

# BACnet Integration Guidelines

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CoolMasterNet  
CooLinkNet  
CooLinkHub  
CooLinkBridge

BACnet Integration Guidelines

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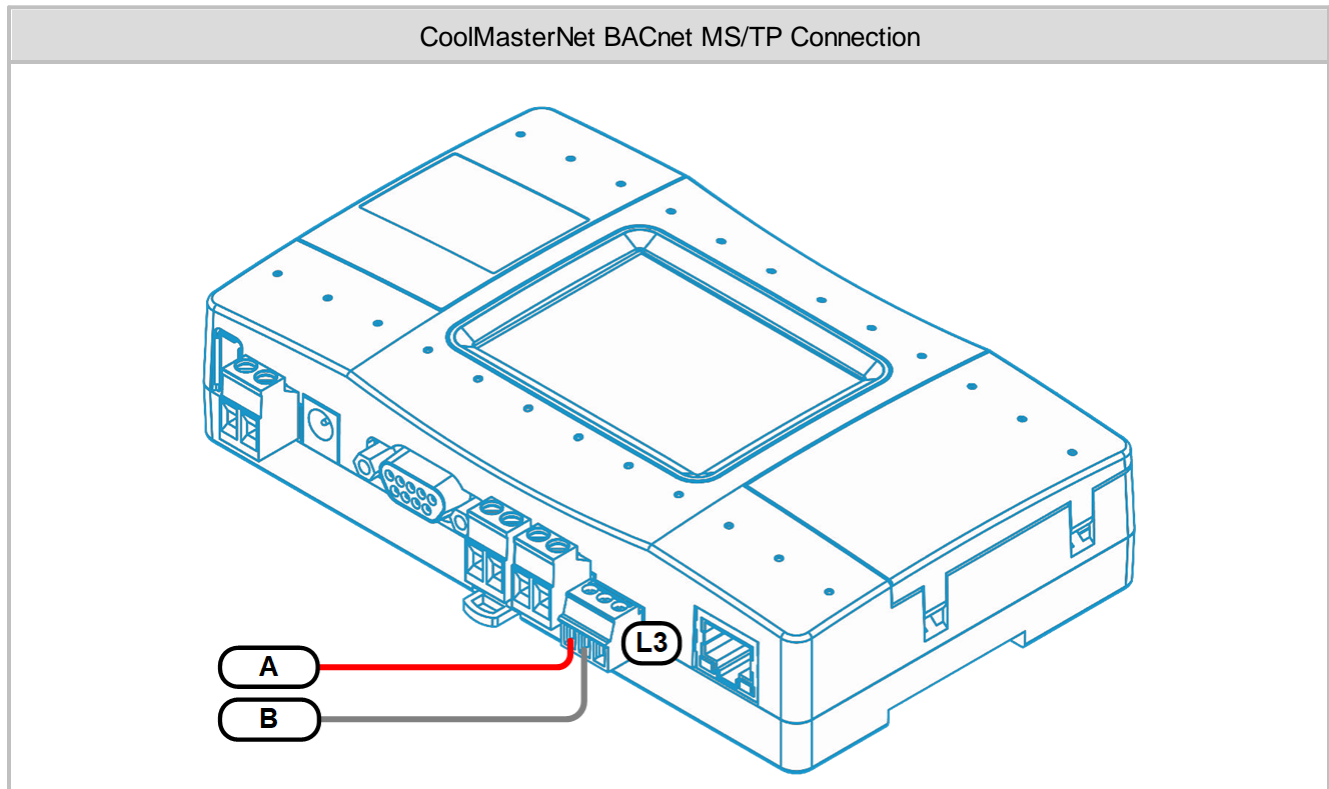
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# 1 Connection

CoolAutomation devices support BACnet MS/TP and/or BACnet IP protocols with accordance to the ANSI/ASHRAE Standard 135-2004.

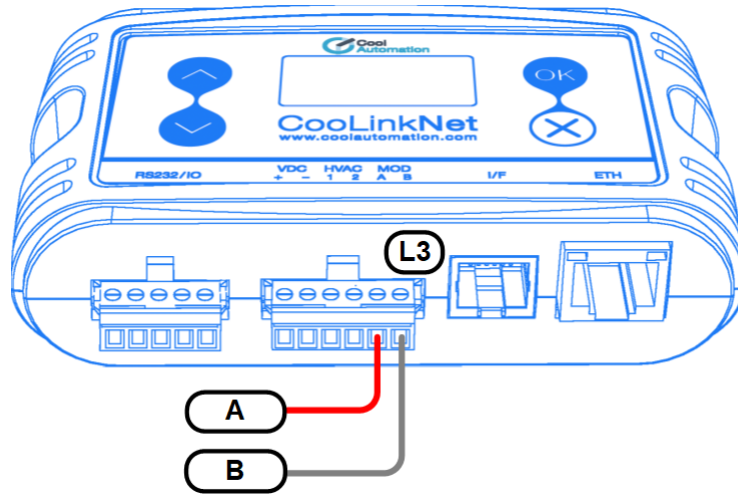
## 1.1 BACnet MS/TP Connection

In BACnet MS/TP mode physical connection to the CoolAutomation devices is implemented over “Two-Wire” electrical interface in accordance to EIA/TIA-485 standard. Connection is made via 485-A and 485-B terminals. Ground wire connection is not mandatory but highly recommended.



In CoolMasterNet Line L3 is recommended for BACnet MS/TP connection, although Lines L4, L5, L6 and L7 can also be used for that purpose. Picture above shows connection to Line L3.

## CoolLinkNet/CoolLinkHub/CoolLinkBridge BACnet MS/TP Connection



In CoolLinkNet/CoolLinkHub/CoolLinkBridge devices **only** Line L3 can be used for BACnet MS/TP connection.

## 1.2 BACnet IP Connection

BACnet IP is supported in CoolMasterNet and CoolLinkNet/CoolLinkHub/CoolLinkBridge devices. Devices are communicating on the Ethernet TCP/IP network using UDP protocol. Physical connection in this case is made via RJ45 Ethernet connector.

## 2 Configuration

CoolAutomation device must be configured to support BACnet functionality. Configuration is made via CoolAutomation's proprietary ASCII\_IF interface described in details in [Programmer Reference Manual \(PRM\)](#) document for the corresponding device.

One BACnet MS/TP and one BACnet IP connection can run simultaneously on CoolAutomation device. Additional MS/TP connections are not supported although physical interfaces may be available.

### 2.1 BACnet MS/TP Configuration

BACnet MS/TP interface module of CoolAutomation device has to be activated by assigning appropriate communication Line. In CoolMasterNet it is highly recommended to use Line L3, although it is possible to use any of the following lines: L4, L5, L6, L7 lines. Using line L3 in CoolLinkNet/CoolLinkHub/CoolLinkBridge for BACnet MS/TP is mandatory.

CoolMasterNet BACnet MS/TP activation:

```
>line type L3 BAC
OK, Boot Required!
```

CoolLinkNet/CoolLinkHub/CoolLinkBridge BACnet MS/TP activation:

```
>line type L3 BAC
OK, Boot Required!
```

Use `line` command to check if BACnet MS/TP module is already activated and to display it's parameters.

CoolMasterNet:

```
>line
L1: DK Master U00/G00 myid:0B
Tx:2/2 Rx:2/2 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L2: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L3: BACnet TS:0x40(64) DEV_INST:0x000040(64) 9600_8N1
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L4: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L5: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L6: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L7: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L8: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
OK
```

CoolLinkNet/CoolLinkHub/CoolLinkBridge:

```
>line
L1: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L2: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L3: BACnet TS:0x40(64) DEV_ID_INST:0x000040(64) 9600_8N1
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L4: MIM2 Slave U00/G00 Not Connected
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
L5: Unused
Tx:0/0 Rx:0/0 TO:0/0 CS:0/0 Col:0/0 NAK:0/0
OK
```

Next: VA's have to be configured to use BACnet MS/TP module. See: [VA's Configuration](#).

### 2.1.1 BACnet MS/TP MAC Address

On MS/TP networks, MAC address or TS (This Station) address is the eight bit address used to identify devices on a single RS-485 subnet. TS can be configured with `line myid` command (in this example TS will be set to 0x41 or 65 decimal):

```
>line myid L3 41
OK, Boot Required!
```

TS can be queried with `bacnet` or `line` command.

### 2.1.2 BACnet MS/TP Frame Format

The default BACnet MS/TP frame format in CoolAutomation devices is 9600\_8N1:

Baud Rate	9600 bps
Data Bits	8
Parity	None
Stop Bits	1

Frame format parameters are configurable with `line baud` command:

```
>line baud L3 19200_8N2
OK, Boot Required!
```

In above example frame format will become 19200 bps, 8 data bits, no parity, 2 stop bits.

## 2.2 BACnet IP Configuration

BACnet IP module is activated with below command:

```
>bacnet IP enable
OK, Boot Required!
```

BACnet IP server is started by device only after it establishes an Ethernet link and gets proper IP address (dynamic via DHCP or static). Ethernet and IP management is done with `ifconfig` command that is out of the spec of this document.

To query BACnet IP status use `bacnet` command without parameters:

```
>bacnet
Dev instance   : 64 (0x000040)
BACnet IP      : enabled
UDP port       : 47808 (0xBAC0)
BACnet MSTP    : L3
TS address     : 64 (0x40)
OK
```

The default UDP port number used by BACnet IP Server is 47808 (0xBAC0). This is "well-known" Ethernet port assigned for the BACnet IP protocol. If required port number can be changed (new port number in example below will be 503):

```
>bacnet port 503
OK, Boot Required!
```

Next: VA's have to be configured to use BACnet IP Server. See: [VA's Configuration](#).

## 2.3 VA's Configuration

VA's -Virtual Addresses are used by CoolAutomation devices in order to simplify translation of the Indoor Unit number - UID into Instance Number of the BACnet Object Identifier.

UID is a string in format **Ln.XYY**. For Example:

**L1.102** - Indoor Unit 102 on line L1

**L2.003** - Indoor Unit 003 on line L2

List of UID's detected (visible) by CoolAutomation device can be retrieved with **ls** command.

```
>ls
L1.100 ON 19C 30C High Fan OK # 0
L1.101 OFF 28C 23C High Cool OK - 0
```

Each UID can have none, one or a number of associated VA's. VA's are plain numbers starting from 1. Device can automatically allocate and associate VA's with existing (visible by **ls** command) UID's:

```
>va auto
OK
```

To query allocated VA's use **va** command without parameters:

```
>va
INDOORS
L1.100 --> 0001 [Hex: 0x0011 | Dec: 00017]
L1.101 --> 0002 [Hex: 0x0021 | Dec: 00033]
OK
```

In example above UID L1.100 has a VA=0001 and UID L1.101 has a VA=0002. Numbers is '[' ']' braces are not applicable for BACnet modules (they are used for Modbus modules).

VA's can be allocated or deallocated (deleted) all together or separately. As shown above for automatic VA's allocation **va auto** command is used. It is possible to allocate VA for specific UID. For example, allocate VA 0004 for UID L1.102:

```
>va + L1.102 0004
OK
```

In this case UID does not have to be detected (visible) by CoolAutomation device at the VA allocation time. It is allowed to allocate a number of VA's for any given UID.

To delete all allocated VA's:

```
>va delall
OK
```

Specific VA can also be deleted (below command will delete VA 0004):

```
>va - 0004
OK
```

Alternatively all VA's associated with specific UID can be deleted (below command will delete all VA's associated with UID L1.102):

```
>va - L1.102
OK
```

Once VA's are allocated BACnet MS/TP and/or BACnet IP can be used to access Indoor Unit parameters. Translation of the VA into Instance Number of the BACnet Object Identifier is made according to the scheme below:

Object Identifier bits																															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Type										Instance Number																					
										VA							Index														

### 3 BACnet Tables

#### Supported Object Types

Object Type	Abbreviation	Read/Write	Encoding
Binary Value	BV	R/W	5
Binary Input	BI	RO	3
Analog Value	AV	R/W	2
Analog Input	AI	RO	0
Multi State Value	MV	R/W	19
Character String Value	CSV	RO	40
Integer Value	IV	RO	45
Positive Integer Value	PIV	R/W	48

#### 3.1 Indoor Unit Objects

Object Identifier bits				Object Description
31		22		
21		8		
Type	Instance			
	VA	Index		
BV		00		ON/OFF
AV		00		Room Temperature Set Point x10 °C
AI		00		Room Temperature x10 °C
MV		00		Fan Speed: 1 - Low 2 - Medium 3 - High 4 - Auto 5 - Top 6 - Very Low 7 - Super High 8 - HRV Super High 9 - HRV Low FreshUp 10 - HRV High FreshUP
MV		01		Operation Mode: 1 - Cool 2 - Heat 3 - Auto 4 - Dry 5 - HAUX 6 - Fan 7 - Heat+HAUX 9 - HRV Auto 10 - HRV Bypass 11 - HRV Heat Exchange 12 - HRV Normal
BI		00		HVAC Failure Indication. Present Value = 0 - No Failure Present Value = 1 - Failure. "Active Text" property contains failure code
BV		01		Filter Sign.
BI		01		Demand State (Therm_ON)
MV		02		Louver 1 - Vertical 2 - 30 deg 3 - 45 deg 4 - 60 deg 5 - Horizontal 6 - Auto (Swing) 7 - Off 8 - No Louver Control





## 4 Commands Reference

[line](#)  
[bacnet](#)  
[va](#)

### 4.1 bacnet

#### SYNOPSIS

```
bacnet
bacnet IP enable
bacnet IP disable
bacnet port <PORT>
bacnet instance <DEV_INST>
```

#### DESCRIPTION

- Without parameters `bacnet` command displays current bacnet configuration.
- `bacnet IP` command is used to enable or disable BACnet IP module.
- `bacnet port` command is used to configure UDP port used by BACnet IP module.
- `bacnet instance` command is used to configure Device Instance of the Device Object Identifier.

#### EXAMPLE

See examples in [Configuration](#) chapter.

### 4.2 line

#### SYNOPSIS

```
line
line type <Ln> BAC
line myid <Ln> <TS>
line baud <Ln> <FRAME>
```

#### DESCRIPTION

<Ln> parameter denotes communication line number like for example: L3 or L4.

- Without parameters `line` command prints status of all communication lines available in specific device.
- `line type` command is used to activate BACnet MS/TP module on line <Ln>.
- `line myid` command is used to change TS address. <TS> parameter should be provided as hexadecimal number without leading 0x.
- `line baud` command is used to change BACnet MS/TP frame format for line <Ln>. <FRAME> parameter format is <BAUD>\_<8|9><N|E|O><1|2>. Supported baud rates for <BAUD> parameter are: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200. Frame format change is effective only after power reset.

#### EXAMPLE

See examples in [BACnet MS/TP Configuration](#) chapter.



## 4.3 va

### SYNOPSIS

```
va
va auto
va + <UID> <VA>
va delall
va - <UID> | <VA>
va ram <N>
```

### DESCRIPTION

<UID> parameter denotes Indoor Unit identifier/number like for example: L1.100 or L2.003. <VA> parameter denotes VA number in decimal format.

- Without parameters `va` command prints status of all allocated VA's.
- `va auto` command is used to automatically distribute VA's for all detected UID's one to one. Previously allocated VA's will be deleted
- `va + <UID> <VA>` command will allocate VA for given UID. Number of VA's allocated for UID is not limited.
- `va delall` command will delete all allocated VA's.
- `va - <UID>` will delete all allocated VA's for given UID.
- `va - <VA>` will delete specific VA.
- `va ram <N>` resizes RAM memory used for VA's. Parameter <N> denotes a desired total number of VA's that can be allocated. By default N=170. VA's memory resize is effective only after power reset.

### EXAMPLE

See examples in [VA's Configuration](#) chapter.