SIEMENS

SIPROTEC

Catalog sheet 7XV5103 ***Not suitable for PROFIBUS***

RS485 – Bus systems for SIPROTEC-Devices up to 115 kbit/s 7XV5103

The RS485 Bus is a cost-effective half-duplex communication bus, which is, due to its relatively high interference immunity, not only used in industrial systems for monitoring and control, but now is increasingly used by utilities in substations for SCADA and protection applications. Protocols such as DIGSI, IEC 60870-5-103, DNP 3 and Modbus up to 115 kBit/s are used between a station master and a maximum of up to 31 slave devices on twisted, screened, two-core wire. Under ideal conditions the length of the bus may reach up to 1000m. A pre-requisite therefore is the correct configuration of the bus, the application of suitable cables and plug connectors as well as correct termination of the bus. Devices with different termination methods require special adaptors to achieve the highest possible interference immunity. The RS 485 bus systems 7XV5103 are optimised in this respect for our control and protection product range.

With the ordering code 7XV5103 two different RS 485 bus systems are available.
When combining the required components for a RS 485 bus the corresponding application examples contained in this document can be of assistance.

The bus system with 9 pole Sub-D connectors has been applied for a long time in systems with SIPROTEC protection devices, the converters 7XV5 and master units. Connection to the individual devices is done directly with a special Y-cable or with a corresponding adapter cable to devices with different termination methods. The bus terminates in a 9 pole Sub-D bus termination plug with integrated 220 Ohm resistance.

The bus system with RJ45 plugs was specially developed for SIPROTEC devices with serial modules with RJ45 connections and is constructed with cost-effective doubly screened CAT 5 patch cables. The connection of the individual devices to the two redundant buses is done via two special Y-adapter cables each. The buses each terminate with a RJ45 bus termination plug with 120 Ohm resistance.

A combination of the two bus systems and the different device interfaces or a combination of the two systems is also possible using the Y-adapter cable 7XV5103-2BA00.

General specifications:

- For data transfer up to 115 kbit/s (e.g.. DIGSI, IEC60870-5-103, DNP 3).
- Variable bus structure with screened cables of various lengths.
- Metal plated, screened plug housings with reduced mounting depth and strain relief.
- Bus termination with termination plugs and integrated resistor.
- Connection of the SIPROTEC 4 protection devices with redundant IEC 60870-5-103-interface via the Y-adapter cable and RJ45-plug.
- Connection of the SIPROTEC 4 protection devices with RS485 interface and Sub-D plug directly, or via a Y-adapter cable.
- Adapter-/ cable for compact protection devices with RS485-interface on screw terminals e.g. 7SJ600, 7SD600, 7RW600 etc..
- Connection to various RS 485 converters e.g. 7XV5650/51.
- Combination of both bus systems is possible.
- Max. length of the bus within a common earthing system may be up to 1000m.

Not suitable for Profibus DP and Profibus FMS

Instructions regarding the configuration of the RS485 bus system

The housings of all devices connected to the bus must be solidly grounded to a common ground to avoid dangerous ground currents flowing via the cable screens.
Larger distances, especially into other buildings with separate grounding system should preferably be done via converters (e.g. 7XV5650/51) using FO links.

The RS485 bus must be of radial design i.e. tee-offs from the bus (e.g. a terminal strip) to the connected bus devices may not be used. This would then correspond to a star configuration which has negative influence on the functionality.

The bus must be terminated at the first device (in general this is the Master) and at the last device with a bus terminating resistance to avoid interference due to reflection. Between these terminals no further terminating resistances may be connected.

As all of the devices, maximum 32 (including Master) are listening in on the RS485 bus, all the devices on the bus must be set with the same baud rate and the same data format.
The Slaves must all have different device addresses.

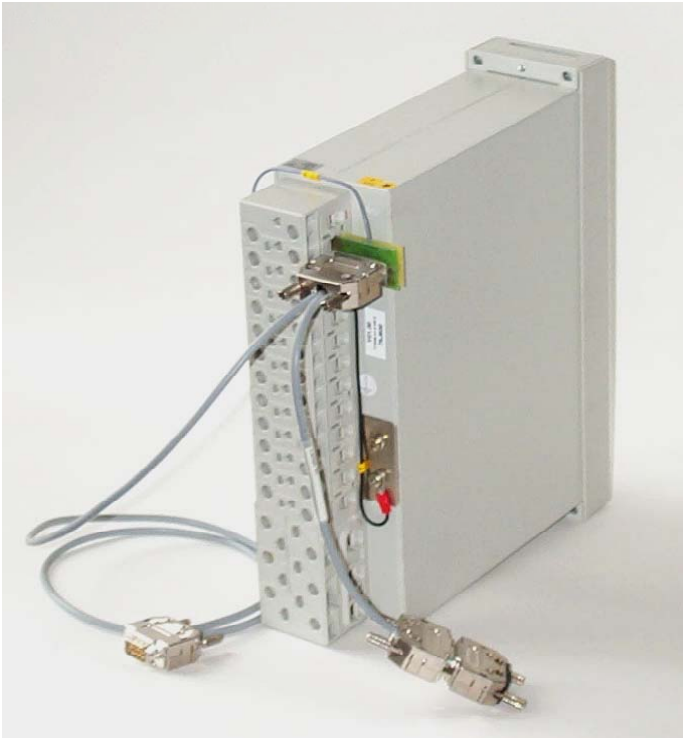
Within the system only one Master may be active at any time and only one Slave may answer.

The bus system with 9 pole Sub-D bus termination plugs

The bus system with 9 pole Sub-D bus termination plugs has been used with SIPROTEC protection devices, the converters 7XV5 and Siemens master units for a long time. The connection of individual devices to devices with various connection modes is done directly via specialised Y cables, or via suitable adapter cables. The bus terminates at a 9 pole Sub-D bus termination plug with integrated 220 Ohm resistance.

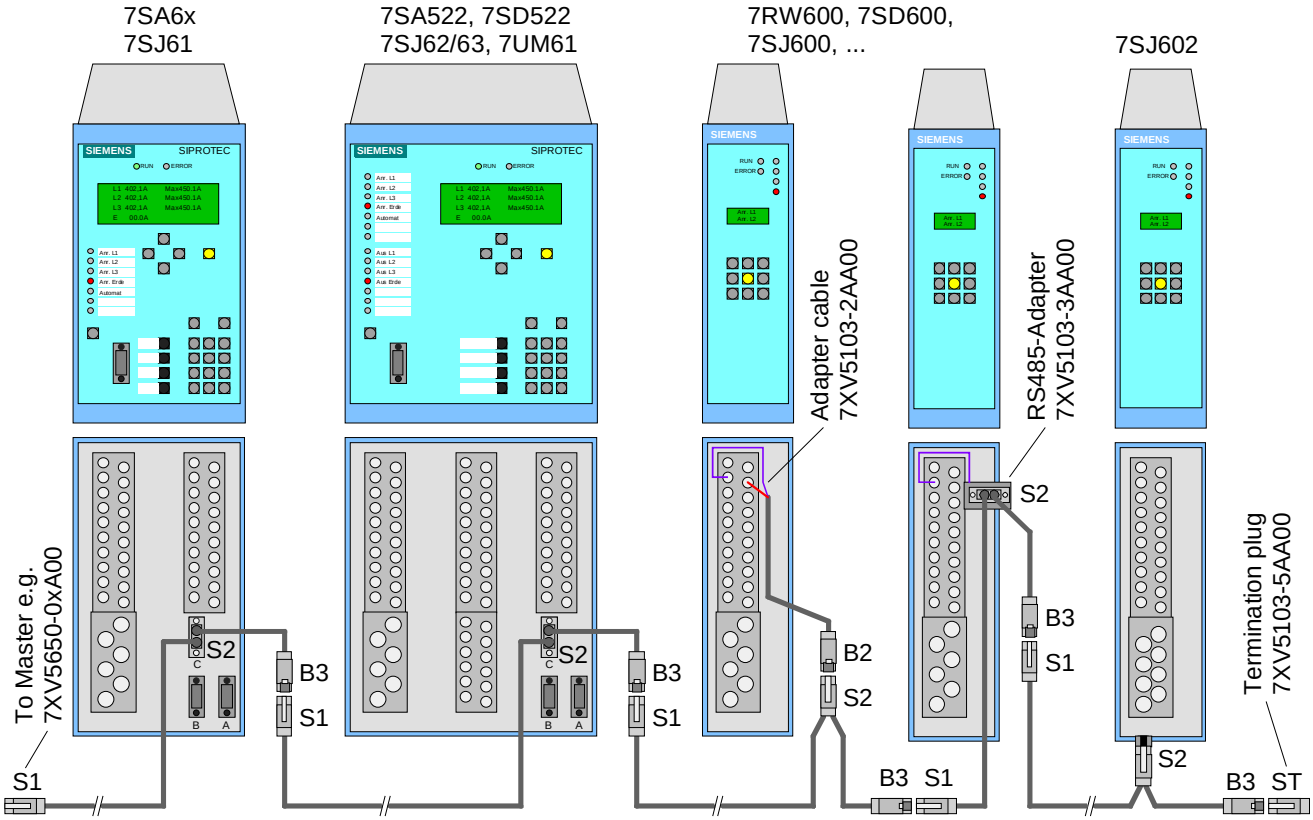
Specifications:

- Direct connection to SIPROTEC 4 protection devices with RS485 interface via a FO – RS485 converter 7XV5650/51.
- Adapter-/ cable for compact protection devices with RS485-interface on screw terminals e.g. 7SJ600, 7SD600, 7RW600 etc.
- 4 cable lengths from 1 to 10 metres
- 2-core, twisted and screened cable with 9 pole Sub-D plug connectors
- Metal plated, screened plug housings with reduced mounting depth and strain relief
- Data transfer up to 115 kbit/s (e.g. DIGSI, IEC 60870-5/VDEW)
- Maximum length of the bus up to 1000 metres within a common grounding system.
- Bus termination with termination plugs and integrated 220 Ohm resistance.



Application example 1:

The 9 pole male plug of the Y bus cable S1 always comes from the Master side and provides the connection to the Slaves via the 1, 3, 5 or 10 m long cable and 9 pole male plug S2. At the plug S2 a 20 cm long cable with a 9 pole female connection B3 is provided for the extension of the bus. The compact protection devices e.g. 7SJ600 are directly connected via the adapter cable 7XV5103-2AA00 with female plug B2 or an RS485 adapter 7XV5103-3AA00. After the final device, a bus termination plug 7XV5103-5AA00 is connected to the plug B3 for bus termination.



Appl. 1: SIPROTEC protection devices on the RS485-Bus

Selection and ordering data (Bus with Sub-D connectors)

RS485 Y-bus cable 2-core screened with 9 pole Sub-D plugs	**7**	**X**	**V**	**5**	**1**	**0**	**3**	**-**	**0**	**A**	**A**		
Length 1 m												**0**	**1**
Length 3 m												**0**	**3**
Length 5 m												**0**	**5**
Length 10 m												**1**	**0**
RS485 bus cable extension 2-core screened with 9-pole Sub-D plug	**7**	**X**	**V**	**5**	**1**	**0**	**3**	**-**	**1**	**A**	**A**		
Length 10 m												**1**	**0**
Length 20 m												**2**	**0**
Length 30 m												**3**	**0**
Length 40 m												**4**	**0**
Length 50 m												**5**	**0**
RS485 Adapter / accessories	**7**	**X**	**V**	**5**	**1**	**0**	**3**	**-**		**A**	**A**	**0**	**0**
Adapter cable with 2-core screened with cable lug / 9-pole Sub-D connector for devices with screw terminals or compact protection devices e.g. 7SJ600									**2**				
RS485 adapter with 9 pole Sub-D connector for mounting on screw terminals of compact protection devices e.g. 7SJ600, 7SD600 etc.									**3**				
Bus termination plug 220 Ohm, 9-pole Sub-D connector									**5**				
Connector cable for RTD-box to SIPROTEC 4 (xx = 05/25/50 m)									**7**	**A**	**A**	**x**	**x**

Bus system with RJ45 patch cables

The bus system with RJ 45 connectors was specially developed for SIPROTEC devices for communication modules with serial RJ45 connectors and is built with low cost doubly screened CAT 5 patch cables. Connection of the individual devices to the two redundant buses is done via two special Y adapter cables each. The buses each terminate with a RJ45 bus termination plug with integrated 120 Ohm resistance.

Specifications:

- Cost-effective bus structure with screened patch cables (CAT 5) with RJ45 plugs.
- Cable lengths from 0,5 - 20 metres (7KE6000-8G)
- Connection of SIPROTEC 4 protection devices with redundant IEC 60870-5-103 interfaces via Y adapter with RJ45-plug.
- Connection of SIPROTEC 4 protection devices with RS485 interface via Y cable to Sub-D connector.
- Adapter-/ cable for compact protection devices e.g.. 7SJ600, 7SD600, 7RW600 etc..
- Metal plated plug housings with strain relief of the cable connections
- Compact plugs
- Data transfer up to 115 kbit/s (e.g. DIGSI, IEC 60870-5 / VDEW)
- Maximum extension of the bus of up to 800 m within a common grounding system.
- Bus termination with termination plug and integrated 120 Ohm resistance
- Connection to the FO -RS485 converter 7XV5650 or the bus system with Sub-D connector via Y adapter.

Instructions regarding the configuration of the RS485 bus system

The housings of all devices connected to the bus must be solidly grounded to a common ground to avoid dangerous ground currents flowing via the cable screens.
Larger distances, especially into other buildings with separate grounding system should preferably be done via converters (e.g. 7XV5650/51) using FO links.

The RS485 bus must be of radial design i.e. tee-offs from the bus (e.g. a terminal strip) to the connected bus devices may not be used. This would then correspond to a star configuration which has negative influence on the functionality.

Only CAT 5 double screened patch cables (e.g. 7KE6000) may be used as bus cables. The maximum bus length may not exceed 800 m.

The bus must be terminated at the first device (in general this is the Master) and at the last device with a bus terminating resistance to avoid interference due to reflection. Between these terminals no further terminating resistances may be connected.

As all of the devices, maximum 32 (including Master) are listening in on the RS485 bus, all the devices on the bus must be set with the same baud rate and the same data format.
The Slaves must all have different device addresses.

Within the system on each bus only one Master may be active at any time and only one Slave may answer.

Application example 2: Connection of SIPROTEC 4 to a (redundant) control system

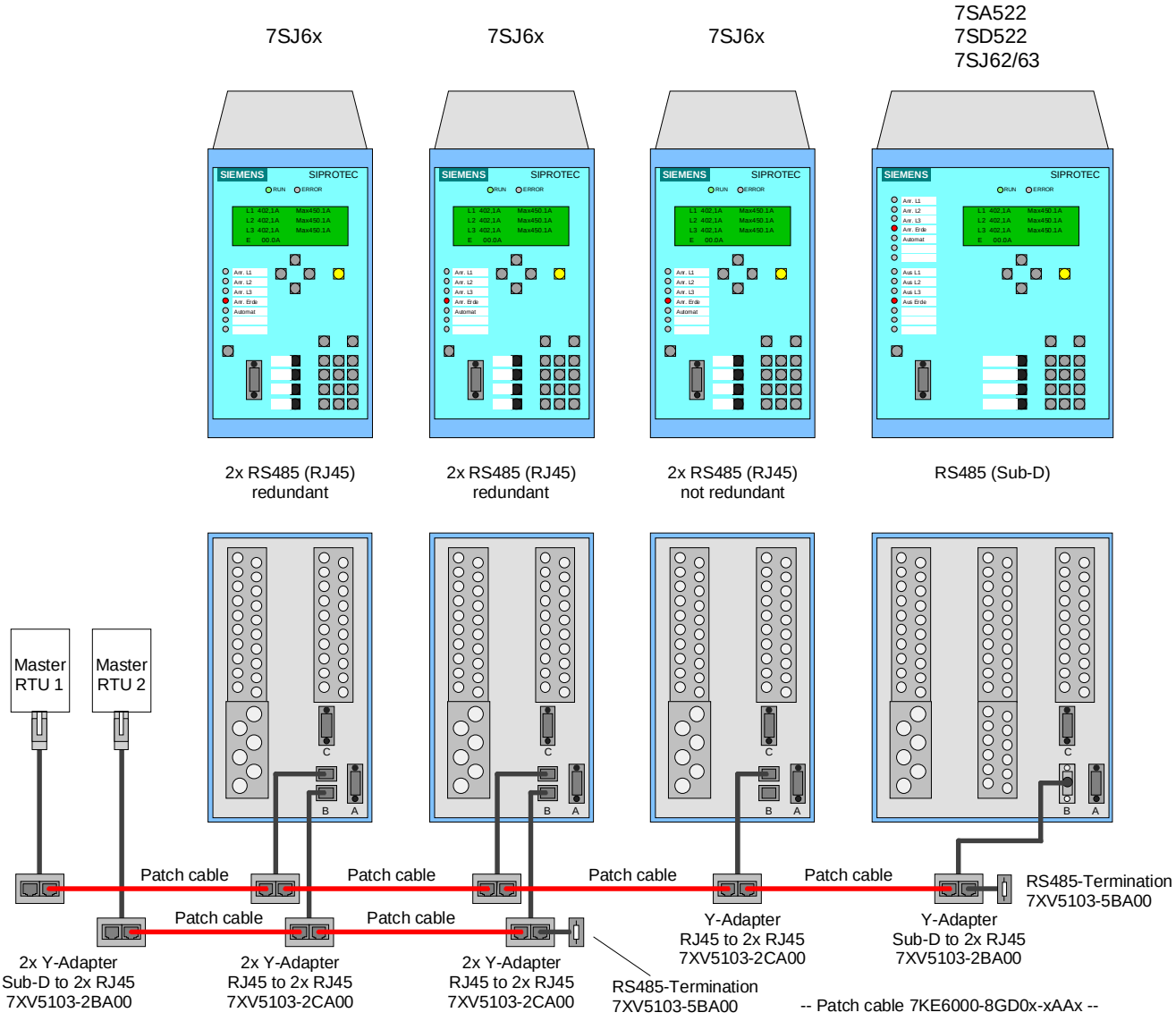
The RS485-bus cable system with patch cables (CAT 5) was developed as a cost effective alternative to the previous systems 7XV5103 with Sub-D connectors. Advantage is taken of the world-wide proliferation of patch cables and the compact dimensions of the RJ45 plug. This allows a redundant IEC 60870-5-103-inteface with a single interface module within a SIPROTEC 4 device.

Two different Y adapters allow for the implementation of a RS485 bus with patch cables and the connection of devices having RS485 interfaces of different construction. Both Y adapters have two RJ45 socket connectors in parallel to facilitate the implementation of the buses. The 30 cm long connection cable to the device either has a RJ45 or Sub-D plug.

Devices with Sub-D plug (e.g. Master RTU, 7XV5650/51, SIPROTEC 4 devices with Sub-D are connected using the Y adapter 7XV5103-2BA00.

Devices with RJ45-connector such as SIPROTEC 4 with redundant IEC 60870-5-103-interface are connected with the
Y adapter 7XV5103-2CA00. For the redundant bus system 2 Y adapters are required per SIPROTEC 4 device.

After the final device the bus is terminated with a bus termination plug 7XV5103-5BA00.
For the redundant bus system, a bus termination resistance is required for each bus



Appl. 2: Connection of SIPROTEC 4 to a (redundant) control system.

Application example 3: Connection of SIPROTEC 4 to a (redundant) control system

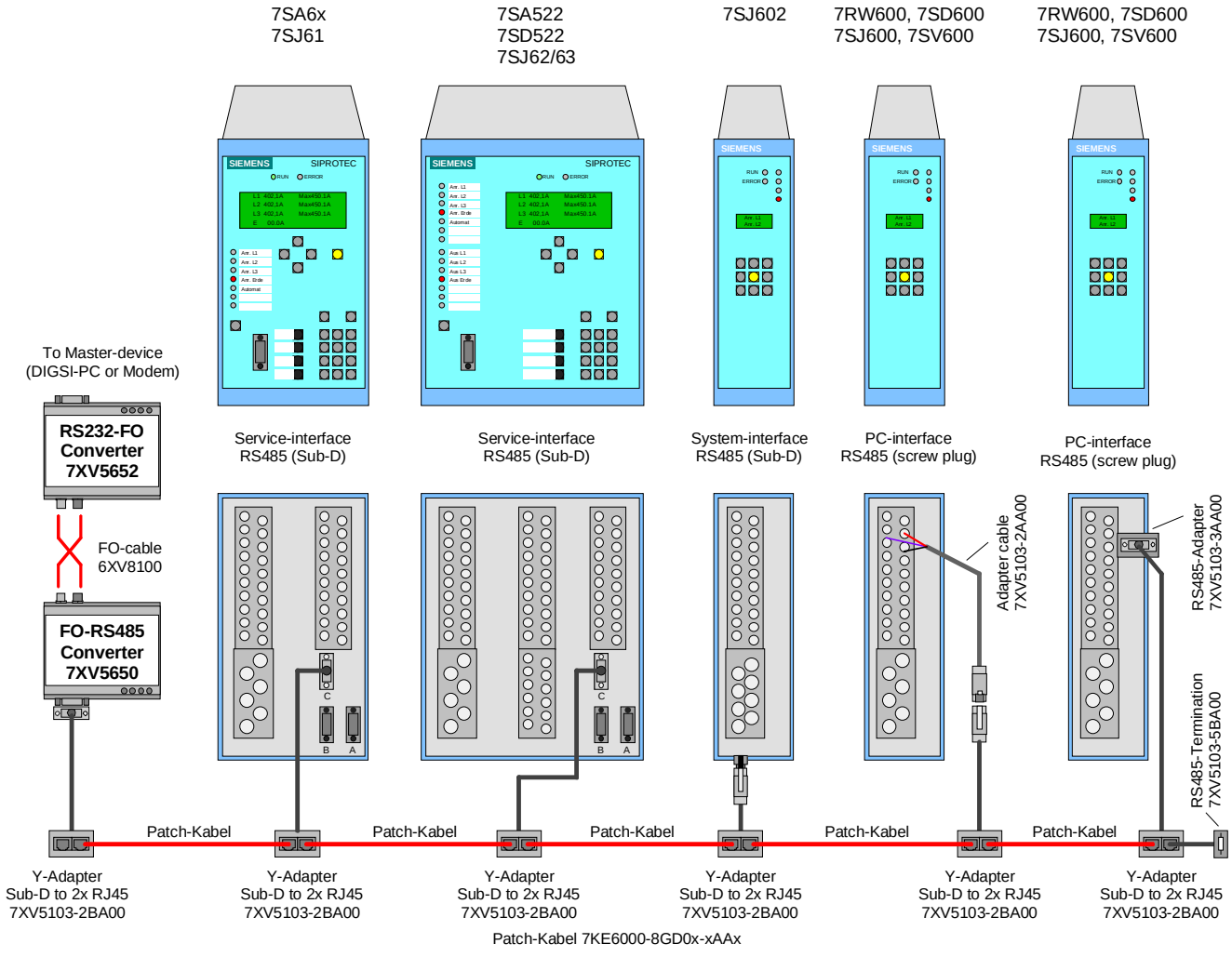
The RS485-bus cable system with patch cables (CAT 5) was developed as a cost effective alternative to the previous systems 7XV5103 with Sub-D connectors. Advantage is taken of the world-wide proliferation of patch cables and the compact dimensions of the RJ45 plug.

The Y adapter 7XV5103-2BA00 allows for the implementation of a RS485 bus with patch cables and the connection of various SIPROTEC devices having RS485 interfaces. The Y adapters have two RJ45 socket connectors in parallel to facilitate the implementation of the buses. The 30 cm long connection cable to the device either has a RJ45 with suitable pin allocation.

Devices with RS485 interface and Sub-D plug (7XV5650/51, SIPROTEC 4 devices) with Sub-D are connected using the Y adapter 7XV5103-2BA00.

Devices with RS485 interface on screw plugs require an additional adapter for 9 pole Sub-D to single core e.g. 7XV5103-2AA00 or 7XV5103-3AA00.

After the last device, the bus is terminated with a bus termination device 7XV5103-5BA00.



Appl. 3: Central operation SIPROTEC-device with DIGSI 4

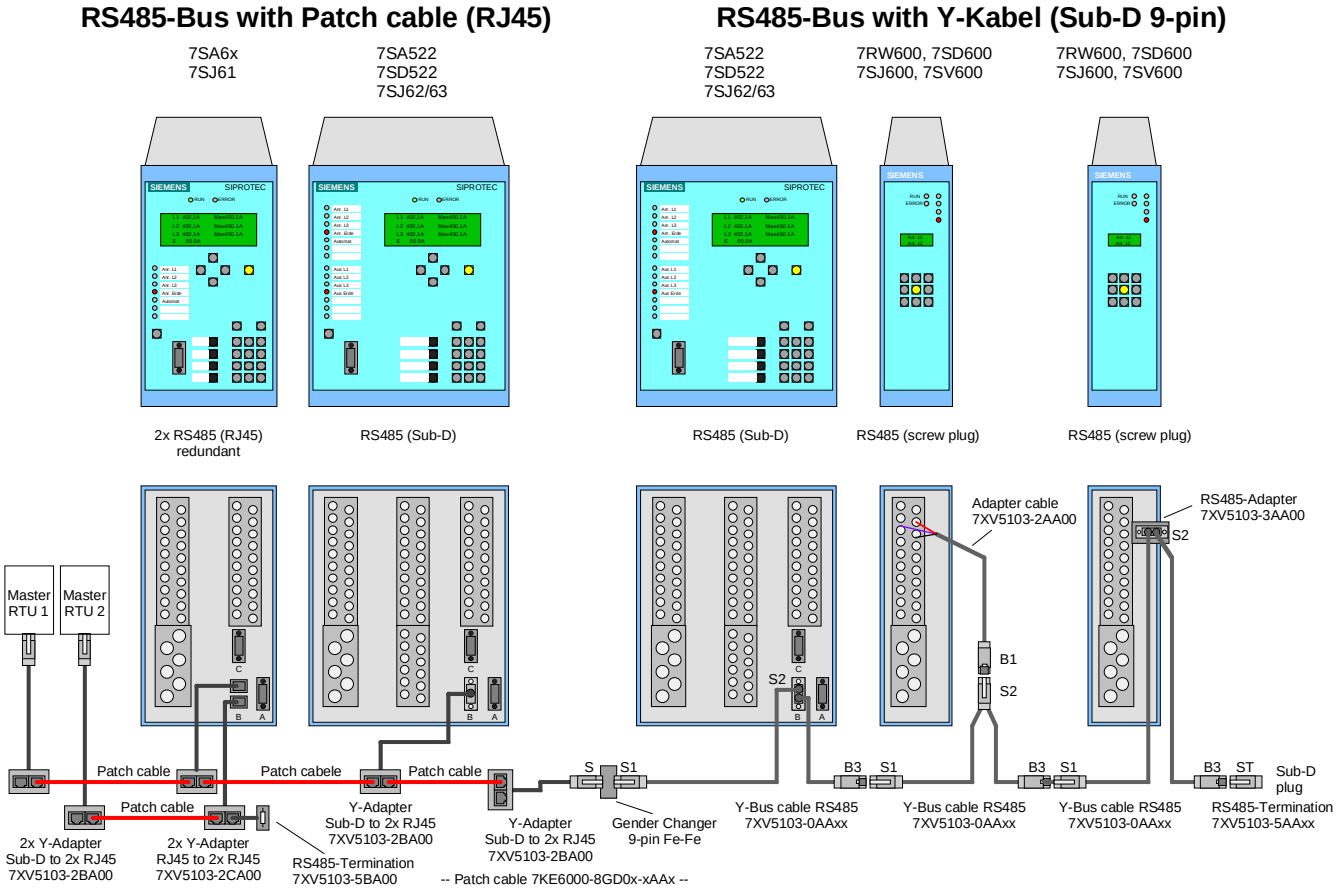
Selection and ordering data (Bus with RJ45 patch cable*)

RS485 Adapter / Accessories	7 X V 5 1 0 3 -				0	0
Adapter cable 2-core, screened with cable lug/9 pole Sub-D connection for devices with screw terminals or compact protection devices e.g. 7SJ600		2	A	A		
Y adapter cable for connection of SIPROTEC 4 or other devices with 9 pole Sub-D connection to a RS485 bus with patch cables (RJ45)		2	B	A		
Y adapter cable for connection of SIPROTEC 4 with redundant T103-interface module to a RS485 bus with patch cables (RJ45)		2	C	A		
RS485 adapter with 9 pole Sub-D connection for mounting on screw terminals with compact protection devices e.g. 7SJ600, 7SD600 etc..		3	A	A		
Bus termination cable 220 Ohm in a 9 pole Sub-D connection		5	A	A		
Bus termination cable 120 Ohm in a RJ45 plug		5	B	A		

* Ordering data for patch cable see last page

Application example 4: Connecting both bus systems 7XV5103

The Y adapter 7XV5103-2BA00 enables the configuration of the RS485-Busses with RJ45-patch cables and the connection of SIPROTEC-devices with RS485-interface brought out Sub-D connection.
Using an additional gender changer (Fe-Fe), enables the connection of a RS485 bus with Y bus cables 7XV5103-0AAxx instead of a SIPROTEC device.



Appl. 4: Connecting the bus systems 7XV5103

Selection and ordering data

RS485 Y-bus cable 2 core screened with 9 pole Sub-D connection	**7**	**X**	**V**	**5**	**1**	**0**	**3**	**-**	**0**	**A**	**A**						
Length 1 m												**0**	**1**				
Length 3 m												**0**	**3**				
Length 5 m												**0**	**5**				
Length 10 m												**1**	**0**				

RS485 bus cable extension 2 core screened, 9 pole Sub-D connection.	**7**	**X**	**V**	**5**	**1**	**0**	**3**	**-**	**1**	**A**	**A**						
Length 10 m												**1**	**0**				
Length 20 m												**2**	**0**				
Length 30 m												**3**	**0**				
Length 40 m												**4**	**0**				
Length 50 m												**5**	**0**				

RS485 Adapter / Accessories	**7**	**X**	**V**	**5**	**1**	**0**	**3**	**-**				**0**	**0**				
Adapter cable 2 core screened with cable lug/9 pole Sub-D connection for devices with screw terminals or compact protection devices e.g. 7SJ600									**2**	**A**	**A**						
Y adapter cable for connection of SIPROTEC 4 or other devices with 9 pole Sub-D connection to a RS485 bus with patch cables (RJ45)									**2**	**B**	**A**						
Y adapter cable for connection of SIPROTEC 4 with redundant T103-interface module to a RS485-Bus with patch cables (RJ45)									**2**	**C**	**A**						
RS485 adapter with 9 pole Sub-D connection for mounting to screw terminals for compact protection devices e.g. 7SJ600, 7SD600 etc.									**3**	**A**	**A**						
Bus termination cable 220 Ohm in a 9-pole Sub-D connection									**5**	**A**	**A**						
Bus termination cable 120 Ohm in a RJ45 plug									**5**	**B**	**A**						

RS485 cable to RTD-box	**7**	**X**	**V**	**5**	**1**	**0**	**3**	**-**	**7**	**A**	**A**						
Connection cable for RTD-box 7XV5662-xAD to SIPROTEC 4 Open cable ends, each 5 / 20 cm with cable lugs to 9-pole Sub-D connection with integrated bus termination resistance 220 Ohm																	
Length 5 m												**0**	**5**				
Length 25 m												**2**	**5**				
Length 50 m												**5**	**0**				

Patch cable CAT5 double shield (SFTP)	**7**	**K**	**E**	**6**	**0**	**0**	**0**	**-**	**8**	**G**		**0**		**-**		**A**	**A**		**/BB**	
with 2x RJ45 plugs 1:1 connection											**D**									
Length 0,5 m													**0**		**0**			**5**		
Length 1,0 m													**0**		**1**			**0**		
Length 2,0 m													**0**		**2**			**0**		
Length 3,0 m													**0**		**3**			**0**		
Länge 5,0 m													**0**		**5**			**0**		
Length 10,0 m													**1**		**0**			**0**		
Length 15,0 m													**1**		**5**			**0**		
Length 20,0 m													**2**		**0**			**0**		

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