

# Calibration Using an ARA FTS Flow Calibrator

Use the *Quality Control Form* located on the last page to record data easily in the field.

## Calibrate Temperature

On the N-FRM Sampler Home Screen select **SETUP** and then select **SYSTEM SETUP**. Scroll down and select **AMBIENT TEMPERATURE** and then select **OFFSET**. Change the value to **0.000** and select **YES** to save changes.

Place the tip of the FTS Temperature Sensor into the louvers and attach the clip onto the N-FRM Sampler temperature radiation shield. Allow the sensors enough time to equilibrate before recording the Indicated Temperature (sampler) and Actual Temperature (FTS). Determine the difference between the Indicated Temperature and Actual Temperature to be used as the offset value.



$$\text{OFFSET} = (\text{FTS Temp}) - (\text{N-FRM Temp})$$

On the N-FRM Sampler Home Screen select **SETUP** and then select **SYSTEM SETUP**. Scroll down and select **AMBIENT TEMPERATURE** and then select **OFFSET**. Change the value to the desired offset, calculated above and select **YES** to save changes.

## Calibrate Barometric Pressure

On the N-FRM Sampler Home Screen select **SETUP** and then select **SYSTEM SETUP**. Scroll down and select **BAROMETRIC PRESSURE** and then select **OFFSET**. Change the value to **0.000** and select **YES** to save changes.

Record the Indicated Barometric Pressure (N-FRM) and the Actual Barometric Pressure (FTS). Determine the difference between the Indicated Barometric Pressure and the Actual Barometric Pressure to be used as the offset value.

$$\text{OFFSET} = (\text{FTS Barometric Pressure}) - (\text{N-FRM Barometric Pressure})$$

On the N-FRM Sampler Home Screen select **SETUP** and then select **SYSTEM SETUP**. Scroll down and select **BAROMETRIC PRESSURE** and then select **OFFSET**. Change the value to the desired offset, calculated above and select **YES** to save changes.

## Calibrate Flow Rate

To calibrate an N-FRM Sampler, a multi-point calibration must be performed in order to determine the calibration factors. These values can then be entered manually into the N-FRM Sampler.

### FTS Calibrator:

- Select **MODE:HOME** and rotate the selector knob to select **MODE:FLOW**
- With no flow running through the VFD, select **ZERO** to zero the sensors
- After using the **ZERO** function, AMB FLOW, and STD FLOW should be 0.00 LPM. If not, select **ZERO** again to re-initialize the sensors.
- Connect the FRM adapter to the sampler inlet. The other end of the hose should be connected to the VFD outlet (right side).

### N-FRM Sampler:

- From the Home Screen select **SETUP**
- Scroll down, select **SYSTEM SETUP**, and then select **FLOW RATE**
- Select **SLOPE**, turn knob to set slope to **1.000**, and select **YES** to save changes
- Select **INTERCEPT**, turn knob to set intercept to **0.000** and select **YES** to save changes
- Select **SET FLOW** and adjust to **14.5** and select **YES** to save changes
- Select **PUMP:OFF** to turn the pump **ON**
- Allow the pump to run for a few minutes until the FTS Gas Temperature stabilizes
- Record the **IND. FLOW** from the N-FRM Sampler and the **AMB. FLOW** from the FTS Flow Calibrator
- Repeat the above steps, adjusting the **SET FLOW** to 15.5, 16.5, 17.5, and 18.5.

### Calculations:

For easy calculations, our *Calibration Worksheet* Excel file is available for download on the Support page on our website, [www.arainstruments.com/support](http://www.arainstruments.com/support), or you can create your own.

Input the Indicated Flow Rate and Actual Flow Rate values into the spreadsheet. Determine the Slope and Intercept.

	A	B	C	D	E	F	G
	<b>Set Flow Rate</b>	<b>Indicated Flow (Sampler)</b>	<b>Actual Flow (FTS)</b>	<b>Adjusted Flow</b>	<b>Difference</b>	<b>Percent Error</b>	
1	14.5	14.53	14.63	14.63385267	0.0038527	0.026334044	
2				=B2*\$B\$10+\$B\$11	=D2-C2	=E2/C2*100	
3	15.5	15.5	15.58	15.58610685	0.0061068	0.039196719	
4	16.5	16.51	16.58	16.57167273	-0.008327	-0.050224769	
5	17.5	17.48	17.52	17.51820631	-0.001794	-0.010237981	
6	18.5	18.48	18.49	18.49401411	0.0040141	0.021709638	
7							
8							
9							
10	Slope	<b>0.975807806</b>	=SLOPE(C2:C6, B2:B6)				
11	Intercept	<b>0.461085849</b>	=INTERCEPT(C2:C6, B2:B6)				
12							

Figure 9. Determine Slope and Intercept in Excel.

**Change the Slope and Intercept on the N-FRM Sampler:**

- From the Home Screen select **SETUP**
- Scroll down, select **SYSTEM SETUP**, and then select **FLOW RATE**
- Select **SLOPE** and turn knob to desired value
- Select **YES** to save changes
- Select **INTERCEPT** and turn knob to desired value
- Select **YES** to save changes

# QUALITY CONTROL FORM

## SITE INFORMATION

Location: \_\_\_\_\_ Sampler: \_\_\_\_\_ Serial No: \_\_\_\_\_

Tech: \_\_\_\_\_ Flow Rate Standard: \_\_\_\_\_ Serial No: \_\_\_\_\_

Date: \_\_\_\_\_ Temperature Standard: \_\_\_\_\_ Serial No: \_\_\_\_\_

Time: \_\_\_\_\_ Pressure Standard: \_\_\_\_\_ Serial No: \_\_\_\_\_

## MAINTENANCE SCHEDULE

Weekly:	Service Water Trap
Monthly:	Clean PM10 Inlet, PM2.5 Cyclone, Filter Holder, and RTP Profiler Filter Inspect O-Rings Perform Leak Check Perform flow, temperature, pressure, and clock verification
Annually:	Replace PM10 Inlet, PM2.5 Cyclone, and Filter Holder O-Rings Rebuild Pump Perform flow, temperature, and pressure calibrations

## AUDIT RESULTS

ACTION	INDICATED (Sampler)	ACTUAL (FTS)	% DIFFERENCE	CONTROL LIMITS
Flow Rate (LPM)				4%
Ambient Temp. (°C)				± 2°C
Barometric Pressure (mmHg)				±10 mmHg
Clock Time				±2 min/mo
Leak Check				0.00 LPM

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## MULTI-POINT CALIBRATION

SET FLOW (LPM)	INDICATED FLOW (Sampler)	ACTUAL FLOW (FTS)
14.5		
15.5		
16.5		
17.5		
18.5		

	INITIAL	FINAL
SLOPE:		
INTERCEPT:		