

Protocol Description WRF08 BACnet MS/TP RS485

Version 1.3, 23.12.2010

1 Index of changes

| Version | Date | Description |
|---------|------------|--|
| 1.0 | 26.04.2010 | 1st Draft |
| 1.1 | 11.08.2010 | Link options of configuration software adapted |
| 1.2 | 16.08.2010 | Subnet mask settings |
| 1.3 | 23.12.2010 | Added note to deactivate other BACnet stacks |

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2 Introduction

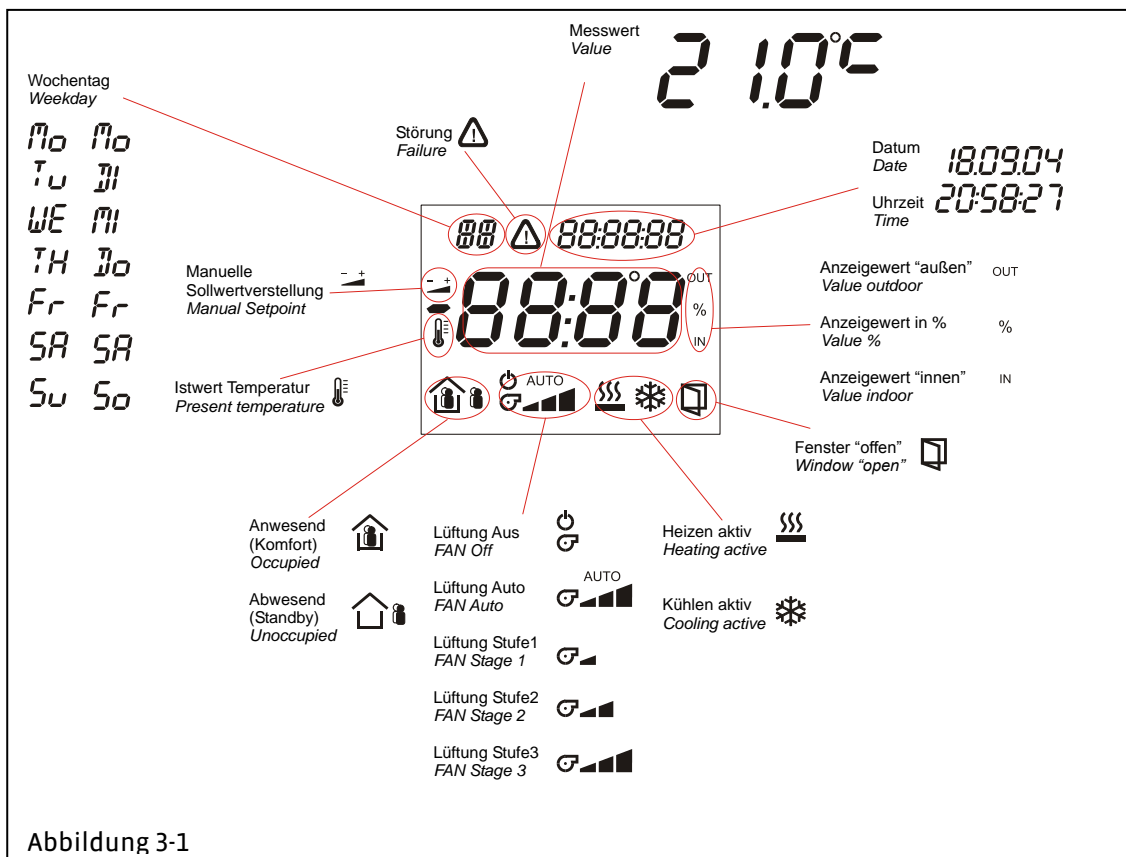
The present document describes the serial interface of the room operating panel WRF08 BACnet MS/TP-RS485.

For further information and definitions on the topic BACnet, please see www.big-eu.org.

3 Description

3.1 LCD-Display

The following signs can be indicated on the LCD-display:



Via the LCD display different values can be indicated. As a standard, only the temperature is displayed. Which values shall be shown in the display can be adjusted by using the configuration software. A short description of the software can be found in chapter 7.

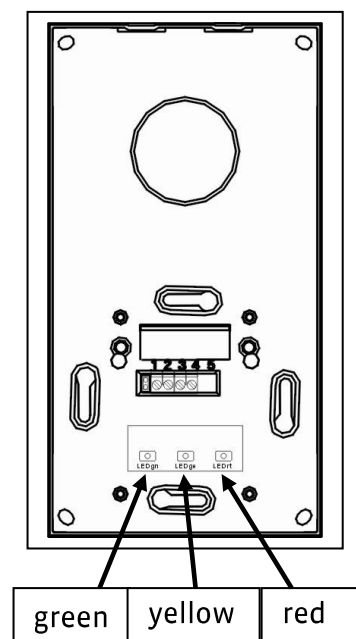
The following values can be indicated in the display:

- Room temperature, outdoor temperature,
- 4 external values with selectable unit
- 4 setpoints effective and offset with selectable unit
- Date, time and weekday
- symbols showing fan-coil stages, occupancy, fault, heating, cooling, window

3.2 Lower part of device (base plate): LED-Display

The room operating panel has 3 LEDs for the indication of different status for verifying device functions and bus communication

- UV: The green UV-LED is designed for the display of operation. In the standard operation, the LED is blinking in a 1s-cyclus.
- RX/TX: The yellow RX/TX-LED is blinking for 500ms, if the device is addressed directly.
- ERROR: The red Error-LED shows the status of the BUS communication. A constant lighting shows, that no valid communication is recognized at the BUS. A blinking LED shows, that a valid communication is recognized but that the device is not integrated in the token circulation. If the communication is valid and the participation in the token circulation is active, the LED is off.



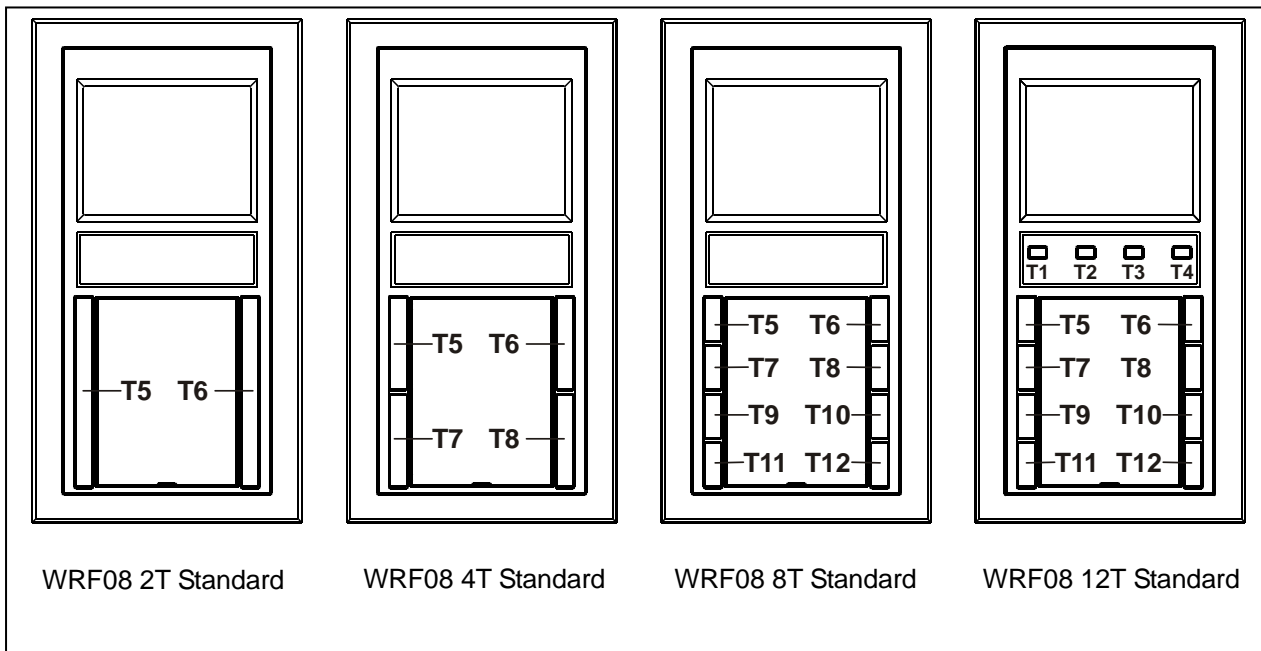
3.3 BACnet addressing

Each device in a BACnet network requires an unique device ID. The device ID is composed of the MAC address and a device ID offset. Both values can be modified in the modification menu.

The MAC address is the device address in the MS/TP network, the device ID is the device address in the BACnet network.

The default as supplied for the device-offset-id is 100. Device identifiers from 0 through 4194299 can be set by altering the device address or offset, after which the device is newly started and initialized.

3.4 Definition Button Numeration



The corresponding function of the button can be adjusted via the configuration software described in chapter 7.

The following button functions are possible:

- Button pressed / not pressed e.g. for light, blind
 - BACnet objekcs pushbutton_01 – pushbutton_12 (Typ BINARY_INPUT, BI1001-1012) show the current state of the buttons
- Adjustment of set point
 - Up to four set point offsets with selectable unit can be adjusted
 - When actuating the button, the corresponding set point is indicated in the display
 - The offsets can be overridden by the corresponding BACnet objects ext_setpoint_offset_x (type: Analog Value, AV1527-1530).
- Adjustment of fan stage
 - The current fan stage is automatically indicated in the display
 - The offsets can be overridden by the corresponding BACnet object ext_fan_coil_stage (type: MULTISTATE_VALUE, MV-1539).
- Adjustment of room occupancy
 - The current room occupancy is indicated in the display automatically.
 - The room occupancy can be overridden by the corresponding BACnet object ext_room_occupancy (type: BINARY_VALUE, BV-1540).

3.5 Modification menu

The following settings are possible: temperature calibration, setting the MAC address, baudrate and device-offset-ID.

| | |
|------------------------------|---|
| Enter the modification menu: | Parallel actuation of the buttons T5, T7, T10 und T12 for a time exceeding 10s. |
| Switch to next menu: | Parallel actuation of the buttons T5, T7, T10 und T12 for a time exceeding 10s. |
| Kalibriermodus verlassen: | No button actuation for a time exceeding 10s. |
| Specific Feature WRF08 4T: | The calibration mode is polled by the buttons T5 and T8. Please make sure, that the push-button is pressed via the entire width. |
| Specific Feature WRF08 2T: | The calibration mode is polled by the buttons T5 and T6. Please make sure, that the push-button T5 on the upper buttonpart is fully pressed and that the push-button T6 is fully pressed on the lower part. |

Changed values getting valid after a warm start.

3.5.1 Temperature Calibration Mode

Each temperature sensor is calibrated during production by the manufacturer. Due to the fact, that the temperature measuring with flush-mounting sensors is besides the voltage-dependent self-heating of the electronics also affected by the temperature dynamic of the wall, a recalibration might become necessary in some cases.

For the user the calibration mode offers the possibility to make a supplementary calibration via the operating buttons without needing a service engineer to make these adjustments via the RS485 bus.

| | |
|---------------------------------|---|
| Visualization calibration mode: | All button-response-LEDs are on. |
| Adjust temperature: | Buttons T5 or T7 or T9 or T11 for + 0,1 Buttons T6 or T8 or T10 or T12 for - 0,1 |

3.5.2 Setting the MAC address

Bus addresses can be set in the range of 1-127. The MAC-Adress is the device address in the MS/TP network!

| | |
|-------------------------|---|
| Visualization MAC mode: | The button-response-LEDs T5, T7, T9 und T11 (left side) are on. |
| Set address: | Buttons T5 or T7 or T9 or T11 for - 1 Buttons T6 or T8 or T10 or T12 for + 1 |

3.5.3 Setting the baudrate

The following baudrates are supported:

- 1 9600
- 2 19200
- 3 38400
- 4 57600
- 5 76800
- 6 115200

Visualization Baud-Modus: The button-response-LEDs T6, T8, T10 und T12 (right side) are on.

Set baudrate: button T5 or T7 or T9 or T11 for the previous baudrate
 button T6 or T8 or T10 or T12 for the next baudrate

In addition a bus terminating resistor 120 Ohm can be connected.

3.5.4 Setting the device-offset-ID

Setting the device-offset-ID takes place in four steps. In the first step, a change of the units is possible, afterwards a change of the hundred, then ten thousand and in the fourth step the millionth digit can be changed.

Visualization ID step 1: The button-response-LEDs T5 and T6
Visualization ID step 2: The button-response-LEDs T7 and T8
Visualization ID step 3: The button-response-LEDs T9 and T10
Visualization ID step 4: The button-response-LEDs T11 and T12
Set values: button T5 or T7 or T9 or T11 for -1
 button T6 or T8 or T10 or T12 für +1

4 Hardware Installation

Devices can be connected by a twisted-pair cable (120 Ω line resistance). The maximum number of bus users (without use of a bus repeater) is defined by the RS485 transceiver. For detailed information on installation and mounting, please see the product data sheet WRF08-RS485-Modbus and the data sheet wiring_rs485_network.pdf.

4.1 RS485 Transceiver

The maximum number of bus participants without use of a repeater is preset by the RS485-transceiver. The transceiver used allows 128 devices per bus segment at maximum. In addition a bus terminating resistor 120 Ohm can be connected.

4.2 Protocol

The protocol used is the international standard BACnet MS/TP. This enables connection to appropriate remote terminals such as an automation station or a building services management system supporting the BACnet MS/TP protocol.

The standard defines the transmission parameters as 8N1, i.e. 8 data bits, no parity, 1 stop bit. The baud rate is freely selectable (9600, 19200, 38400, 57600, 76800, 115200), and is set in the modification menu. It is also possible to set the BACnet MAC address (bus address) of the device. A different bus address is needed for each device!

4.2.1 BACnet Configuration Tool

BACnet MS/TP wireless receivers are always operated together with other BACnet automation stations or building services management systems such as BACnet operating workstations. All parameter settings are possible through a configuration software supplied by Thermokon. Tools from the particular manufacturer of an automation station or building services management system are used to start up a BACnet network.

5 BACnet

5.1 BACnet Device Profile and BIBBs

The device is operating with the device profile BACnet Application Specific Controller (B-ASC).

The following BIBBs are implemented:

| | |
|-----------|--|
| DS-RP-B | Data Sharing-ReadProperty-B |
| DS-WP-B | Data Sharing-WriteProperty-B |
| DS-RPM-B | Data Sharing-ReadPropertyMultiple-B |
| DS-COVU-B | Data Sharing-COV-Unsolicited-B |
| DM-DDB-B | Device Management-Dynamic Device Binding-B |
| DM-DOB-B | Device Management-Dynamic Object Binding-B |
| DM-DCC-B | Device Management-DeviceCommunicationControl-B |
| DM-TS-B | Device Management-TimeSynchronization-B |

5.2 BACnet Objects

The room operating panel has 62 BACnet-Object. Two of these objects serve for the basic settings of the device. Five File-Objects serve for the configuration.

5.2.1 Description of objects for Basic Device Settings

| Object_name | Object type / Instanz | Function |
|-----------------------------|---|--|
| Thermokon_WRF08_BACnet | Device Object Offset-Device-ID+MAC-Adresse | The Device-Object makes the features for characterization of the device in the BACnet network available. Among others, the object list, the manufacturer and the software version is indicated. Additionally, basic settings like MAX-Master are possible. |
| Offset_device_id | Analogue Value 1 AV-1 | This value plus the set MAC (0-127) corresponds to the device ID (writeable 0-4194200) after write, reset and new initialize. |
| COV-Mode | Multistate Value 1 MV-1 | This setting is for COV mode. The following modes are supported: - Off - Local broadcast - Global broadcast |
| Configuration register file | File Object 1 FI-1 | Designed for reading and writing of configuration properties by means of the configuration software. |
| Input registers file | File Object 2 FI-2 | Designed for reading out of readable objects with the configuration software. |
| Holding registers file | File Object 3 FI-3 | Designed for reading and writing of read- and writeable objects with the configuration software. |
| Configuration coils file | File Object 4 FI-4 | Designed for reading and writing of the configuration bits by means of the configuration software. |
| Coils file | File Object 5 FI-5 | Designed for reading and writing of read- and writeable binary objects with the configuration software. |

Table 5-1 Description of objects for Basic Device Settings

5.2.2 Description of the read-only BACnet objects

| Objekt_Name | Objekt Typ / Instanz | Funktion |
|----------------------|-----------------------|----------------------------|
| pushbutton_01 | BinaryInput-1001 | Current state of button 1 |
| pushbutton_02 | BinaryInput-1002 | Current state of button 2 |
| pushbutton_03 | BinaryInput-1003 | Current state of button 3 |
| pushbutton_04 | BinaryInput-1004 | Current state of button 4 |
| pushbutton_05 | BinaryInput-1005 | Current state of button 5 |
| pushbutton_06 | BinaryInput-1006 | Current state of button 6 |
| pushbutton_07 | BinaryInput-1007 | Current state of button 7 |
| pushbutton_08 | BinaryInput-1008 | Current state of button 8 |
| pushbutton_09 | BinaryInput-1009 | Current state of button 9 |
| pushbutton_10 | BinaryInput-1010 | Current state of button 10 |
| pushbutton_11 | BinaryInput-1011 | Current state of button 11 |
| pushbutton_12 | BinaryInput-1012 | Current state of button 12 |
| room_temperature | AnalogInput-1259 | Room temperature |
| setpoint_offset_1 | AnalogInput-1260 | Offset set point 1 |
| setpoint_effective_1 | AnalogInput-1261 | Effective set point 1 |
| setpoint_offset_2 | AnalogInput-1262 | Offset set point 2 |
| setpoint_effective_2 | AnalogInput-1263 | Effective set point 2 |
| setpoint_offset_3 | AnalogInput-1264 | Offset set point 3 |
| setpoint_effective_3 | AnalogInput-1265 | Effective set point 3 |
| setpoint_offset_4 | AnalogInput-1266 | Offset set point 4 |
| setpoint_effective_4 | AnalogInput-1267 | Effective set point 4 |
| fan_coil_stage | Multi-StateInput-1272 | Fan coil stage |
| room_occupancy | BinaryInput-1273 | Room occupancy |

Table 5-2 Description of the read-only objects

5.2.3 Description of readable and writeable BACnet objects

| Objekt_Name | Objekt Typ / Instanz | Bedeutung |
|-----------------------|----------------------|-------------------------|
| outdoor_temperature | AnalogValue-1520 | Outdoor temperature |
| ext_value_1 | AnalogValue-1521 | External value 1 |
| ext_value_2 | AnalogValue-1522 | External value 2 |
| ext_value_3 | AnalogValue-1523 | External value 3 |
| ext_value_4 | AnalogValue-1524 | External value 4 |
| ext_setpoint_offset_1 | AnalogValue-1527 | Set point 1 offset |
| ext_setpoint_offset_2 | AnalogValue-1528 | Set point 2 offset |
| ext_setpoint_offset_3 | AnalogValue-1529 | Set point 3 offset |
| ext_setpoint_offset_4 | AnalogValue-1530 | Set point 4 offset |
| base_setpoint_1 | AnalogValue-1533 | Basic set point 1 |
| base_setpoint_2 | AnalogValue-1534 | Basic set point 2 |
| base_setpoint_3 | AnalogValue-1535 | Basic set point 3 |
| base_setpoint_4 | AnalogValue-1536 | Basic set point 4 |
| ext_fan_coil_stage | MultiStateValue-1539 | External fan coil stage |
| ext_room_occupancy | BinaryValue-1540 | External room occupancy |
| led_button_12 | BinaryValue-2257 | LED button 12 on/off |
| led_button_11 | BinaryValue-2258 | LED button 11 on/off |
| led_button_10 | BinaryValue-2259 | LED button LED10 on/off |
| led_button_9 | BinaryValue-2260 | LED button LED9 on/off |
| led_button_8 | BinaryValue-2261 | LED button LED8 on/off |
| led_button_7 | BinaryValue-2262 | LED button LED7 on/off |
| led_button_6 | BinaryValue-2263 | LED button LED6 on/off |
| led_button_5 | BinaryValue-2264 | LED button LED5 on/off |
| symbol_fault | BinaryValue-2265 | Symbol fault on/off |
| symbol_heating | BinaryValue-2266 | Symbol heating on/off |

| Objekt_Name | Objekt Typ / Instanz | Bedeutung |
|----------------|----------------------|--------------------------------|
| symbol_cooling | BinaryValue-2267 | Symbol cooling on/off |
| symbol_window | BinaryValue-2268 | Symbol window on/off |
| lock_buttons | BinaryValue-2269 | Deactivate Button actuation |
| lock_occupancy | BinaryValue 2270 | Deactivate Room occupancy |
| lock_fan_coil | BinaryValue 2271 | Deactivate Fan speed |
| lock_setpoint | BinaryValue 2272 | Deactivate Set point |

Table 5-3 Description of readable and writeable objects

5.3 Description of configuration properties

5.3.1.1 File Objekt 1- Configuration register file

The following table lists all properties of File Object 1 . These properties can be modified using the Thermokon configuration software.

| Index | Beschreibung | Value range | Default |
|-------|--|---|--------------------------|
| 1 | Intensity background illumination LCD, after 15s without button actuation (rest) | 0 – 100% | 10% |
| 2 | Intensity background illumination LCDwith button actuation (active) | 0 – 100% | 100% |
| 3 | Intensity background illumination labelling area after 15s without button actuation (rest) | 0 – 100% | 10% |
| 4 | Intensity background illumination labelling areawith button actuation (active) | 0 – 100% | 100% |
| 5 | Function button -T1 | without special function(default) Set point 1 + Set point 1 – Set point 2 + Set point 2 – Set point 3+ Set point 3 – Set point 4 + Set point 4 – Fan stage Plus with "AUTO" Fan Stage Minus with "AUTO" Fan stage Plus without "AUTO" Fan stage Minus without "AUTO" Fan stage only "AUTO" Room unoccupied Room occupied | without special function |
| 6 | Function button -T2 | | without special function |
| 7 | Function button -T3 | | without special function |
| 8 | Function button -T4 | | without special function |
| 9 | Function button -T5 | | without special function |
| 10 | Function button -T6 | | without special function |
| 11 | Function button -T7 | | without special function |
| 12 | Function button -T8 | | without special function |
| 13 | Function button -T9 | | without special function |
| 14 | Function button -T10 | | without special function |
| 15 | Function button -T11 | | without special function |
| 16 | Function button -T12 | | without special function |
| 17 | Function LED -T5 | without special function – (LED controllable via BI 2257) button – (LED = ON if button is pressed LED = OFF if button is not pressed) | button |
| 18 | Function LED -T6 | | button |
| 19 | Function LED -T7 | | button |
| 20 | Function LED -T8 | | button |
| 21 | Function LED -T9 | | button |

| Index | Beschreibung | Value range | Default |
|-------|--|---|------------|
| 22 | Function LED -T10 | | button |
| 23 | Function LED -T11 | | button |
| 24 | Function LED -T12 | | button |
| 25 | Display weekday | off english german | off |
| 26 | Display date | off english german | off |
| 27 | Display time | off Display time including seconds Display time without seconds | off |
| 28 | Display time mode | 24h – mode 12h - mode | 24h – mode |
| 29 | Updating interval of display in seconds | 0 .. 255s | 10s |
| 30 | Temperature-Offset for calibration of temperature sensor | -10K .. +10K | 0K |
| 31 | Upper adjustable range set point 1 | 0 .. +100 unit depends on setting | +3 |
| 32 | Lower adjustable range set temperature 1 | -100 .. 0 unit depends on setting | -3 |
| 33 | Step range set point 1 | 0 .. 100 unit depends on setting | 0.5 |
| 34 | Basic set point after reset – set point 1 | 0 .. 100 unit depends on setting | 22 |
| 35 | Upper adjustable range set point 2 | -100 .. +100 unit depends on setting | +3 |
| 36 | Lower adjustable range set point 2 | -100 .. +100 unit depends on setting | -3 |
| 37 | Step range set point 2 | 0 .. 100 unit depends on setting | 0.5 |
| 38 | Basic set point after reset – set point 2 | 0 .. 100 unit depends on setting | 22 |
| 39 | Upper adjustable range set point 3 | -100 .. +100 unit depends on setting | +3 |
| 40 | Lower adjustable range set point 3 | -100 .. +100 unit depends on setting | -3 |
| 41 | Step range set point 3 | 0 .. 100 unit depends on setting | 0.5 |

| Index | Beschreibung | Value range | Default |
|-------|---|---|-------------|
| 42 | Basic set point after reset – set point 3 | 0 .. 100 unit depends on setting | 22 |
| 43 | Upper adjustable range set point 4 | -100 .. +100 unit depends on setting | +3 |
| 44 | Lower adjustable range set temperature 4 | -100 .. +100 unit depends on setting | -3 |
| 45 | Step range set point 4 | 0 .. 100 unit depends on setting | 0.5 |
| 46 | Basic set point after reset – set point 4 | 0 .. 100 unit depends on setting | 22 |
| 47 | Fan coil stages | 1 – 3 | 3 |
| 48 | Unit set point 1 | temperature percent no unit | temperature |
| 49 | Unit set point 2 | | temperature |
| 50 | Unit set point 3 | | temperature |
| 51 | Unit set point 4 | | temperature |
| 52 | Unit value 1 | temperature percent no unit | temperature |
| 53 | Unit value 2 | | temperature |
| 54 | Unit value 3 | | temperature |
| 55 | Unit value 4 | | temperature |
| 56 | COV-Increment temperature | 0 .. 10K | 0.5K |
| 57 | COV-Increment percent | 0 .. 10% | 1% |
| 58 | COV-Increment no unit | 0 .. 10 | 1 |
| 59 | Lock external values | 0 .. 255s | 5s |

Table 5-4 Description of configuration properties in File Object 1

5.3.1.2 File Objekt 4 - Configuration coil file

The following table lists all properties of File Object 4. These properties can be modified using the Thermokon configuration software.

| Index | Beschreibung | Wertebereich | Grund-einstellung |
|-------|--|---|---------------------|
| 1 | Display room temperature (internal sensor) | on/off | on |
| 2 | Display outdoor temperature (present value from AV-1520) | on/off | off |
| 3 | Display external value 1 (present value from AV-1521) | on/off | off |
| 4 | Display external value 2 (present value from AV-1522) | on/off | off |
| 5 | Display external value 3 (present value from AV-1523) | on/off | off |
| 6 | Display external value 4 (present value from AV-1524) | on/off | off |
| 7 | Display set point 1 offset | on/off | off |
| 8 | Display set point 1 effective | on/off | off |
| 9 | Display set point 2 offset | on/off | off |
| 10 | Display set point 2 effective | on/off | off |
| 11 | Display set point 3 offset | on/off | off |
| 12 | Display set point 3 effective | on/off | off |
| 13 | Display set point 4 offset | on/off | off |
| 14 | Display set point 4 effective | on/off | off |
| 15 | Display fan coil stage after reset | on/off | on |
| 16 | Display room occupancy after reset | on/off | on |
| 17 | Activate device by button press | on/off | off |
| 18 | Unit temperature | °C / °F The selection is valid for all objects which have temperature units (set points, external values, room temperature, outdoor temperature) ! | °C |
| 19 | Display temperature | fade in/fade out tenth point | fade in tenth point |
| 20 | Display value without unit | fade in/fade out Komma | fade in comma |
| 21 | Display with set point 1 adjustment | offset/effective | offset |
| 22 | Display with set point 2 adjustment | offset/effective | offset |

| Index | Beschreibung | Wertebereich | Grund-einstellung |
|-------|-------------------------------------|------------------|-------------------|
| 23 | Display with set point 3 adjustment | offset/effective | offset |
| 24 | Display with set point 3 adjustment | offset/effective | offset |

Table 5-5 Description of configuration properties in File Object 4

5.3.2 BACnet Device Object

5.3.2.1 Device object -> MAX-Master property

This property can be written between 0 and 127 and defines up to which address further users are polled on the bus. It is an MS/TP-specific property.

5.3.2.2 Device object-> Object identifier

Each device in a BACnet network requires a unique device ID. The device offers two ways of altering the ID. The device ID is composed of the MAC address, produced by the address DIP switch, and a device ID offset, written by a BACnet object. The default as supplied for this object is 100, the default MAC address is 127 arising a device id of 227. Device identifiers from 0 through 4194299 can be set by altering the MAC address or offset, after which the device is newly started and initialized.

5.3.2.3 Device object-> object name, description

These two properties are writeable, with a maximum text length of 64 characters. The object name property must also be unique within a BACnet network.

6 Function Description

6.1.1 COV-Treating

The functionality can be selected with the multistate value object (MV-1). Writing the present value property (1-3) selects the COV mode. The following settings can be made:

| Index | Name | Description |
|-------|------------|--|
| 1 | no cov | COV-Service is deactivated. Values can only be read using the ReadProperty-service. |
| 2 | local cov | COV-Service is activated. Values are sent as a local broadcast message (only MS/TP network). |
| 3 | global cov | COV-Service is activated. Values are sent as a global broadcast message (global BACnet network). |

Table 6-1 Setting the COV-service

| Configuration | | |
|-----------------------------------|---------------------------|---|
| Index | Name | Beschreibung |
| <i>File Object 1 Index 57</i> | COV-Increment temperature | If a temperature value changes by the adjusted value COV-Increment temperature, the new temperature value is transmitted as a COV-service |
| <i>File Object 1 Index 58</i> | COV-Increment percent | If a percent value changes by the adjusted value COV-Increment percent, the new percent value is transmitted as a COV-service. |
| <i>File Object 1 Index 59</i> | COV-Increment no unit | If a no unit value changes by the adjusted value COV-Increment no unit, the new no unit value is transmitted as a COV-service. |

Table 6-2 COV-service parameters

6.1.2 Display

By means of the following configuration properties the indication of the display can be changed. It is possible to adjust different brightness values for the LCD display and the label area. Furthermore, the interval for the toggling of the display in the LCD can be changed.

| Configuration | | |
|---|--|--|
| Index | Name | Description |
| <i>File Object 1</i> <i>Index 1</i> | Intensity background illumination LCD, after 15s without button actuation (rest) | If no button is pushed for 15s, the device falls back in the sleeping mode. Values between 0 (OFF) and 100% can be adjusted. |
| <i>File Object 1</i> <i>Index 2</i> | Intensity background illumination LCD with button actuation (active) | Upon button actuation the device is back in the active mode. Values between 0 (OFF) and 100% can be adjusted. |
| <i>File Object 1</i> <i>Index 3</i> | Intensity background illumination labelling area after 15s without button actuation (rest) | If no button is pushed for 15s, the device falls back in the sleeping mode. Values between 0 (OFF) and 100% can be adjusted. |
| <i>File Object 1</i> <i>Index 4</i> | Intensity background illumination labelling area with button actuation (active) | Upon actuation of a button, the device is back in the active mode. Values between 0 (OFF) and 100% can be adjusted. |
| <i>File Object 1</i> <i>Index 29</i> | Updating interval of display in seconds | Interval for the toggling of the display to the next value in seconds to be displayed. |

Table 6-3 Display parameters

6.1.3 Buttons and LED

The WRF08_BACnet is available in the types 2T, 4T, 8T and 12T. Every button can be field programmed. Buttons T5-T12 have an additional LED. The function of the LED is also be field programmable.

| Output | | |
|---|---------------|----------------------|
| Type | Name | Description |
| <i>Binary Input Object</i> 1001 - 1012 | pushbutton_xx | Current button state |

Table 6-4 Objects for status message of buttons

| Input | | |
|---|---------------|---|
| Type | Name | Description |
| <i>Binary Value Object</i> 2258 - 2264 | led_button_xx | Control of LED by a higher-level system. |
| <i>Binary Value Object</i> 2269 | lock_buttons | Via this object the buttons to which no special function is assigned, are locked. |

Table 6-5 Objects for control of LED

| Configuration | | |
|-------------------------------------|--------------------|---|
| Index | Name | Description |
| <i>File Object 1</i> Index 5-16 | Function button Tx | Here the configuration of the corresponding button function is made. |
| <i>File Object 1</i> Index 17-24 | Function LED Txx | Optionally, the LEDs can be coupled to the button or set via the network. |

Table 6-6 Button configuration properties

6.1.4 Set Points

Up to 4 set points can be indicated in the display as effective or offset values. The unit can be adjusted individually for each set point. A change of the set point is feasible via the buttons or the network. As output values the effective set point and the adjusted offset are made available.

| Output | | |
|--|----------------------|---|
| Type | Name | Description |
| <i>Analog Input Object</i> 1260, 1262, 1264, 1266 | setpoint_offset_x | Current set point offset. Can be changed by the user by means of button actuation or via the input object ext_setpoint_offset_x. After a manual set point adjustment, the input object ext_setpoint_offset_x can be deactivated for a selectable time (see locking of parameter external default). Thus, it can be prevented, that the user inputs are directly overwritten by network updates. |
| <i>Analog Input Object</i> 1261, 1263, 1265, 1267 | setpoint_effective_x | The effective set point is calculated of the set point offset and the basic set point. |

Table 6-7 Set point output objects

| Input | | |
|---|-----------------------|---|
| Type | Name | Description |
| <i>Analog Value Object</i> 1527-1530 | ext_setpoint_offset_x | External default of offset by a higher-level system. |
| <i>Analog ValueObject</i> 1533-1536 | base_setpoint_x | External default of a basic set point by a higher-level system. As long as no valid value is received in this object, the value of the configuration property basic set point after reset is valid. |
| <i>Binary Value Object</i> 2272 | lock_setpoint | Locks the buttons of the set point adjustment. |

Table 6-8 Set point input objects

| Configuration | | |
|---|-----------------------------|--|
| Index | Name | Description |
| <i>File Object 1</i> <i>Index 31, 35, 39, 43</i> | Upper adjustable range | Threshold value for upper range of set point offset adjustment by means of the buttons. |
| <i>File Object 1</i> <i>Index 32, 36, 40, 44</i> | Lower adjustable range | Threshold value for lower range of set point offset adjustment by means of the buttons. |
| <i>File Object 1</i> <i>Index 33,37,41,45</i> | Step range | Determines the step range of the manual set point adjustment by means of the buttons. |
| <i>File Object 1</i> <i>Index 34, 38, 42, 46</i> | Basic set point after reset | After a restart of the device, the value adjusted here is used as a basic set point. This value remains valid as long as another value is received by the input object base_setpoint_x. |
| <i>File Object 1</i> <i>Index 48, 49, 50, 51</i> | Unit | For every set point the unit can be freely selected. For selection <i>temperature, percent and no unit</i> are available. Display of temperature is depending on the property <i>unit temperature</i> . (see File-Objekt4, Index 18) |
| <i>File Object 4</i> <i>Index 7, 9, 11, 13</i> | Display offset value | Here it can be selected if the offset value shall be displayed. |
| <i>File Object 4</i> <i>Index 8, 10, 12, 14</i> | Display effective value | Here it can be selected if the effective value shall be displayed. |
| <i>File Object 4</i> <i>Index 21, 22, 23, 24</i> | Display with adjustment | Selection of set point display upon change of button. It is possible to display the effective set point or the set point offset. |

Table 6-9 Set point configuration parameters

6.1.5 External Values

Up to four external values (defaults of a higher-level station) can be displayed. The unit of each value can be freely chosen.

| Input | | |
|--|---------------|---|
| Type | Name | Description |
| <i>AnalogValue</i> <i>1521 - 1524</i> | ext_value_1-4 | External default for external values for indication in the display. |

Table 6-10 External value objects

| Configuration | | |
|--|---------|--|
| Index | Name | Description |
| <i>File Object 1</i> <i>Index 52-55</i> | Unit | Free selectable between <i>temperature</i> , <i>percent</i> and <i>no unit</i> |
| <i>File Object 4</i> <i>Index 3-6</i> | Display | The display can be switch on/off for every external value. |

Table 6-11 External value parameters

6.1.6 Room Occupancy

Room occupancy can be changed by a higher-level BMS as well as locally via the buttons. The current status is determined by the value updated latestly as both types have equal rights. An exception is the possibility to lock the external default. See chapter 6.1.10! Local change of room occupancy can be locked by the BMS.

| Output | | |
|------------------------------------|----------------|---|
| Type | Name | Description |
| <i>Binary Input</i> <i>1273</i> | room_occupancy | Outputs the current status of room occupancy. |

Table 6-12 Room occupancy output objects

| Input | | |
|------------------------------------|--------------------|---|
| Type | Name | Description |
| <i>Binary Value</i> <i>1540</i> | ext_room_occupancy | External default of room occupancy by a higher-level system. After a local adjustment of the room occupancy the input object ext_room_occupancy can be deactivated for a selectable time (see property lock external default). Thus, it can be prevented that user input is directly overwritten by network updates. |
| <i>Binary Value</i> <i>2270</i> | lock_occupancy | Locks the button for room occupancy. |

Table 6-13 Room occupancy input objects

| Configuration | | |
|---|------------------------------------|--|
| Index | Name | Description |
| <i>File Object 1</i> <i>Index 5-16</i> | Function button Tx | Here any button can be assigned to the room occupancy. The allocations „room occupied“ and „room unoccupied“ are feasible. |
| <i>File Object 4</i> <i>Index 16</i> | Display room occupancy after reset | After the boot up of the device, the room occupancy is faded in automatically. If the setting is deactivated, the occupancy is faded in as soon as it has changed, regardless whether locally changed or by an update via the network. |

Table 6-14 Room occupancy properties

6.1.7 Fan coil

The fan stage can be changed by a higher-level system or locally via a button.
Up to 3 fan stages are feasible. It can be distinguished between manual or automatic mode.

| Output | | |
|--------------------------------|----------------|---|
| Type | Name | Description |
| <i>MultiStateInput</i> 1272 | fan_coil_stage | Indicates the current status of the fan stages. |

Table 6-15 Fan coil output objects

| Input | | |
|-----------------------------|--------------------|---|
| Type | Name | Description |
| <i>Binary Value</i> 1539 | ext_fan_coil_stage | External default of the fan stage by a higher-level system. After a local setting of the fan stages the input object ext_fan_coil_stage can be deactivated for a selectable (see Property lock external default). Thus, it can be prevented that the user input is directly overwritten by a network update. |
| <i>Binary Value</i> 2270 | lock_fan_coil | Locks the buttons of the fan stages. |

Table 6-16 Fan coil input objects

| Configuration | | |
|---|------------------------------|---|
| Index | Name | Description |
| <i>File Object 1</i> <i>Index 5-16</i> | Function Taste Tx | Here any button can be assigned to the change of a fan stage. Possibilities for this setting can be found in the description of the button functions. |
| <i>File Object 4</i> <i>Index 16</i> | Display fan coil after reset | After the boot up of the device, the fan stage is faded in automatically. If the setting is deactivated, the fan stage is faded in as soon as it has changed, regardless whether locally or by an update via the network. |

Table 6-17 Fan coil parameters

6.1.8 Date and Time

For setting of time and date, the TimeSynchronization Service is used. This service is designed for Synchronization of the time within the same time zones. In the Device Object, time and date of a device can be inquired via the features `localDate` and `localTime`. For the indication in the display, note that time and date are only faded in, if the device received a valid time or a valid date via the TimeSynchronization Service.

| Configuration | | |
|--|-------------------|--|
| <i>File Object1</i> <i>Index 25</i> | Display weekday | Fading in of weekday. If the weekday shall be faded in, it can be selected between German and English display. |
| <i>File Object1</i> <i>Index 26</i> | Display date | Fading in of date. If the date shall be faded in, it can be selected between German and English display |
| <i>File Object1</i> <i>Index 27</i> | Display time | Fading in of time. If the time shall be faded in, it can be selected between display with and without seconds. |
| <i>File Object1</i> <i>Index 28</i> | Display time mode | The time can be displayed in 12h or 24h mode. |

Table 6-18 Date and time properties

6.1.9 Symbols

In the display the symbols failure, heating, cooling and window can be indicated.

| Input: | | |
|---------------------|----------------|--|
| Type | Name | Description |
| BinaryValue 2265 | symbol_fault | The symbol „failure“ can be faded in and out via a higher-level system. |
| BinaryValue 2266 | symbol_heating | The symbol „heating active“ can be faded in and out via a higher-level system. |
| BinaryValue 2267 | symbol_cooling | The symbol „cooling active“ can be faded in and out via a higher-level system. |
| BinaryValue 2268 | symbol_window | The symbol „window open“ can be faded in and out via a higher-level system. |

Table 6-19 Symbols

6.1.10 Lock External Values

Changes made by the user for set points, room occupancy or fan stages via the buttons are decoupling the corresponding BACnet input objects from the internal calculations. After expiration of the adjusted time, the input objects are released again. Thus, it is guaranteed, that the user inputs are not directly overwritten by via the network. The values can be synchronized via the network.

| Configuration | | |
|-----------------|----------------------|---|
| <i>Index 59</i> | Lock external values | <p>The locking becomes active upon changes of the room occupancy, fan stages and set points.</p> <p>If the room occupancy is changed by the user, the object <code>ext_room_occupancy</code> (BinaryValue-1540) is decoupled.</p> <p>If the fan stage is changed by the user, the object <code>ext_fan_coil_stage</code> (MultiStateValue-1539) is decoupled.</p> <p>If a set point is changed by the user, the corresponding object <code>ext_setpoint_offset_x</code> (AnalogValue-1527-1530) is decoupled.</p> |

Table 6-20 Lock external values

7 Configuration Software

Thermokon provides a configuration software by which the user can comfortably configure the WRF08 via the BACnet network.

7.1 Software Installation

For the installation of the configuration software, the setup file „WRF08_RS485_Config_Setup.exe“ must be started. Please note that you must have administrator rights for the installation. During the installation, please follow the screen instructions.
Deactivate other running BACnet-Stacks on your laptop/PC. Otherwise the configuration software cannot access the network!!

After a successful operation, the configuration software can be started via the “Starting Menu/Programs/Thermokon“

Operating systems supported: Windows9x; WindowsNT; WindowsMe; Windows2000;
 WindowsXP; WindowsServer

Note: Using operating systems Windows XP english version, Vista or Windows 7 it is recommended not to use the default Windows path for installation. Please use a path like “C:\Thermokon\” !!!

7.2 Network settings

If the IP address of the computer is not obtained automatically, please ensure that laptop/PC and BACnet router are in the same Subnet. The Subnet mask has to be set accordingly !!!

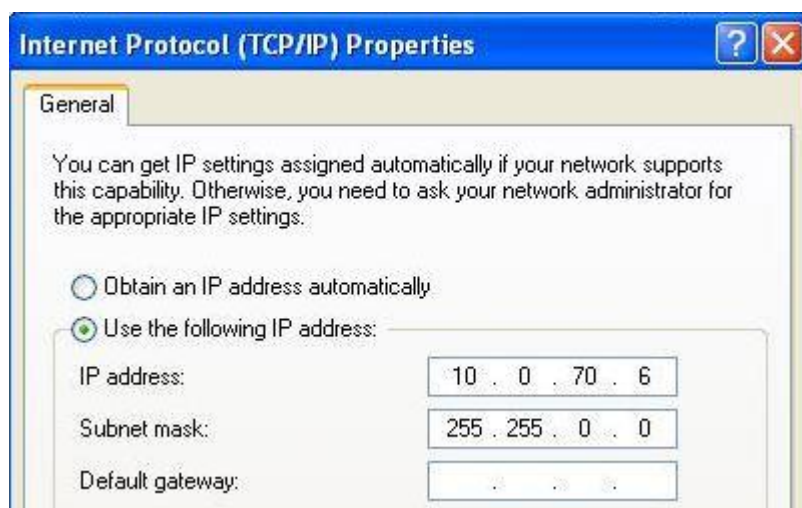


Figure 7-1 Example Subnet mask setting

7.3 Configuration of WRF08-BACnet

7.3.1 Start

After having started the software, the following starting window is shown.



Figure 7-2 Login

For the start, no user name and no password must be mentioned. In the user management, a new user should be created afterwards. As soon as a new user is created, the fields for user name and password must be filled in, accordingly. A registration without valid inputs in these fields is no longer possible, thus.



Figure 7-3 Select a device

After successful registration, the field for device selection is released. When confirming the selection with OK, the main window is entered.

7.3.2 Main window

The main window is divided in the following areas:

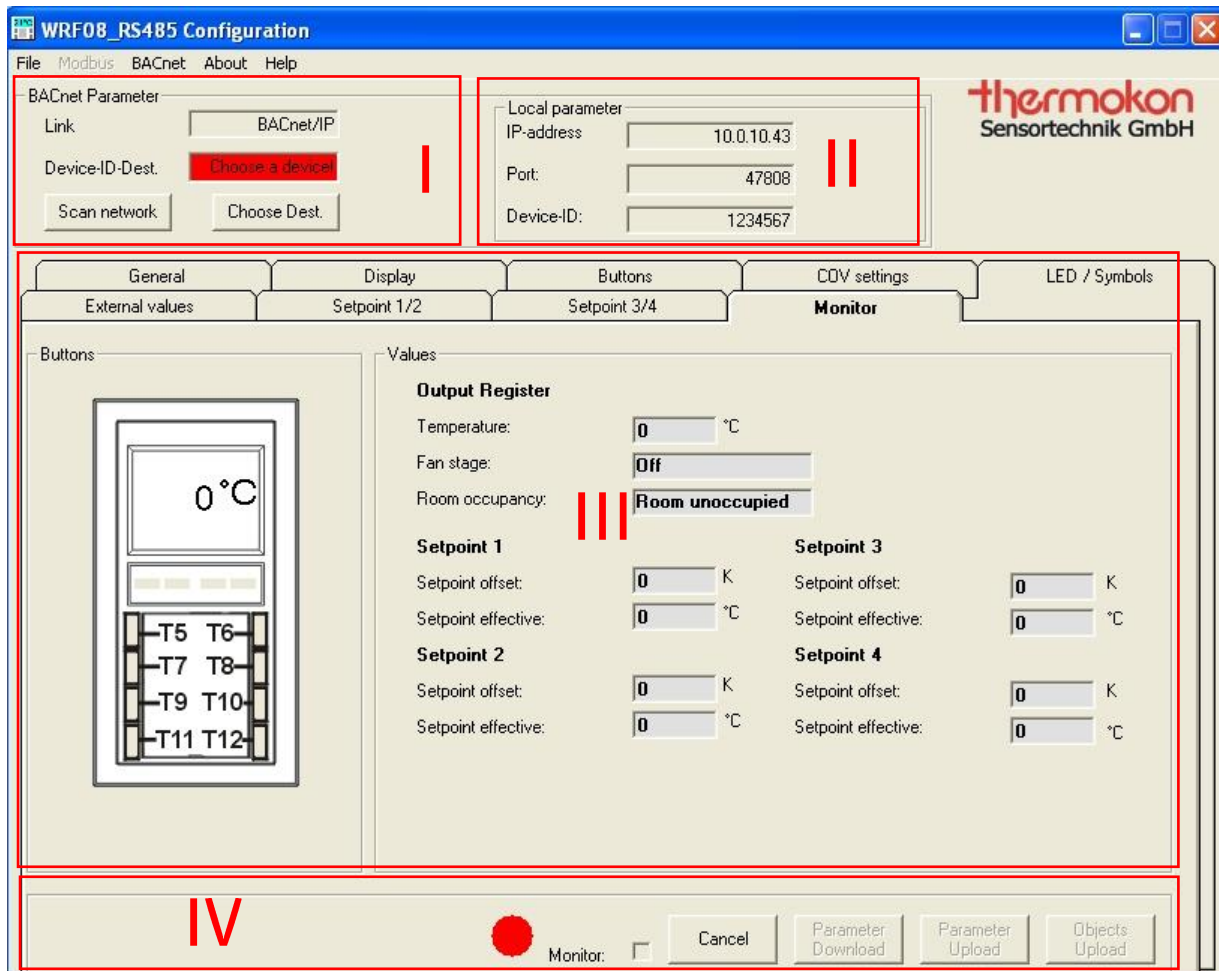


Figure 7-4 Main window

I. Network scan and Destination

The BACnet network is scanned for WRF08 devices. Afterwards, the device that shall be configured is selected from the list. The link shows if the search for the devices in the IP network or in another local MS/TP network shall be carried out. Therefore, the PC/Laptop must be included in the RS485 line via an interface converter.

Local properties

The BACnet properties are indicated, which were executed in the menu BACnet-> settings of user. The display of the properties is depending on link set by the user.

Device configuration

Here all properties for the configuration of the WRF08 can be set. Moreover, the device can be tested in the monitor operation or monitored.

Action bar

The user has the option to supervise, read out or to write the device (monitor).

7.3.3 Menu

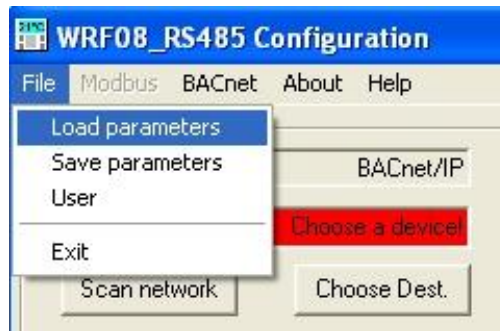


Figure 7-5 Menu: File

Load parameters:
Save parameters:
User:

Configuration saved before are loaded.
The current configuration is saved in a text file.
Opens a menu for user management.

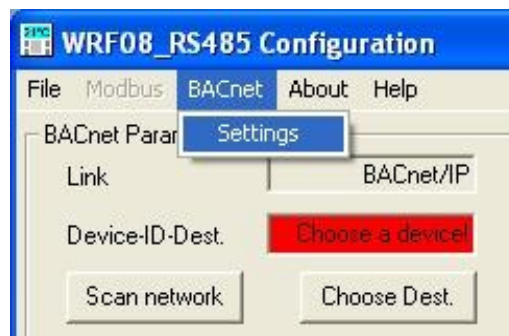


Figure 7-6 Menu BACnet

Settings:

Setting of properties for access to the BACnet network.

7.3.3.1 User management



Figure 7-7 User management window

After selection of the menu point, the window shown above is opened. In the upper part of the window the entered users are listed. In the lower part users can be created and deleted, accordingly.



Figure 7-8 Create a new user

For creating a new user, you must be registered as administrator. The user name of the new user as well as a password must be entered. It is also possible to create users without administrator rights. In this case, the users only have read access to the WRF08.

7.3.3.2 BACnet network properties

In the window BACnet network properties all properties for control of the access to the BACnet network can be made.

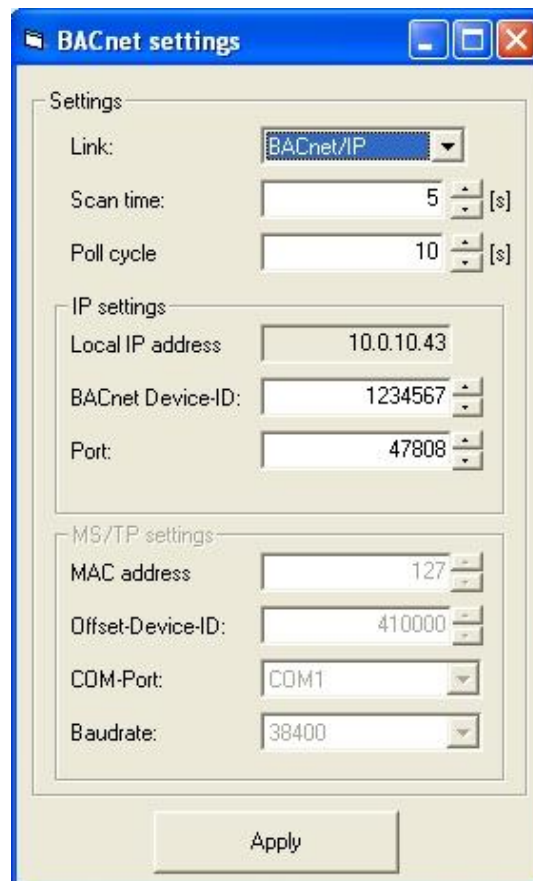


Figure 7-9 BACnet network properties

Settings:

| | |
|-------------|---|
| Link: | Selection between the access via BACnet/IP or BACnet MS/TP. Actually only the IP-Link is available! |
| Scan Time: | Determines how long a tool waits for response from the BACnet network during the network scan. |
| Poll Cycle: | Determines the cycle time in which the device is queried if the monitor function is activated. |

IP settings:

| | |
|-------------------|---|
| Local IP address: | Local IP-address of the computer. It cannot be changed! |
| BACnet Device-ID: | Setting of the device-ID with which the configuration tool shall be shown in the network. |
| Port: | The Port by which the access to the network is made. |

MS/TP settings:

| | |
|--------------|---|
| MAC address: | The address by which the configuration tool is shown in the MS/TP line. |
|--------------|---|

Offset-Device-ID:

COM-Port: The COM-Port to which the interface converter is connected.
Baudrate: The baud rate by which the MS/TP network is accessed.

7.3.4 Network Scan and Destination Selection

Before a device in the network is accessed or before a device can be selected from the list, the network must be scanned for devices.

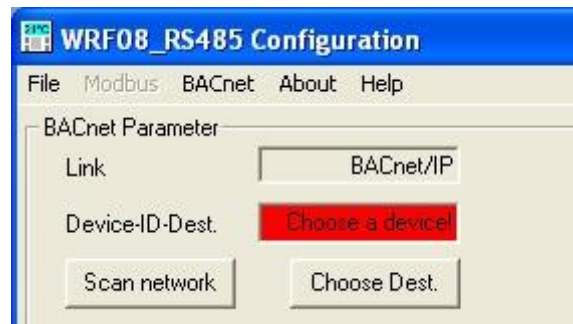


Figure 7-10 Network scan and destination

After „Scan network“ is selected, a new window is shown. Here it can be adjusted in which address range devices shall be searched.

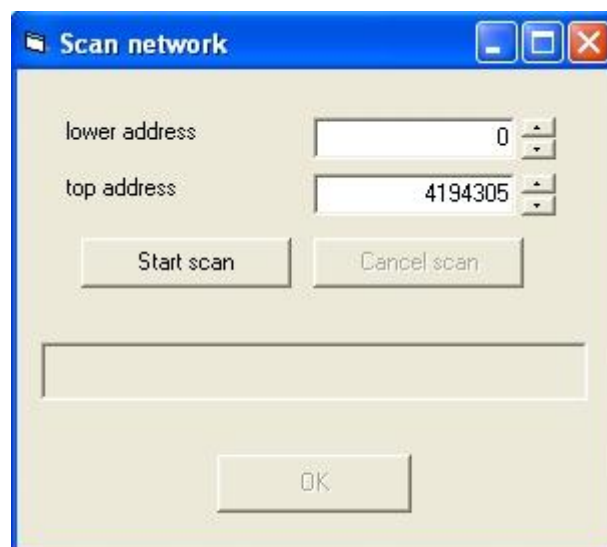


Figure 7-11 Network scan window

If the scan was ended successfully, the desired device can be selected from the list. For opening the list, „Choose Dest.“ must be confirmed in the main window.

The device list appears.

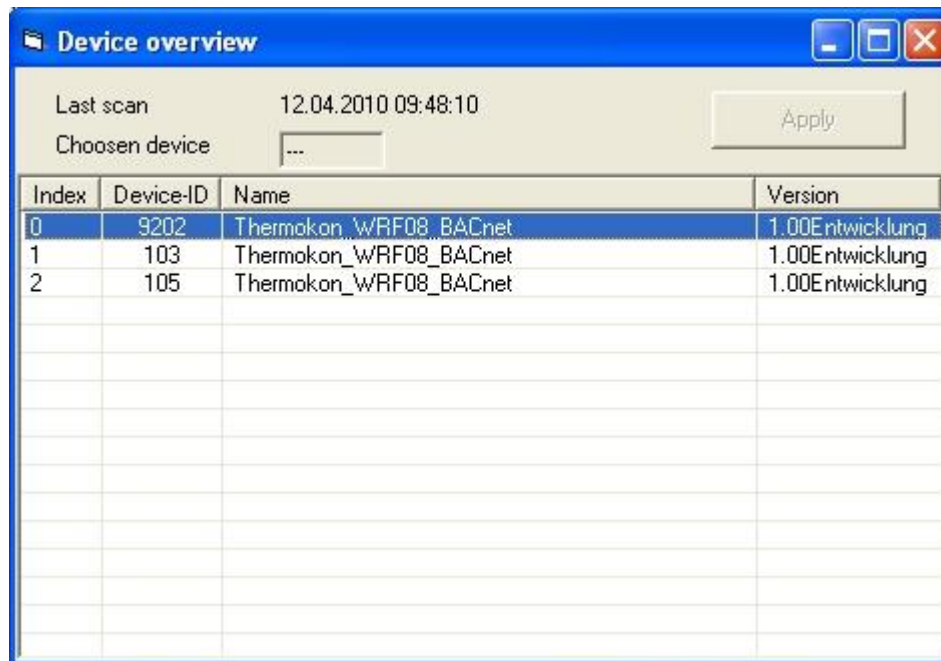


Figure 7-12 Device list

For selection of the device the entry must be marked and the window must closed with *Apply*. In the main window the selected address appears in the field *Device-ID Dest*.

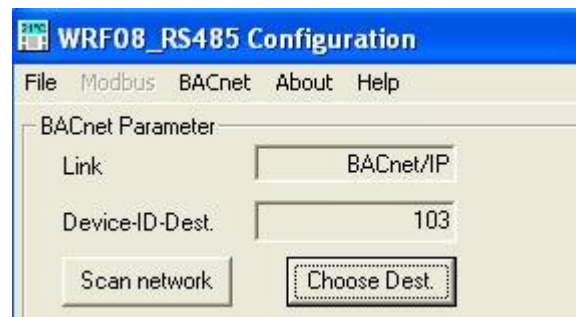
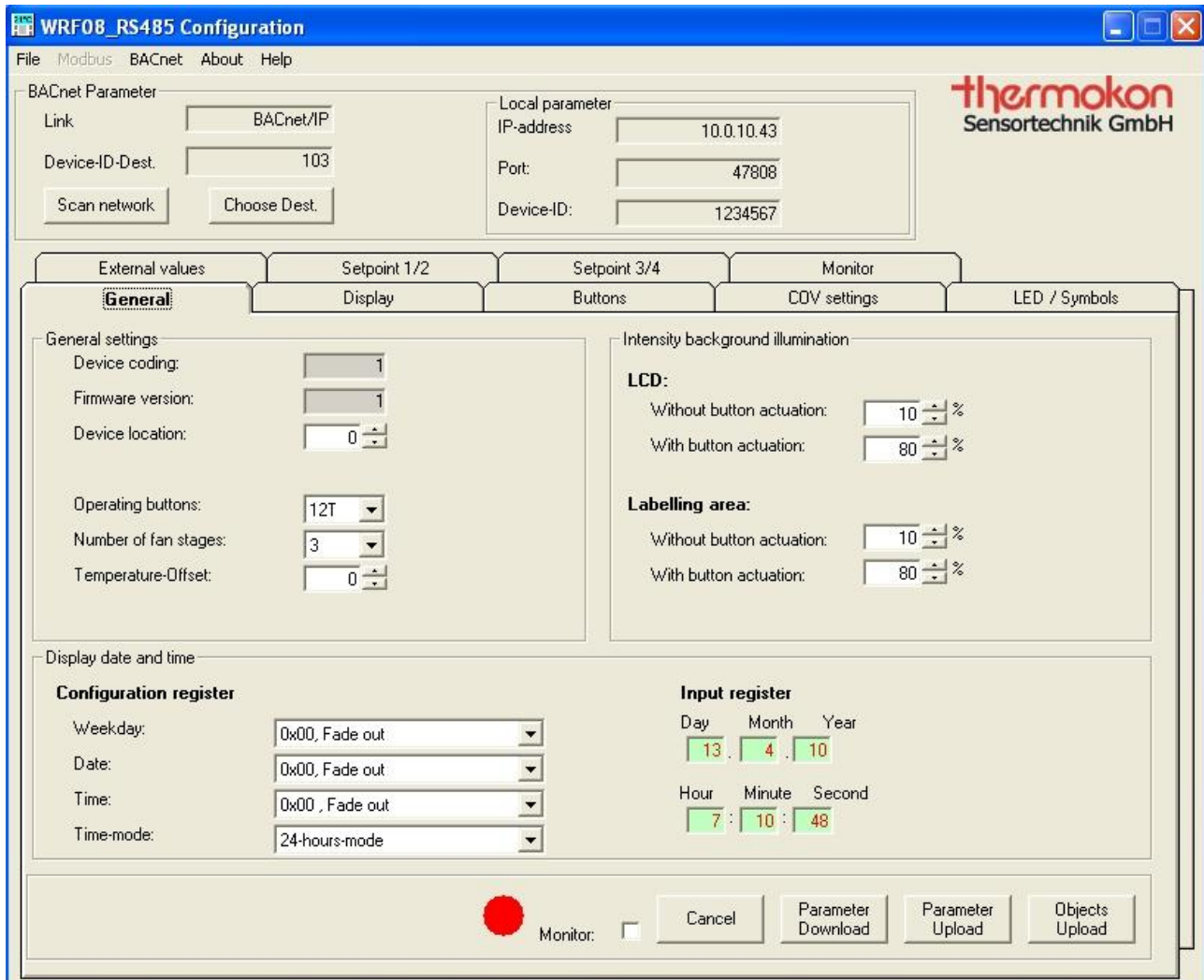


Figure 7-13 Display of the selected destination

7.3.5 Device Configuration

Under the different register cards access to all properties of the device is available. It is distinguished between configuration properties (values saved in the EEPROM) and the objects. The objects are writeable BACnet objects. The fields of these objects are green. Furthermore, the BACnet type and the instance is mentioned for these objects.

Configuration properties and objects are written to the device via different selection buttons. The button „Property Download“ lists all properties plus the objects of the device.



The screenshot shows the 'WRF08_RS485 Configuration' window with the following sections:

- Menu:** File, Modbus, BACnet, About, Help
- BACnet Parameter:**
 - Link: BACnet/IP
 - Device-ID-Dest: 103
 - Buttons: Scan network, Choose Dest.
- Local parameter:**
 - IP-address: 10.0.10.43
 - Port: 47808
 - Device-ID: 1234567
- thermokon Sensortechnik GmbH logo**
- Tabs:** External values, Setpoint 1/2, Setpoint 3/4, Monitor, Display, Buttons, COV settings, LED / Symbols
- General settings:**
 - Device coding: 1
 - Firmware version: 1
 - Device location: 0
 - Operating buttons: 12T
 - Number of fan stages: 3
 - Temperature-Offset: 0
- Intensity background illumination:**
 - LCD:**
 - Without button actuation: 10 %
 - With button actuation: 80 %
 - Labelling area:**
 - Without button actuation: 10 %
 - With button actuation: 80 %
- Display date and time:**
 - Configuration register:**
 - Weekday: 0x00, Fade out
 - Date: 0x00, Fade out
 - Time: 0x00, Fade out
 - Time-mode: 24-hours-mode
 - Input register:**
 - Day: 13, Month: 4, Year: 10
 - Hour: 7, Minute: 10, Second: 48
- Buttons at the bottom:** Monitor (with a red indicator light), Cancel, Parameter Download, Parameter Upload, Objects Upload

Figure 7-14 Main window

In the registration card the device can be configured as requested. Changed fields are shown in red colour. User without administrator rights only have read access!

In the lower border, all options for access to the device are available. The fields are only activated if a device was selected.



Figure 7-15 Action bar

| | |
|---------------------|--|
| Cancel: | Cancels all changes in the fields made by the use. |
| Parameter download: | Download all parameter and objects from device |
| Parameter upload: | Upload configuration parameters to device |
| Objects upload: | Upload objects to device |
| Monitor: | Polls the objects of the device in cyclical periods. |

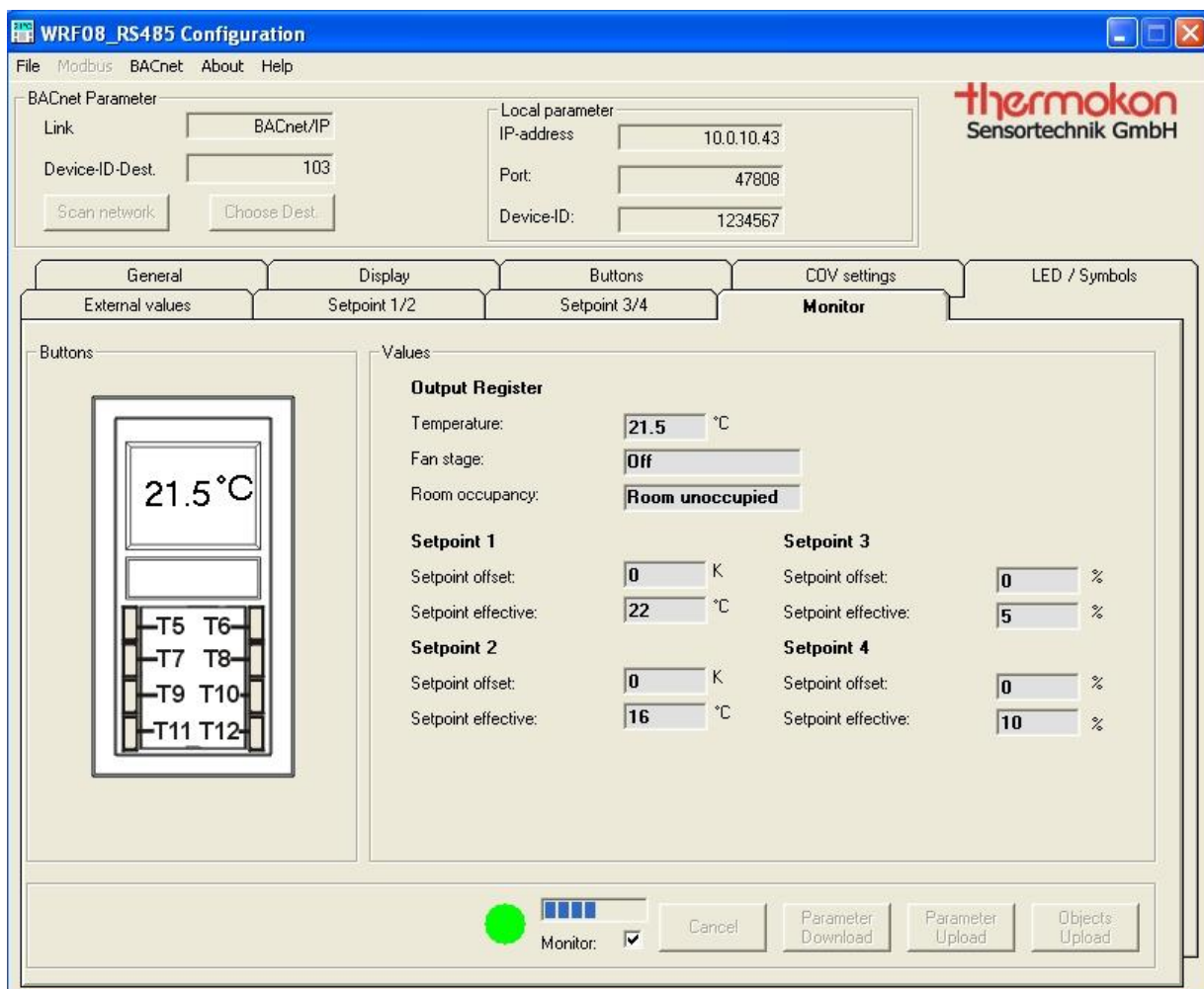


Figure 7-16 Device monitoring

8 PICS

BACnet Protocol Implementation Conformance Statement

Vendor Name: "Thermokon Sensortechnik"
 Product Name: "WRF08-BACnet"
 Product Model Number: "1.0"

Product Description: "Multi-function Room Operating Panel with interface BACnet MS/TP RS485, for temperature detection and integrated operation of HVAC, lighting and blinds for single room control."

BIBBs Supported:

| Supported BIBBS | BIBB Name |
|-----------------|--|
| DS-RP-B | Data Sharing-Read Property-B |
| DS-RPM-B | Data Sharing-Read Property Multiple-B |
| DS-WP-B | Data Sharing-Write Property-B |
| DS-COVU-B | Data Sharing-COV Unsolicited-B |
| DM-DDB-B | Device Management – Dynamic Device Binding – B |
| DM-DOB-B | Device Management – Dynamic Object Binding – B |
| DM-DCC-B | Device Management – Device Communication Control – B |
| DM-TS-B | Device Management – Time Synchronization - B |

BACnet Standard Application Services Supported:

ReadProperty
 ReadPropertyMultiple
 WriteProperty
 DeviceCommunicationControl
 I-Am
 I-Have
 UnconfirmedCOVNotification
 Time Synchronization

Standard Object Types Supported:

| Object-Type | Dynamically Creatable Deleteable | Optional Properties supported | Writable Properties | Property Range Restrictions |
|----------------------|--|--|--|-----------------------------------|
| Analog Input | <input type="checkbox"/> | COV_Increment Description | | |
| Analog Value | <input type="checkbox"/> | COV_Increment Description | Present_Value | |
| Binary Input | <input type="checkbox"/> | Description Inactive_Text Active_Text | | |
| Binary Value | <input type="checkbox"/> | Description Inactive_Text Active_Text | Present_Value | |
| Device | <input type="checkbox"/> | Description Max-Info-Frames Max-Master Location localTime localDate | Object name Description Max_Master Location | |
| Multi-state Input | <input type="checkbox"/> | Description State Text | | |
| Multi-state Value | <input type="checkbox"/> | Description State_Text | Present_Value | |

Data Link Layer Option:

MS/TP master. Baud rate(s): [9600,19200,38400,57600,76800,115200]

Device Address Binding:

Is static device binding supported?

Yes ☐No ☒**Character Sets Supported:**

ANSI X3.4

Special Functionality:

Maximum APDU size in octets: 480

9 Annex

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