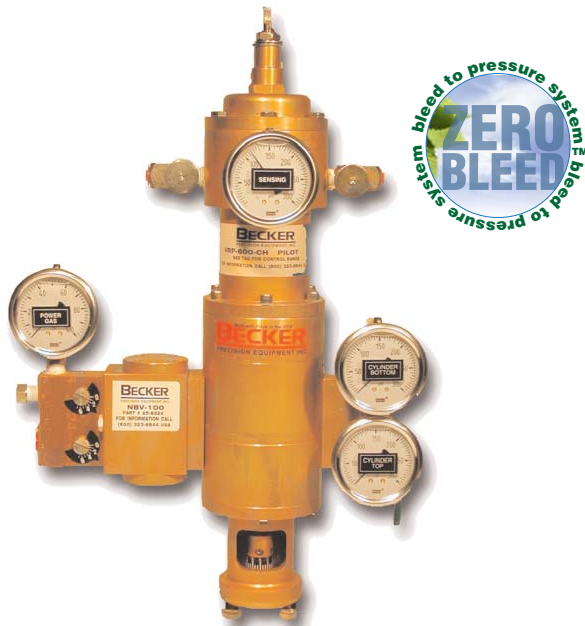


## VRP-CH Series Valve Regulation Pilot

For Use with Double-Acting Operated Actuators

### Description

The Becker Model VRP-CH Double-Acting Pilot provides pressure control when utilized with a double-acting piston actuated control valve. The VRP-CH measures process sensing pressure and positions the double-acting actuator to maintain the pressure setpoint. The VRP-CH may be utilized for pressure control applications with setpoints ranging from 1.0 psig (6.9 kPa) to 1300 psig (8964 kPa). The VRP-CH is typically utilized when Bleed to Pressure System (BPS™) may be used to eliminate atmospheric bleed emissions.



**Figure 1** - Becker Model VRP-600-CH pressure control system shown with optional NBV-100 Non-Bleed Valve

### VRP-CH Applications

- Pressure control
- Power plant type pressure control

### Compatible Actuators

- RPDA Series (small volume models)
- RPDA Series (large volume models)
- LPDA Series (small volume models)
- LPDA Series (large volume models)

### Application Guidelines

#### • Large Volume Actuators

Large volume actuators are defined as actuators with piston displacement (volume) greater than 2000 in<sup>3</sup> that typically require high flow volume instrumentation. For actuators larger than 2000 in<sup>3</sup>, it is recommended that a VRP-CH with Model VB-Series Volume Boosters be utilized.

#### • High Gain Systems

Power plant feeds and other similar systems require fast stroking speed to satisfy required system gain. For high gain applications, it is recommended that a VRP-CH with VB be utilized.

#### • Two-Stage Pressure Cuts

Where two-stage pressure cuts are incorporated, it is recommended to use the VRP-CH in conjunction with either an RPDA or LPDA Series actuator. This includes working monitor regulators.

#### • Globe Style Control Valves

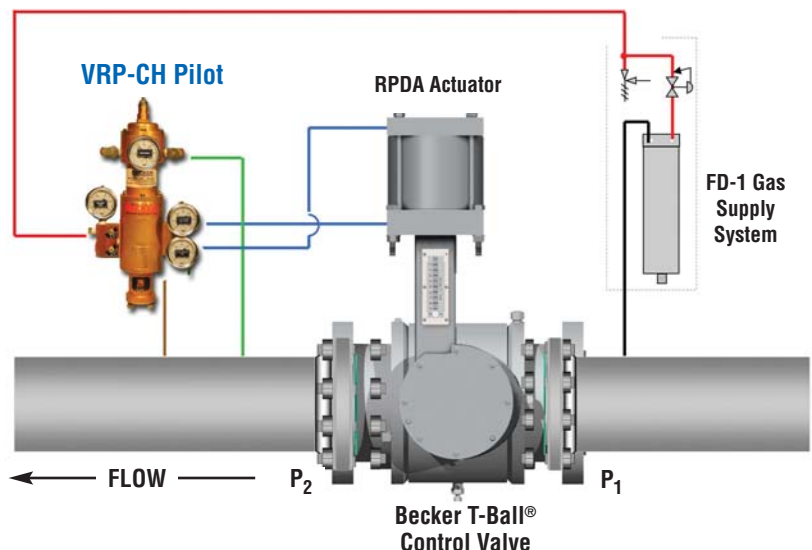
The VRP-CH is the only VRP Pilot compatible with LPDA Series when utilized with globe style control valves such as the Becker Globe series valves.

**Figure 2** - VRP-CH configured for downstream pressure control and Bleed to Pressure System (BPS™)

The VRP-CH may be utilized with any Becker double-acting series actuator and control valve combination to achieve downstream pressure control. The VRP-CH shown is utilizing the Bleed to Pressure System BPS™ feature to eliminate all atmospheric emission.

### Schematic Legend

- Sensing Pressure ( $P_2$ )
- Upstream Pressure ( $P_1$ )
- Exhaust (Discharge)
- Supply Gas (Regulated)
- Intermediate Pressure (Actuator)

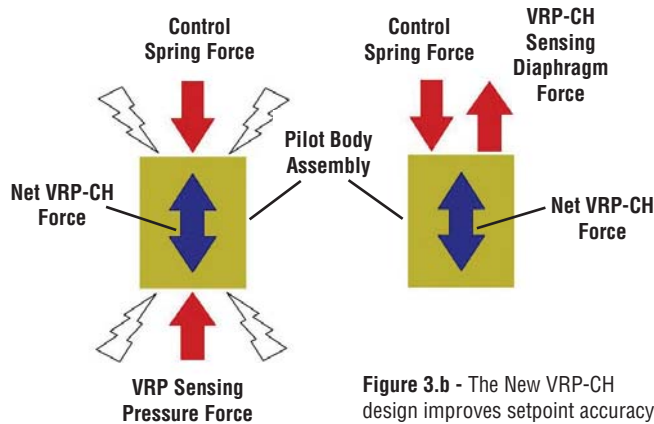


### Benefits of the New VRP-CH Combined Chamber Design

- The VRP sensing pressure and the control spring are combined in the same "CH" combined chamber so that only the net force is transmitted to the VRP body.
- VRP-CH sensitivity improves to  $\pm 0.75\%$ .
- The VRP-CH control spring is enclosed and protected from potentially corrosive effects of the atmosphere.
- The new VRP-CH design reduces the number of models available which makes selection and support of VRP-CH easier.
- The combined chamber design is identical for all Becker VRP. Additionally, new control spring designs provide for wider setpoint range and greater sensitivity.
- The increased volume of the VRP-CH combined chamber dampens noise or vibration present in the measured variable (sensing tap).

### Improve Performance and Minimize Bleed Gas Emissions!

Optimum performance is achieved by pairing the VRP-CH with genuine Becker control valve actuators. If existing control valve actuators are in service, the addition of a VRP-CH can improve performance as well as minimize bleed gas emissions. Becker VRP-CH Pilots are compatible for retrofit with most manufacturers' double-acting piston style actuators. Consult Becker Precision Equipment for more information.



**Figure 3.a** - The Original VRP design subjects the VRP Pilot body to crushing forces

The original VRP is subjected to acting forces from the VRP Control Spring and the VRP Sensing Pressure Force. The net force on the VRP can reduce sensitivity and accuracy.

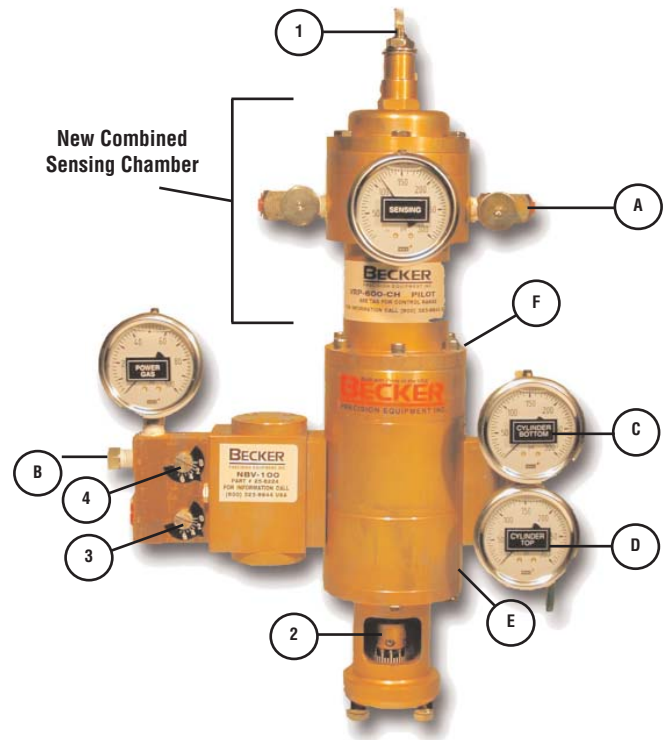
**Original VRP Accuracy =  $\pm 1.0\%$**

**Figure 3.b** - The New VRP-CH design improves setpoint accuracy and sensitivity

The new VRP-CH design combines the VRP Sensing Pressure Force and the VRP Control Spring Force both within the "CH" Combined Chamber. The new CH design eliminates the crushing effect of internal VRP forces and applies only the net force to the pilot body. The result is increased setpoint accuracy and sensitivity.

**New VRP-CH Accuracy =  $\pm 0.75\%$**

The new combination chamber of the VRP-CH provides improved performance over previous VRP



**Figure 4** - Becker Model VRP-600-CH pressure control system

The VRP-CH is specifically designed for natural gas pressure regulation and provides a simple, economical alternative to the controller and positioner combination. The VRP-CH is shown with optional NBV No-Bleed Valve to eliminate bleed gas when the control valve is at both full-open and full-closed positions.

**Table 1** - VRP-CH Port Definitions

VRP-CH Port Definitions	Port Size	Item
Sensing (Input)	1/4" FNPT	A
Power Gas Supply (Input)	1/4" FNPT	B
Cylinder Bottom (Output)	1/4" FNPT	C
Cylinder Top (Output)	1/4" FNPT	D
Exhaust (Discharge)	1/4" FNPT	E
Breather Vents	1/4" FNPT	F

Reference Figure 4

**Table 2** - VRP-CH Adjustments

VRP-CH Adjustments	Item
Setpoint Adjustment	1
Sensitivity Adjustment	2
Cylinder Top Adjustable Orifice	3
Cylinder Bottom Adjustable Orifice	4

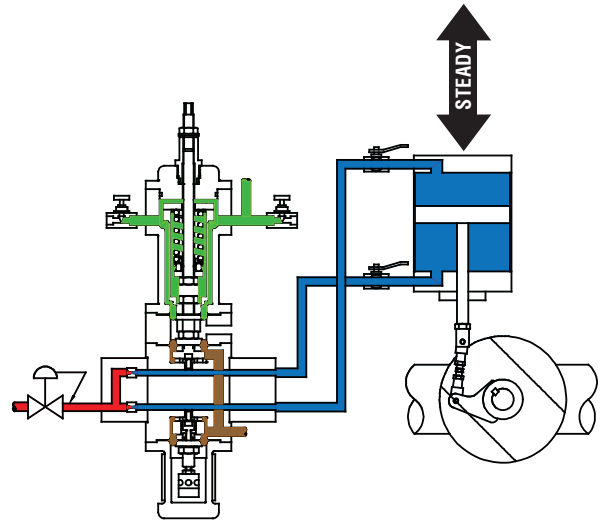
Reference Figure 4

### How it Works (Downstream Pressure Control)

The energy to operate the control valve is obtained from the differential between supply gas pressure and discharge gas pressure. When the measured variable is at setpoint the pilot output pressures to cylinder top and bottom are equal (Figure 5.1). The control valve remains stationary. As the measured variable rises above setpoint, the pilot pistons move downward. This causes a decrease in cylinder top pressure and an increase in cylinder bottom pressure creating a force to close the valve and lessen the flow (Figure 5.2). The measured variable returns to setpoint, and the pilot output pressures will automatically return to equilibrium at the new valve position. If the measured variable falls below setpoint, the opposite reaction takes place (Figure 5.3).

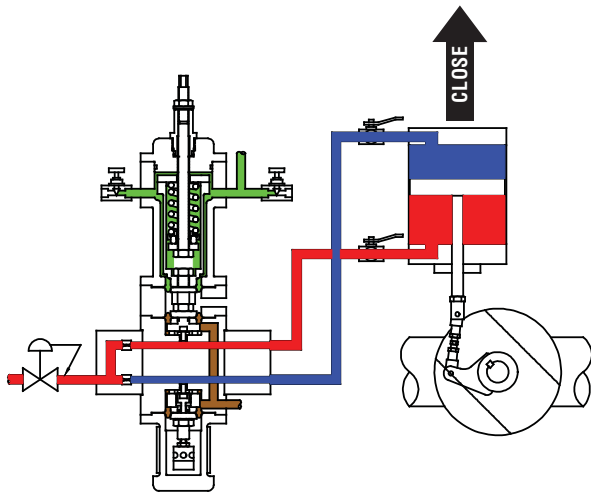
#### Schematic Legend

- Exhaust Pressure (Discharge)
- High Pressure Gas
- Intermediate Pressure Gas
- Measured Variable (Downstream Pressure)



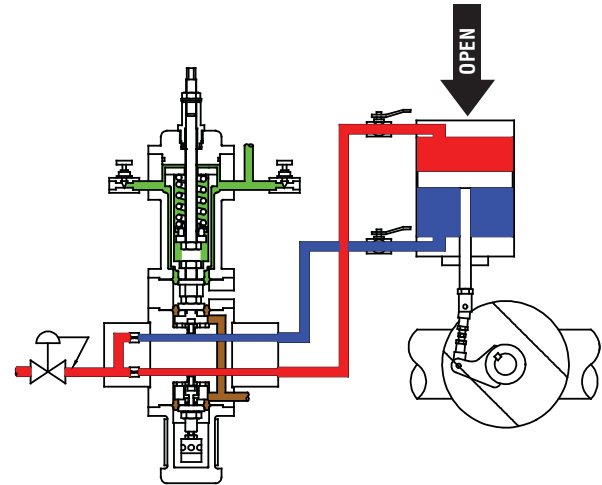
**Figure 5.1** - Setpoint satisfied

When the measured variable is at setpoint the pilot output pressures to cylinder top and bottom are equal, and the control valve remains stationary.



**Figure 5.2** - Downstream pressure climbs above setpoint

When the measured variable rises above setpoint the pilot pistons move downward causing an increase in cylinder bottom pressure and a decrease in cylinder top pressure. The control valve moves towards the closed position.



**Figure 5.3** - Downstream pressure falls below setpoint

If the measured variable falls below setpoint, the pilot pistons move upward causing a decrease in cylinder bottom pressure and an increase in cylinder top pressure. The control valve moves toward the open position.

**Table 3 - Technical Specifications for VRP-CH Pilot**

Technical Specifications	
Steady State Gas Consumption	~100 (see Table 4)
Supply Gas	dry, filtered (100μ) gas
Maximum Flow Capacity	500 scfh (14.2 scmh)
Maximum Supply Pressure	400 psig (2758 kPa)
Maximum Supply-Discharge Differential	250 psig (1723 kPa)
Minimum Supply-Discharge Differential	50 psig (345 kPa)
Operative Ambient Temperature Range	-20°F to +160°F (-29°C to +71°C)
Approximate Weight	12 lbs (5.4 kg)
Minimum Deadband	0.2% sensing pressure
Independent Linearity	±1.0% positioning range
Resolution	0.1% of positioning range
Control Accuracy	±0.75% of setpoint
Maximum Sensing Pressure	
VRP-175-CH	225 psig (1551 kPa)
VRP-600-CH	600 psig (4136 kPa)
VRP-1000/1300-CH	1500 psig (10342 kPa)
Setpoint Range	1.0 psig - 1300 psig (6.9 kPa - 8966 kPa)
Housing	Meets NEMA 3 Classification
Installation Orientation	Vertical position recommended. Custom bracket supplied with Becker Actuators. 2" pipe mount provided for retrofit to other manufacturers' actuators.
Materials of Construction	
External Parts	Anodized AL 2024 316 SS available (for marine environments)
Internal Parts	316 SS and anodized AL 2024
Springs	Plated steel
Diaphragms	Buna-n reinforced by nylon fabric
Seats and O-rings	Buna-n
Tubing and Tubing Fittings	316 SS
Gauges	2 1/2" dial liquid filled with stainless steel case (standard issue with units of psig dual units of psig/kPa available)

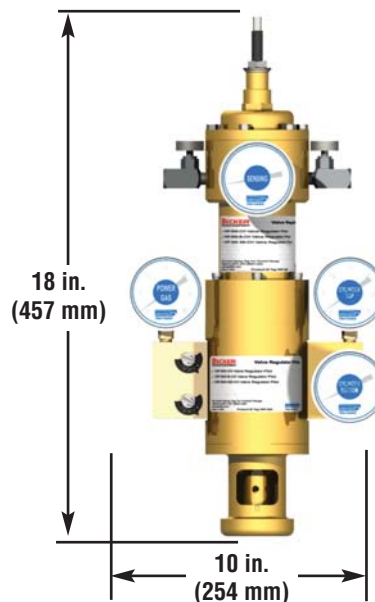
**Table 4 - Bleed Rates (consumption) for Becker Control Instrumentation**

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-CH Pilot	VRP-SB-GAP	VRP-SB-PID Pilot	HPP-4 Positioner	HPP-5 Positioner	HPP-SB Positioner	DNGP Positioner
Bleed Rates (Consumption)									
Steady State Bleed <sup>3</sup> Non-Bleed	~100	<10	zero	zero	zero	~100	<10	zero	zero
Full-Open/Full-Closed Bleed to Pressure	Y <sub>1</sub>	N	Y	Y	N	Y <sub>1</sub>	Y <sub>2</sub>	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
2. Requires Model DPS-2 or NBV Non-Bleed Device to eliminate bleed
3. Bleed rates are estimated utilizing supply gas pressure = 100 psig
4. Bleed to Pressure System (BPS™) eliminates all atmospheric bleed

**Figure 6 - Overall dimensions of VRP-600-CH**



**Table 5 - Selection Chart for VRP-CH Series Pilots**

VRP-SB-CH Model Number	Control Range (psig/kPa)	Spring Color	Part Number	Setpoint change/ revolution of setpoint screw <sup>2</sup>	Maximum Remote Setpoint Range <sup>3</sup>	Repair Kit Part Number
<b>VRP-175-CH<sup>1</sup></b>	1.0 – 10 psig (6.9 – 69 kPa)	Gold	25-8236	0.57 psig/rev (3.9 kPa/rev)	3.1 psig (21.4 kPa)	30-9002
	7.0 – 30 psig (48 – 207 kPa)	Beige	25-8238	2.0 psig/rev (14 kPa/rev)	11 psig (75.8 kPa)	30-9002
	15 – 50 psig (103 – 345 kPa)	Burgundy	25-8239	3.0 psig/rev (21 kPa/rev)	16.5 psig (113.8 kPa)	30-9002
	20 – 85 psig (138 – 596 kPa)	Pink	25-8240	6.4 psig/rev (44 kPa/rev)	35.2 psig (242.7 kPa)	30-9002
	50 – 175 psig (345 – 1207 kPa)	Yellow	25-1306	23 psig/rev (159 kPa/rev)	125 psig (862 kPa)	30-9002
<b>VRP-600-CH</b>	25 – 140 psig (172 – 965 kPa)	Beige	25-8238	7.4 psig/rev (51 kPa/rev)	41 psig (283 kPa)	30-9004
	50 – 175 psig (345 – 1207 kPa)	Burgundy	25-8239	11 psig/rev (76 kPa/rev)	62 psig (427 kPa)	30-9004
	135 – 300 psig (931 – 2069 kPa)	Pink	25-8240	24 psig/rev (166 kPa/rev)	132 psig (910 kPa)	30-9004
	275 – 600 psig (1896 – 4137 kPa)	Yellow	25-1306	85 psig/rev (586 kPa/rev)	325 psig (2241 kPa)	30-9004
<b>VRP-1000-CH</b>	550 – 1000 psig (3792 – 6895 kPa)	Yellow	25-1306	144 psig/rev (993 kPa/rev)	700 psig (4826 kPa)	30-9005
<b>VRP-1300-CH</b>	800 – 1300 psig (5516 – 8964 kPa)	Gray	25-1562	227 psig/rev (1565 kPa/rev)	900 psig (6205 kPa)	30-9005

**Notes**

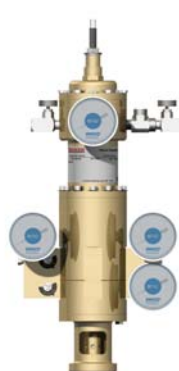
1. These models should only be used for applications that require high gain. Consult Becker prior to specifying these models.
2. Maximum remote setpoint range is based upon Model SM-1140 remote setpoint module with maximum motor range of 5.8 revolutions. See Becker RSM brochure for additional information.
3. Maximum remote setpoint range reported is applicable to units with discrete (pulse) signal. Remote setpoint modules with analog (4-20 mA) signal have a maximum remote setpoint range equal to the full control range of the VRP-CH.



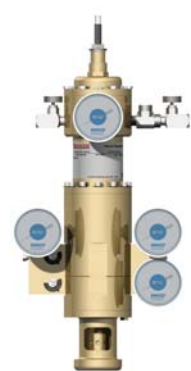
**Figure 7.1 - Model VRP-175-CH**



**Figure 7.2 - Model VRP-600-CH**



**Figure 7.3 - Model VRP-1000-CH**



**Figure 7.4 - Model VRP-1300-CH**

## VRP-CH Series Pilot Accessories

Realize Optimum Performance of your VRP-CH Series Pilot with these popular instrumentation accessories!



### Bleed to Pressure System (BPS™)

Most Becker control instrumentation feature the unique capability to discharge vent gas into the downstream pipeline or alternate low pressure gas system. This feature is exclusive to Becker and provides complete elimination of atmospheric bleed gas emissions.



### VB Series Volume Boosters

VB Series Volume Boosters are utilized in conjunction with some Becker control instrumentation to provide adequate instrumentation flow volume for larger volume piston actuators. Volume Boosters are typically only required for ball valve regulators models 12T and larger. Additionally, Volume Boosters may be utilized to provide increased actuator stroking speed for applications such as power plant and other short system applications. As with all Becker instrumentation, Volume Boosters may be discharged into a lower pressure system to eliminate atmospheric bleed. Volume Boosters are compatible with the VRP-CH.

*Reference Becker VB Volume Booster sales literature for additional information.*



### AB Series Atmospheric Bleed Control

When conditions allow discharge to pressure system only part of the time, install an AB Series Atmospheric Bleed Control. The AB-Control may be installed for automatic switching that temporarily permits atmospheric bleed. The AB-Control will maintain adequate differential pressure between supply gas and discharge pressure to operate the control valve actuator and control instrumentation. The AB-Control is not applicable when the control instrumentation constantly discharges to atmosphere.

*Reference Becker AB Atmospheric Bleed sales literature for additional information.*



### NBV Series No-Bleed Valve

The NBV Series No-Bleed Valve eliminates bleed gas from Becker double-acting control instrumentation when corresponding control valve is at full-open and full-closed positions. This is ideal for monitor regulators and standby regulators that typically remain in the full-open or full-closed positions. The NBV features bleed shutoff at both ends of valve travel without adjustment. The NBV is the primary choice for non-bleed technology on Becker double-acting control instrumentation. The NBV is compatible with all Becker double-acting Valve Regulator Pilots (VRP) and double-acting High Pressure Positioners (HPP).

*Reference Becker NBV No-Bleed Valve sales literature for additional information.*



### PS Series Non-Bleed Sensor

The PS Series Non-Bleed Sensor renders the Becker double-acting control instrumentation non-bleeding when the control valve reaches full-open and full-closed positions. This is ideal for monitor regulators and standby regulators that typically remain in the full-open or full-closed positions. The PS features bleed shutoff at one end of valve travel. If bleed shutoff is required at both ends of travel, two PS will be required. The PS is the secondary choice for non-bleed technology and should be used only in applications where the NBV will not suffice such as when the VRP-CH must discharge to high pressure systems (above 60 psig).

*Reference Becker PS-2 Series sales literature for additional information.*

## VRP-CH Series Pilot Accessories

Realize optimum performance of the VRP-CH Series with these popular instrumentation accessories!



### SP Series Setpoint Pump

Provides a simple and accurate method of applying false signal pressure during initial adjustment of pilots. The pump can provide a false signal pressure of 20%-40% in excess of working pipeline pressure which eliminates the need for nitrogen bottles or electronic calibration devices. The Setpoint Pilot is compatible with all models and series of Becker VRP Pilots.

*Reference Becker SP Setpoint Pump sales literature for additional information.*



### RSM Series Remote Setpoint Module

The Remote Set Point Module provides remote adjustment of VRP-CH set point via an electrical input signal. All Remote Setpoint Motors are equipped with internal limit switches to prevent over-travel of setpoint. A 4-20 mA feedback of Remote Setpoint Module motor is standard. All Becker RSMs are rated explosion proof Class 1, Div. 1 for use in hazardous locations. The standard RSM input signals are:

#### Digital Pulse Input

- 24 V D.C.
- 120 V A.C.

#### Analog Current Input

- 4-20 mA command signal/24 V D.C.
- 4-20 mA command signal/120 V A.C.

*Reference Becker RSM Remote Setpoint Module sales literature for additional information.*



### Panel Mounting

Custom panel mounting is available to suit the specific application needs. All panels come fully assembled, tested, and adjusted per requirements. Panel mounting simplifies retrofit of Becker instrumentation to existing equipment and ensures satisfactory performance and fit. A variety of configurations and options are available.



### Stainless Steel Option

All Becker Precision Control instrumentation is manufactured from high-strength anodized aircraft aluminum alloy (AL2024). The standard aluminum construction provides adequate durability in most installation environments. In applications where the environment is unusually harsh, the instrumentation may be specially ordered in a stainless steel option. The stainless steel option is typically utilized in the following areas:

- Marine environments
- Chemical plants
- Offshore platforms
- Coastal regions

**Table 6** - Selection table for Becker Control Valves and Actuators

	VRP-CH Pilot	VRP-B-CH Pilot	VRP-SB-CH Pilot	VRP-SB-GAP	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
RPDA 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 ( $< 2000 \text{ in}^3 / 0.033\text{m}^3$ )
5. RPDA and LPDA Large Models are defined as actuator sizes 12T and larger ( $\geq 2000 \text{ in}^3 / 0.033\text{m}^3$ )
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 Becker for application assistance.
8. NBV No-Bleed Valves may only be utilized when  $P_{\text{discharge}} \leq 60 \text{ psig (414 kPa)}$  and/or  $P_{\text{supply}} \leq 150 \text{ psig (1034 kPa)}$ .
9. PS-2 and DPS-2 Non-Bleed Sensors must be utilized when  $P_{\text{discharge}} > 60 \text{ psig (414 kPa)}$  and/or  $P_{\text{supply}} > 150 \text{ psig (1034 kPa)}$ .
10. VB Series Volume Boosters are necessary for power plant regulation, surge control applications, or when large model RPDA are utilized.

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**Figure 8** - Becker Model VRP-Pilots on Globe Valve Regulators  
Becker VRP combined with Becker LPDA Series Actuators used on globe pattern valves are ideal for regulation in LDC systems. Incorporation of the BPS™ feature eliminates all atmospheric emissions.



**Figure 9** - Becker Model VRP-Pilots on Ball Valve Regs  
VRP installed on RPDA Series actuator provides reliable overpressure protection in a simple instrumentation package. Note addition of the PS Non-Bleed Sensor eliminates bleed gas when control valve is full-open.

**\*CAUTION:** This information is intended as a guideline for application of Becker Precision Equipment products. Becker strongly recommends consulting Becker Engineering prior to application of any product.

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

