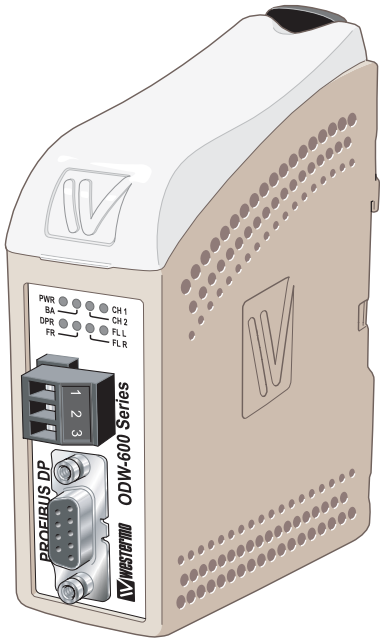
User Guide

ODW-611

Fibre Optic Modem

6650-2201



Industrial Converter
PROFIBUS DP to
Fibre Optic Link.
Point to Point applications

www.westermo.com

Legal information

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http://www.westermo.com

Safety

Before installation:

Read this manual completely and gather all information on the unit. Make sure that you understand it fully. Check that your application does not exceed the safe operating specifications for this unit.

This unit should only be installed by qualified personnel.

This unit should be built-in to an apparatus cabinet, or similar, where access is restricted to service personnel only.

The power supply wiring must be sufficiently fused, and if necessary it must be possible to disconnect manually from the power supply. Ensure compliance to national installation regulations.

This unit uses convection cooling. To avoid obstructing the airflow around the unit, follow the spacing recommendations (see Cooling section).

Before mounting, using or removing this unit:

Prevent access to hazardous voltage by disconnecting the unit from power supply. Warning! Do not open connected unit. Hazardous voltage may occur within this unit when connected to power supply.

Class 1 Laser Product

Do not look directly into fibre optical fibre port or any connected fibre although this unit is designed to meet the Class 1 Laser regulations.

Care recommendations

Follow the care recommendations below to maintain full operation of unit and to fulfil the warranty obligations.

This unit must not be operating with removed covers or lids.

Do not attempt to disassemble the unit. There are no user serviceable parts inside.

Do not drop, knock or shake the unit, rough handling above the specification may cause damage to internal circuit boards.

Do not use harsh chemicals, cleaning solvents or strong detergents to clean the unit.

Do not paint the unit. Paint can clog the unit and prevent proper operation.

Do not expose the unit to any kind of liquids (rain, beverages, etc). The unit is not water-proof. Keep the unit within the specified humidity levels.

Do not use or store the unit in dusty, dirty areas, connectors as well as other mechanical part may be damaged.

If the unit is not working properly, contact the place of purchase, nearest Westermo distributor office or Westermo Tech support.

Fibre connectors are supplied with plugs to avoid contamination inside the optical port.

As long as no optical fibre is mounted on the connector, e.g. for storage, service or transportation, should the plug be applied.

Note. Fibre Optic Handling

Fibre optic equipment needs special treatment. It is very sensitive to dust and dirt. If the fibre will be disconnected from the modem the protective hood on the transmitter/ receiver must be connected. The protective hood must be kept on during transportation. The fibre optic cable must also be handle the same way.

If this recommendation not will be followed It can jeopardise the warranty.

Cleaning of the optical connectors

In the event of contamination, the optical connectors should be cleaned by the use of forced nitrogen and some kind of cleaning stick.

Recommended cleaning fluids:

- Methyl-, ethyl-, isopropyl- or isobutyl-alcohol
- Hexane
- Naphtha

Maintenance

No maintenance is required, as long as the unit is used as intended within the specified conditions.

Agency approvals and standards compliance

Type	Approval / Compliance
EMC	EN 61000-6-2, Immunity industrial environments
	EN 55024, Immunity IT equipment
	EN 61000-6-3, Emission residential environments
	FCC part 15 Class B
	EN 50121-4, Railway signalling and telecommunications apparatus
	IEC 62236-4, Railway signalling and telecommunications apparatus
Safety	EN 60950-1, IT equipment

FCC Part 15.105 Notice: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

Declaration of Conformity

Westermo Teleindustri AB

Declaration of conformity

The manufacturer Westermo Teleindustri AB
SE-640 40 Stora Sundby, Sweden

Herewith declares that the product(s)

Type of product	Model	Art no	Installation manual
Industrial Converter, PROFIBUS DP to fibre optic link	ODW-611	3650-0001, 3650-0010 3650-0020, 3650-0030	6650-2201
	ODW-612	3650-0501, 3650-0510 3650-0520, 3650-0530	6650-2211
Industrial Converter, RS-232 to fibre optic link	ODW-621	3650-0101, 3650-0110 3650-0120, 3650-0130	6650-2221
	ODW-622	3650-0601, 3650-0610 3650-0620, 3650-0630	6650-2231
Industrial Converter, RS-485 to fibre optic link	ODW-631	3650-0201, 3650-0210 3650-0220, 3650-0230	6650-2221
	ODW-632	3650-0701, 3650-0710 3650-0720, 3650-0730	6650-2231

is in conformity with the following EC directive(s).

No	Short name
89/336/EEG	Electromagnetic Compatibility (EMC)

References of standards applied for this EC declaration of conformity.

No	Title	Issue
EN 61000-6-2	Immunity for industrial environments	2 (2001)
EN 55024	Information technology equipment – Immunity	1 (1998)
EN 61000-6-3	Emission standard for residential, commercial and light-industrial environments	1 (2001)

Herewith declares that product(s) listed above is in conformity with

No	Title	Issue
FCC part 15	Radio frequency devices	2003

Hans Levin
Technical Manager
15th March 2006

Postadress/Postal address	Tel.	Telefax	Postgiro	Bankgiro	Org.nr/ Corp. identity number	Registered office
S-640 40 Stora Sundby	016-428000	016-428001	52 72 79-4	5671-5550	556361-2604	Eskilstuna
Sweden	Int+46 16428000	Int+46 16428001				

Type tests and environmental conditions

Electromagnetic Compatibility			
Phenomena	**Test**	**Description**	**Level**
ESD	EN 61000-4-2	Enclosure contact	± 6 kV
		Enclosure air	± 8 kV
RF field AM modulated	IEC 61000-4-3	Enclosure	20 V/m 80% AM (1 kHz), 80 – 2000 MHz
RF field 900 MHz	ENV 50204	Enclosure	20 V/m pulse modulated 200 Hz, 900 ± 5 MHz
Fast transient	EN 61000-4-4	Signal ports	± 2 kV
		Power ports	± 2 kV
Surge	EN 61000-4-5	Signal ports unbalanced	± 2 kV line to earth, ± 2 kV line to line
		Signal ports balanced	± 2 kV line to earth, ± 1 kV line to line
		Power ports	± 2 kV line to earth, ± 2 kV line to line
RF conducted	EN 61000-4-6	Signal ports	10 V 80% AM (1 kHz), 0.15 – 80 MHz
		Power ports	10 V 80% AM (1 kHz), 0.15 – 80 MHz
Power frequency magnetic field	EN 61000-4-8	Enclosure	100 A/m, 50 Hz, 16.7 Hz & 0 Hz
Pulse Magnetic field	EN 61000-4-9	Enclosure	300 A/m, 6.4 / 16 µs pulse
Voltage dips and interruption	EN 61000-4-11	AC power ports	10 & 5 000 ms, interruption 10 & 500 ms, 30% reduction 100 & 1 000 ms, 60% reduction
Mains freq. 50 Hz	EN 61000-4-16	Signal ports	100 V 50 Hz line to earth
Mains freq. 50 Hz	SS 436 15 03	Signal ports	250 V 50 Hz line to line
Voltage dips and interruption	EN 61000-4-29	DC power ports	10 & 100 ms, interruption 10 ms, 30% reduction 10 ms, 60% reduction +20% above & –20% below rated voltage
Radiated emission	EN 55022	Enclosure	Class B
	FCC part 15		Class B
Conducted emission	EN 55022	AC power ports	Class B
	FCC part 15	AC power ports	Class B
	EN 55022	DC power ports	Class B
Dielectric strength	EN 60950	Signal port to all other isolated ports	2 kVrms 50 Hz 1min
		Power port to other isolated ports	3 kVrms 50 Hz 1min 2 kVrms 50 Hz 1min (@ rated power < 60V)
Environmental			
Temperature		Operating	–40 to +55°C
		Storage & Transport	–40 to +70°C
Humidity		Operating	5 to 95% relative humidity
		Storage & Transport	5 to 95% relative humidity
Altitude		Operating	2 000 m / 70 kPa
Service life		Operating	10 year
Vibration	IEC 60068-2-6	Operating	7.5 mm, 5 – 8 Hz 2 g, 8 – 500 Hz
Shock	IEC 60068-2-27	Operating	15 g, 11 ms
Packaging			
Enclosure	UL 94	PC / ABS	Flammability class V-1
Dimension W x H x D			35 x 121 x 119 mm
Weight			0.24 kg
Degree of protection	IEC 529	Enclosure	IP 21
Cooling			Convection
Mounting			Horizontal on 35 mm DIN-rail

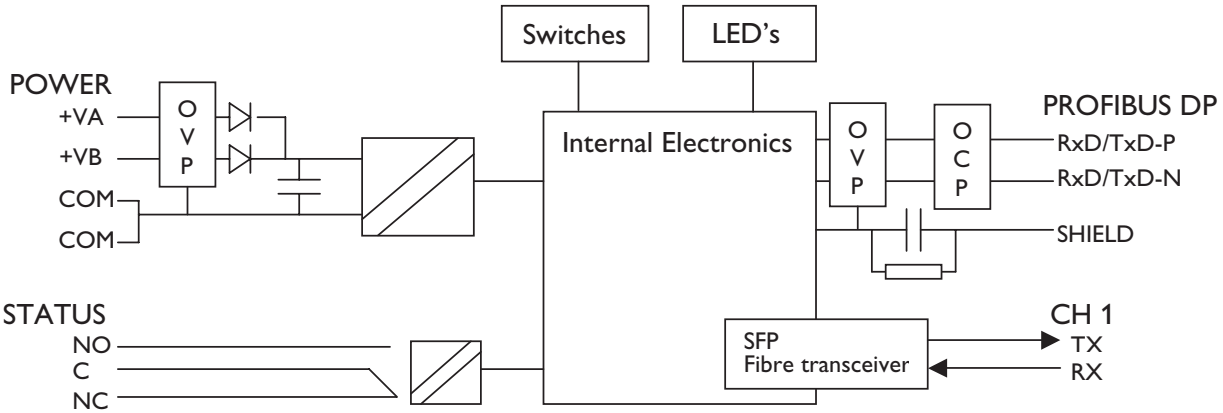
Description

Introduction

The ODW-611 is a fibre optic modem for point to point applications, that converts between electrical PROFIBUS DP and fibre optical link. The maximum distance of the fibre link depends on selected transceiver and fibre type. Distance up to 80 km (50 miles). ODW-611 is designed for harsh out-door usage, in industrial, road or railway installations. The PROFIBUS data rate is set automatically as soon as ODW-611 has identified a correct data frame. Retiming ensures the correct PROFIBUS DP signal format.

- 9-position D-sub PROFIBUS DP connector
- Data rate up to 12 Mbit/s
- Automatic data rate detection and retiming
- Point to point communication via fibre optical network
- Small Form Factor Pluggable (SFP) transceivers
- LC fibre connectors, single or multi mode
- Fibre distance up to 80 km
- Redundant power supply, 2 kVAC galvanic isolated to other ports
- Status interface
- Designed for harsh environments

Functional description



OVP Over Voltage Protection
OCP Over Current Protection

Converter PROFIBUS DP – optical fibre

ODW-611 is a fibre optic modem that converts between electrical PROFIBUS DP and fibre optical link.

Data rate up to 12 Mbit/s

ODW-611 converts PROFIBUS DP data in data rate from 9600 bit/s up to 12 Mbit/s. Retiming of the PROFIBUS DP data ensures that the correct signal format is transmitted from the ODW-611 converter.

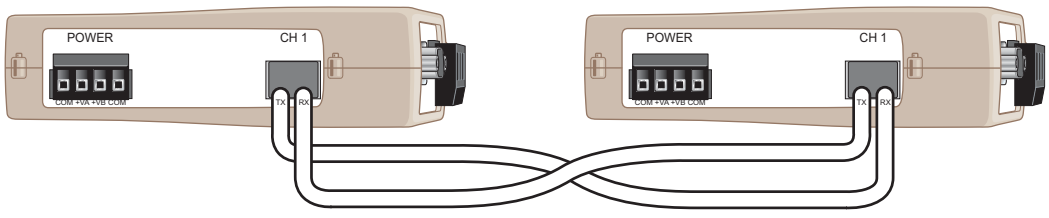
Automatic data rate detection

The PROFIBUS data rate is set automatically as soon as ODW-611 has identified a correct data frame, independently of whether data is received from PROFIBUS DP or the fibre optical link. Detected data rate remains until a number of consecutive faulty received frames or after a delay without any received frame. This is set by switches, with default setting of one faulty frame or 65 535 t_{Bit}.

Point to point communication via fibre optical network

The electrical PROFIBUS DP network is transferred via a fibre optical network by the use of two ODW-611 units. This application is useful e.g. for long distance communication, where electromagnetic interferences may occur or when isolation of the electrical network is needed.

The maximum optical fibre distance depends on selected fibre transceiver and fibre type. Distance up to 80 km (50 miles).



Point to point communication, fibre optical connection

Functionality and status indication

At power on, all LED's will be active during an initiation sequence followed by an automatic initiation of the optical fibre link. The alarm will be set until the fibre optical link is in operation and ready to transfer PROFIBUS DP data.

Data frames are transferred over the fibre optical link as long as the link is in operation and the data rate has been detected.

When the fibre optical link is out of operation, it will be indicated by a local alarm, and this will set the alarm output. When the link returns to operations mode, the alarm will rest automatically.

The Bus active (BA) LED is set if data frames are received on the electrical PROFIBUS DP port and the data rate is detected, independently of the status on fibre optical link.

Redundant power supply, galvanic isolated (2 kVAC) to other ports

ODW-611 should be supplied with safety extra low voltage (SELV). It is designed to operate permanently over a wide input range and provided with two independent inputs for enhanced redundancy if either supply fails.

9-position D-sub PROFIBUS DP connector

The pin assignment for the connector is in compliance with PROFIBUS standard EN 50 170.

Single or multimode LC fibre connectors

ODW-611 uses Small Form Factor Pluggable (SFP) transceivers that are in compliance with Multi-Sourcing Agreement (MSA). A wide range of different fibre transceivers and connectors can be used.

Status port

This port enables supervision of fibre optical link status by a relay with both normally open and closed contacts.

The status will be set if:

- Local or remote fibre link errors exist.
- The unit is out of service, e.g. no power supply.

Designed for hash environments, such as industrial, road and railway applications

ODW-611 complies with standards for industrial environments and railway signalling and telecommunications apparatus. Additionally the wide temperature range ODW-611 permits it to be installed in out-door cabinets without any additional measures, such as heating, etc.

System delay in an optical network

PROFIBUS DP data transferred from one ODW-611 unit via an optical network to a second unit will be delayed, due to the length of optical fibre and the signal processing within the unit. The signal processing delay is dependent on the data rate, and the fibre delay is dependent on the total length of the optical fibre.

	Delay @ Up to 1.5 Mbit/s	Delay @ 3 /12 Mbit/s
Optical fibre length delay (typical)	5 µs/km	5 µs/km
Signal processing, electrical to fibre (max)	1 t_{Bit} + 1.0 µs	5 t_{Bit} + 1.0 µs
Signal processing, fibre to electrical (max)	0.3 µs	0.3 µs
Overall system delay, one-way. From received PROFIBUS DP data at one unit until transmitted data at the other unit	5 µs/km + 1.0 µs + 1 t_{Bit}	5 µs/km + 1.0 µs + 5 t_{Bit}

Note t_{Bit} = 1 / Baud rate (Baud rate in Bit/s)

Example

Overall system delay, one-way	Delay @ 0.5 Mbit/s	Delay @ 1.5 Mbit/s	Delay @ 12 Mbit/s
200 m fibre length	4.0 µs	2.7 µs	2.4 µs
2000 m fibre length	13.0 µs	11.7 µs	11.4 µs

During configuration of the PROFIBUS DP master it may be necessary to adjust the bus parameter Slot time, the monitoring time (t_{Bit}) of the sender of the frame for acknowledgement of recipient. The additional time resulting from the optical fibre and ODW-611 is twice the overall one-way delay.

Interface specifications

Power	
Rated voltage	12 to 48 VDC
Operating voltage	10 to 60 VDC
Rated current	300 mA @ 12 VDC 150 mA @ 24 VDC 75 mA @ 48 VDC
Rated frequency	DC
Inrush current I^2t	0.2 A^2s
Startup current*	1.0 A peak
Polarity	Reverse polarity protected
Redundant power input	Yes
Isolation to	PROFIBUS DP and Status port
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm^2 (AWG 24-12)

* External supply current capability for proper startup

Status	
Port type	Signal relay, changeover contacts
Rated voltage	Up to 48 VDC
Operating voltage	Up to 60 VDC
Contact rating	500 mA @ 48 VDC
Contact resistance	< 50 mΩ
Isolation to	PROFIBUS DP and Power port
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm^2 (AWG 24 – 12)

FX (Fibre)	SM-LC80	SM-LC40	SM-LC15	MM-LC2
Fibre connector	LC duplex	LC duplex	LC duplex	LC duplex
Fibre type	Singlemode 9/125 mm	Singlemode 9/125 mm	Singlemode 9/125 mm	Multimode, 62.5/125 and 50/125 mm
Wavelength	1550 nm	1310 nm	1310 nm	1310 nm
Transmitter Output optical power min/max	–5/0 dBm **	–5/0 dBm **	–15/–8 dBm **	–20/–14 dBm *
Receiver Input sensitivity	–34 dBm (max)	–34 dBm (max)	–31 dBm (max)	–31 dBm (max)
Receiver Input optical power Maximum	–5 dBm (min) ***	–3 dBm (min) ***	–8 dBm (min)	–8 dBm (min)
Bit error rate (BER)	$<1 \times 10^{-10}$	$<1 \times 10^{-10}$	$<1 \times 10^{-10}$	$<2.5 \times 10^{-10}$
Transceiver type	Small Form Factor Pluggable (SFP) Multi-Sourcing Agreement (MSA) compliant			
Laser class	Class 1, IEC 825-1 Accessible Emission Limit (AEL)			

* Output power is power coupled into a 62.5/125 mm multimode fibre.
** Output power is power coupled into a 9/125 mm singlemode fibre.
*** The optical power should be reduced by at least 5 dB (SM-LC80) or 3dB (SM-LC80) between the optical output and input.

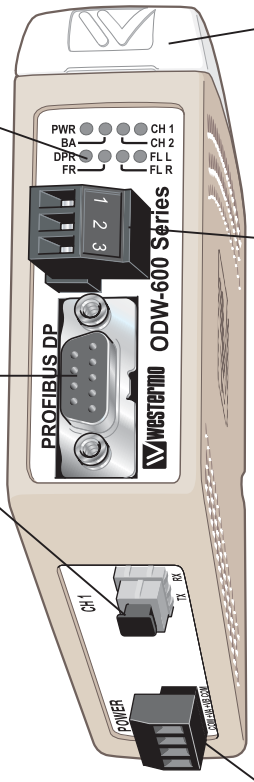
Optical Power Budget

The maximum supported link lengths as specified in table above should only been seen as indicative. The allowed link length is calculated from the Optical Power Budget (OPB), the available optical power for a fibre-optic link, and the attenuation of the fibre, comprising losses due to in-line connectors, splices, optical switches and a margin for link aging (typical 1.5 dB for 1300 nm).

The worst-case Optical Power Budget (OPB) in dB for a fibre-optic link is determined by the difference between the minimum transmitter output optical power and the lowest receiver sensitivity.

PROFIBUS DP (RS-485)	
Electrical specification	EIA RS-485 / EN 50 170
Data rate	9 600 bit/s, 19.2, 93.75, 187.5, 500 kBit/s, 1.5, 3, 6 and 12 Mbit/s
Data format	8 data bits, even parity, 1 stop bit, 11 bits total
Protocol	PROFIBUS DP / EN 50170
Data Rate detection	Yes, compliant with EN 50 170
Retiming	Yes
Turn around time	In accordance with EN 50 170
Transmission range	≤1200 m, depending on data rate and cable type (EIA RS-485)
Settings	None, external termination and failsafe biasing
Protection	Installation Fault Tolerant (up to ±60 V)
Isolation to	Power and Status port
Connection	9-pin D-sub female
Shielded cable	Not required
Conductive housing	Isolated to all other circuits and housings

Connections



LED Indicators (for details see next page)

DIP-switches accessible under lid (for details see page 16)

FX(Fibre) (for details see page 12)

Status screw terminal

3-position	Direction	Description
No. 1	NO	Contact with C when link is in operation
No. 2	C	Common
No. 3	NC	Open (no contact with C) when fibre link is in operation

Power screw terminal

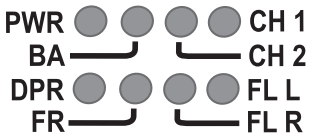
4-position marking	Description
No. 1	–Voltage
No. 2	+Voltage A
No. 3	+Voltage B
No. 4	–Voltage

PROFIBUS DP (RS-485) D-sub

9-position	Direction	Description
No. 1	–	–
No. 2	–	–
No. 3	In/Out	RxD/TxD-P
No. 4	Out	CNTR-P
No. 5	–	DGND
No. 6	Out	VP
No. 7	–	–
No. 8	In/Out	RxD/TxD-N
No. 9	–	–

LED Indicators

LED	Status	Description
PWR Power	ON	In service (power).
	Flashing	Fault condition.
	OFF	Out of service.
BA Bus active	ON	PROFIBUS DP in operation. Received data frame with detected data rate on the electrical PROFIBUS DP or optical fibre port.
	OFF	Data frame with detected data rate has not been received, or received frames have been interrupted during a time, or a number of consecutive faulty frames*.
CH 2	OFF	Not used.
CH 1 Channel	ON	Fibre link at port CH 1 in operation. Data can be transmitted.
	OFF	Fibre link at port CH 1 out of operation.
DPR Receive PROFIBUS DP	Flash	Receive data on the electrical PROFIBUS DP port. Data will be transmitted to the fibre link, if it is a correct PROFIBUS DP frame.
	OFF	–
FR Receive fibre link	Flash	Receive data on the Fibre Link. This frame is transmitted to the PROFIBUS DP channel.
	OFF	–
FL R Failure link remote	ON	Remote Fibre Link failure. A fibre link is out of operation at any other unit of the optical network.
	OFF	All fibre links are in operation at all other units in the fibre optical network.
FL L Failure link local	ON	Local fibre link failure. This unit has identified a fibre link failure.
	OFF	Fibre link of this unit is in operation.

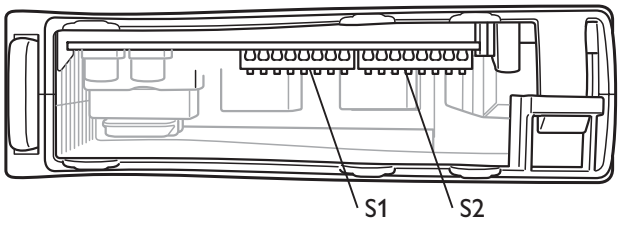


* Time and number of frames are set by DIP-switch S:2.

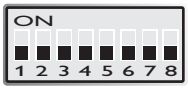
DIP-switch settings

Before DIP-switch settings:

Prevent damage to internal electronics from electrostatic discharges (ESD) by discharging your body to a grounding point (e.g. use of wrist strap).

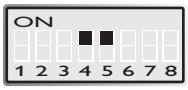


S1 DIP-switch

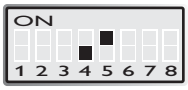


Not used

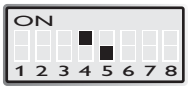
S2 DIP-switch



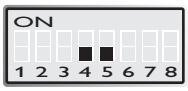
20 seconds interruption in receiving frames, until inactive BA[2])



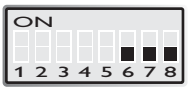
10 seconds interruption in receiving frames, until inactive BA[2])



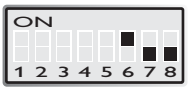
5 seconds interruption in receiving frames, until inactive BA[2])



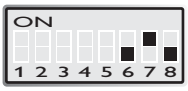
65535 t_{Bit} interruption in receiving frames, until inactive BA[2])[3])



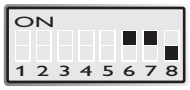
1 faulty frame, until inactive BA[1])



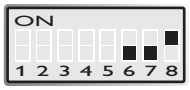
2 consecutive faulty frames, until inactive BA[1])



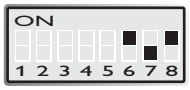
3 consecutive faulty frames, until inactive BA[1])



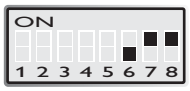
4 consecutive faulty frames, until inactive BA[1])



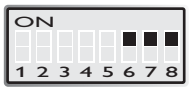
5 consecutive faulty frames, until inactive BA[1])



6 consecutive faulty frames, until inactive BA[1])



7 consecutive faulty frames, until inactive BA[1])



8 consecutive faulty frames, until inactive BA[1])[2])

[1]) BA led active = PROFIBUS DP in operation.
(Bus Active)

[2]) Delay since last correct received frame until PROFIBUS DP is out of operation.
(BA led inactive)

[3]) t_{Bit} = 1 / Baud rate.
(Baud rate in Bit/s)

DIP-switch 1–3 always set OFF

Factory settings

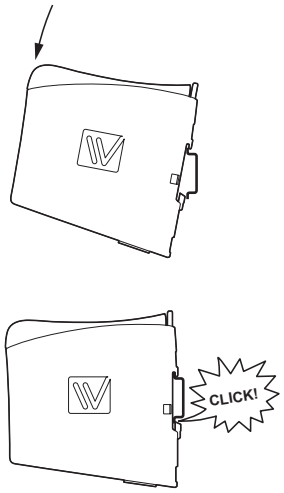
S1 

S2 

Mounting

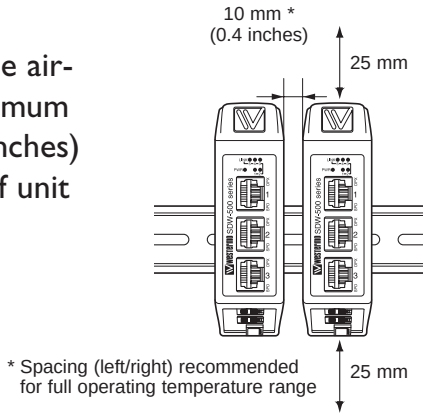
This unit should be mounted on 35 mm DIN-rail, which is horizontally mounted inside an apparatus cabinet, or similar.

Snap on mounting, see figure.



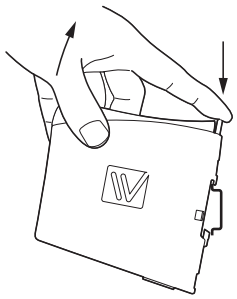
Cooling

This unit uses convection cooling. To avoid obstructing the air-flow around the unit, use the following spacing rules. Minimum spacing 25 mm (1.0 inch) above /below and 10 mm (0.4 inches) left /right the unit. Spacing is recommended for the use of unit in full operating temperature range and service life.



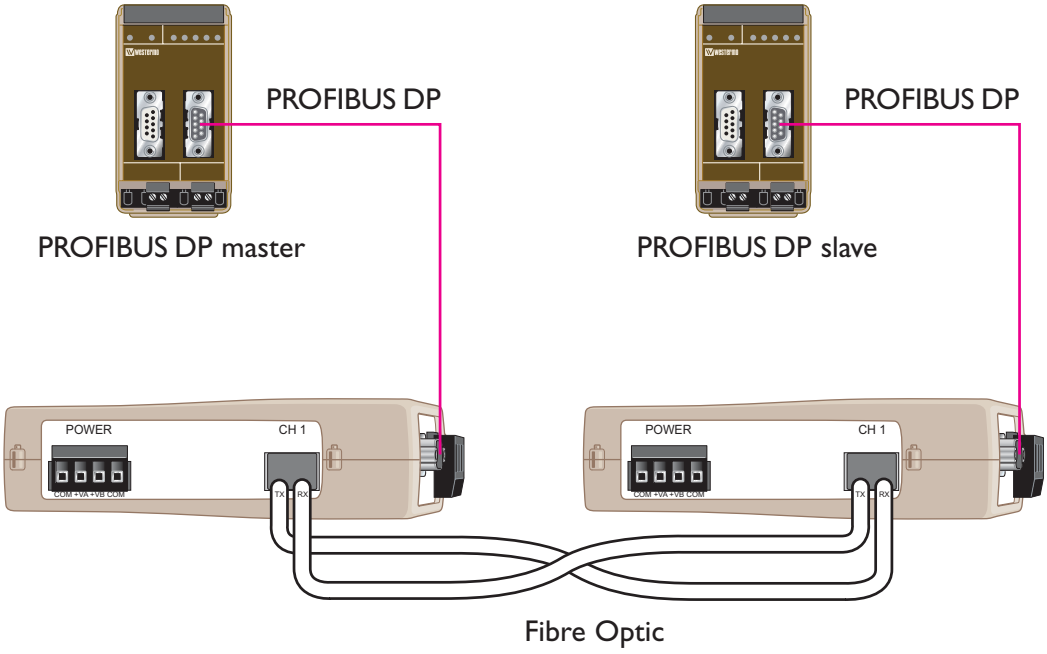
Removal

Press down the black support at the top of the unit. See figure.



Start up guide

Follow the steps below to get the unit up and running in a simple application.



- Use the factory DIP-switch settings.
- Connect The fibre link between the both units.
- Connect the power supply to both ODW-611.
  - The Fibre link should be in operation, indicated by active CH1 LED.
- Connect the PROFIBUS DP connectors between both ODW-611 and PROFIBUS units configured to be units in the PROFIBUS DP network.
  - The PROFIBUS DP will be in operation and the data rate should have been identified, indicated by BA LED.
- The point to point application is up and running.

Hints

- If the distance is long it may be necessary to adjust the bus parameter Slot time, the monitoring time (t_{Bit}) of the sender of frame for acknowledgement of recipient, at configuration of the PROFIBUS DP master.
- If the time between transferred PROFIBUS DP frames is long, it may be neccessary to allow a longer time of interruption in receiving frames, using DIP-switches.
- If disturbances in the PROFIBUS DP network, result in missed frames, it may be necessary to allow a number of consecutive faulty frames before the bus is out of operation, using DIP-swithes.

Westermo Teleindustri AB • SE-640 40 Stora Sundby, Sweden
Phone +46 16 42 80 00 Fax +46 16 42 80 01
E-mail: info@westermo.se
Westermo Web site: www.westermo.com

Subsidiaries

Westermo OnTime AS
Gladsvei 20 0489 Oslo, Norway
Phone +47 22 09 03 03 • Fax +47 22 09 03 10
E-mail: contact@ontimenet.com

Westermo Data Communications Ltd
Talisman Business Centre • Duncan Road
Park Gate, Southampton • SO31 7GA
Phone: +44(0)1489 580 585 • Fax.:+44(0)1489 580586
E-Mail: sales@westermo.co.uk

Westermo Data Communications GmbH
Goethestraße 67, 68753 Waghäusel
Tel.: +49(0)7254-95400-0 • Fax.:+49(0)7254-95400-9
E-Mail: info@westermo.de

Westermo Data Communications S.A.R.L.
9 Chemin de Chilly 91160 CHAMPLAN
Tél : +33 1 69 10 21 00 • Fax : +33 1 69 10 21 01
E-mail : infos@westermo.fr

Westermo Teleindustri AB have distributors in several countries, contact us for further information.

REV.A 6650-2201 2005.11 Mälartryck AB, Eskilstuna, Sweden