

## How to calibrate the UPC of ChroZen GC

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ChroZen UPC (Ultimate Pneumatic Control) system controls precisely the carrier gas and other gas flow into GC. The UPC system consists of proportional valves, sensors (pressure and flow), and restrictors (frits). Proportional valve is supplied with a certain voltage from the inlet or detector UPC board according to the flow rate setting, and the sensor will measure the pressure or flow rate through the UPC manifold (block).

There are three steps to check UPC work, 'Sensor zero', 'Valve calibration', and 'Flow calibration'. With these three calibration steps described in this service note, you can calibrate the flow rate of inlet and detector or troubleshoot the UPC system.

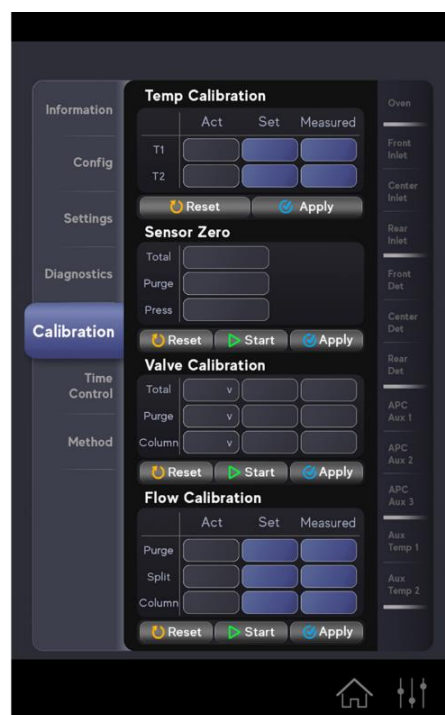


Figure 1. ChroZen GC – Calibration window

## Service Note



## &lt;Contents&gt;

- I. Calibration for Capillary Inlet
- II. Calibration for Packed Inlet
- III. Calibration for Flame Ionization Detector (FID)
- IV. Calibration for Thermal Conductivity Detector (TCD)

## &lt;Before running this...&gt;

- ❖ First, make sure the gas is enough for supplying to the GC.
- ❖ Go to [Setting] window by touching icon (see Figure 2) located bottom right of GC LCD display.
- ❖ Second, touch the [Calibration] menu and select inlet or detector you want to calibrate from the right side of the LCD display.
- ❖ Then, proceed calibration in the order 'Sensor Zero', 'Valve Calibration' and 'Flow Calibration' described in this service note.

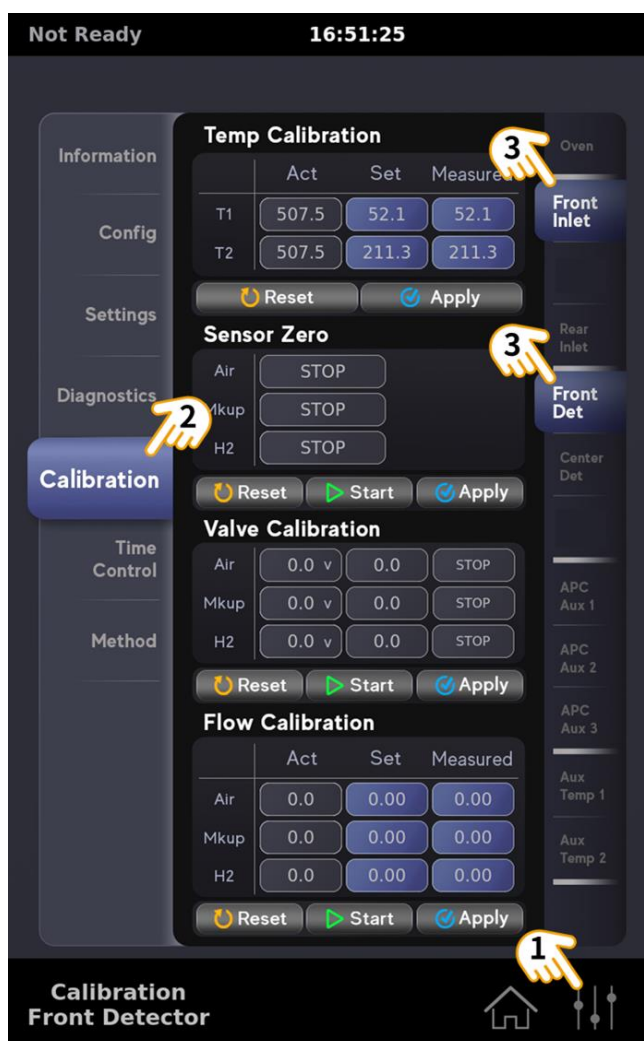


Figure 2. How to open the calibration window

## Service Note



## I. Calibration for Capillary Inlet

\* Before calibration, set the type of carrier gas and capillary column dimension in the 'Capillary Configuration' window (In this note, N<sub>2</sub> is used as a carrier gas and 0.32 mm ID capillary column is used for calibration).

## a. Sensor Zero for Capillary Inlet

1. Touch [Start] button to proceed 'Sensor Zero'.
2. Then 'Sensor Zero' is started and CHECKING message appears.
3. When 'Sensor Zero' is finished without any problem, PASS message appears.
4. Touch [Apply] button and COMPLETE message displays then press [Stop] button to save the 'Sensor Zero'.

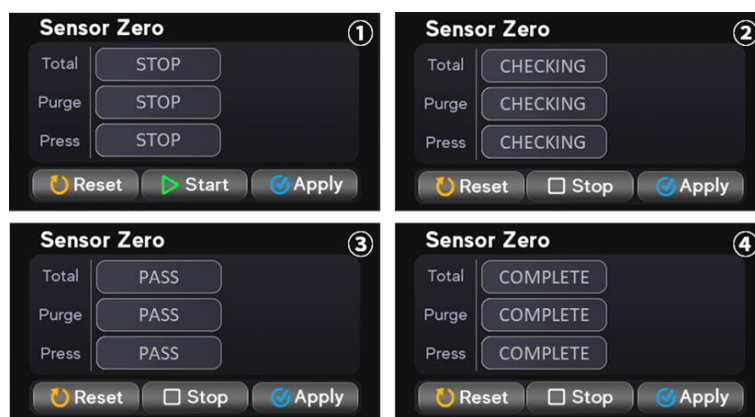


Figure 3. Sensor zero procedure for capillary inlet

## b. Valve Calibration for Capillary Inlet

1. Touch [Start] button to proceed 'Valve Calibration'.
2. Then 'Valve Calibration' is started and CHECKING message appears.
3. First, UPC system begins to control 'Total' flow by 33 mL/min, 'Purge' flow by 3 mL/min, and 'Column' flow by 3 mL/min (split ratio 1:10) for 0.32 mm I.D. column.
  - \* For 0.25 mm I.D. column: Total (23 mL/min), Column (1 mL/min), Purge (3 mL/min)
  - \* For 0.53 mm I.D. column: Total (53 mL/min), Column (5 mL/min), Purge (3 mL/min)
4. Next, UPC system begins to adjust the proportional valve voltage to 'Total' flow by 63 mL/min, 'Purge' flow by 3 mL/min, and 'Column' flow by 3 mL/min (split ratio 1:20) for 0.32 mm I.D. column.
  - \* For 0.25 mm I.D. column: Total (53 mL/min), Column (1 mL/min), Purge (3 mL/min)
  - \* For 0.53 mm I.D. column: Total (103 mL/min), Column (5 mL/min), Purge (3 mL/min)
5. After two points checking at split ratio 1:10 and 1:20 is finished without any problem, the flow rate of 'Total', 'Purge', and 'Column' is going down to 0.0 mL/min.
6. When three flow rate values fall below 0.3 mL/min, PASS message appears, then, touch the [Apply] and press [Stop] button to save the 'Valve Calibration'.

## Service Note

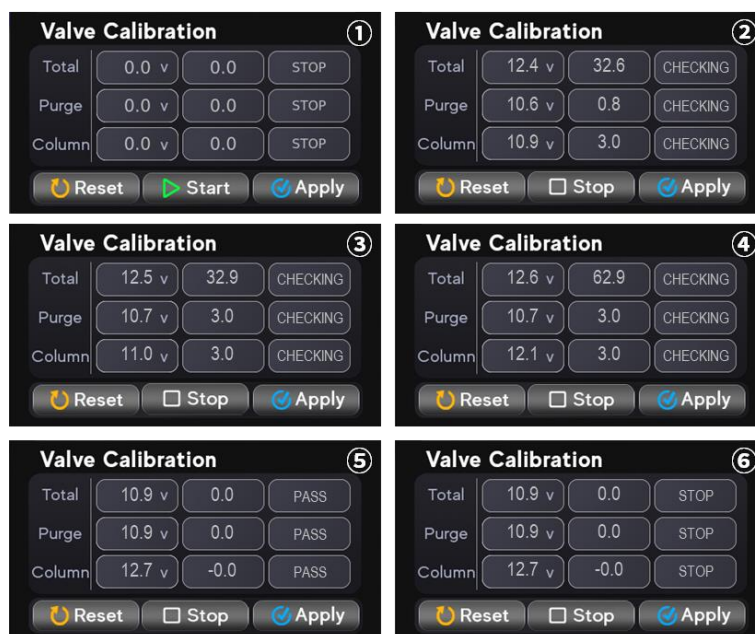


Figure 4. Valve calibration procedure for capillary inlet

**c. Flow Calibration for Capillary Inlet**

1. Enter the [Set] value of 'Purge' to 3 mL/min
2. Enter the [Set] value of 'Split' flow rate (Enter the desired split flow rate for flow calibration. In general case, 'Split' flow rate is calibrated and 57 mL/min for 0.32mm, 19mL/min for 0.25mm and 45mL/min for 0.53mm column).
3. And, enter the [Set] value of 'Column' flow rate (Enter the desired 'Column' flow rate for flow calibration. In general case, 'Column' flow is calibrated at 3 mL/min for 0.32 mm I.D., 1 mL/min for 0.25 mm I.D. and 5 mL/min for 0.53 mm I.D. column).
4. Then, press the [Start] button. After pressing the [Start] button, UPC block will begin to control the entered flow rate.

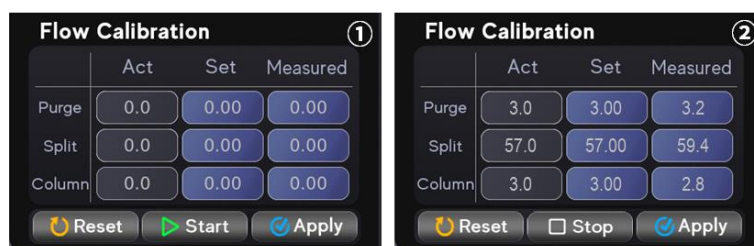


Figure 5. Flow calibration procedure for capillary inlet

5. First, connect the digital flowmeter to purge vent line (indicated in Figure 6) and check the actual flow rate of 'Purge'.

## Service Note

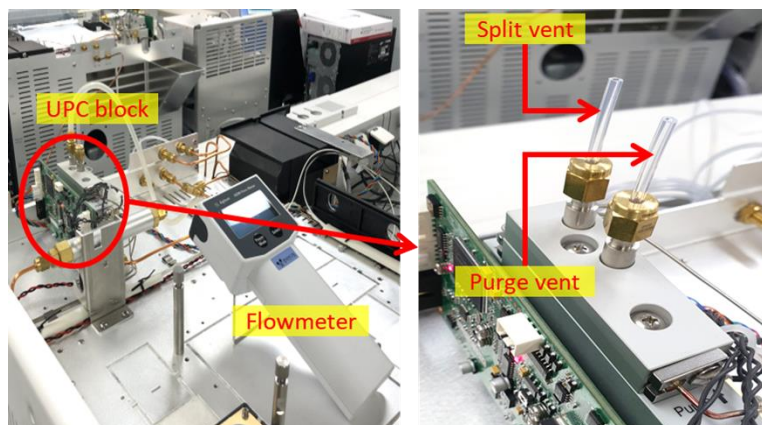


Figure 6. Where to measure the 'Purge' & 'Split' flow using a digital flowmeter

6. Enter the actual flow value of 'Purge' to [Measured] cell.
7. Repeat to check the actual flow rate of 'Purge' and adjust [Measured] value until [Set] value and actual flow rate are equal or similar.

*\* During the calibration process, you may need to adjust the [Measured] value several times to match the actual flow rate with the [Set] value. In this case, refer to the examples shown in Supplement 2 on page 15.*

8. When the [Set] value and actual flow rate of the 'Purge' are equal or similar, press the [Apply] button.
9. Second, connect the digital flowmeter to end of the detector and check the actual 'Column' flow rate.

*\* When you check the actual 'Column' flow rate using a digital flowmeter, disconnect the ignitor from the FID body first, and then place the digital flowmeter into the hole of the FID as shown in Figure 7 (When a capillary column installed with FID detector).*

*\*\* When you check the actual 'Column' flow rate using a digital flowmeter, connect the digital flowmeter to TCD's sample outlet. (When a capillary column installed with TCD detector).*

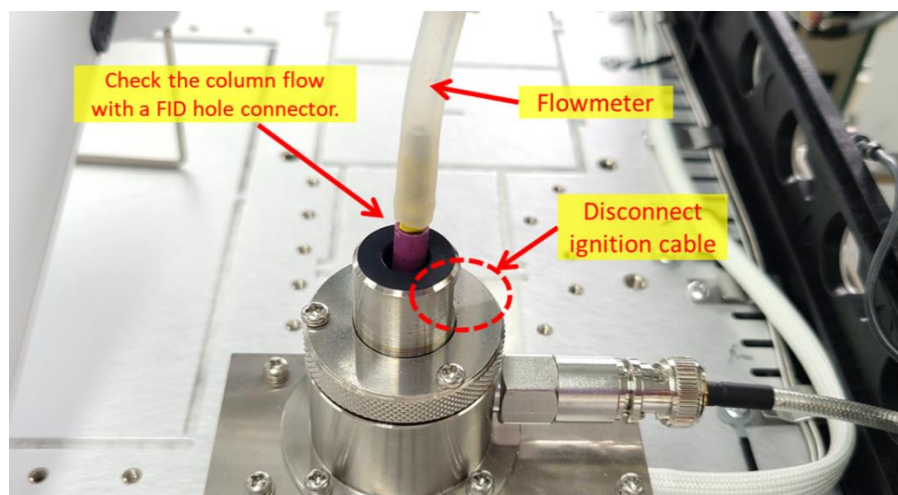


Figure 7. How to check the capillary column flow

## Service Note



10. Enter the actual flow of 'Column' to [Measured] cell.
11. Repeat to check the actual flow rate of 'Column' and adjust [Measured] value until [Set] value and actual flow rate of 'Column' are equal or similar.
12. When the [Set] value and actual flow rate value of the 'Column' are equal or similar, press the [Apply] button.
13. Lastly, connect the digital flowmeter to split vent line (indicated in Figure 6) and check the actual flow rate of 'Split'.
14. Enter the actual flow value of 'Split' to [Measured] cell.
15. Repeat to check the actual flow rate of 'Split' and adjust [Measured] value until [Set] value and actual flow rate of 'Split' are equal or similar.
16. When the [Set] value and actual flow rate of the 'Split' are equal or similar, press the [Apply] button.

*\* Make sure to proceed with the calibration in order of 'Purge', 'Column', and 'Split' (If 'Split' is calibrated before 'Column', it is difficult for the UPC block to adjust 'Split' flow accurately while adjusting 'Column' flow rate).*

17. After capillary inlet flow calibration, turn on the appropriate flow rate for the column installed your GC and check with a digital flowmeter to see if each flow rate is well controlled.

## II. Calibration for Packed Inlet

**\* Before calibration, set the type of carrier gas in the 'Packed Configuration' window (In this note, N<sub>2</sub> is used as a carrier gas for calibration).**

### a. Sensor Zero for Packed Inlet

1. Touch [Start] button to proceed 'Sensor Zero'.
2. Then 'Sensor Zero' is started and CHECKING message appears.
3. When 'Sensor Zero' is finished without any problem, PASS message appears.
4. Touch [Apply] button and COMPLETE message displays then press [Stop] button to quit the 'Sensor Zero'.

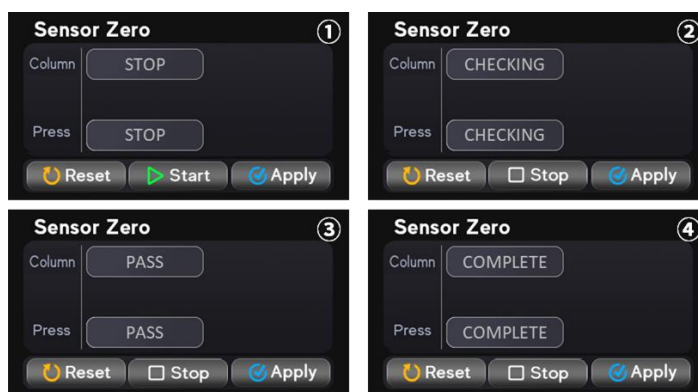


Figure 8. Sensor zero procedure for packed inlet

## Service Note

**b. Valve Calibration for Packed Inlet**

1. Touch [Start] button to proceed 'Valve Calibration'.
2. Then 'Valve Calibration' is started and CHECKING message appears.
3. First, UPC system begins to control 'Column' flow by 10 mL/min.
4. Next, UPC system begins to adjust the proportional valve voltage to 'Column flow by 20 mL/min.
5. After two points checking at 10 and 20 mL/min is finished without any problem, the flow rate of 'Column' is going down to 0.0 mL/min.
6. When the flow rate falls below 0.3 mL/min, PASS message appears, then touch the [Apply] and press [Stop] button to save the 'Valve Calibration'.



Figure 9. Valve calibration procedure for packed inlet

**c. Flow Calibration for Packed Inlet**

1. Enter the both [Set] and [Measured] values to 15 mL/min or any desired flow rate and press the [Start] button.
2. Then the UPC block will begin to control the entered flow rate.

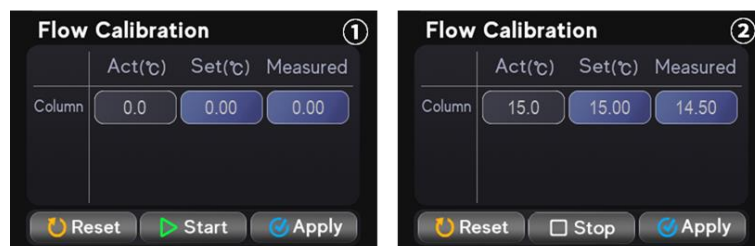


Figure 10. Flow calibration procedure for packed inlet

3. Connect the digital flowmeter to end of the detector and check the actual column flow rate.

## Service Note



\* When you check the actual 'Column' flow rate using a digital flowmeter, disconnect the ignitor from the FID body first, and then place the digital flowmeter into the hole of the FID as shown in Figure 7 (When a packed column installed with FID detector).

\*\* When you check the actual 'Column' flow rate using a digital flowmeter, connect the digital flowmeter to TCD's sample outlet. (When a packed column installed with TCD detector).

4. Enter the actual flow value to [Measured] cell.
5. Repeat to check the actual flow rate and adjust [Measured] value until [Set] value and actual flow rate are equal or similar.

\* During the calibration process, you may need to adjust the [Measured] value several times to match the actual flow rate with the [Set] value. In this case, refer to the examples shown in Supplement 2 on page 15.

6. When the [Set] value and actual flow rate are equal or similar, press the [Apply] button.
7. After packed inlet flow calibration, turn on the appropriate flow rate for the column installed your GC and check with a digital flowmeter to see if each flow rate is well controlled.

### III. Calibration for Flame Ionization Detector (FID)

\* Before calibration, set the type of Mkup gas in the 'FID Configuration' window (In this note, N<sub>2</sub> is used as a Mkup gas for calibration).

#### a. Sensor Zero for FID

1. Touch [Start] button to proceed 'Sensor Zero'.
2. Then 'Sensor Zero' is started and CHECKING message appears.
3. When 'Sensor Zero' is finished without any problem, PASS message appears.
4. Touch [Apply] button and COMPLETE message displays, then press [Stop] button to save the 'Sensor Zero'.

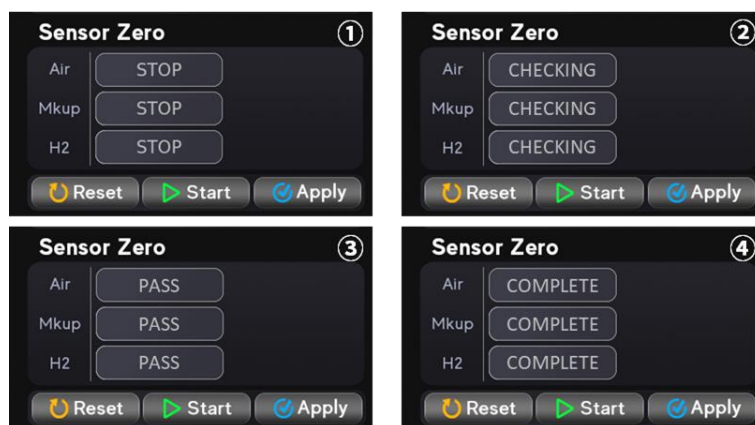


Figure 11. Sensor zero procedure for FID

## Service Note

**b. Valve Calibration for FID**

1. Touch [Start] button to proceed 'Valve Calibration'.
2. Then 'Valve Calibration' is started and CHECKING message appears.
3. First, UPC system begins to control 'Air' flow by 50 mL/min, 'Mkup' flow by 20 mL/min, and 'H2' flow by 20 mL/min.
4. After stabilization and calibration, the flow rate of 'Air', 'Mkup', and 'H2' is going down to 0.0 mL/min.
5. Next, UPC system begins to adjust the proportional valve voltage to 'Air' flow by 100 mL/min, 'Mkup' flow by 50 mL/min, and 'H2' flow by 50 mL/min.
6. After two points checking is finished without any problem, the flow rate of 'Air', 'Mkup', and 'H2' is going down to 0.0 mL/min.
7. When three flow rate values fall below 0.3 mL/min, touch the [Apply] then press [Stop] button to save the 'Valve Calibration'.

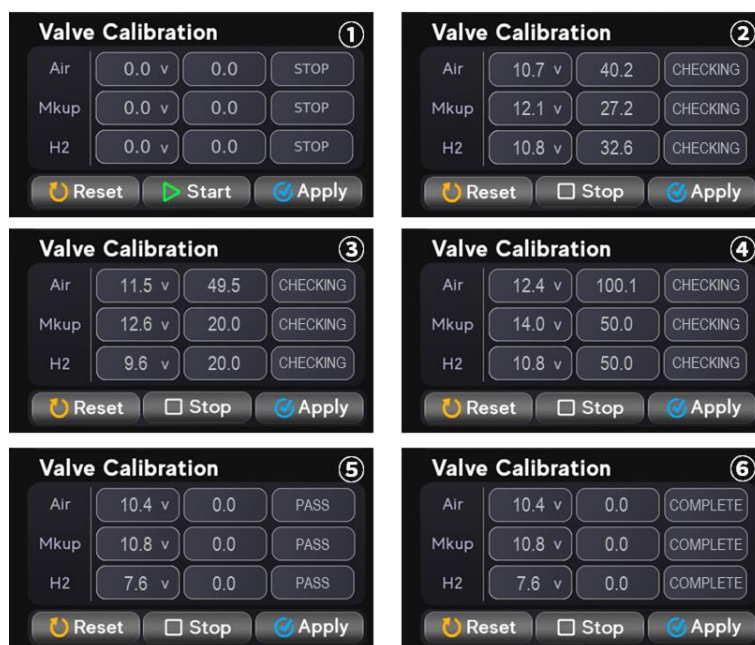


Figure 12. Valve calibration procedure for FID

**c. Flow Calibration for FID**

1. Enter the [Set] value of 'Air' 300 mL/min and press the [Start] button.
2. Then the UPC block will begin to control the entered flow rate.



Figure 13. Flow calibration procedure for FID

## Service Note



3. Connect the digital flowmeter to FID hole (indicated in Figure 14) and check the actual flow rate of 'Air'.

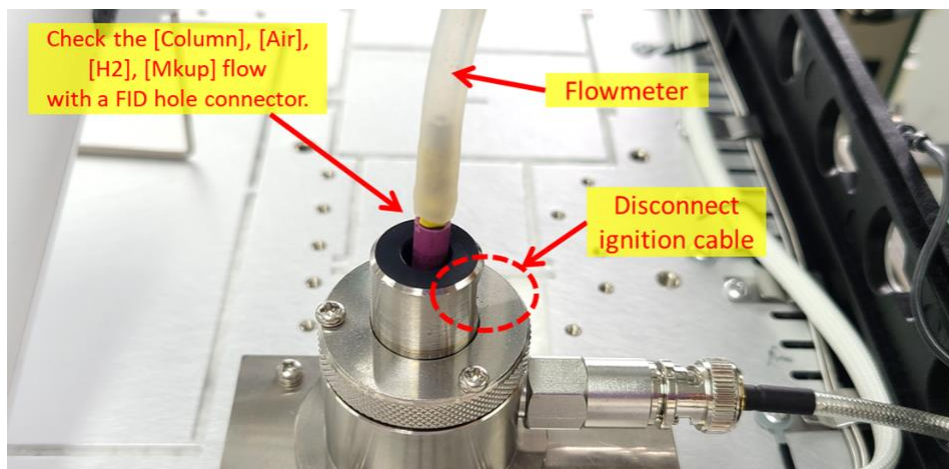


Figure 14. Where to measure the actual flow for FID flow calibration

*\* When you check the actual flow rate of the detector, disconnect the ignitor from the FID body first.*

4. Enter the actual flow value to [Measured] cell.
5. Repeat to check the actual flow and adjust [Measured] value until [Set] value and actual flow rate are equal.

*\* During the calibration process, you may need to adjust the [Measured] value several times to match the actual flow rate with the [Set] value. In this case, refer to the examples shown in Supplement 2 on page 15.*

6. When the [Set] value and actual flow rate are equal or similar, press the [Apply] button.
7. Calibrate the 'Mkup' and 'H2' flow in order in the same way as the 'Purge' calibration ('Mkup' flow will be calibrated at 20 mL/min, 'H2' flow will be calibrated and 30 mL/min).

*\* When proceeding detector calibration, you can proceed regardless of the order of 'Air', 'Mkup', and 'H2'.*

8. After detector flow calibration, connect the ignition cable, turn on the flow rate of the FID.
9. Check if each flow rate is well controlled and make sure the FID ignites well.

## Service Note



## IV. Calibration for Thermal Conductivity Detector (TCD)

\* Before calibration, set the type of Mkup gas in the 'TCD Configuration' window (In this note, N<sub>2</sub> is used as a Mkup gas for calibration).

## a. Sensor Zero for TCD

1. Touch [Start] button to proceed 'Sensor Zero'.
2. Then 'Sensor Zero' is started and CHECKING message appears.
3. When 'Sensor Zero' is finished without any problem, PASS message appears.
4. Touch [Apply] button and COMPLETE message displays then press [Stop] button to save the 'Sensor Zero'.

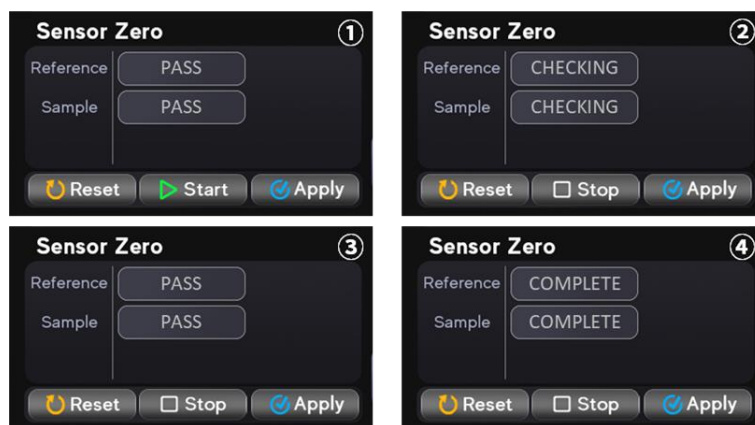
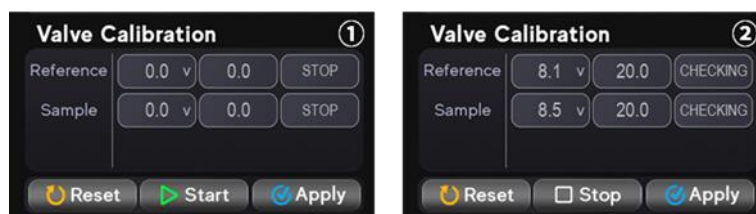


Figure 15. Sensor zero procedure for TCD

## b. Valve Calibration for TCD

1. Touch [Start] button to proceed 'Valve Calibration'.
2. Then 'Valve Calibration' is started and CHECKING message appears.
3. First, UPC system begins to control 'Reference' flow by 20 mL/min and 'Sample' flow by 20 mL/min.
4. Next, UPC system begins to adjust the proportional valve voltage to 'Reference' flow by 50 mL/min and 'Sample' flow by 50 mL/min.
5. After two points checking is finished without any problem, the flow rate of 'Reference' and 'Sample' is going down to 0.0 mL/min.
6. When two flow rate values fall below 0.3 mL/min, touch the [Apply] then press [Stop] button to save the 'Valve Calibration'.



## Service Note

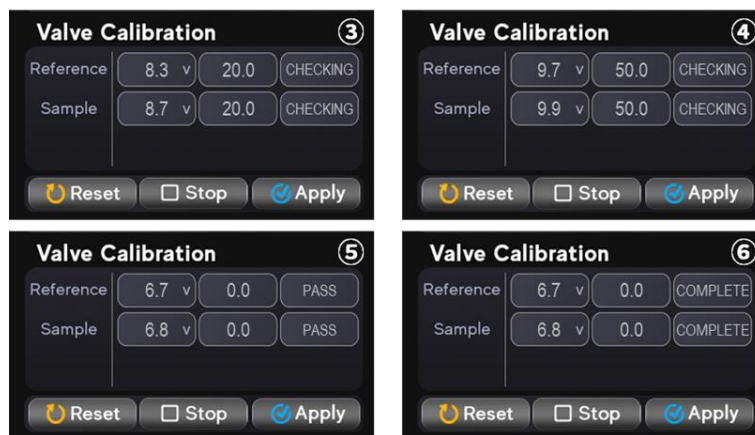


Figure 16. Valve calibration procedure for TCD

## c. Flow Calibration for TCD

1. Enter [Set] and [Measured] of 'Reference' to 30 mL/min and press the [Start].
2. Then the UPC block will begin to control the entered flow rate.

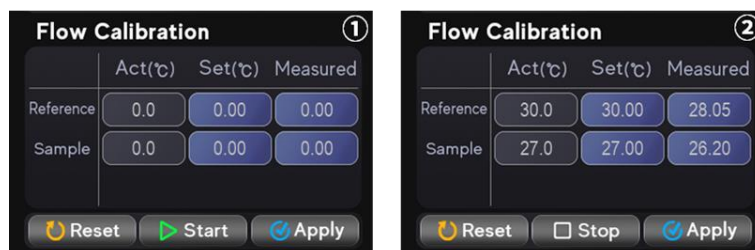


Figure 17. Flow calibration procedure for TCD

3. Connect the digital flowmeter to reference line of TCD detector (indicated in Figure 18) and check the actual flow rate of 'Reference'.

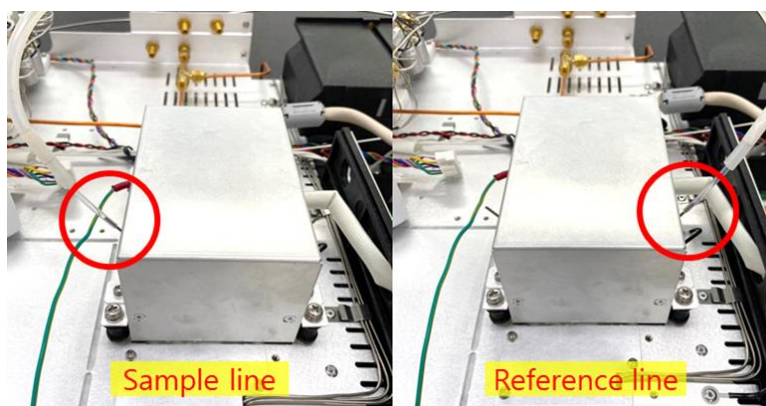


Figure 18. Where to measure the actual flow for TCD flow calibration

4. Enter the actual flow value to [Measured] cell.
5. Repeat to check the actual flow and adjust [Measured] value until [Set] value and actual flow rate are equal or similar.

\* During the calibration process, you may need to adjust the [Measured] value several times to match the actual flow rate with the [Set] value. In this case, refer to the examples shown in Supplement 2 on page 15.

## Service Note



6. When the [Set] value and actual flow rate are equal or similar, press the [Apply] button.
7. After 'Reference' calibration, enter [Set] and [Measured] of 'Sample' to 27 mL/min and press the [Start] button.
8. Then the UPC block will begin to control the entered flow rate.
9. Connect the digital flowmeter to sample line of TCD detector (indicated in Figure 18) and check the actual flow rate of 'Sample'.
10. Enter the actual flow value to [Measured] cell.
11. Repeat to check the actual flow and adjust [Measured] value until [Set] value and actual flow rate are equal or similar.  
*\* During the calibration process, you may need to adjust the [Measured] value several times to match the actual flow rate with the [Set] value. In this case, refer to the examples shown in Supplement 2 on page 15.*

12. When the [Set] value and actual flow rate are equal or similar, press the [Apply] button.

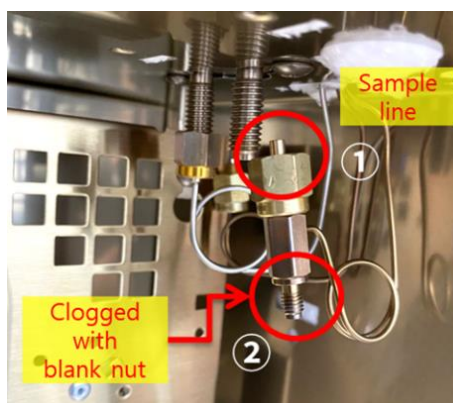


Figure 19. Where to measure when the sample line is not installed on TCD

*\* If the GC does not have a sample line of the TCD detector, measure the actual sample flow by referring to Figure 19.*

13. After detector flow calibration, check if each flow rate is well controlled.

## Service Note



## Supplement 1.

## Troubleshooting of the valve calibration failure

Sometimes the valve calibration fails repeatedly. At this time, solve the problem by referring to the causes and solutions as below.

## Case 1. Fail\_VH

Problem	If the flow rate does not flow even though the voltage of the proportional valve increased.
Cause	(1) UPC board, (2) Proportional valve
Solution	Two causes depend on whether the actual flow is measured or not. When you measure the actual flow rate using a digital flowmeter, (1) if the flow is normally measured, replace the UPC board because the problem was caused by a malfunction of the UPC board, (2) if the flow rate is not measured, replace the proportional valve with a new one.

## Cause 2. Fail\_16V

Problem	If the flow rate does not flow when the voltage of the proportional valve is 16 V or less.
Cause	(1) UPC board, (2) Proportional valve
Solution	Same as the Case 1. Fail_VH.

## Cause 3. Fail\_FL

Problem	If flow rate cannot be stabilized (if there is fluctuation).
Cause	There is some leakage or clogging (blockage) in the path of gas flow.
Solution	Figure out the leakage or clogging and repair it.

## Service Note



## Supplement 2.

## Example of Flow Calibration

During the calibration process, you may need to adjust the [Measured] value several times to match the [Actual] value with the [Set] value.

When the actual flow rate is measured lower than [Set] value, enter lower value than the last [Measured] value. When the actual flow rate is measured higher than [Set] value, enter higher value than the last [Measured] value.

**Example 1. When the actual flow rate is lower than [Set] value.**

Step 1.	[Set] 3.0 mL/min, [Actual] 2.0 mL/min → Enter 2.0 mL/min to [Measured]
Step 2.	[Set] 3.0 mL/min, [Actual] 2.5 mL/min → Enter 1.8 mL/min to [Measured]
Step 3.	[Set] 3.0 mL/min, [Actual] 2.8 mL/min → Enter 1.7 mL/min to [Measured]
Step 4.	[Set] 3.0 mL/min, [Actual] 3.0 mL/min → Done

**Example 2. When the actual flow rate is higher than [Set] value.**

Step 1.	[Set] 3.0 mL/min, [Actual] 4.0 mL/min → Enter 4.0 mL/min to [Measured]
Step 2.	[Set] 3.0 mL/min, [Actual] 3.5 mL/min → Enter 4.3 mL/min to [Measured]
Step 3.	[Set] 3.0 mL/min, [Actual] 3.2 mL/min → Enter 4.5 mL/min to [Measured]
Step 4.	[Set] 3.0 mL/min, [Actual] 3.0 mL/min → Done