CHAPTER 6 Sensor Calibration and Sensitivities

6.1 OVERVIEW

The system calibrates sensors to obtain accurate correlation to smoke levels, then uses operator selected sensitivities to determine alarm threshold levels. Only photoelectric and ionization smoke sensors are calibrated. The heat sensor is not calibrated, although it does participate in calibration activities to validate its health. The FRCM input and other output devices are not calibrated.

Calibrations are performed per the traditional techniques for photoelectrics and ionization devices. However, the improved technology in the devices lessens the traditional preference for devices. Photoelectric devices more accurately measure black smoke than their predecessors, but also have drastically improved sensitivity to gray smoke and other smoke profiles. Therefore, in many cases, photoelectrics alone serve the purpose of multiple devices or devices with multiple detection types.

6.2 LEVEL DEFINITIONS

Sensors typically output a digital value corresponding to their smoke obscuration value. During conditions of no smoke, this is referred to as the "clean-level". The clean level of the sensor is allowed to slowly compensate itself (by an average of one digital count every two hours) corresponding to environmental conditions such as dust accumulation.

The sensors are also automatically calibrated regularly to accurate smoke levels. Upon system interrogation, the sensor responds with a "fire level" corresponding to a particular smoke obscuration. The system then uses the fire and clean level to individually calibrate each sensor to a very accurate level.

Pre-alarm levels are defaulted "on" in the Cheetah configuration software. To remove the pre-alarm feature of any detector, at the detector configuration menu a "<" is observed following the P1 and P2 headers. By removing the ">" the pre-alarm feature for that detector will be removed.

6.3 CALIBRATION TIMES

The default weekly system "fire level" calibration is Wednesday @ 12:00 PM, but this can be changed during system configuration. This calibration should be performed during a period of time that represents conditions the sensor will encounter. It is also advantageous to calibrate during a time when personnel are available in case a trouble is encountered. This system calibration includes fire level adjustments. The weekly calibration cannot be disabled.

The clean level is an ongoing calibration to zero out environmental conditions as described above. Subsequent power-ups shall not require calibrations unless devices are moved or reconfigured. **Upon installation of sensor, when the environment is clean, the installer shall calibrate both the clean and fire levels.**

6.4 PHOTOELECTRIC SENSOR

The system allows photoelectrics to have alarm level sensitivities between 0.8% and 3.5% obscuration using calibration techniques per UL268 black smoke testing. The resolution is 0.1%, the accuracy is of a similar magnitude. Sensitivities are configured per Section 7.3.2. For photoelectrics, entry is a number between 08 and 35 for 0.8% to 3.5% respectively.

The photoelectric is "fire level" tested at a factory adjusted 4.0% obscuration. The system uses the sensor's digital values for fire level and clean-level to program the device to respond when the selected alarm level is reached. For optimal operation pre-alarm1 is the lowest level, followed by pre-alarm2 level, then by the alarm levels. The pre-alarm 1, pre-alarm 2, alarm 1 and alarm 2 sensitivities are set as needed to optimize sensitivity, yet minimize nuisance alarms due to environmental conditions.

6.5 IONIZATION SENSOR

Ionization sensors measure smoke levels by MIC'S. MIC's are Measurement Ionization Chamber levels measured in picoAmps. This is the preferred measurement system for the gray smoldering smoke that ionization detectors most efficiently detect. Ionization sensors must be set to an alarm threshold of 80pA MIC for all time based conditions. Although a user entry field exists for the pre-alarm levels of ionization detectors, this feature is not yet available.

In simple terms, 100 pA MIC's represents no smoke obscuration and 0 pA represents extremely dense smoke. The system has setup of 80 pA sensitivity. The "fire-level" test is performed at 50 pA.

To improve accuracy, the ionization sensor reports an average MIC level corresponding to samples previously taken. These samples are taken at approximate one second intervals, so after power-up or reset there can be delays until the appropriate number of samples are obtained.

6.6 THERMAL SENSOR

The thermal sensor is programmed in degrees Fahrenheit. It does not have clean level calibration as dust levels do not effect the device. The temperatures are accurately set at the factory; its fire-level calibration is to validate sensor health and accuracy with a fire level correspondance to 212F. Heat detectors can be adjusted between 135-150^{o}F. Default setting is 140^{o}.

6.7 SENSOR LEVEL CHART

	Photoelectric	Ionization	Thermal
Clean Level (Decimal Counts)	41-82	31-92	Not applicable
Fire Level (Decimal counts)	162-225	156-229	240