FAAST FLEX™ ASPIRE PIPE NETWORK DESIGN INSTRUCTIONS

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Document Conventions

The following typographic conventions are used in this document.

Convention	Description
Bold	Used to denote: emphasis Used for names of menus, menu options, toolbar buttons
Italics	Used to denote: references to other parts of this document or other documents. Used for the result of an action

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1 ASPIRE Software

The performance of an aspirating smoke detection system is dependent on the design of the pipe network used to transport air back to the smoke detector.

FAAST FLEX ASPIRE is a Windows®-based application that aids the specifications and design of pipe networks for FAAST FLEX detectors, both conventional and addressable.

ASPIRE is a calculation tool used to ensure optimum design of FAAST FLEX aspirating smoke detection pipe networks.

The below parameters must comply with local standards:

- Transport time
- Balance
- Sampling Point Sensitivity
- Sampling Point Pressures

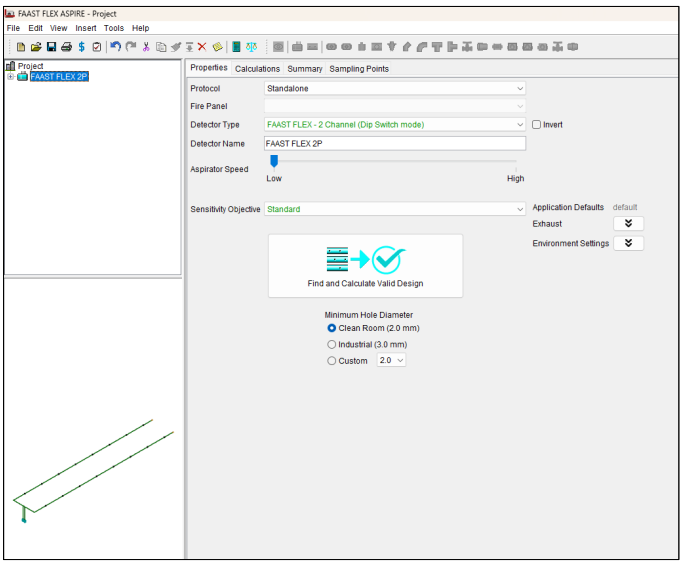


Figure 1: The ASPIRE Interface

1.1 System Balance

Balance is the relationship between the lowest and highest flow expressed as a percentage.

It is recommended to have a balance close to 100% if possible, while the ideal minimum is 70%.

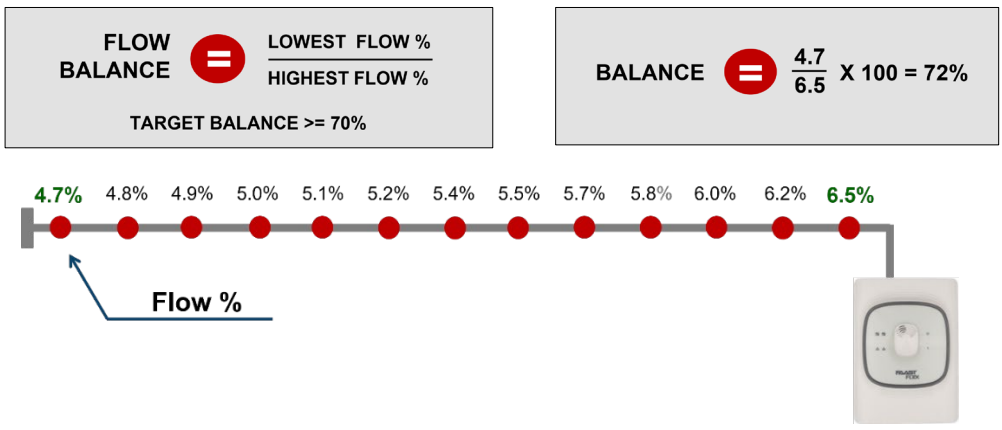


Figure 2: System Balance

1.2 Preferences

To set your preferences for ASPIRE, follow these steps:

1. Start ASPIRE, click **Tools**, and **Preferences**. The below window appears:

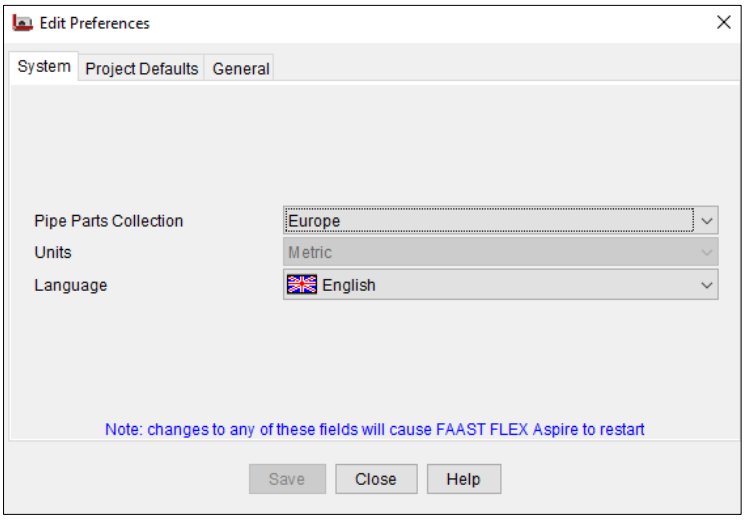


Figure 3: System Preferences

The preferences include three tabs: System, Project Defaults and General.

2. Select the **System** preferences you want:
   - Pipe Parts Collection (or region)
   - Units
   - Language
3. Select the **Project Defaults** to configure the following parameters:

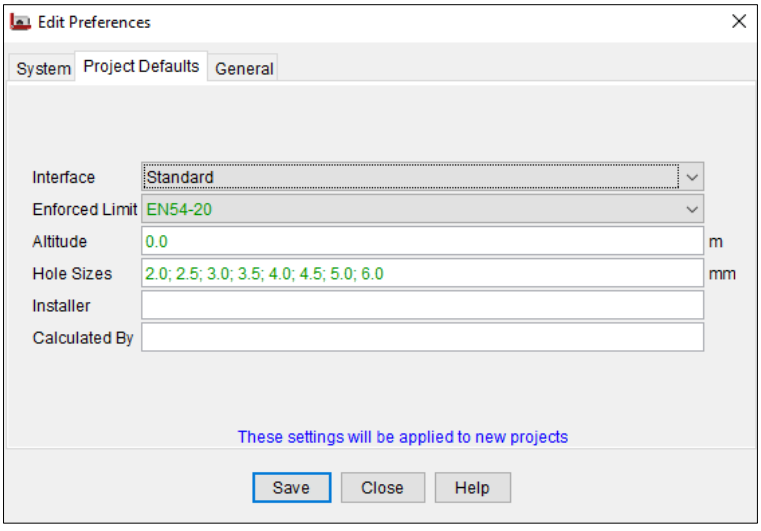


Figure 4: Project Defaults Preferences

   - Interface: Standard or Advanced. Refer to Section 1.3 Interface for more details.
   - Enforced Limit: Custom or EN54-20
   - Altitude
   - Hole Sizes
   - Installer
   - Calculated By
4. Select the **General** to configure general parameters, such as: saving options for your projects.

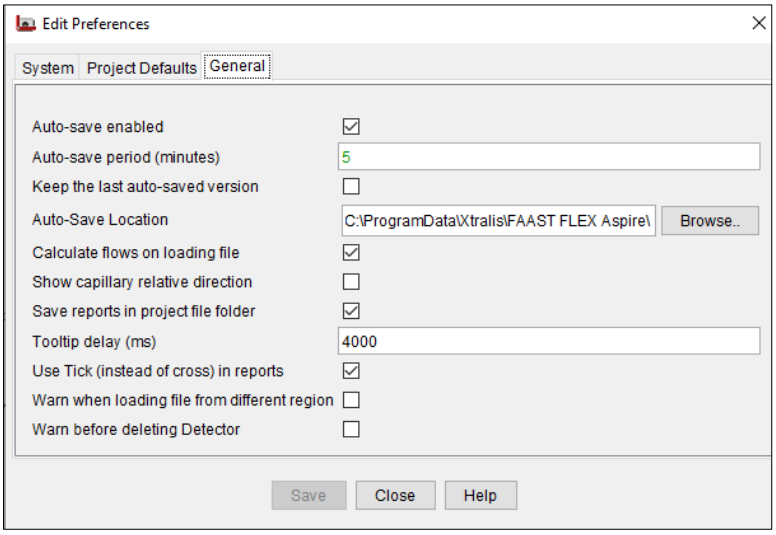


Figure 5: General Preferences

5. Click **Save**. Changing any of the settings on this tab will require ASPIRE to be restarted to take effect.

1.3 Interface

ASPIRE has two Interfaces: Standard and Advanced.

The Standard Interface is easy to use and applicable to most applications. The Advanced Interface should be used if the application requires one of the following:

- The aggregation of the smoke from multiple holes to make them act like one super hole
- The grouping of holes into separate groups, where each group uses a different sensitivity from the other

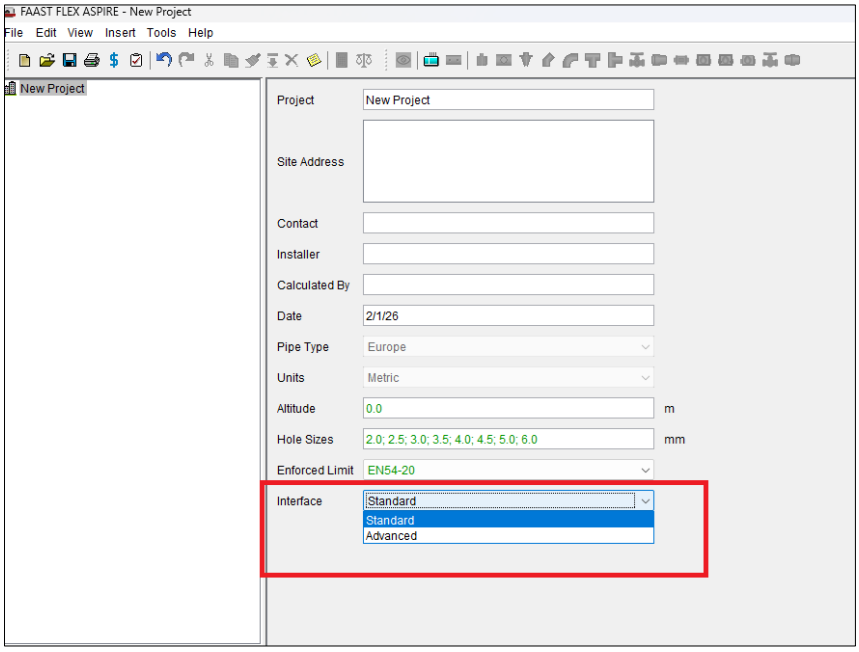


Figure 6: Choosing the Interface

1.3.1 Standard Interface

The Standard Interface appears by default when you start ASPIRE.

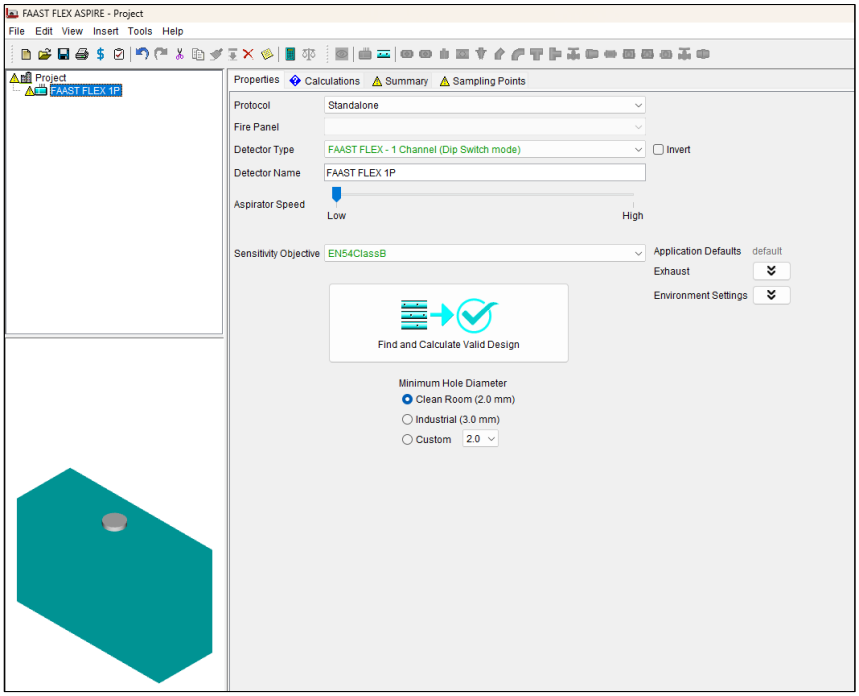


Figure 7: Standard Interface

Through this interface you can manage these functions:

- Properties
- Calculations
- Summary
- Sampling Point

1.3.1.1 Properties

The properties Tab allows you to enter the detector derails such as: Detector Type, Detector Name, Aspirator Speed, Sensitivity Objective, …etc.

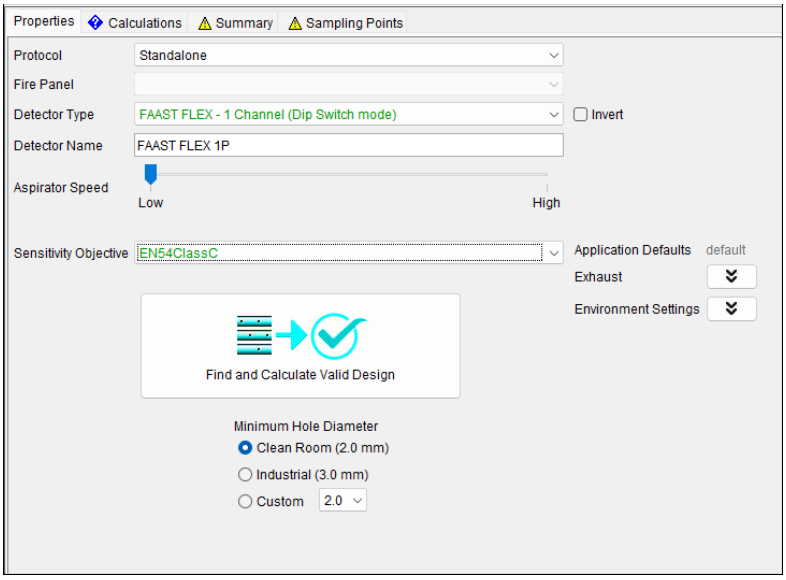


Figure 8: Properties Tab

- **Protocol:** This list allows you to select the communication protocol used to connect with Fire Alarm Control Panels (FACPs). The default value is “standard” which uses a conventional/standalone detector. Alternatively, you can choose AP (Advanced Protocol) or CLIP (Common Loop Interface Protocol) for addressable detectors.
- **Fire Panel:** This list allows you to select the specific Fire Panel that will be connected to the FAAST FLEX unit. If the default value is used in the previous menu (Protocol), no options will be available in the Fire Panel list.
- **Detector Type:** This list allows you to select the type of detector for your customer site. Based on the selections made in the first two lists (Protocol and Fire Panel), the available detector types will generate dynamically.
- **Detector Name:** This field displays the name of the detector you have selected.
- **Aspirator Speed:** Some detector models allow you to adjust the aspirator speed. Increasing the aspirator speed will normally reduce the transport time for smoke samples reaching the detector.
- **Sensitivity Objective:** EN54 Class A, EN54 Class B or EN54 Class C.

  Important Note: The performance and limitations of the devices (such as sensitivity, number of holes, etc.) depend on the selected Protocol and the specific Fire Panel combination.

1.3.1.2 Calculations

The **Calculations** tab shows you the results of your calculated pipe network design and the status of its validity.

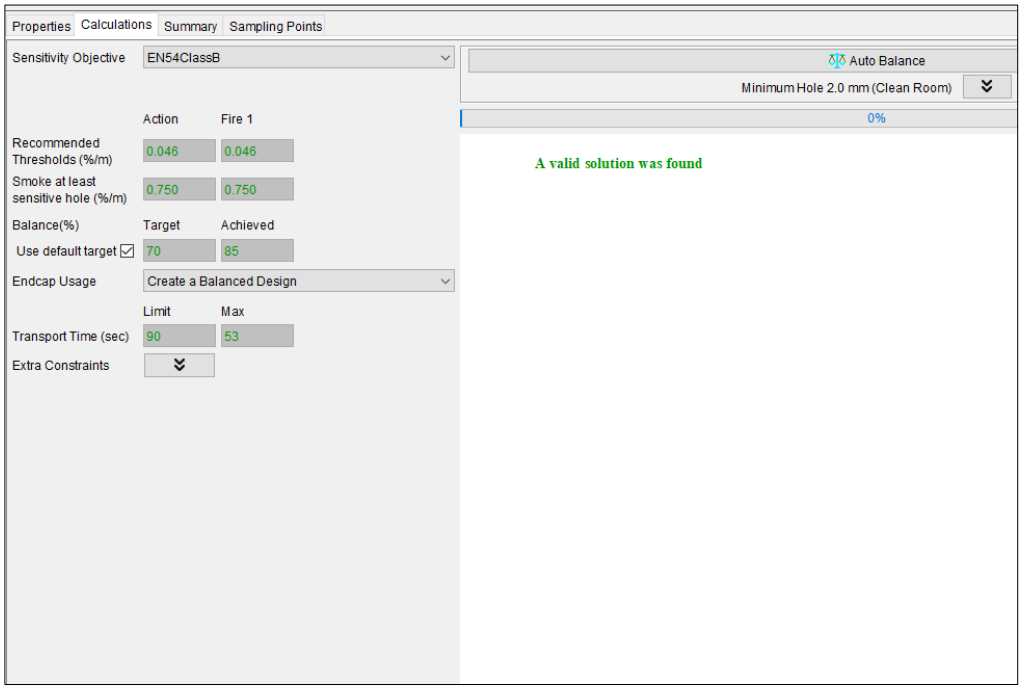


Figure 9: Calculations Tab

This window also shows:

- Sensitivity objective
- Recommended thresholds and smoke at least sensitive hole
- Target balance and achieved
- Maximum and limit transport time in second
- Extra constraints which have minimum hole flow rate and target suction pressure

1.3.1.3 Summary

The Pipe Summary Tab displays the current pipe configuration. This tab gives a summary of the pipe network connected to the detector. As extra pipes are added you will need to select **Calculate** to update these details. Some figures, such as the distance between holes, may vary. When this occurs the range of distances will be displayed instead of a figure. Select the pipe in the tree view to see the details.

Properties | Calculations | Summary | Sampling Points

	[New Pipe]	Exhaust	[The Detector]
Pipe Length	36.0	0.0	36.0
First Position	8.0 m		8.0 m
Number of Sam...	8		8
Hole Spacing	4.0 m		4.0 m
Pipe Internal Di...	21.0 mm	21.0	21.0 mm
Capillary Intern...	8.0 mm		8.0 mm
End Vent Diam...	3.0 mm		3.0 mm
Ambient Pressure	0		
Maximum Trans...	53 sec		53 sec
Sector Pressure	146	0	
Total Flow	31.9	31.9	31.9

Figure 10: Summary Tab

- **Pipe Length:** The total length of pipe connected to the detector.
- **First Position:** The distance from the detector to the first hole.
- **Number of Sample Points:** Total number of sample holes for the pipe.
- **Hole Spacing:** Distance between holes.
- **Pipe Internal Diameter:** The ID (Internal Diameter) of the pipe.
- **Capillary Internal Diameter:** The ID (Internal Diameter) of any capillaries.
- **End Vent Diameter:** The size of the hole in the endcap.
- **Ambient Pressure:** The relative difference in suction pressure between the location of the sample point and the location of the detector exhaust (ignoring height effects). If the detector exhausts air back into the same area it samples, the ambient pressure should be set to zero (0) Pa.
- **Maximum Transport Time:** The maximum calculated transport time for an air sample to travel from a sample point to the detector.
- **Sector Pressure:** The suction pressure for each pipe at the detector.
- **Total Flow:** The amount of air collected by each pipe.

1.3.1.4 Sampling Point

Sampling Points tab shows Sensitivity, Pressure, Transport Time, Hole diameter, Flow, Flow%, Dilution for each sample hole.

Properties | Calculations | Summary | Sampling Points

	Action Sensitivity	Fire Sensitivity	Pressure	Transport Time	Hole Diameter	Flow	Flow%	Dilution	Tube Diameter	Tube Length
1:Section0-1	0.339	0.339	123	16	3.0	4.3	13.6	7		
1:Section0-2	0.352	0.352	114	18	3.0	4.2	13.1	8		
1:Section0-3	0.373	0.373	78	21	3.0	3.9	12.3	8	8.0	2.00
1:Section0-4	0.384	0.384	73	24	3.0	3.8	12.0	8	8.0	2.00
1:Section0-5	0.394	0.394	70	28	3.0	3.7	11.7	9	8.0	2.00
1:Section0-6	0.387	0.387	94	32	3.0	3.8	11.9	8		
1:Section0-7	0.392	0.392	92	40	3.0	3.8	11.7	9		
1:Section0-8	0.335	0.335	91	53	3.0	4.4	13.7	7		

Figure 11: Sampling Point Tab

1.3.2 Advanced Interface

The **Advanced** interface appears as shown below.

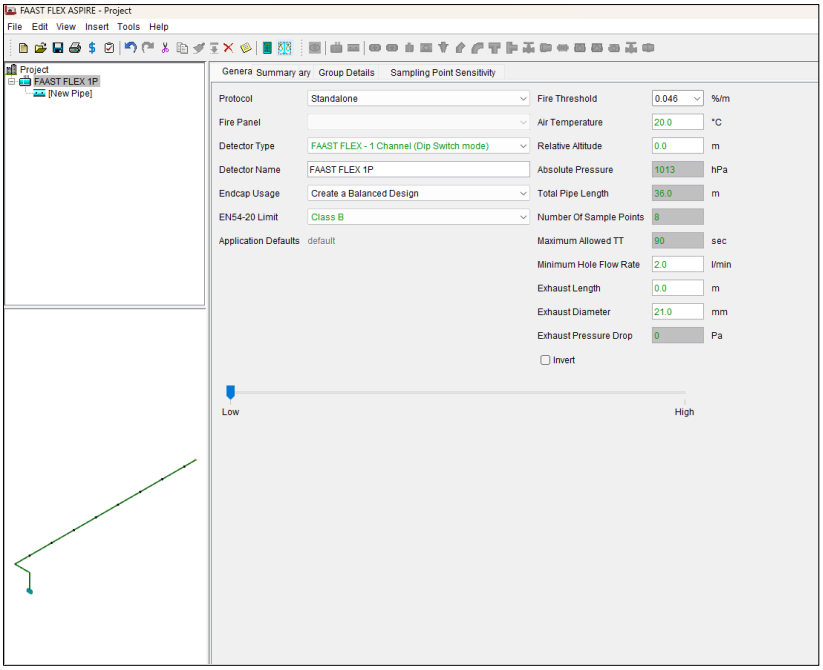


Figure 12: Advanced Interface

The advanced interface includes the below functions:

- General
- Summary
- Group Details
- Sampling Point Sensitivity

1.3.2.1 General

The General tab of the Detector View is shown in the window below:

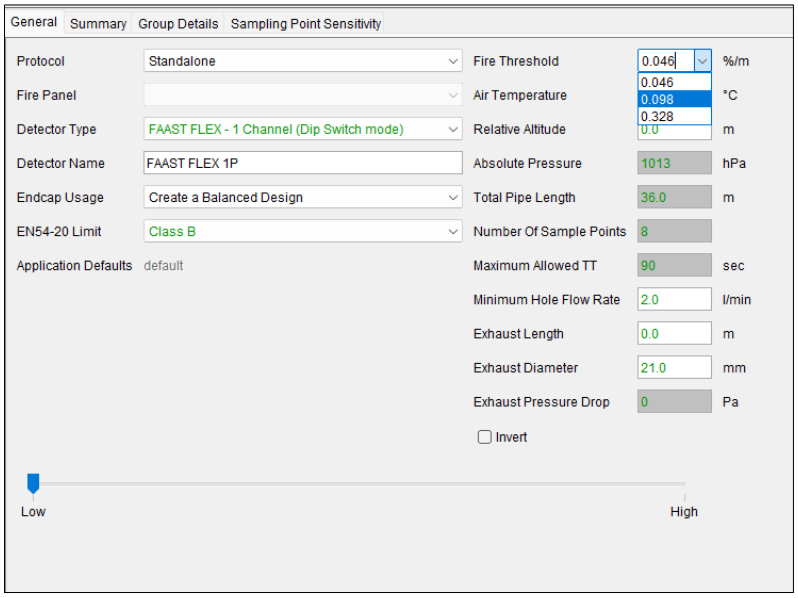


Figure 13: Group Details Tab

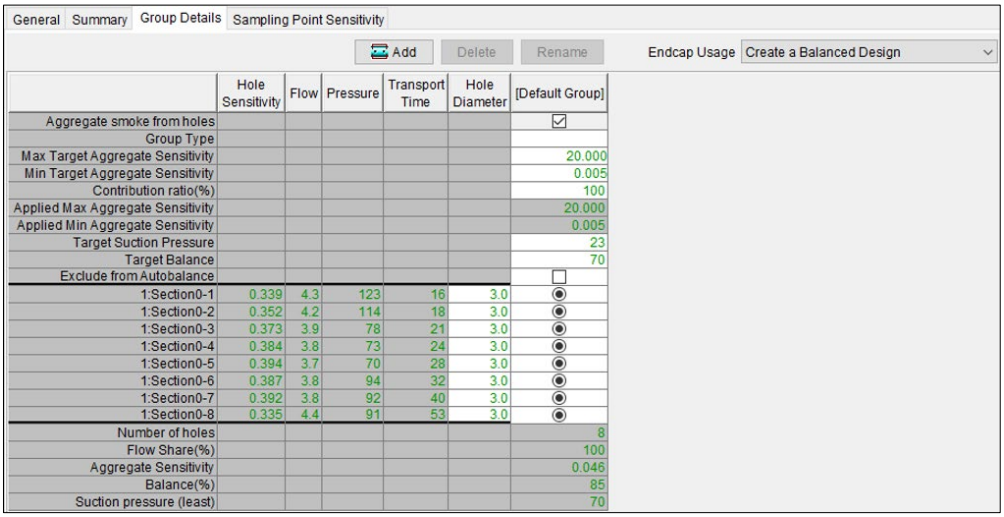
- **Protocol:** This list allows you to select the communication protocol used to connect with Fire Alarm Control Panels (FACPs). The default value is “standard” which uses a conventional/standalone detector. Alternatively, you can choose AP (Advanced Protocol) or CLIP (Common Loop Interface Protocol) for addressable detectors.
- **Fire Panel:** This list allows you to select the specific Fire Panel that will be connected to the FAAST FLEX unit.
- **Detector Type:** This list allows you to select the type of detector for your customer site. Based on the selections made in the first two lists (Protocol and Fire Panel), the available detector types will generate dynamically.
- **Detector Name:** This field displays the name of the detector you have selected.
- **Aspirator Speed:** Increasing the aspirator speed will normally reduce the transport time for smoke samples reaching the detector.
- **Endcap Usage:** Endcap usage determines how you wish to use endcaps.
- **Create a balanced design:** This increases the sensitivity of detection for each hole as more air comes into the pipe network through sample holes rather than the endcap vent. By default, 3mm holes are used.
- **Use endcaps to reduce transport time:** This option increases the hole sizes in the endcaps so that the air from the sample holes is transported faster to the detector. By default, 4mm holes will be used.
- **Apply EN54-20 Limit**
- **Application:** If you find that you are regularly creating a similar type of site from the factory defaults, you should consider creating your own sets of defaults to allow you to design sites more consistently and faster.
- **Fire Threshold:** The amount of smoke required at the detector to activate the fire alarm (Fire 1).
- **Temperature:** The expected average temperature of the air being sampled by the detector. Temperature affects the viscosity and density of air, hotter air travels faster.
- **Relative Altitude:** The relative offset of this detector from the altitude specified for the project.
- **Absolute Pressure:** The expected average air pressure at the detector based on the sum of the project altitude and the detector’s relative altitude. Air pressure affects the transport time.
- **System Flowrate:** The amount of air collected by the detector per minute.
- **Total Pipe Length:** This is the total length of all pipes connected to the detector. If this number is red you will need to decrease the size of the pipe network for the detector to work effectively. Alternatively, you can select a different Detector Type as another model may be able to support your proposed pipe network.
- **Number of sample points:** All detector types have an upper limit on the number of sample points that can be effectively used. Having too many sample points connected to a detector will reduce the sucking pressure to an unacceptable lower limit that may compromise detection.
- **Maximum Transport Time:** This is the maximum acceptable amount of time for a smoke sample to travel from a sample hole to the detector.
- **Minimum Hole Flow Rate:** This is the minimum acceptable amount of air to be sampled by each hole per minute.
- **Exhaust Length:** The total length of exhaust pipe.
- **Exhaust Diameter:** The diameter of the exhaust pipe.
- **Exhaust Pressure Drop:** Calculated estimate of the pressure drop across the exhaust.
- **Inverted Detector:** For some sites, it may be most practical to install the detector in an inverted (upside-down) position. Check this box if the detector will be inverted.

1.3.2.2 Summary

The summary window is similar in both Standard and Advanced interfaces. Refer to section 1.3.1.1 for more information.

1.3.2.3 Group Details

The Group Details tab is used to create groups of sampling holes that work together to simulate a large, more sensitive sampling point.



	Hole Sensitivity	Flow	Pressure	Transport Time	Hole Diameter	[Default Group]
Aggregate smoke from holes						☑
Group Type						
Max Target Aggregate Sensitivity						20.000
Min Target Aggregate Sensitivity						0.005
Contribution ratio(%)						100
Applied Max Aggregate Sensitivity						20.000
Applied Min Aggregate Sensitivity						0.005
Target Suction Pressure						23
Target Balance						70
Exclude from Autobalance						☐
1:Section0-1	0.339	4.3	123	16	3.0	◉
1:Section0-2	0.352	4.2	114	18	3.0	◉
1:Section0-3	0.373	3.9	78	21	3.0	◉
1:Section0-4	0.384	3.8	73	24	3.0	◉
1:Section0-5	0.394	3.7	70	28	3.0	◉
1:Section0-6	0.387	3.8	94	32	3.0	◉
1:Section0-7	0.392	3.8	92	40	3.0	◉
1:Section0-8	0.335	4.4	91	53	3.0	◉
Number of holes						8
Flow Share(%)						100
Aggregate Sensitivity						0.046
Balance(%)						85
Suction pressure (least)						70

Figure 14: Group Details Tab

- **Group Type:** Allows the group settings to be set to a standard group type.
- **Max Target Aggregate Sensitivity:** The upper limit of smoke detection for the group of holes.
- **Min Target Aggregate Sensitivity:** The lower limit of smoke detection for the group of holes.
- **Contribution ratio (%):** The proportion of sampling points within the group that would be expected to sense a fire event. For example, in a large room the smoke from a fire event at one end of the room may only reach half of the sample points. In this case the Contribution Ratio would be set to 50%.
- **Applied Max Aggregate Sensitivity:** The upper limit of smoke detection that is applied to this group. It is the Max Target Aggregate Sensitivity * Contribution Ratio.
- **Applied Min Aggregate Sensitivity:** The lower limit of smoke detection that is applied to this group. It is the Min Target Aggregate Sensitivity * Contribution Ratio.
- **Target Suction Pressure:** The lower limit of suction pressure for holes in the group.
- **Target Balance:** The least acceptable balance for the group of holes.
- **Exclude from AutoBalance:** The option allows you to protect your settings from being altered when the AutoBalance function is run.
- **Pipe/Section:** The details for each sample point in the pipe network. Click the radio button for each hole to collect them into groups. Holes can be moved from one group to another by selecting the radio button in the other group.
- **Number of holes:** Count of the number of sample points. (Ignores blocked or open endcaps).
- **Flow Share (%):** The proportion of the detector's flow in this group.
- **Aggregate Sensitivity:** Is defined for a group of holes. It is the uniform smoke level required at each hole (with clean air at all others outside the group) to produce a fire alarm at the detector.
- **Balance:** The lower limit of balance expected for the group of holes. This value is usually set to 70% or higher because the holes in the group should have similar characteristics.
- **Suction Pressure (least):** The lower limit of suction pressure (in Pa) for the sample hole.

1.3.2.4 Sampling Point Sensitivity

The Sampling Point Sensitivity tab is shown in the window below:

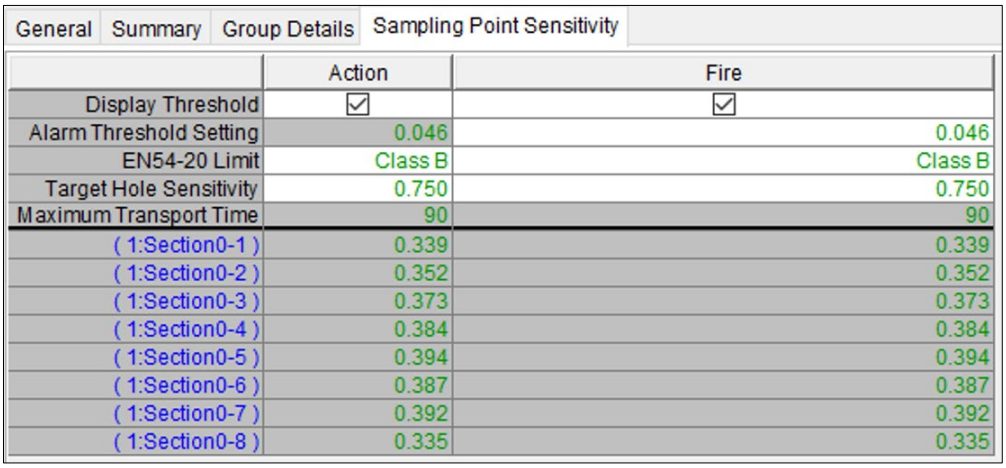


Figure 15: Sampling Point Sensitivity Tab

This window allows you to set up the Sensitivity Levels you prefer for the pipe network design.

Sensitivity Levels

FAAST FLEX can be configured in field to work with three different sensitivity levels:

- High (default): 0.046 %obs/m
- Medium: 0.098 %obs/m
- Low: 0.328 %obs/m

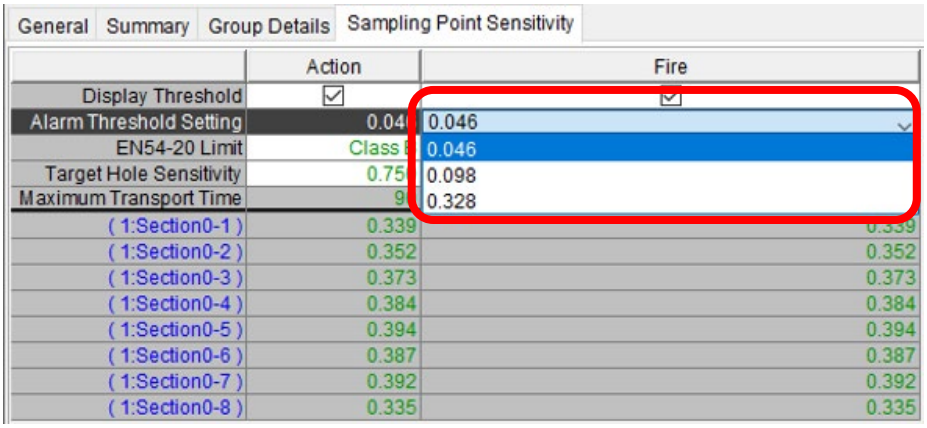


Figure 16: FAAST FLEX Sensitivity Levels

2 Create a New Project

Each time you start ASPIRE it will automatically open a new project. A project contains the detectors, pipes and holes required for a project.
The following steps explain how to add the pipe network design to a project and calculate the results.

1. Click the **Add Detector** icon  in the top toolbar.
2. Choose the detector properties by selecting the **Properties** tab, the following window appears:

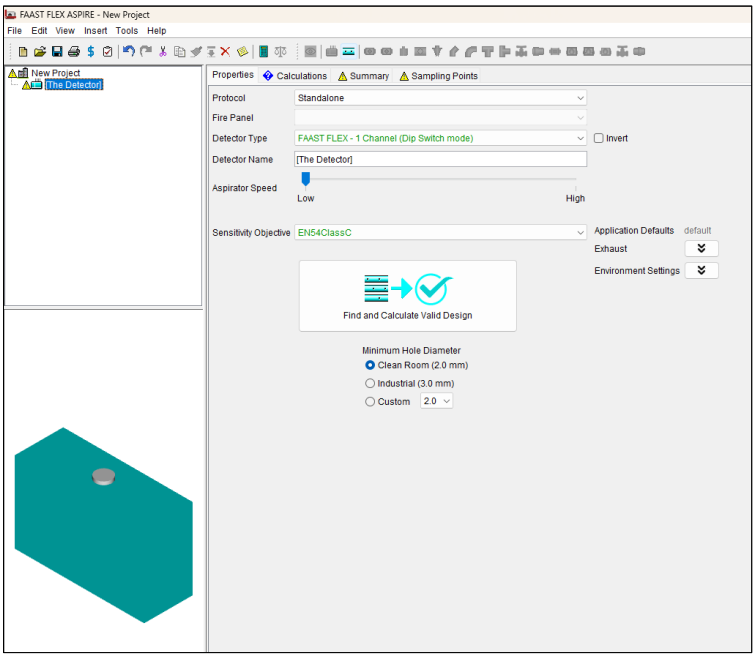


Figure 17: Detector Properties

3. Choose the **Protocol**,
4. Choose the **Fire Panel**,
5. Choose the **Detector Type**,
6. Choose **Aspirator speed**, **Exhaust length** and **Diameter**,
7. Choose the **Sensitivity Objective**,
8. Add the pipe(s) by clicking on its icon . The Pipe Wizard window appears, refer to Chapter 3 Pipe Wizard.
9. Calculate the results. Refer to Chapter 4 Calculate Results for more information.

3 Pipe Wizard

The Pipe Wizard automates the addition of new pipes to a detector. It will lead you through all of the steps required to configure a pipe. To access the pipe wizard select a detector, then select **Insert | Add Pipe**. Once you have completed the creation of a pipe, you can view the details of any pipe by selecting it in the tree view.

3.1 Pipe Network Choice

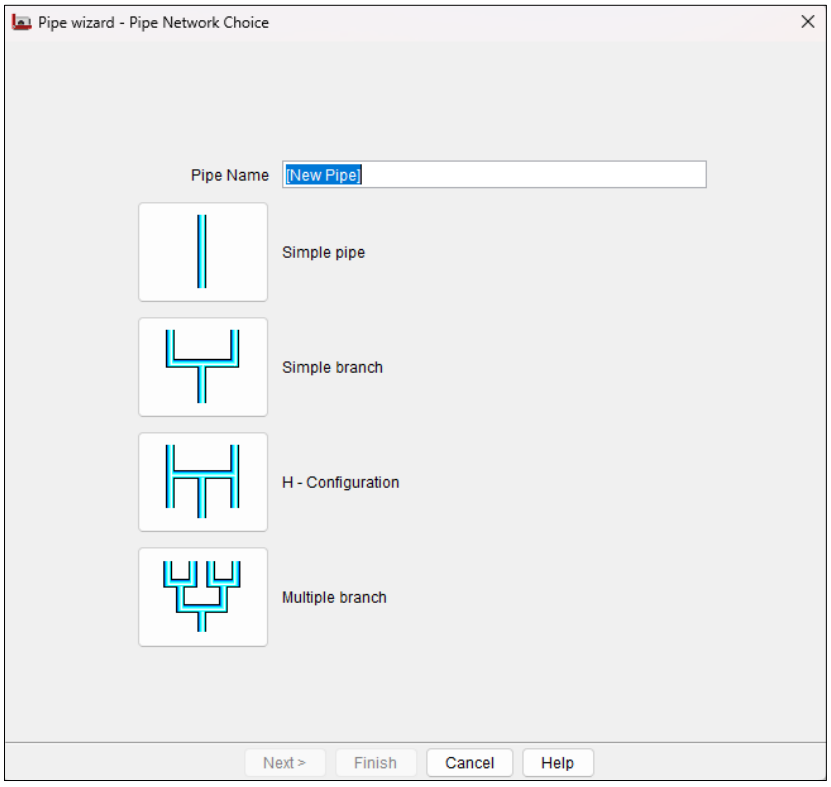


Figure 18: Pipe Wizard

Enter a **Name** and select which type of pipes is to be added to the detector.

- **Simple Pipe:** Pipes that may have many bends as it is simple, but you can add branches later on.
- **Simple branch:** Pipes that are used to fill in a section of a room which is not covered by other pipe work.
- **H configuration:** Pipes that are recommended for small, square rooms as they have good balance and uses less pipe than equivalent single pipes.
- **Multiple Branch:** Pipes that are used in large rooms or rooms with odd shapesFor example, we choose Simple pipe.

3.2 The Simple Pipe Screen of the Pipe Wizard

To access the Pipe Wizard select a detector, then select **Insert | Add Pipe**.

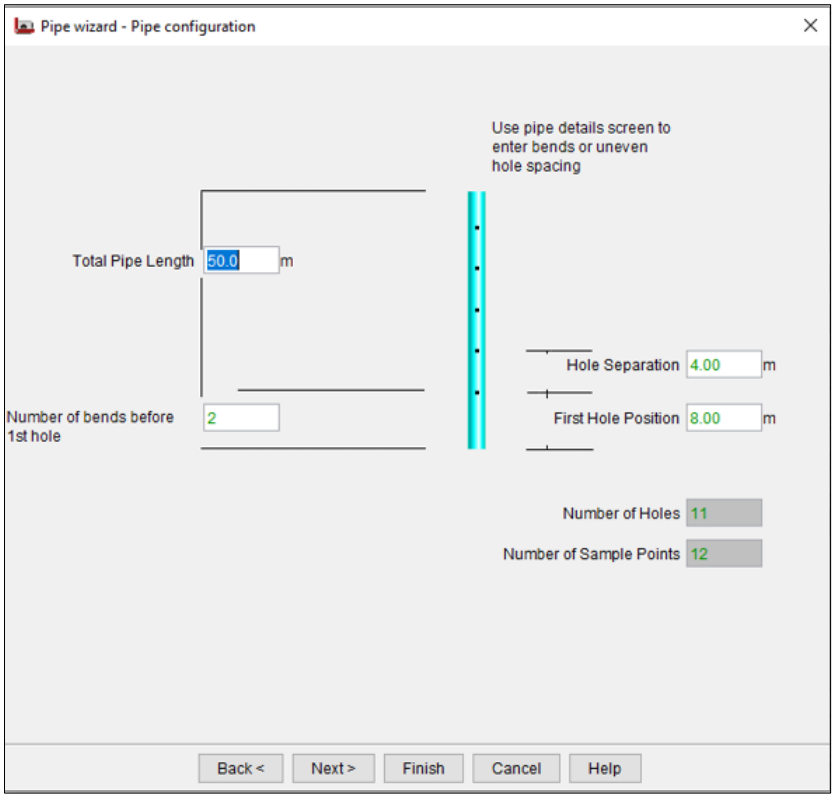


Figure 19: Simple Pipe Screen

The default configuration settings can be modified by **Tools | Application defaults | Simple Pipe Wizard**.

These settings allow you to configure a pipe which may have bends but does not split into more than one pipe.

- **Total Pipe Length:** Enter the length of the pipe.
- **Number of bends before the first hole:** Enter the number of bends before the pipe network reaches the first sample hole.
- **First Hole Position:** Set the distance to the first sample hole in the pipe.
- **Hole Separation:** Set the distance between sample holes in the pipe. If you are using a variety of different distances between holes, enter the most common distance here and manually edit the distances when the pipe wizard has finished.
- **Number of Holes:** The number of holes that will be generated based on the values you have entered. (Calculated by ASPIRE.)
- **Number of Sample Points:** This adds the endcap hole to the list of holes. (Calculated by ASPIRE.)
- **Back <:** Returns you to the previous screen of the pipe wizard.
- **Next >:** Moves you on to the next screen in the pipe wizard.
- **Finish:** Selecting this button will cause the pipe wizard to automatically accept the default values for any options which you have not already set.

3.3 The Pipe Properties Screen of the Pipe Wizard

To use a variety of different size hole diameters then enter the most common size in the **Hole Diameter** field and once the wizard is finished you will need to manually edit the **Sizes**.

To edit the **Sizes**, select the section of pipe in the tree view, click on the appropriate cell in the Hole Diameter column, and edit the size by entering the value, or by choosing a diameter from the drop-down list.

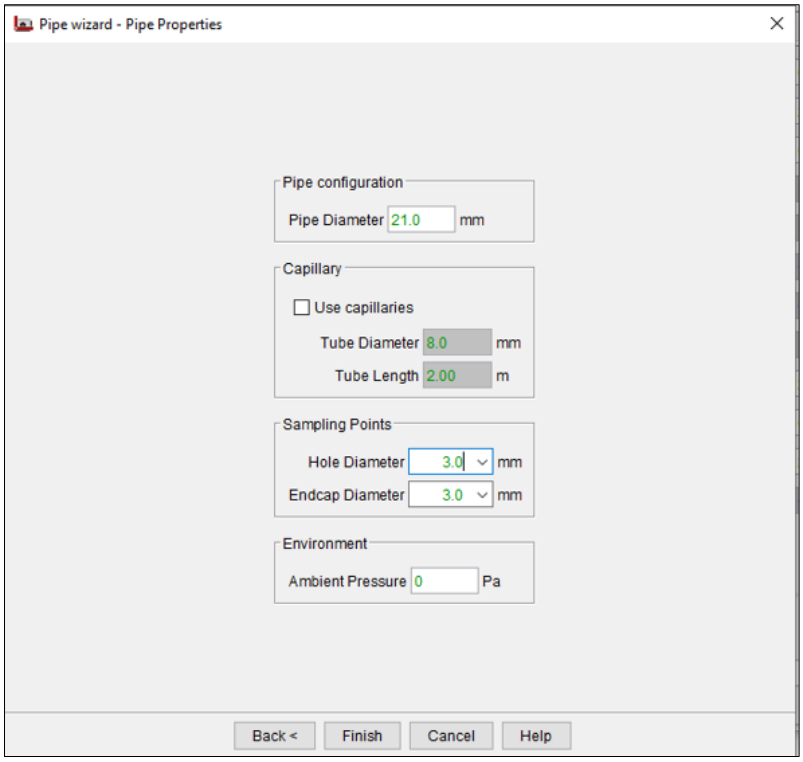


Figure 20: Pipe Properties Screen

Pipe Configuration

- **Pipe Diameter:** Enter the ID (Internal Diameter) of the pipe network.

Capillary

- **Use Capillaries:** Check this checkbox if you would like to use capillaries.
- **Capillary Diameter:** If you choose to use capillaries, enter the internal diameter of the capillaries.
- **Capillary Length:** If you choose to use capillaries, enter their length.

Sampling Points

- **Hole Diameter:** The standard size of holes in the pipe network. You can manually change the size of individual holes once the Pipe Wizard has finished.
- **Endcap Diameter:** The standard size of endcap holes in the pipe network. You can manually change the size of individual holes once the Pipe Wizard has finished.

Environment

- **Ambient Pressure:** Enter the pressure differential between the pipe network and the detector's exhaust outlet. This will be zero unless there are air-tight areas between the pipe network and detector.

3.4 The Pipe View

Selecting any pipe, or section of pipe, in the project tree will display the below details:

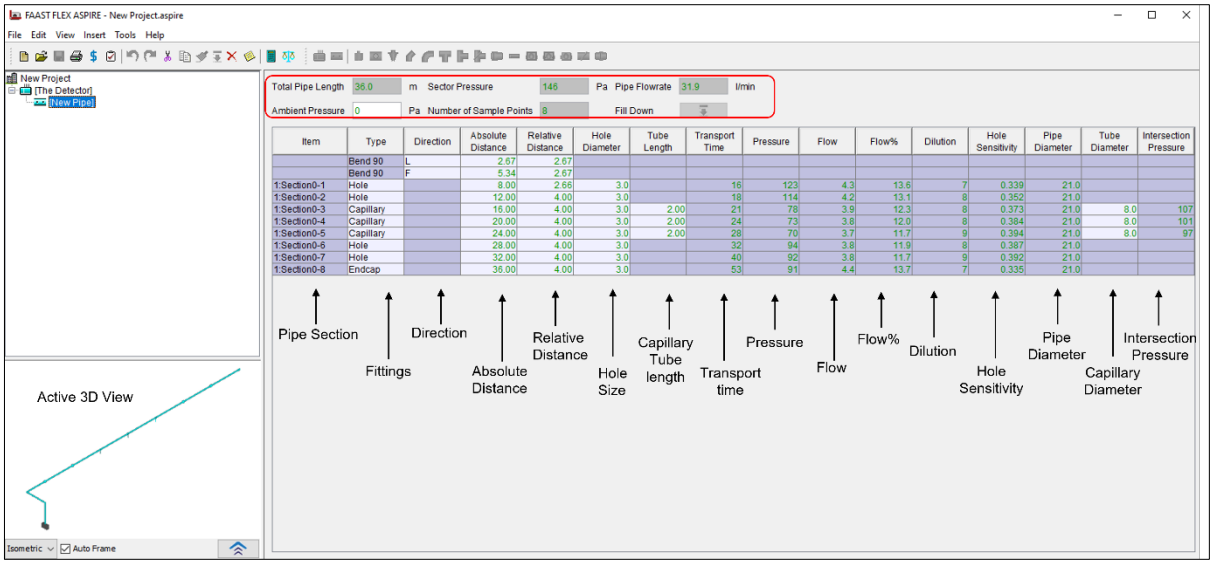


Figure 21: Pipe View

This panel displays all the calculated pipe details. The top of the panel shows pipe properties. The bottom of the panel shows the details for each section.

You can customize the columns that appear on the Pipe View display:

Summary Information

- **Total Pipe Length:** The total length of all sections of pipe. Total Pipe Length may be altered by clicking on the relevant cell in the Relative Distance column and entering a new value. The Total Pipe Length will be updated to show the new value. The total pipe length ignores sections of pipe with blocked endcaps such as those sections used for cleaning or maintenance checks.
- **Sector Pressure:** The suction expected at the start of the pipe.
- **Pipe Flowrate:** The amount of air expected to be sampled by this pipe (liters per minute).
- **Ambient Pressure:** The difference in pressure between this pipe and the detector exhaust outlet. A positive value indicates that the air pressure for the room sampled by the pipe is higher than the air pressure at the detector exhaust outlet.
- **Number of Sample Points:** The total number of sample points in this pipe.

Detailed Information

- **Item:** The name of each section of pipe.
- **Type:** Type of each item of pipe in the design. You can change holes for capillaries, and Water Traps for Endcaps by clicking on the component that you wish to change and select another component from the drop-down list.
- **Direction:** Indicates the direction that a bend or elbow will take.
- **Absolute Distance:** Distance from the start of the pipe (detector).
- **Relative Distance:** Distance relative to the previous item in the list.
- **Hole Diameter:** The diameter of the hole for this sampling point.
- **Capillary Length:** This changes the length of the capillary tube for this capillary. For a drop pipe this is the pipe length in the drop pipe.
- **Transport Time:** The time it will take for an air sample to move from the sample point to the detector. (Calculated by ASPIRE).
- **Pressure:** The suction pressure at the sample point. This should be at least 25 Pa. Cross drafts in the sampling area may require more suction pressure. (Calculated by ASPIRE).
- **Flow:** The amount of airflow from the sample point (L/min). (Calculated by ASPIRE).

- **Flow%:** The percentage of the total air flow that will come from this sample point. (Calculated by ASPIRE).
- **Dilution:** Dilution of the flow through sample points. The Dilution is calculated as: 1 / Flow% X 100.
- **Hole Sensitivity:** The amount of smoke required at this hole with clean air entering all other holes to cause the detector to alarm. Higher numbers indicate less sensitivity. (Calculated by ASPIRE).
- **Pipe Diameter:** ID (Internal Diameter) of sampling pipe.
- **Capillary Diameter:** ID (Internal Diameter) of the capillary. For drop pipes this is the pipe diameter.
- **Intersection Pressure:** The pressure (in Pa) at the point where the capillary intersects the pipe.

4 Calculate Results

After setting up the pipe network design, click **Find and Calculate Valid Design** to see the calculated results:

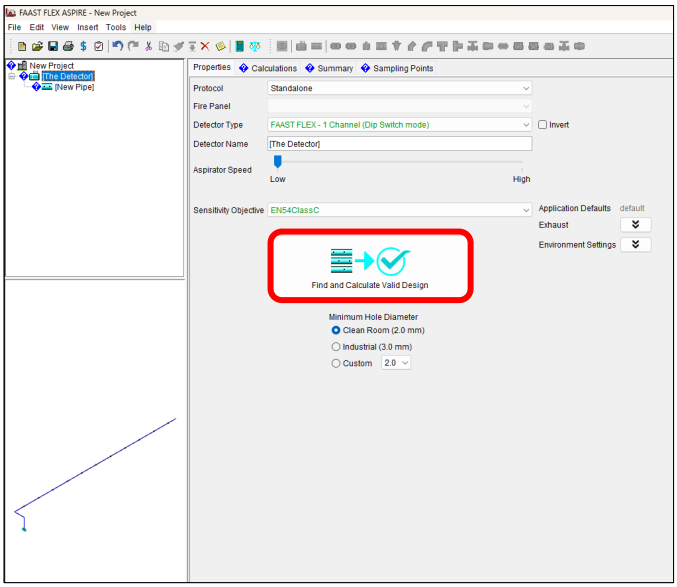


Figure 22: Calculate Results

ASPIRE will show you whether the calculations passed or failed. In this example, the calculations passed.

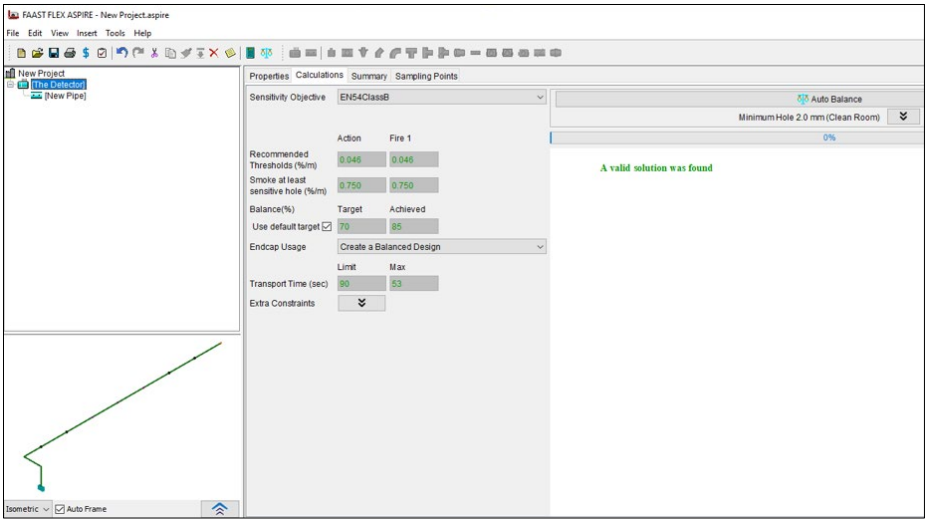


Figure 23: A Valid Pipe Network Design

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