Belimo Energy Valve™

Operating Manual

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BELIMO

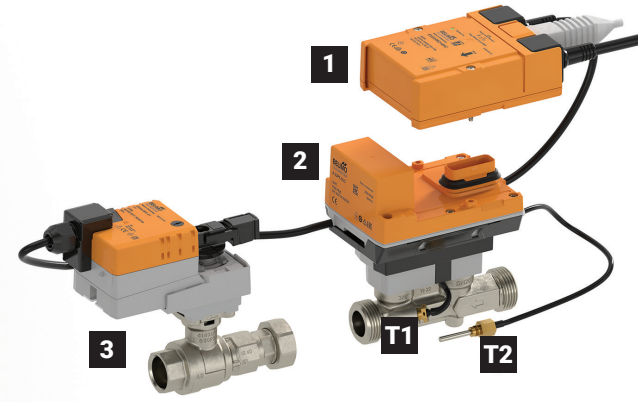
Table of Contents

Component Identification

Overview

Ultrasonic flow meter with temperature and glycol compensation is wet calibrated to obtain published accuracy specifications. The Belimo Energy Valve 4 is now an IoT device with a suite of cloud-based services which can benchmark coil performance, analyze glycol concentration, store energy data, send alerts and commission for optimal performance.

The Energy Valve 4 is a pressure independent valve that measures and manages coil energy by using an embedded ultrasonic flow meter, along with supply and return water temperature sensors. The Energy Valve 4 also has the patented Power Control and Belimo Delta T Manager™ logic built-in that monitors coil performance and optimizes the available energy of the coil by maintaining the Delta T. In addition to the standard control signal DDC and feedback wiring, it communicates its data to the Building Management System (BMS) via BACnet MS/TP or BACnet/IP as well as Modbus RTU and Modbus TCP/IP. The built-in web server collects up to 13 months of data that can be downloaded to external tools for further optimization.

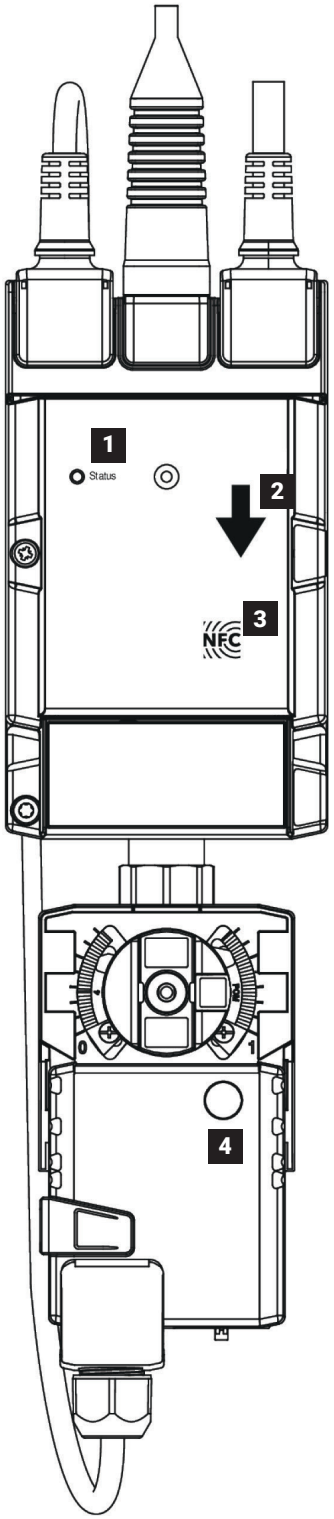


1 Logic module
2 Sensor module
3 Characterized control valve with actuator
T1 Integrated temperature sensor
T2 External temperature sensor

Components
The Belimo Energy Valve 4 consists of a characterized control valve, an actuator and a thermal energy meter with a logic and a sensor module. The logic module provides the power supply, the communication interface and the NFC connection of the energy meter. All relevant data are measured and recorded in the sensor module. This modular design of the energy meter means that the logic module can remain in the system if the sensor module is replaced.

Flow Tolerances
Flow Measurement Tolerance +2% of the actual Flow.
Flow Control Tolerance of +5% of the actual Flow.
V'nom = flow rating of valve as listed in catalog.

Product Structure



1 **LED Display green**

On:	In operation (Power ok)
Off:	No Power
Flashing:	Action needed with Belimo Assistant App

2 **Flow Direction**

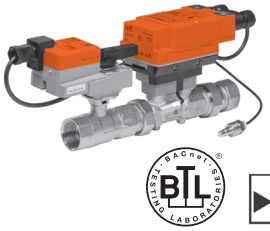
3 **NFC Interface**

4 **Operating Button**

Product Range Overview

		Valve Nominal Size		Type	Suitable Actuators	
	GPM Range	Inches	DN [mm]	2-way	Non Fail-Safe	Electronic Fail-Safe
NPT	1.65…6.6*	½	15	EV050	LRX-E, ARX-E (N4)	AKRX-E (N4)
	2.7…11*	¾	20	EV075		
	4.5…18.2*	1	25	EV100		
	7.1…28.5*	1¼	32	EV125	NRX-E, ARX-E (N4)	
	11…44*	1½	40	EV150		
	16.5…66*	2	50	EV200	ARX-E (N4)	
	25…100*	2	50	EV200H**		

*V'nom = Maximum flow for each valve body size.
** Fluid temperature range is 39...250°F [4...120°C]



5-year warranty

MODE OF OPERATION

The Energy Valve is an energy metering pressure independent control valve that optimizes, documents, and proves water coil performance.

PRODUCT FEATURES

Measures Energy: using its built-in electronic flow sensor and supply and return temperature sensors.
Controls Power: with its Power Control logic, providing linear heat transfer regardless of temperature and pressure variations.
Manages Delta T: on board logic manages low Delta T optimizing coil, chiller and boiler efficiency reducing pumping cost.

ACTUATOR SPECIFICATIONS

Control type	modulating
Manual override	LR, NR, AR, AKR
Electrical connection	3 ft. [1 m] cable with ½" conduit fitting
Communication	BACnet IP, BACnet MS/TP, Modbus TCP, Modbus RTU, Webserver, Belimo MP-Bus, Analog

VALVE SPECIFICATIONS

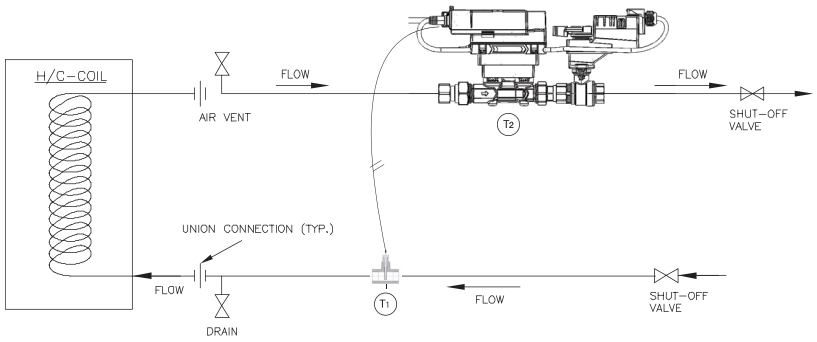
Fluid	chilled or hot water, up to 60% glycol max
Sizes	½", ¾", 1", 1¼", 1½", 2"
End fitting	NPT female
Materials	
Body	
Valve	forged brass, nickel plated
Sensor housing	forged brass, nickel plated
Ball	stainless steel
Stem	stainless steel
Characterizing disc	Tefzel®
Fluid temp range	14...250°F [-10...+120°C], 39...250°F [4...120°C] (EV200H)
Body pressure rating	360 psi
Close-off pressure	200 psid
Differential pressure range (ΔP)	see technical documentation
Remote temperature sensor length	
½...2"	9.8 ft. [3 m]
Leakage	0%
Rangeability	100:1
Flow control tolerance	±5%
Flow measurement tolerance	±2%

Installation

Piping

It is recommended that the Energy Valve 4 is installed on the return side of the coil. This diagram illustrates a typical application. Consult engineering specification and drawings for particular circumstances.

Belimo recommends installing one strainer per system. If the system has multiple branches, it is recommended to install one strainer per branch.

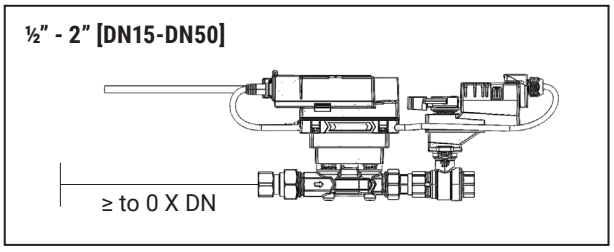


Installation

Inlet Length
There are no requirements for straight inlet sections prior to the flow sensor. Product has been tested to and fulfills the requirements of EN1434-4:2022

Outlet Length
No requirements for outlet length. Elbows can be installed directly after the valve.

Differential Pressure Sensor
When installing the differential pressure sensor, refer to the corresponding installation instructions for the 22WDP-51XXX. The connection of the differential pressure sensor is described in the installation instructions for the Energy Valve.



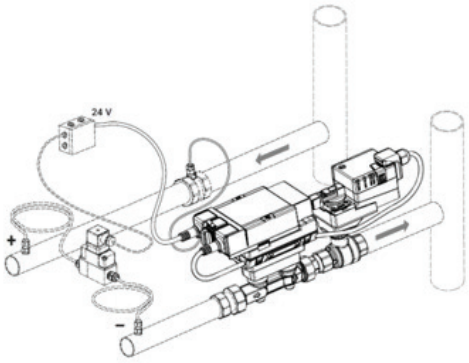


Figure: installation 22WPD-51XXX

Control Mode Sequence of Operation

Flow Control

To set the Energy Valve 4 to Flow Control, set the Control Mode to Flow Control in the Setting area of the Web View, under Configuration Control Function. Refer to the Web View settings table on page 22.

Flow Control Application

Use Flow Control to achieve pressure independent valve performance. The valve will react to changes in system pressure to match the flow setpoint from the controller.

Flow Control Sequence of Operation

The Energy Valve 4 uses its ultrasonic or magnetic flow meter and logic to throttle its characterized control valve (CCV) to maintain the flow set point. The valve will respond to the control signal DDC except when the current flow is within ±5% of the control signal DDC.

When the Delta T Manager is enabled, it will activate its logic when the actual ΔT drops 2°F below the dT Setpoint. It does that by throttling the valve close until the dT setpoint is reached. The Energy Valve 4 will resume its normal operation based on the control signal DDC when the control signal DDC drops 5% of V'max below the Delta T Manager's current flow. The Delta T Manager will not operate when the flow is below 25% of V'max. In addition, the Delta T Manager minimum flow will always be greater than 25% of V'max. The flow also needs to be above 25% of V'max for 5 minutes before the Delta T Manager will engage. 25% is the default. However, for specific applications it is possible to operate the Delta T Manager down to 10% of V'nom. This setting is available in Webview on the Settings tab under the Delta T Management section.

The Energy Valve 4 is pressure independent over its entire throttling range with available differential pressure from 1-50 psid. When the available differential pressure is less than 5 psid, refer to the Flow Reduction Chart to verify adequate differential pressure to obtain desired V'max.

Power Control

To set the Energy Valve 4 to Power Control, set the Control Mode to Power Control in the Settings area of the Web View, under Configuration Control Function. Refer to the Web View Settings table on page 22.

Power Control Application

Use Power Control to achieve a precise linear power output of the heat exchanger over its operating range. Power Control combines pressure independent valve performance with temperature independent coil performance. The valve will react to changes in system pressure and to changes in water differential temperature to match the power setpoint from the controller.

Power Control / Sequence of Operation

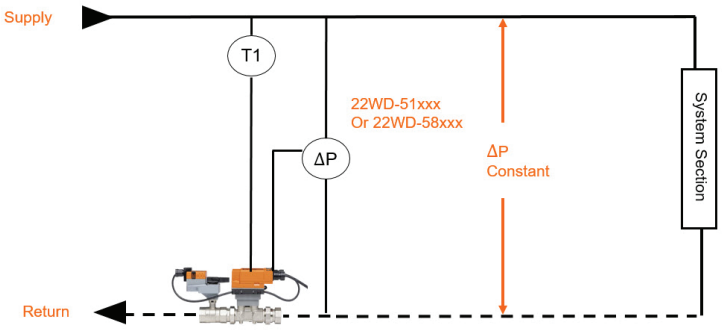
The Energy Valve 4 uses its ultrasonic or magnetic flow meter and logic to throttle its characterized control valve to maintain the power set point. The valve will respond to the control signal DDC except when the current power is within ±5% of the control signal DDC.

When the Delta T Manager is enabled, it will activate its logic when the actual ΔT drops 2°F below the dT setpoint. It does this by throttling the valve close until the dT setpoint is reached. The Energy Valve 4 will resume its normal operation based on the control signal DDC; when the DDC setpoint drops 5% of V'max below the Delta T Manager's current flow. The Delta T Manager will not operate when the flow is below 25% of V'max. In addition, the Delta T Manager minimum flow will always be greater than 25% of V'max. The flow also needs to be above 25% of V'max for 5 minutes before the Delta T Manager will engage. 25% is the default. However, for specific applications it is possible to operate the Delta T Manager down to 10% of V'nom. This setting is available in Webview on the Settings tab under the Delta T Management section.

With Power Control, the Energy Valve 4 is pressure and temperature independent over its entire throttling range with available differential pressure from 1-50 psid. When the available differential pressure is less than 5 psid, refer to the Flow Reduction table on page 43 to verify adequate differential pressure to obtain desired V'max and associated P'max.

Differential Pressure Control Application

The electronic differential pressure controller is used to maintain the differential pressure (dp) at a constant set value between two points in a hydronic circuit. In addition, it can be used as a flow rate and power limiter. This is a stand-alone mode and cannot be combined with DT Manager. See figure overview.



Differential Pressure Control Sequence of Operation

In this operating mode, the Energy Valve does not receive a setpoint from the building management system. The differential pressure is measured with the differential pressure sensor connected to the Energy Valve. This value is monitored by the Energy Valve and compared with the preset setpoint. If a deviation is detected between the measured value and the setpoint, this is compensated automatically by the logic integrated in the Energy Valve. To accomplish this, the Energy Valve either opens or closes the valve. The following three operating states could occur at this time:

1. **Measured differential pressure is less than the differential pressure setpoint:** To reduce the pressure drop across the Energy Valve and increase the differential pressure between the measuring points, the valve is opened further until the setpoint is reached. If the differential pressure on the system side is not sufficiently high, the setpoint may not be reached. In this case, the Energy Valve moves to the maximum opening position of 90°.
2. **Measured differential pressure corresponds to the differential pressure setpoint:** No action is taken by the Energy Valve. The opening position is retained.
3. **Measured differential pressure is greater than the differential pressure setpoint:** To reduce the differential pressure between the two measuring points, more pressure drop must be generated across the Energy Valve. In this case, the valve opening is reduced until the setpoint, or minimum position, is reached. The Energy Valve is never completely closed during standard differential pressure control mode in order to ensure that changes in the system (change in pump head or flow changes due to controlling control valves) can be detected.

Easily adjustable setpoint

The desired setpoint is simple to adjust on the device. Various options are available for this purpose:

- Belimo Assistant App, simple communication with the Energy Valve thanks to NFC
- Web server integrated in the Energy Valve
- Belimo Cloud, value change from anywhere
- Bus Communication, via BACnet, Modbus or MP-Bus

Adjustable flow limitation

A maximum flow V'max can be specified for the Energy Valve. Even if the effective differential pressure is below the setpoint, the Energy Valve does not open further when V'max is reached. This makes it possible to avoid situations in which other parts of the hydronic system have too little energy at their disposal.

Flow limitation adjustment range: V'max = 25…100% of V'nom

Adjustable maximum power

A maximum power Q'max can be specified for the Energy Valve. The valve position is not increased further when the set maximum heating or cooling power is reached. This setting can be used as a simple way to ensure that the controlled system segment is not able to draw too much power.

Maximum power adjustment range: Q'max = 1%…Q'nom

Sensor drift compensation

After a longer operating time, a drift can occur on the differential pressure sensor, which can be compensated for as follows:

1. Close the Energy Valve completely (web server, Belimo Assistant App, manually)
2. The measured differential pressure is displayed (web server, Belimo Assistant App)
3. Measure the existing differential pressure via the measurement points (additional system-side measurement connections necessary)
4. Calculate and enter the required offset (web server, Belimo Assistant App)

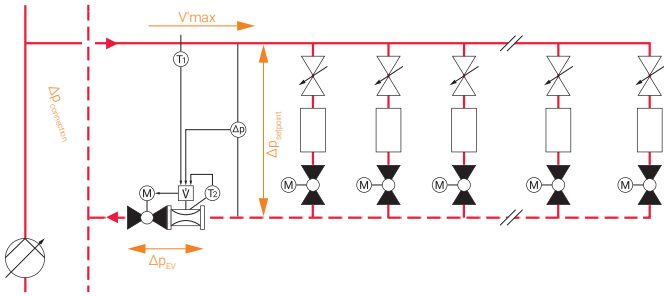
Sizing for Differential Pressure Control

If the Energy Valve will be used to control the differential pressure, then an additional differential pressure sensor is needed. This is not included in the scope of delivery of the Energy Valve. Two different versions are available and can be obtained from Belimo.

Sensor Part Number	Measuring Range (psi)	Differential Pressure Set Point Range (psi)
22WDP-511	0…15	1.5…12
22WDP-512	0…30	3…24
22WDP-514	0…50	5…40
22WDP-515	0…100	10…50

As described in the chapter Functionality, the Energy Valve in differential pressure control mode adjusts its Hydronic resistance by changing the valve opening so that the pressure drop across the Energy Valve occurs that is required to achieve the desired differential pressure between the measuring points.

To select a suitable Energy Valve, the required Cv value must be calculated. The sizing is made for nominal flow.
Required specifications:
– Nominal flow V'_{max} in the branch
– Desired differential pressure $dp_{setpoint}$ between the measurement points
– System differential pressure $dp_{connection}$ between the connection points of the system segment



1. Calculation of the necessary pressure drop across the Energy Valve
   – $dp_{EV} = dp_{connection} – dp_{setpoint}$

Note: If additional high pressure losses occur between $dp_{connection}$ and $dp_{setpoint}$ (e.g. long pipeline), these must also be taken into account.

2. Calculation of the necessary flow coefficient of the Energy Valve C_{vEV}

$$C_{vEV} = \frac{V'_{max}}{\sqrt{\Delta p_{EV}}}$$

3. Selection of the Energy Valve
   – The previously calculated C_{vEV} must be less than the $C_{vtheor.}$ of the selected valve type.

$C_{vtheor.}$ and V'_{max} for differential pressure control with Energy Valve

Model	Size	$C_{vtheor.}$ [GPM]	V'_{max} range [GPM]
EV050+....	½" [DN 15]	3.67	1.65…6.6
EV075+...	¾" [DN 20]	6.17	2.7…11
EV100+...	1" [DN 25]	10.14	4.5…18.2
EV125+...	1¼" [DN 32]	16.32	7.1…28.5
EV150+...	1½" [DN 40]	22.18	11…44
EV200+...	2" [DN 50]	35.20	16.5…66
EV200+...	2" [DN 50]	35.20	25…100

For the best possible control capability, the smallest possible nominal diameter should be selected. V'_{max} must also be considered.

Example: V'_{max} = 40.9 GPM
$\Delta p_{setpoint}$ = 6.5 PSI
$\Delta p_{connection}$ = 15.9 PSI

1. $\Delta p_{EV} = \Delta p_{connection} – \Delta ps_{etpoint}$ = 15.9 PSI – 6.5 PSI = 9.4 PSI

2.
$$C_{vEV} = \frac{V'_{max}}{\sqrt{\Delta p_{EV}}}$$

3. Selection EV150+... ($Cv_{theor.}$ = 22.18 / V'_{max} = 11...44)

Operating Range for Differential Pressure Control

In differential pressure control mode, the Energy Valve automatically changes its opening position to achieve the pressure drop required to reach the desired differential pressure setpoint. The flow that occurs is specified by the system segment supplied. The following limitations must be taken into account:

Maximum flow

The specified V'_{nom} value of the Energy Valve must not be exceeded.

V'_{nom} Energy Valve

Valve type	Size	V'_{nom} [GPM]
EV050+....	½" [DN 15]	6.6
EV075+...	¾" [DN 20]	11
EV100+...	1" [DN 25]	18.2
EV125+...	1¼" [DN 32]	28.5
EV150+...	1½" [DN 40]	44
EV200+...	2" [DN 50]	66
EV200+...	2" [DN 50]	100

Maximum flow at which $dp_{Setpoint}$ is reached:

$$\text{max. } V' = C_{vtheor.} \cdot \sqrt{\Delta p_{EV}}$$

Minimum flow with flow reduction

Reduction of the flow through the control valves in the system section. Differential pressure control is carried out up to a minimum flow of 0.7% V'nom

Behavior when the minimum flow rate is undercut

The position of the angle reached at 0.7% of V'nom is retained ("freeze position")

Start-up behavior after the flow rate has fallen below the minimum flow rate

Differential pressure control mode is resumed when one of the following conditions is fulfilled:

If a flow rate is detected (≥ 0.2% V'nom) and the measured differential pressure falls below 50% of the differential pressure setpoint value or the measured flow rate is higher than 1.2% V'nom.

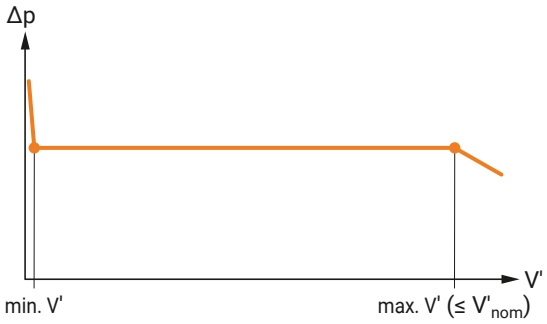
Note: In control mode differential pressure control, the valve is never completely closed. Instead of the "freeze position" described above, a valve opening of 27% is approached as the starting position for control operation if:

- The valve is restarted
- After a power failure
- The manual override was previously operated
- No differential pressure is present at a flow rate < 0.7% V'nom

If the flow rate cannot be measured due to a malfunction in the flow sensor or due to air bubbles in the system, the differential pressure is controlled within the valve opening range from 27% to 100%.

The system switches from actuator opening position 27% to control mode when:

- A flow rate higher than 0.2% V'nom is detected



Differential pressure control operating range

Control Mode Sequence of Operation

Position Control

To set the Energy Valve 4 to Position Control, set the Control Mode to Position Control in the Settings area of the Web View, under Configuration Control Function. Refer to the Web View Settings table on page 22.

Position Control Application

Use Position Control to achieve pressure dependent valve performance or to verify control response during installation, maintenance and troubleshooting. The flow meter will report actual flow at all valve positions.

Position Control Sequence of Operation

The Energy Valve 4 uses position feedback and logic to throttle its characterized control valve to maintain the valve position. The valve will respond to the control signal DDC except when the position is within ±5% of the control signal DDC.

Delta T Manager Options

To configure the Delta T Manager options, set the Configuration dT-Manager in the Settings area of the Web View. Refer to the Web View Settings table on page 22.

The Delta T Manager monitors the ΔT across the coil. When the ΔT drops below the set point, the Delta T Manager logic throttles the valve close to increase ΔT above the setpoint. When the Delta T Manager is enabled, it will activate its logic when the actual ΔT drops 2°F below the dT Setpoint. It does that by throttling the valve close until the dT setpoint is reached. The Energy Valve 4 will resume its normal operation based on the control signal DDC when the DDC setpoint drops 5% of V'max below the Delta T Manager's current flow. The Delta T Manager will not operate when the flow is below 25% of V'max. In addition, the Delta T Manager minimum flow will always be greater than 25% of V'max. The flow also needs to be above 25% of V'max for 5 minutes before the Delta T Manager will engage. Two Delta T Manager options are available: dT Manager and dT Manager Scaling. 25% is the default. However, for specific applications it is possible to operate the Delta T Manager down to 10% of V'nom. This setting is available in Webview on the Settings tab under the Delta T Management section.

Control Mode Sequence of Operation

dT Manager Application

Use dT Manager to assure circuit overflow is eliminated below the Delta T Limit Value. Limiting function can be applied to all Control Modes of operation; Flow, Power and Position. Belimo suggests using this mode with changing air mass flow rate.

Sequence of Operation

This logic, when activated, will limit the heat exchanger ΔT to a fixed dT setpoint by reducing valve flow. The dT setpoint is equal to the Delta T Limiting Value found in Web View settings.

dT Manager Scaling Application

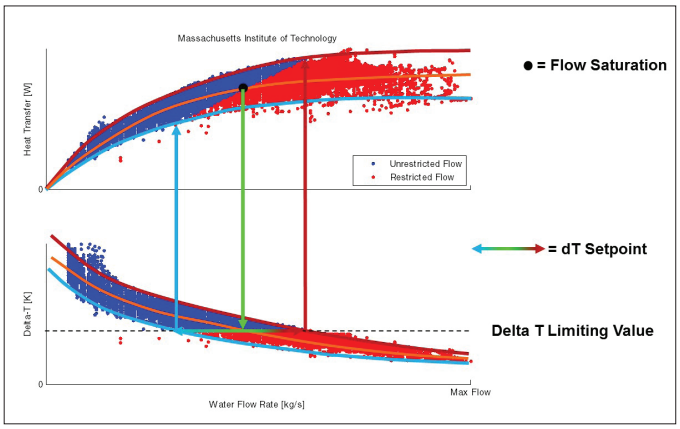
This limiting function can be applied to all control modes of operation: flow and power. Building operators are assured circuit overflow is eliminated below the scaled (variable) dT setpoint. Belimo suggests using this mode with changing temperature of the inlet air flow or inlet water supply.

Sequence of Operation

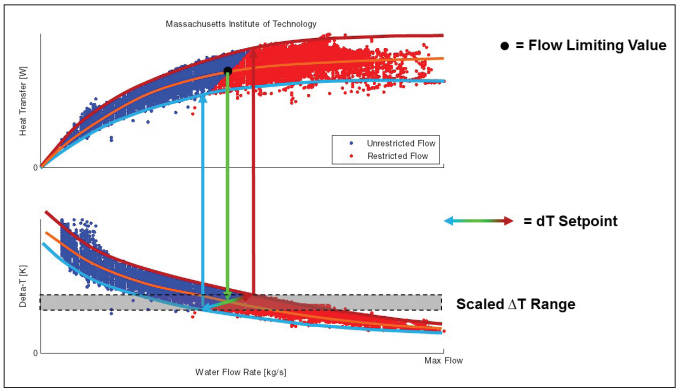
This logic, when activated, will limit the heat exchanger ΔT to a scaled (variable) dT setpoint by reducing valve flow. The dT setpoint = (Delta T Limit Value /Flow Saturation Value)* (actual flow). The Flow Saturation Value found in Web View is a required setting for this logic.

Graphical dT Manager and dT Manager Scaling Operation

In the graphs shown here, the blue and red data points were captured by allowing the Energy Valve 4 to operate with the Delta T Manager disabled and, under normal operating conditions for a sufficient period, to collect data ranging from light to full load. Unrestricted flow, shown with blue data points, occurs when the dT manager is inactive. Restricted flow, shown with red data points, would be eliminated when dT Manager is active.



Typical Representation of dT Manager Function with Flow Control or Power Control



Typical Representation of dT Manager Scaling Function with Flow Control or Power Control

Configuration of the Energy Valve 4

The Energy Valve 4 can be configured locally two different ways. It can be accomplished either using a smart phone with the Belimo Assistant App or using the local Web View interface via belimo.local:8080. The following chapter describes how to configure the Energy Valve 4 using the Belimo Assistant App first then followed by configuration using Web View.

Configuring the Energy Valve 4 Using NFC and the Belimo Assistant App

The NFC logo on the Energy Valve 4 indicates that the device can be operated with the Belimo Assistant App.

Requirement:
Device must be powered. Refer to wiring section for connecting.

NFC or Bluetooth-enabled smartphone

Belimo Assistant App (Google Play and Apple App Store)

NFC: Position the NFC-enabled smartphone on the thermal energy meter so that both NFC antennas of the smartphone and thermal energy meter are on top of each other.

Bluetooth: Connect the Bluetooth-enabled smartphone to the thermal energy meter via "Bluetooth NFC converter" ZIP-BT-NFC.

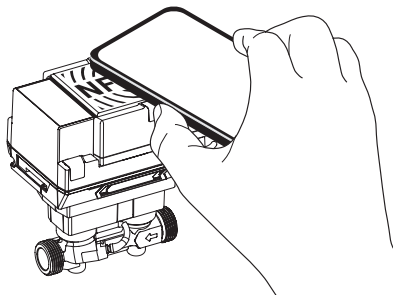
Technical data and operating instructions can be found on the ZIP-BT-NFC data sheet.

Download on the App Store

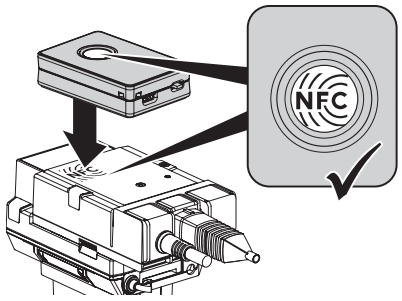
GET IT ON Google Play

NFC

NFC



Bluetooth



Configuration using Web View

The Energy Valve 4 Web View is a built-in web server that is used to configure the valve settings and view current and historical data. It can be accessed from a computer with a web browser. The Energy Valve 4 must be connected to a TCP/IP network.

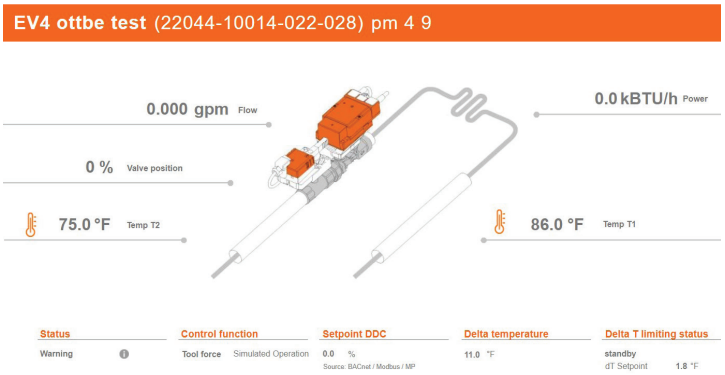
Connecting the Energy Valve to Ethernet Prior to Version 4.2 Released April 25, 2024

To configure the Energy Valve 4 using Web View, the Energy Valve 4 must be connected to a TCP/IP network. If connecting the Energy Valve 4 to a laptop computer directly using a **static** connection without connecting to a LAN, configure the laptop IP address to 192.168.0.200 before connecting to the Energy Valve 4. Then, open a web browser and type in the following address in the web browser address bar: http://192.168.0.10:80

If connecting the Energy Valve 4 to a laptop computer directly using a **dynamic** peer to peer connection without connecting to a LAN, no laptop IP configuration is required. Open a web browser and type in the following address in the web browser address bar: http://169.254.1.1

Login

- Access to the actuator is protected by the user name and password.
- Three default user types are available at login. Each user type has different security rights to Web View. Refer to the Web View user table.



Web View User Table

Username:	guest	maintenance	admin
Password*:	**guest**	**belimo**	**Contact Belimo Tech Support**
Web View Page			
Dashboard	Read	Read	Read
Overview	Read	Read/Write	Read/Write
Override and Trend Control	Read	Read/Write	Read/Write
Data Log Chart	Read	Read	Read/Write
Settings	Read	Read	Read/Write
Status	Read	Read/Write	Read/Write
Date & Time Settings	--	Read/Write	Read/Write
IP Settings	--	Read/Write	Read/Write
Version Information	--	Read/Write	Read/Write
Mobile	Read	Read	Read/Write
Data Logging	Read	Read	Read/Write
BACnet / MP Settings	Read	Read	Read/Write

*Password is case sensitive

Web View

Connecting the Energy Valve to Ethernet with Version 4.2 Released April 25, 2024

For Energy Valve version 4.2 released April 25th 2024 there is an additional security feature added allowing the use of https. This requires a secure certificate which is generated by the Energy valve and loaded in the web browser. In addition to this it is required to configure the certificate on the Energy Valve

The following steps show
1. How to login to the device
2. How to install the secure certificate in the web browser and how to configure the certificate on the Energy Valve.

The secure certificate is not mandatory, it is only needed if using https if desired the Energy valve can still be accessed using http://169.254.1.1

Login

- How to login to the Energy Valve
- Enter IP address http://169.254.1.1 in web browser click enter
- Click Advanced to proceed Fig. 1
- Scroll down and select Proceed to the IP address of the device in this case it is 10.200.29.81 Fig, 2 (wording may differ by browser
- Enter Default User name and password Fig. 3
  - User: admin (all lower case)
  - Password: tlnsg (all lower case)
- Overview page will be displayed Fig. 4

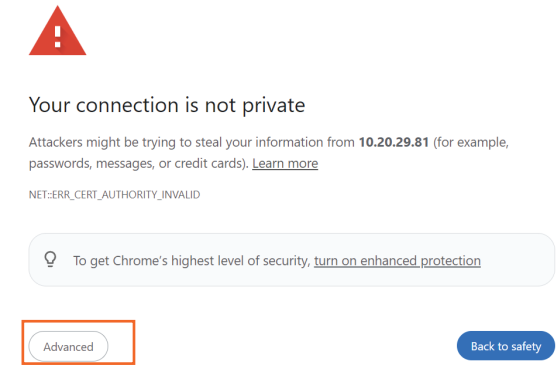


Figure 1

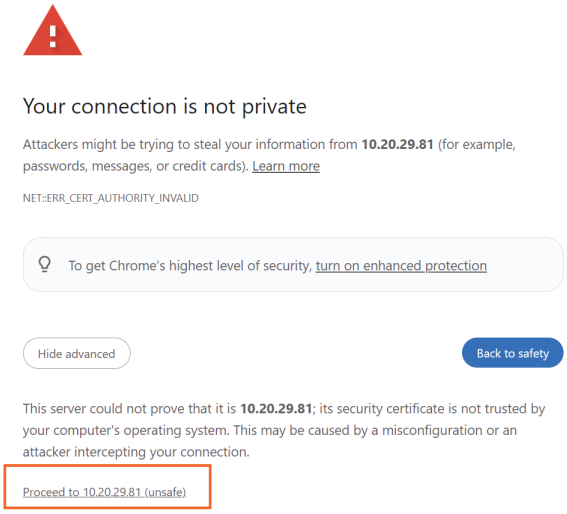


Figure 2

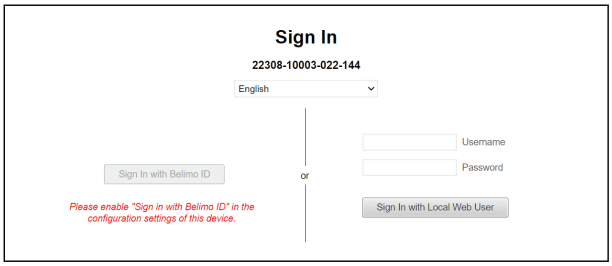


Figure 3

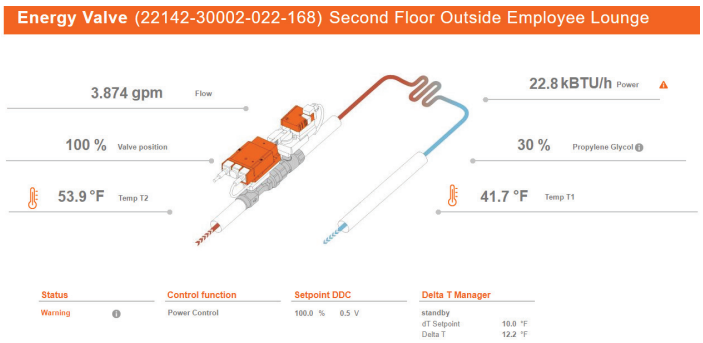
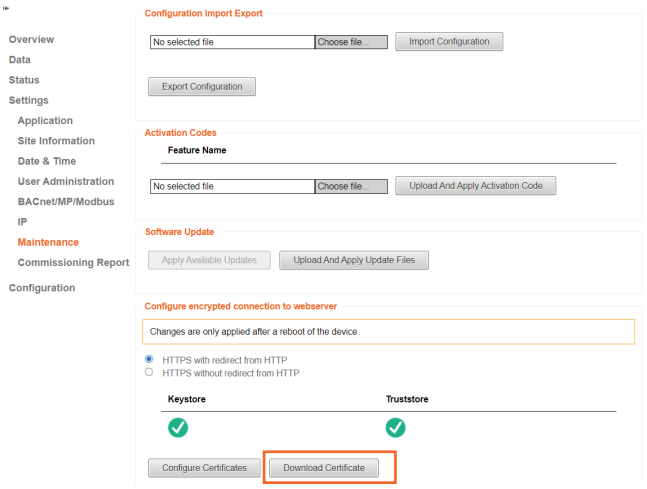
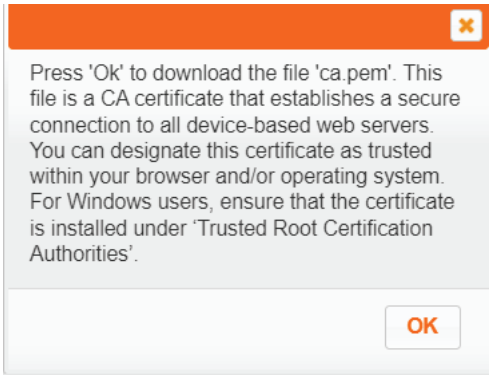


Figure 4

Installing Trusted Certificate in Web browser Step 1. Download Certificate

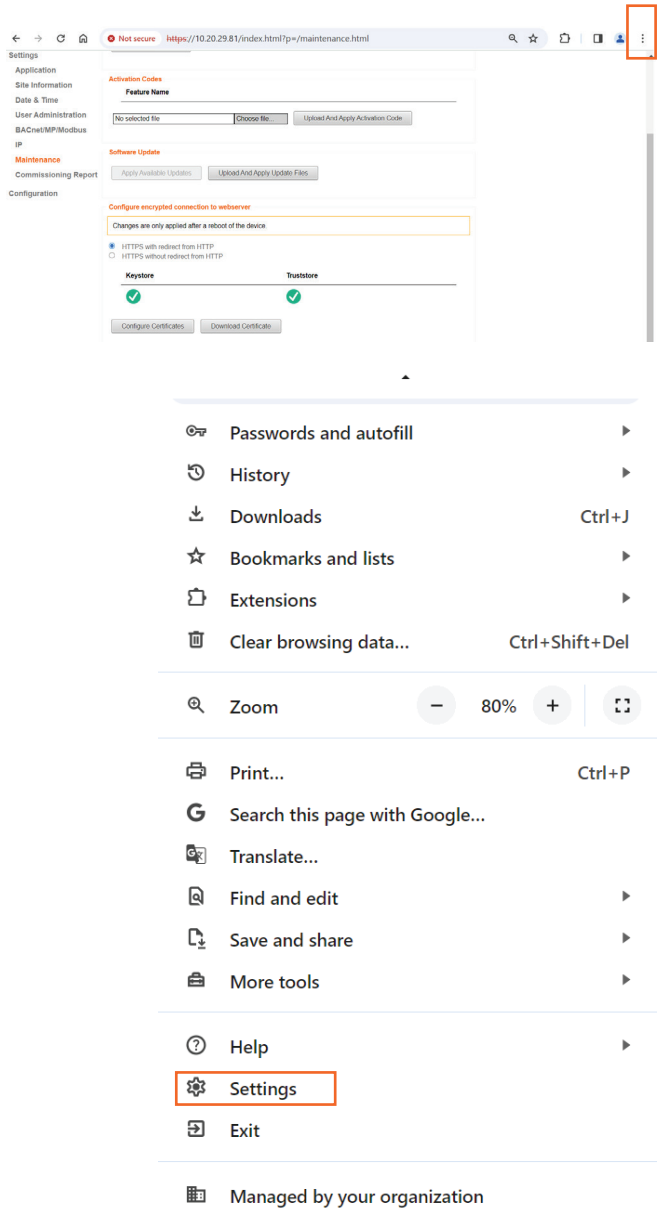
- **The following steps are not mandatory and only needed if https:// is desired. The trusted certificate only needs to be loaded once into the web browser**
- Under Maintenance page select Download Certificate
- Select Ok
- Note location where you save the certificate ca.pem file
- This will imported into web browser in next step





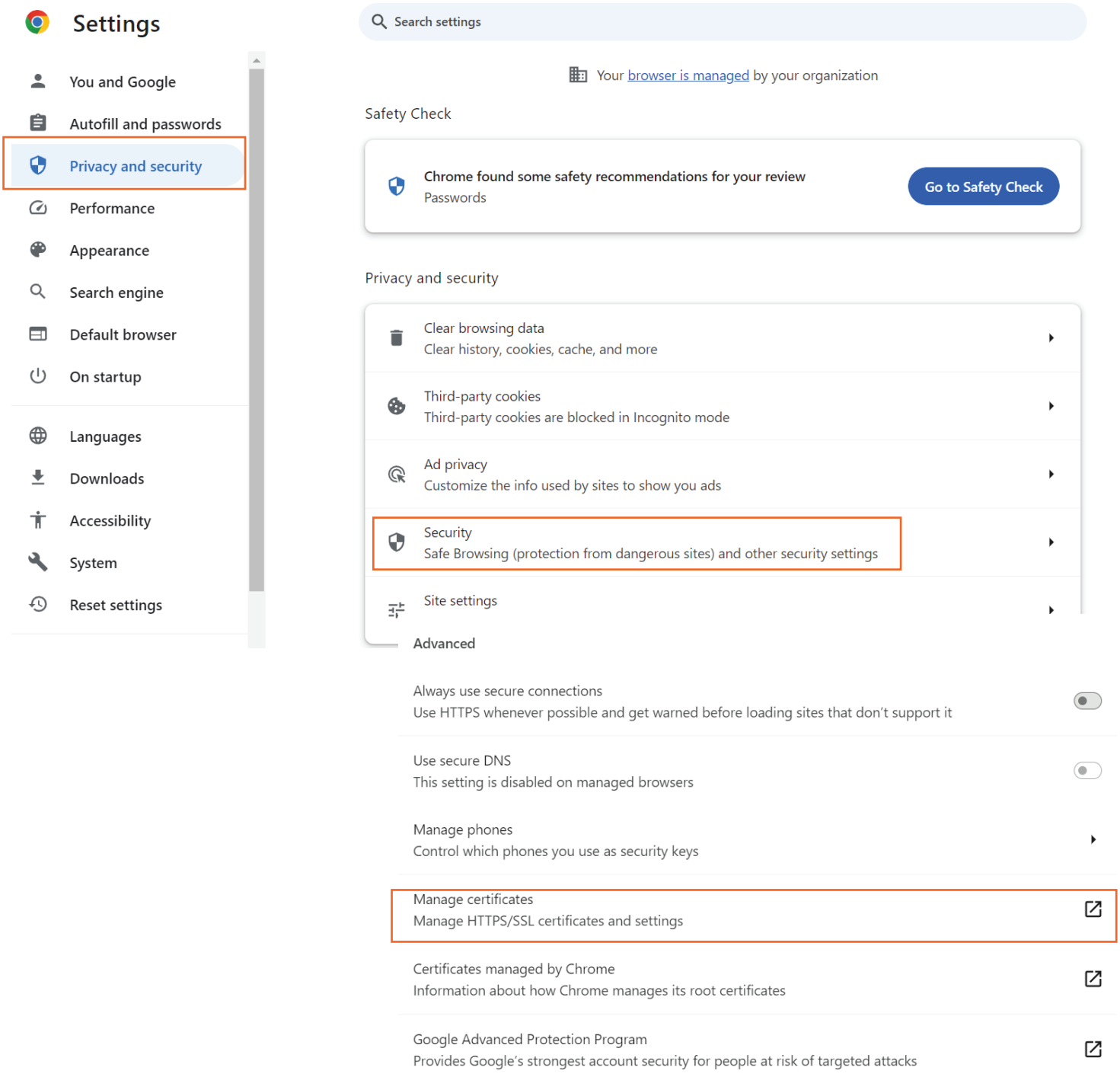
Installing Trusted Certificate in Web browser Step 2.
Access the section to load certificate

- The process may vary depending on browser the example is using google chrome
- Click on 3 dots in upper right corner of web browser
- Scroll down to Settings



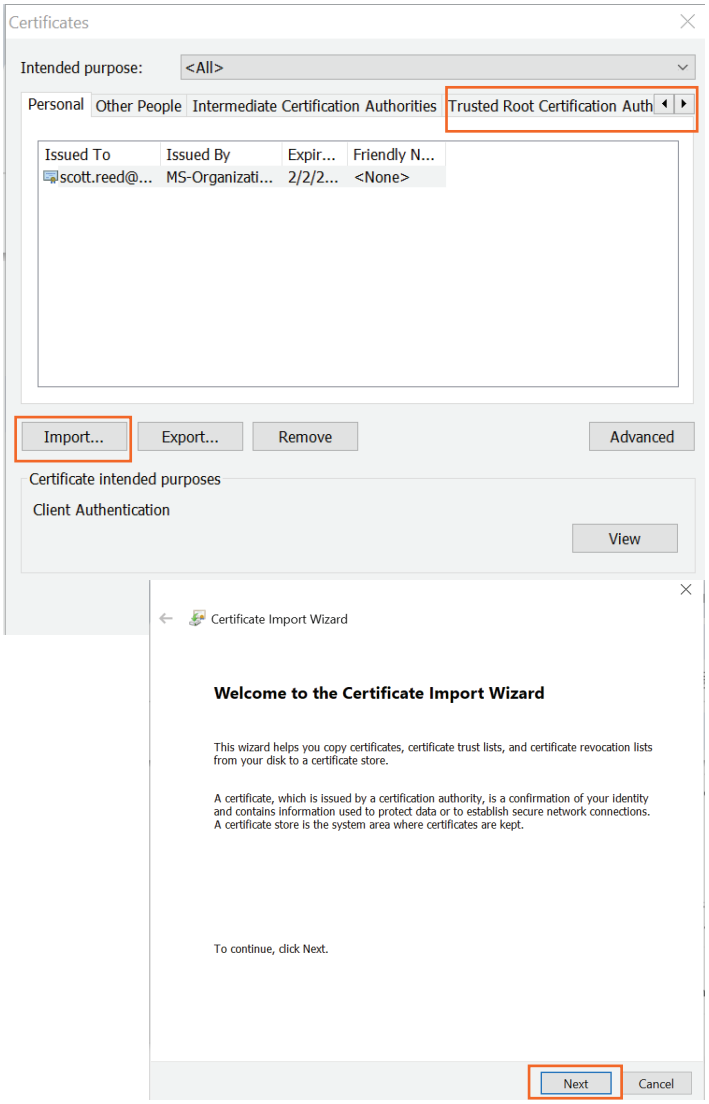
Installing Trusted Certificate in Web browser Step 2 continued.
Access the section to load certificate

- Select Privacy and security
- Select Security
- Scroll down & click Manage Certificates



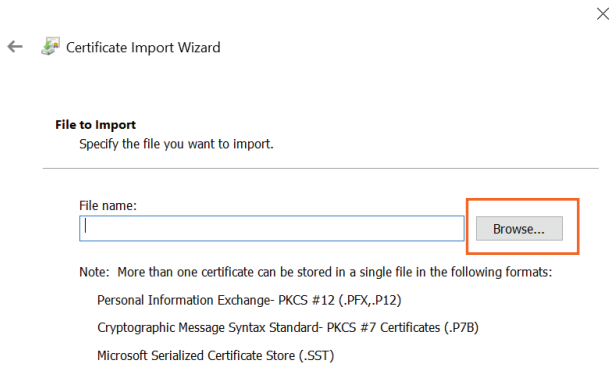
Installing Trusted Certificate in Web browser Step 3.
Import certificate

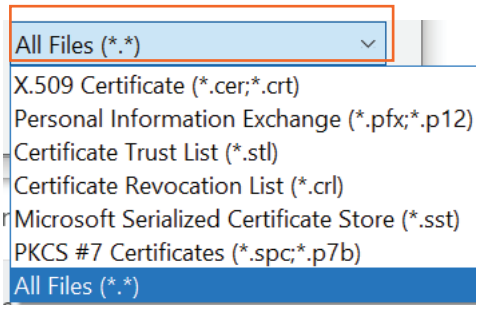
- Select 4th tab on top Trusted Root Certificate Authorities
- Click Import
- Import Wizard will start
- Click Next

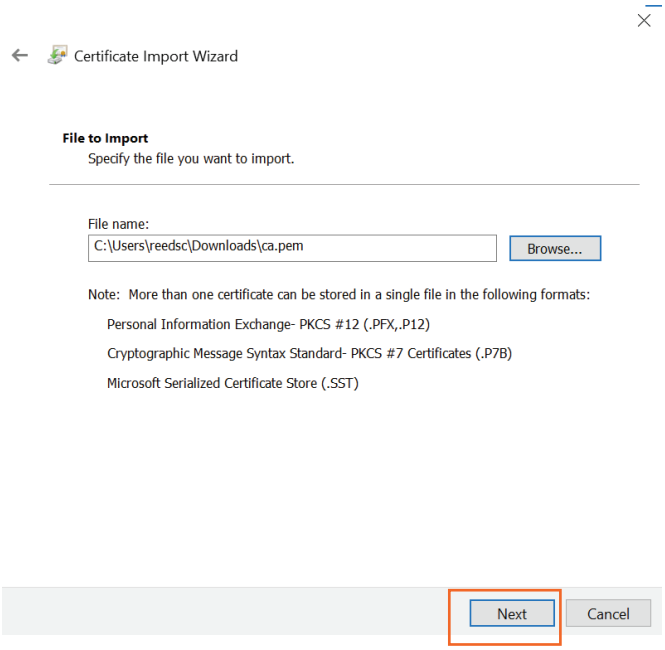


Installing Trusted Certificate in Web browser Step 3 continued.
Load ca.pem file

- Select Browse
- Select all files to see the ca.pem file downloaded in step 1
- Click Next on Files to Import window

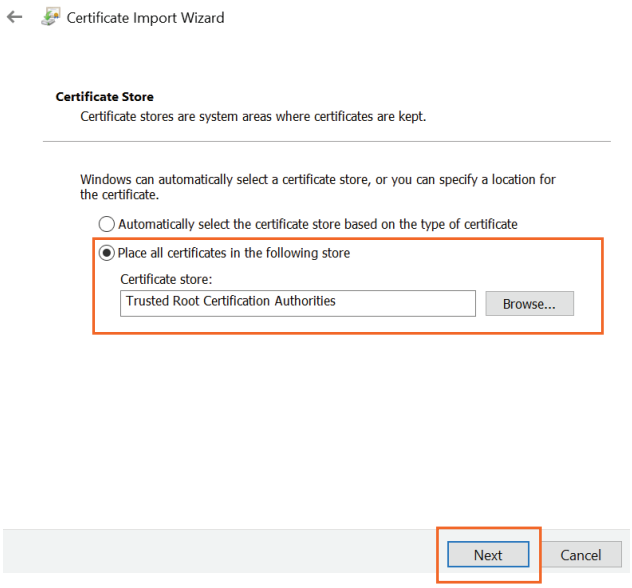


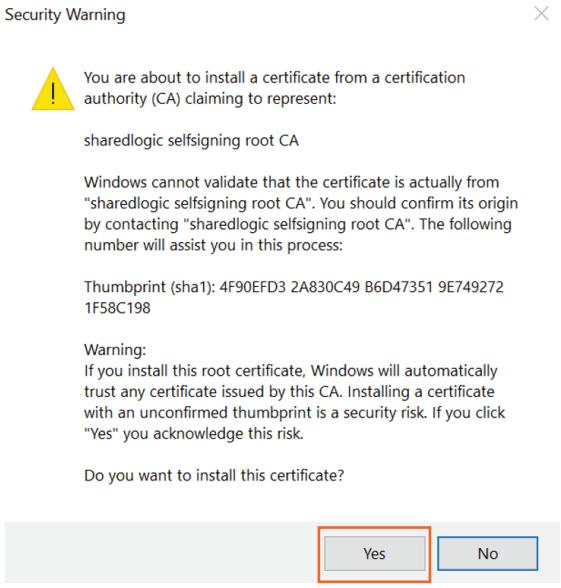


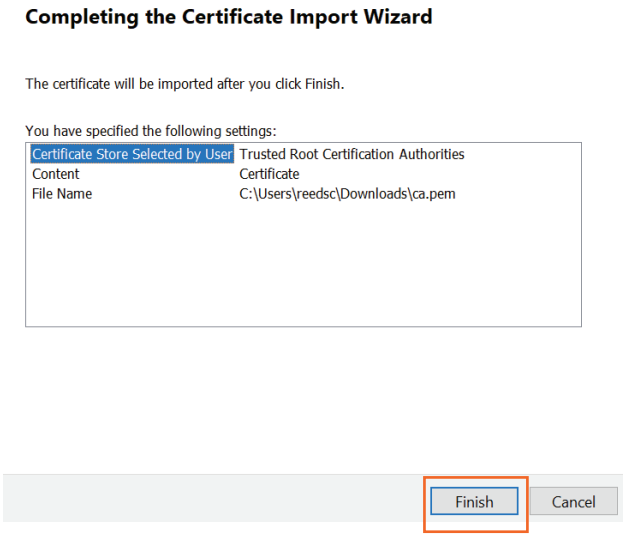


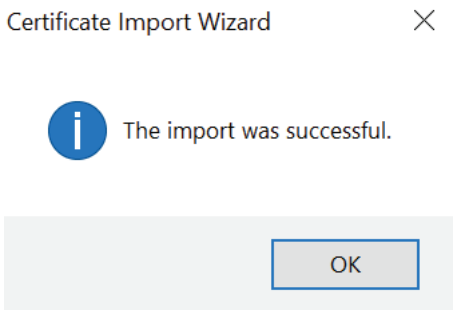
Installing Trusted Certificate in Web browser Step 4 Finish import

- Select Place all certificates in the following store
- Click Next
- Click Yes to acknowledge security warning
- Click Finish
- Import Successful click ok to finalize



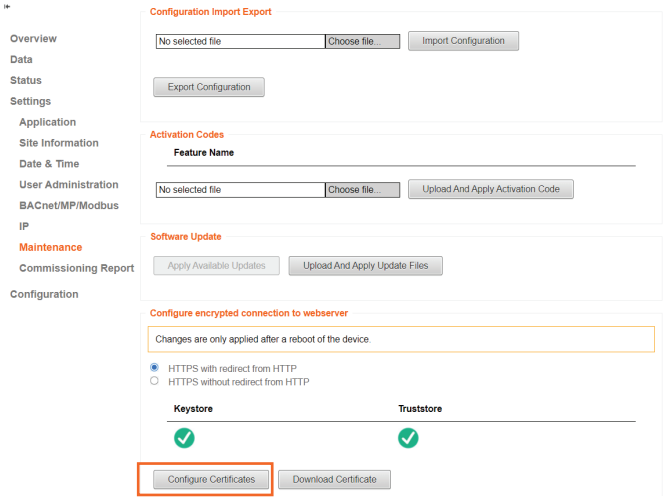


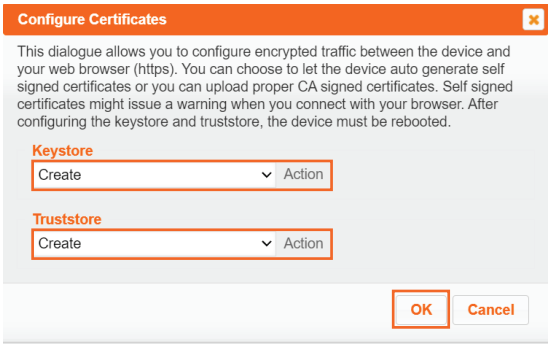


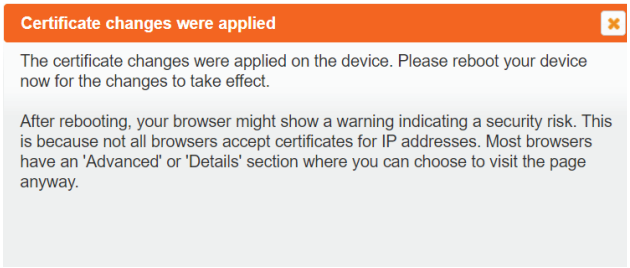


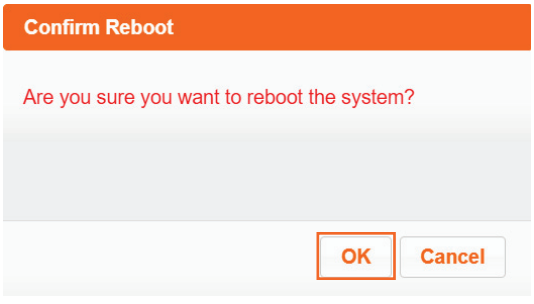
Step 5 Configure the certificate on the Energy valve. This step needs to be done on every Energy Valve using https://

- It is recommended that the IP address is set before this step is completed. This is done on the IP page under settings. If the IP address is changed after this step is completed, this step will need to be repeated to re-establish the secure connection between the Energy Valve and the browser
- Under Maintenance page select Configure Certificates
- Click Create Option from the drop-down menus, then click OK
  - The process will run it may take several minutes before the message Certificate changes were applied appears
- Click OK to reboot the device







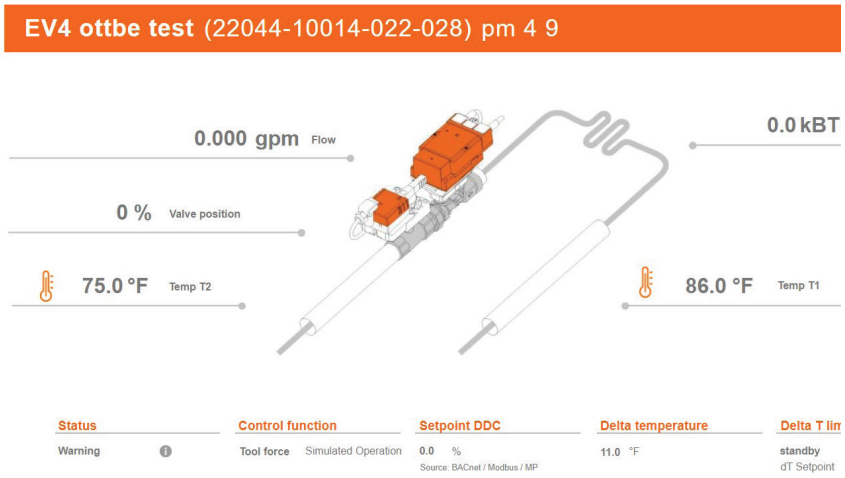


Web View

The Energy Valve 4 Web View is a graphical user interface accessed via a network or internet to set up, calibrate and change the parameters of the Belimo Energy Valve 4. Web View consists of the following page views:

Overview

The overview page allows you to see the setpoint, flow, valve position, differential pressure if this mode is selected, glycol percentage if activated, Delta T, and mode of operation. Double click on a heading item to see an historical trend of the data.



Data

Web View provides an analytical view of the historical data with the ability to select the type of data to analyze; primarily used for maintenance and troubleshooting.

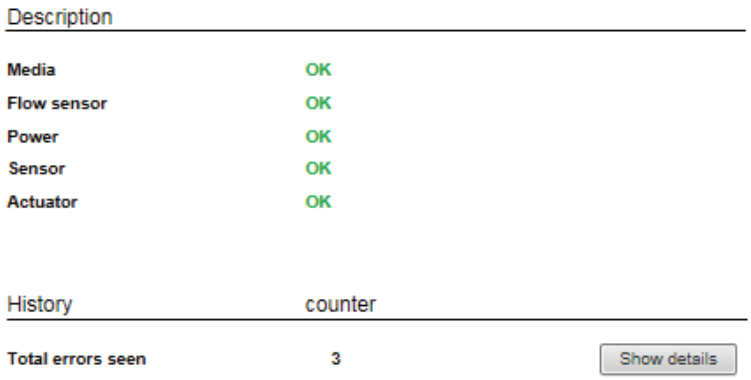
This view also, provides key performance indicators. In addition, the Delta T set point suggestion is also integrated. To calculate, press the coil characteristic button below the x axis.

Web View

Status

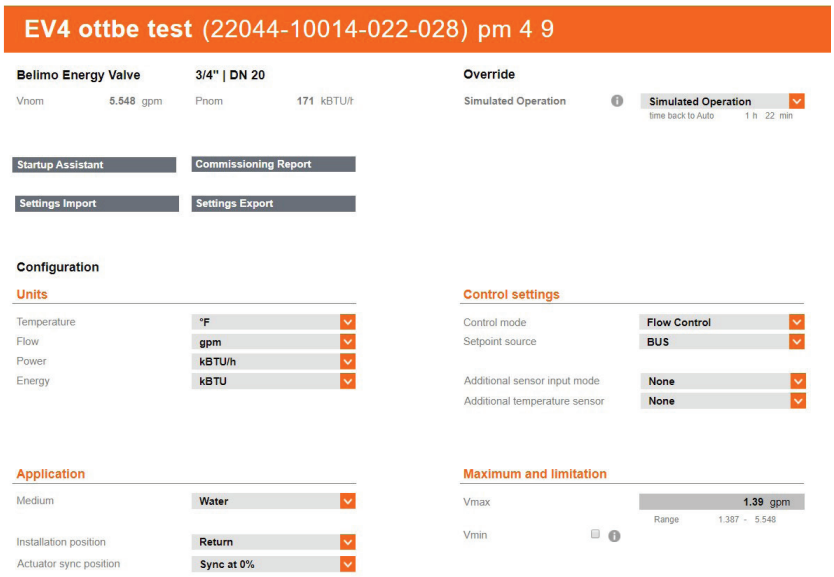
Status provides an error count by type and time elapsed of last occurrence. The Show details button accesses additional information with possible solutions to the error.

These errors can be reset to zero, and should be reset after commissioning, to clear any errors that may have occurred due to the valve and system not being fully operational.



Settings

Access and adjust the operating settings. Refer to the Web View Settings table on page 22.

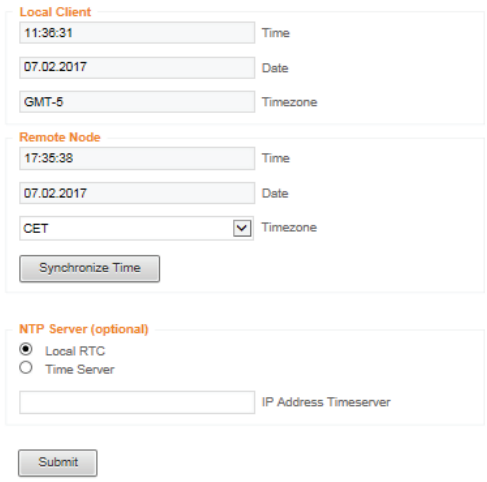


Configuration Options

Date and Time Settings

These settings provide different ways to set the date and time. The time can be entered manually, synchronized through a computer, or synchronized with a Time Server.

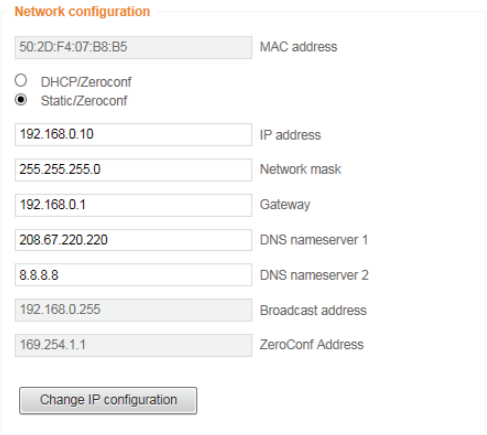
If BACnet communication is enabled, Local Client Date and Time will be automated through BACnet.



IP Settings

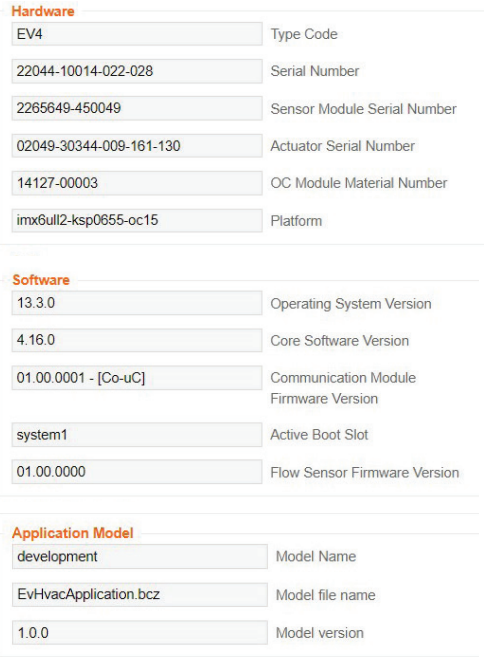
The IP Settings configure the valve communication on a TCP/IP network. They allow the valve to have a dynamic IP address (requires an active DHCP server) or a static IP address (requires an IP address, Network Mask and Gateway address from IT manager). The Broadcast address will be generated automatically.

The DNS Servers are listed here by default. If different ones are preferred, they will need to be assigned by the customer IT infrastructure responsible for the Energy Valve 4 installation.



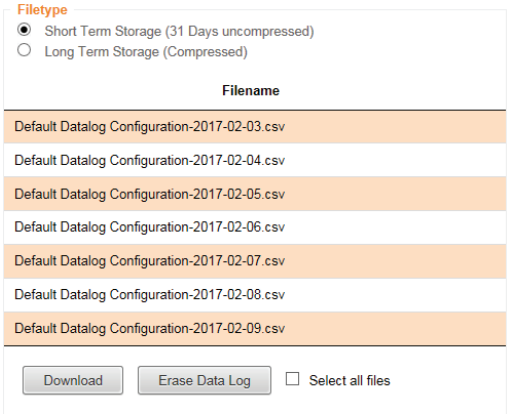
Version Information

The current software version is displayed.



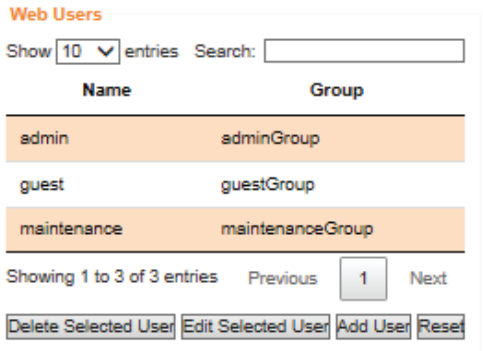
Data Logging

This shows the location to download all the historical data into a spreadsheet (.csv) that can be uploaded to the Data Analysis Tool™ for further analysis. See Data Analysis Tool™ page.



User Administration

Add, delete, and edit user information, including password management. See the Web View User Table for User Profiles.



Maintenance

Maintenance: Configuration Import /Export

This feature allows the Energy Valve 4 settings to be downloaded (export configuration) from one valve and imported to another valve via an XML file format. The valve size and actuator type need to be the same for this function.

Activation Codes: This is used for uploading a code for additional features, such as glycol monitoring. These codes, along with pricing, can be provided by Belimo Technical Support.

Update: Last Update indicates the status of updates for security and operational performance. These include:

No Updates applied – none of the available updates have been executed.

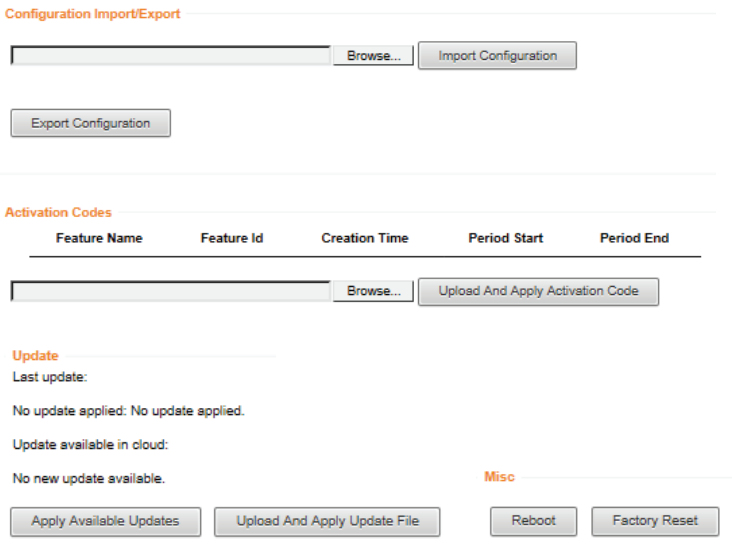
Update available in cloud

No new updates available

Apply available updates: executed downloaded updates

Upload and apply update file: downloads available updates and executes

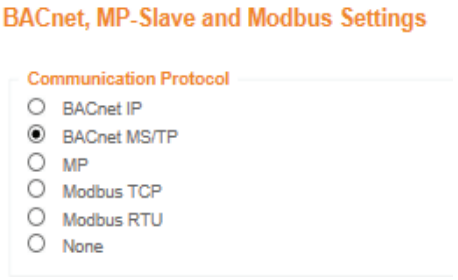
Misc: Reboot - performs the function of power cycling the actuator for a restart. Factory Reset restores the Energy Valve 4 actuator settings to settings when it left the Belimo factory.



BACnet, MP-Slave and Modbus Settings

This page is used to set the type of communication and settings for the Energy Valve 4. All BACnet configurations must be set prior to connecting to the BACnet network to avoid communication and settings problems.

- BACnet is a building automation communication protocol worldwide standard.
- MP is a Belimo protocol that allows for communication to multiple Belimo devices at the same time.
- Modbus is also a building automation communication protocol.
- None is the default value, when selected the valve will not communicate via BACnet.



BACnet/IP Settings

Port: The UDP port value defaulted to 47808

Simple/Foreign Device: A Simple Device requires communication only on its own IP subnet, or when there is a BBMD device on its subnet to handle routing of broadcast messages between subnets. A Foreign Device communicates to devices on subnets other than its own and to do so, must register with a BBMD device on a remote subnet.

Instance ID: A unique ID number for the EV device object on the BACnet network (between 0 and 4194303). This is ***not*** a read only value.

Device Name: Name used to represent the device in the BACnet system.

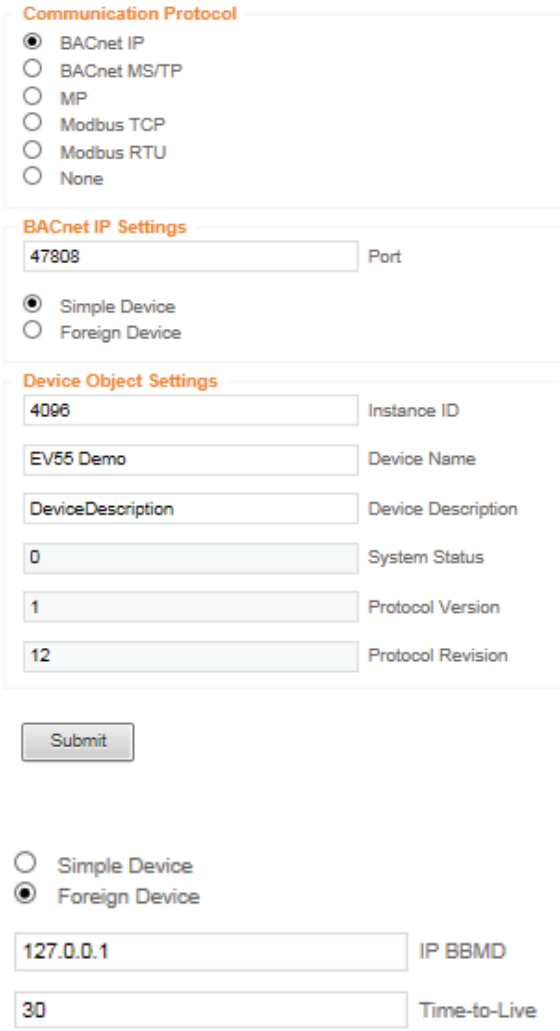
Device Description: General detail of the device.

System Status: Indicates that the valve is operational. This is a read only value. 0 is operational, 1 is not operational.

Protocol Version and Revision: These are read only values to show the BACnet protocol version and revision that the communication software follows.

IP BBMD: IP address entered must be the address of the BBMD router on a different subnet.

Time to Live: The time in seconds between updated registrations with the BBMD router. If the BBMD router has a TTL setting, this value should match the router's.



BACnet MS/TP Settings

Baud Rate: The transmission speed within the MS/TP network. All devices on the same network must be set to the same baud rate. Available rates: 9600, 19200, 38400, 76800, 115200.

MAC: The MAC address on the MS/TP network. This number must be unique within the network. Available values range from 1 to 127.

Max Master: Max_Master must be large enough that all MS/TP MAC addresses are within it. If unsure, set to 127.

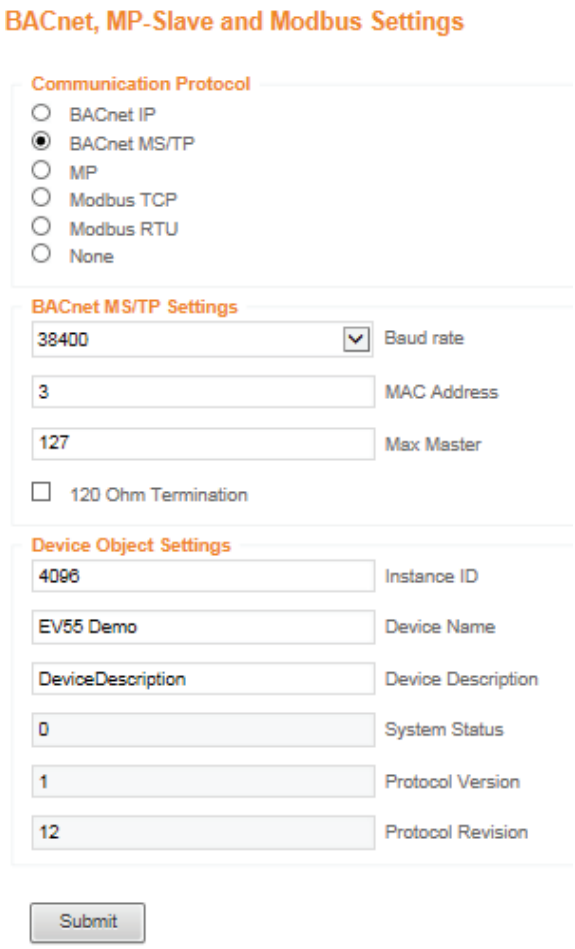
120 Ohm Termination: MS/TP networks require termination resistors on end-of-line devices. Turning on this setting will provide the required 120 Ohm termination on this BACnet device. Use this setting with great caution as adding termination resistance on a device in the middle of a network can cause significant network problems.

Instance ID: A unique ID number for the EV device object on the BACnet network (between 0 and 4194303). This is *not* a read only value.

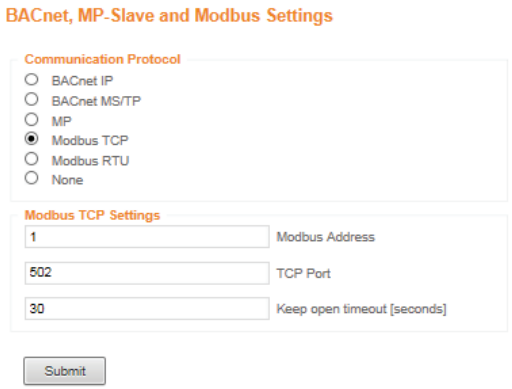
Device Name: Name used to represent the device in the BACnet system.

System Status: Indicates that the valve is operational. This is a read only value. 0 is operational, 1 is not operational.

Protocol Version and Revision: These are read only values to show the BACnet protocol version and revision that the communication software follows.



Modbus TCP Settings



TCP Unit ID: Each device in a network is assigned a unique unit address from 1 to 247. Default Value: 1

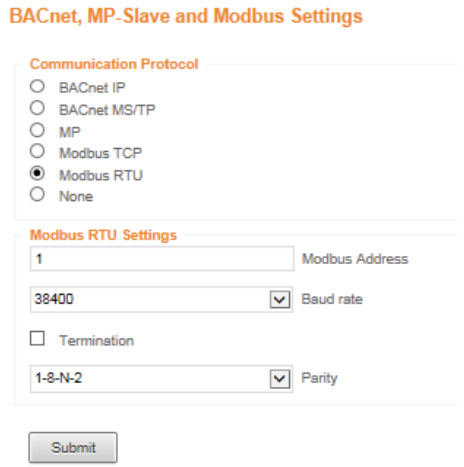
TCP Port: Modbus is a serial communications protocol for client-server communication between a switch (server) and a device in the network running Modbus client software (client). A client sends a message to a TCP port on the switch.

The listening TCP port 502 is reserved for Modbus communications. It is mandatory to listen by default on that port. However, some markets or applications might require that another port is dedicated to Modbus over TCP.

This is the case when interoperability is required with non =S=products, such as in Building Control. For that reason, it is highly recommended that the clients and the servers allow the user to parameterize the Modbus over TCP port number. It is important to note that even if another TCP server port is configured for Modbus service in certain applications, TCP server port 502 must still be available in addition to any application specific ports.

Keep Open timeout [seconds]: How long a device can take to respond before it is considered a timeout. Default Value: 30 seconds

Modbus RTU Settings



Modbus Address: Each device in a network is assigned a unique unit address from 1 to 247.

Default Value: 1

Range: 1-247

Baud rate: The transmission speed within the Modbus RTU network. All devices on the same network must be set to the same baud rate.

Default Value: 38400

Range: 9600, 19200, 38400, 76800, 115200

Parity: The transmission format used by Modbus that indicates the start bits, data bits, parity and stop bits.

Default Value: 1-8-N-2

Range:

1-8-N-1 (1 start, 8 data, no parity, 1 stop bit)

1-8-N-2 (1 start, 8 data, no parity, 2 stop bit)

1-8-E-1 (1 start, 8 data, even parity, 1 stop bit)

1-8-O-1 (1 start, 8 data, odd parity, 1 stop bit)

Cloud Settings

Datalog Service Connection Status: The status of the cloud connection

Cloud Server: The address of the connected host Server

Datalog and Task Mode: The connection to PUB nub status

MAC Address: The MAC address of the connected Energy Valve 4

Datalog Service: Allows for data transfer between the Energy Valve 4 and the cloud

Task Service: Allows for automatic updating of the Energy Valve 4 flow and Delta T setpoints based on data captured by the valve in the cloud

Update Mode: Allows for automatic updating of the Energy Valve 4 flow and Delta T setpoints based on data captured by the valve in the cloud

Log Levels: Status of Java Log and System Log levels

Disabled: No updates are downloaded

Device_Controlled: Updates are shown on the Maintenance page in Web View and not installed automatically, they are offered

Cloud_Controlled_Manual: The updates need to be released by the device owner in the cloud. The device installs the update immediately after release.

Cloud_Controlled Auto: The updates are released by Belimo and propagated to the devices. The device installs the update immediately after release.

Current Owner: The individual that has current ownership of the device. This is typically the name of the user that configured the cloud settings and corresponds to the email address provided on initial set up.

Refresh Current Owner: Simple refresh button to explicitly ask the cloud to tell us the current owner (for example after the product was transferred in the cloud).

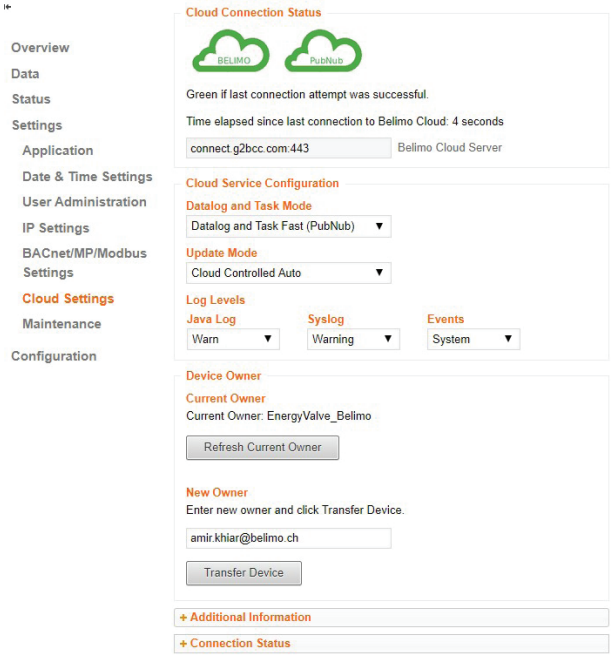
New Owner: Used when starting a transfer from a current owner (or no owner yet) to a new owner which requires pressing the Transfer device button after new owner is entered.

Additional Information: By clicking on the load button, displays more ownership information and device details.

Connection Status: Runs a routine that will help troubleshoot connection to the Belimo cloud

Connectivity Requirements: Customer provided Ethernet Cable Dedicated Internet Connection

Requirements for Cloud Connection: Gateway IP Address that allows a route to the internet. In case of DNS restrictions: IP addresses of internal DNS servers.



Firewall rule to allow communication
Action: Pass / Allow

Address family: IPv4

Protocol: https over TCP

Source: IP address of device or subnet designated to Energy Valve devices

Destination: https://connect.g2bcc.com

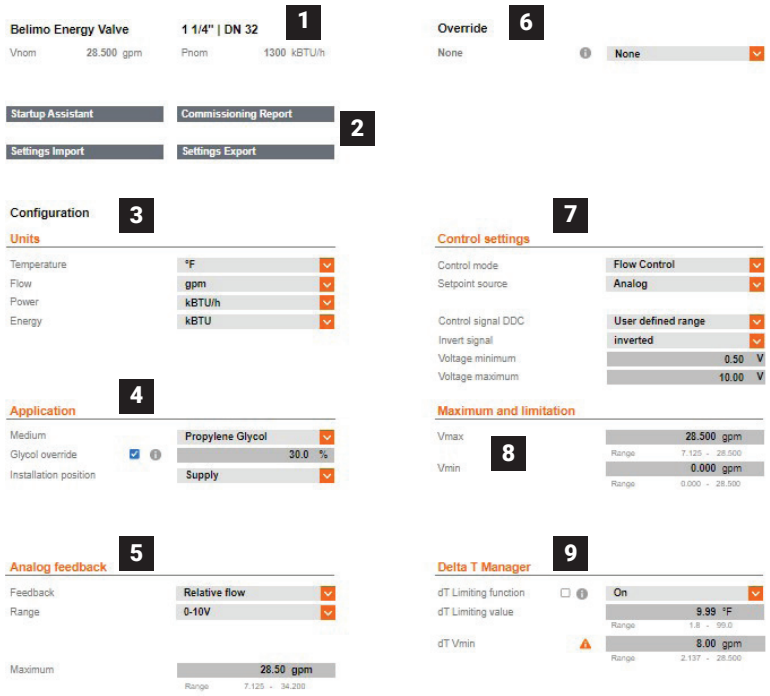
Communication details
Used protocol is https

Port of the server endpoint: 443

DNS address of cloud server: https://connect.g2bcc.com

Field Programming and Commissioning Options

All Energy Valve 4 actuators can be field programmed with either the Belimo Assistant App or with an Ethernet cable connected to a computer with web browser to access the actuator's web page (Web View). Refer to the table for a list of settings than can be changed in the field.



Without Differential Pressure Control Mode

Web View Settings

TAB	SETTING	FUNCTION	DEFAULT / RANGE
1. General Information	**Valve Size**	Defines the full flow cataloged capacity (V'nom) of the valve.	**(Default factory set to the valve size)** ½" – 6" [DN 15 – DN 150]
2. Functions	**Set Up Assistant**	A set up routine that runs on first power up to assist the installer with configuring the valve. Can also be run again by selecting here and any changes made will be applied.	N/A
	Import/ Export	Allows the export of valve settings and Import into another valve in XML Format.	N/A
	Comissioning Report	Generates a PDF of valve configuration settings for records.	N/A
3. Units	**Temperature**	Units: water supply, return, and delta T.	**Fahrenheit** Celsius, Kelvin
	Flow	Units: water flow rate through the valve.	**GPM** M3/s, M3/h, l/s, l/min, l/h
	Power	Units: thermal power through the valve.	**kBTU/h** W, kW, BTU/h, Ton
	Energy		**kBTU** J, kWh, MWh, kBTU, Ton H, MJ, GJ
4. Application	**Installation Position**	Identify the installed water service location of the valve and its embedded temperature sensor, or piped in series with the valve (T2). The sensor w/ longer cable is remote (T1) and will be assigned opposite the water service of the valve.	**Valve in Return Pipe** Valve in Supply Pipe
	Medium	Water or water/glycol composition used to accurately calculate: flow, thermal power and energy.	**Water** Monoethylene Glycol Polyethylene Glycol

Web View Settings Continued

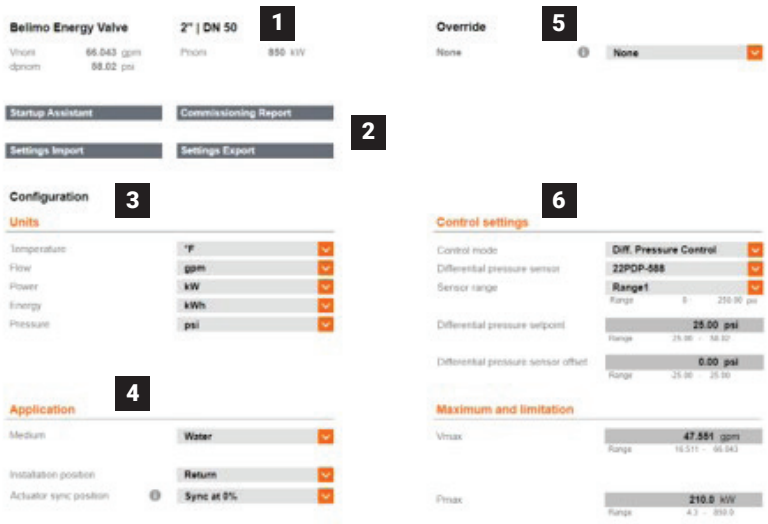
TAB	SETTING	FUNCTION	DEFAULT / RANGE
5. Analog Feedback	**Feedback**	Actuator analog feedback signal output on wire #5 u-signal.	**Flow** Power, T supply T return, delta T Valve position
	Range	Actuator analog feedback linear signal range.	**2-10 V** 0.5-10 V 0-10 V
	Maximum	Setting to equate 10 VDC or maximum feedback information. Setting must match the DDC range maximum setting. The grey box is an entry field and not the actual measured feedback and will hold the last value entered in it. The factory setting on this is 0.	**Flow** **0 to V'Nom** Position 0 to 100% (0-90 deg.) Temperature 32°F to 212°F 0°C to 100°C Power 0 to P'nom
6. Override	**Override Functions**	Override functions to move the valve to a particluar point or position which can be used for testing and commissoning purposes. All engaged overrides stop and go back to normal operation automatically after two hours.	
	Auto	Normal operation no override.	**Auto**
	Close	Moves actuator to close valve.	N/A
	Open	Moves actuator to open valve.	N/A
	V'nom	In flow control moves the actuator to full open position.	N/A
	V'max	In flow control moves the actuator to V'max setting.	N/A
	Motor Stop	Stops the valve at current position.	N/A
	P'nom	In power control mode moves the actautor to P'nom position (full open).	N/A
	P'max	In Power control mode moves the actautor to P'max setting.	N/A
	Simulated Operation	Engages simulation of flow and temperature that can be viewed on the overview page.	N/A

Web View Settings Continued

TAB	SETTING	FUNCTION	DEFAULT / RANGE
7. Control Settings	**Setpoint Source**	Defines how the BMS valve set point is sent to the acuator either analog on wire 3 or via BACnet, Modbus or MP).	**Analog** Bus (BACnet, Modbus, MP)
	Control Mode	Controlled variable assigned to the actuator control signal DDC, wire # 3.	**Flow Control** Power Control Position Control
	Invert Control Signal DDC	"No" valve modulates open when 10 VDC is received. "Yes" 10 VDC control signal DDC closes the valve.	**No** Yes
	Additional Sensor Input Mode	The Meter has the capability to add an additional sensor input to collect system data via wire.	Range Active, Passive Switch
	Additional Temperture Sensor	Allows the selection of additional temperture sensor	None, PT1000, Ni1000EU, NTC10k2, NTC10k3
8. Maximum & Limitation	**Vmax**	Used with Flow Control mode, this is the maximum flow setting of the valve with a full flow output from the controller.	**V'Nom**
	Pmax	Used with Power Control Mode this is the maximum power setting of the valve with full output from the controller.	25% to 100% of P'nom
	Vmin	Used with Flow Control mode, this is the minimum flow setting of the valve to maintain a minumum flow rate for particular applications.	25% - 100% of V'nom Defined by size in Webview
9. Delta T Manager	**Delta T Limiting Function**	Setting to disabled or enabled with limiting logic: On or dT Manager Scaling. Both use settings "Delta T Limiting Value" but only dT Manager Scaling uses the "Flow Saturation Value."	**Off** On dT Manager Scaling
	Delta T Limiting Value	Low limit parameter for dT setpoint: • For dT Manager this is the dT setpoint. • For dT Manager Scaling this will reset so the dT setpoint is scaled, or variable. Data Analysis Tool may be used to help determine value. The grey box is an entry field and not the actual measured Delta T and will hold the last value that is entered in it.	**10°F** 2°F to100°F 1.1°C to 55.5°C Default >30% of V'max Option >10% of V'nom
	Flow Saturation Value	Parameter used with dT Manager Scaling to reset the Delta T Limiting Value. When dT Manager Scaling is active: • If actual flow is less than this parameter the dT setpoint will be reset below the Delta T Limiting Value. • If actual flow is equal to this parameter the dT setpoint will be equal to Delta T Limiting Value. • If actual flow is greater than this parameter the dT setpoint will be reset above the Delta T Limiting Value. Data Analysis Tool may be used to help determine value.	(User defined) >30%-100% of V'max

Field Programming and Commissioning Options with Differential Pressure Control Mode

All Energy Valve 4 actuators can be field programmed with either the Belimo Assistant App or with an Ethernet cable connected to a computer with web browser to access the actuator's web page (Web View). Refer to the table for a list of settings than can be changed in the field.



With Differential Pressure Control Mode

Web View Settings with Differential Pressure Control Mode

TAB	SETTING	FUNCTION	DEFAULT / RANGE
1. General Information	**Valve Size**	Defines the full flow cataloged capacity (V'nom) of the valve.	**(Default factory set to the valve size)** ½" – 6" [DN 15 – DN 150]
2. Functions	**Set Up Assistant**	A set up routine that runs on first power up to assist the installer with configuring the valve. Can also be run again by selecting here and any changes made will be applied.	N/A
	Import/ Export	Allows the export of valve settings and Import into another valve in XML Format.	N/A
	Comissioning Report	Generates a PDF of valve configuration settings for records.	N/A
3. Units	**Temperature**	Units: water supply, return, and delta T.	**Fahrenheit** Celsius, Kelvin
	Flow	Units: water flow rate through the valve.	**GPM** M3/s, M3/h, l/s, l/min, l/h
	Power	Units: thermal power through the valve.	**kBTU/h** W, kW, BTU/h, Ton
	Energy		**kBTU** J, kWh, MWh, kBTU, Ton H, MJ, GJ
	Pressure	Measures the Differntial Pressure.	**kPa** Pa, bar, psi, mbar
4. Application	**Installation Position**	Identify the installed water service location of the valve and its embedded temperature sensor, or piped in series with the valve (T2). The sensor w/ longer cable is remote (T1) and will be assigned opposite the water service of the valve.	**Valve in Return Pipe** Valve in Supply Pipe
	Medium	Water or water/glycol composition used to accurately calculate: flow, thermal power and energy.	**Water** Monoethylene Glycol Polyethylene Glycol

Web View Settings Continued

TAB	SETTING	FUNCTION	**DEFAULT /** RANGE
5. Override	**Override functions**	Override functions to move the valve to a particluar point or position which can be used for testing and commissoning purposes. All engaged overrides stop and go back to normal operation automatically after two hours.	
	Auto	Normal operation no override.	**Auto**
	Close	Moves actuator to close valve.	N/A
	Open	Moves actuator to open valve.	N/A
	V'nom	In flow control moves the actuator to full open position.	N/A
	V'max	In flow control moves the actuator to V'max setting.	N/A
	Motor Stop	Stops the valve at current position.	N/A
	P'nom	In power control mode moves the actautor to P'nom position (full open).	N/A
	P'max	In Power control mode moves the actautor to P'max setting.	N/A
	Simulated operation	Engages simulation of flow and temperature that can be viewed on the overview page.	N/A
6. Control Settings	**Control Mode**	Controls Diffrential pressure from feedback of differntial pressures sensor selected.	**Differential Pressure Control**
	Differential Pressure Sensor	Selection of the installed differential pressure sensor.	**None**
	Sensor Range	Selection of ranges 1 to 4 for the measuring range set on the 22PDP-58XXX (this selection option is not available with the 22WDP-51XXX).	**None**
	Differential Pressure Setpoint	Adjustment of the desired differential pressure setpoint.	**None**
	Differential Pressure Offset	Provides the ability to correct sensor drift.	**None**
	Maximum and Limitation	V'max is the maximum flow rate of the valve. When the set V'max value is reached, the differential pressure is not increased any further, even if the setpoint has not yet been reached.	**V'nom** 25 to 100% of V'nom
	Maximum and Limitation	P'max is the maximum power of the valve. When the set P'max value is reached, the differential pressure is not increased any further, even if it falls below the setpoint.	**P'nom** 25 to 100% of P'nom

Troubleshooting

PROBLEM	FIELD OBSERVATIONS	POSSIBLE SOLUTION
Actuator will not move.	Green LED is not on or flashing.	Verify the power supply and control signal DDC are wired and operating correctly. If the actuator wiring is correct and the Green LED is not blinking, the actuator has failed. Note: the LED is solid green while booting up.
	Green LED is flashing but the valve will not move.	Valve may have debris. Depress the black gear release button on the side of the actuator and use the override handle to clear any debris that may have clogged the valve. If the valve does not move, then remove the actuator from valve and try to manually operate the valve stem.
Actuator does not modulate with the control signal DDC as expected.	Valve throttles to either full open or closed.	Verify the hydronic circuit is filled, water is flowing, and isolation valves are opened. When Mode of Control is set to Flow or Power, any control signal DDC greater than 0.5 or 2 VDC means there is a flow command. The flow or power logic will open the valve to satisfy the demand. Delta T Manager may be active.
Valve is yielding low flow but cannot be commanded to the full flow setting.	Valve is partially open but will not move to a full open position with a full control signal DDC command.	If the Delta T Manager is enabled it may be regulating the ΔT. Disable Delta T Manager until the chiller or boiler is operating correctly.
Requested flow cannot be reached; actual flow is lower than commanded flow.	Valve is fully open.	If the valve is fully open and flow feedback is 5% lower than flow set point, this event is captured in the Status Summary in Web View. Increase the pump differential pressure to resolve low flow problems.
Flow measurements are not stable.	Air may be in the system.	Check for air in the system. Remove air from the system to solve the problem.
Flow Control, Power Control, and dT Manager Scaling are not working.	Flow calculation is 0 GPM.	See any flow error listed on the Status area of the Web View.
Temperature sensor does not work.	Web View Indication: -15°F > Temp. > 300°F -26°C > Temp. > 149°C	Remove remote sensor wires from the terminals and verify resistance with an ohm meter. Replace if damaged. Below are typical PT 1000 readings: 176°F [80°C] = 1347 ohms 68°F [20°C] = 1078 ohms 50°F [10°C] = 1039 ohms
Device running slow when viewed in BACnet front end.	Device busy or slow.	Reduce the number of points being pulled in BACnet system and/or reduce the polling rate.
Valve does not respond to analog control signal DDC.	2-10 analog control signal DDC is modulated but the actuator does not respond.	Once Object SpRel has been written to via BACnet, the valve will no longer respond to analog control signal DDC. The only way to restore the valve responding to the analog control signal is to power cycle the actuator.
Flow Sensor does not work properly.	For ½" through 2" - Error byte communicates failure status.	Replace sensor.

Glossary of Terms

ΔT
Measured differential temperature between water supply and return.

Analog
A linear signal from one device to another that is used to move or read values. It is also used by a controller to modulate an actuator. Typical analog signal range is 2-10 VDC, 0-10 VDC, or 4-20 mA.

BACnet
A world-wide communication protocol standard that is used in building automation. BACnet uses two common communication mechanisms, BACnet/IP which communicates over Ethernet networks, and BACnet MS/TP, which communicates over 2 or 3-wire RS485 networks.

BMS (Building Management System)
A computer-based control system installed in buildings to control and monitor the building's mechanical and electrical equipment.

CCV
A Belimo patented ball valve that provides high rangeability, zero leakage, and high close-off.

DDC (Direct Digital Control)
A controller with software to operate control valves, dampers and other devices.

Delta T Limit Value
A setting used by the Delta T Manager to limit coil overflow.

Delta T Manager
A patented flow limiting logic applied to the Energy Valve 4 Control Modes.

dT Manager
An option in the Delta T Manager logic that produces a fixed dT setpoint.

dT Manager Scaling
An option in the Delta T Manager logic that produces a variably scaled dT setpoint.

delta T (ΔT)
The difference in the supply and return temperatures of a coil.

dT setpoint
The set point used by the Delta T Manager logic. When used with dT Manager it is a fixed setting. When used with dT Manager Scaling it becomes a calculated variable over a scaled range.

Flow Saturation Limit Value / Flow Saturation
A setting used with dT Manager Scaling to reset the Delta T Limiting Value and create a variable, dT setpoint.

Ghost Energy
Leaky control valves can create ghost heating and cooling demand and excess ventilation, which comes with a need to dehumidify or preheat. Also, there is ghost pumping for the additional chilled water and heating water flows along with ghost heating and cooling. A 1% leakage creates a 5 to 10% loss of energy.

MP-Bus (MP)
A Belimo communication protocol. The ZTH US tool uses this protocol to view and change actuator settings.

P'max
The maximum thermal power setting.

P'nom
The maximum thermal power of the heat exchanger.

V'max
The maximum valve flow setting.

V'nom
The maximum valve flow.