



TEI0004 TRM

Revision: v.31

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# 1 Table of Contents

|     |                                         |    |
|-----|-----------------------------------------|----|
| 1   | Table of Contents .....                 | 2  |
| 2   | Overview .....                          | 3  |
| 2.1 | Key Features .....                      | 3  |
| 2.2 | Block Diagram .....                     | 3  |
| 2.3 | Main Components .....                   | 4  |
| 3   | Signals, Interfaces and Pins .....      | 5  |
| 3.1 | JTAG Connector Pinout .....             | 5  |
| 3.2 | USB Interface .....                     | 5  |
| 4   | On-board Peripherals .....              | 6  |
| 4.1 | FTDI FT2232H IC .....                   | 6  |
| 4.2 | On-board LEDs .....                     | 6  |
| 5   | Power .....                             | 7  |
| 5.1 | Power supply of the adapter board ..... | 7  |
| 6   | Technical Specifications .....          | 8  |
| 6.1 | Absolute Maximum Ratings .....          | 8  |
| 6.2 | Recommended Operating Conditions .....  | 8  |
| 6.3 | Operating Temperature Range .....       | 8  |
| 6.4 | Physical Dimensions .....               | 8  |
| 7   | Revision History .....                  | 10 |
| 7.1 | Hardware Revision History .....         | 10 |
| 7.2 | Document Change History .....           | 10 |
| 8   | Disclaimer .....                        | 11 |
| 8.1 | Data Privacy .....                      | 11 |
| 8.2 | Document Warranty .....                 | 11 |
| 8.3 | Limitation of Liability .....           | 11 |
| 8.4 | Copyright Notice .....                  | 11 |
| 8.5 | Technology Licenses .....               | 11 |
| 8.6 | Environmental Protection .....          | 11 |
| 8.7 | REACH, RoHS and WEEE .....              | 11 |

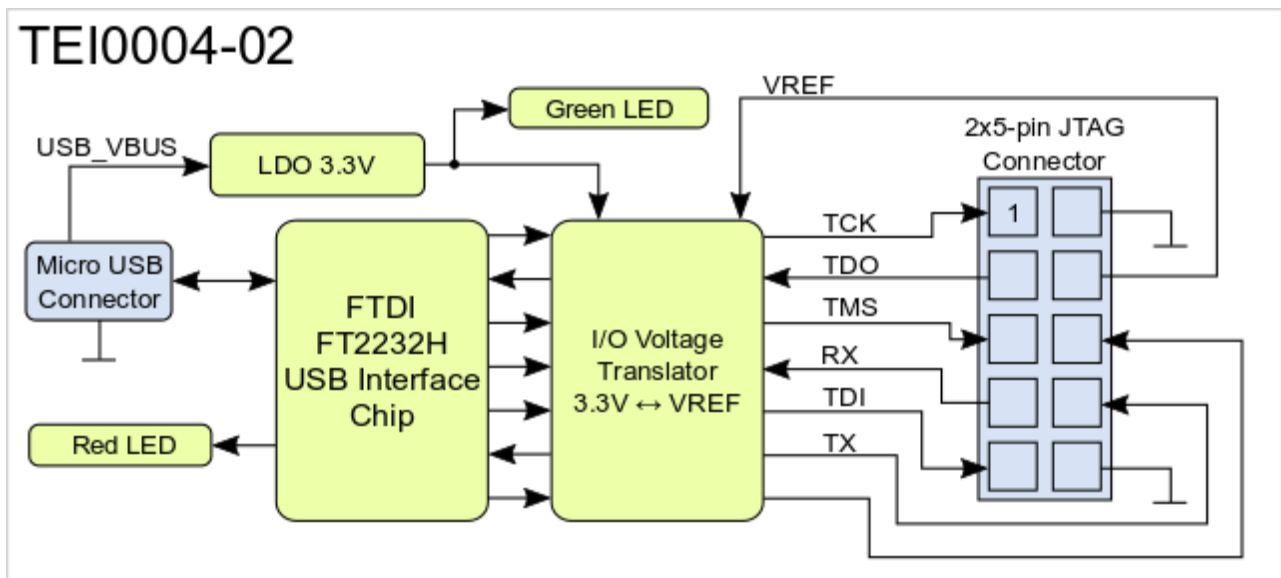
## 2 Overview

<https://wiki.trenz-electronic.de/display/PD/TEI0004+TRM> for the current online version of this manual and other available documentation. Arrow USB Programmer2 is an FT2232H based JTAG Adapter supported by Intel Quartus.

### 2.1 Key Features

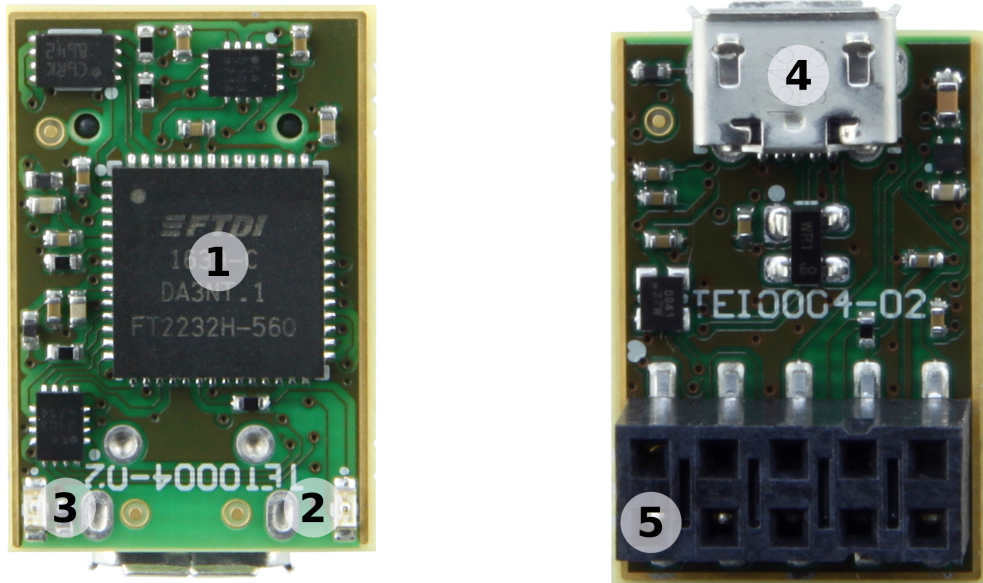
- Supported by Intel Quartus (JTAG Mode only)
- Intel JTAG Compatible Pinout
- Additional UART Channel available
- Based on FTDI FT2232H USB2 Interface
- Micro USB Connector
- RED activity LED
- GREEN Power-on LED

### 2.2 Block Diagram



**Figure 1:** TEI0004-02 Block Diagram.

## 2.3 Main Components



**Figure 2:** TEI0004-02 main components.

1. FTDI FT2232H IC
2. RED LED (Activity)
3. Green LED (Power-on)
4. Micro USB2 Connector
5. 2x5-pin JTAG Connector (White dot marks Pin 1)

## 3 Signals, Interfaces and Pins

### 3.1 JTAG Connector Pinout

The 2x5 female socket have to be connected to the corresponding pin header on the target system. The signal assignment of the pin header on the adapter board is fully compatible to original USB blaster. Furthermore there is also an UART interface available and I/O-pin reserved for future use.

Following table describes the pin-assignment to the signals of the interfaces:

| Signal                     | Pin Number | Pin Number | Signal                                                                       |
|----------------------------|------------|------------|------------------------------------------------------------------------------|
| TCK (output from adapter)  | 1          | 2          | GND                                                                          |
| TDO (input to adapter)     | 3          | 4          | Reference I/O-voltage from target board for JTAG and UART                    |
| TMS (output from adapter)  | 5          | 6          | Reserved Output (May be used as Processor Reset in future software releases) |
| UART RX (input to adapter) | 7          | 8          | UART TX (output from adapter)                                                |
| TDI (output from adapter)  | 9          | 10         | GND                                                                          |

**Table 1:** JTAG Connector pin assignment.

### 3.2 USB Interface

The USB interface is provided by the FTDI FT2232H IC. The entire USB protocol is handled on chip and compatible to USB 2.0 High Speed (480 MBps) and Full Speed (12 MBps).

## 4 On-board Peripherals

### 4.1 FTDI FT2232H IC

FTDI FT2232H IC Channel A is used in MPPSE Mode for JTAG, Channel B is available as UART. FT2232H EEPROM is programmed with Arrow Programmer2 Identifier to be recognized by the support library for Quartus.

### 4.2 On-board LEDs

On-board LEDs indicating power-on and JTAG activity:

| Color | Description   |
|-------|---------------|
| Green | Power-on LED  |
| Red   | JTAG activity |

**Table 2:** On-board LEDs.

## 5 Power

### 5.1 Power supply of the adapter board

Arrow Programmer2 is powered via USB.

## 6 Technical Specifications

### 6.1 Absolute Maximum Ratings

| Parameter           | Min  | Max  | Units | Reference Document                   |
|---------------------|------|------|-------|--------------------------------------|
| VREF                | -0.5 | 4.6  | V     | Nexperia 74AVCH4T245 data sheet      |
| USB VBUS            | 4.75 | 5.25 | V     | USB 2.0 Specification                |
| Voltage on I/O pins | -0.5 | 4.6  | V     | Nexperia 74AVCH4T245 data sheet      |
| Storage temperature | -40  | +90  | °C    | LED 19-213/R6C-AL1M2VY/3T data sheet |

**Table 3:** Absolute maximum ratings.

### 6.2 Recommended Operating Conditions

| Parameter             | Min  | Max  | Units | Reference Document              |
|-----------------------|------|------|-------|---------------------------------|
| VREF                  | 0.8  | 3.6  | V     | Nexperia 74AVCH4T245 data sheet |
| USB VBUS              | 4.75 | 5.25 | V     | USB 2.0 Specification           |
| Voltage on I/O pins   | 0    | VREF | V     | Nexperia 74AVCH4T245 data sheet |
| Operating temperature | -40  | +85  | °C    | FTDI FT2232H data sheet         |

**Table 4:** Recommended operating conditions.

### 6.3 Operating Temperature Range

Industrial grade: -40°C to +85°C.

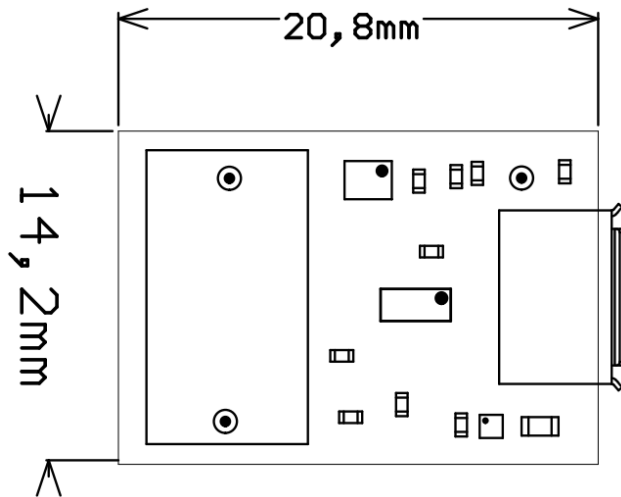
Arrow Programmer2 can be used within industrial temperature range.

### 6.4 Physical Dimensions

- Module size: 14.2mm × 20.8mm. Please download the assembly diagram for exact numbers.
- Highest part on PCB: 7.37 mm. Please download the step model for exact numbers.

All dimensions are given in millimeters and mil.





**Figure 3:** Physical dimensions drawing.

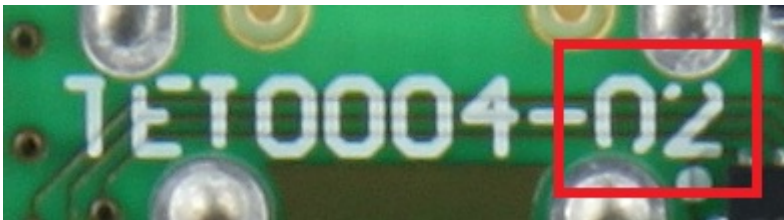
## 7 Revision History

### 7.1 Hardware Revision History

| Date | Revision | Notes                     | PCN | Documentation Link      |
|------|----------|---------------------------|-----|-------------------------|
| -    | 01       | Prototypes                | -   | -                       |
| -    | 02       | First production release. | -   | <a href="#">TEI0004</a> |

**Table 5:** Hardware revision history.

Hardware revision number can be found on the PCB board together with the module model number separated by the dash.



**Figure 4:** Revision number.

### 7.2 Document Change History

| Date                                                                                           | Revision             | Contributors  | Description                                                                             |
|------------------------------------------------------------------------------------------------|----------------------|---------------|-----------------------------------------------------------------------------------------|
|  2023-06-09 | <a href="#">v.51</a> | John Hartfiel | <ul style="list-style-type: none"> <li>Bugfix VREF recommended voltage range</li> </ul> |
| 2022-05-05                                                                                     | v.50                 | John Hartfiel | <ul style="list-style-type: none"> <li>renaming</li> </ul>                              |
| 2017-11-23                                                                                     | v.31                 | Ali Naseri    | updated block diagram                                                                   |
| 2017-11-21                                                                                     | v.25                 | Ali Naseri    | <ul style="list-style-type: none"> <li>First TRM release</li> </ul>                     |

**Table 6:** Document change history.

## 8 Disclaimer

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Please also note our data protection declaration at <https://www.trenz-electronic.de/en/Data-protection-Privacy>

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