thermokon®

HOME OF SENSOR TECHNOLOGY

Description

for

WRF06 RC BACnet MS/TP
WRF06 RC (x) BACnet MS/TP
WRF07 RC (x) BACnet MS/TP

Index of Changes

Revision	Date	Description
A	29.07.2019	First release
B	03.02.2020	Description for BV-114 added (firmware v1.1.0 or higher).
C	26.09.2023	Correction 2.7
D	12.04.2024	Renamed the Room Controller into "…RC…", WRF06 RC and WRF06 RC (x) added

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1 Introduction

The present document describes the BACnet-Objects of the room controller:
WRF06 RC BACnet MS/TP
WRF06 RC (x) BACnet MS/TP
WRF07 RC (x) BACnet MS/TP

1.1 Hardware Installation

The room operating panel can be connected by means of a twisted-pair cable (line resistance 120 Ohm). For detailed information on installation and mounting, please see the product datasheet.

1.2 RS485 Transceiver

The maximal number of bus participants without the use of a repeater is default by the RS485 transceiver. The transceiver used in the device enables 32 devices per bus segment.

1.3 Protocol

The protocol used is the internationally standardized BACnet MS/TP protocol. This allows the connection to corresponding counterparts, e.g. an automation station or a BMS that supports the BACnet MS / TP protocol. The transmission parameters are set to 8N1 (8 data bits, no parity, 1 stop bit) according to the standard.
The baud rate is freely selectable and can be set via dip switch.

1.4 Configuration Options

The device can be adapted to the corresponding bus topology by means of a dip switch.

- MAC-Address of the device (1 - 127)
- Baud rate 9600, 19200, 38400, 57600, 76800 or 115200

1.5 Dip switch and LED

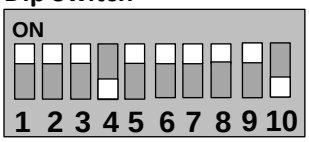
LEDs

Via the integrated LEDs the current operating status of the BACnet interface is indicated.

LED	Meaning
STA	Blinks during normal operation Lights up permanently during sensor initialization of device start
RXD	Blinks when RS485 BACnet telegrams are received
TXD	Blinks when RS485 BACnet telegrams are sent
ERR	Lights up in case of a corrupt bus configuration and internal errors

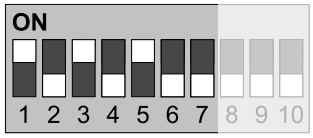
Note: During start-up, all 4 LEDs flash for a few seconds.

Dip Switch

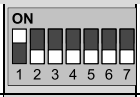
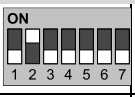
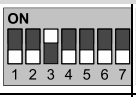
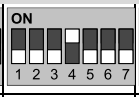
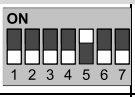
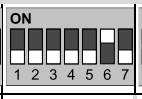


Example: MAC-Address 119, 57600 Baud

MAC-Address

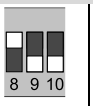
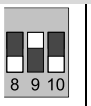
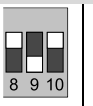
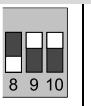
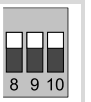


(I.e.: 1 + 4 + 16 = MAC adresss 21)

Dip-switch							
Wert	**on= 2^0 (1)**	on= 2^1 (2)	on= 2^2 (4)	on= 2^3 (8)	on= 2^4 (16)	on= 2^5 (32)	on= 2^6 (64)

Adress-range 1..127

Baud rate

							
off off off	on off off	off on off	on on off	off off on	on off on	off on on	on on on
9600	19200	38400	57600	76800	115200		

1.6 Controller

1.6.1 Device Types

The controller is integrated in the following devices: AO2V, OVR, OVT, DO2R, DO2T, 6WV.

1.6.2 Function Mode of PI-Controller

The integrated PI-controller controls the temperature of set point. The control variable resulting is directly output to the outputs. The PI-controller can be set by properties. The control variable of the controller is re-calculated approx. every second.

1.6.3 Change-Over Operation

The device can be used for a 2-pipe and a 4-pipe wire system. The corresponding selection is made via the BACnet objects BV-112.
If the change-over operation is activated, the corresponding mode (heating or cooling of controller) must be defined via MV-0.
The Change-Over Operation runs via output 1.

1.6.4 Energy Stop / Dew Point Detector

If a window contact or a dew point detector are connected to the digital inputs and the digital inputs are parameterized the same, both are directly affecting the control.

1.6.5 Override of Outputs

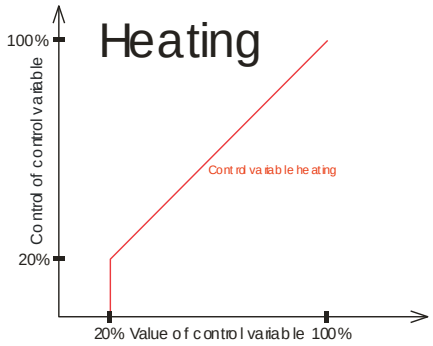
During operation an overriding of the outputs is possible via the BACnet objects AO-0 and AO-1. The automatic mode of an output is activated if the corresponding value is -1. In automatic mode, the output is directly linked to the manipulated variable of the controller.

1.6.6 Minimal Control Variable

Via the BACnet object BV-111 can be selected weather the minimal control variable is only used, if the control variable is > 0.

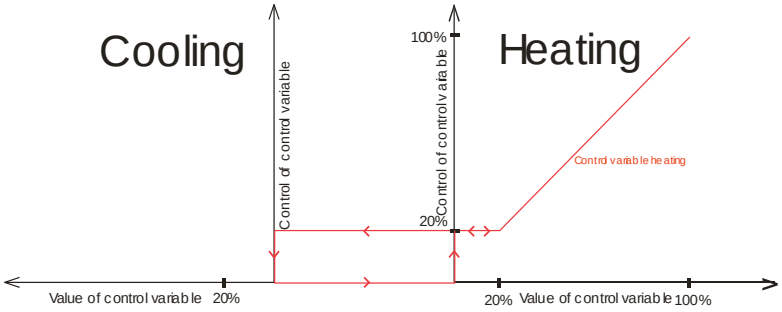
Mode Selection Control Variable

(1) Mode selection Control Variable > 0
Ymin = 20%



The control variable is only sent to the output if the calculated value of the control variable is bigger than the minimal control variable.

(2) Mode selection Control Variable = 0
Ymin = 20%



The minimal control variable at the output remains unchanged until the controller changes the operating mode

1.6.7 Calculating Set Points:

(1) OCCUPIED

- *Heating set point* =basic set point + offset + poti offset*
- *Cooling set point* = basic set point + dead zone + offset + Poti-Offset*

(2) UNOCCUPIED

- *Heating set point* = basic set point + offset + poti offset* -night lowering
- *Cooling set point* = basic set point + dead zone + offset + poti offset* + night lowering

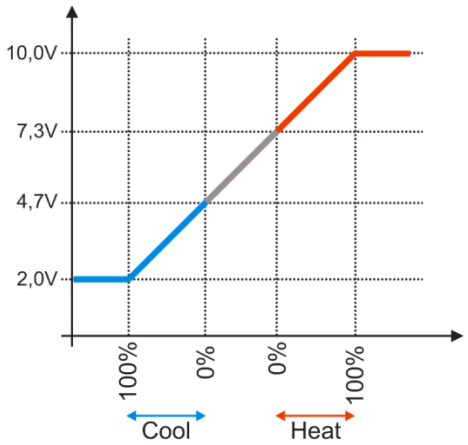
*if used

1.6.8 Function 6WV for BELIMO® 6-way valves

If device type “6WV” (for BELIMO® 6-way valves) is enabled, output AO1 is used as control variable output for 6-way valve. Control variable is calculated by integrated PI controller and the output voltage is adapted according to characteristic curve of used device type. Choosing type 6WV_INV inverts sequences for heating and cooling.

100…0% cooling ⇒ 2,0…4,7V
0…100% heating ⇒ 7,3…10,0V

Output AO1 with enabled 6WV-function.

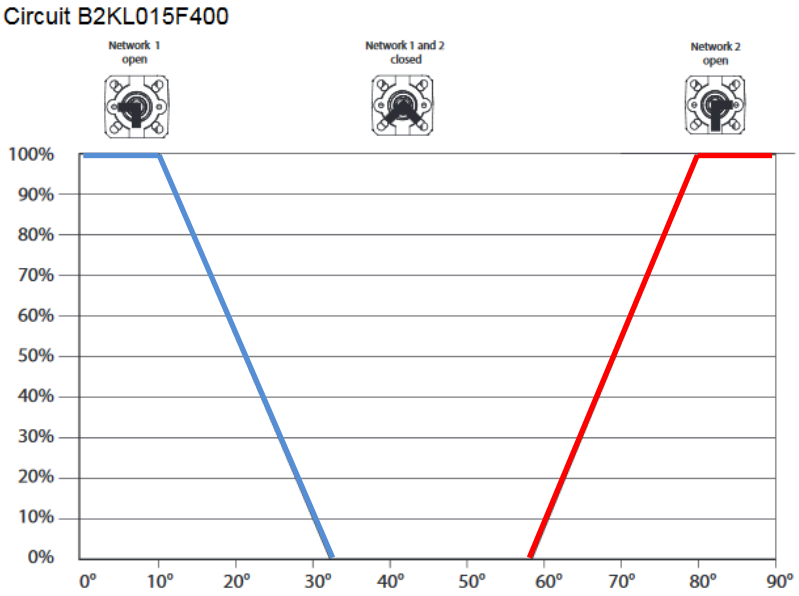


Type: 6WV
100…0% cooling ⇒ 2,0…4,7V
0…100% heating ⇒ 7,3…10,0V

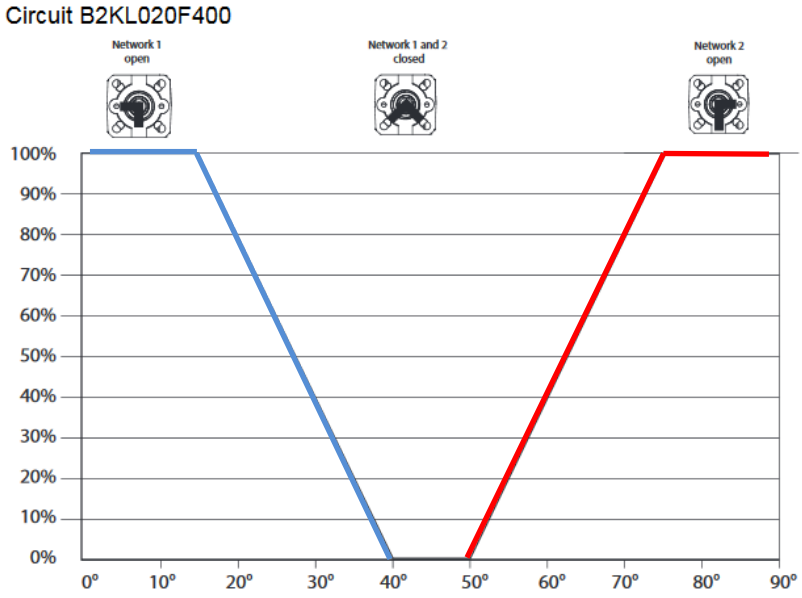
Type: 6WV_INV
heating cooling sequences inverted

1.6.9 Function 6WV for SAUTER 6-way valves DN15 und DN20

If device type „6WV_DN15“, or „6WV_DN20“ (for SAUTER 6-way valves) is enabled, output AO1 is used as control variable output for 6-way valve. Control variable is calculated by integrated PI controller and the output voltage is adapted according to characteristic curve of used device type. Please see SAUTER datasheet 58.001, B2KL: 6-way-ball valve with male thread, PN16).



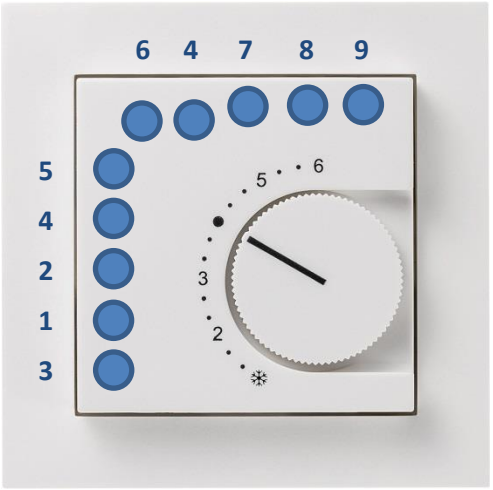
Picture 1 Charactersitic curve of DN15 valve (extract from SAUTER datasheet 58.001e)



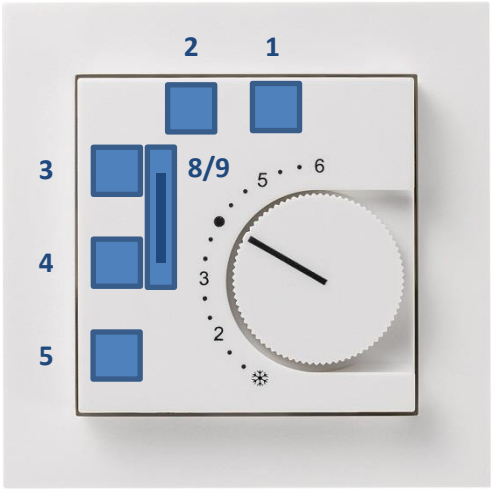
Picture 2 Charactersitic curve of DN20 valve (extract from SAUTER datasheet 58.001e)

1.7 LED- and Button-Mapping

LED-Mapping



Button-Mapping



2 Description BACnet Objects

2.1 Device Object

Property	Access	Range	Default
Object Identifier (Device ID)	R	0…4194302	Device Offset ID + MAC-Address
Object Name	R		DeviceID_ModelName *Example: "123_WRF07 BACnet MSTP"*
Object Type	R		Device
Description	RW	Max. 32 characters	
Location	RW	Max. 32 characters	
System Status	R		Operational
Vendor Name	R		Thermokon Sensortechnik GmbH
Model Name	R		WRF07 BACnet MSTP
Protocol Version	R		1
Protocol Revision	R		12
Max. APDU Length	R		480
Segmentation Support	R		no
APDU Timeout	R		3000 ms
Number APDU Retries	R		3
Max Masters	R		127
Max Info Frames	RW		1

2.2 Analog Inputs

Object	Description	
AI-0	Temperature	°C / °F
AI-1	Relative Humidity	%rF
AI-2	Absolute Humidty	g/m³ / gr/ft³
AI-3	Enthalpy	kJ/kG / BTU/lbs
AI-4	Dewpoint	°C / °F
AI-5	Setpoint Absolute	°C / °F
AI-6	Setpoint Adjustment	°C / °F
AI-7	PI-Controller Mode	1 = off 2 = heating 3 = cooling 4 = AUTO heating 5 = AUTO cooling
AI-8	PI-Controller Y Heat	0…100%
AI-9	PI-Controller Y Cool	
AI-10	Output 1 Value	0…10V
AI-11	Output 2 Value	
AI-12	Digital Input 1 Counter	After read out, this value will be set to 0.
AI-13	Digital Input 2 Counter	
AI-14	Digital Input 3 Counter	
AI-15	Digital Input 4 Counter	

2.3 Binary Inputs

Object	Description	
BI-0	Occupancy	0: unoccupied 1: occupied
BI-1	Button 1	0: released 1: pressed
BI-2	Button 2	
BI-3	Button 3	
BI-4	Button 4	
BI-5	Button 5	
BI-6	Button 6	
BI-7	Button 7	
BI-8	Button 1 (saved)	0: released 1: pressed The information will saved until next read out.
BI-9	Button 2 (saved)	
BI-10	Button 3 (saved)	
BI-11	Button 4 (saved)	
BI-12	Button 5 (saved)	
BI-13	Button 6 (saved)	
BI-14	Button 7 (saved)	
BI-15	Switch Position 1	0: released 1: pressed
BI-16	Switch Position 2	
BI-17	Switch Position 1 (saved)	0: released 1: pressed The information will saved until next read out.
BI-18	Switch Position 2 (saved)	
BI-19	Digital Input 1	0: false 1: true
BI-20	Digital Input 2	
BI-21	Digital Input 3	
BI-22	Digital Input 4	
BI-23	Digital Input 1 (saved)	0: false 1: true The information will saved until next read out.
BI-24	Digital Input 2 (saved)	
BI-25	Digital Input 3 (saved)	
BI-26	Digital Input 4 (saved)	

2.4 Analog Values

Object	Description	
AV-0	Setpoint Adjustment Range	-100 … +100 °C / °F
AV-1	Base Setpoint	-100 … +100 °C / °F
AV-100	Offset Device ID	Offset Device ID + MAC = Device ID
AV-101	Temperature Offset	-20 … +20 °C / °F
AV-102	Rel. Humidity Offset	-10 … +10 %rF
AV-103	Base Setpoint after Reset	-100 … +100 °C / °F
AV-104	Setpoint Adjustment Range After Reset	-100 … +100 °C / °F
AV-105	Setpoint Unoccupied Adjustment	-100 … +100 °C / °F
AV-106	Occupancy Party Time	0 … 86400 s (0…24 h)
AV-107	PI-Ctr. Dead Band	0 … 100 °C / °F
AV-108	PI-Ctr. xp Heat	0 … 100 °C / °F
AV-109	PI-Ctr. Tn Heat	0 … 100 Min.
AV-110	PI-Ctr. Y-min Heat	0 … 100%
AV-111	PI-Ctr. Y-max Heat	0 … 100%
AV-112	PI-Ctr. PWM-cycle Heat	0 … 10800 s (0…3 h)
AV-113	PI-Ctr. xp Cool	0 … 100 °C / °F
AV-114	PI-Ctr. Tn Cool	0 … 100 Min.
AV-115	PI-Ctr. Y-min Cool	0 … 100%
AV-116	PI-Ctr. Y-max Cool	0 … 100%
AV-117	PI-Ctr. PWM-cycle Cool	0 … 10800 s (0…3 h)
AV-118	PI-Ctr. Frost Protection	0 … 100 °C / °F
AV-119	Fan Stage 1 Threshold Y Heat	0 … 100% Depending on the control variables of the PI controller for heating / cooling, the fan levels are activated according to the threshold values.
AV-120	Fan Stage 2 Threshold Y Heat	
AV-121	Fan Stage 3 Threshold Y Heat	
AV-122	Fan Stage 1 Threshold Y Cool	
AV-123	Fan Stage 2 Threshold Y Cool	
AV-124	Fan Stage 3 Threshold Y Cool	
AV-125	Fan Stage 1 Output Voltage	0 … 10V
AV-126	Fan Stage 2 Output Voltage	
AV-127	Fan Stage 3 Output Voltage	

Note: The objects starting from AV-100 are configuration parameters that retain the values even after a restart.

2.5 Binary Values

Object	Description	
BV-0	PI-Ctr. Energy Hold Off	0: false 1: true
BV-1	PI-Ctr. Enable	0: false 1: true
BV-2	PI-Ctr. Dewpoint	0: false 1: true
BV-3	Occupancy Override	0: unoccupied 1: occupied
BV-100	Unit-System	0: Imperial 1: SI
BV-101	COV Enable - Temperature	0: disable 1: enable
BV-102	COV Enable - rel. Humidity	
BV-103	COV Enable - abs. Humidity	
BV-104	COV Enable - Enthalpy	
BV-105	COV Enable - Dewpoint	
BV-106	COV Enable - Setpoint	
BV-107	COV Enable - Occupancy	
BV-108	COV Enable - Buttons	
BV-109	COV Enable - Switch	
BV-110	COV Enable - Inputs	
BV-111	PI-Ctr. Y-Min. if Y>0	0: false 1: true

BV-112	PI-CTR. Change Over	0: false 1: true
BV-113	Occupancy after Reset	0: unoccupied 1: occupied
BV-114	Disable State LEDs (STA, RXD, TXD, ERR)	0: LEDs not disabled 1: LEDs disabled

Note: The objects starting from BV-100 are configuration parameters that retain the values even after a restart.

2.6 Multistate Values

Object	Description	
MV-0	PI-Ctr. Mode Override	off heat cool automatic
MV-1	Fan Stage	Stage 0 (Fan OFF) Stage 1 (manual) Stage 2 (manual) Stage 3 (manual) automatic
MV-100	Device Type	AO2V (AO1: heat, AO2: cool)
		DO2R (DO1: heat, DO2: cool)
		DO2T (DO1: heat, DO2: cool)
		OVR (DO1: heat, AO2: cool)
		OVT (DO1: heat, AO2: cool)
		4DI (4 digitale Eingänge)
		6WV For BELIMO® 6-Wegeventil, (AO1: 2…4,7V cool, 7,3...10V heat)
		6WV_INV For BELIMO® 6-Wegeventil, (AO1: 2…4,7V heat, 7,3...10V cool)
		6WV_DN15 Für SAUTER 6-Wegeventil DN15
		6WV_DN20 Für SAUTER 6-Wegeventil DN20
MV-101	PI-Ctr. Mode after Reset	off heat cool automatic
MV-102	Setpoint Visualization	Always Heat-Setpoint Heat- and Cool-Setpoint
MV-103	Button 1 Function	Contact Pulse Unoccupied Pulse Occupied Toggle Occupancy Contact Occupied Pulse Party Time Fan Stage UP Fan Stage DOWN Fan Stage Loop (0, 1, 2, 3, Auto, 0, 1, …)
MV-104	Button 2 Function	
MV-105	Button 3 Function	
MV-106	Button 4 Function	
MV-107	Button 5 Function	
MV-108	Button 6 Function	
MV-109	Button 7 Function	
MV-110	Button 8 Function	
MV-111	Button 9 Function	

MV-112	LED 1 Function	Bus Controlled Occupancy PI Controller Active PI Controller Heating PI Controller Cooling Fan Stage 0 Fan Stage 1 Fan Stage 2 Fan Stage 3 Fan AUTO
MV-113	LED 2 Function	
MV-114	LED 3 Function	
MV-115	LED 4 Function	
MV-116	LED 5 Function	
MV-117	LED 6 Function	
MV-118	LED 7 Function	
MV-119	LED 8 Function	
MV-120	LED 9 Function	
MV-121	Input 1 Function	NC Contact NC Dewpoint NC Window NC Occupancy NC PI Ctr. Auto/Off NC PI Ctr. Heat/Cool NO Contact NO Dewpoint NO Window NO Occupancy NO PI Ctr. Auto/Off NO PI Ctr. Heat/Cool
MV-122	Input 2 Function	
MV-123	Input 3 Function	
MV-124	Input 4 Function	
MV-125	Input 1 Counter Mode	Edge Pulse
MV-126	Input 2 Counter Mode	
MV-127	Input 3 Counter Mode	
MV-128	Input 4 Counter Mode	
MV-129	Number of Fan Stages	0 (Fan OFF) 1 (manual) 2 (manual) 3 (manual) 0 (Fan OFF) 1 (automatic) 2 (automatic) 3 (automatic)
MV-130	Fan Stage after Reset	0 (Fan OFF) 1 (manual) 2 (manual) 3 (manual) automatic
MV-131	Min. Fan Stage	0 1 2 3

Note: The objects starting from MV-100 are configuration parameters that retain the values even after a restart.

2.7 Analog Outputs

Object	Description	
AO-0	Output 1 Value Override	0…10 V (-1 disables the override function)
AO-1	Output 2 Value Override	

2.8 Binary Outputs

Object	Description	
BO-0	LED 1	False = LED off True = LED on
BO-1	LED 2	
BO-2	LED 3	
BO-3	LED 4	
BO-4	LED 5	
BO-5	LED 6	
BO-6	LED 7	
BO-7	LED 8	
BO-8	LED 9	

3 BACnet PICS

BACnet Protocol Implementation Conformance Statement

Date:	04.04.2019
Vendor Name:	Thermokon Sensortechnik GmbH (Vendor ID: 396)
Product Names:	WRF07 BACnet MSTP
Firmware Revision:	1.0.0
Application Software Version:	1.0.0
BACnet Protocol Revision:	1.12
Product Description:	Sensor device with BACnet MS/TP RS485 interface.
BACnet Standardized Device Profile:	BACnet Smart Sensor (B-SS)

4 BACnet BIBBs

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 Unsubscribed, B
DM-DOB-B	Device Management, Dynamic Object Binding, B
DM-DCC-B	Device Management, Device Communication Control, B
DM-DDB-B	Device Management, Dynamic Device Binding, B

BACnet Standard Application Services Supported:

ReadProperty
ReadPropertyMultiple
WriteProperty
DeviceCommunicationControl
WhoHas
WhoIs

Standard Object Types Supported:

Object-Type	Dynamically Creatable Deleteable	Optional Properties supported	Writable Properties
Binary Input	No	Description, COV Increment	
Binary Value	No	Description	Present Value
Binary Output	No	Description	Present Value
Analog Input	No	Description, COV Increment	COV Increment
Analog Value	No	Description	Present Value
Analog Output	No	Description	Present Value
Multistate Values	No	Description	Present Value
Device	No	Description	Description

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 [X]

Character Sets Supported:

UTF-8

Special Functionality:

Maximum APDU size in octets: 480