USER GUIDE

Wolverine
DDW-120

Industrial Ethernet SHDSL Extender

General information

Legal information

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Under no circumstances shall Westermo be responsible for any loss of data or income or any special, incidental, and consequential or indirect damages howsoever caused.

More information about Westermo can be found at the following Internet address: **www.westermo.com**

Software tools

Related software tools are available in the folder software tools under technical support on the Westermo website.

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. Branch circuit protection (fuse) is required for this unit with rating not exceeding 20 A.

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. To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

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.
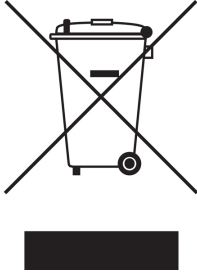
Warning:

To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

For more information see General safety, art. no.100-5001.

Maintenance

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

Product disposal

This symbol means that the product shall not be treated as unsorted municipal waste when disposing of it. It needs to be handed over to an applicable collection point for recycling electrical and electronic equipment.

By ensuring this product is disposed of correctly, you will help to reduce hazardous substances and prevent potential negative consequences to both environment and human health, which could be caused by inappropriate disposal.

Simplified EU declaration of conformity

Hereby, Westermo declares that the equipment is in compliance with EU directives. The full EU declaration of conformity and other detailed information are available at the respective product page at www.westermo.com. .

Agency approvals and standards compliance

Type	Approval / Compliance
	EN 61000-6-2, Immunity industrial environments
	EN 61000-6-4, Emission standard for industrial environments
	EN 50121-4, Railway signalling and telecommunications apparatus
Safety	UL/CSA/IEC/EN 60950-1, IT equipment
SHDSL	ITU-T G.991.2, G.SHDSL and G.SHDSL.bis standard
Environmental	NEMA TS 2-2003 version 02.06 Traffic Controller Assemblies with NTCIP Requirements

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.

Type tests and environmental conditions

Phenomena	Test	Description	Test levels
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 – 2 000 MHz 10 V/m 80% AM (1 kHz), 2 000 – 6 000 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
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
Radiated emission	EN 61000-6-4	Enclosure	EN 61000-6-4, up to 6 GHz
Conducted emission	CISPR 16-2-1	DC power ports	EN 61000-6-4
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)
Temperature	EN 60068-2-1 EN 60068-2-2	Operating	–40 to +70°C
		Storage & Transport	–40 to +70°C
Humidity	EN 60068-2-30	Operating	5 to 95% relative humidity
		Storage & Transport	5 to 95% relative humidity
Altitude		Operating	2 000 m / 70 kPa
Reliability prediction (MTBF)	MIL-HDBK- 217F	Operating	1 180 000 hours
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
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	IP21
Cooling			Convection
Mounting			Horizontal on 35 mm DIN-rail

Description

Functional description

The DDW-120 Ethernet Extender is the ideal solution for extending your Ethernet network over copper cables where in the past the only option would have been fibre.

At shorter range the transfer rate will be as fast as 15.3 Mbit/s in both directions. Depending on the quality of the cables distances up to 15 km are possible.

DDW-120 is transparent for multicast addressing, VLAN packets, VPN pass-through for IPSec and for protocols like MODBUS/tcp and Profinet. The Link Fault Forward (LFF) functionality in DDW-120 forwards information about the Ethernet link status, this is sent over the SHDSL link between two DDW-120 units. In many applications it is a requirement to disconnect the link on the other side of the SHDSL link if the primary Ethernet link goes down.

The units will auto negotiate the transmission speed but can also be forced to choose a slower (more reliable) or faster (less reliable) data rate.

Communication speed and distance depends on the cable characteristics, communication reach with different cables can be calculated with DDW-tool

DDW-120 have dual power input in case power supply redundancy is needed. In case only one power source is connected the unit will still operate according to specification.

DDW-120 can be used in point-to-point applications or as start and termination unit together with other Wolverine products in daisy-chain applications.

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.

Getting started

The DDW-120 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-120.

❶ Connect the SHDSL Line

1) Connect the twisted pair to DSL screw terminal 1 and 2 (polarity independent) situated at the base of the DDW-120.

❷ Connect the Ethernet Line

Connect Ethernet to the TX port on the front of the DDW-120.
The factory settings for the DDW-120 is plug and play mode where TX port is enabled for:

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

The DDW-120 will automatically sense the data rate of the connected unit and cable type.

❸ 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-120 is as CPE.

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

Depending on the quality of the line and the distance there is possibility to select autobaud function.
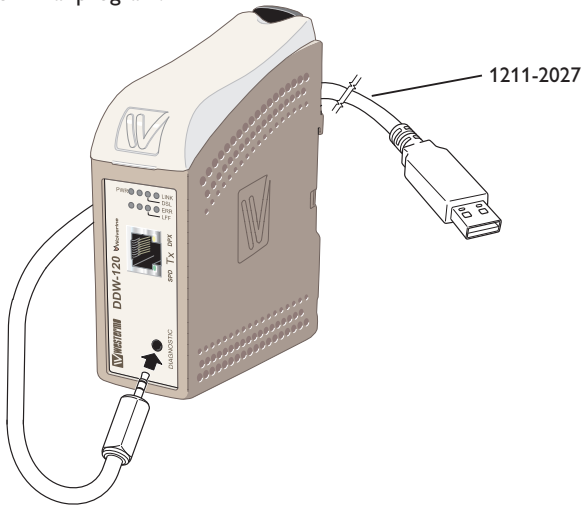
This is done via DIP switches in the unit configured as CO. Factory default is autobaud, reliable mode.

> **Note!**
> If the DSL link is not established, the speed might be set to high for the distance.

Diagnostic information

The DDW-120 can display diagnostic information on two way:

1) Using the Westermo diagnostic tool DDWtool.exe.

2) Using a terminal program.

1211-2027

Using DDW-tool

1) Connect the standard cable 1211-2027 to the diagnostic port, located under the lid of DDW-120.

2) Choose the corresponding Com port in the drop list of the tool. The tool will try to find the port used by the debug cable.

3) Click the button connect, if the correct com port is selected DDW-tool will be updated with actual status online information.

Information from diagnostic tool

- Software release
- Serial number
- DIP switch settings
- If the unit is configured as CO or CPE
- Ethernet link status
- Ethernet data rate
- Ethernet duplex
- System uptime
- DSL uptime
- DSL negotiations
- LFF status
- DSL link state
- DSL data rate
- DSL noise margin (information is sampled and continually displayed)

Using a terminal program

If a customer supervision system is used the DDW-120 can provide with diagnostic status.
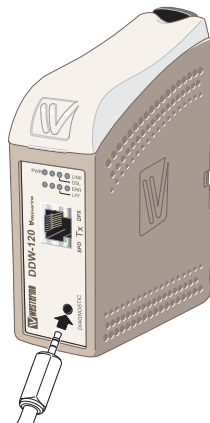
The DDW-120 support

Data rate: 115.2 kbit/s
Data bits: 8
Stop bits: 1
Parity: None
Flow control: None

The unit is responing to two commandon

1) DIAG
2) 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 (bit/s)
- DSL noise margin (dB)
- Ethetnet data rate
- Ethernet duplex

Information from RUNDIAG command

- DSL link state
- DSL Data rate (bit/s)
- DSL Noise margin (dB)

The DDW-120 is ready for commando then prompt "DDW" is transmitted to supervisor system.

The commando RUNDIAG will continuously send the information. Approx update with 1s base. Commando is aborted by sending "any key to abort".

Interface specifications

Power	
Rated voltage	12 to 48 VDC
Operating voltage	10 to 60 VDC
Rated current	240 mA @ 12 VDC 110 mA @ 24 VDC 60 mA @ 48 VDC
Rated frequency	DC
Inrush current, I^2t	0.23 A^2s
Startup current*	0.65 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

* If external power supply is used it must meet specified start up current

| Service port	
Electrical specification	TTL-level
Data rate	115.2 kbit/s
Data format	8 data bits, none parity, 1 stop bits, no flow control
Circuit type	SELV
Transmission range	15 m
Isolation to	All other
Galvanic connection to	None
Connection	2.5 mm jack, use Westermo cable 1211-2027

DSL	
Electrical specification	IEEE G.991.2 Annex B
Data rate	192 kbit/s to 15304 kbit/s
Protocol	EFM according to IEEE 802.3-2004
Transmission range	According to ITU-T G.991.2 depending on the line quality
Protection	Overcurrent / overvoltage protection circuit and varistor
Isolation to	All other
Connection	Detachable screw terminal
Connector size	0.2 – 2.5 mm^2 (AWG 24 - 12)
Shielded cable	Not required

| 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
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
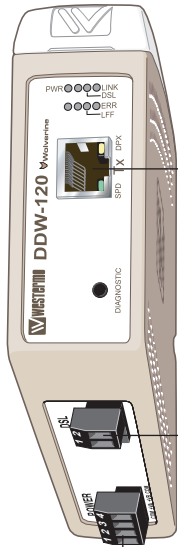
Ethernet TX connection (RJ-45 connector) 1 – 4**

Position	Direction*	Description
1	In/Out	TD+
2	In/Out	TD–
3	In/Out	RD+
4	–	Not Connected
5	–	Not Connected
6	In/Out	RD–
7	–	Not Connected
8	–	Not Connected

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

DSL screw connector 1 & 2

Position	Direction	Description
1	In/Out	2-wire Receive/ Transmit SHDSL
2	In/Out	2-wire Receive/ Transmit SHDSL

Power connection

Position	Direction*	Description
1	In	Common
2	In	+ Voltage A
3	In	+ Voltage B
4	In	Common

* Direction relative this unit

** 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.

LED indicators

LED	Status	Description
PWR (green)	OFF	No internal power
	ON	Internal power ok / boot ok
LFF (green)	OFF	LFF disabled
	ON	LFF enabled
ERR (red)	OFF	LFF not active
	ON	LFF active, link fault on this unit
	Flash	LFF active, link fault on opposite unit
DSL	OFF	No DSL link
	ON	DSL link established
	Flash	DSL link negotiating
LINK	OFF	No Ethernet link
	ON	Ethernet link established
	Flash	Ethernet traffic indication
SPD	OFF	Ethernet speed, 10 Mbit/s
	ON	Ethernet speed, 100 Mbit/s
DPX	OFF	Ethernet duplex, half
	ON	Ethernet duplex, full

PWR ○○○○ LINK
        └─ DSL
    ●●●● ERR
        └─ LFF

DPX

SPD
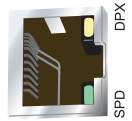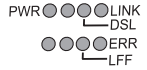
DIP-switch settings

⚠️ **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).

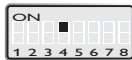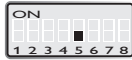**NOTE** DIP-switch alterations are only effective after a power on.

S1   S2
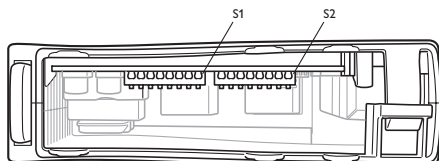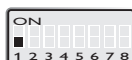
S1 DIP-switch

Standard speed

Turbo speed

Manual speed locked according to S2:4-8*

Autobaud, normal mode**
(Standard speed 192 kbit/s – 5.7 Mbit/s)
(Turbo speed 192 kbit/s – 15.3 Mbit/s)

Autobaud, high speed mode**
(Standard speed 192 kbit/s – 5.7 Mbit/s)
(Turbo speed 192 kbit/s – 15.3 Mbit/s)

Autobaud, reliable mode**
(Standard speed 192 kbit/s – 5.7 Mbit/s)
(Turbo speed 192 kbit/s – 15.3 Mbit/s)

CPE,
Customer Premises Equipment

CO,
Central Office

LFF disabled

LFF enabled

S1: 6, 7 and 8 not used

* Autobaud is recommended. When using manual locked speed user must make sure a correct noise margin is achieved. Westermo recommends at least 3 dB noise margin for reliable operation.

** Negotiation of speed may take up to 3 minutes to complete.

S2 DIP-switch

Ethernet auto-negotiation disabled

Ethernet auto-negotiation enabled

Ethernet speed 10 Mbit/s
(if auto-neg. disabled)

Ethernet speed 100 Mbit/s
(if auto-neg. disabled)

Ethernet half duplex
(if auto-neg. disabled)

Ethernet full duplex
(if auto-neg. disabled)

DSL-speed 192 kbit/s*
DSL-speed 6200 kbit/s**

DSL-speed 384 kbit/s*
DSL-speed 6712 kbit/s**

DSL-speed 512 kbit/s*
DSL-speed 7224 kbit/s**

DSL-speed 768 kbit/s*
DSL-speed 7736 kbit/s**

DSL-speed 1024 kbit/s*
DSL-speed 8248 kbit/s**

DSL-speed 1280 kbit/s*
DSL-speed 8760 kbit/s**

DSL-speed 2048 kbit/s*
DSL-speed 9272 kbit/s**

DSL-speed 2304 kbit/s*
DSL-speed 9784 kbit/s**

DSL-speed 2688 kbit/s*
DSL-speed 10296 kbit/s**

DSL-speed, 3072 kbit/s*
DSL-speed 10808 kbit/s**

DSL-speed, 3456 kbit/s*
DSL-speed 11320 kbit/s**

DSL-speed, 3840 kbit/s*
DSL-speed 11832 kbit/s**

DSL-speed, 4224 kbit/s*
DSL-speed 12344 kbit/s**

DSL-speed, 4608 kbit/s*
DSL-speed 13112 kbit/s**

DSL-speed, 4992 kbit/s*
DSL-speed 13880 kbit/s**

DSL-speed, 5376 kbit/s*
DSL-speed 14648 kbit/s**

DSL-speed 5696 kbit/s*
DSL-speed 15304 kbit/s**
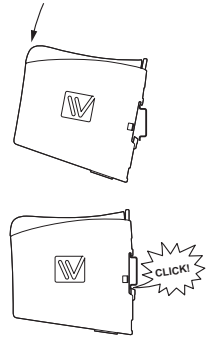
*   Standard speed S1:1 OFF
**   Turbo speed S1:1 ON

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.
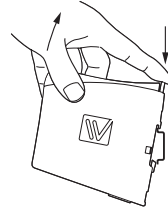
Snap on mounting, see figure.

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.

10 mm *
(0.4 inches)

25 mm

* Spacing (left/right) recommended for full operating temperature range

25 mm
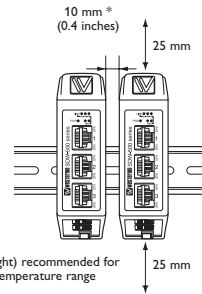
Removal

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

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