



INTRODUCTION

There are many instances where aspirated smoke detectors are specified, but where the very high sensitivity that is normally inherent in these devices is an unnecessary expense. The A200 Series Laser Aspirated Smoke Detector provides the perfect solution.

A200 Series aspirating smoke detectors are available in single or dual channel formats giving a large monitored area using sampling holes in the place of point detectors.

The A211E-LSR single channel unit has a single detection pipe, and comes standard with one sensor, another System Sensor 7251 laser sensor can be fitted if required. With two detectors fitted, the Mode selection allows the second detector to operate as an OR function (either detector can alarm) or as an AND function (to simulate a 'Double Knock' type operation).

The A222E-LSR unit is equipped with two detection pipe channels and one 7251 laser sensor for each channel. A high performance aspirator and flow monitoring circuits ensure a constant, monitored flow level which can be displayed on a 10 element bar graph with adjustments for high and low flow thresholds. Three alarm levels give warnings at their pre-set levels.

The A200 Series units incorporate in-line air filters to remove dust particles from the air samples.

A USB port (located on the underside of the unit) may be used to download all the data that is logged within the unit (extra software program required for this). This can then be used to look at events or trends over a period of time.

The A211E-LSR provides closed loop sampling whereby the exhausted air can be returned to the sampled area making it particularly suitable for prison cells.

The detector may be configured to operate either as a stand alone unit, providing volt free relay contacts to signal fire alarm and fault or as a loop controlled device, communicating with a compatible analogue addressable control panel. In the loop controlled mode the fire alarm relay is controlled by panel command.

A200 Series smoke detectors are powered by an external 24Vdc power supply.

With the use of an exhaust pipe, the system is IP65 rated, allowing its use in many harsh environments, and applications where regular hosing is performed.

SPECIFICATIONS

Number of Sensors:	1/2 Laser Sensors (System Sensor 7251 required)
Filtration:	2 stage dust particle filter
Flow Monitoring:	Thermal device, high and low thresholds. 10 element bar graph indication. Loop fault reporting.
Supply Voltage:	24VDC (Nominal) 18-30VDC (12W minimum)
Supply Current:	120 mA - 500 mA depending on fan speed setting and supply voltage. Maximum current 350mA @24VDC with no aspirating pipe (See table 5 for typical currents/fan speeds)
Maximum Pipe Length:	1 Chan - 100 metres 2 Chan - 2 x 100 metres
IP rating:	IP50 / IP65 optional
Operating Temperature:	-10°C to 55°C
Operating Humidity:	10 to 93% RH (non-condensing)
Fuse Type/Rating:	'T' European sub-miniature (TR5) 1.25 A Anti-surge

INSTALLATION

A200 Series Installation

The front cover of the A200 will need to be removed to secure the unit permanently in place. This is done using the special key that is supplied, which fits into the screw hole in each corner of the unit. **Please keep the key in a safe place.**

The A200 should be secured to a suitable surface through the 4 corner fixing points as shown below using suitable fasteners, for example no.6 wood screws.

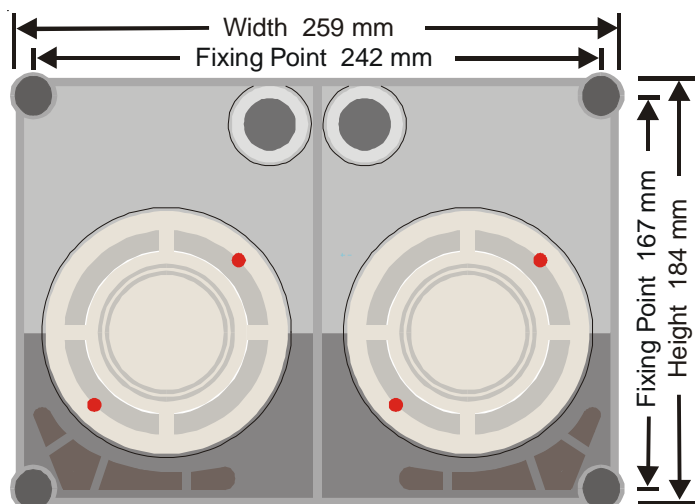


Figure 1: A200 Series Mounting Hole Centres

Pipe Sections

For full details of pipe installation please see the appendices at the back of this manual.

Smoke tests should be performed before planning and installing the pipe network.

Material

For CEA4022 compliance, the pipe should be red ABS to EN 50086-1 (Crush 1, Impact 1, Temp 33).

Dimensions

Metric: 25.0mmOD - 21mmID;

Imperial: 3/4"BSP (26.7mmOD - 20mmID)

Note: Both metric and imperial sizes will fit into the unit.

Lengths may be cut as required, and joined by permanent sockets, removable socket unions or solvent welded.

The A200 inlet port is tapered to allow a push fit of the sampling pipe. The pipe should be cut squarely to ensure a good, airtight seal. **Solvent adhesive should not be used for this joint.**

Fixings

The means of fixing the pipe to the structure will depend on site conditions. The normal methods are pipe clips, saddle clamps or even tie wraps. Fixing centres are typically 1.5m apart.

Holes

The sampling pipe is perforated with sampling holes at design spacing. These are typically 3mm and can either be pre-drilled or drilled in situ. Care should be taken to avoid swarf entering the pipe. It is always good practice to blow compressed air through the pipe after drilling to clear any debris before final connection to the equipment. In standard configuration, with pipe hanging from ceiling, the holes will be placed underneath, so the smoke can easily rise up into the hole. Capillary tubes can also be used with the holes as in figure 2.

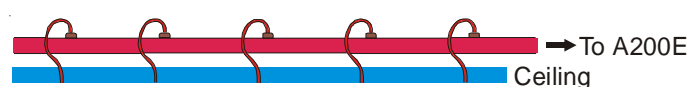


Figure 2: Capillary Tube Sample Holes

End Cap

The end of the pipe should be terminated with an end cap, having a central hole typically 6mm in diameter.

If the end cap is not used, then practically no air will be drawn through the side holes.

Without a hole in the end cap the contributions from the side holes will tend to be very unbalanced.

Bends

Bends are either 45 or 90 degrees. For the 90-degree bends it is very important that slow radii are used and not a sharp elbow, as this will introduce unacceptable pressure losses, and significantly increase the response times from holes beyond the bend.

T Pieces

A T joint can be used on pipes to produce 2 branches. It is recommended that the total number of holes in a resulting pipe system is no more than the number of holes estimated for a single pipe design. For example, if a single 100M pipe can have up to 18 holes, 2 branches can have up to 9 holes each. It is important that the branches have a balanced design - that is, they should be approximately equal in length and number/size of holes). For further information, please see the maximum pipe length/hole size data in Table 6 and the T Piece example shown later in the manual.

Exhaust

In most installations the exhaust should be left open, but there are some circumstances when it may be necessary to connect a pipe to the exhaust port to divert the exhaust away from the location of the unit; For example to reduce noise, reduce risk of interference/deliberate obstruction, improved environmental protection etc.

Pipe of the same specification as the sample runs should be used and its length limited to a maximum of 10m to avoid significant reduction in the airflow. Care should be taken to position the new exhaust outlet where it cannot be accidentally or deliberately blocked.

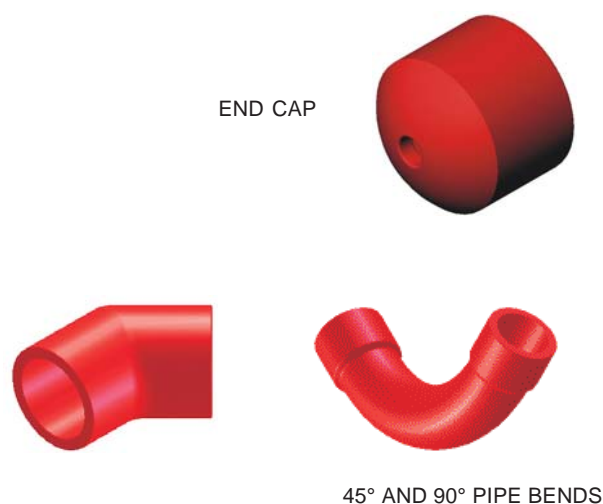


Figure 3: Pipe Accessories

A222E-LSR Installation

Where the two pipe A222E-LSR unit is used, it is important that the air flow through the two pipes is balanced otherwise the sensitivities of the two sensors will be affected. Further details can be found in the appendices.

A200 SERIES WIRING

Warning

Before working on the system, notify the proper authorities that the system is undergoing maintenance and will be temporarily out of service. Ensure that all power is removed before opening the A200.

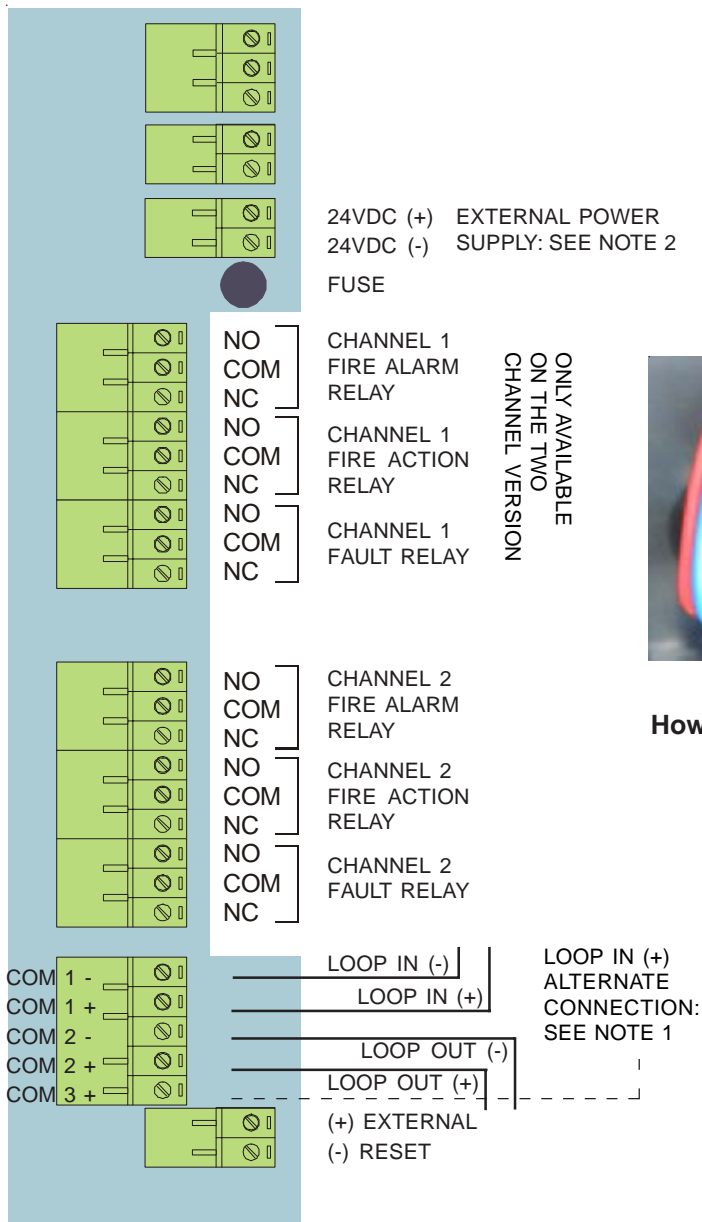
Note: All wiring must be in accordance with local requirements

Wiring connections are made to pluggable terminal blocks which will accept wire sizes from 1mm² to 2.5mm². For best results, screened cable should be used. Refer to the control panel instructions for cable type limitations.

The terminal blocks are accessed by removing the A200 cover, and then carefully lifting the front plate away from the A200 housing. A ribbon cable connects the front plate to the main PCB, which may be unplugged if necessary.

Power Connection

The A200E unit is designed to run from a nominal 24VDC supply. The supply should be connected to the 2 way connector on the main circuit board ensuring that the



Note 1: The A200 has built in short circuit isolators. If short circuit isolators are not required, Loop In (+) should be connected to terminal COM 3 +. COM 1 + is not used.

Note 2: IMPORTANT: If multi-core cables are used, the communications loop wiring should **NOT** be run in the same cable as the 24 VDC supply.

Figure 4: A200 Series Wiring

wires are correctly orientated. It is recommended that the wires should be a minimum size of 16 x 0.25mm (18AWG), or larger if the supply is further than 5m from the system.

A ferrite core is provided for EMC compliance. This should be fitted to the supply wiring as shown in figure WF.

The current drawn is dependent on the fan speed – see Table 4 for details.

Once wiring has been completed, the A200 should be re-assembled in reverse order.

IMPORTANT

The glands on the top of the unit that provide entry for the cabling must to be sealed to ensure that the only air entering the unit is coming in through the sample pipes. all wiring must pass through the cable seals provided and no additional holes should be made. In order to pass a cable through a seal it is necessary to make a small hole in the centre of the seal with a pointed implement (e.g. small screwdriver) and then force the cable through the hole into the box. The small hole will expand to accommodate any cable diameter from 4 to 10mm and then provide an airtight seal.

ADDRESS SELECTION

The A200 address is selected using the address wheels mounted on the rear of the laser sensor(s). To set the address: Ensure that power has been removed from the detector; remove the sensor from its base by rotating anti-clockwise, and then use a flat blade screwdriver to turn the rotary switches to the desired address (Figure 5).



Figure WF: How to Fit the Ferrite

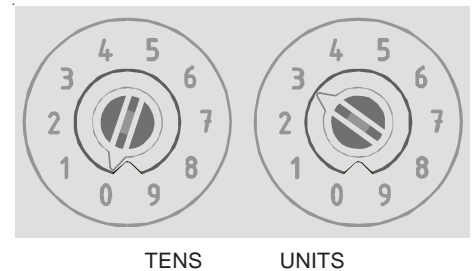


Figure 5: Decade Address Switches

In the stand alone mode of operation, any sensor addresses may be used except 00, which is not recognised by the A200. Ensure that the channel 1 (left hand) sensor is set to a lower address than channel 2.

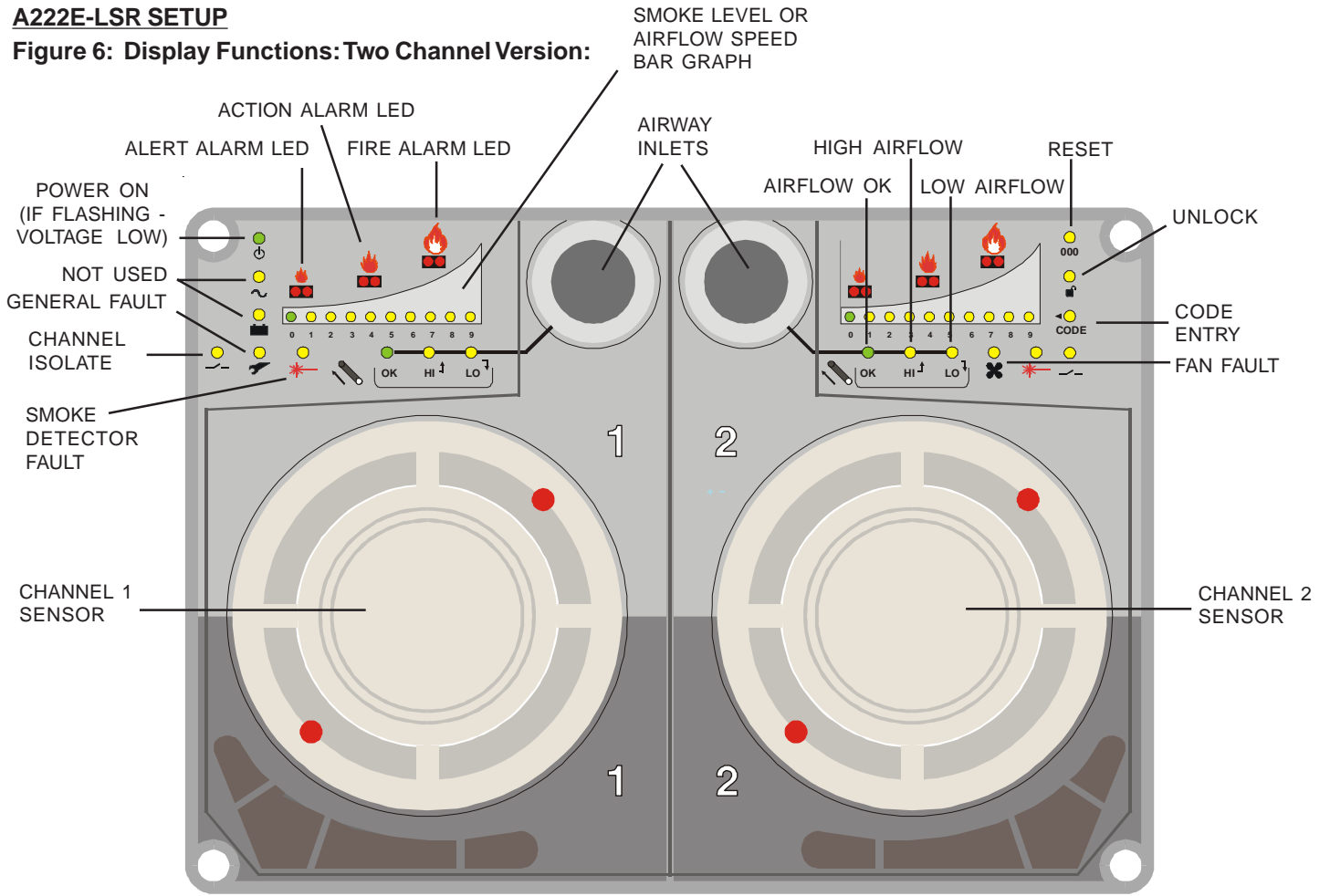
In its loop communication mode, the A200 will use the address(es) set on the sensor(s) as it's loop detector and module addresses. Fire and sensor fault signals are communicated via the corresponding detector addresses whilst A200 air flow and operational status are communicated via corresponding module addresses. Thus if an A211E single channel unit is used, it will take one sensor and one module address; if an A222E two channel unit is used it will take two sensor and two module addresses (the A222E will use address number n and $n + 1$).

Again any addresses may be used except 00, and the channel 1 (left hand) sensor must be set to a lower address than channel 2.

Once the address has been set, insert the sensor into its base and rotate clockwise until it drops into place. Continue rotating clockwise until it locks into place.

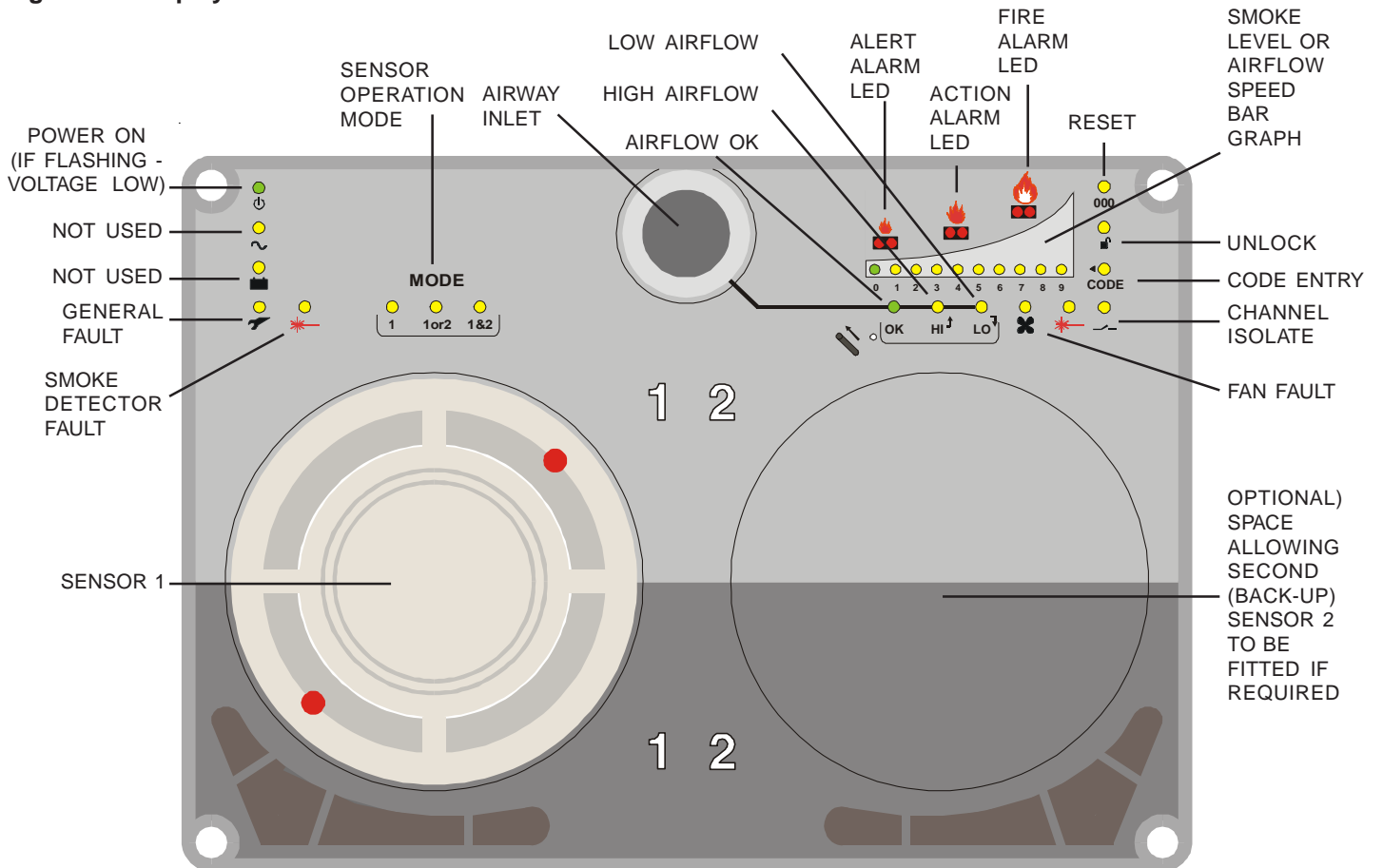
A222E-LSR SETUP

Figure 6: Display Functions: Two Channel Version:



A211E-LSR SETUP

Figure 6a: Display Functions - One Channel Version:



GENERAL INFORMATION

Relay Operation

All relays provide volt free contact outputs.

Fault Relay: N/O and N/C contacts available. Energized at power on, provides fault output for the aspiration unit (power fail, fan fail, hi/low flow, general fault). Non-latching operation, output clears when fault is cleared.

Action Relay: N/O and N/C contacts available. Output switches when smoke level exceeds preset action value.

Fire Relay: N/O and N/C contacts available.

In remote, loop communications mode, the action relay is non-latching and the fire relay is under the control of the remote fire panel.

In local, stand-alone mode the action and fire relays follow the settings of the action and fire alarm LEDs.

Alarm LEDs

When under loop communication control the alarm LEDs do not latch and are set on and off according to the detected level of smoke relative to the preset alert, action and fire threshold values.

When under local control, the LEDs can be set to latching or non-latching. Resetting the LEDs when latched is performed at the unit using the set-up buttons, or by switching off the power.

Power-on Reset

At power on, the aspiration unit performs a general reset which takes a few seconds to complete before entering the normal aspiration mode. On the single channel unit, when a second sensor is added (or removed) the power on reset will take longer (c.1 min) while the unit recognises and reconfigures the change. This delay only happens the first time the unit is used after a change.

Reset Input

Applying a potential (5-30VDC) between the ± External Reset wiring connections will cause the unit to perform a general reset.

Power-on Initialisation

The device performs an internal firmware compatibility check at power on. If there is no problem, the unit gives one long beep in the start up sequence. If there is a potential problem, the unit will beep and flash its LEDs three times before continuing to operate. Contact the supplier if this fault condition occurs.

A211E-LSR

The A211E is shipped from the factory with one sensor fitted into position 1 (left hand side). The A211E uses this sensor address as its own address.

Do not use the A211E unit without a sensor fitted in position 1. Without this the addresses will not be properly defined.

When a second sensor is fitted to position 2 (right hand side), it must be set with an address higher than position 1. The A211E address still uses the Sensor 1 address, but it is the sensor in position 2 which is now active in the single 'Channel 1' mode. Both configurations use Channel 2 Alarm/Action/Fault relays (see Fig. 4).

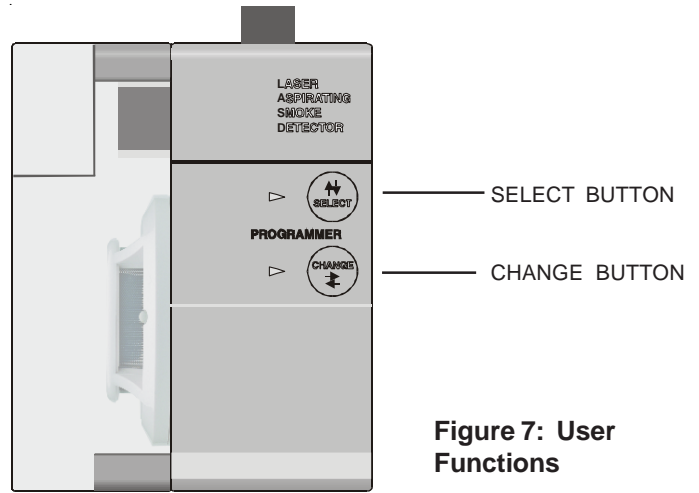


Figure 7: User Functions

Detector Set Up

Refer to figures 6 and 7 to identify buttons and LED indicators.

To enter the detector set-up mode, press and hold the <SELECT> and <CHANGE> keys simultaneously on the right hand side of the A200 housing until the unit beeps, and the Code Entry LED starts flashing.

Access Code

To proceed, a code needs to be entered into the A200. This code also determines the mode of operation of the detector - Stand Alone or Loop Controlled.

To enter the code, press the <CHANGE> button repeatedly - the LEDs on the channel 2 (Right Side) Smoke Level / Airflow Speed bar graph will illuminate in turn. Once the desired number LED is illuminated, press <SELECT>. Repeat for each figure in the code.

- To enter Stand alone mode the code is 510
- To enter Loop Controlled mode the code is 124

Warning: Please ensure that these codes are kept secure as they permit access to operation functions of the A200.

Once the third number has been entered, the A200 will go straight into its set up mode, starting from RESET. The unlock LED will remain illuminated whilst the unit is in the setup mode. At each stage, once the correct value is set press the <SELECT> key momentarily to accept the setting and step to the next function. The current stage in the set-up is indicated by LED indicators as described in table 1. Settings are modified by pressing the <CHANGE> button. Note that after the final step, momentarily pressing <SELECT> will wrap back to step one.

To exit from setup at any point, press and hold the <SELECT> key. If no button is pressed for one minute, the A200 will automatically exit the setup mode.

Note: On power up, in the Loop Controlled mode, the sensor LEDs are turned on until the relevant channel has been polled by the control panel. In Stand-Alone mode, detector LEDs will start blinking at power up.

The smoke detector LEDs will occasionally be on steady for a few seconds at power up, and once per hour thereafter, as the sensors undergo an automatic test.

Setup functions are displayed sequentially as in table 1.

Table 1: A222E-LSR: Set-Up Procedure.

Step	Mode	Indication	Function
1.	Reset	Reset LED flashes.	Resets the A200 after a fire or fault signal.
2.	Isolate Channels	Both Isolate LED flashes.	Isolates either or both channels from the relay output. Press <CHANGE> to cycle through options in the following sequence: Both LEDs Blinking: Neither channel isolated. Both LEDs steady: Both channels isolated. Ch 1 Blinking; Ch2 LED steady: CH2 isolated. CH1 steady; Ch 2 Blinking: CH1 Isolated.
3.	Set Fan Speed	Power LED flashes.	Press <CHANGE> to cycle through the fan speeds. Speed is indicated simultaneously on both bar graphs. Fan speed will alter as the <CHANGE> button is pressed.
4.	Set Channel 1 Airflow Bar graph Sensitivity	Channel 1 Flow OK LED flashes; Current setting displayed on Channel 1 bar graph.	Press <CHANGE> to cycle through sensitivity settings. Sensitivity will be indicated on Channel 1 bar graph. Higher value is higher sensitivity.
5.	Set Channel 2 Airflow Bar graph Sensitivity	Channel 2 Flow OK LED flashes; Current setting displayed on Channel 2 bar graph.	Press <CHANGE> to cycle through sensitivity settings. Sensitivity will be indicated on Channel 1 bar graph. Higher value is higher sensitivity.
6.	Set Channel 1 Airflow bar graph HIGH	Channel 1 Flow High LED flashes; Current High flow setting displayed on Channel 1 bar graph.	Press <CHANGE> to cycle through possible High flow settings. Setting is indicated on the Channel 1 bar graph.
7.	Set Channel 1 Airflow bar graph LOW	Channel 1 Flow Low LED flashes; Current Low flow setting displayed on Channel 1 bar graph.	Press <CHANGE> to cycle through possible Low flow settings. Setting is indicated on the Channel 1 bar graph.
8.	Set Channel 2 Airflow bar graph HIGH	Channel 2 Flow High LED flashes; Current High flow setting displayed on Channel 2 bar graph.	Press <CHANGE> to cycle through possible High flow settings. Setting is indicated on the Channel 2 bar graph.
9.	Set Channel 2 Airflow bar graph LOW	Channel 2 Flow Low LED flashes; Current High flow setting displayed on Channel 2 bar graph.	Press <CHANGE> to cycle through possible Low flow settings. Setting is indicated on the Channel 2 bar graph.
10.	Set Channel 1 smoke ALERT threshold	Channel 1 Alert Alarm LED flashes. Current Alert setting displayed on Channel 1 bar graph.	Press <CHANGE> to cycle through Channel 1 Alert settings. Setting is indicated on Channel 1 bar graph.
11.	Set Channel 1 smoke ACTION threshold	Channel 1 Action Alarm LED flashes. Current Action setting displayed on Channel 1 bar graph.	Press <CHANGE> to cycle through Channel 1 Action settings. Setting is indicated on Channel 1 bar graph.
12.	Set Channel 1 smoke FIRE threshold	Channel 1 Fire Alarm LED flashes. Current Fire Alarm setting displayed on Channel 1 bar graph.	Press <CHANGE> to cycle through Channel 1 Fire Alarm settings. Setting is indicated on Channel 1 bar graph.
13.	Set Channel 2 smoke ALERT threshold	Channel 2 Alert Alarm LED flashes. Current Alert setting displayed on Channel 2 bar graph.	Press <CHANGE> to cycle through Channel 2 Alert settings. Setting is indicated on Channel 2 bar graph.
14.	Set Channel 2 smoke ACTION threshold	Channel 2 Action Alarm LED flashes. Current Action setting displayed on Channel 2 bar graph.	Press <CHANGE> to cycle through Channel 2 Action settings. Setting is indicated on Channel 2 bar graph.
15.	Set Channel 2 smoke FIRE threshold	Channel 2 Fire Alarm LED flashes. . Current Fire Alarm setting displayed on Channel 2 bar graph.	Press <CHANGE> to cycle through Channel 2 Fire Alarm settings. Setting is indicated on Channel 2 bar graph.
16.	Set Buzzer Options	Buzzer sounds.	Sets buzzer operation. Press <CHANGE> button to select: <ul style="list-style-type: none"> Long Beep: In fault A200 beeps once each 30 seconds. In fire A200 beeps continuously until alarm is acknowledged by pressing either button, it then beeps once every 15 seconds until reset. Short beep – A200 gives no audible alarms.
17.	Set Latching Options (not available in Loop Controlled Mode)	Smoke detector fault LEDs flash.	Press <CHANGE> button to select Latching and Non-Latching Alarm LEDs. Setting is indicated on the 0 and 1 bar graph LEDs: <ul style="list-style-type: none"> 0 (Green) - Non-Latching 1 (Yellow) - Latching (<i>not possible in Loop Controlled mode</i>) Both channels will be set the same (setting in Loop Controlled Mode is non-latching).
18.	Set Flow Delay	'Hi/Lo Flo' LEDs both flash	Press <CHANGE> to set required delay on Bar Graph (see Table 3). Note that both channels will have the same setting. Press <SELECT> once the desired Flow Delay is selected to accept and cycle to next mode.
19.	Calibrate Flow Sensors	Fan Fault LED flashes; Channel 1 and Channel 2 bar graph LED on constant.	Press and hold <CHANGE> key to start calibration. As calibration starts, all LEDs are extinguished and the fan stops. After a few seconds, the Power On, Fan Fault and Unlock LEDs start flashing. Fan remains off to calibrate zero flow. After a few seconds the fan turns on to calibrate normal flow. On completion of calibration the unit exits the setup mode and airflow is displayed for a few seconds.

Table 1a: A211E-LSR: Set-Up Procedure.

Step	Mode	Indication	Function
1.	Reset	Reset LED flashes.	Resets the A200 after a fire or fault signal.
2.	Isolate Channel	Isolate LED flashes.	Isolates the channel from the relay output. Press <CHANGE> to cycle through the two options: LED Blinking: Channel not isolated. LED steady: Channel isolated.
3.	Set Fan Speed	Power LED flashes.	Press <CHANGE> to cycle through the fan speeds. Speed is indicated on the bar graph. Fan speed will alter as the <CHANGE> button is pressed.
4.	Set Channel Airflow bar graph Sensitivity	Channel Flow OK LED flashes; Current setting displayed on bar graph.	Press <CHANGE> to cycle through sensitivity settings. Sensitivity will be indicated on bar graph: Higher value is higher sensitivity.
5.	Set Channel Airflow bar graph HIGH	Channel Flow High LED flashes; Current High flow setting displayed on bar graph.	Press <CHANGE> to cycle through possible High flow settings. Setting is indicated on the bar graph.
6.	Set Channel Airflow bar graph LOW	Channel Flow Low LED flashes; Current Low flow setting displayed on bar graph.	Press <CHANGE> to cycle through possible Low flow settings. Setting is indicated on the bar graph.
7.	Set Channel smoke ALERT threshold	Channel Alert Alarm LED flashes. Current Alert setting displayed on bar graph.	Press <CHANGE> to cycle through Alert settings. Setting is indicated on bar graph.
8.	Set Channel smoke ACTION threshold	Channel Action Alarm LED flashes. Current Action setting displayed on bar graph.	Press <CHANGE> to cycle through Action settings. Setting is indicated on bar graph.
9.	Set Channel smoke FIRE threshold	Channel Fire Alarm LED flashes. Current Fire Alarm setting displayed on bar graph.	Press <CHANGE> to cycle through Fire Alarm settings. Setting is indicated on bar graph.
10.	Set Detector Mode	Mode 1 LED flashes.	Press <CHANGE> to cycle through Mode settings. Three different modes can be selected: <ul style="list-style-type: none"> • 1 Only – The single sensor acts on its own and the display shows its state. • 1 or 2 – Two sensors work in parallel and the display shows the higher of the two levels. • 1 & 2 – Two sensors act independently and both are required to go into alarm. The display shows the lower of the two levels.
11.	Set Buzzer Options	Buzzer sounds.	Sets buzzer operation. Press <CHANGE> button to select: <ul style="list-style-type: none"> • Long Beep: In fault A200 beeps once each 30 seconds. In fire A200 beeps continuously until alarm is acknowledged by pressing either button, it then beeps once every 15 seconds until reset. • Short beep – A200 gives no audible alarms.
12.	Set Latching Options (not available in Loop Controlled Mode)	Smoke Detector Fault LED flashes.	Press <CHANGE> button to select Latching and Non-Latching Alarm LEDs. Setting is indicated on the 0 and 1 bar graph LED: <ul style="list-style-type: none"> • 0 (Green) - Non-Latching • 1 (Yellow) - Latching (setting in Loop Controlled Mode is non-latching).
13.	Set Flow Delay	'Hi/Lo Flo' LEDs both flash	Press <CHANGE> to set required delay on Bar Graph (see Table 3). Press <SELECT> once the desired Flow Delay is selected to accept and cycle to next mode.
14.	Calibrate Flow Sensors	Fan Fault LED flashes; bar graph LED on constant.	Press and hold <CHANGE> key to start calibration. As calibration starts, all LEDs are extinguished and the fan stops. After a few seconds, the Power On, Fan Fault and Unlock LEDs start flashing. Fan remains off to calibrate zero flow. After a few seconds the fan turns on to calibrate normal flow. On completion of calibration the unit exits the setup mode and airflow is displayed for a few seconds.

Note: Should any change be made to the pipework, or any fan adjustment made, then it is necessary to recalibrate the fan sensors as in step 19 of table 1, or step 14 of table 1a, depending on the version.

Once the set-up mode has been exited, the smoke sensor levels are displayed on the cumulative bar graph displays. Depressing either the <SELECT or <CHANGE> keys will toggle between airflow and smoke readings on the bar graph display. If no button is pressed for about a minute, the A200 bar graphs will return to display the smoke reading.

BAR GRAPH LEVELS

The bar graph display indicates the level of smoke being detected. Table 2 shows how the levels on the bar graph correspond to the smoke levels being detected. These are also the levels at which the alarms can be set.

Table 2: Bar-graph Levels

Bar-graph Levels	Obscuration	
	%/Metre	dB/Metre
1	0.03	0.001
2	0.06	0.003
3	0.13	0.006
4	0.31	0.013
5	0.72	0.031
6	1.24	0.054
7	1.93	0.085
8	2.63	0.116
9	3.33	0.147

CONFIGURING THE A200 UNIT

Fan Speed

The Fan Speed should be set as high as possible to achieve the fastest transport time from the sampling point to the sensors, this is especially important for longer pipe lengths and for installations that must conform to the requirements of CEA4022. There is, however, a balance to be achieved between performance and the unit's power requirements, and reference should be made to the current consumption figures in the specifications prior to setting this value. Fan speeds of 3 and below should not be used for standard configurations.

Flow Sensitivity

This setting determines the responsiveness of the system in reporting blocked sampling points or broken pipes. The number of sampling points and fan speed are the main factors to consider for this setting.

Table 3 shows typical settings for a variety of standard fan speed/hole quantity combinations. Other speed/hole combinations should be verified by testing during commissioning.

Flow Delay

An increase/decrease in flow above/below the FLOW HIGH/FLOW LOW limits will result in a FLOW FAULT after a delay of approximately 15s. Once the flow is returned to a normal level, the fault condition will be cleared within about 2s. These are the factory set default values.

In environments where the sampled airflow may be affected by sudden temperature/pressure changes or there is a risk of physical interference with the sampling point (e.g. prison cell applications), it may be necessary to increase the delay between the flow going out of limits and signalling a FLOW FAULT condition. Delay values of up to 270s before signalling a fault are available when setting up the detector (see Table 4).

Table 3: Typical Flow Sensitivity Settings

PIPE SETUP (all 50m lengths unless otherwise stated)	RECOMMENDED FAN SPEEDS	FLOW SENSITIVITY
13 x 3mm Sampling Holes, 1 x 6mm End Hole	9	9
8 x 3mm Sampling Holes, 1 x 6mm End Hole	6-9	9
4 x 3mm Sampling Holes, 1 x 6mm End Hole	6-9	7
1 x 5mm Sampling Hole, 1 x 5mm End Hole	6-9	5
1 x 8mm End Hole	5-9	2
1 x 8mm End Hole (10m Pipe)	3-9	1

Table 4: Flow Delay Settings

BARGRAPH LED	FLOW INTO FAULT DELAY (Seconds)	FLOW OUT OF FAULT DELAY (Seconds)
0*	15	2
1	30	18
2	60	18
3	90	18
4	120	18
5	150	18
6	180	18
7	210	18
8	240	18
9	270	18

*Factory default setting

Note: all timings are approximate

TESTING

Testing should only be carried out by qualified personnel. Before undertaking any testing ensure that the proper authorities have been informed, and if necessary, that the unit has been isolated from the fire control panel to prevent unwanted alarms.

Sensor Testing

With the unit powered up and the top cover removed the sensors can be tested for functionality using methods described by the manufacturer (for example aerosol spray or magnet test).

System Testing

Alarm: The installed system must be checked with the top cover securely fitted. As a minimum, smoke should be introduced to the furthest sampling point from the A200E unit on each branch of the pipe. The choice of smoke source is dependant on the installation but in all cases the smoke must be present for the duration of the test – aerosol sprays for point detectors **DO NOT** work on aspirated systems.

If it is possible to get close to the sampling point then a basic, functional check can be carried out with smoke matches or lighted taper etc. But for measurable performance tests then refer to Appendix A of the FIA Code of Practice for Aspirating Systems to select the appropriate test for the installation.

Fault: Simulate a fault on the A200E unit (for example, block the outlet pipe) and check that a fault is signalled at the fire panel.

MAINTAINANCE

With normal use, the filter elements will eventually become contaminated with dust particles, impeding airflow. It is recommended that it be changed every six months.

To change the filter:

1. Unscrew the top cover
2. Lift out the foam filter elements from its housing
3. Fit a new filter kit so that it lies flush with the top of its housing
4. Replace the top cover
5. Test the unit as described above.

IMPORTANT

To ensure maximum efficiency and longevity of the filter, when fitting the replacement filter element kit, the **Coarse** filter needs to be fitted first into the pipe.

ACCESSORIES

The following accessories are available to order:

Model Number	Product
02-FL50	Replacement Filter Element Kit
20-LA0015	Replacement Key to Open Detector.

LASER SAFETY INFORMATION

The 7251 Laser Sensor is a Class 1 laser product. Any radiation emitted inside the smoke sensor is completely within the protective housings and external covers. The laser beam cannot escape from the sensor during any phase of operation.

Table 5: A200E Current Consumption

Fan Speed Bargraph Value	Current mA
0	110
1	120
2	130
3	150
4	170
5	190
6	220
7	235
8	265
9	300

Table 6: Problem Solving

Problem	Possible Solutions
Power light flashing.	Ensure supply to external power connector within limits.
No lights on display. Fan not running	Ensure supply leads correctly orientated. Ensure that FUSE correctly seated in socket and fuse not blown.
No lights on display. Fan running OK.	Ensure ribbon cable fully seated into main & display boards.
Flow HI/LO light on	Ensure sampling pipes correctly installed, lid fitted and box fully sealed. Ensure filters not blocked. Ensure flow calibration procedure has been carried out.
Flow reading on Bargraph display moves erratically.	Decrease Flow sensitivity setting and re-calibrate air flows.
Flow reading on Bargraph unresponsive to broken/blocked pipes	Increase Flow sensitivity setting and re-calibrate air flows.
Sensor(s) unresponsive to smoke tests	Ensure sampling pipe installed correctly and undamaged. Ensure that holes and pipe length do not exceed limits for detector. Ensure that recommended test method is used.

APPENDICES

Detailed here is information to assist in the set-up of the air-sampling system, including:

1. Basic Principals of Aspirating Systems
2. Typical Set-Up Examples
3. Guide to Available Pipe Parts
4. Typical Set-Up Examples for Unusual Applications

The pipe network is just as important as the detector itself in providing a means of obtaining a reliable and continuous sample of air to be monitored.

The pipework for air-sampling systems can vary greatly depending on the particular application. Following are guidelines that can be applied to any wide-bore systems. Please remember that these are general guidelines only. For each specific installation the local standards and codes of practice should be adhered to. Guidance on the design of systems is given in BS 5839, BS 6266 and/or BFPSA Code of Practice for Aspirating Detection Systems.

1. Basic Principals

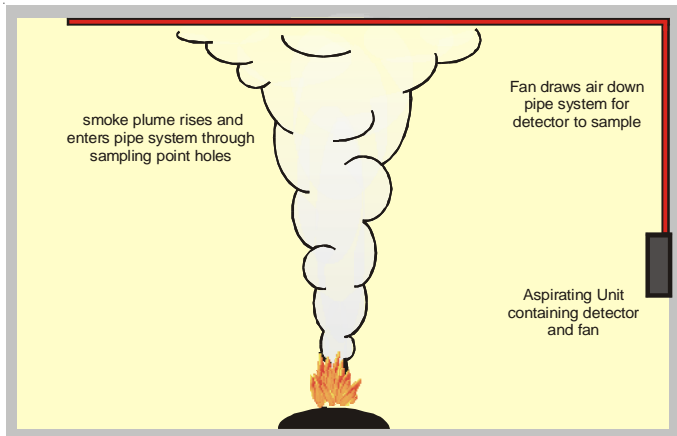


Figure 1.1 Pipe System Operation

1.1 Smoke Tests

IMPORTANT

It is strongly recommended that, before designing the pipe-work system, smoke tests be undertaken in order to show the patterns of air movement within the areas to be protected. This is particularly important in rooms with air-handling equipment. In all cases the aim must be to place the sampling pipes at the position the smoke is most likely to reach.

Smoke boxes or smoke matches can be used to establish air movement within the protected area, from which the best place to locate the pipes can be discovered, as well as where to place the sampling holes in the pipe.

If air handling equipment is present in the environment, consideration must be given to all the variable settings that are available (for example, if it is switched on or off, or if an air conditioning unit has a directional wave facility).

1.2 Response Times

This is the transport time taken from when a sample enters a pipe to when the detector unit enters alarm mode.

Response times should be within reasonable limits. The simplest method of achieving this is to keep pipe lengths to a minimum. This may not always be possible but in the following example the benefits of using more than one pipe in short lengths is demonstrated (this is being used as a general example only, for any specific installation a proper calculation will need to be made - This would include the length of the piping, height of the room, the frequency and size of the sampling holes etc).

In Figure 1.2.1, a room has a single sampling pipe that provides detection for the whole room:

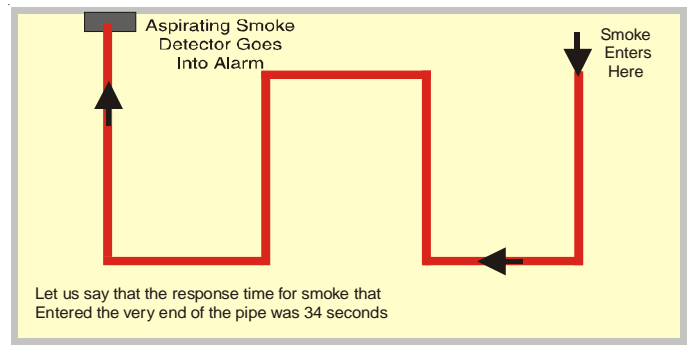


Figure 1.2.1 Single Sampling Pipe

In Figure 1.2.2, the same room has a two channel detector, allowing two sampling pipes:

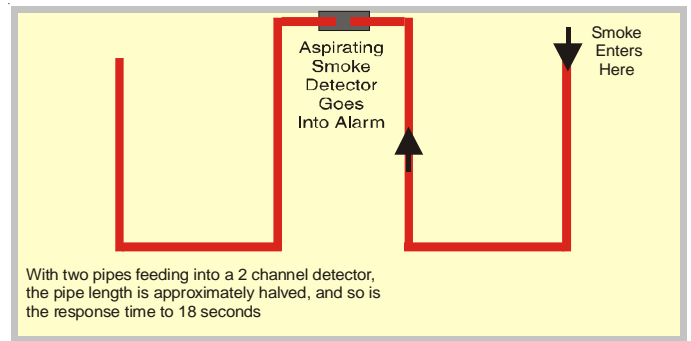


Figure 1.2.2 Two Sampling Pipes

The system gives the same coverage as it would with one pipe, but the response time is quicker. The principal shown here is also relevant when considering the dilution rate. Please see the following section for details on this.

1.3 Dilution

The response time example does not only show the benefit of shorter pipes on response times. Dilution is also kept to a minimum by reducing the length of the pipes. As the name suggests, dilution is the process of lessening the concentration of smoke particles as the sample is drawn towards the detector.

For example, if there is a sampling pipe measuring 50 metres and it has sampling holes every 5 metres, giving 10 sampling holes including the end cap. It can be assumed in this simplified case that the sampling holes let in approximately the same amount of air as each other.

A smoke source of 2% obscuration/metre is introduced at the far end of the pipe. No other smoke is entering any of the other sampling holes. As the smoke passes each hole, it is added to with clean air. When the sample reaches the detector it is now at 0.2% obscuration/metre or 1/10th of its starting density. Therefore if the first alarm threshold is set at 0.2% obs/m, the smoke outside the hole must exceed 2% obs/m to sound the alarm.

It is the case, therefore, that the longer the pipe and the greater the number of sampling holes, the more susceptible the system will be to dilution. It is wise to work on a worst case principle in these situations. In actuality the calculation of dilution is not as straightforward as above and more factors are involved. Each system will have different characteristics meaning precise calculation is extremely complicated. Issues that will affect the dilution rate include size and number of holes, T-pieces and elbow joints in the pipe system, diameter of the pipe itself, and outside elements such as air temperature, pressure and humidity etc.

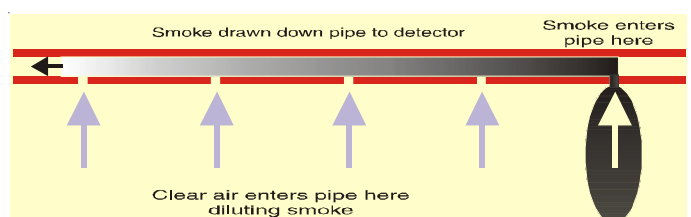


Figure 1.3.1 Smoke Dilution

As seen in the previous section on response times, shorter pipe runs minimise dilution. In Table 1.3.1 there is a rough guide to varying dilution rates for wide-bore systems - **IMPORTANT:** The different characteristics of each installation must also be taken into account when assessing the dilution rate. many factors can affect this, as previously discussed.

Alarm level	0.1%	0.2%	0.5%
Holes	%obs/m	%obs/m	%obs/m
5	0.50	1.00	2.50
10	1.00	2.00	5.00
15	1.50	3.00	7.50
20	2.00	4.00	10.00
25	2.50	5.00	12.50
30	3.00	6.00	15.00
35	3.50	7.00	17.50
40	4.00	8.00	20.00
45	4.50	9.00	22.50
50	5.00	10.00	25.00

Table 1.3.1 General Dilution Rates for Wide-Bore Systems

1.4 Pipe Construction and Sampling Holes

Single channel System Sensor aspirating detectors have a maximum pipe length of 100 metres.

Dual channel aspirating detectors have a maximum pipe length of 100 metres for each channel. Wherever possible, the pipe lengths for each channel need to be kept to broadly similar lengths (for example, if channel 1 has a pipe length of 30 m, channel 2 should be approximately the same length). Failure to do this can result in slow response times, thereby negating some of the early warning ability of the system.

System Sensor recommends that ABS piping be used due to its strength and heat resistant properties. The pipe sections should be glued together using a suitable ABS glue to avoid separation or leaks. If a section of pipe is likely to need to be disconnected for some reason in the future, removable unions should be used instead.

Important: Never glue pipes into the aspirating detector unit itself.

Sampling holes should be 3mm in diameter. The end of the pipe should be capped and have a hole of 6mm in diameter.

Important: Elbows and bends in the pipe system can affect the flow of air/smoke through the pipes and should only be used when necessary.

Capillary Sampling

Short lengths of small diameter flexible pipe may be spurred off from the main wide-bore pipe. This pipe should have an internal diameter of no less than 7mm and can be of lengths up to 5 metres. For this a sampling point assembly should be used (an example is shown below).



Capillary tubes can be used to provide concealed sampling points. If the sampling points need to be as unobtrusive as possible, the capillary allows the point to be placed flush to the surface. These are most commonly used when the main wide-bore pipe runs through a ceiling void, with capillary sample pipes placed through the false ceiling.

Note 1: It is recommended to avoid running lengths of pipe with both standard sampling holes and capillary sampling points on them as this can unbalance the airflow and slow the response time from the capillary points.

Note 2: Though British Standard BS 5839-1 states that there must be a minimum of 25mm between the ceiling and the sampling point of a detector, because the aspirating system actually draws air through the sampling points (holes in the pipework in this case), it can be possible to mount the sampling points flush with the ceiling providing the manufacturer confirms that this will not be detrimental to the effectiveness of the system to detect fire.

1.5 The Design Process

When designing the actual sampling pipe network there are many factors that need to be considered. The site must be carefully surveyed and as much information as possible should be gathered.

1.5.1 Requirements

The first consideration is to precisely ascertain the requirements of the installation. Once these have been decided, the type of situation can be looked at.

1.5.2 Activities

The types of activities that take place within the space are very important. A public area of a particular shape could well have different system requirements to a warehouse of a similar shape.

Other information such as the expected hours of operation, whether the area is manned or unmanned and whether any pollution or dirty air is present should also be taken into account.

1.5.3 Physical Characteristics

Once the general installation type has been considered, the physical characteristics of the space should be looked at.

- Is it a room, void, cabinet or enclosure?
- Are there any floor or ceiling voids and, if so, how are they divided, are there any ducts, what are these used for and are there any services already present?
- What are the exact measurements of the space?
- What materials have been used and are there any areas where the network has to avoid?
- Are there any existing fire protection systems and where are they situated?

1.5.4 Environmental Conditions

The environment within the space can have a very significant bearing on which sampling method should be used to protect it. As already mentioned, the smoke tests are vital in gathering this information. This can tell you the patterns of air movement, the rate of circulation and whether the airflow is static at any point. Other considerations include:

- If fresh air is introduced, at what rate and in what quantity?
- Is a reference detector necessary due to pollution?
- What is the temperature and relative humidity and are these constant or variable?
- Are there any activities that may produce smoke, dust, steam or flames and how often does this occur?

1.5.5 Risk Assessment

With any installation it is likely that some areas require more protection than others. This could be because of expensive equipment or a particularly vulnerable area such as a store for flammable materials. These more susceptible areas must be considered along with any structural hazards such as synthetic materials and foams or soft wood partitioning.

1.5.6 Potential Sites

There are also factors to consider when deciding where to position the detector unit itself. The main aim when positioning the unit is to try to ensure a balanced system. This means that the pipes should be kept at similar lengths. It is also important to try and keep response times and dilution to a minimum.

The unit requires a power supply and access will be required for maintenance. There may also be aesthetic reasons why a particular position is not suitable.

1.5.7 Exhaust Pipe

The exhaust pipe on the bottom of the aspirating detector unit can have piping added should it be required, for example if the air passing through the detector needs to be returned to its source. Extra piping can also be used to reduce the noise of the fan if needed.

2. Typical Set-Up Examples

Set out below are some examples of maximum length pipe configurations that can be used with an A200 unit. It should be possible to adapt these examples for shorter pipe run systems; however some specific applications will have specific considerations that must be taken into account, and local standards may also apply.

The default size for sample holes is 3mm, and the end hole is 6mm. Ensure that no hole is less than 100mm from a bend or 'T' piece

Table 2.1 shows the maximum allowable pipe lengths for CEA 4022 compliance. In the examples shown below, which fulfill the requirements of this table, the fire alarm threshold, set at the control panel, should be at sensitivity level 1 (most sensitive).

For short to mid range application, it is recommended that the fan speed for the A200E is kept at a default setting of 5 (this will be suitable in many circumstances). The primary effect of changing the fan speed will be to increase or decrease the transport time.

Default settings are programmed into the detector for the high and low flow limits. It should not normally be necessary to change these settings.

Table 2.1: A200E Series Pipe Installation Limits

The following figures apply to System Sensor A211E / A222E detectors.

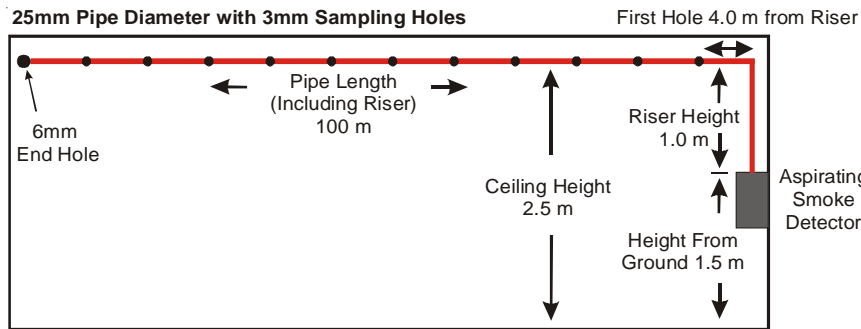
DETECTOR	A211E	A222E
SENSITIVITY ALARM LEVEL	1	1
FAN SPEED	9	9
SINGLE PIPE PER INLET -		
Length (Per Pipe/Inlet) Metres	100	100
Max Number of Holes (Per Pipe)	18	18
SINGLE 'T' (2 PIPES) PER INLET -		
Max Length (Per Pipe) Metres	100	50*
Max Number of Holes (Per Pipe)	9	6*

All pipes are Metric 25mm or Imperial 3/4" (27.6mm). All sample holes are 3mm, with 6mm end hole.

* Estimated Values

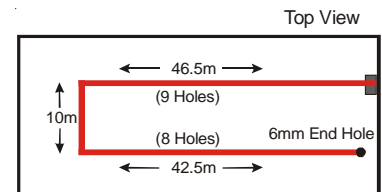
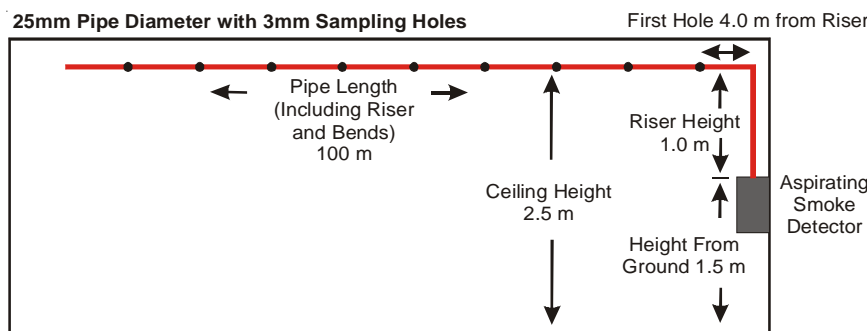
A211E Single Channel System

Example 1:



Pipe Length (m)	No. of 3mm Holes	Hole Spacing (m)	Fan Speed	Alarm Level
100	18	5.3	9	1

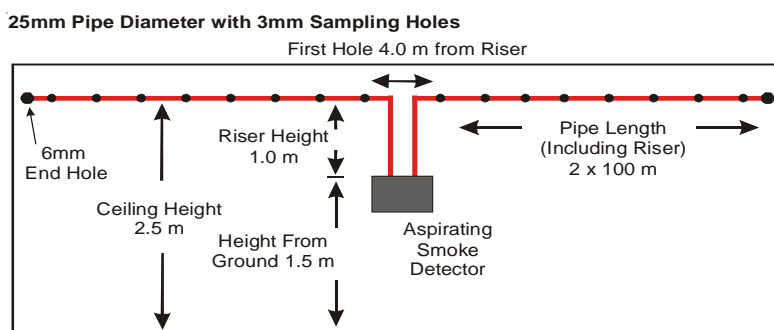
Example 2: With Bends



Pipe Length (m)	No. of 3mm Holes	Hole Spacing (m)	Fan Speed	Alarm Level
100	17	5.25	9	1

A222E Dual Channel System

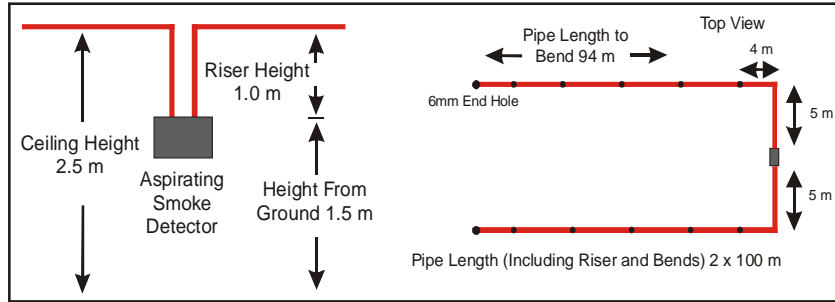
Example 1:



Pipe Length (m)	No. of 3mm Holes	Hole Spacing (m)	Fan Speed	Alarm Level
2 x 100	2 x 18	5.3	9	1

Example 2: With Bends

25mm Pipe Diameter with 3mm Sampling Holes First Hole 9 m from Riser



Pipe Length (m)	No. of 3mm Holes	Hole Spacing (m)	Fan Speed	Alarm Level
2 x 100	2 x 18	5	9	1

Using T Pieces

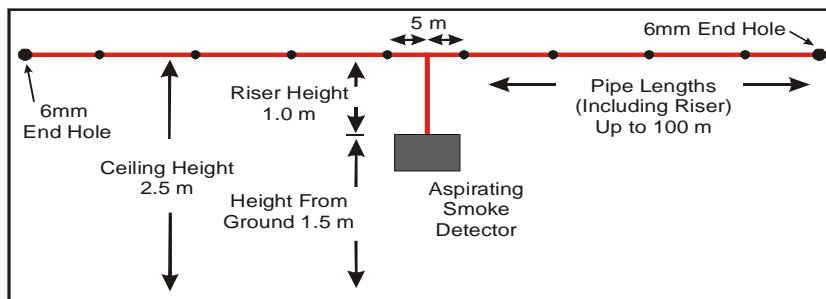
Note 1: It is important that the airflow through the 2 branches is balanced, so each branch will need to be of a similar length and number of holes.

Note 2: Using more than one T piece on each channel has not been tested and therefore cannot be recommended.

Example 1: 1 Channel

25mm Pipe Diameter with 3mm Sampling Holes - 1 Channel with T-Piece

First Hole 5 m from Riser

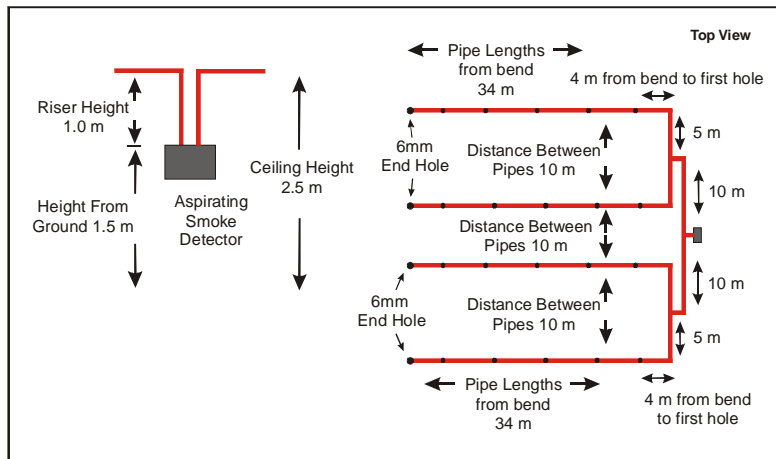


Pipe Length (m)	No. of 3mm Holes	Hole Spacing (m)	Fan Speed	Alarm Level
1 x 2 x 100	2 x 9	10.5	9	1

Example 2: 2 Channel

25mm Pipe Diameter with 3mm Sampling Holes - 2 Channel with 2 T-Pieces

First Hole 19 m from Riser











Pipe Length (m)	No. of 3mm Holes	Hole Spacing (m)	Fan Speed	Alarm Level
2 x 2 x 50	2 x 2 x 6	5	9	1

3. Guide to Available Pipe Parts





System Sensor offers the following pipe parts:

3.1 Metric 25mm Pipe Options

Model Number	Product Description	
02-0001-25	Large Bore Red Pipe 3m Length, 25mm	
02-1001-25	Straight Union Large Bore 25mm	
02-1002-25	90 deg. Bend Large Bore 25mm	
02-1003-25	45 deg. Elbow Large Bore 25mm	
02-1005-25	Removable Union Large Bore 25mm	
02-1007-25	T-Piece 25mm	
02-1006-25	End Cap for Large Bore 25mm	
02-FLU2	Filter Unit 25mm With Filter Element (for Harsh environment)	 25mm Wide Bore Pipe Filter Unit

3.2 Common Accessories

There are a number of accessories that can be used:

Model Number	Product Description	
02-1008-15	Flush Capillary Sampling Point (T Piece & 1.5m Capillary Tube) For use with false ceilings	  Pipe Ceiling
02-1009-00	Sampling Point Label (Roll of 100)	
02-1010-00	Open Pipe Clip (25mm)	
02-1110-00	Closed Pipe Clip (25mm)	
02-1011-00	ABS Pipe Adhesive (250ml tin)	

4. UNUSUAL APPLICATIONS

In these different and variable situations, it is vital to perform smoke tests to establish the air movements.

4.1 Freezer rooms

Freezer rooms often introduce extra difficulties into the design of a system. The air temperatures at which the room operates must be taken into account.

If the aspirating pipe network is inside the cold room the following points should be noted:

- 1) The pipes should be suspended (or attached) further away than usual from the ceiling or wall as these may contract and expand with large changes in air temperature.
- 2) Sampling holes should be drilled on the **side of the pipes** to minimise the risk of blockage owing to ice formation.
- 3) Vertical pipes running into the room from outside, and areas where condensation could collect, must be avoided.

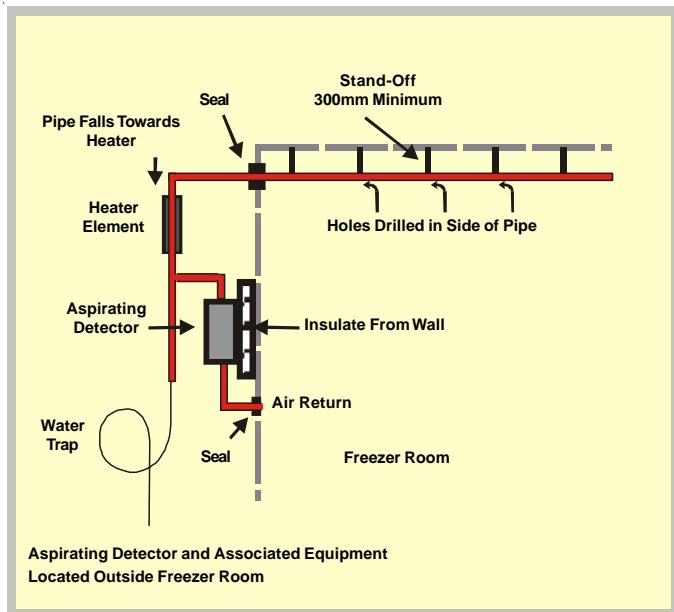
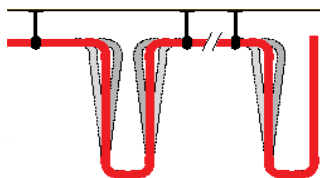


Figure 4.1: Typical Freezer Room Example

Temperature changes may cause expansion or contraction in the aspirating pipe. ABS pipe has a linear coefficient of expansion of around $10^{-4}/^{\circ}\text{C}$ and large temperature changes can have a significant effect. These changes typically occur as the system is run to operational temperature. So the air can easily vary from $+18^{\circ}\text{C}$ at installation to -35°C in operation, representing a 53°C differential. This drop applied to a 50m pipe run gives an expected end to end pipe movement of 265mm. If the design of the system gives no allowance for such variation in the pipe length, it is advisable to incorporate one or more simple 'U' bends to act as an expansion/contraction point as shown:



4.2: Cold Stores

Cold stores are similar to the freezer rooms with one major difference, the temperature. The temperature in a cold store is a lot less than a freezer and is typically just at or above 0°C .

The pipes should be kept out of the immediate airflow from a chiller unit, if used, as its air is often significantly colder than the room itself in order to maintain the correct temperature.

In a cold room application it is not usually necessary to use a heater element but only a water trap to remove condensation.

4.3: High buildings

Typical examples: Atria; Cathedrals

When designing a system to fit in a very large and high room such as an atrium or high level warehouse, it is important to consider the various possibilities. A simple atrium design is shown below, utilising two pipes. The smoke cloud is shown as an example of how a stratification layer prevents the pipes at the top of the building from detecting smoke particles. The height at which the smoke forms a layer varies depending on temperature and therefore a vertical sampling pipe is used to cover this. There may be no stratification layer at all if the air in the room is at a particular temperature, especially if smoke ventilation is needed.

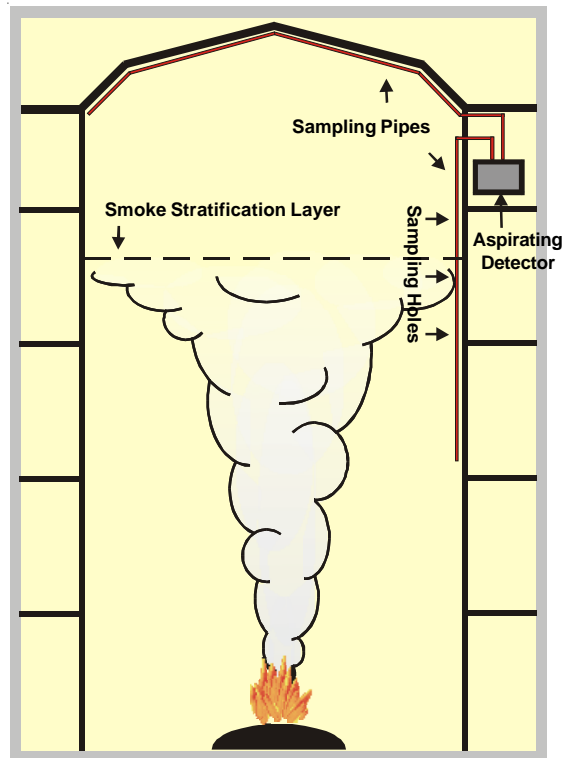


Figure 4.3: Typical Atrium Example

4.4: Supermarkets and Storage Areas

Supermarkets and storage areas require a high level of protection due to the possible number of people using the space at certain times of the day and/or due to the value of the goods present.

There are two ways of applying the pipe network. The exact structure of the roof is likely to determine the better or most appropriate solution. The pictures below assume a simple room layout.

In one alternative the pipes will follow the contour of the roof. To comply with UK code of practice BS5839:1, pipes will be placed at a maximum distance of 10m from each other and sampling holes will also be sited at a maximum of 10m from each other, with the hole serving the apex no more than 600mm away from the roof.

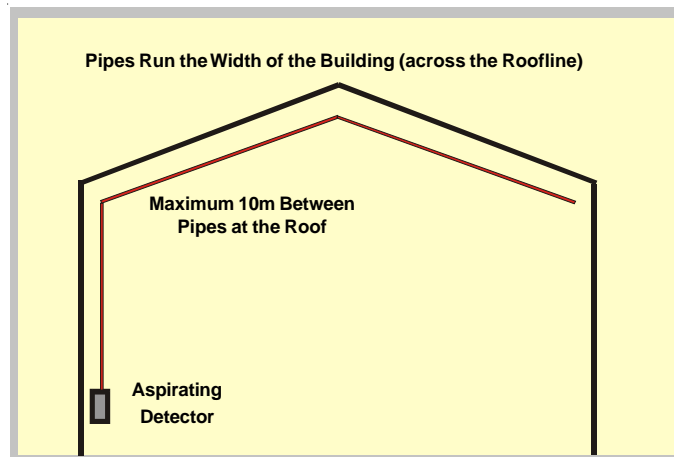
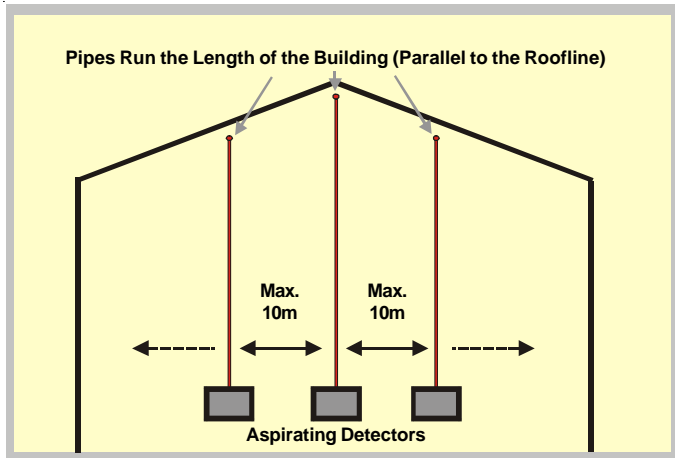


Figure 4.4.1: High Roof Example 1
Pipes Running Across the Width of the Roofline

ENGLISH

DEUTSCH

The second alternative shows the pipes running in parallel along the roof. Again to comply with UK requirements the pipes should be a maximum distance of 10m apart, sample holes in each pipe will be 10m from each other and the pipe serving the apex should not be further than 600mm from the top of the roof.



**Figure 4.4.2: High Roof Example 2
Pipes Running Parallel to the Roofline**

4.5: Warehouses

Warehouses can be considered to be similar to supermarkets except the same problems that can occur with high buildings need to be taken into account as well. Vertical sampling points may be needed and the pipe lengths should be considered carefully to ensure reasonable response times.