TX-Team GmbH

TX-TEAM

IS0200 Embedded System

NanoBoard - based Industrial Router / Edge Gateways

Status: 07.10.2022

Technical Documentation

TX-TEAM

Thank you for purchasing an innovative TX-Team system

The latest information about our products Mini PC / IPC / Firewall / Server / customized solutions
are online at: **www.tx-team.com.**
Some systems are delivered without sotware media. Latest drivers and software con be obtainted online in our shop
under „Service".

Warranty

A warranty according to the EU rules „guarantee and returns" is provided for all Systems of Tx-Team. For cases of
extended warranty periods please refer to your invoice or consult or support.

Based upon the EU regulations this devices meets the requirements of: $C\epsilon$

• 2014/30/EU „electromagnetic compatibility "
• 2014/35/EU „low-voltage directive"
• 2009/125/EC „Ecodesign Directive "
• 2011/65/EU „RoHS Directive "
• Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and
  telecommunications terminal equipment and the mutual recognition of their conformity

General information environmental protection

TX-Team defined own standards for environmental friendly manufacturing and product design. In addition to the legal
guidelines ecological requirements are steadily implemented and improved:

• Easy repair and upgrade through a bulding block concept
• low- and no-noise systems
• longevity
• low power consumption by using latest technology and efficient power
• supplies
• low material mix
• high percentage of regional manufactured components
• avoiding of poisenious substances
• avoiding of unnecessary packaging and advertising material
• Materials can be recycled

Regarding to 2006/66/EG we are obligated to inform our customers about the following issue:
You are, according to the Battery Directive, obliged by law to return all spent batteries and/or accumulators. They
can therefore batteries, which you bought at the seller free to the public collection points in its immediate vicinity give
or returned to the seller. Batteries, whose return you are required to be designated by signs, consisting of a ton
of garbage out and the chemical symbol for the classification as crucial heavy metal (Cd for cadmium, HG for
mercury or Pb for lead).

Disposing of old appliances:

All TX-Team systems and their respective parts are mainly manufactured of recycling material under high
environmental and quality standards.
TX-Team systems meets all respective EU regulations, in particular WEEE and RoHS. As well as our suppliers are
obligated to those regulations. For recycling issues please refer to your local recycling facilities.
TX-Team GmbH is member of EAR, our **WEEE registration no. is: DE57864190**

For technical issues please contact us:
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Thank you for your purchase.

We hope your new system will successfully support your work!

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List of Abbreviations and Symbols

ARM	Acorn RISC Machines
SoC	System on Chip
GPIO	General Purpose Input Output

1 Abstract

Thank you for choosing a TX-Team industrial PC system.
TX-Team systems are designed for quick and easy setup and use.
This documentation is intended to answer common questions, give some tips and serve as a technical reference.

The industrial small-sized system IS0200 is a rugged embedded system for a variety of industrial applications, as well as non-industrial applications that are particularly critical or involve difficult environmental conditions. Ubuntu Core is pre-installed on the IS0200. This Ubuntu variant is specially designed for IoT applications. It is based on the huge Ubuntu software ecosystem and can be operated identically to the desktop version. However, it is lighter and therefore does not have a graphical user interface. Many frequently required software packages are already pre-installed, e.g. NodeRED.

The industrial router, small-sized IRS0200 is based on the same hardware platform, but comes along with the special router operating system OpenWRT (alternatively IPFire is also possible). The WAN connection (Internet) can be established either via the wired WAN port or via mobile radio with integrated LTE module.

All systems are shipped preconfigured and are ready-to-use.

2 Technical Documentation

2.1 Hardware

2.1.1 General information

The hardware of the system essentially consists of the carrier board (mainboard) TX-Team Nanoboard. Connected to it is the CPU module Friendlyarm NanoPi Duo, which contains the ARM SoC (the CPU).

An important criterion for the security of systems at critical IT points is the freedom from "black boxes" and backdoors. We take this topic very seriously and therefore include the open-source CPU module NanoPi Duo in our solution. Detailed documentation and circuit diagrams can be found here:

http://wiki.friendlyarm.com/wiki/index.php/NanoPi_Duo2

The software used is also OpenSource, see "Software" for details.

For further information, plans and CAD data about the case and the Nanoboard carrier board please contact us. Contact: see end of this document.

2.1.2 Datasheet

The following table shows the data sheet (LTE module and software are configuration dependent):

Datasheet

Housing / Physical properties	
Case	Full aluminium heat sink profile housing, black anodised
Dimension	134x76x55 mm (WxDxH)
Cooling	Directly via the housing, passive cooling optional
Mounting option	- DIN rail DIN-/ Wall mounting bracket - TX-Team 19" bracket for 19 inch rack
Weight	0,5 kg

Hardware		
CPU Allwinner H3 SoC	4x 1.2 GHz	
RAM		512 MB DDR3
Motherboard		TX-Team carrier board + Friendlyarm NanoPi Duo2 SOM

Memory	1x 32GB µSD-Card (Industrial, MLC, 0..+70°C)
ODD	-
Graphic	-

Ports

I/O front (standard)	2x RJ45, 1x USB 2.0
I/O back	1x 12pin PhoenixContact terminal: 1x serial console 8x GPIO 1x SPI 1x I²C 1x UART 1x 5V DCOut 1x 7..35V DC-In Receptacle connector included in delivery (MPN: 1757116 or CPF 5,08/12)
Internal I/O	internal I/Os can be occupied - depending on the configuration: 1x mPCIe full size (for 3G/4G modem) 1x SIM socket 2x USB 2.0 4x GPIO 1x Infrared 1x CVBS 1x Audio out 1x Audio in 1x camera interface for OV5640

Communication

Wireless LAN	802.11 b/g/n Blutooth v4 optional
LTE	Quectel EC25 - 150Mbps downlink and 50Mbps uplink (LTE Cat.4) - especially for M2M and IoT applications - Worldwide LTE, UMTS/HSPA+ and GSM/GPRS/ EDGE coverage

Power supply

Input voltage	DC wide range input 7..35V, PhoenixContact screw terminal
power supply unit external AC/DC adapter Input: 100 to 240 VAC output: 12V	ErP 2009/125/EC RoHS 2011/65/EU EMC 2014/30/EU LVD 2014/35/EU overcurrent protection overtemperature protection overvoltage protection
Power consumption	idols 1W 100% load 3W

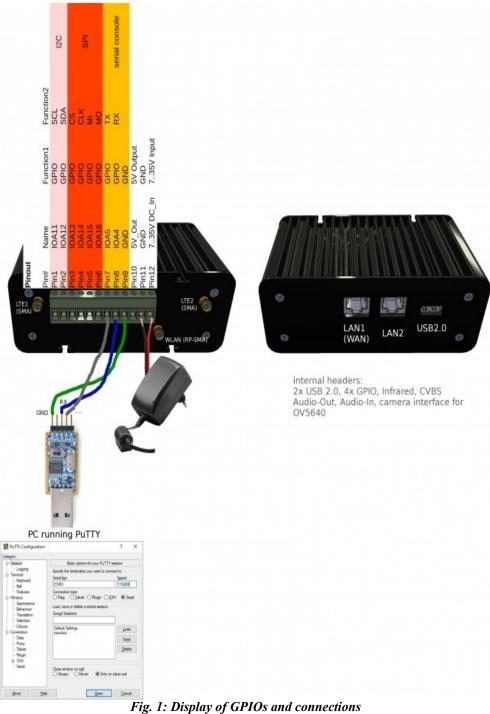|	
	Software
	compatible to:
Operating system	- OpenWRT - Ubuntu Core Linux - Further compatibilities on request
	Environmental conditions
Operating temperature	-20..70°C
Air humidity	80% rel. humidity
Protection class	IP40
Short-circuit protection	continuous, automatic recovery
Overload protection	8A
USB transient protection	meets the requirements IEC 61000-4-2 (ESD) ±20kV (air), ±12kV (contact)IEC 61000-4-4-4
	Conformity & Certifications
Conformity	CE, RoHS, ErP Lot7, Meets the requirements of EnergyStar
	General information
Scope of delivery	System, 2 LTE antennas, power cable, power supply, documentation, CE declaration of conformity, 1x WLAN antenna, screwable rubber feet
Long-term availability	until 2022
Localization	Type of power cable, operating system language, keyboard layout, documentation language English (UK) English (US) German
Warranty	3 years Bring-In
Miscellaneous	Note: You need a serial console cable to access the system's terminal. There is no graphics output. Refer to the "Recommendation" section for the appropriate cable.

Tab. 1: Datasheet

2.1.3   Connectivity

The hardware has several GPIOs and the possibility to connect external systems via SPI or I²C. The pin assignment together with the voltage output and input is shown in the following figure.

At the front of the device there are the two LAN ports, the WAN and LAN port. Both ports have their own controller. You can decide yourself about the configuration whether you want to

use them as WAN or LAN ports. If an LTE module is present, both ports are preconfigured as LAN, without an LTE module the port labeled "WAN" is configured as uplink to the wired Internet via an existing modem.

Fig. 1: Display of GPIOs and connections

2.2   Operating System – Ubuntu

2.2.1   General information

Ubuntu Core is a lightweight version of Ubuntu Desktop without a graphical user interface. The particularly stable and reliable operating system has been specially developed for embedded and IoT applications.

2.2.2   Login

Since the system does not have a graphics port, there are three ways to access it:

1. via a serial console: Connect a serial - to - USB cable (available in our online shop under accessories) between a PC and the IS(R)0200 as shown in the figure above. Via the freeware program PuTTY (or a comparable client) you can "redirect" the output of the system.
In the following example the USB-to-Serial converter is connected to COM3.

Fig. 2: Serial connection via PuTTY

2. via SSH: also with Putty or via the command prompt (Windows) or terminal (Linux) - as shown in the following example.

Login for systems with Ubuntu Core:

Fig. 3: Display of GPIOs and connections

Two user accounts are preconfigured:

User: pi

Password: [without]

User: root

Password: fa

Fig. 4: Switch User

2.2.3   IP Addresses and Interfaces

The next figures show the existing network interfaces and the notation of the designation.

Eth0:   LAN-Interface with the preconfigured IP 192.168.180.2:1

Eth1:   WAN interface (or 2nd LAN port), preconfigured as DHCP client.

I.e. an IP is assigned to this port if there is a DHCP server in the corresponding network. In the following example the address 192.168.180.116 was assigned.

WLAN0:   The WLAN interfaces

l0:   loopback - Interfaces

Fig. 5: *Output of ifconfig*

2.2.4   Further applications

The pre-installed Ubuntu Core already comes with a large number of useful applications. Additional software from the rich Ubuntu repositories can be installed as follows. Even the use of Docker is possible thanks to the powerful hardware:

#sudo apt-get update
#sudo apt-get install <Paketname>

Besides this, there is WiringNP pre-installed. WiringNP is comparable to the popular library WiringPI for RasperryPI - based systems. It facilitates access to the GPIOs.

In the following example, we show a sample code to make an LED blink. Connect a normal LED (2.2V / 20mA) with a pre-resistor of about 55 Ohm to GPIO7.

Since the notation of the GPIO pins under Linux does not match the labeling of the pins on the hardware, you have to use the following command to find out which pin GPIO7 is. In this case GPIO7 is GPIO11

4.1 Verify WiringNP

The WiringNP library contains a set of gpio commands. Users can use them to access the GPIO pins on a nano board. You can verify your WiringNP by running the following command:

```
gpio readall
```

Fig. 6: ***Displaying the GPIO Map***

Open a new program in an editor, e.g.

nano test.c

Type the following lines:

```
#include <wiringPi.h>
int main(void)
{
  wiringPiSetup() ;
  pinMode (7, OUTPUT) ;
  for(;;)
  {
    digitalWrite(7, HIGH) ;
    delay (500) ;
    digitalWrite(7,  LOW) ;
    delay (500) ;
  }
}
```

Compile and run "test.c":

```
gcc -Wall -o test test.c -lwiringPi -lpthread
sudo ./test
```

You can see the LED is blinking.

Fig. 7: ***Blinking LED with WiringNP***

Of course, you can also do this via shell script - without compiling:

```
LED=7
gpio mode $LED out
while true; do
    gpio write $LED 1
    sleep 0.5
    gpio write $LED 0
    sleep 0.5
done
```

Fig. 8: *Blinking LED with WiringNP as Shellscript*

2.2.5   Additional Information

NanoPI Duo Wiki page:

http://wiki.friendlyarm.com/wiki/index.php/NanoPi_Duo2#WiringPi_and_Python_Wrapper

Ubuntu Wiki:

https://help.ubuntu.com/community/CommunityHelpWiki

2.3   *Operating System OpenWRT*

2.3.1   *General information*

OpenWRT is a special router/firewall distribution for embedded systems. The operation is intuitive and easy to learn. OpenWRT is similar to Firmware on standard low-end routers, but more extensive, Open Source and community - maintained.
The most important functions are shown here.

Analogous to the access methods already mentioned, it also works under OpenWRT via a serial console or SSH. The best method to administer the system is the web interface which you access via this address in the browser (the system must be connected via the LAN port):

http://192.168.1.1

Login for the web interface and the console:

User: root

Password: OpenWRT

Note: WLAN encryption is not set by default, you should do this in the WLAN setting for security reasons if WLAN is used.
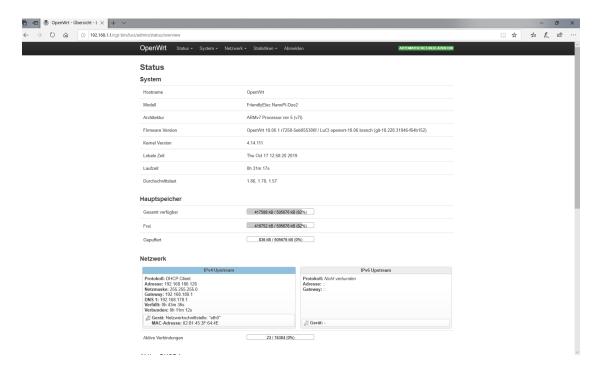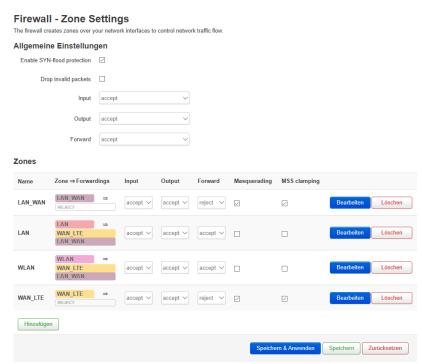

Fig. 9: *OpenWRT Main Screen*
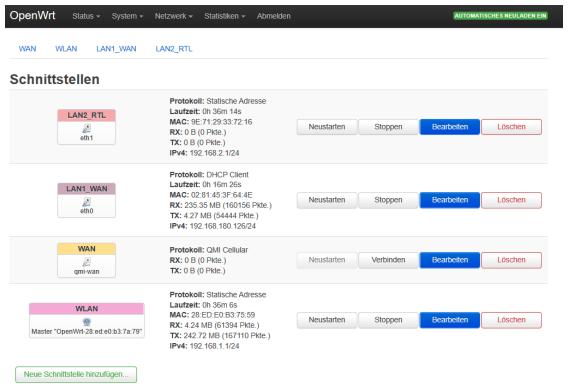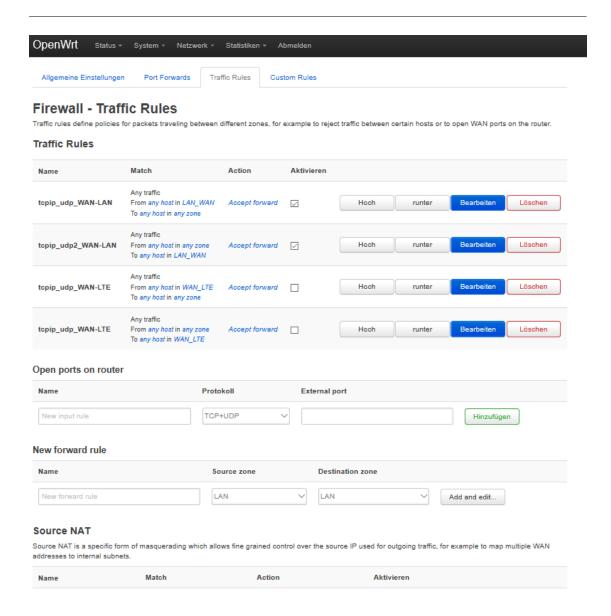
Fig. 10: **Firewall Basis-Settings**

Fig. 11: **Overview of the interfaces, here with LTE (WAN)**

The firewall is set so that UDP and TCP traffic between WAN and WLAN and LAN is possible.

The traffic between LAN and WLAN is blocked.

Note: For configurations with LTE module, the mobile phone interface (here: WAN_LTE) becomes the WAN port. The two Ethernet ports then act as two (independent) LAN interfaces.

2.3.2   Additional Information

OpenWRT Wiki

www.openwrt.org

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