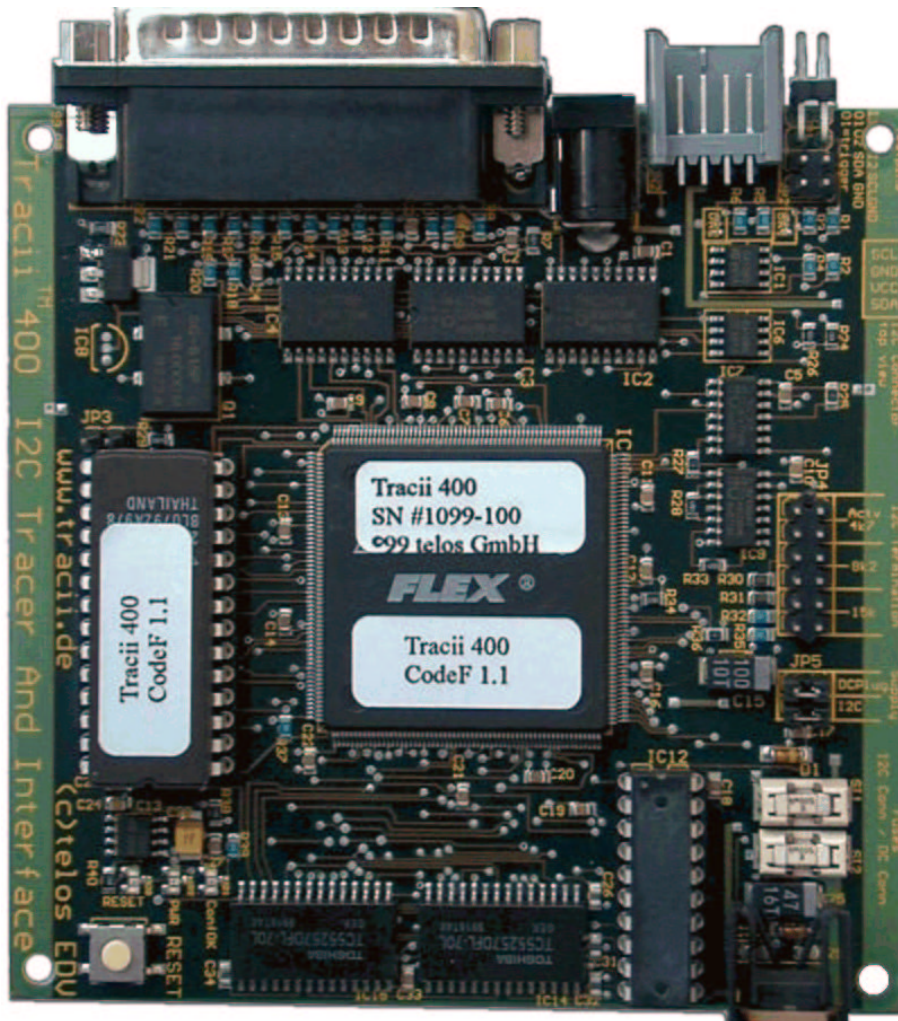


400 kBit/s I2C Interface and Monitor

Tracii400

Document-Version 2.0 (25.10.2002)



USER MANUAL

telos EDV Systementwicklung GmbH

<http://www.telos.info/>

Important Note!

Before the hard- and software is used, this user manual should be read with attention.

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1. Terms

5V I2C	I2C bus operating at a voltage of 5V
EPP	Enhanced Parallel Port
I2C	Two-wire communication bus
SDA	I2C signal line: Data
SCL	I2C signal line: Clock
SUB-D	Connector Type
Tracii 400	I2C Tracer from telos

2. Limitations

This product is not designed for use in life support appliances, devices, or systems where malfunction of this product can reasonably be expected to result in personal injury. Customers using or selling this product for use in such applications do so at their own risk and agree to fully indemnify telos for any damages resulting from such improper use or sale.

3. General Product Description

The **Tracii400** device is a development tool for I2C bus systems. Attached to a personal computer's parallel port, it can be used as an I2C tracer, I2C master or I2C slave provided that an application software is installed on the personal computer, which supports these features.

3.1. Common Properties

- The device supports 7- and 10-bit I2C addresses.
- It can deal with transfer rates up to 400 kBit/s and is Standard- and Fast-Mode compliant.
- The I2C bus termination can be configured.
- The device is connected to the personal computer via the EPP interface (bi-directional parallel port).
- The board size is 10cm * 10cm.
- The **Tracii400** device can be supplied either by the power supply of the I2C bus or by an external power supply (8-9 V).
- An internal 64k buffer is available for trace- master- and slave-data.

3.2. Tracer Properties

As a **tracer** device, it provides the opportunity to monitor the data transfers on a given I2C bus.

- The tracer writes the traced data in the internal buffer.
- Traces can be limited to certain addresses.
- If the personal computer is unable to read the trace data in real-time, the I2C clock is stretched before an internal buffer overflow occurs.
- Trigger outputs can be used to detect start conditions, stop conditions, acknowledge bits and frame errors.

- Timestamps are supported

3.3. Master- and Slave-Properties

The **master** function allows the device to be used as an I2C master. It can initiate data transfers to and from slave devices.

The device can also operate as an **I2C slave** and listen to certain I2C addresses and respond to transfer requests issued by other master devices in a predefined manner.

4. About this Manual

The **Tracii400** device is a peripheral device. The device's features can be used only via an application software that supports these features.

This document focuses on the **Tracii400** device hardware and describes the features that can be offered by the device. In order to use the device efficiently, it is necessary to read the software documentation, as well.

Depending on the used software, the purchased licenses and the personal computer's performance, some features that are described in the following sections may be limited or not available.

5. Product Quality

This product has been carefully developed with a focus on quality. However, quality can always be further improved. telos appreciates every hint that may serve this purpose. Chapter 9 includes addresses where such information can be sent to.

6. Introduction

6.1. Part List

The parts listed below have been shipped with the product. Before the hardware is used for the first time, it should be carefully checked, if all parts are included in the box and if the parts have not been obviously damaged during delivery.

If parts are missing or damaged, refer to the chapter 9.

- **Tracii400** Board
- Plug for the I2C connector
- telos Product CD including the user manual

6.2. Additional Requirements

In order to use the device, a personal computer is required which runs a tracer software that supports the **Tracii400** device.

The personal computer must provide an EPP-compliant parallel port for the device attachment.

Currently, telos offers the following software products for **Tracii400** devices:

- **TraciiTalk** features master- and slave-support.
- **TraciiSpy** is a software that permits the usage of the device's tracer function.
- **TraciiWork** is an application programming interface. It is recommended for users who want to build customized I2C applications on the PC.

For details and information about further products please refer to

<http://www.telos.info/> or chapter 9.

7. Installation

This chapter provides a step-by-step instruction that should guide you through the installation of the device.

7.1. Unpacking

Tracii400 devices, like all electronic equipment, are static sensitive. Please take the proper precautions when handling such a device. Keep the board in its conductive wrapping until you are ready to use it. Use and store it in an ESD-safe location.

7.2. Power Supply Configuration

The device's power supply can be configured in three different ways:

- The device can be powered by the attached I2C bus.
- The device can be powered by an external power supply.
- The device can be powered by an external power supply and it can additionally provide the power supply for the I2C bus.

The configuration is done by the jumper JP5 which is shown in Figure 1.

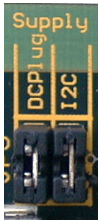


Figure 1: Power Supply Configuration

Details concerning these configurations can be found in sections 7.2.1, 7.2.2 and 7.2.3.

The powerline of the I2C bus is protected by the 500mA fuse SI1. The powerline of the external power supply is protected by the 500mA fuse SI2. A red signal on the board is active when the board is correctly supplied. If that signal is not active even though a power supply (via I2C bus or external power supply) seems to be properly attached according to the following sections, the corresponding fuse must be checked.

Warning: The fuses must not be replaced by fuses with other values than 500mA.

7.2.1. Separate Power Supplies for I2C Bus and Tracii400

If the *Tracii400* device should be supplied by an external power supply and the I2C bus comes with its own power supply, the Jumper “I2C” must be removed and the Jumper “DCPlug” must be set.

This configuration is required if the supply of the I2C bus cannot be charged by additional 200mA.

7.2.2. Single External Power Supply for I2C Bus and Tracii400

An I2C bus which does not draw more than 50mA, can be supplied by an external power supply that is connected to the *Tracii400* device. The external power supply must provide a stabilised voltage of 8-9 Volt and a current of at least 200mA.

In order to use this configuration, both jumpers “I2C” and “DCPlug” of JP5 (Figure 1) must be connected.

7.2.3. Tracii400 Device supplied by the I2C Bus

If the I2C bus that is attached to the *Tracii400* device, can be charged with additional 200mA; it can be used to supply the tracer. Then, an external power supply is not required.

In that case, the jumper “I2C” must be connected and the jumper “DCPlug” must be removed.

7.3. Device Attachment

When the power supply has been properly pre-configured, the device can be attached to the PC, the power supply, the I2C bus and the test pins.

7.3.1. PC Connection

The device must be connected to the personal computer’s EPP-compliant parallel port. A simple D-SUB 25 one-by-one cable with a female and a male end has to be used for connection.

The EPP mode may have to be configured in the personal computer’s BIOS set-up. Refer to the PC’s documentation for further information. Please note that the ECP and other modes are not supported by *Tracii400* devices.

7.3.2. Power Supply

After the device has been connected to the personal computer and the jumpers related to the power supply have been configured according to section 7.2, the external power supply can be connected if it is required.

7.3.3. I2C Connection and Bus Termination

Connection

The I2C bus has to be connected to the 4-pin connector shown in Figure 2. The pin allocation is given in Table 1.

Only those I2C buses can be connected to a *Tracii400* device which are operating at a voltage of 5-5.5 Volt.

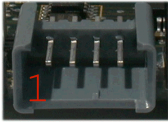


Figure 2: I2C Bus Connector

PIN	Name	Description
1	SCL	I2C Clock Line
2	GND	Common Ground
3	VCC	Power Supply
4	SDA	I2C Data Line

Table 1: I2C Connector's Pin Allocation

Pin 3, VCC, can be optionally connected if

- the I2C bus has to supply the *Tracii400* device or
- the external power supply connected to the *Tracii400* device should supply the I2C bus

Please refer to Section 7.2 for details.

Termination

The termination of the I2C bus lines can be configured by the jumper field JP4, which is shown in Figure 3. The 6 jumpers are grouped into 3 pairs of 2 jumpers. One jumper of a pair is related to the SDA line and the other one is related to the SCL line. **Therefore, both jumpers of a pair must always be configured in the same way.**

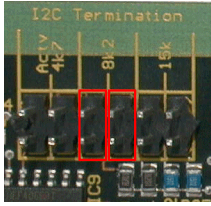


Figure 3: Jumper Field JP4. Bus Termination

The possible configurations are given in Table 2.

4k7	8k2	15k	Resulting Termination
OPEN	OPEN	OPEN	No Termination
CLOSE	CLOSE	CLOSE	2k5
CLOSE	CLOSE	OPEN	3k
CLOSE	OPEN	CLOSE	3k6
CLOSE	OPEN	OPEN	<u>ILLEGAL</u>
OPEN	CLOSE	CLOSE	5k3
OPEN	CLOSE	OPEN	8k2
OPEN	OPEN	CLOSE	15k

Table 2: I2C Bus Termination Settings

7.3.4. Test Pins

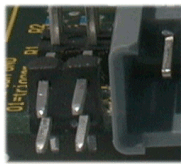


Figure 4: Testpin Allocation

The device provides four test pins O1, O2, I1 and I2 (Figure 4).

Testpin O1

The *Tracii400* device can signal certain I2C events such as start conditions, stop conditions, frame errors and acknowledges via test pin O1. The events which can cause the signal O1 to be activated must be selected using the application software. Each time, when an event has to be signalled, a low-

high-low strobe of 1ms length is generated. This signal might be used to trigger oscilloscopes or logic analysers.

Testpins O2, I1 and I2

The test pin O2 is a general purpose output pin which can be controlled directly by the application.

I1 and I2 are input pins. The applied signals can be read by the application software.

Testpin Support

Currently, only the application “TraciiSpy” supports the usage of test pin O1.

The test pins O2, I1 and I2 can be applied by the application “TraciiTalk”.

Please refer to the software’s user manual for further information concerning the usage of the test pins.

8. Trouble Shooting

The following section should help fixing problems which occur during set-up or operation of the device.

If any problems occur, the following items should be perused in the given order:

1. Is the underlay clean?
2. Is the board visually damaged?
3. Have the cables been properly attached?
4. Do the cables match the specifications? The cables length' must not exceed 2m!
5. Is the power supply correctly configured?
 - a. Have the jumpers been set correctly?
 - b. Is the power supply working?
6. Is the termination properly configured?

If all these checks have been performed successfully, a problem report may be sent to the address given in chapter 9.

9. Contact

Address:	telos EDV Systementwicklung GmbH Schlüterstraße 16 20146 Hamburg/Germany
Phone:	+49(0)40 450173-61
Fax	+49(0)40 450173-99
URL:	www.telos.info
eMail (Support):	mailto:support@tracii.info

10. Further I2C Products

Beside *Tracii400* devices, telos offers further I2C tools that are very useful during the development of I2C related systems.

The complete product portfolio can be found at <http://www.telos.info/>