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INSTRUMENT MANUAL
VP50
PROPORTIONAL CONTROL VALVE



Ref: YM50002 (01/07)

IMPORTANT SAFETY WARNING

Please read these instructions carefully **BEFORE** this instrument is installed or maintained.

To conform with the Health and Safety at Work Act 1974 our product should be installed, used and maintained in accordance with :-

1. Normal safety procedures.
2. The installation and operating instructions provided for each instrument.
3. BS6739 for general applications.
4. BSEN 60079 for hazardous area applications.

If for any reason local conditions dictate non-compliance with the above, we should be consulted.

These converters are intended for use in industrial compressed air systems only. Ensure that adequate pressure relief provision is installed if application of system supply pressure could cause downstream equipment to malfunction. Installation should be in accordance with local and national compressed air and instrumentation codes.

Products certified for use in explosion proof (flameproof) or intrinsically safe installation **MUST**

- a) Be installed in accordance with local and national codes for hazardous area installations
- b) Only be used in situations which comply with the certification conditions stated in this handbook.
- c) Only be maintained by qualified personnel with adequate training on hazardous area instrumentation.

Before using these products with fluids other than air, for non-industrial applications, or for life-support systems consult Norgren.

LIMITED WARRANTY, DISCLAIMER & LIMITATION OF REMEDIES

Items sold by Norgren are warranted to be free from defects in materials and workmanship for a period of two years from the date of manufacture, provided said items are used according to Norgren's recommended usages. Norgren's liability is limited to the repair of, refund of purchase price paid for, or replacement in kind of, at Norgren's sole option, any items proved defective, provided the allegedly defective items are returned to Norgren prepaid. The warranties expressed above are in lieu of and exclusive of all other warranties.

There are no other warranties, expressed or implied, except as stated herein. There are no implied warranties of merchantability or fitness for a particular purpose, which are specifically disclaimed. NORGREN'S liability for breach of warranty as herein stated is the exclusive remedy, and in no event shall NORGREN be liable or responsible for incidental or consequential damages, even if the possibility of such incidental or consequential damages has been made know to NORGREN.

Norgren reserve the right to discontinue manufacture of any product or change product materials, design, or specifications without notice.

Our policy is one of continuous research and development. We therefore reserve the right to amend without notice the specifications given in this document. Customers are responsible for ensuring that the product is used only for the purpose of which it is intended. In case of doubt Norgren will be pleased to advise

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SETTING UP / CALIBRATION

Ideal for most standard industrial applications which require better control and performance than an open loop system.

If you need more information, please read the complete handbook.

1. Connect an air supply (11 bar max) to the VP51 filtered to 5 µm; use thread sealant. (e.g red loctite 542)
 - **Use Oil-Free Air**
 - **Do NOT use PTFE Tape**
2. Connect a suitable signal source (0-10V, 4-20mA) to range to pin 3 (blue) +ve and pin 4 (black) common –ve.
3. Connect a 24V dc power supply across Pin 1 (red) and Pin 4 (black)
 - **Check the connections and Polarity**
4. Connect a suitable load or gauge to the outlet port.
5. Switch on supply and the proportional valve should operate.
6. Set-up can be made off-line (pressure) for desired outlet pressure, feedback signal and range settings. Fine tuning can be performed using online set-up.
7. Adjust the Proportional and Integral Gains, Dither Amplitude and Speed, if necessary.

DESCRIPTION OF OPERATION

Norgren's VP50 proportional control valve delivers high levels of flexibility and functionality

Norgren, the motion and fluid control specialist, offer a wide range of proportional valve technologies for use in automation and control. The VP50 is ideal for deployment in a wealth of industrial automation applications. The VP50 offers dynamic pressure control up to 10 bar with either 0-10V or 4-20mA signals

Employing glandless lightweight Teflon coated spool valve technology the VP50 has the benefit of proven reliability with figures in the range of 30 million cycles plus, and is particularly resistant to corrosion and wear. Suitable for output pressures in the range of 0 to 150 psi the VP50 features low power consumption (<1W) and can operate in compressed air environments that are both dry and non-lubricated. Ambient operating temperature is set at 0°C to 50°C and the units benefit from IP65 protection.

The VP50 provide High Speed, High Flow and High Accuracy which is necessary for applications requiring a fast response

It has a lightweight aluminium spool and a glandless design with ultra low friction Teflon coating.

The electronic dither overcomes any static friction effects with a pilot change of 3 psi for 10-90% step.

It is necessary for this application to operate in large volumes requiring very fast response giving a flow of up to 1200l/min which is provided by the large spool size and direct air flow.

INSTRUMENT MOUNTING

Mechanical

Only suitably qualified personnel should attempt installation and all health and safety standards should be strictly adhered to.

Environmental Conditions

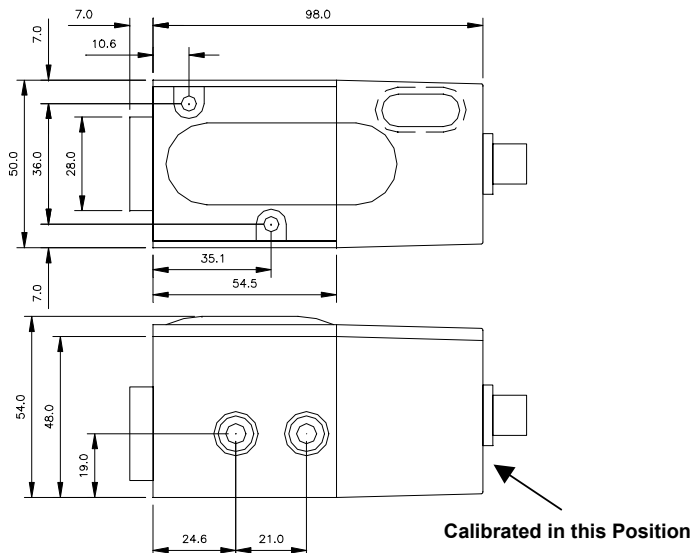
The VP50 has the ingress protection rating IP65. This means that it is dust tight and can withstand moisture. However, it is recommended that the mounting location is as clean as possible.

Mounting

The VP50 can be mounted in any orientation. The unit should be secured to its mounting surface using two M4 set screws which are at the least 50mm long accompanied by suitable washers to prevent loosening from vibration.

Effects of changing mounting orientation

The VP50 is calibrated in a horizontal position as per illustration below. Mounting the VP50 in any other mounting orientation may cause a slight shift in the calibration point which is set in the factory. It is recommended that the calibration be checked for compatibility with the customers application once installation is complete.



INSTRUMENT MOUNTING

Pneumatic

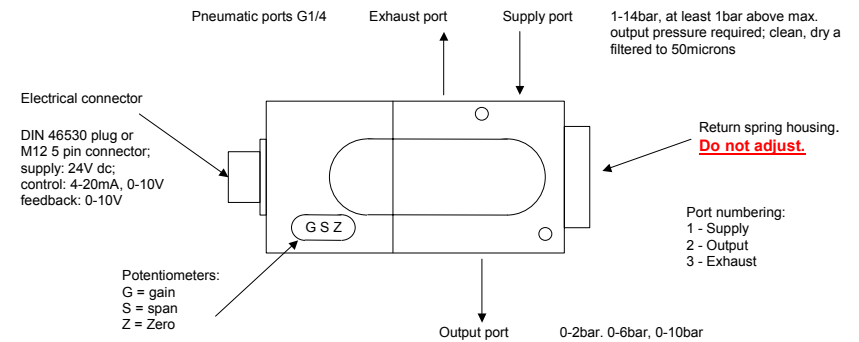
Before installation ensure a suitable air supply is provided. Only suitably qualified personnel should attempt installation and all health and safety standards should be strictly adhered to. The VP50 requires an air supply of at least 1 bar (15psi) greater than the minimum required output pressure and not exceeding 14bar (200psi). The air must be filtered at least 50 microns using a suitable Norgren filter and must not be non-lubricated.

Ensure all air supplies are isolated before beginning the installation and that suitable eye and hand protection is being worn.

Insert fittings into the supply port (labelled 1) and the output port (labelled). Note: under no circumstances use PTFE tape to seal the fittings. Use only an anaerobic pipe sealant. An exhaust silencer may be inserted into Port 3 if desired, all ports are 1/4" BSP or 1/4" NPT. It is important to ensure both supply and output pipework is suitably sized for the flow and pressure of air that it will be required to handle.

Secure the supply and output pipework into the fittings. Ensure that no dirt or metal swarf is allowed to fall into the valve.

Once all pipes are secure slowly increase the supply air pressure to the unit until it is settled at the required level. The unit will operate perfectly with a supply pressure which is 1Bar above the maximum required output pressure, however a slight shift in the factory calibration may be observed. It is recommended that the calibration is checked after installation is complete.



Electrical

Before installation ensure all power supplies, PLC input and output cards are locked in their OFF position. Only suitably qualified personnel should attempt installation and all health and safety standards should be adhered to.

All electrical connections to the valve are made via the M12 5 pin connector provided. This plug should be connected to the controller and power supply whilst disconnected from the valve.

Connect the 24v ($\pm 6v$) power supplied to pin 1 (+ve) and pin 4 (-ve common) of the M12 5 pin connector. Refer to the electrical installation diagram below for details of the plug. The electrical supply should not exceed 30v to avoid damaging the valve. The 24v electrical power source will need to be capable of supplying at least 4mA.

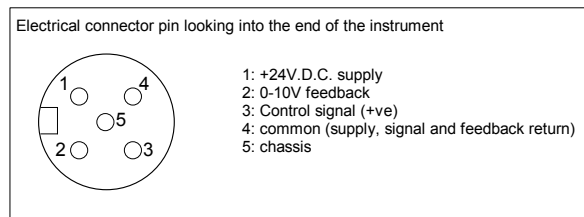
Connect the control signal (4 – 20mA or 0 – 10v etc) to pin 3 (+ve) and pin 4 (-ve) common). Ensure that the control signal provided by the PLC or controller is correct for the valve. Voltage control signal sources must be capable of supplying at least 5mA. Current source control signals must be able to supply an output voltage of at least 6v.

Pin 5 is the chassis of the valve. The use of screened cable is recommended for EMC protection. The screen of this cable should be connect to pin 5 of the connector.

IMPORTANT WARNING - READ BEFORE ENERGIZING

The unit that you have purchased has been factory set so that the feedback voltage is 10 Volts when the unit is at the "Factory Set Full Scale Output Pressure". If the unit is re-ranged so that the output pressure is ever above this pressure, then the customer feedback will be above 10 Volts. Please ensure that the device measuring the feedback will not be harmed by voltages over 10 Volts – e.g. If you have purchased a unit that has an output pressure at full scale of 8 bar, and 10V full scale feedback, and demand a pressure (P2) of 10 Bar output (by either re-ranging or by supplying more than 100% input signal) than the corresponding feedback signal will be 12.5 Volts (As P2 is 25% above 8 Bar)

Reassemble the plug and connect the plug to the valve. Proceed to commissioning



The VP50 does not have components that require user maintenance. If there is a concern or problem contact your regional Norgren Distributor.

DESCRIPTION OF OPERATION

The VP50 is an air piloted proportional valve incorporating :-

- *Glandless spool with spring return*

The position of the spool within the sleeve determines whether inlet air is directed through to the outlet or exhaust port

The spool position depends on the balance of forces acting on it:

- The force of the pilot diaphragm and
 - The spring return force
- The balance of forces allows the spool position to vary
As position varies, so does the output pressure

- *Air pressure pilot*

The distance between the face of the flapper and the air nozzle creates a back-pressure which governs the pilot output pressure.

This distance is controlled by a coil attached to the flapper which extends and contracts when energised in a magnetic field.

The pilot output pressure provides the force to move the spool

- *Control Electronics*

The Control Electronics drive the pressure pilot coil, which monitors the instruments outlet pressure, creating the closed loop control system

The demand signal is compared to currently measured pressure. If errors occur then the two are amplified, generating a signal which changes the pilot output pressure.

The spool moves, changing the instrument output pressure. A continual comparison and adjustment must be made to bring the error down to zero.

There is an electronic dither signal super-imposed on the coil drive, which helps to overcome static friction in the system. It contributes to extremely low hysteresis which provides this excellent dynamic performance.

TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	SUGGESTED ACTION
No output pressure	Loss/No control signal	Check connections/wiring
	No power supply	
	Faulty Ground Wiring	Use adequate 50 micron filtration
	Contamination	
Low Output Pressure	Insufficient Input Pressure	Increase Input Pressure
	Incorrect wiring	Check all common –ve connections are correct
	Low load volume	Check pipe size is adequate (i.e >4mm)
Continuous Full Output Pressure	Blocked Spool	Use adequate 50 micron filtration
	Non-common grounding	Check common –ve and earth wiring are correct and separate
Maximum Outlet Pressure not available	Insufficient Input pressure	Increase available input pressure
Minimum Outlet pressure too High	Calibration	Check Zero and Span Potentiometer settings
Outlet Pressure Oscillates (chattering)	Wiring problem	Check common –ve
	Interference Effects	Use Shielded cable
	Calibration	Reduce Gain setting
	Low load volume	Check Pipe Assembly
Unit behaves above/below specification	Settings changed from Factory set-up	Customer to re-adjust Zero and Span in unison
	Check signs of damage to external casing	
	Age of the unit	
Unit has an air leak	Confirm system set-up. Correct power and pressure inputs	If mishandling of unit has led to failure such as incorrect voltage supplied to PCB or contamination the unit will be considered beyond repair.
	Has the unit been opened?	

SPECIFICATIONS

Medium	Compressed air, dry 5 micron filtered air, non-lubricated
Input / Output signal	See Product Selector on Datasheet
Supply Pressure Range	14 bar maximum for 10 bar and 6 bar variants 8 bar maximum for 2 bar variants 6 bar minimum for 10 bar and 6 bar variants* 4 bar minimum for 2 bar variant.
<i>*For an output pressure close to or greater than the minimum supply pressure specified the supply pressure used must be greater than the required output pressure + 1bar</i>	
Preferred Range (Low Pressure)	< 1watt resulting in low energy usage and no excessive heat discharge
Operating Temperature Range	0°C to +50°C
Dew Point	-20°C pressure at 7 bar g in accordance with ISO 8573.1
Environment Protection	IP65 in normal operation
RFI/EMI Protection is incorporated	

TYPICAL PERFORMANCE FIGURES

Accuracy	Linearity and Hysteresis are typical 0.25%
Supply Pressure Effect	Compressed air, dry 5 micron filtered air, non-lubricated
Temperature Effect	Typically better than 0.03% of span/°C for span and zero over operating range
Response Time	<80mS (10-90% step into 0.1l load)
Flow Capacity	Up to 1200l/m
Air Consumption (typical)	<5l/min
Input Impedance	10KΩ for voltage variants, 250Ω for current variants.
Insulation Resistance	>100MΩ at 50Vdc, electrical terminals to case
Over Current Protection	Over voltage to 30V (non-continuous, 60 seconds) for current variant.
Long Term Stability	100-200 million cycles
Rangeability	Multiturn trimpots for zero, span and gain adjust, accessible via removeable grommet. Zero and span pots to provide 50% rangeability (applicable to variants listed in Input Impedance) Gain pot to be factory set to a minimum to suit small load applications. May be increased to improve small signal dynamics and overall accuracy in large load applications.
Life	>30 million 100% steps
Vibration / Shock Resistance	<3% output shift for 3g sine, 10-150Hz (3 axes)

EC DECLARATIONS

EC DIRECTIVE
89/336/EEC (EMC) and 97/23/EC (PED)

DECLARATION OF CONFORMITY

Watson Smith declares under our sole responsibility that the product listed below

Product: VP50 Proportional Valve

Manufactured by: Watson Smith Instrumentation
Norgren Ltd.
Cross Chancellor Street.
Leeds, LS6 2RT
England

Conforms with the protection requirements of the European Parliament and the Council Directive of 29 May 1997 on the approximation of the laws of the Member State, relating to EC Pressure Equipment Directive 97/23/EC;

And with the protection requirements of Council Directive 89/336/EEC (amendments 92/31/EEC and 93/68/EEC) on the approximation of the laws of the Member State relating to electromagnetic compatibility.

Representative samples of the VP50 Proportional Valve have been tested in accordance with conformity assessment procedure to demonstrate compliance with the European Parliament and the Council Directive 97/23/ EC; and with the following standards relating to EMC:

BS EN 61000-6-4 : 2001	Electromagnetic Compatibility Part 6 - 4 Generic Standard Emission standard for industrial environments
BS EN 61000-6-2 : 1999	Electromagnetic Compatibility Part 6 - 2: Generic Standards - Immunity for industrial environments

Signed:  Date: 4/5/05

Name: P. Hartley

Position: Managing Director

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