Protected VARAN Digital Mixed Module PVDM 087

The PVDM 087 Protected VARAN Digital Mixed Module has 4 digital +24 V/2 A outputs (positive switching) and 4 digital inputs. In and outputs are galvanically isolated from the VARAN bus and have a separate voltage supply. The outputs are back-readable and the 2nd output supply can be disconnected through a safety component.
There are also diverse diagnostic functions available in this module:

Input filters are available to suppress noise signals occurring in the signal lines.

In addition to the I/O connectors, LEDs show the signal status as well as the error status.

The port allows the construction of the VARAN bus in a line structure.

The component has IP67 protection

Technical Data

Interface

Interfaces	1x VARAN In (RJ45) 1x VARAN Out (RJ45) (maximum length: 100 m)

Digital Outputs

Number of outputs	4
Short-circuit proof	yes
Galvanic isolation	yes (60 V)
Maximum current load allowed / channel	2 A *
Maximum total current	4 A *
Voltage drop over power supply (output current 4 A)	≤ 1 V
Residual current (output inactive)	≤ 0.1 mA
Turn-on delay	< 400 µs
Turn-off delay	< 400 µs
Status display	yellow LEDs

***** The maximum allowable current of 4 A per connector contact at 60 °C ambient temperature must not be exceeded.

The device shall be supplied from an isolating transformer having a secondary Listed fuse rated either:

a) max 5 amps for voltages 0-20 V (0-28.3 Vp), or
b) 100 VA/Vp for voltages of 20-30 V (28.3-42.4 Vp).

Digital Inputs

Number of inputs	4	
Galvanic isolation	yes (60 V)	
Input voltage	typically +24 V	maximum +30 V
Maximum holding brake current per sensor input	80 mA per input	
Signal level	low: < +5 V	high: > +15 V
Switching threshold	typically +11 V	
Input current	typically 6 mA at + 24 V	
Max. residual current allowed	0.1 mA	
Input delay	typically 6 ms	
Status display	yellow LEDs	

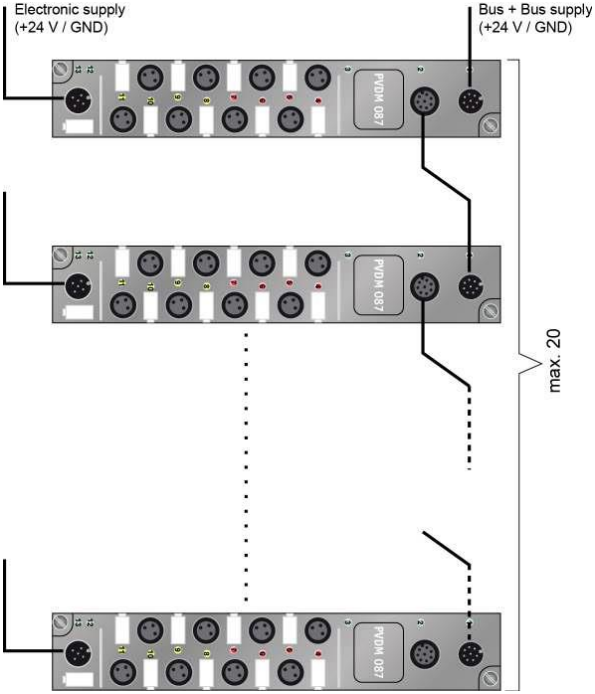
Diagnostic Functions for Digital Inputs

The sensor supply current for the digital inputs (Pin 1: X3-X6) is monitored and the control is informed of an overload via the status word.

Electrical Requirements

Bus supply voltage	18-30 V DC	
I/O supply	18-30 V DC	
Current consumption of the bus supply	typically 85 mA	maximum 100 mA
Current consumption of I/O supply	corresponds to load of the digital outputs and the current capacity on the sensor supplies: maximum 4 A	

A maximum of 20 modules can be connected in series!



The supply for the entire electronics is provided with the VARAN bus. The outputs (X7 - X10) are powered via the supply X11. The supply voltage for inputs X3 - X6 is also provided via X11.
The 24 V bus supply is only provided through VARAN when it is connected via VARAN.
CAUTION! VARAN modules, which are not designed to be powered over VARAN, can be damaged when connected to modules with an active power supply.

The device must be supplied by a galvanically isolated source with a maximum of 24 V DC and a UL-certified 4 A fuse (UL 248) in the secondary circuit.

Ratings

Supply	18-30 V DC Class 2
Digital Outputs	4x 2 A per channel maximum 4 A total 24 V DC

Miscellaneous

Article number	14-108-087
Software Macro	PVDM0850_IM
Hardware version	1.x
Standard	UL 508 (E247993)

Environmental Conditions

Storage temperature	-20 … +85 °C	
Operating temperature	0 … +60 °C	
Mounting position	any	
EMC stability	in accordance with EN 61131-2	
Shock resistance	EN 60068-2-27	150 m/s²
Protection type	EN60529	IP67

Important Guidelines

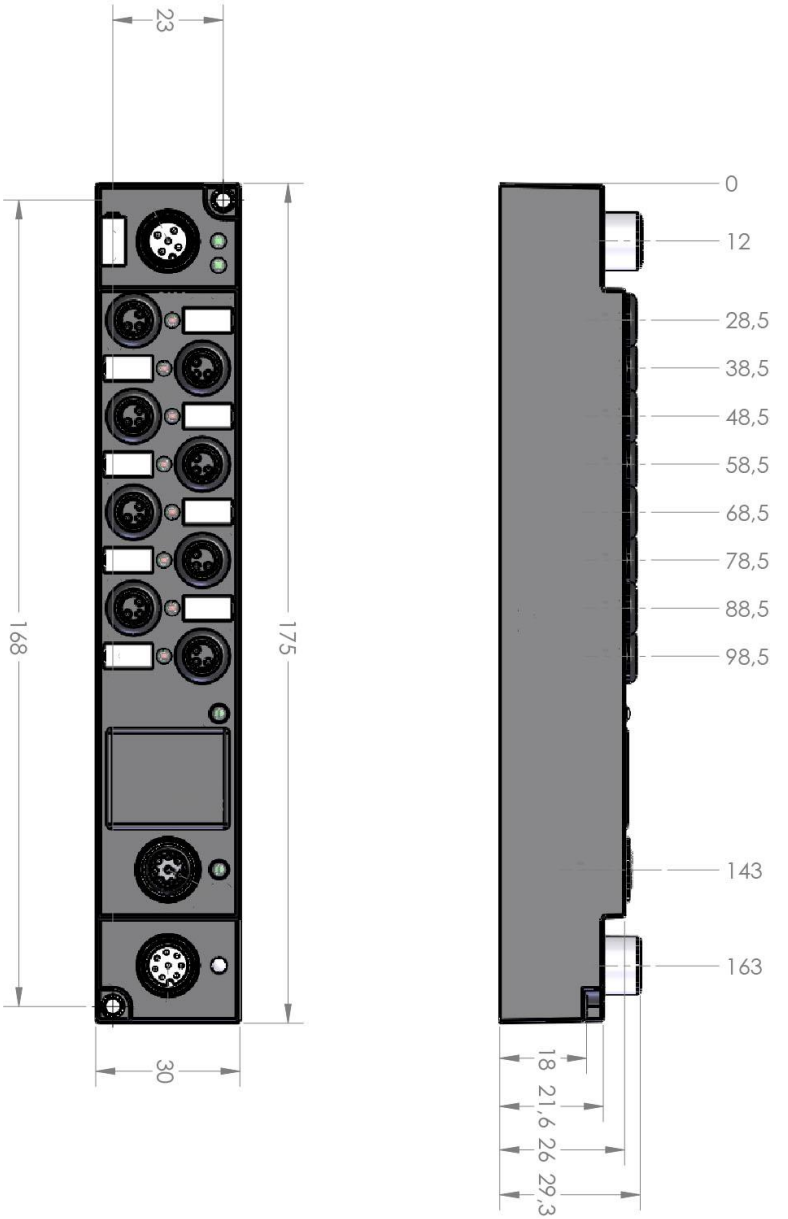
The IP67 protection rating is only reached when the appropriate opposing connector is correctly connected. If a plug or socket is not used, protective covers are required.

Erni screw for M12 (Art. No: 374343):

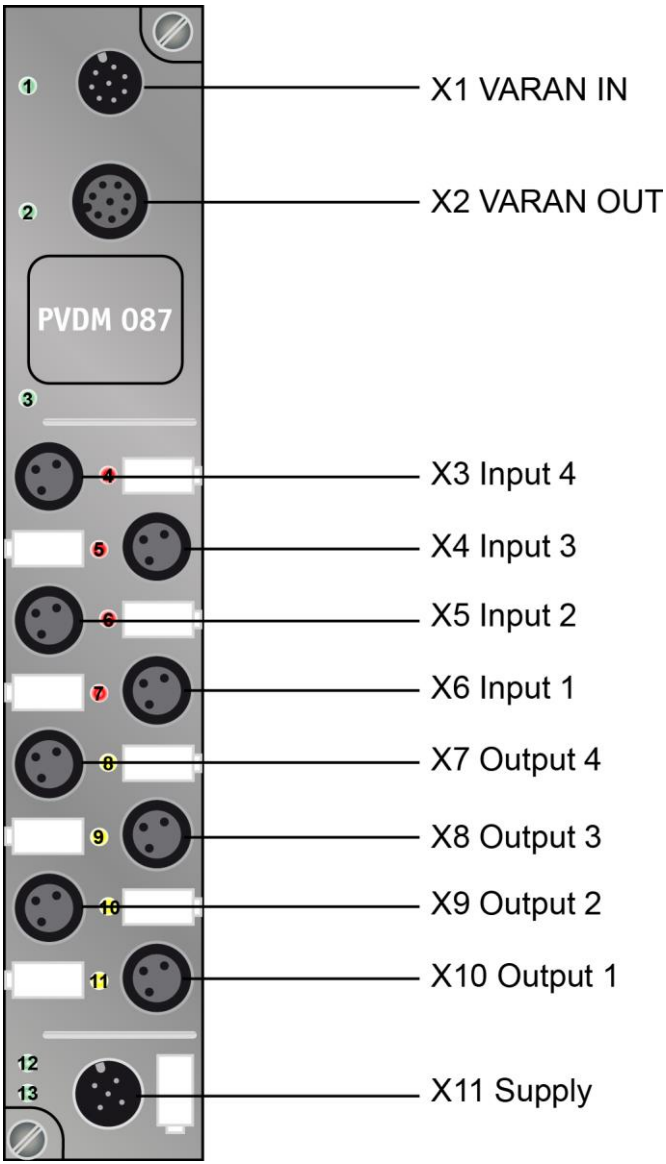
Erni nut for M12 (Art. No: 374342):

Phoenix Contact screw for M8 (Art. No. 1682540):

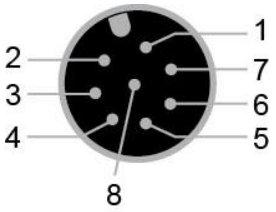
Mechanical Dimensions



Connector Layout



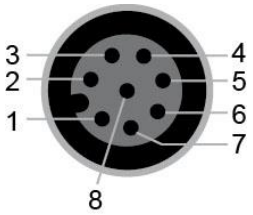
X1 VARAN In (M12 plug, 8-pin, type A)



Pin	Function
1	n c
2	TX/RX+
3	TX/RX-
4	n c
5	RX/TX+
6	GND
7	+24V bus supply
8	RX/TX-

The sleeve is ground.

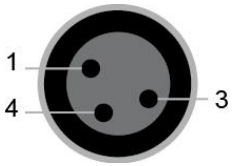
X2 VARAN Out (M12 socket, 8-pin, type A)



Pin	Function
1	n c
2	TX/RX+
3	TX/RX-
4	n c
5	RX/TX+
6	GND
7	+24V bus supply
8	RX/TX-

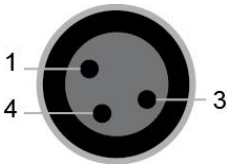
The sleeve is ground.

X3 – X6 inputs (M8 sockets, 3-pin, type A)



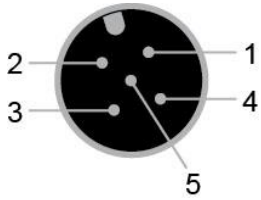
Pin	Function
1	+24 V sensor supply
3	EXGND
4	Input

X7 – X10 outputs (M8 socket, 3-pin, type A)



Pin	Function
1	- not connected
3	EXGND
4	Output

X11 Supply (M12 plug 5-pin, type A)



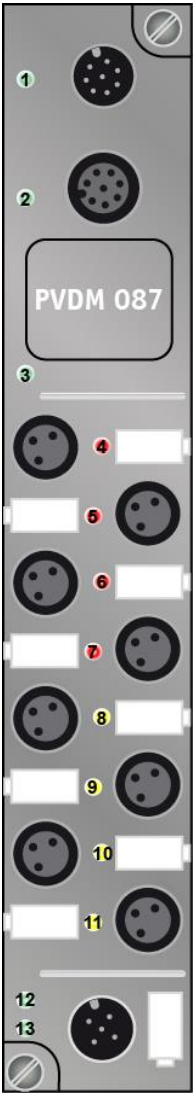
Pin	Function
1	EXGND
2	GND
3	+24 V supply inputs
4	+24 V supply outputs
5	+24 V bus supply

Note:

- The digital I/Os (24 V I/O supply for in- and outputs) are galvanically separated from the bus supply (24 V bus supply for electronics).
- The ground potential of the 24 V bus supply is GND.
- The ground potential of the 24 V I/O supply is EXGND.
- The 24 V bus supply can be optionally connected via X1 or X11.
- The maximum allowable current of 4 A per connector contact at 60 °C must not be exceeded.

For use with UL listed (CYJV) size M12 cords only!

Status LEDs



LED	Color	Function
1	green/yellow	VARAN IN LINK/ACTIVE
2	green/yellow	VARAN OUT LINK/ACTIVE
3	green/red	group diagnostic STATUS OK/ERROR
4	yellow/red	input 4 ACTIVE/ERROR
5	yellow/red	Input 3 ACTIVE/ERROR
6	yellow/red	Input 2 ACTIVE/ERROR
7	yellow/red	Input 1 ACTIVE/ERROR
8	yellow/red	Output 4 ACTIVE
9	yellow/red	Output 3 ACTIVE
10	yellow/red	Output 2 ACTIVE
11	yellow/red	Output 1 ACTIVE
12	green	+24 V DC I/O supply
13	green	+24 V DC bus supply

Applicable Connectors

X1	8-pin M12 cable socket, A coded, different models, diverse manufacturers e.g. Phoenix Contact, SACC-M12FS-8Q SH, 1553640
X2	8-pin M12 cable connector, A coded, different models, diverse manufacturers e.g. Phoenix Contact, SACC-M12MS-8Q SH, 1543236
X3-X10	3-pin M8 cable connector, A coded, different models, diverse manufacturers e.g. Phoenix Contact, SACC-M8MR-3CON-M, 1699902
X11	5-pin M12 cable socket, A coded, different models, diverse manufacturers e.g. Phoenix Contact, SACC-M12FS-5SC, 1508242

General Information on the Digital Outputs

All 4 outputs are powered by a common +24 V supply.

The cross section of the +24 V and 0 V supply line must be designed for the maximum output current drawn by a group. A maximum of 4 A per contact is allowed.

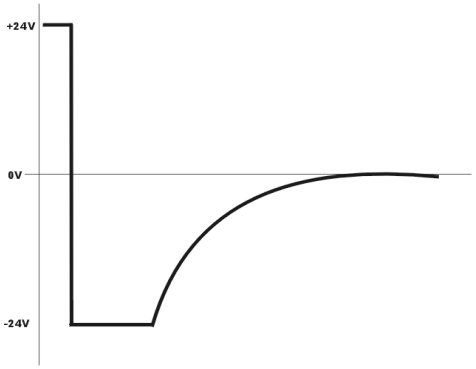
Caution!
When inductive loads are not equipped with a protective circuit, high surge currents flow over the 0 V line when the load is disconnected since the internal protective circuit is wired against 0 V. An excessively long or too thin 0 V conductor can lead to undesired responses from the outputs or the affected module.

The outputs and can be turned off by turning off the +24 V supply voltage. In this case, the output LEDs show the actual status of the outputs and not for the CPU.

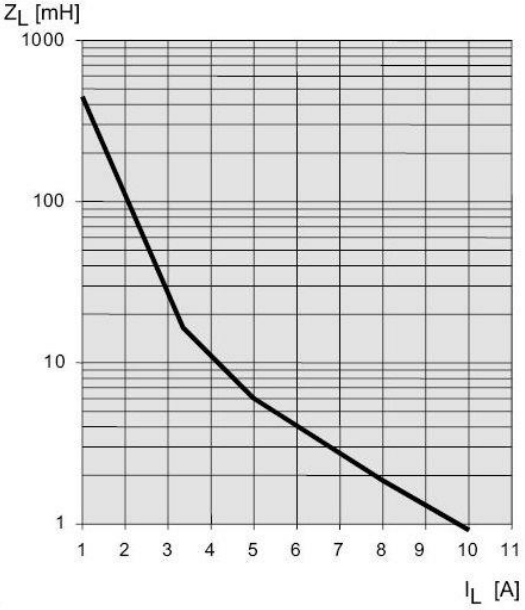
Applying power to an output whose supply voltage exceeds 0.7 V is not allowed.

All outputs are internally protected against +24V. Braking of inductive loads is limited to -24 V as shown in the graph below. However, an additional protection circuit directly on inductive loads is recommended (freewheeling diode) to avoid a system failure caused by voltage spikes (cross talk on analog lines). This results in a slowing of the energy dissipation.

Disconnecting inductive loads:


+24V
0V
-24V

Maximum allowable inductive load for an output without an external protective circuit:



It should be noted that frequent switching of inductive loads leads to additional thermal loading of the internal protective circuit and the maximum total current allowed may have to be reduced.

Control Address Mapping

Address (hex)	Size (Byte)	Description
0000	264	SPI Master
0140	64	Reserved
0180	64	VARAN Configuration registers

Recommended Shielding for VARAN

The real-time VARAN Ethernet bus system exhibits very robust characteristics in industrial environments. With the application of IEEE 802.3 standard Ethernet physics, the potentials between an Ethernet line and sending/receiving components are separated. In the event of an error, the VARAN Manager resends messages to a bus participant immediately. The shielding described below is principally recommended.

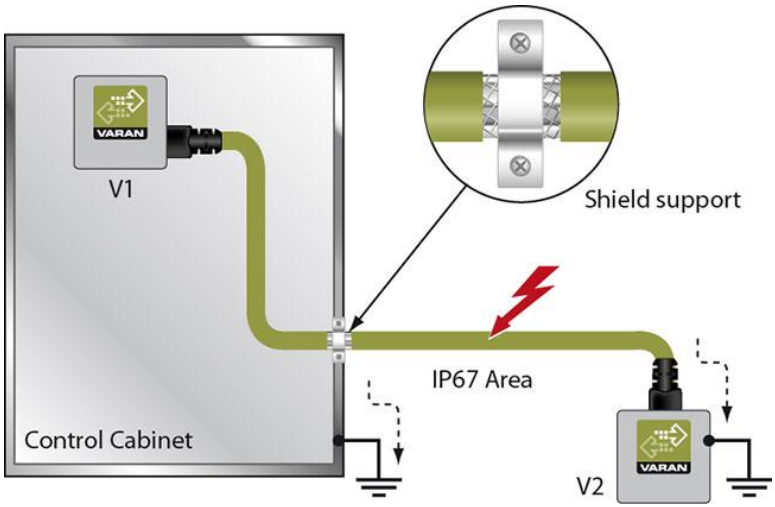
For applications in which the bus is run outside the control cabinet, the correct shielding is required. Especially when, for structural reasons, the bus line must be placed next to sources of strong electromagnetic interference. It is recommended to avoid placing VARAN bus lines parallel to power cables whenever possible.

SIGMATEK recommends the use of CAT5e industrial Ethernet bus cables.

For the shielding, an S-FTP cable should be used. An S-FTP bus is a symmetric, multi-wire cable with unshielded pairs. For the total shielding, a combination of foil and braiding is used. A non-laminated variant is recommended.

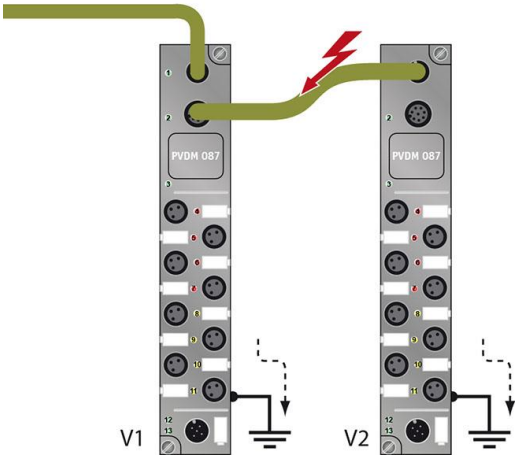
1. Wiring from the Control Cabinet to an External VARAN Component

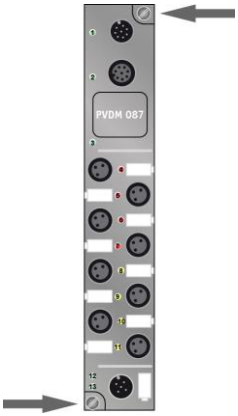
If the Ethernet lines are connected from a VARAN component to a VARAN node located outside the control cabinet, the shielding should be placed at the entry point to the control cabinet housing. All noise can then be dissipated before reaching the electronic components.



2. Wiring Outside of the Control Cabinet

If a VARAN bus cable is placed outside of the control cabinet, no additional shield support is required. This requires that only IP67 modules and connectors be used. These components are very robust and noise resistant. The shielding of all sockets in IP67 modules are internally connected to common bus or electrically connected to the housing, whereby the deflection of voltage spikes does not flow through the electronics.

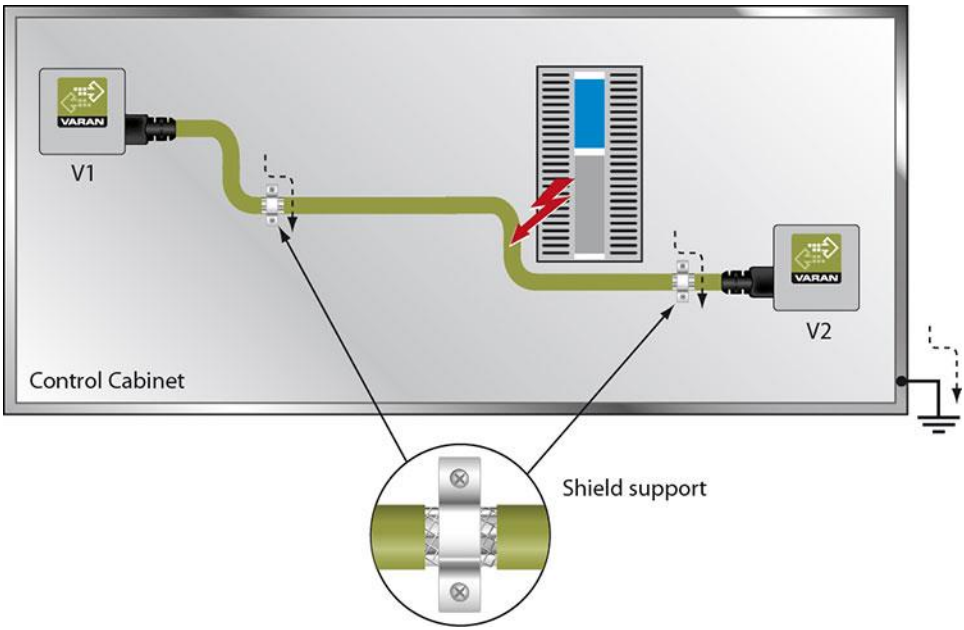




CAUTION!
The ground connection for the PVDM 087 is made via the two metal sleeves of the through-hole (upper right and lower left) in the plastic housing. A sufficiently conductive connection must be ensured.

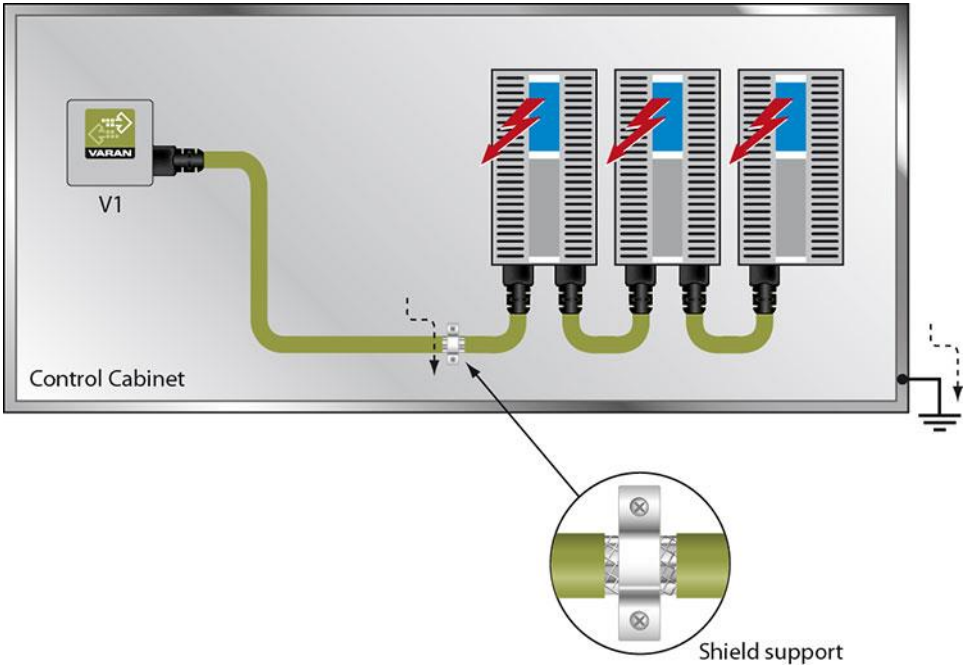
3. Shielding for Wiring Within the Control Cabinet

Sources of strong electromagnetic noise located within the control cabinet (drives, transformers, etc.) can induce interference in a VARAN bus line. Voltage spikes are dissipated over the metallic housing of a RJ45 connector. Without additional protective measures, noise will be conducted over the control cabinet through the circuit board of electronic components. To avoid error sources with data exchange, it is recommended that shielding be placed before any electronic components in the control cabinet.



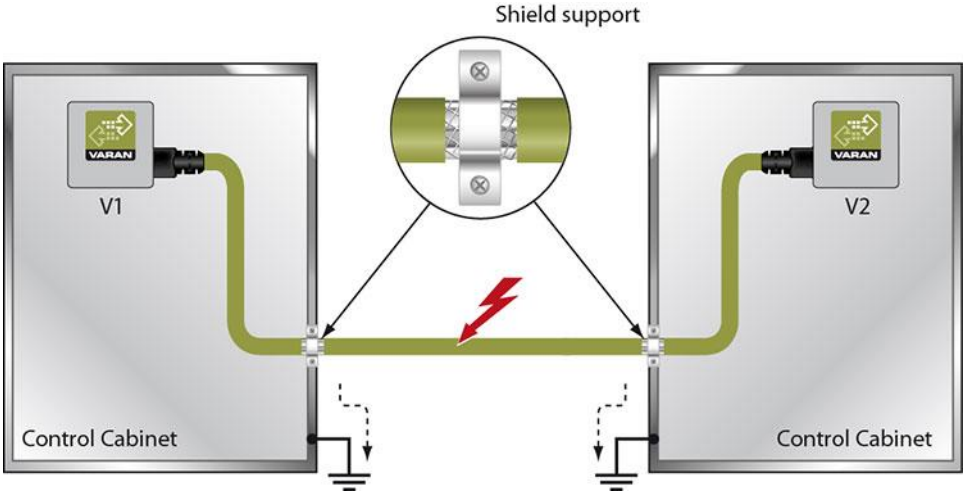
4. Connecting Noise-Generating Components

With the connection of power components that generate strong electromagnetic interference, it is also critical to ensure correct shielding. The shielding should be placed before a power element (or group of power elements).



5. Shielding Between Two Control Cabinets

If two control cabinets must be connected over a VARAN bus, it is recommended that the shielding be located at the entry point of each cabinet. Noise is therefore prevented from reaching the electronic components in both cabinets.



Addressing

Address (hex)	Size (bytes)	Access Type	Description	Reset Value
	1		Input Register* Bit 0: Channel 1 Bit 1: Channel 2 Bit 7: Channel 8	00
	1		Output Register* Bit 0: Channel 1 Bit 1: Channel 2 Bit 7: Channel 8	00
5112	1	r/w	Error Status Register (high active)* Bit 0: Channel 1-2 Bit 1: Channel 3-4 Bit 2: Channel 5-6 Bit 3: Channel 7-8 Bit 4: Periphery reset latched Bit 5 7: Reserved	00
5112	1		Input Register optimized for pvdm087 Bit 0: Input Channel 5 Bit 1: Input Channel 6 Bit 2: Input Channel 7 Bit 3: Input Channel 8 Bit 4: reserved Bit 5: Error Status Register Channel 5-6 Bit 6: Error Status Register Channel 7-8 Bit 7: Periphery reset latched	00

* PVDM 087 hardware uses only four channels. The wiring is listed below.

Wishbone Register	PVDM 087 Hardware
Input Register Bit 4: Channel 5 Bit 5: Channel 6 Bit 6: Channel 7 Bit 7: Channel 8	Connection to Input 1 Input 2 Input 3 Input 4
Output Register Bit 0: Channel 1 Bit 1: Channel 2 Bit 2: Channel 3 Bit 3: Channel 4	Connection to Output 1 Output 2 Output 3 Output 4
Error Status Register Bit 2: Channel 5-6 Bit 3: Channel 7-8	Connection to Error Status 5 and 6 Error Status 7 and 8