I/O Board Alarms

Diagnostic alarms for any I/O board can be displayed and reset from the toolbox. For troubleshooting and general diagnostic alarm information refer to GEH-6421 Volume I, Chapter 8.

Board	Fault	Fault Description	Possible Cause
VCMI	**1**	SOE Overrun. Sequence of Events data overrun	Communication problem on IONet
	2	Flash Memory CRC Failure	Board firmware programming error (board will not go online)
	3	CRC Failure Override is Active	Board firmware programming error (board is allowed to go online)
	16	System Limit Checking is Disabled	System checking was disabled by configuration
	17	Board ID Failure	Failed ID chip on the VME I/O board
	18	J3 ID Failure	Failed ID chip on connector J3, or cable problem
	19	J4 ID Failure	Failed ID chip on connector J4, or cable problem
	20	J5 ID Failure	Failed ID chip on connector J5, or cable problem
	21	J6 ID Failure	Failed ID chip on connector J6, or cable problem
	22	J3A ID Failure	Failed ID chip on connector J3A, or cable problem
	23	J4A ID Failure	Failed ID chip on connector J4A, or cable problem
	24	Firmware/Hardware Incompatibility	Invalid terminal board connected to VME I/O board
	25	Board inputs disagree with the voted value	A problem with the input. This could be the device, the wire to the terminal board, the terminal board, or the cable.
	30	ConfigCompatCode mismatch; Firmware: #; Tre: # The configuration compatibility code that the firmware is expecting is different than what is in the tre file for this board	A tre file has been installed that is incompatible with the firmware on the I/O board. Either the tre file or firmware must change. Contact the factory.
	31	IOCompatCode mismatch; Firmware: #; Tre: # The I/O compatibility code that the firmware is expecting is different than what is in the tre file for this board	A tre file has been installed that is incompatible with the firmware on the I/O board. Either the tre file or firmware must change. Contact the factory.
	32	P5=###.## Volts is Outside of Limits. The P5 power supply is out of the specified operating limits	A VME rack backplane wiring problem and/or power supply problem
	33	P15=###.## Volts is Outside of Limits. The P15 power supply is out of the specified operating limits	If "Remote Control", disable diagnostic and ignore; otherwise probably a back plane wiring or VME power supply problem.

34	N15=###.## Volts is Outside of Limits. The N15 power supply is out of the specified operating limits	If "Remote Control", disable diagnostic and ignore; otherwise probably a VME backplane wiring and/or power supply problem.
35	P12=###.## Volts is Outside of Limits. The P12 power supply is out of the specified operating limits	If "Remote I/O", disable diagnostic and ignore; otherwise probably a VME backplane wiring and/or power supply problem.
36	N12=###.## Volts is Outside of Limits. The N12 power supply is out of the specified operating limits	If "Remote I/O", disable diagnostic and ignore; otherwise probably a VME backplane wiring and/or power supply problem.
37	P28A=###.## Volts is Outside of Limits. The P28A power supply is out of the specified operating limits	If "Remote Control", disable diagnostic and ignore; otherwise probably a VME backplane wiring and/or power supply problem.
38	P28B=###.## Volts is Outside of Limits. The P28B power supply is out of the specified operating limits	If "Remote Control", disable diagnostic and ignore; otherwise probably a VME backplane wiring and/or power supply problem.
39	P28C=###.## Volts is Outside of Limits. The P28C power supply is out of the specified operating limits	If "Remote Control" disable diagnostic. Disable diagnostic if not used; otherwise probably a backplane wiring and/or power supply problem.
40	P28D=###.## Volts is Outside of Limits. The P28D power supply is out of the specified operating limits	If "Remote Control" disable diagnostic. Disable diagnostic if not used; otherwise probably a backplane wiring and/or power supply problem.
41	P28E=###.## Volts is Outside of Limits. The P28E power supply is out of the specified operating limits	If "Remote Control" disable diagnostic. Disable diagnostic if not used; otherwise probably a backplane wiring and/or power supply problem.
42	N28=###.## Volts is Outside of Limits. The N28 power supply is out of the specified operating limits	If "Remote Control" disable diagnostic. Disable diagnostic if not used; otherwise probably a backplane wiring and/or power supply problem.
43	125 Volt Bus=###.## Volts is Outside of Limits. The 125-Volt bus voltage is out of the specified operating limits	A source voltage or cabling problem; disable 125 V monitoring if not applicable.
44	125 Volt Bus Ground =###.## Volts is Outside of Limits. The 125-Volt bus voltage ground is out of the specified operating limits	Leakage or a fault to ground causing an unbalance on the 125 V bus; disable 125 V monitoring if not applicable.
45	IONet-1 Communications Failure. Loss of communication on IONet1	Loose cable, rack power, or VCMI problem
46	IONet-2 Communications Failure. Loss of communication on IONet2	Loose cable, rack power, or VCMI problem
47	IONet-3 Communications Failure. Loss of communication on IONet3	Loose cable, rack power, or VCMI problem
48	VME Bus Error Detected (Total of ### Errors). The VCMI has detected errors on the VME bus	The sum of errors 60 through 66 - Contact the factory.
49	Using Default Input Data, Rack R.#. The VCMI is not getting data from the specified rack	IONet communications failure - Check the VCMI and/or IONet cables.
50	Using Default Input Data, Rack S.#. The VCMI is not getting data from the specified rack	IONet communications failure - Check the VCMI and/or IONet cables.

51	Using Default Input Data, Rack T.#. The VCMI is not getting data from the specified rack	IONet communications failure - Check the VCMI and/or IONet cables.
52	Missed Time Match Interrupt (## uSec). The VCMI has detected a missed interrupt	Possible VCMI hardware failure
53	VCMI Scheduler Task Overrun. The VCMI did not complete running all its code before the end of the frame	Possibly too many I/O
54	Auto Slot ID Failure (Perm. VME Interrupt). The VCMI cannot perform its AUTOSLOT ID function	I/O board or backplane problem
55	Card ID/Auto Slot ID Mismatch. The VCMI cannot read the identity of a card that it has found in the rack	Board ID chip failed
56	Topology File/Board ID Mismatch. The VCMI has detected a mismatch between the configuration file and what it actually detects in the rack	ID chip mismatch - Check your configuration
57	Controller Sequencing Overrun	Too much application code used in controller. Reduce the code size.
58	Controller PCODE Version Mismatch between R,S,and T. R, S, and T have different software versions	Error during controller download - revalidate, build, and download all 3 controllers.
59	IONet Communications Failure. Loss of communications on the slave VCMI IONet	Loose cable, rack power, or VCMI problem (VCMI slave only)
60-66	VME Error Bit # (Total ## Errors). The VCMI has detected errors on the VME bus	VME backplane errors - Contact factory.
67	Controller Board is Offline. The VCMI cannot communicate with the controller	Controller failed or is powered down.
68-87	I/O Board in Slot # is Offline. The VCMI cannot communicate with the specified board	I/O board is failed or removed. You must replace the board, or reconfigure the system and redownload to the VCMI, and reboot.
88	U17 Sectors 0-5 are not write protected	Sectors not write protected in manufacturing. Contact the factory.
89	SRAM resources exceeded. Topology/config too large	The size of the configured system is too large for the VCMI. You must reduce the size of the system.

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GE Industrial Systems

VDSK Interface Board

Board Specification

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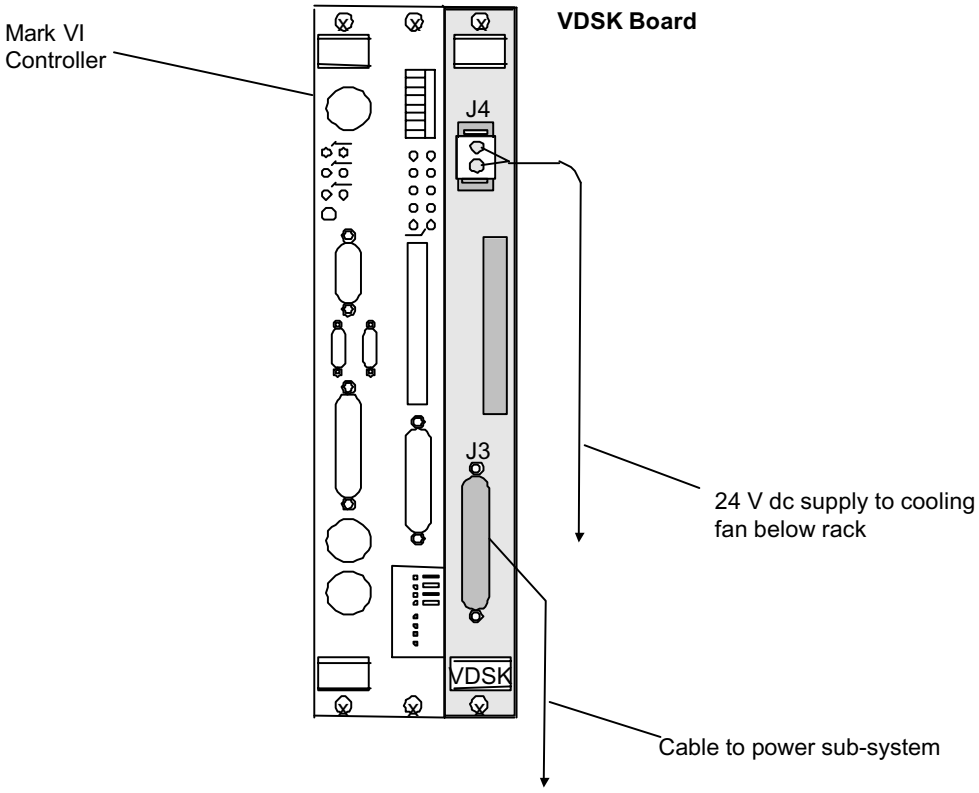
Fax: + 1 540 387 8606 (All)

("+" indicates the international access code required when calling from outside the USA)

Issue date: 2002-06-30

Functional Description

The VDSK interface board provides power subsystem monitoring to the VCMI. VDSK is mounted adjacent to the Mark VI controller in the standalone controller rack. It is not used in the other types of control racks.



VDSK Board with Adjacent Controller Operation

VDSK supports three functions as follows:

- Interconnects the PDM with the power subsystem monitoring functions of the VCMI through the 96-pin P2 backplane connector and the 37-pin sub-miniature D connector on the front panel. This connection is through a 64-pin ribbon cable connected at the back of the VME backplane.
- Interconnects ±12 V from the 96-pin P1 backplane connector to a front panel mounted 2-pin connector to power the 4.3 watt 24 V dc VME rack mounted fan assembly. This is from the front panel J4 connector.
- Provides a board mounted 16-pin Ethernet ID connector, which interfaces to the VCMI board through the P2 backplane connector ribbon cable.

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VTCC Thermocouple Processor Board

Board Specification

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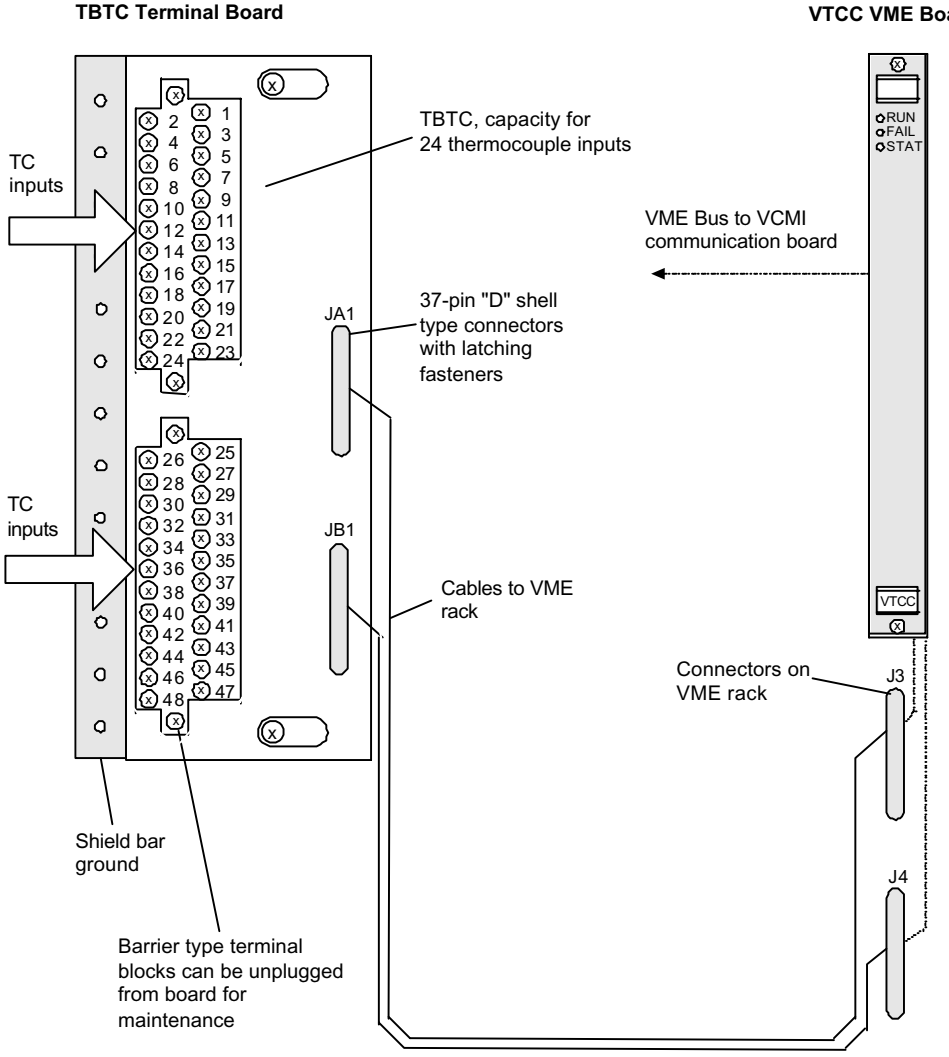
Issue date: 2002-06-30

Functional Description

Input data is transferred over the VME backplane from VTCC to the VCMI and then to the controller.

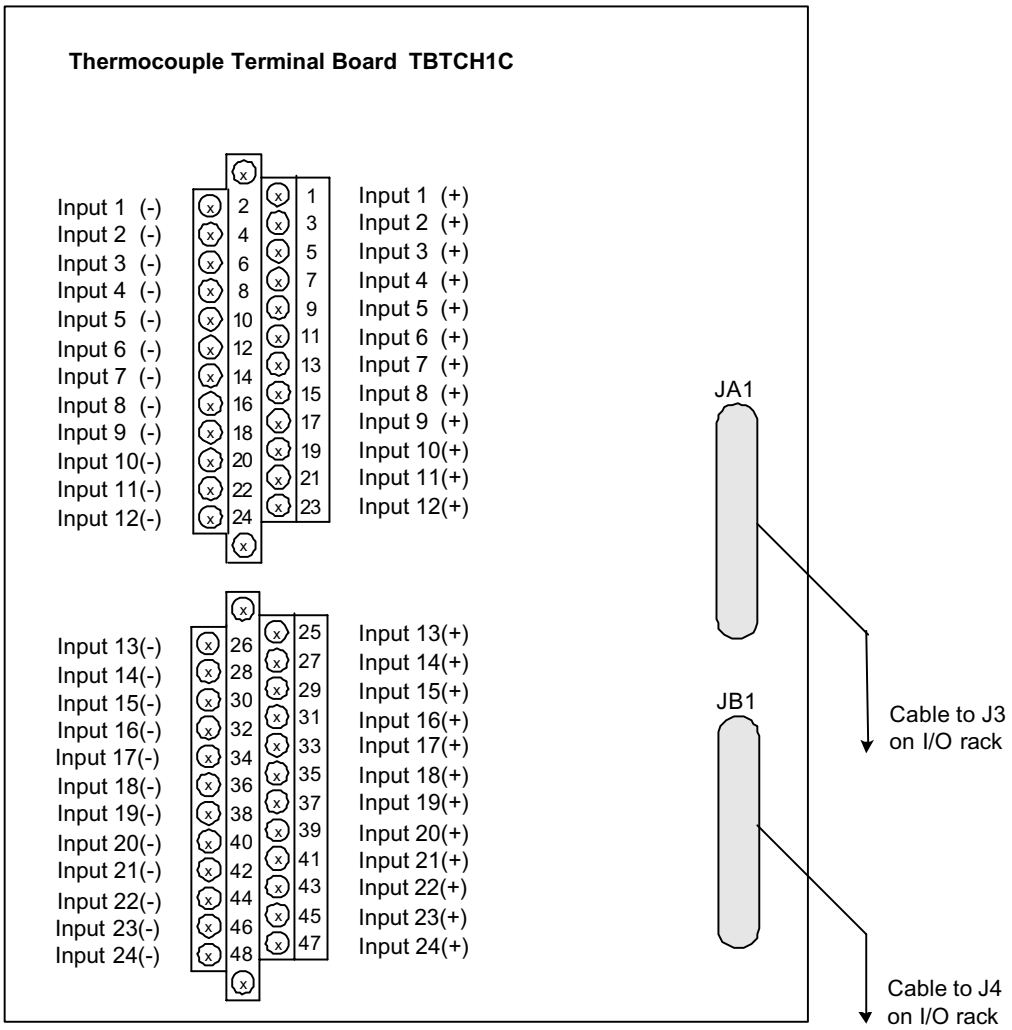
The thermocouple processor board VTCC accepts 24 type E, J, K, S (see note), or T thermocouple inputs. These inputs are wired to two barrier type blocks on the terminal board TBTC. Cables with molded plugs connect the terminal board to the VME rack where the VTCC thermocouple board is located. The TBTC can provide both simplex (TBTCH1C) or triple module redundant (TMR) (TBTCHIB) control.



Thermocouple Input Terminal Board, I/O Board, and Cabling

Installation

Thermocouples are wired directly to two I/O terminal blocks. These blocks are mounted on the terminal board and held down with two screws. Each block has 24 terminals accepting up to two #12 AWG wires. A shield termination strip attached to chassis ground is located immediately to the left of each terminal block.

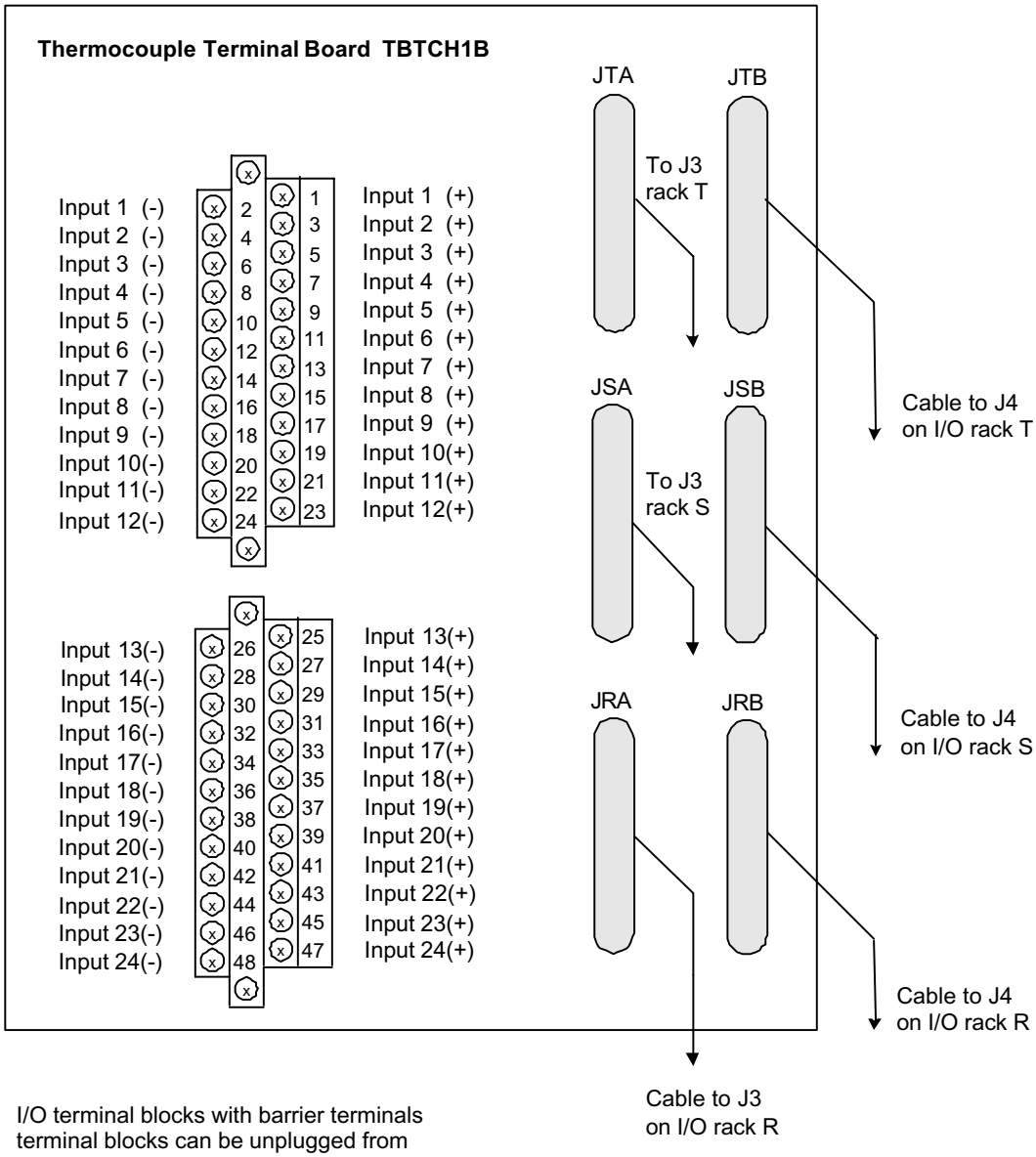


I/O terminal blocks with barrier terminals terminal blocks can be unplugged from terminal board for maintenance

Up to two #12 AWG wires per point with 300 V insulation

TMR version of this board has connectors JRA, JSA, and JTA for inputs 1-12, and connectors JRB, JSB, and JTB for inputs 13-24.

TBTCH1C (Simplex) Wiring and Cabling



I/O terminal blocks with barrier terminals terminal blocks can be unplugged from terminal board for maintenance

Up to two #12 AWG wires per point with 300 volt insulation

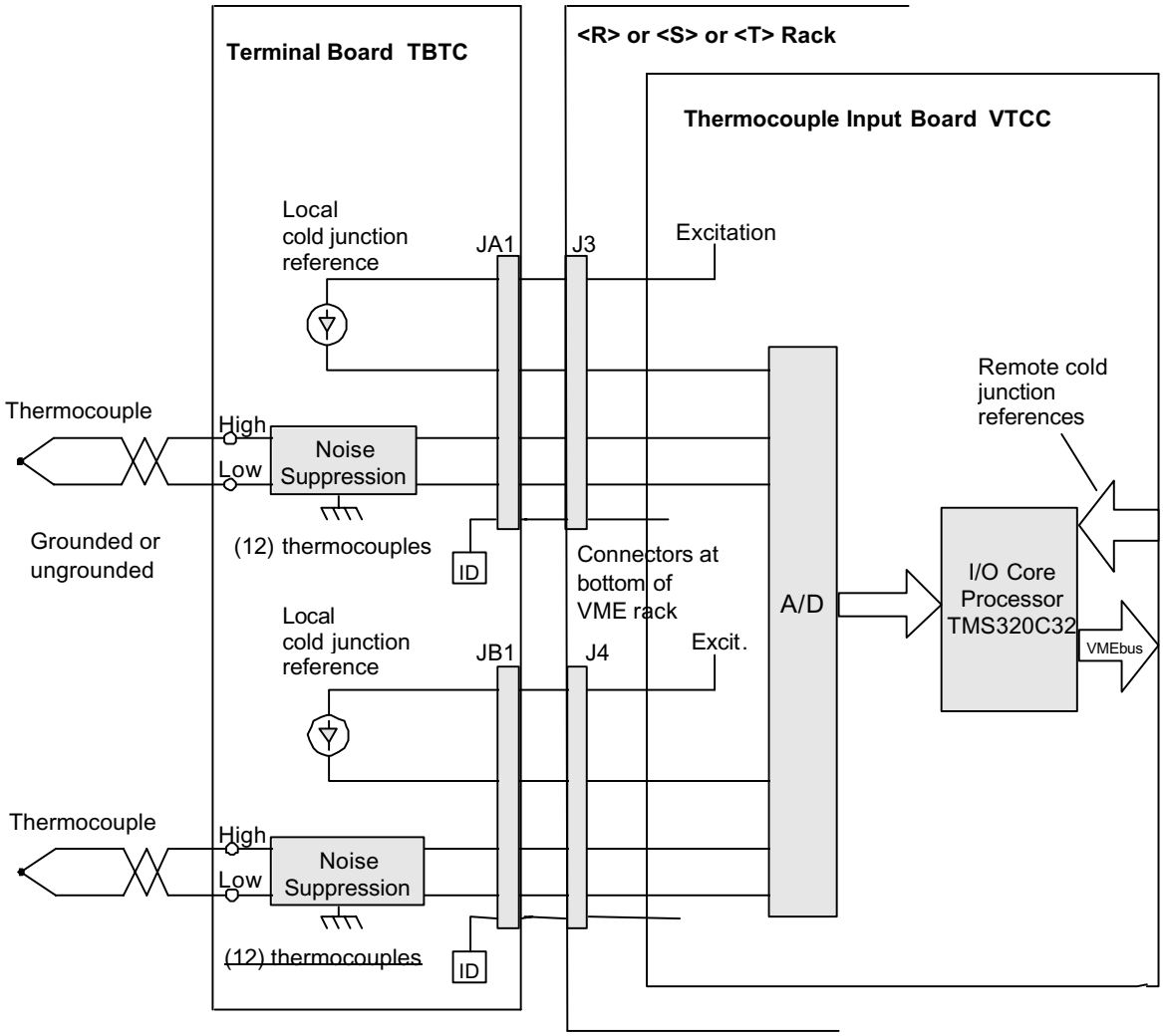
TBTCH1B (TMR) Wiring and Cabling

Operation

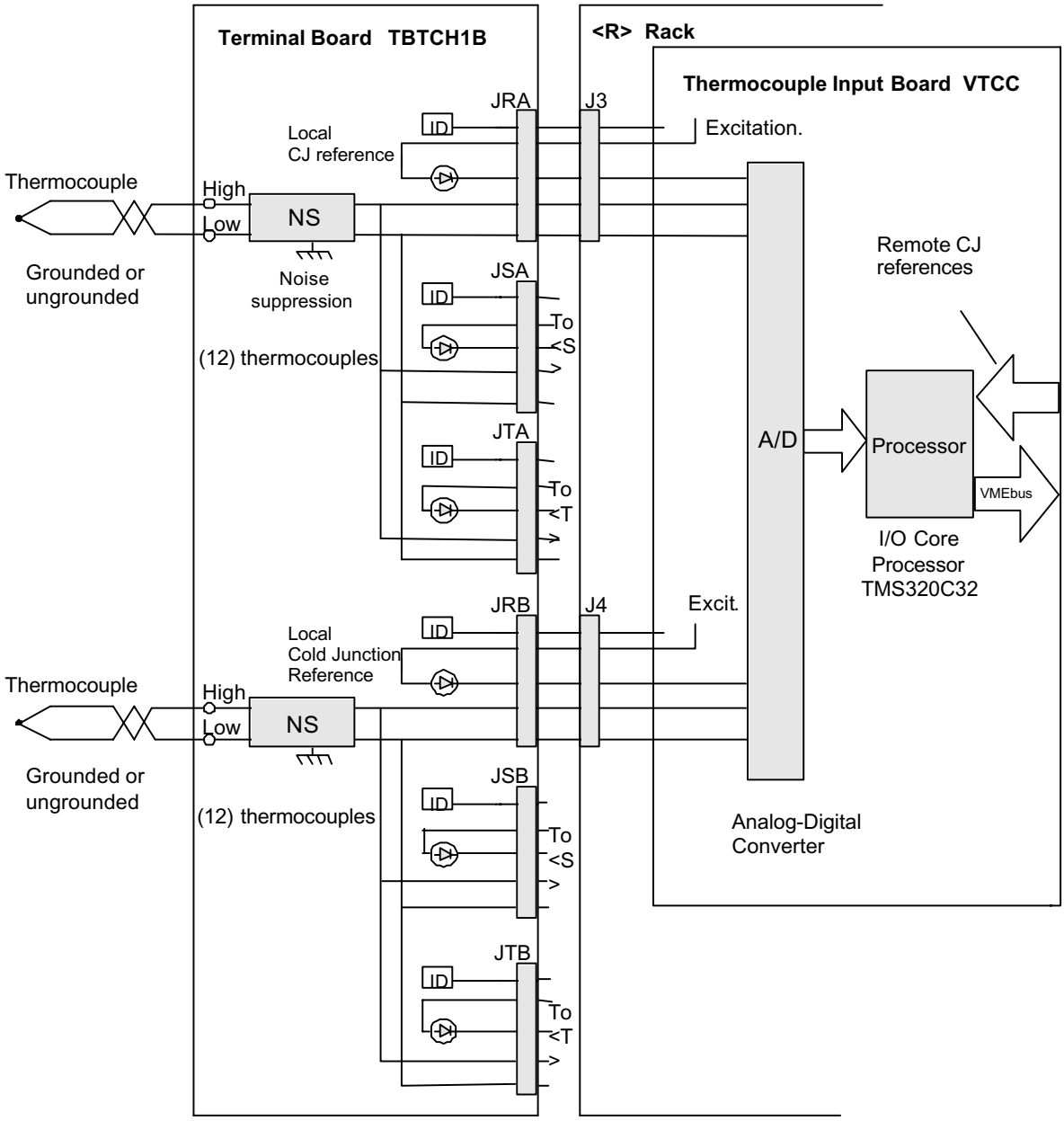
The 24 thermocouple inputs on the TBTC can be grounded or ungrounded. They can be located up to 300 meters (984 feet) from the turbine control cabinet with a maximum two-way cable resistance of 450 ohms. High frequency noise suppression and two cold junction reference devices are mounted on the board.

Linearization for individual thermocouple types is performed in software by VTCC. A thermocouple which is determined to be out of the hardware limits is removed from the scanned inputs in order to prevent adverse affects on other input channels. If both cold junction devices are within the configurable limits, then the average of the two is used for cold junction compensation. If only one cold junction device is within the configurable limits, then that cold junction is used for compensation. If neither cold junction device is within the configurable limits, then a default value is used.

Note VTCC boards manufactured after software version VTCC-100100C and higher have additional thermocouple and cold junction features. The new design boards permit the use of S-type thermocouples, in addition to all previous types. They also provide for a remote cold junction compensation feature for thermocouple inputs. This allows the user to select whether cold junction compensation is done based on a temperature reading at a remote location or at the terminal board as explained above. The calculations are the same as previous VTCC boards, only the source of the cold junction reading changes.


Terminal Board TBTC
<R> or <S> or <T> Rack
Thermocouple Input Board VTCC
Local
cold junction
reference
JA1
J3
Excitation
Remote cold
junction
references
Thermocouple
High
Low
Noise
Suppression
Grounded or
ungrounded
(12) thermocouples
ID
Connectors at
bottom of
VME rack
A/D
I/O Core
Processor
TMS320C32
VMEbus
Local
cold junction
reference
JB1
J4
Excit.
Thermocouple
High
Low
Noise
Suppression
(12) thermocouples
ID

Simplex Thermocouple Inputs



TMR Thermocouple Inputs

Thermocouple inputs are supported over a full-scale input range of –8.0 mV to +45.0 mV. The following table shows typical input voltages for different thermocouple types versus minimum and maximum temperature range. It is assumed the cold junction temperature ranges from +32 to +158 °F.

Thermocouple Types and Range

Thermocouple Type	E	J	K	S	T
Low range, °F / °C	–60 / –51	–60 / –51	–60 / –51	0 / –17.78	–60 / –51
mV at low range with reference at 158 °F (70 °C)	–7.174	–6.132	–4.779	–0.524	–4.764
High range, °F / °C	1100 / 593	1400 / 798	2000 / 1093	3200 / 1760	750 / 399
mV at high range with reference at 32 °F (0 °C)	44.547	42.922	44.856	18.612	20.801

The thermocouple inputs and cold junction inputs are automatically calibrated using the filtered calibration reference and zero voltages.

There are two cold junction references used per VTCC, one for connector J3 and J4. Each reference can be selected as either remote (from VME bus) or local (from associated terminal board, T type or D type). All references are then treated as sensor inputs (for example, averaged, limits configured). The two references can be mixed, one local and one remote. Cold junction signals go into signal space and are available for monitoring. Normally the average of the two is used. Acceptable limits are configured, and if a cold junctions goes outside the limit, a logic signal is set. A 1 °F error in the cold junction compensation causes a 1°F error in the TC reading.

Hard coded limits are set at 32 to 158 °F, and if a cold junction goes outside these, it is regarded as bad. Most cold junction failures are open or short circuit. If one cold junction fails, the good one is used. If both cold junctions go bad, the backup value is used, which can be derived from cold junction readings on other terminal boards, or can be the configured default value.

Specifications

Typical VTCC Specification

Item	Specification
Number of channels	24 channels per terminal board and I/O board
Thermocouple types	E, J, K, S, T thermocouples, and mV inputs
Span	-8 mV to +45 mV
A/D converter	Sampling type 16-bit A/D converter with better than 14-bit resolution
CJ compensation	Reference junction temperature measured at two locations on each TC terminal board (optional for remove CJs).
	TMR board has six cold junction references.
Cold junction temperature accuracy	Cold junction accuracy 2 °F
Conformity error	Maximum software error 0.25 °F
Measurement accuracy	53 microvolts (excluding cold junction reading)
	Example: 3 °F, type K, at 1000 °F, including cold junction contribution (RSS)
Common mode rejection	Ac common mode rejection 110 dB @ 50/60 Hz, for balanced impedance input
Common mode voltage	±5 V
Normal mode rejection	Rejection of 250 mV rms is 80 dB @ 50/60 Hz
Scan time	All inputs are sampled at 120 times per second for 60 Hz operation; for 50 Hz operation it is 100 times per second
Fault detection	High/low (hardware) limit check
	High/low system (software) limit check
	Monitor readings from all TCs, CJs, calibration voltages, and calibration zero readings

Diagnostics

Three LEDs at the top of the front panel provide status information. The normal RUN condition is a flashing green, and FAIL is a solid red. The third LED shows a steady orange if a diagnostic alarm condition exists in the board.

Each thermocouple type has Hardware Limit Checking based on preset (non-configurable) high and low levels set near the ends of the operating range. If this limit is exceeded a logic signal is set and the input is no longer scanned. If any one of the 24 inputs hardware limits is set it creates a composite diagnostic alarm, L3DIAG_VTCC, referring to the entire board. Details of the individual diagnostics are available from the toolbox The diagnostic signals can be individually latched, and then reset with the RESET_DIA signal.

In TMR, systems limit logic signals are voted and the resulting composite diagnostic is present in each controller.

Each thermocouple input has system limit checking based on configurable high and low levels. These limits can be used to generate alarms, and can be configured for enable/disable, and as latching/nonlatching. RESET_SYS resets the out of limit signals.

Each terminal board cable has its own ID device, which is interrogated by the I/O board. The board ID is coded into a read-only chip containing the terminal board serial number, board type, revision number, and the JA1/JB1 connector location.

The TMR version of this board has six ID devices, one for each cable connector. Details of the VTCC diagnostics are in GEH-6421D, Vol. I *Mark VI System Guide*, Chapter 8, *Troubleshooting and Diagnostics*.

The thermocouple board is configured using the toolbox. The following table summarizes configuration choices and defaults. For details refer to GEH-6403, *Control System Toolbox for Configuring the Mark VI Controller.*

Configuration

Thermocouple Board Configuration (Part 1 of 2)

Parameter	Description	Choices
Configuration		
SysFreq	System frequency (used for noise rejection)	50 or 60 Hz
SystemLimits	Enables or disables all system limit checking	Enable, disable
Auto Reset	Automatic Restoring of Thermocouples removed from scan	Enable, disable
J3J4:I200TBTCH1A	Terminal board	Connected, Not Connected
ThermCpl1	First of 24 thermocouples - board point signal	Point edit (input FLOAT)
ThermoCpl Type	Thermocouples supported by VTCC; unused inputs are removed from scanning, mV inputs are primarily for maintenance.	Unused, mV, S, T, K, J, E
	When configured for mV input, the signal span is –8 mV to +45 mV. The input is not compensated for CJ and is a straight reading of the terminal board mV input. In order to detect open wires, each input is biased using plus and minus 0.25 V through 10 megohm resistors. This should be taken into account if high impedance mV signals are to be read.	
LowPassFiltr	Enable 2 Hz low pass filter	Enable, disable
SysLim1 Enabl	Enables or disables a temperature limit which can be used to create an alarm.	Enable, disable
SysLim1 Latch	Determines whether the limit condition will latch or unlatch; reset used to unlatch.	Latch, unlatch
SysLim1 Type	Limit occurs when the temperature is greater than or equal (>=), or less than or equal to (<=) a preset value.	Greater than or equal, less than or equal
SysLimit 1	Enter the desired value.	Engineering units
SysLim2 Enabled	Enables or disables a temperature limit which can be used to create an alarm.	Enable, disable
SysLim2 Latch	Determines whether the limit condition will latch or unlatch; reset used to unlatch.	Latch, unlatch
SysLim2 Type	Limit occurs when the temperature is greater than or equal (>=), or less than or equal to (<=) a preset value.	Greater than or equal, less than or equal
SysLimit 2	Enter the desired value.	Engineering units
TMR Diff Limt	Limit condition occurs if 3 temperatures in R, S, T differ by more than a preset value (deg F); this creates a voting alarm condition.	–60 to 2,000
ColdJunc1	First CJ reference - Board point signal (similar configuration as for thermocouples but no low pass filter or CJ type choices of local or remote).	As above (input FLOAT)
ColdJunc2	Second CJ reference – Board point signal (similar configuration as for thermocouples but no low pass filter or CJ type choices of local or remote).	As above (input FLOAT)

Thermocouple Board Configuration (Part 2 of 2)

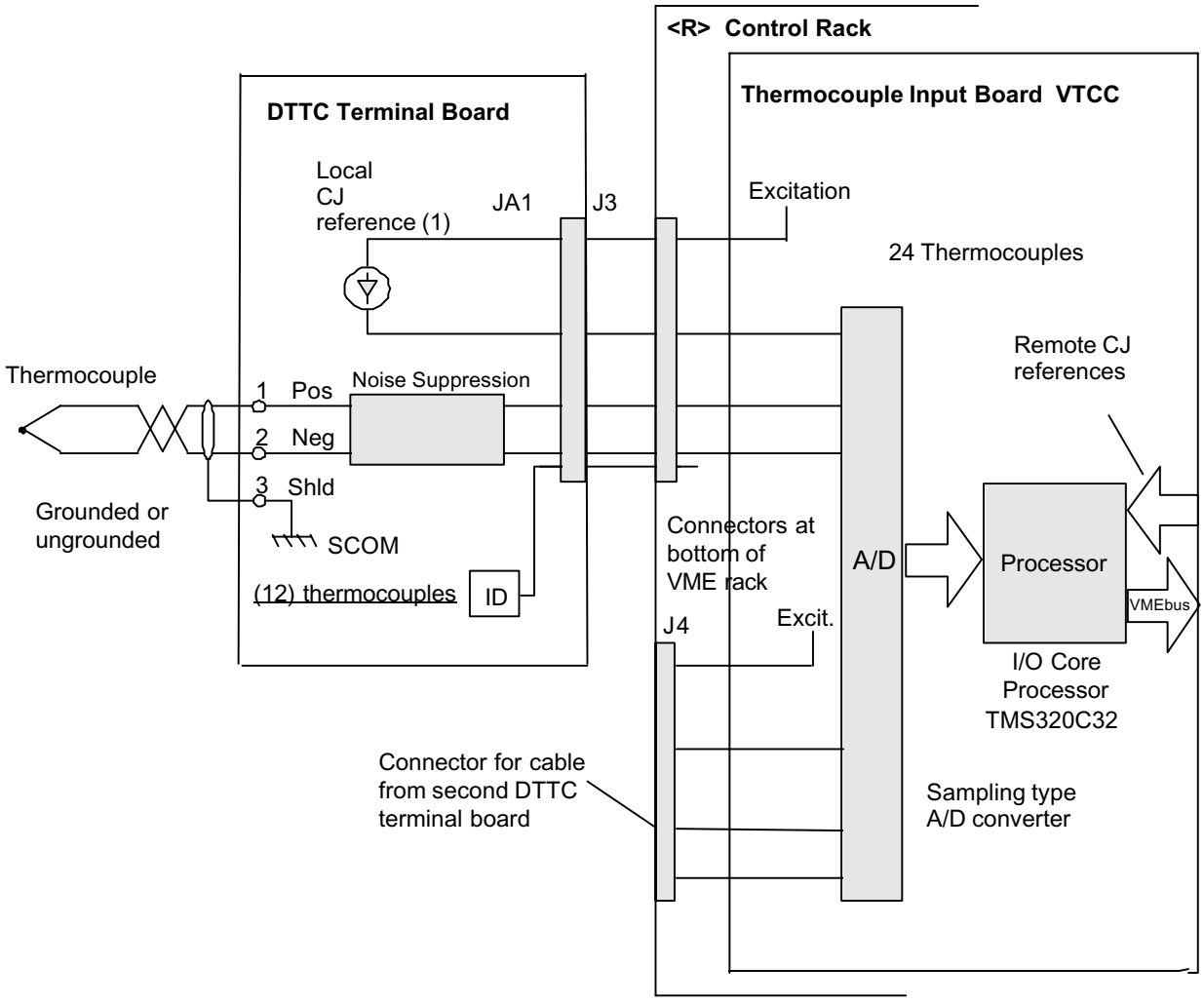
Board Points (Signals)	Description - Point Edit (Enter Signal Connection Name)	Direction Type
L3DIAG_VTCC1	Board diagnostic	Input BIT
L3DIAG_VTCC2	Board diagnostic	Input BIT
L3DIAG_VTCC3	Board diagnostic	Input BIT
SysLim1TC1	System limit 1 for thermocouple	Input BIT
:	:	Input BIT
SysLim1TC24	System limit 1 for thermocouple	Input BIT
SysLim1CJ1	System limit 1 for CJ	Input BIT
SysLim1JC2	System limit 1 for CJ	Input BIT
SysLim2TC1	System limit 2 for thermocouple	Input BIT
:	:	Input BIT
SysLim2TC24	System limit 2 for thermocouple	Input BIT
SysLim2CJ1	System limit 2 for CJ	Input BIT
SysLim2CJ2	System limit 2 for CJ	Input BIT
CJ Backup	CJ backup	Output FLOAT
CJ Remote 1	CJ remote 1	Output FLOAT
CJ Remote 2	CJ remote 2	Output FLOAT
ThermCpl1	Thermocouple reading	Input FLOAT
:	:	Input FLOAT
ThermCpl24	Thermocouple reading	Input FLOAT
ColdJunc1	CJ for TC's 1–12	Input FLOAT
ColdJunc2	CJ for TC's 13–24	Input FLOAT

DTTC Simplex Thermocouple Terminal Board

The DTCC board is a compact terminal board designed for DIN-rail mounting. The board has 12 thermocouple inputs and connects to the VTCC thermocouple processor board with a single 37-pin cable. This cable is identical to the one used on the larger TBCC terminal board. The on-board signal conditioning and cold junction reference are identical to those on the TBTC board.

An on-board ID chip identifies the board to the VTCC for system diagnostic purposes.

Two DTTC boards can be connected to the VTCC for a total of 24 inputs. Only the simplex version of the board is available. The terminal boards can be stacked vertically on the DIN-rail to conserve cabinet space. High density Euro-Block type terminal blocks are permanently mounted to the board with two screw connections for the ground connection (SCOM). Every third screw connection is for the shield.

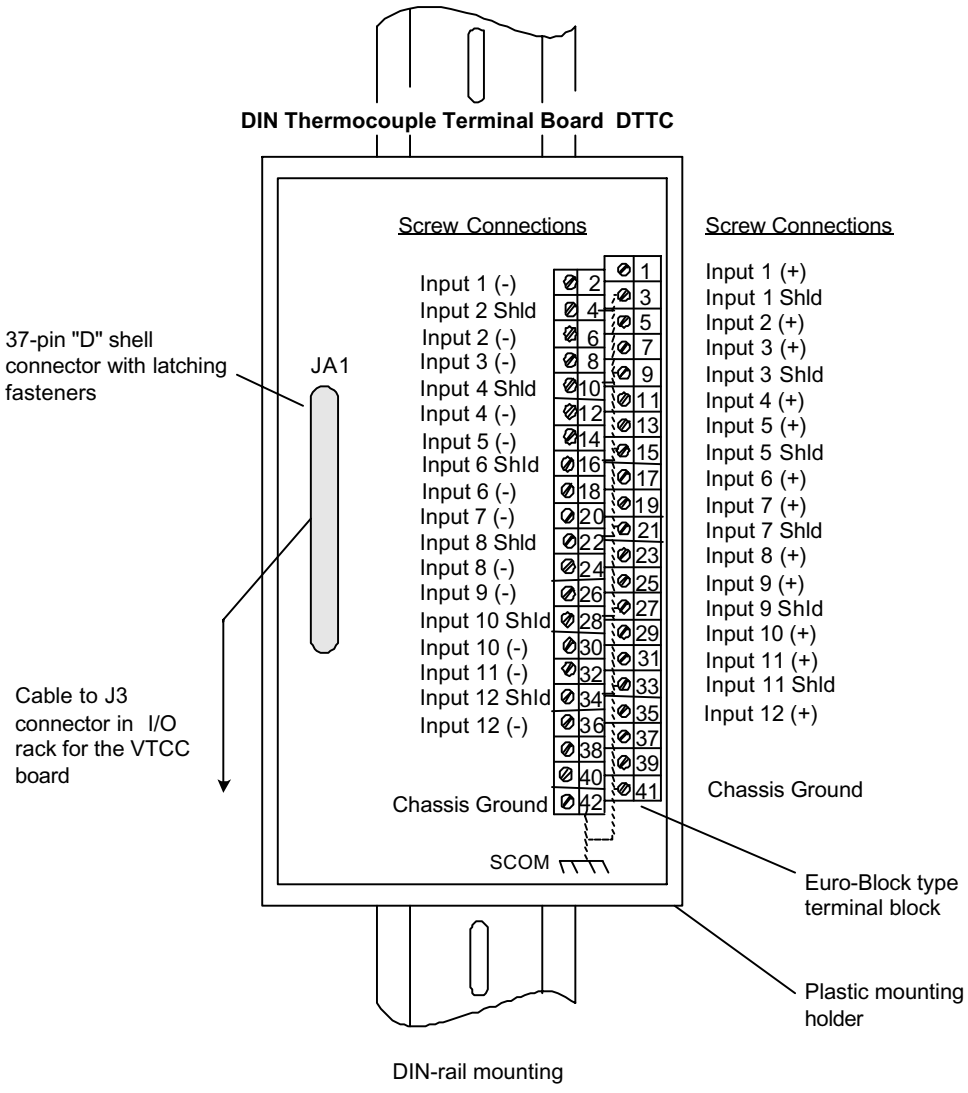


DTTC for Thermocouple Inputs

Installation

Shield screws are provided on this board, internally connected to SCOM.

The DTTC board slides into a plastic holder which mounts on the DIN-rail. Thermocouples are wired directly to the terminal block. The Euro-Block type terminal block has 42 terminals and is permanently mounted on the terminal board. Typically #18 AWG wires are used. There are two screws for the SCOM (ground) connection, which should be as short a distance as possible.



DTTC Wiring and Cabling

I/O Board Alarms

Diagnostic alarms for any I/O board can be displayed and reset from the toolbox. For troubleshooting and general diagnostic alarm information refer to GEH-6421 Volume I, Chapter 8.

I/O Board Diagnostic Alarms

Board	Fault	Fault Description	Possible Cause
VTCC	**2**	Flash Memory CRC Failure	Board firmware programming error (board will not go online)
	3	CRC failure override is Active	Board firmware programming error (board is allowed to go online)
	16	System Limit Checking is Disabled	System checking was disabled by configuration.
	17	Board ID Failure	Failed ID chip on the VME I/O board
	18	J3 ID Failure	Failed ID chip on connector J3, or cable problem
	19	J4 ID Failure.	Failed ID chip on connector J4, or cable problem
	20	J5 ID Failure	Failed ID chip on connector J5, or cable problem
	21	J6 ID Failure	Failed ID chip on connector J6, or cable problem
	22	J3A ID Failure	Failed ID chip on connector J3A, or cable problem
	23	J4A ID Failure	Failed ID chip on connector J4A, or cable problem
	24	Firmware/Hardware Incompatibility	Invalid terminal board connected to VME I/O board
	30	ConfigCompatCode mismatch; Firmware: #; Tre: # The configuration compatibility code that the firmware is expecting is different than what is in the tre file for this board	A tre file has been installed that is incompatible with the firmware on the I/O board. Either the tre file or firmware must change. Contact the factory.
	31	IOCompatCode mismatch; Firmware: #; Tre: # The I/O compatibility code that the firmware is expecting is different than what is in the tre file for this board	A tre file has been installed that is incompatible with the firmware on the I/O board. Either the tre file or firmware must change. Contact the factory.
	32-55	Thermocouple ## Raw Counts High. The ## thermocouple input to the analog to digital converter exceeded the converter limits and will be removed from scan	A condition such as stray voltage or noise caused the input to exceed +63 millivolts.
	56-79	Thermocouple ## Raw Counts Low. The ## thermocouple input to the analog to digital converter exceeded the converter limits and will be removed from scan	The board has detected a thermocouple open and has applied a bias to the circuit driving it to a large negative number, or the TC is not connected, or a condition such as stray voltage or noise caused the input to exceed –63 millivolts.

80,81	Cold Junction # Raw Counts High. Cold junction device number # input to the A/D converter has exceeded the limits of the converter. Normally two cold junction inputs are averaged; if one is detected as bad then the other is used. If both cold junctions fail, a predetermined value is used	The cold junction device on the terminal board has failed.
82,83	Cold Junction # Raw Counts Low. Cold junction device number # input to the A/D converter has exceeded the limits of the converter. Normally two cold junction inputs are averaged; if one is detected as bad then the other is used. If both cold junctions fail, a predetermined value is used	The cold junction device on the terminal board has failed.
84,85	Calibration Reference # Raw Counts High. Calibration Reference # input to the A/D converter exceeded the converter limits. If Cal. Ref. 1, all even numbered TC inputs will be wrong; if Cal. Ref. 2, all odd numbered TC inputs will be wrong	The precision reference voltage on the board has failed.
86,87	Calibration Reference # Raw Counts Low. Calibration Reference # input to the A/D converter exceeded the converter limits. If Cal. Ref. 1, all even numbered TC inputs will be wrong; if Cal. Ref. 2, all odd numbered TC inputs will be wrong	The precision reference voltage on the board has failed.
88,89	Null Reference # Raw Counts High	The null reference voltage signal on the board has failed.
90,91	Null Reference # Raw Counts Low. The null (zero) reference number # input to the A/D converter has exceeded the converter limits. If null ref. 1, all even numbered TC inputs will be wrong; if null ref. 2, all odd numbered TC inputs will be wrong	The null reference voltage signal on the board has failed.
92-115	Thermocouple ## Linearization Table High. The thermo-couple input has exceeded the range of the linearization (lookup) table for this type. The temperature will be set to the table's maximum value	The thermocouple has been configured as the wrong type, or a stray voltage has biased the TC outside of its normal range, or the cold junction compensation is wrong.
116-139	Thermocouple ## Linearization Table Low. The thermo - couple input has exceeded the range of the linearization (lookup) table for this type. The temperature will be set to the table's minimum value	The thermocouple has been configured as the wrong type, or a stray voltage has biased the TC outside of its normal range, or the cold junction compensation is wrong.
160-255	Logic Signal # Voting mismatch	A problem with the input. This could be the device, the wire to the terminal board, the terminal board, or the cable.
256-281	Input Signal # Voting mismatch, Local #, Voted #. The specified input signal varies from the voted value of the signal by more than the TMR Diff Limit	A problem with the input. This could be the device, the wire to the terminal board, the terminal board, or the cable.

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VRTD Processor Board

Board Specification

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met during installation, operation, and maintenance. The information is supplied for informational purposes only, and GE makes no warranty as to the accuracy of the information included herein. Changes, modifications and/or improvements to equipment and specifications are made periodically and these changes may or may not be reflected herein. It is understood that GE may make changes, modifications, or improvements to the equipment referenced herein or to the document itself at any time. This document is intended for trained personnel familiar with the GE products referenced herein.

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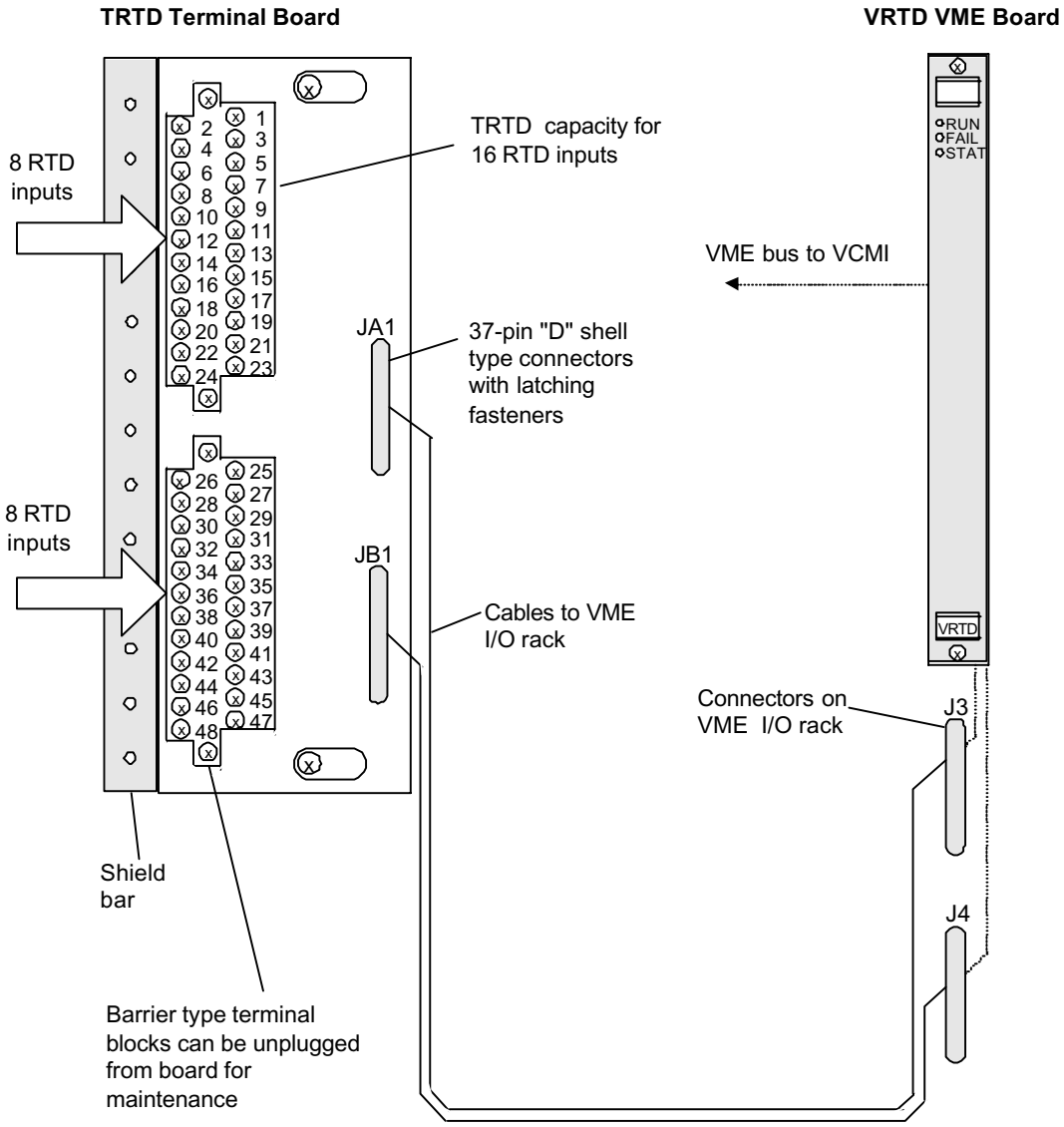
Section	Page

Functional Description

The Resistance Temperature Device (RTD) processor board (VRTD) accepts 16, three-wire RTD inputs. These inputs are wired to two barrier type blocks on the RTD terminal board (TRTD). Inputs to TRTD have noise suppression circuitry to protect against surge and high frequency noise. Cables with molded fittings connect the terminal board to the VME rack where the VRTD processor board is located.

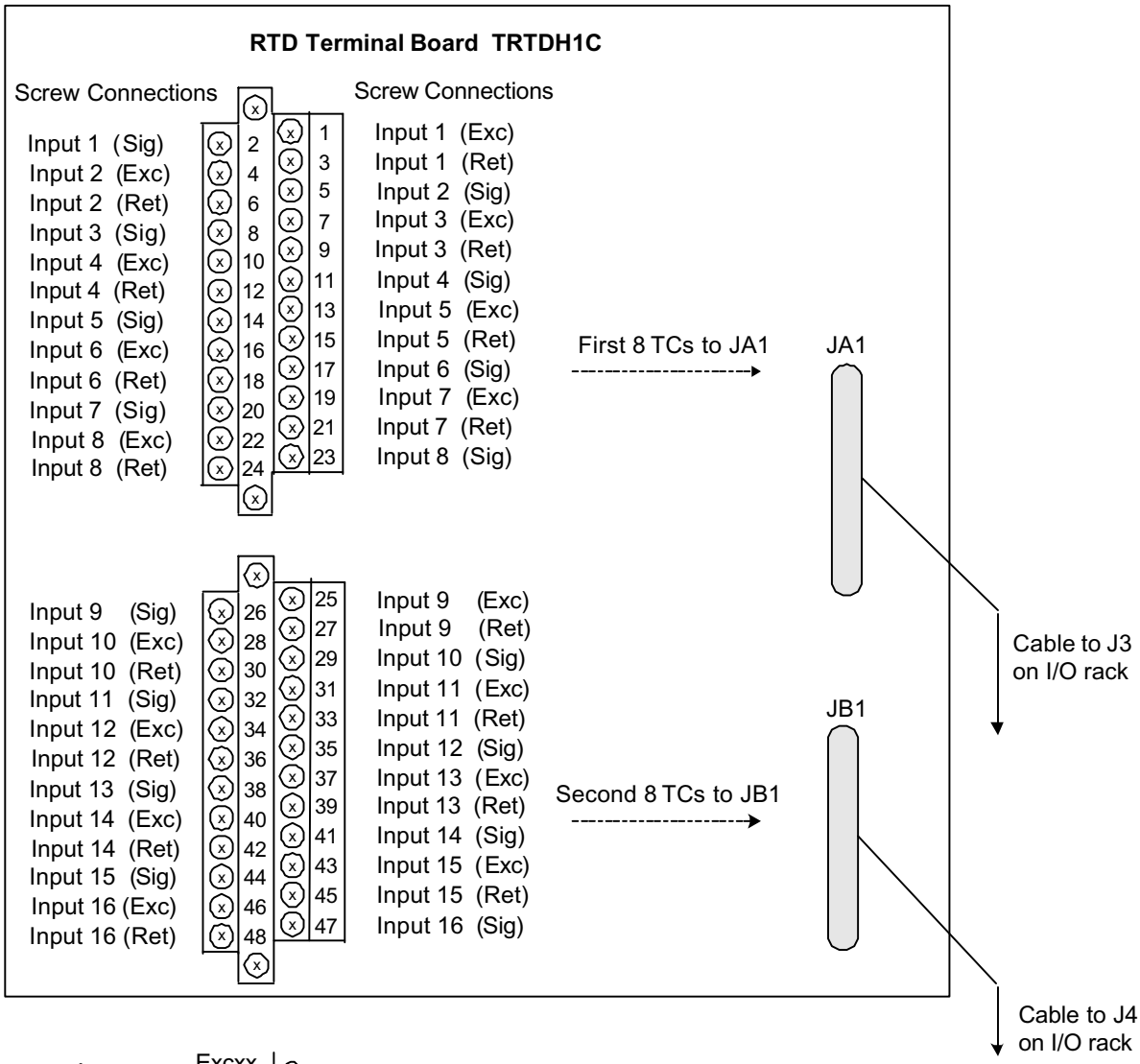
There are two versions of TRTD, simplex and a TMR version that fans out the signals to three VRTD boards. VRTD converts the inputs to digital temperature values and transfers them over the VME backplane to the VCMI, and then to the controller.



RTD Input Terminal Board, I/O Board, and Cabling

Installation

The sixteen RTDs are wired directly to two I/O terminal blocks mounted on the terminal board. Each block is held down with two screws and has 24 terminals accepting up to #12 AWG wires. A shield termination strip attached to chassis ground is located immediately to the left of each terminal block.



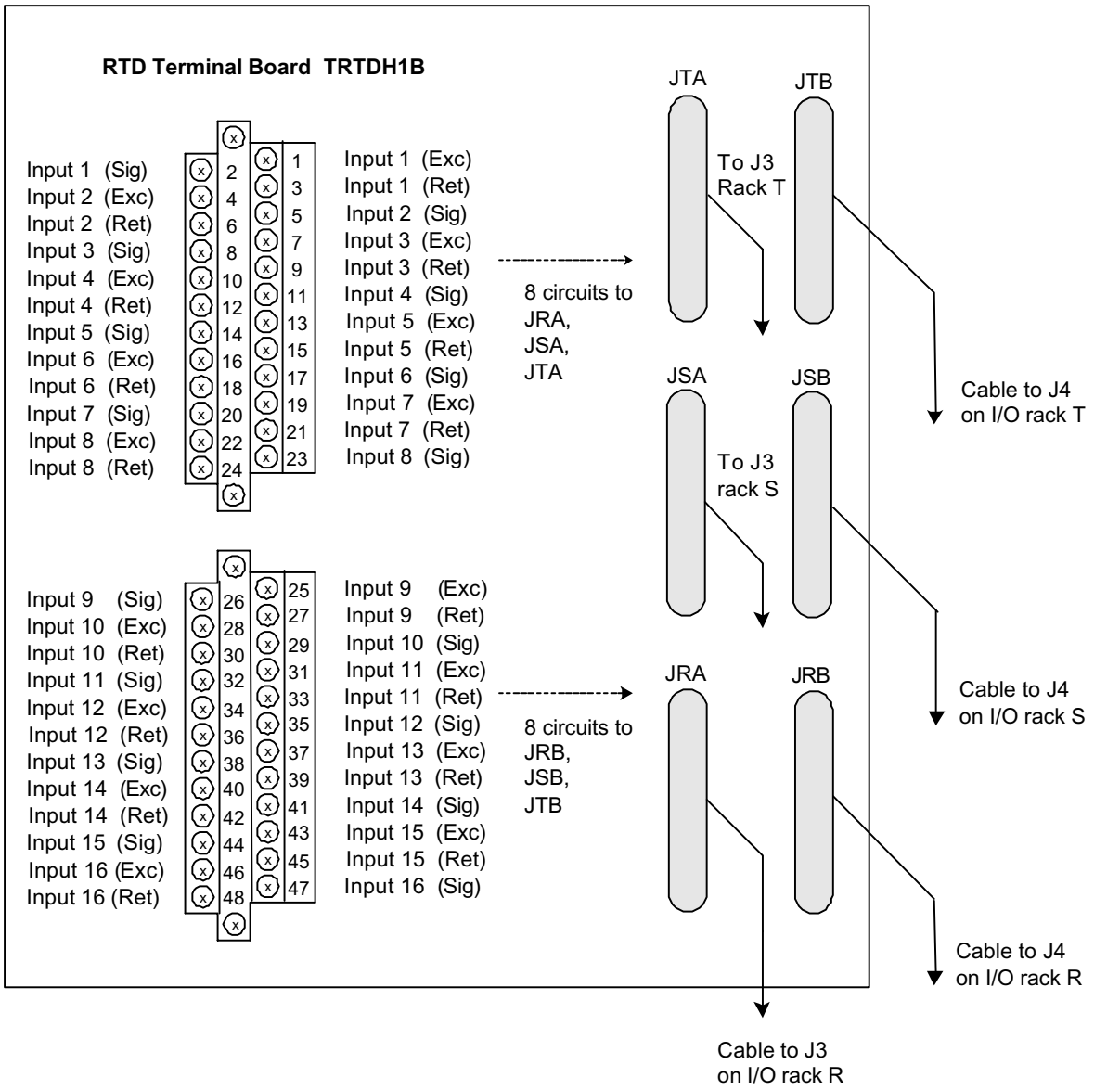
Application Note:

- Optional Ground: connnect the "B" wire to ground;
- RTD group wiring, that is sharing the "B" wire;
  tie the "B" wires together at the RTDs,
  tie the "Sigxx" signals together at the TRTD termination board, and interconnect with one wire.

TRTDH1C (Simplex) Board Wiring

TRTDH1B provides redundant RTD inputs by fanning the inputs out to VRTD boards in the R, S, and T. The inputs meet the same environmental, codes, resolution, suppression, and function requirements as with the TRTD terminal board, however, the fast scan is not available.

All RTD signals have high frequency decoupling to ground at signal entry. RTD multiplexing on the VRTD boards is coordinated by redundant pacemakers so that the loss of a single cable or loss of a single VRTD does not cause the loss of any RTD signals in the control database. VRTD boards in R, S, and T read RTDs simultaneously, but skewed by two RTDs, so that when R is reading RTD3, S is reading RTD5, and T is reading RTD7, and so on. This ensures that the same RTD is not excited by two VRTDs simultaneously, and hence produce bad readings.



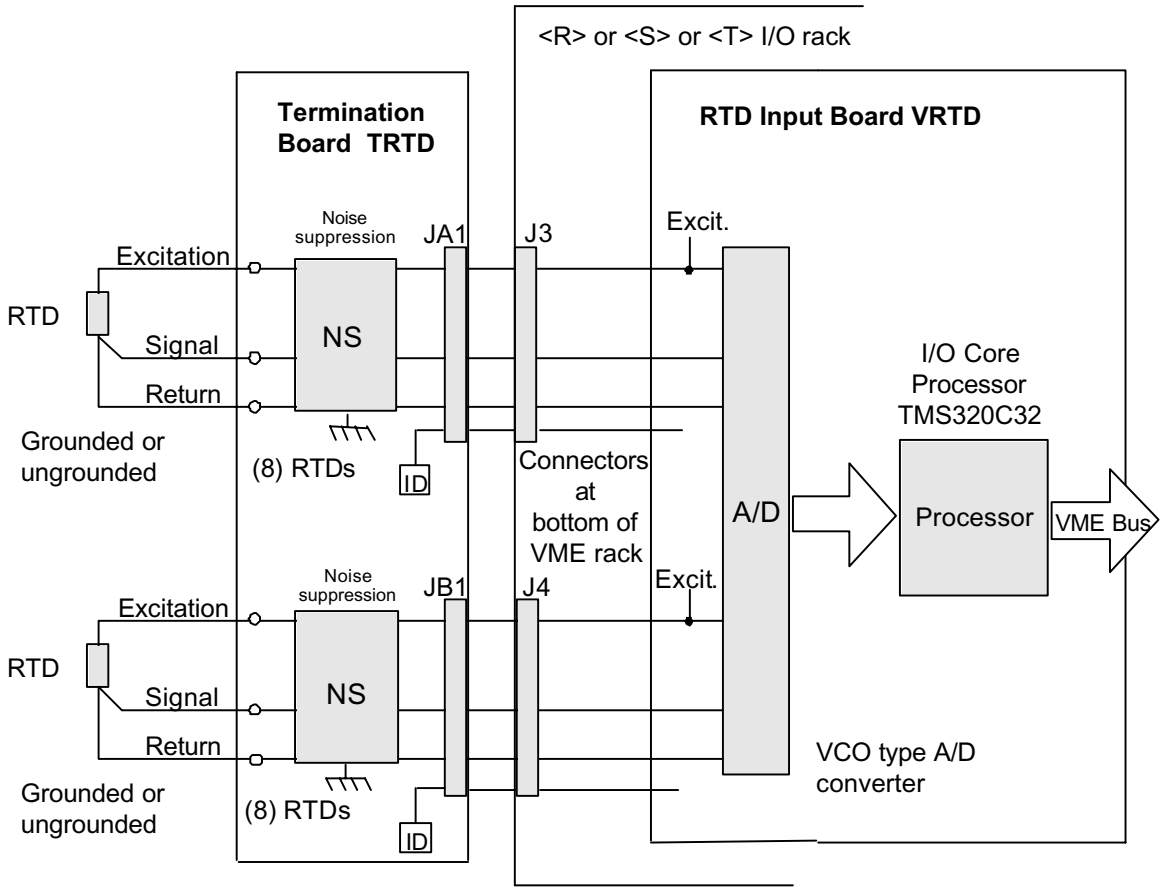
TRTDH1B (TMR) Board Wiring

Operation

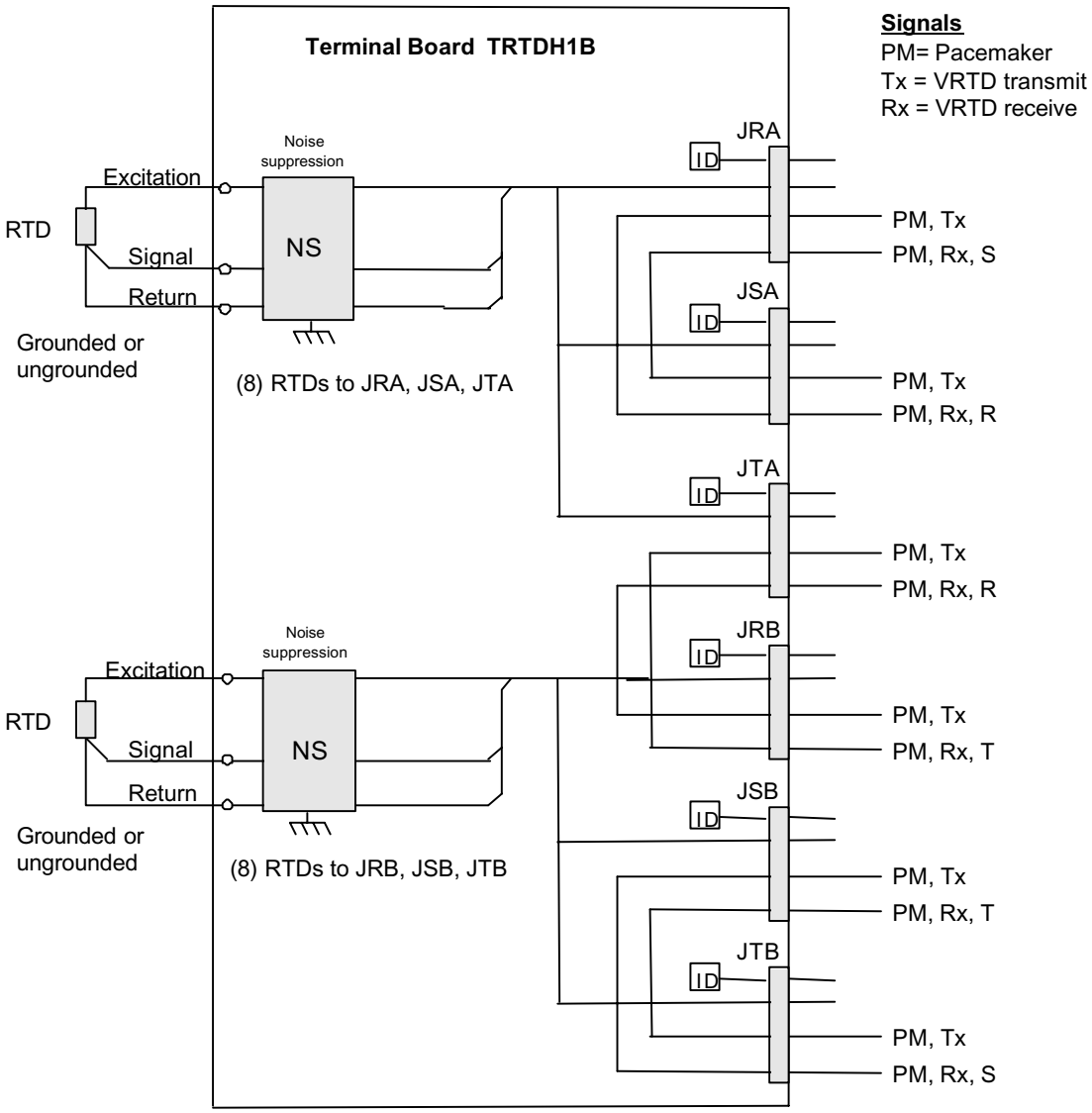
The terminal board supplies a 10 mA dc multiplexed (not continuous) excitation current to each RTD, which can be grounded or ungrounded. The 16 RTDs can be located up to 300 meters (984 feet) from the turbine control cabinet with a maximum two-way cable resistance of 15 ohms.

The VCO type A/D converter in the VRTD board uses voltage to frequency converters and sampling counters. The converter samples each signal and the excitation current four times per second for normal mode scanning, and 25 times per second for fast mode scanning, using a time sample interval related to the power system frequency. Linearization for the selection of 15 RTD types is performed in software by the digital signal processor.

RTD open and short circuits are detected by out of range values. An RTD that is determined to be out of hardware limits is removed from the scanned inputs in order to prevent adverse affects on other input channels. Repaired channels are reinstated automatically in 20 seconds, or can be manually reinstated.



TRTD (Simplex) Inputs and Signal Processing



TRTD (TMR) Inputs and Signal Processing

Specifications

RTD Specifications

Item	Specification
Number of channels	16 channels per terminal board 16 channels per VRTD board
RTD types	10, 100, and 200 ohm platinum 10 ohm copper 120 ohm nickel
Span	0.3532 to 4.054 volts
A/D converter resolution	14-bit resolution
Scan Time	Normal scan 250 ms (4 Hz) Fast scan 40 ms (25 Hz)
Power consumption	Less than 12 watts
Measurement accuracy	See Tables
Common mode rejection	Ac common mode rejection 60 dB @ 50/60 Hz Dc common mode rejection 80 dB
Common mode voltage range	± 5 V
Normal mode rejection	Rejection of up to 250 mV rms is 60 dB @ 50/60 Hz system frequency for normal scan
Maximum lead resistance	15 ohms maximum two way cable resistance
Fault detection	High/low (hardware) limit check High/low (software) system limit check

VRTD Accuracy

RTD Type	Group Gain	Accuracy at 400 °F
120 ohm nickel	Normal_ 1.0	2 °F
200 ohm platinum	Normal_ 1.0	2 °F
100 ohm platinum	Normal_ 1.0	4 °F
100 ohm platinum (–60 °F to 400 °F)	Gain_ 2.0	2 °F
10 ohm copper	10 ohm Cu_10	10 °F

VRTD Types and Ranges

RTD Type	Name/Standard	Range degree C	Range degree F
10 ohm copper	MINCO_CA GE 10 Ohm Copper	–51 to +260	–60 to +500
100 ohm platinum	SAMA 100	–51 to +593	–60 to +1100
100 ohm platinum	DIN 43760 IEC-751 MINCO_PD MINCO_PE PT100_DIN	–51 to +700	–60 to +1292
100 ohm platinum	MINCO_PA IPTS-68 PT100_PURE	–51 to +700	–60 to +1292
100 ohm platinum	MINCO_PB Rosemount 104 PT100_USIND	–51 to +700	–60 to +1292
120 ohm nickel	MINCO_NA N 120	–51 to +249	–60 to +480
200 ohm platinum	PT 200	–51 to +204	–60 to +400

Diagnostics

Three LEDs at the top of the VRTD front panel provide status information. The normal RUN condition is a flashing green and FAIL is a solid red. The third LED is normally off but shows a steady orange if a diagnostic alarm condition exists in the board.

Two types of diagnostic checking are applied to all inputs, hardware limit checking and system limit checking.

Each RTD type has hardware limit checking based on preset (non-configurable) high and low levels set near the ends of the operating range. If this limit is exceeded a logic signal is set and the input is no longer scanned. If any one of the 16 input's hardware limits is set it creates a composite diagnostic alarm, L3DIAG_VRTD, referring to the entire board. Details of the individual diagnostics are available from the toolbox. The diagnostic signals can be individually latched, and then reset with the RESET_DIA signal.

Each RTD input has system limit checking based on configurable high and low levels. These limits can be used to generate alarms, and can be configured for enable/disable, and as latching/nonlatching. RESET_SYS resets the out of limit signals. In TMR systems limit logic signals are voted and the resulting composite diagnostic is present in each controller.

Each connector has its own ID device, which is interrogated by the I/O board. The board ID is coded into a read-only chip containing the terminal board serial number, board type, revision number, and the JA1/JB1 connector location. The TMR board version has six ID chips, one for each connector.

Descriptions of the VRTD diagnostics are in GEH-6421D, Vol. I *Mark VI System Guide*, Chapter 8, *Troubleshooting and Diagnostics*.

Configuration

Like all I/O boards, the RTD board is configured using the toolbox. This software usually runs on a data highway connected CIMPLICITY station or workstation. For details refer to GEH-6403, *Control System Toolbox for Configuring the Mark VI Turbine Controller*.

Typical VRTD Configuration

Module Parameter	Description	Choices
Configuration		
System limits	Enable or disable all system limit checking	Enable, disable
Auto reset	Enable or disable restoring of RTDs removed from scan	Enable, disable
Group A rate	Sampling rate and system frequency filter for first group of 8 inputs	4 Hz, 50 Hz filter 4 Hz, 60 Hz filter 25 Hz
Group A gain	Gain 2.0 is for higher accuracy if ohms <190, first group of 8 inputs	Normal_1.0 Gain_2.0 10 ohm Cu_10.0
Group B rate	Sampling rate and system frequency filter for second group of 8 inputs	4 Hz, 50 Hz filter 4 Hz, 60 Hz filter 25 Hz
Group B gain	Gain 2.0 is for higher accuracy if ohms <190, second group of 8 inputs	Normal_1.0 Gain_2.0 10 ohm Cu_10.0
J3J4:IS200TRTDH1C	Terminal board	Connnected, not connected
RTD1	First of 16 RTDs - Board point signal	Point edit (input FLOAT)
RTD type	RTDs linearizations supported by VRTD; select RTD or Ohms Input (unused inputs are removed from scanning)	Unused CU10 MINCO_CA PT100_DIN MINCO_PD PT100_PURE MINCO_PA PT100_USIND MINCO_PB N120 MINCO_NA MINCO_PIA PT100_SAMA PT200 MINCO_PK Ohms
SysLim1 Enable	Enables or disables a temperature limit for each RTD, can be used to create an alarm	Enable, disable
SysLim1 Latch	Determines whether the limit condition will latch or unlatch for each RTD; reset used to unlatch.	Latch, unlatch
SysLim1 Type	Limit occurs when the temperature is greater than or equal (>=), or less than or equal to (<=) a preset value.	Greater than or equal Less than or equal
System Limit 1	Enter the desired value of the limit temperature, Deg F or Ohms	–60 to 1,300

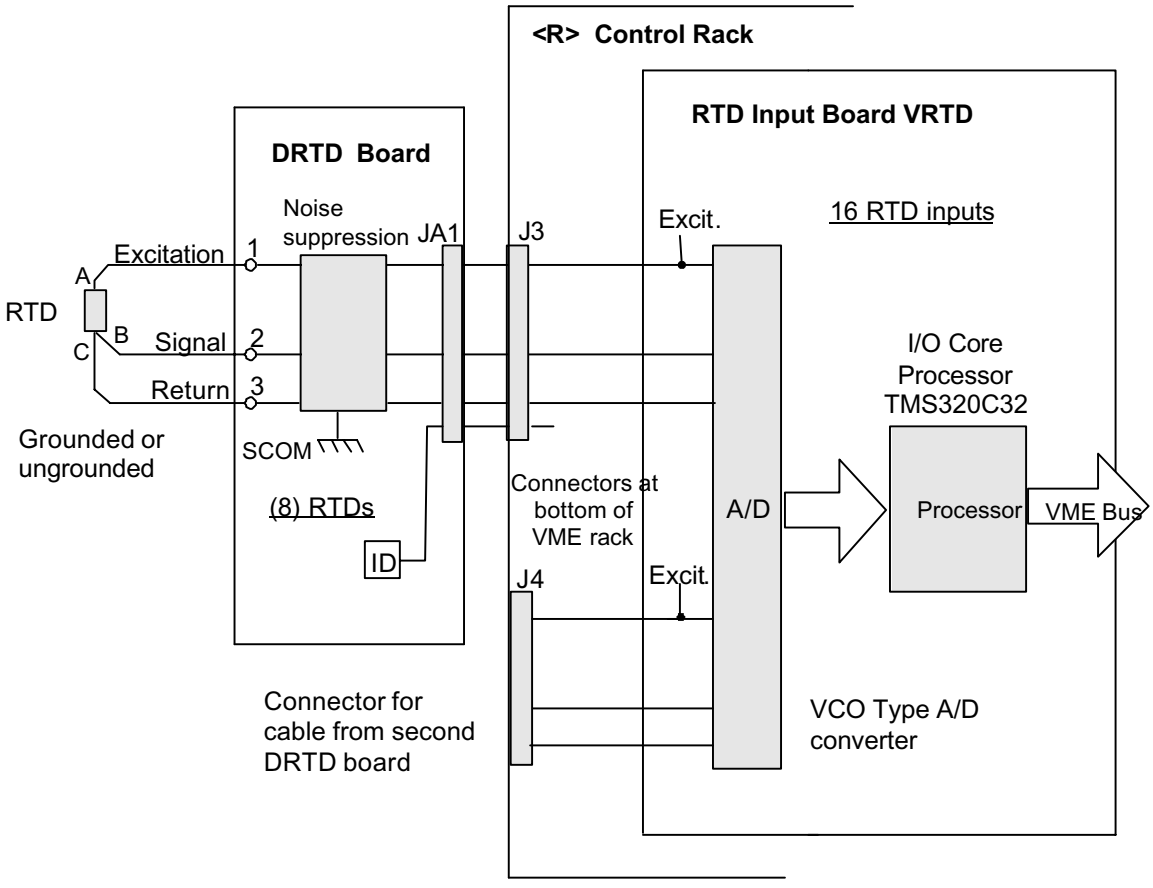
	SysLim2 Enable	Enables or disables a temperature limit which can be used to create an alarm	Enable, disable
	SysLim2 Latch	Determines whether the limit condition will latch or unlatch; reset used to unlatch.	Latch, unlatch
	SysLim2 Type	Limit occurs when the temperature is greater than or equal (>=), or less than or equal to (<=) a preset value.	Greater than or equal Less than or equal
Limit 2	System	Enter the desired value of the limit temperature, Deg F or Ohms	–60 to 1,300
Diff Limt	TMR	Limit condition occurs if 3 temperatures in R,S,T differ by more than a preset value; this creates a voting alarm condition.	–60 to 1,300

Signals	Board Point	Description-Point Edit (Enter Signal Connection)	Direction	Type
	L3DIAG_VRTD1	Board diagnostic	Input	BIT
	L3DIAG_VRTD2	Board diagnostic	Input	BIT
	L3DIAG_VRTD3	Board diagnostic	Input	BIT
	SysLim1RTD1	System limit 1	Input	BIT
	:	:	Input	BIT
	SysLim1RTD16	System limit 1	Input	BIT
	SysLim2RTD1	System limit 2	Input	BIT
	:	:	Input	BIT
	SysLim2RTD16	System limit 2	Input	BIT

DRTD Simplex Thermocouple Terminal Board

The DRTD board is a compact RTD terminal board, designed for DIN-rail mounting. The board has eight RTD inputs and connects to the VRTD processor board with a single 37-pin cable. This cable is identical to those used on the larger TRTD terminal board. The terminal boards can be stacked vertically on the DIN-rail to conserve cabinet space. Two DRTD boards can be connected to the VRTD for a total of 16 temperature inputs. Only a simplex version of the board is available.

The on-board noise suppression is similar to that on the TRTD. High density Euro-Block type terminal blocks are permanently mounted to the board, with two screw connections for the ground connection (SCOM). An on-board ID chip identifies the board to the VRTD for system diagnostic purposes.

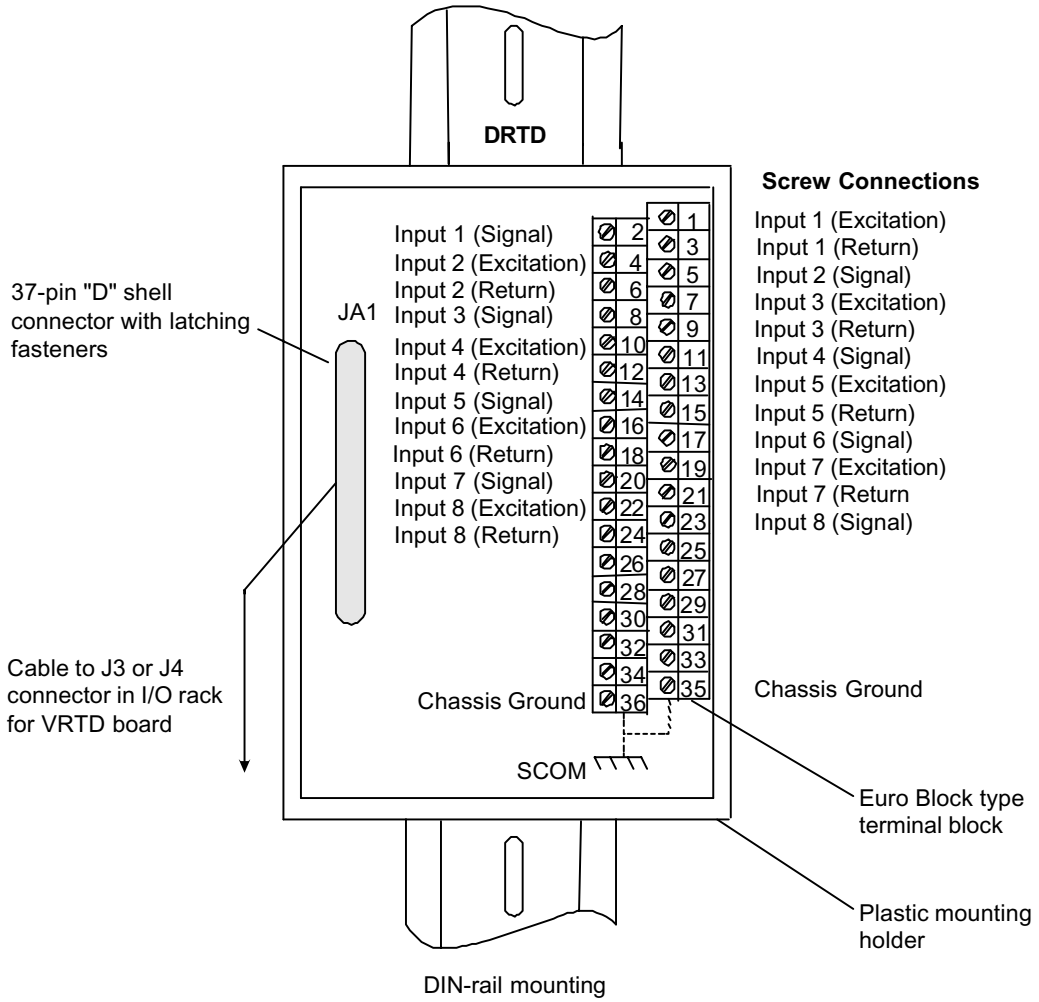


DRTD Board

Installation

There is no shield termination strip with this design.

The DRTD board slides into a plastic holder which mounts on the DIN-rail. The eight RTDs are wired directly to the terminal block. The Euro-Block type terminal block has 36 terminals and is permanently mounted on the terminal board. Typically #18 AWG wires (shielded twisted triplet) are used. Terminals 25 through 34 are spares. There are two screws for the SCOM (ground) connection, which should be as short a distance as possible. For wiring grounded RTDs, see the section, *Installation* for the TRTD board.



DRTD Board Wiring and Cabling

I/O Board Alarms

Diagnostic alarms for any I/O board can be displayed and reset from the toolbox. For troubleshooting and general diagnostic alarm information refer to GEG-6421 Volume I, Chapter 8.

I/O Board Diagnostic Alarms

Board	Fault	Fault Description	Possible Cause
VRTD	**2**	Flash Memory CRC Failure	Board firmware programming error (board will not go online)
	3	CRC failure override is Active	Board firmware programming error (board is allowed to go online)
	16	System Limit Checking is Disabled	System checking was disabled by configuration.
	17	Board ID Failure	Failed ID chip on the VME I/O board
	18	J3 ID Failure	Failed ID chip on connector J3, or cable problem
	19	J4 ID Failure	Failed ID chip on connector J4, or cable problem
	20	J5 ID Failure	Failed ID chip on connector J5, or cable problem
	21	J6 ID Failure	Failed ID chip on connector J6, or cable problem
	22	J3A ID Failure	Failed ID chip on connector J3A, or cable problem
	23	J4A ID Failure	Failed ID chip on connector J4A, or cable problem
	24	Firmware/Hardware Incompatibility	Invalid terminal board connected to VME I/O board
	30	ConfigCompatCode mismatch; Firmware: #; Tre: # The configuration compatibility code that the firmware is expecting is different than what is in the tre file for this board	A tre file has been installed that is incompatible with the firmware on the I/O board. Either the tre file or firmware must change. Contact the factory.
	31	IOCompatCode mismatch; Firmware: #; Tre: # The I/O compatibility code that the firmware is expecting is different than what is in the tre file for this board	A tre file has been installed that is incompatible with the firmware on the I/O board. Either the tre file or firmware must change. Contact the factory.
	32-47	RTD # high voltage reading, Counts are Y	An RTD wiring/cabling open, or an open on the VRTD board, or a VRTD hardware problem (such as multiplexer), or the RTD device has failed.
	48-63	RTD # low voltage reading, Counts are Y	An RTD wiring/cabling short, or a short on the VRTD board, or a VRTD hardware problem (such as multiplexer), or the RTD device has failed.

64-79	RTD # high current reading, Counts are Y	The current source on the VRTD is bad, or the measurement device has failed.
80-95	RTD # low current reading, Counts are Y.	An RTD wiring/cabling open, or an open on the VRTD board, or a VRTD hardware problem (such as multiplexer), or the RTD device has failed.
96-111	RTD # Resistance calc high, it is Y Ohms. RTD # has a higher value than the table and the value is Y	The wrong type of RTD has been configured or selected by default, or there are high resistance values created by faults 32 or 35, or both 32 and 35.
112-127	RTD # Resistance calc low, it is Y Ohms. TRD # has a lower value than the table and the value is Y	The wrong type of RTD has been configured or selected by default, or there are low resistance values created by faults 33 or 34, or both 33 and 34.
128-151	Voltage Circuits for RTDs, or Current Circuits for RTDs have Reference raw counts high or low, or Null raw counts high or low	Internal VRTD problems such as a damaged reference voltage circuit, or a bad current reference source, or the voltage/current null multiplexer is damaged.
152	Failed one Clock Validity Test, scanner still running. In TMR mode, the firmware tests whether the three TMR boards are synchronized and will stop scanning inputs under certain conditions	VME board, terminal board, or cable could be defective.
153	Failed one Phase Validity Test, scanner still running. In TMR mode, the firmware tests whether the three TMR boards are synchronized and will stop scanning inputs under certain conditions	VME board, terminal board, or cable could be defective.
154	Failed both Clock Validity Tests, scanner shutdown. In TMR mode, the firmware tests whether the three TMR boards are synchronized and will stop scanning inputs under certain conditions	VME board, terminal board, or cable could be defective.
155	Terminal Board connection(s) wrong. Cables crossed between <R>, <S>, and <T>	Check cable connections.
156	25 Hz Scan not Allowed in TMR Mode, please reconfigure	Configuration error. Choose scan of 4 Hz_50 Hz Fltr or 4 Hz_60 Hz Fltr.
160-255	Logic Signal # Voting mismatch. The identified signal from this board disagrees with the voted value.	A problem with the input. This could be the device, the wire to the terminal board, the terminal board, or the cable.
256-271	Input Signal # Voting mismatch, Local #, Voted #. The specified input signal varies from the voted value of the signal by more than the TMR Diff Limit	A problem with the input. This could be the device, the wire to the terminal board, the terminal board, or the cable.

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