313	CH.38 HI 1 (1 = TRIP)
10314	CH.38 LO 1 (1 = TRIP)
10315	CH.38 DIF 1 (1 = TRIP)
10316	CH.38 HI 2 (1 = TRIP)
10317	CH.38 LO 2 (1 = TRIP)
10318	CH.38 DIF 2 (1 = TRIP)
10319	RESERVED
10320	RESERVED
10321	CH.39 HI 1 (1 = TRIP)
10322	CH.39 LO 1 (1 = TRIP)
10323	CH.39 DIF 1 (1 = TRIP)
10324	CH.39 HI 2 (1 = TRIP)
10325	CH.39 LO 2 (1 = TRIP)
10326	CH.39 DIF 2 (1 = TRIP)
10327	RESERVED
10328	RESERVED
10329	CH.40 HI 1 (1 = TRIP)
10330	CH.40 LO 1 (1 = TRIP)
10331	CH.40 DIF 1 (1 = TRIP)
10332	CH.40 HI 2 (1 = TRIP)
10333	CH.40 LO 2 (1 = TRIP)
10334	CH.40 DIF 2 (1 = TRIP)
10335	RESERVED
10336	RESERVED
10337	CH.01 HI 1 (1 = ACK)
10338	CH.01 LO 1 (1 = ACK)
10339	CH.01 DIF 1 (1 = ACK)
10340	CH.01 HI 2 (1 = ACK)
10341	CH.01 LO 2 (1 = ACK)
10342	CH.01 DIF 2 (1 = ACK)
10343	RESERVED
10344	RESERVED
10345	CH.02 HI 1 (1 = ACK)
10346	CH.02 LO 1 (1 = ACK)
10347	CH.02 DIF 1 (1 = ACK)
10348	CH.02 HI 2 (1 = ACK)
10349	CH.02 LO 2 (1 = ACK)



10350	CH.02 DIF 2 (1 = ACK)
10351	RESERVED
10352	RESERVED
10353	CH.03 HI 1 (1 = ACK)
10354	CH.03 LO 1 (1 = ACK)
10355	CH.03 DIF 1 (1 = ACK)
10356	CH.03 HI 2 (1 = ACK)
10357	CH.03 LO 2 (1 = ACK)
10358	CH.03 DIF 2 (1 = ACK)
:	:
:	:
10631	RESERVED
10632	RESERVED
10633	CH.38 HI 1 (1 = ACK)
10634	CH.38 LO 1 (1 = ACK)
10635	CH.38 DIF 1 (1 = ACK)
10636	CH.38 HI 2 (1 = ACK)
10637	CH.38 LO 2 (1 = ACK)
10638	CH.38 DIF 2 (1 = ACK)
10639	RESERVED
10640	RESERVED
10641	CH.39 HI 1 (1 = ACK)
10642	CH.39 LO 1 (1 = ACK)
10643	CH.39 DIF 1 (1 = ACK)
10644	CH.39 HI 2 (1 = ACK)
10645	CH.39 LO 2 (1 = ACK)
10646	CH.39 DIF 2 (1 = ACK)
10647	RESERVED
10648	RESERVED
10649	CH.40 HI 1 (1 = ACK)
10650	CH.40 LO 1 (1 = ACK)
10651	CH.40 DIF 1 (1 = ACK)
10652	CH.40 HI 2 (1 = ACK)
10653	CH.40 LO 2 (1 = ACK)
10654	CH.40 DIF 2 (1 = ACK)
10655	RESERVED
10656	RESERVED

**INPUT REGISTERS (FUNCTION CODE 4)**

ADDRESS	DESCRIPTION OF FUNCTION
30001	CHANNEL 01 TEMP 0.1 DEG K
:	:
:	:
30040	CHANNEL 40 TEMP 0.1 DEG K
30041	GROUP 1 AVG TEMP 0.1 DEG K
30042	GROUP 1A AVG TEMP 0.1 DEG K
30043	GROUP 2 AVG TEMP 0.1 DEG K
30044	GROUP 3 AVG TEMP 0.1 DEG K
30045	GROUP 4 AVG TEMP 0.1 DEG K
30046	GROUP 5 AVG TEMP 0.1 DEG K
30047	GROUP 6 AVG TEMP 0.1 DEG K
30048	CHANNEL 01 DIFF TEMP 0.1 DEG K
:	:
:	:
30087	CHANNEL 40 DIFF TEMP 0.1 DEG K
30088	BOX TEMP 0.1 DEG K

**HOLDING REGISTERS (FUNCTION CODE 3)**

ADDRESS	DESCRIPTION OF FUNCTION
40001	FILTER (1 = MIN
40002	AUTOSCAN TIME (1-30sec)
40003	GROUP 1 CONF POINTS (0-GRP)
40004	GROUP 1 CONF LABEL (0-8)
40005	GROUP 1 CONF OPTION (0=INDV)
40006	GROUP 1 CONF ARM TIME (0-99m)
40007	GROUP 1A CONF POINTS (0-GRP)
40008	GROUP 1A CONF LABEL (0-8)
40009	GROUP 1A CONF OPTION (0=INDV)
40010	GROUP 1A CONF ARM TIME (0-99m)
40011	GROUP 2 CONF POINTS (0-GRP)
40012	GROUP 2 CONF LABEL (0-8)
40013	GROUP 2 CONF OPTION (0=INDV)
40014	GROUP 2 CONF ARM TIME (0-99m)
40015	GROUP 3 CONF POINTS (0-GRP)
40016	GROUP 3 CONF LABEL (0-8)
40017	GROUP 3 CONF OPTION (0=I
40018	GROUP 3 CONF ARM TIME (0-99m)
40019	GROUP 4 CONF POINTS (0-GRP)
40020	GROUP 4 CONF LABEL (0-8)

40021	GROUP 4 CONF OPTION (0=INDV)
40022	GROUP 4 CONF ARM TIME (0-99m)
40023	GROUP 5 CONF POINTS (0-GRP)
40024	GROUP 5 CONF LABEL (0-8)
40025	GROUP 5 CONF OPTION (0=INDV)
40026	GROUP 5 CONF ARM TIME (0-99m)
40027	GROUP 6 CONF POINTS (0-GRP)
40028	GROUP 6 CONF LABEL (0-8)
40029	GROUP 6 CONF OPTION (0=INDV)
40030	GROUP 6 CONF ARM TIME (0-99m)
40031	GROUP 1 ARM TEMP 0.1 DEG. K
40032	GROUP 1A ARM TEMP 0.1 DEG. K
40033	GROUP 2 ARM TEMP 0.1 DEG. K
40034	GROUP 3 ARM TEMP 0.1 DEG. K
40035	GROUP 4 ARM TEMP 0.1 DEG. K
40036	GROUP 5 ARM TEMP 0.1 DEG. K
40037	GROUP 6 ARM TEMP 0.1 DEG. K
40038	GROUP 1 SETPT: HI 1 TEMP 0.1 DEG. K
40039	GROUP 1 SETPT: LO 1 TEMP 0.1 DEG. K
40040	GROUP 1 SETPT: DIF 1 TEMP 0.1 DEG. K
40041	GROUP 1 SETPT: HI 2 TEMP 0.1 DEG. K
40042	GROUP 1 SETPT: LO 2 TEMP 0.1 DEG. K
40043	GROUP 1 SETPT: DIF 2 TEMP 0.1 DEG. K
40044	GROUP 1A SETPT: HI 1 TEMP 0.1 DEG. K
40045	GROUP 1A SETPT: LO 1 TEMP 0.1 DEG. K
40046	GROUP 1A SETPT: DIF 1 TEMP 0.1 DEG. K
40047	GROUP 1A SETPT: HI 2 TEMP 0.1 DEG. K
40048	GROUP 1A SETPT: LO 2 TEMP 0.1 DEG. K
40049	GROUP 1A SETPT: DIF 2 TEMP 0.1 DEG. K
40050	GROUP 2 SETPT: HI 1 TEMP 0.1 DEG. K
40051	GROUP 2 SETPT: LO 1 TEMP 0.1 DEG. K
40052	GROUP 2 SETPT: DIF 1 TEMP 0.1 DEG. K
40053	GROUP 2 SETPT: HI 2 TEMP 0.1 DEG. K
40054	GROUP 2 SETPT: LO 2 TEMP 0.1 DEG. K
40055	GROUP 2 SETPT: DIF 2 TEMP 0.1 DEG. K
40056	GROUP 3 SETPT: HI 1 TEMP 0.1 DEG. K
40057	GROUP 3 SETPT: LO 1 TEMP 0.1 DEG. K
40058	GROUP 3 SETPT: DIF 1 TEMP 0.1 DEG. K
40059	GROUP 3 SETPT: HI 2 TEMP 0.1 DEG. K
40060	GROUP 3 SETPT: LO 2 TEMP 0.1 DEG. K
40061	GROUP 3 SETPT: DIF 2 TEMP 0.1 DEG. K
40062	GROUP 4 SETPT: HI 1 TEMP 0.1 DEG. K
40063	GROUP 4 SETPT: LO 1 TEMP 0.1 DEG. K

40064	GROUP 4 SETPT: DIF 1 TEMP 0.1 DEG. K
40065	GROUP 4 SETPT: HI 2 TEMP 0.1 DEG. K
40066	GROUP 4 SETPT: LO 2 TEMP 0.1 DEG. K
40067	GROUP 4 SETPT: DIF 2 TEMP 0.1 DEG. K
40068	GROUP 5 SETPT: HI 1 TEMP 0.1 DEG. K
40069	GROUP 5 SETPT: LO 1 TEMP 0.1 DEG. K
40070	GROUP 5 SETPT: DIF 1 TEMP 0.1 DEG. K
40071	GROUP 5 SETPT: HI 2 TEMP 0.1 DEG. K
40072	GROUP 5 SETPT: LO 2 TEMP 0.1 DEG. K
40073	GROUP 5 SETPT: DIF 2 TEMP 0.1 DEG. K
40074	GROUP 6 SETPT: HI 3 TEMP 0.1 DEG. K
40075	GROUP 6 SETPT: LO 3 TEMP 0.1 DEG. K
40076	GROUP 6 SETPT: DIF 3 TEMP 0.1 DEG. K
40077	GROUP 6 SETPT: HI 4 TEMP 0.1 DEG. K
40078	GROUP 6 SETPT: LO 4 TEMP 0.1 DEG. K
40079	GROUP 6 SETPT: DIF 4 TEMP 0.1 DEG. K
40080	CHANNEL 01 SETPT: HI 1 TEMP 0.1 DEG. K
40081	CHANNEL 01 SETPT: LO 1 TEMP 0.1 DEG. K
40082	CHANNEL 01 SETPT: HI 2 TEMP 0.1 DEG. K
40083	CHANNEL 01 SETPT: LO 2 TEMP 0.1 DEG. K
40084	CHANNEL 02 SETPT: HI 1 TEMP 0.1 DEG. K
40085	CHANNEL 02 SETPT: LO 1 TEMP 0.1 DEG. K
40086	CHANNEL 02 SETPT: HI 2 TEMP 0.1 DEG. K
40087	CHANNEL 02 SETPT: LO 2 TEMP 0.1 DEG. K
40088	CHANNEL 03 SETPT: HI 1 TEMP 0.1 DEG. K
40089	CHANNEL 03 SETPT: LO 1 TEMP 0.1 DEG. K
40090	CHANNEL 03 SETPT: HI 2 TEMP 0.1 DEG. K
40091	CHANNEL 03 SETPT: LO 2 TEMP 0.1 DEG. K
:	:
:	:
40228	CHANNEL 38 SETPT: HI 3 TEMP 0.1 DEG. K
40229	CHANNEL 38 SETPT: LO 3 TEMP 0.1 DEG. K
40230	CHANNEL 38 SETPT: HI 4 TEMP 0.1 DEG. K
40231	CHANNEL 38 SETPT: LO 4 TEMP 0.1 DEG. K
40232	CHANNEL 39 SETPT: HI 3 TEMP 0.1 DEG. K
40233	CHANNEL 39 SETPT: LO 3 TEMP 0.1 DEG. K
40234	CHANNEL 39 SETPT: HI 4 TEMP 0.1 DEG. K
40235	CHANNEL 39 SETPT: LO 4 TEMP 0.1 DEG. K
40236	CHANNEL 40 SETPT: HI 3 TEMP 0.1 DEG. K
40237	CHANNEL 40 SETPT: LO 3 TEMP 0.1 DEG. K
40238	CHANNEL 40 SETPT: HI 4 TEMP 0.1 DEG. K
40239	CHANNEL 40 SETPT: LO 4 TEMP 0.1 DEG. K

## 18.12 IDENTIFICATION (FUNCTION CODE 17):

QUERY: NN 17 CRC CRC

NN = node number, 17 = ID function code, CRC CRC = two byte Modbus RTU CRC.

RESPONSE: NN 17 18 00 RC VM Vm MM / DD / YY ETM-40 CRC CRC

NN = node number, 17 = ID function code, 18 = number of bytes to follow, RC = run condition, VM = version major, Vm = version minor, ASCII string that is the firmware date, ETM-40 ASCII string indicating the ETM-40 instrument, CRC CRC = two byte Modbus RTU CRC.

## **19.0 REMOTE OPERATOR INTERFACE**

19.1 REMOTE OPERATOR INTERFACE (ROI), MODBUS, FUNCTION CODE 100 - The ETM-40US contains a feature that allows the functions of the keypad to be accessed remotely in MODBUS. The returned data is that of the LCD display of the ETM-40US. This feature allows for any function that can be performed locally at the keypad to be implemented remotely. All functions that are performed remotely are seen on the LCD of the ETM-40US.

QUERY: NN 100 KP CRC CRC

NN = node number, 100 = 3 digit ROI function code, KP = single byte key press function from table below, CRC CRC = two byte Modbus RTU CRC.

00	=	NONE (returns current display)
01	=	RESET
02	=	VIEW ALARMS
04	=	ENTER/ACK
08	=	SETUP
16	=	ESC
32	=	SETPTS
64	=	▼ (DOWN ARROW KEY)
128	=	▲ (UP ARROW KEY)

RESPONSE: NN 100 88 (20 bytes of 1st line of display) CR LF (20 bytes of 2nd line of display) CR LF (20 bytes of 3rd line of display) CR LF (20 bytes of 4th line of display) CR LF CRC CRC

NN = node number, 100 = 3 digit ROI function code, 88 = number of bytes to follow, CR = carriage return, LF = line feed, 4 ea. 20 byte ASCII blocks of the display, CRC CRC = two byte Modbus RTU CRC

19.2 READ COIL LABEL (FUNCTION CODE 101):

QUERY: NN 101 ADH ADL CRC CRC

NN = node number, 101 = function code, ADH:ADL = two byte address of desired coil (1-320), CRC CRC = two byte Modbus RTU CRC.

RESPONSE: NN 101 30 ASCIISTRING CRC CRC

NN = node number, 101 = function code, 30 = number of bytes to follow, ASCIISTRING = returned label string for the requested coil, CRC CRC = two byte Modbus RTU CRC.

19.3 READ INPUT STATUS LABEL (FUNCTION CODE 102):

QUERY: NN 102 ADH ADL CRC CRC

NN = node number, 102 = function code, ADH:ADL = two byte address of desired input status (1-168), CRC CRC = two byte Modbus RTU CRC.

RESPONSE: NN 102 30 ASCIISTRING CRC CRC

NN = node number, 102 = function code, 30 = number of bytes to follow, ASCIISTRING = returned label string for the requested input status, CRC CRC = two byte Modbus RTU CRC.

19.4 READ HOLDING REGISTER LABEL (FUNCTION CODE 103):

QUERY: NN 103 ADH ADL CRC CRC

NN = node number, 103 = function code, ADH:ADL = two byte address of desired holding register (1-94), CRC CRC = two byte Modbus RTU CRC.

RESPONSE: NN 103 30 ASCIISTRING CRC CRC

NN = node number, 103 = function code, 30 = number of bytes to follow, ASCIISTRING = returned label string for the requested holding register, CRC CRC = two byte Modbus RTU CRC.

19.5 READ INPUT REGISTER LABEL (FUNCTION CODE 104):

QUERY: NN 104 ADH ADL CRC CRC

NN = node number, 104 = function code, ADH:ADL = two byte address of desired input register (1-21), CRC CRC = two byte Modbus RTU CRC.

RESPONSE: NN 104 30 ASCIISTRING CRC CRC

NN = node number, 104 = function code, 30 = number of bytes to follow, ASCIISTRING = returned label string for the requested input register, CRC CRC = two byte Modbus RTU CRC.

## **INDEX BY SECTION**

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- 2.0 Thermocouples
- 3.0 Mounting
- 4.0 Wiring
- 5.0 Configuration
- 6.0 Initial Operation
- 7.0 Global Status and Channel Screen Description
- 8.0 Normal Operation
- 9.0 Fault Conditions
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- 11.0 Keypad Description
- 12.0 Factory Default Settings
- 13.0 Setup/Configuration
- 14.0 Setpoints
- 15.0 Input/Output Modules
- 16.0 Reset
- 17.0 Calibration
- 18.0 RS-485 Communication
- 19.0 Remote Operator Interface

**FIGURES SECTION:**

FIG. 1 MOUNTING DIMENSIONS AND SPECIFICATIONS

FIG. 2 ETM-40US CONFIGURATION WORKSHEET

FIG. 3 ETM-40US FLOWCHART

FIG. 4 GENERAL ELECTRICAL CONNECTIONS

FIG. 5 WIRING DIAGRAM - POWER WIRING

FIG. 6 WIRING DIAGRAM - ALTRONIC ANNUNCIATOR SYSTEMS

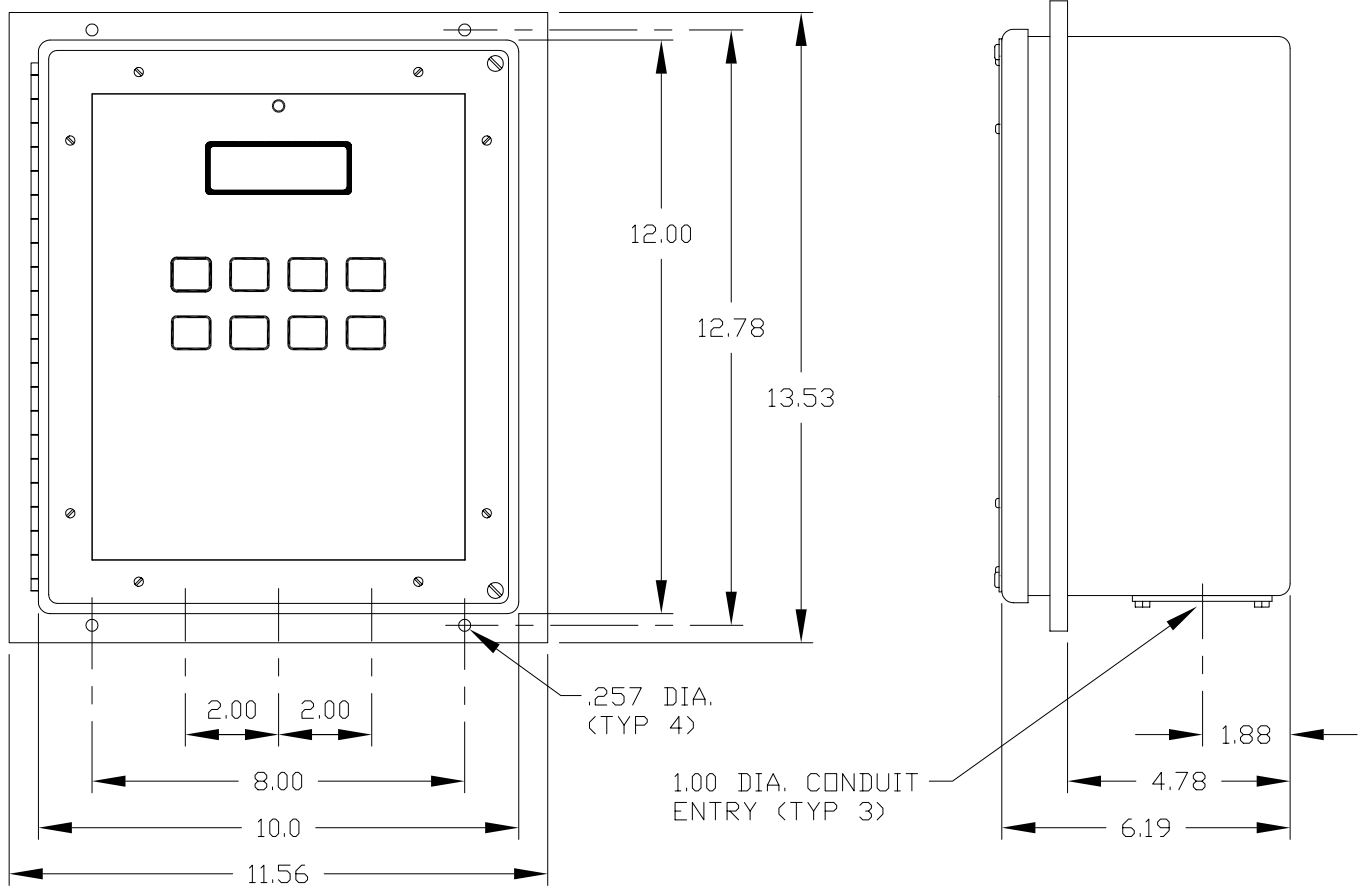
FIG. 7 WIRING DIAGRAM - INPUT MODULE (REMOTE RESET)/ OUTPUT MODULES

FIG. 8 WIRING DIAGRAM - DC RELAY

FIG. 9 WIRING DIAGRAM - RS-485 COMMUNICATIONS



# FIG.1 MOUNTING DIMENSIONS AND SPECIFICATIONS, ETM-40US



**NOTES:** 1. PANEL CUTOUT IS 10.12 X 12.12.  
2. ALL DIMENSIONS IN INCHES.

## SPECIFICATIONS:

**MONITORED TEMPERATURE POINTS:** 40

**POWER:** 10-36 VDC, 4 W MAX. OR 100-250 VAC 10 W MAX.

**THERMOCOUPLE TYPE:** "J" (IRON CONSTANTAN) OR "K" CHROMEL-ALUMEL)

**TEMPERATURE UNITS:** PROGRAMMABLE °F OR °C

**AMBIENT TEMPERATURE RANGE:** -40°C TO 80°C (-40°F TO 175°F)

**LCD OPERATE TEMPERATURE RANGE:** -20°C TO 70°C (-4°F TO 158°F)

**DISPLAY:** BACKLIT 4 X 20 LCD CHARACTER

**ENCLOSURE:** NEMA 4, WEATHERPROOF

**MEASUREMENT RANGE:** TYPE "J" THERMOCOUPLE: -60°C TO 750°C (76°F TO 1382°F)

TYPE "K" THERMOCOUPLE: -60°C TO 800°C (76°F TO 1472°F)

**SCANNER ACCURACY:** ± 1%, ± 1° EXCLUSIVE OF THERMOCOUPLE ERROR

**DISPLAY UPDATE RATE:** 1 SECOND

**THERMOCOUPLE SCAN RATE:** ALL 40 CHANNELS - 1 SECOND

**DISPLAY AUTO SCAN RATE:** ADJUSTABLE FROM 1 TO 30 SECONDS PER CHANNEL

**GROUPS:** 7

**INPUT MODULE:** 1 STANDARD PLUGGABLE SOLID STATE RELAY

**OUTPUT MODULES:** 4 STANDARD PLUGGABLE SOLID STATE RELAYS

**GROUP PROTECTION MODES:** ABSOLUTE HIGH, ABSOLUTE LOW, DIFFERENTIAL FROM AVERAGE

**OUTPUT GROUP LOGIC:** N/O, N/C, LATCHING, NON-LATCHING

**COMMUNICATIONS CAPABILITY:** RS-485, MODBUS RTU

**HAZARDOUS AREA CLASSIFICATION:** CLASS I, DIV.2, GROUPS C & D

## FIG.2 ETM-40US CONFIGURATION WORKSHEET

**SERIAL #:** \_\_\_\_\_ **SITE:** \_\_\_\_\_

**UNITS:** \_\_\_\_\_ °F \_\_\_\_\_ °C

**AUTO SCAN:** \_\_\_\_\_ YES \_\_\_\_\_ NO

**FILTER:** \_\_\_\_\_ (1 = min filtering, 255 = max filtering, default = 230)

**GROUP CONFIG:**

	# POINTS	SETPTS	LABEL	ARM TEMP	ARM TIME
GROUP 1	_____	_____	_____	_____	_____
GROUP 1A	_____	_____	_____	_____	_____
GROUP 2	_____	_____	_____	_____	_____
GROUP 3	_____	_____	_____	_____	_____
GROUP 4	_____	_____	_____	_____	_____
GROUP 5	_____	_____	_____	_____	_____
GROUP 6	_____	_____	_____	_____	_____

**I/O MODULE CONFIG:**

INPUT \_\_\_\_\_ SHELF \_\_\_\_\_ FAIL SAFE  
 OUT 1 \_\_\_\_\_ SHELF \_\_\_\_\_ FAIL SAFE \_\_\_\_\_ LATCHING \_\_\_\_\_ NON-LATCHING  
 OUT 2 \_\_\_\_\_ SHELF \_\_\_\_\_ FAIL SAFE \_\_\_\_\_ LATCHING \_\_\_\_\_ NON-LATCHING  
 OUT 3 \_\_\_\_\_ SHELF \_\_\_\_\_ FAIL SAFE \_\_\_\_\_ LATCHING \_\_\_\_\_ NON-LATCHING  
 OUT 4 \_\_\_\_\_ SHELF \_\_\_\_\_ FAIL SAFE \_\_\_\_\_ LATCHING \_\_\_\_\_ NON-LATCHING

**RS-485 COMMUNICATIONS:** NODE NUMBER \_\_\_\_\_ BAUD RATE \_\_\_\_\_

**THERMOCOUPLE TYPE:** \_\_\_\_\_ "J" THERMOCOUPLE \_\_\_\_\_ "K" THERMOCOUPLE

**FAULT LOG RETENTION:** \_\_\_\_\_ PWR CYCLE \_\_\_\_\_ RESET KEY \_\_\_\_\_ INPUT MOD

**SECURITY:** \_\_\_\_\_ CONFIG. \_\_\_\_\_ SETPNT \_\_\_\_\_ MODBUS \_\_\_\_\_ PASSWORD

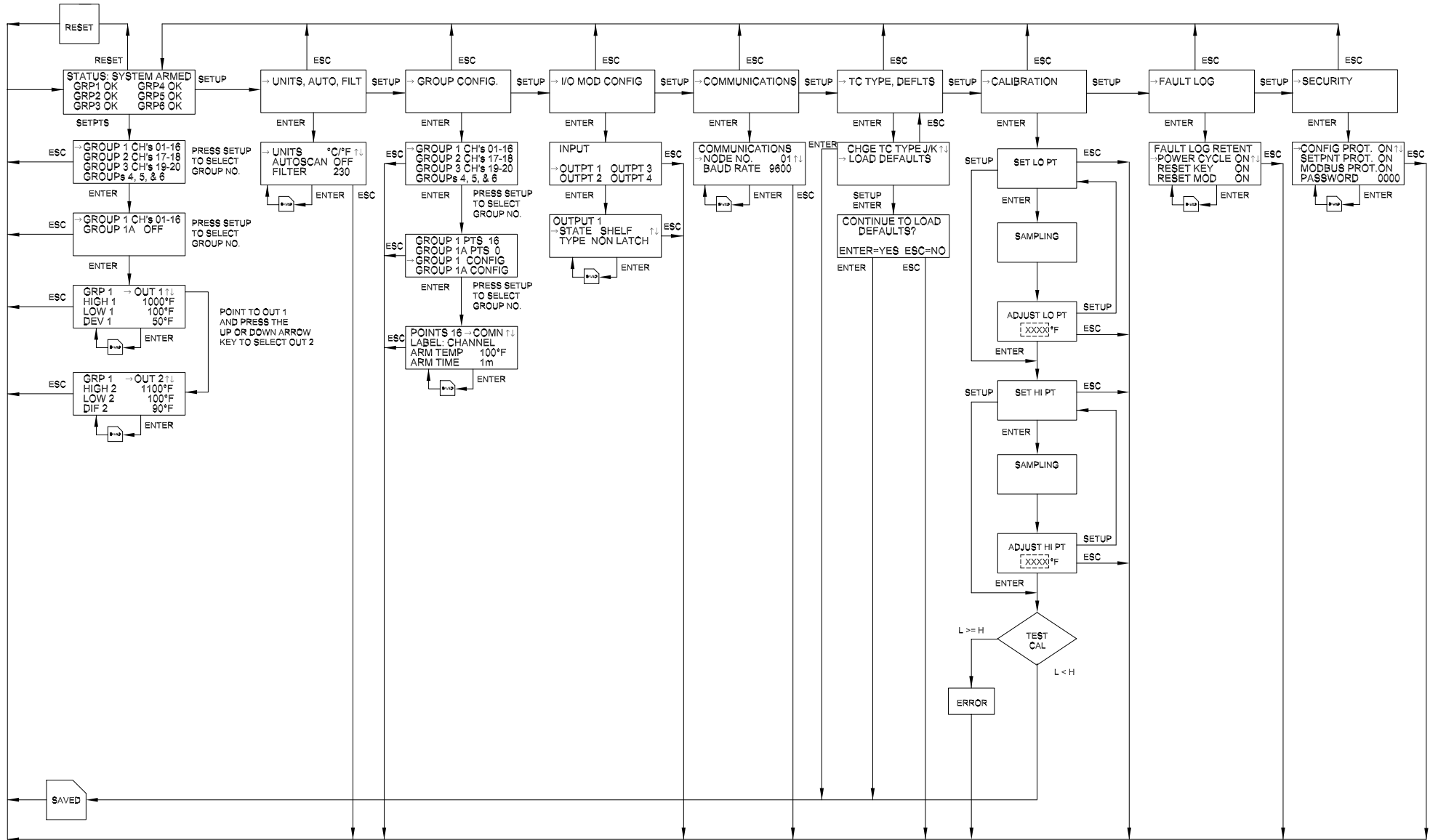
CONTINUED ON NEXT PAGE

## FIG.2 CONTINUED ETM-40US CONFIGURATION WORKSHEET

### SETPOINTS:

CH 01	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 02	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 03	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 04	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 05	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 06	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 07	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 08	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 09	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 10	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 11	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 12	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 13	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 14	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 15	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 16	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 17	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 18	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 19	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 20	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 21	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 22	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 23	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 24	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 25	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 26	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 27	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 28	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 29	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 30	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 31	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 32	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 33	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 34	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 35	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 36	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 37	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 38	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 39	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____
CH 40	H1 _____	L1 _____	D1 _____	H2 _____	L2 _____	D2 _____

# FIG.3 ETM-40US - FLOWCHART



**VIEW ALARMS:** DISPLAYS HISTORY OF CHANNELS, UP TO 16 TOTAL FOR EACH GROUP, IN THE ORDER THAT THEY HAVE EXCEEDED THEIR SETPOINT VALUES.  
NOTE: TO CLEAR THE FAULT HISTORY, WHEN CONFIGURED, PRESS THE "RESET" KEY, ALL CURRENT NON-FAULTED ALARMS WILL CLEAR.

**RESET:** RESETS ALL CURRENT NON-FAULTED ALARMS AND RETURNS THE OUTPUT SWITCH TO THE NON-FAULTED CONDITION WHEN IT IS SET TO LATCHING.

**△ ▽:** THE UP AND DOWN ARROW KEYS ADVANCE THE DISPLAY TO THE NEXT CHANNEL AND TEMPERATURE VALUE.

**SETPTS:** WHEN THE SETPTS KEY IS PRESSED THE SETPOINT WILL BE DISPLAYED FOR 30 SECONDS AND WILL AUTOMATICALLY REVERT BACK TO THE NORMAL DISPLAY MODE IF NO KEY IS PRESSED. IF THE UP OR DOWN ARROW KEY IS PRESSED THE SETPOINT VALUE WILL INCREMENT OR DECREMENT AND REFRESH THE TIMER. PRESSING THE ENTER KEY SAVES THE NEW VALUE. PRESSING THE SETUP KEY ADVANCES TO THE NEXT SETPOINT. IF THE ESC KEY IS PRESSED, THE DISPLAY WILL REVERT BACK ONE SCREEN AND RETAIN THE PREVIOUS SETPOINT VALUE.

## DEFAULT SETTINGS

FOR FACTORY  
DEFAULT SETTINGS  
SELECT  
"LOAD DEFAULTS"

J OR K THERMOCOUPLE  
°F OR °C UNITS  
TIMERS  
0 MIN.

SETPOINTS:  
HI - 1000°F  
LO - 0°F  
DIF - 100°F

MANUAL SCAN  
ALL CHANNELS  
PROTECTION: OFF  
NODE NUMBER: 01  
FILTER: 230

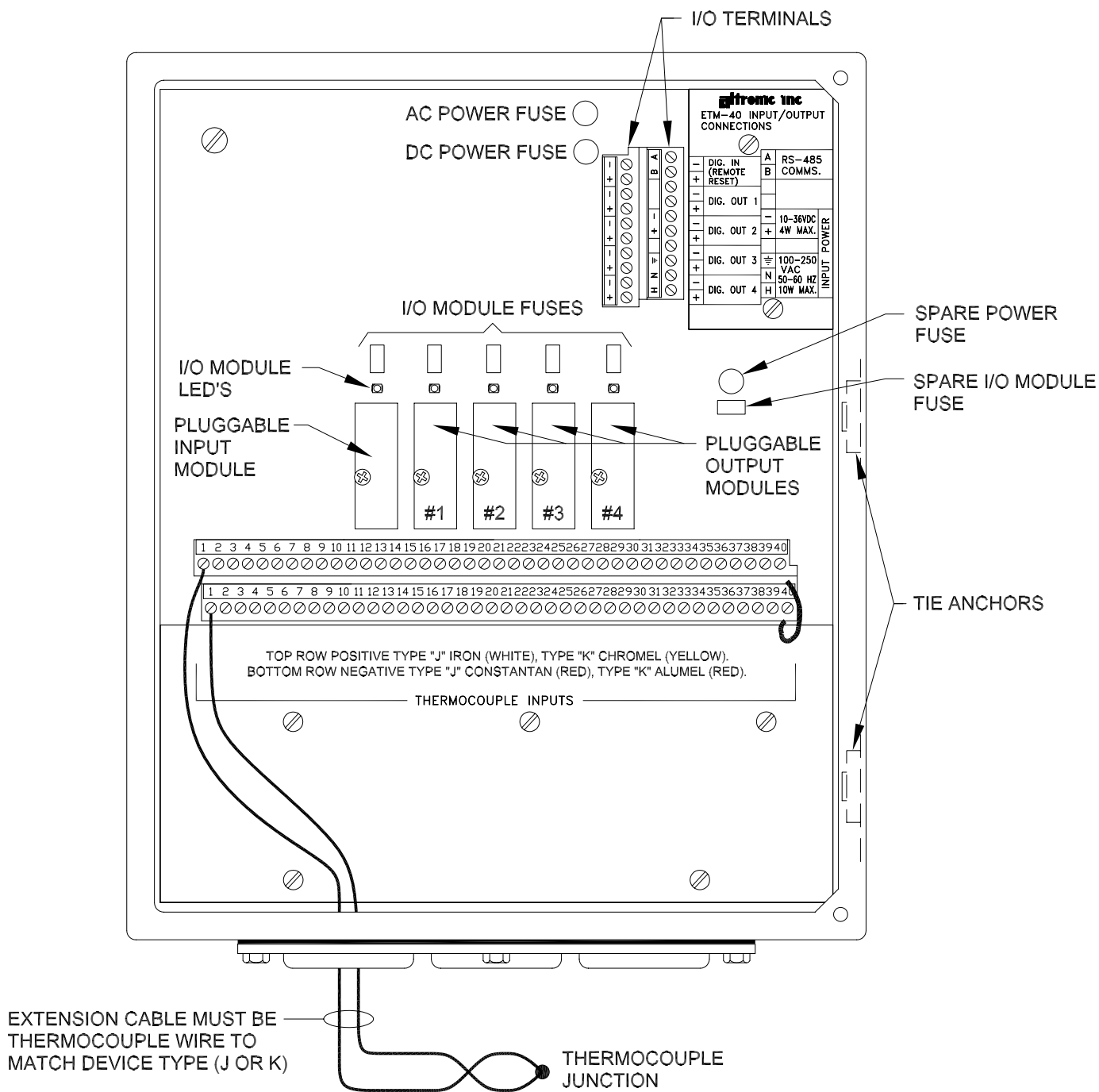
OUTPUT SWITCHES:  
SHELF STATE  
NON-LATCHING

## FLOWCHART KEY

△ ▽ USE UP AND  
DOWN ARROW  
KEYS TO SCROLL

SAVED KEY

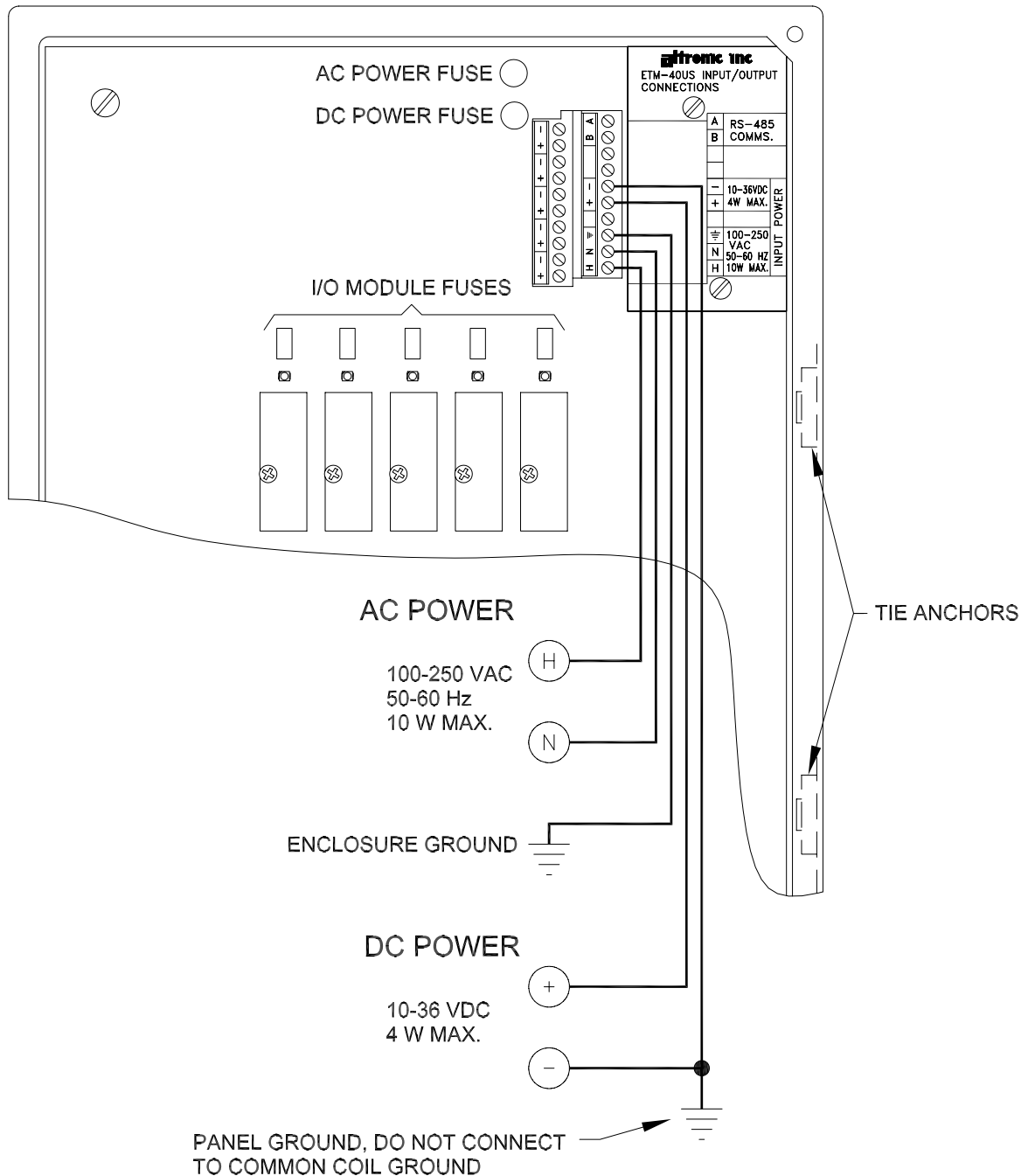
# FIG. 4 GENERAL ELECTRICAL CONNECTIONS, ETM-40US



**NOTES:**

1. ALWAYS USE POINT 1 AND PROCEED IN SUCCESSION TO THE HIGHEST POINT REQUIRED.
2. ALL THERMOCOUPLES AND EXTENSION WIRE MUST BE THE SAME TYPE. ALL CONNECTIONS TO BE CLEANED, TIGHTLY TWISTED AND INSULATED WITH CERAMIC WIRE NUTS.
3. SEPARATE THERMOCOUPLE WIRING FROM POWER INPUT AND OUTPUT WIRING. USE TIE ANCHORS ON ENCLOSURE SIDE.
4. ALL UNUSED THERMOCOUPLE INPUTS MUST BE SHUNTED FOR PROPER OPERATION.
5. THERMOCOUPLES SHOULD BE EITHER ALL UNGROUNDED OR ALL GROUNDED.
6. FOR CLASS 1, DIV. 2, GROUP C & D APPLICATIONS, MOUNT IN SUITABLE ENCLOSURE.

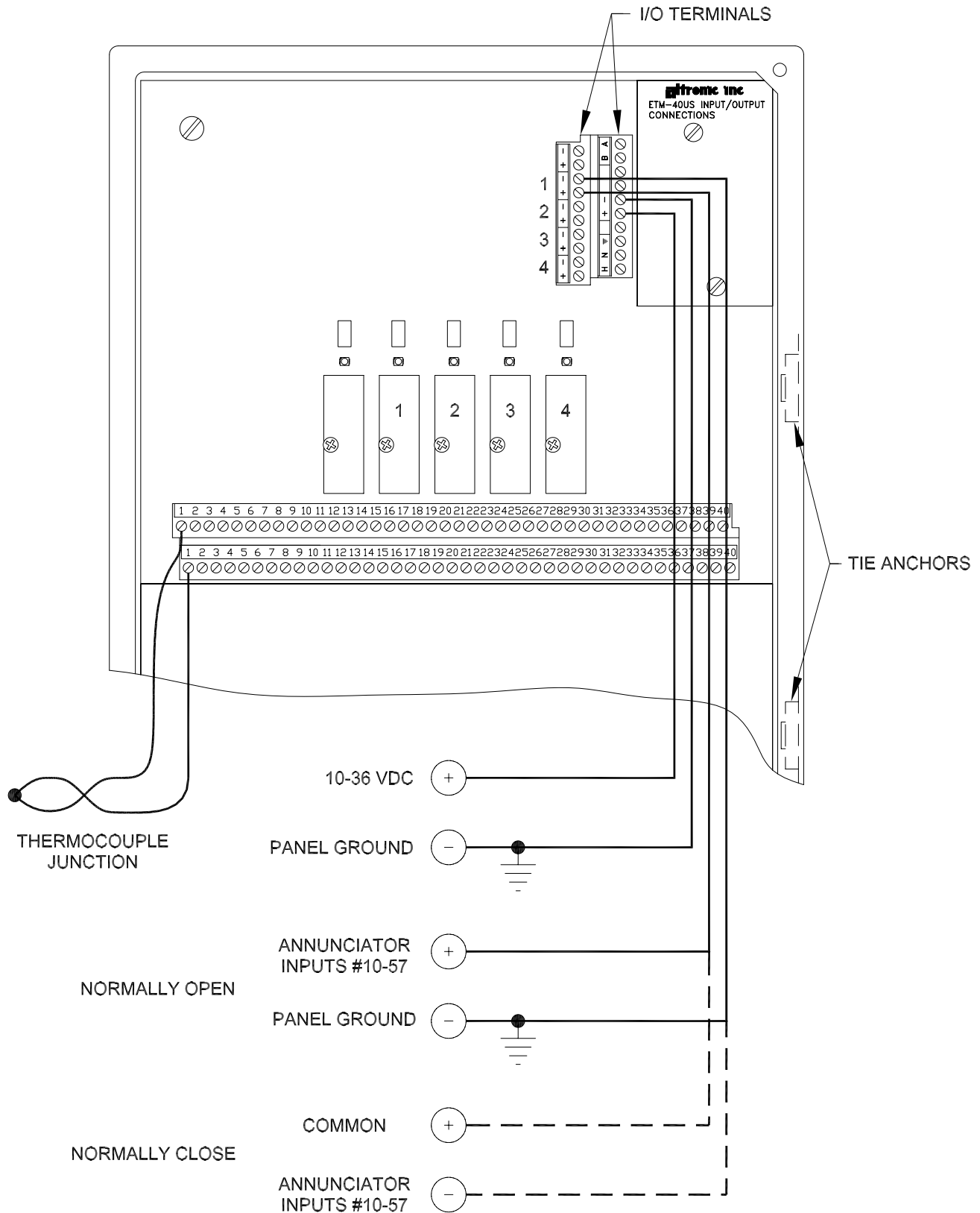
**FIG. 5 WIRING DIAGRAM, POWER WIRING**



**NOTES:**

1. FUSES: POWER - REPLACEABLE 3 AMP SLOW BLOW P/N 601983  
I/O MODULE - REPLACEABLE 3 AMP P/N 601460
2. POWER WIRING - THE ETM-40US WILL OPERATE FROM **EITHER** 10-36VDC, 24 VOLTS NOMINAL **OR** 100-250VAC, 120 VOLTS NOMINAL.
3. DC POWER - CONNECT THE POWER INPUT WIRES, PLUS TO TERMINAL 10-36VDC + AND MINUS TO -; POWER REQUIREMENT IS 10 TO 36 VDC 4 WATTS MAX. CONNECT THE MINUS TERMINAL (-) TO PANEL GROUND WHICH SHOULD BE THE SAME AS ENGINE GROUND. **DO NOT** GROUND THIS DEVICE DIRECTLY TO THE IGNITION SYSTEM COMMON COIL GROUND.
4. AC POWER - CONNECT THE POWER INPUT WIRES, **HOT** TO TERMINAL 100-250VAC "H" **NEUTRAL** TO "N" AND **GROUND** TO GROUND TERMINAL. THE GROUND TERMINAL IS THE SAME ELECTRICALLY AS THE ENCLOSURE. **DO NOT** GROUND THIS DEVICE DIRECTLY TO THE IGNITION SYSTEM COMMON COIL GROUND.
5. USE TIE ANCHORS WITH TIE WRAPS TO SECURE POWER WIRING TO ENCLOSURE. KEEP SEPARATE FROM THERMOCOUPLE WIRING.

**FIG. 6 WIRING DIAGRAM, ALTRONIC ANNUNCIATOR SYSTEMS, ETM-40US**

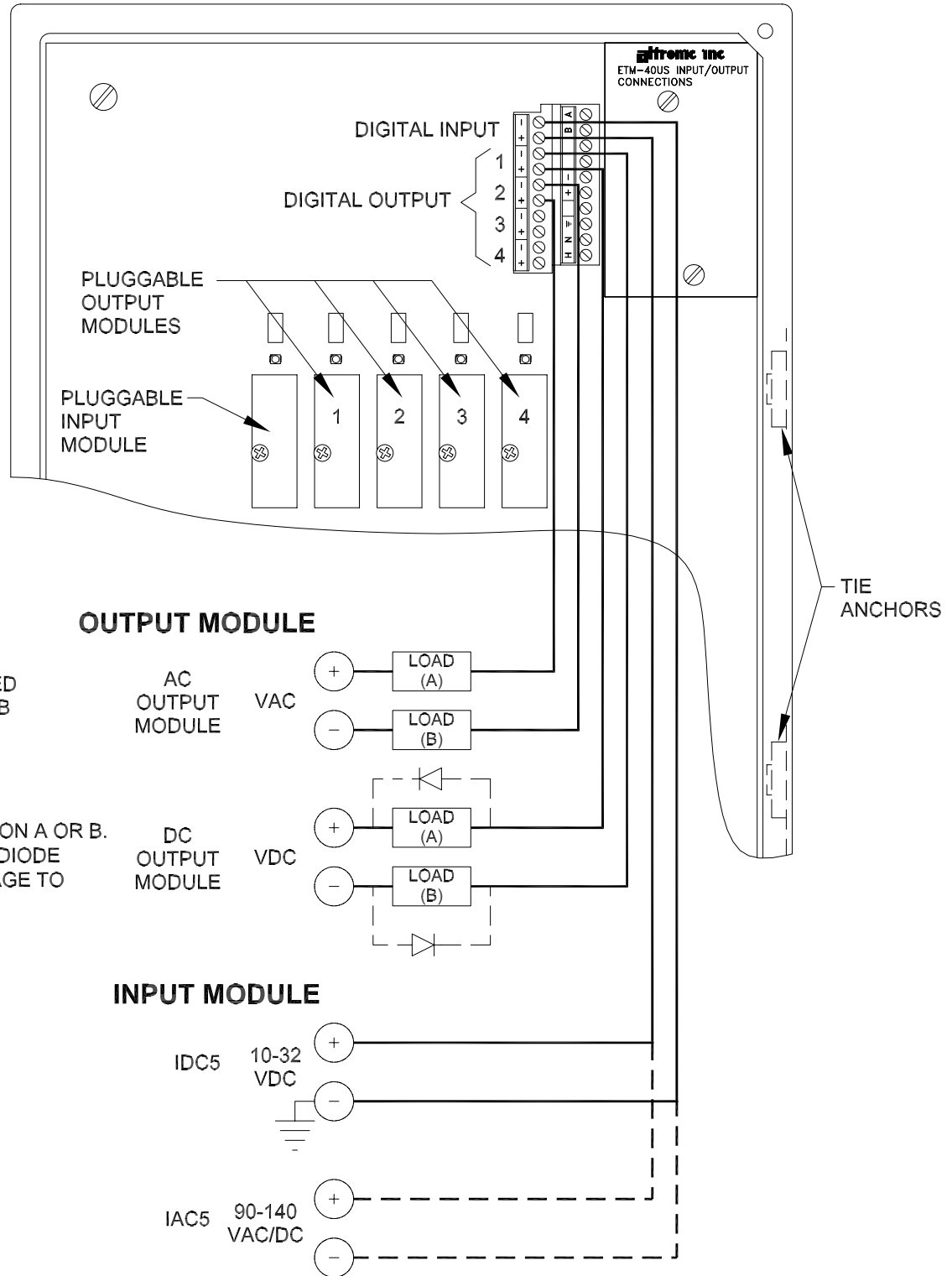


**NOTES:**

1. USE OUTPUT MODULE ODC5 (691056) FOR CONNECTION TO ALTRONIC ANNUNCIATOR SYSTEMS.
2. CONNECT GROUNDS TO PANEL GROUND ONLY. DO NOT CONNECT TO COMMON COIL GROUNDS.
3. USE TIE ANCHORS WITH TIE WRAPS TO SECURE POWER WIRING TO ENCLOSURE. KEEP SEPARATE FROM THERMOCOUPLE WIRING.

# FIG. 7 WIRING DIAGRAM

## INPUT MODULE (REMOTE RESET) / OUTPUT MODULES, ETM-40US



LOAD MAY BE WIRED IN LOCATION A OR B

LOAD MAY BE WIRED IN LOCATION A OR B. DC INDUCTIVE LOADS MUST BE DIODE SUPPRESSED TO PREVENT DAMAGE TO THE I/O MODULE.

**OUTPUT MODULES:**

- 691125 - 5-48 Vdc, 5.0 A.
- 691056 - 5-60 Vdc, 2.0 A.
- 691066 - 5-200 Vdc, 0.67 A.
- 691065 - 24-280 Vdc, 2.0 A.

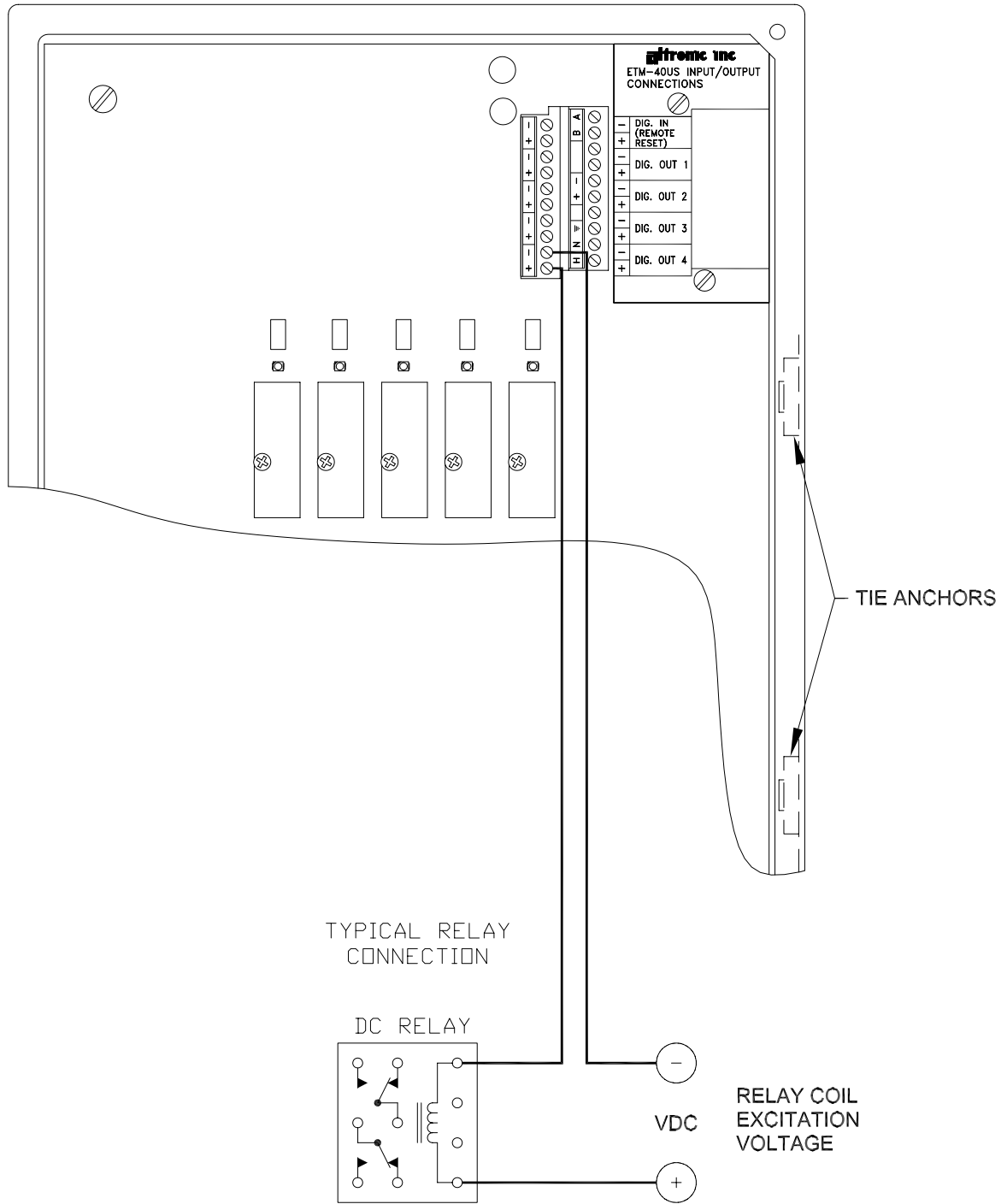
**INPUT MODULES:**

- 691057 - 10-32 Vdc.
- 691064 - 90-140 Vdc/DC.

- LED OPERATION:** THE POWER LED INDICATOR BLINKS WHEN POWER IS APPLIED TO THE SYSTEM.
- FOR THE NORMALLY CLOSED CONFIGURED OUTPUT MODULES (ENERGIZED FOR RUN), THE LED WILL BE ON IN THE NORMAL RUN STATE AND OFF FOR A FAULT CONDITION.
  - FOR THE NORMALLY OPEN CONFIGURED OUTPUT MODULES, THE LED WILL BE OFF IN THE NORMAL RUN STATE AND TURN ON FOR A FAULT CONDITION.
  - FOR THE INPUT MODULE, THE LED WILL BE ON WHEN ACTIVE.



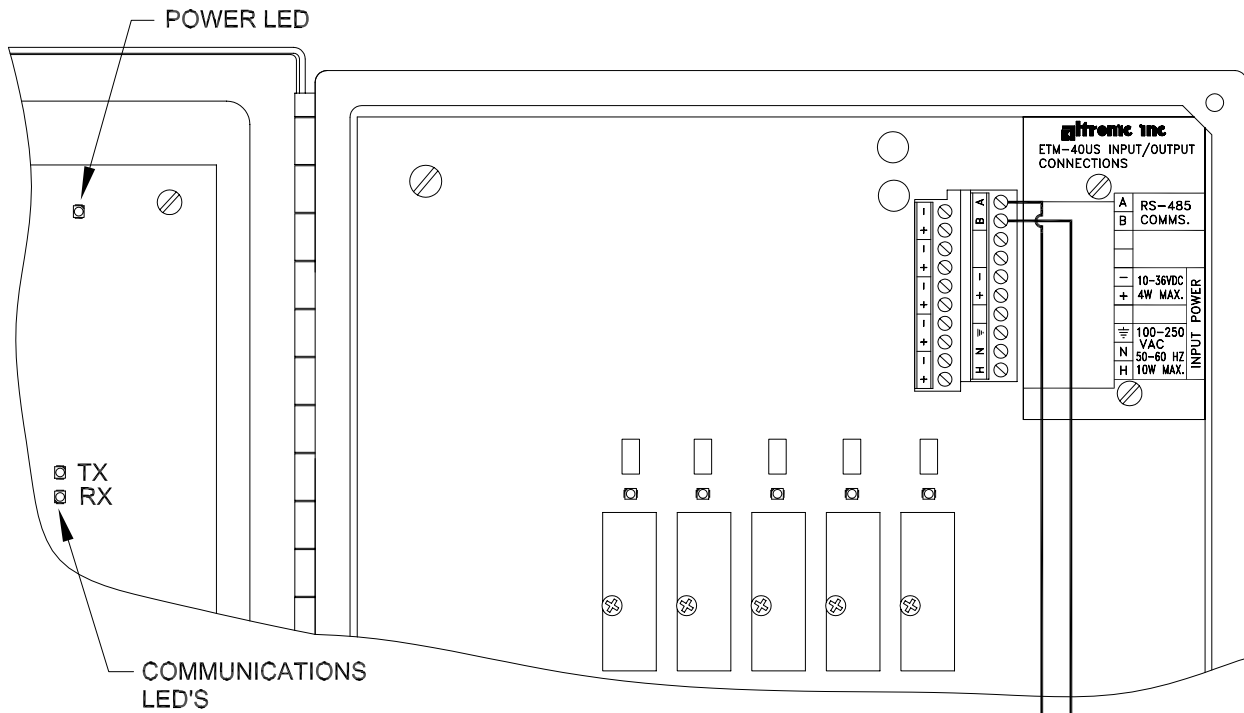
# FIG. 8 WIRING DIAGRAM, DC RELAY



**NOTE:**

1. USE ODC5 (691056) OUTPUT MODULE IN ETM-40 UNIT TO CONTROL DC RELAY.

# FIG. 9 WIRING DIAGRAM, RS-485 COMMUNICATIONS

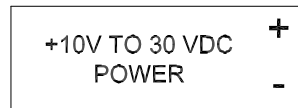


## RS-485 COMMUNICATIONS (MULTIPLE SLAVE UNITS)

NOTE: CONNECT A 120Ω RESISTOR BETWEEN RS-485 "A" AND RS-485 "B" TERMINALS AT THE MASTER FOR LONG BUS RUNS.

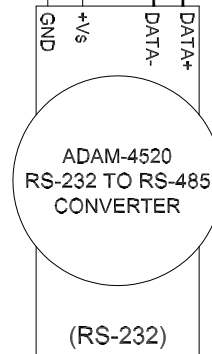
NOTE: USE SHIELDED CABLE FOR RS-485 CONNECTIONS. CONNECT TO GROUND AT MASTER ONLY.

## PC HOOK-UP



ADVANTECH  
ISOLATED RS-232 TO RS-485 CONVERTER  
P/N ADAM-4520

ADVANTECH AMERICA  
1-408-245-6678  
or  
1-800-800-6889



NOTE: FOLLOW INSTRUCTIONS WITH CONVERTER.

TO COMPUTER  
RS-232 PORT