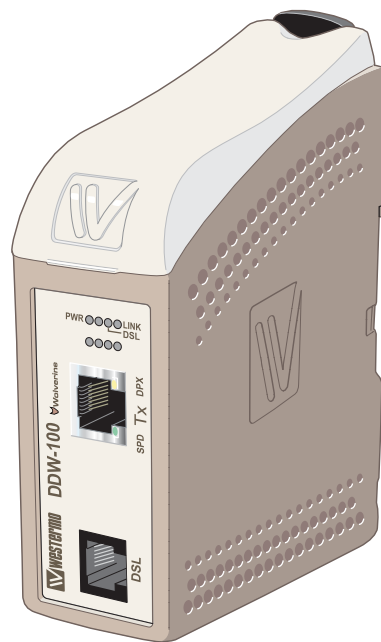


User Guide
6621-2202



DDW-100



*Industrial Ethernet
SHDSL Extender*

www.westermo.com

Legal information

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

<http://www.westermo.com>

Safety



Before using this unit:

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.

Hazardous voltage may occur within this unit when connected to power supply or TNV circuits.

Prevent access to hazardous voltage by disconnecting the unit from power supply and all other electrical connections.

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



Before installation:

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 Installation section).

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 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 part may be damaged.

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

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 UL listed, UL 60950-1 CSA 22.2 No 60950-1-03
SHDSL	ITU-T G.991.2, G.SHDSL standard

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
SHDSL Ethernet bridge / DIN rail mounted	DDW-100	3621-0002

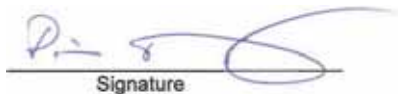
is in conformity with the following EC directive(s).

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

References of standards applied for this EC declaration of conformity.

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

The last two digits of the year in which the CE marking was affixed: 08



Signature

Pierre Öberg
R&D Manager
16th April 2009

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Type tests and environmental conditions

Electromagnetic Compatibility			
Phenomena	Test	Description	Test levels
ESD	EN 61000-4-2	Enclosure contact	± 6 kV
		Enclosure air	± 8 kV
RF field AM modulated	EN 61000-4-3	Enclosure	10 V/m 80% AM (1 kHz), 80 – 1 000 MHz 20 V/m 80% AM (1 kHz), 80 – 2 700 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 earth
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
		Signal 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 other isolated ports	2 kVrms 50 Hz 1 min
		Power port to other isolated ports	3 kVrms 50 Hz 1 min 2 kVrms 50 Hz 1 min (@ rated power <60 V)
Environmental			
Temperature		Operating	-25 to +65°C
		Storage & Transport	-25 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			0.2 kg
Degree of protection	IEC 529	Enclosure	IP 21
Cooling			Convection
Mounting			Horizontal on 35 mm DIN-rail

Description

Functional description

SHDSL represents the best of several symmetric DSL technologies that have been combined into a single industry standard. The DDW-100 is designed as a transparent Ethernet Extender (Ethernet Bridge) for 10/100BaseTX networks. It is transparent for multicast addressing, VLAN packets, VPN pass-through for IPsec and for protocols like MODBUS/tcp and Profinet.

SHDSL allows the re-use of existing twisted copper pair with data rates from 192 kbit/s to 2.3 Mbit/s in both directions (Symmetric DSL), according to standard ITU-T G.991.2.

Based on the quality of the line and the communication speed, distances up to 10 km can be achieved, this however depends of the quality of the line and cable characteristics. This differs from application to application, therefore a unique feature is implemented providing reliable-, normal-, or high speed mode.

Distance on /data rate without noise, cable type is AWG24, 0,2 mm²

Tested distances with Cat 5 cables

192 kbit/s	>6 km
384 kbit/s	>6 km
512 kbit/s	>6 km
768 kbit/s	>6 km
1024 kbit/s	>3 km
1280 kbit/s	> 3 km
2048 kbit/s	> 3 km
2304 kbit/s	> 3 km

Distances up to 10 km at 192 kbit/s have also been verified with a 1mm² cable.

Description of used nomenclature:

Noise margin:

The margin between signal and noise (dB)

CO/CPE:

CO (Central Office) answering central unit, the CO configures the CPE when establishing a connection. CPE (Customer Premises Equipment) is the unit that initiates the connection.

Annex A and B:

Annex A in ITU-T Rec. G.991.2 describes those specifications that are unique to SHDSL systems operating under conditions such as those typically encountered within North American networks.

Annex B in ITU-T Rec. G.991.2 describes those specifications that are unique to SHDSL systems operating under conditions such as those typically encountered within European networks.

Getting started

The DDW-100 is easy to use and install, the units work in pairs, one as has to be configured as CO (Central Office) and one as CPE (Customer Premises Equipment). This configuration is made with DIP-switches situated under the lid of the DDW-100.

① Connect the SHDSL Line

There are two options for connecting the SHDSL line:

- 1) Connect the twisted pair to DSL screw terminal 1 and 2 (polarity independent) situated at the base of the DDW-100
- 2) Connect the line using the RJ-12 port on the front panel of the DDW-100.

Note! that these two connections are parallel, it is not possible to connect both at the same time.

② Connect the Ethernet Line

Connect Ethernet to the TX port on the front of the DDW-100.

The factory settings for the DDW-100 is plug and play mode where TX port is enabled for:

- ⌘ Ethernet Auto-negotiation enabled.
- ⌘ Auto MDI/MDI-X.
- ⌘ Auto-polarity enabled.

The DDW-100 will automatically sense the data rate of the connected unit and cable type.

③ Settings in the units

The units operate in pairs, one as CO (Central Office) and one as CPE (Customer Premises Equipment). Factory setting in the DDW-100 is as CPE.

Note! Before connection and installation one of the connecting units have to be reconfigured as a CPE, see DIP-switch S1:4.

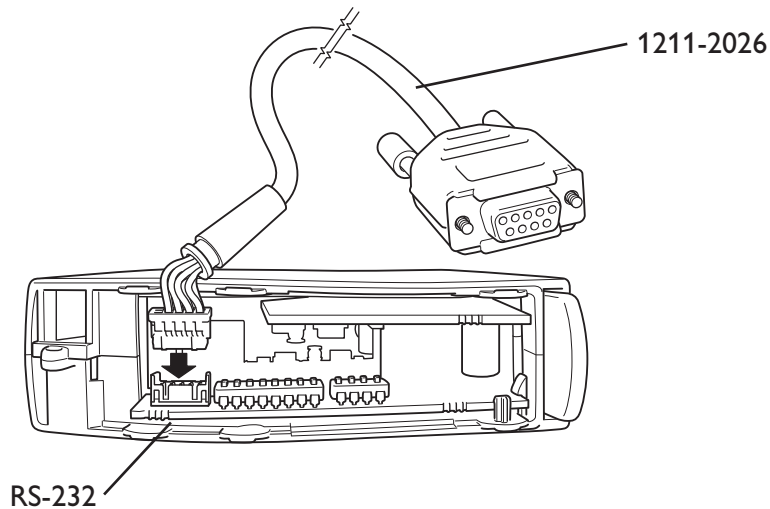
Depending on the quality of the line and the distance there is possibility to select the optimised speed.

This is done via DIP switches in the unit configured as CO. Factory default is 192 kbit/s. When selecting higher speed note if the DSL link is established, if not, the selected speed is too high for the distance.

Diagnostic information:

The DDW-100 can display diagnostic information using a terminal program

- 1) Connect a Westermo standard cable 1211-2026 (two metre 9-pole D-sub) to the RS-232 interface located under lid.



- 2) Open a terminal program with settings:
Data rate: 115.2 kbit/s
Data bits: 8
Stop bits: 1
Parity: None
Flow control: None
- 3) Type command DIAG or RUNDIAG

Information from DIAG command

- Software release
- DIP switch settings
- If the unit is configured as CO or CPE
- If the unit is configured for Annex A or Annex B
- DSL link state
- DSL data rate
- DSL noise margin
- Ethernet data rate
- Ethernet duplex

Information from RUNDIAG command

DSL Link state
DSL Datarate
DSL Noise Margin

Space aborts running diagnostics.

Interface specifications

Power	
Rated voltage	12 to 48 VDC
Operating voltage	10 to 60 VDC
Rated current	290 mA @ 12 VDC 140 mA @ 24 VDC 80 mA @ 48 VDC
Rated frequency	DC
Inrush current, I^2t	0.098 A ² s
Startup current	0.6 A _{peak}
Polarity	Reverse polarity protected
Redundant power input	Yes
Isolation to	All other
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm ² (AWG 24 – 12)
Shielded cable	Not required

DSL Leased Line	
Electrical specification	ITU-T G.991.2 Annex B
Data rate	192 kbit/s to 2.304 Mbit/s
Protocol	ITU-T G.991.2, Annex E Clear Channel Data
Transmission range	According to ITU-T G.991.2 depending on the line quality: Typical values using noise-free AWG26 Cables 2.3 Mbit/s reach > 3 km 192 kbit/s reach > 6 km
Protection	Bidirectional transient surge arrestor
Isolation to	All other
Galvanic connection to	None
Connection	Detachable screw terminal and RJ-12
Connector size	0.2 – 2.5 mm ² (AWG 26 – 12)
Shielded cable	Not required
Conductive housing	No
Number of ports	1

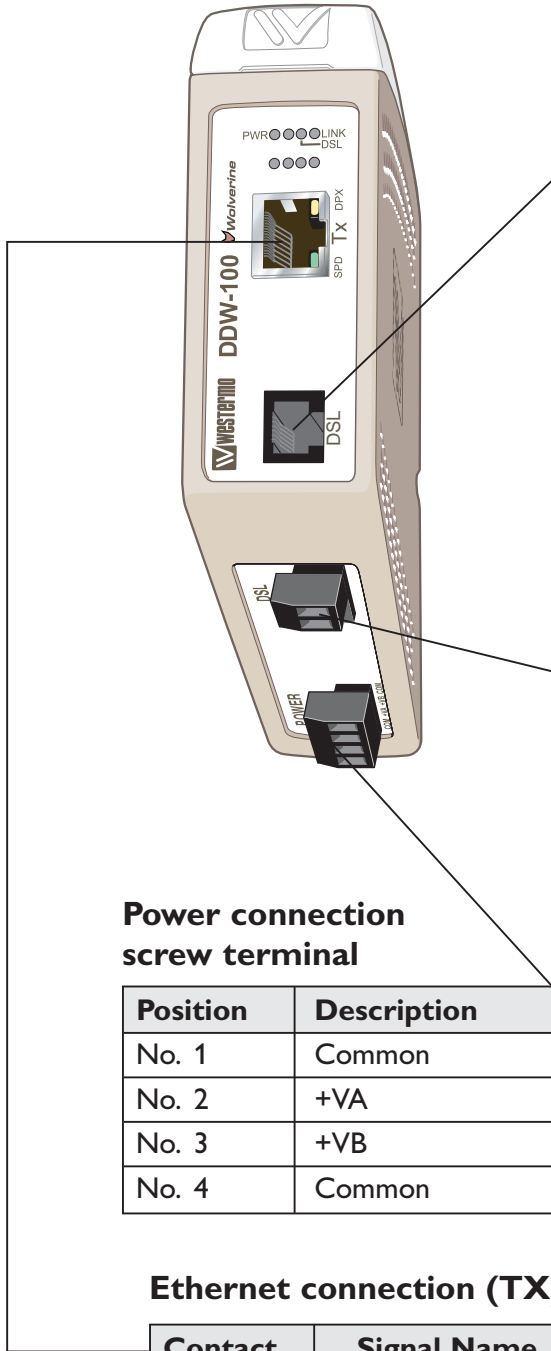
RS-232, Console port	
Electrical specification	RS-232/V.24
Data rate	115.2 kbit/s
Data format	8 data bits, none parity, 1 stop bit, no flow control
Circuit type	SELV
Transmission range	15 m
Isolation to	All other
Connection	Westermo cable 1211-2066

Ethernet TX	
Electrical specification	IEEE std 802.3. 2000 Edition
Data rate	10 Mbit/s, 100 Mbit/s, manual or auto
Duplex	Full or half, manual or auto
Circuit type	SELV
Transmission range	100 m
Isolation to	All other
Connection	RJ-45 MDI or auto MDI/MDI-X
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
Miscellaneous	If Auto-Neg. is disabled then this interface will be set MDI, see below.
Number of ports	1

* 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.

Connections



DSL RJ-12 connector

Position	Direction	Description
No. 1		NC
No. 2		NC
No. 3	In/Out	2-wire Receive/ Transmit SHDSL
No. 4	In/Out	2-wire Receive/ Transmit SHDSL
No. 5		NC
No. 6		NC

SHDSL screw connector*

Position	Direction	Description
No. 1	In/Out	2-wire Receive/ Transmit SHDSL
No. 2	In/Out	2-wire Receive/ Transmit SHDSL

* Note that only one of the DSL connections should be used.

Power connection screw terminal

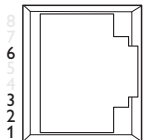
Position	Description
No. 1	Common
No. 2	+VA
No. 3	+VB
No. 4	Common

The DDW-100 supports redundant power connection. The positive input are +VA and +VB, the negative input for both supplies are COM. The power is drawn from the input with the highest voltage.

Ethernet connection (TX) (RJ-45 connector)

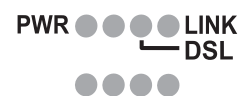
Contact	Signal Name	Direction	Description/Remark
No.1	TD+	In/Out	Transmitted/Received data
No. 2	TD-	In/Out	Transmitted/Received data
No. 3	RD+	In/Out	Transmitted/Received data
No. 4			
No. 5			
No. 6	RD-	In/Out	Transmitted/Received data
No. 7			
No. 8			
Shield			HF-connected

CAT 5 cable is recommended. Unshielded (UTP) or shielded (STP) connector can be used.

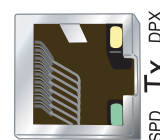


LED Indicators

LED	Status	Indication of
PWR	OFF	Unit has no power
	ON	Internal power
	Slow flash	Initialisation progressing
	Fast FLASH	Initialisation error
DSL *	OFF	Unit is unconnected
	Flash 1 (200 ms)	Unit is initializing DSL, only CO
	Flash 2 (400 ms)	Unit is in activation phase 1 of DSL link establishment
	Flash 3 (1 s)	Unit is in activation phase 2 of DSL link establishment
	ON	Unit has established a DSL connection
LINK	OFF	No Ethernet link
	ON	Good Ethernet link
	Flash	Ethernet data is transmitted or received, traffic indication



LED	Status	Indication of
SPD	OFF	10 Mbit/s
	ON	100 Mbit/s
DPX	OFF	HDPX, Half Duplex
	ON	FDPX, Full Duplex



* DSL LED indicator	Description
Flash 1 (only in CO)	Both CO and CPE have power and the line is connected
Flash 2 (both in CO and CPE)	Synchronisation phase of DSL link
Flash 3 (both in CO and CPE)	Activation phase of DSL link
ON (both in CO and CPE)	Unit has established a DSL connection

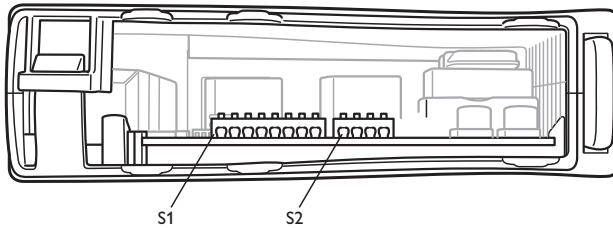
DIP-switch settings



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 DIP-switch alterations are only effective after a power on. A setting configured by any other method during normal operation, overrides the DIP-switch setting. However, at power up, the DIP-switch settings have precedence over the setting configured by any other method.



S1* DIP-switch

	Ethernet Auto-negotiation enabled. Auto MDI/MDI-X. 10 Mbit/s auto-polarity enabled.		384 kbit/s
	Speed 100 Mbit/s *		512 kbit/s
	Speed 10 Mbit/s *		768 kbit/s
	Full-Duplex, FDPX *		1.024 Mbit/s
	Half-Duplex, HDPX *		1.280 Mbit/s
	Central, CO		2.048 Mbit/s
	Remote, CPE		2.304 Mbit/s
	192 kbit/s		

* Configured as MDI • S1: 8 are not used

Factory settings

S1

Auto-negotiation enabled, CPE, 192 kbit/s

S2 DIP-switch



Annex B Enabled



High-Speed Mode,
Noise Margin = 0 dB



Reserved for Annex A



Normal Mode,
Noise Margin = 3 dB



Reliable Mode,
Noise Margin = 6 dB



Manual Speed Selected
(Locked Speed) see S1:5-7

Factory settings

S2



Annex B enabled, manual speed selected

Description of normal, high-speed and reliable mode

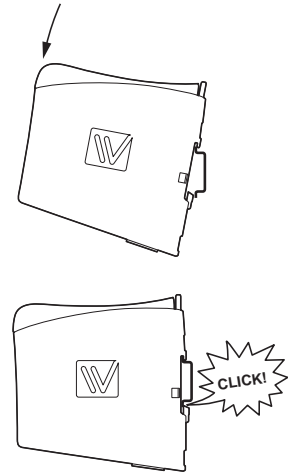
With SW2:2, 3 the DDW-100 is set to reliable, high-speed or normal mode. Choose mode depending on your application, if you wish to transmit large amounts of non critical data, choose high-speed mode with a noise margin 0 dB. If the data is critical, choose reliable mode.

When choosing one of reliable, high-speed or normal modes, the DDW-100 will automatically set the highest possible speed according to the noise margin and distance. The algorithm for sensing highest possible speed may result in a longer connection time because several attempts have to be done to achieve a connection.

If the connection time is critical, it is possible to discover the connection speed using the diagnostic port, then set the unit manually according to achieved speed.

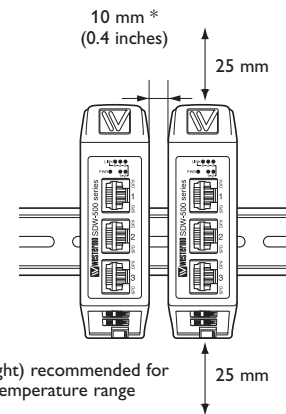
Mounting

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.



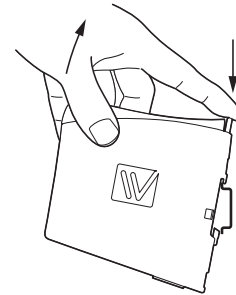
Cooling

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.



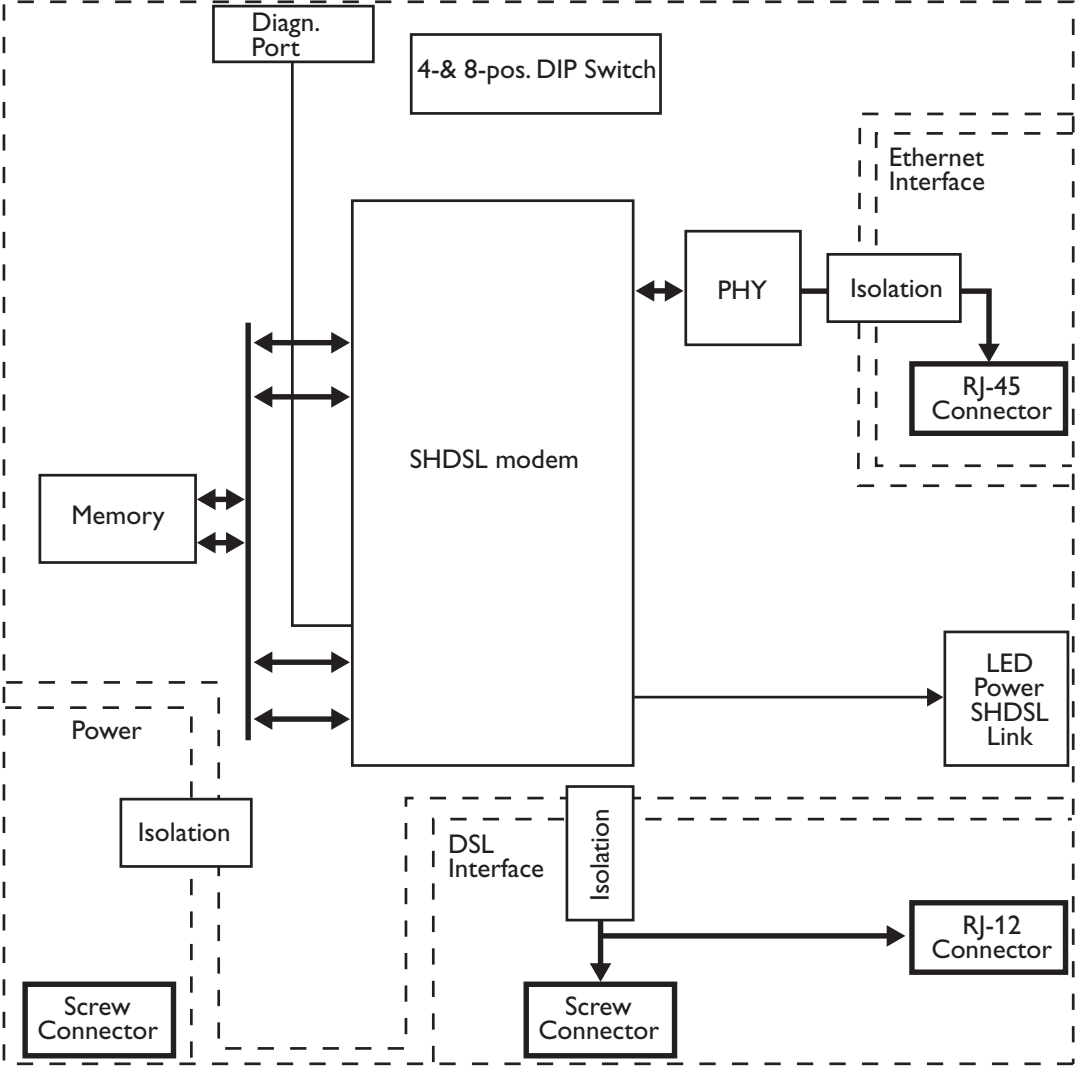
Removal

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

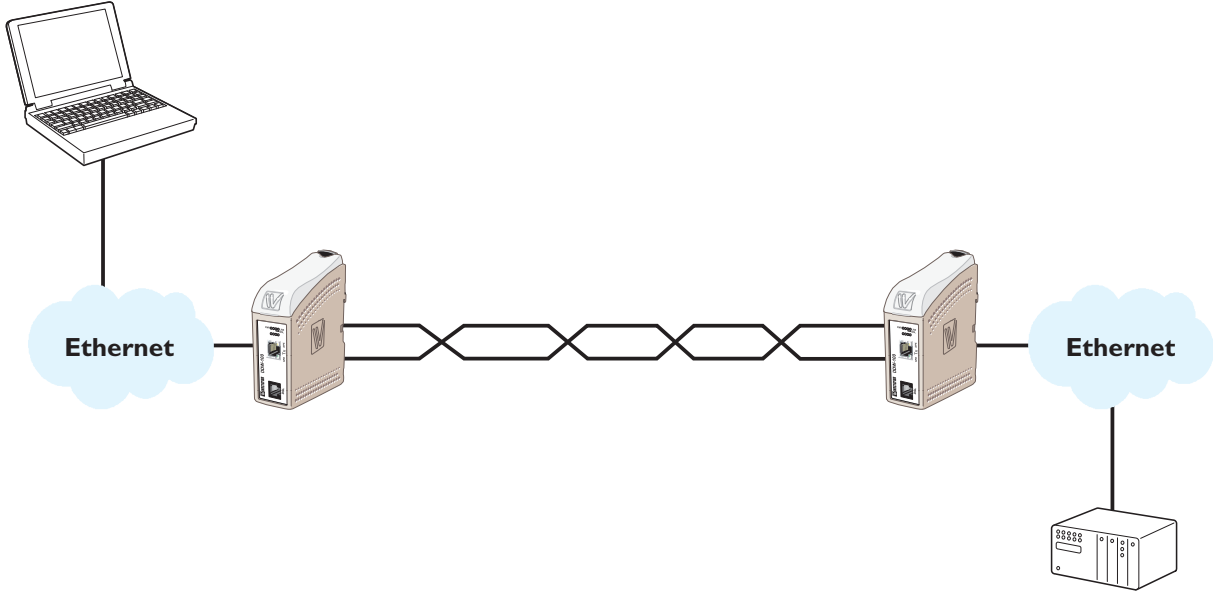


Application

Block diagram



DDW-100 as an transparent Ethernet extender





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