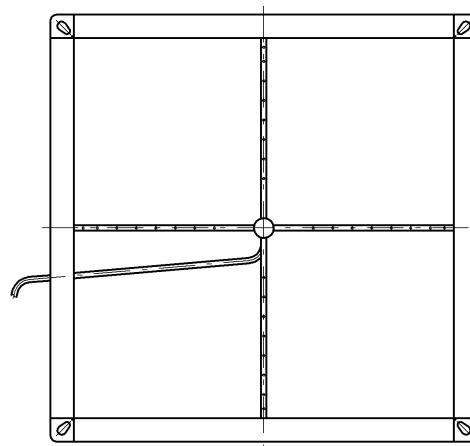
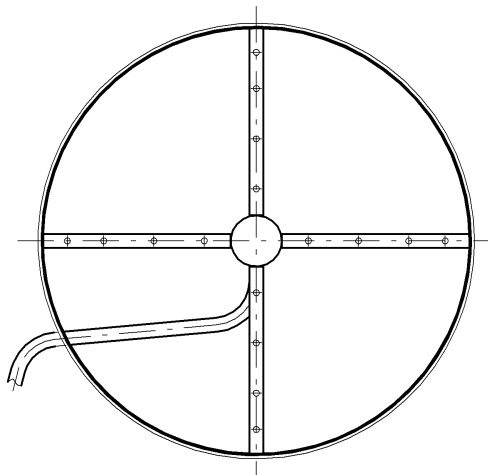




# Volumetric flow controller measuring cross

**MKAR**

**MKAQ**



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## Volumetric flow controller measuring cross MKAR / MKAQ

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## Volumetric flow controller measuring cross MKAR / MKAQ

### Description

The volumetric flow controller measuring cross type MKAR / MKAQ (round and rectangular design) is mainly used for measuring the air volumetric flow downstream of the central unit or fan or for adjusting branch ducts or in ventilation and air-conditioning installations of large shopping centres having several tenants, for determining the share in energy costs of the ventilation and air-conditioning installation. The measuring cross substantially facilitates the measurement of the air volumetric flow, compared with the previous cost- and time-intensive measuring method, in which many individual points have to be measured.

The measuring deviation of the volumetric flow measuring cross is

$\pm 5\%$  at  $100\% V_{nenn}$ .

The measuring cross is largely insensitive to the intake flow, since 12 measuring points are distributed on this measuring cross according to the median line method. In comparison with measuring rods having only 4 measuring points or measuring orifices, this gives optimum measurement results. However, to avoid unnecessary sources of error, the measuring cross should be placed at a distance of at least  $1 \times D$  to  $2 \times D$  behind bends or T-junctions.

The differential pressure determined at the measuring cross can be measured with a (static or dynamic) pressure measuring device. The air volume throughput is calculated using the measured differential pressure value and the conversion charts on p. 7.

In the design of type MKAR-...-MExx or MKAQ-...-MExx with electric transducer, the controller calibrated ex works transmits a 0-10 V DC output signal

(which corresponds to 0-100% of the set air volume  $V_{nenn}$ ) to the DDC/ZLT system.

When using measuring crosses in systems with heavy dust contamination, suitable filters must be connected upstream. For polluted air, the measuring crosses must be used in combination with a controller with a static membrane pressure sensor. In this case, it is absolutely necessary to observe the mounting position. The measuring crosses are not suitable for air containing sticky and greasy particles.

For air contaminated with aggressive media, measuring crosses of type MKAR-...-KU in plastic design must be used. The volumetric flow measuring crosses are available in round design (type MKAR) and rectangular design (type MKAQ). To adjust branch ducts, they can be combined with manually adjustable dampers or multi-leaf dampers.

### Field of application

- for supply and return air systems
- for constant or variable volumetric flows
- Differential pressure range from 50 to 1000 Pa
- for ambient temperatures of 0 - 55°C

### Construction

#### Housing

- Galvanised sheet steel (-SV, standard)
- Galvanised sheet steel with DD coating on the inside (-DD, at an extra charge)
- Stainless steel V2A 1.4301 (-V2, at an extra charge)
- Plastic PPs (-KU, only available for type MKAR and up to size NW400)

#### Measuring cross

- extruded aluminium profile

#### Measuring cross support

- plastic PA6
- Plastic PP (only available for type MKAR and up to size NW400)

### Model

**MKAR:** Round model, for spiral duct connection to DIN 24145, with seal (size  $\varnothing$  125-400 air-tight to DIN 1946/4)

**MKAQ:** Rectangular model, for duct connection to DIN 24190

**-MExx:** with electric controller

- Control voltage 24 V AC 50/60 Hz
- Temperature compensation from 5 - 40°C
- Duct velocity from 2 - 15 m/s

### Accessories

**Metu flange (-MF1) (MKAR-...-SV / -V2 only)**

- on both sides, duct flange type AF
- Tension ring to connect Metu flange and counter flange

**Flat flange (-FF1) (MKAR-...-SV only)**

- on both sides, according to DIN 24154/5

**Flat flange (-FF2) (MKAR-...-V2 only)**

- on both sides, according to DIN 24154/5

**Flat flange (-FF3) (MKAR-...-KU only)**

- on both sides, according to DIN 24154/5

**Rubber lip seal (-GD1) (MKAR-...-SV / -V2 only)**

- on both sides, special rubber

**Electr. controller (-MExx)**

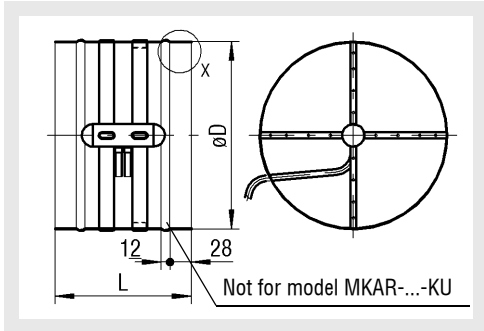
- VRD3 - Belimo (-ME01)
- VRP-M, VFP300 - Belimo (-ME02)
- VRP-M, VFD3 - Belimo (-ME03)
- GUAC-DM3 - Gruner (-ME04)
- GUAC-DM3-MB - Gruner (-ME06)
- GUAC-SM3 - Gruner (-ME05)
- GUAC-SM3-MB - Gruner (-ME07)
- VRU-D3-BAC (-ME08)
- VRU-M1-BAC (-ME09)

# Volumetric flow controller measuring cross MKAR / MKAQ

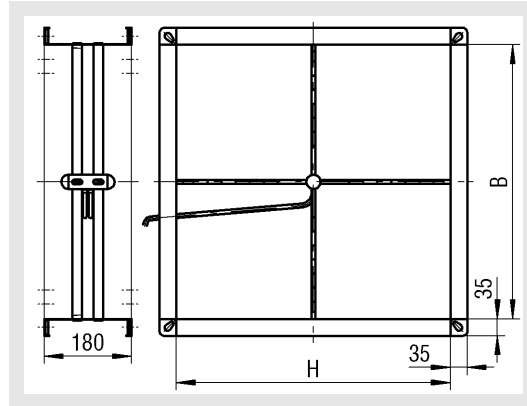
## Models and dimensions

### Dimensions

#### MKAR (round)



#### MKAQ (rectangular)



#### Available sizes

NW	MKAR-...-SV / -V2	MKAR-...-KU	L
	øD	øD	
100	98	-	180
110	-	110	
125	123	125	
140	138	140	
160	158	160	
180	178	180	
200	198	200	
225	223	225	
250	248	250	
280	278	280	
315	313	315	
355	353	355	
400	398	400	
500	498	-	
560	558	-	
630	628	-	

#### Available sizes

B	H
0140	0100
0160	0140
0180	0160
0200	0180
0225	0200
0252	0225
0300	0252
0318	0300
0357	0318
0400	0357
0449	0400
0500	0449
0503	0500
0565	0503
0600	0565
0634	0600
0700	0634
0711	0700
0797	0711
0800	0797
0894	0800
0900	0894
1000	0900
1003	1000
	1003

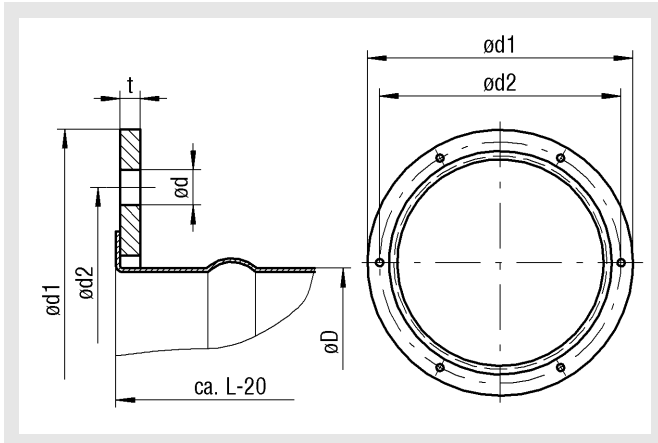
All combined lengths and widths available.

## Volumetric flow controller measuring cross MKAR / MKAQ

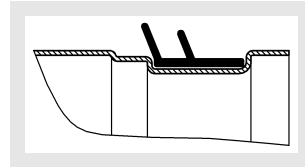
### Dimensions of accessories

Flat flanges (-FF1/-FF2 / -KU-...-FF3), on both sides,  
(MKAR only) according to DIN 24154/5

#### Detail X



Rubber lip seal (-GD1)  
MKAR-...-SV / -V2 only  
Detail X



With electric controller (-MExx)

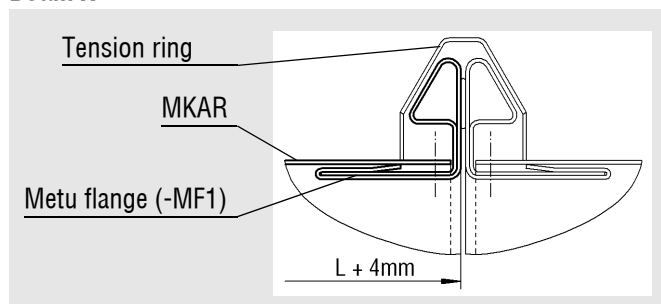
Electric controllers of different makes  
can be mounted to the measuring crosses.

### Available sizes for flat flange (-FF1 / -FF2 / -KU-...-FF3)

Size	MKAR					t
	$\varnothing D$	$\varnothing d1$	$\varnothing d2$	$\varnothing d$	Number of holes	
100	98	154	129	7	4	3
125	123	177	155	7	4	3
140	138	202	176	7	6	4
160	158	222	194	7	6	4
180	178	242	216	7	6	4
200	198	263	235	7	6	4
224	222	287	259	7	6	4
250	248	313	286	7	6	4
280	278	353	322	9,5	8	5
315	313	388	356	9,5	8	5
355	353	428	395	9,5	8	5
400	398	474	438	9,5	12	5
450	448	524	487	9,5	12	5
500	498	574	541	9,5	12	5
560	558	654	629	11,5	16	6
630	628	726	698	11,5	16	6

Metu flange (-MF1) with tension ring  
on both sides (MKAR-...-SV / -V2 only)

#### Detail X

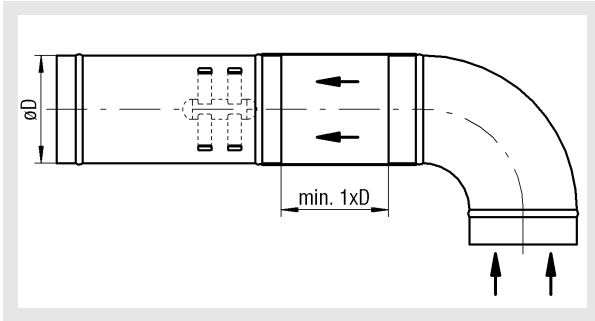


## Volumetric flow controller measuring cross MKAR / MKAQ

### Installation

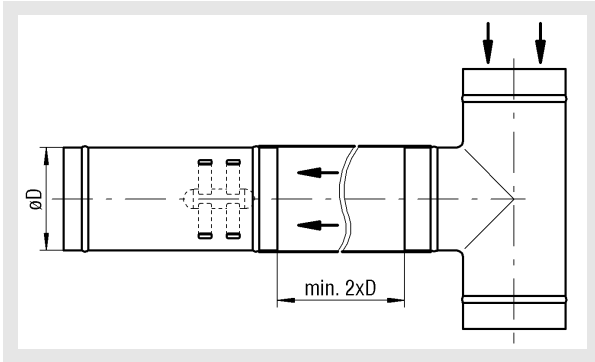
for MKAR (round)

Distance to a connection spigot with bend



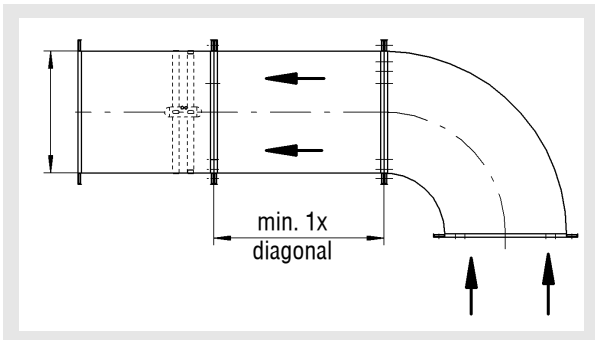
Distance to other connection pieces

(e.g. branching piece, reducing piece, T-junction, etc.)



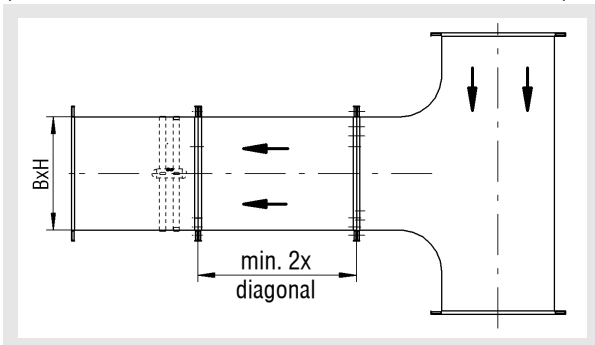
for MKAQ (rectangular)

Distance to a connection spigot with bend



Distance to other connection pieces

(e.g. branching piece, reducing piece, T-junction, etc.)



### Assembly and maintenance instructions

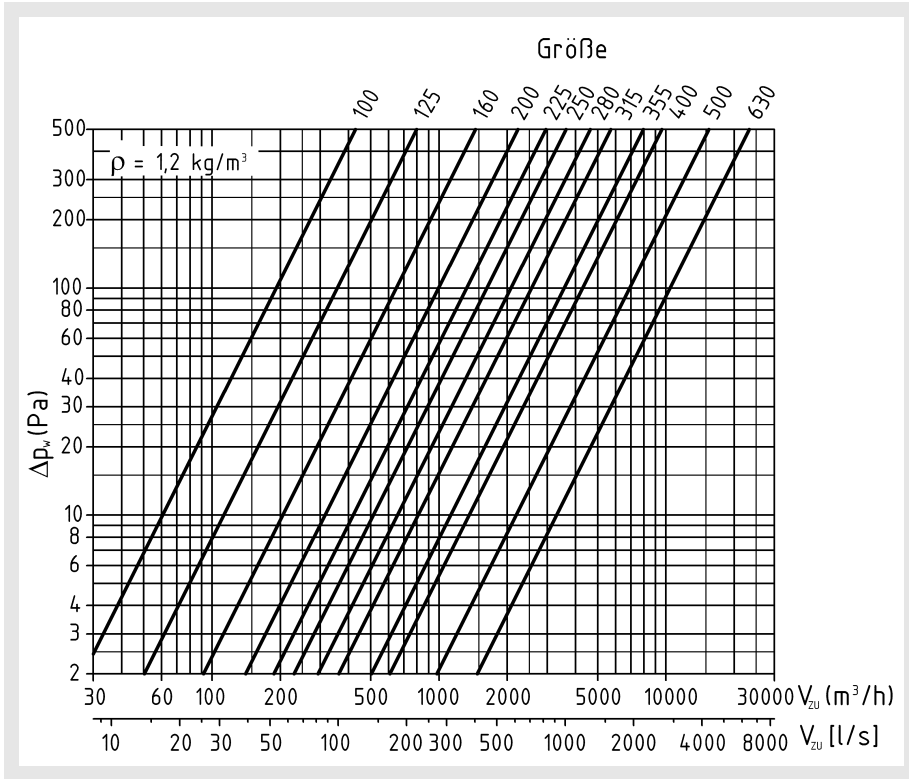
1. When the device is delivered, check whether the volumetric flow measuring crosses are complete and delivered without damage. Complaints have to be communicated immediately and directly to the transporter and SCHAKO.
2. The volumetric flow measuring crosses must not be carried on the control components or the measuring cross, but only on the housing.
3. The volumetric flow measuring crosses must be carefully stored on-site. They must be protected from dust, dirt and from direct weather effects.
4. The volumetric flow measuring crosses must be installed in a way to allow inspection.
5. Assembly must be carried out by expert personnel, observing recognised technical rules and regulations.
6. For polluted air, the volumetric flow measuring crosses must be used in combination with a controller with a static membrane pressure sensor. In this case, it is absolutely necessary to observe the mounting position. The measuring crosses are not suitable for air containing sticky and greasy particles.

# Volumetric flow controller measuring cross MKAR / MKAQ

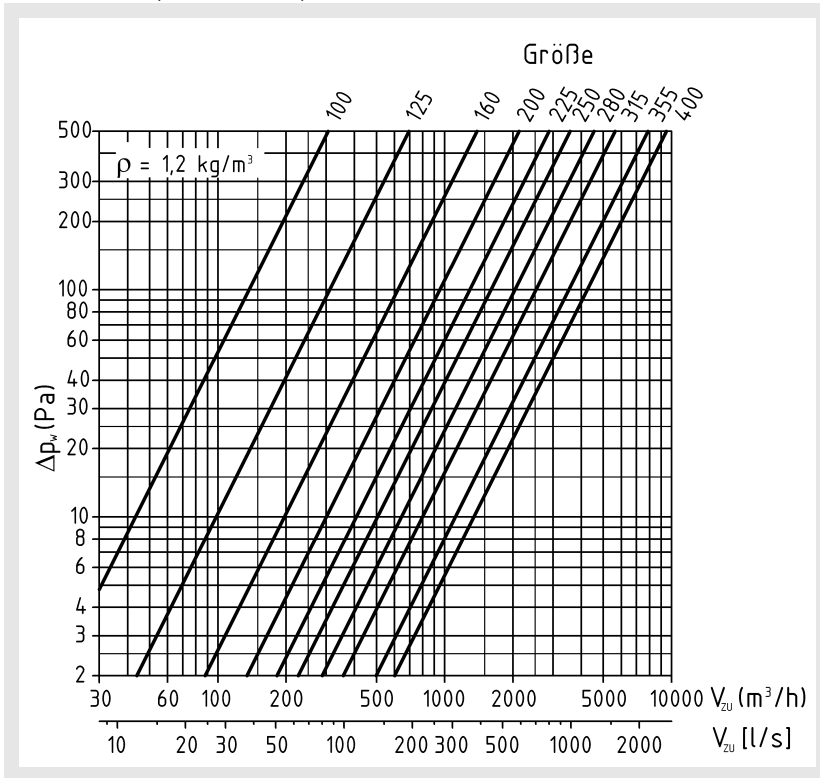
## Technical data

### Selection charts

MKAR (round design)

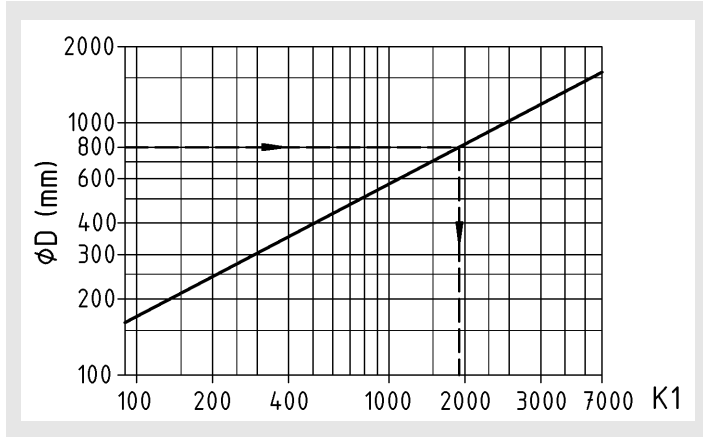


MKAR-...-KU (round design)



# Volumetric flow controller measuring cross MKAR / MKAQ

## MKAQ (rectangular design)



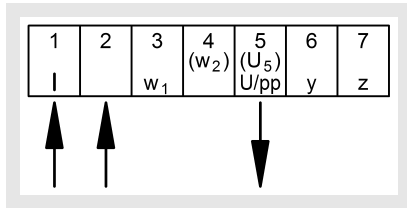
$$\phi D = \sqrt{\frac{4 \cdot B(\text{mm}) \cdot H(\text{mm})}{\pi}}$$

$$V = K1 \cdot \sqrt{\frac{\Delta p_W(\text{Pa})}{\rho}}$$

$$V_{\text{neff}} = F \times EK$$

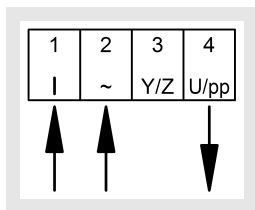
Actual value measurement via feedback signal  $U_5$  using a voltmeter or PC tool

### Terminal assignment VRD3-S0 / VRP-M



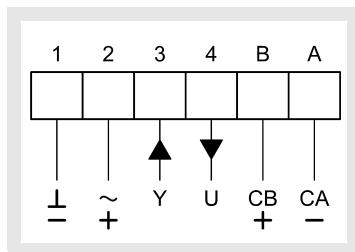
Supply voltage: 24 V AC/DC (terminals 1+2)  
 Measurement output 2 - 10 V DC (terminals 1+5)  
 Measurement output 0 - 10 V DC (terminals 1+5)

### GUAC

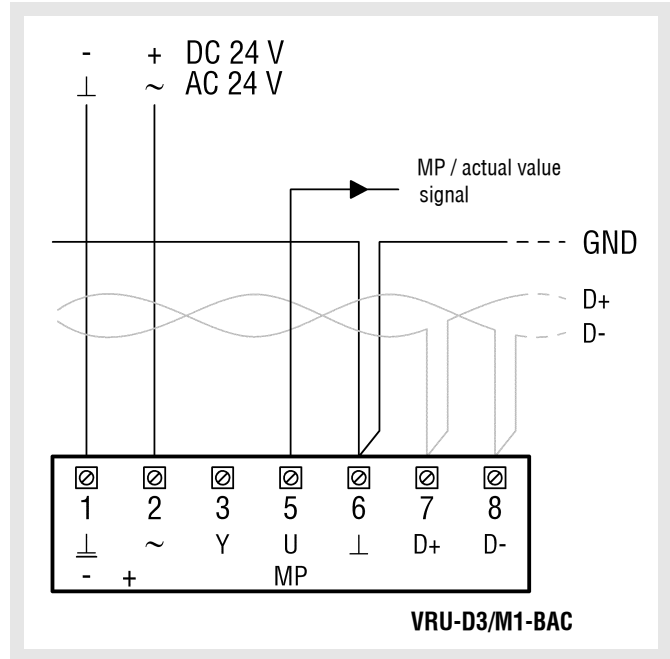


Supply voltage: 24 V AC/DC (terminals 1+2)  
 Measurement output 2 - 10 V DC (terminals 1+4)  
 Measurement output 0 - 10 V DC (terminals 1+4)

### GUAC-...-MB (modbus)



## BACnet MS/TP / Modbus RTU / hybrid operation



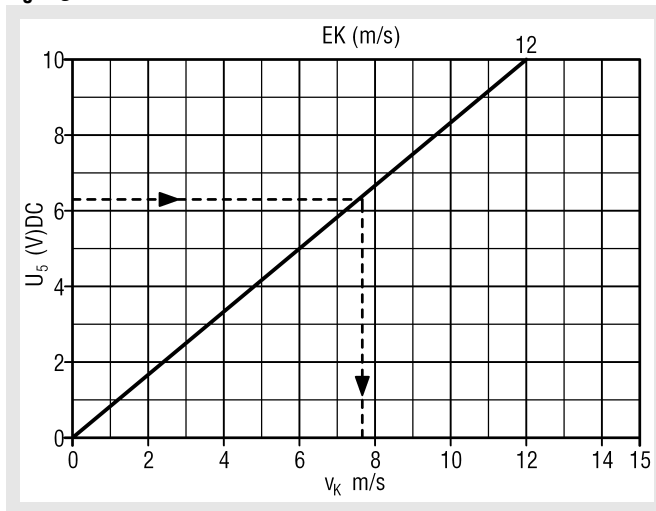
The actual value signal  $U_5$  is a real feedback of the volumetric flow actual value for monitoring and controlling the air throughput volume.

Alternatively, the feedback signal can also be monitored via BACnet MS/TP or Modbus RTU.



## Volumetric flow controller measuring cross MKAR / MKAQ

$U_5$  signal 0-10 V DC



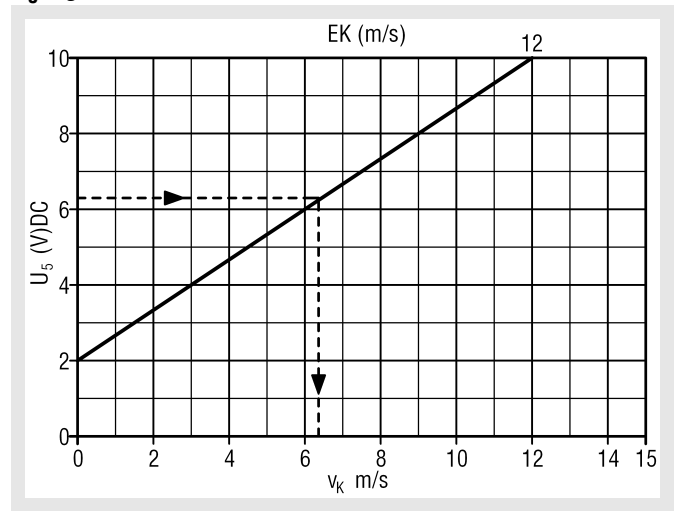
### Example

Assume: Measurement output signal  $U_5 = 6,3$  V DC  
Calibration curve MKAR / MKAQ = 12 m/sec

Measured value: Duct velocity  $v_K = 7,6$  m/s

Air volume V:  $v_K \times F \times 3600 = V$

$U_5$  signal 2-10 V DC



### Example

Assume: Measurement output signal  $U_5 = 6,3$  V DC  
Calibration curve MKAR / MKAQ = 12 m/sec

Measured value: Duct velocity  $v_K = 6,3$  m/s

Air volume V:  $v_K \times F \times 3600 = V$

## Legend

$V_{ZU}$	(m <sup>3</sup> /h) [l/s]	= Supply air volume
$\rho$	(kg/m <sup>3</sup> )	= Density
$\Delta p_w$	(Pa)	= Differential pressure
V	(m <sup>3</sup> /h)	= Air volume flow
K1		= Measuring cross constant
$\varnothing D$	(mm)	= Hydraulic diameter
$V_{nenn}$		= Nominal volumetric flow
$v_K$		= Duct velocity
F	(m <sup>2</sup> )	= Area
EK	m/s	= Calibration curve

## Volumetric flow controller measuring cross MKAR / MKAQ

### MKAR order code

01	02	03	04	05	06	07	08
Type	Nominal width	Material	Measuring unit	Calibration curve	$V_{nenn}$	Mode	Duct connection
<b>Example</b>							
MKAR	-200	-SV	-ME01	-12	-01316	-2	-KA0

All fields must be filled when ordering.

#### Sample

**MKAR-200-SV-ME01-12-01316-2-KA0**

Volumetric flow meter type MKAR, round design | NW 200 | Made of galvanised sheet steel | With measuring unit VRD3 Belimo | With calibration curve 12 m/s | With  $V_{nenn}$  1316 m<sup>3</sup>/h | Mode 2-10V | Without rubber lip seal / without flange

#### Order details

##### 01 - Type

MKAR = volumetric flow meter type MKAR, round design

##### 02 - Nominal width

- 100 = NW 100 mm (not possible for MKAR-...-KU)
- 110 = NW 110 mm (only possible for MKAR-...-KU)
- 125 = NW 125 mm
- 140 = NW 140 mm
- 160 = NW 160 mm
- 180 = NW 180 mm
- 200 = NW 200 mm
- 225 = NW 225 mm
- 250 = NW 250 mm
- 280 = NW 280 mm
- 315 = NW 315 mm
- 355 = NW 355 mm
- 400 = NW 400 mm
- 500 = NW 500 mm (not possible for MKAR-...-KU)
- 560 = NW 560 mm (not possible for MKAR-...-KU)
- 630 = NW 630 mm (not possible for MKAR-...-KU)

##### 03 - Material

- SV = Galvanised sheet steel (standard)
- V2 = Stainless steel V2A, 1.4301
- DD = DD coating on the inside for models in galvanised sheet steel
- KU = Plastic PPs

##### 04 - Measuring unit

- ME00 = without controller with spigot for hose connection (standard)
- ME01 = VRD3 - Belimo
- ME02 = VRP-M, VFP300 - Belimo
- ME03 = VRP-M, VFD3 - Belimo
- ME04 = GUAC-DM3 - Gruner
- ME06 = GUAC-DM3-MB - Gruner
- ME05 = GUAC-SM3 - Gruner
- ME07 = GUAC-SM3-MB - Gruner
- ME08 = VRU-D3-BAC
- ME09 = VRU-M1-BAC

##### 05 - Calibration curve

- 00 = without measuring unit (standard)
- 08 = 8 m/s calibration curve
- 09 = 9 m/s calibration curve
- 10 = 10 m/s calibration curve
- 11 = 11 m/s calibration curve
- 12 = 12 m/s calibration curve (standard with measuring unit)
- 13 = 13 m/s calibration curve
- 14 = 14 m/s calibration curve
- 15 = 15 m/s calibration curve
- 16 = 16 m/s calibration curve

##### 06 - $V_{nenn}$

xxxxx = 5-digit value, the respective volumetric flow value in m<sup>3</sup>/h is determined based on the calibration curve.

##### 07 - Mode

- 0 = 0-10 V
- 2 = 2-10 V (standard)

**The mode 2-10V is installed on bus-capable controllers!!!**

## **Volumetric flow controller measuring cross MKAR / MKAQ**

### **08 - Duct connection**

- KA0 = without rubber lip seal / without flange (standard)
- FF1 = with flat flange (pair), on both sides, galvanised steel
- FF2 = with flat flanges (pair), on both sides, stainless steel V2A 1.4301
- FF3 = with flat flanges PPs (pair), on both sides (only possible for MKAR-...-KU)
- GD = with rubber lip seal (only possible for MKAR-...-KU)
- MF1 = with Metu flanges (pair), on both sides, galvanised sheet steel (not possible for MKAR-...-KU)

## Volumetric flow controller measuring cross MKAR / MKAQ

### MKAQ order code

01	02	03	04	05	06	07	08
Type	Width	Height	Material	Measuring unit	Calibration curve	V <sub>nenn</sub>	Mode
<b>Example</b>							
MKAQ	-0400	-0800	-SV	-ME01	-12	-13824	-2

All fields must be filled when ordering.

#### Sample

**MKAQ-0400-0800-SV-ME01-12-13824-2**

Volumetric flow meter type MKAQ, rectangular design | In width 400 mm | In height 800 mm | Made of galvanised sheet steel | With measuring unit VRD3 Belimo | With calibration curve 12 m/s | With V<sub>nenn</sub> 13824 m<sup>3</sup>/h | Mode 2-10V

#### Order details

##### 01 - Type

MKAQ = volumetric flow meter type MKAQ, rectangular design

ME05 = GUAC-SM3 - Gruner

ME07 = GUAC-SM3-MB – Gruner

ME08 = VRU-D3-BAC

ME09 = VRU-M1-BAC

##### 02 - Width

0140- 0160- 0180- 0200- 0225- 0252- 0300 - 0318- 0357-  
0400- 0449- 0500 - 0503- 0565- 0600 - 0634- 0700 - 0711-  
0797- 0800 - 0894- 0900 - 1000 - 1003  
in mm, always four digits

##### 06 - Calibration curve

00 = without measuring unit (standard)

08 = 8 m/s calibration curve

09 = 9 m/s calibration curve

10 = 10 m/s calibration curve

11 = 11 m/s calibration curve

12 = 12 m/s calibration curve (standard with measuring unit)

13 = 13 m/s calibration curve

14 = 14 m/s calibration curve

15 = 15 m/s calibration curve

16 = 16 m/s calibration curve

##### 03 - Height

0100- 0140- 0160- 0180- 0200- 0225- 0252- 0300 - 0318-  
0357- 0400- 0449- 0500 - 0503- 0565- 0600 - 0634- 0700 -  
0711- 0797- 0800 - 0894- 0900 - 1000 – 1003  
in mm, always four digits

##### 07 - V<sub>nenn</sub>

xxxxx = 5-digit value, the respective volumetric flow value in m<sup>3</sup>/h is determined based on the calibration curve.

##### 04 - Material

SV = Galvanised sheet steel (standard)

V2 = Stainless steel V2A, 1.4301

DD = DD coating on the inside for models in galvanised sheet steel

##### 08 - Mode

0 = 0-10V

2 = 2-10V (standard)

**The mode 2-10V is installed on bus-capable controllers!!!**

##### 05 - Measuring unit

ME00 = without controller with spigot for hose connection (standard)

ME01 = VRD3 - Belimo

ME02 = VRP-M, VFP300 - Belimo

ME03 = VRP-M, VFD3 - Belimo

ME04 = GUAC-DM3 - Gruner

ME06 = GUAC-DM3-MB - Gruner

## Volumetric flow controller measuring cross MKAR / MKAQ

### Specification texts

Volumetric flow measuring cross in round design, for use in supply and return air systems, for constant or variable volumetric flows. Allowed differential pressure range: 50-1000 Pa. Allowed ambient temperatures: 0 - 55°C Housing consisting of galvanised sheet steel, measuring cross made of extruded aluminium profile and measuring cross support made of plastic PA6. Special measuring cross allows position-independent installation.

Product: SCHAKO type **MKAR**

- Housing made of:
  - Galvanised sheet steel (-**SV**)
  - galvanised sheet steel with DD coating (-**DD**)
  - Stainless steel 1.4571 (-**V2**)
  - Plastic PPs, measuring cross made of extruded aluminium profile and measuring cross support made of plastic PP (-**KU**)

Accessories:

- Electric controller (-**MExx**)  
Control voltage 24 V AC 50/60 Hz wired ex works The 0-10 V DC output signal can be used for actual value display (corresponding to 0-100 % of the set volumetric flow  $V_{\text{nein}}$ ) in DDC/ZLT systems.
- Metu flanges (-**MF1**), on both sides, type AF (-SV / -V2 only)
- Flat flanges (-**FF1**), on both sides, according to DIN 24154/5, for model (-SV)
- Flat flanges (-**FF2**), on both sides, according to DIN 24154/5, for model (-V2)
- Flat flanges (-**FF1**), on both sides, according to DIN 24154/5, for model (-KU)
- Rubber lip seal (-**GD1**) made of special rubber (-SV / -V2 only)

Volumetric flow measuring cross in rectangular design, for use in supply and return air systems, for constant or variable volumetric flows. Allowed differential pressure range: 50-1000 Pa. Allowed ambient temperatures: 0 - 55°C Housing consisting of galvanised sheet steel, measuring cross made of extruded aluminium profile and measuring cross support made of plastic PA6. Special measuring cross allows position-independent installation.

Product: SCHAKO type **MKAQ**

- Housing made of:
  - Galvanised sheet steel (-**SV**)
  - galvanised sheet steel with DD coating (-**DD**)
  - Stainless steel to DIN 1.4571 (-**V4A**)

Accessories:

- With electric controller (-**MExx**),  
Control voltage 24 V AC 50/60 Hz wired ex works The 0-10 V DC output signal can be used for actual value display (which corresponds to 0-100 % of the set air volume  $V_{\text{max}}$ ) in DDC/ZLT systems.