

Industriefunkuhren



Technical Manual

Large Scale Display

Model 4985

ENGLISH

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Valid for Devices 4985 with FIRMWARE Version: **08.xx**
and REMOTE-SOFTWARE (HMC) Version: **01.06**

Version number (Firmware / Manual)

THE FIRST TWO DIGITS OF THE VERSION NUMBER OF THE TECHNICAL MANUAL AND THE FIRST TWO DIGITS OF THE FIRMWARE VERSION MUST **COMPLY WITH EACH OTHER**. THEY INDICATE THE FUNCTIONAL CORRELATION BETWEEN DEVICE AND TECHNICAL MANUAL.

THE DIGITS AFTER THE POINT IN THE VERSION NUMBER INDICATE CORRECTIONS IN THE FIRMWARE / MANUAL THAT ARE OF NO SIGNIFICANCE FOR THE FUNCTION.

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Symbols and Characters



Operational Reliability

Disregard may cause damages to persons or material.



Functionality

Disregard may impact function of system/device.



Information

Notes and Information.



Safety regulations

The safety regulations and observance of the technical data serve to ensure trouble-free operation of the device and protection of persons and material. It is therefore of utmost importance to observe and compliance with these regulations.

If these are not complied with, then no claims may be made under the terms of the warranty. No liability will be assumed for any ensuing damage.



Safety of the device

This device has been manufactured in accordance with the latest technological standards and approved safety regulations

The device should only be put into operation by trained and qualified staff. Care must be taken that all cable connections are laid and fixed in position correctly. The device should only be operated with the voltage supply indicated on the identification label.

The device should only be operated by qualified staff or employees who have received specific instruction.

If a device must be opened for repair, this should only be carried out by employees with appropriate qualifications or by **hopf** Elektronik GmbH.

Before a device is opened or a fuse is changed all power supplies must be disconnected.

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

The safety may be impaired when the device does not operate properly or if it is obviously damaged.

CE-Conformity



This device fulfils the requirements of the EU directive 89/336/EWG "Electromagnetic compatibility" and 73/23/EWG "Low voltage equipment".

Therefore the device bears the CE identification marking (CE = Communautés Européennes = European communities)

The CE indicates to the controlling bodies that the product complies with the requirements of the EU directive - especially with regard to protection of health and safety for the operator and the user - and may be released for sale within the common markets.

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1 Functions

The basic version of the large display 4985 consists of a matrix measuring 16 x 64 LED. Two lines of 42 mm or one line of 84 mm alphanumeric characters can be displayed on this matrix.

The device can operate as a large display for values such as grid time, difference time and mains frequency which can be transferred from **hopf** System 7001.

Different display and decoding programs are integrated in the large display 4985.

The large display is equipped with a highly accurate quartz clock which can be synchronized with a DCF77 signal. The DCF77 signal can be supplied to the BNC connector via an antenna or as a pulse to the respective inputs. The large display generates a DCF77 pulse and thus synchronizes further devices.

Time and date can be displayed in different formats.

1.1 Housing

The large display is set up in a black lacquered aluminium housing for wall installation.

The front pane is of red and of coated acrylic glass and fixed into guiding rails of the housing.

For installation and configuration of the large display the right side panel of the housing and the front pane should be pulled to the right. The side panel of housing is mounted into guiding rails with spring locks.



1.2 Initial Operation

The large display 4985 is delivered in its casing ready for operation. It is now only necessary to install the connections required for operation.

1.2.1 Opening and Closing of Housing

For installation of the display the right side panel of the housing needs to be removed. The right side panel is fixed into the housing by spring locks.

Opening

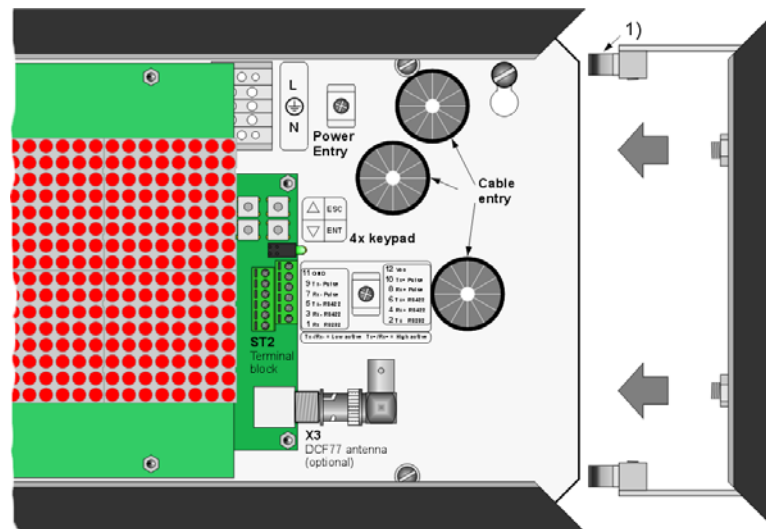


- Pull the right side panel to the right out of the housing
(ATTENTION: DO NO JAM)
- When pulling out, override the pressure point of the spring locks **at the top** first and then **at the bottom** (traction approximately 50N – corresponding with at driving power of approximately 5kg)
- Pull the front pane to the right out of the housing



Pay attention to a secure hold when opening the large display.

Closing



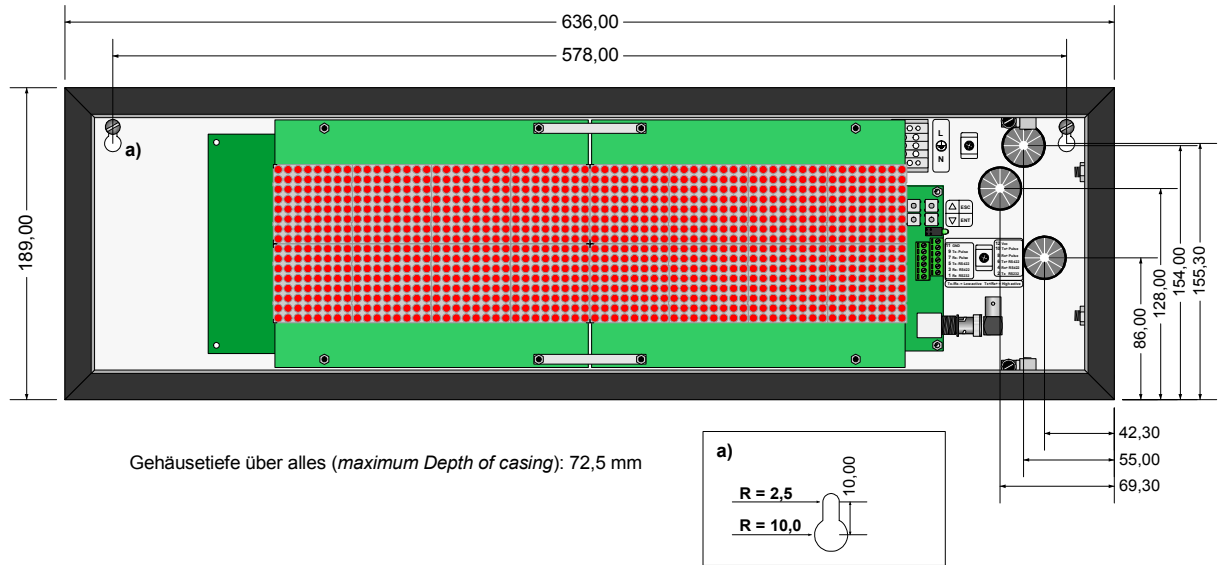
- Push the front pane in the front guiding rails of the housing (coated side of front pane outside)
- Insert the fixing brackets of the side panel in the appropriate guiding rails of the housing at the top and bottom (ATTENTION: DO NO JAM)
- When snapping the side panel into the housing pay attention to the fact that the front pane and the rear panel are placed in the appropriate guiding rails of the side panel
- When snapping in, the pressure point of the spring locks (1) must be overridden



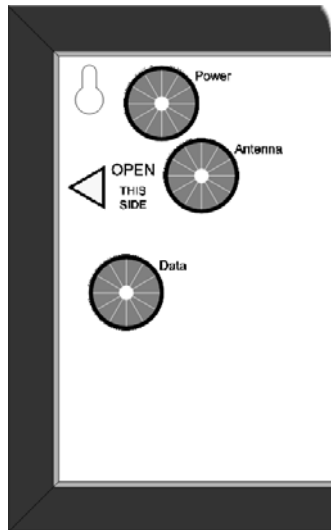
Pay attention to a secure hold when closing the large display.

1.2.2 Wall Mounting and Cable Entry

The large display is mounted at the wall by fixing apertures (a) in the rear panel.

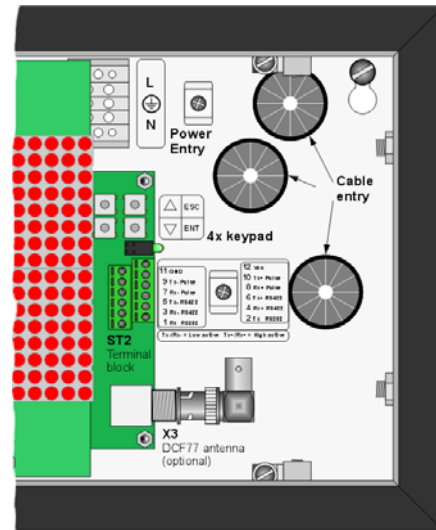


For cable entry (power supply, antenna cable and data cable) there are three marked openings available.



Rückseite Gehäuse

After connection, the cables should be fixed with the according strain relief into the housing.



Installation and commissioning may only be carried out by suitable specialist personnel. In doing so the respective country-specific regulations (e.g. VDE, DIN) are to be observed.

1.2.3 Selection of hardware

The display 4985 is equipped with a serial interface in the following format:

RS232 (V.24)
RS422 (V.11)

Physically only one interface can be used as an input. No handshake lines are provided for using the RS232 interface (3-conductor operation).

1.2.4 Allocation of the RS422 interface

When several displays are connected parallel to one RS422 interface, the lines Rx+ RS422 and Rx- RS422 run to the first display and continue parallel from there to the last display. Jumper J6 (terminator) is to be positioned on the final display in the chain.

1.2.5 Allocation of the DCF77 pulse input

When several displays are connected to a DCF77 pulse, then the lines Rx- Pulse and Rx+ Pulse run to the first display and continue parallel from there to the last display. Jumper J5 (terminator) is to be positioned on the final display in the chain.

1.2.6 LEDs

During normal operation the green LED shows the DCF77 pulse. The yellow LED is on for as long as signals are emitted via the serial interface.

During an update the green LED flashes in the pulse of the incoming data. In case of error the yellow LED is on permanently.

1.2.7 Operation via keys

The keys can be accessed after the front screen has been removed or pushed aside. Functions of the keys:

- | | |
|----------------|---|
| Key ▲/▼ | <ol style="list-style-type: none">1. Keys ▲/▼ activated: The display menu is activated and scrolled through forwards (key ▲) or backwards (key ▼).2. Key ENT selected: The selected value can be increased (key ▲) or diminished (key ▼). |
| Key ENT | <ol style="list-style-type: none">1. Direct entry into the clock input menu.2. Enter function. Selection of the displayed menu item/value via key ▲/▼. |
| Key ESC | Escape function. Cancel the current entry and return to the next higher menu level. |
| Key ▲+▼ | Pressing both keys for 5 seconds sets the following functions to standard: Color, display, interface. |

1.3 Operating the Settings Menu

When the voltage supply is switched on the program status and the date appear on the display for 10 sec.:

e.g. **Vers. 08.00**
 29 JUL 2008

The menu serves to observe and alter respective values. When an item in the menu is selected first the respective values are shown. The menu is a closed loop, i.e. from the first menu item it is possible to scroll back to the last and scroll forward to the first one directly. It is only possible to exit a sub-menu via key **ESC**. The values entered in the individual items of the sub-menu are retained!

To change a value key **ENT** must continue to be pressed until the respective value flashes in the display. Use keys **▲** and **▼** to change the value. This value is adopted by continuing to press key **ENT** until no further value is selected. If key **ESC** is pressed during this process the alterations of values in this menu item are canceled.

Keys **▲** and **▼** take you from the standard display to the main menu.

Key **ENT**: time input
Key **▲**: date input
Key **▼**: version

Example of setting process:

System is in standard mode. Time and date are displayed.

Key **ENT** is pressed ->

The system shows the menu item time input i.e. the following is displayed:

Time:
hh:mm:ss

hh represents current hour, **mm** current minutes and **ss** current seconds.

The displayed time runs.

1. key **ENT** is pressed ->

The time display stops. The hours start flashing.

2. key **ENT** is pressed->

The hours stop flashing. The minutes begin to flash.

3. key **▲** is pressed->

The minutes are increased by 1, unless the minutes are 59, otherwise they are set to 00. They continue flashing.

4. key **ENT** is pressed->

The minutes stop flashing. The seconds start flashing.

5. key **ENT** is pressed->

The seconds stop flashing. The time continues running from the value set.

6. key **ESC** is pressed->

The display returns to the standard mode. The display shows the (altered) time and date.

Alternatively

4. key **ESC** is pressed->

The minutes stop flashing. The current time is displayed again (the alteration has been rejected.)

5. key **ESC** is pressed->

The display returns to the standard mode. The display shows the (unchanged) time and date.

1.4 Main Menu Scheme

Time

Date

Module no.

Time zone _____ Difference time

Changeover of standard/daylight saving time

Changeover daylight saving time/standard time

System bits _____ Display

F-String

Synchronous

System Byte

Serial Port _____ COM:

Mode byte 1

Mode byte 2

Parameter _____ Language

Brightness

Quartz control value

Time-out status

Time-out DCF77-SIM

DCF77 pulse length LOW HIGH

Enable reset

Alignment of the antenna

Display programme version

1.5 View / Set Time (TIME)

Hours (00..23), minutes (00..59), seconds (00..59) are displayed and changed.

1.6 View / Set Date (DATE)

The day of the week (Monday..Sunday), day (01..last day of the month), month (January..December), year (2000..2099) are displayed and changed.

When the entry is completed the day is checked and, if necessary, reset to the last day of the month. Values between 01 and 31 are possible.

1.7 Module number (MODULE)

The number of the module identifies the device at the serial interface for the remote software (on request).

The number of the module can be set between 00..99.

1.8 Sub-Menu Time Zone (TIME ZONE)

1.8.1 Difference Time (DIFF. TIME)

The difference time can be set between -12:59 and +12:59.

The hours (-12..+12) and the minutes (00..59) are set separately.

Standard: **+01.00**



The setting of the difference time is only possible in the modes 'quartz clock', 'slave clock via DCF77 pulse' and 'DCF77 signal simulation'.

1.8.2 Start Daylight Saving Time (START DST.)

On this date the time is put forward by 1 hour (in quartz mode only).

The following are displayed and set: the day of the week in that month (0..5), the day of the week (Mon..Su), the month (Jan..Dec), the hour (00..23) of the changeover.

Example:

The 4th Sunday in March 02h. Display: **4.SU.MAR.02**

If the day of the week in that month equals 5 the last possible one occurring is meant.

If the day of the week in that month equals 0 no changeover is carried out (not in the other direction either).

Standard: **5.SU.MAR.02**

1.8.3 End of Daylight Saving Time (END DST.)

On this day the time is set back by 1 hour (in quartz mode only).

Display and setting as START DST.

Standard: **5.SU.OCT.03**

1.9 Sub-Menu System Bits (SYSTEMBITS)

Some features are set in "bits".

The bits are assembled in groups of 8 (bytes).

Every bit works like a switch. A bit has two possible statuses: "0" and "1".

The bits are displayed in the sequence bit7, bit6 ... bit0!

When, for example, only bit 7 is set ("1"), the display is as follows: **1000 0000**

The statuses represent features which are listed in the following tables.

1.9.1 Settings Display (DISPLAY)

Bit	Bit	Bit	Bit	Display	Function
b7	b6	b5	b4		
0	0	0	0	small (42mm)	time and date
0	1	1	0	small (42mm)	Local & UTC
0	1	x	0	small (42mm)	Local time and UTC
1	0	0	0	large (84mm)	time
1	0	1	0	large (84mm)	time with small seconds
1	1	0	0	large (84mm)	date
1	1	1	0	large (84mm)	day of the week
0	x	x	1	small (42mm)	Display F-String of Board 7515 in System 7001
1	x	x	1	large (84mm)	Display F-String of Board 7515 in System 7001
b3					not in use
b2					
0					format of date European (day - month - year)
1					format of date US (month - day - year)
b1	b0				
0	0				local time with daylight saving time changeover
0	1				local time without daylight saving time changeover
1	x				UTC

Standard: **0000 0000**

Mode Radio Controlled Clock,
display small (time/date), European format of date,
local time with daylight saving time changeover

1.9.2 F-STRING

See "Operation as Matrix Display".

Standard: **0000 0000**

1.9.3 Clock Functions (SYNCHRONOUS)

Bit	Bit	Bit	Function
b7	b6	b5	not in use
b4			
0			DCF77 simulation local
1			DCF77 simulation UTC
b3			
0			DCF77 as difference input (like RS422)
1			DCF77 al TTL input
b2			not in use
b1	b0		type of synchronization
0	0		quartz clock
0	1		synchronous clock via master/slave string
1	0		synchronous clock via DCF77 pulse
1	1		DCF77 signal / simulation

Standard: **0000 0011**

radio controlled clock via antenna input, DCF77-simulation with local time base, difference time 1h (CET).



The colon between the hours and the minutes flashes when the clock is not synchronous. Otherwise the colon is always visible.

1.9.4 System Byte (Special Function)

Bit	Function
b7	not allocated
b6	not allocated
b5	not allocated
b4	not allocated
b3	not allocated
b2	not allocated
b1	not allocated
b0	Timeout for F-String 0=active, 1=inactive

Standard: **0000 0000**

Timeout for F-String active

1.10 Sub-Menu Serial Interface (SERIAL PORT)

The matrix display is equipped with a serial interface which can be set independently. The data can be exchanged via the signal levels RS232c (V.24) or RS422 (V.11). The interfaces can be used for transmissions of data strings to other computers.

The interface is used as an input for the data which are to be displayed in the matrix display mode. Moreover the firmware updates can be carried out via this interface.

Different data strings for the output are available. Customized data strings can be obtained on request. The following settings can be carried out for the serial interfaces.

1.10.1 Parameter of the serial interface (COM:)

Baud rate: 150, 300, 600, 1200, 2400, 4800, 9600, 19200Bd

Parity: no, even, odd

Word length: 7Bit, 8Bit

Stop bits: 1, 2

Display e.g. **COM: 9600Bd**

NO 8W 1S

Standard: **9600Bd, no parity, 8 data bits, 1 stop bit**

1.10.2 Configuration of the Data String (Mode byte)

The output of the time information received can be carried out via the interfaces in different data strings by defining the internal status of the clock. This enables the user to synchronise connected computers with the accurate time. The output time individually required, the string structure and the control characters used can be selected via information input in **mode byte 1 and 2**.

The standard setting is **1111 1111** local time, without second advance, with daylight saving time changeover, with control characters on the second change, CR/LF, without delayed transmission, on request only.

1.10.2.1 Local Time or UTC of the Serial Output with Mode byte 1

Bit position 7	Time zone
on	Local time
off	UTC (Universal Time Co-ordinated)

1.10.2.2 Second Advance of the Serial Output with Mode byte 1

Bit position 6	Second advance
off	with second advance
on	without second advance

1.10.2.3 Local Time or Standard Time in the Serial Output with Mode byte 1

Bit position 5	
off	Standard time (wintertime)
on	Local time (with dayl. saving time changeover)

1.10.2.4 Last Control Character as On-Time Marker with Mode byte 1

This setting can be used to transmit the last control character (see structure of data string) absolutely accurately at the edge of the next second change.

Bit position 4	Control characters on the second change
off	Last character on the second change
on	Last character instantly

1.10.2.5 Control Characters CR and LF with Mode byte 1

The order of the characters CR and LF can be exchanged by means of this switch.

Bit position 3	Control characters CR and LF
off	LF/CR
on	CR/LF

1.10.2.6 Delayed Transmission

When the setting is "control characters on the second change" the last character of the data string is transmitted directly on the second change and, immediately after this, the new data string valid for the next second change. This may cause errors in overloaded computers. Bit position 2 can be used to delay the transmission of the new data string depending on the Baud rate.

Example:

Baud rate 9600 Baud

Milliseconds	with delay	without delay
000	final character (ETX)	final character (ETX)
002	–	new data string
025	–	end of new data string
930	new data string	–
955	end of new data string	–
000	final character (ETX)	final character (ETX)

Baud rate 2400 Baud

Milliseconds	with delay	without delay
000	final character (ETX)	final character (ETX)
002	–	new data string
105	–	end of new data string
810	new data string	–
913	end of new data string	–
000	final character (ETX)	final character (ETX)

Bit position 2	Delayed transmission
off	with delay
on	without delay

1.10.2.7 Synchronisation point of time with Mode byte 1

Bit 1	Bit 0	Transmission point of time
off	off	Transmission every second
off	on	Transmission on the minute change
on	off	Transmission on the hour change
on	on	Transmission on request only

1.10.3 Selection of Data String with Mode byte 2

This mode byte sets the data string emitted. At present only bit positions 0-3 have a function. The remaining bits are for later extensions.

Bit position				Structure of data string
3	2	1	0	
off	off	off	off	Standard <i>hopf</i> data string
off	off	off	on	Standard <i>hopf</i> with 4-digit year
off	off	on	off	DCF-Master/Slave data string
off	off	on	on	Siemens SINEC H1
off	on	off	off	T-String

1.10.4 User String Identifier

When the display runs in the mode "String display"/user string, the user string is shown with the identification number set here. The identification number can be set from 00 to 99.

1.11 General Display Parameters (Parameter)

1.11.1 Language (LANGUAGE)

Setting the language only affects the abbreviations of the time/date output.

The output of the abbreviations of the days of the week and the months can be in the following languages:

- English
- German
- French
- Spanish
- Italian

(ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO)

1.11.2 Brightness (BRIGHTNESS)

The brightness of the LED display can be adjusted to the respective ambient conditions via this menu.

Values can be set between 0 and 120 per cent. Values over 100 per cent serve to compensate for loss of light intensity by the LED display due to age.

1.11.3 Quartz Control Value (QUARTZ)

Only qualified personnel may alter the quartz control value, if the deviation shown in quartz mode is too large. The quartz frequency must then be calibrated by adjusting this value with the aid of a highly accurate reference value.

1.11.4 Status Time-Out in min

Setting the delay which indicates a synchronisation error. The period after which a synchronisation error is indicated can be delayed. The value can be set between 2 and 255 minutes.

1.11.5 DCF77-SIM Time-Out in min

Setting the delay after which the DCF77 pulse output is interrupted if there is a synchronisation error. The value can be set from 2 to 255 minutes, whereby the setting 255 means that simulation is not interrupted (infinite simulation).

1.11.6 DCF77-Simulation Pulse Duration (HIGH/LOW) in ms

The duration of the low pulse can be set from 50-154ms, that of the high pulse from 150-250ms. The standard setting is 100ms for low and 200ms for high.

1.12 Release Reset

Here the program in the clock can be reset. After a reset all the parameters are set anew from the values stored and checked.

The program version is shown for 10 seconds or until the next key is pressed.

After that the clock must be synchronised again.

1.13 Alignment of the Antenna

When this item is selected the signal, which is received by the antenna, is displayed. Only the first part of a second is displayed.

This function helps to remedy reception problems.

Start the programme from the menu with the command **"antenna alignment"**.

The display shows the incoming DCF77-signal as an oscillogram.

On every second change (except in the 59th second) the signal should dip distinctly (wave trough). The best reception position is found by slowly turning the antenna position (max. wave trough). The reception suffices when the second pulse is displayed without interference.

After the start of the alignment programme the amplification of the signal is set again. This process takes 20-30 seconds depending on the local strength of the signal. The display shows the DCF77 signal oscillogram with a dipped signal on every second change.

When the antenna is slowly turned away from the set position, the received field strength decreases when the antenna is positioned correctly. This is indicated by a dipping signal line and a gradually decreasing dipping of the signal in the display.

When the antenna is turned by exactly 90°, hardly any DCF77signal should be detected. From this position the antenna is again turned by exactly 90° to the optimum position.

1.14 Display of Version

The version and the date of origin of the programme are shown.

After restart the large display is shown in this menu for 10 seconds or until another key is pressed.

There is no further function in this menu item.

2 Software

The HMC-software (*hopf* management software) is the remote software to setup the board 4985 and can be found on the CD under '..\software\products\hmc\'.

Please look at the description of the HMC-software for the minimum system requirements for the client PC.

The serial interface cable supplied is connected between the PC (in the free serial interface) and the large display 4985 (**COM0**). If done turn on both devices and start-up the HMC Remote Software.

The transmission parameters in the PC for communication with the large display 4985 have to be the following values (status on delivery):

- Baud rate: 9600 Baud
- Word length: 8 Bit
- Number of stop bits: 1
- Parity: NO



The transmission parameter for the serial PC interface must be the same as the Radio Controlled Clock Interface **COM0**.

The delivery status can be reset by pressing the keys ▲ und ▼ of the display 4985 concurrently 5 seconds.

3 Large display as radio-controlled clock

Under the menu item DISPLAY you can choose between display as radio-controlled clock or as large display (see 1.9.1 - Settings Display (DISPLAY)).

- Bit 4 = 0 Radio Controlled Clock
- Bit 4 = 1 Matrix Display

The control board for the large display contains a DCF77 receiver which is used to decode the time/date information. The DCF77 signal can be supplied by an active **hopf** antenna or a DCF77 simulation or by the DCF77 pulse.

A **hopf** antenna or the DCF77-simulation are electrically the same. The DCF77 decoder program under the menu SYNCHRON is activated for this supply (see 1.9.3 Clock Functions (SYNCHRONOUS)).

b1	b0		type of synchronization
0	0		quartz clock
0	1		synchronous clock via master/slave string
1	0		synchronous clock via DCF77 pulse
1	1		DCF77 signal / simulation

The clock requires about 6 minutes to synchronise itself with the DCF77 signal.

3.1 Installation of the Antenna

Use a coaxial cable RG 59 to connect the **hopf** antenna supplied or a DCF77 antenna signal to the angled BNC connector on the control board.

The length of the cable must not exceed 500m if you use a **hopf** antenna or a DCF77 simulation.

Please consider the following points when installing the antenna

- The antenna is of wide-band design to achieve a high short-term accuracy of ± 1 msec. of the decoded DCF77 signal. Therefore do not place the antenna near electric or magnetic sources (< 5 m) of interference like monitors, engines, power control cabinets etc.
- When using an indoor antenna also take into account the shielding effect of buildings, reinforced concrete walls or corrugated iron sheeting as they are HF-proof to a large extent. The **hopf** antenna should be installed as close as possible to a window.

3.1.1 Alignment of the antenna

All the **hopf** antennas, except for the all-round antenna 4437, are of directional design. They must therefore be aligned to the DCF77 transmitter situated in Mainflingen near Frankfurt /Main.

The indoor and outdoor antennas have an arrow below the antenna housing which must point to Frankfurt.

If you need help aligning the antenna or if there is interference in reception call up the menu item "antenna alignment" which shows the antenna signal in the display (see 1.13).



If the colon between the hour and the minutes flashes in the display, the clock does not receive (no longer receives) a radio signal.

3.1.2 Indirect Lightning Protection

To avoid lightning striking via the antenna into the large display the antenna can be protected by an indirect lightning protection. When using an outdoor antenna lightning protection should be installed.

3.1.3 DCF77-Pulse Synchronization

All the **hopf** clocks and systems send a decoded DCF77 pulse. This pulse can also be used for synchronization. To feed this in the DCF77 pulse input is activated via menu (see 1.9.3 Clock Functions (SYNCHRONOUS)).

- Bit 1 = 1 decoding DCF77
- Bit 0 = 0 decoding DCF77 pulse input

The DCF77-pulse signal is connected to the "Rx Pulse" terminals. The signals from the terminals "Tx Pulse" of a different large display or from the pulse outputs of other **hopf** clocks can be used as a source.

It takes 6 minutes for the clock to synchronise itself with the DCF77 pulse.

3.1.4 Synchronization by Master/Slave-String

The large display can also be synchronized by another **hopf** clock via the serial interface. The time, for example, can be adopted from a GPS system where a DCF77 signal is not available. The setting is made via the menu (see 1.9.3 Clock Functions (SYNCHRONOUS))

- Bit 1 = 0 no DCF77 decoding
- Bit 0 = 1 Master/Slave-String serial interface

It takes approx. 4 minutes for the clock to synchronize itself via the interface.

3.1.5 Quartz Clock Operation

If the large display should not be or cannot be synchronized by external time sources it can also operate with the internal accuracy of a quartz clock. The settings can be made by menu (see 1.9.3 Clock Functions (SYNCHRONOUS))

Bit 1 = 0 no DCF77 decoding

Bit 0 = 0 quartz mode

In this operating mode the synchronisation status is not indicated by the colon between hour and minute: the colon is permanently on.

The accuracy of the operating mode depends on external parameters, above all on the temperature and time since the last calibration. Trained personnel can calibrate the clock using the parameter quartz value in the menu or by operating in a synchronised mode (also see 1.11.2).

3.2 Time/Date Display

The output of the time can be set to different formats under the menu DISPLAY (see 1.9.1 Settings Display (DISPLAY)).

Please take note of the settings under PARAMETER / LANGUAGE for the output of time and date (see pt. 1.11.1 / 1.10.2.1).

4 Operation as Matrix Display

If connected to the system 7001 the large displays are connected to board 7515 via RS422 (V.11) to achieve the so-called party-line operation (see diagram in the appendix). Depending on the setting of System Byte 1 the display can filter and display the following data strings from the serial interface boards 7515. The data of the serial interface are checked for identification (F0-F8) and the values in the display are updated if a data string valid for this display arrives. Via System Byte 1, Bit 0-5, it is possible to determine which string is shown in the matrix display.

B5	B4	B3	B2	B1	B0	Identification	display
0	0	0	0	0	0	F0	System time
0	0	0	0	0	1	F1	Grid time
0	0	0	0	1	0	F2	Difference time
0	0	0	0	1	1	F3	Frequency (50Hz)
1	0	0	0	1	1	F3	Frequency (60Hz)
0	1	0	0	1	1	F3	Difference frequency (50Hz)
1	1	0	0	1	1	F3	Difference frequency (60Hz)
0	0	0	1	0	0	F4	Temperature und Humidity
0	0	0	1	0	1	F5	Power 1
0	0	0	1	1	0	F6	Power 2
0	0	0	1	1	1	F7	Synchronization via string
0	0	1	0	0	0	F8	Customized string

The setting large/small characters of System Byte 0 (Bit7) also influences the output of the F-strings. For further details please see description of the respective string.



When operating as matrix display the baud rate should be set to at least 4800 baud.

4.1 F0 = system time

When system time is set the 4985 board filters the following string from serial transmission.

Structure of string:

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"F"	46
3	"0"	30
4	"S"	53
5	"y"	79
6	space	20
7	hour tens	30-32
8	hour unit	30-39
9	colon	3A
10	minute tens	30-35
11	minute unit	30-39
12	colon	3A
13	second tens	30-36
14	second unit	30-39
15	ETB (End of Block)	17
16	ETX (End of Text)	03

Once the above data string has been received the hours, minutes and seconds are displayed as follows:

12:34:56

If the display is set to "small characters" (height of characters 42mm) a second string (grid time) is filtered from the serial transmission and shown in the bottom line of the display. It appears as follows:

Sy 12:34:56

N1 12:34:57

4.2 F1 = grid time

In the setting grid time the 4985 board filters the following string from the serial transmission.

Structure of the string

<u>Character no.:</u>	<u>Meaning</u>	<u>Range of values in Hex</u>
1	STX (Start of Text)	02
2	"F"	46
3	"1"	31
4	"N"	4E
5	"1"	31
6	space	20
7	hour tens	30-32
8	hour unit	30-39
9	colon	3A
10	minute tens	30-35
11	minute unit	30-39
12	colon	3A
13	second tens	30-36
14	second unit	30-39
15	ETB (End of Block)	17
16	ETX (End of Text)	03

Once the above data string has been received the hours, minutes and seconds are displayed as follows:

12:34:56

If the display is set to "small characters" (height of characters 42mm) a second string (grid time) is filtered from the serial transmission and shown in the bottom line of the display. It appears as follows:

N1 12:34:56

Sy 12:34:57

4.3 F2 = Difference time

In the setting difference time the 4985 board filters the following string from the serial transmission.

Structure of the string

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"F"	46
3	"2"	30
4	"t"	53
5	column	7F
6	column	7F
7	sign (+/-)	2B-2D
8	column	7F
9	column	7F
10	hour tens	30-32
11	hour unit	30-39
12	colon	3A
13	minute tens	30-35
14	minute unit	30-39
15	colon	3A
16	second tens	30-36
17	second unit	30-39
18-22	5 * Space	20
23	CR (Carriage Return)	0D
24	millisecond hundreds	30-39
25	millisecond tens	30-39
26	millisecond unit	30-39
27	ETB (End of Block)	17
28	ETX (End of Text)	03

After receiving the above string seconds and milliseconds appear as follows in the display:

+ 06,447

If the display is set to "small characters" (height of characters 42mm) the difference time in hours, minutes, seconds and milliseconds is presented as follows:

**t + 00:00:06
447**

4.4 F3 = Mains frequency and difference frequency

In the setting mains frequency the 4985 board filters the following string from serial transmission.

Structure of the string

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"F"	46
3	"3"	33
4	"f"	66
5	"1"	31
6	space	20
7	frequency tens	30-39
8	frequency unit	30-39
9	comma	2C
10	frequency 1/10	30-39
11	frequency 1/100	30-39
12	frequency 1/1000	30-39
13	space	20
14	"H"	48
15	"z"	7A
16	ETB (End of Block)	17
17	ETX (End of Text)	03

In addition to the size of the characters it is also possible to select a basis of 50 or 60 Hz for the display of the frequency and the difference frequency (see 4 , Operation as Matrix Display).

The display mains frequency appears as follows:

49,998

height of digits 84 mm

f1 49,998 Hz

height of digits 42 mm

df -00,002 Hz

The display of the difference frequency appears as follows:

+00,002

height of digits 84 mm

df +00,002 Hz

height of digits 42 mm

f1 50,002 Hz

4.5 F4 = Temperature and Humidity

When set to temperature and humidity the 4985 board filters the following string from serial transmission.

Structure of the string:

<u>Character no.:</u>	<u>Meaning</u>	<u>Range of values in Hex</u>
1	STX (Start of Text)	02
2	"F"	46
3	"4"	34
6	tens temperature	30-39
7	unit temperature	30-39
8	"°"	40 (@)
9	"C"	43
10	tens humidity	30-39
11	unit humidity	30-39
12	"%"	25
13	"H"	48
14	ETB (End of Block)	17
15	ETX (End of Text)	03

After the above data string has been received temperature and humidity are displayed as follows:

32° C 56%H

This data string is displayed in digits of 84mm height only.

4.6 F5 / F6 = Power 1 und 2

In the setting power the 4985 board filters the following strings from the serial input.

Structure of string:

<u>Character no.:</u>	<u>Meaning</u>	<u>Range of values in Hex</u>
1	STX (Start of Text)	02
2	"F"	46
3	"5"/"6"	35/36
6	Power 1000s	30-39
7	Power 100sr	30-39
8	Power tens	30-39
9	Power unit	30-39
10	ETB (End of Block)	17
11	ETX (End of Text)	03

When the above data string has been received either power 1 or 2 is transmitted to the display.

1235 MW

This data string is displayed in digits of 84mm height only.

4.7 F7 = Master/Slave Data String

This data string serves to supply the large display with time information via the 7515 board. The data string includes the difference time of the base system so that UTC can be displayed with the correct difference to the local time.

The string is transmitted in the 59th second with the data of the next complete minute. The final character "ETX" is transmitted exactly on the second change and switches the data valid in the large display.

The status is structured as follows:

	b3	b2	b1	b0	Meaning
Status nibble:	x	x	x	0	No announcement hour
	x	x	x	1	Announcement DST-ST-DST)
	x	x	0	x	Standard time (ST)
	x	x	1	x	Daylight saving time (DST)
	x	0	x	x	No announcement leap second
	x	1	x	x	Announcement leap second
	0	x	x	x	Quartz mode
	1	x	x	x	Radio-controlled mode
Day of the week nibble:	0	0	0	1	Monday
	0	0	1	0	Tuesday
	0	0	1	1	Wednesday
	0	1	0	0	Thursday
	0	1	0	1	Friday
	0	1	1	0	Saturday
	0	1	1	1	Sunday

The difference time is transmitted in hours and minutes. Transmission is in BCD. The difference time can be up to $\pm 12:59$ h.

The sign is inserted as the highest bit in the hours.

Logic "1" = local time before UTC

Logic "0" = local time after UTC

Example :

90.00 difference time + 10:00 hrs.

01.30 difference time - 01:30 hrs.

The time is displayed as if operating as (radio-controlled) clock. The format of the display is set under the menu DISPLAY (see 1.9.1 Settings Display (DISPLAY)).

Structure of string:

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"F"	46
3	"7"	37
4	status high-nibble	30-39, 41-46
5	status low-nibble	30-39, 41-46
6	tens hour	30-32
7	unit hour	30-39
8	tens minute	30-35
9	unit minute	30-39
10	tens second	30-36
11	unit second	30-39
12	tens day	30-33
13	unit day	30-39
14	tens month	30-31
15	unit month	30-39
17	tens year	30-39
18	unit year	30-39
19	tens difference hours	30, 31, 38, 39
20	unit difference hours	30-39
21	tens difference minutes	30-35
22	unit difference minutes	30-39
23	CR	0D
24	LF	0A
25	ETX	03

4.8 F8 = Special string

This setting can be used to present your own data on the large display. The presentation can be either:

1-line:

height of characters : 84 mm
max. no. of characters: 6¹
ASCII characters : HEX 20 - HEX 5A
Special characters, digits and capital letters

or

2-line:

height of characters: 42 mm
max. no. of characters: 10 characters / line
ASCII characters: HEX 20 - HEX 7A
Special characters, digits, capital and small letters

The following control characters are used:

STX = Start of Text	HEX02	
ETX = End of Text	HEX03	
LF = Linefeed	HEX0A	to change lines
DEL = Delete	HEX7F	to insert an empty column

Fewer than the maximum number of characters can also be used. LF or ETX are always the first or final characters.

1 to be able to delete the display with spaces 16 characters are permitted in the string. 6 large characters fit over the full width of the display.

The strings must be structured as follows:

1-line:

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"F"	46
3	"8"	38
4	"1" for 1-line	31
5	1st character	20-5A
:		
:		
20	final character	
21	ETX	03

2-line:

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"F"	46
3	"8"	38
4	"2" for 2-line	32
5	1st character – 1st line	20-7A
:		
:		
14	final character – 1st line	
15	LF line feed	0A
16	1st character – 2 nd line	20-7A
:		
:		
25	final character – 2nd line	
26	ETX	03

4.9 U/u = User string

To present a user string the same setting is required as for the F8 string.

After the identification number "u" or "U" the user string includes a reference number from 00 to 99. The string received is only presented if this reference number corresponds with the reference number in the device.

The F- string is always displayed. Therefore it is a user string for all identification numbers.

The user string can be used to display different individual data on different large displays. These are displayed either

1-line:

height of characters:	84 mm
max. no. of characters:	6 ¹
ASCII characters:	HEX 20 - HEX 5A Special characters, digits and capital letters

or

2-line:

height of characters:	42 mm
max. no. of characters:	10 characters/line
ASCII characters:	HEX 20 - HEX 7A Special characters, digits, capital and small letters

The following control characters are used:

STX = Start of Text	HEX02	
ETX = End of Text	HEX03	
LF = Linefeed	HEX0A	to change lines
DEL = Delete	HEX7F	to insert an empty column

Fewer than the maximum number of characters can also be used. LF or ETX are always the first and final characters.

¹ to be able to delete the display with spaces 16 characters are permitted in the string. 6 large characters fit over the full width of the display.

The strings must be structured as follows:

1-line:

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"U"	55
3	Identification 1st digit	30-39
4	Identification 2nd digit	30-39
5	1st character	20-5A
:		
:		
20	final character	20-5A
21	ETX	03

2-line:

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"u"	75
3	Identification 1st digit	30-39
4	Identification 2nd digit	30-39
5	1st character – 1st line	20-7A
:		
:		
14	final character – 1st line	
15	LF line feed	0A
16	1st character – 2nd line	20-7A
:		
:		
25	final character – 2nd line	
26	ETX	03

5 Output diagrams

Unless otherwise indicated all values are given in 2 digits without operational sign.

5.1 Mode Radio Controlled Clock

5.1.1 Time/date small (42mm)

1st line: day of the week (abbreviation) hour:minute:second

2nd line: day month (abbreviation) year (4-digit)

In US format 2nd line: month (abbreviation), day, year (4-digit)

Example 1: (German abbreviation / European date format)

DI 08:28:30

31 JUL 2001

Example 2: (English abbreviation / US date format)

TU 08:28:30

JUL 31 2001

5.1.2 Local Time and UTC

1st line: LOC hour:minute:second

2nd line: UTC hour:minute:second

Example:

LOC 08:28:30

UTC 06:28:30

5.1.3 Time large (84mm)

One line: hour:minute:second

Example 1: (normal)

08:34:58

Example 2: (small seconds)

08:34⁵⁸

5.1.4 Date large (84mm)

One line: day/month/year

in US format: month/day/year

Example1: (European format)

31/07/01

Example 2: (US format)

07/31/01

5.1.5 Day of the Week and Date small (42mm)

1st line: Day of the Week (abbreviation)
2nd line: day / month / year (4 digit)

If US format 2nd line: month / day / year (4 digit)

Example 1: (German abbreviation / European date format)

MIT
16 / 07 / 2008

Example 2: (English abbreviation / US American date format)

WED
07 / 31 / 2008

5.1.6 Day of the Week large (84mm)

one line: Day of the Week (abbreviation)

WED

5.2 Mode Matrix Display



If the connection to the board 7515 is broken or the system 7001 is down, the message "Connection Lost" appears in the display after approx. 5 seconds.

5.2.1 F0/F1 System and grid time

5.2.1.1 System and grid time small (F0 small)

1st line: "Sy" hour:minute:second(system time)
2nd line: "N1" hour:minute:second (grid time)

Example:

Sy 12:34:56
N1 12:34:57

5.2.1.2 Grid and system time (F1 small)

1st line: "N1" hour:minute:second (grid time)
2nd line: "Sy" hour:minute:second (system time)

Example:

N1 12:34:57
Sy 12:34:56

5.2.1.3 System time large (FO large)

One line: hour:minute:second (system time)

Example:

12:34:56

5.2.1.4 System time large (F1 large)

One line: hour:minute:second (grid time)

Example:

12:34:57

5.2.2 F2 Difference time

5.2.2.1 Difference time (F2 small)

1st line: "t" operational sign hour:minute:second
2nd line: milliseconds

Example:

t + 00:00:06
447

5.2.2.2 Difference time (F2 large)

One line: operational sign seconds, milliseconds

Example:

+ 06,447



Display up to $\pm 99,999$. In case of overflow $\pm 99,999$ is displayed.

5.2.3 F3 Frequency/Difference frequency

5.2.3.1 Frequency/Difference frequency (F3 small)

1st line: "f1" frequency with 2 pre- and 3 post-comma digits "Hz"
2nd line: "df" difference frequency with 2 pre- and 3 post-comma digits "Hz"

Example:

f1 49,998 Hz
df -00,002 Hz

5.2.3.2 Frequency/Difference frequency (F3 small/difference)

1st line: "df" difference frequency with 2 pre- and 3 post-comma digits "Hz"
2nd line: "f1" frequency with 2 pre- and 3 post-comma digits "Hz"

Example:

df +00,002 Hz
f1 50,002 Hz

5.2.3.3 Frequency (F3 large)

One line: frequency with 2 pre- and 3 post-comma digits

Example:

49,998

5.2.3.4 Difference frequency (F3 large/difference)

One line: operational sign and frequency with 2 pre- and 3 post-comma digits

Example:

+00,002

5.2.4 F4 Temperature and humidity (always large)

One line: temperature "°C" and humidity "%H"

Example:

32°C 56%H

5.2.5 F5 & F6 Power (always large)

one line: power (4-digit) "MW"

Example:

5467 MW

5.2.6 F7 Master/Slave

see 5.1 Mode Radio Controlled Clock

5.2.7 F8 & U/u: User Strings

5.2.7.1 User String small

1st line max. 10 characters over the full width
2nd line max. 10 characters over the full width

If the text contains smaller characters slimmer characters are possible per line.

Example 1:

**Nil values
measured**

Example 2:

**25 cm
new snow**

5.2.7.2 User String large

one line: 6 characters digits/ special characters/capital letters

Example:

WAIT

6 Data strings

6.1 General Information on the Serial Output of the 4985 Board

If ETX on the second change is set a transmission gap occurs of up to 970 msec depending on the baud rate. Please take this into consideration when programming a Time-Out on the reception side.

In all the strings it is possible to change the order of CR and LF via **Mode byte 1**.

6.2 Data Format of the Serial Transmission

The data are transmitted in ASCII as BCD values and can be shown by any terminal programme (example: **TERMINAL.EXE** under Windows). The following ASCII control characters are possibly used in the structure of the data string

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



Status values are to be decoded separately (see structure of data string)

6.3 Serial Request

The requests of data strings which are not listed in this section are described under the respective data strings.

6.3.1 Serial Requests with ASCII Characters (Standard a. Standard 2000)

On request the data string can also be emitted by an ASCII character entered by the user. The following characters release a transmission of the data string:

ASCII "D" – for time/ date (Local-Time)
ASCII "G" – for time/date (UTC-Time)

The system responds with the corresponding data string within 1 msec.

This is often too fast for the requesting computer. Therefore it is possible to delay the response in steps of 10msecs when requested via software. To delay the transmission of the data string the small letters "d, g" with a two-digit multiplication factor are transmitted from the requesting computer to the clock.

The multiplication factor is interpreted by the clock as a hexadecimal value.

Example:

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

After about 2550 milliseconds the clock transmits the data string time/date (UTC-time).

6.4 Structure of the Hopf Standard String

<u>Character no.:</u>	<u>meaning</u>	
1	STX (Start of Text)	
2	Status (internal status of the clock)	; see 6.4.1
3	Day of the week (1=Monday ... 7=Sunday) In UTC time bit 3 in the day of the week is set to 1	; see 6.4.1
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)	; see 6.1
17	CR (Carriage Return)	; see 6.1
18	ETX (End of Text)	

6.4.1 Status and day of the week nibble in the *hopf* Standard Data String

The second and third ASXCII characters in the data string contain the status and the day of the week nibble. The status is decoded binarily. Structure of these characters:

	b3	b2	b1	b0	Meaning
Status nibble:	x	x	x	0	No announcement hour
	x	x	x	1	Announcement (DST-ST-DST)
	x	x	0	x	Standard time (ST)
	x	x	1	x	Daylight saving time (DST)
	0	0	x	x	Time/date invalid
	0	1	x	x	Quartz mode
	1	0	x	x	Radio-controlled mode
	1	1	x	x	Radio-controlled mode (high accuracy))
Day of the week nibble:	0	x	x	x	CESZ/ CET
	1	x	x	x	UTC time
	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.4.2 Example of a Transmitted *hopf* Standard Data String

(STX)E3123456170496(LF)(CR)(ETX)

Radio operation (high accuracy)

Daylight saving time

No announcement

It is Wednesday 17.04.96 - 12:34:56 h

() - ASCII- control characters e.g. (STX)

6.5 Standard *hopf* Data String 2000

The structure of the data string is identical to the standard string. The only difference is the 4-digit year.

<u>Character no.:</u>	<u>Meaning</u>	
1	STX (Start of Text)	
2	Status (internal status of clock)	; see 6.4.1
3	Day of the week (1=Monday ... 7=Sunday) In UTC time bit 3 in the day of the week is set to 1	; see 6.4.1
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 century	
15	unit century	
16	tens year	
17	unit year	
18	LF (line feed)	; see 6.1
19	CR (Carriage Return)	; see 6.1
20	ETX (End of Text)	

6.5.1 Data String 2000 Status- and Day of the Week Nibble

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

	b3	b2	b1	b0	Meaning
Status nibble:	x	x	x	0	No announcement hour
	x	x	x	1	announcement (DST-ST-DST)
	x	x	0	x	Standard time (ST)
	x	x	1	x	Daylight saving time (DST)
	0	0	x	x	Time / date invalid
	0	1	x	x	Crystal operation
	1	0	x	x	Radio operation
	1	1	x	x	Radio operation (high accuracy)
Day of the week nibble:	0	x	x	x	CEST/CET
	1	x	x	x	UTC-time
	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.5.2 Example of a Transmitted Data String 2000

(STX)E312345603011996(LF)(CR)(ETX)

radio operation (high accuracy)

daylight saving time

no announcement

It is Wednesday 03.01.1996 - 12:34:56 h.

() - ASCII-control characters e.g. (STX)

6.6 Data string SINEC H1

The control characters STX and ETX are transmitted only if the output "with control characters" is set. Otherwise these control characters will be dropped.

The data string can be requested via "?".

<u>Character no.:</u>	<u>Meaning</u>	<u>Value (range of values)</u>	
1	STX (start of text)	\$02	
2	"D" ASCII D	\$44	
3	":" colon	\$3A	
4	tens day	\$30-33	
5	unit day	\$30-39	
6	"." point	\$2E	
7	tens month	\$30-31	
8	unit month	\$30-39	
9	"." point	\$2E	
10	tens year	\$30-39	
11	unit year	\$30-39	
12	"," semi-colon	\$3B	
13	"T" ASCII T	\$54	
14	":" colon	\$3A	
15	day of the week	\$31-37	
16	"," semi-colon	\$3B	
17	"U" ASCII U	\$55	
18	":" colon	\$3A	
19	tens hours	\$30-32	
20	unit hours	\$30-39	
21	"." point	\$2E	
22	tens minutes	\$30-35	
23	unit minutes	\$30-39	
24	"." point	\$2E	
25	tens seconds	\$30-36	
26	unit seconds	\$30-39	
27	"," semicolon	\$3B	
28	"#" or space	\$23 / \$20	; see 6.6.1
29	"*" or space	\$2A / \$20	; see 6.6.1
30	"S" or space	\$53 / \$20	; see 6.6.1
31	"! " or Space	\$21 / \$20	; see 6.6.1
32	ETX (end of text)	\$03	

6.6.1 Status in the Data String SINEC H1

The characters 28-31 in the data string SINEC H1 indicate the status of the synchronization of the clock.

Meaning:

Character no.: 28 =	"#" Space	No radio synchronization after reset, time invalid radio synchronization after reset, clock minimum quartz mode
Character no.: 29 =	"*" Space	time from the internal quartz of the clock time via radio reception
Character no.: 30 =	"S" Space	Daylight saving time Standard time
Character no.: 31 =	"! " Space	announcement of a ST/DST or DST/ST changeover no announcement

6.6.2 Example of a Transmitted Data String SINEC H1

(STX)D:03.01.96;T:1;U:12.34.56; _ _ _ _ (ETX) (_) = Space

- Radio operation
- no announcement
- standard time
- it is Wednesday 03.01.96 – 12:34:56 h

6.7 Data String T-String

The T-String can be transmitted with all modes (e.g. with advance or final character on the second change.

The data string can be requested via "T" .

Character no.:	Meaning	Value (range of values)
1	"T" ASCII T	\$54
2	":" colon	\$3A
3	tens year	\$30-39
4	unit year	\$30-39
5	":" colon	\$3A
6	tens month	\$30-31
7	unit month	\$30-39
8	":" colon	\$3A
9	tens day	\$30-33
10	unit day	\$30-39
11	":" colon	\$3A
12	tens day of week	\$30
13	unit day of week	\$31-37
14	":" colon	\$3A
15	tens hour	\$30-32
16	unit hour	\$30-39
17	":" colon	\$3A
18	tens minute	\$30-35
19	unit minute	\$30-39
20	":" colon	\$3A
21	tens second	\$30-36
22	unit second	\$30-39
23	CR (carriage return)	\$0D
24	LF (line feed)	\$0A

6.7.1 Example of a transmitted data string T-string

T:96:01:03:03:12:34:56(CR)(LF)

It is Wednesday 03.01.96 - 12:34:56 h

6.8 Master/Slave-String

The Master/Slave-String is used to synchronize slave-systems with the time data of the master system with an accuracy of $\pm 0,5$ msec. In the data string the difference time to UTC is also transmitted.

After the transmission of the year index the difference time is transmitted in hours and minutes. Transmission is in BCD. The difference time may be up to ± 11.59 hours.

The operational sign is inserted as the highest bit in the hours.

Logic "1" = local time before UTC

Logic "0" = local time after UTC

Example:

90.00 difference time + 10.00 h
 01.30 difference time – 01.30 h
 81.30 Difference time + 01.30 h

The complete string is structured as follows:

Character no.:	Meaning	Value (range of values)	
1	STX (start of text)	\$02	
2	Status	\$30-39,\$41-46	; see 6.8.1
3	day of the week	\$31-37	; see 6.8.1
4	tens hour	\$30-32	
5	unit hour	\$30-39	
6	tens minute	\$30-35	
7	unit minute	\$30-39	
8	tens second	\$30-36	
9	unit second	\$30-39	
10	tens day	\$30-33	
11	unit day	\$30-39	
12	tens month	\$30-31	
13	unit month	\$30-39	
14	tens year	\$30-39	
15	unit year	\$30-39	
16	tens diff. time + op. sign. hr.	\$30,\$31,\$38,\$39	
17	unit diff. time hr.	\$30-39	
18	tens diff. time minute	\$30-35	
19	unit diff. time minute	\$30-39	
20	LF (line feed)	\$0A	; see 6.1
21	CR (carriage return)	\$0D	; see 6.1
22	ETX (end of text)	\$03	

6.8.1 Status in the Data String Master-Slave

	b3	b2	b1	b0	Meaning
Status nibble:	x	x	x	0	No announcement hour
	x	x	x	1	Announcement (DST-ST-DST)
	x	x	0	x	Standard time (ST)
	x	x	1	x	Daylight saving time (DST)
	x	0	x	x	No announcement leap second
	x	1	x	x	Announcement leap second
	0	x	x	x	Radio operation
	1	x	x	x	Radio operation (high accuracy)
Day of the week nibble:	0	0	0	1	Monday
	0	0	1	0	Tuesday
	0	0	1	1	Wednesday
	0	1	0	0	Thursday
	0	1	0	1	Friday
	0	1	1	0	Saturday
	0	1	1	1	Sunday

6.8.2 Example of a Transmitted Data string Master-Slave

(STX)831234560301968230(LF)(CR)(ETX)

Radio operation, no announcement, standard time, Wednesday, 03.01.96, 12:34:56 h
The difference time to UTC is + 2.30 h.

6.8.3 Setting

To synchronize the **hopf** Slave the following settings **must** be observed :

- Output every minute
- Output second advance
- ETX on the second change
- 9600 Baud, 8 Bit, 1 Stop bit, no parity

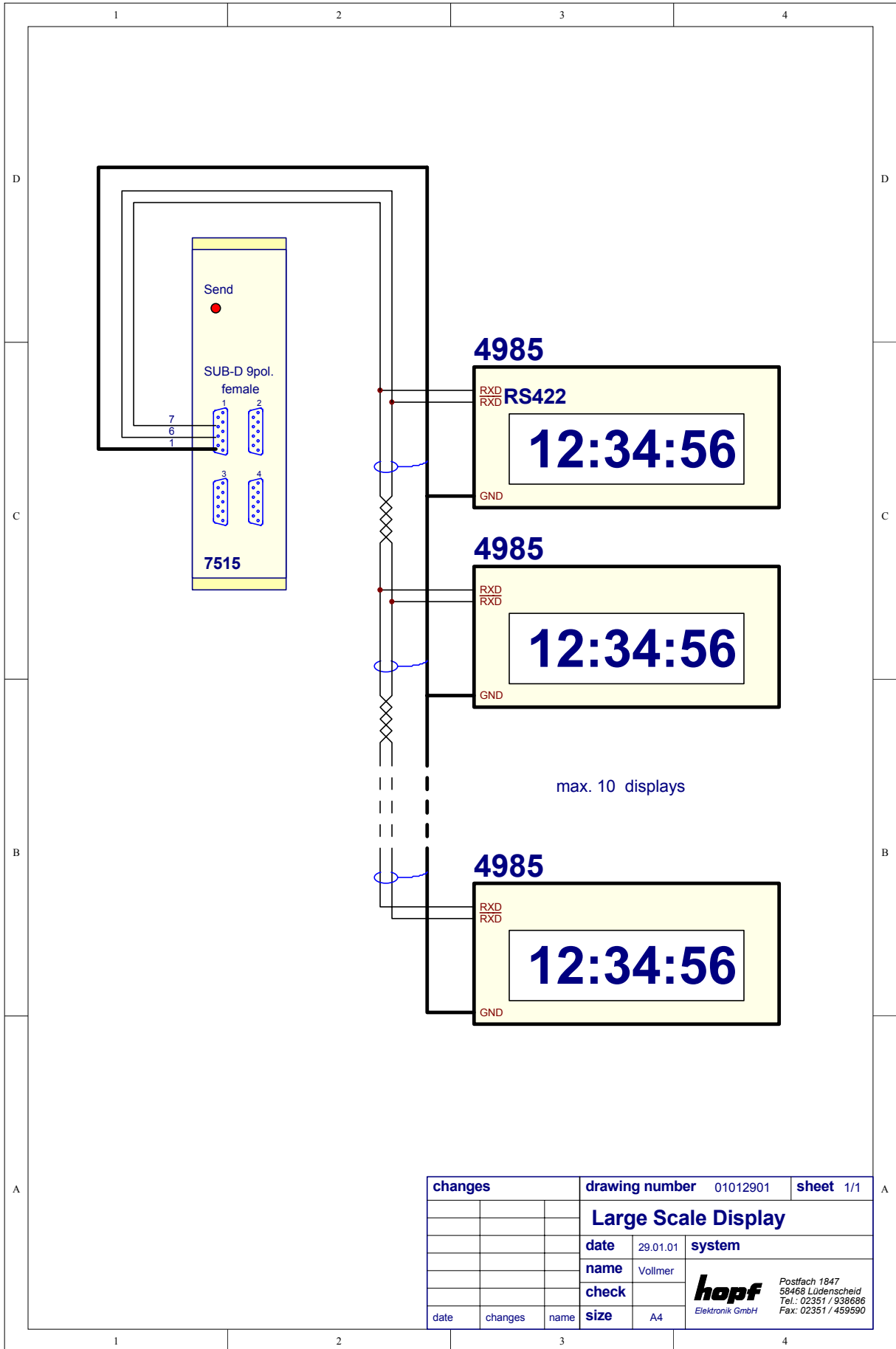
In this setting the best control of the time basis is achieved in the slave systems.

7 Technical data radio-controlled clock large display 4985

Voltage supply:	100-240 V AC / 50-60 Hz, 20 VA
Operating voltage 4985 board:	+ 5 V DC \pm 5%
Display:	+ 5 V DC \pm 5%
Power consumption:	ca. 2.5 A at 5 V
housing dimensions:	see chapter 1.2.2 Wall Mounting and Cable Entry
Serial interface:	RS232 and RS422 without Handshake
DCF77pulse input:	RS422 Hardware or TTL gauge
DCF77pulse output:	RS422 Hardware
Temperature range:	0-70° C
Readability:	in 2 lines each with 42 mm high characters \Rightarrow 20 m In 1 line each with 84 mm high characters \Rightarrow 40 m
Custom-made products:	Hard- and software solutions according to customer specifications



hopf reserves the right to make any modifications to the hard- and software at any time.



changes		drawing number 01012901		sheet 1/1	
		Large Scale Display			
		date	29.01.01	system	
		name	Vollmer		
		check			
date	changes	name	size	A4	

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