Keysight APM1000E 100/1000BASE-T1 Media Converter

KEYSIGHT TECHNOLOGIES

User Guide

Notices

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The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation.

Please refer to keysight.com/go/takeback to understand your trade in options with Keysight in addition to product takeback instructions.

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Information to the user:

This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference.

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List of Tables

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1 Product Inspection

Check the Product

Upon receiving the APM1000E 100/1000BASE-T1 Media Converter from Keysight Technologies, perform the following product inspection:

- Inspect the outer shipping container, foam-lined instrument case, and product for damage.
- Retain the outer cardboard shipping container until you have inspected the contents of the shipment for completeness, and you have checked the product mechanically and electrically.
- Locate the shipping list and verify that all items ordered were received.

Package Contents

Your APM1000E-CLK 100/1000BASE-T1 Media Converter package contains the following:

- One APM1000E 100/1000BASE-T1 Media Converter device
- One standard 2-meter, 8-wire Ethernet cable (CAT6e)
- One standard 1-meter, USB 3.0 Type "A" to USB-C cable
- Three 1-meter, MMCX male to SMA male cables
- One standard 1-meter, 100/1000BASE-T1 cable with TE MATEnet connector

Your APM1000E 100/1000BASE-T1 Media Converter package contains the following:

- One APM1000E 100/1000BASE-T1 Media Converter device
- One standard 2-meter, 8-wire Ethernet cable (CAT6e)
- One standard 1-meter, USB 3.0 Type "A" to USB-C cable
- One standard 1-meter, 100/1000BASE-T1 cable with TE MATEnet connector

If anything is missing, contact Keysight Technologies “Service and Support” on page 32 for prompt assistance.

Visual Inspection

Be sure to inspect all instrument cables, Ethernet cables, and devices carefully before making a connection. Inspect all cables and connectors for metal particles, scratches, deformed threads, dents, or bent, broken, or misaligned center conductors. Do not use damaged cables.

Product Specifications

The following are the product specifications for the APM1000E 100/1000BASE-T1 Media Converter and its key internal components.

Dimensions and Weight

Table 1-1 shows the APM1000E 100/1000BASE-T1 Media Converter's dimensions and weight.

Table 1-1 Dimensions and Weight for APM1000E

Physical Quantity	Measurement
Length	6.831" (173.5 mm)
Width	2.488" (63.2 mm)
Depth	1.264" (32.1 mm)
Product weight	7.1 oz (200 g)
Product shipping weight	24.7 oz (700 g)

Other Specifications

Table 1-2 shows the APM1000E 100/1000BASE-T1 Media Converter's other specifications.

Table 1-2 Other Specifications for APM1000E

Specification	Description
Housing materials	Anodized aluminum and rubber
Product rating	6 W
Operating temperature range	23 °F (-5 °C) to 140 °F (60 °C)
Operating humidity	50% to 80% RH

Comparison Table for APM1000E and APM1000ET

Table 1-3 compares APM1000E and APM1000ET.

Table 1-3 Comparison Between APM1000E and APM1000ET

Feature	APM1000E	APM1000ET
100/1000BASE-T1 support	Yes	Yes
Two different built-in PHYs	Yes	Yes
Active tap	No	Yes
External clock option	Yes (APM1000E-CLK)	No

2 Hardware Overview

100/1000BASE-T1 Media ConverterHardware Setup

The APM1000E 100/1000BASE-T1 Media Converter contains the following two different Ethernet physical layer implementations (PHYs) that are internally connected:

- 100/1000BASE-T1 PHY
- Conventional 1000BASE-T Ethernet PHY

Data received over either connection, is automatically sent out on the other, creating a seamless link between the two attached devices. Full-duplex operation is supported, enabling data to be sent in both directions simultaneously.

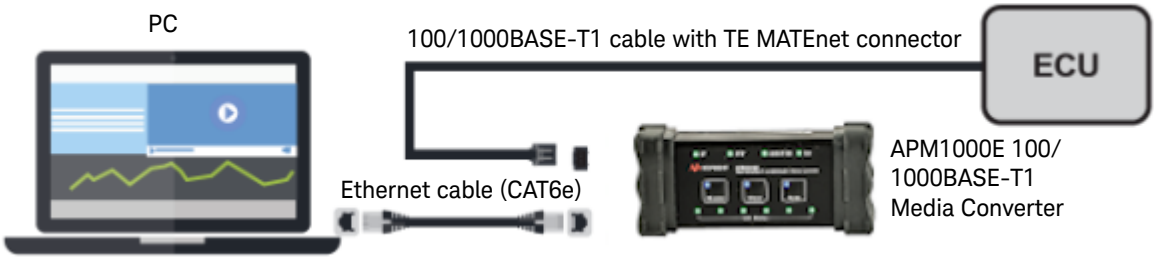

Figure 2-1 APM1000E 100/1000BASE-T1 Media Converter Hardware Setup

A typical application of the APM1000E 100/1000BASE-T1 Media Converter is to connect an Automotive Ethernet ECU to the Ethernet port on a laptop or desktop PC.

Device Power

Power the APM1000E 100/1000BASE-T1 Media Converter in using the Certified USB 3.0 Port. Earlier versions or uncertified devices may not supply the current required for reliable operation.

Label and Status Indicators

NOTE No calibration is required.

The use of label and status indicators are detailed as follows.

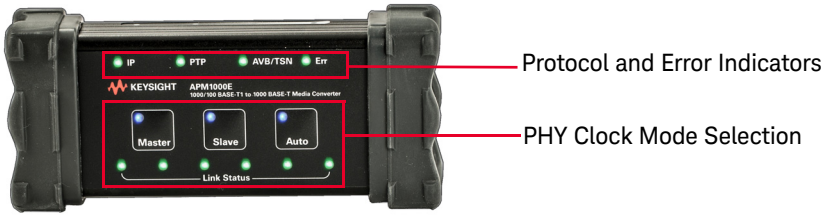

Figure 2-2 Label and Status Indicators

Protocol and Error Indicators

The LEDs in Figure 2-2 are active when the APM1000E 100/1000BASE-T1 Media Converter has identified specific protocols in the Ethernet Traffic. These LEDs are useful to determine if an IP socket is open, if a synchronization protocol at PTP is executing, or if there is an Audio/Video stream active.

If the error indicator is solidly active, the messages received are of poor signal quality. A flashing error indicator signifies a malformed frame is received.

PHY Clock Mode Selection

Linking one PHY with another uses a single clock between the two for synchronous data transmission and reception. There are three modes the PHY can assume regarding this clock. Identify the current mode of operation by a flashing indicator inside the button, as indicated in Figure 2-2.

- **Master**: The PHY supplying the clock signal
- **Slave**: The PHY receiving the clock signal
- **Auto**: The PHY will detect the clock mode setting of other devices to set to master or slave automatically

NOTE **When not using the Auto mode, it is important to ensure that two PHY's connected are not both masters or both slaves, or there will be no link established.**

APM1000E 100/1000BASE-T1 Media Converter Connection Status

The LED within each button also indicates if there is a connection between the APM1000E 100/1000BASE-T1 Media Converter to the Vehicle Spy. A slow flash indicates not connected, while a rapid flash indicates Vehicle Spy is currently online and receiving information.

88Q2112 PHY IEEE/Legacy Mode

If you have an APM1000E 100/1000BASE-T1 Media Converter containing Rev A2 of Marvell's 88Q2112, there is a setting that will allow it to work with older silicon revisions. For more details on these modes, refer to Marvell Documentation.

This mode can be changed in the neoVI Explorer configuration utility or by holding one of the buttons when the device is powered up, as described in Table 2-1.

Table 2-1 LED Color for Different Modes

LED Color	Mode	Configuration
Blue	IEEE Mode: Meets all IEEE requirements	Hold Master button while powering the device
Magenta	Legacy Mode: Compatible with A0/A1 revisions of Marvell's 88Q2112 PHY	Hold Slave button while powering the device

Link Status

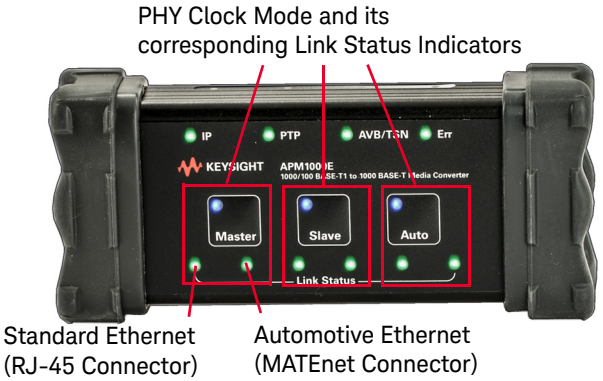

Figure 2-3 Link Status for the PHY Clock Mode

Each PHY Clock Mode has its corresponding Link Status indicators under its button. The indicator is solid when there is a link established with another PHY and flashing when there is no link. The left indicator is for the standard Ethernet (RJ-45 Connector) and the right indicator is for the Automotive Ethernet (MATEnet Connector).

Link Speed

Toggle the link speed between 100/1000 Mbps by holding any of the three buttons until the Link Status indicators change color. The change in color represents the following:

- Green indicates 1000 Mbps
- Orange indicates 100 Mbps

SQI Indicators

Figure 2-4 SQI Indicators

On the side of the case are four multi-color LEDs tied to the Automotive Ethernet SQI (Signal Quality Index), as indicated in Figure 2-4. There are 12 discrete levels for the SQI which directly correlates to the BER reported by the PHY as it receives frames.

Table 2-2 LED Color Representing SQI Levels

LED Color	SQI Level	Indication
Green	9 – 12	Good (BER < 10E-20)
Blue	5 – 8	Acceptable
Red	1 – 4	Poor (BER > 10E-7)

Bootloader Mode

Figure 2-5 Bootloader Mode

You may see all three LEDs on the top label flashing synchronously with the four LEDs on each side of the case, as indicated in Figure 2-5. This means the device is in bootloader mode, which should only happen when flashing the APM1000E 100/1000BASE-T1 Media Converter's firmware. If this is observed unexpectedly or remains in the mode after trying to update firmware, contact Keysight Technologies "Service and Support" on page 32 for prompt assistance.

NOTE **Connecting through a USB hub can sometimes interfere with a successful firmware update. If you encounter this, try the update connected directly to a USB 3 interface on the computer.**

Connector Interfaces

The connector interfaces are detailed as follows.

Ethernet Interfaces

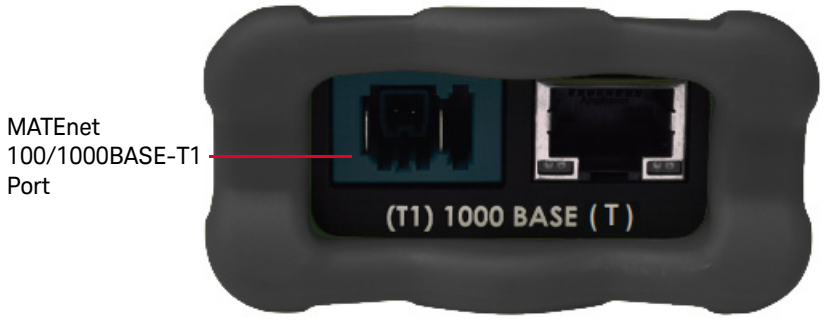

Figure 2-6 MATEnet 100/1000BASE-T1 Port

MATEnet Port (Left)

A connector designed specifically for 100/1000BASE-T1 and automotive requirements.

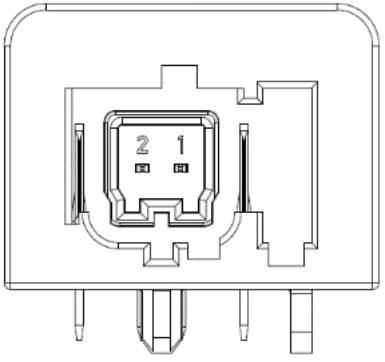

Figure 2-7 APM1000E 100/1000BASE-T1 Media Converter MATEnet Port

Table 2-3 APM1000E 100/1000BASE-T1 Media Converter MATEnet Pinout

Pin Number	Label	Description
1	TRD+	Data transmit and receive, positive
2	TRD-	Data transmit and receive, negative

Table 2-4 Mating Connector Information

Component	Te Connectivity Part Number
Connector	9-2302454-9
Insert	2302450-1
Strain relief	9-2302452-1
Crimp sockets	1-1703930-1

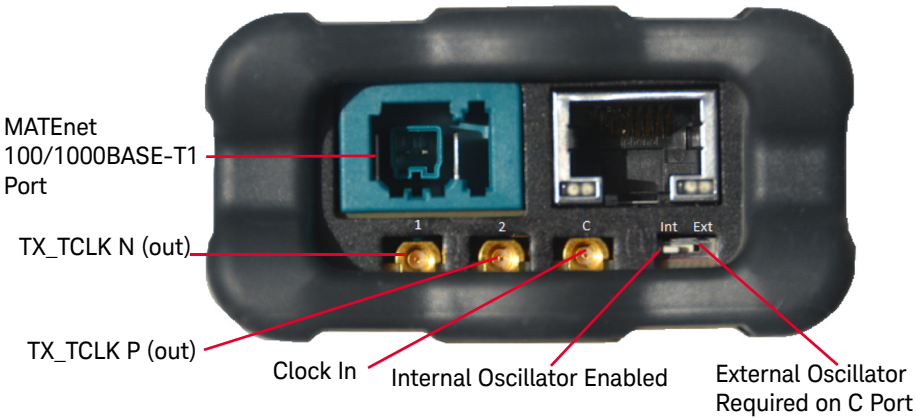

Figure 2-8 MATEnet 100/1000BASE-T1 Port for APM1000E-CLK

TX_TCLK N (out), TX_TCLK P (out), Clock In, Internal Oscillator, and External Oscillator Required on C Port

When the Internal Oscillator is enabled or set to **Int**, the 25 MHz crystal is multiplied by up to 750 MHz and then divided by six to output the TX_TCLK differential 125 MHz Clock through ports TX_TCLK N (out) and TX_TCLK P (out).

For this functionality, you will need to set the output registers using the API, Vehicle Spy Software, or any personalized tool.

By switching to the External Oscillator Required on C Port to **Ext**, you can feed an external 25 MHz clock signal through Clock In - port C. This way, you no longer use the internal crystal as a reference; instead, the external 25 MHz signal is used as a clock reference.

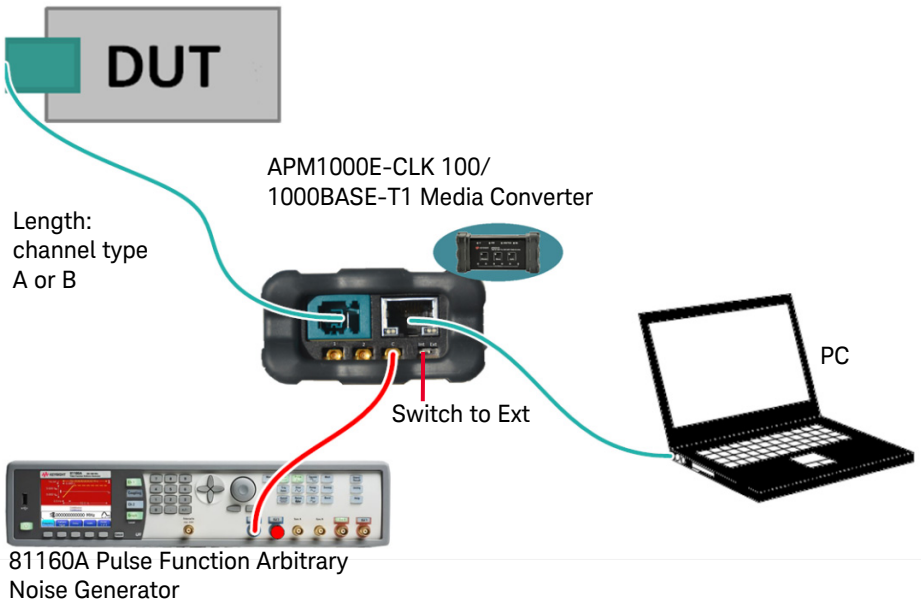

Figure 2-9 Connection Diagram for Receiver Tests with Direct Link (with External Clock)

Figure 2-9 shows the setup used for the calibration and the Receiver (Rx) Frequency Tolerance Compliance Test. For more information, refer to “Test 97.2.3 - Receiver Frequency Tolerance to ±100ppm Deviation” in the Keysight AE6910R Automotive Ethernet Rx Compliance Test Software Installation and User Guide.

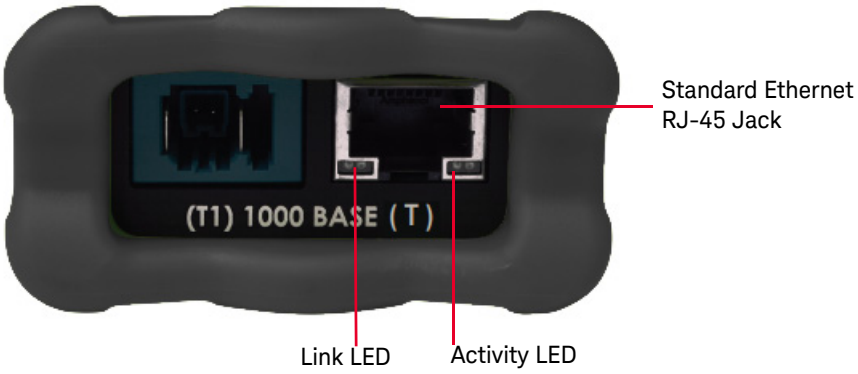

Figure 2-10 Standard Ethernet RJ-45 Jack

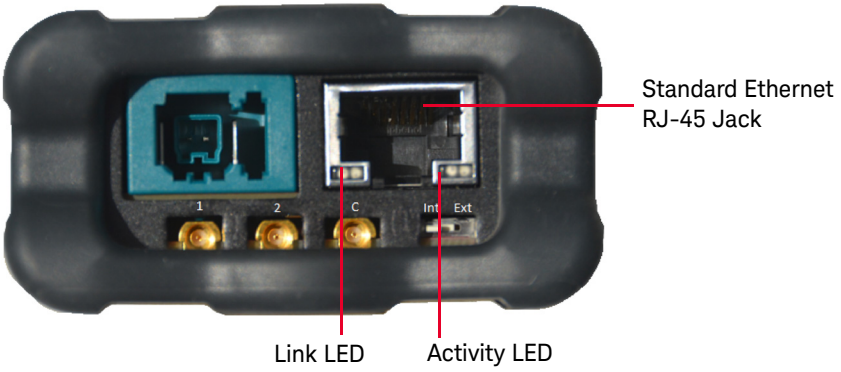

Figure 2-11 Standard Ethernet RJ-45 Jack for APM1000E-CLK

RJ-45 Port (Right)

An industry-standard conventional Ethernet jack.

The RJ-45 port has a pair of integrated LEDs that provide information about the APM1000E 100/1000BASE-T1 Media Converter's conventional Ethernet connection:

- **Link LED (Green)**: Indicates that there is a valid link between the APM1000E 100/1000BASE-T1 Media Converter and another 10/100/1000 Ethernet device.
- **Activity LED (Orange)**: Flashes when traffic passes in either direction over the attached Ethernet cable.

In normal operation, you should see the Link LED always on, and the Activity LED flashing at a variable rate, with faster flashing, indicating a higher data transfer.

The APM1000E 100/1000BASE-T1 Media Converter's standard 10/100/1000 Ethernet connection does not auto-negotiate speed as commonly expected when seeing an RJ-45 jack. It matches the speed of the 100/1000BASE-T1 and is set to 100 or 1000 Mbps using the membrane buttons on the top label. There is a plan for auto-negotiation of link speed for this port in a future firmware release.

USB/Power Interfaces

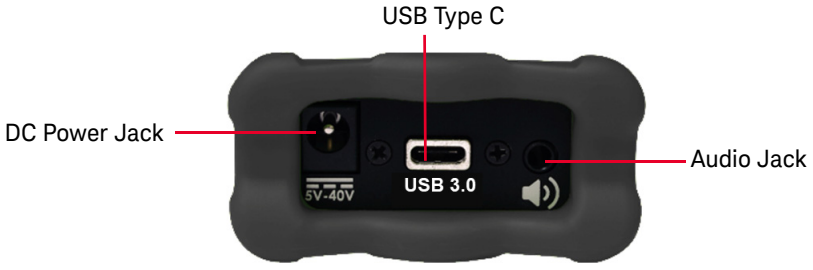

Figure 2-12 APM1000E 100/1000BASE-T1 Media Converter USB/Power Interfaces

DC Power Jack (Left)

No DC supply is provided with your purchase.

USB Type C (Center)

In addition to serving as the connection to a host computer for configuration and data transfer, the device may also be powered through this interface when connected to a certified USB 3.0 host port. Connecting to older or uncertified hardware may not provide sufficient current, which could result in unreliable operation.

1/8" Audio Jack (Right)

This interface is not used and may not be present on future hardware revisions of this product.

A Appendix

List of Abbreviations

Table A-1 Abbreviation and Definition

Abbreviation	Definition
B	
BER	Bit Error Rate
E	
ECU	Electronic/Engine Control Unit
P	
PHY	Physical layer
S	
SQI	Signal Quality Index
T	
TRD	Transmit/Receive data

B Appendix

Service and Support

Use the following web link to contact Keysight for service and support:

www.keysight.com/find/contactus

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