

IO expansion board usage guide

The IO extension board provides the following features:

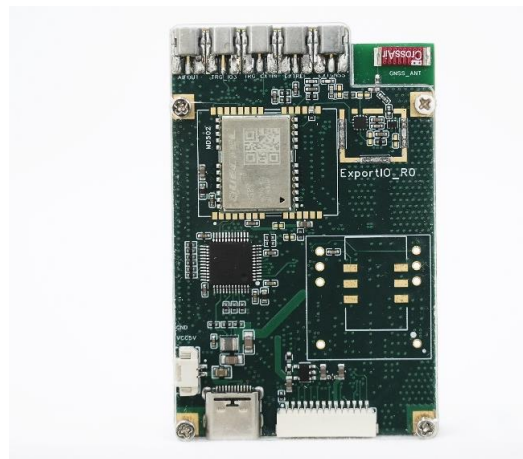
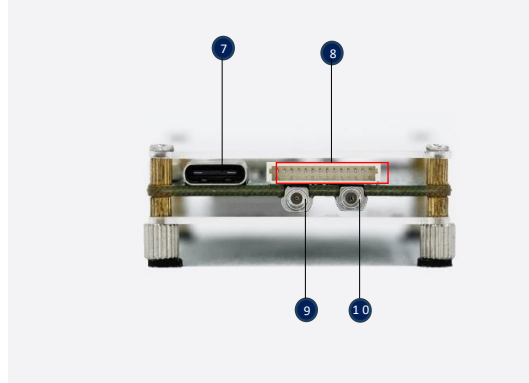
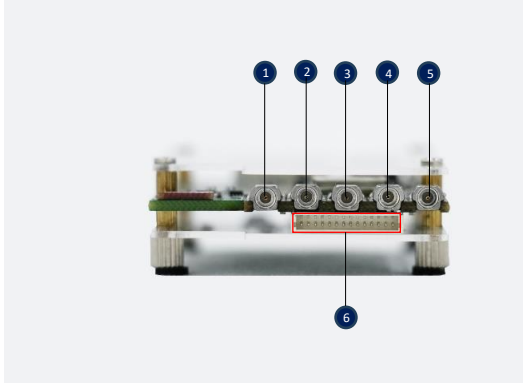
- 1) On-board GNSS positioning function (optional) provides GNSS geolocation and time information for the SA series spectrum analyzer, including 1pps. On-board antennas and external active antennas are supported.
- 2) The on-board GNSS, high-performance disciplined OCXO (optional) provides a disciplined reference clock with 1pps for the SA Series spectrum analyzers and supports switching between multiple trigger sources.
- 3) Provides trigger inputs and outputs, analog IF output, reference input and reference output for the MMCX-F physical interface. (SAE-90, SAE-200, SAN-400)

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1. Port display

1	External GNSS antenna connection interface	6	MUXIO multi-function interface
2	External reference input that can be used to test external references	7	Auxiliary power supply interface Type-C interface
3	External trigger input that can be used to test external triggers	8	MUXIO multi-function interface
4	The output is triggered, and the module is actually connected TRG_IO3	9	Analog IF output for connecting to SAE devices
5	Analog IF output interface for SAE equipment	10	This interface requires a connection to the module's reference input interface



2. Port description

No	Interface	Illustrate
1	Analog IF output	SAE-90, SAE-200, SAN-400 support
2	External trigger output	All models are supported
3	External trigger input	All models are supported
4	External reference clock input	SAE-90, SAE-200, SAN-400 support
5	External active GNSS antenna input	All models are supported
6	Auxiliary power supply interface Type-C	All models, only when using GNSS to tame the clock
7	Analog IF input - slave spectrum analyzer	SAE-90, SAE-200, SAN-400 support
8	External reference clock output - to the spectrum analyzer	All models are supported
9	MUXIO Input - Slave Spectrometer	SAE-90, SAE-200, SAN-400 support Adapter boards are required for SAN-45, SAN-60 M2, SAM-60 M3, and SAM-80

3. Connection instructions


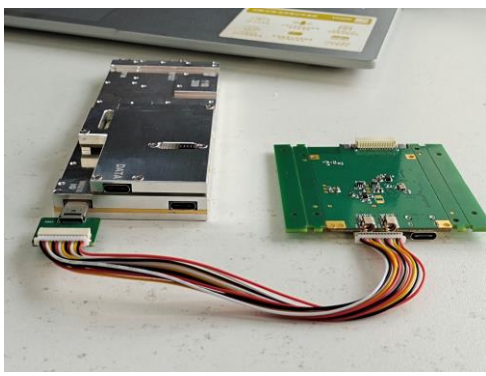
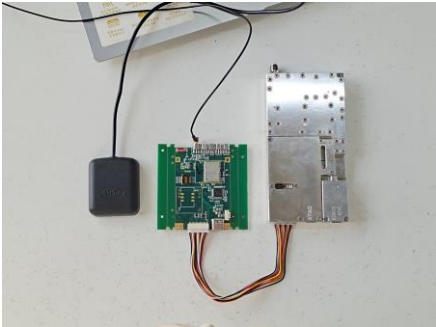

- 1) SAN-45, SAN-60 M2, SAM-60 M3, SAM-80, SAE-90, SAE-200, SAN-400 and other products need to be connected to the IO expansion board.
- 2) GNSS antennas and other devices can be connected to external interfaces at any time.
- 3) When the device is equipped with a CM22 crystal oscillator, the IO extension board needs additional power supply, and the power supply of the ordinary adapter is sufficient, and the IO extension board can be opened in any order.

4. Connection methods and functions of the I/O expansion board

All color-changing fonts with underlining in the text can be clicked by Ctrl+Left Mouse Button to jump to the corresponding content description.

4.1 GNSS interface

4.1.1 Schematic diagram of the connection

<p>SAE-90, SAE-200, SAN-400</p>	<p>SAN-45, SAN-60 M2, SAM-60 M3, SAM-80</p> <p>You need to use the MUXIO adapter to connect to the MUXIO interface of the spectrum analyzer</p>
<p>Internal antenna connection diagram</p>  A photograph showing the internal antenna connection for SAE-90, SAE-200, and SAN-400 modules. A silver GNSS module is connected to a green IO expansion board via a multi-colored ribbon cable.	<p>Internal antenna connection diagram</p>  A photograph showing the internal antenna connection for SAN-45, SAN-60 M2, SAM-60 M3, and SAM-80 modules. A silver GNSS module is connected to a green IO expansion board via a multi-colored ribbon cable.
<p>Diagram of the external antenna connection</p>  A photograph showing the external antenna connection for SAE-90, SAE-200, and SAN-400 modules. A silver GNSS module is connected to a green IO expansion board via a multi-colored ribbon cable. A black external antenna is connected to the module.	<p>Diagram of the external antenna connection</p>  A photograph showing the external antenna connection for SAN-45, SAN-60 M2, SAM-60 M3, and SAM-80 modules. A silver GNSS module is connected to a green IO expansion board via a multi-colored ribbon cable. A black external antenna is connected to the module.

The internal antenna connection interface in the left figure shows that the MUXIO multi-function interface of the SAE-200 module is connected to the MUXIO multi-function interface of the IO expansion board, which corresponds to the No. 8 port in

the port display chapter in Chapter 1.

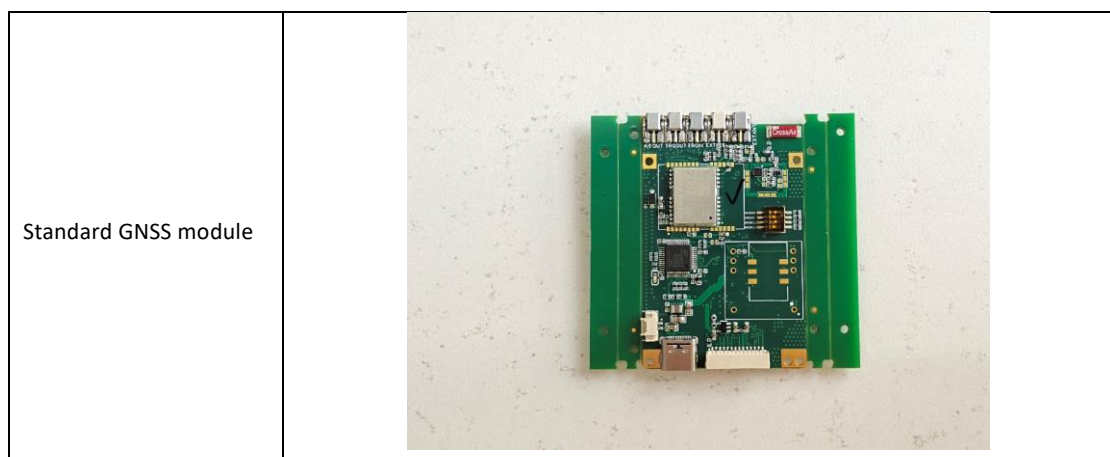
Description of the external antenna connection interface in the left figure: In addition to the interface of the internal antenna connection interface, you also need to connect the external antenna to the external GNSS antenna interface of the IO expansion board, that is, the No. 1 interface in the port display chapter in Chapter 1.



The internal antenna interface connection description in the figure on the right: The MUXIO multi-function interface of the SAM-60 module is connected to the MUXIO multi-function interface of the IO expansion board, which corresponds to the No. 8 interface in the port display chapter in Chapter 1.

Description of the external antenna connection interface in the figure on the right: In addition to the interface of the internal antenna connection interface, you also need to connect the external antenna to the external GNSS antenna interface of the IO expansion board, that is, the No. 1 interface corresponding to the port display chapter in Chapter 1.

For a description of the module's ports, please refer to the Quick Start Guide in the attached materials.

4.1.2 A physical display of the types of GNSS modules

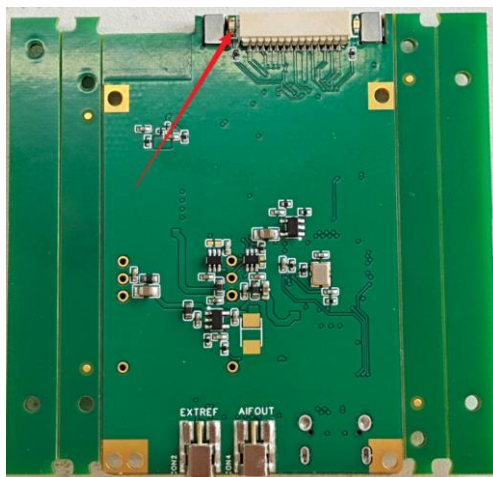


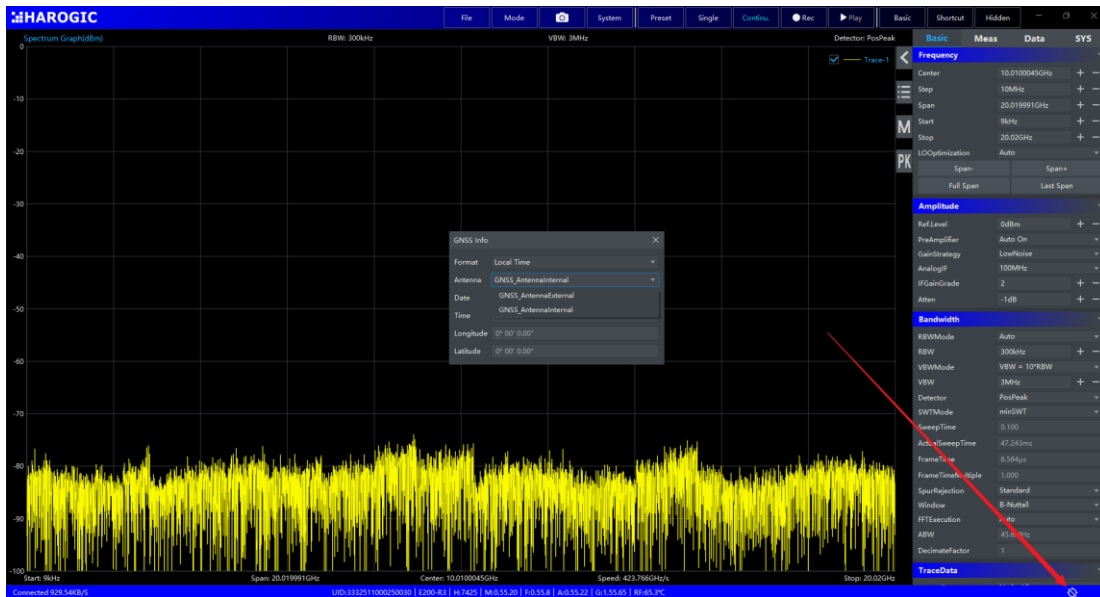
<p>Highest precision GNSS module</p>	
<p>High-quality GNSS module (GNSS disciplined clock with 1PPS) is provided</p>	

4.1.3 GNSS module locking instructions

The modules used in the following figures are SAE-200 examples.

1. **GPS lock judgment of standard GNSS module and higher precision GNSS module**
 - 1) The internal and external antennas are locked according to the indicator of the IO expansion board or the lock logo on SAStudio4 to determine whether the GPS is locked.





- 2) Open SAStudio4 and check whether the HCD code is correct and whether the latitude and longitude time information is correct.

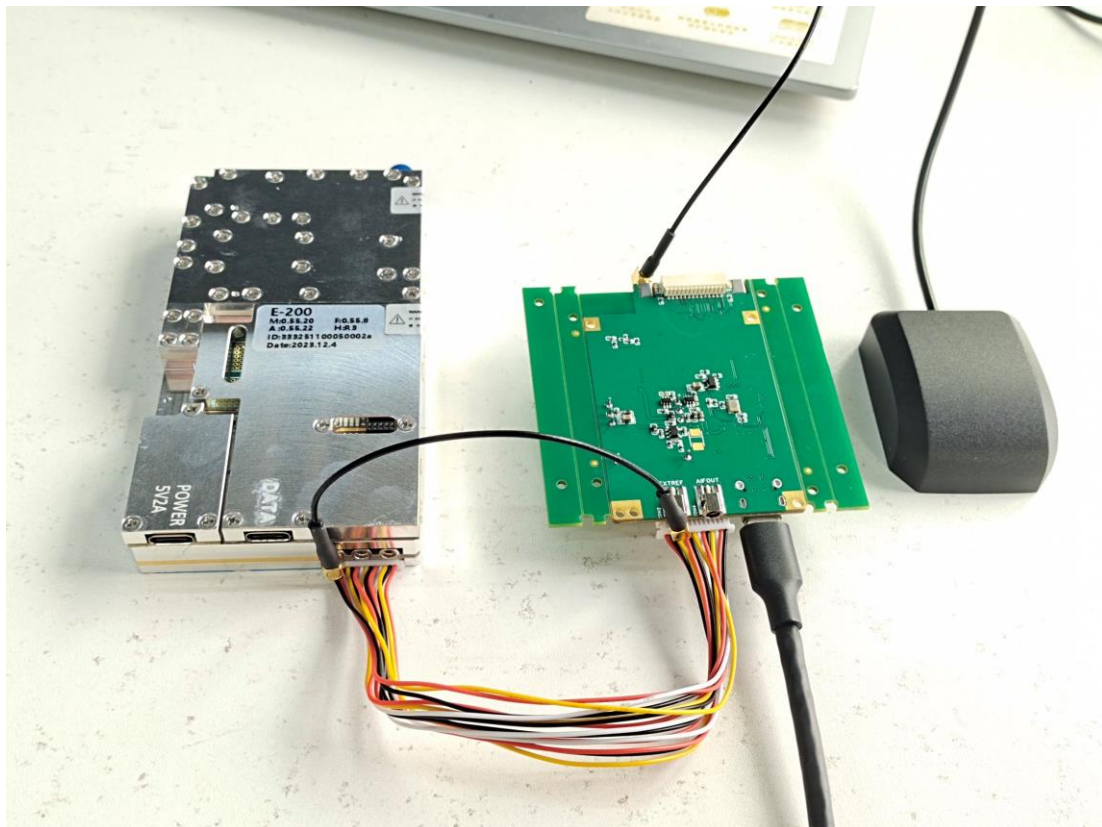


2. High-quality GNSS module GPS lock judgment

Since the high-quality GNSS module comes with a CM22 crystal oscillator, additional power supply is required for use, please connect the Type-c power cable to the box selected position in the figure below.



The connection diagram is shown in the figure below:



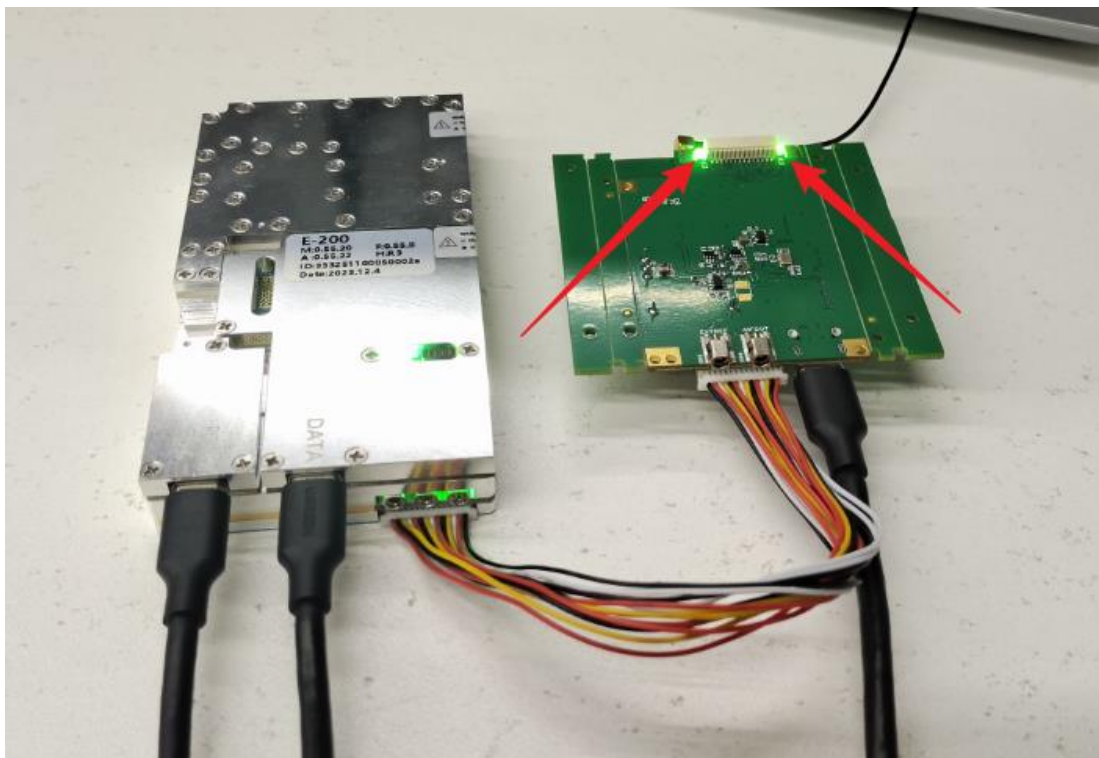
1) CM22 locking method

First, open the IQS_GetIQ_FixedPoints.sln file in Accompanying Materials\Windows\HTRA_API_Example\HTRA_C++_Examples\IQS_GetIQ_FixedPoints and write the code shown in the following figure. (Note that you are writing the code after the Device_Open() function !).

```
36 Status = Device_Open(&Device, DevNum, &BootProfile, &BootInfo); //Turn on the device.
37
38
39 if (Status == APIRETVAL_NoError) {
40
41
42
43
44 GNSSAntennaState_TypeDef GNSSAntennaState;
45 GNSSAntennaState = GNSS_AntennaExternal;
46 Status = Device_SetGNSSAntennaState(&Device, GNSSAntennaState); //Set GNSS antenna status.
47
48
49 DOCKWorkMode_TypeDef DOCKWorkMode;
50 DOCKWorkMode = DOCKO_LockMode;
51 Status = Device_SetDOCKWorkMode(&Device, DOCKWorkMode); //Set DOCKO working status in GNSS.
52
53 DeviceInfo_TypeDef DeviceInfo; //A structure that stores device information, including device UID, device model, firmware version, and so on.
54 Status = Device_QueryDeviceInfo(&Device, &DeviceInfo); //Get device information, including device UID, device model, firmware version, and so on.
55
```

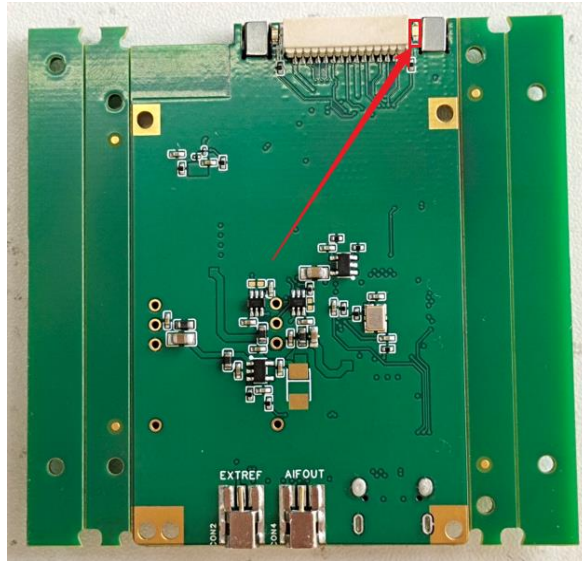
Then, after hitting the breakpoint after Device_SetDOCKWorkMode the () function, click "Run" to run the example, and wait until the breakpoint position is reached, do not click "Continue", wait for about 10-30 seconds, check whether the two indicators of the IO expansion board are on, if the indicators are both on, the external antenna and CM22 are locked successfully, otherwise, the lock fails. If the lock fails, repeat the above steps several times, if it persists, contact technical support.

The locking success is shown in the following figure:



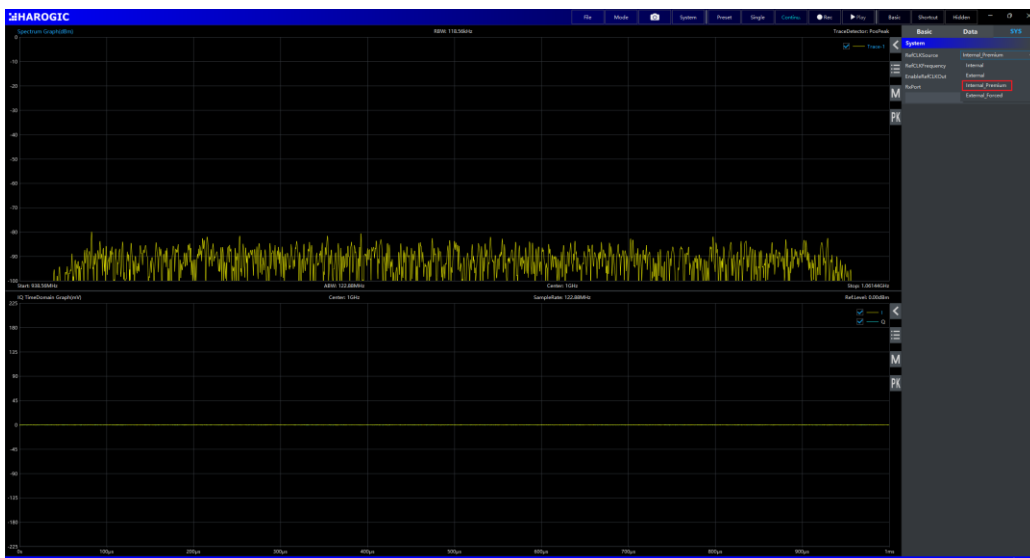
2) CM22 lock-in judgment

Once the device is powered on, check the CM22 lock. Judgment method: The position indicator light in the following figure is on, indicating that the CM22 has been successfully locked (please make sure that the GPS has been locked before that).



- 3) The GNSS lock is determined by the same method as the GPS lock of the standard GNSS module and the better accuracy GNSS module, as described above.
- 4) Use SASstudio4 to test the CM22 as a reference clock source (GPS and CM22 crystal oscillator need to be locked first).

Open SASdtuio4, switch to IQ mode, click on the "System" submenu, and select "Internal_Premium" as the reference clock source. When the reference clock source is switched to "Internal_Premium", SASstudio4 can continue to operate normally without warnings or error pop-ups, and the CM22 can be used as a reference clock source normally.

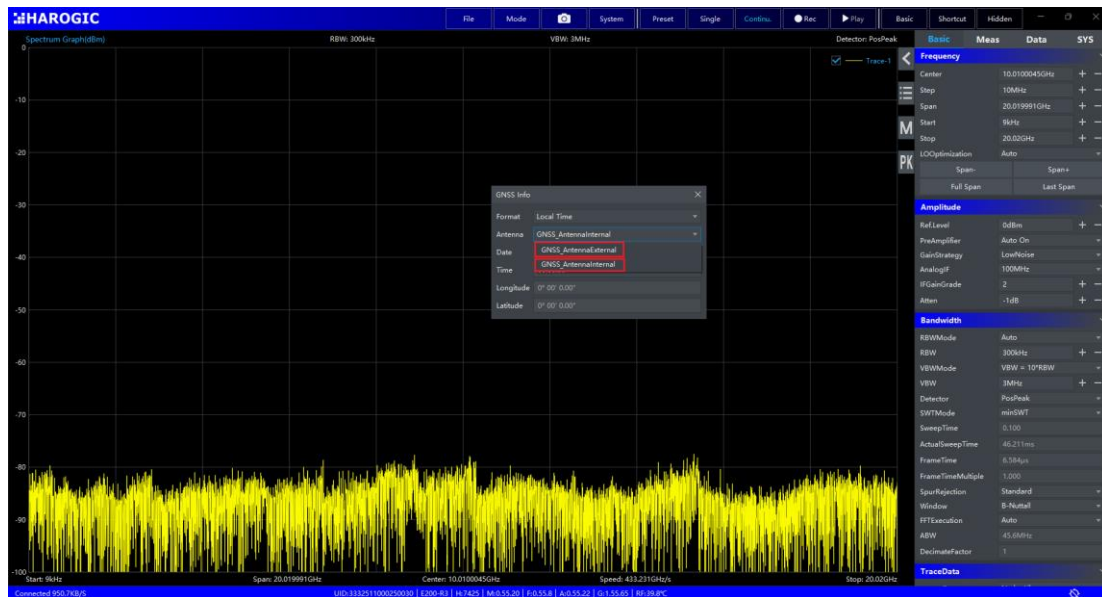


5) Notes:

- ① When you are using a high-quality IO extension board with a GNSS module with a CM22 crystal oscillator, make sure to provide additional power to the IO extension board.
- ② When you use this IO expansion board, please make sure that the GPS is locked first, and then lock the CM22 crystal oscillator.
- ③ When testing the CM22 as a reference clock source with SAStudio4, lock on to the GPS and CM22 crystal before using the " Internal_Premium " reference source in SAStudio4.

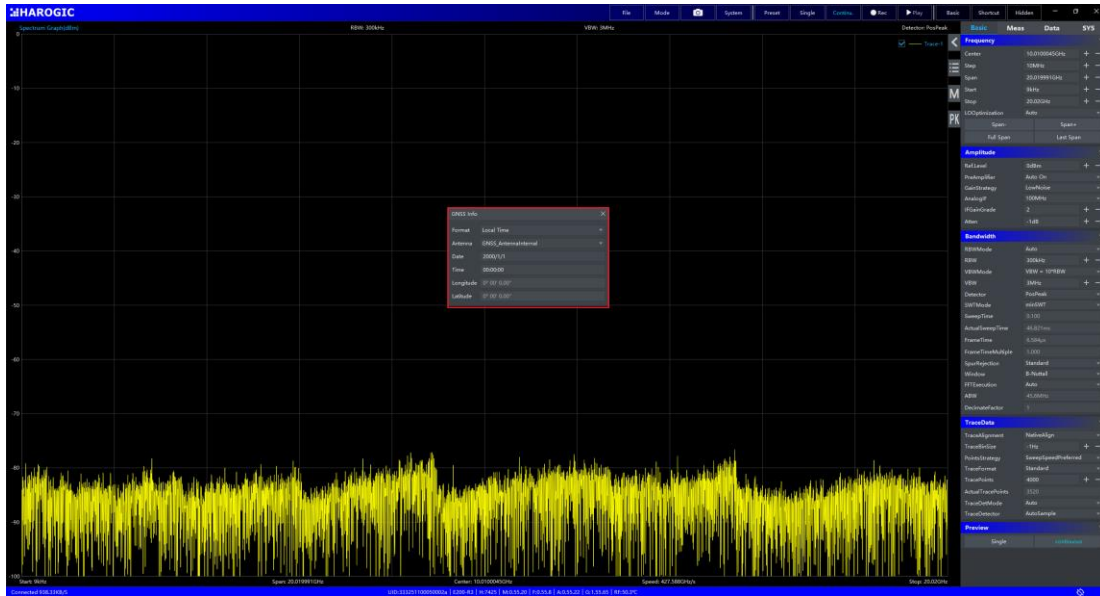
4.1.4 GNSS antenna instructions for use

1. Antenna switching mode:



2. Internal antenna (the I/O expansion board defaults to internal antenna).

Open SAStudio4, click the "System" submenu, select "GNSS Information", and you can see the default date, time, longitude, latitude and other information in the pop-up window.

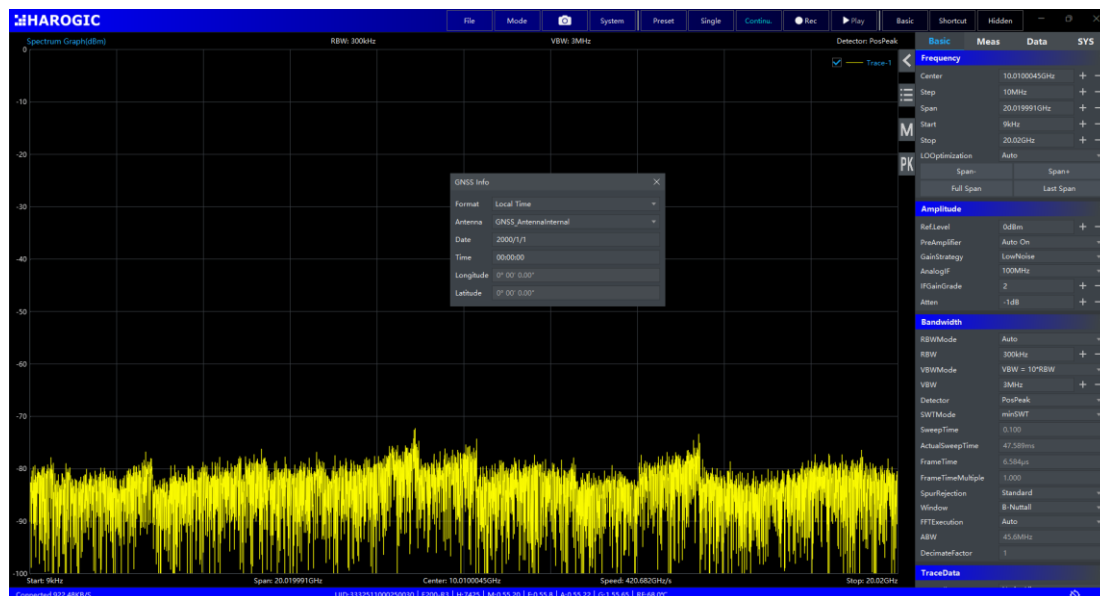


Note: When you are using the internal antenna, please move outside to an open area for testing, otherwise it may affect your ability to use this feature.

3. External antennas

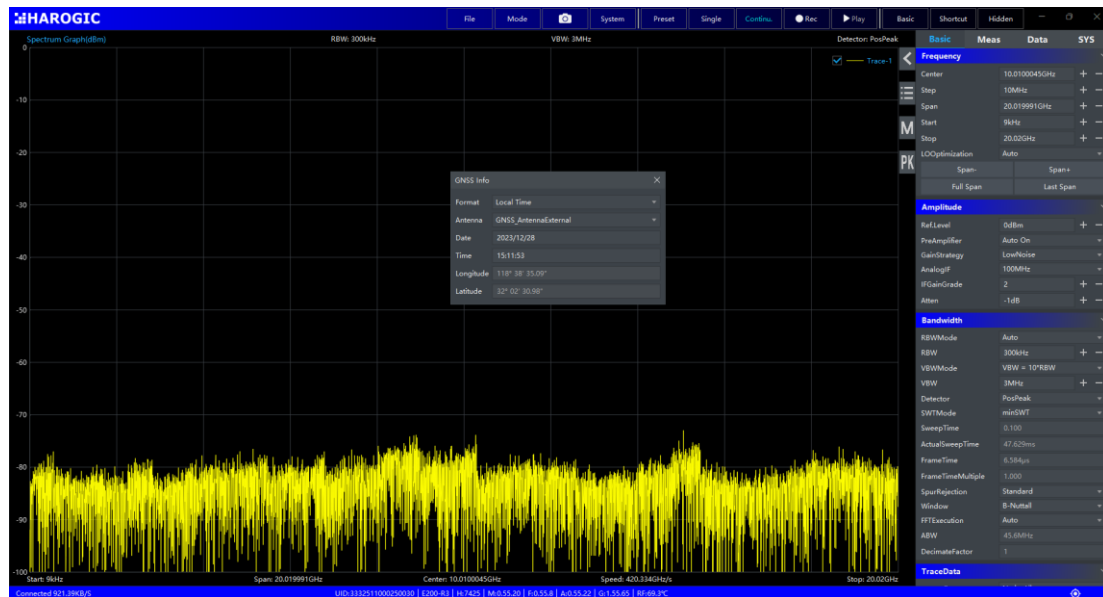
Connect the GNSS interface of the GPS antenna to the IO expansion board. Open SAStudio4, click the "System" submenu, select "GNSS Information", and select "External Antenna" in the pop-up window.

If the pop-up window you observe is shown in the following figure, the device is initially unlocked:



If the pop-up window you observe is shown in the following figure, the lock is

successful. At this time, you can see the locked date, time, longitude, latitude and other information:


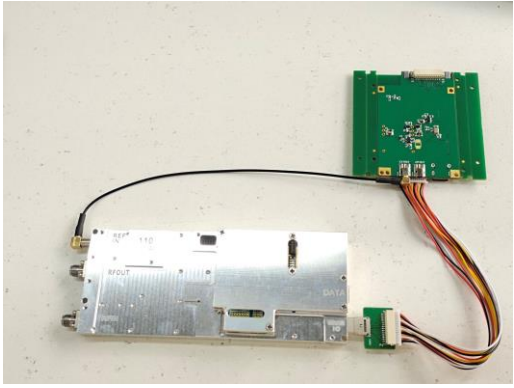


4.1.5 Precautions

- 1) When you are not connected to an external GPS antenna, the GNSS information displayed in SAStudio4 is the default GNSS information, and when you are connected to an external GPS antenna, the GNSS information displayed in SAStudio4 is the GNSS information of the external antenna.
- 2) The default antenna status of the IO expansion board is "internal antenna", you do not need to do anything, you can use it directly, but when you use the internal antenna, please move to an open place outside for testing, connect the device and wait for a while (within 10 minutes) to check the lock status of the device.
- 3) When using an external GPS antenna indoors, make sure that the receiver of the external antenna is placed in an unobstructed location, such as outside a window. If you are using an external GPS antenna outdoors, please move to an open area and ensure that the external antenna is unobstructed, and wait for a moment (within 10 minutes) after connecting the device to check the lock status of the device.

4.2 Trigger, reference interface

4.2.1 Schematic diagram of the connection

SAE-90, SAE-200, SAN-400	SAN-45, SAN-60 M2, SAM-60 M3, SAM-80 You need to use the MUXIO adapter to connect to the MUXIO interface of the spectrum analyzer
	

Interface connection description in the left figure: The reference input interface of the SAE-200 module is connected to the reference input port of the IO expansion board, that is, the No. 10 interface in the port display chapter in Chapter 1. The MUXIO multi-function interface of the SAE-200 module is connected to the MUXIO multi-function interface of the IO expansion board, which corresponds to the No. 8 port in the first chapter of Port Display.

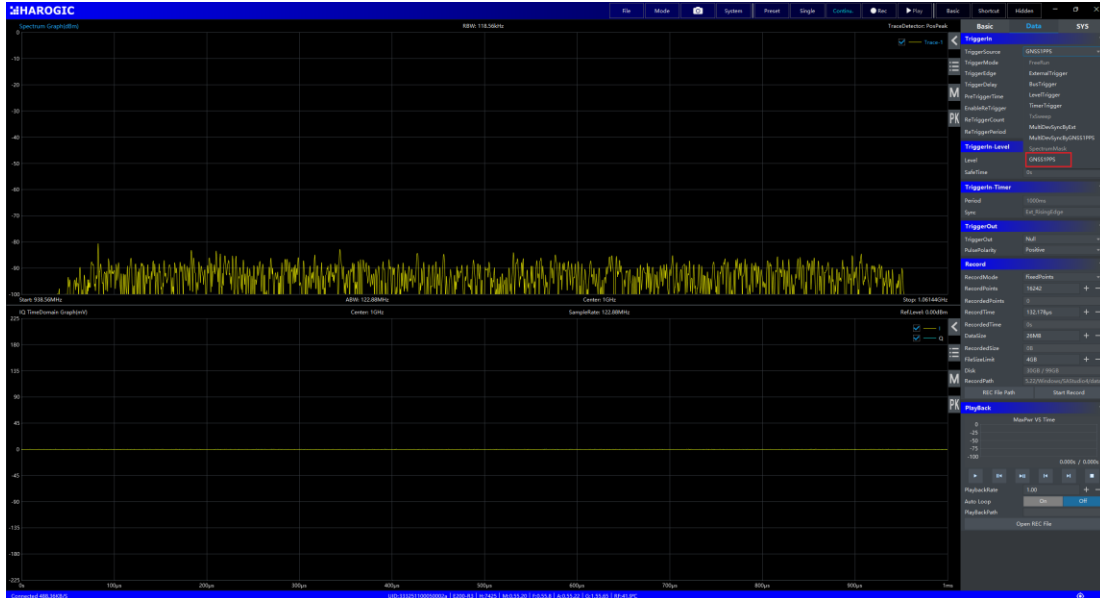
Interface connection description in the figure on the right: The reference input interface of the SAM-60 module is connected to the reference input port of the IO expansion board, that is, the No. 10 interface in the port display chapter in Chapter 1. The MUXIO multi-function interface of the SAM-60 module is connected to the MUXIO multi-function interface of the IO expansion board, which corresponds to the No. 8 port in Chapter 1.

For a description of the module's ports, please refer to the Quick Start Guide in the attached materials.

4.2.2 Description of the trigger function

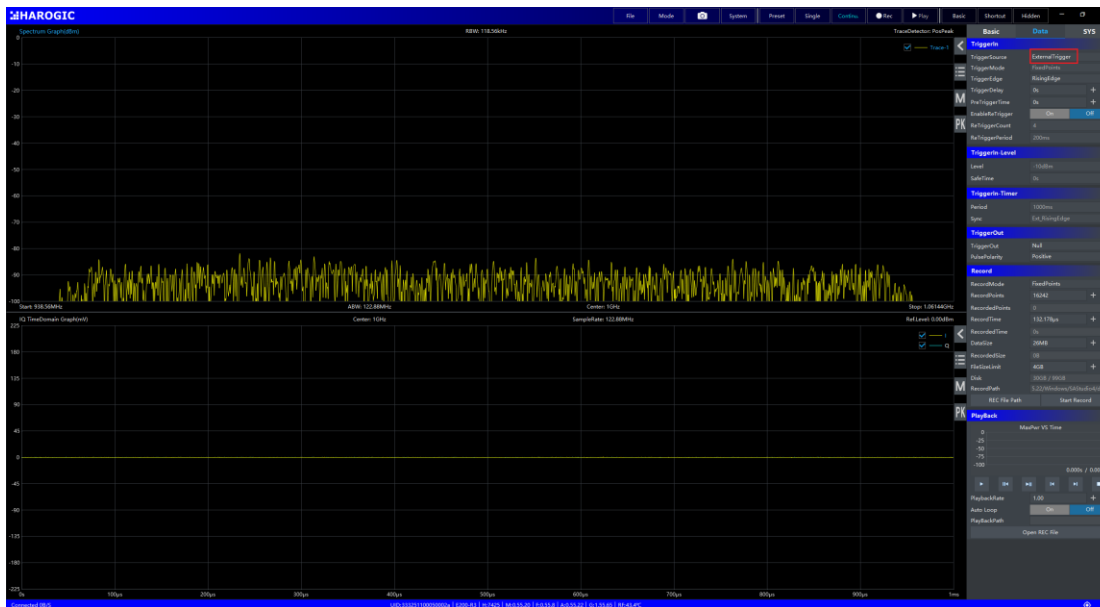
- 1) GNSS 1PPS trigger (needs to wait for GPS lock)

Switch SAStudio4 to IQS mode, wait for GPS to lock, turn on SAStudio4, switch to IQ mode, select the "Data" submenu, and set the trigger source to "GNSS-1PPS Trigger". If a normal response is triggered, the function is normal.



2) Externally triggered

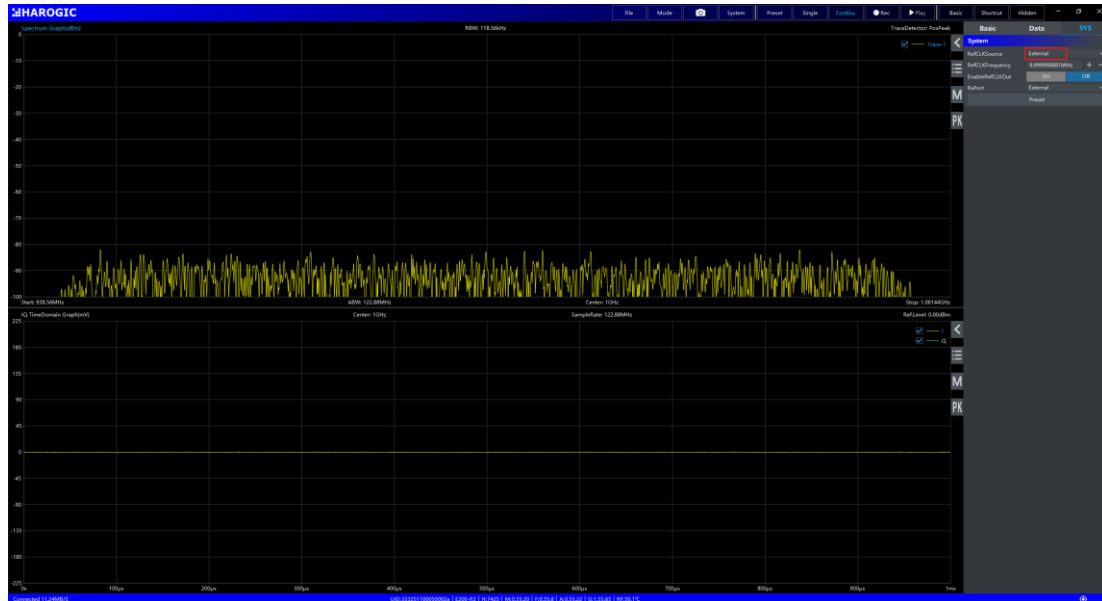
Find a suitable trigger source, connect to interface 3 of the IO expansion board, open SAStudio4, switch to IQ mode, select the "Data" submenu, and set the trigger source to "External Trigger". If a normal response is triggered, the function is normal.



4.2.3 Refer to the clock source function description

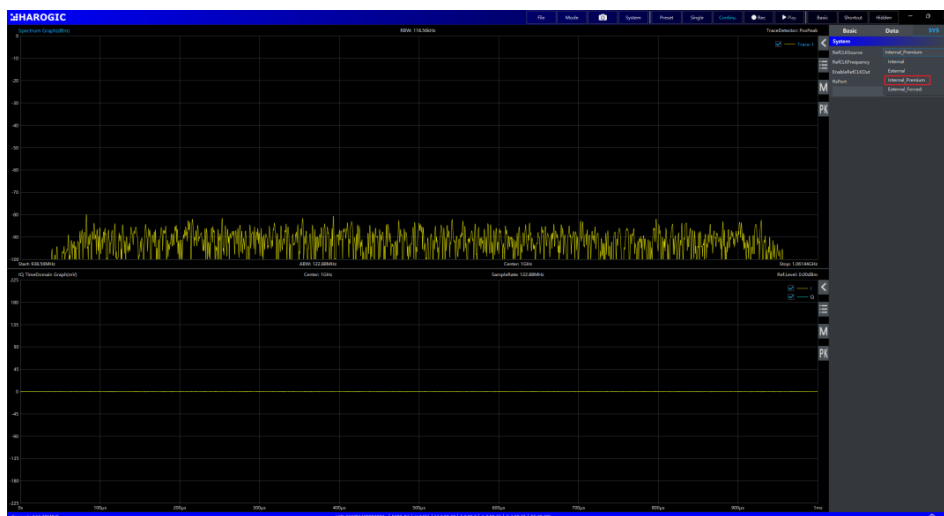
1. External reference clock source

Find a suitable reference source, connect to interface 2 of the IO expansion board, open SASTuido4, switch to IQ mode, select the "System" submenu, and set the reference clock source to "External". If the response is normal, the function is normal.



2. The CM22 is used as a reference clock source

After GPS lock and CM22 lock, (please refer to 4.1.3 GNSS module locking instructions for locking judgment and locking method), open SASTuido4, switch to IQ mode, select the "System" submenu, and set the reference clock source to "Internal Clock Source - High Quality". If the response is normal, the function is normal.



5. Appendix: Check if the HCD code is correct:

Calculate $HCD/256$ and take its integer part, assuming that this value is x

1. When the GNSS module does not have CM22:

Independent IO Expansion Board: $x = 17$

NX: $x = 33$

PX: $x = 49$

2. When the GNSS module has CM22:

Independent IO: $x = 25$

NX: $x = 41$

PX: $x = 57$