

# 16-Channel Yearly Time Switch

## TR 648 S DCF



**Illustration 1 : TR 648 S DCF**

TR 648 S DCF EIB	648 9 201
DCF 77 Antenna	907 0 271
Obelisk 2.0 Programming set	907 0 305
Obelisk 2.1 Software	931 0 961

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## 1 Functional Characteristics of the TR 648 DCF

The TR 648 DCF 16-Channel yearly switching clock is a built-in series device for installation in distributions. The connection to the EIB is made through a bus connection terminal.

The switching clock offers the following characteristics:

- 500 permanently-held switching times for:
  - Daily switching times
  - Weekly switching times
  - Date switching times
  - Priority switching times
  - Impulse
  - 1 x switching for vacation/holidays.
  - Holidays without a fixed date (e.g. Easter, will be recalculated automatically every year)
  - In addition for each channel, 9 further weekly programs with priority levels P1 to P9 (Priority program)
- Astronomical program with sunrise and sunset times on channels 1...4
- Manual switching for a limited time and permanent switching (effective permanently)
- Random program can be activated for every channel

## 1.1 Priority Programs

A priority program is a special weekly program which is called up at certain periods of the year and replaces the normal weekly program for a specified duration (minimum of 1 day) (see Figure 2).

The programming of a priority program consists of:

1. Input of the desired switching times for the priority program
2. Definition of a start and an end date (period of time)

### Example:

Normal weekly program:       Daily 8:00 on, 18:00 off

Priority program:

Switching times:               Daily 10:00 on P1, 22:00 off P1 (Priority 1)

Time period:                   P1 12.06 to 31.08

In this case, the normal weekly program will be implemented completely normally from 1 January to 11 June 24:00 and from 1 September to 31 December.

In the period from 12.6. to 31.8., the priority program will be implemented **exclusively** and the normal weekly switching times will be suppressed.

If multiple priority programs overlap in the same time period, the program with the highest index will always be active in the time of the overlapping.

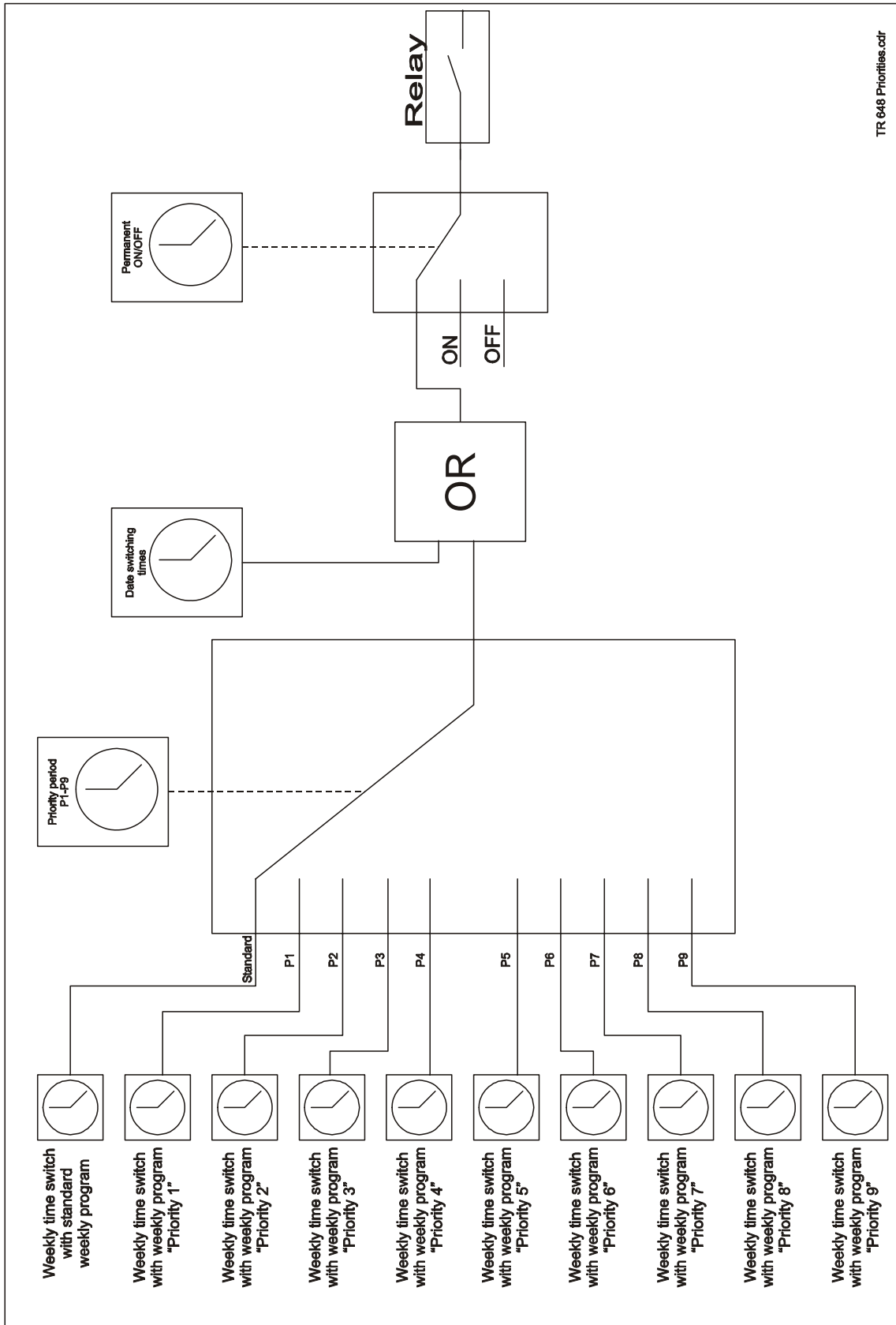
For example: Weekly program P2 suppresses weekly program P1, which means that **only** P2 will be implemented.

The normal weekly program has no priority, meaning P0, and will thereby be suppressed by all other priorities and types of switching time.

A priority can also be used more than once if necessary, for example, P1 from 6.12 to 31.08 and from 22.12 to 6.1.

Weekly program P1 will therefore be implemented in both periods of time.

Mode of operation of the priorities



TR 648 Priorities.cdr

Illustration 2: Priorities

## 1.2 General Priority Rules

Every type of switching has a defined priority level in relation to the others if they occur simultaneously (e.g. weekly switching time Mon 12:00 on / date switching time Mon 4 March 12:00). Within the same type of switching time, the following will apply in principle: **Off has priority over On**, meaning that the weekly switching time Off suppresses the weekly switching time On.

- A continuous switching has the highest priority of all

followed by the following in decreasing rank of priority:

- Permanent ( $P_{\text{off}}$ ,  $P_{\text{on}}$ )
- 1x Date switching times
- Date switching times
- Priority P9
- Priority P8
- Priority P7
- Priority P6
- Priority P5
- Priority P4
- Priority P3
- Priority P2
- Priority P1
- Weekly switching times

Astronomic switching times are suppressed during priority time periods P5 ... PP and are otherwise to be considered like 1x date switching times (see Chapter “Astronomic Program”).

## 1.3 Random Program

A random program has the effect that a channel will be switched on or off randomly at time periods from 10 to 120 minutes.

The random program must be activated manually for each channel through the keyboard (input channel number + press Dat button).

This random switching will take place only at times in which the clock is switched ON through the normal switching program.

This function is used primarily for the simulation of people present (illumination) for temporarily unoccupied premises.

## **1.4 Function 1x**

The function 1x can be used for switching times based on date and for priority periods of time (1x priorities). After implementation of the date-related switching time, it will be automatically deleted from the memory at the end of the day of implementation.

## **1.5 1x Priorities (Priorities With Year Inputs)**

Should a priority period of time be used only once, it can be provided with a year input. Priority periods of time can also be input for several years in advance.

After the expiry of the 1x priority time period, it will be deleted automatically from the memory, whereby the switching times associated with the priority time period will be retained in the clock and can be used for further priority time periods.

## **1.6 Holidays Without a Fixed Date**

With the help of the holiday program, holidays without a fixed date can be programmed for several years in advance.

Customer-specific holidays can also be created and saved with the Obelisk PC software.

In principle, one differentiates between three types of holidays:

1. Fixed holidays: On the same date every year
2. Floating holidays: e.g. last Wednesday in May
3. Holidays without a fixed date, meaning depending upon the date of Easter: e.g., Good Friday (2 days before Easter) or Whitsun (49 days after Easter)

The date of the holidays without a fixed date is adapted automatically every year by the clock.

The free holidays are calculated for an optional number of years by the Obelisk software.

## 1.7 *Astronomical Program*

An astronomical program enables switching as a function of sunrise and sunset times (e.g. shutters, outside lighting,...).

An astronomical program can be stored in the TR 648 for channels 1 ... 4 each with the use of the Obelisk software.

The conditions for the astronomical program can be input in the Obelisk software.

They are:

- Location (Longitude / latitude)
- Time zone (e.g. CET)
- Input of an offset of max.  $\pm 120$  minutes (taking account of different site conditions such as mountain, valley, etc. ...)
- Inhibit times (e.g. for shutters: Mornings not before 7:00, evenings not after 21:00)

The input is made for the most usual locations effortlessly through selection from a list. Further locations can be set through direct input of longitude and latitude (resolution  $0.5^\circ$ ).

Furthermore, the astronomical program can be adapted at any time using the Obelisk software:

- Every individual astronomical switching time can be changed manually
- On days on which astronomical switching times are not desired, they can also be suppressed specifically:
  - For one or more days by programming a priority time period of P5...P9 or permanently On/Off
  - Or through a 1x date switch-off time (for an individual astronomical switch-on time)

## 1.8 *Time Synchronisation*

The time synchronisation of the switching clock can be accomplished optionally using the DCF 77 radio signal (antenna required) or via the bus through the reception of a date and a time telegram. If a valid time telegram is received by the bus and the clock is synchronised with it, no new bus synchronisation will take place before the following day.

The DCF synchronisation takes place every night shortly before 2:00 and shortly before 3:00 in the morning.

A forced synchronisation (through bus or DCF) is possible at any time with the transmit call function (hold the Dat button pressed approx. 3s)

## 1.9 *Send Time*

The clock can also be used to provide the time, meaning time and date are sent to slave clocks (theben Osiria), display units, etc. through the bus.

### **1.10 Programming of the Switching Times Program**

The complete switching time programming (except for astronomical times) can be performed directly on the device through keyboard input or through the Obelisk PC Programming Set. The software runs under WINDOWS 9X, 2000, NT, XP.

The input of different switching times is performed quickly and simply with a click of the mouse. The transmission of the program is performed through an EEPROM memory card (OBELISK), which is programmed on the PC to an interface and then inserted and read into the switching clock. This also enables quick copying of a switching program.

The Obelisk software permits, for example:

- To create switching time, priority and holiday programs clearly
- To select regional and national holidays on a databank
- To define or add new holiday programs
- To create an astronomical program automatically for a certain location conveniently
- To check the program in a graphical simulation
- To program switching time programs in an EEPROM memory module (Obelisk card)
- To read out switching time programs from the EEPROM memory module
- To archive switching time programs on a hard disk in the PC
- To print out switching time programs in tabular form
- To copy parts out of an existing time switching time program and to insert them into a new or existing program
- To define a new rule for summer/winter time (if a DCF antenna is not connected)

### **1.11 Other Features of the TR 648 DCF**

- It is no longer necessary to send an “Off” command and an “On” command alternatingly one after the other as before to initiate the sending of a telegram. It is possible, for example, for the same switching commands to follow each other.
- The power supply for the DCF antenna is already integrated.

## 2 Technical Data

<b>Number of channels:</b>	16				
<b>Memory places:</b>	500 permanently-held using EEPROM				
<b>Automatic programs:</b>	Daily, weekly, yearly, astro, impulse programs				
<b>Special programs:</b>	<ul style="list-style-type: none"> <li>• In addition to the standard weekly program, 9 further weekly programs can be input for every channel. These weekly programs can be called up by providing start and end dates. Example: Weekly program No. 5 from 24.12 – 6.1.</li> <li>• Holiday programs</li> <li>• Date switching commands and 1x date switching command can extend every weekly program</li> <li>• Using ON and OFF priority commands, it is possible to inhibit the switching program by inputting the start and end dates.</li> <li>• Astronomical program</li> <li>• Random program can be activated</li> </ul>				
<b>Manual access possibilities:</b>	<ul style="list-style-type: none"> <li>• Temporary manual switching</li> <li>• Permanent manual switching</li> </ul>				
<b>Inputs:</b>	1 x DCF 77 for antenna				
<b>Programming</b>	Using the 10x keyboard or with the Obelisk PC program and Obelisk memory card				
<b>Shortest switching interval:</b>	1 second				
<b>Switching accuracy:</b>	1 second				
<b>Block formation:</b>	Free formation of weekday blocks				
<b>Summer/Winter time switchover:</b>	Automatically or through the DCF 77 radio signal				
<b>Power supply:</b>	Takes place through bus voltage				
<b>Power consumption:</b>	Approx. 9 mA				
<b>Cycle accuracy:</b>	1 sec/ day or DCF77 precision				
<b>Cycle reserve:</b>	> 1.5 years through environmentally acceptable lithium cell				
<b>Allowable ambient temperature:</b>	-5°C to +45°C				
<b>Type of protection:</b>	IP 20				
<b>Mounting:</b>	on DIN rail				
<b>Housing dimensions:</b>	45 x 105 x 60 mm (H/W/D) REG width 6 TE				
<b>Accessories</b>	<table> <tr> <td>Antenna for DCF reception</td> <td>907 0 271</td> </tr> <tr> <td>Obelisk programming set</td> <td>907 0 305</td> </tr> </table>	Antenna for DCF reception	907 0 271	Obelisk programming set	907 0 305
Antenna for DCF reception	907 0 271				
Obelisk programming set	907 0 305				

2.1 Dimensional Drawings / Connection Drawings

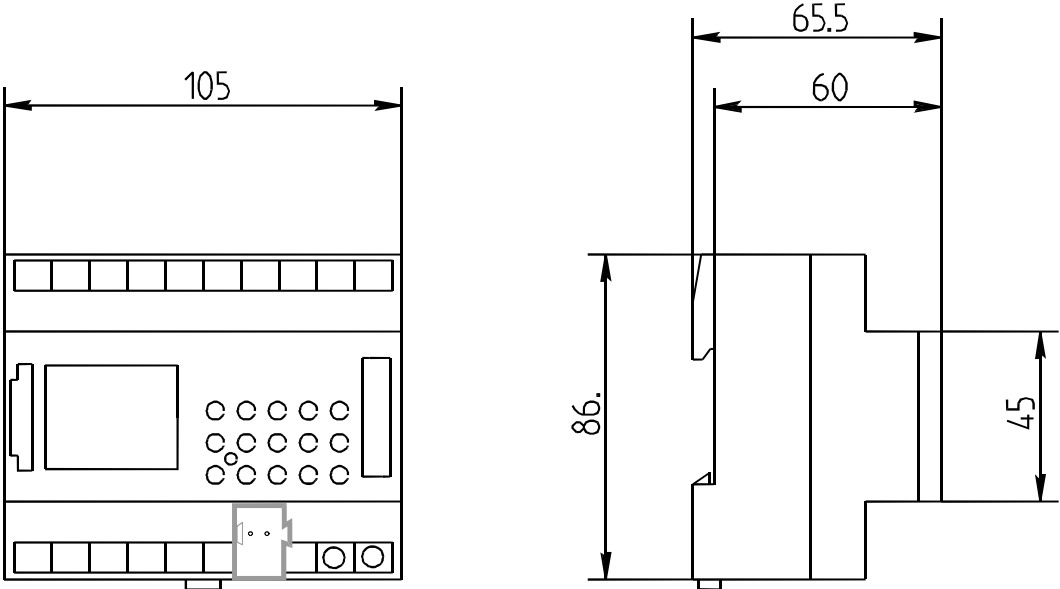


Illustration 3: Dimensions

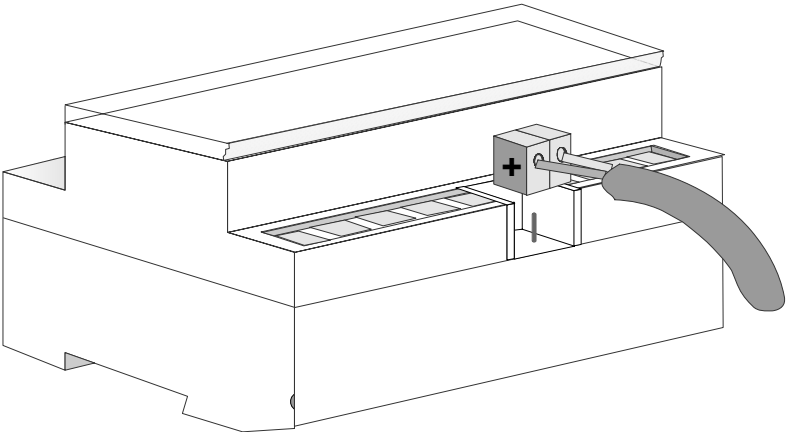


Illustration 4: Bus connection

### 3 The "Switch, Value, Priority, HVAC, Scenes" Application Program

#### 3.1 General

The following functions are available in the application program

Function	Description
Switch	Send switch telegrams (ON / OFF)
Value	Send value telegrams (0...255)
Priority	Send priority telegrams (Prio On / Prio Off / No Priority)
HVAC	HVAC telegrams for individual room regulation: Auto, comfort, standby, Economy mode, frost and heat protection
Scenes	Multiple telegrams can be sent to different subscribers simultaneously through a single channel
Temperature	Temperature values can also be sent as a part of a scene

#### 3.2 Selection in the Product Databank

<b>Manufacturer:</b>	THEBEN-WERK ZEITAUTOMATIK
<b>Product family:</b>	Time switches
<b>Product type:</b>	16-Channel yearly switching clock
<b>Product name:</b>	TR 648 DCF

Download the application from: <http://www.theben.de>

### 3.3 Functional Characteristics

#### 3.3.1 Channels

The clock has 16 time-dependent programmable switching channels.

A switch, priority, value or HVAC telegram can be sent optionally on every channel.

The sending can be suppressed if required through inhibit objects for one or more channels.

Every channel can initiate a scene when switching on and off.

#### 3.3.2 Scenes:

8 freely configurable scenes are available.

A scene is a combination of up to 6 telegrams which, when selected, are transmitted without delay when switching a channel on or off respectively.

Every channel can therefore initiate a maximum of two different scenes, one when switching on and the other when switching off.

All scene telegrams are sent with the 6 common scene objects.

Every object can be parameterised freely as switching, value, priority HVAC or temperature object.

In this way, different types of actuators or groups of actuators can be controlled simultaneously at one switching time point (switching / dimming / shutter actuators).

As a part of a scene, temperature values can be sent as setpoint values.

**Example:** The “end of work” scene implements the following commands simultaneously with different group addresses and types of telegram:

- Switch off light
- Lower heating
- Close shutters
- Switch on alarm system
- Lock entrance gate
- Switch on outside lighting

### 3.3.3 Inhibit Objects:

Using 4 inhibit objects, it is possible to suppress the time switching program of the clock through the bus.

The channel or combination of channels on which an inhibit object should work can be set with parameters for every inhibit object.

If an inhibit object is set, further telegrams will not be sent from the inhibited channel objects.

If the inhibit object is reset again, the actual status of the channel objects will be sent immediately to the bus.

### 3.3.4 HVAC Functions (*Heating, Ventilation, Air Conditioning*)

The TR 648 DCF is also in the position to control an individual room controller time-dependent through HVAC telegrams.

For this purpose, HVAC modes of operation such as auto, comfort, standby, Economy mode, frost protection and heat protection can be sent to a room thermostat.

**Note:**

Communication between a bus coupler and a switching clock (and thereby the implementation of the application program) will take place only when the clock is in the automatic mode. As long as the clock is not in the automatic mode, any actions will be implemented later when the automatic mode is restored.

### 3.4 Communication Objects

#### 3.4.1 General

No.	Object Name	Function	Type	Behaviour
0...15	Channels 1...16	Send switching, value, priority or HVAC telegram when switching the particular channel on or off	1 Bit/ 2 Bit/ 1 Byte	Send
16...21	Scene object 1...6	Send switching, value, priority, HVAC mode, temperature. object type can be selected on the page "Object types for scenes"	1 Bit, 2 Bit, 1 Byte, 2 Byte	Send
22...25	Inhibit object 1...4	Inhibit those channels which were selected on the parameter pages "Inhibit object 1...4"	1 Bit	Receive
26	Time	Send clock time to the bus or receive from the bus	3 Byte	Send / Receive
27	Date	Send date to the bus or receive from the bus	3 Byte	Send / Receive
28	Time request	External Time request (only if "Send time" was selected)	1 Bit	Receive

Number of communication objects:	29
Number of group addresses:	36
Number of assignments:	36

### 3.4.2 Description

- Objects 0...15 “Channel 1...16“

Send objects for the value or the status of the particular clock channel.

- Objects 16...21 “Scene Object 1...6“

Every scene can send through these 6 common scene objects.

Every object can be parameterised freely as switching, value, priority, HVAC or temperature object.

- Objects 22...25 “Inhibit Object 1...4“

Every inhibit object can inhibit any desired combination of channels.

In this way, certain functions can be suppressed specifically.

1 = Activate inhibit object

0 = Deactivate inhibit object

- Object 26 “Time” and Object 27 “Date”

Depending on parameterisation, these objects can either send or receive.

See “Function of Time and Date Objects” on the “General” parameter page.

The sending will take place in the EIS 3 (time) and EIS 4 (date) standard formats.

- Object 28 “Time request”

If this object is written with a value of 1 or 0, the clock will immediately send a time and a date telegram.

This object appears only if the “Send time and date” function has been selected.

### 3.5 Parameters

**Table 1:** Parameters on the “General” Page

Item	Possible Settings	Meaning
Functional mode of objects and date	Send time and date  Receive time and date	If “send” has been selected, the clock can send the actual time and date to the bus cyclically as well as on request.  If “receive” has been selected, the clock can be set through external time and date telegrams.
Sending of time and date	Only on request Every minute Every hour Every day at 0:00 hrs. Every day at 0:02 hrs. Every hour and at 0:02 hrs.	Parameter appears if “Send time and date” type of object has been set. Setting, if and/or how often the time and date should be sent.  Remark: Sending can be initiated at any time through the “Time request” object.
Number of inhibit objects	No inhibit object 1...4 Inhibit object	How many inhibit objects should be used?
Should scenes be possible	Yes No	If scenes are supposed to be programmed, set “Yes”.

**Table 2:** Parameters on the “Channel 1...16” Page

Item	Possible Settings	Meaning
Type of object	Switch Value Priority HVAC mode	Setting whether a switching (1 Bit), value (8 Bit), priority telegram (2 Bit) or an HVAC mode should be sent when switching the channel.

**Parameters during “Switch” setting**

Switching behaviour when clock $\wedge$ Off	On Off	Setting whether an OFF or ON telegram should be sent when the channel is switched off.
Switching behaviour when clock $\wedge$ On	On Off	Setting whether an OFF or ON telegram should be sent when the channel is switched on.

**Table 2 (Continued) Parameters During “Value” Setting**

Item	Possible Settings	Meaning
Value if channel $\wedge$ Off	0...255	Setting the value which should be sent (dimming value, position description, etc.) when the channel is switched off. It is possible to send any desired value between 0 and 255.
Value if channel $\wedge$ On	0...255	Setting the value which should be sent when the channel is switched on.

**Parameters with “Priority” setting**

Priority value if channel $\wedge$ Off	Priority inactive Priority OFF Priority ON	Setting the priority status which should be sent when the channel is switched off.
Priority value if channel $\wedge$ On	Priority inactive Priority OFF Priority ON	Setting the priority status which should be sent when the channel is switched on.

**Parameter with “HVAC mode” setting**

HVAC mode if channel $\wedge$ Off	Auto Comfort Standby Economy mode Frost and heat protection	Setting the HVAC mode which should be sent when the channel is switched off.  In this way, it is possible for the room temperature regulator to assume a new setpoint.
HVAC mode if channel $\wedge$ On	Auto Comfort Standby Economy mode Frost and heat protection	Setting the HVAC mode which should be sent when the channel is switched on.

**Identical during every setting:**

Scene if channel $\wedge$ Off	No scene Scene 1, 2, 3, 4, 5, 6, 7, 8	Setting the scene which should be activated when the channel is switched off.
Scene if channel $\wedge$ On	No scene Scene 1, 2, 3, 4, 5, 6, 7, 8	Setting the scene which should be activated when the channel is switched on.
Sending mode	Not cyclically 1 min/ 2 min/ 4 min/ 8 min/ 16 min/ 32 min/ 64 min/ 128 min	Setting whether the channel should send to the bus once or regularly and, if so, at which intervals.

**Table 3: Parameters on the “Inhibit Object 1 – 4” Pages**

Item	Possible Settings	Meaning
inhibition object Inhibits channels 1, 2, 3, 4	Neither channel 1 nor 2 Channel 1 Channel 2 Channel 1 and Channel 2	Every inhibit object can inhibit any desired combination of channels.  The channels on which an inhibit object should be effective can be set here.
and inhibits	Neither Channel 3 nor 4 Channel 3 Channel 4 Channel 3 and Channel 4	
and inhibits	Neither Channel 5 nor 6 Channel 5 Channel 6 Channel 5 and Channel 6	
and inhibits	Neither Channel 7 nor 8 Channel 7 Channel 8 Channel 7 and Channel 8	
and inhibits	Neither Channel 9 nor 10 Channel 9 Channel 10 Channel 9 and Channel 10	
and inhibits	Neither Channel 11 nor 12 Channel 11 Channel 12 Channel 11 and Channel 12	
and inhibits	Neither Channel 13 nor 14 Channel 13 Channel 14 Channel 13 and Channel 14	
and inhibits	Neither Channel 15 nor 16 Channel 15 Channel 16 Channel 15 and Channel 16	

**Table 4: Parameters “Object Types for Scenes” Pages**

The TR 648 has 6 scene objects in total.

The type of telegram which every object should send is set here. All combinations amongst each other are possible.

Item	Possible Settings	Meaning
Type of object of scene object 1, 2, 3, 4, 5, 6	Switching Value Priority HVAC mode Temperature	Kind of telegram which should be sent by the particular scene object.

**Table 5: Parameters on the “Scene 1...8” Pages**

A scene consists of any desired combination of 6 scene objects (see Table 4) and can be called up when switching a channel (see Table 2). Completely different events can be controlled simultaneously with the same scene, such as reduced heating, dim light, switch on alarm system, for example.

Item	Possible Settings	Meaning
Scene object 1, 2, 3, 4, 5, 6 sends	Following telegram No telegram	Which of the 6 scene objects should be used is set here.

The following parameters can be set depending upon the type of object defined on the page “Object Types for Scenes”:

Switching command	OFF ON	For “Switch” type of object. Select type of switching telegram
Value	0...255	For “Value” type of object Input desired value
Priority	Priority inactive Priority OFF Priority ON	For “Priority” type of object Select priority status
HVAC mode	Auto Comfort Standby Economy mode Frost and heat protection	For “HVAC mode” type of object Select desired HVAC mode for individual room regulation
Temperature	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 20,5, 21, 21,5, 22, 22,5, 23, 24, 25, 26°C	Set the desired temperature assignment which should be sent to a thermostat, for example .

## 4 Additional Expert Information

### 4.1 Communication of the TR 648 With the Bus

The transmission of data between the TR 648 and the EIB bus coupler will take place only when the clock is in the automatic mode.

Reason: In all other modes, data which should be transmitted can be changed, so that data which is not up-to-date could arrive at the bus. Should a switching command be sent while the clock is not in the automatic mode, it will be sent again later when the automatic mode returns.

### 4.2 Bus Synchronisation

As already explained, the switching clock can receive time (EIS 3) and date telegrams (EIS 4) for time synchronisation.

The following points are to be observed however with this so-called bus synchronisation:

- Two time windows are available daily between 1:58:44 hrs. and 2:13:00 hrs. as well as between 2:58:44 hrs. and 3:13:00 hrs., during which the clock is prepared to accept time and date telegrams received.
- Outside of these two time windows, the clock is prepared only once to receive a time and date telegram independently.
- Another possibility is the implementation of a so-called manual send call. By pressing the Dat button for 3 seconds, a time window is opened for 14 minutes. Within this time window, the clock is again prepared to receive time and date telegrams (as often as wanted). After this time window, the clock is prepared to receive time and date telegrams independently only once again.
- 
- Furthermore, it is to be observed that the date will also be adapted in the case of a deviation of the weekday by +/- one day in the time telegram relative to the weekday set on the clock. Time telegrams with a deviation of more than one weekday will not be accepted. If there is no weekday in the time telegram, it will be accepted however. The use of time telegrams without a statement of the weekday is not to be recommended as problems can arise because of a lack of clarity in the case of a daily transmission.
- If the clock is additionally synchronised by a DCF signal, synchronisation through the bus will be inhibited.

#### **Recommendation !**

**If absolutely exact synchronisation is required between certain clocks in the EIB system, the synchronisation should be performed using the DCF signal. With the use of this procedure, transmission times from the bus are eliminated (e.g. through multiple couplers). Every TR 648 DCF - EIB has an appropriate input for the DCF antenna for this purpose.**

### 4.3 Program rescan

If the time or date is changed (through keyboard input, through radio or bus synchronisation) a “rescan” will take place in the clock. This means that the clock will calculate its switching status again so that switching times are not jumped over and thereby not implemented. If the clock recognises a change of the switching status, it will be sent. The following points are to be observed with this procedure, which is advantageous in principle:

- As manual switching (switching overrides) are not in the switching time memory, the manual switching can be lost through the “rescan” under certain conditions.
- Impulses located in the past will also not be recognised when looking back.

In addition, the “rescan” takes place:

- after resetting
- after programming
- after deletion and/or change of switching times
- after summer time/winter time switchover

#### **IMPORTANT:**

- If the clock changes into a new priority time period over 0.00, a “**rescan**” will be performed for the **priorities**. This means that it will behave as if the new priority had already been active on the previous day and immediately assumes the switching status which would have predominated at midnight on the previous day.

Advantage: Program P1: 22:00 on / 6:00 off from 1.05 to 31.05  
Program P2: 23:00 on / 7:00 off from 1.06 to 30.06

When looking back, the clock would switch between P1 and P2 at 0:00 on 1.6 as no switching time is present at this point. With the “look back”, the switching time from 23:00 on the previous day is taken into account and the channel remains switched on.

In certain cases this “rescan” is **not desired**. The switch-on can be suppressed there through a date switch time (OFF) at 0:00 at the beginning of the priority (here on 1.6). This measure is however only necessary when within the new priority the last switching time on the day (meaning before 24:00) is a switch-on time.

## 5 Additional Literature

- TR 648 – DC77 EIB Operating Instructions
- OBELISK PC programming software manual