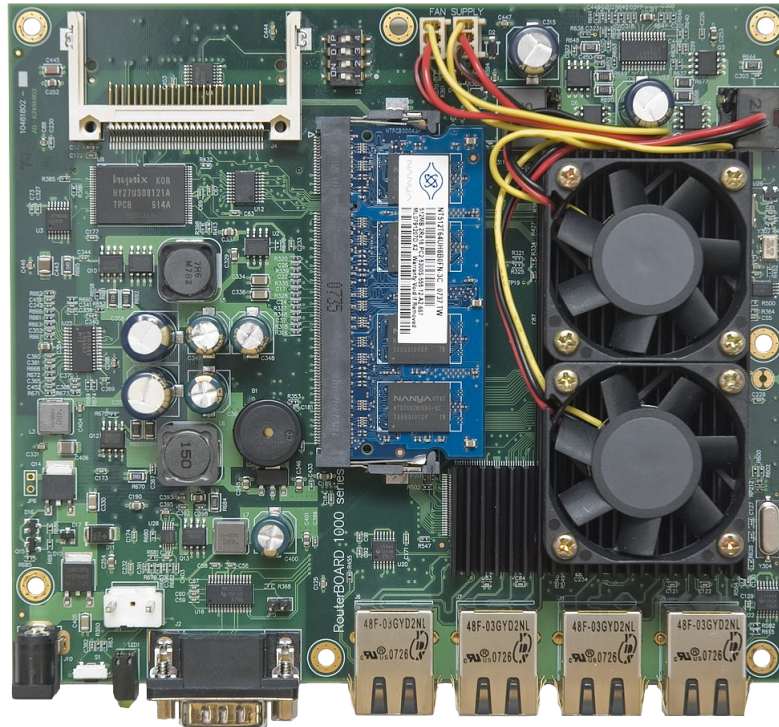


RouterBOARD 1000

User's Manual

Rev. A (Nov-2008)



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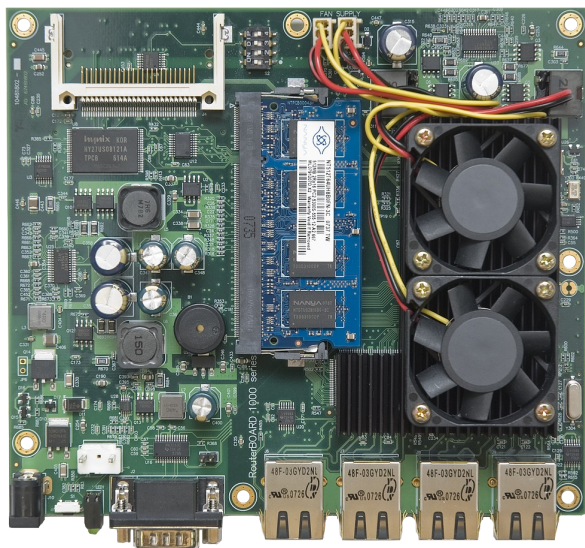
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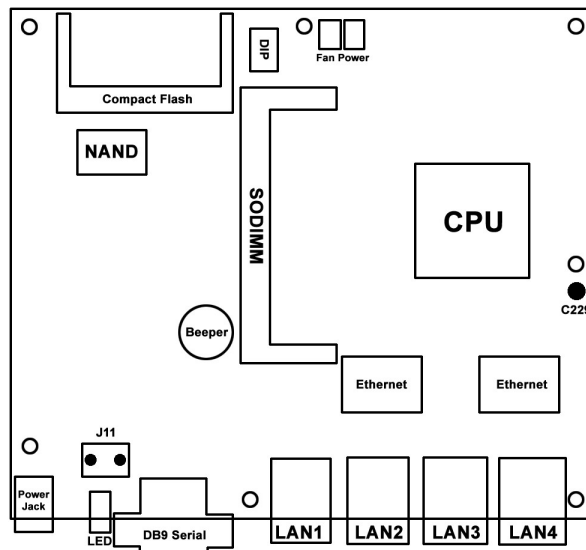
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System Board View and Layout



Top view



Layout

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

Specifications

	RouterBOARD 1000
CPU	MPC8548 1333MHz network CPU
Memory	SODIMM slot, no onboard module
Boot loader	RouterBOOT
Data storage	64MB onboard NAND memory chip
Ethernet	Four 10/100/1000 Mbit/s Gigabit Ethernet ports supporting Auto-MDI/X
MiniPCI slot	-
Expansion	-
CompactFlash slots	Two independent CompactFlash slots (True IDE Microdrive supported)
Serial port	One DB9 RS232C asynchronous serial port
LEDs	Power and User LED
Beeper	+
Power	Power jack: 12VDC, no PoE
Fan control	Two 5V DC fan power output headers with rotation sensor and automatic fan switching (maximum output current - 300mA total)
Dimensions	14 cm x 16 cm (5.51 in x 6.29 in)
Weight	312g
Temperature	Operational: -20°C to +65°C (-4°F to 149°F)
Humidity	Operational: up to 70% relative humidity (non-condensing)
Power consumption	13W min/35W max

Hardware Guide

Memory and Storage Devices

Memory

There is no onboard memory, but the device has a SODIMM slot for DDR2 modules, it is recommended to use modules with at least 667MHz (PC-4200)

Storage Device

The device is equipped with one 64MB NAND nonvolatile memory chip.

CompactFlash Slots

The board has two independent CompactFlash slots that support Compact Flash Type I or II cards and True IDE Microdrive storage devices. The first one (**J4**) is bootable. **Warning! The RouterBOARD 1000 series boards do not support hot insert of CompactFlash/Microdrive devices.**

Extension Slots

MiniPCI Slots

This device doesn't have any miniPCI slots

Daughterboard Connector

This device doesn't have any daughterboard connectors

Input/Output Ports

LAN ports

There are four LAN ports. The ports do not support Power over Ethernet.

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.

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 two fans to the RouterBOARD, but only one of them will work at a time. They will receive 5.5V 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

First to use the board:

- 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 or two CompactFlash modules or Microdrive hard drives, which you can use as an alternative boot device (in **J4** slot only) or additional storage media (in any or both slots);
- If not already installed, install board in a case, connect other peripherals and cables.

You can also order a pre-assembled system with RouterBOARD and extension cards of your choice already installed in a case.

Powering

Power options:

- **J10** power jack: 12V DC
- **J11** alternative power connector, used when device installed in a rackmount case, also 12V DC

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 CompactFlash module or a Microdrive hard drive installed in the first (**J4**) CompactFlash slot. 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 1000 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

MikroTik RouterOS, starting from version 3.0rc1, is fully compatible with RouterBOARD 1000 series embedded boards.

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 2.11
```

```
RouterBoard 1000
```

```
CPU frequency: 1333 MHz
```

```
Memory size: 512 MB
```

```
Press any key within 2 seconds to enter setup
```

```
RouterBOOT-2.11
```

```
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 '*'.

Configurable Options

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.

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.

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 on RouterBOARD 1000

Health monitor

This menu shows the current fan status.

```
[admin@MikroTik] > system health print
  fan-mode: manual
  use-fan: main
  active-fan: main
[admin@MikroTik] >
```

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).

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: "rb1000"
  serial-number: "154201C1DD3C"
  current-firmware: "2.11"
  upgrade-firmware: "2.11"
[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 (**TP12**) 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.

DIP Switch

The DIP switch can be used to control the RB1000 CPU frequency. Use this switch with extreme caution, as only the mentioned configurations will provide any useful result, other settings can damage your device.

DIP #1234	CCB	Frequency
0110 (default)	533	1333
1001	600	1200
0101	533	1066
1010 (not recommended)	600	1500

DIP switch positions affect the CCB and Multiplier. #AABB, so AA=Multiplier (10=x2, 01=x2.5), BB=CCB

Example: To downclock the RB1000 to 1066MHz, set the DIP switches to OFF-ON-OFF-ON

Appendix

Connector Index

J4	CompactFlash slot 1 (bootable)	
J5	CompactFlash slot 2	
J2	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)
J6-J9	RJ45 Gigabit Ethernet 1000Base-T port LAN1 (no PoE)	
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)	
JP1	DC Fan 1 connector	

	1	GND
	2	+5.5 V DC
	3	Rotation speed feedback
JP2	DC Fan 2 connector	
	1	GND
	2	+5.5 V DC
	3	Rotation speed feedback

Button Index

S1	Software Reset 1 button. Loads the Primary boot loader
S2	DIP switch for frequency control
TP12	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.