Technical Description

Receiver

4455

hopf Elektronik

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1 General Information

The receiver series 4450 has been replaced by the intelligent modules 4455.

In principle the board contains three modules.

1. The integrated receiver U2900B/FP as customer designed IC with improved input wiring for the noise suppression.
2. A micro-processor unit with controlable reception and simulation programme.
3. Output unit for pulses (option).

The DCF77 signal is decoded by the microprocessor. The simulated DCF77 signal is available as output.

This creates several advantages.

1. The processor bridges a bad reception for up to xx minutes[1].
2. The pulses are exactly 100 or 200 msec. rsp. wide.
3. There is no reception jitter from second to second.
4. The pulse edge is far closer to the absolute second time mark.

2 Starting

2.1 Voltage Supply

All versions need a voltage supply of 5V DC ±5%. It is to be connected to pin 1 for +5V, and pin 21 for 0V (ground).

2.2 Antenna Connection

The active ***hopf*** antenna is connected to the receiver via the pins 2 antenna core (hot line) and 3 antenna ground.

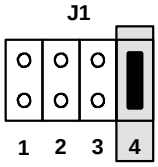
Please note : When designing the base circuit board please make sure that the antenna core runs between two antenna ground lines. No other components must be connected to the antenna ground. It avoids shunt currents which reduce the input sensitivity of the receiver.

[1] xx is dependent of configuration. Times set is optional, unlimited simulation is available.

2.3 Alignment of the Antenna

The connected antenna must be aligned at right angles to the direction Frankfurt.

If the direction Frankfurt is not known call up the alignment of the antenna programme.



For this purpose jumper J 1/4 is plugged in and the voltage supply switched on. In options "pulse" and "interface" the alignment programme can also be started by a low-signal at contact 9.

After about 20 seconds the sensitivity necessary for the location and the antenna position has been reached. The DCF pulse line (contact 15) stays on the low-level all or most of the time. LED 1 behaves correspondingly, it lights up all or most of the time.

If the antenna is turned from the set position the reception field strength grows weaker. This causes the duration of the low-level on the DCF pulse line and the time LED 1 is lit to become increasingly shorter.

This procedure allows to find the reception minimum for the DCF77 signal. From that point the antenna must be turned by 90°.

Then the alignment programme is left by unplugging jumper J 1/4 or by high level at contact 9 rsp.

Please note : After three minutes the alignment programme is left automatically. It can, if necessary, be restarted by switching the voltage supply off and on again.

The alignment of the antenna can be controlled by serial interface (see pt. 3.3.9).

3 I/O Signals

3.1 DCF Pulse

All models have the DCF pulse output at pin 15. After switching on the voltage supply it takes at least 3 minutes of faultless DCF reception to achieve the DCF pulse.

During this time the following checks are carried out:

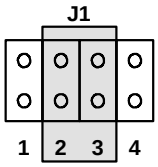
- During the first minute the internal time base is synchronized to the DCF second and minute mark.
- During the second minute the first DCF time data string is read. After parity and plausibility checks the time data string is loaded into a control clock and continued in second steps.
- After another minute the new DCF data string is compared with the control clock after the according checks. If both times are the same the time information is taken over into the base clock. The DCF signal is produced from the base clock time.

Even if other read-in DCF data are faulty the right DCF pulse is put out because of this base time. If the reception is interfered for more than xx minutes the DCF pulse is also interfered. In every second a low information is put out.

3.2 Output Signals (option)

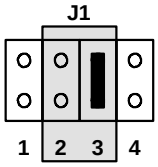
In addition to the DCF-pulse other pulses can be read off. The pin row is then extended by the according pin. The signals are TTL compatible and switch from high to low level. Two output groups can be selected by means of jumper J 1/2 and J 1/3.

3.2.1 Pulse Group 1



pin	pulse	width
10	1 second	0,5 sec.
11	1 minute	1 sec.
12	10 minutes	1 sec.
4	15 minutes	1 sec.
16	30 minutes	1 sec.
17	1 hour	1 sec.
18	1 day	1 sec.
19	summer time	permanent pulse

3.2.2 Pulse Group 2



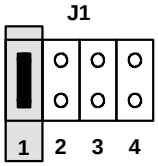
pin	pulse	width
10	1 second	0,5 sec.
11	1 minute	1 sec.
12	10 minutes	1 sec.
4	30 minutes	1 sec.
16	1 hour	1 sec.
17	1 day	1 sec.
18	status	
19	status	

3.2.3 Status DCF Reception

signal pin 14	pin 13	meaning
H level	H level	time not available
L level	H level	quartz synchronous
H level	L level	radio synchronous
L level	L level	radio synchronous

3.3 Serial Interface on TTL-Level (option)

Additional to the pulse output there is a serial interface without handshake signals implemented with the ***hopf*** 602x standard data string. The signals are available on TTL level , RxD (pin 5) and TxD (pin 20).

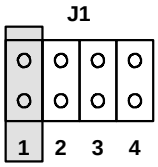


The interface is put into the basic setting by connecting jumper 1/1 (as delivered).

- 9600 baud, 8 data bit, 1 stop bit, no parity
- transmit every second
- time/ date, CET (local time)
- with control characters (STX, ETX)
- without second advance

3.3.1 Alterations of the Interface Parameter

Alterations of the above described settings are caused by transmitting a configuration data string to the clock.



The new settings are taken over on the next second change, under the condition that jumper J1/1 is not plugged in.

3.3.2 Structure Configuration Data String

no.	ASCII Character	Hex Value	Meaning
1	P	50	ident.config. data string
2	0..F	30-39, 41-46	config. byte 1 high nibble
3	0..F	30-39, 41-46	config. byte 1 low nibble
4	0..F	30-39, 41-46	config. byte 2 high nibble
5	0..F	30-39, 41-46	config. byte 2 low nibble
6	carriage return	13	end ident. of transmission

3.3.2.1 Configuration Byte 1 High Nibble

Bit 3	Bit 2	Bit 1	Bit 0	meaning
1	X	X	X	output CEST/CEWT
0	X	X	X	output UTC
X	1	X	X	word length 7 bit
X	0	X	X	word length 8 bit
X	X	0	0	no parity
X	X	0	1	no parity
X	X	1	0	parity even
X	X	1	1	parity odd

3.3.2.2 Configuration Byte 1 Low Nibble

Bit 3	Bit 2	Bit 1	Bit 0	meaning
0	X	X	X	1 stop bit
1	X	X	X	2 stop bit
X	0	0	0	150 baud
X	0	0	1	300 baud
X	0	1	0	600 baud
X	0	1	1	1200 baud
X	1	0	0	2400 baud
X	1	0	1	4800 baud
X	1	1	0	9600 baud
X	1	1	1	19200 baud

3.3.2.3 Configuration Byte 2 High Nibble

Bit 3	Bit 2	Bit 1	Bit 0	meaning
0	X	X	X	transmit with second advance
1	X	X	X	transmit without second advance
X	0	X	X	with ETX on the second change
X	1	X	X	without ETX on the second change
X	X	1	1	free
X	X	0	1	free
X	X	1	0	free
X	X	0	0	free

3.3.2.4 Configuration Byte 2 Low Nibble

Bit 3	Bit 2	Bit 1	Bit 0	meaning
0	X	X	X	output string time only
1	X	X	X	output string time/date/status
X	0	X	X	transmit with ctrl. charac. STX/ETX
X	1	X	X	transmit without control characters
X	X	0	0	transmit every second
X	X	0	1	transmit every minute
X	X	1	0	transmit every hour
X	X	1	1	transmit on request only

3.3.3 Configuration of Interfaces

Example: The data string **>P96F8(CR)<** sets the standard setting of the circuit board (see pt. 3.3.2). If the data string output should occur only on the minute change, you can get the new telegram with help by pt. 3.3.2.1 - 3.3.2.4.

Settings	Bit 3	Bit 2	Bit 1	Bit 0	binary value	hexadecimal value
Output MESZ	1					
Word length 8 Bit		0			=>1001	9
no Paritybit			0	1		
1 Stopbit	0					
9600 baud		1	1	0	=> 0110	6
without second advanced	1					
without ETX at the second change		1			=> 1111	F
idle Bits			1	1		
time / date / status	1					
with control character STX/ETX		0			=> 1001	9
output every minute			0	1		

Now the necessary data string is **>P96F9(CR)<**. The configuration telegram must always correlate to this model. At the first time the **"P**" character followed by a transmit telegram (4 byte) and at least the **(CR)**.

Procedure

- Jumper J2 must always be connected (autoreset).
- Jumper J1connected - see pt.3.3
- interface transmits the data string every second
- transmission of the data string >P96F8(CR)< to the receiver.
- pull Jumper J1 - data string is transmitted every second.
- transmission of the data string >P96F9(CR)< for output every minute.
- transmission of the data string every minute.

3.3.4 The Data String

The received time can be put out in a data string stating the internal status of the clock via the interface. This enables the user to synchronize connected computer systems with the official time for the Federal Republic of Germany. The output point of time, the string structure wanted and the used control characters can be set by means of the configuration string.

3.3.4.1 Data Format of the Serial Transmission

The data are transmitted in ASCII as BCD values using the following special characters.

Hex	meaning
$20	Space
$0D	CR (carriage return)
$0A	LF (line feed)
$02	STX (start of text)
$03	ETX (end of text)

3.3.4.2 Serial Requests

The data string output can be started by a user control character. These control characters are:

ASCII	meaning
"U"	time
"D"	time/ date
"G"	UTC time/date

Within one msec the system answers with the according data string.

This is quite often too fast for the requesting computer, it is therefore possible to cause an answer delay in 10 msec. steps as part of the request. To delay the transmission of the data string small letters "u, d, g," with a two digit multiplication factor are sent from the requesting computer to the clock.

The clock interprets the multiplication factor as hexadecimal value.

Example:

The computer transmits **ASCII u05** (hex 75, 30, 35)

The clock answers with the data string time only after 50 milliseconds.

The computer transmits **ASCII gFF** (hex 67, 46, 46)

The clock answers with the data string UTC time/ date after 2550 milliseconds.

3.3.5 Structure Data String Time and Date (standard)

The control characters STX and ETX are transmitted only if the output is preset with control characters. In case of a setting "ETX delayed" the last character ETX is transmitted exactly on the next second change.

character no.	Meaning
1	STX (start of text)
2	status (internal status of the clock)
3	day of the week (1= Monday ... 7= Sunday) if UTC time bit 3 is set to 1 for the day of the week
4	tens hour
5	unit hour
6	tens minute
7	unit minute
8	tens second
9	unit second
10	tens day
11	unit day
12	tens month
13	unit month
14	tens year
15	unit year
16	LF (line feed)
17	CR (carriage return)
18	ETX (end of text)

3.3.6 Structure Data String Time Only (standard)

The control characters STX and ETX are transmitted only if the output was preset with control characters. In case of the setting "ETX delayed" the last character (ETX) is transmitted exactly on the next second change.

character no.	meaning
1	STX (start of text)
2	tens hour
3	unit hour
4	tens minute
5	unit minute
6	tens second
7	unit second
8	LF (line feed)
9	CR (carriage return)
10	ETX (end of text)

3.3.6.1 Status Byte in the Data String Time Date

The second and the third ASCII characters contain the status and the day of the week. The status is decoded binary. Structure of these characters:

b7	b6	b5	b4	b3	b2	b1	b0	meaning
X	X	X	X	X	0	0	1	Monday
X	X	X	X	X	0	1	0	Tuesday
X	X	X	X	X	0	1	1	Wednesday
X	X	X	X	X	1	0	0	Thursday
X	X	X	X	X	1	0	1	Friday
X	X	X	X	X	1	1	0	Saturday
X	X	X	X	X	1	1	1	Sunday
X	X	X	0	X	X	X	X	no announcement hour
X	X	X	1	X	X	X	X	announcement hour (ST-WT-ST)
X	X	0	X	X	X	X	X	winter time (WT)
X	X	1	X	X	X	X	X	summer time (ST)
X	X	X	X	1	X	X	X	UTC time
0	0	X	X	X	X	X	X	time/date invalid
0	1	X	X	X	X	X	X	quartz operation
1	0	X	X	X	X	X	X	radio operation (basic accuracy)
1	1	X	X	X	X	X	X	radio operation (high accuracy)

3.3.6.2 Example of a Transmitted Data String

(STX)E312958230783(LF)(CR)(ETX)

radio operation (high accuracy)
summer time
no announcement
it is Wednesday 13:29:58 23.07.83
( ) - ASCII control characters e.g. (STX)

3.3.7 Setting the Clock via Serial Interface

Time and date can also be set via the serial interface. The following data string is required:

character no.	meaning	value range hex
1	"S" for setting time	53
2	tens hour	30...32
3	unit hour	30...39
4	tens minute	30...35
5	unit minute	30...39
6	tens second	30...35
7	unit second	30...39
8	tens day	30...33
9	unit day	30...39
10	tens month	30...31
11	unit month	30...39
12	tens year	30...39
13	unit year	30...39
14	day of the week	31...37
15	carriage return	0D

Alternatively in position 15 and 16 a status information can be transmitted which sets the clock status internally to summer or winter time. The 17. character must then be "carriage return".

character no.	meaning	value range hex
15	status high nibble	34 or 35
16	status low nibble	30 or 38
17	carriage return	0D

Meaning of the status byte:

Hex 48 = summer time
Hex 50 = winter time

Example of a transmission:

>S1234560708942CR< for Tuesday 07.08.94, 12:34:56
>S123456070894248CR< for Tuesday 07.08.94, 12:34:56 summer time

3.3.8 Trigger Reset

Transmitting the ASCII character "R" (hex 52) followed by a carriage return (hex 0d) triggers a restart of the clock module.

3.3.9 Align Antenna

Transmitting the ASCII character "A" (hex 41) followed by a "carriage return" (hex 0d) starts the special function "align antenna" in the clock module (see pt. 2.3).

During the mode "align antenna" the DCF-reception is turned off. The function is left automatically after three minutes and the clock module changes to normal reception mode. Sending a reset information also stops the "align antenna mode".

It is also possible to start the alignment of the antenna by means of the control characters „a“ Hex 61 followed by „carriage return“ (Hex 0d). The receiver puts out the internal values of the reception quality via the serial interface.

The values represent the current position of the DCF-lowering. To achieve the best resolution of the reception process it is not the absolute values which are calculated and transmitted but the difference to the previous value. The values are put out continuously without breaks in a 3 byte long ASCII data string.

String Structure of the Antenna Values :

character no.	meaning	value range hex
1.	EOT, ENQ	04, 05
2.	ASCII 0..F	30-39, 41-46
3.	ASCII 0..F	30-39, 41-46

On every internal second change a "Hex 05" instead of a "Hex 04" is transmitted as a start signal. This can synchronise the output. The two following values must be interpreted as hex values (0x00-0xff) and changed to a ShortInteger after an ASCII correction. (value range -128 to + 127).This measure represents the incoming DCF signal.

If the incoming value is to be displayed on the monitor it must be added to the previous one with the correct sign, which results in the new Y-position of the co-ordinates of the monitor. After every new value the x-co-ordinate is increased by 1. It is advisable to synchronise the display with the second change (start signal Hex 05).

3.3.10 Alignment of the Antenna with Windows ™ Software

Software ,using the above mechanism, to display the antenna values under Windows ™ is available. This program helps a great deal when installing an antenna in disturbed surroundings. When this software is in operation jumper1 must be connected. (default setting of serial parameter).

Also the reception module can comfortable be set via the interface.

4 LED 2 / LED 3

The internal status of the DCF-reception is indicated by means of the LEDs 2 and 3.

LED 3	LED 2	meaning
off	off	no base time available or DCF disturbed for more than xx [1] minutes
off	on	base time at hand DCF disturbed for less than xx minutes
on	off	base time available DCF not disturbed
on	on	base time available DCF not disturbed quartz control on, leap second control on

[1] xx depends on the configuration. Times can be set according to need. If the simulation time is unlimited, this status can be achieved only by interrupting the voltage supply of the receiver.

5 Technical Data

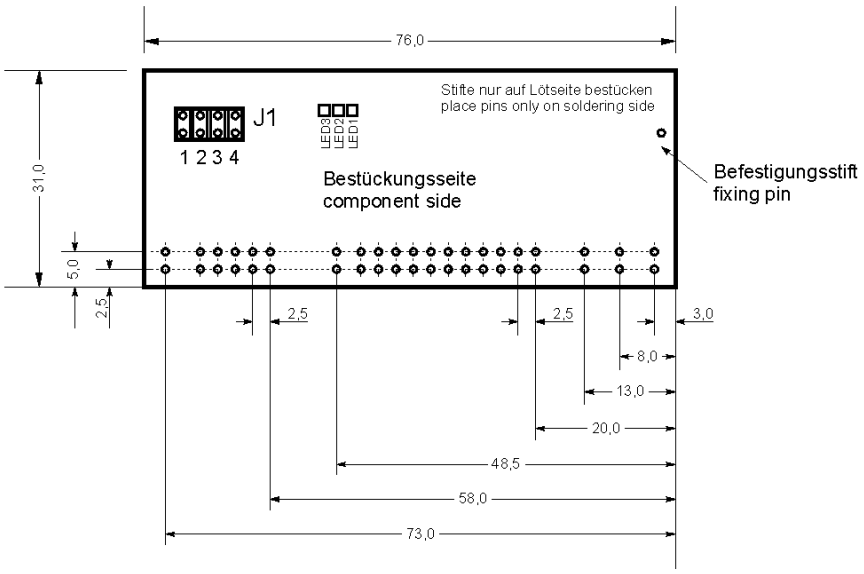
voltage supply	+5V DC, ±5%
power consumption	max. 300mW
band width	ca.40 Hz
control range	ca. 70 dB
input sensitivity	40µV
output pulse	TTL-compatible
negative DCF-decoding-pulse	100/200ms ±1ms
temperature range	0°C - 50°C
time offset	±2msec.
DCF-simulation	55 min. (times can set optional)

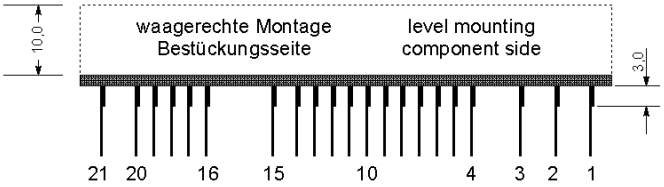
5.1 DCF77 - Receiver 4455

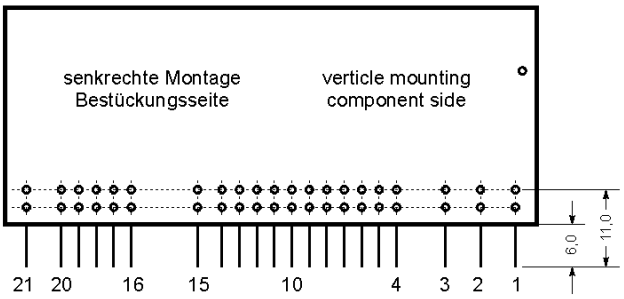
receiver, horizontal installation measurements:	76 x 31 x 16mm connector pins 10mm
receiver, vertical installation measurements:	76 x 16 x 31mm connector pins 10mm

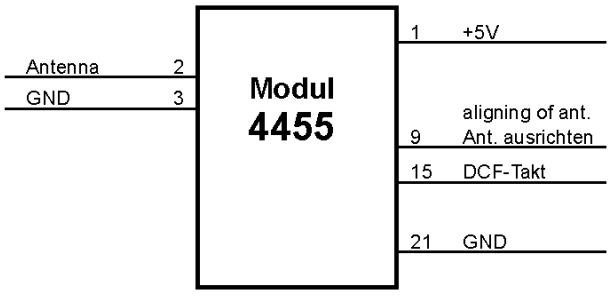
connector pins and measurements compatible with receiver 4450

Please note : The ***hopf*** company withhold the right to soft and hardware alterations at any time.









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Modul 4455

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