
HERD beam test 2021 master DAQ control software manual

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Abstract

1. Overview

This document will show you how to use the master DAQ software and how to integrate the example code into your subsystem DAQ software.

The master DAQ software have been tested running on a WINDOWS 32bit/64bit platform. The command will be sent to the subsystem through standard TCP socket.

All the DAQ computers should be in the same LAN and all the ip should be written into *HERD-MASTER-DAQ.ini*. The default ip is "127.0.0.1" and the default port is 24.

```
[version]
version=1

[master]
ip=192.168.1.100
tcp_port=24
udp_port=4660

[iscmos0]
ip=192.168.1.101
tcp_port=24
udp_port=4660
mode=0
frequency=2

[iscmos1]
ip=127.0.0.1
tcp_port=24
udp_port=4660
mode=3
frequency=1

[trd]
ip=127.0.0.1
tcp_port=24
udp_port=4660
mode=2
frequency=2

[pd]
ip=127.0.0.1
tcp_port=24
udp_port=4660
mode=0
frequency=2

[scd0]
ip=127.0.0.1
tcp_port=24
udp_port=4660
mode=0
frequency=3

[scd1]
```

Figure 1. HERD-MASTER-DAQ ini

2. Master DAQ control software GUI

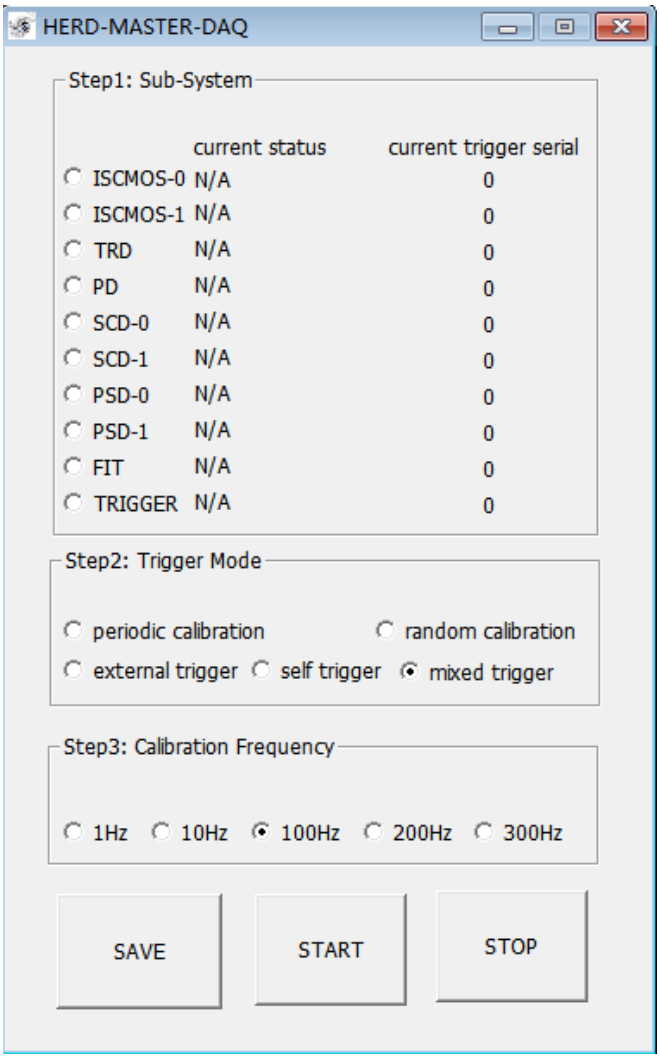

Figure 2. HERD-MASTER-DAQ GUI

3. Set the trigger mode and the calibration frequency

You need 4 steps:

1 choose your subsystem

2 choose the trigger mode which you need

3 choose the calibration frequency, this item is only valid when you choose *periodic calibration* or *random calibration*

4 push the SAVE button and parameters will be saved to the file *HERD-MASTER-DAQ.ini*.

4. Start DAQ

You can push the START button to launch a run after you've finished the setting.

These steps will happen in order when you've pushed the START button:

1 The master DAQ software will send a START command immediately to all the subsystems one by one. The subsystem should start DAQ immediately when it received the command. It is suggested that the subsystem launch a new file to store the data of this new run. When the subsystem has already started DAQ, a feedback command should be sent back, in order to tell the master DAQ software that the subsystem's ready and the trigger switch could be turn ON.

2 The master DAQ software will read the file *HERD-MASTER-DAQ.ini,* translate and then send the command controlling the trigger mode and calibration frequency to the trigger system.

3 The hardware of the trigger system will be configured, but the trigger switch is OFF at this moment.

4 After 4 seconds, the master DAQ software will send a command to the trigger system, and the trigger switch will be ON, all the subsystems will receive DI2C packages or LEMO/TTL pulse, they will be in the running state.

5. Stop DAQ

You can push the STOP button to stop a run when the subsystem is running. These steps will happen in order when you've pushed the STOP button:

1 The master DAQ software will send a STOP command immediately to the trigger system and the trigger switch will be OFF, all the subsystems will not receive any DI2C packages or LEMO/TTL pulse immediately.

2 After 4 seconds, the master DAQ software will send a STOP command to all the subsystems one by one. The subsystem should stop DAQ when it received the stop command.

It is suggested that the subsystem close this run's file. When the subsystem has already stopped DAQ, a feedback command should be sent back to the master DAQ software, in order to avoid exceptions.

6. Command format

The start command is a 16 bytes hex word 0xFF80000800000000EE00000100000000

The stop command is a 16 bytes hex word 0xFF80000800000000EE00000000000000

Feedback command is the same as the received content.

You can take the example code as a reference.

7. Notes to the example code

It is important that the subsystem should close the socket every time when it received a command and sent back. Please wait for the blocking, which is generated by the accept() function and do not halt on recv() function. Using this method, you can stop your software anytime you want to debug and you can re-join the master DAQ network anytime when you are ready. You do no need to restart the master DAQ software and not interrupt the other systems.

The ip of the master DAQ software should be changed easily. The default ip configuration of the master DAQ computer is 192.168.1.100

8. Test tips

When the example code have already been integrated into your software and you want to start a test. Please follow these steps:

1 Prepare two computers, take a note of their ip address. for example, the master computer ip address is 192.168.1.100 and the subsystem ip is 192.168.1.101. Copy the *HERD-MASTER-DAQ.ini and HERD-MASTER-DAQ.exe to* the master computer.

2 Open the *HERD-MASTER-DAQ.ini* and fill the ip part of your subsystem computer, for example ISCMOS-0, please change from 127.0.0.1 to 192.168.1.101 under [iscmos0]

3 Fill in the ip part of your subsystem computer to your code, for example, please change it like this line:

const char subsystem_ip[]　　="192.168.1.101;"

and then re-compile your code

4 Run you code and the *HERD-MASTER-DAQ.exe.* You can push the START button and the subsystem computer will get the START message

5 Special tip: there's no trigger computer in your test, so you will just get the current status code when you send the message successfully. Take iscmos-0 as an example:

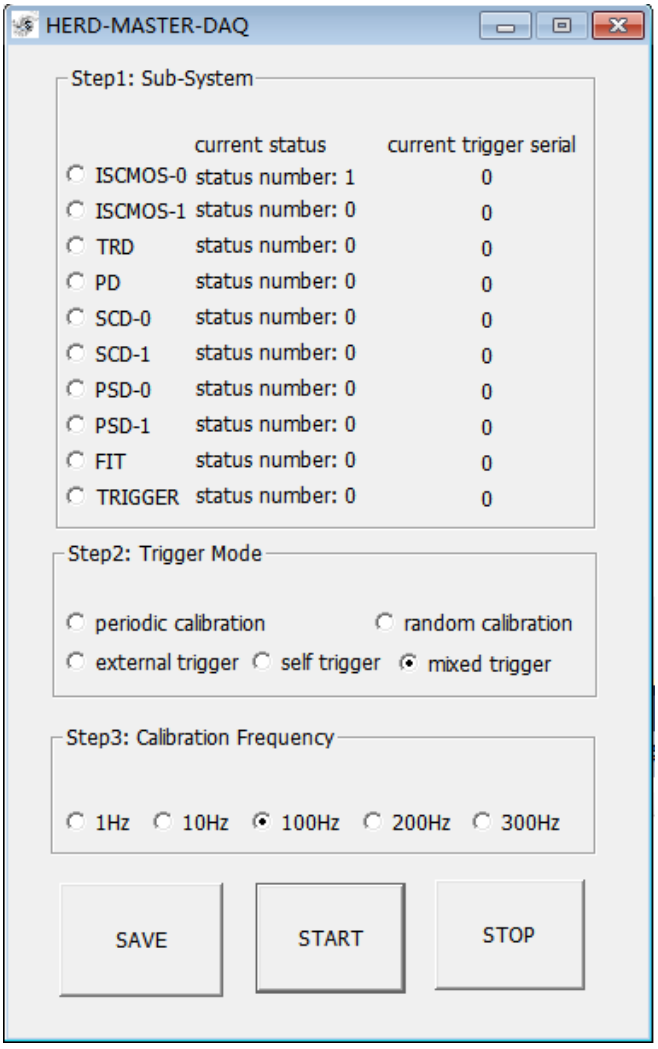

Figure 2. When the START command sent and received successfully during test

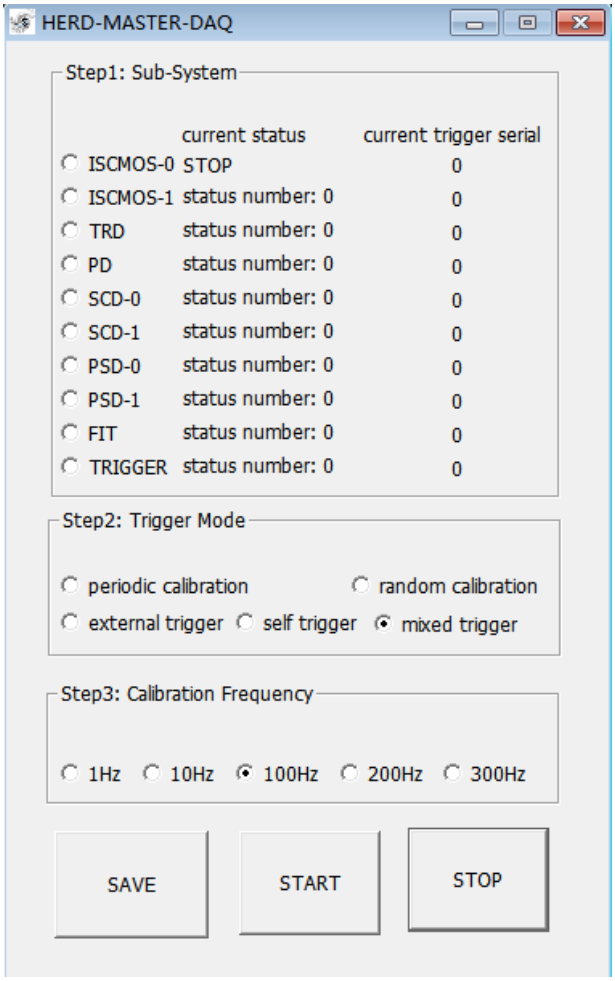

Figure 3. When the STOP command sent and received successfully during test

9. Trigger mode

1 Periodic calibration, a periodic pulse trigger will be sent to the subsystem. When it is LEMO/TTL, it is a high effective pulse and the high time is 2us. When it is DI2C, the trigger type is 2.

2 Random calibration, a random pulse trigger will be sent to the subsystem. When it is LEMO/TTL, it is a high effective pulse and the high time is 2us, but the time interval between the pulses is random, the minimum interval is set by the calibration frequency. When it is DI2C, the trigger type is 3.

3 External trigger the trigger pulse from the INFN-PS-MASTER port will be fan out to all the subsystems. When it is LEMO/TTL, it is a high effective pulse and the high time is 2us. When it is DI2C, the trigger type is 0. The dead time is controlled by their busy signal.

4 Self trigger the trigger pulse is generated by the trigger hardware which process the signals from all the trigger PMT. When it is LEMO/TTL, it is a high effective pulse and the high time is 2us. When it is DI2C, the trigger type is 1. The dead time is controlled by their busy signal.

5 Mixed trigger this mode means different to different subsystems:

The following subsystems: ISCMOS-0, ISCMOS-1, TRD, PD, which are driven by the DI2C package:

When the spill is ON, the trigger pulse from the INFN-PS-MASTER port will be fan out to all the subsystems. The trigger type is 0.When the spill is OFF, the periodic trigger pulse will be fan out to them. The dead time is controlled by their busy signal. The trigger type is 2

The following subsystems: SCD-0, SCD-1, PSD-0, PSD-1 FIT, which are driven by the LEMO/TTL pulse:

When the spill is ON, the trigger pulse from the INFN-PS-MASTER port will be fan out to the SCD-0, PSD-0 FIT, there will be no trigger pulse at SCD-1 PSD-1. When the spill is OFF, the periodic trigger pulse will be fan out to SCD-1 PSD-1 FIT.

There are spare LEMO/TTL or DI2C port. Please contact me if you want to change these configuration.

10. Calibration frequency

It is effective for the calibration pulses in *periodic calibration mode*, *random calibration mode* and *mixed trigger mode.* this choice determine the time interval between pulses.

11. Current status

Here is the list of the status code:

Status number 0: ip of this subsystem is default 127.0.0.1, no connection

Status number 1: the command have been sent and received successfully.

Status number 2: the command have been sent, but received feedback is not the same as

the command sent

Status number XXXX: XXXX is a large number, it means that there's a socket error, you can get the detail information at https://docs.microsoft.com/en-us/windows/win32/winsock/windows-sockets-error-codes-2

RUNNING,per-cali@XXHz:

RUNNING,random calibration

RUNNING,external trigger

RUNNING,self-trigger

RUNNING,mixed trigger

The current configuration parameters of this subsystem in the file *HERD-MASTER-DAQ.ini*

RUNNING,distribute trigger: the trigger subsystem switch is ON, and it is distributing the LEMO/TTL pulse and DI2C trigger package to all the subsystems at this moment.

STOP: STOP command have been sent successfully to this subsystem and the trigger subsystem switch is OFF.

12. Hardware configuration

The default hardware of the trigger configuration

Table 1. Sub-system interface

Signal	Type	Direction	Default value
INFN-PS MASTER-TRIG	LEMO/TTL/5V	input,	postive edge effective
INFN-PS MASTER-SPILL	LEMO/TTL/5V	input	High effective:beam ON
FIT-TRIG	LEMO/TTL/5V	output	postive edge effective
FIT-BUSY	LEMO/TTL/5V	input	High effective:busy
PSD-0-TRIG	LEMO/TTL/5V	output	postive edge effective
PSD-0-BUSY	LEMO/TTL/5V	input	High effective:busy

PSD-1-TRIG	LEMO/TTL/5V	output	postive edge effective
PSD-1-BUSY	LEMO/TTL/5V	input	High effective:busy
SCD-0-TRIG	LEMO/TTL/5V	output	postive edge effective
SCD-0-BUSY	LEMO/TTL/5V	input	High effective:busy
SCD-1-TRIG	LEMO/TTL/5V	output	postive edge effective
SCD-1-BUSY	LEMO/TTL/5V	input	High effective:busy
ISCMOS-0	DI2C	input/output	N/A
ISCMOS-0	DI2C	input/output	N/A
TRD	DI2C	input/output	N/A
PD	DI2C	input/output	N/A

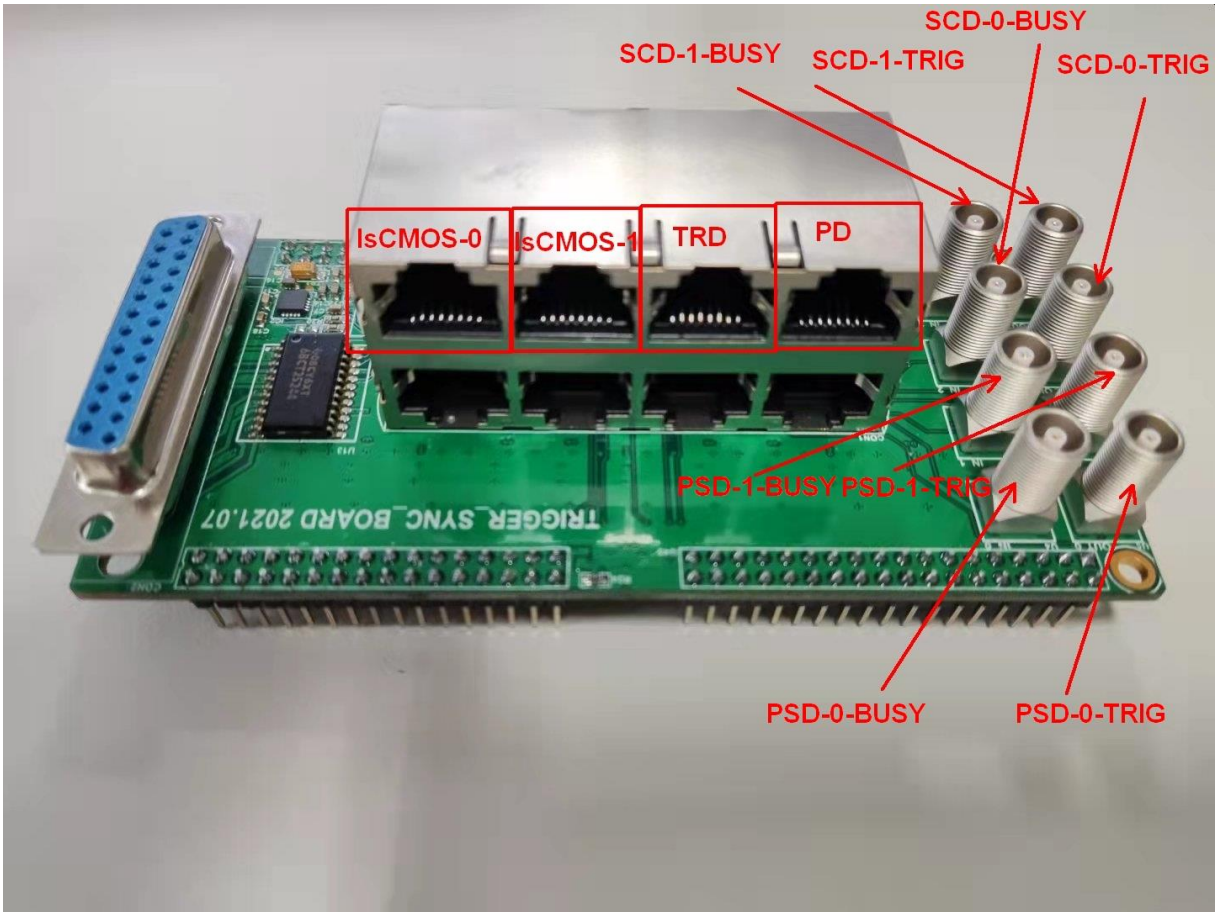

Figure 4. Upper connectors

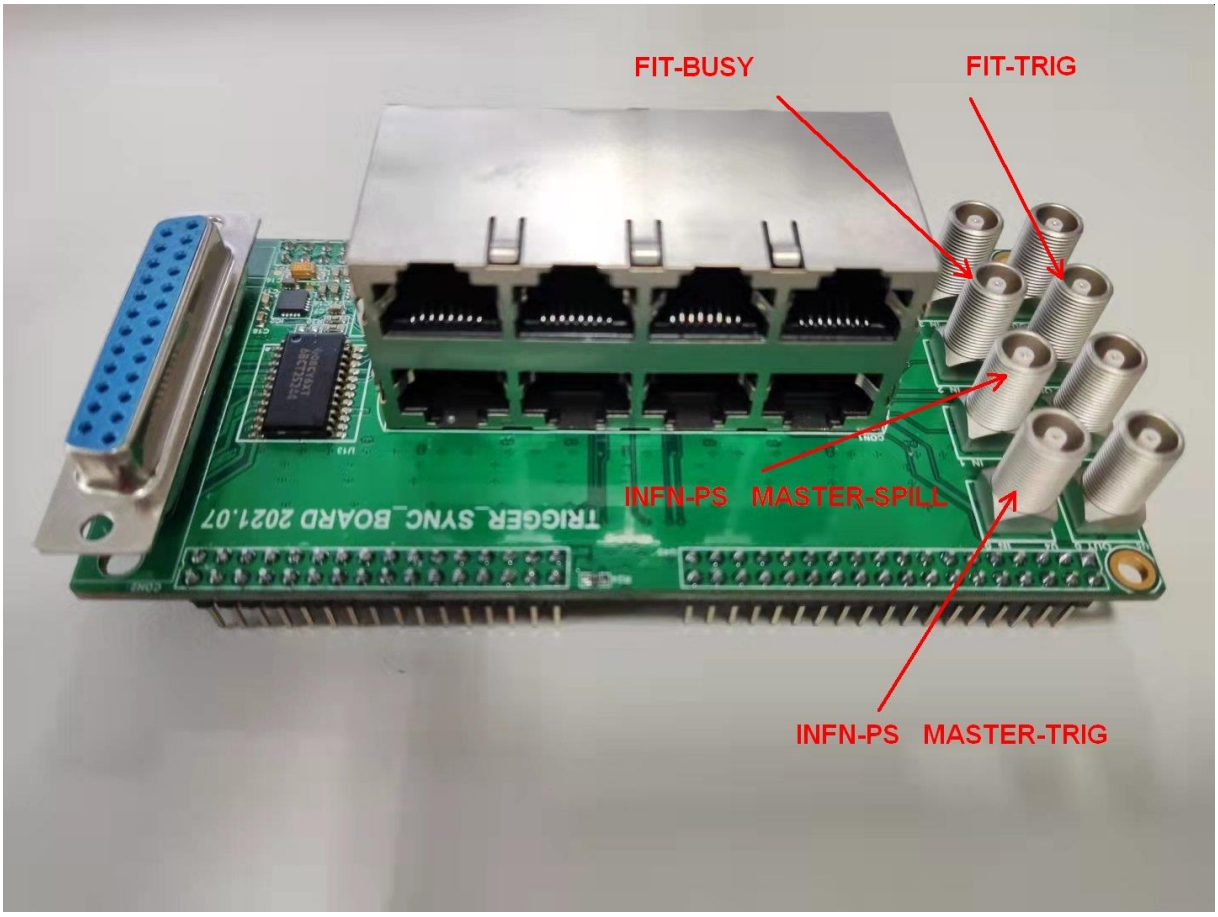

Figure 5. Lower connectors

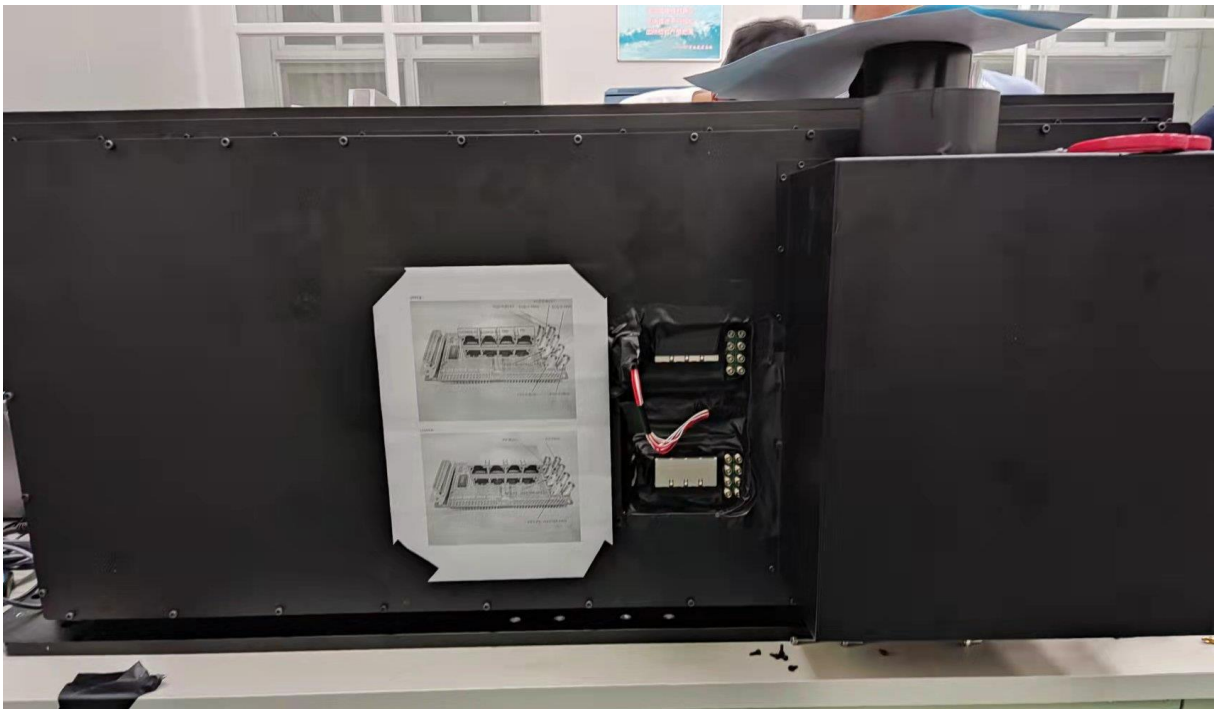

Figure 6. Trigger system interface