technica engineering

100BASE-T1 SFP MODULE

USER MANUAL

July 2020

Manual-Version: 2.1

Hardware-Version: 2.7

CONTENT

1 GENERAL INFORMATION

1.1 Functionality and Features of the 100BASE-T1 SFP Module

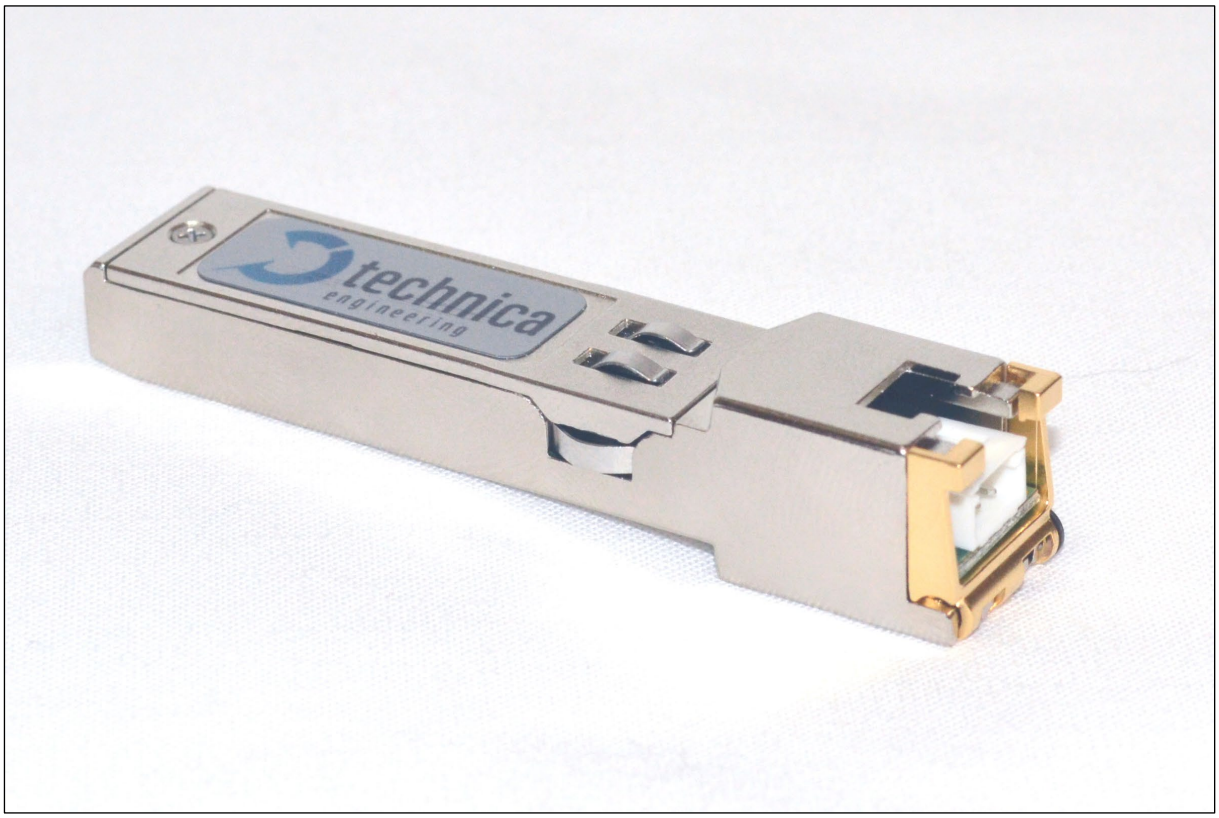


Figure 1-1: 100BASE-T1 SFP MODULE

The **Technica Engineering 1000BASE-T1 SFP Module A2 PHY** fits into a standard Small Form-factor Pluggable slot.

It uses the SGMII and generates 100 Mbit/s full-duplex 100BASE-T1.
It is self-configuring after powerup to Automotive 100BASE-T1.

SERDES interface is not supported!

After power-up, it self-configures to Automotive 1000BASE-T1.
Registers of the integrated transceiver are accessible via an I²C interface for diagnosis and reconfiguration.

The SFP Modules do not work in a “plug-and-play” manner with any SFP-capable system. Only the use with our MediaGateway (https://technica-engineering.de/en/produkt/mediagateway/) can be guaranteed. To set-up the SFP Modules to work in your system, you must be able to interface via I²C and get in touch with Broadcom (the phy manufacturer) to receive the NDA protected phy-register setting datasheet to initialize the phy properly. In this regard, Technica cannot support, due to NDA restrictions.

One Link LED shows link status.

1.1.1 General Information

Voltage requirement:	3.3 Volt DC +/- 0.03 Volt
Size:	68 x 14 x 14 mm
Weight:	0,1 kg
International Protection:	IP 2 0
Operating temperature:	0 to +70 °Celsius

1.1.2 LINKS

The User can download the latest firmware and documentation for the 100BASE-T1 SFP MODULE here:

https://technica-engineering.de/en/produkt/100base-t1-sfp-module/

1.1.3 General operating and safety strategy of Technica Engineering’s Products

Technica Engineering’s products are designed for operation in automotive systems and for supply voltages of nominal 12 V or 24 V. The applicable limit, values adhere to the standard norms for 12 V or 24 V automotive onboard power systems correspondingly and can be found in the mentioned norms.

Should Technica Engineering’s products be operated in voltage ranges beyond those specified in the norms, which represents a breach of the conditions of operation, then this will void the product warranty and Technica Engineering will assume no liability whatsoever for the results and/or consequences thereof.

This is especially valid whenever the voltage level reaches or exceeds the limits of the low-voltage directive. In this case, damage to the devices cannot be excluded. Due to the manufacturing characteristics of the devices, there is no imminent fire hazard from the device itself, if the devices are being operated in an environment according to the conditions of use. A secondary fire hazard cannot be excluded, should those conditions not be met. Protection against overvoltage cannot be provided in such a breach of the conditions of use.

1.1.4 General design rules for the power supply of Technica Engineering's products

The power supply circuit of Technica Engineering's products is equipped with self-protection components. This automatic function protects the devices against excessive temperature and too high supply-voltage by switching the device off. This automatic switch-off function is independent of any software function.

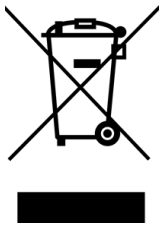
The root cause of excessive temperature in the power supply circuit can eventually be due to a too high environment temperature or due to an internal failure of the device. In both cases, the automatic switch-off function will switch off the power supply from the device to avoid further damage.

The protection against too high supply-voltage protects the device even in case of an internal failure of the Technica Engineering device.

1.2 Warranty and Safety Information

	Before operating the device, read this manual thoroughly and retain it for your reference. The latest documentation for the 100BASE-T1 SFP Module can be downloaded here: https://technica-engineering.de/en/produkt/100base-t1-sfp-module/
	Use the device only as described in this manual. Use only in dry conditions. Do not insert any foreign object in the slots/openings of the housing. Do not apply power to a damaged device. The device may only be used by specialists.

	Do not open the device. Otherwise, the warranty will be lost.
	This product is intended for use in automotive-test environments. An automotive-test environment includes test setups or test benches in the office, laboratory and workshop areas. In the test setups, the same environmental conditions apply as in vehicle electrical systems. Technica Engineering products are not intended to be used as standard IT equipment. The test systems and products from Technica Engineering are designed as customer and application-specific test modules that are only used by specialists for the development and test facilities. When integrating the modules in a vehicle or test set-up, the user must ensure appropriate ventilation or air convection. Technica Engineering products must not be considered as a safety element out of context when using safety-critical systems and must be included in the safety assessment when used. The development class in a safety system must be taken into account with standard QM referred to ISO26262.
	 The device can get hot. Do not cover the device due to fire danger. Do not place the device near highly flammable materials due to fire danger. Do not use the device above the specified operating temperature. The operating temperature is the ambient temperature of the installation space.

	This symbol is only valid in the European Union. If you wish to discard this product, please contact your local authorities or dealer and ask for the correct method of disposal. Technica Engineering GmbH is registered as a manufacturer of the brand "Technica Engineering" and the device type "Small devices of Information- and Telecommunications- technology for exclusive use in non-private Households". WEEE reg. No. DE 20776859
CE	Please refer to CHAPTER 8 for the EU Declaration of Conformity following Directive 2014/30/EU.

1.3 RoHS Certificate of Compliance

Technica Engineering's 100BASE-T1 SFP Module complies with RoHS (Restriction of Hazardous Substances Directive) Certificate of Compliance.

2 HARDWARE INTERFACES

2.1 Molex Connector

The 100BASE-T1 line is connected by a Molex connector.

Hardware Versions 2.7 and higher use:

- Molex 0533250260 Header 2.0mm
- Molex 510900200 Housing
- Molex 50212-8000 Crimp Contact

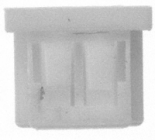
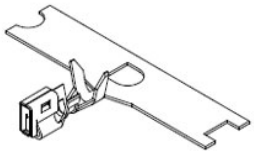
Name	Picture	Part Number
Molex Header 2.0mm		0533250260
Molex Housing		51090-0200
Molex 50212-8000 Crimp Contact		50212-8000

Table 2-1: Parts Molex Connector

Pinning:

Pin	Function	Pin	Function
1	100BASE-T1 Plus	2	100BASE-T1 Minus

Table 2-2: Pinning of Molex Connector

2.2 SFP Socket Connector

Pinning:

Pin	Function	Pin	Function
1	GND	11	GND
2	GND	12	SGMII_RXD_N
3	n.c.	13	SGMII_RXD_P
4	I2C_DAT	14	GND
5	I2C_CLK	15	3.3. Volt
6	GND	16	3.3. Volt
7	n.c.	17	GND
8	GND	18	SGMII_TXD_P
9	n.c.	19	SGMII_TXD_N
10	GND	20	GND

Table 2-3: Pinning of SFP Socket Connector

3 STARTUP AND CONFIGURATION

3.1 Startup

After 3.3 Volt power is applied, the SFP module starts up and self-configures the BCM54811S transceiver by the I2C interface. This lasts 100ms. In the first 100ms, the processor on the module acts as an I2C master. Do not apply any master activity on the bus during this time!

3.2 Self-Configuration

The SFP Module configures itself to 100BASE-T1 after power-up. Master-/Slave Configuration is done according to the DIP switch on the bottom of the device.

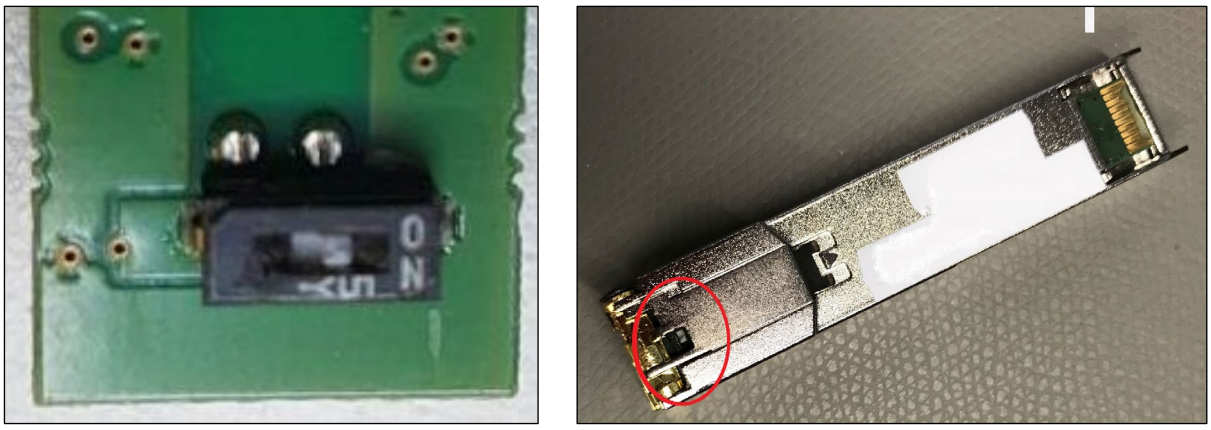


Figure 3-1: DIP-Switch

To reconfigure the DIP switch the lock has to be opened (see pictures).

ON/right = as Master
OFF/ left = as Slave

3.3 I2C Interface

3.3.1 I2C configuration

100ms after power-up of the module it can be configured by I2C.

The module operates with f_{SCL} up to 100kHz without requiring clock stretching.
The module may clock stretch with f_{SCL} greater than 100kHz and up to 400 kHz.

The module processor listens as a slave on the 7-bit address 0x50.

b1010 000X = 0xA0
Read access beyond address 95 will return 0x00.

The BCM54811S transceiver can be accessed at I2C slave 7-bit address 0x40.

b1000 000X = 0x80

Read access to register 0x02 will always return 0x03, 0x62 (Device ID).
Write access to register 0x00 with value 0x02, 0x00 will configure the module to BR Slave.
Write access to register 0x00 with value 0x02, 0x08 will configure the module to BR Master.

For a complete register map please have a look at the BCM54811S datasheet (Broadcom NDA required).

3.3.2 I2C map register

Memory-Map (read only registers):

Data Bytes	Byte Number	Comment
0x03	0	Identifier SFP
0x04	1	Ext. Identifier
0x80	2	Connector
0x00, 0x00, 0x00, 0x00	3-6	Transceiver high
0x00, 0x00, 0x00, 0x00	7-10	Transceiver low
0x00	11	Encoding
0x01	12	Bitrate Nominal in 100 MBit
0x00	13	Reserved
0x00	14	Link Length Fiber
0x00	15	Link Length Fiber
0x00	16	Link Length Fiber
0x00	17	Link Length Fiber
0x0A	18	Link Length Copper in meter
0x00	19	Reserved
'T','e','c','h','n','i','c','a',' ','E','n','g','.', ' ',' ',' '	20-35	Vendor Name
0x00	36	Reserved
0x00, 0x00, 0x00	37-39	Vendor ID
'1','0','0','B','A','S','E','-','T','1',' ',' ',' ', ' ',' ',' '	40-55	PartNumber
0x00, 0x00, 0x00, 0x00	56-59	Revision Number
0x00, 0x00, 0x00	60-62	Reserved
0xBC	63	Check Code for Field 0-62
0x00, 0x00	64-65	Options
0x00	66	Bitrate max
0x00	67	Bitrate min
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00	68-83	Serial Number String
0x00, 0x00, 0x00, 0x00	84-87	Date Code high
0x00, 0x00, 0x00, 0x00	88-91	Date Code low
0x00, 0x00, 0x00	92-94	Reserved
0x42	95	Check Code Extended for Field 64-94

Table 3-1: Memory map

3.3.3 I2C Device addressing and operation

3.3.3.1 I2C Current address read

The current read operation only requires the device address to read the word to be sent. When the acknowledgment is received from the SFP module, the current address data word is serially clocked out.

Example: Read the current address of the SFP module (b1010000X).

		<-I2C_device ->																		
HOST	START	MSB						LSB	READ										NACK	STOP
		1	0	1	0	0	0	0	1	0	X	X	X	X	X	X	X	X	1	
SFP										ACK	MSB							LSB		
											<- DATA WORD->									

3.3.3.2 Random address read

The random address read requires two operations to perform the read.

Example: Read a random address of the SFP module (b1010000X)
First, a write operation to specify the address desired to read:

		<-I2C_device ->									<-I2C Memory address->								
HOST	START	MSB						LSB	WRITE		MSB							LSB	
		1	0	1	0	0	0	0	0	0	X	X	X	X	X	X	X	X	0
SFP										ACK									ACK

Then a read operation to read the previous address specified:

		<-I2C_device ->																		
HOST	START	MSB						LSB	READ										NACK	STOP
		1	0	1	0	0	0	0	1	0	X	X	X	X	X	X	X	X	1	
SFP										ACK	MSB							LSB		
											<- DATA WORD->									

3.3.3.3 Sequential read

The sequential reads are started by either a current word address read or a random address read. To specify a sequential read, the host responds with an acknowledge instead of a stop after each data word.

First, a write operation to specify the address desired to read:

		<-I2C_device ->									<-I2C Memory address->								
HOST	START	MSB						LSB	WRITE		MSB							LSB	
		1	0	1	0	0	0	0	0	0	X	X	X	X	X	X	X	X	0
SFP										ACK									ACK

Then the read operations:

		<-I2C_device ->																																
HOST	START	MSB						LSB	READ										ACK											NACK	STOP
		1	0	1	0	0	0	0	1	0	X	X	X	X	X	X	X	X	1	X	X	X	X	X	X	X	X	1	
SFP										ACK	MSB							LSB		MSB							LSB				
											<-DATA WORD n->									<-DATA WORD n+1->											

3.3.3.4 Byte write

The write operation requires 8-bits of data word address following the device address write word and acknowledgment.

Example: Byte write operation into the SFP module (b1010000X)

		<-I2C_device ->									<-MEMORY ADDRESS->									<-DATA WORD->									
HOST	START	MSB						LSB	WRITE		MSB							LSB		MSB							LSB		STOP
		1	0	1	0	0	0	0	0	0	X	X	X	X	X	X	X	X	0	X	X	X	X	X	X	X	X	0	
SPF										ACK									ACK									ACK	

3.3.3.5 Sequential write

The sequential write is started in the same way as a single byte write, but the hostmaster does not send a stop condition after the first word is clocked in.

		<-I2C_device ->									<-MEMORY ADDRESS->									<-DATA WORD 1->									<-DATA WORD 2->									
HOST	START	MSB						LSB	WRITE		MSB							LSB		MSB							LSB		MSB							LSB		STOP
		1	0	1	0	0	0	0	0	0	X	X	X	X	X	X	X	X	0	X	X	X	X	X	X	X	X	0	X	X	X	X	X	X	X	X	0	
SPF										ACK									ACK									ACK									ACK	

4 ADDITIONAL INFORMATION

- The 100BASE-T1 SFP MODULE is optimized for automotive use. The maximum cable length for 100BASE-T1 segments is limited to 15 meters
- A Bug in the used 100BASE-T1 PHY shows a linkup on the slave-side (LED is lit), even if the plus and minus PINs are swapped. Data transmission is not possible

5 LIST OF FIGURES

6 CHANGELOG

Version	Chapter	Description	Date
1.0	All	First release	
2.0	All	Complete rework of all chapters	25.04.2019
2.1	1.1.3	Added information on General Operating and Safety Strategy of Technica Engineering's Products	July 2020
	1.1.4	Added information on General Design Rules for the Power Supply of Technica Engineering's Products	
	1.2	Warranty and Safety Information updated	
	1.3	RoHS Certificate of Compliance added	
	8	Declaration of conformity added	

7 CONTACT

If you have any questions regarding this product, please feel free to contact us:

Technica Engineering GmbH
Leopoldstr. 236
80807 München
Germany

Technical support:
support@technica-engineering.de

General Information:
Info@technica-engineering.de

Most current user manuals and product information:
https://technica-engineering.de/en/

8 DECLARATION OF CONFORMITY

Български

С настоящото Technica Engineering GmbH декларира, че продуктът Модул за улавяне 100BASE-T1 SFP Module (TE-1430), е в съответств ие с Директива 2014/30/ЕС. Цялостният текст на ЕС декларацията за съответствие може да се намери н а следния интернет адрес:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Čeština

Tímto Technica Engineering GmbH prohlašuje, že produkt 100BASE-T1 SFP Module (TE-1430), je v souladu se směrnicí 2014/30/EU. Úplné znění EU prohlášení o shodě je k dispozici na této internetové adrese:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Dansk

Hermed erklærer Technica Engineering GmbH, at produktet 100BASE-T1 SFP Module (TE-1430), er i overensstemmelse med Direktiv 2014/30/EU. EU-overensstemmelseserklæringens fulde tekst kan findes p følgende internetadresse:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Deutsch

Hiermit erklärt Technica Engineering GmbH, dass das Produkt 100BASE-T1 SFP Module (TE-1430) die Richtlinie 2014/30/EU entspricht. Der vollständige Text der EU-Konformitätserklärung ist unter der folgenden Internetadresse verfügbar:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Eesti

Käesolevaga deklareerib Technica Engineering GmbH, et toode hõivamismoodul 100BASE-T1 SFP Module (TE-1430), vastab direktiivi 2014/30/EL nuetele. ELi vastavusdeklaratsiooni tielik tekst on kttesaadav jrgmisel internetiaadressil:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

English

Hereby, Technica Engineering GmbH declares that the product 100BASE-T1 SFP Module (TE-1430), complies with Directive 2014/30/EU. The full text of the EU declaration of conformity is available at the following internet address:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Español

Por la presente, Technica Engineering GmbH declara que el producto 100BASE-T1 SFP Module (TE-1430), es conforme con la Directiva 2014/30/UE. El texto completo de la declaración UE de conformidad está disponible en la página web siguiente:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Ελληνικά

Με την παρούσα ο/η Technica Engineering GmbH, ότι το προϊόν 100BASE-T1 SFP Module (TE-1430), πληροί την οδηγία 2014/30/ΕΕ. Το πλήρες κείμενο της δήλωσης συμμόρ φωσης ΕΕ διατίθεται στην ακόλουθη ιστοσελίδα στο διαδίκτυο:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Français

Le soussigné, Technica Engineering GmbH, déclare que le produit 100BASE-T1 SFP Module (TE-1430), est conforme la directive 2014/30/UE. Le texte complet de la déclaration UE de conformité est disponible l'adresse internet suivante:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Hrvatski

Technica Engineering GmbH ovime izjavljuje da je proizvod 100BASE-T1 SFP Module (TE-1430) u skladu s Direktivom 2014/30/EU. Cjeloviti tekst EU izjave o sukladnosti dostupan je na sljedećoj internetskoj adresi:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Italiano

Il fabbricante, Technica Engineering GmbH, dichiara che il prodotto 100BASE-T1 SFP Module (TE-1430), conforme alla direttiva 2014/30/UE. Il testo completo della dichiarazione di conformità UE disponibile al seguente indirizzo Internet:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Latviešu

Ar šo Technica Engineering GmbH deklarē, ka produkts 100BASE-T1 SFP Module (TE-1430), atbilst Direktīvai 2014/30/ES. Pilns ES atbilstības deklarācijas teksts ir pieejams šādā interneta v ietnē:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Lietuvių

Aš, Technica Engineering GmbH, patvirtinu, kad produktas sugavimo modulis 100BASE-T1 SFP Module (TE-1430), atitinka Direktyvą 2014/30/ES. Visas ES atitikties deklaracijos tekstas prieinamas šiuo internet adresu:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Magyar

Technica Engineering GmbH igazolja, hogy a termék 100BASE-T1 SFP Module (TE-1430) a 2014/30/EU irányelvnek. Az EUmegfelelőségi nyilatkozat teljes szövege elérhető a következő internetes címen:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Malti

B'dan, Technica Engineering GmbH, niddikjara li l-prodott 100BASE-T1 SFP Module (TE-1430), huwa konformi madDirettiva 2014/30/UE. It-test kollu tad-dikjarazzjoni ta' konformit tal-UE huwa disponibbli f'dan l-indirizz tallnternet li ġej:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Nederlands

Hierbij verklaar ik, Technica Engineering GmbH, dat het 100BASE-T1 SFP Module (TE-1430) product voldoet aan richtlijn 2014/30/EU. De volledige tekst van de EUconformiteitsverklaring kan worden geraadpleegd op het volgende internetadres:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Polski

Technica Engineering GmbH niniejszym oświadcza, że produkt 100BASE-T1 SFP Module (TE-1430), jest zgodny z dyrektywą 2014/30/UE. Pełny tekst deklaracji zgodnośc I UE jest dostępny pod następującym adre sem internetowym:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Português

O(a) abaixo assinado(a) Technica Engineering GmbH declara que o produto 100BASE-T1 SFP Module (TE-1430), está em conformidade com a Diretiva 2014/30/UE. O texto integral da declarao de conformidade está disponível no seguinte endereo de Internet:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Română

Prin prezenta Technica Engineering GmbH declară ca produsul 100BASE-T1 SFP Module (TE-1430), este în conformitate cu Directiva 2014/30/UE. Textul integral al declarației UE de conformitate este disponibil la următoarea adresă internet:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Slovensko

Technica Engineering GmbH potrjuje, da je izdelek 100BASE-T1 SFP Module (TE-1430), skladen z irektivo 2014/30/EU. Celotno besedilo izjave EU o skladnosti je na voljo na naslednjem spletnem naslovu:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf

Slovensky

Technica Engineering GmbH týmto vyhlasuje, že product 100BASE-T1 SFP Module (TE-1430), je v slade so smernicou 2014/30/EÚ. Úplné EÚ vyhlásenie o zhode je k dispozícii na tejto internetovej adrese:
https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-1430.pdf