

SIEMENS

RS485-FO Converter (1 channel) 7XV5650-0xA00

for asynchron protocols up to 115 kBaud

Operating Instructions



Oct. 2006

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1 General Instructions

This manual includes the information required for the normal use of the products described therein. It is intended for technically qualified personnel which has been specially trained or has special knowledge in the fields of protection-, instrumentation-, control-, and automatic control engineering (called automation in the following).

The knowledge and the technically correct translation of the safety instructions and warnings included in this manual are a prerequisite for the safe installation and commissioning, as well as for safety during operation and maintenance, of the product described. Only qualified personnel, as defined in the following explanation, possess the technical knowledge required to interpret correctly and to put into action for each individual case the safety instructions and warnings given in this document in a general manner.

This manual is an integral part of the scope of delivery. However, it cannot take into account every detail on all types of the described product and also every possible case regarding installation, operation or maintenance. If further information is desired or in case special problems should arise, which are not treated adequately in this document, it is possible to obtain additional details from the local Siemens office or from the addresses stated in the back of this manual.

Additionally, we point out that the content of this product documentation is not part of or modifies any previous or existing agreement, promise, or legal relationship.

All obligations by Siemens result from the respective purchase order which also includes the complete and exclusively valid warranty provision. The contractual warranty regulations are neither extended nor limited by the statements in this document.

1.1 Qualified Personnel

Tampering with the device/system or noncompliance with the safety notices given in this manual may cause severe bodily injury or property damage. Therefore any interventions on the device/system may only be performed by adequately qualified personnel.

Qualified personnel as per the safety notices given in these instructions or on the product itself is:

- personnel involved in planning and configuration activities and familiar with the safety concepts used in automation engineering;
- operating personnel trained for working with automation systems and familiar with the content of this manual as far as it deals with operational aspects;
- commissioning and service personnel having adequate training and qualification to repair this type of automation equipment and/or having authorization to commission, release, ground and tag devices, systems and electrical circuits.

1.2 Safety Notes

These operating instructions contain notes that are to be complied with for your personal safety as well as to avoid property damages. These notes are marked by a triangular warning symbol and the different degrees of danger are categorized as follows:



Danger

Disregard of the corresponding precautionary measures will cause death, severe bodily injury or considerable property damage.



Warning

Disregard of the corresponding precautionary measures may cause death, severe bodily injury or considerable property damage.



Attention

Disregard of the corresponding precautionary measures may lead to slight bodily injury or minor property damage.



Note

Shall draw your attention to special information on the product, product handling or the corresponding section of the documentation.



Qualified personnel

Commissioning and operation of the equipment is to be performed by qualified personnel only. In the context of safety notes in this manual, the term qualified personnel refers to persons authorized to perform commissioning, grounding and labelling of devices, systems and electrical circuits.

1.3 Intended Use

Please observe the following



Warning

The device must be operated only within the scope of its intended use according to these operating instructions and in connection with third-party equipment or compounds recommended or accepted by Siemens.

Faultless and safe operation of the product require proper transport, storage, mounting and installation as well as careful operation and maintenance.

1.4 Explanation of the symbols at the device:



Danger

Warning of a danger.

Please read the documentation.

To be operated only by qualified personnel.



Double insulation

1.5 Exclusion of liability

The contents of this document have been reviewed on their compliance with the hardware and software described therein. Yet, deviations cannot be excluded, so that we cannot guarantee full compliance. The specifications in this document are, however, reviewed at regular intervals. Necessary corrections will be included in the next edition. You are invited to send us your suggestions for improvement.

1.6 Copyright

Copyright Siemens AG 2000. All rights reserved.

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Subject to technical changes without notice.

2 Operating Instructions

2.1 Scope of Application

The RS485 / FO Signal Converter is used for optical connection of up to 31 units with a bus-enabled electric RS485 interface to an FO connection that leads, e.g., to a star coupler, thus allowing to establish an interference-immune connection between the field devices and the centralized operating unit.

2.2 General Data

The signal converter has a plastic housing that can be snapped onto a DIN EN 50022 mounting rail. The optical interface is equipped with BOFC ST-connectors and designed for signals with a wavelength of 820 nm. The differential RS485 bus interface to the terminal units is connected via a 2-pole terminal block or a 9-pin SubD socket. Up to 31 devices can be connected to the bus. For point-to-point connection, the line can be terminated using a resistor terminator. The auxiliary power supply is fed in via 2 terminals. Because of its extremely wide auxiliary voltage range (DC 24 - 250 V and AC 60 - 250 V), the converter can be connected without switchover to all common types of station batteries and AC mains voltage supplies. The front cover has LEDs for indication of the operating voltage status (green LED) and for the data flow in all directions (yellow LED).

The readiness for service of the unit is indicated by means of a potential-free signalling contact (terminals 1,2) that can be used to communicate the following fault conditions to a control center:

- No supply voltage
- Failure of internal power supply

When a fault condition is present, the contact is closed.

RS485/FO signal converters are available in two versions:

- one-channel version with BOFC ST-connector: 7XV5650-0BA00
- two-channel version with BOFC ST-connector: 7XV5651-0BA00

2.3 Protocol transparency

Data transmission by the RS485 / FO signal converter is protocol-transparent in both directions, thus allowing the use of the converter for all common protocols (e.g. IEC protocol, DIGSI etc.) from 9600 bauds up to 115 kbauds.

2.4 Data transfer

The RS485 interface, which may be connected as a bus, is a two wire half duplex interface i.e. one can only receive or transmit at one point in time. This interface is only suitable in master/slave configurations, with a single master.

As up to 32 devices (including Master) are all communicating on the RS485 bus, they must all be set to the same baud rate and data format. Each slave must have a different device address. Within the system, only one Master may be active, and only one slave may respond.

The logic of the optical interface is positive (Light OFF in idle state), incoming light signals are treated as active = 1 (high). For use in systems operating with a negative logic, the converter can be switched over to negative logic by means of a switch that is accessible from outside. Inversion of the logic applies to both the optical input and the optical output of this interface. On delivery, the converter is set to positive logic (Light OFF in idle state).

In the quiescent state (no data transfer), the RS485 interface is in the receive mode, and the optical module is in the transmit mode, i.e. data received by the RS485 interface are transmitted by the optical output.

From the optical interface, the data direction is controlled by a baud rate-dependent logic. In idle state (no data transfer) the optical module is in Transmit mode.

On arrival of optical data, the first signal edge reverses the data direction. On receiving the stop bit, the data direction is immediately reset to its previous mode.

3 Technical datas

3.1 Hardware features

<p>Mechanical design Housing Dimensions Weight Degree of protection Housing Terminals</p>	<p>Plastic, EG90 see dimensional drawings approx. 250g according EN60529, IEC60529 IP 51 plastic IP 20</p>
<p>Auxiliary voltage U_H Rated input voltage - DC voltage - AC voltage Fuse internal Class of protection (depends on input voltage) Power consumption - DC voltage - AC voltage</p>	<p>24 V - 250 V DC \pm 20 % 24 V - 230 V AC \pm 20 % / 45-65 Hz 1,25 A slow blow (not changeable) III With U_H = U_{HN}; typical value 3 W 2.5 W; 3.5 VA</p>
<p>Alarm relay 1 Relay Connector Test voltage Switching voltage (nominal value) Switching capability Switching current Fault indicator</p>	<p>MSR-Relay, 1 NC (open) contact, potential free 2-pol. Phönix terminal 3,7 kV_{eff} 250 V DC 20 W/VA 1 A permanent LED green: 5 V o.k,</p>
<p>RS485-interface Connector Baudrate Test voltage</p>	<p>9-pol. SUB-D, socket or 2-pole Phoenix terminal 9600 - 115200 bauds 2 kV AC towards other connections</p>

<p>Optical interfaces</p> <p>Optical inputs / outputs</p> <p>Optical connectors</p> <p>Laser class 1 acc. EN60825-1/-2</p> <p>Data flow indication</p> <p>Wave length</p> <p>Launched power</p> <p>Sensitivity</p> <p>Optical budget</p> <p>Maximum distance spanned</p> <p>Baud rates</p>	<p>1 transmitter, 1 receiver</p> <p>Factory setting: Light OFF in idle state</p> <p>BFOC ST-connectors (plastic protective caps)</p> <p>yellow LED: FO Receiving data</p> <p>820 nm</p> <p>-19dBm with 50/125µm multimode fibre</p> <p>-15dBm with 62,5/125µm multimode fibre</p> <p>-6,2dBm with 200µm HCS fibre</p> <p>-30dBm</p> <p>10dB (+3 dB system budget-safety margin)</p> <p>3.0 km with 62,5/125µm multimode fibre</p> <p>1.5 km in combination with SIPROTEC systems with 62,5/125µm multimode fibre</p> <p>3.5 m with 980/1000 plastic fibre</p> <p>9600 - 115200 Baud</p>
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3.2 Safety Tests

<p>Safety tests</p> <p>according DIN EN 61010 Part1</p> <p>Overvoltage category</p> <p>Degree of pollution</p> <p>Fire resistance classification according to UL 94</p>	<p>III</p> <p>2</p> <p>V0</p>
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3.3 Dielectric Tests

<p>Dielectric tests EN61010 IEC 255-5: ANSI/IEEE C37.90.0</p> <p>Voltage test (routine test) Auxiliary power to relay Auxiliary power to RS485 interface Relay to RS485 interface</p> <p>Surge voltage test (type test) VDE 0435, Pt. 303 Auxiliary power to relay Auxiliary power to RS485 interface Relay to RS485 interface</p>	<p>5,25 kV DC / 1s (with bypass capacitors) 3,7 kV AC / 50Hz / 1s (without bypass capacitors)</p> <p>5 kV (peak); 1,2/50 μs; 0,5 J; 3 pos. and 3 neg. surges in intervals of 5 s all circuits, class III (not on open contacts)</p>
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3.4 Interference Emission

<p>Interference Emission Standard: EN 50081-1 Conducted interference, only power supply voltage IEC CISPR 22, EN55022 VDE 0878 Teil 22</p> <p>Radio interference field strength IEC CISPR 22, EN55022 VDE 0878 Teil 22</p>	<p>150 kHz to 30 MHz</p> <p>Limit class B Limit class B</p> <p>30 MHz to 1000 MHz Limit class B Limit class B</p>
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3.5 Interference immunity

<p>Interference immunity IEC 255-22 (product standards) EN 61010-1 (Generic standard)</p> <p>High frequency test IEC 60255-22-1, class III VDE 0435 Teil 303, Klasse III</p> <p>Electrostatic discharge (ESD) IEC 61000-4-2, class III IEC 60255-22-2 class III EN 61000-4-2, of degree 4</p> <p>Irradiation with HF field, non modulated IEC 60255-22-3, Klasse III</p> <p>Irradiation with HF field, amplitude modulated IEC 61000-4-3 ENV 50140, class III EN 61000-4-3</p> <p>Irradiation with HF field, pulse modulated IEC 61000-4-3 ENV 50140 / ENV50204, class III</p> <p>Fast transient disturbance / burst IEC 61000-4-4, class IV IEC 60255-22-4, class IV EN 61000-4-4, class IV</p>	<p>1 MHz; 400 surges per s; dur. 2 s 2,5 kV longit.voltage; 1,0 kV transverse voltage</p> <p>4 kV contact discharge, 8 kV air discharge, both polarities; 150 pF; Ri = 330 Ohm</p> <p>10 V/m; 27 MHz to 500 MHz</p> <p>10 V/m; 80 MHz to 1000 MHz; 80% AM; 1kHz</p> <p>10 V/m; 900 MHz; repetition frequency 200 Hz; duty cycle of 50% or duty cycle of 100%</p> <p>On auxiliary voltage inputs 4 kV; 5/50 ns; 5 kHz; burst duration 15 ms Repetition 300 ms; both polarities; Ri = 50 Ohm; Test duration 1 min</p>
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<p>Fast transient disturbance / burst IEC 61000-4-4, Klasse III</p> <p>IEC 60255-22-4, Klasse III</p> <p>EN 61000-4-4, Klasse III</p>	<p>On signal lines 2 kV; 5/50 ns; 5 kHz; burst duration 15 ms Repetition 300 ms; both polarities; Ri = 50 Ohm; Test duration 1 min</p>
<p>Line conducted HF, amplitude modulated IEC 61000-4-6, class III EN 61000-4-6, class III</p>	<p>10 V; 150 kHz to 80 MHz; 80% AM; 1 kHz</p>
<p>Immunity to power frequency magnetic field EN 61000-4-8, class IV</p>	<p>30 A/m, permanent; 300 A/m during 3 s; 50 Hz</p>

3.6 Climatic Stress tests

<p>Ambient Temperatures EN 60068-2-1 and -2-2</p>	
<p>Recommended operating temperature</p>	<p>-5°C to +55°C (+23° F to +131°F)</p>
<p>Limiting temporary (transient) operating</p>	<p>-20°C to +70°C (-4° F to +158°F)</p>
<p>Limiting temperature during storage (packing from the factory)</p>	<p>-25°C to +55°C (-13° F to +131°F)</p>
<p>Limiting temperature during transport (packing from factory)</p>	<p>-25°C to +70°C (-13° F to +158°F)</p>
<p>Permissible humidity</p>	<p>mean value per year < 75% relative humidity, 30 days per yaer 95% rel. humidity, condensation not permissible!</p>

3.7 Mechanical Stress Tests

<p>Vibration and shock during operation</p>	
<p>Vibration IEC 60255-21-1, class 1 IEC 60068-2-6</p>	<p>sinusoidal 10 Hz to 60 Hz: ±0,035mm amplitude.; 60Hz - 150 Hz: 0,5g acceleration Frequency sweep rate 10 oktave/min 20 cycles in 3 orthogonal axes,</p>
<p>Shock IEC 60255-21-2, class 1</p>	<p>semi-sinusoidal Acceleration 5 g, duration 11 ms, 3 shocks in each direction of 3 orthogonal axes</p>
<p>Seismic vibration IEC 60255-21-2, class 1 IEC 60068-3-3</p>	<p>sinusoidal 1 Hz to 8 Hz: +3,5mm amplitude (horizontal axis) 1 Hz to 8 Hz: +1,5mm amplitude (vertical axis) 8 Hz to 35 Hz: 1g acceleration (horizontal axis) 8 Hz to 35 Hz: 0,5g acceleration (vertical axis) Frequency sweep rate 1 octave / min 1 cycle in 3 orthogonal axes</p>

3.8 Dimension Drawings

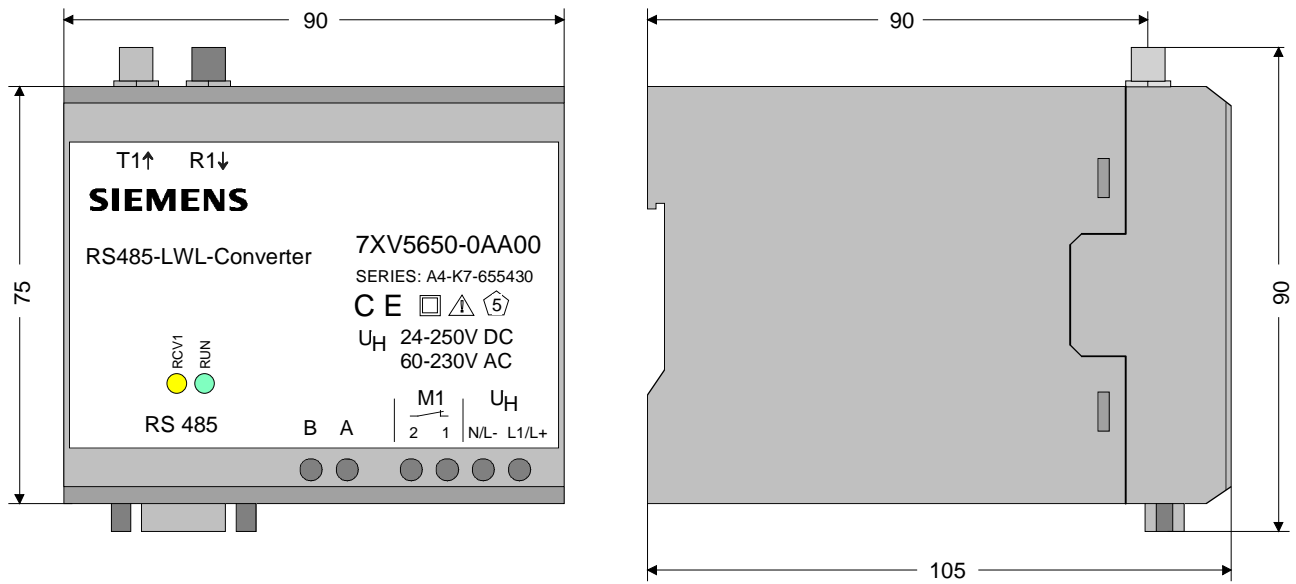


Fig. 1: Dimension Drawings

3.9 Ordering Data

Name	Order-No.
RS485-FO Converter with 1 FO-Interfaces and 1 RS485-Interface	7 X V 5 6 5 0 - 0
Optical In- / Output	A 0 0
BFOC ST-connector	B

4 Description of the Functional Unit

The housed signal converter is a hard-wired and tested functional unit. It is provided with a snap-on mounting device for a 35 mm DIN EN 50022 rail and with screw-type terminals for safe connection of the auxiliary power supply. The RS485 interface is connected either to screw-type terminals or to the 9-pin SubD socket. The fiber-optic channel are connected by BOFC ST-terminals. The unit is free of silicone and halogen as well as flame-retardant.

4.1 Terminal Assignment

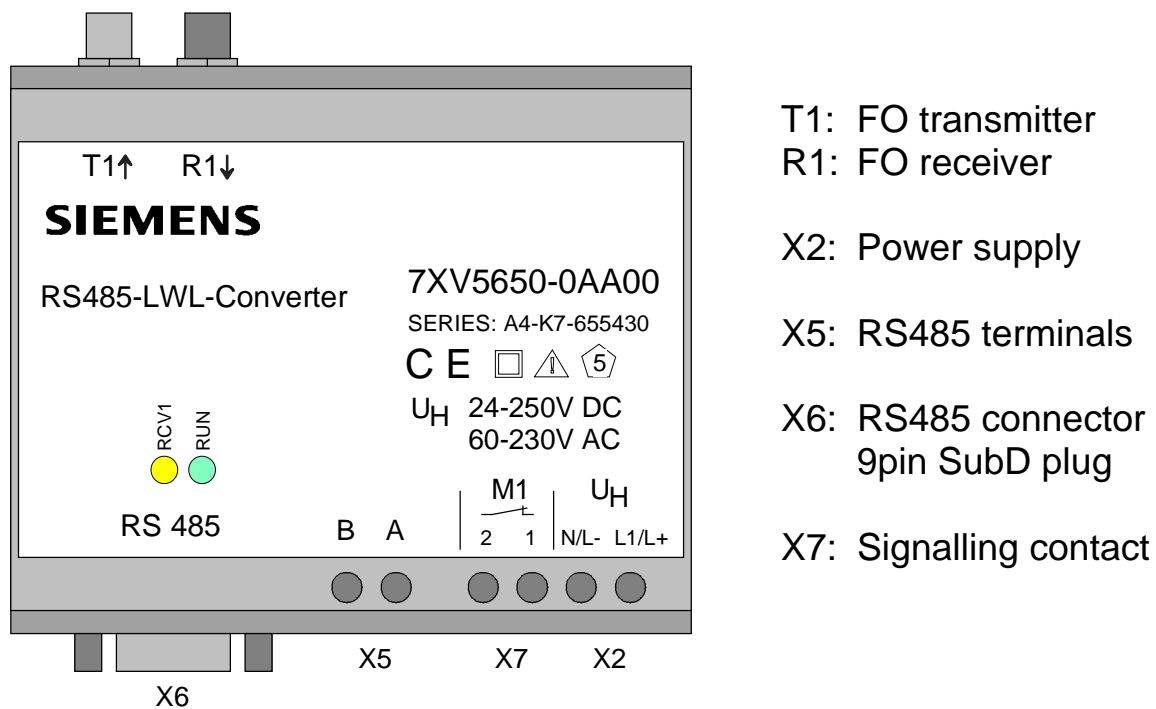


Fig. 2: Terminal Assignment

4.2 Screw-type terminals X2, X7, X5

Pin	Assignment	Symbol
X2, Pin 1	Power supply pin 1 (L+)	DC: L+ AC: L
X2, Pin 2	Power supply pin 2 (L-)	DC: L- AC: N
X7, Pin 1	Relay contact pin 1	1
X7, Pin 2	Relay contact pin 2	2
X5, Pin 1	RS485 connector pin A	A
X5, Pin 2	RS485 connector pin B	B

Tab. 1: Screw-type terminals X2, X7, X5

4.3 RS485-Connector X6

Pin	Assignment	Symbol
1	not connected	
2	not connected	
3	RS485-Connector Pin A	A
4	not connected	
5	Signal ground	GND
6	Power supply +5V DC	VCC
7	not connected	
8	RS485-Connector Pin B	B
9	not connected	

Tab. 2: RS485-Connector Sub-D 9-pol. female X6

4.4 FO-Connections

The receiving optical connectors are marked with R1/2, the transmitting connections with T1/2 (see Fig. 2).

ATTENTION! Please tight the mechanical screw connections of the FO - cables with FSMA plug carefully and only by hand (do not use tools). The ST plugs are to be shifted with the lateral nose into the groove of the device connection and locked afterwards. During the installation of the FO - cables the bending radius specified for the cable is to be kept.

4.5 Switch positions

The DIP switches can be actuated from outside.

Down view

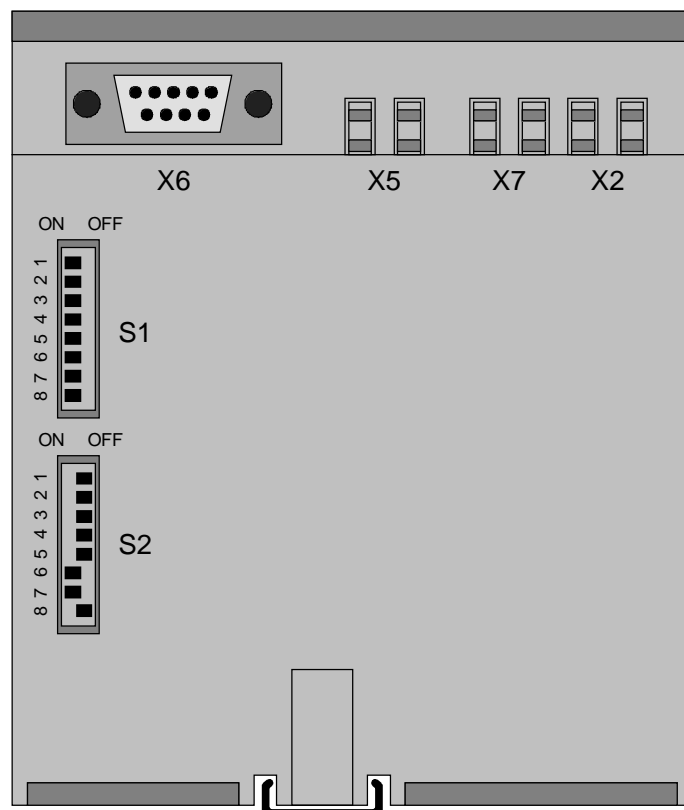


Fig. 3: Switch positions S1, S2

4.6 Assignment Switch 1

Switch S1	Position	Meaning
1+2	both off	RS485 terminators (120 Ω) not active
1+2	both on	RS485 terminators (120 Ω) active
3 4 5 6 7	on on on on on	May not be changed
8 8	off on	Light ON in idle state Light OFF in idle state

Tab. 2: Assignment S1

4.7 Assignment Switch 2

Switch S2	Position	Meaning
1 2 3 4 5 6 7 8	off off off off off on on off	May not be changed

Tab. 3: Assignment S2

5 Installation and Commissioning



Warning

When operating electrical devices, certain parts are necessarily under dangerous voltage. Therefore, disregard of the operating notes may cause severe bodily injury or property damage. Installation and electrical connection of the device should be performed by adequately qualified personnel only. In particular, all warnings must be strictly observed.



Warning

Do not look directly in the FO-transmitter diode T1 if you wear optical aid (glasses, contact lens)

5.1 Reference to Installation

- The devices are permitted only for operation within enclosed housings or cabinets and places of installation are to be accessible only for qualified personnel.
- The device is clipped on a 35 mm top-hat rail (according to EN50022).
- The installation location should be free of vibrations. The admissible temperature (operation or functional temperature) is to be observed (see technical data).
- Disregard of the temperature range required for proper function may cause malfunction, failure or destruction of the device.

5.2 Connection

The chapter 'Connection' describe how to connect data- and power supply cables for a save operation. For the electrical connection the regulations on the raise of heavy-current installations are to be observed.

5.2.1 Power supply X2

The wires for the auxilliary voltage are screwed on terminal X2 at he bottom side of the device. The assignment of the terminals is printed at the front side or can be read in this manual. Because the device has no ON/OFF switch this switch must be installed external if it's necessary.

Connection to screw terminals:

Terminal cross section:	max. 2,5 mm ²
Stripping length:	3 bis 5 mm
Cable cross section: (Single core cable or litz wire)	0,14 bis 1,5 mm ²

5.2.2 Alarm relay terminals X7

X5 offers a potential free contact, which is closed if the device fails. The loss of the power supply is a device failure. The wires for the alarm contacts are screwed on terminal X7 at he bottom side of the device. The assignment of the terminals is printed at the front side or can be read in this manual.

Connection to screw terminals:

Terminal cross section:	max. 2,5 mm ²
Stripping length:	3 bis 5 mm
Cable cross section: (Single core cable or litz wire)	0,14 bis 1,5 mm ²

5.2.3 Fibre Optic (FO) connections Rx, Tx

- Only optical fibres prepared according the regulations are to be used. The admissible optical budget is to be observed
- FO-types (only multimode) and max. distance see technical datas.
- Transmitter diodes are printed with Tx.
- Receiver diodes are printed with Rx.
- The FO-cables must be crossed, that means a FO-connection is done between Tx output and Rx input and vice versa.



Note

When installing optical fibres the prescribed bending radius is to be observed.

5.2.4 RS485-Bus connection X6

A shielded 2-core twisted-conductor cable is recommended. Connect one conductor to -X5/A (signal A) and one conductor to -X5/B (signal B) using screw-type terminals, or connect the standard bus cable e.g. 7XV5103 to the 9-pin subD socket. To guarantee a trouble-free use of the converter according to the specified characteristics, set the cable screen on one side of the cable to the earth potential.

If possible, use a metallic SUB-D connector on the opposite side to connect to the earth potential. If this is not possible connect the cable screen on a screen track or a earhted mounting track with a fitting clamp.

5.3 Commissioning

- Clip the signal converter on the top-hat rail according EN 50022 with the help of clip-on mounting. Do not make any changes at the device.
- Check whether the operation data comply with the values on the rating plate. Not change any DIP-switch at the device, before reading this manual.
- Connect FO cable to FO receiver (Rx) and FO transmitter (Tx) with the help of ST-plugs. Be carefull when connecting the FO plugs and avoid any dust at the FO – connections.
- Connect to RS485 terminals and screw them for permanent use.
- Connect the alarm relay terminals X7.
- Connect auxiliary power to the terminals X2 (DC: L+ / AC: L1 and DC: L- / AC: N).
- The device is ready for use after switching on the auxiliary power. The green LED `RUN` lights up.

5.4 Maintenance

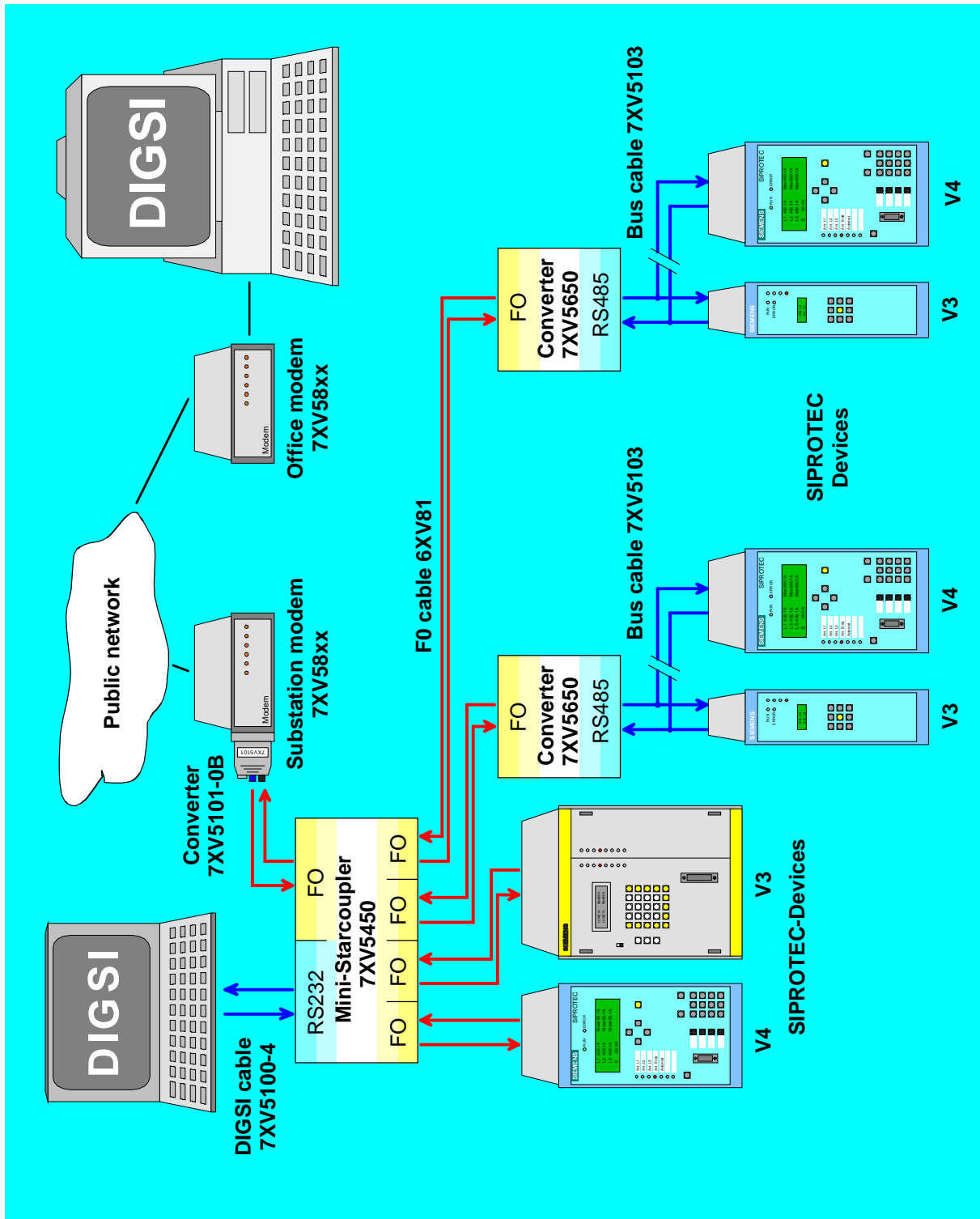
The signal converter requires no maintanance. For cleaning please use a dry and free of fuzz rag. Put the caps onto the FO-interfaces to avoid dust pollution and interference from sun light or any artifiical light source.

Do not use any liquid agents or substances for cleaning.

6 Applications

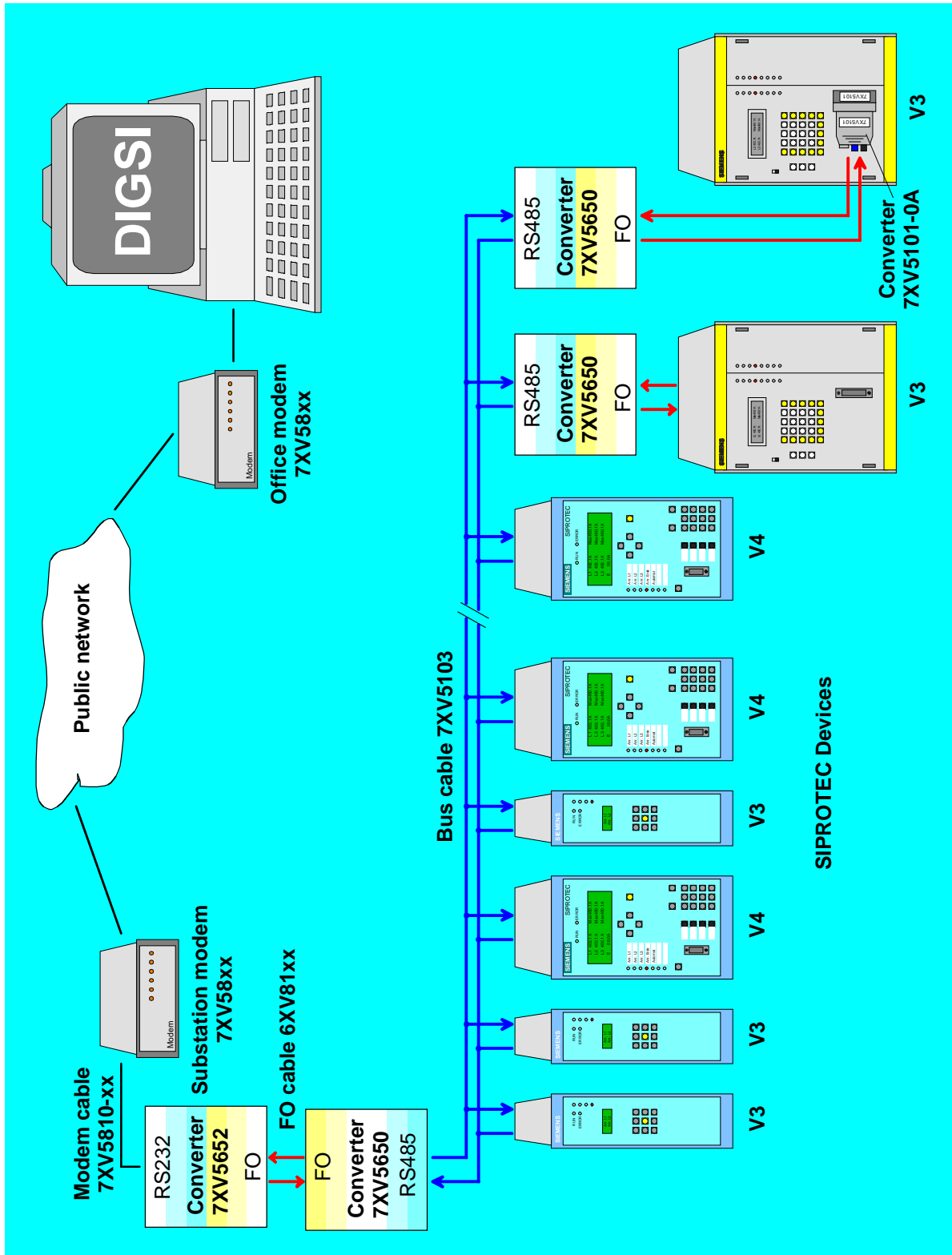
6.1 Optical star structure

When adding RS485/fibre optic converters in a connection into an existing optical system with star couplers connected in radial structure, it is possible to connect a number of devices with RS485 interfaces.



6.2 Bus structure with fibre optic spur

One device with fibre optic interface can be coupled to an existing RS485 bus structure. Data format and baudrate must be consistent within a system. Each device must have a different device address.



EG-Konformitätserklärung
 EC Declaration of Conformity
 No E471015-1

Hersteller: Siemens Aktiengesellschaft
 Manufacturer: Bereich Anlagenbau und Technische Dienstleistungen ATD
 Technische Dienstleistungen TD

Anschrift: Siemensstraße 33
 Address: D - 71254 Ditzingen
 Bundesrepublik Deutschland

Produkt-
 bezeichnung: RS485-LWL Konverter
 Product description: 7XV5650-0xA00 , 7XV5651-0xA00
 RS485-FO Converter

Das bezeichnete Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischer Richtlinien überein:
The product described above in the form as delivered is in conformity with the provisions of the following European Directives:

89/336/EWG Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit
 (geändert durch 91/263/EWG, 92/31/EWG, 93/68/EWG und 93/97/EWG).

Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility (amended by 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC)

73/23/EWG Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen (geändert durch 93/68/EWG)

Council Directive on the approximation of the laws of the Member States related to electrical equipment designed for use within certain voltage limits (amended by 93/68/EEC)

Die Konformität mit den Richtlinien wird nachgewiesen durch die Einhaltung folgender Normen:

Conformity to the Directives is assured through the application of the following standards:

Referenznummer <i>Reference number</i>	Ausgabedatum <i>Edition</i>	Referenznummer <i>Reference number</i>	Ausgabedatum <i>Edition</i>
EN 50081-1	1992	EN 50082-2	1995
EN 61010	1993		

Ditzingen, den / the 20. August 1998
 Siemens AG

Pust, GL /Pflugfelder, GL


 Unterschrift
 signature

Gottwald, Kaufm. HGL


 : Unterschrift
 signature

Name, Funktion
 Name, function

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

This declaration certifies the conformity to the specified directives but contains no assurance of properties. The safety documentation accompanying the product shall be considered in detail

If you have any notes or questions on this product please contact us under the following address:

Siemens AG

Power Transmission and Distribution
Power Automation

Depart. PTD PA 13
Postfach 4806
D-90026 Nürnberg

Telefax (+49 911) 433-8301

Further informations regarding our products in the INTERNET under:

<http://www.SIPROTEC.com>

or please visit our Download Area which is part of our WEB-site, where also the latest version of this manual is available as a PDF-file.