ATTACHMENT 15

CONTINUOUS EMISSIONS MONITOR SYSTEM (CEMS)

Continuous Emissions Monitor System (CEMS)

Overview

Four subsystems are required to make up a continuous emissions monitoring system.

I) Sample System

This system is comprised of the sample probe, transport line, double pass sample conditioner, sample pump and regulator as well as sample and exhaust manifolds.
The sample is drawn from the stack through the probe and transport line via the sample pump and is sent to the first pass of the sample conditioner. This first pass of the sample conditioner cools the sample down to the ambient temperature inside the cabinet to initially remove any moisture present in the gas. The exact volume and pressure of sample required by the analyzer(s) is then regulated by the backpressure regulator and sent to the second pass of the sample conditioner. This second pass is chilled by thermo-electric coolers to bring the sample temperature below dew point and remove any remaining moisture. Excess sample is sent directly to the exhaust manifold and vented outside the building. All moisture removed from the sample by the first and second pass of the conditioner is removed by two peristaltic pumps to avoid sample contamination by air intrusion.

II) Analyzers

The analyzer rack contains three separate analyzer units, one oxygen analyzer with a range of 0 – 25 percent and two analyzers for carbon monoxide with ranges of 0 – 200 ppm and 0 – 3000 ppm. Internal piping sends the required volume of gas sample from the sample system to each of the analyzers. This allows for simultaneous measurement of all three units. After being analyzed, the sample gas is vented out of the building via the exhaust manifold. Analog 4 – 20 madc signals proportional to each gas value is then transmitted to the data logging equipment.

III) Calibration System

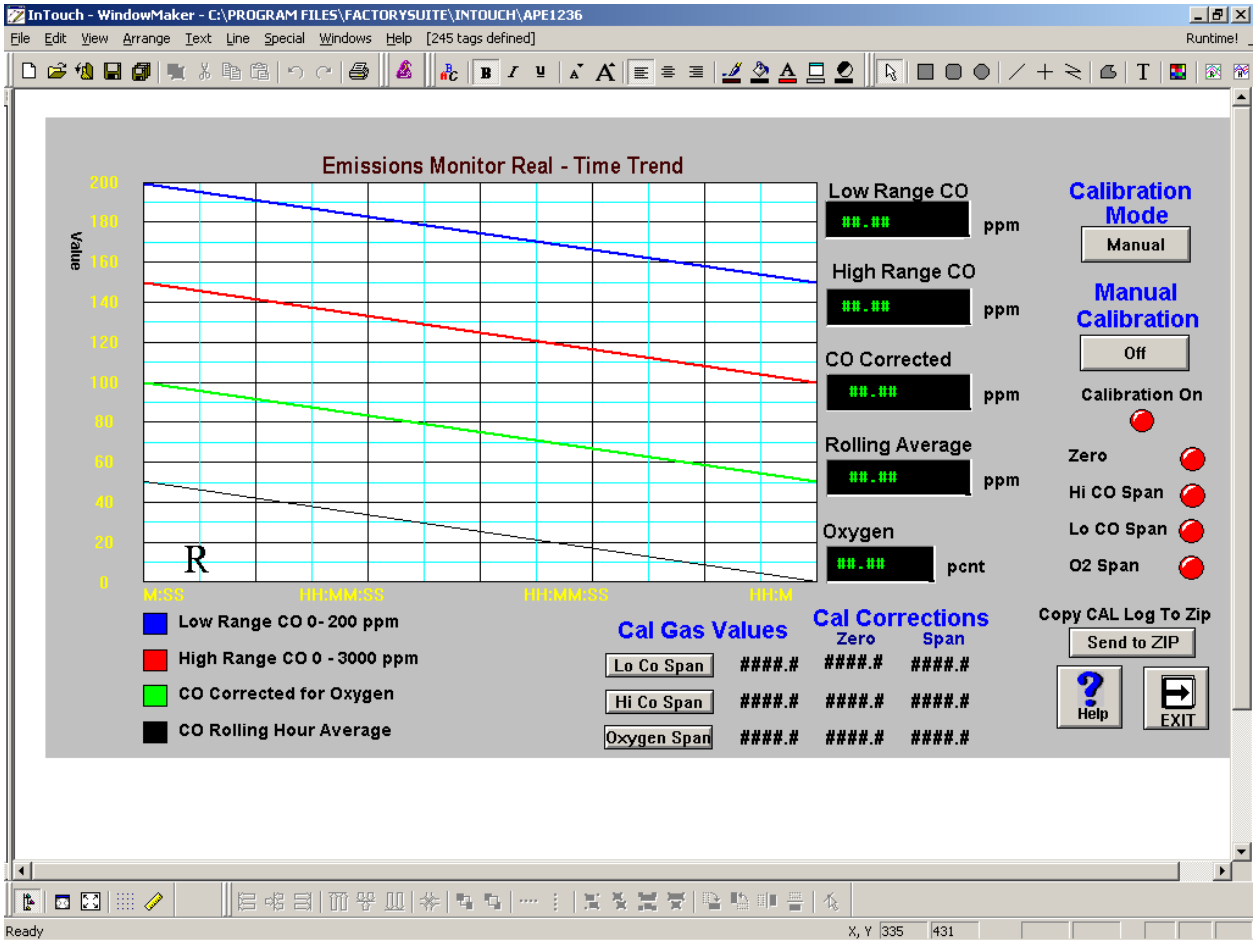
Since the analyzers require calibration on a regular basis a system to perform this function has been included. The system is comprised of four calibration gasses certified to a known value and solenoids to control the introduction of these gasses to the analyzers. The calibration gasses consist of a pure nitrogen zero gas, two carbon monoxide/nitrogen mixtures equal to or greater than 80 percent of the two carbon monoxide analyzer ranges and an oxygen/nitrogen mixture equal to or greater than 80 percent of the oxygen analyzer range. The calibration sequence is controlled by the Data Logging and Control System. This sequence floods the sample probe with the calibration gasses one at a time for five minutes each via a calibration line connected to the probe. The gas is then drawn into the sample system, conditioned and delivered to the analyzers just like the normal sample. The first calibration gas to be introduced will always be the pure nitrogen called zero gas. This allows the zero calibration of all three analyzers at once. The remaining gasses called span gasses are then introduced one at a time for five minutes each. After the last calibration gas time period is complete, the system remains in the calibration mode for an additional five minutes to purge all calibration gas from the sample system.

IV) Data Logging and Control System

Consisting of an Allen-Bradley SLC-5/05 processor and WonderWare SCADA software, this system performs all data logging and calculations required by the state and federal environmental regulations. This system also controls the calibration sequence and alarm functions. Switches, indicators and operator interface screens complete the system.
The following pages show the continuous emissions monitoring system interface screens available to the operators

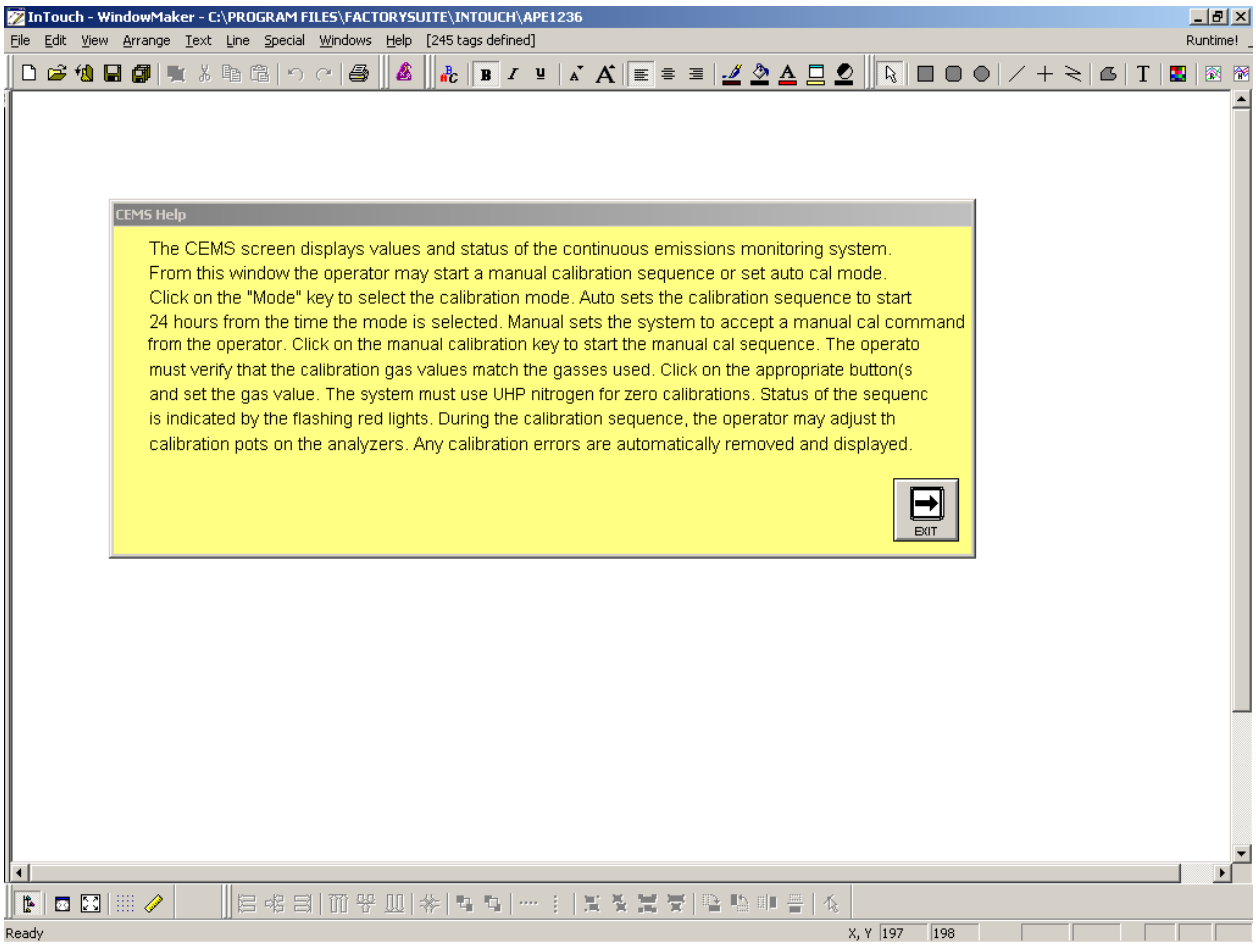
Overview Screen

This screen gives operators real time values for all analyzers, carbon monoxide corrected to 7 percent oxygen, the hourly rolling average for carbon monoxide calibration sequence status and calibration correction values applied to the signals from the analyzers. Critical values are displayed on a real time trend window. This screen also provides the operators with the means to set calibration gas values, start a manual (unscheduled) calibration sequence and turn on or off the automatic (scheduled) calibration sequence.



Help Screen

Clicking the help button on the overview screen displays the following popup screen. This help information instructs the operator on how to perform the most common functions.



Start Up and Operational Procedures

1) **An Off-On switch is located on the CEMS panel. Placing this switch to the on position starts the warm up mode for the analyzers and is indicated by a slow flash of the red indicator light. This warm up period controlled by the data logging and control system is one hour long and is required to heaters in the analyzers to stabilize.**

2) **Five minutes before the end of the warm up period, the control system will activate the sample conditioner system. Once the conditioner's sample coolers are at their required temperatures, the sample pump will automatically start.**

3) **Verify the proper sample flow rate on the rate indicator. This should be approx. 2.5 lpm. If it is not, adjust the backpressure regulator located inside the cabinet and piped to the sample manifold to obtain the correct flow rate. The sample pressure should be 3 – 3.5 psi.**

4) **At the end of the warm up period, the red flashing indicator light will extinguish indicating online status of the CEMS.**

5) **At this point, the system requires a manual calibration. To perform this function, open the CEMS screen on the PC and verify that the calibration mode is set to manual. To change this, click on the mode button until "Manual" is displayed. Verify that the calibration gas values are correct. This information is located on certification tags attached to the individual bottles. If it is required to change the values, simply click on the appropriate button and enter the correct value(s).**

6) **Open the valves on the four calibration gas bottles and set the pressure to approx. 5 psig.**

7) **On the CEMS screen, start the calibration mode by clicking on the manual cal start button. The red indicator light on the panel will show steady on.**

8) **Indicating lights on the CEMS screen inform the operator the status of the calibration mode. The modes are zero first followed by three spans then purge. At five minutes for each mode, the calibration will take 25 minutes. During the zero calibration, observe the zero values on all three analyzers. When they stabilize, make any required adjustments using the "Zero" pots located on each analyzer until their respective readings are 0.**

9) **Following the zero calibration, each of the analyzers will go into span mode one at a time. Observe the status indicators on the screen then observe the corresponding analyzer reading. When this reading has stabilized, adjust as necessary using the appropriate "Span" pot until the reading matches the gas value. Repeat this procedure for the remaining analyzer spans.**

10) **At the end of zero and all span calibration modes, the unit will enter a purge mode. This is indicated on the CEMS screen by "Calibration On" and no other calibration mode lights. This purge is required to purge all calibration gasses and replace them with actual sample gas from the stack.**

11) **At the end of the five minute purge period, the CEMS is online and operational. Any automatic corrections the control system needed to make will be displayed on the CEMS screen.**

12) **If it is desired to have the control system perform automatic calibrations, place the calibration mode to "Automatic". The automatic calibration will start 24 hours from the time auto mode was selected.**

13) **To shutdown the CEMS simply place the OFF-ON Switch to the off position.**

Alarms and Troubleshooting

The CEMS alarms are indicated in two places, a rapid flash of the red indicator and the alarm logs within Wonderware. The operator should familiarize himself with the procedures to view and acknowledge alarms in Wonderware as they will give the operator enough information to correct the problem or call appropriate service personnel.

Below is a troubleshooting guide for the most common problems that might be encountered.

1) **Sample System**
   - A) **Pump will not start after warm up period – The pump is controlled by the conditioner. Located on the front of this conditioner are two green LED's, labeled "Cool" and "Dry" Verify that both on illuminated.**

     The LED "cool" indicates that the conditioner is at temperature. If it is out, the conditioner temp control is bad and needs repair.

     The LED "Dry" indicates that there is no water in the sample filter/intrusion bowl. If this is out, look for water in the bottom of the filter bowl. If water is present, remove bowl and dry the filter and bowl then reassemble. Make sure that the peristaltic pumps are operational and that the tubing is not clogged.

     If both LED's are out, check the incoming power to the conditioner. This power is controlled by a relay mounted on the terminal strip mounting rail. The relay is energized from the control system PLC. Refer to the wiring diagram for the CEMS.

   - B) **Sample flow rate – The sample flow rate is controlled by the backpressure regulator. If the operator is unable to set the correct flow rate, the following should be checked.**

     High flow rate would indicate a plugged regulator or vent system. Verify that the regulator piping and the associated tubing are free of obstructions.

     Low flow rates could be an indication of dirty sample filter, plugged sample transport line or a bad diaphragm in the regulator. Inspect each area and correct any problems encountered.

2) **Analyzers**
   Analyzers will not calibrate – The sample system must be fully operational in order to calibrate the analyzers. If it is not, follow the steps outlined above before attempting a calibration sequence. If the sample system is operational, verify that the calibration gas cylinders are not empty and that the calibration lines are not plugged. Be sure to check the line from the panel to the probe. If all lines are clear, replace the solenoids. All solenoids should be replaced at the same time.

3) **Additional trouble – Any problems not covered above should be referred to qualified service personnel.**