VARAN Bus Coupler Module VBC 021

For connecting two VARAN bus systems

VARAN 1: **1 x VARAN In**
2 x VARAN Out

VARAN 2: **1 x VARAN In**
1 x VARAN Out

1 x ETHERNET Port
VARAN transmits Ethernet (VtE)

This bus coupler module is used to connect two independent VARAN bus systems.

Data can be exchanged between the two bus systems over VtE and two double buffers (synchronous and asynchronous). The VBC 021 also ensures that both bus systems synchronize.

until HW 1.x

since HW 2.x

Technical Data

Performance data

Interface connections	1 x ETHERNET Port VtE (RJ45) 10/100MBit **VARAN1**: 1 x VARAN In (RJ45) 2 x VARAN Out (RJ45) **VARAN2:** 1 x VARAN In (RJ45) 1 x VARAN Out (RJ45) (maximum length VARAN: 100 m)
Internal data memory (SPI-Flash)	4 MBit/s

Electrical requirements

Supply voltage	18 – 30 V DC
Current consumption of voltage supply	Typically 200 mA (at + 24 V) (until HW 1.x) Typically 120 mA (at + 24 V) (since HW 2.x)

Only suitable for connection to secondary isolated power supply rated 24 V DC. Fuse in accordance with UL248 shall be connected in the field between the supply source and device terminals.

Uniquement pour la connexion à une alimentation isolée secondaire de tension nominale 24 V DC. Un fusible conforme UL248 doit être placé entre la source d'alimentation et les bornes de l'appareil.

Miscellaneous

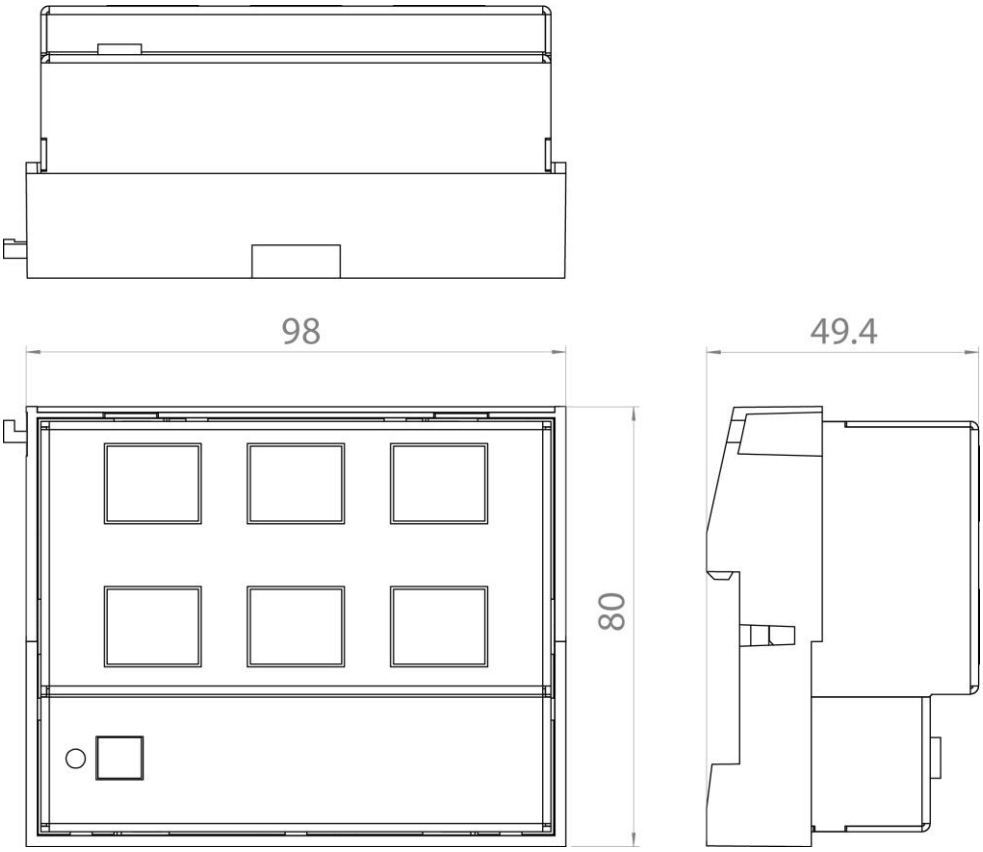
Article number	16-054-021
Hardware version	1.x, 2.x

Environmental conditions

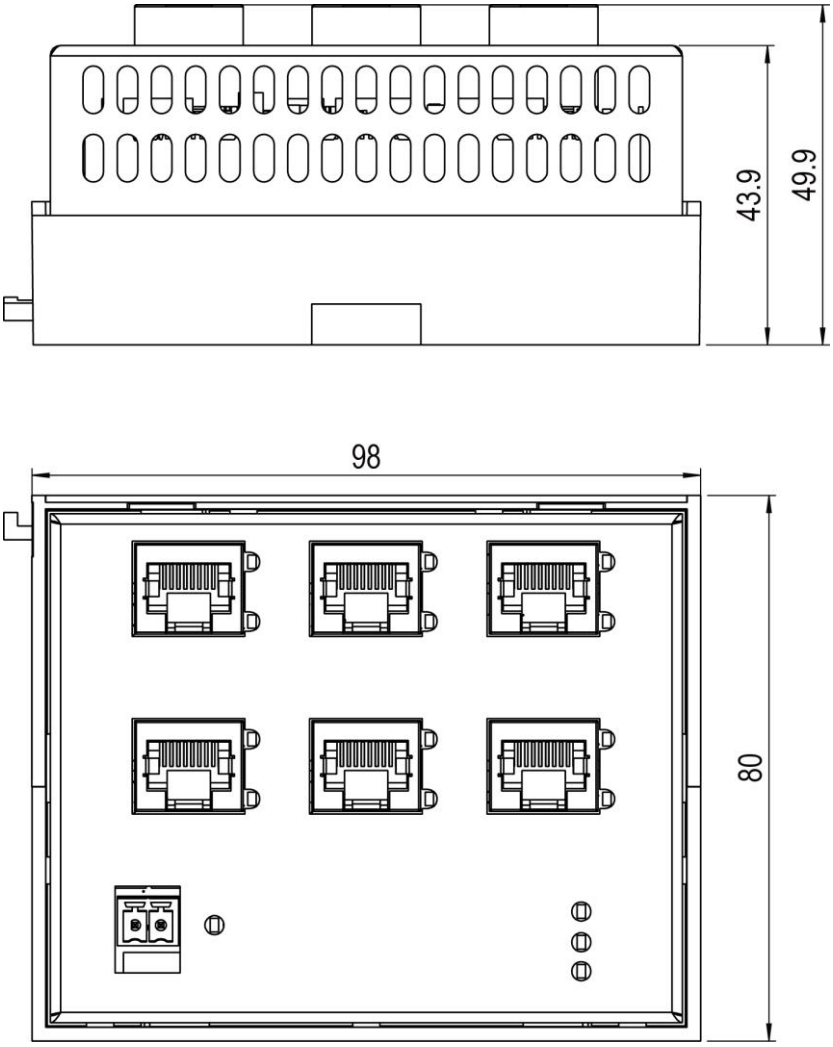
Storage temperature	-20 – +85 °C	
Environmental temperature	0 – +60 °C	
Humidity	0 - 95 %, uncondensed	
EMC stability *)	According to EN 61000-6-2 (industrial area)	
EMC noise generation	According to EN 61000-6-4 (industrial area)	
Shock resistance	EN 60068-2-27	150 m/s²
Protection Type	EN 60529	IP 20

*) Control box mounting required

Mechanical Dimensions until HW 1.x

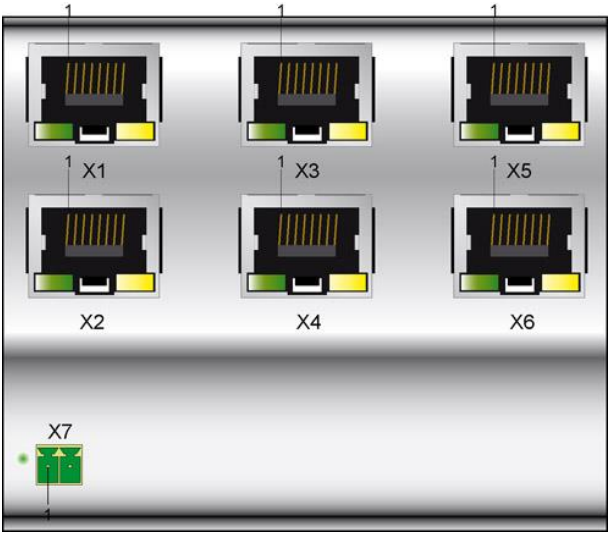


Mechanical Dimensions since HW 2.x

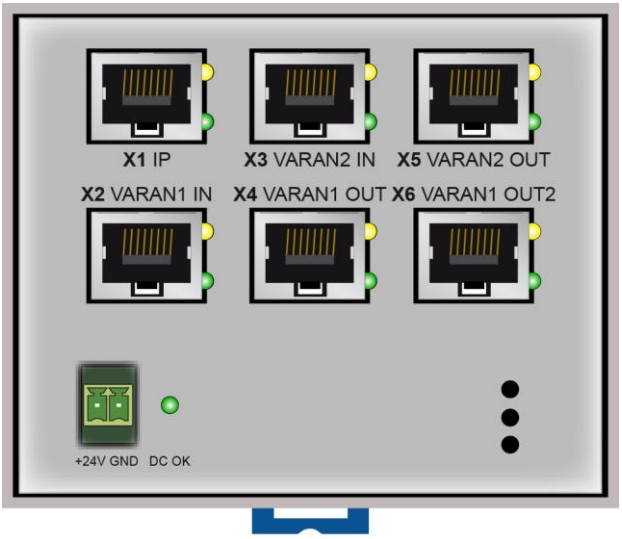


Connector Layout

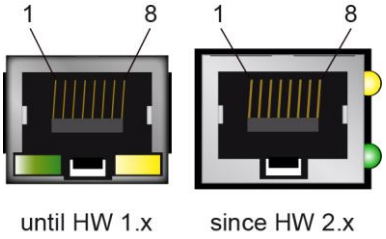
Connector Layout until HW 1.x



Connector Layout since HW 2.x



X1: ETHERNET Port (VtE)

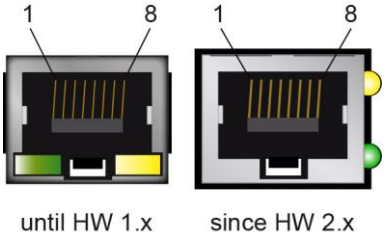


Pin	Function
1	TX/RX +
2	TX/RX -
3	RX/TX +
4 - 5	not connected
6	RX/TX -
7 – 8	GND

LEDs	Function
Yellow	ACTIVE
Green	LINK

LED	Color	Description
ACTIVE	Yellow	Lights when data is exchanged over the ETHERNET
LINK	Green	Lights when the connection between the two PHs is established
	Green	Blinks when data is received over the ETHERNET

X2: VARAN 1 IN

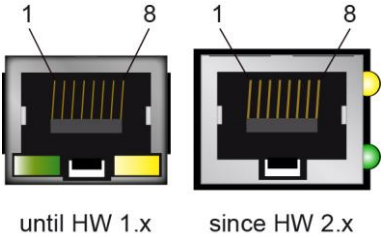


Pin	Function
1	TX/RX +
2	TX/RX -
3	RX/TX +
4 - 5	not connected
6	RX/TX -
7 – 8	GND

LEDs	Function
Yellow	ACTIVE
Green	LINK

LED	Color	Description
ACTIVE	Yellow	Lights when data is exchanged over the VARAN bus
LINK	Green	Lights when the connection between the two PHs is established
	Green	Blinks when data is received over the VARAN bus

X3: VARAN 2 IN

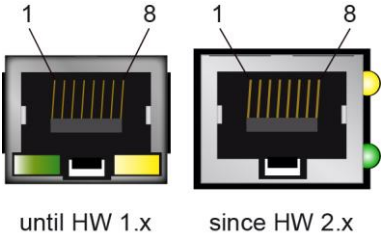


Pin	Function
1	TX/RX +
2	TX/RX -
3	RX/TX +
4 - 5	not connected
6	RX/TX -
7 – 8	GND

LEDs	Function
Yellow	ACTIVE
Green	LINK

LED	Color	Description
ACTIVE	Yellow	Lights when data is exchanged over the VARAN bus
LINK	Green	Lights when the connection between the two PHs is established
	Green	Blinks when data is received over the VARAN bus

X4: VARAN 1 OUT1

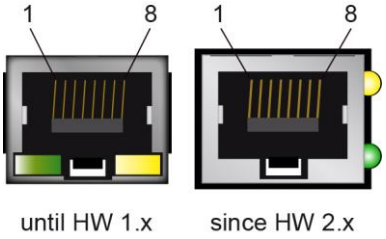


Pin	Function
1	TX/RX +
2	TX/RX -
3	RX/TX +
4 - 5	not connected
6	RX/TX -
7 – 8	GND

LEDs	Function
Yellow	ACTIVE
Green	LINK

LED	Color	Description
ACTIVE	Yellow	Lights when data is exchanged over the VARAN bus
LINK	Green	Lights when the connection between the two PHs is established
	Green	Blinks when data is received over the VARAN bus

X5: VARAN 2 OUT

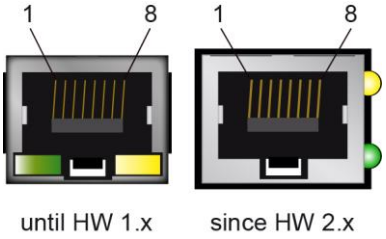


Pin	Function
1	TX/RX +
2	TX/RX -
3	RX/TX +
4 - 5	not connected
6	RX/TX -
7 – 8	GND

LEDs	Function
Yellow	ACTIVE
Green	LINK

LED	Color	Description
ACTIVE	Yellow	Lights when data is exchanged over the VARAN bus
LINK	Green	Lights when the connection between the two PHs is established
	Green	Blinks when data is received over the VARAN bus

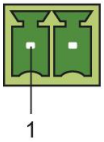
X6: VARAN 1 OUT2



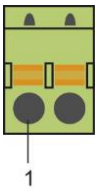
Pin	Function
1	TX/RX +
2	TX/RX -
3	RX/TX +
4 - 5	not connected
6	RX/TX -
7 – 8	GND

LEDs	Function
Yellow	ACTIVE
Green	LINK

X7: Power plug



Pin	Function
1	+24 V supply
2	GND



Useable connectors

Connector with spring clamp:
Phoenix Contact: FK-MCP 1.5/ 2-ST-3.5

The complete C-DIAS plug set CKL 141 with spring clamp is available from SIGMATEK with the article number 12-600-141.

Detailed Description

General

The VBC 021 appears in each of the VARAN bus systems as an independent VARAN client.

Synchronizing VARAN bus systems

In combination with the hardware classes, the VBC 021 ensures that both bus systems are synchronized with one another. As soon as the isochronous task has started in both VARAN bus systems, the VBC 021 starts to measure the phase offset between the two bus systems. The hardware class ensures that in VARAN bus 2, the VARAN-Manager regulates its bus cycle so that both systems are synchronized.

CAUTION!
The VARAN 2 side of a VBC 021 must only be present once within a VARAN bus system, otherwise conflicts will occur during synchronization.
For CPUs with multiple VARAN Managers, this applies to both VARAN Managers.

Synchronous double buffer

The synchronous double buffer (1kbyte) ensures that data exchange between the two bus systems is possible through the synchronous bus cycle without the danger of inconsistent data.

Asynchronous double buffer

The asynchronous double buffer (1kbyte) ensures that data exchange between the two bus systems is possible through the asynchronous bus cycle without the danger of inconsistent data.

VARAN transmits ETHERNET (VtE)

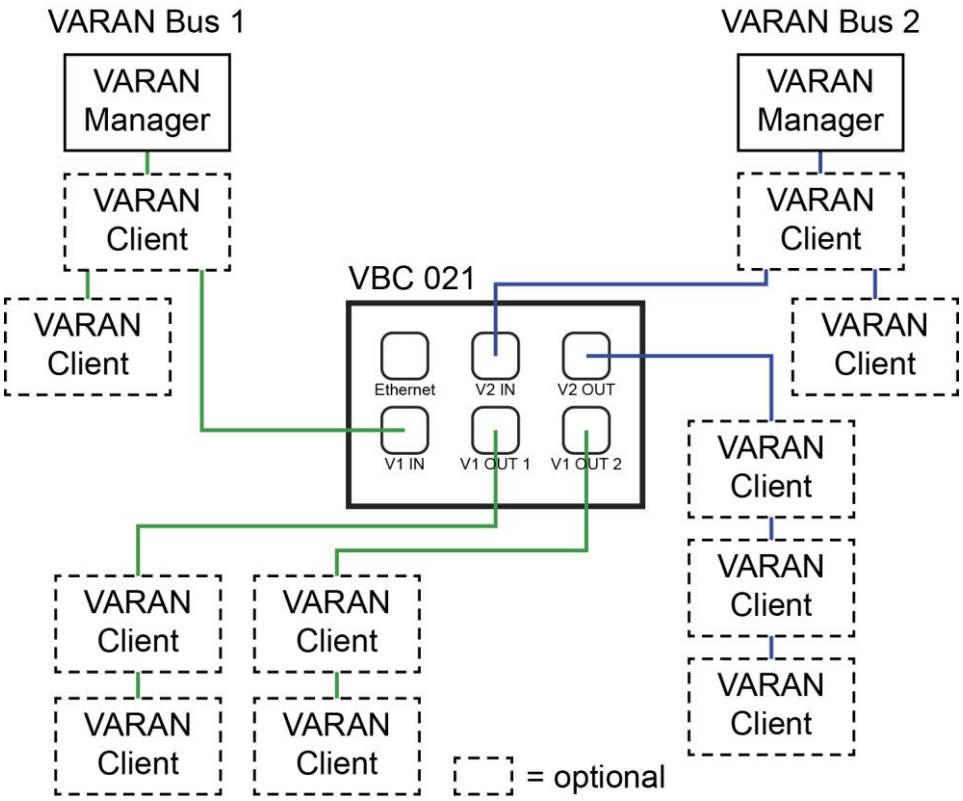
The VARAN bus provides the possibility to transmit Ethernet packets.
Some VARAN clients have an Ethernet port. The incoming Ethernet packets are distributed, as with a HUB, to all other Ethernet ports in the VARAN bus and the VARAN-Manager (and therewith the CPU) using VtE.

With the **VBC 021** Ethernet packets in a VARAN bus are not only provided using VtE in the Ethernet port, but also transmitted to the other VARAN bus and from there, distributed with VtE to the Manager and all other clients with a VARAN Ethernet port.

Bus Structure on the VBC 021

The VARAN bus can be configured in a tree and/or linear structure. The advantage of the tree structure is shorter response times from the farthest VARAN clients that with a linear structure.

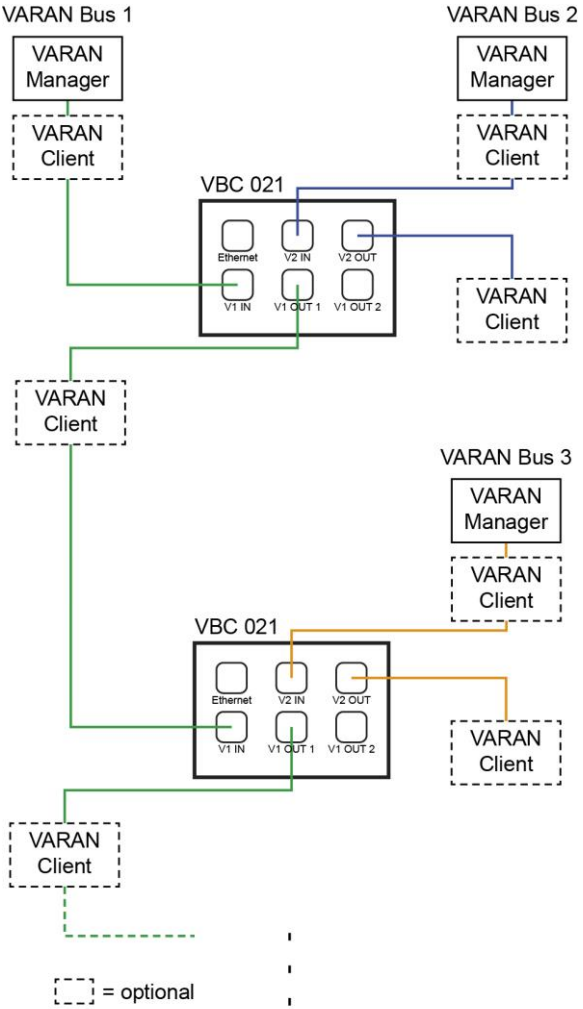
The VBC 021 allows the configuration of a tree structure on the VARAN 1 side; on the VARAN 2 side, the continuation of a linear structure is possible.



Coupling more than 2 VARAN bus systems

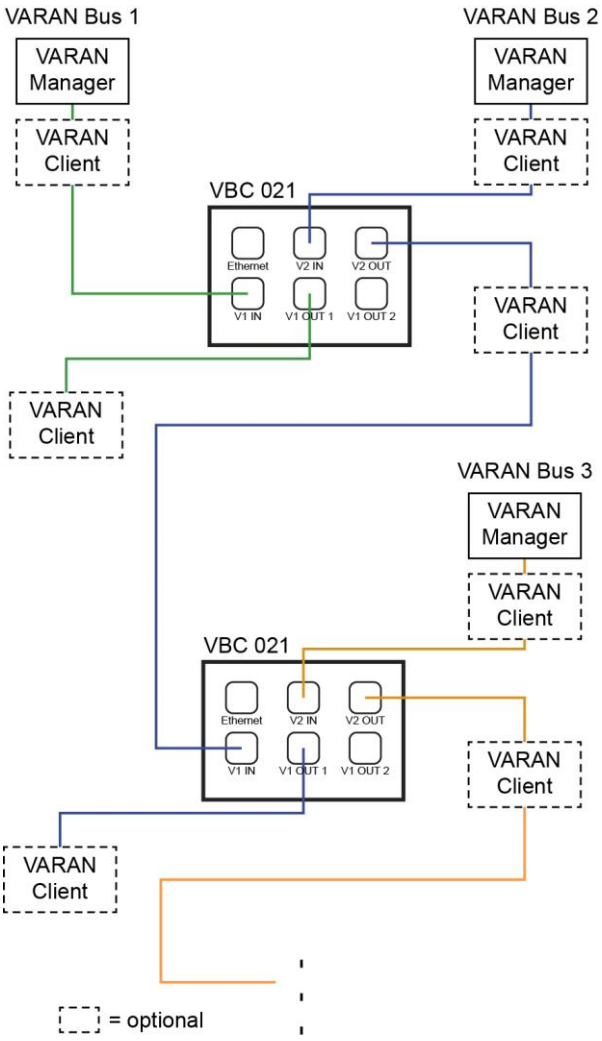
If VARAN bus systems are coupled with the VBC 021 via the VARAN 1 side, then depending on memory and performance limits, any number of VARAN bus systems can be coupled by cascading the VBC 021 until the VARAN bus subscriber limit of is reached.

Example of coupling VARAN bus systems with VBC 021 via the VARAN 1 side:



Coupling further VARAN strands with VBC 021

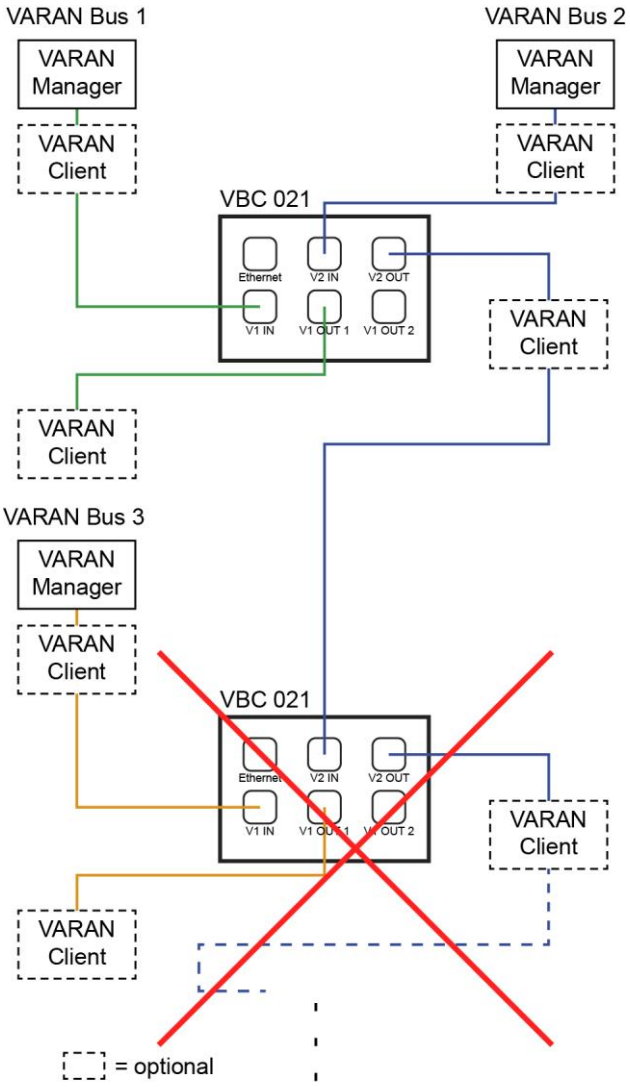
If VARAN bus systems are coupled with the VBC 021 via the VARAN 2 side, up to 4 VARAN bus systems can be coupled by cascading the VBC 021 (limited to a max of 4 VARAN bus systems to keep the jitter on the VARAN bus ≤ 100 ns , as the bus participants behind the VARAN bus systems will no longer be able to synchronize).



Coupling up to 4 VARAN strands with VBC 021

Within a VARAN bus system, the VARAN 2 side of a VBC 021 can be available only once since conflicts can otherwise occur.

Example of an impermissible VARAN bus coupling:



Recommended Shielding for VARAN

The VARAN real-time Ethernet bus system exhibits a very robust quality in harsh industrial environments. Through the use of IEEE 802.3 standard Ethernet physics, the potential 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. It is principally recommended that the shielding guidelines below be followed.

For applications in which the bus is run outside the control cabinet, the correct shielding is required. This is especially important, if due to physical requirements, the bus cables must be placed next to sources of strong electromagnetic noise. It is recommended that whenever possible, to avoid wiring VARAN-Bus lines parallel to power cables.

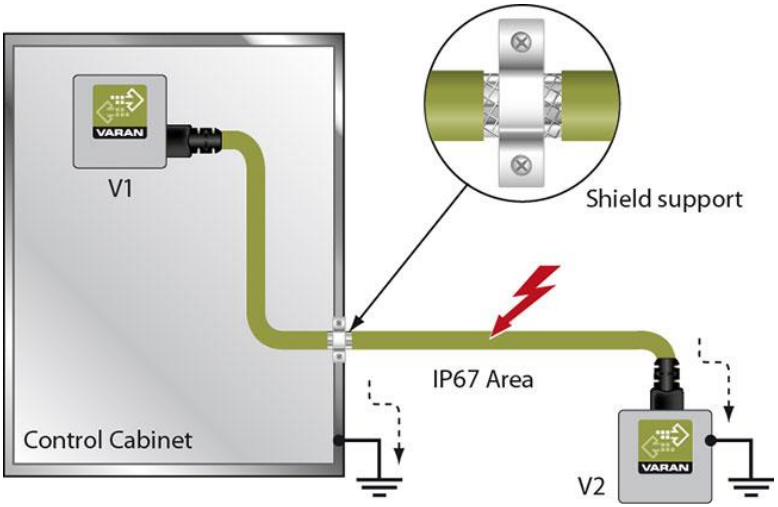
SIGMATEK recommends the use of CAT5e industrial Ethernet bus cables.

For the shielding variants, an S-FTP bus line is recommended.
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.

The VARAN cable must be secured at a distance of 20 cm from the connector for protection against vibration!

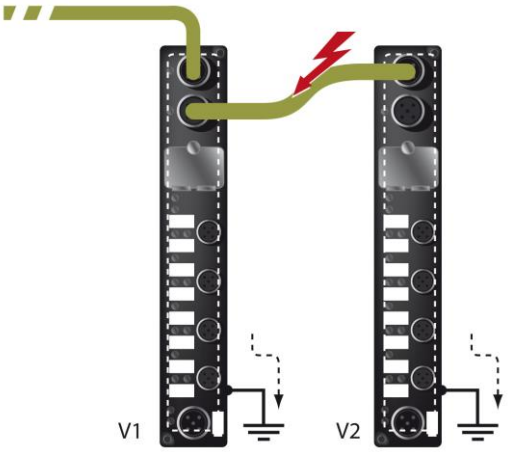
1. Wiring from the Control Cabinet to an External VARAN Component

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 deflected from the electronic components before reaching the module.



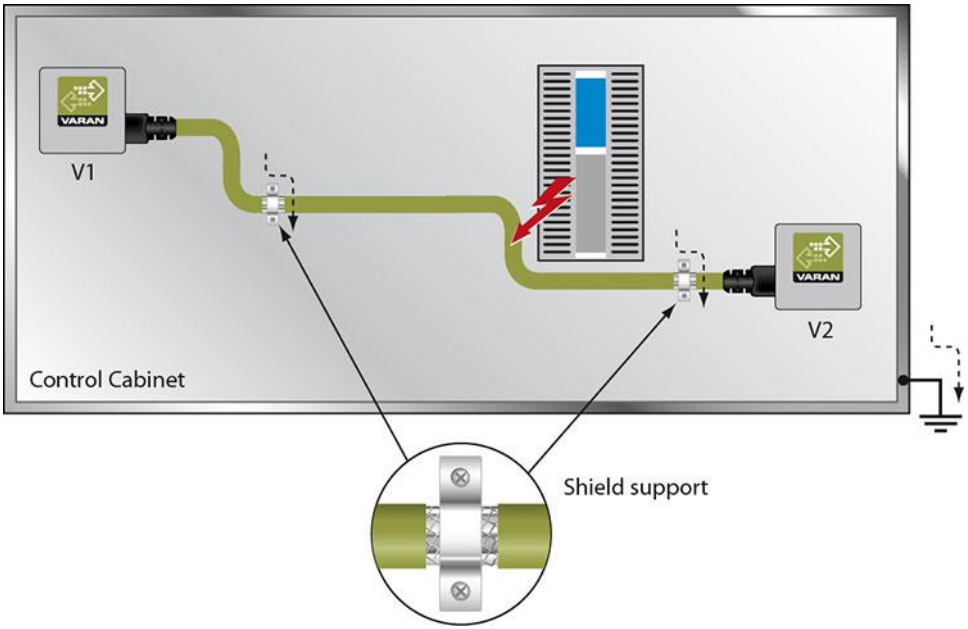
2. Wiring Outside of the Control Cabinet

If a VARAN bus cable must be placed outside of the control cabinet only, no additional shield connection is required. This requires that only IP67 modules and connectors be used. These components are very robust and noise resistant. The shielding for 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.



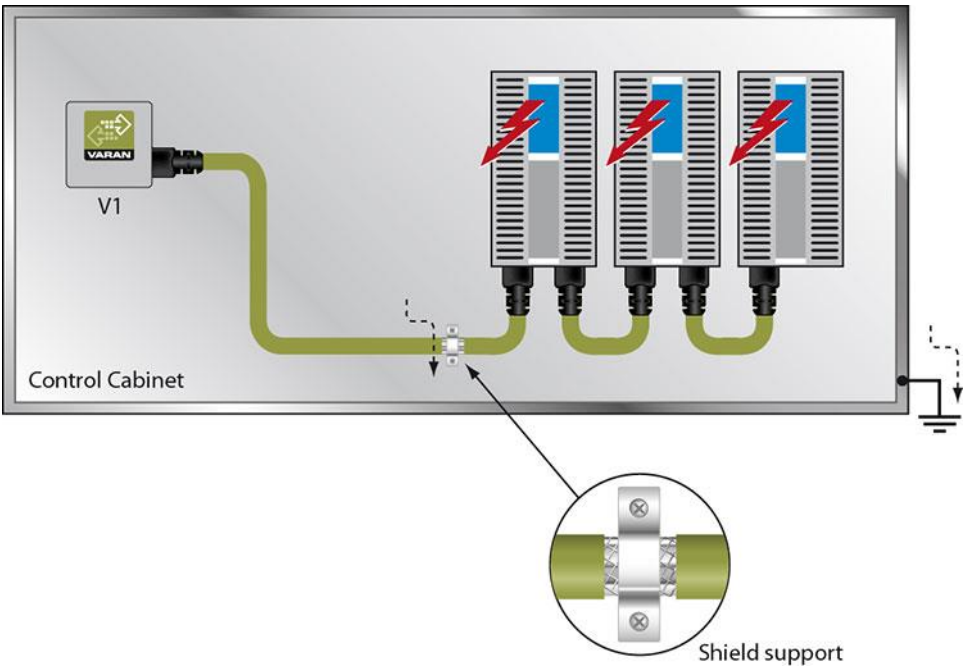
3. Shielding for Wiring Within the Control Cabinet

Sources of strong electromagnetic noise located within the control cabinet (drives, Transformers, etc.) can induce interference in a VARAN bus line. Spike voltages are deflected over the metallic housing of a RJ45 connector. Noise is conducted through the control cabinet housing without further action from the electronic components To eliminate sources of noise during data transfer, it is recommended that the shielding for all electronic components be connected within the control cabinet.



4. Connecting Noise-Generating Components

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



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 points of both cabinets. Noise can be thereby stopped from reaching the electronics within the control cabinet.