GPS to DCF77 Nixie clock converter – The Documentation

"Firmware Version 1.00C"

08.03.2008

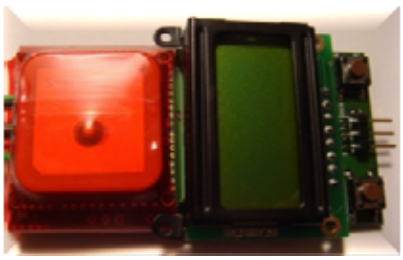
www.nixieclocks.de

This GPS-CLOCK device, receives its ultra accurate time and date information from GPS satellites, (yes even indoor) and converts the date and clock data into a DCF77 pulse train system.

Normally DCF77 clocks are only used in Germany or some neighbouring countries, but now the whole world can enjoy our DCF77 nixie clocks better, faster and more accurate than ever seen before.

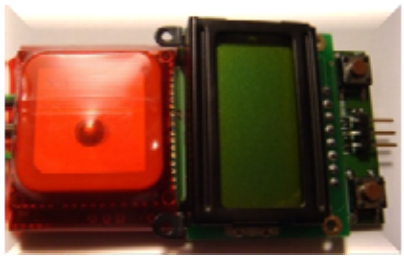
The converter consists of a high end GPS unit, an LCD display, an ATMEL processor, a high quality pcb and all smd parts mounted on the pcb.

All our nixie clocks with DCF77 input capabilities will work.



1. Unpacking the unit

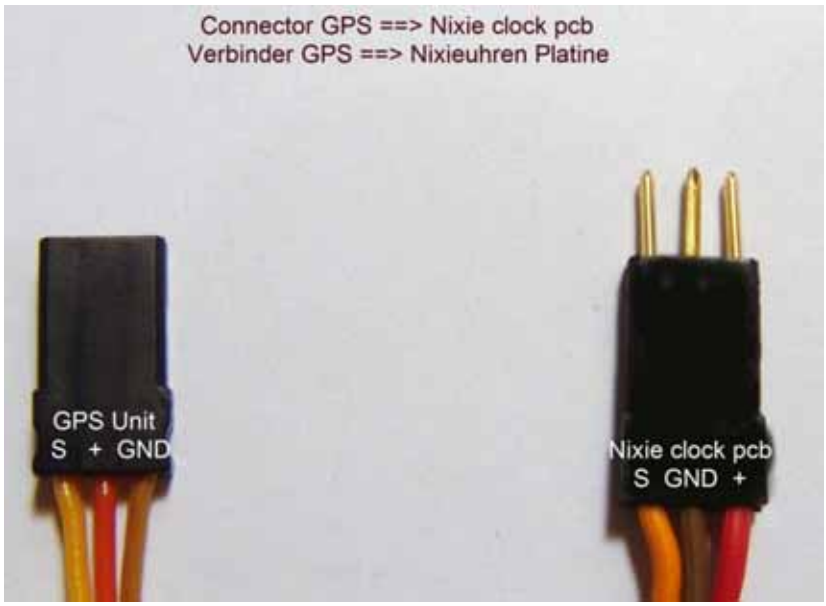
When you receive the unit, it is fully tested and the GPS antenna is fixed to the pcb with red shrinking tube. The GPS antenna is connected via a 4 wire cable to the pcb. On the top you find 2 buttons. They are used to enter the menu and to alter settings in the converter unit. The function will be described later.



Also at the top you find a 3 pin row. This is used to connect the GPS converter to the nixie clock.

2. Connect the unit to the nixie clock

To connect the unit to the nixie clock, you need a three wire cable. That can be a few meters long. Here is how to connect the unit to the clock:



The connector on the clock pcb is called „J1“. This is where the DCF77 normally is connected. This is where you have to connect this unit now.

The connector has 5 pins. Pin1 and 2 are not used. But pin 3, 4 and 5 are used to connect the converter. See how it is done with the help of the table.

Clock PCB connector „J1“	**Cable from the converter**
Pin 3 = S = Signal	„S“ = Signal
Pin 4 = GND	GND
Pin 5 = +5 Volt	+ 5 Volt

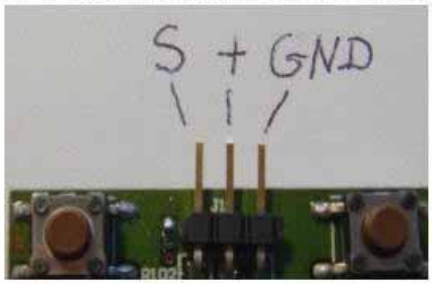
Here you see the picture of the nixie clock pcb and of the converter. See the part that is called „DCF77“. This is where to connect your converter.

The clock pcb with the important connectors

The picture on the top shows the J1 connector of the clock pcb.
You only need the pins "S", "GND" and "+"

Now connect "S"of the clock pcb to "S" of the GPS unit,
"GND" of the clock pcb to "GND" of the GPS unit
and "+" to "+" of the GPS unit.
That is all. Please take care not to mix the cables!

The GPS Unit with the 3 important connectors



3. Power up the unit

After you have made the cable, connect the cable from the converter to the clock pcb and power the nixie clock.

The first 6 sec the LCD will show GPS clock and the firmware version, while it send initialization codes to the GPS unit in the background.

After this the WAIT GPS screen will appear, line 2 show S=0 000. If this continues unchanged for over 1 sec, you have GPS communication fail, wrong GPS or wrong baud rate or wrong connections.

S= displays the number of satellites, 000 counts up when a new valid NMEA parcel has been received. Any GPS module will send a full NMEA once a second, so this number must increase.
The unit is default set to require a minimum of 3 satellites before it will continue.

All GPS units deliver UTC time. They have no summer or winter time. You simply setup the offset and go to main clock and date screen to see the results are correct and after 1-2 minutes it will be displayed on your nixie clock as if a perfect DCF77 signal was connected.

The GPS unit will now try to receive a valid signal. If so, the blinking will be a second pulse and the clock will show the GPS time and date. It should look like this:

As the GPS might not be your local time, you can now set the time to your local time by using the menu buttons.

4. The menu

The converter has a **MENU button** on the top left and a **SET button** on the top right.

Menu 0 shows the **time** and the **date**. This is the default value.

Menu 1 shows the actual **height** and **speed.**

Menu 2 shows the **max height** and the **max speed**. Press SET to reset maximum.

Menu 3 and 4 show the **global position** (longitude and latitude)

Menu 5 shows the **actual temperatures** .

If you press the SET button it will switch from C to F and back.

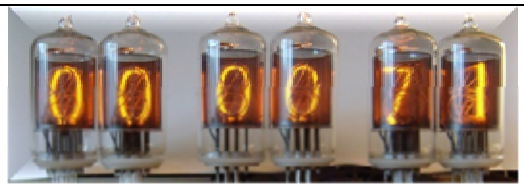
Menu 6 shows the **max temperature.** Press SET to reset maximum.

Menu 7 lets you choose what will be shown in the nixie clock at second 50.

You can choose between **date or temperature**. Just press the SET button to switch between date and temperature. If no temperature sensors are mounted there it makes no sense to show the temperature instead of the date. **The value of TEMP 1 will be shown in the Nixie clock**. TEMP 2 values will only be shown in the LCD display of the GPS converter unit.

The 10th of minutes on the nixie clock is used to indicate negative temperatures. The unit can also show Fahrenheit on the Nixie clock. This needs 3 digits, so one of minutes and both seconds tubes are used to create a 3 digit temperature display.

If the temperature sensor is connected the readout will be like this:

	+17 degrees Celsius
	+71 degrees Fahrenheit
	+ 131 degrees Fahrenheit
	- 11 degrees Celsius

The nixie clock can only show 1 temperature from sensor TEMP 1, but the GPS unit can show 2 temperatures on the LCD display.

The bottom line of the LCD display shows **the number of satellites** that the unit receives.

Try to optimize the antenna location (near window) so you have at least 3-4 satellites. It is best to have 6-8, but that is not always possible if it is overcast, raining or your windows are covered with aluminium foil.

However this GPS module we supply with this unit, is known to give best in class indoor reception, no other modules we have tried can match this.

Menu 8 shows the **offset UP option**.

In this menu you change the GPS time to your local time. Press the SET button to **increase the GPS time** by 30 minutes. Press until your time offset from the GPS time is correct.

The clock will set automatically at the next minute change to your local time.

PLEASE NOTE: If the nixie clock tubes switch off after 3 minutes, don't panic! The GPS module might not have found a valid signal – so the clock will stay off until a signal has been found. Then the clock tubes will go on again and show the correct time!

If the GPS signal gets interrupted due a poor signal, the Nixie clock will continue to run on the internal 4MHz oscillator during this "blackout". The Nixie clock has two DCF77 indicator LED outputs. The green one will blink if GPS (DCF77) signal is good, so you can easily see if you have a good or a bad signal. You can also see on the LCD display if the time runs or is frozen. This will tell you good or lost signal from GPS. In any case the Nixie clock will keep good time for a long time.

Menu 9 is the same as menu 8 – but in this menu you can **decrease the GPS time.**

In this menu you change the GPS time to your local time. Press the SET button to **decrease the GPS time** by 30 minutes. Press until your time offset from the GPS time is correct.

The clock will set automatically at the next minute change to your local time.

Additional information

a) Some versions of nixie clocks 1.06 or older with trafo powersupply were not designed to handle the extra 5V current. But such a nixie clock can be modified to comply with the current demand. The 7805 needs to be changed to LOW DROP type LM2937-5. The rectifier needs to be changed to schotky type and the capacitors need to be 3000 uF before the regulator and 1000uF after the regulator. That's all. But you only need to do the changes if the LCD backlight flickers.

b) Resistor R103 is default 18 ohm 0805 size. It sets the back light level. 16 ohm is the max, and 25 to 33 ohm can be used to save power and heat in 5V regulators and still make it possible to read the LCD in night/no light.

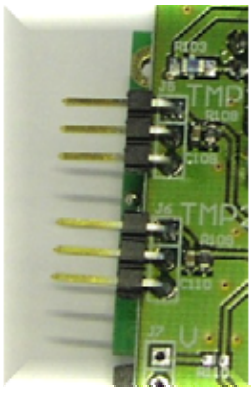
c) Resistor R201 is default 910 ohm 0603 size, It sets the contrast level on the LCD. The higher the value the lighter becomes the text. The lower the value the darker the texts gets on the LCD display.

d) Remember to check the temperature of your nixie clock 7805 regulator, now this regulator also supply the GPS and LCD back light, so if burning hot, you must add heat sink, it is also possible to unsolder it, add wires so the regulator can be mounted in your metal case if such is used.

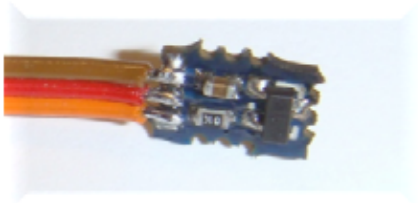
e) If you have no reception of the GPS signals, you can use a longer cable from the GPS antenna to the converter. Use a 4 wire cable and connect the cable to the existing socket that was connected to the converter pcb when is was sent to you. The cable could be a few meters long. You might shrink the antenna into shrinking tube so that it can even be used outside the window. In most cases the GPS signal will be received close to a window.

f) For advanced users there will be a PC **Software** that lets you configure the GPS unit in all different ways. To use that free programme you will need a USB level converter that can be purchased from us.

g) Temperature sensors can be purchased later, or simply ask for instructions how to make your own. The unit can handle almost any analog sensor. The PC SW is needed to calibrate them if you use other non standard sensors.



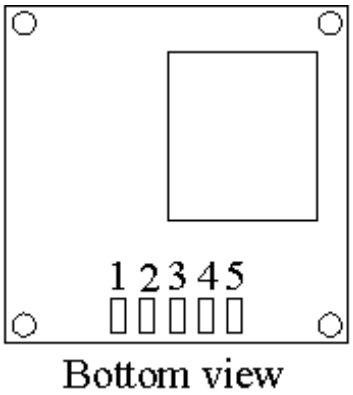
The Temp 1 and 2 connectors
From the top S + GND



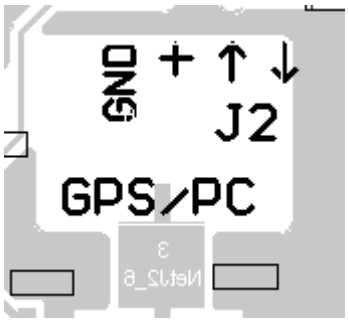
Temperature sensor.

f) If you want to solder the cable between the GPS antenna and the converter module yourself, you should stick to the following description:

Pin #	Name	Type	Description
1	VCC	P	Power input +
2	RX	I	Data input (TTL level)
3	TX	O	Data output (TTL level)
4	GND	P	Ground
5	GND	P	Ground



GPS Antenna bottom view



Converter PCB bottom view – connector J2

Connectors on GPS Antenna **Converter PCB connector J2**

1	VCC	P	Power input +	+ 5 Volt
2	RX	I	Data input (TTL level)	Out ↓
3	TX	O	Data output (TTL level)	In ↑
4	GND	P	Ground	
5	GND	P	Ground	GND

h) Connecting the temperature sensor to a 3 wire cable. As you can see in the picture, the cable is connected as follows:

Left	GND
Middle	+
Right	signal