1. Managing the PE653 as a Z-Wave device

The PE653, as a Z-Wave certified device, is completely manageable via its Z-Wave command class implementation. The PE653 is, by implementation a Z-Wave device which is built upon the Generic Device type of SWITCH BINARY and the Specific device type of Binary Power Switch. It supports the following list of Z-Wave command classes.

Z-Wave Command Class	Command Class Version	Number of instances
POWERLEVEL	1	1
MANUFACTURER_SPECIFIC	1	1
VERSION	1	1
CLOCK	1	1
MULTI_INSTANCE	1	1
CONFIGURATION	1	1
ASSOCIATION	1	1
SWITCH_BINARY	1	5
SWITCH_ALL	1	1
THERMOSTAT_SETPOINT	1	1
SENSOR_MULTILEVEL	1	1

All command classes are fully Z-Wave compliant as per Version 7 of the Z-Wave Command Class Specification. Command Class specific qualifiers to support are listed below.

1.1. CLOCK Command Class

The CLOCK command Class is fully supported as documented in the Z-Wave Command Class Specification for support of a 24-hour clock. The PE653 does not support weekday settings.

1.2. MULTI-INSTANCE Command Class

The MULTI-INSTANCE command Class is fully supported as documented in the Z-Wave Command Class Specification for support for managing the five instances of the SWITCH_BINARY command class.

1.3. CONFIGURATION Command Class

The CONFIGURATION command Class is fully supported as documented in the Z-Wave Command Class Specification for the following configuration parameters. The 'CC Parameter Number 'value'' in the table below is the value used to populate the 'parameterNumber' byte of the Configuration Command Class packet. The Configuration Report messages received from the PE653 will be identical in format to the Set messages with the exception of the 'cmd' byte being 'REPORT' instead of 'SET'.

Configuration CC Parameter Number 'name'	**CC Parameter Number 'value'**	**Description**
PE653 OPERATION MODE	*0x01*	
FIREMAN_TIMEOUT	*0x02*	Used to Disable, enable and set fireman cool down durations for preventing heater over heating.
TEMP_CALIBRATION_OFFSETS	*0x03*	Sets temperature offsets which will then be applied to the actual pool and/or spa temperature measured by the PE653.
CIR_1_EV_SCHED_1	*0x04*	Used to set or clear the 1st of three possible ON/OFF activation schedules for Circuit-1
CIR_1_EV_SCHED_2	*0x05*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for Circuit-1

CIR_1_EV_SCHED_3	*0x06*	Used to set or clear the 3rd[t] of three possible ON/OFF activation schedules for Circuit-1
CIR_2_EV_SCHED_1	*0x07*	Used to set or clear the 1st of three possible ON/OFF activation schedules for Circuit-2
CIR_2_EV_SCHED_2	*0x08*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for Circuit-2
CIR_2_EV_SCHED_3	*0x09*	Used to set or clear the 3rd[t] of three possible ON/OFF activation schedules for Circuit-2
CIR_3_EV_SCHED_1	*0x0A*	Used to set or clear the 1st of three possible ON/OFF activation schedules for Circuit-3
CIR_3_EV_SCHED_2	*0x0B*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for Circuit-3
CIR_3_EV_SCHED_3	*0x0C*	Used to set or clear the 3rd[t] of three possible ON/OFF activation schedules for Circuit-3
CIR_4_EV_SCHED_1	*0x0D*	Used to set or clear the 1st of three possible ON/OFF activation schedules for Circuit-4
CIR_4_EV_SCHED_2	*0x0E*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for Circuit-4
CIR_4_EV_SCHED_3	*0x0F*	Used to set or clear the 3rd[t] of three possible ON/OFF activation schedules for Circuit-4
CIR_5_EV_SCHED_1	*0x10*	Used to set or clear the 1st of three possible ON/OFF activation schedules for Circuit-5
CIR_5_EV_SCHED_2	*0x11*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for Circuit-5
CIR_5_EV_SCHED_3	*0x12*	Used to set or clear the 3rd[t] of three possible ON/OFF activation schedules for Circuit-5
POOL_SPA_SUPPORT_MODE	*0x13*	Used to select whether the PE653 is controlling a POOL only, SPA only or both POOL and SPA
VSP_SPD_SETTING_1	*0x20*	Used to set the variable speed pumps 1st activation speed (VSP Speed 1)
VSP_SPD_SETTING_2	*0x21*	Used to set the variable speed pumps 2nd activation speed (VSP Speed 2)
VSP_SPD_SETTING_3	*0x22*	Used to set the variable speed pumps 3rd activation speed (VSP Speed 3)
VSP_SPD_SETTING_4	*0x23*	Used to set the variable speed pumps 4th activation speed (VSP Speed 4)
VSP_SPD_1_EV_SCHED_1	*0x24*	Used to set or clear the 1st of three possible ON/OFF activation schedules for VSP Speed 1
VSP_SPD_1_EV_SCHED_2	*0x25*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for VSP Speed 1
VSP_SPD_1_EV_SCHED_3	*0x26*	Used to set or clear the 3rd of three possible ON/OFF activation schedules for VSP Speed 1
VSP_SPD_2_EV_SCHED_1	*0x27*	Used to set or clear the 1st of three possible ON/OFF activation schedules for VSP Speed 2
VSP_SPD_2_EV_SCHED_2	*0x28*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for VSP Speed 2
VSP_SPD_2_EV_SCHED_3	*0x29*	Used to set or clear the 3rd of three possible ON/OFF activation schedules for VSP Speed 2
VSP_SPD_3_EV_SCHED_1	*0x2A*	Used to set or clear the 1st of three possible ON/OFF activation schedules for VSP Speed 3
VSP_SPD_3_EV_SCHED_2	*0x2B*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for VSP Speed 3

VSP_SPD_3_EV_SCHED_3	*0x2C*	Used to set or clear the 3rd of three possible ON/OFF activation schedules for VSP Speed 3
VSP_SPD_4_EV_SCHED_1	*0x2D*	Used to set or clear the 1st of three possible ON/OFF activation schedules for VSP Speed 4
VSP_SPD_4_EV_SCHED_2	*0x2E*	Used to set or clear the 2nd of three possible ON/OFF activation schedules for VSP Speed 4
VSP_SPD_4_EV_SCHED_3	*0x2F*	Used to set or clear the 3rd of three possible ON/OFF activation schedules for VSP Speed 4
VSP_MAX_PUMP_SPEED	*0x31*	Used to set the MAXIMUM speed the 4 VSP speeds can be set to.
FREEZE_CONTROL	*0x32*	Used to enable or disable freeze control support at the PE653

1.1.1. PE653 Operation Mode (0x01)

The PE653 has several settings that modify the PE653 circuit behaviors and inter-dependencies. These settings and modes are defined in detail in the User manual. You may use this Configuration parameter to set these modes. To set the mode set the mode of operation, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to 0x01
- The 'level' byte set to two (2), e.g., a two byte value being sent
- The 'configurationValue1' byte set to the circuit or variable speed pump speed to activate when the Cleaner/Booster pump needs to be active. The valid settings for this field are one of the following.

Circuit or pump speed to use for Booster/Cleaner operation	**'configurationValue1'**
Booster/Cleaner Functionality not supported	0x01
Circuit-1 used for Booster/Cleaner	0x02
Variable Speed pump Speed-1 used for Booster/Cleaner	0x03
Variable Speed pump Speed-2 used for Booster/Cleaner	0x04
Variable Speed pump Speed-3 used for Booster/Cleaner	0x05
Variable Speed pump Speed-4 used for Booster/Cleaner	0x06

- The 'configurationValue2' byte is used to indicate the following two pieces of information.
  - Whether the installed pump is a one or two speed pump
  - Whether the Booster/Cleaner is installed or not

The valid setting for this field is the combination (logical ORing) of these two pieces of information. This field can have the following values applied to it.

Installed Pump Type	**Booster/Cleaner Installed**	**'configurationValue2'**
One Speed	NO	0x00
One Speed	YES	0x01
Two Speed	NO	0x02
Two Speed	YES	0x03

1.1.2. PE653 Fireman Timeout (0x02)

The PE653 allows the user to configure whether there is a fireman cool down period associated with an attached heater (circuit 5) and if there is, how long the cool down period will be. You may use this Configuration parameter to set these modes. To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to 0x02
- The 'level' byte set to one (1), e.g., a one byte value being sent
- The 'configurationValue1' byte set to one of the following.

Fireman state and timeout to be applied	'configurationValue1'
Fireman Disabled (no heater installed)	0xFF
Fireman Enabled (heater installed) with no cool down period	0x00
Fireman Enabled (heater installed) with cool down period = 1 minute	0x01
Fireman Enabled (heater installed) with cool down period = 2 minute	0x02
Fireman Enabled (heater installed) with cool down period = 3 minute	0x03
Fireman Enabled (heater installed) with cool down period = 4 minute	0x04
Fireman Enabled (heater installed) with cool down period = 5 minute	0x05
Fireman Enabled (heater installed) with cool down period = 6 minute	0x06
Fireman Enabled (heater installed) with cool down period = 7 minute	0x07
Fireman Enabled (heater installed) with cool down period = 8 minute	0x08
Fireman Enabled (heater installed) with cool down period = 9 minute	0x09
Fireman Enabled (heater installed) with cool down period = 10 minute	0x0A
Fireman Enabled (heater installed) with cool down period = 11 minute	0x0B
Fireman Enabled (heater installed) with cool down period = 12 minute	0x0C
Fireman Enabled (heater installed) with cool down period = 13 minute	0x0D
Fireman Enabled (heater installed) with cool down period = 14 minute	0x0E
Fireman Enabled (heater installed) with cool down period = 15 minute	0x0F

1.1.3. PE653 Temperature Calibration Offsets (0x03)

The PE653 allows the user to configure whether or not temperature compensation should be applied to the actual temperatures read for the air temp and/or water temperature. You may wish to apply an offset to have the PE653 temperature readings match those of a different device or thermometer. To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to 0x03
- The 'level' byte set to four (4), e.g., a four byte value being sent
- The '**configurationValue1'** byte sets the amount of compensation you wish to apply to the actual water (pool/spa) reading taken by the PE653. This value is an offset in degrees Fahrenheit and may have the value of -20F to +20F (in 1 degree increments), inclusive. Only whole number offsets are allowed. A setting of zero results in NO offset being applied.
- The '**configurationValue2'** byte sets the amount of compensation you wish to apply to the actual Air (freeze protection) reading taken by the PE653. This value is an offset in degrees Fahrenheit and may have the value of -20F to +20F (in 1 degree increments), inclusive. Only whole number offsets are allowed. A setting of zero results in NO offset being applied.
- The '**configurationValue3'** byte shall always be set to zero.
- The '**configurationValue4'** byte shall always be set to zero.

1.1.4. PE653 Circuit Schedules (0x04 through 0x12)

The PE653 allows the user to configure whether or not there will be scheduled ON and OFF times created to turn a circuit ON/OFF during a 24-hour period. Each circuit can have up to 3 scheduled activation times applied to it. Each scheduled ON/OFF activation time MUST have a valid ON and OFF time assigned. The ON and OFF times are 16-bit values and minutes from

midnight (where midnight equals 0). To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to one of the values 0x04 through 0x12.
- The 'level' byte set to four (4), e.g., a four byte value being sent
- The '**configurationValue1'** byte set to the high 8-bits of the 16-bit schedule ON time
- The '**configurationValue2'** byte set to the low 8-bits of the 16-bit schedule ON time
- The '**configurationValue3'** byte set to the high 8-bits of the 16-bit schedule OFF time
- The '**configurationValue4'** byte set to the low 8-bits of the 16-bit schedule OFF time

1.1.5. PE653 Pool/Spa Installation configuration (0x13)

The PE653 allows the user to configure whether the pool/spa installation consists of a POOL only, a SPA only or both. To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to 0x13
- The 'level' byte set to one (1), e.g., a one byte value being sent
- The 'configurationValue1' byte set to one of the following.

Installed POOL/SPA Configuration	'configurationValue1'
A POOL ONLY installation	0x00
A SPA ONLY installation	0x01
Both a POOL and SPA are part of the installation	0x02

1.1.6. Variable Speed Pump Speed Settings (0x20 through 0x23)

Some installations will have a Variable Speed Pump installed instead of a one or two speed pump. In these installations the PE653 allows the user to configure what the activation speeds for the four variable speed pump speed settings will be set to. The range for these settings is a 400 to 3450 RPM (inclusive), in 10 RPM increments. The high end of the speed range can be further restricted via the VSP maximum speed configuration setting (see configuration parameter 0x31 description for more details. To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to one of the values of 0x20 through 0x23.
- The 'level' byte set to two (2), e.g., a two byte value being sent
- The '**configurationValue1'** byte set to the high 8-bits of the desired 16-bit pump speed setting
- The '**configurationValue2'** byte set to the low 8-bits of the desired 16-bit pump speed setting

1.1.7. Variable Speed Pump Speed Schedules (0x24 through 0x2F)

The PE653 allows the user to configure whether or not there will be scheduled ON and OFF times created to turn a variable speed pump speed ON/OFF during a 24-hour period. Each variable speed pump speed can have up to 3 scheduled activation times applied to it. Each scheduled ON/OFF activation time MUST have a valid ON and OFF time assigned. The ON and OFF times are 16-bit values and minutes from midnight (where midnight equals 0).
NOTE: Only one pump speed can be active at a time.
To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to one of the values 0x24 through 0x2F.
- The 'level' byte set to four (4), e.g., a four byte value being sent
- The '**configurationValue1'** byte set to the high 8-bits of the 16-bit schedule ON time
- The '**configurationValue2'** byte set to the low 8-bits of the 16-bit schedule ON time
- The '**configurationValue3'** byte set to the high 8-bits of the 16-bit schedule OFF time
- The '**configurationValue4'** byte set to the low 8-bits of the 16-bit schedule OFF time

1.1.8. Variable Speed Pump MAX Pump Speed Settings (0x31)

The PE653 allows the user to configure what the MAXIMUM allowable activation speed can be for any of the four variable speed pump speed settings. The Maximum pump speed setting can be set to any of the valid PUMP Speed settings, which is the range 400 to 3450 RPM (inclusive), in 10 RPM increments. If a Maximum Pump speed setting is applied, any existing set pump speeds that exceed the Maximum value will automatically be set to the new Maximum Speed setting. To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to one of the values of 0x31.
- The 'level' byte set to two (2), e.g., a two byte value being sent
- The '**configurationValue1'** byte set to the high 8-bits of the desired 16-bit Maximum pump speed setting
- The '**configurationValue2'** byte set to the low 8-bits of the desired 16-bit Maximum pump speed setting

1.1.9. PE653 Freeze Control (0x32)

The PE653 allows the user to configure whether or not Freeze Control operation is enabled for this installation. If it is, the user can further specify what pump(s) and/or variable speed pump speed is activated when a freeze condition occurs. To configure this behavior, issue a Configuration Set command with the:

- The 'parameterNumber' byte set to 0x32
- The 'level' byte set to four (4), e.g., a four byte value being sent
- The '**configurationValue1'** byte sets the temperature threshold at which a freeze condition is present. This setting is in degrees Fahrenheit and has a valid range of 34F to 44F inclusive, in 1 degree Fahrenheit increments.
- The '**configurationValue2'** byte sets the PE653 circuits to be activated upon detection of a freeze condition. This can be any one of the following values:

Turn Circuit 5 ON	Turn Circuit 4 ON	Turn Circuit 3 ON	Turn Circuit 2 ON	Turn Circuit 1 ON	'configurationValue2' value
NO	NO	NO	NO	NO	0x00
NO	NO	NO	NO	YES	0x01
NO	NO	NO	YES	NO	0x02
NO	NO	NO	YES	YES	0x03
NO	NO	YES	NO	NO	0x04
NO	NO	YES	NO	YES	0x05
NO	NO	YES	YES	NO	0x06
NO	NO	YES	YES	YES	0x07
NO	YES	NO	NO	NO	0x08
NO	YES	NO	NO	YES	0x09
NO	YES	NO	YES	NO	0x0A
NO	YES	NO	YES	YES	0x0B
NO	YES	YES	NO	NO	0x0C
NO	YES	YES	NO	YES	0x0D
NO	YES	YES	YES	NO	0x0E
NO	YES	YES	YES	YES	0x0F
YES	NO	NO	NO	NO	0x10
YES	NO	NO	NO	YES	0x11
YES	NO	NO	YES	NO	0x12
YES	NO	NO	YES	YES	0x13

YES	NO	YES	NO	NO	0x14
YES	NO	YES	NO	YES	0x15
YES	NO	YES	YES	NO	0x16
YES	NO	YES	YES	YES	0x17
YES	YES	NO	NO	NO	0x18
YES	YES	NO	NO	YES	0x19
YES	YES	NO	YES	NO	0x1A
YES	YES	NO	YES	YES	0x1B
YES	YES	YES	NO	NO	0x1C
YES	YES	YES	NO	YES	0x1D
YES	YES	YES	YES	NO	0x1E
YES	YES	YES	YES	YES	0x1F

- The '**configurationValue3'** byte sets the Variable Speed Pump Speed to be activated upon detection of a freeze condition. This can be any one of the following values:

Variable Speed Pump Speed to activate during a freeze condition	**'configurationValue3' value**
NONE	0x00
Variable Pump Speed 1	0x01
Variable Pump Speed 2	0x02
Variable Pump Speed 3	0x03
Variable Pump Speed 4	0x04

- The '**configurationValue4'** byte shall always be set to zero.

1.4. ASSOCIATION Command Class

The ASSOCIATION command Class is fully supported as documented in the Z-Wave Command Class Specification. The PE653 supports only one association group (Group ID 1) and that group can contain a maximum of five associated devices.

1.5. SWITCH_BINARY Command Class

The SWITCH_BINARY command Class is fully supported as documented in the Z-Wave Command Class Specification. The PE653 supports five instances of this command class, one for each of the five circuit push buttons on the front of the PE653. Instance one of the command class manages Circuit-1, Instance two manages Circuit-2 and so on.

1.6. THERMOSTAT_SETPOINT Command Class

The THERMOSTAT_SETPOINT command Class is fully supported as documented in the Z-Wave Command Class Specification for support setpoint types HEATING # 1 (setpoint type 1) and FURNACE (setpoint type #7). The remaining setpoint types are unsupported. The HEATING #1 setpoint is used for setting the POOL target temperature and the FURNACE setpoint is used for setting the SPA target temperature. The valid ranges for both of these setpoint types is 40 to 104 degrees Fahrenheit, in 1 degree increments.

1.7. SENSOR_MULTILEVEL Command Class

The SENSOR_MULTILEVEL command Class is fully supported as documented in the Z-Wave Command Class Specification for retrieving the current (adjusted) water temperature being monitored by the PE653. If the PE653 is in POOL mode, the value returned will be the POOL water temperature. If the PE653 is in SPA mode, the value returned will be the SPA water temperature. The value returned will be a one byte value of the water temperature in degrees Fahrenheit.