User's manual

ELPROMA ATOMIC DCF77N CLOCK

DCF CLOCK

`03:53:56  (Ti)`
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ELPROMA
ELECTRONICS

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CONTENTS

INTRODUCTION

DCF77N clock

The Elproma DCF77N clock is developed to guarantee the exact time on LAN or stand-alone computer systems. The DCF77N clock system receives the radio signal which is transmitted by the DCF77 Atomic clock transmitter near Frankfurt in Germany. The time signal is based on the vibration frequency of the caesium atom. The accuracy is about 1 second in 300.000 years. The Elproma DCF77N clock receives this time signal and checks whether the time frame is correct or not.

Inside the DCF77N clock a system of internal clocks ensure that the received time is the correct time. This way erroneous received time signals can never disturb your computer time and the exact time is guaranteed. Even after 3 days without power and not receiving the DCF signal, the accurate time is guaranteed. From now on the accurate time is always available for your operating system and application programs.

Special features include a low voltage alarm contact, a switched mains and relay contact output controlled by a programmable 7 day timer and a 24V slave clock output. The Elproma DCF77N clock has found its way in the market where exact time is essential. Amongst the many applications you will find: time registration systems, banking, stock exchange, transportation companies, airlines, research, broadcasting.

Special functions:
- Alarm contact . This contact will be opened when the time is not synchronised and when there is no mains supply.
- 230V relay output with extra relay contact
- Timer with 8 switch times per day. For Windows a special setup program is provided, other operating systems can work with a terminal program.
- 24V Slave clock output, each minute a 1 sec. pulse is provided in reversed polarity.

DCF transmitter

The DCF 77 signal is transmitted from Mainflingen (near Frankfurt/Main), Germany (N 50° 01'; E 09° 00'). It contains complete information about time, date and season-related time changes. Full transmission of the DCF signal lasts 59 seconds. The frequency used by the DCF transmitter is 77.5 kHz.

The DCF77N clock can be used in all countries having central European time.

Pack list

- Quickstart document
- DCF77N clock
- DCF Receiver with cable
- RS232 cable (9p-Dconn female- female)
- Utility CD

INSTALLATION

Connecting the DCF77N clock

On the back of the unit there are several connectors and a push button switch:

| HD15, special functions | Computer RS232 | Receiver | 230V relay switch | 230V relay output |
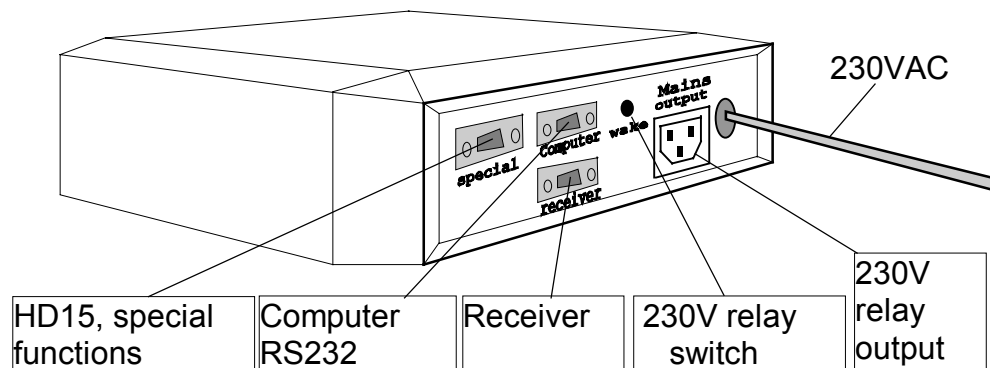
- 230V AC: Use a grounded mains connection!
- 230V relay output: 230VAC switched mains output for use with timer
- 230V relay switch: Manual ON switch for the relay output
- Computer RS232: DB9M connector for serial connection to a computer
- Receiver: DB9F connector for DCF77 receiver
- HD15, special functions :
  1. Alarm relay (NO,NC)
  2. Timer relay contact (NO, NC)
  3. 24V Slave clock 1 second minute pulse
 4. Extra RS232 connection for future expansion

Connection

1. Switch off the computer
2. Find a spot for the DCF77N main unit out of direct sunlight
3. Connect the clock to your PC with the serial cable
4. Plug the mains plug into a properly grounded wall outlet
5. Switch on the computer.
6. To connect the receiver see the next chapter.

Receiver installation

The DCF receiver is housed in a small box with a 5 meter cable attached. If 5 meter is not long enough the cable can be extended up to max. 50 meters. In the chapter "Extending the receiver cable" is shown how to do this.
The long side of the receiver must be pointed in the direction of Frankfurt, Germany. On the underside of the receiver a small red light indicates the reception. The light should be on each second for 100ms or 200ms. Before you attach the receiver to a wall check if it is the best place for DCF77 reception. The DCF77 signal is very sensitive to interference, so please check the following:

- At least 2 meters away from monitors.
- The receiver must be mounted as shown on the picture below.
- Keep the receiver away from large metal objects
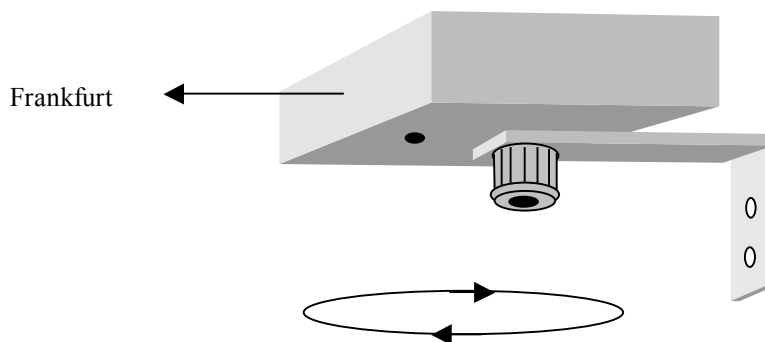
Outside mounting

The receiver can be mounted outside. If possible find a place where the unit is not exposed to sunlight all day. If the cable has to go through a wall we recommend to take the cable out of the receiver, put it through the hole and connect the receiver again. How to do this is explained in the chapter "Extending the receiver cable" .

Connecting

Connect the DCF-receiver to the DC77N on the lower DB9F connector. The red light in the frontpanel and on the underside of the receiver will blink if there is reception.
Turn the receiver until the light blinks every second for a short period (0,1 or 0,2 sec.), except at the 59th second.
When the reception is good the clock will show the correct time within 5 minutes.
After each fully received minute the signal quality indicator on the display (top-right corner) will show 5 lines increasing in length. If the indicator has less than 5 lines after a period of 10 minutes the reception is not good, in this case relocate the receiver.

Utility software

There are several programs on the CD to set the clock and to set the time in your PC.
The programs are located in different folders for different operating systems.
Each folder contains the software and some documentation if needed.

WIN9598:   Programs for Windows 95, 98, Millennium and XP

WIN31311:   Programs for Windows 3.1 and 3.11

WINNT: Programs for Windows NT and 2000

DOS: Programs for MS-DOS and to synchronize to a Novell file server

NOVELL: File server Network Loadable Module software.

LINUX: Program for linux

SUN: Program for Sun solaris

For MSWindows (95,98, Millennium, NT and 2000) a simple program can be used to set
all settings of the DCF77N clock. This DCFSetup program will be explained in the next
chapter.

To set the clock in other operating systems you have to use a terminal program. For
more information see chapter "Terminal commands".

DCFSETUP PROGRAM

DCFSetup (95, 98, NT, Millennium and 2000)

With this program you can program all settings (including the timer) of the clock.
Copy the DCFSetup program from CD to a DCF folder on your local harddisk.
It is possible to run the program from CD but the COM-port choice will not be saved in this case. First quit all running DCF programs, only one program can use the serial port.
When you start the program the following screen appears:

Settings tab

Language:
This program has 5 language choices. For English click the button left to "English".

230V relay mode:
The 230V output can function in 4 different modes.

- **Off**, the 230V output is switched off.
- **On**, the 230V output is switched on.
- **Alarm**, normally the output will be Off, when the time is not synchronised the output will be On.
- **Timer**, it is possible to set 8 switch moments for each day. See "Timer tab" for more information on the timer.
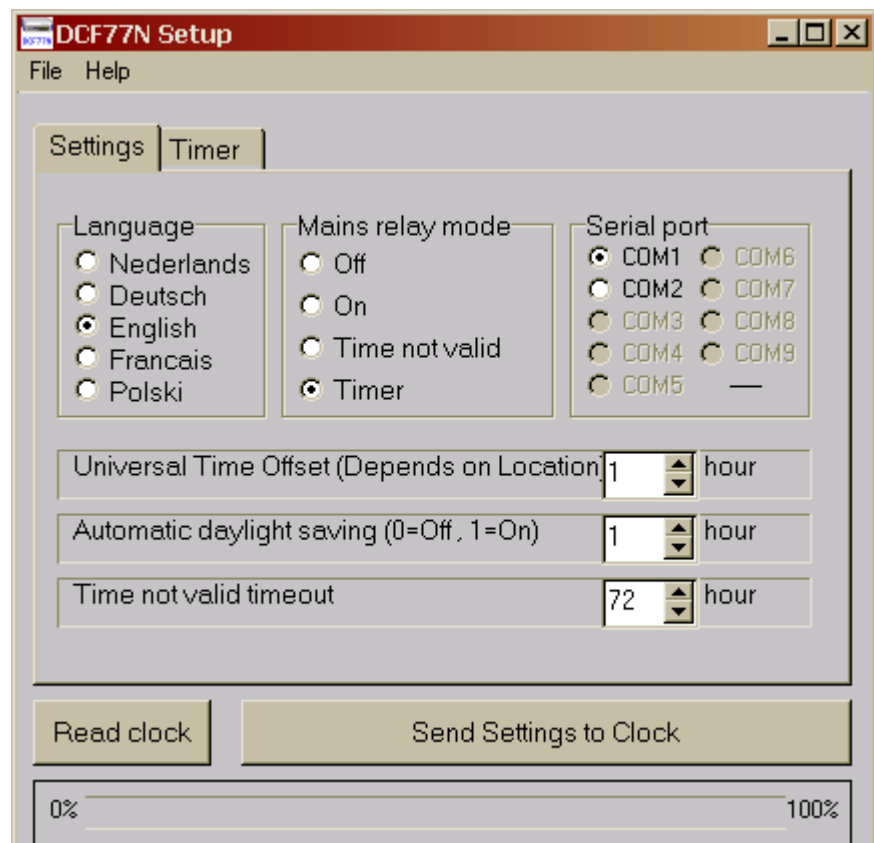
Serial port:
Choose the correct port (where the clock is connected to). Your choice will be saved to harddisk for the next time. The unavailable ports are shown grey.
If a wrong port is chosen an error message will appear, in this case check the serial cable and select the port where it is connected to.

Serial port not available:

If the serial port where the clock is connected to is not shown, quit the DCFSetup program and quit any running DCF utility programs. Only one program can use the serial port at the same time!

UTC offset:
This setting determines the time zone. The value is the time difference between local time and UTC (=GMT).

Automatic daylight saving
If this setting is "1" (On) the time will be set forward on the last Sunday morning in March from 03:00 to 04:00 and set back on the last Sunday morning in October from 03:00 to 02:00.

Time not valid timeout
This is the time before the 'not synchronised' message will appear. Default value is 72 hours, this gives a maximum of 0.5 seconds time error.
When there is no mains supply, there is also no DCF reception. For an exact time it is important to always leave the clock on.

Send/receive
The lower progress bar shows the progress of data communication between PC and clock.

Timer tab

On this tab you can set 8 switch times per day for the mains relay output.

Click on the square next to one of the 8 times. With On/Off you can select the output state. To edit the time use the leftmost window 'Edit selected time' and click on the up/down arrows to change.
When all switch times have been set you can press 'Send settings to clock'. The progress bar will now fill up to 100%. Now all settings are valid. The clock will remember these settings, so unless you want to change something you can leave the program now.
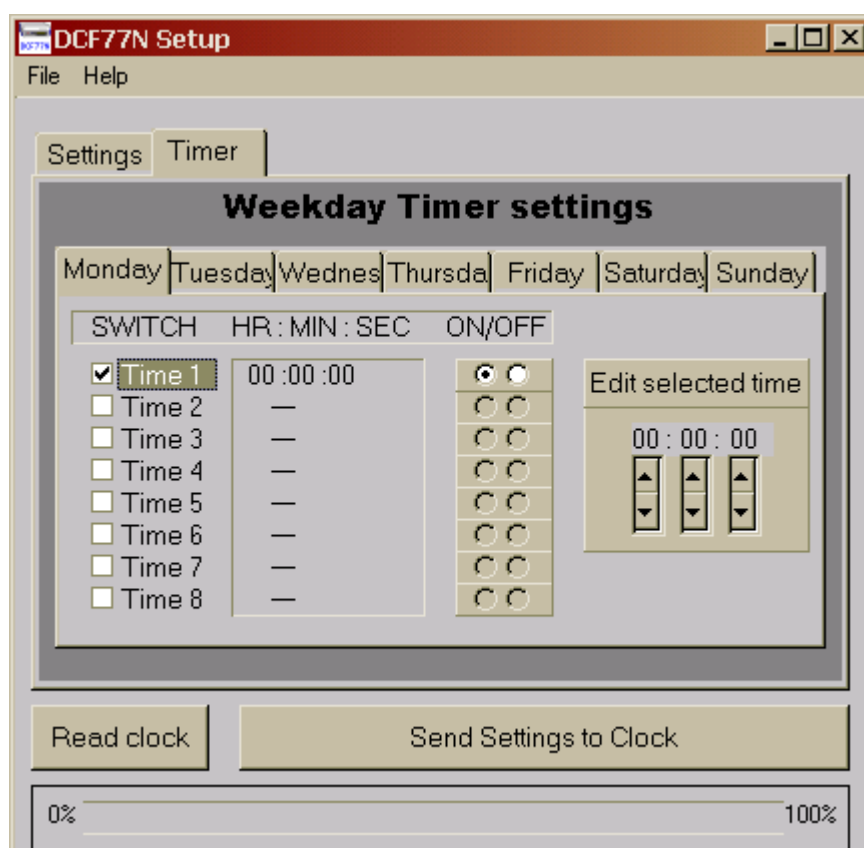
OPERATION

On the front of the clock a red light inside the O of 'DCF clock' lights up every second to indicate DCF reception.
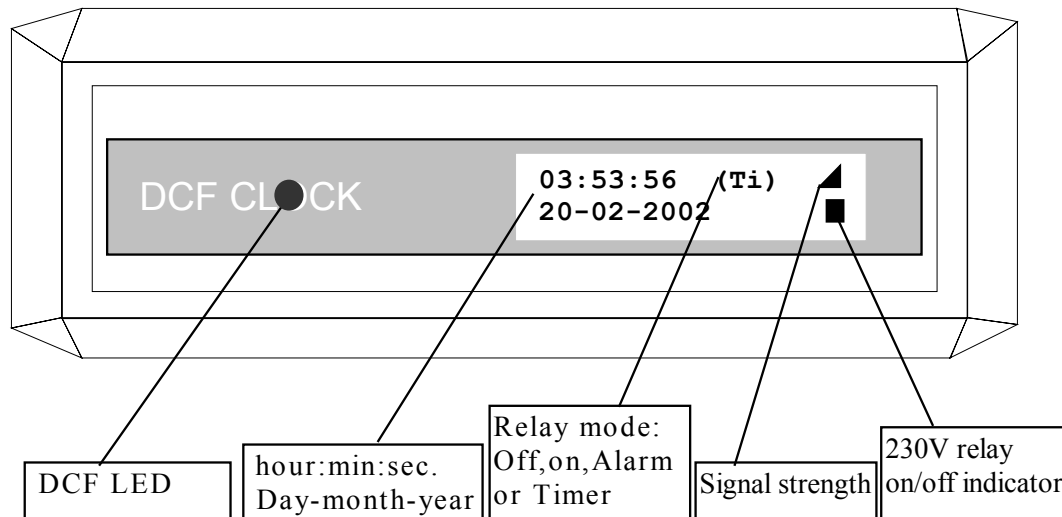
As soon as the internal time is synchronised with the DCF signal the clock will show Time, day, month, year, relay mode, signal strength and relay position.

- DCF led: This light blinks every second for 100 or 200ms, except at the 59th second.
- Signal strength: There are 5 bar increasing in length. Every time a good DCF frame is received an extra bar shows, up to 5 max. Each time a bad frame is received 1 bar disappears.
- 230V Relay mode:
    - **Off**, the 230V relay output is off.
    - **On**, the 230V relay output is on.
    - **Alarm**, The relay is normally off, when there is an alarm the relay will switch on giving 230V at the output
    - **Timer**, The 230V output can be switched on and off using the timer settings (max. 8 switch times per day).
- 230V relay on/off indicator, if an inverse 'o' shows the relay is off, when an inverse 'I' shows the relay is on.

Connections

230V Relay output

On the back of the clock is the 230V relay output. This output can be programmed by the timer. Maximum switch power is 1000W and is fused with a 6,3A fuse.


HD15, special functions | 230V relay activate | 230V relay output
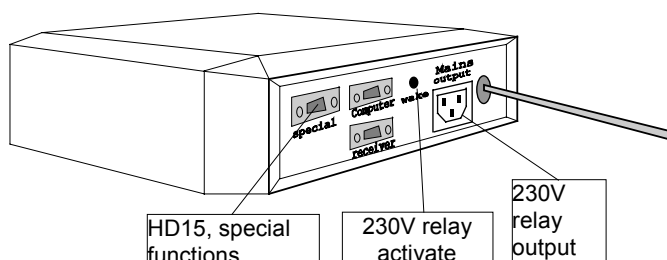
HD15 special functions

1: Slaveclock +	6: Slaveclock Common	11: Slaveclock -
2: Serial2 out	7: NC extra contact (timer)	12: 0V, gnd
3: Serial2 in	8: CO extra contact (timer)	13:+24V output (1A fuse)
4: NC alarm contact	9: NO extra contact (timer)	14:+5V output (1A fuse)
5: NO alarm contact	10: 0V, gnd	15:CO alarm contact

Extra timer relay contact

Together with the mains relay output relay a separate relay contact switches at the same time.

HD15, Pin 7:   Common (CO)
HD15, Pin 8:   Normally closed (NO)
HD15, Pin 9:   Normally open (NC)
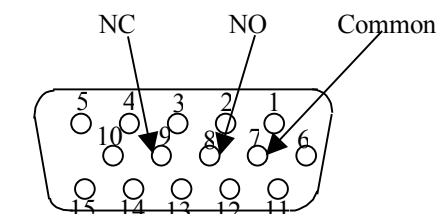
Alarm contact

NO + CO: This contact is normally open or closed and will switch when power is off or the time is not synchronised. .
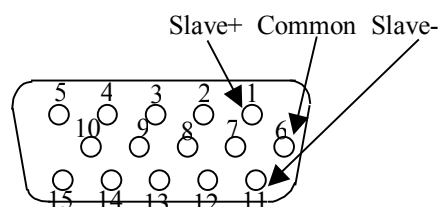
HD15, Pin 4:   Common (CO)
HD15, Pin 15:   Normally closed (NO)
HD15, Pin 5:   Normally open (NC)
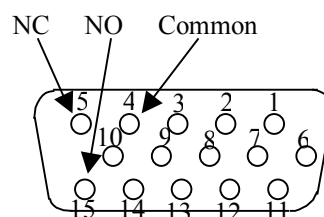
24V slave clock output

The slave clock output gives every minute a 24V signal with changing polarity and a duration of 1 second. Max. current is 500mA.

HD15, Pin 1:   Slaveclock +
HD15, Pin 6:   Common
HD15, Pin 11:   Slaveclock -

+5V and +24V outputs

Both outputs can be used to power external devices with a maximum current of 500mA.

HD15, pin 12: 0V, massa
HD15, pin 13: +24V output (1A fuse)
HD15, pin 14: +5V output(1A fuse)

Serial2

For future expansion.

HD15, pin 2: RS232 output
HD15, pin 3: RS232 output

230V Relay activation switch

Next to the mains output is a small button located. This switch can be used to switch the mains power ON, when it is OFF. This can be used in those cases where a computer is switched on and off automatically by the clock and you want to switch the computer on manually.

RS232 Computer connection (DB9M)

The top 9 pole connector is used to connect the computer to the DCF77N clock.

DB9M, pin 2: TXD
DB9M, pin 3: RXD
DB9M, pin 5: GND
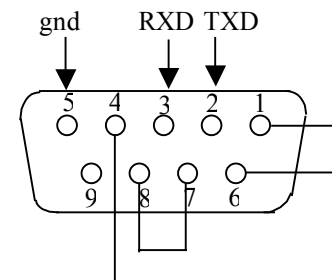
RS232 cable (shielded)

Female 9 pole (DB9F)	Female 9 pole (DB9F)
Pin 1	Pin 1
Pin 2	Pin 2
Pin 3	Pin 3
Pin 4	Pin 4
Pin 5	Pin 5
Pin 6	Pin 6
Pin 7	Pin 7
Pin 8	Pin 8
Pin 9	Pin 9

Receiver connector (DB9F)

See chapter 'Connecting the DCF receiver'.

Terminal commands

All clock settings can be programmed by using a terminal program.

Serial settings:

Set the terminal program to the correct serial port and the following serial setting.

Baudrate:19200, Databits:8, Stopbits:1, Parity: Even

All clock commands start with a '$' sign and ends with a Carriage return (CR).

$N=X The 'N' is the command number and the 'X' is the value:

Setting 1 = Language   **Possible values:**   **0 =**   **Dutch**
                                                                   1 =   **German**
                                                                   2 =   **English**
                                                                   3 =   **French**
            example: $1=2   {= English}   **4 =**   **Polish**

Setting 2 = UTC difference   **Possible values:**   **-12 ... 12**
            This is the time difference between your local time and Universal Time
            Coördinated (UTC or GMT).
            example: $2=1   {+1 hour difference to UTC}

Setting 3 = Automatic daylight saving   Possible values: 0 or 1 {off or on}
            Daylight saving On/Off: When "ON" the time will be set back 1 hour at 03:00 the
            last Sunday morning in March and 1 hour forward at 02:00 the last Sunday
            morning in October.
            example: $3=1   { Automatic daylight saving is on}

Setting 4 = Time valid period   **Possible values: 1 ... 99**
            This specifies the length of time before the clock will report that it has not
            received a correct DCF signal. Default is 72 hours which results in less than max.
            0.5 seconds time error.
            example: $4=72   { Time valid period = 72 hours}

Setting 5 = Relay mode,   Possible values: 0 = Off
                                                 1 = On
                                                 2 = On when not synchronised
                                                 3 = Timer
         This setting determines the way the 230 output is used. Off, On or as a warning for
         an unsynchronised time
         example: $5=3   { The mains relay output will switch on/off at times defined in the
         timer settings, see next chapter}

Timer programming

When the relay mode is set to Timer ($5=3), you can program the switch times with the commands $21 up to $27. This timer uses weekday programming, so command $21 is for Monday, $22 is for Tuesday, etc.
There is a maximum of 8 switch times per day.

$<21..27> =N,HH,MM,SS,<ON/OFF>

N is switch time number (0..7)
HH is the hour
MM is minutes
SS is seconds
ON/OFF to indicate on or off for the mains relay output.

To delete a switch time: **$<21..27>=N,DEL**

example: $22=1,11,10,00,ON   Every Tuesday at 11:10:00 The output is switched On

Factory settings

To reset the clock to its factory state you have to enter the following two commands:

$99=
$100=

Programming information

The next chapter describes the commands you can use to get the time from the clock to your computer. This information can be used to write your own driver for operating systems that are not supported by Elproma.

Serial settings (asynchronic):

Baudrate:19200, Databits:8, Stopbits:1, Parity: Even

Time request

Request send to the time.
1. **75h** (= 117 dec) Time request. The answer from the DCF PC Clock is send to the computer at the half of the second (can be the same second!).
2. **78h** (= 120 dec) - Time request. The answer from the DCF PC Clock is send to the computer at the beginning of the next second.

Automatical time transmission:

The following byte can be send to the clock: 01xxxxxx (Bin)
xxxxxx is a binairy number from 0 to 63 which is the time interval in minutes. Every time this interval has passed the clock will send the time on the first second of the minute.

example: **40h** (=64 dec) stop automatic transmission
             41h (=65 dec) every minute the time will be sent

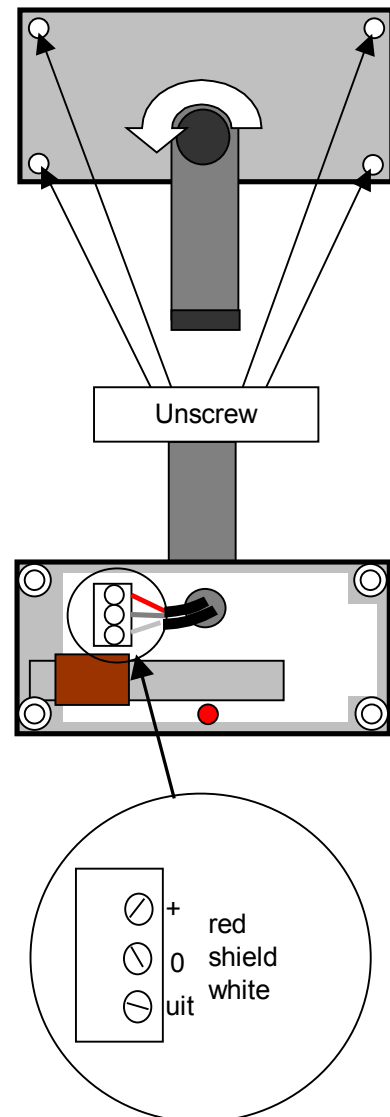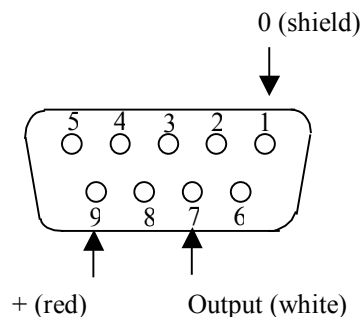## Clock time format:

The clock sends the following 10 bytes:

- START_BYTE   BAh - when the request was 75h
-    OR   BBh - when the request was 78h
- HOURS   Binary
- MINUTES   Binary
- SECONDS   Binary
- YEAR   Binary
- MONTH   Binary
- DAY_OF_MONTH Binary
- WEEK_DAY   Binary,(Mon=1, Tue=2, ...,Sun=7)
- CHECK_SUM   checksum (sum modulo 256) of fields 2-8
After the calculation the result is logical ANDed with 7Fh and the result placed in this field.
- STOP_BYTE_VAL   C5h - when the time is valid
     OR
- STOP_BYTE_INV   D2h - when the time is invalid

Connecting the receiver

o Hold the antenna with metal bracket towards you.
o Loosen the cable gland.
o Remove the 4 small screws in the corners that keep the box together.
o Carefully take off the top.
o Unscrew the three connection in the terminal block.
o If the cable is going through a wall then first drill a hole and put the new cable through.
o Then put the new cable through the cable gland and connect as shown in the picture.
o Check the connections carefully!
o Now first put the screws back and put the sealing rings on top. Now replace the top of the box and close the box tight.
o Now turn the cable gland very tight.
o The receiver can be mounted now.

The other side of the cable can be soldered directly to the DB9M connector or connected to the old cable by means of a terminal block. The connections of the DB9M are shown below.

Unscrew

+
0
uit

red
shield
white

0 (shield)

```
  5   4   3   2   1
  O   O   O   O   O

    O   O   O   O
    9   8   7   6
```

+ (red)   Output (white)

Trouble shooting

Serial port not available in DCFSetup:

If the serial port where the clock is connected to is not shown, quit the DCFSetup program and quit any running DCF utility programs (e.g. DCFWIN).
Only one program can use the serial port at the same time!

LED does not blink

1. DCF-receiver is placed in the wrong position or wrong location. Try to turn the receiver until the led starts to flash.
2. Remove the receiver from the wall and try to walk around for a better location.
3. DCF-Receiver is not connected to the lower DB9 connector.

DCFClock always starts with the wrong time

Inside the clock a small lithium battery supplies the internal backup clock. The battery has an expected life of more than 10 years in normal use, but when the clock is often switched off, the battery will be empty sooner. The minimal expected life is 5 years. When the battery is empty, the internal clock does not run anymore. This can be checked by switching the unit off at zero seconds, then after ten seconds back on and check the display. If the clock starts where you switched it off, the battery is empty. In this case please call our service department for a replacement battery.

Specifications

DCF77N

Ambient temp.	10°C to max. 40°C
Mains supply	230VAC 24 Watt max, 250mA fuse
Dimensions	200 x 190 x 80 mm.
Weight	800 g.
230V output	230VAC 1000W max, 6,3A fuse
Relay outputs	Normally open or closed contacts, 1A fuse
Accuracy	When synchronised: -10ms up to +40ms max. deviation unsynchronised: +/-7,2 ms max. per hour

DCF-Receiver

Ambient temp.	-30° to max. +50° Celsius
Supply	8VDC to 12VDC
Dimensions	85 x 45 x 22 mm
Mounting	wall bracket

- Never place the main DCF77N unit in direct sunlight.
- The computer and clock should be grounded properly.
- Don't use any solvents to clean the unit.
- Don't open the main DCF77N unit unless you are a certified repair engineer