

Clean Power VFD

AN004 - Integration to Building Management System using native BACnet IP

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Application overview

This application note describes how to interface with the Clean Power Variable Frequency Drive (VFD) using BACnet IP over the Ethernet network. BACnet IP support was introduced with the Clean Power VFD's firmware 2024.12.01. Using the Clean Power VFD with native BACnet IP makes it easy integration with BMS (Building Management System) for control and monitoring free of charge.

BACnet background

BACnet (Building Automation and Control Network) is an open data communication protocol for building automation and control networks.

BACnet provides a vendor-independent networking solution to enable Interoperability among equipment and control devices for a wide range of building automation applications. It was designed specifically to meet the communication needs of building automation and control systems.

It includes specific support for building automation applications such as heating, ventilation, air-conditioning, lighting, access control, elevators, security and fire detection systems.

BACnet enables interoperability among these systems by defining communications messages, formats and rules for exchanging data, commands, and status information.

Implementation guides

Software Compatibility

Please make sure to update your Clean Power VFD's firmware to version 2024.12.01 or later to use BACnet IP functionality.

You can find the link to download the firmware in the latest firmware release notes on the [SmartD Help Center](#).

BACnet IP Specification & Objects Definition

Please refer to the latest SmartD Clean Power VFD BACnet IP specifications for the definitions of all BACnet objects. In the [VFD Engineering Tools Download](#) webpage.

Step-by-step instructions

Step-by-step instructions on integrating and configuring the Clean Power VFD with BACnet IP.

1. **Connect Clean Power VFD to the Ethernet network:** Ensure network compatibility and software supporting BACnet IP.
2. **Configure BACnet IP on the Clean Power VFD:** Configure and enable the native BACnet IP functionality on the Clean Power VFD.
3. **Integration with BMS:** Discover the Clean Power VFD and map BACnet objects.
4. **Test the system:** Use the BMS interface to validate BACnet communication with the Clean Power VFD.
5. **Monitor and Adjust:** After the initial setup and testing, continue to monitor the system and make any necessary adjustments.

By following these steps, you can successfully integrate and configure the Clean Power VFD with a BMS for advanced motor speed control using the Clean Power VFD's native BACnet IP functionality.

Please note that these instructions are general guidelines. For specific instructions related to your hardware and application, refer to the manufacturer's documentation.

Configure BACnet IP on the Clean Power VFD

Refer to the [Clean Power VFD user guide - BACnet IP configuration](#) for full information

Make sure that the Clean Power VFD is connected to the Ethernet network, if not please refer to the

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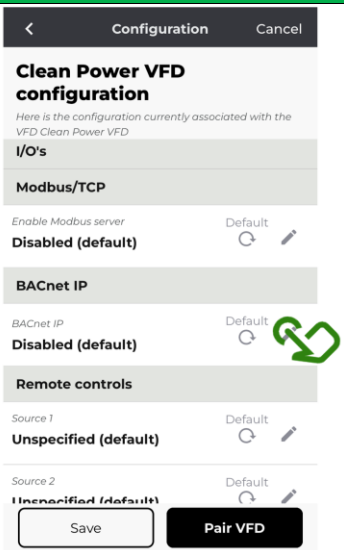
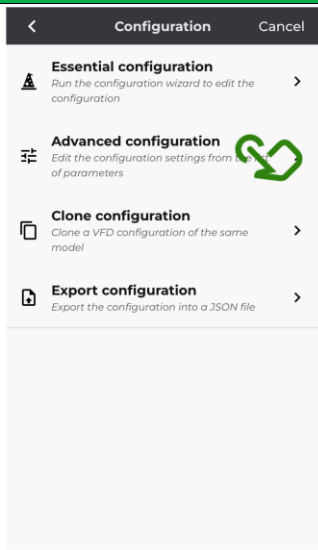
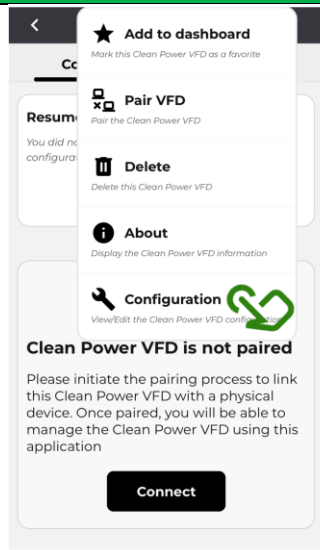
AN004_INTEGRATION TO BMS USING BACNET IP_EN_002

AN003-Connecting the Clean Power VFD to Ethernet Network.

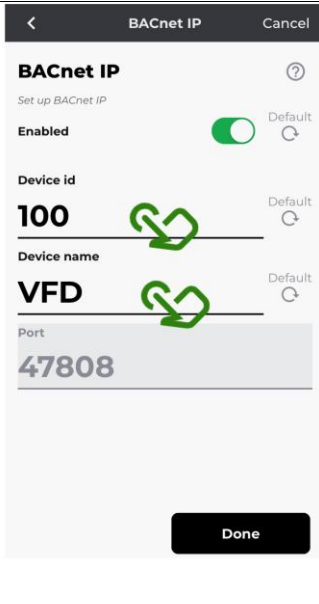
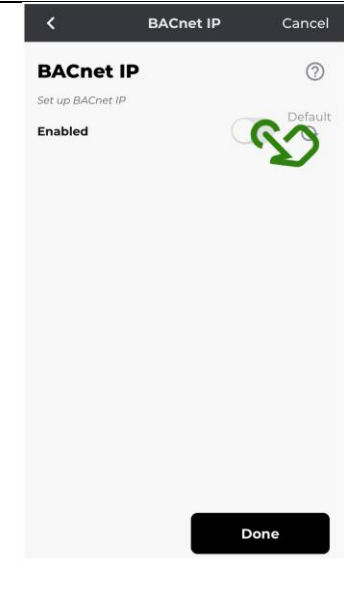
Please note that the screenshots used in this application notes can change for improving the Clean Power VFD mobile application's user experience.

Currently the BACnet IP configuration is only available on the Clean Power VFD mobile application. Please follow the steps below to **configure and enable the Clean Power VFD's native BACnet IP** functionality:

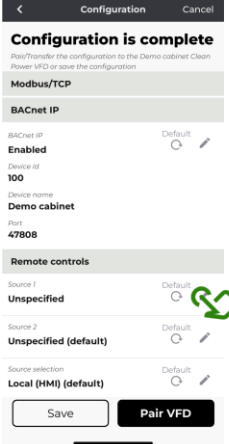
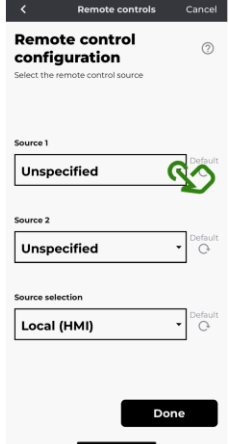
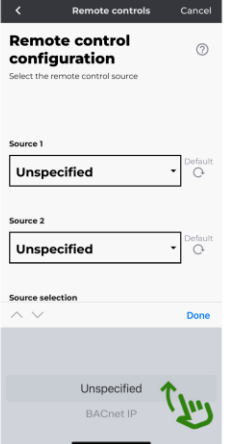
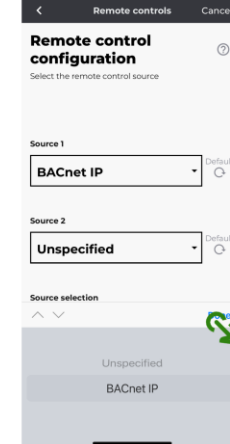
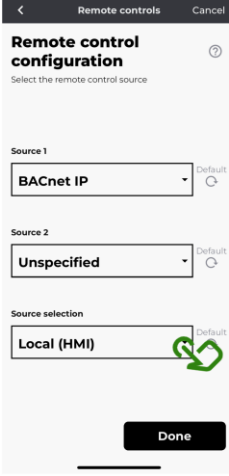
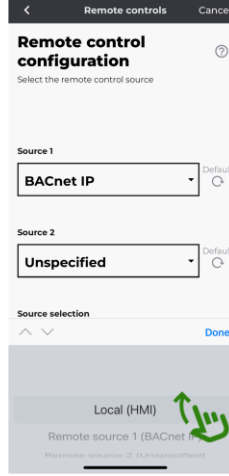
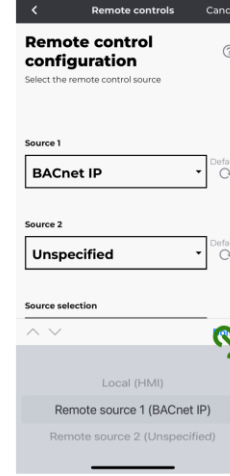
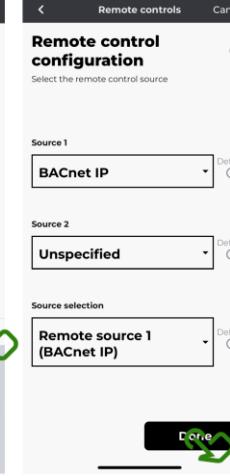
Step-by-step mobile configuration



- Open the Clean Power VFD application on your mobile device
- Click on the upper-right corner of the app to open the menu
- Select the **Configuration** menu item
- On the Configuration screen, click on **Advanced configuration**
- Scroll down until you have **BACnet IP** and click on the pencil



- Slide the **Enabled** switch to enable BACnet IP
- Once enabled, you can specify the BACnet device identifier (**Device id**) and **Device name**
- Click on **Done**

   	<ul style="list-style-type: none"> • Expand the Remote controls section • Click on the pencil on the Source 1 item • Scroll up to select BACnet IP • Click on Done
   	<ul style="list-style-type: none"> • Click on Source Selection • Scroll up to select Remote source 1 (BACnet IP) • Click on Done
<ul style="list-style-type: none"> • Click on Save • Transfer to VFD 	

Integration with BMS

Please follow the steps below to connect the Clean Power VFD to a Building Management System (BMS) using BACnet IP:

1. **Open BMS configuration software:** On the BMS, open the configuration or commissioning software for device discovery.
2. **Initiate device discovery:** Use the BMS software to search for new BACnet devices on the network. It should detect the Clean Power VFD by its Device Id or IP address.
3. **Access the BACnet Device object:** Once the Clean Power VFD is discovered or added to the device tree or list, locate and select the Clean Power VFD Device object with the right BACnet Device Id.
4. **Check the Vendor Name property:** Look for **Vendor Name** property, this property provides the information on the VFD's vendor or manufacturer, it must read **SmartD Technologies**.
5. **Check the model name property:** Look for **Model Name** property, this property provides the information of the VFD's model number, it must read **SDB-1-xxxx-A** or **SDB-2-xxxx-A** depending of the

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Clean Power VFD's model. For example: SDB-1-2185-A for the 480V 3PH 18.5kW 25HP or SDB-2-2220-A for the 600V 3 PH 22kW 30HP.

6. **Map BACnet objects:** Once the Clean Power VFD is found, map the Clean Power VFD's BACnet objects.
 - System objects
 - Motor control objects
 - Alarm objects
 - Optional read-only objects: power meter, motor nameplate, cooling management, and metrics
7. **Verify parameters mapping:** Double-check that each mapped BACnet point corresponds to the correct VFD parameter for effective control and monitoring.

BACnet mapping—Clean Power VFD management

Please follow the steps below to connect the Clean Power VFD to a Building Management System (BMS) using BACnet IP:

Map BACnet object MV31 for Clean Power VFD's status: This allows the BMS to know and show the Clean Power VFD's state, it is recommended to poll the **MV31** periodically to get the Clean Power VFD and take proper action if required, such as reset after lockout.

Map BACnet object BV30 for reset lockout: This allows the BMS to reset the Clean Power VFD once the critical condition has been resolved to put it back in operation (0: No action, 1: Reset lockout).

Map BACnet objects MV40 and MV41 for remote control: This allows BMS to get and set the Clean Power VFD's control mode. **MV40** is used for the **Remote Control Mode** and **MV41** the **Remote Control Source**.

Verify BACnet system objects mapping:

- Read **MV31** to get the current Clean Power VFD's system state, depending on the current state:
- It should read **2** if the Clean Power VFD's has not been configured.
- It should read **13** if the Clean Power VFD's has been configured but auto-tuning has not be run.
- It should read **3** if the auto-tuning has been done and it is ready to run.
- Read **MV40** to get the current Clean Power VFD's remote control state, as the BACnet IP has been configured and enabled, it should read 2 (Remote control).
- Read **MV41** to get the current Clean Power VFD's remote control source, as the BACnet IP has been configured and enabled, it should read 1 (Remote source 1).

BACnet mapping—Motor control

Please follow the steps below to map the Clean Power VFD's motor control objects in the BMS using BACnet IP:

Map BACnet objects for motor control status: This allows the BMS to get the current motor control status, so the BMS can decide on the next motor control action.

- MV0: Motor state
- MV1: Motor direction
- MV2: Motor control mode
- AV3: Motor frequency
- AV4: Motor velocity
- AV5: Motor torque

- MV6: Motor preset frequency
- MV7: Motor preset velocity

Map BACnet objects for motor control commands: This allows the BMS to control the motor.

- MV10: Send motor command
- MV11: Change motor direction
- AV12: Set motor frequency
- AV13: Set motor velocity
- AV14: Set motor torque
- MV15: Change motor control mode
- MV16: Set motor preset frequency index
- MV17: Set motor preset velocity index

Verify BACnet motor control objects mapping:

- Make sure that the motor is stop, read **MV10** to get the current motor state, it should read **2** (Halted)
- Read **MV11** to get the current motor's direction, it should read **1** (Forward) or **2** (Reverse).
- If **MV11** is **1** (Forward), write **2** to **MV11** to set the motor to reverse. Read **MV11** to get the current motor's direction again, it should read **2** (Reverse).
- If **MV11** is **2** (Reverse), write **1** to **MV11** to set the motor to forward. Read **MV11** to get the current motor's direction again, it should read **1** (Forward).
- Write **5** (Torque mode) to **MV15** to set the motor control mode to Torque control. Read **MV2** to get the current motor's control mode, it should read **5** (Torque mode).
- Read **AV5** to get the current motor's torque. If **AV5 is 0** then write **100** to **AV14** to set a new motor torque. Read **AV5** to get the current motor's torque, it should read **800**.
- Read **AV5** to get the current motor's torque. If **AV5 is greater than 0**, write **current motor's torque / 2** (example: AV5 = 100, write 50) to **AV14** to set a new motor torque. Read **AV5** to get the current motor's torque, it should read the initial torque / 2.
- Write **1** (Frequency mode) to **MV15** to set the motor control mode to frequency control. Read **MV2** to get the current motor's control mode, it should read **1** (Frequency mode).
- Read **AV3** to get the current motor's frequency. If **AV3 is 0** then write **30** to **AV12** to set a new motor frequency. Read **AV3** to get the current motor's frequency, it should read **30**.
- Read **AV3** to get the current motor's frequency. If **AV3 is greater than 0**, write **current motor's frequency / 2** (example: AV3 = 60, write 30) to **AV12** to set a new motor frequency. Read **AV3** to get the current motor's frequency, it should read the initial frequency / 2.
- Write **3** (Velocity mode) to **MV15** to set the motor control mode to velocity control. Read **MV2** to get the current motor's control mode, it should read **2** (Velocity mode).
- Read **AV4** to get the current motor's velocity. If **AV4 is 0** then write **800** to **AV13** to set a new motor velocity. Read **AV4** to get the current motor's velocity, it should read **800**.
- Read **AV4** to get the current motor's velocity. If **AV4 is greater than 0**, write **current motor's velocity / 2** (example: AV4 = 800, write 400) to **AV13** to set a new motor velocity. Read **AV4** to get the current motor's velocity, it should read the initial velocity / 2.

BACnet mapping—Alarms

Please follow the steps below to map the Clean Power VFD's alarm objects in the Building Management System (BMS) using BACnet IP:

Please note that BACnet COV (Change Of Value) is not supported yet and will be added in the future.

Map BACnet objects for alarms: This allows the BMS to get the Clean Power VFD's alarm state and acknowledge the alarm. Please refer to BACnet Specifications to learn more about alarms.

- BV500 – BV699: Alarm status
- BV700 – BV899: Alarm acknowledgement (0: No action, 1: Acknowledge)

Test the system

Please follow the steps below to test the BACnet communication between the Clean Power VFD and the Building Management System (BMS):

- 1- Test Communication:** Use the BMS interface to send a command, like a start/stop signal or speed adjustment, and verify that the VFD responds appropriately.
- 2- Check Data Points:** Confirm that real-time data (e.g., motor speed, current draw, energy consumption) is correctly displayed in the BMS.
- 3- Monitor for Alarms:** Test fault reporting by simulating a fault condition (if safe) and ensure that the BMS receives the appropriate alarm signal.

Monitor and optimize

Please follow the steps below to monitor and optimize the BACnet communication between the Clean Power VFD and the Building Management System (BMS):

Adjust Polling Rates: Set optimal polling rates (1 to 5 seconds) in the BMS to avoid overloading the network while maintaining responsive communication.

- In applications like **HVAC systems, pumps, and fans**, where the data doesn't change rapidly, a **1 second** polling rate is usually sufficient. This provides up-to-date information without putting excessive load on the network.
- For applications where real-time data isn't crucial, like **environmental monitoring or logging trends**, slower polling rates of **2 to 5 seconds** reduce network traffic while still capturing the needed data.
- When **multiple devices are connected**, especially in large industrial systems, slower polling rates **1 to 5 seconds** help manage traffic and prevent bottlenecks. Devices with higher importance can be prioritized with faster rates, while less critical devices are polled at a slower rate.

Document Settings:

Record all BACnet IP and device settings, including IP address, subnet, gateway, device ID, and mapped points, for future maintenance and troubleshooting.

Conclusion

Connecting the Clean Power VFD to an Ethernet network enables remote monitoring, real-time data analysis, streamlined diagnostics, improved energy management, and centralized control for enhanced system efficiency and reliability.

For further information, and detailed specifications, or to initiate an implementation in your operations, please visit our website: <https://smartd.tech/> or contact us at +1-866-776-2783

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