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## Purpose

To describe the initial installation and installation after service procedures of the NO<sub>x</sub> analyzers in the DLI AQMN stations.

The procedures described are in conformity with the relevant clauses of EN 14211 and the manufacturer's recommendations.

## Principle

The analyser is installed at a monitoring station in such a way that normal operation of the analyser is not compromised. This implies that the analyser is sheltered and shielded from dust, rain and snow, direct sun radiation, strong temperature fluctuations etc. An enclosure (caravan) with air conditioning which fulfils these requirements is used (see DLI-QD-101 General Description of the Monitoring Stations). Uninterruptible Power Supply systems are used to smooth voltage fluctuations.

After installation of the analyser at the monitoring station the analyser is tested for proper operation. This is described in following sections.

## Staff involved

This SOP is intended for the staff of the DLI and of the contracted maintenance company who perform (part of) the activities described.


## Equipment

- Nitrogen oxides monitor (Ecotech EC9841B)
- Central sampling line
- Dynamic dilution system (Sabio 4010)
- Zero Air Source (Sabio 1001)
- Calibration gas mixture, NO in nitrogen, certified every 6 months against primary reference gas standard (Certification body)
- Station data processor (Ecotech).

## Relevant documentation

DLI-QD-101 General Description of the Monitoring Stations

DLI-QD-102 Initial Installation and Acceptance Test of Equipment in the DLI AQMN

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## Procedure

### General

When an analyzer is evaluated and approved for use in the DLI AQMN (see DLI-QD-102 Initial Installation and Acceptance Test of Equipment in the DLI AQMN) is transferred to the monitoring station to be installed.

The analyzer is transferred to the station with attention not to damage internal components. Whenever is placed in a vehicle care should be taken to protect the instrument from vibrations, direct sun light etc.

The following sections describe the procedures for proper installation of the analyzers on the instrument rack and the tests performed after the installation to verify proper function of the instrument.

### Initial Check

Check to make certain the instrument arrived undamaged. If you find damage, report it as described in the preface, on the page titled *Claims for Damaged Shipments and Shipping Discrepancies* in the Operation manual.

Analyzers are shipped ready to power up. Occasionally, however, rough handling during shipment causes dislodged PC boards, disconnected cables, or incorrectly positioned switches. Verify that your instrument is in operating condition by performing the following procedure.

#### Remove the Top Cover

Grasp the front top corners of the front panel and pull forward. The panel will pop loose and pivot forward. The top cover retaining hardware is then visible. Use a screwdriver, coin, or your fingers to turn the two retainers 90 degrees. When the retainers are loosened, slide the cover backward about 4 inches and lift the top cover straight up.


#### Service Switch

Opening the front panel allows a view of the secondary panel where four switches are visible. The position of the toggle switches for operating mode is:

- DC Power ON
- Pump ON
- Service IN

The Reset switch is not a toggle switch and is only activated when pressed. It resets the microprocessor. For the EC/ML9841 the pump switch is only applicable if an internal pump has been installed. Most instruments use an external pump to give better vacuum.

When in the OUT position, the Service switch sets the OUT OF SERVICE bit in the 50-pin I/O interface and in the status word from the serial port. The OUT position has no other effect on the operation or validity of the data obtained from the analyzer.

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When the Service switch is set from OUT to IN, the instrument returns to the normal operating conditions.

### **Inspect the Components**

Verify that the components were not damaged in shipping. If any PC boards are dislodged or cables disconnected, follow the instructions below.

### **Reinsert Dislodged Boards**

The bottom edge of the boards must be held in place by the guides. The top of the boards must be attached to the metal bulkheads by the plastic or metal studs with spring tips.

### **Cable Connections**

The cable connectors and the board connectors must be matched securely in place for correct connection. The red indicator on each cable must be positioned at the arrowhead mark on the board connector. Make the connection by pressing the cable connector into the mating connector until a click is heard. Then, fold the retainers inward to secure the connection.

## **Mechanical Installation**

### **Selecting a Location**

Select a location for the analyzer where temperature variation, dust, and moisture are minimal. The location should be well ventilated and should allow convenient access to the operator controls and front panel display. The analyzer can operate in a range of 5° to 40° C without risk of damage.

### **Rack Mount**

The analyzer is supplied with the chassis slides to be mounted on a rack. The rack-mount version is 24 inches (61 cm) deep and fits into a 19 inch (48.3 cm) RETMA instrumentation rack. The front panel will protrude slightly.

**Caution:** The rack-mount version requires a properly ventilated rack enclosure. The temperature inside enclosures that are not properly ventilated may rise as much as 15 C above the ambient air temperature. This may force the analyzer to operate outside of specifications. Optimum operation is obtained at an operating temperature of 20 to 30 °C inside the rack enclosure.

After the analyzer has been mounted, make the pneumatic and electrical connections.


## **Connections**

All pneumatic connections must be secure to ensure accurate operation of the analyzer. The following information describes connection techniques for pneumatic and electrical connections.

### **DAS Connections**

The analyzer is connected to the data logger with an RS232 cable. Ensure that the cable is securely connected to the correct COM port of the logger.

**Caution:** The EC/ML9841 electrical ground is isolated from earth ground. To avoid possible ground loops, all electrical devices connected to the analyzer should have floating inputs (not connected to earth ground).

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### **Sample Gas Connections**

**Caution:** Sample and zero air connections to the EC/ML9841 should be maintained at ambient pressure, with any excess flow vented to the atmosphere.

The EC/ML9841 requires at least 1.00 slpm (0.64 slpm sample plus 50% overflow) of particulate-filtered (<5 micron), dry (noncondensing) sample furnished at all times. A 5 micron inlet filter is necessary and is already installed in the analyzer.

Tubing used for sample gas and exhaust connections must be 1/4 inch OD and 1/8 to 3/16 inch ID. The recommended ID is 5/32 inch. A segment of clean Teflon tubing should be purchased to connect the sample source to the sample inlet.

Only use lines and fittings made of stainless steel, Teflon, Kynar, or glass.

Instructions for tubing connections with Kynar fittings:

- Cut the tubing squarely and remove any burrs.
- Insert the tubing through the back of the nut until it reaches the tube stop in the fitting.
- Tighten the nut finger-tight plus 1-1/2 to 2 turns. A squeaking sound when tightening the nut is normal.
- All nuts should be re-tightened when the system reaches operating temperature.

### **Exhaust Connections**

Connect the exhaust port of the analyzer to vacuum pump capable of 1 slpm at 20" Hg (67 kPa) vacuum (minimum capacity). The pump must be connected through a charcoal exhaust scrubber to remove excess ozone and prevent damage to the pump. The exhaust of the pump should be connected to a manifold exhaust to vent the exhaust gas away.

### **AC Power Connection**

Verify that the power selection switch on the rear panel and the power cord and fuse are appropriate for your use. Move the switch right or left so the appropriate voltage rating (240V) is visible on the switch.

**Warning:** Power is supplied to the analyzer through a three-pin power plug. The ground must not be defeated and an adequate ground must be connected to the instrument, both for proper performance and for the safety of operating personnel.


**Warning:** Be sure to check that the mains power selection switch is at the correct setting before turning the instrument on. Failure to do so may result in damage to the power supply.

Connect the power plug to the power receptacle and press the power switch to the ON position on the rear panel. Also make sure that the DC POWER switch on the front secondary panel is switched to ON.

### **Display Adjustments**

Adjust the display contrast by simultaneously pressing two keys on the front panel

*Up arrow* and *Select* for darker contrast, *Down arrow* and *Select* for lighter contrast.

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**Note:** Pressing the *Up* or *Down* arrow key while not simultaneously pressing the *Select* key when the main screen is displayed causes the screen query, START MANUAL CALIBRATION? If this happens while adjusting the display, press the <Exit> key.

**Note:** The display is sensitive to the ambient air temperature and analyzer temperature. The appearance of the display will vary with changes in these conditions.

## Warmup

When the instrument is initially powered up, several components in the instrument are required to reach operating temperature before the analyzer will begin operation. This process typically requires about 60 minutes from a cold condition.

During the startup period, the message START-UP SEQUENCE ACTIVE will be displayed. This indicates progression toward normal operation.

The startup sequence is keyed to the molycon temperature. The molycon must reach 250° C before the ozone generator will begin operating. This will typically take about 45 minutes. The molycon reaches its operating temperature of 315° ±5° C approximately 60 minutes after applying power.

**Note:** The EC/ML9841 will re-run the above start-up routine whenever power has been lost for more than two minutes. If power is lost for less than two minutes, the analyzer will return to its previous settings without the start-up routine.


## Calibration Check

After the instrument has warmed up and has advanced from the start up sequence to measurement mode perform zero and span check to verify the correct calibration of the instrument. Adjust as necessary.

## Re-Installation

Follow these steps to re-install an instrument which was removed from the station

- Visually inspect the instrument to verify that is not damaged from the transportation. Remove cover and check internal components are placed firmly
- Install the instrument at it's previous position in the instrument rack
- Connect sample inlet tubing
- Connect zero and span inlets tubing
- Connect exhaust tubing
- Connect RS232 cable and secure with screws
- Verify the voltage section and connect the power supply cable
- Switch on the instrument
- Switch on the pump
- Verify communication with data logger
- Allow instrument to warm up

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- Record instrument status in the *Calibration Report* form and perform a zero and span check. Adjust as necessary.

### Reference Procedures

Ecotech EC9841B manual

Sabio 4010 manual

### References

CYS-EN 14211: 2005. Ambient Air Quality-Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence.

### Revision History

Revision 0