Technical Description

Large Scale Display

4985

Safety information

The safety regulations and technical data are important for the smooth running of the devices and the protection of people and equipment. Strict compliance with these regulations is required. In case of non-compliance with these regulations the guarantee and warranty claims for the device and possible consequential damage expire.

Safety of the Devices

The production of this device follows the latest technological standards and safety regulations.

The device must not be assembled by anyone but trained personnel. Please make sure that all the connected cables are laid and fixed properly. The device is to be run with the supply voltage stated on the identification plate only.

Only trained personnel or specialists may operate the device.

Repair on opened devices must not be carried out by anyone but specially trained staff or by the **hopf** company.

If the maintenance work requires the opening of a device or if a fuse needs changing the device must be separated from all voltage supplies.

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labelled accordingly. The safety may be impaired when the device does not operate properly or if it is obviously damaged.

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1 Functions

The basic version of the large display 4985 consists of a matrix measuring 16x64 LED. Two lines of 42 mm or one line of 84 mm alphanumerically characters can be displayed on this matrix.

The device can operate as a large display for values like network time, difference time and power line frequency which can be transferred from the **hopf** System 7001.

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

The large display is equipped with a highly accurate crystal clock which can be synchronised by a DCF77 signal. The DCF77 signal can be supplied to the BNC by an antenna connector or put to the respective inputs as a pulse. The large display generates a DCF77 pulse and can thus synchronise further devices.

Time and date can be displayed in different formats.

1.1 Commissioning

The large display 4985 is delivered in its casing ready for operation. Only the connections required for operation must be installed.

To install the display the right side of the housing must be removed and the red filter screen must be pulled out. Now you can connect, depending on the requirements, voltage-, antenna or data cables to the display. The cables are feed through the holes prepared at the back of the housing and connected to the clamps inside. You will find the connector diagram at the end of the description.

In the back wall there are also mounting holes so that the display can be screwed to a wall.

PLEASE NOTE : THE INSTALLATION IS TO BE CARRIED OUT BY TRAINED PERSONNEL ONLY. PLEASE MAKE SURE THAT THE CABLES ARE DEAD WHEN CONNECTING THE VOLTAGE SUPPLY.

When the voltage supply is connected the position of the program version and the date are displayed for 10 seconds.

e.g. **Vers. 03.00**
19.APR.2001

1.1.1 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. For using the RS232-interface no handshake lines are provided (3 conductor operation).

1.1.2 Initialisation by Keys

The keys can be reached once the filter screen has been removed or pushed aside. Functions of the keys:

Key 3+4	Pressing the key for 5 minutes sets the following functions to standard: Color, display, interface
Key 3/4	1. Keys 3/4 activated: The display menu is activated and scrolled through forwards (T3) or backwards (T4). 2. Key 2 selected: The selected value can be increased (T3) or diminished (T4).
Key 2	1. Direct entry into the clock setting menu. 2. Entry Function. Selection of the displayed item by key 3/4. Menu item/value
Key 1	Escape Function. Rejection of the current entry and return to the next higher menu level.

1.2 Operating the Set Menu

The menu serves to read and change the according values. When an item in the menu is chosen the respective values are shown. The menu is a closed loop, i.e. from the last item you can continue to the first one directly and vice versa. A sub-menu can only be left via key 1. The values entered in the different places of the sub-menu are maintained!

If you want to change a value you must press key 2 so many times until the respective value is flashing. Use keys 3 and 4 to change the value. To take over the value key 2 must be pressed until there is no value selected any longer. If key 1 is pressed during this process the alterations of values in this menu item are canceled.

The keys 2-4 take you from the standard display to the main menu.

Key 2: entry of time

Key 3: entry of date

Key 4: show version

Example of setting process :

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

Key 2 is pressed ->

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

Time:
hh:mm:ss

hh representing the current hour, mm the current minute and ss the current seconds.

The displayed time is running.

1. key 2 is pressed ->

The display of the time stops. The hours start flashing.

2. key 2 is pressed->

The hours stop flashing. The minutes begin to flash.

3. key 3 is pressed->

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

4. key 2 is pressed->

The minutes stop flashing. The seconds start flashing.

5. key 2 is pressed->

The seconds stop flashing. The time continues running from the set point of time.

6. key 1 is pressed->

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

Alternatively

4. key 1 is pressed->

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

5. key 1 is pressed->

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

1.3 Main Menu

- 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
- Serial Port _____ COM:
  - Modebyte 1
  - Modebyte 2
- Parameter _____ language
  - Colour
  - Crystal controlled value
  - Time-out status
  - Time-out DCF-SIM
  - DCF77 pulse length LOW HIGH
- Enable reset
- Alignment of the antenna
- Show programme version

1.4 View/Set Time

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

1.5 View/Set Date

The day of the week (Monday..Sunday), day (01..last day of the month), month (January..December, Year (2000..2099) are shown 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.

1.6 Module

The number of the module identifies the device at the serial interface for the remote software (as an option).

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

1.7 Sub-Menu Time Zone

1.7.1 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**

PLEASE NOTE : THE SETTING OF THE DIFFERENCE TIME IS TAKEN OVER ONLY IF THE TIME DIFFERENCE HAS BEEN RELEASED IN THE SYNCHRONOUS BYTE (BIT5).

1.7.2 Start Daylight Saving Time (START DST.)

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

Displayed and set are: 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:

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

If the day of the week in that month is numbered 5 the last possible one is referred to.

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

Standard: **5.So.MAR.02**

1.7.3 End of Daylight Saving Time (END DST.)

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

Display and setting as START DST.

Standard: **5.OKT.03**

1.8 Sub-Menu System Bits (SYSTEMBITS)

Some features are set in "bits".

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

Every bit works as a switch. A bit has two possible conditions "0" and "1".

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

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

The conditions represent features which are listed below.

1.8.1 Settings Display (DISPLAY)

Bit 7	0	small (42mm)
	1	large (84mm)
Bit 6	0	time
	1	F-String (from board 7515 in the system 7001)
Bit 5	0	time
	1	date (in large display only)
Bit 4	0	seconds normal
	1	seconds always small (in large display & time only)
Bit 2	0	format of date European . (day - month - year)
	1	format of date US (month - day - year)
Bit 0		
0	0	local time
1	0	UTC
0	1	standard time (local without daylight saving time changeover)
1	1	UTC (at present)
Bit 3		not in use

Standard: **0000 0000** display small (time /date) European format of date, local time

1.8.2 F-STRING

See "operating as matrix display".

Standard: **00000000**

1.8.3 Clock Functions (SYNCHRONOUS)

Bit 7..6		not in use
Bit 5	0	disallow difference hours (CET e.g. Germany)
		the difference time is always reset to 1h
	1	allow difference hour (International)
Bit 4	0	DCF77 simulation local
	1	DCF77 simulation UTC
Bit 3..2		not in use
Bit 1..0		type of synchronisation
	0 0	crystal clock
	0 1	synchronous clock via master/slave string
	1 0	synchronous clock via DCF pulse
	1 1	DCF77signal/sim
Standard:	**0000 0011**	radio controlled clock via antenna input
		DCF77-simulation with local time base , difference time 1h (CET).

PLEASE NOTE : THE COLON BETWEEN THE HOURS AND THE MINUTES FLASHES WHEN THE CLOCK IS NOT SYNCHRONOUS. OTHERWISE THE COLON IS ALWAYS VISIBLE.

1.9 Sub-Menu Serial Interface (SERIAL PORT)

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

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

Different time data strings for the output are available. Customised data strings are obtainable on request. The following settings can be done for the serial interfaces.

1.9.1 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**

1.9.2 Configuration of the Data String (Modebyte)

The received time information can be putout via the interfaces in different data strings telling the internal status of the clock. This enables the user to synchronise connected computers with the accurate time. The point of the output, the string structure and the used control characters can be selected by settings in **modebyte 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.

1.9.2.1 Local Time or UTC in the serial Output with Modebyte 1

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

1.9.2.2 Second Advance of the Serial Output with Modebyte 1

Bit position 6	Second advance
off	With second advance
on	Without second advance

1.9.2.3 Local Time or Standard Time in the Serial Output with Modebyte 1

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

1.9.2.4 Last Control Character as On-Time Marker with Modebyte 1

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

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

1.9.2.5 Control Characters CR and LF with Modebyte 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

1.9.2.6 Delayed Transmission

In case of the setting „control characters on the second change“ the last character of the data string is transmitted on the second change and then the new data string which is 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 :

Baudrate 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)

Baudrate 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

1.9.2.7 Synchronisation Point of Time with Modebyte 1

Bit 1	Bit 0	Transmission point
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

1.9.3 Selection of Data String with Modebyte 2

This modebyte sets the putout data string. At present only bit position 0-3 have a function. The other 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

1.10 General Parameter of the Display (Parameter)

1.10.1 LANGUAGE

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

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

- English
- German
- French
- Spanish
- Italian

(ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO)

1.10.2 COLOR

The display can be red, green or yellow[1].

The standard version is equipped with a red filter screen. This must be replaced by a different colour for the display!

PLEASE NOTE : IF THE DISPLAY IS SET TO GREEN AND THERE IS A RED FILTER SCREEN, THE DISPLAY MAY BE TOO DARK TO READ THE FUNCTION. BY PRESSING THE KEYS 3 AND 4 (FOR ABOUT 5 SECONDS) SIMULTANEOUSLY THE DISPLAY IS RESET TO GREEN.

1.10.3 Crystal Control Value (QUARTZ)

Nobody but qualified personnel may alter the crystal control value, if the clock shows too big a deviation in the crystal mode. The crystal frequency must then be calibrated by way of a highly accurate reference value.

1.10.4 Status Time-Out in min

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

1.10.5 DCF77-SIM Time-Out in min

The period after which the DCF77 pulse output is interrupted in case of a synchronisation error can be delayed. The value can be set between 2 and 255 minutes; 255 meaning that the simulation is not stopped. (infinite simulation)

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

The duration of a low-pulse can be set between 50-154ms, and the duration of the high-pulse can be set between 150-250ms. The standard settings are 100ms for low and 200ms for high.

[1] Yellow is caused by the simultaneous lighting up of red and green LEDs. The colour may vary from orange to greenish yellow depending on the angle.

1.11 Release Reset

Here the programme in the clock can be restarted. After a restart all the parameter are set anew and checked.

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

After that the clock must be synchronised again.

1.12 Alignment of the Antenna

When this pt. 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 by **"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 depending on the local strength of the signal 20-30 seconds. 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 if the antenna is positioned correctly. This is indicated by a dipping signal line and a decreasing field strength in the display.

When the antenna is turned by exactly 90° there should be hardly any DCF77-signal left. From this position the antenna is again turned by exactly 90° to the ideal position.

1.13 Display of Version

The version and the date of production of the programme is shown.

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

There is no other function in this menu.

2 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 pt. 1.8.1 - Settings Display (DISPLAY))

Bit 6 = 0 clock
Bit 6 = 1 general large 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 pt. 1.8.3 - Clock Functions (SYNCHRONOUS))

Bit 1 = 1 decoding DCF77
Bit 0 = 1 decoding DCF77-antenna or DCF77-simulation
The clock needs about 6 minutes to synchronise itself with the DCF77 signal.

2.1 Installation of the Antenna

Use a coaxial cable RG 59 to connect the supplied **hopf** antenna or a DCF77 antenna signal to the 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 (< 5 m) electric or magnetic sources of interference like monitors, engines, power control boxes etc.
- In case of an indoor antenna also consider the shielding effect of buildings, reinforced concrete walls or corrugated sheet iron as they are almost HF-proof. We advise installing the **hopf** antenna as close as possible to a window.

2.1.1 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 antenna must be placed at a right angle to the direction of the transmission. The outdoor antennas have a black arrow below the antenna housing which must point to Frankfurt.

If you need help aligning the antenna or if the reception is disturbed call up the menu “antenna alignment” which shows the antenna signal in the display.

PLEASE NOTE : IF THE COLON BETWEEN THE HOUR AND THE MINUTES FLASHES IN THE DISPLAY THE CLOCK DOES NOT RECEIVE (ANY LONGER) A RADIO SIGNAL.

2.1.2 Indirect Lightning Protection

To avoid a lightning-stroke from the antenna to the large display the antenna can be protected by an indirect lightning protection. We advise using the lightning protection for outdoor antennas.

2.1.3 DCF77-Pulse Synchronisation

All the **hopf** clocks and systems send a decoded DCF77-pulse. This pulse can also be used for synchronisation. To feed this in the DCF77 pulse input is activated via menu (see pt. 1.8.3 - Clock Functions (SYNCHRONOUS)).

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

The DCF77-pulse signal is connected to the "DCF-T in" terminals. The signal from the terminal “DCF-T out“ of a different large display or pulse outputs of other hopf clocks can be used as the source for another large display.

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

2.1.4 Synchronisation by Master/Slave-String

The large display can also be synchronised by another **hopf** clock via the serial interface. The time e.g. can be taken over from a GPS system where a DCF77 signal is not available. The setting is done by menu.

Bit 1 = 0 no DCF77-decoding
Bit 0 = 1 Master/slave-string serial interface.

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

2.1.5 Crystal Clock Operation

If the large display is not supposed to or cannot be synchronised by external time sources it can also operate with the internal accuracy of a crystal clock. The settings can be done by menu (see pt. 1.8.3 - Clock Functions (SYNCHRONOUS)).

Bit 1 = 0 no DCF77-decoding
Bit 0 = 0 crystal operation

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 parameter, above all on the temperature and time elapsed since the last calibration. Trained personnel can calibrate the clock using the parameter crystal value in the menu or by operating in a synchronised mode (also see pt. 1.10.3).

2.2 Time/Date Display

The output of the time can be set to different formats under the menu DISPLAY (see pt. 1.8.1 - Settings Display (DISPLAY)).

Please take note of the settings under PARAMETER / LANGUAGE for the output of time and date (see pt. 1.10.1 / 1.9.2.1).

3 Operation as Matrix Display

If connected to the system 7001 the large displays are connected to the board 7515 via RS422 (V.11) to achieve the so-called party-line operation (see diagram in the appendix). Depending on the setting of the system byte 1 the display can filter and show the following data strings from the serial interface boards 7515. The data of the serial interface are checked for the identification (F0-F8) and the values in the display are updated if a significant data string arrives. System byte 1, Bit 0-5 are set 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	network 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	customised string

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

PLEASE NOTE : WHEN OPERATING AS MATRIX DISPLAY THE BAUD RATE SHOULD BE SET TO AT LEAST 4800 BAUD.

3.1 F0 = System Time

When system time is set the board 4985 filters the following string from the 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 (network time) is filtered from the serial transmission and shown in the bottom line of the display. Looking as follows:

Sy 12:34:56

N1 12:34:57

3.2 F1= Network Time

In case of the setting network time the board 4985 filters the following string from the serial transmission.

Structure of 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 (system time) is filtered from the serial transmission and shown in the bottom line of the display. Looking as follows:

N1 12:34:56

Sy 12:34:57

3.3 F2 = Difference Time

If the difference time is set the board 4985 filters the following string from the serial transmission

Structure of 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

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

+ 06,447

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

t + 00:00:06

447

3.4 F3= Power Line Frequency and Difference Frequency

When power line frequency is set the board 4985 filters the following string from the serial transmission.

Structure of 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

Apart from the size of the characters it is also possible to choose for the display of frequency and difference frequency a base of 50 or 60 Hz (see pt. 2 large display as radio controlled clock).

The display of the network frequency looks 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 looks as follows:

+00,002 height of digits 84 mm

df +00,002 Hz height of digits 42 mm

f1 50,002 Hz

3.5 F4 = Temperature and Humidity

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

Structure of 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

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

32° C 56%H

This data string is displayed in the size 84mm height of characters only.

3.6 F5 / F6 = Power 1 and 2

When power is set the board 4985 filters the following string 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 1000s	30-39
7	power 100s	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 shown in the size 84 mm height of characters only.

3.7 F7 = Master/Slave Data String

This data string serves to supply the large display with the time information via the board 7515. 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	Crystal operation
	1	x	x	x	Radio controlled operation
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. The transmission is done in BCD. The difference time can be up to ± 12:59 h.

The sign is shown 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

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

See pt 1.8.1. Setting the 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

3.8 F8 =Special String

You can use this setting to show your own data in the large display. The presentation can be either:

1-line:

height of characters :	84 mm
max. number of characters :	6 [1]
ASCII-characters :	HEX 20 - HEX 5A
	Special characters, digits and capital letters

or

2-lines:

height of characters:	42 mm
max. number of characters :	10 characters / line
ASCII-characters :	HEX 20 - HEX 7A
	Special characters, digits and capital and small letters

The following control characters are used:

STX	= Start of Text	HEX02	
ETX	= End of Text	HEX03	
LF	= Line feed	HEX0A	to change lines
DEL	= Delete	HEX7F	to insert a space

You can also use less than the maximum number of characters per line. LF respectively ETX are always the limiting letters.

[1] 16 characters per string are permitted to be able to delete the display by means of space. 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 lines	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

4 Data strings

4.1 General Information on the Serial Output of the Board 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 by **Mode byte 1.**

4.2 Data Format of the Serial Transmission

The data are transmitted 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)

PLEASE NOTE : STATUS VALUES ARE TO BE DECODED SEPERATELY (SEE STRUCTURE OF DATA STRING)

4.3 Serial Request

The request of data strings which are not listed in this chapter are described with the respective data strings.

4.3.1 Serial Requests by ASCII Characters (Standard and Standard 2000)

The data string can also be putout 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 answers with the same data string within 1 msec.

This is often too fast for the requesting computer. Therefore it is possible to delay the answer in steps of 10msecs in case of a request 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 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).

4.4 Structure of the Hopf Standard String

character no.:	Meaning	
1	STX (Start of Text)	
2	Status	; see 4.4.1
3	Day of the week (1=Monday ... 7=Sunday)	; see 4.4.1
	in UTC time Bit3 in the day of the week is set to 1	
4	tens hours	
5	unit hours	
6	tens minutes	
7	unit minutes	
8	tens seconds	
9	unit seconds	
10	tens day	
11	unit day	
12	tens month	
13	unit month	
14	tens year	
15	unit year	
16	LF (Line Feed)	; see 4.1
17	CR (Carriage Return)	; see 4.1
18	ETX (End of Text)	

4.4.1 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	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	MESZ/MEZ
	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)

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	
1	STX (Start of Text)	
2	Status	; see 4.4.1
3	day of the week (1=Monday ... 7=Sunday) In UTC-time bit 3 is set to 1 in the day of the week	; see 4.4.1
4	tens hours	
5	unit hours	
6	tens minutes	
7	unit minutes	
8	tens seconds	
9	unit seconds	
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 4.1
19	CR (Carriage Return)	; see 4.1
20	ETX (End of Text)	

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 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

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)

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 by **"?"**.

character no.:	meaning	value (value range)	
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 4.6.1
29	"*" or space	$2A / $20	; see 4.6.1
30	"S" or space	$53 / $20	; see 4.6.1
31	"!" or Space	$21 / $20	; see 4.6.1
32	ETX (end of text)	$03	

4.6.1 Status in the Data String SINEC H1

The characters 28-31 in the data string SINEC H1 tell the status of the synchronisation of the clock.

Meaning:

Character no .: 28 =	"#"	no radio synchronisation after reset, time invalid
	Space	radio synchronisation after reset, clock at least in crystal operation
Character no.: 29 =	"*"	Time from the internal crystal of the clock
	Space	Time by radio reception
Character no.: 30 =	"S"	Daylight saving time
	Space	Standard time
Character no.: 31 =	"!"	announcement of a ST/DST or DST/ST changeover
	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

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 by **"T"** .

character no.:	Meaning	value (value range)
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 hours	$30-32
16	unit hours	$30-39
17	":" colon	$3A
18	tens minutes	$30-35
19	unit minutes	$30-39
20	":" colon	$3A
21	tens seconds	$30-36
22	unit seconds	$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

4.8 Master/Slave-String

The Master/Slave-String is used to synchronise slave-systems with the time data of the master system reaching an accuracy of ± 0,5 msec . The data string includes the difference time to UTC.

Following the year the difference time is transmitted in hours and minutes. The transmission is done in BCD. The difference time may be up to . ± 11.59 hours.

The sign is shown 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 (value range)	
1	STX (start of text)	$02	
2	status	$30-39, $41-46	; see 4.8.1
3	day of the week	$31-37	; see 4.8.1
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 + sign h.	$30,$31,$38,$39	
17	unit diff. time hours	$30-39	
18	tens diff. time minutes	$30-35	
19	unit diff. time minutes	$30-39	
20	LF (line feed)	$0A	; see 4.1
21	CR (carriage return)	$0D	; see 4.1
22	ETX (end of text)	$03	

4.8.1 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

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 Std.

4.8.3 Setting

The synchronisation of **hopf** Slave-Systems requires the following setting:

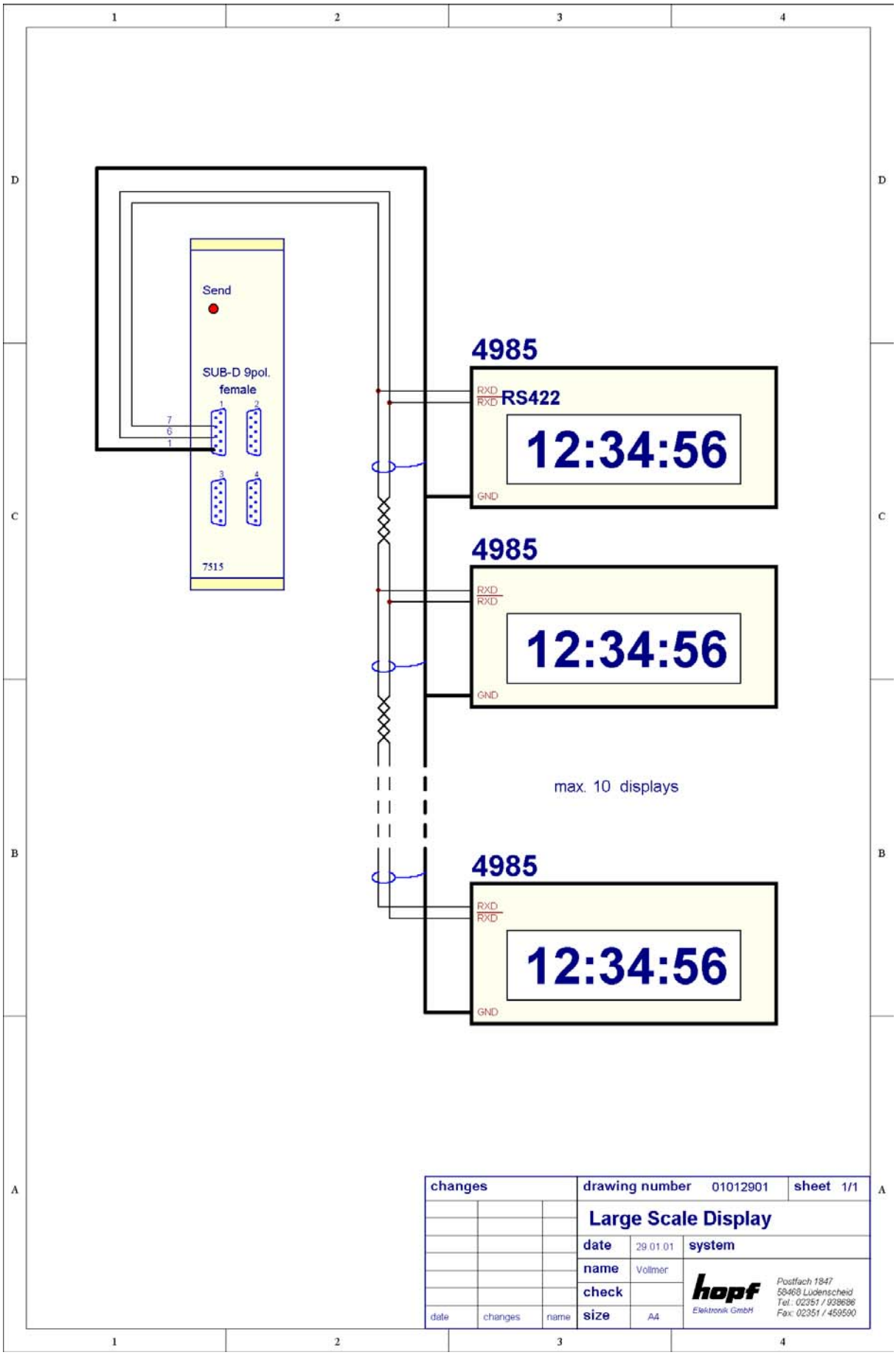
- Output every minute
- Output second advance
- ETX on the second change
- 9600 Baud, 8 Bit, 1 Stop bit, no parity

This setting achieves the best control of the time base in the slave systems.

5 Technical Data Radio Controlled Clock Large Display 4985

voltage supply:	230V AC / 50-60 Hz
operating voltage board 4985:	+ 5V DC ± 5%
display:	+ 5V DC ± 5%
power consumption:	without display ca. 400 mA
	with display ca. 2.5 A
serial interface:	RS232 and RS422 without Handshake
DCF77-pulse input:	RS422 Hardware
DCF77-pulse output:	RS422 Hardware
temperature range :	0-70° C
Readability:	2 lines with 42 mm letters each ⇨ 20 m
	1 line with 84 mm letters ⇨ 40 m
customisation:	Customisation of hard and software is available

PLEASE NOTE : THE **HOPF** COMPANY WITHHOLDS THE RIGHT TO ALTERATIONS IN HARD AND SOFWARE AT ANY TIME.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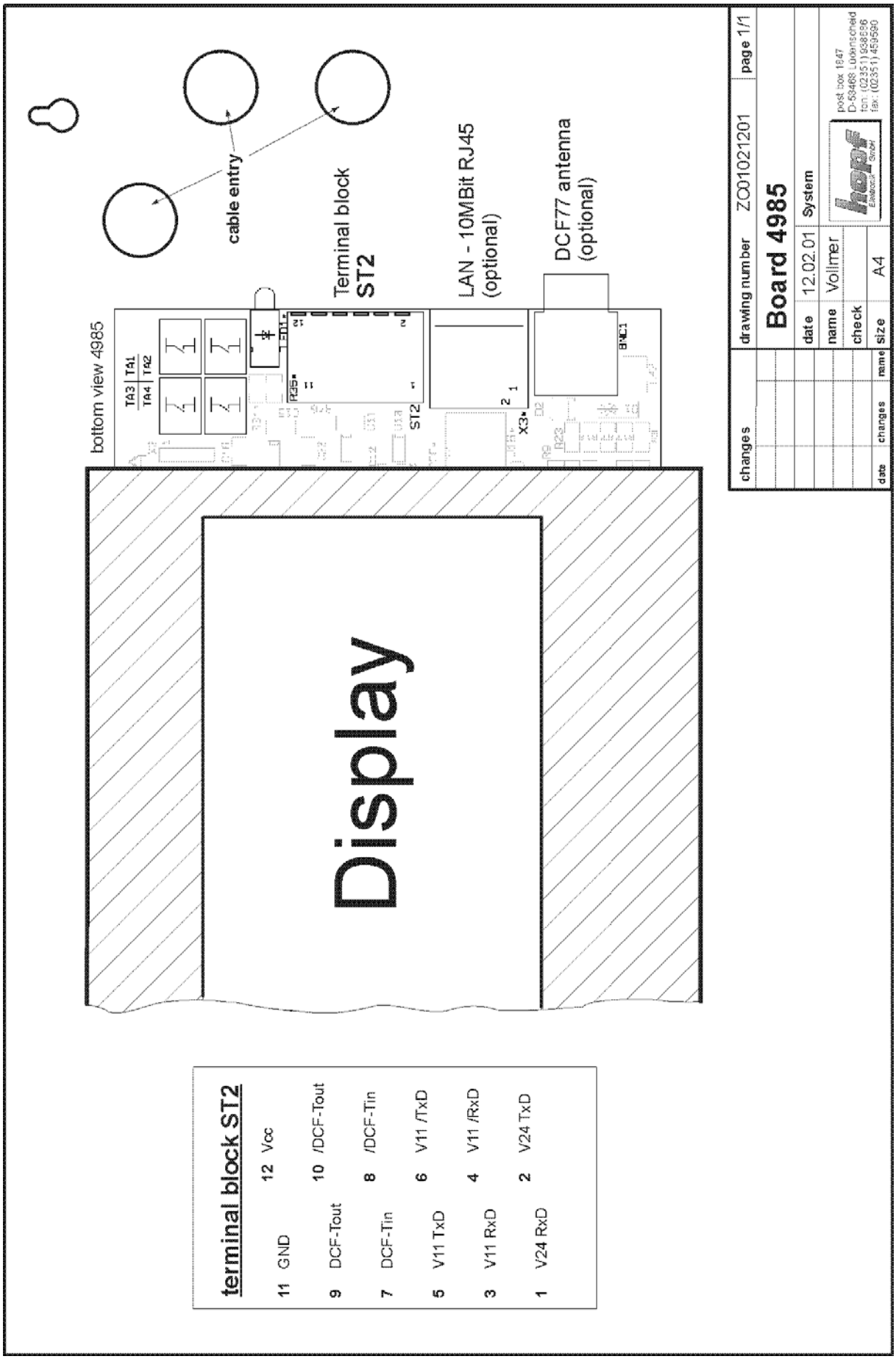
SUB-D 9pol.
female
7
6
1
1
2
3
4
7515
4985
RXD
RXD
RS422
12:34:56
GND
4985
RXD
RXD
12:34:56
GND
max. 10 displays
4985
RXD
RXD
12:34:56
GND
changes
drawing number 01012901
sheet 1/1
Large Scale Display
date 29.01.01
system
name Vollmer
check
size A4
date
changes
name
hopf
Elektronik GmbH
Postfach 1847
58468 Lüdenscheid
Tel.: 02351 / 938686
Fax: 02351 / 459590


cable entry
Terminal block
ST2
LAN - 10MBit RJ45
(optional)
DCF77 antenna
(optional)
bottom view 4985
Display
terminal block ST2
12 Vcc
11 GND
10 /DCF-Tout
9 DCF-Tout
8 /DCF-Tin
7 DCF-Tin
6 V11 /TxD
5 V11 TxD
4 V11 /RxD
3 V11 RxD
2 V24 TxD
1 V24 RxD
changes
drawing number ZO01021201
page 1/1
Board 4985
date 12.02.01
System
name Vollmer
check
size A4
post box 1647
D-58468 Lüdenscheid
fon: (02351) 938656
fax: (02351) 459590