MANUAL

DCF600HS

DCF Clock with serial Interface

21st April 2016

Meinberg Radio Clocks GmbH & Co. KG

Table of Contents

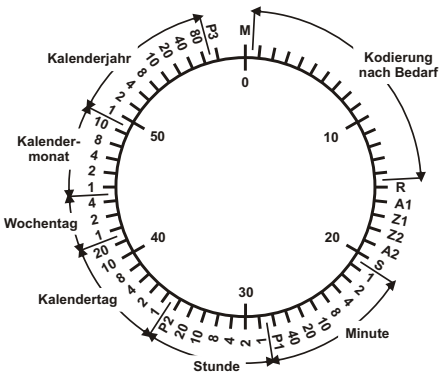
1 General Information about DCF77

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 infomation 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. So some of our clocks are installed in Bibao/Spain as well as in the City of Umeå in northern Sweden - fully statisfying 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.

Gernerally 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 and with a framing of 8N1 once per second. The baud and the framing can be configured by a Monitorprogram.

2.2 Power Supply

The system requires an operating voltage of 19-72V/DC witch is applied via two contacts of the integrated screw terminal. The receiver is DC isolated due to an internal DC/DC converter, the isolation voltage is 1,5KV DC.

2.3 Housing

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.

2.4 Dimensional Drawing

Assignment of the terminal block:

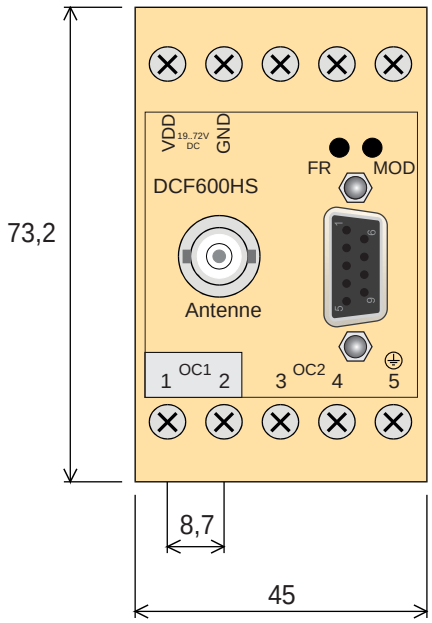
VDD: positive potential of power supply

GND: reference potential of power supply

OC1: photocoupler output (PPO)
- 1: Emitter of photocoupler
- 2: Collector of photocoupler

OC2: photocoupler output (PPO)
- 3: Emitter of photocoupler
- 4: Collector of photocoupler

5: Ground Earth

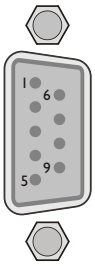


2.5 Mounting the Antenna

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 intermediately, 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 RG175 coaxial cable. When mounting the antenna outdoor the weather proof Antenna AW02 is to use.

2.6 D-SUB Connector Pin Assignments



Pin 1 nc
Pin 2 TxD
Pin 3 RxD
Pin 4 nc
Pin 5 GND
Pin 6 nc
Pin 7 nc
Pin 8 nc
Pin 9 nc

2.7 Pulse Outputs

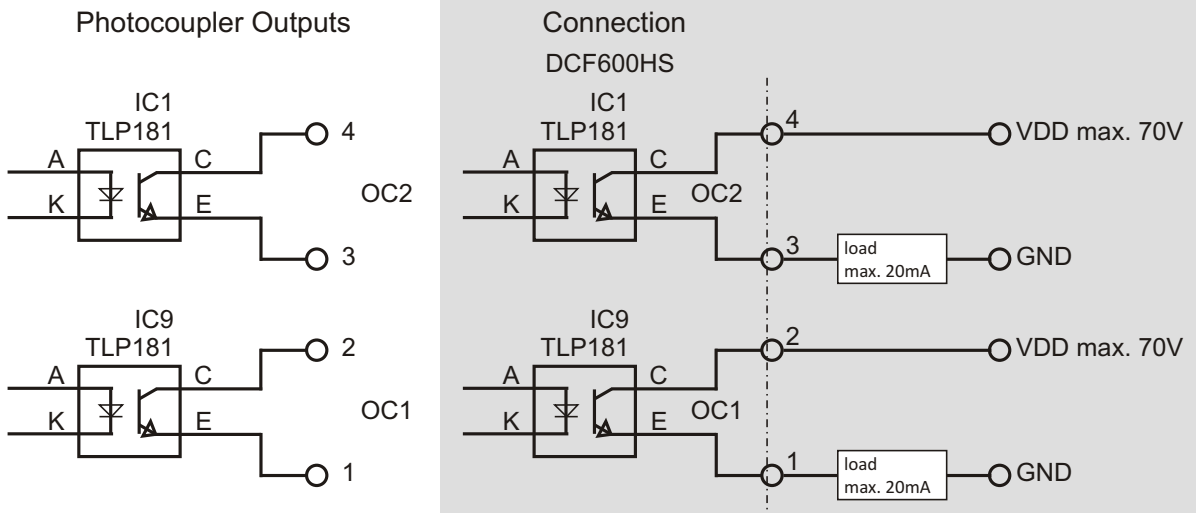
The terminal block provides two photocoupler outputs:

Schraubklemme 1: Emitter of photocoupler 1 (OC1)
Schraubklemme 2: Collector of photocoupler (OC1)
Schraubklemme 3: Emitter of photocoupler 2 (OC2)
Schraubklemme 4: Collector of photocoupler 2 (OC2)
Schraubklemme 5: ground earth

The DCF600HS generates a PPS (pulse per second, OC1) and a PPM (pulse per minute, OC2). 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(OC1,OC2):
(max. 70V, 20mA; 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 Singls 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 ouput 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

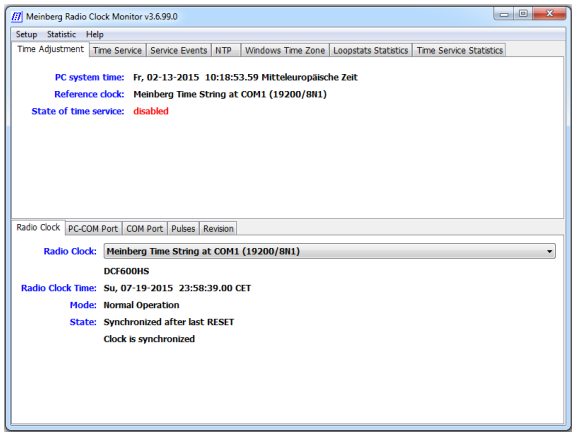
Time slots 1 and 2 are enabled (0 - 6s and 6 - 12s).
In fact, the outputs triggers from 0 - 11,5s.

3 Configuration DCF600HS

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

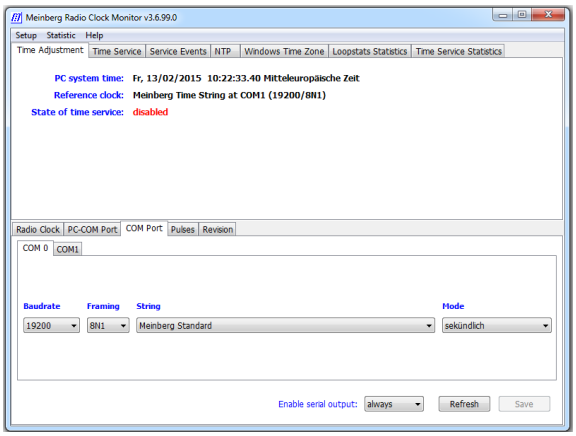
3.1 Configuration MBGMON

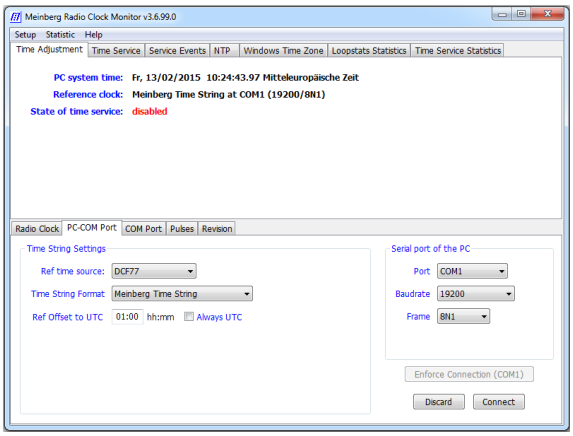
The program serves the configuration of PZFMON Meinberg Radio Clocks. The software can be run on the operating systems Windows 7, Windows Vista, Win9x, Win2000, WinXP and WinNT.



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

Connection



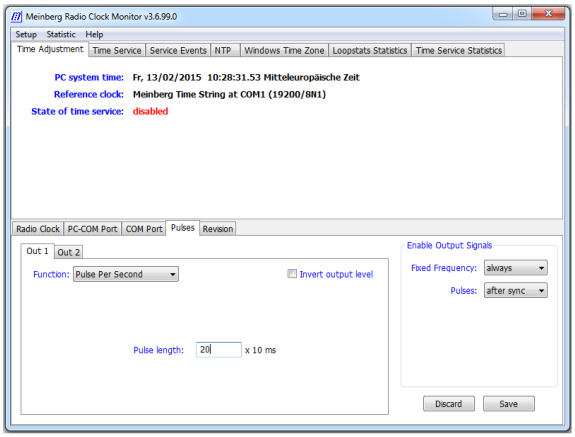


The PC should have generated an automatic connection to the clock, select the tab "Connection" on the button "Force Connection". By activating the button runs the program through possible baud rates and ports.

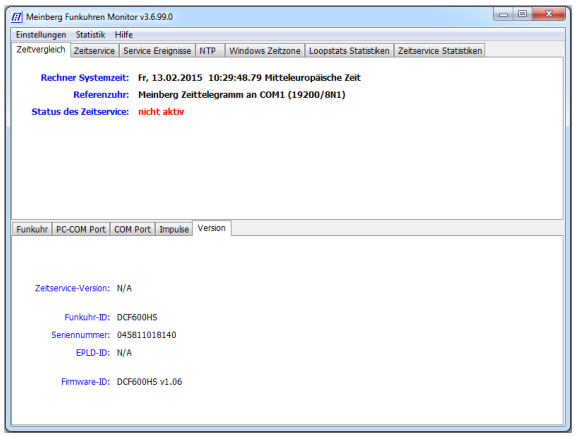
The tab "COM1" is considered in connection with an version of the DCF600HS - RS485. It should be noted that, for a RS485 COM 0 is inactive.

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".



Information

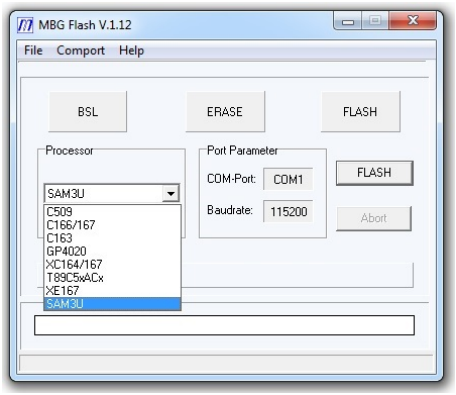


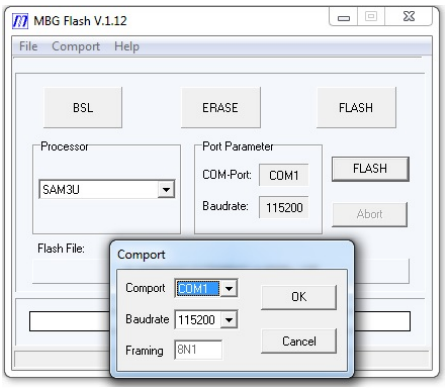
By selecting the tab "Revision" different Informations (Serial number, Firmware) can be shown.

4 Firmware Updates

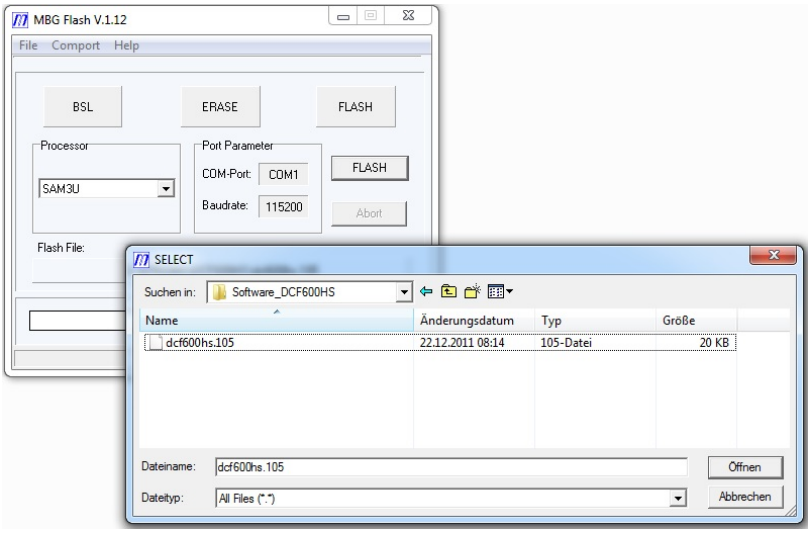
Whenever the onboard software must be upgraded or modified, the new firmware can be downloaded to the internal flash memory via the serial port COM0. There is no need to open the case and insert a new EPROM.

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.

5 Time Strings

5.1 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 syncronized with transmitter
x	time zone indicator:		
	'U'	UTC	Universal Time Coordinated, formerly GMT
	' '	CET	European Standard Time, daylight saving disabled
		'S'	(CEST) European Summertime, daylight saving enabled
y	anouncement 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		

5.2 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:

<STX>***dd.mm.yy/w/hh:mm:ssxxxxuv***<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)
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	anouncement 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		

5.3 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:

<STX>***tt.mm.jj; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.lllle hhhhm***<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 occuracy 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)
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:		
	a:	'#'	clock has not synchronized after reset
		' '	(space, 20h) clock has synchronized after reset
	c:	'*'	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	anouncement 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	anouncement 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)		
n	latitude, the following characters are possible:		

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

5.4 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,*hhmmss.ss,A,bbbb.bb,n,lllll.ll,e,0.0,0.0,ddmmyy,0.0,a*hh*<CR><LF>

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 sending with one bit accuracy at change of second		
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)	
bbbb.bb	latitude of receiver position in degrees leading signs are replaced by a space character (20h)		
n	latitude, the following characters are possible:		
	'N'	north of equator	
	'S'	south d. equator	
lllll.ll	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	
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		

5.5 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:

<GID><ABS><TSQ><CC><CS><ST>*yymmddhhmmsswcc*<GID><CR>

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
yymmdd	the current date:		
	yy year of the century	(00..99)	
	mm month	(01..12)	
	dd day of month	(01..31)	
hh:mm:ss	the current time:		
	hh hours	(00..23)	
	mm minutes	(00..59)	
	ss seconds	(00..59, or 60 while leap second)	
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)

6 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

Produktbezeichnung *Product Designation*	**DCF600HS**

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

EN55022:2010	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