Power Amplifier with PID for EDC-Controlled Pumps

EEA-EDC-436-D*-32 Series

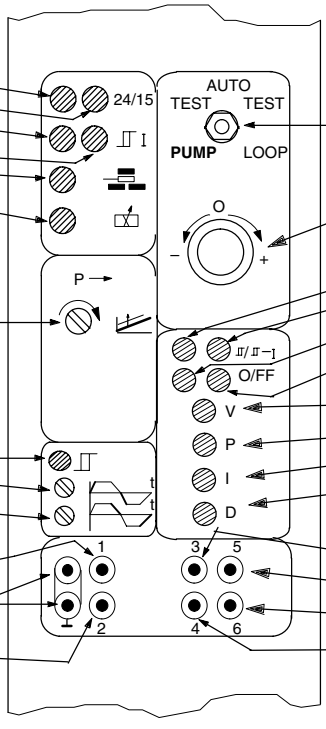
General Description

The EEA-EDC-436-D*-32 Eurocards are power amplifiers with integrated PID modules. Each of these cards replaces two conventional e;ectronic cards.

Features and Benefits

- Includes all features of “A” amplifiers (except gain)
- User configurable PID feed-forward closed-loop operation
- Command input ramps
- Analog feedback sensor interface
- Automatic switch-over p/Q function
- Built-in test feature
- The design reduces the amount of external wiring, saves space in the rack enclosure and requires only one 24V supply
- The general purpose, integrated module can be configured using DIL switches (D1–D9) and potentiometers for the following applications:
  - Closed-loop pressure control using either proportional pressure valves or servo-performance proportional valves
  - Closed-loop velocity control
  - p/Q control with internal or external switch-over from Q to p
- The DIL switch and potentiometer settings can easily be reconfigured on different cards

Front Panel



LEDs

1. 24V power supply input, green
2. 15V control supply output, green
3. Drive (solenoid) enabled, yellow
4. Overload, red
5. Yoke sensor failure, red
6. Drive level to solenoid, yellow

Potentiometers

7. Offset

LED

8. Ramp enabled (yellow)

Potentiometers

9. Command ramp up
10. Command ramp down

Monitor Points ■

11. MP1: conditioned command signal
12. Common ground (0V)
13. MP2: Yoke position

14. Mode switch
    –TEST **PUMP** setting
    –AUTO function setting
    –TEST LOOP setting
15. Test potentiometer

LEDs

16. PID-controller enabled, yellow
17. Integrator enabled, yellow
18. Feedback = command signal, green
19. Sensor failure, red

Potentiometers

20. Feed-forward signal scaling
21. P-gain
22. I-gain
23. D-gain

Monitor Points ■

24. MP3: Command signal
25. MP5: PID-controller output
26. MP6: Integrator output
27. MP4: Feedback signal

■ *∅2,0 (0.0787 dia.) sockets*

This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by ⚠ Electromagnetic Compatibility (EMC).

Model Codes

Ampllifier model	For	Assy. Nr
EEA-EDC-436-D1—32	PVH 57 & 74	02-326 129
EEA-EDC-436-D2—32	PVH 98	02-326 130
EEA-EDC-436-D3—32	PVH 131	02-326 131

Operating Data

Power (input) supply:	bzd 32 bzd 30	20 to 40 V DC (incl. pk-to-pk ripple ± 10% max.) Power ground
Control (output) supplies:	z22	+15V
Reference voltages	z2 b2	+10V x 5 mA –10V x 5 mA
Ananlog inputs:		
Command inputs		
Direct voltage inputs	b6,b8,b10,z8	
Inverting voltage input	z10	
Voltage range		± 10V
Input impedance (voltage)		47 kW
Current input	z6	
Current range		± 20 mA
Input impedance (current)		100 W
Feed-forward Input	d8	
Input impedance		6 kW
Voltage range		± 10V
Input to ramp generatator	d28	
Input impedance		10 kW
Voltage range		± 10V
Inputs from sensors		
Voltage input	d2	
Input impedance		1 MW
Voltage range		0 to 10V or ± 10V ■
Current input		
Input impedance		100 W
Current range (see “DIL Switches” five pages on)		4–20 mA or 0–20 mA
Monitoring of sensor failure for sensors with a current output only		

■ *The demand signal should have the same voltage range as the sensor feedback, i.e. 0 to 10V, or ± 10V*

Operating Data

Digital inputs:	 ***Warning**: in a power-up sequence, the integator should not be enabled until all hydraulic, electric and control power and signals are applied and stable. Abrupt or unpredictable motion may occur if integrator is enabled during this transition time*
Drive enable (power available to solenoid) z24	
Ramps enable b24	
Inegrator enable d14	
PID controller enable d12	
Enabled	17 to 40V
Disabled	0 to 3,5V
Loaad current	$\leq$ 10 mA
Digital outputs:	
Sensor failure d18	
Sensor failure	Supply Voltage – 2V
Sensor OK	< 3V
Load current (withstands a continuous short-circuit condition) This output may be used only in conjunction with sensors providing a current output (4–20 mA)	$\leq$ 100 mA
Feedback = command signal d10	
Feedback matches demand	Supply Voltage – 2V
Feedback does not match demand	< 3V
Load current (withstands a continuous short-circuit condition)	$\leq$ 100 mA
The load at pin d18 and at pin d10 has to be connected to ground	
Analog outputs:	
PID controller output d4	
Error signal d22	
Feedback signal d24	
Load impedance	$\geq$ 10 kW; short-circuit proof
Voltage range	$\pm$ 10V
Output from ramp generator d26	
Load resistance	$\geq$ 5 kW; short-circuit proof
Voltage range	$\pm$ 10V
Alarm output (drive output status) z12	
Set alarm	Enable amplifier (on pin z24) when switching power on
Signal	HIGH when alarm is activated Output = Supply minus 2V I = 50 mA max. LOW when solenoid overload has occurred. (Maintained until reset.) Output = 0 to $\pm$2 volts Output resistance = 50 ohms
Reset after failure	Disable and re-enable on pin z24
Ramp active indicator: b12	
Drive ramping up	Output >10V
Drive ramping down	Output <–10V
Drive not ramping	Output 0V ($\pm$2V ripple)
Output resistance	10 kΩ
Drive signal zero indicator: b20	
Drive signal at null (within deadband limits)	Output = Supply minus 1,5V I = 50 mA max.
Drive active	Output = 0 $\pm$2V
Output resistance	50Ω

Operating Data

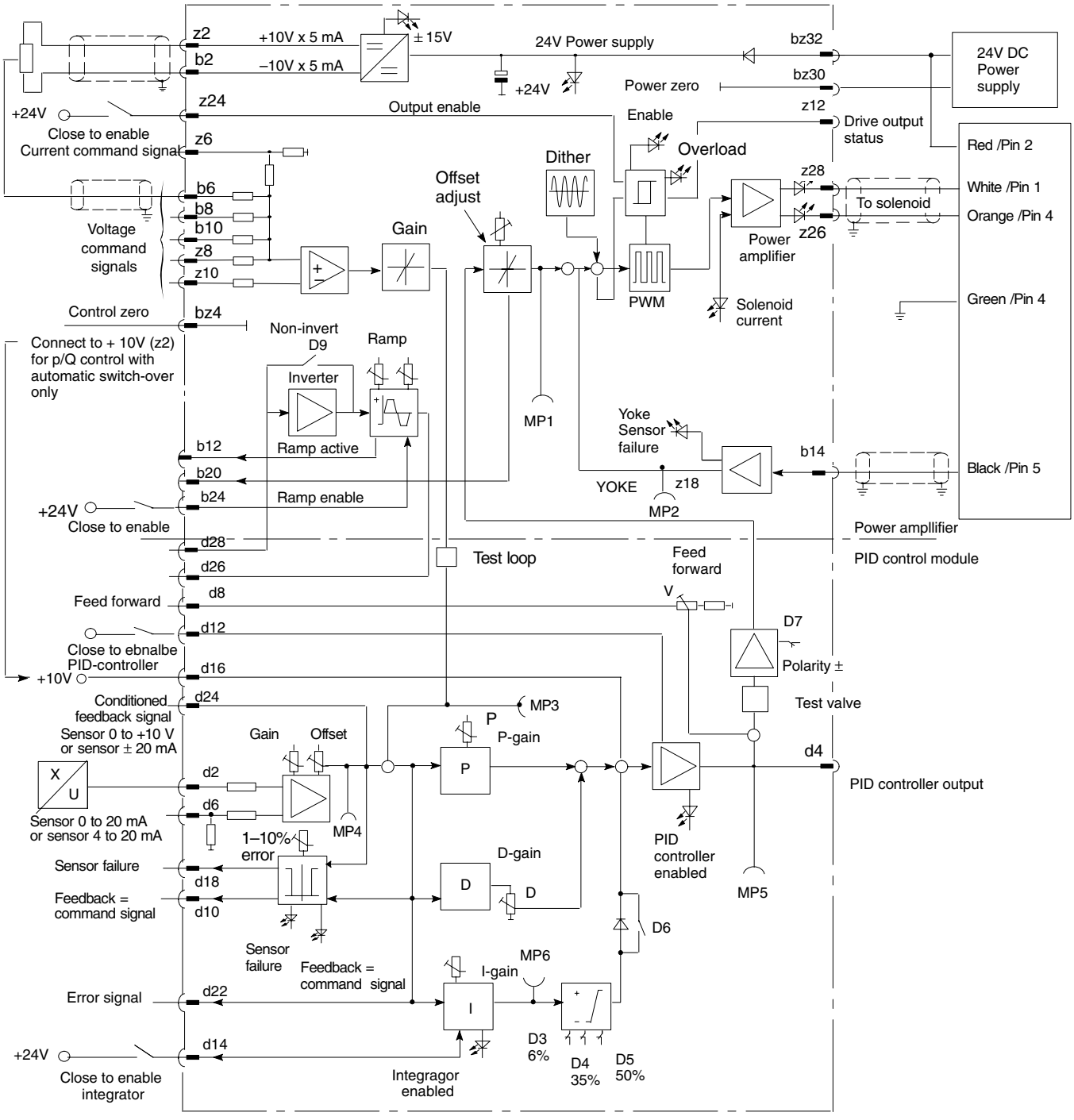
Potentiometers:		
Feed-forward	V = 20% to 100%	(20% is potentiometer fully CCW)
P-gain (depends on DIL switch D2)	P = 0,1 to 50 V/V	(0,1 V/V is potentiometer fully CCW)
I-gain range	K_i = 0,5 to 100V/s/V	(0,5 V/s/V is potentiometer fully CCW)
D-gain range	K_d = 0 to 0,5 V/V/s	(0 V/V/s is potentiometer fully CCW)
Sensor signal gain range ■	90% to 120%	(90% is potentiometer fully CCW)
Sensor signal offset range ■	± 10%	(–10% is potentiometer fully CCW)
Monitor points:		
Conditioned command signal MP1	0V to 10V equals 0% to 100% yoke command	
Yoke position MP2	0V to 10V equals 0% to 100% yoke angle	
Command signal MP3	–10V to 10V equals –10% to 100% closed loop control command	
Feedback signal MP4	–10V to 10V equals –10% to 100% sensor signal	
PID controller output MP5	0V to 10V equals 0% to 100% yoke command	
Integrator output (100%, independent of D3, D4, D5) MP6	0V to 10V equals 0% to 100% integrator term	
Voltage range	± 10%	
Monitor point impedance	10 kΩ	
Ambient conditions:		
Storage temperature range	–25¿ to +85°C (–13° to + 185°F)	
Operating temperature range	0¿ to 50°C (32° to + 122°F)	
Mass	0,4 kg (0.88 lb) approx.	
Installation and start-up guidelines (supplied with product)	9166	
Installation wiring requirements for Vickers electronic products	2468	
Application notes (available on request)	9060	
Supporting products:	See catalogs:	
Power unit options	2419	
Electronic accessories	2460	
Portable test equipment	2462 and 2315	
■ *Located on PID module*	1.6A	

Warning: *Electromagnetic Compatibility (EMC)*

It is necessary to ensure that the valve is wired up in accordance with the connection arrangements shown in this leaflet. For effec protection, the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient earti (ground) points. The metal 7-pin connector part no. 934939 should be used for the integral amplifier.

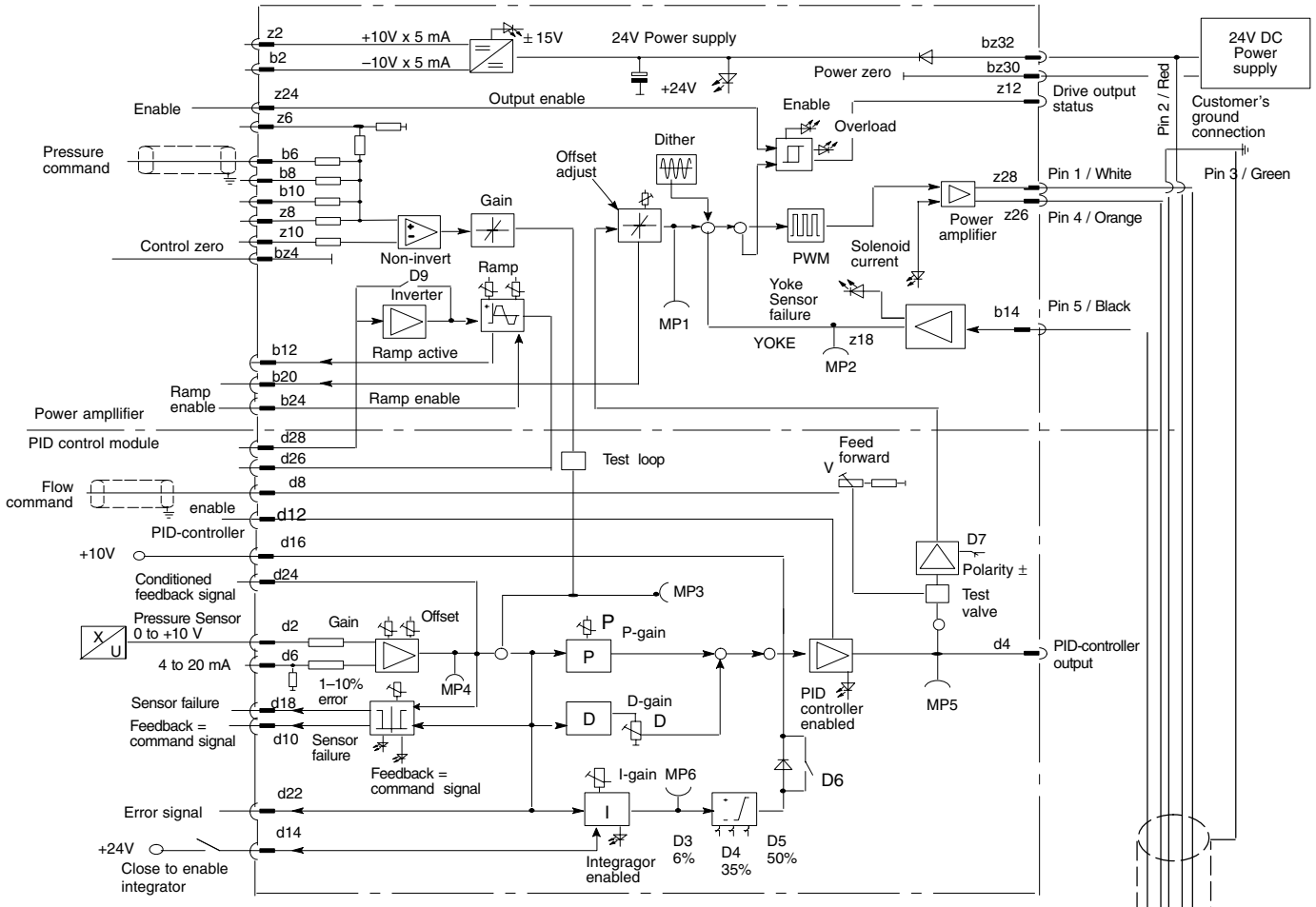
In all cases, both valve and cable should be kept as far away as possible from any source of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

Circuit and Connections

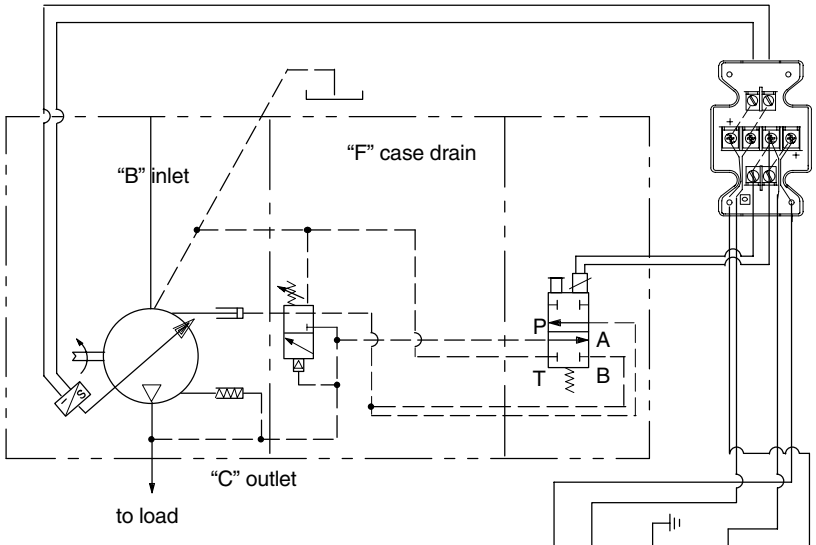


Customer's protective ground protectio

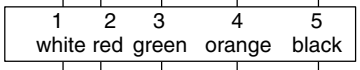
Circuit & Connections for P/Q Control with Pump Wiring



Pump Assembly



Suitable mating plug: Lumberg Type RKC 50/9

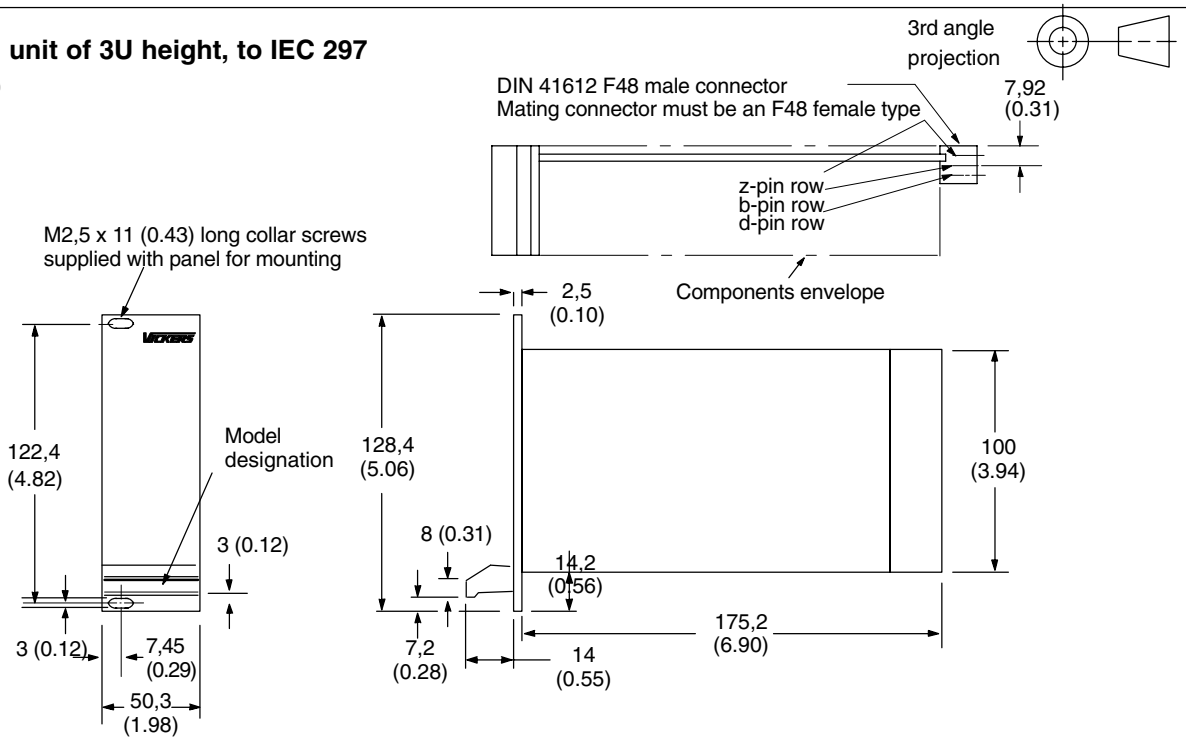


Note
All cables to be screened and grounded as shown.

Installation dimensions

Plug-in unit of 3U height, to IEC 297

mm (inch)



Application notes

Operation of the Integrated Test Mode

The basic operation of the hydraulic actuator can be tested by using the 3-position mode switch mounted on the front panel. To select differnet modes the toggle switch mst be lifted slightly before turning it to a new position.

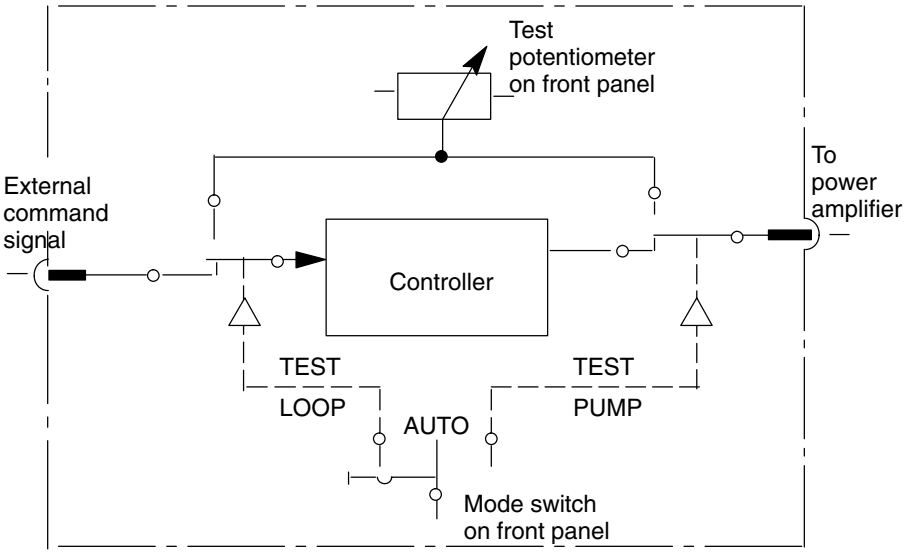
Caution:

Before setting the mode switch to either “Test pump” or “Test loop” make sure the test potentiometer is set to “0”. Otherwise sudden movements of the actuator may occur.

The mode switch has 3 positions:

AUTO

The controller operates in closed-loop mode, using the external command signal. The test potentiometer is disconnected.



TEST PUMP

An open-loop command signal for the valve comes directly from the potentiometer. The external input signal is disconnected. The hydraulic part of the system may be tested in this configuration.

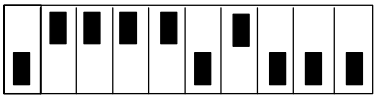
TEST LOOP

The closed-loop command signal for the PID-controller comes directly from the potentiometer. The external signal input is disconnected. This configuration allows for verification of the valve polarity and the ocntrol parameters.

Application notes

DIL Switches

The controller is configured for the application, using DIL switches, located on the board.

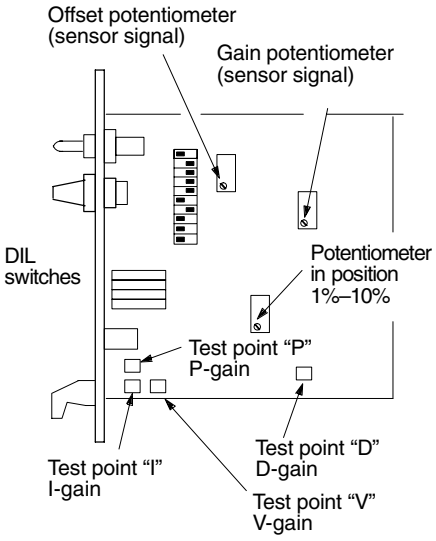


Factory setting

The DIL switch operates as follows:

Switch	ON	OFF
D:1	For sensors with 4 to 20 mA output	For sensors with 20 mA outputs
D:2	P–gain 2 to 50	P–gain 0,1 to 2
D:6	One sided limitation of the integrator output. (only useful for proportional pressure and proportional throttle valves).	No limitations of integrator output
D:7	Inverts the controller output signal	Non-inverted signal
D:8	For sensors with 4 to 20 mA output	For sensors with 20 mA outputs
D:9	Inverts the ramp signal	–
D:10	Not used	–

Locatiom of user features on PID module



For p/Q control with automatic switch-over, connect d16 to z2 (+10V). The flow command signal (Q) is applied to the feed-forward input, d8, and the desired pressure setpoint voltage applied to a command signal input (b6/8/10 or z6/8/10). The pressure feedback sensor is connected to the sensor input d2, or d6 as required.

The pressure control loop will override the flow command to limit the pressure to the level determined by the pressure setpoint voltage. Adjust P and D gains for best performance.

The switches D3, D4 and D5 belong together. They limit the I output volts between 100% (10V) and 5% (0,5V) as follows:

D3	D4	D5	I-limit
ON	ON	ON	100%
ON	ON	OFF	50%
ON	OFF	ON	35%
ON	OFF	OFF	25%
OFF	ON	ON	5,9%
OFF	ON	OFF	5,8%
OFF	OFF	ON	5,3%
OFF	OFF	OFF	5,0%

Reconfiguration of Controller Parameters

Once the controller parameters have been optimized and set, they can be measured by means of an ohmeter. This allows easy reconfiguration of the controller on different cards for use as spare parts or on standard machine series.

Four test points are located on the PID-module for ths purpose, see diagram for locations. The resistance between the appropriate test point and ground (at the front panel monitor point) determines the controller parameters:

PID = P-gain
I = I-gain
D = D-gain
V = Feed-forward gain