

# RDC Remote Direct Control Series 600

## BACnet MS/TP (Master and Slave)

Fieldbus Modules for Controlling Data Points via  
RS485 Protocol BACnet MS/TP

### RDC601 and 601RF

8 Binary Inputs  
6 Binary Outputs (relays) with configurable manual override functions  
4 Analog Inputs for several resistive sensor types and 0..10 V



### RDC621 und 621RF

8 Binary Inputs  
4 Binary Outputs (relays) with configurable manual override functions  
4 Analog Inputs for several resistive sensor types and 0..10 V  
4 Analog Outputs 0..10 V



### RDC631

16 Universal Inputs (analog or binary)  
for several resistive sensor types and 0..10 V

### RDC632

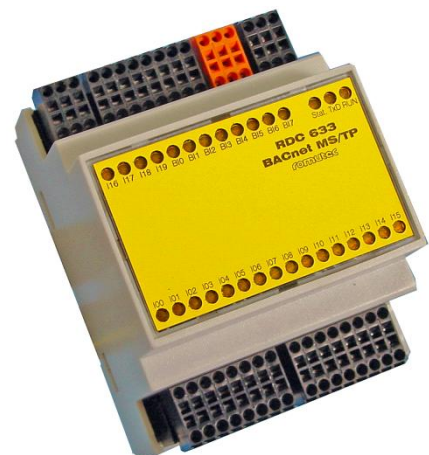
16 Universal Inputs (analog or binary)  
for several resistive sensor types (passive sensors only)

### RDC633

8 Binary Inputs  
20 Universal Inputs (analog or binary)  
for several resistive sensor types and 0..10 V

### RDC641 und 643 (RF)

16 Binary Inputs (RDC641)  
24 Binary Inputs (RDC643)



## 1. Important Notes

To ensure a fast installation and commissioning of the modules described, it is necessary to carefully read and observe the following information and explanations.

### Personnel Qualification

The use of products described in this document is considered exclusively for professionals with skills in PLC programming, electrical specialists, or persons that have been trained by qualified electricians, who are also familiar with the applicable standards. Improper action and damage caused to the described products and third party products due to disregard of information contained in this document, romutec® Control Systems GmbH assumes no liability.

### Intended use:

The devices are to be used exclusively for the terms and features specified in this documentation. With improper use, the manufacturer assumes no product liability and warranty claims.

- Follow all warnings and notes marked on the device or listed in the technical documentation.
- Operate the devices only when properly mounted on a DIN-rail or in a appropriate mounting frame
- The modules should not be installed in the immediate vicinity of frequency converters.
- Frequency converters must be provided with all safety measures in order to comply with the required regulations and guidelines (e.g. line filter, etc.)
- Do not use the product near water or other liquids which can damage the electronic components.
- The supply voltage must correspond to the information in the technical data.
- The terminals of the device should only be wired by authorized and trained personnel.
- Do not perform wiring work whenever the device is powered. There is a risk of electrical shock.
- Connecting and disconnecting the terminals or connectors under voltage should be avoided. The devices might be destroyed.
- Make sure that no objects, e.g. screws or other fastening material, gets into the device.
- Avoid installation in areas with extreme temperature fluctuations. The temperature ranges for storage and operation which are given in the datasheet must be maintained to ensure trouble-free operation.

However, should problems occur, do not try to repair the device yourself. Do not open or disassemble the device. Doing so, parts inside the device might be damaged on contact. Basically, if you have any problems please contact the manufacturer.

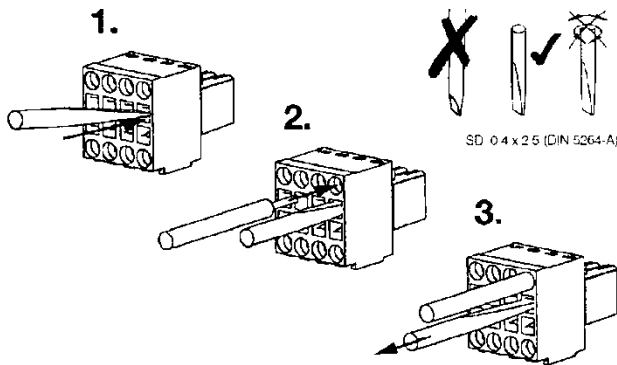
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Errors and changes excepted

## 2. Explanatory notes on wiring the devices

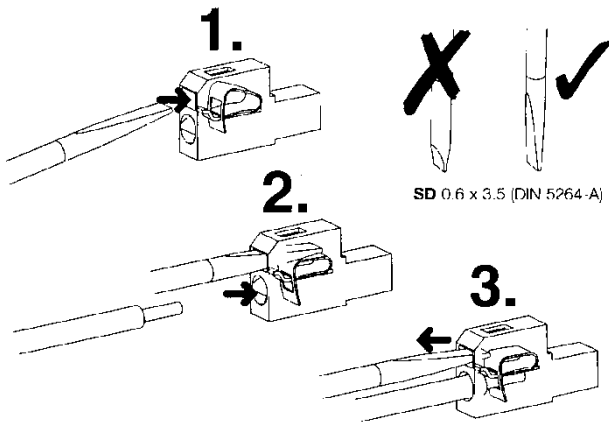
### Pluggable spring-type terminals

Using the spring-type terminals, wiring is very easy. The input terminals and the connector blocks for power supply and bus connection as well are designed for a maximum wire gauge of  $1.0 \text{ mm}^2$ , the output terminals for  $1.5 \text{ mm}^2$  at most. Wires to be connected shall be dismantled 7...8 mm ( $1.0 \text{ mm}^2$ -terminal) or 10 mm ( $1.5 \text{ mm}^2$ -terminal) respectively. They should be inserted into the clamp without using any ferrules.



Important: For working on the  $1.0 \text{ mm}^2$ -terminals, a screwdriver of type SDI 0.4 x 2.5 x 80 shall be used (max. width 2.5 mm).

For working on the  $1.5 \text{ mm}^2$ - terminals, a screwdriver of type SDI 0.6 x 3.5 (DIN 5264-A) shall be used:



Caution: Due to live wires connected to the  $1.5 \text{ mm}^2$ -terminals (binary outputs), up to 230 Volts might be present at these contacts. Therefore they must not be disconnected when the electrical equipment is running!

#### Wires suitable for connection (all inputs and analog outputs)

Clamping range, minimum rated value:  $0.08 \text{ mm}^2$

Minimum wire size AWG 28

Single-wire, min. H05(07) V-U  $0.2 \text{ mm}^2$

Stranded wire, min. H05(07) V-K  $0.2 \text{ mm}^2$

With ferrules acc. DIN 46 228/1: min.  $0.13 \text{ mm}^2$

Sleeve with plastic flange acc. DIN 46 228/4: min.  $0.13 \text{ mm}^2$

Clamping range, maximum rated value:  $1 \text{ mm}^2$

Maximum wire size AWG 18

Single-wire, max. H05(07) V-U  $1 \text{ mm}^2$

Stranded wire, max. H05(07) V-K  $1 \text{ mm}^2$

With ferrules acc. DIN 46 228/1: max.  $0.34 \text{ mm}^2$

Sleeve with plastic flange acc. DIN 46 228/4: max.  $0.34 \text{ mm}^2$

#### Wires suitable for connection (binary outputs, i.e. relay outputs 230 volts)

Clamping range, minimum rated value:  $0.13 \text{ mm}^2$

Minimum wire size AWG 28

Single-wire, min. H05(07) V-U  $0.2 \text{ mm}^2$

Stranded wire, min. H05(07) V-K  $0.2 \text{ mm}^2$

With ferrules acc. DIN 46 228/1: min.  $0.2 \text{ mm}^2$

Sleeve with plastic flange acc. DIN 46 228/4: min.  $0.2 \text{ mm}^2$

Plug gauge acc. EN 60999: a x b =  $\varnothing 2.4 \text{ mm} \times 1.5 \text{ mm}$

Clamping range, maximum rated value:  $1.5 \text{ mm}^2$

Maximum wire size AWG 16

Outside diameter of wire insulation: max. 2.9 mm

Single-wire, max. H05(07) V-U  $1.5 \text{ mm}^2$

Stranded wire, max. H05(07) V-K  $1.5 \text{ mm}^2$

With ferrules acc. DIN 46 228/1: max.  $1.5 \text{ mm}^2$

Sleeve with plastic flange acc. DIN 46 228/4: max.  $1 \text{ mm}^2$

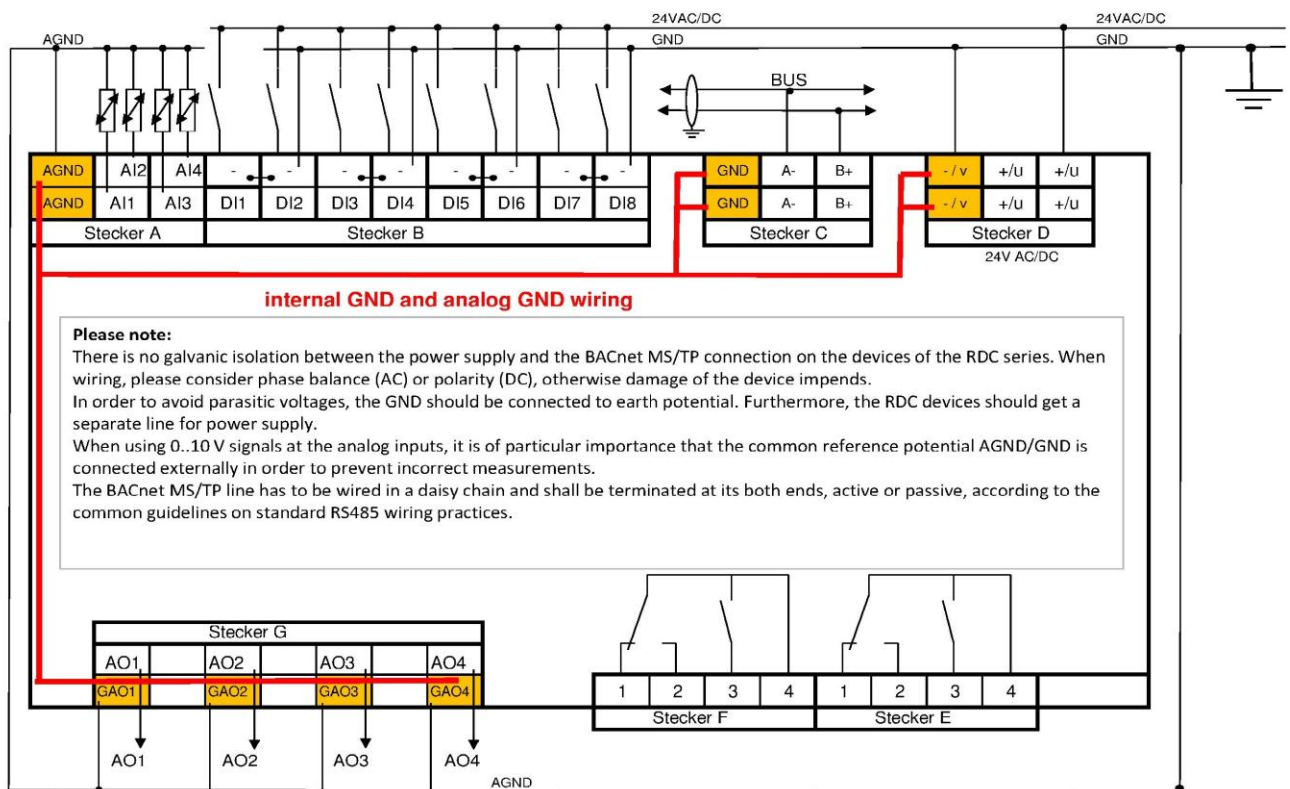
## Order of connected devices

When installing the devices, please consider that, partially, equal potentials which can be found at several terminals of a device are connected on the printed circuit board of the device, not in the terminal itself. So it might happen that subsequent devices will be disconnected when terminals are removed.

**Important:** When connecting several RDC modules in a daisy-chain, due to the current rating of the terminals for the power supply a maximum current of 2.5 A must not be exceeded!

Do not use the terminals for the purpose of sharing potentials. Wire ground (GND), signal common and other reference potentials to all terminals.

The negative potentials/GND at the terminals of the universal inputs are internally bridged.



**Please note:**

There is no galvanic isolation between the power supply and the BACnet MS/TP connection on the devices of the RDC series. When wiring, please consider phase balance (AC) or polarity (DC), otherwise damage of the device impends.

In order to avoid parasitic voltages, the GND should be connected to earth potential. Furthermore, the RDC devices should get a separate line for power supply.

When using 0..10 V signals at the analog inputs, it is of particular importance that the common reference potential AGND/GND is connected externally in order to prevent incorrect measurements.

The BACnet MS/TP line has to be wired in a daisy chain and shall be terminated at its both ends, active or passive, according to the common guidelines on standard RS485 wiring practices.

### 3. Brief Description / Functional Range

#### Hardware

- Intelligent Remote Station
- Real manual operating level for binary and analog outputs, hence control functions are ensured even without bus communication
- 8 binary inputs 24 VAC/DC, galvanically isolated
- 4 or 6 relays outputs 230 VAC, max. 5A
- Completely integrated option of Manual Override (Auto – Off – On)
  
- 4 analog inputs for the use of several passive sensors like Pt1000, Ni1000 and others, or active signals 0..10V
- up to 4 analog outputs 0..10 V, max. 10 mA each
- Complete commissioning of all RDC remote devices already without bus communication
- Convenient signalling of inputs, outputs and bus communication / status by means of LEDs
  
- max. 20 analog inputs for the use of several passive sensors or active signals 0..10V
- optional signalling of inputs and outputs, bus status and operational status via LEDs
  
- max. 24 binary inputs with indication of status, colour red/green or orange

#### Parameterisable Properties

- individually parameterisable functions for each binary input, e.g. inverting the data signal / closed-circuit principle vs. open circuit principle
- Analog inputs configurable for different types of resistive sensors, e.g. Pt1000, Ni1000, and active signals 0..10 V, as required
  
- Monitoring the sensor's wires for wire break and short-circuit, signalled by the means of multicoloured LEDs
- Colours of status LEDs that are indicating the binary inputs' states are configurable via BACnet to red, green or orange
  
- all configurable parameters will be stored in non-volatile memory (EEPROM)
- all settings can be parameterised via BACnet Objects and Properties

#### BACnet MS/TP Bus Connection

- Bus communication via BACnet MS/TP, Master-/Slave and Slave mode possible. Addresses 1..127 means Master mode, addresses 128..250 means Slave mode
  
- RS485 interface, Baud rates 9,600 ... 57,600 Baud, will be detected automatically
  
- Settings and parameters will be loaded into the module automatically during cold start
  
- **Bus termination of the RS485 interface is required (acc. EIA 485) active or passive. Network BIAS resistors 47k integrated. Can also be terminated with 120 Ohm (A-B). Specifications see BACnet Standard, ANSI/ASHRAE Standard 135-2008, 9.2.2 Connections and Terminations.**

## LED Signalling

LED	Status	Meaning
<b>Status</b>	ON	Manual Control Panel O.K.
<b>RxD</b>	Flashing	Device is receiving bus telegrams
<b>RUN</b>	Steady Light	Device is running, all switches are in position 'Automatic'
	Blinking slowly (1Hz)	One or more outputs are manually overridden (at least one switch is in a position different from 'Automatic')
<b>Alx</b>	Blinking, fast	Sensor short circuit (BACnet Reliability = shorted_loop)
	Blinking, slowly	Sensor wire break (BACnet Reliability = open_loop)
	OFF	Normal operating mode (BACnet Reliability = no_fault_detected)
	Steady Light	Sensor out of range (BACnet Reliability = over_range / under_range)
<b>Ulx</b>	Blinking, red or green	Threshold values not identified, value out of designated range
<b>AOx</b>	4-states indicating analog signal 0..10 V in four steps of 25% each:	
	OFF	0 – 2.5 V
	green	2.5 – 5.0 V
	orange	5.0 – 7.5 V
	red	7.5 – 10.0 V
<b>DIx</b>	On	Input activated (closed circuit)
<b>DOx</b>	On	Output activated (relay energised)



## Inputs and Outputs

Binary inputs, 24 VDC (18 ... 30 V), galvanically isolated  
Input current appr. 6 mA when input is energised,  
non-polar, with surge protection,  
Positive logic → common connection is ground (GND), negative logic → common connection is (+)  
Status of every binary input is signalled by the means of a LED, colour red, green or orange as configured.  
The colour can be set in the BACnet Binary Input Object, Property 'Device Type'.

Inputs are realised with optocouplers, in either case both, +/u and GND (-/v) are to be connected.

Analog inputs (e.g. Pt1000, Ni1000), configurable, resolution 16 Bits for passive sensors, characteristic of the type of sensor is stored in the internal flash. Resistance measurement 0 ... 19.5 kOhm.  
Measuring voltage < 5.0 V, Stimulus current ≤ 1 mA  
Surge protection, protected against negative voltage peaks  
Sampling rate typically 100ms  
Each analog input provides a multi-colour LED (red/green/orange), which signals faults like wire break or short-circuit of the sensor's loop.

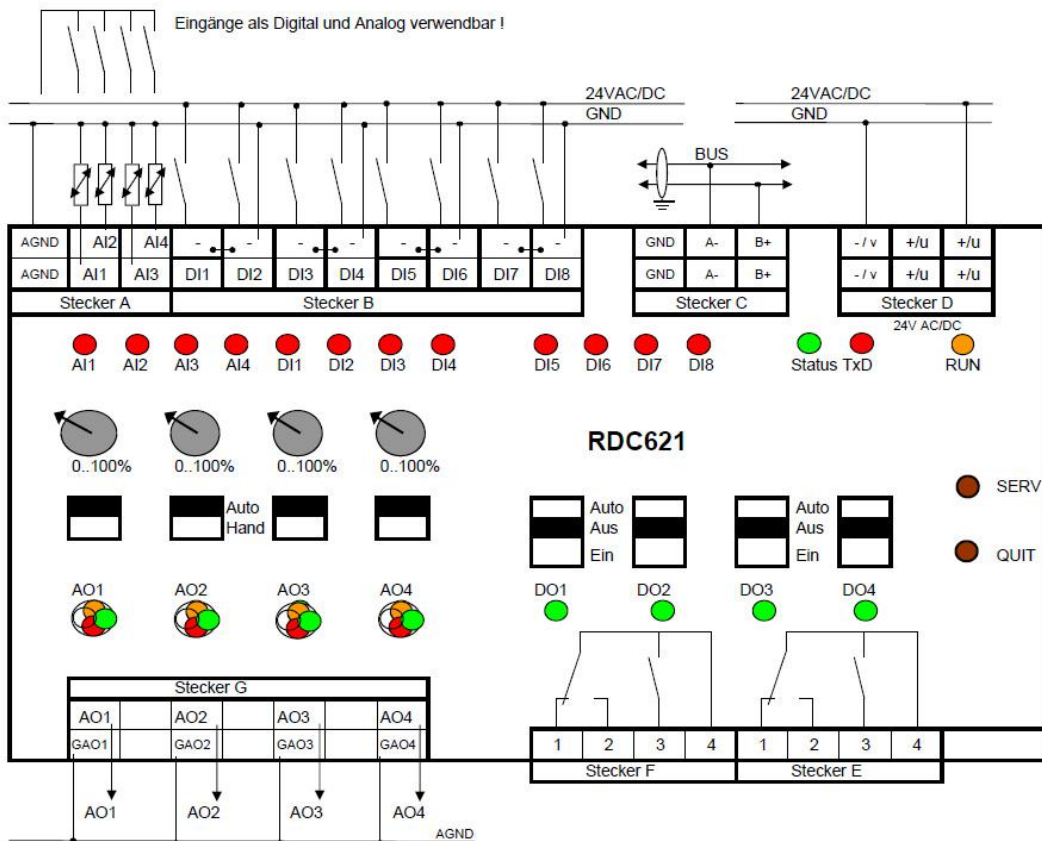
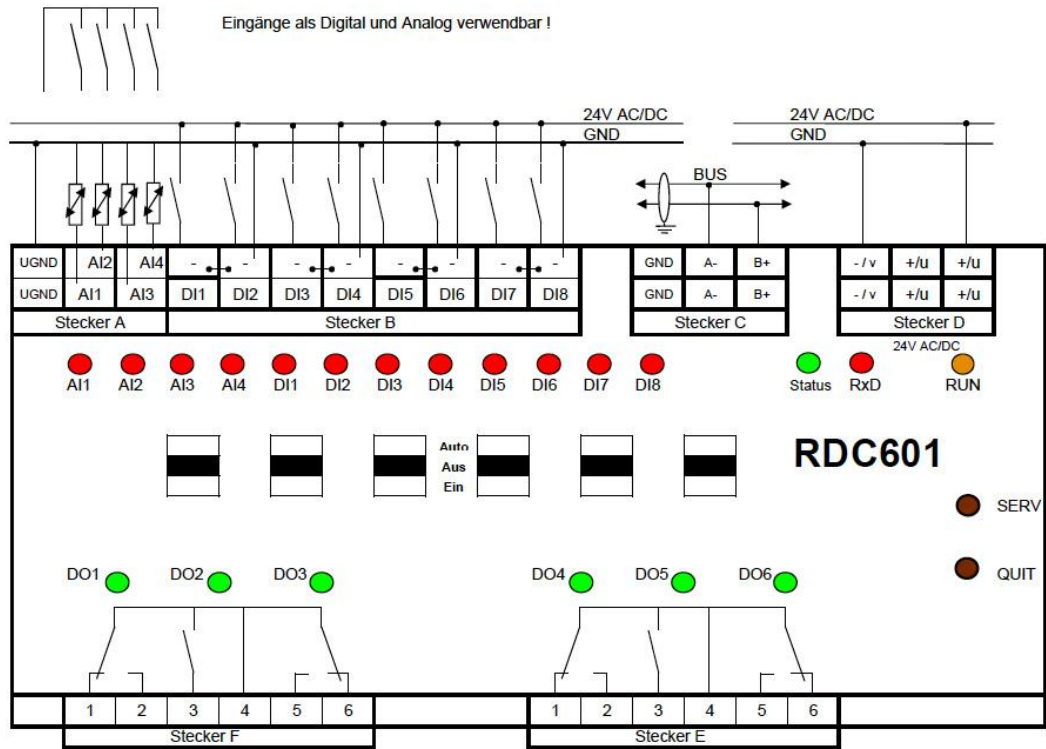
4 or 6 binary outputs, realized as relay contacts  
Relay outputs 230 VAC, make contact, nominal current max. 5A (resistive load)  
Relay outputs 230 VAC, changeover contact, nominal current max. 5A (resistive load)  
Each relay's status is signalled by the means of a green LED whether energised or not.

4 Analog outputs 0..10 V, max. output current 10 mA, resolution 10 Bits  
Each analog output provides a multi-colour LED (red/green/orange) which signals the output's status (output voltage) in four steps: 0..25% = LED Off, 26..50% = LED green, 51..75%= LED orange, 76..100%=LED red.

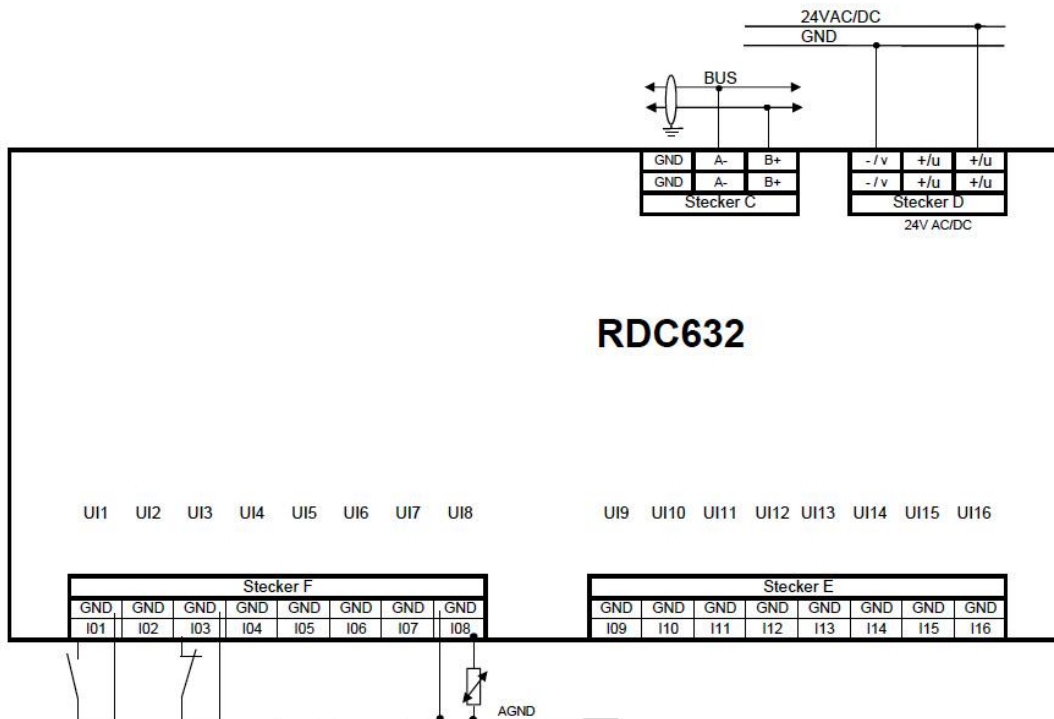
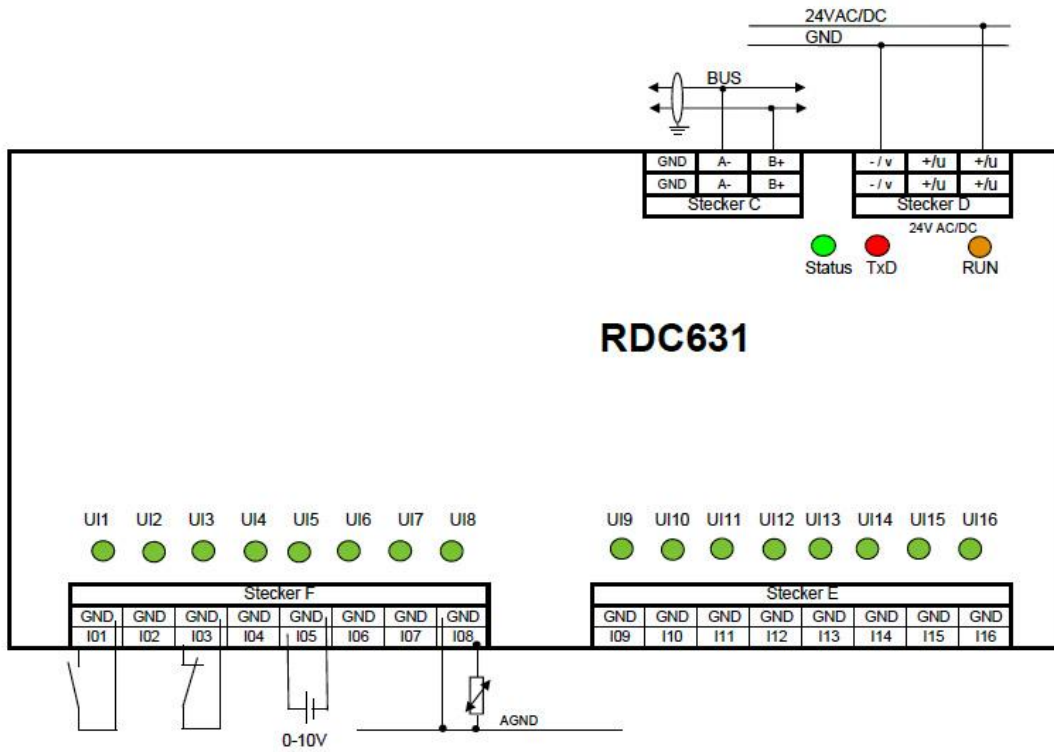
RS485 Bus interface, not galvanically isolated (optionally available, please contact us if required)  
Termination: The first and last bus device connected to the RS485 bus have to be terminated (acc. EIA 485).  
Both, active and passive termination is possible.

Only with RDC601 and RDC621: push-button for triggering lamp test (not available with RDC63x and RDC64x).

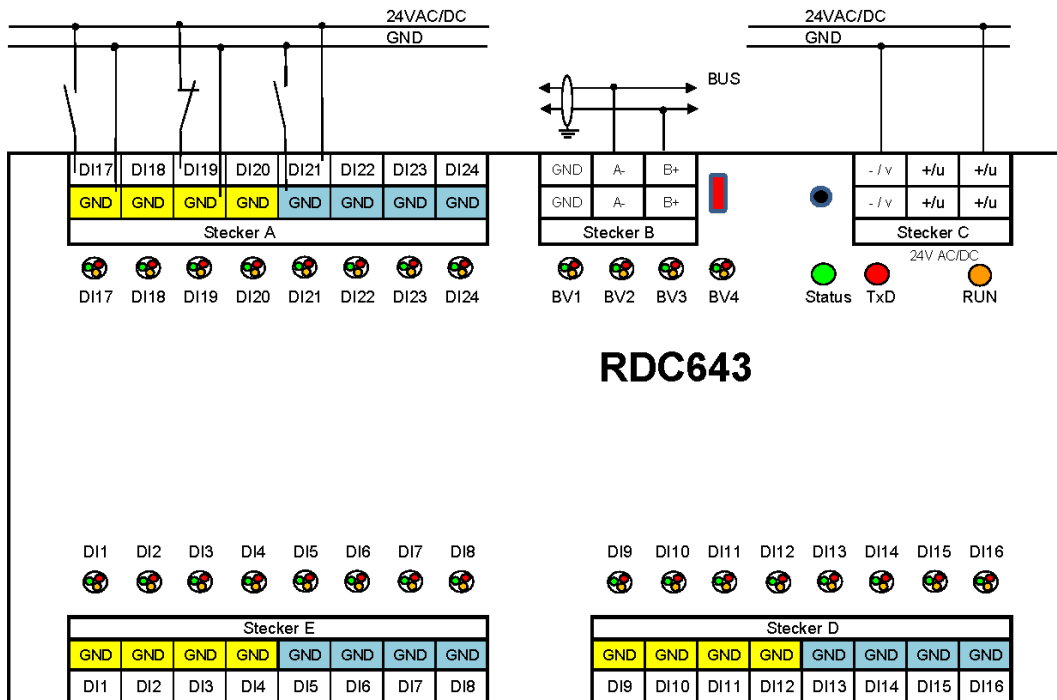
## Wiring Interface:









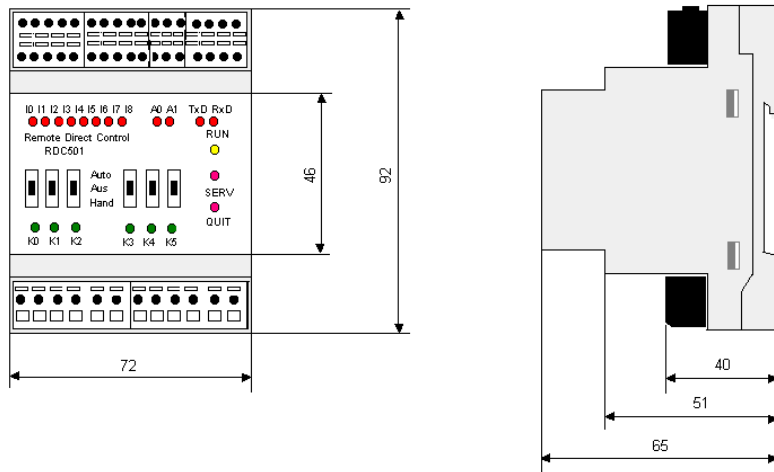


RDC641+643: Reference potential (GND) for the binary inputs is bridged in groups of four inputs in each case: DI1-DI4, DI5-DI8, DI9-DI12, DI13-DI16, DI17-DI20 and DI21-DI24. Inputs are realised with optocouplers; in either case both, +/u and GND (-/v), are to be connected.

## Dimensions

Housings DIN rail 4TE  
Dimensions in mm

Weight: approx. 200 grams



## Connection to a BACnet MS/TP device

Example shown with the router device UBR01:

(Please note: bus termination is required!)

Router/OEM:	UBR01 (MBS)	CTR Link (CT)	L-IP (LOYTEC)	RDC6xx
	B+	+	+(5)	B+
	A-	-	-(6)	A-
	Masse	SC	Masse(4)	GND
Reference to ground for power supply and RS485 (bridge to Earth)				24VAC/DC -/v
<b>Must not be connected to Earth – make sure to use the same phase</b>				24V AC/DC +/u

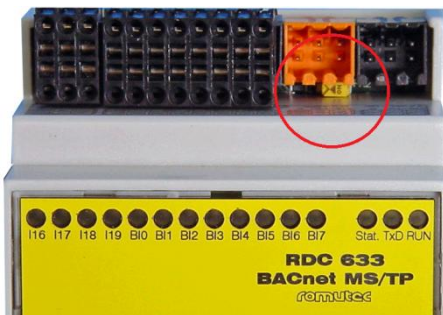
### Baud rate

The RDC Module devices provide the functionality of AUTOBAUD, i.e. there are no adjustments required before commissioning. However, during commissioning the baud rate should be set to a fixed value.

**Baud rates supported:** 1 = 9.600 Bd; 2 = 19.200 Bd; 3 = 38.400 Bd; 4 = 57.600 Bd  
0 = Autobaud (Default)

**Format/Mode** 8, N, 1  
BACnet MS/TP RS485 EIA-485

The devices RDC631, 632 and 633 provide a slide switch that hooks up an integrated terminating resistor of 120 Ohms when applied. This switch can be found underneath the terminal for the bus connection, as shown in the picture below.



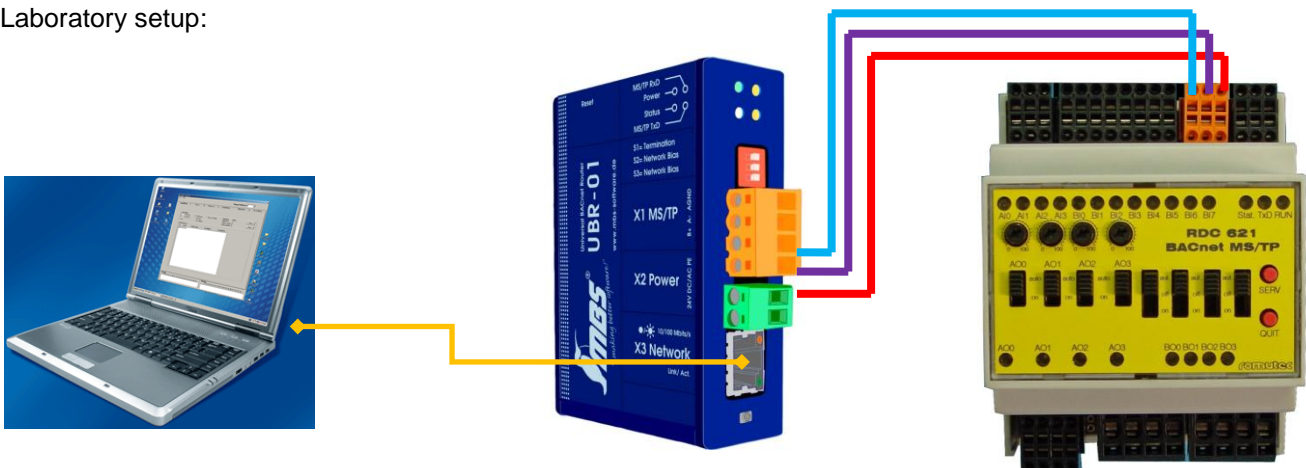
### Bus termination:

Bus termination of the RS485 interface is required (acc. EIA 485) active or passive!  
Network BIAS resistors 47k integrated. Can also be terminated with 120 Ohm (A-B).  
Specifications see BACnet Standard, ANSI/ASHRAE Standard 135-2008, 9.2.2 Connections and Terminations.

Concerning the bus topology, modules of type RDC63x and RDC64x should be placed at the end of the BACnet MS/TP bus.

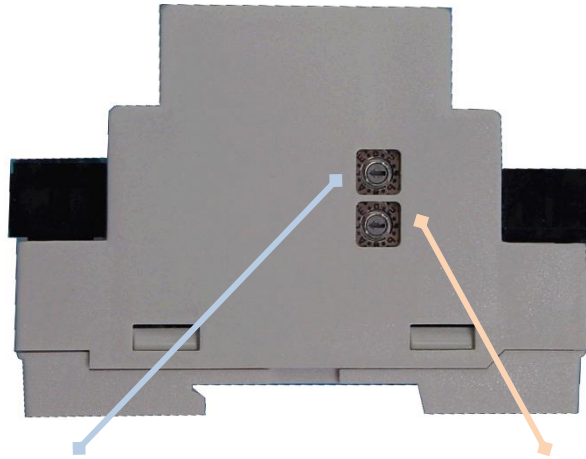
Picture above: RDC633, slide switch or jumper contacts, as the case may be, for terminating the bus

### Laboratory setup:



**Addressing**

The MAC address of a RDC device can be set by positioning the two rotary coding switches at the right side of the module. The values are encoded hexadecimal, as the table below shows.



Value of left switch	Position of left switch	Position of right switch	Value of right switch
0	0	0	0
16	1	1	1
32	2	2	2
48	3	3	3
64	4	4	4
80	5	5	5
96	6	6	6
112	7	7	7
128	8	8	8
144	9	9	9
160	A	A	10
176	B	B	11
192	C	C	12
208	D	D	13
224	E	E	14
240	F	F	15

Address adjusted:                    6 , 6 → 102  
 Method of calculation:  
 Value left + Value right = 96 + 6 = Address 102

**For BACnet MS/TP master devices, generally, the address range of 1..127 shall be applied. MS/TP slave devices shall be operated in the address range of 128..250.**

By setting or programming the **MAC address**, the RDC module will automatically behave as a master or slave device. When run in slave mode, a BACnet master is necessary to communicate to the RDC module. As in the laboratory setup shown above, this might also be a router which is providing slave proxy functionality.

## Commissioning and functions for BACnet MS/TP

The complete setup will be stored in non-volatile memory (EEPROM)

By default, the RDC modules will be delivered being in a standard mode. This means that all special functions like limit monitoring of inputs as described in the following are disabled.

### Manual Override

By using the switches and potentiometers on the control panel, binary and analog outputs can be controlled manually.

Manual override and control of the outputs will work even when there is no configuration data loaded into the devices, just power supply is needed. So, RDC modules meet the requirements of the Standards DIN EN ISO 16484 as well as VDI 3814.

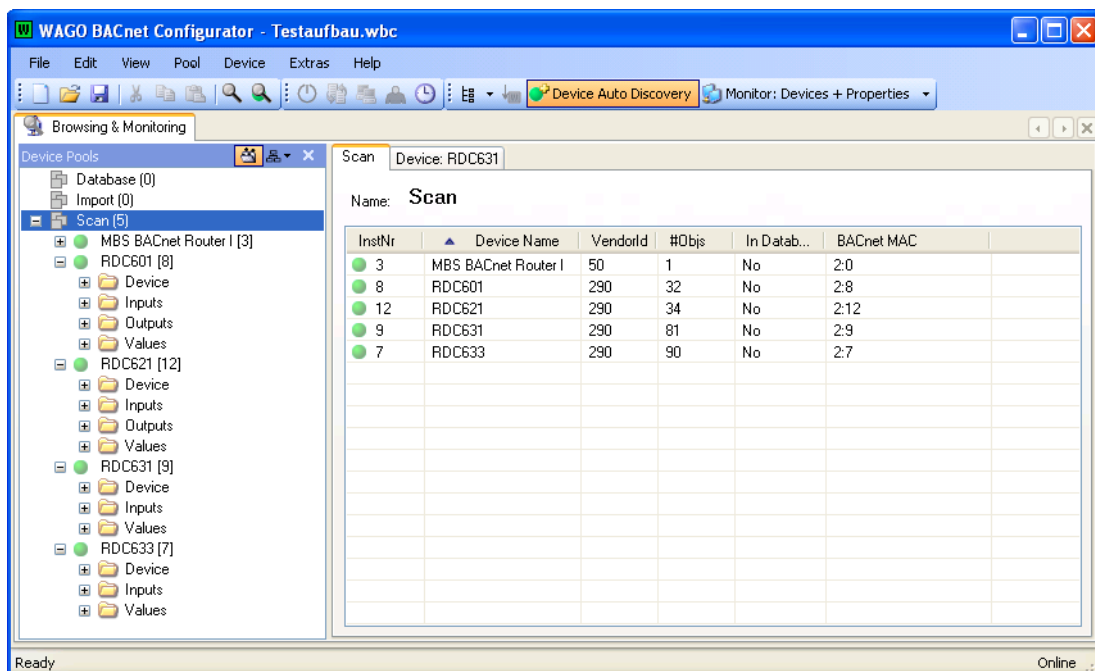
Configuration of several functional parameters, as described further down in this document, will be done through BACnet Objects and Properties.

**The now following information and screenshots are based on the test equipment consisting of:**

- **BACnet router UBR01 (MBS GmbH, Krefeld, Germany, [www.mbs-software.de](http://www.mbs-software.de))**
- **Fieldbus modules RDC601 and RDC621 (romutec GmbH, Buch am Wald, Germany), examples show RDC621 only (both modules just vary in the number of data points).**
- **Software WAGO BACnet Configurator (version 1.3.9.0) (WAGO GmbH & Co. KG, Minden, Germany), can be obtained from WAGO's website [www.wago.com](http://www.wago.com)**

Network communication: PC ← Ethernet → Router ← MS/TP → RDC Module

After starting the program, the following window will appear. Data like Instance numbers or the BACnet MAC address might be different from the screenshot, depending on the connected device.

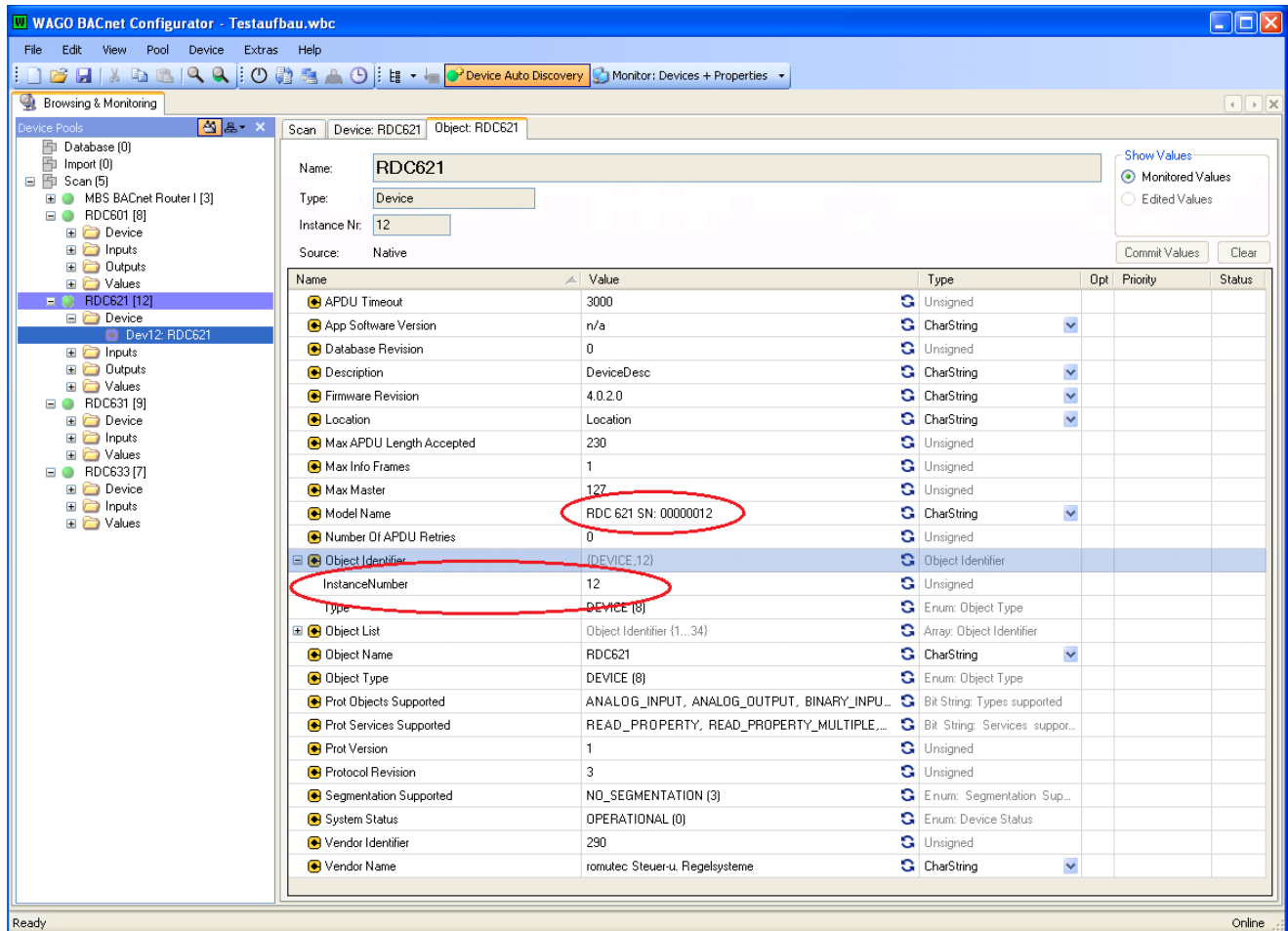




## Device specific data

Each RDC module has a serial number which can also be found at the bottom of the device, and an Instance number, in the example shown this is '00000012'.

The subsequent pictures show the points in question marked in red.

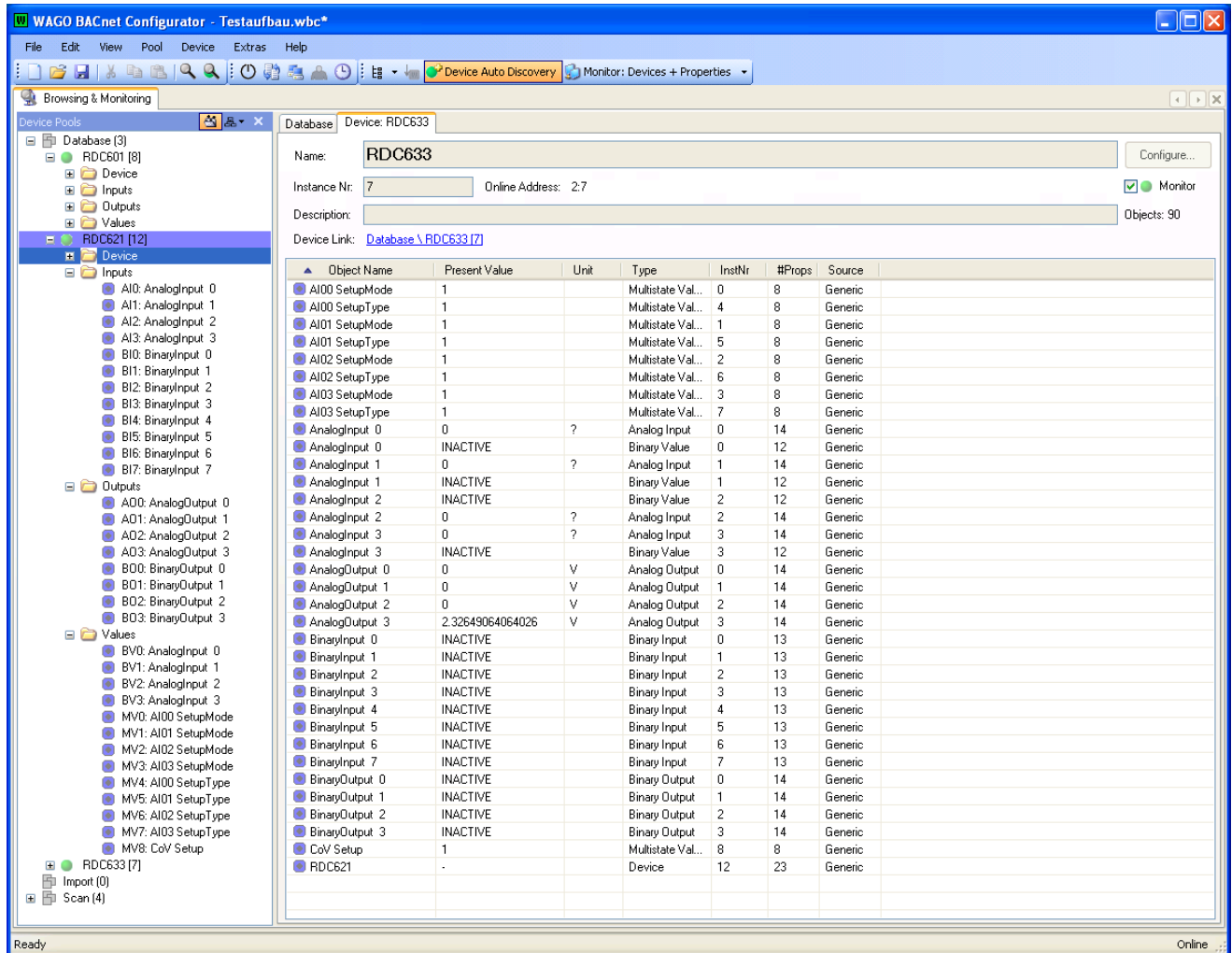


When the devices are shipped, the Instance number (Property 'InstanceNumber') equals the serial number, which is part of the Property 'Model Name'. The Instance number may be changed during commissioning or later on, whereas the Property 'Model Name' and thus the serial number are fix.

The Properties 'Description' and 'Location' can hold character strings that contain up to 63 characters.

## Data points

When selecting a device from the tree structure on the left side, all data points (BACnet Objects) which are provided by the module will be shown. In the example, this is the device 'RDC621(12)' with all Objects expanded.



WAGO BACnet Configurator - Testaufbau.wbc\*

Database: RDC633

Name: RDC633

Instance Nr.: 7 Online Address: 2.7

Description:

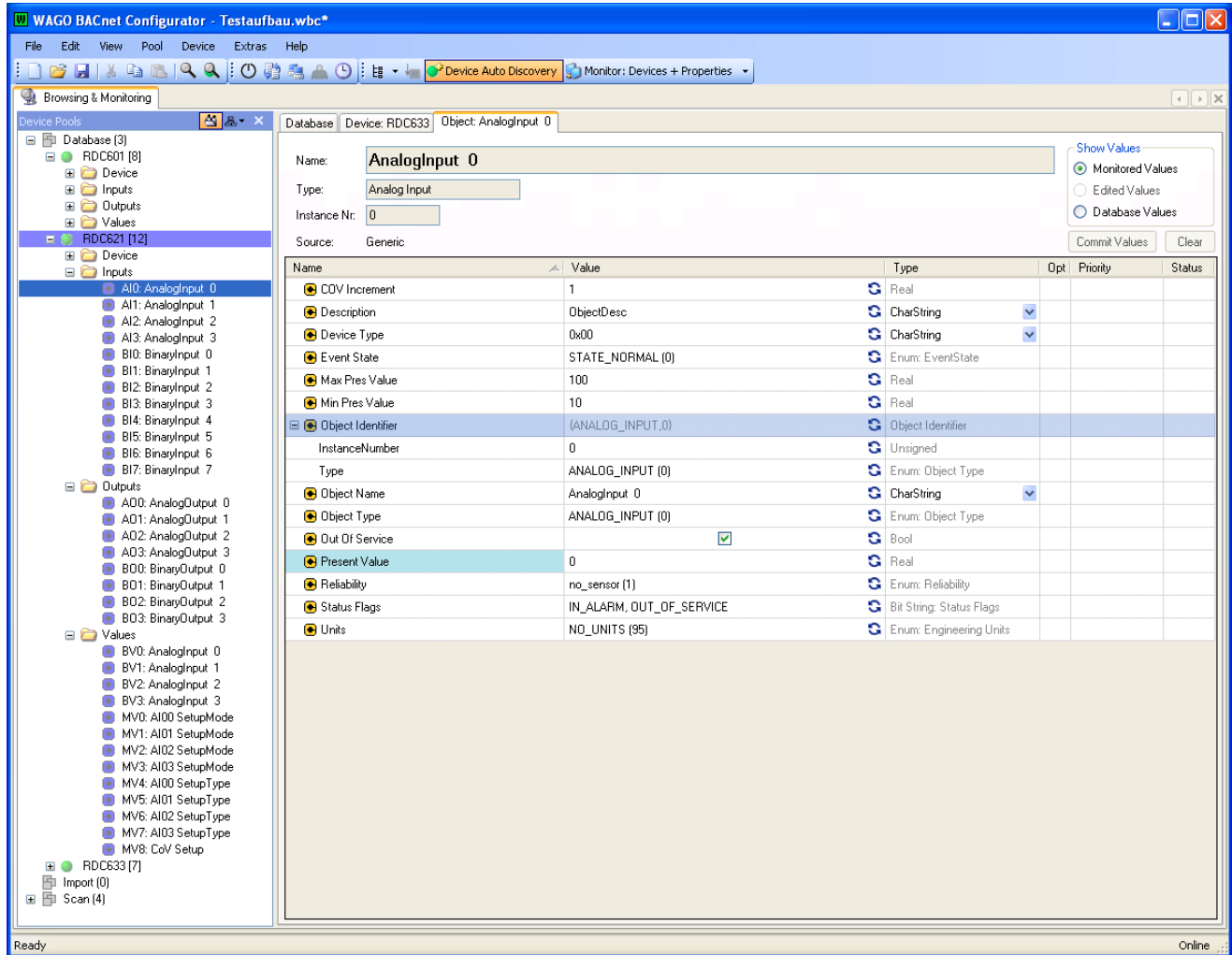
Device Link: Database \ RDC633 [7]

Monitor:  Monitor

Objects: 90

Object Name	Present Value	Unit	Type	InstNr	#Props	Source
AI00 SetupMode	1		Multistate Val...	0	8	Generic
AI00 SetupType	1		Multistate Val...	4	8	Generic
AI01 SetupMode	1		Multistate Val...	1	8	Generic
AI01 SetupType	1		Multistate Val...	5	8	Generic
AI02 SetupMode	1		Multistate Val...	2	8	Generic
AI02 SetupType	1		Multistate Val...	6	8	Generic
AI03 SetupMode	1		Multistate Val...	3	8	Generic
AI03 SetupType	1		Multistate Val...	7	8	Generic
AnalogInput 0	0	?	Analog Input	0	14	Generic
AnalogInput 0	INACTIVE		Binary Value	0	12	Generic
AnalogInput 1	0	?	Analog Input	1	14	Generic
AnalogInput 1	INACTIVE		Binary Value	1	12	Generic
AnalogInput 2	INACTIVE		Binary Value	2	12	Generic
AnalogInput 2	0	?	Analog Input	2	14	Generic
AnalogInput 3	0	?	Analog Input	3	14	Generic
AnalogInput 3	INACTIVE		Binary Value	3	12	Generic
AnalogOutput 0	0	V	Analog Output	0	14	Generic
AnalogOutput 1	0	V	Analog Output	1	14	Generic
AnalogOutput 2	0	V	Analog Output	2	14	Generic
AnalogOutput 3	2.32649064064026	V	Analog Output	3	14	Generic
BinaryInput 0	INACTIVE		Binary Input	0	13	Generic
BinaryInput 1	INACTIVE		Binary Input	1	13	Generic
BinaryInput 2	INACTIVE		Binary Input	2	13	Generic
BinaryInput 3	INACTIVE		Binary Input	3	13	Generic
BinaryInput 4	INACTIVE		Binary Input	4	13	Generic
BinaryInput 5	INACTIVE		Binary Input	5	13	Generic
BinaryInput 6	INACTIVE		Binary Input	6	13	Generic
BinaryInput 7	INACTIVE		Binary Input	7	13	Generic
BinaryOutput 0	INACTIVE		Binary Output	0	14	Generic
BinaryOutput 1	INACTIVE		Binary Output	1	14	Generic
BinaryOutput 2	INACTIVE		Binary Output	2	14	Generic
BinaryOutput 3	INACTIVE		Binary Output	3	14	Generic
CoV Setup	1		Multistate Val...	8	8	Generic
RDC621	-		Device	12	23	Generic

## Analog Inputs



When selecting the 'Inputs' of the Device RDC621(12) from the tree structure, all inputs provided by the module will be shown.

### Analog Inputs:

The configuration of the analog inputs will be done via Properties of the BACnet Object, and with additional BACnet Objects that are associated with the analog input, as well. For analog inputs, there are two MultistateValue Objects for configuring purposes, **Alxx SetupMode** and **Alxx SetupType**. How to use these Objects for configuring the RDC module will be described on the next two pages.

Instead of using the MultistateValue Objects, the RDC's analog inputs can be configured by writing config data directly to the Property '**Device Type**' in the BACnet Analog Input Object. For values to write, see table 1 on page 19.

The Property '**COV Increment**' in the BACnet Analog Input Object determines the minimum change of the Present Value that causes a COV notification message sent to the BACnet network.

With the Proprietary Property '**Offset**' the value of the analog input can be adjusted upwards (+) or downwards (-). Offset values are independent of the working range.

$$\text{Present Value} = \text{measured value} + (+/- \text{Offset})$$

### Please note:

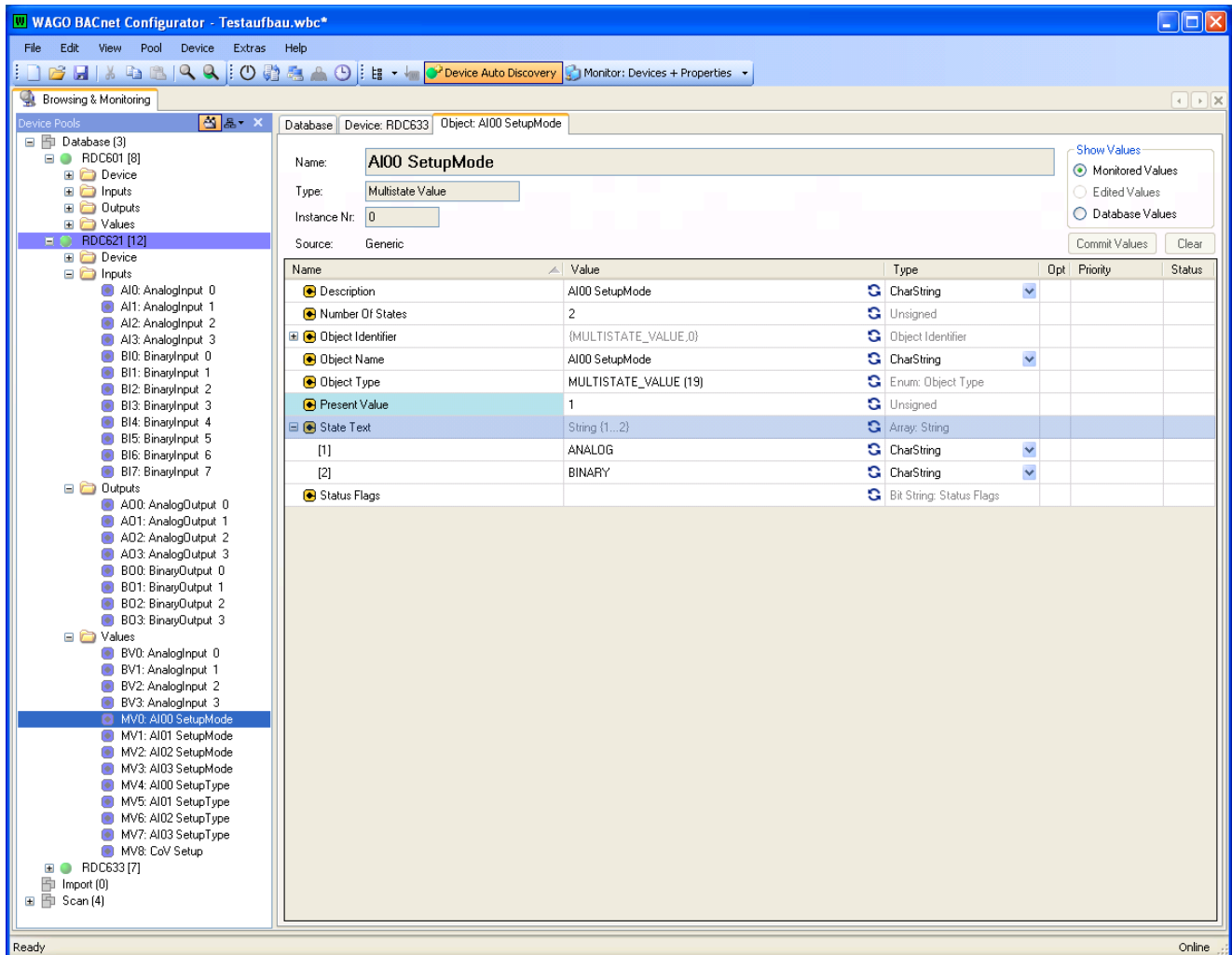
The LED colour of RDC621 and RDC601 devices' universal inputs UI0...UI3 cannot be changed. Due to the hardware design, their colour is immutable red.

## Configuring the Analog Inputs

### Alxx SetupMode

Within the BACnet Object **Alxx SetupMode** there will be configured whether the analog input shall be used as real analog input or as a virtual binary input. The options are shown in the Property **'State Text'** as illustrated in the picture below.

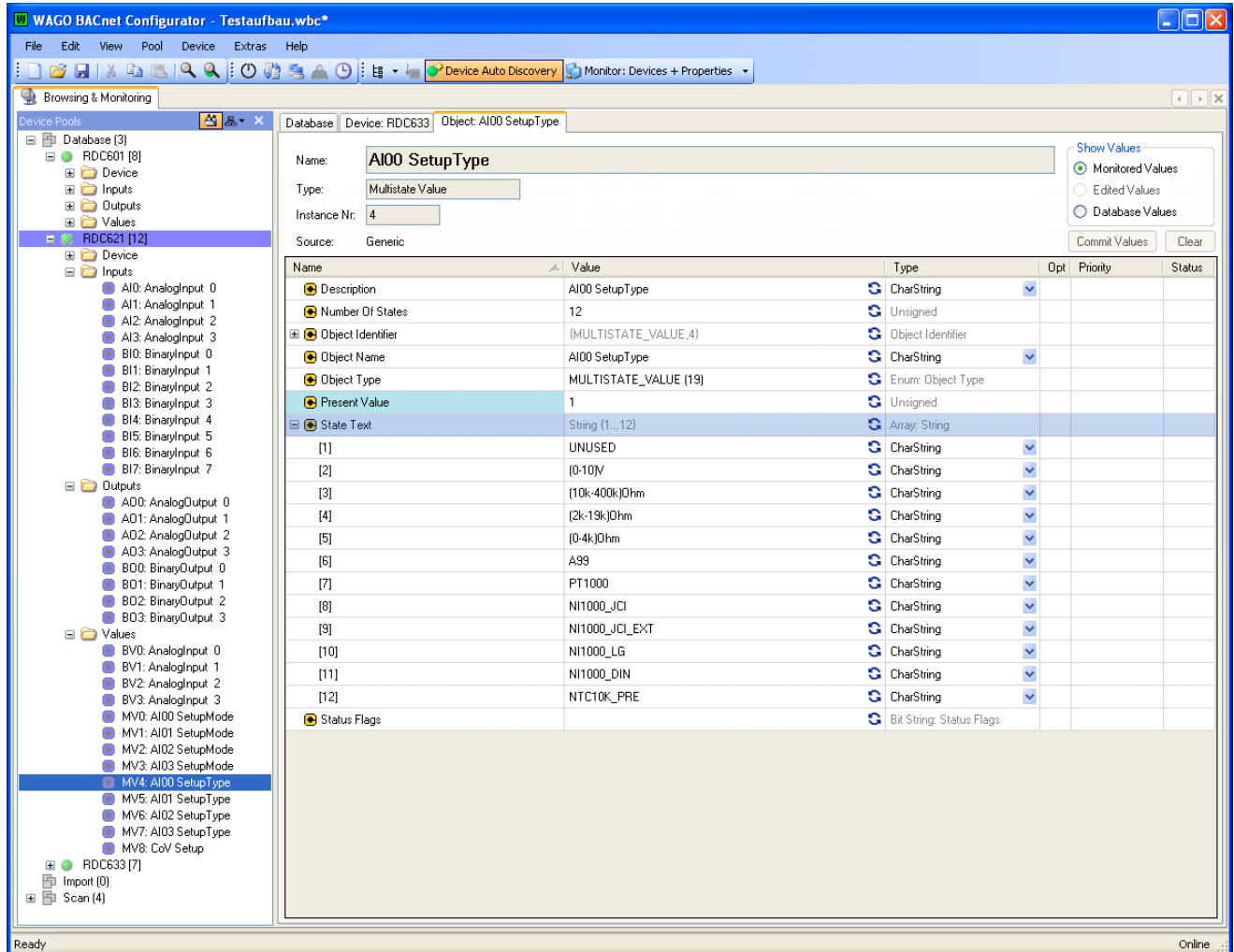
To select one of the options, the **Present Value** of the BACnet Object Alxx SetupMode has to be set to the appropriate value.



In order to use analog inputs as virtual binary inputs, in the BACnet Object Alxx SetupMode the choice 'binary' (Present Value = 2) has to be made. Aside from this, further setup of other properties in additional BACnet objects (e.g. like the Alxx SetupType) might be required to customise the operating mode of the virtual binary input.

## Alxx SetupType

Within the BACnet Object **Alxx SetupType** there will be configured which type of sensor will be connected to the analog input. The options are shown in the Property **'State Text'** as illustrated in the picture below.



MultiStateValue Object Alxx SetupType				AnalogInputObject, Property DeviceType (value in hexadecimal)
State Text	Type of sensor / signal	Range (if applicable)	Present Value (value in decimal)	
1	Unused / no function		0	0x00
2	(0 10) V		1	0x01
3	(10k..400k) Ohm		33	0x21
4	(2k..19k) Ohm		34	0x22
5	(0..4k) Ohm		35	0x23
6	A99 JCI	- 50 ... +120 °C	65	0x41
7	Pt1000	- 50 ... +200 °C	66	0x42
8	Ni1000 JCI	- 46 ... +121 °C	67	0x43
9	Ni1000 JCI ext.	+21 ... +288 °C	68	0x44
10	Ni1000 L&G	- 50 ... +150 °C	69	0x45
11	Ni1000 DIN	- 50 ... +150 °C	70	0x46
12	NTC 10k PRE	- 30 ... + 80 °C	71	0x47
5	BINARY	<= 1mA	163	0xA3
	Binary unused		128	0x80

## Using Universal Inputs as Virtual Binary Inputs:

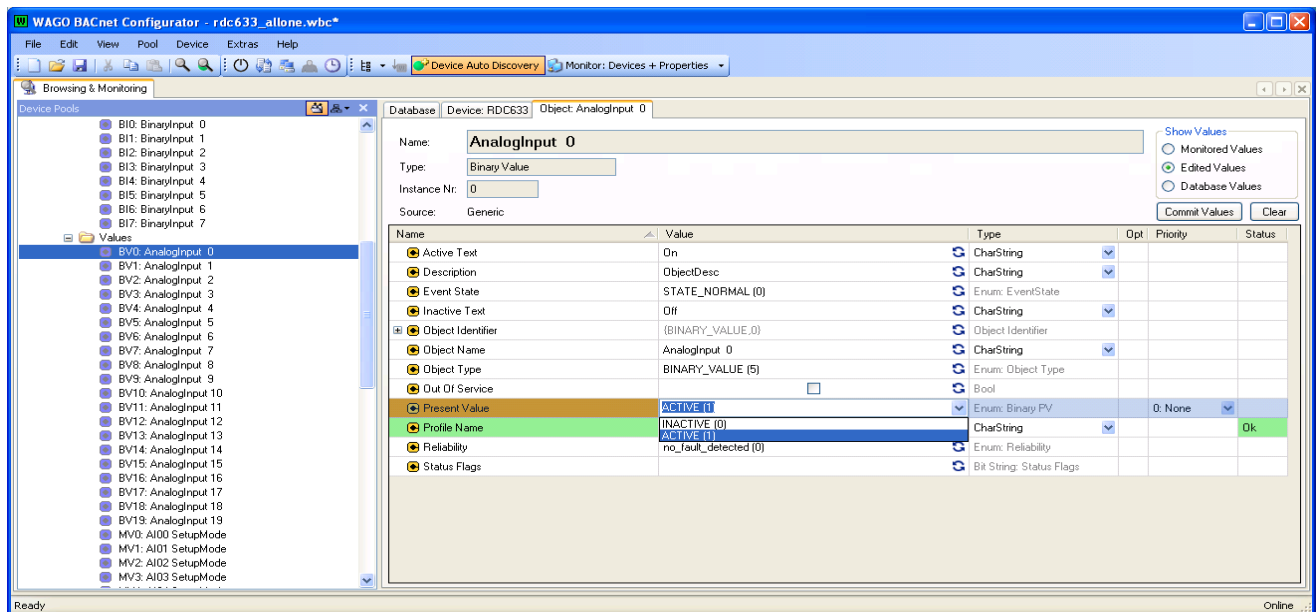
In the following, Alxx means analog/universal inputs AI0 – AI19:

DEVICE – Values: Object **Alxx SetupMode:** '[2] BINARY' selected  
Object **Alxx SetupType:** '[5] (0-4k)Ohm' selected

After configuring the above mentioned BACnet Objects Alxxx SetupMode and Alxx SetupType, the following data should be found in the concerning BACnet Analog Input Object:

DEVICE – Inputs: Object **Analog Input xx** Device Type: 0xA3  
Max Pres Value: 100  
Min Pres Value: 10  
Present Value: e.g. 2.9223 (closed) or infinity (open)

The state of the binary data point will be represented in the BACnet **Binary Value Object** by the **Present Value Property**.



With a setup like described above, the **Present Value** of the BACnet Object '**Binary Value xx**' will be ACTIVE (1) as long as the externally connected contact is open (*negative logic*). The analog input's status LED will be lit. When the contact is closed, the **Present Value** will turn to INACTIVE (0) and the LED will go off.

For *positive logic*, please choose the following setup:

DEVICE – Inputs: Object **Analog Input xx** Device Type: 0xA3  
**Max Pres Value: 10**  
**Min Pres Value: 100**  
Present Value, e.g. 2.9223 (closed) or infinity (open)

With the setup for *positive logic*, the **Present Value** of the BACnet Object '**Binary Value xx**' will be ACTIVE (1), as long as the externally connected contact is closed. The analog input's status LED will be lit. When the contact opens, the **Present Value** will turn to INACTIVE (0) and the LED will go off.

The colour of each status LED can be configured by setting the property '**Profile Name xx**' in the BACnet Object '**Binary Value xx**' (0x00 = LED disabled; 0x01 = red; 0x02 = green; 0x03 = orange (red + green)). When a status LED is blinking red and green, the input signal is neither identified as open contact nor as closed. In this case, please check and readjust Min Pres Value and Max Pres Value.

**Please note:** The LED colour of RDC621 and RDC601 devices' universal inputs UI0...UI3 cannot be changed; their colour is immutable red.



**Analog Input with Special Functions**

***Proprietary Properties for Analog Input Objects:***

**956 – Offset for Present Value**

Using the **proprietary property 956**, a corrective offset of the input value can be realised. This will work independent of the measurement range. The offset value can be positive or negative, e.g. +5 or -5. The **Present Value** then will be issued modified by the offset.

$$\text{Present Value} = \text{measured value} + (\text{+/- offset})$$

**Defining an individual 2-point characteristic**

With the following four proprietary properties it is possible to map the 0..10 V input signal onto the Present Value Property by defining an individual linear slope characteristic based on two points. That way, a measurement range of 0 ... 10 Volts will represent a range of values of -3 to +3, e.g.

<b>962</b>	<b>Property Input Range Low</b>	<b>minimum input voltage</b>
<b>963</b>	<b>Property Input Range High</b>	<b>maximum input voltage</b>
<b>964</b>	<b>Property Output Range Low</b>	<b>minimum corresponding output value</b>
<b>965</b>	<b>Property Output Range High</b>	<b>maximum corresponding output value</b>

- Input Range Low, Input Range High → define the measurement range of the input voltage
- Output Range Low, Output Range High → define the linear relationship between the measurement range of the input voltage and the calculated Present Value.

Formulas that are forming the basis of calculating the Present Value:

$$\text{Present Value} = (\text{Uin} * \text{Slope}) + \text{Offset\_Range}$$

with:

$$\text{Slope} = (\text{OutputRangeHigh} - \text{OutputRangeLow}) / (\text{InputRangeHigh} - \text{InputRangeLow})$$

$$\text{Offset\_Range} = \text{OutputRangeLow} - (\text{Slope} * \text{InputRangeLow})$$

(not to be confused with the proprietary Property 'Offset'!)

<b><u>Example:</u></b>	<b><u>Example 1:</u></b>	<b><u>Example 2:</u></b>
------------------------	--------------------------	--------------------------

InputRangeLow	= 0 V	= 0 V
InputRangeHigh	= 10 V	= 10 V
OutputRangeLow	= -20 °C	= +20 °C
OutputRangeHigh	= +60 °C	= +60 °C
Uin	= 7,5 V	= 7,5 V
PresentValue	= + 40°C	= + 50°C

$$\text{Slope} = (60 - (-20)) / (10 - 0) = 8$$

$$\text{Slope} = (60 - 20) / (10 - 0) = 4$$

$$\text{Offset\_Range} = -20 - (8 * 0) = -20$$

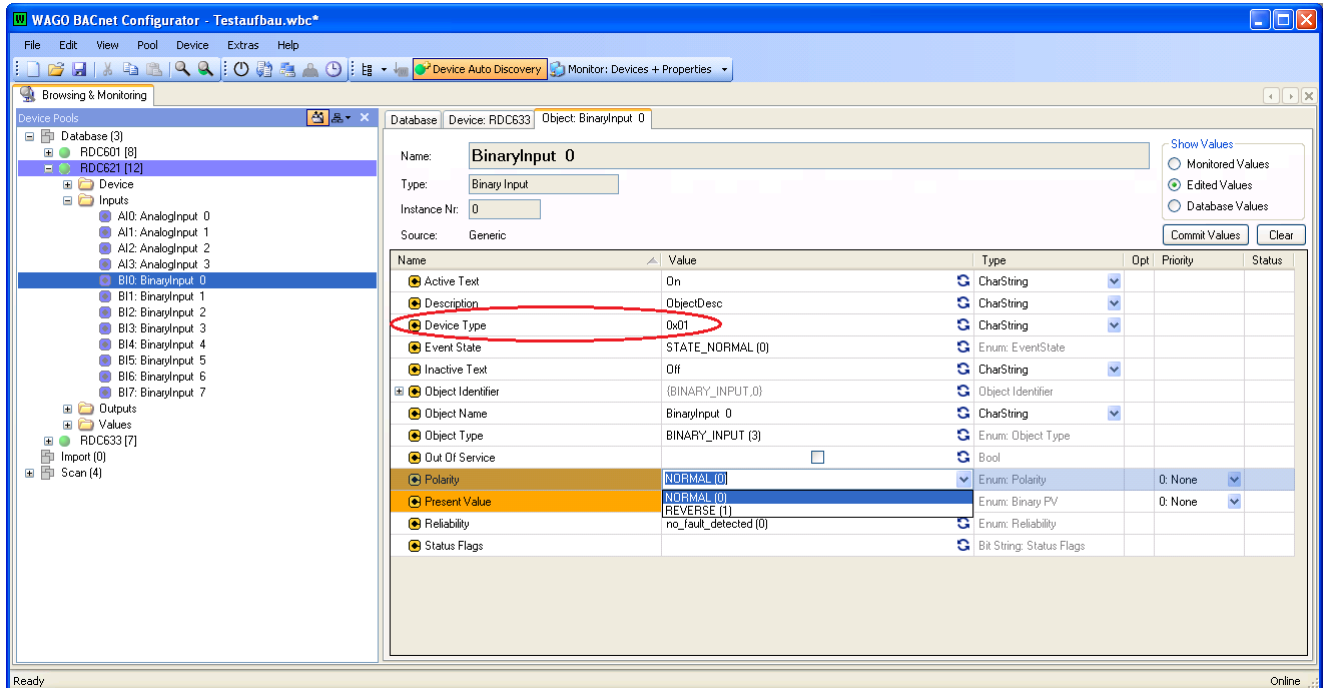
$$\text{Offset\_Range} = +20 - (4 * 0) = +20$$

$$\text{PresentValue} = (7,5 * 8) + (-20) = 40$$

$$\text{PresentValue} = (7,5*4) + (+20) = 50$$

Correct operation can be guaranteed only when the values of **MinPresValue** and **MaxPresValue** are adjusted consistent with the other settings. The Property **Reliability** shows the cause of malfunction.

## Binary Inputs



When selecting the 'Inputs' of the Device RDC621(12) from the tree structure, all inputs provided by the module will be shown.

### Changing the Polarity of Binary Inputs:

The operating mode of each binary input can be inverted by the BACnet Property '**Polarity**'. The operating mode NORMAL usually is used for make contacts, whereas REVERSE will be selected for break contacts to be connected. The LED's status will follow the setting that is made in the Property 'Polarity'.

## Changing a Status LED's Colour (NOT with RDC601 and RDC621):

The status LED's colour of each binary input can be changed in the BACnet Binary Input Object. For this purpose, the Property '**Device Type**' is used. The colours Red, Green and Orange will be coded by values, i.e. 0x01 → Red, 0x02 → Green, and 0x03 → Orange.

When an analog input is configured as binary input, the colour of each status LED can be configured by setting the Property '**Profile Name**' in the relating BACnet Object '**Binary Value**' (0x00 = LED disabled; 0x01 = red; 0x02 = green; 0x03 = orange (red + green)). (**NOT** with RDC601 and RDC621)

### Please note:

The LED colour of RDC621 and RDC601 devices' universal inputs UI0...UI3 cannot be changed. Due to the hardware design, their colour is immutable red.

### With RDC641 and RDC643 only:

The status LED's colour of each binary input can be changed in the BACnet Binary Input Object, using the Property '**Device Type**'. Additionally, there can be configured two colours, one for the status 'ON' and one for the status 'OFF'. The following table shows how to configure the LED's colours.

The left hexadecimal digit of the byte determines the LED's colour for status 'OFF', and with the other digit the colour of status 'ON' is selected:

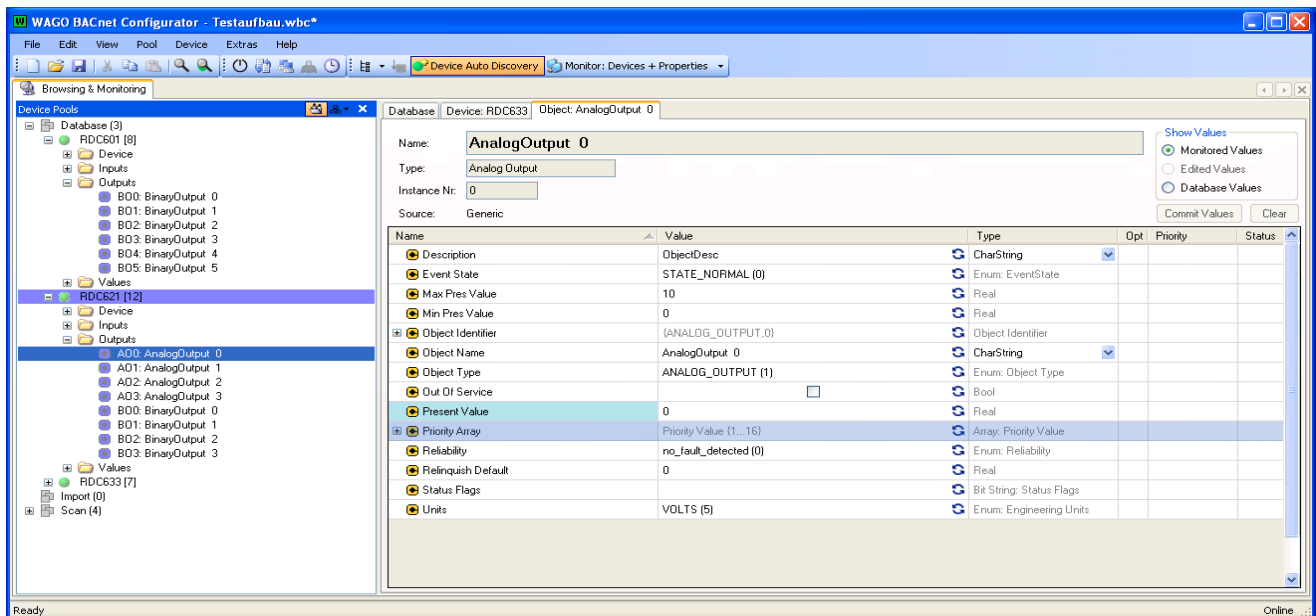
DeviceType	BI 'OFF'	BI 'ON'
0x00	off	off
0x01	off	red
0x02	off	green
0x03	off	red + green
0x10	red	off
0x20	green	off
0x30	red + green	off
0x11	red	red
0x21	green	red
0x31	red + green	red
0x12	red	green
0x22	green	green
0x32	red + green	green
0x13	red	red + green
0x23	green	red + green
0x33	red + green	red + green

### Example: DeviceType value = 0x12

Fire Damper contact open:                      Status LED → Red

Fire Damper contact closed:                      Status LED → Green

## Analog Outputs



When selecting the 'Outputs' of the Device RDC621(12) from the tree structure, all outputs provided by the module will be shown.

### Analog Outputs:

The analog output's operating status will be monitored and signalled by the BACnet Property '**Status Flags**'.

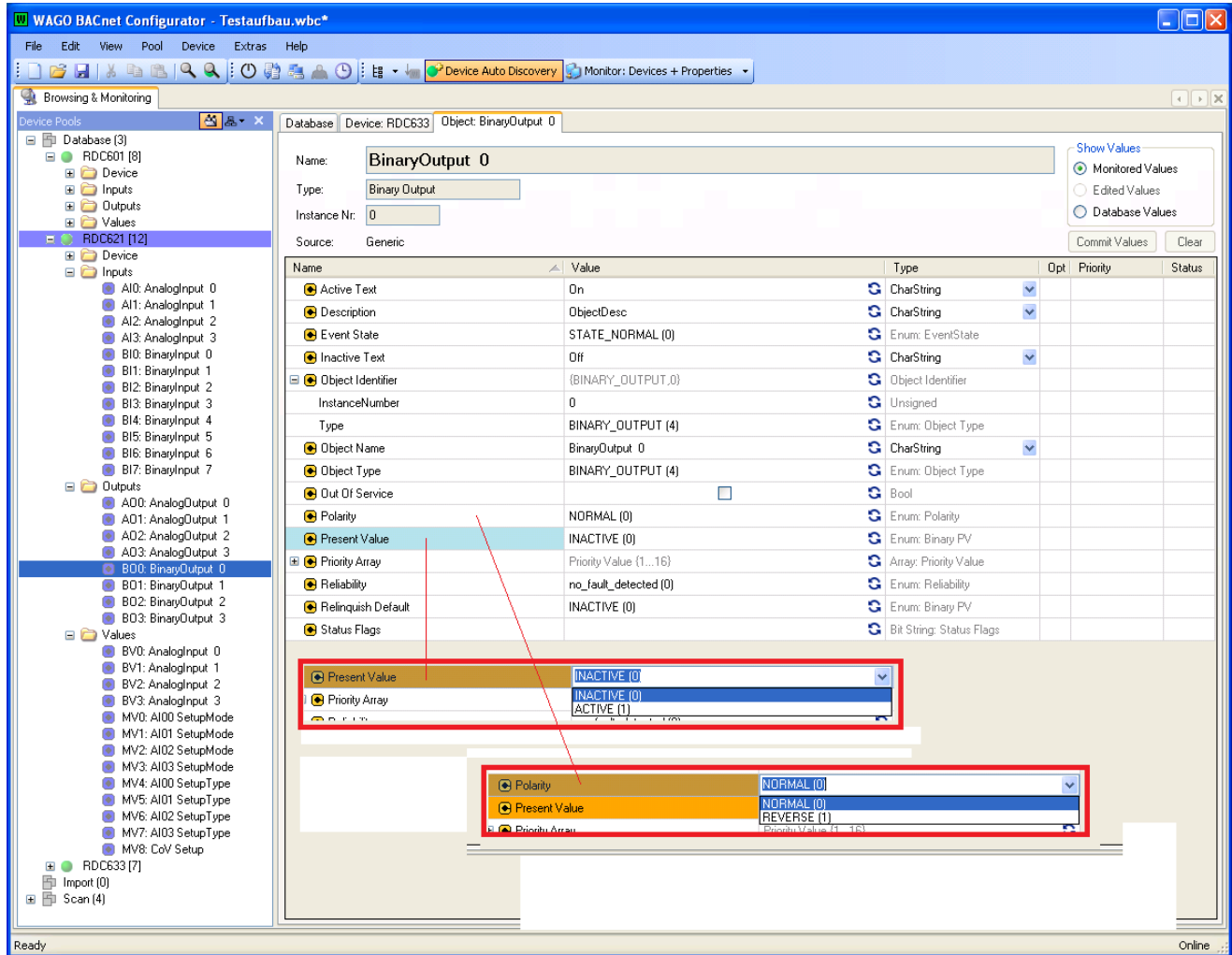
The current value of the output voltage can be seen and commanded via the BACnet Property '**Present Value**'.

The present output voltage of each analog output is shown in four stages by the means of a status LED which will be lit in three colours, depending on the output voltage:

- 0 .. 25% = LED Off
- 26 .. 50% = LED Green
- 51 .. 75% = LED Orange
- 76 .. 100% = LED Red

The BACnet Property '**Relinquish Default**' in the Analog Output Object defines the value which the analog output (Present Value Property and output voltage) shall have immediately after start-up of the RDC device.

## Binary Outputs



When selecting the 'Outputs' of the Device RDC621(12) from the tree structure, all outputs provided by the module will be shown.

### Binary Outputs:

The binary output's operating status will be monitored and signalled by the BACnet Property '**Status Flags**'.

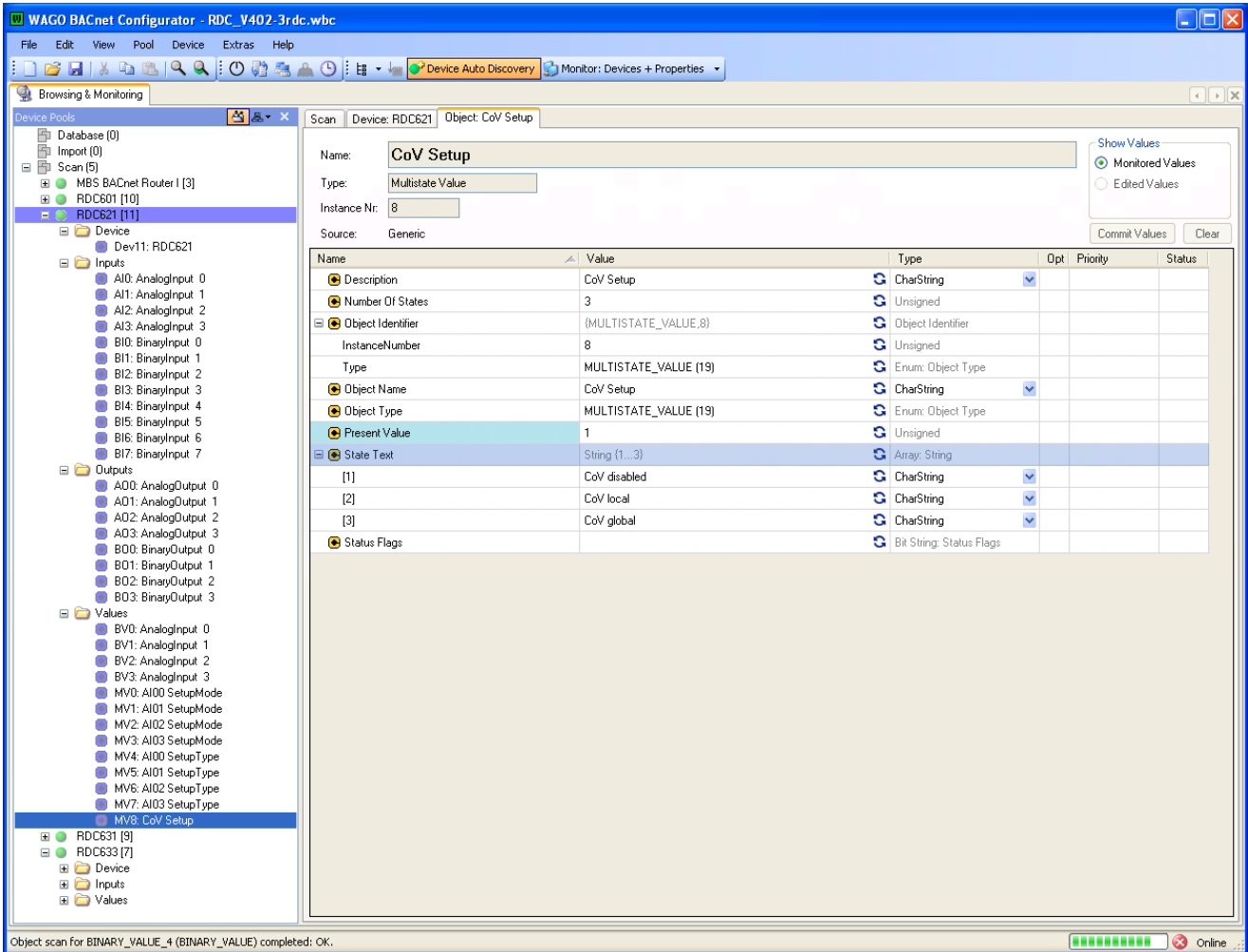
The current status (On/Off) of the output can be seen and commanded via the BACnet Property '**Present Value**'.

Using the BACnet Property '**Polarity**', the binary output's logic can be inverted from positive ('NORMAL') to negative ('REVERSE'). So, it is possible to use a make contact virtually as a break contact.

The status LED of the binary output will always follow the **Present Value**.

The BACnet Property '**Relinquish Default**' in the Binary Output Object defines the status (on-state or off-state) which the binary output (Present Value Property and relay) shall have immediately after start-up of the RDC device.

## Messages caused by a change of value (COV)



When selecting the 'Values' of the Device RDC621(12) from the tree structure, the Multi State Value Objects provided by the module will be shown.

### BACnet Multistate Value Object 'COV Setup':

Configuring the COV functionality of the analog inputs will be done by setting up the Present Value Property within this BACnet Object.

- [1] = COV disabled (no message will be sent caused by COV)
- [2] = COV local (message will be sent to the MS/TP network)
- [3] = COV global (message will be sent to the BACnet network)

When the COV functionality is configured to 'COV local' or 'COV global', messages generally will be sent to the MS/TP network or the entire BACnet network as a whole. There is no possibility for clients to subscribe for the receipt of notifications of changes that may occur to the properties of a particular object.

### COV parameters in data point objects:

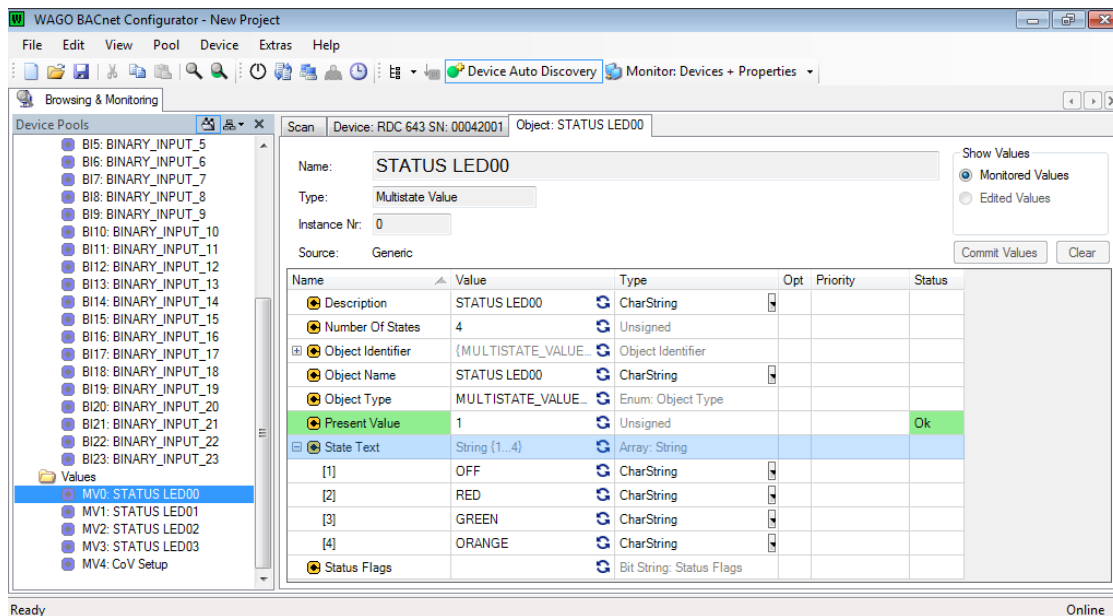
The BACnet Property 'COV Increment' determines the minimum change of value that has to be exceeded to initiate a COV notification message to the network. This applies for both, analog and binary data points.



## Status LEDs without Binary Input

### Multistate Value (only with RDC641, RDC643 and RDC643RF)

The above-mentioned modules provide four status indicating LEDs. They can be 'switched' to Red, Green or Orange by means of the **BACnet Multistate Value Objects (MV0..MV4)**.



The colour of the status LEDs will be controlled by writing the following values to the **Present Value** Property:

- [1] = LED Off
- [2] = LED Red
- [3] = LED Green
- [4] = LED Orange

## Technical Data

Supply voltage	24V AC/DC, $\pm 10\%$
Power consumption	max. 100 mA (terminals of supply voltage max. 2.5 A current rating)
<b>Interface</b>	<b>RS485 (not galvanically isolated), GND combined with -V terminal</b>
<b>Binary Inputs:</b>	galvanically isolated
Voltage	Activated by +/- 24V AC/DC (positive/negative logic)
Current	max. 10mA per channel
<b>Analog Inputs:</b>	Sensors: Pt1000/Ni1000 and others
	Resistor 0..19.5 kOhm
Current	max. 1mA per channel
Resolution	16 Bits
<b>Binary Outputs:</b>	Switching voltage max.: 250 VAC / 30 VDC
	Contact rating: 625 VA / 150 W
	Maximum switching current (resistive load): 5 A
	Nominal load (resistive): 2,5 A / 250 VAC; 5 A / 30 VDC
	Durability:
	at nominal load 50.000 cycles
	without load 5.000.000 cycles
<b>Analog Outputs:</b>	0..10 V, max. 10mA
Environmental conditions	Operating temperature 0..50°C Transport and storage temperature -20..+70°C Relative humidity 5..95%, non-condensing
Protection class	IP20
Dimensions	Width x Height x Depth: 72 x 92x 70 mm Standard installation housing, 4TE
Terminals	Spring-type terminal blocks, 1.0 und 1.5 m <sup>2</sup> (see page 3)
Mounting	DIN-rail, DIN EN50022
CE compliance	CE Directive 2004/108/EG (EN50081-1, EN50082-2) CE Directive 2006/95/EG (EN60730)  EN 61000-4-2 / IEC 801-2 Electrostatic discharge ESD Kontakt discharge 8 kV / air discharge 8 kV EN 61000-4-5 / IEC 801-5 Surge Signal lines 2 kV EN 61000-4-4 / IEC 801-4 Burst Inputs - outputs +/- 2 kV Power supply AC / DC +/- 2 kV

**Type Overview:**

<u>Item No.</u>	<u>Designation</u>	<u>Description</u>	
00002805	RDC601	4xAI, 8xDI, 6xDO with integrated manual overrides	BACnet MS/TP, RS485
00002806	RDC601R	4xAI, 8xDI, 6xDO, I/O for RDCx01F	BACnet MS/TP, RS485
00002774	RDCx01F	Manual override panel for RDCx01R	for RDC101R and RDC601R
	RDC601RF	Set RDC601R + RDCx01F	RJ45 cable 3m included
00002807	RDC621	4xAI, 4AO, 8xDI, 4xDO, with integrated manual overrides	BACnet MS/TP, RS485
00002808	RDC621R	4xAI, 4AO, 8xDI, 4xDO, I/O for RDCx21F	BACnet MS/TP, RS485
00002772	RDCx21F	Manual override panel for RDCx21R	for RDC121R and RDC621R
	RDC621RF	Set RDC621R + RDCx21F	RJ45 cable 3m included
00002849	RDC631	16xAI active/passive or DI	BACnet MS/TP, RS485
00002850	RDC632	16xAI passive or DI, without status LEDs	BACnet MS/TP, RS485
00002851	RDC633	20xAI active/passive or DI, 8xDI	BACnet MS/TP, RS485
00002876	RDC633R	20xAI active/passive or DI, 8xDI for RDCx33F	BACnet MS/TP, RS485
00002875	RDCx33F	Manual override panel for RDCx33R	for RDC133R and RDC633R
	RDC633RF	Set RDC633R + RDCx33F	RJ45 cable 3m included
00002915	RDC641	16x Binary inputs	BACnet MS/TP, RS485
00002910	RDC643	24x Binary inputs	BACnet MS/TP, RS485
00002916	RDC643R	24x Binary inputs for RDCx43F	BACnet MS/TP, RS485
00002917	RDCx43F	Manual override panel for RDCx43R	for RDC143R and RDC643R
	RDC643RF	Set RDC643R + RDCx43F	RJ45 cable 3m included

## Additional Variants



In order to implement a real local override / indication device (LO/ID) according to DIN EN ISO 16484 into the door of a switching cabinet, special types of modules are available. Functionally, they are similar to the basic devices, as RDC601 and RDC621.

The basic unit (RDC601R or RDC621R) is a rail-mounted device which provides the terminal blocks for inputs and outputs, whereas the panel that provides the switches and potentiometers for manual override and the status LEDs as well, will be installed in a mounting rack in the front of the switching cabinet (19" rack, space required 24TE/3HE). Panel and basic unit will be interconnected by an Ethernet RJ45 cable. The distance between the two components might be up to 300 meters.

## Types of split variants

Item No.	Designation	Description	
00002806	RDC601R	4xAI, 8xDI, 6xDO, I/O for RDCx01F	BACnet MS/TP, RS485
00002774	RDCx01F	Manual override panel for RDCx01R	for RDC101R and RDC601R
00002808	RDC621R	4xAI, 4AO, 8xDI, 4xDO, I/O for RDCx21F	BACnet MS/TP, RS485
00002772	RDCx21F	Manual override panel for RDCx21R	for RDC121R and RDC621R
00002876	RDC633R	20xUI, 8xDI for RDCx33F	BACnet MS/TP, RS485
00002875	RDCx33F	Manual override panel (status indication) for RDCx33R	for RDC133R and RDC633R
00002916	RDC643R	24x Binary inputs for RDCx43F	BACnet MS/TP, RS485
00002917	RDCx43F	Manual override panel (status indication) for RDCx43R	for RDC143R and RDC643R
00002864	3MRJ45	Cable RJ45, length 3m	

The term 'Local Override/Indication Device' (LO/ID) is defined in the standard ISO 16484-2.

Definition:

*'LO/ID – Interface to field equipment for limited operation independent of the processing unit providing priority indication, switching, and/or positioning.'*

## Supported Objects and Properties

### Device Object

DEVICE	<b>Object_Identifier</b>	R	
DEVICE	<b>Object_Name</b>	R/W	
DEVICE	<b>Object_Type</b>	R	
DEVICE	<b>System_Status</b>	R	
DEVICE	<b>Vendor_Name</b>	R	
DEVICE	<b>Vendor_Identifier</b>	R	
DEVICE	<b>Model_Name</b>	R	
DEVICE	<b>Firmware_Revision</b>	R	
DEVICE	<b>Application_Software_Version</b>	R	
DEVICE	<b>Location</b>	R/W	
DEVICE	<b>Description</b>	W	
DEVICE	<b>Protocol_Version</b>	R	
DEVICE	<b>Protocol_Revision</b>	R	
DEVICE	<b>Protocol_Services_Supported</b>	R	
DEVICE	<b>Protocol_Object_Types_Supported</b>	R	
DEVICE	<b>Object_List</b>	R	
DEVICE	<b>Max_APDU_Length_Accepted</b>	R	480 Characters
DEVICE	<b>Segmentation_Supported</b>	R	No Segmentation
DEVICE	<b>APDU_Segment_Timeout</b>	R/W	
DEVICE	<b>APDU_Timeout</b>	R/W	
DEVICE	<b>Number_Of_APDU_Retries</b>	R	
DEVICE	<b>Time_Synchronization_Recipients</b>		
DEVICE	<b>Max_Master</b>	R/W	
DEVICE	<b>Max_Info_Frames</b>	R/W	
DEVICE	<b>Database_Revision</b>	R	

Valid for all modules

## Analog Input Object

Analog Input	<b>Object_Identifier</b>	R	
Analog Input	<b>Object_Name</b>	R/W	
Analog Input	<b>Object_Type</b>	R	
Analog Input	<b>Present_Value</b>	R	
Analog Input	<b>Description</b>	W	
Analog Input	<b>Device_Type</b>	R/W	For Configuring Analog Inputs
Analog Input	<b>Status_Flags</b>	R	
Analog Input	<b>Event_State</b>	R	
Analog Input	<b>Reliability</b>	R	
Analog Input	<b>Out_Of_Service</b>	W/R	
Analog Input	<b>Min_Pres_Value</b>	R/W	
Analog Input	<b>Max_Pres_Value</b>	R/W	
Analog Input	<b>COV_Increment</b>	W/R	

## Analog Output Object

Analog Output	<b>Object_Identifier</b>	R	
Analog Output	<b>Object_Name</b>	R/W	
Analog Output	<b>Object_Type</b>	R	
Analog Output	<b>Present_Value</b>	W	
Analog Output	<b>Description</b>	W/R	
Analog Output	<b>Device_Type</b>	W/R	
Analog Output	<b>Status_Flags</b>	R	
Analog Output	<b>Reliability</b>	R	
Analog Output	<b>Out_Of_Service</b>	R	
Analog Output	<b>Units</b>	R/W	
Analog Output	<b>Min_Pres_Value</b>	R/W	
Analog Output	<b>Max_Pres_Value</b>	R/W	
Analog Output	<b>Priority_Array</b>	R	
Analog Output	<b>Relinquish_Default</b>	R	
Analog Output	<b>COV_Increment</b>	W	

## Binary Input Object

Binary Input	<b>Object_Identifier</b>	R	
Binary Input	<b>Object_Name</b>	R/W	
Binary Input	<b>Object_Type</b>	R	
Binary Input	<b>Present_Value</b>	R	
Binary Input	<b>Description</b>	W/R	64 Characters
Binary Input	<b>Device_Type</b>	R/W	For Configuring Binary Inputs
Binary Input	<b>Status_Flags</b>	R	
Binary Input	<b>Event_State</b>	R	
Binary Input	<b>Reliability</b>	R	
Binary Input	<b>Out_Of_Service</b>	W	
Binary Input	<b>Polarity</b>	R/W	
Binary Input	<b>Inactive_Text</b>	W/R	
Binary Input	<b>Active_Text</b>	W/R	

## Binary Output Object

Binary Output	<b>Object_Identifier</b>	R	
Binary Output	<b>Object_Name</b>	R/W	
Binary Output	<b>Object_Type</b>	R	
Binary Output	<b>Present_Value</b>	W	
Binary Output	<b>Description</b>	W/R	
Binary Output	<b>Status_Flags</b>	R	
Binary Output	<b>Event_State</b>	R	
Binary Output	<b>Reliability</b>	R	
Binary Output	<b>Out_Of_Service</b>	R	
Binary Output	<b>Polarity</b>	R/W	
Binary Output	<b>Inactive_Text</b>	R/W	
Binary Output	<b>Active_Text</b>	R/W	
Binary Output	<b>Priority_Array</b>	R	
Binary Output	<b>Relinquish_Default</b>	R	



## Binary Value Object

Binary Value	<b>Object_Identifier</b>	R	
Binary Value	<b>Object_Name</b>	R/W	
Binary Value	<b>Object_Type</b>	R	
Binary Value	<b>Present_Value</b>	R	
Binary Value	<b>Description</b>	W/R	
Binary Value	<b>Status_Flags</b>	R	
Binary Value	<b>Reliability</b>	R	
Binary Value	<b>Out_Of_Service</b>	W	
Binary Value	<b>Inactive_Text</b>	R/W	
Binary Value	<b>Active_Text</b>	R/W	
Binary Value	<b>Profile_Name</b>	R/W	For configuring LED colours

## Multistate Value Object

Multistate Value	<b>Object_Identifier</b>	R	
Multistate Value	<b>Object_Name</b>	R/W	
Multistate Value	<b>Object_Type</b>	R	
Multistate Value	<b>Present_Value</b>	R	
Multistate Value	<b>Description</b>	W/R	
Multistate Value	<b>Status_Flags</b>	R	
Multistate Value	<b>Out_Of_Service</b>	W/R	
Multistate Value	<b>Number_Of_States</b>	R	
Multistate Value	<b>State_Text</b>	R	

R = read; W=write