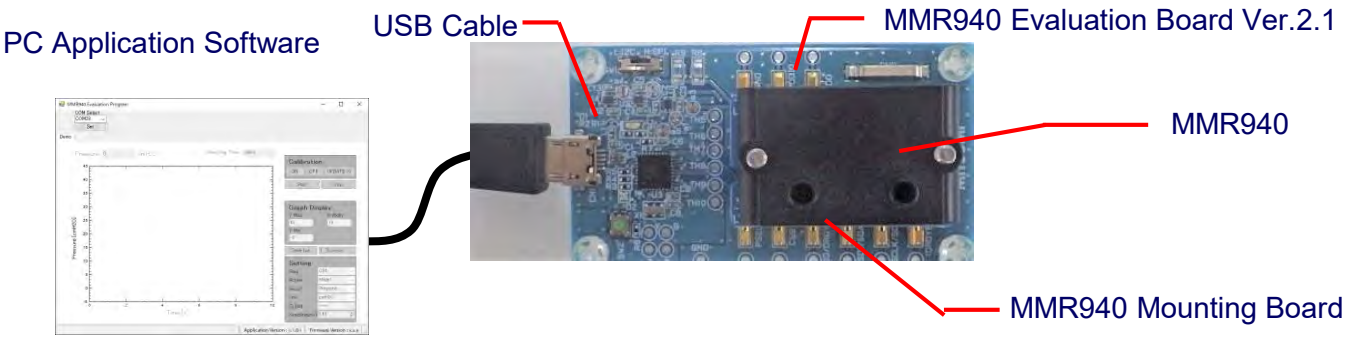
Micro Differential Pressure Sensor

MMR940 Evaluation Kit User's Manual

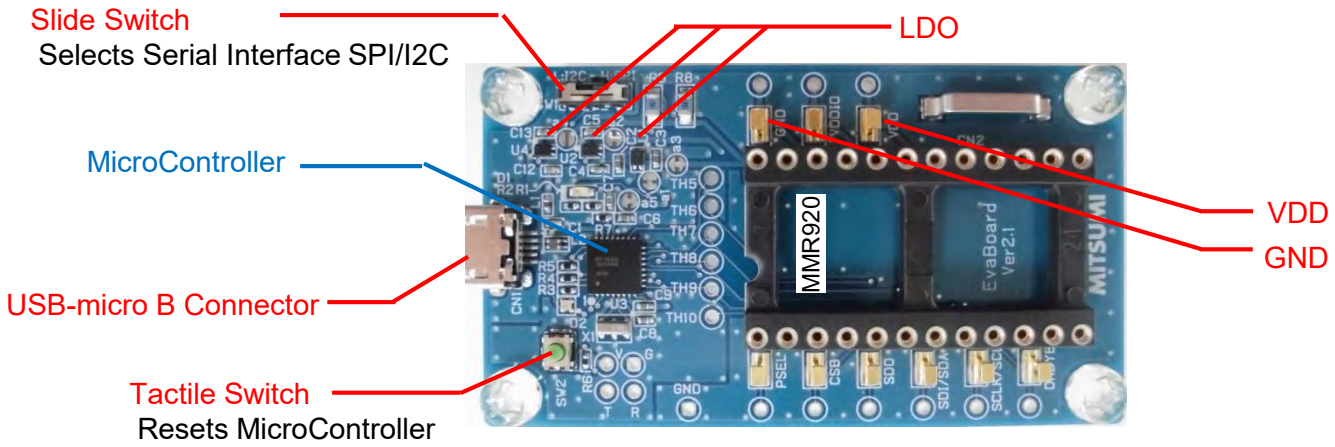
Rev.1.1

1. Evaluation kit

This evaluation kit consists of an evaluation board Ver. 2.1, a socket mounting board and PC application software.



1-1. Evaluation board Ver.2.1



1. Evaluation kit

1-2. Evaluation Application

When the “MMR940_EvaluationProgram.zip” file is unzipped, the file structure is as follows.
* Do not change the file structure.

MMR940_EvaluationProgram_ver.1.x.x.x
- MMR940_EvaluationProgram.exe : Application
- NPlot.dll : Library for drawing graphs
- UserData : Data storage folder
- cdc_inf : USB driver storage folder

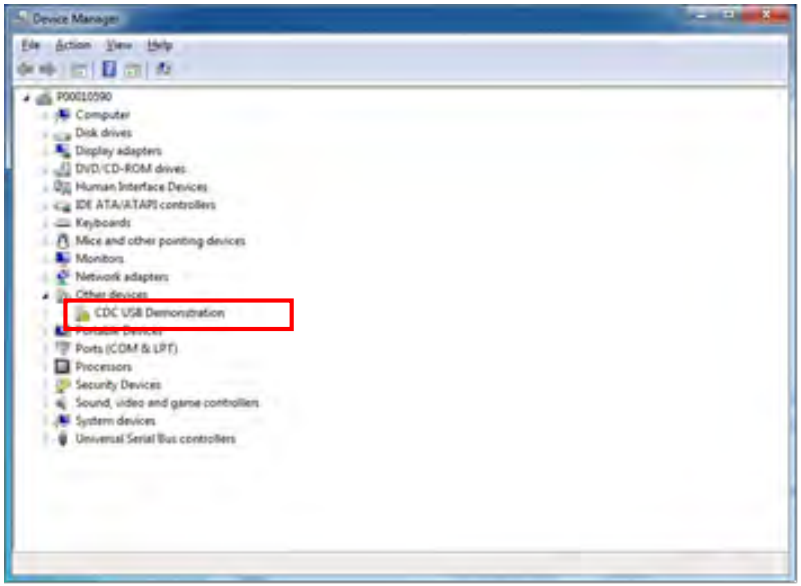
* “.NET Framework 3.5” is required.
  If it is not installed, download the file from Microsoft website and install it.

2. Driver installation and checking procedures

To use the evaluation board, a specific driver must be installed.
Install the driver following the procedures below.
* Target OS: Windows 7

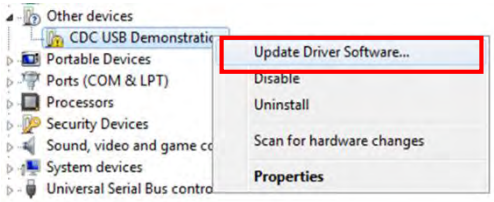
Windows 10 does not require driver installation.

2-1. Connect the evaluation board and the PC using a USB Micro-B cable.
2-2. Open [Device Manager] and right-click on [CDC USB Demonstration].

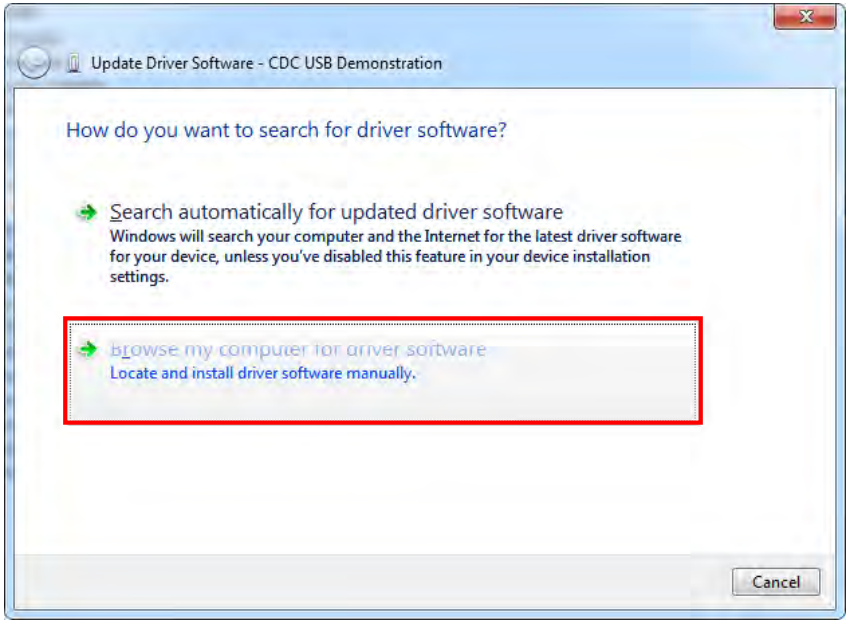


2. Driver installation and checking procedures

2-3. Open [Update Driver Software (P)…].

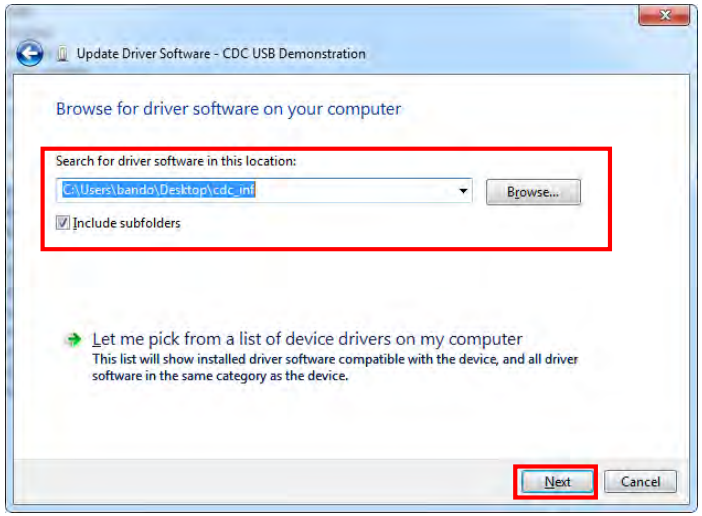


2-4. Select [Browse my computer for driver software (R)].

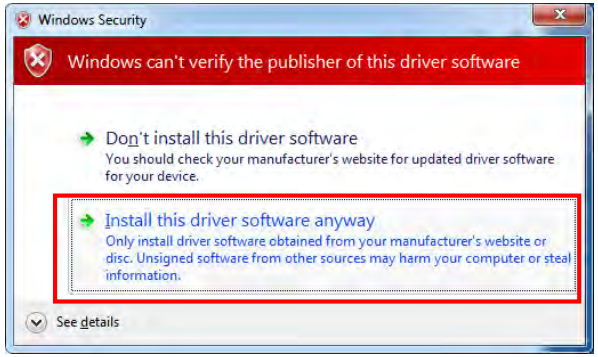


2. Driver installation and checking procedures

2-5. Click [Browse (R)] to select “cdc_inf file” in “MMR940_EvaluationProgram_ver.x.x.x.x” zip file. Then, click [Next].



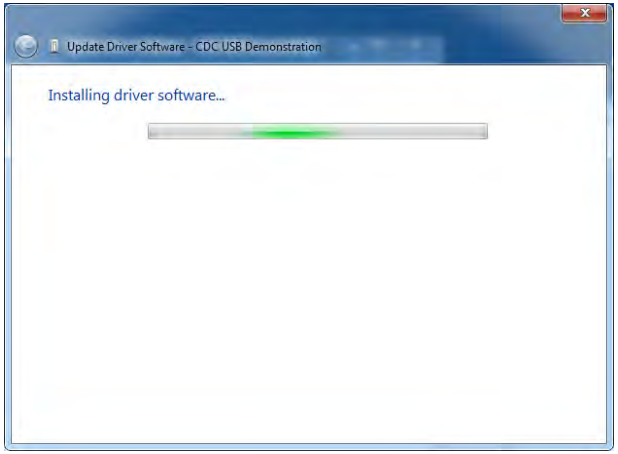
2-6. Click [Install this driver software anyway].



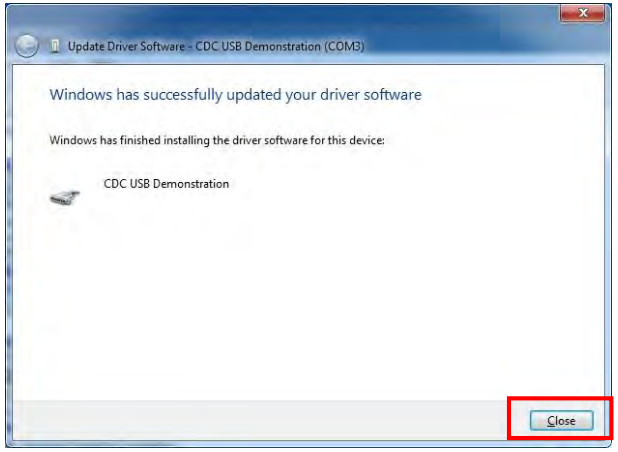
2. Driver installation and checking procedures

2-7. Installation will start.

* It may take several minutes until the installation is completed.

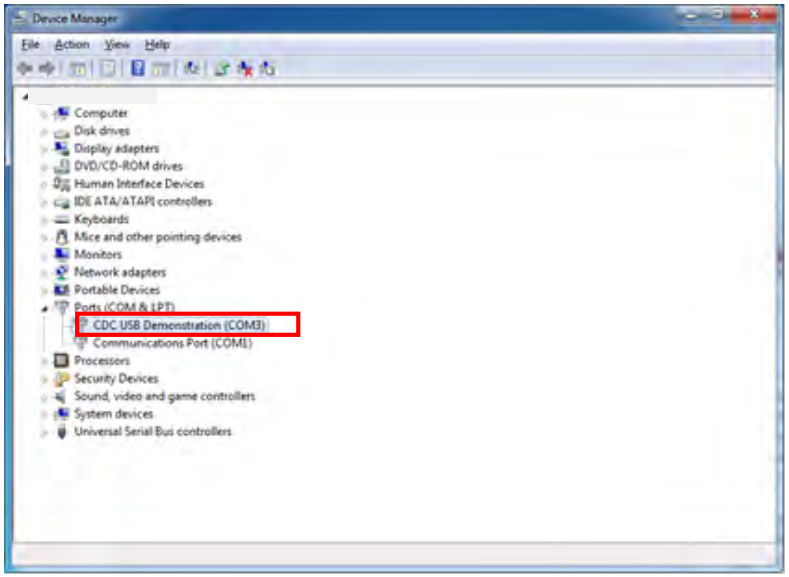


2-8. When the installation is completed, a window shown below will appear. Click [Close] button.



2. Driver installation and checking procedures

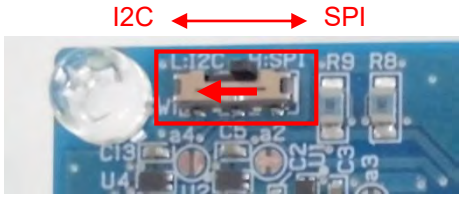
2-9. After the installation, check that [CDC USB Demonstration (COMxx)] is shown in the Device Manager window while the evaluation board is connected.

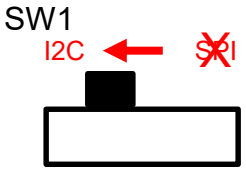


2-10. Check the assigned port number because the CDC USB Demonstration (COMxx) is used for communication setting.
Note: Assignment of COM port depends on the PC to use.

3. Evaluation procedure

3-1.Check the Slide Switch SW1 on the evaluation board is “I2C”. (This application is exclusive to I2C communication.)

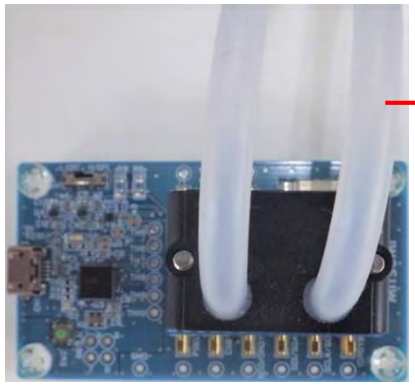




3-2. The tubes for applying air pressure is connected to MMR940 nozzles.

Nozzle B
Pressure opening to Bottom of MEMS sensor die

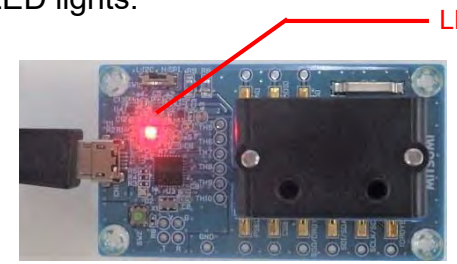
Nozzle T
Pressure opening to Top of MEMS sensor die



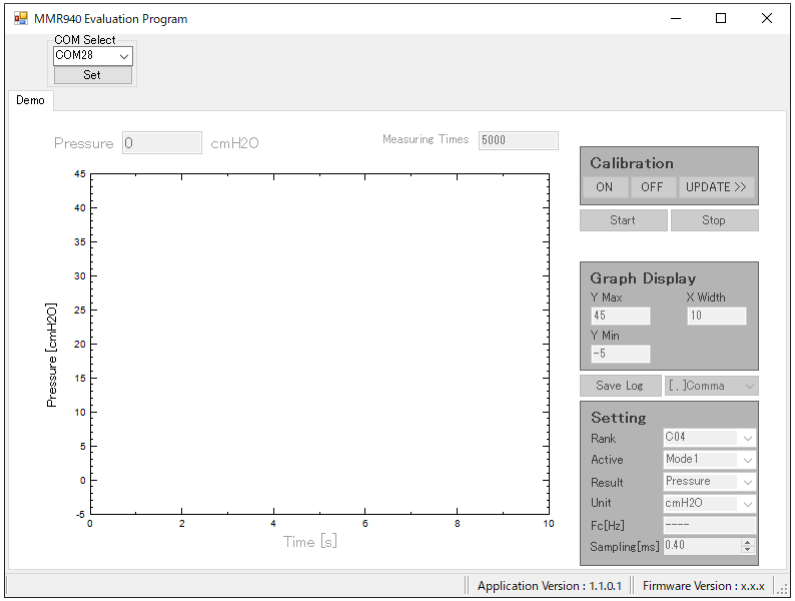
Please be careful about static electricity generated when handling the tube.
For detail, please read “Precautions for handling tubes” on page 21.

3. Evaluation procedure

3-4. Connect the evaluation board with the PC using USB Micro-B cable.
After that, LED lights.

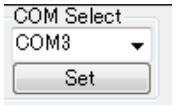


3-5. Start the evaluation application “MMR940_EvaluationProgram.exe”.
This window will appear.

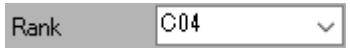


3. Evaluation procedure

3-6. Click the down arrow (▼) of the COM Select and select the COM port for the evaluation board.
Click [Set] to establish communication.



3-7. Select a pressure rank from drop-down list.



The specifications of each pressure rank of MMR940 are as follows.

Rank	Range[cmHO]	Resolution[cmH2O/LSB]
C02	-20 ~ 20	0.00001
C04	-40 ~ 40	0.00001
C07	-70 ~ 70	0.00002
C10	-100 ~ 100	0.00002

3-8. Select an active mode from drop-down list.

The specifications of each active mode of MMR940 are as follows.

	Data output rate[msec]
Mode1	0.4
Mode2	0.8
Mode3	1.6
Mode4	3.2

3-9. Select a result mode from drop-down list.

The specifications of each result mode of MMR940 are as follows.

	Output Data
Pressure	Raw Pressure[cmH2O]
Temperature	Temperature [deg.C]
Press. 1st LPF	LPF output [cmH2O]

3-10. When pressure measurement, select the unit from drop-down list.

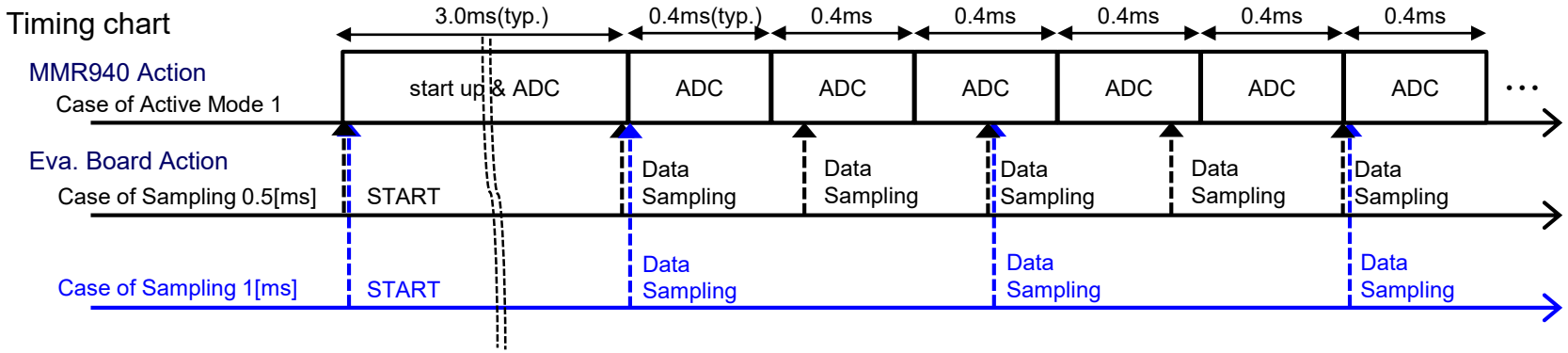
3. Evaluation procedure

3-11. When “Press.1st LPF” is selected in result mode, set the cut-off frequency.
It will change the range that can be set the cut-off frequency in the active mode.

	Cut-off Frequency[Hz]
Mode1	0 ~ 2560
Mode2	0 ~ 1280
Mode3	0 ~ 640
Mode4	0 ~ 320

3-12. Data acquisition from MMR940 can be set period.
Data is output at the data rate set in [Sampling].

	Setting Range[ms]
Sampling	0.40 ~ 10000



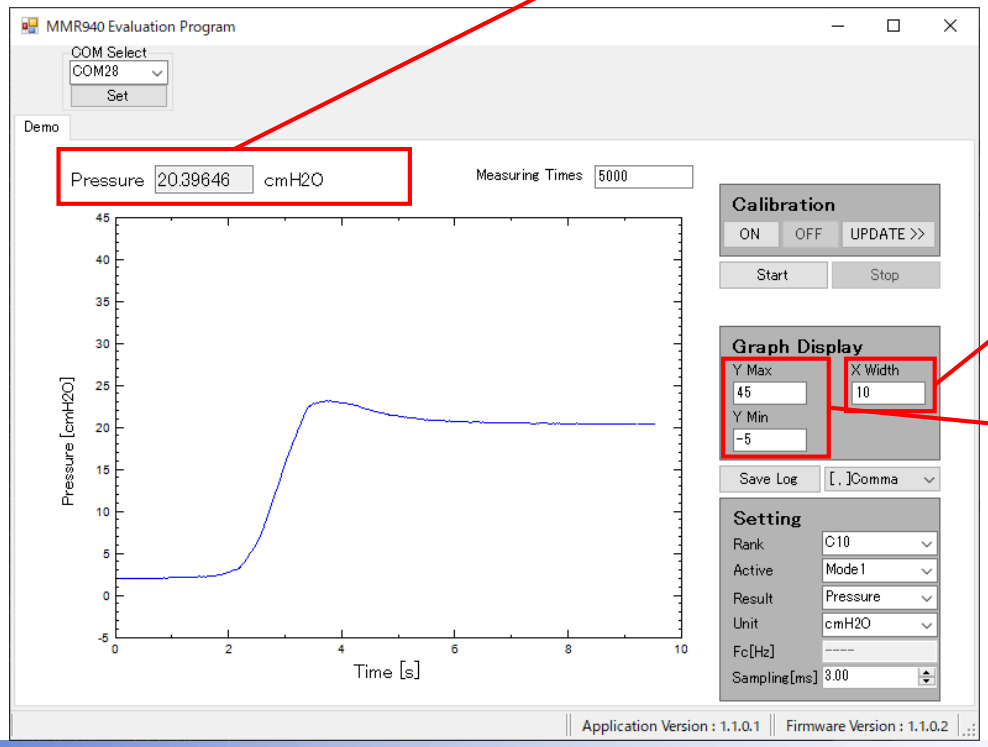
3. Evaluation procedure

3-13. Specify the number of data you want to measure in the Measuring Times box.
(It is specified 5000 times when the evaluation app is started.)

3-14. Start the measurement, click [Start].

To stop the measurement, click [Stop].

The latest data of Result Mode is displayed.



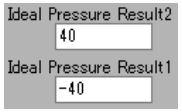
X width adjustment
(Changeable only when measurement is stopped)

Y width adjustment

4. Calibration procedure

4-1. To set the calibration, click [UPDATE>>]

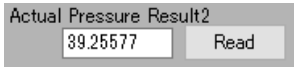
4-2. Set the pressure range to use. ※Set in the unit specified in [Unit].



4-3. Apply maximum pressure.

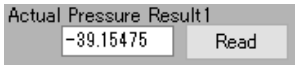
4-4. Start the measurement, click [Start].

4-5. After the pressure stabilizes, click [Read] for Actual Pressure Result2.



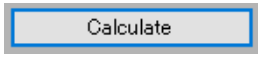
4-6. Apply minimum pressure.

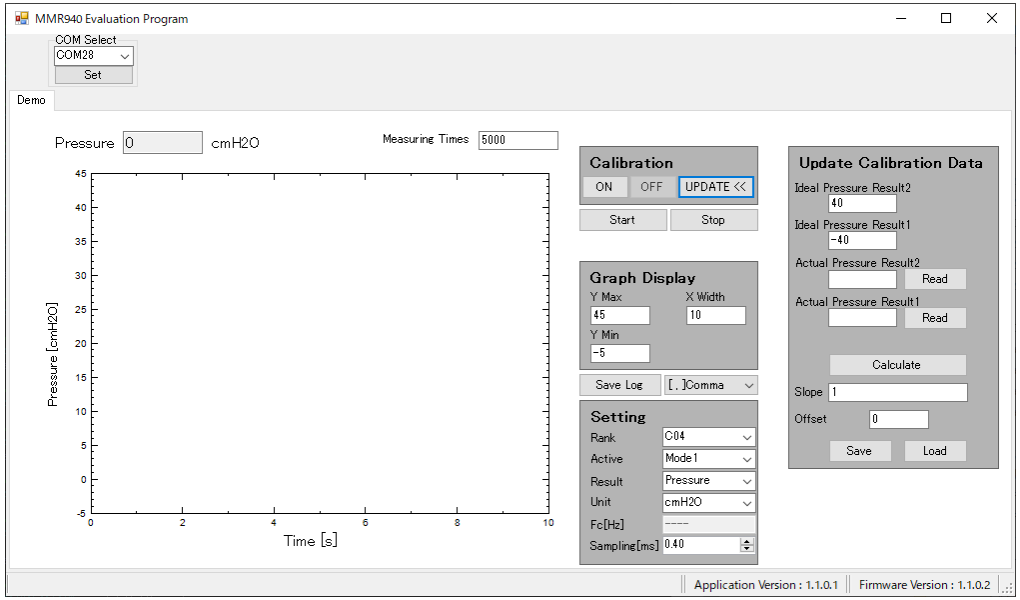
4-7. After the pressure stabilizes, click [Read] for Actual Pressure Result1.



4-8. To stop the measurement, click [Stop].

4-9. To calculate Slope and Offset, click [Calculate].





4. Calibration procedure

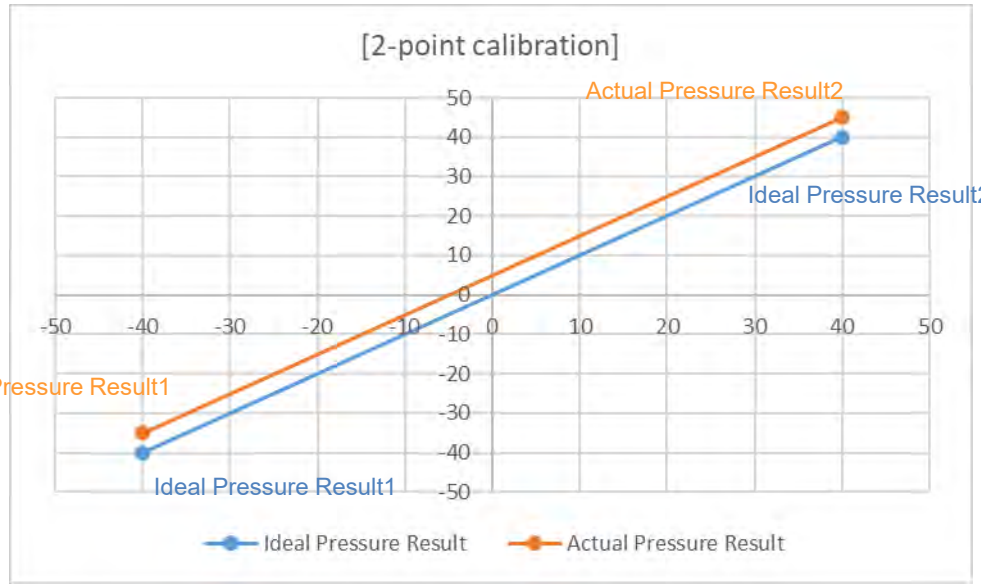
4-10. Calibration settings can be saved, click [Save].

Save

4-11. Saved calibration settings can be load, click [load].

Load

4-12. Definition of Calibration



$$Slope = \frac{Ideal\_Pressure_{Result2} - Ideal\_Pressure_{Result1}}{Actual\_Pressure_{Result2} - Actual\_Pressure_{Result1}}$$

$$Offset = Ideal\_Pressure_{Result1} - Actual\_Pressure_{Result1} \times Slope$$

[Calibration ON]

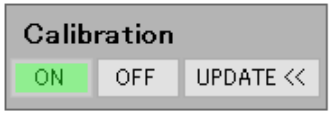
$$Pressure = Actual\_Pessure_{Result} \times Slope + Offset$$

[Calibration OFF]

$$Pressure = Actual\_Pessure_{Result}$$

5. Evaluation procedure（when calibration is ON）

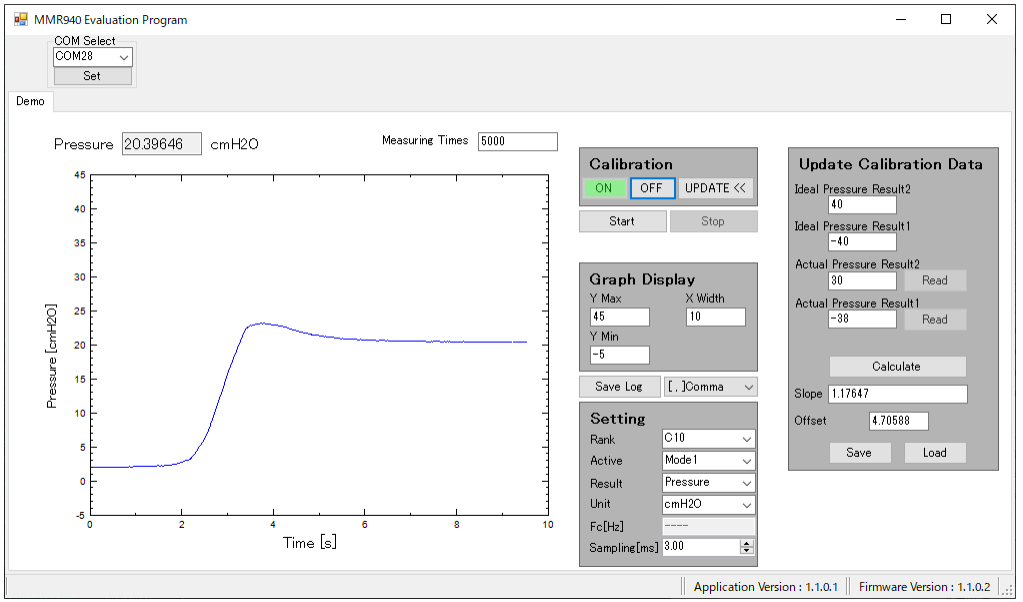
5-1. Click [ON] in Calibration to enable the calibration function.



5-2. Specify the number of data you want to measure in the Measuring Times box.
(It is specified 5000 times when the evaluation app is started.)

5-3. Start the measurement, click [Start].

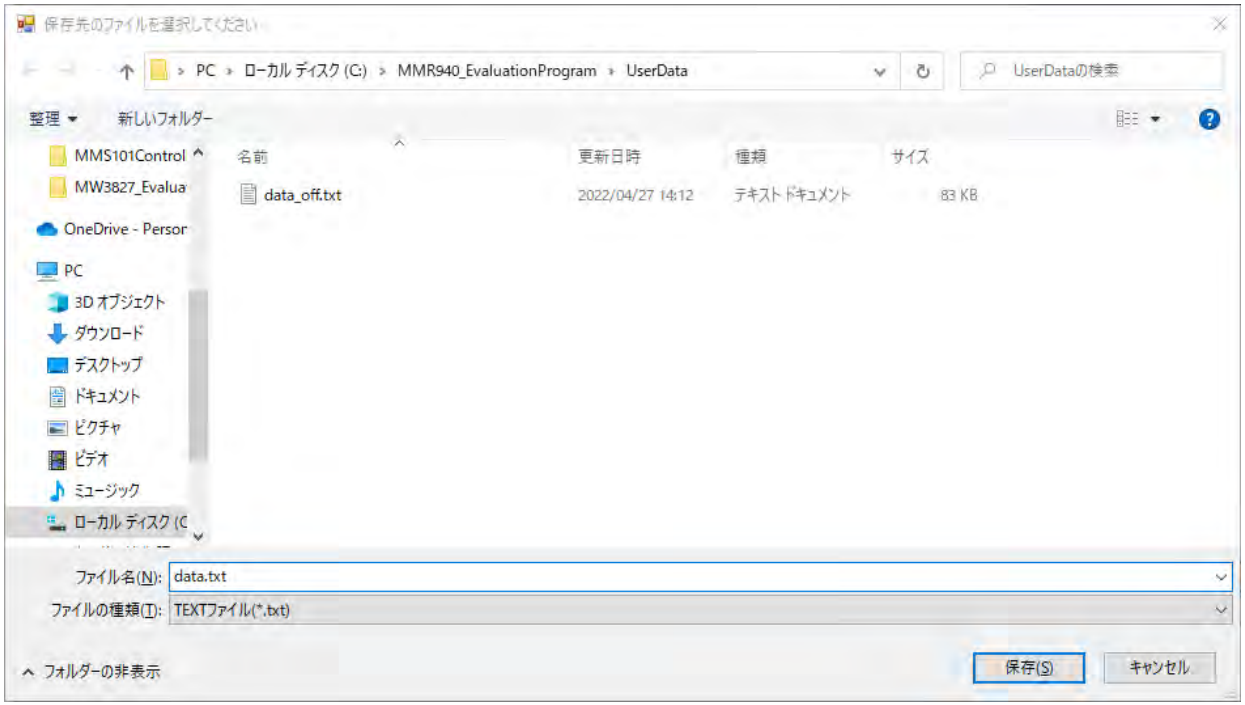
To stop the measurement, click [Stop].



6. Measurement data storage

6-1. To save the measured data, click [Save Log].

The window shown below is displayed.
Enter the file name and press the Save button.
If you specify an existing file name, it is overwritten and saved.
Please be careful.



6. Measurement data storage

6-2. About measured data

Note that the file specified as a destination to save the measured data is overwritten by the new data.
The saved file is output as shown below.

[Calibration OFF]

```
2022/10/19 11:31:35
Model: MTM MMR940
Active Mode: Mode1
Result Mode: Pressure
Cutoff Frequency[Hz]: ----
Calibration: OFF
Slope: -
Offset: -
Measured Time[s],Sensor Value[cmH2O]
0.00302,4.81465
0.00606,4.80384
0.00909,4.78762
0.01213,4.78491
0.01518,4.78627
0.01823,4.78491
0.02128,4.7705
0.02431,4.77951
0.02736,4.81105
```

Separator

[Calibration ON]

```
2022/10/19 11:31:20
Model: MTM MMR940
Active Mode: Mode1
Result Mode: Pressure
Cutc   Frequency[Hz]: ----
Calibration: ON
Slope: 1
Offset: 0
Measured Time[s],Sensor Value[cmH2O]
0.00302,4.94912
0.00604,4.95768
0.00909,4.98968
0.01212,4.96895
0.01515,4.95498
0.01819,4.96039
0.02123,4.94011
0.02427,4.97841
0.02731,4.95002
```

Saved date and time

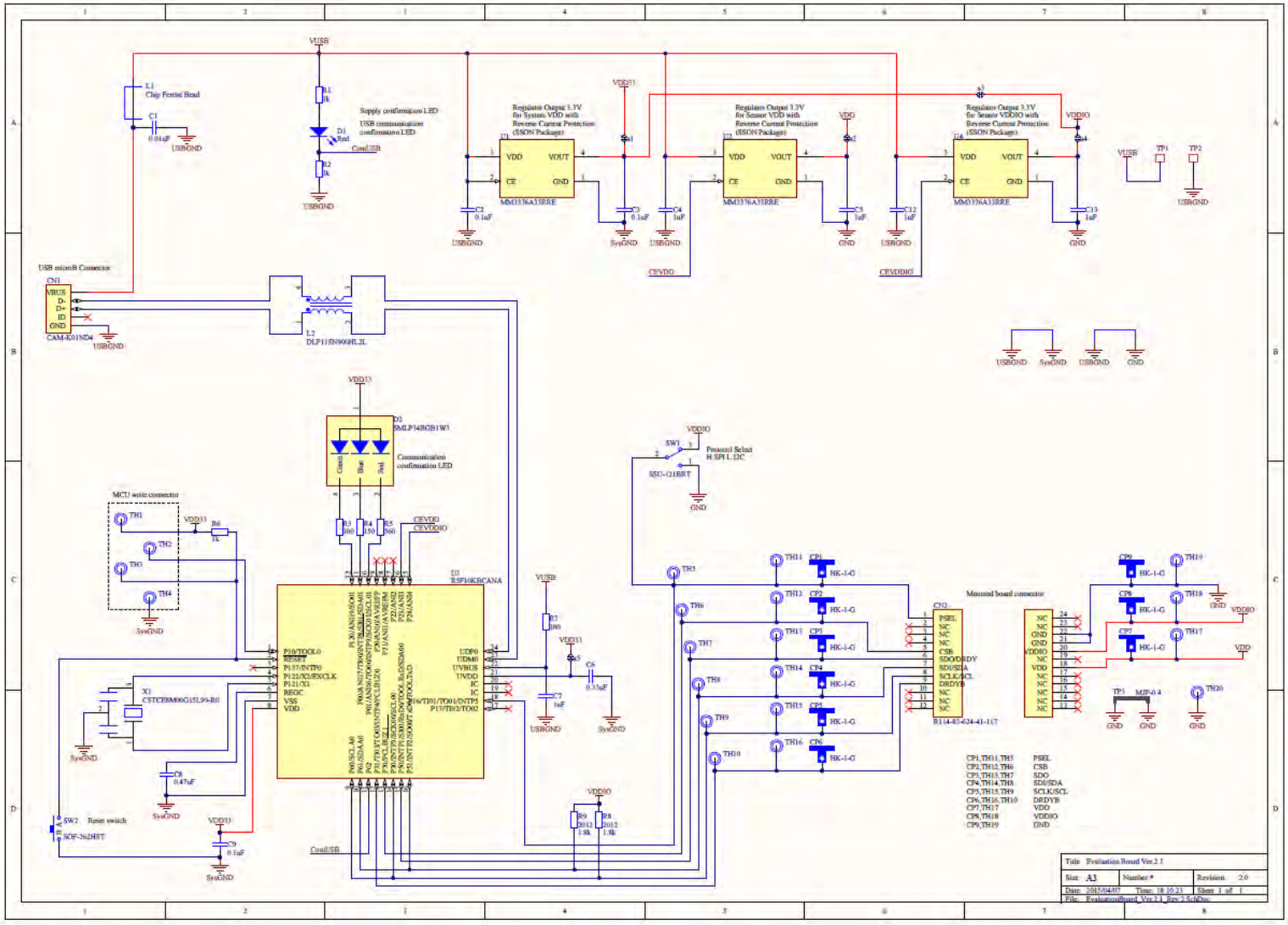
Settings

pressure or temperature data

Measurement time

6-3. The separator for saving data can be selected comma[,], semicolon[;], and tab[ ] in drop-down list below.

7. Schematic Circuit Diagram



8. Evaluation board BOM list

■MMR940 Evaluation Board Ver.2.1 BOM List

No.	Description	Designator	Model	Value	Quantity
1	Capacitor	C1	GRM155B11E103KA01D	0.01uF	1
2	Capacitor	C2, C3, C9	GRM155B10J104KA01D	0.1uF	3
3	Capacitor	C6	GRM155R61A334KE15D	0.33uF	1
4	Capacitor	C4, C5, C7, C12, C13	GRM155R70J105MA12D	1uF	5
5	Capacitor	C8	GRM155R60J474KE19D	0.47uF	1
6	USB microB Connector	CN1	CAM-K01ND4	-	1
7	DIL Socket 24Pin	CN2	R114-83-624-41-117	-	1
8	LED Red @SMD Type	D1	SML-311UTT86	-	1
9	RGB LED	D2	SMLP34RGB1W3	-	1
10	Chip Ferrite Bead	L1	BLM15PD121SN1D	-	1
11	Chock Coil	L2	DLP11SN900HL2L	-	1
12	Resistor	R1, R2, R6	RMC1/16SK102FTH	1k	3
13	Resistor	R3, R7	RMC1/16SK101FTH	100	2
14	Resistor	R4	RMC1/16SK151FTH	150	1
15	Resistor	R5	RMC1/16SK561FTH	560	1
16	Resistor	R8, R9	RK73H2ATTD1801F	1.8k	2
17	SW-SPDT	SW1	SSU-121BRT	-	1
18	SW-PB	SW2	SOF-262HST	-	1
19	200mA Regulator(PLP-4A)	U1, U2, U4	MM3376A33RRE	-	3
20	Renesas MicroController	U3	R5F10KBCANA	-	1
21	8MHz Ceramic Resonator	X1	CSTCE8M00G15L99-R0	-	1

9. Precautions for handling tubes

When handling a tube for applying air pressure, static electricity is generated due to friction with hands and nozzles.
If the tube is made of silicone, static electricity is particularly likely to occur.
So do not use silicone tube.

The generated static electricity is stored in the tube.
The static electricity may affect the sensor characteristics.

Example of measurement results of electrostatic charge during tube handling