

Netzer Breakoutboard – Circuit Description and Assembly Manual R1.1 (2011-11-27)

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1 Circuit Description

Sheet 1 shows the slot for *Netzer* and extension port. The *Netzer* can be directly soldered or plugged in via sockets. All IO pins of *Netzer* are protected against high input currents with serial 100 Ω resistors. SW_Reset pulls the *Netzer* reset pin to ground and generates a system reset at the *Netzer* and at a potentially connected board at the extension port which can be plugged in via two 10-pin headers with 2 mm grid. *Netzer* is supplied with the 3.3V generated before. For a flexible Extension Port all *Netzer* pins and all available voltages (also SUP_AUX, see below) are connected.

Sheet 2 shows the power supply. The input voltage (6 V – 24 V, AC or DC) from X401 is protected against reverse polarity (B401), ESD (D401) and short circuits (F401). The voltage (SUP_AUX) is connected to the extension port. The upper part generates from DC or AC with the switching regulator IC4 (in combination with D401, L401 and electrolytes C402 and C403) a stable 5V (+5V_AUX). A switching regulator was chosen for a wide voltage input range. An extra heat sink is not required.

Alternatively, a Power-over-Ethernet supply device (Silver Telecom ones are used here) can be mounted. The 48V source voltage (POE_VA1, _VA2, _VB1 and _VB2) is picked directly from *Netzer*. The power supply generates +5V (optional galvanically isolated –Ag9050-S or galvanically connected Ag8005-S). L701, C701 and C702 are used for low ripple. R702 is a resistance indicating the PoE-device the power class required for the power sourcing equipment (Class 0, see Table 1).

Power CLASS	Programming Resistance (Ohms)	Min Power (W)	Max Power (W)
0	Do not assemble	0.44	12.95
1	698 \pm 1%	0.44	3.84
2	383 \pm 1%	3.84	6.49
3	249 \pm 1%	6.49	12.95

Table 1: Power classes for Ag9050 or Ag8005 (Source: from data sheet)

D701, D702, T401 and R401 are used for prioritized O-ring of the PoE voltage for +5V_AUX. Transistor T401 is open for +5V_AUX only if there is no PoE voltage via R401. PoE has the highest priority. R701 (A for Ag9050, B for Ag8005) compensates the voltage drop of D702 - the PoE voltage is adjusted to 5.2V.

The voltage behind T401 is the first power supply of +5V switchable through SW_P. The linear voltage regulator IC2 converts the +5V to 3.3V. LED_P indicates this voltage.

Ground and power supplies are quickly accessible via wire pads and screw terminals (X10 and X20).

Sheet 3 shows the Breakout parts for testing *Netzer* IOs. All IOs are connected to LEDs via driver (IC5 and IC6). The LEDs are used as port state indicators. R5 and R6 adjust the LED current. With jumpers JP1 and JP2 the LED drivers can be deactivated as well.

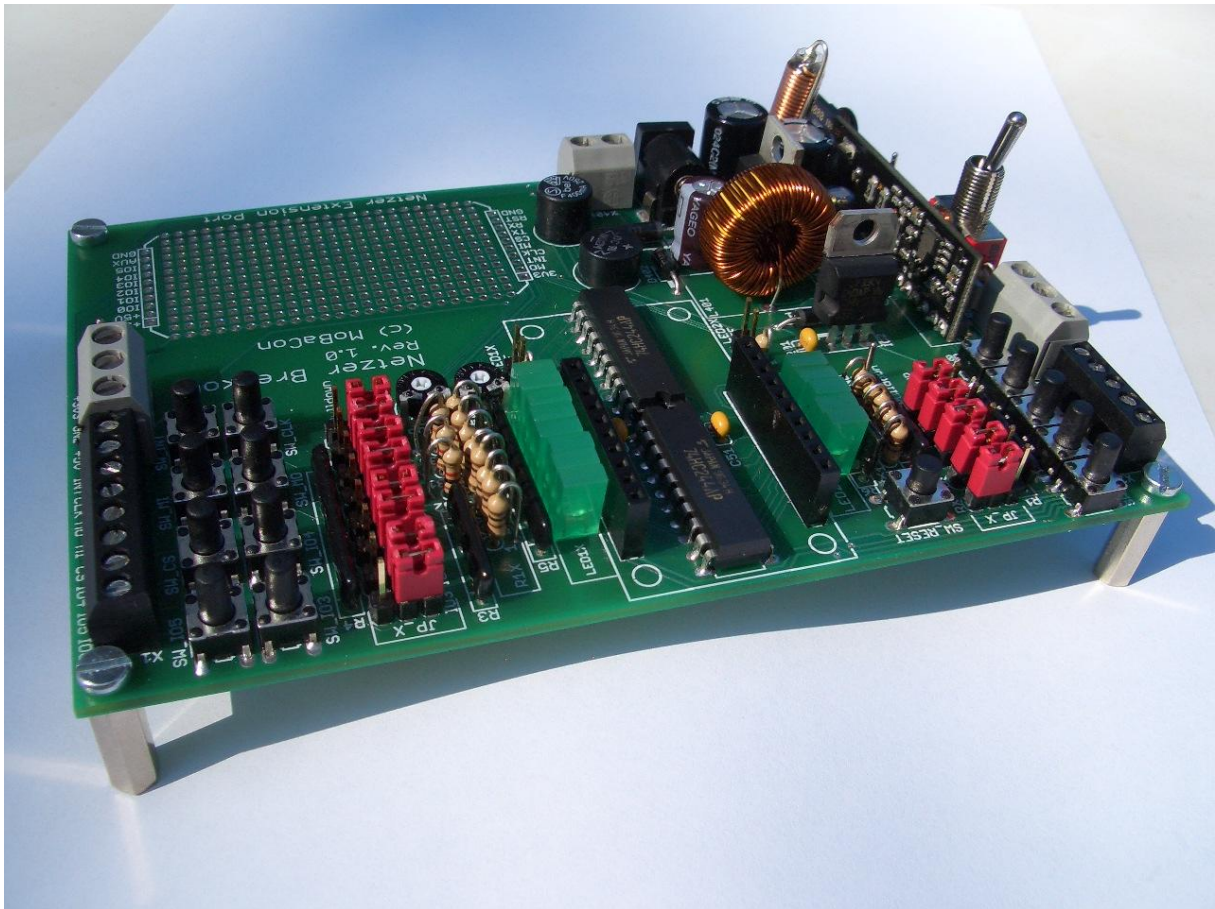
Each IO pin is connected to the middle pin of a three-pole jumper. A jumper bridge chooses between a 10 k Ω pull-up (R1 and R3) or pull-down resistor (R2 and R4). The IOs *SPI_CLK* and *SPI_MI* are an exception because their pull-ups can be adjusted by a potentiometer (R28

and R29) in a range between 1 k Ω – 11 k Ω . That can be useful if the *Netzer* I2C mode is used. In that mode the resistors have to be adjusted for an intended bus frequency.

Last but not least the switches named SW_XX can pull any IO to ground. A configured *Netzer* input and an activated pull-up are necessary for using these switches.

2 Module

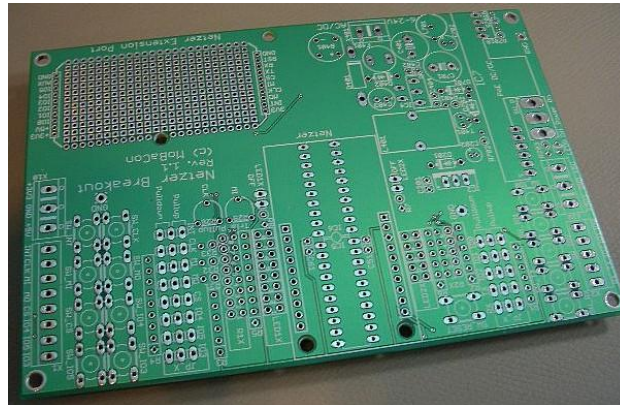
The module has the dimensions 134 mm x 90 mm. All delivered parts are THT parts. The level for assembly is estimated as medium difficult, because of the amount of parts to assemble.



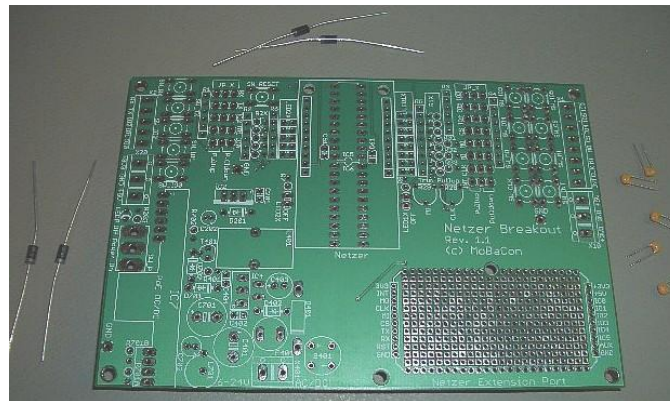
The board has four mounting holes for distance bolts or enclosure.

3 Assembly manual

Parts marked with **(PoE)** are optional and must only be assembled if the PoE option is chosen.

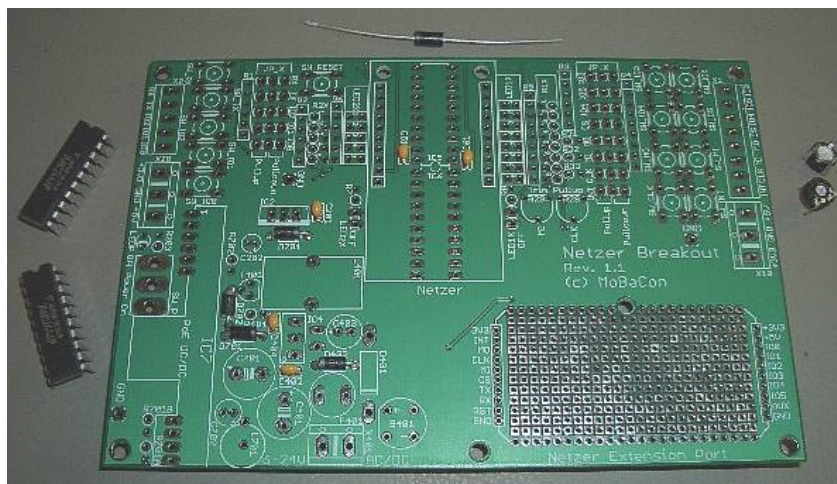


3.1 Step 1



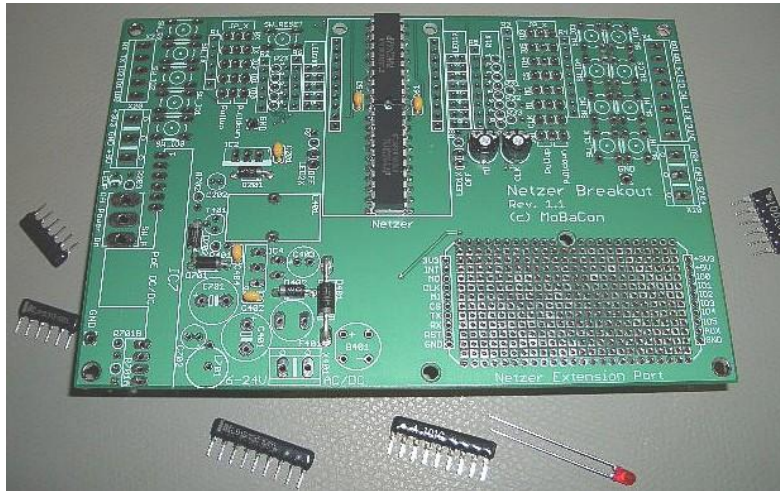
Part number	Description	Package	Value	Notes or speciality
D201, D701 (PoE)	Rectifier diode 1N4001	DO-41	50 V, 1 A	Mark at diode
C51, C61, C201, C402, C404	Multilayer Ceramic condensator	RM2,5	100 nF	-
D402, D702 (PoE)	Schottky rectifier diode 1N5819	DO-41		Mark at diode

3.2 Step 2



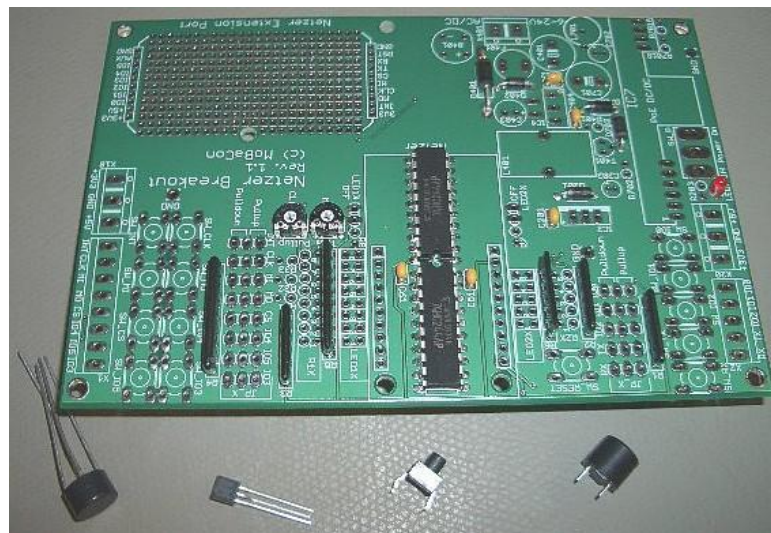
Part number	Description	Package	Value	Notes or speciality
D401	Suppressor diode P6KE30A	CB417	6 A	Mark at diode
R28, R29	Trim potentiometer	Lying, 6mm	10 k Ω	-
IC5, IC6	74HC244 - 8-Bit bus driver	DIL20		Indentation marks pin 1

3.3 Step 3



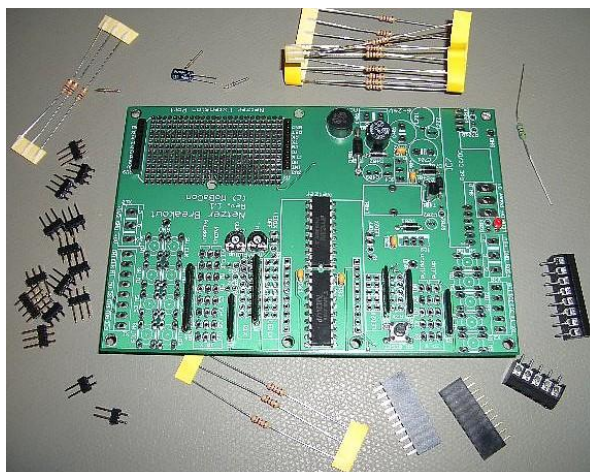
Part number	Description	Package	Value	Notes or speciality
R4	Resistor network	9 x 2.54	8 x 10 k Ω	Mark at pin 1
R1, R2, R3	Resistor network	6 x 2.54	5 x 10 k Ω	Mark at pin 1
R5	Resistor network	9 x 2.54	8 x 100 Ω	Mark at pin 1
R6	Resistor network	6 x 2.54	5 x 100 Ω	Mark at pin 1
LEDP	LED	3 mm	Red	Check correct polarity!

3.4 Step 4



Part number	Description	Package	Value	Notes or speciality
Extension Port	2 sockets	2 x 10 pole	RM 2,00 mm	
B401	Round bridge rectifier	RB1A	80 V / 1.5 A	Check correct polarity!
SW_RESET	Push button	6x6 mm	7 mm height	
F401	Micro fuse quick	TR5	0,4 A	Use socket if possible
T401	PNP transistor BC640	TO-92	80 V / 1 A	Check correct polarity!

3.5 Step 5



Part number	Description	Package	Value	Notes or speciality
R1X (8 pieces), R2X (5 pieces)	Carbon-film resistor	EU0309V	100 Ω / 0,25 W	Rings: brown-black-brown
R401	Carbon-film resistor	EU0309V	82 Ω / 1 W	Rings: Grey-red-black
R203, R31, R32	Carbon-film resistor	EU0309V	1 k Ω / 0.25 W	Rings: Brown-black-red
R7, R8, R33	Carbon-film resistor	EU0309V	10 k Ω / 0.25 W	Rings: Brown-black-orange
R701 (PoE)	Carbon-film resistor	EU0309V	Variant A: 100 k Ω / 0.25 W Variant B: 15 k Ω / 0.25 W	Mount variant A for Ag9050 (galvanically isolated). Rings: brown-black-yellow. Mount variant B for Ag8005 (galvanically connected). Rings: brown-green-orange
R702 (PoE)	Carbon-film resistor	EU0309V	-	See Table 1
Netzer socket	2 sockets	2 x 10 pole	RM 2,54 mm	
C202	Electrolytic capacitor, radial	1.5-4	2,2 μ F / 50 V	Check correct polarity!
JP1, JP2	Pin header	2-pole	RM 2.54 mm	
JP_X (13 pieces)	Pin header	3-pole	RM 2.54 mm	
X1	Screw terminal	8-pole	RM 3.5 mm	
X2	Screw terminal	5-pole	RM 3.5 mm	
3 ground connectors	Wire pad	1 mm		

3.6 Step 6



Part number	Description	Package	Value	Notes or speciality
X401	Screw terminal	2-pol	RM 5,0 mm	
X10, X20	Screw terminal	3-pol	RM 5,0 mm	
SW_X (13 pieces)	Push button	6x6 mm	9,5 mm height	

LED_1X (8 pieces) LED_2X (5 pieces)	Rectangle LED	2x5 mm	Green	Check correct polarity! Bar marks cathode.
C702 (PoE)	Electrolytic capacitor radial, 105°C, low ESR, RM 2,0mm	CPOL- EU2-5	10 μ F / 50 V	Check correct polarity!
C403	Electrolytic capacitor RM 5,0	E2.5-7	330 μ F / 16 V	Check correct polarity!

3.7 Step 7



Part number	Description	Package	Value	Notes or speciality
C401, C701 (PoE)	Electrolytic capacitor 10x20mm, RM 5.0mm	E3.5-10	470 μ F / 35 V	Check correct polarity!
IC7 (PoE)	PoE Module	SIP-10	+5.0 V	Variant A : Ag9050 (galvanically isolated). Variant B : Ag8005 (galvanically connected).

3.8 Step 8



Part number	Description	Package	Value	Notes or speciality
IC2	Voltage regulator	TO220	+3.3 V	Check correct polarity! Mark indicates tab Optionally use heat sink
IC4	Simple switch 1A step- down voltage regulator	TO220-5	+5.0 V	Check correct polarity! Mark indicates tab
L401	Round storage choke		330 μ H / 1 A	
L701 (PoE)	Axial EMI suppression choke		10 μ H / 5 A	

After this step the power supply (6-24V AC/DC) can be connected to X401 for the first time. There should be a voltage of 5V between ground and the middle pad of the not yet assembled switch SW_P.

For testing the PoE option a *Netzer* must be plugged into socket. Afterwards, an Ethernet patch cable can be connected via PoE power supply. Leave the other power supply connected.

Now the voltage of the SW_P middle pad against ground should be about 5.5V. After unplugging the Ethernet cable again there should be 5V.

If all voltages are ok unplug Ethernet cable, power supply and remove *Netzer* from the board.

3.9 Step 9



Part number	Description	Package	Value	Notes or speciality
SW_P	Rocker switch On-On	AS50APC	6 A-125 VAC	

Reconnect power supply (external supply and/or PoE) and switch SW_P on. Now the red LED should indicate power. Also check voltages 5V and 3.3V at the screw terminals (X10 or X20). Plug in *Netzer* afterwards (switch off power supply first!). Install jumper, distance bolts and extension boards as needed.

