

# UM11602

## RDDRONE-T1ADAPT 100BASE-T1 to 100BASE-TX media converter

Rev. 1 — 17 May 2021

User manual

### Document information

Information	Content
Keywords	100BASE-T1 Ethernet, media converter, evaluation board, TJA1101B, ARM Cortex-M0+
Abstract	The RDDRONE-T1ADAPT media converter is intended to be used to evaluate automotive T1 Ethernet. Featuring both a 2-pin 100BASE-T1 Ethernet connector and an RJ45 100BASE-TX connector, the RDDRONE-T1ADAPT allows standard RJ45 and T1 peripherals to communicate over a reliable 2-wire T1 interface.



## Revision history

Rev	Date	Description
v.1	20210517	Initial version

## 1 Introduction

The RDDRONE-T1ADAPT Ethernet adapter board is intended to be used as a platform for evaluating the use of T1 Ethernet in a variety of application areas. This network media converter allows 100BASE-T1 automotive devices and devices with traditional 100BASE-TX incorporating an RJ45 connector to be combined in a single network. This document is the user guide for the RDDRONE-T1ADAPT 100BASE-T1 to RJ45 adapter board. It describes how to use the board to connect a standard 100BASE-TX Ethernet interface to a T1 node or T1 network switch. It also describes how a pair of boards can be used to allow two remote RJ45 nodes to communicate via a reliable two-wire T1 interface by translating 100BASE-TX nodes to 100BASE-T1 and back again to 100BASE-TX.

This release of the adapter board supports 100 Mbit/s links on the RJ45 and T1 connectors. Automatic mode detection is enabled on the T1 connectors, so no further adjustments are needed.

## 2 Finding kit resources and information on the NXP website

NXP Semiconductors provides online resources for this media converter at <http://www.nxp.com/RDDRONE-T1ADAPT>. A getting started link provides quick-reference information relevant to using the RDDRONE-T1ADAPT along with links to downloadable assets. Additional information can be found at <http://nxp.gitbook.io/rddrone-t1adapt>.

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The NXP community is at <https://community.nxp.com>. A dedicated robotics community can be found at <https://community.nxp.com/community/mobilerobotics>.

## 3 Kit contents

The RDDRONE-T1ADAPT kit contains:

- PCB board
- 1 x 2-wire T1 Ethernet cable with JST-GH connector
- 1 x 3-pin (2-wire) power cord with JST-GH connector

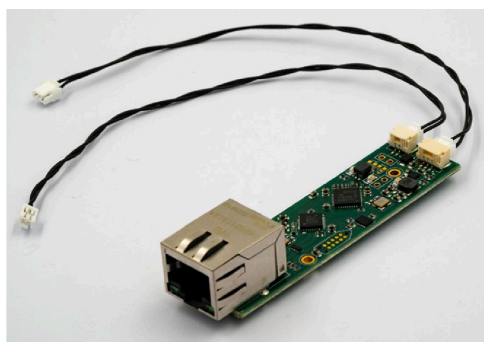
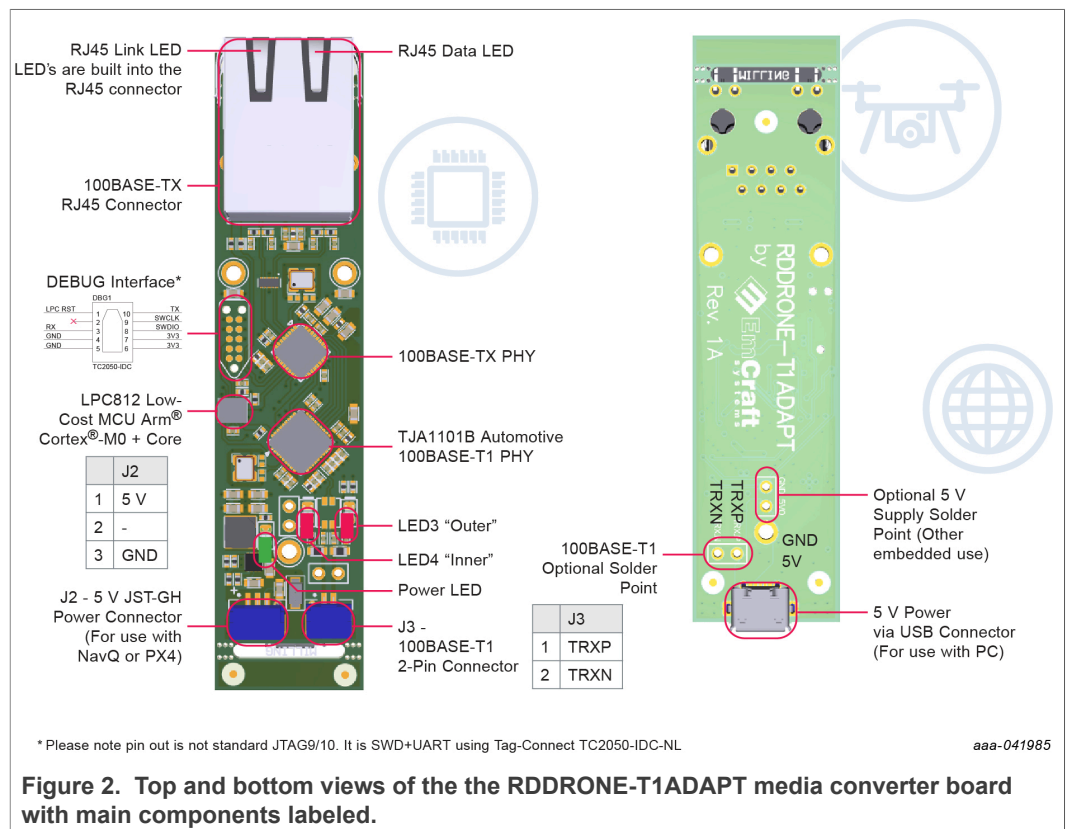


Figure 1. T1ADAPT board with supplied T1 and power cables

## 4 Overview of the RDDRONE-T1ADAPT media converter

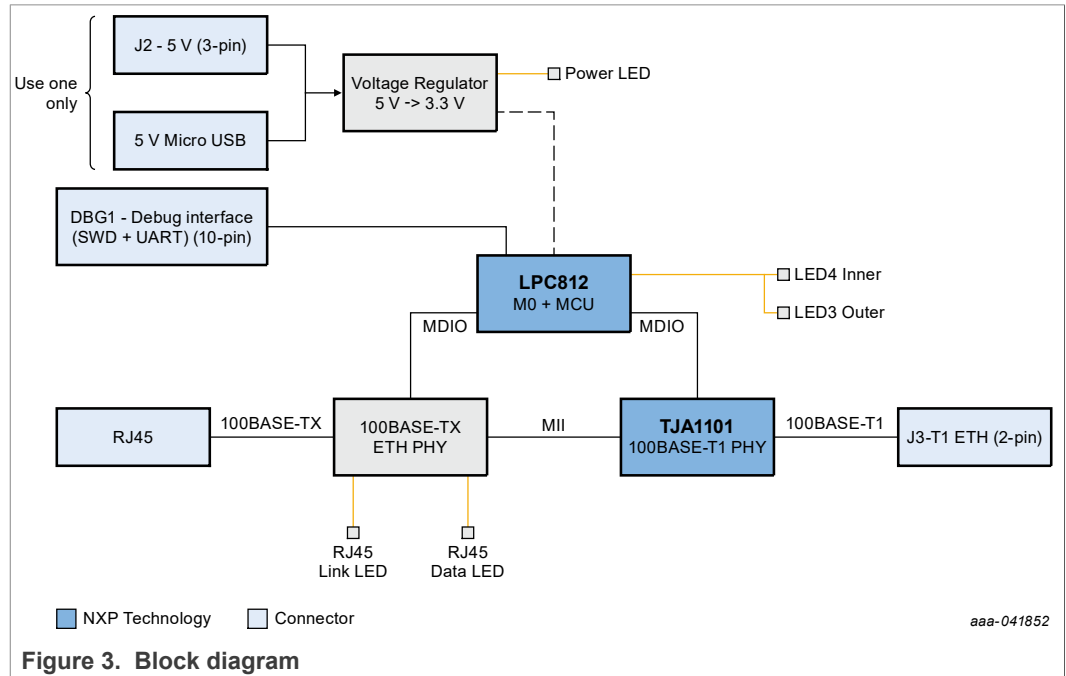
The RDDRONE-T1ADAPT Ethernet adapter board is an evaluation platform for automotive two-wire Ethernet (100BASE-T1). It can be used to connect a standard Ethernet device, such as a PC or single-board computer, to a peripheral device with a T1 Ethernet interface. Two RDDRONE-T1ADAPT boards can be used to connect two standard Ethernet devices together via a T1 network. Top and bottom views are shown in [Figure 2](#). Software source code is available on request through NXP sales if the user needs to modify the configuration. However, the board is preprogrammed and designed for plug-and-play operation with no additional software needed.



**Figure 2. Top and bottom views of the the RDDRONE-T1ADAPT media converter board with main components labeled.**

### 4.1 Block diagram

A block diagram of the RDDRONE-T1ADAPT media converter is shown in [Figure 3](#).



## 4.2 Main components

The main components on the RDDRONE-T1ADAPT board are highlighted in [Figure 4](#) and discussed briefly in the following sections.

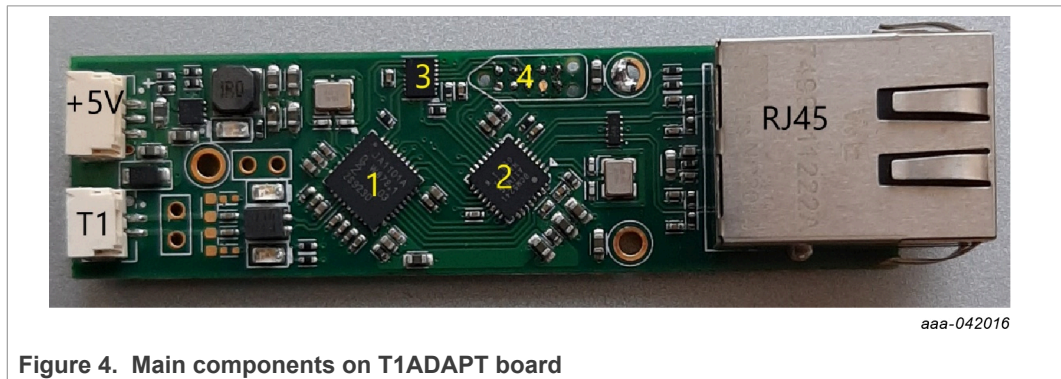


Figure 4. Main components on T1ADAPT board

### 4.2.1 TJA1101B (1)

The TJA1101B 100BASE-T1 automotive Ethernet PHY from NXP Semiconductors is used to support the automotive Ethernet (T1) side of the media converter. The TJA1101B offers 100 Mbit/s transmit and receive capability over an unshielded twisted pair (UTP) cable of up to at least 15 m [\[1\]](#).

### 4.2.2 100BASE-TX PHY (2)

The 100BASE-TX Ethernet PHY supports the standard Ethernet side of the media converter.

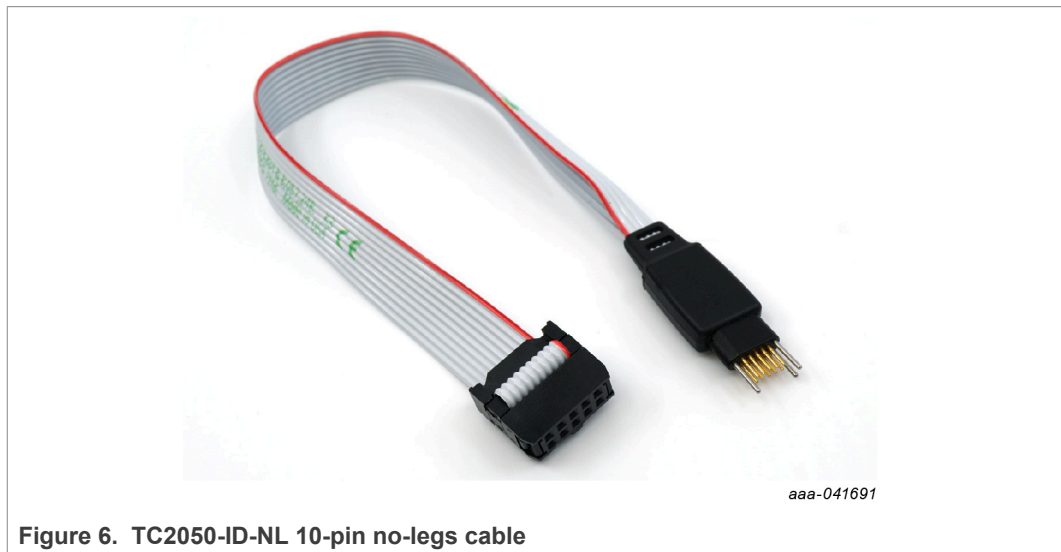
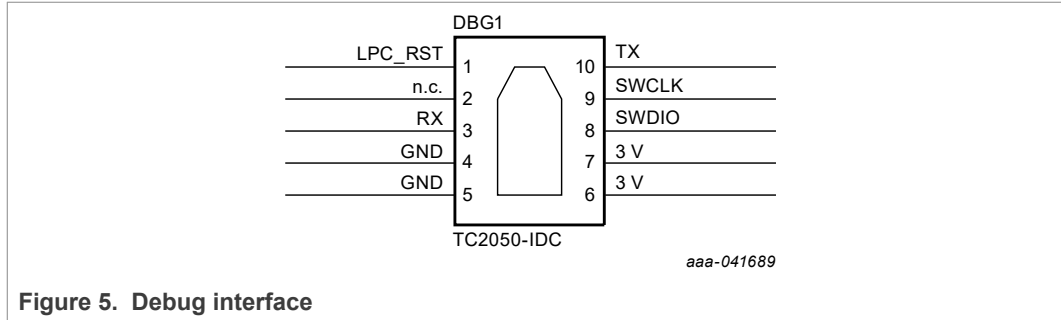
### 4.2.3 LPC812 (3)

The ARM Cortex-M0+ micro is used to configure the two back-to-back PHYs and to control the master/slave behavior of the TJA1101B [\[2\]](#).

### 4.2.4 Debug connector (4)

This debug interface, illustrated in [Figure 5](#), can be used to program the device. Since a physical connector is not mounted on the board, a cable such as the TC2050-ID-NL illustrated in [Figure 6](#) can be used to interface with the board via the debug interface. Note that the board is designed for plug-and-play and does not need to be configured for evaluation purposes. The source code is available on request for users that need to adjust the configuration.

**Note:** While the interface accepts standard SWD debugger signals, this is not a standard JTAG/SWD pinout. UART signals have also been included for debugging purposes. A custom wiring or board adapter will need to be configured in order to connect to a traditional JTAG/SWD debugger.



#### 4.2.5 LEDs

A number of status LEDs are provided:

- A green power LED that lights up when power is supplied to the board.
- Two red T1 status LEDs: 'inner' and 'outer' (see [Figure 2](#)). A stable T1 connection has been established between the two on-board PHYs when the 'inner' status LED is flashing and the 'outer' status LED is solid on.
- Two green LEDs on the RJ45 connector. An RJ45 connection has been established when the Data status LED is flashing and the Link status LED is solid on.

#### 4.2.6 Connectors

Four physical connectors have been mounted on the board:

- A 3-pin JST-GH power connector
- A 2-pin 100BASE-T1 Ethernet connector
- A standard RJ45 Ethernet connector
- A standard Micro USB connector (mounted on the bottom of the board; see [Figure 2](#))

## 5 Power supply

The RDDRONE-T1ADAPT board needs an external 5 V supply. The 5 V supply can be provided by a PC or laptop via the USB connector on the bottom of the board, or via a 3-pin JST-GH power cord. Note that the USB connector is only used to provide the 5 V supply; there is no actual USB data communication. The 3-pin connector can be used with a single-board computer or NavQ/PX4 device (pin 1 = 5 V; pin 3 = GND).

## 6 System configurations

The RDDRONE-T1ADAPT is designed to interface between standard 100BASE-TX Ethernet and two-wire automotive Ethernet in order to evaluate T1 performance. A number of system configurations are possible.

**Note:** T1 Ethernet is designed to be used with unshielded cable lengths <15 meters.

### 6.1 Evaluating T1 between two 100BASE-TX devices

In [Figure 7](#), a pair of RDDRONE-T1ADAPT boards are used to connect two standard PCs with RJ45 connectors together over a 2-wire T1 network. The adaptors communicate with each other via T1 and the power is supplied by the PCs over USB cables.

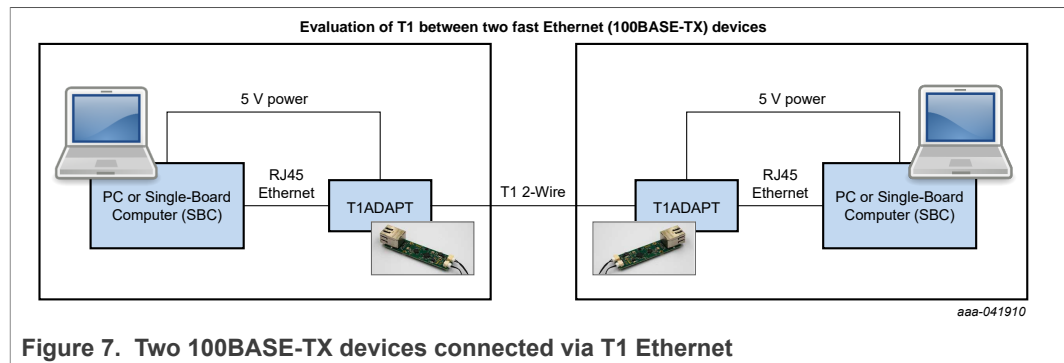


Figure 7. Two 100BASE-TX devices connected via T1 Ethernet

### 6.2 Evaluating communication between a TX and a T1 device

In [Figure 8](#), an RDDRONE-T1ADAPT is used to connect a PC or single-board computer to a T1 peripheral. In this configuration, the power may be supplied through the 3-pin JST-GH connector with 5 V power coming from a pin header or matching connector on the single-board computer.

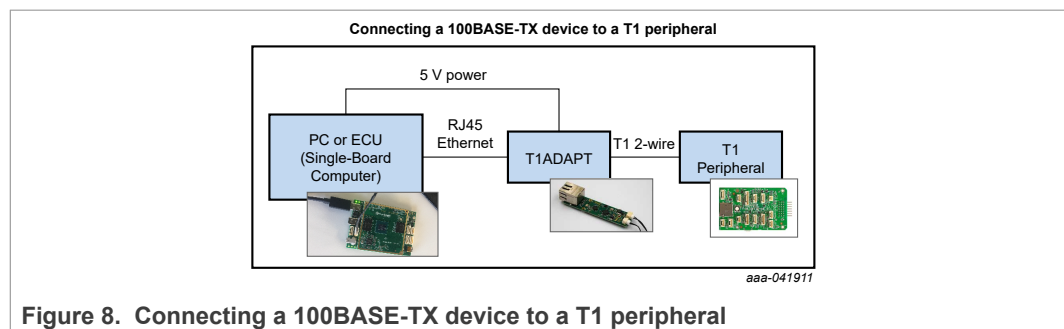


Figure 8. Connecting a 100BASE-TX device to a T1 peripheral



### 6.3 Connecting a 100BASE-TX device to a T1 network switch

In [Figure 9](#), an RDDRONE-T1ADAPT is used to connect a PC or single-board computer to T1 network switch (such as RDDRONE-T1ETH8).

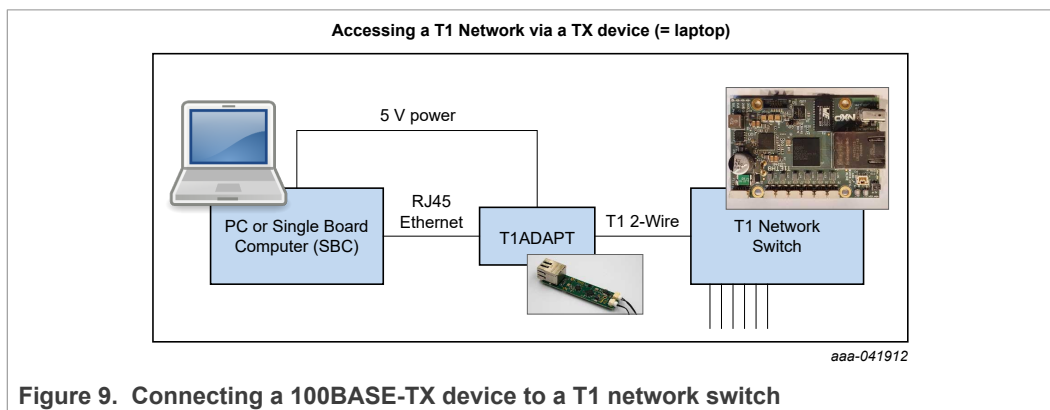


Figure 9. Connecting a 100BASE-TX device to a T1 network switch

## 7 Operation

Once the RDDRONE T1ADAPT and peripherals have been connected and powered up, the firmware alternates which adapter device is the dominant controller on the T1 bus until a stable connection is established. In the absence of a signal, the firmware resets the PHYs and tries again to establish a link.

## 8 References

- [1] TJA1101B 100BASE-T1 PHY for automotive Ethernet, <https://www.nxp.com>.
- [2] LPC812 ARM Cortex-M0+ microcontroller, <https://www.nxp.com>

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