MICROSENS

Entry Line Industrial Gigabit Ethernet VDSL2 Extender

User Manual

MS657023X

Version 1.0
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1 Product Introduction

The Industrial Gigabit Ethernet VDSL2 Extender MS657023X allows the transmission of Gigabit Ethernet data over simple twisted-pair lines. Therefore Ethernet signals are converted into VDSL2 signals and vice versa. The extender is used per pair. One device has to be configured as master, the other one as remote unit. The data rate depends on the transmission distance and the quality of the cable.

The device is intended for DIN-rail mounting. For wall mounting the DIN-rail adapter at the rear side must be removed. A 12-24 VDC power interface with screw terminal is placed on the top side. All data connectors, the DIP switch and LED indicators are placed on the bottom side. RJ-45 connectors are used for the 10/100/100Base-T Gigabit Ethernet (GBE) port and the VDSL2 interface.

To simplify the cabling at the VDSL2 interface a RJ-45 adapter with screw terminal is available.

1.1 Features

- High speed Ethernet extension over UTP, CAT 5e/6/7 and two-wire lines
- Support ITU-T G.993.5 G.vectoring and G.INP
- Selectable 8 different profile settings via DIP switch (G.INP/Interleaved, target SNR 6/8/12/24 dB, symmetric/asymmetric modes)
- Compatible with third-party VDSL2 IP DSLAM when operates in in CPE(RT) mode
- Wide operating temperature range from -20° to 65° C
- Cost effective bridge function to connect two Ethernet LANs
- IEEE 802.1Q VLAN tag transparent
- Easy installation via simple plug-and-play

2 Interfaces

All data ports, LEDs and the DIP switch are placed on the bottom. Details are shown in the following figure:

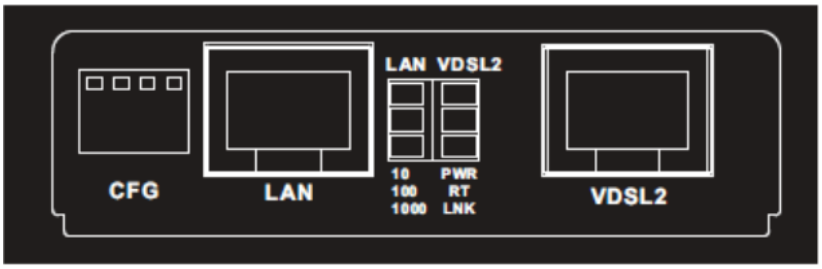


Figure 2-1: Bottom View / Data Interface

2.1 LAN Port

The device is equipped with a 10/100/1000Base-T Ethernet port with RJ-45 connector which supports auto-negotiation and auto-crossing.

2.2 VDSL Port

For the VDSL interface a RJ-45 connector is utilized too. But only pin 4 and 5 are used. Therefore a RJ-11 could be used instead. However the use of high quality RJ-45 connectors is recommended. For 2-wire lines Microsens offers a RJ-45 adapter with screw terminal. This adapter eliminates the need of crimped connector.

2.3 LED Indicators

An extended LED interface gives detailed information about the device status.
The color of the LEDs is always green.

PWR LED

A static green LED indicates that the device is powered.

VDSL LEDs

RT LED: The RT LED indicates the configured device mode. "ON" means that the device is configured as remote unit.

LNK LED: This LED informs about the VDSL link. The LED is on if a valid link is established. Slow blinking indicates that the device is in learning mode. Fast blinking indicates data transmission. The learning mode should be finished after around 90 seconds. Otherwise the connection should be checked.

LEDs for Ethernet (LAN) Port

For the Ethernet port 3 LEDs are used. They are indicating link speed and data transmission. Only the LED for the established link speed is on. Blinking indicates data transmission.

2.4 DIP Switch

The device is equipped with DIP switch selection which allows users to select the parameters in order to meet the needs of different applications.
DIP switch 1 allows you to configure the unit as master (OT) or remote (RT). Usually, the master unit is located at the central office site of service providers or headquarter of enterprise while the remote unit is located at home, remote sites or branch offices.
Please note the remote unit (RT) will always follow the setting of master unit (OT). When the unit operates in RT (CPE) mode, DIP switches 2, 3 and 4 have no functions. When the unit operates in OT mode, DIP switches supports 8 different profile settings for different applications and environments.

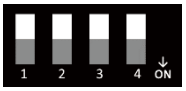
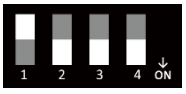
Role	DIP Switch				Symmetrical/ Asymmetrical	G.INP/ Interleaved Mode	Target SNR Margin (dB)	Max Data Rate DS/US (Mbps)
	1	2	3	4				
Master (OT)					Symmetrical	G.INP	8	160/160
					Asymmetrical	G.INP	8	220/110
					Symmetrical	Interleaved	6	160/160
					Asymmetrical	Interleaved	6	220/110
					Symmetrical	G.INP	12	150/150
					Asymmetrical	G.INP	12	220/100
	 *Special profile for poor environment				Symmetrical (Forcing 30a profile to link, and disable band 0 to 2.2MHz)	G.INP	24	20/20
					Asymmetrical (Standard profile Annex A 17a-eu32)	Interleaved	6	150/50
Remote (RT)	ON	N/A	N/A	N/A	Remote unit (RT) will always follow the setting of master unit (OT). When the unit operates in RT (CPE) mode, DIP switches 2, 3 and 4 have no functions.			

Table 2.4: DIP switch

The configured settings are specified as followed:

1. **Symmetrical profile:** Downstream and upstream rate are symmetrical.
2. **Asymmetrical profile:** Downstream and upstream rate are asymmetrical. Asymmetric profile can be used for services like video streaming or IP surveillance services which require high traffic flow in one direction.
3. **GINP:** Retransmission mode that provides enhanced protection against impulse noise or to increase the efficiency of providing impulse noise protection (INP).
4. **Interleaved:** Interleaved mode has a slower transfer rate and increase latency in exchange for error correction. A general line setting mode that provides common impulse noise protection.
5. **Max Data Rate Downstream/ Upstream:** This parameter specifies the maximum net data rate for the bearer channel as desired by the operator of the system. The data rate is coded in steps of 1000 bit/s (G.997.1).
6. **Target SNR Margin Downstream/ Upstream setting:** This is the noise margin the xTU-R/C receiver shall achieve, relative to the BER requirement for each of the downstream bearer channels, or better, to successfully complete initialization. (G.997.1)
7. **Special Profile Setting (DIP 2: Off, DIP 3 and 4: On)** is for application of near end distance or poor environment, Target SNR Margin is set to high value of 24dB and rate limit at 20Mbps to ensure channel stability. In addition, band 0 to 2.2MHz is disable to avoid possible effects by low frequency. Because this item is set to 30a profile, so its train up time is about 15 sec to 20 sec.
8. **Profile Setting (DIP 2, 3 and 4: On)** is standard profile Annex A 17a-eu32.

2.5 Power Supply

On the top side, the earth terminal (M4 screw) and the power interface with screw terminal plug are placed. Connect the earth terminal to the protective earthing conductor of the buildings installation.

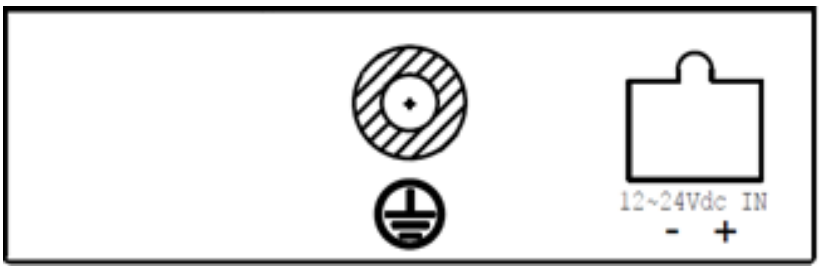


Figure 2.5: Top View - Power Supply

Insert the positive and negative wires into V+ and V- contact of the terminal block and tighten the wire-clamp screws to prevent the wires from being loosened.

The total power consumption is approximately 4.5 W.

Please consider the following wiring requirements:

- Wire range: 0.75 mm² to 2.5 mm²
- Solid wire (AWG): 12-18
- Stranded wire (AWG): 12-18
- Torque: 5 lb-In / 0.5 Nm / 0.56 Nm
- Wire Strip length: 7-8 mm
- Max wire length: 3m (9.84 ft)

WARNING: Any exceeded input voltage will not make this unit function and may damage this unit.

WARNING: Always ground the power source to maintain a clean power input.

3 Installation

3.1 Precautions and Safety Warnings

- Disconnect all power from devices before attempting installation!
- This device is intended for installation only in **restricted access locations** as defined where both these conditions apply:
  - Access is through the use of a lock or tool and key, or other means of security, and is controlled by the authority responsible for the location.
  - Access can only be gained by service persons or by users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken.
- All electric installations must be carried out in accordance with local and national regulations.
- Do not work on the system, connect or disconnect cables during periods of lightning activity.
- The equipment must be connected to earth.
- Shield of RJ-45 cables has to be connected to the same earth potential as the equipment.
- If the VDSL interface is used for the connection between two buildings, all necessary protective measures must be ensured externally.
- This equipment relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 1 A is used.

3.2 Mounting

3.2.1 DIN-rail mounting

The device is intended for DIN-rail mounting. The DIN-rail adapter is placed at the rear side.

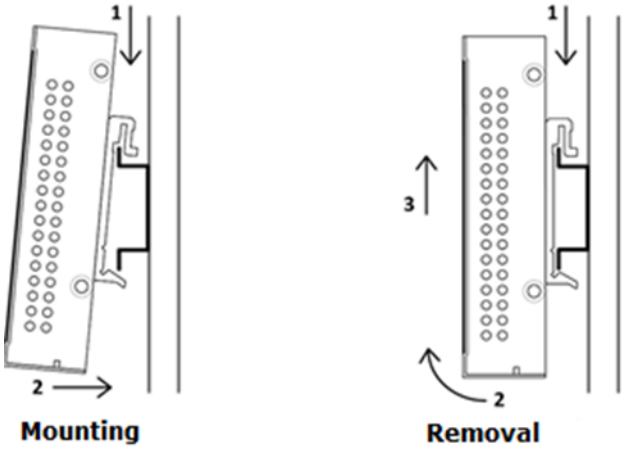


Figure 3.1.1: DIN-rail mounting

Mounting Steps

STEP 1: Hook the unit over the DIN-rail.
STEP 2: Push the bottom of the unit towards the DIN-rail until it snaps into place.

Removal Steps

STEP 1: Push the unit down to free the bottom of the DIN-rail.
STEP 2: Rotate the bottom of the unit away from the DIN-rail.
STEP 3: Unhook top of unit from DIN-rail.

3.2.2 Wall mounting

For wall-mounting the DIN-rail adapter must be re-moved. At the rear side two mounting holes are placed which can be used for horizontal or vertical wall-mounting.

3.3 Installation Procedure

STEP 1: Configure both GBE (Gigabit Ethernet) extenders by using the DIP switch. For point-to-point applications, one unit must be configured as master (OT) and the other one as slave (RT).

STEP 2: Connect the device to earth.

STEP 3: Connect the GBE extender configured as slave with a regular cat. 5 cable to the LAN (Local Area Net-work).

STEP 4: Power on the GBE extender by connecting the power terminal.

STEP 5: Connect both GBE extenders via the VDSL port.

STEP 6: Connect the LAN port of the second GBE extender (master) with a regular cat. 5 cable.

STEP 7: Power on the second GBE extender

3.4 VDSL Port – RJ-45 Adapter

For 2-wire lines Microsens offers a RJ-45 adapter with screw terminal. This adapter eliminates the need of crimped connectors. The adapter (P/N: MS180293) is not included in the scope of delivery and must be ordered separately.

Figure 3.3: Adding RJ-45 Adapter

4 Typical Applications - Performance

4.1 Scenario 1: Symmetrical Application

At first a typical symmetrical application (connection between two PCs) is presented. The data volume in both directions is of the same order of magnitude. Nevertheless both VDSL extenders must be configured in a different way. One device operates as master (OT), the other one as remote unit.

max. Upstream: 150 MBit/s
max. Downstream: 150 MBit/s

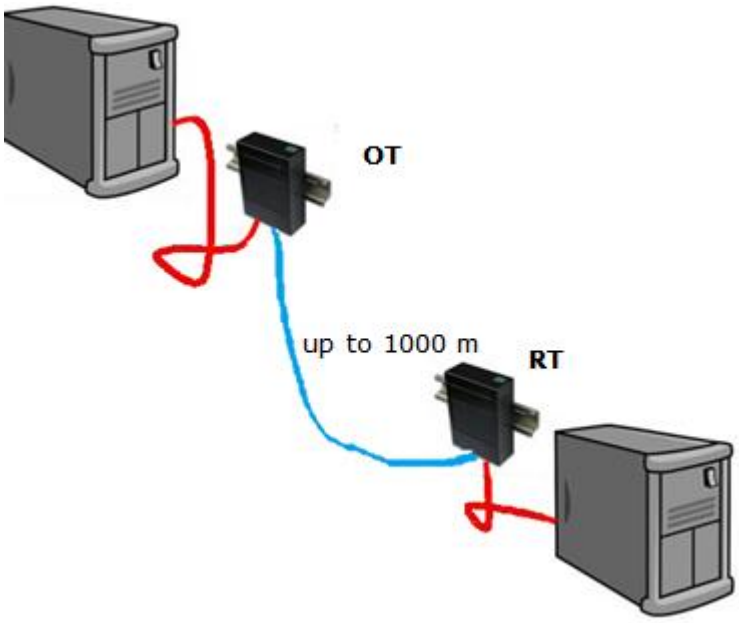


Figure 4-1: Symmetrical Application

UTP, 26AWG		
Profile Setting 1: Symmetric, SNR 8dB, G.INP		
Distance (Feet)	Upstream Line Rate* (Mbps)	Downstream Line Rate* (Mbps)
500	155	158
1,000	122	126
1,500	75	80
2,000	48	56
2,500	28	38
3,000	23	28

Table 4.1: Symmetrical Application - Typical Performance

4.2 Scenario 2: Asymmetrical Application

In IP camera applications the received and transmitted data rates are different. The GBE VDSL2 extender supports this demand and offers asymmetrical configuration modes. These modes allow an increased data rate in one direction.

max. Upstream: 100 MBit/s
max. Downstream: 200 MBit/s

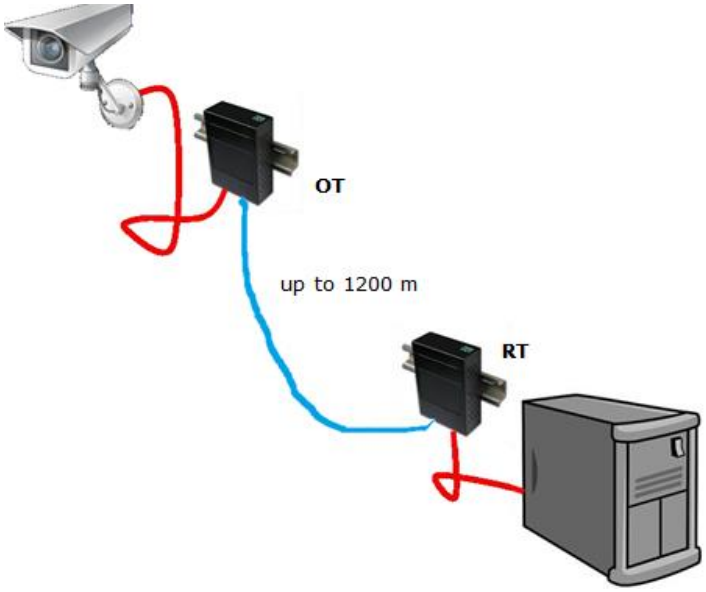


Figure 4-2: Asymmetrical Application

UTP, 26AWG		
Profile Setting 1: Asymmetric, SNR 8dB, G.INP		
Distance (Feet)	Upstream Line Rate* (Mbps)	Downstream Line Rate* (Mbps)
500	100	200
1,000	54	129
1,500	49	112
2,000	39	84
2,500	23	60
3,000	11	45
4,000	6	40

Table 4.2: Asymmetrical Application - Typical Performance

* The above performance data is for reference only, the actual data rate may vary depending on the quality of the cable and environmental factors.

5 Technical Specifications

Type	Entry Line Industrial Gigabit Ethernet VDSL2 Extender
LAN Interface	10/100/1000Base-T Gigabit Ethernet Auto-negotiation and auto-crossing IEEE 802.3, 802.3u and 802.3z RJ-45 connector
VDSL2 Interface	Complying with ITU-T G993.1-2-5/G.997.1/ G.998 DMT encoding, G.INP RJ-45 connector (Wire 4 and 5 are used only)
VDSL2 Cabling	Cat. 5e, 6, 7; ISTY (2-wire)
Power Supply	12…24 VDC via pluggable screw terminal
Power Consumption	max. 4.5 W
Power Wiring	Cross-sectional area: 0.75 mm² to 2.5 mm² Solid wire: AWG 12-20; Stranded wire: AWG 12-20 Terminal torque: 5 lb-In / 0.5 Nm / 0.56 Nm Wire strip length: 7- 8 mm Max wire length: 3m (9.84 ft)
LEDs	Power; Ethernet Link, speed and activity; VDSL mode (RT or OT); sync (link, idle or training)
Installation	DIN-rail (EN 50022) or wall-mounting
Dimensions (WxHxD)	96.2 x 22.8 x 73.4 mm
Temperature	-20…65° C (operating)
Rel. Humidity	0…95 % (non-condensing)
EMC	CE class A
Safety	EN 62368-1

6 Mechanic