Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

Large Scale Display

Model 4985

ENGLISH

Version: 11.02 - 06.09.2013

Valid for Devices 4985 with FIRMWARE Version: **11.xx**
and REMOTE-SOFTWARE (HMC) Version: **01.07**

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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.

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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 2004/108/EC "Electromagnetic Compatibility" and 2006/95/EC "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(RC) with a board 7515(RC).

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.

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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 of housing

a. Pull the right side panel to the right out of the housing
(ATTENTION: DO NO JAM)

b. 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)

c. Pull the front pane to the right out of the housing

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

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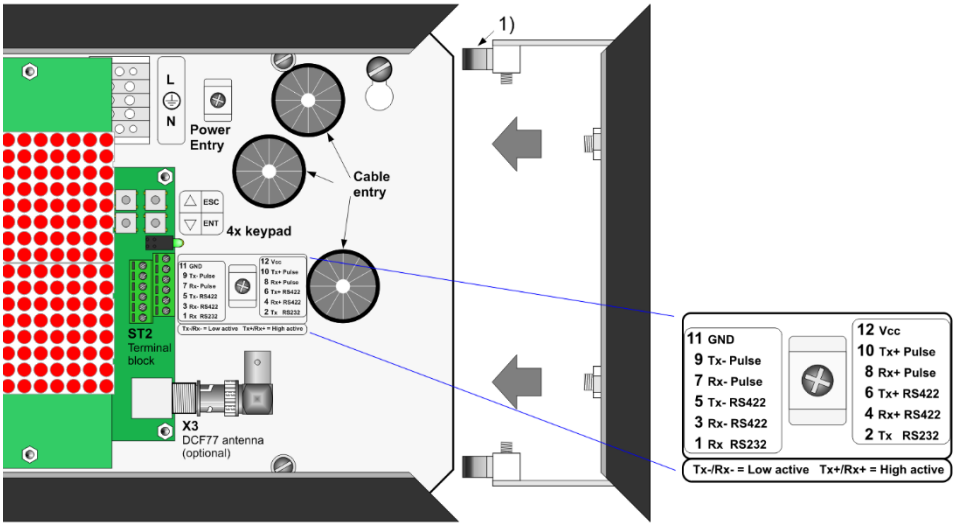
Closing the housing



a. Push the front pane in the front guiding rails of the housing (coated side of front pane outside)

b. 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)

c. 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

d. 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.

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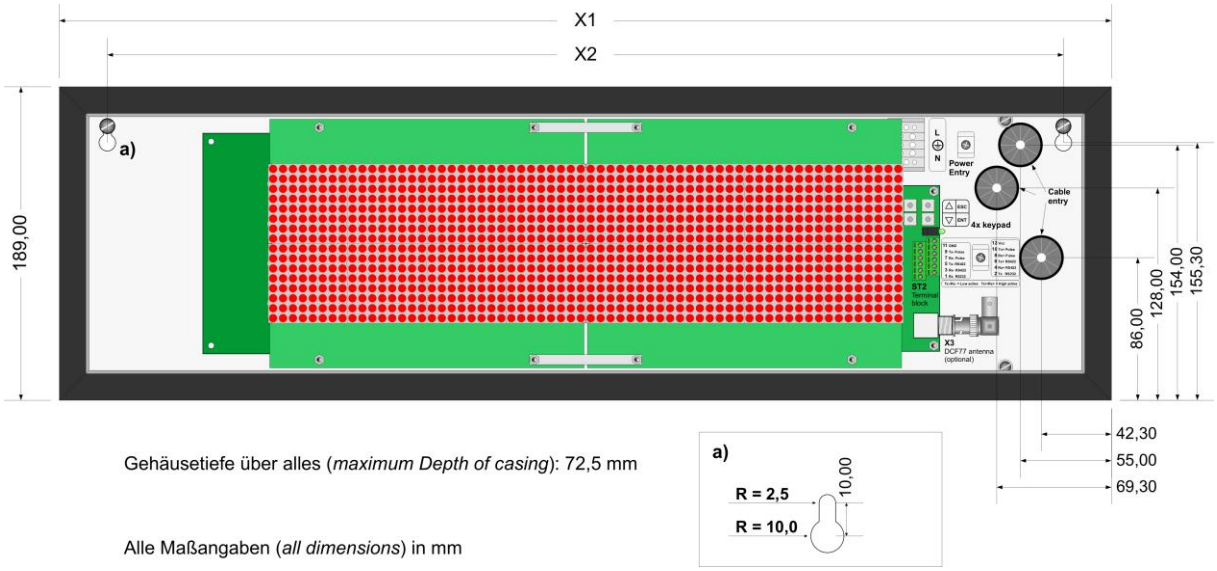
1.2.2 Wall Mounting and Cable Entry

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

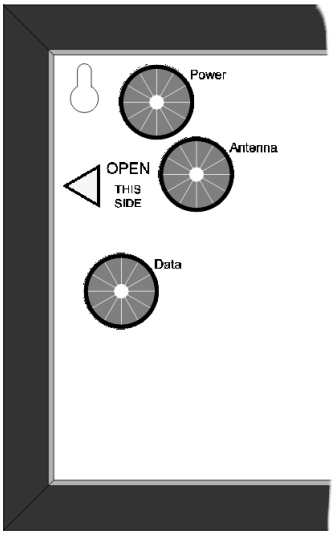


Gehäusetiefe über alles (*maximum Depth of casing*): 72,5 mm

Alle Maßangaben (*all dimensions*) in mm

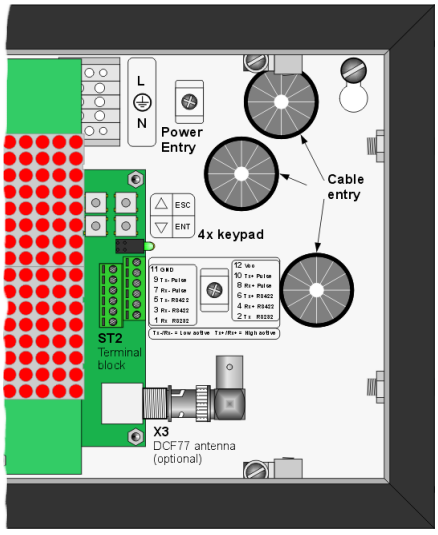
Model	X1	X2
4985	636,0	578,0
4985EXT3	824,0	770,0

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



Backside Housing

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.

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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 DCF77 Pulse Synchronisation

The display 4985 can be synchronized by means of a DCF77 pulse either in RS422- or in TTL-level.

1.2.5.1 Allocation of the DCF77 Pulse Input (RS422)

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. The synchronisation in RS422 level has to be activated in the clock menu (see ***chapter 1.4.5.3 Clock Functions in Radio Controlled Mode (SYNCHRON)***).

1.2.5.2 Allocation of the DCF77 Pulse Input (TTL)

When the DCF77 pulse is available in TTL level (low active) it has to be connected to RX-pulse and GND. The synchronisation in TTL level has to be activated in the clock menu (see ***chapter 1.4.5.3 Clock Functions in Radio Controlled Mode (SYNCHRON)***).

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 ▲/▼	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**	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: Colour, display, interface.

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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. 11.02**
06. SEP. 2010

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 cancelled.

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.

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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

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1.4.1 View / Set Time (TIME)

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

1.4.2 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.

1.4.3 Module Number (MODUL)

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.

1.4.4 Sub-Menu Time Zone (TIME ZONE)

1.4.4.1 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'.

1.4.4.2 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**

1.4.4.3 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**

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1.4.5 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.

1.4.5.1 Settings Display (DISPLAY)

In menu DISPLAY the following settings are made:

1. **Selection of the Operation Mode:**

   Radio-controlled Mode: Bit 4 = 0

   For synchronization via DCF77 antenna signal / DCF77 antenna simulation (77.5kHz), DCF77 pulse, serial ***hopf*** Elektronik GmbH Master/Slave String or operation as crystal clock. For display of time/date.

   Matrix-Mode: Bit 4 = 1

   For operation at board 7515(RC) for display of data from F-String of board 7515(RC). The selection of the used F-String is made in menu F-STRING.

   Matrix-Mode with F7 String: Bit 4 = 1

   In this mode and when operated at board 7515(RC) the same display diagrams as in radio-controlled mode are available. For display of time/date when operated at board 7515(RC).

2. **Selection of Type Size:**

   Display in the size 84mm, single-line, or the size 42mm, double-line, provided a double-line indication for the appropriate display diagram is supported.

Settings in Radio Controlled Mode (Bit 4 = 0)

Bit	Bit	Bit	Bit	Bit		
b7	**b6**	**b5**	**b4**	**b3**	**Display**	**Function**
0	0	0	**0**	x	small (42mm)	Time and date
0	0	1	**0**	x	small (42mm)	Date and day of the week
0	1	x	**0**	x	small (42mm)	Local time and UTC
1	0	0	**0**	0	large (84mm)	Time
1	0	0	**0**	1	large (84mm)	Time extended (day of the year : hour : minute : second)
1	0	1	**0**	x	large (84mm)	Time with small seconds
1	1	0	**0**	x	large (84mm)	Date
1	1	1	**0**	x	large (84mm)	Day of the week

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Settings in Matrix Mode with F7 String (Bit 4 = 1)

Bit	Bit	Bit	Bit	Bit		
b7	**b6**	**b5**	**b4**	**b3**	**Display**	**Function**
0	0	0	**1**	x	small (42mm)	Time and date
0	0	1	**1**	x	small (42mm)	Date and day of the week
0	1	x	**1**	x	small (42mm)	Local time and UTC
1	0	0	**1**	0	large (84mm)	Time
1	0	0	**1**	1	large (84mm)	Time extended (day of the year : hour : minute : second)
1	0	1	**1**	x	large (84mm)	Time with small seconds
1	1	0	**1**	x	large (84mm)	Date
1	1	1	**1**	x	large (84mm)	Day of the week

Settings in Matrix Mode (Bit 4 = 1)

b7	b6	b5	b4	b3	Display	Function
0	x	x	1	x	small (42mm)	Display F-String F0 to F6 of Board 7515(RC)
1	x	x	1	x	large (84mm)	Display F-String F0 to F6 of Board 7515(RC)

Selecting double-line display (42mm) the display is only indicated if the display diagram of the appropriate Fx string supports a double-line indication.

Settings for Radio Clock Mode and for Matrix-Mode with F7 String

b2						Function
0						Format of date European (day - month - year)
1						Format of date US (month - day - year)

b1	b0					Function
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

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1.4.5.2 Selecting Display in Matrix Mode (F-STRING)

Selecting the display in matrix mode the appropriate string F-STRING is set in this menu. **The bits B6 and B7 are without function right now.**

B5	B4	B3	B2	B1	B0	Identifier	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 and 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	Synchronisation via String
0	0	**1**	0	0	0	F8	User defined String

Standard: **0000 0000**

The F7 string in matrix mode has a special status. With this string the same display diagrams are available as in radio controlled mode.

Therefore, in matrix mode with selected F7 string all settings for the time display (menu display) are available just as in radio controlled mode.

The behaviour of display 4985 in case of F-String failure (connection failure to board 7515(RC)) can be parameterized in menu SYSTEMBYTE (see chapter 1.4.5.4).

1.4.5.3 Clock Functions in Radio Controlled Mode (SYNCHRON)

The used synchronization signal for the operation in radio controlled mode is set here. This menu is without function in matrix mode.

Bit	Bit	Bit		Function
b7	**b6**	**b5**		not in use
b4				
0				Output DCF77 pulse (1Hz) with time base local time
1				Output DCF77 pulse (1Hz) with time base UTC
b3				
0				DCF77 as difference input (like RS422)
1				DCF77 as TTL input

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Bit	Bit	Bit		Function
b2				not in use
b1	**b0**			**Type of synchronization**
0	0			Quartz clock
0	1			Synchronization via ***hopf*** master/slave string
1	0			Synchronization via DCF77 pulse
1	1			Synchronization via DCF77 signal / DCF77 simulation (77.5 kHz)

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.

1.4.5.4 System Byte (Special Function)

The behaviour of display 4985 in case of F-string failure (connection failure to board 7515(RC)) is parameterized here.

- Timeout for F-string activated: 5 seconds after F-string failure the message CONNECTION LOST appears.
- Timeout for F-string disabled: The last indicated display is permanently shown.

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

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1.4.6 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.

1.4.6.1 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**

1.4.6.2 Configuration of the Data String (Mode Byte 1+2)

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.

1.4.6.2.1 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)

1.4.6.2.2 Second Advance of the Serial Output with Mode Byte 1

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

1.4.6.2.3 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)

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1.4.6.2.4 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

1.4.6.2.5 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

1.4.6.2.6 Delayed Transmission with Mode Byte 1

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

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1.4.6.2.7 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

1.4.6.3 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 ***hopf*** data string
off	off	off	on	Standard ***hopf*** 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

1.4.6.4 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.

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1.4.7 General Display Parameters (PARAMETER)

1.4.7.1 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
- Romanian
- Hungarian

(ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO ROMANESTE MAGYAR)

1.4.7.2 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.

1.4.7.3 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.

1.4.7.4 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.

1.4.7.5 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).

1.4.7.6 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.

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1.4.8 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.

1.4.9 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.

1.4.10 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.

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2 *hmc* Remote Software

The ***hmc*** (***hopf*** management console) 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*** remote 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 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.

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3 Large Display as Radio-Controlled Clock / Matrix Display

Under the menu item DISPLAY you can choose between display as radio-controlled clock or as large display (see ***chapter 1.4.5.1 Settings Display (DISPLAY)***).

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

3.1 Operation as Display with Radio-Controlled Clock (Radio-controlled Mode)

Required settings for radio-controlled mode: Menu DISPLAY, Bit 4 = 0

The control board for the large display contains a DCF77 receiver. The DCF77 signal can be supplied either by an active ***hopf*** antenna or DCF77 simulation (77.5 kHz). A ***hopf*** antenna or the DCF77-simulation are electrically the same.

Alternatively the synchronization can be realized via DCF77 pulse (1Hz) or the serial ***hopf*** Master/Slave String.

The adjustment of the synchronization signal is set in menu SYNCHRON (see **chapter *1.4.5.3 Clock Functions in Radio Controlled Mode (SYNCHRON)***).

b1	b0	Type of synchronization
0	0	Quartz clock
0	1	Synchronization via ***hopf*** master/slave string
1	0	Synchronization via DCF77 pulse (1Hz)
1	1	Synchronization via DCF77 signal / DCF77 antenna simulation (77.5kHz)

The clock requires approx. 10 minutes to synchronise itself with the DCF77 signal.

3.1.1 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 ±1msec. 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.

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3.1.1.1 Alignment of the Antenna

All the ***hopf*** DCF77 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 ***chapter 1.4.9 Alignment of the Antenna***).

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

3.1.1.2 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 ***chapter 1.4.5.3 Clock Functions in Radio Controlled Mode (SYNCHRON)***).

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 approx. 10 minutes for the clock to synchronise itself with the DCF77 pulse.

3.1.1.3 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 ***chapter 1.4.5.3 Clock Functions in Radio Controlled Mode (SYNCHRON)***).

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.

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3.1.1.4 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 ***chapter 1.4.5.3 Clock Functions in Radio Controlled Mode (SYNCHRON)***).

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 ***chapter 1.4.7.3 Quartz Control Value (QUARTZ)***).

3.1.2 Setting of Time/Date Display

The output of the time can be set to different formats under the menu DISPLAY (see ***chapter 1.4.5.1 Settings Display (DISPLAY)***).

Please take note of the settings under PARAMETER / LANGUAGE for the output of time and date (see ***chapter 1.4.7.1 / 1.4.6.2.1***).

3.1.3 Overview Display - Radio Controlled Clock Mode

3.1.3.1 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

3.1.3.2 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

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3.1.3.3 Time large (84mm)

One line: hour:minute:second

Example 1: (normal)

08:34:58

Example 2: (small seconds)

08:34 58

Example 3: (time extended: 'time of the year':hour:minute:second)

PLEASE NOTE: only visible in 4985ext3!

154:08:34:58

3.1.3.4 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

3.1.3.5 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

3.1.3.6 Day of the Week large (84mm)

One line: Day of the Week (abbreviation)

WED

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3.2 Operation as Matrix Display

Required settings for matrix mode: Menu DISPLAY, Bit 4 = 1

If connected to the system 7001(RC) the large displays are connected to board 7515(RC) via RS422 (V.11) to achieve the so-called party-line operation (see diagram in the appendix). Depending on the setting of **Menu F-String** the display can filter and display the following data strings from the serial interface boards 7515(RC). 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 **Menu F-String**, Bit 0-5, it is possible to determine which string is shown in the matrix display. **Bit 6-7 without function at present**.

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 the **Menu Display**, Bit7 also influences the output of the F-strings. See description of the respective string.

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

The behaviour of display 4985 in case of F-string failure can be parameterized in **menu SYSTEMBYTE (see chapter *1.4.5.4 System Byte (Special Function)*).**

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3.2.1 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

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3.2.2 F1 = Grid Time

In the setting grid 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	"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

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3.2.3 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

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3.2.4 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 ***chapter 1.4.5.2 Selecting Display in Matrix Mode (F-STRING)***).

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

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3.2.5 F4 = Temperature and Humidity

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

Structure of the string

Character no.:	Meaning	Range of values in Hex
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.

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3.2.6 F5 / F6 = Power 1 und 2

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

Structure of string

Character no.:	Meaning	Range of values in Hex
1	STX (Start of Text)	02
2	"F"	46
3	"5"/"6"	35/36
6	Power thousands	30-39
7	Power hundreds	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.

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3.2.7 F7 = Master/Slave Data String

This data string serves to supply the large display with time information via the 7515(RC) 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 ± 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 ***chapter 1.4.5.1 Settings Display (DISPLAY)***).

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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

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3.2.8 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:	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 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.

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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 – 2nd line	20-7A
:		
:		
25	final character – 2nd line	
26	ETX	03

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3.2.9 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.

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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

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3.2.10 Output Diagrams – Matrix Display

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

3.2.10.1 Connection Failure

The behaviour of display 4985 in case connection failure to board 7515(RC) can parameterized in menu SYSTEMBYTE (see ***chapter 1.4.5.4***).

Timeout for F-string activated: 5 seconds after F-string failure the message CONNECTION LOST appears.

Timeout for F-string disabled: The last indicated display is permanently shown.

3.2.10.2 F0/F1 System and Grid Time

3.2.10.2.1 System and Grid Time small (F0 with 42mm)

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

3.2.10.2.2 Grid and System Time (F1 with 42mm)

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

3.2.10.2.3 System Time large (F0 with 84mm)

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

Example:

12:34:56

3.2.10.2.4 Grid Time large (F1 with 84mm)

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

Example:

12:34:57

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3.2.10.3 F2 Difference Time

3.2.10.3.1 Difference Time (F2 with 42mm)

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

Example:

t + 00:00:06
447

3.2.10.3.2 Difference Time (F2 with 84mm)

One line: operational sign seconds, milliseconds

Example:

+ 06,447

Display up to ± 99,999. In case of overflow ± 99,999 is displayed.

3.2.10.4 F3 Frequency/Difference Frequency

3.2.10.4.1 Frequency/Difference Frequency (F3 with 42mm)

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

3.2.10.4.2 Frequency/Difference Frequency (F3 with 42mm)

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

3.2.10.4.3 Frequency (F3 with 84mm)

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

Example:

49,998

3.2.10.4.4 Difference Frequency (F3 with 84mm)

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

Example:

+00,002

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3.2.10.5 Temperature and Humidity (F4 with 84mm)

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

Example:

32°C 56%H

3.2.10.6 Power (F5 / F6 with 84mm)

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

Example:

5467 MW

3.2.10.7 Master/Slave (F7 like Radio Controlled Clock)

All displays as in radio-controlled mode can be set.

Bit 4 in menu display must remain set to 1

3.2.10.8 User Strings (F8 & U/u)

3.2.10.8.1 User String (with 42mm)

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

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

Example 1:

Nil values
measured

Example 2:

25 cm
new snow

3.2.10.8.2 User String (with 84mm)

For display 4985 (4985ext3)

One line: 6 (9) characters digits / special characters / capital letters

Example:

WAIT

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4 Data strings

4.1 General Information on the Serial Output of the Display 4985

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**.

4.2 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)

4.3 Serial Request

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

4.3.1 Serial Requests with ASCII Characters (Standard and 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).

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4.4 Structure of the *hopf* Standard String

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	status (internal clock status)	$30-39, $41-46
3	day of the week (1=Monday ... 7=Sunday) for UTC time bit 3 is set to 1 in the day of the week	$31-37
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	LF (line feed)	$0A
17	CR (carriage return)	$0D
18	ETX (end of text)	$03

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4.4.1 Status and Day of the Week Nibble in the *hopf* Standard Data String

The second and third ASCII characters in the data string contain the status and the day of the week nibble. The status is decoded binary.

Structure of these characters:

	b3	b2	b1	b0	Meaning
Status:	x	x	x	0	No announcement hour
	x	x	x	1	Announcement (DST-DT-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:	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

4.4.2 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)

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4.5 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.

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	status (internal clock status)	$30-39, $41-46
3	day of the week (1=Monday ... 7=Sunday) for UTC time bit 3 is set to 1 in the day of the week	$31-37
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	thousandths year	$31-32
15	hundreds year	$30, $39
16	tens year tens digit	$30-39
17	unit year unit digit	$30-39
18	LF (line feed)	$0A
19	CR (carriage return)	$0D
20	ETX (end of text)	$03

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4.5.1 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 binary.

Structure of these characters:

	b3	b2	b1	b0	Meaning
Status:	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:	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

4.5.2 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)

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4.6 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 **"?"**.

Character No.	Meaning	Hex-Value
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	";" semicolon	$3B
13	"T" ASCII T	$54
14	":" colon	$3A
15	day of the week	$31-37
16	";" semicolon	$3B
17	"U" ASCII U	$55
18	":" colon	$3A
19	tens hour	$30-32
20	unit hour	$30-39
21	"." point	$2E
22	tens minute	$30-35
23	unit minutes	$30-39
24	"." point	$2E
25	tens second	$30-36
26	unit second	$30-39
27	";" semicolon	$3B
28	"#" or space	$23 / $20
29	"*" or space	$2A / $20
30	"S" or space	$53 / $20
31	"!" or space	$21 / $20
32	ETX (end of text)	$03

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4.6.1 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.		Meaning
28	"#"	Time invalid
	" " (Space)	Time valid (clock at least in crystal operation)
29	"*"	Clock in crystal operation
	" " (Space)	Clock time by radio reception
30	"S"	Daylight saving time (DST)
	" " (Space)	Standard time (ST)
31	"!"	Announcement of a (DST-ST-DST) change over
	" " (Space)	No announcement

4.6.2 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

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4.7 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	Hex-Value
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 the week	$30
13	unit day of the 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

4.7.1 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

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4.8 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 ± 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	Hex-Value
1	STX (start of text)	$02
2	status	$30-39, $41-46
3	day of the week	$31-37
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	difference time tens hour / operational sign	$30-31, $38-39
17	difference time unit hour	$30-39
18	difference time tens minutes	$30-35
19	difference time unit minutes	$30-39
20	LF (line feed)	$0A
21	CR (carriage Return)	$0D
22	ETX (end of text)	$03

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4.8.1 Status in the Data String Master-Slave

	b3	b2	b1	b0	Meaning
Status:	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	Crystal operation
	1	x	x	x	Radio operation
Day of the Week:	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

4.8.2 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.

4.8.3 Setting

To synchronize the ***hopf*** Slave systems 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.

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5 Technical Data Radio-Controlled Clock Large Display 4985

Technical Data	Board 4985
Voltage supply:	85-250V AC (47-440Hz) or 110-250V DC
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 level
DCF77pulse output:	RS422 hardware
Temperature range:	Operating: 0° to +55° C Storage: -20° to +75° C
Readability:	in 2 lines each with 42mm high characters ⇨ 20m in 1 line each with 84mm high characters ⇨ 40m
Humidity:	Max. 95%, not condensed
LED colour:	Red
Protection:	IP40 for indoor mounting
Housing:	Housing for wall mounting Material: aluminium, black
Weight:	Approx. 3.7kg
Backup-Clock Accuracy:	± 25 ppm at constant temperature in a range of +10° to +50° C
Backup-Clock Buffering (maintenance-free):	3 days
Operation:	Via 4 keys and LED display With ***hmc*** (***hopf*** Management Console) via serial interface
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.

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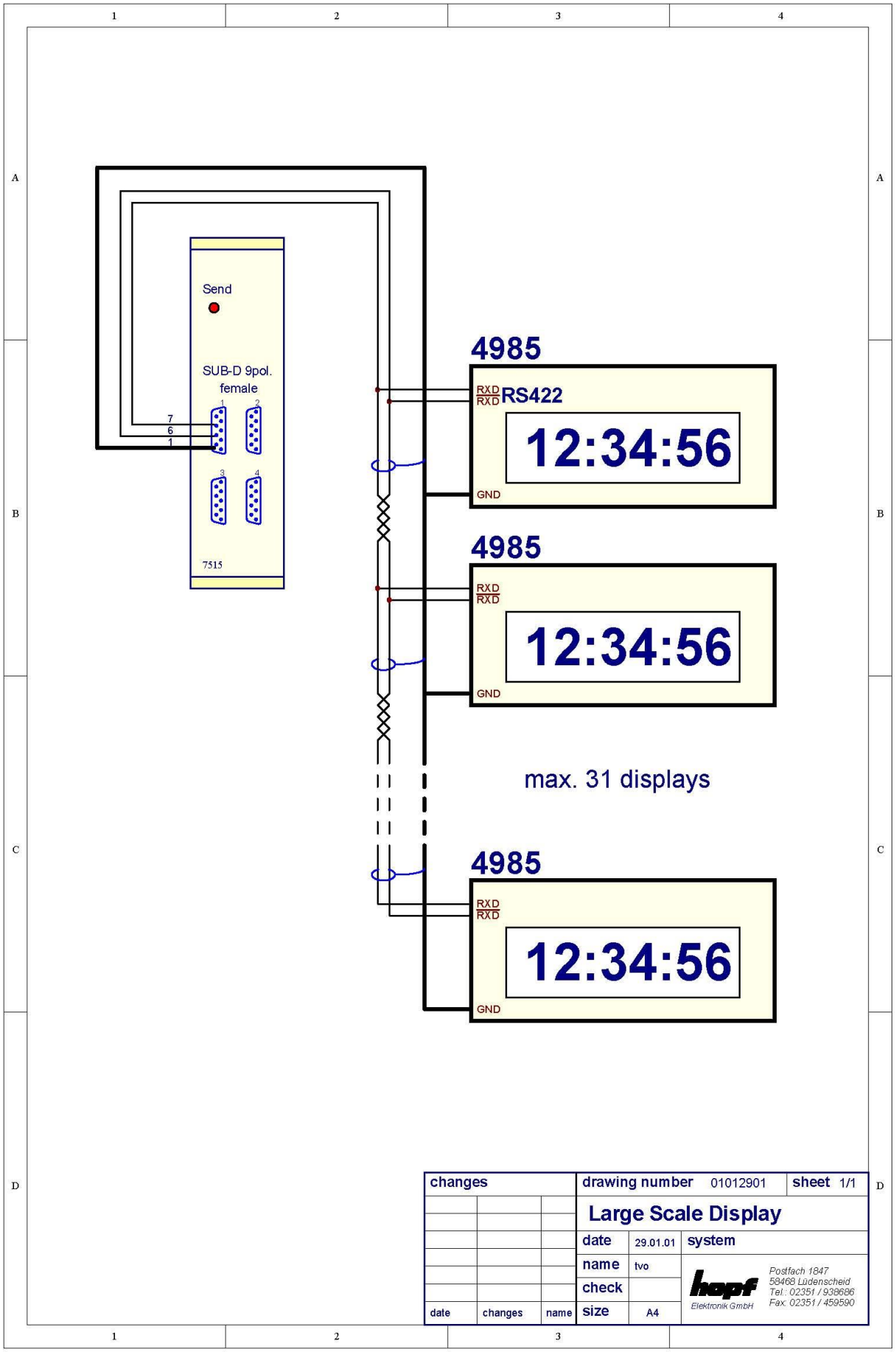

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