

1000BASE-T1 SFP MODULE A2 PHY

USER MANUAL

March 2021

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1 GENERAL INFORMATION


1.1 Functionality and Features of the 1000BASE-T1 SFP Module A2 PHY




Figure 1-1: 1000BASE-T1 SFP Module A2 Phy

The **Technica Engineering 1000BASE-T1 SFP Module A2 PHY** fits into a standard Small Form-factor Pluggable slot. It uses the SGMII and generates 1000 Mbit/s full-duplex.

 SERDES interface is not supported!

 100BASE-T1 is not supported!

After power-up, it self-configures to Automotive 1000BASE-T1. Registers of the integrated transceiver are accessible via the 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 Marvell (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 Features

- 1000BASE-T1 and SGMII converter
- Marvell 88Q2112 A2 PHY (“IEEE Compliant” (See [CHAPTER 4.1](#)) or “A0 compatible” mode settable via phy register settings)
- Fits into a standard SFP slot
- Power requirements: 3.3 Volt DC
- Supports I2C for internal register access
- Master/Slave either via small DIP switch or PHY register settings
- Status LEDs
- DIP switch for Master/ Slave configuration

1.1.2 General Information

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

1.1.3 LINKS

The User can download the latest firmware and documentation for the 1000BASE-T1 SFP Module A2 PHY here:

<https://technica-engineering.de/en/produkt/1000base-t1-sfp-module/>

1.1.4 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.





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



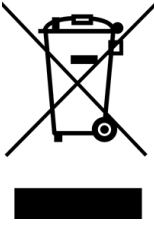

The power supply solution of Technica Engineering's products is equipped with a self-protection mechanism. This automatic function protects the internal electronic components against excessive temperature and too high supply-voltage by switching the device off. This automatic switch-off function is independent of any software function. Excessive temperatures in the device, can be caused by high environmental temperatures or internal failures of the device. The device can protect itself by shutting down its own power supply avoiding further damage to itself.

The operator/user of this devices must take measures for the right protection of the power supply lines and the according connector. The maximum power consumption of the Technica Engineering products is written in this user manual.

Please take care that some of the products are working with a step-up converter. So, the current needed in case of undervoltage conditions must be considered as higher than at nominal voltage level. The user must choose the right fuse or other over current protection measures.

1.2 Warranty and Safety Information

	<p>Before operating the device, read this manual thoroughly and retain it for your reference.</p> <p>The latest documentation for the 1000BASE-T1 SFP Module can be downloaded here: https://technica-engineering.de/en/produkt/1000base-t1-sfp-module/</p>
	<p>Use the device only as described in this manual.</p> <p>Use only in dry conditions.</p> <p>Do not insert any foreign object in the slots/openings of the housing.</p> <p>Do not apply power to a damaged device.</p> <p>The device may only be used by specialists.</p>
	<p>Do not open the device. Otherwise, the warranty will be lost.</p>
	<p>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.</p> <p>When integrating the modules in a vehicle or test set-up, the user must ensure appropriate ventilation or air convection.</p> <p>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.</p>

	<p> The device can get hot.</p> <p>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.</p>
	<p>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</p>
	<p>Please refer to CHAPTER 8 for the EU Declaration of Conformity following Directive 2014/30/EU.</p>

1.3 RoHS Certificate of Compliance

Technica Engineering's 1000BASE-T1 SFP Module complies with RoHS (Restriction of Hazardous Substances Directive) Certificate of Compliance.

2 HARDWARE INTERFACES

2.1 Molex Connector

The 1000BASE-T1 line is connected by a Molex connector.

Hardware Version 2.3. uses:

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


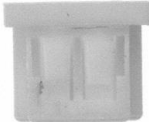
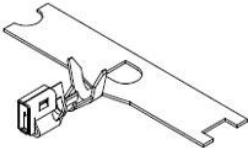
Name	Picture	Part Number
Molex Header 2.0mm		0533250260
Molex Housing		51090-0200
Molex 50212-8000 Crimp Contact		50212-8000

Table 2-1: Parts Molex Connector

Pinning:

Pin	Function	Pin	Function
1	1000BASE-T1 Plus	2	1000BASE-T1 Minus

Table 2-2: Pinning of Molex Connector

2.2 SFP Socket Connector

SFP Socket connector:

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 black MQS connector

3 STARTUP AND CONFIGURATION

3.1 Startup

After 3.3 Volt power is applied, the SFP module starts up and self-configures the 88Q2112_A2 transceiver by MDIO interface. This lasts 100ms. Do not apply any I2C activity on the bus during this time!

3.2 Self-Configuration

The SFP Module configures itself to 1000BASE-T1 after power-up. Master-/Slave Configuration is done according to the DIP switch on the bottom of the device.

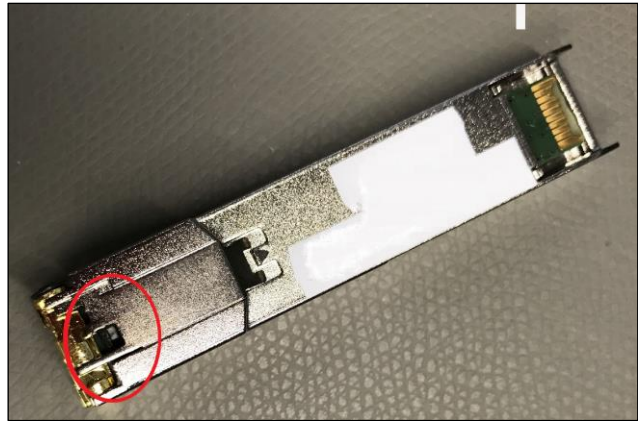


Figure 3-1: DIP-Switch

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 53kHz without requiring clock stretching. The module may clock stretch with f_{SCL} greater than 53kHz 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 88Q2112_A2 transceiver can be accessed at I2C slave 7-bit address 0x40.

 b1000 000X = 0x80

The 88Q2112_A1 PHY does not support I2C interfaces. However, the microcontroller acts as a bridge between the host and the PHY. Commands from the Host are processed by the microcontroller. The microcontroller accesses the PHY through the MDIO interface and forwards the information to the Host.

For a complete register map please have a look at the 88Q2112_A1 datasheet (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
'1','.', '1', 0x00	56-59	Revision Number 1.1
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).

3.3.4 I2C access to the 88Q2112_A2 transceiver

The 88Q2112_A2 PHY listens as a slave on the 7-bit address 0x40. Every internal register of the PHY (16 bits) is accessed by defining the Device Number (1 byte) and the Register address (2 bytes). The I2C Memory address is mapped as:

Address	Register name
0x00	Device number
0x01	Register_address_MSB
0x02	Register_address_LSB
0x03	PHY_Register_Operation_Status
0x04	PHY_Register_data_MSB
0x05	PHY_Register_data_LSB

Table 3-2: Register addresses

3.3.4.1 Register description

- **Device number:**
 Defines the device number of the register to access
- **Register_address_MSB:**
 Defines the Most significant byte of the register to access
- **Register_address_LSB:**
 Defines the Less Significant Byte of the register to access
- **PHY_Register_Operation_Status**
 - **Bit 0 – Read Start Condition Flag (Read/Write)**
 This flag is set by the master after specifying the first 3 bytes of the register (Devices number, Register_address_MSB and Register_address_LSB) when a read operation is triggered.
 - **Bit 1 – Read In Progress Flag (Read)**
 This flag is set by the slave during the reading operation
 - **Bit 2 – Read Operation Done Flag (Read)**
 This flag is set by the slave when the reading operation is finished. This flag can be read after triggering the read to ensure that the data has finished reading.
 - **Bit 3 – Write Start Condition Flag (Read)**
 This flag is set by the slave when a write operation is triggered.

- **Bit 4 – Write In Progress Flag (Read)**
This flag is set by the slave during the writing operation

- **Bit 5 – Write Operation Done Flag (Read)**
This flag is set by the slave when the writing operation is finished. This flag can be read after writing the PHY_register_data_LSB to ensure that the data has finished writing

- **PHY_register_data_MSB**
When a reading operation, this register contains the MSB of the PHY register.
When a write operation, this register contains the MSB to write in the PHY register

- **PHY_register_data_LSB**
When a reading operation, this register contains the LSB of the PHY register.
When a write operation, this register contains the LSB to write in the PHY register

4 ADDITIONAL INFORMATION

- The 1000BASE-T1 Port is optimized for automotive UseCase. The maximum line length for each 1000BASE-T1 segment is limited to 10 meters.
- In the previous versions because of a bug not all the messages were forwarded from I2C to MDIO but this Bug has been fixed in software version 1.0.4.

4.1 Disclaimer

The “**IEEE Compliant mode**” is defined by the chip vendor. Technica Engineering cannot be held responsible for the interoperability of this chip and hence the complete product with other devices if the interoperability issues are caused by the “**IEEE Compliant mode**”.

5 LIST OF FIGURES

Figure 1-1: 1000BASE-T1 SFP Module A2 Phy	3
Figure 3-1: DIP-Switch	10

6 CHANGELOG

Version	Chapter	Description	Date
1.0	All	First release	
2.0	All	Second release	21.09.2018
2.1.1	All	Design and correction of the bugs	05.03.2019
2.1.2	All	Control the User Manual of A2 Phy	08.05.2019
2.2	All	Rework	25.09.2019
2.3	Cover and 1.2	Rework and update	Jun 2020
2.4	1.1.4	Added information on General Operating and Safety Strategy of Technica Engineering's Products	July 2020
	1.1.5	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	
2.5	4	Additional information added	Jan 2021
2.6	4.1	Disclaimer for Marvell IEEE Mode added	March 2021

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 1000BASE-T1 SFP Module (TE-1437), е в съответствие с Директива 2014/30/ЕС. Цялостният текст на ЕС декларацията за съответствие може да се намери на следния интернет адрес:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Čeština

Tímto Technica Engineering GmbH prohlašuje, že produkt 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>

Dansk

Hermed erklærer Technica Engineering GmbH, at produktet 1000BASE-T1 SFP Module (TE-1437), er i overensstemmelse med Direktiv 2014/30/EU. EU-overensstemmelseserklæringens fulde tekst kan findes på følgende internetadresse:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Deutsch

Hiermit erklärt Technica Engineering GmbH, dass das Produkt 1000BASE-T1 SFP Module (TE-1437) 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-te-1437.pdf>

Eesti

Käesolevaga deklareerib Technica Engineering GmbH, et toode hõivamismoodul 1000BASE-T1 SFP Module (TE-1437), vastab direktiivi 2014/30/EL nõuetele. ELi vastavusdeklaratsiooni tselik tekst on kttesaadav jrgmisel internetiaadressil:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

English

Hereby, Technica Engineering GmbH declares that the product 1000BASE-T1 SFP Module

(TE-1437), 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-te-1437.pdf>

Español

Por la presente, Technica Engineering GmbH declara que el producto 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>

Ελληνικά

Με την παρούσα ο/η Technica Engineering GmbH, ότι το προϊόν 1000BASE-T1 SFP Module (TE-1437), πληροί την οδηγία 2014/30/ΕΕ. Το πλήρες κείμενο της δήλωσης συμμόρφωσης ΕΕ διατίθεται στην ακόλουθη ιστοσελίδα στο διαδίκτυο:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Français

Le soussigné, Technica Engineering GmbH, déclare que le produit 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>

Hrvatski

Technica Engineering GmbH ovime izjavljuje da je proizvod 1000BASE-T1 SFP Module (TE-1437) 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-te-1437.pdf>

Italiano

Il fabbricante, Technica Engineering GmbH, dichiara che il prodotto 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>

Latviešu

Ar šo Technica Engineering GmbH deklarē, ka produkts 1000BASE-T1 SFP Module (TE-1437), atbilst Direktīvai 2014/30/ES. Pilns ES atbilstības deklarācijas teksts ir pieejams šādā interneta vietnē:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Lietuvių

Aš, Technica Engineering GmbH, patvirtinu, kad produktas sugavimo modulis 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>

Magyar

Technica Engineering GmbH igazolja, hogy a termék 1000BASE-T1 SFP Module (TE-1437) a 2014/30/EU irányelvnek. Az EÜmegfelelőségi nyilatkozat teljes szövege elérhető a következő internetes címen:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Malti

B'dan, Technica Engineering GmbH, niddikjara li l-prodott 1000BASE-T1 SFP Module (TE-1437), huwa konformi madDirettiva 2014/30/UE. It-test kollu tad-dikjarazzjoni ta' konformit ta-UE huwa disponibbli f'dan l-indirizz talInternet li ġej:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Nederlands

Hierbij verklaar ik, Technica Engineering GmbH, dat het 1000BASE-T1 SFP Module (TE-1437) 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-te-1437.pdf>

Polski

Technica Engineering GmbH niniejszym oświadcza, że produkt 1000BASE-T1 SFP Module (TE-1437), jest zgodny z dyrektywą 2014/30/UE. Pełny tekst deklaracji zgodności UE jest dostępny pod następującym adresem internetowym:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Português

O(a) abaixo assinado(a) Technica Engineering GmbH declara que o produto 1000BASE-T1 SFP Module (TE-1437), está em conformidade com a Diretiva 2014/30/UE. O texto integral da declaração de conformidade está disponível no seguinte endereço de Internet:

<https://technica-engineering.de/wp-content/uploads/2021/03/eu-declaration-of-conformity-te-1437.pdf>

Română

Prin prezenta Technica Engineering GmbH declară ca produsul 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>

Slovensko

Technica Engineering GmbH potrjuje, da je izdelek 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>

Slovensky

Technica Engineering GmbH týmto vyhlasuje, že produkt 1000BASE-T1 SFP Module (TE-1437), 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-te-1437.pdf>