APPLICATION NOTE

The Altronic ETS Temperature Scanner is a high quality instrument specifically designed for use on internal combustion engines. While it is capable of proper operation with most types of available thermocouples and thermocouple extension wire, the following recommendations will minimize potential problems in virtually all applications:

1. Before installing the ETS scanner, existing thermocouples and wiring must be checked for continuity and/or shorts to ground. If either is detected, new wiring or thermocouples are required for proper operation of the ETS scanner.

2. If making a new installation or rewiring an existing one, use a high quality shielded thermocouple extension wire such as Thermex, Inc. part number 20J902-SS or equivalent.

3. Use thermocouples specifically designed for use on engines since vibration failures can be a problem with general purpose thermocouples.

Properly installed, the ETS scanner will provide reliable, long-term service.

WARNING - TO INSURE RETENTION OF DATA IN MEMORY:

DO NOT UNPOWER THE DEVICE WHILE IN THE CONFIGURATION MODE OR FOR AT LEAST TWO MINUTES AFTER LEAVING CONFIGURATION MODE.

NOTICE TO USERS OF ETS-24 MODEL TEMPERATURE SCANNERS

This Operating Manual describes the features and operation of the ETS-40 model scanner. The ETS-24 models function in the same manner but are limited to 24 sensing points and 4 outputs with two groups each (8 groups total).

Please note these specific limitations:

1. Only points 01 through 24 are available. Points 25 to 40 have no connection terminals and will read the "ice point" (32°F. or 0°C.) if called up from the keyboard.

2. Only outputs 1 through 4 are available. Outputs 5 to 7 are not available.

   NOTE: DO NOT assign points to outputs 5, 6 or 7; no protection will be provided for points assigned to outputs 5, 6, or 7.

ALTRONIC, INC.
712 TRUMBULL AVE.
GIRARD, OHIO 44420

OPERATING MANUAL

ETS-24/40

VERSION C

FORM ETS OM 7-91

SECTION 1

GENERAL DESCRIPTION

1.0 GENERAL DESCRIPTION - ALTRONIC ETS-24/40 TEMPERATURE SCANNER

1.1 GENERAL

The Altronic ETS temperature scanner is a microprocessor-based, multi-point temperature scanning device designed especially for use on medium to large internal combustion engines. The ETS has the following features:

- Model ETS-24: 24 Monitored Points divided into as many as 8 Groups. There are 4 solid state relay Outputs; up to two (2) Groups may be assigned to each Output (2 X 4 = 8).
- Model ETS-40: 40 Monitored Points divided into as many as 14 Groups. There are 7 solid state relay Outputs; up to two (2) Groups may be assigned to each Output (2 X 7 = 14).
- User setable Low, High and Differential Setpoints
- Several Automatic Display Scan Modes
- Acknowledge Mode to allow troubleshooting
- RS422 Communications capability
- Optional Analog Outputs representing the average temperature of two Groups

1.2 DISPLAY AND SCANNING CAPABILITY

The ETS has the following display capability:

- Display Channel No. and Monitored Temperature of any point. Temperature range: +32°F. to +1,832°F. / 0°C. to +1,000°C.
- Display Channel No. and Monitored Temperature of all Points at a scan rate of 3 seconds per point
- Display Channel No. and Monitored Temperature of all Points of selected Output at a scan rate of 3 seconds per point
- Display Average Temperature of each Group
- Display Fault Status of all Outputs
- Display specific Data regarding Faulted Points
- Display all entered Set-up Data

NOTE: Protection scanning of all points occurs continuously regardless of the display mode or prior faults.

1.3 PROTECTION CAPABILITY

The ETS has the following protection capability:

- User can arrange the monitored points into as many as 8 (ETS-24) or 14 (ETS-40) Groups with 2 Groups assigned to each Output.
- For each of the Groups, there is protection from any combination of 3 user entered setpoints: Absolute Low Limit, Absolute High Limit, and Differential. The Differential Limit is the amount by which any point may vary from a selected average of the points in that Group without causing the Output relay to alarm.
- The solid state Output relays can be assigned to any function (such as alarm, shutdown, etc.) desired by the user consistent with his programming of the ETS channels.

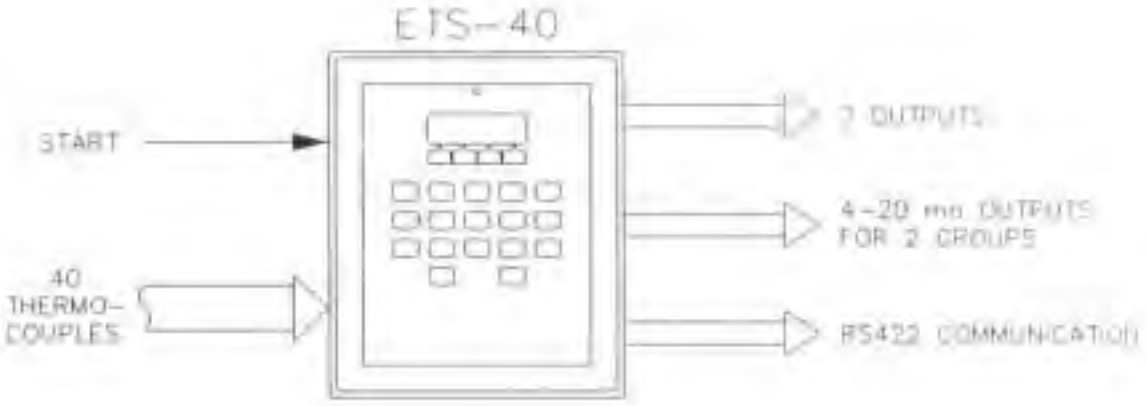
1.4 TROUBLESHOOTING CAPABILITY

The ETS has the following troubleshooting capability:

- An Acknowledge function to reset an alarmed Output to allow troubleshooting while maintaining all current fault information.
- An individual Output Reset function to re-cycle the pre-programmed start-up sequence or for a fixed 10 minute test cycle.

FIG.1

TYPICAL FUNCTIONS - ETS-40



SECTION 2

REQUIRED DATA

MONITORED POINT DESCRIPTION	NO.	OUTPUT #1 1.1-GROUP-1.2 (4-20ma)		OUTPUT #2 2.1-GROUP-2.2 (4-20ma)		OUTPUT #3 3.1-GROUP-3.2	
	01						
	02						
	03						
	04						
	05						
	06						
	07						
	08						
	09						
	10						
	11						
	12						
	13						
	14						
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	36						
	37						
	38						
	39						
	40						

SETPOINTS:				
LOW SETPOINT	(41)		(42)	(43)
HIGH SETPOINT	(51)		(52)	(53)
DIFF. SETPOINT	(61)		(62)	(63)
OUTPUT LOGIC:	(91)		(92)	(93)
NORMALLY OPEN				
NORMALLY CLOSED				
LATCHING				
NON-LATCHING				
DELAY TIME				
ATTAINED TEMP.				

MONITORED POINT DESCRIPTION	NO.	OUTPUT #1 1.1-GROUP-1.2 (4-20ma)	OUTPUT #2 2.1-GROUP-2.2 (4-20ma)	OUTPUT #3 3.1-GROUP-3.2
	01			
	02			
	03			
	04			
	05			
	06			
	07			
	08			
	09			
	10			
	11			
	12			
	13			
	14			
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	30			
	31			
	32			
	33			
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	36			
	37			
	38			
	39			
	40			
SETPOINTS:		(41)	(42)	(43)
LOW SETPOINT				
HIGH SETPOINT		(51)	(52)	(53)
DIFF. SETPOINT		(61)	(62)	(63)
OUTPUT LOGIC:		(91)	(92)	(93)
NORMALLY OPEN				
NORMALLY CLOSED				
LATCHING				
NON-LATCHING				
DELAY TIME				
ATTAINED TEMP.				

OUTPUT #4 4.1-GROUP-4.2	OUTPUT #5 5.1-GROUP-5.2	OUTPUT #6 6.1-GROUP-6.2	OUTPUT #7 7.1-GROUP-7.2	PT. NO.
				01
				02
				03
				04
				05
				06
				07
				08
				09
				10
				11
				12
				13
				14
				15
				16
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				34
				35
				36
				37
				38
				39
				40
(44)	(45)	(46)	(47)	
(54)	(55)	(56)	(57)	
(64)	(65)	(66)	(67)	
(94)	(95)	(96)	(97)	

SECTION 3

CHANNEL DESCRIPTION

3.0 ETS CHANNEL DESCRIPTION / DATA ENTRY

3.1 OVERVIEW - The notation "1st" or "2nd" following the Channel numbers indicates the configuration level. Many channels have two modes. The first level is reached by entering the Channel number; the second level is reached from the first level by pushing the GROUP button. The second level is indicated on the display by a decimal point following the Channel number. To enter data on data entry channels, it is necessary to first put the ETS into the configuration mode by entering Channel 99, the password and pushing the ENTER button.

A. MONITORED POINTS

01-40	1st*	Monitored Temperature
01-40	2nd	Assigned Output(s)

B. SETPOINTS

41-47	1st	Low Setpoint for Group 1 Points
41-47	2nd	Low Setpoint for Group 2 Points
51-57	1st	High Setpoint for Group 1 Points
51-57	2nd	High Setpoint for Group 2 Points
61-67	1st	Differential Setpoint for Group 1 Points
61-67	2nd	Differential Setpoint for Group 2 Points

C. AVERAGE TEMPERATURE READOUT

71-77*	1st	Average Temperature of Group 1
71-77*	2nd	Average Temperature of Group 2

D. DISPLAY SCANNING

80*	Scan of All Monitored Points
81-87*	Scan of Points in Selected Output

E. FAULT CHANNELS

88*	Status of Faulted Points
89*	Output Fault Status

F. SET-UP CHANNELS

00	1st	Highest Channel No. Used in Application
00	2nd	Designated Node No. for RS422 Communication
60	1st	Per Cent Temperature Change Limit
60	2nd	Select Differential Calculation
90		Reset Selected Output
91-97	1st	Output Logic
91-97	2nd	Lockout Time; Average Group Initiate Temp.
98**		Select Readout Scale and Thermocouple Type
99		Password/configuration

G. 4-20 MA OUTPUTS

48,49,68,69	Scaling Factors
50,70*	Ma Output
58,78	Reset Response Rate Factors

* Display only channels; no data entered on these channels.

** Enter set-up data for Channel 98 BEFORE entering any temperature setpoint data.

3.2 **CHANNEL DESCRIPTION** - The following is a description of the Channel entries for the ETS-40. The display readout is printed at the right edge of the page for various channel entries.

- An "E" in the display format [42LE 400] indicates the ETS is in the configuration or data Entry mode. As soon as ENTER is pressed, the data is actually entered into the ETS memory and the "E" disappears from the display [42L 400]. Section 3.3 gives a detailed step-by-step entry/display sequence for the various Channels.
- Some display readouts are in general form. The codes used for the general display format are:

```
  cc = Channel no. displayed (01 thru 99)
   o = Output no. displayed (1 thru 7)
   g = Group no. displayed (1 or 2)
   f = Fault code displayed (L-low, H-high, P-differential)
 ttt = Displayed temperature (3-digit)
tttt = Displayed temperature (4-digit)
  ss = Displayed time in seconds (2-digit)
 sss = Displayed time in seconds (3-digit)
  xx = Other displayed value
```

CHANNEL 00: HIGHEST CHANNEL NO. USED

Channel 00 is used to enter the highest Channel no. to be used in the specific application (01 - 40). The Channel no. entered will be the highest (last) channel scanned on the general scan (Channel 80) before reverting to Channel 01. This prevents unnecessary scanning of unused channels.

Enter the configuration mode by entering the password in Channel 99, then enter Channel 00 and press ENTER.
EXAMPLE: 25 points to be monitored (01 - 25) [00E 25]

Channel 00 may also be used to designate the particular machine with a node no. to be used in connection with the RS422 communication port.

Enter the configuration mode by entering the password in Channel 99, then enter Channel 00 and press ENTER and GROUP.
EXAMPLE: Designate machine as node no. 15 (max. is 999) [00.E 15]

CHANNELS 01-40: MONITORED POINT CHANNELS

Channels 01-40 are used for two purposes: Displaying the monitored temperature of the Channel entered and assigning each point to one or two Groups.

Enter Channel No. - The display will show the monitored Temperature of the selected Channel No.: [cc tttt]

If the point is faulted on any of the assigned setpoints the display will indicate the fault code:
Fault code f = L-low, H-high, P-differential: [cc f.tttt]

If the faulted point is the first latched point to fault, the Channel No. will blink: (cc blinking) [cc f.tttt]

Enter the configuration mode by entering the password in Channel 99, then enter the specific Channel number and press ENTER. This is the Conf. (1st) mode. Then push the GROUP button to get to the Conf. (2nd) mode.
Conf. (1st) - Assign Selected Point to First Specific Output (o) and Group (g): [cc E o.g]
Conf. (2nd) - Assign Selected Point to Second Specific Output (o) and Group (g): NOTE DECIMAL PT. [cc.E o.g]

EXAMPLE: Assign Channel 17 to Output 1, Group 1 and Output 3, Group 2.
Conf. (1st) - Enter 17, press ENTER, enter 1,1: [17 E 1.1]
Conf. (2nd) - Press ENTER, GROUP, enter 3,2: [17.E 3.2]

NOTE: If the ETS has the 4-20 ma output option, keep in mind when assigning Groups that the proportional outputs apply to Output 1, Group 1 and Output 2, Group 1.

IMPORTANT: Leave "0.0" as the entry for Output.Group in any unused channels 01-40. The "0.0" entry can also be used to temporarily disable any individual point without having to disarm the entire Output for that point.

CHANNELS 41-47, 51-57, 61-67: SETPOINTS

Each of the 14 groups (2 per Output) can have up to three setpoints assigned: Absolute Low, Absolute High and Differential. To enter the setpoints, call the channels as follows:

LOW SETPOINT 4X, where X = Output No.
HIGH SETPOINT 5X, where X = Output No.
DIFFERENTIAL 6X, where X = Output No.

Example: 43 for LOW setpoint for Output No. 3

		LOW	HIGH	DIFF.
OUTPUT NO. 1	CHANNEL	41	51	61
OUTPUT NO. 2	CHANNEL	42	52	62
OUTPUT NO. 3	CHANNEL	43	53	63
OUTPUT NO. 4	CHANNEL	44	54	64
OUTPUT NO. 5	CHANNEL	45	55	65
OUTPUT NO. 6	CHANNEL	46	56	66
OUTPUT NO. 7	CHANNEL	47	57	67

NOTE: An entry of "0" for any setpoint disables that setpoint.

In each case, there are two levels of configuration:

Conf. (1st) = Group 1 Setpoint for that Output. This is automatically reached by entering the configuration mode by entering the password in Channel 99. Then enter the specific Channel number desired and press ENTER.

Conf. (2nd) = Group 2 Setpoint for that Output. First enter the Conf. (1st) mode; then push the GROUP button on the keyboard to get to the Conf. (2nd) mode. See the examples under the specific setpoint descriptions for details.

CHANNELS 41-47: LOW SETPOINT CHANNELS

Channels 41-47 are used to enter the LOW setpoint value for each Output Group. Channel 4X is used for Output X; for example, Channel 41 is for Output 1.

The first level of configuration is used for the LOW setpoint for Group 1 of the selected Output: [o.1LE ttt]

The second level of configuration is used for the LOW setpoint for Group 2 of the selected Output: [0.2LE ttt]

EXAMPLE: Assign LOW setpoints for Output 2:
Enter Channel 42 and press ENTER: [2.1LE 0]
Conf. (1st) - Output 2, Group 1 = 400°F. [2.1LE 400]
Conf. (2nd) - Output 2, Group 2 = Not used [2.2LE 0]

IMPORTANT: An open thermocouple connection will cause the LOW setpoint to be tripped UNLESS the setpoint entry is "0".

NOTE: See above for description of getting into Conf. (1st) and Conf. (2nd) modes.

CHANNELS 51-57: HIGH SETPOINT CHANNELS

Channels 51-57 are used to enter the HIGH setpoint value for each Output Group. Channel 5X is used for Output X; for example, Channel 53 is for Output 5.

The first level of configuration is used for the HIGH setpoint for Group 1 of the selected Output: [o.1HEtttt]

The second level of configuration is used for the HIGH setpoint for Group 2 of the selected Output: [o.2HEtttt]

EXAMPLE: Assign HIGH setpoints for Output 1:

Enter Channel 51 and press ENTER:	[1.1HE 0]
Conf. (1st) - Output 1, Group 1 = 800°F.	[1.1HE 800]
Conf. (2nd) - Output 1, Group 2 = 760°F.	[1.2HE 760]

NOTE: See previous page for description of getting into Conf. (1st) and Conf. (2nd) modes.

CHANNELS 61-67: DIFFERENTIAL SETPOINT CHANNELS

Channels 61-67 are used to enter the DIFFERENTIAL setpoints for each Output Group. Channel 6X is used for Output X; for example, Channel 65 is for Output 5. DIFFERENTIAL is the limit by which any point in the group may vary (plus or minus) from a selected average of the points in that group (see CHANNEL 60). The entry is a single number which is the same for plus or minus from the selected average.

The first level of configuration is used for the DIFFERENTIAL setpoint for the first Group of the Selected Output: [o.1PE ttt]

The second level of configuration is used for the DIFFERENTIAL setpoint for the second Group of the Selected Output: [o.2PE ttt]

EXAMPLE: Assign DIFFERENTIAL setpoints for Output 5:

Enter Channel 65 and press ENTER:	[5.1PE 0]
Conf. (1st) - Output 5, Group 1 = 90°F.	[5.1PE 90]
Conf. (2nd) - Output 5, Group 2 = 125°F.	[5.2PE 125]

NOTE: See previous page for description of getting into Conf. (1st) and Conf. (2nd) modes.

CHANNEL 60: PER CENT TEMPERATURE CHANGE LIMIT / DIFFERENTIAL CALCULATION

Channel 60 has two functions:

Conf. (1st) - Percent Change per Scan Cycle [cc E xx]
Conf. (2nd) - Differential Calculation [cc.E x]

The first level of configuration is used to limit the change seen by the ETS from one scan to the next to the entered percentage. The entry may be any number from 1 to 99 in 1% increments.

EXAMPLE: If the setpoint is set 10% above the normal operating temperature and it is desired to see two successive scans before faulting, enter a number lower than 10, for example "8". [60E 8]

CAUTION: It is not recommended that numbers lower than "5" be used as many scan cycles may be required to reach the fault level if a very small percentage limit is used.

The second level of configuration is used to select the method of differential temperature calculation.

EXAMPLE: To compare each point in a Group to the average temperature of all points in that Group, enter "0". [60.E 0]

To compare each point in a Group to the average temperature of the other points in that Group, enter "1": [60.E 1]

NOTE: See page 3-4 for description of getting into Conf. (1st) and Conf. (2nd) modes.

CHANNELS 71-77: AVERAGE GROUP TEMPERATURE READOUT

Entering Channel 71-77 and pressing ENTER gives the average Group temperature readout for the Output specified. Channel 7X is used for the average temperature for Output X, Groups 1 or 2: |o.g tttt|

EXAMPLE: Channel 74 gives the average temperature reading for Output 4, Group 1: |4.1 tttt|

Push GROUP button to get Group 2; |4.2 tttt|

4-20 MA OUTPUT CHANNELS

If the ETS has the 4-20 ma output feature, there are eight channels assigned to the control or readout of these functions. The ETS outputs a 4-20 ma signal proportional to the average temperature of the monitored points in Output 1, Group 1 and Output 2, Group 1. The channels that apply to this feature are:

OUTPUT 1, GROUP 1 (Output read on Channel 50)

Channel 48:	Enter the Temperature value giving 4 ma output:	|48E tttt|
Channel 49:	Enter the Temperature value giving 20ma output:	|49E tttt|
Channel 50:	Displays the Ma output corresponding to the average temperature of Output 1, Group 1 points:	|50 xx.x|
Channel 58:	Enter the Reset Response Rate (in seconds) for the output signal (typically 1 to 10 seconds):	|58E ss|

OUTPUT 2, GROUP 1 (Output read on Channel 70)

Channel 68:	Enter the Temperature value giving 4 ma output:	|68E tttt|
Channel 69:	Enter the Temperature value giving 20ma output:	|69E tttt|
Channel 70:	Displays the Ma output corresponding to the average temperature of Output 2, Group 1 points:	|70 xx.x|
Channel 78:	Enter the Reset Response Rate (in seconds) for the output signal (typically 1 to 10 seconds):	|78E ss|

Example: For Output 1, Group 1 Points, it is desired to have a 4-20 ma signal proportional to the average temperature over a range of 600° to 1000°F.

Channel 48:	Enter "600":	|48E 600|
Channel 49:	Enter "1000":	|49E 1000|
Channel 58:	Enter "1":	|58 1|
Channel 50 readout:	At 600°F.	|50 4.0|
	At 740°F.	|50 9.6|
	At 800°F.	|50 12.0|
	At 900°F.	|50 16.0|
	At 1000°F.	|50 20.0|

CHANNEL 80: AUTOMATIC SCANNING OF ALL POINTS

Entering Channel 80 and pressing ENTER causes the ETS to go into an automatic, continuous scan mode of all designated points at the scan rate of 3 seconds per point. The scan starts on Channel 01 and progresses in numerical order. The last channel scanned is the entry in Channel 00 which allows the user to avoid scanning unused channels. [cc tttt]

EXAMPLE: Scan is on Channel 15: [15 856]

If any point is faulted, the fault code is displayed: [cc f.tttt]

If the faulted point is the first latched point to fault, Channel No. will blink: (cc blinking) [cc f.tttt]

EXAMPLE: Scan on point 24, faulted (first-out latched point) on High: (24 blinking) [24 H. 873]

NOTE: The scan may be advanced manually simply by pushing the ADV SC button.

CHANNELS 81-87: AUTOMATIC SCAN OF POINTS OF SELECTED OUTPUT

Entering Channel 8X and pressing ENTER causes the ETS to go into an automatic scan mode for all points in selected Output X. The points are displayed in numerical order starting with the lowest number first and progressively at the rate of 3 seconds per point. All points in Group 1 of selected Output X are displayed first followed by all points in Group 2 of the same Output. These channels permit the User to have an automatic scan of certain points of interest in a particular Output Group. [cc tttt]

EXAMPLE: Scan is on Channel 28: [28 158]

If any point is faulted, the fault code is displayed: [cc f.tttt]

If the faulted point is the first latched point to fault, Channel No. will blink: (cc blinking) [cc f.tttt]

EXAMPLE: Scan on point 11, faulted on Diff: (11 blinking) [11 F. 791]

NOTE: The scan may be advanced manually simply by pushing the ADV SC button.

CHANNEL 88: POINT FAULT STATUS

Entering Channel 88 and pressing ENTER will cause the ETS to display the first point to fault (if any) and show the Output affected, the fault code and the temperature at which the point faulted: [cc.of-tttt]

EXAMPLE: Point 14 faults first on High setpoint of Output 3 at 240°F. [14.3H. 240]

Pushing the ADV SC button changes the display to another faulted point (if any). The ADV SC button is pushed as many times as there are faulted points until you come back to the first displayed point.

NOTE: The blinking point in Channel 88 is the first point to fault in an Output that is configured to be latching (see Channels 91-97). Points assigned to Outputs that are configured to be non-latching remain listed in Channel 88 only as long as the point remains in a faulted condition.

CHANNEL 89: OUTPUT FAULT STATUS

Entering Channel 89 and pressing ENTER will cause the ETS to display simultaneously the logic fault status of all seven Outputs. Seven digits are displayed representing Outputs 1 through 7 from left to right. A simple binary code is used where 1 = normal status, 0 = faulted status: [1111111]

EXAMPLE: Outputs no. 2 and 5 are faulted: [1011011]

NOTE: When an Output is disarmed (held in the non-alarm state) by a Reset start-up timer, a blinking "1" will display in that Output position. When an Output is disarmed by the Acknowledge function, a blinking "0" or "1" will display in that Output position indicating the actual logic state of the Output.

CHANNEL 90: INDIVIDUAL OUTPUT RESET

NOTE: The entries on Channel 90 are NOT password protected and can be used without first entering configuration mode.

Channel 90 permits the user to reset any Output to the pre-programmed start-up status by entering the Output number: [90E o]
Any faulted points in the selected Output are removed from the record in Channel 88 as long as the reset condition exists.

For a fixed 10 minute test lockout on a given Output, enter the Output number twice: [90E oo]

To end the lockout on a given Output, enter the Output no. and 0: [90E o0]

EXAMPLE: For Output No. 4,
To re-cycle the start-up cycle, enter 4: [90E 4]
For fixed 10 minute test lockout, enter 4, 4: [90E 44]
To end lockout, enter 4, 0: [90E 40]

CHANNELS 91-97: INITIAL OUTPUT LOGIC AND START-UP CYCLE

To set the Output Logic and Start-up Cycles, first enter the configuration mode through Channel 99. Then enter the Channel 9X for the selected Output X and press ENTER.

Conf. (1st) - Establish the Logic for the Output solid state relay: [9XE ab]

- a = 0 for normally open;
- a = 1 for normally closed.
- b = 0 for non-latching output;
- b = 1 for latching output.

EXAMPLE: Output 3, norm. open, latching output: [93E 01]

NOTE: Once the logic (N/O or N/C) is established, it is necessary to set the 7-position Switch 8 on the power circuit board located in the bottom of ETS enclosure. For each Output set for normally open, set the corresponding switch to the OPEN position; for each Output set for normally closed, set the corresponding switch to the CLOSED position. This procedure sets the logic for the LED output indicator to be lit when (and only when) any output is faulted.

Conf. (2nd) - Establish the Lockout Time from an attained Average Group Temperature for Group 1 points for the specific Output: [C sss.ttt]

- sss = lockout time in seconds
- ttt = attained average temp. for Group 1

EXAMPLE: Output 3, 45 seconds after Group 1 average temp. reaches 200°F.:

Enter 45:	[E 45. 0]
Press ENTER:	[E 45. 0]
Enter 200:	[E 45.200]
Press ENTER:	[93. 45.200]

EXAMPLE: Output 3, 45 seconds after start-up:

Enter 45:	[E 45. 0]
Press ENTER:	[E 45. 0]
Enter 0 (disarms temp. factor):	[E 45. 0]
Press ENTER:	[93. 45. 0]

EXAMPLE: Output 3, after Group 1 average temp. reaches 200°F.:

Enter 0 (disarms time factor):	[E 0. 0]
Press ENTER:	[E 0. 0]
Enter 200:	[E 0.200]
Press ENTER:	[93. 0.200]

CHANNEL 98: SELECT TEMPERATURE SCALE AND TYPE THERMOCOUPLE

Channel 98 is used to select display readout in degrees C. or F. and the type thermocouple (Type J or K). First enter the configuration mode by entering the password in Channel 99. Then establish the code for the readout and type thermocouple: [98E ab]

a = 1 for degrees C.
a = 2 for degrees F.
b = 1 for Type J
b = 2 for Type K

EXAMPLE: For degrees F. readout with type J thermocouple: [98E 21]

NOTE: It is also necessary to set Switch A on the power circuit board located in the bottom of the ETS enclosure. Set as follows:

Type J - Switch 1 CLOSED, Switch 2 OPEN
Type K - Switch 1 OPEN, Switch 2 CLOSED

NOTE: Enter the data for Channel 98 BEFORE entering any temperature setpoints.

CHANNEL 99: PASSWORD/CONFIGURATION CHANNEL

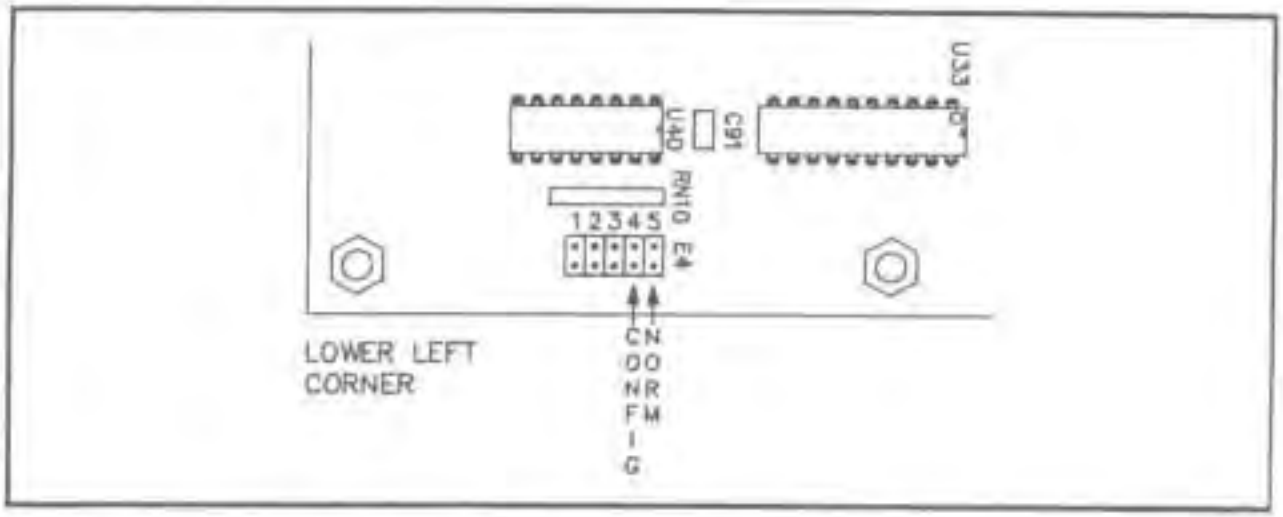
Channel 99 is the configuration channel. All data entries such as setpoints, logic commands, etc. are password protected. Therefore, it is not possible to change these entries without first entering the password in Channel 99.

NOTE: The current entry in any channel can be read on the display without entering the configuration mode (i.e. without the use of the password). The password and configuration mode are required ONLY to change channel entries.

1. ENTERING DESIRED PASSWORD - The ETS-40 is shipped with a standard password of "9768". If a different password is preferred, proceed as follows. Move the small jumper on the main logic board (mounted to the ETS enclosure cover) to the fourth position from the top (see drawing below).

Enter 99 and press "ENTER":	[99E 0]
Enter desired password, for example "1234":	[99E 1234]
Press "ENTER":	[99 1234]

Re-position the circuit board jumper in the last (fifth) position for normal operation.



2. ENTERING THE CONFIGURATION MODE - In order to enter or change data in any of the channel entries, it is first necessary to enter the configuration mode.

Enter 99 and press "ENTER":	[99E 0]
Enter your password, for example "1234":	[99E 1234]
Press "ENTER":	[99 HELLO]

All four status indicators should be flashing indicating the ETS is now in the configuration mode. This allows any channel data entry to be changed.

5. LEAVING THE CONFIGURATION MODE - To leave the configuration mode and return to normal operation with protected entries, proceed as follows:

Enter 99 and press "ENTER":	[99E 0]
Enter 0:	[99E 0]
Press "ENTER":	[99 -----]

The ETS is now in the normal operating mode.

3.3 DATA ENTRY

A. To enter data, it is first necessary to enter the configuration mode.

Enter 99 and press "ENTER":	[99E 0]
Enter your password, for example "1234":	[99E 1234]
Press "ENTER":	[99 1234]

All four status indicators should be flashing indicating the ETS is in the configuration mode.

B. To enter data on a particular channel, follow the sequence given below:

CODE FOR DISPLAY DESIGNATION

o = Output no. (1-7)
g = Group no. (1, 2)
f = Fault code (L, H, P)
cc = Channel no.
x, ab = Value other than temperature
ss, sss = Time in seconds
ttt = Temperature (999 max.)
tttt = Temperature (1999 max.)

CHANNEL 98: (Enter 98 first)	Enter Channel and press ENTER:	[ccE 0]
	Enter Values (ab):	[ccE ab]
	Press ENTER:	[cc ab]
CHANNEL 60:	Enter Channel and press ENTER:	[ccE 0]
	Enter % Value (ab):	[ccE ab]
	Press ENTER:	[cc ab]
	Press GROUP:	[cc.E 0]
	Enter Differential calculation code:	[cc.E x]
	Press ENTER:	[cc. x]
CHANNEL 00:	Enter Channel and press ENTER:	[00E 0]
	Enter highest Channel no. used (cc):	[00E cc]
	Press ENTER:	[00 cc]
	Press GROUP:	[00.E 0]
	Enter Node No. (ab):	[00.E ab]
	Press ENTER:	[00. ab]
CHANNELS 01-40:	Enter Channel and press ENTER:	[ccE .]
	Enter Output.Group for 1st assignment:	[ccE o.g]
	Press ENTER:	[cc o.g]
	Press GROUP:	[cc.E .]
	Enter Output.Group for 2nd assignment:	[cc.E o.g]
	Press ENTER:	[cc. o.g]
CHANNELS 41-47, 51-57, 61-67:	Enter Channel (cc):	[cc ------]
	Press ENTER:	[o.1fE 0]
	Enter Setpoint (tttt):	[o.1fEtttt]
	Press ENTER:	[o.1f tttt]
	Press GROUP:	[o.2fE 0]
	Enter Setpoint (tttt):	[o.2fEtttt]
	Press ENTER:	[o.2f tttt]
CHANNELS 91-97:	Enter Channel and press ENTER:	[ccE 0]
	Enter values (ab):	[ccE ab]
	Press ENTER:	[cc ab]
	Press GROUP:	[cc. 0. 0]
	Press ENTER:	[E 0. 0]
	Enter Delay Time (sss):	[E sss. 0]
	Press ENTER:	[E sss. 0]
	Enter Attained Temperature (ttt):	[E sss.ttt]
	Press ENTER:	[cc.sss.ttt]

CHANNELS 48,49,	Enter Channel and press ENTER:	[ccE 0]
68,69:	Enter Temperature values (tttt):	[ccE tttt]
	Press ENTER:	[cc tttt]
CHANNELS 58,78:	Enter Channel and press ENTER:	[ccE 0]
	Enter Reset rates (ss):	[ccE ss]
	Press ENTER:	[cc ss]

C. When finished with entering data into the ETS, it is important to leave the configuration mode and return to normal, keyboard-protected status.

CHANNEL 99:	Enter Channel and press ENTER:	[99E 0]
	Enter 0:	[99E 0]
	Press ENTER:	[99 -----]

NOTE: DO NOT INDEFINITELY LEAVE THE ETS IN THE CONFIGURATION MODE OR CUT THE POWER OFF TO THE ETS WHEN IN THE CONFIGURATION MODE.

SECTION 4

OPERATION

4.0 OPERATION

4.1 **DISPLAY ANY POINT** - Enter the specific Channel No. for a constant readout of that channel's monitored temperature. If the point is faulted, the display will blink and indicate the fault code.

EXAMPLE: Enter Channel 25, normal reading of 742: |25 742|
Faulted on High, current
temperature of 790: |25 H. 790|

To check Group and Output assignment:
Press ENTER: |25 2.1|
Press GROUP: |25. 4:1|
Channel 25 is assigned to Output 2, Group 1
and to Output 4, Group 1.

4.2 **SCAN ALL CHANNELS** - Entering Channel 80 and pressing ENTER causes the ETS to scan all designated channels (from Channel 01 through the channel entered in Channel 00) at a scan rate of 3 seconds per point. The display readout is per section 4.1 for both normal and faulted points. Pushing the ADV SC button will override the automatic scan and advance the display to the next point. The scan can be restarted at Channel 01 at any time by pressing CLEAR, then ENTER. See the description for Channel 80.

4.3 **SCAN ALL POINTS OF SELECTED OUTPUT** - Entering Channel 8X and pressing ENTER causes the ETS to scan all channels of the selected output X at a scan rate of 3 seconds per point. For example, entering Channel 86 gives a scan of all points assigned to Output No. 6. All points in Group 1 of the selected Output are scanned first followed by all points in Group 2. The display readout is per section 4.1 for both normal and faulted points. Pushing the ADV SC button will override the automatic scan and advance the display to the next point. See description for Channels 81-87.

4.4 **DISPLAY OF AVERAGE GROUP TEMPERATURE** - Entering Channel 7X causes the ETS to display the average temperature of the points assigned to Output X, Group 1. Then push the GROUP button to display the average temperature of Output X, Group 2. See description for Channels 71-77.

EXAMPLE: Display average temperatures for Output 2:
Enter Channel 72: |72 -------|
Press ENTER: |2.1 791|
Press GROUP: |2.2 756|
The average temperatures for Output 2 are:
Output 2, Group 1: 791 degrees
Output 2, Group 2: 756 degrees

4.5 SETPOINTS - To check the setpoint value, enter the Channel for the function and Output No. desired:

LOW SETPOINTS	-	CHANNELS 41-47
HIGH SETPOINTS	-	CHANNELS 51-57
DIFFERENTIAL SETPOINTS	-	CHANNELS 61-67

EXAMPLE: Check HIGH setpoints for Output 6:

Enter Channel 56:	[56 ------]
Press ENTER:	[6.1H 220]
Press GROUP:	[6.2H 190]

The HIGH setpoints for Output 6 are:
Output 6, Group 1: 220 degrees
Output 6, Group 2: 190 degrees

NOTE: See section 3.2 and 3.3 for information regarding changing setpoints.

4.6 FAULTED POINTS - As described above, any mode displaying a single point (whether continuously or when scanning) which is faulted will show the following display (using Channel 25 as example):

EXAMPLE: Channel 25, faulted on High, current temp of 790°F. [25 H. 790]

For more detailed information on all faulted points, enter Channel 88 and press ENTER. The ETS will then display the first-out faulted channel as follows:

EXAMPLE: Channel 25, faulted on High setpoint of Output 2 at 778°F.

Enter Channel 88:	[88 ------]
Press ENTER:	[25.2H. 778]

NOTE: The displayed temperature here is the monitored temperature at which the fault was detected - not the current temperature. The current temperature can be read by entering the Channel number.

Pushing the ADV SC button changes the display to another faulted point (if any) that has faulted since the first-out fault occurred. Subsequent faults are displayed at each push of the ADV SC button:

- Points assigned to <u>non-latching</u> Outputs will appear in Channel 88 only as long as the point remains faulted (even if the first point to fault).
- Points assigned to <u>latching</u> Outputs will remain latched in Channel 88 until cleared by a Reset command. The blinking point in Channel 88 is the first point to fault that is assigned to a <u>latching</u> Output.

NOTE: Low (L) or High (H) faults will display in priority over a Differential (P) fault on the same point.

4.7 FAULTED OUTPUTS - The red LED above the display indicates a faulted output when lit. Entering Channel 89 and pressing ENTER causes the ETS to display the logic fault status (see NOTE) of all seven Outputs. Seven digits are displayed representing Outputs 1 through 7 from left to right. A simple binary code is used with 1 = normal status, 0 = faulted status.

EXAMPLE: Outputs no. 2 and 5 are faulted:

Enter Channel 89:	[89 -----]
Press ENTER:	[1011011]

NOTE: A blinking "0" or "1" indicates that Output position is locked out (held in the non-alarm state) by either the Reset start-up timer or the Acknowledge function. See description for Channel 89.

4.8 **ACKNW (ACKNOWLEDGE) BUTTON** - The ACKNW button allows the user to disarm a faulted Output while maintaining fault information in Channel 88. During Acknowledge, Channel 89 will indicate the actual logic state of the Output (blinking).

EXAMPLE: Output 2 has faulted; it is desired to clear alarm until the situation is corrected.

Press ACKNW button and press ENTER:	[89E 0]
Enter Output No.:	[89E 2]
Press ENTER:	[89 2]

Output 2 will now revert to non-fault status. The ETS continues all other functions and will cause Outputs other than no. 2 to fault if a point in another Output goes into a faulted state.

To revert to normal operation and clear Channel 88:

Press ACKNW button and press ENTER:	[89E 0]
Enter Output No. and zero:	[89E 20]
Press ENTER:	[89 20]

CAUTION: **The Acknowledge function disables the specified Output indefinitely until cancelled or Reset. DO NOT leave the monitored machine with the Acknowledge function active.**

4.9 **INDIVIDUAL OUTPUT RESET** - Entering Channel 90 and pressing ENTER permits the user to individually reset any of the seven Outputs to the pre-programmed start-up cycle (determined by entries in Channels 91-97) or to a fixed 10 minute test lockout. Any faulted points in the reset Output will not display in Channel 88 during the reset condition. Outputs in the reset mode will show blinking "1" in Channel 89.

EXAMPLE: To reset Output no. 6:

Enter Channel 90 and press ENTER:	[90E 0]
To enter the start-up cycle, enter 6, press ENTER:	[90 6]
For fixed 10 minute lockout, enter 66, press ENTER:	[90 66]
To end lockout, enter 60, press ENTER:	[90 60]

See the description for Channel 90 for more detail.

NOTE: Although similar, there are differences between the operation of the Acknowledge Function and the Reset action through Channel 90.

- Acknowledge disarms the specified Output and maintains first-out fault information in Channel 88 UNTIL the instruction is entered to cancel Acknowledge. Channel 89 shows the actual logic state (blinking) while the Acknowledge function is active.
- The Channel 90 Reset disarms the specified Output only for a specified limited period or condition after which the ETS reverts to operation based on the actual status of the monitored points for that Output. Fault information is erased from Channels 88 and 89 during the reset condition. Reset overrides and cancels Ackhowledge.

4.10 **DISARM INDIVIDUAL POINTS** - Entering "0.0" for the Output.Group entry for a particular Channel causes that Channel to be by-passed for any fault checks. Therefore, the "0.0" entry can be used to temporarily disarm a point (that may have a disabled thermocouple or may of necessity be in a fault condition) without disarming the entire Output for that point. You must enter the configuration mode to change the Output.Group assignment - see Section 3.3 (Points 01-40) for details.

CAUTION: The "0.0" entry disables the specified Point indefinitely until the normal "Output.Group" entry is restored.

4.11 **RESET BUTTON** - Pressing the RESET button resets all Outputs to normalized status and re-cycles the lock-out timers for all Outputs. It also clears Channels 88 and 89 of all fault information. The RESET button performs the same function from the keyboard as the I/1 input (remote reset).

4.12 **ADV SC (ADVANCE SCAN) BUTTON** - Pressing the ADVANCE SCAN button advances the display to the next point when viewing the scanning channels (80-87) or the faulted point channel (88). On Channels 80-87, holding down the ADV SC button causes the channels to be scanned more rapidly than the normal rate of 3 seconds per point.

4.13 **GROUP BUTTON** - The GROUP button accomplishes the following functions:

- Used to enter and/or display the second Output and Group selection for monitored points (Channels 01-40);
- Used to enter and/or display the Group 2 setpoints for each Output (Channels 41-47, 51-57, 61-67);
- Used to enter and/or display the code for differential calculation (Channel 60);
- Used to display the Group 2 average temperatures (Channels 71-77);
- Used to enter and/or display the Output lockout time and average attained temperature (of Group 1 points) to initiate timer (Channels 91-97).

See the specific channel descriptions for detail.

4.14 **CLEAR BUTTON** - The CLEAR button is used to cancel an entry (an erroneous number, for example) prior to pushing the ENTER button. The display will revert to the previous data.

4.15 **DISPLAY STATUS INDICATORS** - There are four display status indicators at the lower edge of the display. These are indicated on the front of the ETS and, from left to right, indicate the following when on:

- No. 1: At least one Output is in the Reset mode.
- No. 2: At least one point is faulted.
- No. 3: Channel 88 or 89 is active on the display.
- No. 4: The Acknowledge function is active disabling an Output.
- All 4: The ETS is in the configuration (data entry) mode.

4.16 **CHANNELS WITH SPECIAL DISPLAY** - In most cases, when a Channel number is entered, that number remains on the display as other information is displayed. The following Channels are exceptions in that the Channel number disappears after the ENTER button is pushed.

Channels 41-47:	Enter "4X"	[4X ------]
	Press ENTER	[X.1L tttt]
	Press GROUP	[X.2L tttt]
Channels 51-57:	Enter "5X"	[5X ------]
	Press ENTER	[X.1H tttt]
	Press GROUP	[X.2H tttt]
Channels 61-67:	Enter "6X"	[6X ------]
	Press ENTER	[X.1P tttt]
	Press GROUP	[X.2P tttt]
Channels 71-77:	Enter "7X"	[7X ------]
	Press ENTER	[X.1 tttt]
	Press GROUP	[X.2 tttt]
Channels 80-87:	Enter "8X"	[8X ------]
	Press ENTER	[cc tttt]
Channel 88:	Enter "88"	[88 ------]
	Press ENTER	[cc.of.tttt]
Channel 89:	Enter "89"	[89 ------]
	Press ENTER	[1111111]

NOTE: See Section 3.2, Channel Description, for explanation of the code format used for the above display information.

4.17 **PROTECTION** - The ETS Temperature Scanner provides protection through the use of the seven output solid state relays described elsewhere in this manual. The versatility for programming setpoints and grouping of monitored points allows the user wide latitude in designing protection to fit his specific requirements. The specifics of the protection coverage are covered in sections 1.0, 2.0 and 3.0 of this manual.

SECTION 5

INSTALLATION

5.0 INSTALLATION

5.1 GENERAL INSTALLATION LAYOUT - Refer to figure 2 for the general layout of wiring in and out of the ETS-40 Scanner.

5.2 MOUNTING THE ETS - The ETS is preferably panel-mounted off the monitored machine in such a manner as to minimize exposure to vibration. Refer to figure 3 for physical mounting details.

5.3 OPERATING ENVIRONMENT - Operating temperature range is 32° to 158° F. / 0° to 70° C. Humidity specification is 0 - 95%, non-condensing.

5.4 PART NO. DESIGNATION - The electrical rating of various parts of the ETS scanner is designated in the full device Part No. which is found on the inside of the enclosure.

EXAMPLE: ETS - 40mn - xy

m = Letter designating the required Power Source:
A = 110 VAC, D = 24 VDC

n = Letter designating 4-20ma Option:
P = 4-20 ma output on Groups 1.1 and 2.1

x = Number designating Input Module type:
1 = IDC5 module: 10-32 VDC - white case
2 = IAC5 module: 90-140 VAC/DC - yellow case

y = Number designating Output Module type:
4 = ODC5 module: 60 VDC, 2A. - red case
5 = OAC5A module: 24-280 VAC, 2A. - black case
6 = ODC5A module: 5-200 VDC, 0.67A. - red case

5.5 ELECTRICAL HOOK-UP - GENERAL:

A. The power connections to the ETS-40 must be in accordance with the National Electrical Code. The ETS-40 is suitable for installation in Class I, Division 2 locations. The external power is connected to the ETS plus (+) and minus (-) connections (see figure 4); the Ground terminal in the ETS must be connected to earth ground which may be the same as the power negative (-). The input power has a 3-amp protective fuse. The ETS can be powered in one of the following ways:

1. 24 VDC POWERED MODELS:
   - 24 volt battery with trickle charger (2 amp min. capability);
   - DC power supply capable of furnishing 18-36 VDC, 5 amps.
2. 110 VAC POWERED MODELS:
   - A source of "instrument quality" 110-120 VAC free from line spikes such as caused by the turning-on of electric motors, etc.

B. Power wiring and signal (thermocouple) wiring must be in separate conduits and conduit entries into the ETS to avoid undesired electrical interaction. Separate as follows (see figure 2):

1. Thermocouple extension wires, RS422 wiring.
2. Thermocouple extension wires.
3. Input power, output modules O/1 - O/7, input module I/8.

C. The Input Module I/1 (master reset) is protected with a 3-amp fuse. It is necessary to impose a voltage within the rating of the particular module used (see section 5.4 above) to effect a reset condition. The keyboard RESET button also provides the same function.

D. The solid state Output Modules (O/1 - O/7) have the following associated with each device (see section 5.4 for electrical ratings):
   - an LED indicator mounted directly above its associated solid state relay; the output switch is in the closed position when the LED is on.
   - a 3-amp fuse in the output leg mounted on the circuit board directly below its associated solid state relay.

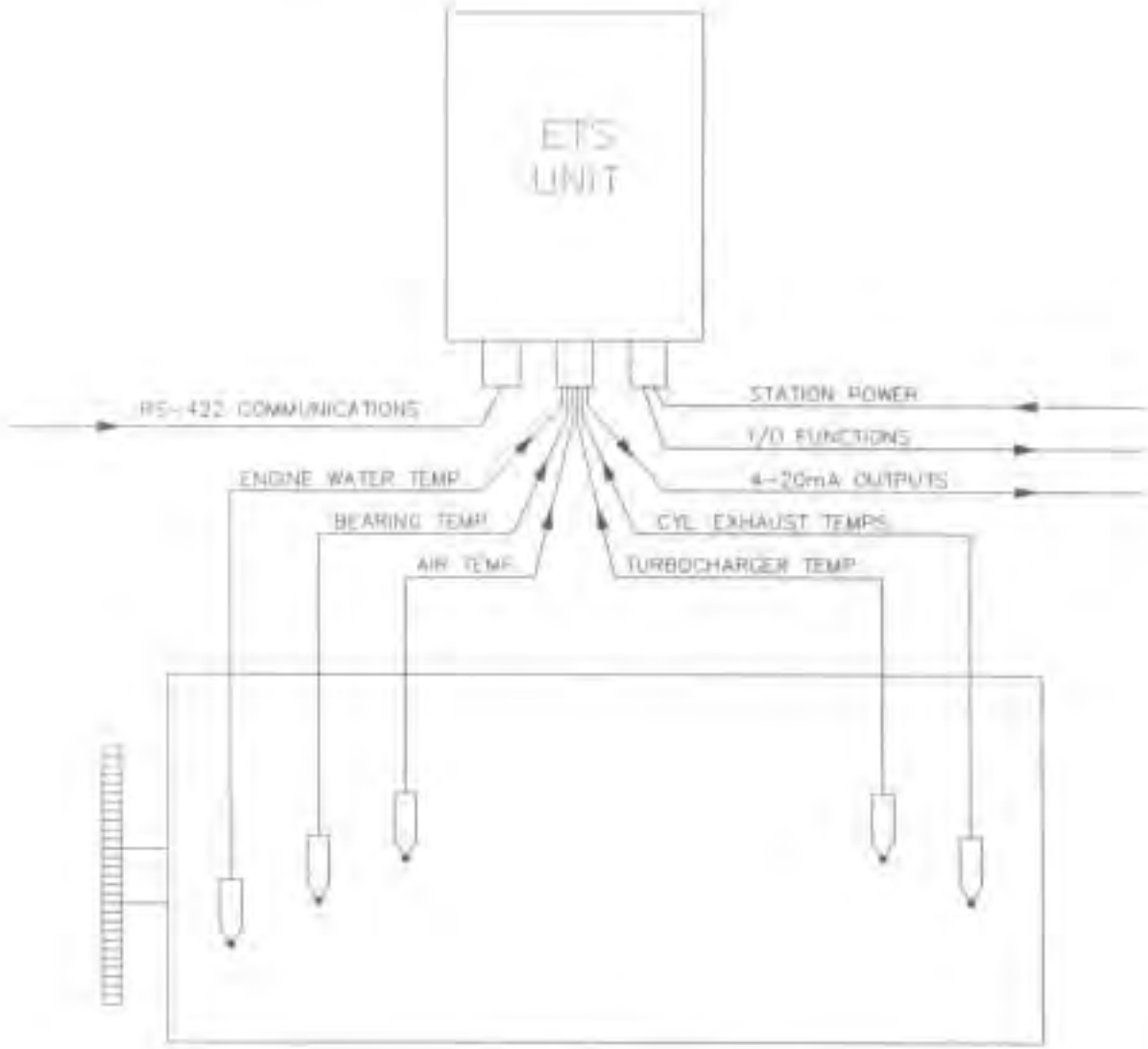
E. All terminations to the ETS are to plug-in type terminal strips, these require only that the wire insulation be stripped back approximately 1/4". A small screwdriver is used to secure the conductor to the plug-in connector. The plug-in connectors must be lifted away from the bottom of the box for removal.

5.5 TERMINAL STRIP DESIGNATION (See figure 4)

TERMINAL NO.	FUNCTION
TOP STRIP:	
1	Input I/1 Remote Reset - negative (-)
2	Input I/1 Remote Reset - positive (+)
3	Output 1 - negative (-) for DC models
4	Output 1 - positive (+) for DC models
5	Output 2 - negative (-) for DC models
6	Output 2 - positive (+) for DC models
7	Output 3 - negative (-) for DC models
8	Output 3 - positive (+) for DC models
9	Output 4 - negative (-) for DC models
10	Output 4 - positive (+) for DC models
11	Output 5 - negative (-) for DC models
12	Output 5 - positive (+) for DC models
13	Output 6 - negative (-) for DC models
14	Output 6 - positive (+) for DC models
15	Output 7 - negative (-) for DC models
16	Output 7 - positive (+) for DC models
17	Analog Output 1 - negative (-)
18	Analog Output 1 - positive (+)
19	Analog Output 2 - negative (-)
20	Analog Output 2 - positive (+)
24	RS-422 - XMA
25	RS-422 - XMB
26	RS-422 - REC. A
27	RS-422 - REC. B
30	Ground
31	Input Power - negative (-) for DC models
32	Input Power - positive (+) for DC models
LOWER STRIP:	
1-40 Top Row	Thermocouple positive (+): Type J - Iron (white) Type K - Chromel (yellow)
1-40 Bottom Row	Thermocouple negative (-): Type J - Constantan (red) Type K - Alumel (red)

FIG.2

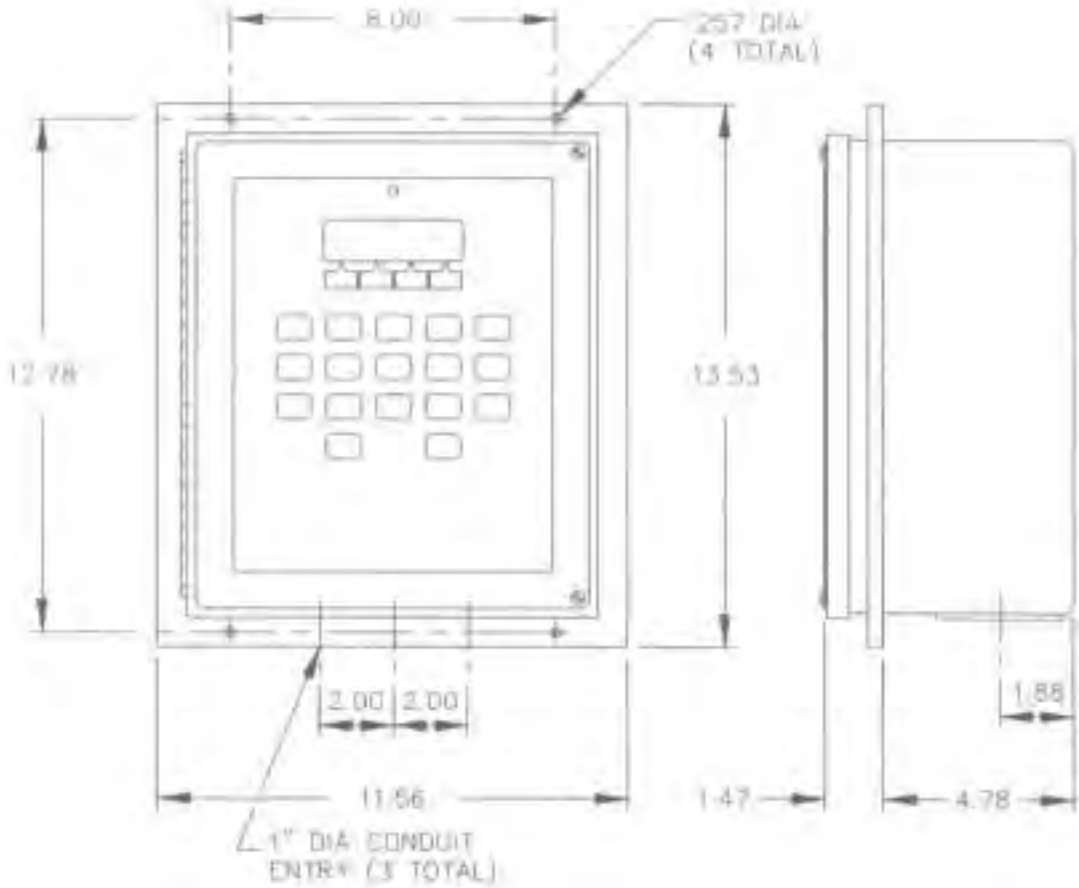
GENERAL INSTALLATION LAYOUT



FUNCTION	ETS TERMINAL NO.
THERMOCOUPLE INPUTS	1-40 DUAL TERM. STRIP
REMOTE RESET	1 & 2
OUTPUT FUNCTIONS	3 THRU 16
4-20mA OUTPUT 1	17 & 18
4-20mA OUTPUT 2	19 & 20
COMMUNICATIONS	24 THRU 27
STATION POWER +	32 (+)
STATION POWER -	31 (-)
STATION GROUND	30 (⏚)

FIG.3

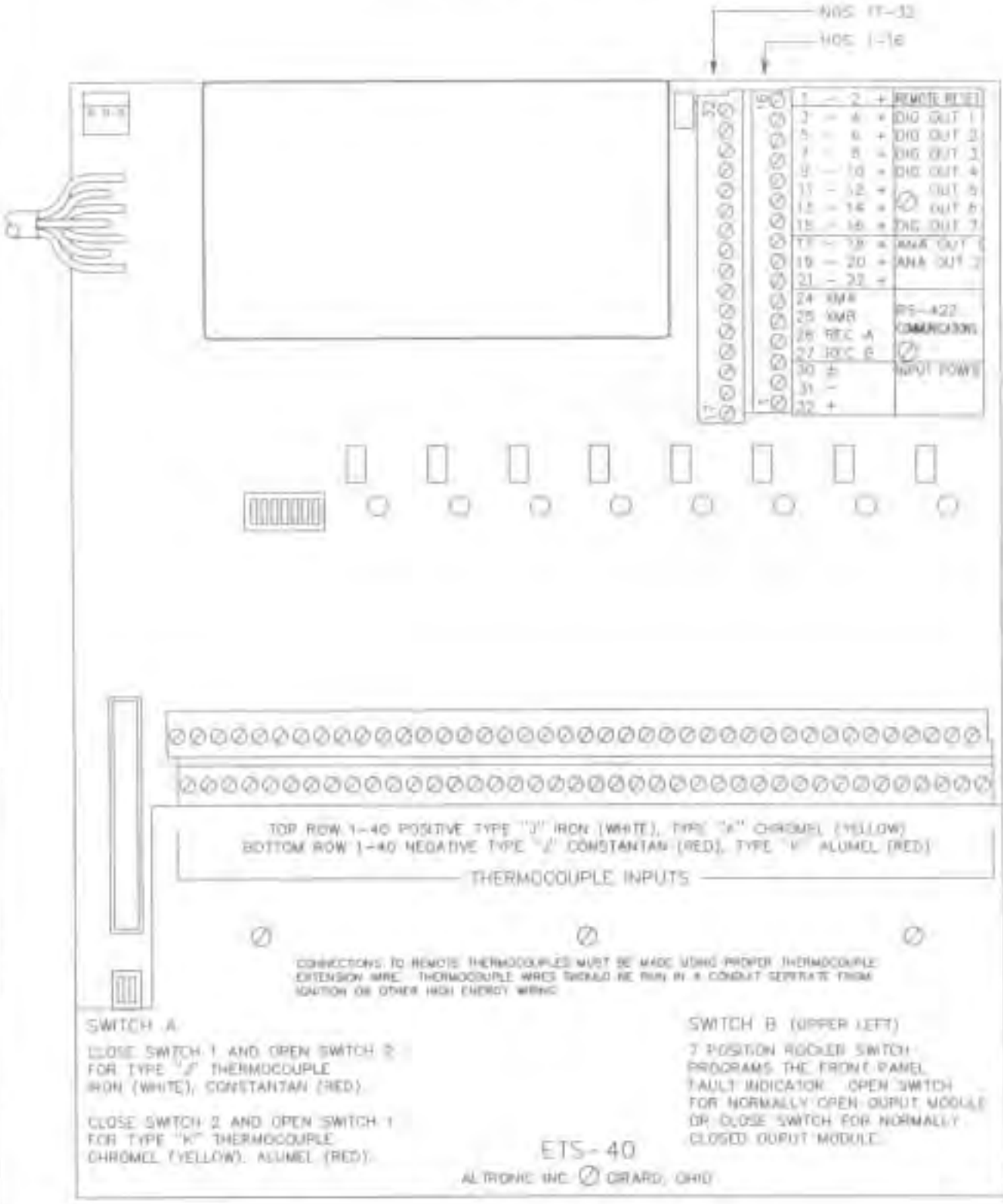
ETS MOUNTING DIMENSIONS



NOTE: PANEL CUT-OUT IS 10.12 X 12.12
ALL DIMENSIONS IN INCHES

FIG.4

TERMINAL LAY-OUT

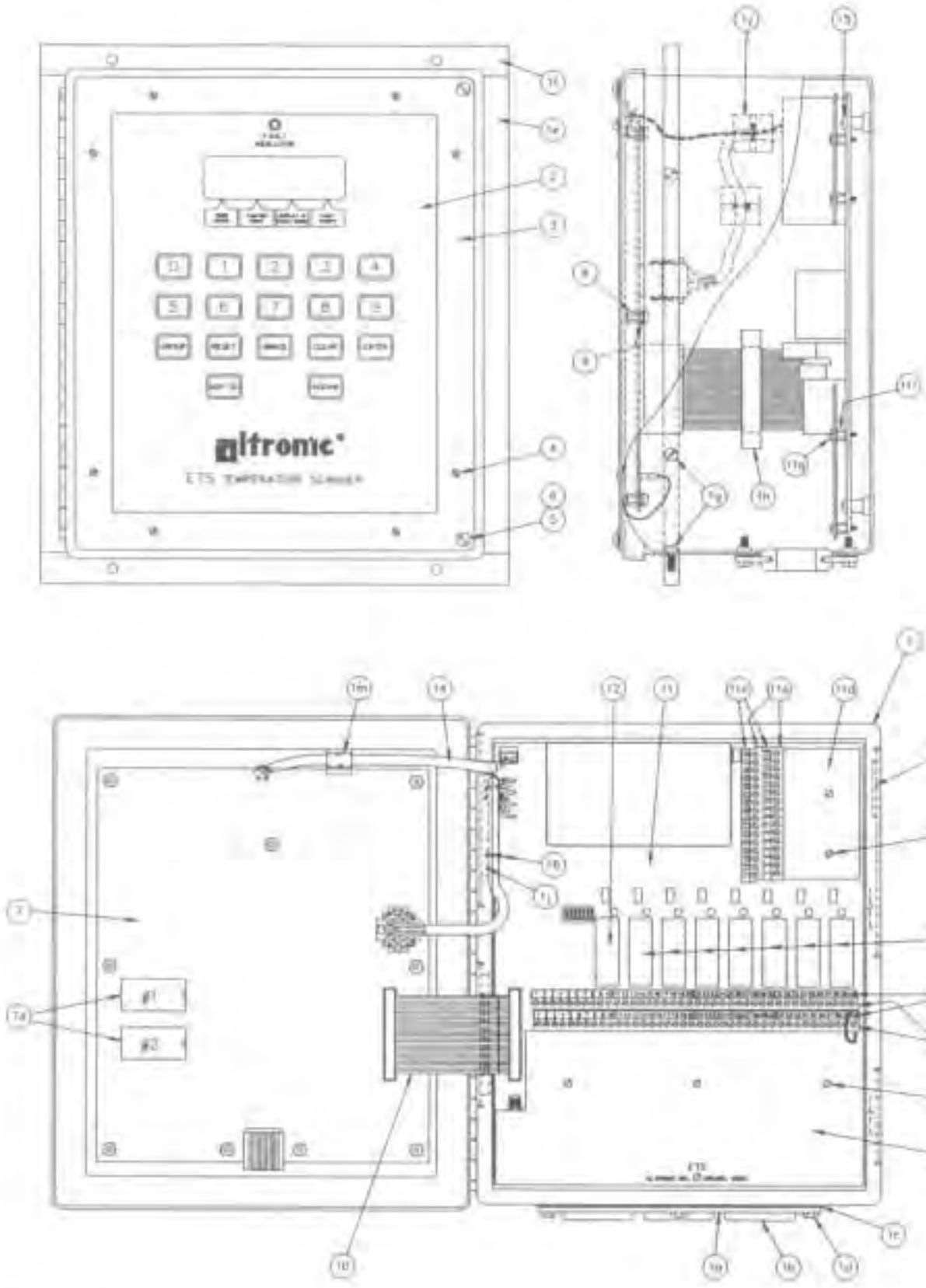


SECTION 6

PARTS LIST

PARTS IDENTIFICATION

FIG.5



6.0 PARTS LIST - ETS-24/40

FIGURE 6 REF. NO.	PART NO.	DESCRIPTION
5-1	610 231	Enclosure
-1a	610 221	Plate, entry
-1b	610 256	Grommet
-1c	210 625	Gasket
-1d	902 599	Screw 10-24 nyloc
-1e	610 219	Mounting bar - horizontal
-1f	610 220	Mounting bar - vertical
-1g	902 439	Screw 10-32
-1h	610 257	Cable clamp, ribbon cable
-1j	610 166	Tie anchor
-1k	602 300	Label - S/N
-1m	501 212	Wire clip
-2	610 217	Keypad
-3	602 283-2	Frame
-4	902 578	Screw 4-40
-5	902 611	Screw 10-32
-6	610 443	O-ring
-7	672 081-ETS	Logic board assembly
-7a	601 471-ETS	Memory chip
-8	610 227	Standoff, aluminum
-9	902 459	Lock-nut 6-32
-10	610 209	Jumper cable
-11	681 034-1	I/O board assembly, ETS-40F, 12VDC
	681 034-2	I/O board assembly, ETS-40D, 24VDC
	681 034-3	I/O board assembly, ETS-40A, 115VAC
	681 034-4	I/O board assembly, ETS-24F, 12VDC
	681 034-5	I/O board assembly, ETS-24D, 24VDC
	681 034-6	I/O board assembly, ETS-24A, 115VAC
-11a	610 242	Receptacle plug, 16-position
-11b	610 243	Receptacle plug, 20-position (ETS-40)
	610 307	Receptacle plug, 12-position (ETS-24)
-11c	602 370	Label - plug terminal (ETS-24)
	602 371	Label - plug terminal (ETS-40)
-11d	602 290-1	Label, ETS-40D, 24VDC
	602 290-2	Label, ETS-40F, 12VDC
	602 290-3	Label, ETS-24D, 24VDC
	602 290-4	Label, ETS-24F, 12VDC
	602 302-1	Label, ETS-40A, 115VAC
	602 302-2	Label, ETS-24A, 115VAC
-11e	602 289	Label, T.C. input
-11f	610 228	Standoff, aluminum
-11g	902 598	Screw 6-32
-12	691 057	Input module IDC5
	691 064	Input module IAC5
-13	691 056	Output module ODC5
	691 065	Output module OACSA
	691 066	Output module ODC5A
-14	683 001	LED cable and plug assembly
-15	902 439	Screw 10-32
-16	610 145	Cable tie