Technical Description

DCF77 Receiver-Module

4460

Safety information

The Safety Instructions and Technical Data serve to ensure trouble-free operation and protection of operating personnel and equipment. Strict compliance with these instructions is therefore necessary.

Failure to comply with these Safety Instructions will VOID the Warranty and any claims made under its terms.

Further no liability will be assumed by ***hopf*** Elektronik GmbH, for ensuing consequential damages, resulting from non-compliance.

Safety of the Devices

This instrument has been manufactured in accordance with the latest technological standards and acknowledged safety regulations.

The instrument should only be operated and maintained by properly trained and qualified technical personnel.

Please ensure that all cable connections are laid and fixed in position correctly. The instrument should only be operated with the supply voltage indicated on the identification plate. Note that multiple input power options exist (factory installed).

If an instrument must be opened for repair, this should only be carried out by technicians or engineers with corresponding qualifications or by ***hopf*** Elektronik GmbH company, or its representatives.

If the maintenance work requires the opening of a device or if a fuse needs changing, the device must first be disconnected from all power supplies.

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labeled accordingly.

The safety may be impaired when the device does not operate properly or if it is obviously damaged. Contact your local ***hopf*** Elektronik GmbH representative for required action.

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1 General Information

The receiver unit 4460 serves to synchronise the control devices with cyclic pulses. The data are emitted potential free.

The unit can operate in a wide voltage range 12-60V DC (optional 36-75VDC).

2 Mechanical Structure

The electronic is placed in a plastic terminal box with screw terminals for the connections. The package is fixed to a bar.

3 Set-up

When the operating voltage is connected to the screw terminals (see block wiring diagram) and the antenna to the BNC-connector the device is ready for operation.

Please Note: REVERSED POLARITY OF THE OPERATING VOLTAGE DOES NOT DESTROY THE PACKAGE. THERE IS A BRIEF CURRENT OF 1 A. AFTER A REVERSED POLARITY THE DEVICE MUST BE DISCONNECTED FROM THE VOLTAGE SUPPLY FOR 20 SEC.

3.1 Push-Button Switch Functions

The push-button switch has two functions:

- starting the programme "Alignment of the antenna".
- programme reset

Which programme is selected depends on how long the switch is pressed.

If the switch is pressed for 1 second, the programme "Alignment of the antenna" is started. If the switch is pressed for more than 3 seconds, a reset is carried out after the button is released.

The timing is assisted by the LEDs on the front panel which extinguish as soon as the button is pressed and then relight consecutively at second intervals. After three seconds all LEDs are lit.

3.2 Alignment of the Antenna

The connected antenna must be installed at a right angle to the direction Frankfurt. If the direction Frankfurt is not known precisely, the antenna alignment programme can be started. To do so the antenna is directed to the approximate direction Frankfurt. Then the alignment programme is started by pressing a push-button switch on the front panel. The programme starts when the switch is pressed for about one second.

To support the time control the LEDs on the front panel are switched off when the push button switch is activated and the yellow LED **"D"** (DCF77 pulse) light up again at second intervals. When the alignment programme is started the LEDs extinguish again. After approximately 20 sec the amplification for the DCF77 signal required for the location and the antenna position is automatically set.

The DCF77 pulse-diode lights up continually or for some time now. When the antenna is now turned slowly the reception field strength changes. This causes the lit period of the LED to change too. Weaker field strength means the LED lights up shorter. Thus the reception minimum of the DCF77 signal is found easily. The LED only flashes at the minimum or stays off. From the minimum position the antenna is turned by exactly 90° to the maximum position. Then the alignment programme is left again by reset.

Please Note: AFTER THREE MINUTES THE ALIGNMENT PROGRAMME IS LEFT AUTOMATICALLY. IT CAN BE RESTARTED IF NECESSARY.

4 Reset-Function

The reset function is started by the push-button switch on the front panel. If the button is pressed for more than 3 seconds a reset is carried out as soon as the button is released.

5 Permanent Operation

After the voltage supply has been connected the DCF77 pulse LED flashes every second. This indicates the perfect running of the programme in the micro-processor. It is not an indication of the quality of the DCF77 signal.

After 3-4 minutes of perfect DCF77 reception the internal clock is synchronised with the DCF77 time for the first time.

5.1 LED-Function

LED2 and LED3 display the internal status of the DCF77 reception and they have the following function:

LED3 F	LED2 Q	LED-Function
off	off	no base time at hand or DCF77-simulation time is out of date
off	on	base time at hand, DCF77 signal is simulated
on	off	base time at hand, radio operation
on	on	base time at hand, radio operation with control of the quartz frequency and the leap second

LED1	DCF77 Pulse

5.2 Quartz and Leap Second Control

During disturbed reception the base clock is continued by means of a quartz. The accuracy of the DCF77 pulse then depends on the accuracy of this quartz. To keep the drift as small as possible the quartz is adjusted indirectly by the DCF77 frequency during good reception. The adjustment values are stored in a non-volatile memory.

Also during good reception, the DCF77 leap second is compared to the base clock leap second and if necessary adjusted in small steps of between 16 µsec and 496 µsec after the minute change. This keeps the deviation of the simulated pulses from the true second edge to a maximum of ± 2 msec.

5.3 DCF77-Simulation

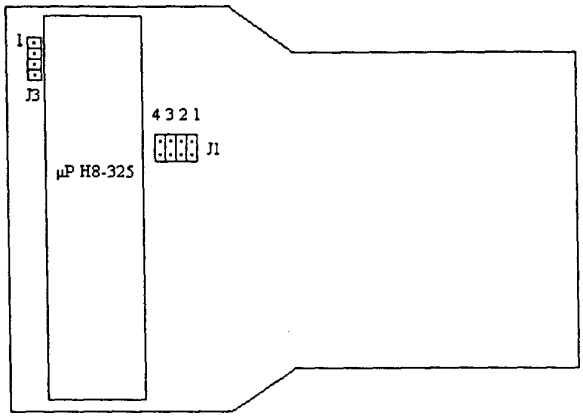
A DCF77 pulse simulation is available in the modes 2, 4 and 5. The simulation begins once the device has received a valid time after switch-on. If the reception is disturbed the DCF77 pulse output will be simulated again. As a rule the simulation time is limited to 55 minutes. The simulation can be extended by our company to a maximum of 4 hours or the time limitation can be cancelled completely (infinite simulation). After this time span the LED2 extinguishes. The synchronous clocks connected to the DCF77 pulse are no longer synchronised. In this condition a more or less wide disturbing pulse (glitch), depending on the DCF77 antenna signal, appears at the outputs.

As a rule the pulse width is 100 msec for "DCF77 low-pulse" and 200 msec for "DCF77 high-pulse". These pulses can be set to 70 msec for a "DCF77 low-pulse" and 160 msec for a "DCF77 high-pulse" ex works.

6 Output Signals

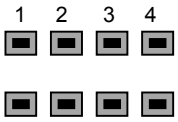
Various output pulses can be read off potential free via 5 optical couplers. The maximum switch voltage is 60V DC / 20 mA (ohm load). The following pulse groups are available. The according group can be selected by means of jumpers in the unit.

Jumper Position



6.1 Pulse Group 0

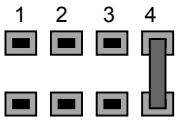
Jumper:



output	pulse	pulse duration
pulse 1	1 sec	0,5 sec
pulse 2	1 min	1 sec
pulse 3	10 min	1 sec
pulse 4	15 min	1 sec
pulse 5	30 min	1 sec

6.2 Pulse Group 1

Jumper:

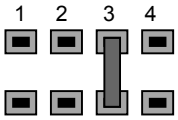


output	pulse	pulse duration
pulse 1	1 sec	0,5 sec
pulse 2	1 min	1 sec
pulse 3	1 hour	1 sec
pulse 4	1 day	1 sec
pulse 5	s/w - bit	varies

summer time = optical coupler switched

6.3 Pulse Group 2

Jumper:

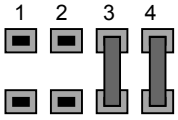


output	pulse	pulse duration
pulse 1	1 sec	0,5 sec
pulse 2	1 min	1 sec
pulse 3	1 hour	1 sec
pulse 4	1 day	1 sec
pulse 5	DCF77-sim.	0 / 100 / 200 msec

Please Note: PULSE DURATION FOR DCF77 PULSES SEE POINT 5.3.

6.4 Pulse Group 3

Jumper:

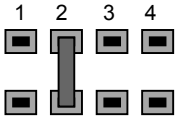


output	pulse	pulse duration
pulse 1	1 sec	0,5 sec
pulse 2	1 min	1 sec
pulse 3	1 hour	1 sec
pulse 4	1 day	1 sec
pulse 5	radio operation	varies

radio = optical coupler switched

6.5 Pulse Group 4

Jumper:

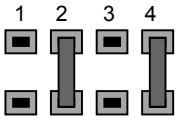


output	pulse	pulse duration
pulse 1	DCF77-sim	0 / 100 / 200 msec
pulse 2	DCF77-sim	0 / 100 / 200 msec
pulse 3	DCF77-sim	0 / 100 / 200 msec
pulse 4	DCF77-sim	0 / 100 / 200 msec
pulse 5	radio operation	varies

Please Note: PULSE DURATION FOR DCF77 PULSES SEE POINT 5.3.

6.6 Pulse Group 5

Jumper:

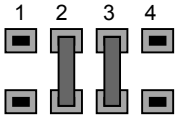


output	pulse	pulse duration
pulse 1	DCF77-sim	0 / 100 / 200 msec
pulse 2	1 min	1 sec
pulse 3	10 min	1 sec
pulse 4	15 min	1 sec
pulse 5	30 min	1 sec

Please Note: PULSE DURATION FOR DCF77 PULSES SEE POINT 5.3.

6.7 Pulse Group 6

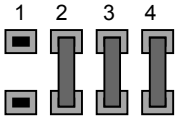
Jumper:



output	pulse	pulse duration
pulse 1	0 h	1 sec
pulse 2	5 h	1 sec
pulse 3	6 h	1 sec
pulse 4	12 h	1 sec
pulse 5	15 h	1 sec

6.8 Pulse Group 7

Jumper:



By means of this pulse group the hours are put out binary. The binary signals above 24 serve for the further subdivision of the hour in 10 minute steps. Every 10 minutes an output sequence is started to check the line and output optical couplers. The binary valence of the pulse exits are defined as follows.

output	valence
pulse 1	1
pulse 2	2
pulse 3	4
pulse 4	8
pulse 5	16

For the hours the hexadecimal values **"01 H"** till **"24 H"** will put out.

Whereas **"01 H"** represent the first hour and **"24 H"** the twenty fourth hour respectively zero hour because the value **"00 H"** is used for operating check up. The hour output is permanent.

Mechanism to check up the optical couplers

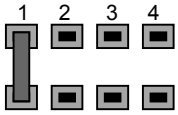
Every 10 minutes the optical couplers will give out a test sequence. This sequence will announce in the 58. second with the value **"00 H"**. In the 59. second the **test value** will be issued.

The test values are defined in the following table:

time	value
xx.xx.58 h	00 H
xx.09.59 h	1A H
xx.19.59 h	1B H
xx.29.59 h	1C H
xx.39.59 h	1D H
xx.49.59 h	1E H
xx.59.59 h	1F H
xx.xx.00 h	time in Hex

6.9 Pulse Group 8

Jumper:



Various pulses are put out in pulse group 8:

output 1 : Every hour one pulse is put out for one second at this output

output 2 : There is a pulse for 1 second at 3h every day

output 3 : Every 11 seconds there is one pulse for one second. This pulse output is synchronized to the beginning of the day. The last pulse is sent 17 seconds before midnight.

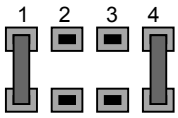
output 4 : Every 15 seconds there is a pulse of 10 seconds.

output 5 : Every 5 minutes there is a pulse of 1 second.

output	pulse	pulse duration
pulse 1	1 hour	1 sec
pulse 2	3 o'clock	1 sec
pulse 3	11 sec	1 sec
pulse 4	15 sec	10 sec
pulse 5	5 min	1 sec

6.10 Pulse Group 9

Jumper:



output	pulse	time correction	pulse duration
pulse 1	1 min	yes	1 sec
pulse 2	1 hour	yes	1 sec
pulse 3	1 min	yes	1 sec
pulse 4	1 min	no	1 sec
pulse 5	1 hour	no	1 sec

The output of pulses will be follow normally a timer grid of minutes and hours.

Differently the output is handled in case of a summer-/wintertime or a winter-/summertime changeover.

6.10.1 Winter-/Summertime Changeover

In case of a winter-/summertime changeover the time jumped from 01:59:59h to 03:00:00h.

At the minute-pulse output additionally 60 pulses will take out and at the hour-pulse output additionally 1 pulse will take out. The pulse duration is 1 sec and the pulse cycle is 3 sec.

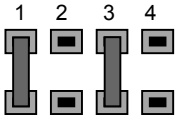
6.10.2 Summer-/Wintertime Changeover

In case of a summer-/wintertime changeover the time jumped from 02.59.59h to 02.00.00h.

At the minute-pulse output the next 60 pulses and at the hour-pulse output the next one pulse wouldn't execute.

6.11 Pulse Group 10

Jumper :



The output signal to the optical coupler corresponds with the signals of pulse group 4:

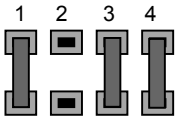
output	pulse	pulse duration
Pulse 1	DCF77-Sim	0 / 100 / 200 msec
Pulse 2	DCF77-Sim	0 / 100 / 200 msec
Pulse 3	DCF77-Sim	0 / 100 / 200 msec
Pulse 4	DCF77-Sim	0 / 100 / 200 msec
Pulse 5	radio operation	alternating

The DCF77-simulation time in pulse group 10 is two hours after a DCF77 reception failure.

These values are altered automatically with the setting of the mode. When the simulation time is over the optical couplers for the DCF77 pulse outputs stay switched off until a valid time has been received.

6.12 Pulse Group 11

Jumper:



The output signal to the optical coupler corresponds with the signals of pulse group 4:

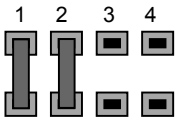
output	pulse	pulse duration
Pulse 1	DCF77-sim	0 / 100 / 200 msec
Pulse 2	DCF77-sim	0 / 100 / 200 msec
Pulse 3	DCF77-sim	0 / 100 / 200 msec
Pulse 4	DCF77-sim	0 / 100 / 200 msec
Pulse 5	radio operation	alternating

The DCF77-simulation time in pulse group 11 is 12 minutes after a DCF77 reception failure.

These values are altered automatically with the setting of the mode. When the simulation time is over the optical couplers for the DCF77 pulse outputs stay switched off until a valid time has been received.

6.13 Pulse Group 12

Jumper:



Different pulses can be activated by selecting pulse group 12. At present only optical coupler 1 is activated.

output	pulse	pulse duration
pulse 1 pulse 2 pulse 3 pulse 4 pulse 5	every 9 sec	1 sec

Output 1: A pulse output with a duration of one second takes place every 9 seconds. The pulse output will be synchronised at the beginning of day. Changeover points are considered.

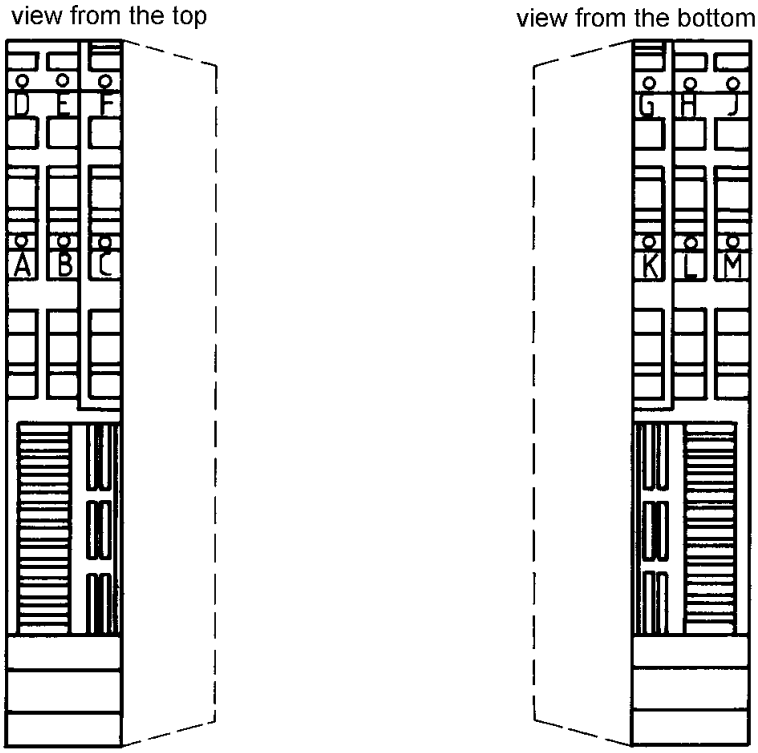
Please Note: PULSE GROUP 13 TO 15 ARE NOT IN USE JET !

7 Technical Data

voltage supply:	FG 446000: 12-60 V DC FG 446020: 36-75 V DC
power:	max. 1 W
input sensitivity	
DCF77 receiver:	40 µV
control range:	70 dB
time offset:	± 2 msec after adjustment
output pulses:	opto-uncoupled
pulse jitter:	± 1 msec
switching capacity optical coupler, ohmic load:	60 V / 20 mA for each optical coupler
temperature range:	0° C - 70° C
measurement of housing (WxHxD):	100 x 75 x 35 mm
extras:	Hard- and software alterations according to customer specifications are possible.

Please Note: THE **HOPF** COMPANY WITHHOLD THE RIGHT TO HARD- AND SOFTWARE ALTERATIONS AT ANY TIME.

8 Connections



K	+9...60 V
G	GND
D	+ pulse 1
A	- " 1
E	+ " 2
B	- " 2
F	+ " 3
C	- " 3
J	+ " 4
M	- " 4
H	+ " 5
L	- " 5