INSTALLATION AND MAINTENANCE INSTRUCTIONS
TC866E Series LASER ASPIRATED SMOKE DETECTOR

Honeywell

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 TC866E Series Laser Aspirated Smoke Detector provides the perfect solution.

TC866E 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 TC866E1001 single channel unit has a single detection pipe, and may be used with one laser smoke sensor, or two sensors configured to give "double knock" detection (Note: the 1001 comes standard with one sensor, another System Sensor 7251 laser sensor can be fitted if required).

The TC866E2009 unit is equipped with two detection pipe channels and one 7251 laser sensor for each channel and can thus cover twice the area of the TC866E1001. 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 TC866E Series units incorporate in-line air filters to remove dust particles from the air samples. These are housed in removable transparent cartridges enabling rapid inspection and maintenance.

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 TC866E1001 provides closed loop sampling whereby the exhausted air can be completely 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.

TC866E 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:	Cartridge 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 Pipe Length:	1 Chan - 75 metres
	2 Chan - 50 metres per channel
IP rating:	IP50 / IP65 optional
Operating Temperature:	-10°C to 60°C
Operating Humidity:	10 to 95% RH (non-condensing)

INSTALLATION

TC866E Series Installation

The front cover of the TC866E 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 TC866E 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.

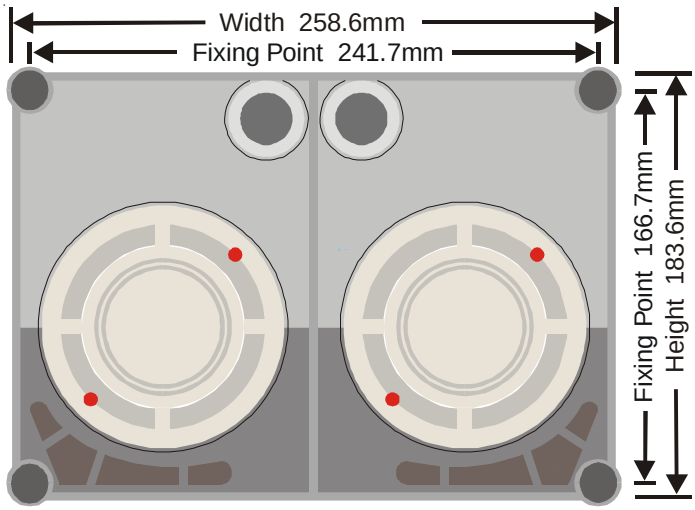


Figure 1: TC866E Series Mounting Hole Centres

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

ABS or UPVC, copper or stainless steel may also be used if required.

Dimensions

Metric:	25.0mmOD - 20mmID;
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: Sockets [permanent], solvent welded or Socket Unions [removable]

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.

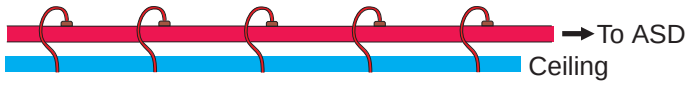


Figure 2: Capillary Tube Sample Holes

End Cap

The end of the pipe is terminated with an end cap with a hole, typically 6mm diameter in it.

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

If the end cap does not have a hole then 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

Use of T joints should be avoided as much as possible in these types of low pressure wide bore systems. They make the pipe design and air flow calculation very difficult to predict with any accuracy.

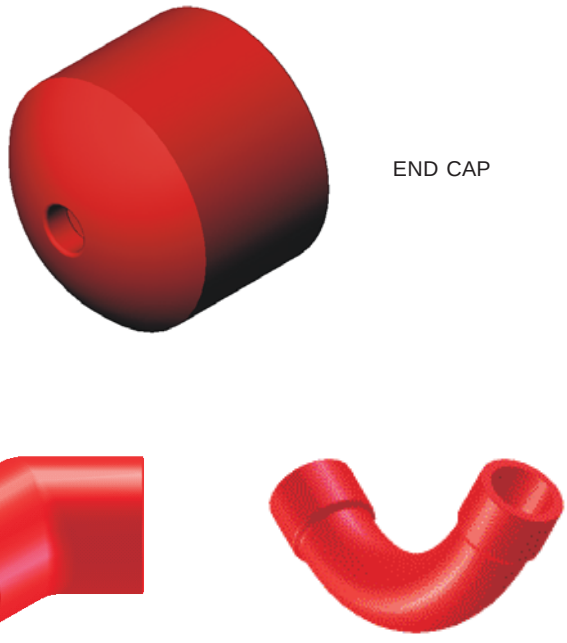


Figure 3: Pipe Accessories

TC866E2009 Installation

Where the two pipe TC866E2009 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.

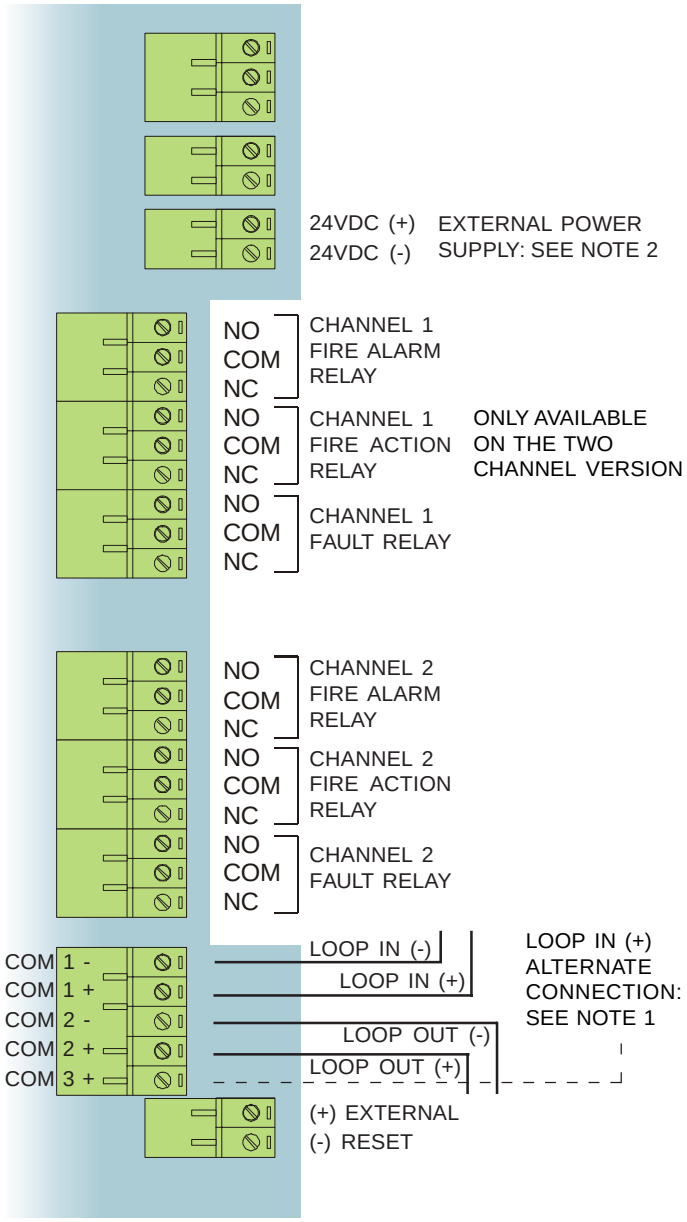
TC866E SERIES WIRING

Note: All wiring must be in accordance with local requirements

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 TC866E.

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 TC866E cover, and then carefully lifting the front plate away from the TC866E housing. A ribbon cable connects the front plate to the main PCB, which may be unplugged if necessary. Once wiring has been completed, the TC866E should be re-assembled in reverse order.



Note 1: The TC866E 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: TC866E Series Wiring

Important

The glands on the top of the unit that provide entry for the cabling will need to be sealed to ensure that the only air entering the unit is coming in through the pipes.

ADDRESS SELECTION

The TC866E 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).

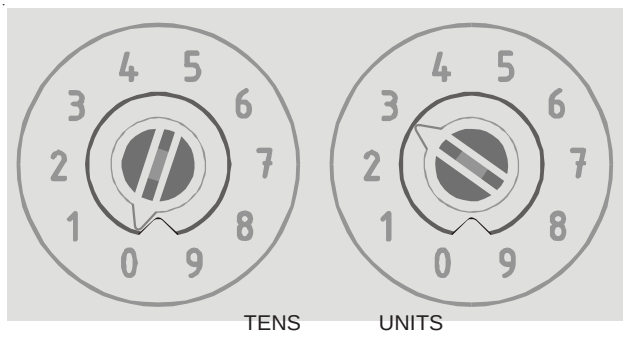


Figure 5: Decade Address Switches

In the stand alone mode of operation, any sensor addresses may be used except 00, which is not recognised by the TC866E. Ensure that the channel 1 (left hand) sensor is set to a lower address than channel 2.

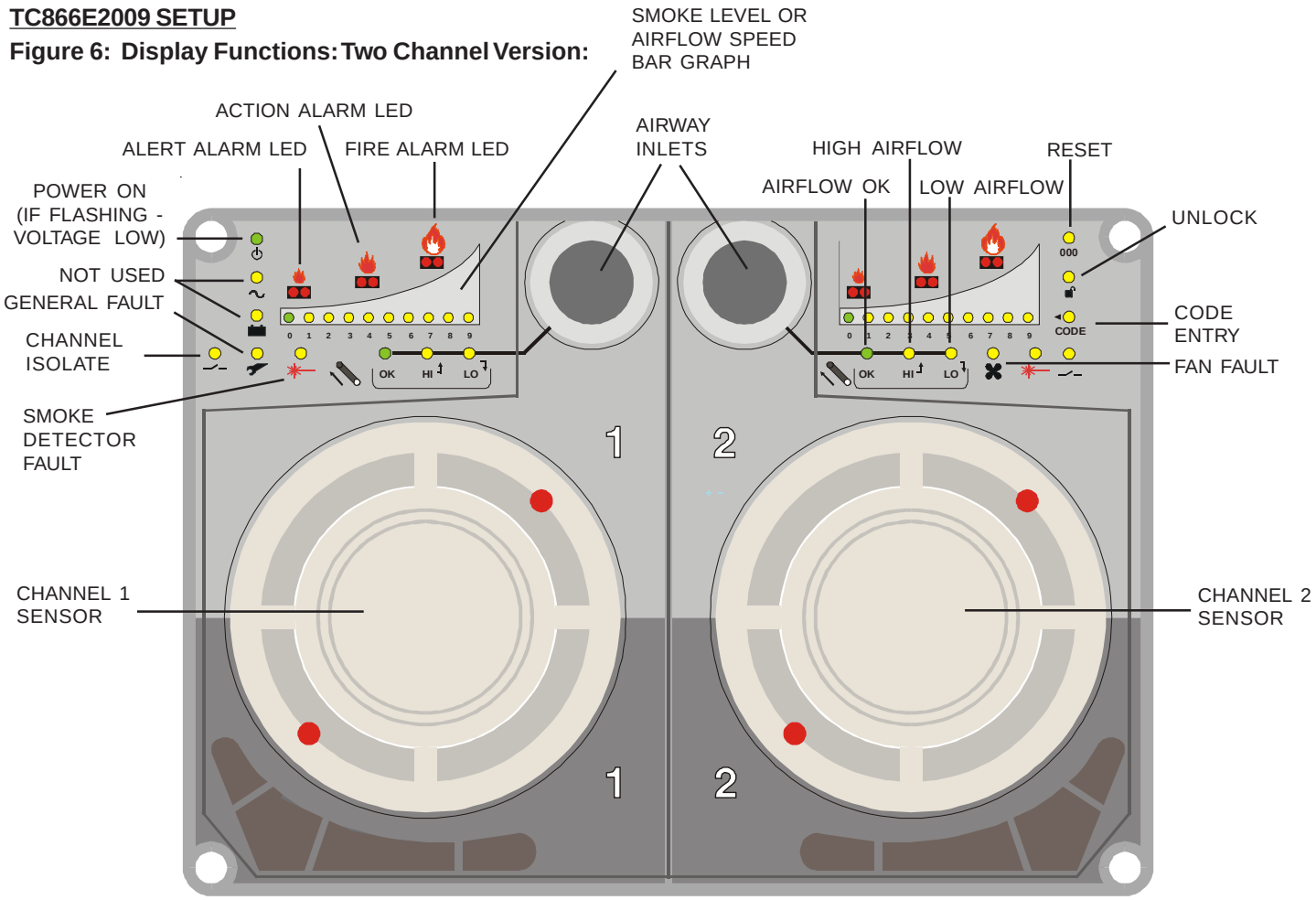
In its loop communication mode, the TC866E will use the address(es) set on the sensor(s) as it's loop detector and module addresses. Fire and sensor fault signals are communicated via the corresponding detector addresses whilst TC866E air flow and operational status are communicated via corresponding module addresses. Thus if a 1001 single channel unit is used, it will take one sensor and one module address; if a 2009 two channel unit is used it will take two sensor and two module addresses (the 2009 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.

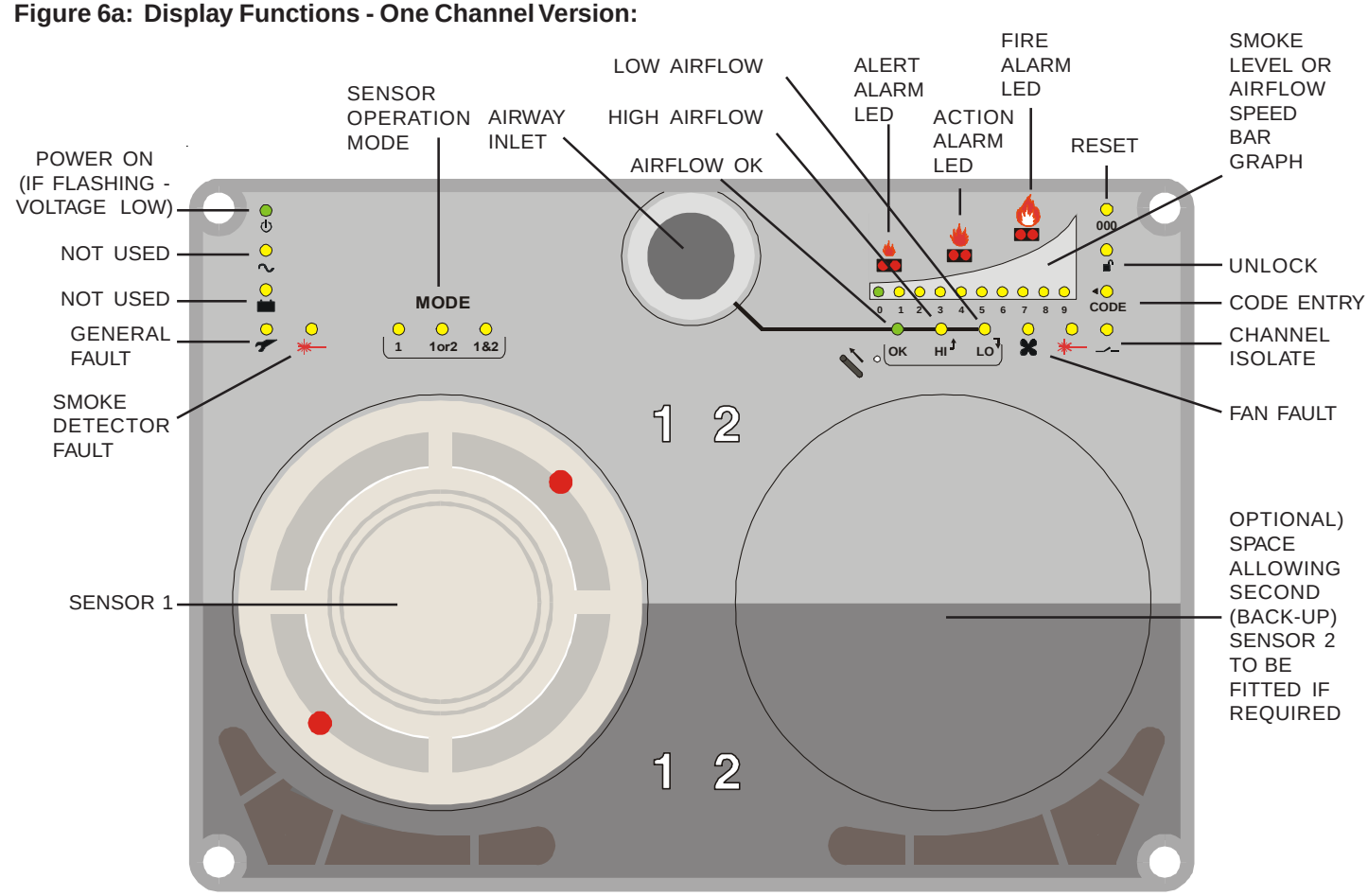
TC866E2009 SETUP

Figure 6: Display Functions: Two Channel Version:



TC866E1001 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.

TC866E1001

The 1001 is shipped from the factory with one sensor fitted into position 1 (left hand side). The 1001 uses this sensor address as its own address.

Do not use the 1001 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 1001 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).

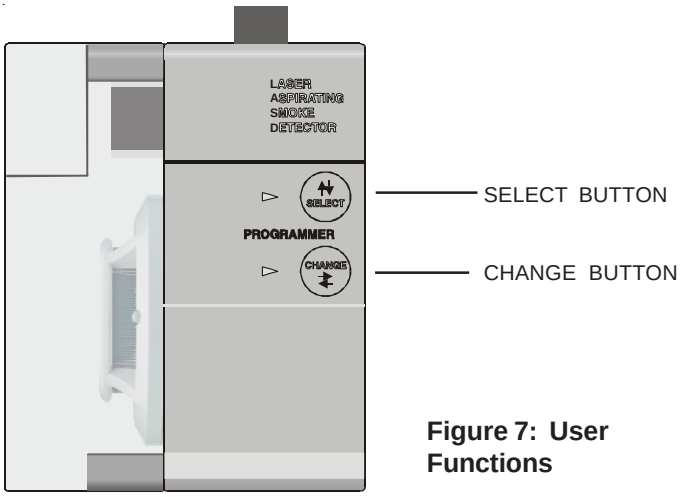


Figure 7: User Functions

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 TC866E housing until the unit beeps, and the Code Entry LED starts flashing.

Access Code

To proceed, a code needs to be entered into the TC866E. 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 TC866E.

Once the third number has been entered, the TC866E 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 TC866E 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: TC866E2009: Set-Up Procedure.

Step	Mode	Indication	Function
1.	Reset	Reset LED flashes.	Resets the TC866E 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 1Airflow 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: • Long Beep: In fault TC866E beeps once each 30 seconds. In fire TC866E beeps continuously until alarm is acknowledged by pressing either button, it then beeps once every 15 seconds until reset. • Short beep – TC866E 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: • 0 (Green) - Non-Latching • 1 (Yellow) - Latching (*not possible in Loop Controlled mode*) Both channels will be set the same (setting in *Loop Controlled Mode* is non-latching).
18.	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: TC866E1001: Set-Up Procedure.

Step	Mode	Indication	Function
1.	Reset	Reset LED flashes.	Resets the TC866E 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: • **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: • Long Beep: In fault TC866E beeps once each 30 seconds. In fire TC866E beeps continuously until alarm is acknowledged by pressing either button, it then beeps once every 15 seconds until reset. • Short beep – TC866E 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: • 0 (Green) - Non-Latching • 1 (Yellow) - Latching (setting in *Loop Controlled Mode* is non-latching).
13.	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 re-calibrate the fan sensors as in step 18 of table 1, or step 13 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 TC866E 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.

Bar-graph Levels	Obscuration	
	%/Metre	dB/Metre
1	0.03	0.003
2	0.06	0.004
3	0.13	0.007
4	0.31	0.014
5	0.72	0.029
6	1.24	0.072
7	1.93	0.145
8	2.63	0.219
9	3.33	0.295

Table 2:Bar-graph Levels

CONFIGURING THE TC866E UNIT

Detailed information of pipework set-ups can be found in the *Typical Set-Up Examples* section of the *Appendices* at the back of this manual, together with a standard configuration for the settings shown in Tables 1 and 1a. It should be possible to adapt these examples for most systems, but they remain simple examples for guide purposes only - specific applications will have specific considerations that must be taken into account, and local standards will apply .

The default size for sample holes is 3mm, and the end hole is 6mm.

It is recommended that the fan speed for the TC866E is kept at a default setting of 5 (this will be suitable for most 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, and flow sensitivity. It should not normally be necessary to change these settings.

MAINTAINANCE

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

1. Unscrew the top cover
2. Lift out the foam filter element from its housing
3. Fit a new filter element so that it lies flush with the top of its housing
4. Replace the top cover

ACCESSORIES

The following accessories are available to order:

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

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.

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.

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

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

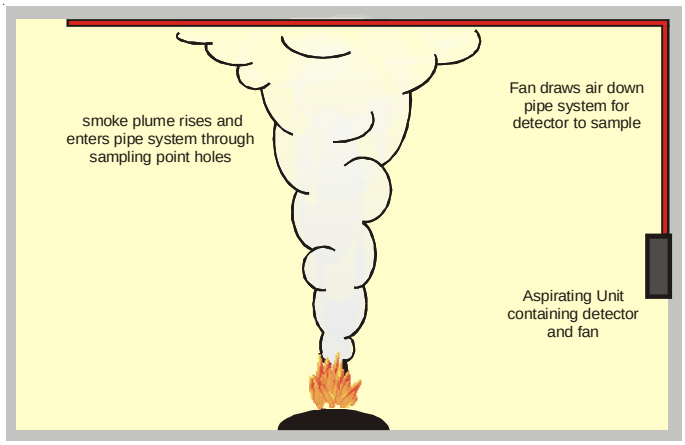


Figure 1.1 Pipe System Operation

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:

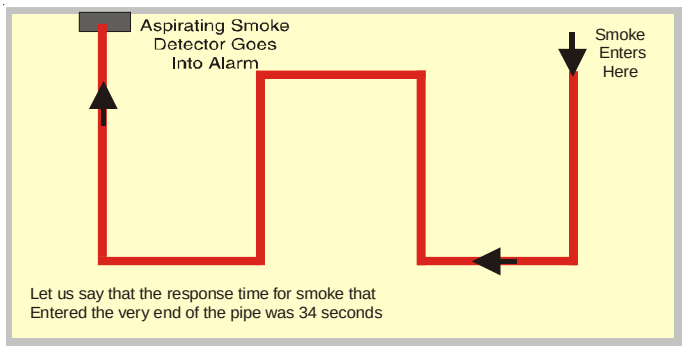


Figure 1.2.1 Single Sampling Pipe

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

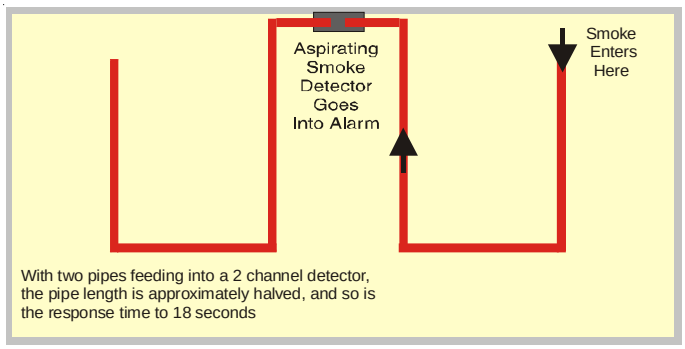


Figure 1.2.2 Two Sampling Pipes

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.

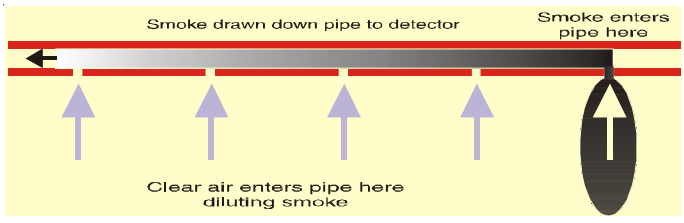


Figure 1.3.1 Smoke Dilution

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 Holes	0.1% %obs/m	0.2% %obs/m	0.5% %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 Honeywell aspirating detectors have a maximum pipe length of 75 metres.

Dual channel aspirating detectors have a maximum pipe length of 50 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.

Honeywell 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. The use of T-Pieces makes it very difficult to calculate dilution rates, air flow and response times and is therefore not recommended.

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

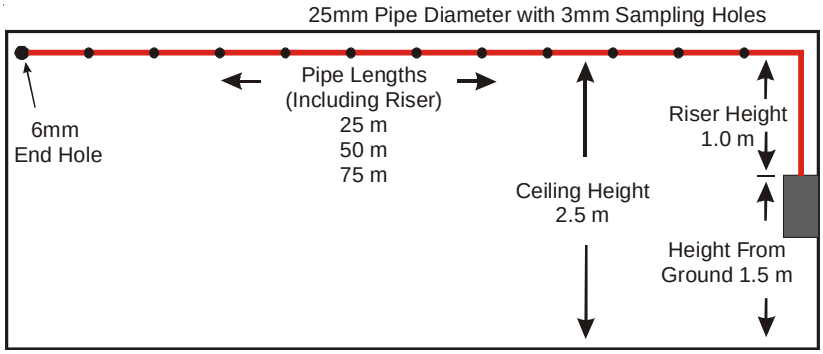
The exhaust pipe on the bottom of the aspirating detector unit can have piping added should it be required, for example if the air passing through the detector needs to be returned to its source. Extra piping can also be used to reduce the noise of the fan if needed.

2. Typical Set-Up Examples

Below are some typical examples of pipe configurations and the settings required for a TC866E unit. It should be possible to adapt these examples for most systems, but they remain simple examples for guide purposes only - specific applications will have specific considerations that must be taken into account, and local standards will apply .

TC866E1001 Single Channel System

Example 1:



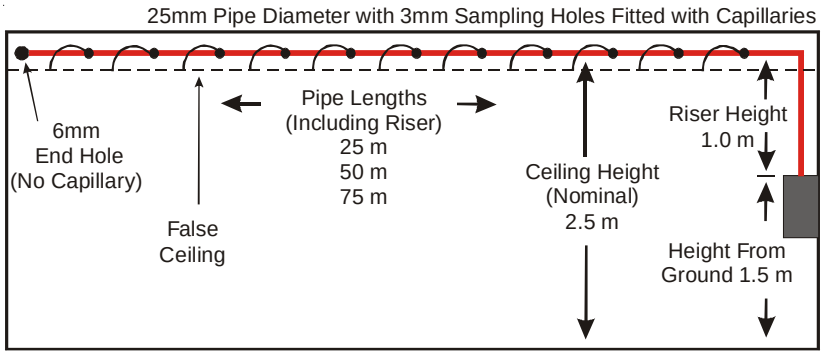
Transport Time Max: At farthest hole

Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
75	14	5	5	130	2	1.46	3	3.13	4	7.32	21.4	61.6
50	9	5	5	123	2	0.89	3	1.92	4	4.53	11.4	81.1
25	4	5	5	101	2	0.5	3	1.09	4	2.58	4.6	96.4
75	14	5	5	130	1	0.73	2	1.46	3	3.13	21.0	61.6
50	9	5	5	123	1	0.45	2	0.89	3	1.92	11.4	81.1
25	4	5	5	101	1	0.25	2	0.50	3	1.09	4.6	96.4

The first 3 rows are figures calculated with the Alert/Action/Alarm settings at 2,3 & 4 respectively. The second 3 rows are calculated with the settings at 1,2 & 3.

Example 2: With Capillaries



Capillary Length: 1m

Capillary Diameter: 4mm

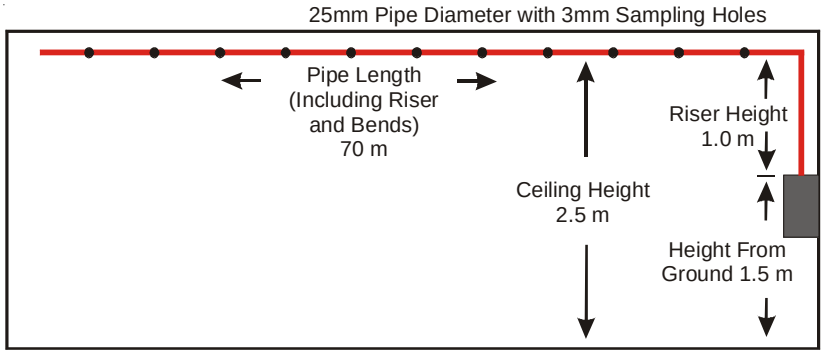
Transport Time Max: At farthest hole

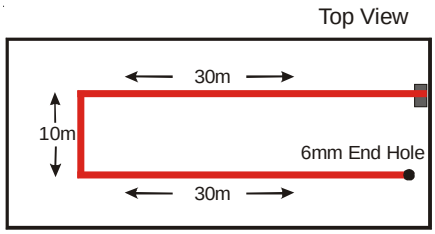
Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
75	14	5	5	115	2	1.58	4	3.39	6	7.91	21.5	68.3
50	9	5	5	107.2	2	0.96	4	2.07	6	4.86	11.8	88.3
25	4	6	5	86.8	2	0.64	4	1.38	6	3.27	5.9	96.2
75	14	5	5	115	1	0.79	2	1.58	3	3.39	21.5	68.3
50	9	5	4	107.2	1	0.48	2	0.96	3	2.07	11.8	88.3
25	4	6	4	86.8	1	0.32	2	0.64	3	1.38	5.9	86.8

The first 3 rows are figures calculated with the Alert/Action/Alarm settings at 2,4 & 6 respectively. The second 3 rows are calculated with the settings at 1,2 & 3.

Example 3: With Bends





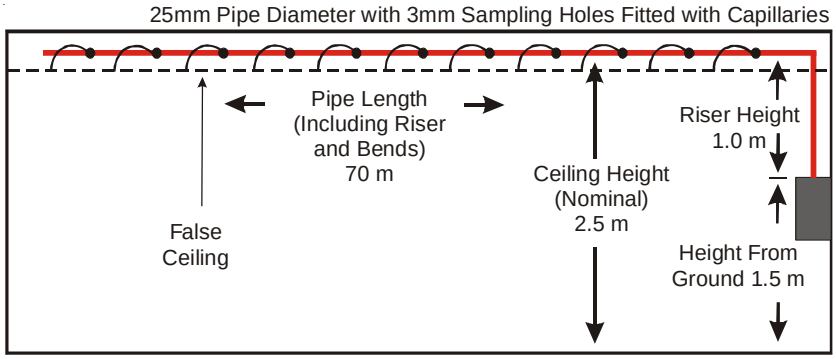
Transport Time Max: At farthest hole

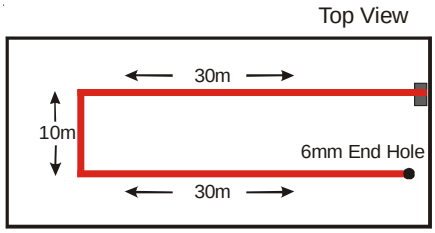
Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
70	6	5,15, 25 45,55,65	5	98.7	1	0.35	2	0.71	3	1.52	19.1	78.2
70	6	5,15,25 45,55,65	5	98.7	2	0.71	3	1.52	4	3.6	19.1	78.2

The first figures are calculated with the Alert/Action/Alarm settings at 1,2 & 3 respectively. The second are calculated with the settings at 2,3 & 4.

Example 4: With Capillaries and Bends





Capillary Length: 1m

Capillary Diameter: 4mm

Transport Time Max: At farthest hole

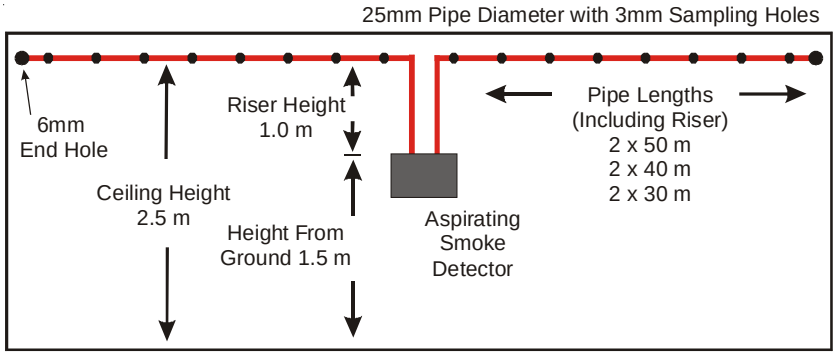
Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
70	6	5,15, 25 45,55,65	5	85.0	1	0.38	2	0.77	3	1.65	19.9	86.1
70	6	5,15,25 45,55,65	5	85.0	2	0.77	3	1.65	4	3.9	19.9	86.1

The first figures are calculated with the Alert/Action/Alarm settings at 1,2 & 3 respectively. The second are calculated with the settings at 2,3 & 4.

TC866E2009 Dual Channel System

Example 1:



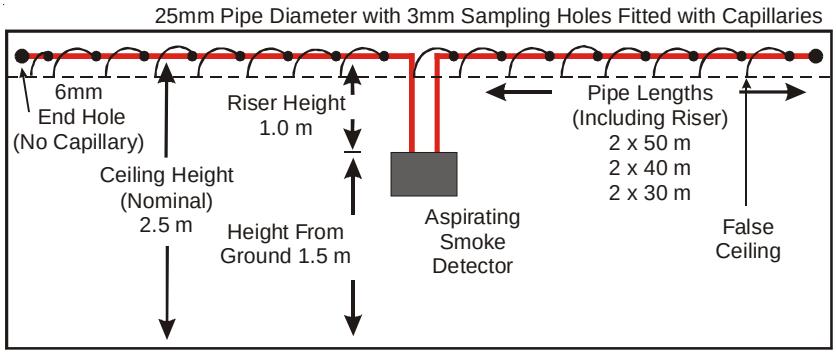
Transport Time Max: At farthest hole

Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
2 x 50	2 x 9	5	5	121.4	2	1.77	3	3.81	4	8.85	11.6	81.0
2 x 40	2 x 7	5	5	115.6	2	1.43	3	3.08	4	7.2	8.5	88.2
2 x 30	2 x 5	5	5	106.4	2	1.14	3	2.45	4	5.76	5.8	94.1
2 x 50	2 x 9	5	5	121.4	1	0.89	2	1.77	3	3.81	11.6	81.0
2 x 40	2 x 7	5	5	115.6	1	0.72	2	1.43	3	3.8	8.5	88.2
2 x 30	2 x 5	5	5	106.4	1	0.57	2	1.14	3	2.45	5.8	94.1

The first 3 rows are figures calculated with the Alert/Action/Alarm settings at 2,3 & 4 respectively. The second 3 rows are calculated with the settings at 1,2 & 3.

Example 2: With Capillaries



Capillary Length: 1m

Capillary Diameter: 4mm

Transport Time Max: At farthest hole

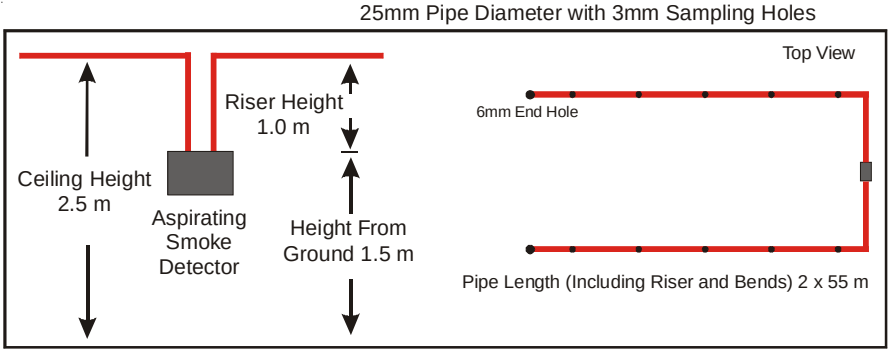
Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
2 x 50	2 x 9	5	5	102.1	2	1.86	3	4.0	4	9.28	11.9	66.6
2 x 40	2 x 7	5	5	99.8	2	1.63	3	3.49	4	8.13	9.0	92.7
2 x 30	2 x 5	5	5	91.6	2	1.38	3	2.97	4	6.94	6.4	96.0
2 x 50	2 x 9	5	5	102.1	1	0.94	2	1.86	3	4.0	11.9	66.0
2 x 40	2 x 7	5	5	99.8	1	0.82	2	1.63	3	3.49	9.0	92.7
2 x 30	2 x 5	5	5	91.6	1	0.69	2	1.38	3	2.97	6.4	96.0

The first 3 rows are figures calculated with the Alert/Action/Alarm settings at 2,3 & 4 respectively. The second 3 rows are calculated with the settings at 1,2 & 3.

Example 3: With Bends

25mm Pipe Diameter with 3mm Sampling Holes



Transport Time Max: At farthest hole

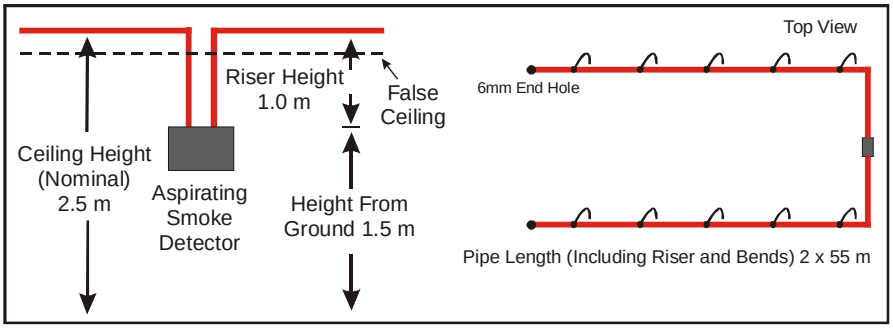
Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
2 x 55	2 x 5	10,20, 30 40,50	5	93.7	1	0.43	2	0.87	3	1.87	13.7	86.5
2 x 55	2 x 5	10,20,30 40,50	5	93.7	2	0.87	3	1.87	4	4.4	13.7	86.5

The first figures are calculated with the Alert/Action/Alarm settings at 1,2 & 3 respectively. The second are calculated with the settings at 2,3 & 4.

Example 4: With Capillaries and Bends

25mm Pipe Diameter with 3mm Sampling Holes Fitted with Capillaries



Capillary Length: 1m

Capillary Diameter: 4mm

Transport Time Max: At farthest hole

Alert/Action/Alarm Level: Obscuration defined at farthest hole

Pipe Length (m)	No. of Holes	Hole Spacing (m)	Fan Speed	Fan Flow (l/mn)	Alert Level	Obscure (%/m)	Action Level	Obscure (%/m)	Alarm Level	Obscure (%/m)	Transport Time (Max)	Hole Balance (%)
2 x 55	2 x 5	10,20, 30 40,50	5	82.4	1	0.5	2	0.99	3	2.13	14.4	91.6
2 x 55	2 x 5	10,20,30 40,50	5	82.4	2	0.99	3	2.13	4	5.02	14.4	91.6

The first figures are calculated with the Alert/Action/Alarm settings at 1,2 & 3 respectively. The second are calculated with the settings at 2,3 & 4.

3. Guide to Available Pipe Parts

Honeywell offers the following pipe parts:

3.1 Imperial 3/4 Inch Pipe Options

Model Number	Product Description	
02-0001-27	Large Bore Red Pipe 3m Length, 3/4"	
02-1001-27	Straight Union Large Bore 3/4"	
02-1002-27	90 deg. Bend Large Bore 3/4"	
02-1003-27	45 deg. Elbow Large Bore 3/4"	
02-1005-27	Removable Union Large Bore 3/4"	
02-1007-27	T-Piece 3/4"	
02-1006-27	End Cap for Large Bore 3/4"	
02-FLU1	Filter Unit 3/4" With Filter Element (for Harsh environment)	

3.2 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)	

3.3 Common Accessories

There are a number of accessories that can be used across either the ¾" or 25mm pipe sizes:

Model Number	Product Description	
02-1008-15	Flush Capilary Sampling Point (T Piece & 1.5m Capillary Tube) For use with false ceilings	 
02-1009-00	Sampling Point Label (Roll of 100)	
02-1010-00	Open Pipe Clip (25mm and 3/4")	
02-1110-00	Closed Pipe Clip (25mm and 3/4")	
02-1011-00	ABS Pipe Adhesive (250ml tin)	