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Instruction Manual of ForceSensorEvaluationKit5

Outline

This document is the instruction manual for ForceSensorEvaluationKit5.
ForceSensorEvaluationKit5 can acquire MMS101 logging data by PC and USB communication or Ethernet communication. For Ethernet communication, up to 5 MMS101 can be connected and acquired simultaneously.
Refer to the datasheet for more information on MMS101.

Rev.1

2022.11.1
MITSUMI ELECTRIC CO.,LTD.
Semiconductor Business Div.

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INDEX

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■ Evaluation Kit Configuration

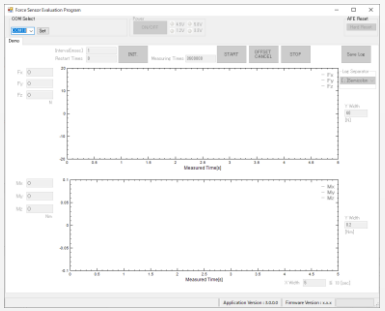
This evaluation kit consists of below:

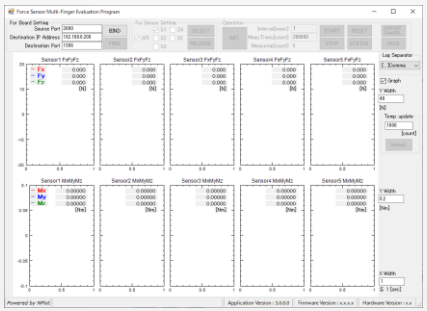
✓ Force sensor sample

✓ Conversion Board Conv.BD Ver1.1

✓ Evaluation Board ForceSensorMultiFingerEvaBoard Ver.3.0
FW Ver.0.1.0.1

✓ Evaluation App. ForceSensor_EvaliationProgram Ver. 3.0.0.0





✓ Cable

- For sensor connection

- Ethernet cable

※Ethernet cable is not included.
Required Spec. Ethernet cable:
Cat5e or higher/ RJ-45 Plug

- USB Type-C cable

※USB cable is not included.
Required Spec. USB cable: USB ver2.0/Type-C

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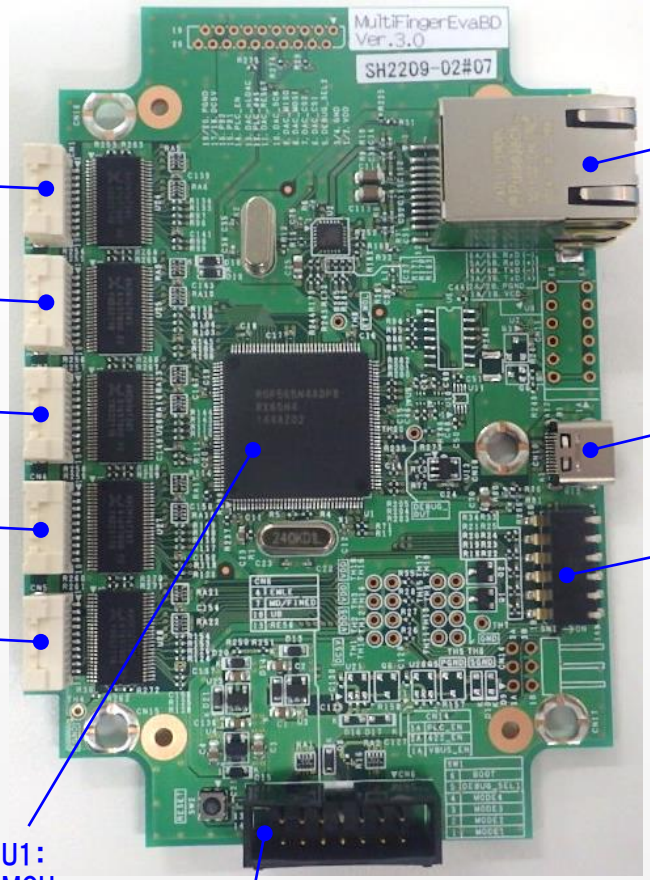
■ Evaluation Board

ForceSensorMultiFingerEvaBoardVer3.0
Board size: 80x115mm



CN1:
Sensor connector(S1)

CN2:
Sensor connector(S2)

CN3:
Sensor connector(S3)

CN4:
Sensor connector(S4)

CN5:
Sensor connector(S5)

CN7:
Modular Jack

CN10:
USB Type-C connector

SW11:
Mode-setting DIP SW

U1:
MCU

CN6:
Connector (for JTAG)

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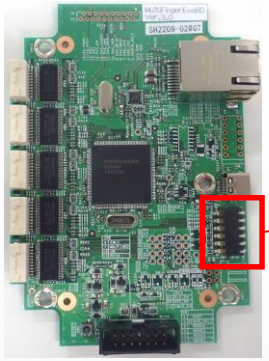
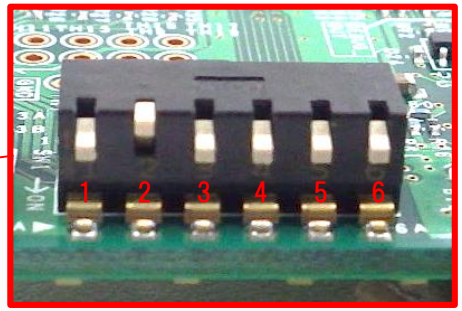
■ Setting The Evaluation Board

Mode-setting DIP SW

Set the interface and IP address to communicate with Host (only in Ethernet).



Mode-setting DIP SW



*DIP SW5, 6 are fixed to OFF (↓).

- Interface Settings

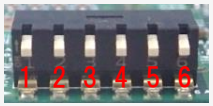
I/F	DIP SW1	DIP SW2
USB	OFF(↓)	OFF(↓)
Ethernet	OFF(↓)	ON(↑)

- IP Address Settings (only in Ethernet)

IP Address	DIP SW3	DIP SW4
192.168.0.200	OFF(↓)	OFF(↓)
192.168.0.201	OFF(↓)	ON(↑)

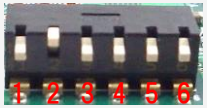
Setting e.g.:

✓I/F：USB



DIP SW1	DIP SW2	DIP SW3	DIP SW4	DIP SW5	DIP SW6
OFF(↓)	OFF(↓)	OFF(↓)	OFF(↓)	OFF(↓)	OFF(↓)

✓I/F: Ethernet, IP Address: 192.168.0.200



DIP SW1	DIP SW2	DIP SW3	DIP SW4	DIP SW5	DIP SW6
OFF(↓)	ON(↑)	OFF(↓)	OFF(↓)	OFF(↓)	OFF(↓)

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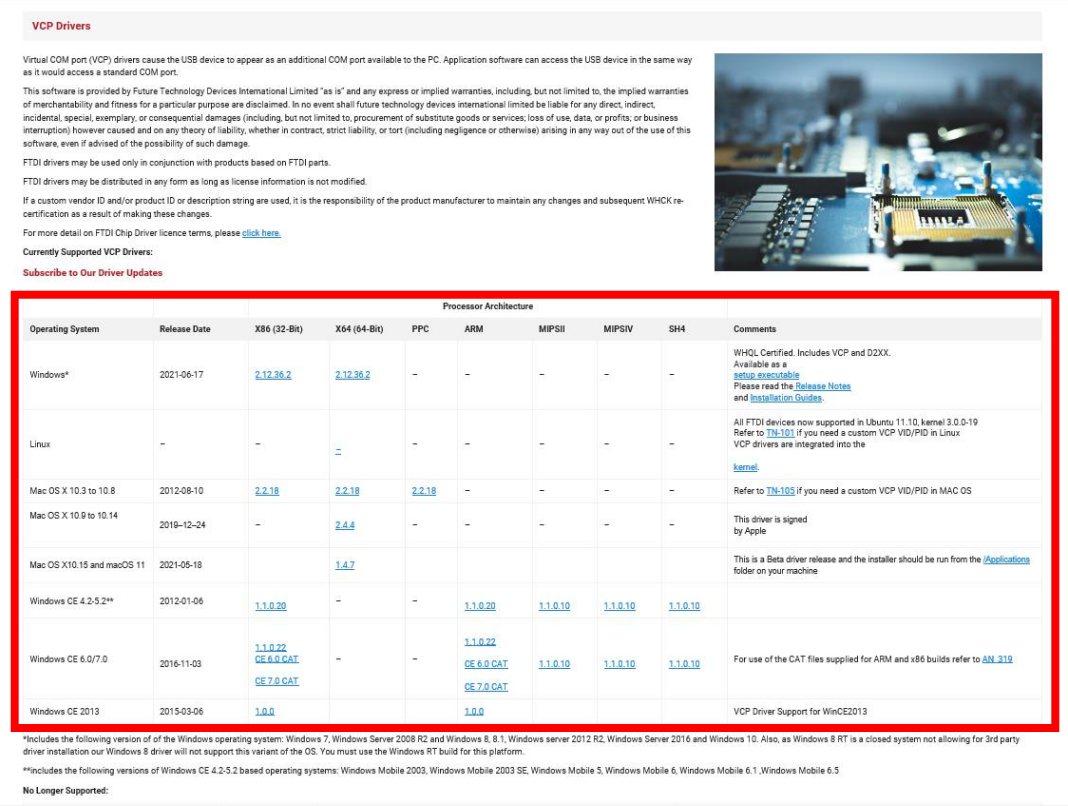
■ USB Communication_Driver Introduction Method

This evaluation board operate a UART-USB conversion of FTDI's IC.
To download or update the driver, please follow the steps below.

1. Download the latest driver file from the FTDI website.
   Please select the driver to your operating system.

   FTDI drivers download website:https://www.ftdichip.com/Drivers/VCP.htm



VCP Drivers

Virtual COM port (VCP) drivers cause the USB device to appear as an additional COM port available to the PC. Application software can access the USB device in the same way as it would access a standard COM port.

This software is provided by Future Technology Devices International Limited "as is" and any express or implied warranties, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose are disclaimed. In no event shall future technology devices international limited be liable for any direct, indirect, incidental, special, exemplary, or consequential damages (including, but not limited to, procurement of substitute goods or services; loss of use, data, or profits; or business interruption) however caused and on any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwise) arising in any way out of the use of this software, even if advised of the possibility of such damage.

FTDI drivers may be used only in conjunction with products based on FTDI parts.

FTDI drivers may be distributed in any form as long as license information is not modified.

If a custom vendor ID and/or product ID or description string are used, it is the responsibility of the product manufacturer to maintain any changes and subsequent WHCK re-certification as a result of making these changes.

For more detail on FTDI Chip Driver licence terms, please click here.

Currently Supported VCP Drivers:

Subscribe to Our Driver Updates

		Processor Architecture							
Operating System	Release Date	X86 (32-Bit)	X64 (64-Bit)	PPC	ARM	MIPSII	MIPSIV	SH4	Comments
Windows*	2021-06-17	2.12.36.2	2.12.36.2	–	–	–	–	–	WHQL Certified. Includes VCP and D2XX. Available as a setup executable Please read the Release Notes and Installation Guides.
Linux	–	–	–	–	–	–	–	–	All FTDI devices now supported in Ubuntu 11.10, kernel 3.0.0-19 Refer to TN-101 if you need a custom VCP VID/PID in Linux VCP drivers are integrated into the kernel.
Mac OS X 10.3 to 10.8	2012-08-10	2.2.18	2.2.18	2.2.18	–	–	–	–	Refer to TN-105 if you need a custom VCP VID/PID in MAC OS
Mac OS X 10.9 to 10.14	2019–12–24	–	2.4.4	–	–	–	–	–	This driver is signed by Apple
Mac OS X10.15 and macOS 11	2021-05-18		1.4.7						This is a Beta driver release and the installer should be run from the /Applications folder on your machine
Windows CE 4.2-5.2**	2012-01-06	1.1.0.20	–	–	1.1.0.20	1.1.0.10	1.1.0.10	1.1.0.10	
Windows CE 6.0/7.0	2016-11-03	1.1.0.22 CE 6.0 CAT CE 7.0 CAT	–	–	1.1.0.22 CE 6.0 CAT CE 7.0 CAT	1.1.0.10	1.1.0.10	1.1.0.10	For use of the CAT files supplied for ARM and x86 builds refer to AN_319
Windows CE 2013	2015-03-06	1.0.0			1.0.0				VCP Driver Support for WinCE2013

*Includes the following version of of the Windows operating system: Windows 7, Windows Server 2008 R2 and Windows 8, 8.1, Windows server 2012 R2, Windows Server 2016 and Windows 10. Also, as Windows 8 RT is a closed system not allowing for 3rd party driver installation our Windows 8 driver will not support this variant of the OS. You must use the Windows RT build for this platform.

**includes the following versions of Windows CE 4.2-5.2 based operating systems: Windows Mobile 2003, Windows Mobile 2003 SE, Windows Mobile 5, Windows Mobile 6, Windows Mobile 6.1 ,Windows Mobile 6.5

No Longer Supported:

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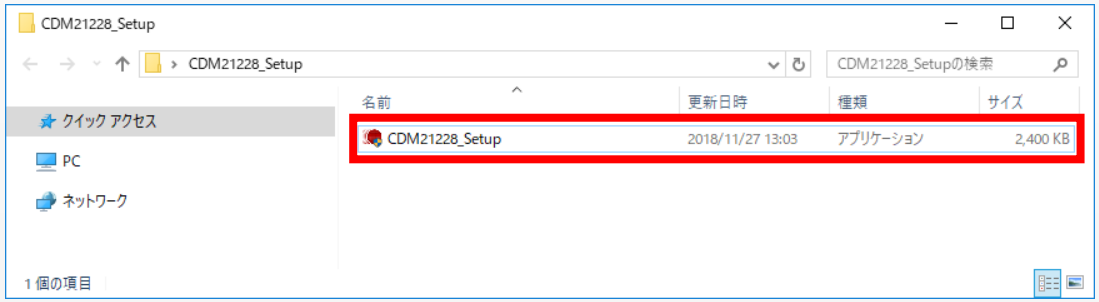
e.g.: For Windows

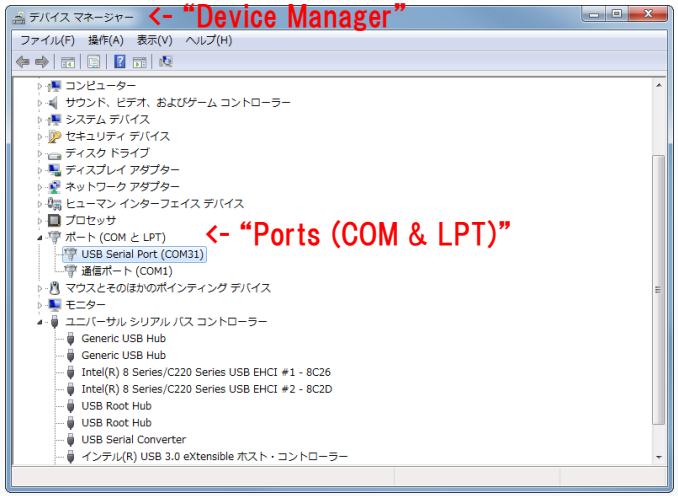
Operating System	Release Date	Processor Architecture: X86 (32-Bit)	X64 (64-Bit)	PPC	ARM	MIPSII	MIPSIV	SH4	Comments
Windows*	2021-06-17	2.12.36.2	2.12.36.2	–	–	–	–	–	WHQL Certified. Includes VCP and D2XX. setup executable Please read the Release Notes and Installation Guides
Linux	–	–	–	–	–	–	–	–	All FTDI devices now supported in Ubuntu 11.10, kernel 3.0.0-19 Refer to TN-101 if you need a custom VCP VID/PID in Linux VCP drivers are integrated into the kernel.
Mac OS X 10.3 to 10.8	2012-08-10	2.2.18	2.2.18	2.2.18	–	–	–	–	Refer to TN-105 if you need a custom VCP VID/PID in MAC OS
Mac OS X 10.9 to 10.14	2019–12–24	–	2.4.4	–	–	–	–	–	This driver is signed by Apple
Mac OS X10.15 and macOS 11	2021-05-18		1.4.7						This is a Beta driver release and the installer should be run from the /Applications folder on your machine
Windows CE 4.2-5.2**	2012-01-06	1.1.0.20	–	–	1.1.0.20	1.1.0.10	1.1.0.10	1.1.0.10	
Windows CE 6.0/7.0	2016-11-03	1.1.0.22 CE 6.0 CAT CE 7.0 CAT	–	–	1.1.0.22 CE 6.0 CAT CE 7.0 CAT	1.1.0.10	1.1.0.10	1.1.0.10	For use of the CAT files supplied for ARM and x86 builds refer to AN_319
Windows CE 2013	2015-03-06	1.0.0			1.0.0				VCP Driver Support for WinCE2013

Click “setup executable” and download the setup file

The following file will be downloaded.
Click “CDM21228_Setup”, and install according to the displayed information.



2. After the installation is completed, confirm that “USB Serial Converter” and “USB Serial Port (COMx)” are displayed in the device manager with the evaluation board connected.
*When connecting for the first time, recognition may take some time.



3. USB Serial Port (COMx) is required for communication settings. Check the assigned port number.
*The port number assignment differs depending on the PC.

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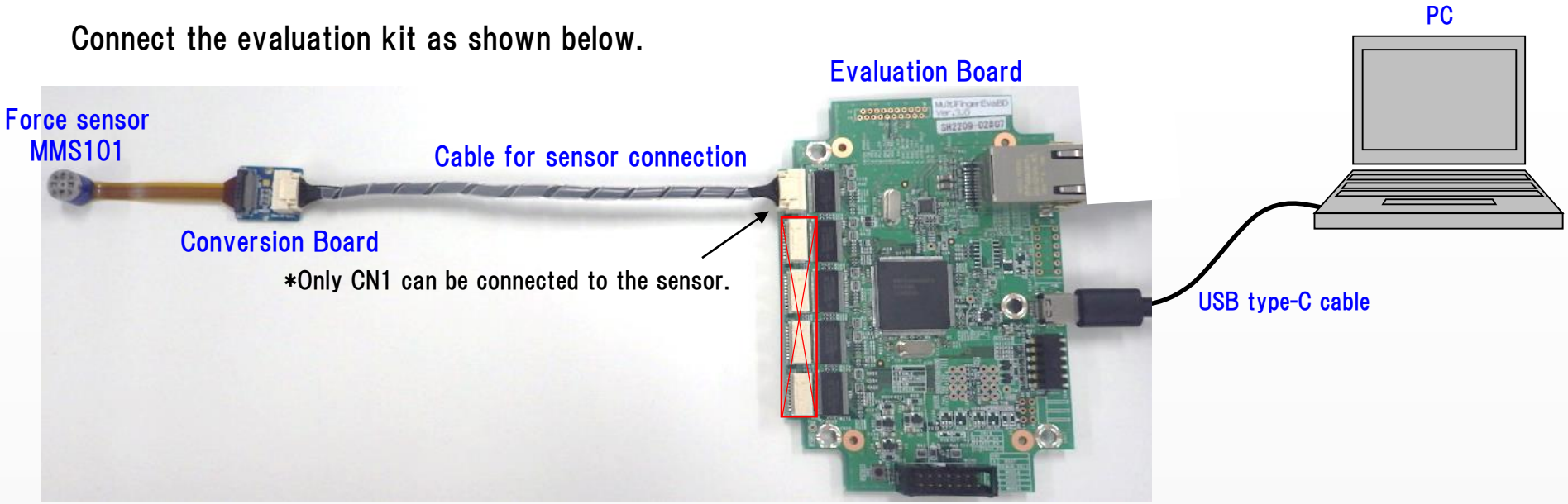
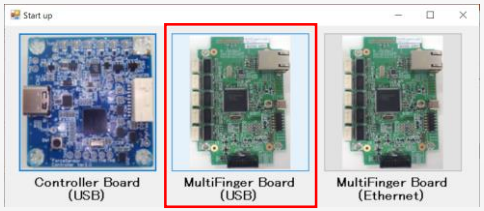
■ USB Communication_Evaluation Kit Start

Connect the evaluation kit as shown below.



After the connection of the evaluation kit is completed, start “ForceSensor_EvaluationProgram.exe” in the “ForceSensor_EvaluationProgram_ver.3.0.0.0” zip file.
When the app is started, a ″Start up″ dialog will be displayed. Click “MultiFinger Board (USB)″.



*To operate this application, .NET Framework 3.5 must be valid. The activation procedure is posted on the Microsoft website (the following URL). If it is not activated, activate it according to the contents of the website.

Microsoft .NET Framework 3.5 activation procedure homepage URL:
https://blogs.technet.microsoft.com/askcorejp/2018/10/05/enable_net35_win10/

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■ USB Communication_Evaluation App. Display Screen

Data acquisition interval setting
*The setting is 1-10000msec (1msec step)

Initiation button
*Read matrix correction coefficient from the AFE IC inside the sensor. Then the sensor operation is started. The button turns light green while sensor is operating.

Power switch
1.2V:Sensor digital power supply
4.5V:Power supply for sensor built-in LDO (sensor analog power supply)

Logging start button

Logging stop button

AFE IC (inside sensor) reset button

COM selection

Data save button
*Continuous measurement data is output as a CSV file,

Offset temperature correction update setting
*Offset temperature correction is performed for each set number of data acquisitions.

Log Separator Selection
(select the delimiter format for log data)

Fx,Fy,Fz measurement value

Fx,Fy,Fz measurement graph

Fx,Fy,Fz measurement graph Y-axis scale setting
*Set around 0 N

Number of measurement times

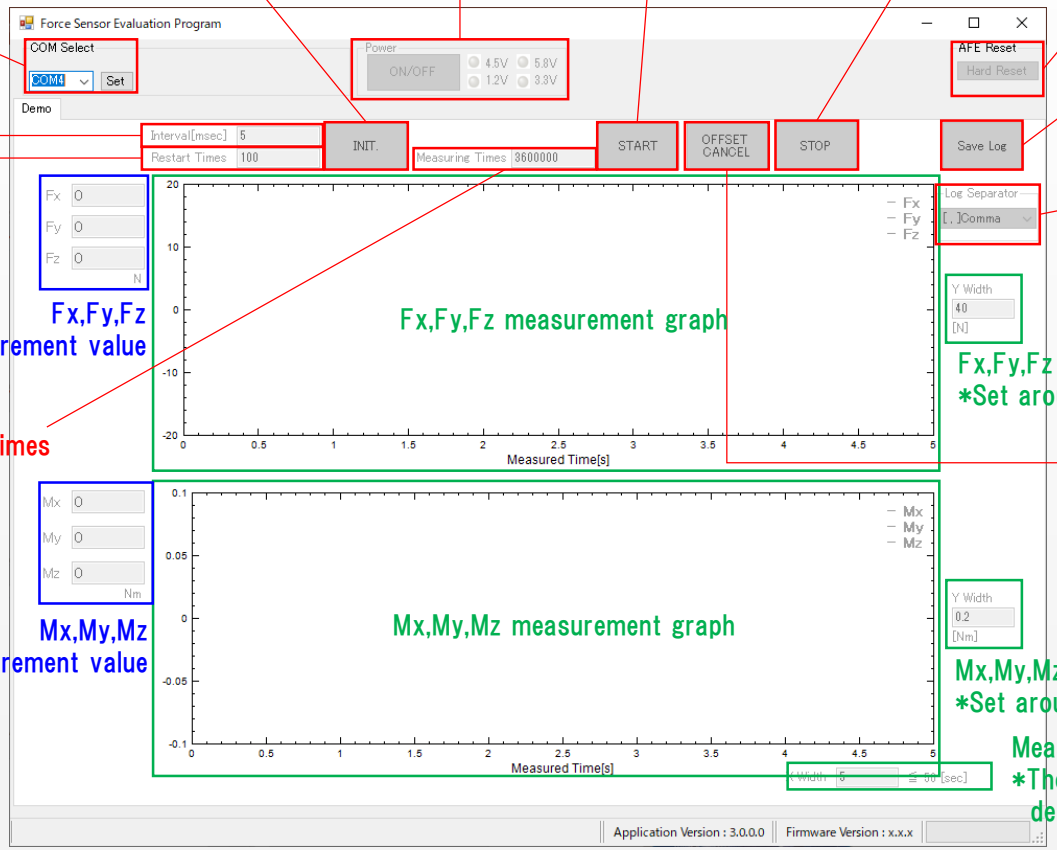
Offset cancel button
(change to light green when ON state.)

Mx,My,Mz measurement value

Mx,My,Mz measurement graph

Mx,My,Mz measurement graph Y-axis scale setting
*Set around 0 Nm

Measurement graph X-axis scale setting
*The maximum value that can be set changes depending value of interval



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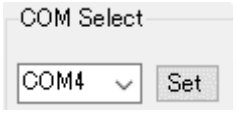
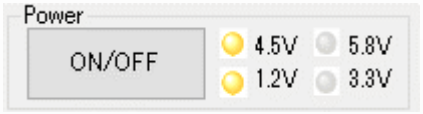
■ USB Communication_Evaluation App. Basic Instruction for Use

1. Select the COM port on the evaluation board. Click the “Set” button.

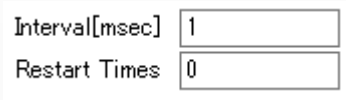


*The COM port depends on the PC.

2. Click the “ON/OFF” key on Power. => Turn on LED of 4.5V, 1.2V.



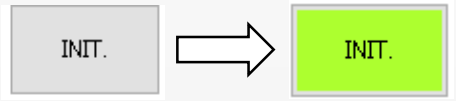
3. Enter Interval and Restart times.



*The temperature sensor value for offset/temperature control is updated every number of times the numerical value set in Restart Times is acquired.

e.g. Restart Times: 0 -> Temperature sensor value acquisition is the first time only. No temperature sensor value updating is performed thereafter.
Restart Times: 1 -> Update temperature sensor value every time
Restart Times: 10 -> Temperature sensor value updated once every 10 data acquisitions

4. Click the “INIT.” button.



*The sensor operation is started.
The “INIT.” button turns light green while the sensor is operating.
Click it again to stop the sensor operation.

5. Enter Measuring Times.

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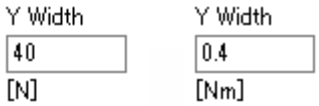
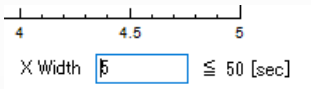
■ USB Communication_Evaluation App. Basic Instruction for Use

6. Enter Y Width. (Value can be changed even during measurement)



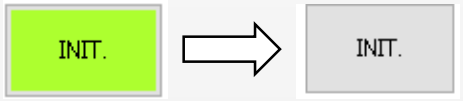
7. Enter X Width. (Value can be changed even during measurement)



8. Click the “START” button. => The data logging starts.

9. Click the “STOP” button. => The data logging stops.
   If the data of Measuring Times se before measurement is acquired, measurement will stop without clicking the “STOP” button.

10. Click the “INIT.” button => The sensor operation stops.



*The sensor operation is stopped.
The “INIT.” button turns gray after the sensor operation stops.

*Before replacing the sample while the application is running, stop the sensor operation and press the ″ON/OFF″ key on Power to drop 4.5V, 1.2V. After replacement, press the ″ON/OFF″ key on Power again to turn on 4.5V, 1.2VLED, and then proceed from step 3 of the basic usage.

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■ USB Communication_Evaluation App. Offset Cancel Function

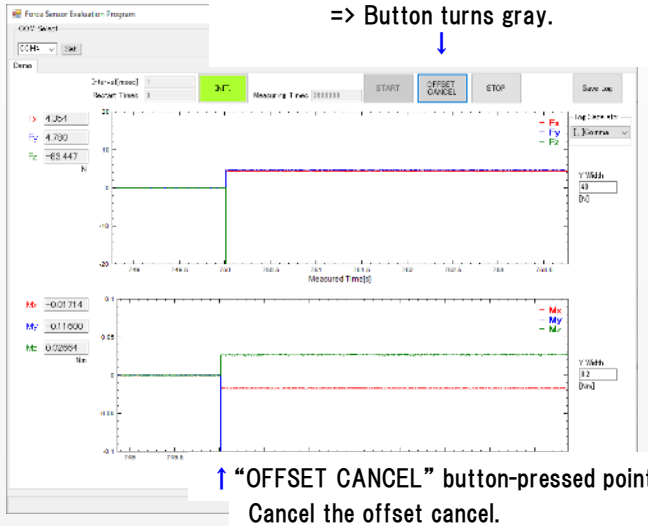
The sensor output has an initial offset. Offset also occurs in the mounted condition or in gravity.
It is possible to cancel the offset deviation with the “OFFSET CANCEL” button.
Click the “OFFSET CANCEL” button again to cancel the offset cancel.

↑Click “OFFSET CANCEL” button => Button turns light green.

↑“OFFSET CANCEL” button-pressed point

Pressing the ″OFFSET CANCEL″ key averages the last 10 readings and cancels the offset.

Click “OFFSET CANCEL” button again.
=> Button turns gray.



↑“OFFSET CANCEL” button-pressed point

Cancel the offset cancel.

Please click the ″OFFSET CANCEL″ button after more than 5min has elapsed since sensor operation started to use.
*It is recommended that the output (initial-drift) stabilization wait time after sensor activation be equal to or greater than 5min.

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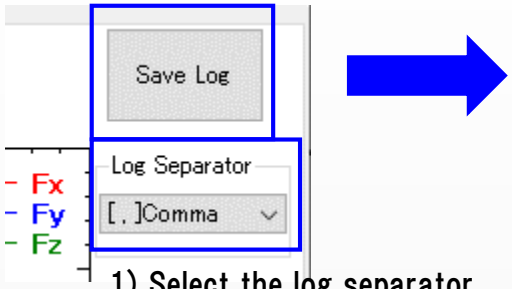
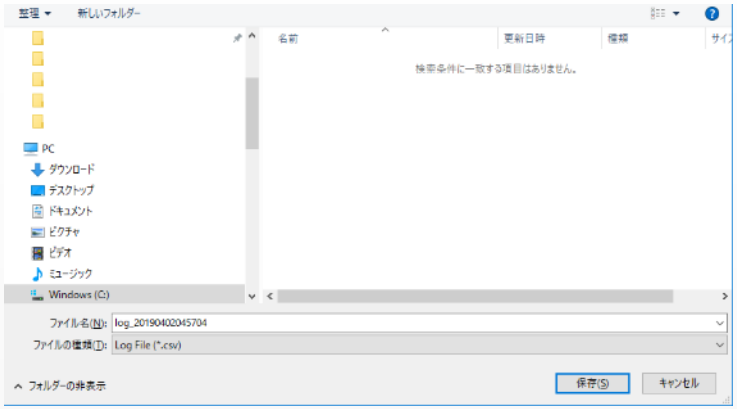
■ USB Communication_Evaluation App. Log Data Save Function

2) Click the “Save Log” button.



1) Select the log separator.
[,]Comma
[;]Semicolon
[ ]Tab

The following window will be displayed. Enter the file name and click the “Save” button.



The data will be saved in the following format.

	A	B	C	D	E	F	G	H	I
1	2019/4/3 14:20								
2	count[times]	Measured Time[s]	Fx Value[N]	Fy Value[N]	Fz Value[N]	Mx Value[Nm]	My Value[Nm]	Mz Value[Nm]	Temp.Value[degC]
3	1	0.00244	0.014	−0.095	−1.537	0.00095	−0.0007	−0.00027	0
4	2	0.003681	0.013	−0.12	−1.318	0.00121	−0.00062	−0.00087	0
5	3	0.004922	0.009	−0.125	−1.214	0.00113	−0.00081	−0.00121	0
6	4	0.006161	−0.011	−0.106	−1.052	0.00119	−0.00085	−0.00088	0
7	5	0.0074	0.003	−0.111	−0.961	0.00093	−0.00067	−0.00131	0
8	6	0.008641	0.005	−0.133	−0.837	0.0012	−0.00091	−0.00124	0
9	7	0.009882	0.003	−0.099	−0.743	0.0009	−0.00081	−7.00E−05	0

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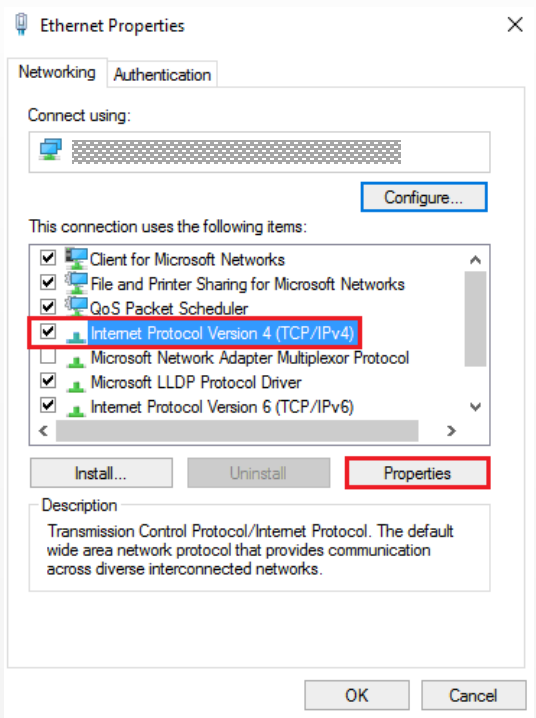
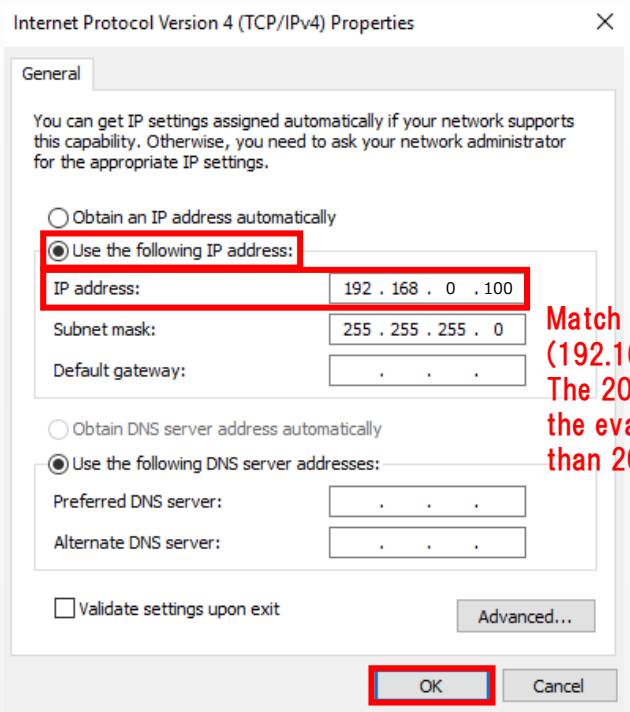
■ Ethernet Communication_Host(PC) Setting

Follow the procedures below to set Host(PC).

1. Select “Internet Protocol Version 4(TCP/IPv4)” in “Ethernet Properties” and select “Properties”.
2. In “Internet Protocol Version 4(TCP/IPv4)”, select “Use the following IP address:” checkbox, and then enter “IP address”. “Subnet mask” is automatically entered when IP address is entered.





Match IP addressing up to the third octet (192.168.0).
The 200 series of the 4th octet will be used on the evaluation board side. Please use other than 200 series.

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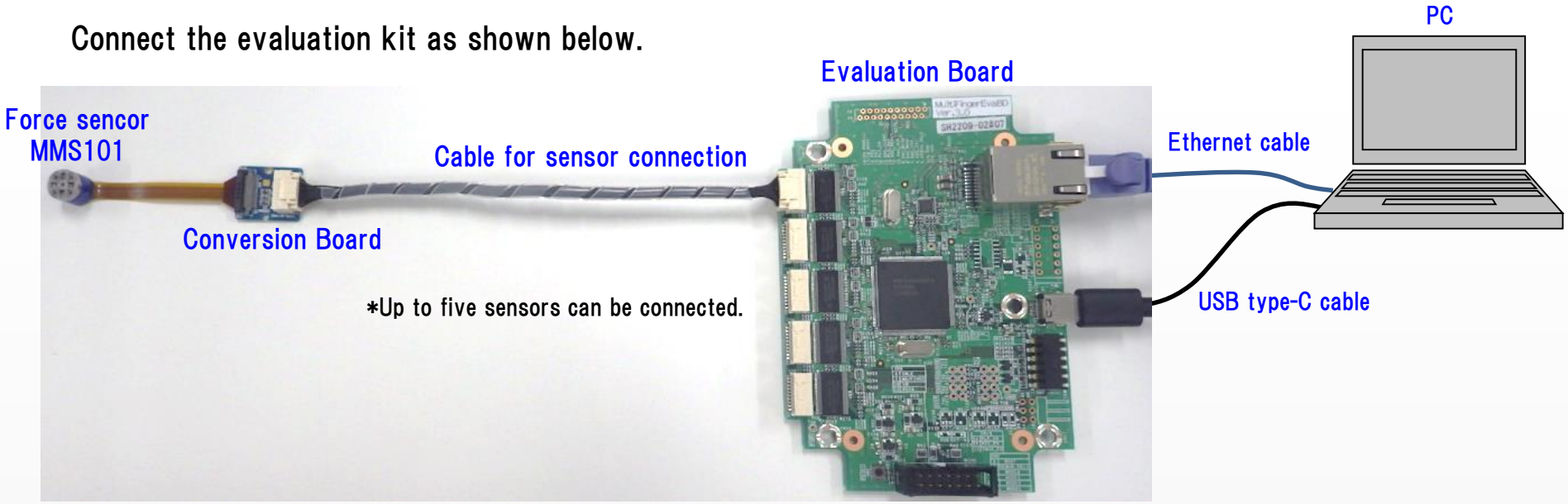
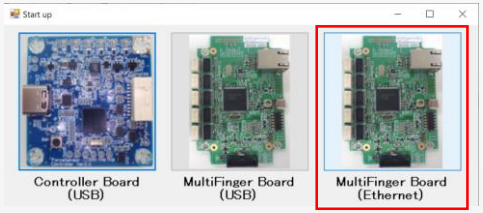
■ Ethernet Communication_Evaluation Kit Start

Connect the evaluation kit as shown below.



After the connection of the evaluation kit is completed, start “ForceSensor_EvaluationProgram.exe” in the “ForceSensor_EvaluationProgram_ver.3.0.0.0” zip file.
When the app is started, a ″Start up″ dialog will be displayed. Click “MultiFinger Board (Ethernet)″.



*To operate this application, .NET Framework 3.5 must be valid. The activation procedure is posted on the Microsoft website (the following URL). If it is not activated, activate it according to the contents of the website.

Microsoft .NET Framework 3.5 activation procedure homepage URL:
https://blogs.technet.microsoft.com/askcorejp/2018/10/05/enable_net35_win10/

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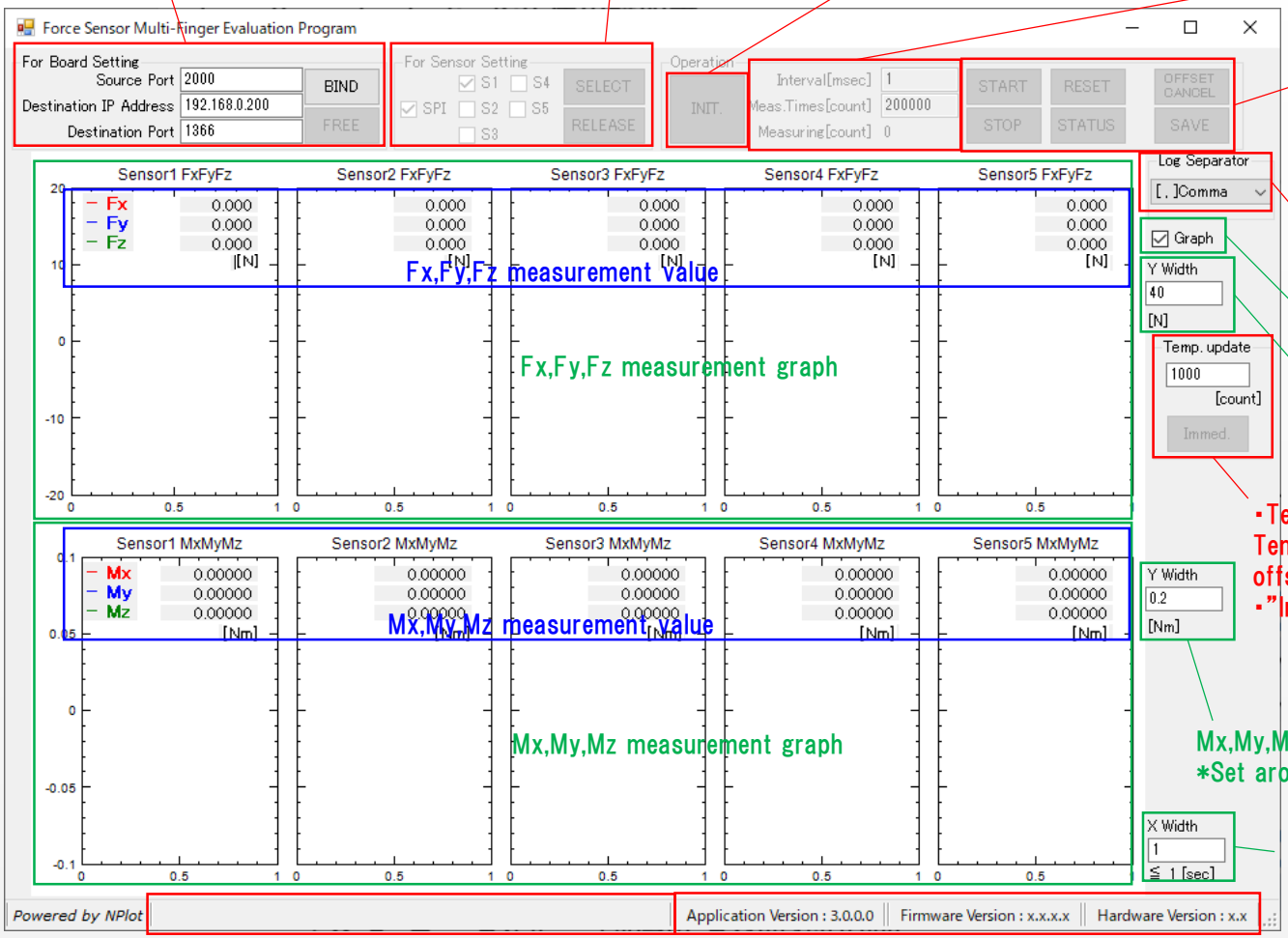
■ Ethernet Communication_Evaluation App. Display Screeen

Ethernet communication setting with board
- Source Port: PC port number
- Destination IP Address: Board IP address
- Destination Port: Board port number
- "BIND" button: Communication establishment
- "FREE" button: Communication release

Communication setting with sensor
- Select "SPI"
- S1~S5: Select the sensor to be measured

"INIT." button:
Read the matrix operation correction coefficients form the sensor, and start sensor operation. Change to light green during operation

Interval: Data acquisition interval setting
*The setting is 1-1000msec (1msec step)
Meas.Times: Number of measurements setting
Measuring: Number of measurements display



"START" button: Measurement start button
"STOP" button: Measurement stop button
"RESET" button: Board initialize button
"STATUS" button: Board state check button
"OFFSET CANCEL" button: Offset cancel button
"SAVE" button: Data save button
*Measurement data is output as a text data.

Log Separator Selection
(select the delimiter format for log data)

Graph drawing ON/OFF

Fx,Fy,Fz measurement graph Y-axis scale setting
*Set around 0 N

- Temp. update:
Temperature sensor value update setting for offset temperature correction
- "Immed." button: Temperature update button

Mx,My,Mzmeasurement graph Y-axis scale setting
*Set around 0 Nm

Measurement graph X-axis scale setting
*The maximum value that can be set changes depending value of interval

Displaying the response value of "STATUS" button

Version display

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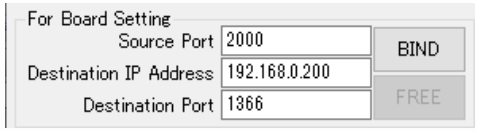
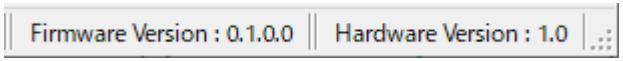
■ Ethernet Communication_Evaluation App. Basic Instruction for Use

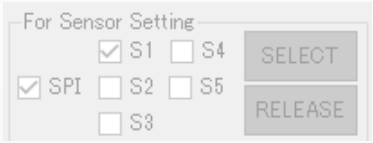
1. Communication setting with the board
   Set the port number, IP address, and the port number of the local PC, and then click "BIND". Button "FREE" to cancel.



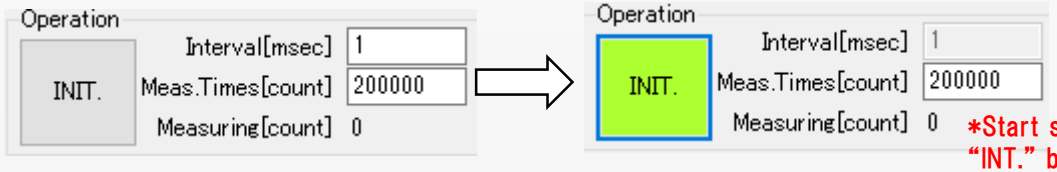
   When communication with the board is established, Firmware version and Hardware version of the board are displayed.



2. Selection of sensor to be measured
   Select SPI, select sensor 1~5 with S1~S5, and click "SELECT".
   Button "RELEASE" to cancel.

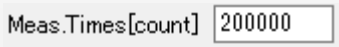


3. Enter "Interval" and press "INIT.".



*Start sensor operation. While the sensor is operating, the "INT." button turns to the light green button. Click again to stop sensor operating.

4. Enter "Meas.Times".



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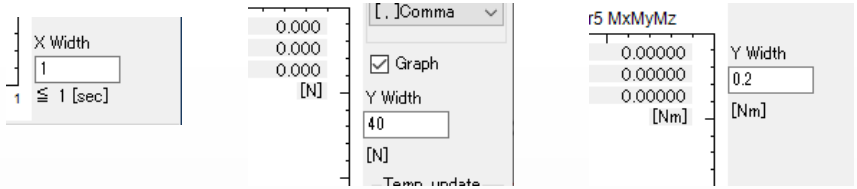
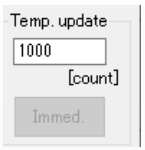
■ Ethernet Communication_Evaluation App. Basic Instruction for Use

5. Enter X Width and Y Width. (Value can be changed even during measurement)



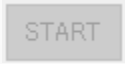
6. Enter Temp. update



*The temperature sensor value for offset/temperature control is updated every number of times the numerical value set in Restart Times is acquired.

e.g. Restart Times: 0 -> Temperature sensor value acquisition is the first time only. No temperature sensor value updating is performed thereafter.
Restart Times: 1 -> Update temperature sensor value every time
Restart Times: 10 -> Temperature sensor value updated once every 10 data acquisitions

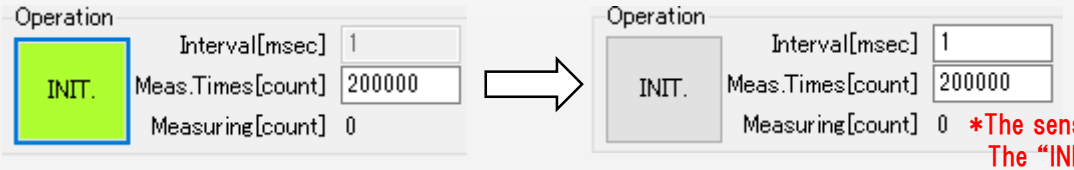
7. Click the “START” button. => The data logging starts.



8. Click the “STOP” button. => The data logging stops.
If the data of Measuring Times se before measurement is acquired, measurement will stop without clicking the “STOP” button.

9. You can disable chart drawing by unchecking ″Graph″.
Depending on the specification of PC, it may not be possible to acquire the data at the period set in ″Interval″ by dividing the processing capacity to draw the graph. You can override data acquisition by disabling graph drawing.

10. Click the “INIT.” button. => The sensor operation is stops.



*The sensor operation is stopped.
The “INIT.” button turns gray after the sensor operation stops.

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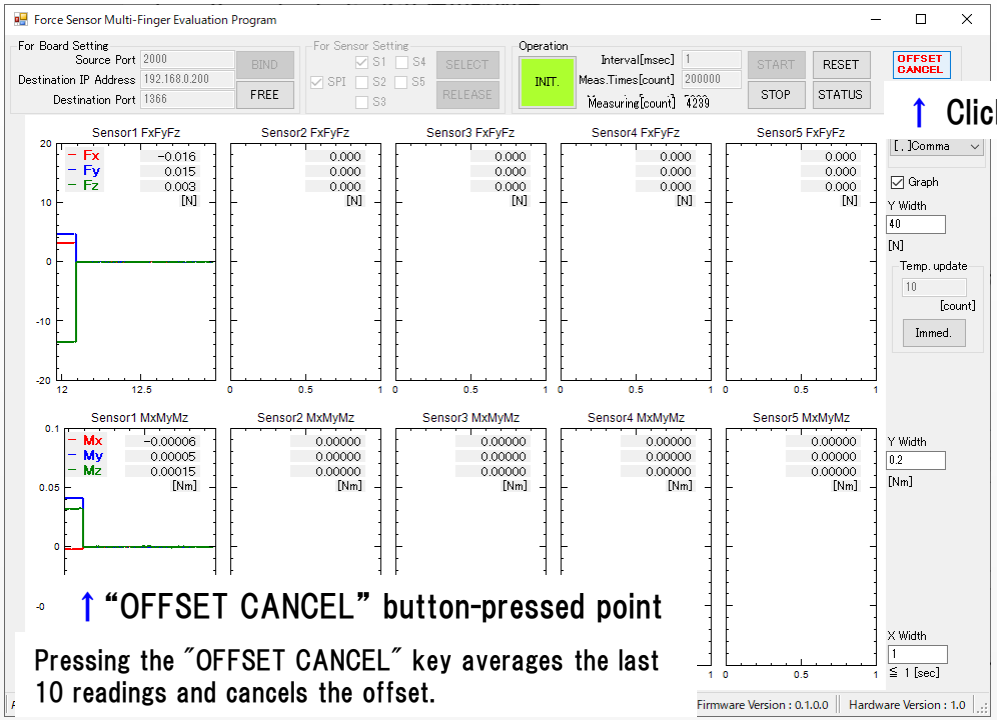
■ Ethernet Communication_Evaluation App. Offset Cancel Function

The sensor output has an initial offset. Offset also occurs in the mounted condition or in gravity.
It is possible to cancel the offset deviation with the “OFFSET CANCEL” button.
Click the “OFFSET CANCEL” button again to cancel the offset cancel.

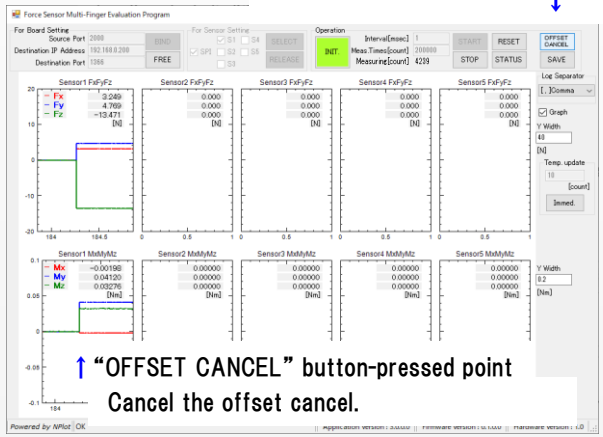


↑ “OFFSET CANCEL” button-pressed point

Pressing the ″OFFSET CANCEL″ key averages the last 10 readings and cancels the offset.

↑ Click “OFFSET CANCEL” button => It changes to red.

Click “OFFSET CANCEL” button again.
=>Return to black.



↑ “OFFSET CANCEL” button-pressed point

Cancel the offset cancel.

Please click the ″OFFSET CANCEL″ button after more than 5min has elapsed since sensor operation started to use.
*It is recommended that the output (initial-drift) stabilization wait time after sensor activation be equal to or greater than 5min.

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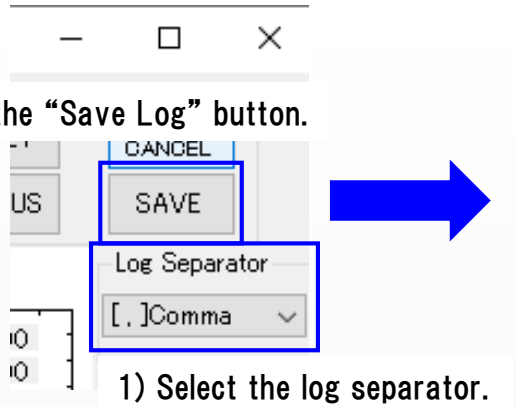
■ Ethernet Communication_Evaluation App. Log Data Save Function

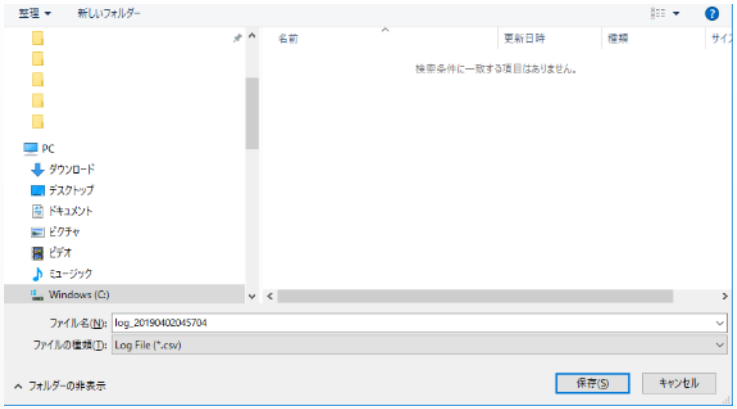
The data acquired by measurement can be saved with the “Save Log” button.



2) Click the “Save Log” button.

1) Select the log separator.
[,]Comma
[;]Semicolon
[ ]Tab

The following window will be displayed. Enter the file name and click the “Save” button.



The data will be saved in the following format.

	A	B	C	D	E	F	G	H	I
1	2019/4/3 14:20								
2	count[times]	Measured Time[s]	Fx Value[N]	Fy Value[N]	Fz Value[N]	Mx Value[Nm]	My Value[Nm]	Mz Value[Nm]	Temp.Value[degC]
3	1	0.00244	0.014	−0.095	−1.537	0.00095	−0.0007	−0.00027	0
4	2	0.003681	0.013	−0.12	−1.318	0.00121	−0.00062	−0.00087	0
5	3	0.004922	0.009	−0.125	−1.214	0.00113	−0.00081	−0.00121	0
6	4	0.006161	−0.011	−0.106	−1.052	0.00119	−0.00085	−0.00088	0
7	5	0.0074	0.003	−0.111	−0.961	0.00093	−0.00067	−0.00131	0
8	6	0.008641	0.005	−0.133	−0.837	0.0012	−0.00091	−0.00124	0
9	7	0.009882	0.003	−0.099	−0.743	0.0009	−0.00081	−7.00E−05	0