

nutpwrman

Linux Command-Line Tool

This manual describes the nutpwrman tool for the Linux command-line. Purpose of this tool is configuration, controlling and monitoring of the Ethernut 5 hardware features which are connected to the integrated power-manager.

Author: Daniel Otte

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1 About the power-manager

Ethernut 5 is equipped with an additional microcontroller – besides the main ARM CPU – which is designed to manage the powering features of the board.

The power-manager is an Atmel AVR ATmega168 microcontroller equipped with 16 KiB of Flash memory, 1 KiB of SRAM, clocked with 8 MHz and reprogrammable by the main CPU.

Ethernut 5 is delivered with free power-management software, licensed under 3-clause BSD license, which is able to receive commands from the main CPU and report some status information back. The I²C-Bus connecting the power-manager with the main CPU also connects to the real-time-clock (RTC). This RTC is also able to trigger an interrupt at the power-manager which can be used to power-up or reset the board.

The power-manager can

- enable / disable 1.8 V / 3.3 V / 5.0 V power
- enable / disable power for the MMC- / SD-Card slot
- enable / disable the clock of the Ethernet PHY
- enable / disable the reset line of the Ethernet PHY
- enable / disable the power-save feature of the RS232 level shifter
- enable / disable power at the USB host port
- enable / disable powering via Power-over-Ethernet (PoE)
- read the board temperature
- read the analog value of the input voltage at the barrel connector
- control the green user LED

2 Options overview

The following options exist to invoke nutpwrman

```
> pwrman [-f]
    print a short status report

> pwrman help
    print a help message with a short description of available options

> pwrman [-f] status
    print a short status report

> pwrman [-f] on|off [<feature> ...]
    enable / disable specified features

> pwrman [-f] led [<on-time> [<off-time>]]
    print or set led blink time

> pwrman [-f] temp
    print board temperature (in degree Celsius)

> pwrman [-f] vaux
    print voltage at the barrel connector

> pwrman [-f] rtc req [<addr> [<length>]]
    request <length> registers from RTC starting with address <addr>

> pwrman [-f] rtc show
    show requested registers from RTC in hex

> pwrman [-f] rtc set <addr> [<data> ...]
    set RTC registers to given values starting with address <addr>

> pwrman [-f] int set on|off <feature> [<feature> ...]
    [on|off <feature> [<feature> ...]]
    set interrupt response states

> pwrman [-f] int get
    get interrupt response states

> pwrman [-f] reset
    reset power-manager

> pwrman [-f] version
    print power-manager firmware version
```

The optional `-f` (force) flag tells `nutpwrman` to open the device even if it is in use by the kernel

Feature name	Feature description
board	1.8 V and 3.3 V supply
vbin	supply via USB device connector
vbout	USB host connector supply
mmc	MMC slot supply
rs232	RS-232 driver
ethclk	Ethernet PHY clock
ethrst	Ethernet PHY reset
int	RTC interrupt

2.1 Help command

```
> pwrman help
```

The help command prints the following overview of available commands

```
> pwrman help
pwrman [-f]
  - print settings
pwrman help
  - print this help text
pwrman [-f] status [<feature> ...]
  - print status
pwrman [-f] on|off [<feature> ...]
  - enable/disable specified features
pwrman [-f] led [<on-time> [<off-time>]]
  - print or set led blink timer
pwrman [-f] temp
  - print board temperature (in degree Celsius)
pwrman [-f] vaux
  - print auxiliary input voltage
pwrman [-f] rtc req [<addr> [<length>]]
  - request <length> registers from rtc starting with address
<addr>
pwrman [-f] rtc show
  - show requested registers from rtc in hex
pwrman [-f] rtc set <addr> [<data> ...]
  - set rtc registers to given values starting with address
<addr>
pwrman [-f] int set on|off <feature> [<feature> ...] [on|off
<feature> [<feature> ...]]
  - set RTC interrupt response states
pwrman [-f] int get
  - get information about RTC interrupt response
```

```
pwrman [-f] reset
  - reset power management controller
pwrman [-f] version
  - print firmware version

-f forces opening the device even if it is in use by the kernel

features:
  board  - 1.8 V and 3.3 V supply
  vbin   - supply via USB device connector
  vbout  - USB host connector supply
  mmc    - MMC slot supply
  rs232  - RS232 driver
  ethclk - Ethernet PHY clock
  ethrst - Ethernet PHY reset
  int    - RTC interrupt
```

2.2 Status reports

There are two kinds of reports, the long report and the short report. They do not differ in the information they present, but in how they present this.

2.2.1 Short report

```
> pwrman [-f]
```

The short report lists the features by their status

```
> pwrman
on:  board vbin vbout mmc rs232 ethclk
off: ethrst int
```

2.2.2 Long report

```
> pwrman [-f] status [<feature> ...]
```

The `status` command lists the status of the specified features or all features statuses if no feature is specified

```
> pwrman status board
board: on
```

```
> pwrman status board int
board: on
int: on
```

```
> pwrman status
board: on
vbin: off
vbout: on
mmc: off
rs232: on
ethclk: off
ethrst: off
```

```
int: on
```

2.2.3 Temperature report

```
> pwrman [-f] temp
```

The `temp` command reports the board temperature in degree Celsius.

```
> pwrman temp  
31.625°C
```

2.2.4 Auxiliary voltage report

```
> pwrman [-f] vaux
```

The `vaux` command reports the voltage at the barrel connector in volts.

```
> pwrman vaux  
11.263V
```

2.3 Status changes

2.3.1 On command

```
> pwrman [-f] on [<feature> ...]
```

The `on` command can be used to enable the specified features.

2.3.2 Off command

```
> pwrman [-f] off [<feature> ...]
```

The `off` command can be used to disable the specified features.

2.4 LED control

```
> pwrman [-f] led [<on-time> [<off-time>]]
```

The `led` command reports the on- and off-time if invoked with no further arguments. If an on-time or an on-time and an off-time are specified these values are set in the corresponding registers in the power-manager. The time are in the range from 0 to 15 and correspond to the time the green user LED is switched on and off in 200 ms units.

2.5 RTC control

The Ethernet 5 is equipped with an RTC of the type PCF8563T from NXP. Please consult the appropriate datasheet for information about programming the RTC.

This RTC is controlled via I²C-bus either from the host CPU or from the power-manager. `nutpwrman` allows you to instruct the power-manager to write data to or read data from RTC registers.

Reading data is handled in a two step process. First the data has to be requested and then, after a short delay, the requested data can be fetched from the power-manager and shown by `nutpwrman`.

2.5.1 Requesting RTC data

```
> pwrman [-f] rtc req [<addr> [<length>]]
```

The `rtc req` command requests the content of `<length>` registers starting at address `<addr>`. Addresses range from 0 to 15 and length ranges from 1 to 16. If no length is specified 16 - `<addr>` is assumed. If no address is specified 0 is assumed as starting address.

```
> pwrman rtc req 1 3
requesting 3 bytes, starting at 1
```

```
> pwrman rtc req
requesting 16 bytes, starting at 0
```

2.5.2 Setting RTC data

```
> pwrman [-f] rtc set <addr> [<data> ...]
```

The `rtc set` command allows setting specific RTC registers to specific values. Registers, starting with the register indicated by `<addr>`, are set to the corresponding item in `<data>`.

For example:

```
> pwrman [-f] rtc set 9 7 8 14
```

causes

register		new value
9	←	7
10	←	8
11	←	14

Address and data can also be specified in hex by prefixing with '0x' or in octal by prefixing with '0'.

2.6 Interrupt / alarm control

2.6.1 Setting interrupt configuration

```
pwrman [-f] int set on|off <feature> [<feature> ...] [on|off
<feature> [<feature> ...]] ...
```

The `int set` command can be used to configure which features should be switched on or off if an interrupt / alarm is raised by the RTC. The argument list begins with either the word `on` or `off` followed by a list of features which would be switched into the corresponding state. The list may also contain `on`, `off`, `active` or `inactive` where `on` and `off` changes the state to which the following features are switched while `active` or `inactive` can be used to switch interrupt handling at all on or off.

Features are first switched off and then switched on. So listing the same feature in the on and the off list causes a short reset if an interrupt occurs.

For example

```
> pwrman int set on board off board active
```

Can be used to reset the board, including the main CPU, if an interrupt occurs.

2.6.2 Getting interrupt configuration

```
pwrman [-f] int get
```

The `int get` command reports the interrupt response configuration.

```
> pwrman int get
* RTC interrupt handling is enabled
* disable after RTC interrupt: board
* enable after RTC interrupt: board
```

2.7 Resetting the power-manager

```
pwrman [-f] reset
```

The `reset` command can be used to restart the power-manager. The power-manager normally makes use of the watchdog-circuit integrated in the ATmega168, so it should automatically restart if it encounters an unrecoverable error condition.

2.8 Requesting version information

```
pwrman [-f] version
```

The `version` command allows retrieval of version information about the power-manager and also about nutpwrman itself.

```
> pwrman version
pwrman (host software):
  version: 3.0
  build date: Jan 15 2014
  build time: 19:24:46
Power-Management-Controller:
  version: 3.0
  manufacturer-ID: egnite GmbH
  model: ethernut 5
  device-ID: ethernut 5 nutpwrman ver. 3.0
  device-revision: build: 9 (2014-01-13T17:06:47+0100)
```

3 Watchdog example

```
1. #!/bin/sh
2.
3. delay=$1
4. if [ "x$delay" == "x" ]; then
5.     delay="1"
6. fi
7. min=$( date +%M )
8. timeout=$( expr "(" $min + $delay ")" % 60 )
9. pwrman rtc set 9 0x$timeout;
10. pwrman int set on board off board active;
11. pwrman rtc set 1 3;
```

The shell script shown above implements a simple watchdog functionality.

Line 3 to 6 sets the value of the `delay` variable to the parameter given to the script or 1 if no parameter is specified. `delay` contains the number of minutes before the power-manager will reset the board if not “reconfigured”.

Line 7 and 8 set `timeout` to the minute value of the time where the power-manager should reset the board.

Line 9 sets the `MINUTE_ALARM` register in the RTC to the previously computed timeout value.

Line 10 initializes the interrupt handling in a way that raising an interrupt will reset the main CPU.

Line 11 sets the AIE and TIE bits in the RTC, which enable interrupt generation in the RTC.

www.egnite.de | www.ethernut.de

E-Mail: info@egnite.de | Tel.: +49 (0)2305 441256 | Fax: +49 (0)2305 441487

egnite GmbH | Erinstrasse 9, 44575 Castrop-Rauxel, Germany

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