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Service Note

07-018A
8/12/07

M452 Troubleshooting Guide

Sensor and System Troubleshooting

These are the guidelines for diagnosing system and sensor malfunctions using the four digital Status Outputs provided by the M452. All troubleshooting should be done after the M452 has been turned on and allowed to warm up for at least 15 minutes.

1 Status LED's

On the top of the M452 are five status LED's.
The Status LED labeled 'CPU STATUS' is used to verify the status of the CPU inside the M452. This LED should blink on and off continuously while the sensor is on. If this LED stops blinking while power is applied to the sensor, a CPU failure is indicated.
The other four Status LED's on the M452 exactly mirror the four Status Outputs described in the following sections.

2 Status Outputs

Table 5-1 below describes the function of the status outputs. More details as to the meaning of the status outputs are described in the following sections.

Table 1: Status Outputs

Output #	Name	On State / LED On	Off state / LED Off
1	Sensor O.K.	Normal State	Reference or Measure > 4995mV; Reference < 1000mV
2	Invalid Reading	Pressure > 45 PSIA, Negative Ozone Concentration	Normal State
3	Lamp Low	Reference Detector<600mV	Normal State
4	Cell Dirty	Measure/Reference ratio < 0.5 (zero gas)	Normal State

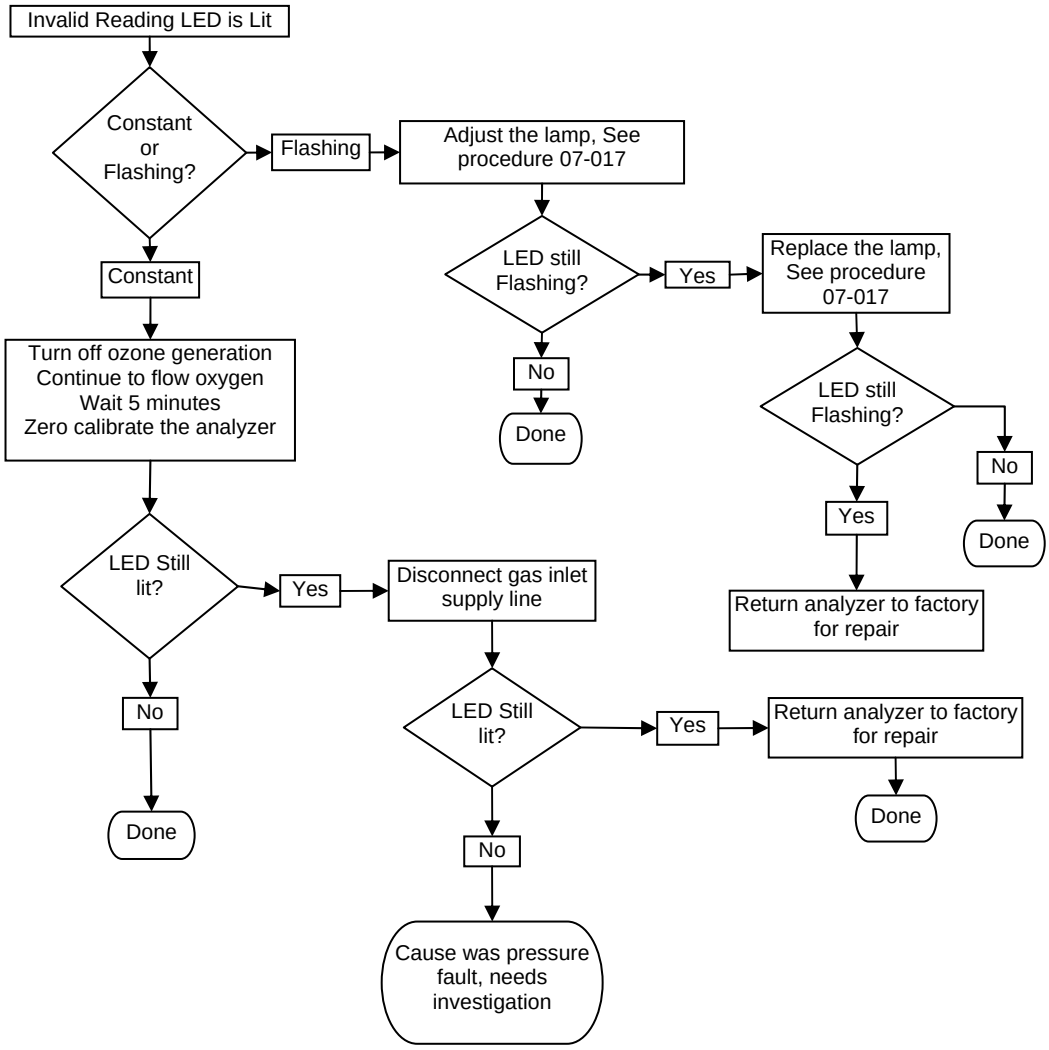
3 Sensor O.K.

The normal state for the Sensor O.K. output is ON. During the warm-up period on start-up this output will stay off until the UV lamp reaches a minimum intensity. If this output remains off after the 15 minute warm-up period, or goes off during normal operation, then the M452 is in need of servicing.
If the Sensor O.K. output turns off AND the Lamp Low output is on, this indicates that the lamp intensity has below the minimum level required for proper operation.
If the Sensor O.K. output turns off and the Lamp Low output is also off, then one of the analog voltages in the sensor has exceeded the range of the internal A/D converter. Adjustment by qualified service personnel is required.

4 Invalid Reading

The normal state for the Invalid Reading output is OFF. If this output turns on, this indicates that the M452 is still operational, but a system fault or calibration fault exists that may make the current ozone reading invalid. The Invalid Reading output is turned on for any of the following conditions:

1. When the measured pressure in the M452 exceeds 45 PSIA.
2. When the measured concentration has exceeded the full-scale concentration range of the sensor.
3. When the sensor is indicating an excessive negative reading.
4. If the LED is blinking – this can mean that the lamp is fluctuating and causing the reading to jump around to over range or under range.
5. Follow the flowchart below for resolution.



5 Lamp Low

The normal state for the Lamp Low output is OFF. If this output turns on, this indicates that the UV lamp intensity as measured by the reference detector has dropped below 600mV.

1. If the Lamp Low output turns ON and the Sensor O.K. output is ON, this indicates that the lamp intensity is still adequate for measurement
    a. Lamp adjustment should be made when possible, see procedure 07-017.
2. If the Lamp Low output turns ON and the Sensor O.K. output is OFF, this indicates a failure condition and accurate measurement is no longer possible.
    a. If this condition exists – adjust or replace the lamp, see procedure 07-017.

6 Cell Dirty

The normal state for the Cell Dirty output is OFF. If this output turns on, then the ratio of the measure detector to the reference detector (at zero) is < 0.5. This value is calculated when the zero calibration is performed.

When this output is on, it indicates a loss of optical transmission through the windows in the absorption cell or a calibration fault.

1. If this LED is lit, the unit will need to be returned to TAPI for repair.

7 Status Output Summary Table

Table 2 below is a logic truth table summarizing the recommended actions based on the states of the four status outputs. A '1' indicates the output is ON, a '0' indicates the output is OFF, and 'X' indicates the output is in either state.

Only use this table after analyzer has warmed up for at least 15 minutes.

Sensor OK	Invalid Reading	Lamp Low	Cell Dirty	Actions
1	**0**	**0**	**0**	Normal operation, no action required
0	**X**	**X**	**X**	Service required, adjust or replace the lamp (see procedure 07-017) Calibrate at Zero
1	**1**	**X**	**X**	Check Pressure > 45 PSIA Verify that concentration has not exceeded full scale range of sensor. Calibrate at Zero.
1	**X**	**1**	**X**	Lamp adjustment useful, though not required
1	**X**	**X**	**1**	Return to factory