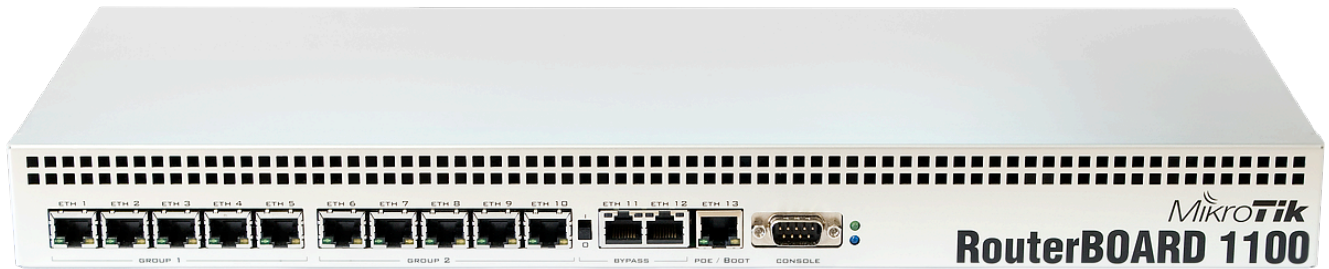


RouterBOARD 1100

User's Manual



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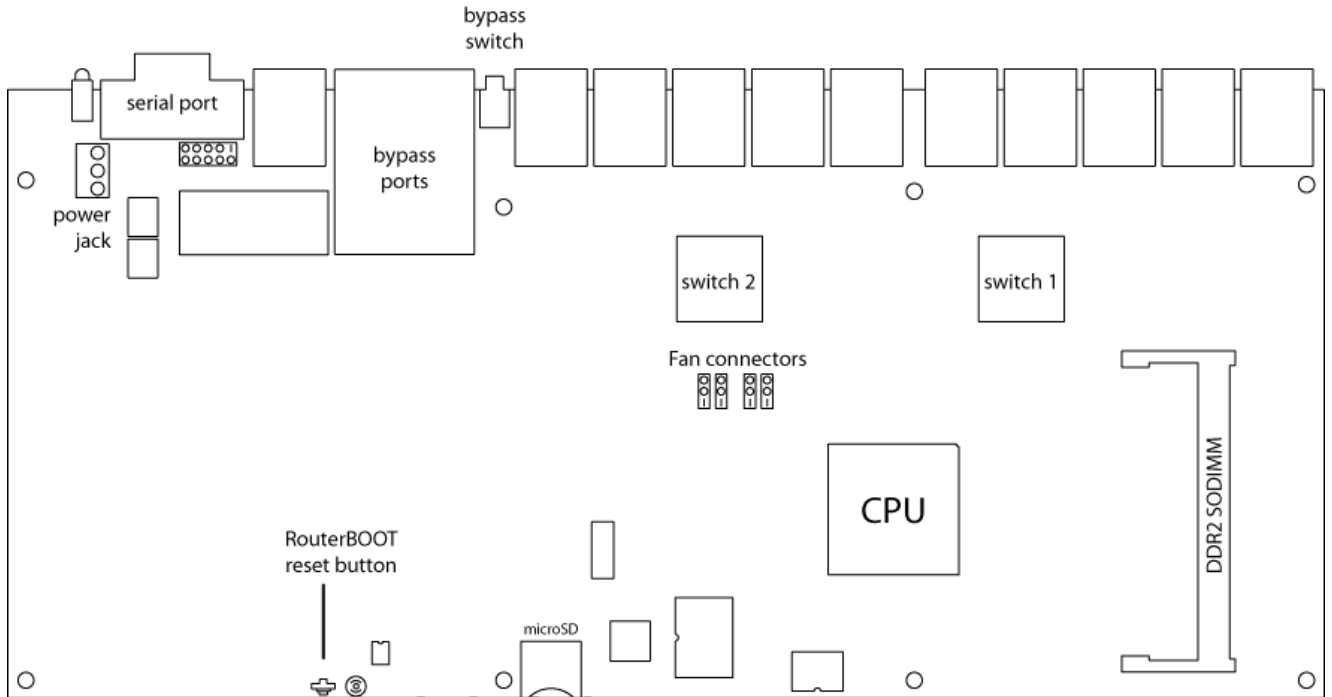
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RMA Instructions are located on our webpage here: <http://rma.mikrotik.com>

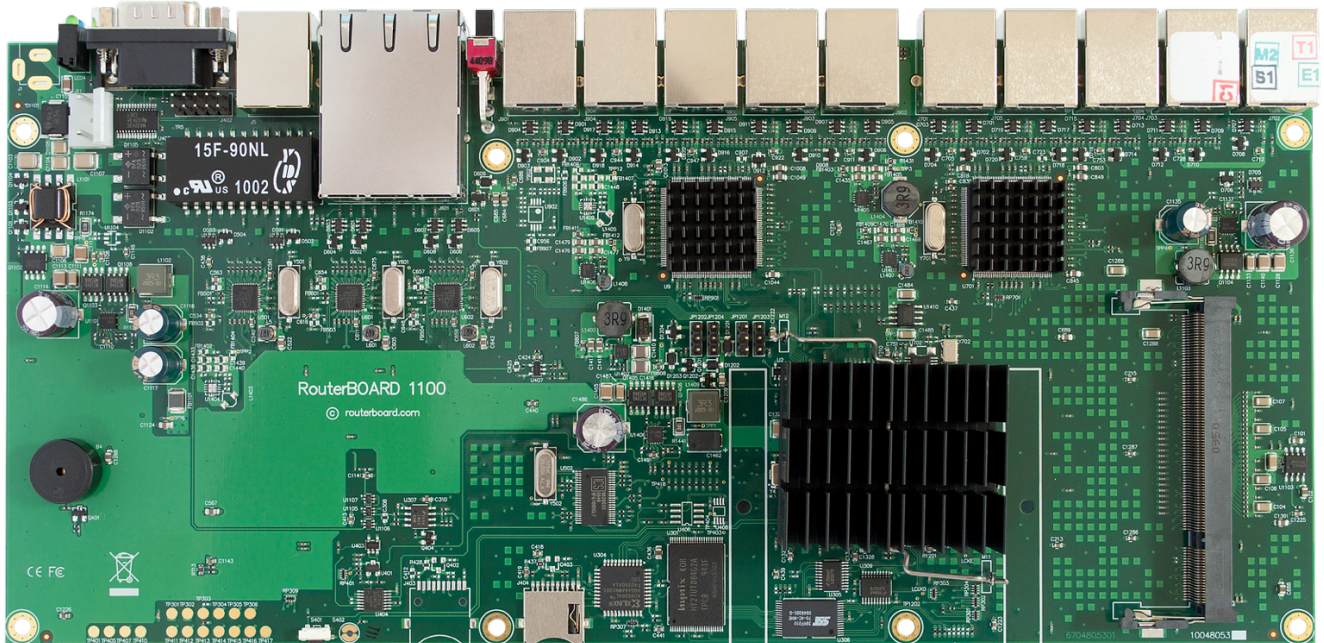
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System Board View and Layout



RouterOS reset hole



You can download the board dimensions and case design files (PDF and DXF) from www.routerboard.com

Specifications

RouterBOARD 1100/AH	
CPU	RB1100: MPC8544 800MHz RB1100AH: P2010 1066MHz RB1100AHx2: P2020 1066MHz dual core CPU with IPsec acceleration
Memory	SODIMM slot, no onboard module
Boot loader	RouterBOOT
Data storage	onboard NAND memory chip
Ethernet	Thirteen 10/100/1000 Mbit/s Ethernet ports supporting Auto-MDI/X
MiniPCI slot	-
Expansion	-
CompactFlash slots	One microSD card slot on board, accessible by opening the case
Serial port	One DB9 RS232C asynchronous serial port
LEDs	Power and User LED
Beeper	+
Power at the board	Power jack: 12-24VDC; PoE on Ether13: 12-24VDC
Power at the case	IEC C14 jack: 110-220VDC
Fans	JP1202 and JP1204 - 12V; 0,2A max. JP1201 and JP1203 - 3,3V; 0,3A max. Only one Fan in each pair will rotate, other will start when first fails. Only one pair can be connected at the same time (two fans).
Dimensions	Board: 135 mm x 291 mm 1U rackmount case: 44 x 176 x 442 mm
Weight	365g board only, 1275g assembled with case
Temperature	Operational: -20°C to +65°C (-4°F to 149°F)
Humidity	Operational: up to 70% relative humidity (non-condensing)
Power consumption	12W min/25W max

Hardware Guide

Memory and Storage Devices

Memory

There is no onboard memory, but the device has a SODIMM slot for one DDR2 module, it is recommended to use modules with at least 667MHz (PC-4200). The RB1100 device supports modules of up to 2GB, but due to software limitations, RouterOS will be able to use only 1.5GB of it.

microSD slot

The board has one microSD card slot which supports microSD and microSDHC cards for expanding the storage in RouterOS

Input/Output Ports

Ethernet ports

There are thirteen ethernet ports. There are two switch groups, five ports each. The Ether13 port supports Power over Ethernet.

The RB1100 device also has two Ethernet bypass ports (Ether11 and Ether12). The bypass mode can be activated by turning the bypass switch next to them to the position **1**. Position **0** turns off the bypass mode and ports work as usual.

All cables made to EIA/TIA 568A/B cable specifications will work correctly (see **Connector Index** for pinout). Note that this port supports automatic cross/straight cable correction (Auto MDI/X), so you can use either straight or cross-over cable for connecting to other network devices.

Ethernet bypass mode

Bypass mode is used to cross-connect the two RJ45 connectors (Ether11 and Ether12) electrically thus creating an extended Layer 1 network. Traffic present on either network (Internal or External) is seen on the other network immediately.

If the router would stop working for some reason, the ports would be connected together as if there would be no router in between. You could configure your network to allow this, and in case of hardware failure, the communications would still work, as if the (broken) router wouldn't exist there.

DB9 Serial Port

The RS232C standard male DB9 asynchronous serial port may be used for initial configuration, or for attaching a modem or any other RS232 serial device. TxD (pin 3) of this port has -5V DC power when idle. Some signals are not connected, so this implementation may not be considered to support full hardware flow-control, so software flow-control (XON/XOFF) or none at all should be used.

Fan Connectors

You can connect up to four fans to the RouterBOARD, but only two of them will work at a time. They will receive 12V DC power. The board supports fan speed feedback signaling. RouterOS can be configured to change the active fan, if the current active one is not rotating (note that if a fan does not have rotation sensor, it will be considered failed).

LEDs

Power LED

Power LED is on when the board is powered.

User LED

User LED may be programmed at user's option. It is lit by default when the board starts up, then it is turned off when the bootloader runs kernel.

User's Guide

Assembling the Hardware

In most cases you do not need to use any additional boot devices, as you can boot the RouterBOARD from the onboard NAND memory. You can also install one microSD card which you can use as an alternative boot device (not for RouterOS) or additional storage media;

To disassemble the case, you will need a Phillips P2 screwdriver.

Powering

Power options:

1. **PoE on Ether13** supports 12-24V DC powering with a passive PoE injector. The device does not support power over datalines.
2. **J11** power connector, used when device installed in a rackmount case, 12-24V DC. Connects to the built-in PSU.

Booting options

First, RouterBOOT loader is started. It displays some useful information on the onboard RS232C asynchronous serial port, which is set to 115200bit/s, 8 data bits, 1 stop bit, no parity by default. Also supports hardware (RTS/CTS) flow control. The loader may be configured to boot the system from the onboard NAND module or from Ethernet network. See the respective section of this manual for how to configure booting sequence and other boot loader parameters.

Onboard NAND Storage Device

The RouterBOARD may be started from the onboard NAND storage chip. As there is no partition table on the device, the boot loader assumes the first 4MiB form a YAFFS filesystem, and executes the file called "kernel" stored in the root directory on that partition. It is possible to partition the rest of the medium by patching the kernel source.

Internal Storage Device

The RouterBOARD may be started from a microSD card slot, although RouterOS doesn't support this. At least two partitions must exist on the device, first of which being the ELF image the board is to be booted from (normally, it is a Linux kernel, appended with the kernparm ELF section that specifies the root partition name and, optionally, other kernel parameters of your choice).

Booting from network

Network boot works similarly to PXE or EtherBoot protocol, and allows you to boot a RouterBOARD 1100 series boards from an executable image stored on a TFTP server. It uses BOOTP or DHCP (configurable in boot loader) protocol to get a valid IP address, and TFTP protocol to download an executable (ELF) kernel image combined with the initial RAM disk (inserted as an ELF section) to boot from (the TFTP server's IP address and the image name must be sent by the BOOTP/DHCP server).

To boot the RouterBOARD computer from Ethernet network you need the following:

- An ELF kernel image for the loader to boot from (you can embed the kernel parameters and initrd image as ELF sections called *kernparm* and *initrd* respectively)
- A TFTP server which to download the image from
- A BOOTP/DHCP server (may be installed on the same machine as the TFTP server) to give an IP address, TFTP server address and boot image name

See the RouterBOOT section on how to configure loader to boot from network.

Note that you must connect the RouterBOARD you want to boot, and the BOOTP/DHCP and TFTP servers to the same broadcast domain (i.e., there must not be any routers between them).

Operating System Support

MikroTik RouterOS, starting from version v5, is fully compatible with RouterBOARD 1100 series embedded boards. If your device is preinstalled with an earlier RouterOS release, please upgrade RouterOS to v4.9 or newer.

RouterBOOT

The RouterBOOT firmware (also referred as Bootloader here) provides minimal functionality to boot an Operating System. It supports serial console via the onboard serial port at the boot time. The loader supports booting from the onboard NAND device and from a network server (see the respective section for details on this protocol).

Boot Loader Configuration

Loader parameters may be configured through the onboard RS232C DB9 asynchronous serial interface. To connect to it, use a standard null-modem cable. By default, the port is set to 115200bit/s, 8 data bits, 1 stop bit, no parity. **Note** that the device also implements the hardware (RTS/CTS) flow control.

To enter the loader configuration screen, press any key (or only [Delete] key (or [Backspace] key – see the note for the respective configurable option), depending on the actual configuration) just after the boot loader is asking for it:

```
RouterBOOT booter 2.27
RouterBoard 1100

CPU frequency: 800 MHz Memory size: 512 MB
Press any key within 2 seconds to enter setup

RouterBOOT-2.27
What do you want to configure?
  d - boot delay
  k - boot key
  s - serial console
  o - boot device
  r - reset configuration
  e - format nand
  g - upgrade firmware
  i - board info
  p - boot protocol
  t - do memory testing
  x - exit setup
your choice:
```

To select a menu point, press the key written at the beginning of this line. Pressing [Enter] selects the option marked with '*'.

boot delay – how much time to wait for a key stroke while booting (1..9 seconds; **2 second** by default).

boot key – which key will cause the loader to enter configuration mode during **boot delay** (any key | <Delete> key only; **any key** by default). Note that in some serial terminal programs, it is impossible to use the [Delete] key to enter the setup – in this case it might be possible to do this with the [Backspace] key.

serial console – to configure initial serial console bitrate (1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200; **115200** bps by default).

boot device – initial boot device (boot over Ethernet | boot from NAND, if fail then Ethernet | boot from CompactFlash only | boot Ethernet once, then NAND | boot Ethernet first, then CompactFlash | boot from NAND only; **boot from NAND, if fail then Ethernet** by default). You can also select **boot chosen device** option to boot from the device selected immediately, without saving the setting.

reset configuration – whether to reset all the boot loader settings to their respective default values (yes | no; **no** by default).

format nand – perform a low-level NAND format. During this operation, all previously marked bad sectors are retested to find out if they are faulty indeed.

upgrade firmware – receive a new boot loader image using XModem protocol over serial line or using DHCP/BOOTP and TFTP protocols through the Ethernet network (upgrade firmware over ethernet | upgrade firmware over serial port).

board info – prints the serial number, boot loader version, CPU frequency, memory size and MAC addresses of the onboard Ethernet ports

boot protocol – network booting protocol (bootp protocol | dhcp protocol; **bootp protocol** by default).

do memory testing – performs a full memory test.

cpu-frequency -

a	-	MEM: 333DDR	CPU: 333MHz
b	-	MEM: 333DDR	CPU: 500MHz
c	-	MEM: 333DDR	CPU: 667MHz
d	-	MEM: 333DDR	CPU: 833MHz
e	-	MEM: 400DDR	CPU: 400MHz
f	-	MEM: 400DDR	CPU: 600MHz
g	-	MEM: 400DDR	CPU: 800MHz
h	-	MEM: 400DDR	CPU: 1000MHz
i	-	MEM: 533DDR	CPU: 533MHz
*j	-	MEM: 533DDR	CPU: 800MHz
k	-	MEM: 533DDR	CPU: 1067MHz
l	-	MEM: 533DDR	CPU: 1333MHz

Boot Loader Upgrading

The boot loader is needed to initialize all the hardware and boot the system up. Newer loader versions might have support for more hardware, so it's generally a good idea to upgrade the loader once a newer version is available.

The boot loader upgrading is possible from MikroTik RouterOS, from within the “/system routerboard” menu. Updates are included with each RouterOS update. The procedure is described in the MikroTik RouterOS manual: http://wiki.mikrotik.com/wiki/Manual:Bootloader_upgrade

You can also upgrade the loader through the onboard serial port using XModem protocol (programs available for all major OSs). For example, you can use HyperTerminal for Windows or Minicom for Linux to upload the boot loader. Alternatively if you have a DHCP/BOOTP and TFTP servers available, you can specify the loader image as a boot image and choose the **bios upgrade over ethernet** option in the boot loader configuration menu. The loader will get the image from the TFTP server and upgrade itself. The most current loader image is available for download on www.routerboard.com.

Primary Boot Loader

There are two boot loaders present on the NOR flash memory chip. Secondary is the main one, that is executed by default. This is the one that can be upgraded. In case something goes wrong in the upgrade process, or you have set some incorrect settings that render it unusable, you can load the Primary boot loader by holding the Software Reset 1 button (**S1**), connecting the power, and then releasing the button/jumper. The Primary boot loader has the default settings, which can not be changed. It is also not possible to upgrade it.

RouterOS functions

Health monitor

This menu shows the current fan status.

```
[admin@MikroTik] /system health> print
fan-mode: auto
use-fan: main
active-fan: auxiliary
voltage: 12V
current: 861mA
fan-speed: 9878RPM
temperature: 32C
cpu-temperature: 40C
power-consumption: 10.3W
```

RB1100AH doesn't have any fans. All Fan options apply to RB1100Ahx2 only.

fan-mode – whether to use automatic fan failover (auto | manual; **manual** by default).

use-fan – which fan to use in manual mode (main | auxiliary; **main** by default).

The RB1100Ahx2 also features a fan RPM monitor and fan RPM control by CPU temp (less noise).

Firmware information

This menu displays RouterBOARD model number, serial number, the current boot loader version and the version available in the current software packages installed.

```
[admin@MikroTik] > system routerboard print
routerboard: yes
model: "rb1100"
serial-number: "154201C1DD3C"
current-firmware: "2.27"
upgrade-firmware: "2.27"
[admin@MikroTik] >
```

The firmware version can be upgraded using **"/system routerboard upgrade"** command.

Firmware Settings

Boot loader settings are also accessible through this menu.

```
[admin@MikroTik] > system routerboard settings print
baud-rate: 115200
boot-delay: 2s
boot-device: nand-if-fail-then-ethernet
enter-setup-on: any-key
boot-protocol: bootp
enable-jumper-reset: yes
[admin@MikroTik] >
```

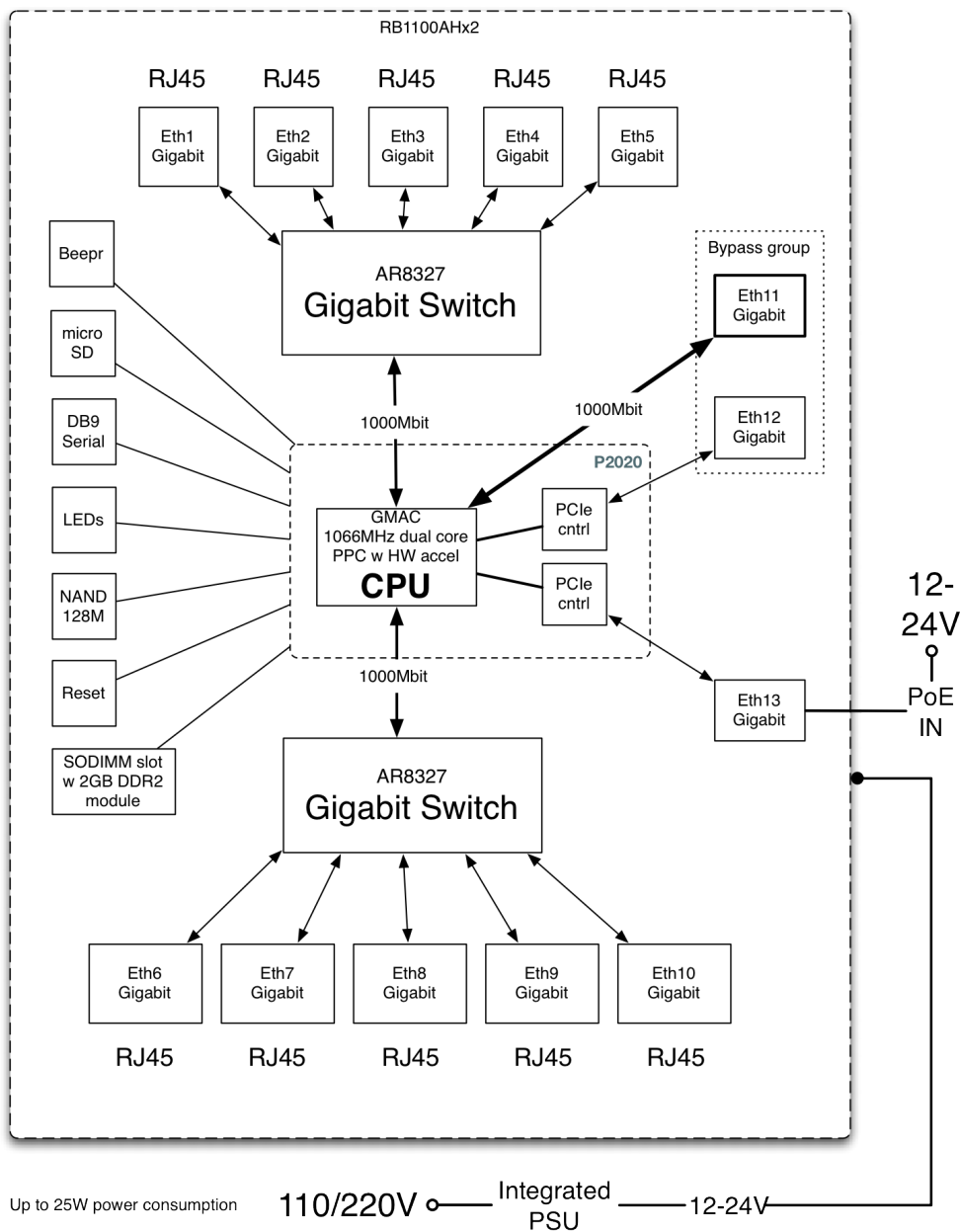
The Software Reset 2 button (TP12) reset hole, which resets both boot loader settings and RouterOS setting by default, can be disabled in this menu (it will still reset the boot loader settings).

Software Reset

It is possible to reset all software configuration by using the Software Reset 2 button hole (C229, see schematic) during the power-up. No confirmation or passwords will be asked, so use with caution. This feature can be disabled in the “system routerboard settings” menu by switching the “enable-jumper-reset” parameter to “no”. Simply use a metal object to short circuit the metallic reset hole (TP12) while booting.

Appendix

Block Diagram



Note: RB1100Ahx2 is pictured above. Compared to the image, RB1100AH has only single core, and does not have HW acceleration for Ipsec encryption, the rest is the same.

Connector Index

J404	MicroSD slot (bootable)	
J401	RS232C male DB9 serial port	
	2	RxD (Receive Data)
	3	TxD (Transmit Data)
	5	GND
	7	RTS (Request to Send)
	8	CTS (Clear to Send)
J402	Alternate serial port (see 12 for pinout)	
J701-J705 (Group one)	RJ45 Gigabit Ethernet 1000Base-T ports in two switch groups	
J901-J905 (Group two)		
J501	Bypass port group	
J5	RJ45 Gigabit Ethernet 1000Base-T port with PoE (Ether13)	
J10	Power jack (12 V DC, positive contact is the central pin)	
J11	Alternative power Jack (12 V DC, positive contact is the leftmost pin, closer to J10)	
JP1201 JP1202 JP1203 JP1204	DC Fan 1 connector	
	1	GND
	2	+5.5 V DC
	3	Rotation speed feedback

Button Index

S401	Software Reset 1 button. Loads the Primary boot loader
S402	Software Reset 2 button hole. Resets RouterOS settings

Ethernet Cables

RJ45 Pin	Color	Function (100Mbit)	Function (1Gbit)	RJ45 pin for Straight cable (MDI, EIA/TIA568A)	RJ45 pin for Crossover cable (MDI-X, EIA/TIA568B)
1	Green	TX+ Data	Data A+	1	3
2	Green/White	TX- Data	Data A-	2	6
3	Orange	RX+ Data	Data B+	3	1
4	Blue	-	Data C+	4	4
5	Blue/White	-	Data C-	5	5
6	Orange/White	RX- Data	Data B-	6	2
7	Brown	-	Data D+	7	7
8	Brown/White	-	Data D-	8	8

Serial Null-modem (Console) Cable with Loopback

DB9f	Function	DB9f	DB25f
------	----------	------	-------

1 + 4 + 6	CD + DTR + DSR	N/C	N/C
N/C	CD + DTR + DSR	1 + 4 + 6	6 + 8 + 20
2	RxD	3	2
3	TxD	2	3
5	GND	5	7
7 + 8	RTS + CTS	7 + 8	4 + 5

N/C – not connected.

J402 Serial port pinout

DTR	4
CTS	8
TXD	3
RTS	7
RXD	2
DSR	6
DCD	1
GND	5

Pins 1,4,6 are connected together. Pin 9 and pin 10 are not connected