SmoothRemote

Technical Document - Device Number:00120001

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INNOVUS

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1. General Information

Table 1. Dimensions

Colour	Dark Grey
Size	210 x 38 x 21 mm (L x B x H)

Table 2. Technical Specification

Power Supply	2 x AAA Batteries
Battery Life Time	Approx. 3 Years
Number of Leds	11

MCU	ZW301 (Z-Wave)

Table 3. Operation

Local	9 Buttons
Radio	Z-Wave Certified

Table 4. Installation

Temperature	5 - 55 Degrees Celsius (Non Condensing)(indoor use only)(IP40)

Table 5. Other

Approvals	EMC, CE, RoHS, Z-Wave

1.1. Functionality

The SmoothRemote is a fully functional Z-Wave remote controller, with Z-Wave administrative, on/off and light dimming capabilities. As a standalone product the device is capable of setting up a Z-Wave network with other devices regardless of vendor, functioning as primary, secondary and inclusion controller, setting up associations in other devices and sending virtually any command through the Association Command Configuration Command Class. Together with the Innovus House Controller, the remote becomes capable of controlling non-listening devices as well, such as most battery driven devices.

1.2. Leds

The device has 10 yellow leds (A, B and I-VIII) and one red (E). Leds I-VIII are associated with button I-VIII and used to report the status of administrative actions on the buttons, such as Button Learn , Button Delete and Button Status . The last two yellow leds (A and B) are used to report status of Add Node , Remove Node , Learn Mode , Controller Change and Controlled Associations . E is a busy/error indication led. When the remote is busy the led will be on continuously until its done, when something has gone wrong the led will flash red for 5 seconds. When an action is completed successfully the remote will light all leds for 750 ms.

1.3. Buttons

The remote is equipped with 9 buttons, which can distinguish between short and long presses (also called clicks and holds) and combinations. A press is considered a hold when it is longer than 400 ms. When combinations of presses on a single button are needed, for instance a double click, each press needs to happen within 500 ms of each other, otherwise they will be considered separate sequences, in this case two single clicks. Similarily combinations of presses involving multiple buttons needs to happen within 1000 ms of each other. These values are all configurable through Z-Wave, see Section 2.2.4, "Configuration" .

Button I-VIII are normal operation buttons. The shift button, marked by an arrow, is used for special administrative actions.

Each Sequence of Button Presses is tied to an Association Group and each Association Group is linked to a Default Z-Wave Command . When the sequence is pressed, the group is activated and the command is send to the associated nodes. In addition to the default command a number of custom commands can be created and linked to groups, see Section 2.2.2, "Association Command Configuration" . The default command will be send before the custom commands. When a sequence of button presses is linked to an Administrative Action as well, the group will be activated first and the administrative action will be performed after.

The following table lists the possible operations on the buttons and the associated groups:

Table 6. Button Sequence to Group Relationship

Sequences	Groups
Click (I-VIII + Shift)	1-9
Double Click (I-VIII + Shift)	10-18
Hold (I-VIII + Shift)	19-27
Click followed by Hold (I-VIII + Shift)	28-36
Release (I-VIII + Shift)	37-45
Click (Shift) followed by Click (I-VIII)	46-53
Double Click (Shift) followed by Click (I-VIII)	54-61
Triple Click (VIII+Shift)	62-63
4x Click (VIII+Shift)	64-65
Double Click followed by Hold (Shift)	66
Triple Click followed by Hold (Shift)	67
Triple Click (Shift) followed by Triple Click (VIII)	68

The following table shows what administrative actions the button sequences activate:

Table 7. Button Sequence Administrative Action Relationship

Sequences	Actions
Click (Shift)	Start Add Node
Double Click (Shift)	Start Remove Node
Hold (Shift)	Learn the Controlled Association Destination
Click followed by Hold (Shift)	Learn the Controlled Association Source
Release (Shift)	Stop Showing Battery or Button Status
Click (Shift) followed by Click (I-VIII)	Button Learn (I-VIII)
Double Click (Shift) followed by Click (I-VIII)	Button Delete (I-VIII)
Triple Click (VIII)	Send Node Information Frame
Triple Click (Shift)	Start Learn Mode
4x Click (VIII)	Send Wake Up Notification
4x Click (Shift)	Start Controller Change
Double Click followed by Hold (Shift)	Show Battery Status
Triple Click followed by Hold (Shift)	Show Button Status
Triple Click (Shift) followed by Triple Click (VIII)	Factory Reset

1.3.1. Show Battery Status

The device will show how much battery life is left while the button is held down, by lighting up led I-VIII like a status bar. Led I corresponds to roughly 12 % life left, I + II corresponds to 24%, I + II + III corresponds to 36 % etc. If less than 12% life is left led E will turn on.

1.3.2. Factory Reset

This action should only be used as a last resort since it will leave the rest of the Z-Wave network in an undefined state. A better option is to use a controller, which is part of the network, to exclude the device, see Section 2.7, "Learn Mode" . Factory reset will set the device back to the configuration and state it had from the factory. When completed all the leds will flash to confirm the action.

1.3.3. Time-outs and Cancel

Any operation that is waiting for a user interaction, this could be Add Node , Remove Node , Learn Mode , etc. has a timeout value of 10 seconds, whereafter it will simply cancel. It is also possible to manually cancel the operation, by pressing any button which is not part of the operation.

2. Z-Wave

2.1. Device Information

Table 8. General Information

Z-Wave Developer's Kit Version	5.01
API Library	zw_controller_portable_zw030xs.lib
Chip	ZW0301 Single Chip
Z-Wave Device Class Version	13
RF Operating Frequency	868 MHZ (EU)
Basic Type	Controller
Generic Device Type	Generic Controller
Specific Type	Portable Remote Controller
Listening	No
Optional Functionality	Yes

2.2. Supported Command Classes

The following subchapters lists the supported command classes, with information specific to the device.

2.2.1. Association

Supported command class version is 1. The number of supported groupings is 68. The maximum number of nodes per group is 30, if a group reaches this amount of associations, further attempts to associate will result in led E blinking for 5 seconds and the request being ignored. Only node ids within the legal range (1-232) will be accepted, if an Association Set contains a node id outside this range the request will be ignored and led E will be blinking for 5 seconds.

The following table lists the Z-Wave Commands send to the nodes in each group when they are activated:

Table 9. Groups and Commands

Groups	Commands
1-7	COMMAND_CLASS_BASIC

Groups	Commands
	BASIC_SET
	0xFF
8	COMMAND_CLASS_SWITCH_ALL
	SWITCH_ALL_ON
10-16	COMMAND_CLASS_BASIC
	BASIC_SET
	0x00
17	COMMAND_CLASS_SWITCH_ALL
	SWITCH_ALL_OFF
19-25	COMMAND_CLASS_SWITCH_MULTILEVEL
	SWITCH_MULTILEVEL_START_LEVEL_CHANGE
	0x20
	0x00
28-34	COMMAND_CLASS_SWITCH_MULTILEVEL
	SWITCH_MULTILEVEL_START_LEVEL_CHANGE
	0x60
	0x00
37-43	COMMAND_CLASS_SWITCH_MULTILEVEL
	SWITCH_MULTILEVEL_STOP_LEVEL_CHANGE
9, 18, 26-27, 35-36, 44-68	COMMAND_CLASS_HAIL
	HAIL

All commands are multicast with acknowledge option on.

If a device is removed from the network by the remote or any other controller in the network, all associations with it are removed.

2.2.2. Association Command Configuration

Supported command class version is 1. The device supports fully configurable commands corresponding to a setting of 1 in the Configurable Cmd bit and a setting of 0 in the V/C bit, allowing other nodes to control and monitor the commands send from the remote. The Max Command Length is 20. Max Command Records is 150 and the device has no command records allocated initially.

A Command Configuration Set command will always use one of the Free Command Records, even if it is identical to one of the normal Associations. The only exceptions to this rule are:

1. If the Command Record is a duplicate of an already existing Association or Command Record, that is (node, group, command) tupple.

2. There are no more Free Command Records

3. The maximum number of supported nodes per group has been reached, see Section 2.2.1, "Association" .

4. The node id is not within the legal range (1-232).

2., 3. and 4. will be indicated by led E blinking for 5 seconds.

The remote assumes all Command Configuration Sets received to be correct. This means that no checks are performed to validate that the received Command Record specifies a unique endpoint instance. So for instance it is technically possible to make two command records in the same group point to the same node id and endpoint (though not allowed according to the Z-Wave standard).

When a group is activated all Command Records containing the specific group will be send as single casts with acknowledge option on and in reverse of order what they were set (last in first out).

If a node is removed from the network by the remote or any other controller in the network, all command records containing it are removed.

The remote can only process one Association Command Configuration request at a time. If another request is received while processing an Association Get, a Command Configuration Get or if the remote is in the process of activating a group, a reply will be send with an Application Busy frame:

Table 10.

COMMAND_CLASS_APPLICATION_STATUS
APPLICATION_BUSY
0
0

2.2.3. Battery

Supported command class version is 1. The device will respond with Battery Low Warning on Battery Gets if levels reaches less than approximately 20% of the battery.

2.2.4. Configuration

Table 11. Parameters

Number	Size	Range	Default	Description
0	1	0-255	50	Button Press Time, time for presses on a single button to register as seperate and not part of a sequence, measured in 0.01s. 0 is interpreted as a 1.
1	1	0-255	100	Button Multiple Press Time, time for presses on multiple buttons to register as seperate and not part of a sequence, measured in 0.01 s. 0 is interpreted as a 1.
2	1	0-255	40	Button Hold Time, time for presses to register as being held down in 0.01s. 0 is interpreted as a 1.
3	2	0-65536	168	Network Update Interval, time between network updates in 256 seconds. Disabled if 0.

Warning: All Configuration values have serious effects on the functioning of the device and as such shouldn't be changed unless one is certain of the consequences.

2.2.5. Manufacturer Specific

Supported command class version is 1. Manufacturer Specific command class, makes it possible to uniquely identify this type of device in a Z-Wave network. On receiving a Manufacturer Specific Get the device will respond with the following:

Table 12. Manufacturer Specific Report

Manufacturer ID 1	0x00
Manufacturer ID 2	0x77
Product Type ID 1	0x00
Product Type ID 2	0x12
Product ID 1	0x00
Product ID 2	0x01

With Innovus products, Product Type ID uniquely identifies a specific product, this could be as in this instance a SmoothRemote or a RAone SmartPower. Product ID identifies a feature set of the specific product. If for instance a command class is added, removed or changed in a future version of the product, Product ID will be changed.

2.2.6. Version

Supported command class version is 1. The Version command class makes it possible to read version information from the device. This includes Z-Wave library type, protocol version, command class versions and the application software version.

When requesting the version information using Version Get, the device will respond with the following:

Table 13. Version Report

Z-Wave Library Type	0xXX
Z-Wave Protocol Version	0xXX
Z-Wave Protocol Sub Version	0xXX
Application Version	0xXX
Application Sub Version	0xXX

2.2.7. Wake Up

Supported command class version is 2.

Table 14. Wake Up Capabilities

Minimum Wake Up Interval Seconds	0x000100
Maximum Wake Up Interval Seconds	0x00FF00
Default Wake Up Interval Seconds	0x000E00
Wake Up Interval Step Seconds	0x000100

Note: The device will just use the middle byte when setting intervals, so illegal intervals can still result in changes in wake up behaviour. Setting interval to 0 will disable wake up. Wake Up Notifications will then only be possible through Button Press Activation .

The device will stay awake for 3 seconds after a wake up has been notified or a packet has been received. So each packet received by the device will prolong the awake time with 3 seconds. The remote will go to sleep immediately when receiving a Wake Up No More Information or if the wake up isn't notified successfully.

Setting wake up node to 0xFF will make the device broadcast its Wake Up Notifications, this is also the default setting.

It is possible to make the device send a Wake Up Notification by a button presses, see Table 7, "Button Sequence Administrative Action Relationship" .

If the wake up node is removed from the network by the remote itself or any other controller, the wake up node will be set back to the broadcast address.

2.3. Controlled Command Classes

The following subchapter list the controlled command class with information specific to the device. It is worth noting that since the device supports the Association Command Configuration command class, it is possible to configure it to control pretty much any command class. The listed command classes are those that are available when using the remote as a standalone product and exposed through normal associations and button presses.

2.3.1. Association

Controlled command class version is 1. The device is able to setup Associations in other devices, provided they support Associations and have a maximum of 8 Supported Groupings.

Destination Device

The remote needs to know the two devices to be associated, called source and destination. First the remote needs to be informed of the destination node, Table 7, "Button Sequence Administrative Action Relationship" shows how this is initiated. Now led A will light continuously to indicate the remote is ready to accept a Node Information frame from another device, which it will assume is the destination node, see the destination device manual for how to do this. The remote will flash all leds to confirm, when the Node Information frame has been received. The destination node will be saved for future reference and can be used for multiple source nodes. Learning another destination node or removing the batteries will delete it.

Source Device, Groups and Updating Routes

Learning the source node is equally simple, see Table 7, "Button Sequence Administrative Action Relationship" . Led B will light continuously to indicate the device is ready to accept a Node Information frame from the source device, see the source device manual for how to do this. When received the remote will ask the source device how many Supported Groupings it has. If it only has one Supported Grouping, the Association will be setup immediately. Otherwise the user will be asked to choose a group by pressing one of the buttons I-VIII. The leds corresponding to the Supported Groupings in the source device will light up. So for instance if it has 3 Supported Groupings, then led I-III will light up and pressing any of the buttons I-III will setup an Association in the source with the destination.

When the Association source is learned and the group is chosen, the device will ask the source whether the destination node already is in the specific group, it will be removed if it is, otherwise if there is still room in the group the node will be added. If the source node is a Routing Slave / Enhanced Slave, routes will be updated with routes to associated nodes and if supported and present the Wake Up Node. It is important to remember that a Routing Slave / Enhanced Slave only has room for 5 routes, so if more is needed, some Associations will simply exists without routes. The result is that the specific node will send routed to the 5 destinations with routes and direct to the rest. The remote will not try to discern which nodes are in direct range and which are not, when assigning routes. There is an extra route to the SUC node, so the remote will not try to assign routes to it if this is part of the Associations, which leaves an extra route to another node.

If at any point led E starts to flash for 5 seconds, the process has failed. This can be caused by a couple of things. Does the source support more than 8 groupings? Or maybe not even Associations at all? Maybe the source device's group is full or maybe some communication failed. In these cases its important to realise what might have happened. Check whether the destination has been associated with the source despite the error as it would otherwise be removed by repeating the process. Check the source device's manual on Associations, how many devices can be associated and how many groupings are there? Is there any chance the limit might have been reached?

2.3.2. Basic

Controlled command class version is 1. The remote sends Basic Set with the value 0xFF and 0x00 to nodes associated with group 1-7 and 10-16, see Table 9, "Groups and Commands" .

2.3.3. Multilevel Switch

Controlled command class version is 1. The remote sends Multilevel Switch Start Level Change to nodes associated with group 19-25 and 28-34 and Multilevel Switch Stop Level Change to group 37-43, see Table 9, "Groups and Commands" .

2.3.4. Switch All

Controlled command class version is 1. The remote sends All Switch On and All Switch Off to nodes associated with group 8 and 17, see Table 9, "Groups and Commands" .

2.4. Add Node

The remote can include other nodes (Controllers or Slaves) in the Z-Wave network by starting the Z-Wave add node process, see Table 7, "Button Sequence Administrative Action Relationship" . The process uses normal power, low power inclusion is not possible. Led A will blink when the remote is ready to receive information from the device to be included. Learn Mode must then be started on this device. When the remote detects it, the state immediately changes to busy and a lot of protocol information is exchanged. When done successfully all the leds will light up to confirm otherwise led E will blink for 5 seconds to indicate a failure. In case of failures one should generally exclude the device before trying to include it again because the state of the device is somewhat uncertain.

The remote will try to set any included static controller to SUC/SIS if there is no such device already.

Awake time is extended on successfully adding a node, see Section 2.12.1, "Extended Awake Time" .

2.5. Remove Node

The remote can exclude other nodes (controllers or slaves) in the Z-Wave network by starting the Z-Wave remove node process, see Table 7, "Button Sequence Administrative Action Relationship" . The process uses normal power, low power exclusion is not possible. Led B will blink when the remote is ready to receive information from the device to be excluded. Learn mode must then be started on this device. When the remote detects it, the state immediately changes to busy and protocol information is exchanged. When done successfully all the leds will light up to confirm otherwise led E will blink for 5 seconds to indicate a failure. In case of failures one should just repeat the process.

2.6. Controller Change

The remote can perform a Controller Change provided it is a Primary Controller in the Z-Wave network by starting the Z-Wave Controller Change process, see Table 7, "Button Sequence Administrative

Action Relationship" . The process uses normal power, low power Controller Change is not possible. Led A and B will blink when the remote is ready to receive information from the device to become the new Primary Controller. Learn Mode must then be started on this device. When the remote detects it, the state immediately changes to busy and protocol information is exchanged. When done successfully all the leds will light up to confirm otherwise led E will blink for 5 seconds to indicate a failure. In case of failures one should just repeat the process.

Awake time is extended after a successfull controller change, see Section 2.12.1, "Extended Awake Time" .

2.7. Learn Mode

The remote can be added to, removed from a Z-Wave network or made a Primary Controller by setting it in Learn Mode, see Table 7, "Button Sequence Administrative Action Relationship" . Another Inclusion Controller (needs to be primary if its a Controller Change) is needed to initiate the process, this could for instance be another SmoothRemote. This controller needs to be put in add node, remove node or controller change state, see the device manual for how this is done. When ready the remote will continuously light led A and B. Once the other controller is detected, the remote's state will change to busy lighting led E continuously until the process is done and the state is changed to confirm and all leds will flash to signal that the process completed successfully. If something goes wrong led E will flash for 5 seconds, which generally means the process should be repeated. Learn Mode will time out if no other controller is detected within 10 seconds.

When excluded the device is put into Factory Default state resetting all protocol and application data to defaults.

Awake time is extended after a successfull Learn Mode, see Section 2.12.1, "Extended Awake Time" .

2.8. Send Wake Up Notification

The remote can be forced to send Z-Wave Wake Up Notifications through a Button Sequence to the Wake Up Node, if one is present otherwise it is broadcasted, see Section 2.2.7, "Wake Up" . The remote confirms the action by flashing all the leds once. This can be used to synchronize the remote against the Wake Up Node, in case this has pending updates, by signaling to the Wake Up Node, that the remote is listening until receiving a Wake Up No More Information.

2.9. Send Node Information Frame

The remote can be forced to send a Z-Wave Node Information Frame, see Table 7, "Button Sequence Administrative Action Relationship" . The remote confirms the action by flashing all the leds once. Awake time will be extended by this, see Section 2.12.1, "Extended Awake Time" .

2.10. Configure Buttons

This describes how the buttons can be configured to control other Z-Wave devices. There are two primary operations the user can perform in relation to configuring buttons, see Table 7, "Button Sequence Administrative Action Relationship" . Button learn describes the process of adding or removing a single device from the buttons. Button delete removes all devices linked to a specific button. Only the buttons I-VIII can be configured directly in this manner.

The following table shows the affected groups, they correspond directly to the groups activated when click, double click, hold, click followed by hold and release is performed on any of the buttons I-VIII:

Table 15. Button - Affected Groups Relationship

Button	Groups				
I	1	10	19	28	37
II	2	11	20	29	38
III	3	12	21	30	39
IV	4	13	22	31	40
V	5	14	23	32	41
VI	6	15	24	33	42
VII	7	16	25	34	43
VIII	8	17	26	35	44

2.10.1. Button Learn

Table 7, "Button Sequence Administrative Action Relationship" shows how to activate button learn, when done the led associated with the button pressed (I-VIII) will start to blink, this indicates that the remote is ready to accept a Node Information frame from another device, see the specific device manual for how to do this. When the remote receives a Node Information frame it will check whether the source device is in any of the affected groups, it is removed if so, otherwise it is added to all of them. When performing the action, the state of the remote will change very shortly to busy and then flash all leds to indicate the operation succeeded.

Note there is a limited amount of room for devices in each group, see Section 2.2.1, "Association" . If any group is full and the user tries to add another device to the button, led E will blink for 5 seconds indicating an error occured.

2.10.2. Button Delete

Table 7, "Button Sequence Administrative Action Relationship" shows how to delete the contents of a button. When performing the action, the state of the remote will change very shortly to busy and then flash all the leds to indicate the operation succeeded. Every node in all the affected groups are deleted by this action.

2.10.3. Button Status

See Table 7, "Button Sequence Administrative Action Relationship" for how to activate this. Buttons which have devices in the affected groups will light up while the button is held down. This can be used as a feedback mechanism to gauge the status of the buttons.

2.11. Network Topology Updates

The device can use a Static Update Controller to keep it's routes up to date. The device will request the SUC for updates two times a day if one is present.

2.11.1. SUC Update Overflow

The SUC is unable to transfer more than 64 network changes if it is based on 4_XX or earlier versions of the Z-Wave API. In such a case the routing tables will have to be replicated. This situation is called

a SUC Update Overflow and will be indicated by led E flashing everytime the remote is awake, that is whenever a button is pressed. Replication is done by reincluding the remote on the SUC, without excluding it first.

2.12. Non-Listening

Since the device isn't normally listening, the device is said to be "sleeping" to save power, communication with the device is only possible at specific times, limited to the time after a successfull Add Node , Remove Node , Controller Change , Learn Mode , Send Node Information Frame and Send Wake Up Notification . It is possible to communicate with the device at other times as well, but these are periods where the device is guaranteed to atleast stay awake for a while.

This ofcourse also means the remote cannot function as a repeater in the Z-Wave network.

2.12.1. Extended Awake Time

The remote implements an extended awake time by keeping the radio turned on and postponing sleep by 30 seconds and when some device communicates with it sleep is put atleast 3 seconds into the future, allowing for a continuous flow of information even beyond the 30 seconds if needed.