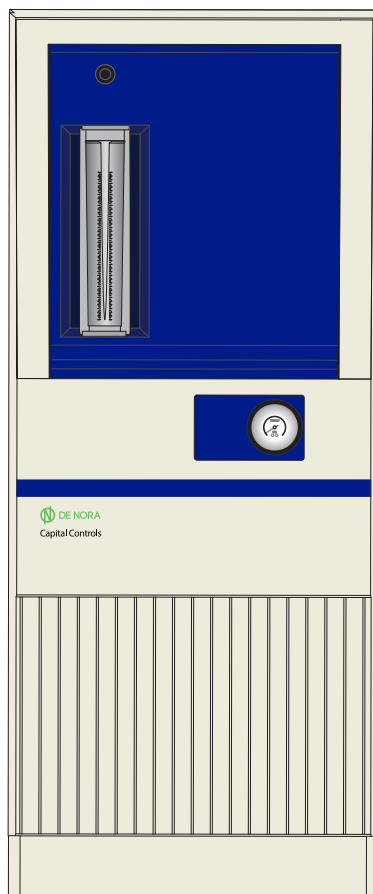


# Capital Controls<sup>®</sup> Series **4100**

## Floor Mounted Gas Feeders for Capacities to 3000 PPD (60 kg/h)

Series 4100 floor cabinet mounted gas feeders are vacuum operated, solution feed, sonic flow feeders available with either manual or automatic control.



Each gas feeder is composed of three parts; a vacuum regulator, a control module, and an ejector. The off-white cabinet, which encloses the control module is constructed of molded high impact polystyrene and pressure formed thermoplastic with a textured, easily maintained finish.

Gas feed rates are dependent on the maximum withdrawal rates from gas containers and the location of the vacuum regulator. Wall, cylinder or ton container mounted vacuum regulator locations may be selected for the best system design. The flowmeter, mounted in the control module is available in a wide selection of capacities. Maximum gas feeder capacities range from 10 to 3000 lb/day (0.2 to 60 kg/h).

When automatic control is required, the Chloromatic<sup>™</sup> valve, mounted within the control module responds to control signals from a water flow transmitter.

The ejector has a fixed diameter nozzle and throat, the size of which depends on the maximum gas feed rate and the hydraulic conditions existing in the water supply and gas solution lines.

Several control modules may be used together to construct a system for multipoint application of gas. The gas flow from the vacuum regulator may be divided to feed more than one application point with the flow to that point being either manually or automatically controlled. The sum of the flows to each application point cannot exceed the capacity of the vacuum regulator.

Automatic changeover systems use two vacuum regulators without the necessity of a separate changeover valve. Units similar to those for feeding chlorine (but with different materials of construction) are available for feeding sulfur dioxide, ammonia and carbon dioxide gases. The maximum capacity of the feeders is 2000 lb/d of sulfur dioxide, 1000 lb/d of ammonia, and 1500 lb/d of carbon dioxide.

- **Modern Design:** The gas feeder features sonic flow differential pressure control requiring no moving parts which results in increased life expectancy and dependability. Integrated circuits and a single corrosion resistant electrical enclosures increase reliability to the automatically controlled models.
- **Inlet Valve Body:** Inlet valve body is constructed of Hastelloy C-22, which has a lifetime warranty against corrosion.
- **Control Signals:** The Chloromatic™ valve insures positive response to electrical signals representing either water flow or PLC control.
- **Safety:** Vacuum operation provides protection for plant operating personnel and equipment. Built-in design features prevent damage to the gas feeder under abnormal operation conditions.
- **Versatility:** The availability of separate gas feeder components allows for the selection and mounting in locations most suitable for the operation of the gas feeder system.

## Engineering Specifications

### Vacuum Regulator

The vacuum regulator may be mounted on a wall or directly on a cylinder valve or the gas valve of a ton container. When mounted on a cylinder valve, the regulator is limited to 100 lb/day (2 kg/h) maximum of gas. When mounted on the gas valve of a ton container, the regulator is limited to 500 lb/day (10 kg/h) maximum of gas.

On wall or ton container mounted vacuum regulators, the unit is protected from liquified gas damage (up to the volume of one full ton container eductor tube) by means of a combination manifold trap. Trapped liquified gas is vaporized by a 25W electric heater.

Two vacuum regulators are used in an automatic changeover system. Either vacuum regulator is selected by the station operator, allowing gas to flow until the gas source is exhausted. At that point, the second vacuum regulator opens to allow gas feed to continue. Each regulator has an indicator to show whether it is in "Reserve", "Operating", or a "Empty" condition.

Temperature limits are 2 to 54°C (35 to 130°F). Options include a gas pressure gauge and a low temperature switch to sense liquified gas presence having contacts rated at 10W, 120V max.

### Control Module

Ejector vacuum level is indicated by a gauge reading in English and metric units mounted on the front of the control module.

For multipoint application of gas solution, each point requires a separate control module containing a flowmeter and a manual or automatically controlled rate valve. Each application point also requires an ejector. Any combination of capacities may be used as long as the total does not exceed the capacity of the vacuum regulator.

For residual or flow + residual control, a residual controller is required. This can be cabinet or remote mounted.

Available optionally are alarm switches to provide indication of loss of vacuum in the event of ejector failure, or excess vacuum as would occur when the gas supply is interrupted or depleted. These switches are rated at 10 A 120 V.

### Flowmeter

Standard metering tubes are available with the following maximum capacities: 10, 25, 50, 100, 200, 300, 500, 1000, 2000 and 3000 lb/day of chlorine gas. The equivalent metric capacities are 200 g/h, 500 g/h, and 1, 2, 4, 6, 10, 20, 40 and 60 kg/h. Metering tubes have dual scales in English and metric units.

Flowmeter rangeability is 20:1 for any one metering tube. Flow meter accuracy is within ±4% of maximum flow meter capacity.

### Chloromatic™ Valve

The Chloromatic valve has two major components: the control valve and the control valve operator. The control valve consists of a housing, a shaped precision plug and a corrosion resistant plastic seat. The plug is positioned with respect to the seat by the valve operator to provide precise control of chlorine feed rates in accordance with the electric input signal(s) to the valve operator. The valve moves from full open to full closed position in 15 seconds.

The control valve operator consists of a solid state electronic circuit, a stepping motor and a mechanism to position the control valve plug. The single input valve operator can be adapted to respond to any one of the following signals: 4-20, 0-16, or 0-20 mAdc; 1-5, 0-4, or 0-5 Vdc (normally from a flow transmitter).

Alternately, the Series 1451 controller can combine the water flow transmitter signal with the chlorine residual analyzer signal and send a single signal to the Chloromatic valve.

A dosage adjustment knob is provided to set the gas to process water ratio to compensate for differences in gas demand. The dosage adjustment is combined with an on-off switch for power shut-off to the motor.

With power to the motor disconnected, the valve can be operated manually by a knob connected to the motor drive shaft.

Temperature limits on the Chloromatic valve are 20 to 125°F (-7 to +52°C).

As an option, valve alarm contacts are available to indicate full open or full closed position of the valve. These contacts rated at 0.1 A, close on alarm.

If recording or totaling of chlorine gas flow is required, an optionally available 4-20 mAdc signal proportional to gas flow is available. Included with this option are the loss-of-vacuum and excess vacuum alarm switches, used to induce a zero flow signal in the event of ejector failure or gas supply interruption. Additional contacts are available on these same switches to provide an alarm function.

### Ejector Requirements

Water passing through the ejector generates the vacuum required to operate the gas feeder. Water consumption and required inlet pressure are dependent on the amount of chlorine being fed and the ejector back pressure created by the chlorine solution piping system. Water passing through the ejector must be reasonably clean. If high temperature water is used, (above 80°F/26°C), ejector performance will be impaired due to decreased solubility of the gas. Reference should be made to pipe manufacturers product literature for decreased pressure ratings of PVC piping. Series 4100 gas feeders are supplied with ejectors for solution lines with back pressures up to 200 psig (1380 kPa) depending on capacity. The ejector may be wall mounted and if the capacity does not exceed 100 lb/day (2 kg/h), it may be pipeline mounted. The ejector is supplied with a check valve and an emergency drain connection to prevent water from reaching the vacuum regulator.

### Accessories

#### Standard:

- Insect screen for vent line
- Bottle for ammonia solution
- Spare Gaskets
- Tub of thread lubricant
- Universal wrench

#### Optional:

- Additional Control Modules and Ejectors for Multipoint Application
- Amperometric Titrator (Bulletin 299.0001)
- Automatic Changeover System (2nd Vac. Reg.)
- Automatic Control Valve (Bulletin 100.0310)
- Booster Pumps
- Chloralert Plus™ Chlorine Gas Detector (Bulletin 325.0025)
- Chlorine Vaporizers (Bulletin 115.0020)
- Chlorine Pressure Reducing Valves (Bulletin 115.0015)
- MicroChem®2 Series 4000 (Bulletin 210.0100)
- Diffusers
- Flexible Connectors and Manifolds
- Integral Residual Controller for Automatic Chlorinators and Sulfonators (Bulletin 315.0005)
- Low Temperature Switch in Vacuum Regulator
- Pressure Gauge Mounted on Vacuum Regulator
- Switches for Electric-Manual Operation on Automatic Models
- Vacuum Switches (High and/or Low)
- Valve Alarm Contacts

### Electrical Requirements

For Chloromatic™ valve 0.3 A at 120 Vac; 0.15A at 240 Vac.

### Materials of Construction

Hast-C22, Cyclocac™<sup>1</sup>, Valox™<sup>1</sup>, PVC, Silver Tantalum alloy, Viton™<sup>2</sup>, Teflon™<sup>2</sup>, Kynar™<sup>3</sup> and borosilicate glass are used in the construction of the gas feeder and ejector. The mounting manifold is ductile iron with corrosion-resistant coating. The Chloromatic™ valve is constructed of PVC, Kynar™<sup>3</sup> and Flurosint™<sup>4</sup> and the valve operator is mounted in a die cast aluminum housing.

- 1 Trademark of General Electric
- 2 Trademark of E.I. DuPont Co.
- 3 Trademark of Elf Atochem North America, Inc.
- 4 Trademark of DSM Corp.

### Description of Operation

Water flowing through the ejector creates a vacuum which acts on a diaphragm assembly to open the inlet valve admitting gas from the source into the vacuum regulator. A spring-opposed diaphragm regulates the vacuum to a closely controlled value. At this point the gas flow may or may not be divided to feed gas to one or more locations. For each application point, the gas passes through a flow meter to either a manual or an automatically controlled rate valve. The controlled flow then goes to the ejector where it is thoroughly mixed and dissolved in the water and carried to the application point as a solution.

When the gas flow is divided and multiple metering tubes and ejectors are used, each operates independently of the others. Adjustment of one of the gas flow rates has no effect on the other rates.

The system is completely under a vacuum from the ejector to the gas inlet valve during operation. If the water supply to the ejector is stopped, or the operating vacuum is lost for any reason, the spring-loaded gas inlet valve immediately closes to isolate the gas feeder from the gas supply. Any gas under pressure which might enter the regulator is vented from the system through the built-in pressure relief valve. If the source of gas is exhausted, the gas port closes to prevent excess vacuum levels from developing in the source.

### Shipping Weight and Cubage

180 lb (82 kg), 42 cu ft (1.2 cu m)

# Capital Controls® Series 4100

Floor Mounted Gas Feeders for Capacities to 3000 PPD (60 kg/h)

## Equipment Description

The gas feeder shall be a vacuum operated solution feed type with a capacity of \_\_\_\_\_ to \_\_\_\_\_ lb/day or \_\_\_\_\_ kg/h of gas. It shall be of sonic flow design suitable for (manual control) (automatic pacing from flow rate) (automatic control from flow rate and residual control) and equipped with a rotameter having an integral scale and a 20:1 range. Ejector vacuum level shall be indicated on a 2 ½ inch gauge mounted on the front of the floor mounted control module. Both the rotameter and all gauges shall have dual scales in both English and metric units. Cabinet accuracy shall be +/- 4% F.S. The floor mounted control module housing shall be of fiberglass-reinforced polyester plastic, molded high impact polystyrene and pressure formed thermoplastic with a textured easy to maintain finish.

The gas feeder vacuum regulator shall be (cylinder) (ton container) (wall) mounted and be suitable for automatic changeover systems without using an external valve. Filtration of the gas shall be through an easily removable cartridge filter except when cylinder mounting is used. A combination trap and heater assembly shall be supplied except when cylinder mounting is used. The heater shall be a clip-on wrap type.

When required for automatic operation, a Chloromatic™ control valve shall be mounted within the control module. It shall consist of a precision tapered corrosion resistant plug and seat and an electric stepping motor operator contained in a single corrosion resistant housing. It shall be used for both emergency manual and automatic control alleviating the need for a separate manual control valve. The electronic components of the operator shall be mounted on printed circuit boards of the latest electrical design, including integrated circuits.

The motor operator shall be wired to a terminal strip within the housing to which all electrical connections shall be made. Valve travel time between limits shall be 15 seconds. A dosage adjustment, located within the control module to prevent unauthorized tampering, shall be provided.

The operator shall operate on 120/240 V, 50/60 Hz and shall respond to the following signal(s); \_\_\_\_\_. An ejector shall be provided having a check valve and emergency drain valve to prevent water or solution from flooding the chlorinator. The gas feeder shall be De Nora Water Technologies Series 4000.

## Warranty and Capability

De Nora Water Technologies offers a one (1) year limited warranty on the cabinet and components. A three (3) year limited warranty is also offered on the vacuum regulator diaphragm and springs. In addition, a lifetime warranty is offered on the vacuum regulator Hast-C22 inlet valve body.

De Nora Water Technologies is ISO 9001 certified to provide quality and precision materials. Disinfection technologies, water quality monitors and instrumentation for water and wastewater are areas of specialization. Over 35 years of industrial and municipal application experience in the water and wastewater industries is incorporated into the equipment design to provide high quality comprehensive solutions for the global market.



WATER MADE EASY

MARINE

ENERGY

MUNICIPAL

INDUSTRIAL



[info.dnwt@denora.com](mailto:info.dnwt@denora.com)

[www.denora.com](http://www.denora.com)

© Copyright 2016 Industrie De Nora S.p.A. - All rights reserved.

De Nora, ON circle, Our research - your future, electrochemistry at your service (and any other trademark name) are trademarks or registered trademarks of Industrie De Nora S.p.A. in Europe and/or other countries. Other trademarks used herein are the registered trademarks of their respective owners.

The information contained herein is offered for use by technically qualified personnel at their discretion and risk without warranty of any kind.

DNWT - Capital Controls® Series 4100 - 105.0005.0 - 08/2016