COAT MM Calibration Procedure

Goal of the procedure is to set and monitor how gain and offset of the sensor signal is adjusted, or needs to be, when calibration is performed. The standard fluid will be COAT reference oil density measured by ASTM D4052.

1) Use a CMF025M and Available Paired Transmitter that is shown to be in good working order by Emerson Processing – Micro Motion Division.
2) Input all meter calibration coefficient values for the Meter into the Transmitter using a Hart Communicator, or other device.
3) Some labs may read 4-20 mA for outputs, but you may convert to 1-5 Volt using 250 Ohm high accuracy resistors.
4) Set all Micro Motion Density output limits to: LLV - 0 g/mL and ULV - 2 g/mL
5) The density output signal can be in mA, V, or a variable frequency. If your DAQ is reading voltage (1-5 V) from the MM output, then your uncorrected gain and offset will be 0.5 and -0.5, respectively. If your DAQ is reading milliamps (4-20 mA) from the MM output, then your uncorrected gain and offset will be 0.125 and -0.125, respectively. Realizing that each lab has different signal conditioning, they may have different gains and offsets.
6) Ideally, this has been the case and everyone is using coefficients supplied by Emerson for their Micro Motion sensor. These coefficients can only be changed due to manufacturer calibration.
7) Initial calibration of each device will require setting its MM Density DAQ coefficients gain and offset to mathematically uncorrected values. Only first-order corrections are allowed.
8) Run two flushes of a known oil (i.e. **832 or 833**) to remove hang-up from previous fluids and add a CAT 1R-1808 fresh filter with the first charge. On the third and final charge, add a new TEI assigned filter with DATE CODE **NONOUL**. Run the engine for 10 minutes (5 minutes at idle, and 5 minutes at 1800 rpm) to flow the newest oil through the Micro Motion circuit (lines, meter, and pump). At ten minutes, stop the oil pump first, then stop the engine and leave off until the all the next steps are complete. This will add an extra 10 minutes of warmup time to a test.
9) Obtain D4052 density data from your laboratory at the intervals outlined in the COAT procedure and verify that the linear R^2 is greater than 0.9999. These points will be used to set the DAQ's new gain and offset.
10) Set the Box temp (average of TMicIn and TMicOut) to 30±0.75°C. The box and MM temperature must be stable around 30°C for at least 30 minutes. Record data for 120 seconds and average data (@1Hz). Use D4052 30°C density as set point.
11) Set the Box temp to 50±0.75°C. The box and MM temperature must be stable around 50°C for at least 30 minutes. Record density and temperature data at 1 Hz for 120 seconds and average it. Use D4052 50°C density as set point.
12) Set the Box temp to at least 70°C or 80±0.75°C, whichever the lab feels comfortable with. The box and MM temperature must be stable around 70°C or 80°C for at least 30 minutes. Record data for 120 seconds and average data. Use D4052 70°C or 80°C density as set point.
    Max temperature under investigation. Different labs may have to move electronic hardware, and find the maximum temperature attainable with their hardware.

13) Calculate the DAQ's New Gain and Offset using the calculated voltage or current readings and the D4052 Density values. These new coefficients will be added to the LTMS file for future reference. An example of the new gain and offset for voltage applications may be 0.523 and -.492, respectively, for a 1-5V output signal.
14) A calibration must occur during each Reference Test, but only a change in measured density of 1.0% or more at the 70°C (or max temperature possible) will require change of the DAQ's gain and offset. The Gain and Offset will be updated in the LTMS for each Reference event. An alarm will be set and repair required if the density measured is more than 2% different from the D4052 value. For example, oil **832** has D4052 value of .8392 at 70C. If the new calibration coefficients produce a shift of more than .0084 g/mL, the new coefficients must be changed in the LTMS. If the shift is more than .0168 for oil **832**, the equipment needs to be evaluated by Emerson Process - Micro Motion Division.

Recommendations:
Sensors should be 2013 or newer.
Could purchase a new transmitter to get SMV (Smart Meter Verification)

Intertek system
Sensor: CMF025M319N2BAEZZZ
Transmitter: 5700R12ABAAZZZAAZZZ TG (with Modbus option)
Puck 800 is not attached to sensor

SwRI system
Sensor: CMF025M319N2BAE3ZZ s/n 14520608
Transmitter: 2500D3ABBAECZ s/n 14620608
Puck 800 processor is attached to sensor

Lubrizol system
Sensor: CMF025
Transmitter:
Puck 800 processor