

# Type DO200 Odorant Injection System



Figure 1. Type ROC809 Remote Telemetry Unit



Figure 2. Standard Wick Insert



Figure 3. Type DO200 Pneumatic Panel

## Introduction

The Type DO200 is a computerized odorant injection system for natural gas using patented solenoid injector technology that eliminates the need for plunger pumps.

The solenoid injectors provide odorant injection accuracy to be maintained over the entire flow range of the system, approaching infinite turn down.

Automatic calibration during operation adjusts for any changes in mechanical components and also detects failures for alarming. Report by exception alarming is a configurable option.

The system can also be configured to use redundant injectors and/or an emergency backup or bypass absorption system.

# Type DO200

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## Specifications

The Specifications section on this page provides the ratings and other specifications for Type DO200.

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### Pneumatic Panel

**Material**

Stainless steel plate

**Installation**

Wall mount

**Weight**

70 lbs / 31 kg (based on configuration)

**Overpressure Relief Valve**

*Stainless Steel with Following Rating Option:*  
1450 psi / 100 bar

**Electrical Protection**

*Explosion proof:*  
Class I, Division 1 and 2 - Groups B, C, D Class I,  
Zone 1 and 2 - Groups IIB+H2, IIA

**Mechanical Connections**

*Odorant Inlet and Discharge:*  
1/4 in. / 6.4 mm OD Tube fitting (double ferrule)  
*Gas Inlet and Discharge:*  
3/8 in. / 10 mm OD Tube fitting (single ferrule)

**Maximum Working Pressure**

*Supply:* 1450 psi / 100 bar  
*Injection:* 1450 psi / 100 bar

**Odorant Flow Rate**

0.13 to 3.70 gal/hr / 0.5 to 14.0 l/hr  
(0.89 to 24.97 lbs/hr at 6.75 lbs/gal)  
Up to 88 gal/day / 330 l/day

**Temperature Range**

14 to 140°F / -10 to 60°C

### Odorant Tubing Loop

**Body Material**

304 or 316 Stainless steel

**Maximum Working Pressure**

1450 psi / 100 bar

**Maximum Emergency Design Pressure**

1450 psi / 100 bar

### Solenoid Valves

**Body Material**

304 Stainless steel

**Gasket Material**

Fluorocarbon (FKM)

**Valve Operation**

Electromagnetic

**Maximum Working Pressure**

870 psi / 60.0 bar

**Power Requirements**

12 Vdc

**Electrical Protection**

*Explosion proof:*  
Class I, Division 1 - Groups A, B, C, D

### Stabilizer Filter Type SA/2

**Body Material**

Steel

**Maximum Working Pressure**

1450 psi / 100 bar

**Gasket Material**

Nitrile (NBR) rubber

### Type ROC809 Remote Telemetry Unit

Refer to Type ROC809 Technical Specifications,  
please go to: [www.Emerson.com](http://www.Emerson.com)

Real time and historical data can be read locally or remotely by a laptop computer using ROCLINK 800 configuration software, or remotely using third party SCADA products utilizing ROC or Modbus protocol.

ROCLINK 800 software is available for complete configuration and operation of the system including:

- Display of real time and historical data
- Configuration of alarms
- Archival of historical data

## Benefits

- Uniform distribution of odorant due to frequent smaller injections and enhanced absorption from the wick insertion.
- High turndown ratio. For example, one specific configuration would evenly distribute odorant at flow rates from 2000 to 1,000,000 SCFH / 53.6 to 26,800 Nm<sup>3</sup>/h without mechanical adjustment.
- Automatic calibration of injection system during normal operation ensuring consistent odorization.
- Environmentally friendly with no venting of gas or odorant while operating.
- Extremely low maintenance cost.
- Variety of redundancy and backup options for reliable odorization.
- User friendly configuration software.
- Standard and scalable hardware platform that supports additional station I/O for AGA flow calculations and PID control algorithms.

## Operation

The Type DO200 Odorant Injection System operates on the basic principle of a fixed differential pressure and orifice used to measure a non-compressible fluid.

Fixed differential pressure is maintained using double cut regulation by fixed differential pressure regulators (Type SA/2 regulators) which reference  $P_2$  and reduce the inlet pressure of a regulating station to  $P_2 + \Delta P$ .  $\Delta P = 8.7$  to  $21.7$  psi /  $0.60$  to  $1.5$  bar,  $\Delta P_{max} = 21.7$  psi /  $1.5$  bar (an alternate high pressure source can be used). This pressure loading of the Differential Pressure (DP) tube filled with odorant is used to inject liquid odorant into the downstream pipeline through an on/off valve (the fixed orifice<sup>(1)</sup>) with a known flow coefficient that is controlled by the automated system.



**Figure 4.** Type DO200 Intrinsic Safe Panel

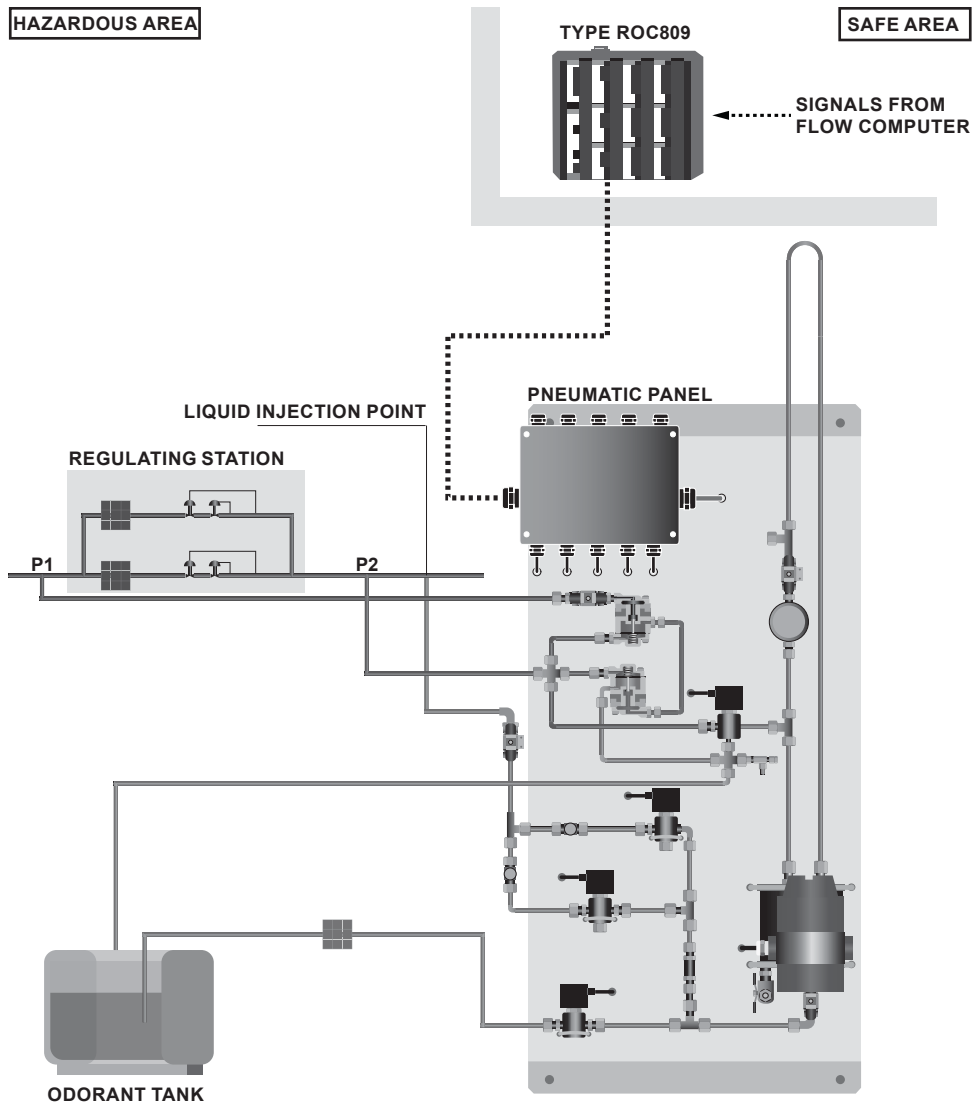
The objective of the automated control system is to maintain an injection rate specified by the user which is proportional to the gas flow. Accuracy of injection is accomplished utilizing relatively small injections which are automatically resized over a wide range dependent upon variations in the gas flow. This results in a turn down ratio for the system that can exceed 500:1 (the addition of a simple by-pass system utilizing the odorant storage tank can allow the turn down ratio to approach infinity). The calculated volume of the odorant in the DP tube is utilized to recalibrate the injection valve flow coefficient each time the DP tube is refilled.

During the refill cycle the pressure used for injection is relieved into the downstream pipeline which eliminates venting of gas to atmosphere or an expansion tank. Liquid odorant refill of the DP tube is typically accomplished by using all or some part of the  $P_2 + \Delta P$  pressure to load the odorant storage tank thus pushing the liquid out of the tank and into the DP tube,  $\Delta P = 8.7$  to  $21.7$  psi /  $0.60$  to  $1.5$  bar.

Since the unit uses only pressure for injection there are few moving parts in the system resulting in very little maintenance. Relatively low cost options for both automated and emergency redundancy for odorization are also available.

1. Although the valve orifice is fixed for a specific application the valve can be adjusted manually to accommodate flow rates as small as 2 MSCFH to over 33,000 MSCFH with one injector.

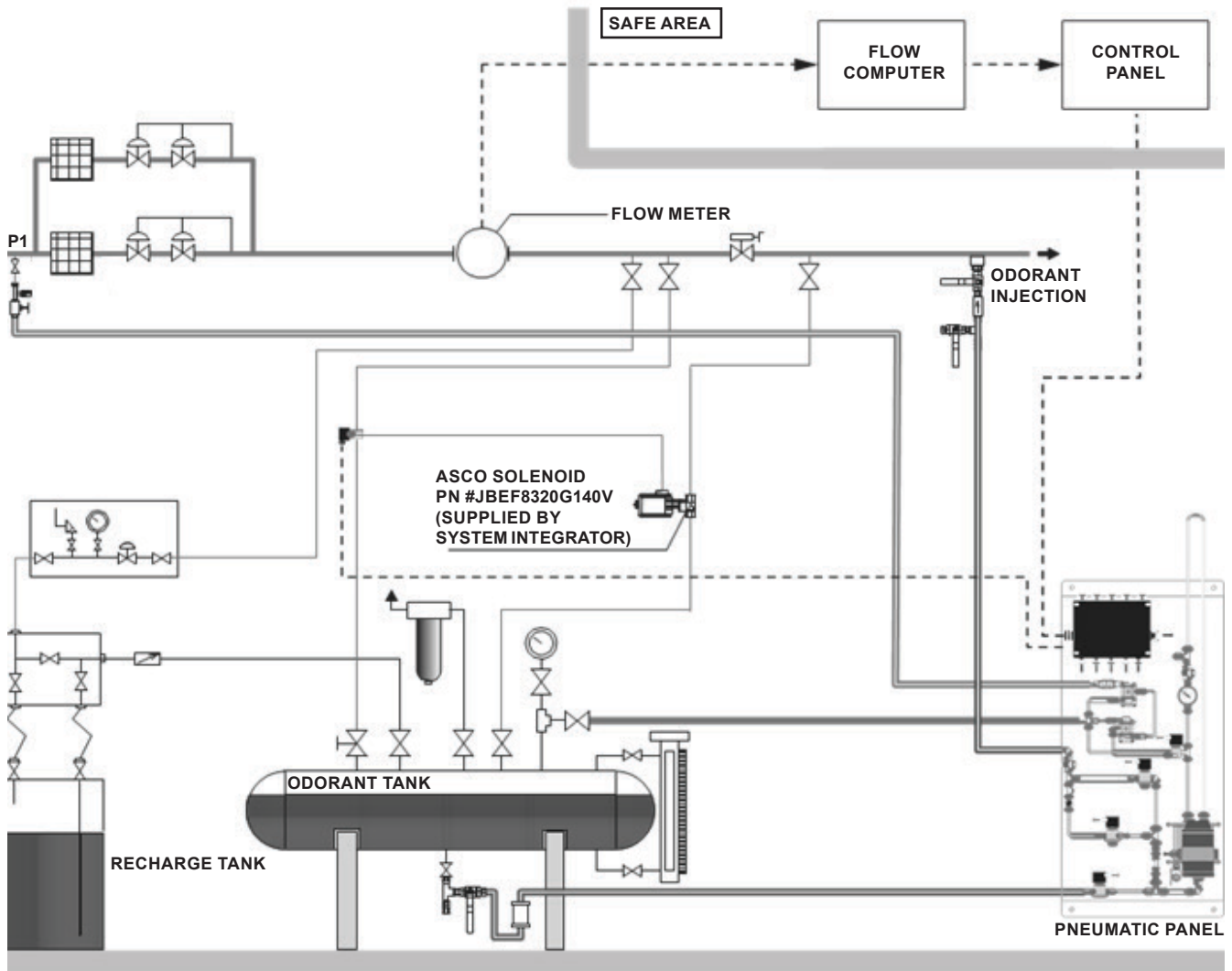
# Type DO200



**Figure 5. General Installation Schematic**

The gas flow rate is obtained through either a corrected gas volume pulse input or an instantaneous flow rate analog input (4 to 20 mA) signal. The gas flow rate can also be configured manually to a fixed value. Odorant injection rate is then calculated using accumulated flow in order to reduce variability.

In cases where the station does not have a flow computer, the Type ROC809 can be connected directly to a pulse output from the turbine or an analog output from a differential pressure transmitter (Rosemount Types 3051, 3095, etc.).



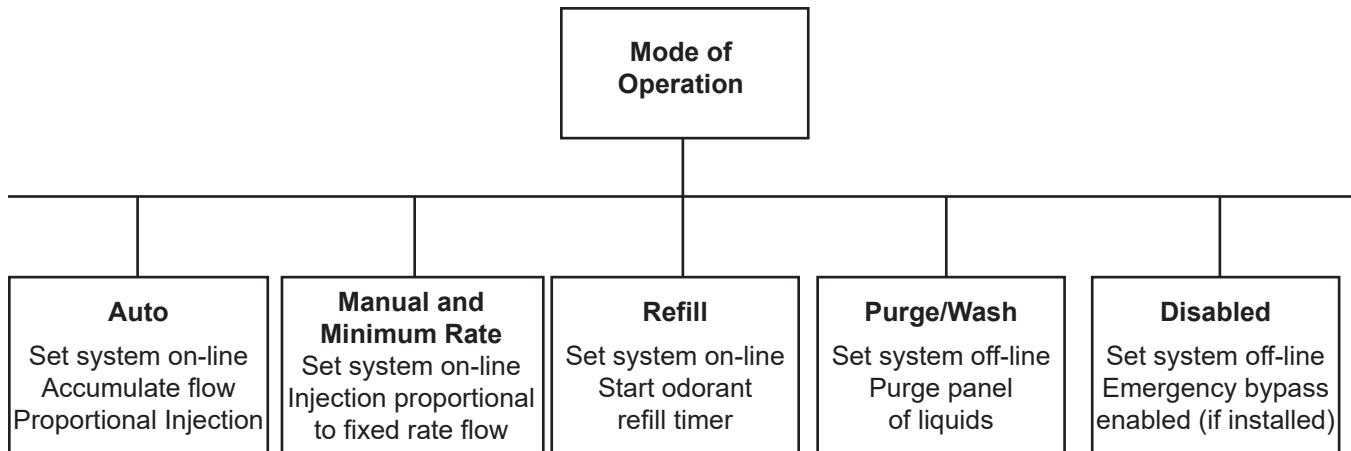
**AUTOMATED PRESSURE BALANCING SYSTEM WITH BYPASS SCHEMATIC**

**Figure 6.** Type Dosaodor Automated Pressure Balancing System with Bypass Schematic

Variability between the calculated and actual injection volume is used to automatically adjust injection parameters for any changes in the system and to detect alarm conditions or system failure, the DP tube assembly is used to monitor the actual use of odorant. In the event of power failure, configuration information and archived historical data are maintained.

The Type DO200 is designed to purge the odorant back into the tank in the event that mechanical maintenance is required. Odorant is pushed back into the tank and gas is purged through the system to absorb any remaining liquid.

# Type DO200



## Modes of Operation

The system is designed to operate in one of six modes which determine the system function and how outputs will be controlled.

### Auto Mode

System is set on-line. Injection rate is calculated based on current flow rate input (pulse or analog input) and configured concentration.

### Manual Mode

System is set on-line. Injection rate is calculated based on configured manual gas flow rate and concentration.

### Minimum Rate Mode

System is set on-line. Injection rate is calculated based on configured minimum flow rate and concentration.

### Refill Mode

Injector is off-line. Odorant is refilled with odorant and calculation is performed to verify injector volume rate. Once refill is complete, system returns to prior mode (during normal operation).

### Purge/Wash Mode

System is set off-line. Odorant is emptied from odorant calibration cylinder and back to the supply tank. During Gas Wash Cycle, solenoids are opened to allow gas flow through the odorant tubing loop and injectors. Gas Wash Cycle and Injector Flush Cycle are available.

## Disabled Mode

Injector and panel functions are off-line. Emergency bypass system enabled if available.

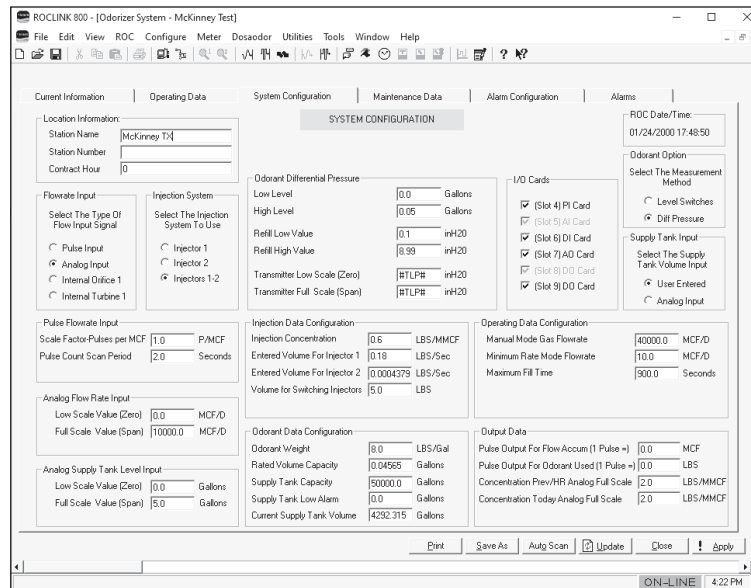
## ROCLINK 800 Configuration Software

### Note

**Operation copy of ROCLINK 800 is required to run the Odorization software. Refer to ROCKLINK800 Configuration Software User Manual, D301249X01 for installation and start up of the ROC809.**

ROCLINK 800 Configuration Software, a Windows® based program, enables complete configuration either local or remote of the Type DO200 Odorant System. This allows the viewing of data in real time, management of the historical data and control of the alarm conditions. Connection is via serial port, ethernet port or remote communications.

The ROCLINK 800 Software has a user friendly Windows® interface. The Configuration Tree navigation interface makes accessing features quick and easy. Drop-down menus simplify accessing the software functions. Dialog boxes and drop-down list boxes help direct selections and data entry. Actions can be performed with the keyboard or a mouse.



**Figure 7.** Type DO200 Configuration Display

The main specifications of the ROCLINK 800 Software are as follows:

- MS® Windows® interface
- Single configuration point for all connectable odorizing units
- Complete configuration for each parameter of the odorizer system
- Display of real time data, historical data and alarms

## Minimum Software and Hardware Requirements

- Pentium®-class processor (233 MHz or greater recommended)
- CD-ROM drive
- Windows® 98, ME, NT 4.0 (Service Pack 6), 2000 (Service Pack 2) or XP
- 64 MB of RAM (Random Access Memory)
- 15 to 75 MB of available hard disk space, depending on operating system and revision level

## Configuration Selection

The purpose of this section is to facilitate Ordering Guide selections.

The minimum requirements for product installation are as follows:

1. There must be a differential pressure of at least 14.5 psi / 1 bar between upstream and downstream of the regulation station.

2. The tank containing the odorant fluid must be pressurized. The odorant storage tank is usually pressurized by the system up to 8.7 to 21.7 psi / 0.60 to 1.5 bar higher than outlet pressure.
3. Downstream pressure must be maintained as constant as possible in order to maintain accuracy of odorant injection.

If these conditions are not fulfilled, please contact your Emerson representative for alternate configurations.

## Base Panel

### A6 Option

- Construction based on North American standards with CSA certified components.
- Configuration does not include the Type ROC809 Controller necessary for the functioning of the system. The Type ROC809 is available from the Remote Automation Solutions.

## Model (Dual Injector is the Standard Construction)

### B1 Option – Dual Injector

- This option provides two injection solenoids installed in parallel for redundancy in the event of an injector failure.
- An alternate use of dual injectors is for increased turndown. In the event the flow conditions vary, it is possible to create a low flow injector and a high flow injector for scenarios such as seasonal loads.

# Type DO200

**Table 1. Maximum Odorant Injection Rate using International Standard Unit**

MAXIMUM GAS VOLUME, SM <sup>3</sup> /H		MAXIMUM INJECTION RATE, GAL/HR / L/HR
40 mg/Sm <sup>3</sup> (THT)	10 mg/Sm <sup>3</sup> (Mercaptan)	
12,500	50,000	0.13 / 0.5
25,500	100,000	0.26 / 1.0
50,000	200,000	0.53 / 2.0
100,000	400,000	1.06 / 4.0
150,000	600,000	1.59 / 6.0
200,000	800,000	2.11 / 8.0
250,000	1,000,000	2.64 / 10.0
300,000	1,200,000	3.17 / 12.0
350,000	1,400,000	3.70 / 14.0

### Notes

**The two solenoid valves do not operate simultaneously. It is therefore not possible to use the B1 configuration in order to serve two gas transport lines at the same time.**

**The two solenoid valves can work in exchange mode. When the desired quantity of odorant (determined by a parameter accessible by the user) is injected, the solenoid valve that has just operated will go into rest mode leaving the task of injection to the alternate solenoid valve.**

### Calculate Required Odorant Injection Rate

The injector solenoid is selected based on the maximum gas flow rate and the desired odorant concentration. The following information and calculation will determine this value.

From a theoretical viewpoint, this takes into account the following:

#### International Standard Unit

- C = concentration of odorant (mg/Sm<sup>3</sup>)
- Q<sub>g</sub> = maximum gas flow rate (Sm<sup>3</sup>/h)
- ρ = density of liquid odorant (kg/dm<sup>3</sup>)
- Q<sub>o</sub> = maximum odorant flow rate (l/h)
- Q<sub>o</sub> = C x Q<sub>g</sub> / (1,000,000 x ρ)

For the purposes of proportioning, we may consider the odorant density as ρ = 1 kg/dm<sup>3</sup>.

For example, if the maximum line flow is 90,000 Sm<sup>3</sup>/h and the odorant used is THT (with a desired concentration of 40 mg/Sm<sup>3</sup>) then the appropriate option from the table below is C4.

By formula:

$$Q_o = \left( \frac{40 \text{ mg}}{\text{Sm}^3} \right) \left( \frac{1 \text{ kg}}{1,000,000 \text{ mg}} \right) \left( \frac{90,000 \text{ Sm}^3}{\text{h}} \right) \left( \frac{\text{dm}^3}{1 \text{ kg}} \right) \left( \frac{1 \text{ l}}{1 \text{ dm}^3} \right)$$

$$Q_o = 3.6 \text{ l/hr}$$

Using the equation result, the fourth column of Table 1 shows the first value exceeding the calculated value which will suggest which configuration to choose (in the specific case of C4).

If different odorant concentrations from those specified in the table (40 and 10 mg/Sm<sup>3</sup>) are used, it is advisable to use the given formula and fourth column of Table 2 to determine the correct configuration.

For example, if the maximum line flow is 15,000 Sm<sup>3</sup>/h and the odorant used is THT (with a desired concentration of 38 mg/Sm<sup>3</sup>) then the appropriate option is C2.

$$Q_o = \left( \frac{38 \text{ mg}}{\text{Sm}^3} \right) \left( \frac{1 \text{ kg}}{1,000,000 \text{ mg}} \right) \left( \frac{15,000 \text{ Sm}^3}{\text{h}} \right) \left( \frac{\text{dm}^3}{1 \text{ kg}} \right) \left( \frac{1 \text{ l}}{1 \text{ dm}^3} \right)$$

$$Q_o = 0.57 \text{ l/hr}$$

#### North America Standard Unit

- C = concentration of odorant (lbs/MMSCF)
- ρ = density of liquid odorant (lbs/gal)
- Q<sub>g</sub> = maximum gas flow rate (MMSCF/h) At 6.75 lbs/gal is equivalent to:
- Q<sub>o</sub> = maximum odorant flow rate (gal/h)
- Q<sub>o</sub> = C x Q<sub>g</sub> / ρ

For example, if the maximum line flow is 7 MMSCF/h and the odorant used is THT (with a desired concentration of 1.0 lbs/MMSCF) then the appropriate option from Table 2 is C4.

By formula:

$$Q_o = \left( \frac{1 \text{ lb}}{\text{MMSCF}} \right) \left( \frac{7 \text{ MMSCF}}{\text{h}} \right) \left( \frac{\text{gal}}{6.85 \text{ lbs}} \right) = 1.04 \text{ gal/hr}$$

**Table 2. Maximum Odorant Injection Rate using North American Standard Unit**

MAXIMUM GAS VOLUME, MMSCF/H		MAXIMUM INJECTION RATE	
1.0 lbs/MMSCF (THT)	0.5 lbs/MMSCF (Mercaptan)	GAL/HR / L/HR	LBS/HR (At 6.75 LBS/GAL)
0.89	1.78	0.13 / 0.5	0.89
1.78	3.57	0.26 / 1.0	1.78
3.57	7.13	0.53 / 2.0	3.57
7.13	14.27	1.06 / 4.0	7.13
10.70	21.40	1.58 / 6.0	10.70
14.27	28.53	2.11 / 8.0	14.27
17.83	35.67	2.64 / 10.0	17.83
21.40	42.80	3.17 / 12.0	21.40
24.97	49.93	3.70 / 14.0	24.97

At 6.75 lbs/gal is equivalent to:

$$\left(\frac{1.78 \text{ gal}}{\text{h}}\right)\left(\frac{6.85 \text{ lbs}}{\text{gal}}\right) = 7 \text{ lbs/hr}$$

Using the equation result, the fifth column of Table 2 shows the first value exceeding the calculated value which will suggest which configuration to choose (in the specific case of C4).

If different odorant concentrations from those specified in the table (1.0 and 0.5 lbs/MMSCF) are used it is advisable to use the given formula and the table to determine the correct configuration.

If a different density is required, use the fourth column for selection.

For example, if the maximum line flow is 20 MMSCF/h and the odorant used is mercaptan (with a desired concentration of 0.6 lbs/MMSCF) then the appropriate option from Table 2 is C6

$$Q_o = \left(\frac{0.6 \text{ lb}}{\text{MMSCF}}\right)\left(\frac{20 \text{ MMSCF}}{\text{h}}\right)\left(\frac{\text{gal}}{6.75 \text{ lbs}}\right) = 1.78 \text{ gal/hr}$$

At 6.75 lbs/gal is equivalent to:

$$\left(\frac{1.78 \text{ gal}}{\text{h}}\right)\left(\frac{6.75 \text{ lbs}}{\text{gal}}\right) = 12 \text{ lbs/hr}$$

### Wick Insert Installation Option (Select One)

Select based on pipe size.

- Standard wick insert (for downstream size < 10 in. (NPS 10 / DN 250))
- Long wick insert (for downstream size ≥ 10 in. (NPS 10 / DN 250))

### Fittings Installation Option (Swagelok as standard)

Stainless steel Swagelok fittings are used standard for the Type DO200 Panel.

### Automation Software and License Key

Software for management of the Type DO200 system compatible with Type ROC809 platform hardware and Type DO200 license key.

The software may be ordered individually or in combination with the pneumatic panel.

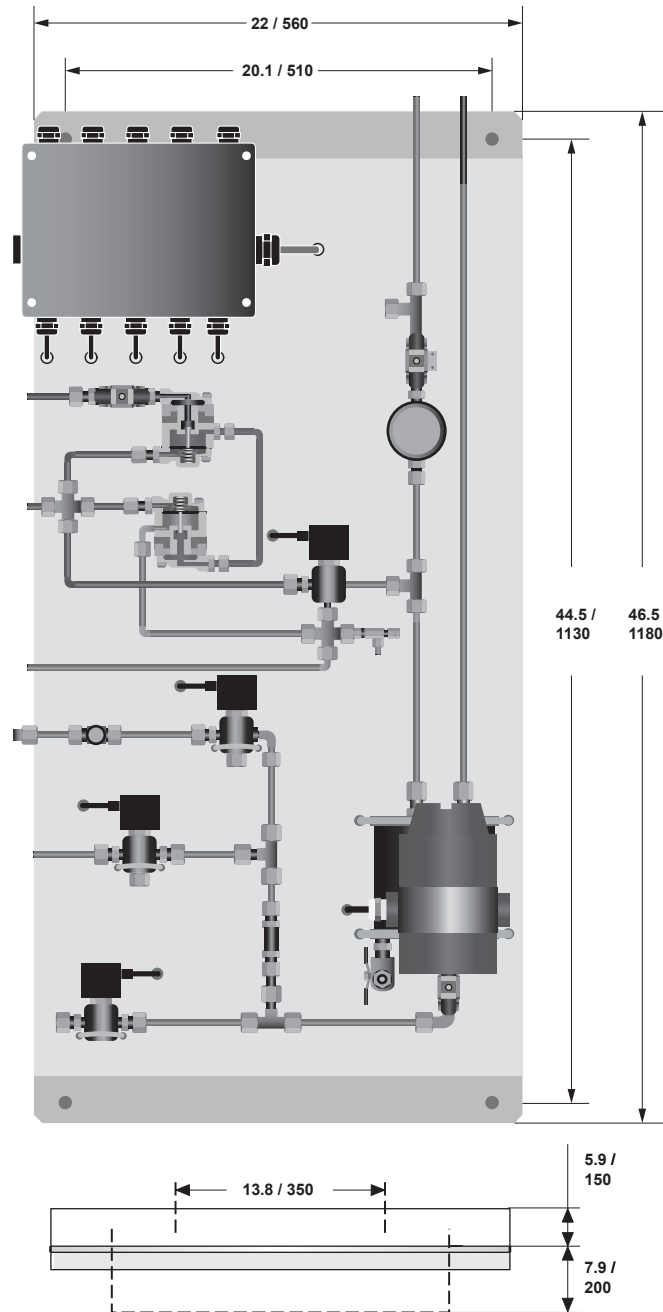
The pneumatic panel must be ordered with the automation software and license key.

### Optional Component

#### Cabinet for Pneumatic Panel

A stainless steel cabinet may be selected as an option. Dimensions in In. / mm: 37 x 18.2 x 78.4 / 940 x 460 x 1990.

# Type DO200



OPTIONAL STAINLESS STEEL CABINET  
DIMENSIONS IN IN. / MM: 37 X 18.2 X 78.4 / 940 X 460 X 1990

Figure 8. Pneumatic Panel Overall Dimensions

## Ordering Guide

### Base Panel

- A6 Type DO200 odorant injection system completed with:
  - Pneumatic Panel
    - Stainless steel panel
    - Installation kit (bracket, pipe connection, valves, etc.)
    - Explosion proof Class I, Division 1 and 2 - Groups B, C, D - Class I, Zone 1 and 2 - Groups IIB+H2, IIA
    - Included 1/4 in. fitting connectors for 3/8 and 1/4 in. / 9.5 and 6.4 mm OD tubing

### Model

- B1 Dual Injector

### Odorant Injection Rate Required (Select One)

- 0.13 gal/hr / 0.5 l/hr
- 0.26 gal/hr / 1.0 l/hr
- 0.53 gal/hr / 2.0 l/hr
- 1.06 gal/hr / 4.0 l/hr
- 1.58 gal/hr / 6.0 l/hr
- 2.11 gal/hr / 8.0 l/hr
- 2.64 gal/hr / 10.0 l/hr
- 3.17 gal/hr / 12.0 l/hr
- 3.70 gal/hr / 14.0 l/hr

### Wick Insert Installation Option (Select One)

- Standard Wick Insert
- Long Wick Insert

### Fittings Installation Option

- Swagelok Fittings (standard)

### Automation Software and License Key

- Software for pneumatic panel control, available with Type ROC809 plus Type DO200 license key

### Optional Component

- Stainless steel cabinet for pneumatic panel

## Type ROC809 Configurations and Options

### Required Components

- Type ROC809E Controller (1 required)
- Type ROC800 24 Vdc Power Supply (1 required)
- Type ROC800 Discrete Relay Output Card (2 required)
- Type ROC800 Discrete Input Card (1 required)
- Type DS800 Runtime License (1 required)

### Select Input Card Type for Flow Rate Input

(Choose only one for configuration)

- Type ROC800 Analog Input Card (1 required)
- Type ROC800 Pulse Input Card (1 required)

### Optional Equipment

- Type ROCLINK800 Software (at least 1 license required)
- Type ROC800 LOI Cable (1 required)
- Type ROC800 Ethernet Crossover Cable (1 required)
- Type ROC800 RS232 Comm Module (1 required)
- Type ROC800 RS485 Comm Module (1 required)
- Type ROC800 14.4 Dial-up Modem Comm (1 required)
- Type ROC800 Analog Output Card (1 required)
- Power Supply Charger 24 Vdc (1 required)

# Type DO200

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