

# Manual 2Wire Converter

**Ethernet everywhere**

via any existing pair of wires



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# 1. About this product

## 1.1. Features

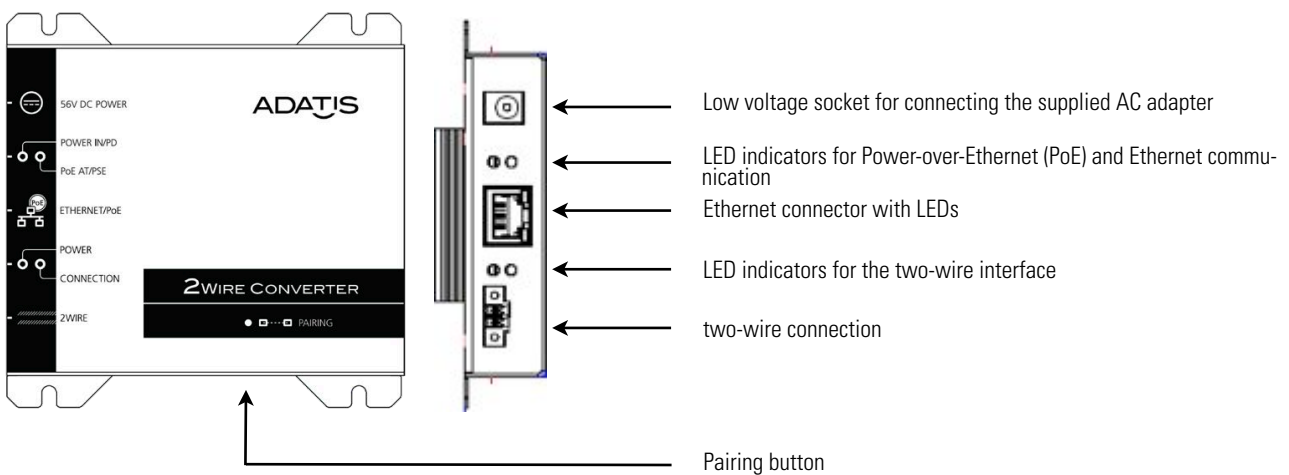
**Ethernet connection for remote devices:** The Adatis 2Wire Converter provides an Ethernet port at locations where no structured cabling exists. The connection is made via any unused pair of wires. Distances of up to 500 m can be bridged. Structured cabling is usually restricted to distances up to 100 m. Therefore the 2Wire Converter will not only bring Ethernet to sites where no structured cabling exists but it will also extend Ethernet port distances to up to 500m. As the power supply for both of the 2Wire Converters and an attached Power-over-Ethernet device is transported over the same pair of wires, the wires must be power-free.

**Flexible power supply:** The power supply of the converter boxes can be accomplished in 3 ways: Firstly, via Power-over-Ethernet, secondly using the supplied AC adapter or thirdly via the two-wire line. Power supply via PoE has lower priority compared to any other method of power supply.

**PD or PSE:** Depending on the device type, the Ethernet port on the converter behaves in terms of power-over-Ethernet (PoE) either as "powered device (PD)" which is powered by an Ethernet switch or a PoE power injector, or as a "power sourcing equipment (PSE)" which provides up to 20 W Power-over-Ethernet to connected devices.

**AES encryption:** In order to ensure safe communication and prevent wiretapping, the Ethernet communication via the two-wire line is encrypted using the built-in encryption technology AES with 128 bit.

## 1.2. Equipment overview



### 1.3. Content of delivery

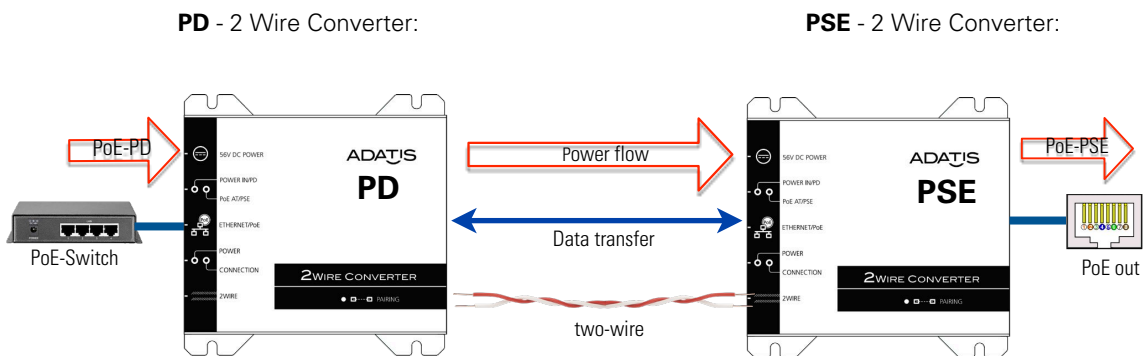
As **2Wire Set**:

- **two** 2Wire Converter
- power supply
- this manual

As **2Wire Option** (together with a unit of the XT- or XS-series):

- **one** 2Wire Converter
- pre-installed daughterboard in XT- /XS-device
- power supply
- this manual

### 1.4. Distinction between PD- and PSE Box



If no PoE is requested the connection sequence does not matter.

The PD - Box is connected to the PoE-Ethernet-Switch.

The PSE - Box provides PoE to connected devices at the remote end.

## 2. Mechanical assembly

**Mount or screw device:** The converter requires no special installation. The housing is designed either as a desktop case on a flat surface or can be screwed by means of the lateral flaps on a wall or other surface. When fastening, take care that the housing is not mechanically damaged and especially not distorted due to excessive force. A warped housing could damage the circuit board inside. Furthermore it is possible to mount the 2Wire Converter on a DIN rail in an electrical distribution panel. The converter boxes can therefore be optionally ordered with a DIN rail adapter mounted.



If the installation place is remote or difficult to reach, do the pairing of the units before the final installation see Section 5 "[pairing](#)".

## 3. Electrical assembly

### 3.1. Two-wire connection

The two-wire connection is made by a pluggable screw terminal with a spacing of 3.5 mm. This allows for convenient installation. The screw is suitable for wires and strands and designed for wire cross-sections from 0.13 to 1.5 mm<sup>2</sup> (AWG 26-16). Cables should be stripped to a length of about 6-7 mm.

The M2 screw of the terminal must only be tightened by hand. The maximum torque is 0.34 Nm.



It is important to ensure that the lines used are power-free. The connection of powered wires to the 2Wire Converter may damage the device.

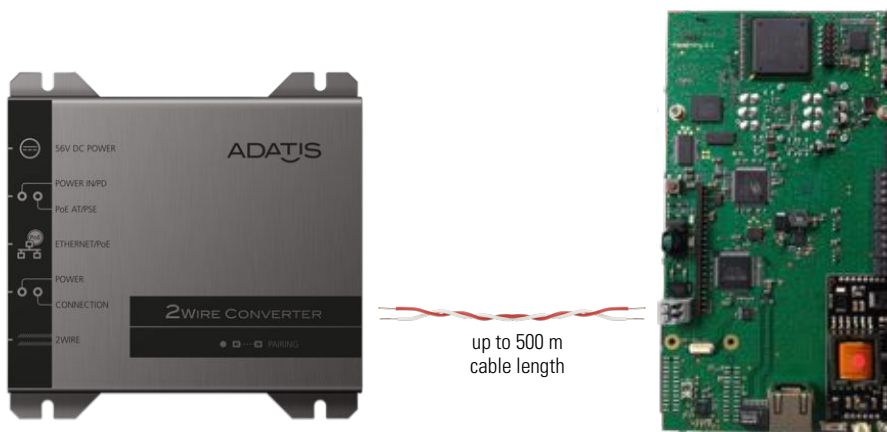
**Polarity:** The polarity should be the same on both devices. An internal reverse polarity protection detects and corrects incorrect polarity automatically.

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### 3.2. Two-wire connection at XT- / XS-device

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If the device was ordered as 2Wire Option for an XT- or XS-device, two wire ends of the two wire-line will be connected to the converter box the other two wire ends of the cable will be connected to the two-wire socket on the XT- respectively XS-board.



In this case the Ethernet interface in the respective device has no function and will be closed by a plastic plug to avoid any faulty connection.

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### 3.3. Ethernet connection

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The Ethernet connection is made on the RJ45 socket. The Ethernet interface has a so called auto-MDIX function. This guarantees a functioning connection, even if a crossover cable with twisted polarity (consciously or unconsciously) will be used instead of a normal Ethernet cable.

Furthermore, the interface has an automatic detection of transmission speed 10/100 Base-T and supports both half- and full-duplex communication.

Due to the two-wire transmission, the maximum data rate is limited to 50 Mbits/s, even if the Ethernet connection is 100Base-T.

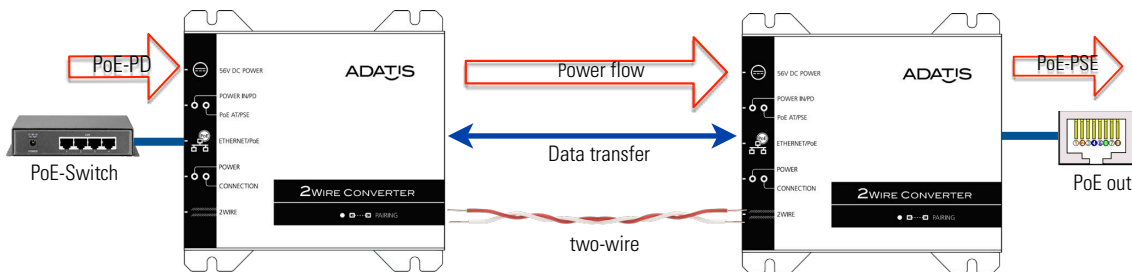
## 4. Power supply

### 4.1. 2Wire Set

The 2Wire Converter boxes can be used completely independently of other Adatis products to provide an Ethernet connection even without the presence of structured cabling.

Depending on the type of power supply, you can distinguish two basic modes of operation. For illustration in the following, the side at which the network switch is connected refers to the local side, and the converter box on the other side of the two-wire connection to the remote side:

#### 4.1.1. Power supply via a PoE switch



**Connection on the local side:** As shown in the figure, the power supply is implemented via PoE from the network switch. From the perspective of the PoE switch, the converter box is a "powered device" (PD), which is supplied with 12.5 W (802.3af) or 25 W (802.3at) electrical power. The supplied power is used on the one hand for the local converter box, which needs appr. 3 W for its own consumption. The rest of the power is passed on via the two-wire connection to the remote converter box, which is supplied by that. After deduction of the consumption of the two converter boxes the remaining power is available for the supply of a connected PoE device on the remote side.

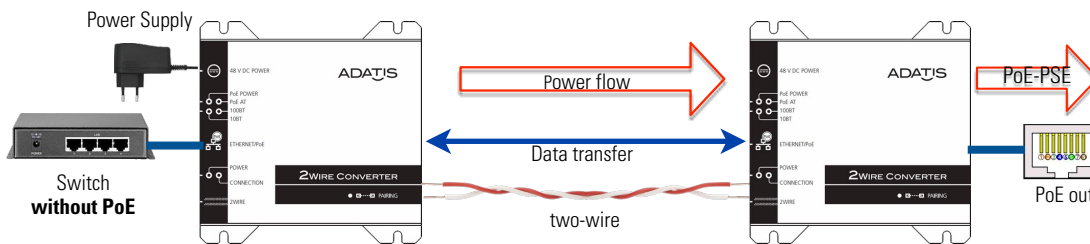
**Consideration of power dissipation:** Also note that when exploiting the maximum cable length of 500 m, a power loss in the wire pair is unavoidable. Losses in the cabling will reduce the available power at the remote end. Therefore, the line should be as short as required and the cross section of the wires used should be chosen as large as possible. Thus, a wire with 0.8 mm cross section is preferred over a line with only 0.6 mm cross section. In order to improve the cable cross section it is also possible to connect cables in parallel. The use of a PoE+ switch is also helpful to increase the output at the remote end to appr. 20 W.

#### 4.1.2. Power supply via the supplied AC adapter

**Network switch without PoE:** If only a network switch without PoE function is available, the supplied power adapter can be used to source power.



You should only use the supplied AC adapter which has a voltage of 48 V DC. The power rating of the supplied adapter is sufficient to power both converter boxes and an attached PD at the remote end with PoE.



**Additional to a 802.3af PoE-switch:** Power by an AC adapter is also recommended if the switch only delivers standard PoE with 12.5 W, but a connected device on the remote end needs the full 12.5 W of PoE power.

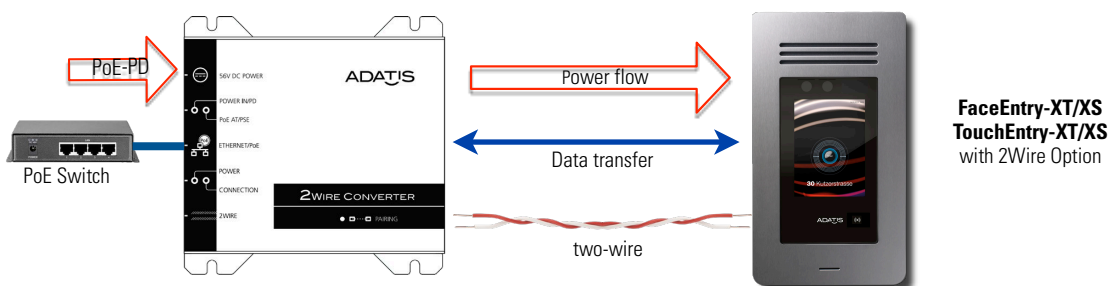
**Redundant power supply:** The local power supply has priority over PoE power by the Ethernet switch. As soon as an AC adapter is connected, the converter box will draw its power from the local source, even if the power was delivered via PoE beforehand. If the AC adapter fails, the converter box will revert to PoE supply. This will, however, not be uninterrupted, as the switch will need to determine the PD-class of the convert box before supplying power.

## 4.2. 2Wire Option

The 2Wire Option can be selected when ordering an XT- or XS-device, enabling these products to be operated via any existing pair of wires. The two-wire option consists of a daughterboard, which is factory mounted within the housing of the XT/XS-devices. This daughterboard has the functionality of a converter box. For an upgrade of NON two-wire devices with the 2Wire Option, these device must be returned to the manufacturer.

The power options of the 2Wire Option are similar to the power options shown above for the 2Wire Set.

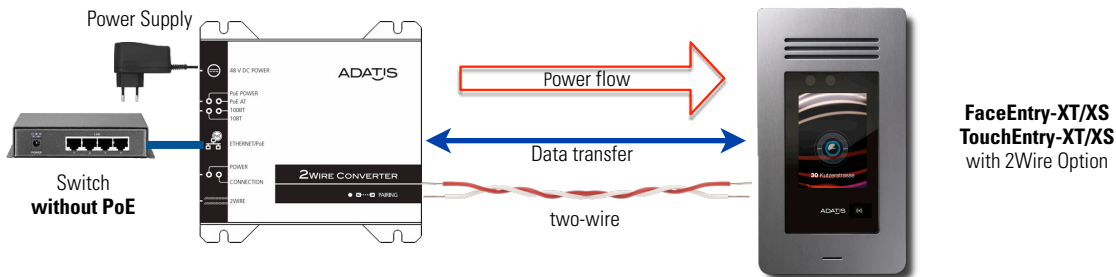
### 4.2.1. Power supply via a PoE switch



The FaceEntry-XT product is specified for more than 6 W of power, especially for higher settings of the display brightness. In order to supply an XT-product, the use of a PoE plus network switch, according to the standard 802.3at, is mandated. Otherwise, a reliable operation of the XT device cannot be guaranteed. An operation with the standard PoE power may cause a voltage drop and thus a failure of the XT device depending on the operating condition of the device. If the switch does not support the 802.3at standard, a power injector (e. g. Adatis accessories, Order# 8240) or the supplied AC adapter may be used.



#### 4.2.2. Power supply via the supplied AC adapter



If no PoE supply exists, the converter box and thus the XT/XS-device can be powered by the supplied power supply. The cross section of the two-wire line must be sufficient in order to prevent an excessive voltage drop on the line. It is recommended to test the available cabling prior to installation. As an approximate value, a bell wire with 0.8 mm cross section and a length of 250 m is recommended.

## 5. Pairing

Pairing means the establishment of a secure communication channel between two converter boxes.

**No password entry required:** The data transfer over the two-wire line is encrypted by the AES-128 encryption standard. The pairing button is a convenient way to establish a secure communication without the need to enter a password at both ends or any further configuration of the boxes.

**Locating the pairing button:** The pairing button can be reached through the hole on the top of the cover below the lettering "2Wire Converter" with a paper clip.



When pressing the button inside the converter box you have to be careful not to drop any metal fragments into the unit. The button is located approximately 5 mm below the lid. A pen clip used should be introduced as perpendicular as possible in order to reach only the button. Do not use any long thin wire as this wire could bend and cause a short circuit to the electrical components inside the unit.

**Pairing process:** The pairing buttons of the respective two boxes (or of a box and the XT/XS-board) should be pressed in shortly in succession: When pressing a pairing button the respective green two-wire power LED flashes. This is best done before mounting the boxes. The flashing of the LED indicates that the device performs a pairing operation, in which an exchange of the password occurs. After completing the pairing process, this LED lights up constantly. The devices are now connected and the transfer of data is encrypted.

**The password is stored non-volatile:** The pairing procedure must be performed only once during installation. Even after the failure of the supply voltage the two boxes remain associated with each other, which means they keep the same password. When you exchange a box, or - in the case of 2Wire Option - the XT/XS-device equipped with a 2Wire Option, the pairing must be performed again to facilitate communication and to connect the devices. The pairing can be repeated any number of times.

## 6. LED displays

### 6.1. LEDs for Power-over-Ethernet (PoE) and Ethernet communication



#### PoE PD - green

The LED „PoE PD“ lights up when the converter box is powered by at least one of the above options. If only one network cable is connected, the lighting of this LED indicates that the Ethernet switch used (or an intermediary PoE injector) supplies the converter box with power.



#### PoE PSE - green

If the converter box is supplied with the AC adapter or the two-wire cable, the Ethernet port can also be used as a power source for connected PoE devices according to the 802.3af standard. The LED "PoE PSE" is indicating information with different flashing sequences about the state of supply and possible error conditions. The LED is basically off when there is no power supply of a connected device. Conversely, this LED is on when the connected device is actively supplied with power via PoE. The possible error conditions are signaled by the flashing codes listed in the table:

PSE state	LED code	Flashing sequences
no PD connected	OFF	LED off
PSE port active	ON	LED permanently on
Short circuit at PoE port	Flashing 1 time	LED is flashing 1 time for 100 ms
Overload	Flashing 2 times	LED is flashing 2 times for 100 ms

### 6.2. LEDs at the RJ45 Ethernet connector

An RJ45 Ethernet connector is used to connect the network cable. Two LEDs at the top end of the connector signal the connection status as described below:



#### LED - yellow

This LED is lit if there is an active link, this means the connection is established.



#### LED - green

This LED is lit if there is a full duplex connection. The LED flashes when data is transmitted.

### 6.3. LEDs for two-wire terminal



#### Power green

When this LED is on the modem section of the converter is supplied with power. If this LED does not light even if the unit is powered and PoE-PD-LED is on, the converter is defective and needs to be returned for repair.

**When pairing:** If the pairing button is pressed, this LED flashes regularly and indicates that a pairing process is underway. After pairing is completed, the LED will again light constantly. The process of pairing is described in section 5, "[pairing](#)".



#### Connection - green/yellow/red

Via traffic light colors, the quality of the two-wire connection is indicated:

Connection state	LED
no connection	OFF
active connection - good line quality	ON green
active connection - average line quality	ON yellow
active connection - bad line quality	ON red
Data transmission	Flashing green or yellow

**Bad line quality:** If a bad line quality is signalled, either the cable is too long or the device has eventually been connected incorrectly. In these cases, the installation should be checked, as an abort of the connection and the data transfer is imminent.

## 7. Glossary

10Base-T	Older Ethernet standard by the IEEE 802.3 standard since 1991 for transmission via each twisted pair of wires for transmitting and receiving at a speed of 10 Mbit/s
100Base-TX	Standard Ethernet via so-called structured cabling category Cat-5 (one twisted pair per transmission direction) with a speed of 100 Mbit/s
802.3af	The extension of the Ethernet standard to a power supply for the device. Power-over-Ethernet (PoE) is a procedure that can power network devices via a 4-wire Ethernet cable. The maximum power is 12.5 W.
802.3at	Extended Power-over-Ethernet standard, which is also known as PoE+ or PoE plus, with increased power up to 25 W.
AES	The <b>A</b> dvanced <b>E</b> ncryption <b>S</b> tandard is now the most secure encryption method which was announced as the default and as the successor to the older DES and 3DES methods by the National Institute of Standards and Technology (NIST) since 2000.
Auto-MDIX	Devices with Auto-MDIX function have the ability to autonomously recognize the transmit and receive lines of the connected device and adjust them. Here, the use of cable type (crossed or uncrossed) does not matter.
AWG	<b>A</b> merican <b>W</b> ire <b>G</b> auge is an encoding of the wire diameter and is mostly used in North America. It features electric wires of strands and solid wires and is mainly used in electrical engineering to describe the cross-section of wires.
Crossover cable	A cross cable or crossover cable is in the computer network technology a eight-wire cable, in which some cable wires are crossed in one of the RJ45 connector. While a straight-through Ethernet cable connects computers with switches, you can connect two computers (or two switches) directly using a crossover cable. With the proliferation of auto-MDIX, crossover cables are not required anymore, as network devices can perform the crossover function of the wires electronically when needed.
Full duplex	Today's Ethernet standards have each one pair for transmit and the receive direction. So they can independently and simultaneously transmit and receive. This is known as full duplex operation.
Half duplex	In early Ethernet networks, only one cable was used for both transmission and for reception. So you could not send and receive simultaneously. This alternate sending and receiving is known in communications as half-duplex. This form is still supported if necessary to ensure compatibility with older existing technology.
Pairing	Pairing is the process to assign two devices to each other. During the pairing process, keys are exchanged, so that an encrypted connection between the devices is accomplished without requiring a password entry at each device.
PD	A <b>p</b> owered <b>d</b> evice is a terminal which is powered via Ethernet.
PoE plus	see 802.3at
Power injector	A power injector or PoE Injector is a so-called mid-span device, which is inserted between the network switch and the PD and which supplies power to the respective wires. This may be required if switches are used without PoE function.

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PSE	The <b>P</b> ower <b>S</b> ourcing <b>E</b> quipment is a component of the PoE architecture that finds out whether a PoE-compatible device namely a powered device (PD) is connected and must be supplied with power. When the PSE detects a PD device, it provides it with power over the existing data line. Depending on the power requirements there are several PD classes, which differ in the amount of power that needs to be supplied.
RJ45	With RJ45 8-pin a standard modular connector is called, which is used worldwide for Ethernet networks. In the Ethernet sector shielded terminals and plugs are used. The unshielded version is also used for ISDN.
Signature resistor	The signature resistor refers in the PoE architecture to the characteristic impedance for the equipment to be powered. The PSE device notes with the help of the signature resistor, if a device connected to the network is a PD and to which class this PD corresponds.

## 8. Declaration of Conformity

Adatis GmbH & Co. KG  
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90425 Nuremberg

declares, that the device

### **2WIRE CONVERTER**

comply with the requirements of the directives on electromagnetic compatibility 2004/108/RG and has been developed and manufactured in accordance with the following standards:

transient emissions:  
EN55022, EN61000-3-2, EN61000-3-3

interference resistance:  
EN55024 (EN61000-4-2 bis -6; -8; -11)

Nuremberg, August 1st, 2015

Adatis GmbH & Co. KG

p.p. Michael Gilge (Managing Director)

Note: This declaration becomes invalid if the product without the explicit permission of Adatis  
→ is modified, supplemented or changed in any other way, as well as  
→ in improper connection or improper use.