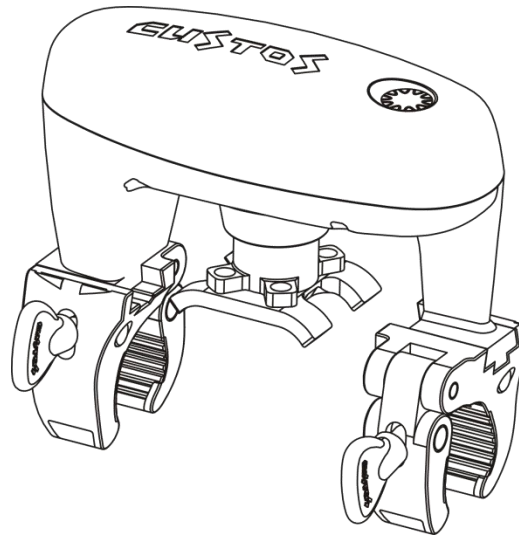


Custos Ball Valve Servo

Technology for Humanity



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1 REVISION HISTORY

1.1 Software Revision Change

Date	SW Rev	Description	Section
4-Aug-20	V3.05	<ol style="list-style-type: none"><li data-bbox="349 387 1114 417">1. Water Alarm Cancellation – Change to x1 short click from 2x short click<li data-bbox="349 417 1161 479">2. Water Alarm Timeout – Water Leak Alarm UI 30 seconds timeout before BVS physical installation is triggered.<li data-bbox="349 479 1125 509">3. Leak Sensor Detection – Extended to 1 second detecting time from 10ms	UI Operation Logic

2 INTRODUCTION

2.1 What's Z-Wave™ ?

Z-Wave is international wireless protocol used for Smart Home. It's a mesh network technology to ensure reliable two-way communication with each other.

Z-Wave provides interoperability and security from multi-vendors to make sure Certified Products work within any Z-Wave network.

2.2 Custos BVS

Custos Ball Valve Servo "Custos BVS" is capable for outdoor deployment for controlling quarter turn water valve OPEN / CLOSE. It also supports auto CLOSE valve when water leak is detected by Local Leak Sensor Probe. Custos BVS can be operated in any Z-Wave network with other Z-Wave certified gateways or devices from other manufacturers. All mains operated nodes within the network will act as signal repeater regardless of vendor to increase reliability of the network.

3 FEATURES & SPECIFICATIONS

3.1 Physical Specifications

Parameter	Value
Model No.	BVS-ZWU (US) / BVS-ZWE (EU)
Dimensions	14.8 x 9.6 x 13.3mm
Weight	BVS Unit: 603g
Body Color	White
Knob Color	Blue
Waterproof and Dustproof	IP66 level / Outdoor deployment
Usage	For Indoor and Outdoor Water Valve On/Off
Operation Temperature	14~122°F (-10 ~ +50°C)
Relative Humidity	8% ~ 80%

3.2 Hardware Specifications

Parameter	Value
Z-Wave Module	ZGM130S037HGN1
Z-Wave RF Distance	40m (Indoor) / 140m (Outdoor)
Region Frequency	US: 908.4 & 916MHz, FCC CFR47 Part 15.249 EU: 868.42 & 869.85MHz
Motor Torque Power	Adaptive torque output max: 6n.m
Water Leak Sensor	Local Water Leak Sensor Probe
Temperature Sensor	Built-in MCP9700x, Range from -40°C to +125°C / (-40°F to +257°F)
Action Button	Touch Sense Button x 1
LED Indicator & Sound Indicator	3 colors LED. (Green, Yellow & Red); Buzzer (Max. 85dB)
Power Supply	AC-DC: AC (110V 60Hz / 220V 50Hz); DC (12V / 1A)
Power Consumption	Standby: ~10mA @ 12VDC = 0.12W Full Operation: Max ~700mA @ 12VDC = 8.4W

4 WHAT'S IN THE BOX

Standard Custos BVS package comes with below items

- A. Custos BVS Main Unit x 1
- B. AC-DC Adaptor x 1, (AC 110/220V to DC 12V/1A)
- C. Local Leak Sensor Probe x 1 (Optional, depend on SKU)

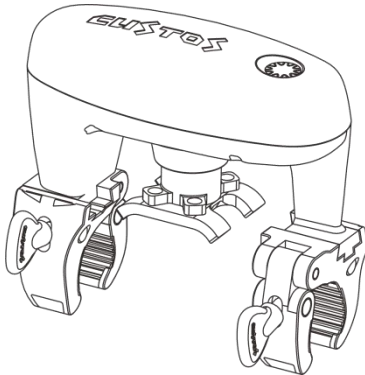


Figure 4A

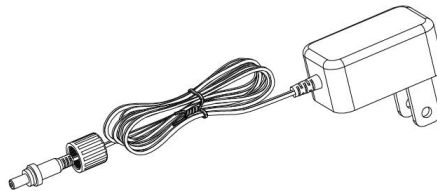


Figure 4B

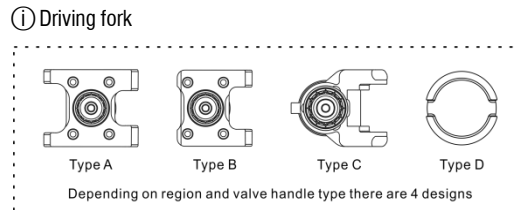
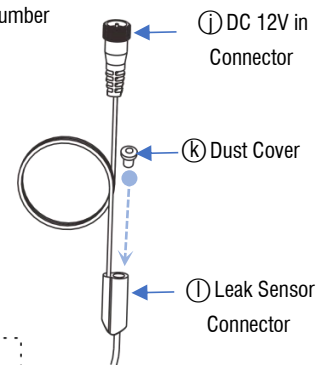
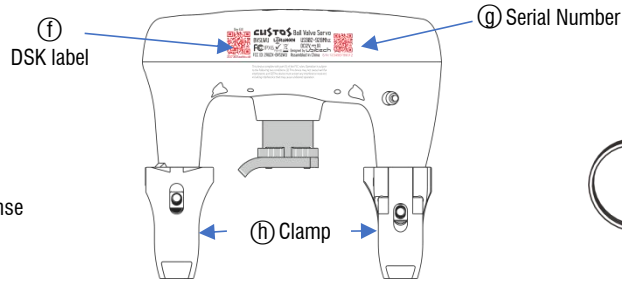
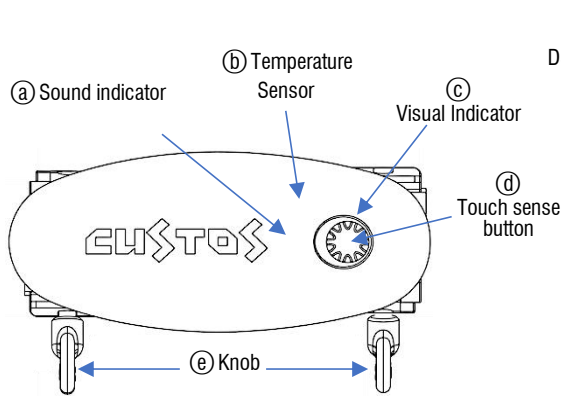


Figure 4C

5 UNDERSTANDING CUSTOS BVS

5.1 Connectors & Interfaces

Terminology	Description	Terminology	Description
a Sound indicator	Buzzer	g Serial number	Serial number label
b Temperature Sensor	Built-in temperature sensor	h Clamp	Clamp on water pipe. Max 1-1/4 inch
c Visual indicators	3 Colors LED with green, yellow & red	i Driving fork	Couple with valve handle
d Touch sense button	Network, water valve and alarm operations	j Power connector	DC 12V / 1A in
e Knob	Use to adjust Clamp widths	k Dust cover	Prevent Dust and Water
f DSK label	Z-Wave“SmartStart” and product label	l Leak sensor connector	Local leak sensor probe



6 PHYSICAL INSTALLATION

6.1 Quick Installation Instruction:

- Make sure the power is disconnected.
- Turn the Valve Handle in Close position.
- Choose the right size Fork of BVS and aligning with Valve Handle. *Refer to “Figure 6A”
- Make sure the Knob and Valve Handle are facing on same side. *Refer to “Figure 6B”
- Tighten Clamps while holding down the Custos BVS.
- Unplug the Dust Cover and plug Local Water Sensor Probe into connector tightly. (Optional) *Refer to Figure 6C
- Connect the 5.5mm circular power jack from DC Adaptor to the coupling socket from BVS, turn clockwise to secure the water seal cover.
- Plug DC Adaptor into AC Power Outlet.

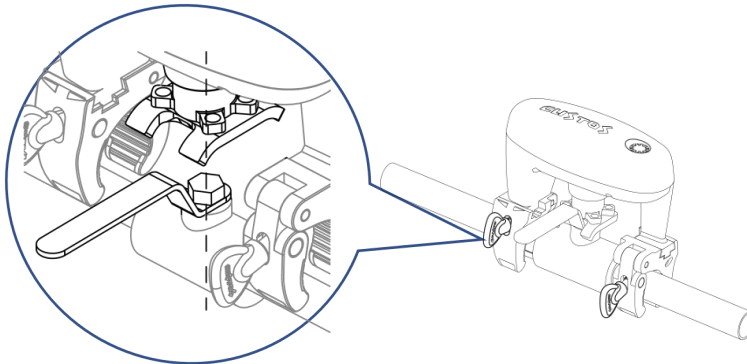


Figure 6A

Figure 6B

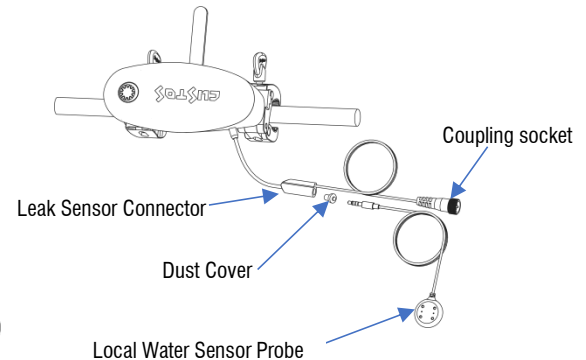


Figure 6C

7 WORKING MODE SUPPORT

7.1 Standalone

- Support Water Valve Operation, Water Leak detection & Alarm, Inclusion, Exclusion and Factory Default Reset.
- By default, Custos BVS is in Standalone Mode with Factory Default Setting and it's not belonged to any Z-Wave Mesh Network.
- End user can enjoy all regular functions without Z-Wave benefit. Such as Water Valve, Leak detection by Local Leak Sensor Probe.

7.2 Mesh Network

- Support SmartStart, Classic Inclusion, Exclusion & Factory Default Reset.
- After Adding Custos BVS to a Z-Wave Mesh Network, end-customer can fully enjoy all functions, such as remote control, associate with other Z-Wave end devices...

7.3 Water Valve

- Support OPEN, CLOSE, PAUSE
- RESUME during OPEN/CLOSE operation.
- Manual Calibration position of valve handle. (Only support operate by Touch Sense Button)
- Water Valve will be closed automatically once Local Water Leak Sensor Probe is triggered.
- Water Valve can be triggered with associated other Z-Wave end-devices. (Only in Mesh Network Mode)

7.4 Water Leak Sensor & Alarm

- Water Leak Alarm will be activated and to CLOSE Water Valve automatically once Local Water Leak is detected.
- Once Local Water Leak is detected then Custos BVS will also send out Water Leak Alarm with no location support to Z-Wave Gateway. (Only in Mesh Network Mode)

7.5 Temperature Sensor

- By default, BVS sends temperature report automatically to gateway when every 1°C or 1.8°F degree changed. (Only in Mesh Network Mode).

8 KEY & INDICATORS BEHAVIOR

8.1 Touch Sense Button

- Short Press: One click comes with one short beep sound.
- Long Hold: Press and holding the key. “Come with 1 x short beep sound per second”

8.2 Visual Indicator

- 3 Colors LED: GREEN, YELLOW & RED
- ON Event: ON, quick blinking and slow blinking

8.3 Sound Indicator

- Buzzer: Long & short beep sound.

9 TOUCH SENSE BUTTON KEYLOCK

Custos BVS is capable for outdoor deployment. To prevent mis-operation by rain drop, end-user can enable Touch Sense Button Keylock function.

9.1 Keylock Enable

After enabled Touch Sense Button Keylock function, Custos BVS will not accept any key event excepting Touch Sense Button Keylock Disable function. (Refer to 9.2)

- i. Start: Long hold Touch Sense Button with 3 beep sounds then short click 3 times.
- ii. Process: Yellow LED on 1 second then Red LED on 1 second with 1 beep sound.
- iii. Success: Yellow LED slow blinking.

9.2 Keylock Disable

- i. Start: Long hold Touch Sense Button with 3 beep sounds then short click 3 times.
- ii. Process: Yellow LED on 1 second then Red LED on 1 second with 3 beep sounds.
- iii. Success: LED indicator resume previous status. (Yellow LED blinking or Green LED slow blinking)

10 SETUP Z-WAVETM NETWORK

10.1 Check Custos BVS Status:

- i. Before Adding into Z-Wave Network, you have to make sure Custos BVS is in Standalone mode.
- ii. By default, Custos BVS does not belong to any Z-Wave Network and color indicator is keeping in Yellow Blinking.
*If not, please perform “Factory Default Reset - refer to 10.4” or “Remove from Z-Wave Network – refer to 10.3”

10.2 Add Custos BVS into Z-Wave Network:

Custos BVS supports Security 2 Command Class while a Security S2 enabled controller is needed. It supports SmartStart and Classis Inclusion.

- i. SmartStart:
By using SmartStart, end-user by scanning the Z-Wave QR code or entering PIN Code or DSK String into S2 Enabled Gateway.
Please refer to 14.11 SmartStart Labeling.
To enable Security S2 in Gateway, please refer to Gateway’s user manual.
- ii. Classic Inclusion:
To be used if your controller does not support SmartStart
 - a. Set your Z-Wave Gateway into Inclusion mode / Add device.
 - b. On your Custos BVS
 - Start: Short press Touch Sense Button 3 times.
 - Processing: Yellow LED and short beep sound keeping continue. For security inclusion support, you may need to entering first 5 digit that show on QR Code label, please refer to the instructions of central controller.
 - Success: Green LED on 1 second with 2 short beep sounds.
 - The LED indication changes to Green LED slow blinking from Yellow LED blinking.

10.3 Remove Custos BVS from Z-Wave Network:

Set your Z-Wave Gateway into Exclusion mode / Remove device.

- i. Start: Short press Touch Sense Button with 3 beep sounds.
- ii. Processing: Yellow LED and short beep sound keeping continue.
- iii. Success: Green LED on 1 second with 2 short beep sounds.
- iv. The LED indication Changes to Yellow LED blinking.

10.4 Factory Default Reset:

To remove Custos BVS without involve gateway in Exclusion / Remove device operation and BVS will reset all setting to Factory Default Setting. “Please use this procedure only when the network primary controller is missing or otherwise inoperable”

- i. Start: Long hold Touch Sense Button with 10 beep sounds then short click 5 times.
- ii. Processing: Yellow LED ON 1 second then wait 2-5 seconds.
- iii. Success: Green LED on 2 second with long beep sounds for 2 seconds.

***Factory Default Reset will:**

- a. **Remote the BVS from Z-Wave Network;**
- b. **Delete the association setting;**
- c. **Restore the configuration settings to the default.**

11.4 Pause OPEN/CLOSE Operation

Pause only take effect during OPEN or CLOSE operation.

- i. Start: Short click Touch Sense Button 1 time.
- ii. Processing: Yellow LED blinking and Valve stop operation.

11.5 Resume OPEN/CLOSE Operation

Resume only take effect during Pause operation.

- i. Start: Short click Touch Sense Button 1 time.
- ii. Finished: Valve resume to operation (Continue to Opening / Closing) and LED indicator changes to LED blinking.

12 WATER LEAK ALARM

12.1 Water Leak Detection & Alarm

Custos BVS comes with Local Leak Sensor Probe and support following functions, in short, once Water Leak is detected, Water Leak Alarm will be activated, hence the water valve will be closed spontaneously, at this moment all other operations will not be accepted except Water Leak Alarm Cancellation.

- i. Activated Water Leak Alarm
 - RED LED fast blinking.
 - Fast beep sound.
- ii. CLOSE Water Valve automatically
- iii. Send out Water Alarm Notification to Z-Wave Gateway. (Only support in Mesh Network Mode)
- iv. Water Valve keeps in CLOSE position
- v. The operation is forbidden temporarily until perform Water Alarm Cancellation operation. (Refer 12.2)

12.2 Water Leak Alarm Cancellation

Water Leak Alarm Cancellation operation only accepted when Local Water Leak Sensor Probe is no longer detected water.

- i. Start: Long hold Touch Sensor Button with 2 beep sounds
- ii. Success: The LED indicator changes to previous status. (Yellow LED blinking or Green LED slow blinking and buzzer goes silence.)

13 TEMPERATURE SENSOR

13.1 Temperature Report

- iii. By default, Custos BVS will send report to Gateway automatically in 1 °C or 4°F change of ambient temperature.
- iv. Custos will send out °F in US version and °C for other versions.

14 Z-WAVETM SOFTWARE DEFINITIONS

14.1 Software Specifications

Parameter	Value
Wireless Technology	Z-Wave
Z-Wave Certification Type	Z-Wave Plus v2 Certification
Z-Wave SDK Version	v7.13.2
Z-Wave Library	Enhanced 232 Slave
Z-Wave Role Type	Always On Slave
Device Type	Binary Switch
Generic Device Type	Switch Binary
Specific Device Type	Specific Type Not Used
Security Class	Non-Security, S0, S2 Unauthenticated and S2 Authenticated
SmartStart	Support: After powering on, SmartStart is auto activated if it's out of Z-Wave network when power on
Firmware Update	Support: Firmware upgrade support via RF, "Over The Air (OTA)"
Association	Support 5 Groups. Lifeline, Water Valve, Water Leak, Overheat & Underheat
Factory Default Reset	Support: Device Locally Reset
Power Down Memory	Support: Valve ON/OFF status, Leak Alarm support suddenly power cut and restore previous status

14.2 Z-Wave Plus™ Info

Z-Wave Plus Version	2
Role Type	5 (ZWAVEPLUS_INFO_REPORT_ROLE_TYPE_SLAVE_ALWAYS_ON)
Node Type	0 (ZWAVEPLUS_INFO_REPORT_NODE_TYPE_ZWAVEPLUS_NODE)
Installer Icon Type	0x1500 (ICON_TYPE_GENERIC_VALVE_OPEN_CLOSE)
User Icon Type	0x1500 (ICON_TYPE_GENERIC_VALVE_OPEN_CLOSE)

14.3 Version CC

Parameter	Value
Z-Wave Protocol Library Type	0x03
Z-Wave Protocol Version	0x07
Z-Wave Protocol Sub Version	0x0D
Firmware 0 Version	0x03 – Z-Wave Chip Major Firmware Version
Firmware 0 Sub Version	0x02 – Z-Wave Chip Minor Firmware Version
Hardware Version	0x03
Number of firmware targets	0x00

14.4 Manufacturer Specific

Parameter	Value
Manufacturer ID 1	0x02
Manufacturer ID 2	0x70
Product Type ID 1	0x01
Product Type ID 2	0x01
Product ID 1	0x00
Product ID 2	0x0A

14.5 Notification CC

Notification Type		Notification Events / State		Description
Heat Alarm	0x04	State idle	0x00	Notification value for the state variable going to idle (V5)
		Overheat detected	0x02	No Location Support Event
		Underheat detected	0x06	No Location Support Event
Water Alarm	0x05	State idle	0x00	Notification value for the state variable going to idle (V5)
		Water leak detected	0x02	No Location Support Event
Water Valve	0x0F	Valve operation status	0x01	Event Parameter 1 byte = - 0x00 = Valve does not let the water run through - 0x01 = Valve lets the water run through

14.6 Indicator CC

Parameter	Value
Indicator ID	0x50 = (Node Identify)
Property ID	0x03 = (On/Off Periods) 0x04 = (On/Off Cycles) 0x05 = (On time within an On/Off period)

14.7 Basic CC Mapping of Water Valve

Basic CC	Map to CC	Value
Basic Set	Binary Switch Set	0x00 = ON / Water Valve OPEN (Valve lets water run through) 0xFF = OFF / Water Valve CLOSE (Valve doesn't let water run through)
Basic Report	Binary Switch Report	0x00 = ON / Water Valve OPEN (Valve lets water run through) 0xFF = OFF / Water Valve CLOSE (Valve doesn't let water run through)

14.8 Association Group Info (AGI)

Association Group	Name	Node Count	Function
1	Lifeline	5	<ul style="list-style-type: none"> - Device Reset Locally Notification - Basic Report - Binary Switch Report - Indicator Report - Sensor Multilevel Report – Temperature “Auto report based on Configuration Parameter 0x22 Setting.” - Heat Alarm Notification Report (0x04) <ul style="list-style-type: none"> - 0x00 = State idle - 0x02 = Overheat – no location support - - 0x06 = Underheat – no location support - Water Alarm Notification Report (0x05) <ul style="list-style-type: none"> - 0x00 = State idle - 0x02 = Water leak detected – no location support - Water Valve Notification Report (0x0F) <ul style="list-style-type: none"> - 0x01 = Valve operation <ul style="list-style-type: none"> ● 0x00 = VALVE CLOSED/OFF (Valve does not let the water run through.) ● 0x01 = VALVE OPEN/ON (Valve lets the water run through)
2	Water Valve	5	<ul style="list-style-type: none"> - Basic Set (By default the Configuration CC parameter 0x11 (17) “Inverse Water Valve report” is enabled to send out following report.) <ul style="list-style-type: none"> - 0x00 = Let the water run through (Based on Configuration Parameter 0x13) - 0xFF = Doesn’t let the water run through. (Based on Configuration Parameter 0x12)
3	Leak Sensor	5	<ul style="list-style-type: none"> - Basic Set <ul style="list-style-type: none"> - 0x00 = IDLE / CANCEL (Based on Configuration Parameter 0x32 Setting) - 0xFF = TRIGGERED (Based on Configuration Parameter 0x31 Setting)
4	Overheat Alarm	5	<ul style="list-style-type: none"> - Basic Set <ul style="list-style-type: none"> - 0x00 = IDLE / CANCEL (Based on Configuration Parameter 0x27 Setting) - 0xFF = TRIGGERED (Based on Configuration Parameter 0x26 Setting)
5	Freeze Alarm	5	<ul style="list-style-type: none"> - Basic Set <ul style="list-style-type: none"> - 0x00 = IDLE / CANCEL (Based on Configuration Parameter 0x2C Setting) - 0xFF = TRIGGERED (Based on Configuration Parameter 0x2B Setting)

14.9 Supported Command Classes IN NIF

Command Class	Version	Not added	Non-secure added	Security 0 added		Security 2 added	
				Non-secure	Secure	Non-Secure	Secure
ZWAVEPLUS_INFO	2	Support	Support	Support	---	Support	---
SWITCH_BINARY	2	Support	Support	---	Support	---	Support
ASSOCIATION	3	Support	Support	---	Support	---	Support
MULTI_CHANNEL_ASSOCIATION	4	Support	Support	---	Support	---	Support
ASSOCIATION_GRP_INFO	3	Support	Support	---	Support	---	Support
NOTIFICATION	8	Support	Support	---	Support	---	Support
TRANSPORT_SERVICE	2	Support	Support	Support	---	Support	---
VERSION	3	Support	Support	---	Support	---	Support
MANUFACTURER_SPECIFIC	2	Support	Support	---	Support	---	Support
DEVICE_RESET_LOCALLY	1	Support	Support	---	Support	---	Support
INDICATOR	3	Support	Support	---	Support	---	Support
POWERLEVEL	1	Support	Support	---	Support	---	Support
SECURITY	1	Support	Support	Support	---	Support	---
SECURITY_2	1	Support	Support	Support	---	Support	---
SUPERVISION	1	Support	Support	Support	---	Support	---
FIRMWARE_UPDATE_MD	5	Support	Support	---	Support	---	Support
SENSOR_MULTILEVEL - Temperature	11	Support	Support	---	Support	---	Support
CONFIGURATION	4	Support	Support	---	Support	---	Support
APPLICATION STATUS	1	Support	Support	Support	---	Support	---
BASIC COMMAND	2	Support	Support	Support	Support	Support	Support
BATTERY	1	Support	Support	---	Support	---	Support

14.10 Configuration CC

Note: No Bulk Support equals to True. It will return an Application Rejected Request Command when receiving Configuration Bulk Set or Get (if received without Supervision encapsulation). It will reset all its configuration parameters if either manually reset to factory default or receives a Configuration Default Reset Command. It will NOT modify or reset any configuration parameter when being included or excluded of a Z-Wave network

Water Valve - 1				
Parameter No.	0x11 (17)			
Name	Inverse Water Valve Report			
Info	Inverse Switch Binary Report value			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x01 (1)
	Read only	False	Default Value	0x01 (1)
	Altering capabilities	False	Advanced	False
Description	Inverses Switch Binary Report when Water Valve = 0x00 "Valve doesn't let the water run through in Notification and real physical status."			
	Value	Function		
	0x00 (0)	Disable: 0x00 = does not let water run through, 0xFF = let water run through. Based on Configuration CC setting 0x12 & 0x13		
	0x01 (1) * Default Value	Enable: 0x00 = let water run through, 0xFF = does not let water run through Based on Configuration CC setting 0x12 & 0x13		
Parameter No.	0x12 (18)			
Name	Association Group 2 SET Value			
Info	Valve SET Value when receives 0xFF			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x01 (1)
	Altering capabilities	False	Advanced	False
Description	Configure Association Group 2 Basic Set value when Binary Switch Report = 0xFF *(Related to Configuration setting 0x11)			
	Value	Function		
	0x00 (0)	Disable Basic Set (Send nothing)		
	0x01 (1) * Default Value	Basic ON (0xFF)		
	0x02 (2)	Basic OFF (0x00)		

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Water Valve - 2				
Parameter No.	0x13 (19)			
Name	Association Group 2 SET Value			
Info	Valve SET Value when receives 0x00			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x02 (2)
	Altering capabilities	False	Advanced	False
Description	Configure Association Group 2 Basic Set value when Binary Switch Report = 0x00 *(Related to Configuration setting 0x11)			
	Value	Function		
	0x00 (0)	Disable Basic Set (Send nothing)		
	0x01 (1)	Basic ON (0xFF)		
	0x02 (2) * Default Value	Basic OFF (0x00)		

Temperature Sensor - 1				
Parameter No.	0x21 (33)			
Name	Temperature Report Unit			
Info	Configure reporting temperature unit			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x02 (2)
	Altering capabilities	False	Advanced	False
Description	Configure Temperature Unit report. The default Unit is depended on Regional Frequency Setting. (By default, US=°F and EU=°C)			
	Value	Function		
	0x00 (0)	Disable Auto Temperature Report		
	0x01 (1)	Report Celsius °C unit		
	0x02 (2) * Default Value	Report Fahrenheit °F unit		
Parameter No.	0x22 (34)			
Name	Temperature Threshold Change			
Info	Temperature threshold to auto report			
Properties	Size	2 Bytes	Min Value	0x0000 for °C / 0x0100 for °F
	Format	Unsigned Integer	Max Value	0x00FF for °C / 0x01FF for °F
	Read only	False	Default Value	0x0001 = 1°C / 0x0104 = 4 °F
	Altering capabilities	False	Advanced	False
Description	Configure Temperature threshold changed and send auto report			
	Value	Function		
	0x0000 ~ 0x00FF	Higher Byte set to x0 represents Celsius °C unit		
	0x0100 ~ 0x01FF	Higher Byte set to x1 represents Fahrenheit °F unit		

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Temperature Sensor – 2

Parameter No.	0x23 (35)			
Name	Temperature Report Offset			
Info	Configure Temperature Report Offset			
Properties	Size	2 Bytes	Min Value	0x0000 for °C / 0x0100 for °F
	Format	Unsigned Integer	Max Value	0x10FF for °C / 0x11FF for °F
	Read only	False	Default Value	0x0000 = 0°C / 0x0100 = 0 °F
	Altering capabilities	False	Advanced	False
Description	Configure Temperature Offset degree; Higher byte 0x = Positive degree and 1x= Negative degree			
	Value	Function		
	0x0000 ~ 0x10FF	0x0000 ~ 0x00FF, (0 ~ +255); Higher Byte 00 = Positive Celsius "+°C" e.g. 0x0002 = +2°C 0x1000 ~ 0x10FF, (-0 ~ -255); Higher Byte 10 = Negative Celsius "-°C" e.g. 0x0002 = -2°C		
	0x0100 ~ 0x11FF	0x0100 ~ 0x01FF, (0 ~ +255); Higher Byte 01 = Positive Fahrenheit "+°F" e.g. 0x010A = +10°F 0x1100 ~ 0x11FF, (-0 ~ -255); Higher Byte 10 = Negative Fahrenheit "-°F" e.g. 0x110A = -10°F		
Parameter No.	0x24 (36)			
Name	Overheat Trigger Value			
Info	Configure overheat report trigger value			
Properties	Size	2 Bytes	Min Value	0x0000 for °C / 0x0100 for °F
	Format	Unsigned Integer	Max Value	0x00FF for °C / 0x01FF for °F
	Read only	False	Default Value	0x0028=40°C / 0x0168=104 °F
	Altering capabilities	False	Advanced	False
Description	Configure Overheat report trigger value. "Higher byte 0x00 represents Celsius °C unit, 0x01 represents Fahrenheit °F unit			
	Value	Function		
	0x0000 ~ 0x00FF	From 0°C to 255°C		
	0x0100 ~ 0x01FF	From 0°F to 255°F		
Parameter No.	0x25 (37)			
Name	Overheat Recover value			
Info	Configure overheat recover report value			
Properties	Size	2 Bytes	Min Value	0x0000 for °C / 0x0100 for °F
	Format	Unsigned Integer	Max Value	0x00FF for °C / 0x01FF for °F
	Read only	False	Default Value	0x001E = 30°C / 0x0156 = 86°F
	Altering capabilities	False	Advanced	False
Description	Configure Overheat Recover Value			
	Value	Function		
	0x0000 ~ 0x00FF	From 0°C to 255°C		
	0x0100 ~ 0x01FF	From 0°F to 255°F		

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Temperature Sensor – 3

Parameter No.	0x26 (38)			
Name	Association Group 4 Overheat Trigger			
Info	Overheat Trigger SET value			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x00 (0)
	Altering capabilities	False	Advanced	False
	Description			
Configure Overheat Trigger Value in Association Group 4				
	Value	Function		
	0x00 (0) * Default Value	Disable Basic Set (Send nothing)		
	0x01 (1)	Send Basic ON (0xFF)		
	0x02 (2)	Send Basic OFF (0x00)		
Parameter No.	0x27 (39)			
Name	Association Group 4 Overheat Cancel			
Info	Overheat Cancellation SET value			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x00 (0)
	Altering capabilities	False	Advanced	False
	Description			
Configure Overheat Cancellation SET value				
	Value	Function		
	0x00 (0) * Default Value	Disable Basic Set (Send Nothing)		
	0x01 (1)	Send Basic ON (0xFF)		
	0x02 (2)	Send Basic OFF (0x00)		
Parameter No.	0x28 (40)			
Name	Freeze Trigger Value			
Info	Configure Freeze Trigger Report value			
Properties	Size	2 Bytes	Min Value	0x0000 for °C / 0x0100 for °F
	Format	Unsigned Integer	Max Value	0x00FF for °C / 0x01FF for °F
	Read only	False	Default Value	0x0000=0°C / 0x0120=32 °F
	Altering capabilities	False	Advanced	False
	Description			
Configure Freeze Trigger Report Value				
	Value	Function		
	0x0000 ~ 0x00FF	From 0°C to 255°C		
	0x0100 ~ 0x01FF	From 0°F to 255°F		

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Temperature Sensor – 4

Parameter No.	0x29 (41)			
Name	Freeze Recover Value			
Info	Configure Freeze Recover Report Value			
Properties	Size	2 Bytes	Min Value	0x0000 for °C / 0x0100 for °F
	Format	Unsigned Integer	Max Value	0x00FF for °C / 0x01FF for °F
	Read only	False	Default Value	0x0002 = 2°C / 0x0124 = 36 °F
	Altering capabilities	False	Advanced	False
Description	Configure Freeze Recover Report Value			
	Value	Function		
	0x0000 ~ 0x00FF	From 0°C to 255°C		
	0x0100 ~ 0x01FF	From 0°F to 255°F		
Parameter No.	0x2A (42)			
Name	Freeze Detection Valve Control			
Info	Configure Valve Control during freeze			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x01 (1)
	Read only	False	Default Value	0x01 (1)
	Altering capabilities	False	Advanced	False
Description	Enable / Disable Valve Control during Freeze when Water Leak is detected "Detected by built-in temperature sensor. Refer to Configuration CC parameter 0x28 (41) & 0x29 (42)			
	Value	Function		
	0x00 (0)	Ignore / Allowed to control Water Valve during Freeze detection		
	0x01 (1) * Default Value	Forbidden to control Water Valve during Freeze detection		
Parameter No.	0x2B (43)			
Name	Association Group 5 Freeze Trigger			
Info	Configure Freeze Trigger SET value			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x00 (0)
	Altering capabilities	False	Advanced	False
Description	Configure Association Group 5 Freeze Detection Trigger Basic Set value			
	Value	Function		
	0x00 * Default Value	Disable Basic Set (Send nothing)		
	0x01	Basic Set ON (0xFF)		
	0x02	Basic Set OFF (0x00)		

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Temperature Sensor – 5				
Parameter No.	0x2C (44)			
Name	Association Group 5 Freeze Cancel			
Info	Freeze Cancellation SET value			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x00 (0)
	Altering capabilities	False	Advanced	False
Description	Configure Association Group 5 Freeze Detection Cancellation Basic Set value			
	Value	Function		
	0x00 * Default Value	Disable Basic Set (Send nothing)		
	0x01	Basic Set ON (0xFF)		
0x02	Basic Set OFF (0x00)			

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Water Leak				
Parameter No.	0x31 (49)			
Name	Association Group 3 Water Leak Trigger			
Info	Water Leak Trigger SET value			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x01 (1)
	Altering capabilities	False	Advanced	False
Description	Configure Association Group 3 Water Leak Trigger Basic Set value			
	Value	Function		
	0x00 (0)	Disable Basic Set (Send nothing)		
	0x01 (1)	Basic Set ON (0xFF)		
0x02 (2) * Default Value	Basic Set OFF (0x00)			
Parameter No.	0x32 (50)			
Name	Association Group 3 Water Leak Cancel			
Info	Water Leak Cancellation SET value			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x02 (2)
	Read only	False	Default Value	0x00 (0)
	Altering capabilities	False	Advanced	False
Description	Configure Association Group Water Leak Cancellation Basic Set value			
	Value	Function		
	0x00 (0)	Disable Basic Set (Send nothing)		
	0x01 (1)	Basic Set ON (0xFF)		
0x02 (2) * Default Value	Basic Set OFF (0x00)			
Parameter No.	0x33 (51)			
Name	Water Leak Detection Valve Control			
Info	Disable / Enable Water Leak Valve Control			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x01 (1)
	Read only	False	Default Value	0x01 (1)
	Altering capabilities	False	Advanced	False
Description	Disable / Enable Valve Control when Water Leak detected			
	Value	Function		
	0x00 (0)	Disable to control Water Valve when Water Leak is detected		
0x01 (1) * Default Value	Enable to control Water Valve when Water Leak is detected			

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User Interface				
Parameter No.	0x41 (65)			
Name	Buzzer			
Info	Enable / Disable Buzzer			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x01 (1)
	Read only	False	Default Value	0x01 (1)
	Altering capabilities	False	Advanced	False
Description	Enable / Disable Built-in Buzzer Sound			
	Value	Function		
	0x00 (0)	Disable Buzzer		
	0x01 (1) * Default Value	Enable Buzzer		
Parameter No.	0x42 (66)			
Name	LED Brightness Level			
Info	Configure LED Brightness Level			
Properties	Size	1 Byte	Min Value	0x00 (0%)
	Format	Unsigned Integer	Max Value	0x63 (99%)
	Read only	False	Default Value	0x50 (80%)
	Altering capabilities	False	Advanced	False
Description	Configure Built-in LED Brightness Level			
	Value	Function		
	0x00 ~ 0x63	0% ~ 99%		
Parameter No.	0x43 (67)			
Name	Touch Keylock Protection			
Info	Disable / Enable Touch Keylock Protection			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Enumerated	Max Value	0x01 (1)
	Read only	False	Default Value	0x01 (0)
	Altering capabilities	False	Advanced	False
Description	Disable / Enable Touch Keylock Protection			
	Value	Function		
	0x00 (0) * Default Value	Disable Keylock Protection		
	0x01 (1)	Enable Keylock Protection		

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Notification Report				
Parameter No.	0x51 (81)			
Name	Notification Report Lifeline			
Info	Configure Notification Report (Bitmask)			
Properties	Size	1 Byte	Min Value	0x00 (0)
	Format	Bit Field	Max Value	0x0F (15)
	Read only	False	Default Value	0x0D (13)
	Altering capabilities	False	Advanced	False
Description	Configure Notification Report in Association Group 1 Lifeline "Set Bit to 0 = Disable, Set Bit to 1 = Enable"			
	Value	Function		
	Bit 0	Water Valve Open / Close – 0 = Disable / *1 = Enabled		
	Bit 1	Overheat Detection – *0=Disable / 1=Enable		
	Bit 2	Freeze Detection – 0=Disable / *1 = Enable		
Bit 3	Local Water Leak Sensor Probe Detection – 0=Disable / *1=Enable			

14.11 SmartStart Labeling

BVS comes with PIN Code, DSK string and QR Code for SmartStart and as shown in the examples below. The real QR Code can be found on product and package.

- PIN Code with QR Code on BVS's housing.

SmartStart



Pin Code: 12345



DSK: 12345-xxxxx-xxxxx-xxxxx-xxxxx-xxxxx-xxxxx-xxxxx

DSK String with QR Code on Packing, the first 5 digits is PIN code for SmartStart use.

15 APPENDIX

Terminology, all events and operations details including action key event, LED and Buzzer status.

15.1 Z-Wave Terminology

Z-Wave Functionality	Documentation Terminology	Description
Inclusion	Add	The process of adding a node to Z-Wave Network
Exclusion	Remove	The process of removing a node from Z-Wave Network

15.2 System Event Status

Event	Detail	LED	Buzzer
System Ready	BVS is Ready to operate after power on or reset.	Green LED ON 2 seconds	2 beep sounds
Standalone mode heartbeat	Standalone Heartbeat without network connection	Yellow LED blinking	---
Network mode heartbeat	Mesh Network Mode Heartbeat	Green LED slow blinking	---
Event Success	Finished operation and success	Green LED ON 2 seconds	Short beep x 2
Event Error	Operation fail or not available	RED LED blinking 3 times	Long beep x 3
Event Timeout	Operation timeout	RED LED ON	1" Pulse sound

15.3 Touch Sense Button Keylock

Event	Action / Status	Key Action	LED Status	Buzzer Status
Keylock Enable	Enable Lock Key Function	Long hold with 3 beep sounds& click 3 times	Yellow LED ON 1 second Red LED ON 1 second	Long beep x 1
	Success – “In Mesh Network Mode”	---	Yellow LED slow blinking	---
	Success – “In Standalone Mode”	---	Yellow LED blinking	---
Keylock Disable	Disable Lock Key Function	Long hold with 3 beep sounds& click 3 times	Yellow LED blinking	Long beep x 3
	Success – “In Mesh Network Mode”	---	Green LED slow blinking	---
	Success – “In Standalone Mode”	---	Yellow LED blinking	---

15.4 Operation Mode

Operation Mode	Function	Description	Action Key		Operation Support	
			Long	Short	Standalone	Network
Z-Wave Network	SmartStart	Re-power up the BVS unit	---	---	Support	Not Support
	Classic Inclusion	Add into Z-Wave Mesh Network	---	3	Support	Not Support
	Exclusion	Remove from Z-Wave Network	---	3	Support	Support
	OTA	Firmware upgrade Over The Air	---	---	Not Support	Support
	Factory Reset	Perform Device Reset Locally	10	5	Support	Support
Water Valve Manual Operation	Open	Control water valve to full open	---	1	Support	Support
	Close	Control water valve to full close	---	1	Support	Support
	Pause	Pause only works during open/close operation	---	1	Support	Support
	Resume	Resume to previous during Pause operation	---	1	Support	Support
	Auto-calibration	Perform calibrate position and torque force	5	5	Support	Support
Water Leak Alarm	Trigger to close valve	Auto close water valve	---	1	Support	Support
	Alarm Cancellation	Resume to normal operation mode if no alarm triggered	2	---	Support	Support

15.5 Network Operation & Status

Event	Action / Status	Key Action	LED Status	Buzzer Status
SmartStart	To be ready after Power Okay Event	---	Green LED ON 2 seconds	2 beep sounds
	Enter SmartStart and Processing	---	Yellow LED keep blinking	Keep short beep
	Success	---	Green LED ON 1 second	Short beep x 2
	Next status	---	Green LED slow blinking	---
Manual INCLUSION	Start Manual INCLUSION	Click 3 times	Green LED ON 1 second	1" Pulse sound
	Processing	---	Yellow LED keep blinking	Keep short beep
	Success	---	Green LED ON 1 second	Short beep x 2
	Next status	---	Green LED slow blinking	---
EXCLUSION	Start EXCLUSION	Click 3 times	Green LED ON 1 second	1" Pulse sound
	Processing	---	Yellow LED keep blinking	Keep short beep
	Success	---	Green LED ON 1 second	Short beep x 2
	Next status	---	Green LED slow blinking	---
Firmware Upgrade (OTA)	Start → Triggered by Gateway	---	Green LED ON 1 second	1" Pulse sound
	Processing	---	Green & RED LED blinking	Keep short beep
	Success → Waiting SOFT REBOOT	---	LED OFF 10 seconds	Silence 10 seconds
	Next status (Power Okay→FINISHED)	---	Green LED ON 2 seconds	2" Pulse sound
Factory Reset "Device Reset Locally"	Start Factory Reset	Long hold with 10 beep sounds & click 5 times	Yellow LED ON 1 second	---
	Success	---	Green LED ON 2 seconds	2" Pulse sound
	Next status → Standalone Mode	---	Yellow LED keep blinking	---

15.6 Water Valve Operation & Status

Event	Action / Status	Key Action	LED Status	Buzzer Status
OPEN Valve	Start OPEN (Valve in closed position)	Short Click 1 time	Yellow LED keep blinking	---
	Processing	---	Yellow LED keep blinking	Keep short beep
	Success	---	Green LED ON 1 second	Short beep x 2
	Next status (In Network Mode)	---	Green LED slow blinking	---
	Next status (In Standard Mode)	---	Yellow LED slow blinking	---
CLOSE Valve	Start CLOSE (Valve in opened position)	Click 1 time	Green LED ON 1 second	1" Pulse sound
	Processing	---	Yellow LED keep blinking	Keep short beep
	Success	---	Green LED ON 1 second	Short beep x 2
	Next status (In Network Mode)	---	Green LED slow blinking	---
	Next status (In Standard Mode)	---	Yellow LED slow blinking	---
PAUSE Operation	Start PAUSE "Only available during Open/Close operation"	Click 1 time	Yellow LED ON 1 second Red LED ON 1 second	1" Pulse sound
	Processing – "In Network Mode"	---	Yellow LED slow blinking	---
	Next status – "In Network Mode"	---	Green LED keep blinking	---
	Processing – "In Standalone Mode"	---	Yellow LED keep blinking	---
	Next status – "In Standalone Mode"	---	Yellow LED keep blinking	---
RESUME Operation	Start RESUME "Only available during Open/Close operation"	Click 1 time	Green LED ON 1 second	Short beep x 3
	Next Status – Return Open/Close	---	Yellow/Green LED blinking	Keep short beep
Manual Calibration	Start Manual Calibration	Long hold with 5 beep sounds & click 5 times	---	---
	Processing – Open & Close 1-2 cycles	---	Yellow LED keep blinking	Keep short beep
	Next status – "In Network Mode"	---	Green LED slow blinking	---
	Next status – "In Standalone Mode"	---	Yellow LED keep blinking	---

15.7 Water Leak Alarm Operation & Status

Event	Action / Status	Key Action	LED Status	Buzzer Status
Leak Sensor Probe Triggered	Start Water Leak Alarm	---	RED LED fast blinking	Fast beep sound
	Processing – Close Water Valve automatically	---	RED LED fast blinking	Fast beep sound
Leak Alarm Cancellation	Alarm Cancellation	Long hold with 2 beep sounds	Green LED blinking 2 times	Short beep x 2
	Success cancellation	---	Green LED blinking 3 times	Short beep x 3
	Next status – “In Network Mode”	---	Green LED slow blinking	---
	Next status – “ <u>In Standalone Mode</u> ”	---	Yellow LED blinking	---

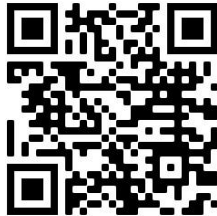
15.8 Patents

CN Patent: ZL 2019 1 0505506.0

US Patent: US 10,995,876 B2

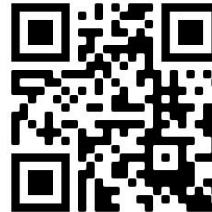
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