

Synergy Enterprise Cloud Toolbox for PK-CLOUD1

Quick Start Guide

Renesas Synergy™ Platform
Synergy Tools & Kits
Tools: Connectivity

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General Precautions

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Renesas Synergy™ Platform

Synergy Enterprise Cloud Toolbox for PK-CLOUD1

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1. Introduction

This Quick Start Guide for PK-CLOUD1 demonstrates the Synergy™ Enterprise Cloud Toolbox (SECT) application. This application project is downloadable from www.renesas.com/cloudtoolbox and includes the following items:

- Embedded code
- Dashboard code
- Quick Start Guide
- Application Note

This application package can be used as a reference solution for users to quickly get started on the Synergy Software Package (SSP), Wi-Fi Framework, and Cellular Framework, as well as Ethernet connectivity, and cloud connectivity with different IoT Cloud Providers using the Renesas Synergy™ Enterprise Cloud Toolbox for PK-CLOUD1 Kit.

2. Prerequisites

As the reader of this quick start guide, you are assumed to have some experience with the IAR Embedded Workbench® for Renesas Synergy™ or Renesas Synergy e² studio ISDE and SSP. The hardware and software requirements listed in the section 3 should be installed.

Note: The MCU board is not pre-programmed with firmware for the Synergy Enterprise Cloud Toolbox application project. To run the bat file and flash the MCU board, see the instructions in the Appendix — Downloading and running the Synergy Enterprise Cloud Toolbox.

You may also have the project software built and ready for flashing on the PK-CLOUD1 Development Kit. For instructions on how to build and flash the software on the device, consult the *Application Note* provided with the Synergy Enterprise Cloud Toolbox. If you run into any problem while going through the instructions in this quick start guide, refer to the limitations listed in section 6.14 for guidance.

3. Requirements

- PC software requirements:
 - Microsoft® Windows® 7 or 10
 - e² studio ISDE v5.4.0.023
 - IAR Embedded Workbench® for Renesas Synergy™ (IAR EW for Synergy) v7.71.3
 - Synergy Software Package (SSP) v1.3.3
 - Synergy Standalone Configurator (SSC) v5.4.0.23
- PK-Cloud1 hardware set requirements:
 - PK-S5D9 Synergy MCU development kit
 - Sensor Shield board
 - Longsys GT202 Wi-Fi board based on Qualcomm (QCA 4002 chipset) with a PMOD plug-in
 - CAT3 PMOD
 - Two antennas
 - Power adapter
 - Two micro USB connector cables
 - Ethernet Cable

4. About the Demonstration

The demonstration application provides a reference design and implementation to get your S5D9 based platform quickly onto the cloud. The application uses NetX™ Secure and NetX MQTT™ to communicate with Amazon Web Solutions (AWS), Microsoft® Azure, and Google IoT cloud providers. This demonstration shows how to integrate functionality from the sensor shield, including the accelerometer, barometric pressure sensor, temperature and humidity sensor, and send this sensor data to the cloud over Ethernet, Wi-Fi, or Cellular network interfaces. How to send commands from the cloud to devices in order to turn an LED on or off is also shown.

The major components (see Figure 2) in the embedded application include:

- SSP components
 - Wi-fi framework
 - Cellular Framework
 - NetX IP stack
 - Cloud APIs (MQTT/TLS)
 - Console framework
- Sensor drivers

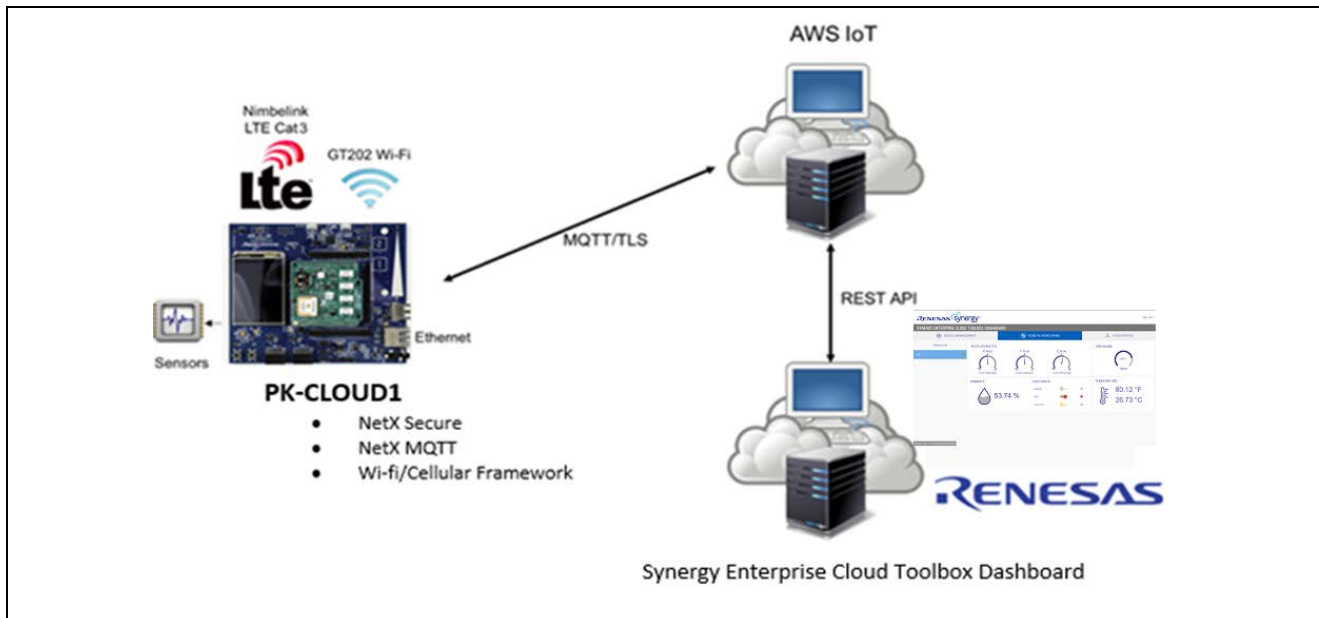


Figure 1 System overview

5. Setting up the Hardware

5.1 Device connections and setup

For device connection details, refer to Figure 2 unless otherwise noted.

1. Connect a micro USB cable to port J5 for the serial console.
2. Connect Wi-Fi module to PMOD A
3. Connect cellular CAT3 module to PMOD B
4. Connect sensor shield. (The shield may already be inserted.)

Note: Do the next step *only after all the other modules and connectors are plugged in!* Port J19 supplies power to the PK-CLOUD1 Synergy MCU board, in addition to the debugger.

5. Connect a micro USB cable to port J19 for the debugger.

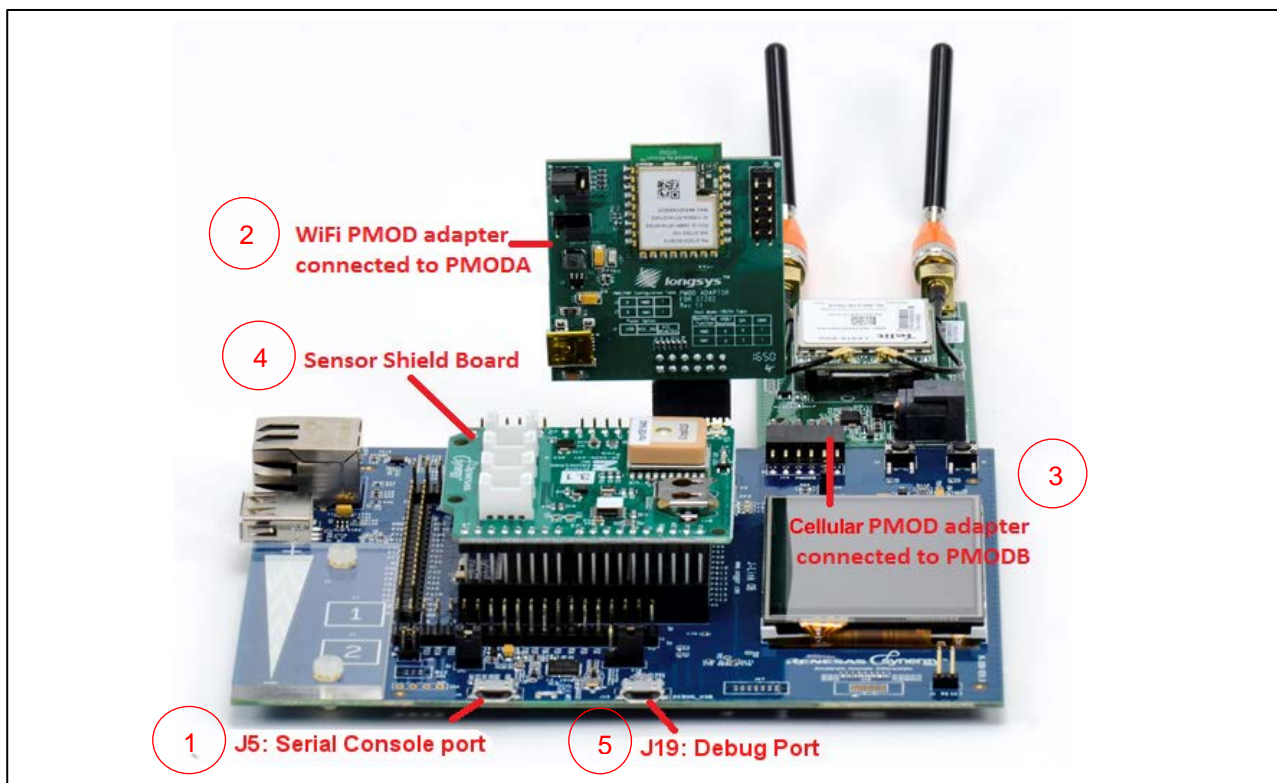


Figure 2 Device connections and setup

Notes:

- After connecting the PK-CLOUD1 device to your computer, if it does not appear as a device, follow the instructions given on the Renesas Synergy Knowledge Base web page for manually assigning the [SEGGER CDC UART driver to the “EL Composite Device” in Windows](#). The Vendor ID and Product ID fields should be set to 0x0000 as shown in Figure 1.
- On Windows 10, and in cases where RFP is installed on the system, shows the Vendor ID and Product ID fields of USBX Device Configuration in the IoTKit Thread may have to be set to 0x0000.

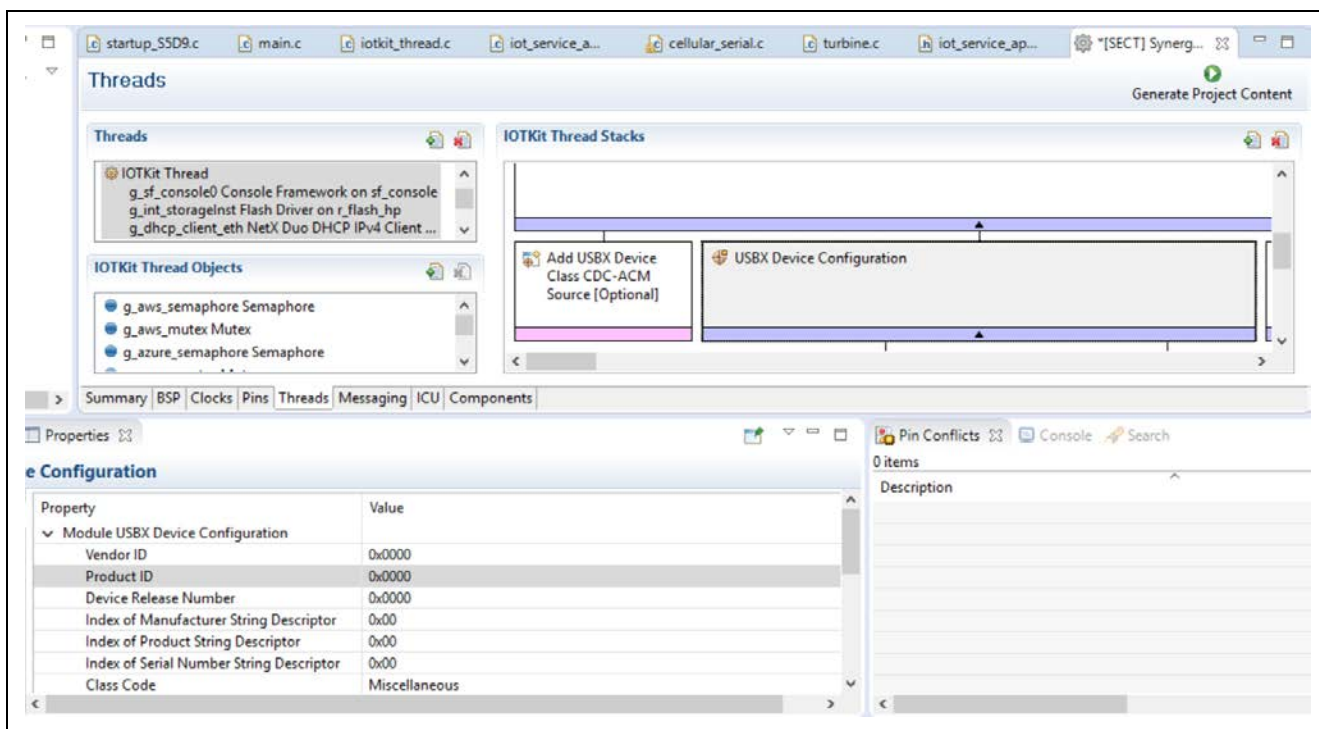


Figure 3 USBX Device Configuration for Windows 10

5.2 Cellular network connections and setup

For Cellular Network connectivity, see Figure 4 and the following steps:

1. Connect the antennas provided with your CAT3 module.
2. Connect the power supply to cellular CAT3 module.
3. Connect cellular CAT3 module.

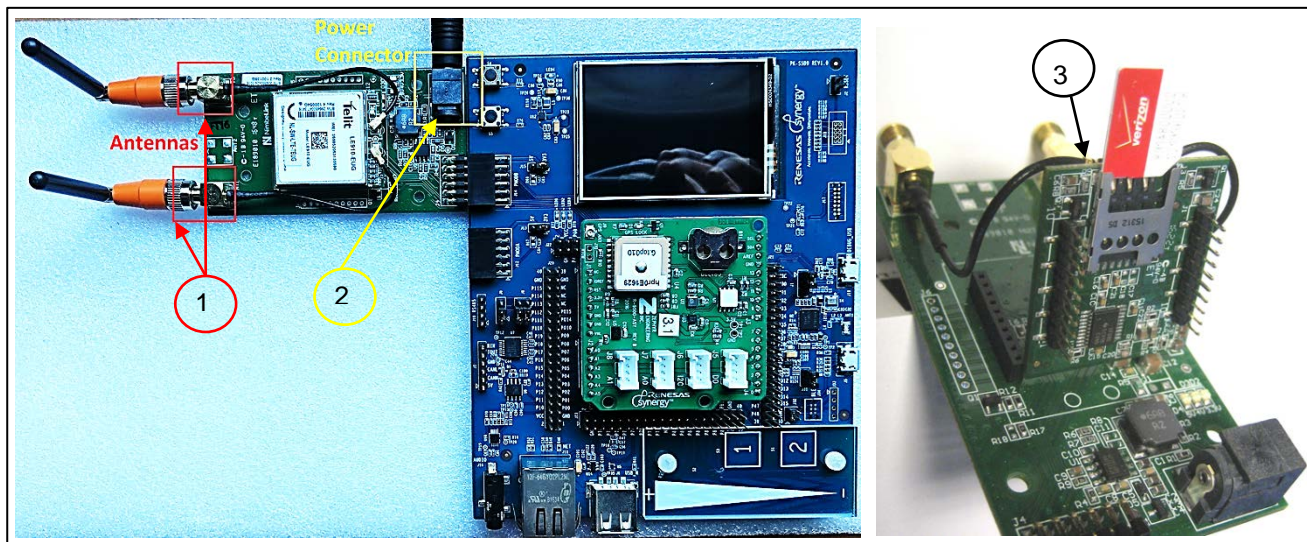


Figure 4 Cellular setup showing the power and the antenna connections

Notes:

- If not already installed in the CAT3 modem daughter board, snap the SIM card out of its outer card and insert it into the socket on the underside of the CAT3 modem daughter board. You have to unplug the daughter board from the PMOD adapter board to do this.
- Make sure that the SIM card gold contacts face the PCB, and the end with the angled corner is inserted first. Push the SIM card all the way in until it bottoms out in the socket. Carefully plug the daughter board back into the PMOD adapter, making sure that both sets of daughter card pins line up with the sockets on the PMOD adapter.

6. Setting up and executing the Demonstration

The main components of the demonstration are the Renesas Synergy™ Enterprise Cloud Toolbox Dashboard and the S5D9 Synergy MCU device built on PK-CLOUD1 kit.

See *Synergy Enterprise Cloud Toolbox Application Note* for instructions to build and install (flash) the embedded application onto the PK-CLOUD1 device and run the Synergy Enterprise Cloud Toolbox Dashboard code. The setup and execution of the demonstration is detailed in the following sections.

6.1 Setting up the PK-CLOUD1 Project

The MCU board is not pre-programmed with the firmware for the Synergy Enterprise Cloud Toolbox application project. For quick flashing of the firmware to the MCU board, refer to the Appendix — Downloading and running the Synergy Enterprise Cloud Toolbox to run the bat file that flashes the MCU board. You can also refer the Application Note for instructions on building the project within the Synergy tools and flashing the MCU board that way. To access the command console from the computer, install TeraTerm (or equivalent serial terminal emulator) and open the terminal with the appropriate COM port configured. The default configuration for the terminal is **9600-8-N-1**. The application waits for a key to be pressed by you before printing the banner on the serial console.

Press **Enter** to access the command prompt.

The following screen shows what the console window looks like on a terminal emulator when the device boots up, the application starts and you press **Enter** to access the command prompt.


```

*****
*                               *
*           Synergy Enterprise Cloud Toolbox           *
*           Version 1.1.0, Released-2018/02/15         *
*                               *
*                               *
*                               *
*****

Initializing sensors: done
Initializing data flash: done
>

```

Figure 5 Sensor initialization and command prompt

Note: You can press **Enter** at any time to return to the Main Menu.

To see a list of available commands type: ?

```

>?
Help Menu
boot : Provision (bootstrap) the device
cell : Cell Provisioning info to be saved
      Usage:
      cell <APN> <Context ID> <PDP Type>
chks : Check TLS connection to server
      Usage:
      chks [aws|azure|google]
cwiz : Network Interface Configuration Wizard

dbug : Turn debug messages on/off. Only applies to cloud interactions
      Usage:
      dbug [on|off]
ktid : Print Kit ID Number
ipcf : IP Address configuration
      Usage:
      ipcf dhcp
      ipcf static IP_ADDR MASK GW DNS
netif : Selection of network interface type
      Usage:
      netif <eth | wifi | cell>
ping  : Ping remote host
      Usage:
      ping HOSTNAME ! IP_ADDR
sens  : Read and print current sensor data
stat  : Print configuration and status
turb  : Run Wind Turbine IoT demo
      Usage:
      turb start
user  : User Information Provisioning
      Usage :
      user <email_id> <password>
vers  : Print version information
wifi  : Wifi Provisioning info to be saved
      Usage:
      wifi <"SSID"> <KEY> <Security Type>
>

```

Figure 6 Help menu for commands

Obtain the Unique Kit ID using the command: **ktid**

```

>ktid

Unique ID: 3160035233303835534c49d77a215454

```

Figure 7 ktid command output to obtain a unique Kit ID

Note: This unique Kit ID is the Serial Number used to register/add the device on the Synergy Enterprise Cloud Toolbox Dashboard (see section 6.6).

6.2 Setting up PK-CLOUD1 for Wi-Fi

Configure the Wi-Fi interface as an active interface using command: **cwiz**

```
>cwiz
Network Interface Selection:
 1. Ethernet
 2. Wi-Fi
Please Enter Your Choice(1-2):>2
WiFi Configuration
Enter the SSID associated with the Network
>K2-Office
Enter Security Type
 1. wep
 2. wpa
 3. wpa2
 4. open
Please Enter Your Choice
>3
Entered Security Type: wpa2
Enter the passphrase
>no-Wifi4u
Following are the entered Wi-Fi configuration details:
SSID: TEST_AP
Security Type: wpa2
Password: no-Wifi4u
Are you sure you want to proceed for connection [y/n]
>y
Wifi settings saved in flash
Wi-Fi setup may take a few moments and may require a few retries.
Connecting to SSID " TEST_AP ": connected.
```

Figure 8 Setting Wi-Fi interface as an active interface

The **cwiz** command displays all supporting network interfaces. To activate the Wi-Fi interface, enter command **2**. Now enter the **SSID**, **passphrase**, and **security type** associated with the network at each prompt. If the Wi-Fi network is not secure, then enter any value other than **1**, **2** and **3**. Wi-fi configuration details will be displayed on console for final user confirmation. Please type ‘**y**’ if configuration details are correct. This Wi-Fi provisioning information from you is stored in internal flash for subsequent use.

```
Enter IP Address Configuration Mode
 1. Static
 2. DHCP
Please Enter Your Choice
>2
Entered IP Configuration Mode: DHCP
Stopping DHCP client.done
Waiting for IP address.done

Wi-Fi Configuration
=====
SSID      : TEST_AP
Key       : no-Wifi4u
Security  : WPA2

IP Configuration
=====
Interface : Wi-Fi
Mode      : DHCP
IP Address : 172.18.1.225
Netmask   : 255.255.252.0
Gateway   : 172.18.0.1
DHCP Server : 172.18.0.1
DNS Server : 120.138.96.18

Cloud Toolbox Configuration
=====
User      : pankaj@adres.com
IoT Cloud : Azure
>
```

Figure 9 IP configuration

To configure the IP address, you are given two options: **Static** and **DHCP**. In Figure 9 the user selected **DHCP**, and the screen shows the IP address assigned to the device.

Figure 10 shows an alternate method to set up Wi-Fi as the network interface, where you provision the Wi-Fi module for the first time on the network using the command **wifi <SSID><KEY><SECURITY TYPE>**.

```
>wifi TEST_AP no-Wifi4u wpa2
Wifi settings saved in flash
>
```

Figure 10 Setting Wi-Fi interface as the active interface

SSID is the SSID name, **KEY** is the password, and **SECURITY TYPE** is the security type of the Wi-Fi network that can be set to **wpa**, **wpa2**, **wep**, or **open**. The Wi-Fi provisioning information is stored in internal flash for subsequent use.

Set the Wi-Fi interface as active interface using the command: **netif wifi**

```
>netif wifi
Selected Network Interface : Wi-Fi

Wi-Fi setup may take a few moments and may require a few retries.

Connecting to SSID "TEST_AP": connected.

>
```

Figure 11 Setting Wi-Fi interface as the active interface

This command reads the provisioning information stored in the internal flash from the previous step and tries to provision it automatically.

Configure the IP address using the command: **ipcf**

```
>ipcf dhcp
Stopping DHCP client.done
Waiting for IP address.done

Interface Configuration
=====
Interface   : Wi-Fi
Mode        : DHCP
IP Address  : 192.168.1.251
Netmask     : 255.255.255.0
Gateway     : 192.168.1.1
DHCP Server : 192.168.1.7
DNS Server  : 192.168.1.7
>
```

Figure 12 IP configuration

The command must be used with either **dhcp** or **static <IP> <MASK> <GW> <DNS>**, depending on whether the IP address is being obtained via DHCP or is statically assigned.

To continue with the demonstration setup, proceed to section 6.5.

6.3 Setting up PK-CLOUD1 for Ethernet

To use the Ethernet as the network interface, enter the command: **cwiz**

```
>cwiz
Network Interface Selection:
 1. Ethernet
 2. Wi-Fi
 3. Cellular

Please Enter Your Choice(1-3):>1
Enter IP Address Configuration Mode
 1. Static
 2. DHCP
Please Enter Your Choice
>2
Entered IP Configuration Mode: DHCP
Stopping DHCP client.done
Waiting for IP address.done

Interface Configuration
=====
Interface   : Ethernet
Mode        : DHCP
IP Address  : 192.168.1.241
Netmask     : 255.255.255.0
Gateway     : 192.168.1.1
DHCP Server : 192.168.1.7
DNS Server  : 192.168.1.7
```

Figure 13 Setting the Ethernet interface as an active interface and the IP configuration

The **cwiz** command displays supported network interfaces. To activate the Ethernet interface, enter command **1**. To configure the IP address, you are given two options: **Static** and **DHCP**. Select the desired option to configure the IP address.

As an alternate method to configure Ethernet as the network interface, use the command: **netif eth**

```
>netif eth
Selected Network Interface : Ethernet
>
```

Figure 14 Setting Ethernet interface as active interface

Configure the IP address using command: **ipcf**

```
>ipcf dhcp
Stopping DHCP client.done
Waiting for IP address.done

Interface Configuration
=====
Interface   : Ethernet
Mode        : DHCP
IP Address  : 192.168.1.241
Netmask     : 255.255.255.0
Gateway     : 192.168.1.1
DHCP Server : 192.168.1.7
DNS Server  : 192.168.1.7
>
```

Figure 15 IP Configuration

The command must be used with either DHCP or Static **<IP> <MASK> <GW> <DNS>**, depending on whether the IP address is obtained via DHCP or is statically assigned.

See section 6.5 to proceed with the demonstration setup.

6.4 Setting up the Cellular network interface for PK-CLOUD1

To use Cellular as the network interface, use the command `cwiz`:

```
>cwiz
Network Interface Selection:
 1. Ethernet
 2. Wi-Fi
 3. Cellular

Please Enter Your Choice(1-3):>3
Cellular Configuration
Enter the APN associated with the Cellular Provider
>UZWINTERNET
```

Figure 16 Cellular module provisioning information

The `cwiz` command displays supported network interfaces. To activate Cellular, enter command **3**. Now enter the APN, Context ID, and PDP type associated with the network at each prompt. Cellular configuration details will be displayed on console for final user confirmation. Please type ‘y’ if configuration details are correct

```
Enter Context ID: Valid range is 1 to 5.
>3
Enter PDP Type
 1. IP
 2. IPU4U6
Please Enter Your Choice
>2
Entered PDP Type: IPU4U6

Following are the entered Cellular configuration details:

APN: UZWINTERNET

Context ID: 3

PDP Type: IPU4U6

Are you sure you want to proceed for connection [y/n]
>y
Initializing, provisioning and setting up a cellular link requires
a few minutes. Please wait for the process to complete.

Initializing Cellular Modem...
Provisioning Cellular Modem: done
Waiting for PPP link: Provisioning Cellular Modem: done
PPP Link is UP
Link is up
>
```

Figure 17 Setting Cellular interface as an active interface

Figure 18 shows an alternate method to use Cellular as the network interface, using the command `cell <APN> <Context ID> <PDP Type>`, followed by the command `netif cell`, as shown in Figure 19.

```
>cell UZWINTERNET 3 IPU4U6
Cellular settings saved in flash
>
```

Figure 18 Cellular module provisioning information

```
>netif cell
Selected Network Interface: Cellular

Initializing, provisioning and setting up a cellular link requires
a few minutes. Please wait for the process to complete.

Initializing Cellular Modem...
Provisioning Cellular Modem: done
Waiting for PPP link: Provisioning Cellular Modem: done
PPP Link is UP
Link is up
>
```

Figure 19 Setting Cellular interface as the active interface

Note that the valid Context ID is from 1 to 5 and the PDP can be either IP or IPV4V6. The APN, Context ID, and PDP types vary across cellular service providers. Contact your cellular service provider to obtain the correct values for these parameters. Use of incorrect values may cause the program to malfunction. For details on various cellular configurations, see section 7.

When the cellular interface link is up, confirm it can communicate with the cellular network by using the command **ping** www.google.com:

```
>ping www.google.com
PING www.google.com (216.58.194.196): 56 data bytes
56 bytes from 216.58.194.196 icmp_seq=0
56 bytes from 216.58.194.196 icmp_seq=1
56 bytes from 216.58.194.196 icmp_seq=2
```

Figure 20 Ping command output

Continue to the following sections to sign up for the Synergy Enterprise Cloud Toolbox Dashboard and add a device to your dashboard.

6.5 Signing up for the Synergy Enterprise Cloud Toolbox Dashboard

The Synergy Enterprise Cloud Toolbox Dashboard is a hosted web application with the functionality to provision devices on either Amazon AWS, Microsoft Azure, or Google IoT Cloud Providers.

Note: If the Cellular interface is not up at this point, contact your Cellular network service provider to troubleshoot the connectivity before proceeding.

The Dashboard GUI provides:

1. User Sign Up
2. Adding MQTT enabled devices to either AWS, Azure, or Google Cloud IoT
3. A remote monitoring view to monitor the real-time sensor information of the connected devices
4. Updating the device state

Note: The URL of the Synergy Enterprise Cloud Toolbox Dashboard is: <https://cloud.renesassynergy.com>

Point your Internet browser to the dashboard to display the Sign-up screen.

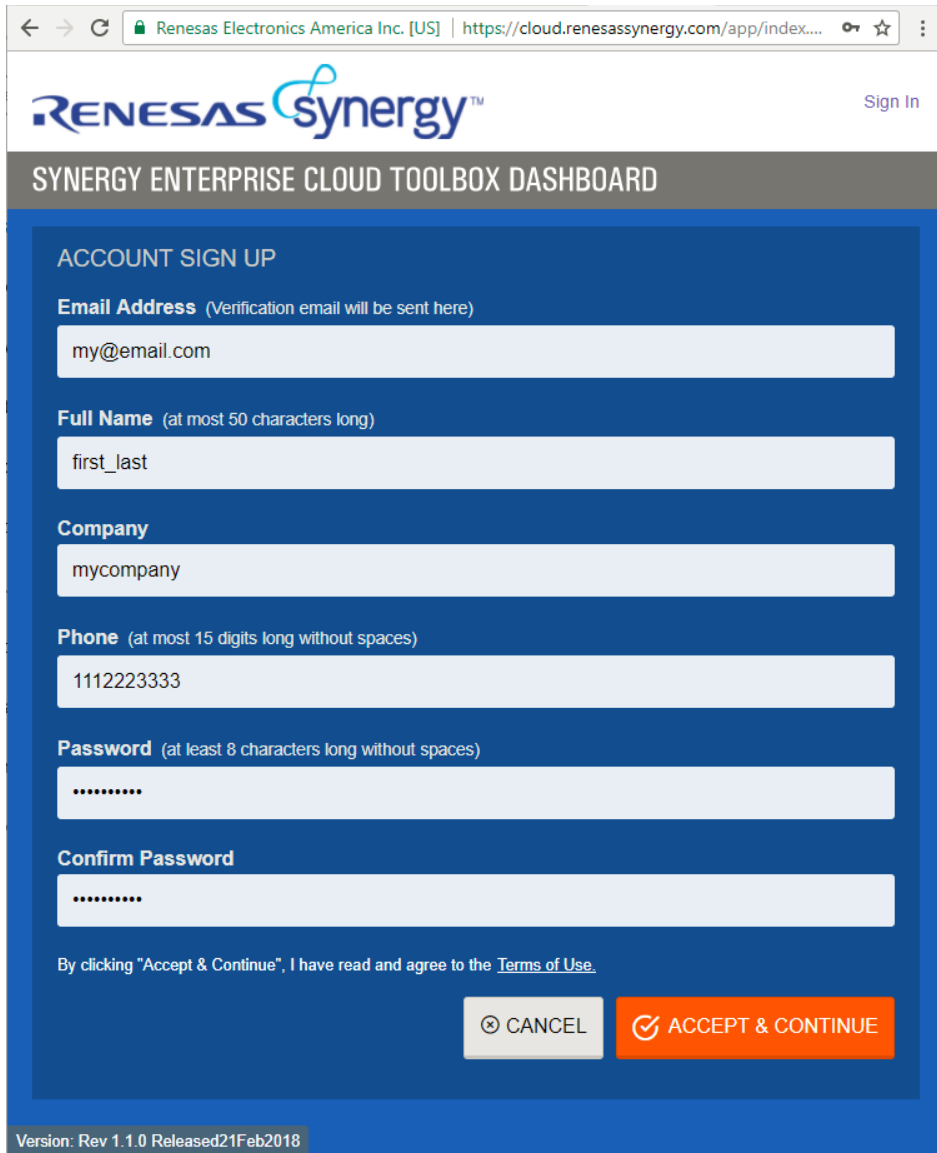


Figure 21 Sign up screen

Fill in the sign-up form and click on **Accept and Continue**. The hints given when you enter information in each field specify any constraints. For example, **Full Name** and **Company** information may contain spaces in between text, whereas space is not a valid input for **Phone** and **Password** fields. Characters allowed in passwords include uppercase and lowercase **letters**, **numbers**, and the following special characters:

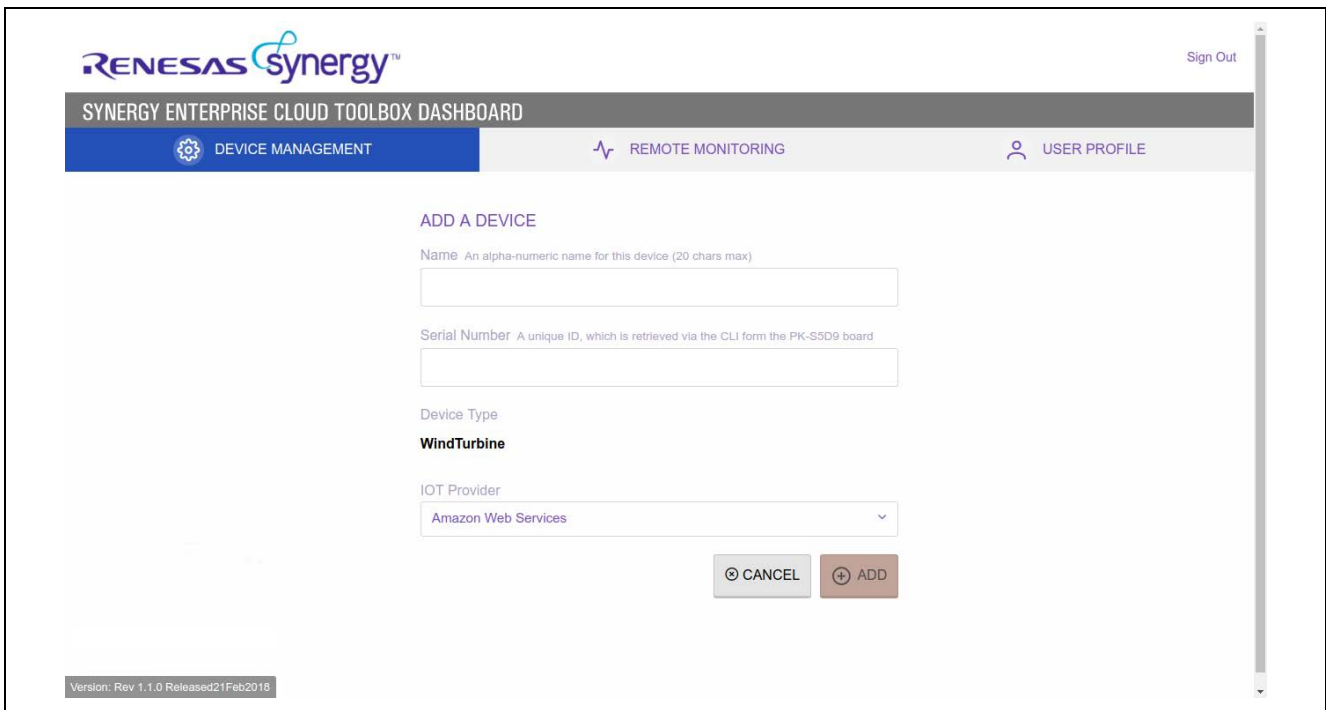
^ \$ * . [] { } () ? - " ! @ # % & / \ , > < ' : ; | _ ~ `

Note: Spaces are not supported in both the user name and password fields.

An activation email will be sent to the email address you used during registration. Clicking the link given in the email will confirm and activate your account. You may then log in using your registered credentials.

6.6 Adding a Device to the Synergy Enterprise Cloud Toolbox Dashboard

After logging in, click **Add Device** from the **Device Management** view to display an **Add A Device** view.



The screenshot displays the Synergy Enterprise Cloud Toolbox Dashboard. At the top left is the Renesas Synergy logo. The dashboard title is 'SYNERGY ENTERPRISE CLOUD TOOLBOX DASHBOARD'. Below the title is a navigation bar with three tabs: 'DEVICE MANAGEMENT' (selected), 'REMOTE MONITORING', and 'USER PROFILE'. The 'Sign Out' link is visible in the top right corner. The main content area is titled 'ADD A DEVICE' and contains the following form fields:

- Name:** An alpha-numeric name for this device (20 chars max). Input field is empty.
- Serial Number:** A unique ID, which is retrieved via the CLI from the PK-S5D9 board. Input field is empty.
- Device Type:** A dropdown menu with 'WindTurbine' selected.
- IOT Provider:** A dropdown menu with 'Amazon Web Services' selected.

At the bottom of the form are two buttons: 'CANCEL' and 'ADD'. A version footer at the bottom left reads 'Version: Rev 1.1.0 Released21Feb2018'.

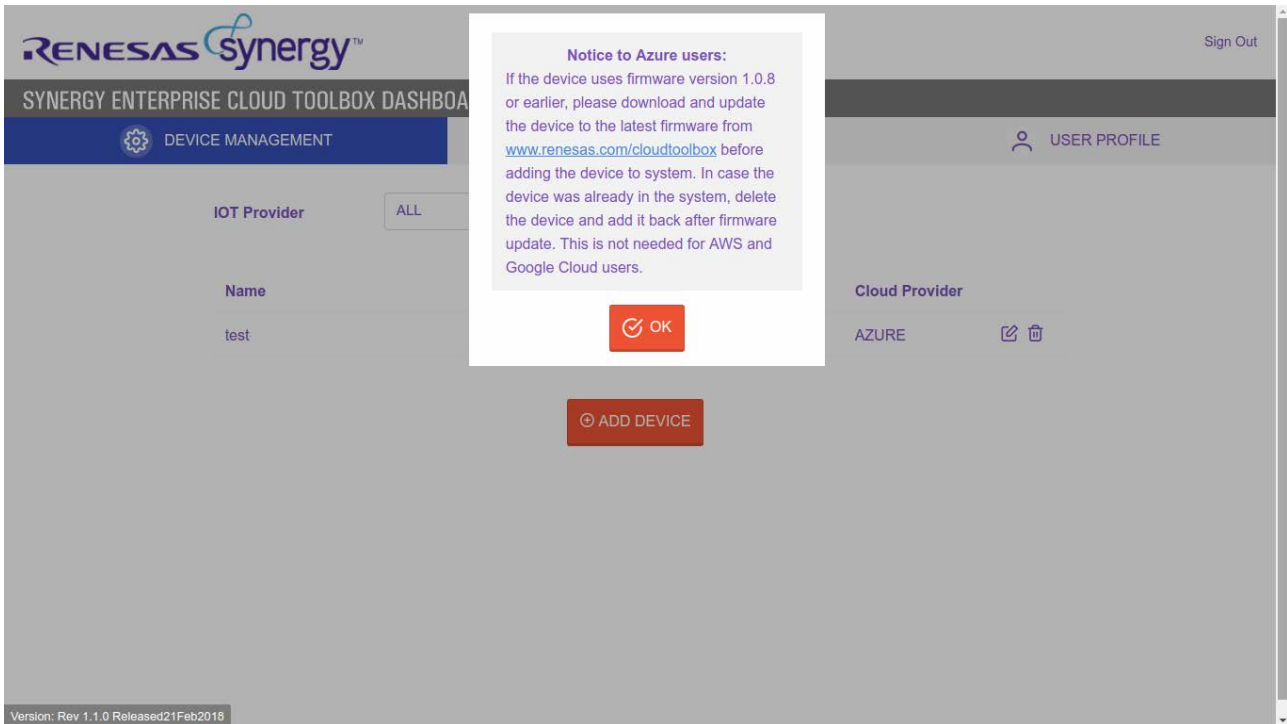
Figure 22 Adding a device

The following steps guide you as you add a device:

1. Enter a user-friendly **Name** for the device (for example, South Wind Turbine)
2. Enter the device **Serial Number**.
The Serial Number is the Unique Kit ID obtained from the PK-CLOUD1 device in section 6.1 (see figures).
3. Select the **IoT Provider** for which the device is registered.

After a successful add operation, the device appears in the **Device Management** device-list. The device is added to the IoT Cloud Provider and becomes available for monitoring after the device has been provisioned (bootstrapped) with the Dashboard (see section 6.8).

In case the user has any devices bootstrapped to Azure IoT, a pop-up message will be displayed on the Device management view as shown in the screens-capture below



The next step is to configure the device with the registered username (email) and password.

6.7 Configuring User Credentials for PK-CLOUD1

Switch to the device for the CLI and configure user email address and password, using the commands: **user**, **email_id**, and **password**. Use the same email address and password you registered for your dashboard.

```
>user myname@mycompany123.com xxxxxxxx
Username saved successfully
Password saved successfully
>
```

Figure 23 User registration

Notes:

1. This command should be triggered after adding the device to the Synergy Enterprise Cloud Toolbox Dashboard.
2. The user credentials should be the same as the ones used during Synergy Enterprise Cloud Toolbox Dashboard, User-signup.

6.8 Provisioning for PK-CLOUD1

To provision the device with the connection credentials and details of the IoT Cloud Provider's platform, do the following:

Execute the command: **boot**

```
>boot

Initializing certificates: done
Starting TLS session: done

Parsing Bootstrap Response:
IoT Service Provider: AWS
IoT Service provider stored successfully
Public Key stored successfully
Private Key stored successfully
Certificate stored successfully
MQTT endpoint stored successfully
Sending bootstrap confirmation to server...
Creating TLS session: done
Initializing certificates: done
Starting TLS session: done
>
>
```

Figure 24 Device bootstrapping

The boot command triggers a request to the Dashboard REST API to pass the configured user credentials and device unique ID. The dashboard authenticates the user and verifies that a device has been added to the users account. Based on the IoT platform to which the device was added, the Dashboard responds to the boot request by sending the connection's identifiers and authentication details.

Upon successful provisioning, the information received from the Dashboard is saved on the device's internal flash.

Note - For chks command it is mandatory to run boot command first with given IoT service provider. Failing to do so will cause chks command to fail.

6.9 Starting the Wind Turbine model on PK-CLOUD1

```
>turb start
Starting turbine demo.

Press <Enter> to return to console prompt.
IoT Service Provider: AZURE
>
```

Figure 25 Start Wind Turbine model

To start the Wind Turbine model on the device, enter the command: **turb start**

The demonstration application starts sending the sensor data to the Synergy Enterprise Cloud Toolbox Dashboard.

After the demonstration has started, you can press the **Enter** key to return to the prompt.

Note: Once the Wind Turbine model has been started, if you want to change the network interface or the IoT Cloud Provider, the system MUST be power-cycled.

6.10 Remote Monitoring on the Synergy Enterprise Cloud Toolbox Dashboard

Switch to the Dashboard view in the browser. Navigate to the **Remote Monitoring** tab to view the real-time device status and the sensor data.

The LEDs associated with the controls are shown in the **LED LIGHTS** section of the user interface.

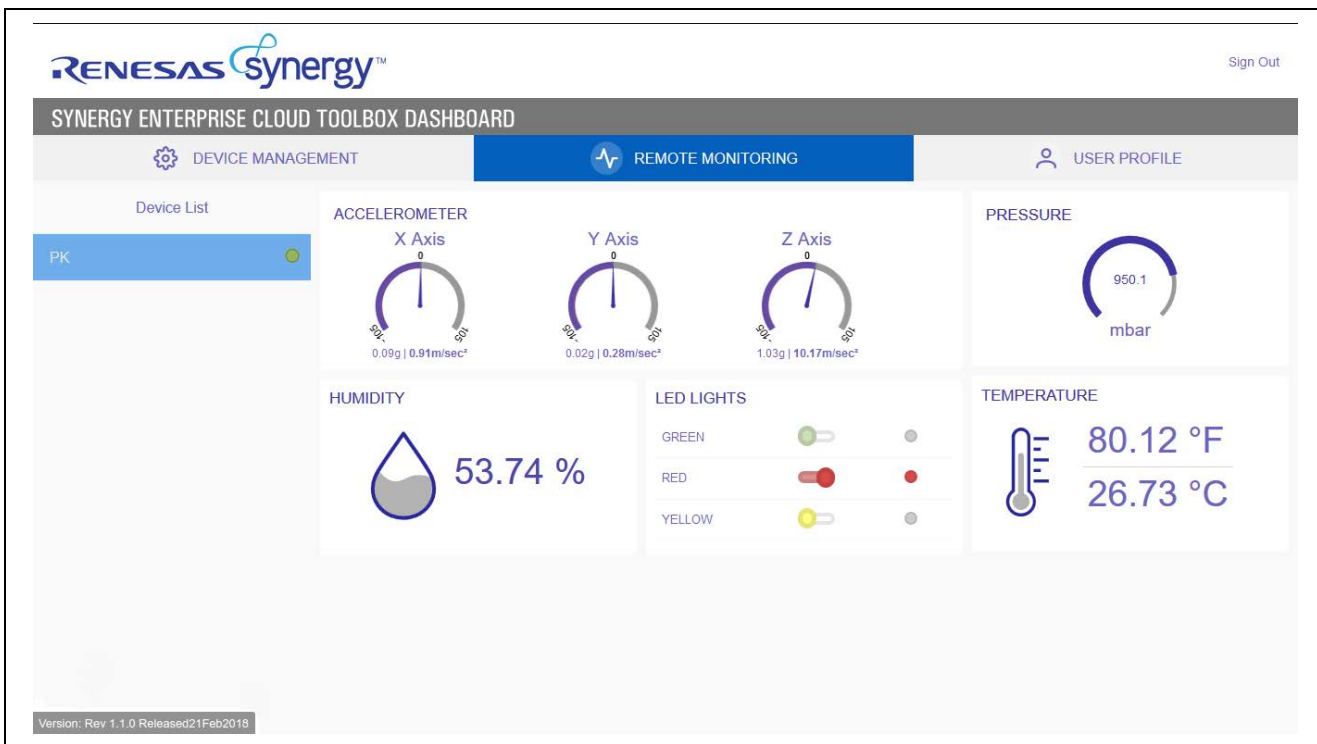


Figure 26 Remote Monitoring

The **Turbine** switch controls the **red** LED on the device, while the **Power** switch controls **green** LED, and the **Ammeter** controls the **yellow** LED.

Click the appropriate switches to update the state of the LEDs on the device.

6.11 Stimulating sensors on PK-CLOUD1

The Sensor shield used in PK-CLOUD1 kit comes equipped with various sensors. These can be stimulated and the updated readings observed on the Dashboard:

- **Humidity sensor:** Blows warm air on the device for 20 seconds. Observe the humidity value change on the Dashboard.
- **Temperature:** Turn on the air conditioner and blow cold air towards the device for few minutes and observe the temperature value change on the Dashboard.
- **Pressure:** Run the test at different altitudes; for example, on the ground or top floor of a high-rise building, to note the change in pressure on the Dashboard.
- **Accelerometer:** Without tilting the device, move it in any direction and observe the X, Y, or Z Axis value change based on the direction you move the device towards.

6.12 Changing IoT cloud providers

Devices bootstrapped with the Dashboard can be switched between the supported IoT Cloud Providers.

In the following example, the device is currently provisioned for the Azure IoT platform. Use the following steps to change the IoT Cloud Provider to AWS:

1. Login to the Synergy Enterprise Cloud Toolbox Dashboard.
2. Go to the **Device Management** view. Locate the device to switch to AWS and click the **Delete** icon.

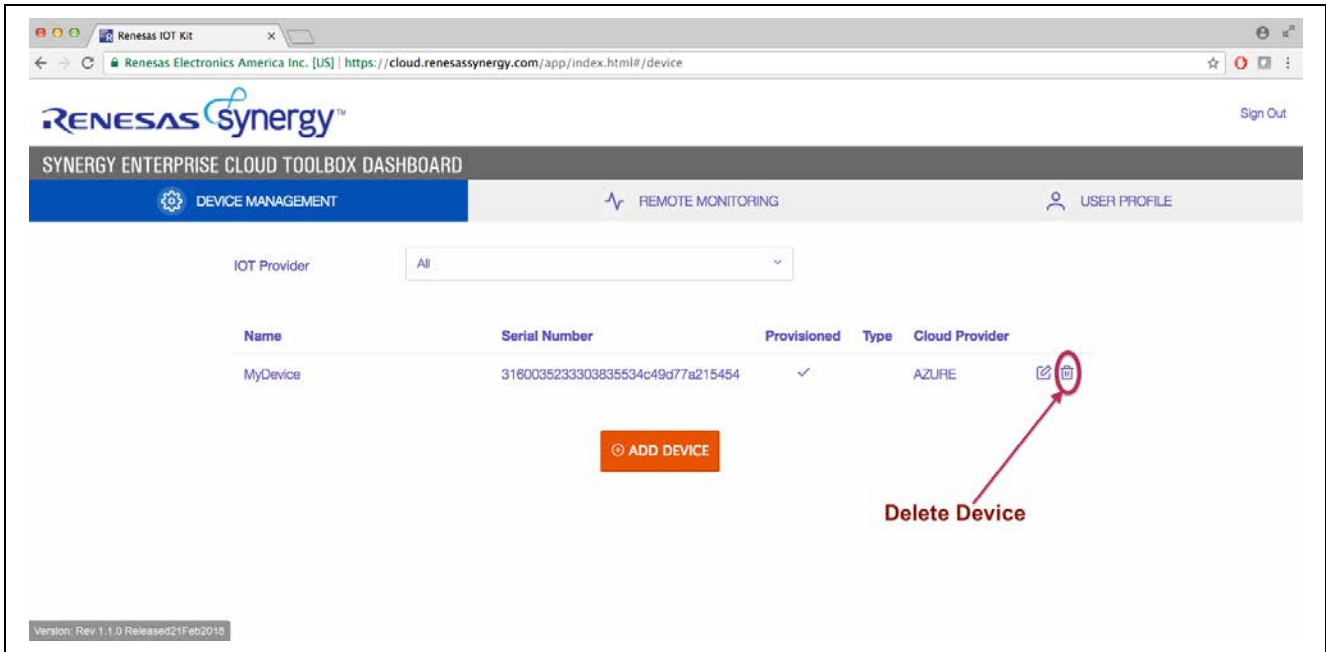


Figure 27 Deleting a device

3. Click on **OK** when asked to confirm the operation.
4. Power cycle the device.
5. Follow the steps to add a device (see section 6.6) and choose **AWS** as the IoT cloud provider.
6. Run the demonstration as instructed in either of section 6.2, 6.3, 6.4 and then follow the instructions mentioned in 6.8 and 6.9.

To switch a device provisioned for AWS to Azure, follow these same steps and choose **Azure** as the IoT cloud provider when you add the device.

Notes:

1. Only a single IoT Cloud Provider connection can be active on the system (dashboard and device) at a given time.
2. Provisioning is a one-time operation for a **Dashboard + Device-IoT Cloud Provider** combination. Once the device is provisioned for an IoT Cloud provider, you don't need to re-provision unless the device is deleted and added back again via the Dashboard.
3. Every time you switch IoT providers, the device must be power cycled. This step is due to a limitation in the MQTT client implementation. See the **MQTT-TLS workarounds** section of the *Application Note* for details.

6.13 Resetting the system from the Synergy Enterprise Cloud Toolbox Dashboard

The reset feature is available only to the admin user. Using the reset functionality, the admin user can delete all devices and users from the system.

Note: This is an **irreversible action**. To access the reset view, click the **Settings** icon on the UI's top-right corner. Clicking **Reset System**, on the reset view, resets the system (see Figure 28 and Figure 29).

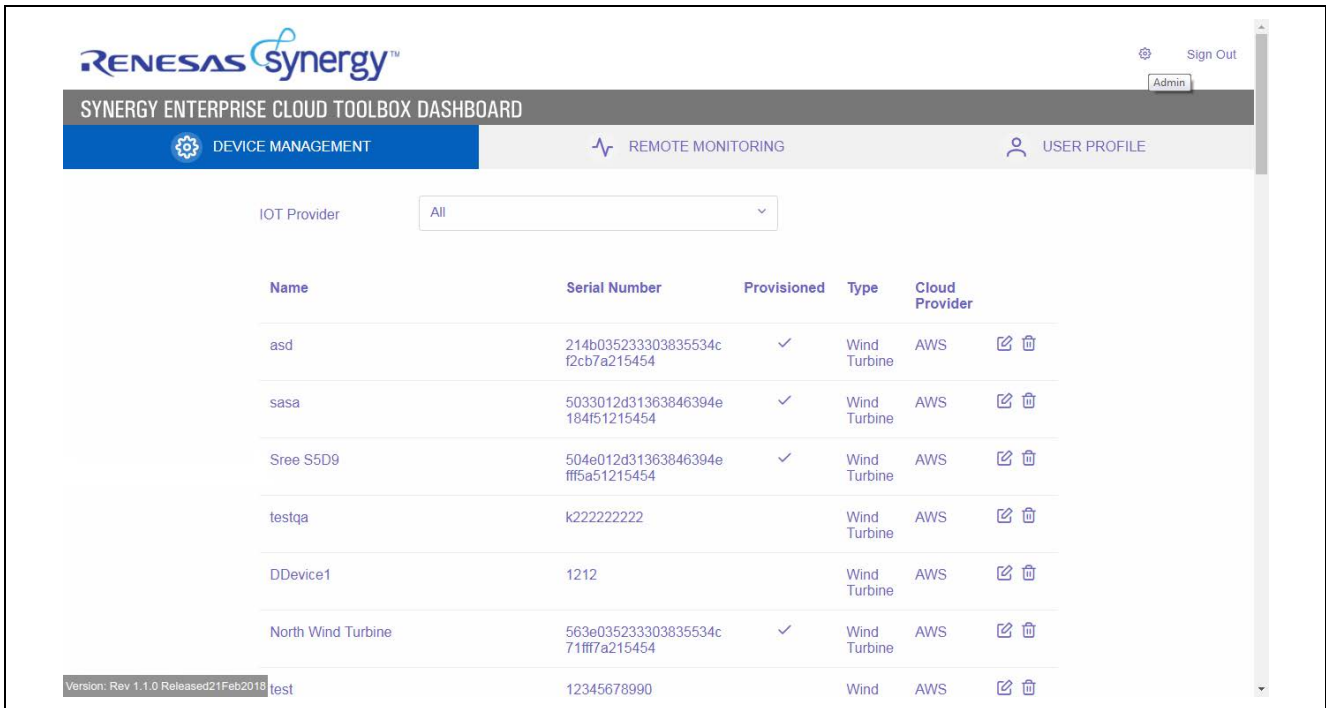


Figure 28 Device Management tab on the Dashboard

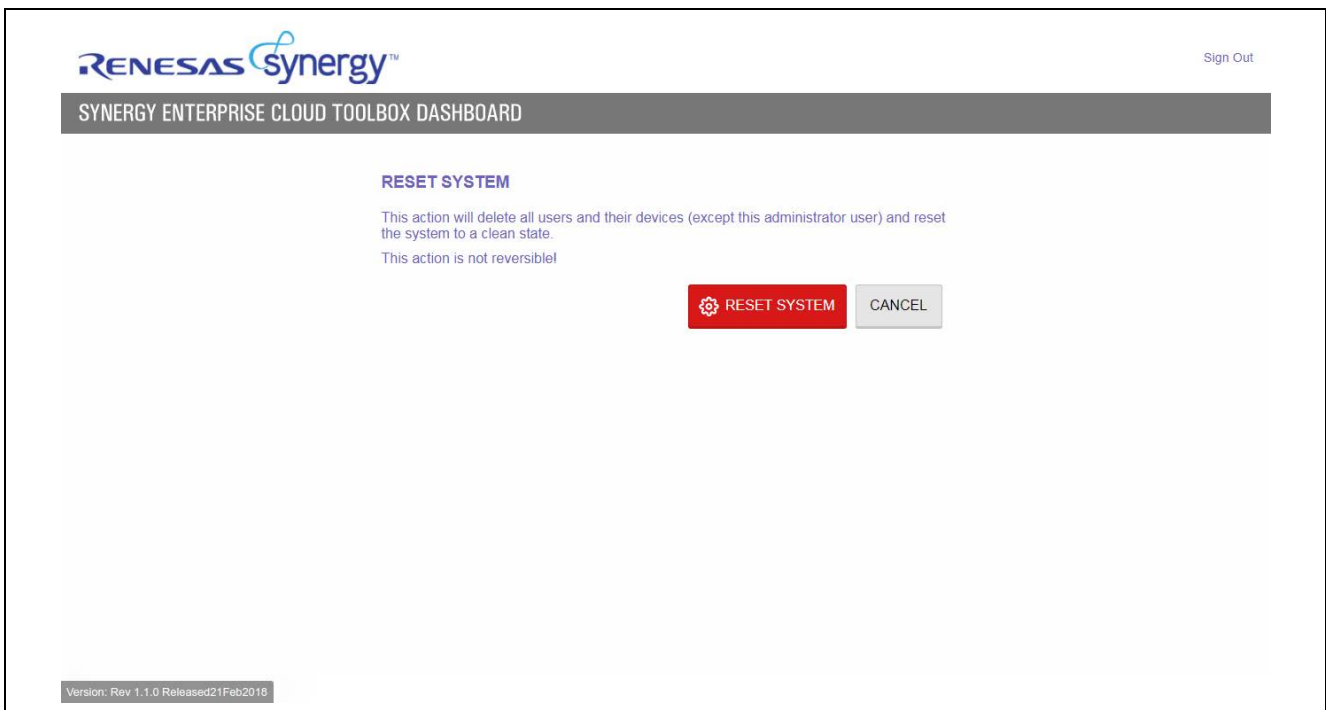


Figure 29 Reset System

6.14 Notes and Limitations

1. It is mandatory that user compiles the IAR project in a different folder from where the e2studio project has been compiled.
2. After a network interface has been selected, if you want to change it, the system **MUST** be power-cycled and a new network interface selected.
3. If certificate provisioning fails for a device, you need to delete the device from Dashboard and add it back. In the case of a provisioning failure, see section 6.1 for instructions.
4. If the boot command fails for a device, you must delete the device from the Dashboard and add it back. In the case of a boot command failure, see section 6.1 for instructions. The command could fail with the following errors:
 - A. Starting TLS session; could not start TLS session (0x109)
 - B. Parsing Bootstrap Response: IoT Provider not found. Aborting.
 - C. The command gets stuck after starting the TLS session and bootstrap does not begin.
5. After changing the LED status from the Dashboard, it can take up to 10 seconds for the LED on the PK-CLOUD1 device to change.
6. Google-cloud IoT does not provide information regarding the connected state of the devices to its IoT platform. As a result, on the **Remote Monitoring** tab view, the icon indicating the connectivity status is gray, instead of green, for the device.
7. The Dashboard UI uses Server Sent Events (SSE).

SSE is part of the HTML5 standard. However, Microsoft (MSFT) does not support SSE in Internet Explorer (IE) and Edge. As an alternative, polling is used to get events from the server. Depending on the polling interval, the updates may appear to be delayed.

For details on SSE and the lack of support on MSFT browsers, visit https://en.wikipedia.org/wiki/Server-sent_events and <https://caniuse.com/#feat=eventsourcing>.
8. In some corporate Ethernet and Wi-Fi connections, the browser refresh rate could be slow and may need manual refreshing to receive updates. In certain cases, this error is indicated on the Dashboard with a warning on the status of communication between the device and the Dashboard.

To mitigate this issue, ensure that the Corporate Network allows the following ports to successfully run Synergy Enterprise Cloud Toolbox:

TCP Ports: 80 (HTTP), 443 (HTTPS) and 8883 (MQTT over TLS)

UDP Ports: 123 (SNTP), 53 (DNS).

In cases when these solutions do not update the browsers, the firewall settings should be checked.
9. If the command line returns an **Unsupported Command** error, check the format and retype the command using the correct format.
10. Google-cloud IoT is not supported in Rev 1.0.
11. The Dashboard on Azure IoT for some kits does not get updated automatically and needs to be manually refreshed to see the changes.
12. If 'turb start' command on Google-cloud fails with an error "Unable to initialize IoT service Google," power cycle the device and retry the command.
13. When upgrading from Rev 1.0 to Rev 1.1, user will need to re-bootstrap a device using "boot" command after flashing new version of firmware.
14. For Synergy Enterprise Cloud Toolbox release build older than 1.1 ver 3.0, user will face issue during "turb start" command to connect Azure IoT due change in server certificate and will need to upgrade to SECT release 1.1 rev 3.0.

Note: Google-cloud IoT is in Beta Launch stage. For details, see <https://cloud.google.com/terms/launch-stages>

7. Configuring the Cellular Framework

The Cellular Framework implementation in SSP v1.3.0 and later provides support for NimbeLink CAT3 modules. The following part numbers represent the three supported NimbeLink CAT3 modems.

- NL-SW-LTE-TSVG
- NL-SW-LTE-TEUG
- NL-SW-LTE-TNAG

Notes:

- The Cellular framework implementation only supports NL-SW-LTE-TSVG and NL-SW-LTE-TEUG modems. The type of modem can be configured through ISDE (see Figure 30).
- The User should ensure they configure the correct modem type in the project. Failing to do so cause a cellular framework initialization failure.
 - For the Asia and Europe regions, use modem part number NL-SW-LTE-TEUG.
 - For the USA, use modem part number NL-SW-LTE-TSVG.

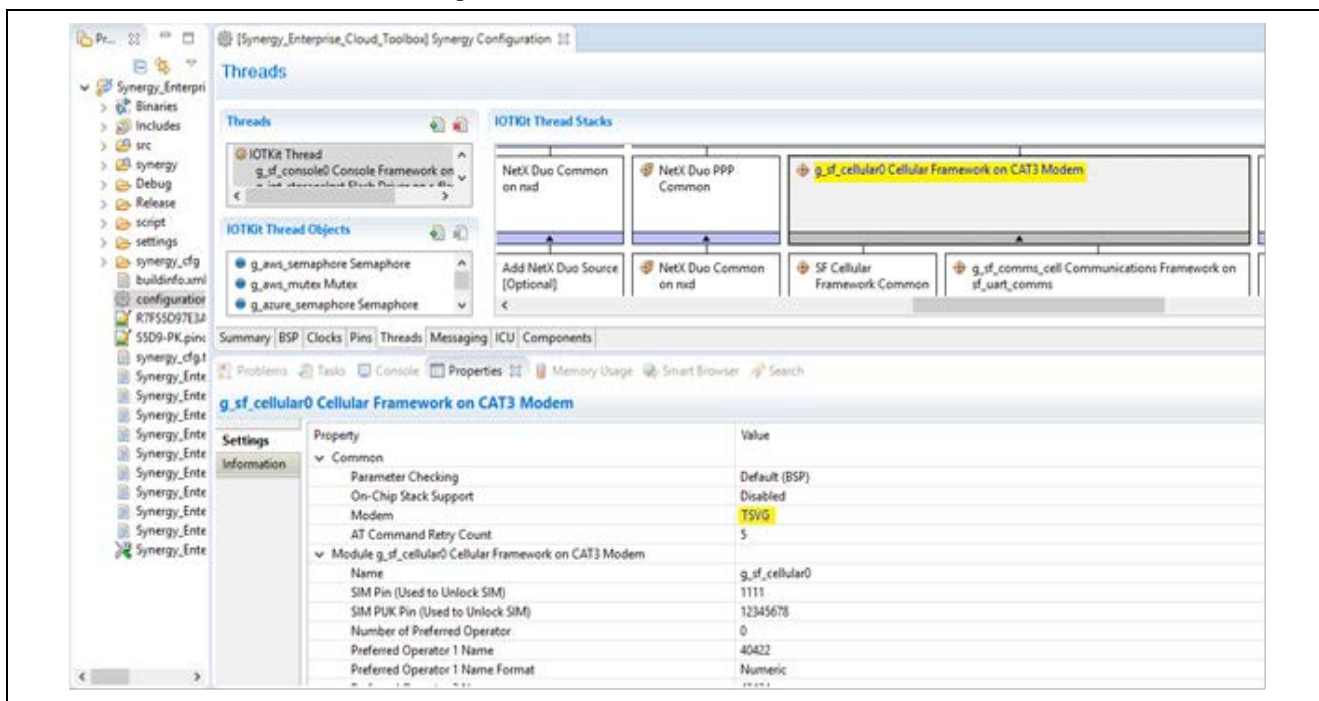


Figure 30 Cellular framework Modem type configuration

Before running the project, you are required to connect the CAT3 PMOD cellular module to PMODB on the PK-CLOUD1 MCU device. The CAT3 module has a slot for a SIM card. You will need to purchase a SIM card and data plan for it from your Cellular Service provider. The CAT3 module IMEI number and SIM ID number from the SIM card will be needed when you activate the data plan with the service provider. The service provider for the SIM card will activate the CAT3 module and add the device to their network (this can be done over the phone or via email). After successfully activating the CAT3 module on the service provider’s network, use the command line interface to configure your CAT3 module for one of the supported service providers as described in section 6.4. Supported service providers are Tata Docomo Network (India), Jio (India), Verizon (USA), and Vodafone (Europe).

Notes:

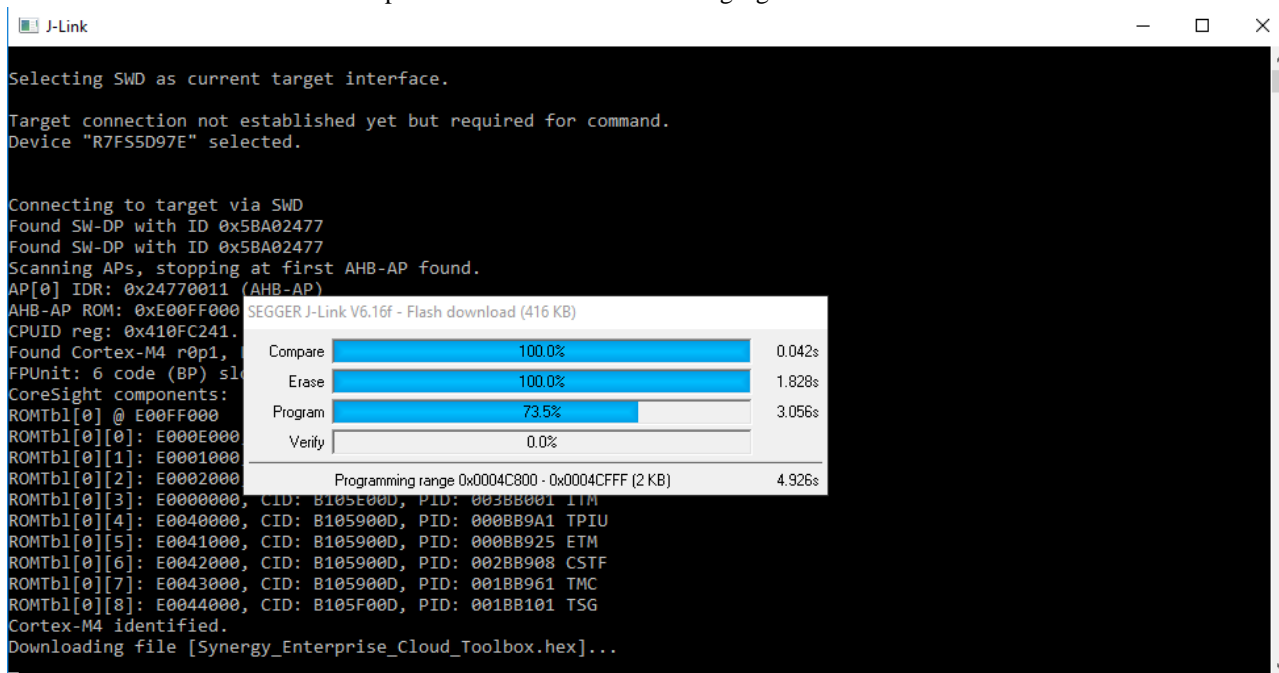
- Sometimes the service provider associates the IMEI and SIM numbers together therefore interchanging the SIM with different cellular hardware modules may not work.
- Synergy Enterprise Cloud Toolbox requires the use of the PK-Cloud1 kit (not sold commercially). Contact Renesas sales to get one.
- To configure the Cellular setup, use the command cell <APN> <Context ID> <PDP Type>.
- The valid APN, Context ID and PDP Type need to be obtained from your Cellular service provider:
 - Valid Context ID range is **1 to 5**
 - Valid PDP types are **IP** and **IPV4V6**
 - For Tata Docomo SIM in India, use the command cell internet **1 IP**

- For Jio SIM in India, use the command cell internet **1 IP**
- For Verizon SIM in USA, use the command cell 463b012d31363846394e04a551215454**INTERNET 3 IPV4V6**
- For Vodafone in Europe, use the command cell internet **1 IP**

8. Appendix — Downloading and running the Synergy Enterprise Cloud Toolbox

Use the following steps to download and run Synergy Enterprise Cloud Toolbox.

1. Install the J-Link driver to enable J-Link On Board (JLOB-J19) to be recognized by Windows. The driver can be downloaded at <https://www.segger.com/downloads/jlink>.
2. Extract the **PK_Cloud1_TEUG_bat.zip** for the Asia and Europe regions modems or the **PK_Cloud1_TSVG_bat.zip** for the USA region modem.
3. Make sure all the connections are made as described in section 5.
4. Run s1.bat file in the unzipped folder.
5. Make sure the download is completed as shown in the following figures.




```
J-Link
ROMTbl[0] @ E00FF000
ROMTbl[0][0]: E000E000, CID: B105E00D, PID: 000BB00C SCS
ROMTbl[0][1]: E0001000, CID: B105E00D, PID: 003BB002 DWT
ROMTbl[0][2]: E0002000, CID: B105E00D, PID: 002BB003 FPB
ROMTbl[0][3]: E0000000, CID: B105E00D, PID: 003BB001 ITM
ROMTbl[0][4]: E0040000, CID: B105900D, PID: 000BB9A1 TPIU
ROMTbl[0][5]: E0041000, CID: B105900D, PID: 000BB925 ETM
ROMTbl[0][6]: E0042000, CID: B105900D, PID: 002BB908 CSTF
ROMTbl[0][7]: E0043000, CID: B105900D, PID: 001BB961 TMC
ROMTbl[0][8]: E0044000, CID: B105F00D, PID: 001BB101 TSG
Cortex-M4 identified.
Downloading file [Synergy_Enterprise_Cloud_Toolbox.hex]...
J-Link: Flash download: Bank 0 @ 0x00000000: 2 ranges affected (458752 bytes)
J-Link: Flash download: Total time needed: 2.301s (Prepare: 0.077s, Compare: 0.017s, Erase: 0.000s, Program: 2.192s, Ver
ify: 0.010s, Restore: 0.003s)
J-Link: Flash download: Bank 1 @ 0x40100000: 1 range affected (6336 bytes)
J-Link: Flash download: Total time needed: 0.497s (Prepare: 0.069s, Compare: 0.011s, Erase: 0.118s, Program: 0.293s, Ver
ify: 0.000s, Restore: 0.003s)
O.K.

Reset delay: 100 ms
Reset type NORMAL: Resets core & peripherals via SYSRESETREQ & VECTRESET bit.
Reset: Halt core after reset via DEMCR.VC_CORERESET.
Reset: Reset device via AIRCR.SYSRESETREQ.

Script processing completed.

Type "connect" to establish a target connection, '?' for help
J-Link>
```

For instructions on how to build and flash the software on the device using e² studio ISDE and IAR EW for Synergy, see the *Application Note* provided with the Synergy Enterprise Cloud Toolbox.

Website and Support

Support: <https://synergygallery.renesas.com/support>

Technical Contact Details:

- America: <https://www.renesas.com/en-us/support/contact.html>
- Europe: <https://www.renesas.com/en-eu/support/contact.html>
- Japan: <https://www.renesas.com/ja-jp/support/contact.html>

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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Sep 29, 2017	—	Initial release
1.08	Jan 11, 2018	—	Changed PK-S5D9 to PK-CLOUD1 and updated procedures.
1.10	Feb 21, 2018	—	Updated the following items in the document: <ul style="list-style-type: none">— Screenshots throughout— Dashboard UI to display firmware upgrade message for Azure devices.— Pop-up message in Dashboard display for Azure devices

Synergy Enterprise Cloud Toolbox for PK-CLOUD1 Quick Start Guide

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<http://www.renesas.com>Refer to "<http://www.renesas.com/>" for the latest and detailed information.**Renesas Electronics America Inc.**1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351**Renesas Electronics Canada Limited**9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004**Renesas Electronics Europe Limited**Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: +44-1628-651-700, Fax: +44-1628-651-804**Renesas Electronics Europe GmbH**Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327**Renesas Electronics (China) Co., Ltd.**Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679**Renesas Electronics (Shanghai) Co., Ltd.**Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999**Renesas Electronics Hong Kong Limited**Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022**Renesas Electronics Taiwan Co., Ltd.**13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670**Renesas Electronics Singapore Pte. Ltd.**80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300**Renesas Electronics Malaysia Sdn.Bhd.**Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510**Renesas Electronics India Pvt. Ltd.**No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777**Renesas Electronics Korea Co., Ltd.**17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338

Renesas Synergy™ Platform
Synergy Enterprise Cloud Toolbox
for PK-CLOUD1
Quick Start Guide

