

Amazon ACK HMCU On NuMaker-M032SE

www.nuvoton.com

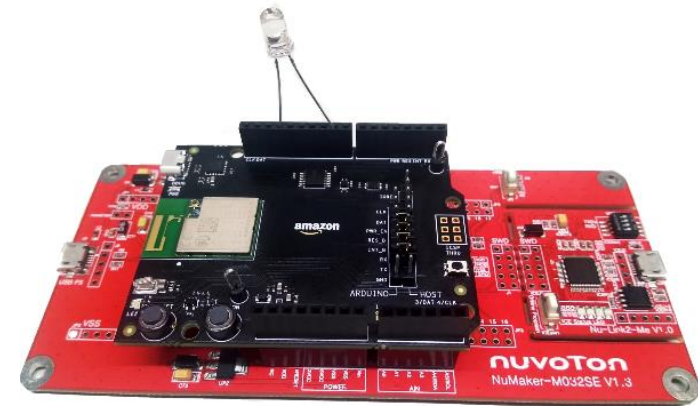
MS70 Wayne Lin

2021/1/20

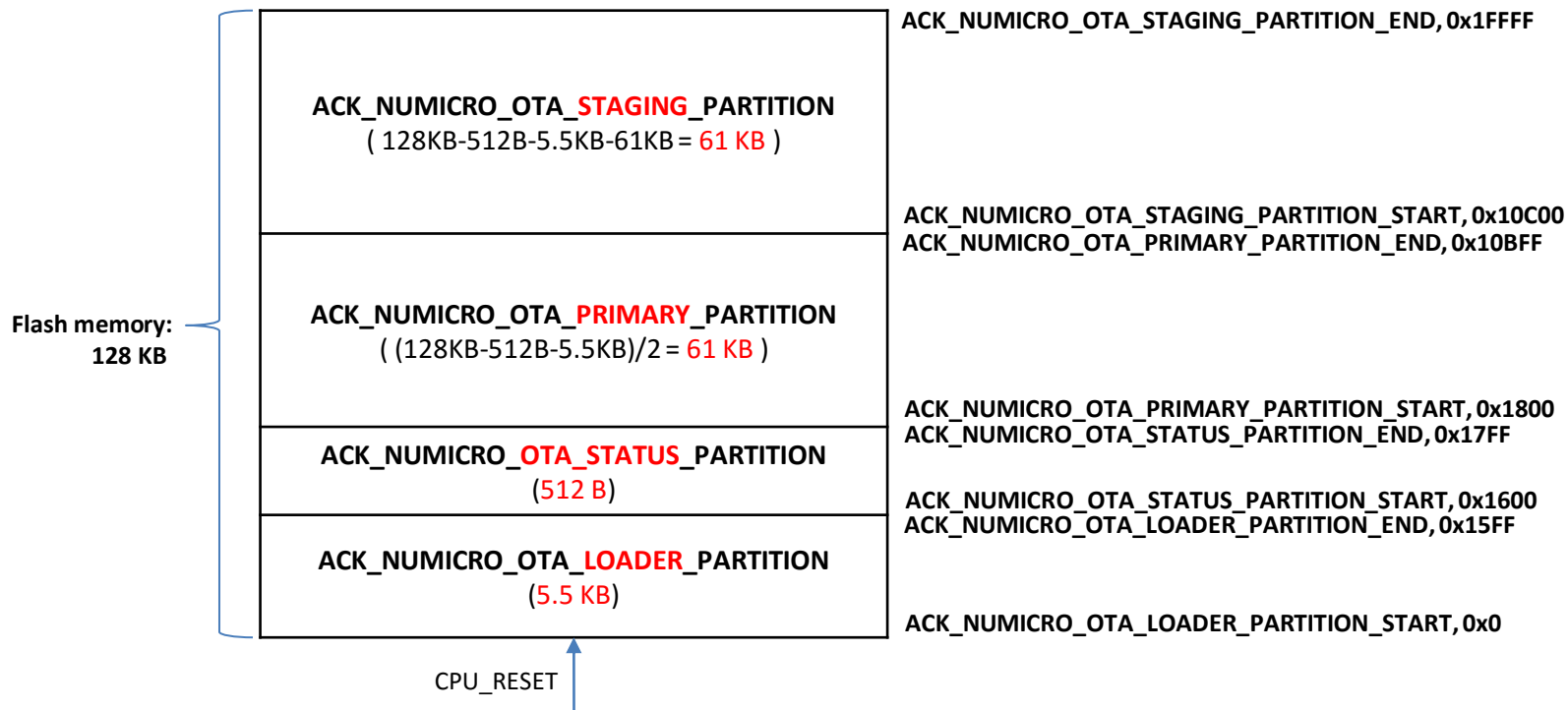
- **Introduction**
- **Partition layout, Boot flow & OTA upgrading**
- **Demo**
- **Some notes**

Introduction

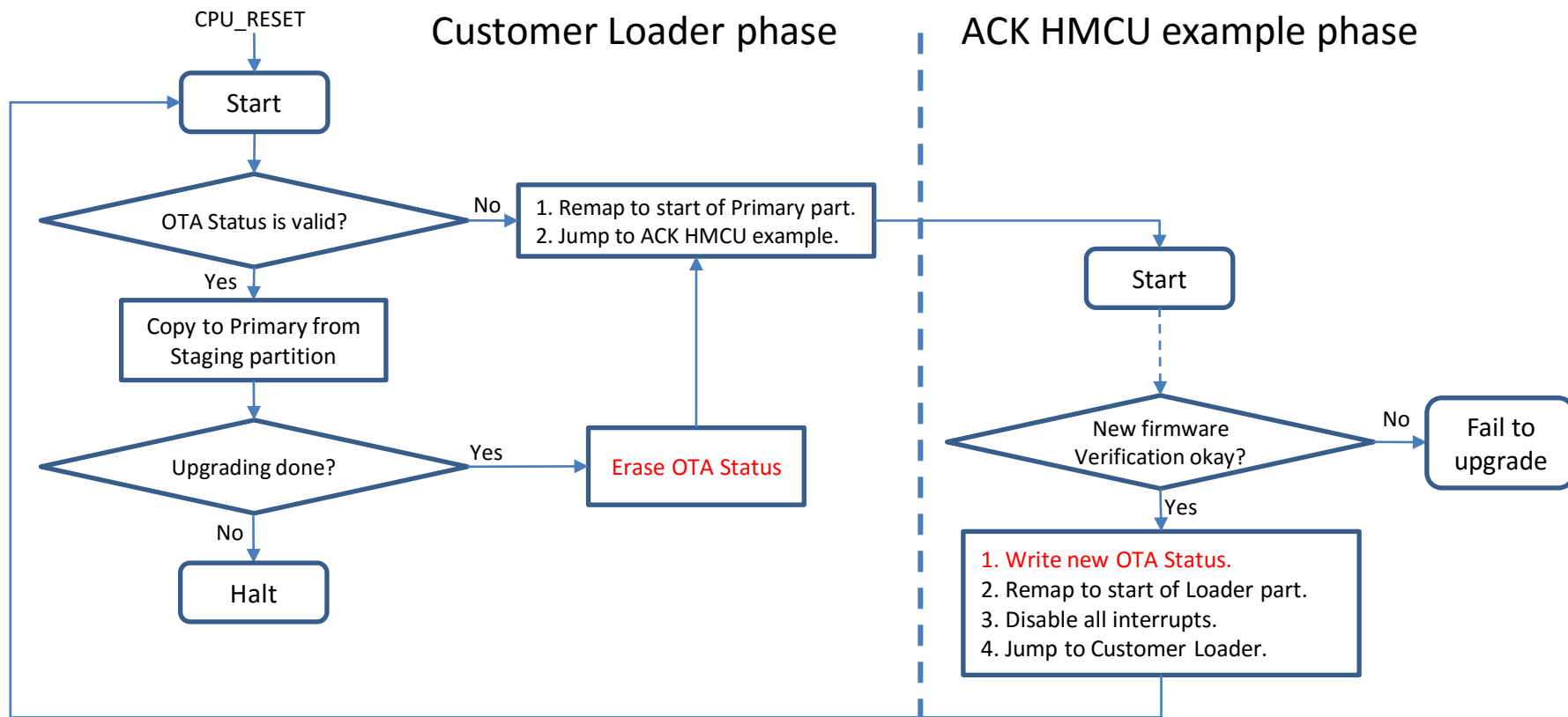
- **ACK – Alexa Connect Kit**
- **An Amazon-managed solution that makes it simpler, faster, and more economical to create and manage Alexa-controlled, Wi-Fi-enabled smart devices.**
 - ACK module
 - High-reliability/Low-latency device control cloud
 - ACK Management Console
 - Extensibility APIs
 - Dash Replenishment Service



Partition layout



Boot flow & OTA upgrading



Demo

- Requirements
- Driver Installation
- Build Steps
- HMCU Board Setting
- ACK HMCU Firmware Installation
- ACK HMCU Boot Option Configuration

Requirements

- **Hardware**

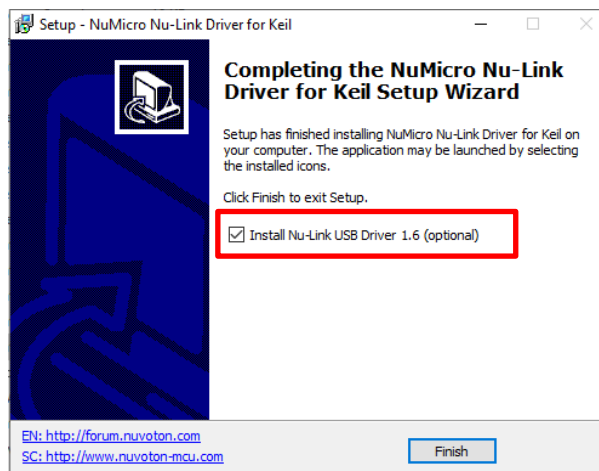
- An ACK module board (USI MT7697H development kit)
- An development board for ACK HMCU (NuMaker-M032SE board)
- An internet-accessible **2.4G** Wi-Fi router
- A mobile phone with Alexa APP
- A LED, a dupont line and an USB Micro line

- **Software/Drivers**

- Keil MDK 5.26
- Latest Nu-Link Keil drivers
- Python-3.8 environment

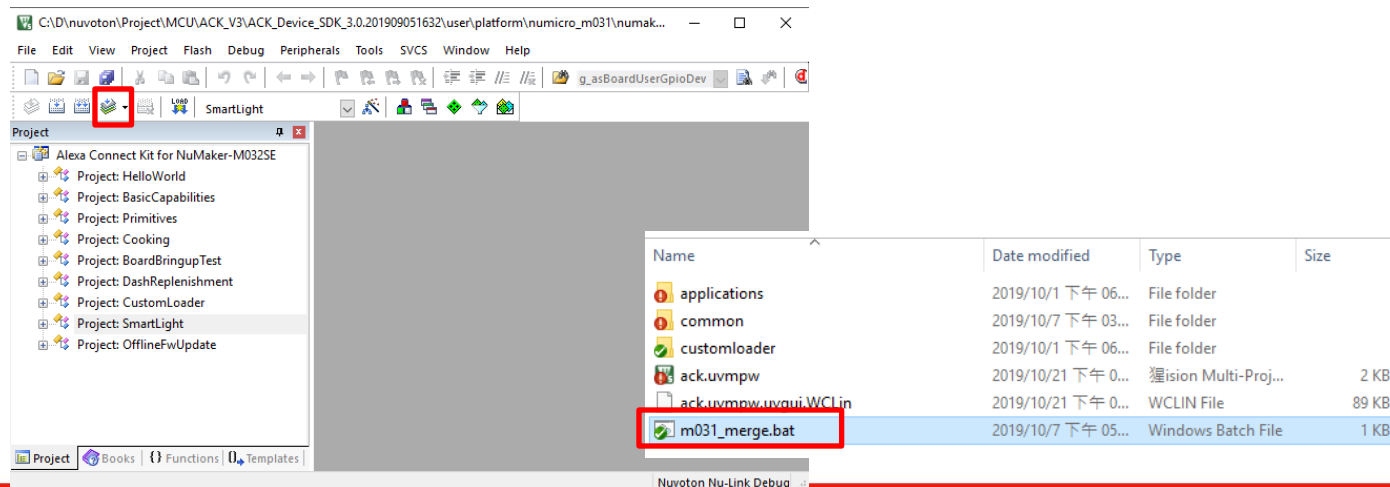
Driver Installation

- **Install “Nu-Link Driver for Keil” on Window platform**
 - Nuvoton provides installshield wizard to help user to install these utilities for keil.
 - It also includes a Nu-Link USB Driver. Please install it for MDK-ARM debugger and Nuvoton virtual COM(VCOM) function.



Build Steps

- Open ack.uvmpw Keil multiple project file using MDK 5.26.
 - Path: <Path-to-ACK_Device_SDK>\user\platform\numicro_m031\numaker-m032se\ack.uvmpw
- Press “Batch rebuild” to build all examples.
- Finally, execute “m031_merge.bat” to merge customer_loader and example into a hex file.



Python Installation

- **Python 3.8** or later is required, with the following optional modules (install with pip): intelhex, protobuf, pyserial.
 - Download: <https://www.python.org/ftp/python/3.8.6/python-3.8.6-amd64.exe>
 - The **intelhex** is *MUST* before you executing the **m031_merge.bat** script.
 - To execute '**pip install intelhex**' in command line window.
 - Remember to add python execution to **PATH** variable.

m031_merge.bat

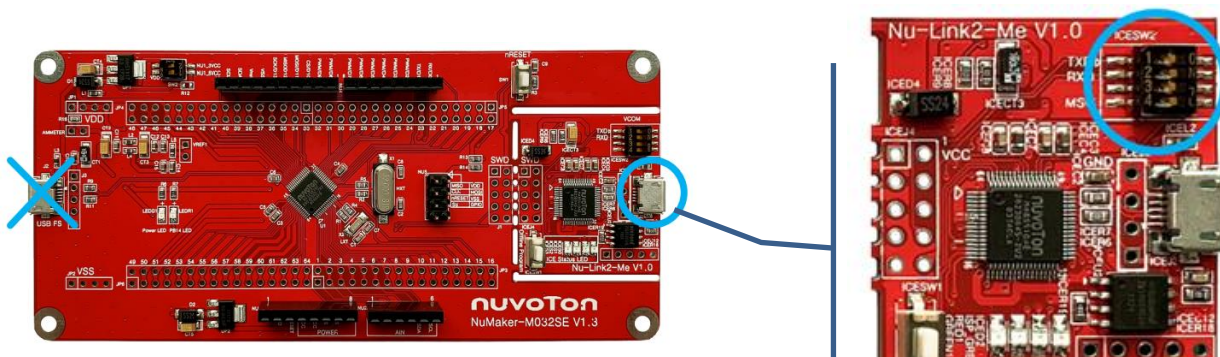
- This is batch script for window platform. Help user to get all merged firmwares for programming, just a double-click step.
- It invokes some python utilities Amazon provided
 - For producing a merged firmware for NuMicro MCU.
 - For OTA upgrading file for publishing on Amazon Cloud.
 - Please remember to modify the device type for yours.

Name	Date modified	Type	Size
applications	2019/10/1 下午 06...	File folder	
common	2019/10/7 下午 03...	File folder	
customloader	2019/10/1 下午 06...	File folder	
ack.uvmpw	2019/10/21 下午 0...	Verision Multi-Proj...	2 KB
ack.uvmpw.uvgui.WCLin	2019/10/21 下午 0...	WCLIN File	89 KB
m031_merge.bat	2019/10/7 下午 05...	Windows Batch File	1 KB

Merged_BasicCapabilities.hex	2019/10/21 下午 0...	HEX File	177 KB
Merged_BoardBringupTest.hex	2019/10/21 下午 0...	HEX File	153 KB
Merged_Cooking.hex	2019/10/21 下午 0...	HEX File	186 KB
Merged_DashReplenishment.hex	2019/10/21 下午 0...	HEX File	162 KB
Merged_HelloWorld.hex	2019/10/21 下午 0...	HEX File	159 KB
Merged_OfflineFwUpdate.hex	2019/10/21 下午 0...	HEX File	79 KB
Merged_Primitives.hex	2019/10/21 下午 0...	HEX File	182 KB
Merged_SmartLight.hex	2019/10/21 下午 0...	HEX File	182 KB

HMCU board Setting









- Switch Pin 1 and pin 2 of VCOM(ICESW2) on Nu-Link2-Me to “ON” position.
- Bridge USB micro line between Nu-Link2-Me and PC.
- After that, PC will show a “NuMicro MCU” disk on Window file manager.

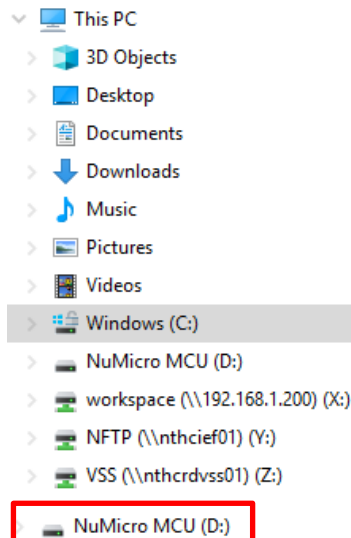


- **Nu-Link2-Me firmware upgrade guiding**
 - Please find out Chapter 5 of ‘NuMicro Cortex-M Keil ICE driver user manual.pdf’ in installed Nu-Link_Keil driver folder - C:\Program Files (x86)\Nuvoton Tools\Nu-Link_Keil\.

ACK HMCU Firmware Installation

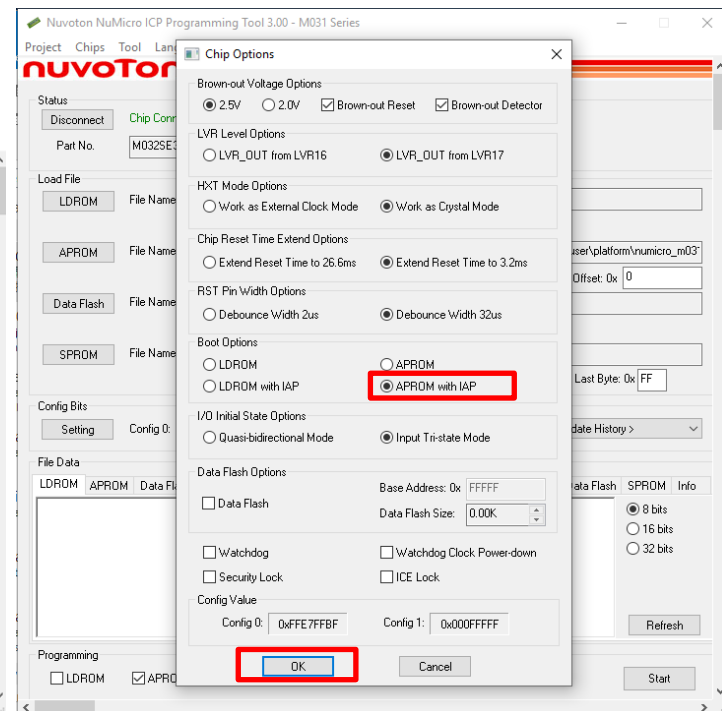
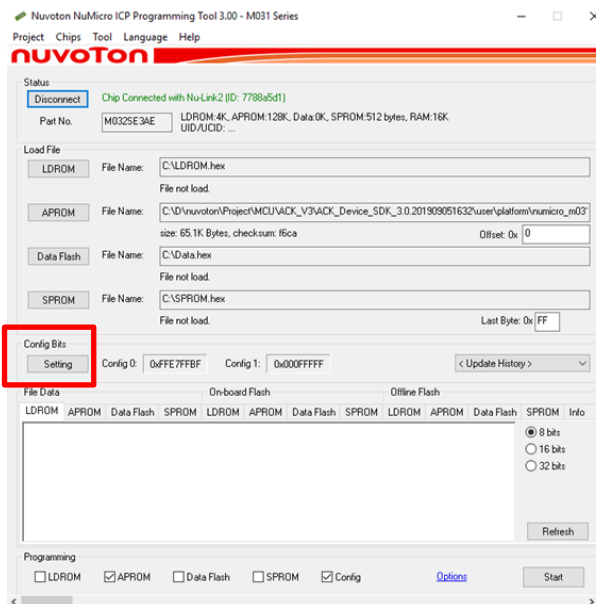
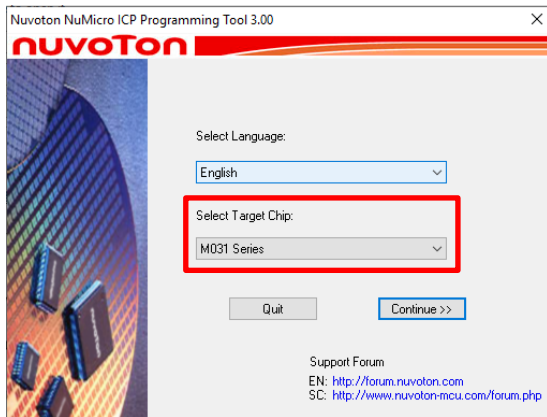
- Drag-and-drop firmware into “NuMicro MCU” disk.
 - The firmware includes a bootloader and an ACK example in a .hex file is merged by hexmerge.py.
 - After copying finished, firmware installation is done.

	Merged_BasicCapabilities.hex	2019/10/21 下午 0...	HEX File	177 KB
	Merged_BoardBringupTest.hex	2019/10/21 下午 0...	HEX File	153 KB
	Merged_Cooking.hex	2019/10/21 下午 0...	HEX File	186 KB
	Merged_DashReplenishment.hex	2019/10/21 下午 0...	HEX File	162 KB
	Merged_HelloWorld.hex	2019/10/21 下午 0...	HEX File	159 KB
	Merged_OfflineFwUpdate.hex	2019/10/21 下午 0...	HEX File	79 KB
	Merged_Primitives.hex	2019/10/21 下午 0...	HEX File	182 KB
	Merged_SmartLight.hex	2019/10/21 下午 0...	HEX File	182 KB



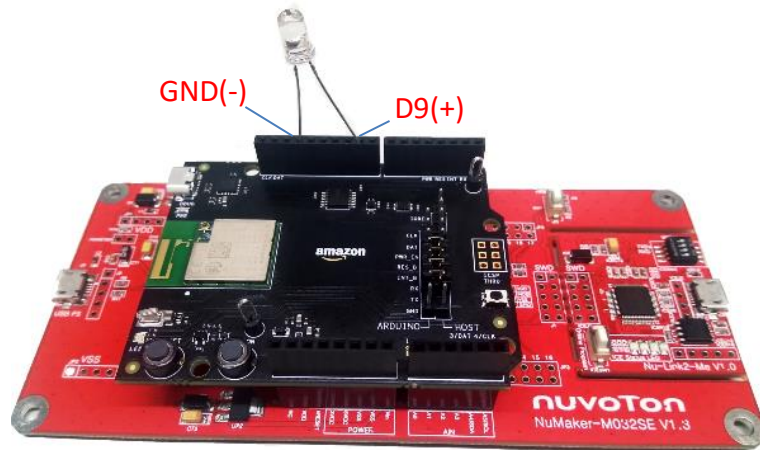
ACK HMCU Boot Option Configuration

- Configure “Boot Options” is in “APROM with IAP” mode using ICP programming Tool.



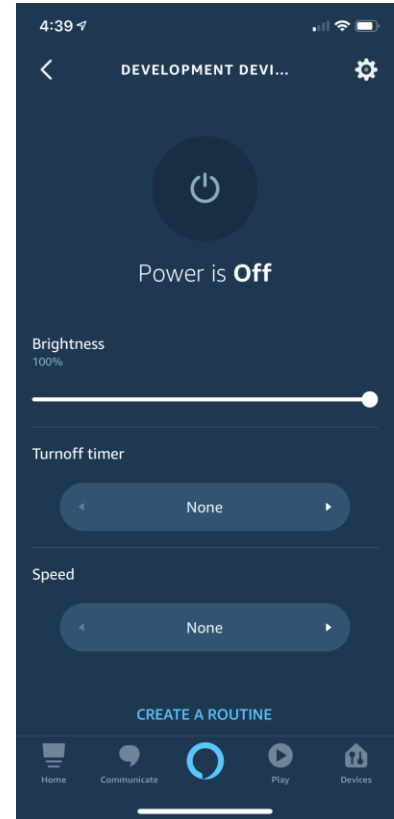
Wiring and Alexa APP

- Mount ACK connectivity board on Arduino shield of NuMaker board.
- Connect a LED to D9(+) and GND(-).
- Use terminal utility to see Log
 - Open window device manager to get Nuvoton VCOM COM port number.
 - UART communication setting is **115200N81**.
- Associate with an Internet-accessible Wi-Fi router
- Install Amazon Alexa APP in your mobile device
 - Got an Amazon account to login.
 - Make sure the APP version number is latest.



Alexa APP controlling

- You can use Alexa APP to set smart-light functions
 - Press Turn-on/off button
 - LED will be turn-on/off.
 - Slide brightness bar to [1-100] percent.
 - LED light brightness will be adjusted.
 - Select speed option to none/low/medium/high.
 - LED blink speed will changed to none/low/medium/high.
 - Select Turnoff timer option to none/5mins/10mins/1hours.
 - LED will be turn be after specified time.

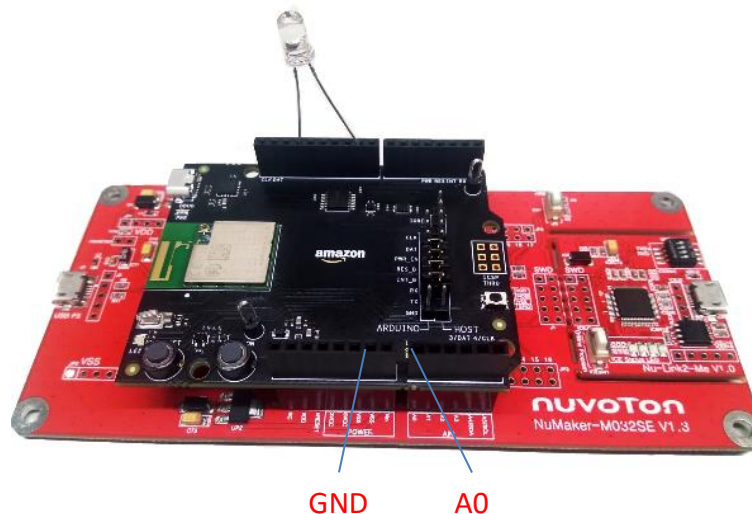


Speech controlling

- Golden utterances
 - <https://developer.amazon.com/zh/docs/device-apis/alexa-brightnesscontroller.html>
- You also can talk to Alexa APP below commands.
(Renamed development board to light)
 - Alexa, turn-on light
 - Alexa, turn-off light
 - Alexa, set turn off timer to **five minutes**. (none/5minutes/10minutes/1hour)
 - Alexa, set the speed to **low** on light. (none/low/medium/high)
 - Alexa, set light to **fifty** percent. [1-100%]

To Restore factory setting

- You can use a dupont line to short A0 to GND over 5 seconds to enter restoring factory setting mode.
 - After restoring, all settings on ACK module will be cleared. So, you need to register ACK module again.

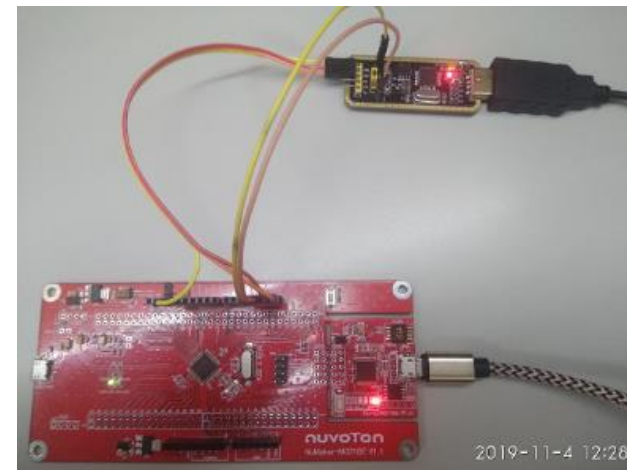


HMCU firmware version control

- You can modify `ACKUser_GetFirmwareVersion` function to do version control. This version number is for ACK HMCU firmware OTA upgrading.
 - PATH: `<PATH-TO-ACKDeviceSDK>\user\platform\numicro_m031\ack_user_device.c`
 - We use building-date-time to implement the function.
 - You need to publish new version number and HMCU firmware on Amazon cloud.

Offline OTA Validation

- Amazon engineer develops an ACK module simulator using python language. This is without ACK module connective, just connect HMCU board with an USB2Serial dongle.
 - Path: <Path_To_ACK_Device_SDK>\test\validation\validate-ota.py
- More details, you should follow steps in readme.txt file.
 - Path: <Path_To_ACK_Device_SDK>\test\validation\readme.txt
- **Wiring**
 - HMCU_UART_TX -- USB2Serial_RX,
 - HMCU_UART_RX -- USB2Serial_TX
 - HMCU_HOSTINT -- USB2Serial_RTS
 - HMCU_RESET -- USB2Serial_CTS
 - HMCU_GND -- USB2Serial_GND



m031_offline_ota.bat

- This is batch script for window platform. It can help user to do ACK HMCU offline OTA validation.
- Hint: Before do the batch script, you should finished steps in previous 'Offline OTA validation' slide.
- Set timeout thresholds
 - If your xxxxx.ota file size is bigger, you should enlarge the timeout thresholds in validate-ota.py for firmware downloading and applying.
 - For smartlight.ota example, we enlarge the **HMCU_OTA_COMPLETE** to 30 and **RESTART_DEVICE** to 10 seconds.
- Execute
 - Execute m031_offline_ota.bat, then press reset button on board.
 - Wait validation done, then see report .

```

77 .....ackModule.SetOtaImage(otaImage, args.force)
78 .....orchestrator.WaitForMarkers(
79 .....    Marker(MarkerKind.HMCU_OTA_COMPLETE),
80 .....    timeout=30,
81 .....    description=STR_SCRIPT_STEP_ADVERTISE_OTA)
82 .....
83 .....orchestrator.WaitForMarkers(
84 .....    Marker(MarkerKind.HMCU_OTA_RESTART_DEVICE),
85 .....    timeout=10,
86 .....    description=STR_SCRIPT_WAIT_FOR_OTA_APPLY)

```

```

C:\Windows\system32\cmd.exe
Path of output file is Smartlight
ACK Device SDK Over-the-Air update validator version 0.5.
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[19:11:03.0.039] [44804] Waiting for HMCU to be (re-)started.
[19:11:04.0.961] [44804] HMCU started.
[19:11:04.0.964] [44804] Updated image to PRIMARY partition from STAGING.
[19:11:04.0.964] [44804] VECMAP = 0x0
[19:11:04.0.966] [44804]
[19:11:04.0.967] [44804] CPU @ 48000000Hz
[19:11:04.0.968] [44804] [CRT: ACKUser.GetFirmwareVersion:73] Jan 20 2021 18:53:12 0x15011412350c
[19:11:04.0.970] [44804] [CRT: ACK_Initialize:117] ACK Device SDK Implementation Core (re-)started; firmware version 230
94375888140 (0x15011412350c).
[19:11:05.0.171] [44804] Completed successfully: 'Send Module Booted message to HMCU and wait for HMCU to enter Booted l
ifecycle state'.
[19:11:05.0.178] [44804] [CRT: ACKUser.GetFirmwareVersion:73] Jan 20 2021 18:53:12 0x15011412350c
[19:11:05.0.572] [44804] Completed successfully: 'Wait for HMCU to send host config, and enter Not Connected lifecycle s
tate'.
[19:11:08.0.068] [44804] Completed successfully: 'Set ACK module connected state to true, and wait for HMCU to enter Con
nected lifecycle state'.
[19:11:10.0.151] [44804] Completed successfully: 'Delay by 2 second(s)'.
[19:11:28.0.588] [44804] Completed successfully: 'Advertise Over-the-Air update to HMCU, and wait for HMCU to succeed or
fail retrieving and applying it.'.
[19:11:28.0.592] [44804] Completed successfully: 'Wait for the HMCU to apply the Over-the-Air update image, after having
retrieved all of it.'.
[19:11:28.0.731] [44804] Analyzing...
[19:11:28.0.731] [44804] Info: UART communication with the ACK module appears stable.
[19:11:28.0.733] [44804] Info: No errors were encountered downloading and applying the Over-the-Air update image from th
e ACK module.
[19:11:28.0.734] [44804] PASS

```

ACK development kits

- Please visit Amazon ACK official page
 - <https://developer.amazon.com/en-US/alexa/connected-devices/alexa-connect-kit/dev-kits>

MO31 Series Resources

- **Link to Keil tools for Nuvoton NuMicro**
 - <http://www2.keil.com/nuvoton/M0-M23>
- **Technical reference manual**
 - http://www.nuvoton.com/resource-files/TRM_M031_Series_EN_Rev1.03.pdf
- **Development board user manual**
 - http://www.nuvoton.com/resource-files/UM_NuMaker-M032SE_EN_Rev1.00.pdf
- **Latest Nu-Link Keil driver download**
 - https://www.nuvoton.com/opencms/resource-download.jsp?tp_GUID=SW0520101208200142
- **Latest ICP Programming tool download**
 - https://www.nuvoton.com/resource-download.jsp?tp_GUID=SW1720200221181328