

GE Oil & Gas

# The Becker\* DNGP: Fail-Safe Protection for Your Gas Pipeline



imagination at work

# DNGP with Modbus® Communication protocol features ZERO Bleed\* technology and control logic designed for natural gas control valves

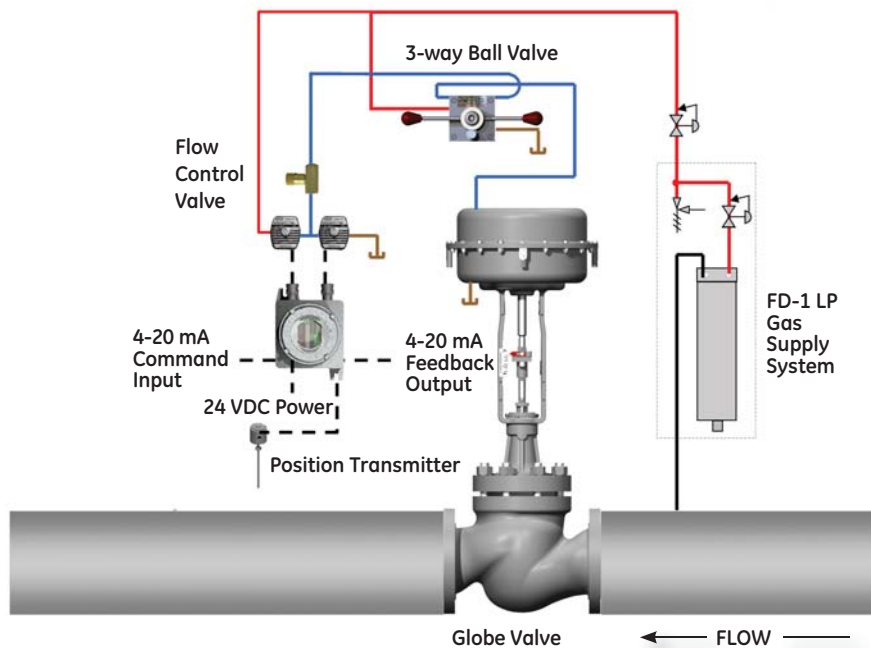
The Becker Digital Natural Gas Positioner (DNGP) from GE Energy supports pressure and flow control applications, is compatible with all Becker actuators and may be retrofit to other manufacturers' control valve packages. Its features make the DNGP a true plug-and-play positioner, one that configures easily with any control valve actuator, application logic via menu selections, or tubing configuration. Simple, reliable and versatile, and with multiple redundant safeguards for natural gas pipelines, the Becker DNGP is designed specifically to work with advanced, pneumatically actuated natural gas control valve applications that use electronic communication. A variety of accessories are available to optimize the positioner's performance.

## DNGP Applications

- Pressure control
- Flow control

## Compatible Actuators

- RPDA Series
- RPSR Series
- SYDA Series
- SYSR Series
- LPDA Series
- LPSR Series
- LD Series
- RSD Series
- Other pneumatic actuators (contact GE for assistance)



**Figure 1** - DNGP Configured with Becker LD Series Actuator and Globe Control Valve

The DNGP is shown configured with a Becker LD Series Linear Diaphragm Actuator and a Model 41000 Series Globe Control Valve. This configuration utilizes a solenoid valve system specifically designed for low power supply gas pressures of 40 psig (276 kPa) or less. This DNGP configuration is also compatible with the Becker RSD Series Rotary Spring and Diaphragm actuator used with the V-0 Series control valve.

- Line Pressure
- Exhaust
- Regulated Supply Pressure
- Loading Pressure

# Sophisticated natural gas control valve technology and electronic communication

## Features

- ZERO steady state consumption
- Atmospheric bleed gas may be eliminated by using BPS\* Bleed to Pressure System
- Accepts 4-20 mA analog or 12 or 24 V D.C. discrete positioning signal without an I/P transducer
- Explosion proof design allows installation in hazardous locations
- NEMA Rating: Explosion proof for Class I, Groups C and D, Class II, Groups E, F, G, and Class III hazardous locations
- Modbus® communication capability and DNGP Dashboard PC Interface allows simple, user-friendly remote calibration and performance visibility
- CSA approved
- High volume and pressure capabilities allow DNGP utilization on large volume actuators without need for volume boosters
- Logic board available for installation within RTU cabinet in order to reduce installation costs
- Failure of input signal or valve feedback signal may be configured to:
  - Lock control valve in last position
  - Stroke to full-open control valve position
  - Stroke to full-closed control valve position
- Becker VRP-Pilots may be incorporated with DNGP to provide completely pneumatic overpressure protection (pressure control override)
- Compatible with most pneumatic control valves and most control valve actuators
- Power gas up to 250 psig
- Menu configured for split range control to allow staging of multiple parallel control valve runs
- Manual local positioning of control valve via menu navigation buttons during standby mode
- Spare 3A power fuse and spare JP2-Jumper located on board
- Diagnostic solenoid cycle counter provides exact maintenance scheduling capabilities at site or remotely
- Provides remote indication of operational mode status (automatic, manual, or standby)
- Fault indicating LED provides easy troubleshooting diagnostics.
- Easy and informative illuminated multi-line display
- Serial port interface allows local communication and simple future software upgrades
- High/Low electronic position limit switches integrated with DNGP offer simple and flexible setup
- Optional remote DNGP mounting



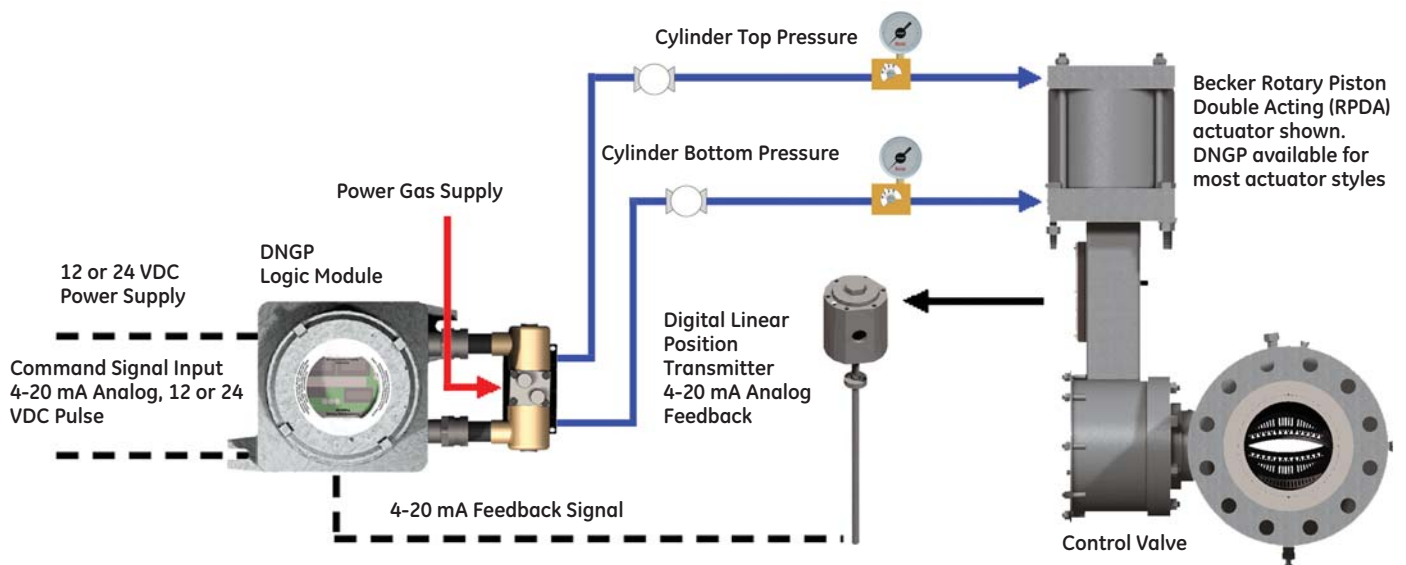
Figure 2 - Digital Natural Gas Positioner (DNGP)

# Simple and reliable design for rugged natural gas pipeline applications with low environmental impact

## The Engineering Behind the Design

The DNGP configuration shown below is double-acting and sends pressure to both sides of the control valve actuator. As one side of the actuator cylinder is pressurized, the other side of the cylinder is exhausted. The energy to operate the control valve is obtained from the differential between supply gas pressure and discharge gas pressure. An electrical signal is supplied to the DNGP from an RTU and an electrical position feedback signal is supplied by a position transmitter. The DNGP controls a spring-centered dual-coil solenoid valve. When the input signal matches the feedback signal within a specified-deadband, the DNGP does not energize either solenoid. The solenoid valve

remains in the center position trapping pressure in both sides of the cylinder. The valve remains in a steady state position with ZERO BLEED. A change in input signal causes the DNGP to energize the opening or closing solenoid depending on positioner action to move the actuator in the respective direction. The DNGP energizes the solenoid valve until the feedback signal matches the input signal and a steady state condition is achieved. The “deadband” in which the actuator remains in steady state is adjustable from 0.1% to 2.0% of valve position. The DNGP can cause the control valve to fail open, fail closed, or remain in last position on loss of input signal or valve feedback signal.



**Figure 3** - DNGP Digital Natural Gas Positioner

Becker Model DNGP Electro-Pneumatic Positioners feature ZERO bleed technology. The DNGP eliminates the need for an I/P transducer and may be configured to lock the control valve in last position if the electronic command input signal is lost. The DNGP is compatible with all Becker control valve actuators. The DNGP package represents a true plug and play positioner. It is easily configurable for any control valve actuator, application logic via menu selections, or tubing configuration.

## Technical Specifications

<b>Electrical Power Requirements</b>	12 to 30 V D.C., 1 to 2 Amps including DNGP heater and transmitter heater (3 Amp line fuse recommended)
<b>Over Current Protection</b>	20 Joule, 2000 Amp surge and lightning transient protection 3 Amp fuse for logic module 24V D.C power
<b>Position Input Signal</b>	4-20 mA (Split range: menu selectable and adjustable - minimum 4 mA signal range)
<b>Transmitter Feedback Signal</b>	4-20 mA Analog (available for feedback to RTU) Internal or external loop power (selectable)
<b>Cycle Counter Feedback Signal</b>	Single Terminal 24 Volts (150 mA maximum current) when either solenoid is energized. Valve Position Feedback Module: Standard (Rotary Type), Linear Type and Alternate Rotary Types Available. Consult your Becker Control Valve representative for additional information
<b>Display</b>	Vacuum Fluorescent Display
<b>Electrical Manual Override</b>	Manual Positioning via raise/lower keys (must engage Manual Mode with Auto/Manual/Standby Switch)
<b>Communications</b>	DNGP Dashboard PC Interface, Modbus(R) communication protocol
<b>Loss of Signal Options</b>	Drive to 4.0 mA position (open or closed valve position) drive to 20 mA position (open or closed valve position) or lock in last position
<b>Input and Transmitter Signal Impedance</b>	100 to 200 ohms
<b>Maximum Power Supply Gas Pressure</b>	250 psig (1724 kPa) with High Pressure 5/3 DNGP Solenoid Valve (check maximum actuator power supply pressure limitations)
<b>Pneumatic Port Connections</b>	1/4" FNPT standard, larger sizes available for additional capacity
<b>Electrical Conduit Connections</b>	3/4" FNPT standard
<b>Input Signal Action</b>	Direct or Reverse-Acting (menu selectable)
<b>Pneumatic Action</b>	Double-Acting or Single-Acting
<b>Deadband</b>	Adjustable from 0.1% to 2.0% of full travel
<b>Hysteresis</b>	<1.0% full scale (with standard Rotary Position Feedback Module)
<b>Linearity</b>	<±1.0% full scale (with standard Rotary Position Feedback Module)
<b>Repeatability</b>	<±0.3% full scale (with standard Rotary Position Feedback Module)
<b>Operating Temperature</b>	-20°F to +150°F (-29°C to +66°C)
<b>Influence of Temp. on Valve Position</b>	<0.01% per °F (<0.02% per °C)
<b>Steady State Gas Consumption</b>	ZERO
<b>Supply Regulator Capacity</b>	100 SCFM at 250 psig (1724 kPa), 45 SCFM at 100 psig (689 kPa) , 30 SCFM at 60 psig (414 kPa) - Natural Gas
<b>Electrical Classifications</b>	Electrical Enclosure Explosion Proof for: Class I, Groups C and D, Class II, Groups E, F, and G, and Class III hazardous locations. CSA approved. Available without enclosure for control room placement of logic board
<b>Approximate Weight</b>	15 lbs. (5.6 kg) includes standard explosion proof DNGP enclosure solenoid valve

DNGP Positioner Spare Parts	Part Number
High Pressure 5/3 Solenoid Valve - Complete Assembly	20-4500
High Pressure 5/3 Solenoid Valve Body	20-4506
High Pressure 5/3 Solenoid Coil - 24 VDC	20-4509
High Pressure 5/3 Solenoid Coil - 12 VDC	20-4518
Low Pressure 2/2 Solenoid Valve - 24 VDC (less than 40 psig)	20-4202
High Pressure 3/2 Solenoid Valve - 24 VDC (40 to 150 psig)	20-4221
3 Amp Replacement Fuse (Input Power)	31-9002
DNGP Control Board (includes display board and terminals)	31-0016

Standard models ONLY listed above. Please contact your sales representative prior to ordering.

Bleed Rates (consumption) for Becker Control Instruments  
 Becker control instrumentation features low bleed and ZERO bleed technologies to minimize fugitive natural gas emissions and any environmental impact.

	VRP-CH Pilot	VRP-B-CH Pilot	VRP-SB-GAP Pilot	VRP-SB_CH Pilot	VRP-SB-PID Pilot	HPP-4 Positioner	HPP-5 Positioner	HPP-SB Positioner	DNGP Positioner
<b>Bleed Rates (Consumption)</b>									
Steady State Bleed <sup>3</sup> (scfh)	~100	<10	zero	zero	zero	~100	<10	zero	zero
Full-Open/Full-Closed ZERO bleed <sup>4</sup>	Y1	Y2	Y	Y	Y	Y1	Y2	Y	Y
Bleed to Pressure System (BPS) <sup>4</sup>	Y	N	Y	Y	N	Y	Y	Y	Y

Notes

1. Requires Model PS-2 or NBV Non-Bleed Device to eliminate bleed when control valve is in full-open or full-closed position
2. Requires Model DPS-2 or NBV Non-Bleed Device to eliminate bleed when control valve is in full-open or full-closed position
3. Bleed rates are estimated utilizing Supply Gas Pressure=100 psig (690 kPa) and are reliant upon process activity. All bleed rates are reported in standard cubic feet per hour (scfh).
4. Bleed to Pressure System (BPS) eliminates all atmospheric bleed emission by containing bleed gas within piping system.

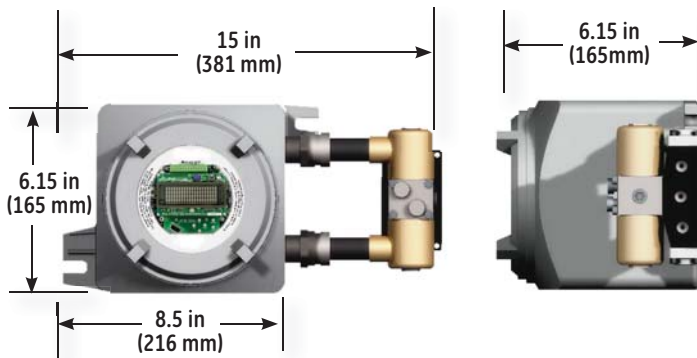
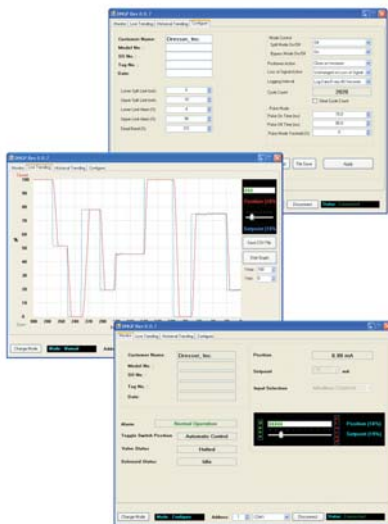


Figure 4 - DNGP with High Pressure 5/3 Solenoid Valve for Standard Double-Acting Application.

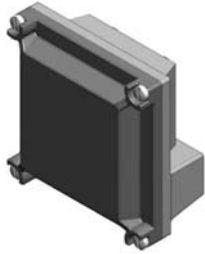
### DNGP Dashboard PC Interface Software

The DNGP Dashboard PC Interface Software allows communication from a PC to the DNGP positioner via Modbus® communication protocol. The software’s tabular design allows switching between screens for monitoring, live and historical command signal and valve position trending, and setting configuration. When set for Modbus® control, the setpoint can be controlled remotely, overriding the local command signal. Alarms in the Monitor screen notify the user of any faults such as loss of command or feedback signal, or if valve is not responding to actuation. The Live Trending screen allows the user to monitor or export live setpoint and valve position data, aiding in valve diagnostics and performance visibility. The Historical Trending screen shows up to 5 hours of past setpoint and position data stored in the DNGP’s memory. In the Configure screen, all local menu-selectable tuning and calibration features can be adjusted remotely via a PC. These settings can be saved as data files and reloaded to restore settings. The DNGP Dashboard software optimizes the performance of the DNGP positioner while offering a simple user-friendly interface.



# DNGP Series Positioner Accessories

Realize Superior Performance of your DNGP Series Electro-Pneumatic Positioner with these popular accessories.



## Rotary Valve Position Feedback Transmitter (optional)

Valve position feedback is communicated to the DNGP by an electronic valve position transmitter. One valve position feedback is a rotary type unit. The rotary valve position feedback transmitter is available with valve status limit switches in a variety of configurations. All Becker valve position transmitters are rated explosion proof for use in hazardous locations.

The DNGP does require a valve position feedback transmitter in order to function.

**Transmitter:** 4-20 mA output, loop powered

**SPDT:** Single pole, double throw

**Housing:** NEMA 7, 4, 4X, Class I, Groups C & D, Division 1 & 2

**DPDT:** Double pole, double throw

**Switches:** 2 or 4 up to 125 V D.C. at .5 amps

**Option:** 2 or 4 hermetically sealed switches up to 250 V A.C. at 15 amps



## Linear Valve Position Feedback Transmitter (standard)

Valve Position Feedback is communicated to the DNGP Logic Module by an electronic Valve Position Transmitter. A Linear Valve Position Feedback improves DNGP performance. The Linear Valve Position Feedback Transmitter features a non-contact design which provides improved hysteresis and positioning capabilities. All Becker Valve Position Transmitters are rated explosion proof for use in hazardous locations.

The DNGP does require a Valve Position Feedback Transmitter in order to function.

**Transmitter:** 4-20 mA output, 10-20 V D.C. powered

**Housing:** NEMA 7, 4, 4X, Class I, Groups C & D, Division 1 & 2



## Bleed to Pressure System

Most Becker control valve instrumentation features the unique capability to discharge vent gas into the downstream pipeline or alternate low pressure gas system. This feature is exclusive to Becker and virtually eliminates atmospheric bleed gas.



## AB Series Atmospheric Bleed Control

When conditions allow discharge to pressure system only part of the time, an AB-Control is available for automatic switching that temporarily permits atmospheric bleed. The AB-Control maintains adequate differential pressure between supply gas pressure and discharge pressure to operate the control valve actuator and control instruments. The AB-Control is not applicable when the control instrumentation constantly discharges to atmosphere.

Reference Becker AB Series sales literature for additional information.

Selection table for Becker Control Valves and Actuators

	VRP-CH Pilot	VRP-B-CH Pilot	VRP-SB-CH Pilot	VRP-SB-GAP Pilot	VRP-SB-PID Pilot	HPP-4 Positioner	HPP-5 Positioner	HPP-SB Positioner	DNGP Positioner	NOTES
<b>Applications</b>										
Pressure Control	•	•	•		•	•	•	•	•	1,2
Flow Control						•	•	•	•	2
Power Plant Type Pressure Control	•				•	•		•	•	3
Power Plant Type Flow Control						•		•	•	3
Surge Control						•		•		
On/Off				•						
<b>Compatible Actuators</b>										
RPDA Series (Small Models)	•	•		•		•	•		•	4
RPSR Series (Large Models)	•			•	•				•	5
RPSR Series			•	•	•			•	•	
LPDA Series (Small Models)	•	•		•		•			•	4
LPDA Series (Large Models)	•			•		•	•		•	5
LPSR Series			•	•	•			•	•	
LD Series			•	•	•			•	•	6
<b>Instrumentation Options</b>										
Bleed to Pressure System (BPS)	•		•	•		•	•	•	•	7
AB Series Atmospheric Bleed Control	•		•	•		•	•	•	•	
NBV Series No-Bleed Valve	•	•				•	•			8
DPS-2 Series Non Bleed Sensor	•	•				•	•			9
PS-2 Series Non Bleed Sensor	•					•				9
SP Series Setpoint Pump	•	•	•	•	•					
RSM Series Remote Setpoint Module	•	•	•	•	•					
Panel Mounting	•	•	•	•	•				•	
Stainless Steel Option	•	•	•	•	•	•	•	•	•	
VB Series Volume Booster	•		•		•	•		•		10
QEV Series Quick Exhaust Valve				•				•		
I/P Transducer						•	•	•		
SLV Series Signal Lock Valve						•	•	•		

1. Pressure control applications include: pressure letdown, primary regulation, monitors, standby, overpressure protection, underpressure protection, and relief valve.
2. All positioners require controller device to perform pressure control or flow control.
3. Power plant regulation includes all power plants and “fast-acting” short systems.
4. RPDA and LPDA Small Models are defined as actuator sizes 14L and smaller > 2000 in<sup>3</sup> / 0.033m<sup>3</sup>
5. RPDA and LPDA Large Models are defined as actuator sizes 12T and larger > 2000 in<sup>3</sup> / 0.033m<sup>3</sup>
6. LD Series Actuators are limited to Becker CVE Series Globe Valves
7. BPS™ is limited to discharge pressure systems below 300 psig (2068 kPa). Consult GE for application assistance.
8. NBV No-Bleed Valves may only be utilized when  $P_{discharge} > 60$  psig (414 kPa) and/or  $P_{supply} > 150$  psig (1034 kPa).
9. PS-2 and DPS-2 Non-Bleed Sensors must be utilized when  $P_{discharge} > 60$  psig (414 kPa) and/or  $P_{supply} > 150$  psig (1034 kPa).
10. VB Series Volume Boosters are necessary for power plant regulation, surge control applications, or when large model RPDA are utilized.

Additional resources are available on our website. Sales literature, sizing software, and technical manuals are available for download at [www.ge.com/energy](http://www.ge.com/energy)



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