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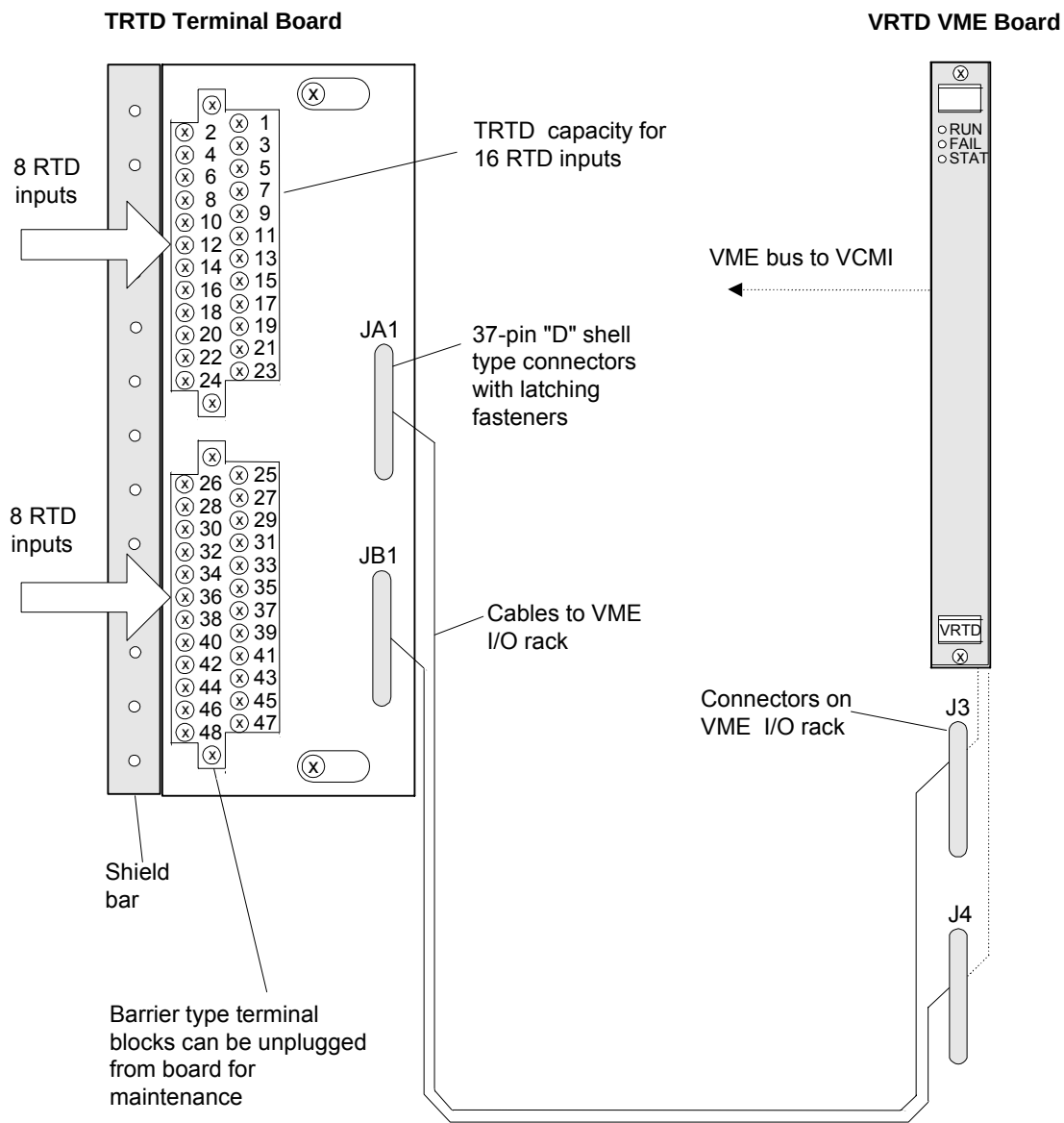
VRTD RTD Input

VRTD RTD Input

Functional Description

The Resistance Temperature Device (RTD) Input (VRTD) board accepts 16, three-wire RTD inputs. These inputs are wired to a RTD terminal board (TRTD or DRTD). Cables with molded fitting connect the terminal board to the VME rack where the VRTD processor board is located.

VRTD excites the RTDs and the resulting signals return to the VRTD. 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

➤ To install the V-type board

- 1 Power down the VME processor rack
- 2 Slide in the board and push the top and bottom levers in with your hands to seat its edge connectors
- 3 Tighten the captive screws at the top and bottom of the front panel

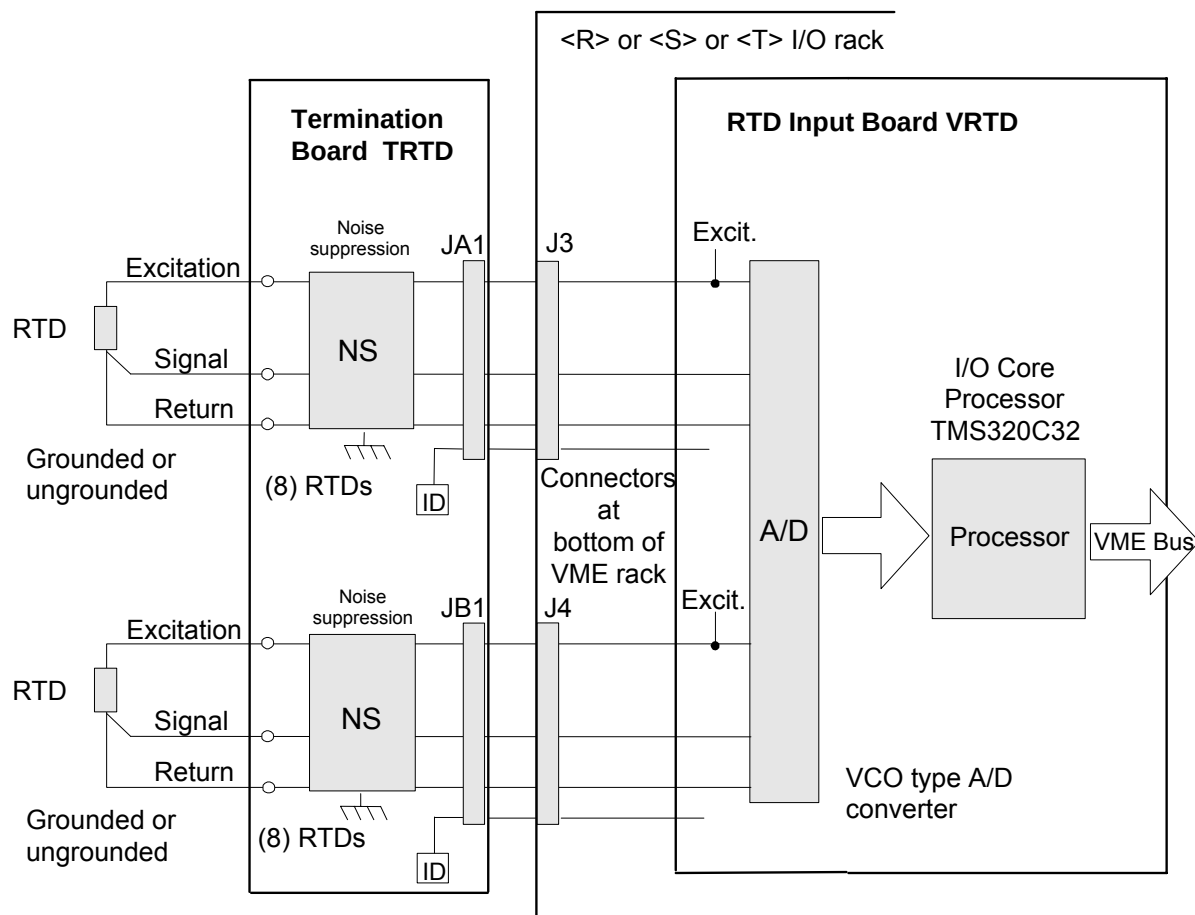
Note Cable connections to the terminal boards are made at the J3 and J4 connectors on the lower portion of the VME rack. These are latching type connectors to secure the cables. Power up the VME rack and check the diagnostic lights at the top of the front panel. For details, refer to the section on diagnostics in this document.

Operation

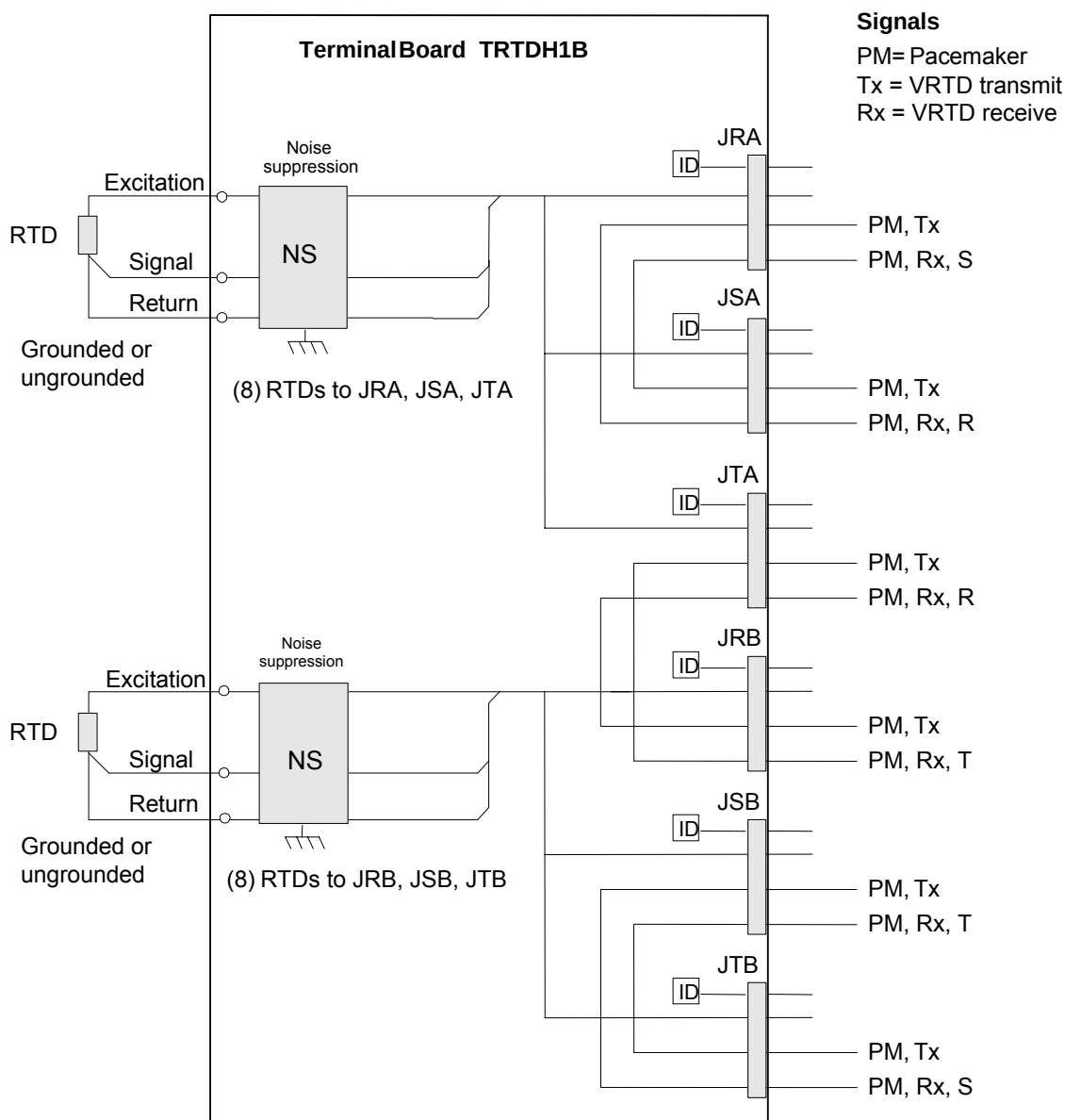
VRTD supplies a 10 mA dc multiplexed (not continuous) excitation current to each RTD through the terminal board. The resulting signal returns to VRTD. The VCO type A/D converter uses voltage to frequency converters and sampling counters. The converter samples each signal and the excitation current four 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. Software in the digital signal processor performs the linearization for the selection of 15 RTD types.

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

In triple modular redundant (TMR) configuration, TRTDH1B provides redundant RTD inputs by fanning the inputs to three VRTD boards in the R, S, and T racks. All RTD signals have high frequency decoupling to ground at signal entry. RTD multiplexing is coordinated by redundant pacemakers so that the loss of a single cable or VRTD does not cause the loss of any RTD signals in the control database. VRTD boards in R, S, and T read RTDs simultaneously. The RTDs read by each VRTD differ by two RTDs, such that when R reads RTD3, S reads RTD5, and T reads RTD7, and so on. This ensures that the same RTD is not excited by two VRTDs simultaneously and hence produce bad readings.



RTD Inputs and Signal Processing, Simplex System



Specifications

Item	Specification
Number of channels	16 channels per VRTD board
RTD types	10, 100, and 200 Ω platinum 10 Ω copper 120 Ω nickel
Span	0.3532 to 4.054 V
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 W
Measurement accuracy	See Tables

Item	Specification
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 Ω maximum two way cable resistance
Fault detection	High/low (hardware) limit check High/low (software) system limit check Failed ID chip

RTD Accuracy

RTD Type	Group Gain	Accuracy at 400 °F
120 Ω nickel	120 Ω nickel	2 °F
200 Ω platinum	Normal_ 1.0	2 °F
100 Ω platinum	Normal_ 1.0	4 °F
100 Ω platinum -51 to 240°C (- 60 °F to 400 °F)	Gain_ 2.0	2 °F
10 Ω copper	10 Ω Cu_10	10 °F

RTD Types and Ranges

RTD inputs are supported over a full-scale input range of 0.3532 to 4.054 V. The following table shows the types of RTD used and the temperature ranges.

RTD Type	Name/Standard	Range °C	Range °F
10 Ω copper	MINCO_CA GE 10 Ω Copper	-51 to +260	-60 to +500
100 Ω platinum	SAMA 100	-51 to +593	-60 to +1100
100 Ω platinum	DIN 43760	-51 to +700	-60 to +1292
	IEC-751		
	MINCO_PD		
	MINCO_PE		
	PT100_DIN		
100 Ω platinum	MINCO_PA	-51 to +700	-60 to +1292
	IPTS-68		
	PT100_PURE		
100 Ω platinum	MINCO_PB	-51 to +700	-60 to +1292
	Rosemount 104		
	PT100_USIND		
120 Ω nickel	MINCO_NA	-51 to +249	-60 to +480
	N 120		
200 Ω 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. Diagnostic checks include the following:

- 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 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/non-latching. 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.
- The resistance of each RTD is checked and compared with the correct value, and if high or low, a fault is created.
- Each connector has its own ID device, which is interrogated by the I/O processor board. The terminal board ID is coded into a read-only chip containing the terminal board serial number, board type, revision number, and the connector location. If a mismatch is encountered, a hardware incompatibility fault is created.

Configuration

Note The following information is extracted from the toolbox and represents a sample of the configuration information for this board. Refer to the actual configuration file within the toolbox for specific information.

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	Connected, not connected
RTD1	First of 16 RTDs - Board point signal	Point edit (input FLOAT)

Module Parameter	Description	Choices	
RTDRTD type	RTDs linearizations supported by VRTD;VRTD select RTDRTD or Ohms Input (unused inputs are removed from scanning)	Unused CU10 PT100_DIN PT100_PURE PT100_USIND N120 MINCO_PIA PT200 Ohms	MINCO_CA MINCO_PD MINCO_PA MINCO_PB MINCO_NA PT100_SAMA MINCO_PK
SysLim1 Enable	Enables or disables a temperature limit for each RTD,RTD can be used to create an alarm	Enable, disable	
SysLim1 Latch	Determines whether the limit condition will latch or unlatch for each RTD;RTD reset used to unlatch.	Latch, unlatch	
SysLim1 Type	Limit occurs when the temperature is greater than or equal ($\geq$), or less than or equal to ($\leq$) 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 ($\geq$), or less than or equal to ($\leq$) a preset value.	Greater than or equal Less than or equal	
System Limit 2	Enter the desired value of the limit temperature, Deg F or Ohms	-60 to 1,300	
TMR Diff Limt	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	

Board Point Signals	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

Alarms

Fault	Fault Description	Possible Cause
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.

Fault	Fault Description	Possible Cause
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.

TRTD RTD Input

Functional Description

The RTD Input (TRTD) terminal board accepts 16, three-wire RTD inputs. These inputs are wired to two barrier type terminal blocks. The inputs have noise suppression circuitry to protect against surge and high frequency noise. TRTD communicates with one or more I/O processors, which convert the inputs to digital temperature values and transfer them to the controller.

There are four versions of TRTD as follows:

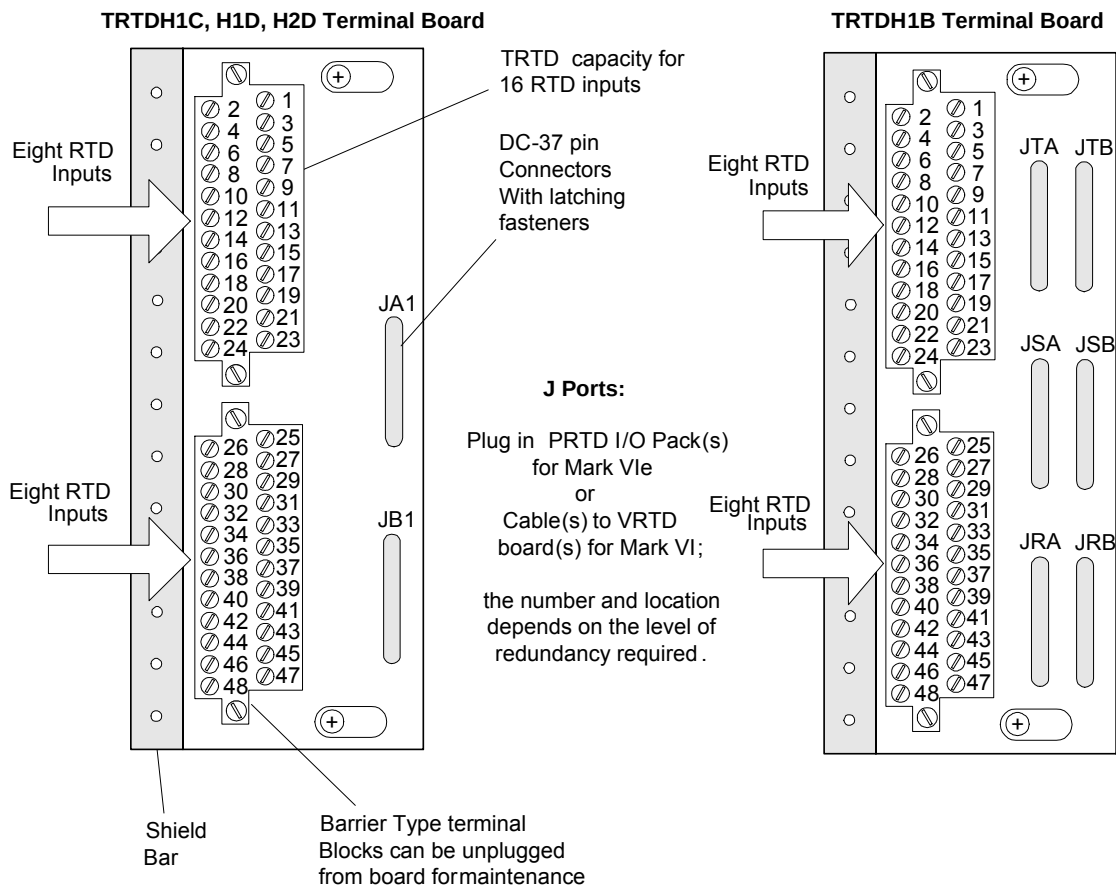
- TRTDH1B is a TMR version that fans out the signals to three VRTD boards using six DC-type connectors.
- TRTDH1C is a simplex board with two DC-type connectors for VRTD.
- TRTDH1D is a simplex board with two DC-type connectors for PRTD, normal scan.
- TRTDH2D is a simplex board with two DC-type connectors for PRTD, fast scan.

Mark VI Systems

In the Mark* VI system, TRTDH1B and TRTDH1C works with the VRTD processor and supports simplex and TMR applications. One TRTDH1C connects to the VRTD with two cables. In TMR systems, TRTDH1B connects to three VRTD processors with six cables.

Mark VIe Systems

In the Mark VIe system, TRTDH1D and TRTDH2D works with the PRTD I/O pack and support simplex applications only. Two PRTD packs plug into the TRTD for a total of 16 inputs.



RTD Input Terminal Boards

Installation

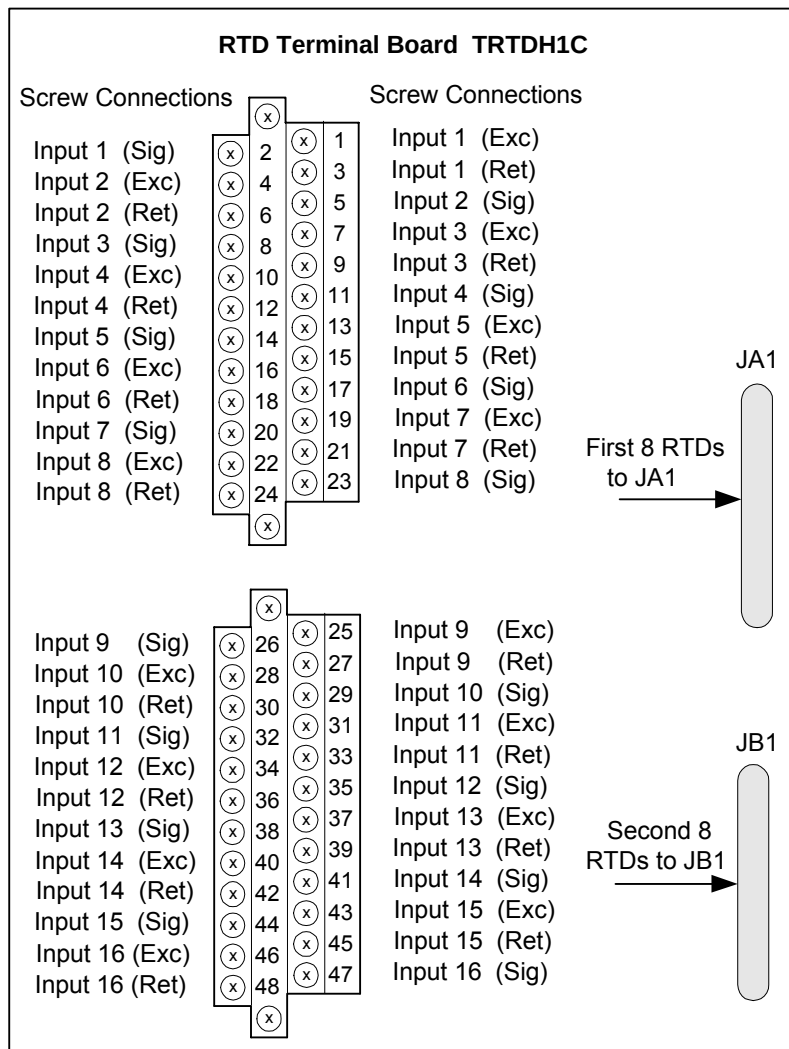
Connect the wires for the 16 RTDs directly to the two terminal blocks on the terminal board. Each block is held down with two screws and has 24 terminals accepting up to #12 AWG wires. A shield terminal strip attached to chassis ground is located immediately to the left of each terminal block.



Caution

For CE mark applications, double-shielded wire must be used. All shields must be terminated at the shield terminal strip. Do not terminate shields located at the end device.

In a TMR Mark VI system, TRTDH1B provides redundant RTD inputs by fanning the inputs to three VRTD boards in the R, S, and T racks. The inputs meet the same environmental, resolution, suppression, and function requirements and codes as the TRTDH1C terminal board; however, the fast scan is not available.



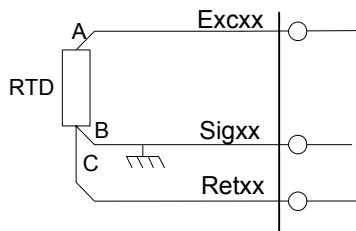
J-Port Connections

Plug in PRTD I/O Pack(s) for Mark VIe

or

Cable to VRTD I/O board(s) for Mark VI;

The number and location depends on the number of inputs required.



Application Note:

- Optional Ground: connect 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 terminal board, and interconnect with one wire.

TRTDH1C RTD Terminal Board Wiring

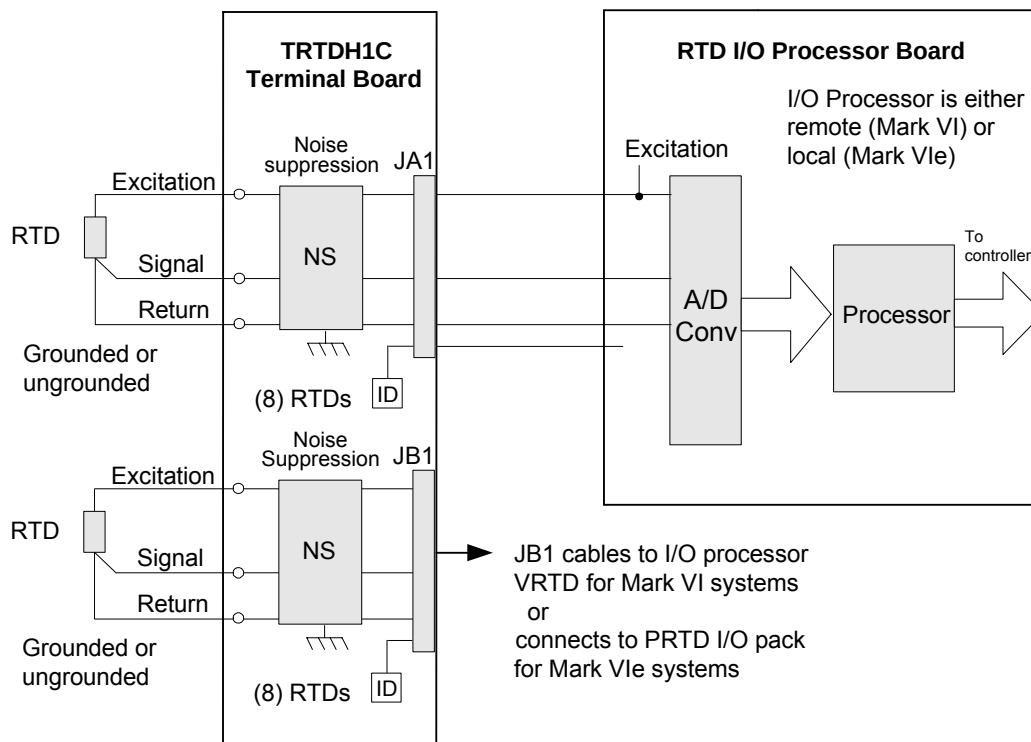
Operation

TRTD 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 m (984 ft) from the turbine control cabinet with a maximum two-way cable resistance of 15 Ω .

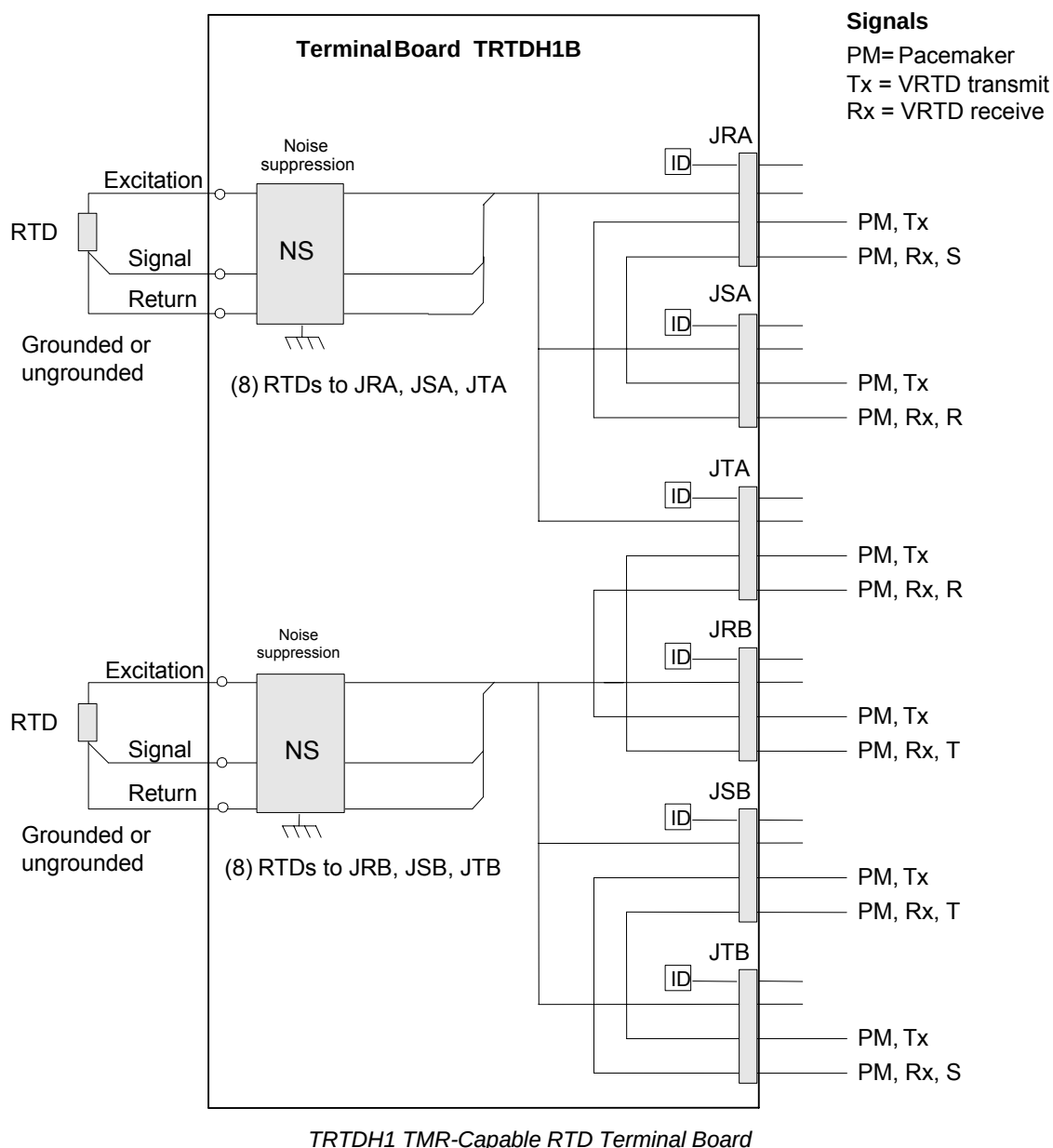
The A/D converter in the I/O processor samples each signal and the excitation current four times per second for normal mode scanning and 25 times per second for fast mode scanning, using a time sample interval related to the power system frequency. Software performs the linearization for the selection of 15 RTD types.

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

All RTD signals have high-frequency decoupling to ground at signal entry. RTD multiplexing in the I/O processor is coordinated by redundant pacemakers so that the loss of a single cable or I/O processor does not cause the loss of any RTD signals in the control database.



TRTD (Simplex) Inputs and Signal Processing



Specifications

Item	Specification
Number of channels	Eight channels per terminal board
RTD types	10, 100, and 200 Ω platinum 10 Ω copper 120 Ω nickel
Span	0.3532 to 4.054 V
Maximum lead resistance	15 Ω maximum two-way cable resistance
Fault detection	High/low (hardware) limit check High/low (software) system limit check Failed ID chip

RTD Accuracy

RTD Type	Group Gain	Accuracy at 400 °F
120 Ω nickel	120 Ω nickel	2 °F
200 Ω platinum	Normal_ 1.0	2 °F
100 Ω platinum	Normal_ 1.0	4 °F
100 Ω platinum -51 to 240°C (- 60 °F to 400 °F)	Gain_ 2.0	2 °F
10 Ω copper	10 Ω Cu_10	10 °F

RTD Types and Ranges

RTD inputs are supported over a full-scale input range of 0.3532 to 4.054 V. The following table shows the types of RTD used and the temperature ranges.

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

Diagnostics

Diagnostic checks include the following:

- 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 input's hardware limits is set, it creates a composite diagnostic alarm, L3DIAG_XXXX, 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/non-latching. 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.
- The resistance of each RTD is checked and compared with the correct value, and if high or low, a fault is created.
- Each connector has its own ID device, which is interrogated by the I/O processor board. The terminal board ID is coded into a read-only chip containing the terminal board serial number, board type, revision number, and the connector location. If a mismatch is encountered, a hardware incompatibility fault is created.

Configuration

There are no jumpers or hardware settings on the board.

DRTD Simplex RTD Input

Functional Description

The Simplex RTD Input (DRTD) terminal 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 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 VRTD for a total of 16 temperature inputs. Only a simplex version of the board is available.

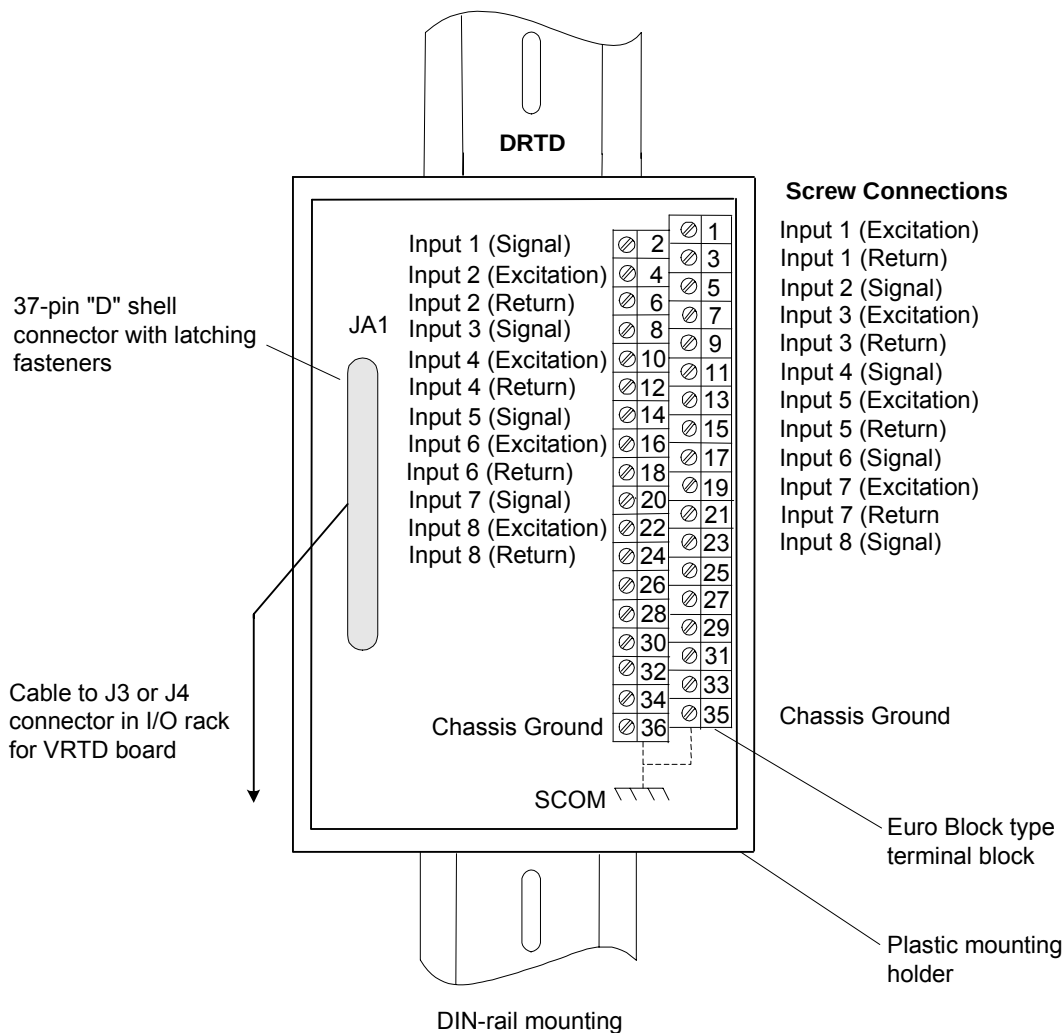
Note The DRTD board does not work with the PRTD I/O pack.

Installation

Note There is no shield terminal strip with this design.

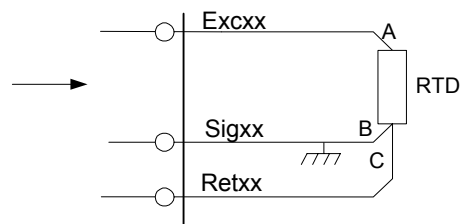
Mount the plastic holder on the DIN-rail and slide the DRTD board into place. Connect the wires for the eight RTDs directly to the terminal block. The Euro-Block type terminal block has 36 terminals and is permanently mounted on the terminal board. Typically #18 AWG wires (shielded twisted triplet) are used. Terminals 25 through 34 are spares. Two screws, 35 and 36, are provided for the SCOM (ground) connection, which should be as short a distance as possible.

Note SCOM must be connected to ground.



Application Notes:

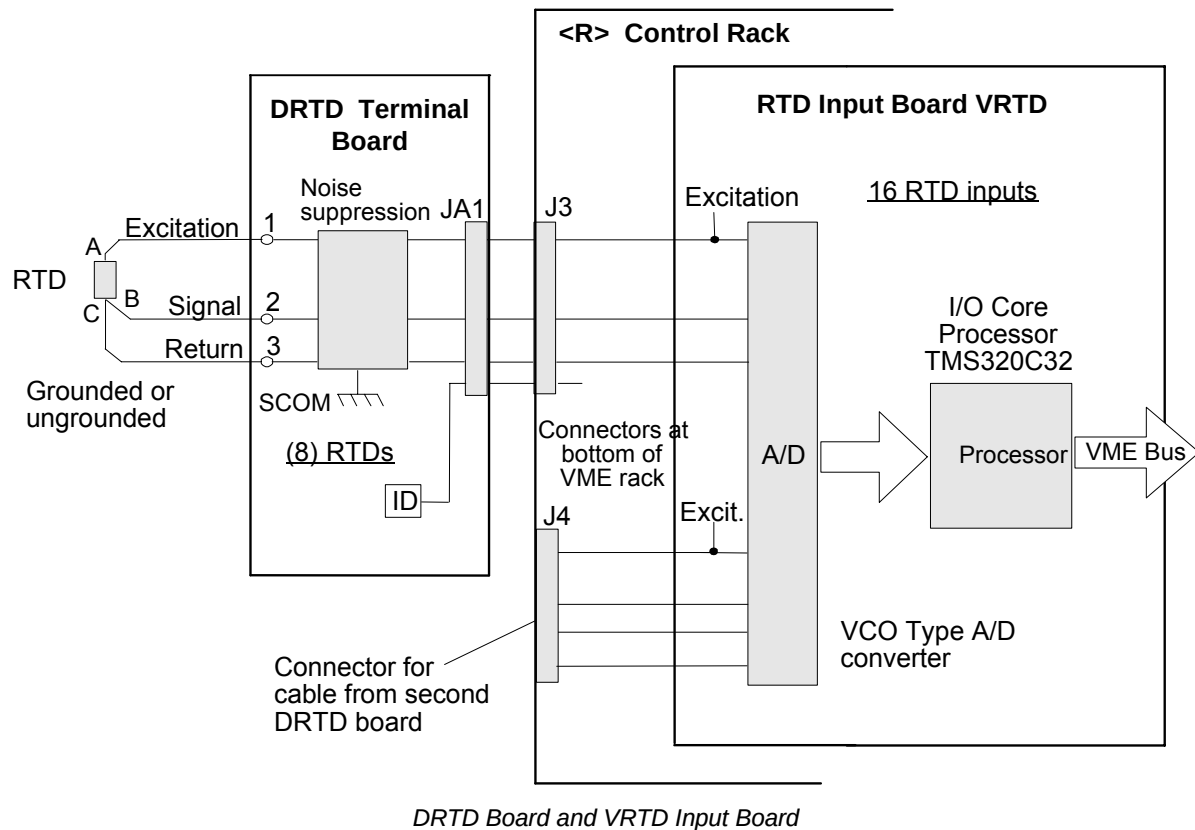
- Optional Ground: connect the "B" wire to ground;
- RTD Group wiring, that is sharing the "B" wire; tie the "B" wires together at the RTDs, tie the "Sigxx" signals together at the TRTD termination board, and interconnect with one wire.



DRTD Board Wiring and Cabling

Operation

The noise suppression on DRTD is similar to that on 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 VRTD for system diagnostic purposes.



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

VRTD's VCO type A/D converter 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. Software in the digital signal processor performs the linearization for the selection of 15 RTD types.

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

Specifications

Item	Specification
Number of channels	Eight channels per terminal board
RTD types	10, 100, and 200 Ω platinum 10 Ω copper 120 Ω nickel
Span	0.3532 to 4.054 V
Maximum lead resistance	15 Ω maximum two-way cable resistance
Fault detection	High/low (hardware) limit check High/low (software) system limit check Failed ID chip

RTD Types and Ranges

RTD inputs are supported over a full-scale input range of 0.3532 to 4.054 V. The following table shows the types of RTD used and the temperature ranges.

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

Diagnostics

Diagnostic checks include the following:

- 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 input's hardware limits is set, it creates a composite diagnostic alarm, L3DIAG_XXXX, 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/non-latching. 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.
- The resistance of each RTD is checked and compared with the correct value, and if high or low, a fault is created.
- Each connector has its own ID device, which is interrogated by the I/O processor board. The terminal board ID is coded into a read-only chip containing the terminal board serial number, board type, revision number, and the connector location. If a mismatch is encountered, a hardware incompatibility fault is created.

Configuration

There are no jumpers or hardware settings on the board.