

Remote Testing Environment



revision v1.1.0



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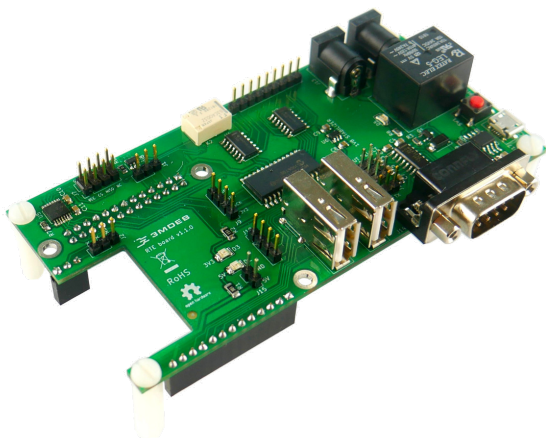
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Product description

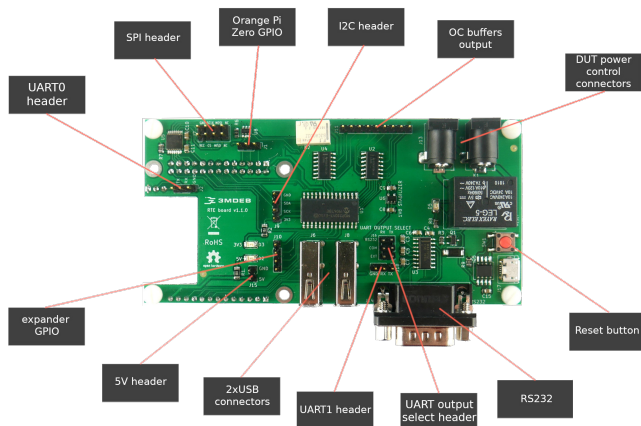
RTE is a hat designed for Orange Pi Zero board which runs specially crafted Linux distribution using the Yocto Project. RTE boards are used for controlling **Device Under Test** fully remotely through the network interface. Most common applications are:

- debugging tasks,
- flashing firmware,
- controlling GPIOs
- power management for **Device Under Test**.





RTE elements



- 2x additional USB connectors

Connect additional storages, external flash programmers, USB-RS232 or USB-UART converters.

- 2x4 SPI header

standard 2.5mm IDC compatible header with all necessary signals to flash SPI chips.

- 1x4 I2C header

Populated pins: 3.3V, SCK, SDA, GND.

- 1x3 UART0 header

Orange Pi Zero system debug output and console (pins: RX, TX, GND).

- 1x3 UART1 header

UART header for 3V3 serial communication with DUT (pins: RX, TX, GND).



RTE elements

- 1x3 GPIO header

GPIO pin header directly connected to Orange Pi zero platform.

- 1x4 GPIO header

GPIO pin header connected to GPIOs expander with no OC buffers.

- 1x12 GPIO header

GPIO pin header connected to Open Collector buffers.

- DB9 male connector

Connector for RS232 communication with a hardware flow control.

- 2x3 UART OUTPUT SELECT header

Header destined for selecting serial output between UART1 header and DB9 RS232 connector.

- 1x2 5V output header

Populated pins: **5V**, **GND**.

- Relay

Controls Device Under Tests power supply

- 2x DC jack

5.5/2.1mm female connectors for a Device Under Test power supply controlled directly through the relay.

- micro USB connector

Connector for powering up RTE and OrangePi Zero setup.



Reasons behind choosing RTE

- high accessibility and flexibility

test your device from any location.

- efficiency

simplify validation: write one script and run it on unlimited platforms. Don't repeat yourself!

- independent development

open hardware license: modify, upgrade and set it as you like. All blueprints are at your disposal.

- instant setup

intuitive connection: you do not need to be a certified engineer.

- automation

time is money: let the machine do all the work for you



Product features

Key features

- Cheaper and more feature-rich in comparison to other products
- Ultra-fast SPI flashing (16MHz)
- In-Circuit Programming (program onboard SPI Flash)
- Pomona connector to work with Serial Flash soldered on board
- Two logic levels SPI (1.8V and 3.3V)
- Remote power control over the target device
- Open Hardware
- Open Source software attached
- Open Source REST API controller
- Cost-free future software improvements

Yocto meta-rte

Our specially crafted operating system fully customized for Remote Testing Environment platform aspects. **meta-rte** is based on open source project - **Yocto Project** used for building Linux-based systems regardless of the hardware architecture. **meta-rte** has most mandatory tools and dependencies required for everyday debugging task with various range of hardware. RTE running **meta-rte** is ready to use completely out of the box, without the need for additional laborious configuration.

Moreover, open source solutions such as the Yocto Project and **meta-rte** provides possibility to rebuild the whole system strictly for the end users requirements, making the whole set more universal with endless applications!

More information can be found at <https://github.com/3mdeb/meta-rte>



Product features

REST API

RteCtrl is a REST API controller used for RTE board. It comes with meta-rte operating system and starts automatically on port **8000** without the necessity of additional configuration. REST API dashboard can be reached through the Internet browser and provides a possibility to:

- control Device Under Test power supply (coldboot and warmboot)
- reset Device Under Test platform
- flash Device Under Test firmware

Remote Testing Environment control

PWR RELAY

File to flash: No file selected.

no flashing operation performed

More information can be found at <https://github.com/3mdeb/RteCtrl>

DISCLAIMER: Before starting the flashing procedure through REST API console, make sure that appropriate SPI logic levels are set accordingly to [SPI](#) section.



Specification

GPIO header (1)

First GPIO header (**J1**) is a 1x3 pin header straight type 2.54mm pitch. It is derived directly from Orange Pi GPIOs for general use. By default, these GPIOs are set to **INPUT** mode.

Maximum voltage for all data signals: 3.3 V.

Description	Pin #
GPIO12	1
GPIO11	2
GPIO6	3

GPIO header (2)

Second GPIO header (**J10**) is a 1x4 pin header straight type 2.54mm pitch. It is derived from GPIO expander on RTE board. They are accessible for general use. By default, these GPIOs are set to **INPUT** mode.

Maximum voltage for all data signals: 3.3 V. Expander GPIO: 25 mA maximum output current.

Description	Pin #
GPIO400	1
GPIO401	2
GPIO402	3
GPIO403	4



GPIO header (3)

Third GPIO header (**J11**) is a 1x9 pin header straight type 2.54mm pitch. It is derived from GPIO expander on RTE board with an additional connection to OC (Open Collector) buffers. By default, these GPIOs are set to **OUTPUT** mode.

Maximum voltage for all data signals: 3.3 V. OC buffers: 40 mA maximum output current.

Description	Pin #
GPIO407	1
GPIO415	2
GPIO414	3
GPIO408	4
GPIO409	5
GPIO410	6
GPIO411	7
GPIO412	8
GPIO413	9

I2C header

I2C header (**J9**) is 1x4 pin header straight type 2.54mm pitch. It is used to rather low-speed applications such as reading sensors or accessing DACs and ADCs.

Maximum voltage for all data signals: 3.3 V.

Description	Pin #
3V3	1
SCK	2
SDA	3
GND	4



SPI header

SPI header (J7) is a 2x4 pin header straight type 2.54mm pitch. It is used to control the application SPI flash with a minimal set of connections.

Maximum voltage for all data signals: 3.3 V.

Description	Pin #	Pin #	Description
Vcc	1	2	GND
CS	3	4	SCLK
MISO	5	6	MOSI
ISP	7	8	NC

Revision v1.1.0 features new possibilities for SPI configuration:

- SPI **Vcc** pin has been populated - power is now supplied to the SPI **Vcc** connector and can be enabled/disabled on demand:

GPIO406 (OC_OUT1) state	SPI Vcc
0 - low	disabled (by default)
1 - high	enabled

- user can choose the voltage level for **Vcc** SPI - either 1.8V or 3.3 V:

GPIO405 (OC_OUT2) state	SPI Vcc voltage level
0 - low	1.8 V (by default)
1 - high	3.3 V

- user can enable/disable SPI lines (some platforms have problems when booting with SPI wires connected):

GPIO404 (OC_OUT3) state	SPI lines (MOSI/MISO/CS/SCLK)
0 - low	disabled (by default)
1 - high	enabled



UART OUTPUT SELECT header

UART OUTPUT SELECT header (J16) is a 2x3 pin header straight type 2.54mm pitch. It is used for enabling serial communication output: RS232 DB9 port (J14) or UART1 header (J18). If jumpers are not attached, serial ports are disabled.

Jumper position (TX)	Jumper position (RX)	Serial communication enabled
RS232 + COM	RS232 + COM	RS232 DB9 port (J14)
EXT + COM	EXT + COM	3.3V UART1 header (J18)

RS232 connector

RS232 connector (J14) is a DB9 male 9 pin connector for serial communication between Remote Testing Environment and Device Under Test platform. It supports a hardware flow control. RS232 connector can be enabled/disabled according to [UART OUTPUT SELECT](#) section.

Pin #	Signal	Description
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear to Send
9	RI	Ring Indicator



UART0 header

UART0 header (**J2**) is a 1x3 pin header straight type 2.54mm pitch. It is derived from Orange Pi Zero serial debug UART for debugging and serial communication purposes.

Maximum voltage for all data signals: 3.3 V.

Description	Pin #
GND	1
RX	2
TX	3

UART1 header

UART1 header (**J18**) is a 1x3 pin header straight type 2.54mm pitch. It is used for serial communication with DUT. UART1 header can be enabled/disabled according to [UART OUTPUT SELECT](#) section.

Maximum voltage for all data signals: 3.3 V.

Description	Pin #
GND	1
RX	2
TX	3



Power output header

Power output header (**J15**) is 1x2 pin header straight type 2.54mm pitch. It is used for additional 5V or ground pin connections with various devices.

Description	Pin #
5V	1
GND	2

DC jack

Two DC Jacks (**J12** and **J13**) are 5.5/2.1mm female plug connectors used for Device Under Test power supply. The output from DC Jacks is controlled through a relay. There is no matter whether **J12** or **J13** plug is input/output for power supply.

Relay

Relay (**K1**) is a mechanical switch for controlling Device Under Test power supply.

Technical reference:

- 1 Form C (1PDT) contact arrangement
- 5 V coil nominal voltage
- 70 Ohms nominal resistance
- 72 mA nominal current
- 24 VDC maximal input voltage
- 10 A maximal input voltage
- Expected relay life: 100 000 operations

Relay state is indicated by LED (**D5**) located near relay and can be controlled via meta-rte operating system through GPIO199:

GPIO199 state	Relay state	D5 LED state
0	OFF	OFF
1	ON	ON



USB connectors

USB connectors (**J6**, **J8**) available on RTE are additional USB type A ports derived from Orange Pi Zero header. They can be used for storage extension, serial communication through various adapters or USB programmer extension.

microUSB connector

The micro USB connector (**J17**) is a USB B micro socket for powering up RTE and OrangePi Zero setup. It is required to use a 5V/2A power adapter. There is no difference whether the user plugs the power supply to the micro USB connector located on RTE board or use OrangePi Zero original socket.

Reset button

Reset button (**SW1**) located near relay is used for resetting the RTE itself.



Shopping kit

Full Remote Testing Environment set includes:

Category	Description	Quantity
shield	Remote Testing Environment v1.1.0	1
control unit	Orange Pi Zero 256MB RAM version	1
power supply	MicroUSB 5V/2A	1
storage	SanDisk 16GB microSD card (with preinstalled compatible system)	1
clip	Pomona 8-pin SOIC clip for Device Under Test SPI interface	1
cables	standard female-female connection wire 2.56mm raster	8
cables	IDC 8-pin wires for Device Under Test SPI interface	1
cables	DC Jack - DC Jack power cable for Device Under Test	1
cables	RS232 D-Sub 9P/9P cable for serial communication	1
jumpers	jumper for UART OUTPUT SELECT header	2
spacers	Polyamide M3 spacers and bolts	4

Price: ~93 €



Revision history

v1.1.0

- added **Open hardware** logo
- added **SW1** reset button
- added **D5** relay state LED indicator
- added **J16** 2x3pin UART OUTPUT SELECT header
- added **J18** 1x2pin UART1 header
- added 1.8V stabilizer
- populated SPI **Vcc** pin
- modified capacitors near MAX3232 SOIC
- reduced OC buffers GPIO header (J11) from 12 to 9 pin
- eliminated issue with J6 USB port (unreliable detection of USB devices)

v1.0.0

- added RoHS logo
- added Crossed Wheelie Bin logo
- modified footprints of the pin headers

v0.5.3

- enlarged added holes

v0.5.2

- modified I2C GPIO expander outputs connections (now 4 of them are connected to the dedicated header)
- modified version number on board
- removed SPI header for APU recovery with output pin role information labels
- removed 7 and 8 pin of SPI header with GPIO expander connection



v0.5.1

- added micro USB connector for power supply
- added 5 V power supply pins
- added SPI connector for APU SPI recovery
- added fiducials on the bottom layer
- added pins information labels
- modified relay control system elements placement
- modified SPI connector for APU paths placement
- modified project text descriptions
- removed 2 pin GPIO expander connector

v0.5

- added 5 V power supply signal diode (red) + limiting current resistor
- added 3.3 V power supply signal diode (orange) + limiting current resistor
- relay NO/NC connection switched to the previous configuration
- switched `SPI1_MISO` with `SPI1_MOSI` output
- mirrored `RS232` socket pads
- removed I2C pull-up resistors

v0.3.6

- relay NO/NC connection switched

v0.3.5

- enlarged the hole diameter by 0.1 mm

v0.3.4

- added 3mdeb logo and board name on PCB
- modified elements marks placing



v0.3.3

- added SPI output IO pins connection with GPIO
- added PCB mechanical schematic
- added I2C INT pins connection
- added mounting holes
- added fiducials
- modified MOSFET transistor pinout numeration
- modified USB footprint from horizontal to vertical
- modified I2C GPIO expander with OC buffers connection

v0.3.2

- added mounting holes
- modified relay pinout
- removed I2C to GND connection

v0.3.1

- modified power supply from 5V to 3V3 for I2C bus **MCP23017**, and **MAX3232**
- removed capacitors connected to the I2C bus

v0.3

- added I2C bus with output header
- added **MCP23017** I2C GPIO expander
- added second **SN74LS06** OC buffer
- added relay with required neighboring items
- added **MAX3232** RS232 electrical level changer
- added RS232 socket
- added GPIO output header for pins unused to OC buffer control
- modified some of input pins connection
- removed ARK joint for the relay module
- removed header for relay module control