Technical brochure

Temperature controls, Type KPU

KPU temperature controls are temperature-controlled electrical switches, which are applied for regulation and safety monitoring of refrigeration and air conditioning systems.

KPU sensors are available with vapor charge or with adsorption charge.Temperature controls with adsorption charge are widely used to give frost protection, while vapor charged sensors are used where small differential is required.

All KPU temperature controls have a single pole double throw (SPDT) contact system. The position of the switch depends on the thermostat setting and the bulb temperature.

Features

- Wide temperature regulating range allows use in low, medium, and high temperature refrigeration application and air-conditioning systems
- Snap-action electrical contacts minimize chatter, bounce and wear, and ensure long-term electrical and mechanical reliability
- Fingertip manual trip feature allows contact function testing without tools
- Easily replaces other manufacturers' temperature controls
- Ultra-short bounce time
- Long operating lifetime
- Vibration and shock resistant
- SPDT switch allows NC or NO function option as well as alarm capability
- Automatic and manual reset versions available

Approvals

UL listed for USA and Canada, file E31024

Technical data

Ambient temperature
−40 to 122 °F , 175 °F up to 2 hours.

Cable entry
7/8" cable entry for ½" male pipe thread connection (conduit boss)

Maximum wire dimension
10 AWG

Enclosure
NEMA 1

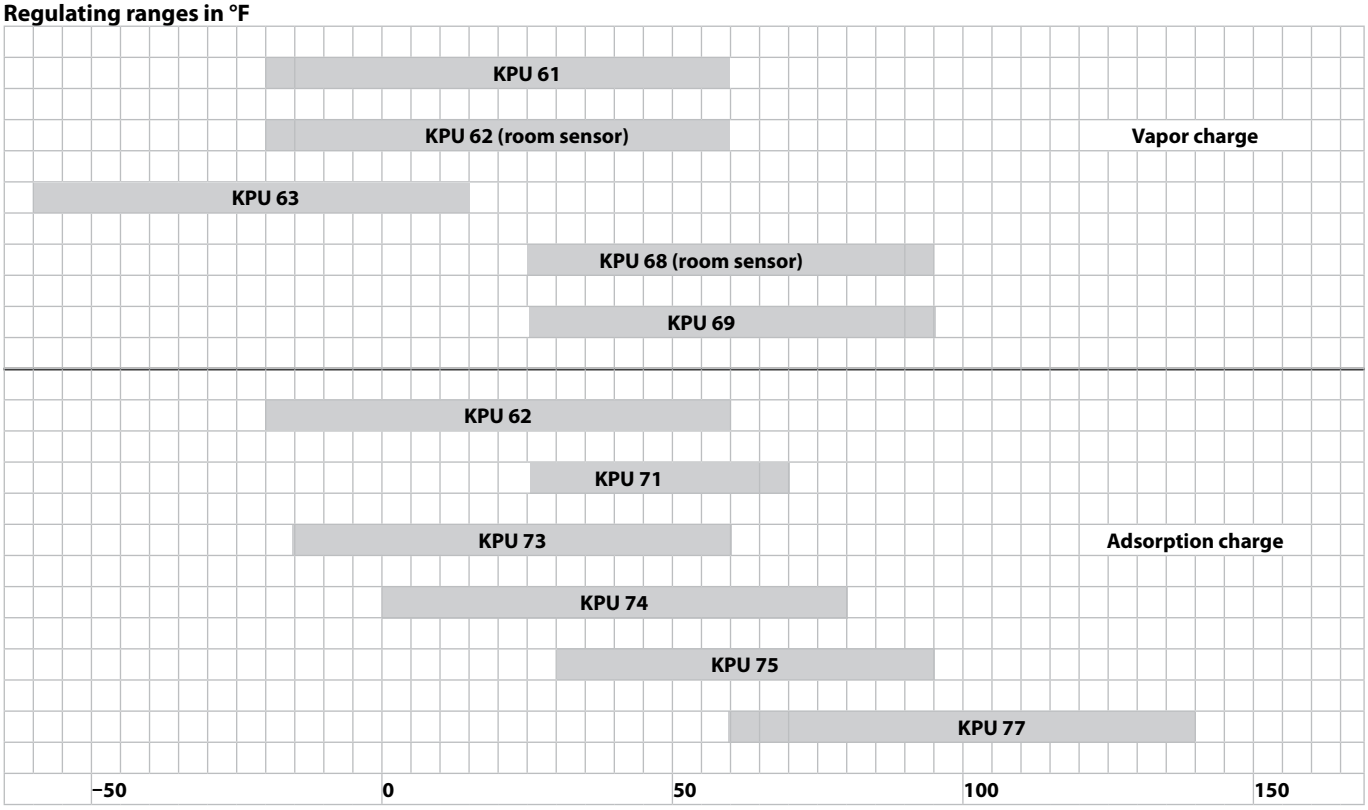
Switch
SPDT - single pole double throw

Contact load

NAM rating
Alternating current
FLA = 24 A @ 120 VAC
24 A @ 240 VAC
LRA = 144 A @ 120 VAC
144 A @ 240 VAC
LRA is rated for make only
Direct current
12 W pilot duty @ 240 VDC

European rating (acc. to EN 60947)
Alternating current
AC1: 16 A, 400 VA
AC3: 16 A, 400 VA
Direct current
DC 13: 12 W, 220 V control current

Regulating ranges in °F



Ordering

Charge	Type	Bulb type	Range [°F]	Differential at lowest temperature setting [°F]	Differential at highest temperature setting [°F]	Max. bulb temp. [°F]	Reset function	Cpaillary tube length [in..]	**Code no.**
Vapour (1)	KPU 61	A	−20 → 60	8 → 40	2.5 → 13	250	auto.	80	**060L5201**
	KPU 61	A	−20 → 60	8 → 40	2.5 → 13		auto.	200	**060L5202**
	KPU 61	B	−20 → 60	8 → 40	2.5 → 13		auto.	80	**060L5203**
	KPU 61B	B	−20 → 60	fixed 10	fixed 3.5		man. (3)	80	**060L5204**
	KPU 61B	B	−20 → 60	fixed 10	fixed 3.5		man. (3)	200	**060L5205**
	KPU 62	C1	−20 → 60	8 → 40	2.5 → 13		auto.	room sensor	**060L5206**
	KPU 61	B	−20 → 60	8 → 40	2.5 → 13		auto. (4)	80	**060L5210**
	KPU 63	A	−60 → 15	18 → 125	5 → 15		auto.	80	**060L5213**
	KPU 63	B	−60 → 15	18 → 125	5 → 15		auto.	80	**060L5214**
	KPU 68	C1	25 → 95	8 → 45	3 → 13		auto.	room sensor	**060L5215**
	KPU 69	B	25 → 95	8 → 45	3 → 13		auto.	80	**060L5217**
Adsorption (2)	KPU 62	C2	−20 → 60	9 → 36	3 → 14	175	auto. (4)	room sensor	**060L5207**
	KPU 73	E3	−15 → 60	6 → 18	5 → 50		auto.	80	**060L5208**
	KPU 73	E1	−15 → 60	22 → 125	15 → 45		auto.		**060L5209**
	KPU 73B	E3	−15 → 60	fixed 6	fixed 6		man. (3)		**060L5211**
	KPU 73	D	−15 → 60	6 → 35	5 → 32		auto.		**060L5212**
	KPU 71	E2	25 → 70	5.5 to 18	4 → 16		auto.		**060L5218**
	KPU 71B	E2	25 → 70	fixed 5	fixed 5		man. (3)		**060L5216**
	KPU 74	E1	0 → 80	9 → 35	9 → 35		auto.		**060L5219**
	KPU 74B	E1	0 → 80	fixed 10	fixed 10		man. (3)		**060L5220**
	KPU 75	F	30 → 95	6 → 29	4.5 → 21.5	230	auto.		**060L5221**
	KPU 75	E2	30 → 95	6 → 30	4.5 → 22	230	auto.		**060L5222**
	KPU 77	E3	60 → 140	6 → 18	6.3 → 18	265	auto.		**060L5223**

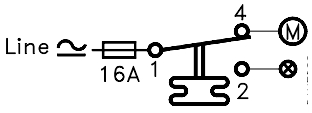
(1) Bulb must be installed in colder position than thermostat housing and capillary tube

(2) Bulb can be placed warmer or colder than thermostat housing and capillary tube, but variations from + 70 °F ambient temperature will influence the scale accuracy

(3) Manual minimum reset. Marked with letter B. Fixed differential. These controls have no hand knob.

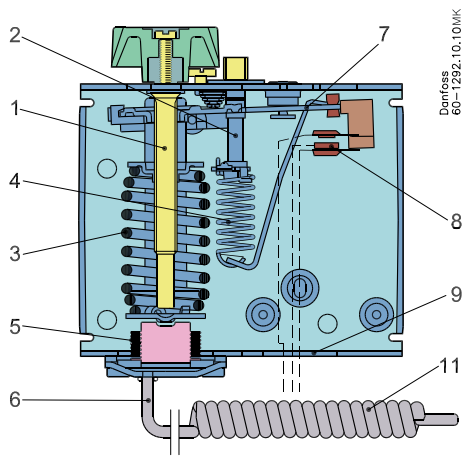
(4) With manual switch and top plate

Contact system

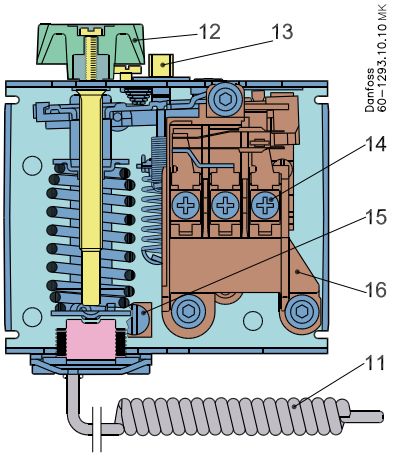
Switch type - single pole double throw	Switch action	Applicaton
SPDT 	1. Terminals 1-4 close high and open low Terminals 1-2 can be used as low temperature alarm 2. Terminals 1-2 open high and close low Terminals 1-4 can be used as high temperature alarm	1. Low temperature cut-out 2. High temperature cut-out

Design function

1. Temperature setting spindle
2. Differential setting spindle
3. Main spring
4. Differential spring
5. Bellows
6. Capillary tube
7. Main arm
8. Switch
9. Cable entry
11. Temperature sensor
12. Setting knob
13. Differential setting screw
14. Control terminals
15. Ground terminal
16. Contact housing



Key sketch of KPU themperature control



KPU themperature control without front cover

Switches in KPU controls have a snap-action function, triggered when cut-in or cut-out temperature is reached. Snap-action creates a number of advantages:

- high contact load capability
- ultra-short bounce time
- long mechanical and electrical life
- high resistance to pulsation and vibration
- vibration resistance up to 4g in range 0 - 1000 Hz
- long mechanical and electrical service life

Terminology

Set point
A predetermined value to which a control is adjusted and at which it performs its intended function.

Differential
The differential is the difference between the cut-in and cut-out temperatures. The differential is necessary for satisfactory automatic operation of the controlled system.

Mechanical differential (intrinsic differential)
The mechanical differential is the differential set by the differential spindle.

Snap function
A specific contact force is maintained until snap is initiated. The time over which contact force reaches zero is a few milliseconds; therefore, contact bounce due to vibration, for example, cannot occur at cut-out. The snap-action contact system will continue to function even when micro-welds are created between the contacts during cut-in. The force created to separate the contacts is strong enough to instantly shear off all contact surface welds that may have been created by cut-in action. These design features ensure that the cut-out setting of the KPU control remains highly accurate and completely independent of the magnitude of the current load.

Reset
1. Manual reset:
A unit with manual reset can only be restored to operational mode by activating the external reset button.
On min. reset units the set value is equal to the cut-out value for falling temperature.
On max. reset units the set value is equal to cut-out value for rising temperature.

2. Automatic reset
A unit with automatic reset is restored to operational mode automatically.

FLA - Motor Full Load Amperes
FLA is the largest current that a motor or other device is designed to carry at rated voltage and other specific conditions. Also often called current at rated conditions.

LRA - Locked Rotor Amperes
LRA is the largest current that the motor is designed to carry with shaft or rotor immobilized.

Setting and resets

Temperature controls with automatic reset

Set the cut-in temperature on the "RANGE" scale. Set the differential on the "DIFF" scale. The controlled system will start at the temperature set on the RANGE scale and will be stopped when the temperature falls the number of degrees set on the DIFF scale.

Please note that the differential scale is only a reference. The exact value of distances on the scale depends on where in its range the control cut-in is set. Use the differential scale as a guide, and if precise function is required, establish the differential setting by comparing function with an accurate thermometer in the controlled zone.

If the compressor does not stop at the desired low temperature, check the differential to ensure that it is not set at too high a value.

The thermostat automatically resets and the compressor starts once the temperature rises above the range scale setting.

Temperature controls with manual minimum reset

Set the cut-out temperature on the range scale. The differential is fixed.

Restart the compressor by pressing the reset button after the temperature of the sensor rises to a value equal to the range scale setting plus the fixed differential.

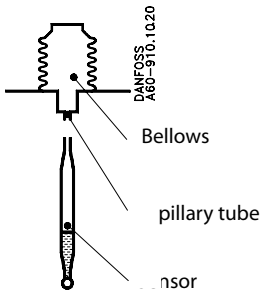
Temperature controls with manual maximum reset

Set the cut-out temperature on the range scale. The differential is fixed.

Restart the compressor by pressing the reset button after the temperature of the sensor falls to a value equal to the range scale setting minus the fixed differential.

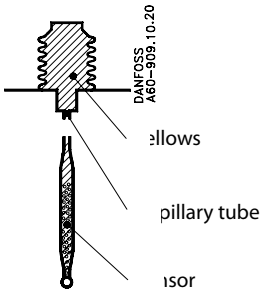
Charges

1. Vapor charge



The sensor contains saturated vapor with a small quantity of liquid. When temperature rises, liquid evaporates, and pressure inside the sensor increases.
After all of the liquid has evaporated, additional heat results in only a small pressure rise inside the element. Vapor charges are appropriate for low temperature applications and others where the bellows must be protected from deformation by ambient temperature. The sensing element must be colder than the bellows at all times so that condensation of evaporated fluid occurs in the element only, and not in the bellows.
As long as the sensor is the coldest part of the thermostat, ambient temperature has no effect on regulating accuracy.

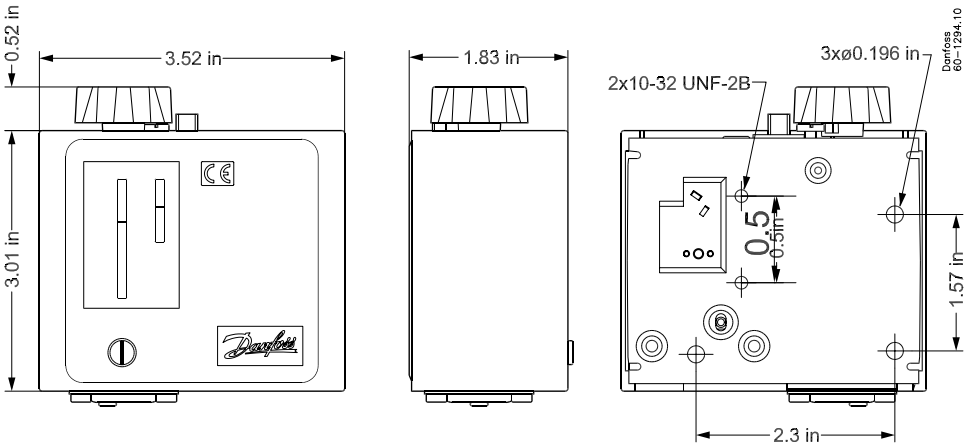
2. Adsorption charge



Sensors with adsorption charges contain a superheated gas together with a solid having a large adsorption surface. The sensor can be placed in zones that are warmer or colder than the control housing and capillary tube, but variations of more than +70°F may influence scale accuracy.

Dimensions of KPU without capillary tube

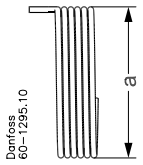
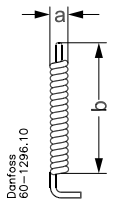
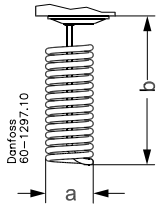
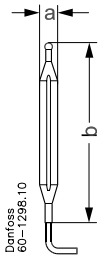
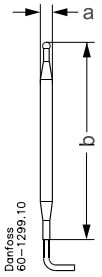
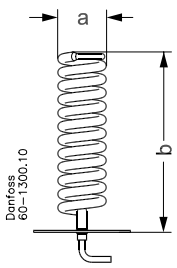
weight of KPU without capillary tube ~ 0.77 lb
weight of 80" cap. tube ~ 0.17 lb
weight of 200" cap tube ~ 0.43 lb



All controls are supplied with universal mounting bracket and mounting screws as standard accessory.

Approximate weight of the bracket and mounting screws: 0.615 lb

Temperature controls sensor types

A		Straight capillary tube Sensing length: 15″ a = 3 1/8″	KPU 61 KPU 63 Vapor charge
B		Remote air coil a = 3/8″ b = 2 3/4″	KPU 61 KPU 69 Vapor charge
C		Room sensor C1 a = 1½″ b = 1 1/4″ Room sensor C2 a = 1″ b = 3″	KPU 62 KPU 68 Vapor charge KPU 62 Adsorption charge
D		Double contact remote bulb a = 3/8″ b = 3 3/8″ NOTE! Can not be used in sensor pocket	KPU 73 Adsorption charge
E		Remote bulb E1 a = 1/4 b = 3 3/4″ E2 a = 3/8″ b = 4½ ″ E3 a = 3/8 ″, b = 3 3/8 ″	KPU 73, KPU 74 Adsorption charge KPU 71, KPU 75 Adsorption charge KPU 73, KPU 77 Adsorption charge
F		Remote duct coil a = 1″ b = 3 5/8″	KPU 75 Adsorption charge