System Build Manual

Original Instructions

Allen-Bradley

AADvance Controller

Catalog Numbers T9110 T9300 T9310 T9401/2 T9431/2 T9451 T9481/2



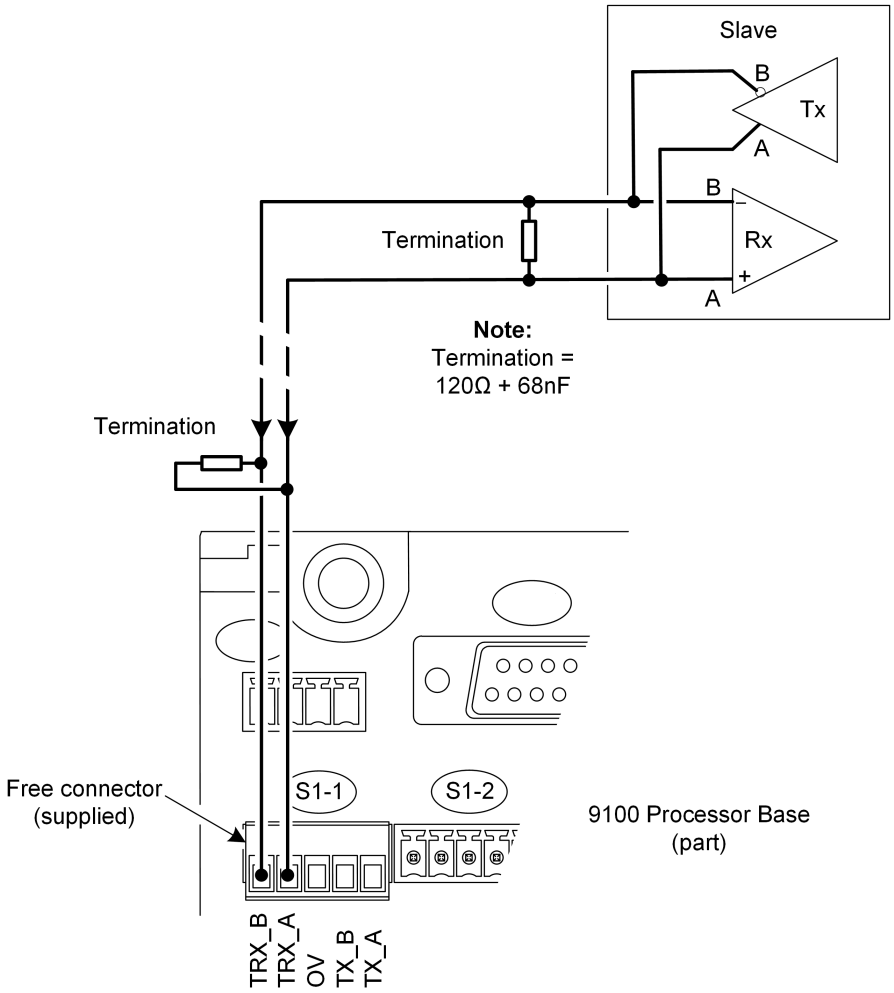






Connect a Slave Device, Half Duplex

You can use a half duplex serial connection to connect a single MODBUS Slave device to the AADvance controller. To make the physical connection, do the following:



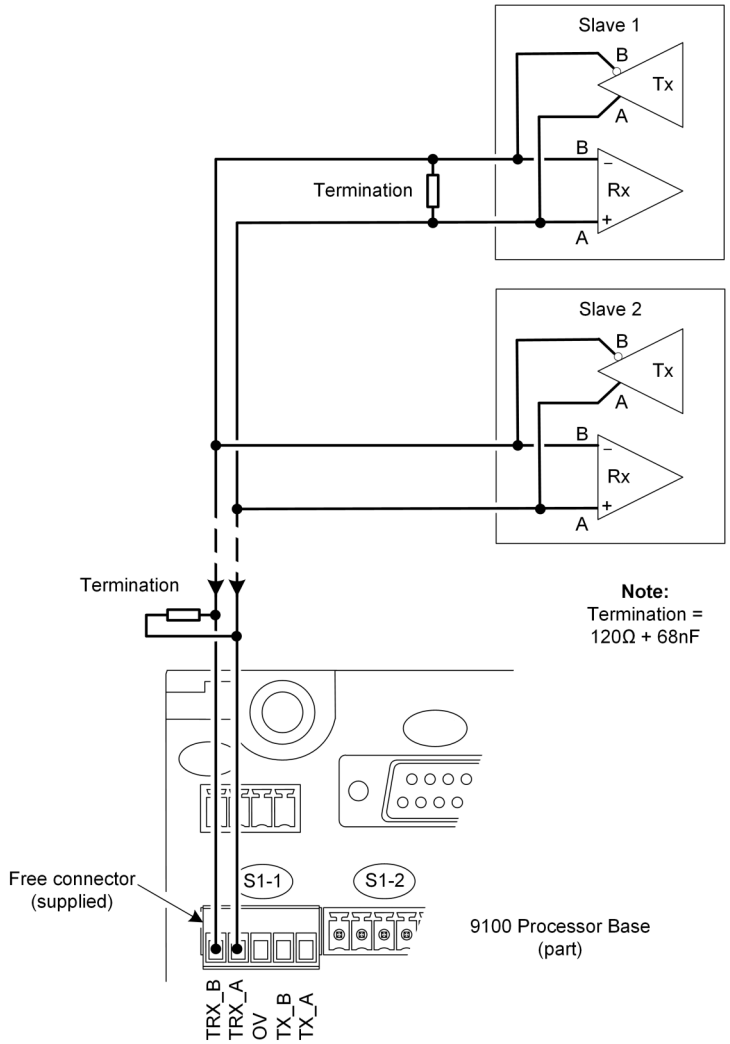
1. Select an applicable cable. We recommend 3-pair, overall shielded cable.
2. Remove the serial port connector from the T9100 processor base unit.
3. Make the connections shown in the illustration. Terminate the twisted pairs with a 120 Ω resistor in series with a 68 nF capacitor at the receiver ends.
4. Connect the signal ground (not illustrated) from the 0 V terminal to the slave device.

IMPORTANT Do not connect the signal ground to the AC safety ground.

5. Insert the connector into the T9100 processor base unit.

Connect Multiple Slave Devices, Half Duplex

You can use a half duplex serial connection to connect multiple MODBUS Slave devices to the AADvance controller. To make the physical connection, do the following:



1. Select an applicable cable. We recommend 3-pair, overall shielded cable.
2. Remove the serial port connector from the T9100 processor base unit.
3. Make the connections shown in the illustration. Terminate the twisted pairs with a 120 Ω resistor in series with a 68 nF capacitor at the receiver ends.
4. Connect the signal ground (not illustrated) from the 0 V terminal to the slave device.

IMPORTANT Do not connect the signal ground to the AC safety ground.

5. Insert the connector into the T9100 processor base unit.

System Security

Serial networks are closed and local and have limited protocol functionality, so they are immune to any external attack apart from local deliberate sabotage. The AADvance system, however, with its workstations and DCS interfaces, uses Ethernet networks which are frequently part of a larger corporate network and can expose the system to accidental or malicious infection or attack.

These steps help prevent such issues:

- Network and workstation security must be used when installing and setting up the system. As a minimum set up the following security measures:
  - AADvance must not be on a network with open unsecured access to the Internet.
  - The Firewall must be active on the Workstation, helping prevent access to the relevant Ethernet ports on each communication interface. Anti-virus software must be installed and be kept updated.

IMPORTANT Firewalls have been known to change the operation of the AADvance Discover tool.

  - The workstation must be password protected. If the workstation is a laptop, it must be kept locked when not in use.
  - If the workstation uses a hardware license USB dongle it must be kept secure, without it the workstation will not run.
  - The application must be password protected.
  - Removable media, such as USB storage devices and CDs, must be virus checked before use in the system.

Connecting Field Wiring

Connect the field wiring to the screw terminal blocks on the termination assemblies.

Use conductor wire with a cross section of 16 AWG. The stripping length should be 6mm (1/4 in.) and a conductor temperature rating of 85 °C. Apply a tightening torque of 0.5 Nm (0.37 ft. lb.) to the terminal screws.

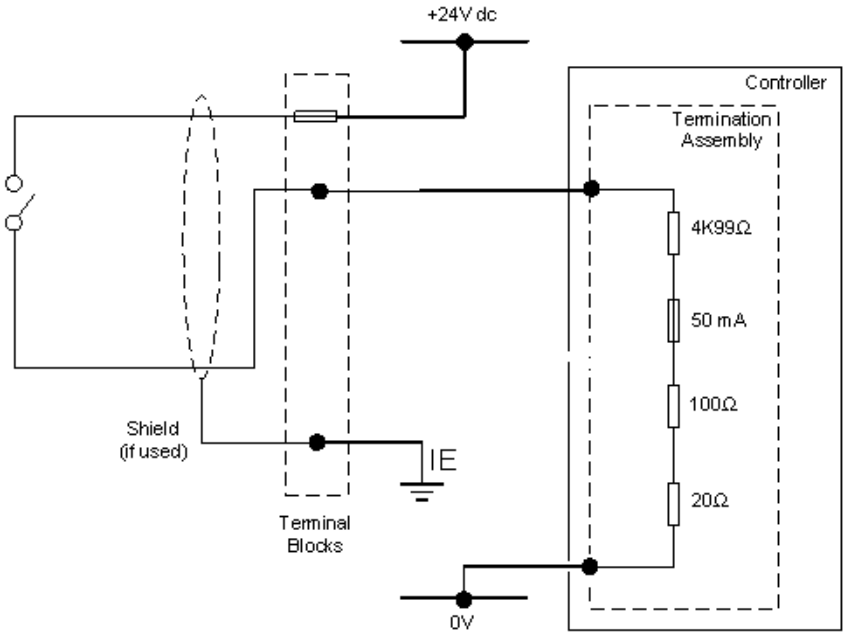


Digital Input Field Loop Circuits

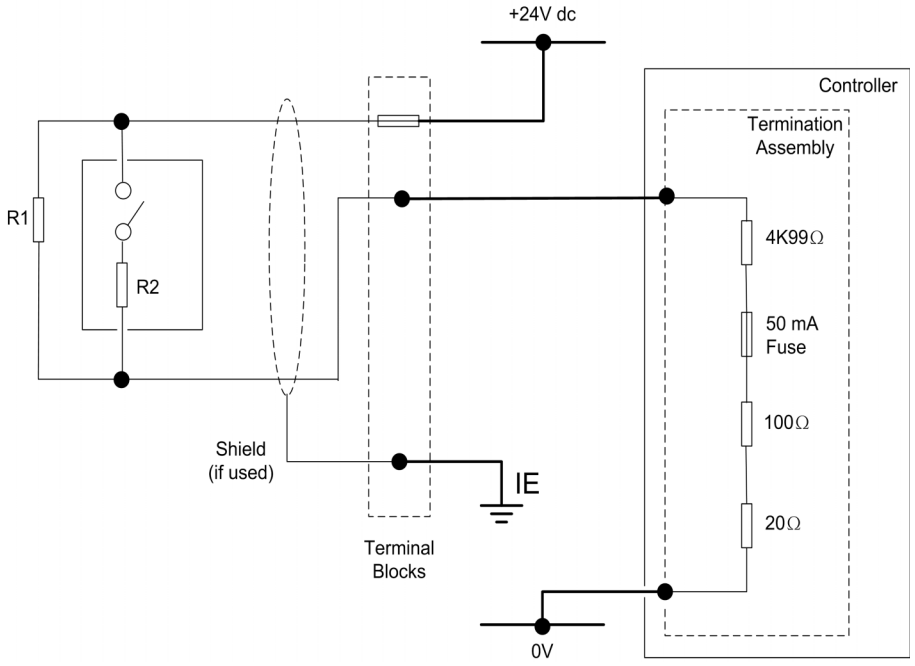
Recommended Field Loop Circuits

This section contains recommended field loop circuits for line monitoring digital inputs used in Emergency Shutdown or Fire & Gas applications.

Field Loop Circuit for Digital Input



Field Loop Circuit for Line Monitored Digital Input for Emergency Shutdown Systems (ESD)



The suggested values for R1 and R2 are as follows:

R1 = 15K Ω 1%, 1W (maximum power dissipated is 47mW at 26.4V)

R2 = 3K9 Ω 1%, 1W (maximum power dissipated is 182mW at 26.4V)

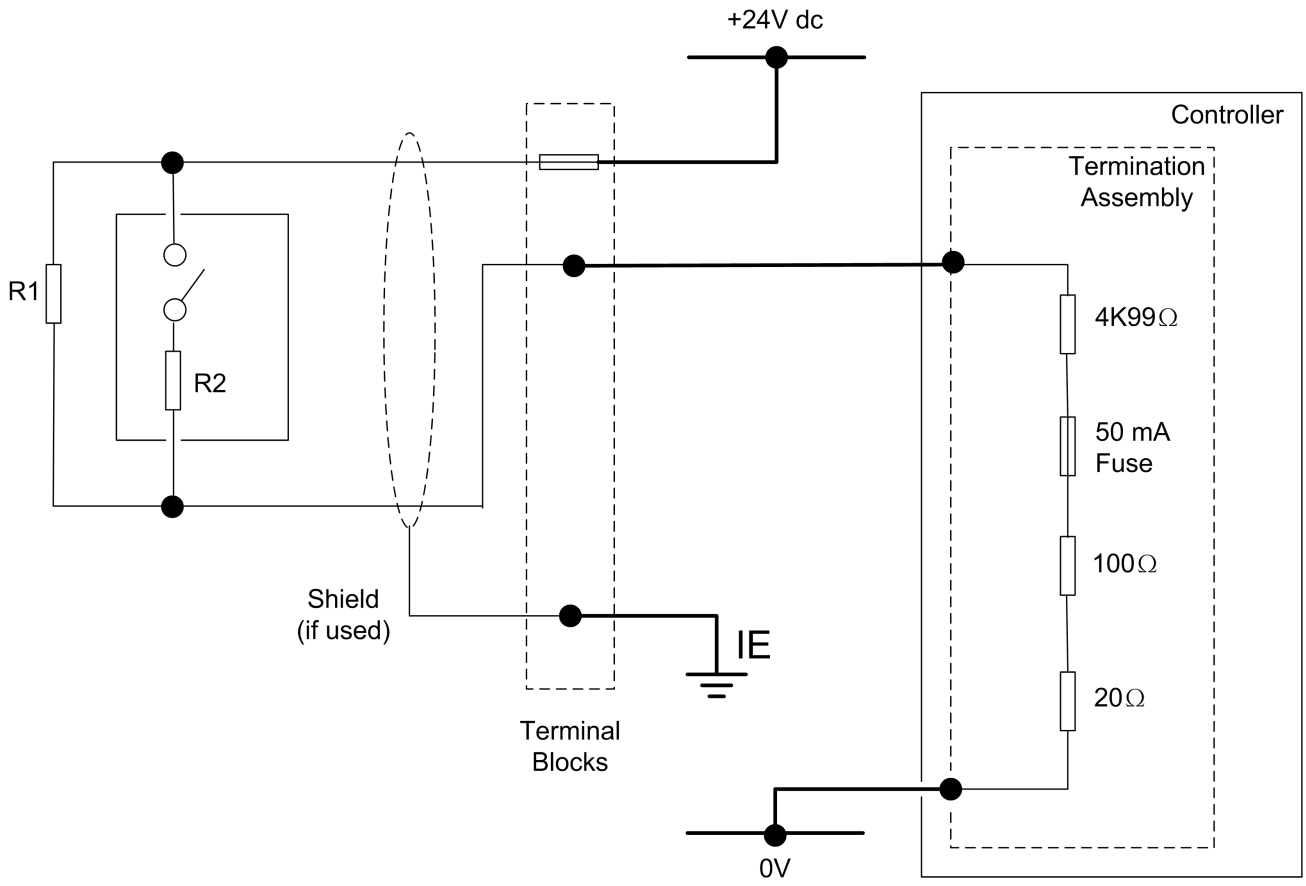
Suggested threshold values for both of the above circuits are as follows:

Threshold ID		**Value (mV)**
Maximum Allowed	=	32000
		SHORT CIRCUIT
Threshold 8	=	19000
Threshold 7	=	18500
		ON (nominal 16V)
Threshold 6	=	11000
Threshold 5	=	10500
		INDETERMINATE
Threshold 4	=	6500
Threshold 3	=	6000
		OFF (nominal 8V)
Threshold 2	=	3500
Threshold 1	=	3000
		OPEN CIRCUIT

Assumptions:

- Loop supply voltage = 24V ± 10%
- Maximum Field Cable Line Resistance: < 100 Ω total; this means < 50 + 50 Ω for the two cables.
- Minimum Isolation is 0.75M Ω between the field loop conductors.
- These values will allow the input to detect more accurately different voltage levels that represent OPEN CCT - OFF - ON - SHORT CCT and will also detect Over Voltage and an input which is neither ON nor OFF. The values verify that a line fault will be declared before it becomes possible for a false declaration of On and Off states due to a combination of resistor value drift and loop voltage variation.

Field Loop Circuit for Line Monitored Digital Input for Fire and Gas Systems (F & G)



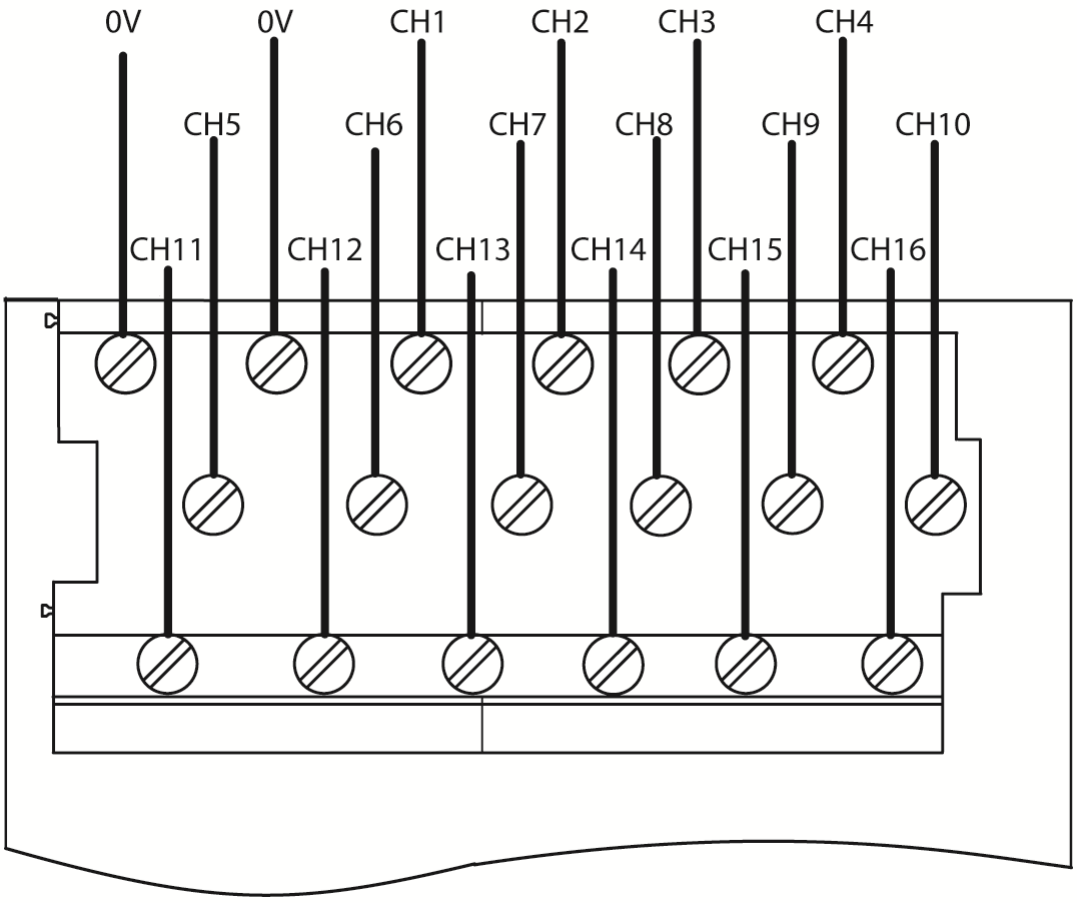
- The F&G circuit will also allow two devices to be in alarm without reporting short circuit.
- All of the input circuits are suitable for simplex, dual and TMR configurations.
- The F&G circuit assumes that the devices are volt-free contacts.
- For further information, please refer to application note AN-T90001 Field Loop Configuration, which is located in the Rockwell Automation Knowledgebase Support Center. This also includes advice for fire detectors which are not simple volt free contacts.

Digital Input Slew Tolerance

It is possible during sustained periods of abnormal input voltage slewing that channels can be declared faulted as a consequence of diagnostics otherwise designed to ensure the channels are operating within their designed safety accuracy.

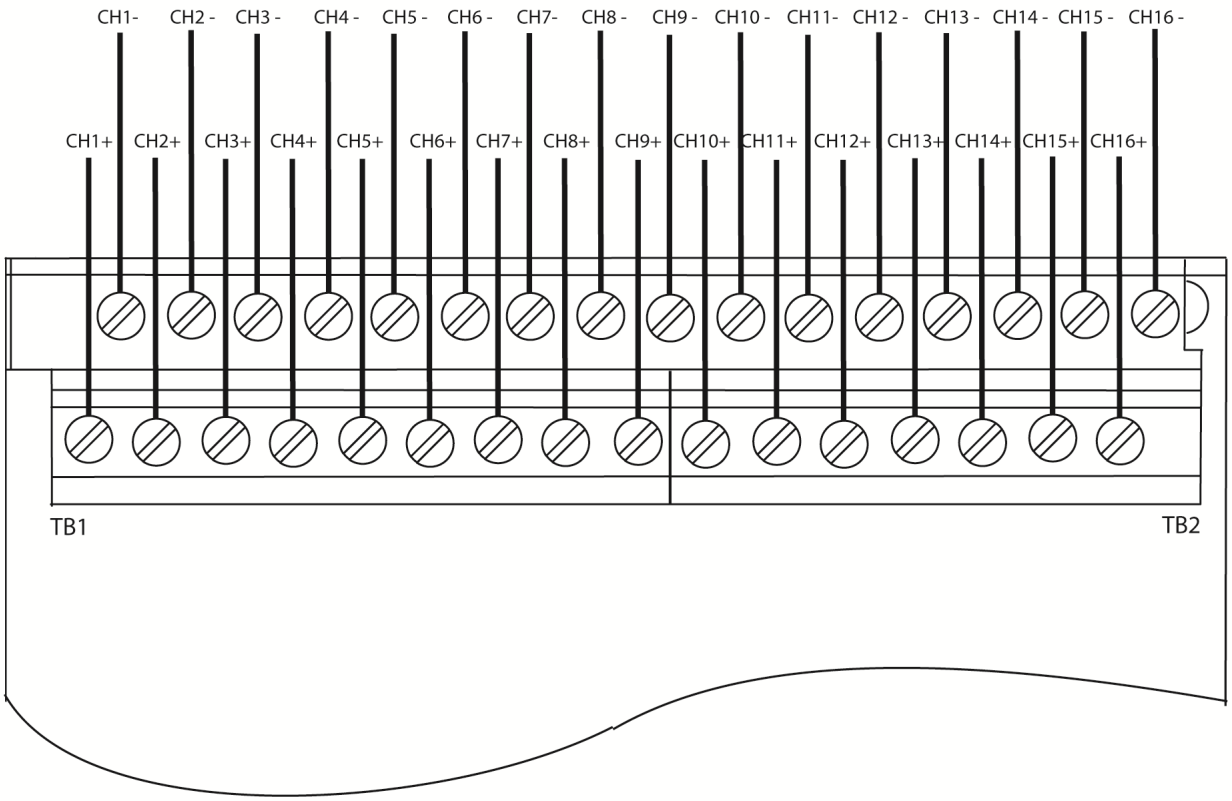
To avoid spurious declaration of channel faults it is necessary to ensure that the input signal condition satisfies the maximum slew rate criteria defined in the Solutions Handbook. Accordingly it may be necessary to condition the input signal such as by filtering or by appropriate choice of process safety time.

Connections to T9801 Non-isolated Digital Input TA — 16 Channel Simplex



- Apply a minimum tightening torque of 0.5 Nm (0.37 ft. lb.) to the terminal screws.

Connections to T9802/T9803 Isolated Digital Input TA — 16 Channel Dual/TMR



- Apply a minimum tightening torque of 0.5 Nm (0.37 ft. lb.) to the terminal screws.

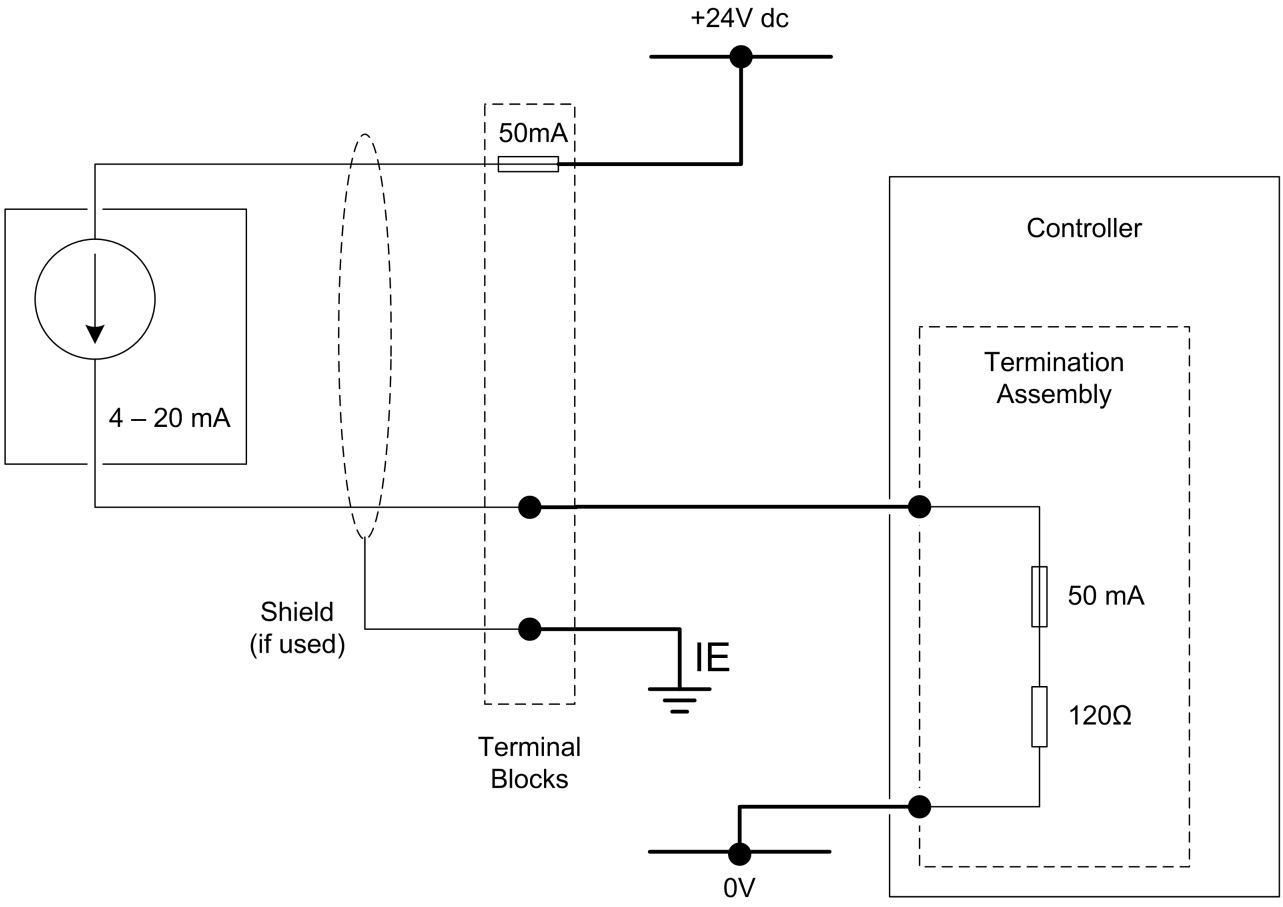
Analogue Input Field loop Circuits

These circuits can be used for simplex, dual and triple configurations of analogue input modules. Fit a fuse (as shown) in each circuit to protect the field wiring.

The recommended field loop circuits for analogue inputs are as shown below.

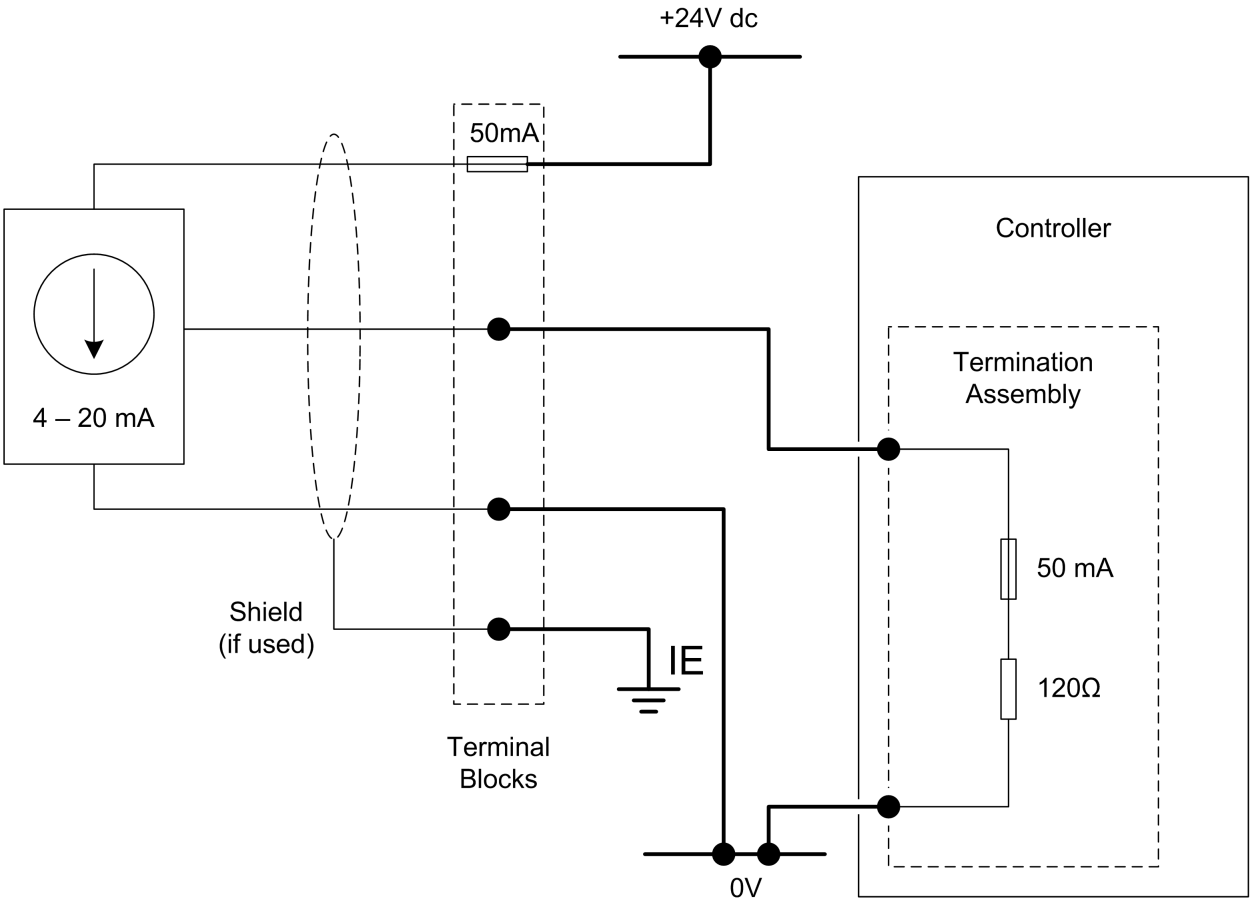
Field Loop Circuit for 2-Wire Analogue Input

Figure 17 - Wire Analogue Input Field Loop



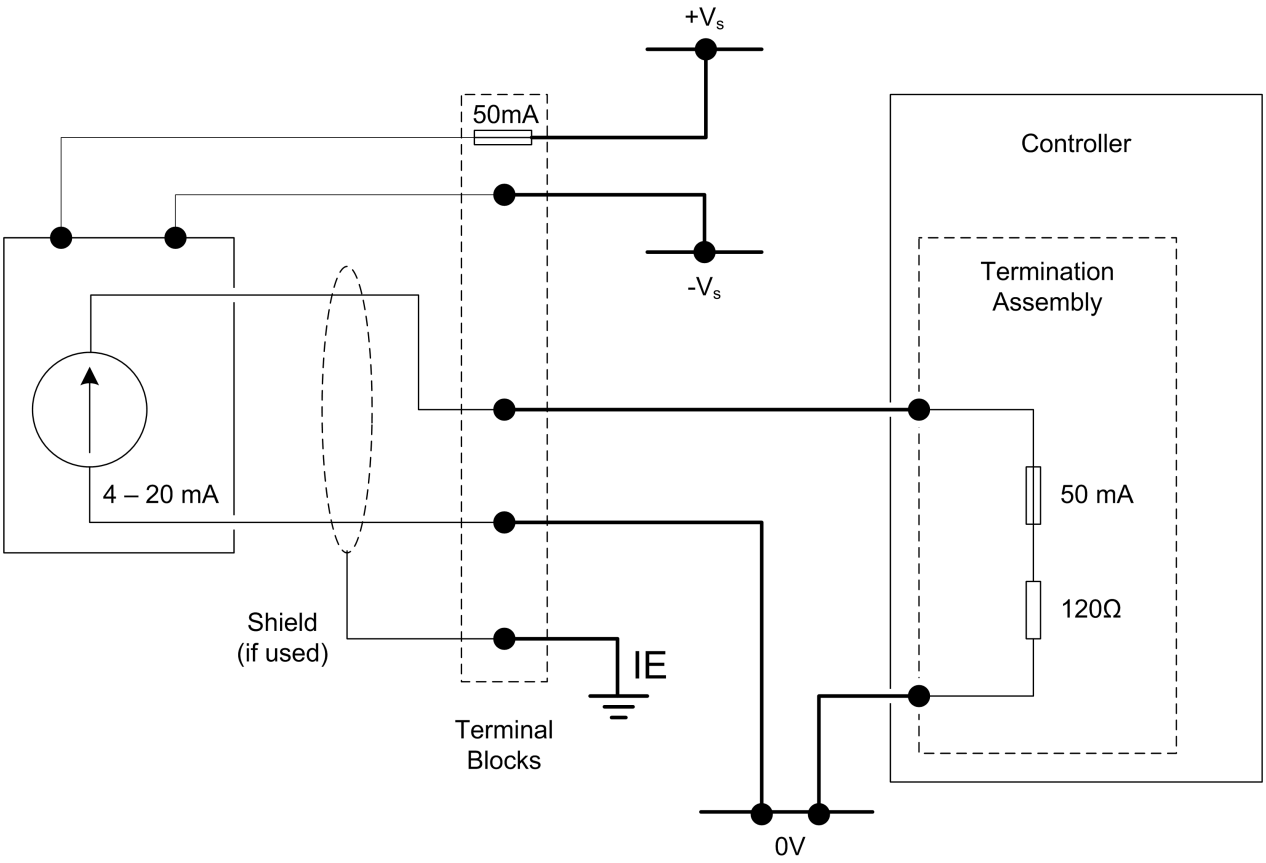
Field Loop Circuit for 3-Wire Analogue Input

Figure 18 - Wire Analogue Input Field Loop



Field Loop Circuit for 4-Wire Analogue Input

Figure 19 - Wire Analogue Input Field Loop

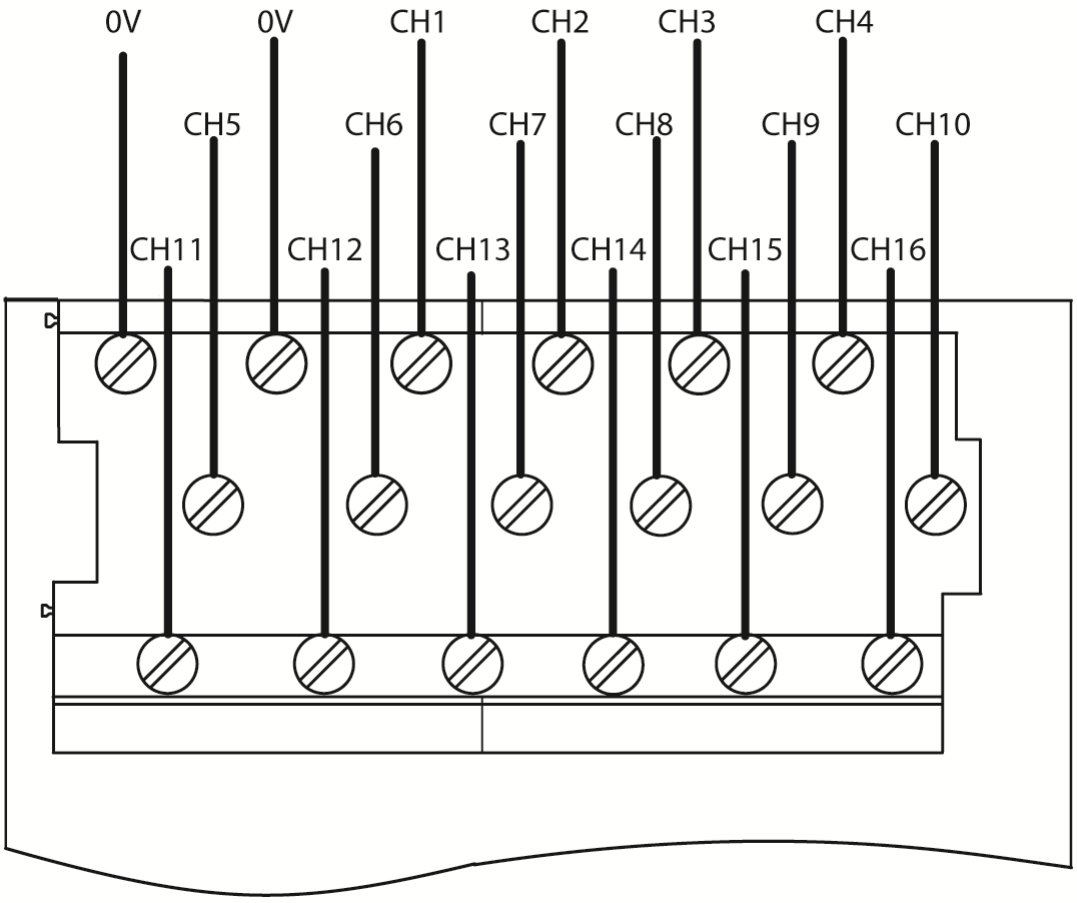


Analogue Input Slew Tolerance

It is possible during sustained periods of abnormal input current slewing that channels can be declared faulted as a consequence of diagnostics otherwise designed to ensure the channels are operating within their designed safety accuracy.

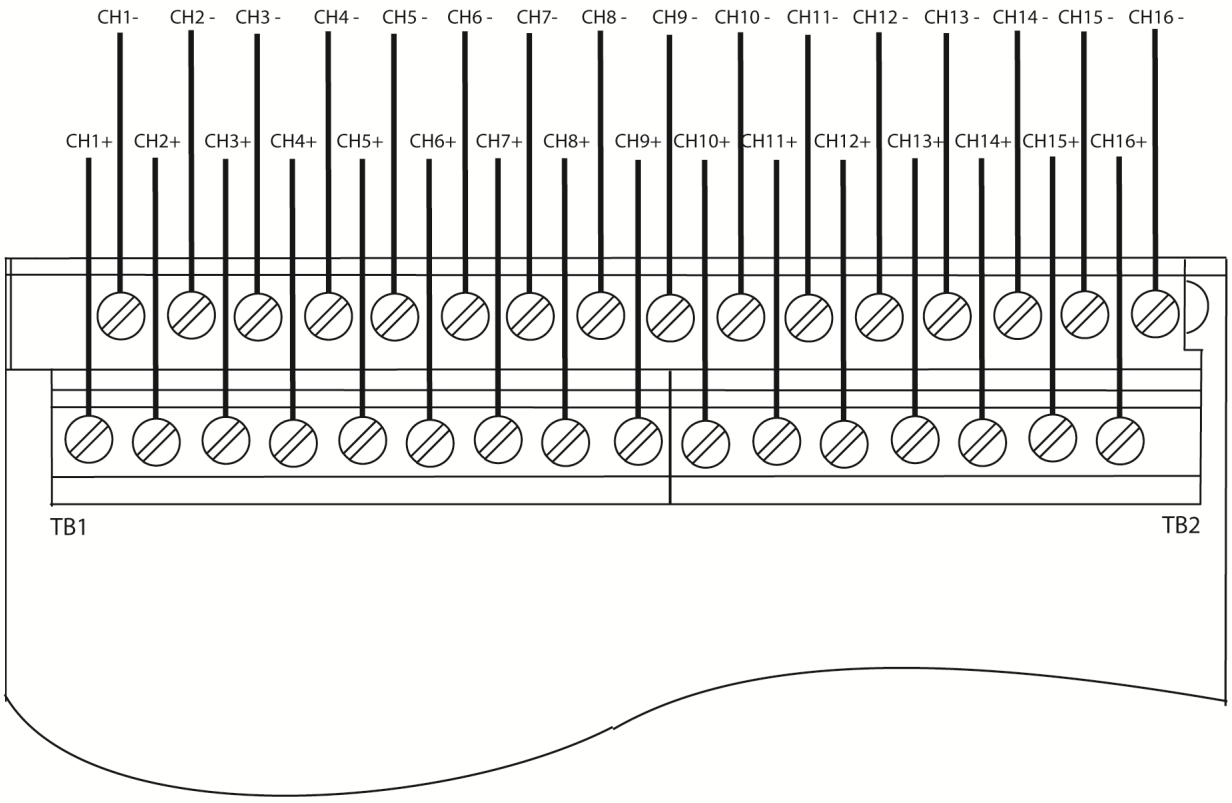
To avoid spurious declaration of channel faults it is necessary to ensure that the input signal condition satisfies the maximum slew rate criteria defined in the Solutions Handbook. Accordingly it may be necessary to condition the input signal such as by filtering, sensor slew rate configuration or by appropriate choice of process safety time.

Connections to T9831 Non-isolated Analogue Input TA — 16 Channel Simplex



- Apply a minimum tightening torque of 0.5 Nm (0.37 ft. lb.) to the terminal screws.

Connections to T9832/T9833 Isolated Analogue Input TA — 16 Channel TMR



- Apply a minimum tightening torque of 0.5 Nm (0.37 ft. lb.) to the terminal screws.

Recommended Field Circuit for Digital Outputs

This circuit is applicable for simplex and dual configurations of digital output modules. The two 10 A fuses shown are included on the termination assembly within the controller. The 5 A fuses satisfy UL508 requirements for digital output field supplies, see illustration below:

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
T9882	Analogue output TA, 8 channel, dual
T9844	Frequency Input Module TA, Simplex, Active (not yet released)
T9845	Frequency Input Module TA, Dual, Active (not yet released)
T9846	Frequency Input Module TA, TMR, Active (not yet released)
T9847	Frequency Input Module TA, Simplex, Passive (not yet released)
T9848	Frequency Input Module TA, Dual, Passive (not yet released)
T9849	Frequency Input Module TA, TMR, Passive (not yet released)

Expansion Cable Assembly

Expansion cable assembly, comprising expansion cable and two adapters

Part No.	Part Description
T9310-02	Backplane expansion cable, 2 meter

Blanking Covers

Part No.	Part Description
T9191	Blanking cover (tall) for I/O positions with no TA fitted
T9193	Blanking cover (short) for I/O positions with TA or a Processor

Spares and Tools

Part No.	Part Description
T9901	Replacement input fuse 50 mA for T9801/2/3 and T9831/2/3, pack of 20 [1]
T9902	Replacement output fuse 10A for T9851/2, pack of 20 [2]
T9903	Replacement coding pegs (pack of 20)
T9904	Replacement backplane clips (pack of 20)
T9905	Replacement processor 3 V lithium cell, pack of 20 [3]
T9906	Replacement program enable key
T9907	Installation tool kit
T9908	Fuse Extractor Tool

[1] T9901: No 396/TE5 50 mA time lag fuse; UL 248-14, 125 V, Leadfree; manufactured by Littelfuse.

[2] T9902: SMF Omni-Block, Surface Mount Fuse Block 154 010, with a 10 A, 125 V Fast Acting Fuse, Littelfuse.

[3] T9905: Polycarbon monofluoride Lithium Coin Battery, BR2032, 20 mm dia; Nominal voltage 3 V; Nominal capacity (mAh) 190; Continuous standard load (mA) 0.03; Operating temperature -30 °C to +80 °C, supplied by Panasonic.