100/1000Base-T1-TX-L

Version	Description	Data
V10	First Released	2024/10/1
V11	Correct description	2025/03/10
V12	Correct Hardware Pinout	2025/04/15

1 Description

1.1 Overview

The BUELEC **100/1000Base-T1-TX-L** is a compact bidirectional physical layer converter designed for seamless interoperability between standard RJ45 Ethernet (100/1000Base-TX) and dual-wire automotive Ethernet (100/1000Base-T1). Compliant with the 100/1000BASE-T1 protocol, it ensures full compatibility with automotive Ethernet PHYs from leading vendors such as NXP, TI, Broadcom, Marvell, and Realtek. The device delivers zero packet loss, rock-solid connection stability, and ultra-low latency, making it ideal for diagnostic, testing, and integration applications in automotive networks.

Built on proven PHY solutions—Marvell 88Q2112 for 1 Gbps—the converter offers excellent performance and superior electromagnetic interference (EMI) resistance. It supports dual power inputs via 5.5 mm DC barrel jack (5–16 V for 100 Mbps; 5–36 V for 1 Gbps) and USB Type-C, with a rugged, sandblasted aluminum alloy enclosure measuring just 103 × 71 × 26 mm. Integrated status LEDs provide real-time feedback on link activity and data rates, while an onboard MCU enables automatic master/slave mode switching with reset and supports future firmware upgrades or secondary development.

Chipset Architecture

- **1 Gbps Mode**: Marvell 88Q2112 (T1 side) + Realtek RTL8211FI (TX side)
- Mature, field-proven silicon ensures reliable full-duplex operation at theoretical line-rate speeds in both directions.
- Onboard MCU facilitates secondary development and over-the-air firmware updates.

Power Supply

- Dual-input design: 5.5 × 2.1 mm DC jack + USB Type-C PD
- Wide input voltage tolerance with low-ripple, stable regulation.
- Enables flexible deployment in bench, in-vehicle, or portable diagnostic scenarios.

Mechanical Design

- Ultra-compact form factor: 103 mm (L) × 71 mm (W) × 26 mm (H)

- CNC-machined sandblasted aluminum alloy housing for durability and heat dissipation.

Connectivity Accessories

- Includes 1× TE Mate-NET port adapter board
- Includes 1× HMTD port adapter board
- Provides plug-and-play compatibility with common automotive Ethernet header connectors for rapid prototyping and field deployment.

Automotive-Grade Performance Chip

- AEC-Q100 qualified chip Marvell 88Q2112 for reliable operation in automotive environments.
- Integrated OPEN Alliance TC10-compliant EMI filter helps suppress common-mode noise and supports signal integrity over unshielded twisted-pair cabling.

Human-Machine Interface

- **TX Side (RJ45)**: Pair of link/activity LEDs + speed indicator (100/1000 Mbps).
- **T1 Side (Twinax)**: Pair of link/activity LEDs + dedicated master/slave status LED; 1 Gbps variant includes Signal Quality Indicator (SQI) display.
- Intuitive visual feedback for rapid troubleshooting of connection health, negotiation mode, and signal integrity.

1.2 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, ensuring reliable data transmission in mixed-network setups.
- **High-Speed Performance**: Delivers 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 and harsh conditions, exceeding standard automotive requirements.

- **Industrial-Grade Durability**: Engineered to industrial standards with wide operating temperature range (-40°C to +85°C), vibration resistance, and EMI shielding, making it suitable for demanding 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 with standard T1 connector (e.g., Rosenberger HMTD or equivalent) on one side and RJ45 port on the other; powered via PoDL (Power over Data Line) or external DC input for flexible deployment.

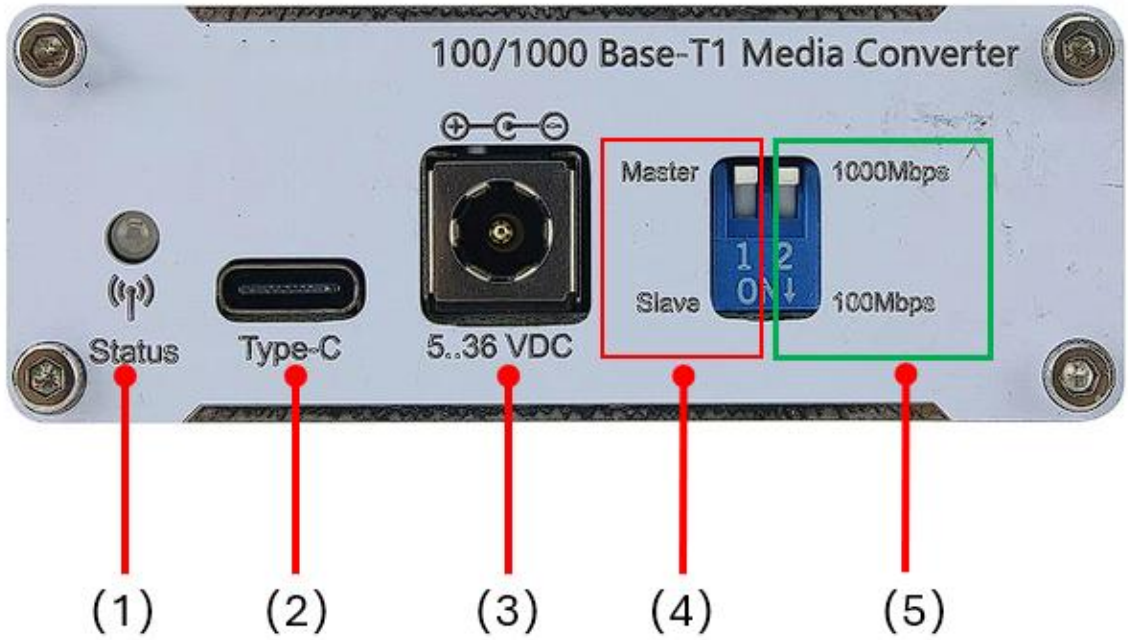
2 Hardware Manual

2.1 Specification

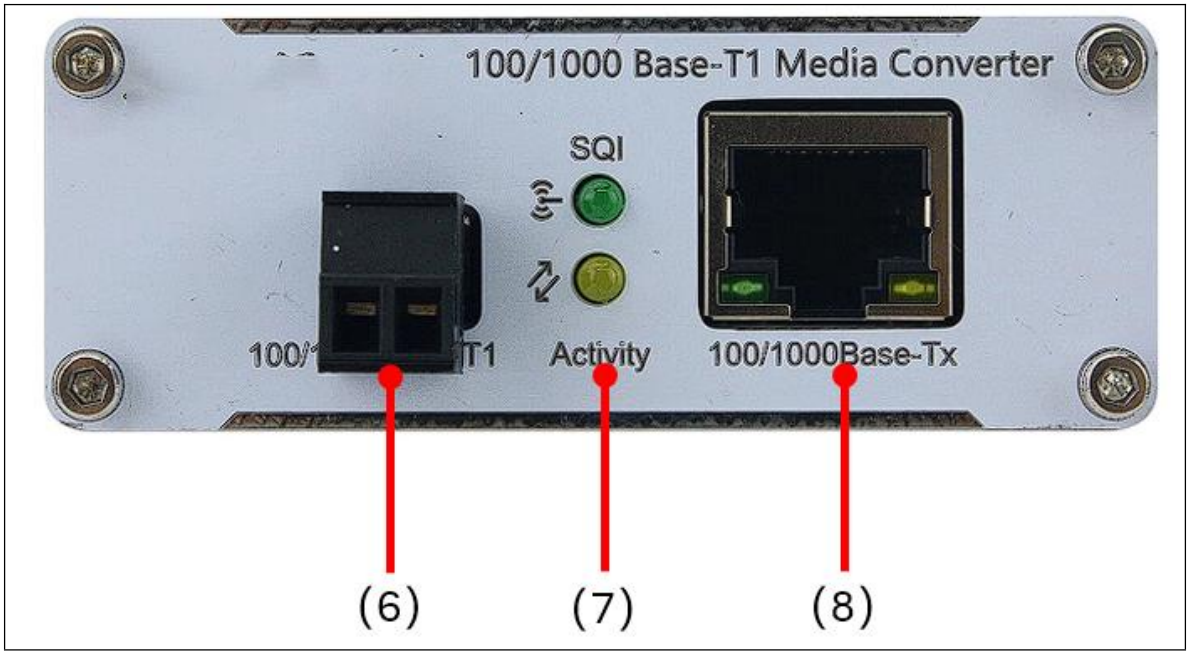
Items	Parameter	Description
Power Input	USB type-C	5V/2A
	DC Jack 5.5*2.1	5-36V (Comes with)
Product Size	LxWxH	103mm x 71mm x 26mm (4.1" x 2.8" x 1")
Product Weight	Kg	0.2
Product Case	Material	Aluminum alloy and sandblasted
Working Temperature	Degree	-45-85 Industrial
T1 Phy Chip	Marvell	88Q2112
Tx Phy Chip	REALTEK	RTL8211FI
Support OS	Windows,Linux,MacOs,Drivers free plug and play	
Support Device	PC,Notebook,ARM Board,Raspberry Pi,Jetson Nano,etc..	
UserGuide	Linux,Windows	

2.2 Hardware Interface

s

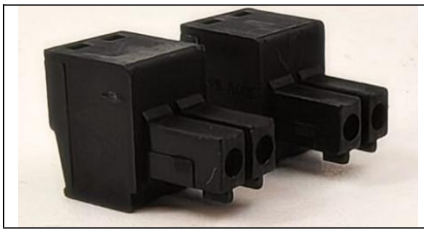


Item	Parameters	Description
1	Status Indication	T1 connection status indicator. • Light indicates a successful connection • Otherwise a failed Connection
2	Type-C Port Power Supply	5V, compatible with phone chargers • When Power from Type-C, no need to power from DC-Jack
3	DC Jack Power Supply	5-36V, 5.5*2.1mm • When Power from DC-Jack, no need to power from type-c port
4	Master/Slave Selection	Master/Slave working mode selection • One has to be set as Master, the other has to be set as Slave when connection
5	100Mbps/1000Mbps Selection	Working mode Selection • 1000Mbps • 100Mbps

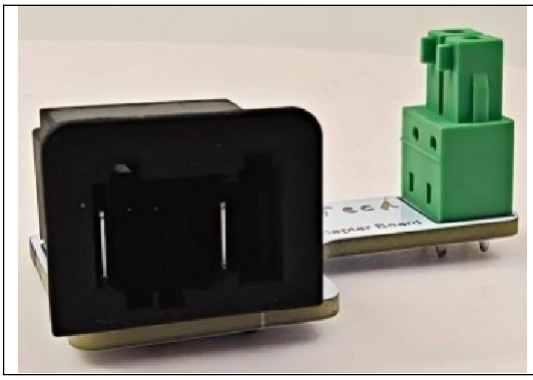


Item	Parameters	Description
6	15EDGK-3.81mm left	100/1000Base-T1 Port **TRX_P +** • Adaptive Support
	15EDGK-3.81mm Right	100/1000Base-T1 Port **TRX_N -** • Adaptive Support
7	SQI	Signal Quality Indicator • A constantly light signal indicates full signal strength. • The duty cycle is used to indicate communication quality.
	Activity	Rx/Tx Indicator • Led flashing when data transmission
8	100/1000Base-Tx	1000Mbps Tx, RJ45 Port

2.3 15EDGK-3.81mm

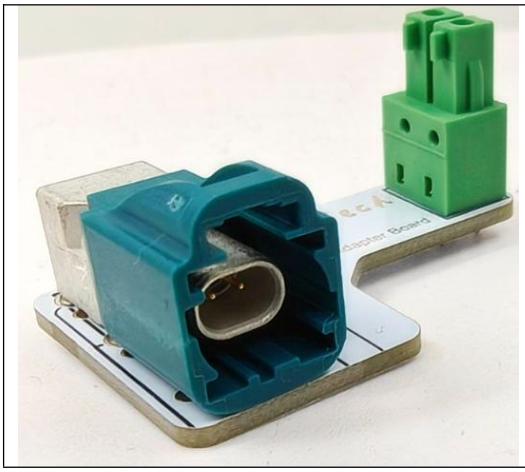
	Part Number 15EDGK-3.81mm-2P

2.4 TE MATE net Adapter Board

	TE Part Number: 2304372-1

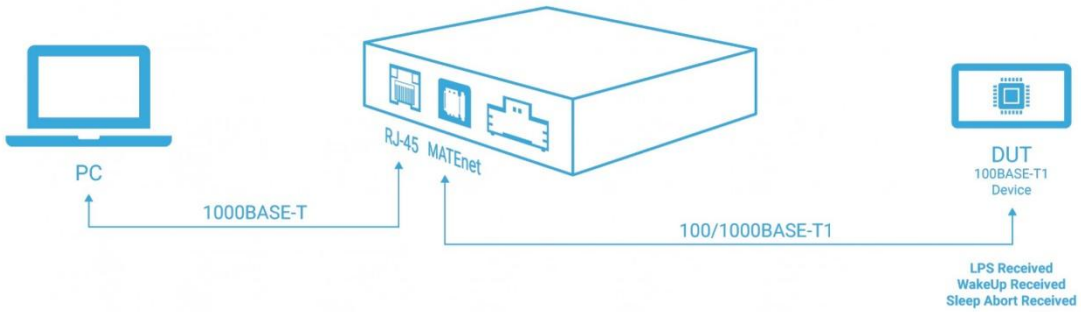
Pin	Description
1	TRX_P
2	TRX_N

2.5 HMTD Adapter Board

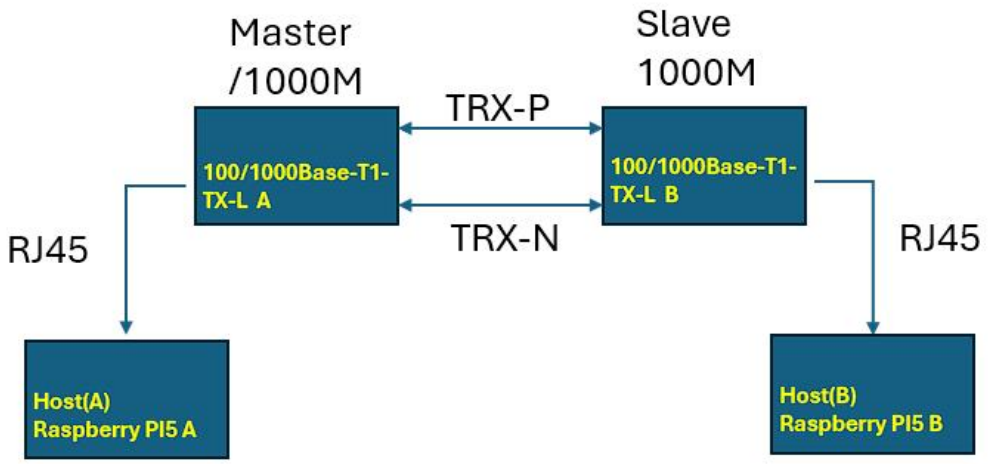
	Part Number: E6S20A-40MT5-Z

2.6 Usage Connection Figure

Usage Connection Figure



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
```

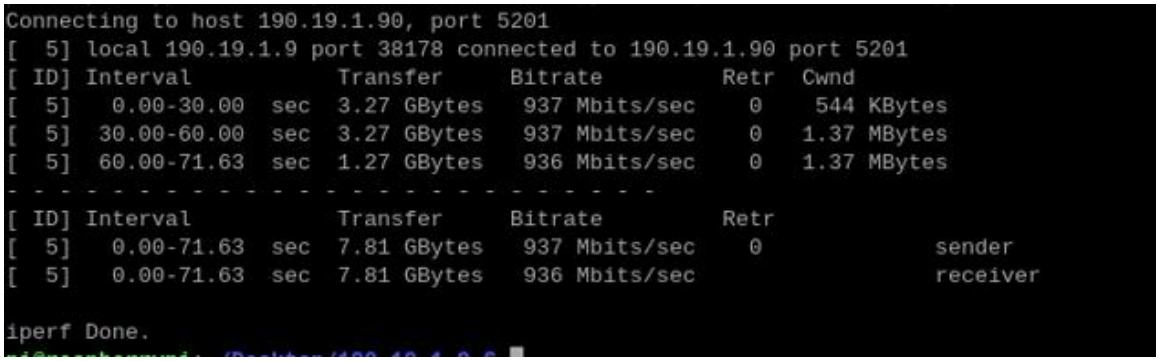
4.4 UDP Test

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
```



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

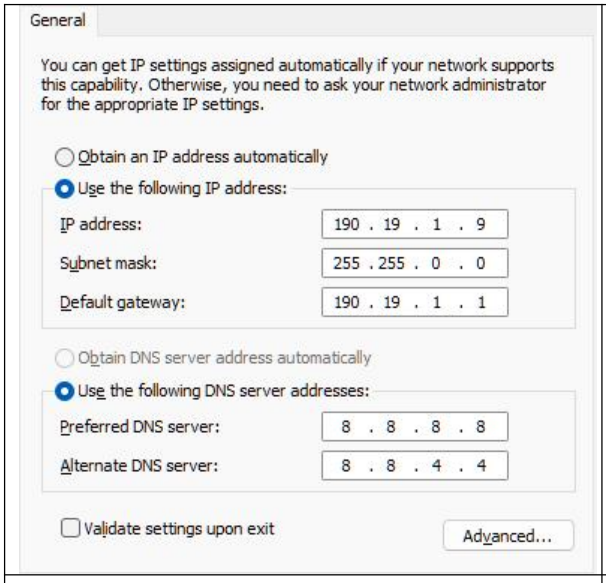
Download from our github link:

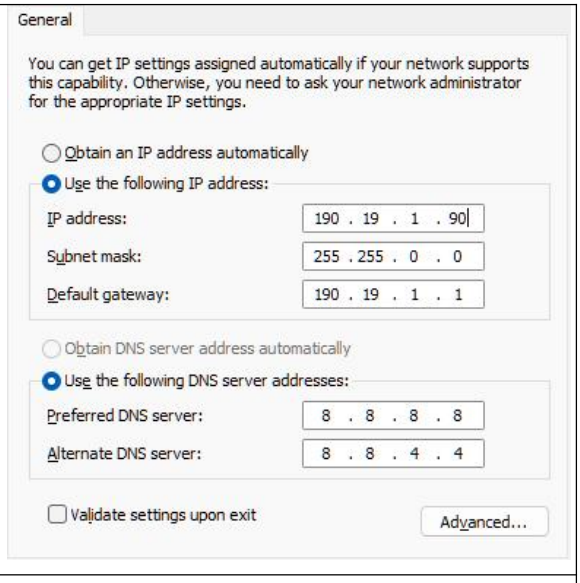
https://github.com/buelec-tech/100-1000Base-T1-TX-L unzip iperf3.6_64bit.zip

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 >
```

```
PS F:\iperf3.6_64bit> .\iperf3.exe -c 190.19.1.90 -B 190.19.1.9 -w 100M -t 1
warning: Ignoring nonsense TCP MSS 0
Connecting to host 190.19.1.90, port 5201
[  5] local 190.19.1.9 port 3499 connected to 190.19.1.90 port 5201
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec   115 MBytes   962 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec   115 MBytes   962 Mbits/sec                  sender
[  5]   0.00-1.03   sec  14.8 MBytes   120 Mbits/sec                  receiver
```

6 Packing List

- 1 x Automotive Ethernet converter
- 1 x 12V 1A power adapter
- 1 x 1.5m/4.9ft RJ45 network cable
- 1 x 15EDG 3.81mm terminal block
- 1 x TE MATE net Adapter Board
- 1 x HMTD Adapter Board