

## Specification 227CM & CMX



## TOC

## Seite

1. Additional information .....	3
1.1. Preamble .....	3
1.2. Version .....	3
2. General Description .....	4
2.1. Safety remarks .....	4
2.2. Notes .....	4
3. Mechanical requirements .....	5
3.1. Dimension CM .....	5
3.2. Dimension CMX .....	6
3.3. Mechanical properties .....	7
3.4. Angle of rotation adjustment .....	8
3.5. Damper connection .....	9
3.6. Labeling CM .....	10
3.7. Labeling CMX .....	11
3.8. Cover .....	13
4. Electrical Properties .....	21
4.1. 5 Nm / C Controller .....	21
4.2. 10 Nm / C Controller .....	22
4.3. 15 Nm / C Controller .....	23
4.4. Input signal Y (analog) .....	24
4.5. Output signals U (analog) .....	25
4.6. Software .....	26
4.7. Modbus Protocol .....	27
4.8. Connection .....	32
5. Approvals / Standards .....	33
6. Shipping configuration .....	33
6.1. CM and CMX Minimum version .....	33
6.2. CMX Maximum version .....	34
7. Changes .....	35

## 1. Additional information

### 1.1. Preamble

This document describes the basic conditions for the development of a continuous controlled (C) actuator based on the Gruner type 227.

The actuator is controlled by proportional controllers, positioners or DDC-systems. Different operating modes can be realized by using override control signals.

All possible configurable versions are described in the following sections.

### 1.2. Version

Version	Running time	Torque	Motor	Communication
Continuous control 24 V <sub>AC</sub> (50/60 Hz) / DC ±20%	100 s [20...120s]	5 Nm [45 in-lb]	BLDC	PP-Bus ModBus
	150 s [60...240s]	10 Nm [90 in-lb]		
	150 s [60...240s]	15 Nm [135 in-lb]		

## 2. General Description

### 2.1. Safety remarks

The actuators are not suitable for use in explosive atmospheric applications!

All service to the actuators (mounting, electrical connection, retrofitting and repair) must be carried out with the power supply disconnected. A trained and competent person considering the wiring diagrams, local and national regulations shall do the electrical connection. Use copper twisted conductors only. Provide disconnect and overload protection if necessary.

This actuator may only be operated by 24 V<sub>AC/DC</sub>!

The transformer must be sized according to technical data of the actuator (see section below). Electronics and controllers must be powered from a separate transformer when controller power is full-wave rectified. Otherwise the controller or the actuator may be damaged. Always read the controller installation instructions before making any connection!

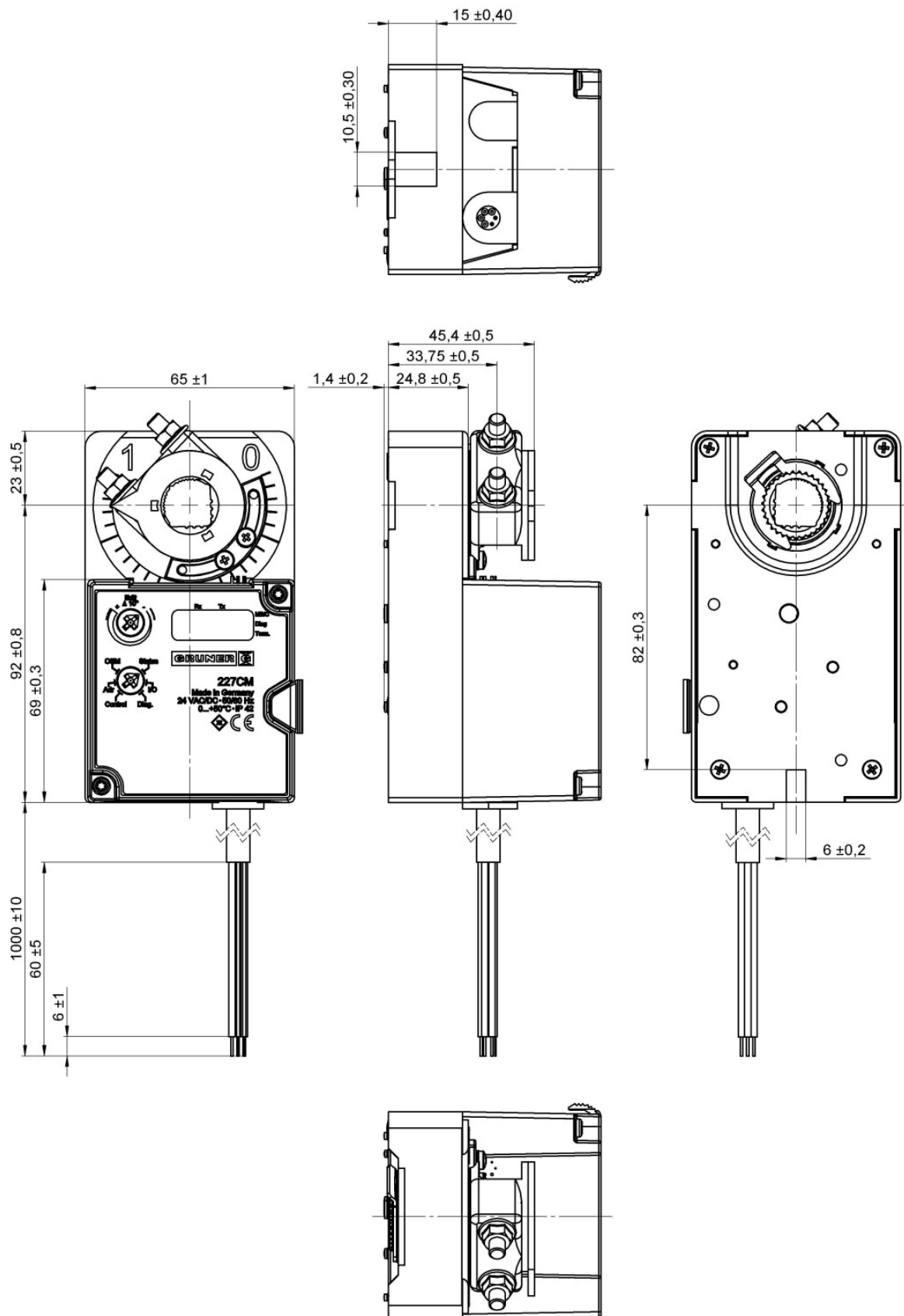
### 2.2. Notes

- Actuators are provided with color coded wires. Associated to the color you find numbers as follows BU = 1, BN = 2, BK = 3 and GY = 4.
- Observe polarity on secondary of transformers. All common and signal (–) must be connected in line. Incorrect polarity can cause controller damage or operation error.
- Long wire runs requires a 4-wire configuration (connect common for power and control signal at the actuator or close by). Greater than a 0.2 V drop must be avoided for any common wire.
- Always use a separate transformer when controller power is full-wave rectified.
- Controller and actuators must have separate transformers for paralleled multi-actuator application.
- Provide overload protection for line voltage and disconnect as required

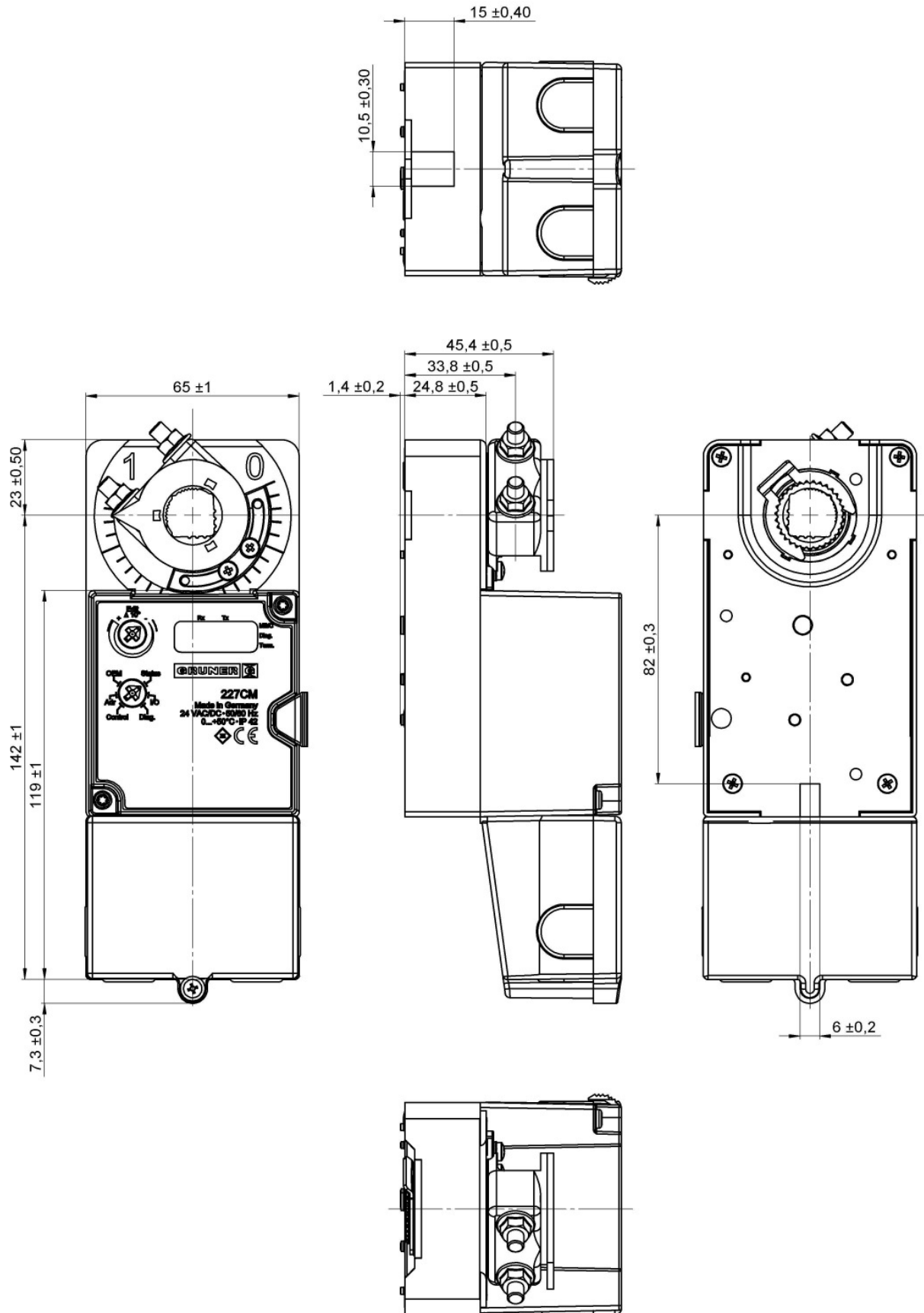
Multiple Actuators (maximum quantities)	227CM
Master-Slave Via U, feedback signal	5 pcs

### 3. Mechanical requirements

#### 3.1. Dimension CM



### 3.2. Dimension CMX



### 3.3. Mechanical properties

Angle of rotation:	Max. $93^{\circ} \pm 2^{\circ}$ Adjustable end-stops
Direction of rotation:	Normal [CW] and Invers [CCW ] adjustable
Ambient temperature:	-30 °C...+50 °C [-22 °F...122 °F]
Storage temperature:	-30 °C...+80 °C [-22 °F...176 °F]
Ambient humidity:	5...95 % r.H. no condensing (EN 60730-1)
Manual operation:	The manual declutch button is part of the Gruner standard version. It is possible to manually change the position of the damper. However the actuator will control to the desired angle, according to the external reference signal Y. The controller can be turned off in order to allow manual settings and to keep the position unchanged.
Service Life	>60.000 cycles ( $0^{\circ}$ ... $95^{\circ}$ ... $0^{\circ}$ ) >1'000'000 partial cycles (max. $\pm 5^{\circ}$ )
Maintenance:	Maintenance-free
Warranty:	5 years on material and production

#### 3.3.1. 5 Nm [45 in-lb] Controller

Nominal torque ( $M_{dmin.}$ ):	5 Nm [45 in-lb]
Start-up torque (typ.)	6 Nm (peak min. 1 s) [53 in-lb (peak min. 1 s)]
Running time.	100 s / $90^{\circ}$
Sound power level:	< 35 dB(A)
Weight:	<div>CM: ca. 0,435 kg [ca. 0.96 lb]</div> <div>CMX: ca. 0,515 kg [ca. 1.14 lb]</div>

#### 3.3.2. 5 Nm [45 in-lb] Controller S

Nominal torque (min.):	5 Nm [45 in-lb]
Start-up torque (typ.)	6 Nm (peak min. 1 s) [53 in-lb (peak min. 1 s)]
Running time.	20 s / $90^{\circ}$
Sound power level:	< 45 dB(A)
Weight:	<div>CM: ca. 0,435 kg [ca. 0.96 lb]</div> <div>CMX: ca. 0,515 kg [ca. 1.14 lb]</div>

### 3.3.3. 10 Nm [90 in-lb] Controller

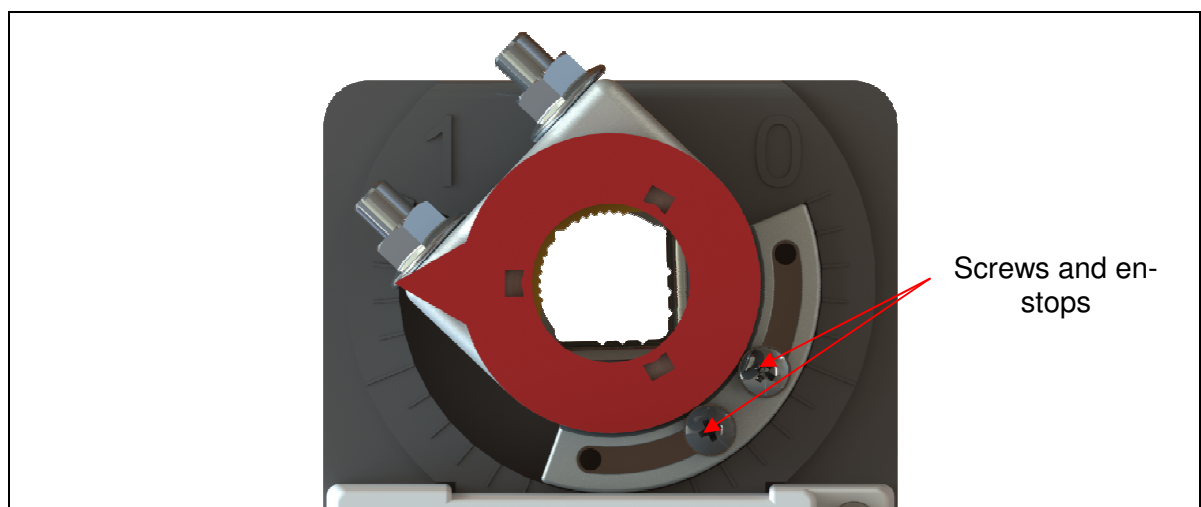
Nominal torque (min.):	10 Nm [90 in-lb]
Start-up torque (typ.)	12 Nm (peak min. 1 s) [106 in-lb (peak min. 1 s)]
Sound power level:	< 35 dB(A)
Running time.	150 s / 90°
Weight:	<div>CM: ca. 0,460 kg [ca. 1.01 lb]</div> <div>CMX: ca. 0,540 kg [ca. 1.19 lb]</div>

### 3.3.4. 15 Nm [135 in-lb] Controller

Nominal torque (min.):	15 Nm [135 in-lb]
Start-up torque (typ.)	16 Nm (peak min. 1 s) [142 in-lb (peak min. 1 s)]
Sound power level:	< 35 dB(A)
Running time.	150 s / 90°
Weight:	<div>CM: ca. 0,460 kg [ca. 1.01 lb]</div> <div>CMX: ca. 0,540 kg [ca. 1.19 lb]</div>

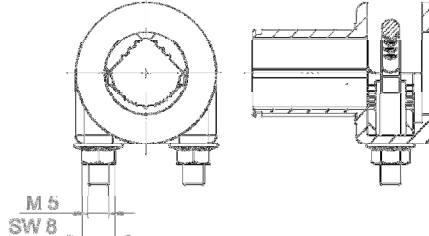
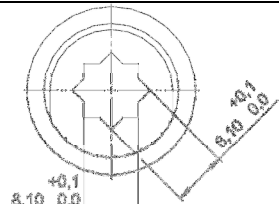
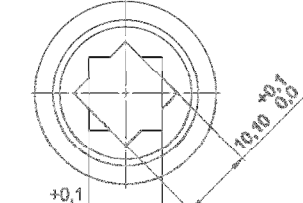
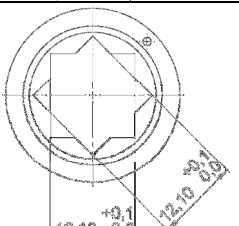
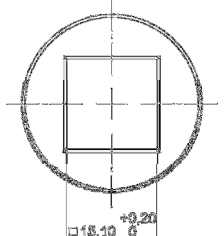
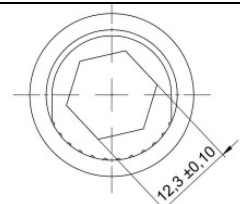
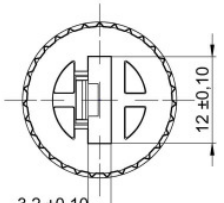
## 3.4. Angle of rotation adjustment

Both end stops are adjusted to 0° and 90°. For smaller rotation angles, loosen the screws at the metal end stop, adjust the end stop as requested and fasten the screws again. Make sure that with closed damper the motor is on and stop. If necessary re-adjust the metal stop. The necessary screwing torque is 1Nm [9 in-lb].

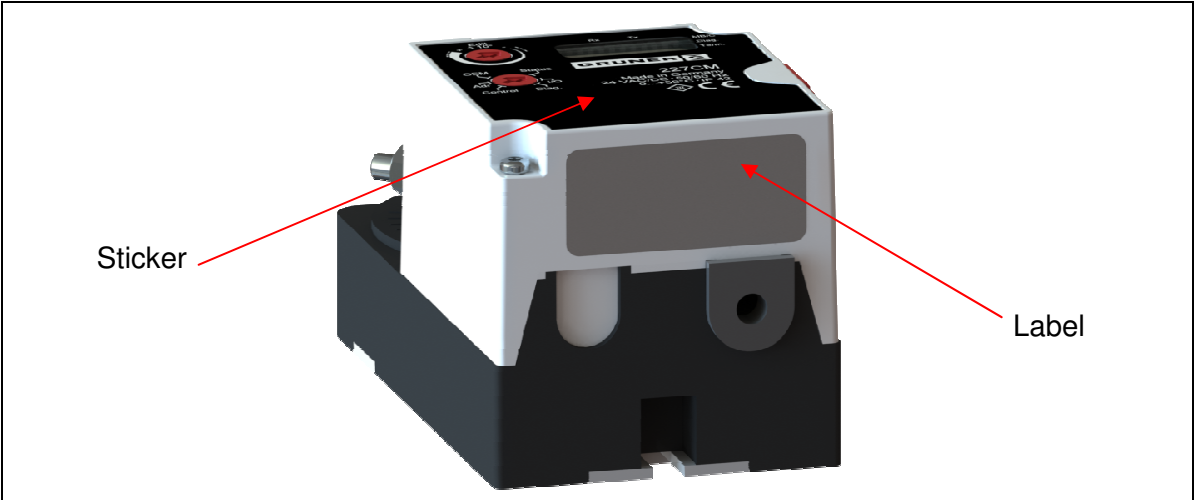


### 3.5. Damper connection


It is possible to deliver the Gruner 227C with universal clamp or different Form fit inserts.  
The standard 227C is delivered with universal clamp.  
Dimensions as follows:

	<p>Universal clamp + Red plastic pointer  <math>\varnothing</math> 8...16 mm  <math>[\varnothing 5/16" \dots 5/8"]</math>  <math>\square</math> 8...12 mm  <math>[\square 5/16" \dots 15/32"]</math></p>
	<p>8 mm form fit (8E8)  <math>[\square 5/16"]</math>          227-EINS-001-B-.</p>
	<p>10 mm form fit (8E10)  <math>[\square 7/16"]</math>          227-EINS-002-B-.</p>
	<p>12 mm form fit (8E12)  <math>[\square 15/32"]</math>          227-EINS-002-A-.</p>
	<p>15 mm form fit (4E15)  <math>[\square 17/32"]</math>          200-EINS-002-A-.</p>
	<p>12 mm form fit (6E12)  <math>[\text{hexagonal } 15/32"]</math>          227-EINS-003-A-.</p>
	<p>3 mm x 12 mm form fit (2E12.3)  <math>[\text{rectangle } 0.118" \times 0.472"]</math>          227-EINS-003-A-.</p>

3.6. Labeling CM



3.6.1. Sticker

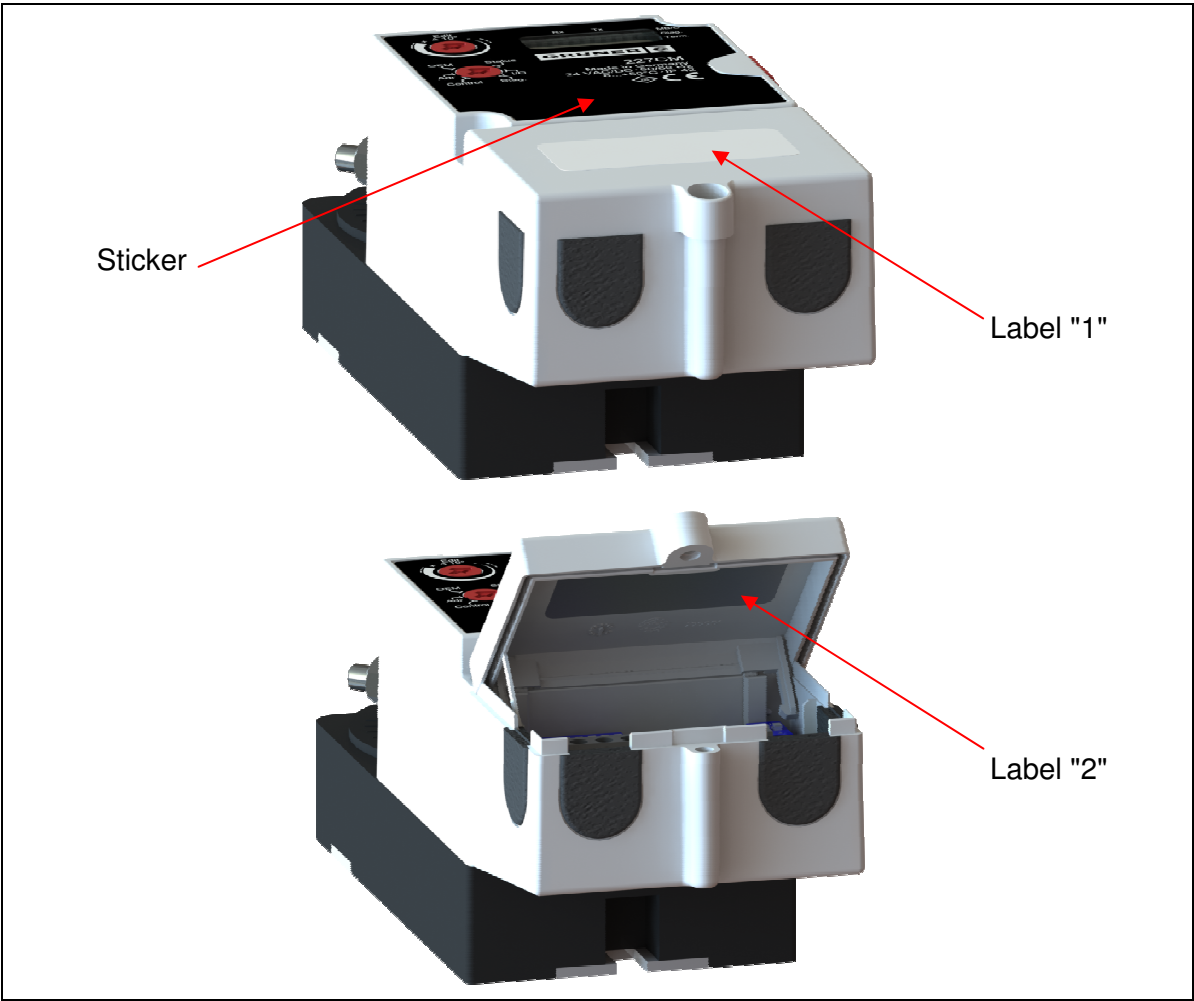
Colour:	Blue / Ral 5002
Printing	White (fluorescent)
	

The sticker is black with white text and symbols. It features a circular 'Edit' knob with a 10° scale, a 'Status' knob, and a 'Control' knob. The text includes 'GRUNER G', 'Schalten und Bewegen', '227CM', 'Made in Germany', '24 VAC/DC • 50/60 Hz', '0...+50°C • IP 42', and various safety symbols like CE, a warning triangle, and a diamond with 'III'.


3.6.1. Label

Colour:	silver
Size:	45 mm × 20 mm
<div>Gruner type-no. Nominal torque Power consumption (Standby) • wire sizing Running time • Angle of rotation</div> <div>Connection scheme Production-No • Rev. • Production date</div>	

3.7. Labeling CMX



3.7.1. Sticker

Colour:	Blue / Ral 5002
Printing	White (fluorescent)
	

3.7.2. Label "1"

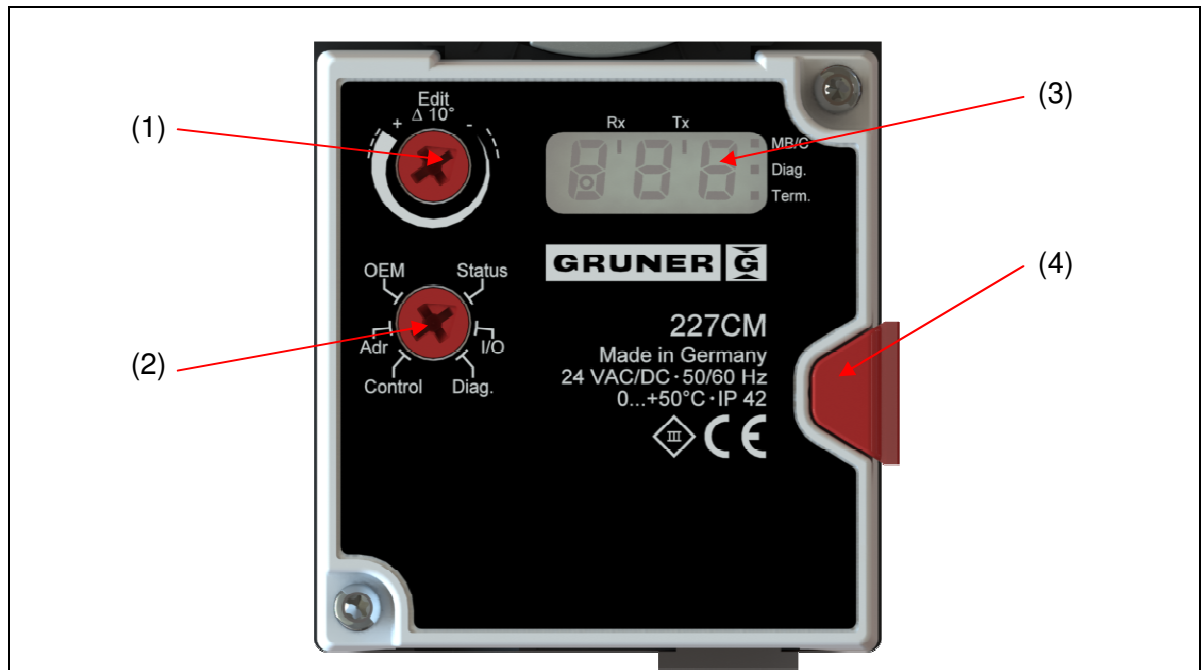
Colour:	white
Size:	45 mm × 20 mm
<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p><b>227CMX-024-15-MB</b></p> <p><b>15 Nm</b></p> <p><b>3 W (2 W) • 4,5 VA</b></p> <p><b>150 s (90°) • 95°</b></p> <p>XXXXXXX • XX • 13/07</p> </div> <p>Gruner type-no. Nominal torque Power consumption (Standby) • wire sizing Running time • Angle of rotation Production-No • Rev. • Production date</p>	

3.7.3. Label "2"

Colour:	silver
Size:	45 mm × 20 mm
<p>Connection scheme</p> <div style="display: flex; justify-content: space-around; align-items: flex-end; margin-top: 20px;"> <div style="text-align: center;"> <p>⊥ ~ B A</p> <p>- +</p> <div style="display: flex; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">4</div> </div> </div> <div style="text-align: center;"> <p>⊥ ~ AI1 AO1</p> <p>- +</p> <div style="display: flex; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">4</div> </div> </div> <div style="text-align: center;"> <p>B A AI2 ⊥ SW SW</p> <p>- + -</p> <div style="display: flex; gap: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">4</div> <div style="border: 1px solid black; padding: 2px 5px;">5</div> <div style="border: 1px solid black; padding: 2px 5px;">6</div> </div> </div> </div>	

### 3.8. Cover

The cover shows the appropriate units and if diagnostic functions are set. Also there is the 3-digit display (function see 3.8.4) to show selected functions, values and units. The units are printed on the sticker.


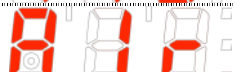
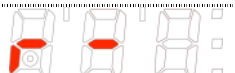












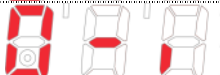
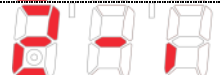
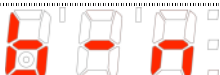
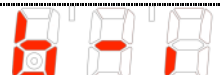

#### 3.8.1. Value selector (1) ( $\Delta 10^\circ$ / Edit)

The value selector allows the changing of values. The position of the arrow shows the value set. The changes are displayed as soon as the selector is moved  $\pm 10^\circ$  from its position. By turning the selector up or down the corresponding values are shown

### 3.8.2. Function selector (2) for CM and CMX minimum version





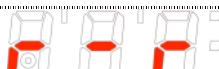



The function selector allows choosing the function depending on its position. If there is no function selected the display will show three dashes (- - -).



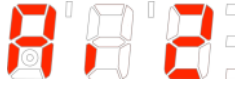



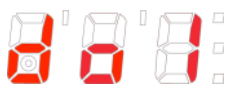




Function	Description		
Status	Shows the actual position of the damper in percent, calculated to the adapted angle of rotation.		
I/O	Allows to select the signal of the different Analog inputs		
		A(i)1u	Voltage Input signal is set to analog input port 1
		A(i)1r	resistance Input signal is set to analog input port 1
	The choosen Input mode shall be shown as follows:		
		resistance Input signal is set to analog input port 1	
	Voltage Input signal is set to analog input port 1		
Diag	Opens the diagnose menu. All input signals on Y are neglected and the controller only operates according to the selected override function. All override functions are disabled after a time-out of 10 hours. Selecting another function will disable the Test function and set it automatically to OFF		
		OFF	Test mode is switched off. The actuator starts controlling according to external signal Y.
		Ai1	Showing the actual value at the analog input port 1 This voltage input signal shall be shown in the range of $0...100 \times 10^{-1} V$ The resistance input signal shall be shown as the actual Value $\times 10 \Omega$
		op(en)	Actuator gets position $\alpha_{max}$ The display toggles after the selection of the function between the actual position (8s showing time) and the function (2s showing time).
		cL(ose)	Actuator gets position $\alpha_{min}$ The display toggles after the selection of the function between the actual position (8s showing time) and the function (2s showing time).
		Ao1	Activates the analog output and starts an saw tooth signal from $0V_{DC}...10V_{DC}...0V_{DC}$
		Adp	Adaption drive is switched on.
		123	Showing the software version V123. After 3s showing the display shows OFF again.

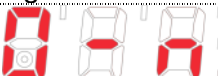



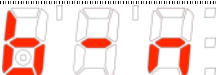


Function	Description			
Control	Allows to set the direction of rotation for C Control (normal and inverse) and the input signal range (0...10 VDC or 2...10 VDC) of the reference signal Y. The feedback signal range of U corresponds to Y.			
		0-10 V <sub>DC</sub> , normal		2-10 V <sub>DC</sub> , normal
		0-10 V <sub>DC</sub> , invers		2-10 V <sub>DC</sub> , invers
	Also for the C Control with ModBus it allows to change the direction of rotation.			
		ModBus normal		ModBus invers
Adr (only ModBus)	Allows setting the address of the Modbus actuator, by turning the value selector. It is possible to set the address from 1 up to 247.			
		If the value selector is turned to the end-stop "+", the Display shows "2 i n", this allows to select the second level. If the second level is chosen, this is indicated in the display by a small circle		
	In the second level the functions are as follows			
	Status	Back to level one		
	I/O	Not in use		
	Test	Not in use		
	Control	Allows to switch the Modbus termination on / off		
	Adr.	Allows to select the ModBus parameter (see separate documentation)		
	OEM	Allows to set the ModBus delay (see separate documentation)		
OEM	Allows selecting preset values.			
	more TBD			

### 3.8.3. Function selector (2) for CMX maximum version

The function selector allows choosing the function depending on its position. If there is no function selected the display will show three dashes (- - -).

Function	Description	
Status	Shows the actual position of the damper in percent, calculated to the adapted angle of rotation.	
I/O	Allows to select the signal of the different Analog inputs	
		A(i)1u Voltage Input signal is set to analog input port 1
		A(i)1r resistance Input signal is set to analog input port 1
		A(i)2u Voltage Input signal is set to analog input port 2
		A(i)2r resistance Input signal is set to analog input port 2
	The choosen Input mode shall be shown as follows:	
		resistance Input signal is set to analog input port 1 resistance Input signal is set to analog input port 2
		Voltage Input signal is set to analog input port 1 Voltage Input signal is set to analog input port 2
		Voltage Input signal is set to analog input port 1 resistance Input signal is set to analog input port 2
		resistance Input signal is set to analog input port 1 Voltage Input signal is set to analog input port 2

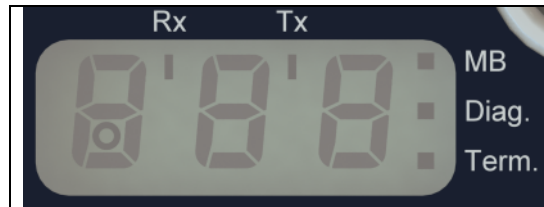
Function	Description	
Diag	<p>Opens the diagnose menu. All input signals on Y are neglected and the controller only operates according to the selected override function. All override functions are disabled after a time-out of 10 hours. Selecting another function will disable the Test function and set it automatically to OFF</p>	
		oFF Test mode is switched off. The actuator starts controlling according to external signal Y.
		Ai1 Showing the actual value at the analog input port 1 This voltage input signal shall be shown in the range of $0 \dots 100 \times 10^{-1} \text{ V}$ The resistance input signal shall be shown as the actual Value $\times 10 \ \Omega$
		Ai2 Showing the actual value at the analog input port 2 This voltage input signal shall be shown in the range of $0 \dots 100 \times 10^{-1} \text{ V}$ The resistance input signal shall be shown as the actual Value $\times 10 \ \Omega$
		op(en) Actuator gets position $\alpha_{\max}$ The display toggles after the selection of the function between the actual position (8s showing time) and the function (2s showing time).
		cL(ose) Actuator gets position $\alpha_{\min}$ The display toggles after the selection of the function between the actual position (8s showing time) and the function (2s showing time).
		Ao1 Activates the analog output and starts an saw tooth signal from $0 \text{ V}_{\text{DC}} \dots 10 \text{ V}_{\text{DC}} \dots 0 \text{ V}_{\text{DC}}$
		do1 Activates the digital output 1 The display toggles after the selection of the function between the "0" and "1". shown as follows:  
		Adp Adaption drive is switched on.
		123 Showing the software version V123. After 3s showing the display shows oFF again.

Function	Description
Control	Allows to set the direction of rotation for C Control (normal and inverse) and the input signal range (0...10 V <sub>DC</sub> or 2...10 V <sub>DC</sub> ) of the reference signal Y. The feedback signal range of U corresponds to Y.
	 0-10 V <sub>DC</sub> , normal  2-10 V <sub>DC</sub> , normal
	 0-10 V <sub>DC</sub> , invers  2-10 V <sub>DC</sub> , invers
	Also for the C Control with ModBus it allows to change the direction of rotation.  ModBus normal  ModBus invers
Adr (only ModBus)	Allows setting the address of the Modbus actuator, by turning the value selector. It is possible to set the address from 1 up to 247.
	
	If the value selector is turned to the end-stop "+" the Display shows "2 i n", this allows to select the second level. If the second level is chosen, this is indicated in the display by a small circle
	In the second level the functions are as follows
	Status Back to level one
	I/O Not in use
	Test Not in use
OEM	Control Allows to switch the Modbus termination on / off
	Adr. Allows to select the ModBus parameter (see separate documentation)
	OEM Allows to set the ModBus delay (see separate documentation)
OEM	Allows selecting preset values. <b>more TBD</b>

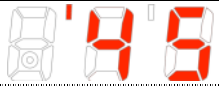



### 3.8.4. Display (3)

The display (3) uses 7-segment numbers in full 3-digits. Additional signs include a small circle, three square dots and two rectangular slashes.

The square dots are used with the externally printed text to visualize certain functions or modes. It is meant to denote the mode of operation of the actuator shown in the display.

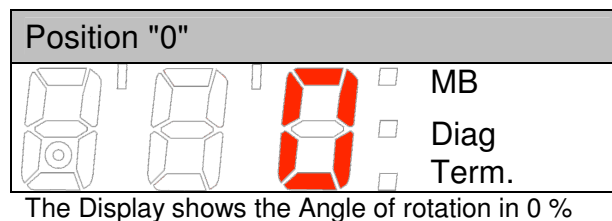
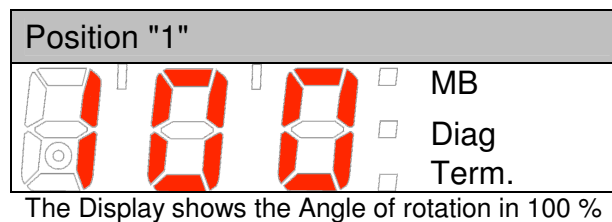


3-digit 7-segment display

Function	Description	
MB		If the ModBus mode is activated, this is indicated by a square dot. (see pic.)
		If the ModBus mode is deactivated, there is no square dot for the indication. (see pic.) Actuator is then controlled via analog input signal AI1
	For further information how to set the controller to the different modes read 3.8.2	
Diag.		If the diagnostic mode is activated, this is indicated by square dot. (see pic.).
	For further information how to set the controller to the Diagnostic mode read 3.8.2	
Term.		If the controller is set as Modbus termination, this is indicated by square dot. (see pic.).
	For further information how to set the controller to the diagnostic mode read 3.8.2	
Rx	When there is traffic on Modbus network, the rectangular slash is toggling.	
Tx	When the controller is transmitting information, the rectangular slash is toggling.	
○	Actuator is not in its adapted angle of rotation	

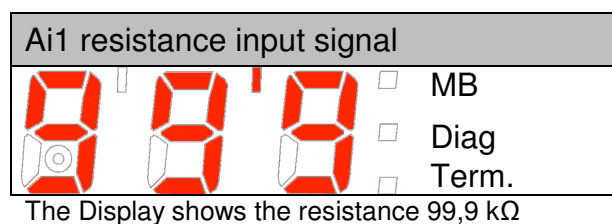
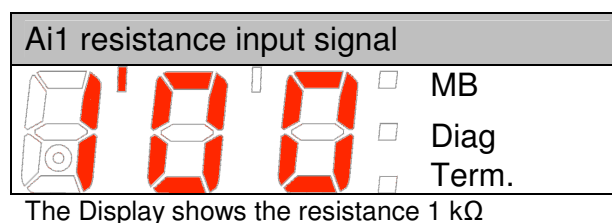
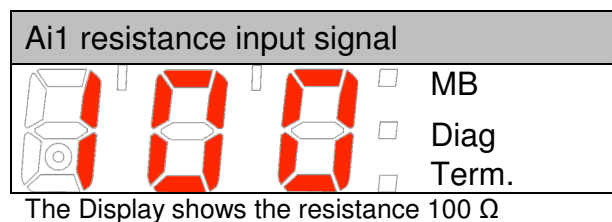
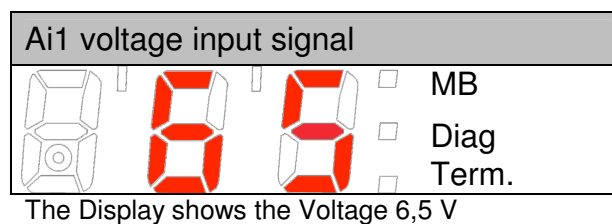
If the controller tries to match reference and actual position this is shown as flashing dot of the chosen mode.

If the function "status" is chosen and the direction of rotation is normal [CW], the actual angle of rotation is shown in the display as follows



The shown values are calculated to the adapted angle of rotation.

If the function "I/O" is chosen the rectangular slashes are used to define the thousand separators. In this case the display would show numbers as followed:

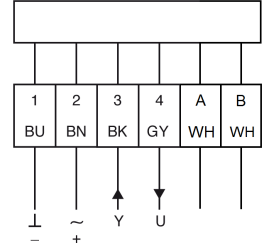


## 4. Electrical Properties

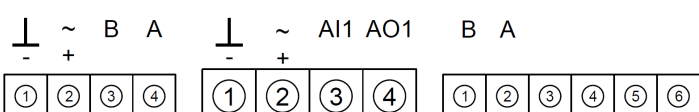
### 4.1. 5 Nm / C Controller

Nominal Voltage:	24 V <sub>AC</sub> (50/60Hz) / V <sub>DC</sub> ±20%
Synchronized speed:	± 5 %
Power consumption:	2,5 W
Standby:	1,0 W
Wire sizing:	4,0 VA
Control:	VAV
Input signal Y (analogue):	(0)2...10 V <sub>DC</sub> / (0)4...20 mA R <sub>i</sub> > 100 kΩ
Output signal U (analogue): Feedback angle	(0)2...10 V <sub>DC</sub> / max. 0,5 mA (See section 4.5) Supplied by PP-Bus or analogue

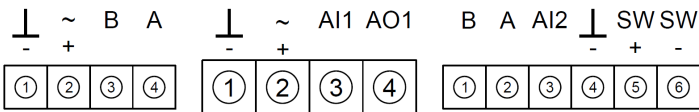
#### 4.1.1. CM

Connection scheme	
-------------------	---

#### 4.1.2. CMX minimum version

Connection scheme	
-------------------	--

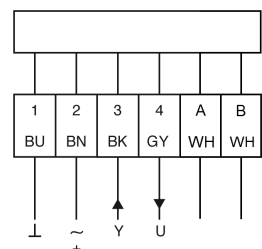
#### 4.1.3. CMX maximum version

Connection scheme	
-------------------	--

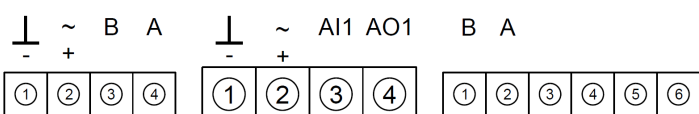
## 4.2. 10 Nm / C Controller

Nominal Voltage:	24 V <sub>AC</sub> (50/60Hz) / <sub>DC</sub> ±20%
Synchronized speed:	± 5 %
Power consumption:	2,5 W
Standby:	1,5 W
Wire sizing:	5,0 VA
Control:	VAV
Input signal Y (analogue):	(0)2...10 V <sub>DC</sub> / (0)4...20 mA R <sub>i</sub> > 100 kΩ
Output signal U (analogue): Feedback angle	(0)2...10 V <sub>DC</sub> / max. 0,5 mA Supplied by PP-Bus or analogue

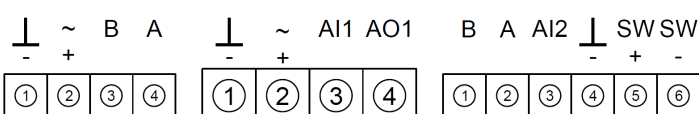
### 4.2.1. CM

Connection scheme	
-------------------	--

### 4.2.2. CMX minimum version

Connection scheme	
-------------------	--

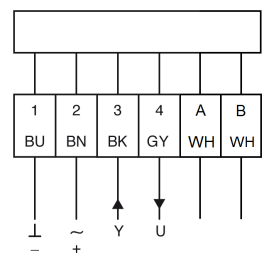
### 4.2.3. CMX maximum version

Connection scheme	
-------------------	--

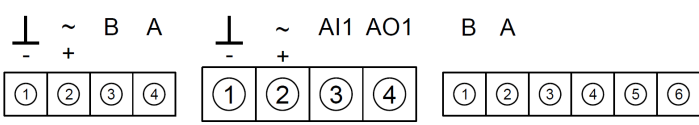
### 4.3. 15 Nm / C Controller

Nominal Voltage:	24 V <sub>AC</sub> (50/60Hz) / <sub>DC</sub> ±20%
Synchronized speed:	± 5 %
Power consumption:	3,0 W
Standby:	2,0 W
Wire sizing:	4,5 VA
Control:	VAV
Input signal Y (analogue):	(0)2...10 V <sub>DC</sub> / (0)4...20 mA R <sub>i</sub> > 100 kΩ
Output signal U (analogue): Feedback angle	(0)2...10 V <sub>DC</sub> / max. 0,5 mA Supplied by PP-Bus or analogue

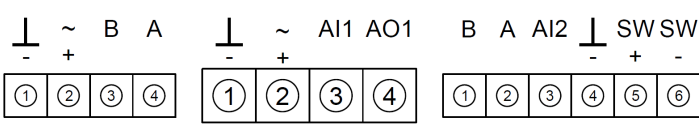
#### 4.3.1. CM

Connection scheme	
-------------------	--

#### 4.3.2. CMX minimum version

Connection scheme	
-------------------	--

#### 4.3.3. CMX maximum version

Connection scheme	
-------------------	--

#### 4.4. Input signal Y (analog)

The input signal Y allows to control the actuator according to the selected mode of operation.

In mode 0...10V<sub>DC</sub> the input signal Y matches to the following flows:

$$\alpha_{act} = \alpha_{min} + \frac{Y}{10V_{DC}} \times (\alpha_{max} - \alpha_{min})$$

and the flows match to Y = 0V<sub>DC</sub> as ( $\alpha_{min}$ ) and Y = 10V<sub>DC</sub> as ( $\alpha_{max}$ )

$$Y = 10V_{DC} \times \frac{\alpha_{act} - \alpha_{min}}{\alpha_{max} - \alpha_{min}}$$

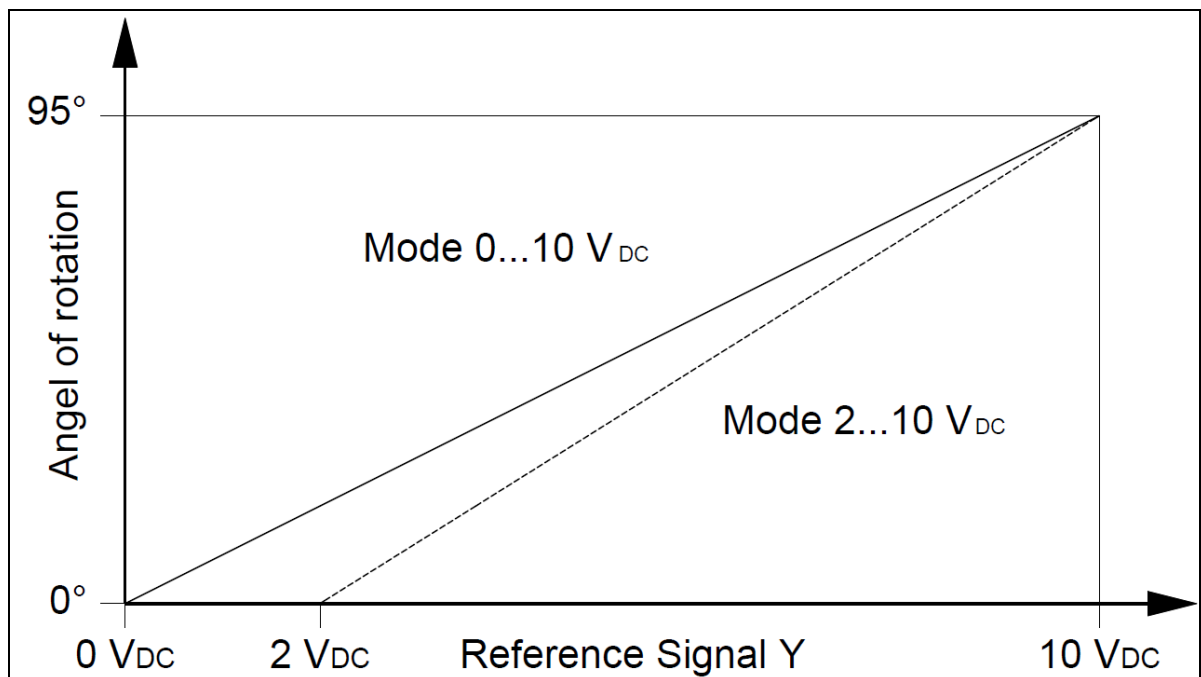
In mode 2...10V<sub>DC</sub> the input signal Y matches to the following flows:

$$\alpha_{act} = \alpha_{min} + \frac{Y - 2V_{DC}}{8V_{DC}} \times (\alpha_{max} - \alpha_{min})$$

and the flows match to Y = 2V<sub>DC</sub> as ( $\alpha_{min}$ ) and Y = 10V<sub>DC</sub> as ( $\alpha_{max}$ )

$$Y = 2V_{DC} + 8V_{DC} \times \frac{\alpha_{act} - \alpha_{min}}{\alpha_{max} - \alpha_{min}}$$

with the special function of Y = 0V<sub>DC</sub> to (close damper)



Characteristic control signal Y in both input modes

#### 4.5. Output signals U (analog)

The output signal U follows the selected mode of operation and shows the actual Angle normalized to the selected nominal Angle value.

In mode 0...10V<sub>DC</sub> the output signal U matches to the following flows:

$$U = 10V_{DC} \times \frac{\alpha_{act}}{\alpha_{nom}}$$

and to calculate the actual Angle from the feedback signal U:

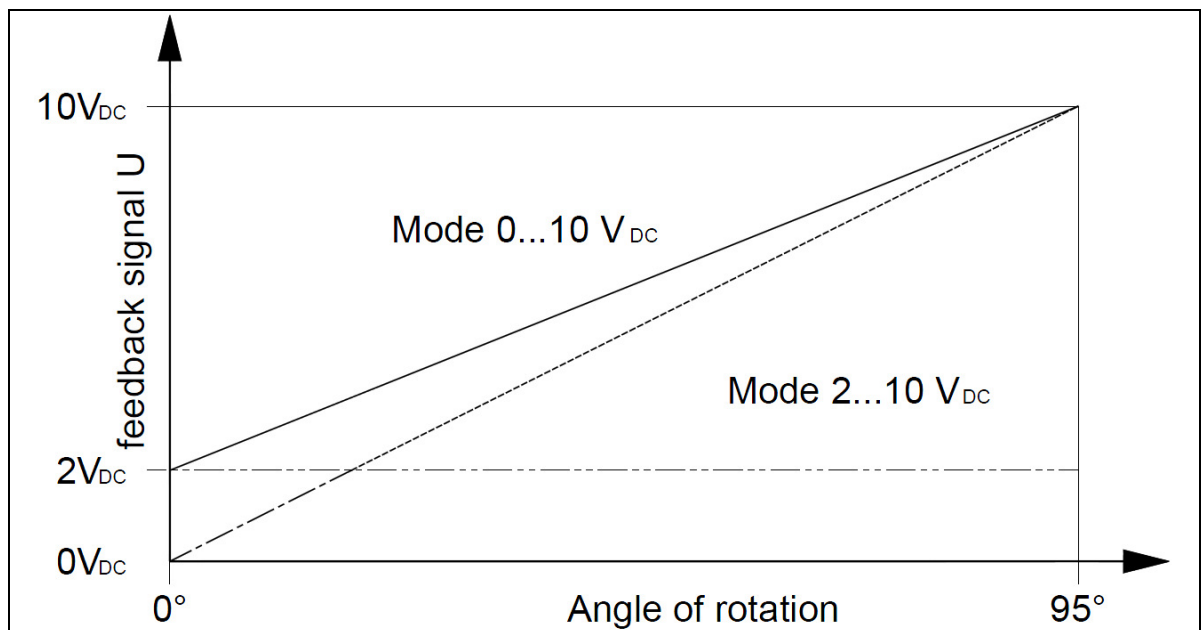
$$\alpha_{act} = \alpha_{nom} \times \frac{U}{10V_{DC}}$$

In mode 2...10V<sub>DC</sub> the output signal U matches to the following flows:

$$U = 2V_{DC} + 8V_{DC} \times \frac{\alpha_{act}}{\alpha_{nom}}$$

And to calculate the actual Angle from the feedback signal U:

$$\alpha_{act} = \alpha_{nom} \times \frac{U - 2V_{DC}}{8V_{DC}}$$



Characteristic of feedback signal U in both input modes

#### 4.6. Software

P-Position:	4
I-Position:	10
P-V-Controller:	3
I-V-Controller:	3
Overload protection:	Electronic switch-off after reaching maximum allowable torque (min. 1Nm over nominal torque). The actuator saves this blockage position. The memory will be cleared after a 10 h reset or after Mode is switch on.
Elapsed hour counter:	Time when the actuator is connected
Cycle counter:	When the direction of rotation was changed
Password:	FFFFh => 65535
Serial No.:	YYMMDDhhmmss + Testdevice-No.

Analog input 2...10V <sub>DC</sub>	
Close	Ground
$\alpha_{\min}$	2 V <sub>DC</sub>
$\alpha_{\max}$	10 V <sub>DC</sub>
Open ( $\alpha_{\max}$ )	24 V <sub>AC/DC</sub>

Analog input 0...10V <sub>DC</sub>	
$\alpha_{\min}$	0 V <sub>DC</sub>
$\alpha_{\max}$	10 V <sub>DC</sub>
Open ( $\alpha_{\max}$ )	24 V <sub>AC/DC</sub>

##### 4.6.1. CM / CMX minimum version

I/O's	
AI1 (optional)	<div> <div> Analog input: Sensor input:  Accuracy: </div> <div> (0)2...10V<sub>DC</sub> PT1000 -40°C...+150°C (842 Ω...1.573 Ω) calibrated at 1 kΩ [-40°F...302°F] 1,8‰ ≡ ±0,5°C </div> </div>
Analog output	(0)2...10 V <sub>DC</sub>

#### 4.6.2. CMX maximum version

I/O's	
AI1 (optional)	Analog input: 0(2)...10V <sub>DC</sub> Sensor input: PT1000 -40 °C...+150 °C (842 Ω...1.573 Ω) calibrated at 1 kΩ [-40 °F...302 °F] Accuracy: 1,8‰ ≡ ±0,5 °C
Analog output	(0)2...10 V <sub>DC</sub>
AI2 (optional)	Analog input: (0)2...10V <sub>DC</sub> Sensor input: PT1000 -40 °C...+150 °C (842 Ω...1.573 Ω) calibrated at 1 kΩ [-40 °F...302 °F] Accuracy: 1,8‰ ≡ ±0,5 °C Digital input: I / 0
Auxiliary switch	Max. 60 V <sub>AC/DC</sub> / min. 0,5 A

#### 4.7. Modbus Protocol

Transmission protocol	
Protocol:	ModBus / RTU
Baud rate:	1200, 2400, 4800, 9600, 19200, 38400
Byte sequence:	LSB
Byte format:	8 data bits, 2 stop bits, none parity 8 data bits, 1 stop bits, none parity 8 data bits, 1 stop bits, even parity 8 data bits, 1 stop bits, odd parity
Address range:	1 to 247
Max. Data bytes	1
Resistance:	120 Ohm (Software)

##### 4.7.1. Function code ModBus

Following functions codes are implemented:

Function code	Name	Description
03h	read hold register	Device parameter / actual values read (integer / float)
06h	Write single register	Device parameter single word write

##### 4.7.2. Data type

The data types, that are used of each register can be found in the parameter tables.  
 CHAR is a 8 bit integer value. The CHAR value use the lbyte of a word register.  
 BYTE is a 8 bit integer value. The BYTE value use the lbyte of a word register  
 WORD is a 16 bit integer value. The WORD value use the lbyte and the hbyte of a word register  
 (except as explicitly noted otherwise)

#### 4.7.3. Holding register Costumer (parameter table)

-r functions-code 0x03h -w functions-code 0x06h

Name	Address decimal	Data typ	Value range	r/w	Description
Set point	0	WORD	0..10000	r/w	Set point [%] 0 ..100.00 see register 122: '0': set point is read only
Override control	1	WORD	0..4	r/w	Override control '0' - - - '1' open '2' close '3' min '4' max
Command	2	WORD	0..4	r/w	Command '0' - - - '1' adaption '2' - - - '3' - - - '4' controller reset
Device ID	3	WORD	0..3	r	Device ID '0' - - - '1' standard actuator '2' VAV '3' fire damper
Relative position	4	WORD	0..10000	r	Relative position [%] 0 .. 100.00 65535 = this function is not supported
Absolute position	5	WORD	0..65000	r	Absolute position [°] [mm] 0 .. 650.00 65535 = this function is not supported
Relative flow	6	WORD	0..10000	r	VAV flow [%] 0 .. 100.00
Absolute flow	7	WORD	0 65535	r	VAV flow [m³/h][l/s][pa]
Sensor value 1	8	WORD	[°C] 0..65535 [mV] 0..10000	r	External sensor value [Ω] 0 .. 10000 [mV] 0 ..10000
Sensor value 2 (optional)	9	WORD	[°C] 0..65535 [mV] 0..10000	r	External sensor value [Ω] 0 .. 10000 [mV] 0 ..10000
Analog output (optional)	10	WORD	[mV] 0..10000	r/w	Analog output [mV] 0 ..10000 see register 122
Digital output (optional)	11	WORD	[-] 0..1	r/w	Digital output 0 ..1

#### 4.7.4. Service Values

-r functions-code 0x03h -w functions-code 0x06h

Name	Address decimal	Data typ	Value range	r/w	Description		
Serial number 1	100	WORD	101..991 2	r	serial number JJMM		
serial number 2	101	WORD	100..312 3	r	serial number DDHH		
serial number 3	102	WORD	01..5959 9	r	serial number MMSSX X = test number		
software version	103	WORD	1..65535	r	software version		
service in-formation	104	WORD	0..65535	r	see table status-register		
min value relative	105	WORD	0..10000	r/w	min value [%] 0 .. 100.00		
max value relative	106	WORD	0..10000	r/w	max value [%] 0 .. 100.00		
sensor type 1	107	WORD	0..4	r/w	sensor type '0' - - - '1' active sensor [mV], '2' passive sensor [1k] '3' *passive sensor [1 .. 20k] '4' *Digital 0/1 * not implemented		
bus fail position	108	WORD	0..2	r/w	bus fail position '0' last set point no bus monitoring '1' at timeout position close bus monitoring timeout 120s '2'.at timeout position open bus monitoring timeout 120s		
min value absolute	120	WORD	0..65535	r/w	min value [m³/h][l/s][pa]		
max value absolute	121	WORD	0..65535	r/w	max value [m³/h][l/s][pa]		
mode signal set point analog output	122	WORD	0..2	r/w	Value	Referencing signal	Analog Out
					0	Analog In 1	absolute position [V] 0 .. 10
					1	communication via modbus register 0	absolute position [V] 0 .. 10
					2	communication via modbus register 0	value register 10

Name	Address decimal	Data typ	Value range	r/w	Description
sensor type 2 (optional)	123	WORD	0..4	r/w	sensor type '0' - - - '1' active sensor [mV], '2' passive sensor [1k] '3' *passive sensor [1 .. 20k] '4' *Digital 0/1 * not implemented

#### 4.7.5. Error handling

If the server receives the request, but detects a communication error (parity, LRC, CRC, wrong address...), no response is returned. The client program will eventually process a timeout condition for the request.

If the server receives the request without a communication error, but cannot handle it (for example, if the request is to read a non-existent register), the server will return an exception response informing the client of the nature of the error.

device response:

Ad- dress	Function code +80h	Error code	CRC	End
1 byte	1 byte	1 byte	2byte(CRC_Lbyte, C_Hbyte)	3,5 Chars

Error code	Name	Description
01h	Illegal function	The function code received in the query is not an allowable action
02h	Illegal data address	The data address received in the query is not an allowable register address. Register address are read only.
03h	Illegal data value	A value contained in the query data field is not an allowable value. Wrong number of registers. Register address are read only.
06h	Slave device busy	Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long-duration program command.

#### 4.7.6. Description interface parameter ModBus

Display Number	eprom-value	Baudrate	Parity	Stop bits
1	0	1200	none	1
2	1	1200	none	2
3	2	1200	even	1
4	3	1200	odd	1
5	4	2400	none	1
6	5	2400	none	2
7	6	2400	even	1
8	7	2400	odd	1
9	8	4800	none	1
10	9	4800	none	2
11	10	4800	even	1
12	11	4800	odd	1
13	12	9600	none	1
14	13	9600	none	2
15	14	9600	even	1
16	15	9600	odd	1
17	16	19200	none	1
18	17	19200	none	2
19	18	19200	even	1
20	19	19200	odd	1
21	20	38400	none	1
22	21	38400	none	2
23	22	38400	even	1
24	23	38400	odd	1

## 4.8. Connection

### 4.8.1. Cable for CM

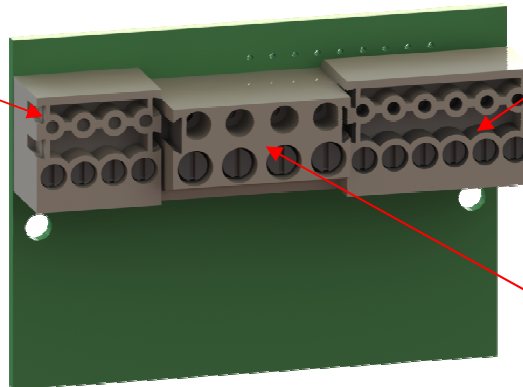
Standard cable length is 1000mm. Different needed cable length are specified as "clXX" (designation in dm) in the Gruner Type no.

Length: 1000 mm  
Strand cross section:  $4 \times 0,75 \text{ mm}^2$   
 $2 \times 0,38 \text{ mm}^2$   
Strand designation:

1	BU	(Blue)
2	BN	(Brown)
3	BK	(Black)
4	GY	(Grey)
A	WH	(White)
B	WH	(White)

### 4.8.2. Connector for CMX

Pluggable PCB  
terminal 8543  
Item  
25.602.5453.0



Pluggable PCB  
terminal 8543  
Item  
25.602.5653.0

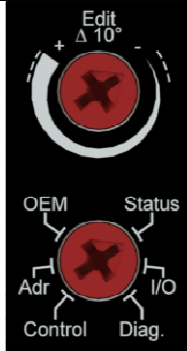
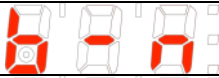
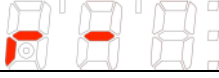
Pluggable PCB termi-  
nal 8142  
Item  
25.602.2453.0

## 5. Approvals / Standards

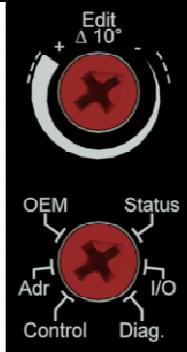
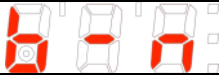
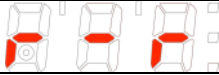
2004 / 108 / EG  
2006 / 95 / EG  
DIN EN 60730-1  
DIN EN 60730-2-14

## 6. Shipping configuration

### 6.1. CM and CMX Minimum version

Bulk packaging:	-
Operating manual:	-
Mounting:	Anti-rotation bracket and screws
Misc.:	-
Delivery position:	"0"
Direction of rotation:	Normal [CW]
Mode:	2...10 V <sub>DC</sub>
Password:	FFFFh => 65535
Delivery position value and function selector:	 <p>"_"</p> <p>"Status"</p>
Baud rate:	38400
Delay:	5
Byte format:	8 data bits, 1 stop bits, none parity
Address range:	1
Modbus termination:	Off
Control:	
I/O:	
ModBus register 107:	"2"
Sensortype	Passive sensor [1k]
ModBus register 122:	"2"
Reference Signal Analog Output	Communication via Modbus register 0 Value register 10

## 6.2. CMX Maximum version

Bulk packaging:	-
Operating manual:	-
Mounting:	Anti-rotation bracket and screws
Misc.:	-
Delivery position:	"0"
Direction of rotation:	Normal [CW]
Mode:	2...10 V <sub>DC</sub>
Password:	FFFFh => 65535
Delivery position value and function selector:	 <p>"_"</p> <p>"Status"</p>
Baud rate:	38400
Delay:	5
Byte format:	8 data bits, 1 stop bits, none parity
Address range:	1
Modbus termination:	Off
Control:	
I/O:	
ModBus register 107:	"2"
Sensortype	Passive sensor [1k]
ModBus register 122:	"2"
Reference Signal Analog Output	Communication via Modbus register 0 Value register 10
ModBus register 123:	"2"
Sensortype	Passive sensor [1k]

## 7. Changes

[illegible]