MANUFACTURER DOCUMENT PACKAGE

# Manufacturer's Manual

Reference package for procurement and maintenance review

GENERAL ELECTRIC

## IS200TBAIH1CED

**ANALOG I/O TERMINAL BOARD**

Used with the applicable Mark VIe TBAIH1C configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: GEH-6721G Mark VIe Control System Guide Volume II, TBAI section pages 43 to 48

| Fault | Fault Description | Possible Cause |
|---|---|---|
| 317 | Controller pid [ ], exch [ ] minor sig mismatch, IONet [ ] | I/O pack outputs exchange received with minor signature different than expected |
| 318 | Controller pid [ ], exch [ ] cfg timestamp mismatch, IO-Net [ ] | I/O pack outputs exchange received with configuration timestamp different than expected |
| 335 | Code Segment CRC mismatch | Process Code Segment CRC mismatch |
| 338 | I/O pack Mapper SSI signals are not being updated | I/O pack SSI data is not being updated |
| 339 | I/O pack App SSO signals are not being received | I/O pack SSO data is not being updated |
| 340 | I/O pack Mapper static data structure CRC mismatch | Mapper static data CRC does not match |
| 341 | I/O pack Mapper I/O compatibility code mismatch | I/O pack mapper I/O Compat does not match firmware |
| 342 | I/O pack App compatibility code mismatch | I/O pack App I/O Compat does not match firmware |
| 343 | I/O pack App BOPLIB static data CRC mismatch | I/O pack application data structure CRC changed |
| 344 | I/O pack process code segment CRC mismatch | I/O pack process - code seg CRC bad |
| 345 | I/O pack App static config data CRC mismatch | I/O pack application data structure CRC changed |
| 351 | I/O pack App Periodic thread [ ] timing overrun | An I/O pack application thread over/under run |
| 353 | Sys Config Shmem CRC mismatch | Config Shmem CRC changed |

# TBAI Analog Input/Output

## Functional Description

The Analog Input/Output (TBAI) terminal board supports 10 analog inputs and 2 outputs. The 10 analog inputs accommodate two-wire, three-wire, four-wire, or externally powered transmitters. The analog outputs can be set up for 0-20 mA or 0-200 mA current. Inputs and outputs have noise suppression circuitry to protect against surge and high frequency noise.

TBAI has three DC-37 pin connectors provided on TBAI for connection to the I/O processors. Simplex applications are supported using a single connector (JR1). TMR applications are supported using all three connectors.

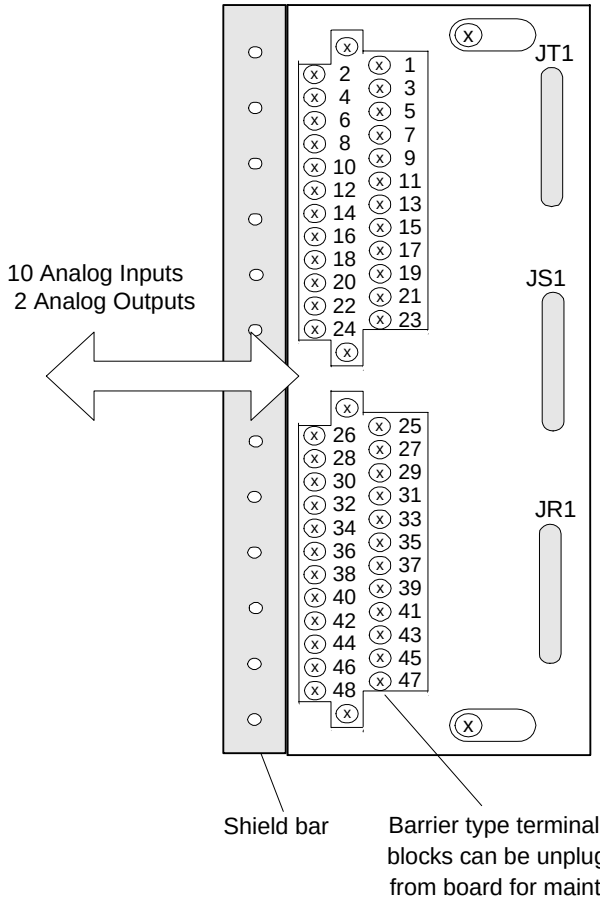
In TMR applications, the input signals are fanned to the three connectors for the R, S, and T controls. TMR outputs combine the current of the three connected output drivers and determine the total current with a measuring shunt. TBAI then presents the total current signal to the I/O processors for regulation to the commanded setpoint.

### Mark VI Systems

In the Mark* VI system, TBAI works with VAIC processor and supports simplex and TMR applications. One or two TBAIs can be connected to the VAIC. In TMR systems, TBAI is cabled to three VAIC boards.

### *Mark VIe Systems*

In the Mark VIe system, TBAI works with the PAIC I/O pack and supports simplex and TMR applications. In TMR systems, three PAICs plug directly into the TBAI.




**J ports conections:**

Plug in PAIC I/O Pack for Mark VIe system

or

Cables to VAIC boards for Mark VI system;

The number and location depends on the level of redundancy required.

*TBAI Input Terminal board*

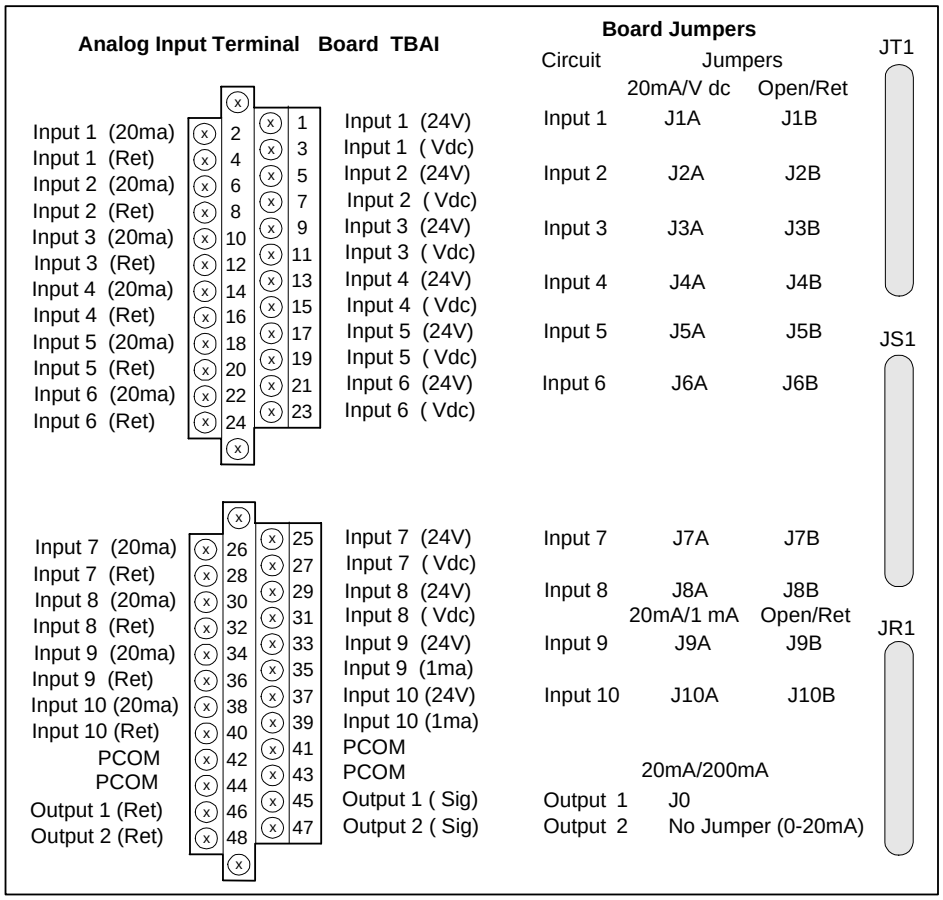
## *Installation*

Connect the input and output wires 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 terminal attachment point is located adjacent to each terminal block.

TBAI can accommodate the following analog I/O types:

- 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, 0-20 mA
- Analog output, 0-200 mA

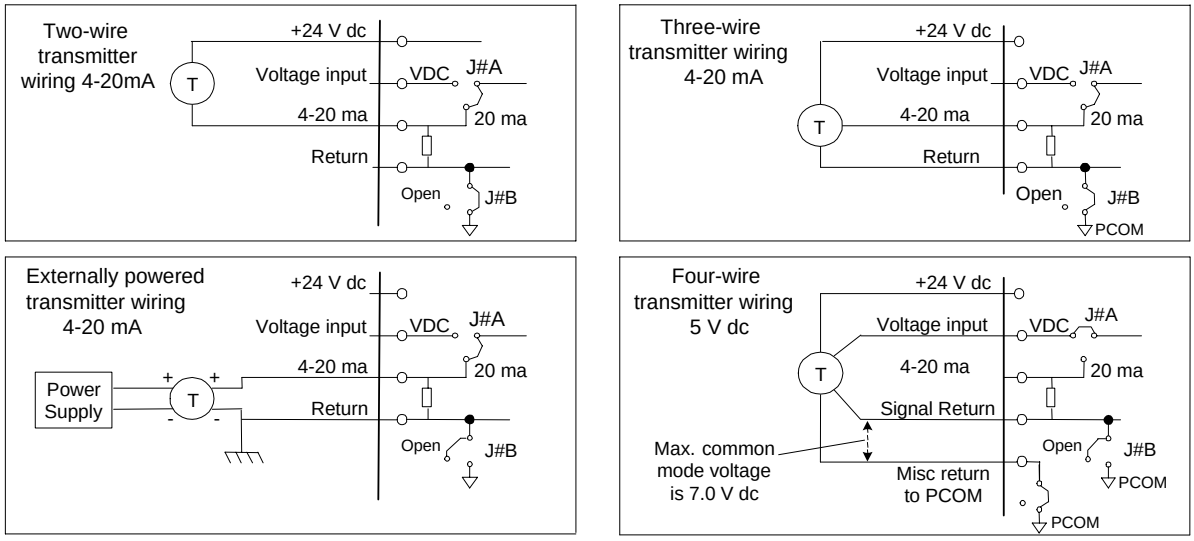
The following diagram shows the wiring connections, jumper positions, and cable connections for TBAI.




**J ports connections:**

Plug in PAIC I/O Pack for Mark VIe
or
Cable(s) to VAIC board(s) for Mark VI;

The number and location depends on the level of redundancy required.




*TBAI Terminal Board Wiring*

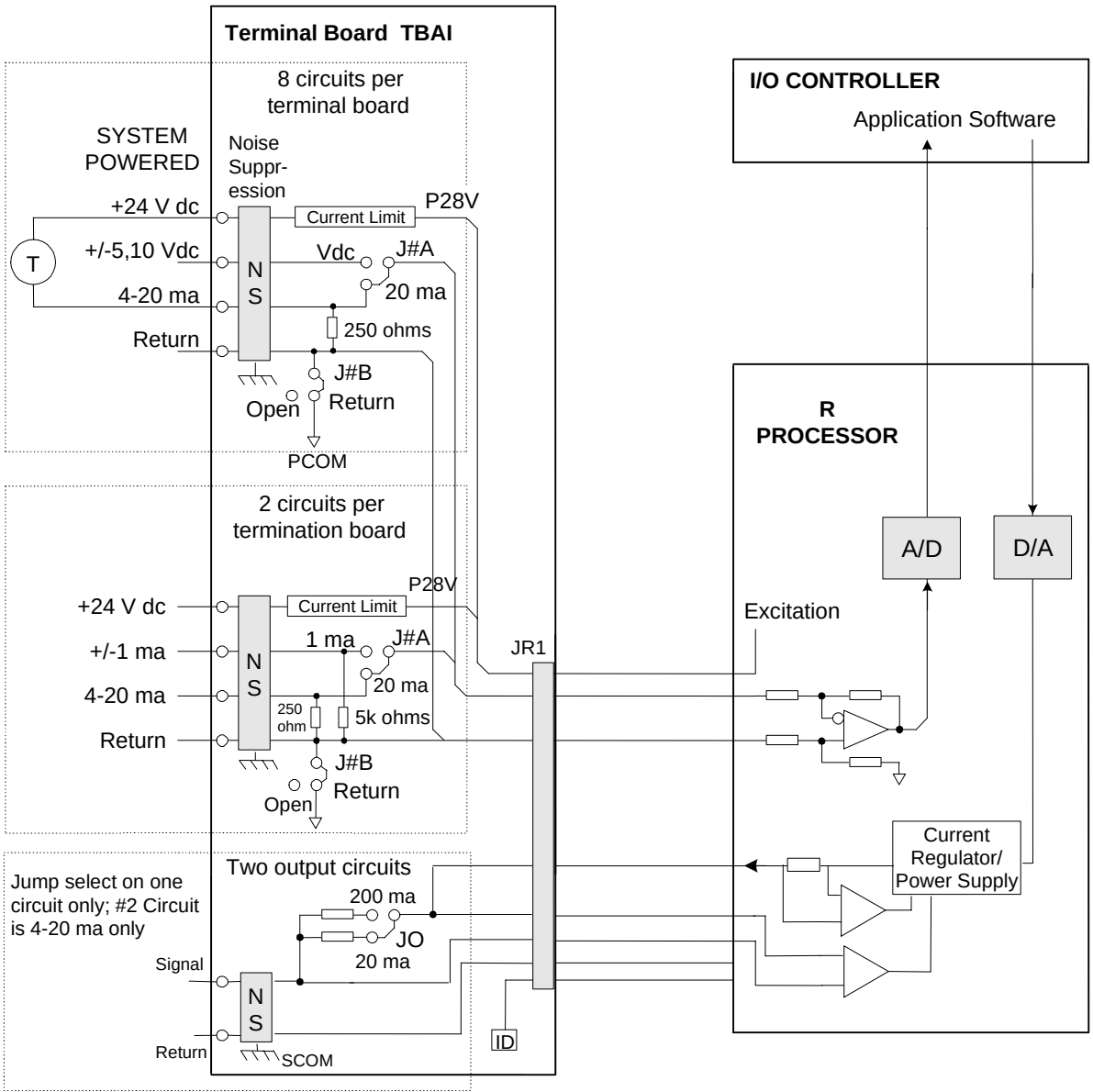
## *Operation*

TBAI provides a 24 V dc power source for all the transducers. The inputs can be configured as current or voltage inputs using jumpers (J#A and J#B). One of the two analog output circuits is 4-20 mA and the other can be configured as 4-20 mA or 0-200 mA. The following table displays the analog I/O capacity of TBAI.

| Quantity | Analog Input Types | Quantity | Analog Output Types |
|---|---|---|---|
| 8 | ±10 V dc, or ±5 V dc, or 4-20 mA | 1 | 0-20 mA or 0-200 mA |
| 2 | 4-20 mA, or ±1 mA | 1 | 0-20 mA |

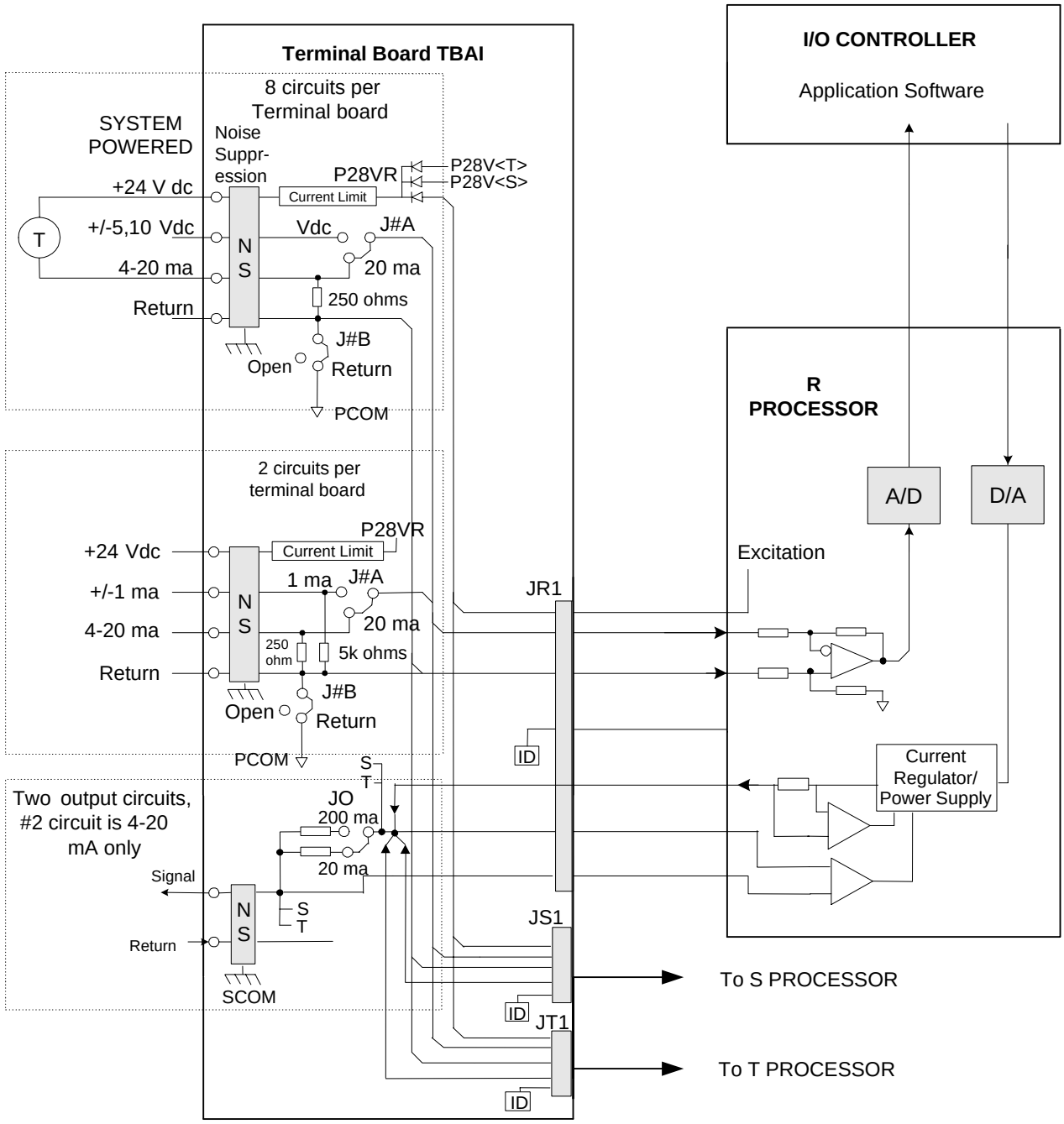
**Note** With the noise suppression and filtering, the input ac CMR is 60 dB, and the dc CMR is 80 dB.

Each 24 V dc power output is rated to deliver 21 mA continuously and is protected against operation into a short circuit. Transmitters/transducers can be powered by the 24 V dc source in the control system, or can be independently powered. Jumper JO selects the type of current output. Diagnostics monitor each output and a suicide relay in the I/O controller disconnects the corresponding output if a fault cannot be cleared by a command from the processor.




*Simplex Analog Inputs and Outputs*

In a TMR system, analog inputs fan out to the three I/O controllers (VAIC or PAIC). The 24 V dc power to the transducers comes from all three controllers and is diode shared on TBAI. Each analog current output is fed by currents from all three controllers. The actual output current is measured with a series resistor, which feeds a voltage back to each I/O controller. The resulting output is the voted middle value (median) of the three currents. The following figure shows TBAI in a TMR system.




*Analog Inputs and Outputs, TMR*

## Specifications

| Item | Specification |
|---|---|
| Number of channels | 12 channels (10 AI, 2 AO) |
| Input span, transmitters | 1-5 V dc from 4-20 mA current input |
| Outputs | 24 V outputs provide 21 mA each connection |
| Maximum lead resistance | 15 Ω maximum two-way cable resistance, cable length up to 300 m (984 ft) |
| Output load | 500 Ω for 4-20 mA output, TBAIH1B with VAICH1C |
| | 800 Ω for 4-20 mA output, TBAIH1C with VAICH1D |
| | 800 Ω for 4-20 mA output, TBAIH1C with PAIC |
| | 50 Ω for 200 mA |
| **Physical** | |
| Fault detection | Monitor total output current<br>Check connector ID chip for hardware incompatibility |
| Temperature | -30 to 65ºC (-22 to +149 ºF) |
| Size | 10.16 cm wide x 33.02 cm high ( 4.0 in x 13 in) |

## Diagnostics

Diagnostic tests are made on the terminal board as follows:

- The board provides the voltage drop across a series resistor to indicate the output current. The I/O processor creates a diagnostic alarm (fault) if any one of the two outputs goes unhealthy.
- Each cable connector on the terminal board has its own ID device that is interrogated by the I/O controller. 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. When this chip is read by the I/O controller and a mismatch is encountered, a hardware incompatibility fault is created.

## Configuration

The terminal board is configured by jumpers. For the location of these jumpers, refer to the installation diagram. The jumper choices are as follows:

- Jumpers J1A through J8A select either current input or voltage input.
- Jumpers J1B through J8B select whether the return is connected to common or is left open.
- Jumpers J9A and J10A select either 1 mA or 20 mA input current.
- Jumpers J9B and J10B select whether the return is connected to common or is left open.
- Jumper J0 sets output 1 to either 20 mA or 200 mA.