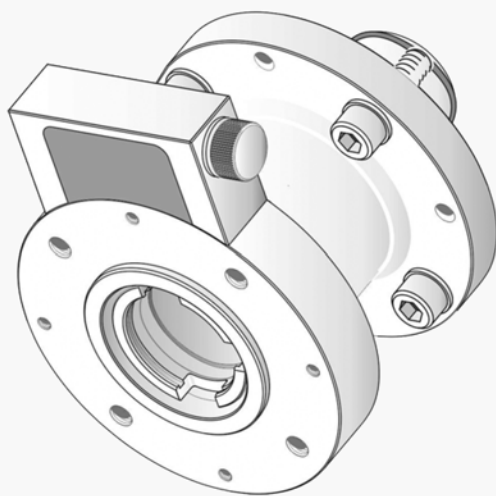


Torque measurement flange

DMF 10.1, DMF 14.5, DMF 16.1

for AUMA actuators

SA 07.2 – SA 16.2/SAR07.2 – SAR 16.2



Read operation instructions first.

- Observe safety instructions.
- These operation instructions are part of the product.
- Store operation instructions during product life.
- Pass on instructions to any subsequent user or owner of the product.

Target group:

This document contains information for assembly, commissioning and maintenance staff.

Table of contents	Page
1. Safety instructions.....	3
1.1. Prerequisites for the safe handling of the product	3
1.2. Range of application	3
1.3. Warnings and notes	4
1.4. References and symbols	4
2. Version and scope of delivery.....	5
2.1. Short description	5
2.2. Scope of delivery	5
2.3. Name plate	5
3. Transport and storage.....	7
3.1. Transport	7
3.2. Storage	7
4. Assembly.....	8
4.1. Basic information on assembly	8
4.2. DMF: mount to multi-turn actuator	9
4.3. Multi-turn actuator with fitted DMF: mount to valve/gearbox	11
5. Electrical connection.....	12
6. Signal processing.....	13
7. Technical data.....	14
7.1. Technical data Torque measurement flange	14
Index.....	18

1. Safety instructions

1.1. Prerequisites for the safe handling of the product

Standards/directives	The end user or the contractor must ensure that all legal requirements, directives, guidelines, national regulations and recommendations with respect to assembly, electrical connection, commissioning and operation are met at the place of installation.
Safety instructions/warnings	All personnel working with this device must be familiar with the safety and warning instructions in this manual and observe the instructions given. Safety instructions and warning signs on the device must be observed to avoid personal injury or property damage.
Qualification of staff	<p>Assembly, electrical connection, commissioning, operation, and maintenance must be carried out by suitably qualified personnel authorised by the end user or contractor of the plant only.</p> <p>Prior to working on this product, the staff must have thoroughly read and understood these instructions and, furthermore, know and observe officially recognised rules regarding occupational health and safety.</p>
Commissioning	Prior to commissioning, imperatively check that all settings meet the requirements of the application. Incorrect settings might present a danger to the application, e.g. cause damage to the valve or the installation. The manufacturer will not be held liable for any consequential damage. Such risk lies entirely with the user.
Operation	<p>Prerequisites for safe and smooth operation:</p> <ul style="list-style-type: none">• Correct transport, proper storage, mounting and installation, as well as careful commissioning.• Only operate the device if it is in perfect condition while observing these instructions.• Immediately report any faults and damage and allow for corrective measures.• Observe recognised rules for occupational health and safety.• Observe national regulations.• During operation, the housing warms up and surface temperatures > 60 °C may occur. To prevent possible burns, we recommend checking the surface temperature prior to working on the device using an appropriate thermometer and wearing protective gloves.
Protective measures	The end user or the contractor are responsible for implementing required protective measures on site, such as enclosures, barriers, or personal protective equipment for the staff.
Maintenance	<p>To ensure safe device operation, the maintenance instructions included in this manual must be observed.</p> <p>Any device modification requires prior written consent of the manufacturer.</p>

1.2. Range of application

The torque measurement flange (DMF) is designed for mounting to AUMA actuators. The DMF can be mounted to the following types:

- AUMA multi-turn actuators of type range:
SA 07.2 – SA 16.2/SAR 07.2 – SAR 16.2

Other applications require explicit (written) confirmation by the manufacturer.

No liability can be assumed for inappropriate or unintended use.

Observance of these operation instructions is considered as part of the device's designated use.

1.3. Warnings and notes

The following warnings draw special attention to safety-relevant procedures in these operation instructions, each marked by the appropriate signal word (DANGER, WARNING, CAUTION, NOTICE).



Indicates an imminently hazardous situation with a high level of risk. Failure to observe this warning results in death or serious injury.




Indicates a potentially hazardous situation with a medium level of risk. Failure to observe this warning could result in death or serious injury.



Indicates a potentially hazardous situation with a low level of risk. Failure to observe this warning could result in minor or moderate injury. May also be used with property damage.



Potentially hazardous situation. Failure to observe this warning could result in property damage. Is not used for personal injury.

Safety alert symbol  warns of a potential personal injury hazard.
The signal word (here: DANGER) indicates the level of hazard.

1.4. References and symbols

The following references and symbols are used in these instructions:

Information

The term **Information** preceding the text indicates important notes and information.



Symbol for CLOSED (valve closed)



Symbol for OPEN (valve open)



Result of a process step

Describes the result of a preceding process step.

2. Version and scope of delivery

2.1. Short description

Functional principle

The torque measurement flange (DMF) was specially developed for precise torque recording in actuators.

The DMF is compact, free of bearings and wear.

Static and dynamic torques for both rotating and immobile output shaft are measured with the DMF.

The torque provided by the actuator also acts on the DMF. The resulting torsion between the flanges of the DMF is recorded and converted into an analogue high-precision output signal via an amplifier.

Information

To assess possible increasing valve sluggishness, a precise comparison with the previously recorded torques is possible, provided identical environmental conditions as well as similar actuator and valve settings prevail during the measurements.

2.2. Scope of delivery

The scope of delivery for torque measurement flanges includes:

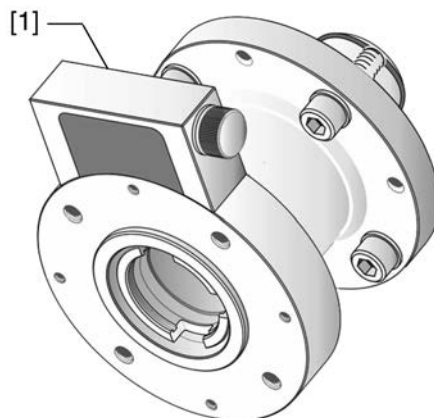
- Torque measurement flange (DMF) with hollow shaft extension and 4 screws for mounting to actuator as well as operation instructions.

Optional scope of delivery:

- 3 m connecting cable for DMF (plug/socket connector, socket, 5-pole M12) and open end wires with wire end sleeves for customer connection. Straight or angled cable output, as desired.
AUMA article numbers:
 - K008.536 Connecting cable with connecting socket, straight cable output
 - K008.535 Connecting cable with connecting socket, 90° cable output

2.3. Name plate

Figure 1: Arrangement of name plate



[1] Name plate of torque measurement flange

Description of name plate

Figure 2: Name plate (example)



- [1] Name of manufacturer
- [2] Address of manufacturer
- [3] **Type designation**
- [4] **Order number**
- [5] **Serial number**
- [6] Measuring range
- [7] Output signal
- [8] Assignment
- [9] **Data Matrix code**

Type designation These instructions apply to the following devices types and sizes:

Torque measurement flange: DMF 10.1, DMF 14.5, DMF 16.1

Order number The product can be identified using this number and the technical data as well as order-related data pertaining to the device can be requested.

Please always state this number for any product inquiries.

On the Internet at <http://www.auma.com> > Service & Support > myAUMA, we offer a service allowing authorised users to download order-related documents such as wiring diagrams and technical data (both in German and English), inspection certificate and the operation instructions when entering the order number.

Serial number

Table 1:

Description of serial number (example of 2418MX12345)			
24	18	MX12345	
24	Positions 1+2: Assembly in week = week 24		
	18	Positions 3+4: Year of manufacture = 2018	
		MX12345	Internal number for unambiguous product identification

Data Matrix code When registered as authorised user, you may use our **AUMA Assistant App** to scan the Data Matrix code and directly access the order-related product documents without having to enter order number or serial number.

Figure 3: Link to AUMA Assistant App:



For further Service & Support, software/apps/... refer to www.auma.com.

3. Transport and storage

3.1. Transport

For transport to place of installation, use sturdy packaging.



Suspended load!

Death or serious injury.

- Do NOT stand below suspended load.
- Attach ropes or hooks for the purpose of lifting by hoist only to housing and NOT to handwheel.
- Actuators mounted on valves: Attach ropes or hooks for the purpose of lifting by hoist to valve and NOT to actuator.
- Actuators mounted to gearboxes: Attach ropes or hooks for the purpose of lifting by hoist only to the gearbox using eyebolts and NOT to the actuator.
- Secure load against falling down, sliding or tilting.
- Perform lift trial at low height to eliminate any potential danger e.g. by tilting.

3.2. Storage

NOTICE

Danger of corrosion due to inappropriate storage!

- Store in a well-ventilated, dry room.
- Protect against floor dampness by storage on a shelf or on a wooden pallet.
- Cover to protect against dust and dirt.
- Apply suitable corrosion protection agent to uncoated surfaces.

Long-term storage

For long-term storage (more than 6 months), observe the following points:

1. Prior to storage:
Protect uncoated surfaces, in particular the output drive parts and mounting surface, with long-term corrosion protection agent.
2. At an interval of approx. 6 months:
Check for corrosion. If first signs of corrosion show, apply new corrosion protection.

4. Assembly

4.1. Basic information on assembly

- Information** To avoid damage caused by inappropriate assembly, heed the following points:
- Flange surfaces must be even and undamaged and free from contamination.
 - Imperatively heed specified tightening torques for fastening the DMF. Always fasten screws crosswise.
 - Avoid mechanic pressure on the compound material inside the DMF.
 - Avoid uneven heating of DMF.

Mounting the DMF to AUMA multi-turn actuator

Figure 4: Example

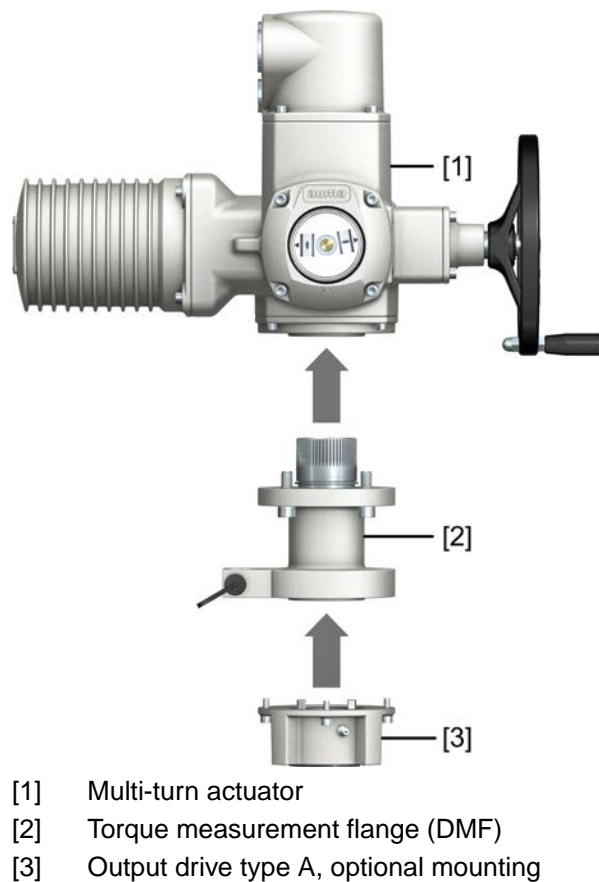


Table 2: Suitable AUMA multi-turn actuators

AUMA multi-turn actuator	SA/SAR 07.2/07.6/10.2	SA/SAR 14.2/14.6	SA/SAR 16.2
Bearing flange of multi-turn actuator	F10	F14	F16
DMF	DMF 10.1	DMF 14.5	DMF 16.1
Output mounting flange for multi-turn actuator	F10	F14	F16
Output drive flange	F10	F14	F16
DMF output drive	A, B1, B2, B3, B4; D according to EN ISO 5210 A, B, D, E according to DIN 3210		
Further output drive types (optional mounting)	AK; AG		

4.2. DMF: mount to multi-turn actuator

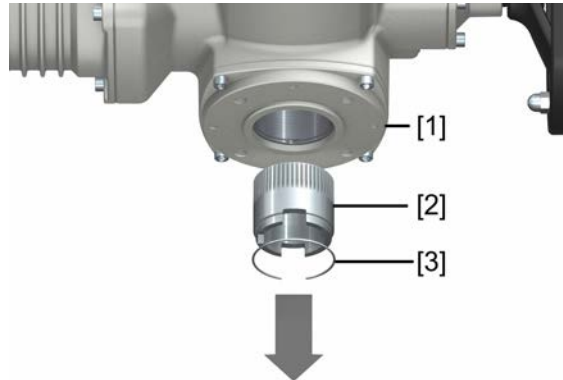
The torque measurement flange (DMF) is directly mounted directly on the bearing flange of the multi-turn actuator.

If an output drive type (A, AK, AG) is already available at the bearing flange of the actuator and/or an output drive sleeve is fixed to the actuator hollow shaft, they must be removed first.

Remove output drive sleeve

1. If available: Unfasten output drive type (A, AK, AG) from bearing flange [1].
2. Loosen circlip [3].
3. Remove available output drive sleeve [2] from hollow shaft.

Figure 5: Removal of a previously mounted output drive sleeve

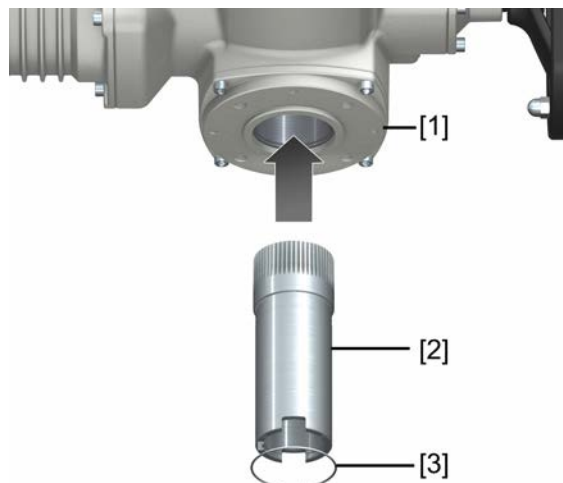


- [1] Bearing flange of multi-turn actuator
- [2] Output drive sleeve
- [3] Circlip

Mount DMF to multi-turn actuator

1. Check if DMF output mounting flange and actuator bearing flange [1] match.
2. Check if splines of DMF hollow shaft match the splines of the hollow shaft inside the multi-turn actuator.
3. Slightly grease the DMF hollow shaft splines and fit DMF hollow shaft [2] into hollow shaft of the multi-turn actuator.
4. Place retaining ring [3].

Figure 6: Mount DMF hollow shaft



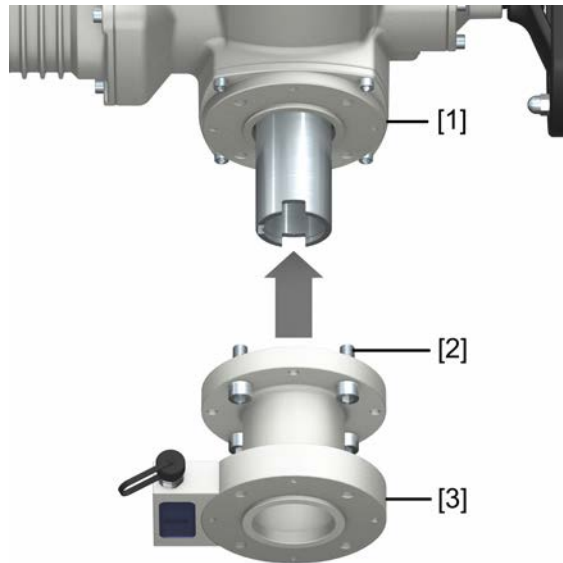
- [1] Bearing flange of multi-turn actuator
- [2] DMF hollow shaft
- [3] Circlip

5. Place DMF on hollow shaft and on bearing flange of multi-turn actuator [1].

Information: Ensure that the spigot fits uniformly in the recess and that the mounting faces are in complete contact.

6. Fasten DMF using the screws attached to the bearing flange [1].

Information: We recommend applying liquid thread sealing material to the screws to avoid contact corrosion.



- [1] Bearing flange of multi-turn actuator
[2] Screws
[3] Torque measurement flange (DMF)

7. Tighten screws crosswise with a torque according to table <Tightening torques for screws> .

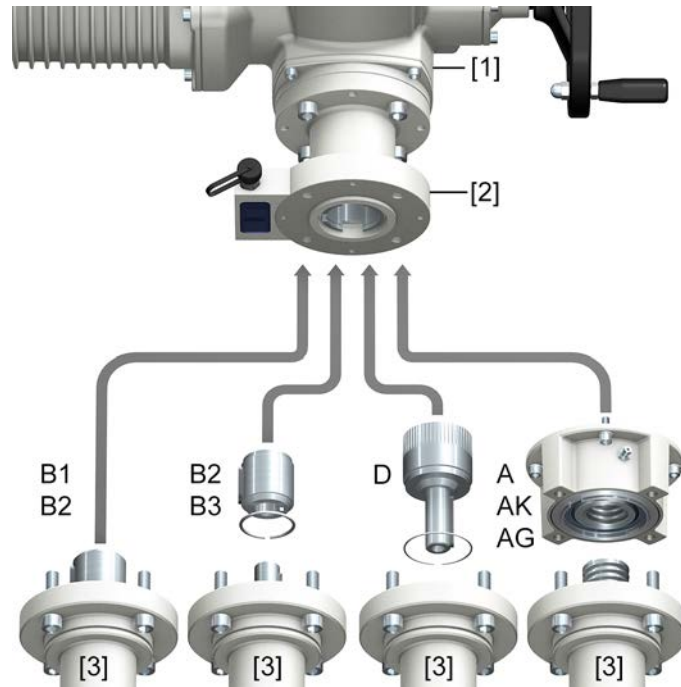
Table 3: Tightening torques for screws

Screws	Tightening torque T_A [Nm]	
	Strength class 8.8	Strength class A2-80 ¹⁾
M10	51	48
M16	214	200
M20	431	392

- 1) DMF is supplied by AUMA including screws [2] of strength class A2-80

4.3. Multi-turn actuator with fitted DMF: mount to valve/gearbox

Figure 7: Mounting principle of various output drive types



- [1] Multi-turn actuator with mounted DMF
[3] Flange valve/gearbox

Mounting a multi-turn actuator with fitted DMF to valve/gearbox is basically identical to the mounting of a multi-turn actuator without DMF. The mounting steps for mounting to a valve or a gearbox are described in the operation instructions pertaining to the actuator (chapter <Assembly>).

References relating to mounting various output drive types in combination with torque measurement flange:

- For output drive types B1 and B2, the connection to the valve or the gearbox is made by directly placing the multi-turn actuator onto the input shaft of the valve or gearbox.
- For output drive types B3 and B4, the connection between the hollow shaft of the DMF and the valve/gearbox is made via output drive sleeve with parallel key, which is fixed in the DMF hollow shaft by means of a circlip.
- For output drive types A (A, AK, AG), the connection to the valve is made by mounting the output drive type A to the DMF. In this instance, the stem nut of the output drive type A engages directly into the dog of the DMF hollow shaft.
- For output drive type D, the connection between the hollow shaft of the DMF and the valve/gearbox is made via output drive shaft with parallel key, which is fixed in the DMF hollow shaft by means of a retaining ring.

5. Electrical connection

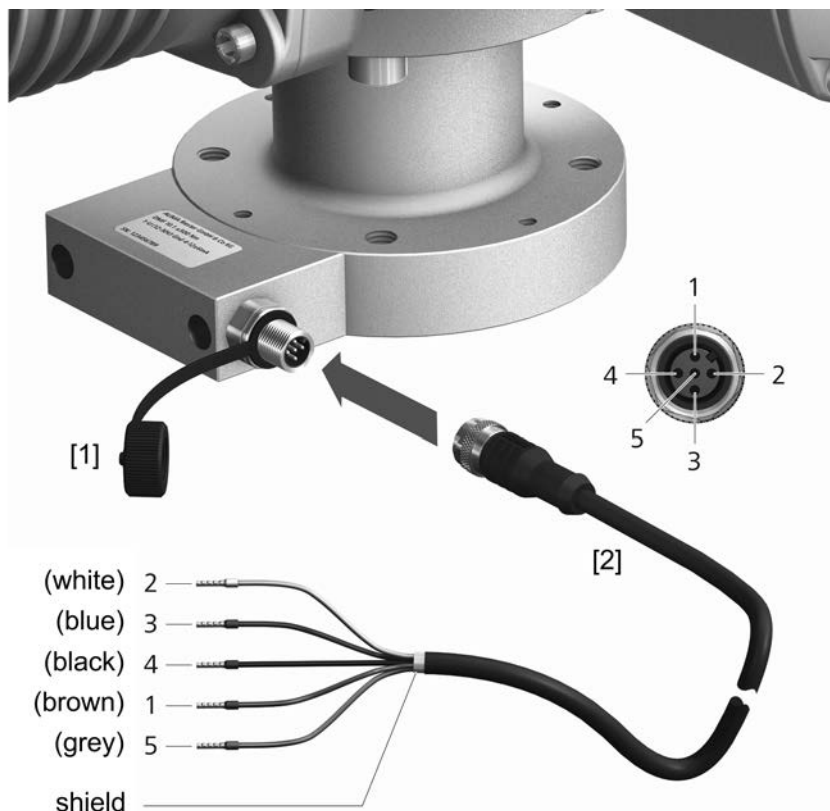


Danger due to incorrect electrical connection

Failure to observe this warning can result in death, serious injury, or property damage.

→ The electrical connection must be carried out exclusively by suitably qualified personnel.

The connecting cable to the DMF is shielded and extremely robust, ideally suited for industrial applications, protected against polarity reversal, designed in enclosure protection IP67 and equipped with M12x1 coupling for connection.



[1] Sealing cap

[2] Connecting cable (customer side) with plug/socket connector

Power supply and current signal connections

Assignment

Pin 1 (brown)	Power supply connection (10 – 30 V DC)
Pin 2 (white)	Not connected
Pin 3 (blue)	Ground connection (–)
Pin 4 (black)	Current signal connection (12 ±6 mA)
Pin 5 (grey)	Not connected
Shield	Connect to ground/pin 3 (blue)

Connect plug/socket connector

1. Unscrew sealing cap [1].
2. Place plug/socket connector [2] and tighten cap nut.

6. Signal processing

The amplifier integrated into the torque measurement flange provides an analogue current signal, proportional to the torque and depending on the direction of rotation within the ranges 12 ± 6 mA:

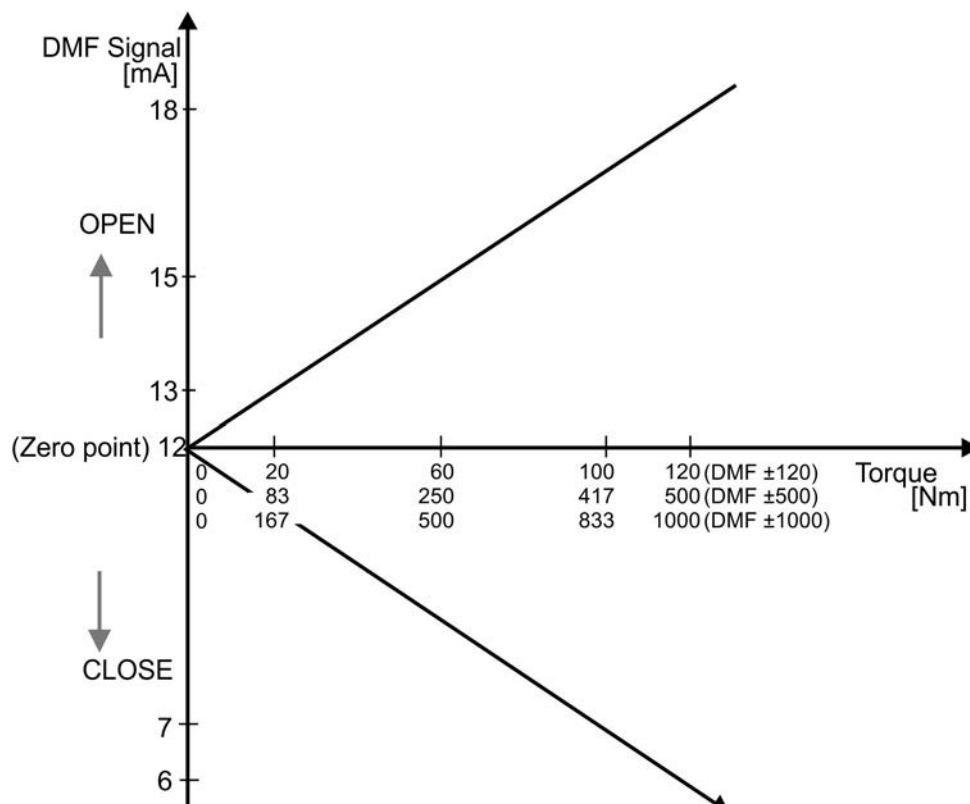
from 6 to 12 mA [–... Nm] and

from 12 to 18 mA [+... Nm]

Under no-load conditions, i.e. if no torque is present, 12 mA are provided.

Information Depending on both mounting conditions and temperature, zero point shift might occur under no-load condition (deviation of 12,000 mA) and must be considered for future assessment/measurements.

Figure 8: Signal processing, represented for clockwise closing direction.



For counterclockwise closing direction, end position assignment OPEN and CLOSED will change:

$CLOSED_{max} = 18$ mA and $OPEN_{max} = 6$ mA

Information Signal assessment and, if required, visualisation must be implemented by the user! Individual options are available, such as:

- Signal processing and, if applicable, visualisation must be implemented by own controls
- Measurement card and software "LabVIEW"
- Display unit (AUMA article no. K009.091)

7. Technical data

Information The following tables include standard and optional features. For detailed information on the customer-specific version, refer to the order-related data sheet. The technical data sheet can be downloaded from the Internet in both German and English at <http://www.auma.com> (please state the order number).

7.1. Technical data Torque measurement flange

Information relating to the sensor			
	DMF 10.1	DMF 14.5	DMF 16.1
Suitable AUMA multi-turn actuator	SA 07.2/SA 07.6/10.2	SA 14.2/SA 14.6	SA 16.2
Output mounting flange for mounting to multi-turn actuator according to EN ISO 5210	F10	F14	F16
Output drive flange	F10	F14	F16
Measuring range ¹⁾	±120 Nm	±500 Nm	±1000 Nm
Accuracy ²⁾	±2 % of the measuring range end value		
Insulation resistance	> 2 G Ω		
Temperature coefficient of rated value	0.2 %/10 °K		
Temperature coefficient of zero point	0.2 %/10 °K		
Reference temperature	20 °C		
Storage temperature	−40 °C to +105 °C		
Ambient temperature	−40 °C to +80 °C		
Maximum usage torque/nominal torque ³⁾	1-fold nominal torque		
Limit torque ⁴⁾	2-fold nominal torque		
Breaking torque ⁵⁾	4-fold nominal torque		
Version/material	Anodised aluminium		
Corrosion protection	KS		
Enclosure protection according to EN 60529	IP67		
Dimensions	Ø 125 x 102 (157 x 125 x 102)	Ø 175 x 144 (207 x 175 x 144)	Ø 210 x 165 (242 x 210 x 165)

- 1) The amplifier integrated in the torque measurement flange supplies an analogue current signal, proportional to the torque within the ranges 12 ±6 mA (from 6 – 12 mA for clockwise closing-> [- ... Nm] and from 12 – 18 mA-> for counterclockwise opening [+ ... Nm]). Under no-load conditions, i.e. if no torque is present, 12 mA are provided. Depending on both mounting conditions and temperature, a zero point deviation might occur under no-load condition (deviation of 12,000 mA) which must be considered for future assessments/meas-urements.
- 2) This indication contains non-linearity, measurement deviation at initial and final values and failure of proof test (for reference temperature of 20 °C and identical mounting position); temperature impacts are indicated separately.
- 3) Largest torque for which a defined and repeatable relation exists between torque and output signal.
- 4) Torque for which - when exceeded - significant changes of measurement properties of the torque measurement flange must be accounted for.
- 5) Torque for which - when exceeded - mechanical destruction must be accounted for.

Information on integral amplifier	
Power supply (U _B)	10 – 30 V DC
Limit frequency (at −3 dB)	1,000 Hz
Output signal ¹⁾	12 ±6 mA; 3-wire
Load	(U _B – 6 V)/0.0205 A up to max. 500 Ω
Connection	M12x1 5-pole connector
Assignment	1 = U _B ; 3 = Ground; 4 = Current signal

- 1) The amplifier integrated in the torque measurement flange supplies an analogue current signal, proportional to the torque within the ranges 12 ±6 mA (from 6 – 12 mA for clockwise closing-> [- ... Nm] and from 12 – 18 mA-> for counterclockwise opening [+ ... Nm]). Under no-load conditions, i.e. if no torque is present, 12 mA are provided. Depending on both mounting conditions and temperature, a zero point deviation might occur under no-load condition (deviation of 12,000 mA) which must be considered for future assessments/meas-urements.

Information on connecting cable		
AUMA article numbers	K008.536	Connecting cable with connecting socket, straight cable output; Length of cable 3 m
	K011.223	Connecting cable with connecting socket, straight cable output; Length of cable 5 m
	K011.224	Connecting cable with connecting socket, straight cable output; Length of cable 10 m
Plug/socket connector	Socket, 5-pole M12	
Contact material	CuZn gold-plated	
Enclosure protection according to EN 60529	IP67 when inserted and locked	
Cable shield	PUR black; free of PVC, silicone and halogen; shielded cable	
Cable length	3 m	
Cable diameter	5.6 mm	
Wire diameter	5 x 0.34 mm ²	
Wire	Fine-stranded; approx. 42 x 0.1 mm	
Wire insulation	PP, free of halogen	
Bending radius, fixed installation	Min. 5 x cable diameter	
Wire colour and contact assignment	Brown (1), white (2), blue (3), black (4), grey (5)	
Ambient temperature, fixed installation	-40 °C to +90 °C	

Index		V	
		Version	5
A		W	
Applications	3	Wiring diagram	6
Assembly	8		
Assignment	6	Y	
Assistant App	6	Year of production	6
AUMA Assistant App	6		
C			
Commissioning	3		
Corrosion protection	7		
D			
Data Matrix code	6		
Device type	6		
Directives	3		
E			
Electrical connection	12		
I			
Identification	5		
Inspection certificate	6		
M			
Maintenance	3		
Measuring range	6		
N			
Name plate	5		
O			
Operation	3		
Order number	6, 6		
Output signal	6		
P			
Production, year	6		
Protective measures	3		
Q			
Qualification of staff	3		
R			
Range of application	3		
S			
Safety instructions	3		
Safety instructions/warnings	3		
Scope of delivery	5		
Serial number	6, 6		
Signal processing	13		
Size	6		
Standards	3		
Storage	7		
T			
Technical data	14		
Transport	7		
Type (device type)	6		
Type designation	6		

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