MANUAL

DCF600HS

DCF Clock with serial Interface

24th July 2018

Meinberg Funkuhren GmbH & Co. KG
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1 General Information about DCF77

The radio remote clocks made by Meinberg receive the signal from the long wave transmitter DCF77. This long wave transmitter installed in Mainflingen near Frankfurt/Germany transmits the reference time of the Federal Republic of Germany. This time reference is either the Central European Time (Mitteleuropäische Zeit, MEZ) or the Central European Summer Time (Mitteleuropäische Sommerzeit, MESZ). The transmitter is controlled by the atomic clock plant at the Federal Physical Technical Institute (PTB) in Braunschweig/Germany and transmits the current time of day, date of month and day of week in coded second pulses. Once every minute the complete time information is available.

At the beginning of every second the amplitude of the high precision 77.5 kHz carrier frequency is lowered by 75% for a period of 0.1 or 0.2 sec. The length of these time marks represent a binary coding scheme using the short time mark for logical zeroes and the long time mark for logical ones. The information on the current date and time as well as some parity and status bits can be decoded from the time marks of the 15th up to the 58th second every minute. The absence of any time mark at the 59th second of a minute signals that a new minute will begin with the next time mark.

Our radio remote clocks decode the highly accurate information on date and time within a wide range around Germany. Some of our clocks are installed in Bilbao/Spain as well as in the City of Umeå in northern Sweden – fully satisfying the requirements of the users. The radio remote clocks automatically switch to summertime and back. The reception of the time information is free of charge and does not need to be registered.

Generally it is important to position the antenna in an optimal way. It should be mounted at least 30 centimeters away from the clock unit and from solid steel. The antenna should be aligned at a right angle to the direction of the transmitter (Frankfurt).

- **M**: Minutenmarke (0.1 s)
- **R**: Aussendung über Reserveantenne
- **A1**: Ankündigung Beginn/Ende der Sommerzeit
- **Z1, Z2**: Zonenzeitbits
  - **Z1, Z2 = 0, 1**: Standardzeit (MEZ)
  - **Z1, Z2 = 1, 0**: Sommerzeit (MESZ)
- **A2**: Ankündigung einer Schaltsekunde
- **S**: Startbit der codierten Zeitinformation
- **P1, P2, P3**: gerade Paritätsbits
2 Overview DCF600HS

2.1 RS232 Output

An asynchronous serial port can be used to transmit information on date and time to other devices. The clock is configured to send time messages automatically with 19200 baud and with a framing of 8N1 once per second. The baud and the framing can be configured by a Monitor program.

2.2 Power Supply

The system requires an operating voltage of 20-60 V DC with a contact of the integrated screw terminal. The receiver is DC isolated due to an internal DC/DC converter, the isolation voltage is 1.5 KV DC.

2.3 Housing - Technical Specifications

The receiver module is mounted in a plastic housing for 35mm DIN mounting rails. Two status LEDs (for modulation and free-running mode), the BNC antenna connector and a D-SUB connector for the serial RS232 interface are integrated in the front side of the housing.

<table>
<thead>
<tr>
<th>Chassis Type:</th>
<th>Dold Enclosure type KO4762, IP40 protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Dimensions:</td>
<td>73.2mm x 45mm x 120mm (hight x width x depth)</td>
</tr>
<tr>
<td>Elektr. Anschlüsse:</td>
<td>9 pin sub D female connector</td>
</tr>
<tr>
<td></td>
<td>Antenna - BNC female connector</td>
</tr>
<tr>
<td></td>
<td>screw terminal for connecting the pulse outputs and the power supply</td>
</tr>
<tr>
<td>Betriebsspannung:</td>
<td>20-60 V DC</td>
</tr>
<tr>
<td>Stromaufnahme:</td>
<td>approx. 100 mA</td>
</tr>
<tr>
<td>Ambient Temperature:</td>
<td>0 .. 50°C / 32 .. 122°F</td>
</tr>
<tr>
<td>Storage Temperature:</td>
<td>-20 .. 70°C / -4 .. 158°F</td>
</tr>
<tr>
<td>Humidity:</td>
<td>max. 85%</td>
</tr>
</tbody>
</table>
2.4 Assignment of the Terminal Connectors

Assignment of the terminal block: 1

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD:</td>
<td>positive potential of power supply</td>
</tr>
<tr>
<td>GND:</td>
<td>reference potential of power supply</td>
</tr>
<tr>
<td>Photocoupler outputs (PPO)</td>
<td></td>
</tr>
<tr>
<td>1:</td>
<td>PP 1- Emitter of photocoupler</td>
</tr>
<tr>
<td>2:</td>
<td>PP 1+ Collector of photocoupler</td>
</tr>
<tr>
<td>3:</td>
<td>PP 2- Emitter of photocoupler</td>
</tr>
<tr>
<td>4:</td>
<td>PP 2+ Collector of photocoupler</td>
</tr>
<tr>
<td>5:</td>
<td>Ground Earth</td>
</tr>
</tbody>
</table>

2.5 Mounting the Antenna

Generally it is important to position the antenna in an optimal way. The antenna should be aligned at a right angle to the direction of the transmitter (Frankfurt). It should be mounted at least 30 centimeters away from the clock unit and from solid steel. A distance of several meters is recommended to all TVs or computer monitors.

If the antenna is installed properly and the signal from DCF77 can be received without strong distortions, the "Mod." LED starts blinking exactly once per second, corresponding to the time marks from DCF77. If this LED flashes intermittently, there is some electrical noise around which prevents the microprocessor from decoding the time message. So a better location for the antenna must be found. In case of correct reception it takes up to three minutes after power-up until the clock is synchronized and the 'FR' LED is turned off. It is turned on again to indicate the loss of or an error in reception. If the clock have lost reception for more than 2 hours the 'FR' LED starts blinking. The scope of supply includes an active ferrite antenna for indoor mounting (AI01) and 5m of RG174 coaxial cable. When mounting the antenna outdoor the weather proof Antenna AW02 is to use.

1tightening torque of the screws in the terminal block max. 0.9 Nm
2.6 D-SUB Connector Pin Assignments

![D-SUB Connector Pin Assignments Diagram]

2.7 Pulse Outputs

The terminal block provides two photocoupler outputs:

- **Screw clamp 1:** Emitter of photocoupler 1 (PP 1-)
- **Screw clamp 2:** Collector of photocoupler (PP 1+)
- **Screw clamp 3:** Emitter of photocoupler 2 (PP 2-)
- **Screw clamp 4:** Collector of photocoupler 2 (PP 2+)
- **Screw clamp 5:** Ground earth

The DCF600HS generates a PPS (pulse per second, PP 1) and a PPM (pulse per minute, PP 2). This pulses have a duration of 200 ms and are generated after the clock has synchronized first. The pulse output is electrically insulated by a photocoupler.

In case of DCF77 reception failure the pulse generator is active even for the next 12 hours. After that period the generator will be disabled.
Photocoupler output (PP 1, PP 2):
(max. 70 V, 20 mA; E = Emitter, C = Collector), pulse duration: 200 ms
Pulses

Idle Mode
Selecting “Idle” deactivates the output.

Pulses Per Second, Per Min, Per Hour Modes
These modes generate pulses of defined length once per second, once per minute or once per hour. “Pulse length” determines the pulse duration (10 msec...10 sec).

Cyclic Pulse mode - generating of periodically repeated pulses
The value of “Time” determines the time between two consecutive pulses. This cycle time must be entered as hours, minutes and seconds. The pulse train is synchronized at 0:00 o'clock local time, so the first pulse of a day always occurs at midnight. A cycle time of 2 seconds for example, would cause pulses at 0:00:00, 0:00:02, 0:00:04 etc. Basically it is possible to enter any cycle time between 0 and 24 hours, however usually a cycle times that cause a constant distance between all consecutive pulses make sense.

DCF77 Marks
In “DCF77 Marks” mode the selected output simulates the telegram as transmitted by german time code transmitter DCF77. The generated time code is related to the local time zone. If you want DCF simulation to be disabled when the clock is in free running mode, you can enter the delay (given in minutes) for deactivating the DCF-Simulation with the ’Timeout’ value. DCF Simulation is never suspended, if the delay value is zero.

Single Shot Modus
Selecting Single Shot generates a single pulse of defined length once per day. You can enter the time when the pulse is generated with the ’Time’ value. The value “pulse length” determines the pulse duration. The pulse duration can vary from 10 msec to 10 sec in steps of 10 msec.
Timer Mode
This mode simulates a programmable day assigned timer. Three turn-off and turn-on times are programmable for each output. If you want to program a switchtime, change the turn-on time "On" and the corresponding turn-off time "Off". A turn-on time later than the turn-off time would cause a switch program running over midnight. For example a program "On" 10:45.00, "Off" 9:30.00 would cause an active output from 10:45 to 9:30 (the next day!). If one or more of the three switching times are unused just enter the same time into the values "On" and "Off". In this case the switch time does not affect the output.

As already mentioned, the outputs home position is selected by "active: high or low".

Time Slots
In this mode, you can select defined time slots. "Number of Time Slots" determines the number and length of the time slots based to one minute. The "Pre-limit buffer" allows to set a premature shutdown. This can be configured in the range between 50ms and 500ms to prevent overlap of time slots.

Example:

- Number of Time Slots = 10
- Pre-limit buffer = 500ms

Time slots 1 and 2 are enabled (0 - 6s and 6 - 12s).
In fact, the outputs triggers from 0 - 11.5s.
3 Configuration DCF600HS

Please note that the following configurations only can be set via the RS-232 interface!

Device configurations and status information can be done or can be retrieved using the following Meinberg programs:

- **MBGMONITOR WX**: Monitor program for older Windows versions (< WIN 7)
- **MBGDEVMAN**: for Windows (≥ WIN 7) and Linux operating systems, the Meinberg Device Monitor is available – a comprehensive program that can be used to perform not only configuration and monitoring but also firmware updates.

### 3.1 Configuration mit MBGMON

The program serves the configuration of PZFMON Meinberg Radio Clocks. The software can be run on the operating systems Windows 7, Windows Vista, Win9x, Win2000, WinXP and WinNT.

A connection between the DCF600HS and the program can be produced by serial port. The configurations are described below.

**Connection**
The PC should have generated an automatic connection to the clock, select the tab "Connection" on the button "Force Connection". By activating the button runs the program through possible baud rates and ports.

The tab "COM1" is considered in connection with an version of the DCF600HS - RS485. It should be noted that, for a RS485 COM 0 is inactive.

**Impulse**

The program MBGMON has the ability to configure the signal outputs of DCF600HS. Then select the tab "Pulses". The pulse outputs, pulselength and the serial interface can be configured freely. Confirm your selection with "Save".
By selecting the tab "Revision" different Informations (Serial number, Firmware) can be shown.
3.1.1 Firmware Updates

Whenever the onboard software must be upgraded or modified, the new firmware can be downloaded to the internal flash memory via the serial port COM0. There is no need to open the case and insert a new EPROM.

In order to load the appropriate software during operation of DCF600HS you must have the Flash program "mbgflash.exe" (included) to start.

First, select "Processor" the designated processor SAM3U. Then check under "Comport" the correct port (COM 1/COM 2).

Then choose "File" - "Open" the selected firmware. Now, by "Flash" button, the selected firmware is loaded into the DCF600HS. In this operation, the device must be connected to the given operating voltage.
3.2 Configuration with Meinberg Device Manager

The program serves the configuration of Meinberg Radio Clocks. The software can be run on the operating systems Windows 7 or higher and under the following Linux distributions: Ubuntu / Mint Linux / Debian / SUSE Linux / CentOS.

Documentation:

Download:

A connection between the system and the program can be produced by serial port. The configurations are described in the mbgdevman-documentation.
Connection

The PC should have generated an automatic connection to the clock, select the tab "Search Devices" (Nr.9). Alternatively, you can use the button "Add Device" (Nr.1) to generate a connection to the clock by using the same configure (Port / Baud / Framing).

Configuration

With button 4 ("Configure Device") various configurations can be carried out on the system. Please note that any changes you make in the settings must always be confirmed with the "Apply Configuration" button. Use the "Restore Configuration" button to reset all settings back to their default values. For more information, please refer to the Meinberg Device Manager manual.

Firmware Update

With mbgdevman you can conveniently proceed a firmware update. After recognizing the serial connection in the main window and selecting the device, an upload dialog (Flash Device Firmware) will be opened with pressing on button 7 ("Firmware Updates").

Buttons "Open Firmware Update File" and "Apply" for starting firmware updates.

Here you can use the "Open Firmware Update File" button to select the update package that was previously saved on the local PC or on the network. With the "Apply" button the update procedure can be started. After a successful update the device will be restarted.
4 Time Strings

4.1 Format of the Meinberg Standard Time String

The Meinberg Standard Time String is a sequence of 32 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. The format is:

<STX>D:dd.mm.yy;T:w;U:hh.mm.ss;uvxy<ETX>

The letters printed in italics are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

<STX> Start-Of-Text, ASCII Code 02h

sending with one bit accuracy at change of second

dd.mm.yy the current date:
  dd day of month (01..31)
  mm month (01..12)
  yy year of the century (00..99)

w the day of the week (1..7, 1 = Monday)

hh.mm.ss the current time:
  hh hours (00..23)
  mm minutes (00..59)
  ss seconds (00..59, or 60 while leap second)

uv clock status characters (depending on clock type):
  u: '#' GPS: clock is running free (without exact synchr.)
     PZF: time frame not synchronized
     DCF77: clock has not synchronized after reset
     (space, 20h)
     GPS: clock is synchronous (base accuracy is reached)
     PZF: time frame is synchronized
     DCF77: clock has synchronized after reset
  v: '*' GPS: receiver has not checked its position
     PZF/DCF77: clock currently runs on XTAL
     (space, 20h)
     GPS: receiver has determined its position
     PZF/DCF77: clock is synchronized with transmitter

x time zone indicator:
  'U' UTC Universal Time Coordinated, formerly GMT
  'CET' (CET) European Summer Time, daylight saving enabled
  'S' (CEST) European Standard Time, daylight saving disabled

y announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:
  '!' announcement of start or end of daylight saving time
  'A' announcement of leap second insertion
  (space, 20h) nothing announced

<ETX> End-Of-Text, ASCII Code 03h
4.2 Format of the SAT Time String

The SAT Time String is a sequence of 29 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. The format is:

\(<\text{STX}>dd.mm.yy/w/hh:mm:ssxxxxuv<\text{ETX}>\)

The letters printed in italics are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

- **<STX>**: Start-Of-Text, ASCII Code 02h
  - Sending with one bit accuracy at change of second

- **dd.mm.yy**: the current date:
  - \( dd \quad \text{day of month} \) (01..31)
  - \( mm \quad \text{month} \) (01..12)
  - \( yy \quad \text{year of the century} \) (00..99)
  - \( w \quad \text{the day of the week} \) (1..7, 1 = Monday)

- **hh:mm:ss**: the current time:
  - \( hh \quad \text{hours} \) (00..23)
  - \( mm \quad \text{minutes} \) (00..59)
  - \( ss \quad \text{seconds} \) (00..59, or 60 while leap second)

- **xxxx**: time zone indicator:
  - ‘UTC’ Universal Time Coordinated, formerly GMT
  - ‘CET’ European Standard Time, daylight saving disabled
  - ‘CEST’ European Summertime, daylight saving enabled

- **u**: clock status characters:
  - ‘#’ clock has not synchronized after reset
  - ‘ ‘ (space, 20h) clock has synchronized after reset

- **v**: announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:
  - ‘!’ announcement of start or end of daylight saving time
  - ‘ ‘ (space, 20h) nothing announced

- **<CR>**: Carriage Return, ASCII Code 0Dh
- **<LF>**: Line Feed, ASCII Code 0Ah
- **<ETX>**: End-Of-Text, ASCII Code 03h
4.3 Format of the Uni Erlangen String (NTP)

The time string Uni Erlangen (NTP) of a GPS clock is a sequence of 66 ASCII characters starting with the STX (start-of-text) character and ending with the ETX (end-of-text) character. The format is:

\[
<\text{STX}>tt.mm.jj; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.lllle hhhhm<\text{ETX}>
\]

The letters printed in italics are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

- **dd.mm.yy** the current date:
  - **dd** day of month (01..31)
  - **mm** month (01..12)
  - **yy** year of the century (00..99)
- **w** the day of the week (1..7, 1 = Monday)
- **hh.mm.ss** the current time:
  - **hh** hours (00..23)
  - **mm** minutes (00..59)
  - **ss** seconds (00..59, or 60 while leap second)
- **v** sign of the offset of local timezone related to UTC
- **oo:oo** offset of local timezone related to UTC in hours and minutes
- **ac** clock status characters:
  - ‘#’ clock has not synchronized after reset
  - ‘ ‘ (space, 20h) clock has synchronized after reset
  - ‘*’ GPS receiver has not checked its position
  - ‘ ‘ (space, 20h) GPS receiver has determined its position
- **d** time zone indicator:
  - ‘S’ CEST European Summertime, daylight saving enabled
  - ‘ ‘ CET European Standard Time, daylight saving disabled
- **f** announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:
  - ‘!’ announcement of start or end of daylight saving time
  - ‘ ‘ (space, 20h) nothing announced
- **g** announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:
  - ‘A’ announcement of leap second insertion
  - ‘ ‘ (space, 20h) nothing announced
- **i** leap second insertion
  - ‘L’ leap second is actually inserted
  - ‘ ‘ (active only in 60th sec.)
  - ‘ ‘ (space, 20h) no leap second is inserted
- **bbb.bbbb** latitude of receiver position in degrees
  - leading signs are replaced by a space character (20h)
- **lll.llll** longitude of receiver position in degrees
  - leading signs are replaced by a space character (20h)
- **hhhm** hour angle

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'N'     north of equator
'S'     south d. equator

LLLLL     longitude of receiver position in degrees
leading signs are replaced by a space character (20h)

e     longitude, the following characters are possible:
'E'     east of Greenwich
'W'     west of Greenwich

hhhh     altitude above WGS84 ellipsoid in meters
leading signs are replaced by a space character (20h)

<ETX>     End-Of-Text, ASCII Code 03h
4.4 Format of the NMEA 0183 String (RMC)

The NMEA String is a sequence of 65 ASCII characters starting with the ‘$GPRMC’ character and ending with the characters CR (carriage return) and LF (line-feed). The format is:

```
$GPRMC,hhmss.ss,A,bbbbb.bb,n,lllllll.e,0.0,0.0,ddmmyy,0.0,a*hh
```

The letters printed in italics are replaced by ASCII numbers or letters where as the other characters are part of the time string. The groups of characters as defined below:

- **$** Start character, ASCII Code 24h
- **hhmmss.ss** the current time:
  - **hh** hours (00..23)
  - **mm** minutes (00..59)
  - **ss** seconds (00..59, or 60 while leap second)
  - **ss fractions** of seconds (1/10 ; 1/100)
- **A** Status (A = time data valid)
  - (V = time data not valid)
- **bbbbb.bb** latitude of receiver position in degrees
  - leading signs are replaced by a space character (20h)
  - ‘N’ north of equator
  - ‘S’ south d. equator
- **lllllll.e** longitude of receiver position in degrees
  - leading signs are replaced by a space character (20h)
  - ‘E’ east of Greenwich
  - ‘W’ west of Greenwich
- **ddmmyy** the current date:
  - **dd** day of month (01..31)
  - **mm** month (01..12)
  - **yy** year of the century (00..99)
- **a** magnetic variation
- **hh** checksum (EXOR over all characters except ‘$’ and ‘‘’)
- **<CR>** Carriage Return, ASCII Code 0Dh
- **<LF>** Line Feed, ASCII Code 0Ah
4.5 Format of the ATIS standard Time String

The ATIS standard Time String is a sequence of 23 ASCII characters terminated by a CR (Carriage Return) character. The format is:

\(<\text{GID}\rangle<\text{ABS}\rangle<\text{TSQ}\rangle<\text{CC}\rangle<\text{CS}\rangle<\text{ST}\rangle\text{ymmddhmmsswcc}<\text{GID}\rangle<\text{CR}\rangle\n
The letters printed in italics are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

- **<GID>** Address of the receiver code 7Fh
- **<ABS>** Originator of message ASCII ‘0’ code 30h
- **<TSQ>** Telegram number ASCII ‘0’ code 30h
- **<CC>** Command code ASCII ‘S’ for SET code 53h
- **<CS>** Command code ASCII ‘A’ for ALL code 41h
- **<ST>** Time status ASCII ‘C’ for valid time code 43h
- **ymmddhmmss** the current date:
  - yy year of the century (00..99)
  - mm month (01..12)
  - dd day of month (01..31)
- **w** the day of the week (1..7, 1 = 31h = Monday)
- **cc** checksum in hex, built from all characters including GID, ABS, TSQ, CC, ST, ...
- **<CR>** Carriage Return, ASCII code 0Dh

(The standard interface configuration for this string type is 2400 baud, 7E1)
5 Declaration of Conformity

Konformitätserklärung

Doc ID: -2016-04-21

Hersteller
Manufacturer
Meinberg Funkuhren GmbH & Co. KG
Lange Wand 9, D-31812 Bad Pyrmont

erklärt in alleiniger Verantwortung, dass das Produkt,
declares under its sole responsibility, that the product

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards

EN55032:2012 Limits and methods of measurement of radio interference characteristics
of information technology equipment

EN55024:2010 Limits and methods of measurement of Immunity characteristics of information
technology equipment

EN 50581:2012 Technical documentation for the assessment of electrical and electronic products
with respect to the restriction of hazardous substances

gemäß den Richtlinien 2014/30/EU (Elektromagnetische Verträglichkeit), 2014/35/EU (Niederspannungsrichtlinie),
2011/65/EU (Beschränkung der Verwendung bestimmter gefährlicher Stoffe) und 93/68/EWG (CE Kennzeichnung)
sowie deren Ergänzungen.
following the provisions of the directives 2014/30/EU (electromagnetic compatibility), 2014/35/EU (low voltage
directive), 2011/65/EU (restriction of the use of certain hazardous substances) and 93/68/EEC (CE marking) and
its amendments.

Bad Pyrmont, 2016-04-21

Günter Meinberg
Managing Director