



TMR

Simplex

Analog I/O Module

The Mark* VleS Functional Safety Analog Input / Output (I/O) module provides an interface between the process analog sensors / actuators (10 analog inputs and two analog outputs) and the Mark VleS Safety control logic. The Analog I/O module consists of two orderable parts: the Analog I/O pack and the Analog I/O terminal board. All safety Analog I/O modules use the same Analog I/O pack, IS420YAICS1B. There are two DIN-rail mounted Analog I/O terminal boards available to provide the necessary redundancy and terminal block styles. Users can select the configuration that best addresses their needs for availability and SIL level. The Analog I/O module is available in both Simplex and Triple Modular Redundant (TMR) configurations. This document discusses the Simplex Analog I/O (IS410STAIS2A) terminal board and the TMR Analog I/O (IS410TBAIS1C) terminal board.

In a TMR configuration, the controller selects the median analog input values returned by the TMR I/O pack(s) (thus rejecting a high or low out of range value) and the I/O pack electronics combine the analog outputs with a patented circuit design that rejects a bad performing I/O pack.

Simplex Analog I/O (STAI) Terminal Board

The STAI terminal board is a compact analog input terminal board that accepts 10 analog inputs and two analog outputs, and connects to the YAIC I/O pack. The 10 analog inputs accommodate two-wire, three-wire, four-wire, or externally powered transmitters. The analog outputs are configured for 0 to 20 mA. An on-board ID chip identifies the board to the I/O pack for system diagnostic purposes.

TMR Analog I/O (TBAI) Terminal Board

The TBAI terminal board is an analog input terminal board used in TMR and Simplex configurations that supports 10 analog inputs and two outputs, and connects to the YAIC I/O pack. The 10 analog inputs accommodate two-wire, three-wire, four-wire, or externally powered transmitters. The analog outputs can be configured for 0 to 20 mA. Inputs and outputs have noise suppression circuitry to protect against surge and high frequency noise. The TBAI has three DC-37 pin connectors for three TMR I/O packs or one Simplex I/O pack.

The Analog I/O Terminal Board with YAIC I/O Pack Specifications table provides the specifications for the Analog I/O terminal boards available for use in the Mark VleS Functional Safety System. For more information on the YAIC I/O pack and the STAI and TBAI terminal boards, refer to the chapter “PAIC, YAIC Analog I/O Modules” in the document *Mark VleS Functional Safety Systems for General Market Volume II: System Guide for General-purpose Applications (GEH-6855_Vol_II)*.

Analog I/O Terminal Board with YAIC I/O Pack Specifications

Item	TERMINAL BOARD	
	IS410STAIS2A	IS410TBAIS1C
Product Name	Mark VleS Analog I/O	Mark VleS Analog I/O
Life-cycle Status	Active	Active
I/O Pack Redundancy	Simplex	Simplex or TMR
I/O Pack	IS420YAICS1B (qty 1) (order separately)	IS420YAICS1B (qty 3 or 1) (order separately)
Number of Channels	12 channels per module (10 AI, 2 AO)	12 channels per module (10 AI, 2 AO)
Analog Input Span	<ul style="list-style-type: none"> AI channel 1-8: 1 to 5 V dc, ± 5 V dc, ± 10 V dc, 0 to 20 mA AI channel 9-10: 0 to 20 mA, ± 1 mA 	<ul style="list-style-type: none"> AI channel 1-8: 1 to 5 dc, ± 5 V dc, ± 10 V dc, 0 to 20 mA AI channel 9-10: 0 to 20 mA, ± 1 mA
Analog Input Converter Resolution	16-bit A/D Converter	16-bit A/D Converter
Analog Input Accuracy	0.1% of full scale over the full operating temperature range	0.1% of full scale over the full operating temperature range
Analog Input Noise Suppression	<ul style="list-style-type: none"> Hardware filter with single pole down break at 500 rad/sec Software filter using a two pole low pass filter, configurable for 0.75 Hz, 1.5 Hz, 3 Hz, 6 Hz, or 12 Hz 	<ul style="list-style-type: none"> Hardware filter with single pole down break at 500 rad/sec Software filter using a two pole low pass filter, configurable for 0.75 Hz, 1.5 Hz, 3 Hz, 6 Hz, or 12 Hz
Analog Input Common Mode Rejection	<ul style="list-style-type: none"> AC CMR 60 dB at 60 Hz, up to ± 5 V common mode voltage DC CMR 80 dB with -5 to +7 V peak common mode rejection 	<ul style="list-style-type: none"> AC CMR 60 dB at 60 Hz, up to ± 5 V common mode voltage DC CMR 80 dB with -5 to +7 V peak common mode rejection
Analog Input Common Mode Voltage Range	± 5 V (± 2 V CMR for the ± 10 V inputs)	± 5 V (± 2 V CMR for the ± 10 V inputs)
Analog Output Accuracy	0.5%	0.5%
Analog Output Converter Resolution	14-bit D/A Converter	14-bit D/A Converter
Analog Output Load	800 Ω max for 0 to 20 mA output	800 Ω max for 0 to 20 mA output
Field Wiring Terminal Block	Euro style box-type terminal blocks	Barrier-type Terminal Blocks
Field Wiring	24 AWG min, 12 AWG max	22 AWG min, 12 AWG max
I/O Scan Time	Supported Controller I/O Scan rates: 10 ms, 40 ms, 80 ms, 160 ms	
Diagnostic Fault Detection	Power-up self test, continuous monitoring of internal power supplies, incorrect terminal board check, hardware limit checking based on configurable high and low levels for 4-20 mA inputs, health of D/A convert circuits, analog output current contribution monitoring, and suicide relay disconnects failed outputs in TMR configuration to allow other two I/O packs to control	
I/O Pack DC Control Power	28 V dc at 8 W control power per YAIC; up to additional 7 W depending on how much of 4-20 mA sensor power is sourced from Analog I/O terminal board	
I/O Pack DC Power Connector	Micro Mate-N-Lok receptacle (AMP 1445022-3)	
I/O Pack Construction	Aluminum case	
I/O Pack Health	Visual status LEDs, circuit health variables available to control logic	
Termination Module Dimensions (includes cover and I/O pack) (H x W x D)	17.0 x 15.7 x 15.3 cm (6.7 x 6.2 x 6.0 in)	
Safety Rated	Yes, compliant with IEC 61508	
Hazardous Locations Capability	Class 1, Div 2 / Class 2, Zone 2 / ATEX. For ratings and further details, refer to the document <i>Mark VleS Functional Safety System Equipment in Hazardous Locations (HazLoc) Instruction Guide (GEH-6861)</i> .	
G3 Compliant	Yes	
Ambient Operational Temperature	-40 to 70°C (-40 to 158°F)	
Storage Temperature	-40 to 85°C (-40 to 185°F)	
Mounting Method	DIN-rail mounted	
I/O Pack Replacement Part Number	IS420YAICS1B	
Terminal Board Part Number	IS410STAIS2A	IS410TBAIS1C
Module Cover Replacement Part Number	151X1202YE04PP01BL	151X1202YE08PP16BL