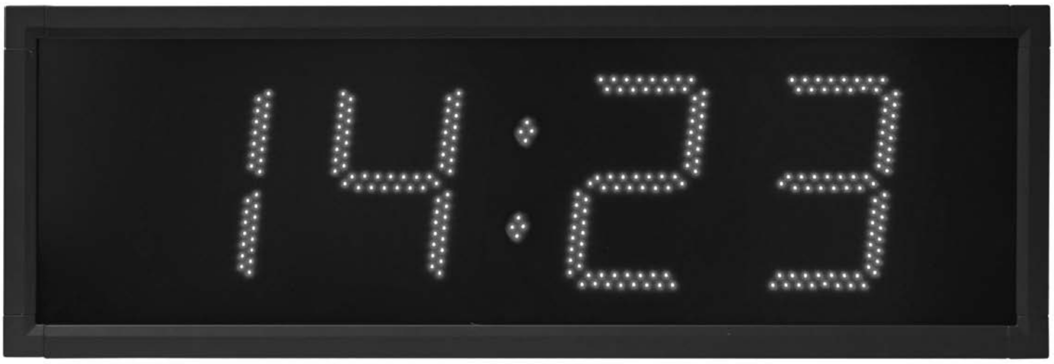
Swiss Time Systems

INSTRUCTION MANUAL

In- and Outdoor Digital Clock DSC Series



BE-800584.07

Certification of the Producer

STANDARDS

The digital clock DSC has been developed and produced in accordance with the EU Standards 2006/95/ES (LVD), 2004/108/ES (EMC), 2011/65/EU (RoHS), 2002/96/EC (WEEE):
Applied Standards:
EN 60950-1/Cor. (2011)
EN 55022 (2010), class B
EN 55024 (2010)
EN 50121-4/Cor. (2008)

References to the Instruction Manual

1. The information in this Instruction Manual can be changed at any time without notice.
   The current version is available for download on www.mobatime.com.
2. This Instruction Manual has been composed with the utmost care, in order to explain all details in respect of the operation of the product. Should you, nevertheless, have questions or discover errors on this manual, please contact us.
3. We do not answer for direct or indirect damages, which could occur, when using this Manual.
4. Please read the instructions carefully and only start setting-up the product, after you have correctly understood all the information for the installation and operation.
5. The installation must only be carried out by skilled staff.
6.

Table of contents

1 Description

General purpose digital clock, intended for outdoor use • The clock meets the requirements of the majority of conventional applications • 7-segment LED display of high luminance elliptical LEDs provide for excellent readability even on direct sunlight • Ten combinations of the height and the number of digits • Autonomous operation with internal TCXO • NTP multicast or unicast synchronization in Ethernet or WiFi network • Slave clock operation in wireless WTD system based on a transmitter which sends the time signal • Slave clock operation controlled by self-setting MOBALine code • Slave clock operation controlled by built-in RS 232, RS 485 or IRIG-B interface • LED display in red, pure green, amber, blue or white colour • Single or double sided clock • Clock frame made of powder coated aluminium profiles • Wall mounting for single sided clock • Ceiling suspension or wall bracket mounting for double as well as single sided clock

1.1 Basic properties

- digit height of 100, 180, 250, 320 or 500 mm, which corresponds to readability distance of 40, 70, 100, 130, 200 m;
- digits in red, pure green, blue, white or amber colour;
- manual or automatic adjustment of the luminosity of LED displays;
- front side glass with dark filter and antiglare surface for improved readability;
- single or double sided design, for wall mounting (for single-sided clock design, only), or to be suspended or fixed to wall bracket;
- mounting on tiltable console for easy installation procedure;
- clock frame made of powder coated aluminium profiles, RAL7040 colour (light grey) as standard, any other RAL colour on request;
- adjustment of clock parameters using two pushbuttons inside the clock (behind the cover) or through remote controller;
- autonomous TCXO time base, with the possibility of synchronization using the following: DCF 77 radio signal, one-minute 24 V pulses, the MOBATIME serial code, MOBALine, RS 232, RS 485, IRIG-B or GPS;
- configuration / monitoring via MOBA-NMS is possible;
- NTP multicast or unicast synchronization in Ethernet or WiFi network;
- slave clock operation in wireless WTD system (868MHz) based on a transmitter which broadcasts the time signal;
- mains powered 100-240VAC; DC powering on request;
- protection degree IP 65;

The clock

- display of time values (either 12 or 24 hours time cycle), four-digit (HH:MM) or six digit (HH:MM SS) format;
- possibility of leading zero suppression when displaying the time and date;
- display of temperature in °C or °F – up to two sensors connectable;
- alternating indication of time, date and temperature, with adjustable period of each of the displayed data;
- possibility of setting up the time zone.

Stop watch

- counting up, starting from zero, up to 99 hours;
- countdown from a set up value, with stop at zero, automatic restart or counting to negative values;
- indication of intermediate times, “freezing“ of the display, cumulated interim time;
- counting in steps of one minute, one second or 1/100 second;
- control using the keyboard or IR remote control;
- concurrently, possibility of changeover into the time/date display mode, or the temperature indication

Accessories

- DCF 77 signal receiver
- temperature sensor with protection degree IP 66
- keyboard for stopwatch control, connected via 5 m cable
- remote IR controller for clock set up and stopwatch control

On request

- internal relay – relay can switch for specified duration, when the stopwatch in the countdown mode reach the zero

2 Installation

⚠ the connection to the 110/230 V AC power network can only be done by authorized personnel with appropriate qualification and training;
⚠ connect the cables always in unpowered state – otherwise the risk of electric shock exist;
⚠ producer is not responsible for breakdowns caused by unsuitable clock mounting on the bearing surface;

2.1 Single-sided clock up to DSC.320

- assemble the wall mounting console if delivered disassembled;
- drill at least four anchoring holes into the wall, of a diameter adequate to appropriate screws, use the mounting console as a template;
- mount the console on the wall and put it into a fully tilted out position;
- shift the clock body into the flipped out console arms and fix it by tightening the screws;
- dismantle the back cover of connectors on the clock body; the cover incorporates gap with sealings for passage of cables in the inside of he clock;
- arrange all cables to appropriate length and connect them to the appropriate terminals on the PCB; see the description of the connectors and observe the correct polarity where necessary;
- fix the cables with the holder in correct positions in order to maintain regular spacing between the cables in the area of passing through sealing; use appropriate force to not to damage the cables insulation;
- configure the Line type jumper according to used synchronisation signal (applies only for DCF, MOBALine, Serial MOBATIME code, polarized impulse line or IRIG-B);
- mount back the connector cover;
- tilt the clock into vertical position and fix the position of the console;

2.2 Single-sided clock DSC.500

- drill at least four anchoring holes into the wall, of a diameter adequate to appropriate screws. As a template for marking the position of the holes use the wall console (mounting frame);
- mount the console to the wall using appropriate screws and dowels with respect to the wall material;
- loosen the hanging M10 allen screws on console in order to be cca 6mm of thread visible;
- prepare the cables and fix them on the wall in order to be placed behind the small rectangular cover equipped with the sealed slot;
- hang the display body onto the console in order to fit four hanging screws into the pear-shaped holes;
- using special key unlock (turn by 90° clockwise) the two locks on the bottom of the frame and open the front window. Use the support to keep the front window opened;
- tighten four hanging screws using the allen key, the display is then fixed on the wall;
- dismount the small rectangular cover on the bottom part of backpanel, pull all cables through the opening and fix them by the metal bar. Mount the cover back.

Make sure the cables are evenly distributed in the fixing bar and in the sealed slot;

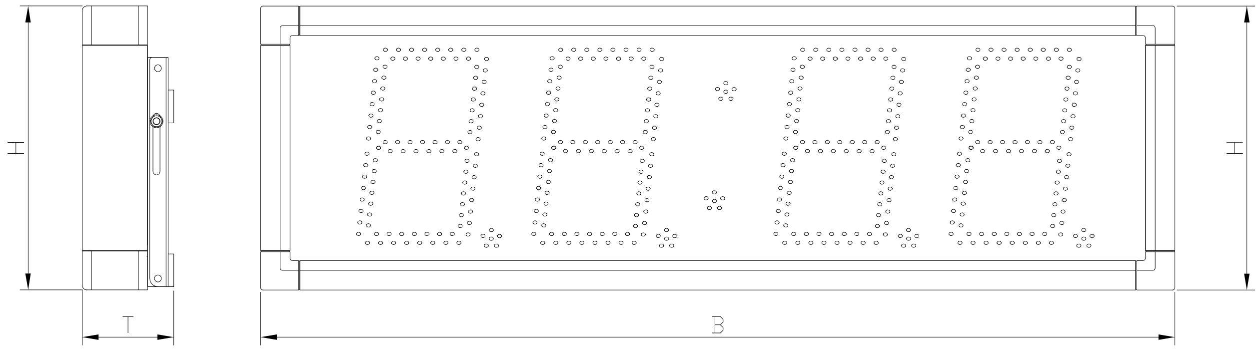
- arrange and cut the cables to the appropriate length. Strip the wires and connect them to corresponding board terminals. Observe the right polarity where necessary;
- configure the Line type jumper according to used synchronisation signal (applies only for DCF, MOBALine, Serial MOBATIME code, polarized impulse line or IRIG-B);
- apply the power and check if the display works correctly;
- close the front window and secure it using two locks (turn by 90° anti-clockwise) on the bottom of the display body frame;
- dismount the mounting eyes and screw-in the delivered covering allen screws;

2.3 Double-sided clock up to DSC.320

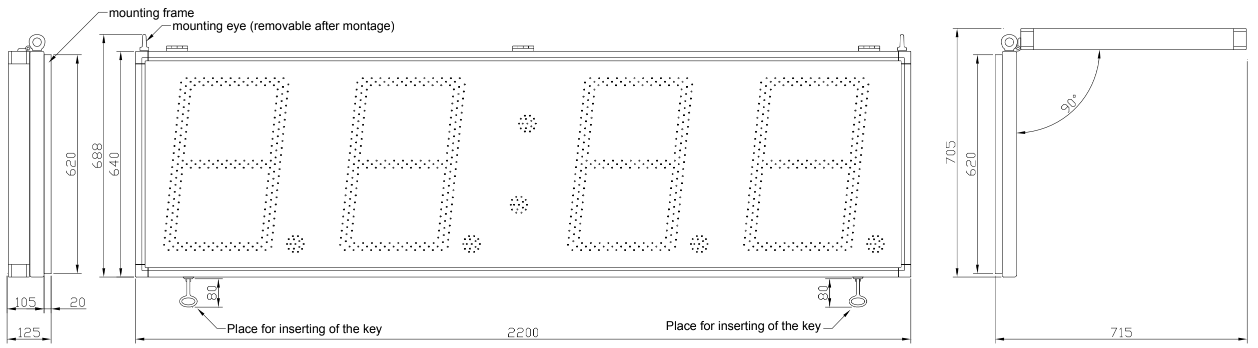
- the double-sided clock consists of the displaying (SLAVE) part, control (MASTER) part and the wall side mounting console, both parts are linked via one cable;
- the clock is delivered as a one unit (both parts mounted on the console);
- if the console has the bottom cover, remove it (5x screw M4) first, bottom cover is attached to the console by steel wire (captive cover);
- unscrew locking screws and put clock parts into fully tilted out positions;
- dismantle the back connector cover on the MASTER part; the cover incorporates gap with sealings for passage of cables into the clock;
- disconnect the MASTER-SLAVE connecting cable;
- release four allen screws on back side of the clocks and take out the both clock parts from the console;
- drill appropriate number of anchoring holes in the wall for 10-12 mm dia. wood screws, use the mounting console as a template;
- push all incoming cables (power, temperature, synchronization) through the upper tube of the console and through he oval hole, then mount the console on the wall;
- put both sides into a fully tilted out positions;
- hang the SLAVE part on one side of the console and tighten the four screws on the back side of the clock part;
- hang the MASTER part on second side of the console and tighten the four screws on the back side of the clock part;
- connect the MASTER-SLAVE cable;
- arrange all incoming cables to appropriate length and connect them to the appropriate terminals on the PCB; see the description of the connectors and observe the correct polarity where necessary;
- fix the cables with the holder in correct positions in order to maintain regular spacing between the cables in the area of passing through sealing; use appropriate force to not to damage the cables insulation;
- configure the Line type jumper according to used synchronisation signal (applies only for DCF, MOBALine, Serial MOBATIME code, polarized impulse line or IRIG-B);
- mount back the connector cover;
- tilt the clock parts into vertical position and fix them by locking screws;
- mount back the bottom cover if delivered;

2.4 Mechanical drawing

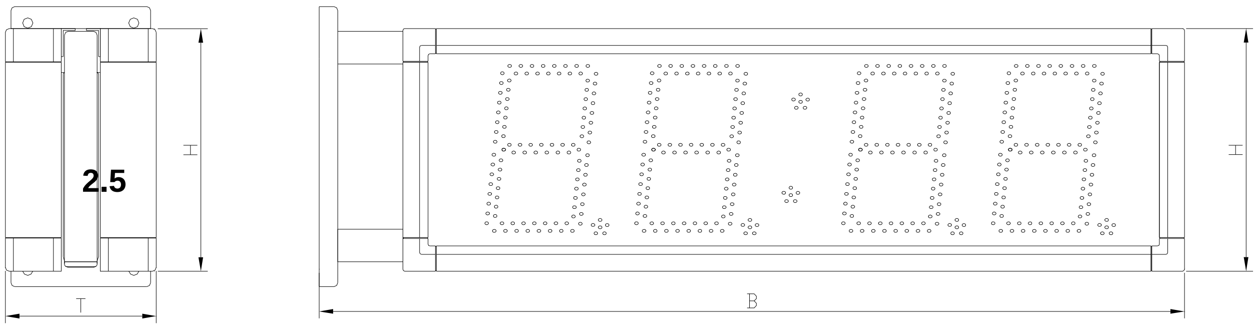
2.4.1 Single-sided clock up to DSC.320

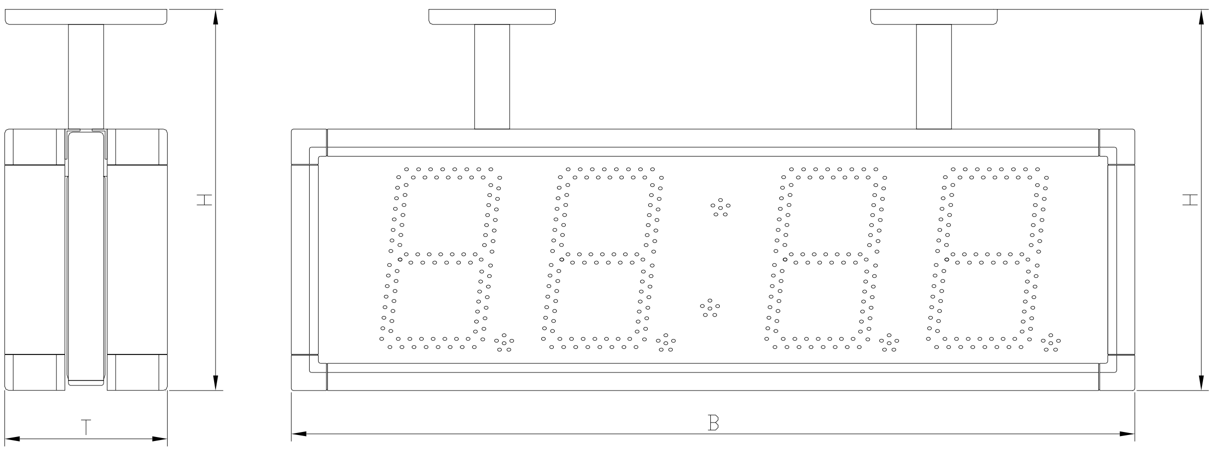


2.4.2 Single-sided clock DSC.500

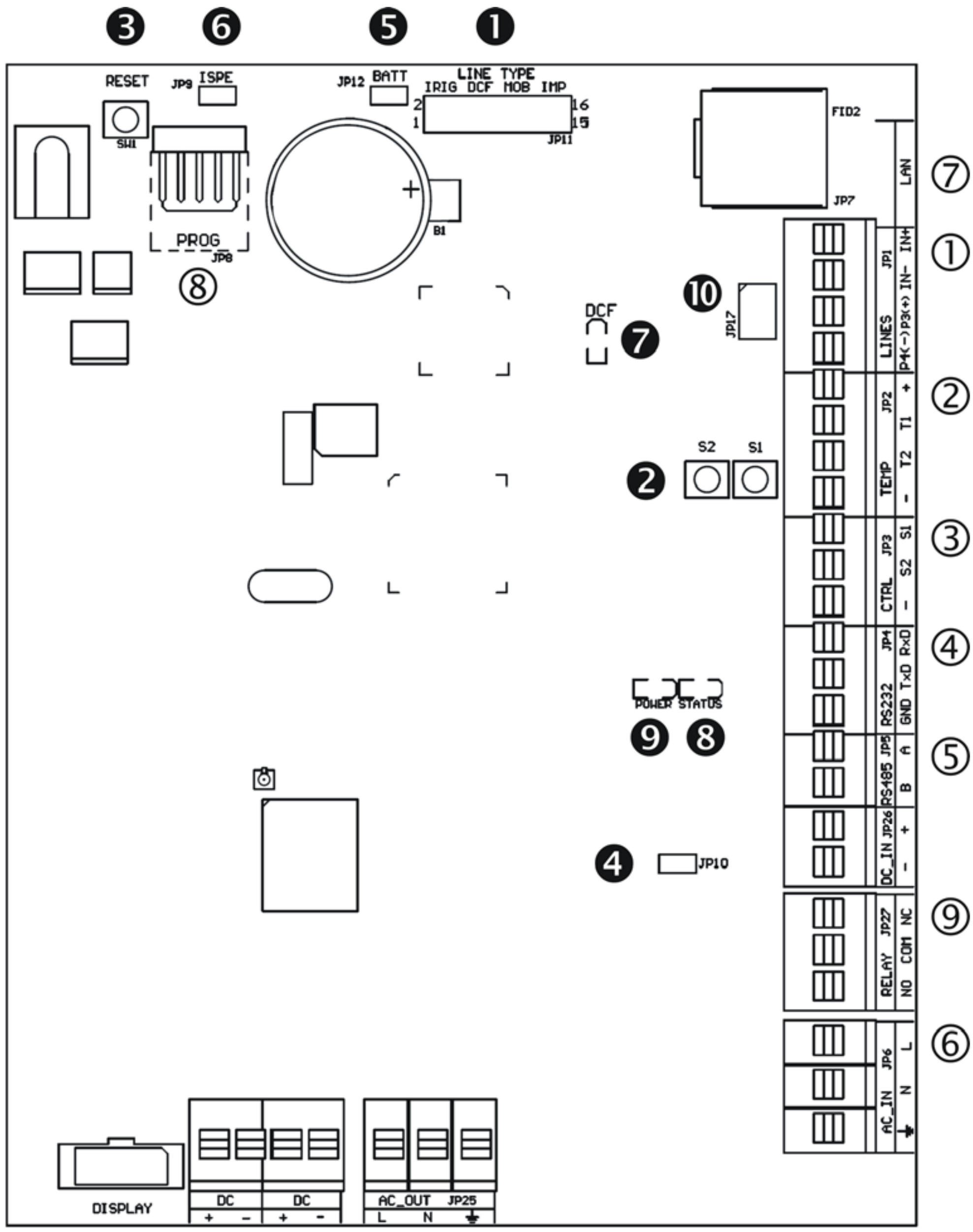


2.4.3 Double-sided clock up to DSC.320





Connectors and control elements



① LINES, DC/DCF OUT – JP1
② TEMP – JP2
③ CTRL – JP3
④ RS232 – JP4 (version SI)
⑤ RS485 – JP5 (version SI)
⑥ 100 – 240VAC – JP6
⑦ LAN - JP7 (version NTP)
⑧ PROG – JP8
⑨ RELAY – JP27 (optional)

❶ Line type jumper – JP11
❷ PB1, PB2 buttons
❸ RESET button
❹ TRE jumper – JP10 (version SI)
❺ BATT jumper – JP12
❻ jumper ISPE – JP9
❼ LED indication of DCF signal
❽ state LED
❾ LED indication of powering
❿ jumper DC Out / DCF Out – JP17

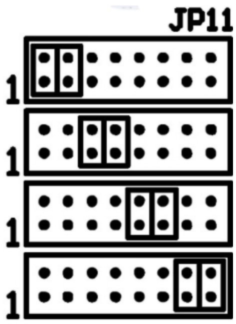
Note: The placement of the particular connectors and control elements is different for the DSC.100 clocks.

2.6 Function of the plug connectors

① **LINES, DC/DCF OUT** – JP1	time signal inputs: The DCF/GPS receiver, polarized impulse line, MOBALine, MOBATIME serial code, IRIG-B, power supply output: DC OUT 12–40 VDC or passive DCF current loop output
② **TEMP** – JP2	connection of the temperature sensor(s)
③ **CTRL** – JP3	connection of the keyboard
④ **RS232** – JP4 (optional)	connection of the RS232 serial line
⑤ **RS485** – JP5 (optional)	connection of the RS485 serial line
⑥ **100 – 240VAC** – JP6	powering 100 - 240 VAC voltage
⑦ **LAN -** JP7 (optional)	RJ45 10BaseT/100TX (IEEE 802.3) auto negotiation
⑧ **PROG** – JP8	clock firmware programming
⑨ **RELAY** – JP27(optional)	switching contact connection

2.7 Setting elements

❶ **Line type** jumper – JP11 — for the setting of the slave line type



IRIG / AFNOR

DCF

MOBALine

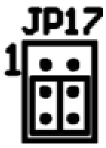
(Un)polarized impulse line
MOBATIME serial code
Active DCF code

❷ **PB1, PB2**	control pushbuttons
❸ **RESET**	the RESET button
❹ **TRE** jumper – JP10 (optional)	RS485 terminating resistor enable
❺ **BATT** jumper – JP12	backup battery connection
❻ **ISPE** jumper – JP9	invoking the firmware programming mode
❼ **DCF** LED	indication of receiving the DCF signal
❽ **STATE** LED	state indication
❾ **POWER** LED	power indication
❿ jumper DC Out / DCF Out – JP17	Output signal setting on pins 3, 4 of the JP1 connector

DC Out

pin3 = DC Out + (12-40V)

pin4 = DC Out -



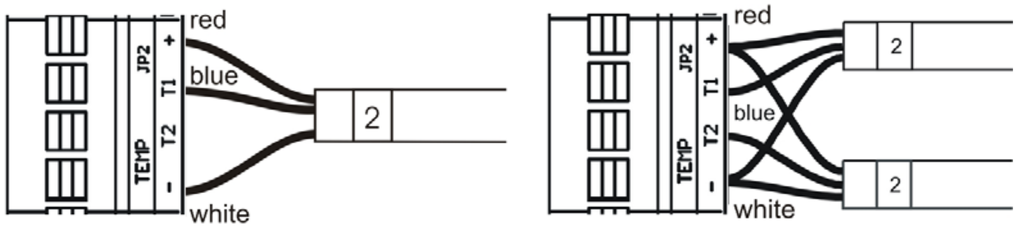
passive DCF Out

pin3 = (+)

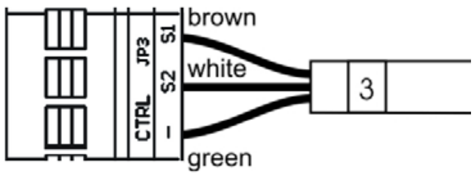
pin4 = (-)

2.8 Connection of the cable ends

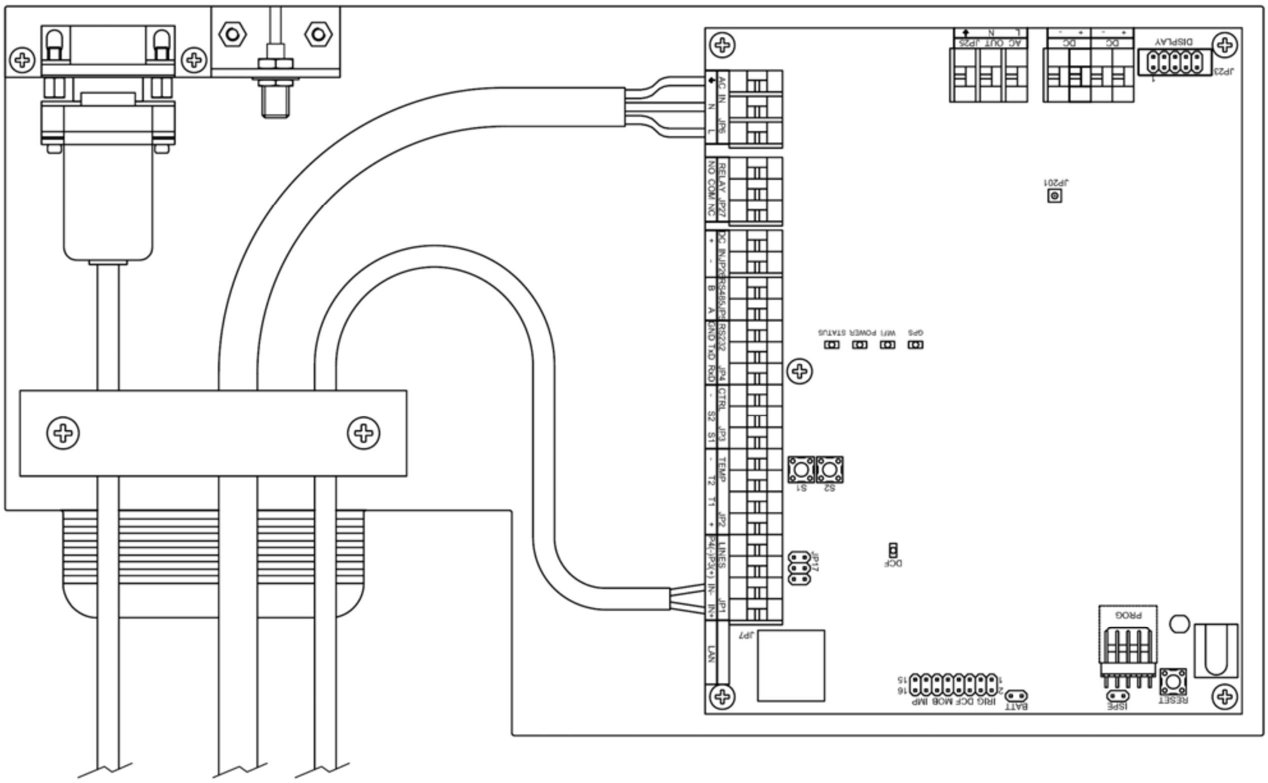
TEMP wire connection – 1 or 2 thermometers



CTRL wire connection



2.9 Cables arrangement



3 Control of the clock using keyboard or pushbuttons

The clock is adjusted and controlled using two pushbuttons located on the control PCB. If you use a keyboard for setting the stopwatch, then use the pushbuttons **PB1** and **PB2** for the clock setting.

Abbreviations used for the key strokes

PB1L, **PB2L**	pushing the pushbutton for more than 1 second
PB1S, **PB2S**	pushing the pushbutton for less than 1 second

Function of the pushbuttons in the "Clock" mode

PB1S	time correction to the whole minute (±30 sec)
PB2S	changeover of the displayed items Time -> date -> temperature -> stopwatch -> time
PB1L	entry into the time and date setting mode
PB2L	entry into the clock menu

3.1 Setting of time and date

The setting of time and calendar date takes place in following steps: year – days – months – hours – minutes. The entry into the time and date setting mode occurs by pushing the **PB1L** pushbutton.

The display shows the following:

The item to be adjusted is now blinking.

Move to another item by pushing the **PB1S** pushbutton. After having adjusted the minutes and by pushing **PB1S,** the entered values are stored (the seconds are set to zero) and the operation of the clock resumes. The clock returns into normal working mode.

Function of the pushbuttons in the "Time and date setting" mode.

PB1S	advancement to another item to be set up
PB2S	increase of the item to be set up by 1
PB2L	continuous increase of the current item

3.2 Menu for the setting of the clock parameters

The entry into the parameter setup menu is done by pushing the **PB2L** button.

The display shows the following:

The item to be adjusted
is now blinking

The options for the parameter setup are shown in the clock menu table (chapter 5).

Function of the pushbuttons in the setup menu mode

PB1S	storage of the current item and move to another menu item
PB1L	storage of values and return into normal display mode, or entry into the submenu, where it is permitted by the program
PB2S	increase of the current item by 1
PB2L	continuous increase of the current item

3.2.1 Submenu for user-specific setting of time constants for data switchover

In menu item **P2** (time constants for automatic switching over of values) set value **U,** then by pushing the **PB1L** enter the submenu. The item to be set is blinking.

By pushing the **PB2S** button the adjusted value is increased in steps of 1, by pushing the **PB2L** button the value will be continuously increased.

The display shows the following:

Enter the time constant for the display of time in seconds. Push the **PB1S** button and enter the constant for date display in seconds.

Push the **PB1S** pushbutton.

The display shows the following:

Enter the time constant for the display of temperature in seconds. Push the **PB1S** pushbutton and enter the constant for stopwatch display in seconds.

By pushing the **PB1L** button are the entered values stored and the clock returns to the menu item **P2**.

3.2.2 Submenu for setting of the user-specific time zone

Choose the value **U** in the item **P7** (time zone displaying) in the clock menu, then enter the submenu for setting the parameters of the user-specific time zone by pushing the **PB1L** pushbutton. The item to be set is blinking.

By pushing the **PB2S** button, the adjusted value is increased in steps of 1, by pushing the **PB2L** button, the value will be continuously increased.

The display shows the following (example: -12 hours):

Enter the offset of the required time zone compared to UTC time within -12 to +12 hours. Decimal point means 0.5 hour.

Switch over to setting the way of setting daylight saving time (DST) by pushing **PB1S**.

The display shows the following:

Possibility:
n – no DST is used
F – DST defined by fixed date
C – DST defined by calculated date

DST defined by fixed date and time

If the value **F** is set in the item **dt:**, enter the submenu for entering fixed date and time by pushing **PB1L**.

The item to be set is blinking. By pushing the **PB2S** button, the adjusted value is increased in steps of 1, by pushing the **PB2L** button, the value will be continuously increased.

Symbols on the display:

Fh	change to summer time; entry of the hour at daylight saving begins
bh	shift back; entry of the hour at daylight saving ends

The display shows the following:

Enter the hour at which the daylight saving time begins.

Push **PB1S**.

The display shows the following:

Enter the day of the month. Push **PB1S**. Enter the month in which the daylight saving time begins.

Push **PB1S**.

The display shows the following:

Adjust the hour at which the daylight saving time ends.

Push **PB1S.**

The display shows the following:

Enter the day of the month. Push **PB1S**. Enter the month in which the daylight saving time ends.

The daylight saving time has been set to start on April 28th at 2 o'clock and to end on October 10th at 3 o'clock in the example described above.

Save the setting by pushing **PB1L** and return to item **dt:.** Return to the clock menu item **P7** with another push of the **PB1L** button.

DST defined by calculated date

If the value **C is set** in item **dt:**, enter the submenu for the calculated date by pushing **PB1L**.

The item to be set is blinking. By pushing **PB2S,** the adjusted value is increased in steps of 1, by pushing the **PB2L** button, the value will be continuously increased.

Symbols in the display:

F	change to summer time
b	setting the time back

Scope of the setting:

Week	1. – 4.,L (the last one), P (last but one) and H (first after 15th day in the month)
Day of the week	1. – 7. (Mo – Su)
Month	1. – 12.

The display shows the following:

Enter the week in which the daylight saving time begins. Push **PB1S**. Enter the day of the week at which the daylight saving time begins.

Push **PB1S**.

The display shows the following:

Enter the month in which the daylight saving time begins. Push **PB1S.** Enter the hour at which the daylight saving time begins.

Push **PB1S**.

The display shows the following:

Enter the week in which the daylight saving time ends. Push **PB1S**. Enter the day of the week at which the daylight saving time ends.

Push **PB1S**.

The display shows the following:

Enter the month in which the daylight saving time ends. Push **PB1S**. Enter the hour at which the daylight saving time ends.

The daylight saving time has been set to start on the last Sunday in March at 2 o'clock and to end on the last Sunday in October at 3 o'clock in the above described example.

Save the setting by pushing **PB1L** and return to the item **dt:**. Return to the clock menu item **P7 with** another push of the **PB1L** button.

3.2.3 Submenu for network services configuration

Choose the value **2** or **3** in the item **P19** (network workmode selection) in the clock menu, then enter the submenu by pushing the **PB1L** pushbutton for configuring the network services (Multicast support in unicast workmode, SNMP service, Telnet service). The item to be set is blinking.

The display shows the following:

Set value **1** for enabling the multicast support in the unicast workmode or value **0** for disabling it by pushing the **PB2S**.

Switch to the next parameter – SNMP communication support by pushing the **PB1S**. The display shows the **Sn: 1**. Set value **1** for enabling the SNMP support or value **0** for disabling it by pushing the **PB2S**.

Switch to the next parameter – Telnet support by pushing the **PB1S**. The display shows the **tn: 1**. Set value **1** for enabling the telnet support or value **0** for disabling it by pushing the **PB2S**.

By pushing **PB1L** save the setting and return to item **P19**.

3.2.4 Manual setting of the IP address of the clock

Choose the item **P20** in the main menu and push the **PB1L** button to enter the submenu for setting the IP address. The item to be set is blinking.
By pushing **PB2S,** the adjusted digit value is increased in steps of 1, by pushing the **PB2L** button, the value will be continuously increased.

The display shows the following:

Enter the four octets of the IP address step by step. Switch to next digit or octet respectively by pushing the **PB1S**. Octets are marked by letters **A**, **b**, **C** and **d**.

By pushing the **PB1L** button, the entered values are stored and the clock returns to the menu item **P20.**

3.2.5 Manual setting of the subnet mask

Choose the item **P21** in the main menu and push the **PB1L** button to enter the submenu for setting the subnet mask. The item to be set is blinking.

By pushing **PB2S,** the adjusted value is increased in steps of 1, by pushing the **PB2L** button, the value will be continuously increased.

The display shows the following:

Enter the four octets of the subnet mask step by step. Switch to the next octet by pushing the **PB1S** button. Octets are marked by letters **A**, **b**, **C** and **d**.

By pushing the **PB1L** button, the entered values are stored and the clock returns to the menu item **P21.**

3.2.6 Manual setting of default gateway IP address

Choose item **P22** in the main menu and push the **PB1L** button to enter the submenu for setting the default gateway IP address. The item to be set is blinking.
By pushing **PB2S** the adjusted digit value is increased in steps of 1, by pushing the **PB2L** button the value will be continuously increased.

The display shows the following:

Enter the four octets of the gateway IP address step by step. Switch to the next digit or octet respectively by pushing the **PB1S** button. Octets are marked by letters **A**, **b**, **C** and **d**.

By pushing **PB1L** button are the entered values stored and the clock returns to the menu item **P22.**

3.2.7 Submenu for setting the multicast group address

Choose the menu item **P23** and then enter the submenu by pushing the **PB1L** pushbutton for setting the multicast group address. The item to be set is blinking.
By pushing the **PB2S** button, the adjusted digit value is increased in steps of 1; by pushing the **PB2L** button, a continuous increase of the value takes place.

The display shows the following:

Enter the four octets of the IP address step by step. Switch to the next digit or octet respectively by pushing the **PB1S** button. Octets are marked by the letters **A**, **b**, **C** and **d**.

By pushing the **PB1L** button, the entered values are stored and the clock returns to the menu item **P23**.

3.2.8 Submenu for the setting of the NTP unicast synchronization

Choose the menu item **P24** then enter the submenu by pushing the **PB1L** pushbutton for setting the parameters of the NTP unicast synchronization. The item to be set is blinking.
By pushing the **PB2S** button, the adjusted digit value is increased in steps of 1; by pushing the **PB2L** button, the value will be continuously increased.

The display shows the following:

Set the four octets of the NTP server's IP address step by step. Switch to the next digit or octet respectively by pushing the **PB1S** button. Octets are marked by letters **A**, **b**, **C** and **d**.

After the last octet setting, set the constant **x** which determines the interval of synchronization in seconds.

By pushing the **PB1L** button, the entered values are stored and the clock returns to the menu item **P24.**

Note: Through the setup menu is possible to set only one NTP server IP address. If more than one NTP server addresses were previously configured (using telnet or MOBA-NMS tool), after opening the **P24** submenu the IP address of currently active NTP server is displayed. When the IP address was modified and the configuration is saved using the setup menu, the IP address is stored to the definition of the first NTP server, the other NTP server addresses are cleared including those defined by the NTP server domain names.

4 Control of the clock using IR remote control

A 2-digit address is assigned to the clock. With the IR remote control the clock can be locked. The setting of time, date and the clock parameters can only take place at clocks in an unlocked state.

Function of the pushbuttons in normal display mode

pushing **F1** + entry of 2-digit address, using numerical pushbuttons	unlock the clock with the corresponding address
holding down **F1** button	unlock all clocks within the reach of the IR beam of the remote control unit
holding down **F2** button	lock all clocks within the reach of the IR beam of the remote control unit
holding down **F3** button	display the address of all locked clocks within the reach of the IR beam of the remote control

Function of the pushbuttons in the “Clock“ operation mode

SET	entry into the time and date setting mode
The **+** button	button brightness increase (not applicable when **P0** is set to **A**)
The **-** button	button brightness decrease (not applicable when **P0** is set to **A**)
CLOCK	visualisation of time
DATE	visualisation of date
TEMP	visualisation of temperature
TIMER	visualisation of stopwatch
MENU	entry into the menu of setting of clock parameters
CLR	time correction to the whole minute (±30 sec)

4.1 Setting of time and date

The time and date values are adjusted in the following sequence: year – day – month – hours – minutes. By pushing the **SET** button enter the time and date setting mode.

The display shows the following:

The item to be set is blinking.

After having set up the minutes the value is blinking. By pushing the **OK** button the value is stored (with seconds reset to zero) and the clock operation resumes. The clock returns into normal working mode.

Function of the pushbuttons in the “Time and date setting“ mode

The **+** pushbutton	increase of the value adjusted, in steps of 1
The **–** pushbutton	decrease of the value adjusted, in steps of 1
Holding down the **+** button	continuous increase of the value set up

Holding down the **–** button	continuous decrease of the value set up
ESC	return into normal display mode, without storage of the data
>>	move to next parameter
<<	move to previous parameter
CLR	entry of zero or minimum value
OK	storage of values set up and return into normal working mode, followed with seconds reset
Pushbuttons **0–9**	entry of the corresponding numerical value

4.2 Menu for the setting of the clock parameters

The entry into the menu for the setting of the clock parameters is done be pushing the **MENU** button.

The display shows the following:

The item to be set is blinking.

The options for the parameters to be set up are shown in the menu table on page (chapter 5).

Function of the pushbuttons in the “MENU“ mode

>>	move to next menu item
<<	move to previous menu item
The **+**	button increase of the value adjusted, in steps of 1
The **-**	button decrease of the current value, in steps of 1
Holding down the **+** button	continuous increase of the value set up
Holding down the **–** button	continuous decrease of the value set up
ESC	return into the normal working mode, without storing the modified items
OK	storing of the modified items and return into the normal working mode
SET	enter the sub-menu, where it is possible
Pushbuttons **0–9**	entry of the corresponding numerical value Note: During entering the numbers in the octets of the IP addresses the editing to the next digit moves automatically.

4.2.1 Submenu for user-specific setting of time constants for data switchover

In menu item **P2** (time constants for automatic switching over of values) set value **U,** then by pushing the **SET** enter the submenu. The item to be set is blinking.

The display shows the following:

Enter the constant for time display, in seconds. Push the **>>** button and enter the time constant for the display of date, in seconds.

Push **SET**,

The display shows the following:

Enter the time constant for the display of temperature, in seconds. Push the **>>** button and enter the time constant for the display of stopwatch, in seconds.

By pushing **OK** are the entered values stored and the clock returns to the menu item **P2**.
By pushing **ESC** return to **P2** item without storing.

4.2.2 Submenu for setting of the user-specific time zone

Choose the value **U** in the item **P7** (time zone displaying) in clock menu, then by pushing the **SET** enter the submenu for setting the parameters of the user-specific time zone. The item to be set is blinking.

The display shows the following (example: -12 hours):

Enter the offset of the required time zone compared to UTC time within -12 to +12 hours. Decimal dot means 0,5 hour.

Switch over to setting the way of setting daylight saving time (DST) by pushing **>>**.

The display shows the following:

Options:
n – no DST is used
F – DST defined by fixed date
C – DST defined by calculated date

Return to the clock menu item **P7** by pushing the **OK** button.

DST defined by entering fixed date and time
If the value **F** is set in item **dt:**, by pushing **SET** enter the submenu for entering fixed date and time. The item to be set is blinking.

Symbols on the display:

Fh	change to summer time; entry of the hour at daylight saving begins
bh	shift back; entry of the hour at daylight saving ends

The display shows the following:

Enter the hour at which the daylight saving time begins.

Push **>>**.

The display shows the following:

Enter the day of the month. Push **>>**. Enter the month in which the daylight saving time begins.

Push **>>**.

The display shows the following:

Enter the hour at which the daylight saving time ends.

Push **>>**.

The display shows the following:

Enter the day of the month. Push **>>**. Enter the hour at which the daylight saving time ends.

The daylight saving time has been set to start on April 28th at 2 o'clock and end on October 10th at 3 o'clock in the above described example.

Save the setting and return to item **dt:** by pushing **OK**, return to the clock menu item **P7** by another push of the **OK** button.

B. By entering calculated date

If the value **C is set** in item **dt:**, by pushing **SET** enter the submenu for the calculated date. The item to be set is blinking.

Symbols in the display:

F	change to summer time
b	setting the time back

Scope of the setting:

Week	1. – 4.,L (the last one), P (last but one) and H (first after 15th day in the month)
Days of the week	1. – 7. (Mo – Su)
Month	1. – 12.

The display shows the following:

Enter the week in which the daylight saving time begins. Push **>>**. Enter the day of the week in which the daylight saving time begins.

Push **>>**.

The display shows the following:

Enter the month in which the daylight saving time begins. Push **>>.** Enter the hour in which the daylight saving time begins.

Push **>>**.

The display shows the following:

Enter the week in which the daylight saving time ends. Push **>>**. Enter day of the week in which the daylight saving time ends.

Push **>>**.

The display shows the following:

Enter the month in which the daylight saving time ends. Push **>>**. Enter the hour in which the daylight saving time ends.

The daylight saving time has been set to start on last Sunday in March at 2 o'clock and end on last Sunday in October at 3 o'clock in the above described example.

By pushing **OK** save the setting and return to item **dt:**. Another push of the **OK** button returns to the clock menu item **P7**.

4.2.3 Submenu for network services configuration

Choose the value **2** or **3** in the item **P19** (network workmode selection) in the clock menu, then enter the submenu by pushing the **SET** for configuring the network services (Multicast support in unicast workmode, SNMP service, Telnet service). The item to be set is blinking.

The display shows the following:

Set value **1** for enabling the multicast support in the unicast workmode or value **0** for disabling it.

Switch to the next parameter – SNMP communication support by pushing the **>>**. The display shows the **Sn: 1**. Set value **1** for enabling the SNMP support or value **0** for disabling it.

Switch to the next parameter – Telnet support by pushing the **>>**. The display shows the **tn: 1**. Set value **1** for enabling the telnet support or value **0** for disabling it.

By pushing **OK**, the entered values are stored and the clock returns to the menu item **P19**. By pushing **ESC**, the clock returns to **P19** without saving.

4.2.4 Manual setting of the IP address of the clock

Choose the item **P20** in the main menu and push the **SET** button to enter the submenu for setting the IP address. The item to be set is blinking.

The display shows the following:

Enter four octets of the IP address step by step. Switch to another octet by pushing the **<<** and **>>** buttons. Octets are marked by letters **A**, **b**, **C** and **d**.

By pushing **OK,** the entered values are stored and the clock returns to the menu item **P20.** By pushing **ESC** the clock returns to **P20** without storing.

4.2.5 Manual setting of the subnet mask

Choose the item **P21** in the main menu and push the **SET** button to enter the submenu for setting the subnet mask. The item to be set is blinking.

The display shows the following:

Enter the four octets of the subnet mask step by step. Switch to another octet by pushing the **<<** and **>>** buttons. Octets are marked by letters **A**, **b**, **C** a **d**.

By pushing **OK,** the entered values are stored and the clock returns to the menu item **P21.** By pushing **ESC**, the clock returns to **P21** without saving.

4.2.6 Manual setting of default gateway IP address

Choose the item **P22** in the main menu and push the **SET** button to enter the submenu for setting the default gateway IP address, the item to be set is blinking.

The display shows the following:

Enter the four octets of the gateway IP address step by step. Switch to another octet by pushing the **<<** and **>>** buttons. Octets are marked by letters **A**, **b**, **C** and **d**.

By pushing **OK**, the entered values are stored and the clock returns to the menu item **P22**. By pushing **ESC**, the clock returns to **P22** without saving.

4.2.7 Submenu for setting the multicast group address

Choose the menu item **P23** and then enter the submenu by pushing the **SET** for setting the multicast group address. The item to be set is blinking.

The display shows the following:

Enter the four octets of the IP address step by step. Switch to the next digit or octet respectively by pushing the **>>** button. Octets are marked by the letters **A**, **b**, **C** and **d**.

By pushing **OK**, the entered values are stored and the clock returns to the menu item **P23**. By pushing **ESC**, the clock returns to **P23** without saving.

4.2.8 Submenu for the setting of the NTP unicast synchronization

Choose the menu item **P24** and then enter the submenu by pushing the **SET** for setting the parameters of the NTP unicast synchronization. The item to be set is blinking.

The display shows the following:

Set the four octets of the NTP server's IP address step by step. Switch to the next digit or octet respectively by pushing the **>>** button. Octets are marked by letters **A**, **b**, **C** and **d**.

After the last octet setting, set the constant **x** which determines the interval of synchronization in seconds.

By pushing **OK**, the entered values are stored and the clock returns to the menu item **P24**. By pushing **ESC**, the clock returns to **P24** without saving.

Note: Through the setup menu is possible to set only one NTP server IP address. If more than one NTP server addresses were previously configured (using telnet or MOBA-NMS tool), after opening the **P24** submenu the IP address of currently active NTP server is displayed. When the IP address was modified and the configuration is saved using the setup menu, the IP address is stored to the definition of the first NTP server, the other NTP server addresses are cleared including those defined by the NTP server domain names.

5 The clock menu table

Program item	Function	Scope of the values	
		(default values are printed in bold)	
P0	Display brightness	1-30, **A** (automatic adjustment, without the possibility of changing in normal display mode)	
P1	Time display format	**24 h**, 12 h	
P2	Time constants for automatic data switching over	**1**-6, U, 0	
		1	continuous display of time
		2	continuous display of date
		3	continuous display of temperature
		4	continuous display of stop watch
		5	display sequence: time 6 sec, date 3 sec.
		6	display sequence: time 8 sec, date 3 sec, temperature 3 sec.
		U*	time constants set up by user, in seconds for each specific displayed data
		0	automatic switching over disabled
P3	Time zone of synchronization source	0 - 64, **A** (automatically)	
P4	Type of synchronization source	1 - 10, **A** (automatically)	
		A	auto detection, applicable for: DCF, the Mobatime serial code, MOBALine, WTD, IRIG-B, NTP or GPS
		1	autonomous operation without synchronization
		2	synchronization by DCF signal
		3	the MOBATIME serial code
		4	MOBALine
		5	24 V DC impulses, at minute intervals
		6	24 V DC impulses at half minute intervals
		7	24 V DC impulses at second intervals
		8	DCF-FSK, IRIG-B Standard, IRIG-B 123, IRIG-B DIEM, AFNOR A, AFNOR C
		9	RS232
		10	RS485
		11	Internal GPS receiver
		12	Active DCF code
P5	Impulse line processing mode	**1**-4	
		1	polarized impulses, synchronization and time adjustment
		2	polarized impulses; time synchronization only
		3	non-polarized impulses, synchronization and time adjustment
		4	non-polarized impulses; time synchronization only
P6	Time zone for MOBALine or Timezone-server MOBATIME	1-20, **0** (off) – for MOBALine synchronization or 1-15, **0** (off) – for NTP synchronization	
P7	Time zone of displayed time and date	0 - 64, **A** (automatically), U* (user time zone) U1-U7 (preconfigured time zone entry by MOBA-NMS)	

P8	Clock address for IR remote control and the serial protocols	1-**99** **0**-31, **L** (listen only) at SI version **0**-15 - at WTD version	
P9	IR controller autolock	1-60, **U** ("automatic lock" is OFF) Time in minutes for "automatic lock" since the last depression of button on the IR unit	
P10	Time format display	**1**-2	
		1	time with leading zero
		2	time without leading zero
P11	Date format display	1-**2**	
		1	date with leading zero
		2	date without leading zero
P12	Temperature format display	**°C**	
		°F	
P13	Protocol for RS232 and RS485 communication	**1** - IF482	
		2 - Supervised RS485	
		3 - DC master	
		4 - DC slave	
		5 - TP RS485 master	
		6 - TP RS485 listener	
		7 - DC2 slave	
		8 - TPHB RS485 master	
		9 - TPHB RS485 listener	
		10 - ITRON2000	
		11 - DC3 slave	
		12 -TPHP RS485 master	
		13 - TPHP RS485 listener	
P14	Modulation speed for RS232 and RS485	1-7	
		1	1 200 Baud
		2	2 400 Baud
		3	4 800 Baud
		4	9 600 Baud
		5	19 200 Baud
		6	38 400 Baud
		7	57 600 Baud
P 15	Transmission parameters for RS232 and RS485	Number of data bits	8
			7
P 16		Number of stop bits	**1**
			2
P 17		Parity	n no parity
			o odd
			E even
P 18	Special operation mode	**0**	normal mode
		1	special mode 1
		2	special mode 2
P19	Network operation mode	1	NTP and PoE: multicast (without IP address) WiFi: initial network MOBA – WIFI, IP address assigned by DHCP
		2*	NTP and PoE: unicast – network param. defined manually WiFi: wireless network defined by user, IP address set manually
		3*	NTP and PoE: unicast – network param. defined by DHCP WiFi: wireless network defined by user, IP address assigned by DHCP

P20	IP address	IP*	edit network parameters in manual setting mode or display parameters assigned by DHCP
P21	Subnet mask	Su*	
P22	Gateway	Gt*	
P23	Multicast addr.	Mc*	setting of multicast group address
P24	Unicast NTP addr	Uc*	setting of NTP unicast server address
SW version		r_._(e.g.: r1.15)	

* possibility to enter the submenu.

Items P19 to P24 available in NTP and WiFi variants only

6 Control of the stopwatch via keyboard

The operation of the stopwatch is controlled and the device is adjusted using three pushbuttons on the connected keyboard. The keyboard cable must be connected to the CTRL plug connector.

Abbreviations used for the key strokes

PB1L, PB2L	pushing of the pushbutton for a period of more than 1 second
PB1S, PB2S, PB3S	short-time pushing of the pushbutton

Function of the pushbuttons in the "Stopwatch" mode

PB2S	indication switch over: time - date - temperature - stopwatch - time
PB2L	stopwatch menu
PB3S, PB1S, PB1L	according to the stopwatch mode setup

6.1 The stopwatch menu

The stopwatch menu is entered by long pushing of the **PB2** pushbutton (stopwatch must be displayed). The parameter adjustment is to be performed according to the menu table (chapter 8).

Function of the pushbuttons in the "Stopwatch Menu" mode

PB1S	move to another menu item
PB1L	storage of the parameters; return to the stopwatch display mode when counting up from zero; or entry into the initial time setting mode when counting down
PB2S	increase of the current value, in steps of 1
PB2L	continuous increase of current value

6.2 Setting of the initial time for counting down

When counting down is selected, the initial time setting mode is entered from the stopwatch MENU or directly from the "Stopwatch" display mode by pushing the **PB1L** button. The item to be set is blinking.
By pushing the **PB2S** button is the adjusted value increased in steps of 1, by pushing the **PB2L** button will be the value continuously increased. By pushing **PB1S** move to the next item. By pushing the **PB1L** save the setting and return to "Stopwatch" display mode.

Enter the data in the following order depending on the item **S2** setting (unit):

Counting unit	Data order
1/100 second	<Minute>:<Second>.<Hundredths of second>
1 second	<Hours>:<Minutes>:<seconds>.
1 minute	<Hours>:<Minutes>
1 day	<Days>

By pushing the **PB1L** button, the entered values are stored and the clock returns to the "Stopwatch" display mode.

7 Control of the stopwatch using IR remote control

A 2-digit address is assigned to the stopwatch. With the IR remote control the stopwatch can be locked. Controlling and the stopwatch parameter adjustment are only allowed in unlocked state.

Function of the pushbuttons in the “Stopwatch“ mode

pushing the F1 button + entry of 2-digit address using numerical pushbuttons	unlocking of a clock with the corresponding address
holding down the **F1** button	unlocking of all clocks within the reach of the IR beam of the remote control
holding down the **F2** button	locking of all clocks within the reach of the IR beam of the remote control
holding down the **F3** button	display of the addresses of all locked clocks within the reach of the IR beam of the remote control
CLOCK	visualisation of time
DATE	visualisation of date
TEMP	visualisation of temperature
TIMER	visualisation of the stopwatch
MENU	entry into stopwatch parameter setup menu
SET	entry into setting initial time of counting down
S/S, HOLD, RES	function depends on the stopwatch operation mode set

7.1 The stopwatch menu

The stopwatch menu is entered by pushing **MENU** button (stopwatch must be displayed). The parameter adjustment is shown in the stopwatch menu table (chapter 8).

Function of the pushbuttons in the “Stopwatch Menu“ operation mode

>>	storing the current value and transition to another menu item
<<	storing the current value and transition to previous menu item
The **+** button	increase of the adjusted value in steps of 1
The **-** button	decrease of the adjusted value in steps of 1
Holding down the **+** button	continuous increase of the item set up
Holding down the **-** button	continuous decrease of the item set up
ESC	return into normal display mode,
OK	storage of the parameters; return into the stopwatch display mode when counting up from zero; or entry into the initial time setting mode when counting down

7.2 Setting of initial time for counting down

When counting down is selected, the initial time setting mode is entered from the stopwatch MENU or directly from the “Stopwatch” display mode by pushing the **PB1L** button. The item to be set is blinking.

Enter data in following order depending on the item **S2** setting (counting unit):

Counting unit	Data order
1/100 second	<Minutes>:<Seconds>.< Hundredths of second >
1 second	<Hours>:<Minutes>:<Seconds>.
1 minute	<Hours>:<Minutes>
1 day	<Days>

By pushing the **OK** button, the entered values are stored and the clock returns to the “Stopwatch” display mode. By pushing **ESC**, the clock returns without storing.

7.3 Switching contact

When counting down mode is applied optional switching contact can be used, which switches at zero-crossing. It is possible to control an external device such as sound devices. There is normally open contact (NO), normally closed contact (NC) and common contact (COM) on the relay port (JP27) available.

8 Stopwatch menu table

Program option	Function	Scope of the values (default values are printed in bold)		
S0	Counting direction	**1** - 4		
		1	upwards	
		2	downwards from a time moment set in advance, with stop at zero	
		3	downwards from a time moment set in advance until zero, with automatic restart from a specified time moment	
		4	downwards from a set time moment, until zero, and keeping the cont into minus value	
S1	Control of intermediate time periods (corresponding keyboard keys are listed in brackets)	**1** – 4		
		1	S/S (PB3S)	Alternating START - STOP -„UNFREEZE“ of DISPLAY (if it was frozen)
			HOLD (PB1S)	“Freezing” of displaying data with the counter proceeding in the counting
			RES (PB1L)	Setting the counter to zero in STOP operation mode, for counting up, and return to a present value in all other counting mode
		2	S/S (TL3K)	Alternating START - STOP -„UNFREEZE“ of DISPLAY (if it was frozen)
			HOLD (PB1S)	The first depression of this button causes the display to freeze on the respective time achieved and lets the counter running. Further activation of the button shows the intermediate time elapsed from the first depression of the button.
			RES (PB1L)	Reset of the counter in the STOP mode while in counting up. Return to a preset value in other counting modes.
		3	S/S (PB3S)	count up from zero, or from a present value in countdown mode. Next activation of the button causes the display to freeze and to resume the count from zero in counting up, or from a preset value in countdown mode.
			HOLD (PB1S)	Unfreezing of the display, leaving the counter to continue in counting
			RES (PB1L)	Counter reset (to zero), or return to a preset time followed with counter stop
		4	S/S (PB3S)	Triggering the counter
			HOLD (PB1S)	Stopping the counter
			RES (PB1L)	Resetting the counter or return to a preset time, with counter stop

S2	Counting unit		**1** - 4
		1	Counting in increments of 1/100 sec. (with 4-digit display the counting goes on until 59.99 sec., and then continues with displaying of minutes : seconds).
		2	Counting in increments of 1 second (with 4-digit display the counting goes on until 59 minutes and 59 seconds; and follows with displaying of hours : minutes).
		3	Counting in 1 minute steps
		4	Counting in periods after one day. A subtraction or an addition always takes place around midnight. Capacity of counting up to 9999 days. When counting is stopped, the dot is displayed after the last digit.
S3	Contact closing		1 – 30, **0** (function disabled)
			Time period of contact closing for stopwatches passing through zero, while operating in countdown mode, starting from a preset time moment.

The stopwatch count range	**Counting direction**			
	Upwards	**Downwards**		
Counting unit Format	**S0: 1 Max.**	**S0: 2;3 Min.**	**S0: 4 Min.**	**S0: 2;3;4 Max.**
1/100 second MM:SS.HS	59:59.99	00:00.00	-9:59.99	59:59.99
1 second HH:MM:SS	99:59:59	00:00:00	-9:59:59	99:59:59
1 minute HH:MM	99:59	00:00	-9:59	99:59
1 day DDDD	9999	0000	0000	9999

9 Local time calculation

9.1 Basic setting – control according to source of synchronization

P3	A	Time zone is taken over according to the source of synchronization
P4	2 – 12, A	Synchronization signal type
P6	0	Neither MOBALine time zone nor Timezone-server are used
P7	A	Display time and date according to source of synchronization incl. daylight saving time

This setting is suitable for digital clocks synchronized by a DCF receiver or controlled by a master clock as slave clock in a time distribution system. The internal time zone table isn't used.

9.2 Calculation using MOBALine time zones

P3	A	Time zone is taken over according to the source of synchronization. The UTC time calculation is based on the MOBALine information.
P4	4	MOBALine
P6	1 - 20	Selection of the MOBALine time zone
P7	A	Display time and date according to chosen MOBALine time zone, incl. daylight saving time

This setting is suitable for digital clocks controlled by a master clock as a MOBALine slave clock in a time distribution system with possibility to display different MOBALine time zones

9.3 Calculation using Timezone-server MOBATIME

P3	A	NTP protocol uses UTC time zone
P4	A	automatic
P6	1 - 15	Selection of the Timezone-server time zone
P7	A	Display time and date according to chosen Timezone-server time zone, incl. daylight saving time

This setting is suitable for NTP digital clocks controlled by MOBATIME NTP servers which support the Timezone-server functionality.

9.4 Calculation using timezone entries preconfigured by MOBA-NMS software

P3	A	NTP protocol uses UTC time zone
P4	A	automatic
P6	0	No timezone server is used
P7	U1-U7	Display time and date according to chosen preconfigured timezone entry, incl. daylight saving time

This setting is suitable for NTP digital clocks, where several user defined timezone entries should be used. The timezone enties are preconfigured by means of the MOBA-NMS software.

9.5 Calculation according to internal time zone table

P3	0 – 64	According to the time zone in which source of synchronization works (e.g. value 2 for DCF in west Europe)
P4	1 – 12, A	Autonomous operation or any type of the synchronizing signal
P6	0	Neither MOBALine time zone nor Timezone-server are used
P7	0 – 64, U	Display time and date by calculation from the UTC time according to chosen time zone, incl. daylight saving time

This setting is suitable for autonomous digital clocks or in cases when the displayed time in another time zone than the one provided by the synchronization source is needed. Displayed time and date calculation is based on the internal time zone table or on the user–specific time zone parameters. See the chapter 15 with actual Time zone definition table.

10 Non-network clock operation

Configure the jumper JP11 according to table (chapter 2.7.) if the source of synchronization is DCF signal, Mobatime serial code, polarized impulse line, MOBALine or IRIG-B. Choose the item **P4** in main MENU (chapter 5) and set the type of synchronization. The auto detection mode (P4:A), when the type of synchronization signal is set automatically, is applicable for DCF signal, Mobatime serial code, MOBALine, IRIG-B and WTD.
The permanently lit colon during the time display signalizes the clock is synchronized by the synchronisation source.

10.1 Autonomous clock synchronized by DCF 77 receiver

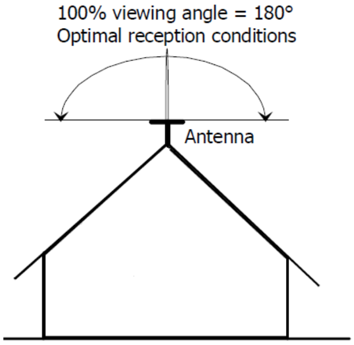
- Set value **A** in items **P3**, **P4** and **P7** in the main MENU (chapter 5).
- Connect the DCF 77 receiver to the LINES connector (IN+, IN- terminals) using a twin-wire cable.
- The maximum wire length depends on its diameter (app.100 - 300 m).
- In case the connection is correct and the input signal is at high level, the LED on the receiver is flashing periodically once a second, with 1 pulse left out at the 59th second.
- In case the polarity is incorrect, the LED does not flash. In such a case, interchange the two wires.
- Install the receiver at a place with high-level radio signal. Don't install the receiver near sources of interfering signals, such as the personal computers, TV sets or other types of power consumers (the digital clock itself generates interfering signals too).
- Position the receiver with its transparent cover (DCF 450) or the arrow on the cover (DCF 4500) facing the transmitter (located in Frankfurt, Germany). Presuming the good quality DCF 77 signal the synchronisation takes place in approx. 3 to 4 minutes. In case of poor quality of the signal (mainly during the day time) the first time setting is to be done manually. The red LED of the receiver displays a working connection by flashing once a second without flickering.

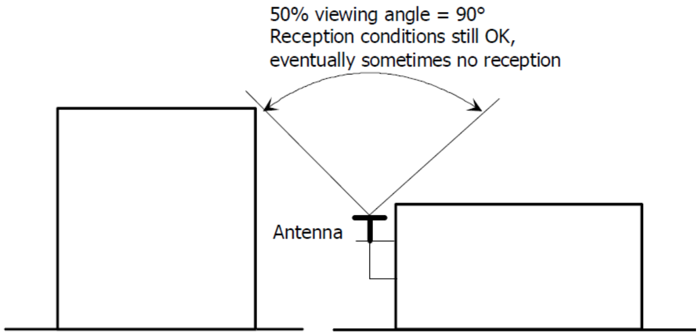
10.2 Autonomous clock synchronized by GPS4500 receiver

- Set value **A** in items **P3**, **P4** and the desired time-zone in the **P7** item in the main MENU (chapter 5).
- Using jumper JP17 set the power supply output (DC OUT) on pins 3, 4 of the JP1 connector.
- Connect GPS receiver to the LINES connector (IN+, IN- terminals for the signal and P3+, P4- terminals for antenna powering) using a four-wire cable. Please note the correct polarity of the wires – see the GPS user manual.
- For the correct placing of the receiver please follow the GPS user manual.
- Presuming the good position of the GPS receiver the synchronisation takes place in approx.10 to 20 minutes.

10.3 Autonomous clock synchronized by internal GPS receiver

- Set value **A** in items **P3** and **P4** and the desired time-zone in the **P7** item in the main MENU (chapter 5).
- Connect the GPS antenna cable to dedicated SMA connector.
- Place the GPS antenna according to following recommendation





- Presuming the good position of the GPS antenna the synchronisation takes place in approx. 6 to 8 minutes.
- Reception of the GPS data is indicated by blinking GPS LED on the PCB.

10.4 Slave clock controlled by synchronizing impulses

On digital clock connected in time distribution system controlled by synchronizing impulses choose the item **P4** in the main menu and set it according type impulse lines (one minute, half minute, second pulses) and in item **P5** choose mode of processing impulse line (polarized / unpolarized impulses, synchronization and time setting / synchronization only). Set the value **A** in items **P3** and **P7**.

10.4.1 Synchronization and time setting – P5 mode 1 and 3

Clocks are set according to the slave line time on the Master clock.

- Stop the slave line on Master clock.
- Set all slave clocks on the same time. Set the current date on the digital clock. The clocks stand still and the colon flashes in 2 second interval.
- Set the time of the slave line to the same time as on slave clocks.
- Run the slave line on Master clock.
- After receiving each impulse is displayed time increased by one minute (or by 30 seconds or 1 second respectively)
- After the expiration of run-out time the slave clocks are synchronized by the time information generated by the master clock, the colon flashes constantly.
- In case of the line fault the clock displays the right time information based on its own quartz time base. When the normal operation of the line resumes, the slave clock adjusts itself to the time equal to the master clock.

10.4.2 Synchronization only – P5 mode 2 and 4

The clock time-base is synchronized by incoming pulses in normal operation of the slave line.

- Set current date and time on the slave clocks according the master clock time with accuracy of ±30 seconds (or ±15 seconds, or ±0,5 second respectively).
- The colon flashes in 2 second interval.
- After 2-3 minutes are the clocks synchronized with the master clock. The colon is permanently lit during the time display.
- In case of the line fault the clock displays the right time information based on its own quartz time base. When the normal operation of the line resumes, the clock synchronizes with the incoming pulses.

10.5 Slave clock controlled by MOBATIME serial code, MOBALine, Active DCF code or IRIG-B

- After the connection of the digital clock to the signal source, time and date are adjusted automatically, following the receipt of valid time information.
- In case of Active DCF code set the menu item **P4** to value **12**, otherwise use the value **A**.
- The time setting with using the MOBATIME serial code or Active DCF code takes place within at least 3 to 4 minutes, for MOBALine and IRIG-B within 6 to 15 seconds.

10.6 Slave clock controlled by IF482 over RS232 or RS485

- After the connection of the digital clock to the line, time and date are adjusted automatically, following the receipt of valid time information.
- Synchronisation takes place within at least 5 minutes.

10.7 Slave clock controlled by supervised RS485

Supervised RS485 line available on the DTS.480x timeservers offers exact time synchronization as well as monitoring the correct function of connected slave clocks.

- If the DC clock should be monitored set in menu item **P8** unique address in the range 1 to 32. The value "L" means that the clocks are synchronized only (without monitoring).
- It is necessary to register the clock under the used address in DTS.
- The time synchronization starts within a few tens of seconds after start-up.
- Failure of slave clock function is signalized by an alarm in DTS.
- On the RS485 line you can use the jumper TRE - JP10 to connect the termination resistor 120R between the signals A and B for the correct termination of RS485.

10.8 Cascaded connection of the DCF/GPS synchronised clock

- Connect the DCF 77 receiver to the LINES connector (IN+, IN- terminals) using a twin-wire cable.
- Set the passive DCF OUT output 3, 4 of the JP1 connector using the jumper JP17.
- When using the GPS receiver, the external power supply is needed - parameters 12-24 VDC – min. 5VA.
- Interconnect the cascaded clock using a twin-wire cable from the LINES connector (P3+, P4- terminals) to the LINES connector (IN+, IN- terminals) of the next clock.
- In case the connection is correct and the input signal is at a high level, the LED on the receiver and the green LED in the clock is flashing periodically once a second, with 1 pulse left out at the 59th second.

10.9 Synchronization in WTD system

- The items **P3, P4** and **P7** are set to value **A** by the production.
- Set the **P8** item to the address of the WTD-T transmitter.

- The colon is permanently lit after successful signal receiving from WTD-T transmitter.

10.10 Connecting the slave displays through RS485

The clock equipped with the SI interface allows connecting up to 32 slave displays, which show the same information as the main display. The RS485 (JP5) interface is used for the connection. Two signals (A, B) and the ground connection GND (from the JP4) are used. For the signals A and B it is recommended to use the twisted pair (pay attention for the same polarity by all displays), another twisted pair is used for the GND connection.

If the overall length of the RS485 bus is longer than ca 500m, enabling the TRE – JP10 is recommended in the last clock.

- In the clock serving as the master display, set the **P13** to value **3** (DC master)
- In the slave displays set the **P13** to value **4** (DC slave)
- Items **P14** – **P17** are set automatically to 9600 baud, 8 bits, even parity, 1 stop-bit.

In case of communication problems it is possible to lower the communication speed. The modification of the items **P14-P17** is necessary to proceed in all connected displays identically.

11 NTP clock operation

11.1 Unicast mode

The clock is synchronized to UTC (Universal Time Coordinated) from a NTP server (up to four NTP server IP addresses configurable) and must have assigned its own IP address.The clock requests in defined intervals the actual time from the NTP server. If the server is not available, the clock tries to contact the other defined servers in cyclic way until the valid response from the NTP server is received.

This operating mode supports the monitoring and configuration of the movement via the network connection by means of the Telnet, SNMP or the MOBA-NMS software tool. For supervision and configuration with MOBA-NMS the clock's IP address can be used or the multicast group address having last octet cleared to zero (presuming the multicast is not disabled).

It is necessary to set apropriate time-zone for correct displaying of local time and date – see the chapter 9 for details.

Default network parameters:

IP address	0.0.0.0
subnet mask	0.0.0.0
default gateway	0.0.0.0
NTP server address 1	0.0.0.0
NTP server address 2	0.0.0.0
NTP server address 3	0.0.0.0
NTP server address 4	0.0.0.0
NTP request time [s]	10
DNS server	0.0.0.0
SNMP manager 1	0.0.0.0
SNMP manager 2	0.0.0.0
multicast config address	239.192.54.0
alive notification interval [min]	30
configuration port number	65532
time zone client port number	65534
DHCP	enabled
SNMP	enabled
Multicast support	enabled
Telnet	enabled

11.1.1 Network parameters assignation by DHCP

The menu item **P19** must be set to value **3** (default). Network parameters are automatically obtained from a DHCP server.
The following DHCP options will be evaluated automatically:
[50] IP address
[3] Gateway address
[1] Subnet mask
[42] List with up to four NTP server addresses
[42] Time zone server address (usually same as NTP server address)
[234] SNMP manager address
[43] or [224] Additional options (refer to document BE-800793)
The network administrator must configure the DHCP options accordingly.
Assigned parameters can be checked in the submenu of items **P20** to **P22**.

11.1.2 Manual setting through setup menu

The menu item **P19** must be set to value **2**.

- See chapter 4.2.4 for setting the clock's IP address in the item **P20** submenu
- See chapter 4.2.5 for setting the subnet mask in the item **P21** submenu
- See chapter 4.2.6 for setting the gateway in the item **P22** submenu
- See chapter 4.2.7 for setting the multicast group address in the item **P23** submenu

11.1.3 See chapter 4.2.8 for setting the unicast NTP server address in the item **P24** submenu. Manual setting through telnet

The menu item **P19** must be set to value **1** or **2**. To establish the first connection through telnet, the following procedure is needed because the initial IP address of the clock is 0.0.0.0:

- assign a new IP address to the clock's MAC address (marked on the product label) by windows command **arp -s <IP address> <MAC address>**

  example: arp -s 192.168.0.190 00-16-91-FE-90-00
- reset the clock or power-cycle it and do the following within 2 minutes
- the IP address is temporarily matched to the clock (only valid when the current IP address is 0.0.0.0) by windows command **ping <IP address>** , the clock should answer the two last ECHO requests at least

  example: ping 192.168.0.190
- do the following within 30 seconds after the ping

  connect to the clock and make the needed settings (see lower) by windows command **telnet <IP address>** or use the Hyperterminal application

Setting parameters over telnet:

- request for entering the password appears after connection (default password is 718084)
- the information about software and hardware version followed by the MAC address is displayed after entering the correct password
- inserted commands must be confirmed by pushing the Enter key, use the Backspace key for correcting typing errors
- command **help** or **?** displays help with a command list
- command **reset** resets the clock (changes are written to Flash)
- command **conf -p** displays current parameters from setup menu
- command **conf –n** displays current network parameters
- command **conf -?** displays help for command conf parameters

  example: conf -i 192.168.0.190 sets the clock's IP address to 192.168.0.190
- it is necessary to end telnet connection by command **exit**

  Windows 7 note: The telnet is not activated in Windows 7 by default. For activating it go to the "Control Panel" in "Start menu", click on "Uninstall a program (link)" in "Control Panel", click on "Turn Windows features on or off (link)" in "Programs and Features", click in "Windows Features" box and find the "Telnet Client" check box. Allow the system to install the appropriate files – should take only a few seconds. The administrator rights are necessary for this operation.Hyperterminal note: The Hyperterminal application can be used as an alternative to telnet. It is necessary to activate the "Send line ends with line feeds" and "Echo typed characters locally" in the Properties -> Settings -> ASCII setup window.

11.1.4 SNMP

The DSC clock supports SNMP version 2c notifications and parameter reading and setting by means of SNMP GET and SET commands. This allows to integrate the clock to a network management system. The DSC clock (SNMP agent) can send alarm notifications and alive notifications to a SNMP manager. The IP address of the SNMP manager can be provided to the clock by DHCP, Telnet, SNMP or the MOBA-NMS. The structure of supported parameters is defined in a MIB file (refer to document TE-800728 for details). In addition the clock supports the “system” node parameters defined by MIB-2 (RFC-1213)
Alarm notifications are asynchronous messages and are used to inform the manager about the appearance / disappearance of alarms.
Alive notifications are sent out periodically to report availability and state of the clock. The interval time can be configured.

SNMP community strings:

read community	romobatime
read / write community	rwmobatime
notification (trap) community	trapmobatime

11.2 Multicast mode

The clock is synchronized to UTC (Universal Time Coordinated) from a NTP server. The clock receives NTP multicast packets transmitted by the NTP server in a specified time cycle. This type of synchronization requires no clock’s own IP address and is therefore suitable for an easy commissioning of the large systems of slave clocks. Further this mode supports monitoring and parameter configuration by means of MOBA-NMS software.

For supervision and configuration with MOBA-NMS the multicast group address can be used or the multicast group address having last octet cleared to zero. The Multicast operating mode signifies only a minimum amount of configuration work for a network administrator.

It is necessary to set apropriate time-zone for correct displaying of local time and date – see the chapter 9 for details.

Default network parameters:

multicast group address	239.192.54.1
multicast config address	239.192.54.0
configuration port number	65532
time zone client port number	65534

The menu item **P19** must be set to value **1**. See chapter 4.2.7 for setting the multicast group address in the item **P23** submenu.

12 WiFi clock operation

In the item **P19,** choose if the clock will be connected to default wireless network MOBA-WIFI, where network parameters (IP address, subnet mask and gateway) will be set automatically (DHCP), or to wireless network set by user via telnet, where network parameters could be set manually (telnet, clock menu) or automatically (DHCP). If the DHCP is used, the parameters assigned by the server can be checked in the items **P20** to **P22** submenus.

12.1 Parameters of default wireless network

Net name (SSID):	**MOBA-WIFI**
Used coding:	**WPA**
Coding key:	**hgfedcba**
DHCP:	**allowed**

12.2 Setting process

- set WiFi router to parameters of default wireless network
- in the item **P20** submenus display assign IP address
- by windows command **telnet <IP address>** connect to the clock and make needed setting (see lower)

  example: telnet 192.168.0.190

Setting the network parameters using telnet

- it is necessary to push ENTER key after connection
- the request for the password appears (initial password is 718084)
- the software and hardware version displays if password entering was successful
- inserted commands can be send off using Enter key, the Backspace key serves for correction of the typing errors
- command **help** or **?** displays help with command's list
- command **reset** makes clock reset (setting modifications are written to data flash)
- command **conf –p** displays current setting of the menu parameters
- command **conf –n** displays current network parameters, MAC address and wireless network parameters
- command **conf –?** displays help for command conf parameters
- it is necessary to end telnet by command **exit**
- After expiration of two minutes timeout after telnet ending there is another two minute period, when the telnet is not functional. The clock is then performing the NTP time synchronisation. This period also takes place at the beginning of every hour.

Example of setting network parameters using telnet:

- command **conf –l mobatime** set network name of new wireless network
- command **conf –w 4** set version of used coding on WPA2 for new wireless network

- command **conf –d abcdefg** set the security key for new wireless network
- command **conf –u 192.168.0.130** set IP address of NTP server on 192.168.0.130
- command **conf –p19:02** set the clock for connecting to the new initiated wireless network with manually preset network parameters
- command **conf –i 192.168.0.190** set clock IP address to 192.168.0.190
- command **conf –s 255.255.255.0** set subnet mask of the clock on 255.255.255.0
- command **conf –g 192.168.0.254** set gateway of the clock on 192.168.0.254
- command **exit** ends telnet and writes changes into Flash

13 Testing mode, parameter reset

13.1 Synchronisation test

The synchronisation signal receive process can be displayed in special testing mode. This can be useful for example when the problems with the DCF signal receipt appear.

Display description during synchronisation test mode:
Two digits on the left side show the current DCF bit number (goes up from 0 to 58). Third digit show the type of current DCF bit (0 or 1). The last digit shows the number of successfully received DCF telegrams. The colon indicates that the DCF bit is currently received. The dot behind the last digit signalizes synchronised clock.

Entering the synchronisation test mode:

- Enter the clock menu, move to the software version item by several pushes of the **PB1S** on the control PCB or **>>** on IR**.**
- Keep pushing both buttons on control PCB simultaneously or button **DISP** on IR until the display shows **C0:00**
- Use the **PB2** or **+** button on IR to set the value behind the colon to **03**
- Keep pushing simultaneously both clock PCB buttons or the **DISP** button on IR, until the display shows synchronisation information

13.2 Parameter reset

If necessary, the clock parameters can be set to factory defaults by the following procedure.

Activating the parameter reset:

- Enter the clock menu, move to the software version item by several pushes of the **PB1S** on the control PCB or **>>** on IR**.**
- Keep pushing both buttons on control PCB simultaneously or button **DISP** on IR until the display shows **C0:00**
- Using the **PB2** or **+** button on IR set the value behind the colon to **04**
- Keep pushing simultaneously both clock PCB buttons or the DISP button on IR, until the display shows FAC1 and clock makes reset

14 Update firmware

14.1 Update firmware using RS232

- Switch-off the clock.
- Install and run the Flash Magic software.
- Open the configuration file „LPC2366 dc3.fms“ over the File -> Open Settings menu
- Set used COM Port and open file firmware „DSC_<version>.hex“ (e.g. DSC_NTP_POE_v349.hex) using the Browse key
- Connect the programmer to serial COM Port of computer (the USB-RS232 converter can be used) and connect the power supply to the jack on the programmer.
- Install the jumper ISPE (JP9).
- Connect the programmer to connector PROG (JP8), LED POWER placed on the clock lights up.
- Click the Start button to run programming, after completion a “Finished” message will be displayed in the bottom part of the widow
- Disconnect the programmer and remove the ISPE jumper.
- Firmware version can be checked in the last item of clock menu.

14.2 Update firmware over Ethernet at NTP version

- Create a folder on the computer disk and copy "tftpd32.ini", "tftpd32.chm" and "tftpd32.exe" in it. Copy the file of new firmware "dc3app.bin" as well.
- Run "tftpd32.exe" let only TFTP Server in the window Settings -> Global Settings set, don’t change other settings.
- By the Browse key open choice of active directory and find the one which contains the given firmware
- Connect to the clock by the windows command **telnet <ip clock address>**
  example: telnet 192.168.0.190
- The page of telnet requesting will appear, after the password entered identification of current software version and clock MAC address displays.
- Enter the command **fu** in telnet window for start the automatic update clock firmware from the "dc3app.bin" file.
- Information about sending file and its progress displays in the tftpd32 programme window after the command entering. Connection to telnet is ended automatically.
- Wait about 1 minute after end of sending. Connect the telnet to clock again.
- After entering the password, check if the firmware version is correct, if it isn’t, it is necessary to repeat the whole procedure.
- Close the telnet window and end the program tftpd32 with the command **exit**.

15 Time zone table

Time zone entries in the standard season table (version 10.1).

Time zone	City / State	UTC Offset	DST Change	Standard → DST	DST → Standard
00	UTC (GMT), Monrovia, Casablanca	0	No		
01	London, Dublin, Edinburgh, Lisbon	0	Yes	Last Sun. Mar. (01:00)	Last Sun. Oct. (02:00)
02	Brussels, Amsterdam, Berlin, Bern, Copenhagen, Madrid, Oslo, Paris, Rome, Stockholm, Vienna, Belgrade, Bratislava, Budapest, Ljubljana, Prague, Sarajevo, Warsaw, Zagreb	+1	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
03	Athens, Istanbul, Helsinki, Riga, Tallinn, Sofia, Vilnius	+2	Yes	Last Sun. Mar. (03:00)	Last Sun. Oct. (04:00)
04	Bucharest, Romania	+2	Yes	Last Sun. Mar. (03:00)	Last Sun. Oct. (04:00)
05	Pretoria, Harare, Kaliningrad	+2	No		
06	Amman	+2	Yes	Last Thu. Mar. (23:59)	Last Fri. Oct. (01:00)
07	UTC (GMT)	0	No		
08	Kuwait City, Minsk, Moscow, St. Petersburg, Volgograd	+3	No		
09	Praia, Cape Verde	-1	No		
10	UTC (GMT)	0	No		
11	Abu Dhabi, Muscat, Tbilisi, Samara	+4	No		
12	Kabul	+4.5	No		
13	Adamstown (Pitcairn Is.)	-8	No		
14	Tashkent, Islamabad, Karachi, Yekaterinburg	+5	No		
15	Mumbai, Calcutta, Madras, New Delhi, Colombo	+5.5	No		
16	Astana, Thimphu, Dhaka, Novosibirsk	+6	No		
17	Bangkok, Hanoi, Jakarta, Krasnoyarsk	+7	No		
18	Beijing, Chongqing, Hong kong, Singapore, Taipei, Urumqi, Irkutsk	+8	No		
19	Tokyo, Osaka, Sapporo, Seoul, Yakutsk	+9	No		
20	Gambier Island	-9	No		
21	South Australia: Adelaide	+9.5	Yes	1st Sun. Oct (02:00)	1st Sun. Apr. (03:00)
22	Northern Territory: Darwin	+9.5	No		
23	Brisbane, Guam, Port Moresby, Magadan, Vladivostok	+10	No		

24	Sydney, Canberra, Melbourne, Tasmania: Hobart	+10	Yes	1st Sun. Oct. (02.00)	1st Sun. Apr. (03:00)
25	UTC (GMT)	0	No		
26	UTC (GMT)	0	No		
27	Honiara (Solomon Is.), Noumea (New Caledonia),	+11	No		
28	Auckland, Wellington	+12	Yes	Last Sun. Sep. (02:00)	1st Sun. Apr. (03:00)
29	Majuro (Marshall Is.), , Anadyr	+12	No		
30	Azores	-1	Yes	Last Sun. Mar. (00:00)	Last Sun. Oct. (01:00)
31	Middle Atlantic	-2	No		
32	Brasilia	-3	Yes	3rd Sun. Oct. (00:00)	3rd Sun. Feb. (00:00)
33	Buenos Aires, Santiago	-3	No		
34	Newfoundland, Labrador	-3.5	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
35	Atlantic Time (Canada)	-4	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
36	La Paz	-4	No		
37	Bogota, Lima, Quito, Easter Island, Chile	-5	No		
38	New York, Eastern Time (US & Canada)	-5	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
39	Chicago, Central Time (US & Canada)	-6	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
40	Tegucigalpa, Honduras	-6	No		
41	Phoenix, Arizona	-7	No		
42	Denver, Mountain Time	-7	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
43	Los Angeles, Pacific Time	-8	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
44	Anchorage, Alaska (US)	-9	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
45	Honolulu, Hawaii (US)	-10	No		
46	Midway Islands (US)	-11	No		
47	Mexico City, Mexico	-6	Yes	1st Sun. Apr. (02:00)	Last Sun. Oct. (02:00)
48	Adak (Aleutian Is.)	-10	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
49	UTC (GMT)	0	No		
50	UTC (GMT)	0	No		
51	UTC (GMT)	0	No		
52	UTC (GMT)	0	No		
53	UTC (GMT)	0	No		
54	Scoresbysund, Greenland	-1	Yes	Last Sun. Mar. (00:00)	Last Sun. Oct. (01:00)
55	Nuuk, Qaanaaq,Greenland	-3	Yes	Last Sat. Mar. (22:00)	Last Sat. Oct. (23:00)
56	Qaanaaq, Greenland	-4	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
57	Western Australia: Perth	+8	No		
58	Caracas	-4.5	No		
59	CET standard time	+1	No		
60	Santiago, Chile	-4	Yes	2nd Sun. Oct. (00:00)	2nd Sun. Mar. (00:00)

61	Chile, Easter Island	-6	Yes	2nd Sat. Oct. (22:00)	2nd Sat. Mar. (22:00)
62	Baku	+4	Yes	Last Sun. Mar. (04:00)	Last Sun. Oct. (05:00)
63	UTC (GMT)	0	No		
64	UTC (GMT)	0	No		

In countries where the DST switch date changes annually (e.g. Iran, Israel), the time zone has to be defined manually in the user time zone table (entries 80 – 99).

Legend:

UTC:	Universal Time Coordinate, equivalent to GMT
DST:	Daylight Saving Time
DST Change:	Daylight Saving Time changeover
Standard → DST:	Time change from Standard time (Winter time) to Summer time
DST → Standard:	Time change from Summer time to Standard time (Winter time)

Example:

2nd last Sun. Mar. (02:00) Switch over on the penultimate Sunday in March at 02.00 hours local time.

16 Engineering data

16.1 Standard design of the clock

Specifications		DSC.100.4	DSC.100x.6	DSC.180.4	DSC.180x.6	DSC.250.4	DSC.250x.6	DSC.320.4	DSC.320x.6	DSC.500.4	DSC.500x.6
Display	digit height [mm]	100	100	180	180	250	250	320	320	500	500
	number of digits	4	6	4	6	4	6	4	6	4	6
Time display format	HH : MM	✓		✓		✓		✓		✓	
	HH : MM : SS		✓		✓		✓		✓		✓
Date display format	DD. MM.	✓		✓		✓		✓		✓	
	DD. MM. YY		✓		✓		✓		✓		✓
Powering	100-240V~, 50-60 Hz	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	24 V= ± 20%	on request									
Power consumption [VA]	single-sided	20	30	30	40	45	65	70	100	70	100
	double-sided	40	60	60	80	90	130	140	200	140	200
Timekeeping in ambient temperature -25 ÷ +60 °C	running reserve	6 years									
	accuracy without synchronization	±0,3 sec/day									
Accuracy of temp. measurement	range -25 ÷ +80 °C	±0,5 °C									
	range -50 ÷ +125 °C	±2,0 °C									
Environment	temperature	-25 ÷ +60 °C									
	humidity	0 - 95% (without condensation)									
	protection degree	IP 65									
Weight [kg]	single-sided N.N version	6	8	10	13,5	17	24,5	21,5	30,5	52,5	75
	single-sided N.S version	8,5	11,5	14	19,5	24	32	30,5	42	75	98
	single-sided N.B version	8,5	12	14,5	19,5	24	32,5	31	42,5	75,5	98,5
	double-sided D.S version	13,5	19	23	31,5	39,5	54	50,5	69,5	122	164,5
	double-sided D.B version	13,5	19	23,5	31,5	40	54,5	50,5	70	122,5	165
Dimensions [mm] (W x H x D)	single-sided N.N version	530x191 x 85	750x191 x 85	840x260 x 85	1220x260 x 85	1250x350 x 85	1740x350 x 90	1410x410 x 90	2090x410 x 90	2200x640 x 105	3250x640 x 105
	single-sided N.S version	530x300 x 100	750x300 x 100	840x360 x 100	1220x360 x 100	1250x450 x 100	1740x450 x 105	1410x510 x 105	2090x510 x 115	2200x790 x 115	3250x790 x 115
	single-sided N.B version	580x191 x 100	800x191 x 100	900x260 x 100	1280x260 x 100	1320x350 x 100	1810x350 x 105	1490x410 x 105	2170x410 x 115	2300x640 x 115	3350x640 x 115
	double-sided D.S version	530x300 x 165	750x300 x 165	840x360 x 165	1220x360 x 165	1250x450 x 165	1740x450 x 170	1410x510 x 170	2090x510 x 180	2200x790 x 180	3250x790 x 180
	double-sided D.B version	580x191 x 165	800x191 x 165	900x260 x 165	1280x260 x 165	1320x350 x 165	1810x350 x 170	1490x410 x 170	2170x410 x 180	2300x640 x 180	3350x640 x 180

Note:

- dimensions of clock versions N.S and D.S are including ceiling suspensions 100 mm height (for model DSC.500.N.S and DSC.500.D.S 150 mm height)
- dimensions of clock versions N.B and D.B are including standard wall bracket
- weights of clock versions N.S, N.B, D.S and D.B are including standard ceiling suspensions or wall bracket

16.2 Voltage range and electric current consumption of the lines

Type of slave line	Voltage range	Electric current consumption
MOBALine	5 – 30 VAC	6 – 34 uA
MIN, CODE	+- 12 – 30 V	10 – 18 mA
MIN, CODE (on request)	+- 30 – 60 V	10 – 18 mA
IRIG B	20 mVpp – 2 Vpp	20 uA – 2 mA

17 Accessories

17.1 Single sided clock

• Instruction manual	1 pc
• IR remote control unit	1 pc
• Wood screws for fixing the console inclusive dowels	4 (6) pcs

17.2 Double side clock

• Instruction manual	1 pc
• IR remote control unit	1 pc
• Wood screws for fixing the suspension including dowels	4 (8) pcs

17.3 Optional accessories

- AD 450 radiosignal receiver
- AD 10 radiosignal receiver (high selectivity)
- GPS 4500 receiver
- magnetic GPS antenna for internal GPS receiver with cable 5m
- TP 3m - temperature sensor, IP 66, with cable 3 m
- TP 30m - temperature sensor, IP 66, with cable 30 m
- TP RS485 - temperature sensor with RS 485 interface, power supply 12 VDC, without cable (max. length 1200m)
- TP LAN - temperature sensor with Ethernet interface, power supply 5 VDC, cable between sensor and interface 3 m
- SK - keyboard for stopwatch control, cable 5 m
- REL - internal relay

18 Cleaning

Clean surface of clock only. Use soft rags and antistatic detergents. Don't use synthetics.

19 Disposal of used batteries

The user is lawfully obligated to return unusable batteries. Disposal of used batteries through household waste is prohibited! Batteries which contain dangerous substances are labelled with a picture of a crossed out trash bin. The symbol means that this product may not be disposed through household waste. Below the symbol, the dangerous substance is indicated with an abbreviation: Cd = Cadmium, Hg = Quicksilver, Pb = Lead. Unusable batteries can be returned free of charge at appropriate collection points of your waste disposal company or at shops that sell batteries. By doing so, you fulfil your legal responsibilities and help protect the environment.

20 Guarantee and maintenance

- The device is intended for a normal operational environment according to the corresponding norm.
- The following circumstances are excluded from the guarantee:
  - inappropriate handling or interventions
  - chemical influences
  - mechanical defects
  - external environmental influences (natural catastrophes)
- Repairs during and after the guarantee period are assured by the manufacturer.

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