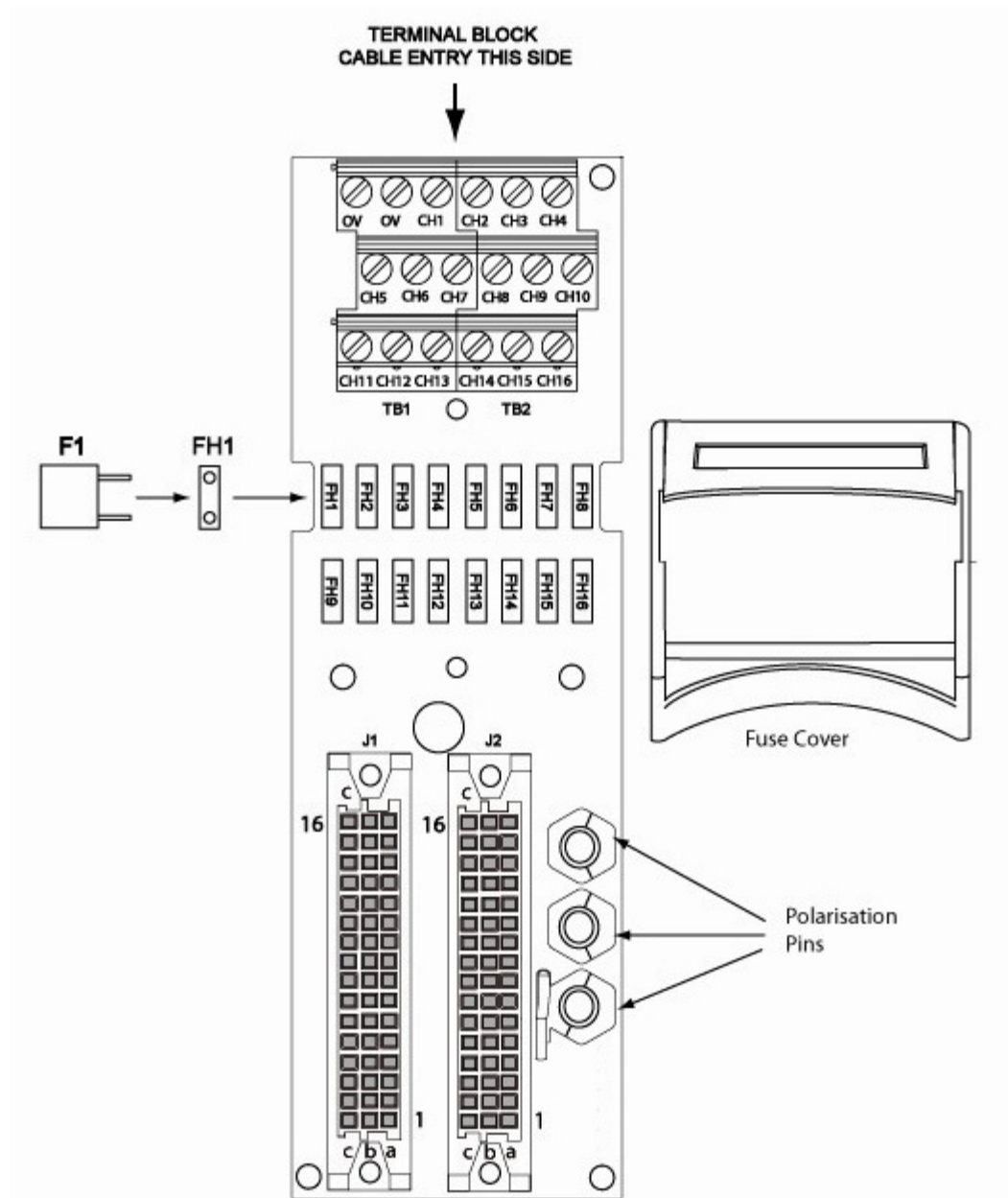


Figure 6 - Top View



T9892 Digital Output Termination Assembly

The T9892 Terminal Assembly module operates in conjunction with the T9451 Digital Output Module and provides 8 dual configuration output channels. It shares the same pin-out as the standard AADvance T9852 Digital Output Terminal Assembly and has the same coding peg configuration. The difference is that the T9892 has a separate connector for the field power input voltage connections (the left most terminal block shown below). It also has additional fusing to give extra protection against field faults.



WARNING: For Continuous Mode applications the measures specified in this section for High Demand applications must be applied.

Table 8 - Modules for SIL 2 Fault Tolerant High demand Architecture

Position	Module Type
I/P A & B	2 × T9401/2 Digital Input Module, 24 Vdc, 8/16 Channel + T9802 Digital Input TA, 16 Channel, Dual or 2 × T9431/2 Analogue Input Module, 8/16 channel + T9832 Analogue Input TA, 16 Channel, Dual 1 × T9300 I/O Base unit
CPU A & CPU B	2 x T9110 Processor, T9100 Processor Base Unit
O/P A & B	2 × T9451 Digital Output Module, 24 Vdc, 8 Channel + T9852 Digital Output TA, 24 Vdc, 8 channel, T9300 Base Unit or 2 x T9481/T9842 Analogue Output Module, 3/8 Ch, Isolated + T9882 Analogue Output TA, 8 Ch, Dual and T9300 Base Unit

SIL 3 Architectures

SIL 3 architectures have at least two or three processor modules and are applicable for use with:

- SIL 3 de-energize to trip applications.
- SIL 3 energize to action applications when fitted with dual digital output modules.
- SIL 3 high demand applications where the required safe state is more than 4 mA, when fitted with dual analogue output modules (A 'safe state' is an output configured to go to a specific value, or configured to hold last state).

Faulted input modules in a SIL 3 arrangement can be replaced without a time limit; faulted output modules must be replaced within the MTTR assumed in the PFD calculations.

In all SIL 3 architectures, when the processor modules have degraded to 1001D on the first detected fault, the system must be restored to at least 1002D by replacing the faulty processor module within the MTTR assumed in the PFD calculations or all SIL 3 safety instrumented function and high demand safety instrumented functions must be shut down.

SIL 3 Fail-safe I/O, Fault Tolerant Processor

A SIL 3, fail-safe I/O with a fault tolerant processor architecture has a simplex input and output arrangement with dual or triple processor modules. The dual processor modules operate in 1002D under no fault conditions and degrade to 1001D on detection of the first fault in either module. When there are faults on both modules the configuration fails-safe.

Table 10 - Modules for SIL 3 Fault Tolerant Architectures

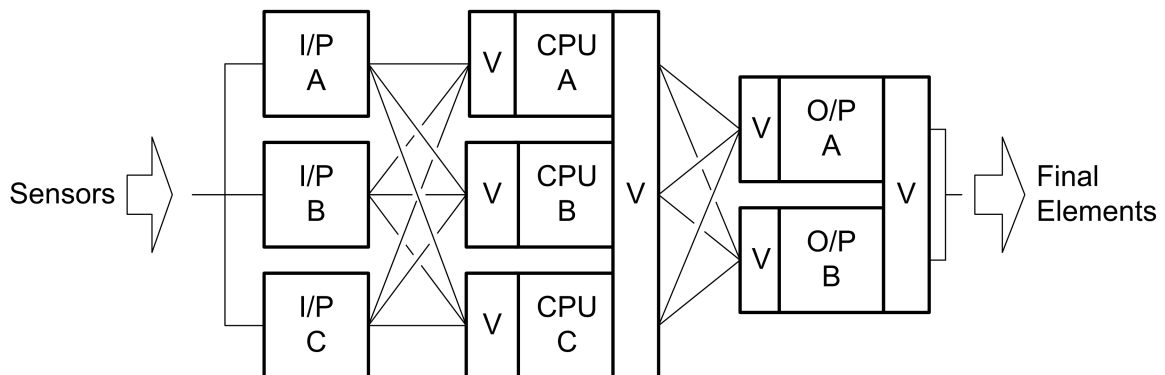
Position	Module Type
I/P A and I/P B	2 x T9401/2 Digital Input Module, 24 Vdc, 8/16 Channel + T9802 Digital Input TA, 16 Channel, Dual or 2 x T9431/2 Analogue Input Module, 8/16 Channel + T9832 Analogue Input TA, 16 Channel, Dual 2 x T9300 I/O Base Unit
CPU A & CPU B	2 x T9110 Processor Module, 9100 Processor Base Unit
O/P A and O/P B	1 x T9451 Digital Output Module, 24 Vdc, 8 Channel + T9851 Single Digital Output TA, 24 Vdc, 8 Channel for de-energize to action T9300 Base unit 2 x T9451 Digital Output Module, 24 Vdc, 8 Channel + T9852 Dual Digital Output TA for energize to action T9300 Base Unit Or 2 x T9481/T9842 Analogue Output Module, 3/8 Ch, Isolated + T9882 Analogue Output TA, 8 Ch, Dual T9300 Base Unit

SIL 3 TMR Input and Processor, Fault Tolerant Output

A SIL 3 TMR architecture offers the highest level of fault tolerance for an AADvance controller and consists of triple input modules, triple processors and dual output modules.

- The input and processor modules operate in a 2003D under no fault conditions, degrade to 1002D on detection of the first fault in any module, and degrade to 1001 on the detection of faults in any two modules and will fail-safe when there are faults on all three modules.

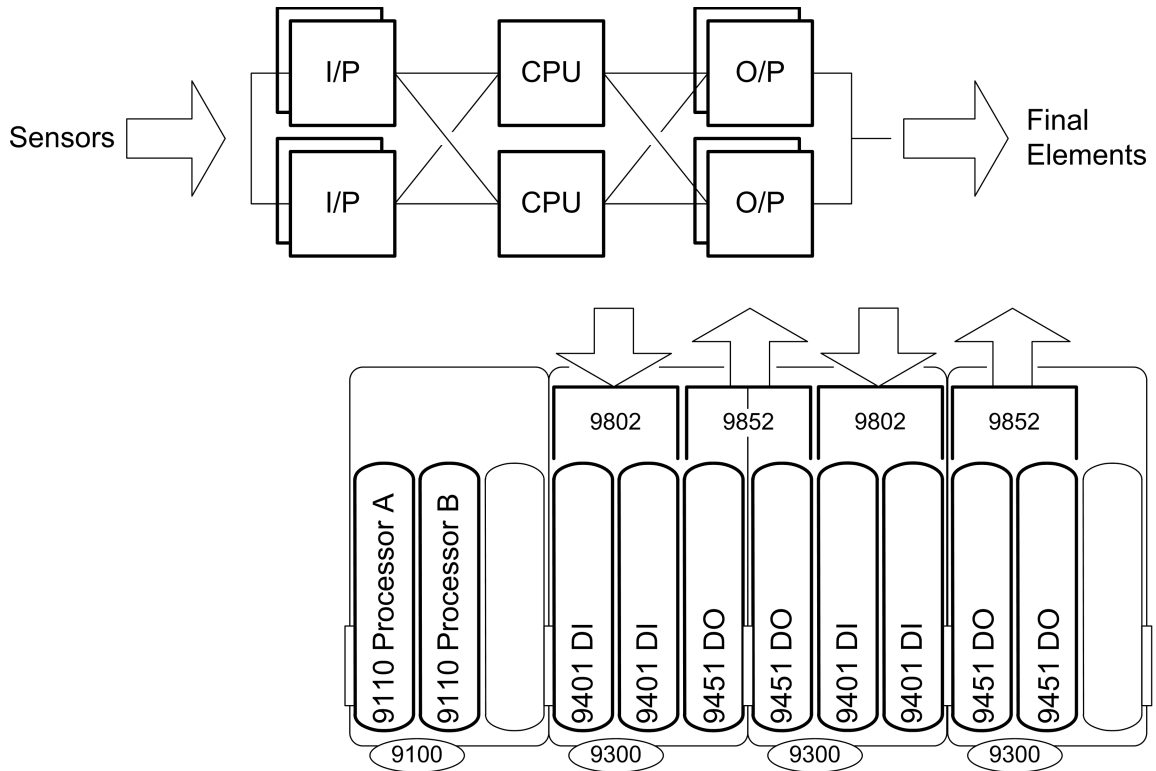
In the event of a failure in any element of a channel, the channel processor will still produce a valid output which could be voted on because of the coupling between the channels. This is why the triple modular redundant implementation supplies a configuration that is inherently better than a typical 2003 voting system.



Digital Output Modules

A digital output module fault must be repaired within the MTTR which was used in the PFD calculation. This rule applies to simplex digital output modules in de-energize to trip applications and to dual digital output modules in energize to action applications.

Figure 16 - Increased I/O System



The T9852 dual termination assembly can be used with both 8 channel and 16 channel input modules.

Triple Modular Redundant Architecture

A SIL 3 TMR architecture offers the highest level of fault tolerance for an AADvance controller and consists of triple input modules, triple processors and dual output modules.

If a failure occurs in an element of a channel, the channel processor will still supply a satisfactory output which could be voted on because of the coupling between the channels. This is why the triple modular redundant implementation has a configuration that is inherently better than a typical 2003 voting system.

Specify I/O Base Units

The T9300 I/O base unit (3 way) is a single, standardized design which suits all termination assemblies and I/O modules. The base unit can have one triple modular redundant assembly, one dual assembly and one simplex assembly or up to three to simplex assemblies. The dual and triple modular redundant assemblies can bridge adjacent base units, so two base units can (for example) hold three dual assemblies.

Choosing Termination Assemblies

The use of termination assemblies gives the AADvance system flexibility for creating different architectures and expanding the system. Each termination assembly is a very simple circuit that is matched to a type of I/O module and to a specified module configuration. This table shows a summary of the termination assemblies which are available and the related I/O module configurations.

Table 17 - Choosing a Termination Assembly

	Simplex I/O Module Configuration	Dual I/O Module Configuration	Triple I/O Module Configuration
Digital input	T9801, Digital Input TA, 16 channel, Simplex Commoned (non-isolated)	T9802, Digital Input TA, 16 channel, Dual	T9803, Digital Input TA, 16 channel, Triple
Analogue input	T9831, Analogue Input TA, 16 channel, Simplex, commoned (non-isolated)	T9832, Analogue Input TA, 16 channel, Dual	T9833, Analogue Input TA, 16 channel, Triple
Digital output	T9851, Digital Output TA, 8 channel, Simplex, commoned (non-isolated)	T9852, Digital Output TA, 8 channel, Dual (non-isolated)	Not applicable
Analogue Output	T9881, Analogue Output TA, 8 Channel, Simplex, commoned	T9882, Analogue Output TA, 8 channel, Dual	Not applicable

IMPORTANT The termination assemblies for inputs have 8-channel I/O modules and 16-channel I/O modules. A dual or triple arrangement can be made of 8- or 16-channel modules, but not a mixture of the two.

You need one termination assembly for each group of related modules. For example:

- Four T9401 digital input modules used in two, dual redundant configurations need two T9802 termination assemblies — one for each pair of modules
- Four T9401 digital input modules used for simplex inputs need four T9801 termination assemblies — one for each module

Table 31 - Digital Output Module Specification

Attribute	Value
Safety integrity level	IEC 61508 SIL 3 ⁽¹⁾
Safety level degradation	1oo1D, 1oo2D
Self-test interval	<30 minutes (30s for each module)
Electrical Characteristics	
Module supply voltage:	
Voltage	Redundant +24 Vdc nominal; 18 Vdc to 32 Vdc
Module supply power dissipation	3.0 W (10.2 BTU/hr.)
Output Voltage:	
Maximum voltage without damage	-1 V to +60 Vdc
Operating field supply voltage	18 Vdc to 32 Vdc
Maximum Field Voltage Slew Rate	150 V/s [⁽²⁾ , ⁽³⁾]
Output current:	1 A continuous for each channel
Minimum current required for line monitoring	10 mA for each module (20 mA for dual pair)
Maximum voltage drop	1 Vdc
Maximum current at de-rated temperature De-rated current at maximum temperature	8 A all channels @ 60 °C 6 A all channels @ 70 °C
Maximum De-energised Output Voltage Slew Rate	12 V/ms ⁽⁴⁾
Maximum Energised Output Current Slew Rate	0.9 A/ms ⁽⁴⁾
Output off resistance (effective leakage)	50 K Ω
Voltage monitoring accuracy	± 0.5 V
Current monitoring accuracy	± 10 mA
Output overload protection	
Surge	2 A for up to 50 ms
Continuous	1.5 A
Maximum field loop power dissipation	0.57 W for each field loop (1.94 BTU/hr.)
Mechanical Specification	
Dimensions (height $\times$ width $\times$ depth)	166 mm $\times$ 42 mm $\times$ 118 mm (6-1/2 in. $\times$ 1-21/32 in. $\times$ 4-21/32 in.)
Weight	340 g (12 oz.)
Casing	Plastic, non flammable

(1) SIL 3 is the maximum achievable for a single channel. Selected CPU, input and output voting configurations could increase or decrease the correct SIL achieved. Refer to the Safety Manual for more details.

(2) Limit not applicable if all outputs are energised.

(3) Limit not applicable if perturbations are less than 2.0 Vpp or last less than 3 minutes in any 60 minute period.

(4) Limit not applicable to transgressions lasting less than the process safety time configured for the module.

Transgression of the slew rate limits identified above may lead to channel failure resulting from diagnostics otherwise designed to verify that channels are operating within their defined safety accuracy.

T9851/2 Termination Assemblies for Digital Outputs

A T9851 is a simplex termination assembly for 8 digital output channels. The T9852 is a dual 8 channel output termination assembly. The terminal blocks also accept two 24 Vdc power sources for field power. The termination assembly incorporates two replaceable 10 A fuses, one for each field power source.

T9851/2 Digital Output Termination Assembly Specifications

Table 32 - Digital Output TA Specification

Attribute	Value
Functional Characteristics	
Field connections	8; Wiring: Conductor cross section maximum 1.31 mm ² (16 AWG); Stripping length 6mm (¼ in.)
Modules supported	T9851 : one T9852 : two
Electrical Characteristics	
Field supply fuses	10 A for each field supply
Mechanical Specification	
Dimensions (height x width)	
T9851	132 mm × 42 mm (5-¼ in. × 1-21/32 in.)
T9852	132 mm × 84 mm (5-¼ in. × 3-5/16 in.)
Weight	
T9851	133 g (5oz.)
T9852	260 g (10oz.)

T9892 Digital Output Termination Assembly

The T9892 Terminal Assembly module operates in conjunction with the T9451 Digital Output Module and provides 8 dual configuration output channels. It shares the same pin-out as the standard AADvance T9852 Digital Output Terminal Assembly and has the same coding peg configuration. However, the T9852 termination has a separate a connector for the field power input voltage connections and additional fusing for protection against field faults.

Parts List

Base Units

Part No.	Part Description
T9100	Processor base unit
T9300	I/O base unit (3 way)

Modules

Part No.	Part Description
T9110	Processor module
T9401	Digital input module, 24 Vdc, 8 channel, isolated
T9402	Digital input module, 24 Vdc, 16 channel, isolated
T9451	Digital output module, 24 Vdc, 8 channel, isolated, commoned
T9431	Analogue input module, 8 channel, isolated
T9432	Analogue input module, 16 channel, isolated
T9481	Analogue output module, 3 channel, isolated
T9482	Analogue output module, 8 channel, isolated

Special Application Modules

Part No.	Part Description
T9441	Frequency Input Module (Product not yet released. Contact Sales for more information)

Termination Assemblies

Part No.	Part Description
T9801	Digital input TA, 16 channel, simplex, commoned
T9802	Digital input TA, 16 channel, dual
T9803	Digital input TA, 16 channel, TMR
T9831	Analogue input TA, 16 channel, simplex, commoned
T9832	Analogue input TA, 16 channel, dual
T9833	Analogue input TA, 16 channel, TMR
T9851	Digital output TA, 24Vdc, 8 channel, simplex, commoned
T9852	Digital output TA, 24Vdc, 8 channel, dual
T9881	Analogue output TA, 8 channel, simplex commoned