Data sheet

Electronically controlled temperature regulator type KVQ and EKS 67

Introduction

The KVQ and EKS 67 is an electronic temperature controlled evaporating pressure regulator that regulates the temperature of the medium in systems where precise temperature regulation is demanded.

The KVQ and EKS 67 controls the temperature of the medium so that the required temperature is maintained to an accuracy of ±0.5°C or less.

Features

Apart from its normal regulating function, the KVQ and EKS 67 electronic system contains a defrost function and an alarm function. It also has facilities for a series of supplementary functions:

- *Remote setting of reference temperature*
- *Temperature readout on external display*
- *Temperature diagnosis*
- *Evaporating pressure limiter*

Defrost, external alarm, and supplementary functions require the connection of extra equipment.

Approvals

UL listed, file SA7200

CSA certified, LR 92682

Technical data

Valve / Actuator type KVQ

Regulating range	p_e = 0 → 7 bar		
Refrigerent temperature in regulating range	Refrigerant	p_e = 0 bar (p_e)	p_e = 7 bar (p_e)
	R 22	−41°C	15°C
	R 134a	−30°C	32.5°C
	R 404A	−47°C	10°C
	R 407C	−35°C	17°C
	R 507	−47°C	8°C
Refrigerants	CFC, HCFC and HFC		
Ambient temperature	During operation: −45 → +40°C During transport: −50 → +70°C		
Max. working pressure PB	21.5 bar		
Max. test pressure p'	28 bar		
Power supply	24 V pulsating a.c. from EKS 67 regulator		
Max. consumption	30 VA / 24 V a.c.		
Enclosure	IP 54 acc. to IEC 529		
Cable entry	Pg 13.5		

During forced closing by hot-gas defrosting

Max. closing pressure	17.5 bar
Max. hot gas temperature	120°C

Technical data *(continued)*

Regulator EKS 67

Regulating range	−35 → +25°C REF The unit regulates with an accuracy ≤ ±0,5°C
Functions	1. *LIMIT (alarm limit):* 1 → 5°C ±0.5°C on both sides of REF 2. *DELAY (alarm delay):* 15 → 120 min. 3. *DEFROST (defrost stop):* 0 → 25°C
Regulating principle	PI, proportional, integral.
Regulation parameters	Proportional amplification: K_p = 2 → 6 Factory setting: K_p = 4 Integral time: T_n = 2 → 6 min. Factory setting: T_n = 4 min.
Ambient temperature	−20°C → +40°C (for plastic case) −20°C → +45°C (for silumin case) −20°C → +50°C (for panel mounting)
Ambient temperature at transport	−40°C → +60°C
Supply voltage	24 V a.c. +10% / −15%, 50/60 Hz Max. consumption: 2 VA / 24 V a.c.
Alarm	Alarm is indicated by ON/ALARM lamp being out Alarm output voltage falls to 0 V a.c.
Cable entry	Pg 9 (for plastic case) Pg 13,5 (for silumin case)
Enclosure	IP 41 (for plastic case) IP 54 (for silumin case)

Sensor type Pt 1000 ohm
Application range, enclosure

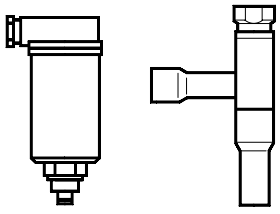
Sensor type	**Code no.**	Application range	Enclosure
Pt 1000 ohm surface sensor, type AKS 21A	**084N2007**	−70°C → +160°C	IP 67
Pt 1000 ohm media sensor, type AKS 21M	**084N2003**	−70°C → +160°C	IP 67
Pt 1000 ohm immersion sensor with conn. box, type AKS 21W	**084N2016**	−70°C → +120°C	IP 56
Pt 1000 ohm immersion sensor, type AKS 21W	**084N2017**	−70°C → +160°C	IP 56

Time constants

Sensor type	Time constant max. sec.	Object of measurement
AKS 21A	14	Fixed on copper tube
AKS 21W	18	Water flow
AKS 21M	35	Air at velocity of 4 m / sec.
AKS 21M	6	Water flow

Cable cross section	0.2 mm^2

Ordering



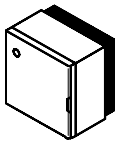
Valve / Actuator type KVQ

Type	Rated capacity [1] kW				Valve			Actuator
					Connection		**Code no.**	**Code no.**
	R 22	R 134a	R 404A/R 507	R 407C	mm	in.		
KVQ 15	8.0	6.0	7.2	7.3	16	5/8	**034L0117**	**034L0105**
KVQ 22	8.0	6.0	7.2	7.3	22	7/8	**034L0114**	
KVQ 28	18.9	14.1	16.9	17.2	28		**034L0119**	**034L0106**
						1 1/8	**034L0115**	
KVQ 35	18.9	14.1	16.9	17.2	35	1 3/8	**034L0120**	

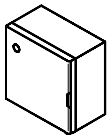
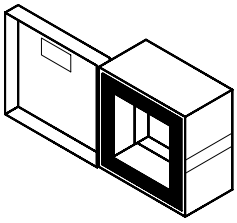
[1]) Rated capacity is the valve capacity at evaporating temperature t_e = −10°C, condensing temperature t_c = +25°C and pressure drop across valve Δp = 0.2 bar. 1 kW = 0.284 ton (TR).

Ordering
(continued)

Controller type EKS 67

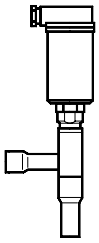
Symbol	EKS 67 complete controller	**Code no.**
	Complete controller (incl. base with triac module and mounting brackets)	**084B1020**

Components for controller type EKS 67

Symbol	EKS 67 components	**Code no.**
	Controller insert	**084B1021**
	Multipurpose case (silium case) incl. base with triac module and mounting bracket	**084B1035**
	DIN rail for mounting bracket	**084B3161**

Sensor type AKS, Pt 1000 ohm
Technical data, code nos., dimension and weights, see section "Temperature sensors, type AKS" in this catalogue.

Capacity KVQ 15-35



1 kW = 0,284 ton (TR)

Refrigerant	t_e	Capacity in kW											
		KVQ 15-22						KVQ 28-35					
		Pressure drop Δp bar											
	°C	0.05	0.1	0.2	0.3	0.5	0.7	0.05	0.1	0.2	0.3	0.5	0.7
R 22	−40	2.1	2.9	3.9	4.6	5.3	5.6	4.9	6.8	9.3	10.8	12.5	12.9
	−30	2.7	3.7	5.1	6.1	7.5	8.2	6.3	8.8	12.1	14.4	17.5	19.3
	−20	3.3	4.7	6.5	7.8	9.7	11.1	7.9	11.0	15.3	18.4	22.9	26.0
	−10	4.1	5.7	8.0	9.7	12.2	14.1	9.6	13.5	18.9	22.9	28.8	33.2
	0	4.9	6.9	9.7	11.8	14.9	17.4	11.6	16.3	22.9	27.8	35.3	41.0
	+10	5.8	8.2	11.6	14.1	17.9	21.0	13.8	19.4	27.3	33.2	42.3	49.5
R 134a	−30	1.8	2.6	3.5	4.1	4.7	4.9	4.4	6.1	8.2	9.6	11.0	11.2
	−20	2.4	3.3	4.6	5.5	6.6	7.2	5.7	7.9	10.9	12.8	15.5	17.0
	−10	3.1	4.3	6.0	7.2	8.9	10.0	7.3	10.2	14.1	17.0	21.0	23.6
	0	3.8	5.4	7.5	9.0	11.3	13.0	9.0	12.7	17.7	21.5	27.0	30.7
	+10	4.7	6.6	9.3	11.2	14.1	16.4	11.1	15.7	22.0	26.5	33.5	38.8
R 404A/ R 507	−40	1.8	2.4	3.3	3.9	4.7	5.0	4.1	5.8	7.9	9.2	11.0	11.9
	−30	2.2	3.2	4.5	5.3	6.5	7.3	5.4	7.5	10.4	12.4	15.3	17.2
	−20	2.9	4.0	5.6	6.8	8.5	9.7	6.8	9.4	13.2	15.9	20.0	22.9
	−10	3.6	5.1	7.2	8.7	10.9	12.7	8.6	12.1	16.9	20.5	26.0	30.0
	0	4.5	6.2	8.8	10.8	13.6	16.0	10.5	14.8	20.8	25.3	32.2	37.5
	+10	5.4	7.6	10.7	13.1	16.7	19.5	12.7	18.0	25.3	30.7	39.3	46.0
R 407C	−40	1.7	2.3	3.1	3.6	4.2	4.4	3.9	5.4	7.3	8.5	9.9	10.2
	−30	2.3	3.1	4.3	5.2	6.4	7.0	5.4	7.5	10.3	12.2	14.9	16.4
	−20	2.9	4.1	5.7	6.9	8.5	9.8	7.0	9.7	13.5	16.2	20.2	22.9
	−10	3.7	5.2	7.3	8.8	11.1	12.8	8.7	12.3	17.2	20.8	26.2	30.2
	0	4.6	6.5	9.1	11.1	14.0	16.4	10.9	15.3	21.5	26.1	33.2	38.5
	+10	5.6	8.0	11.3	13.7	17.4	20.4	13.4	18.8	26.5	32.2	41.0	48.0

The values in the capacity table refer to the evaporator capacity and are based on liquid temperature t_l = +25°C ahead of the thermostatic expansion valve.
Dry, saturated vapour ahead of the KVQ valve is assumed.

Correction factors for liquid trremperature t_l

t_l °C	10	15	20	25	30	35	40	45	50
R 134a	0.88	0.92	0.96	1.0	1.05	1.10	1.16	1.23	1.31
R 22	0.90	0.93	0.96	1.0	1.05	1.10	1.13	1.18	1.24
R 404A/ R 507	0.84	0.89	0.94	1.0	1.07	1.16	1.26	1.40	1.57
R 407C	0.88	0.91	0.95	1.0	1.05	1.11	1.18	1.26	1.35

Sizing

For optimum performance, it is important to select a KVQ valve according to system conditions and application.
The selection is also dependant on the acceptable pressure drop across the valve.
The following data must be used when sizing a KVQ valve:

- Refrigerant, CFC, HCFC or HFC
- Evaporator capacity Q_e in kW
- Evaporating temperature t_e in °C
- Liquid temperature ahead of expansion valve t_l in °C
- Max. acceptable pressure drop in the valve in bar
- Connection size in inches or mm.

Valve selection

Example

When selecting the appropiate valve it may be necessary to convert the actual evaporator capacity using a correction factor. This is required when your system conditions are different than the table conditions.
The selection is also dependant on the acceptable pressure drop across the valve.
The following example illustrates how this is done.

Refrigerant: R 22
Evaporator capacity: Q_e = 20 kW
Evaporating temperature: t_e = 0°C ~ 4.0 bar
Liquid temperature ahead of expansion valve: t_l = 35°C
Max. pressure drop in the valve Δp = 0.2 bar
Connection type: Solder
Connection size: 1 $^1/_8$ in.

Valve selection *(continued)*

Step 1

Determine the correction factor for liquid temperature t_l ahead of expansion valve.

From the correction factors table (see below) a liquid temperature of 35°C, R 22 corresponds to a factor of 1.10.

Correction factors for liquid temperature t_l

t_l °C	10	15	20	25	30	35	40	45	50
R 134a	0.88	0.92	0.96	1.0	1.05	1.10	1.16	1.23	1.31
R 22	0.90	0.93	0.96	1.0	1.05	1.10	1.13	1.18	1.24
R 404A/ R 507	0.84	0.89	0.94	1.0	1.07	1.16	1.26	1.40	1.57
R 407C	0.88	0.91	0.95	1.0	1.05	1.11	1.18	1.26	1.35

Step 2

Corrected evaporator capacity is
Q_e = 20 x 1.1 = 22 kW

Step 3

Now select the appropriate capacity table R 22 and choose the column for an evaporating temperature of t_e = 0°C.

Using the corrected evaporator capacity, select a valve that provides an equivalent or greater capacity at an acceptable pressure drop across the valve of 0.2 bar.

KVQ 28/35 delivers 22.9 kW at a 0.2 bar pressure drop across the valve.

Based on the required connection size of 1 $^1/_8$ in., the KVQ 28 is the proper selection for this example.

Step 4

KVQ 28, 1 $^1/_8$ in. solder connection:
code no. 034L0115 and actuator
code no. 034L0106, see Ordering

Transformer selection

The choice of transformer depends on the total power consumption.

KVQ EKS 67	DEFROST	ALARM	Total consumpt. VA
× 32 VA/24 V a.c			32
× 32 VA/24 V a.c	× 24 VA/24 V a.c		56
× 32 VA/24 V a.c	× 24 VA/24 V a.c	× 12 VA/24 V a.c	68

Total power consumption = sum of the individual power consumptions.
A class II transformer should be used according to CEE 15.

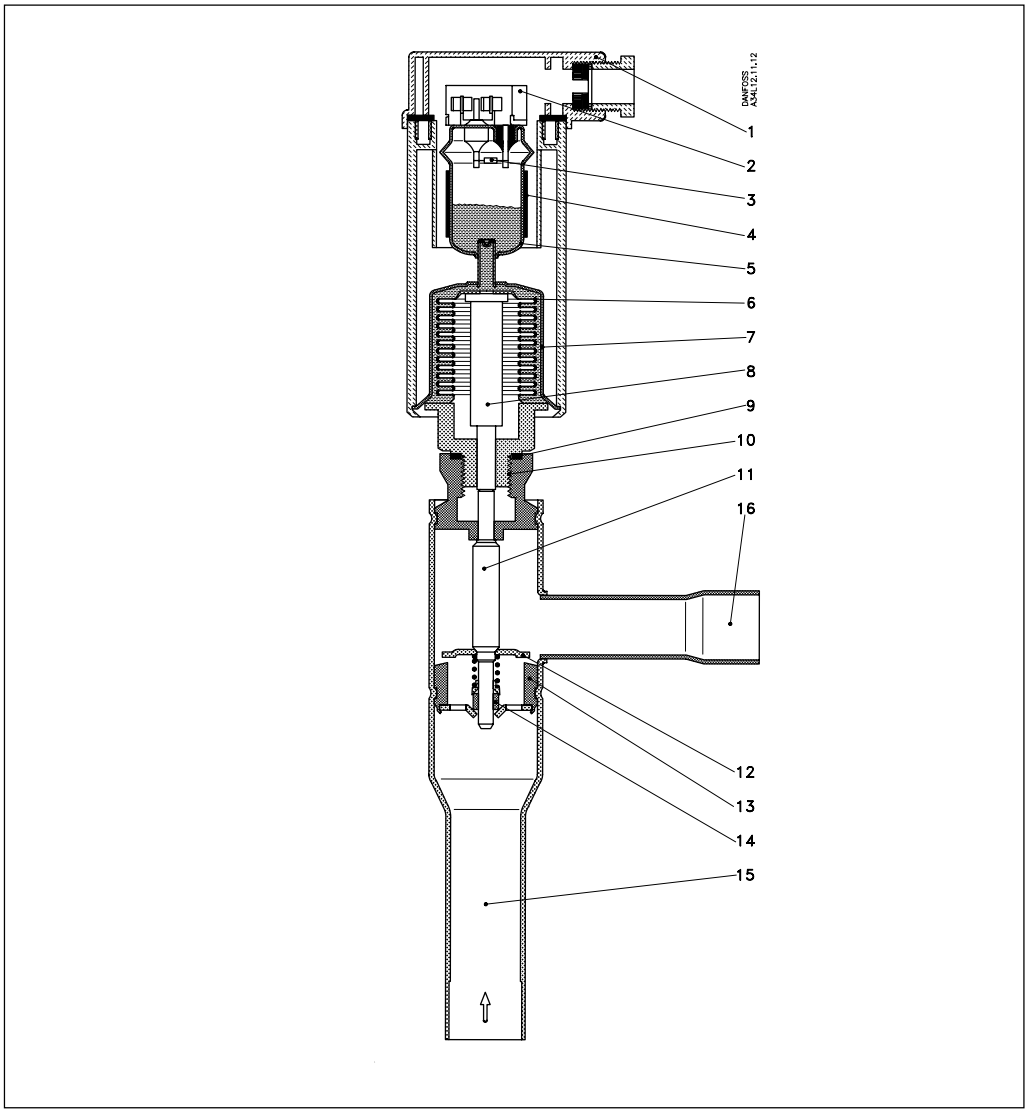
Example

No.	Connections	Consumpt. VA
2	KVQ + EKS 67 à 32 VA / 24 V a.c.	64
2	ALARM à 12 VA / 24 V a.c.	24
1	DEFROST à 24 VA / 24 V a.c.	24
Total consumption		112

In this example the choice is a transformer sized to suit the power consumption:
115 VA / 24 V a.c., 50/60 Hz or greater

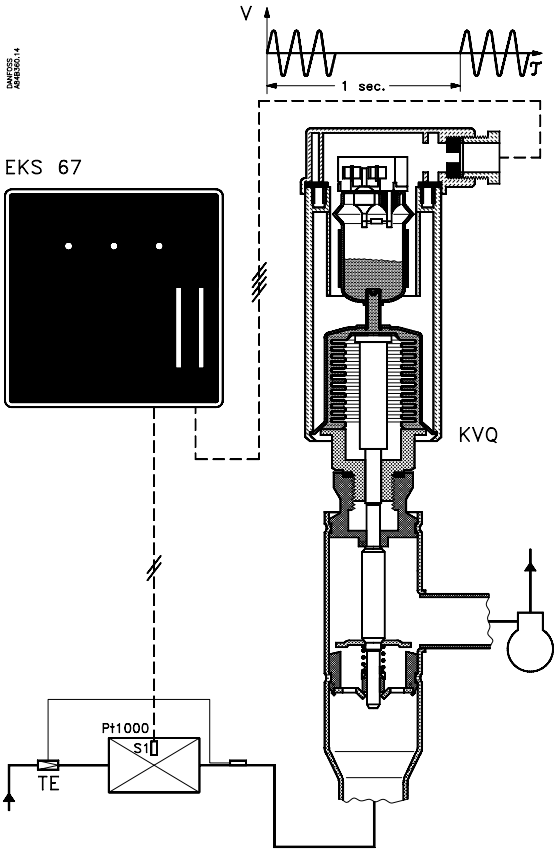
Design

Valve / Actuator type KVQ



1. Cover
2. Connection terminals
3. NTC resistor
4. Heating element
5. Pressure reservoir
6. Bellows
7. Bellows capsule
8. Pressure pin
9. Gasket
10. Threaded connection
11. Guide pin
12. Valve plate
13. Orifice
14. Damping device
15. Inlet
16. Outlet

Function



Regulation of KVQ with electronic controller EKS 67
The form of regulation is pulse cascades of a.c. supply voltage

On deviations between the required and registered temperature the EKS 67 instantaneously sends more or fewer pulses to the actuator to counteract the error. The pressure in the actuator changes slightly so that the valve moves in the opening or closing direction.
Changes in the suction pressure have no influence because the bellows area is the same as the orifice area.

In the event of current failure, the valve will be fully open.

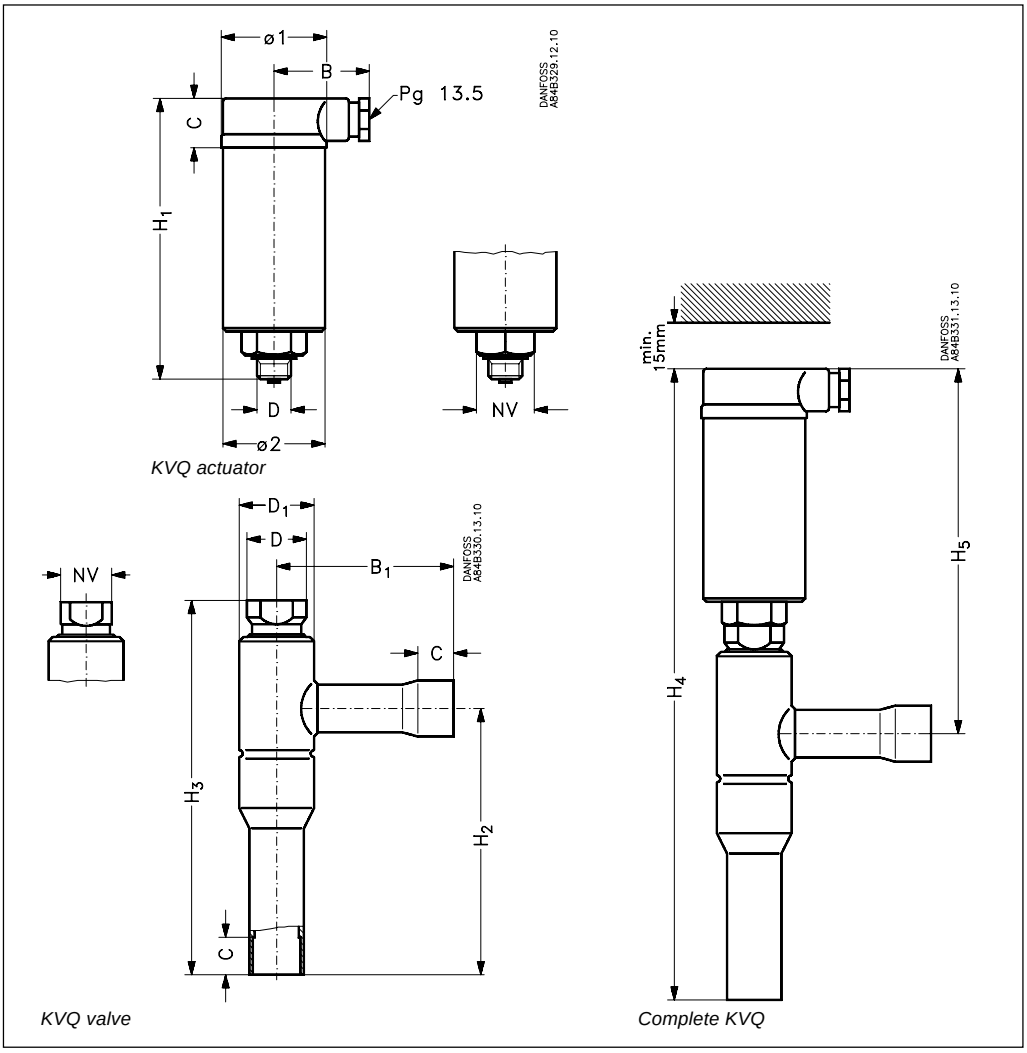
EKS 67 defrost function
During defrosting, the temperature rises above the set alarm LIMIT. This cuts in the controller DELAY function, i.e. the timer that delays alarm release.
If the temperature setting for defrost function cut-off is reached before the delay time has elapsed, the controller cuts off defrosting. At the same time DELAY is set at zero.
If the selected ALARM delay is exceeded during a defrost period, defrosting is stopped by the ALARM delay and the alarm is activated (lamp goes out) until the temperature of the medium is again within the alarm limit.

Hot-gas defrosting
Defrosting with hot-gas is initiated by an external defrost timer and KVQ is forced closed by the EKS 67.
As soon as EKS 67 registers that KVQ is closed, the lamp "DEFROST" lights up and voltage is applied to the triac output.
The solenoid valve opens so that hot gas is able to flow into the evaporator. A defrost sensor, S2, is placed at the point on the evaporator where ice disappears last. When the temperature at sensor S2 reaches the temperature set on the EKS 67, defrosting is stopped. The solenoid valve closes and the lamp "DEFROST" goes out. After defrost, the KVQ valve opens slowly to avoid liquid hammer.

Electric defrosting
Electric defrosting is also started by a signal from an external defrost timer.
The lamp "DEFROST" lights up and voltage is applied to the triac output.
The solenoid valve ahead of the thermostatic expansion valve closes.
The heating element is cut in without the KVQ valve being previously closed.
When the temperature on the evaporator rises, the KVQ valve will be fully open.
Electric defrosting is cut off when defrost sensor S2 measures a temperature corresponding to the stop temperature set on the EKS 67. The solenoid valve ahead of the thermostatic expansion valve opens.
There are facilities for forced defrosting of the plant.

Dimensions and weights

Valve / Actuator type KVQ



KVQ actuator

Type	H_1 mm	B mm	C mm	NV mm	D mm	∅ 1 mm	∅ 2 mm	Weight kg
KVQ 15-22	162.5	54	27	32	M16 × 1.5	63	60	0.5
KVQ 28-35	162.5	54	27	32	M18 × 1.5	63	60	0.5

KVQ valve

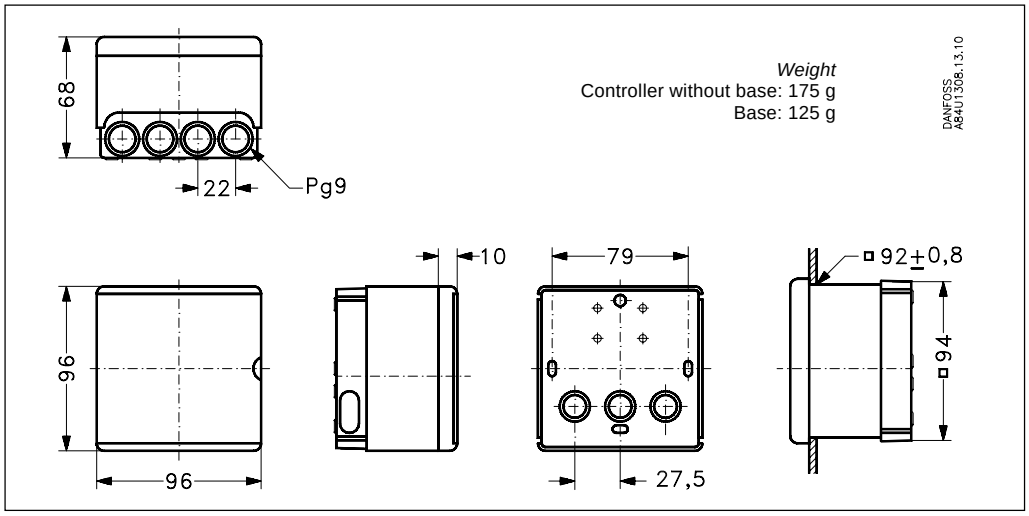
Type	Connect. Solder		Total	H_2	H_3	B_1	C	D	D_1	NV	Weight
	in.	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
KVQ 15	5/8	16	303	99	152	64	12	30	28	24	0.4
KVQ 22	7/8	22	303	99	152	64	17	30	28	24	0.4
KVQ 28	1 1/8		366	155	215	105	22	43	35	30	0.8
KVQ 28		28	366	155	215	105	22	43	35	30	0.8
KVQ 35	1 3/8	35	366	155	215	105	25	43	35	30	0.8

Complete KVQ

Type	H_4 mm	H_5 mm
KVQ 15-22	303	204
KVQ 28-35	366	211

Dimensions and weights
(continued)

Controller type EKS 67



DK-6430 Nordborg
Denmark