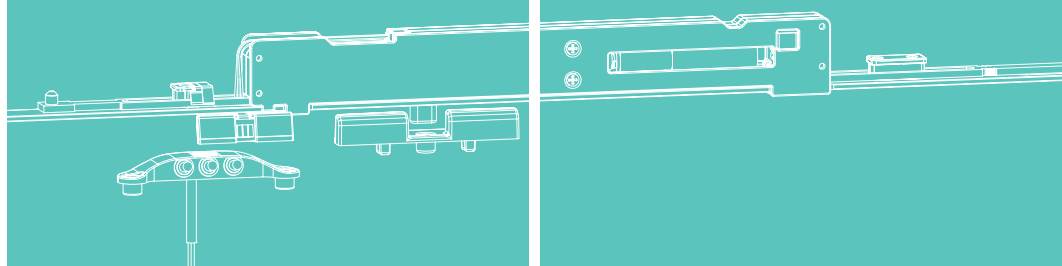
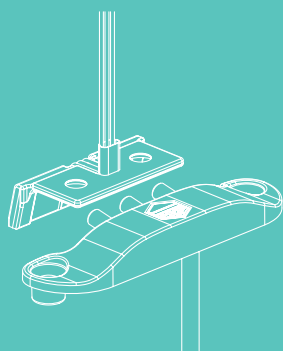




# MACO MULTI-MATIC

TILT AND TURN HARDWARE



## ASSEMBLY INSTRUCTIONS

E-Hardware

Use only by certified specialists!

**Copy of the original instructions**

## Key and abbreviations



Sash rebate height (SRH)



Handle Height (HH)



Sash rebate width (SRW)



Backset (DM)



Sash rebate width and height



Rebate gap (FL)



Maximum sash weight



Rebate leg (U)



Turn&Tilt element (DK)



Offset (V)



Tilt&Turn element (KD)



Rebate depth (FT)



Turn-only element (DR)



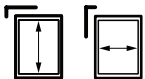
Multi-Matic (MM)



Corner element standard



Multi-Matic  
with tilt lock bolt (MM-KS)



Corner element short



Drive motor fixed



Drive motor variable

AWD = Application Diagram

ZV = Central locking system



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## Certificates and Declarations

MACO declares that the drive motor is an incomplete machine within the meaning of the European Machinery Directive (2006/42/EC).

The declaration of incorporation can be accessed via the QR code.

The incomplete machine complies with the following basic requirements:

- Machinery Directive 2006/42/EC
- Safety of electrical appliances for household use DIN EN 60335-1 / DIN EN 60335-2-103
- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- RoHS Directive 2011/65/EU

Drive motor



Commissioning device





## Important Information

### Target group

This documentation is intended exclusively for specialist companies and certified specialists (e.g. carpenter, metalworker for construction technology, window and glass façade builder).

Electrical work may only be carried out by a qualified electrician according to DIN VDE 1000-10!

### Instructions for use

- › Unless otherwise indicated, measurements are made in millimetres.
- › Mount all hardware parts professionally as described in this manual and observe all safety instructions!
- › All diagrams are only symbolic.
- › Further technical documents can be found in our online catalogue (TOM) at [extranet.maco.eu](http://extranet.maco.eu)
- › This print document is constantly being revised and is available for download in the current
- › version at [www.maco.eu](http://www.maco.eu).
- › Printing errors, mistakes and changes are reserved.
- › Please send feedback or suggestions and ideas for improvements on our instructions by email to: [feedback@maco.eu](mailto:feedback@maco.eu).

### Material notes

- › The hardware parts described in this guide are made of stainless steel or galvanised passivated steel and sealed in accordance with DIN EN 12329. They must not be used in environments with aggressive, corrosive air content.
- › Do not use acid-curing sealants, as these can lead to corrosion of the hardware parts.
- › The door lock elements may only be surface-treated before the hardware is installed. Any subsequent surface treatment may restrict the functionality of the hardware. In this case, no warranty claims can be made against the hardware manufacturer.



## **WARNING!** **Important safety instructions!**

It is important to follow these instructions to ensure people's safety! Incorrect assembly can lead to serious injuries.

### Manufacturer's Declaration/State of the Art

The drive has been tested and manufactured in accordance with the applicable European directives. A corresponding declaration of incorporation is available. You are only allowed to operate the devices if there is a declaration of conformity for the entire system.

The drive is state-of-the-art and requires suitably qualified personnel for installation, maintenance, etc.

### Intended use

In the case of perpendicularly installed turn / tilt-and-turn windows in roofed and enclosed spaces, window sashes with the E-hardware are operated via switch or push-button automatically so that the window opened inwards into a tilt position limited by the scissor stays.

However, the window sash can also be tilted or turned inwards manually by pressing a window handle. When closing and locking a window sash, it is usually necessary to overcome the counterforce of a weather seal.

The E-hardware may only be installed horizontally at the bottom of the profile!

The information on areas of application, sash weights and fabrication guidelines of the profile manufacturers or system providers are mandatory and must be observed!

The centre of gravity or the position of the glass pane may affect the areas of application and max. weights, and must be requested where necessary!

For maintenance purposes, all components on the element must be freely accessible.

Match the required fixing materials with the building structure and the corresponding load and add to them if necessary. Any supplied fixing materials only meet a part of the requirements.

Technical application only according to the technical data. All improper use or any changes to the drive motor are expressly prohibited. In the event of non-compliance, we do not accept any liability for damage to persons or material.

Please also note the "Specifications and Notes on the Product and Liability (VHBH)" from the Quality Association for Locks and Fittings e.V



## Reasonably foreseeable misuse

- Children playing with the window/drive
- Use in smoke and heat exhaust ventilation systems (SHEV)
- Installation in windows marked as an escape route
- Intervention in the safety area of the drive motor without first deactivating it
- Failure to follow the installation/operation and maintenance instructions: The power supply to the device must be disabled when cleaning or when other maintenance work is being carried out.

In order to avoid misuse, a risk assessment in accordance with the Machinery Directive 2006/42/EC is required at the installation site. Protective measures are to be applied in accordance with EN 60335-2-103/2016-05.

## Document Storage/Instruction

Retain these assembly instructions for later use and maintenance. Please hand over the user manual to the end user and ensure they are briefed.

## Installation and operation

**Before installation:** In the fixed installation, a disconnecting device must be provided to ensure all-pole shutdown from the mains supply. Test windows and security elements. The integrity and smooth operation of the window must be ensured.

Before installing the drive motor, the installer must check that the applicable temperature range is present in the environment.

When activating a dead man's switch, no other persons must be in the vicinity of the drive.



### WARNING!

Never connect the drives/control points to 230 V AC! The drive motor may only be operated with safe extra-low voltage (SELV) 24 V DC, otherwise there is danger to life!



### ATTENTION!

If you do not follow these steps, the drive motor may be destroyed. Incorrect handling endangers the equipment. Do not allow any liquid to get inside the device!



### WARNING!

The drive motor opens and closes windows automatically. It stops via a load shutdown. The pressure force is therefore still enough to crush fingers. Do not reach into the window rebate or into the drive motor when the drive is operating!

The drive motor may be operated without additional protection device up to protection class 3 (according to VFF Data Sheet KB.01 "Power-operated windows"). Crushing and shearing points between the window sash and the frame, skylights and curbs must be secured up to a height of 2.5 m by devices that bring movement to a standstill when touched or interrupted by a person (Guideline for "Power-operated windows, doors and gates" of the employers' liability insurance associations - BGR 232).



## NOTES

All moving parts and locking points of the tilt-and-turn hardware, in particular all corner elements, must be greased before the E-hardware is put into operation for the first time.

Lubricate only with lubricants according to the Instructions and Maintenance Manual.

To operate the drive motor, an additional control element (e.g. double button) is required. Only operate the drive motors with controllers from the same manufacturer. In the case of use of third-party products, no liability, warranties and services are accepted.

Reliable operation and the avoidance of damage and hazards are only possible with the careful installation/adjustment according to these instructions.

If you need or want spare parts or extensions, use only original spare parts.

This device may be used by children aged 8 years old and above, as well as by persons with reduced physical, sensory or mental abilities or lack of experience and knowledge, if they are supervised or have been instructed on the safe use of the device and understand the resulting dangers. Children must not play with the device. Cleaning and maintenance must not be carried out by children without supervision.

### For applications on tilt windows

you will need to install safety scissor stays. They prevent damage that can occur due to improper assembly and handling.

Please note: the safety scissor stays must be matched to the opening stroke of the drive. This means that the opening width of the safety scissor stays must be larger than the drive stroke in order to avoid potential blockages.

### Examination

After installation and after each modification of the system, check all functions by means of a test run.





## Maintenance/Repair

The power supply to the device must be cut off at all poles when cleaning or other maintenance work is being carried out. The system must be protected against unintentional restarting.

The windows and drive motors must be checked regularly for product integrity.

Corrosion protection must be carried out according to the specifications of the profile manufacturer.

An annual inspection and maintenance are recommended. Remove contaminants from the equipment.

Check fastening and clamping screws for tightness. Test the drive motors through a test run. The drive gear of the motor is maintenance-free. Defective drive motors may only be repaired in our factory. If the drive motor casing is opened, this will result in loss of warranty and exclusion of warranty. Only original spare parts may be used. Operational readiness must be checked regularly.

Inspect all equipment and cable connections for external damage and contamination. Smoke vents, control panels, fire buttons, ventilation buttons, etc. must not be impaired in their functionality, e.g. be affected by structural measures or stored goods.

## Care

To clean the housing parts, use a soft, slightly damp cloth. To avoid damaging the housing surface, do not use corrosive chemicals, aggressive cleaning solutions or solvent-based agents for cleaning. Permanently protect the drive motor from water/dirt.

## Warranty

MACO's General Terms and Conditions (GTC) apply to the drive motor. (Internet: [www.MACO.eu](http://www.MACO.eu)).

## Disposal



The symbol of the crossed-out rubbish bin states that this electrical or electronic device must not be disposed of in household waste at the end of its service life. There are free collection points for waste electrical and electronic equipment in your area as well as additional collection points for the reuse of such electrical and electronic equipment. The addresses are provided by your city or local government. If the old electrical or electronic device contains personal data, you are solely responsible for deleting said data before disposal. For more information, see [www.elektrogesetz.de](http://www.elektrogesetz.de) or for other languages on WEEE Directive websites.

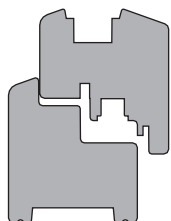
## Product Features

- Hard-to-reach windows can be conveniently tilted via a button (barrier-free)
- The E-hardware operates at two speeds and thus offers protection against injuries and overload (according to the Directive for power-operated windows and protection class 3)
- Operating voltage 24 V DC / power supply 230 V AC; low energy consumption
- When integrated into a home control system (smart home) - E-hardware may control the ventilation by reacting to environmental influences (e.g. rain or wind); with smartphone operation, the resident can control it from any location
- Independent of the electric tilt control, the window can be manually opened, tilted and closed at any time - familiar operation is possible
- Not suitable for SHEV

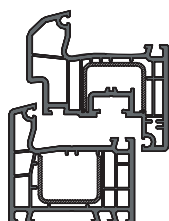
## General processing instructions

### 1 Application materials (frame material)

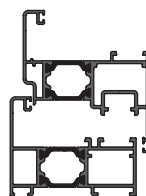
Timber



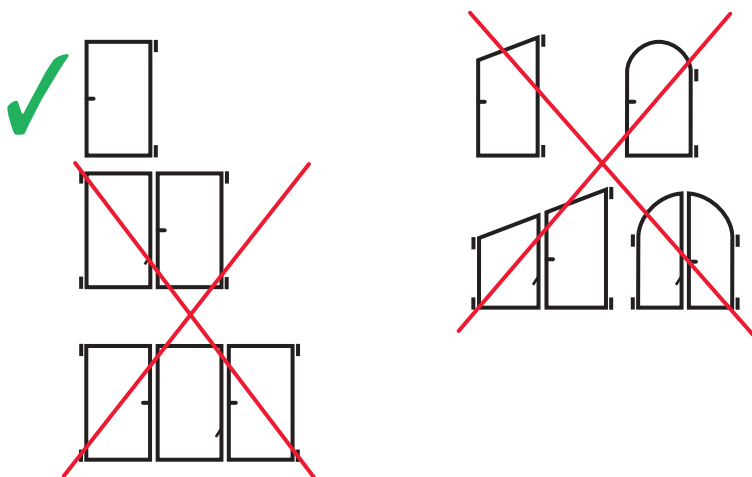
PVC



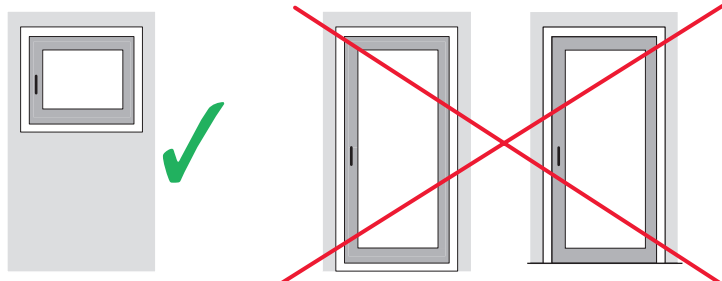
Aluminium



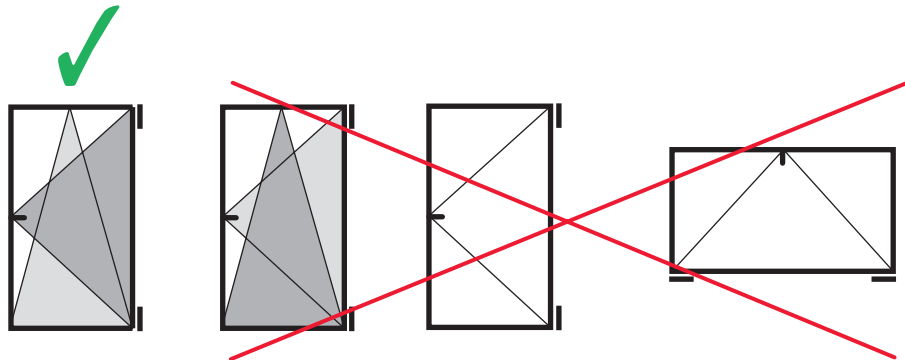
### 2 Forms of application / Sash version



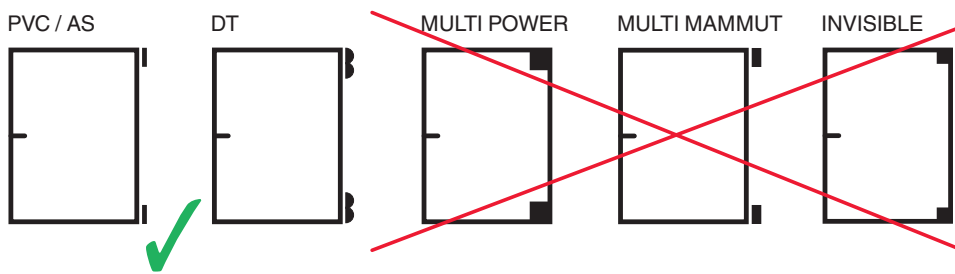
### 3 Window design



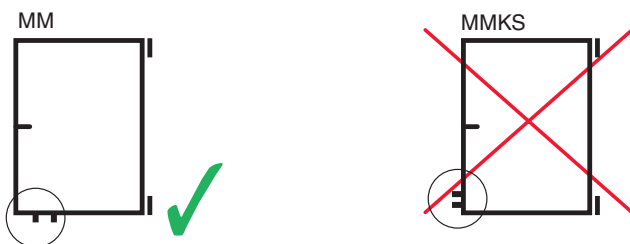
4 Types of opening



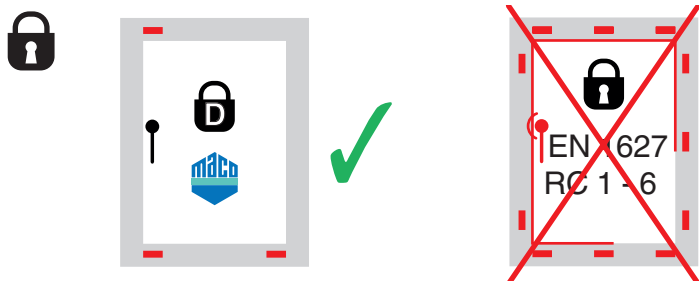
5 Hinge side



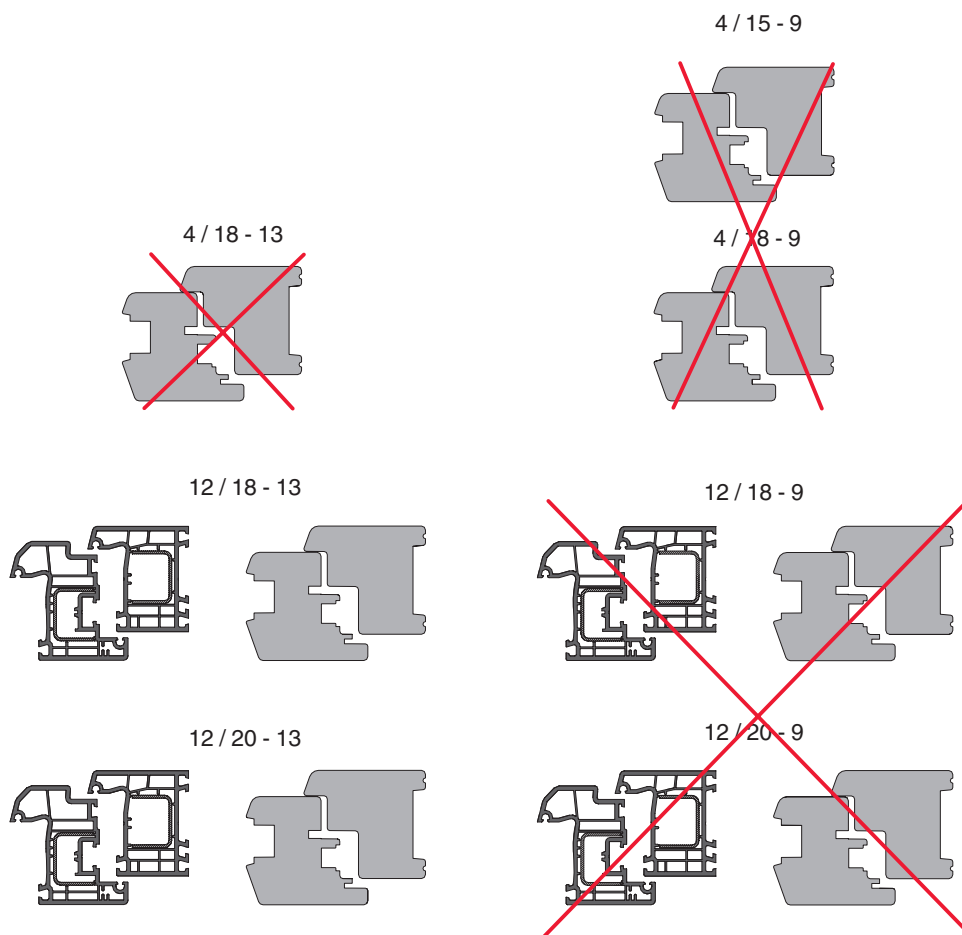
6 Hardware overview



**7 Hardware version (security)**



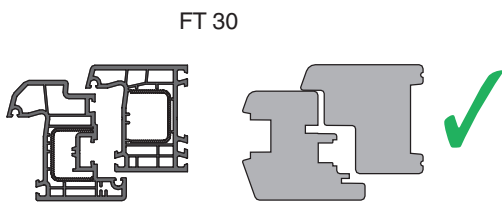
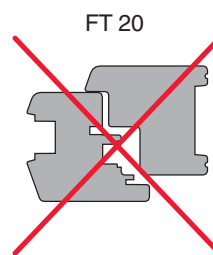
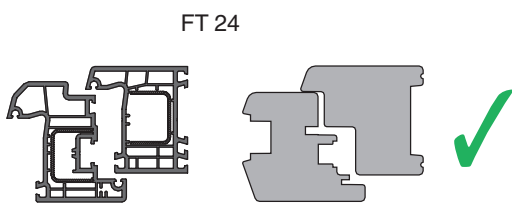
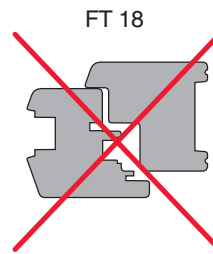
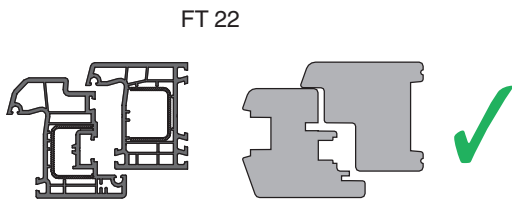
**8 Sash profile - Rebate gap, Rebate leg and Offset**



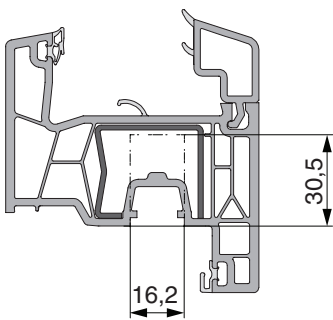
**9 Fitting groove**

The fitting groove must be implemented according to the information in our Print and Online Catalogues!

## 10 Frame rebate



## 11 Space requirements e-hardware



### ATTENTION!

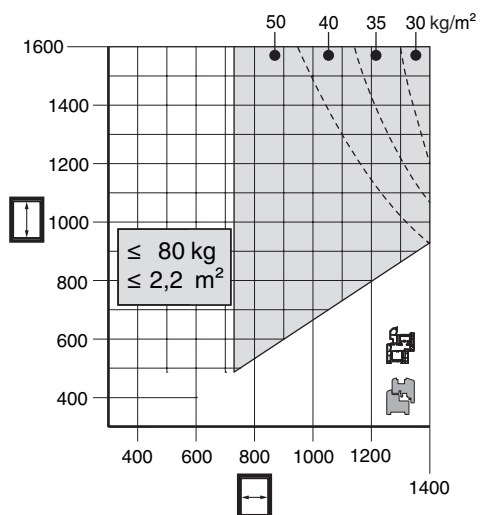
The profile must have a minimum of 30.5 mm space from the rebate gap for the e-hardware to prevent the glass pane from being damaged!

## Application diagram



### IMPORTANT!

Individual systems may restrict the maximum sash weight! Observe the weight information in the respective section!



 Permissible area



for PVC profiles

 Prohibited area

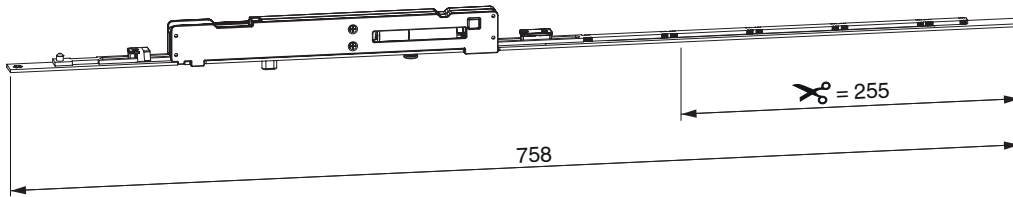


for timber profiles

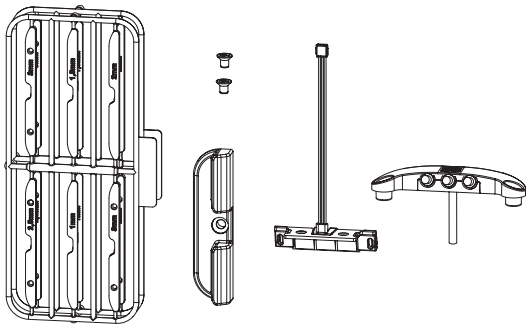
All notes on the use of application diagrams in our print and online catalogues must be taken into account!

## Article list

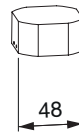
Art. No. 467155  
e-hardware silver



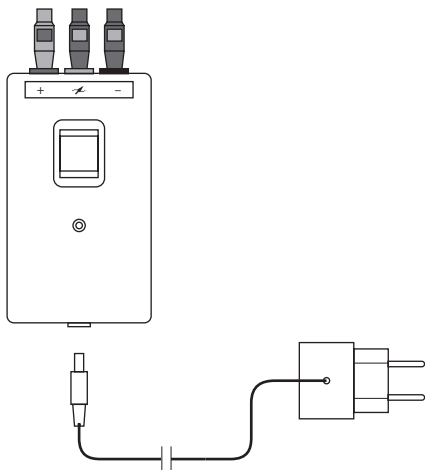
Art. No. 467151  
Power carrier for e-hardware



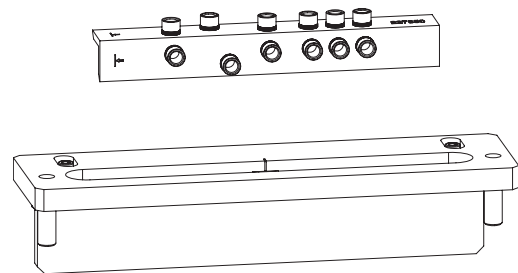
Art. No. 467150  
Power supply for e-hardware



Art. No. 467153  
Commissioning device for e-hardware

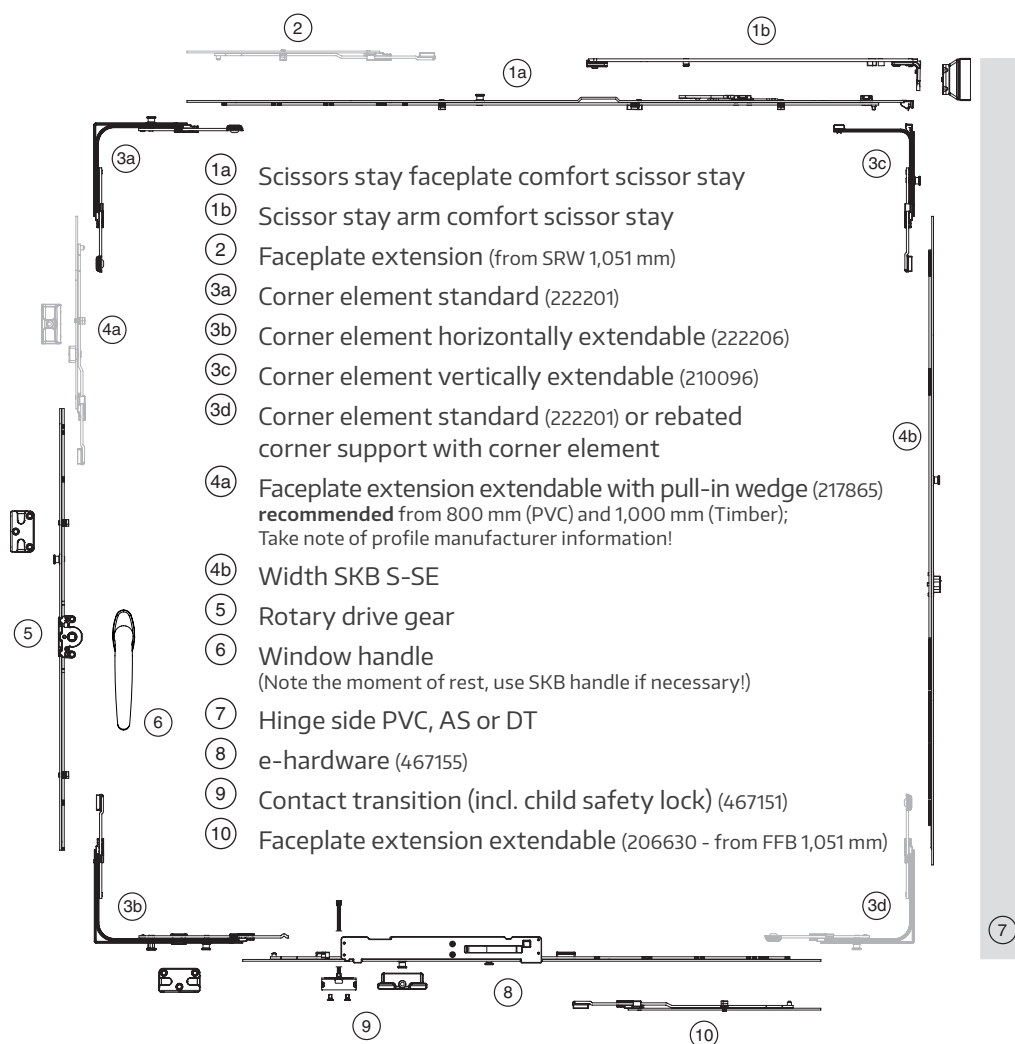


Art. No. 104717  
Jig set (consists of milling jig 227348 and drilling jig 227350. Can only be ordered as a set – not individually!)





## Hardware overview 1-sash Turn&Tilt elements



### DANGER!

The e-hardware may only be installed horizontally at the bottom!



### DANGER!

Max. 60 kg sash weight with an open centre lock, and max. 80 kg sash weight with circumferential centre lock!



### IMPORTANT!

Use as few components (connection points) as possible!



### NOTE!

**Lateral, upper and lower rebate gap**  
 $\geq 12,0$  mm

$\leq 1400 \times 1600$  mm

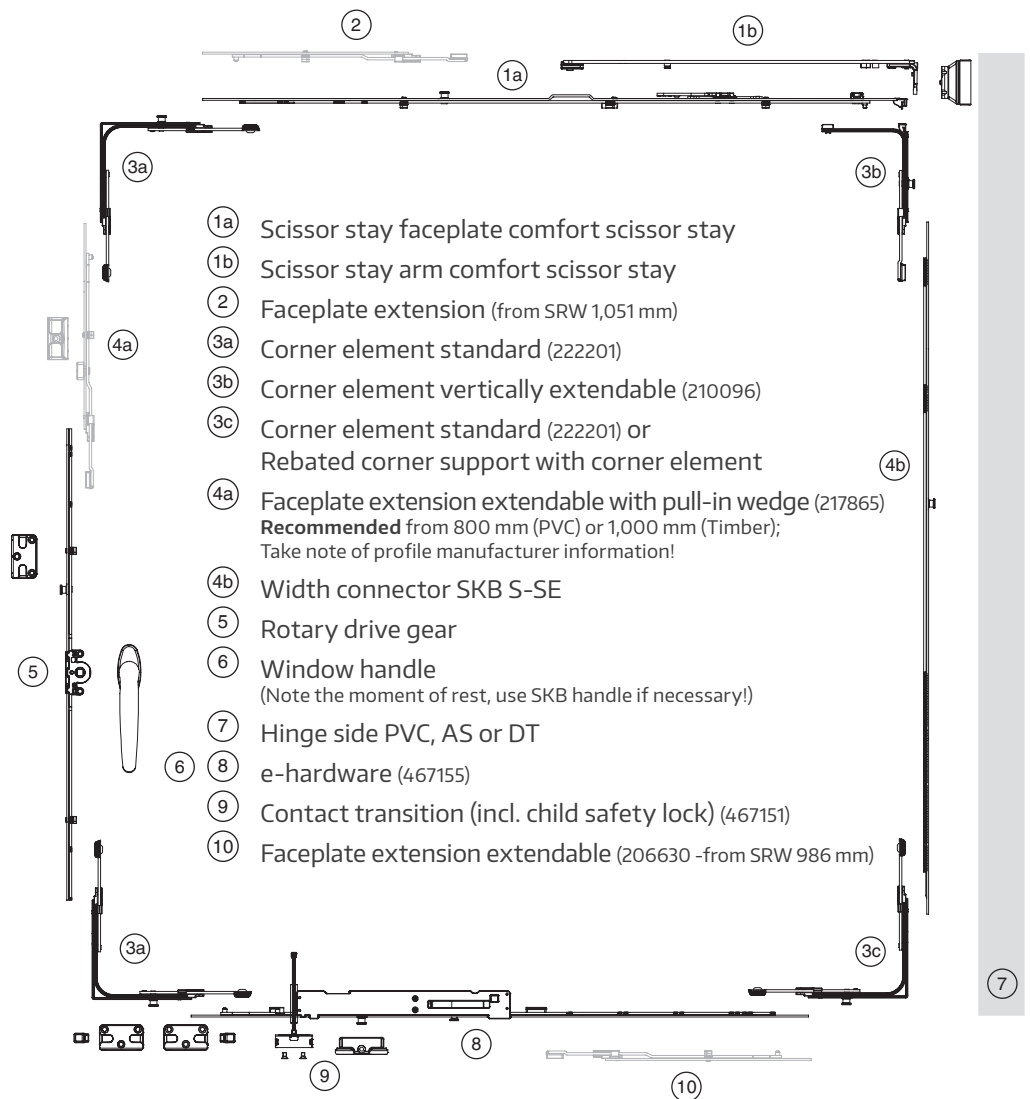
$\geq 800$  mm

$\geq 470$  mm

For version of central locking see assembly instructions central locking Order No. 759173 and Assembly Instructions Comfort Hardware, Order No. 756789en.

Follow the relevant assembly instruction for the selected hinge side version (AS, PVC, DT).

## Hardware overview 1-sash Turn&Tilt elements – slim sash



### DANGER!

The e-hardware may only be installed horizontally at the bottom!



### DANGER!

Max. 60 kg sash weight with an open centre lock, and max. 80 kg sash weight with circumferential centre lock!



### IMPORTANT!

Use as few components (connection points) as possible!



### NOTE!

**Lateral, upper and lower rebate gap**  
 $\geq 12,0$  mm



$\leq 1400 \times 1600$  mm



$\geq 735$  mm



$\geq 470$  mm

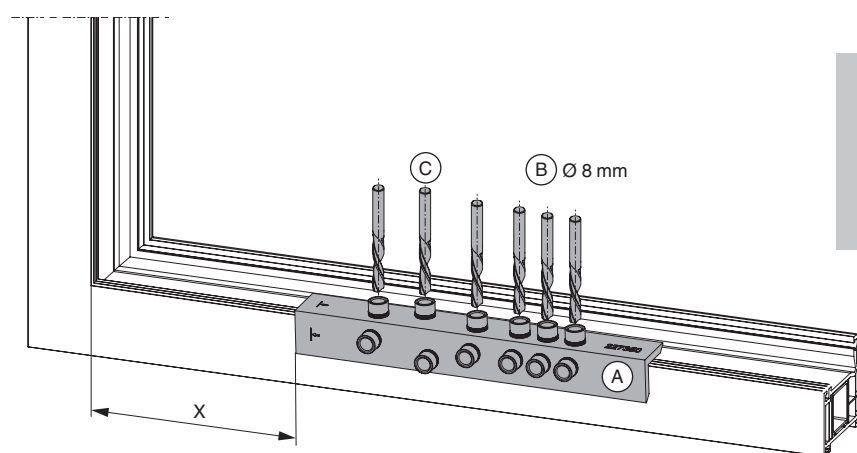
For version of central locking see assembly instructions central locking Order No. 759173 and Assembly Instructions Comfort Hardware, Order No. 756789en.

Follow the relevant assembly instruction for the selected hinge side version (AS, PVC, DT).

## Installation of the hardware (mech. components) on the frame

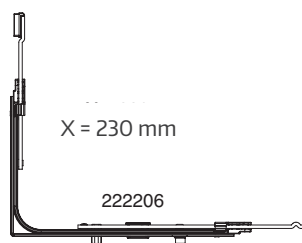
### Use of drilling jig

### Drilling with the jig



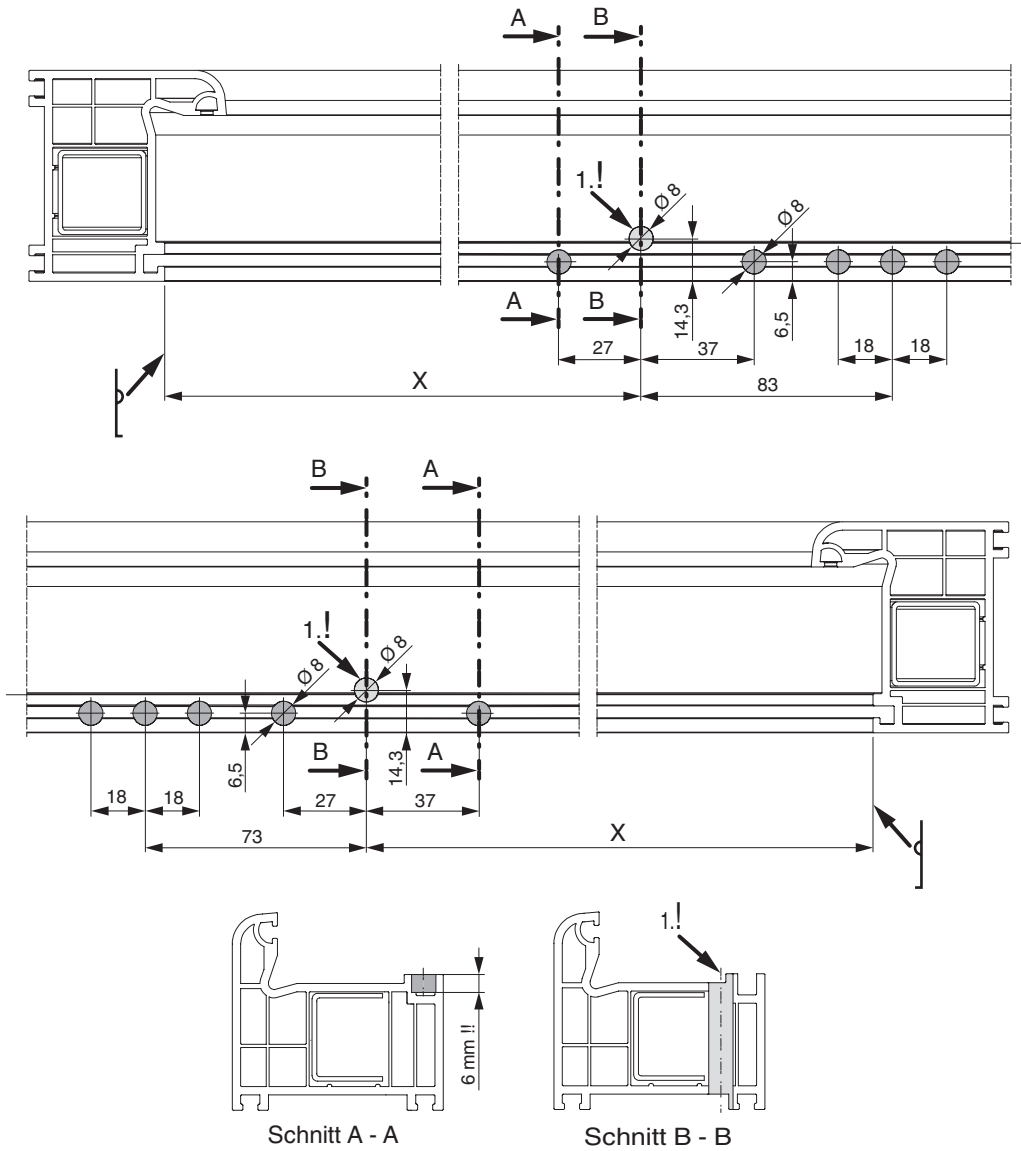
### ATTENTION!

Drill holes maximum to 6 mm deep, to avoid drilling right through the frame!



1. Insert drilling jig Article No. 227350 (A) for right and left sash at the distance X from the frame rebate corner and with drill all holes to a max. depth of 6 mm using drill (B) (max. X for rebate gap 12 mm).
2. Extend the hole (C) through the frame as a through hole.

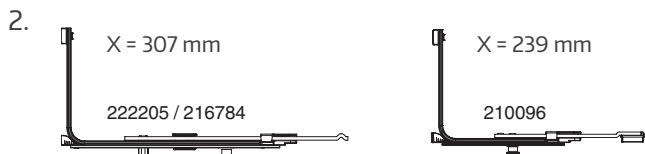
## Drilling pattern



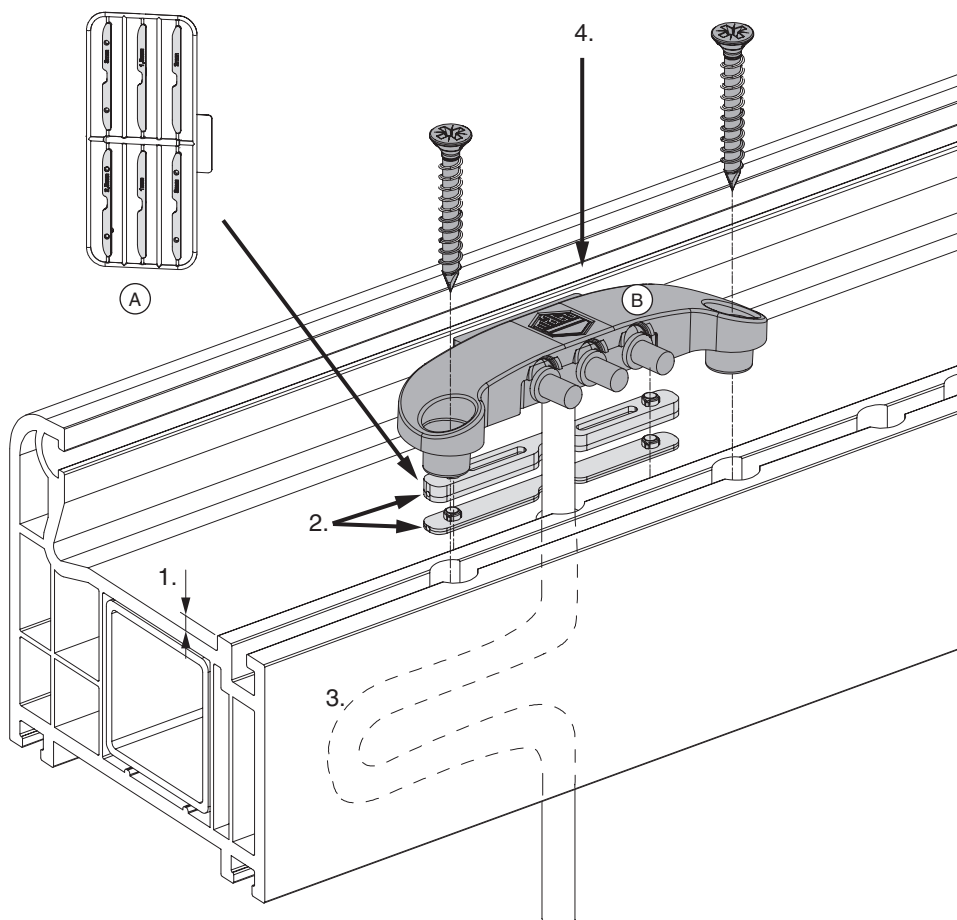
**NOTE!**  
**Lateral, upper and lower rebate gap**  
 $\geq 12,0$  mm

**ATTENTION!**  
 Drill holes to maximum 6 mm deep, to avoid drilling right through the frame!

1. **Attention:** Just drill one through hole! The remaining 5 holes must be max. 6 mm deep.

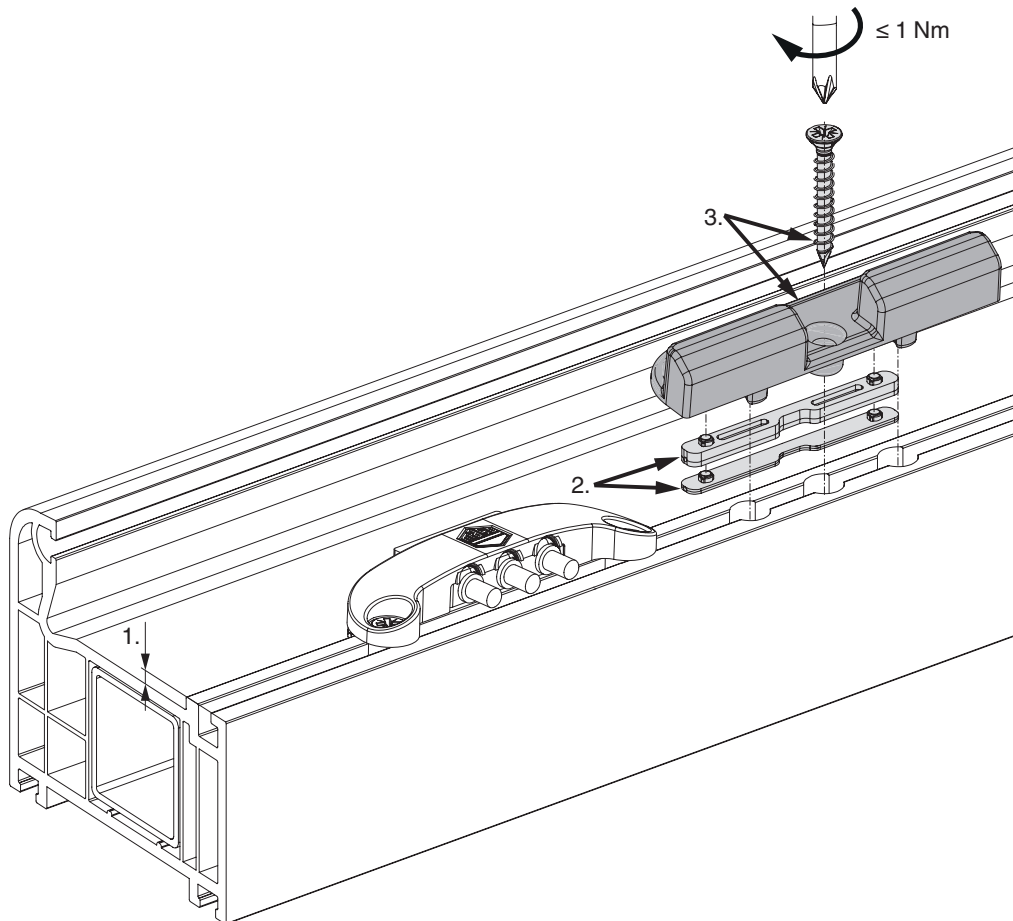


## Assembly of power carrier on the frame component



1. Measure the height of the locating slot.
2. Place the packers (A) to required height on the frame component power carrier.
3. Run the approx. 200 mm cable loop in the frame (for timber cavity, mill on frame outer side).
4. Insert and screw the power carrier (B) frame component into the holes.
5. Spray the contact points of the power carrier with contact spray (Nigrin Repairtec or similar).

## Mounting the child safety lock

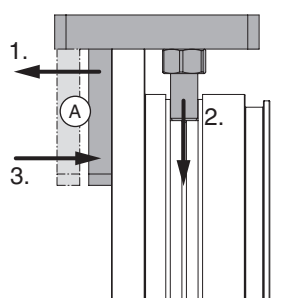


1. Measure the height of the locating slot.
2. Place the packers to required height on the child safety lock.
3. Insert and screw the child safety lock into the holes.

## Installation of the hardware (mech. components) on the sash

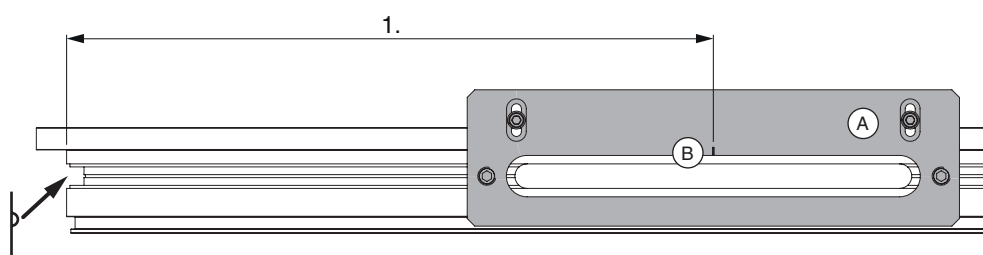
### Use of routing jig

#### Setting the routing jig 227348



1. Release the stop plate (A) of the routing jig by means of screws and slide to the outer edge.
2. Fit the routing jig onto the fitting groove.
3. Push the stop plate (A) to the rebate leg and fix it with screws.

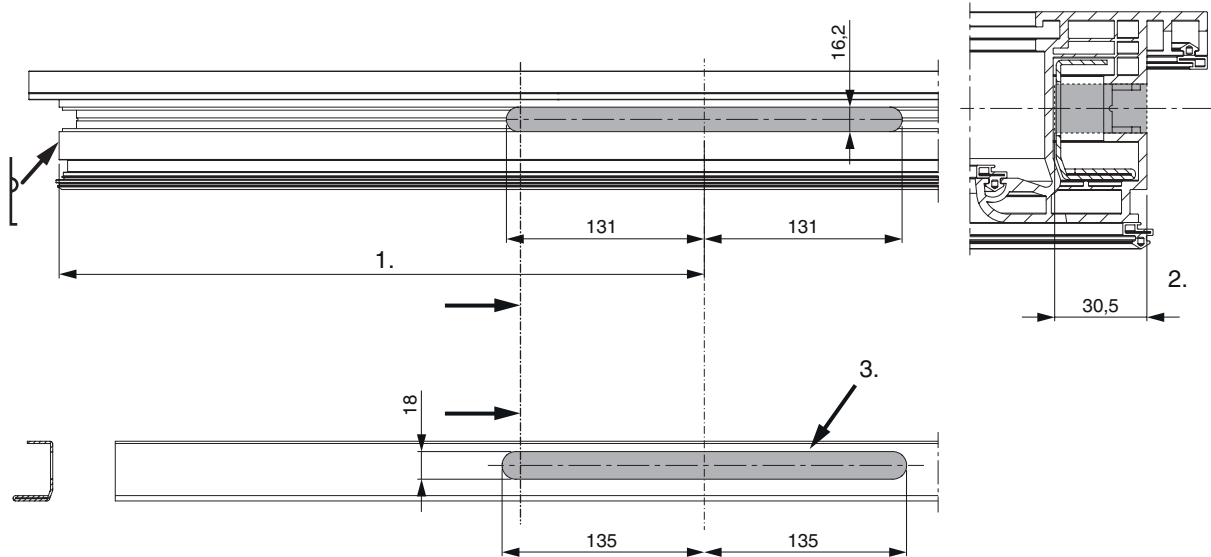
#### Milling with jig for e-hardware (in fitting groove)



1. Set marking:
 

For corner element with tilting pins (222206 / 216784):	427 mm
For corner element without tilting bolts (222201):	360 mm
2. Insert the routing jig (A) in the fitting groove, position with notch (B) on the marking and clamp down tightly. Mill using Ø16 miller and copy ring Ø 27 mm.
3. Apply corrosion protection according to the profile manufacturer.

## Routing image

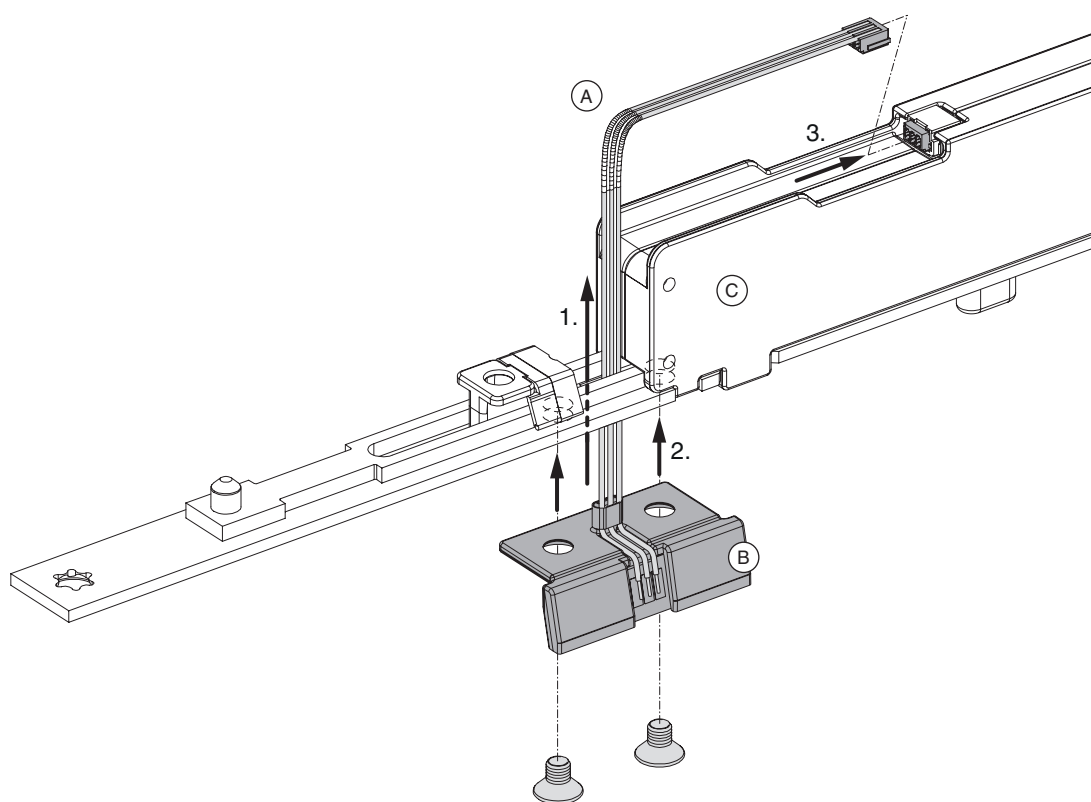


1. For corner element with tilting bolts (222206): 427 mm  
for corner element without tilting bolts (222201): 360 mm
2. Milling depth
3. Apply corrosion protection according to the profile manufacturer.



## Assembly of power carrier sash component

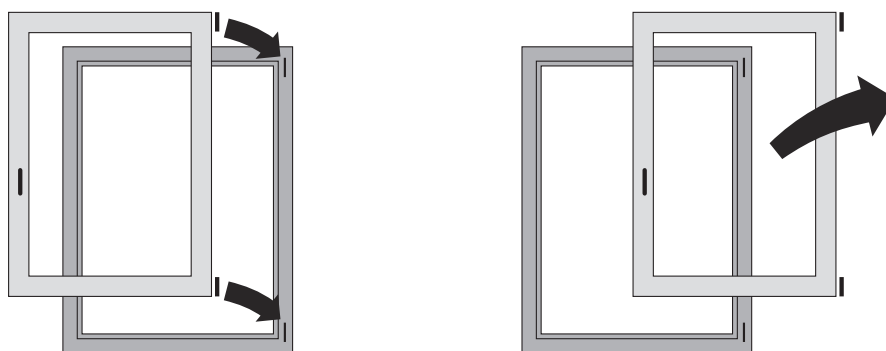
Connect the power carrier sash component to the e-hardware



1. Thread the connection cable (A) through the rectangular opening.
2. Screw the power carrier sash component (B) to the e-hardware (C) (note the side orientation on the left or on the right!).
3. Connect the connection cable to the e-hardware.
4. Spray the contact points of the power carrier with contact spray (Nigrin Repairtec or similar).

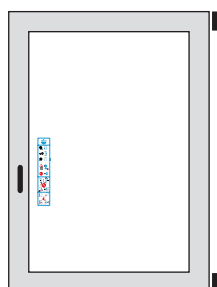
## Additional information

### Hinging and unhinging of the sash



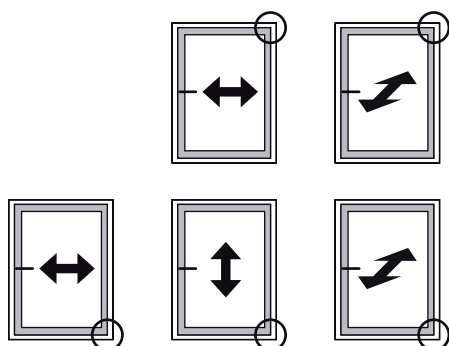
See assembly instructions for the hinge side used.

### Attach window stickers



Attach the supplied stickers to the glass close to the handle.

### Settings on the sash



See assembly instructions for the hinge side used.

## Check smooth operation of central locking system



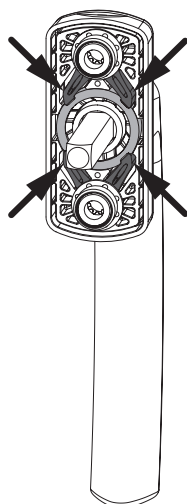
### IMPORTANT!

All moving parts and closing points of the turn&tilt hardware, in particular all corner elements, must be greased before the first commissioning of the e-hardware. Lubricate only with lubricants according to Operating and Maintenance Instructions, Order No. 757859 resp. 757071EN.

1. Check free operation of the window sash.
2. Check the torque of the central lock on the window handle (at the drive gear). The value of 10 Nm must not be exceeded (EN 13115). If there is stiffness when locking, this can be adjusted using the locking pins. Should this be insufficient, the gasket compression can be adjusted.

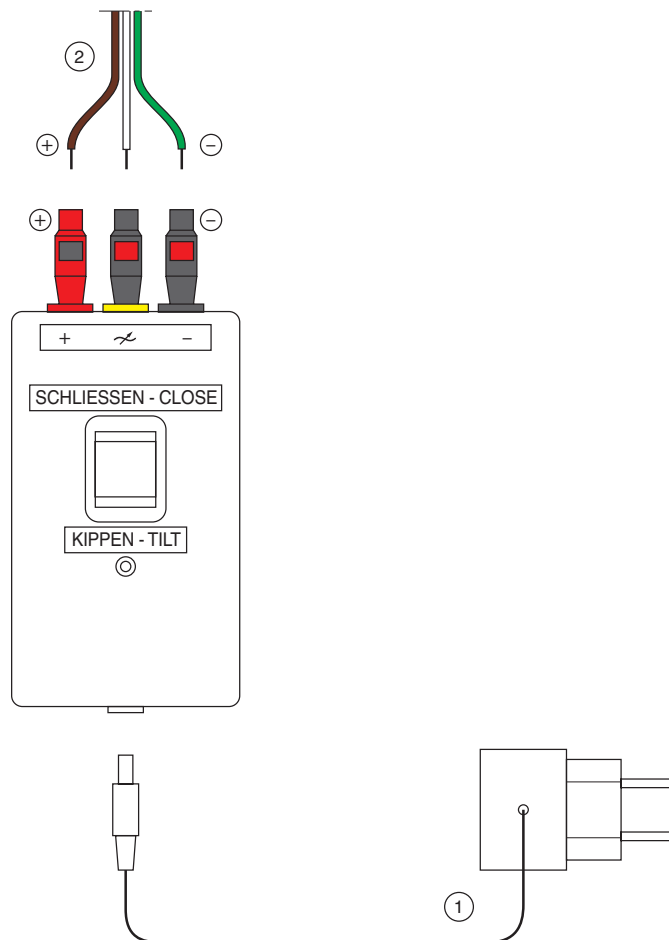
## Check smooth operation of window handle

1. Use only window handles with 90° locking. Do not use handles with locking function!
2. New window handles can have high end-position resistances, which can affect the functionality of the e-hardware. In such cases, it can be helpful to loosen off the resting function (round-off the edges), otherwise there may be problems with the handle position.



## Testing the e-hardware using the commissioning device

1. Connect the power supply line ① to the commissioning device and plug the power supply into the socket. The green LED in the middle of the device must be lit.
2. Connect the wires of the connection line ② to the commissioning device. The middle wire (white) must be connected to the middle connection (yellow), the black wire to the plus connector (red) and the outer wire (green) to the minus connection (black). The stripped wires are clamped and fixed in the respective terminal by pressing the black button.



## Electrical connections and commissioning on-site



**DANGER!**

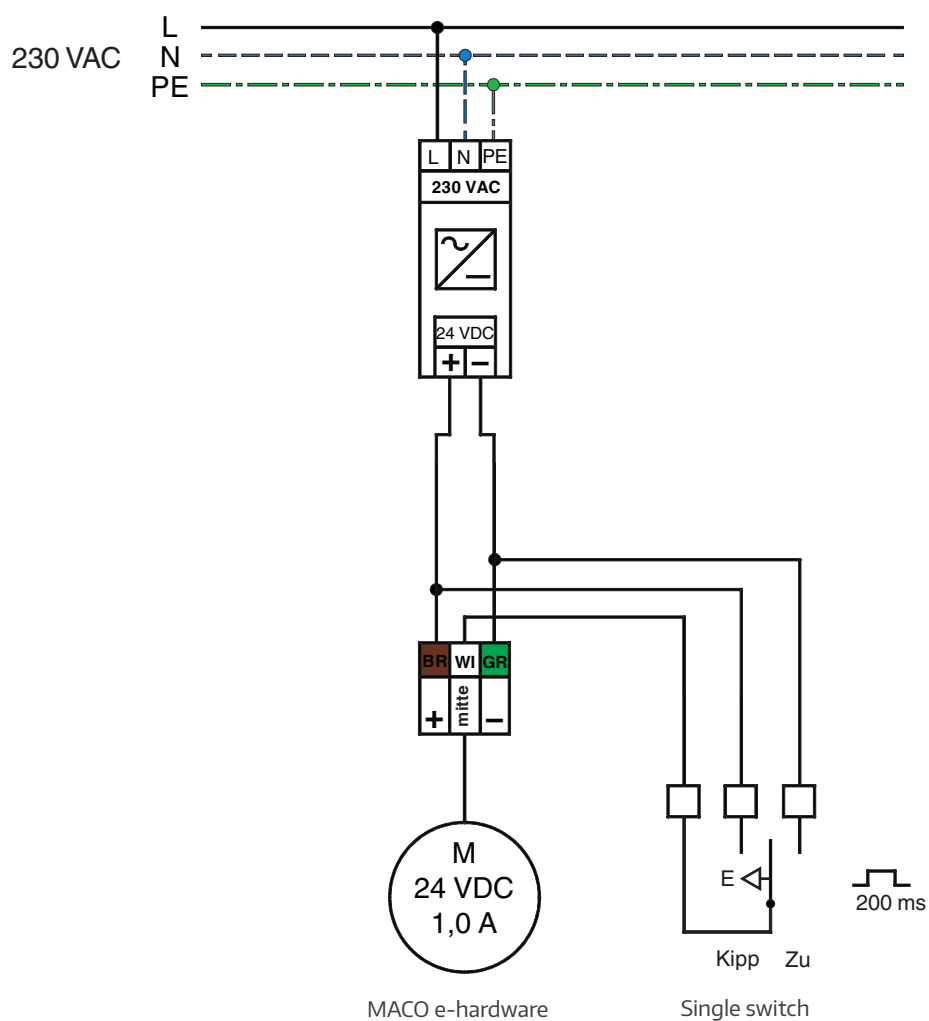
This section of the assembly instructions is intended only for qualified electricians!  
All country-specific regulations and guidelines must be adhered to!



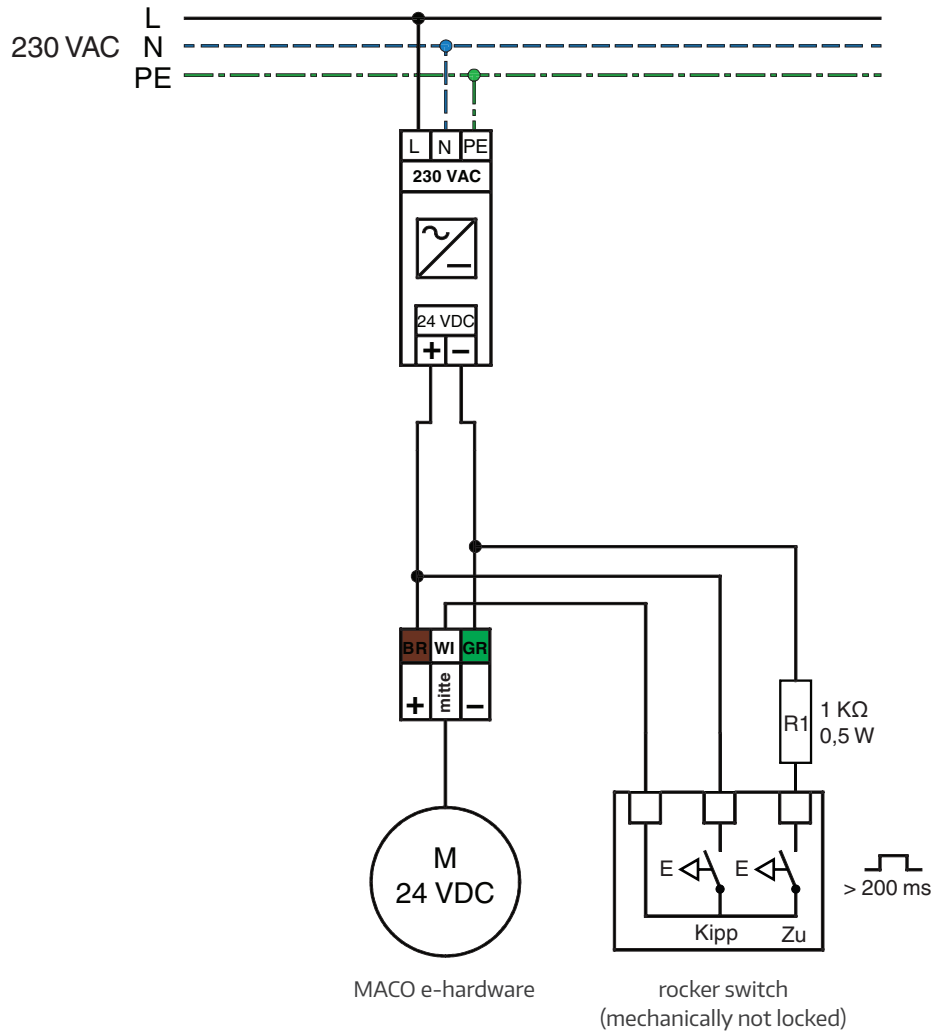
**DANGER!**

**All electrical work may only be carried by trained and authorised professionals!**  
**Working on electrical parts poses a risk to life and could result in death!**

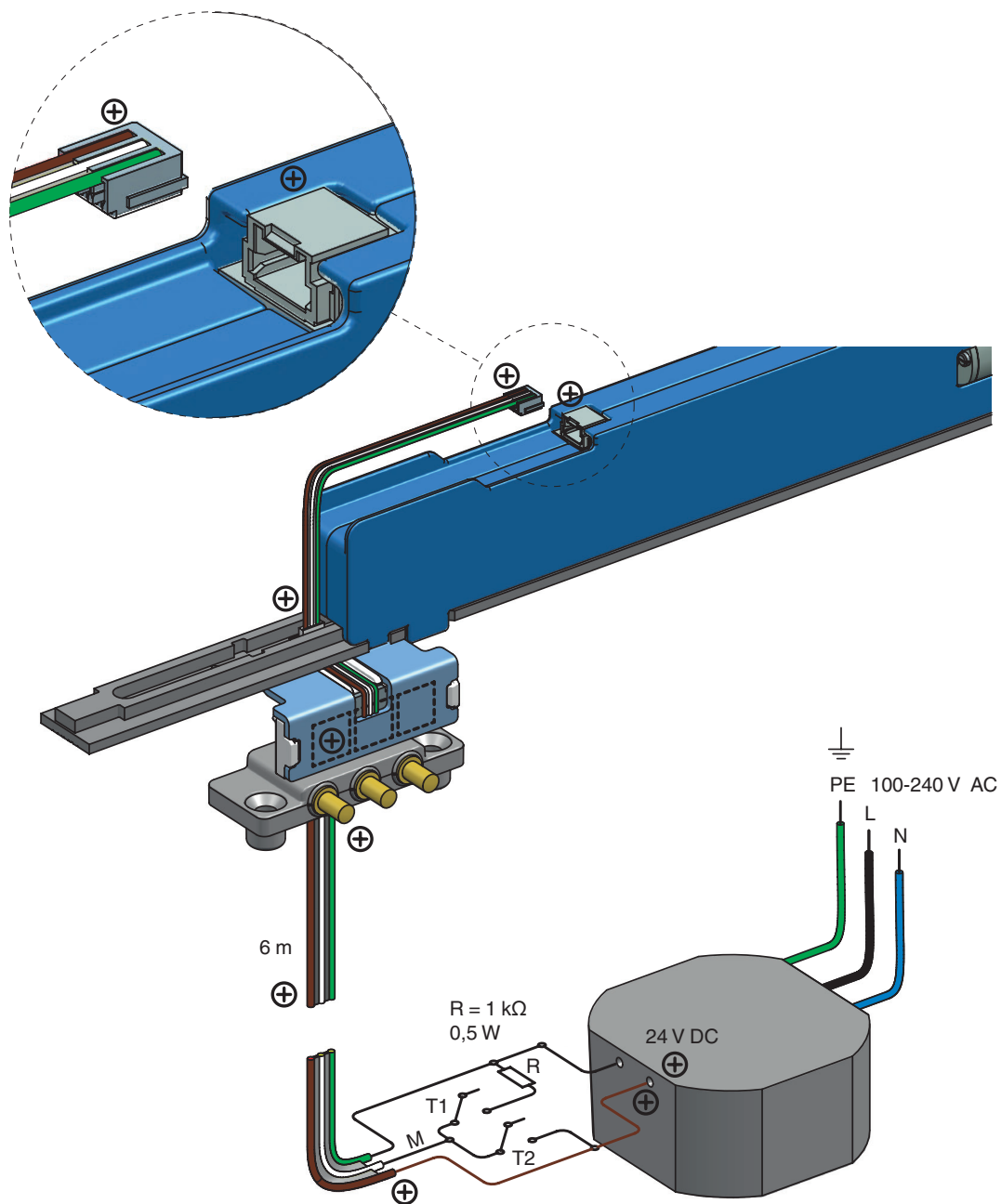
Connection plan for individual switches (two separate switches without mechanical locking)



# Connection plan for rocker switch (single or double)



# Electrical assembly of e-hardware



## General questions and answers

### Is there a predetermined minimum pulse duration for the e-hardware to respond to the motor? Can this be quantified?

As noted in the connection plan, the pulse duration is a minimum of 200 ms.

### When clarifying the interface, the term edge control came up. What does that mean?

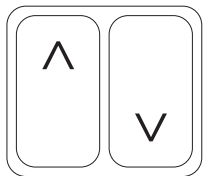
The control is carried out by a signal modification, but is then independent of the further course of the signal.

**Example:** The MACO drive is controlled by a short button push. The course of a movement (to the end position, back to the middle) is not affected by the further pressing or non-pressing of the button.

The term edge control also applies if the signal (the push of a button) must last a certain amount of time in order to be recognised as a change. Crucially, the further signal progression after detecting a change no longer affects the control.

### Is it possible to operate the e-hardware with a normal open/close button?

Yes, there are two possibilities. In the first, the button is mechanically locked, so that both buttons cannot be operated at the same time. The second operation is described in the next point.



Single button

**For a presentation, I'm using a commercial 2-way single button, in which both buttons can be pushed at the same time. Is there a danger here for the drive or the mains power supply? Do I have to stick to the defined resistance of 1 Kilo-ohm for the switching in this case?**

Yes, here you must stick to the resistance according to the circuit diagram, to protect the drive and power supply from a short circuit.

### To act against the residual ripple (alternating voltage on the secondary side of the power supply), the earth is connected to the -24 V output of the power supply, as per the connection diagram. Where does this residual ripple come from?

See universal circuit diagram!

Cheap switching power supplies have a capacitive connection between the primary and secondary side for self-suppression of the high frequencies. The high frequencies would otherwise cause radio-wave disruptions (for information – expensive devices do not require this connection for suppression). However, this capacitive connection now has the effect that on the secondary side against earth/PE an alternating voltage can be measured, which can also be very high, even up to 230 V. However, it is not dangerous because the source is very high-impedance, which means that it can only supply very little electricity, only a few microamps. That's why it's noticeable, but not harmful.





### Is there a solution for a Somfy interface?

Somfy has a similar solution to EnOcean (Smooove UNO io + SKK potential isolation relays - potential-free contacts which are wirelessly controlled by the I/O Homecontrol), but this is not a bidirectional solution. The MACO E-Hardware can thus only be controlled, but cannot provide feedback on its position. However, such a positional feedback can be implemented using the MACO mTronic.

### If we use KNX or LON for control, but do not have an Aumüller ventilation station available, can we then connect to our interface? Does our circuit diagram then work?

In this case, the connection is done with an additional power supply. A potential-free actuator must be used, which switches the MACO e-hardware according to the circuit diagram. Again, this is not a bidirectional solution. The e-hardware can only be controlled, but cannot give a notification on its position.



#### **Generally, the following drive positions can be reported**

(but only with an Aumüller control panel and KNX connection):

Window was tilted by motor,  
Window was closed by motor,  
where applicable, window was moved to turn position by hand.

In no case is there a notification on where the window is actually positioned – whether it has been tilted or closed by hand. This is due to the fact that the drive always returns to the zero position and there are no magnets over the entire hardware and thus no position recording. Only the last position actuated by the drive can be reported.

## External interface providers

<p><b>KNX</b></p> <p>Connection to a KNX network is done via potential-free switch actuators. 2 contacts are required for full control. The switching behaviour must be designed for drives (C Load).</p>	<p>Various manufacturers</p>
<p><b>EnOcean</b></p> <p>Wireless solution by means of Ratio® blinds actuator in combination with various EnOcean wireless switches.</p>	
<p>Detailed information, specifications, products, data sheets, circuit diagrams, etc. directly from the manufacturer ▲ (<a href="http://www.enocean.com/de/home">www.enocean.com/de/home</a>)</p>	
<p><b>Rademacher</b></p> <p>Combined hardware/software solution for home automation with the control of the e-hardware, among others, can be realised.</p>	
<p>Detailed information, specifications, products, data sheets, circuit diagrams, etc. directly from the manufacturer ▲ (<a href="http://www.rademacher.de">www.rademacher.de</a>)</p>	



## Technical Data

<b>Rated voltage:</b>	24 V DC (SELV, +/- 20 %), max. 2 V <sub>ss</sub>
<b>Rated current:</b>	0,8 A
<b>Shutdown current:</b>	1,0 A
<b>Measurement:</b>	19 W
<b>Switching cycle:</b>	30 % (ON: 3 min / OFF: 7 min)
<b>Number of cycles:</b>	max. 20 cycles without a break
<b>Shutdown OPEN:</b>	built-in limit switches
<b>Shutdown in any position (blockage):</b>	yes, safety shutdown in the OPEN and CLOSE direction
<b>Shutdown CLOSE:</b>	built-in load cut-off
<b>Closing speed:</b>	< 5 mm/s at the main closing edge (upper window edge)
<b>Tilt and closing time incl. neutral drive into the manual turn position:</b>	
<b>Tilting:</b>	approx. 60 s
<b>Closing:</b>	approx. 60 s
<b>Sound pressure level L<sub>pA</sub> :</b>	≤ 70 dB(A)
<b>Dimensions (L x W x H):</b>	758 mm x 16 mm x 30 mm
<b>Main closing edge opening:</b>	≤ 200 mm
<b>Built-in materials:</b>	steel (housing), steel, electronic circuit board
<b>Surface temperatures:</b>	no hot/cold surfaces present
<b>Vibrations:</b>	non-existent
<b>Protection class:</b>	III (SELV)
<b>Protection type:</b>	IP 32
<b>Ambient temperature:</b>	-5 °C ... +75 °C
<b>Altitude above N.N. (m):</b>	-
<b>Relative humidity (%):</b>	70%, non-condensing
<b>Suitable for industrial use:</b>	yes
<b>Suitable for residential, business/ commercial areas, small businesses:</b>	yes

## Technical Data (cont'd)

### Pre-requisites:

<b>Window type:</b>	single-sash, rectangular, tilt-and-turn element
<b>Window material:</b>	timber, PVC or aluminium
<b>Profile system:</b>	12 mm rebate gap system with 13 mm hardware axis
<b>Permissible sash weight:</b>	max. 60 kg with open central locking max. 80 kg with circumferential central locking
<b>Sash rebate width (SRW):</b>	735 ... 1400 mm
<b>Sash rebate height (SRH):</b>	470 ... 1600 mm

### IMPORTANT:

The drive can be used without additional protective device up to protection class 3 (as per VFF leaflet KB.01 "Force-powered windows").

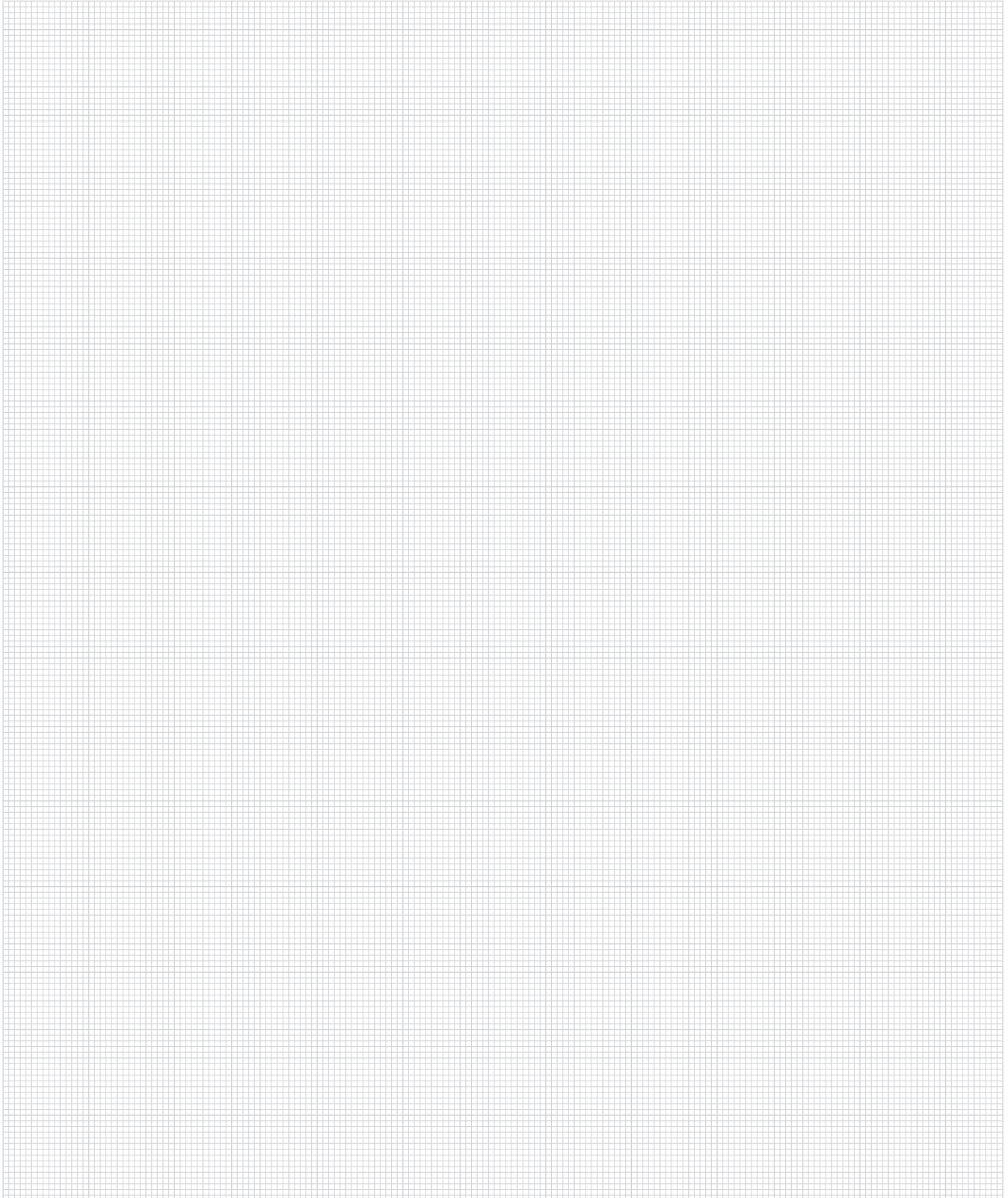
More information on the leaflet at: [www.window.de](http://www.window.de), [www.zvei.de](http://www.zvei.de) and [www.rwa-heute.de](http://www.rwa-heute.de)

The e-hardware is not suitable for use in smoke-heat extraction systems (RWA)!

The e-hardware must never be mounted in windows marked as an escape route!

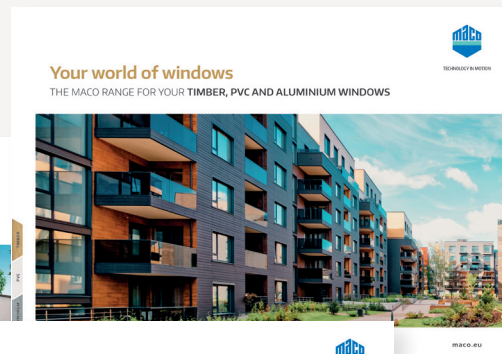
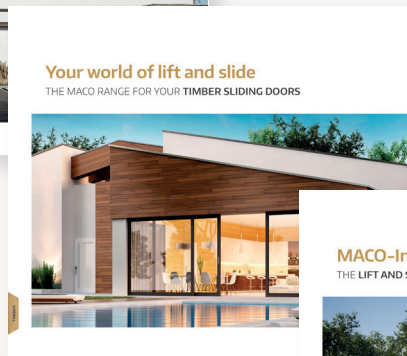
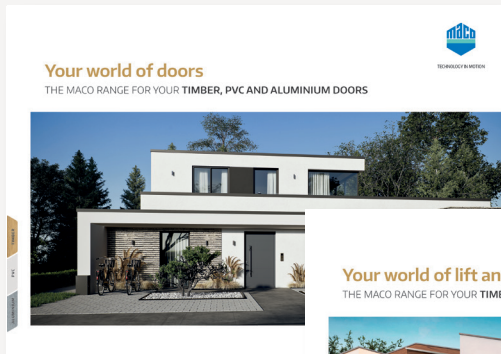


## Notes



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