

BUELEC

100/1000Base-T1-TX-L
BUELEC 100/1000 Base T1 to RJ45 TX
Media Converter

100/1000Base-T1-TX-L



| Version | Description | Data |
|---------|---------------------|------------|
| V10 | First Released | 2024/10/1 |
| V11 | Correct description | 2025/03/10 |

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 1x TE Mate-NET port adapter board
- Includes 1x HMD-T 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.

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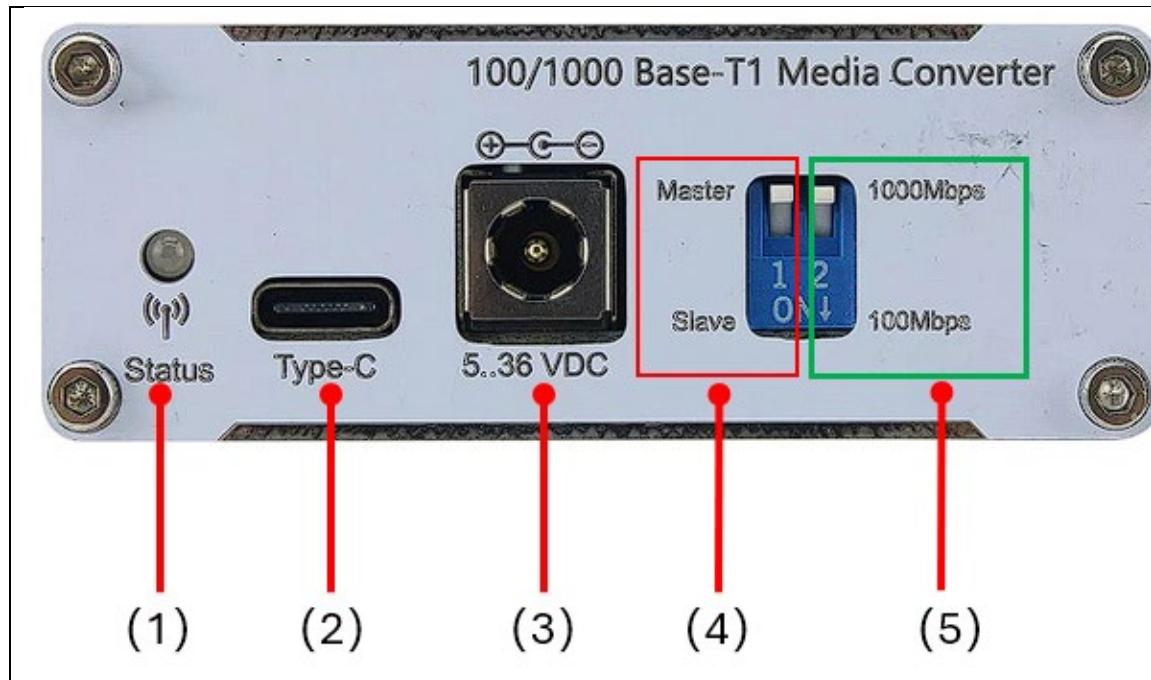
- **Industrial-Grade Durability:** Engineered to industrial standards with wide operating temperature range (-40°C to +85°C), vibration resistance, and EMI shielding, making it suitable for demanding environments like vehicles, factories, and outdoor installations.
- **Advanced Networking Support:** 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 H-MTD 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

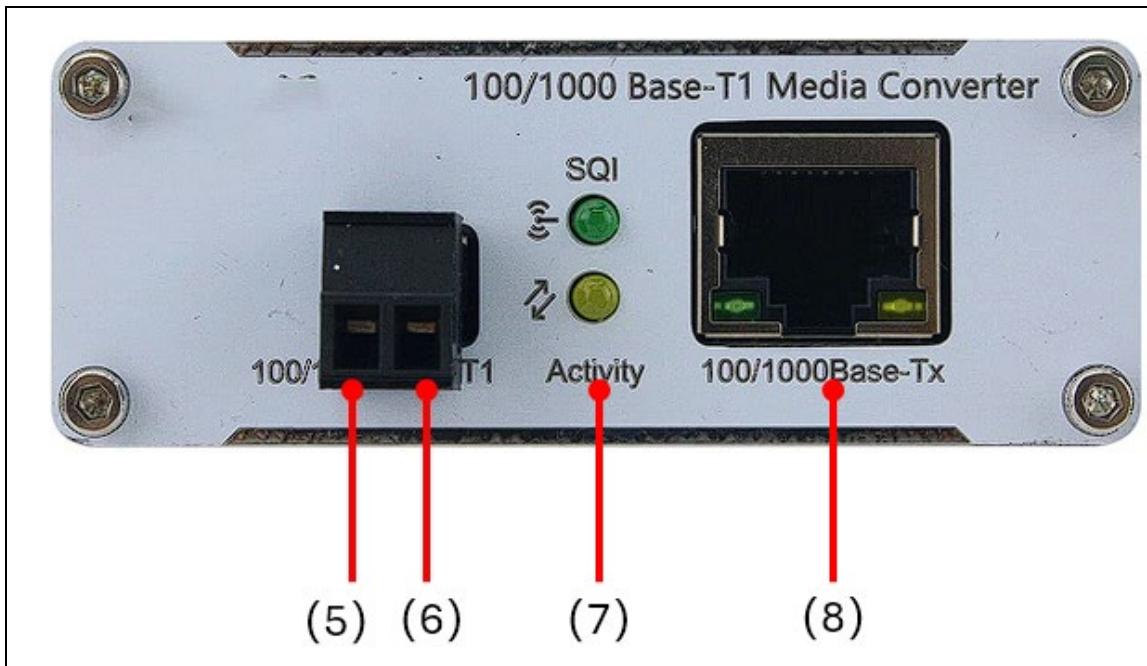
2.1 Specification

| 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



| Item | Parameters | Description |
|------|----------------------------|---|
| 1 | Status Indication | T1 connection status indicator. <ul style="list-style-type: none">• Light indicates a successful connection• Otherwise a failed Connection |
| 2 | Type-C Port Power Supply | 5V, compatible with phone chargers <ul style="list-style-type: none">• When Power from Type-C, no need to power from DC-Jack |
| 3 | DC Jack Power Supply | 5-36V, 5.5*2.1mm <ul style="list-style-type: none">• When Power from DC-Jack, no need to power from type-c port |
| 4 | Master/Slave Selection | Master/Slave working mode selection <ul style="list-style-type: none">• One has to be set as Master, the other has to be set as Slave when connection |
| 5 | 100Mbps/1000Mbps Selection | Working mode Selection <ul style="list-style-type: none">• 1000Mbps• 100Mbps |

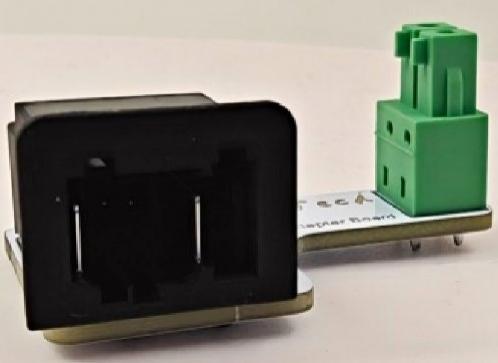


| Item | Parameters | Description |
|------|---------------------|--|
| 5 | 15EDGK-3.81mm left | 100/1000Base-T1 Port TRX_P + <ul style="list-style-type: none">• Adaptive Support |
| 6 | 15EDGK-3.81mm Right | 100/1000Base-T1 Port TRX_N - <ul style="list-style-type: none">• Adaptive Support |
| 7 | SQI | Signal Quality Indicator <ul style="list-style-type: none">• A constantly light signal indicates full signal strength.• The duty cycle is used to indicate communication quality. |
| | Activity | Rx/Tx Indicator <ul style="list-style-type: none">• Led flashing when data transmission |
| 8 | 100/1000Base-Tx | 1000Mbps Tx, RJ45 Port |

2.3 15EDGK-3.81mm

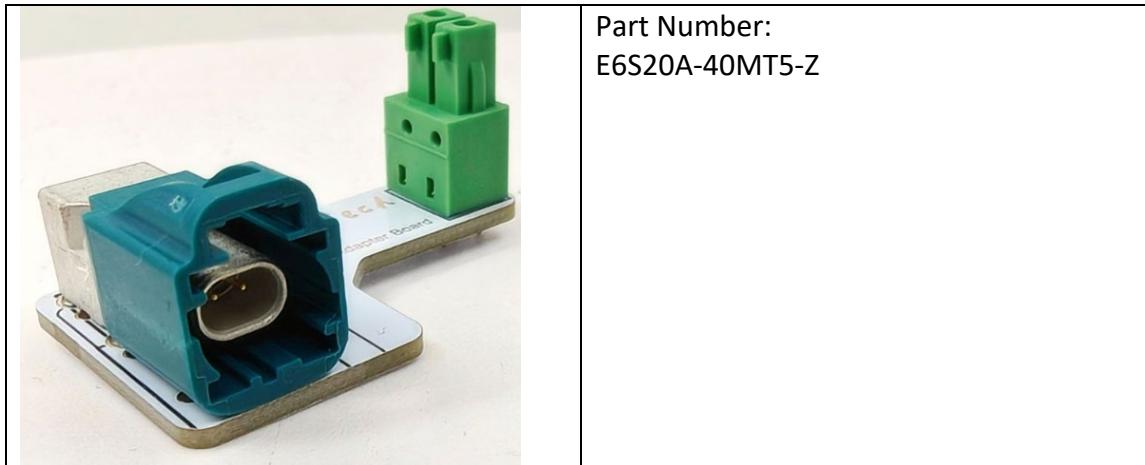
| | |
|---|---------------------------------|
|  | Part Number 15EDGK-3.81mm-2P |
|---|---------------------------------|

2.4 TE MATE net Adapter Board

| | |
|---|---------------------------|
|  | TE Part Number: 2304372-1 |
|---|---------------------------|

| Pin | Description |
|-----|-------------|
| 1 | TRX_P |
| 2 | TRX_N |

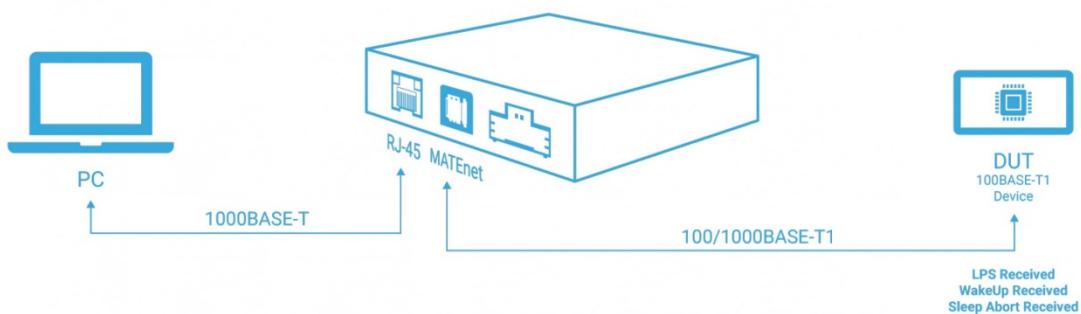
2.5 H-MTD Adapter Board



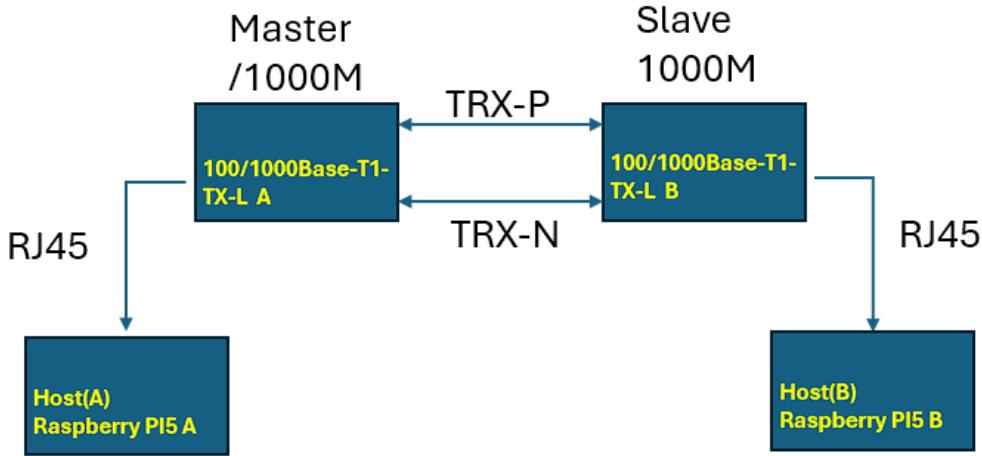
Part Number:
E6S20A-40MT5-Z

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
```

www.buelec-tech.com

sales@buelec-tech.com

support@buelec-tech.com

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 MBBytes
[ 5] 60.00-71.63  sec   1.27 GBytes   936 Mbits/sec    0   1.37 MBBytes
[ -----
[ 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 |
|----------------------|-----------------------|

| | | | | | | | | | | | | | | | | | | | | | |
|--|--|------------------|--------------|-------------------|------------------|------------------|-----------------------|---------------|-----------------------|---------------|---|-------------|-------------------|--------------|-------------------|------------------|------------------|-----------------------|---------------|-----------------------|---------------|
| <p>General</p> <p>You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.</p> <p><input type="radio"/> Obtain an IP address automatically <input checked="" type="radio"/> Use the following IP address:</p> <table border="1" style="margin-left: 10px;"> <tr><td>IP address:</td><td>190 . 19 . 1 . 9</td></tr> <tr><td>Subnet mask:</td><td>255 . 255 . 0 . 0</td></tr> <tr><td>Default gateway:</td><td>190 . 19 . 1 . 1</td></tr> </table> <p><input type="radio"/> Obtain DNS server address automatically <input checked="" type="radio"/> Use the following DNS server addresses:</p> <table border="1" style="margin-left: 10px;"> <tr><td>Preferred DNS server:</td><td>8 . 8 . 8 . 8</td></tr> <tr><td>Alternate DNS server:</td><td>8 . 8 . 4 . 4</td></tr> </table> <p><input type="checkbox"/> Validate settings upon exit Advanced...</p> | IP address: | 190 . 19 . 1 . 9 | Subnet mask: | 255 . 255 . 0 . 0 | Default gateway: | 190 . 19 . 1 . 1 | Preferred DNS server: | 8 . 8 . 8 . 8 | Alternate DNS server: | 8 . 8 . 4 . 4 | <p>General</p> <p>You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.</p> <p><input type="radio"/> Obtain an IP address automatically <input checked="" type="radio"/> Use the following IP address:</p> <table border="1" style="margin-left: 10px;"> <tr><td>IP address:</td><td>190 . 19 . 1 . 90</td></tr> <tr><td>Subnet mask:</td><td>255 . 255 . 0 . 0</td></tr> <tr><td>Default gateway:</td><td>190 . 19 . 1 . 1</td></tr> </table> <p><input type="radio"/> Obtain DNS server address automatically <input checked="" type="radio"/> Use the following DNS server addresses:</p> <table border="1" style="margin-left: 10px;"> <tr><td>Preferred DNS server:</td><td>8 . 8 . 8 . 8</td></tr> <tr><td>Alternate DNS server:</td><td>8 . 8 . 4 . 4</td></tr> </table> <p><input type="checkbox"/> Validate settings upon exit Advanced...</p> | IP address: | 190 . 19 . 1 . 90 | Subnet mask: | 255 . 255 . 0 . 0 | Default gateway: | 190 . 19 . 1 . 1 | Preferred DNS server: | 8 . 8 . 8 . 8 | Alternate DNS server: | 8 . 8 . 4 . 4 |
| IP address: | 190 . 19 . 1 . 9 | | | | | | | | | | | | | | | | | | | | |
| Subnet mask: | 255 . 255 . 0 . 0 | | | | | | | | | | | | | | | | | | | | |
| Default gateway: | 190 . 19 . 1 . 1 | | | | | | | | | | | | | | | | | | | | |
| Preferred DNS server: | 8 . 8 . 8 . 8 | | | | | | | | | | | | | | | | | | | | |
| Alternate DNS server: | 8 . 8 . 4 . 4 | | | | | | | | | | | | | | | | | | | | |
| IP address: | 190 . 19 . 1 . 90 | | | | | | | | | | | | | | | | | | | | |
| Subnet mask: | 255 . 255 . 0 . 0 | | | | | | | | | | | | | | | | | | | | |
| Default gateway: | 190 . 19 . 1 . 1 | | | | | | | | | | | | | | | | | | | | |
| Preferred DNS server: | 8 . 8 . 8 . 8 | | | | | | | | | | | | | | | | | | | | |
| Alternate DNS server: | 8 . 8 . 4 . 4 | | | | | | | | | | | | | | | | | | | | |
| 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

| | |
|----------|--|
| Terminal | Terminal (Admin) cd F:\iperf3.6_64bit <pre> 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 </pre> |
|----------|--|

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
[ 5]  0.00-10.13  sec   114 MBytes  94.6 Mbits/sec
                                         sender
                                         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
[ 5] 0.00-1.00 sec 115 MBytes 962 Mbits/sec
[ 5] 0.00-1.03 sec 14.8 MBytes 120 Mbits/sec
                                             sender
                                             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 H-MTD Adapter Board