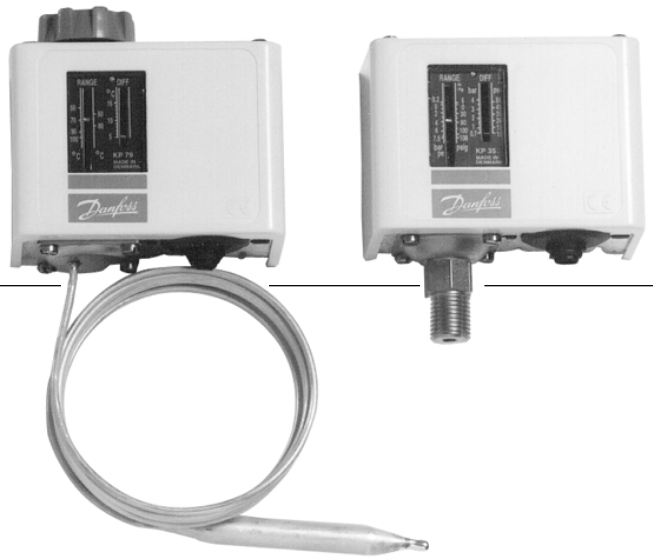
Pressure and temperature controls

Data sheet



Pressure controls and thermostats type KPI and KP

Contents

ISO 9001 quality approval

Danfoss A/S is certificated by BSI in accordance with international standard ISO 9001. This means that Danfoss fulfils the international standard in respect of product development, design, production and sale. BSI exercises continuous inspection to ensure that Danfoss observes the requirements of the standard and that Danfoss' own quality assurance system is maintained at the required level.

KP/KPI
illustrated is KPI 35
with top cover

Introduction

Danfoss KP/KPI pressure controls are used for regulating, monitoring and alarm systems in industry.
KP pressure controls are for gaseous media and air.
KPI pressure controls are suitable for plant in connection with liquid and gaseous media.

The pressure controls are fitted with a single-pole switch changeover (SPDT). The position of the switch depends on the setting of the pressure control and the pressure in the connector.

Features

- Wide regulating range
- Can be used for pumps and compressors
- Small dimensions.
  Space-saving – easy to install in panels
- Shock and impact resistant
- Ultra-short bounce times.
  Limits wear to an absolute minimum and increases reliability
- Electrical connection from front of unit.
  Makes rack mounting easier and also saves space
- Suitable for both alternating current and direct current
- Cable entry for 6-14 mm diameter cables
- Screwed cable entry makes rewiring easy. Standard screwed cable entry Pg 13.5 and Pg 16

Definitions

Range setting
The pressure range within which the unit will give a signal (contact changeover).

Differential
The difference between contact changeover on rising and falling pressure.
The differential is a condition for stable automatic plant operation.

Automatic reset
Units with automatic reset restart automatically after stop.
Min. reset units will restart after the pressure **has risen** by a value greater than that of the fixed differential.
Max. reset units will restart after the pressure **has fallen** by a value greater than that of the fixed differential

Permissible operating pressure
The highest permissible constant pressure or pressure variation the unit can be exposed to.

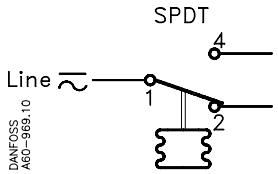
Ordering, IP 33/44 versions Pressure controls **type KP 35 and 36**

Setting range p_e [bar]	Differential [bar]	Permissible operating pressure p_B [bar]	Max. test pressure [bar]	Pressure connection	Contact Material	**Code no.**	Type
–0.2 → 7.5	0.7 → 4	17	22	G $^1/_4$ A	Ag	**060-1133**	KP 35
					Au	**060-5047**	
2 → 14	0.7 → 4	17	22	G $^1/_4$ A	Ag	**060-1108**	KP 36
					Au	**060-1137**	
4 → 12	0.5 → 1.6	17	22	G $^1/_4$ A	Ag	**060-1221**	KP 36
					Au	**060-1144**	

Ordering, IP 33/44 versions Pressure controls **type KPI 35 - 38**

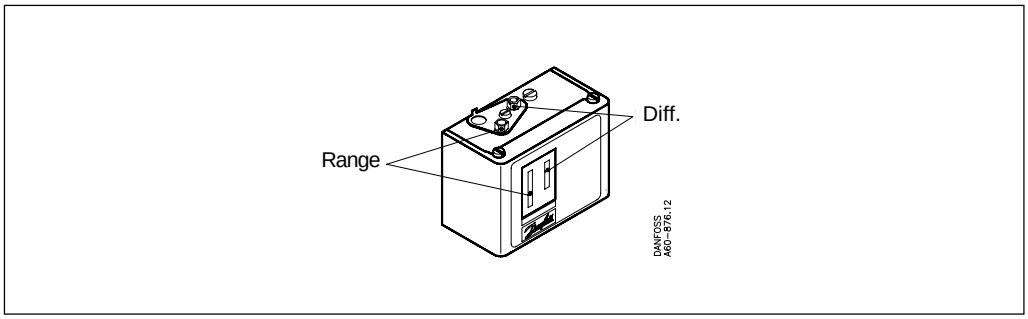
Setting range p_e [bar]	Differential [bar]	Permissible operating pressure p_B [bar]	Max. test pressure [bar]	Pressure connection	Contact Material	**Code no.**	Type
–0.2 → 8	0.4 → 1.5	18	18	G $^1/_4$ A	Ag	**060-1217**	KPI 35
					Au	**060-3164**	
–0.2 → 8	0.5 → 2	18	18	G $^1/_4$ A	Ag	**060-1219**	KPI 35
					Au	**060-3165**	
4 → 12	0.5 → 1.6	18	18	G $^1/_4$ A	Ag	**060-1189**	KPI 36
					Au	**060-1138**	
2 → 12	0.5 → 1.6	18	18	G $^1/_4$ A	Ag	**060-3169**	KPI 36
					Au	**060-3166**	
8 → 28	1.8 → 6	30	30	G $^1/_4$ A	Ag	**060-5081**	KPI 38
					Au	**060-3167**	

Technical data

Description		KP	KPI
Ambient temperature °C		–40 °C - +65 °C (for short periods up to +80 °C)	
Media temperature °C		–40 °C - +100 °C	
Media		Gaseous media and air	Air, oil, fresh water
Parts in contact with medium	Bellows	Tinbronze W. no. 2.1020 to DIN 17662	Tinbronze W. no. 2.1020 to DIN 17662
	Pressure connector	Free-cutting steel W. no. 1.0719 to DIN 1651	Brass W. no. 2.0401 to DIN 17660
Contact system		Single-pole changeover switch (SPDT) 	
Contact load, Ag contact set Contact material AgCdO		**Alternating current:** AC-1: 16 A, 400 V AC-3: 16 A, 400 V AC-15: 10 A, 400V **Direct current:** DC-13: 12 W, 220 V	**Alternating current:** AC-1: 10 A, 440 V AC-3: 6 A, 440 V AC-15: 4 A, 440V **Direct current:** DC-13: 12 W, 220 V
Contact load, Au contact set		See information page 6	
Enclosure, IP 33 grade		Unit must be mounted on a flat surface/a flat fitting and all unused holes covered.	
Enclosure, IP 44 grade		Mounted as IP 33 plus fitting of top cover, code no. **060-1097**	
Cable connection		Entry for 6-14 mm diameter cables	
Mounted on back plate/wall bracket		Vibration proof in the range 0 - 1000 Hz, 4 g (1 g = 9.81 m/s^2)	
Mounted on angle bracket		Not recommended in areas where vibrations occur	
Approvals		EN 60 947-4,5 RINA, Registro Italiano Navale MRS, Maritime Reg. of Shipping, Russia UL approved versions are available	EN 60 947-4,5

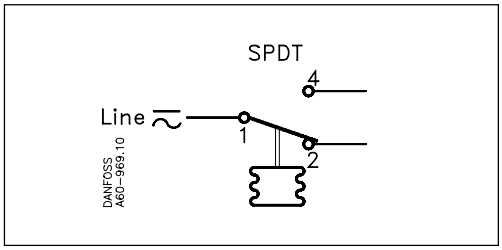
Setting

KP/KPI pressure controls with automatic reset:
Set the upper limit pressure on the range scale. Then set the lower limit pressure on the DIFF scale (the upper limit minus the differential).



Gold contacts

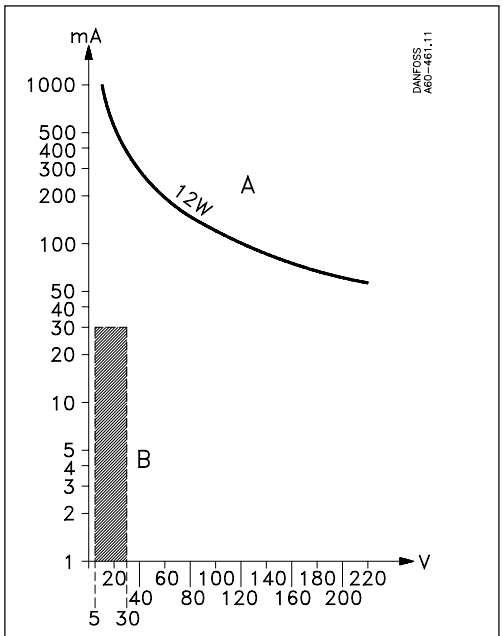
Contact system
Single-pole changeover switch (SPDT)
Contact material: Gold-plated silver



Contact load
Alternating current:

Ohmic load:	AC-1:	10 A, 440 V
Inductive load:	AC-3:	6 A, 440 V
	AC-15:	4 A, 440 V

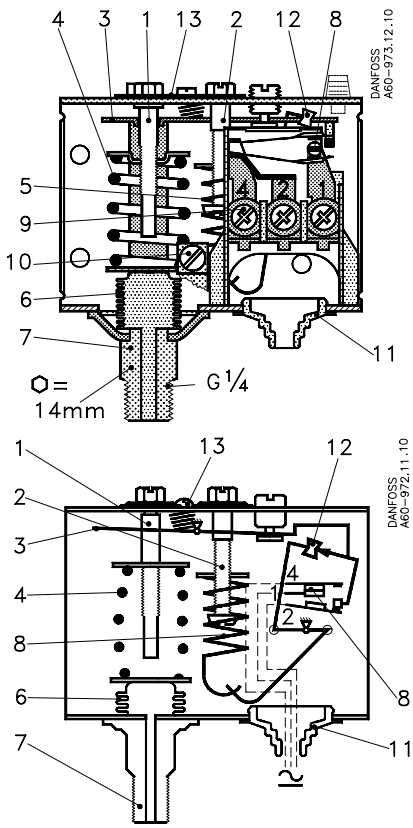
Direct current: DC-13 12 W, 220 V,



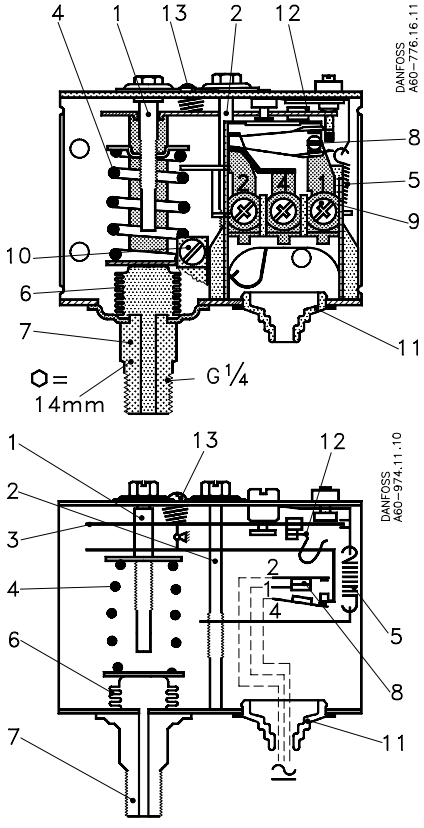
Curve A gives the maximum load.
Hatched area B: Acceptable load for the gold plating of the contact.

Design and function

*Drawing showing principle of **KP** pressure controls*



*Drawing showing principle of **KPI** pressure controls*



1. Setting spindle
2. Differential setting spindle
3. Main arm
4. Main spring
5. Differential spring
6. Bellows
7. Connector
8. Contact system
9. Connection terminals
10. Earth terminal
11. Cable entry
12. Omega spring (KPI)
12. Tumbler (KP)
13. Locking screw (KPI)
13. Locking plate (KP)

KP features

The contact system in KP pressure controls has a snap function. This means that the bellows is active only when the cut-in or cut-out value is reached.
The bellows is connected to the pressure of the controlled plant via the connector (7).

The design of KP pressure controls gives the following advantages:

- High contact load
- Ultra-short bounce times
- Vibration-proof in the range 0-1000 Hz, 4 g (1 g = 9.81 m/s^2)
- Long operating life
- High pulsation protection
- Small dimensions – Easy to mount in panels

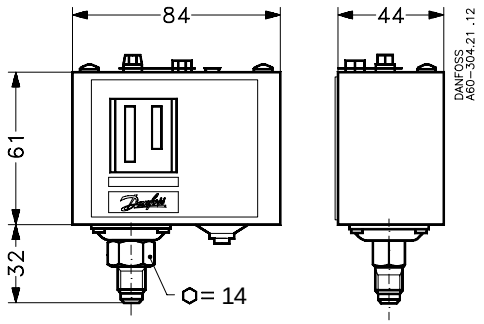
KPI features

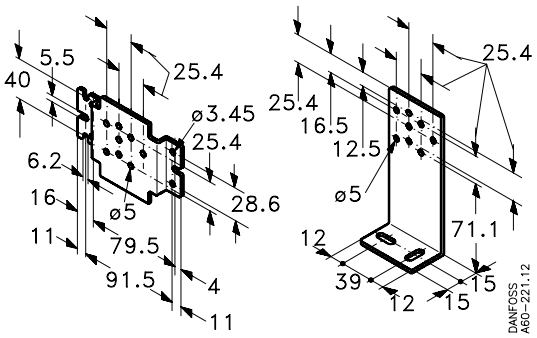
Danfoss KPI pressure controls are designed so that the bellows moves in the same proportion as the pressure change.
To ensure a snap function on contact change-over, an omega spring is located between bellows and contact system.

The design of KPI pressure controls gives the following advantages:

- High contact load
- Ultra-short bounce times
- Vibration-proof in the range 0-1000 Hz, 4 g (1 g = 9.81 m/s^2)
- Long operating life
- Can be used for both liquids and gases
- Small dimensions – Easy to mount in panels

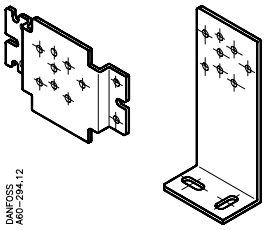
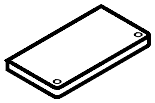
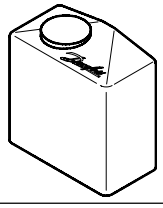
Dimensions and weights





Pressure controls KP 35, KP 36,
KPI 35, KPI 36 and KPI 38:
Weight approx. 0.3 kg

Accessories for KP/KPI pressure controls

Part	Symbol	Description	Total	**Code no.**
Brackets with mounting screws and washers		Wall bracket	10	**060-1055**
		Angle bracket	10	**060-1056**
		4-off screws M4×5 + 4-off washers	1	**060-1054**
Screwed cable entry		Screwed cable entry Pg 13.5 with special nut. For 6-14 mm cables. A standard Pg 16 screwed cable entry can be used for 8-16 mm cables.	5	**060-1059**
Sealing screw		For sealing the setting on KP	20	**060-1057**
Top cover		If a bracket is mounted on the backplate of the housing, the KP/KPI pressure control will have an IP 44 grade of enclosure. The cover covers the setting spindles.	10	**060-1097**
Protective cap		Protective cap for KP/KPI pressure controls. To protect the unit against rain and humidity. Grade of enclosure: IP 44 Material: Polyethylene Max. ambient temperature: 65 °C Min. ambient temperature: –40 °C	7	**060-0031**

KP 44

Introduction

Danfoss dual pressure switch KP 44 is designed for use as a pump guard to control and protect supply water pumps. The KP 44 pump guard combines the function of a pressure switch and a flow monitoring device.

The lefthand pressure bellows controls the pump pressure. The righthand bellows cuts out the pump if the pump suction pressure is too low. In this way the pump is protected from running dry and consequent bearing damage.

Features

- Wide regulating range
- Can be used for pumps and compressors
- Small dimensions.
  Space-saving – easy to install in panels
- Ultra-short bounce times.
  Limits wear to an absolute minimum and increases reliability
- Electrical connection from front of unit.
  Makes rack mounting easier and also saves space
- Suitable for both alternating current and direct current
- Cable entry for 6-14 mm diameter cables
- Screwed cable entry makes rewiring easy. Standard screwed cable entry Pg 13.5 and Pg 16
- Efficient protection of water pumps in case of water supply fails.

Definitions

Range setting
The pressure range within which the unit will give a signal (contact changeover).

Differential
The difference between contact changeover on rising and falling pressure.
The differential is a condition for stable automatic plant operation.

Automatic reset
Units with automatic reset restart automatically after stop.
Min. reset units will restart after the pressure **has risen** by a value greater than that of the fixed differential.
Max. reset units will restart after the pressure **has fallen** by a value greater than that of the fixed differential

Permissible operating pressure
The highest permissible constant pressure or pressure variation the unit can be exposed to.

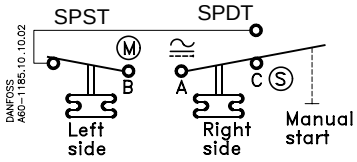
Ordering

Pressure control type KP 44, IP 22

Pressure range		Differential		Permissible operating pressure p_B	Max. test pressure	Pressure connection	Contact Material	**Code no.**
Control [bar]	Safety [bar]	Control [bar]	Safety [bar]	[bar]	[bar]			
2 - 12	0.5 - 6	0.7 - 4.0	1.0	LP/HP: 17	22	2 × G $^1/_4$ A	Ag	**060-0013**

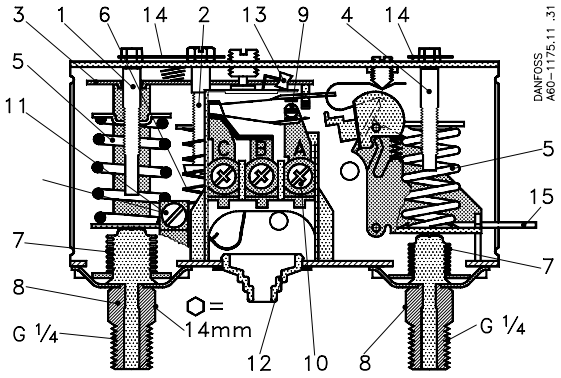
Technical data

Ambient temperature °C		–40 °C - +65 °C (for short periods up to +80 °C)	
Media temperature °C		Max +100 °C	
Media		Fresh water	
Parts in contact with medium	Bellows	Tinbronze	W. no. 2.1020 to DIN 17662
	Pressure connector	Free-cutting steel	W. no. 1.0719 to DIN 1651



Contact material AgCdO	**Alternating current:** AC-1: 16 A, 400 V AC-3: 16 A, 400 V AC-15: 10 A, 400V
Contact load, Ag contact set	**Direct current:** DC-13: 12 W, 220 V
Approvals	EN 60 947-4,-5
Cable connection	Entry for 6-14 mm diameter cables
Mounted on backplate or wall bracket	Vibration-proof in the range 0 - 1000 Hz, 4 g (1 g = 9.81 m/s^2)
Mounting on angle bracket	Not recommended for areas where vibration occurs

Design and function



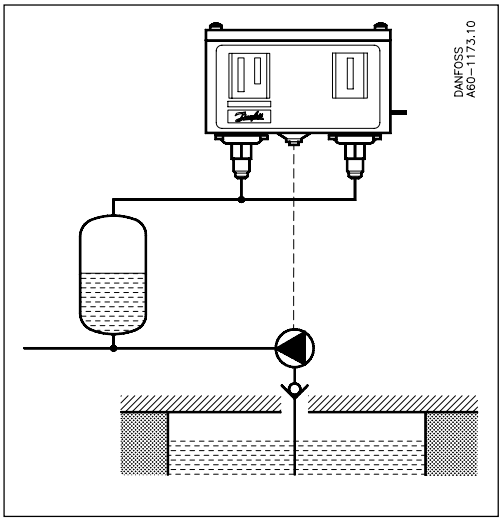
1. Lefthand pressure setting spindle
2. Differential setting spindle
3. Main arm
4. Righthand pressure setting spindle
5. Main spring
6. Differential spring
7. Bellows
8. Pressure connections
9. Switch
10. Terminal
11. Earth terminal
12. Cable entry
13. Tumbler
14. Locking plate
15. Impulse lever

The switch in the KP has a snap-action function, and the bellows moves only when the cut-in or cut-out value is reached.

Water supply from reservoir or well

If water is running short in the well or reservoir, the pump will no longer be able to increase the pressure to the cut-out value. Consequently the pump will keep running - perhaps without water. However, the KP 44 pump guard will stop the pump as soon as the righthand bellows pressure drops below the safety cut-out setting.

The pump can be started again by lifting the impulse lever. The pump will continue to operate when the impulse lever is released, provided that the righthand bellows pressure is higher than the safety cut-out setting plus a fixed differential of 1 bar. If this is not the case, the pump will cut-out again indicating insufficient water supply.

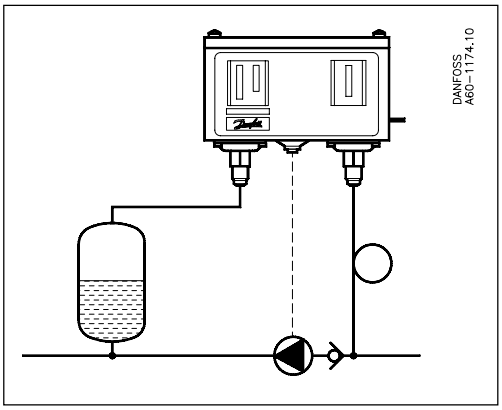


In a hydrophore system where water is pumped from a well or an open tank, both bellows are connected to a pressure outlet on the air side in the pump pressure line, if possible.

Pressurized water supply direct to pump

When water supply fails on the inlet side, the pump will no longer be able to boost the pressure to the cut-out value. Consequently the pump will keep running - perhaps without water.
However, the KP 44 pump guard will stop the pump as soon as the pressure in the pump suction line drops below the safety cut-out setting. The pump will automatically start again when the pump suction pressure has reached the level of 1 bar above the safety cut-out setting.

Automatic start-up will only take place if the righthand bellows is connected to the pump suction line. Air pockets should be avoided to prevent the pump from starting up on air pressure rise, without the presence of water.



In a booster system receiving pressurized water the righthand bellows is connected
- to the low pressure side of the pump for automatic start-up.
- to the high pressure side of the pump for manual start-up.

The lefthand bellows is always connected to the high pressure side of the pump.

Pressure settings

Safety cut-out setting
The righthand bellows will automatically cut-out the pump at the safety cut-out setpoint. Automatic start-up, if any, will take place when the pressure has reached the level of 1 bar above the setpoint. Manual cut-in is made by lifting the impulse lever and releasing it again when the pressure has increased by min. 1 bar.

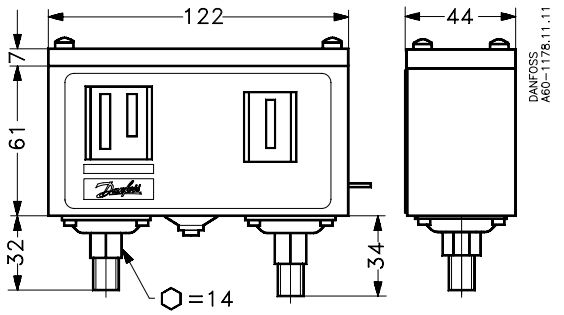
The safety cut-out setpoint is normally determined by the static pressure (the water column). However, in order to avoid disturbing signal interaction, care should be taken to ensure that the safety cut-out setting is at least 1.5 bar lower than the control pressure cut-in setting. See table with pressure setting examples below.

Required tap water pressure	≥ 2.3 bar	≥ 4.0 bar	≥ 5.0 bar	≥ 8.0 bar
Control pressure cut-out setting	3.0 bar	5.0 bar	8.0 bar	12 bar
Differential	0.7 bar	1.0 bar	3.0 bar	4.0 bar
Control pressure cut-in setting	2.3 bar	4.0 bar	5.0 bar	8.0 bar
Max. safety cut-out setting	0.8 bar	2.5 bar	3.5 bar	6.0* bar

** 6.0 bar is the normal max. setpoint*

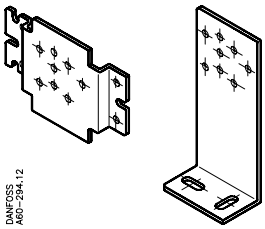
Control pressure settings
Control pressure cut-out setpoint is set on the lefthand pressure setting scale. The differential is set between 0.7 and 4 bar. The control pressure cut-in setting will be the cut-out control pressure less the differential.

Dimensions and weight



Weight approximately 0.5 kg

Accessories for KP 44 pressure controls

Part	Symbol	Description	Total	**Code no.**
Brackets with mounting screws and washers		Wall bracket	10	**060-1055**
		Angle bracket	10	**060-1056**
		4-off screws M4×5 + 4-off washers	1	**060-1054**
Screwed cable entry		Screwed cable entry Pg 13.5 with special nut. For 6-14 mm cables. A standard Pg 16 screwed cable entry can be used for 8-16 mm cables.	5	**060-1059**
Sealing screw		For sealing the setting	20	**060-1057**

Introduction

Danfoss KP thermostats are used for regulating, monitoring and alarm systems in industry.
KP thermostats are temperature-operated electric circuit breakers. The thermostats are fitted with a single-pole switch (SPDT)

The position of the switch depends on the thermostat setting and sensor temperature.
A KP thermostat can be connected and switch to single-phase alternating current motors of up to about 2 kW.

Features

- Wide regulating range
- Small dimensions
  Space-saving - easy to install in panels
- Ultra-short bounce time.
  Limits wear to an absolute minimum and increases reliability.
- Electrical connection at front of unit.
  Makes rack mounting easier and also saves space
- Suitable for both alternating current and direct current
- Cable entry for 6-14 mm diameter cables
- Screwed cable entry makes rewiring easy
- Standard screwed cable entry Pg 13.5 and Pg 16

Definitions

Differential
The difference between cut-in and cut-out temperature. The differential is a condition for stable automatic plant operation.

Mechanical differential (intrinsic differential)
The differential set on the differential spindle of the unit.

Working differential (thermal differential)
The differential on which the plant operates. The working differential is the sum of the mechanical differential and the differential arising from the time constant.

Reset
1. Manual reset.
Resets only when the reset button is pressed.
Min. reset units will restart after the temperature at the thermostat sensor **has risen** by a value greater than that of the fixed differential.
Max. reset units will restart after the temperature at the thermostat sensor **has fallen** by a value greater than that of the fixed differential

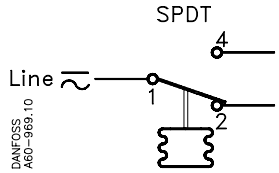
2. Automatic reset.
Units with automatic reset restart automatically after stop.

Ordering

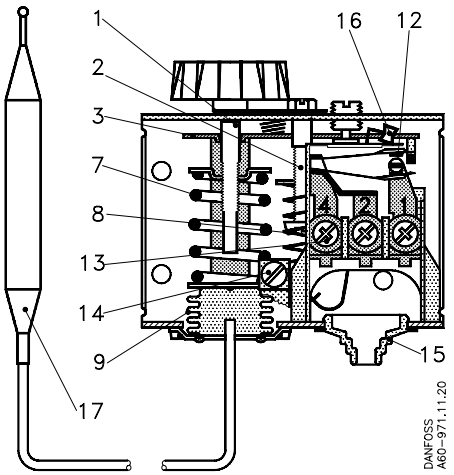
Thermostats **type KP 75 - KP 81**

Setting range p_e [bar]	Differential [bar]	Max. sensor temperature [°C]	Capillary tube length	Contact Material	**Code no.**	Type
0 → 40	3 → 10	80	Room sensor	Ag	**060L1212**	KP 75
				Au	**060L1171**	
30 → 90	5 → 15	150	2	Ag	**060L1184**	KP 78
				Au	**060L1213**	
50 → 100	5 → 15	150	2	Ag	**060L1126**	KP 79
				Au	**060L1214**	
50 → 100	5 → 15	150	5	Ag	**060L1169**	KP 79
				Au	**060L1220**	
0 → 150	7 → 20	200	2	Ag	**060L1125**	KP 81
				Au	**060L1215**	
80 → 150	7 → 20	200	3	Ag	**060L1183**	KP 81
				Au	**060L1216**	
80 → 150	7 → 20	200	5	Ag	**060L1170**	KP 81
				Au	**060L1217**	
80 → 150	8 (Max. reset)	200	2	Ag	**060L1155**	KP 81 (max. reset)
				Au	**060L1218**	

Technical data

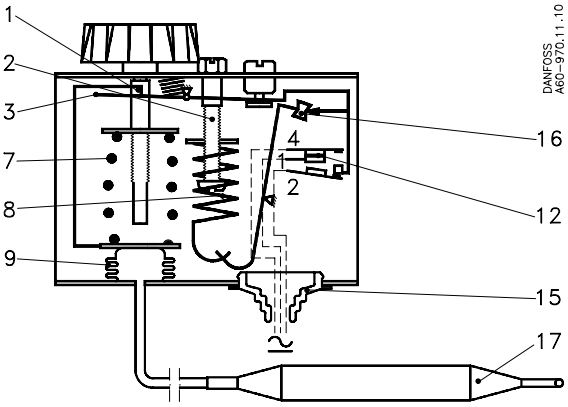
Ambient temperature °C	–40 °C - +65 °C (for short periods up to +80 °C)
Sensor material	Tinned copper Cu/Sn5
Contact system	 Single-pole changeover switch (SPDT
Contact load, Ag contact set Contact material AgCdO	**Alternating current** AC-1: 16 A,400 V AC-3: 16 A, 400 V AC-15: 10 A, 400 V **Direct current:** DC-13: 12 W, 220V
Contact load, Au contact set	See information page 16
Enclosure, IP 33 grade	Unit must be mounted on a flat surface/a flat fitting and all unused holes covered.
Enclosure, IP 44 grade	Mounted as IP 33 plus fitting of top cover, code no. **060-1097**
Approvals	EN 60 947-4,-5 RINA, Regristro Italiano Navale MRS, Maritime Reg. of Shipping, Russia Bureau Veritas Germanischer Lloyd, Germany DNV, Det norske Veritas, Norway Polski Rejestr Statkow, Poland UL approved version are available
Cable connection	Entry for 6-14 mm diameter cables
Mounted on backplate or wall bracket	Vibration-proof in the range 0 - 1000 Hz, 4 g (1 g = 9.81 m/s^2)
Mounted on angle bracket	Not recommended for areas where vibration occurs

Design and function

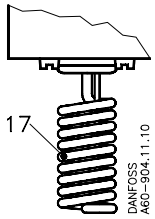


KP 78, KP 79, KP 81

1. Temperature setting spindle
2. Differential setting spindle
3. Main arm
7. Main spring
8. Differential spring
9. Bellows
12. Contact system
13. Connection terminals
14. Earth terminal
15. Cable entry
16. Tumbler
17. Sensor



Drawing showing principle of KP thermostats



KP 75 room sensor

The contact system in KP thermostats has a snap function. This means that the bellows is active only when the cut-in or cut-out value is reached.

The design of KP thermostats gives the following advantages:

- High contact load
- Ultra-short bounce times.
  Limits wear to an absolute minimum and increases reliability.
- Vibration-proof in the range 0-1000 Hz, 4 g (1 g = 9.81 m/s^2)
- Long operating life

Setting

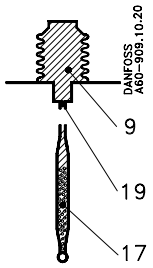
Thermostats with automatic reset
Set the upper limit temperature on the range scale. Then set the differential on the DIFF scale.
The temperature set on the range scale is also the temperature at which contact changeover re-occurs on rising temperature.
The contacts changeover when the temperature has fallen to a value lower than that set on the DIFF scale.
If at lower settings the plant will not start/stop, the reason might be that the differential has been set too high.

Thermostats with minimum reset
Set the temperature on the range scale. The differential setting is fixed.
Min. reset units will restart after the temperature at the thermostat sensor **has risen** by a value greater than that of the fixed differential.

Thermostats with maximum reset
Set the stop temperature on the range scale. The differential setting is fixed.
Max. reset units will restart after the temperature at the thermostat sensor **has fallen** by a value greater than that of the fixed differential

Charges

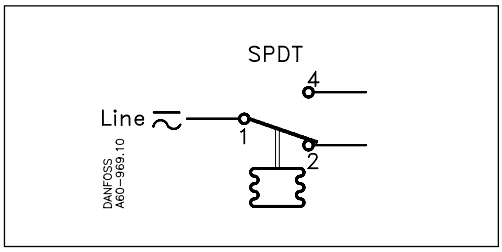
Absorption charge
The charge consists partly of a superheated gas and partly of a solid substance with a large absorption surface.
The solid substance is concentrated in the sensor (17), and consequently it is always the sensor that comprises the temperature-regulating part of the thermostatic element.
The sensor can be placed both warmer or colder than the thermostat housing and capillary tube. However, placing it in an ambient temperature higher or lower than +20 °C can affect the accuracy of the scale.



9. Bellows
19. Capillary tube
17. Sensor

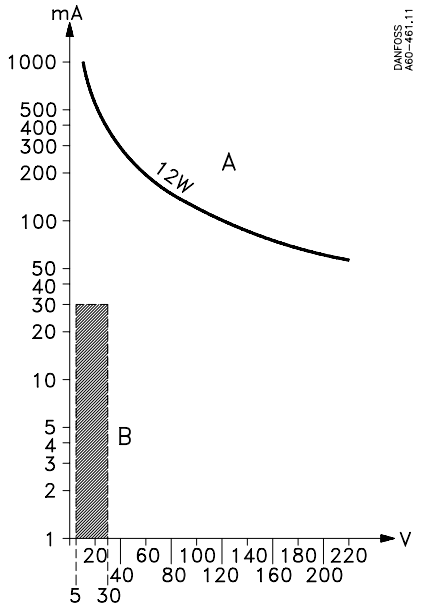
Gold contacts

Contact system
Single-pole changeover switch (SPDT)
Contact material: Gold-plated silver



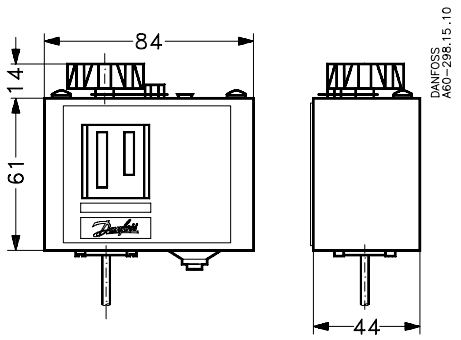
Contact load
Alternating current:

Ohmic load:	AC-1:	10 A, 440 V
Inductive load:	AC-3:	6 A, 440 V
	AC-15:	4 A, 440 V
Direct current:	DC-13:	12 W, 220 V

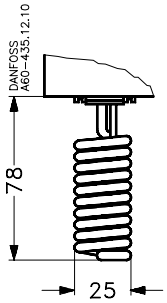


Curve A gives the maximum load.
Hatched area B: Acceptable load for the gold plating of the contact.

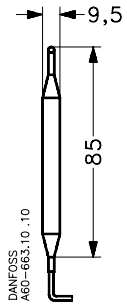
Dimensions and weight



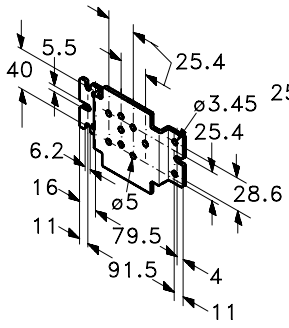
Thermostats KP 75, KP 78, KP 79, KP 81
Weight approx. 0.4 kg



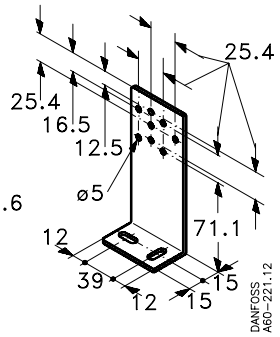
KP 75
Sensor: Tinned copper Cu/Sn 5



KP 78, 79, 81
Sensor: Tinned copper Cu/Sn 5

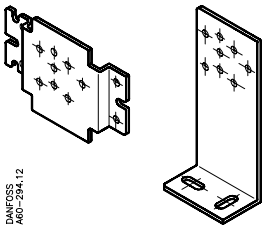
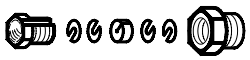
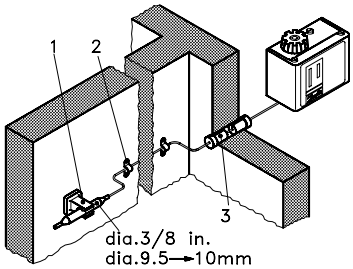
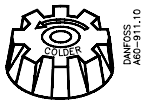
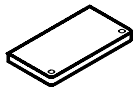
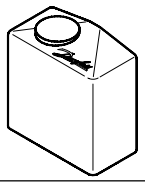
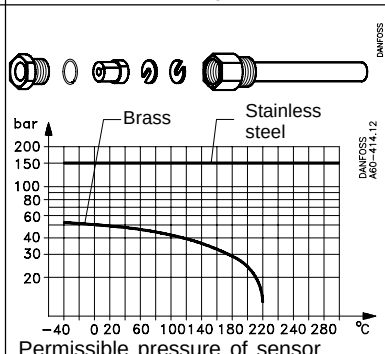
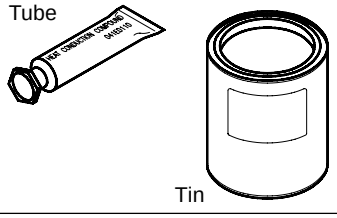


Wall bracket



Angle bracket

Accessories for KP thermostats

Part	Symbol	Description	Total	Code no.
Brackets with mounting screws and washers		Wall bracket for KP	10	**060-1055**
		Angle bracket for KP	10	**060-1056**
		4-off screws M4×5 + 4-off washers	1	**060-1054**
Capillary tube gland		Oil-resistant rubber gasket for max. 110 °C and 90 bar	5	**017-4220**
Sensor holder		For thermostats with ∅9.5 mm sensors	1	**017-4157**
		Rubber plug for wall entry ∅13x20 mm	1 set	**017-5392**
		Sensor holder for wall mounting with four capillary tub clips and 9-off 12 mm pins	20	**017-4201**
Knob			20	**060-1063**
Screwed cable entry		Pg 13.5 with special nut. For 6-14 mm diameter cables. A standard Pg 16 cable entry can be used for 8 -16 mm diameter cables.	5	**060-1059**
Sealing screw		For sealing the setting on KP	20	**060-1057**
Top cover		If a bracket is mounted on the backplate of the housing, the KP thermostats will have an IP 44 grade of enclosure. The cover covers the setting spindles.	10	**060-1097**
Protective cap		Protective cap for KP thermostats. To protect the unit against rain and humidity. Grade of enclosure: IP 44 Material: Polyethylene Max. ambient temperature: 65 °C Min. ambient temperature: –40 °C	7	**060-0031**
Sensor pocket	 Permissible pressure of sensor pipe medium	For all KP thermostats with cylindrical remote sensor. Sensor pocket, gasket and union for screwing into G ½ connectors welded onto tubes, containers, etc.		
		Int. diameter 9.6 mm, insert depth 112 mm (brass). Ext. diameter 11 mm	1	**993N3568**
		Int. diameter 9.6 mm, insert depth 112 mm (st. 18/8). Ext. diameter 11 mm	1	**993N3615**
		Int. diameter 9.6 mm, insert depth 465 mm (brass). Ext. diameter 11 mm	1	**017-4216**
		Media temperature for sensor: 250 °C This temperature can be increased by applying a different gasket material		
Heat-conductive aluminium paste		For KP and RT thermostats with sensor mounted in a sensor pocket. Temperature range: –20 - +150 °C (short-lived +220 °C)		
		Tube with 5 g aluminium paste	1	**041E0110**
		Tin with 750 g aluminium paste	1	**041E0111**

IP 33/44 enclosure

IP 33 grade of enclosure is obtained by mounting the unit on a flat surface or a flat fitting and then covering all unused holes. IP 44 grade of enclosure is obtained by mounting the unit as for IP 33 grade of enclosure and then fitting a top cover, code no. **060-1097.**
Alternatively the unit can be mounted in a polyethylene protective cap, type no. **060-0031.**

IP testing

An IP grade of enclosure certification is obtained when the product has been submitted to an IP test. The IP classification contains two digits, the first IP digit denoting the degree of enclosure against foreign bodies, the second digit denoting the degree of watertightness. The corresponding tests are as follows:

IP 1st digit	**Foreign body Test**	IP 2nd digit	**Watertightness Test** [1])
0	No test	0	No test
1	A ball of ∅50 mm cannot enter	1	Vertically falling drops, dripping water
2	A ball of ∅12.5 mm and a test probe of ∅12 mm, L = 80 mm, cannot be inserted	2	Vertically (±15°) falling drops
3	A rod of ∅2.5 mm cannot enter	3	Water sprays ±60° from vertical
4	A wire of ∅1 mm cannot enter	4	Water sprays from all directions
5	As 4 + Dust in amounts that might cause damage cannot enter	5	Water jets from all directions, 12 l/min
6	As 4 + Dust cannot enter	6	Water jets from all directions, 100 l/min
		7	Immersion in 1 m water
		8	Subject to agreement

[1]) After all these tests, water in amounts that might cause damage must not have entered the enclosure and not have collected in electrically conductive parts or cable entries.

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