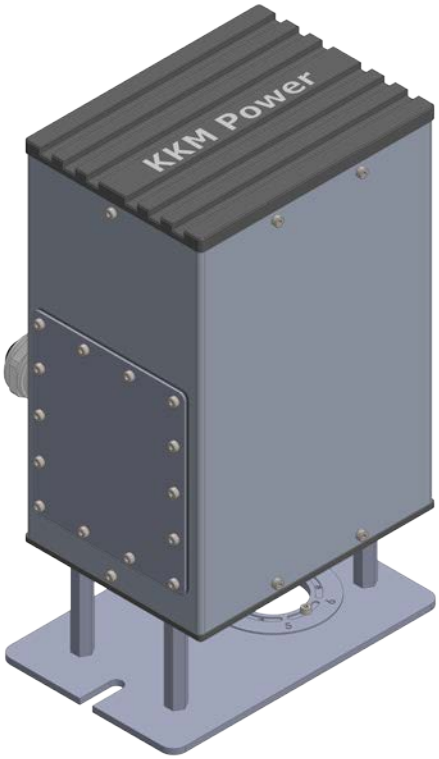
Location:	R&D/Document/ Operation manual	Origin Date	2018-10-30
Name:	ST1384-05-006 Operation manual	Version	V0.7
Document:	RD-D	Status	Draft
Prepared by	David Larsson	Approved by	Linus Gidlöf Örnerfors

Operation manual
ST1384-05-006

Motor drive unit for de-energize tap changer



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Version History

Version	Date	Description	Author
V0.1	181030	Initial version	DL
V0.2	190204	Added info about input pulse width, output fuses, calibration sequence, general content & fuse terminal block	LGÖ
V0.3	190508	Updated manual for new Motor drive unit	LGÖ
V0.3	190611	Updated manual	LGÖ
V0.4	190705	Added info about ground connection	LGÖ
V0.5	190711	Revise pictures, fasteners details	DL
V0.6	191024	Updates for dual power supply lines	LGÖ
V0.7	200114	Added fuse terminal block for signal power line	DL

Contents

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General

Stegia AB and KKM Power Oy are producing motor drive for de-energized tap changers. The function of the motor is to drive tap changer in KKM Power Oy reactors to the selected tap position.
The motor drive contains all mechanical and electrical parts for safe operation.
This specific motor unit is designed for a CCW directional, 6 position tap changer with angle of 61° between each position. A cable required to be mounted thru the cable gland and connected to motor.

Caution
The motor drive unit can only be used for specified KKM Power Oy reactors.
Installation, electrical connections and putting into service must be carried out by qualified skilled persons.
All changes in the structure are strictly forbidden.
Having the motor drive powered on, when the reactor is energized, is strictly forbidden.
The motor drive must be turned off and put in de-energized state, when the reactor is in use
The motor housing must med connected to ground (Earth).

Note: This specification is for reference only, therefore dimensions and layout can be changed without any notice.

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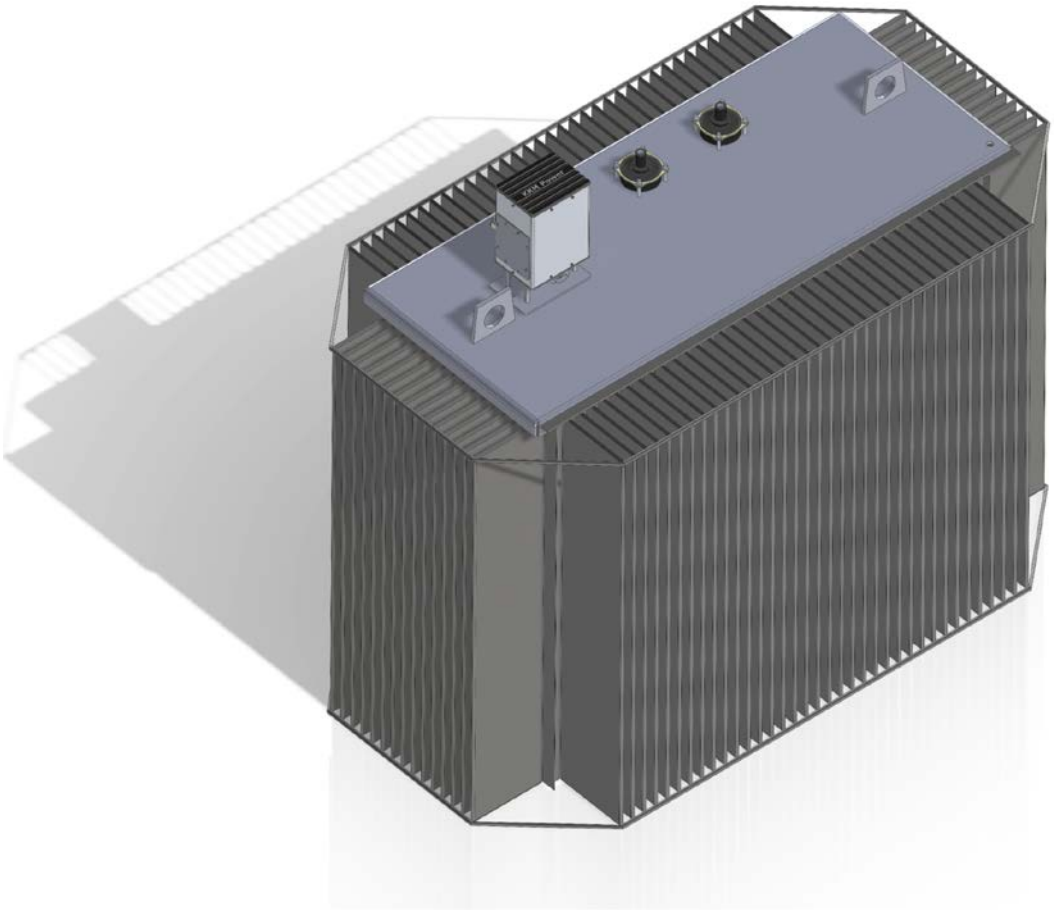
Design

Motor drive unit consists of one part. It is locating on top of the reactor cover connected directly to the tap changer shaft.
Motor drive unit is using aluminum and stainless-steel material. It's designed for outdoor use.
The internal relay is locking type so even if the unit loose power the out signal will be the same.



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Function description

Start up

At startup time, the unit loads the last known stored position from the memory. Every time the position of the unit is updated, the current position is stored in a non-volatile memory.

Stand still

At stand still, the unit checks if the input signals have changed, monitors the shaft position. If the shaft is not in its expected position, the output position relays turn off to indicate position error.

Move up & move down

The move up and move down signals are controlled by +110V signals. These are the POS 3. (move up) and POS 4 (move down). The movement of the shaft starts on falling edges on the input signal. The minimum required pulse width is 1000ms.

Figure 1: The +110V move up and move down signals are controlled the same way

Power indicator

The PIN 12 indicate the power state on the unit. If the unit is powered, the PIN are shorted to the signal supply voltage, and if the unit does not have power, the connection are open. The power indicator is protected with a 150mA resettable fuse and a reverse polarity blocking diode.

Output position indicators

The output position indicators are protected with 150mA resettable fuses and false polarity blocking diodes.

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Document:	RD-D	Status	Draft
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Optional common 0 Volt potential, and negative ground connection
The electrical circuit is in the standard connection, isolated from the supply voltage.
If common 0V connection is needed between 0V Supply and PCB V-, connect POS 13 and POS 14 together. If negative ground potential is needed, further connect 0V (POS 13) to ground (POS 15). If no common connection is needed, leave POS 13 and POS 14 empty. POS 15 is a grounding point and the user must ensure that the unit have a good low impedance connection return path to ground. This connection protects the electronic circuit inside from external disturbances that may damage the motor unit.

Signal description

POS.	Name	Type	Description
1	110V DC	Supply	For motor drive and internal electronics (Disconnect when reactor is in use!)
2	110V DC	Signal	Supply for input and output signals
3	0V DC	Supply	Reference voltage
4	Up	Input	Turn one position up (unless it already is at position 6)
5	Down	Input	Turn one position down (unless it already is at position 1)
6	Calibrate	Input	If the unit need to be re-calibrated. Put the unit in position 1 manually and then set the calibration signal high.
7	Position 1	Outputs	POS. 2 & 7 are shorted if the unit is in position 1, otherwise they are open.
8	Position 2	Outputs	POS. 2 & 8 are shorted if the unit is in position 2, otherwise they are open.
9	Position 3	Output	POS. 2 & 9 are shorted if the unit is in position 3, otherwise they are open.
10	Position 4	Output	POS. 2 & 10 are shorted if the unit is in position 4, otherwise they are open.
11	Position 5	Output	POS. 2 & 11 are shorted if the unit is in position 5, otherwise they are open.
12	Position 6	Output	POS. 2 & 12 are shorted if the unit is in position 6, otherwise they are open.
13	Power	Output	POS. 2 & 13 are shorted if the unit has power, otherwise they are open.
14	0V	Bridge 1	Optional, (connected to POS 3) See page 5
15	V-	Bridge 2	Optional, (connected to PCB V-) See page 5
16	GND	Ground	This position shall be connected to customer ground

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Installation

The motor drive unit shaft is connected directly to the tap changer shaft with an anti-rotation device with 1x screw (Item 1: DIN912 MC6S A4 M5x35) + 1x nut (Item 2: DIN 985 LM6M A4 M5).
Use an internal hex screw size H4 and 8mm wrench to secure the fasteners

The main plate is guided into tap changer cover M8 welded screw and secured in place with 4x nut (Item 3: DIN 934 M6M A4 M8) + 4x washers (Item 4: DIN 9021 RBS A4 8.4x24x2). Use 2x 13mm wrench to secure the fasteners.

See assembly instruction with item balloons on page 8.

The motor housing needs to be properly grounded when the unit is installed. Check that the tap changer ground point, has a good ground connection to customer end. This is because the motor shaft has a braid ground connection to the motor housing. When ESD events occur on the motor, or motor shaft, the energy should be carried away via the customer ground return path.

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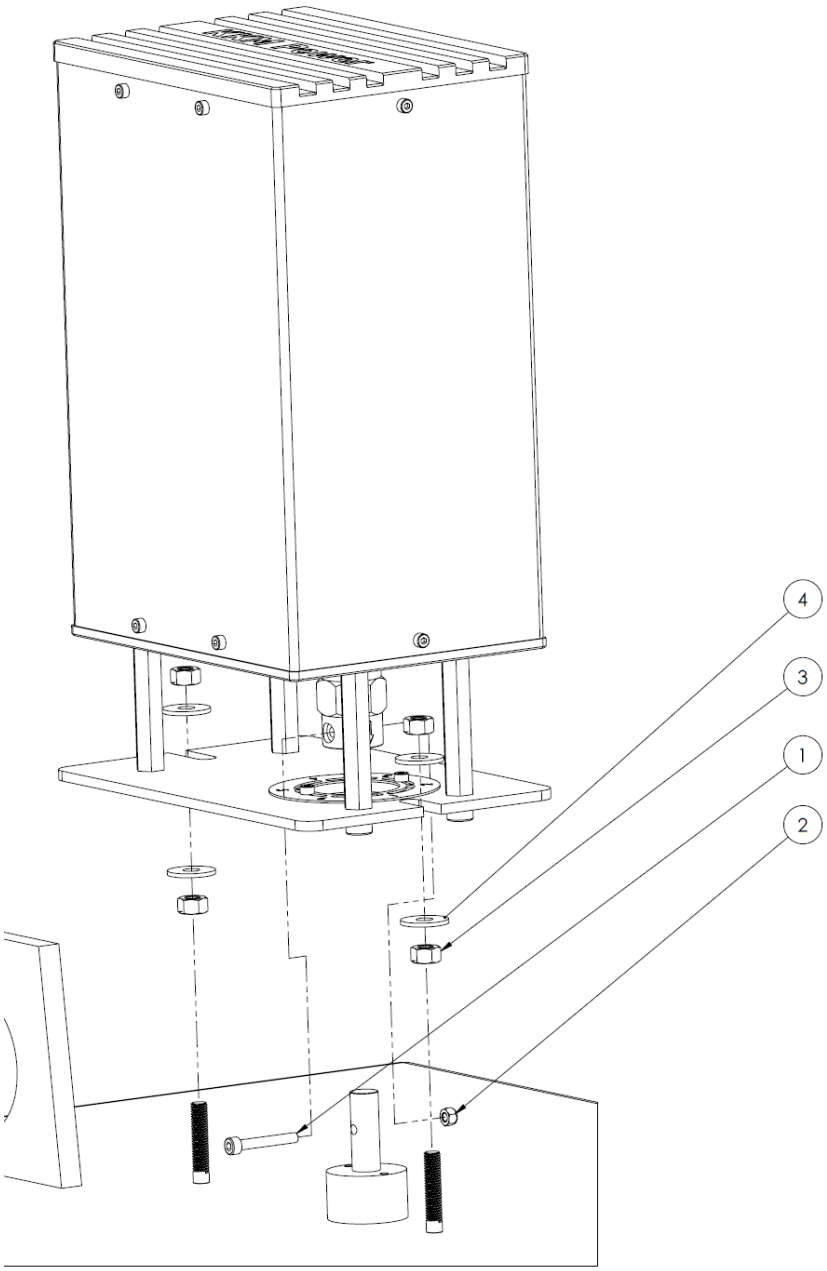

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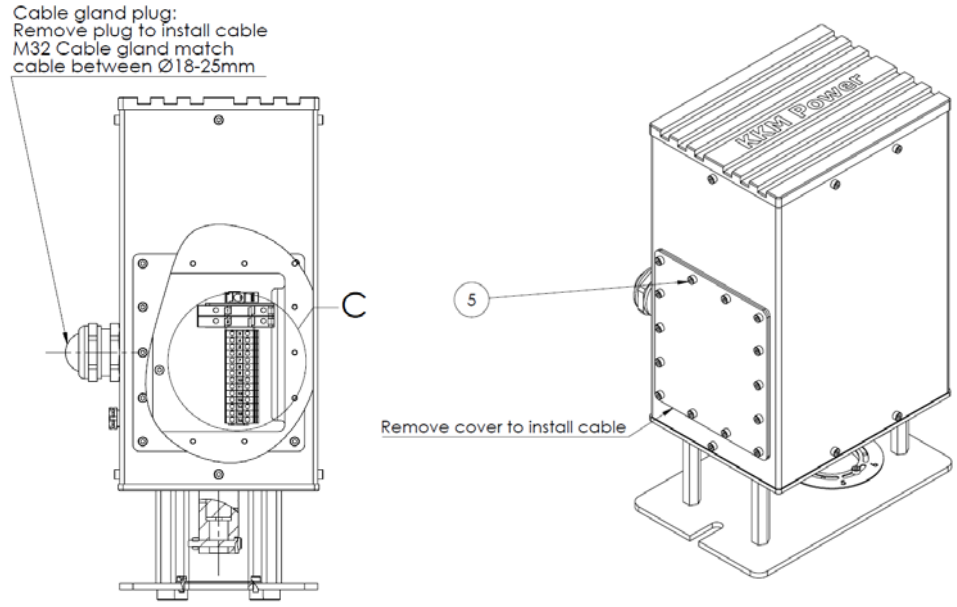
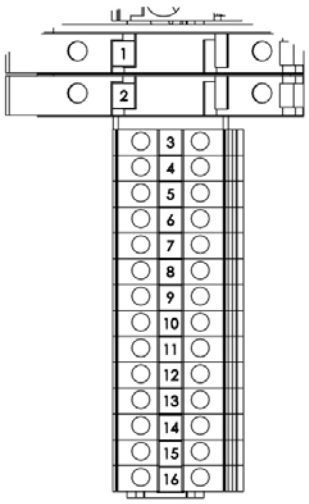
To install the cable the cable gland plug and cover needs to be removed.
Recommended cable is specified to MCMO 12x2.5mm²
The cable should be mounted thru the cable gland and each wire connected to correct terminal block marked in the connection table below.
The cover is secured with 14x screws (Item 5: DIN 912 MC6S A4 M4x8).
Use internal hex screw size H3 to remove and install the cover.





DETAIL C
Terminal positions

CONNECTION TABLE			
POS.	VALUE	ITEM	SPECIFICATION
1	110V DC	Power supply	Fuse, 6A 5x20mm
2	110V DC	Signal supply	Fuse,0.5A 5x20mm
3	0V DC	Power supply	-
4	110V DC	Remote control command MOVE UP	MOVE UP
5	110V DC	Remote control command MOVE DOWN	MOVE DOWN
6	110V DC	Remote control command CALIBRATE input 110V DC	CALIBRATE
7	110V DC	Signal output	POSITION 1
8	110V DC	Signal output	POSITION 2
9	110V DC	Signal output	POSITION 3
10	110V DC	Signal output	POSITION 4
11	110V DC	Signal output	POSITION 5
12	110V DC	Signal output	POSITION 6
13	110V DC	Signal output	POWER ON
14	0V	Optional, see operation manual	Bridge 1
15	V-		Bridge 2
16	GND	Ground connection	-

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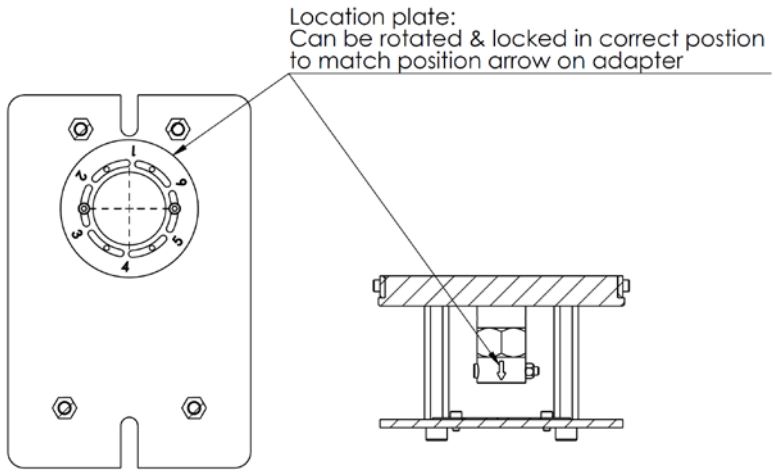
Calibration

The motor has two states. Calibration state and active state. The active state is default at power up. If a re-calibration is needed, Follow the steps listed below.
The calibration state stores a new calibration point.

Calibration sequence:

1. Disconnect the power supply V+ cable to the unit. (No. 1) Ensure that the unit is powered off
2. Turn the tap changer and motor shaft manually to position 1.
3. Connect the calibration input signal to V+, 110V DC (No. 6)
4. Connect the power to the unit. (No. 1)
5. The unit now starts up, and enters the calibration mode
6. The unit now stores the current position of the motor shaft as position No. 1
7. After approx. 30 seconds, the power indicator should turn high and output position 1 should turn high. This indicates that the calibration sequence is finished
8. Disconnect the power cable (No. 1)
9. Disconnect the calibration input signal (No. 6)
10. Start the unit by connecting the power cable. (No. 1) The unit is now in the active state

After the calibration sequence please make sure the tap changer shaft indication arrow and location plate match with the correct tap changer position.



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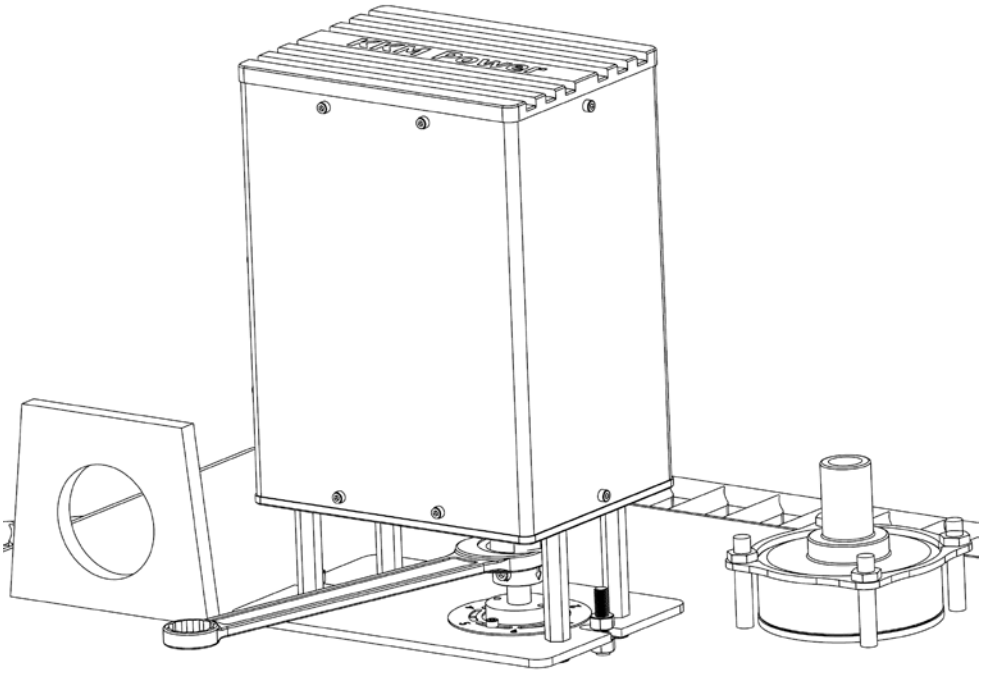
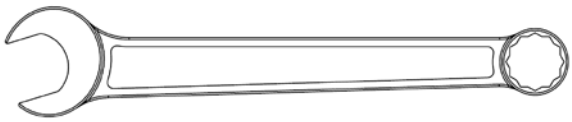
Manual operation

For manual operation make sure the motor drive unit is not connected.
The motor drive unit still have the previous position saved.
A manual position change will turn off the output position indicators.



Use a 30mm wrench to rotate the tap changer shaft to desired position.



Caution
The tap changer unit supply voltage shall be disconnected when the reactor is energized.
Operation of the unit, when the reactor is energized, is strictly forbidden.