PRODUCT HIGHLIGHT

EXPLOSION PRESSURE DETECTORS - SELECTION GUIDE

TYPE OF DETECTION (SINGLE OR PAIRED)

Single detection is sufficient for most applications, however paired detection is an option dependent on customer preference (some users have a tradition of using 2 detectors in tandem at each detection point (location) or 2 detectors may be required to achieve a stable working system for specific high demanding applications (see 'paired' below).

Single Detection:
In this configuration any detector that reaches the detection set point will activate the system (*).

Paired Detection:
In this configuration an minimum of two detectors are required to reach their set point to activate the system. The paired configuration specifies two pressure detectors for each detection point (see 2 below); both detectors must switch simultaneously in order to activate the system. (*)

Paired detection will minimize the risk of spurious (unintended) activation of a protection system in application configurations which are susceptible to the following:

- Pressure fluctuations that could occur in a section of the enclosure
  - high pressure systems such as dense-phase conveying using pressurized air
  - high velocity systems involving large quantities of airflow, in the range of 40 m/s and more
- Direct particle impact on the pressure transducer's face
- Operation error where one detector at a time could be exposed to contact, for instance when cleaning the internal wall of a spray dryer through scraping
- Excessive vibration, for instance large volume shredders in which solid bodies are ground. Remark: for light vibrating equipment such as mills, the detector can also be installed onto a flexible standoff (see Detector Mounting on reverse) to prevent false activations

(*) In this context, detection set-point can be either static or dynamic

STEP 1

Determine type of detection to be utilized, either single or paired (tandem) detection.

QUANTITY OF DETECTION POINTS

The quantity of detection points is dependent on volume and geometry. Large or elongated vessels require multiple detection points to maintain the protection system's response time.

If the hazard volume is physically divided, for instance through internal partitions, a detection point shall be provided for each volume section. The interconnected ductwork is considered part of the protection zone, not a separated volume section. A practical example is a cyclone with a long internal Vortex that utilizes a reduced opening: a detection point shall be provided both on the vortex and on the cylindrical main part.

STEP 2

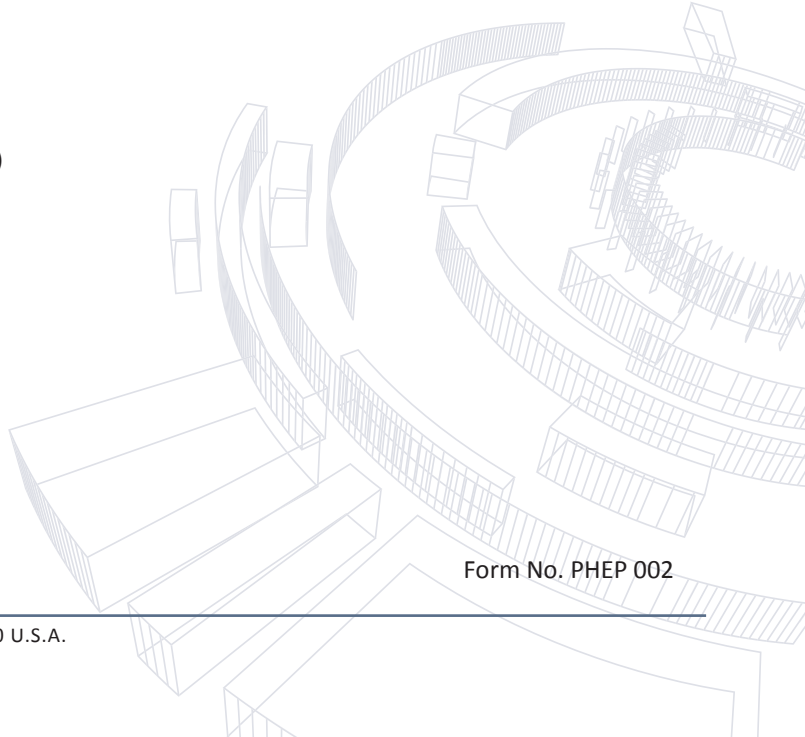
Determine quantity of detection points as follows:

- Hazard volume ≤ 25 m^3 (880 ft^3) - 1 detection point suffices
- Hazard volume > 25 m^3 (880ft^3) - 2 detection points required. Additional detection points must be added based on volume and geometry, and when the protected volume is physically divided.
- Two detection points are required for FM approved systems.

STEP 3

Calculate total quantity of detectors

Single detection point requires one detector per detector point (location)
Paired detection requires two detectors per detector point (location)



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DETECTOR MOUNTING

Detector mounting style is dependent on process requirements. Some applications require a clean-in-process or sanitary connector to allow easy cleaning of the detector's face and its connecting parts.

STEP 4

Select the mounting style from the following options:

- Flush - used in standard applications, also suitable for sanitary applications and where process media build-up is a concern. (see Figure 1)
- Tri-clamp - often required in food industry for easy opening and cleaning. (see Figure 2)
- Transparent Flexible standoff - used when equipment vibration is a concern (see Figure 3)
  A. the equipment is not pressure resistant (maximum pressure that the connector can hold is 100 psig (7 bar)
  or when
  B. contamination is a concern or the customer wants visual inspection of product build-up (flexible connector is transparent)
- Metal Flexible standoff - used when severe equipment vibration is a concern and (see Figure 4)
  A. equipment is pressure resistant (450 psig (31 bar) maximum)
  or when
  B. the process temperature exceeds 175°F (80°C) (the standoff provides a heat sink, 450°F (230°C) maximum process temperature
- Lateral Y - used in installations (see Figure 5)
  A. where the diaphragm could be subjected to impact by particles of material in the process stream
  or in installations
  B. to facilitate cleaning of the process pressure take-off where plugging may occur.
- Air Purge - used in installation where process material is likely to collect in the process pressure take-off. The use of a low pressure, continuous flow of air is used to help prevent material build-up that may cause false pressure readings. Such false pressure readings may result in either failure of the system to recognize an impending explosion or false activation of the system. (see Figure 6)

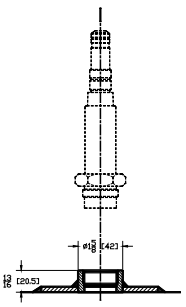


Figure 1

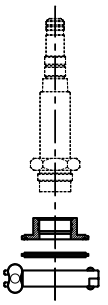


Figure 2

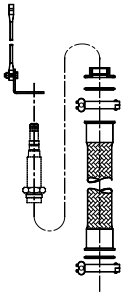


Figure 3

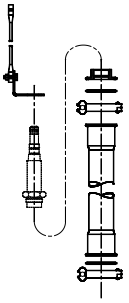


Figure 4

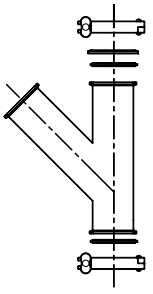


Figure 5

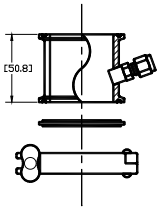


Figure 6

PLACEMENT

STEP 5

Choose the optimal detector placement.
Consider the following when determining pressure detector placement:

- Detectors shall be placed preferably on the vessel, as close as possible to recognized ignition areas or ignition sources and process interconnections.
- Detectors located on ducts shall be within 3 ft (1 m) of process interconnections.
- Location should be unrestricted by internal obstructions
- Ensure that the placement is safely above the maximum product fill level.
- Avoid placement directly in line with directed air flow or material flow.
- Avoid placing the detector close to a source of vibration.
- For paired (tandem) detection both detectors are considered as one detection point. The paired detectors should be placed on the same elevation and spaced at 90°, preferable on different planes.
- Detectors can be prone to vibration and shock. To avoid resonance problems, it is recommended to place detectors as close as possible to corners/reinforcement bars and flanges which are 'areas of equilibrium.' The risk for resonance is higher for detectors installed in the middle of large and thin planes compared to ones installed close to the corner or a smaller and stiffer part of the installation.

SET PRESSURE

Fike's explosion protection control system features the latest state-of-the-art explosion transducer, which detects a rise in pressure long before it reaches an explosive level. This detector transforms pressure into a 4-20 mA signal that is processed within the EPC to offer a static switch-point, a dynamic or dP/dt rate-of-rise switch-point and a warning level. The warning level only transfers a relay output, while the two other settings activate the suppression and/or isolation system. The most common release configuration is an OR between static and dynamic of a detector. An AND between 2 detectors can be selected as well to improve system reliability (see also 'paired detection' under 1 earlier). The settings are configured using the MODE DIP switches on the face of the EPC unit for most of the applications, or through expanded programming using EPWorks Software. The configurations of the DIP switches set the detection parameters of the EPC.

5.1 Static setting

Detection should be set at least 0.5 psig (35 mbar) above atmospheric or maximum process pressure, whichever is higher. Lower set pressures are possible, but not recommended since system stability may be compromised. The fast response time of the detector accommodates higher settings.

It is good practice to select the highest possible static switch-point allowed by the protection system design. Note that high(er) set points will result in higher suppressed pressure values (TSPs) and/or longer mechanical or chemical barrier installation distances. Select the highest allowable static settings for the application (see Limits as defined below in Table 1).

STEP 6

Choose a static value, preferable a setting from the EPC configuration table (see manual or tables 2 and 3), which is allowed to be used according to the protection system design made for that application (consult Fike system designer). Verify that the pressure detector static setting is at least 0.5 psig (35 mbar) above the maximum operating pressure or atmospheric, whichever is higher.

Ensure the set point does not exceed the limits as defined in table 1.

TABLE 1 - STATIC SETTING LIMITS

Volume	Pset Maximum	
Non-Metal Dusts	psig	mbar
0-100 m^3	3.0	200
25-100 m^3	3.0	200
100-1000 m^3	2.0	150
Metal Dusts		
0-1000 m^3	0.5	35

TABLE 2 - CONFIGURATION TABLE FOR EPC (PSIG)

Config #	Operating Mode	Mode Switch Position				Detection Circuit 1			Detection Circuit 2			Detection Circuit 3
		1	2	3	4	Warning Pressure (psig)	Threshold Activation Pressure (psig)	Rate of Rise Threshold (psig/sec)	Warning Pressure (psig)	Threshold Activation Pressure (psig)	Rate of Rise Threshold (psig/sec)	Enabled (Class A = Default)
0	PC Config	off	off	off	off	-User Selectable with Software-			-User Selectable with Software-			-
1	SDR	on	off	off	off	0.2	0.5	20	0.2	0.5	20	yes
2	SDR	off	on	off	off	0.3	0.7	210	0.3	0.7	20	yes
3	SDR	on	on	off	off	1	1.5	20	1	1.5	20	yes
4	SDR	off	off	on	off	1.9	2.3	20	1.9	2.3	20	yes
5	SDR	on	off	on	odd	0.2	0.5	50	0.2	0.5	50	yes
6	SDR	off	on	on	off	0.3	0.7	50	0.3	0.7	50	yes
7	SDR	on	on	on	off	1	1.5	50	1	1.5	50	yes
8	SDR	off	off	off	on	1.9	2.3	50	1.9	2.3	50	yes
9	CZ D1 & D2	on	off	off	on	0.2	0.5	20	0.2	0.5	20	yes
10	CZ D1 & D2	off	on	off	on	1	1.5	20	1	1.5	20	yes
11	CZ D1 & D3	on	on	off	on	0.2	0.5	20	Disabled			yes
12	CZ D1 & D3	off	off	on	on	1	1.5	20	Disabled			yes
13	SDR	on	off	on	on	0.2	0.5	Disabled	0.2	0.5	Disabled	yes
14	SDR	off	on	on	on	1	1.5	Disabled	0.2	0.5	Disabled	yes
15	Config Clear	on	on	on	on	-	-	-	-	-	-	-

Definitions:

Config Clear: Configure Clear - used to change the configuration settings in the Explosion Protection Controller
PC Config: PC Configure - used to provide expanded programming options
SDR: Single Detector Release - any detection channel will initiate a release sequence from the Explosion Protection Controller
CZ D1 & D2 Cross Zone Detection via detection channels 1 and 2
CZ D1 & D3 Cross Zone Detection via detection channels 1 and 3
Filter Settings Detection Circuit 1 & 2 = 1 msec
Detection Circuit 3 = 15 msec

6.2 Pressure Warning

The warning set-pressure warns the operator that the process pressure has risen to an unacceptable high level, and may compromise the protection system stability. If the process pressure would continue to rise, the static switch-point may be reached resulting in the protection system activating.

STEP 7

Select warning pressure:
The warning pressure should be set at 0.5 psig (35 mbar) below the static switch-point if possible. Otherwise any value below the static switch-point and above atmospheric or maximum process pressure, whichever is higher is acceptable. Lower set pressure are possible, but not recommended since system stability may be compromised. It is recommended to select the set pressure from the EPC configuration tables (tables 2 and 3), and then configure the EPC with the DIP switches

TABLE 3 - CONFIGURATION TABLE FOR EPC (mbar)

Config #	Operating Mode	Mode Switch Position				Detection Circuit 1			Detection Circuit 2			Detection Circuit 3
		1	2	3	4	Warning Pressure (mbar)	Threshold Activation Pressure (mbar)	Rate of Rise Threshold (mbar/sec)	Warning Pressure (mbar)	Threshold Activation Pressure (mbar)	Rate of Rise Threshold (mbar/sec)	Enabled (Class A = Default)
0	PC Config	off	off	off	off	-User Selectable with Software-			-User Selectable with Software-			-
1	SDR	on	off	off	off	14	33	1378	14	33	1378	yes
2	SDR	off	on	off	off	23	49	1378	23	49	1378	yes
3	SDR	on	on	off	off	72	102	1378	72	102	1378	yes
4	SDR	off	off	on	off	130	158	1378	130	158	1378	yes
5	SDR	on	off	on	odd	14	33	3447	14	33	3447	yes
6	SDR	off	on	on	off	23	49	3447	23	49	3447	yes
7	SDR	on	on	on	off	72	102	3447	72	102	3447	yes
8	SDR	off	off	off	on	130	158	3447	130	158	3447	yes
9	CZ D1 & D2	on	off	off	on	14	33	1378	14	33	1378	yes
10	CZ D1 & D2	off	on	off	on	72	102	1378	72	102	1378	yes
11	CZ D1 & D3	on	on	off	on	14	33	1378	Disabled			yes
12	CZ D1 & D3	off	off	on	on	72	102	1378	Disabled			yes
13	SDR	on	off	on	on	14	33	Disabled	14	33	Disabled	yes
14	SDR	off	on	on	on	72	102	Disabled	72	102	Disabled	yes
15	Config Clear	on	on	on	on	-	-	-	-	-	-	-

Definitions:

Config Clear: Configure Clear - used to change the configuration settings in the Explosion Protection Controller
PC Config: PC Configure - used to provide expanded programming options
SDR: Single Detector Release - any detection channel will initiate a release sequence from the Explosion Protection Controller
CZ D1 & D2 Cross Zone Detection via detection channels 1 and 2
CZ D1 & D3 Cross Zone Detection via detection channels 1 and 3
Filter Settings Detection Circuit 1 & 2 = 1 msec
Detection Circuit 3 = 15 msec

5.3 Dynamic setting (dP/dt)

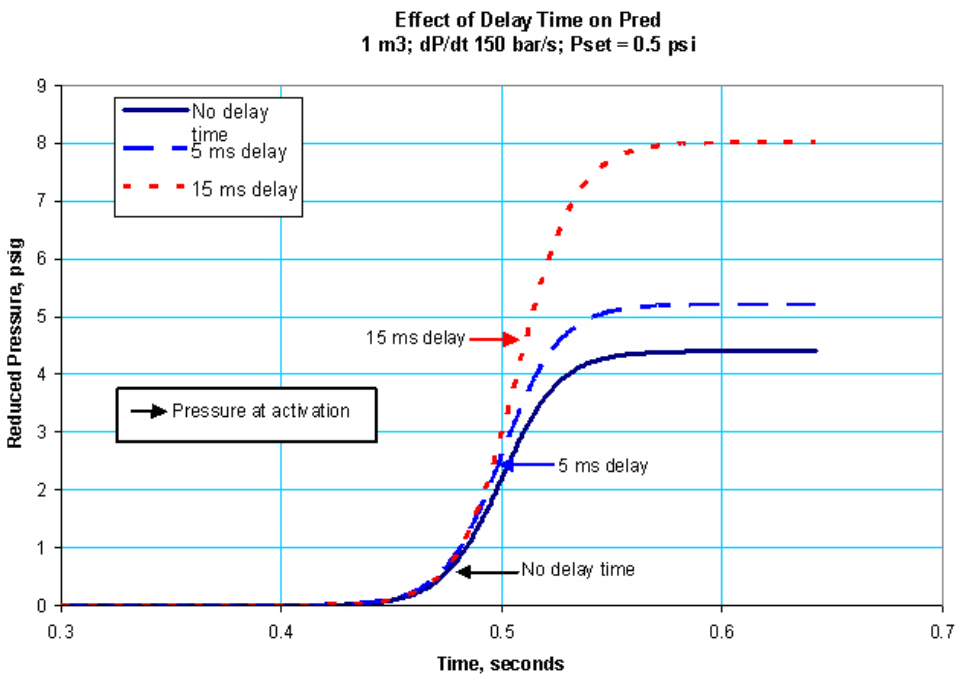
The dynamic setting will detect the developing explosion based on the pressure rate of rise. The rate of rise shall be selected as low as possible but above the maximum rates of rise that can be encountered under normal process operation. The rate of rise setting should be selected through the DIP switches mounted on the face of the EPC, refer to EPC manual and tables 2 and 3.

STEP 8

Select dP/dt setting:
Under normal circumstances, the process pressure will not rise above the lowest dP/dt setting of 20 psig/s (1.3 bar/s). In case of smaller volumes, faster process pressure fluctuations may result and a higher dP/dt may be required.

Remarks:

1. The EPC can ultimately be programmed to offer any logic combination and setting within the transducer's range. Some special application may require a non-standard configuration; contact the certified Fike system designer in your area for support.
2. For some applications, the use of an optical detector may be required. For instance when a large vessel is involved and/or a slow developing explosion can be expected, or when a 'pocket' of explosible fuel should be taken into account rather than a homogeneous mixture filling the entire vessel with an explosible mixture.
3. In some cases, the combination of large volume and low K factor (dP/dt < 80 bar/s) may require the dP/dt setting to be disabled and only static to be used. Setting 13 and 14 can be selected from the configuration table, or they can be programmed into the individual EPC by a Fike trained service technician or engineer.
4. For some applications that have frequent pressure fluctuations, the EPC also has the ability to filter the input values. The filter can be set for 1 ms (no delay time), 5 ms, or 15 ms. The filter value requires the input to exceed its setting for the length of the filter value. If the input drops below its setting for even one sample and then again exceeds its setting, the filter time is restarted. The effect of the filter setting must be accounted for in the design of the system. The graph below is an example of the different filter settings for a given condition. The filter values can be changed by Fike factory personnel.



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