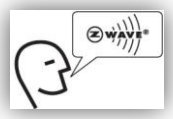

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Applicable Products: AC1-ZW, DC1-ZW

Introduction

This manual describes the supported Z-Wave™ command classes and their usage for the Shades In Motion Z-Wave™ motor controller family. The intended audience is Z-Wave™ installers and programmers. Physical dimensions and installation information can be found in the Installation Manuals. Information on detailed Z-Wave™ class protocols can be found in Zensys document SDS10242 *Z-Wave Device Class Specification*. These devices implement rich support for horizontal blinds with tilt, and tilt only shades. Because this functionality is not currently supported by the Z-Wave™ command classes, the implementation is complex and is more thoroughly described in a separate application note.

The Shades In Motion Z-Wave™ Motor Controller Family of devices is fully interoperable with other devices bearing the Z-Wave™ logo. Our controllers are designed to be always powered and listening, and will function as repeaters in any Z-Wave™ network of devices.

Hardware

Both the AC1-ZW and DC1-ZW support a single motor. The motor can be activated or deactivated via the OPEN and CLOSE buttons labeled on the devices, or through Z-Wave™ commands. The controllers also have a connector designed for use with a drywall flush-mount temperature sensor, and are able to report temperatures back to a controller through the network. Window covering tilt is supported through a special pulsed level change function which can be set via configuration commands.

Each device has a single status LED which reports status information as described in the installation manual. The LED illuminates briefly when a Z-Wave™ command is received which is directed at the unit. This may be disabled by means of a configuration command described later.

The configuration of the unit, as well as calibration data and the last known position of the motor, will not be lost when the unit is reset due to a power interruption. Setting the unit back to the factory defaults, which can be done manually (by holding down the inclusion button while powering up the unit), or through a Z-Wave configuration command, will not remove the unit from a network.

These units employ an auto-calibration feature in order to precisely set and report the motor position. The calibration sequence can be initiated either manually or through a Z-Wave™ command. Commands which instruct the unit to move to a position at the limit of its travel will perform properly even if the unit is not calibrated. However commands which instruct the unit to move to an intermediate position will have no effect when the unit is uncalibrated.

Z-Wave Supported Classes and Behavior

The devices report themselves as Z-Wave™ slave nodes with generic support as a multilevel switch and specific support as a multiposition motor. All command classes supported are version 1 unless otherwise specified. All motor positions are stated as a percentage of fully opened. The supported command classes are:

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COMMAND_CLASS_BASIC
COMMAND_CLASS_SWITCH_MULTILEVEL
COMMAND_CLASS_SWITCH_ALL
COMMAND_CLASS_NODE_NAMING
COMMAND_CLASS_SCENE_ACTIVATION
COMMAND_CLASS_PROPRIETARY
COMMAND_CLASS_CONFIGURATION
COMMAND_CLASS_MANUFACTURER_SPECIFIC
COMMAND_CLASS_VERSION
COMMAND_CLASS_SENSOR_MULTILEVEL
COMMAND_CLASS_SCENE_ACTUATOR_CONF

For each command described which initiates motor movement, the following protocol is observed:

- If the motor is stopped, motion will start in the specified direction.
- If the motor is moving to a position, an additional command directing the motor to the same position will be ignored.
- If the motor is moving to a position, any command directing the motor to a position other than the current destination will cause the motor to briefly stop, then continue in the requested direction to the final position.
- Movement commands to a position other than 0 or 99 will be ignored if the unit is not calibrated.

Command Classes

COMMAND_CLASS_SENSOR_MULTILEVEL

A temperature sensor input is provided on the AC1-ZW and DC1-ZW. The unit will automatically detect the presence of the sensor and report this via a configuration parameter. The sensor value is updated internally every 30 seconds. More frequent queries of the sensor value will not yield additional results.

The precision in the sensor value is set to 0 for Fahrenheit values, and 1 for Celsius values, meaning that a sensor value of 70 when set to the Fahrenheit scale means “70 degrees F” while “203” when set to the Celsius scale means “20.3 degrees C”. Note that the accuracy of the value is dependent on the accuracy of the sensor itself. A configuration parameter is available which allows a linear offset to be applied to the sensor value. This allows for fine tuning the calibration of the sensor in the field.

A number of configuration parameters are available to control the behavior of the sensor. Please see the configuration class below. See the *Z-Wave™ Device Class Specification* for more details on the multilevel sensor command format.

COMMAND	VALUE	BEHAVIOR
SENSOR_MULTILEVEL_GET	-	Request a report. No parameters.
SENSOR_MULTILEVEL_REPORT	Type Precision Scale/Size Value	1 = Temperature See note above 0 = Celsius, 1 = Fahrenheit[1] 16 bit signed temperature value

[1]Fahrenheit is the factory default

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COMMAND_CLASS_BASIC

COMMAND	VALUE	BEHAVIOR
BASIC_SET	0 1-98 99,255	Move motor to the fully closed position Move motor to this percentage open[1] Move motor to the fully opened position[1]
BASIC_GET	-	Request a report. No parameters.
BASIC_REPORT	0 1-98, 99 255	Motor is at the fully closed position Motor is at this percentage open Motor is at the fully opened position Motor position is unknown[2]

[1]A SET command with values 1-99 will have no effect unless the unit is calibrated
[2]Motor position may be unknown if the unit is not calibrated

COMMAND_CLASS_SWITCH_MULTILEVEL

COMMAND	VALUE	BEHAVIOR
SWITCH_MULTILEVEL_SET	0 1-98 99,255	Move motor to the fully closed position Move motor to this percentage open[1] Move motor to the fully opened position[1]
SWITCH_MULTILEVEL_GET	-	Request a report. No parameters.
SWITCH_MULTILEVEL_REPORT	0 1-98, 99 255	Motor is at the fully closed position Motor is at this percentage open Motor is at the fully opened position Motor position is unknown[2]
SWITCH_MULTILEVEL_START_LEVEL_CHANGE	Bit 6: 0 1	All bits ignored except bit 6: Move motor to the fully opened position[3] Move motor to the fully closed position[3]
SWITCH_MULTILEVEL_STOP_LEVEL_CHANGE	-	Stop motor movement

[1]A SET command with values 1-99 will have no effect unless the unit is calibrated
[2]Motor position may be unknown if the unit is not calibrated
[3]See important additional information affecting this command in the configuration command class

COMMAND_CLASS_MANUFACTURER_SPECIFIC

COMMAND	PARAM	EXPECTED VALUES (16 bit)
MANUFACTURER_SPECIFIC_GET	-	Request a report. No parameters.
MANUFACTURER_SPECIFIC_REPORT	Mfgr ID Type ID Prod ID	0x0065 Shades In Motion 0x0001 Single Motor 0x0001 Model DC1-ZW 0x0002 Model AC1-ZW

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COMMAND_CLASS_SWITCH_ALL

COMMAND	VALUE	BEHAVIOR
SWITCH_ALL_SET	0 1 2 255	Disable SWITCH_ALL_ON and SWITCH_ALL_OFF commands Disable SWITCH_ALL_ON command Disable SWITCH_ALL_OFF command Enable SWITCH_ALL_ON and SWITCH_ALL_OFF commands
SWITCH_ALL_GET	-	Request a report. No parameters.
SWITCH_ALL_REPORT	0 1 2 255	SWITCH_ALL_ON and SWITCH_ALL_OFF commands are disabled SWITCH_ALL_ON command is disabled SWITCH_ALL_OFF command is disabled SWITCH_ALL_ON and SWITCH_ALL_OFF commands are enabled
SWITCH_ALL_ON	-	Move motor to the fully opened position[1,2,3]
SWITCH_ALL_OFF	-	Move motor to the fully closed position[1,2,4]

[1]If not disabled by SWITCH_ALL_SET
[2]Factory default is SWITCH_ALL_ON and SWITCH_ALL_OFF disabled
[3]SWITCH_ALL_ON will move motor open when set to factory defaults. Reversible via configuration parameter.
[4]SWITCH_ALL_OFF will move motor closed when set to factory defaults. Reversible via configuration parameter.

COMMAND_CLASS_NODE_NAMING

Assigns a user defined name and/or location for the device, up to 16 characters (8 characters if UTF-16 encoding is selected). Character encoding can be set as described in the *Z-Wave™ Device Class Specification* document.

COMMAND	VALUE	BEHAVIOR
NODE_NAMING_NODE_NAME_SET	<Name>	Set a name for this node. Size inferred from frame
NODE_NAMING_NODE_NAME_GET	-	Request a report. No parameters.
NODE_NAMING_NODE_NAME_REPORT	<Name>	Get name of up to 16 characters
NODE_NAMING_NODE_LOCATION_SET	<Name>	Set a location for this node. Size inferred from frame
NODE_NAMING_NODE_LOCATION_GET	-	Request a report. No parameters.
NODE_NAMING_NODE_LOCATION_REPORT	<Name>	Get location name of up to 16 characters

COMMAND_CLASS_VERSION

COMMAND	PARAM	EXPECTED VALUES (8 bit)
VERSION_GET	-	Request a report. No parameters.
VERSION_REPORT	Type <value> <value> <value> <value>	4 - Device is a Z-Wave™ Basic Slave Z-Wave™ Protocol Version – Varies Z-Wave™ Protocol Sub-Version - Varies Application Version - Varies Application Sub-Version - Varies
VERSION_COMMAND_CLASS_GET	Class	As Specified in the Device Class Specification

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COMMAND_CLASS_SCENE_ACTUATOR_CONF

This class associates a scene number with a motor position. The scene number can then be subsequently used with the Scene Activation command class. Using these two classes, it is possible to activate a group of diverse devices using one multicast, avoiding the uncomfortable "popping" effect which can occur when each node is sent a singlecast.

Scenes are numbered from 1 – 255. The AC1-ZW and DC1-ZW support 16 simultaneous scenes. As additional scenes over 16 are stored to the device, the earliest stored scene is erased. Setting the unit to factory default settings will erase all scenes.

COMMAND	PARAM	VALUE	BEHAVIOR
SCENE_ACTUATOR_CONF_SET	1	1-255	Scene number
	2	-	Ignored
	3	Bit 7:	All bits ignored except bit 7:
		0	Associate scene with current motor position[1]
		1	Associate scene with position in parameter 4
	4	0-99	Position – Ignored if param 3 bit 7 is 0
SCENE_ACTUATOR_CONF_GET	1	0	Request active scene number and position
		1-255	Request position associated with scene number
SCENE_ACTUATOR_CONF_REPORT	1	0	No scene is currently "active" in the unit
		1-255	Scene number
	2	0-99	Motor position associated with requested scene
		255	Requested scene is not programmed into unit
	3	-	Ignored

[1]Ignored if the unit is not calibrated

COMMAND_CLASS_SCENE_ACTIVATION

This class launches the specified scene in the device, i.e., moves the motor to the position previously specified by the SCENE_ACTUATOR_CONF_SET command. This command should be sent as a multicast followed by a sequence of singlecasts which address each device to be activated. A scene is "active" when set with SCENE_ACTIVATION_SET and no other movement command has occurred.

COMMAND	PARAM	VALUE	BEHAVIOR
SCENE_ACTIVATION_SET	1	1-255	Scene number[1]
	2	-	Ignored

[1]Ignored if the unit is not calibrated or if the scene has not been programmed into unit

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COMMAND_CLASS_CONFIGURATION

Configuration parameters are sent and received with a parameter number, size and value.

To set a single parameter to its factory default state, send a CONFIGURATION_SET specifying the parameter and a size field having bit 7 set. If bit 7 is set, all other CONFIGURATION_SET fields will be ignored.

To set all parameters to their factory default state, send a CONFIGURATION_SET command for parameter 0, with a size parameter of 129 and a single value of 85. Only one value is necessary – do not send an array of 129 elements.

Factory default settings are: Unit not calibrated, motor direction "normal", maximum run time = 60 seconds, Z-Wave LED flash enabled, sensor type to WIND, sensor offset 0, sensor not present, SWITCH_ALL functionality disabled, SWITCH_ALL_ON opens the motor, tilt pulsing disabled, pulse ON time and tilt speed = 5, tilt resolution unset, all scenes erased, and node name blank.

Changing a configuration setting will stop any motor movement.

COMMAND: CONFIGURATION_SET

PARAM	SIZE	VALUE	BEHAVIOR
0	129	85	Reset all parameters to factory defaults
1	1	1	Initiate the auto-calibration sequence
2	1	0	Set motor direction to "normal"[1,2]
		1	Set motor direction to "swapped"[1,2]
3	1	60-127	Maximum motor run time in seconds[3]
4	1	0	Disable LED flash upon receipt of Z-Wave™ command
		1	Enable LED flash upon receipt of Z-Wave™ command
5	1	0	Set sensor temperature scale to Celsius
		1	Set sensor temperature scale to Fahrenheit
		2	Set sensor type to SUN[11]
		3	Set sensor type to WIND[11]
6	1	-20 - +20	Offset the temperature result by -20% to +20%[4]
8	1	0	SWITCH_ALL_ON opens motor[5]
		1	SWITCH_ALL_ON closes motor[5]
9	1	0 – 99	Set the number of pulses in a level change command[6,9]
10	1	5 – 40	Set the motor ON time of each pulse, if parameter 9 non-zero[7,8,9]
12	1	5 – 40	Set the tilt speed when using the proprietary counted tilt mode[8,9]
13	1	1 – 254	Tilt resolution[9,10]
		255	Set tilt resolution to "unset" state[9,10]

[1]Unit becomes uncalibrated after receiving this command
[2]Use this parameter if the unit is installed with the motor connections swapped
[3]Limits motor run time as a safety feature. If the value is set above 60, this should be done prior to calibration
[4]Sensor calibration adjustment. Not necessary under normal circumstances
[5]Changes the directional sense of the SWITCH_ALL activation commands.

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[6]When a SWITCH_MULTILEVEL_START_LEVEL_CHANGE command is received, if this parameter is non-zero, the motor will switch briefly on, then off. This parameter specifies the number of times this cycle is repeated and is used to slow the motion of the motor so that a user can make fine manual adjustments to the motor position (as is necessary for a tilt function in horizontal blinds). After the specified number of pulses is complete, the motor will activate continuously (without pulsing) until stopped by a STOP_LEVEL_CHANGE command or the motor reaches full travel.
[7]Sets the length of each pulse, and therefore controls the degree of fine adjustment which can be accomplished during a level change when parameter 9 is non-zero, and also for tilting when using the proprietary counted tilt mode.
[8]Time is in 10ms units. So for example, a value of 15 is 150ms.
[9]An application note exists on tilt implementation which describes these configuration parameters in more detail.
[10] This parameter enables the unit to report the current tilt position (see configuration parameter 14 below). The value to set is the number of discreet positions that the unit may be stopped at as it moves from no tilt to full tilt. If set, unit will count tilt position from 0 (no tilt, shade closed) to n (full tilt, shade opened). There is no way to automatically calibrate the unit to derive this value, it must be observed and manually set at the time of installation.
[11]Converts the sensor port into a unidirectional contact closure port. When set to "SUN" and a contact closure is received, the unit will immediately fully close. When set to "WIND" and a contact closure is received, the unit will immediately fully open.

COMMAND: CONFIGURATION_REPORT (sent in response to CONFIGURATION_GET)

PARAM	SIZE	VALUE	BEHAVIOR
1	1	0	Unit is not calibrated[1]
		1	Unit is calibrated
2	1	0	Motor direction is "normal"[1]
		1	Motor direction is "swapped"
3	1	60-127	Maximum motor run time in seconds (default = 60)
4	1	0	LED flash upon receipt of Z-Wave™ command is disabled
		1	LED flash upon receipt of Z-Wave™ command is enabled[1]
5	1	0	Temperature scale set to Celsius
		1	Temperature scale set to Fahrenheit[1]
		2	Sensor type is SUN
		3	Sensor type is WIND[1]
6	1	-20 - +20	Percentage of offset in temperature reading
7	1	0	Sensor is not present[1,2]
		1	Sensor is present[2]
8	1	0	SWITCH_ALL_ON opens motor[1]
		1	SWITCH_ALL_ON closes motor
9	1	0	Pulsed level change (for manual tilt) disabled[1,5]
		1 - 99	The number of pulses in a level change command[5]
10	1	5 - 40	The motor ON time of each pulse[3,4,5]
11	1	1	Reserved
12	1	5 - 40	Tilt speed for counted (proprietary) tilt mode[3,4,5]
13	1	1 - 254	Tilt resolution[5]
		255	Tilt resolution unset[5]
14	1	0 - (n-1)	Current value of tilt position[5]. n = Value set in parameter 13
15	2	1 - 65535	Calibration Time to fully open shade, 65535 = uncalibrated[3]
16	2	1 - 65535	Calibration Time to fully close shade, 65535 = uncalibrated[3]

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[1]Factory default setting
[2]Updated every 30 seconds
[3]Values are 10ms units
[4] The factory default setting is 5. Used for both manual and counted (proprietary) tilt modes
[5]An Application Note exists on tilt implementation which describes these parameters in more detail

COMMAND_CLASS_PROPRIETARY - COUNTED TILT

This command is used because the Z-Wave™ command classes currently have no approved way to implement tilt. The PROPRIETARY_SET command will pulse the motor n times in the specified direction, then stop. n is specified in Bits 5 - 0 of the second byte of the command. Note that this set command can also be used to stop the tilt process by setting the high bit of the second byte.

Several configuration parameters affect the operation of this command, including 10, 12, 13 and 14. Note that this form of tilt, also referred to as "counted tilt", will work on uncalibrated units, and does not require configuration parameter 9 to be nonzero.

COMMAND	PARAM	VALUE	BEHAVIOR
PROPRIETARY_SET	1 2	224 Bit 7 Bit 6 Bits 5 - 0	Must always be 224 If set, stop movement, other bits ignored 0 = OPEN, 1 = CLOSE Number of tilt cycles (pulses) to move, 63 max[1]

[1]Zero is ignored