2239 Valdes Court
Santa Rosa, CA 95403
707/527-8254 Fax 707/542-9730
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Barrington Consultants Incorporated

TV3

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ON-LINE Temperature Variance Monitor

The **TV3** has three SCADA analog output channels and three independently adjustable dry contact relays for local alarming functions. Factory alarm settings are 10 deg C for ordinary, 20 deg C for urgent, and 100 deg C for high temperature. Alarm setpoints are easily changed on or off site. The default display three sensor temperatures representing A B & C phases on the upper part of the display. Average temperature and Peak Variance temperature is displayed on the lower part of the display. **The TV3** uses platinum RTD's and curve corrected electronics to achieve extremely reliable and accurate readings. The system includes Three 75LB pull magnetic surface mount Platinum 100 Ohm RTD's and 30 year UV treated SJT jacketed connecting cable.

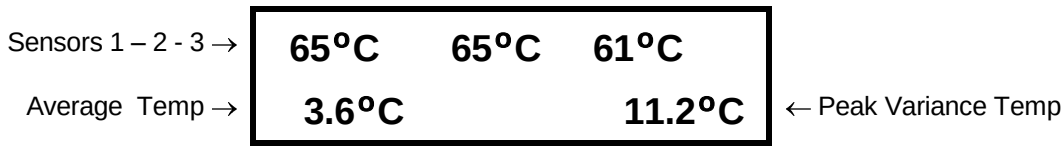
The **TV3** is fully adjustable to alarm from a -40 deg C to 180 deg C temperature differential. All oil filled iron/steel tanked equipment can be monitored with this system.

TV3 OPERATION
FRONT PANEL CONTROL AND DISPLAY

OVERVIEW:
The TV3 features a new, user friendly interface. At the heart of this interface is a 2 line by 16 character alpha-numeric display and a five key keypad.

KEYPAD & DISPLAY OPERATION:
The TV3 unit features a standard display of temperature data. This standard display is shown at all times except when a user has entered one of the two menus to setup the control of the unit. If the user leaves the unit in one of these menus, it will timeout and return to the standard display.

DEFAULT DISPLAY:



Display shows the current temperature of each sensor, the average of the three sensors and the peak variance temperature since the last reset. Pressing both the "⮝" &"⮟" resets this value to the current variance temperature.

KEYPAD KEYS:

MENU When pressed and released, the unit starts the main menu sequence of displays to allow the user to setup the normal operating parameters. When held for three seconds, the unit enters the configuration menu. This secondary menu allows the user to setup the units configuration and calibration of the unit.

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NEXT When the unit is displaying the standard display, no action is taken. When in the main or secondary menu, pressing this key will advance to the next item in the menu's sequence.

PREV When the unit is displaying the standard display, no action is taken. When in the main or secondary menu, pressing this key will return to the previous item in the menu's sequence.

⮝ When the unit is displaying the standard display, no action is taken. When in the main or secondary menu, pressing this key will advance the current parameter to the next possible value.
⮟ When the unit is displaying the standard display, no action is taken. When in the main or secondary menu, pressing this key will change the current parameter to the previous possible value.

NOTE: Pressing both the "⮝" &"⮟" will reset certain values.

MENUS:
The TV3 has a set of menus to setup control values and unit configuration. The lists below detail the sequence for each menu item. The COMM column indicates which values may be read and /or written through the communication link.

CONFIGURATION MENU ITEMS (One press of MENU button.)
The TV3's configuration menu items are listed below in two groups: communications, analog output and calibration.

DISPLAY	DESCRIPTION	COMM
TEMP VAR WARN **10.5ºC**	Temperature variance temp warning Range: -40.0 to +180.0ºC	yes
TEMP VAR URGENT **15.0ºC**	Temperature variance temp urgent Range: -40.0 to +180.0ºC	yes
HIGH TEMP ALARM **123.0ºC**	High temperature alarm Range: -40.0 to +180.0ºC	yes
HYSTERESIS **0.1ºC**	Control Hysteresis value Range: 0.1 to 100.0ºC	yes
ALARM DELAY **1.0 sec**	Alarm delay time Range: 1.0 to 1000.0 seconds	yes

CONFIGURATION MENU (Press and hold MENU button for 3 seconds.)

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COMMUNICATION

DISPLAY	DESCRIPTION	COMM
COMM MODE **<mode>**	Communications mode Modes: RS232, RS485, RS485 Multi	no
COMM RATE **<rate>**	Communication baud rate Possible rates: 1200, 2400, 4800, 9600	no
COMM FORMAT **<format>**	Communication data format Possible formats: 8-N-1, 7-N-1, 7-E-1, 7-O-1	no
COMM ADDRESS **<address>**	Communication address (RS485 Multi only) Possible values: 0-255	no
COMM PERIOD **10.0 min**	Communication output period (0.0 is no output) Range: 0.0 to 3000.0 minutes	yes

DISPLAY	DESCRIPTION	COMM
ANALOG 1 OUT **<mode>**	Analog output 1 mode Possible modes: 0-1ma, 4-20ma, 0-5v	no
ANALOG 2 OUT **<mode>**	Analog output 2 mode Possible modes: 0-1ma, 4-20ma, 0-5v	no
ANALOG 3 OUT **<mode>**	Analog output 3 mode Possible modes: 0-1ma, 4-20ma, 0-5v	no

TEMPERATURE CALIBRATION

DISPLAY	DESCRIPTION	COMM
RTD 1 OFFSET **-1.3ºC**	RTD 1 offset value Range: -20.0 to +20.0ºC	read
RTD 2 OFFSET **-1.3ºC**	RTD 2 offset value Range: -20.0 to +20.0ºC	read
RTD 3 OFFSET **-1.3ºC**	RTD 3 offset value Range: -20.0 to +20.0ºC	read

COMMUNICATIONS STRING FORMAT:
Syntax:

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[..]	Optional items
<..>	Value field
?	Value query
*	Preceding item may be repeated
<cr>	Carriage return
<lf>	Line feed
<chksum>	Checksum, sent only if received with command. Sum of all ASCII characters upto and including '='.

COMMANDS:

[<adr>:] <nem> (?|<value>) [,<nem> (?|<value>)]* [=<chksum>] (<cr>|<lf>)

```
_________ _____ ____________ ____________________ ____________ ____________
   |      |      |            |              |         |
   |      |      |            |              |         |_ Ending
   |      |      |            |              |_ Optional checksum
   |      |      |            |_ Mnemonics may be repeated
   |      |      |_ Query (?) or value
   |      |_ Mnemonic command - see tables below
   |_ Communication Address - multipoint protocol only
```

RESPONSES:

[<adr>:] <nem> <value>) [,<nem> <value>]* [=<chksum>] <cr><lf>

```
_________ _____ _________ ___________________ ____________ _________
   |      |     |           |            |         |
   |      |     |           |            |         |_ Ending
   |      |     |           |            |_ Checksum, if received
   |      |     |           |_ Mnemonics may be repeated
   |      |     |_ Value
   |      |_ Mnemonic command - see tables below
   |_ Communication Address - multipoint protocol only
```

ANALOG SCALING VALUES

	0 to 1 mA	**4 to 20 mA**	**0 to 5 VDC**
Temperature 0°C	0.200 mA	10.00 mA	1.00 VDC
Slope per °C	0.004 mA	0.050 mA	0.020 VDC
Minimum Scale	0 mA = -50°C	4 mA = -120°C	0 VDC = -50°C
Maximum Scale	1 mA = +200°C	20 mA = +200°C	5 VDC = +200°C

TV3 – IBM INTERFACE CABLE

SIGNAL	**TV3**	**9 PIN SERIAL CABLE**

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RS232		
DATA FROM PC	PIN 2	PIN 3
DATA TO PC	PIN 3	PIN 2
GROUND	PIN 1	PIN 5
RS-485		
DATA +	PIN 4	
DATA -	PIN 5	

COMMAND DEFINITIONS:

Set TV3 Alarm, Data output rate or Get TV3 data set

TV3 ?|<value> 0.0 to +3000.0 minutes per transmission

OUTPUT: [<adr>:] P1T, P2T, P3T, AVE, PEAK VAR, FLAG [=<checksum>]<cr><lf>

Set / Get TEMP VAR WARNING .
TVW ?|<value> 1.0 to +1000.0 seconds

Set / Get TEMP VAR ALARM .
TVA ?|<value> 1.0 to +1000.0 seconds

Set / Get HIGH TEMP ALARM .
HTA ?|<value> 1.0 to +1000.0 seconds

Set / Get Hysteresis value.
HYS ?|<value> 0.1 to +100.0 degrees C

Get RTD #1 calibration offset value.
R1O ? -20.0 to +20.0 degrees C

Get RTD #2 calibration offset value.
R2O ? -20.0 to +20.0 degrees C

Get RTD #3 calibration offset value.
R3O ? -20.0 to +20.0 degrees C

NOTES:
1. All numbers are passed as ASCII strings. (CAPS LOCK ON)
2. Maximum input and output string length is 80 characters including ending.
3. All spaces and tabs outside tokens are ignored.
4. All control characters except <cr> and <lf> are ignored.

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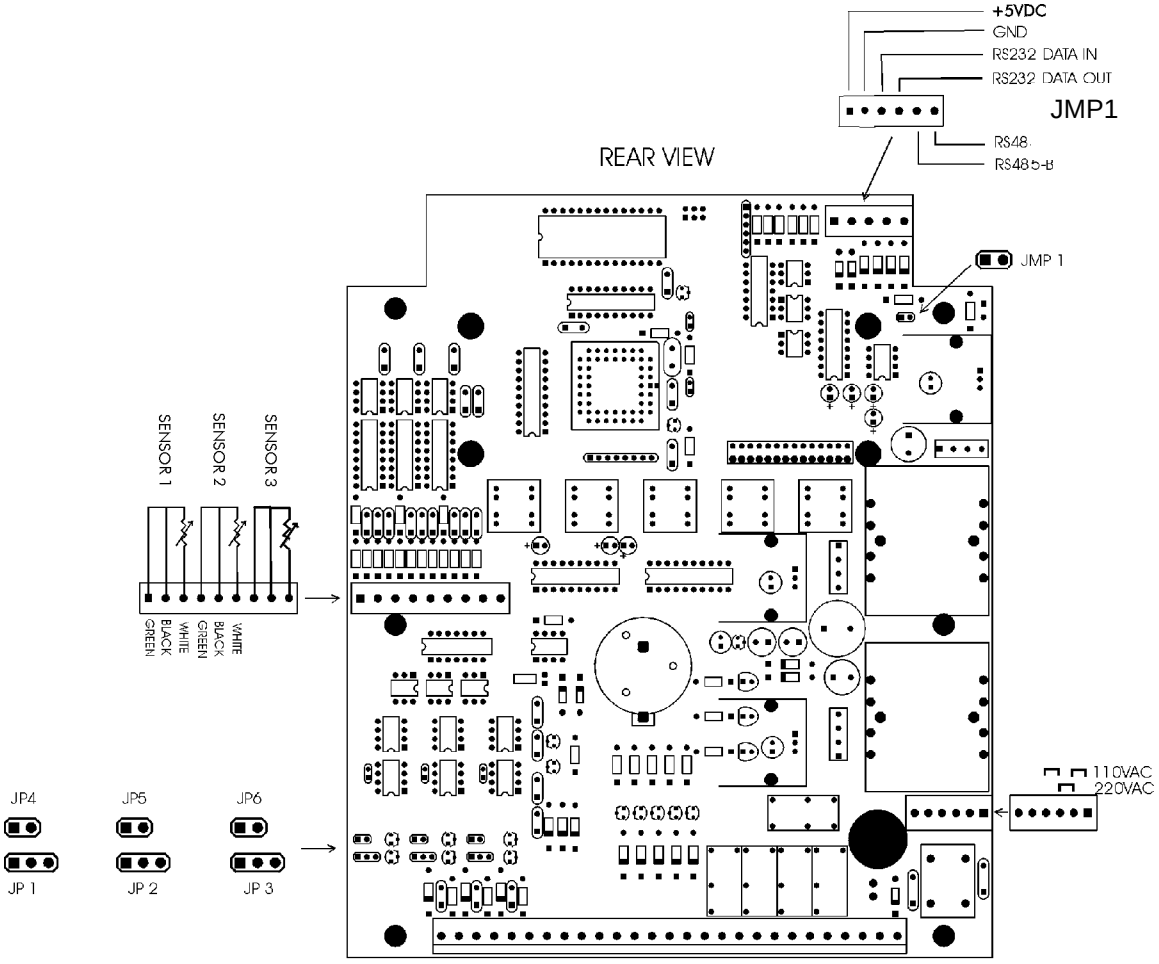

CONFIGURATION JUMPERS: (* = DEFAULT)

JP1	Sensor 3 Analog Output	Jumper on 1&2 – Enables Voltage **Jumper on 2 & 3 - Enables Current ***
JP2	Sensor 2 Analog Output	Jumper on 1 & 2 - Enables Voltage **Jumper on 2 & 3 - Enables Current ***
JP3	Sensor 1 Analog Output	Jumper on 1 & 2 - Enables Voltage **Jumper on 2 & 3 - Enables Current ***
JP4	Sensor 3 Analog Output	Jumper on - 4 to 20 ma **Jumper off - 0 to 1 ma** *
JP5	Sensor 2 Analog Output	Jumper on - 4 to 20 ma **Jumper off - 0 to 1 ma** *
JP6	Sensor 1 Analog Output	Jumper on - 4 to 20 ma. **Jumper off - 0 to 1 ma ***
JMP1	RS485 Termination.	Jumper on - Enables 120 Ohm termination *

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TV-3 INSTALLATION

This procedure will prevent initial false alarms while the TV-3 determines the proper alarm setpoints.

1. Follow mounting Instructions, but do not hook up the alarms or SCADA input.
2 Let the TV-3 monitor the temperatures for a few days/weeks to establish the alarm benchmark setpoints.
2. Read the peak variance temperature on the display.
(This is the maximum temperature variance since installation.)
4. Set the first alarm point a little above the maximum peak temperature.
5. Set the second alarm point 5 -10 degrees beyond the first alarm point.
6. Complete the wiring and installation to annunciation and SCADA.

Installation requires no service interruption or further calibration.

1. Mount the TV-3 enclosure using four machine screws.

2. Punch and mount a 3/4" conduit elbow from the underside of the TV-3 to the interior of the control cabinet. Provide AC power to the TV-3. (The TV3 is shipped for 120VAC operation unless special ordered for 230VAC)

3. Apply a thin film of heat sink compound (NO-OX works fine) to the RTD probe surfaces (located under the sensors) and attach the sensors to the tank surfaces. Be sure that all sensors are located below the tank oil level near the top of the tanks and that all sensor cords are located at the bottom of the sensors. Apply RTV or Silicon around the magnets to seal out moisture.

4. Coil up the extra cable and tie wrap. If it is necessary to shorten the cable length, remove them from the NEMA box and shorten them at the terminal block. Do not remove the cables at the magnetic end of the sensors.

5. Connect the analog points to an existing SCADA system. Program the SCADA master station for -40 to +180 degrees centigrade.

6. Connect the first alarm contact point to an existing annunciation system. The contacts are "dry" and are compatible with existing annunciators. The contact will follow real time conditions. DEFAULT SETTING: The alarm will operate when any sensor is 10 degrees warmer than the mean average temperature for all three sensors.

7. The second alarm contact is provided to allow an urgent alarm to be connected to an existing annunciation system. The contacts are "dry" and are compatible with existing annunciators. This alarm has been factory set at +20 degrees C. (The alarm will operate when any sensor is 20 degrees warmer than the mean average temperature for all three sensors.) This alarm is intended to indicate if an immediate response is required to prevent a failure.

8. Monitor and establish a "benchmark temperature variance".
The TV-3 can be monitored locally. This is useful to establish the benchmark for the first alarm point. This can be done before connecting to an existing alarm system to prevent false alarms while initial settings are established.

9. Set the SCADA temperature variance alarm point slightly higher than the highest peak.

If the SCADA system has "trending" you can get a normal temperature footprint after installation for later comparison.

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Barrington consultants would appreciate any feedback about the TV3. We want to provide top quality products to satisfied customers. We will be happy to answer any questions you might have about installation or operation of our products.

Barrington Consultants bears no responsibility for installation or user operation of the TV3. **It is up to the user to establish the proper alarm points.**

FIELD RECALIBRATION OF SENSOR ANALOG OUTPUT VALUES

Pressing "NEXT" AND "PREV" at the same time enters the analog output calibration procedure. Calibration is done at the factory but can be readjusted in the field using the following procedure.

1. Determine which analog output is desired and configure the jumpers on the rear of the circuit board. Note: remove the 120 ohm termination jumper (JMP1) for RS232 applications. The following is a description of the 0 –1 mA calibration procedure.
2. Enter the configuration mode by pressing menu and holding for 3 seconds.
3. Configure the analog outputs to match the output jumpers selected in step 1. (i.e. 0-1mA)
4. Enter calibration procedure by pressing "NEXT" AND "PREV" AT THE SAME TIME.
5. Display will read ANALOG OUTPUT #1.
6. With a very accurate DC ammeter, read current across analog output #1.
7. Current should read 1.000 DC ma.
8. Using the up and down arrows, adjust the output voltage to read 1.000 DC mA.
9. Pressing "NEXT" will display ANALOG OUTPUT #2.
10. Repeat steps 3, 4, 5, 6, 7 and 8.
11. Pressing "NEXT" will display ANALOG OUTPUT #3.
12. Repeat steps 3, 4, 5, 6, 7 and 8.
13. Press the "MENU" key to return to normal operation.

TV-3 OPERATION

Ideally, the first alarm point for the temperature variance should be set just beyond the normal peak variance temperature. If the alarm point is set too low, there will be nuisance alarms. If the alarm point is set too high it will not alarm at all. The second alarm relay is intended to indicate a major temperature variance problem.

If the SCADA system has "trending" you can get a normal temperature footprint after installation for later comparison.

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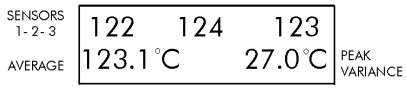
TV3 DISPLAY SCREENS



NORMAL
DISPLAY VIEW

MENU
(PRESS MENU)

- TEMP VAR WARN 10.0 C
- TEMP VAR ALARM 20.0 C
- HIGH TEMP ALARM 100.0 C
- HYSTERESIS 0.1 C
- ALARM DELAY 10.0 sec

CONFIG
(PRESS MENU FOR 3 SECONDS)

- COMM MODE RS232
- COMM RATE 9600
- COMM FORMAT 8-N-1
- COMM ADDRESS 0
- COMM PERIOD 0.0 min
- ANALOG 1 OUT 0-1 ma
- ANALOG 2 OUT 0-1 ma
- ANALOG 3 OUT 0-1 ma
- RTD 1 OFFSET 0.0 C
- RTD 2 OFFSET 0.0 C
- RTD 3 OFFSET 0.0 C

CALIBRATE
(PRESS NEXT & PREV)

- ANALOG #1=1ma 3200
- ANALOG #2=1ma 3200
- ANALOG #3=1ma 3200

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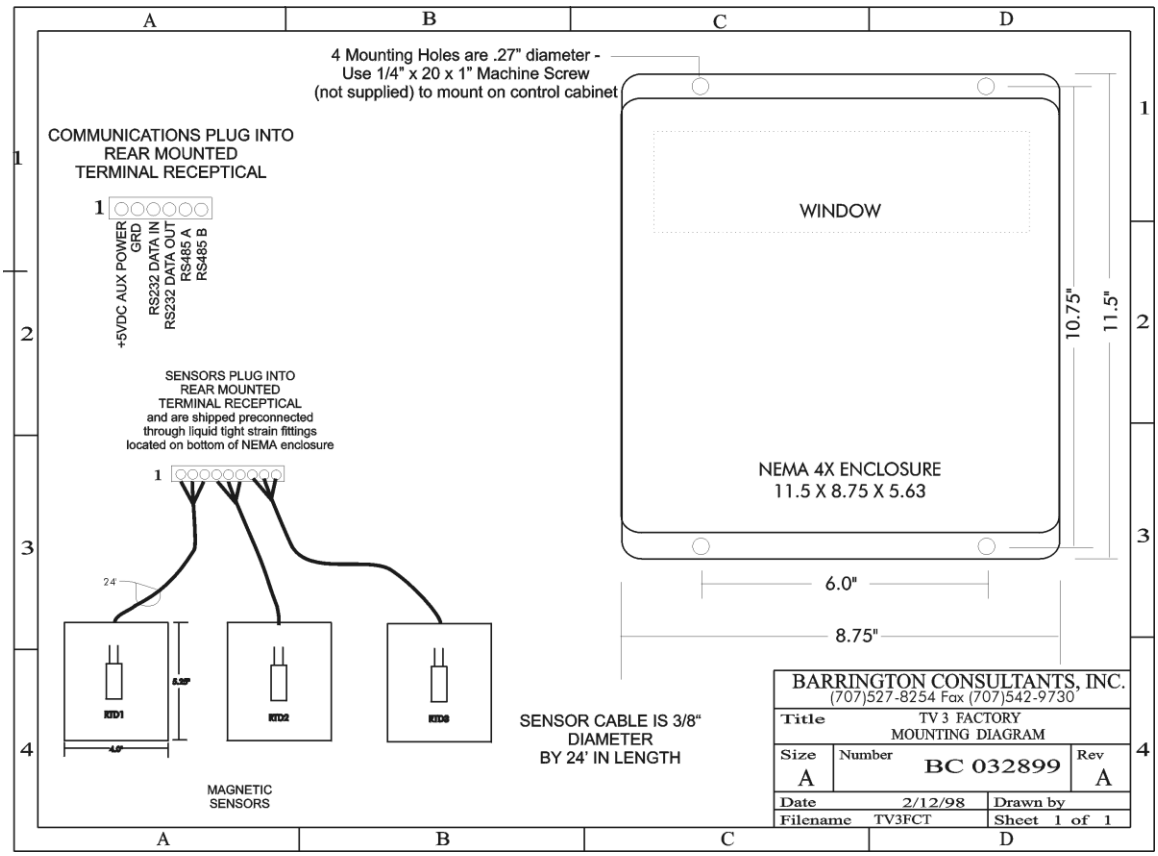

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