



M8228 User's Manual

This document is the User's Manual for M8228, the interface box for the force/torque sensor (loadcell) manufactured by SRI (Sunrise Instruments Co., Ltd). It's strongly recommended that anyone who uses M8228 should read this document before any operation. SRI reserves all the rights of this document. Please do not hesitate to contact SRI if there is any question.

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1. Introduction

The interface box M8228 provides bridge excitation, signal conditioning, data acquisition and digital communication to the user's controller or PC via RS232, CAN Bus or Ethernet. A 24 bit sigma-delta AD converter (16 bit effective) is used to provide high resolution (1/5000 to 1/10000 of full scale) analog to digital converting. The data rate is up to 2 kHz. A 6 axis loadcell is connected to the interface box via a 19pin or a 22 pin connector.



Specifications:

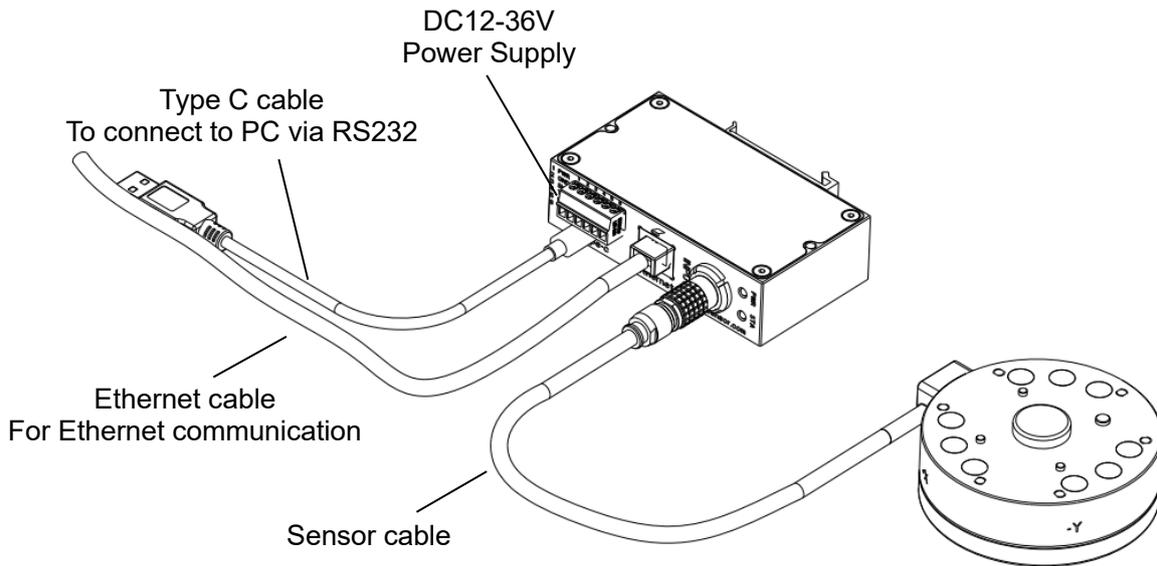
- Analog
 - # of Channels: 6(for M8228S1) or 9(for M8228B1)
 - Programmable gain
 - Automatically adjusting sensor's zero offset
 - Low noise instrumentation amplifiers
- Digital
 - RS232 , CAN Bus(CAN and CAN FD) and Ethernet
 - 24 bit sigma-delta ADC (16 bit effective), Sampling rate: 10 ~ 2000 Hz
 - Resolution: 1/5000 to 1/10000 of full scale
 - Programmable system parameters
- Frontal Panel
 - Loadcell connector: FGG.2B.319 or FGG.XB.322
 - Digital: RS232(Type C) , CAN Bus and Ethernet RJ45
 - Power supply: 12 to 36V, 200mA.
 - Indicated lights: Power & Status
- Software
 - iDAS RD: Debugging software to display real-time sampling curve.
 - Open communication protocol
 - RS232 and Ethernet TCP sample code

Selection Guide:

Model Type	# of Channels	Connector
M8228B1	9	FGG.XB.322
M8228S1	6	FGG.2B.319

2. Quick Start

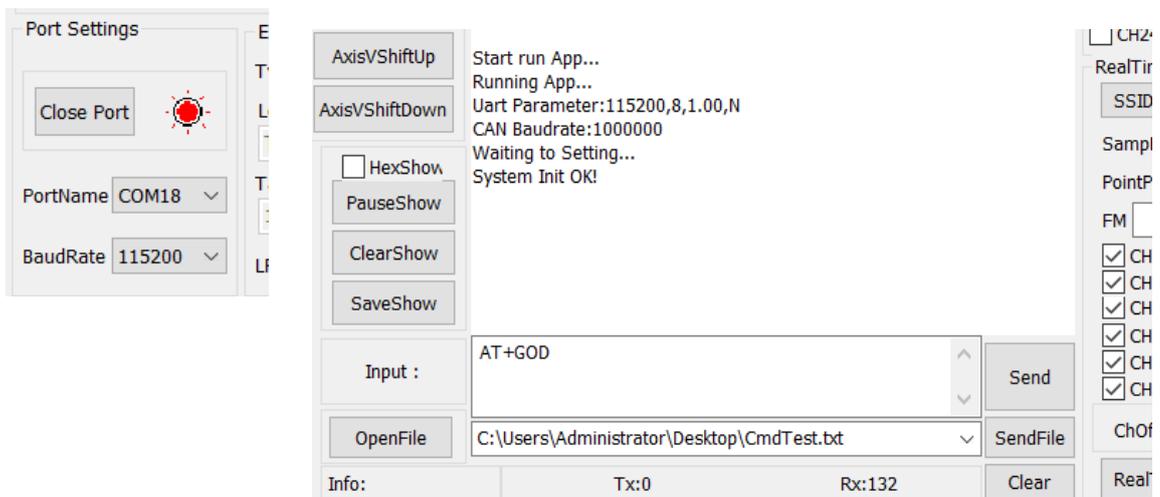
- 1). Connect the loadcell to M8228 via a LEMO connector.
 - 2). Connect M8228 to PC via RS232/Ethernet/CAN.
 - 3). Provide 12-36V DC power supply (not included) to the interface box M8228.
- (Note, if the out put of power module has a separated -V and GND, it's recommended to connect -V to GND. This way is helpful to reduce noise of sampling data.)



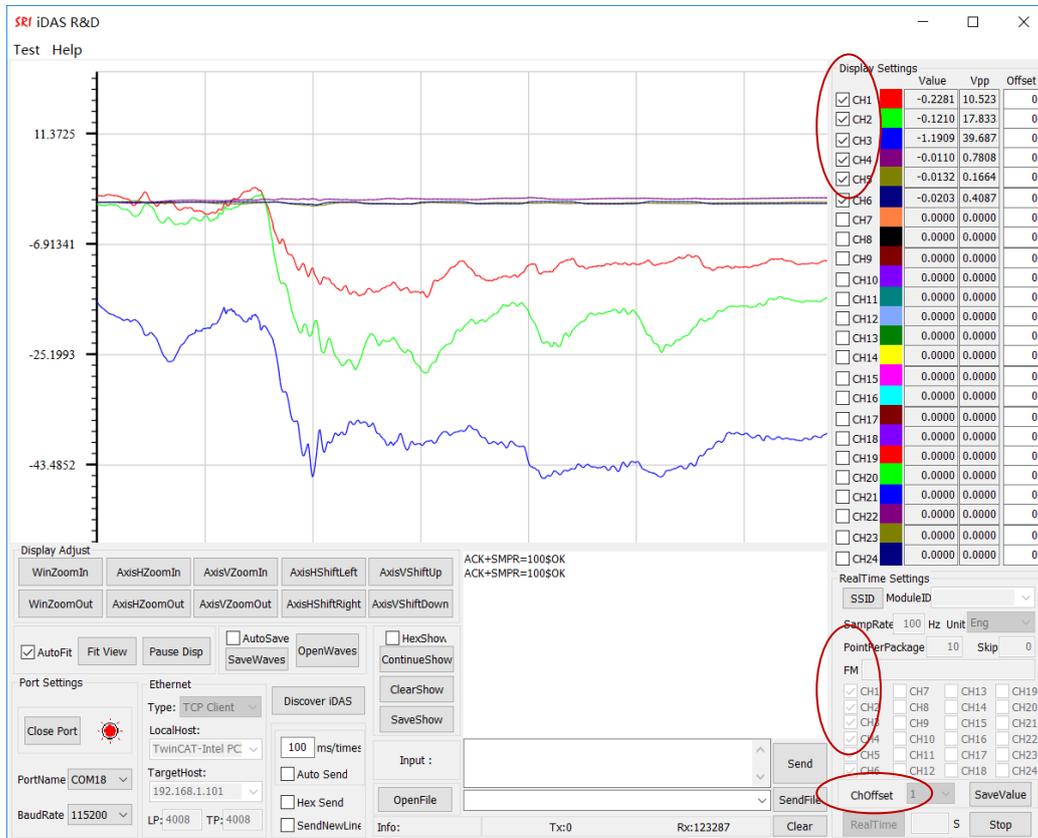
2.1 RS232 communication

Step1: Run iDAS R&D.exe. Then select PortName and BaudRate, and click Open Port. If the port is working, the indicated light will turn red.

Step2: Turn power on. Initialization information will appear in the information box.



Step 3: Select Eng in the “Unit” box, check CH1~CH6 boxes to represent FX, FY, FZ, MX, MY, MZ, then click “RealTime” button to start obtaining real-time force curves.

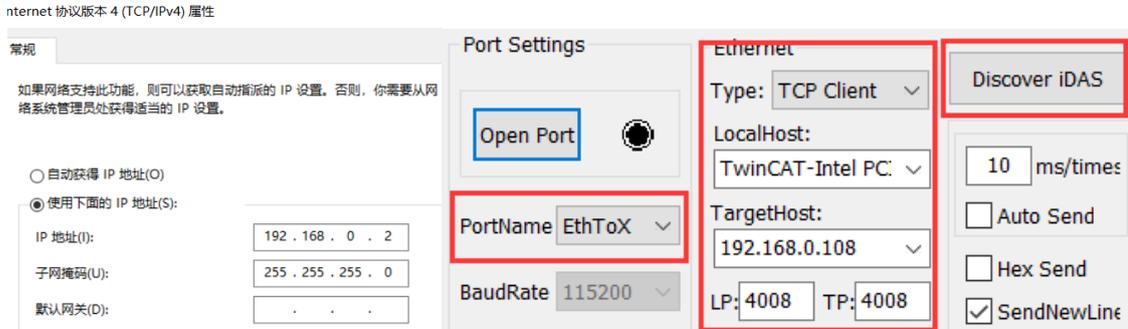


If the information box doesn't show initialization information after 1 minute of power-on, please check if: 1) connection and PortName are correct; 2) BaudRate is selected as 115200. If the real time data of CH1~CH6 are incorrect, please check the decoupled matrix and the calculation unit, and refer to Chapters 4.0, 5.3, 5.4 and 7.0 of this Manual.

2.2 Ethernet communication

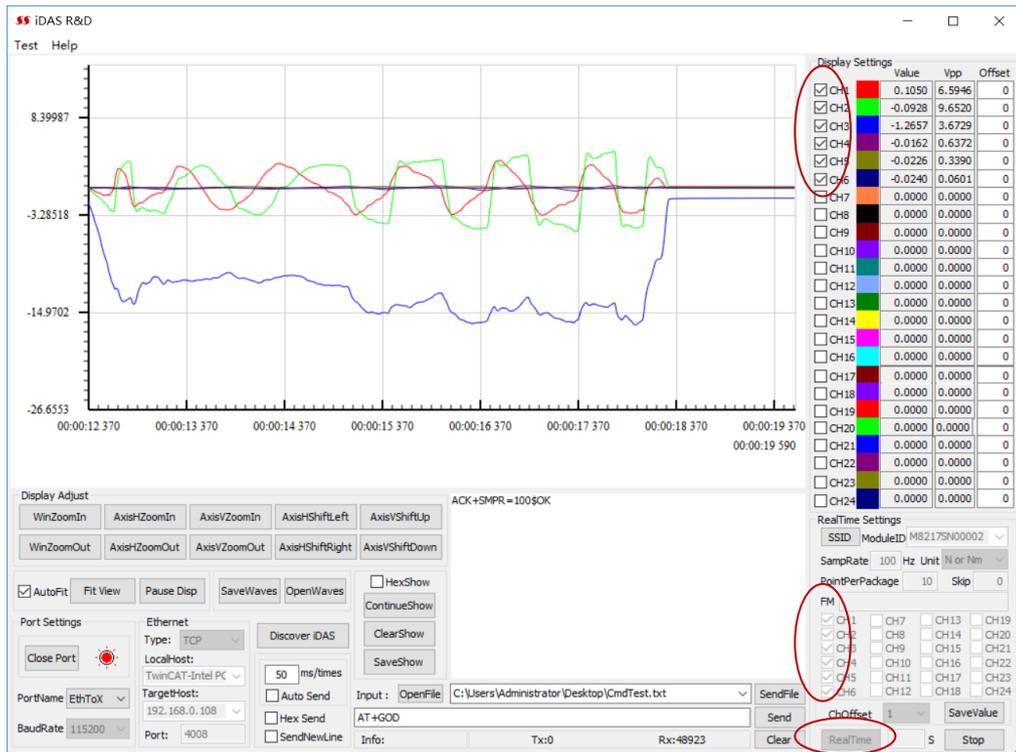
Step 1: Run iDAS R&D.exe. Then set PortName to EthToX; set Ethernet Type to TCP; select LocalHost (your PC's Ethernet card).

Click “Discover iDAS” button, software will search M8228 automatically. “1 iDAS found” will be shown on screen if M8228 is reached successfully.



Step 2: Click “Open Port”, the indicated light will turn red.

Step 3: Select Eng in the output Unit box; check CH1~CH6 boxes to represent FX, FY, FZ, MX, MY, MZ; then click “RealTime” button to start obtaining real-time force/torque curves.





If the pop-up window shows “0 iDAS found”, please try 1) click “Discover iDAS” button again; 2) click “ LocalHost”; 3) change the network card and try again. If the real time data of CH1~CH6 are incorrect, please check the decoupled matrix and the calculation unit, and refer to Chapters 4.0、 5.3、 5.4 and 7.0 of this Manual.

2.3 CAN Bus communication

M8228 supports CAN and CAN FD communication. Customer can select the communication mode by command CRATE.

The default baud rate of CAN is 1Mbps. For CAN FD, default arbitration phase baud rate is 500kbps, default data phase baud rate is 2Mbps(max.5Mbps).

Use RS232 communication to configure ID type, ID filter list, and baud rate for CAN BUS (refer to chapters 4, 5.1.6, 5.1.7, and 5.1.8.). The command should be converted into ASCII. When a command is longer than 8 bytes, the command should be divided into multiple frames.

Example:

RS232 communication

Sent: AT+CIDT=?\r\n

Reply: ACK+CIDT=STD\$OK\r\n

Sent: AT+CFIDL=?\r\n

Reply: ACK+CFIDL=NULL\$OK\r\n

Sent: AT+CRATE=?\r\n

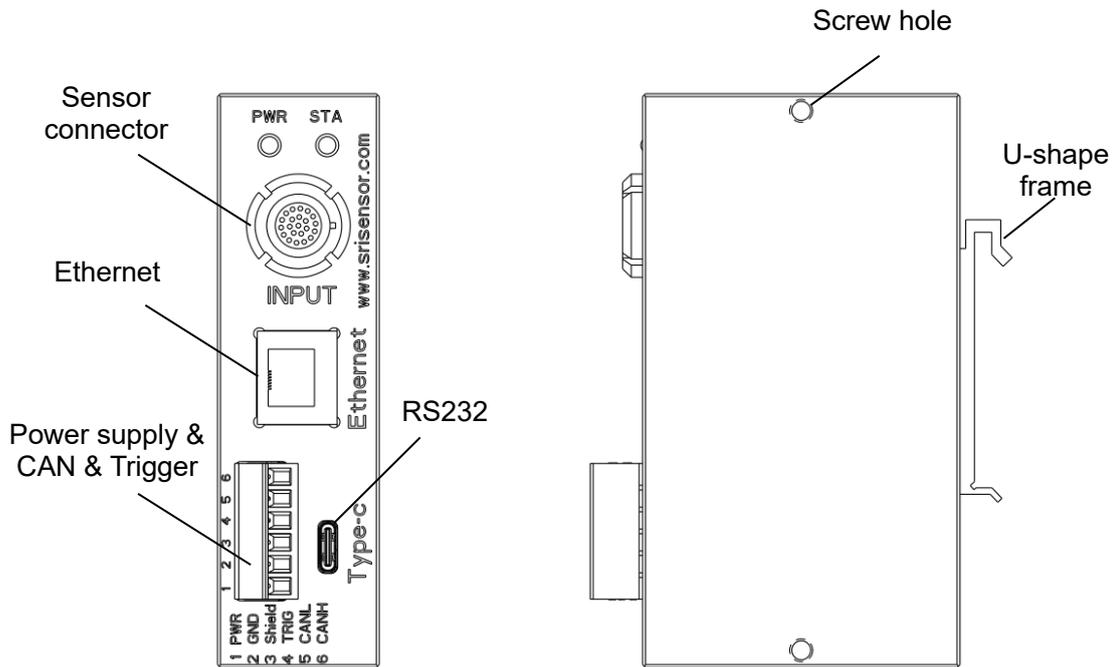
Reply: ACK+CRATE=CAN,500000\$OK\r\n

CAN communication

To convert AT+SMPF=?\r\n to ASCII: 41 54 2B 53 4D 50 46 3D 3F 0D 0A.

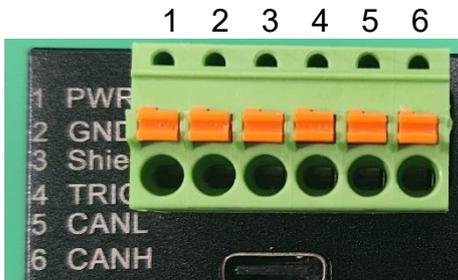
The first frame is: 41 54 2B 53 4D 50 46 3D, and the second frame is: 3F 0D 0A (or: 3F 0D 0A 00 00 00 00 00)

3. Frontal Panel



3.1 Power supply & CAN & Trigger

oadcell, the consumed power is about 4.5W. The cable color codes are defined as follows:



Pin #	Definition	Note
1	PWR	+Power, DC12-36V
2	GND	Ground
3	Shield	To reduce noise, it is recommended to connect the shield to the true ground in your test lab.
4	TRIG	Trigger by shift to GND
5	CANL	CAN BUS
6	CANH	

3.2 Sensor Connector

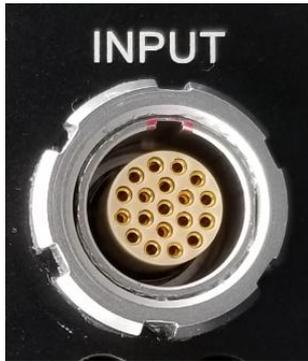
22 pin connector for M8128B1



Pin #	Definition	Note
1	CH1+	Channel 1
2	CH1-	
3	CH2+	Channel 2
4	CH2-	
5	CH3+	Channel 3
6	CH3-	
7	CH4+	Channel 4
8	CH4-	
9	CH5+	Channel 5
10	CH5-	
11	CH6+	Channel 6
12	CH6-	
13	CH7+	Channel 7
14	CH7-	
15	CH8+	Channel 8
16	CH8-	
17	CH9+	Channel 9
18	CH9-	
19	+E	Positive excitation
20	-E	Negative excitation (if support)
21~22	N/A	For future use

Note: To prevent signal interference, it is recommended to short unused sensor signal pins to “-E”.

19 pin connector for M8128S1



Pin #	Definition	Note
1	CH1+	Channel 1
2	CH1-	
3	CH2+	Channel 2
4	CH2-	
5	CH3+	Channel 3
6	CH3-	
7	CH4+	Channel 4
8	CH4-	
9	CH5+	Channel 5
10	CH5-	
11	CH6+	Channel 6
12	CH6-	
13~16	N/A	
17	-E	Negative excitation (if support)
18	+E	Positive excitation
19	GND	

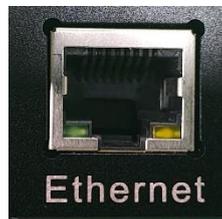
3.3 Ethernet & RS232 connector

(1) USB Type-C connector

M8228 supports RS232 communication. There is a RS232 to USB converter in M8228, so customer can connect M8228 to PC by the type-c connector and communicate via USB.



(2) Ethernet RJ45 connector



3.4 Indicated lights

There are two indicated lights: PWR (Power) and STA (Status). The conditions of these lights are defined as follows:



PWR	STA	Definition	Instruction
ON		Power is on	
ON	Flickering	System is working properly	
ON	ON	Excitation is abnormal	Check the loadcell cable
OFF	Flickering	System works ok. PWR light may get damaged	Either ignore or repair PWR light
OFF	ON	Excitation is abnormal and PWR light may get damaged	Check the loadcell cable or contact us

4. iDAS R&D Debugging Software

iDAS RD is a debugging software that supports the commands of M8228, which can be used to send a series of commands to M8228 to achieve a specific application.

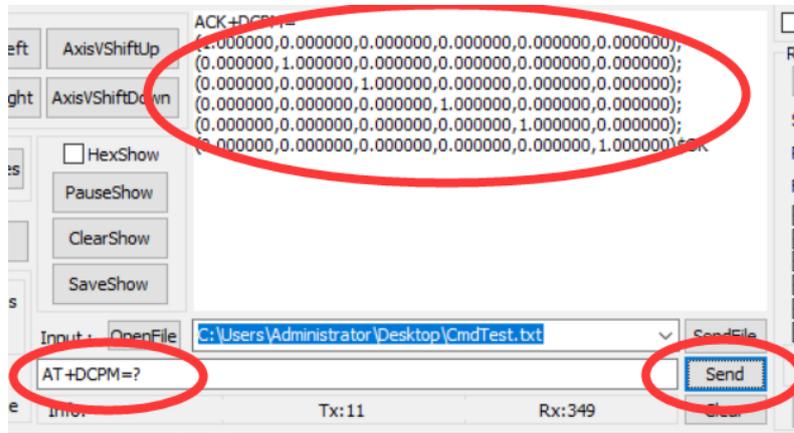
- PC Requirement: WIN 7 and above
- Installation Procedure: Uncompressed iDAS RD
- Support RS232 & Ethernet communication only

4.1 Software Interface



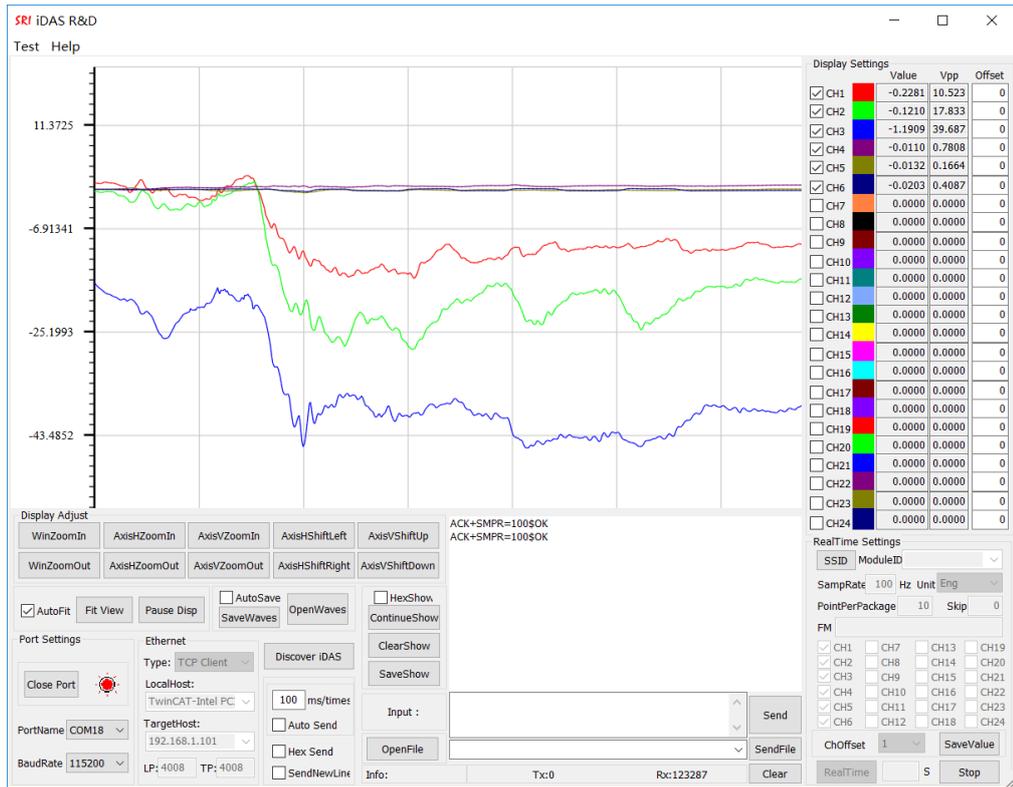
4.2 Send Commands

According to the command format in Section 5.0, type in a command to the Command Box, and click Send. The response information will be shown in the command response window. Error will be prompted or no response will be given if the input command is wrong or is not supported by M8228.



4.3 Realtime data curve

- Step 1: Open Port correctly.
- Step 2: Select CH1 through CH6 at the lower right corner on screen.
- Step 3: Set SampRate to 100Hz, set Unit to N or Nm.
Set PointPerPackage to 10, and put in 0 at Skip.
- Step 4: Select CH1 through CH6 at the top right corner on screen.
- Step 5: Click “Realtime” to get data from M8228, the real time data will be shown in the window.



Note:

With RS232 communication, SampRate is up to 300 Hz for 6-channel data upload and 1 kHz for 1-channel data upload at BaudRate 115200bps.

With Ethernet communication, SampRate is up to 2K Hz for 6-channel data upload.

If the real-time data shown by iDAS R&D is incorrect, please click Stop and send Commands DCPM and DCPCU to make sure that current matrix coefficients and calculation unit match the sensor calibration report. Refer to 5.3, 5.4 and 7.0 of this Manual.

5. Commands

Definition:

Master: The equipment that send commands to M8228, such as PC or the user's control system. M8228 is called as Slave Equipment.

ASCII Code: America Standard Code for Information Interchange, refer to ISO 646.

M8228 commands are comprised of ASCII codes.

Command structures are shown as follows:

Send to Slave Equipment:

AT+CMD=Parameter\r\n

Response from Slave Equipment: (Except for the command GOD and GSD)

ACK+CMD=Parameter\$ResponseCode\r\n



All data that sent to slave equipment must be ASCII code.
All data that received from slave equipment are ASCII code.
Before sent or after received, the data must be converted to or from ASCII

Descriptions:

AT: Frame Header when sending data. All data that are sent to Slave Equipment must be started with AT.

ACK: Frame Header when receiving data. All data that are received from Slave Equipment are started with ACK.

CMD: Command, such as SMPF.

Parameter: Parameters follow a command.

\r\n: Return symbol (Enter), which denotes the end of a command. ASCII code of "\r\n" is "0D 0A".

ResponseCode: Response code, such as OK or ERROR.

\$: Interval symbol.



Note:

- ✍ Parameter '?' denotes that Master is asking for a response from Slave Equipment.
- ✍ M8228 will not respond until the command sent by Master is executed.
- ✍ When debugging with iDAS R&D software, the software performs ASCII conversion and put \r\n at the end of the command automatically.

Example:

Send: AT+SMPF=?\r\n

ASCII: 41 54 2B 53 4D 50 52 3D 3F 0D 0A

Response: ACK+SMPF=100\$OK\r\n

ASCII: 41 43 4B 2B 53 4D 50 46 3D 31 30 30 24 4F 4B 0D 0A

Send: AT+GOD\r\n

ASCII: 41 54 2B 47 4F 44 0D 0A

Response: AA 55 00 1B 04 BB A1 8C B8 41 E0 19 30 42 DD 82 B0 40 A2 62

B8 C0 DB 68 75 40 9B EB 16 40 30

Command	Function	Note
Configuration of RS232/CAN/Ethernet		
UARTCFG	Read or set parameters of RS232	Immediate active
EIP	Read or set Ethernet IP address	Active after restart
EMAC	Read or set Ethernet MAC address	Active after restart
EGW	Read or set Ethernet gateway	Active after restart
ENM	Read or set Ethernet netmask	Active after restart
CRATE	Read or set CAN baud rate	Active after restart
CIDT	Read or set ID type of CAN Bus	Active after restart
CFIDL	Read or set ID of CAN Bus	Active after restart
CFI	Read or set interval time between frames of CAN bus	Active after restart
System parameters		
SMPF	Read or set sampling rate	
DCPM	Read or set decoupling matrix coefficient	
DCPCU	Read or set matrix calculation unit	(mV or mV/V)
SFWV	Read firmware version	
Get real-time data from M8228		
DCKMD	Read or set data validation method	
GSD	Get data from M8228 continuously	
GOD	Get one package data from M8228	
ADJZF	Adjust zero offset of sensor	

5.1 Commands to configure RS232/Ethernet/CAN

5.1.1 UARTCFG / Communication Parameters for RS232

Description: To read or set parameters for RS232

Command Syntax: AT+UARTCFG=Rate,DataBit,StopBit,ParityBit

Command		Possible Response(s)
AT+UARTCFG=? \r\n		Rate,DataBit,StopBit,ParityBit
AT+UARTCFG=Rate, DataBit, StopBit, ParityBit\r\n		OK/ERROR
Note: Immediate effect.		
Parameters		
Parameter	Variable Type (Valid Range)	Description
Rate	Unsigned long int (0 ~ 2 ³² -1)	Baud Rate of RS232 in bps. Baud Rate of RS232 in M8228 can be 9600, 14400, 19200, 38400, 56000, 57600, 115200, 230400, 256000, 460800, 921600bps. Default is 115200
DataBit	Int	Number of data bits in RS232 communication. The choices are: 5,6,7 and 8. Default is 8
StopBit	float	Number of stop bits in RS232 communication. The choices are: 0.5,1.0.1.5 and 2.0. Default is 1.0
ParityBit	char	Parity in RS232 communication. Choices are N,O and E, which denote none, odd and even respectively. Default is N

Example:

Send: AT+UARTCFG=?\r\n

Response: ACK+UARTCFG=115200,8,1.00,N\$OK\r\n

Send: AT+UARTCFG=19200,8,1.00,N\r\n

Response: Messy codes

The baud rate of the master equipment should be changed to the current set value of 19200 in order to communicate correctly.

5.1.2 EIP / Ethernet IP address

Description: To set Ethernet IP address

Command Syntax:AT+EIP=addr0.addr1.addr2.addr3

Command		Possible Response(s)
AT+EIP=?\r\n		addr0.addr1.addr2.addr3
AT+EIP= addr0.addr1.addr2.addr3\r\n		OK/ERROR
Note: Effect after M8228 is restarted.		
Parameters		
Parameter	Variable Type (Valid Range)	Description
addr0.addr1.addr2.addr3	String	Default: 192.168.0.108

Example:

Send: AT+EIP=?\r\n

Response: ACK+EIP=192.168.0.108\$OK\r\n

Send: AT+ EIP=192.168.0.108\r\n

Response: ACK+EIP=192.168.0.108\$OK\r\n

5.1.3 EMAC / Ethernet MAC

Description: To set Ethernet MAC.

Command Syntax:AT+EMAC=addr0-addr1-addr2-addr3-addr4-addr5

Command		Possible Response(s)
AT+EMAC=?\r\n		addr0-addr1-addr2-addr3-addr4-addr5
AT+EMAC= addr0-addr1-addr2-addr3-addr4-addr5\r\n		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
addr0-addr1-addr2-addr3-addr4-addr5	String	12-13-14-15-16-17

Example:

Send: AT+EMAC=?\r\n

Response: ACK+EMAC=12-13-14-15-16-17\$OK\r\n

Send: AT+EMAC=12-13-14-15-16-17\r\n

Response: ACK+EMAC=12-13-14-15-16-17\$OK\r\n

5.1.4 EGW / Ethernet Gateway address

Description: To set Ethernet gateway address.

Command Syntax: AT+EGW= addr0.addr1.addr2.addr3

Command		Possible Response(s)
AT+EGW=?\r\n		addr0.addr1.addr2.addr3
AT+EGW=addr0.addr1.addr2.addr3\r\n		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
addr0.addr1.addr2.addr3	String	192.168.0.1

Example:

Send: AT+EGW=?\r\n

Response: ACK+EGW=192.168.0.1\$OK\r\n

Send: AT+EGW=192.168.0.1\r\n

Response: ACK+EGW=192.168.0.1\$OK\r\n

5.1.5 ENM / Ethernet netmask

Description: To set Ethernet netmask.

Command Syntax: AT+ENM= addr0.addr1.addr2.addr3

Command		Possible Response(s)
AT+ENM=?\r\n		addr0.addr1.addr2.addr3
AT+ENM= addr0.addr1.addr2.addr3\r\n		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
addr0.addr1.addr2.addr3	String	255.255.255.0

Example:

Send: AT+ENM=?\r\n

Response: ACK+ENM=255.255.255.0\$OK\r\n

Send: AT+ENM=255.255.255.0\r\n

Response: ACK+ENM=255.255.255.0\$OK\r\n

5.1.6 CIDT / ID type for CAN Bus

Description: To read or set ID type for CAN Bus.

Command Syntax: AT+CIDT=Type

Command		Possible Response(s)
AT+CIDT=?\r\n		Type
AT+CIDT=Type\r\n		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
Type	String	STD: Standard 11 bits ID EXT: Extended 29 bits ID

Example:

Send: AT+CIDT=?\r\n

Response: ACK+CIDT=STD\$OK\r\n

Send: AT+CIDT=EXT\r\n

Response: ACK+CIDT=EXT\$OK\r\n

5.1.7 CFIDL / ID of CAN Bus

Description: To read or set ID of CAN Bus.

Command Syntax: AT+CFIDL= id1,id2,id3,...,idn

Command		Possible Response(s)
AT+CFIDL=?\r\n		id1,id2,id3,...,idn
AT+CFIDL=id1,id2,id3,...,idn\r\n		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
idn	0 ~ 2 ¹¹ or 0 ~ 2 ²⁹	NULL: no filter Up to 14 IDs: allow these IDs to be passed through

Example:

Send: AT+CFIDL=?\r\n

Response: ACK+CFIDL=NULL\$OK\r\n

Send: AT+CFIDL=0,125,126,127,128\r\n

Response: ACK+CFIDL=0,125,126,127,128\$OK\r\n

5.1.8 CRATE / Baud Rate of CAN Bus

Description: To read or set mode and baud rate of CAN Bus.

Command Syntax: AT+CRATE=Mode:rate

Command	Possible response(s)
AT+CRATE=?	Mode:rate
AT+CRATE=Mode:rate	OK/ERROR

Note:

1. The default baud rate of CAN is 1Mbps. For CAN FD, default arbitration phase baud rate is 500kbps, default data phase baud rate is 2Mbps(max.5Mbps).
2. Send “AT+CRATE= CAN,500000” to set the mode as CAN and the baud rate to 500kbps.
3. Send “ AT+CRATE=CANFD,500000,5000000” to set the mode as CANFD and the arbitration phase baud rate is 500kbps,the data phase baud rate is 5Mbps.
3. Only one method can be used each time.
4. New Baud Rate will be active after M8228 is restarted.

Parameters		
Parameter	Variable Type (Valid Range)	Description
Mode	String	Mode, can be CAN or CANFD
rate	Unsigned long int (0 ~ 2 ³² -1)	Baud Rate in bps. For CAN, the baud rate can be: 1000000, 800000, 500000, 250000, 125000, 100000, 50000 For CANFD, arbitration phase baud rate can be: 1000000, 800000, 500000, 250000, 125000, 100000, 50000 For CANFD, data phase baud rate can be: 5000000, 4000000, 2000000, 1000000, 800000, 500000, 250000

Example:

Send: AT+CRATE=?\r\n

Response: ACK+CRATE=CAN,500000\$OK\r\n

Send: AT+CRATE=CANFD,500000,2000000\r\n

Response: ACK+CRATE=CANFD,500000,2000000\$OK\r\n

5.1.9 CFI / Interval time between frames of CAN Bus

Description: To set Interval time between frames of CAN Bus

Command Syntax: AT+CFI=IntervalTime

Command		Possible response(s)
AT+CFI=?		IntervalTime
AT+CFI=IntervalTime		OK/ERROR
Note: New interval time will be effective after M8122C is restarted.		
Parameters		
Parameter	Variable Type (Valid Range)	Description
IntervalTime	0 ~ 10000	Interval time in μ s. The default value in firmware is 0 μ s.

Example:

Send: AT+CFI=?\r\n

Response: ACK+CFI=10\$OK \r\n

Send: AT+CFI=10\r\n

Response: ACK+CFI=10\$OK \r\n

5.2 SFWV / Firmware version

Description: To read firmware version.

Command Syntax:AT+SFWV=?

Command		Possible Response(s)
AT+SFWV=?\r\n		version
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
version	String	Version #

Example:

Send: AT+SFWV=?\r\n

Response: ACK+SFWV=V11.00\$OK\r\n

5.3 DCPM / Read or set decoupled matrix

Description: To read or set decoupled matrix

Command Syntax:AT+DCPM=Matrix

Command		Possible Response(s)
AT+DCPM=?\r\n		Matrix data
AT+DCPM=Matrix\r\n		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
Matrix	String	The format is as follows.

Example:

Send: AT+DCPM=?\r\n

Response: ACK+DCPM=(0.000041,-0.020164,-0.000348,0.020287,-0.000145,-0.000047);(-0.000160,-0.011703,-0.000089,-0.011668,-0.000217,0.023526);(-0.031415,-0.000185,-0.032273,0.000010,-0.031708,-0.000481);(-0.000888,-0.000014,0.000951,-0.000006,0.000029,0.000009);(-0.000521,0.000011,-0.000531,-0.000009,0.001061,0.000015);(0.000002,0.000754,-0.000008,0.000753,-0.000007,0.000768)\$OK\r\n

Refer to Section 7.0 Loadcell Decoupled Calculation to obtain the decoupling matrix coefficients and calculation units of sensors

5.4 DCPCU / Calculation unit for decoupled data

Description: To set or read calculation unit.

Command Syntax:AT+DCPCU=Unit

Command		Possible Response(s)
AT+DCPCU=?\r\n		Uint
AT+DCPCU=Unit\r\n		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
Unit	String	MV and MVPV(mV/V)

Example:

Send: AT+DCPCU=?\r\n

Response: ACK+DCPCU=MV\$OK\r\n

Send: AT+DCPCU=MVPV\r\n

Response: ACK+DCPCU=MVPV\$OK\r\n

5.5 SMPF / Read or set sampling rate

Description: To read or set sampling rate.

Command Syntax: AT+SMPF=SampleFreq

Command		Possible response(s)
AT+SMPF=?		SampleFreq
AT+SMPF=SampleFreq		OK/ERROR
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
SampleFreq	Unsigned short int (1 ~ 2000)	Sampling Freq in Hz. For example, 200.

Example:

Send: AT+SMPF=?\r\n

Response: ACK+SMPF=300\$OK\r\n

Send: AT+SMPF=200\r\n

Response: ACK+SMPF=200\$OK\r\n

5.6 DCKMD / Set data-check method

Description: To set data-check method.

Command Syntax: AT+DCKMD=Mod

Command		Possible response(s)
AT+DCKMD=Mod		OK/ERROR
Note: iDAS R&D debugging software only supports SUM check.		
Parameters		
Parameter	Variable Type (Valid Range)	Description
Mod	String	Data check methods include SUM and CRC32; The default method SUM is used for data accumulation and verification. See the C language source code of CRC32 in the attached CD.

Example:

Send: AT+DCKMD=?\r\n

Response: ACK+ DCKMD =SUM\$OK\r\n

5.7 GOD / Get one package data from M8228

Description: To get one package data from M8228.

Command Syntax: AT+GOD

Command		Possible response(s)
AT+GOD		DataFormat
Note:		
Parameters		
Parameter	Variable Type (Valid Range)	Description
DataFormat		Data package, refer to the following for details.

5.8 GSD / Get data continuously

Description: To get data continuously.

Command Syntax: AT+GSD

Command		Possible response(s)
AT+GSD		DataFormat
Note: To stop receiving data, send "AT+GSD=STOP\r\n" to M8228.		
Parameters		
Parameter	Variable Type (Valid Range)	Description
DataFormat		Data package, refer to the following for details.

"DataFormat" is defined as follows:

Frame Header	PackageLength	PackageNo	Data	CRC32 / SUM
0xAA ,0x55	HB, LB	2Byte	(ChNum*N*DNpCH)Byte	4Byte / 1Byte

 **Note:**

- ✍ 0xAA ,0x55: Frame header of data package.
PackageLength: Unsigned short int,16-bits, highest byte first, The length of data of each channel, which equals to 2+ChNum*N*DNpCH+1(SUM check) or 2+ ChNum*N*DNpCH+4(CRC32 check)
Where
ChNum: Total number of uploading channels, Default value 6
N: the output unit, Default value 4
DNpCH: Number of sampling points to upload in one package, Default value 1
- ✍ PackageNo: Every package is labeled, which increases in sequence from 0 to 65535.
- ✍ Data: Uploading data with the lowest byte first.
- ✍ CRC32/SUM: CRC32 or Checksum. The default data validation method is Checksum. Use Command DCKMD to select the data validation method (Checksum or CRC32).
CRC32 function (MyCRC_GetCRC32 (uint8_t *pData, uint16_t Length)) in C program is included in the CD-ROM.

Example:

Send: AT+DCKMD=SUM\r\n

Response: ACK+DCKMD=SUM\$OK\r\n

Send: AT+GOD\r\n

Response: AA 55 00 1B C4 C7 01 6A F4 C0 EF 7D 33 C0 49 62 C9 C0 A2
5C C6 BD A6 19 8F BD AF DA 69 3E 6E

Where

0xAA ,0x55: Frame header

00 1B: PackageLength $2+6*4*1+1=27$ bytes;

C4 C7: Package No 50375;

Channel 1 Engineering Unit: 01 6A F4 C0, single-precision float
(C0F46A01) converted into -7.637940;

Channel 2 Engineering Unit: EF 7D 33 C0, single-precision float
(C0337DEF) converted into -2.804561;

Channel 3 Engineering Unit: 49 62 C9 C0, single-precision float
(C0C96249) converted into -6.293248;

Channel 4 Engineering Unit: A2 5C C6 BD, single-precision float
(BDC65CA2) converted into -0.096856;

Channel 5 Engineering Unit: A6 19 8F BD, single-precision float
(BD8F19A6) converted into -0.069873;

Channel 6 Engineering Unit: AF DA 69 3E, single-precision float
(3E69DAAF) converted into 0.228373

SUM Check: 6E

5.9 ADJZF/ Adjust zero offset of sensor

Description: Adjust zero offset of sensor

Command Syntax: AT+ADJZF

Command	Possible response(s)
AT+ADJZF=?	0;0;0;0;0;0 or 1;1;1;1;1;1
AT+ADJZF=1;1;1;1;1;1	OK/ERROR

Note:

Send "1;1;1;1;1;1" to M8228 to adjust zero offset of sensor. M8228 takes more than 2 seconds to complete zero offset adjusting process. During this process, sensor must keep static and do not move.

Send "0;0;0;0;0;0" to make M8228 back to the status which is before zero offset adjusting.

Example:

Send: AT+ADJZF=?\r\n

Response: ACK+ADJZF=0;0;0;0;0;0\$OK\r\n

Send: AT+ADJZF=1;1;1;1;1;1\r\n

Response: ACK+ADJZF=1;1;1;1;1;1\$OK\r\n

6. Get Realtime Data from M8228

Step 1: Use command SMPF to set sampling rate. If the sampling rate is 100Hz:

```
AT+SMPF=100\r\n
```

Step 2: Use command GOD to get one package data or command GSD to get data continuously from M8228. Refer to Sections 5.7 and 5.8



Note:

- ✍ The parameters set by Command SMPF are saved in M8228, and they are still available after power off.
- ✍ If iDAS R&D software is used, M8228 is required to restart (Power off and Power on) before debugging your own codes.
- ✍ If the real time data of CH1~CH6 is incorrect, please check the decoupled matrix and the calculation unit, and refer to Section 4.0, 5.3, 5.4 and 7.0 of this Manual

7. Decoupled Calculation

If the M8228 is purchased together with SRI sensor, the decoupled matrix and calculation unit of SRI sensor have been configured in the M8228. The decoupled matrix and calculation unit can be updated by Command DCPM and DCPCU when necessary.

Decoupled matrix and calculation unit can be found in the calibration report. Two different reports formats will be provided according to the sensor's structure.

7.1 Matrix decoupled loadcell

The decoupled matrix and calculation unit are provided in the calibration report, as shown below:

[DECOUPLED] =	-0.03220	0.49984	0.00136	-1.01398	-0.01208	0.50908
	0.00046	0.84855	0.01531	0.02114	-0.03126	-0.86432
	1.19167	0.00028	1.20748	0.00224	1.19808	0.00320
	-0.06386	-0.00097	0.13028	-0.00009	-0.06523	0.00012
	-0.11090	0.00016	-0.00049	0.00075	0.11138	-0.00019
	-0.00046	0.08401	-0.00067	0.08304	-0.00089	0.08433

The six axis loads can be decoupled as follows:

Step 1: Obtain the raw data of Channels 1 through 6 into mV
 [DAT] = {rawchn1, rawchn2, rawchn3, rawchn4, rawchn5, rawchn6}
 where rawchn1, rawchn2, rawchn3, rawchn4, rawchn5 and rawchn6 are in mV

Step 2: To calculate decoupled loads
 [RESULT]^T = [DECOUPLED]*[DAT]^T
 where [RESULT] = {FX,FY,FZ,MX,MY,MZ}. Force Unit: N. Moment Unit: Nm
 [DECOUPLED] is the above decoupled matrix

The Commands to input the matrix coefficients and to set the calculation unit are as follows:

```
AT+DCPM=(-0.03220,0.49984,0.00136,-1.01398,-
0.01208,0.50908);(0.00046,0.84855,0.01531,0.02114,-0.03126,-
0.86432);(1.19167,0.00028,1.20748,0.00224,1.19808,0.00320);(-0.06386,-
0.00097,0.13028,-0.00009,-0.06523,0.00012);(-0.11090,0.00016,-
0.00049,0.00075,0.11138,-0.00019);(-0.00046,0.08401,-0.00067,0.08304,-
0.00089,0.08433)
AT+DCPCU=MV
```

7.2 Structurally decoupled loadcell

The sensitivity provided in the calibration report needs to be converted into a matrix as shown below:

Voltage Calibration							
Bridge	Capacity	Zero Offset	Nonlinearity	Hysteresis	Output @ Capacity	Sensitivity	Change
	N/Nm	mV/V	%FS	%FS	mV/V	mV/V/EU	%
FX	-5400	0.0131	-0.08	-0.33	-3.0269	5.6054E-04	0.00
FY	5400	0.0007	0.08	0.27	3.0500	5.6481E-04	0.00
FZ	-10800	0.0001	-0.09	-0.18	-0.7369	6.8230E-05	0.00
MX	-540	-0.0027	-0.09	-0.10	-1.8703	3.4636E-03	0.00
MY	-540	-0.0090	-0.09	-0.09	-1.9014	3.5210E-03	0.00
MZ	432	-0.0099	0.05	0.08	1.9603	4.5378E-03	0.00

Sensitivity unit is mV/V/Eu,. The diagonal elements of the matrix are the inverse of the sensitivities (1/Sensitivity). The calculation unit is mV/V.

1783.9940	0	0	0	0	0
0	1770.5069	0	0	0	0
0	0	14656.3095	0	0	0
0	0	0	288.7169	0	0
0	0	0	0	284.0102	0
0	0	0	0	0	220.3711

The Commands to input the matrix coefficients and to set the calculation unit are as follows:

AT+DCPM=(1783.9940,0,0,0,0,0);(0,1770.5069,0,0,0,0);(0,0,14656.3095,0,0,0)
 ;(0,0,0,288.7169,0,0); (0,0,0,0,284.0102,0); (0,0,0,0,0,220.3711)
 AT+DCPCU=MVPV

Four possible conversion formula:

- 1) Sensitivity unit is mV/V/Eu. The conversion formula is 1/Sensitivity.
 Calculation unit is mv/V: AT+DCPCU=MVPV.
- 2) Sensitivity unit is mV/Eu. The conversion formula is 1/Sensitivity.
 Calculation unit is mv: AT+DCPCU=MV.
- 3) Sensitivity unit is V/V/Eu. The conversion formula is 1/Sensitivity/1000.
 Calculation unit mv/V: AT+DCPCU=MVPV.
- 4) Sensitivity unit is V/Eu. The conversion formula is 1/Sensitivity/1000.
 Calculation unit is mv: AT+DCPCU=MV.

7.3 Other Loadcells

Three axis and uni-axial loadcells from SRI can also be connected to M8228. Please follow the method described below to get the matrix.

Three Axis loadcell

Voltage Calibration								
Bridge	Capacity	Zero Offset	Nonlinearity	Hysteresis	Output @ Capacity	Sensitivity	Change	
	N/Nm	mV/V	%FS	%FS	mV/V	mV/V/EU	%	
FX	-20000	0.0101	-0.13	-0.28	-2.8941	1.4471E-04	0.00	
FY	20000	-0.0027	0.11	0.19	2.8894	1.4447E-04	0.00	
FZ	-20000	0.0175	-0.07	-0.27	-0.5441	2.7207E-05	0.00	

Sensitivity unit is mV/V/Eu. The diagonal elements of the matrix are the inverse of the sensitivities (1/Sensitivity).

The Commands to input the matrix coefficients and to set the calculation unit are as follows:

6910.3725	0	0	0	0	0
0	6921.8523	0	0	0	0
0	0	36755.2468	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

So, send the following commands to M8228 to set decoupled matrix and unit.

```
AT+DCPM=(6910.3725,0,0,0,0,0);(0,6921.8523,0,0,0,0);(0,0,36755.2468,0,0,0)
;(0,0,0,0,0,0);(0,0,0,0,0,0); (0,0,0,0,0,0)
AT+DCPCU=MVPV
```

Torque Sensor

Voltage Calibration							
Bridge	Capacity	Zero Offset	Nonlinearity	Hysteresis	Output @ Capacity	Sensitivity	Change
	Nm	V	%FS	%FS	V	V/EU	%
MZ	100	-0.0049	0.04	0.27	2.0445	2.0445E-02	0.00

Sensitivity unit is V/Eu.

The first row and the first column equals to 1/sensitivity/1000.

Calculation unit is mV.

0.048913	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

So, send the following commands to M8228 to set decoupled matrix and unit.

AT+DCPM=(0.048913,0,0,0,0,0);(0,0,0,0,0,0);(0,0,0,0,0,0);(0,0,0,0,0,0);(0,0,0,0,0,0);(0,0,0,0,0,0)

AT+DCPCU=MV

8. Advanced applications

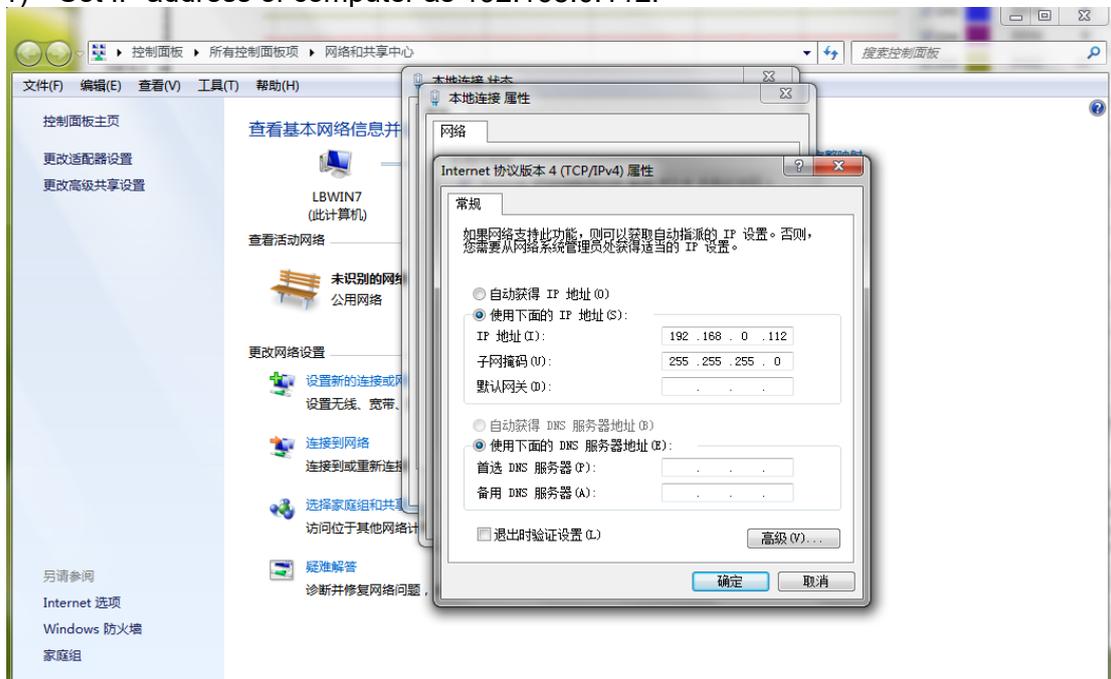
8.1 Connect two M8228 via Ethernet Router

Two M8228(1# and 2#) and PC are connected via a Ethernet Router.

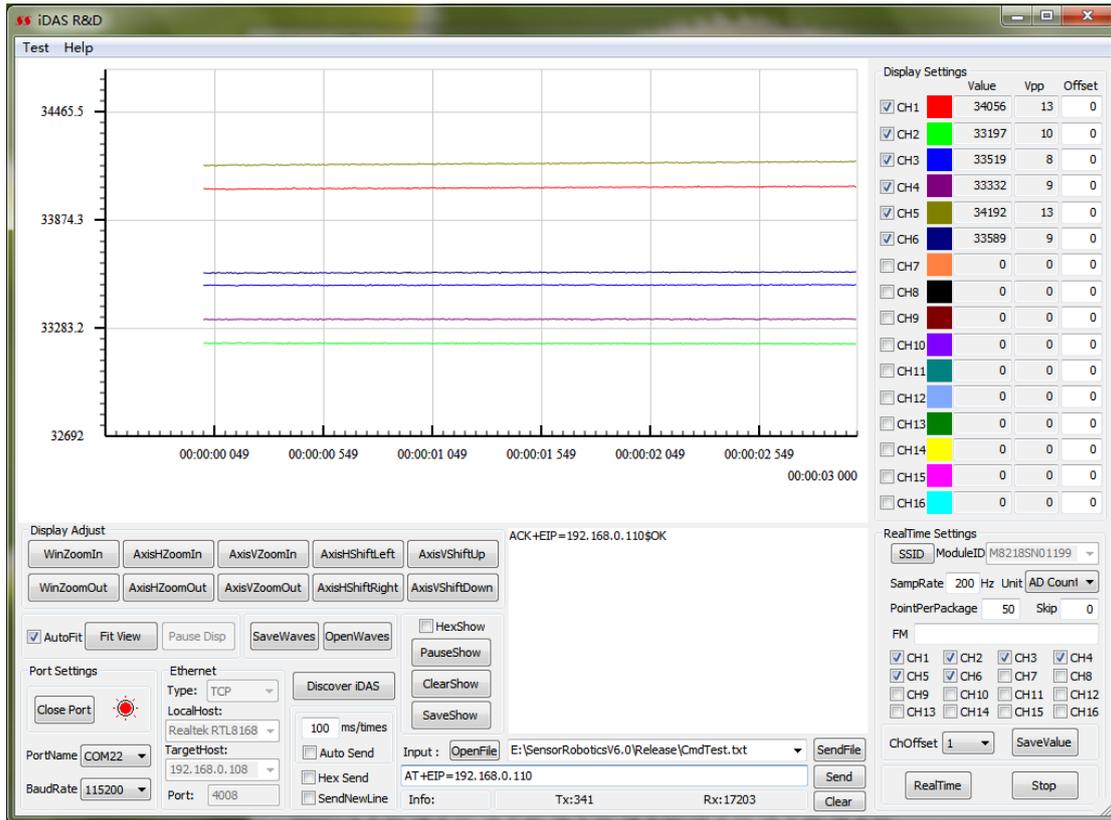


Configuration Steps:

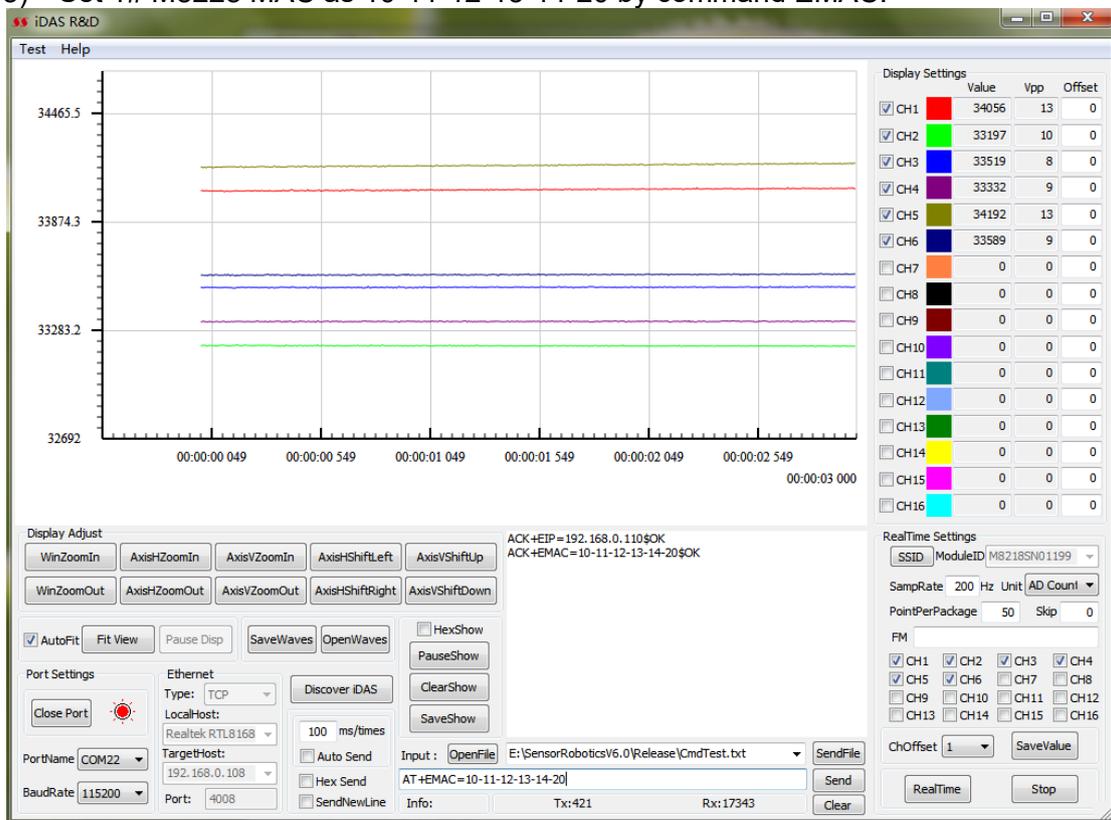
- 1) Set IP address of computer as 192.168.0.112.



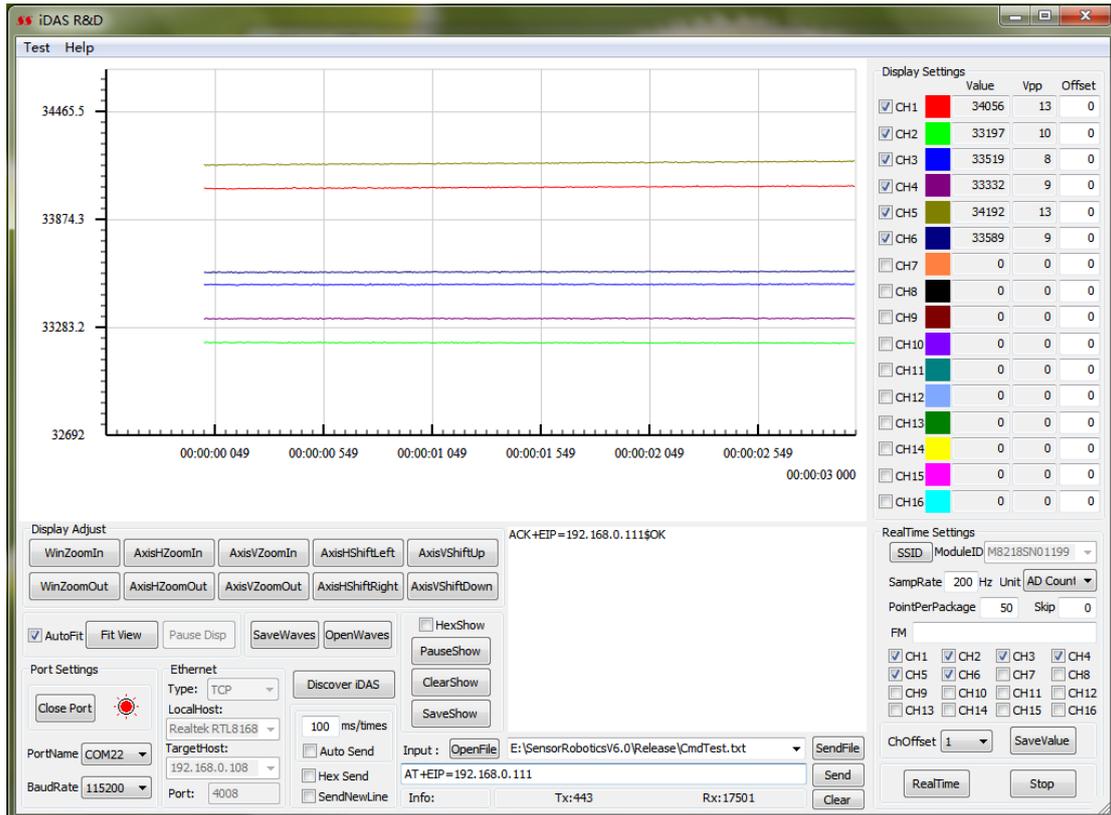
- 2) Set 1# M8228 IP address as 192.168.0.110 by command EIP.



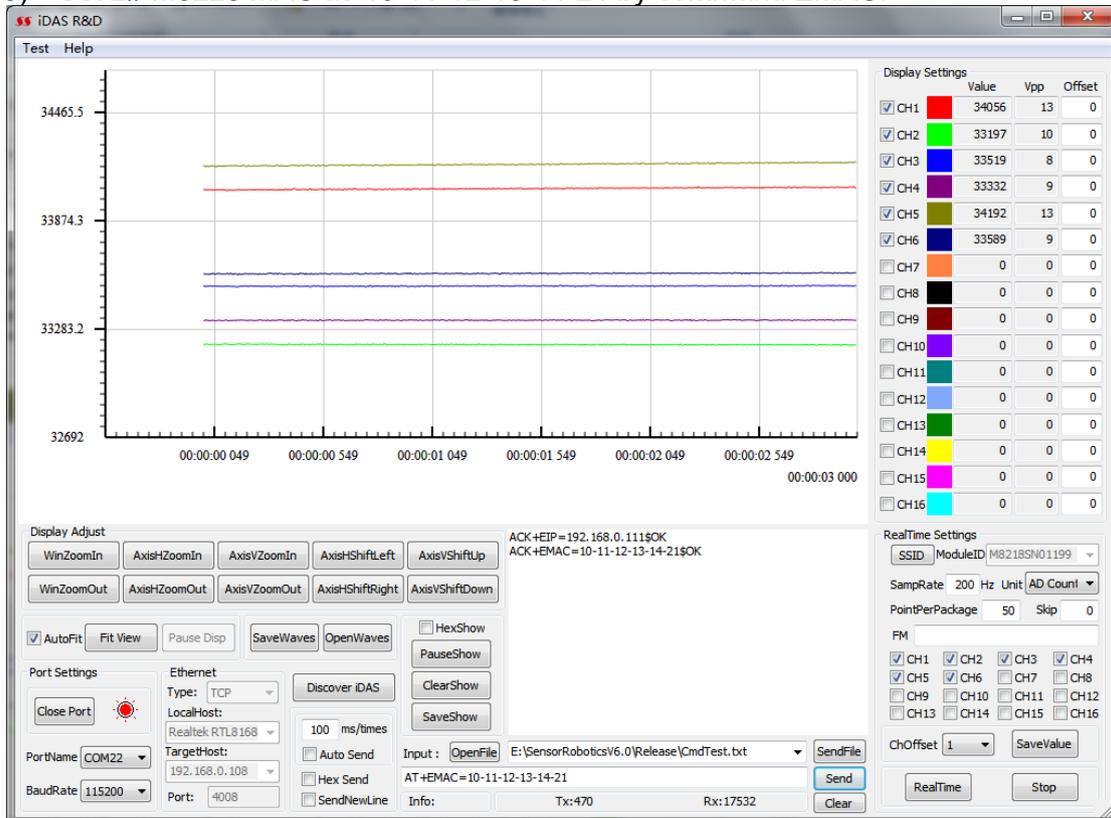
3) Set 1# M8228 MAC as 10-11-12-13-14-20 by command EMAC.



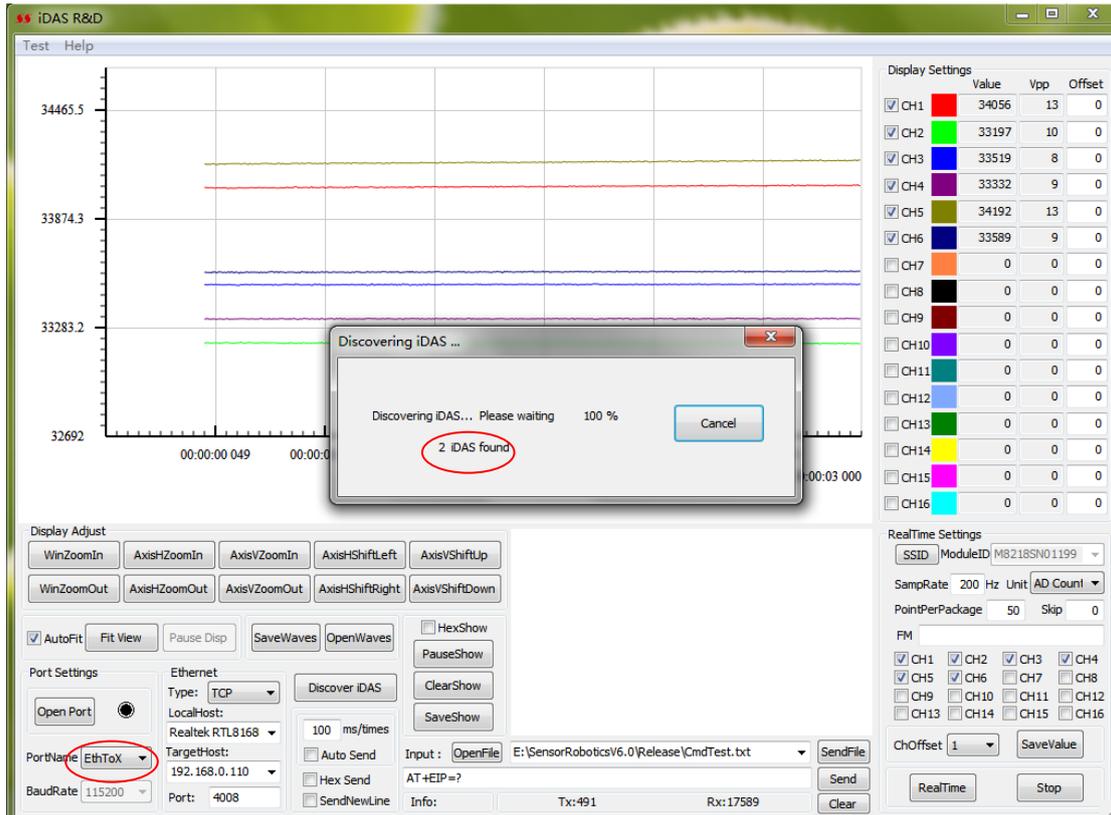
4) Set 2# M8228 IP address as 192.168.0.111 by command EIP.



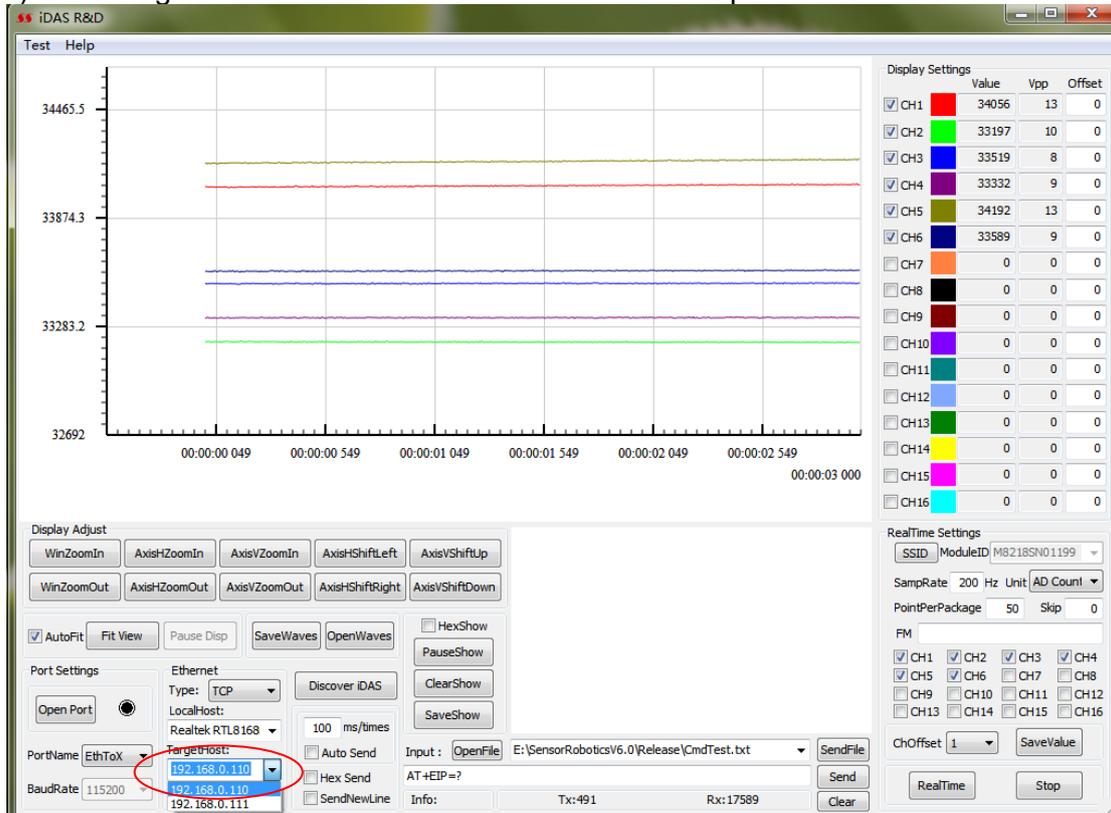
5) Set 2# M8228 MAC as 10-11-12-13-14-21 by command EMAC.



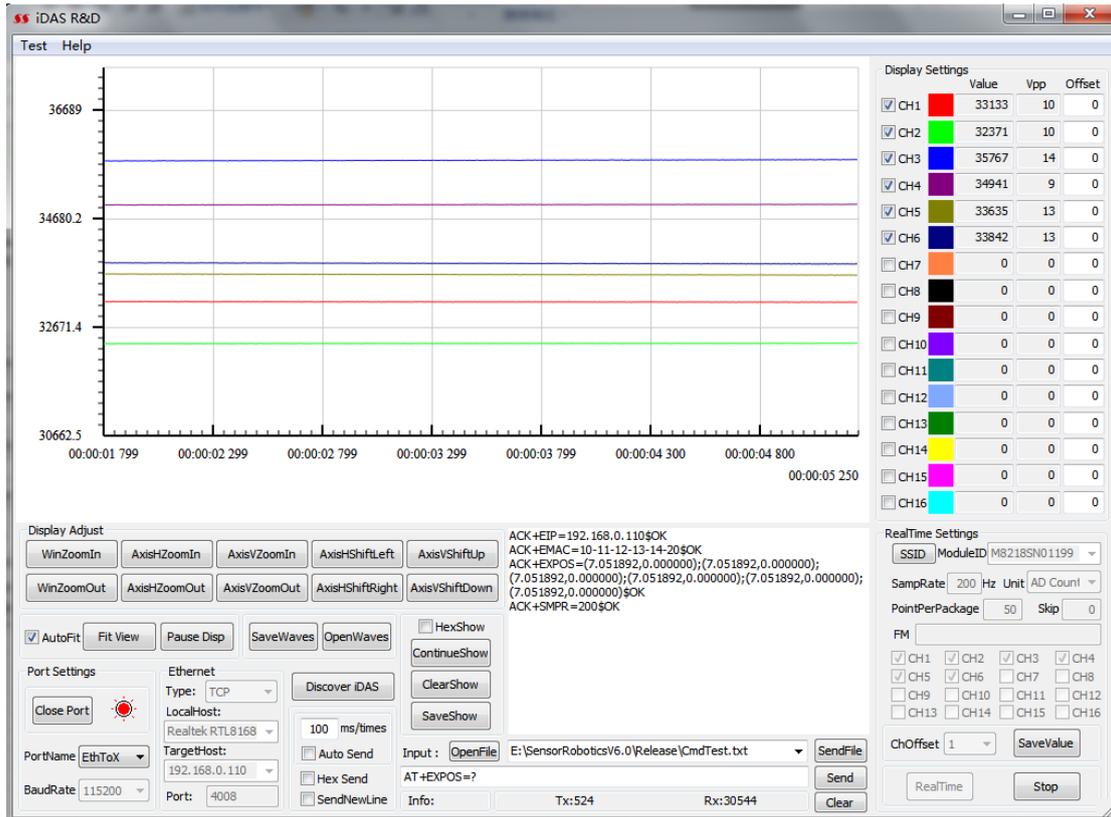
6) Set PortName as EthTox and search M8228 by clicking button DiscoveriDAS.



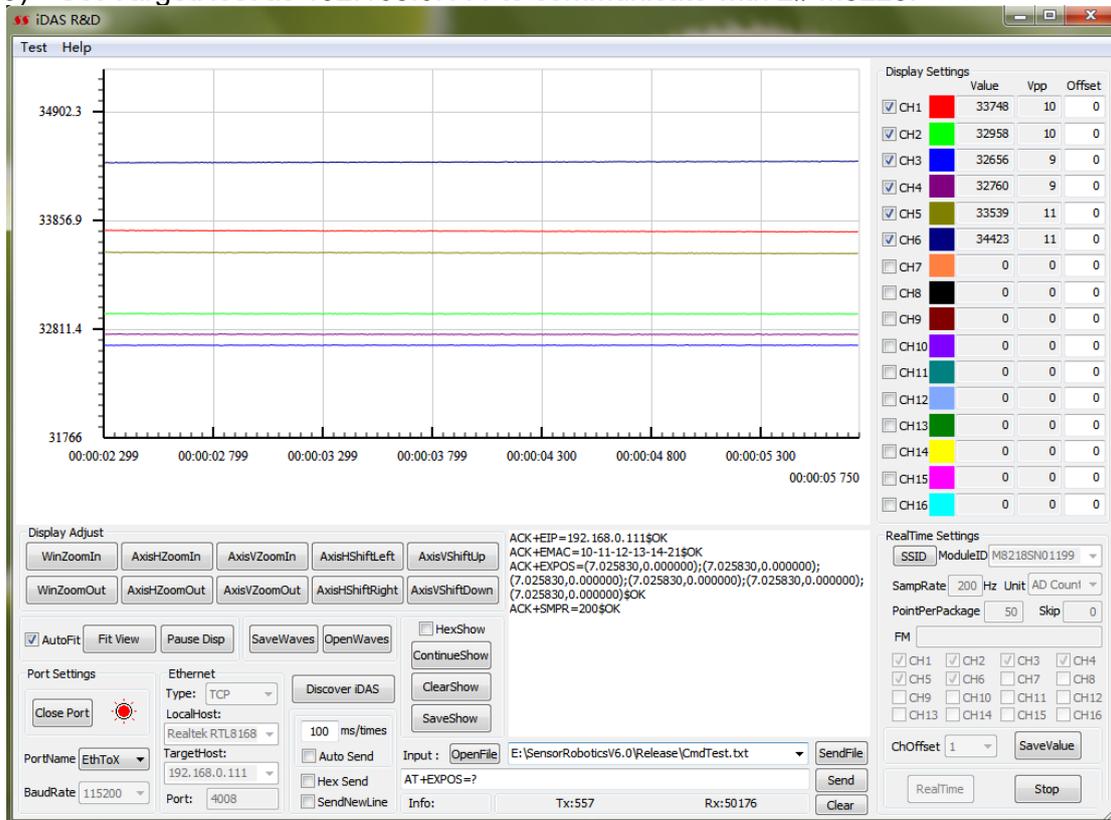
7) Set TargetHost as desired IP and click the button Open Port.



8) Set TargetHost as 192.198.0.110 to communicate with 1# M8228.

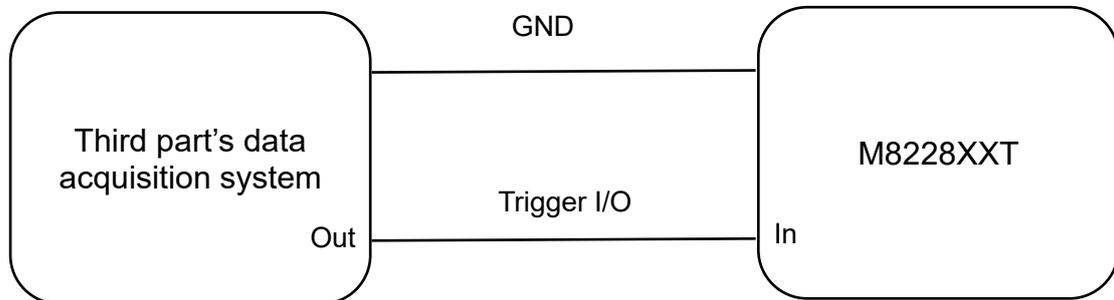


9) Set TargetHost as 192.168.0.111 to communicate with 2# M8228.



8.2 Synchronous sampling with other system

M8228xxT supports digital I/O trigger, therefore M8228XXT can sample sensor signals with other data acquisition system Synchronously.



To trigger M8228XXT, please follow the steps:



- 1) Power on all related equipment.
- 2) Run software iDAS RD and connect to M8228XXT. Please refer to chapter 2.
- 3) Click "Realtime" on the iDAS RD software. Please refer to chapter 2.
- 4) When TRIG shift to 0 (< 0.3V), M8228XXT will be triggered. Note that I/O must hold 0 until test end. Switch TRIG to 1 (>2.7V) to end test.

9. Dimension

