



# WONDOM ICP5 User Guide

IN-CIRCUIT PROGRAMMER FOR PROGRAMMING, APP CONTROL & PC UI - ICP5

By Sure Electronics Co., Ltd.



# Revision History

Revision	Description	Date
V1.0	WONDOM ICP5 PCB version – V100	10-Sept-2021
V1.01	WONDOM ICP5 PCB version – V100 (USB Driver Added)	8-Oct-2021
V1.02	WONDOM ICP5 PCB version – V100 (PC UI Updated)	10-Nov-2021

# Overview

## ICP5 - Multi-Purpose In-Circuit Programmer

For use with WONDOM products integrated with DSP, providing various functions as programming with SigmaStudio, APP control and PC UI control. In addition, ICP5 supports online Firmware Upgrade. Owing to the equipped auto-identification system, ICP5 can recognize the target products automatically once they are connected.



### Online Upgrade

Update ICP5 by your side for use with more products



### Programming

On-board self-boot EEPROM for operating with Analog Devices, Inc., SigmaStudio™



### APP Control

Integrated with Bluetooth BLE for APP control



### PC UI Control

Integrated with USB UART for PC UI Control

# Applicable Products

Model	Brief Description	Programming	APP Control	PC UI Control
APM2	ADAU1701 DSP kernel board	Y	Y (End of Jul, 2022)	Y (End of Nov)
JAB2v2	2.0 / 0.1 Audio amplifier board with DSP & BT 5.0	N	N	Y
JAB3	2.0 / 0.1 Audio amplifier board with ADAU1701 DSP	Y	Y (End of Jun, 2022)	Y (Mid-Nov)
JAB3+	2.0 / 0.1 Audio amplifier board with ADAU1701 DSP & BT 5.0	Y	Y (End of May, 2022)	Y (End of Oct)
JAB4	4.0 / 2.1 / 2.0 / 0.2 30W Audio amplifier board with ADAU1701 DSP & BT 5.0	Y	Y (End of Apr, 2022)	Y (Mid-Oct)
JAB5	4.0 / 2.1 / 2.0 / 0.2 100W Audio amplifier board with ADAU1701 DSP & BT 5.0	Y	Y (End of Mar, 2022)	Y (End of Sep)

N represents for NOT AVAILABLE; Y represents for AVAILABLE.

Y in red means that it's in plan and you can see the estimated release date.

# Contents

We cover the following contents in this document. You can click on the title to skip to corresponding chapter.



**ICP5 Introduction**



**Programming**



**PC UI Control**



**APP Control**

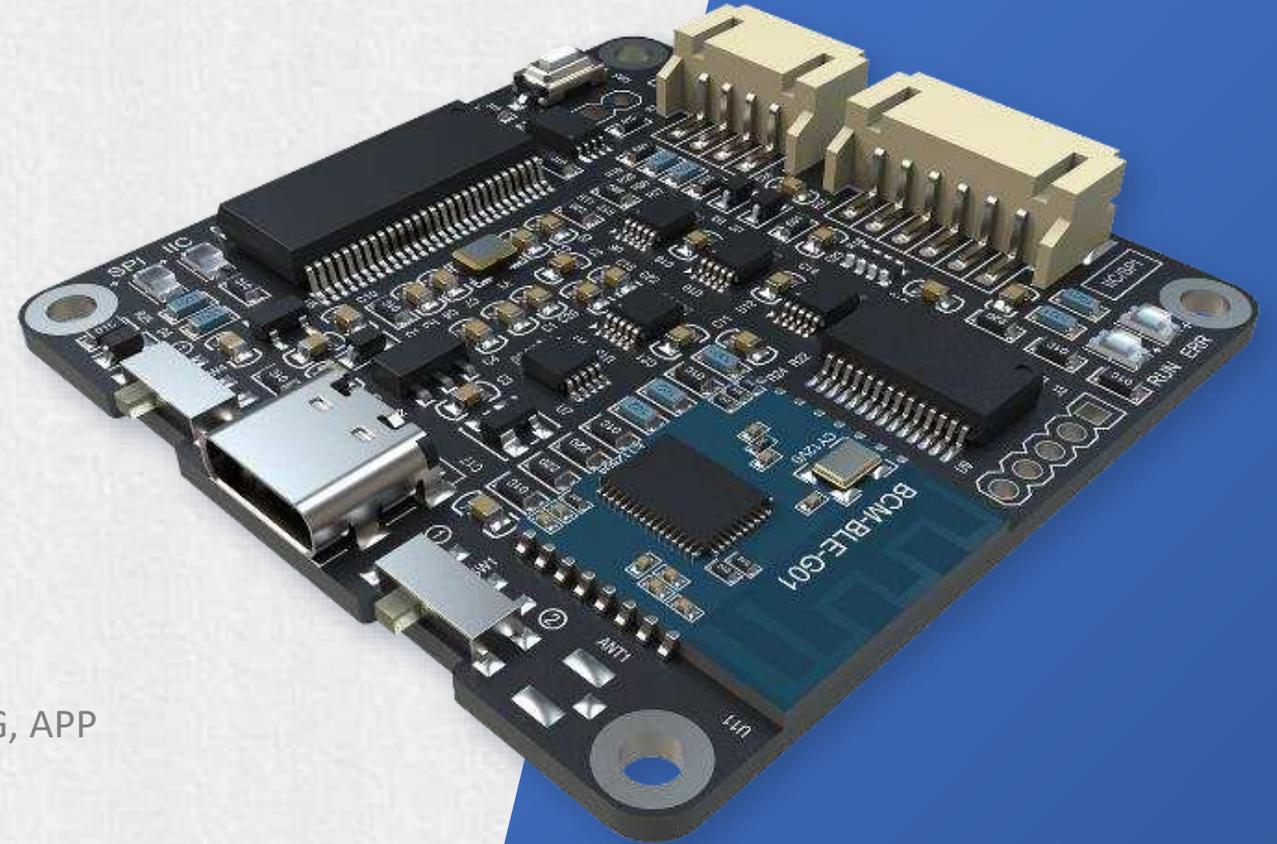


# Introduction of **ICP5 Programmer**

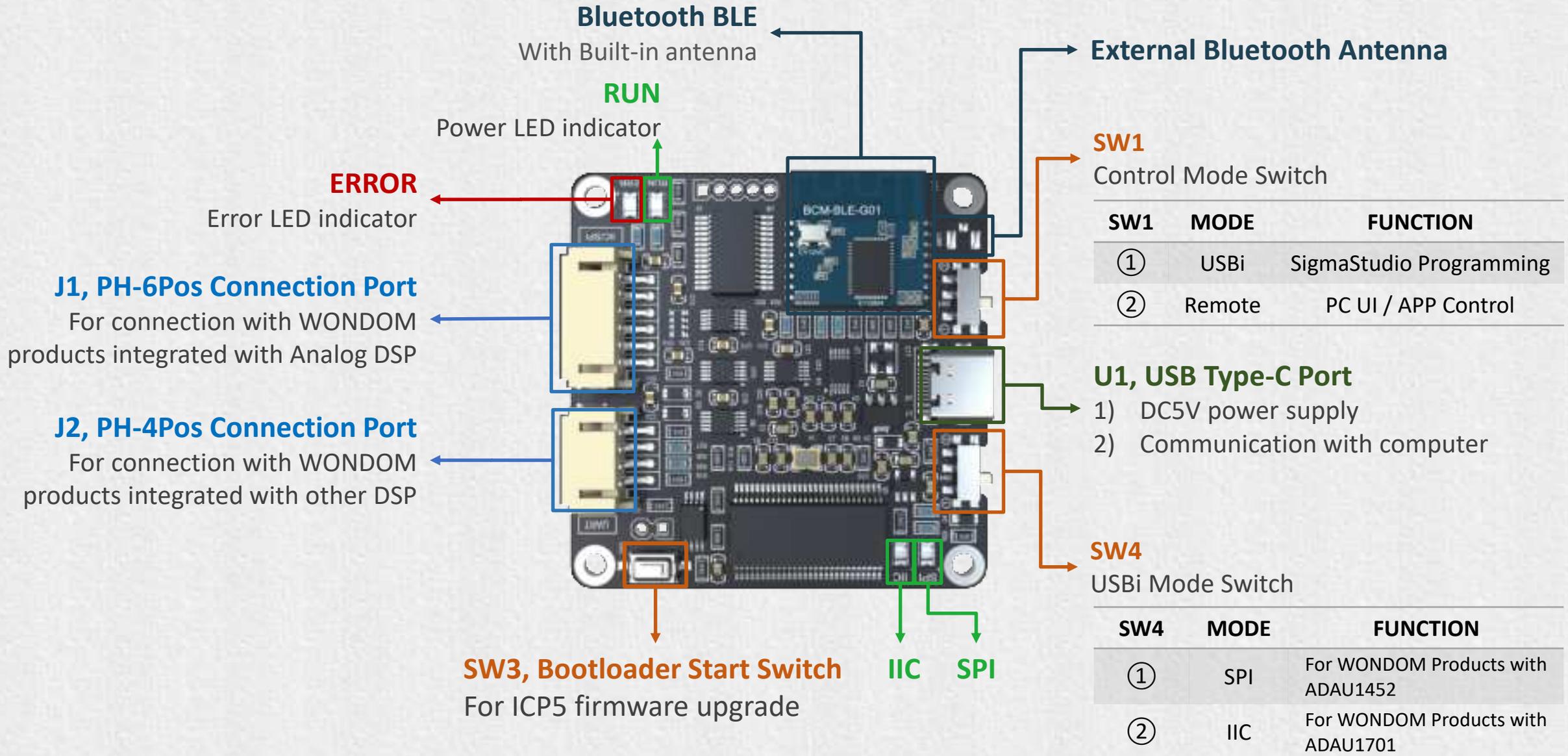
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## ICP5

IN-CIRCUIT PROGRAMMER FOR SIGMASTUDIO PROGRAMMING, APP  
CONTROL & PC UI CONTROL



# Interface Definition



# Power Supply



## U1, DC5V power supply

A USB Type-C port is used for power of ICP5. In addition to power, this USB port supports communication with the computer for programming or PC UI control after connection.

Once ICP5 is connected with target products through the PH-6Pos or PH-4Pos connection port, ICP5 will be powered by the target products directly. There is no need to connect with an extra power supply.

# Bluetooth Module



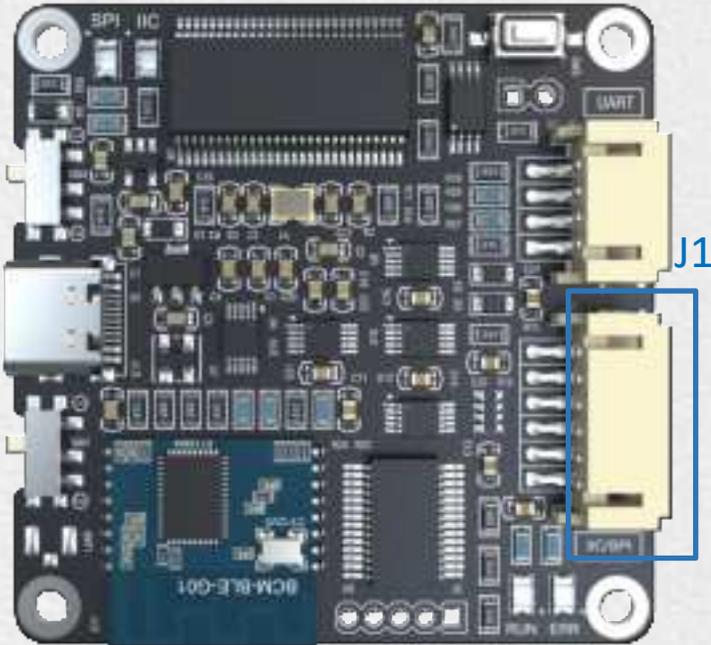
## Bluetooth BLE Module

ICP5 is integrated with high performance Bluetooth BLE module, which are for APP control with target products.

For now, there is no APP available for use with ICP5.

We will develop APPs in the near future.

# Connection Port

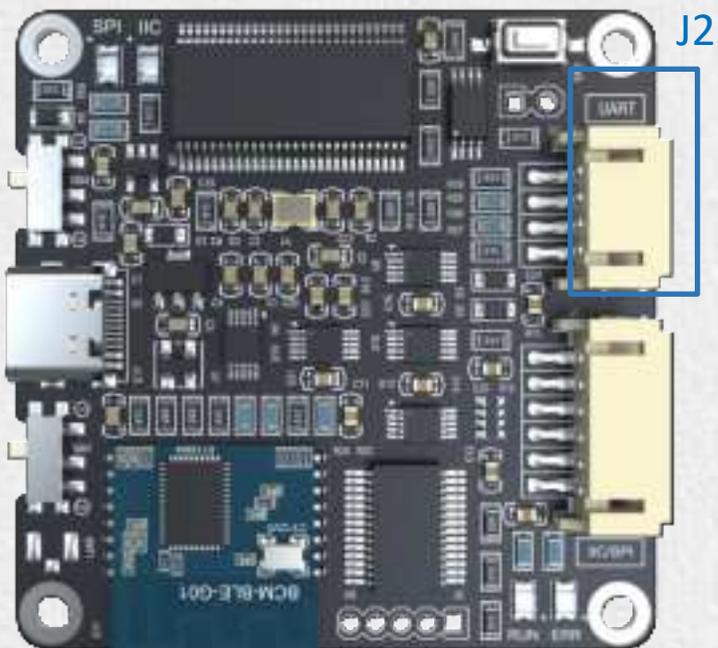


## J1, PH-6Pos-Connection Port

J1, the PH-6Pos-connector, adopting I2C / SPI communication protocol, is used for connection with **WONDOM products that are integrated with Analog ADAU1701 DSP and later ADAU1452 DSP.**

ICP5 is equipped with automatic identification system, which means, it will identify the target product once it is connected.

# Connection Port

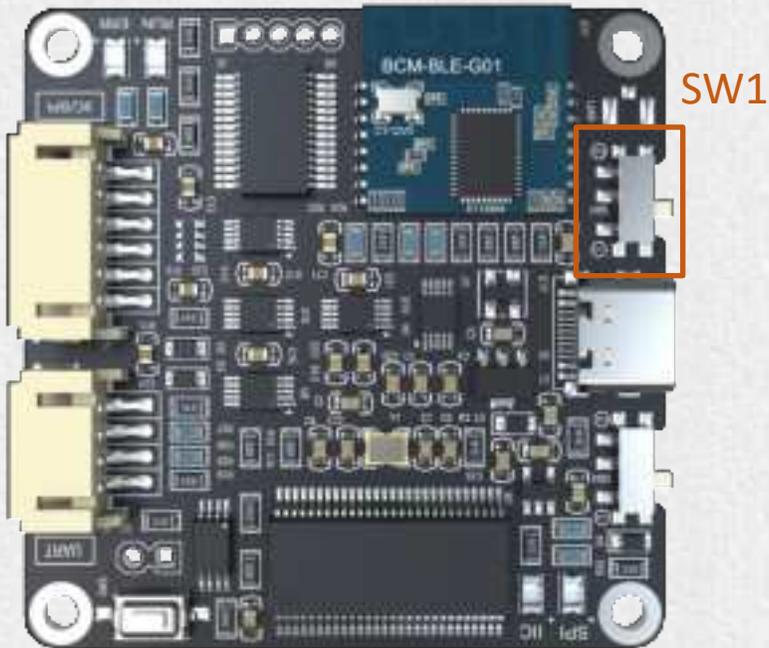


## J2, PH-4Pos-Connection Port

J2, the PH-4Pos-connector, adopting UART communication protocol, is used for connection with WONDOM products integrated with other DSP chips, for now there is only JAB2v2.

Since the DSP used is not from Analog, it will not support programming with SigmaStudio.

# Control Switch



## SW1, Control Mode Switch

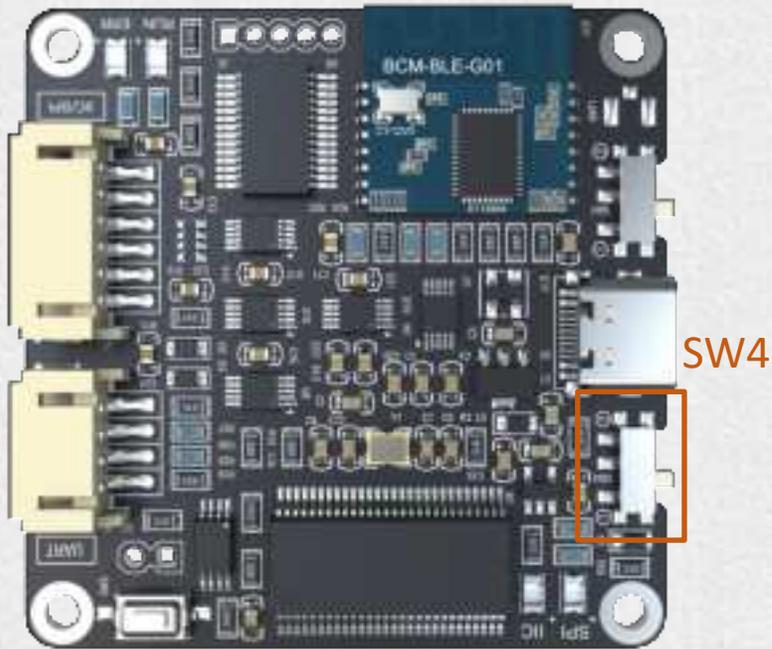
SW1 is a control mode switch between SigmaStudio programming and user interface control (APP control & PC UI control).

SW1	MODE	FUNCTION
①	USBi	SigmaStudio Programming
②	Remote	APP Control / PC UI Control

If you want SigmaStudio programming function, you need to set SW1 at ① “USBi”;

If you want APP / PC UI control, you need to set SW1 at ② “Remote”.

# Firmware Upgrade



## SW4, USBi Mode Switch

As mentioned before, besides current products with ADAU1701 DSP, we will develop products with ADAU1452 in future.

WONDOM products with ADAU1701 DSP communicates with SigmaStudio via I2C, while products with ADAU1452 plans to communicate with SigmaStudio via SPI. Therefore, we leave the switch for future use with ADAU1452 products.

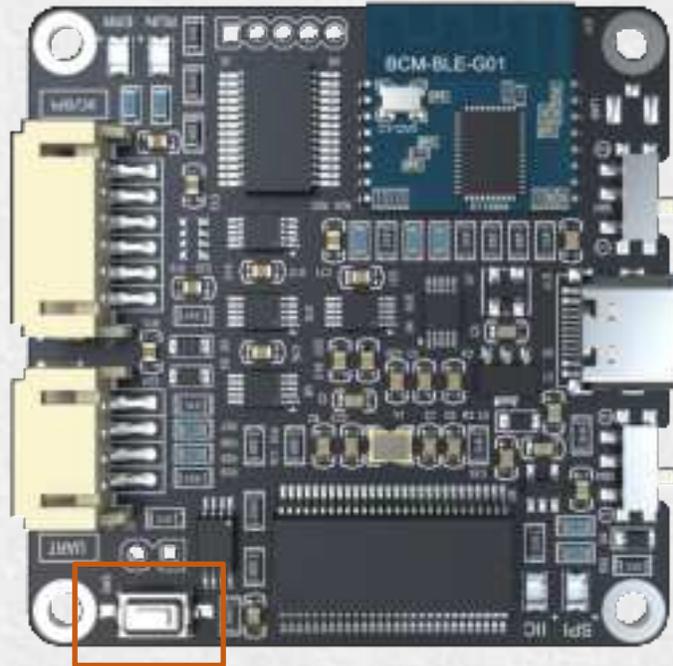
Therefore, besides setting SW1 at ① “USBi”, we need to set SW4 as well before programming.

Set SW4 at ② “IIC” when you want to program products integrated with ADAU1701;

Set SW4 at ① “SPI” when you want to program products integrated with ADAU1452.

SW4	MODE	FUNCTION
①	SPI	For WONDOM Products with ADAU1452
②	IIC	For WONDOM Products with ADAU1701

# Firmware Upgrade



**SW3**

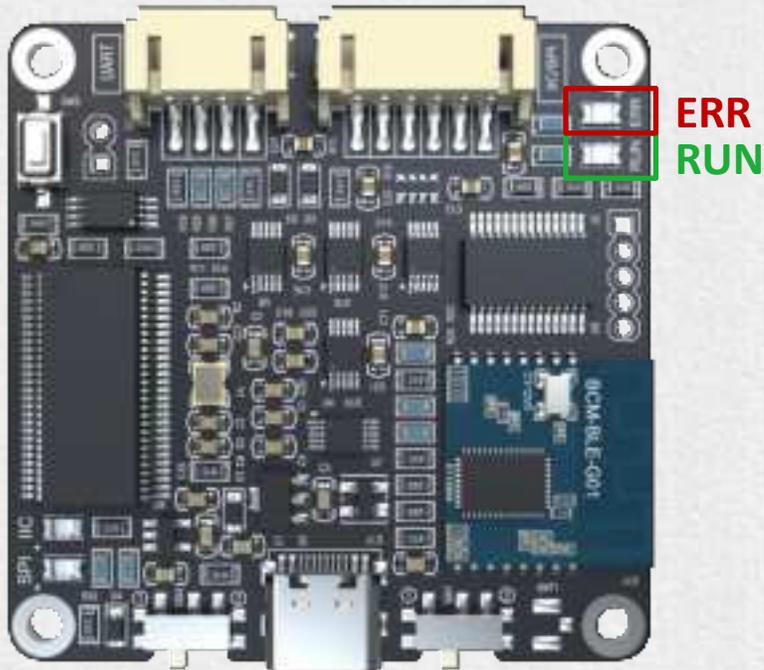
## SW3, Firmware upgrade switch

SW3 is a Bootloader start switch, which is provided to upgrade the firmware program on the ICP5 so that it can be used with various DSP products.

ICP5 needs online firmware upgrade if it's used with a target product for the first time.

As for the details, please refer to “Firmware Update” part.

# LED Indicator



## RUN Indicator

When power on, this indicator will be ON in green;

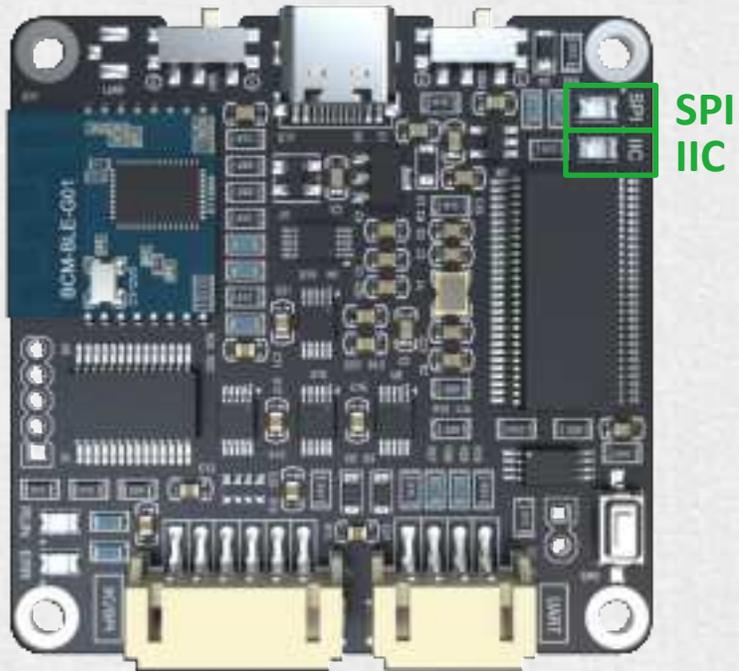
When power off, this indicator will be OFF;

When ICP5 is in BootLoader mode, this indicator will blink.

## ERROR Indicator

This error indicator is red and it will be ON when there is problem in hardware connection problem, or the firmware in ICP5 doesn't match with the connected target product.

# LED Indicator



## IIC Indicator

This indicator is green.

When SW1 is set at ① “USBi” and SW4 is set at ② “IIC”, this indicator will be ON.

## SPI Indicator

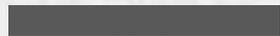
This indicator is green.

When SW1 is set at ① “USBi” and SW4 is set at ① “SPI”, this indicator will be ON.

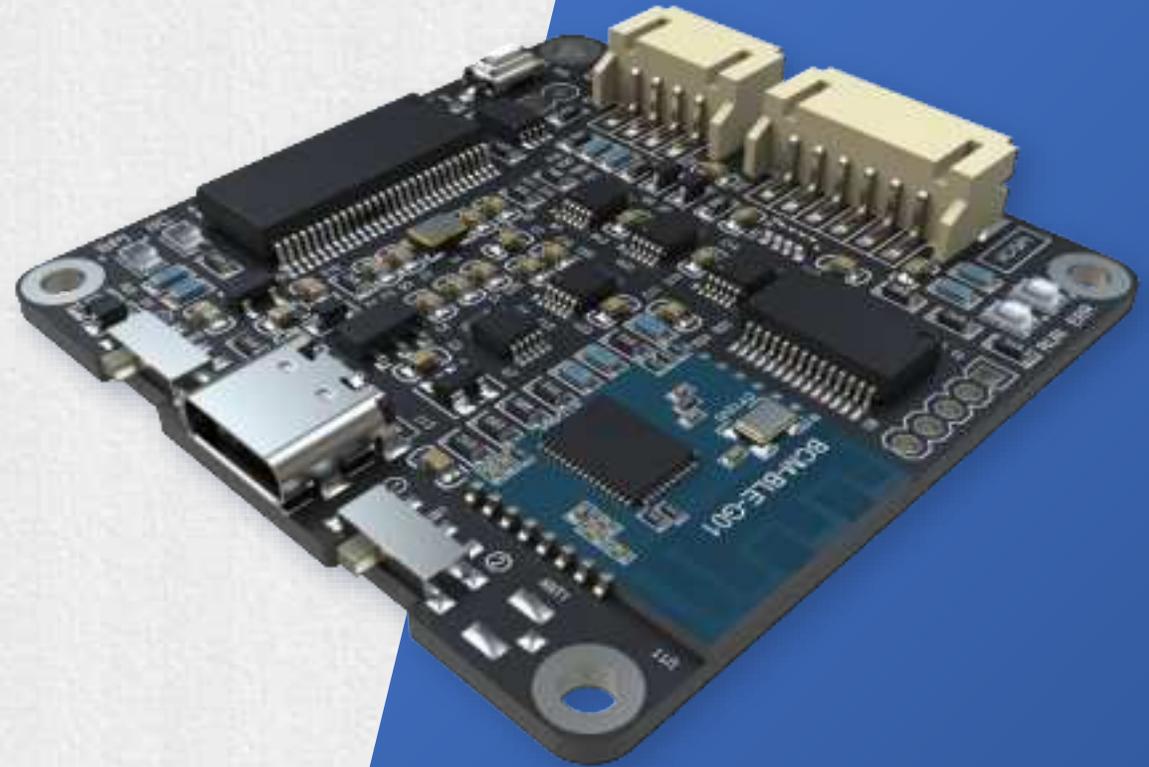


Video Tutorial

# How to UPGRADE FIRMWARE of ICP5



**ICP5**  
IN-CIRCUIT PROGRAMMER FOR SIGMASTUDIO PROGRAMMING, APP  
CONTROL & PC UI CONTROL



# Setting up ICP5

Before using ICP5 for SigmaStudio programming or PC UI control, we need to update the firmware to ICP5. The update is realized by PC UI for flexible upgrade.

Since for now we have only released PC UI for JAB2v2, you need to download this PC UI for update firmware of ICP5. Here is the download link.

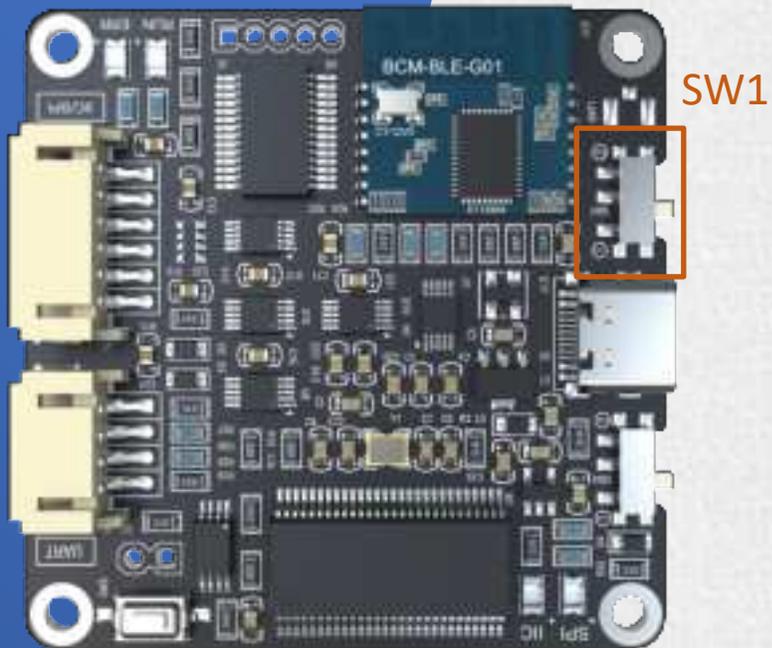
[https://store.sure-electronics.com/images/documents/Miumax For JAB2v2 Setup V1.1.zip](https://store.sure-electronics.com/images/documents/Miumax_For_JAB2v2_Setup_V1.1.zip)

Please install this USB driver before other operations to make sure ICP5 can be recognized.

Unzip this file and double click to install.

<https://store.sure-electronics.com/images/documents/Win10%20Driver.zip>

# ICP5 Settings



Since we need to update firmware by PC UI, we need to set SW1 of ICP5 at ② “Remote” at first. (The picture is just for reference.)

As for SW4, it doesn't matter where it is set at when we want PC UI control and SW1 is set at ② “Remote” .

SW1	MODE	FUNCTION
①	USBi	SigmaStudio Programming
②	Remote	APP Control / PC UI Control

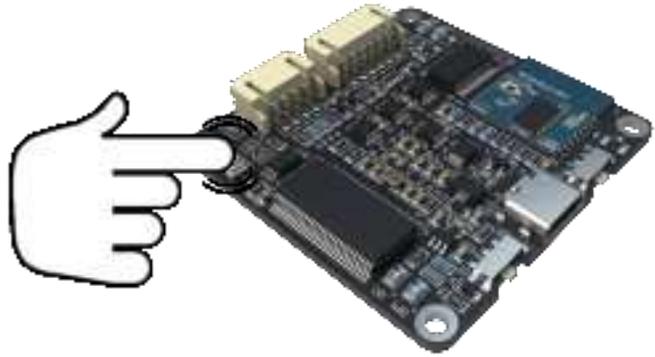
# Firmware Update

ICP5 needs different firmware for use with different products. There is no firmware in ICP5 in default. Therefore, we need to update firmware in ICP5 for the first use with a target product.

We need to enter BootLoader mode for firmware update.

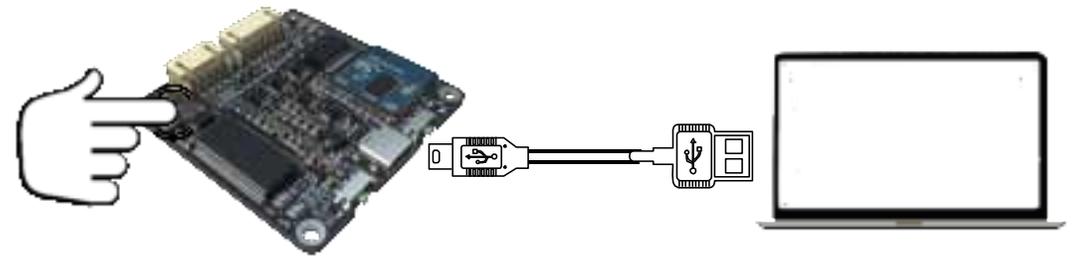
## 1. Press and hold on SW3 on ICP5

We need to press and hold on SW3 on ICP5.  
Please do not connect anything to ICP5 now.

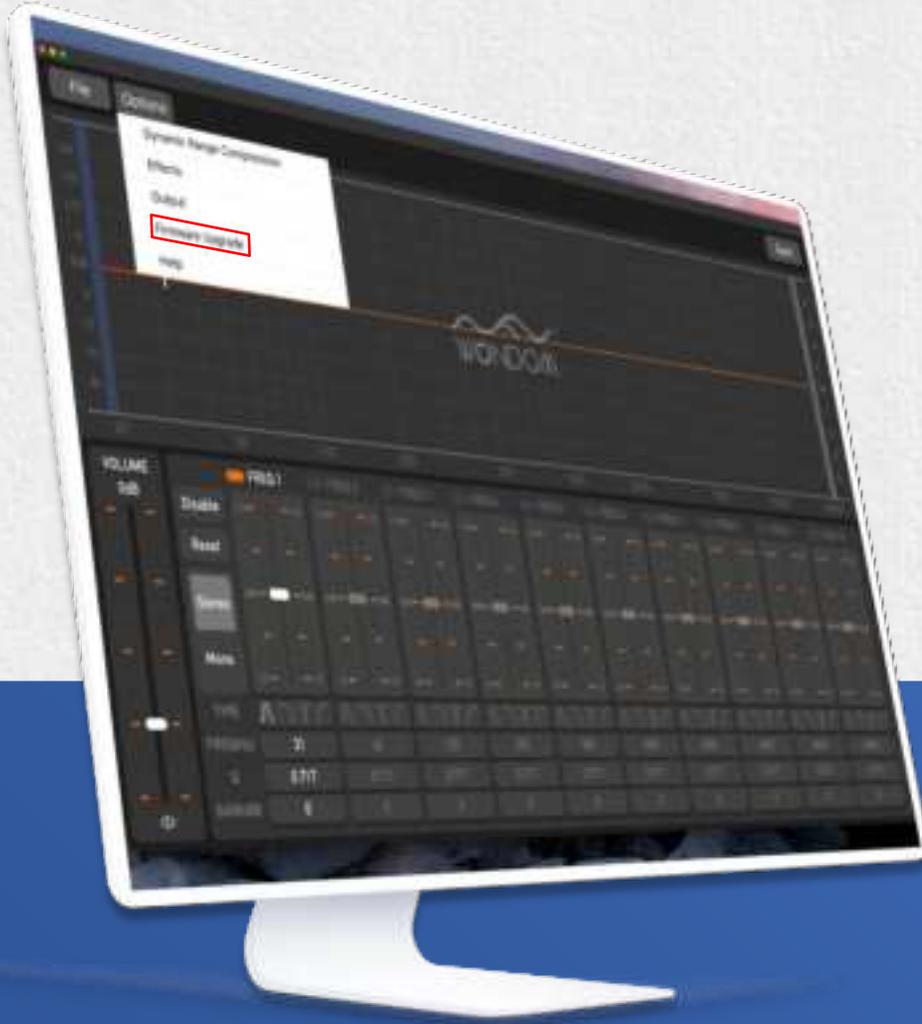


## 2. Connect ICP5 to computer

Connect ICP5 to computer with Type-C cable when holding on SW3.  
When you see “RUN” indicator blinking, it means ICP5 has entered BootLoader mode. You can release SW3 now.



# Firmware Update



## 3. Firmware Update

Run downloaded PC UI.

Click “Firmware Update” in the upper right corner.

The software will automatically update the firmware for controlling JAB2v2 into ICP5.

**After the update is done, “RUN” indicator will turn from blinking to ON.**

There is no need to update firmware next time you use ICP5 with the same target product, except that you use it with a different product for PC UI control.

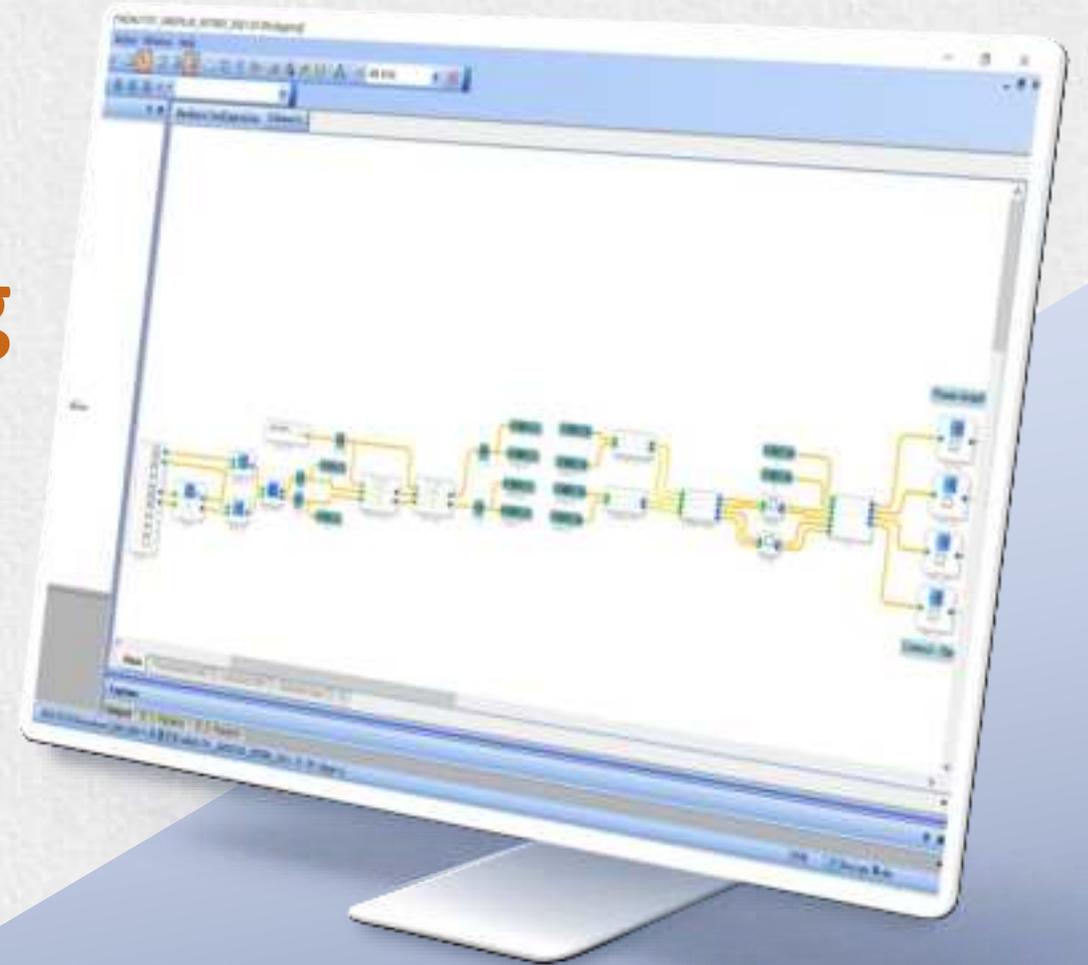


# How to achieve **SigmaStudio programming** with WONDOM ICP5?

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## ICP5

IN-CIRCUIT PROGRAMMER FOR SIGMASTUDIO PROGRAMMING, APP  
CONTROL & PC UI CONTROL



# Checklist

Before starting, please make sure you have the following items on hand.

1 WONDOM Products Integrated with ADAU1701



Here we will use JAB3+ as an example to explain how to connect.

2 Analog Devices, Inc. SigmaStudio™



3 WONDOM ICP5 with a 6-pin cable

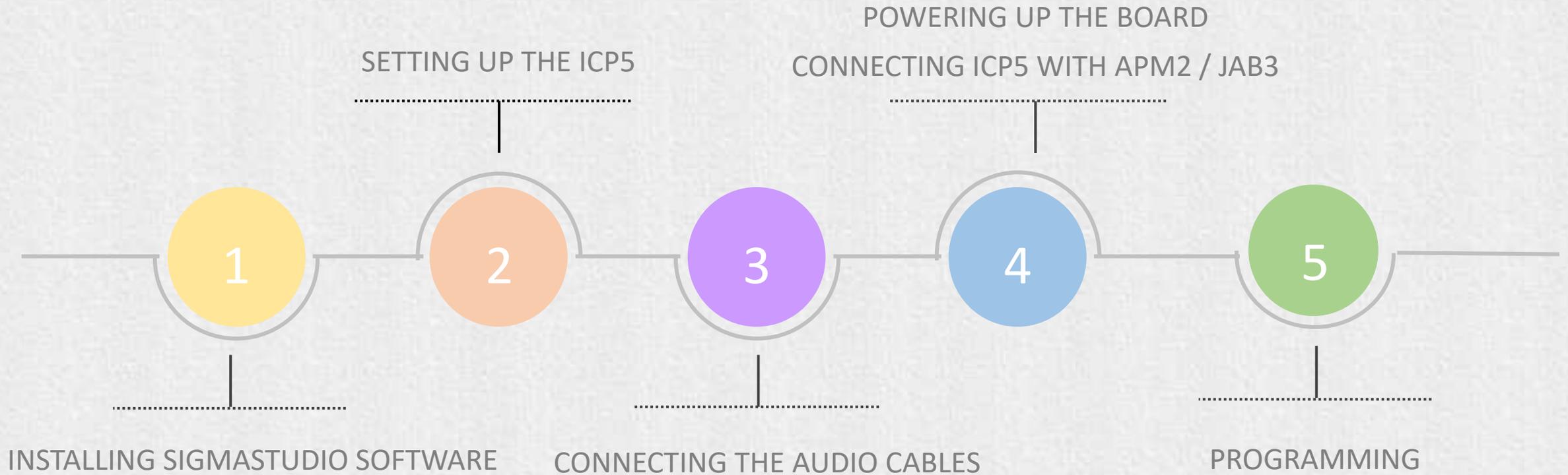


4 Accessories

Speakers  
Cables  
Phone  
...

# Steps

Be sure to follow these connection steps.



# Installing SigmaStudio

1. Open the downloaded zip file and extract the files to your computer. Alternately, insert the SigmaStudio CD into the PC optical drive and select the SigmaStudio folder.

[https://www.analog.com/en/design-center/evaluation-hardware-and-software/software/ss\\_sigst\\_02.html#software-overview](https://www.analog.com/en/design-center/evaluation-hardware-and-software/software/ss_sigst_02.html#software-overview)

2. Install Microsoft .NET Framework version 2.0, if it has not been previously installed. To do so, double-click “dotnetfx.exe”.

3. Double-click “setup.exe” and following the prompts. A computer restart is not required.



# Setting up ICP5

## 2. Set Switches on ICP5

Since we want to realize SigmaStudio programming function, we need to set SW1 of ICP5 at ① “USBi” at first.

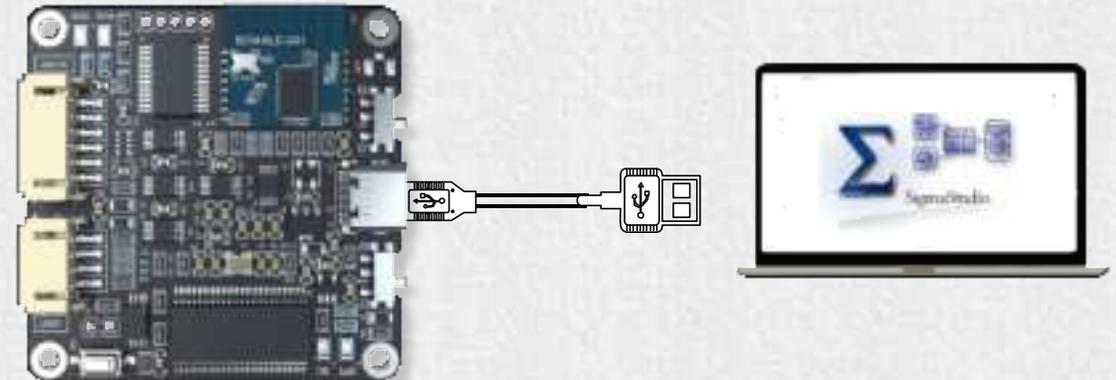
SW1	MODE	FUNCTION
①	USBi	SigmaStudio Programming
②	Remote	APP Control / PC UI Control

As the target product is JAB3+, whose DSP chip is ADAU1701, we need to set SW4 at ② “IIC”.

SW4	MODE	FUNCTION
①	SPI	For WONDOM Products with ADAU1452
②	IIC	For WONDOM Products with ADAU1701

## 3. Connect ICP5 to computer

**Do not connect ICP5 with target product now.**  
Connect ICP5 to the computer with a Type-C cable.



After connection, run SigmaStudio software and create a new project.

# Setting up ICP5

## 3. Check if ICP5 is successfully recognized

Select “USBi” from the list on the left and drag it to the blank area on the right. Repeat the action to move “ADAU1701” and “E2Prom” to the right. Complete the logic connection.

We have made a Basic SigmaStudio programming guide. You can click [HERE](#) to have a reference.

After We need to check whether the ICP5 is recognized by the computer.

If the underpainting of the “USB” turns green, it represents the ICP5 is successfully recognized. See figure 1.

If it turns orange, it means ICP5 is not recognized. Please check the switches and reconnect the ICP5 until it turn green.

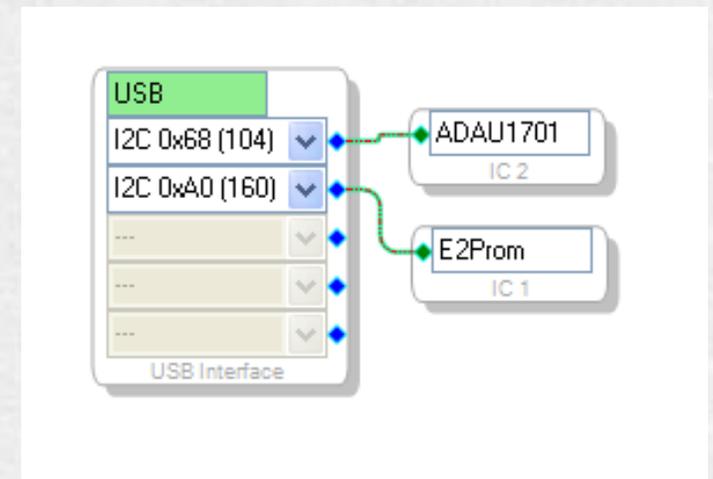


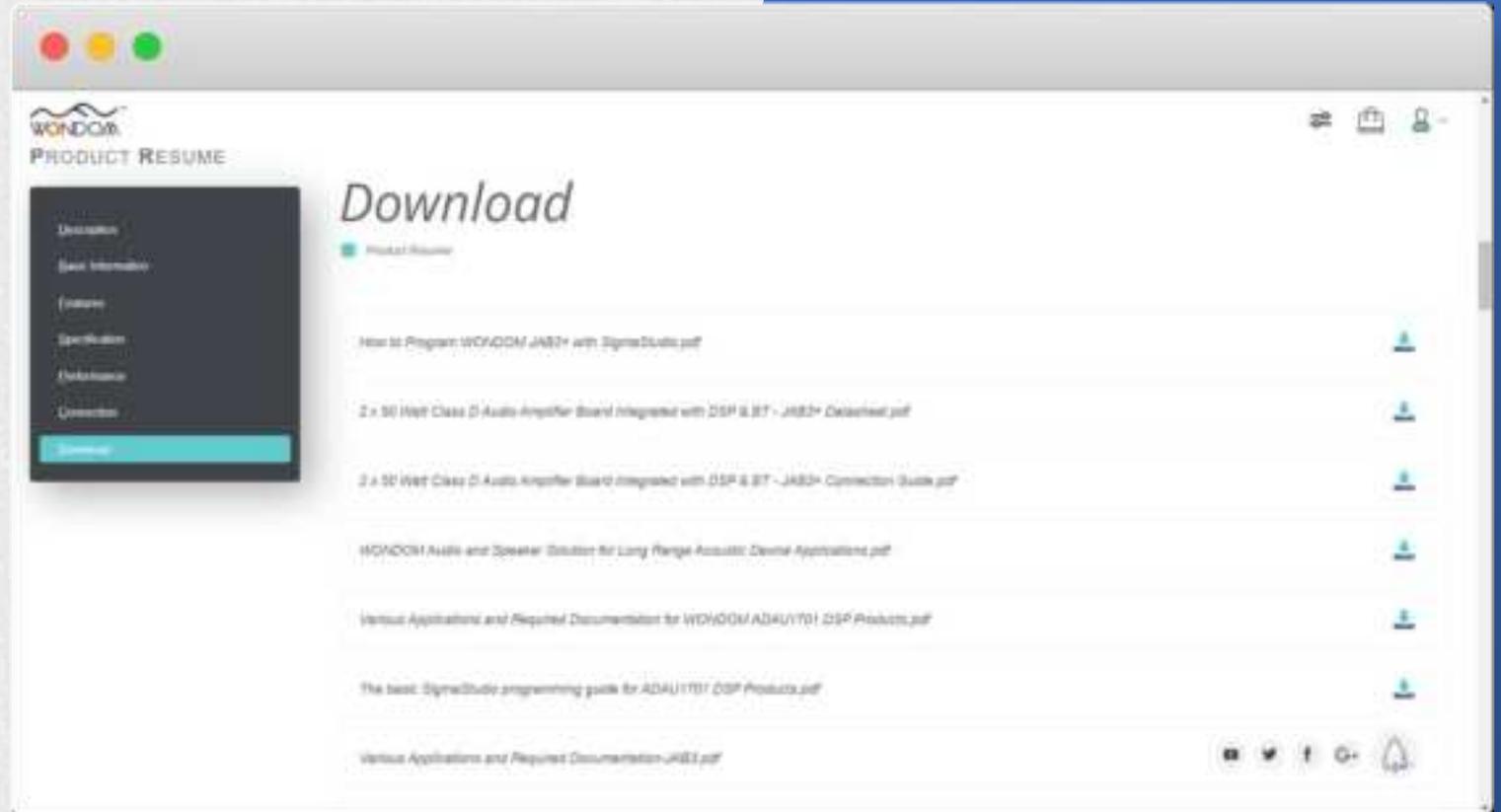
Figure 1

# Connecting Audio Cables

Connecting with speakers to play music when programming can help us monitor in real time if the playback audio meet your requirements. Then you can adjust parameters accordingly.

As for connection, please refer to datasheet or connection guide of each product. You can find the files in the detailed page of products.

If you use ICP5 with APM2 for programming, make sure the SW1 of APM2 is set at ① “RUN”.



# Powering up the board

After connecting with audio cables, it's time to power up the audio system.

Please power the target products with power supply within the recommended range. Otherwise, boards may be damaged permanently.

After powering up, we can connect ICP5 with JAB3+ through a PH-6Pos cable.

Everything is done. We can start programming now.



# Original Program

It's highly suggested to program based on our open-sourced original program.

You can download them in the following table.

Products	Demo Program	Document you may need
APM2	<a href="#">APM2_SigmaStudio.dspproj</a>	<a href="#">Download</a>
JAB3 - Mono	<a href="#">JAB3_SigmaStudio_MONO.dspproj</a>	<a href="#">Download</a>
JAB3 - Stereo	<a href="#">JAB3_SigmaStudio_STEREO.dspproj</a>	
JAB3+	<a href="#">JAB3+ Stereo ADAU1701_DEMOProgram.dspproj</a>	<a href="#">Download</a>
JAB4	<a href="#">JAB4_ADAU1701_DEMOProgram.dspproj</a>	-
JAB5	<a href="#">JAB5_ADAU1701_DEMOProgram.dspproj</a>	<a href="#">Download</a>

# Online Debugging

If you are a greener in programming, you can take our [Basic programming guide](#) as a reference.

During Programming process, we can make use of online debug mode to observe the effects.

The step is as follows.

Click “Link Compile Connect” (see figure 2) and you will find “Ready: Compiled” in the lower right corner of your computer. Then click the “Link Compile Download” (see figure 3) and you will find “Active: Compiled” in the lower right corner of your computer.

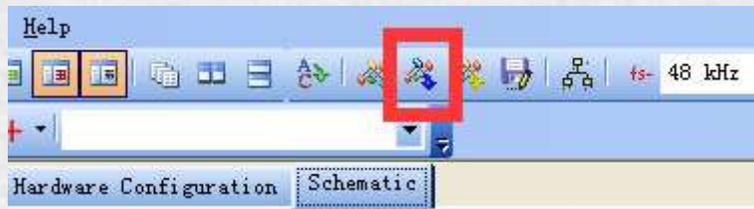


Figure 2

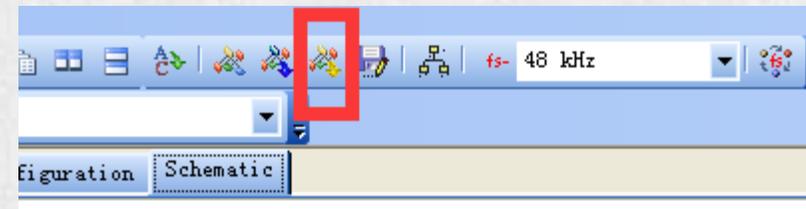
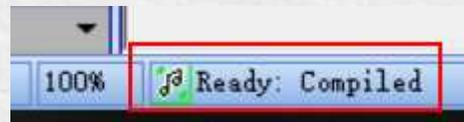


Figure 3



Please note, this is online debug mode, that means, the program will be lost once you re-power on. If you want to run the program offline, you need to write the program into ADAU1701.

# Program Writing

To write program into ADAU1701, please do as follows.

Enter “Hardware Configure” page and right-click the “ADAU1701”, then select “Write Latest Compilation to E2PBOM” to download the program (see figure 4). you will see a prompt window, choose the “I2C” on the right and click “OK” (see figure 5).

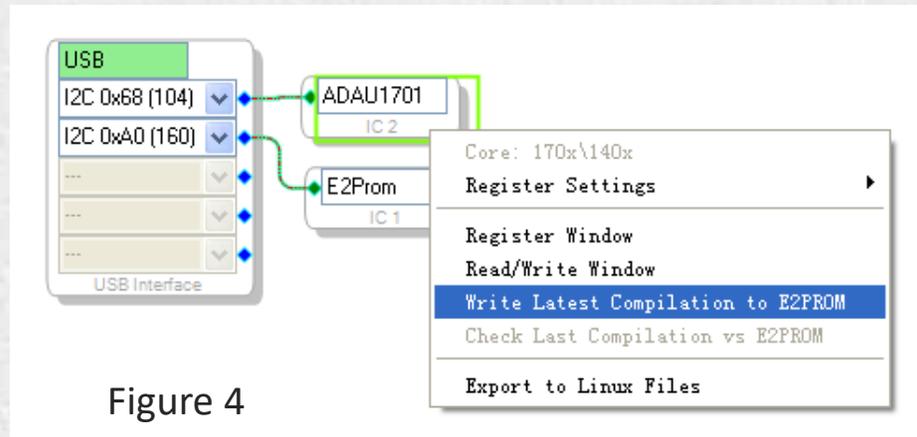


Figure 4

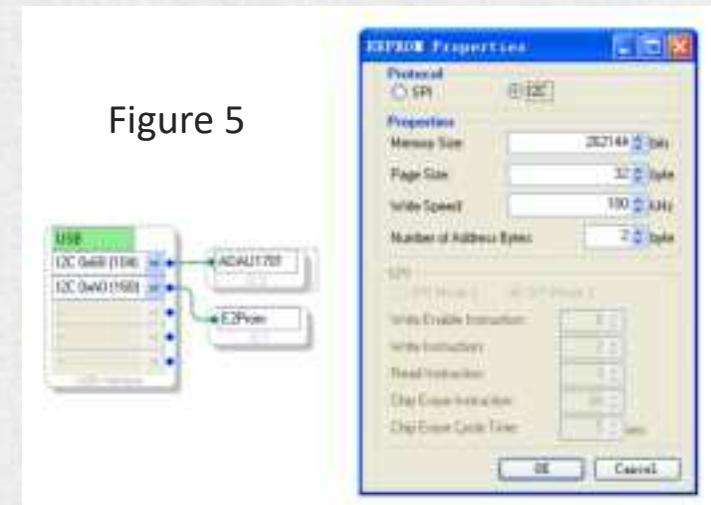


Figure 5

If it shows “Design Mode” in the lower right corner, you need to click “Link Compile Download” at first. When it shows “Active: Compiled”, you can move on to write program into ADAU1701.



# Original Firmware Restore

Original programs would be required if you want all functions of our products integrated with ADAU1701 DSP. You may want to restore original firmware in some cases. Below are original firmware for your download.

## Products

## Original Firmware for Restore Factory Settings

APM2

[APM2 Original Firmware V2.0](#)

JAB3 - Mono

[JAB3 Mono Original Firmware V2.0](#)

JAB3 - Stereo

[JAB3 Stereo Original Firmware V2.0](#)

JAB3+

[JAB3+ Original Firmware](#)

JAB4

[JAB4 Original Firmware](#)

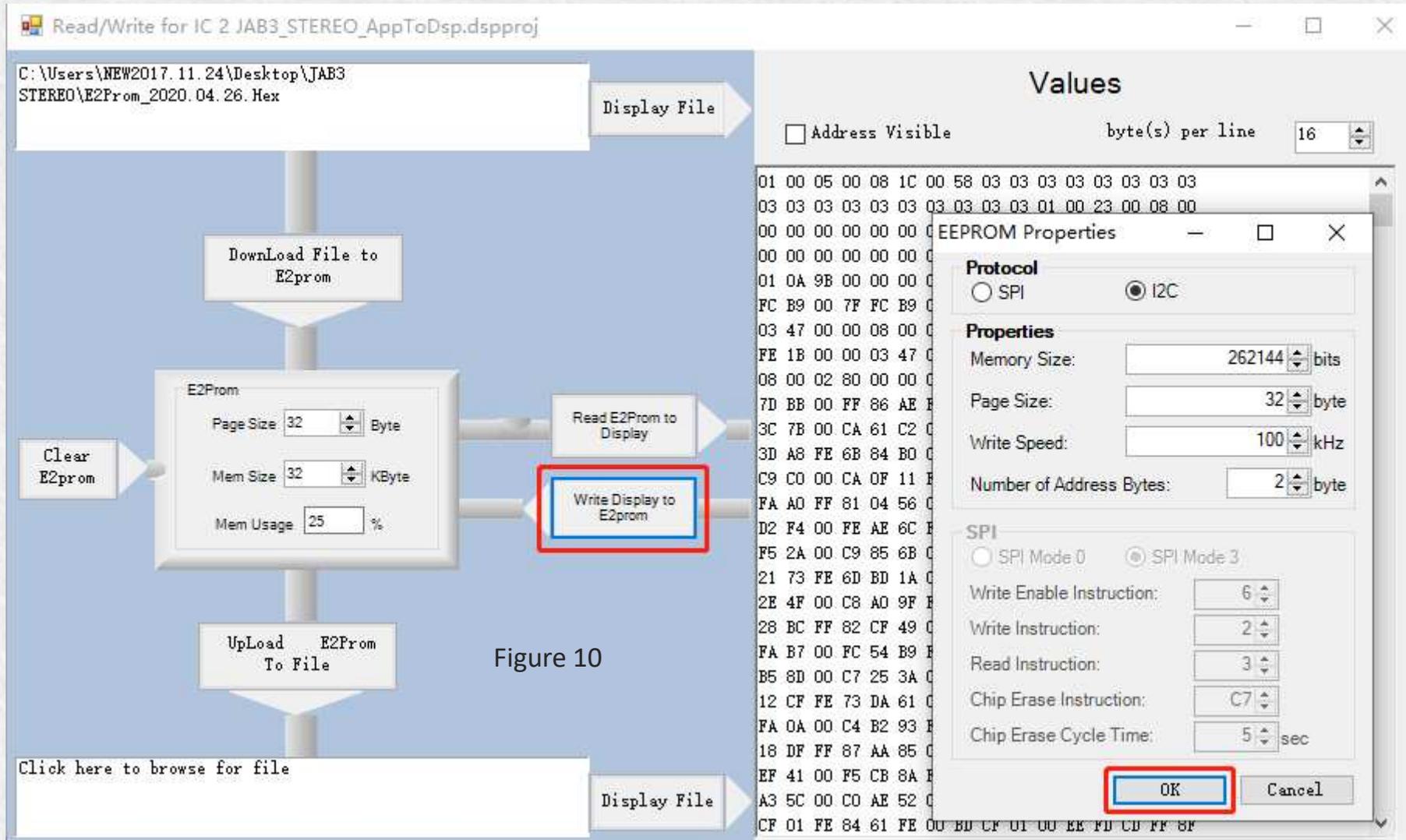
JAB5

[JAB5 Original Firmware](#)



# Original Firmware Restore

3. Click 'Write Display to E2prom' then click 'OK' of the prompt box (Figure 10).



# TROUBLE SHOOTING

TROUBLE	HOW TO SOLVE
ICP5 cannot be recognized by PC	<ul style="list-style-type: none"><li>➤ Make sure you have updated firmware for ICP5</li><li>➤ Make sure the Type-C cable is of good quality and supports data communication</li><li>➤ Make sure ICP5 is not connected to target device when connected to PC</li></ul>
Cannot writing the program into target product successfully	<ul style="list-style-type: none"><li>➤ Make sure the ICP5 be recognized by PC</li><li>➤ Make sure the SW1 of ICP5 is at ① (USBi) and the SW4 on ICP5 is set at ② (IIC) (If the target product is APM2, make sure SW1 on APM2 is set at ① (RUN) as well )</li><li>➤ Make sure it shows “Active: Downloaded” in the lower right corner in SigmaStudio</li></ul>
Target device cannot work normally (cannot play music) under powering condition when connected with ICP5	<ul style="list-style-type: none"><li>➤ Make sure the connection steps are correct and check the input/output cables</li><li>➤ Disconnect with ICP5 and re-power target products</li><li>➤ Make sure the SW1 on APM2 is set at ① (RUN) (Not applicable to other products)</li></ul>



# How to Realize **PC UI Control** with WONDOM ICP5?

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## ICP5

IN-CIRCUIT PROGRAMMER FOR SIGMASTUDIO PROGRAMMING, APP CONTROL & PC UI CONTROL



# PC UI Software

We need to download corresponding PC UI for controlling different products.

For now, we have only released PC UI for JAB2v2. Here is the download link.

<https://store.sure-electronics.com/images/documents/Miumax For JAB2v2 Setup V1.1.zip>

**Please install this USB driver before other operations.**

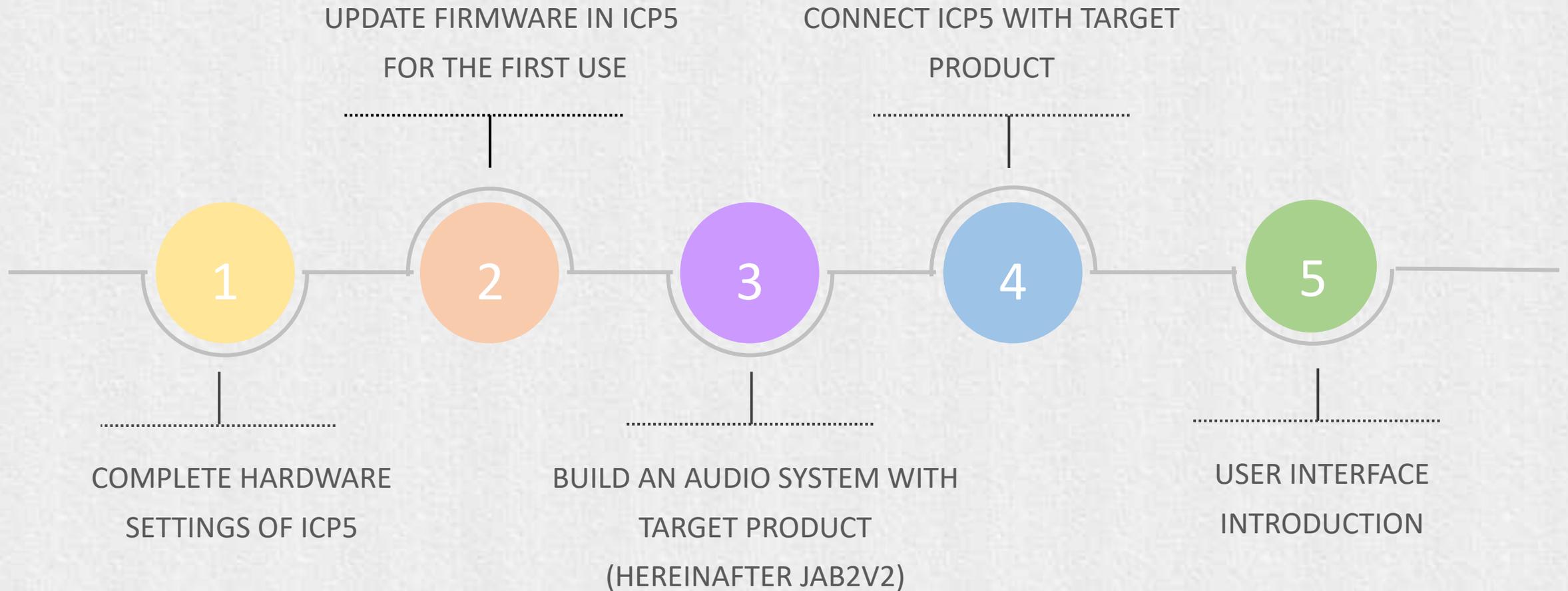
Unzip this file and double click to install.

<https://store.sure-electronics.com/images/documents/Win10%20Driver.zip>

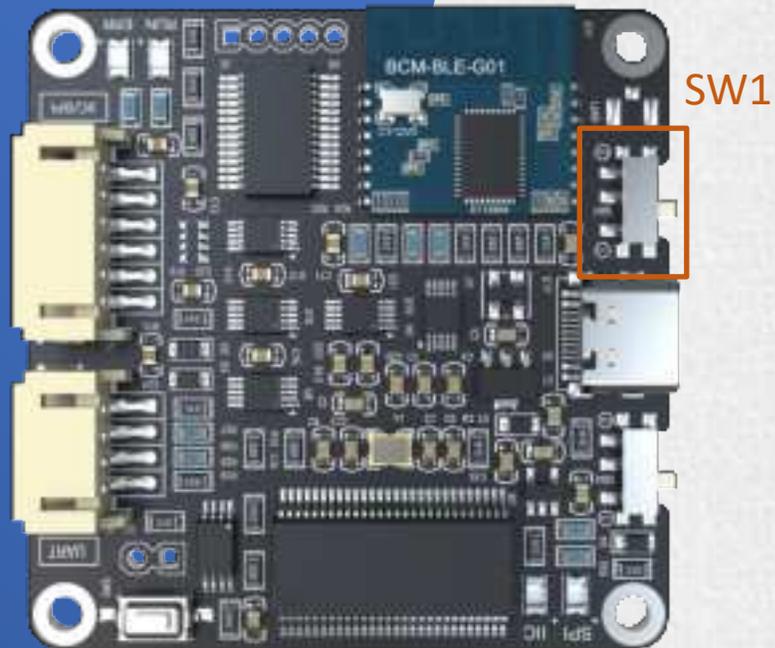
We are working hardly on promoting the releasement of PC UI for other products. You can check estimated release date in the right table.

Model	Matched PC UI
APM2	Y (End of Nov)
JAB2v2	Y
JAB3	Y (Mid-Nov)
JAB3+	Y (End of Oct)
JAB4	Y (Mid-Oct)
JAB5	Y (End of Sep)

# CONTENTS



# ICP5 Settings



Since we want to realize PC UI function, we need to set SW1 of ICP5 at ② “Remote” at first.  
(The picture is just for reference.)

As for SW4, it doesn't matter where it is set at when we want PC UI control and SW1 is set at ② “Remote” .

SW1	MODE	FUNCTION
①	USBi	SigmaStudio Programming
②	Remote	APP Control / PC UI Control

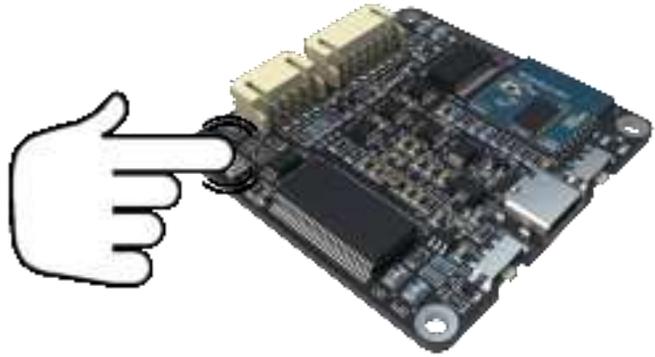
# Firmware Update

ICP5 needs different firmware for use with different products. There is no firmware in ICP5 in default. Therefore, we need to update firmware in ICP5 for the first use with a target product.

We need to enter BootLoader mode for firmware update.

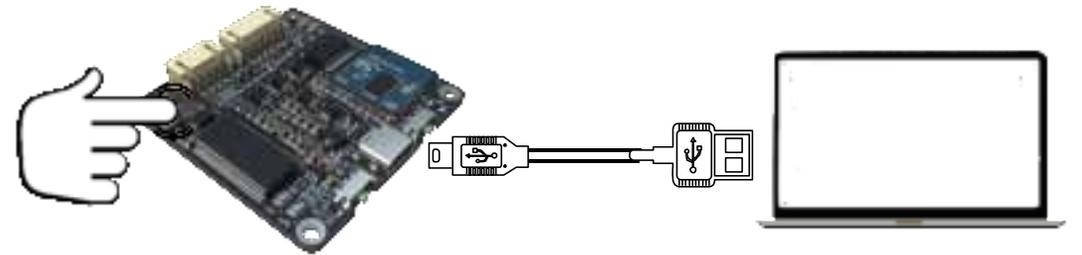
## 1. Press and hold on SW3 on ICP5

We need to press and hold on SW3 on ICP5.  
Please do not connect anything to ICP5 now.

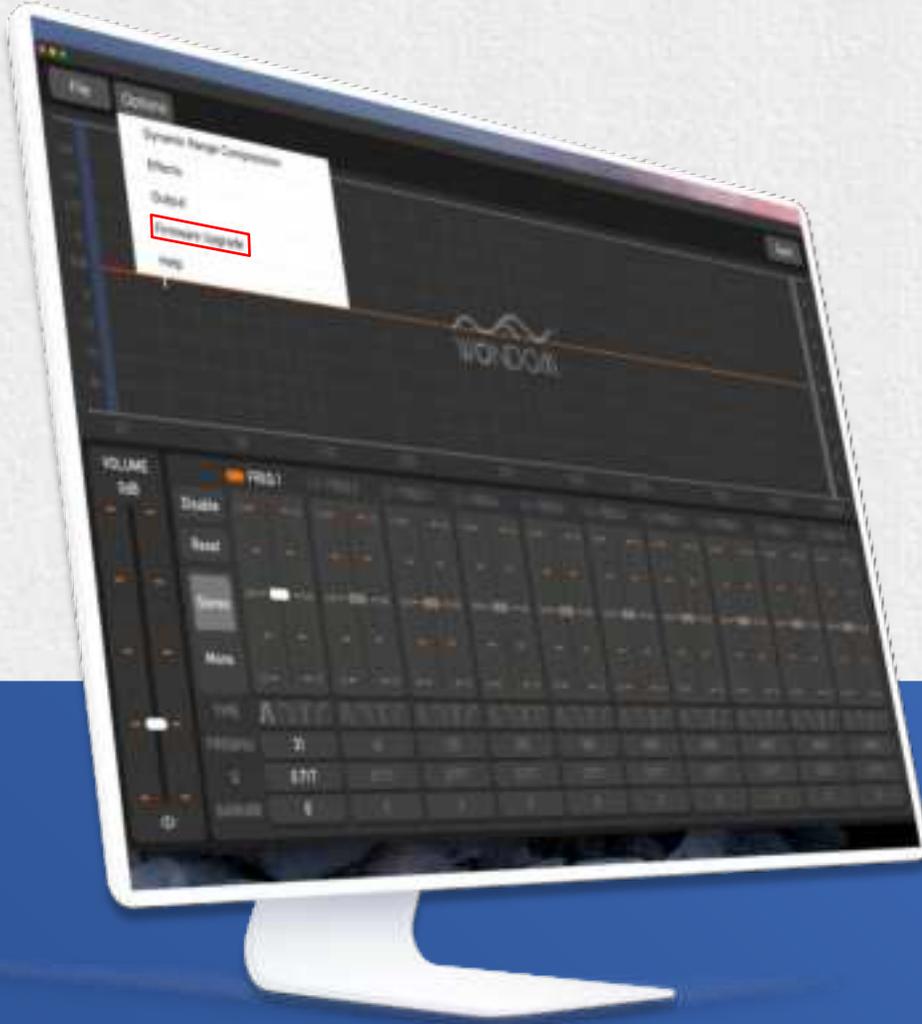


## 2. Connect ICP5 to computer

Connect ICP5 to computer with Type-C cable when holding on SW3.  
When you see “RUN” indicator blinking, it means ICP5 has entered BootLoader mode. You can release SW3 now.



# Firmware Update



## 3. Firmware Update

Run downloaded PC UI.

Click “Firmware Update” in the upper right corner.

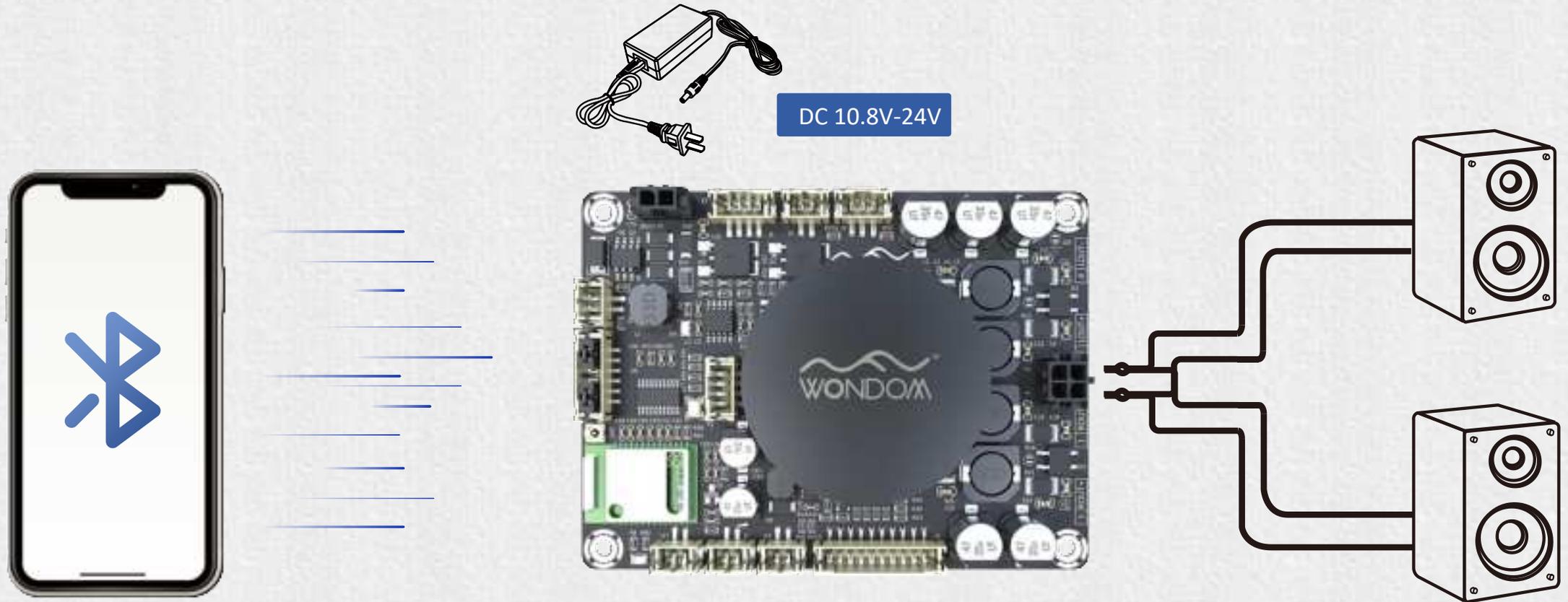
The software will automatically update the firmware for controlling JAB2v2 into ICP5.

After the update is done, “RUN” indicator will turn from blinking to ON.

There is no need to update firmware next time you use ICP5 with the same target product, except that you use it with a different product.

# Audio System

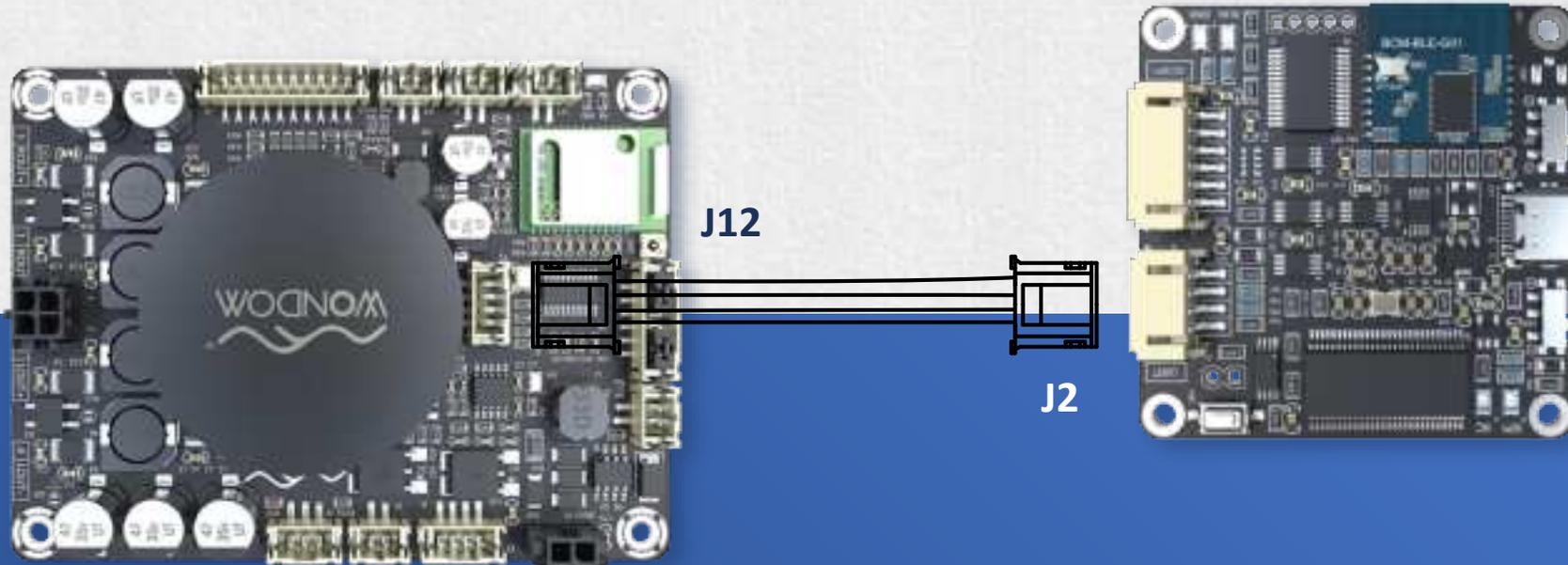
Build a desired audio system with the target product. Once connection is done, power up the system.



# Connect ICP5

Connect ICP5 with the target product.

The DSP chip in JAB2v2 is not from analog, so we connect it with ICP5 through PH-4Pos connector. If there is connection error or the firmware in ICP5 doesn't match the target device, "ERROR" indicator will be ON in red.



# PC UI Control

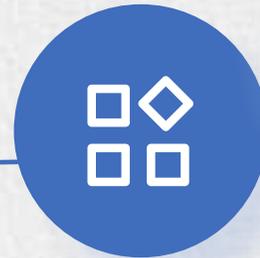
We can start PC UI control then.



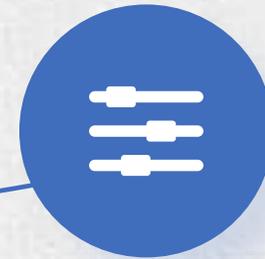
Frequency



Volume

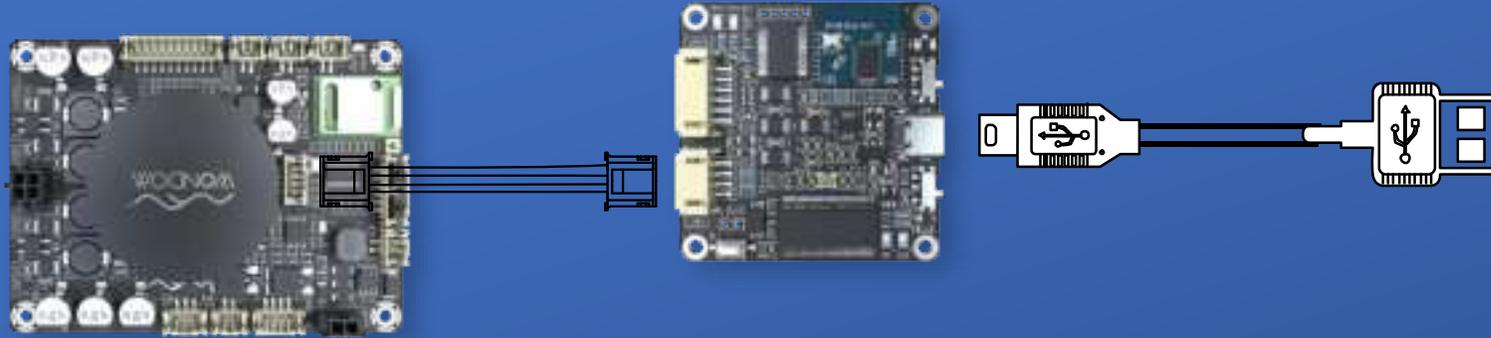


Output Mode



EQ

# Power-off Memory



## Target Product

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If the target product is JAB2, it will keep the parameters once you click “Save” in the software.

If the target products are products with ADAU1701 DSP, the parameters won't be kept. That means, once the product is disconnected with ICP5, it won't be affected by the adjustments in PC UI.

## ICP5 Programmer

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**All the parameters adjustment will be recorded in ICP5 even if it's powered off.**

That means, once you connect ICP5 with the target device, the kept parameters will be loaded and function to target device.



# How to achieve **APP Control** with WONDOM ICP5?

## ICP5

IN-CIRCUIT PROGRAMMER FOR SIGMASTUDIO PROGRAMMING, APP CONTROL & PC UI CONTROL

There is no APP available for ICP5.  
We will working on development of APP right after all the PC UIs been released.

The estimated date is as follow.

Model	Matched PC UI
APM2	Y (End of Jul, 2022)
JAB2v2	N
JAB3	Y (End of Jun, 2022)
JAB3+	Y (End of May, 2022)
JAB4	Y (End of Apr, 2022)
JAB5	Y (End of Mar, 2022)

## FCC WARNING

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be co-located or operating in conjunction with any other

antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module “2AVHCDB-DP11226”

Requirement per KDB996369 D03

## 2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.<sup>3</sup>

Explanation: This module meets the requirements of FCC part 15C (15.247).it Specifically identified AC Power Line Conducted Emission, Radiated Spurious emissions, Band edge and RF Conducted Spurious Emissions, Conducted Peak Output Power, Bandwidth, Power Spectral Density, Antenna Requirement.

## 2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The product antenna uses an irreplaceable antenna with a gain of 1dBi

## 2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.Explanation:This product (ICP5) has no shielding cover, so it is a Limited Single Modular. The main unit is applicable for speakers.

## 2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna); b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered); c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout; d) Appropriate parts by manufacturer and specifications; e) Test procedures for design verification; and f) Production test procedures for ensuring compliance

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application

#### 2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: The module complies with FCC radiofrequency radiation exposure limits for uncontrolled environments. The device is installed and operated with a distance of more than 20 cm between the radiator and your body." This module follows FCC statement design, FCC ID :2AVHCDB-DP11226

#### 2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type").

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product.

The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The product antenna uses an irreplaceable antenna with a gain of 1dBi

## 2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2AVHCDB-DP11226

## 2.9 Information on test modes and additional testing requirements

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Ningde lingyang Electronic Technology Co., Ltd. can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

## 2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15

Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.