VPA 3CG

Profibus DP Fieldbus Option Board

Publication version: VVPA3CG/EN M/A003

User manual

Schneider Electric

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1. General

VAMP Protection Relays can be connected to the Profibus DP by using a Fieldbus board or external device. The relay can then be monitored from the Host system.

Fieldbus board can be installed inside in a 50- or 200-series VAMP-Relays. The external device can be used with 40-, 50-, 200-, 3xx-series VAMP Relays.

2. Specifications

2.1. General

Profibus DP – connections	Interface	9-pin DSUB connector (female)
	Transfer method	RS-485, Half-duplex
	Transfer cable	Twisted pair(1 pair and shield)
	Electrical isolation	500 VDC
Safety		Fulfils EN50178 Standard

Table 1. Specifications

Communication mode	Profibus DP
Communication parameters	
Address	1 to 126
Baud Rate	9.6 kBaud to 12 MBaud

Table 2. Profibus DP communication data

2.2. Profibus cable

Profibus devices are connected in a bus structure. Up to 32 stations (master or slaves) can be connected in one segment. The bus is terminated by an active bus terminator at the beginning and end of each segment (see:

Figure 1. Cabling and bus termination). To ensure error-free operation, both bus terminations must always be powered. When more than 32 stations are used, repeaters (line amplifiers) must be used to connect the individual bus segments.

The maximum cable length depends on the transmission speed and cable type (see: Table 3. Line parameters and Table 4. Line length for different transmission speeds). The specified cable length can be increased by the use of repeaters. The use of more than 3 repeaters in series is not recommended.

Parameter	**Line A**	**Line B**
Impedance	135 … 165 Ω (3 to 20 MHz)	100 … 130 Ω (f > 100 kHz)
Capacity	< 20 pF / m	< 60 pF / m
Resistance	110 Ω / km	-
Wire gauge	> 0,64 mm	> 0,53 mm
Conductor area	> 0,34 mm^2	> 0,22 mm^2

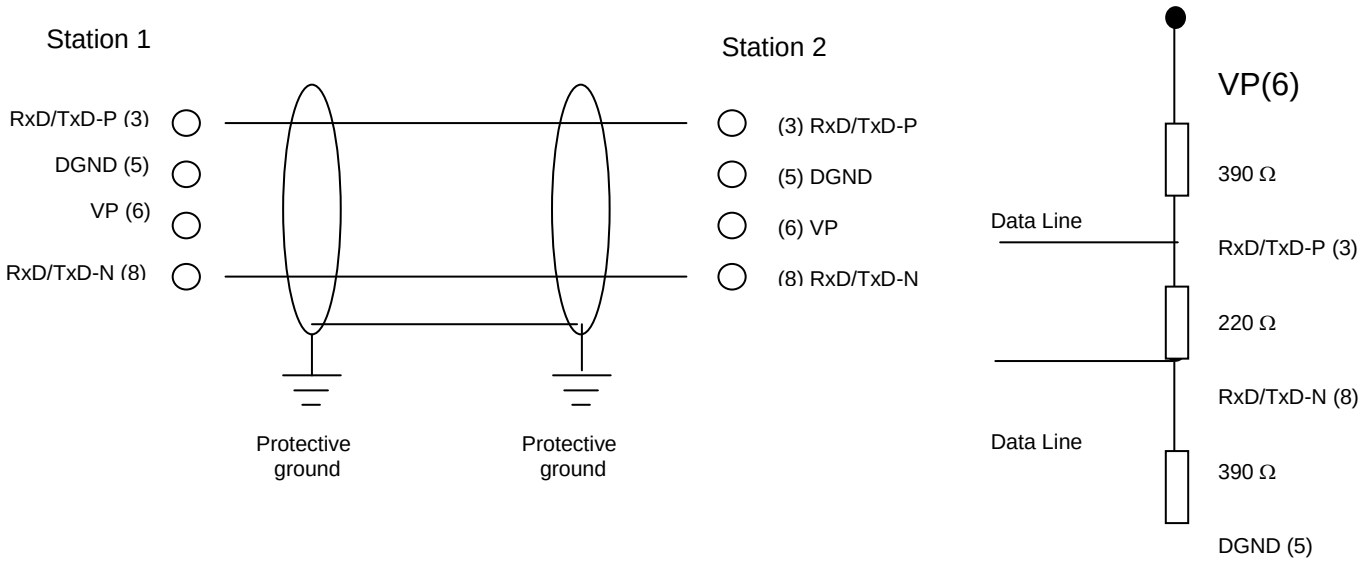
Table 3. Line parameters

Baud rate (kbit/s)	9.6	19.2	93.75	187.5	500	1500	3000-12000
Length line A (m)	1200	1200	1200	1000	400	200	100
Length line B (m)	1200	1200	1200	600	200	-	-

Table 4. Line length for different transmission speeds

Following cables can be used (e.g):

Belden	Profibus Data Cable	3079A
Olflex	Profibus Cable	21702xx
Siemens	SINEC L2 LAN cable for Profibus	6XV1 830-0AH10



Cabling **Bus Termination**

Figure 1. Cabling and bus termination

Pin. No.	**Signal**	**Designation**
1	nc	Not connected
2	nc	Not connected
3	RxD/TxD-P	Receive data/transmission data plus
4	nc	Not connected
5	DGND	Data transmission potential (ground to 5 V)
6	VP	Supply voltage of the terminating resistance-P, (P5V)
7	nc	Not connected
8	RxD/TxD-N	Receive data/transmission data negative
9	nc	Not connected

Table 5. D9 connector pins

3. Profibus DP

3.1. General

Profibus is a vendor-independent, open fieldbus standard for a wide range of applications in manufacturing, process and building automation. Vendor independence and openness are guaranteed by the Profibus standard EN 50 170. With Profibus, devices of different manufactures can communicate without special interface adjustments. Profibus can be used for both high-speed time critical data transmission and extensive complex communication tasks. The Profibus family consists of three compatible versions.

Profibus-DP

Optimised for high speed and inexpensive hook-up, this Profibus version is designed especially for communication between automation control systems and distributed I/O at the device level. Profibus-DP can be used to replace parallel signal transmission with 24 V or 0 to 20 mA.

Profibus-PA

Profibus-PA is designed especially for process automation. It permits sensors and actuators to be connected to one common bus line even in intrinsically safe areas. Profibus-PA permits data communication and power over the bus using 2-wire technology according to the international standard IEC 1158-2

Profibus-FMS

Profibus-FMS is the general-purpose solution for communication tasks at the cell level. Powerful FMS services open up a wide range of applications and provide great flexibility. Profibus-FMS can also be used for extensive and complex communication tasks.

Profibus specifies the technical and functional characteristics of a serial Fieldbus system with which decentralized digital controllers can be networked together from the field level to the cell level. Profibus distinguishes between master devices and slave devices.

Master devices determine the data communication on the bus. A master can send messages without an external request when it holds the bus access rights (the token). Masters are also called active stations in the Profibus protocol.

Slave devices are peripheral devices. Typical slave devices include input/output devices, valves, drives and measuring transmitters. They do not have bus access rights and they can only acknowledge received messages or send messages to the master when requested to do so. Slaves are also called passive stations.

3.2. The Profibus User Organization

World market leaders in automation technology have joined together to form the Profibus User Organization. Since its establishment, 15 countries have formed national user organizations. These national organizations have been united under an organization called Profibus International (PI). The organization represents the interests of Profibus users and manufacturers. Together with its members, this association is pushing to establish the international use of Profibus. Several hundred companies are members of the association. Their primary tasks and goals are listed below.

- Joint marketing activities
- Public relations work
- Spreading of information
- Further development of the technology
- Preparation of certificates confirming conformance to the standard
- Assignment and administration of the ident numbers
- Definition of user profiles
- Preparation of testing guidelines for test laboratories
- Taking care of members

As a member of the Profibus international organization, you will be kept informed of current developments in the area of Fieldbuses. Membership is open to all users and manufacturers as well as technical and scientific institutes.

4. Profibus DP device profiles

4.1. Continuous mode with fixed data set

In this mode the VAMP Protection Relay is sending a configured set of parameters continuously to the Profibus DP master.

4.1.1. Calculation of the Profibus DP buffer length in continuous mode with fixed data set

The needed buffer length for Profibus DP data transfer depends of the biggest offset of any activated parameter and the size of this parameter. The offset and the activation for each available parameter are configurable.

The device calculates the needed buffer length. E.g. if the device's display shows:

InBuf	32byte
OutBuf	0byte,

you have to select the corresponding module "INPUT: 32 Byte" from the .gsd file (e.g. VPA_00F7.gsd) when configuring the Profibus DP master for this device.

The following example reveals the algorithm used by a VAMP device to calculate the needed Profibus DP buffer length:

Example:

- The parameter Eimp (imported active energy) has the biggest offset, 30, of all activated Profibus DP data items in InBuf.
- The size of Eimp item is 4 bytes.
- The parameter DirectO5C (Direct Operate Object 5 Close) has the biggest offset,13 , of all activated Profibus data items in OutBuf.
- The size of DirectO5C is 1 byte.
- Both buffers are forced to the same length.

Input:

Offset of the last occupied byte:

$30 + (4 - 1) = 33$

Round up to next 2^n (n is an integer):

log2 33 = log 33 / log 2 = 5.044.

Round up to next integer → 6.

$2^6 =$ **64**

Output:

Offset of the last occupied byte:

13 + (1- 1) = 13

Round up to next 2^n (n is an integer):

log2 13 = log 13 / log 2 = 3.700.

Round up to next integer → 4.

2^4 = **16**

After restarting the device will display the following buffer sizes:

InBuf	64byte
OutBuf	64byte

If both buffers are in use in the continuous mode, the length of the smaller buffer is forced to match the longer buffer. In the example : 2^4 = 16 is forced to 2^6 = 64

Please select the corresponding module “INPUT/OUTPUT : 64 Byte” from the .gsd file (e.g. VPA_00F7.gsd) when configuring the Profibus DP master for this device.

Note!

It is recommended that maximum size for output buffer in continuous mode is 64 bytes.

4.2. Request mode

Using the request mode it is possible to read all available data from the VAMP Protection Relay and still use only a short buffer for Profibus data transfer. The drawback is the slower overall speed of the data transfer and the need of increased data processing at the Profibus master as every data item must be separately requested by the master from the slave.

Note!

It is not possible to read continuously only one single data item. In request mode you have to request at least two items in turn to get updated data from the device.

After setting the Profibus driver of the device into request mode, the device will restart (wait appr. 30 seconds). After restarting the device will ignore parameter offsets and will display the following fixed buffer sizes:

InBuf	8byte
OutBuf	8byte.

Please select the corresponding module “INPUT/OUTPUT:8 Byte” from the .gsd file (e.g. VPA_00F7.gsd) when configuring the Profibus DP master for this device.

4.2.1. Data request message from the Profibus master

The request is 8 bytes long consisting of three fields:

ID		IND		VALUE			
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7

ID	Type and number of the requested data
IND	Index 0…65535 of the parameter member to be requested or 0 if the parameter is scalar
Value	Not used

The identifier word, **ID**, consists of three bit fields:

Request type				**SM**	**Parameter number**										
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

Request type	0001	Read (0010 = Write)
SM	0	Spontaneous bit(not used)
Parameter number	0..2047	Each available data item in the device has a fixed parameter number

4.2.2. Data response message from the VAMP device

The response message is 8 bytes long consisting of three fields:

ID		IND		VALUE			
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7

ID	Type and number of the requested data
IND	Requested index
Value	Value of the requested data or error code

The identifier word, **ID**, consists of three bit fields:

Response type				**SM**	**Parameter number**										
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

Respone type	0001	Value is ready
	0111	Request rejected
SM	0	Spontaneous bit(not used)
Parameter number	0..2047	The number of the requested parameter.

Error codes in value field in case of response type 0111:

0	Illegal parameter
18	Other fault
101	Unknown request type

4.2.3. Examples of request and response messages

Example 1: Active power

The master requests the measured active power from the device. The hexadecimal byte values are:

ID		IND		VALUE			
10	00	00	00	00	00	00	00

ID:

1 Request type is read

0 00 Parameter number of active power P is 0

IND:

00 00 Index is 0

VALUE:

00 00 00 00 Dummy value

The slave responses with the active power value. The hexadecimal byte values are:

ID		IND		VALUE			
10	00	00	00	00	00	0D	7A

ID:

1 Response type is ‘Value is ready’

0 00 Parameter number is 0. (Copy of request message parameter number)

IND:

00 00 Index is 0. (Copy of request message index)

VALUE:

00 00 0D 7A The active power is 3450 kW ($0D7A_{16}$ = 3450_{10})

5. Installation and commissioning

5.1. Internal adapter 50- and 200-Series Relays

Both 50- and 200-Series VAMP-Relays may be equipped with a dedicated internal adapter exclusive for Profibus communication.

For more information on the ordering of a 50- or 200-Series VAMP Relay equipped with an internal Profibus adapter, please consult the respective user manual.

5.1.1. Internal adapter in 50-Series Relays

The Fieldbus cable must be connected to the X7-Connector (labelled: Profibus DP) on the rear panel of the relay. The 50-Series internal Profibus adapter does not have a termination resistor; therefore, it must be provided by the fieldbus connector.

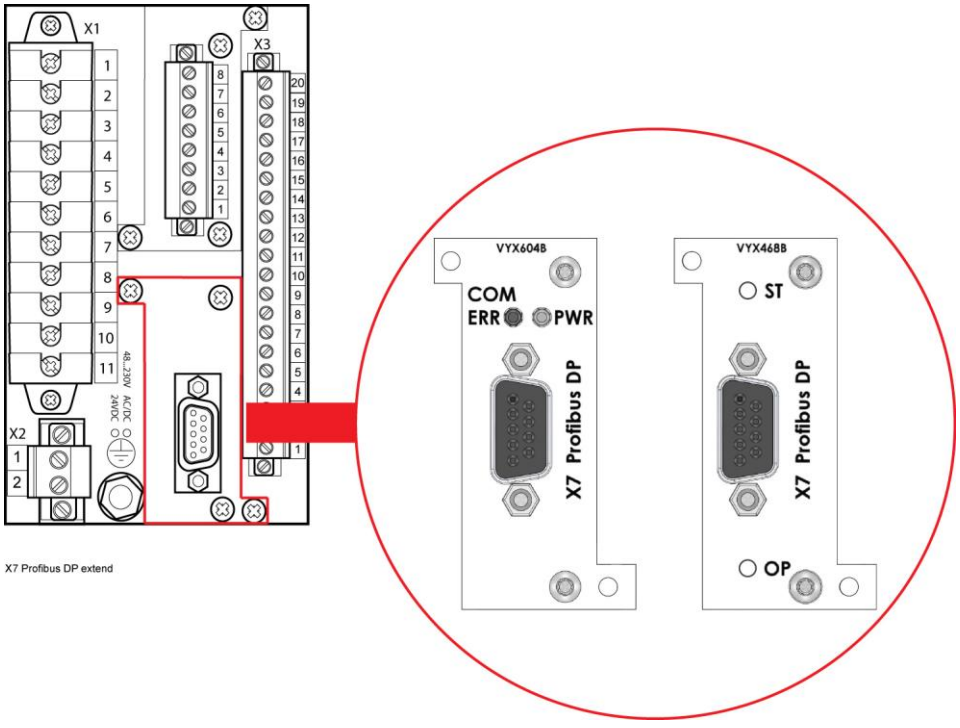


Figure 2. Back panel of 50-Series VAMP Relay

5.1.2. Internal adapter in 200-Series Relays

The Fieldbus cable must be connected to the X5-Connector (labelled: PROFIBUS) on the rear panel of the relay. As with the 50-Series internal adapter; it does not have either a termination resistor.

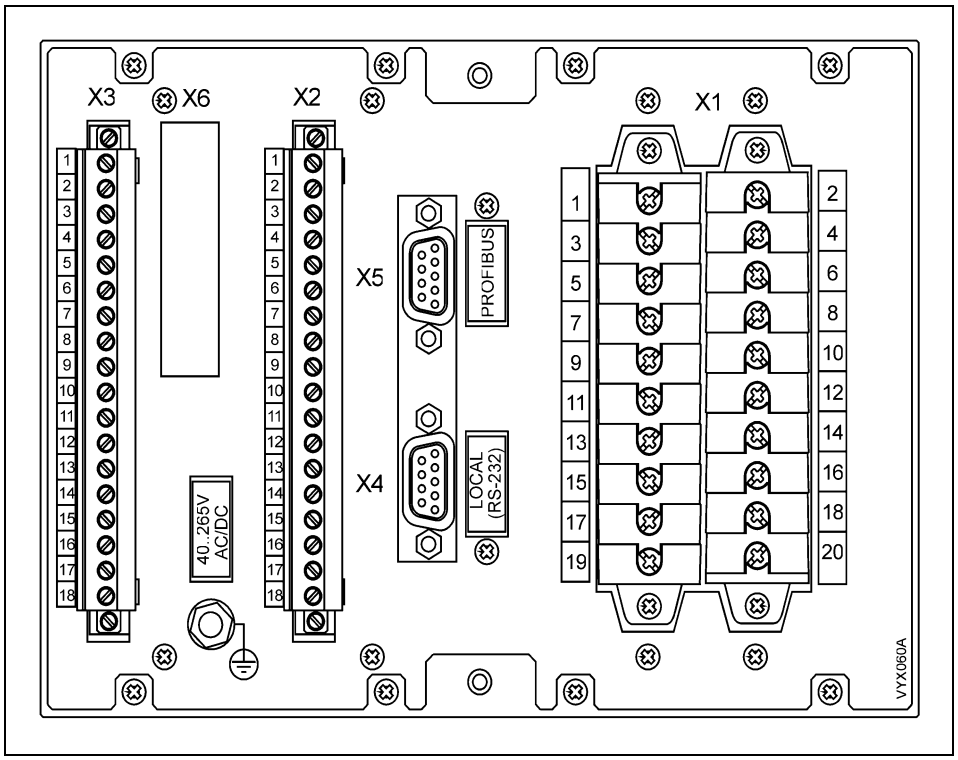


Figure 3. Back panel of 200-Series VAMP Relay

5.2. External adapter (VPA 3CG)

The external adapter (VPA 3CG) can be used with 40-, 50-, 100-, 200- and 3xx-Series VAMP-Relays, and VAMP321 Arc Flash Protection Systems.

5.2.1. VPA 3CG and 200-Series VAMP-Relays

The adapter is connected to the 'REMOTE'-port (connector X5) on a 200-Series VAMP-Relay's rear panel with a VX007–Cable.

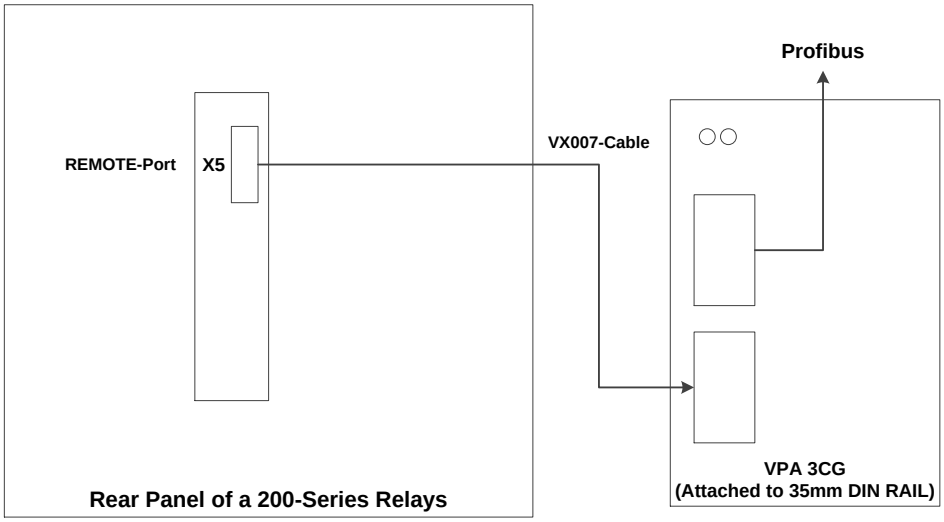


Figure 4. Connecting external adapter (VPA 3 CG) to a 200-Series Relay

5.2.2. VPA 3CG and 50-Series VAMP-Relays

This adapter must be used with 50-series VAMP-Relays whenever Profibus and a second communication protocol are required in the system. Otherwise, it is advisable to order a 50-Series VAMP-Relay with an internal Profibus adapter.

In order to do such an installation, the optional communication modules must be selected as follows: *"L"* must be selected for optional communication module 1, this interface will be used for connecting the relay with the VPA module; while optional communication module 2–*"B", "C", "E"* or *"G"*–must be selected according to the target application for Ethernet, IRIG-B synchronization or VIO12Ax communication.

Please refer to the Manual of your 50-Series VAMP-Relay for more detailed information on the ordering of communication modules.

The external adapter can be connected to a 50-Series VAMP-Relay's REMOTE-Port—according to the description given in the previous paragraph—with a VX054-Cable. The VPA external adapter must be powered from an external 12 Volts power supply through the VX054-Cable.

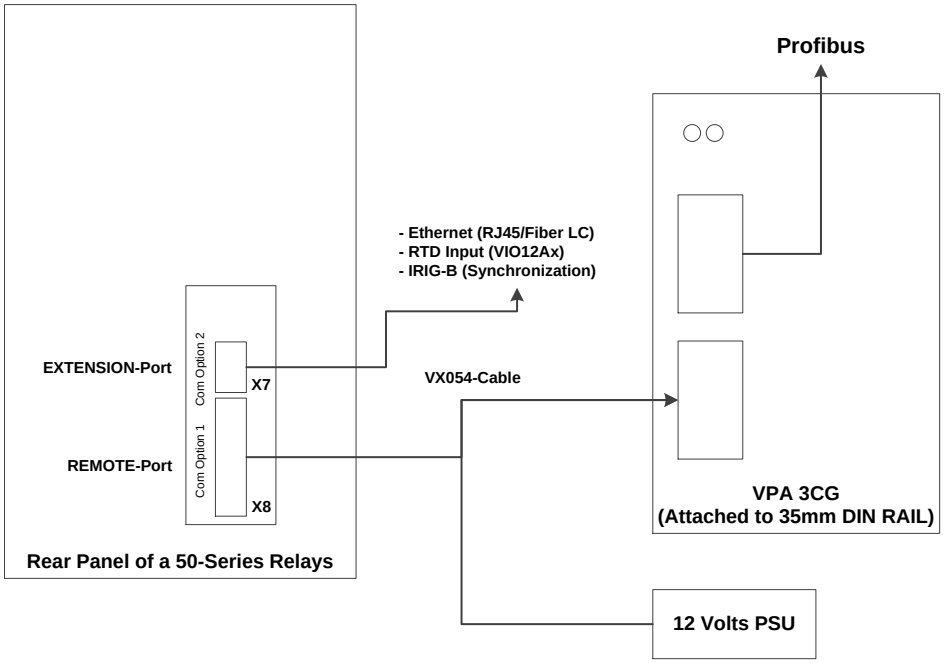


Figure 5. Connecting external adapter (VPA 3 CG) to a 50-Series Relay

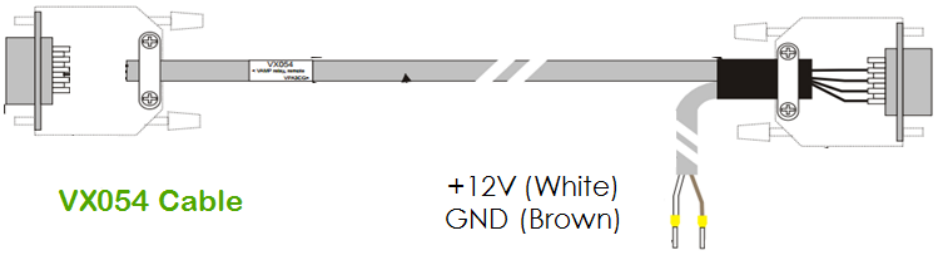


Figure 6. Connecting external adapter (VPA 3 CG) to a 50-Series Relay

5.2.3. VPA 3CG and 3xx-Series VAMP-Relays

The external adapter (VPA 3CG) can be connected to a 3xx-Series VAMP-Relay's or VAMP321 Arc Flash Protection System's COM1- or COM3-Port with a VX072-Cable. Both of these VAMP devices are cable of powering the VPA 3CG module (no external power supply is required).

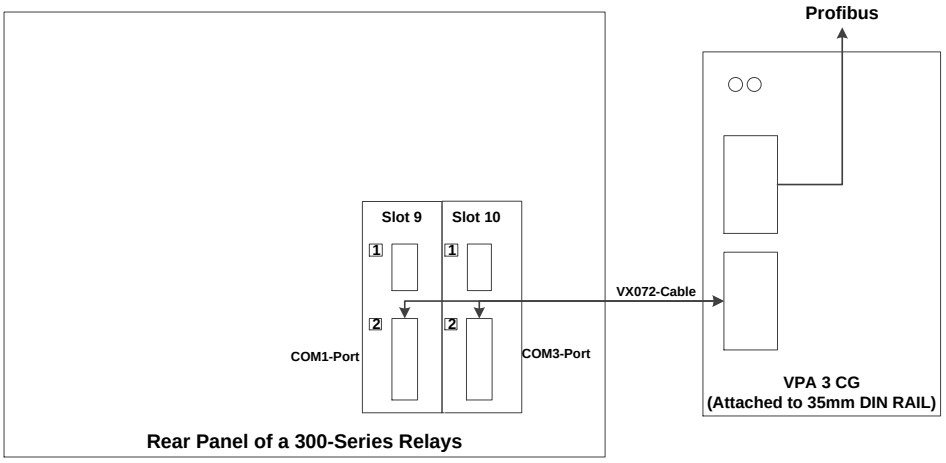


Figure 7. Connecting external adapter (VPA 3CG) to a 3xx-Series Relay

5.2.4. Cables for the External Profibus DP Adapter (VPA 3CG)

Depending on the VAMP Relay-series used, a dedicated cable is needed for interconnection with the VPA 3CG adapter. The following table matches each of the series with its respective cable.

	Cable Type			
Relay Series	VX007-F3	VX028-3	VX054-3	VX072-3
40		x		
50			x*	
200	x			
3xx				x

Table 6. Required cables with all VAMP series

* Requires external 12 Volt power supply (Figure 6)

5.3. Setting the Profibus address and other parameters

The Profibus parameters can be changed from the relay front panel or by VAMPSET® –program.

The parameters are:

- Mode Profibus mode: Continous / Request
- bit/s Speed between the relay and adapter
- InBuf* Input** buffer length
- OutBuf* Output** buffer length
- Addr Profibus address (range 1-126)
- Conv* Type of Profibus adapter (VE, HMS, -)

*) Parameters are read only

**) Input: Relay → Profibus master
Output: Profibus master → Relay

6. Type files

6.1. GSD-file

```
;===============================================================
;GSD file for VPA
;
;2002-07-22 JPH/Vaasa Electronics Ltd.
;
;File  : VPA_00F7.GSD
;===============================================================
#Profibus_DP
; Unit-Defination-List:
GSD_Revision          = 1
Vendor_Name           = "Vaasa Electronics Ltd."
Model_Name            = "VPA"
Revision              = "1.0"
Ident_Number          = 0x00F7
Protocol_Ident        = 0
Station_Type          = 0                           ; DP-Slave
FMS_supp              = 0                           ; no FMS/DP Mixed
Device
Hardware_Release      = "HW1.0"
Software_Release      = "SW1.0"
;
9.6_supp              = 1                           ;baud rate supported
19.2_supp             = 1                           ;baud rate supported
93.75_supp            = 1                           ;baud rate supported
187.5_supp            = 1                           ;baud rate supported
500_supp              = 1                           ;baud rate supported
1.5M_supp             = 1                           ;baud rate supported
3M_supp               = 1                           ;baud rate supported
6M_supp               = 1                           ;baud rate supported
12M_supp              = 1                           ;baud rate supported
; Duration to answer a request by a responder
MaxTsdr_9.6           = 60
MaxTsdr_19.2          = 60
MaxTsdr_93.75         = 60
MaxTsdr_187.5         = 60
MaxTsdr_500           = 100
MaxTsdr_1.5M          = 150
MaxTsdr_3M            = 250
MaxTsdr_6M            = 450
MaxTsdr_12M           = 800
;
Redundancy            = 0                           ; redund. Transceiver
not supp.
Repeater_Ctrl_Sig     = 2                           ; TTL
24V_Pins              = 0                           ; Not connected
;
Implementation_Type   = "SPC3"
Bitmap_Device         = "DP_NORM"
;
; Slave-Specification:
Freeze_Mode_supp      = 1                           ; Freeze-Mode
supported
Sync_Mode_supp        = 1                           ; Sync-Mode supported
Auto_Baud_supp        = 1                           ; auto. Baud. detec.
supp.
Set_Slave_Add_supp    = 0                           ; Set_Slave_Add not
supported
Min_Slave_Intervall   = 10
;
Modular_Station       = 1
Max_Module            = 24
Max_Input_Len         = 200
Max_Output_Len        = 200
Max_Data_Len          = 400
Modul_Offset          = 200
;
```

```
Fail_Safe              = 0                          ; data telegram
without data in
;                                                   ; state CLEAR not
accepted
Slave_Family           = 0
Max_Diag_Data_Len      = 16
;
Unit_Diag_Bit(0)       = "OK"
Unit_Diag_Bit(1)       = "ERROR 1"
Unit_Diag_Bit(2)       = "ERROR 2"
Unit_Diag_Bit(3)       = "ERROR 3"
Unit_Diag_Bit(4)       = "ERROR 4"
Unit_Diag_Bit(127)     = "ERROR 127"
;
Module = "INPUT/OUTPUT: 1 Byte" 0x30
EndModule
Module = "INPUT/OUTPUT: 2 Byte " 0x70
EndModule
Module = "INPUT/OUTPUT: 4 Byte " 0x71
EndModule
Module = "INPUT/OUTPUT: 8 Byte" 0x73
EndModule
Module = "INPUT/OUTPUT: 16 Byte" 0x77
EndModule
Module = "INPUT/OUTPUT: 32 Byte" 0x7F
EndModule
Module = "INPUT/OUTPUT: 64 Byte" 0xC0,0x5F,0x5F
EndModule
Module = "INPUT/OUTPUT: 128 Byte" 0xC0,0x7F,0x7F
EndModule
Module = "INPUT: 1 Byte" 0x10
EndModule
Module = "INPUT: 2 Byte" 0x50
EndModule
Module = "INPUT: 4 Byte" 0x51
EndModule
Module = "INPUT: 8 Byte" 0x53
EndModule
Module = "INPUT: 16 Byte" 0x57
EndModule
Module = "INPUT: 32 Byte" 0x5F
EndModule
Module = "INPUT: 64 Byte" 0x40,0x5F
EndModule
Module = "INPUT: 128 Byte" 0x40,0x7F
EndModule
Module = "OUTPUT: 1 Byte" 0x20
EndModule
Module = "OUTPUT: 2 Byte" 0x60
EndModule
Module = "OUTPUT: 4 Byte" 0x61
EndModule
Module = "OUTPUT: 8 Byte" 0x63
EndModule
Module = "OUTPUT: 16 Byte" 0x67
EndModule
Module = "OUTPUT: 32 Byte" 0x6F
EndModule
Module = "OUTPUT: 64 Byte" 0x80,0x5F
EndModule
Module = "OUTPUT 128 Byte" 0x80,0x7F
EndModule
```

Customers Care Center
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