

# Application Note



## Topic: Vizia RF + RS232 Serial Interface ASCII Programming

### Installation:

First, include the serial interface into your Vizia RF + Network. Your primary controller will assign a node ID to your Serial Interface.

#### To Include:

- Plug RS232 module into power outlet.
- Press and hold LED button until it begins to flash Amber.
- Select "Include Node" in your primary controller to begin inclusion.
- Once included you will be asked to name your RS232 Module.

The RS232 Module becomes a secondary controller in your Vizia RF + network. Once your device has been included you will have to associate all Z-wave devices you would like to control from the serial interface.

From the Primary controller:

1. Select Network (*VRCPG*) or Diagnostics (*RF Installer Tool*)
2. Select RS232 Setup
3. Select the serial interface from the list (*Press [CENTER] button in VRCPG*)
5. Place a check mark in the box next to all devices you would like controlled from the serial interface

**Note:** *Pressing 4ON from the VRCPG will select all devices in your association list.*

6. Select set associations (*Press [CENTER] button in VRCPG*)
  - a. Your remote will begin to process these associations

Once association has been completed your devices and controller will be able communicate to the RS232 module.

Association to the RS232 module is different than associations to 4-button or 1 button controllers. Once you have finished association to the RS232 module if you access the controller association menu again you will not see any check marks next to the nodes. This is normal. If you add a node and want it to be associated (report its status) to the RS232 module, select RS232 Setup and check each node again and save the associations. Once finished your RS232 module will be ready to use.

Repeat this step any time you add new devices to your network.

**Note:** *Because the association information is sent to the devices and not the RS232 module (referred to as reverse association) if you are unable to reach a device you will need to move closer to the dimmer/switch in order to resume association, not the RS232 module.*

### Connectivity:

**UART Settings:** 9600 Baud rate, 8 Data bits, No Parity, 1 Stop bit

**HyperTerminal:** No Flow Control

Properties -> ASCII Setup->"Send line ends with line feeds" and "Echo typed characters locally"

Message format:

Must use uppercase letters

Message start: ">"

Input string is limited to 80 characters

<b>Application Note ID:</b>
HANA0412111
<b>Version number:</b>
2.0
<b>Date:</b>
04/12/2011
<b>Author:</b>
N. Aronov
<b>Product Line:</b>
Vizia RF +
<b>Product:</b>
RS232 Serial Interface
<b>Part Numbers Affected:</b>
VRC0P-1LW

**Commands:** The following is the list of commands understood by the VRC0P serial interface:

CLASS	COMMAND	NOMENCLATURE	DESCRIPTION
Control Commands	N	NODE	Use "N" followed by device number(s) when controlling a single or group of nodes. (Example: >N2,3ON)
	ON	ON	The ON command turns ON a single or group of devices associated to the RS232 module.
	OFF	OFF	The OFF command turns OFF a single or group of devices associated to the RS232 module.
	L	LEVEL	Sets the light level of a dimmer (0-100%) (Example: >N2L50)
	GR	GROUP RECALL	Control 1 or more stored nodes at the same time. The group must first be stored using the Group Store command (Example: >GR1 >ON ) (The control command must be entered on a separate line)
	S	SCENE	Use the Scene command to call a scene that was programmed with the Program Scene command. (Example >N2,3S2)
	DI	DIM	Dim your light using the DIM command (Example: >N2DI)
	BR	BRIGHT	Brighten your light using the Bright command (Example: >N2BR)
	ST	STOP	The stop command stops dim/bright light level changes. This command needs 1-2 milliseconds between DI and BR commands. (Example: >N2ST)
	SE	SEND	The SEND will send any Z-Wave message. This command is generally used for thermostat control, and other non lighting control commands. (Example: >N10SE70,2)
	SS	SECURE SEND	The SECURE SEND will send any Z-Wave message with a secure encryption. This command is used for security devices such as door locks. <i>(Note: Must have a Vizia RF + VRC0P with a +3 on the back label and use the RF Installer tool as primary)</i> (Example: >N10SS98,1,255)
	Feedback Commands	?	REQUEST
UP		UPDATE	The Update command gives you the status of a single or multiple devices activated in your network. (Example: >N2UP)
FI		FIND	Find an unknown Node ID of a device. (Example: >FI4,17,0,1)
SP		COMMUNICATION SPEED	Changes the communication speed/ baud rate. <i>(Note: Must have a Vizia RF + VRC0P with a +3 on the back label)</i> (Example: >SP1)

Program Commands	<b>GS</b>	GROUP STORE	Program a group of devices using the group store command (Note: this is like an Area in our handheld remote) (Example: >N2,3,4GS1)
	<b>PS</b>	PROGRAM SCENE	Programming scenes easily allows a user to send scene commands within a Vizia RF network. (Example: >N2,3,4PS(2-255))
	<b>AP</b>	APPEND	When you exceed the max of 80 characters to a line, use the AP (append) command to extend your RS232 Command. (Example: >N2,3,4..... >AP,25,26,ON)
	<b>NN</b>	NODE NAME	Node name command allows you to Name your device up to 16 Characters. (Example: >N4NN1BEDROOM DIMMER)
	<b>NL</b>	NODE LOCATION	Node Location commands will allow you to name your device location up to 16 characters. (Example: >N4NL1MASTER BEDROOM)
	<b>DE</b>	DEFAULT	Sending the default command will reset the device to factory default. Send DE command while pressing and holding the LED button on the RS232 module.
	<b>IN</b>	INCLUDE/EXCLUDE	Puts RS232 module into include or exclude mode.
	<b>AB</b>	ABORT	Abort command will cancel any previous transmissions sent from serial interface.
	<b>RO</b>	ROUTES	Assigns and deletes routes for the routing slaves (Example: >RO2,4)

- **Control Commands:**

- **Start Association (N):** Associate single or group of nodes (not stored in memory)
  - >N2; Associate Node 2 to the Serial interface
  - >N2,5,10; Associate Nodes 2, 5 and 10 to the Serial interface
  - >N; Removes current association (no nodes assigned)
- **On/Off (ON/OFF):** Turn node or group of nodes ON or OFF
  - >N2ON; Turn node 2 ON
  - >N2,5,10OFF; Turn nodes 2, 5 and 10 OFF
  - >N,ON; Broadcasts to all nearby nodes to turn ON
- **Set Level (L):** Assign a light level for a dimming node or group
  - >N2L50; Set light level to 50% for node 2
  - >N2,5,10L50; Set light level to 50% for nodes 2, 5 and 10

- **Group Recall (GR):** Control a group of nodes that was stored to non-volatile memory with the “GS” command
  - >GR1
  - >ON; Turn ON all nodes in group 1
  
  - >GR1
  - >L50; Set the light level of all nodes in group 1 to 50%
  
- **Scene (S):** Activate a scene stored with the “PS” command. Requires Scene #(1-255) and Fade rate (1-255) parameters
  - >N2,3S2; Activate scene 2 (default fade rate is assumed)
  
  - >GR1
  - >S2,255; Activate scene 2 with default fade rates for group 1
  
- **Dim/Bright (DI/BR):** Dims/Brightens the light from current level for node or a group
  - >N2DI; Dims the light level for node 2 to 0%
  
  - >N2,5,10BR; Brightens the light level for nodes 2, 5, and 10 to 99%
  
  - >GR1
  - >BR; Brightens the light level for group 1 to 99%
  
- **Stop (ST):** Stops the light from changing the level for the node or group (used to stop the DI/BR command operation)
  - >N2,5,10ST; Stops light from changing level for nodes 2, 5 and 10
  
  - >GR1
  - >ST; Stops light from changing level for group 1
  
- **Send (SE):** To provide control to nodes different from lighting control nodes the send command can be used. This command sends any Z-wave command over RF. The first parameter is the command class, the second is the command and the rest of the command is the parameters of the appropriate command class. Refer to the Zensys command class specification for the information on the command classes available for Z-Wave system. (See Appendix A-C)
  - >N5SE69,2; Requests thermostat fan state from thermostat node 5
  
  - >N5SE68,1,1; Set thermostat node 5 fan mode to 1: Will turn the manual fan operation on.
  
  - >N6SE49,4; Requests the level of a multi-level sensor node 6 (i.e. temperature sensor)

- **Secure Send (SS):** To provide control to secure encrypted nodes such as door locks the Secure Send command is used. This command sends any Z-wave command with the security key over RF. The first parameter is the command class, the second is the command and the rest of the command is the parameters of the appropriate command class. Refer to the Zensys command class specification for the information on the command classes available for Z-Wave system. (See Appendix H-I)

**Note:** *Must have a Vizia RF + VRC0P with a +3 on the back label and RF Installer Tool as primary to use this command.*

>N6SS98,1,0; Unlocks the door lock node 6

>N6SS98,1,255; Locks the door lock node 6

>N6SS128,2; Requests the battery level for door lock node 6

- **Feedback Commands:**

- **Request (?):** Provides status information for a node or group of nodes

>?N2; Request light level information from node 2

**Note:** *Update command is preferred*

>N2?Syyy; Request scene #yyy information from node 2

- If yyy=0; current scene information will be returned.

Reports back with:

<N002:044,003,###,III,fff

### = scene number

III = light level

fff = fade rate

>N2?NN or >N2?NL; Requests node name or location for node 2

>?F1bbb,ggg,sss,iii; Request node ID

<Fxxx - Reports back with the node ID, where xxx is a node ID for the device.

- **Update (UP):** After each control command is sent, the sending node is responsible for updating information to all other controllers associated to the same nodes. To keep the system up-to-date, the update command should be appended to all control commands. It is recommended to wait a few seconds between the end of a control command and the start of the update command.

>N1,10,13ON

>UP

- **Find (FI):** This command is used to find the network node ID for a Z-wave node with certain basic, generic and specific classes. It may be used during the installation procedure as well as to check if a node is in the routing table.

>FIbbb,ggg,sss,iii

bbb = basic class number (mandatory field)

ggg = generic class number (mandatory field) (switch = 16, dimmer = 17, thermostat = 8)

sss = specific class number (assumed '0' if field is missing)

iii = instance number for the device (assumed '1' if field is missing)

If any of the class numbers (bbb,ggg,sss) is 0, the command will search for any device.  
The instance # (1-232) will reference the instance in the routing table for certain devices.

Zensys specifies only 4 valid basic classes:

1 = Controller

2 = Static Controller

3 = Slave

4 = Routing Slave

For generic and specific classes refer to the Zensys device class specification.

After searching, the device found will be added to the current association.

Afterward, you can store the current group or send any message using this group.

- **Communication Speed (SP):** This command allows to switch between specific baud rates for the serial communication.

**Note:** *Must have a Vizia RF + VRC0P with a +3 on the back label to use this command*

>SPx

where x can range from 0 to 4 corresponding to the specified baud rate;

0 = 9600 (default)

1 = 19200

2 = 38400

3 = 57600

4 = 115200

**Note:** *After exclusion, reset to default, or changing the speed over RF, the Serial interface will continue to communicate with the speed it had before, but after cycling power it will return to the default, 9600.*

- **Program Commands:**

- **Group Store (GS):** Store current association list in non-volatile memory
  - >N2,5,10GS1; Stored node 2, 5 and 10 to group 1
- **Program Scene (PS):** Store current association light levels to a scene
  - >N2,5,10PS2, 255; Programs current levels as scene 2 with default fade rate for nodes 2, 5 and 10
- **Node Name/Location (NN/NL):** provides access to programming node name and location (allowed up to 16 characters)
  - >NxxxNNdyyy..yyy; Assigns the network name for the node
  - >NxxxNLdyyy..yyy; Assigns the network location for the node
  - xxx = node #
  - d = character set;
    - 0 = standard ASCII
    - 1 = extended ASCII (recommended)
    - 2 = Unicode UTF8
  - yyy..yyy = ASCII string up to 16 characters
- **Append (AP):** Extends the ASCII command when it is over 80 characters
  - >N2,3,4,...xxx.; Association list is full for this line
  - >APyyy,zzzON; The append command allows you to continue with the command on the next line
- **Default (DE):** Defaults the Serial Interface when user is holding the button down
- **Include/Exclude (IN):** Places the Serial Interface in Programming mode for inclusion or exclusion from the network
- **Abort (AB):** Cancels any previous transmission sent from the Serial Interface
- **Routes (RO):** To provide routing slaves with valid routes (when nodes can't reach each other directly) "RO" command is used. Routing slave can have up to 5 nodes assign return routes. When adding new routes, it is recommended to delete all existing routes first.
  - >RO2,0; delete all routes for the routing slave node 2.
  - >RO2,10; setup up to 4 valid routes for node 2 to node 10.

**Serial interface replies:**

A Serial interface replies back every command sent over the serial port. It also replies back after finishing every RF transmission and when adding/removing itself to a Z-wave network. The serial interface receives messages addressed to it and forwards the messages that are not processed by the controller itself to the serial output.

**Receive command replies:**

After receiving commands over the serial port, the serial interface will check for any commands and then process them. If the sent command was correct and the device has enough resources to implement the command, the interface responds with : <E000. – No error message.

If any error has been detected or some of the resources requested are unavailable, the node responds with <Exxx, where xxx is the error number. Possible errors are listed below:

- 0 – No error
- 1 – Wrong start of the string symbol
- 2 – Input buffer overflow
- 3 – Cannot start RF transmission. All buffers are taken
- 4 – Cannot start RF transmission because previous one has not finished
- 5 – Unrecognized command
- 6 – Attempt to send the new buffer over RS232 before previous one had been processed
- 7 – The send Message does not have data fields specified
- 8 – Cannot stop SUC mode. Node is SUC
- 9 – EEPROM is busy, can't store group information
- 10 – No devices with specified properties have been found

**Replies after implementing RF transmission commands:**

After implementing the requested transmission, the serial interface will reply with the string:

<Xyyy;

where yyy is the error code

yyy = 000 if transmission was successful

yyy = 002 if an error was detected during transmission

After receiving <Xyyy; the next command can be sent.



APPENDIX

**A. Multilevel Sensor:** Below is an example of getting information from a Multilevel Sensor (i.e. a temperature sensor used by thermostats). Assume that sensor node ID is 5

```
>N5SE49,4          <- Send multilevel sensor GET
<E000              <- RS interface processed the input
<X000              <- Appropriate message has been sent correctly
<N005:049,005,001,009,075 <- REPORT from the sensor:
```

```
049 – Command class
005 – Command report
001 – The value sent is temperature
009 – The value represented by 1 byte and in deg. F
075 – Temperature 75F
```

**B. Control Thermostat Fan:** Assume that thermostat node is 5

```
>N5SE68,1,1        <- Set thermostat fan mode 1: turns the manual fan operation on.
<E000              <- RS interface processed the input
<X000              <- Appropriate message has been sent correctly
>N5SE68,2          <- Request thermostat fan mode
<E000              <- RS interface processed the input
<X000              <- Appropriate message has been sent correctly
<N005:068,003,001 <- Thermostat report indicate mode 1
>N5SE68,1,0        <- Set thermostat fan mode 0: The manual fan operation goes off
<E000              <- RS interface processed the input
<X000              <- Appropriate message has been sent correctly
>N5SE68,2          <- Request thermostat fan mode
<E000              <- RS interface processed the input
<X000              <- Appropriate message has been sent correctly
<N005:068,003,000 <- Thermostat report indicate mode 1
```

**C. Set Thermostat Set Point:** Assume that thermostat node is 5

```
>N4SE67,1,2,9,80  <- Set thermostat cooling set point to 80F
<E000
<X000
>N4SE67,2,2        <- Request thermostat set point information
<E000
<X000
<N004:067,003,002,009,080 <- Thermostat report with set point 80F.
```

**D. Dimmer control:** Assume dimmer node is node 2.

>N2L50UP	<- Set light level at 50% and request update
<E000	<- Request processed
<X000	<- Request has been sent
<N002:044,003,000,050	<- Node 2 sends back current level as result of update.
>N2OFF,UP	<- Turn dimmer OFF sequence.
<E000	<- Request processed
<X000	<- Request has been sent
<N002:044,003,000,000	<- Response shows light level of 0% or OFF

**E. Updates with Few Nodes:** Assume node 8 is the dimmer and node 4 is the thermostat

>N8,4UP	<- Instead of performing Request use Update
<E000	<- Request processed
<N008:044,003,000,050	<- Response from dimmer
<N004:064,003,003	<- Response from thermostat

**F. If node ID is unknown the find node ID command can be used.**

>N,	<- Empty current group
>F10,8 SE67,1,2,9,80	<- Set the first thermostat cooling set point to 80F
<E000	<- Request processed
<X000	<- Request has been sent
>GS100	<- Store the thermostat as a group 100
>?F10,8	<- Find out what thermostat node ID:
<F004	<- Interface reported that the thermostat has node ID=4

**G. Setup Association Tables for Node:** To setup an association table for the node use association class. Use the Send command to send the association table. (Use Secure Send for security devices)

>SE133,1, Group#, xxx,yyy... <- Add nodes to association list

Group # = 1 for dimmers/switches, 1 – 4 for the Controller buttons  
xxx,yyy = nodes added to the node association list for the switch/dimmer or controller button

> SE133,4, Group#, node1, node2...<- Remove nodes from association list

>N2SE133,1,1,7 <- Add node 7 to the association table for the dimmer node 2

**H. Control a Door Lock:** Assume door lock is node 5.

**Note:** You must have a Vizia RF + VRC0P with a +3 on the back label to perform security commands.

>N5SS98,1,255	<- Lock the door
<E000	<- Request Processed
<E000	<- Request Processed
<N005:152,128,029,161,157,021,204,149,024,057	<- Security nonce message
<E000	<- Request has been sent
>N5SS98,1,0	<- Unlock the door
<E000	<- Request Processed
<E000	<- Request Processed
<N005:152,128,176,098,227,056,039,001,095,155	<- Security nonce message
<X000	<- Request has been sent

**I. Request Door Lock Battery Level:** Assume door lock is node 5.

**Note:** You must have a Vizia RF + VRC0P with a +3 on the back label to perform security commands.

>N5SS128,2	<- Request door lock DC battery level
<E000	<- Request Processed
<E000	<- Request Processed
<N005:152,128,158,087,040,031,223,110,171,002	<- Security nonce message
<X000	<- Request has been sent
<N005:152,064	<- Security command class
<n005:000,128,003,070	<- Door Lock DC battery level is at 70%

*(Security responses have a lowercase "n" when displayed)*

*Leviton disclaims liability for any damages, including but not limited to personal injury, property damage or theft, sustained in connection with the locking and/or unlocking of, or control of doors.*