

CEM 2 Stage Probe



**Part # 07202, 07204, 07206, 07208, 07210
Self-Regulating Heater Part # 07275 (optional)**

User Manual May, 2008



Questions? Contact us at 800-223-3977 or online at
<http://www.cleanair.com/equipment/Express/main.html>

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IMPORTANT!!!

BEFORE YOU BEGIN READ THIS!!!



READ AND UNDERSTAND ALL INSTRUCTIONS BEFORE USING THIS SYSTEM!

SAVE THESE INSTRUCTIONS!!!

- **To Avoid Accidents...**
 - ✓ Keep your work area clean and well lit.
 - ✓ Keep bystanders away.
 - ✓ Exercise common sense.
- **Electrical Safety...**
 - ✓ Do not operate in combustible environments.
 - ✓ DO NOT operate these products when wet or in water.
 - ✓ ALWAYS be sure that the components of this system are running with the correct voltage (120V or 240V).
 - ✓ Never remove a grounding prong or modify a plug.
 - ✓ Do not abuse the power cord or plug. Remove by handling plug only.
- **Personal Safety...**
 - ✓ The CEM 2 Stage Probe can be heated. Use caution when handling equipment during or after testing.
 - ✓ Stay alert and watch what you are doing.
 - ✓ Dress appropriately. Wear the appropriate personal safety devices.
- **Equipment Maintenance...**
 - ✓ Clean Air Express can not ensure that the 2 stage probe is compatible with any other systems. It is highly recommended that Clean Air Express's heated sample lines and temperature controllers (if probe is not supplied with the self-regulating temperature control option) be used. See <http://www.cleanair.com> or call (800) 223-3977 for more information.
 - ✓ All internal maintenance and repairs should be performed by one of Clean Air Express's trained technicians.

Customer Feedback

Clean Air Engineering takes pride in our quality products and services. We strive to provide the highest quality products and services in the industry. We realize the importance of end user input in the continual improvement of our products and services. Customer feedback is of paramount importance. **We encourage your feedback with any suggestions or problems that can help us improve our performance.** A customer feedback form is available online at <http://www.cleanair.com/About/feedback.html>. To emphasize our commitment to quality products and complete customer satisfaction, Clean Air Engineering's manufacturing division, CAE Express, offers what we feel is the best and most comprehensive warranty in the environmental industry.

1 Safety

Safety should always be considered first, and proper safety procedures should be followed.

1.1 Weight and Bulk

Although it is relatively light, the CEM Heated Filter Probe may be difficult for some people to move, particularly with long probe lengths. Two persons should move the probe when necessary.

1.2 Temperature

The CEM Heated Filter Probe is temperature controlled by a single heater. This heater is capable of temperatures of up to 275 degrees Fahrenheit and the possibility for burns does exist. Unplug the probe and allow it to cool before handling or performing any maintenance on it or use insulating gloves when cooling is impractical. Exercise caution when moving the probe before cooling, as the exterior can be very hot.

1.3 Electrical Shock

The probe is powered by a standard 120 VAC line, meaning potentially fatal shocks are possible. The probe is no more dangerous than many household appliances in this regard; however, care must be taken to avoid shock. Before performing any maintenance on the probe assembly, **turn off and unplug the probe** from the 120 VAC line.

1.4 Operation in Ignition Prone Environments

Extreme caution must be taken when using the 2 Stage Probe in combustible or electrically charged environments, as the probe is **not intrinsically safe**. The probe can potentially ignite flammable gasses, starting a fire or causing an explosion. Use extreme care and thoroughly evaluate the operating environment prior to use.



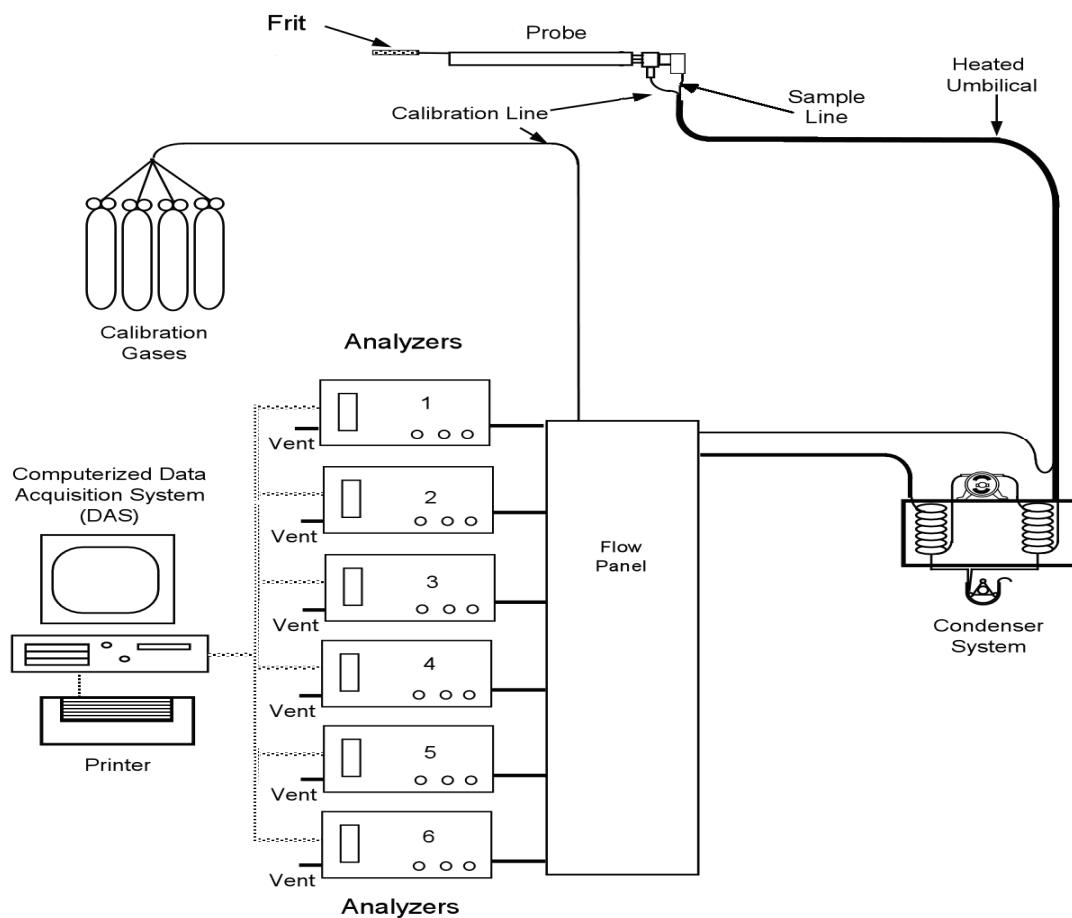
2 Principles of Operation

2.1 40 CFR Part 60 and Part 75

The CEM 2 Stage Probe is designed for Part 60 & 75 RATAs (Relative Accuracy Test Audit).

It is advised that any person using the CEM 2 Stage Probe for a CEM RATA be intimately familiar with the EPA 40 CFR Parts 60 and 75.

For those already well versed in Parts 60 and 75, the operation is as follows. A velocity traverse of the stack must be taken to determine three points across the diameter of the stack that are characteristic of the stack's flow. Samples of a certain predetermined length will then be taken from each of the three points and run through the sample train. A typical sample train will consist of the probe and its associated filters, a heated sample line, a gas conditioner, a flow panel, and a bank of gas analyzers.



2.2 System Components

The CEM 2 Stage Probe is available with a 1/4" or 3/8" stainless steel heated liner with a 1" O. D. protective stainless steel sheath and type K thermocouple. The probe comes in various lengths (2 ft – 10 ft) and can handle temperatures up to 400 °F (1200 °F with optional high temperature heater).

Figure 1 shows the probe and its various features. The probe may be ordered with (order extra part # **07275**) or without a built in temperature controller. If this option is not chosen, an external temperature controller is necessary.

2.2.1 Temperature Controllers

The CEM Heated Filter Probe utilizes a single temperature controller. The temperature controller maintains the specified temperature of the probe. Maintaining a steady temperature around 250°F is important so that moisture, acid gas, and other constituents of the gas stream do not condense out, as this can result in inaccurate data and damage to equipment.

2.2.2 Sample Filters and Filter Holders

Two stainless steel frits OR a single frit and internal glass fiber filter (**9975**) keep the sample clean. The glass fiber filter will prevent particulates greater than 0.02 microns from entering the sampling system. The glass fiber filter (if applicable) needs to be periodically changed to ensure accurate and consistent sampling. However, the glass fiber filters are disposable and last a considerable amount of time with most stack gas streams because the stainless steel frits filter out a large percentage of the particulate. To order replacements call Clean Air Express at (800)-223-3977. Clean Air Express can also be reached by fax at (847)-991-8924; by mail at 212 N. Woodwork Lane Palatine, IL 60067; or on the web at <http://www.cleanair.com/equipment/Express/main.html>

2.2.3 Stainless Steel Frits

At the probe tip is a stainless steel frit (**0740F**), also called a sintered stainless steel filter, which prevent large particulate (≥ 20 micron) from entering the sampling system. The frits are reusable after a thorough soak/cleaning (see the maintenance section), and have proven to be very reliable and effective filtering elements. Care should be taken when removing and replacing the frit, as they can be somewhat fragile. It is recommended that a backup wrench be used.

2.2.4 Power Requirements

The CEM 2 Stage Probe requires a 120 VAC or 240 VAC line capable of supplying 100 to 800 watts of power (depending on probe length).

3 System Operation

There are probes available both with and without a built in thermostat. A probe with a built in thermostat (**07275**) will automatically heat to 250 degrees Fahrenheit.

3.1 Stack Testing

(see Figure 1)

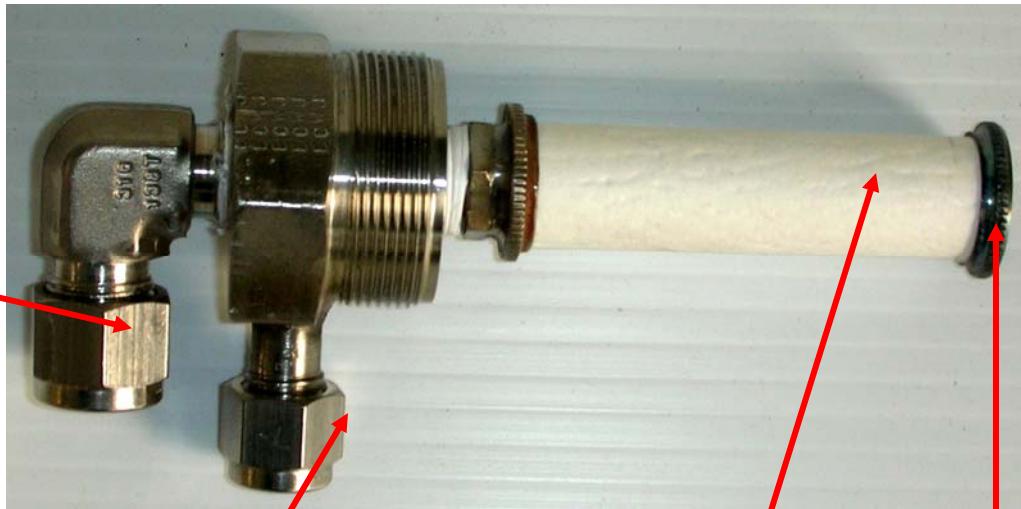
- Be sure all frits and filters are secure in their correct locations.
- Be sure all other connections are secured (analyzers, etc.).
- Connect the sample gas line (1) and the calibration gas line (2) from the heated line securely to the probe.
- Plug the probe's power cord (5) into an appropriate power source.
- *With thermostat:* Plug the type K thermocouple (4) into an appropriate temperature measuring device. The probe temperature will oscillate both above and below the set point but will level out at the desired temperature in approximately 10-15 minutes for the probe to warm up.
Without thermostat: Plug the type K thermocouple (4) into a temperature controller. Set the desired temperature. Wait until the probe reaches the desired temperature.
- Insert the probe into the stack and begin testing.

3.1.1 Removal of Frits and Filters

Both the frit and the filter may be removed for cleaning purposes (see 3.1). The stainless steel frit is removed by either unscrewing it from a 1/4" MNPT fitting or by loosening the nut and ferrule of a 3/8" tube fitting. It is recommended that the user avoids putting shear pressure on this part of the probe to avoid bending or kinking of the tubing. Using a backup wrench as opposed to a single one helps to prevent this.

The glass fiber filter can be removed by unscrewing the back of the probe (the part that contains the sample and calibration connections, see **figure 1**). Unscrew the endcap (6) of this part and the filter will slide off. Replace the filter as necessary.

Figure 1



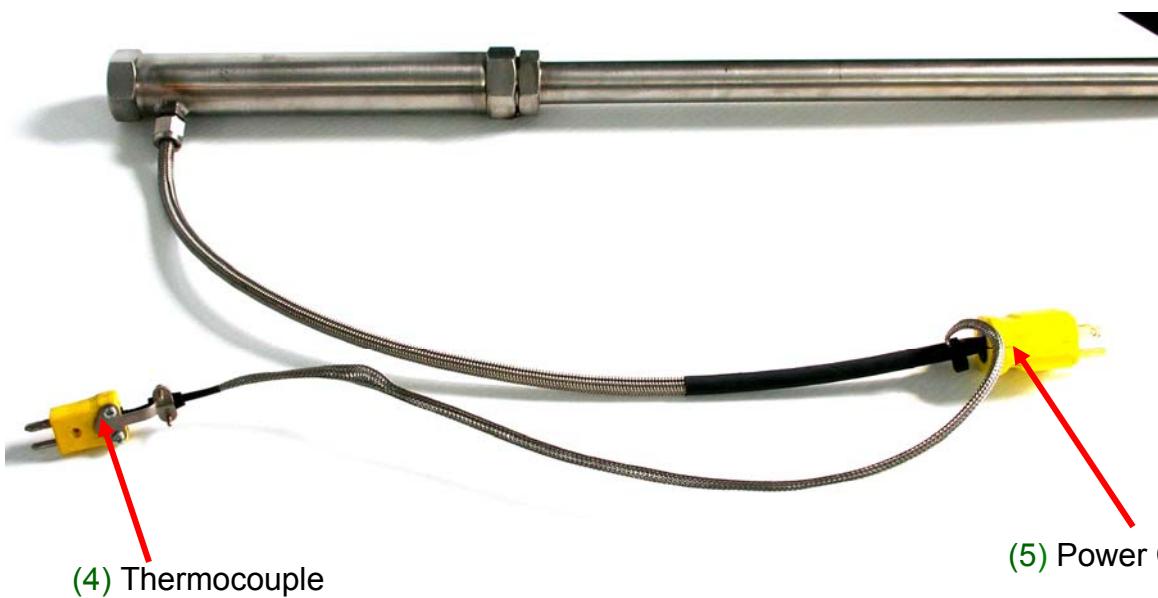
(1) Sample Gas Line Connection

(2) Calibration Gas Line Connection

(3) Glass Fiber Filter

(6) Endcap

Figure 2



(4) Thermocouple

(5) Power Cord

4 Routine Maintenance and Inspection

The CEM 2 Stage Probe has a relatively maintenance-free design, requiring minimum upkeep throughout its lifespan.

 **CAUTION!!** – Do NOT disassemble this product beyond the scope of the manual! For internal maintenance contact Clean Air Express.

4.1 Filter and Frit Upkeep

The sintered stainless steel frit is the probe's first line of defense against particulate. As a result, it accumulates a particle cake and eventually will clog. This particle cake and subsequent blockage of the frit is detrimental to the operation of the probe, as it may scrub certain analytes, and it can impede flow to below acceptable rates. To clean a sintered stainless steel frit, soak overnight (ideally for 24 hours) in a solution of laboratory soap and water then scrub it. Ultrasonic cleaners are the ideal way to clean your frits and maximize longevity. The stainless steel frit is removed by either unscrewing it from a 1/4" MNPT fitting or by loosening the nut and ferrule of a 3/8" tube fitting. Be careful as they can sometimes be fragile. The glass fiber fine-particulate filters also can become caked with particulate and clog, causing the same problems as a clogged frit. Filters can be removed easily without tools. Glass fiber filters are disposable and they CANNOT be cleaned. The glass fiber filters, when combined with the stainless steel frits, have a long lifespan and are rather inexpensive. The filter housings need to be cleaned whenever visible particle buildup is seen in them or at the completion of the test program. The cleaning of the filter housings can be done by wiping the housing and liner of the probe. It is recommended that extra frits be kept onhand to allow for continuous operation.

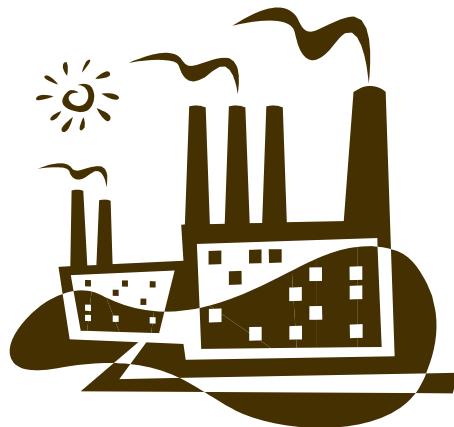
4.2 Check-Out Procedure

Before considering your probe fit for service after a job, check out a few simple things to ensure its good status.

- Always check the frit and filter for tears, punctures, or particle caking, replacing or cleaning as needed.
- Inspect the filter housing gaskets for cracks or tears, and replace if necessary.
- Examine the probe tip fittings (the ferrules, unions, etc.) for excessive wear and repair or replace as required.
- Verify the physical integrity of the probe; no breaks, bends, or physical disconformities.
- Leak-check the probe from the probe tip, ensuring that it holds both positive and negative pressure.
- Verify that the probe can heat to approximately 250 °F or desired temperature up to 275 °F.
- Lastly, general cleanliness promotes good equipment health as well as accurate test results.

4.3 Other Maintenance Issues

For any other maintenance issues, concerns, or questions, please contact Clean Air Express at (800)-223-3977. Clean Air Express can also be reached by mail at 212 N. Woodwork Lane Palatine, IL 60067; by fax at (847)-991-8924 or on the web at <http://www.cleanair.com/equipment/Express/main.html>



5 Troubleshooting

The CEM 2 Stage Probe is very reliable, as most CEM RATA equipment is when setup properly. When something is not working, these points often can provide a solution.

- **System bias check comes up wrong.**

Leak-check the system, and ensure that all heaters are working properly. If the system leak-checks and is heating, ensure that the calibration gas path is complete and unobstructed. If the path is unobstructed but the bias check still fails, replace the frits and filters. Ensure that the glass fiber filter is the correct filters for the analyte to be sampled (ex. using non acid gas resistant filters can scrub acid gas from the sample). If no problems have been uncovered, remove the lines and clean the probe, heated lines, and gas analyzers.

- **Probe not heating**

Probe heaters cannot be replaced in the field. However, the source of failure is usually not a burned-out heater, but a bad connector. Check the connectors for a broken or bent pin, and repair/replace as necessary. Lastly, check to ensure that the temperature controller is operating correctly; if it is not, fix or replace it.

- **Probe overheating**

The overheating of the heater in the probe assembly is often a result of either a thermocouple or temperature controller problem. If a thermocouple's insulation is compromised and the bare wires are allowed to come in contact with a surface, it will report the temperature at that point, rather than at its tip. This can fool a temperature controller into keeping a heater on continuously. If none of the thermo couples has failed, it means that the temperature controller itself has failed and needs to be replaced.

- **Unable to pull sufficient sample flow rate**

If you cannot achieve your desired flow rate make sure your sample pump is not the issue, that it is capable of pulling the flow rate. Then check to ensure that all the frits and filters are not clogged. If they are not, look for a bent stainless steel tube or a crimped Teflon tube, then check the five-way valve is operating properly. The next item to check is the heated sample line; make sure the line is not crimped or clogged. If none of these components are compromised, it is likely that your gas analyzers or the gas conditioner is to blame.

**CLEAN AIR ENGINEERING
PARTS LIST
CEM 2 STAGE PROBE**

May 20, 2008

Parent Part #: 0720(*)

*dependent on length of probe

Type: F

COMPONENT	DESCRIPTION	QTY	UM	TYPE
0315G1	GLASS THERMOCOUPLE WIRE TYPE K 24 GAUGE	3.0	EA	R
93001	1" CAP SS FOR 9300- W/ NUT & FERRULE	2.0	EA	R
9220A	3/8" CAP STAINLESS STEEL	3.0	EA	R
9220	1/4" CAP FITTING WITH NUT AND FERRULE	1.0	EA	R
9512A	MALE ELBOW 3/8" T-1/4" MNPT SS	1.0	EA	R
93191	TUBING 1 1/2" .049 304 S.S.	1.0	FT	R
9316	TUBING 1" X .035 WALL TYPE 304 SS WELDED	7.0	FT	R
9305	TUBING 3/8" X .035 WALL TYPE 304 SS WELDED	7.0	FT	R
96023	TFE HOSE W/SS BRAID-1/4" ID X 3/8" OD	1.0	EA	R
91351	PLUG GROUNDED 15A 125V AC	1.0	EA	R
9944	THERMOCOUPLE QUICK TIP	1.0	EA	R
0316M	STD MALE THERMOCOUPLE PLUG TYPE K	1.0	EA	R
9609	GLASS SOCK	3.0	FT	R
0740F	20MM FRITTED FILTER 20 MICRON GRADE-6" LENGTH	1.0	EA	F
0740G	SINTERED POROUS METAL 316L 20 MICRON ~ 18" LONG .7"X.5"X18"	6.0	IN	R
0419RSMC	UNION MALE 3/8" T-1/4" MNPT	1.0	EA	R
0418SWFC	1/4" X 1/4" SOCKET WELD FEM. CONNECTOR 316SS. TUBE TO PIPE	1.0	EA	R
0740FEC	BLANK - ROUND .700DIA 316SS 12GA	1.0	EA	R
9253T	1" TEFLON FERRULE	1.0	EA	R
9268	1/4" PIPE COUPLING 316 SS	1.0	EA	R
01496	SILICONE HEATER 80" 400W 110V	1.0	EA	R
0418SMC	UNION MALE 1/4" T-1/4" MNPT	1.0	EA	R
9975	FILTER - FINITE ELEMENT USE FOR 9974	1.0	EA	R
99744	FINITE FILTER HOLDER END CAP FOR FILTER SUPPORT ROD	1.0	EA	R
99747	FINITE FILTER HOLDER CENTER SUPPORT CORE	1.0	EA	R

Stainless Steel Frit
0740F



Glass Fiber Filter
Cartridge
9975



Our Guarantee

Clean Air Engineering warrants products to be free from defects and workmanship for a period of one year after delivery date. The sole and exclusive remedy for defective goods shall be repair or replacement of defective parts or payment price of the goods for which damages are claimed, at Clean Air Engineering's option.

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