MEINBERG
FUNKUHREN

Technical Information

Operating Instructions

DU35K

Impressum

Werner Meinberg
Auf der Landwehr 22
D-31812 Bad Pyrmont

Phone: ++49 52 81 - 9309-0
Fax: ++49 52 81 - 9309-30

Internet: **http://www.meinberg.de**
Email: **info@meinberg.de**

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Inhaltsübersicht

General Information about DCF77

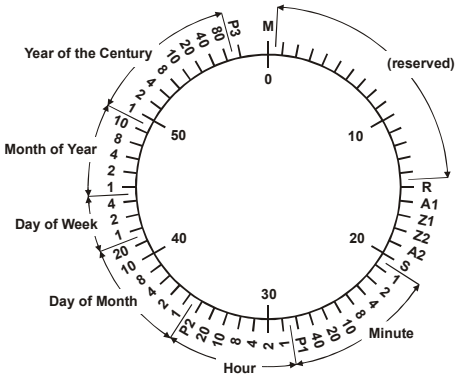
The radio remote clocks made by Meinberg receive the signal from the long wave transmitter DCF77. This long wave transmitter installed in Mainflingen near Frankfurt/Germany transmits the reference time of the Federal Republic of Germany. This time reference is either the Central European Time (Mitteleuropäische 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. So 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).

Figure: Decoding Scheme



M	Start of Minute (0.1 s)
R	RF Transmission via secondary antenna
A1	Announcement of a change in daylight saving
Z1, Z2	Time zone identification
	Z1, Z2 = 0, 1: Daylight saving disabled
	Z1, Z2 = 1, 0: Daylight saving enabled
A2	Announcement of a leap second
S	Start of time code information
P1, P2, P3	Even parity bits

Features of the DU35K

The large display DU35K is a 50mm hight LED matrix display that shows time and date in three lines with eight characters each as follows: day of week, day of month, month, hours, minutes and seconds. It is available as a free running stand alone clock, as a slave clock or as a radio clock with integrated DCF77 receiver.

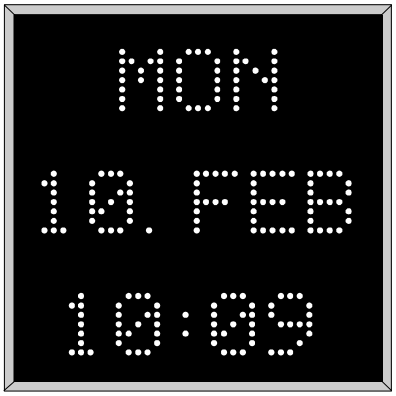


Fig.1: **Front View**

The DCF variant provides automatic changeover of daylight saving. In case of supply voltage failure the on board RTC keeps the time based on XTAL for at least 10 years. The language displayed can be choosen. The wall mounted housing of the DU35K is made of plastic coated steel sheet.

The power connector, the antenna input and the RS232/20mA interfaces provided by DU35K are accessible via connectors in the rear panel of the case.

Installation

Power Supply

The requested supply voltage of 230V/50Hz is applied via the power cord receptacle in the rear panel. After connecting the power cord and the antenna (only DCF variant) the system is ready to operate. Time and date become visible on the display.

DU35K as Stand Alone Clock

After connecting the power supply to the 230V/50Hz net the appearing time/date can be set by the two buttons in the rear panel of the case. The accuracy of the time depends on the precision of the internal quartz base.

An automatic changeover of daylight saving can be programmed as described in section "Daylight Saving".

DU35K as Slave Clock

There are two possibilities of synchronisation. The DU35K can be synchronized either by serial time strings or by pulses per minute. The selection can be set by jumper JP19 on the board (see section "Jumper Arrangement").

Synchronisation by serial Time Strings:

A preconnected radio clock sends the time strings to the DU35K. When the radio clock stops sending time strings the DU35K continues by running on XTAL.

The data transmission occurs either:

- via RS232 or
- via 20mA current loop.

It is possible to connect several DU35Ks or other Displays via serial interface to one radio clock.

Synchronisation by Pulses per Minute:

The DU35K can also operate as a normal slave clock. A preconnected master clock generates the minute slave line with pulse levels up to 48V. Installing the system it is necessary that the DU35Ks time match about ±15 sec. with the master clocks time. Synchronisation with the master clock is indicated by a dot between date and time on the display: When the dot is visible the DU35K runs free, when the dot dissappears the clock is syncronized. Synchronisation is possible only two times per hour. An automatic changeover of daylight saving can be programmed as described in section "Automatic Changeover of Daylight Saving".

DU35K as Radio Clock

It is not possible to run this variant of the DU35K as a slave clock. The DSUB connector (IN) at the rear panel has no effect. The DSUB connector (OUT) can be connected to further DU35Ks or similar systems to run them as slave clocks.

An external ferrit antenna is used to receive the signal from DCF77 and supplies it to the on-board LF receiver where it is demodulated by a synchronous detector with automatic gain control. The demodulated time marks are fed to the clock´s microprocessor.

The time marks from the receiver circuit are filtered and decoded by the microprocessor system. Parity and consistency checks over a period of two minutes take care for detecting errors in the received time string. The checked and decoded time is written to the on-board real time clock and spread by the interfaces. A software watchdog lets the microprocessor recover from malfunction. A power-fail comparator resets the microprocessor if the supply voltage drops below a specified threshold.

In case of supply voltage failure the on-board real time clock keeps the time powered by a lithium battery which has a live time of at least 10 years guaranteed.

After powering up the system the time keeped in the real time clock is displayed immediately. A dot below the colons between hours and minutes on the display indicates the DCF77 signal. This "Modulation Dot" appears until the first synchronisation of the clock. If the antenna is installed properly and the signal from DCF77 can be received without strong distortions, the "Modulation Dot" starts blinking exactly once per second, corresponding to the time marks from DCF77. Because of a better control an acoustic signal is added to the "Modulation Dot" for 2.5 minutes. After loss of reception for more than 6 hours the colons between hours and minutes begins to blink.

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.

In order to get the maximum signal, the antenna should be aligned carefully. If the antenna is installed properly and the signal from DCF77 can be received without strong distortions, the "Modulation Dot" starts blinking exactly once per second, corresponding to the time marks from DCF77. If this dot 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 "Free Running Dot" is turned off.

The scope of supply (only DCF77 variant) 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.

Usage of the Buttons MENU and SET

The time, the language, the brightness and the automatic changeover of daylight saving can be edited by using the buttons MENU and SET.

The button MENU is used to change over from the normal operation mode into the 'set parameters' mode and to select the different menus. The button SET is used to modify the selected menu. When leaving the menu by pushing MENU the modification is acknowledged. When no button is pushed for more than 30 seconds the DU35K goes back into normal operation mode with loosing the last modification that was not acknowledged. The menus in detail are described below.

The Menus in Detail

Time & Date

When pressing SET in this menu the actual valid time/date of the DU35K appears in the display. With additional pressing and keeping pushed of SET the blinking digit of the time is incremented. When the digit has reached the wanted value the SET button is to release. With another brief pressure to SET the next digit begins to blink and can be incremented in the same way. Pressing MENU acknowledges the modification and changes over to the next menu.

Language

When pressing SET in this menu the actual valid language of the DU35K appears in the display. Renewed pressing SET causes another language appearing. When the wanted (and available) language is displayed, the menu is to leave by pressing MENU.

Brightness

The brightness of the display can be graduated in three steps. Press SET in this menu to increment an integer between 1 and 3 where 1 means the most dimmed step and 3 means the fully brightness. Press MENU to acknowledge and to leave this menu.

Daylight Saving

In this menu the automatically changeover of daylight saving can be activated. Press SET in this menu to enable/disable daylight saving and press MENU to acknowledge and to leave this menu.

Winter/Summer Changeover

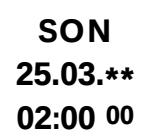
This menu is only visible when the automatically changeover of daylight saving is enabled. Pressing SET lets the user edit the time/date of the changeover as described in section "Time & Date" but there is one peculiarity:

Beginning and ending of daylight saving may either be defined by exact dates for a single year or using an algorithm which allows the DU35K to recompute the effective dates year by year.

The example beside shows how to enter the first case: The day-of-week does not need to be specified and therefore is displayed as wildcard (*). The time/date of next years changeover has to be entered as well (year by year).

In the second case the day-of-week must be specified. Then, starting from the configured date, daylight saving starts the first day whitch matches the configured day-of-week.

The example shows what has to be entered when daylight saving has to start the last sunday in march every year: The year (**) does not need to be specified because the changeover algorithm is valid for all further years, too.

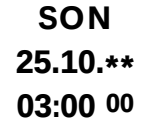


Summer/Winter Changeover

The Summer/Winter menu appears after ending the Winter/Summer menu by pressing MENU and is to be edited as well.

The example beside shows how to enter a fixed time/date for a singe years daylight saving end: The time/date of next years changeover has to be entered as well (year by year).

When daylight saving has to end the last sunday in october every year the following has to be entered: (day-of-week: 1 = monday, 7 = sunday).



Exit

Pressing SET in this menu lets the DU35K change over from the 'set parameters' mode into the normal operation mode. All changes of parameters are valid now.

Rear View DU35K

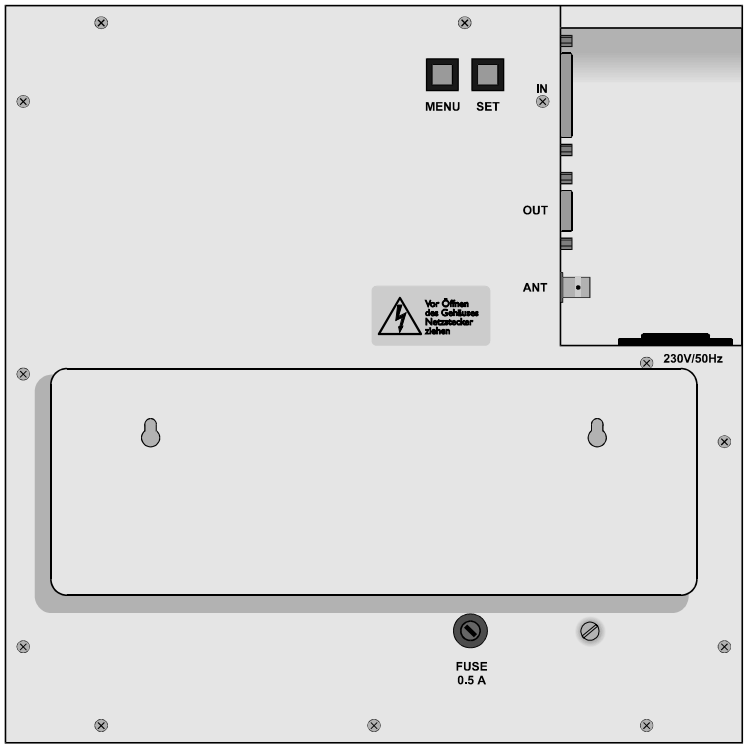


Fig.2: **Rear Panel View**

IN	Input for preconnected clock or master clock (time strings or pulses per minute)
OUT	Output (time strings or pulses per minute) for further DU35Ks or other equivalent Displays.
ANT	Antenna input for external ferrite antenna (only DCF77 variant)
Power	Power supply cord (85-264VAC / 120-375VDC)
FUSE	Fuse (T/500mA)
MENU/SET	Buttons to configure the DU35K

Because it is possible to preconnect clocks in different ways it is necessary to set the jumpers on the main board correctly (see examples Fig.3-6). The factory default setting of the jumpers is: syncronisation by RS232 time strings.

CAUTION
Pull 230V Power Supply Plug before opening the Case

Rear Panel Connectors

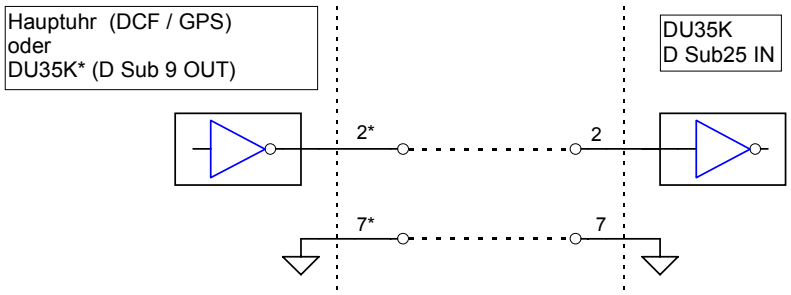
Name	Type	Signal	Cable
IN	25 pin SUB-D	RS232	shielded data line
OUT	9 pin SUB-D	RS232	shielded data line
ANT	BNC	77,5kHz	shielded coaxial line
Power	power cord receptacle	85-264VAC / 120-375VDC	power supply cord

CE Label

CE

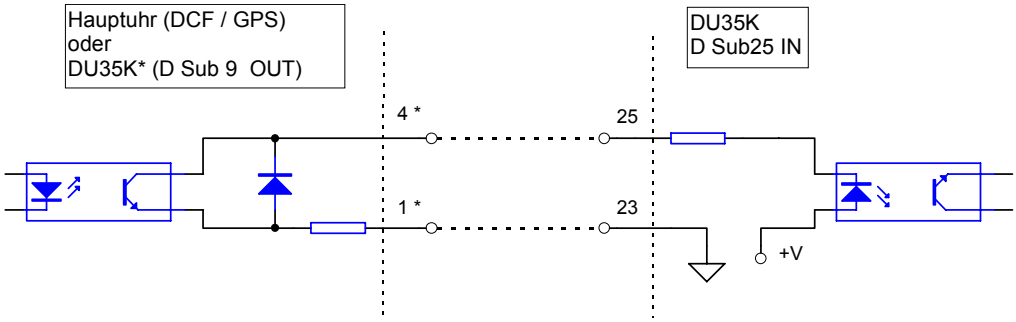
This device conforms to the directive 89/336/EWG on the approximation of the laws of the Member States of the European Community relating to electromagnetc compatibility.

Connection Exaples



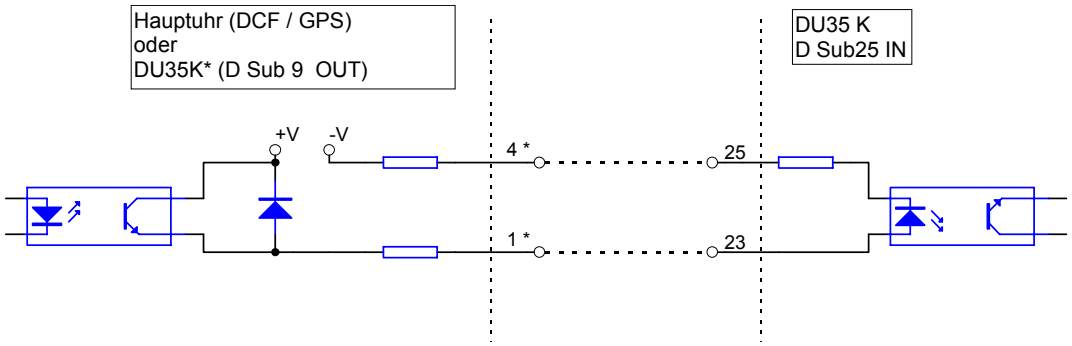
JP7	JP8	JP9	JP16	JP17	JP18	JP19
RS232	x	x	x	x	x	Telegram

Fig.3: **Jumper settings for operating mode: 'Synchronisation by RS232'**



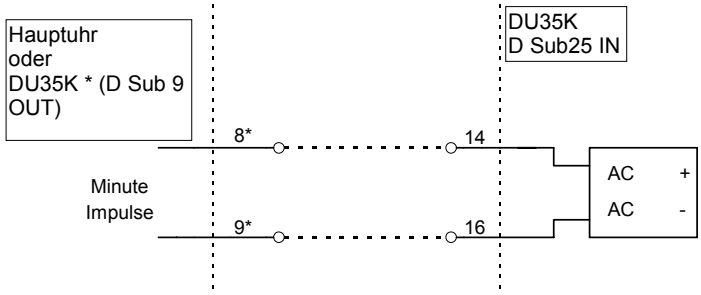
JP7	JP8	JP9	JP16	JP17	JP18	JP19
20 mA	aktiv	aktiv	x	passiv	passiv	Telegram

Fig.4: **Jumper settings for operating mode: 'Synchronisation by 20mA Current Loop' with passive output onto active input**



JP7	JP8	JP9	JP16	JP17	JP18	JP19
20 mA	passiv	passiv	x	aktiv	aktiv	Telegram

Fig.5: **Jumper settings for operating mode: 'Synchronisation by 20mA Current Loop' with active output onto passive input**



JP7	JP8	JP9	JP16	JP17	JP18	JP19
x	x	x	x	x	x	Impulse

Fig.6: **Jumper settings for operating mode: 'Synchronisation by Pulses per Minute'**

Pin Assignments of SUB-D Connector IN

2	Input Time Strings - RS232
3	Output RX_INF - RS232
7	Ground
14	Input Pulses per Minute
16	Input Pulses per Minute
17	Output RX_INF - 20mA -
23	Input Time Strings - 20mA +
24	Output RX_ INF - 20mA +
25	Input Time Strings - 20mA -

Pin Assignments of SUB-D Connector OUT

1	Output Time Strings - 20mA -
2	Output Time Strings - RS232
3	Input RX_INF - RS232
4	Output Time Strings - 20mA +
5	Ground
6	Input RX_INF - 20mA +
7	Input RX_INF - 20mA -
8	Output Pulses per Minute
9	Output Pulses per Minute

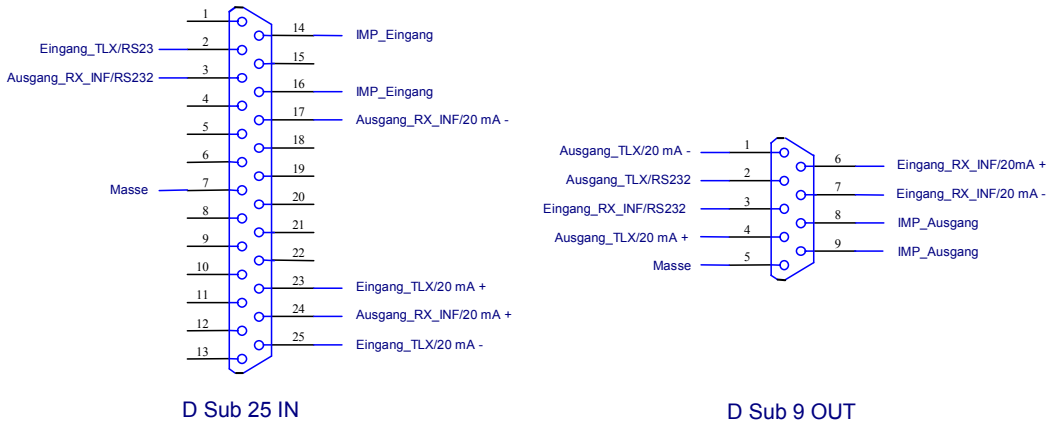


Fig.7: **Pin Assignments of SUB-D Connectors IN and OUT**
(DCF77 variant: The DSub connector (IN) at the rear panel has no effect!)

Technical Specifications:

OPERATION MODE:	- as free running quartz clock with internal RTC - as slave clock synchronized by radio clock or master clock with serial time strings or pulses per minute - as radio clock with integrated DCF77 receiver (option)
DISPLAY:	LED Dot Matrix Display 5 x 7 dots, 3 lines
INPUTS:	RS232 or 20mA current loop (passive/active) or pulses per minute (pulse voltage: 48V max.); DSub25 connector
OUTPUTS:	RS232 or 20mA current loop (passive/active) or pulses per minute (pulse voltage: as adjoining on input); DSub9 connector
BAUDRATE:	9600 baud
FRAMING:	7E2
TIME STRING:	see "Format of the Meinberg Standard Time String"
BUFFERING:	In case of supply voltage failure the on-board RTC keeps the time based on XTAL for more than 10 years.
POWER REQUIREMENTS:	85-264VAC, 50/60Hz / 120-375VDC, approx. 22VA
FUSE:	0,5A(T)
PHYSICAL DIMENSION:	320mm x 320mm x 54mm
WEIGHT:	4,7kg

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)

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:

u: '#' clock has not synchronized after reset
' ' (space, 20h) clock has synchronized after reset
v: '*' DCF77 clock currently runs on XTAL
' ' (space, 20h) DCF77 clock is sync'd with transmitter

x time zone indicator:

'U'	UTC	Universal Time Coordinated, formerly GMT
' '	MEZ	European Standard Time, daylight saving disabled
'S'	MESZ	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)

Jumper Arrangement

Jumper Settings:

JP7	Time String: RS232 / 20 mA
JP8	Input of Time String (20 mA Current Loop): active / passive
JP9	Input of Time String (20 mA Current Loop): active / passive
JP16	automatically Changeover of Daylight Saving: Open - No / Set - Yes
JP17	Output of Time String (20 mA Current Loop): active / passive
JP18	Output of Time String (20 mA Current Loop): active / passive
JP19	Time String / Pulse Mode

Default jumper settings on the board:

JP7	RS232
JP8	active
JP9	active
JP16	no
JP17	passive
JP18	passive
JP19	Time String

In case of DCF77 variant the following jumpers have no effect: JP7, JP8, JP9 and JP19.