Date of last update: 0608

Ref: D7.8.3/0608/E

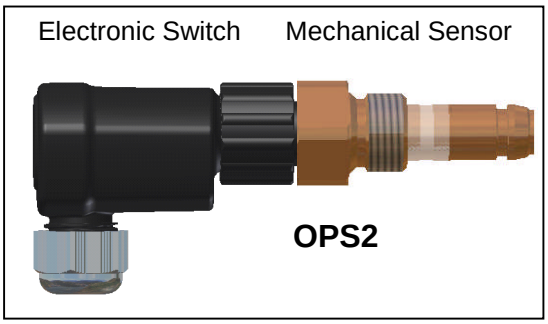
Application Engineering Europe

DWM COPELAND SEMI-HERMETIC COMPRESSOR

OIL PRESSURE DIFFERENTIAL SWITCH OPS2

1 Introduction

The OPS2 monitors the oil pressure differential in reciprocating compressors protecting the compressor against damage if the oil pressure differential falls too low. Internal channels drilled through the housing link the switch to the inlet and outlet ports of the oil pump.

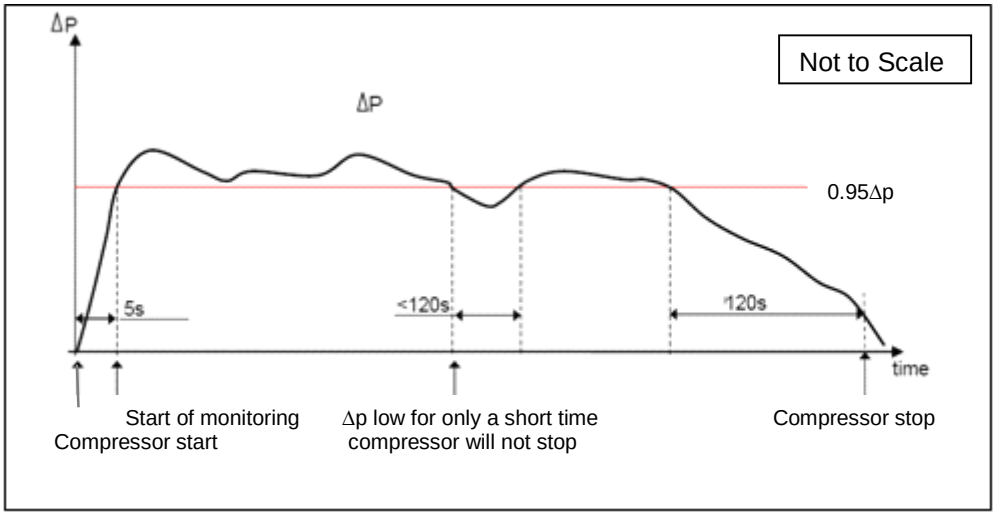


The brass mechanical sensor component which is standard on all DWM Semi-Hermetic compressors with an oil pump is directly screwed into the pump housing of the compressor. The black electronic switch can be screwed onto the brass mechanical sensor. If the electronic switch is to be removed from the brass sensor the refrigeration circuit will not be open to the atmosphere.

The brass mechanical sensor component for the OPS2 is the same as used on the OPS1. The electronic switches are not interchangeable without making changes to the wiring/circuit.

2 Function

The running signal of the compressor contactor activates the OPS2. If the oil pressure differential drops below the preset value for longer than the time delay (120s) the output contact of the OPS2 opens and protects the compressor against internal damage. Also shorter periods of insufficient oil pressure are recognized. The compressor is also shut off after a appropriate extended time delay.



Functional Graph using Pressure Differential x Time Axes

Operation

Power is supplied to the OPS2, after a 3 second delay the relay pulls in and the compressor is ready to start running. The temperature controller for the application activates the compressor contactor and the compressor runs. Once running the compressor contactor gives a signal to the OPS2 (D1). The differential pressure monitoring will only start when the running recognition D1 signal is present. After a delay of 5 seconds the OPS2 starts monitoring.
If a failure (ie incorrect mounting) registers for more than 5 seconds the relay will trip and lock out.

Methods to reset the switch after shutdown:

- Push the internal reset button (1sec)
- Disconnect the switch from the power supply – mains interruption (5sec)
- Remote Reset (1sec)

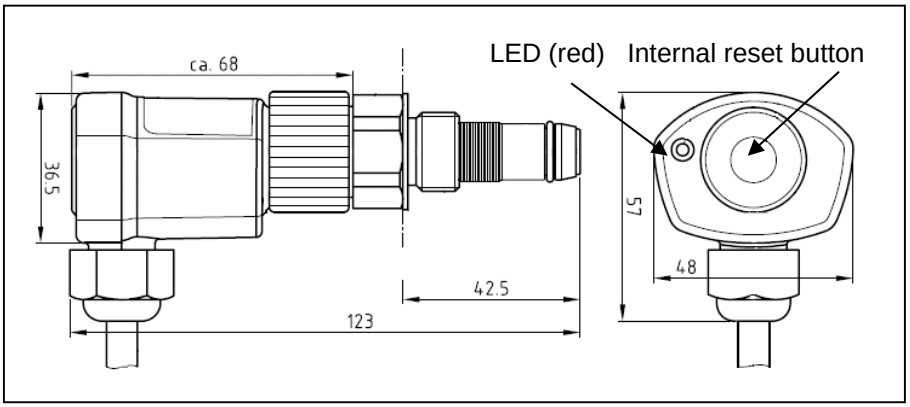
After a time delay of 120s the compressor is able to operate again.

3 Technical Information

3.1 Technical data

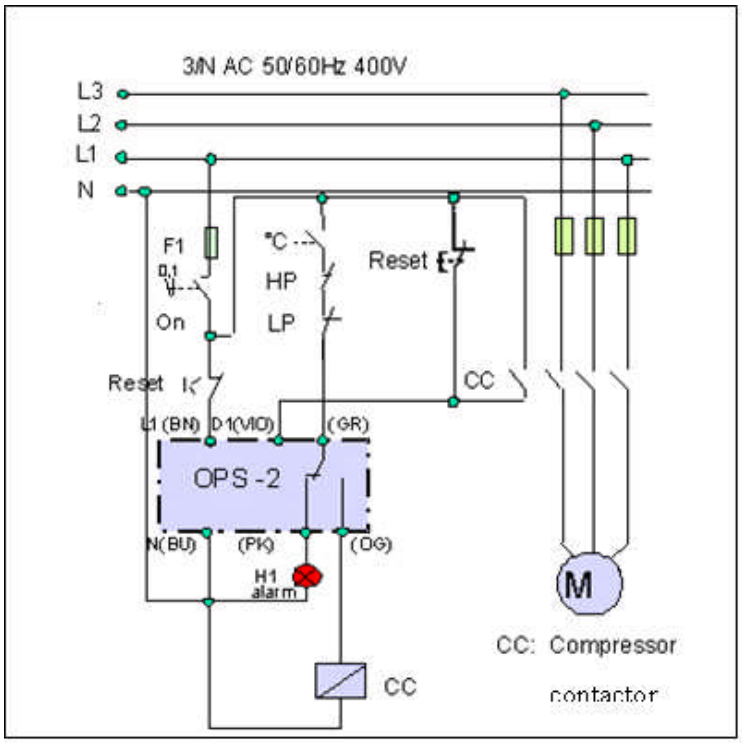
Power supply	115-230V AC, -15%... +10%, 3VA 50/60 Hz
Ambient temperature range	-30…..+ 70°C
Restart Relay after tripping	120 sec ± 5 sec
Start up delay	3 sec ± 1 sec
Differential Pressure	0.95 ± 0.15 bar
Connection cables	6 x AWG18 (O.75mm^2), L = 1m colour coded
Maximum pressure	30 bar
Refrigerant compatibility	Yes (brass)
Protection class according to EN 60529	IP 54
Reset	Manual
Weight	210 g
LED status: 2 x flashes at startup	Software version
LED status: 1 x flash after 2 x flashes above	Standby function
LED status: Continuous red light	No differential pressure
LED status: 10Hz flashing – 10 times per second	Malfunction: - Internal malfunction - Internal power supply is too low - Sensor not correctly mounted into mechanical part - Running signal ON, but relay OUT
LED status:1 Hz flashing – 1 time per second	Restart delay
LED status:LED off	Correct operation

3.2 Dimensions



3.3 Wiring diagram OPS2

Where there is a 5 wire cable connection between the electrical control cabinet and the compressor terminal box to the OPS module, the same wires can be applied to the OPS2 which will give the functions of an OPS1 module. To obtain use of all of the features of the OPS2 a 7 wire cable between electrical control cabinet and the compressor terminal box should be used. Wiring diagrams for both the OPS1 and OPS2 for both are shown on page 5. The wiring diagram below relates to an option using a 7 wire cable.



Wiring:

Brown (BN) = Power supply input
Violet (VIO) = Running signal from the compressor
Grey (GR) = Input changeover contact from the daisy chain
Orange (OG) = Output changeover contact linked to the compressor contactor
Pink (PK) = Output changeover contact linked to the alarm
Blue (BU) = Power supply output

4 Installation advice

The brass mechanical sensor component is standard on all DWM Semi-Hermetic compressors with an oil pump. If it has to be fitted follow the method below:

Wear the correct safety clothing and follow the correct Codes of Practice.
Isolate the compressor mechanically and electrically.
Evacuate the compressor.
Remove the blind plug from the oil pump housing cleaning the internal housing thread.
Applying the copper washer and O ring accordingly insert the brass mechanical sensor into the orifice left by the plug tightening using a socket wrench to a torque of approximately 75Nm.
Taking the OPS2 electronic switch screw it on to the mechanical sensor tightening it by hand to 10Nm. At the same time ensure the electrical leads are running downwards.
Make the electrical connections as per the wiring diagram for the OPS2.
Evacuate the compressor to extract any air contamination.
Set it up for normal operation confirming the tightness of the electronic switch.

5 Commissioning

Switch on the compressor and wait until stable operating conditions are obtained.
If insufficient oil differential pressure is built up during start up or during operation after the time delay expires, the output contact switches off and mechanically locks out. The power supply to the contactor coil is interrupted and the compressor is switched off. Restart is possible after reset and end of time delay of 120s.

6 Function testing

OPS2 setup as normal with fuses removed from power supply to compressor. The control circuit should still be live.

6.1 Correct assembly control test

Control power supply ON	Alarm contact switches to compressor contactor (GR-PK to GR-OG)
Remove electronic switch	Signal for incorrect assembly - LED Code (fast light 10Hz) - Shut-off and locked-out after 5s
Refit electronic switch to the mechanical sensor	
Reset Mains (5s)	Restart time delay 120s - LED Code 1Hz

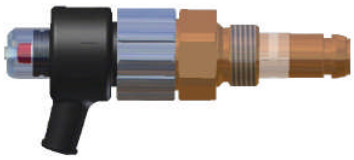
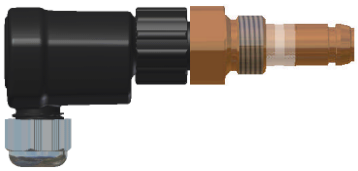
6.2 Brass mechanical sensor - Test differential pressure too low

Control power supply ON	
Cooling required - Thermostat closed circuit	Differential pressure too low - 120s time delay LED Code - Continuous red light
	After time delay, compressor contactor changes to alarm (GR-OG to GR-PK) - Fault signal
Reset Mains (5s)	Restart time delay 120s - LED code 1Hz

6.3 Running signal - Electronic switch is not connected to the brass mechanical sensor

Control power supply ON	LED Code (fast light 10Hz) Shut–off and locked-out after 5s
Fit the electronic switch to the mechanical sensor	
Push Remote Reset	Restart time delay 120s - LED Code 1Hz

7 OPS1 and OPS2 comparison

FUNCTION	 OPS1	 OPS2
Connecting cable AWG 18	√	√
UL / CE conformity	√	√
Status LED with fault blink code	√	√
Screw in part compatible (P/N 3110784)	√	√
Reset function	√	√
Anti tie down		√
Potential free change over relay		√
Dual voltage (115…230V)		√
Correct assembly (mechanical & electronic)		√
Remote Alarm function		√

Advantages:

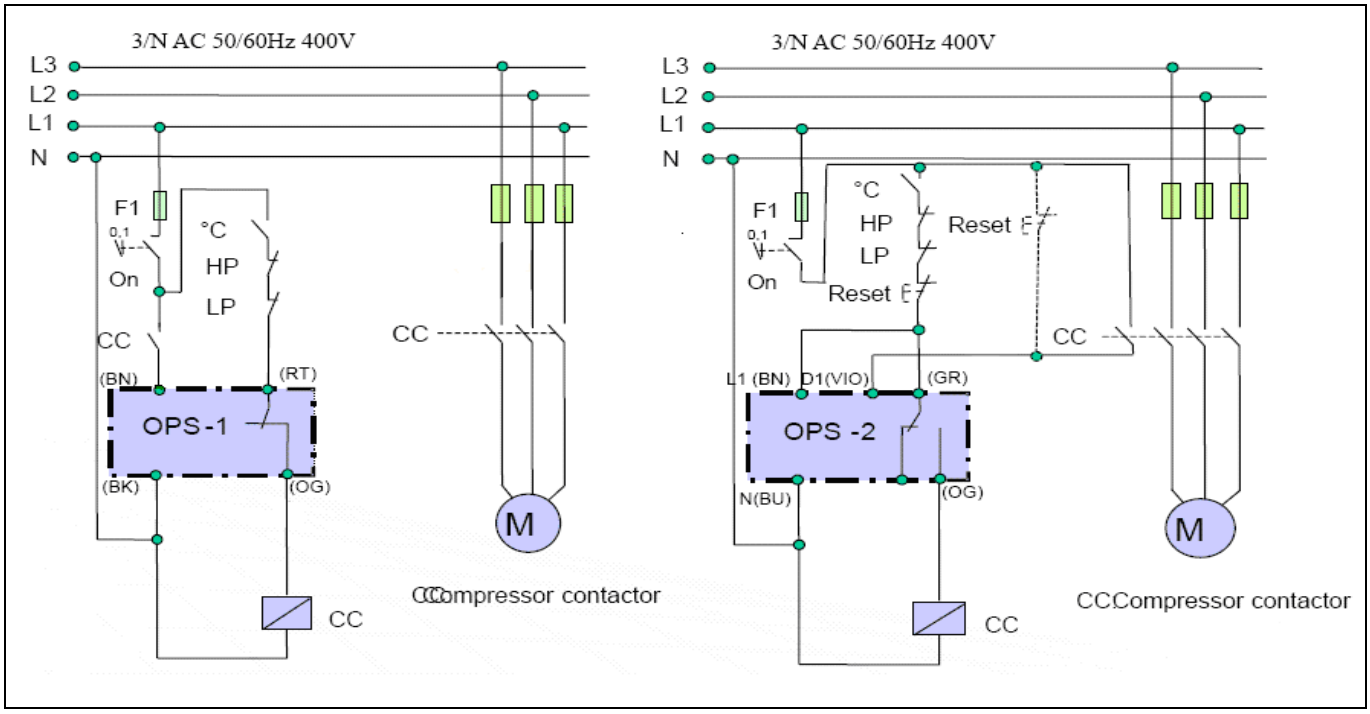
Easily mounted - screwed directly into the pump housing – time reduction
Hermetically sealed – no external capillaries required – no leakage possibility
Anti tie down – the reset button cannot be forcibly held pressed in position bypassing the function of the switch
Retrofit possible - the electrical switch can be replaced without refrigerant loss
Potential free change over relay – control with contactor and alarm possible
Microprocessor technology – latest technology

8 Wiring diagrams OPS1 and OPS2

The electrical part of the OPS-1 can be replaced by the OPS-2 module. Please see connection diagram proposal.

8.1 A 5 wire connecting cable between the electrical control cabinet and the compressor terminal box

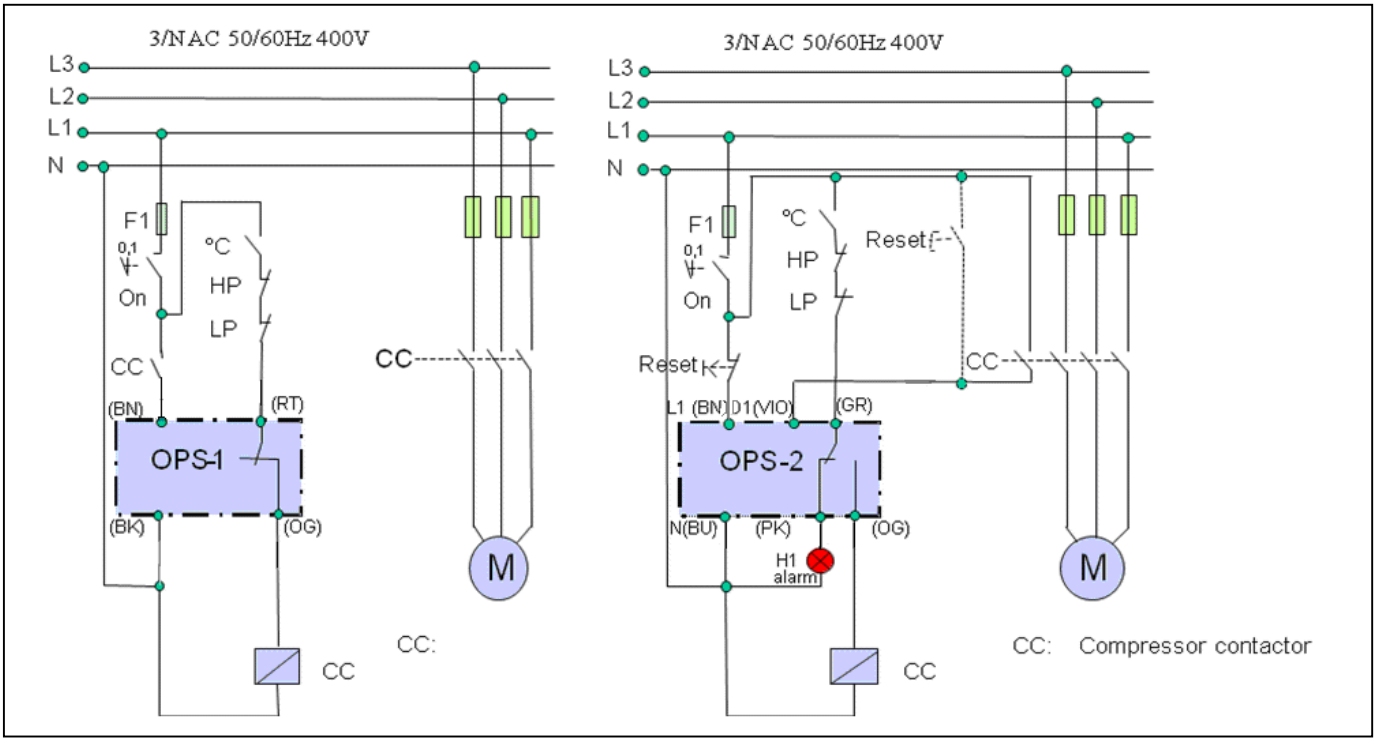
With a 5 wire connecting cable to the OPS module, you can realize the functions of the OPS1 with the OPS2.



8.2

8.3 A 7 wire connecting cable between the electrical control cabinet and the compressor terminal box

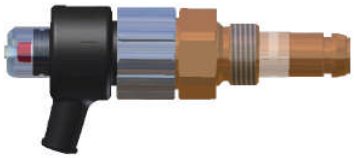
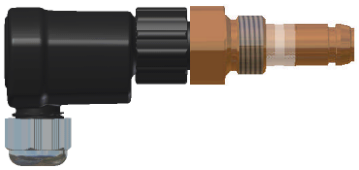
With a 7 wire connecting cable the full function range of the OPS2 can be used.



9 Replacement mechanical solution with OPS1 / OPS2

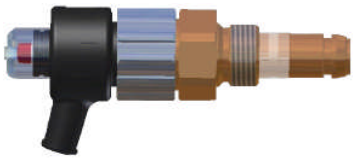
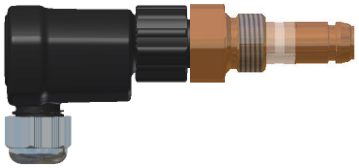
The mechanical solution can be replaced with the OPS1 or the OPS2 module, see connection diagram proposal.

9.1 Alco Controls FD113

	 OPS1	 OPS2
N	BK	BU
21	RT	GR + BN
24	--	PK
22	OG	OG
11	BN*	VIO**

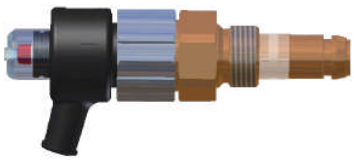
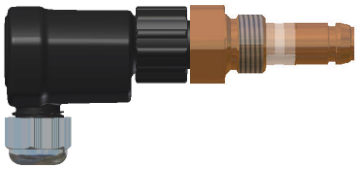
Alco FD113 connection diagram * two different versions **dual voltage version integrated w/o crankcase heater

9.2 Danfoss MP54

	 OPS1	 OPS2
0230	BK	BU
L	RT	GR + BN
0115	BK*	BU**
S	--	PK
M	OG	OG
T2	BN	VIO

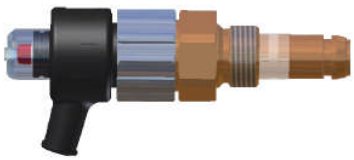
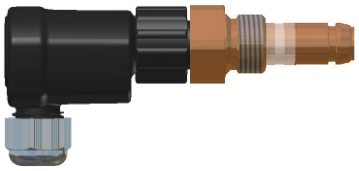
Danfoss MP54 connection diagram * two different versions **dual voltage version integrated

9.3 Penn (Johnson Controls) P45

	 OPS1	 OPS2
0230	BK	BU
L	RT	GR + BN
0115	BK*	BU**
A	--	PK
M	OG	OG
2	BN	VIO

Penn P45 connection diagram * two different versions **dual voltage version integrated w/o crankcase heater

9.4 Penn (Johnson Controls) P28

	 OPS1	 OPS2
0230	BK	BU
L	RT	GR + BN
0115	BK*	BU**
A	--	PK
M	OG	OG
2	BN	VIO

Penn P28 connection diagram * two different versions **dual voltage version integrated w/o crankcase heater