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.

GE Industrial Systems

+1 540 387 7000
www.GEindustrial.com

General Electric Company
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

GE Industrial Systems

VAIC Analog Input 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.

GE may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not provide any license whatsoever to any of these patents. All license inquiries should be directed to the address below. If further information is desired, or if particular problems arise that are not covered sufficiently for the purchaser's purpose, the matter should be referred to:

GE Industrial Systems
Post Sales Service
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

Phone: + 1 888 GE4 SERV (888 434 7378, United States)
+ 1 540 378 3280 (International)

Fax: + 1 540 387 8606 (All)

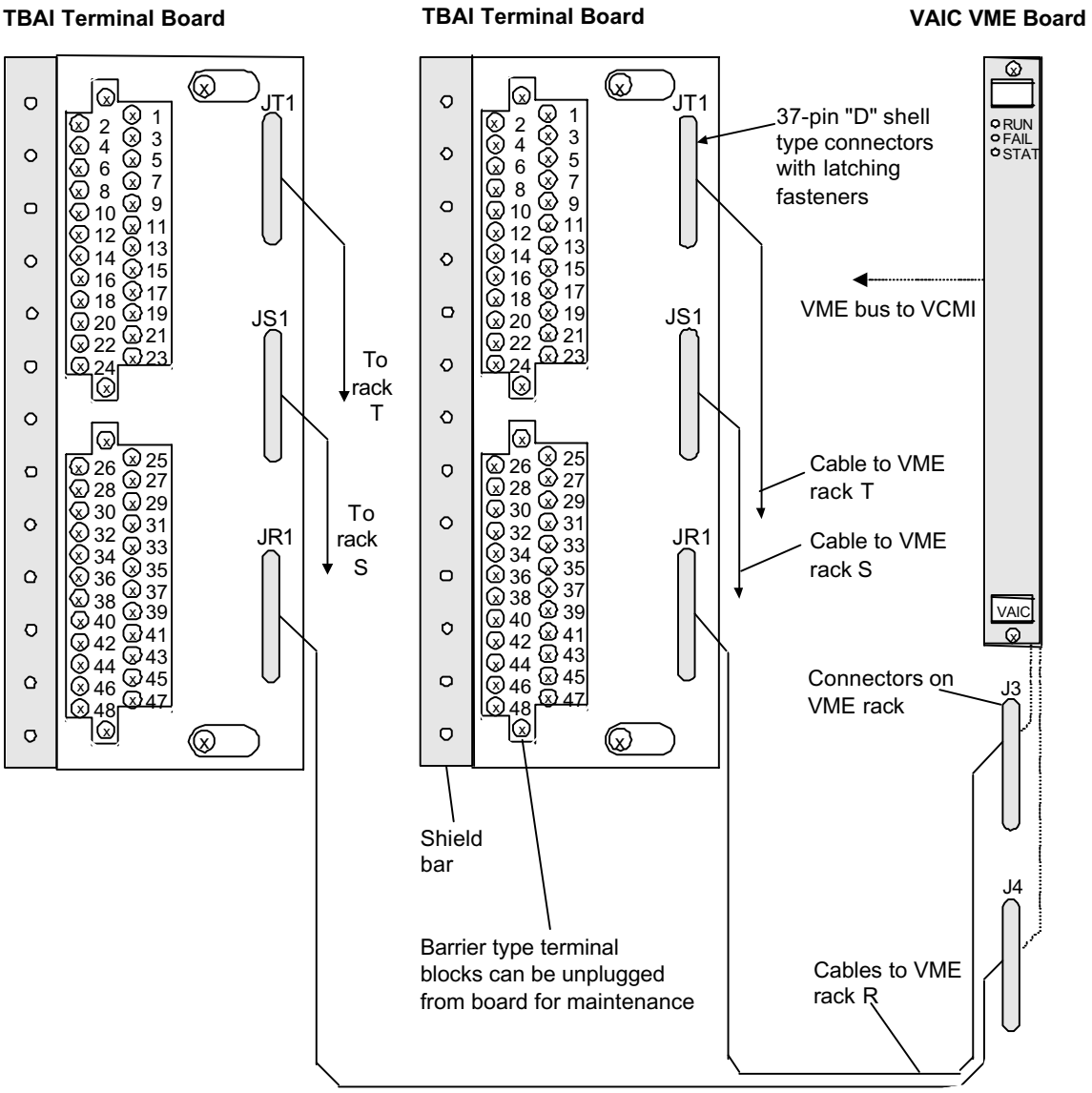
("+" indicates the international access code required when calling from outside the USA)

Issue date: 2002-06-30

Functional Description

The Analog Input Board (VAIC) accepts 20 analog inputs and controls four analog outputs. Ten inputs and two outputs are wired to each Analog Input Terminal board (TBAI). Inputs and outputs have noise suppression circuitry to protect against surge and high frequency noise. Cables connect the terminal board to the VME rack where the VAIC processor board is located.

The VAIC converts the inputs to digital values and transfers these over the VME backplane to the VCMI, and then to the controller. Input signals are fanned out to three VME board racks R, S, and T for TMR applications. The VAIC requires two terminal boards to monitor 20 inputs.



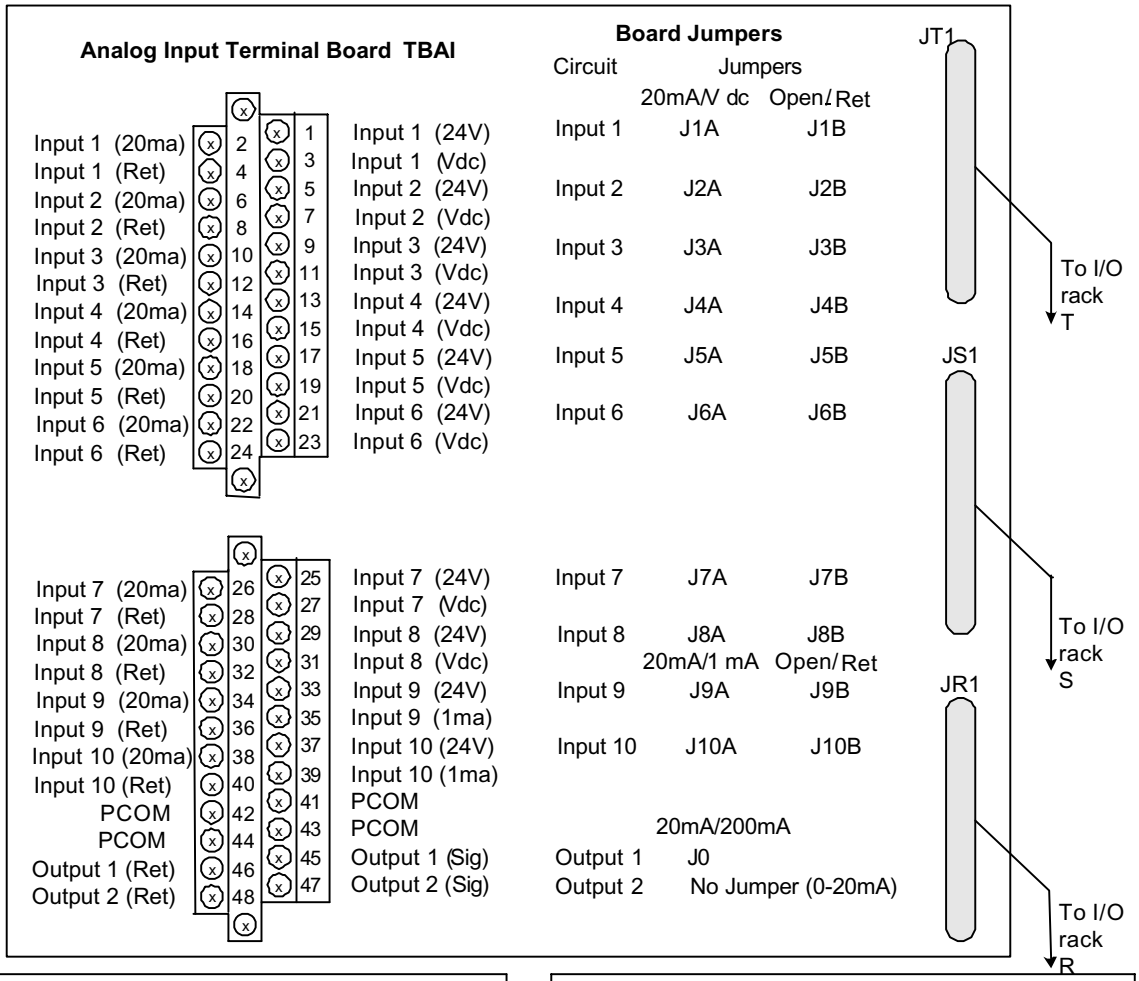
Analog Input Terminal boards, I/O Board, and Cabling (TMR System)

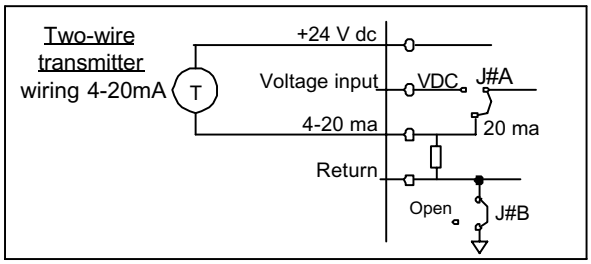
Installation

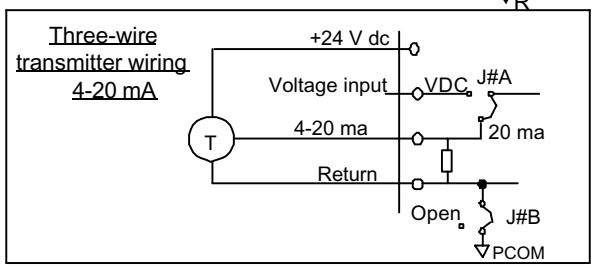
The 10 inputs and two outputs are wired directly to two I/O terminal blocks mounted on the terminal board. Each block is held down with two screws and has 24 terminals accepting up to #12 AWG wires. A shield termination strip attached to chassis ground is located immediately to the left of each terminal block.

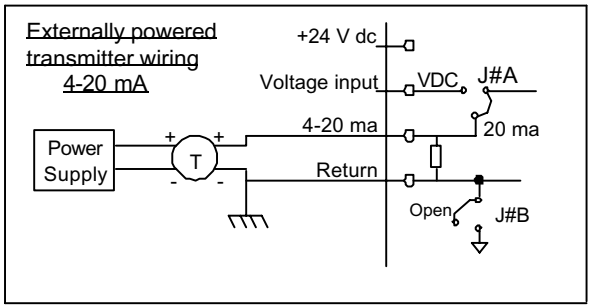
The types of analog inputs and outputs that can be accommodated are as follows:

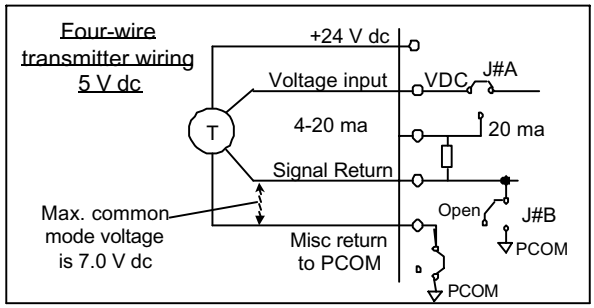
- Analog input, two-wire transmitter
- Analog input, three-wire transmitter
- Analog input, four-wire transmitter
- Analog input, externally powered transmitter
- Analog input, voltage ±5 V, 10 V dc
- Analog output, 20 mA
- Analog output, 200 mA









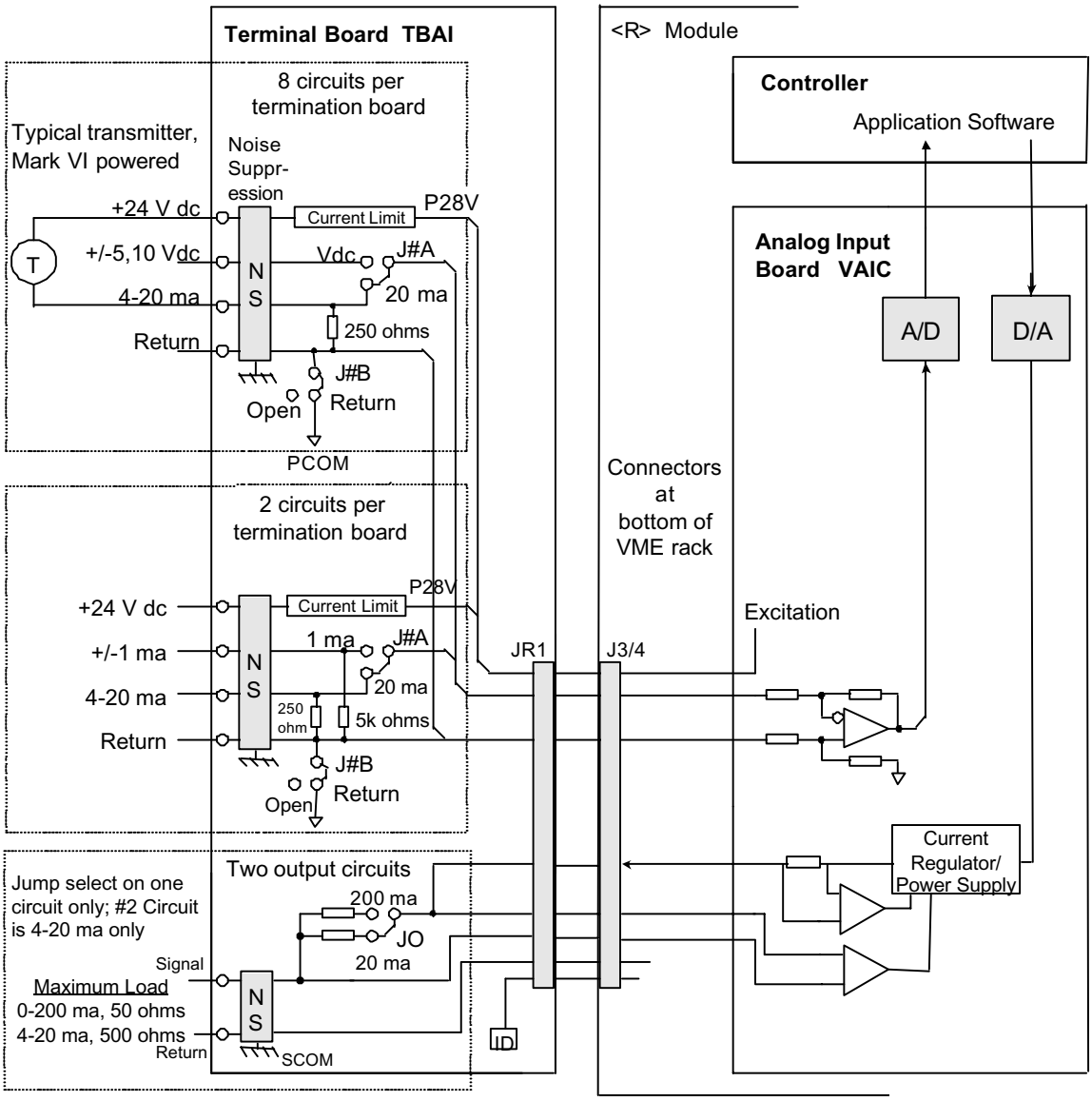


TBAI Terminal Board Wiring

Operation

24 V dc power is available on the terminal board for all the transducers and there is a choice of current or voltage inputs using jumpers. One of the two analog output circuits is 4–20 mA, and the other can be jumper configured for 4–20 mA or 0–200 mA. The same terminal board can be used for TMR applications.

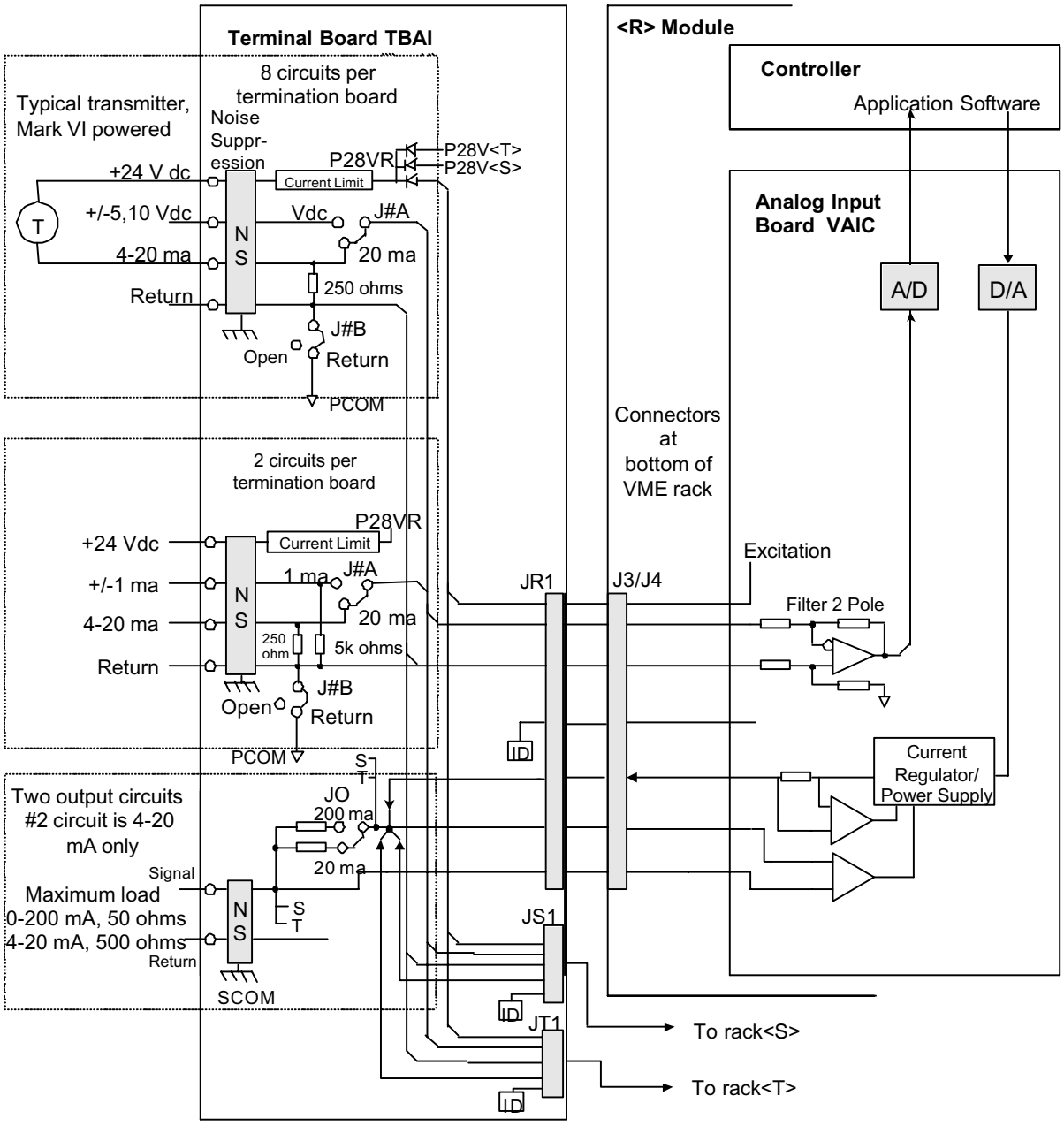
The VAIC board accepts 20 analog inputs, controls four analog outputs, and contains signal conditioning, an analog MUX, A/D converter, and D/A converter.



Simplex Analog Input Processing

In a TMR system, analog inputs fan out to the three control racks from JR1, JS1, and JT1. The 24 V dc power to the transducers comes from all three VAIC boards and is diode shared on the terminal board. Each analog current output is fed by currents from all three VAICs.

The actual output current is measured with a series resistor, which feeds a voltage back to each control rack. The resulting output is the voted middle value of the three currents.



TMR Analog Input Processing

The VAIC analog input/output capacity using two TBAI terminal boards, is shown in the following table.

VAIC Analog Inputs and Outputs

Qty	Analog Input Types	Qty	Analog Output Types
16	± 10 V dc, or ± 5 V dc, or 4–20 mA	2	0–20 mA, or 0–200 mA
4	4–20 mA, or ± 1 mA	2	0–20 mA

With the above noise suppression and filtering, the input ac common mode rejection (CMR) is 60 dB, and the dc CMR is 80 dB.

Transmitter/transducers can be powered by the 24 V dc source in the control system, or can be independently powered. Terminal board jumpers J#A, J#B, and JO set up the type of voltage and current inputs, and select the type of current output. Each output is monitored by diagnostics, and a suicide relay disconnects the corresponding output if a fault cannot be cleared by a command from the processor.

Hardware filters on the terminal board suppress high frequency noise. Additional software filters on VAIC provide configurable low pass filtering.

VAIC Board Specifications

Item	Specification
Number of channels	12 channels per terminal board (10 AI, 2 AO) 24 channels per VAIC board (20 AI, 4 AO)
Input span	1 – 5 V dc
Input converter resolution	16-bit A/D converter with 14-bit resolution
Scan time	Normal scan 10 ms (100 Hz) Inputs 1 through 4 available for scan at 200 Hz
Measurement accuracy	Better than 0.1% full scale
Noise suppression on inputs	The first ten circuits (J3) have a hardware filter with single pole down break at 500 radians/second. The second ten circuits (J4) have a hardware filter with a two pole down break at 72 and 500 rad/second. A software filter, using a two pole low pass filter, is configurable for 0, .75, 1.5 Hz, 3 Hz, 6 Hz, 12 Hz
Common mode rejection	Ac common mode rejection 60 dB @ 60 Hz, with up to ± 5 volt common mode voltage. Dc common mode rejection 80 dB with from –5 to +7 peak volt common mode voltage.

VAIC Board Specifications (continued)

Item	Specification
Common mode voltage range	± 5 V (± 2 V CMR for the ± 10 V inputs)
Maximum lead resistance	15 ohms maximum two-way cable resistance, cable length up to 300m (984 ft)
Output converter	12-bit D/A converter with 0.5% accuracy
Output load	500 ohms for 4–20 mA output 50 ohms for 200 mA output
Power consumption	Less than 31 watts
Compressor stall detection	Detection and relay operation within 30 seconds
Fault detection	Monitor D/A outputs, output currents, and total current Monitor suicide relays and 20/200 mA scaling relays

Diagnostics

Three LEDs at the top of the VAIC 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 displays a steady orange if a diagnostic alarm condition exists in the board.

Each analog input 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_VAIC, which refers 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 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 limits. Details of the diagnostics are in GEH-6421D, Vol. I *Mark VI System Guide*, Chapter 8, *Troubleshooting and Diagnostics*.

The TBAI terminal board 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 JR, JS, JT connector location.

Configuration

The following table summarizes configuration choices and defaults. For details refer to GEH-6403, *Control System Toolbox for Configuring the Mark VI Turbine Controller*.

Typical VAIC Configuration

Parameter	Description	Choices
Configuration		
System limits	Enable or disable system limits	Enable, disable
Output voting	Select type of output voting	Simplex, TMR
Min_ *MA*_Input	Select minimum current for healthy 4–20 mA input	0 to 21 mA
Max_ *MA*_Input	Select maximum current for healthy 4–20 mA input	0 to 21 mA
CompStalType	Select compressor stall algorithm (# of transducers)	0, 2, or 3
InputForPS3A	Select analog input circuit for PS3A	Analog in 1, 2, 3, or 4
InputForPS3B	Select analog input circuit for PS3B	Analog in 1, 2, 3, or 4
InputForPS3C	Select analog input circuit for PS3C	Analog in 1, 2, 3, or 4
SelMode	Select mode for excessive difference pressure	Maximum, average
PressDelta	Excessive difference pressure threshold	5 to 500
TimeDelay	Time delay on stall detection, in milliseconds	10 to 40
KPS3_Drop_Min	Minimum pressure rate	10 to 2000
KPS3_Drop_I	Pressure rate intercept	10 to 100
KPS3_Drop_S	Pressure rate slope	0.05 to 10
KPS3_Delta_S	Pressure delta slope	0.05 to 10
KPS3_Delta_I	Pressure delta intercept	10 to 100
KPS3_Delta_Mx	Pressure delta maximum	10 to 100
KPS3_Drop_L	Threshold Pressure rate	10 to 2000
KPS3_Drop_Mx	Max pressure rate	10 to 2000
J3:IS200TBAIH1A	Terminal board connected to VAIC via J3	Connected, not connected
AnalogIn1	First of 10 analog inputs - board point	Point edit (input FLOAT)
Input type	Current or voltage input type	Unused, 4–20 mA, ± 5 V, ± 10 V
Low_Input	Value of current at the low end of scale	–10 to +20
Low_Value	Value of input in engineering units at low end of scale	–3.4082e+038 to 3.4028e+038
High_Input	Value of current at the high end of scale	–10 to +20
High_Value	Value of input in engineering units at high end of scale	–3.4082e+038 to 3.4028e+038
Input _Filter	Bandwidth of input signal filter	Unused, 0.75, 1.5 Hz, 3 Hz, 6 Hz, 12 Hz

TMR_Diff_Limit	Difference limit for voted inputs in % of high-low values	0 to 100
Sys_Lim_1_Enable	Input fault check	Enable, disable
Sys_Lim_1_Latch	Input fault latch	Latch, unlatch
Sys_Lim_1_Type	Input fault type	Greater than or equal Less than or equal
Sys_Lim_1	Input limit in engineering units	−3.4082e+038 to 3.4028e+038
Sys_Lim_2_Enable	Input fault check	Enable, disable
Sys_Lim_2_Latch	Input fault latch	Latch, unlatch
Sys_Lim_2_Type	Input fault type	Greater than or equal Less than or equal
Sys_Lim_2	Input limit in engineering units	−3.4082e+038 to 3.4028e+038
AnalogOut1	First of two analog outputs - board point	Point edit (output FLOAT)
Output_MA	Type of output current	Unused, 0−20 mA, 0−200 mA
Low_MA	Output mA at low value	0 to 200 mA
Low_Value	Output in engineering units at low mA	−3.4082e+038 to 3.4028e+038
High_MA	Output mA at high value	0 to 200 mA
High_Value	Output value in engineering units at high mA	−3.4082e+038 to 3.4028e+038
TMR Suicide	Suicide for faulty output current, TMR only	Enable, disable
Diff Limit	Current difference for suicide, TMR only	0 to 200 mA
D/A Err Limit	Difference between D/A reference and output, in % for suicide, TMR only	0 to 100 %
J4:IS200TBAIH1A	Terminal board connected to VAIC via J4	Connected, not connected
AnalogIn11	First of 10 analog inputs - board point	Point edit (input FLOAT)
AnalogOut3	First of two analog outputs - board point	Point edit (output FLOAT)

Board Points (Signals)	Description – Point Edit (Enter Signal Connection)	Direction	Type
L3DIAG_VAIC1	Board diagnostic	Input	BIT
L3DIAG_VAIC2	Board diagnostic	Input	BIT
L3DIAG_VAIC3	Board diagnostic	Input	BIT
SysLimit1_1	System limit 1	Input	BIT
:	:	Input	BIT
SysLimit1_20	System limit 1	Input	BIT
SysLimit2_1	System limit 2	Input	BIT
:	:	Input	BIT

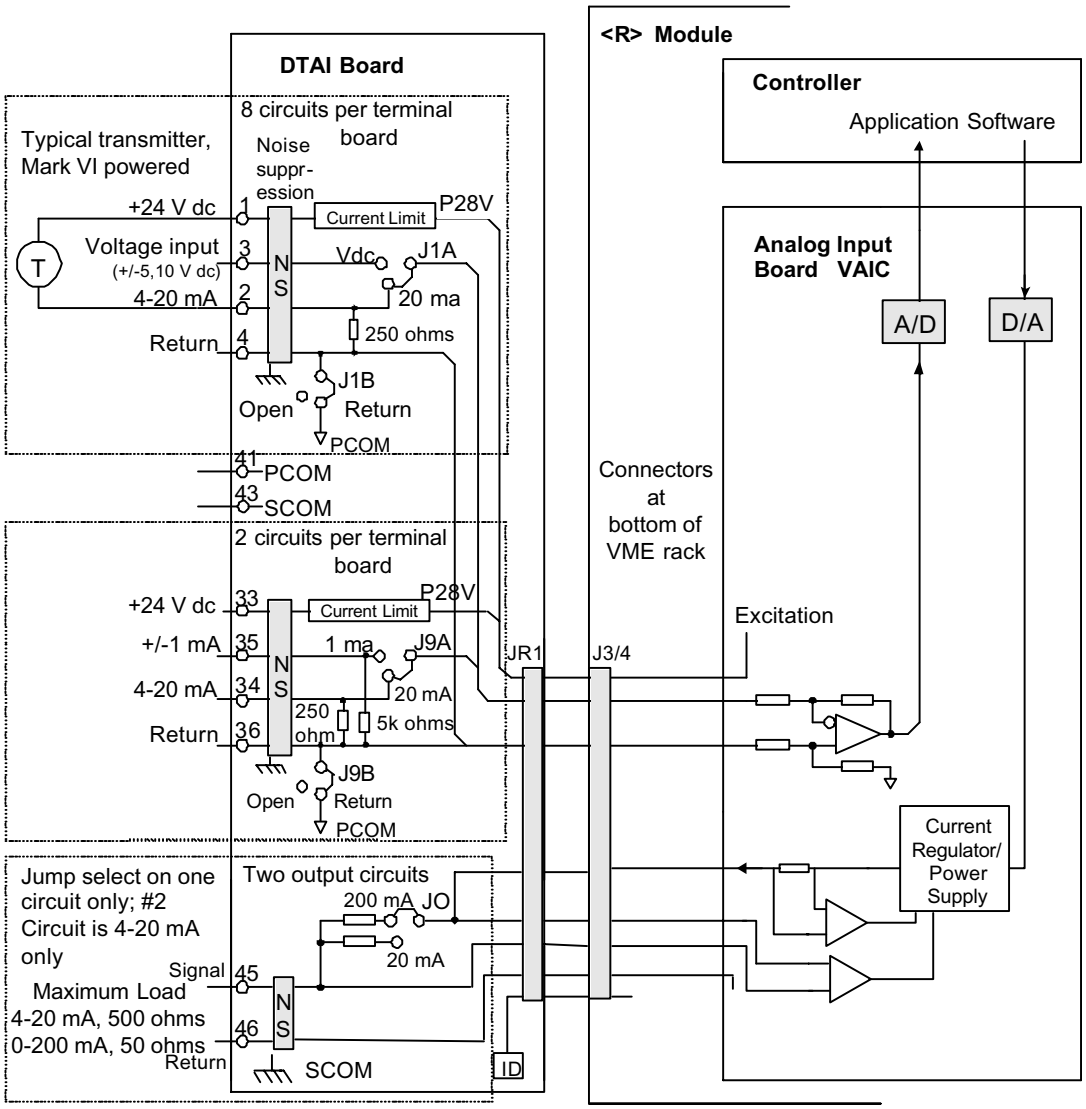
SysLimit2_20	System limit 2	Input	BIT
OutSuicide1	Status of suicide relay for output 1	Input	BIT
:	:	Input	BIT
OutSuicide4	Status of suicide relay for output 4	Input	BIT
DeltaFault	Excessive difference pressure	Input	BIT
CompStall	Compressor stall	Input	BIT
Out1MA	Feedback, total output current, mA	Input	FLOAT
:	:	Input	FLOAT
Out4MA	Feedback, total output current, mA	Input	FLOAT
CompPressSel	Selected compressor press, by stall Algo.	Input	FLOAT
PressRate Sel	Selected compressor press rate, by stall Algor.	Input	FLOAT
CompStallPerm	Compressor stall permissive	Output	BIT

DTAI Simplex Analog Input Terminal Board

The DTAI board is a compact analog input terminal board, designed for DIN-rail mounting. The board has 10 analog inputs and two analog outputs, and connects to the VAIC processor board with a single 37-pin. This cable is identical to those used on the larger TBAI terminal board. The terminal boards can be stacked vertically on the DIN-rail to conserve cabinet space.

Two DTAI boards can be connected to the VAIC for a total of 20 analog inputs and four analog outputs. Only a Simplexversion of the board is available.

The functions and on-board noise suppression are the same as those on the TBAI. 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 VAIC for system diagnostic purposes.

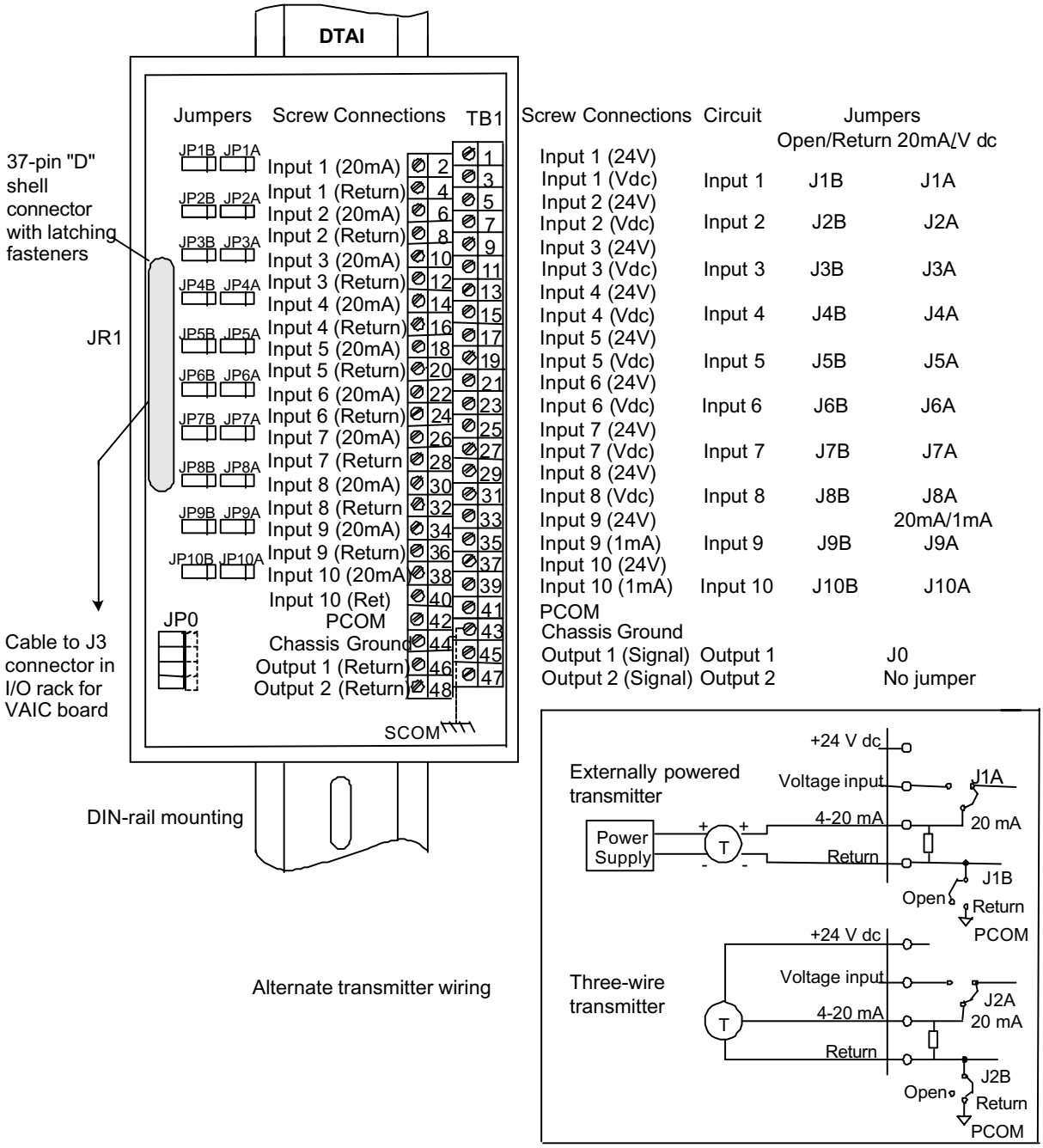


DTAI Board

Installation

There is no shield termination strip with this design.

The DTAI board slides into a plastic holder which mounts on the DIN-rail. The Euro-Block type terminal block has 48 terminals and is permanently mounted on the board. Typically #18 AWG wires (shielded twisted pair) are used. There are two screws for the SCOM (ground) connection, which should be as short a distance as possible.



DTAI Wiring, Cabling, and Jumper Positions

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
VAIC	**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. The firmware on this board cannot handle the terminal board it is connected to	Invalid terminal board connected to VME I/O board- check the connectors and call the factory
	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.
	32-65	Analog Input # Unhealthy	Excitation to transducer, bad transducer, open or short-circuit
	66-69	Output # Individual Current Too High Relative to Total Current. An individual current is N mA more than half the total current, where N is the configurable TMR_Diff Limit	Board failure
	70-73	Output # total Current Varies from Reference Current. Total current is N mA different than the reference current, where N is the configurable TMR_Diff Limit	Board failure or open circuit

74-77	Output # Reference Current Error. The difference between the output reference and the input feedback of the output reference is greater than the configured DA_Err Limit measured in percent	Board failure (D/A converter)
78-81	Output # Individual Current Unhealthy. Simplex mode only alarm if current out of bounds	Board failure
82-85	Output # Suicide Relay Non-Functional. The shutdown relay is not responding to commands	Board failure (relay or driver)
86-89	Output # 20/200 mA Selection Non-Functional. Feedback from the relay indicates incorrect 20/200 mA relay selection (not berg jumper selection)	Configured output type does not match the jumper selection, or VAIC board failure (relay).
90-93	Output # 20/20 mA Suicide Active. One output of the three has suicided, the other two boards have picked up current	Board failure
128-223	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.
224-249	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.

GE Industrial Systems

+1 540 387 7000
www.GEindustrial.com

General Electric Company
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

GE Industrial Systems

VAOC Analog Output 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.

GE may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not provide any license whatsoever to any of these patents. All license inquiries should be directed to the address below. If further information is desired, or if particular problems arise that are not covered sufficiently for the purchaser's purpose, the matter should be referred to:

GE Industrial Systems
Post Sales Service
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

Phone: + 1 888 GE4 SERV (888 434 7378, United States)
+ 1 540 378 3280 (International)

Fax: + 1 540 387 8606 (All)

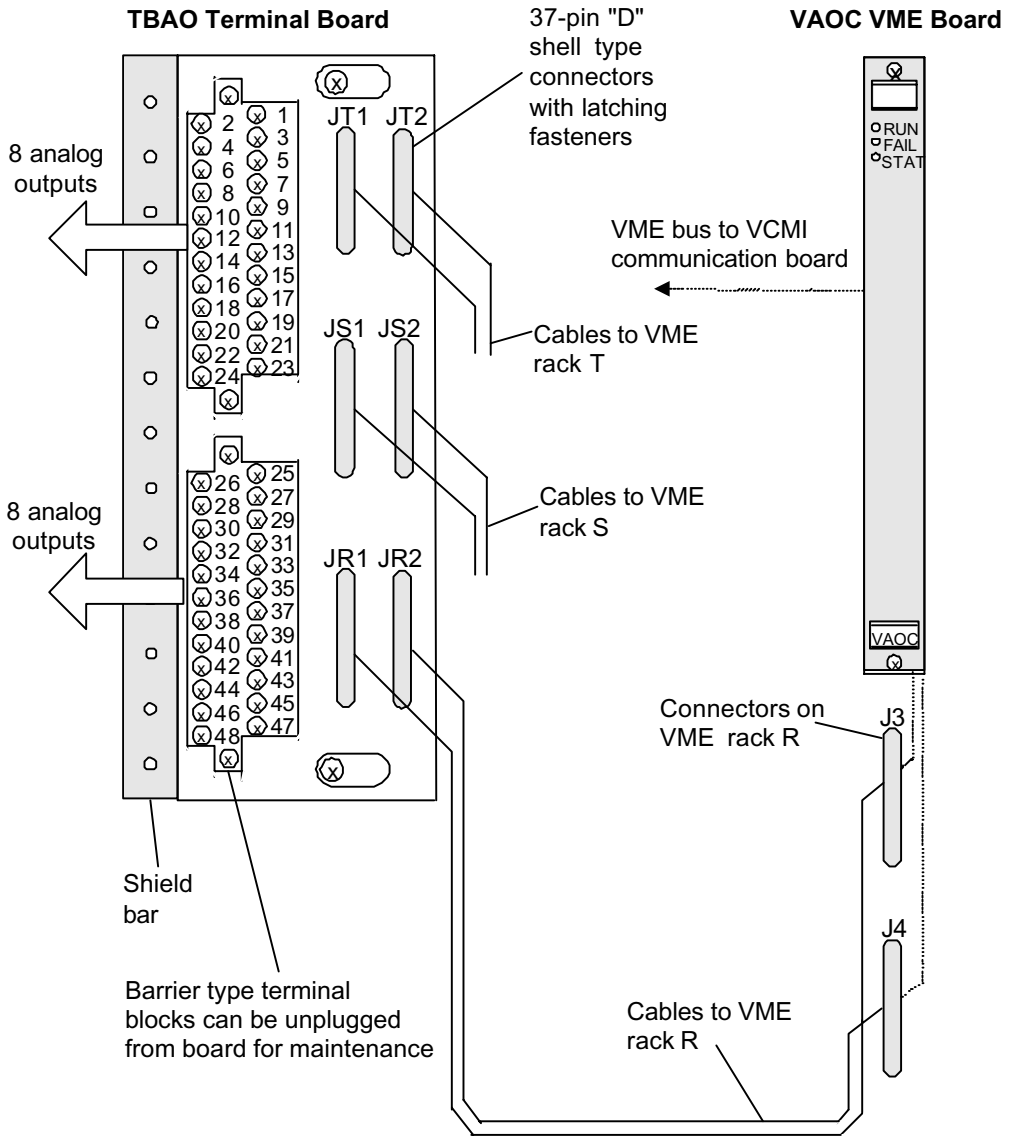
("+" indicates the international access code required when calling from outside the USA)

Issue date: 2002-06-30

Functional Description

The Analog Output Board (VAOC) controls 16 analog, 20 mA, outputs. These outputs are wired to two barrier type blocks on the Analog Output Terminal board (TBAO). Noise suppression circuitry to protect against surge and high frequency noise is mounted on the terminal board. Cables with molded plugs connect the terminal board to the VME rack where the VAOC processor board is located. The VAOC receives digital values from the controller over the VME backplane from the VCMI, and converts these to analog output currents.

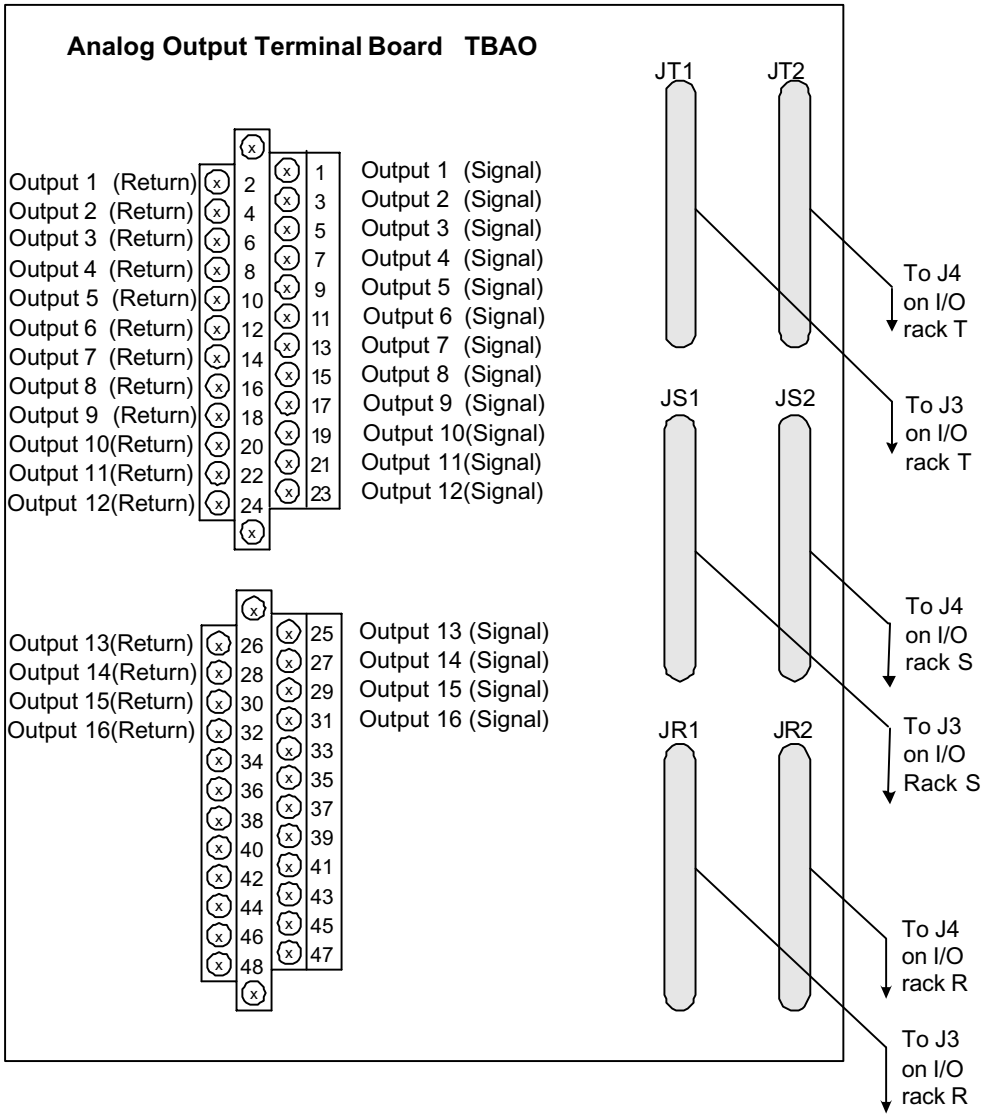
Note TMR applications control signals are fanned into the same terminal board from three VME board racks R, S, and T (see figure below). Six cables are required to support all 16 outputs with TMR.



Analog Output Terminal Board, I/O Board, and Cabling

Installation

The 16 analog outputs 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.



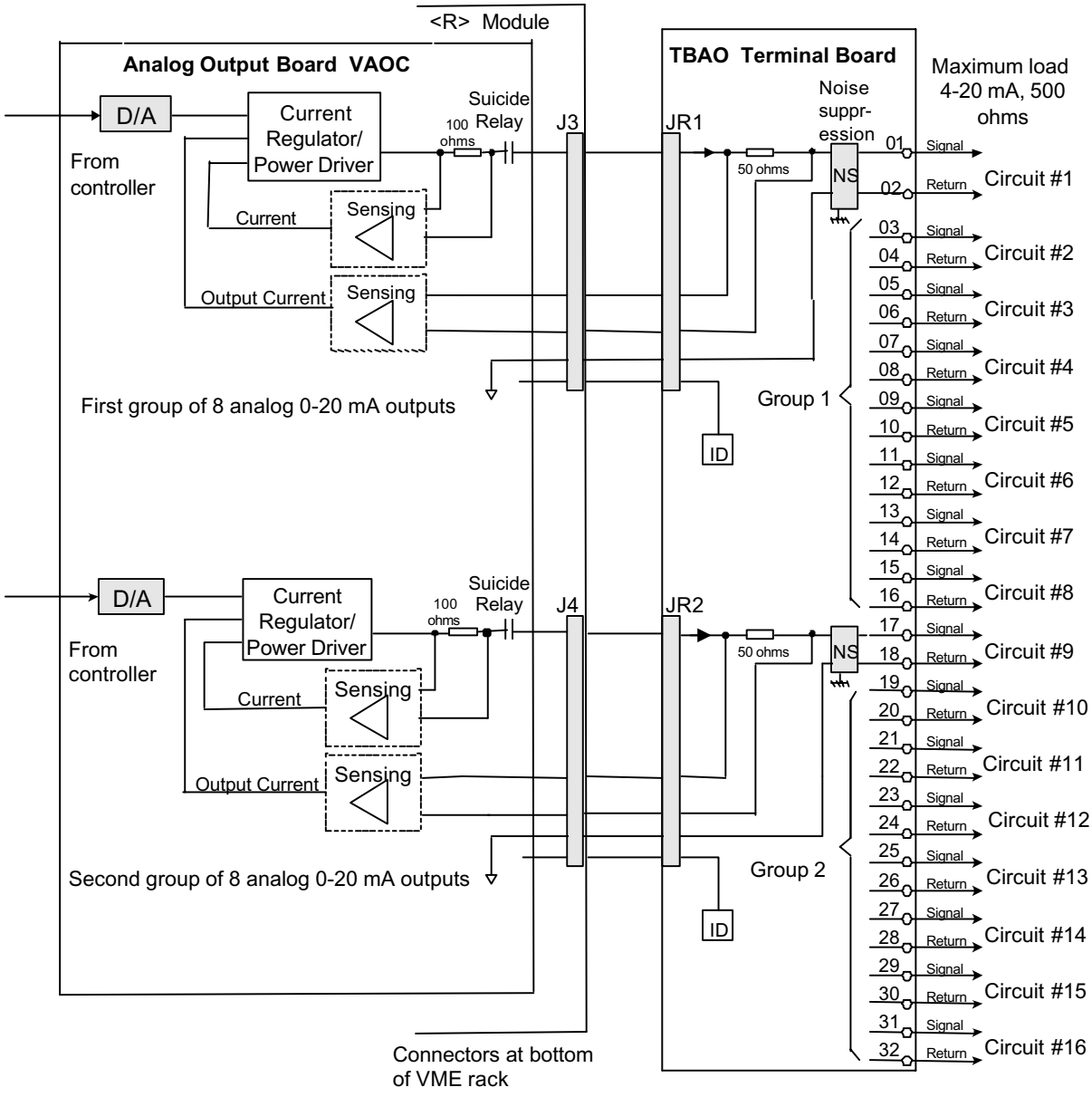
I/O terminal block with barrier terminals terminal blocks can be unplugged from terminal board for maintenance

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

TBAO Terminal Board Wiring

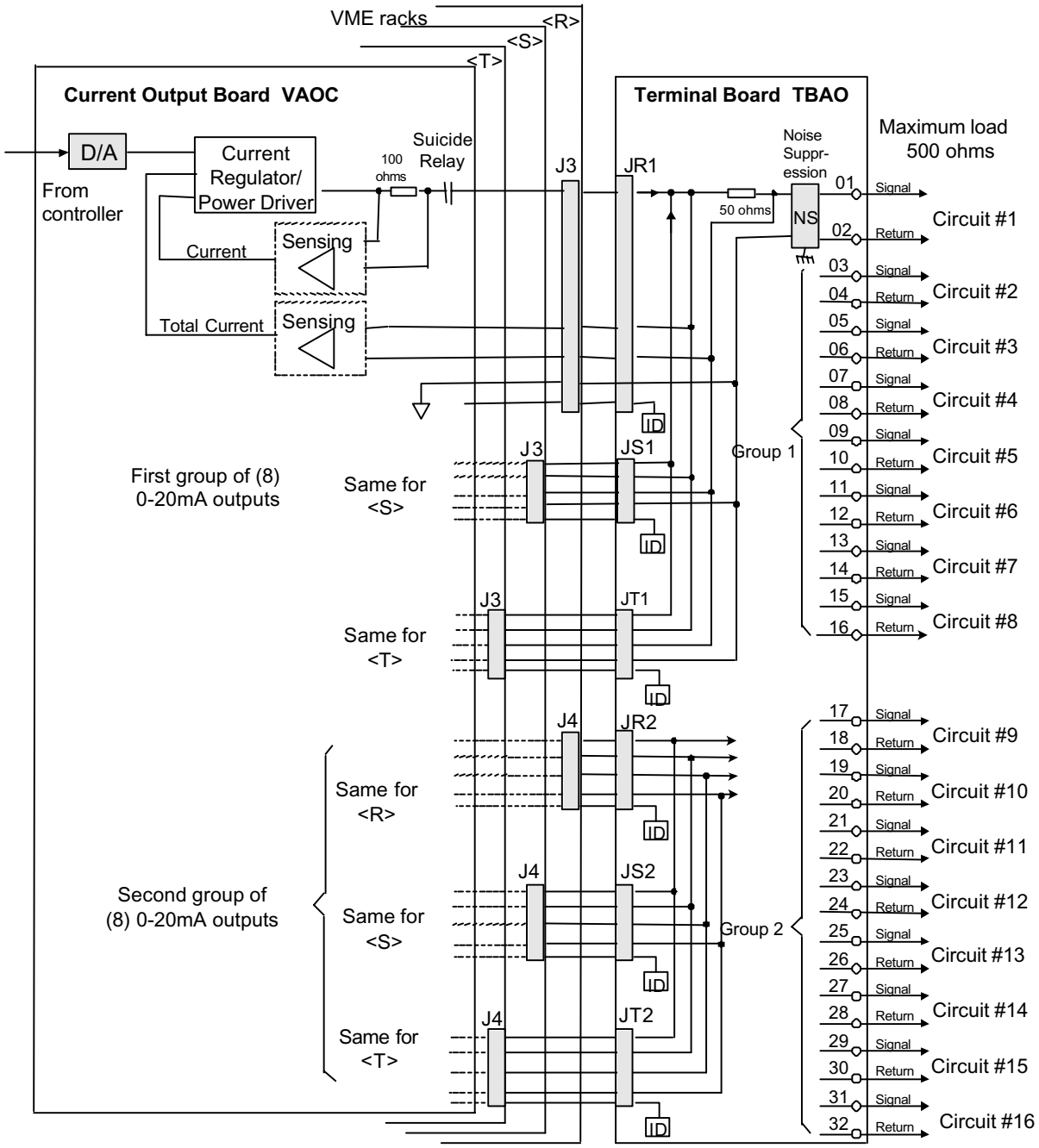
Operation

The terminal board supports 16 analog outputs. Driven devices have a maximum resistance of 500 ohms and can be located up to 300 meters (984 feet) from the turbine control cabinet. VAOC in the VME rack contains the D/A converter and driver which generates the controlled currents as shown in the figure below. The output current is controlled by the voltage drop across a resistor on the terminal board.



Simplex Analog Output Processing

In a TMR system, each analog current output is fed by the sum of the currents from the three VAOCs as shown in the figure below. The total output current is measured with a series resistor which feeds a voltage back to each control rack and VAOC. The resulting output is the voted middle value of the three currents. If one output fails, the other two pickup the current to the correct value. If one output fails high, it is disconnected by the shutdown relay.



TMR Analog Output Processing

Specifications

Each output is monitored by diagnostics. Voltage drops across the local and outer loop current sense resistors, at the control reference, D/A outputs, and at the shutdown relay contacts are sampled and digitized. In the event of a malfunction that cannot be cleared by a command from the processor, the circuit is disconnected by opening the shutdown relay contacts. This isolation function is only operational when configured for TMR operation. Filters reduce high frequency noise and suppress surge on each output near the point of signal exit.

Item	Specification
Number of channels	16 current output channels, single ended (one side connected to common)
Analog outputs	0 – 20 mA, up to 500 ohm burden Response better than 50 rad/sec
D/A converter resolution/accuracy	12-bit resolution with 0.5% accuracy
Frame rate	100 Hz on all 16 outputs
Fault detection	Local current Outer total (TMR) current D/A converter output Suicide relay operation

Diagnostics

Three LEDs at the top of the VAOC 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 displays a steady orange if a diagnostic alarm condition exists in the board.

Standard diagnostic information is available on the inputs and outputs, including high and low limit checks, and high and low system limit checks (configurable). If any one of the 16 outputs goes unhealthy a composite diagnostic alarm, L3DIAG_VAOC, occurs. 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 if they go healthy.

Each cable connector on the terminal board has its own ID device which is interrogated by the I/O board. The ID device is a read-only chip coded with the terminal board serial number, board type, revision number, and the JR, JS, JT connector location.

Configuration

Like all I/O boards, the VAOC board is configured using the toolbox. This software usually runs on a data highway connected CIMPLICITY station or workstation. The following table defines the configuration choices. Refer to GEH-6403, *Control System Toolbox for Configuring the Mark VI Turbine Controller.*

Parameter	Description	Choices
Configuration		
Output Voting	Select type of output voting	Simplex, TMR
J3:IS200TBAOH1A	Terminal board connected to VAOC via J3	Connected, not connected
AnalogOut1	Analog output 1 - board point (first set of 8 analog outputs)	Point edit (output FLOAT)
Output_MA	Type of output current	Unused, 0–20 mA
Low_MA	Output MA at low value	0 to 20 mA
Low_Value	Output in engineering units at low MA	–3.4028e+038 to 3.4028e+038
High_MA	Output MA at high value	0 to 20 mA
High_Value	Output value in engineering units at high MA	–3.4028e+038 to 3.4028e+038
TMR_ Suicide	Enable Suicide for faulty output current, TMR only	Enable, disable
TMR_Diff Limit	Current difference in MA for suicide, TMR only	0 to 20 mA
D/A_Err Limit	Difference between D/A reference and output, in % for suicide, TMR only	0 to 100 %
J4:IS200TBAOH1A	Terminal board connected to VAOC via J4	Connected, not connected
AnalogOut9	Analog output 9 - board point (second set of 8 analog outputs)	Point edit (output FLOAT)

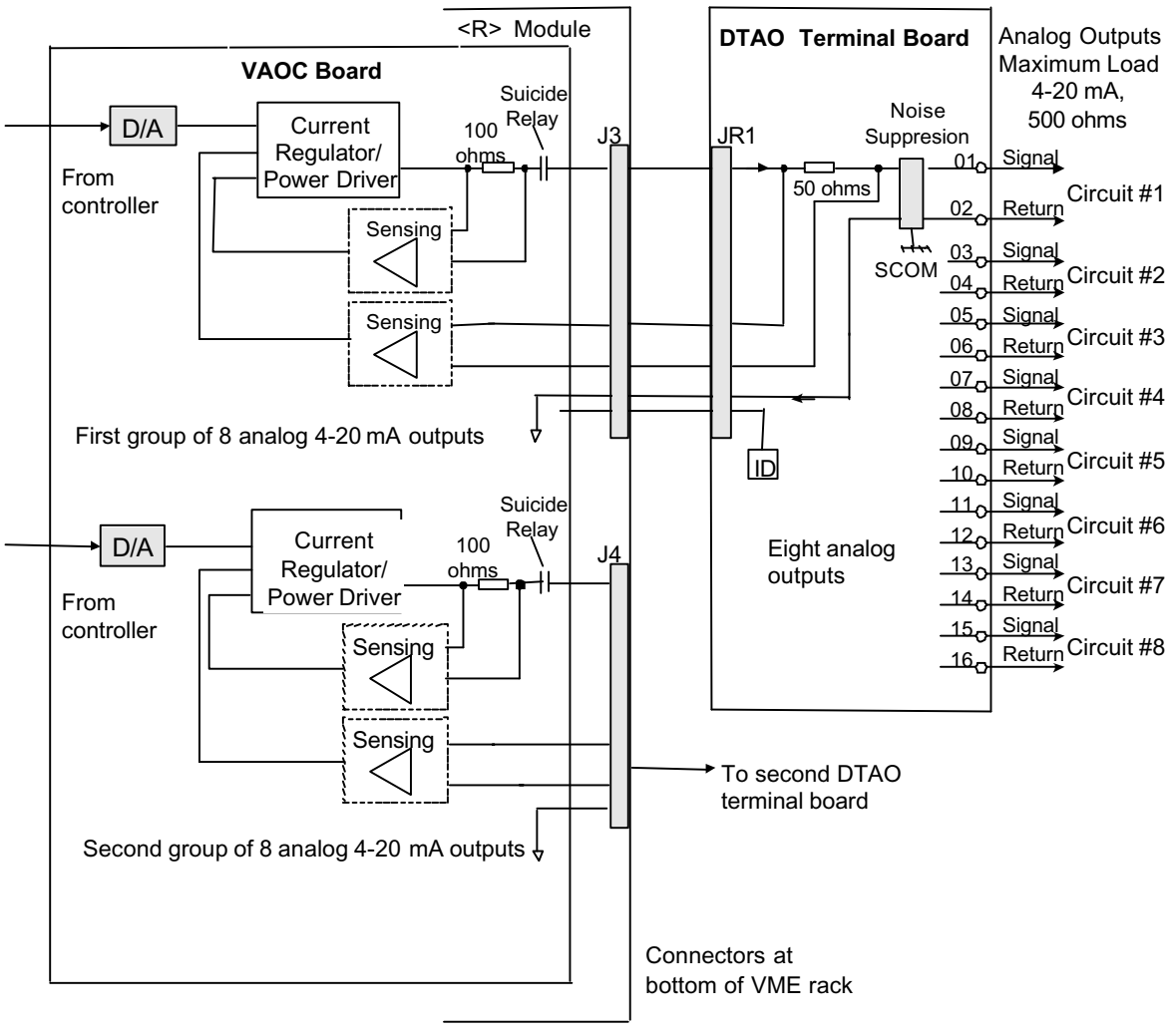
Board Points Signals	Description–Point Edit (Enter Signal Connection)	Direction Type	
L3DIAG_VAOC1	Board diagnostic	Input	BIT
L3DIAG_VAOC2	Board diagnostic	Input	BIT
L3DIAG_VAOC3	Board diagnostic	Input	BIT
OutSuicide1	Status of suicide relay for output 1	Input	BIT
:	:	Input	BIT
OutSuicide16	Status of suicide relay for output 16	Input	BIT
Out1MA	Measure total output current in mA	Input	FLOAT
:	:	Input	FLOAT
Out16MA	Measure total output current in mA	Input	FLOAT

DTAO Simplex Analog Output Terminal Board

The DTAO board is a compact analog output terminal board, designed for DIN-rail mounting. The DTAO board has eight analog outputs and connects to the VAOC processor board with a single 37-pin cable. This cable is identical to those used on the larger TBAO terminal board.

The terminal boards can be stacked vertically on the DIN-rail to conserve cabinet space. Two DTAO boards can be connected to the VAOC for a total of 16 analog outputs. Only a Simplex version of this board is available.

The functions and on-board noise suppression are the same as those on TBAO. 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 VAOC for system diagnostic purposes

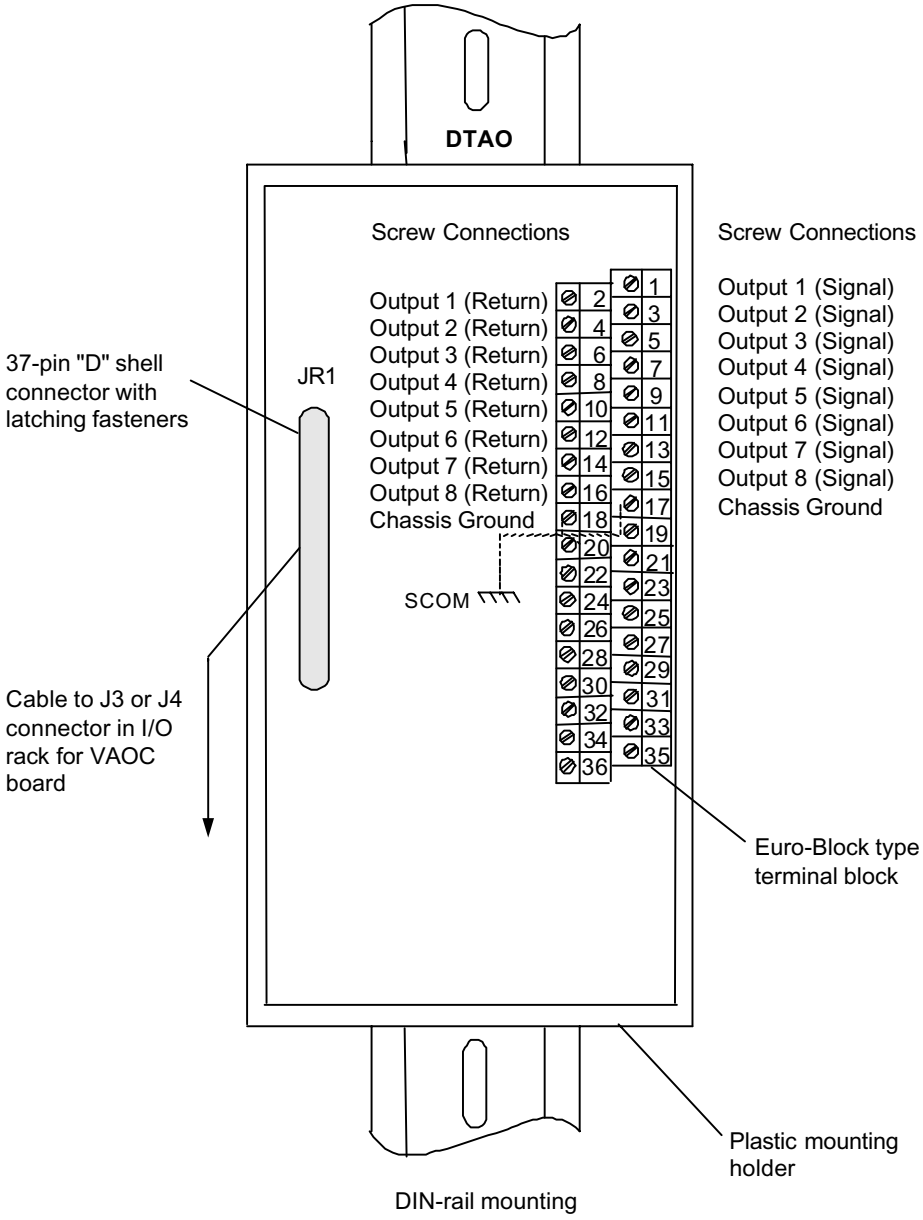


DTAO Board

Installation

There is no shield termination strip with this design.

The DTAO board slides into a plastic holder, which mounts on the DIN-rail. The eight analog outputs are wired directly to the terminal block as shown in the following figure. The Euro-Block type terminal block has 36 terminals and is permanently mounted on the terminal board. Typically #18 AWG wires (shielded twisted pair) are used. There are two screws for the SCOM (ground) connection which should be as short a distance as possible.



DTAO Wiring and Cabling

I/O Board Alarms

Diagnostic alarms for any I/O board can be displayed or 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
VOAC	**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.
	82-97	Output # Total Current Too High Relative to Total Current. An individual current is N mA more than half the total current, where N is the configurable TMR_Diff Limit	Board failure
	98-113	Output # Total Current Varies from Reference Current. Total current is N mA different than the reference current, where N is the configurable TMR_Diff Limit	Board failure or open circuit
	114-129	Output # Reference Current Error. The difference between the output reference and the input feedback of the output reference is greater than the configured DA_Err Limit measured in percent	Board failure (D/A converter)

130-145	Output # Individual Current Unhealthy. Simplex mode alarm indicating current is too high or too low	Board failure
146-161	Output # Suicide Relay Non-Functional. The suicide relay is not responding to commands	Board failure (relay or driver)
162-177	Output # Suicide Active. One output of three has suicided, the other two boards have picked up the current	Board failure

GE Industrial Systems

+1 540 387 7000
www.GEindustrial.com

General Electric Company
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

GE Industrial Systems

VCCC Boards

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.

GE may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not provide any license whatsoever to any of these patents. All license inquiries should be directed to the address below. If further information is desired, or if particular problems arise that are not covered sufficiently for the purchaser's purpose, the matter should be referred to:

GE Industrial Systems
Post Sales Service
1501 Roanoke Blvd.
Salem, VA 24153-6492 USA

Phone: + 1 888 GE4 SERV (888 434 7378, United States)
+ 1 540 378 3280 (International)

Fax: + 1 540 387 8606 (All)

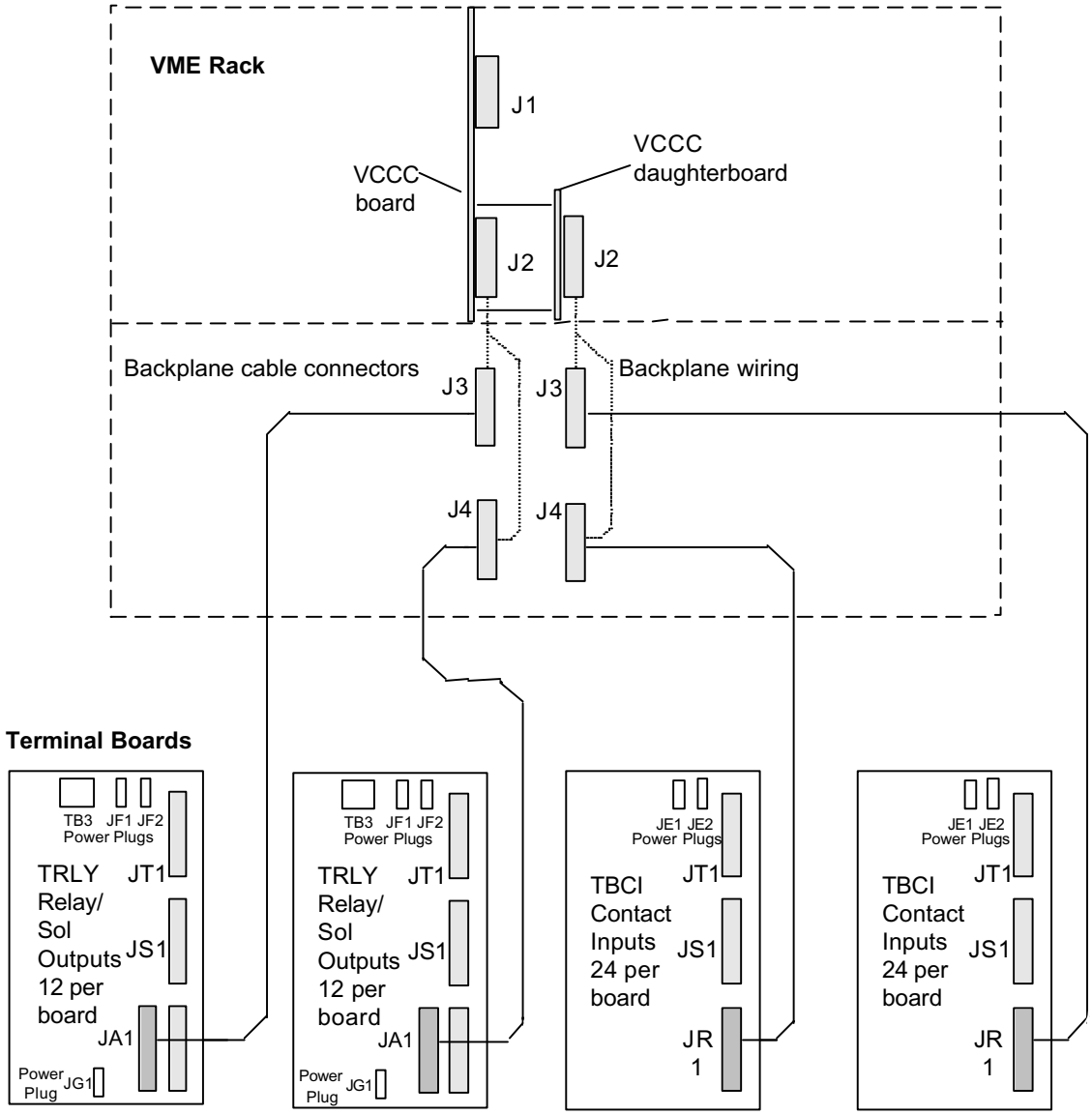
("+" indicates the international access code required when calling from outside the USA)

Issue date: 2002-06-30

VCCC Contact Input Board

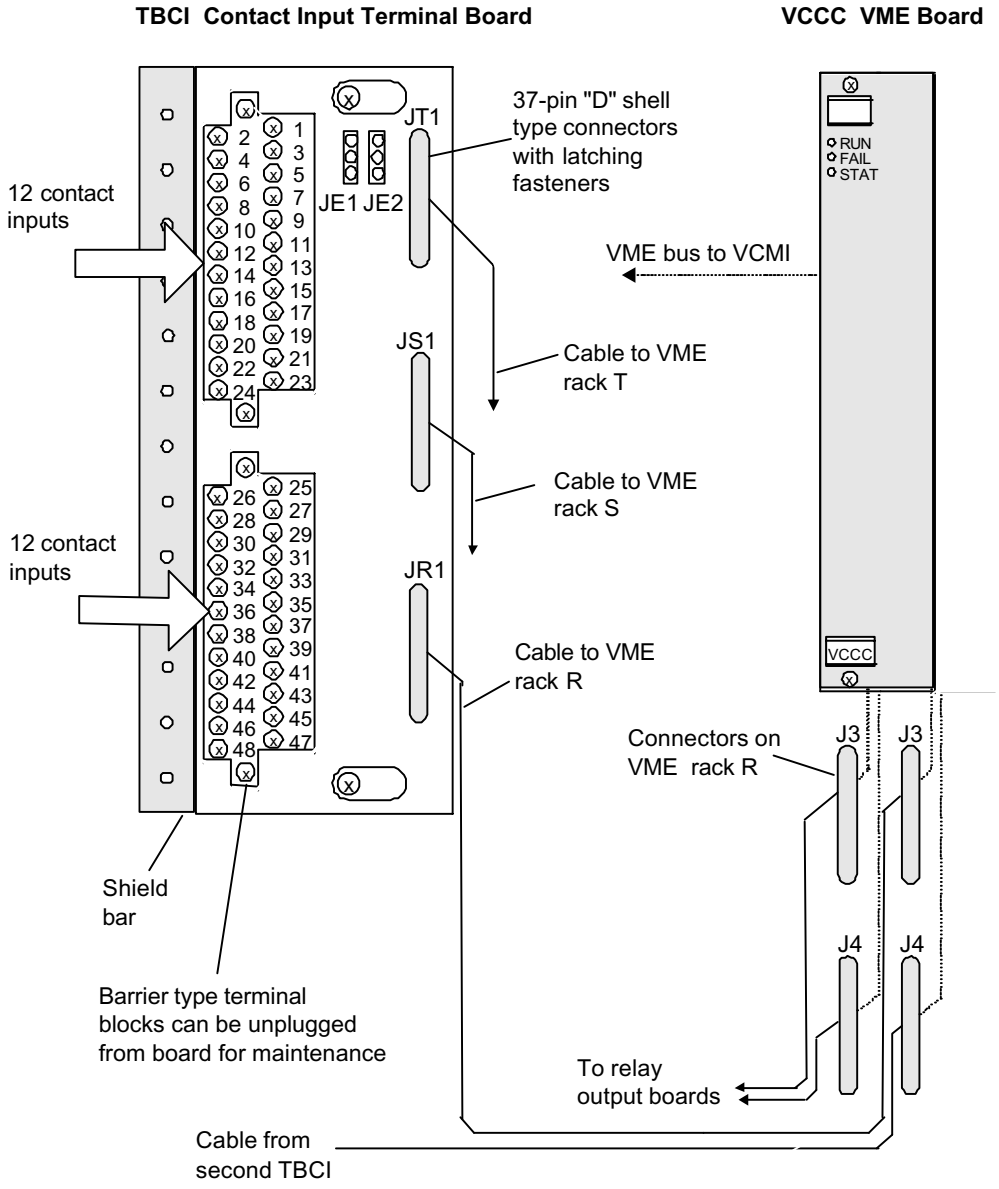
VCRC is a single slot version of VCCC with the same functionality and contact input cables plug into the front of the board.

The Contact Input/Relay Output Board (VCCC) with its associated daughterboard accepts 48 discrete inputs and controls 24 relay outputs. VCCC is a double width module and connects to two sets of J3/J4 plugs via the VME backplane. The Contact Input Terminal Board (TBCI) accepts 24 dry contact inputs, and two boards are required to support 48 inputs. The Relay Output Terminal Board (TRLY) controls 12 relays and is described in the next section.



Simplex Boards and Cabling for Contact Inputs and Relay Outputs

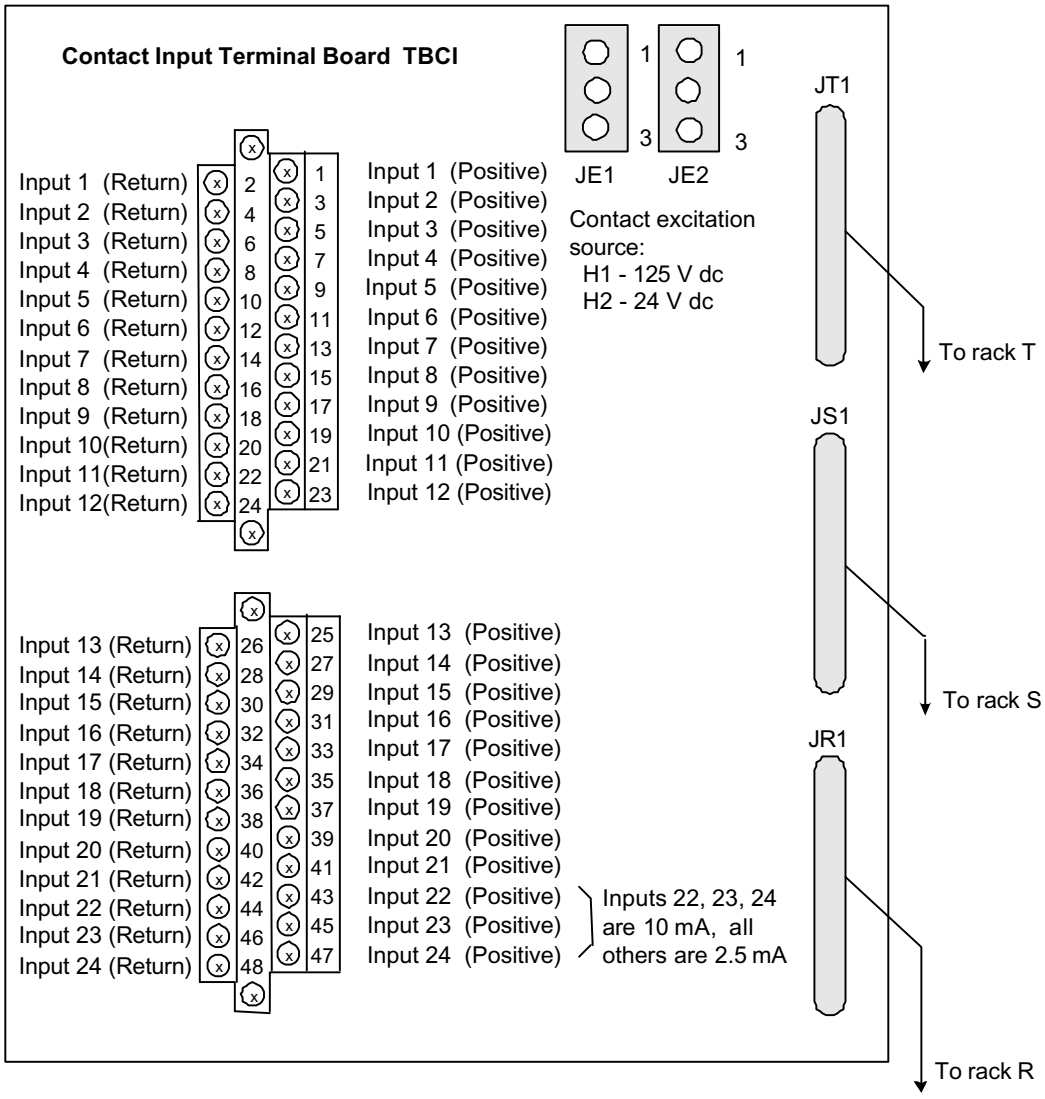
The first 24 dry contact inputs are wired to two barrier type blocks on the TBCI, and a second terminal board is required for inputs 25 – 48. Dc power for the contacts is provided. Contact inputs have noise suppression circuitry to protect against surge and high frequency noise. Cables with molded plugs connect the terminal board to the VME rack where the VCCC processor board is located.



Contact Input Terminal board, I/O Board, and Cabling

Installation

The 24 dry contact inputs 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. The 125 V dc excitation voltage is cabled in through plugs JE1 and JE2.

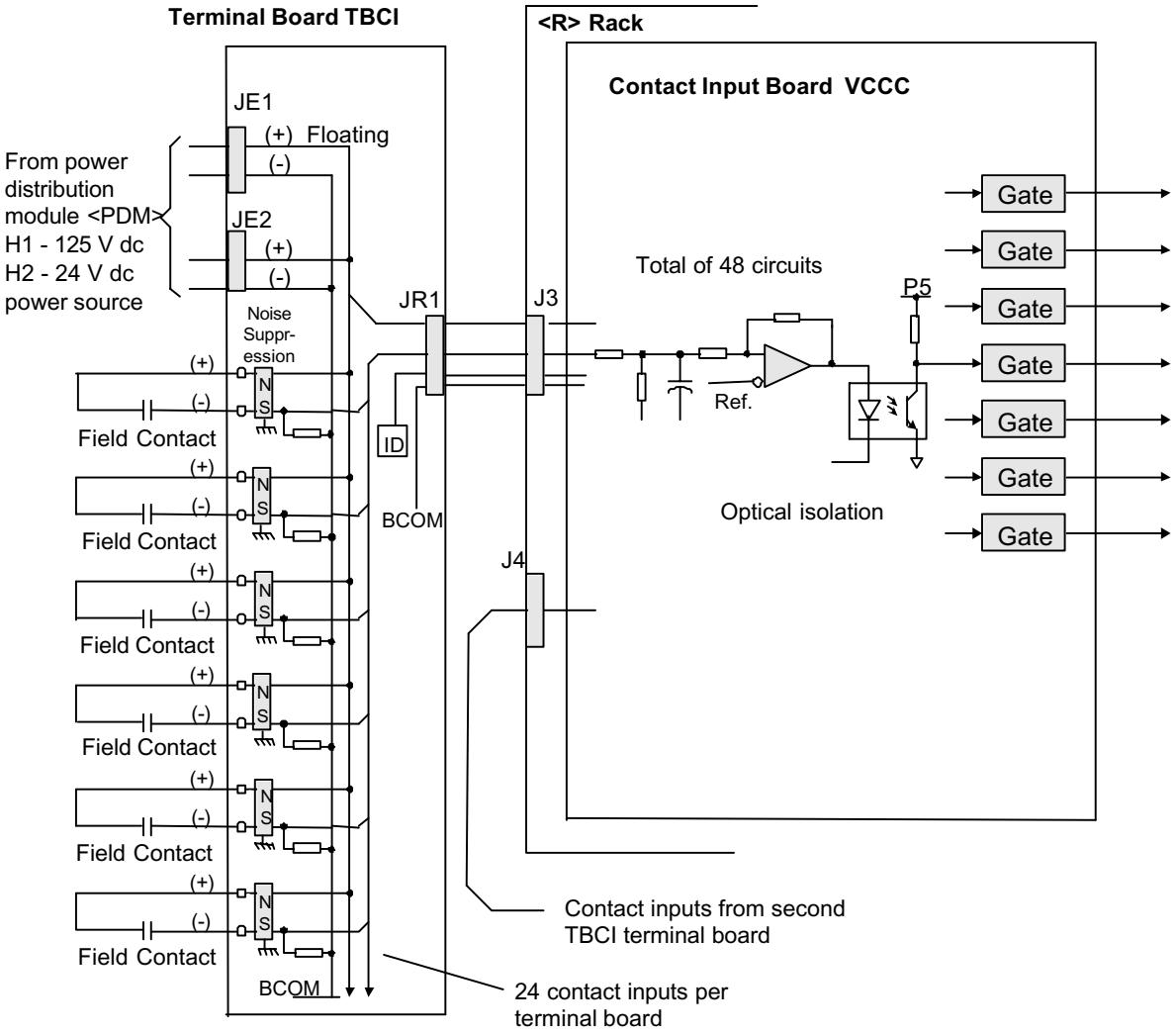


TBCI Terminal Board Wiring

Operation

The VCCC passes the input voltages through optical isolators and transfers the signals over the VME backplane to the VCMI. The VCMI then sends them to the controller. The contact input processing is shown in the following figure.

The TBCIH1 dry contact inputs are powered from a floating 125 V dc (100 – 145 V dc) supply from the turbine control. Power converters convert the 115/230 V ac and/or 125 V dc power sources to a redundant, internal 125 V dc bus to power the electronics. The 125 V dc bus is current limited in the Power Distribution Module prior to feeding each contact input. The TBCIH2 dry contact inputs are powered from a floating 24 V dc (18.5 – 32 V dc) supply.

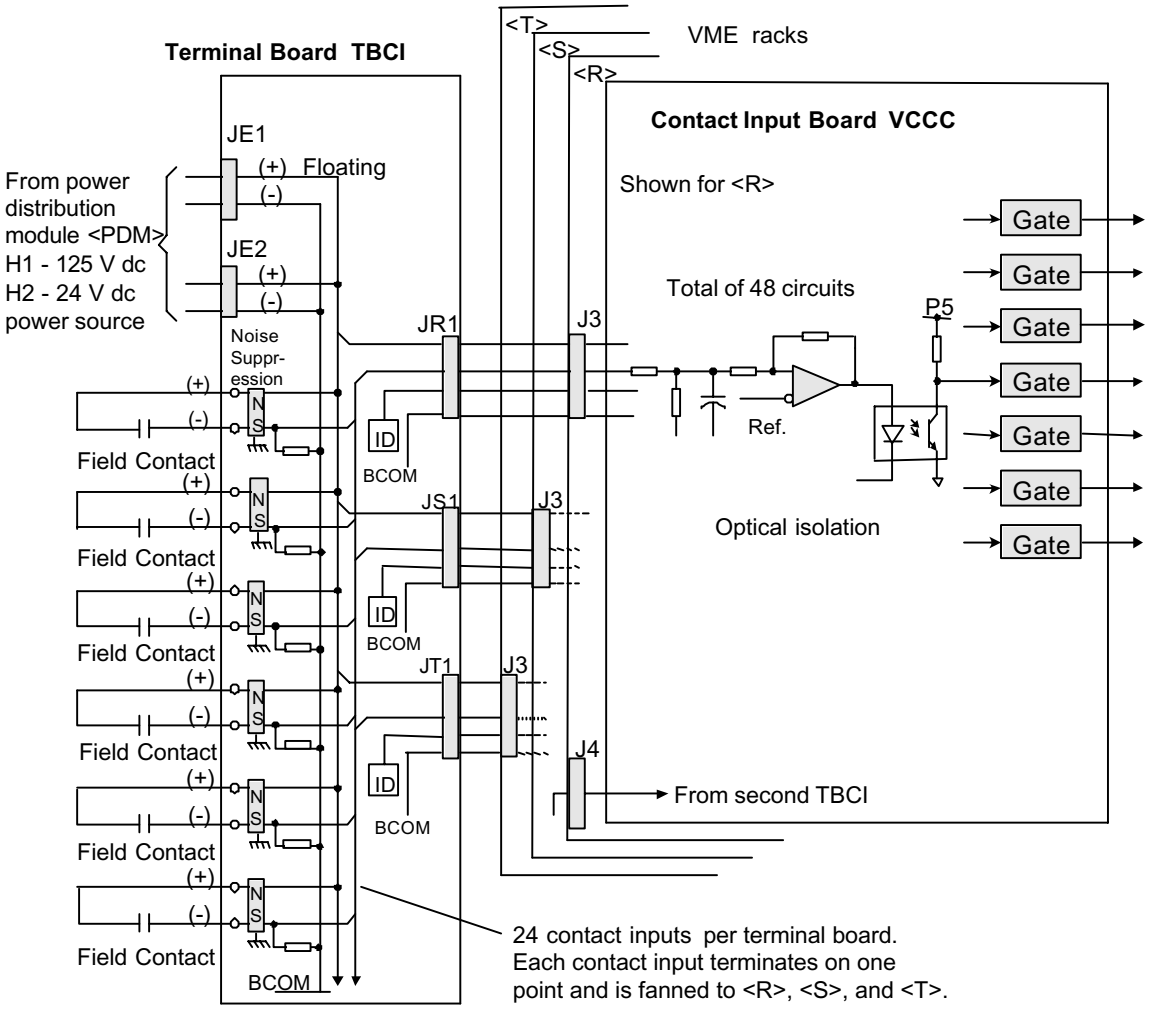


Simplex Contact Input Processing

A pair of termination points is provided for each input with one point (screw) providing the positive dc source and the second point providing the return (input) to the board. The current loading is 2.5 mA per point for 21 of the inputs on each terminal board, and the other three have a 10 mA load to support interface with remote solid-state output electronics.

Each input is optically isolated and sampled at frame rate for control functions, and at 1ms for SOE reporting. A 4 ms hardware filter is used, and noise rejection is 60 V rms at 125 V dc excitation. Contact input circuitry is designed for NEMA Class G creepage and clearance.

For TMR applications contact input voltages are fanned out to three VME board racks R, S, and T via plugs JR1, JS1, and JT1. The signals are processed by the three VCCCs and the results voted by the VCMI board in each controller rack.



TMR Contact Input Processing

Specifications

High speed scanning and recording at 1 ms rate is available for inputs monitoring important turbine variables. The sequence of events recorder reports all contact openings and closures with a time resolution of 1 ms. Contact chatter and pulse widths down to 6 ms are reported.

Filters reduce high frequency noise and suppress surge on each input near the point of signal exit. Noise and contact bounce is filtered with a 4 ms filter. Ac voltage rejection (50/60 Hz) is 60 V rms with 125 V dc excitation.

VCCC Specifications

Item	Specification
Number of channels	48 dry contact voltage input channels (24 per terminal board)
Excitation voltage	H1 - Nominal 125 V dc, floating, ranging from 100 to 145 V dc H2 – Nominal 24 V dc, floating, ranging from 18.5 to 32 V dc
Input current	H1 for 125 V dc applications: First 21 circuits draw 2.5 mA (50 kohms) Last three circuits draw 10 mA (12.5 kohms) H2 for 24 V dc applications: First 21 circuits draw 2.5 mA (10 kohms) Last three circuits draw 9.9 mA (2.42 kohms)
Isolation	Optical isolation to 1500 volts on all inputs
Input filter	Hardware filter, 4 ms
Ac voltage rejection	60 V rms @ 50/60 Hz at 125 V dc excitation
Frame rate	System dependent scan rate for control purposes 1,000 Hz scan rate for SOE monitoring
Power consumption	20.6 watts on the terminal board N/A watts in the VCCC board
Fault detection	Loss of contact input excitation voltage Non-responding contact input in test mode Unplugged cable

Diagnostics

If any one of the 48 inputs goes unhealthy, a composite diagnostic alarm, L3DIAG_VCCC occurs. 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 if they go healthy

Three LEDs at the top of the VCCC front panel provide status information. The normal RUN condition is a flashing green, 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

The dry (isolated) external contacts are monitored, and also the excitation voltage. If the excitation drops to below 40% of the nominal voltage, a diagnostic alarm is set and latched

Each terminal board 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 board serial number, board type, revision number, and the JR1/JS1/JT1 connector location. Refer to GEH-6421D, Vol. I *Mark VI System Guide*, Chapter 8, *Troubleshooting and Diagnostics*

Configuration

Like all I/O boards, the VCCC is configured using the toolbox. This software usually runs on a data-highway connected CIMPLICITY station or workstation. The following table defines configuration choices and defaults. Refer to GEH-6403, *Control System Toolbox for Configuring the Mark VI Turbine Controller*.

Typical VCCC (Contact Input) Configuration

Parameter	Description	Choices
Configuration		
System Limits	Enable all system limit checking	Enable, disable
J3A:IS200TBCIH1A	Terminal board connected to VCCC from J3	Connected, not connected
Contact01	First contact of 24 on first terminal board - board point	Point edit (input BIT)
Contact input	Select contact input	Used, unused
Signal invert	Inversion makes signal true if contact open	Normal, invert
Sequence of events	Select input for sequence of events scanning	Enable, disable
Signal filter	Contact input filter in milliseconds	0, 10, 20, 50
J4A:IS200TBCIH1A	Terminal board connected to VCCC from J4	Connected, not connected
Contact01	First contact of 24 on second terminal board - board point	Point edit (input BIT)

Board Points Signals	Description-Enter Signal Connection Name	Direction Type
L3DIAG_VCCC1	Board diagnostic	Input BIT
L3DIAG_VCCC2	Board diagnostic	Input BIT
L3DIAG_VCCC3	Board diagnostic (For relay output points, see TRLY)	Input BIT