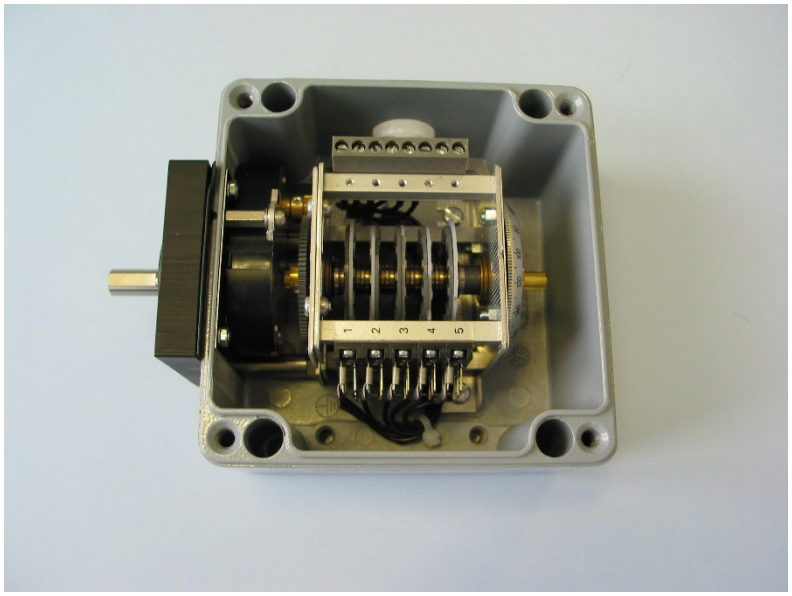
micronor sensors

KWG120/KWG160
General Purpose
Geared Limit Switches
User Guide

Document No. 98-0KWG-02
Revision A



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Revision History

Revision	Date	Technical Contact	Revision Notes
A	09-Feb-2024	DNH	Original Release, Micronor Sensors

File Reference

98-0KWG-02_A_KWG_Manual_FINAL_09Feb2022

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1. Product Overview

1.1 Product Description

MICRONOR KWG series Geared Limit Switches are the all-purpose solution for machine, hoist, and other rotary motion applications requiring a high quality, industrial-grade limit switch. These CE-approved switches can be used in applications with side loads as high as 100 lbf (450 N) and axial loads up to 45 lbf (200 N). The die cast housing is NEMA 4/4X (watertight) or NEMA 4X (watertight and corrosion resistant) rated using a proprietary copper free aluminum alloy offering corrosion resistance similar to stainless steel. A draw wire limit swich configuration is also available, which integrates a draw wire module to a KWG unit.

Rotary limit switches are used in machinery and mechanisms where motion is expressed in rotary motion. The primary purpose of a rotary limit switch is to control the intermediate or end limits of linear or rotary motion. The switch is often used as a safety device to protect against accidental damage to the equipment. Applications range from machine tools in factory environments to cranes and hoists operating in the harsh environments of rail yards and sea ports.

This product line draws upon Micronor's 30+ years expertise in electromechanical control and sensor design – including custom engineered feedback units, motorized potentiometers, cam timers, and proprietary stepless CAM-switch technology. Micronor's KS25B4 precision snap-action, change-over switch and NK single/double cam technology are the core elements for operation in the most demanding, industrial applications.

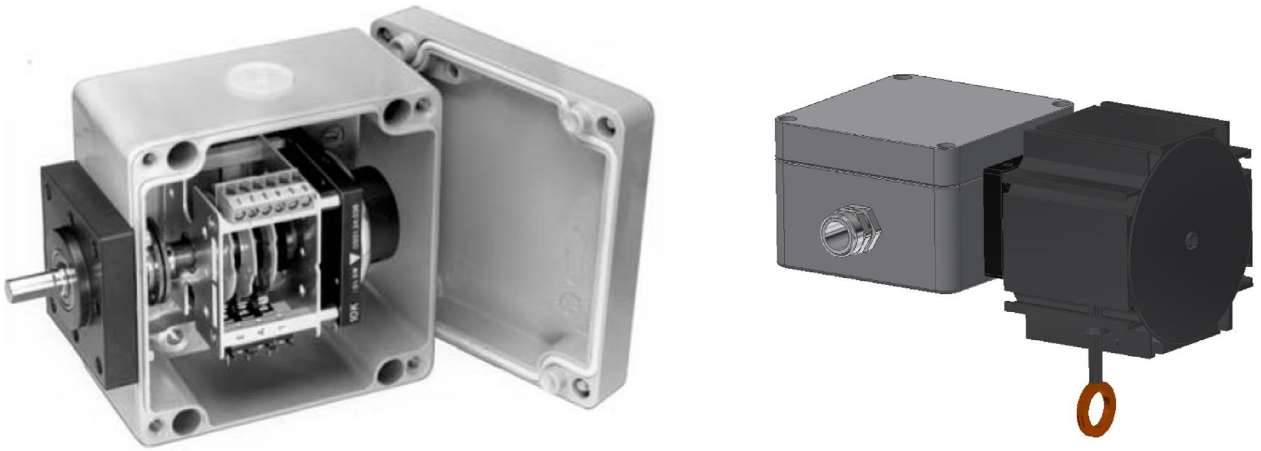

Figure 1. KWG120 series Rotary and KWG120W series Linear (Draw Wire) Limit Switches

Features:

- Combines gear reducer, coupling and cam switches into one compact unit
- Limit switches mechanically decoupled from heavy duty drive shaft – provides reliability and accuracy
- NEMA 4-rated die cast aluminum enclosure
- Industrial grade, heavy duty bearings
- 2-10 cam switch channels
- Easy to replace switches
- Capped hole for PG16 cable gland (user can install cable gland or conduit hub of choice by enlarging hole, if required)
- Transducer-based loop-powered, 4-20mA position output option

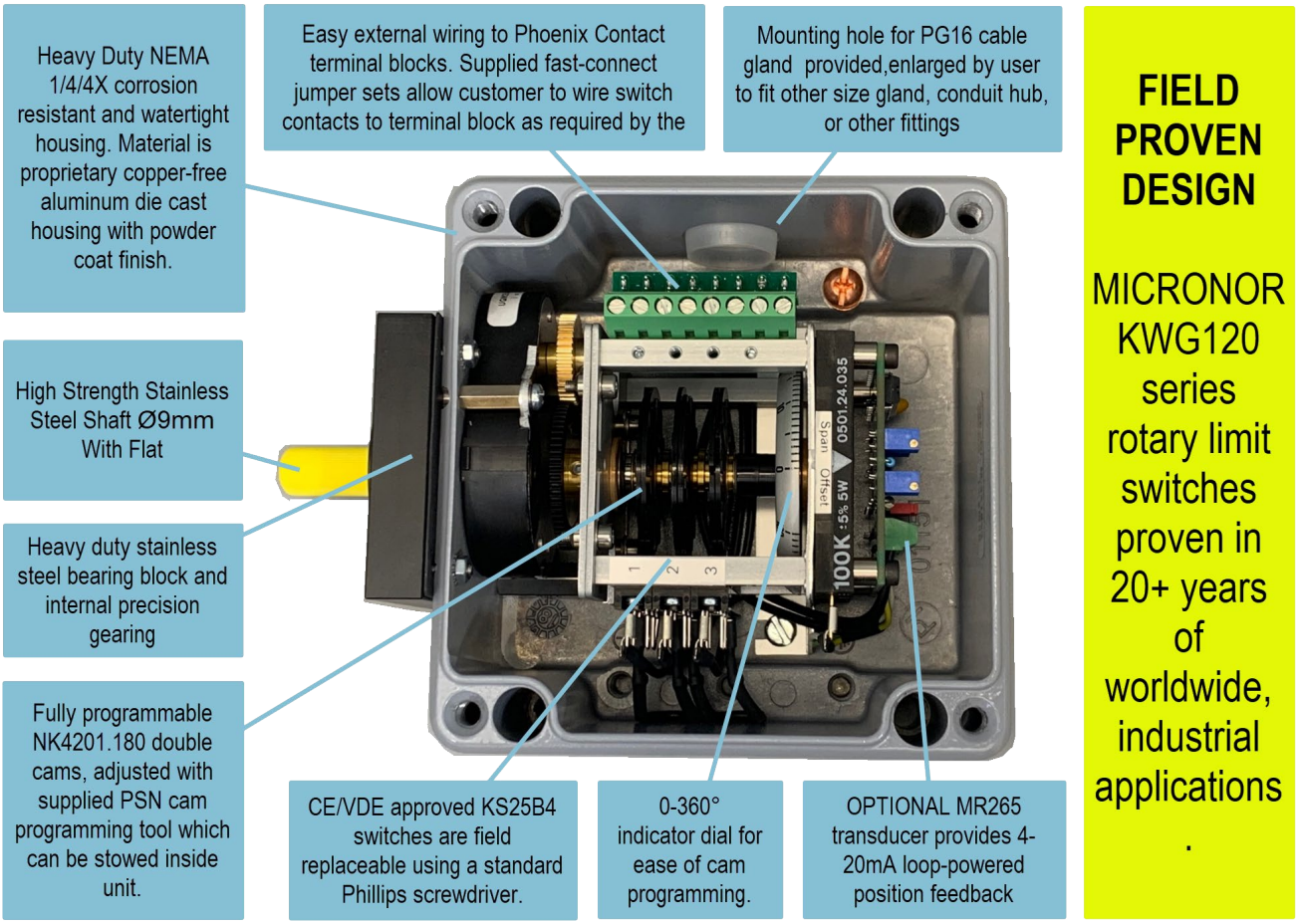

Figure 2. Features of the KWG120 Rotary Limit Switch

1.2 Schematic Diagram

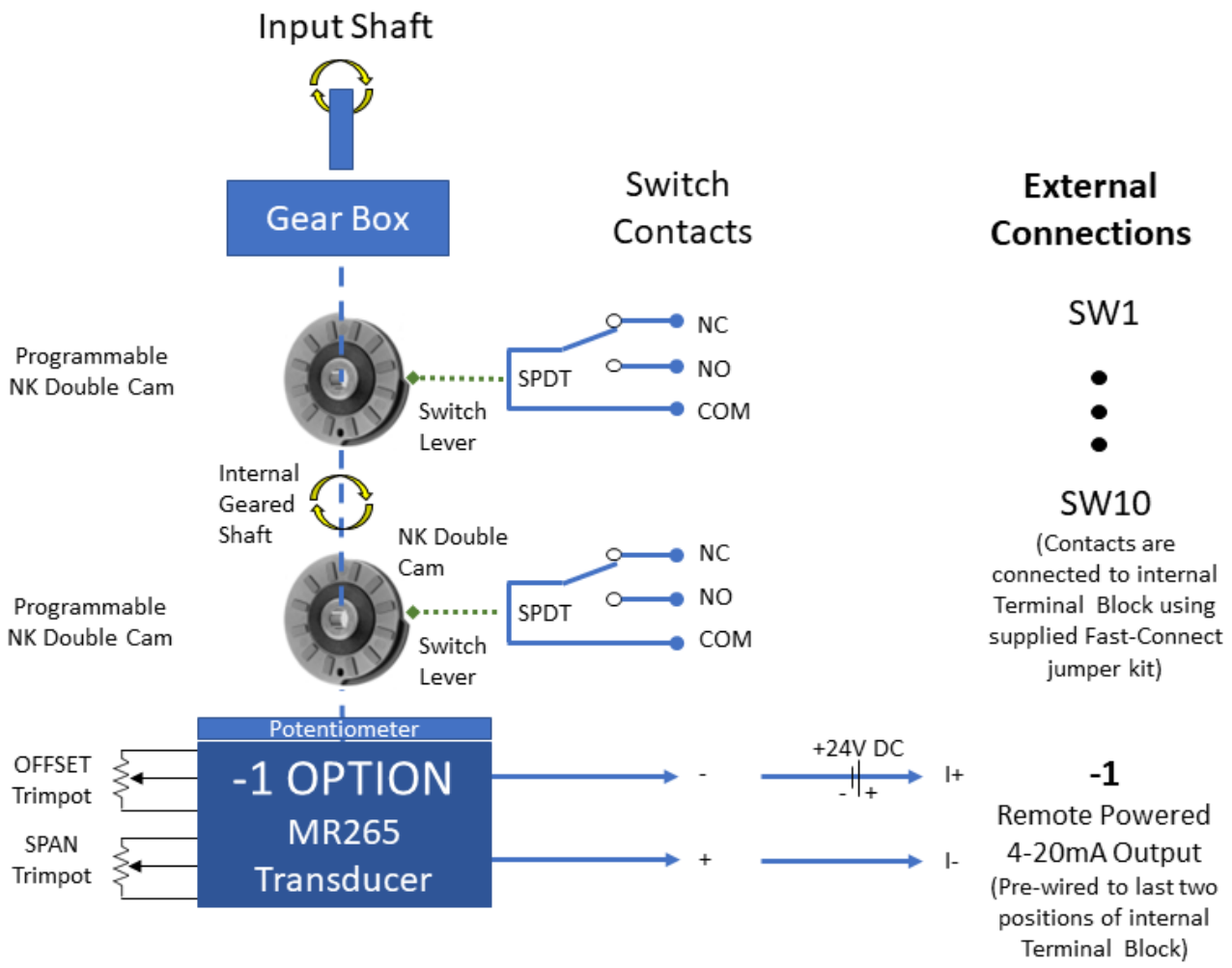

Figure 3. KWG120-KWG160 Schematic Diagram

1.3 Ordering Code

KWG120 - K 2 - M 1 0 0 - 0

Shaft Option
KWG120 Size 120mm, For 1-5 Channels
KWG160 Size 160mm, For 6-10 Channels

No. of Switches (Channels)
K2 to K5 For KWG120, Standard KS25B4 changeover switches
K6 to K10 For KWG160, Standard KS25B4 changeover switches
L2 to L4 For KWG120, Special S840 V20 changeover microswitches
L5 to L8 For KWG160, Special S840 V20 changeover microswitches

Gear Ratio
Step UP (D1:x)
D2 1:2

Single Stage Step DOWN (Ux:1)

U1	U1.25	**U2**	U2.6
U2.75	U3.5	**U4**	U5.0

Multistage Step DOWN (Mx:1)

M12.5	M20	**M25**	M30
M40	M50	M75	**M100**
M200	M300	M300	M420
M600	**M750**	M1000	M1600
M2250	**M2500**		

Special options available:
- **For special gear ratios - contact sales**
- **For special switches - contact sales**
- **For Draw Wire Linear Limit Switch - see KWG120W data sheet**
- **For Heavy Duty IP66 applications - see MR221-MR222 data sheet**

Bold ratios are standard, quick ship configurations
Spewcial Other gear ratios available upon request

Position Transducer Output Option
0 None
1 MR265 4-20mA transducer output (max # of switches Kx or Lx above reduced by 1 with this option)

Replacement Parts

6099.07.778	PSN (black) Cam Programming Key for NK Single and Double Cams
6099.00.035	Type K Switch, KS25B4 changeover switch with silver contacts
6099.22.846	Type L Switch, S840 V20 changeover switch with silver contacts

2. Initial Preparation

2.1 Unpacking and Inspection

The unit was carefully inspected mechanically and electrically before shipment. When received, the shipping carton should contain the following items listed below. Account for and inspect each item before the carton is discarded. In the event of a damaged instrument, write or call your nearest MICRONOR office in either the USA. or Switzerland. Please retain the shipping container in case reshipment is required for any reason.

2.2 Damage in Shipment

All instruments are insured when shipped by MICRONOR. If you receive a damaged instrument you should:

1) Report the damage to your shipper immediately.
2) Inform MICRONOR.
3) Save all shipping cartons.
4) Failure to follow this procedure may affect your claim for compensation.

2.3 Standard Contents

Each KWG product box will contain the following items:

- KWG120 or KWG160 geared limit switch per ordered configuration (see Section 1.3)
- PSN (black) cam programming tool
- Fast-Connect Jumper Set (AWG22, for connecting switch contacts to terminal block):
  - L2-L3, supplied with 6C Terminal Block
  - L4-L5, supplied with 8C Terminal Block
  - L6-L7, supplied with 12C Terminal Block
  - L8-L10, supplied with 16C Terminal Block
- This manual (one printed copy per shipment)

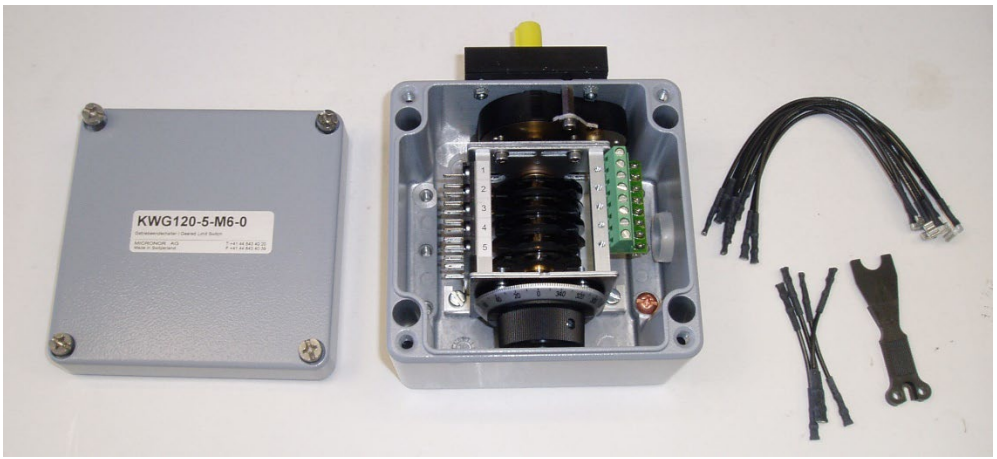

Figure 4. Standard contents of KWG120/KWG160 rotary limit switch

2.4 Warranty Information

MICRONOR warrants this product to be free from defects in material and workmanship for a period of twelve (12) months from date of shipment. During the warranty period we will, at our option, either repair or replace any product that proves to be defective.

To exercise this warranty, write or call MICRONOR SENSORS, or directly contact MICRONOR AG in Switzerland. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitations of **Warranty**

This warranty does not apply to defects resulting from unauthorized modification or misuse of any product or part. This warranty also does not apply to optical interfaces, cable assemblies, fuses or AC line cords.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability of fitness for a particular use. MICRONOR or MICRONOR SENSORS shall not be liable for any indirect, special or consequent damages.

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3. Specifications

3.1 Electrical, Mechanical and Environmental (All Models)

Parameter	Specification	Notes
Enclosure Ratings	UL/NEMA Type 1/4/4X + IP64	die cast aluminum with powder coat finish NOTE: IP rating applies only when unit installed, connected and torqued properly.
Switch Rating KS25B4 (Standard)	Type Mechanical Life Switching Power Temperature Ingress Approvals	Changeover switch 10 x 10^6 cycles (typical) 250 VAC/4 A 60 VDC/1 A -40°C to +85°C IP00 VDE
Switch Rating S840 V20 (Optional)	Type Mechanical Life Resistive Load Inductive Load Temperature Ingress Protection Approvals	Changeover switch with wiping action 10 x 10^6 cycles (typical) 230 VAC/6 A continuous/10 A momentary 24 VDC/6 A continuous/10 A momentary 230 VAC/Power Factor 0.7/3 A 125 VDC/0.5 A 80 VDC/0.75 A 40 VDC/1 A 24 VDC/3 A -40°C to +85°C IP40 VDE, cURus
Cam Programming	1-2 (COM-NC) 1-3 (COM-NO) Repeatability	With Cam Valley Profile: 4°...180° (1...50%) With Cam Peak Profile: 4°...356° (1...99%) 1.8°
Mechanical Rating	Max RPM Mechanical Life Max Radial (Side) Load Max Axial (Thrust) Load Repeatability Hysteresis Shock Resistance Vibration resistance	1500 RPM 10 x 10^6 cycles , 200'000 hrs (typical) 450 N (100 lbf) 200 N (45 lbf) Dependent on gear ratio Dependent on gear ratio 2500 m/s^2, 6ms, IEC68-2-27 200 m/s^2, 10..2000 Hz, IEC68-2-6
Wire Range	Max 2.5 mm2 (22-14 AWG)	External connections via internal Phoenix Contact terminal block
External Interface	Mounting holes provided for PG16 cable gland: KWG120 = 1x KWG160 = 2x	PG16 cable glands not provided. PG16 cable gland accepts 10-14mm OD cable. Hole= Ø22.4mm (supplied with cap) Hole can be enlarged for other cable glands, conduit hubs, or similar fittings

Temperature	-40°C to +85°C	Operating and storage
Humidity	Max 40% RH	
Ingress Protection	IP64	
Weight	KWG120, 1.5kg (3.3 lbs) KWG160, 2kg (4.4 lbs)	

Specifications subject to change without notice

3.2 MR265 4-20mA Position Transducer Output OPTION

The KWG120-1/KWG160-1 (MR265) option is a precision, 2-Wire, potentiometer-based, loop-powered 4-20mA output option.

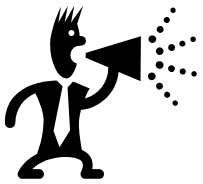
Parameter	**Specification**	**Notes**
MR265	Potentiometer-based transducer	4mA point programmable via Offset trimpot 20mA point programmable via Span trimpot
Angular Travel	355° (equivalent to 98.6% of usable gear ratio)	Equivalent to 98.6% of usable gear ratio, This represents the 5° dead spot between the two ends of potentiometer.
Ext Burden Resistance	500Ω	
Loop Voltage Requirements	24-30 V DC, absolute max ratings	Typical 15mA @ 24V DC (no load)
Linearity/Accuracy	±0.5%	
Temperature	0°C to +70°C	KWG120/KWG160 temperature range to be derated due to MR265 electronics rating

Specifications subject to change without notice

4. Installation Guidelines

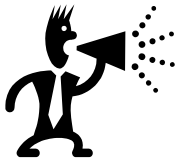
For most efficient use of time, it is recommended to plan the setup and installation in the following order:

1. Pre-plan cam program and switch-to-terminal block wiring using Table 1 template
2. Install jumpers from Switch to Terminal Block.
3. Pre-program cams per Table 1 template
4. Attach desired Cable Gland or Conduit Hub to KWG unit.
5. Mount unit.
6. Install shaft coupling to customer equipment.
7. Make external connections to Terminal Block.
8. Program and scale the MR265 4-20mA output, if OPTION ordered.
9. Exercise system and fine-turn cam programing as required.



Important Wiring Notes

- Use copper conductors rated 85°C or higher
- Tighten terminal torque is 5-7 in-lbs
- Unused conduit ports must be properly sealed to prevent moisture and water leakage into the unit.
- Electrical connections should be performed consistent with governing electrical code.



Important Note About Foreign Objects and Debris (FOD)

- Do not allow any FOD (including wire clippings, metal shavings, etc.) to be left behind in the enclosure.
- FOD could become lodged in the switch mechanism and cause an electrical short or other system failure

4.1 Pre-plan Cam Program and Switch-to-Terminal Block Wiring

Pre-plan cam programming and wiring by filling in Wiring Table (Table 1) based on number of positions available on the Phoenix Contact terminal block. Select wire type, color and size consistent with the project requirements and safety codes. Copper conductors should be rated 85°C or higher.

The Micronor Programmable Cam Switches are designed to be both versatile and easy to operate. However, initial planning is required for cams to be programmed per desired circuit function. Due to the design of the cam, switches cannot be engaged for more than 180°. If the system requires that the switch does not make contact for more than 180°, the normally closed (NC) contact must be wired.

As shown in Example A, a system might requirea circuit connection (closed) from 0° to 100° and open from 101° to 359°. To accomplish this, the switch must be wired in the normally closed (NC and COM) switch contacts.

As shown in Example B, a system that requires a circuit connection for 260°, the normally open (NO and COM) circuit must be used so that the contact circuit is closed from 0° to 260° and open from 261° to 359°.

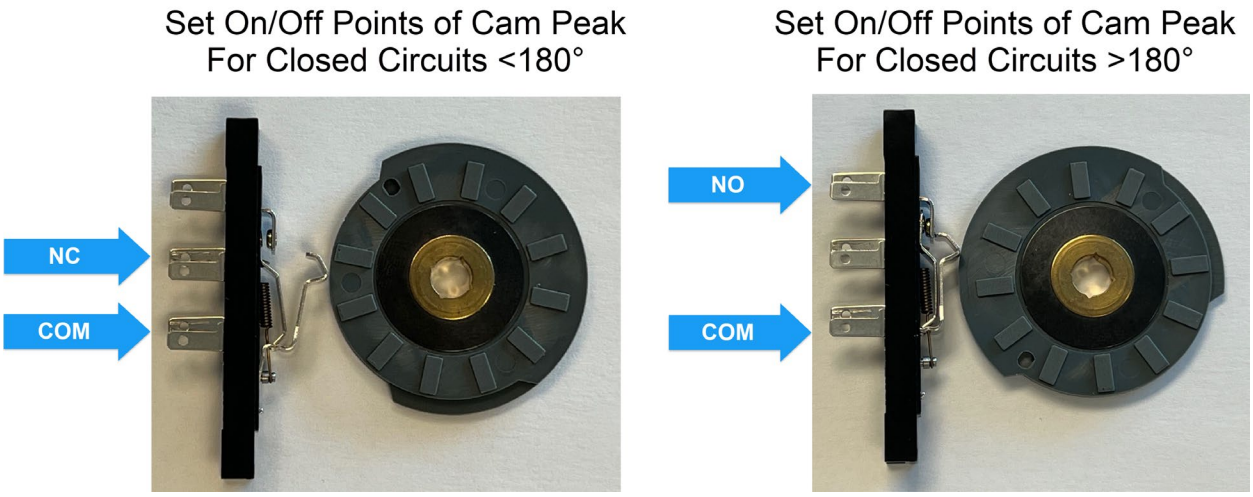


Figure 5. Cam Programming Examples for <180° (A) and ≥180° (B)

Table 1. Wiring Table Template example for KWG120-L2-XXX-0 Configuration

Contact No.	Switch No.	Contact Type	Cam Program (Input shaft degrees or dial setting)		Wire Color and Size	Signal Name
			ON	OFF		
1	Switch 1	Common				
2	Switch 1	NC				
3	Switch 1	NO				
4	Switch 2	Common				
5	Switch 2	NC				
6	Switch 2	NO				
7						
8						
9						
10						
11						
12						
13						
14						
15						

16						

4.2 Install Jumpers from Switch to Terminal Block

Using completed Table 1 template, use the supplied Fast-Connect Jumpers per Table 1 wiring plan from designated switch contact to terminal block position.

To facilitate this step, the cam switch assembly can be removed by loosening the two rear screws holding the rear flange in place – and sliding the assembly back.

To replace a microswitch, follow these steps while consulting **Figure 12**:

1. Using a slotted screwdriver, loosen (but do not remove) the two screws holding the rear mounting flange of the cam switch subassembly.

2. Grab subassembly with two hands and pull straight back to disengage the pins aligning the subassembly to the front gear assembly.

3. Install the jumpers per completed Table 1 template.

4. Remove the two screws holding the microswitch to the frame of the cam switch subassembly. Replace with the new switch and reattach the Fast-Connect jumpers to the designated contacts of the new switch.

5. To re-install the cam switch subassembly, realign alignment pins, slide into place, and tighten the two rear-end mounting screws (that were loosened in Step 1).

4.3 Pre-program the Cams per Template

The following instructions may be used to program the start and stop times of each switch using the supplied PSN (black) cam programming tool and the program developed in Section 4.1:

1. Turn external shaft to the desired START position via dial setting. Insert PSN key ith the numbered side away from the cam and the notched side towards the cam.

2. While gently applying pressure against the cam with the key; rotate the cam to the desired position.

3. Turn external shaft to the desired STOP position, flip over the PSN key and repeat steps 1 and 2 on the other side of the cam.

4. Test the unit to confirm that the switches engage (START) and disengage (STOP) at the appropriate positions.

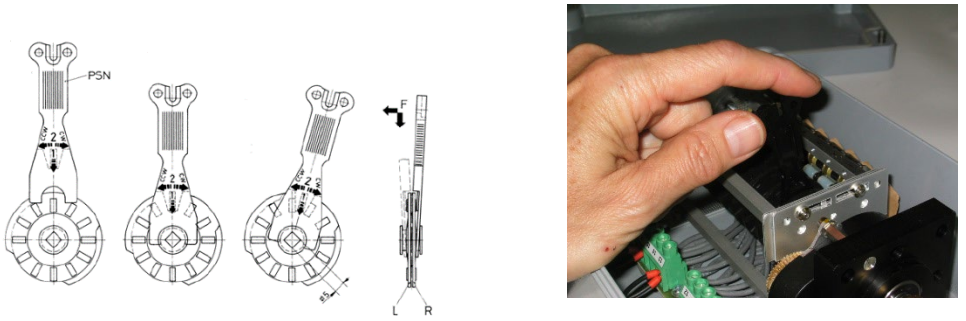
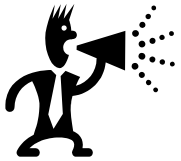


Figure 6. How to Program Cams with the PSN Programming Tool

4.4 Mount desired Cable Gland or Conduit Hub

The KWG120/KWG160 are supplied pre-drilled and capped for one (KWG120) or two (KWG160) PG16 cable glands. PG16 will accept cable OD of 10mm to 14mm. The hole ID is 22.4mm and can be carefull enlarged for other size cable glands, conduit hubs or similar fittings.



Important Note About Foreign Objects and Debris (FOD)

- Do not allow any FOD (including wire clippings, metal shavings, etc.)) to be left behind in the enclosure.
- FOD could become lodged in the switch mechanism and cause an electrical short or other system failure.

4.5 Mounting the Enclosure

Use appropriate hardware to mount limit switch enclosure. On the mounting screws, be sure to use caulking or other sealant appropriate for the operating environment and to ensure proper sealing.

KWG120/KWG160 models have 4x Ø7mm (0.276”) mounting holes on following arrangement:

- KWG120, 82mm x 106mm (3.23-in x 4.17-in)
- KWG160, 140mm x 110mm (5.11-in x 4.33-in)

For reference, consult mechanical drawings of Section 6.

4.6 Install Shaft Coupling to Customer’s Equipment

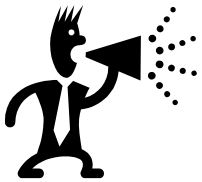
In general, heavy duty/zero backlash couplings should be used to couple the limit switch’s shaft to the customer’s equipment (usually the drum or overspeed sensor).

To order a coupling from most suppliers, the process is to select the coupling style (heavy duty/zero backlash) and the shaft dimensions (and any special features) of both sides. Designating Side A for the Micronor limit switch and Side B for the customer's equipment (typically the drum or over speed sensor):

- Side A (Micronor side) for 9mm ∅ shaft with flat
- Side B (Customer equipment, specify shaft OD, shape and any key/slot features)

Be sure to follow the coupling manufacturer's assembly and installation instructions. This includes using the proper tools and torque values for securing all screws and set-screws.

4.7 Connect External Wiring to Terminal Block



Important wiring notes

- Use copper conductors rated 85°C or higher
- Tighten terminal torque is 5-7 in-lbs
- Unused conduit ports must be properly sealed to prevent moisture and water leakage into the unit.

Electrical connections should be performed consistent with governing electrical code, completed Table 1 template, and following these steps:

1. Pull wire through cable or conduit fitting.

2. Strip wire ends approximately 5-6mm (0,22") length. Using a slotted screwdriver, loosen screws of Phoenix Contact terminal block, insert wire end and close contact by tightening screw (see **Figure 6**).

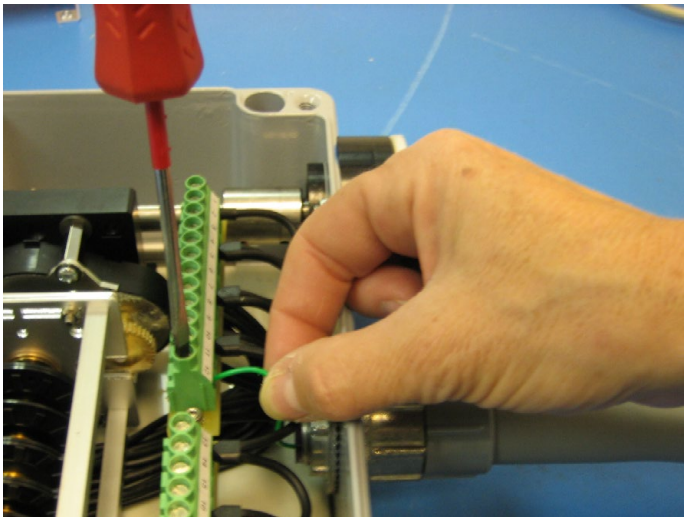


Figure 7. Wiring to the Phoenix Contact Terminal Block

4.8 Connecting and Programming the 4-20mA Position Output OPTION

The KWG120-1/KWG160-1 (MR265) 4-20mA Position Output OPTION is a 2-Wire or loop-power feedback option. That is, the loop is powered in series and provides the advantage that this feedback option can be powered remotely from the PLC location.

The schematic diagram of **Figure 8** shows how the I+/I- current outputs are wired. A 24V DC supply must be inserted in series to power the current loop.

The MR265 Transducer option is based on a PCB Controller and an internal single turn potentiometer mounted on the cam shaft. The analog output is adjustable over a mechanical range of 0° to 355° corresponding to the KWG120's gear ratio less 1.4% (equivalent to 5° not covered by potentiometer) and controller by two accessible trimpots (Offset and Span) and two jumpers (Direction), Offset and Span.

As shown in **Figure 9**, the analog output may be adjusted anywhere between 4mA to 20mA within the yellow shaded area along with the desired electrical direction (4-20mA or 20-4mA) controlled onboard jumpers.

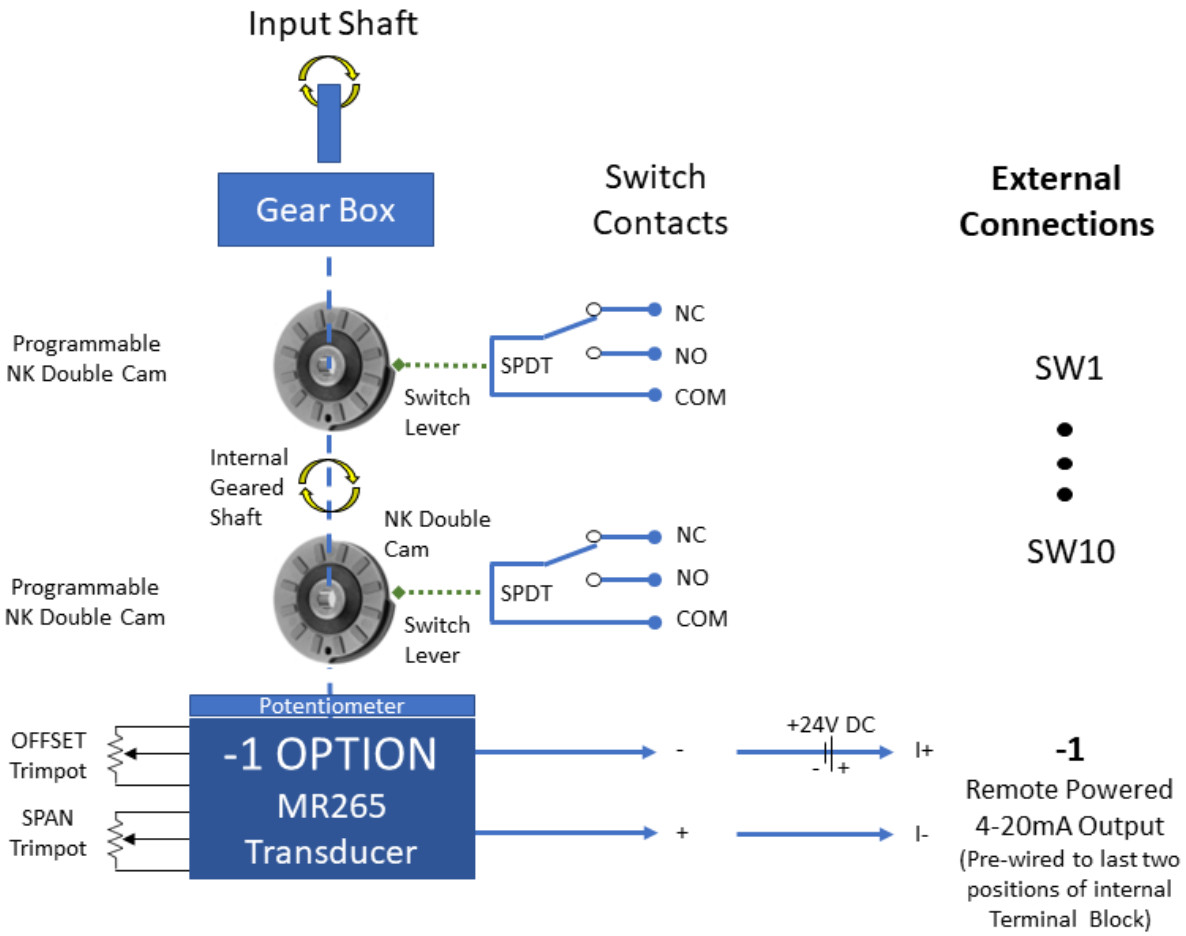
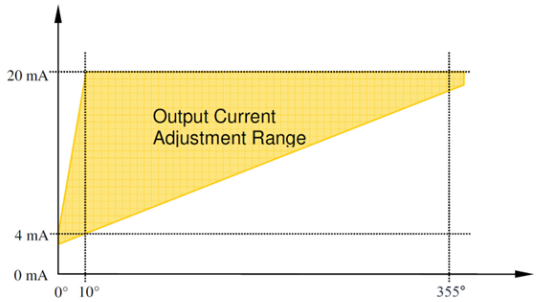


Figure 8. How to wire KWG120-1 MR265 Position Output

SLOPE Trimpot Settings

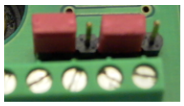
Min Offset: 0°
Max Offset: 10°
Min Slope: 48.5 µA/°
Max Slope: 1.6 mA/°

The curve to the right visualizes the adjustment range which lies within the yellow shaded area.

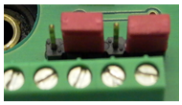


DIRECTION Jumper Settings

4-20mA Output
Follows Scale 0-100



4-20mA Output
Follows Scale 100-0



Direction from input shaft to current loop interface various according to the gear transmission and ratio.

PROGRAMMING Instructions

1. Set potentiometer to desired lower limit (must be within 10° of max potentiometer deflection).
2. Adjust output to 4mA via the trimpot labeled **Offset**.
3. Set potentiometer to desired upper maximum setting.
4. Adjust output to 20mA via the trimpot labeled **Span**.

Figure 9. How to set 4mA/20mA points and Direction of MR265 Output

4.9 Fine Tuning the Cams after Installation

At this point, the KWG unit is pre-programmed, installed and ready for operation.

Exercise the equipment and fine tune any cam settings as required. Note any cam setting changes in the Table 1 template and your project documentation.

4.10 Closing and Sealing the Enclosure

Apply Proper Sealing Techniques To Prevent Damaging Ingress

- On the mounting screws, be sure to use caulking or other sealant appropriate for the operating environment.
- If not using one of the conduit hub (wiring) ports, be sure to properly seal the opening using the supplied threaded plug and proper sealant.
- Failure to apply proper sealing techniques voids product warranty.

5. Maintenance and Service

Under normal operating conditions and use, the KWG120/KWG160 series Limit Switches require no maintenance. The only replaceable component part is the microswitch (consult Section 5.2). Cleaning and re-lubrication of the internal, exposed gears might be necessary if the unit had not been properly sealed and the grease has become contaminated.

Otherwise, it is more practical to replace the entire unit.

5.1 Replaceable Parts

The following replacement ***accessory*** part is available from Micronor:

- PSN Cam Programming Tool, Micronor P/N 6099.07.778. (consult Section 4.3 for use)

The following replacement switch ***component*** part is available from Micronor:

- Type K microswitch, KS25B4, order Micronor 6099.00.035
- Type L microswitch, S840 V2, order Micronor 6099.22.846

The following replacement ***gear lubricant*** is available from Etna-Bechem Lubricants Ltd:

- Contact: Etna-Bechem Lubricants Ltd.
  - 16824 Park Circle Dr, Chagrin Falls, OH 44023
  - Tel 440-543-9845, Fax 440-543-1789
  - Email jcs@etna.com, URL www.etna.com
- Type BERULUB FH 28 (Multipurpose synthetic specialty grease for metals and polymers, rated -31°F/320°F or -35°C/160°C, also consult Section 5.2 for application)

5.2 Replacing Microswitches

Age and heavy duty cycles can eventually wear out the microswitches. Replacements can be ordered. K and L type switches are not interchangeable due to difference in size and width.

Figure 10. Standard K-type KS25B4 precision snap-action switch, order 6099.00.035

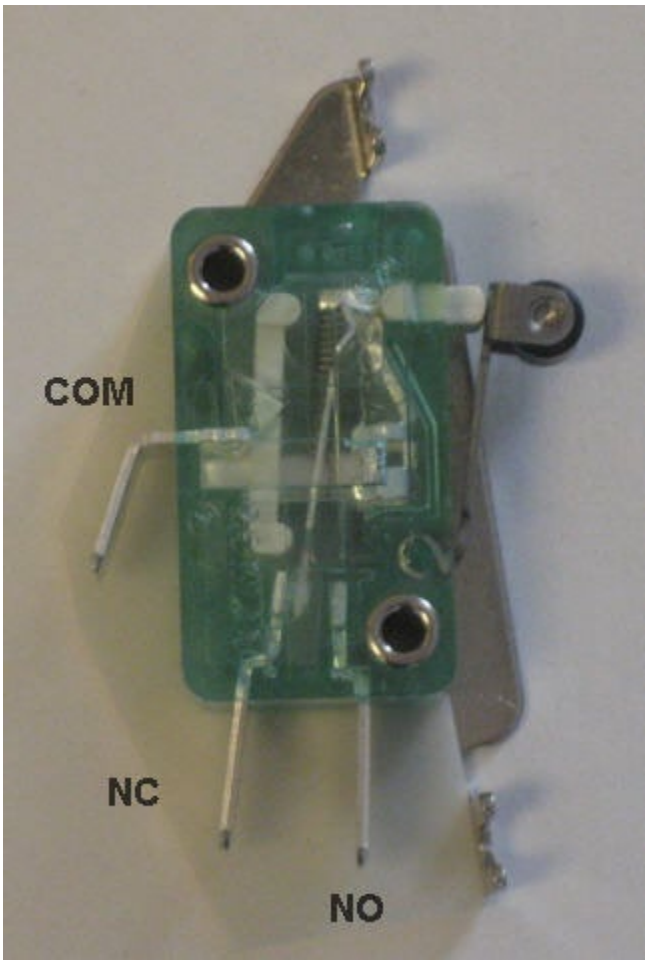


Figure 11. Optional L-type S840 V20 microswitch,, order 6099.22.846

To replace a microswitch, follow these steps while consulting **Figure 12**:

6. Using a large slotted or Phillips screwdriver, remove cover by loosening the 4 mounting screws located on top.

7. Using a slotted screwdriver, loosen (but do not remove) the two screws holding the rear mounting flange of the cam switch subassembly. To gain access to the microswitches, grab subassembly and pull back to disengage from the two mounting screws loosen in the previous step.

8. Gently remove the Fast-Connect jumpers from the existing switch.

9. Remove the two screws holding the microswitch to the frame of the cam switch subassembly. Replace with the new switch and reattach the Fast-Connect jumpers to the designated contacts of the new switch.

10. Align the cam switch subassembly via the front alignment pins and the two back mounting screws (that were loosened in Step 2). Tighten the two bottom mounting screws.

11. Replace cover and tighten the four mounting bolts.

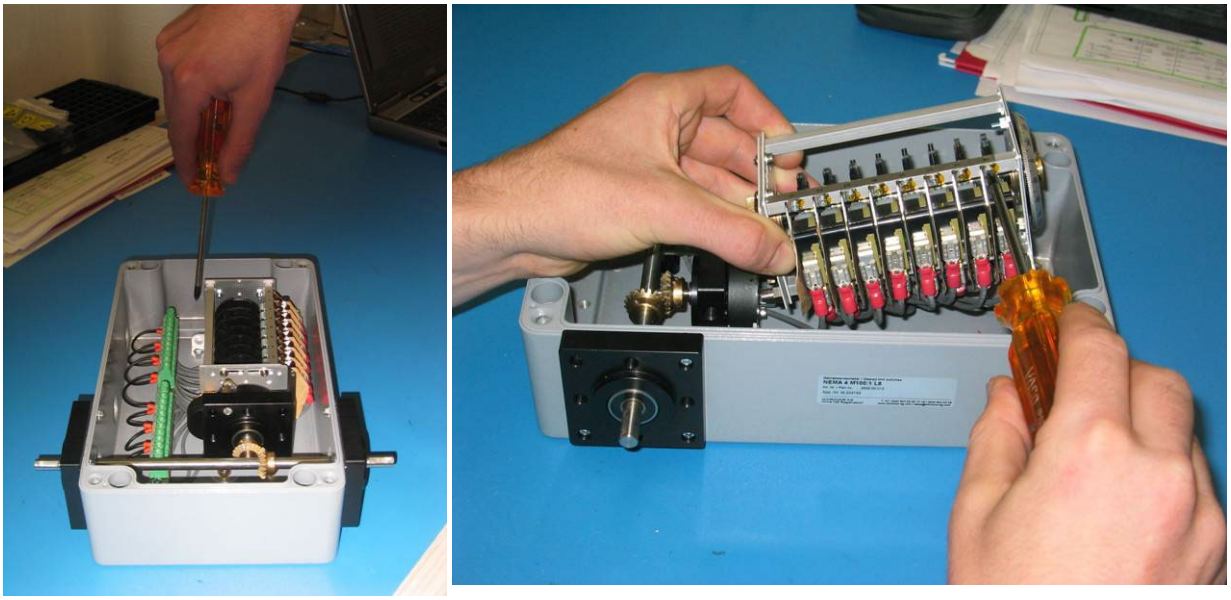


Figure 12. How to replace Microswitch

5.3 Lubricating Cam Switch Gear Junction

Under normal conditions, it is not necessary to lubricate the cam gears. However, if the inside becomes accidentally contaminated, it will become necessary to clean and re-lubricate the gears. Follow these steps:

1. Disconnect external coupling connected to main shaft. This is done to facilitate manual rotation of the gears in the next step.

2. Using a slotted screwdriver (consult **Figure 12**), loosen (but do not remove) the two screws holding the rear mounting flange of the cam switch subassembly. To gain access to the microswitches, grab subassembly and pull back to disengage from the two mounting screws loosen in the previous step. This will expose the two gears – one that is attached to the gear box and the other attached to the cam switch shaft.

3. Clean inside of case and the two gears using lintless swabs/wipes and reagent grade IPA (isopropyl alcohol).

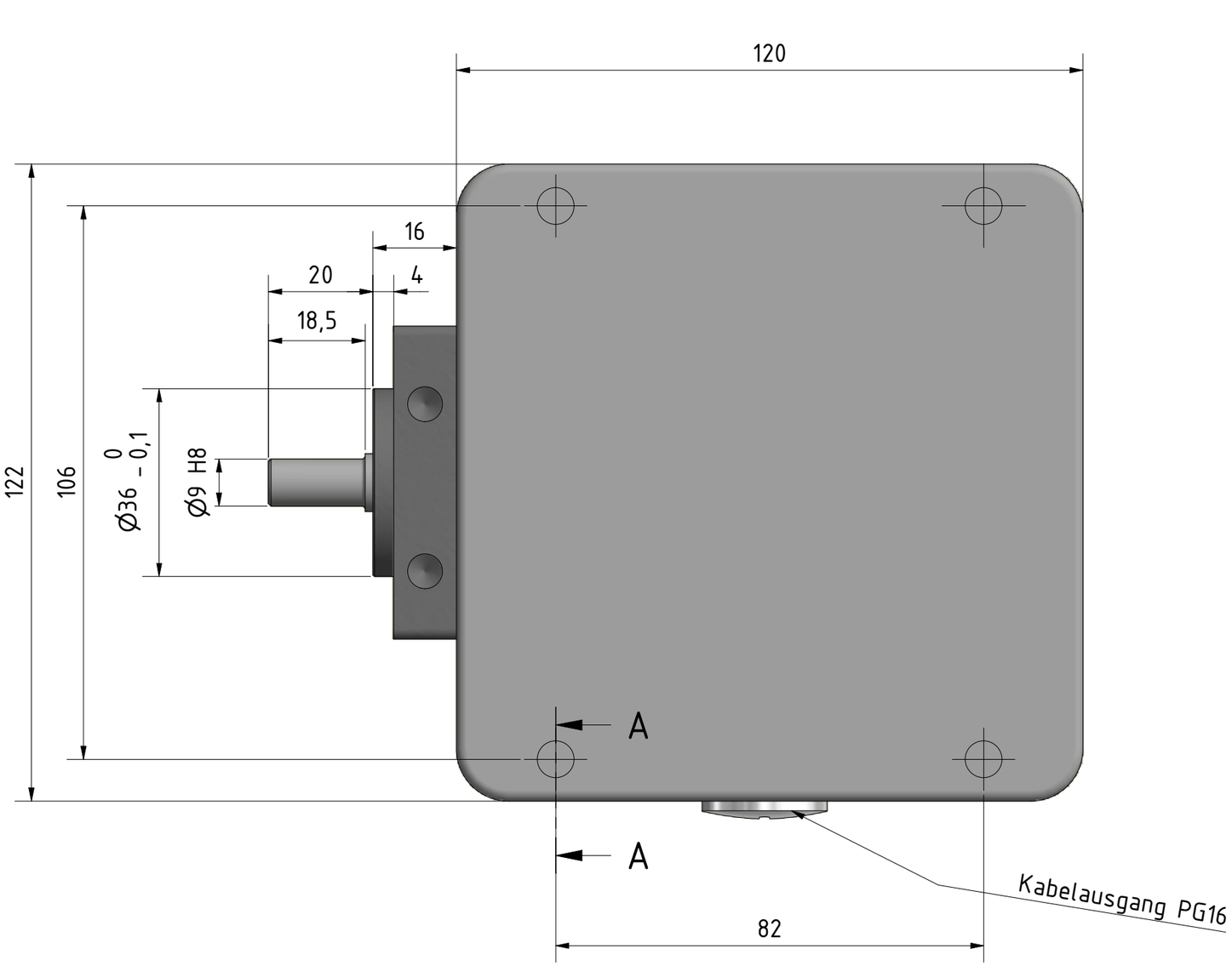
4. While rotating the shaft, apply a moderate amount of grease all around and over each gear.

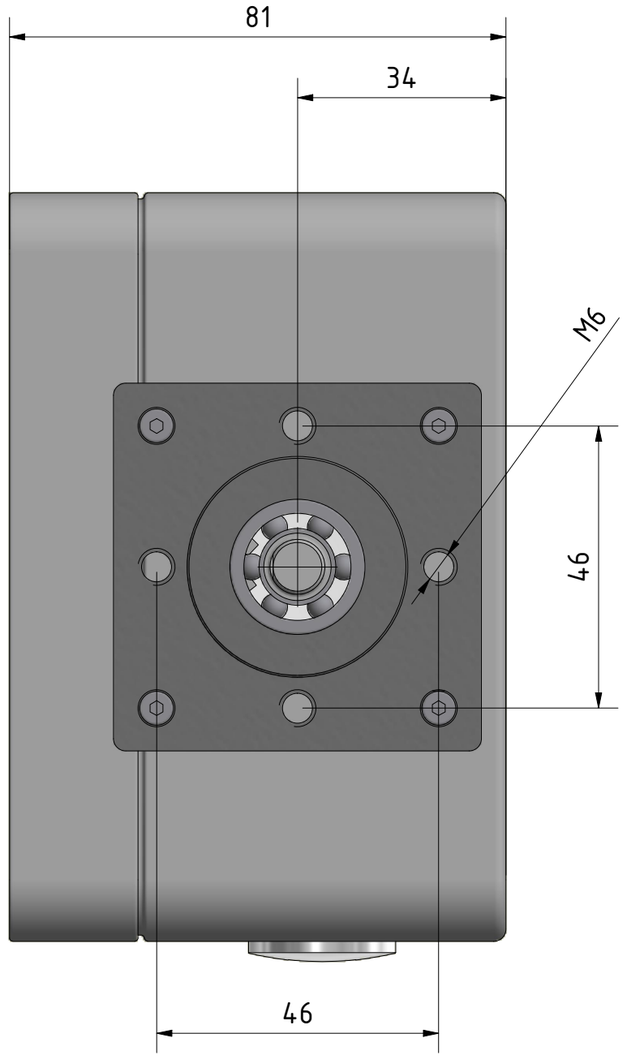
5. Align the cam switch subassembly via the front alignment pins and the two back mounting screws (that were loosened in Step 2). Tighten the two bottom mounting screws.

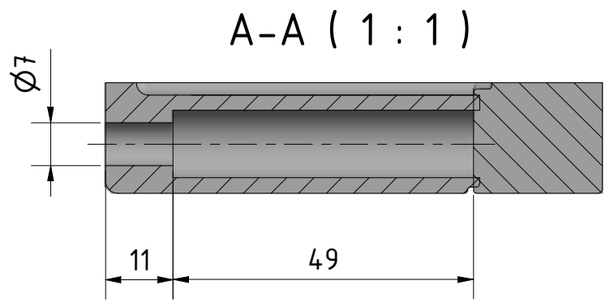
6. Reference Drawings

The following pages provide reference drawings for each model:

- Standard KWG120
- Standard KWG160







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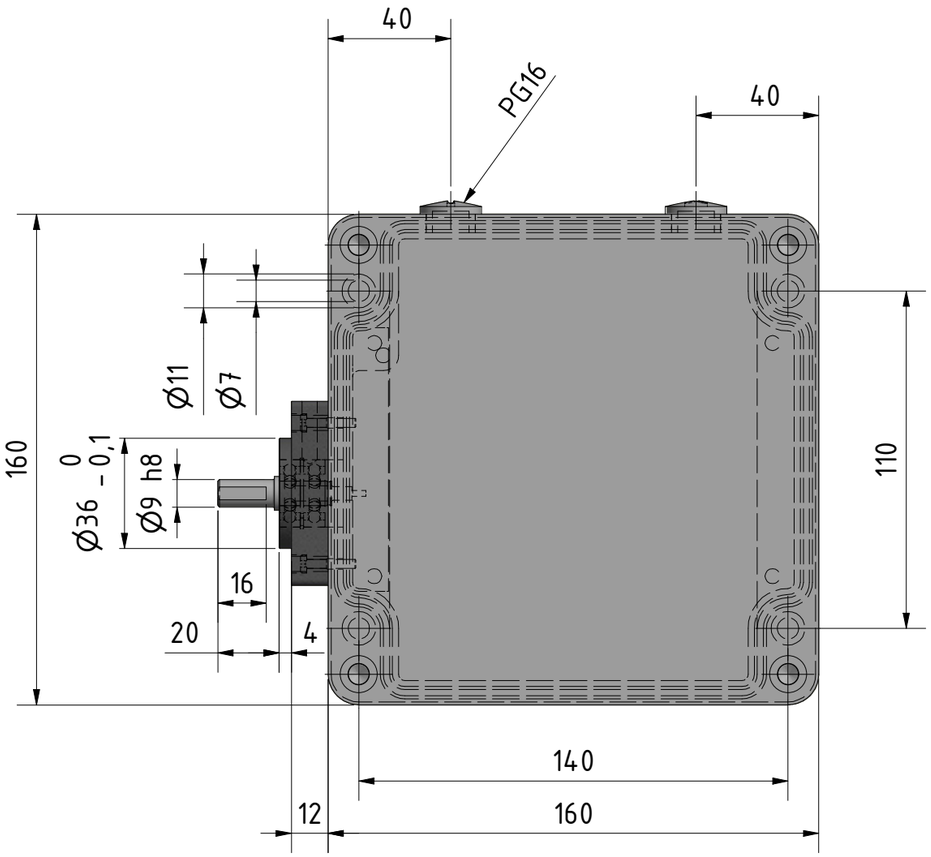
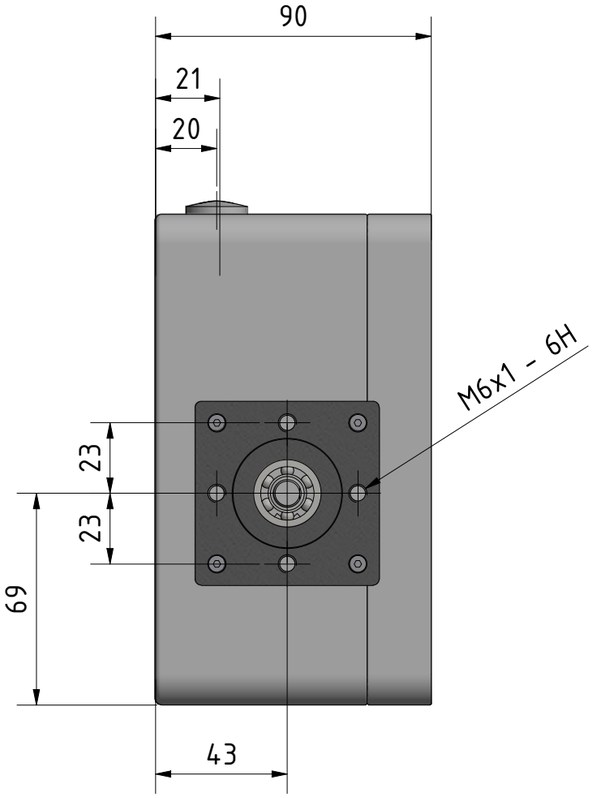
g					Datum	Name	Massstab	Objekt / Bezeichnung
f				Gez.	20.12.2016	M. Zürcher	1 : 1	
e				Kontr.	24.02.2017	L. Wittwer		KWG120 Serie
d				Frei.	24.02.2017	L. Wittwer		
c				**MICRONOR®**			Zeichnungs Nr.	
b				CH - 8105 Regensdorf				918x.xx.xxx
a				T. 044 843 40 25 / Fax. 044 843 40 39				
	Aenderungen	Datum	Name	www.micronor.ch				





Ersetz durch					Stücklisten Nr.		Material	
Ersatz für								
g					Datum	Name	Massstab	Objekt / Bezeichnung
f				Gez.	20.12.2016	M. Zürcher	1 : 2	
e				Kontr.				KWG160
d				Frei.				
c					**MICRONOR®**			Zeichnungs Nr.
b					CH - 8105 Regensdorf			
a					T. 044 843 40 25 / Fax. 044 843 40 39			921x.xx.xxx
	Aenderungen	Datum	Name		www.micronor.ch			