

Operating Guide

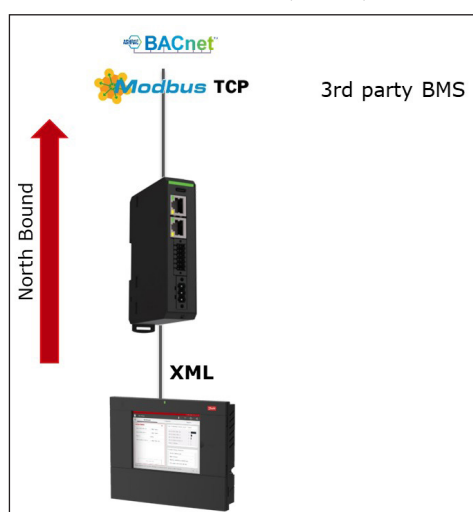
How to convert XML (AK-SM 800A) to Modbus TCP or BACnet IP

GPS-XG-B2

1. Introduction

This configuration is called “North Bound” as allows to integrate System Manager on 3rd party monitoring systems. It is a step-by-step guide to convert XML protocol from AK-SM 800A to destination protocols as either Modbus TCP or BACnet IP.

Note: Danfoss has no liability on any incorrect use or application of this product.



2. Resources needed

- X-Gate with Multigateway App (FW version 5.30 or latest)
- System Manager AK-SM 800A (FW version 4.3 or latest)
- PC with standard browser as Edge or Chrome.
- Optional to test Modbus TCP - Generic Modbus reader (Suggestion: OpenModScan or similar)
- Optional to test BACnet IP (Suggestion: Yabe or similar)

3. How to connect on the configuration PC

Most common configuration will be using a Router coordinating the network.
Both AK-SM 800A and X-Gate must be on the same network.

3.1 DHCP router

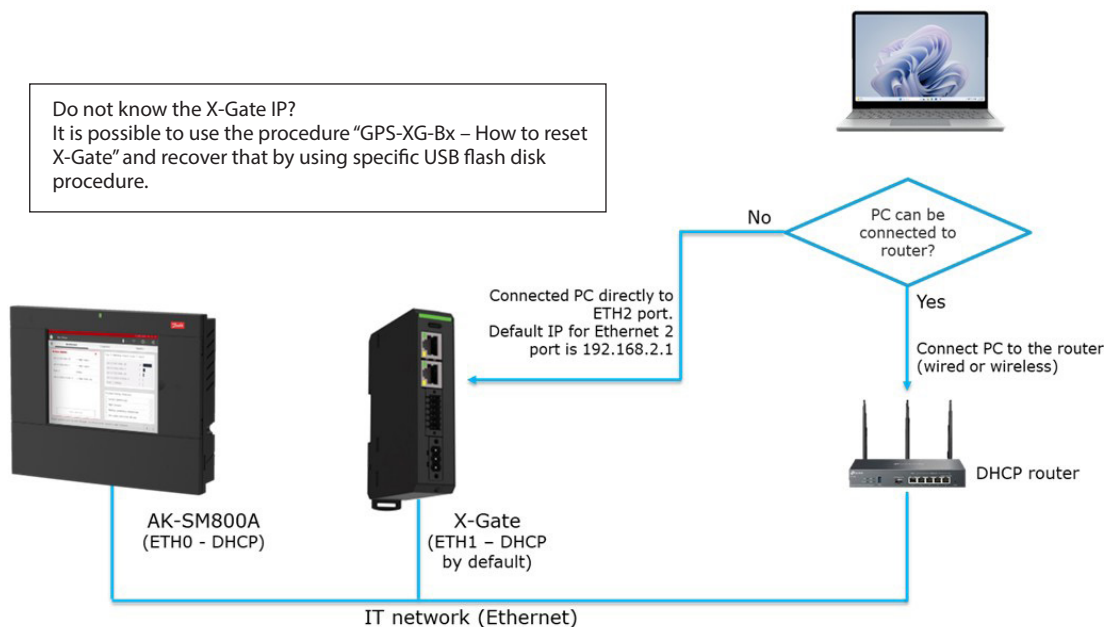
If router is DHCP, both AK-SM 800A and X-Gate will have an IP assigned by this router.
For this configuration, it is necessary to know with IP was assigned for each device by the DHCP router. If a rule was not created in the router, it is possible to check in the AK-SM 800A screen which IP this device is using.
Make a IP rule to assign same IP after lease time (to avoid X-Gate IP being changed after a power reset, for instance).

3.2 Router with no DHCP functionality

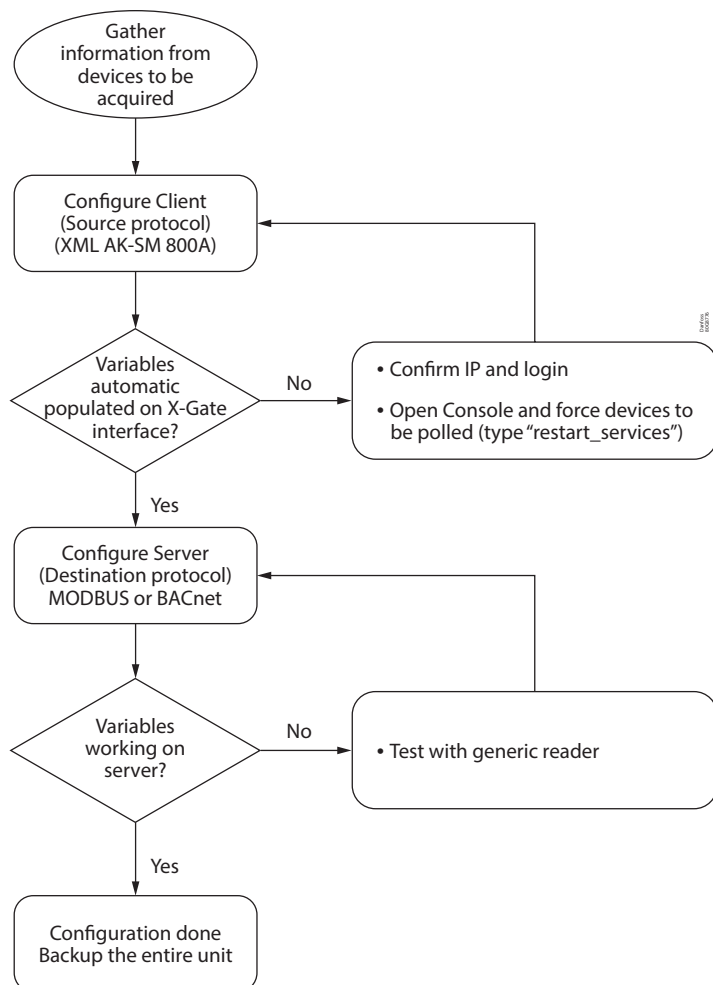
If router is not DHCP, IP addresses must be provided by the IT network administrator to be configured manually into the devices.

3.3 How to access X-Gate interface

- If PC which will be used for commissioning cannot be connected on IT network, it must be connected on X-Gate via its ETH2 port, which is fixed IP 192.168.2.1 (HTTP) by default. At this case, ETH2 port will be used only for configuration/commissioning purposes (ETH1 will be the one connected to the IT network, same AK-SM 800A network).
- If PC can be connected on IT network, simply connect it on IT network via the router and access the X-Gate interface.

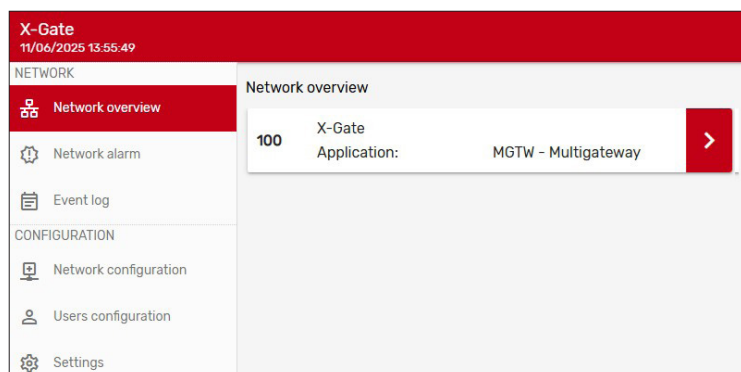


4. Development Flow

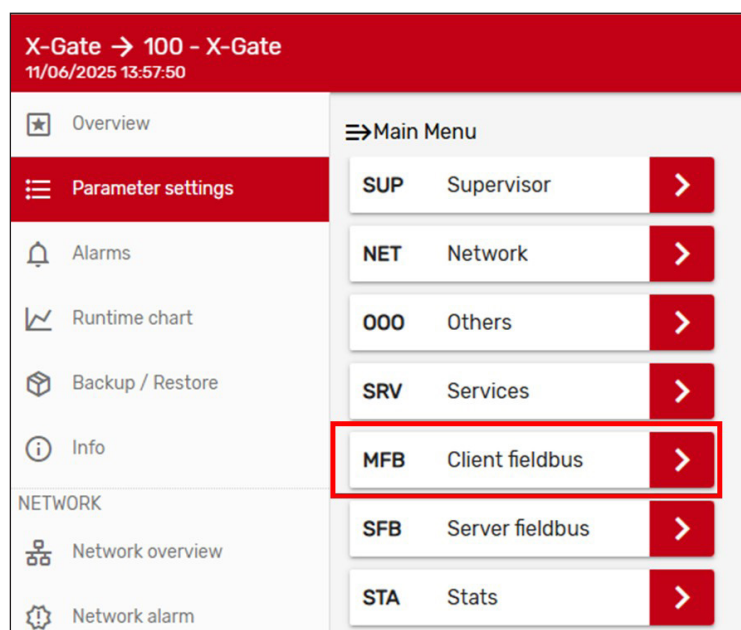


5. Configuring the Client (Source Protocol XML – AK-SM 800A)

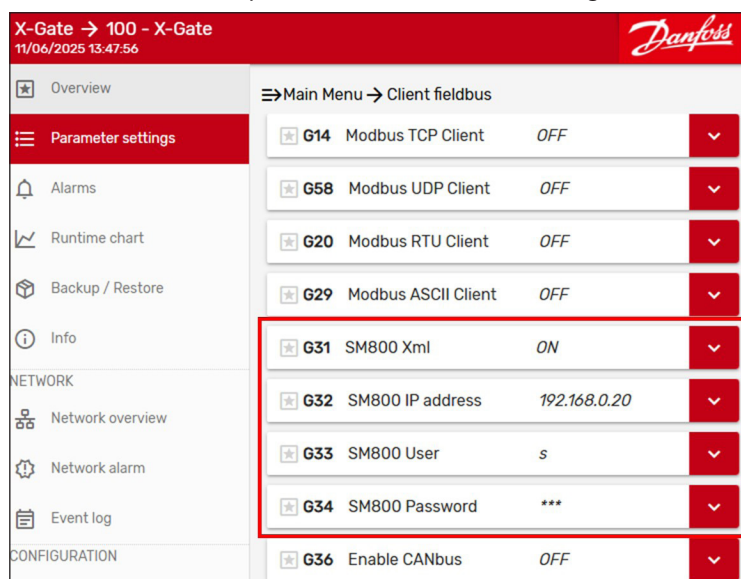
Considering AK-SM 800A is on the same IP range of X-Gate and configured from factory default, go to: Click on “Network Overview” and click on the device “100” (X-Gate).



Click on “Client fieldbus”.



Set the communication parameters on the Client according to AK-SM 800A IP and login credentials.



"G31 - SM800 Xml" Turn it to ON and keep all parameters as G14, G58, G20, G29, G41, G42 and Q30 in OFF).

"G32 - SM800 IP address" Assign the AK-SM 800A IP address accordingly.

"G33 - SM800 User" Insert the user credential (same used on the AK-SM 800A to get access to the unit). Keep in mind that this login must have enough privilege to perform operations as a regular user (on AK-SM 800A database).

"G34 - Password" Insert the password for the login user entered above.

Once this step is finished, click on the "Network overview" button (at the right, as showed on step 5.1)

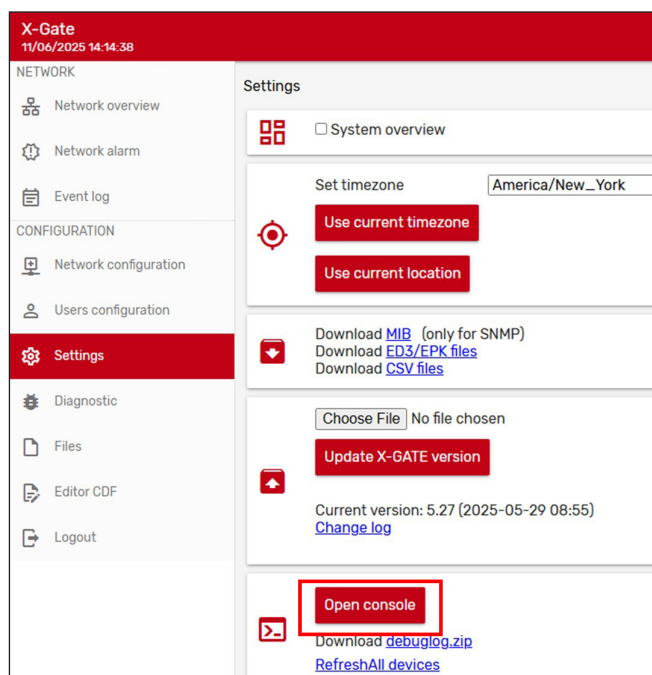
Devices configured in the AK-SM 800A database within an hour will start to be populated in "Network overview" area.

5.1 If devices are not populated from the AK-SM 800A database

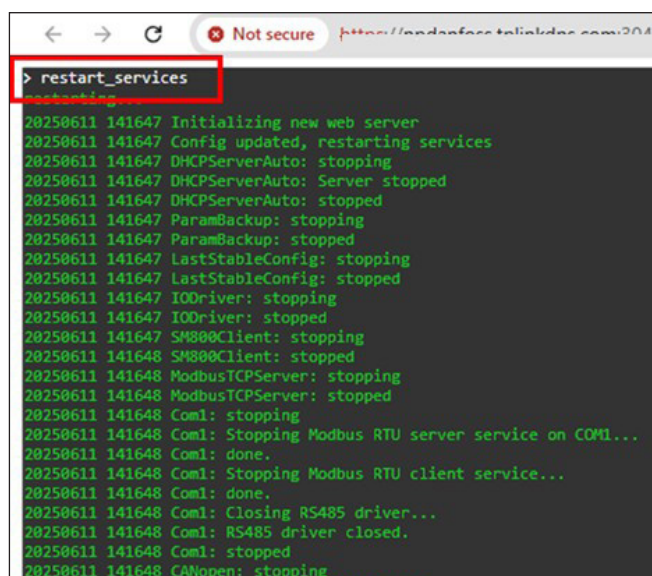
When XML is set as client, it will take a while to populate automatically (typically, devices database is auto-updated every 1h).

To speed up this process, it is possible to go through the upcoming steps and force a database scan manually.

Click on "Settings" button, go down and locate the button "Open console".



In the "Console" which will open, type: "restart_services" and type enter.



Important note regarding devices in X-Gate network overview list.
Devices configured on AK-SM 800A will be populated right after.

This operation lasts a couple of minutes (10/15min first time, depending on how complex is the AK-SM 800A database).

Note: X-Gate refreshes all the devices in its network automatically every one hour (no need to keep using “restart_services” command during normal operation. It is a resource that can be used only during this configuration stage to speed up the commissioning phase).

5.2 Devices in X-Gate database

All devices and controls present in AK-SM 800A database will be populated under “Network overview” after a while. Device addresses will be automatically created by X-Gate and they will be presented individually in this overview area. By clicking on any of these devices, current variables and parameters can be read/write (in the same way they are available on the System Manager).

Device comm ID	Application name in AK-SM800A database	Automatically populated by X-Gate
2	Pack 1 Application:	SM800_080Z0202_041x - 080Z0202_041x
10	ColdRoom CO2 Application:	SM800_084B4081_020x - 084B4081_020x
11	Ice Cream showcase Application:	SM800_080Z0139_061x - 080Z0139_061x
100	X-Gate Application:	MGTW - Multigateway
101	Misc I/O Application:	SM800_MiscIO_u0 - Misc I/O u0
102	Ice Cream showcaseb Application:	SM800_080Z0139_061x - 080Z0139_061x
103	Ice Cream showcasec Application:	SM800_080Z0139_061x - 080Z0139_061x
104	Ice Cream showcasec Application:	SM800_080Z0139_061x - 080Z0139_061x

5.3 Checking if devices are being polled properly

As an example, take one of the devices auto-populated in the X-Gate interface and check its readings (except the number 100 which is the own X-Gate). All the others regard to devices being polled from AK-SM 800A.

If a device on AK-SM 800A database has its address defined as 100, it will be populated on the next free Modbus free ID address.

Note: “Device comm ID” as showed in the item 5.4, tends to follow the same device address in the AK-SM 800A database, if there is some coincidence or conflict, it will be automatically created using another ID.

5.4 Example of proper functioning

On this example below, reading from the device number 10 will be demonstrated by clicking on such device in “Network overview” area.

Variable	Value	Type
Main Switch	Start	R/W variable (Parameter)
Case Setpoint A	10.0°C	R/W variable (Parameter)
A03 Alarm delay	30min	R/W variable (Parameter)
High Temp Alarm	-12.2°C	R/W variable (Parameter)
Low Temp Alarm	-1.1°C	R/W variable (Parameter)
o61 Appl. mode	1. Cmp/Al/Fan/Def	R/W variable (Parameter)
State	Emergency ctrl.	Read Only variable
Case Temp 1	180.0°C	Read Only variable
Liquid In	0.0°C	Read Only variable
Error	ON	Read Only variable
U72 Food temp.	180.0°C	Read Only variable
Vapor Out	180.0°C	Read Only variable

Notice all variables and parameters are being showed properly and must match the readings on the AK-SM 800A. If a communication error happens, readings will be displayed as “NaN”.

6. Configuring the Server (Destination protocol)

Once variables are being polled properly from AK-SM 800A into the X-Gate, it is time to configure the Server, which will be the protocol that will mirror all the variables on the X-Gate and AK-SM 800A database.

This document will guide you to configure two options, either Modbus TCP or BACnet IP.

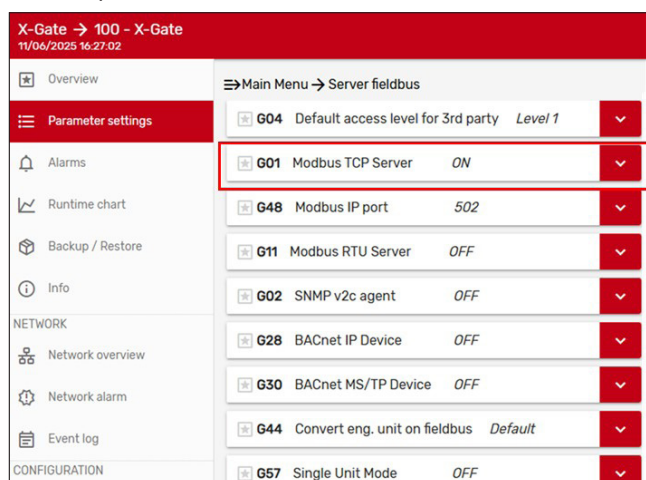


7. Configuring Server as Modbus TCP

Click on “Network Overview” and click on the device “100” (X-Gate)

Click on “Server fieldbus”

Turn the parameter “G01 – Modbus TCP Server” to “ON” as demonstrated in the picture below. Other protocol options keep them all OFF.



7.1 How to access the exposed variables from X-Gate on Modbus TCP.

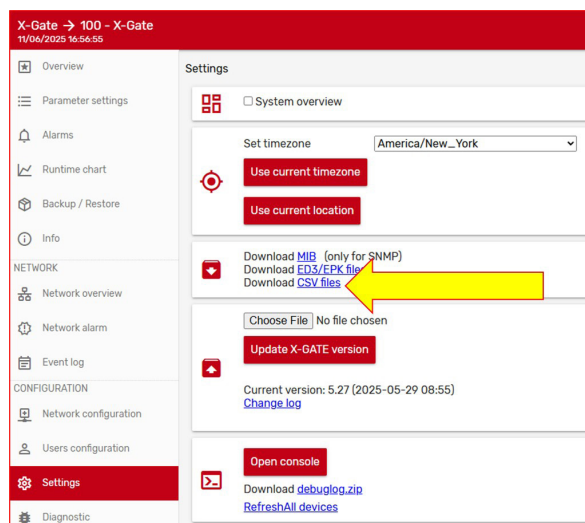
All the devices and its variables will be available on the same X-Gate IP and port 502 (as set in parameter “G48 – Modbus IP port”).

7.2 Generating Modbus documentation (Device and Variable maps)

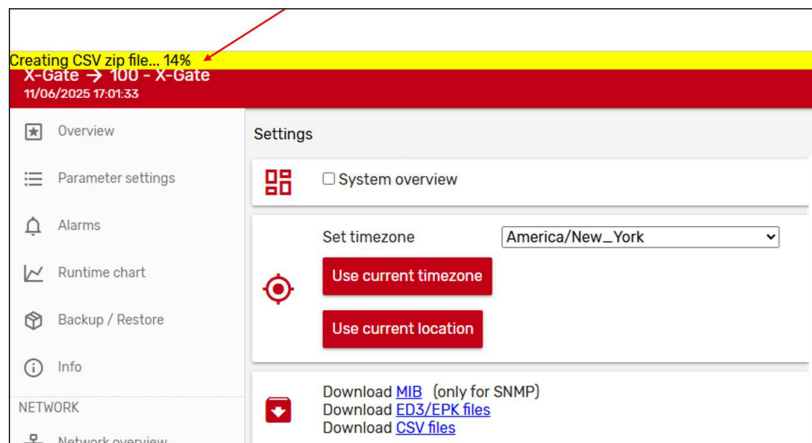
To implement any Modbus information on a Client, all the Modbus addresses, registers, ranges, type of variables and functions to be used need to be shared with the integrator which will read these variables from a 3rd party monitoring system.

This relevant information will be present into a pack of CSV files.

Go to “Settings” button and click on the button “Download CSV files”.

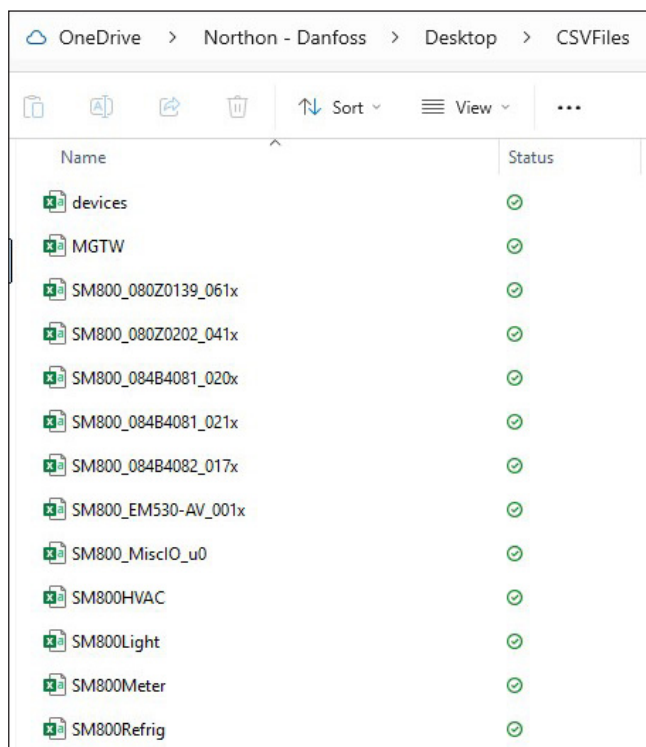


Note: there will be a yellow bar in the top with the progress of CSV files generation. Once finished, a “CSVFiles.zip” file will be in the downloads folder.



7.3 Unzipping the file “CSVFiles.zip”

When this file is unzipped, all relevant files to the system integrator will be there.



7.3.1 Opening “devices.csv” file

This file contains the list of devices configured in the database and all modbus variable map files related to.

For instance, to integrate the “Coldroom CO2” controller. This file indicates that it is under Modbus address 10 and the file containing all the variables will be the “SM800_084B4081_020x.csv” file.

ID	CDFName	Description	ProtocolAddress
100	MGTW	X-Gate	
2	SM800_080Z0202_041x	Pack 1	SM800Client:refs/u0/2
101	SM800_MiscIO_u0	Misc I/O	SM800Client:io/u0
10	SM800_084B4081_020x	ColdRoom CO2	SM800Client:refs/u0/3
11	SM800_080Z0139_061x	Ice Cream showcase	SM800Client:refs/u0/5
102	SM800_080Z0139_061x	Ice Cream showcaseb	SM800Client:refs/u0/6
103	SM800_080Z0139_061x	Ice Cream showcasec	SM800Client:refs/u0/7
104	SM800_080Z0139_061x	Ice Cream showcasec	SM800Client:refs/u0/8

7.3.2 Opening a specific device file

Following the example for the “Coldroom CO2” controller, by opening the “SM800_084B4081_020x.csv” file, it will be shown as follows. Inside the file, there will be all relevant information to a system integrator with all variables available on such device.

Modbus register base	Bit	Default	Min	Max	Decimals	Text	R/W	VarType	EngUnit	Enum	Type	Menu	VarName	EDFtag
		084B4081_020x												SWDescription
		MC948F7C												MODEL
		0												SWID
		200												SWVersion
														VendorDescr
117		0	-1	1		0 Main Switch	R/W	S16		-1=Manual 0=Stop 1=	Overview	mainswitch		
100		2	-50	50		1 Case Setpoint A	R/W	F32	°C		Overview	case_setpoint_a		
10002		30	0	240		0 A03 Alarm delay	R/W	U16	min		Overview			
10019		8	-50	50		1 High Temp Alarm	R/W	F32	°C		Overview	alm_hi1		
10020		-30	-50	50		1 Low Temp Alarm	R/W	F32	°C		Overview	alm_lo1		
2077		0	1	9		0 o61 Appl. mode	R/W	S16		1=1. Cmp/Al/Fan/Def	Overview			
2007		0	0	48		0 State	R	S16		0=Normal ctrl. 1=Ho	Overview	ekcstate		
2532		0	-200	200		1 Case Temp 1	R	F32	°C		Overview	casetemp1		
2544		0	-200	200		1 Liquid In	R	F32	°C		Overview	liquidin1		
2541		0	0	1		0 Error	R	S16		0=OFF 1=ON	Overview	ekcerror		
2702		0	-200	200		1 U72 Food temp.	R	F32	°C		Overview			
2537		0	-200	200		1 Vapor Out	R	F32	°C		Overview	vaporout1		
2530		0	-200	200		1 Air On	R	F32	°C		Overview	evapintemp1		
2531		0	-200	200		1 Air Out	R	F32	°C		Overview	evapouttemp1		
1011		0	-200	200		1 u09 S5 temp.	R	F32	°C		Overview			
2528		0	0	100		0 u23 EEV OD %	R	U16	%		Overview			
1000		0	0	4		0 d01 Def. method	R/W	S16		0=None 1=Electrical	Configuration			
1001		6	0	50		1 Def Stop Temp	R/W	F32	°C		Configura	def_termtmp		
1009		0	0	2		0 d10 DefStopSens.	R/W	S16		0=Time 1=S5 sensor	Configuration			
2205		0	0	10		0 q02 DO2 Config.	R/W	S16		0=None 1=Fans 2=F	Configuration			
2206		0	0	10		0 q03 DO3 Config.	R/W	S16		0=None 1=Fans 2=F	Configuration			
2207		0	0	10		0 q04 DO4 Config.	R/W	S16		0=None 1=Fans 2=F	Configuration			

7.4 Testing and troubleshooting Modbus TCP

If communication needs to be tested or troubleshooted, it is strongly recommended the use of an external Modbus TCP reader.

The “Open ModScan” software is a suggestion used at this point but any other similar application can be applied.

According to document generated by X-Gate on the previous item, “Case Setpoint” is available on the F32 (float 32bit) register 100 using a holding register function as follows.

The screenshot shows the Open ModScan software interface. The top menu bar includes File, Connection, Setup, View, Window, and Help. Below the menu is a toolbar with various icons. The main window displays the Modbus configuration for a device with ID 10. The Address Base is set to 1-based, Start Address is 00100, and Length is 2. The MODBUS Point Type is set to 03: HOLDING REGISTER. The Number of Polls is 157, and Valid Slave Responses is 149. A red arrow points to the 'F32' format selection in the top toolbar, with a note: "Format is float 32bits (swapped)". Another red arrow points to the data read area, showing "40100: 12.5" and "40101:", with a note: "Value read is 12.5C".

It must match the values being read on the X-Gate and AK-SM 800A interface.

The screenshot shows the X-Gate software interface for a ColdRoom CO2 controller. The top bar displays "X-Gate → 10 - ColdRoom CO2" and the timestamp "11/06/2025 18:07:40". The left sidebar contains navigation options: Overview, Parameter settings (selected), Alarms, and Runtime chart. The main area shows the "Root menu → Overview" with three parameters: Main Switch (Start), Case Setpoint A (12.5°C), and A03 Alarm delay (30min). A red box highlights the "12.5°C" value for Case Setpoint A.

8. BACnet IP

BACnet, short for Building Automation Control Network, is a data communication protocol used in building automation and control systems. It allows different building automation devices from various manufacturers to communicate and share information, facilitating the integration of various building systems. Think of it as a language that different building automation devices can understand and use to talk to each other.

8.1 Why customers are asking for BACnet instead of Modbus

BACnet/IP offers several advantages over Modbus TCP, especially when it comes to integration, flexibility, and ease of use.

One key benefit of BACnet/IP is that it is self-documenting. Devices on a BACnet network can automatically share information about themselves, including the types of data they offer. This makes it easier to configure and maintain systems without needing external documentation.

BACnet uses standard object types and variable types, such as:

- Analog Input (AI) – for continuous values like temperature or pressure
- Binary Output (BO) – for on/off commands like a fan or light
- Multi-state Value (MSV) – for settings with more than two options (e.g. fan speed: low, medium, high)
- Schedule, Trend Log, and Alarm objects – for advanced control and monitoring

The great advantage for BACnet, these object types include metadata like units, limits, and descriptions, making the system easy to understand and integrate across different devices and brands.

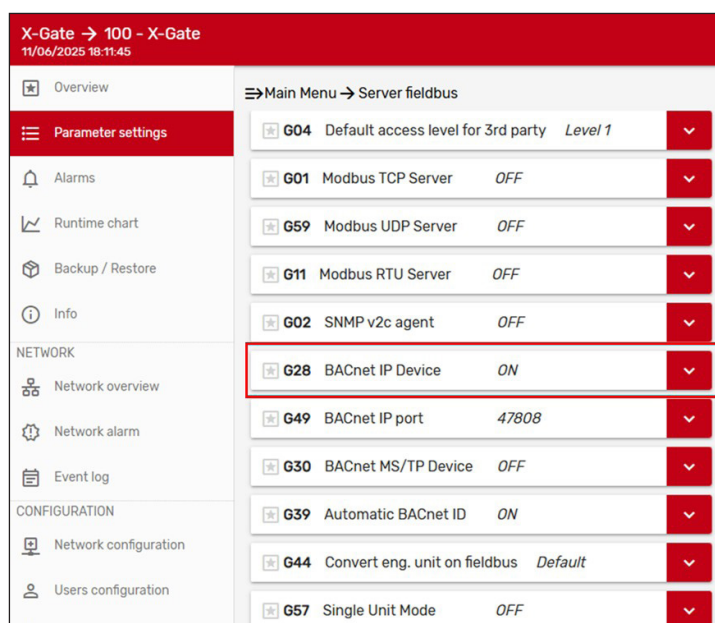
In contrast, Modbus TCP only exchanges raw data (registers) without context. It's up to the user to know what each register means, which increases complexity and the chance of errors.

Overall, BACnet/IP provides a more powerful, scalable, and plug-and-play solution for modern automation needs, making it a better choice than Modbus TCP for system which have connected devices from different vendors, mainly for HVAC applications.

8.2 How to configure BACnet on X-Gate

Click on "Network Overview" and click on the device "100" (X-Gate)
Click on "Server fieldbus"

Turn the parameter "G28 – BACnet IP Device" to "ON" as demonstrated in the picture below. Other protocol options keep them all OFF.



This is all required to configure on the X-Gate to have BACnet IP server working.

8.3 How to test BACnet protocol

Field systems will use their own BACnet tools, nevertheless, to test all the exposed devices on BACnet IP, it is possible to use a generic tool to test the variables mirrored to the BACnet IP side.

8.4 BACnet IP requirements

Other than a BACnet reader, firewall rules need to be allowed, port 47808 must be open and UDP protocol enabled on the PC running such tool. (Usually, corporate PCs are blocked for that).

8.4 Yabe (Test tool)

Yabe is a BACnet reader and can be downloaded from the web, it is an open source application and can be downloaded from the web under this link.

<https://sourceforge.net/projects/yetanotherbacnetexplorer/files/latest/download>

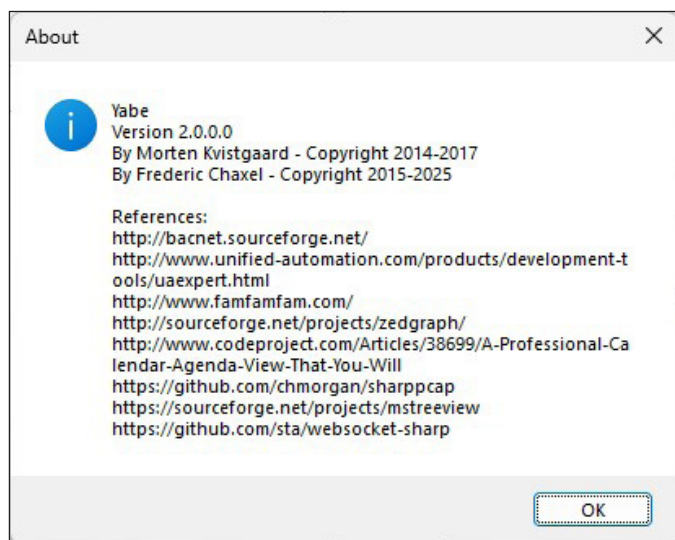
Version 2.0.0 was used for this guide.

This tool is enough to test and show X-Gate is providing the XML coming from AK-SM 800A correctly.

Such tool is not technically supported by Danfoss, being only an suggestion how BACnet can be tested in case X-Gate requires troubleshooting in the field.

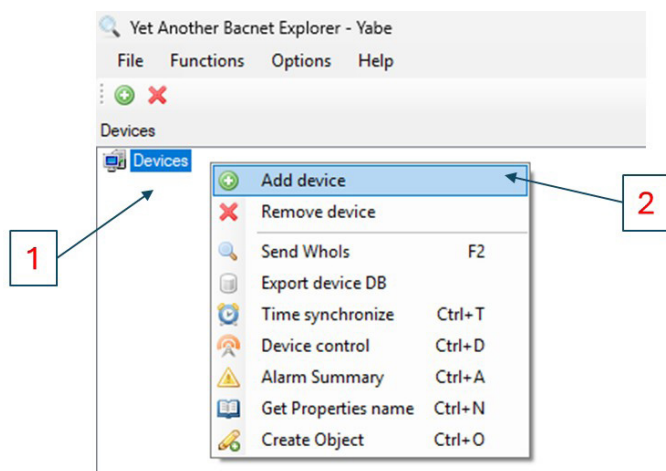
8.4.1 Running Yabe

Open Yabe and ensure the version you are using is 2.0.0 or later.



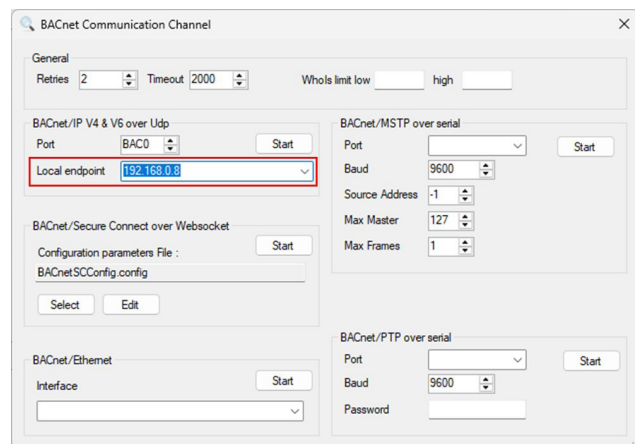
8.4.2 Adding a new BACnet device:

1. Right click on "Devices"
2. Click on "Add device"



8.4.3 Defining BACnet IP

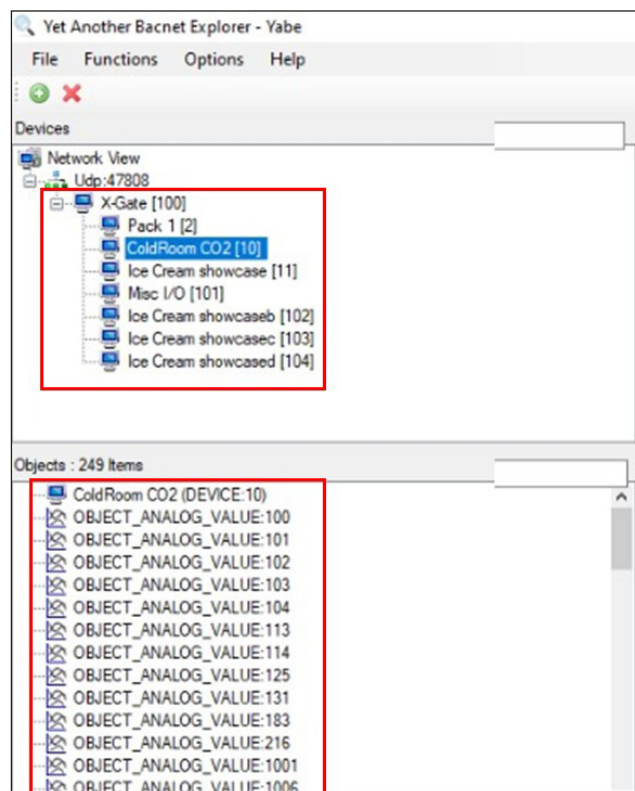
- In the “Local endpoint” field it is needed to select the IP. It is typically the local IP of the PC using Yabe (and not the X-Gate IP).
- Click on “Start” button.



Note: You have on de “Devices” area, all the devices X-Gate has in this database and now available in BACnet format.

Note: All these devices follow the same address as placed in X-Gate database.

Once any device is clicked on, the objects available on each device will be visible in the “Objects” area. (Objects in BACnet are similar to variables available on other protocols).



Operating Guide | How to convert XML (AK-SM 800A) to Modbus TCP or BACnet IP

By clicking on any object (variable available), on the right side there will be the “Properties” window where all the metadata regarding such variable will be available like description, present value, range, unit, among other relevant.

The screenshot shows the 'Yet Another Bacnet Explorer - Yabe' interface. On the left, the 'Objects' list contains 249 items, with 'case_setpoint_a (AV:103)' selected. A red arrow points from this object to the 'Properties' window on the right. The 'Properties' window displays the following metadata for 'case_setpoint_a':

Cov Increment	1
Description	Case Setpoint A
Event State	0 : Normal
Max Pres Value	50
Min Pres Value	-50
Object Identifier	OBJECT_ANALOG_VALUE:100
Object Name	case_setpoint_a
Object Type	2 : Object Analog Value
Out Of Service	False
Present Value	12.6
Priority Array	Object[] Array
Manual Life Safety	
Automatic Life Safety	
Unspecified Level 3	
Unspecified Level 4	
Critical Equipment Control	
Minimum On Off	
Unspecified Level 7	
Manual Operator	
Unspecified Level 9	
Unspecified Level 10	
Unspecified Level 11	
Unspecified Level 12	
Unspecified Level 13	
Unspecified Level 14	
Unspecified Level 15	
Lowest And Default	20
Reliability	0 : No Fault Detected
Relinquish Default	12.6
Resolution	0.1
Status Flags	0000
Units	62 : Degrees Celsius

By dragging and drop a variable in the “Subscriptions, Periodic Polling, Events/Alarms” windows is possible to monitor individually and plot its value.

The screenshot shows the 'Yet Another Bacnet Explorer - Yabe' interface. On the left, the 'Objects' list contains 159 items, with 'case_setpoint_a (AV:103)' selected. A red arrow points from this object to the 'Subscriptions, Periodic Polling, Events/Alarms' window. This window displays a table with the following data:

Show	Device	Objectid	Name	Value	Time	Status	Descript...
☒	100	AV:3264	Params_CP1	93.89	14:50:25	OK	

Below the table, there is a plot area. A red arrow points from the 'Params_CP1' entry in the table to the plot. The plot shows a horizontal line at a value of approximately 93.89, indicating a constant value over time. The x-axis represents time from 49:34 to 50:19, and the y-axis represents the value from 89 to 99.

8.5 Wireshark (Bacnet tool to monitor traffic)

In Wireshark, user can type (bacapp||bacnet||bacp) as a filter (it will filter other unwanted traffic).

Using the Menu item, Statistics->BACnet->USE ONE OF THE OPTIONS.

This can help map out the network based on the traffic seen.

The Statistics menu item has a lot of options you can use to explore ethernet traffic also.

9. FAQ

9.1 Can BACnet IP and Modbus TCP simultaneously used on X-Gate server side?

It is possible but it is not recommended when several variables are being handled (more than 1000 variables).

It is strongly recommended that only one protocol be used at a time.

9.2 My BACnet reader does not read any device on my PC.

Ensure on firewall rules as UDP protocol is enabled and with IT port 47808 port is open. (Over corporate IT networks this port may be closed).

9.3 Can variables configuration be changed?

Only variable descriptions can be changed via CDF editor and using respective CDF device file (Device address and its registers cannot be changed and are automatically polled from AK-SM 800A).

9.4 What happens if a device/control is inserted or deleted at AK_SM800A database?

When a device is inserted, it will be automatically included in the X-Gate database (no action needed).

When a device is deleted, it will be kept in the X-Gate database. It will be silently present and will not generate any issue.

When a device is changed on the database, the new device will be changed accordingly during the polling process each hour.

9.5 Can Modbus RTU or BACnet MS/TP be used as server (destination protocol)?

That is possible but Danfoss do not recommend using RS-485 due to the volume of data on a AK-SM 800A database.

Danfoss A/S

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