User Guide

Using Telegesis Terminal with HA Combined Interface and Five-In-One Device Firmware

Combined Interface firmware version r300

Five-In-One Device firmware version r300/r301

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1 Introduction

Telegesis have launched the Home Automation 1.1 compliant ZigBee AT Command layer on the EM357 Ember platform. The ZigBee HA AT commands allow developers to build a ZigBee HA compliant Combined Interface without the need for any in-depth knowledge of the ZigBee PRO stack. To assist the user in working with the Combined Interface (CI) AT command set, a Five-In-One device has been developed, which can be used with the CI for evaluating Telegesis HA implementations. The Five-In-One device includes five endpoints which can behave as an on/off output, level controllable output, light sensor, temperature sensor and on/off switch. More information about Five-in-One device can be found in the Five-In-One device AT Command set manual (TG-PM-0506-FiveInOneDev-AT-Command-Manual).

A description of the supported AT command set has been included in the CI and Five-In-One device manuals (TG-PM-0505-CI-AT-Command-Manual and TG-PM-0506-FiveInOneDev-AT-Command-Manual), this document will give several examples to assistant the user to have a quick start with the evaluation kits. Although AT command set can work with a serial port communication tool (such as HyperTerminal), Telegesis Terminal is recommended as an easy way to start practising with the Home Automation application. A pre-configured panel is provided as shown in Figure 1, which contains multiple buttons. It can be observed that each button has a specific name on it, for example Info, Bootloader, Help and so on. The user can easily click one of the buttons to issue an AT command.

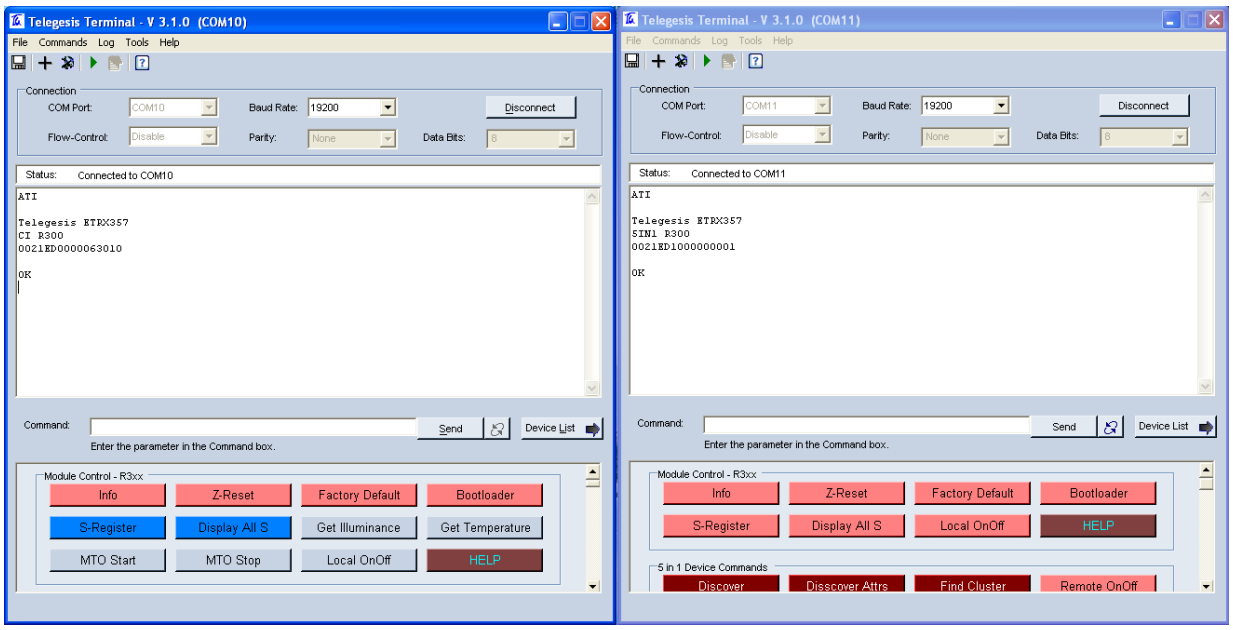


Figure 1. Telegesis Terminal for CI and Five-In-One (5in1) Device

This document provides a user guide to use this version of Telegesis Terminal. Following sections will introduce the preconfigured panels for both CI and Five-In-One Device, then give several examples of using the Telegesis Terminal to implement applications, for example network form and join, publish price and so on. In addition, the use of buttons on the Five-In-One Device will be introduced. The user can follow the induction to use buttons on the Five-In-One Device to join a HA network and send some command instead of sending AT command via serial port.

2 Telegesis Terminal Panel

This section introduces the pre-configured Telegesis Terminal panels of both CI and Five-In-One Device.

2.1 Combined Interface Panel

The CI panel can be used to control the CI module and issue commands as well as display local information or responses from the Five-In-One device. Figure 2 shows the buttons. It can be observed

that the buttons are categorized into five groups: Module control, Network Management, ZDO, Binding, and Combined Interface. The function of the buttons will be introduced in a later section.

Figure 2. Button layout of the CI panel

2.2 Five-In-One Device Panel

The Five-in-One device supports five endpoints (EP) (on/off output, level controllable output, light sensor, temperature sensor and on/off switch). It supports multiple HA server clusters. More information can be found in the Five-In-One At command set manual.

The Five-In-One Device panel, as shown in Figure 3, can be used to control the Five-In-One module and issue commands as well as display local information or response from other device (such as the CI). The panel contains buttons which are categorized into five groups: Module Control, 5-in-1 device commands, Network Management, Binding and ZDO. The function of the buttons will be introduced in a later section.

Figure 3. Button layout of the 5-in-1 panel

2.3 Function of the Buttons on the Telegesis Teminal

The following table maps the buttons with their linked AT commands and a brief description is also given. More information about a specific command and its prompt has been included in the CI or Five-In-One Device manual.

Button Name	Linked AT Command	Description
Module Control-R3xx (includes the buttons on both Five-In-One Device and CI panels)		
Info	ATI	Display Product Identification Information
Z-Reset	ATZ	Software Reset (this will not change the previous S-register settings such as link key and so on)
Factory Default	AT&F	Restore Factory Defaults (Clear all S-Register setting)
Bootloader	AT+BLOAD	Enter The Bootloader Menu (will used to update firmware)
S-Register	ATS	Read/Write S-Register
Display All S	AT+TOKDUMP	Display All S-Register Settings
Get Illuminance (CI)	AT+READATR	Read Illuminance Reading From Light Sensor
Get Temperature (CI)	AT+READATR	Read Temperature Reading From Temperature Sensor
MTO Start (CI)	AT+MTOSTART	Start Many-to-One Function
MTO Stop (CI)	AT+MTOSTOP	Stop Many-to-One Function
Local On/Off	AT+LONOFF	Toggle Local LED for On/Off output server

Help	AT+HELP	Display All Available Commands
Network Management		
Form A NWK(CI)	AT+EN	Establish a Personal Area Network
Energy Scan	AT+ESCAN	Scan the background energy of all channels
Scan for Pan	AT+PANSCAN	Scan for active PANs
Join a Spec PAN	AT+JPAN	Join specific PAN
Join any PAN	AT+JN	Join an open network with matched preconfigured link key
Disas Remote	AT+DASSR	Disassociate Remote Node from PAN
Address Table	AT+ATABLE	Display Address Table
Add addr entry	AT+ASET	Add Address Entry in Local Address Table
Disas Local	AT+DASSL	Disassociate Local Node from PAN
NWK Info	AT+N	Display Network Information
PJOIN	AT+PJOIN	Switch on “Permit Joining” Flag
ZDO		
ID Request	AT+IDREQ	Request node’s NodeID
EUI request	AT+EUIREQ	Request node’s EUI
Node Descriptor	AT+NODEDESC	Request node’s descriptor
Power Des	AT+POWERDESC	Request node’s power descriptor
ACT EP	AT+ACTEPDESC	Request node’s active endpoint list
Simple Des	AT+SIMPLEDESC	Request endpoint’s simple descriptor
Match Des	AT+MATCHREQ	Find nodes which match a specific descriptor
ANNCE	AT+ANNCE	Announce local device in the network
Binding		
Local BTable	AT+LBTABLE	Display local binding table
BSET	AT+BSET	Set local binding table entry
Remote BTable	AT+BTABLE	Display remote binding table
DEI BTable	AT+BCLR	Remove a local binding table entry
Bind to Remote	AT+BIND	Create binding on remote device
Del Remote B	AT+UNBIND	Delete binding on remote device
BindLight	AT+BINDLIGHT	Bind the on/off switch to a on/off output server
UnbindLight	AT+UNBINDLIGHT	Unbind the on/off switch to a on/off output server
End Device Bind	AT+EBIND	End Device Bind Command
Clear Binding(5in1)	AT+CLEARBIND	Clear Local Binding Table

Combined Interface Functions		
Discover Device	AT+DISCOVER	Discover HA device on the HAN
Find Cluster(s)	AT+CLUSDISC	Discover all supported clusters on a remote device
Discover Attrs	AT+ATTRDISC	Discover supported attributes on a remote device
Read Attribute	AT+READATR	Gets an attribute from a remote device which supports a specified cluster
Write Attribute	AT+WRITEATR	Writes an attribute to a remote device which supports a specified cluster
Get Attribute (CI)	AT+GETATR	Get value of a local ZCL attribute
Set Attribute (CI)	AT+SETATR	Set value of a local ZCL attribute
Remote OnOff	AT+RONOFF	Send a On/Off/Toggle command to target
Identify Remote	AT+IDENTIFY	Identify a remote endpoint
Identify Query	AT+IDQUERY	Query a remote endpoint to check identify status
Add Group	AT+GPADD	Add Group On Target Device
View Group	AT+GPVIEW	View Group Information Of Target Devices
Get Group MS	AT+GPGET	Get Group Membership Information From Target Devices
Remove Group	AT+GPRMV	Remove A Group Membership On Target Device
Remove All GP	AT+GPRMALL	Remove All Group Associations On Target Device
Thermostat set	AT+TSTATSET	Thermostat Set
Add Scene	AT+SCADD	Add Scenes
View Scene	AT+SCVIEW	View Scenes
Remove Scene	AT+SCRMV	Remove Scenes
Remove All SC	AT+SCRMALL	Remove All Scenes
Store Scene	AT+SCSTORE	Store Scenes
Recall Scene	AT+SCRECAL	Recall Scenes
Get SC Member	AT+SCGETMSH	Get Membership
Move to Level	AT+LCMVTOLEV	Level Control Move to Level Command
LC Move	AT+LCMV	Level Control Move Command
LC Step	AT+LCSTEP	Level Control Step Command
LC Stop	AT+LCSTOP	Level Control Stop Command
Move to Color	AT+CCMVTOCOL	Colour Control Move to Colour Command
Move Color	AT+CCMVCOL	Colour Control Move Colour Command
Step Color	AT+CCSTEPCOL	Colour Control Step Colour Command
Move to Hue	AT+CCMVTOHUE	Colour Control Move to Hue Command
Move Hue	AT+CCMVHUE	Colour Control Move Hue Command

Step Hue	AT+CCSTEPHUE	Colour Control Step Hue Command
Move to Sat	AT+CCMVTOSAT	Colour Control Move to Saturation Command
Move Sat	AT+CCMVSAT	Colour Control Move Saturation Command
Step Sat	AT+CCSTEPSAT	Colour Control Step Hue Command
Move to HS	AT+CCMVTOHUS	Colour Control Move To Hue and Saturation Command
Move ColorTemo	AT+CCMVTOCT	Colour Control Move to Colour Temperature Command
Door Lock	AT+DRLOCK	Lock/Unlock Door
Five-In-One Devices Functions		
Set Attribute	AT+SETATR	Set value of a local ZCL attribute
Get Attribute	AT+GETATR	Get value of a local ZCL attribute
Discover Device	AT+DISCOVER	Discover HA device on the HAN
Find Cluster	AT+CLUSDISC	Discover all supported clusters on a remote device
Discover Attrs	AT+ATTRDISC	Discover supported attributes on a remote device
Remote OnOff	AT+RONOFF	Send a On/Off/Toggle command to target
Identify Remote	AT+IDENTIFY	Identify a remote endpoint
Identify Query	AT+IDQUERY	Query a remote endpoint to check identify status
Read Attribute	AT+READATR	Gets an attribute from a remote device which supports a specified cluster
Write Attribute	AT+WRITEATR	Writes an attribute to a remote device which supports a specified cluster

3 Application Examples Using Telegesis Terminal

This section gives several examples of utilizing Telegesis Terminal to test some HA applications upon the CI and Five-In-One device. These applications are simple. The user can practice with them to gain further understanding of the CI supported AT command sets before working on their own CI device or any device type supported by Five-In-One device.

The following picture shows the Five-In-One device which contained LEDs and buttons, which will be referred to in the following section.

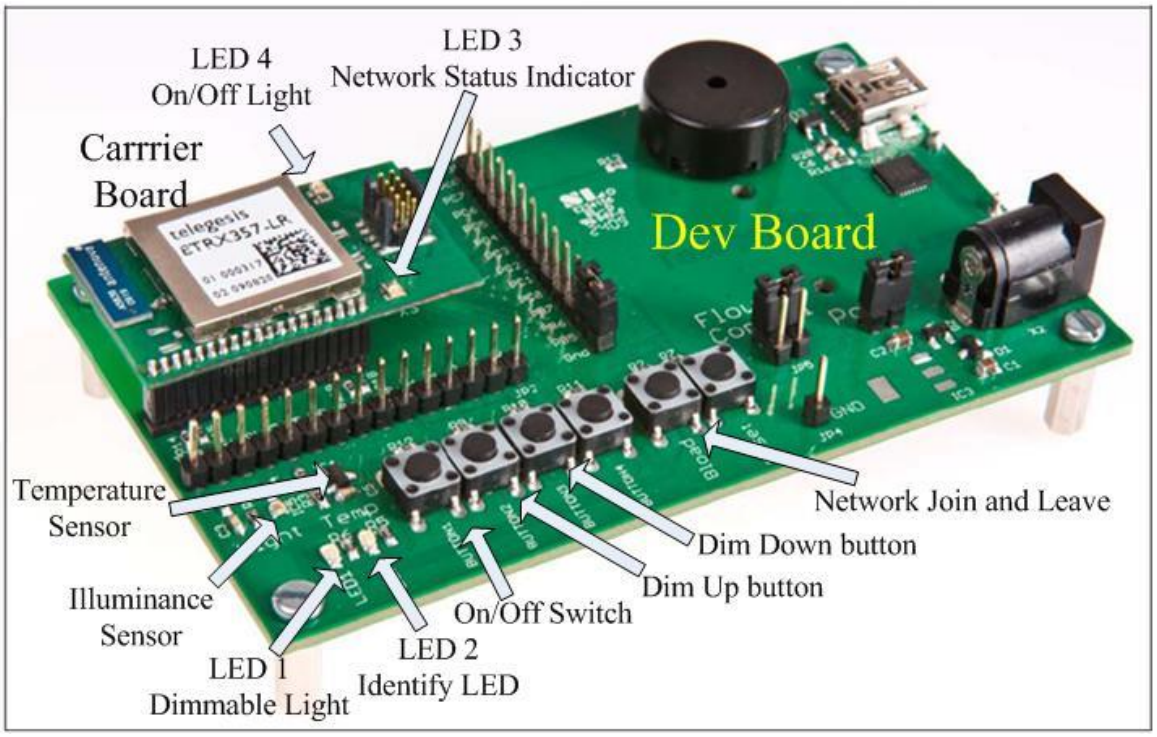


Figure 4. Telegesis Five-in-One Device

3.1 Network formation

In a HA network, the combined interface can be a coordinator, it supports the function of forming a HA network and permitting other nodes to join. Also it can be a router and join an existing HA network. In this document, the Combined Interface is assumed to be a coordinator and the Five-In-One device acts as a router or sleep end device. Joining progress is the same for router and sleep device, therefore the Five-In-One device is considered as a router in this document.

The objective of this test is to test that the CI can form a HA network and the Five-In-One device can join the formed network with HA security settings.

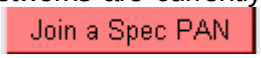
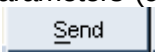
3.1.1 Initial Condition

Set up the CI and the Five-In-One device (e.g. plug each into a PC)

Run Telegesis Terminal; choose the serial ports for both the CI and the Five-In-One device

3.1.2 Implementation Procedure

Item	Test Step	Note
1.	Click the buttons in the CI panel: Form a NWK	This is to forming a HA network. Because the parameter has been configured as following: channel: 11, power:3, PANID: 1456. **JPAN:11,1456,<EPID>** prompt should be observed in CI's terminal, which means a HA network has been formed successfully. The user can also input AT+EN with specific parameters in the Telegesis Terminal command line to form a network.

Network formation progress completed.		
2.	In the terminal for the CI, click 	Open the network for 60 seconds to permit joining
3.	Click the buttons in the Five-In-One Device panel: 	The Five-In-One device will scan for a HA network which is permitting joining and join it. **JPAN:11,1456,<EPID>** prompt should be observed in Five-In-One Device's terminal, which means the Five-In-One Device network has joined the HA network successfully. In the mean time, it will broadcast a Device Announcement and the terminal of CI will show prompt: FFD:<5in1's EUI>,<5in1's NodeID> Note: If the user is not sure about the number of HA networks in the experiment environment,  button can be used on Five-In-One device's terminal. If there are more than one HA networks are currently permitting joining, the user can use  button and fill in the parameters (channel, PANID and EPANID), then click  to join a specific network (CI formed). Network indicator (LED3) on the carrier board will be in fast blink mode when the device is in scanning/joining progress. When it finds a joinable network and joins that network successfully, it will perform slow blink twice.
4.	Click the buttons in the Five-In-One Device panel: 	The Five-In-One Device terminal shows**:** LeftPAN In the mean time, the network indicator does fast blink then slow blinks three times which indicates that the device has left the network successfully.
Join and leave practice complete		

3.2 Use Identify Command

This test is to ascertain that the CI can send Identify commands to identify the Five-In-One device.

Assumption: The CI forms a HA network. When it turns on Permit Join, several nodes join the network. In such a case, the CI will receive a multiple device announcement and the Identify command can be used to locate an individual node.

The Five-In-One device uses on-board LED2 to indicate Identify status. When it receives an Identify command from the CI, it will blink LED2 for a time period which is specified by CI.

3.2.1 Initial Condition

Set up the CI and the Five-In-One device (e.g. plug each into a PC)

Run Telegesis Terminal; choose the serial ports for both the CI and the Five-In-One device

CI forms a network

Five-In-One device joins the CI's network

3.2.2 Implementation Procedure

Item	Test Step	Note
1.	Click the button in CI panel: Identify Remote	The command line will show AT+IDENTIFY:<NodeID>,<EP>,0,0060<Enter Parameter here> Please input Node ID and Endpoint (e.g.01) of the Five-In-One device and remove "<Enter Parameter here>". The Node ID can be got from device announcement. Then click Send button The CI will send an *Identify* command to the Five-In-One device Endpoint 0x01(on/off output)
2.	When the Five-In-One device sends a default response to the CI.	The CI panel display a default response: DEFTREP:<5in1's NodeID>,<EP>,<ClusterID>,<CMDID>,<Status> Note: if the status is not 00, it will be an error code. In the meantime, LED2 on Five-In-One Device blinks for 60 seconds
3.	Click the button in CI panel: Identify Query	The CI will send an *Identify Query* command to request the remaining identify time from the Five-In-One Device
4.	The Five-In-One device sends a response back; the CI panel will display it.	The CI panel will display an *Identify Query* response with remaining time.

3.3 Send On/Off/Toggle command

The objective of this test is to test that the CI can send On/Off/Toggle command to control LEDs on the Five-In-One device dev board.

The Five-In-One device uses the carrier board LED4 (coloured red) to indicate on/off status of the On/Off output cluster. It utilizes LED1 (coloured green) on the dev board for level controllable output. Both LEDs can be turned on and off.

3.3.1 Initial Condition

Set up the CI and the Five-In-One device (e.g. plug each into a PC)

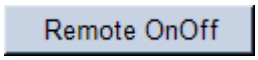
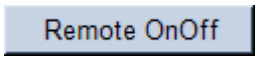
Run Telegesis Terminal; choose the serial ports for both the CI and the Five-In-One device

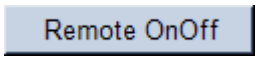
CI forms a network

Five-In-One device joins the CI's network

Set on/off attribute of on/off output of Five-In-One device to be in off status (By default, on/off attribute value is 0x00 and the LED4 is off)

3.3.2 Implementation Procedure

Item	Test Step	Note
1.	Click the button in CI panel: 	The CI will send a *matchdescriptor* request to find out the endpoints which support on/off output server (cluster ID: 0x0006) Then the CI will receive multiple response: DEV:<NodeID>,<EP> If the HA network only have CI and Five-In-One device, one response containing two endpoints will be shown in CI's terminal. Because the Five-In-one device supports on/off server on its endpoint 0x01 and 0x02.
2.	Click the button in CI panel: 	The command line will show AT+RONOFF:<NodeID>,<EP>,0<Enter Parameter here> Please input Node ID and Endpoint (01 or 02) of the Five-In-One device and remove "<Enter Parameter here>". The node Id can be got from device announcement. Then click  button The CI will send a *Toggle* command to the Five-In-One device Endpoint 0x01 or 0x02(on/off output or level controllable output) An LED (LED1 or LED4) on the Five-In-One device will be turned on depending on which endpoint the command was sent to (When ep 0x01 is used the LED4 will glow. When ep 0x02 is used the LED1 will be gradually on). In the meantime, the terminal shows TOGGLE:0000,01, which means the Five-In-One device receives a *Toggle command* from the CI on/off client whose Node ID is 0x0000, endpoint is 0x01
3.	Repeat step 2	The LED will be turned off
4.	Click the button in CI panel: 	The command line will show : AT+RONOFF:<NodeID>,<EP>,0<Enter Parameter here> Please input Node ID and Endpoint (01 or 02) of the Five-In-One device and replace "<Enter Parameter here>" to 1. (The Node ID can be obtained from device announcement). e.g: AT+RONOFF:0123,01,0,1 Then click  button The CI will send an *On* command to the Five-In-One device Endpoint 0x01 or 0x02(on/off output or level controllable output) An LED on the Five-In-One device will come on. (When EP 0x01 is used the LED4 will glow. When EP 0x02 is used the green LED1 will be on). In the meantime, the terminal shows ON:0000,01, which means the Five-In-One device receives a *On command* from the CI on/off client whose NodeID is 0x0000, endpoint is 0x01

5.	Click the button in CI panel: 	The command line will show : AT+RONOFF:<NodeID>,<EP>,0<Enter Parameter here> Please input Node ID and Endpoint (01 or 02) of the Five-In-One device and replace "<Enter Parameter here>" to 0. (The node Id can be obtained from device announcement). e.g: AT+RONOFF:0123,01,0,0 Then click  button The CI will send a *Off* command to the Five-In-One device Endpoint 0x01 or 0x02(on/off output or level controllable output) LED on the Five-In-One device will be off. (When EP 0x01 is used the LED4 will glow. When EP 0x02 is used the LED1 will be turned on). In the meantime, the terminal shows OFF:0000,01, which means the Five-In-One device has received an *Off command* from the CI on/off client whose Node ID is 0x0000, endpoint is 0x01

3.4 Send Level Control command

The objective of this test is to test that the CI can send Level Control commands to control LED1 on the Five-In-One device dev board.

The Five-In-One device uses the LED1 (bright green colour) on the dev board for level controllable output.

3.4.1 Initial Condition

Set up the CI and the Five-In-One device (e.g. plug each into a PC)

Run Telegesis Terminal; choose the serial ports for both the CI and the Five-In-One device

CI forms a network

Five-In-One device joins the CI's network

Set current level of level controllable output of Five-In-One device to be 0 (By default, it is 0 and the LED1 is off).

3.4.2 Implementation Procedure

Item	Test Step	Note
1.	Click the button in CI panel: 	The CI will send a *matchdescriptor* request to find out the endpoints which support on/off output server (cluster ID: 0x0008) Then the CI will receive a response: DEV:<NodeID>,<EP> If the HA network only has CI and Five-In-One devices, one response will be shown in CI's terminal, as the Five-In-one device supports level controllable server on its endpoint 0x02.
2.	Click the button in CI panel:	The command line will show AT+LCMVTOLEV: <NodeID>,02,0,0,12,0066<Enter Parameter here>

	Move to Level	Please input Node ID of the Five-In-One device and Endpoint (02) then remove "<Enter Parameter here>". The Node ID can be obtained from the device announcement. Then click Send button The CI will send a *MoveToLevel* command to the Five-In-One device Endpoint 0x02 (level controllable output). This command requests the Five-In-One device level controllable output to move to level 0x12 LED1 on the Five-In-One device will dim on and stop at level 0x12 (if S64 and S65 keep the default settings, as these two register will affect the MAX and Min level of level controllable output. More information is available in the Five-In-One Device AT command set manual). In the meantime, the terminal shows: LCMVTOLV:0000,01,12,0066, which means the Five-In-One device receives a *MoveToLevel command* from the CI level control client whose NodeID is 0x0000, endpoint is 0x01
3.	Repeat step 2 by changing the level parameter to 00	The LED1 will be turned off.
4.	Click the button in CI panel: LC Move	The command line will show AT+LCMV: <NodeID>,<EP>,0,0,00,FF<Enter Parameter here> Please input Node ID and Endpoint (01 or 02) of the Five-In-One device and replace "<Enter Parameter here>" to 1. The Node ID can be obtained from the device announcement. Then click Send button The CI will send a *Move* command to the Five-In-One device Endpoint 0x02(level controllable output) to request the Five-In-One device to increase level until reaches the Max level FF. (In the progress, the user can use LC Stop on the CI panel to stop the move) If there is no Stop command, the LED1 will be fully turned on after the specified transition time. In the meantime, the terminal shows: LCMV:0000,01,00,FF which means the Five-In-One device receives a *move command* from the CI whose NodeID is 0x0000, endpoint is 0x01

3.5 Read Server Attributes (Illuminance and Temperature)

The objective of this test is to prove that the CI can send proper Read Attributes Requests to the Five-In-One device and the latter will then send a Read Attribute Response back. In addition, the CI should properly display the information carried by the response.

The Five-In-One device supports the illuminance measurement and temperature measurement server clusters. These two clusters utilize the light sensor and temperature sensor on the dev board to provide real-time illuminance and temperature measurement. This test can demonstrate how the CI gets real-time sensor readings. Figure 4 shows the location of the two sensors.

3.5.1 Initial Condition

Set up the CI and the Five-In-One device (e.g. plug each into a PC)

Run Telegesis Terminal; choose the serial ports for both the CI and the Five-In-One device

CI forms a network

Five-In-One device joins the CI's network

3.5.2 Implementation Procedure

Item	Test Step	Note
1.	Click the button in CI panel: 	The command line will show AT+READATR:<NodeID>,03,0,0400,0000<Enter Parameter here> Please input Node ID of the Five-In-One device and remove "<Enter Parameter here>" Then click  button The CI will send a *Read Attribute Request* command to the Five-In-One device to request the Illuminance current measured value of illuminance (Attribute ID: 0000)
2.	When the Five-In-One device sends a response, the CI panel will display it.	The CI panel display a response for example: ILLUMINANCE:1279,03,0000,00,060F The four parameters are: NodeID, Endpoint, AttributeID, Status, Attribute Value Note: if the status is not 00, it will be an error code. In such a case, the Attribute value will not be displayed. The value 060F is the current reading of the illuminance sensor on the Five-In-One Device
3.	Cover the illuminance sensor and repeat step 1	Cover the sensor will change current reading
4.	When the Five-In-One device sends a response, the CI panel will display it.	The CI panel display a response for example: ILLUMINANCE:1279,03,0000,00,0000 As expected, the value of the current illuminance reading will have decreased. It becames to 0000, because it was fully shaded in the test.
Test of getting Illuminance reading completed.		
5.	Click the button in CI panel: 	The command line will show AT+READATR:<NodeID>,04,0,0402,0000<Enter Parameter here>

		Please input Node ID of the Five-In-One device and remove "<Enter Parameter here>" Then click Send button The CI will send a *Read Attribute Request* command to the Five-In-One device to request the current temperature (Attribute ID: 0000)
6.	When the Five-In-One device sends a response, the CI panel will display it.	The CI panel displays a response for example: TEMPERATURE:1279,04,0000,00,00DB The four parameters are: NodeID, Endpoint, AttributeID, Status, Attribute Value (temperature) Note: if the status is not 00, it will be an error code. In such a case, the Attribute value will not be displayed. The value 00DB is the current reading of the temperature sensor on the Five-In-One Device To convert the value: 00DB is a hexadecimal which is 219 in decimal. Current temperature = got value(219)/10 = 21.9 ^{0}C
7.	Heat the temperature sensor and repeat step 1	This will change current reading
8.	When the Five-In-One device sends back a response, the CI panel will display it.	The CI panel display a response for example: TEMPERATURE:1279,04,0000,00,00E1 Current temperature = got value(225)/10 = 22.5 ^{0}C As expected, the value of current Temperature reading increased.
Test of getting Temperature reading completed.		

In addition, the user can use AT+READATR to read other cluster attributes by using Read Atttribute and fill the parameter. Information about AT+READATR command can be found in the Combined Interface AT command set manual.

Please note:

This document only gives some typical examples of the HA applications, which can be built using the CI and Five-In-One device. The main purpose of this document is to provide a quick start guide for the user to be familiar with Telegesis HA AT Command set. In fact, the CI AT command set has more functions that can be utilized with a properly-selected series of AT commands. For instance, the user can use A*dd Group* command to add group on the on/off output endpoint and level controllable output, then use an on/off command to turn both LED1 and LED4 on or off. For more information about the AT commands, please check the provided Combined Interface AT command set manual for information of using Group Cluster commands.

4 Use Physical Buttons on Five-In-One Device Dev Board

The Five-In-One device has six physical buttons on its dev board as shown in Figure 4 (there are markers aside of the button, e.g. Button1, Button2 and so on). Apart from Button4, all the other buttons can be used with predefined functions:

Button name on the Dev board	Functions	Note
Button1	On/Off switch	Pressing this button to send end device binding request, if there is no binding entry for On/Off switch in local binding table. Pressing this button to send a Toggle command via binding, if there have been binding entries for On/Off switch in local binding table. (Please note: when using short press, the button need to be pressed at least 0.2 second.) Long pressing this button for 4 seconds to send an end device binding request to the network coordinator for setting up binding for the On/Off switch cluster on endpoint 0x05.
Button2	Dim up	If the Five-In-One device is configured as a sleep end device, this button is not functional. If the Five-In-One device is not join any network or joined a network as a router, pressing this button will dim up the LED1.
Button3	Dim down	If the Five-In-One device is configured as a sleep end device, this button is not functional. If the Five-In-One device is not join any network or joined a network as a router, pressing this button will dim down the LED1.
Bload	Network Join and leave	Pressing the button to make the device scan and join a HA network, if it not on any HA network. Alternatively, pressing the button to make the device leave a joined HA network, if it has been on a HA network.
Reset	Reset	Hardware reset (it will not reset flash maintained settings, e.g. binding table, s-register and so on)
Press Button2 and Button3 together	Toggle LED4 on the Five-In-One device dev board	Pressing these two buttons together will toggle the On/Off output LED. Long pressing two buttons together for 3 seconds, the device will send an end device binding request for setting up binding for the On/Off output cluster on endpoint 0x01. Long pressing two buttons together for 5 seconds, the device will send an end device binding request for setting up binding for the Level Controllable output cluster on endpoint 0x02. Long pressing two buttons together for 8 seconds, the device will clear local binding table.

4.1.1 Initial Condition

Set up the CI (e.g. plug each into a PC)

Equip the Five-In-One device with 2 AAA batteries (please change the jumper on the dev board to change power supply for the Five-In-One device)

Run Telegesis Terminal; choose the serial ports for both the CI

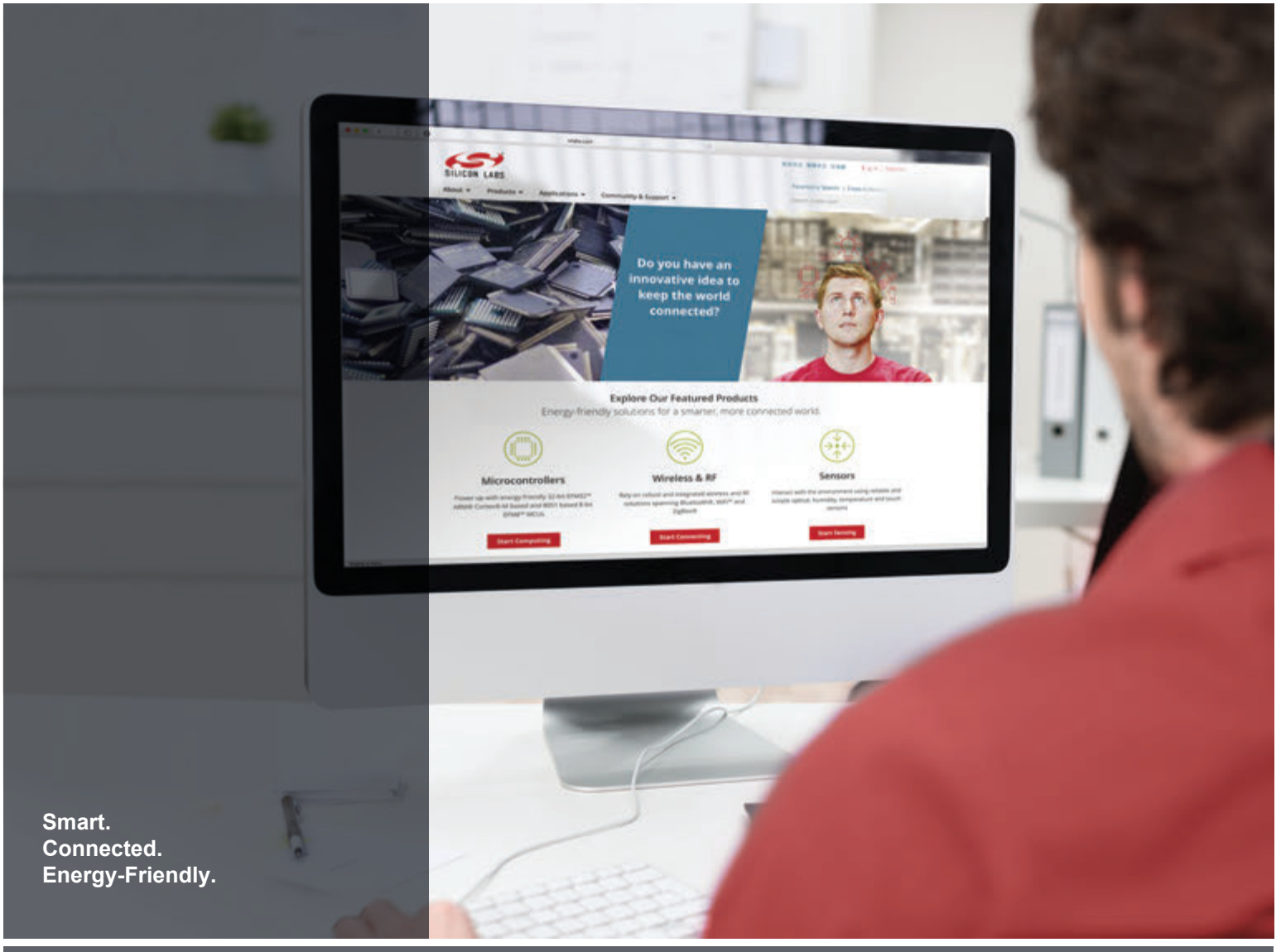
CI forms a HA network and turns permit-join on

The Five-In-One device is not on any network

4.1.2 Implementation Procedure

Item	Test Step	Note
1.	Press Button (Bload)	The Five-In-One device will scan for CI's network and attempt joining. Network indicator (LED3) on the carrier board will be in fast blink mode when the device is in scanning/joining progress. When it finds a joinable network and joins that network successfully, it will perform slow blink twice. The terminal of CI will show prompt: FFD:<5in1's EUI>,<5in1's NodeID> On the Five-in-One device dev board, LED4 (On/Off output LED) is in off status. Please note: it is assumed that the Five-in-One device is configured as a Router.
2.	Press Button 2 and Button3 together	The LED4 on Five-In-One device's carrier board will be turned on.
3.	Repeat step 2	The LED4 on Five-In-One device's carrier board will be turned off.
Test On/Off Switch		
4.	Send End Device Binding from CI Note: to bind the Five-In-One device' On/Off switch to CI's on/off output (EP: 0x0A), CI need to initiate end device binding.	Use CI's terminal to input the following command in command line: AT+EBIND:0a then press 
5.	Within 60 seconds after step4, press Button 1 once (short press)	The Five-In-One device will send an end device binding request to bind its On/Off switch to the On/Off output server on endpoint 0x0A of the CI
6.	Press Button 1 again	The Five-In-One device will send a Toggle command to CI endpoint 0x0A (on/off output). Red LED on CI USB will be turned on.
7.	Press Button 1 again	The Five-In-One device will send a Toggle command to CI endpoint 0x0A (on/off output). Red LED on CI USB will be turned off.
Test Button 2 and Button3 to dim up/down the LED 1 on the Five-in-One device		
8.	Press Button 2 five times	The LED1 will dim on.
9.	Press Button 3	The LED1 will dim off.

Leave network		
10.	Long Press Button (Bload) (6 second), the LED3 will fast blink. Release the button, the Five-In-One device will leave its network.	The Five-In-One device will leave the network. When the Five-In-One device completes the leaving progress, network indicator (LED3) will slow blink four times showing the device has left the network successfully. It is recommended to use reset button to reset the Five-In-One device after leave the network then do other tests.



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