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The 16 UL-Listed Modes of the ACD

This document is intended to explain the 16 different modes of the ACD multi-sensor.

What are the modes?

You will see these modes when programming the panel using the front-panel menus and LE2.

- +S +COHb
- +S/FT +COHb +RFA
- +S +FT +RoR +CO +COHb
- +RoR
- +FT +RoR
- +FT
- +S
- +S +RFA
- +S/H
- +S/H +RFA
- +S/FT/CO +RFA
- +COHb
- +S/H/CO +S +FT +RoR +CO/COHb
- +RoR +COHb
- +FT +RoR +COHb
- +FT +COHb

Why are there so many modes??

These modes provide the ultimate in fire detection in any spot-type detector or sensor. Each mode provides different fire detection technologies *in combination* or *individually*, that allow you to "fine-tune" the ACD for the environment in which it is installed. In addition, a "Reduce False Alarm" feature (RFA) is included in six of the modes, providing additional assurance against unwanted alarms. The panel's Day / Night mode feature can quickly change the ACD from one mode to another, changing the detection criteria to provide the best detection for the time of day along with the best unwanted alarm rejection 24 hours a day.

You will notice two symbols when looking at the modes. Understanding these will assist you in determining how the mode operates.

The "+" sign indicates that the following technology (or technologies) work <u>individually</u> in this mode.

The "/" sign indicates that these detection technologies work <u>together</u> in a multi-sensor fashion.

Examples:

+S + COHb – This mode provides independent operation of the smoke sensor and COHb CO detector function.

+S/FT +COHb +RFA – This mode provides a Smoke/Fixed Temp multi-sensor operation *plus* independent operation of the COHb CO detector *plus* the RFA feature.

Let's look at each mode in more detail.

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ACD Modes:

+S +COHb

This mode provides smoke detection + COHb alarm. This mode also includes the +RFA feature *(Reduce False Alarm)*. The smoke and COHb functions work independently of one another, meaning that if the sensor detects smoke that exceeds the programmed alarm threshold the panel will indicate a fire alarm. Or, if the sensor detects a dangerous level of CO according to the performance outlined by NFPA and UL, the panel will indicate a Carbon Monoxide alarm. Because each element works independently in this mode, two events may be generated by the ACD (smoke alarm (Fire or Supervisory) and a Carbon Monoxide alarm).

+S/FT +COHb +RFA

This mode provides a smoke/heat multi alarm + COHb alarm. This mode also includes the *Reduce False Alarm* feature. The smoke/heat multi operation provides a "heat-enhanced smoke sensor" function. If the temperature increases, the sensor will automatically adjust its alarm threshold to *increase* the sensitivity of the smoke sensor, detecting smoke (and fire) more quickly. If the sensor detects a dangerous level of CO according to the performance outlined by NFPA and UL, the panel will indicate a Carbon Monoxide alarm. Because these work independently in this mode, two events may be generated by the ACD (smoke alarm (Fire or Supervisory) and a Carbon Monoxide alarm). The heat element is used only to modify the smoke sensitivity; there will be no alarm from the heat sensor (high temperature) in this mode.

+S +FT +RoR +CO +COHb

This mode provides smoke detection + fixed temperature heat detection + rate-of-rise heat detection + CO detection + COHb alarm. Each detection element operates independently and is capable of creating an alarm event. If the sensor detects an elevated CO condition or a COHb event, it will indicate a Carbon Monoxide alarm. Note: if the ACD is configured for Fire Alarm, the smoke and heat sensor will produce a fire alarm when activated; the panel will not indicate if the activation was due to smoke or heat. It can only produce one fire alarm in this case. If the ACD is configured for Supervisory however, the smoke sensor will generate a Supervisory and the heat sensor will generate Fire Alarm. The CO sensor will always indicate CO Alarm. This means that when the input action is set as Supervisory, it is possible to see 3 unique events from the same ACD address; smoke at sub-address 00, heat at sub-address 01, and CO at sub-address 02.

+RoR

This mode provides rate-of-rise heat detector operation only. The ACD will ignore smoke and CO in this mode.

+FT +RoR

This mode provides fixed temperature and rate-of-rise heat detection operation. Each heat detection technology operates independently of the other. The ACD will ignore smoke and CO in this mode.

+FT

This mode provides fixed temperature heat detection operation only. The ACD will ignore smoke and CO.

+S

This mode provides smoke sensor operation only. The ACD will ignore heat and CO in this mode.

+S +RFA

This mode provides smoke sensor operation only. The +RFA *Reduce False Alarm* feature is included in this mode. The ACD will ignore heat and CO in this mode.

+S/H

This mode provides smoke/heat multi-sensor detection with a "heat-enhanced smoke sensor" operation. If the temperature increases, the sensor will automatically adjust to *increase* the sensitivity of the smoke sensor. The ACD will ignore CO events in this mode. The heat element is only used to modify the smoke sensor operation and will not create an alarm.

+S/H +RFA

This mode provides smoke/heat multi-sensor detection with a "heat-enhanced smoke" operation along with the *Reduce False Alarm* feature. If there is no temperature increase, the *Reduce False Alarm* feature will be applied to the operation of the smoke sensor. In the event of temperature increase, the ACD will automatically adjust to *increase* the sensitivity of the smoke sensor. The ACD will ignore CO events in this mode. The heat element is only used to modify the smoke sensor operation and will not create an alarm.

+S/FT/CO +RFA

This mode is a smoke/heat/CO multi operation that provides heat- and/or CO-enhanced operation of the smoke sensor along with the *Reduce False Alarm* feature. In the event of temperature and/or CO increase, the ACD will automatically adjust its alarm threshold to *increase* the sensitivity of the smoke sensor. The heat and CO elements are only used to modify the smoke sensor operation; therefore, the panel will not indicate a heat or CO sensor alarm in this mode.

+COHb

This is a COHb-only operation mode. The ACD will ignore smoke and heat events while in this mode. See Annex C for more information on the operation of the COHb function.

+S/H/CO +S +FT +RoR +CO/COHb

This mode provides Smoke/Heat/CO multi operation plus smoke-only operation plus fixed temperature heat operation plus rate-of-rise temperature operation plus heat-enhanced CO detector operation plus COHb operation. This mode also includes the *Reduce False Alarm* feature. Here is another way to explain this mode:

Technology	Type of alarm	Description
S/H/CO Multi	Smoke	The smoke sensor sensitivity is modified automatically by the presence of heat and/or CO
Smoke	Smoke	Smoke sensor, with RFA applied
Fixed Temperature	Heat	Fixed Temperature heat
Rate of Rise	Heat	Rate of Rise heat
Heat-Enhanced CO	CO	CO alarm enhanced by the presence of high heat. If the temperature increases, the sensitivity of the CO element is increased
COHb	CO	COHb detection according to NFPA and UL requirements
RFA	-	The Reduce False Alarm function is applied only to the operation of the smoke sensor

Each technology operates independently of the others.

If there is a heat and/or CO increase when smoke is present, the ACD will automatically *increase* the sensitivity of the smoke sensor. If heat is present without any smoke, the FT and/or RoR elements will detect the event. If heat and CO are present, the ACD will automatically adjust the CO alarm threshold to increase the sensitivity of the CO sensor. If CO is present without heat, or if CO is present according to NFPA/UL requirements, the ACD will indicate a CO alarm (either due to CO or COHb).

+RoR +COHb

This mode provides rate-of-rise heat detection plus COHb detection. Each detection element operates independently of the other. The ACD will ignore smoke while in this mode.

+FT +RoR +COHb

This mode provides fixed temperature heat detection plus rate-of-rise heat detection plus COHb detection. Each detection element operates independently of the other. The ACD will ignore smoke while in this mode.

+FT +COHb

This mode provides fixed temperature heat detection plus COHb detection. Each detection element operates independently of the other. The ACD will ignore smoke while in this mode.

How do I choose the right mode for my application?

Start by evaluating the environment in which the ACD will be located.

Is it a sleeping room where COHb is required?
> ➢ You'll be using one of the modes with COHb or perhaps just the COHb mode. You'll also want to use the ASBL to provide CO alarm notification (Temporal 4 pattern).

Is it a space such as apartments, dormitories, or assisted-living facilities?
> ➢ Consider a mode with independent operation of the detection elements (such as **+S +FT +RoR +CO +COHb**), and set the Input Action to Supervisory. An alarm caused by smoke will create a Supervisory Alarm but an alarm caused by heat will create a Fire Alarm.

Is it a space where smoke detection is needed but unwanted alarms could occur due to tobacco smoke, auto exhaust, or other such nuisance sources?
> ➢ Consider one of the Smoke/Heat/CO multi-modes with RFA; for example, **+S/FT/CO +RFA**.

Is it an area where the temperature varies widely?
> ➢ You may want to avoid the **+RoR** modes. The rate-of-rise alarm threshold is 15°F temperature increase or more per minute.

Is it an area where fire detection is required but there are high levels of transient smoke during the day?
> ➢ Consider using one of the heat modes during the day and switching to a smoke/heat/CO mode during the night.

> ✓ We think you will find that the ACD is an outstanding choice for all of your fire detection applications and challenges.

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Annex A - +RFA: The *Reduce False Alarm* Feature

The *Reduce False Alarm* feature is applied to six of the ACD modes:

- **+S +COHb**
- **+S/FT +COHb +RFA**
- **+S +RFA**
- **+S/H +RFA**
- **+S/FT/CO +RFA**
- **+S/H/CO +S +FT +RoR +CO/COHb**

The +RFA feature is applied only to the smoke-sensing element. When an ACD is initially installed, internal algorithms are used to monitor and adjust for transient smoke events. If the environment is "clean", with no transient smoke events occurring over a period of time, the ACD will automatically adjust its operation to respond to smoke more quickly. However, if the environment has repeated events that may be detected by a smoke sensor (cigarette smoke, auto exhaust, dust, others), the ACD will automatically adjust to delay its response, allowing it more time to evaluate the conditions and confirm if there is an actual fire emergency…or simply a passing event. When using one of the multi-modes, the ACD will further check for the presence of high heat and/or CO to modify its smoke detection operation too.

Note that when testing the ACD with smoke in one of the RFA modes (and with the Test Zones function *disabled*, see Annex B) you may see a delay in operation of the sensor. This is normal and indicates that the RFA feature is operating as expected.

Annex B – Testing the ACD Sensor (FireNET and VES panels)
Because of the advanced signal processing of the ACD, it can be a bit challenging to test with a single test source depending on the mode you are using (smoke, heat, CO). This is particularly true when trying to test the COHb function because of the time vs concentration requirement of the detection. Therefore, a test function has been included that removes the signal processing, allowing you to test the sensor more quickly and easily.

The test function is automatically activated when using the level 2 menu *Test Zones* function. Select the zone(s) you wish to test and start the test. The panel will use a special command to disable the signal processing at all ACD addresses within the zone that is being tested. This will allow you to easily test each detection element that is enabled for the ACD's current mode of operation.

You will note that when the test mode is enabled for an ACD, the polling LEDs do not flash. This can help you to identify those sensors that have the test mode enabled.

(There is a test mode available on the L3 EDIT DEVICE ATRIBUTES menu too (EDIT CONFIGURATION -> EDIT DEVICE ATTRIBUTES -> ACD address -> Edit Modes -> Walk Test Mode). This mode will disable the signal processing delays of the ACD as does the Test Zones function. However, when this mode is enabled there is no indication on the panel display and the mode must be returned to normal manually; it does not reset on its own. Therefore, it is highly recommended that the L2 *Test Zones* function always be used for testing of the ACD.)

Annex C – COHb Requirements from UL 2034

UL 2034 is the standard for Single and Multiple Station Carbon Monoxide Alarms. It outlines the performance requirements for a CO detector based on 10% Carboxyhemoglobin. This is a 'time versus concentration' requirement, as shown below:

A. Carbon monoxide concentration and response time	
Concentration, ppm	Response time, minutes
70 ± 5	60 – 240
150 ± 5	10 – 50
400 ± 10	4 – 15
B. False Alarm – carbon monoxide concentration resistance specifications	
30 ± 3	30 days
70 ± 5	60 minutes

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Background: Carbon monoxide (CO) is a colorless, odorless, tasteless, toxic gas. It is a product of incomplete combustion from automobiles, gas heaters and cooking appliances, wood-burning stoves, and others. Research has determined that CO binds to hemoglobin approximately 230 times more easily than oxygen. Carboxyhemoglobin (COHb) is the compound that results when CO binds to hemoglobin. The result is a reduction in the blood's ability to carry oxygen throughout the body. The symptoms of CO can range from a slight headache, to nausea, to convulsions, to death, depending on the concentration of CO and the length of exposure.

Annex D – Setting the Alarm Thresholds

With so many different detection technologies in the ACD, it may not surprise you that there are many alarm thresholds as well. Some of them can be adjusted where others are fixed. In most cases there is no need to adjust any the alarm thresholds from the default settings.

- ✓ Smoke Heat Multi – the default is 3.0, with a UL-listed programmable range of 1.0 to 3.5. This setting is in percent per foot.
- ✓ Optical - the default is 3.0, with a UL-listed programmable range of 1.0 to 3.5. This setting is in percent per foot.
- ✓ Heat Fixed - the default is 135, with a UL-listed programmable range of 135 to 150. This setting is in degrees F.
- ✓ Rate of Rise – the default is 27, which corresponds to 15°F/minute increase in temperature. For proper operation, do not change this setting from the default.
- ✓ CO – the default is 4 which corresponds to 40 ppm. The programmable range is from 3 – 15 (30 to 150 ppm)
- ✓ COHb – the default setting is 6.2 and may not be changed. This setting allows for operation according to UL and NFPA requirements.
- ✓ Optical Heat CO Multi – the default is 4.0%/ft. and may not be changed.

It is possible to set some of the pre-alarm thresholds as well. Normally these settings are left at the default. If you feel a need to adjust them for a special application it is suggested that you contact Hochiki technical support for assistance.