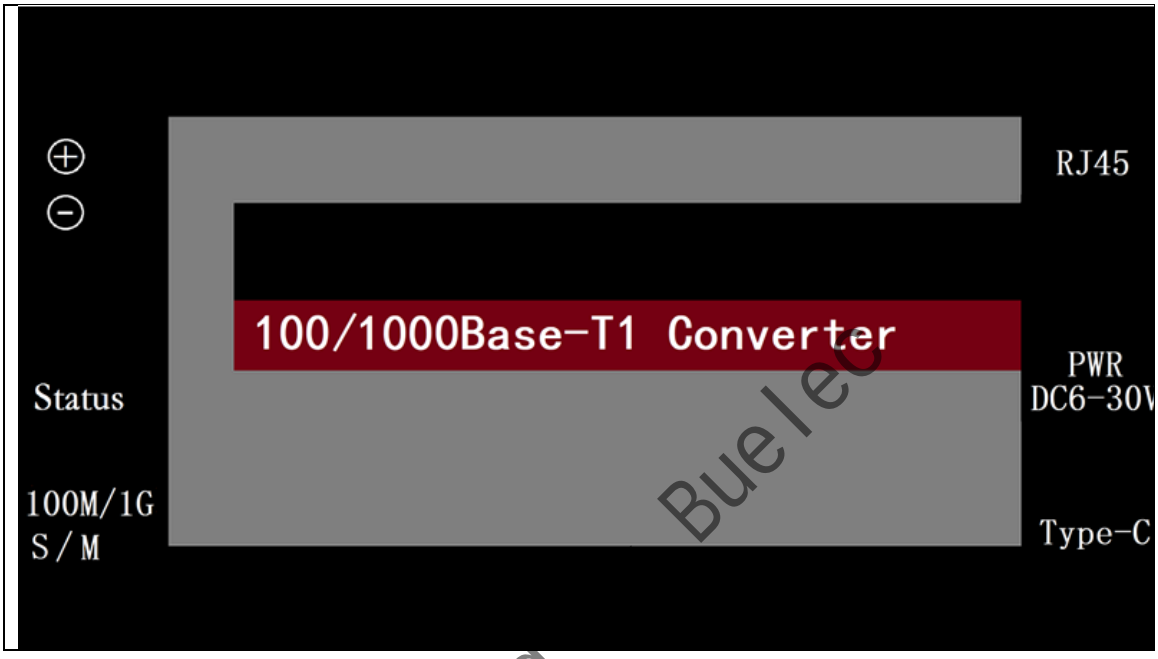
100/1000Base-T1-TX-HMDT User Manual



Data	Version	Description
2024/11/1	V10	
2025/06/12	V11	

1 Introduction

1.1 Low-Cost Product Series

Product Name	T1 Interface	Power Supply	T1 Phy	Tx Phy	Size LxHxW(mm)
100/1000Base-T1-TX-E	15EDG3.81mm-2P MATENET Adapter MATENET Adapter	Type C	Marvell 88Q2112	RTL8211FI	50 × 20× 83
100/1000Base-T1-TX-TE	MATENET Male, 2302461-9	Type C DC Jack	Marvell 88Q2112	RTL8211FI	50 × 20× 83
100/1000Base-T1-TX-HMDT	H-MDT Male, E6S20A-40MT5-Z	Type C DC Jack	Marvell 88Q2112	RTL8211FI	50 × 20× 83

1.2 Product Description

The BUELEC 100/1000Base-T1-TX- HMDT is a compact, high-performance media converter designed to bridge automotive single-pair Ethernet (100/1000BASE-T1) networks with standard twisted-pair Gigabit Ethernet (100/1000BASE-TX) infrastructure.

Utilizing the Marvell 88Q2112 PHY for T1 interface and Realtek RTL8211FI PHY for TX interface, this converter ensures seamless interoperability between modern automotive Ethernet systems and traditional IT networking environments.

It is ideal for in-vehicle diagnostics (DoIP), smart cockpit domain controller flashing/upgrades, ADAS camera/radar development and debugging, industrial automation, and fleet management applications.

T1 Port update to (H-MDT Male,E6S20A-40MT5-Z), Power update to support Both Type C and DC Jack(6-30V)

1.3 Product Features

- **Protocol Compliance:** Fully supports IEEE 802.3bw (1000BASE-T1) for automotive single-pair Ethernet and IEEE 802.3ab (1000BASE-T) for traditional Gigabit Ethernet, enabling reliable data transmission in mixed-network setups.
- **High-Speed Performance:** Delivers up to 1 Gbps full-duplex transmission rates over both T1 (single twisted pair) and TX (RJ45) interfaces, with auto-negotiation for 100/1000 Mbps compatibility and low-latency forwarding.

- **Robust Protection:** Integrated over-voltage, over-current, and ESD (electrostatic discharge) protection safeguards against electrical surges, meeting automotive-grade reliability standards.
- **Industrial-Grade Durability:** Engineered to industrial standards with a wide operating temperature range (-40°C to +85°C), humidity tolerance (0-95% RH non-condensing), vibration resistance, and EMI shielding, making it suitable for harsh environments like vehicles, factories, and outdoor installations.
- **Advanced Networking Support:** Includes IEEE 802.1Q VLAN tagging for traffic segmentation, QoS prioritization, and enhanced security in multi-device ecosystems.
- **Plug-and-Play Design:** Compact form factor (50mm x 20mm x 83mm) with standard T1 **(H-MDT Male,E6S20A-40MT5-Z)** on one side and RJ45 port on the other; Selected powered via **USB Type-C (DC 5V ± 0.5V, ≤355mA) Or DC-Jack (6-30V)** for flexible deployment.

2 Hardware

2.1 Interfaces and Indicators (Detailed Description)

	Interface	Description
(1)	**Power**	(DC 5V).
(2)	**Power**	DC Jack (6-30V)
(3)	**RJ45**	100/1000BASE-T Ethernet port. Connects to PCs, switches, or other network devices using **4 standard** twisted-pair cable (CAT6 recommended).
(4)	**H-MDT T1 +**	100/1000Base-T1 Port TRX_P +
(5)	**H-MDT T1 -**	100/1000Base-T1 Port TRX_N -
(6)	**Status LED**	Dual-function system and link/activity indicator: • **Solid Green**: System self-test passed and device is operating normally.
(7)	**Status LED**	• **Solid (T1 Link)**: 100/1000BASE-T1 link established. • **Blinking**: Data transmission/reception in progress on T1 interface.
(8)	**100M/1000M Switch**	UP: 1000M Down:100M
(8)	**Slave/Master Switch**	UP:Master Down:Slave

2.2 Typical Applications

PC/ARM ↔ RJ45 ↔ [1000BASE-T1-TX-E] ↔ Automotive Device / Network

Input Protocol	Output Protocol	Applications
100BASE-Tx	100BASE-T1	Vehicle diagnostics (DoIP), smart cockpit flashing, ADAS sensor debugging
1000BASE-Tx	1000BASE-T1	High-speed camera/radar data, ECU programming, R&D testing

The 1000BASE-T1-TX-E enables seamless conversion between industrial Ethernet and automotive single-pair Ethernet networks.

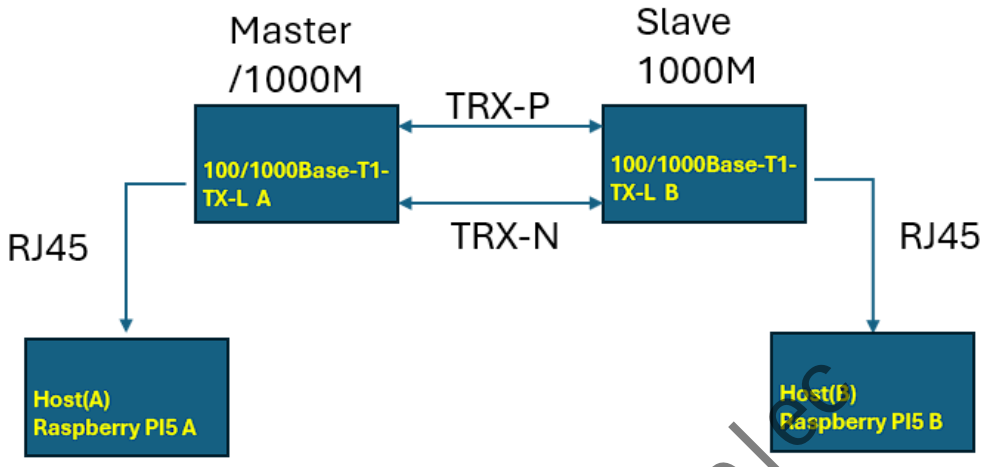
2.3 Product Specifications

Parameter	Specification
Input Voltage	5V ± 0.5V
Operating Current	≤ 355mA
Operating Temperature	-40°C to +85°C
Operating Humidity	0~95% RH (non-condensing)
Dimensions LxHxW	50mm × 20mm × 83mm

2.4 Automotive Ethernet Transmission Distance

T1 Speed Mode	Cable Type	Max Distance
100BASE-T1	Unshielded Twisted Pair (UTP)	20 m
100BASE-T1	Shielded Twisted Pair (STP)	50 m
1000BASE-T1	Unshielded Twisted Pair (UTP)	15 m
1000BASE-T1	Shielded Twisted Pair (STP)	40 m

3 Connection Diagram



Note:
There must be one device set as Master, Another One set as Slave.
Both of the devices should set to the same Speed.

4 User Guide for Linux Os

We use 2 Raspberry PI5, one as client(Master) and one as server(Slave)

Hardware connection as chapter 3.

4.1 Install iperf3

Open terminal window of both raspberry pi5.

```
sudo apt-get install iperf3
```

Note: Do not choose iperf3 as a daemon automatically.
Or it will fail when *you run next boot.*

Download python scripts from our github.

```
sudo git clone https://github.com/buelec-tech/100-1000Base-T1-TX-L
```

4.2 Turn off WI-FI

4.3 Set IP And Ping

Host A As Client (190.19.1.9**), Host B As Server (**190.19.1.90**)**

Host A (Raspberry PI5 A), Client	Host B (Raspberry PI5 B), Server
sudo ifconfig eth0 down sudo ifconfig eth0 190.19.1.9 sudo ifconfig eth0 up	sudo ifconfig eth0 down sudo ifconfig eth0 190.19.1.90 sudo ifconfig eth0 up

Open **Host A** Terminal window, run below command check if network connected.

```
sudo ping eth0 -i 190.19.1.90
```

- If work, then go ahead with chapter 4.4
- If it does not work, re-check connection follow chapter3

4.4 TCP Test

Open Host B (190.19.1.90) Terminal, Set as server

```
sudo iperf3 -s
```

Note: if your system does not install iperf3, follow chapter 4.1

Open Host A (190.19.1.9) Terminal, send data.

```
sudo iperf3 -c 190.19.1.90 -n 8000M -i 30
```

```
Connecting to host 190.19.1.90, port 5201
[  5] local 190.19.1.9 port 48790 connected to 190.19.1.90 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-30.00  sec  3.27 GBytes   937 Mbits/sec    0    518 KBytes
[  5]  30.00-60.00  sec  3.27 GBytes   936 Mbits/sec    0    518 KBytes
[  5]  60.00-71.63  sec  1.27 GBytes   937 Mbits/sec    0    518 KBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-71.63  sec  7.81 GBytes   937 Mbits/sec    0             sender
[  5]   0.00-71.64  sec  7.81 GBytes   937 Mbits/sec                  receiver
```

4.4 UDP Test

Open Host B (190.19.1.90) Terminal, Set as server

```
sudo iperf3 -s
```

Open Host A (190.19.1.9) Terminal , Set as client and send data.

```
sudo iperf3 -c 190.19.1.90 -u -b 8000M -l 8k -n 1000M
```

```
Connecting to host 190.19.1.90, port 5201
[  5] local 190.19.1.9 port 38178 connected to 190.19.1.90 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-30.00  sec  3.27 GBytes   937 Mbits/sec    0    544 KBytes
[  5]  30.00-60.00  sec  3.27 GBytes   937 Mbits/sec    0   1.37 MBytes
[  5]  60.00-71.63  sec  1.27 GBytes   936 Mbits/sec    0   1.37 MBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-71.63  sec  7.81 GBytes   937 Mbits/sec    0             sender
[  5]   0.00-71.63  sec  7.81 GBytes   936 Mbits/sec                  receiver

iperf Done.
```

5 User Guide for Windows

We use 2 windows computers, one as client(Master) and one as server(Slave)

Hardware connection as chapter 3.

5.1 Install iperf3

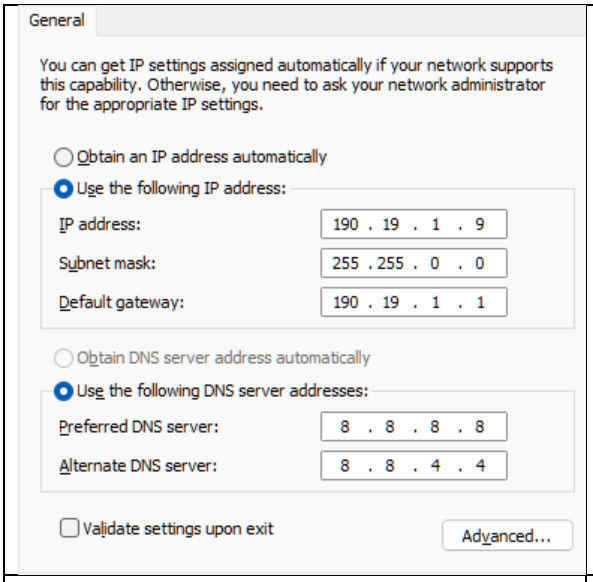
Download from our github link:

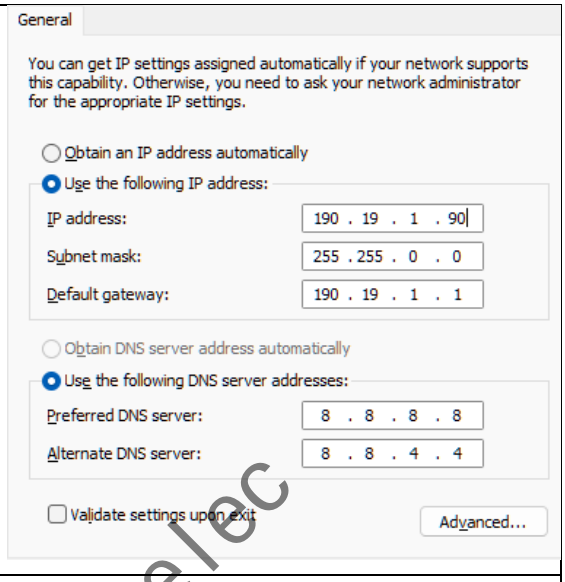
https://github.com/buelec-tech/100-1000Base-T1-TX-L unzip iperf3.6_64bit.zip

5.2 Turn off firewalls

5.3 Set IP And Ping

Computer A IP,Client	Computer B IP ,Server





190.19.1.9 255.255.0.0 190.19.1.1 8.8.8.8 8.8.4.4	190.19.1.90 255.255.0.0 190.19.1.1 8.8.8.8 8.8.4.4

Open Terminal (Admin) on Computer A, Switch to the iperf3 directory

ping -i 190.19.1.9 190.19.1.90 # ping from 190.19.1.9(client)

```
PS F:\iperf3.6_64bit> ping -i 190.19.1.9  190.19.1.90

Pinging 190.19.1.90 with 32 bytes of data:
Reply from 190.19.1.90: bytes=32 time=2ms TTL=128
Reply from 190.19.1.90: bytes=32 time=2ms TTL=128
Reply from 190.19.1.90: bytes=32 time=2ms TTL=128
Reply from 190.19.1.90: bytes=32 time=3ms TTL=128

Ping statistics for 190.19.1.90:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 3ms, Average = 2ms
```

5.4 100M Test

Open Host B (190.19.1.90) Terminal, Set as server

.\iperf3.exe -B 190.19.1.90 -s	**# Host B listen**

Open Host A (190.19.1.9) Terminal, Set as client and send data.

.\iperf3.exe -c 190.19.1.90 -B 190.19.1.9 -w 100M -t 10	**# Host A send data**

```
PS F:\iperf3.6_64bit> .\iperf3.exe -c 190.19.1.90 -B 190.19.1.9 -w 100M -t 10
warning: Ignoring nonsense TCP MSS 0
Connecting to host 190.19.1.90, port 5201
[  5] local 190.19.1.9 port 9557 connected to 190.19.1.90 port 5201
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec   111 MBytes   933 Mbits/sec
[  5]   1.00-2.00   sec  11.2 MBytes  94.4 Mbits/sec
[  5]   2.00-3.00   sec  11.4 MBytes  95.3 Mbits/sec
[  5]   3.00-4.00   sec  11.4 MBytes  95.5 Mbits/sec
[  5]   4.00-5.00   sec  11.2 MBytes  94.4 Mbits/sec
[  5]   5.00-6.00   sec  11.4 MBytes  95.3 Mbits/sec
[  5]   6.00-7.00   sec  11.2 MBytes  94.4 Mbits/sec
[  5]   7.00-8.00   sec  11.4 MBytes  95.5 Mbits/sec
[  5]   8.00-9.00   sec  11.2 MBytes  94.4 Mbits/sec
[  5]   9.00-10.00  sec  11.4 MBytes  95.4 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-10.00  sec   213 MBytes   179 Mbits/sec                  sender
[  5]   0.00-10.13  sec   114 MBytes  94.6 Mbits/sec                  receiver
```

5.4 1000M Test

Open Host B (190.19.1.90) Terminal, Set as server

.\iperf3.exe -B 190.19.1.90 -s	**# Host B listen**

Open Host A (190.19.1.9) Terminal, Set as client and send data.

.\iperf3.exe -c 190.19.1.90 -B 190.19.1.9 -w 100M -t 1 **# -c <host address> ,-B <Client address >**

6 Packing List

No.	Item	Quantity	Unit
1	1000BASE-T1-TX-HMDT Converter	1	pcs
2	Type-C USB Power Cable	1	pcs
3	CAT6 Ethernet Cable	1	pcs

6.1 Accessories Recommend

https://www.buelec-tech.com/product/1000base-t1-cable-h-mdt/