INSTRUCTION MANUAL

Time / Temperature display DT Series

Certification of the Producer

STANDARDS

The digital clock DT has been developed and produced in accordance with the EU Standards 2004 / 108 / EG and 2006 / 95 / EG:
Applied Standards:
mod IEC 60950-1:2005 + IEC-1:2005/Cor.1:2006-08
EN 55022:1998,+A1:2000,+A2:2003,+Cor.2:2003, class B
EN 61000-3-2:2000
EN 61000-3-3:1995, Cor. 1:1997, A1:2001 $C \in$
EN 61000-6-2:2001
EN 50121-4:2000

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.
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Table of contents

1   Description

General-purpose digital display may show up time (alternating the date) and up to three temperatures (depending on model). It is intended for outdoor and indoor use. Display will find use in out- and indoor swimming pools, ski resorts, industrial areas, spas, hospitals, public buildings etc.

1.1   Basic properties

- digit height of 100/57, 100 and 180 mm, which corresponds to readability distance of 40/25, 40 and 70 m;
- digits in red, pure green, blue, white or amber color;
- different colors for each colon possible;
- manual or automatic adjustment of the luminosity of LED displays;
- antiglare front side glass with dark filter 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, or construction with openable front glass for easy installation procedure;
- clock frame made of powder coated aluminum profiles, RAL7040 color (light grey) as standard, any other RAL color on request;
- IR remote for easy access to all functions and display configuration;
- 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;
- NTP multicast or unicast synchronization in Ethernet network;
- mains powered 100-240VAC; DC powering on request;
- protection degree IP 65;

The display
- display of time values (either 12 or 24 hours time cycle), four-digit (HH:MM) format;
- possibility of leading zero suppression when displaying the time and date;
- display of temperature in °C or °F – up to three sensors connectable;
- different types of temperature sensors can be combined

Accessories
- DCF 77 signal receiver
- GPS receiver
- temperature sensors with various interface types
- remote IR controller for clock set up

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 display with digit sizes of up to 100mm

- assemble the wall mounting console if delivered disassembled;
- drill appropriate number of anchoring holes in the wall for 6 mm dia wood 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 the 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 apropriate force to not to damage the cables insulation;
- configure the Line type jumper according to used synchronization 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 display with digit sizes of 180mm

- drill appropriate number of anchoring holes into the wall, of a diameter adequate to accommodate supplied screws. As a template for marking the position of the holes use the mounting bar.
- mount the hanging bar to the wall using appropriate screws.
- prepare the cables and fix them on the wall in order to be placed behind the small rectangular cover equipped with sealed gap for the cables.
- hang the display onto the bar in order to fit the two (three) hanging screws into the pear-shaped holes.
- loosen the hexagonal screws in two bottom corners and open the front window, the gas struts help to keep the front window opened.
- tighten the two (three) hanging screws using the allen key, the display is then fixed on the hanging bar.
- dismount the rectangular cover, drag the cables in and pull them inside.
- 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 apropriate force to not to damage the cables insulation;
- configure the Line type jumper according to used synchronization signal (applies only for DCF, MOBALine, Serial MOBATIME code, polarized impulse line or IRIG-B);
- mount back the connector cover;
- close the front window and mount back the hexagonal screws into both bottom corners – use the adequate force for fastening the screws.
- click-on delivered corner covers, they can be dismounted using narrow screwdriver.

2.3   Double-sided display

- the double-side display consists of the displaying and the control part, and the central mounting console;
- assemble the mounting console if delivered disassembled;
- drill appropriate number of anchoring holes in the wall for 10 mm dia wood screws, use the mounting console as a template;
- mount the console on the wall;
- hang the displaying part on one side of the console, this display part does not incorporate a cover of connectors, and is linked with the control part via cable;
- the remaining installation steps are the same as with the single-sided display, additionally it is necessary to connect the linking cable from the displaying part to mating connector in the control part

2.4 Mechanical drawings

DT.100/57.1C.2T

Luft T°

Wasser T°

446

500

DT.100.1C.3T

DT.100.1C.2T

670

DT.100.1C.1T

°C

360

530

°C

°C

515

530

°C

°C

°C

530

DT.180.1C.3T

DT.180.1C.2T

1090

DT.180.1C.1T

°C

560

940

1
°C

2
°C

830

940

°C

°C

°C

940
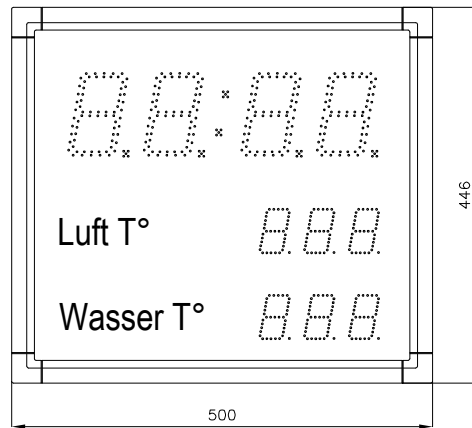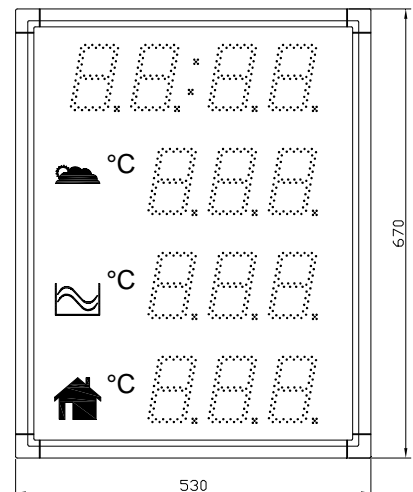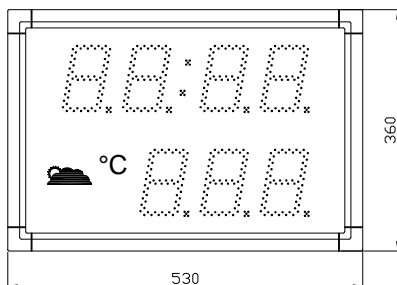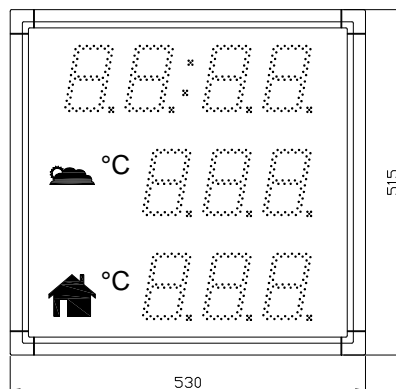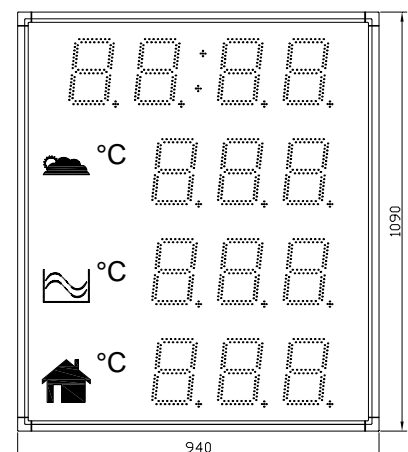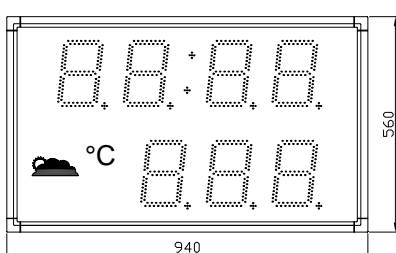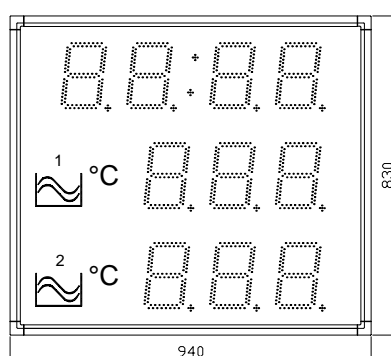
2.5 Connectors and control elements
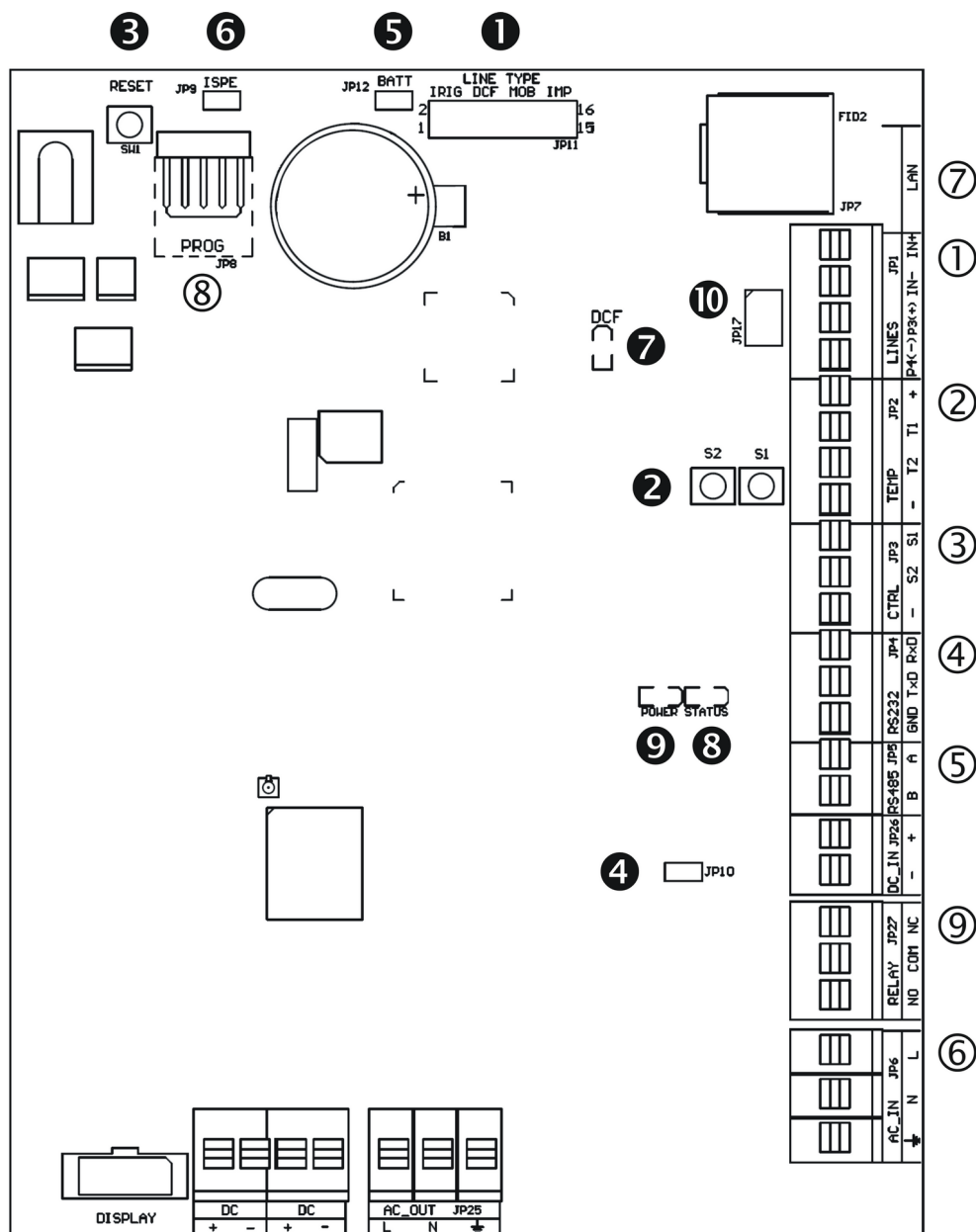
① LINES, DC/DCF OUT – JP1
② TEMP – JP2
③ CTRL – JP3
④ RS232 – JP4 (version SI)
⑤ RS485 – JP5 (version SI)
⑥ 100 – 240VAC – JP6
⑦ LAN - JP7 (version NTP)
⑧ PROG – JP8
⑨ RELAY – JP27 (optional)

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

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
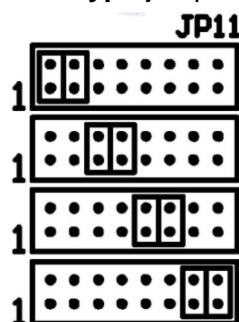
IRIG / AFNOR

DCF

MOBALine

(Un)polarized impulse line
MOBATIME serial code

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 = (-)
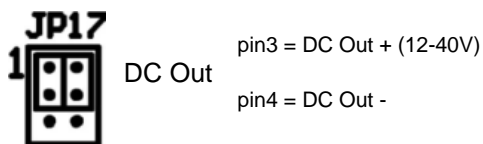
2.8 TP3, TP30 temperature sensors connection

- both temperature sensor types are connected to the JP2 connector terminals using three wires (see the illustration)
- it is possible to connect up to two temperature sensors to single display device, other displays can't be connected to the sensor(s)
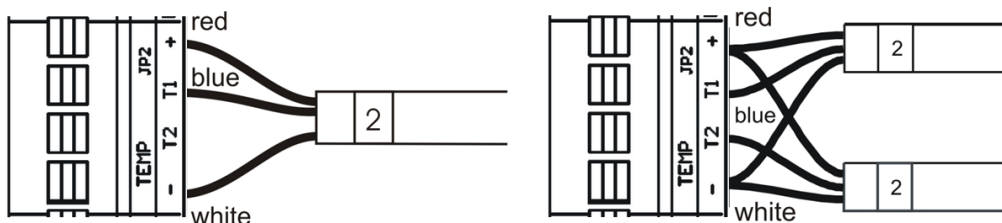
2.9 TP RS485 temperature sensors connection

- the RS485 bus is used for connection of this type of temperature sensors, there can be up to three temperature sensors connected to the bus
- moreover more display units can be connected to the bus, the only limitation is the maximum of 32 devices connected to single bus and total length of the bus of max. 1200m
- the connection is done using six-core twisted pair cable (UTP or STP)
- one of the twisted pairs is used for data transmission, the others are for temperature sensor powering (see the illustration)
- using one twisted pair interconnect the pin 1 (+) of the JP24 in the display and the + terminal on the sensor, use second twisted pair and interconnect the pin 2 (-) of the JP24 connector in the clock and the – terminal on the sensor
- interconnect the pins A and B of the JP5 connector in the clock, and terminals Tx+ and Tx- on the thermometer using one twisted pair. The A signal corresponds to Tx+ and the B corresponds to Tx-.
- in case you need to connect other display device, only the A, B and – signals must be connected in parallel. The + signal must not be connected.
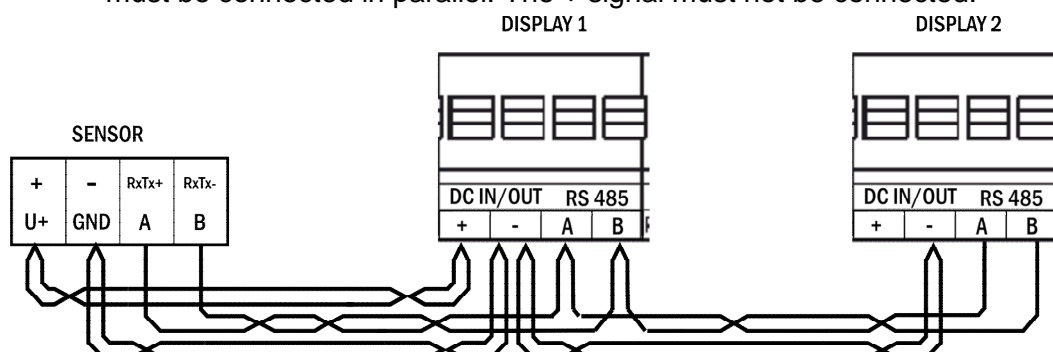
2.10 TP LAN temperature sensors connection

- the Ethernet network is used for connection of this type of temperature sensors, there can be any number of temperature sensors connected in the network
- moreover more display units can communicate to single temperature sensor, single display can communicate to up to three sensors

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- the connection is done using standard UTP or STP cable and network infrastructure
- the sensor is powered from small AC/DC wall adapter

3   Setting of time synchronization type

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 7) 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 synchronization source.

3.1   Autonomous clock synchronized by DCF 77 receiver

- Set value **A** in items **P3**, **P4** and **P6** in the main MENU (chapter 7).
- 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 synchronization 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.

3.2   Autonomous clock synchronized by GPS4500 receiver

- Set value **A** in items **P3**, **P4** and the desired time-zone in the **P6** item in the main MENU (chapter 7).
- 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 synchronization takes place in approx.10 to 20 minutes.

3.3   Autonomous clock synchronized by internal GPS receiver

- Set value **A** in item **P3**, value **13** in item **P4** and the desired time-zone in the **P6** item in the main MENU (chapter 7).
- Connect the GPS antenna cable to dedicated SMA connector.
- Place the GPS antenna according to following recommendation

100% viewing angle = 180°
Optimal reception conditions

Antenna

50% viewing angle = 90°
Reception conditions still OK,
eventually sometimes no reception
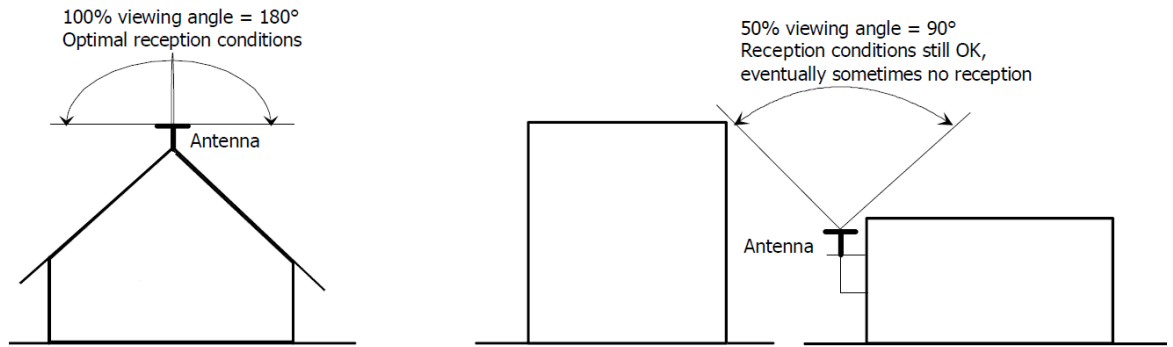
Antenna

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

3.4   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). Set the value **A** in items **P3** and **P6**. 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.

3.5   Slave clock controlled by MOBATIME serial code, MOBALine, 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.
- The time setting with using the serial coded line takes place within at least 3 to 4 minutes, for MOBALine and IRIG-B within 6 to 15 seconds.

3.6   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.

3.7 Synchronization by NTP protocol

The NTP time synchronization can be used when the clock is connected to Ethernet or WiFi network and the NTP server is accessible.
NTP protocol transfers data always UTC time coded, so it isn't necessary to set item **P3** manually. Time zone of synchronization source is internally set to value **0** in this case.

3.7.1 Synchronization by NTP multicast

The clock receives NTP multicast packets transmitted by NTP server in specified time cycle. This type of synchronization can work even when clock has not been assigned its own IP address and so it is suitable for controlling the large system of the slave NTP clocks. Not applicable for WiFi clock.
- Set item **P4** to value **9**
- According to chapter 6.3 set IP multicast address
- For correct displaying of time and date, choose the desired time zone in the item **P6**.

3.7.2 Synchronization by NTP unicast

The clock requests the exact time from the NTP server periodically in a predefined interval. The clock must have been assigned its own IP address and subnet mask (see chapter 5) in this case.
- Set item **P4** to value **10**.
- According to chapter 6.4 set IP address of NTP server and polling interval
- For correct displaying time and date choose desired time zone in item **P6**.

4 Setting the way of displayed time and date calculation

4.1 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
P5	0	Neither MOBALine time zone nor Timezone-server are used
P6	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.

4.2 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
P5	1 - 20	Selection of the MOBALine time zone
P6	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

4.3 Calculation using Timezone-server MOBATIME

P3	A	NTP protocol uses UTC time zone
P4	11, 12	NTP multicast or unicast
P5	1 - 15	Selection of the Timezone-server time zone
P6	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.

4.4 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 – 13, A	Autonomous operation or any type of the synchronizing signal
P5	0	Neither MOBALine time zone nor Timezone-server are used
P6	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.

5 Setting the network parameters for NTP versions

In the item **P17** choose if the network parameters (IP address, subnet mask, gateway NTP servers) will be set automatically (DHCP), or manually (telnet, the clock menu), or they will not be assigned at all (e.g. for NTP multicast).

5.1 Manually setting the network parameters using clock Menu

- According to chapter 6.10 set clock's IP address in item **P18** submenu
- According to chap 6.11 set subnet mask in item **P19** submenu
- According to chap 6.12 set gateway in item **P20** submenu

5.2 Manually setting the network parameters using telnet

Prior to the first connection using telnet, it is necessary to make the following procedure because initial IP address is 0.0.0.0.:

- by windows command **arp -s <IP address> <MAC address>** match new IP address to clock's MAC address (it is marked on the label next to RJ-45 connector)

example: arp -s 192.168.0.190 00-16-91-FE-90-00

- reset the clock or just turn it off/on and do the following within 2 minutes:
- by windows command **ping <IP address>** is this IP address temporary assigned to the clock (it is valid only in case if current IP address is 0.0.0.0), clock should answer two last ECHO requests at least

example: ping 192.168.0.190

- do the following within 30 seconds:
- by windows command **telnet <IP address>** connect to clock and make needed setting (see lower) – set the new IP address at first and correct other parameters if necessary

example: telnet 192.168.0.190

Setting parameters over telnet:

- request for the password appears after connection (default password is 718084)
- the software and hardware version and MAC address 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
- command **conf -?** displays help for command conf parameters

example: conf -i 192.168.0.190 set clock IP address to 192.168.0.190

- it is necessary to end telnet by command **exit**

5.3   Setting of the network parameters by DHCP

The network parameters are automatically assigned by the DHCP server. Assigned parameters can be checked in the submenu items P18 to 20. Besides the network parameters, IP addresses up to four NTP servers can be set using the DHCP option. Following options are supported:

- Option code 42 – NTP servers

  Note: For NTP address assignation, NTP unicast synchronization must be selected.

6 Control of the display 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 controller buttons 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
CLOCK	display of time on the first line (model with clock)
DATE	display of date on the first line (model with clock)
MENU	entry into the display configuration menu
SET	entry into the time setting (model with clock)

Function of the buttons in the time setting and menu operation mode

>>	move to next parameter
<<	move to previous parameter
the **+** pushbutton	increase of the value adjusted, in steps of 1
the **-** pushbutton	decrease of the value adjusted, in steps of 1
holding the **+** pushbutton	continuous increase of the value set up
holding the **–** pushbutton	continuous decrease of the value set up
ESC	return into normal display mode, without storage of the data
OK	storage of values set up and return into normal working mode
SET	entry into a submenu (where possible)
pushbuttons **0–9**	entry of the corresponding numerical value

6.1 Setting of time and date

Press the **SET** button on the IR remote controller.
Enter the data in following order: year - day - month - hour - minutes

The display shows the year:

The actual parameter blinks, to change its value use the **+**, **-** or **0** to **9** buttons, to move to another parameter use the **<<** or **>>** buttons. To set the time press the **OK** button. To exit the time setting without applying the changes press the **ESC** button.

6.2   Menu for the setting of the clock parameters

Press the **MENU** button on the IR remote controller. See the Menu table in chapter 7.

The display shows the first parameter of the menu:

```
P 0 : 8 A
```

The actual parameter blinks, to change its value, use the **+**, **-** or **0** to **9** buttons, to move to another parameter, use the **<<** or **>>** buttons. To save the settings press the **OK** button. To exit the menu without saving press the **ESC** button.

6.3   Setting of NTP multicast synchronization

Set the value **9** in the **P4** (synchronization source) menu item, and then by pushing the **SET** enter the submenu for setting the parameters of the NTP multicast synchronization. The item to be set is blinking.

The display shows the following:

```
8 t : 8 n
```
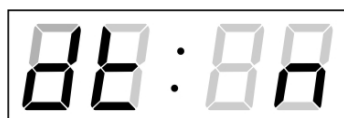
Enter four octets of the IP address (onto which are send NTP multicast packets) step by step. Switch to another octet/digit by pushing the **<<** and **>>** buttons. Octets are marked by letters **A**, **b**, **C** and **d**.

By pushing **OK** are the entered values stored and the display returns to the menu item **P4**. By pushing **ESC** return to **P4** item without storing.

6.4   Setting of the NTP unicast synchronization

Set the value **10** in the **P4** (synchronization source) menu item, and then by pushing SET enter the submenu for setting the parameters of the NTP unicast synchronization. The item to be set is blinking.

The display shows the following:

```
A 0 : 8 2
```

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

After entering last octet enter constant **x** determining interval of synchronization according to the following formula (in seconds): 2^x.

By pushing **OK** are the entered values stored and the display returns to the menu item **P4**. By pushing **ESC** return to **P4** item without storing.

6.5 Submenu for setting of the user-specific time zone

Choose the value **U** in the item **P6** (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):
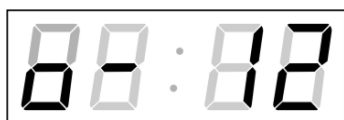
Enter the offset of the required time zone compared to UTC time within -12 to +12 hours. Decimal dot means 0,5 hour.

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

The display shows the following:

Possibility:

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

Pushing the **OK** button returns to the clock menu item **P6**.

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 in 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 in which the daylight saving time ends.

Push **>>**.

The display shows the following:

┃▉. ▉┃.

Enter the day of the month. Push **>>**.
Enter the hour in 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.**

By pushing **OK** save the setting and return to item **dt:**, Another push of the **OK**
button returns to the clock menu item **P6**.

DST defined 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:

FL ▉┃.

Push **>>**.

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

The display shows the following:

┃. ▉2

Push **>>**.

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

The display shows the following:

bL ▉┃.

Push **>>**.

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

The display shows the following:

┃▉. ▉┃

Enter the month in which the daylight
saving time ends. Push **PB1S**. 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 **P6**.

6.6 Setting of the predefined temperature value

It is possible to display a predefined temperature value in each temperature display field without need for the temperature sensor.

Set the value **0** in the **P13** (or **P14** or **P15** respectively) menu item, and then by pushing the **SET** enter the submenu for setting the temperature preset.

The display shows **Fxx.x**. The item to be set is blinking.

Enter temperature preset value in format **xx.x** , the range is from **00.0** to **99.9** degrees.

By pushing **OK**, the entered values are stored and the display returns to the menu item **P13** (or **P14** or **P15** respectively). By pushing **ESC** return without storing.

6.7 Settings for the TP3 / TP30 temperature sensors

Set the value **1** in the **P13** (or **P14** or **P15** respectively) menu item, and then by pushing the **SET** enter the submenu for setting the address and measured temperature correction.

The display shows **A : x**.The item to be set is blinking.

Enter the address of the sensor, use value **1** for **Temp1** input or **2** for **Temp2** input. Push the **>>** button to move to the temperature correction setting.

The display shows **cxx.x**.

Enter temperature correction value in format **xx.x** , the range is from -9.9 to +9.9 degrees.

By pushing **OK**, the entered values are stored and the display returns to the menu item **P13** (or **P14** or **P15** respectively). By pushing **ESC** return without storing.

6.8 Settings for the TP RS485 temperature sensors

Set the value **2** in the **P13** (or **P14** or **P15** respectively) menu item, and then by pushing the **SET** enter the submenu for setting the address, measured temperature correction and communication mode.

The display shows **A : x**. The item to be set is blinking.

Enter the address of the sensor, see the address printed on the sensor body and use the table in the chapter 11 for searching of the numerical representation of the particular address.

Push the **>>** button to move to the temperature correction setting.

The display shows **cxx.x**.

Enter temperature correction value in format **xx.x** , the range is from -9.9 to +9.9 degrees.

Push the **>>** button to move to the communication mode setting.

The display shows **L : x**.

When a **0** value is set, the display works as a master on the RS-485 bus, value **1** means the display works only as a listener on the bus. On the single RS485 bus just one display device must be master and the others must be listeners.

By pushing **OK**, the entered values are stored and the display returns to the menu item **P13** (or **P14** or **P15** respectively). By pushing **ESC** return without storing.

6.9 Settings for the TP LAN temperature sensors

Set the value **3** in the **P13** (or **P14** or **P15** respectively) menu item, and then by pushing the **SET** enter the submenu for setting the IP address, measured temperature correction and timing value. The item to be set is blinking.

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

After entering the last octet push the **>>** button to move to the temperature correction setting.

The display shows **cxx.x**.

Enter temperature correction value in format **xx.x** , the range is from -9.9 to +9.9 degrees.

Push the **>>** button to move to the timing value setting.

The display shows **n :xx**.

Set the value **xx** according to predicted number of display units, which should communicate with the actual temperature sensor. Then the apropriate timing for the communication with the sensor is applied.

By pushing **OK**, the entered values are stored and the display returns to the menu

6.10 Manual setting of the IP address of the clock

Choose the item **P18** 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 **P18.** By pushing **ESC** the clock returns to **P18** without storing.

6.11 Manual setting of the subnet mask

Choose the item **P19** 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:

```
A2:55
```

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 **P19.** By pushing **ESC**, the clock returns to **P19** without saving.

6.12 Manual setting of default gateway IP address

Choose the item **P20** 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:

```
A1:92
```

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 **P20**. By pushing **ESC**, the clock returns to **P20** without saving.

7   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	0	automatic switching over disabled
		1	continuous display of time
		2	continuous display of date
		3	display sequence: time 6 sec, date 3 sec.
P3	Time zone of synchronization source	0 - 64, **A** (automatically)	
P4	Synchronization source	1 - 10, **A** (automatically)	
		A	auto detection, applicable for: DCF, the Mobatime serial code, MOBALine, WDT or IRIG-B
		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*	NTP multicast
		10*	NTP unicast
P5	Time zone for MOBALine or Timezone-server MOBATIME	1-20, **0** (off) – for MOBALine synchronization or 1-15, **0** (off) – for NTP synchronization	
P6	Time zone of displayed time and date	0 - 64, **A** (automatically), U* (user time zone)	
P7	Time format display	**1**-2	
		1	time with leading zero
		2	time without leading zero
P8	Date format display	1-**2**	
		1	date with leading zero
		2	date without leading zero
P9	Clock address for IR remote control	1-**99**	
P10	Time in minutes for "automatic lock" since the last depression of button on the IR unit	1-60, **U** ("automatic lock" is OFF)	
P11	Temperature units display	**°C**	
		°F	
P12	Temperature format display	**0**	with decimal part
		1	without decimal part

P13	Temperature 1 function	**0**	use preset value
		1	TP3/TP30
		2	TP RS485
		3	TP LAN
P14	Temperature 2 function	**0**	use preset value
		1	TP3/TP30
		2	TP RS485
		3	TP LAN
P15	Temperature 3 function	**0**	use preset value
		1	TP3/TP30
		2	TP RS485
		3	TP LAN
P 16	Clock mode operation	**0**	Normal mode
		1	Special mode 1
		2	Special mode 2
P17	Mode of setting the network parameters	**1**	without IP address (NTP multicast only)
		2	Manually
		3	DHCP
P18	IP address	IP*	Manual setting
P19	Subnet mask	Su*	Manual setting
P20	Gateway	Gt*	Manual setting
SW version		r_._	(e.g.: r1.10)

Note: in values marked with * the submenu is accessible by pushing the **SET** buttton

8 Testing mode, parameter reset

8.1 Synchronization test

The synchronization 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 synchronization 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 synchronized clock.

Entering the synchronization test mode:
- Enter the clock menu and keep pushing simultaneously both buttons on the clock PCB or the **DISP** button on the IR controller, 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 synchronization information

8.2 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 and keep pushing simultaneously both buttons on the clock PCB or the **DISP** button on the IR controller, 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

9 Update firmware

9.1 Update firmware using RS232

- Switch-off the clock.
- Install and run the Flash Magic software.
- Open the configuration file „dc3prog.fms" over the File -> Open Settings menu
- Set used COM Port and open file firmware „dc3.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.

9.2 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**.

10 Time zone table

Time zone entries in the standard time zone table (version 10.0).

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	Cairo, Pretoria, Harare	+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, Kaliningrad	+3	No		
09	Praia, Cape Verde	-1	No		
10	UTC (GMT)	0	No		
11	Abu Dhabi, Muscat, Tbilisi, Moscow, St. Petersburg, Volgograd, Samara	+4	No		
12	Kabul	+4.5	No		
13	Adamstown (Pitcairn Is.)	-8	No		
14	Tashkent, Islamabad, Karachi	+5	No		
15	Mumbai, Calcutta, Madras, New Delhi, Colombo	+5.5	No		
16	Astana, Thimphu, Dhaka, Yekaterinburg	+6	No		
17	Bangkok, Hanoi, Jakarta, Novosibirsk	+7	No		
18	Beijing, Chongqing, Hong Kong, Singapore, Taipei, Urumqi, Krasnoyarsk	+8	No		
19	Tokyo, Osaka, Sapporo, Seoul, Irkutsk	+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, Yakutsk	+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), Vladivostok	+11	No		
28	Auckland, Wellington	+12	Yes	Last Sun. Sep. (02:00)	1st Sun. Apr. (03:00)
29	Majuro (Marshall Is.), Magadan, 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	-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	-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, 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

Attention! The Time Zone Table is usually updated every year. The current table is available for download under the following address: *www.mobatime.com* ➔ *Customer Area* ➔ *Customer Support* ➔ *Support Resources* ➔ *Software Tools* ➔ *Time Zone Table*. In case your device is equipped with a newer version than shown in this manual, the current time zone settings should be checked.

11 Table of the addresses for the TP RS485 sensor

Addr.	Num.	Addr.	Num.	Addr.	Num.	Addr.	Num.	Addr.	Num.	Addr.	Num.
0	0	c	12	o	24	A	36	M	48	Y	60
1	1	d	13	p	25	B	37	N	49	Z	61
2	2	e	14	q	26	C	38	O	50		
3	3	f	15	r	27	D	39	P	51		
4	4	g	16	s	28	E	40	Q	52		
5	5	h	17	t	29	F	41	R	53		
6	6	i	18	u	30	G	42	S	54		
7	7	j	19	v	31	H	43	T	55		
8	8	k	20	w	32	I	44	U	56		
9	9	l	21	x	33	J	45	V	57		
a	10	m	22	y	34	K	46	W	58		
b	11	n	23	z	35	L	47	X	59		

Example:
Sensor address '**M**' -> number **48**

12 Engineering data

12.1 Standard design of the display

Technical data		DT.100.1C.1T DT.180.1C.1T	DT.100.1C.2T DT.180.1C.2T	DT.100.1C.3T DT.180.1C.3T	DT.100.2C.1T DT.180.2C.1T	DT.100.2C.2T DT.180.2C.2T	DT.100/57.1C.2
Digit height		100 mm or 180 mm according to version					100 / 57 mm
Display colours		red / yellow / pure green / blue / white					
Number of rows		2	3	4	3	4	3
Time / Date / Display 1		✓	✓	✓	✓	✓	✓
Time / Date / Display 2					✓	✓	
Temperature display 1		✓	✓	✓	✓	✓	✓
Temperature display 2			✓	✓		✓	✓
Temperature display 3				✓			
Power supply	AC standard	100 - 240 VAC, 50 - 60 Hz					
	DC on request	24 VDC ± 20%					
Power consumption	DT.100	20 - 30 VA	30 - 45 VA	45 - 60 VA	30 - 45 VA	45 - 60 VA	28 VA
	DT.180	30 - 36 VA	45 - 69 VA	60 - 92 VA	45 - 69 VA	60 - 92 VA	
Timekeeping in ambient temperature -25 - +60 °C		± 0,3 s / day (accuracy without synchronization)					
Temperature measurement accuracy	-55 ÷-10 °C	± 2°C					
	- 10 ÷ + 85 °C	± 0,5°C					
	+ 85 ÷ + 99,5 °C	± 2°C					
Operating temperature		- 25 to + 60 °C, (0 to 95% humidity non condensing)					
Range of measured temperature		- 55 to + 99,9 °C,					
Protection degree		IP 65					
Weight [kg] (approx.)	DT.100	9,5	13,5	17	13,5	17	8,5
	TD.180	24	35	44	35	44	
Dimension [mm](approx.)	DT.100	530x360x60	530x515x60	530x670x60	560x515x60	530x670x60	500x446x60
	DT.180	940x560x60	940x830x60	940x1090x60	940x830x60	940x1090x60	

12.2 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

13   Accessories

13.1   Single sided display

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

13.2   Double side display

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

13.3   Optional accessories

- AD 450 radio signal receiver
- AD 10 radio signal 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

14   Cleaning

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

15   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 labeled 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 fulfill your legal responsibilities and help protect the environment.

16   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.