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Quick Start: **Radiator Control**

Mount coupling

Lock

Manual control buttons

Indicator lights

Technical specifications

Normal operating voltage	2x AA 1,5V batteries
Frequency range	868.42 MHz
Wireless range	Min. 150 meters in a mesh network

Basic operations

- Easy control of your thermostatic radiator valve.
- Temperature measurement and automatic adjustments.
- Wireless and manual temperature set and report.
- Stand-alone week schedules and time tables.
- Multiple motor control modes.

Installation

1. Place batteries

2. Mount coupling to your Radiator Control

3. Mount adapter to your radiator

(optional)

4. Mount your Radiator Control to your radiator

5. Install you Radiator Control to a Z-Wave network
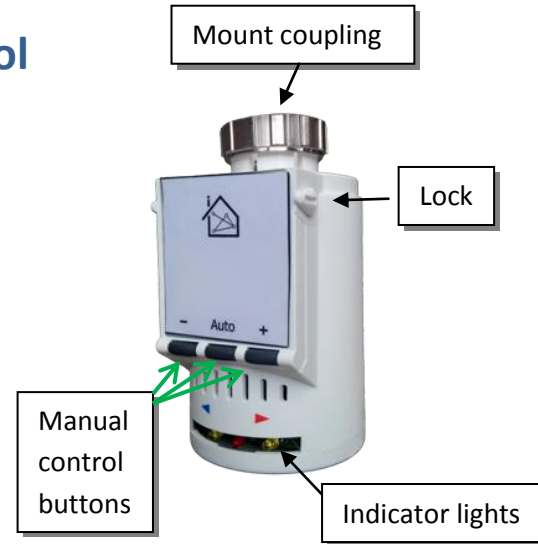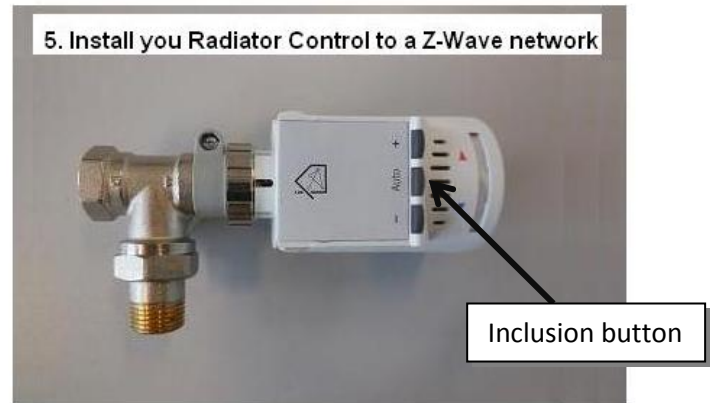
Inclusion button

Include or exclude in a Z-Wave network [1]

1. To include your Radiator Control press and hold button AUTO. After circa **2** seconds release the button AUTO to start inclusion mode. When classic inclusion failed, the product will start Network Wide Inclusion automatically.

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[1] Make sure your Z-Wave controller is in the correct operation mode (include or exclude).

Technical Manual: **Radiator Controller EU**

Caution:
- **This device is using a radio signal that passes through walls, windows and doors. The range is strongly influenced by local conditions such as large metal objects, house wiring, concrete, furniture, refrigerators, microwaves and similar items. On average, the indoor range is approximately 30 meters.**
- **Do not expose this product to excessive heat or moisture.**
- **Prevent long term exposure to direct sunlight.**
- **Do not attempt to repair this product. If the product is damaged or if you are in doubt about the proper operation, take the product back to the place of purchase.**
- **Do not clean the product with any liquid.**
- **Indoor use only.**

Technical details

Normal operating voltage	2x AA 1.5V batteries From 2.3Vdc to 4.0Vdc Do not use rechargeable batteries
Battery lifetime	Normal usage will give approximately 2~3 years lifetime Notice: long and big networks will decrease the battery lifetime
Frequency range	868.42 MHz
Wireless range	Approximately 100 meters in line of sight Min. 150 meters with good mesh network (max 4 hops)
Storage temperature	-5°C to +65°C
Storage humidity	10% to 70%
Operating temperature	0°C to 50°C
Operating humidity:	30% to 80%

Product dimensions (length x width x height)

Radiator Control is 64 x 48 x77mm

Indication mode

The indicator light gives various statuses of the device as follows:

1. Ready for learn mode: indicator light blinks every second
2. Learn in progress (add):   indicator light 2 times every second
3. Learn in progress (remove):   indicator light 3 times every second
4. Learn mode success: indicator light is on for one second
5. Learn mode failed: indicator light blinks 8 times rapidly
6. Mounting successful: indicator light is on for 1 second
7. RF message send failed :   indicator light blinks 6 times rapidly

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Supporting command classes:

Basic type: BASIC_TYPE_ROUTING_SLAVE
Generic type: GENERIC_TYPE_SWITCH_MULTILEVEL
Specific type: SPECIFIC_TYPE_NOT_USED
Listening: False, Z-Wave Lib: 4.53

Class: 0x26 COMMAND_CLASS_SWITCH_MULTILEVEL
Class: 0x31 COMMAND_CLASS_SENSOR_MULTILEVEL
Class: 0x85 COMMAND_CLASS_ASSOCIATION
Class: 0x80 COMMAND_CLASS_BATTERY
Class: 0x84 COMMAND_CLASS_WAKE_UP
Class: 0x86 COMMAND_CLASS_VERSION
Class: 0x72 COMMAND_CLASS_MANUFACTURER_SPECIFIC
Class: 0x46 COMMAND_CLASS_CLIMATE_CONTROL_SCHEDULE
Class: 0x70 COMMAND_CLASS_CONFIGURATION
Class: 0x43 COMMAND_CLASS_THERMOSTAT_SETPOINT
Class: 0x71 COMMAND_CLASS_ALARM
Class: 0xEF COMMAND_CLASS_MARK
Class: 0x81 COMMAND_CLASS_CLOCK

Not listening routing slave

This Z-Wave product will be used as routing slave. Slave nodes are nodes in a Z-Wave network that receive commands and perform actions based on the command. This device will always be in sleep mode because it works on batteries. In sleep mode the device is not active listening, the device will wake up according to the wakeup command class.

Include initiator

The include initiator is used when Primary and Inclusion Controllers include nodes into the network. When both the include initiator have been activated simultaneously the new node will be included to the network (if the node was not included previously).

Exclude initiator

The exclude initiator is used by Primary Controllers to exclude nodes from the network. When the exclude initiator and a slave initiator are activated simultaneously, it will result in the slave being excluded from the network (and reset to Node ID zero). Even if the slave was not part of the network it will still be reset by this action.
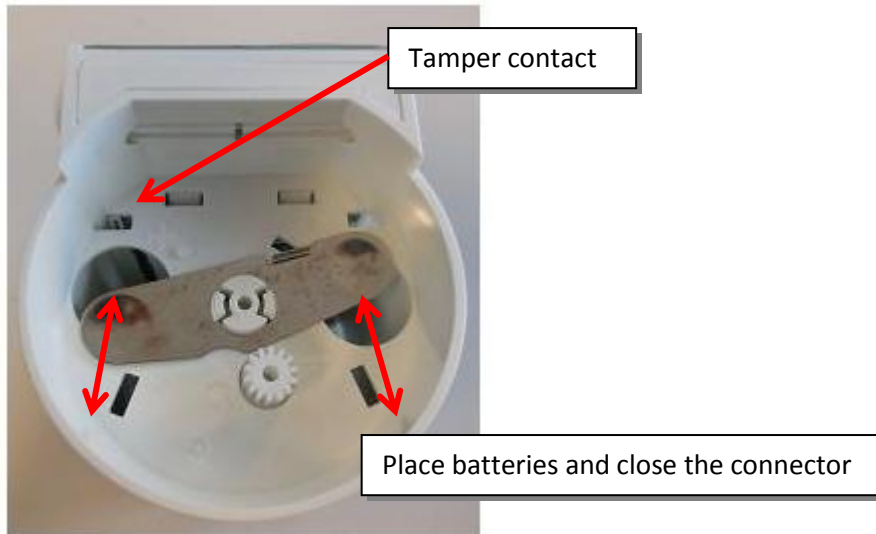
Z-Wave compatibility

Because this is a Z-Wave device, it means it can co-operate with other Z-Wave devices of other manufacturers. It can co-exist in a Z-Wave network existing with product from other manufacturers.
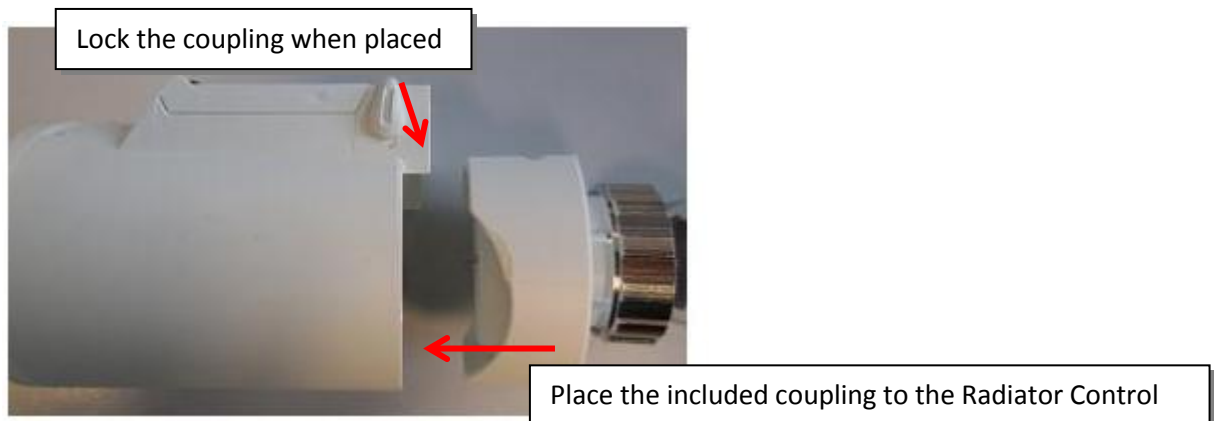
Hops & retries

The Z-Wave range has a range of up to 30 meters in line of sight. This signal is not limited to the 30 meter range due to routing the Z-Wave message to other nodes in the network. This way the range of the Z-Wave network can be expanded to 150 meters indoors (limit of 4 hops).

Installation

NOTE: the radiator used in the picture installation is just an example, there are multiple types of radiators and it is not necessary to use this type to install your BeNext Radiator Control.

1. Place batteries

Tamper contact

Place batteries and close the connector

2. Mount coupling to your Radiator Control

Lock the coupling when placed

Place the included coupling to the Radiator Control

First place the coupling to your Radiator Control, if successful placed the indicator led will go on for one second and the motor is controlled to a fully open position.

NOTE: To make the mounting easier the motor is controlled to fully open position, please wait until the motor is done with controlling before proceeding to the next step.

3. Mount adapter to your radiator (optional):

Mount adapter to your radiator
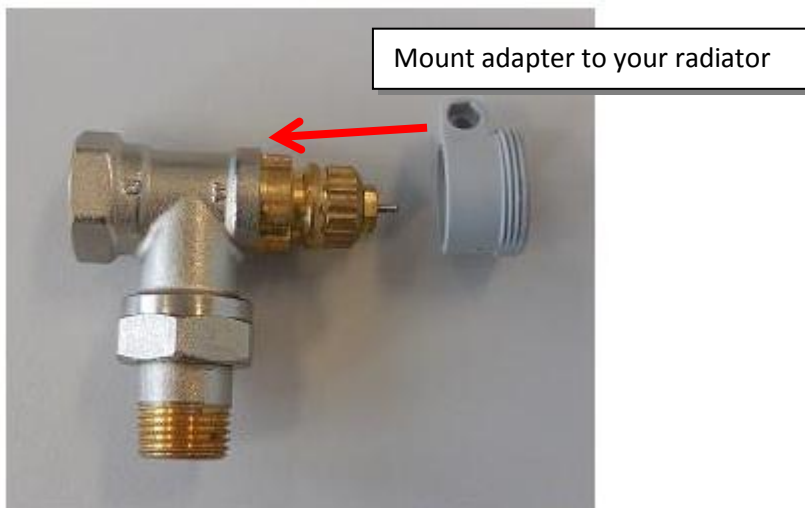
The BeNext Radiator Control is designed for 30 mm radiator winding. If you don't have this an adapter is needed to use your Radiator Control. Read more about this in the chapter adapters.

4. Mount your Radiator Control to your radiator

Place the Radiator Control on your radiator
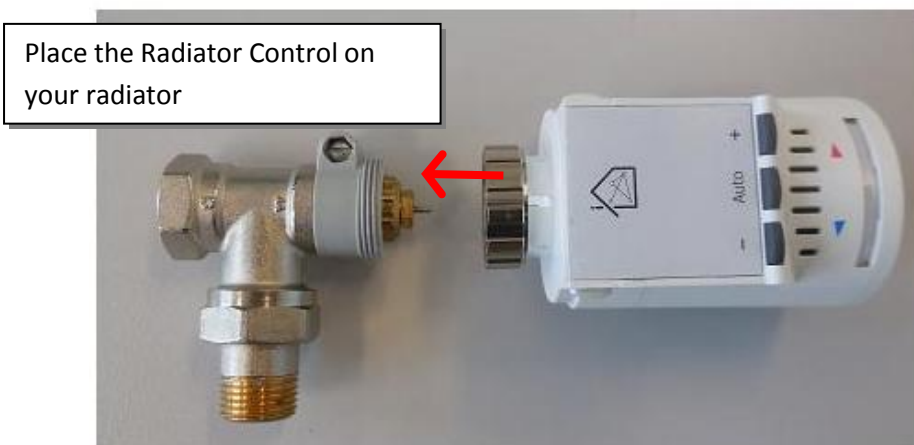
5. Install your Radiator Control in a Z-Wave controller (BeNext Internet Gateway).

Press and hold button AUTO for 2 seconds. Then release to start inclusion.
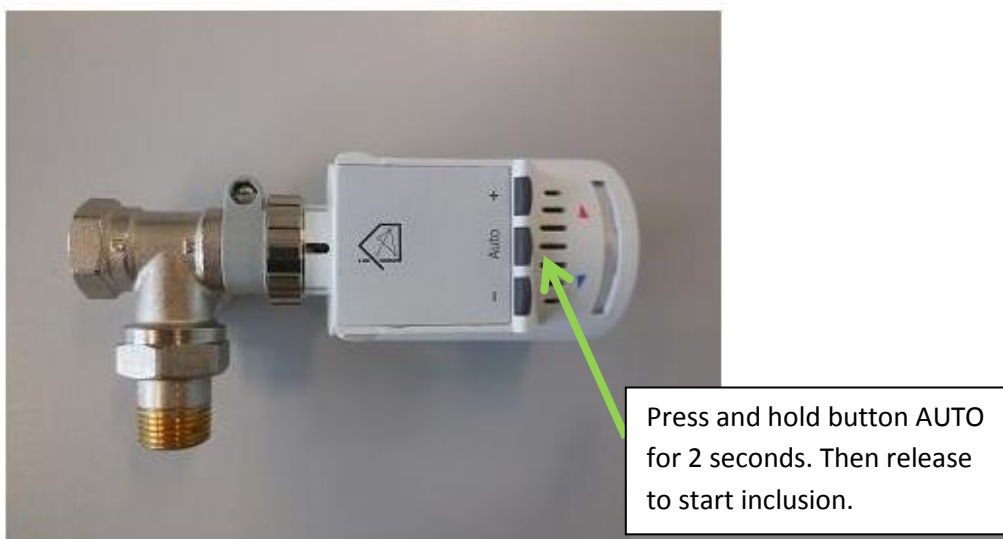
Install product with a Z-Wave controller
   a. Set the Z-Wave controller to inclusion mode.
   b. Press and hold the 'AUTO' button for 2 seconds (led start blinking every second), now release the button to start inclusion.

![BeNext logo]

Adapters

NOTE: Only radiators with a thermostat function can be used, if you have a radiator turn knob (rotary) it is not possible to use the BeNext Radiator Control.

Turn knob

A turn knob is (most likely) without printing and can only be used to open or close your radiator. It probably looks something like this:

If you radiator knob looks similar to above you have to replace the whole radiator coupling to work with the BeNext Radiator Control.

Thermostat knob

The thermostat knob has printing (most likely numbers 1 -5) and can be used to control the temperature. It probably looks something like this:

If you have a thermostat knob there are still a lot of different types of radiator couplings which have a different diameter in winding. The winding is measured around the wired frame of the radiator coupling.

The BeNext Radiator Control comes with a connector which is made for the **30 mm** coupling. There are several adapters available with which the BeNext radiator can work.

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For example:

 26 mm Adapter needed

 30 mm No Adapter needed

 34 mm Adapter needed
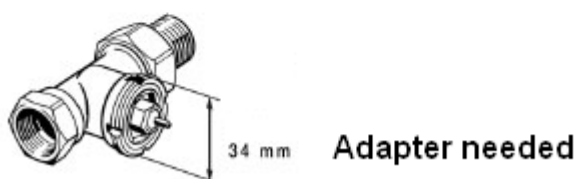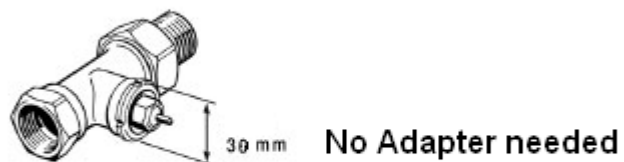
See an overview of available adapters in the appendix A.

Control modes

The BeNext Radiator Control supports two modes.

Temperature control mode

You can configure to this mode by sending the following frame to the Radiator Control.

CONFIGURATION_SET
Parameter: 25 (0x19)
Size: 1
Value: 255 (0xFF)

In this mode the position (0 – 100%) of the motor is determined by a temperature control algorithm. You can set the temperature with Z-Wave (using the climate control schedule command class). It is also possibly to change the temperature manually.

Fixed mode

You can configure to this mode by sending the following frame to the Radiator Control.

CONFIGURATION_SET
Parameter: 25 (0x19)
Size: 1
Value: 0 (0x00)

In this mode you can set the motor position directly with Z-Wave (using the switch multilevel command class). It is also possibly to change the motor position manually.

Change temperature manually

To do this the mode must be configured to *temperature control* mode.

Add temperature:
To add 1 degree* to the current set point press and hold button ON for 1 second*

To confirm that it was successful:
The led wil go on for 1 second
A SCHEDULE_OVERRIDE_REPORT with the new set point is reported.

Distract temperature:
To distract 1 degree* to the current set point press and hold button OFF for 1 second*

To confirm that it was successful:
The led wil go on for 1 second
A SCHEDULE_OVERRIDE_REPORT with the new set point is reported.

Reset set point
To reset to the original set point press and hold button AUTO for 1 second*

To confirm that it was successful:
The led wil go on for 1 second
A SCHEDULE_OVERRIDE_REPORT with the set point is reported.

* values are configurable

Change motor position manually

To do this the mode must be configured to *motor control* mode.

Open valve:

To open the valve with 20%* press and hold button ON for 1 second*

To confirm that it was successful:

The led wil go on for 1 second

A SWITCH_MULTILEVEL_REPORT with the new motor position is reported.

Close valve:

To close the valve with 20%* press and hold button ON for 1 second*

To confirm that it was successful:

The led wil go on for 1 second

A SWITCH_MULTILEVEL_REPORT with the new motor position is reported.

Reset motor position:

In this mode it is not possible to reset the motor percentage

* Values are configurable.

Find set points

If the Radiator Controller enters find set points routine (re-adjust routine) he will look for the *full open* (100%) and *full close (0%)* points of your valve and calculates how much time it takes between those two points. These values are used to decide to position of the valve when in use.

The Radiator Control will enter his find set points routine when

- Product is mounted.
- If mounted the 'AUTO' button is pressed for 7 seconds (led will go on for 1 sec to confirm).

The Radiator Control will not directly enter this routine:

When 'temperature control' mode is configured it can take up to 10 minutes before the Radiator Control enters this.

When 'fixed' mode is configured the Radiator Control will enter this after a new motor position is send.

Z-Wave information

class: 0x25 COMMAND_CLASS_SWITCH_MULTILEVEL
Set the motor to a desired position with a given multilevel.

NOTE: this only works in 'fixed' control mode (read more about this in chapter control modes).

class: 0x20 COMMAND_CLASS_BASIC
The basic command class is mapped to the switch multilevel command class

class: 0x86 COMMAND_CLASS_VERSION
This Command Class is used to obtain information about the *Radiator Control*. The Z-Wave library type, the Z-Wave protocol version and the application version will be reported.

class: 0x72 COMMAND_CLASS_MANUFACTURER_SPECIFIC
This will report information about the manufacturer. This product will contain the manufacturer ID of *BeNext*.
Manufacturer ID of *BeNext* is 138, the ID of this product is 20.

class: 0x70 COMMAND_CLASS_CONFIGURATION
Configuration parameters:

0. **not used**
1. **Set to default**
   Description: Set all config values to default values (factory settings).
                        Read more in chapter Configuration Reset.
   Size: 1 byte*
   Param1:   if 0xFF then set to default
   Param2,3,4:   Not used

2. **Not used**
3. **Not used**
4. **Minimum set point**
   Description: The minimum temperature set point that can be send to the Radiator Control. Any value lower then this will be set to the minimum set point.
   Size: 1 bytes*
   Default: 0x08 (8 C)
   Param1:   The value in degrees
   Param2, 3, 4:   Not used

5. **Maximum set point**
   Description: The maximum temperature set point that can be send to the Radiator Control. Any value higher then this will be set to the maximum set point.
   Size: 1 bytes*
   Default: 0x1C (28 C)
   Param1:   The value in degrees
   Param2, 3, 4:   Not used

6. Set point offset

Description:	The + and – offset around the temperature set point considered as desired temperature. (E.g if Tset is 21 C and offset is 0,5 C there is no temperature control between 20.5 and 21.5 C)
Size:	1 bytes*
Default:	0x05 (0,5 C)
Param1:	The value in 0.1 C.
Param2, 3, 4:	Not used

7. T control measure time

Description:	The interval that the Radiator Control measures a temperature and decides if the motor position is changed because the desired temperature is not reached (only in *temperature control* mode).
Size:	1 bytes*
Default:	0x05 (5 minutes)
Param1:	The value in minutes
Param2, 3, 4:	Not used

8. Set point offset

Description:	The + and – offset around the temperature set point considered as desired temperature. (E.g if Tset is 21 C and offset is 0,5 C there is no temperature control between 20.5 and 21.5 C)
Size:	1 bytes*
Default:	0x05 (0,5 C)
Param1:	The value in 0.1 C.
Param2, 3, 4:	Not used

9. Not used
10. Not used
11. Not used

12. Motor percentage change

Description:	The step size in percentage the motor position is changed every time. Also when changed manually.
Size:	1 bytes*
Default:	0x14 (20%)
Param1:	the value in percentage
Param2, 3, 4:	Not used

13. Not used
14. Not used
15. Not used
16. Not used
17. Not used
18. Not used
19. Not used
20. Not used
21. Not used
22. Not used

23. Button time
Description:	The time any button should be pressed before actuating the functionality behind it.
Size:	1 bytes*
Default:	0x0A (100 ms)
Param1:	The value * 10 ms.
Param2, 3, 4:	Not used

24. Manual temperature offset
Description:	The temperature set point is changed when changed with any of the buttons.
Size:	1 bytes*
Default:	0x0A (1.0 C)
Param1:	The value * 0.1 C.
Param2, 3, 4:	Not used

25. Modes
Description:	The mode that determines the motor position	
Size:	1 bytes*	
Default:	0xFF (temperature control mode)	
Param1:	If val is 0x00:	Fixed mode
	If val is 0x01 – 0xFF:	Temperature control mode
Param2, 3, 4:	Not used	

26. Not used

27. Motor leds
Description:	Show if the motor controls with the leds.	
Size:	1 bytes*	
Default:	0xFF (temperature control mode)	
Param1:	If val is 0x00:	Disable led feedback
	If val is 0x01 – 0xFF:	Enable led feedback
Param2, 3, 4:	Not used	

28. Not used

* If a size is other then given size the frame is ignored totally so configuration values are **not** changed.

class: 0x85 COMMAND_CLASS_ASSOCIATION
The Association command class is used to associate other devices with the *Radiator Control*. The devices that are associated can be controlled on application level.

The *Radiator Control* can be associated into a grouping. If so, the *Radiator Control* can control other Z-Wave device (does not have to be a controller).

The *Radiator Control* has 1 association group.

Group 1
Maximum supported nodes: 1

The clock request is sent to the node in this association group. So the node in this group needs to support the Clock command class.

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Class: 0x80 COMMAND_CLASS_BATTERY
This class is used to request and report battery levels for a given device.

Unsolicited battery report
The Radiator Control sends an unsolicited battery value when:
- New batteries are placed
- The battery level is lower than 20%
  a. This is a warning message and not a reported value
  b. From then on, every new drop a new battery warning is send

class: 0x84 COMMAND_CLASS_WAKE_UP
The Wake Up command class is used at battery-operated devices. This class allows the *Radiator Control* to wake up occasionally to notify others devices, that the *Radiator Control* is ready to receive commands. After receiving the commands the *Radiator Control* will go into sleep mode again. The wake up interval can be set using the WAKE_UP_INTERVAL_SET command.

The default value is 0x1C20 = 7200 sec = 2 hour
The default node is 0xFF = 255 (broadcast)

It is possible to send a **wake up notification** on user interaction. To do this press and hold the Radiator Control for circa 7 seconds. Ignore the blinking of the led and keep the button pressed for at least 7 seconds.

When the wake up time is set to 0 the **wake up notification** is never send periodically, only on user interaction.

Class: 0x31 COMMAND_CLASS_SENSOR_MULTILEVEL
Request the temperature with sensor multilevel command class. The returned value is the measured temperature inside the housing with one decimal.

Class: 0x43 COMMAND_CLASS_THERMOSTAT_SETPOINT

Temperature reference that is used when a new temperature is set with the COMMAND_CLASS_CLIMATE_CONTROL_SCHEDULE.

Class: 0x46 COMMAND_CLASS_CLIMATE_CONTROL_SCHEDULE
Change the temperature set point within a wake up notification.
Send a temperature offset (compared to the thermostat set point) with the override set command when the Radiator Controller sends a wake up notification.

BYTE 1:   COMMAND_CLASS_CLIMATE_CONTROL_SCHEDULE
BYTE 2:   SCHEDULE_OVERRIDE_SET
BYTE 3:   Override type
BYTE 4:   Override state
The override type is the 0x01: Temporary override and is changed when the schedule reached a new switch point.
The override type is the 0x02: Permanent override and is changed when a new SCHEDULE_OVERRRIDE_SET is send to the Radiator Control.

The override state is the value offset (compared to the thermostat set point) * 0.1 C.

Example: Temporary override the temperature to 22 C
1.   Send a THERMOSTAT_SETPOINT_SET, value 20 C
2.   Send a CLIMATE_CONTROL_OVERRIDE_SET, override type = 0x01, override state = 0x14 (2.0 C)

Example: Permanent override the temperature to 15 C
1.   Send a THERMOSTAT_SETPOINT_SET, value 20 C
2.   Send a CLIMATE_CONTROL_OVERRIDE_SET, override type = 0x02, override state = 0xCE (-5.0 C)

<u>Changed the temperature set point within an internal schedule.</u>
The Radiator Control supports an internal schedule. This internal schedule can change the temperature set point on given switch (time) points. Up to 9 switch points per day, 7 days a week.

If you want the Radiator Control to heat a room to the same temperature on the same time every day is recommended to use the internal schedule because.
- The times are more accurate (not depending on the wake up notification).
- Most likely increase battery life time.
- The programmer has put in a lot of effort to make this cool feature work.

To configure a schedule use the command.

BYTE 1:   COMMAND_CLASS_CLIMATE_CONTROL_SCHEDULE
BYTE 2:   SCHEDULE_SET
BYTE 3:   Weekday
BYTE 4 -30:   Switch points

The 24 bytes for switch points are divided into 9 x 3 bytes per switch point.
Byte 1: Hour
Byte 2: Minute
Byte 3: State

NOTE: State 0x7F (127) means that the time is ignored in the schedule, also every time from then on is ignored in the schedule. This way it is possible to set < 9 switch points per day.

The *State* is the **temperature offset** compared to the temperature set at the THERMOSTAT_SETPOINT_SET

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Example:

Set up a schedule for Monday where:
- The room is heated to 19 C at 07:00.
- The room is cooled to 8 C at 08:00.
- The room is heated to 21 C at 17:30.
- The room is cooled to 8 C at 23:00.

1. Send a THERMOSTAT_SETPOINT_SET, value 20 C
2. Configure Mondays switch points.

BYTE 1:	COMMAND_CLASS_CLIMATE_CONTROL_SCHEDULE
BYTE 2:	SCHEDULE_SET
BYTE 3:	0x01 (Monday)
BYTE 4:	0x07 (7)
BYTE 5:	0x00 (0)
BYTE 6:	0xF6 (- 1.0 C)
BYTE 7:	0x08 (8)
BYTE 8:	0x00 (0)
BYTE 9:	0x88 (- 12.0 C)
BYTE 10:	0x11 (17)
BYTE 11:	0x1E (30)
BYTE 12:	0x0A (+ 1.0 C)
BYTE 13:	0x17 (23)
BYTE 14:	0x00 (0)
BYTE 15:	0x88 (- 12.0 C)
BYTE 16:	0x00 (0)
BYTE 17:	0x00 (0)
BYTE 18:	0x7F (state ignored)
BYTE 19:	0x00 (0)
BYTE 20:	0x00 (0)
BYTE 21:	0x7F (state ignored)

…

…

BYTE 28:	0x00 (0)
BYTE 29:	0x00 (0)
BYTE 30:	0x7F (state ignored)

NOTE: This is an example for Monday. Send a whole frame for every day of the week.

Configuration reset

The Radiator Control supports a configuration resets function. Configuration reset means:
-   All configuration values are defaulted

This function can be activated by sending a configuration set frame:

CONFIGURATION_SET
Parameter: 0x01
Size: 0x01 (can't be different from 1)
Value: 0xFF (can be any value except for 0x55 or 0xAA)

When the value of configuration value is requested 2 possible values can be returned.

CONFIGURATION_REPORT
Parameter: 0x01
Value 0x55:   Device doesn't have all his configuration settings anymore.
                Even when a configuration parameter is changed back to the default value
Value 0xAA: Devices still has all his factory settings.
                This are only configuration parameters, wake up interval can be changed.

Always awake mode

The always awake mode is used to request different values from the device e.g. version and manufacturer specific.
The always awake mode can be activated by:
Note: in always awake mode the batteries will be drain very fast, we do not recommend to use this mode.

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Frequently Asked Questions

Q: I can't have my *Radiator Control* included into my Z-Wave network, what am I doing wrong?
A: **1**. Is the controller ready to include any device into the Z-Wave network? If the controller is not in
            Include or exclude mode, the *Radiator Control* will not be included or excluded.
            2. The *Radiator Control* is already included in a Z-Wave network (check your led feedback!).
Exclude the *Radiator Control* and try again.

Q: I have configured a value but when I request it, it is not changed?
A: It is mandatory that the correct size is used while configure a parameter; go to the documentation
about the configuration command class to check if the right size is used during configuration. If the wrong
size is used the frame is ignored totally.

Q: I have configured a new value and when I request it the correct value is returned but the behavior is still
the same?
A: Some configuration parameters have limits of what they can do, go to the documentation about
configuration to check if the value of the configured parameter is out off limit.

Q: How to force a wakeup notification?
A: Keep the pushbutton pressed for more than 18 seconds.

Appendix A: Adapters

Winding	Types	Adapters	Availability
23 mm	Danfoss RA		Included
26 mm	Danfoss RAVL		Included
28 mm	Comap		Not included, available at http://www.conrad.com/ce/en/product/560384/Brass-adapter-for-Comap
30 mm	other	**No adapter needed**	Included
34 mm	Danfoss RAV		Included

There are several different adapters available, for instance the webshop of Conrad shows a list see http://www.conrad.com/ce/en/Search.html;?search=thermostat+adapter if your radiator is not listed in the overview.