



ODW-621

Fibre Optic Modem



Industrial Converter
Serial RS-232 to fibre optic link
Point-to-point applications

Legal information

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More information about Westermo can be found at the following Internet address:

<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 voltages by disconnecting the unit from the power supply.

Warning! Do not open a connected unit. Hazardous voltages may occur within this unit when connected to a power supply.



Class 1 Laser Product

This unit is designed to meet the Class 1 Laser regulations. However, the user is warned not to look directly into fibre optical port or any connected fibre.

Care recommendations

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

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

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

Do not drop, knock or shake the unit. Rough handling beyond 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 waterproof. 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 parts 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.

The plug should be fitted when no optical fibre is inserted in the connector, e.g. during storage, service or transportation.

Note. Fibre Optic Handling

Fibre optic equipment requires careful handling as the fibre components are very sensitive to dust and dirt. If the fibre is disconnected from the modem, the protective plug on the transmitter/receiver must be replaced. The protective plug must be kept on during transportation. The fibre optic cable must also be protected in the same way.

If this recommendation is not followed, it can jeopardise the warranty.

Cleaning of the optical connectors

In the event of contamination, the optical connectors should be cleaned by using 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 61000-6-1, Immunity residential environments
	EN 61000-6-2, Immunity industrial environments
	EN 61000-6-3, Emission residential environments
	EN 61000-6-4, Emission industrial environments
	EN 55022, Emission IT equipment, class A
	EN 55024, Immunity IT equipment
	FCC part 15 Class A
	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 A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

EN 55022 Notice:

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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
Industrial fiberoptic repeaters/media converters	ODW-600 Series	3650-0xxx

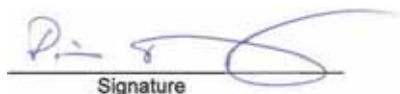
is in conformity with the following EC directive(s).

No	Short name
2004/108/EC	Electromagnetic Compatibility (EMC)

References of standards applied for this EC declaration of conformity.

No	Title	Issue
EN 50121-4	Railway applications – Electromagnetic compatibility – Emission and immunity of the signalling and telecommunications apparatus	2006
EN 55022	Information technology equipment - Emission	2006 +A1:2007
EN 55024	Information technology equipment - Immunity	1998 +A1:2001 +A2:2003
EN 61000-6-1	Electromagnetic compatibility – Immunity for residential environments	2007
EN 61000-6-2	Electromagnetic compatibility – Immunity for industrial environments	2005
EN 61000-6-3	Electromagnetic compatibility – Emission for residential environments	2007
EN 61000-6-4	Electromagnetic compatibility – Emission for industrial environments	2007

The last two digits of the year in which the CE marking was affixed: 09



Signature

Pierre Öberg
Technical Manager
29th September 2009

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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	10 V/m 80% AM (1 kHz), 80 – 800 MHz 20 V/m 80% AM (1 kHz), 800 – 1000 MHz 20 V/m 80% AM (1 kHz), 1400 – 2700 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
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 200 ms, 40% residual voltage 500 ms, 70% residual voltage
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
Radiated emission	EN 55022	Enclosure	Class B
	FCC part 15		Class A
Conducted emission	EN 55022	AC power ports	Class B
	FCC part 15	AC power ports	Class B
	EN 55022	DC power ports	Class A
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 +70°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			0.26 kg
Degree of protection			IP 21
Cooling	IEC 529	Enclosure	Convection
Mounting			Horizontal on 35 mm DIN-rail

Description

This ODW-621 is a fibre optic modem used for point-to-point applications. It acts as a converter between a serial port and a fibre optical link. The maximum distance of the fibre link depends on selected transceiver and fibre type. Distance up to 80 km (50 miles) is available.

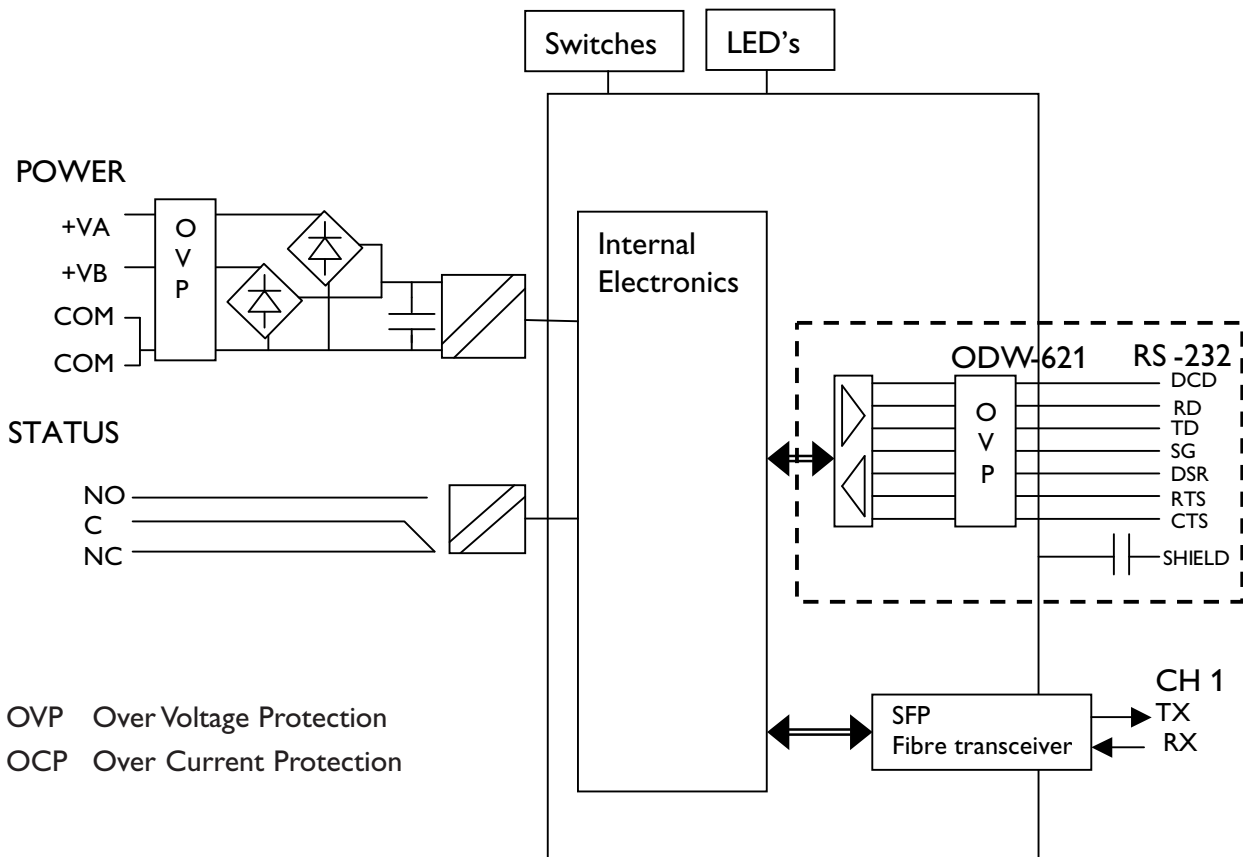
The ODW-621 is designed for harsh out-door usage, in industrial, road or railway installations.

Data will be sent transparently over the fibre optical link via the serial interface RS-232.

- ⌘ Converter serial interface – optical fibre.
- ⌘ Point-to-point communication via fibre optical network.
- ⌘ Serial interface, asynchronous mode.
- ⌘ LC-2 Multimode LC connectors, 5 km (3.1 miles).
- ⌘ LC-15 Singlemode LC connectors, 15 km (9.3 miles).
- ⌘ LC-40 Singlemode LC connectors, 40 km (24.9 miles).
- ⌘ LC-80 Singlemode LC connectors, 80 km (50 miles).
- ⌘ Bi-di Multimode LC connectors, 5 km (3.1 miles).
- ⌘ Bi-di Singlemode LC connectors, 20 km (12.5 miles).
- ⌘ Bi-di Singlemode LC connectors, 40 km (24.9 miles).
- ⌘ Bi-di Singlemode LC connectors, 60 km (37.3 miles).
- ⌘ Designed for harsh environments.
- ⌘ Redundant DC or AC power supply, 2 kVAC galvanic isolated to other ports.
- ⌘ Status interface for fault indication.
- ⌘ Small Form Factor Pluggable (SFP) transceivers.
- ⌘ 9-position D-sub connector

- ⌘ RS-232 interface
- ⌘ Data rate up to 250 kbit/s
- ⌘ RTS/CTS or CTS always active.

Functional description



Converter serial interface – optical fibre

ODW-621 is a fibre optic modem that converts between electrical RS-232 and a fibre optic link.

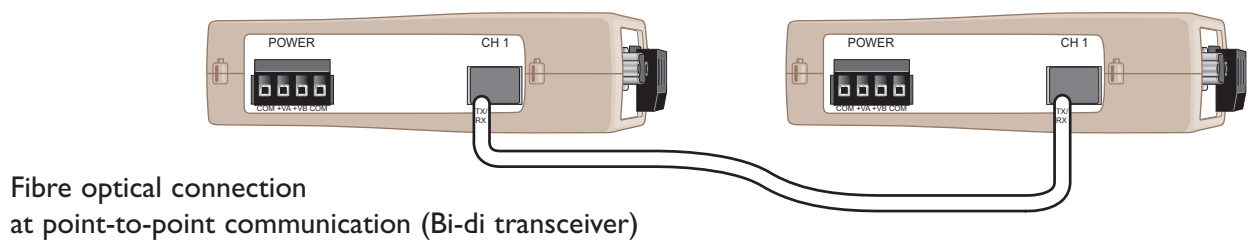
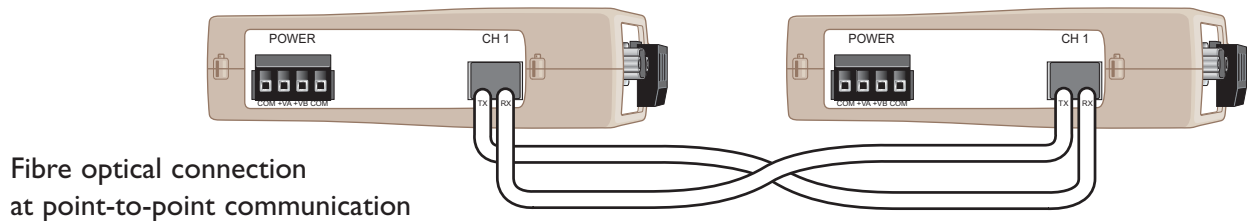
ODW-621 can also be used to convert from RS-232 to RS-485 by using one ODW-621 and one ODW-631.

Data rate up to 250 kbit/s

ODW-621 converts data using rates from 300 bit/s up to 250 kbit/s.

Point-to-point communication via fibre optical network

The serial data is transferred via a fibre optic network between two ODW-621. This application is useful e.g. for long distance communication, where electromagnetic interference may occur or when isolation of the electrical network is needed. The maximum optical fibre distance between two units depends on selected fibre transceiver and fibre type. Distance up to 80 km (50 miles) are available.



Note! The Bi-di transceivers must always be used in pair, see example:

TX 1310 nm → RX 1310 nm
RX 1550 nm ← TX 1550 nm



Bi-di transceiver, TX 1310 nm,
RX 1550 nm.



Bi-di transceiver, TX 1550 nm,
RX 1310 nm.

Optical fibre link 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 optic link is in operation and ready to transfer serial data. Data can be transferred over the fibre optic link as long as the link is in operation.

When the fibre optic link is out of operation this will be indicated by a local alarm output. When the link returns to operation, the alarm will reset automatically.

RS-232 interface

A 9-position female D-sub connector that handles full duplex data rates up to 250 kbit/s. With RS-232 mode the RS-232 interface can handle an arbitrary data rate up to 250 kbit/s without any data rate or data bit settings.

With RTS/CTS control selected, the request to send (RTS) signals will be transferred between the ODW-621s over the fibre optic network. These RTS signals are transferred independently of the data transfer. An RTS signal received at one ODW-621 will set the clear to send (CTS) signal at the other converter.

The data carrier detect (DCD) signal is set as long as the fibre link is in operation, ready to transfer data. The data set ready (DSR) signal is set as long as the ODW-621 is in service. If RTS/CTS is set to OFF will CTS always be set to active.

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

The ODW-621 should be supplied with safety extra low voltage (SELV). It is designed to operate permanently over a wide DC or AC voltage input range and provided with two independent inputs for enhanced redundancy if either supply fails.

Single- or multimode LC fibre connectors

The ODW-621 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 interface

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

The status will be set if:

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

Designed for harsh environments, such as industrial, road and railway applications.

The ODW-621 complies with standards for industrial environments, railway signalling and telecommunications apparatus. Additionally the wide temperature range permits it to be installed in out-door cabinets without any additional measures, such as heating, etc.

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System delay in an optical network

Serial data transferred from one ODW-621 via an optical network to a second one, will be delayed due to the length of optical fibre and the signal processing within the units. The signal processing delay is dependent on the data rate and conversions, and the fibre delay is dependent on the total length of the optical fibre.

Item	Functions	Delay
1	Fibre: Optical fibre length delay (typical)	5 μ s/km
2	Converter electrical to fibre: Signal processing	0.6 μ s (CTS mode) $1 t_{\text{Bit}} + 0.6 \mu$ s (CTS/RTS mode)
3	Converter fibre to electrical: Signal processing	0.6 μ s

Note $t_{\text{bit}} = 1 / \text{Baud rate}$ (Baud rate in bit/s)

The system delay when transferring data from the serial input at one ODW-621 to the serial output of other one is calculated by adding the following:

1. *Fibre*: The optical fibre length delay.
2. *Converter electrical to fibre*: Signal processing delay.
3. *Converter fibre to electrical*: Signal processing delay.

Example 1: Data data transfer from one ODW-621 to a second converter with a total fibre length of 25 km. Data rate of 9 600 bit/s.

1. *Fibre*: The total optical fibre length delay $25 * 5 \mu\text{s} = 125 \mu\text{s}$.
2. *Converter electrical to fibre*: Signal processing delay $1 t_{\text{bit}} + 0.6 \mu\text{s} = 105 \mu\text{s} + 1.0 \mu\text{s} = 106 \mu\text{s}$.
3. *Converter fibre to electrical*: Signal processing delay = 0.6 μ s.
4. The system delay is calculated by adding the delays in items 1 to 3 above = 232 μ s

Example 2: Data transfer from one ODW-621 to a second converter with a total fibre length of 25 km. Data rate of 9 600 bit/s.

5. *Fibre*: The total optical fibre length delay $25 * 5 \mu\text{s} = 125 \mu\text{s}$.
6. *Converter electrical to fibre*: Signal processing delay = 0.6 μ s.
7. *Converter fibre to electrical*: Signal processing delay = 0.6 μ s.
8. The system delay is calculated by adding the delays in item 1 to 3 above = 126 μ s

Interface specifications

Power	
Rated voltage	12 to 48 VDC 24 VAC
Operating voltage	10 to 60 VDC 20 to 30 VAC
Rated current	300 mA @ 12 V 150 mA @ 24 V 75 mA @ 48 V
Rated frequency	DC: – AC: 48 to 62 Hz
Inrush current I^2t	0.2 A ² s
Startup current*	1.0 A _{peak}
Polarity	Reverse polarity protected
Redundant power input	Yes
Isolation to	RS-232 and Status port
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm ² (AWG 24 – 12)
Shielded cable	Not required

* 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	RS-232 and Power port
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm ² (AWG 24 – 12)
Shielded cable	Not required

RS-232	
Electrical specification	EIA RS-232
Data rate	300 bit/s – 250 kbit/s
Transmission range	15 m
Isolation to	Status and Power port
Connection	9-pin D-sub female (DCE)
Shielded cable	Not required, except when installed in railway applications as signalling and telecommunications apparatus and located close to rails*
Conductive housing	Isolated to all other circuits and housings

* To minimise the risk of interference, a shielded cable is recommended when the cable is located inside 3 m boundary to the rails and connected to this port.

The cable shield should be properly connected (360°) to an earthing point within 1 m from this port. This earthing point should have a low impedance connection to the conductive enclosure of the apparatus cabinet, or similar, where the unit is built-in. This conductive enclosure should be connected to the earthing system of an installation and may be directly connected to the protective earth.

Optical Power Budget

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 ageing (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 transmitter's output optical power (min) and the receiver input sensitivity (max).

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 µm	Singlemode 9/125 µm	Singlemode 9/125 µm	Multimode, 62.5/125 and 50/125 µm
Wavelength nm	1550	1310	1310	1310
Transmitter Output optical power min/max	−5/0 dBm**	−5/0 dBm**	−15/−8 dBm**	−20/−14 dBm*
Receiver Input sensitivity, max	−34 dBm	−34 dBm	−31 dBm	−31 dBm
Receiver Input optical power, max	−5 dBm***	−3 dBm***	−8 dBm	−8 dBm
Optical power budget, worst-case	29 dB	29 dB	16 dB	11 dB
Transceiver type	Small Form Factor Pluggable (SFP) Multi-Sourcing Agreement (MSA) compliant			
Laser class	Class 1, IEC 825-1 Accessible Emission Limit (AEL)			

FX (Fibre)	Bi-di LC-60	Bi-di LC-40	Bi-di LC-20	Bi-di MM LC-2
Fibre connector	LC Simplex	LC Simplex	LC Simplex	LC Simplex
Fibre type	Singlemode 9/125 µm	Singlemode 9/125 µm	Singlemode 9/125 µm	Multimode 62.5/125 and 50/125 µm
Wavelength nm, connector 1 Wavelength nm, connector 2	Tx 1310, rx 1550 Tx 1550, rx 1310	Tx 1310, rx 1550 Tx 1550, rx 1310	Tx1310, rx 1550 TX 1550, rx 1310	Tx 1310, rx 1550 Tx 1550, rx 1310
Transmitter Output optical power min/max	−5/0 dBm **	−8/0 dBm **	−10/0 dBm **	−10/−8 dBm *
Receiver Input sensitivity, max	−34 dBm	−34 dBm	−28 dBm	−28 dBm
Receiver Input optical power, max	0 dBm***	0 dBm***	0 dBm	−0 dBm
Optical power budget, worst-case	29 dB	26 dB	18 dB	18 dB
Transceiver type	Small Form Factor Pluggable (SFP) Multi-Sourcing Agreement (MSA) compliant			
Laser class	Class 1, IEC 825-1 Accessible Emission Limit (AEL)			

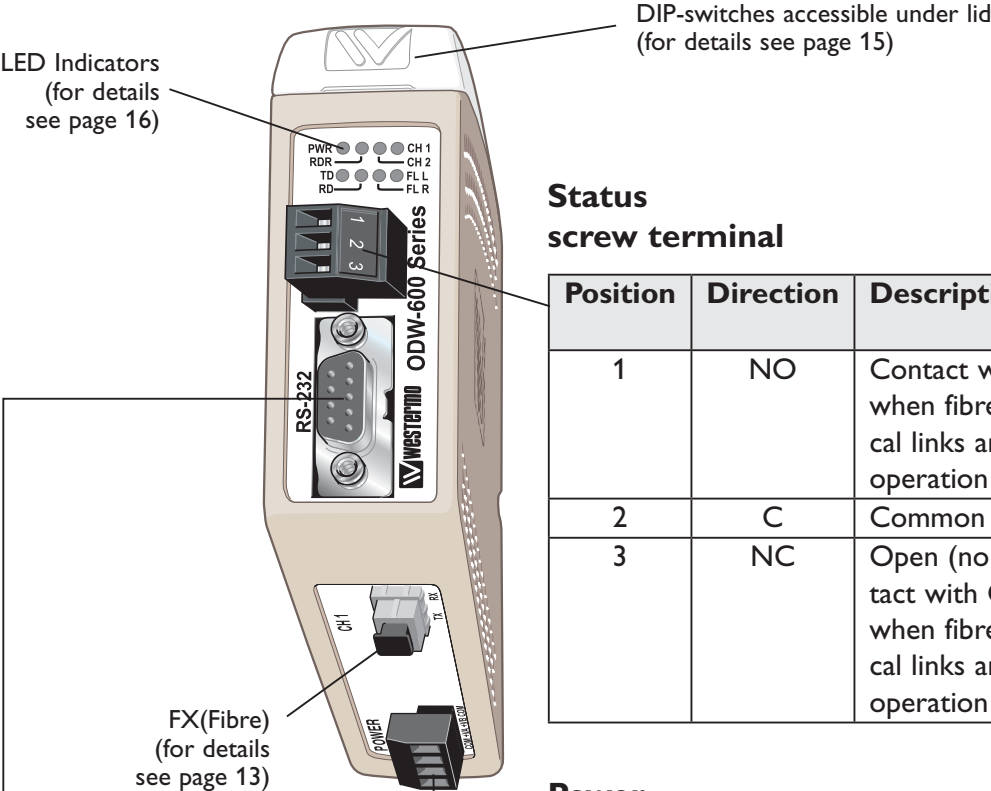
* Output power is power coupled into a 62.5/125 µm multimode fibre

** Output power is power coupled into a 9/125 µm singlemode fibre

*** The optical power should be reduced by at least 5 dB (SM-LC80 and Bi-di LC-60) or 3dB (SM-LC-40 and Bi-di LC-40) between the optical output and input.

Location of Interface ports, LED's and DIP-switches

ODW-621



Status screw terminal

Position	Direction	Description	Product marking
1	NO	Contact with C when fibre optical links are in operation	NO
2	C	Common	C
3	NC	Open (no contact with C) when fibre optical links are in operation	NC

Power screw terminal

Position	Direction*	Description	Product marking
1	In	Common voltage	COM
2	In	Voltage A	+VA
3	In	Voltage B	+VB
4	In	Common voltage	COM

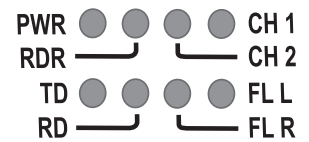
RS-232 D-sub

Position	Direction*	Description
D-sub		
1	Out	Data Carrier Detect (DCD)
2	Out	Received Data (RD)
3	In	Transmitted Data (TD)
4		Not connected
5	–	Signal Ground (SG)
6	Out	Data Set Ready (DSR)
7	In	Request To Send (RTS)
8	Out	Clear To Send (CTS)
9		Not connected

* Direction relative this unit

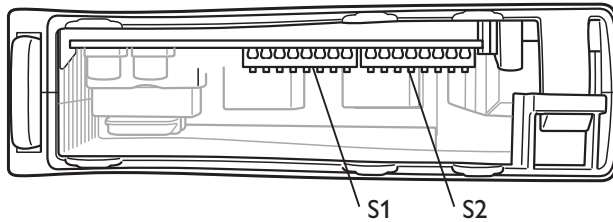
LED indicators

LED	Status	Description
PWR Power	ON	In service (power)
	Flashing	Fault condition
	OFF	Out of service
RDR	OFF	Not used
CH 2	OFF	Not used
CH 1	ON	Fibre link at port CH 1 in operation. Data can be transmitted
	OFF	Fibre link at port CH 1 out of operation
TD Serial data Receive	Flashing	Receive data on the serial port. Data will be transmitted to the fibre link
	OFF	–
RD Fibre link data Receive	Flashing	Receive data on the fibre link. This frame is transmitted to the serial port
	OFF	–
FL R (Red) 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 (Red) 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



Configuration

All needed configurations and parameter settings are done by the DIP-switches, located under the top lid of the ODW-600.



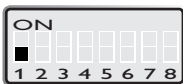
DIP-switch settings

Before DIP-switch settings:

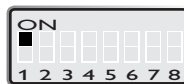
Prevent damage to internal electronics from electrostatic discharges (ESD) by discharging your body to a grounding point (e.g. use of wrist strap)

Note: Disconnect power before DIP-switch settings.

S1 DIP-switch



CTS always active



RTS signal will be transferred to remote modem. When the remote modem receives RTS, CTS will be set to high.

S2 DIP-switch



Set status port of local fibre link error*

* **SW 2:6 ON:** The status relay only change status in the unit that is connected to the receive side.

Factory settings



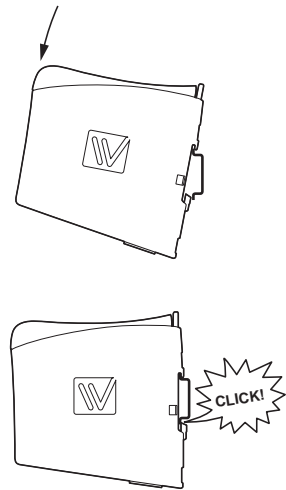
S1



S2

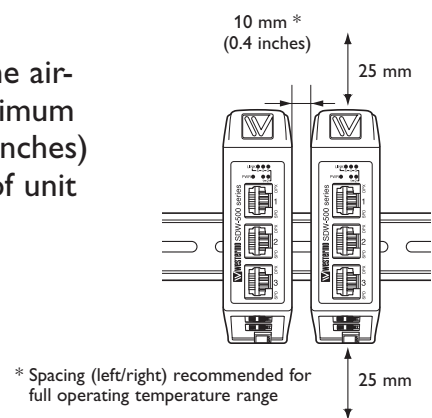
Mounting

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.



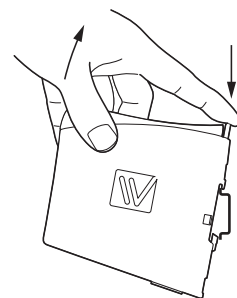
Cooling

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.



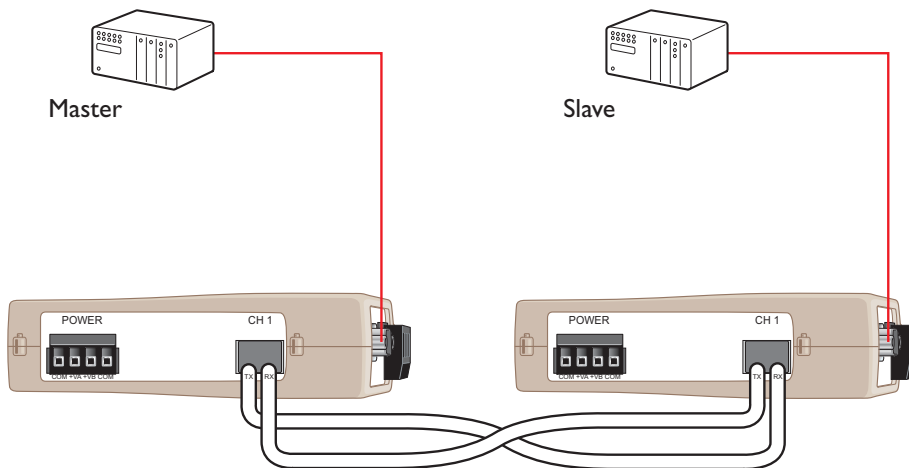
Removal

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



Start up guide, point-to-point application

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



- ⌘ Configure the ODW-621s. Using the factory DIP-switch settings, set:
- ⌘ S1: CTS always active or RTS/CTS control.
- ⌘ Connect The fibre link between the ODW-621s.
- ⌘ Connect the power supply to both ODW-621s.
- ⌘ After a few seconds the fibre link should be in operation, indicated by an active CH1 LED.
- ⌘ Connect the serial cables from PLC master and slave to respective ODW-621s.
- ⌘ Frames from PLC master that are correctly received the ODW-621 should be indicated by flashing TD LED.
- ⌘ Frames that are received via the fibre link will be transmitted to the PLC slave and indicated by flashing RD LED.
- ⌘ Replies from slave to master will be transferred and indicated in the opposite way.
- ⌘ The point-to-point application is up and running.



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