

# What is DCF77 ?

The demodulated signal is a pulse-per-second signal with each falling edge marking the start of the second. The low level state has a width of either 100ms or 200ms which is to be correlated with respectively binary values 0 and 1. A complete broadcast of the time information is composed of 59 pulses followed by a missing one. The missing pulse indicates the end of the minute.

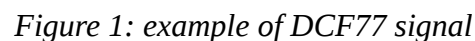


Figure 1: example of DCF77 signal

Each sequence of 59 bits carries the time information in binary coded decimal (BCD) following the schema at figure 2.

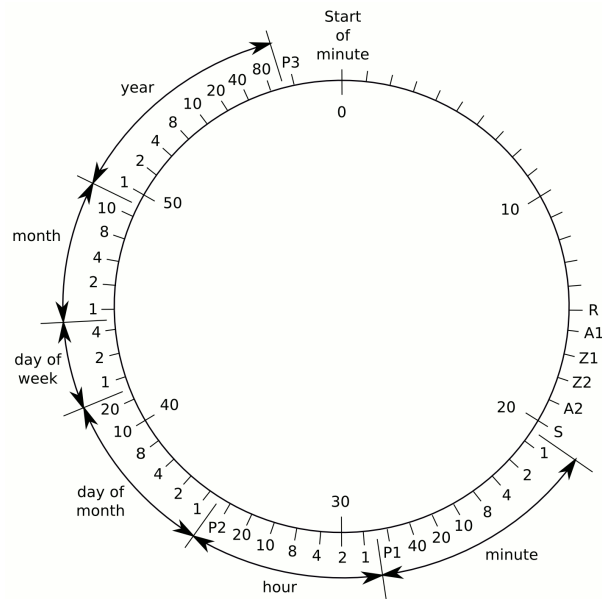


Figure 2: time information provided by one sequence of 59 bits

Unlike GPS technology, DCF77 is not able to provide any information about the geographical location of the receiver.

As already stated, the DCF77 signal is only receivable in a limited surrounding region around Frankfurt, at a maximum distance of about 1900 km from Frankfurt. The area covered by the DCF77 signal is illustrated in figure 3.

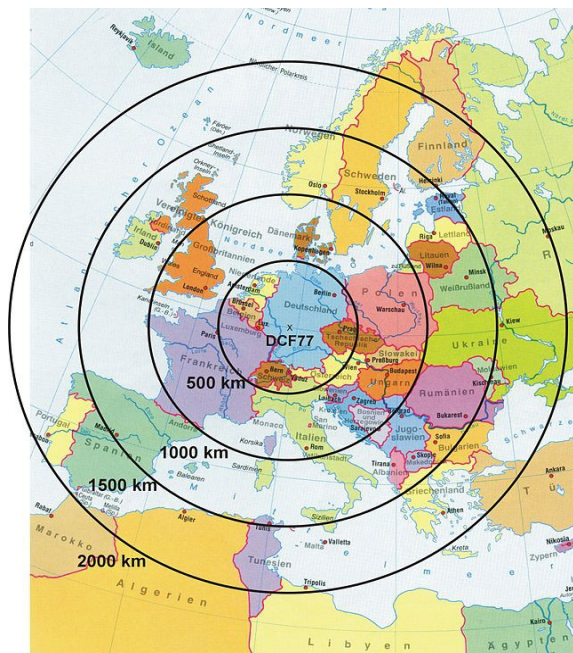


Figure 3: area covered by DCF77 signal

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More information about the DCF77 signal can be obtained on the website of the Physikalisch-Technischen Bundesanstalt (PTB), <http://www.ptb.de>.

## Meinberg C600RS radio clock receiver

The Meinberg C600RS (figure 4) is a DCF77 receiver which provides date/time information and a pulse-per-second signal through its DB25 connector. The date/time information is provided via RS232 protocol and the pulse-per-second signal gives precisely the start mark of each second. The C600RS is then ideally suited to provide accurate date/time information to the USB4CH.

The receiver is powered through the 230V power grid and requires an external DCF77 antenna (figure 5) for its operation. The antenna needs to be connected to the BNC input of the receiver through a coaxial cable which can be up to more than 100 meters in length.



Figure 4: C600RS - DCF77 receiver with RS232 interface

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Figure 5: DCF77 antenna

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## Configuration of the receiver

The C600RS needs to be configured before connecting it to the USB4CH. By factory default, the C600RS is delivered with the following configuration :

- message format : Meinberg Standard time string
- serial transfer speed : 19200 bit/s
- time zone : MESZ

The configuration of the C600RS receiver requires a computer running MS Windows operating system with a serial port to which to connect the receiver.

The first configuration step is to set the time zone of the receiver to UTC. This step requires the *pzfmon* software. Once the software has established a connection with the receiver, set the time zone as indicated in figure 6.

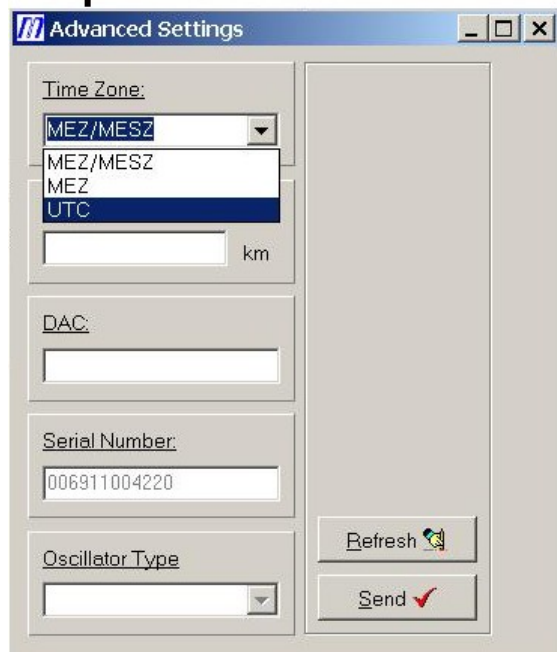
### Step 1



### Step 2



### Step 3



### Step 4

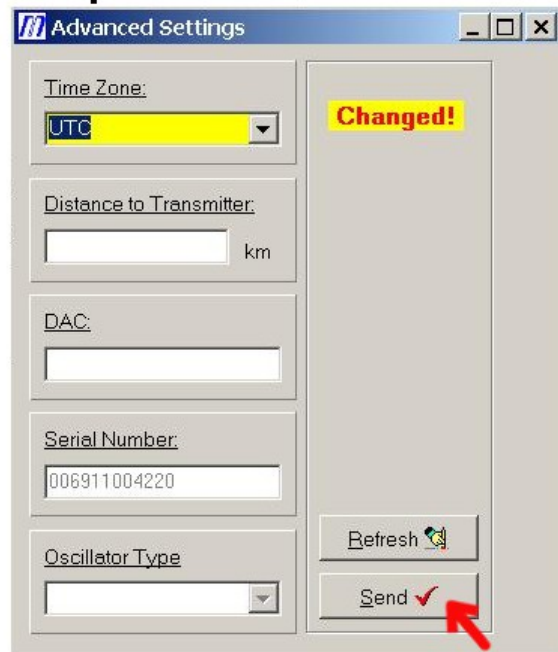
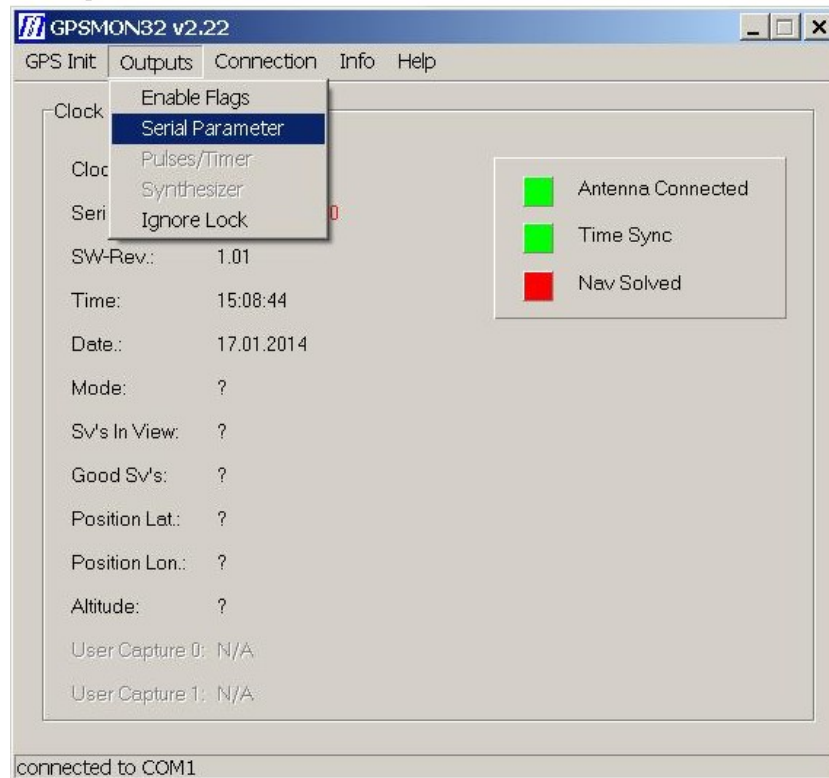


Figure 6: C600RS configuration : setting UTC time zone

The second step is to configure the message format to NMEA and the serial port speed to 4800 bit/s. This step requires the *gpsmon* software and is illustrated in figure 7.

## Step 1



## Step 2

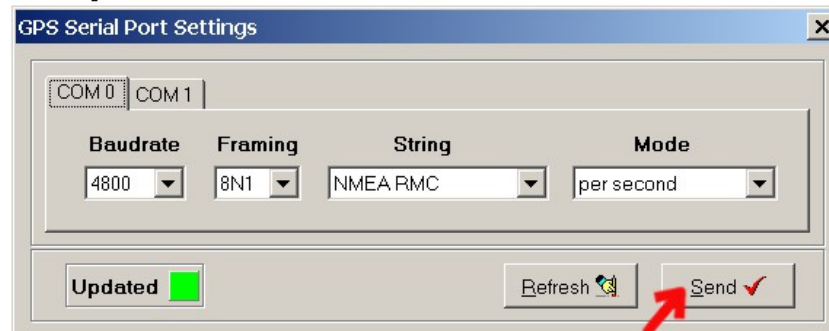


Figure 7: C600RS configuration: setting time format and serial port speed



## Connecting the C600RS to the USB4CH

The C600RS pulse-per-second signal is available with RS232 level voltage and on the output of an opto-coupler. The USB4CH PPS input requires a signal with TTL level. We will then use the opto-coupler output following the schema in figure 8, in order to provide the USB4CH with a TTL level signal.

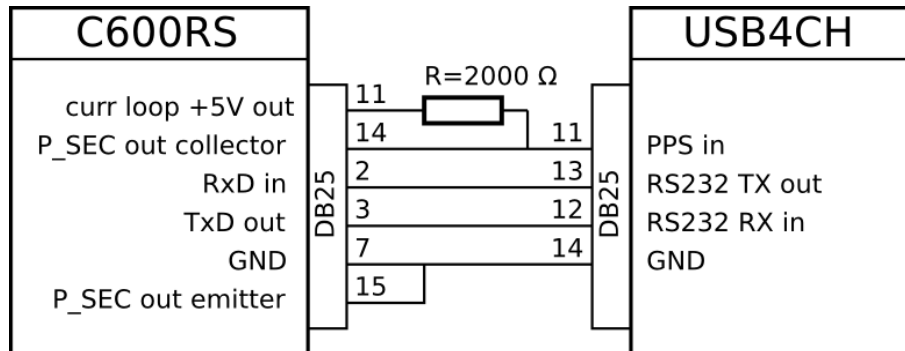


Figure 8: C600RS and USB4CH interconnection

By default, the USB4CH firmware expects a PPS signal with the leading edge precisely aligned with the second tick. However, using the opto-coupler as in the schema in figure 8 produces a PPS signal with the falling edge aligned with the second tick. It is possible to instruct the USB4CH firmware that it needs to take into account the falling edge instead of the leading edge. This is achieved by setting the *PpsPolarity* bit in the User configuration byte when calling the various software provided with the USB4CH (eg: Blast, NmeaTime). Moreover, we also need to tell the USB4CH that the NMEA date/time message is emitted from a Meinberg receiver. This is achieved by issuing the option *g4*. Below you will see how Blast and NmeaTime need to be called when using the C600RS receiver :

```
Blast sn g4 0x10
NmeaTime g4 0x10
```

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## References

- Meinberg C600RS  
<http://www.meinbergglobal.com/english/products/dcf77-clock-serial-interface.htm>
- Symmetric Research USB4CH  
<http://www.symres.com/webpages/products/usb4ch.htm>