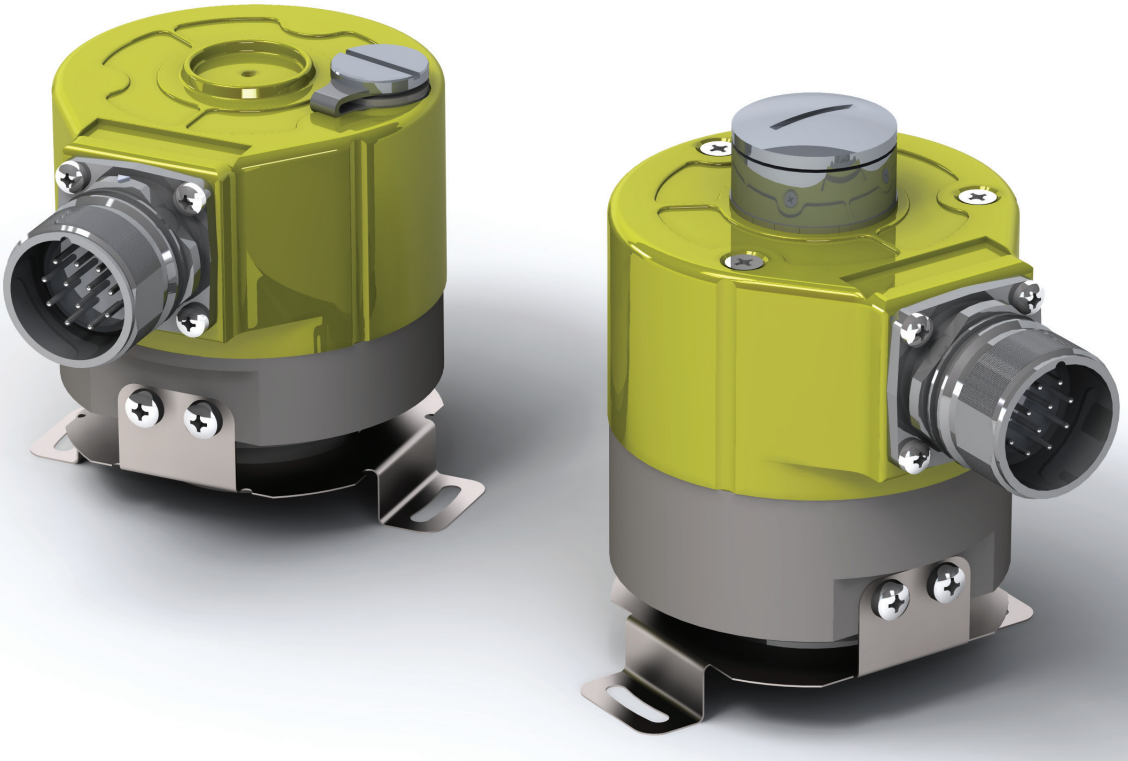
System Components

Motion Control



POWER JACKS

www.powerjacks.com

Contents

8.1. Rotary Limit Switches

8.1.1. RLS-51 Rotary Limit Switches

8.1.1.1. RLS-51 Rotary Cam Limit Switch Overview

Power Jacks products are used in a wide spectrum of industries for lifting, positioning and materials handling applications. All of which require a level of motion control.

Power Jacks RLS-51 series geared cam limit switches are ideal for use as:

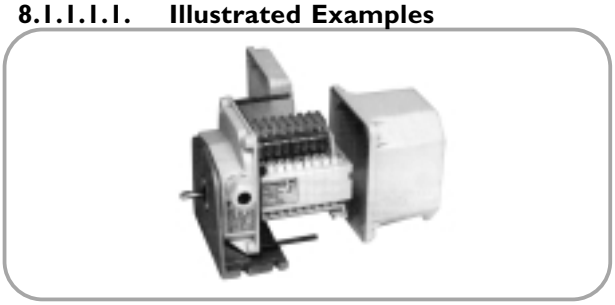
- End of travel limit switches to stop or reverse an actuator system.
- Mid travel signal providers to allow integration of other process operations.

And allow integration of other feedback devices such as potentiometers and encoders inside their compact housing.

RLS-51 Features include:

1. Useable revolutions from 4 to 16000.
2. 2 to 8 position limit switches.
3. Enclosure IP66 as standard.
4. Mounting options for B14 face, B5 flange and B3 foot mounted.
5. Available in three voltages 250 VAC, 24 VDC and 80 VDC.
6. Modular design to allow a wide variety of options.
7. Operating temperature: -40°C → +80°C.

8.1.1.1.1. Illustrated Examples



RLS-51 with 8 Limit Switches and foot mounting

With potentiometer

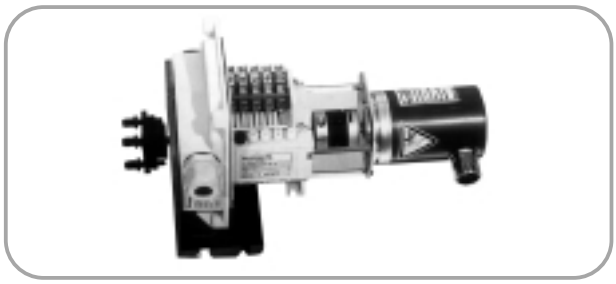
With pulse generator and B5 flange mount

Analogue feedback systems, e.g. potentiometers, can easily be fitted. The same applies to the pulse generator used as a motion indicator for actuator systems.

Gear Part

With motorised adjustment

The switching points for all contacts can be changed commonly by block adjustment - An electric adjusting motor can be retrofitted.



With absolute encoder

For safety disengagements positive opening switching contacts are used: for position or incremental encoders to offer highest safety and finest resolution.

8.1.1.2. RLS-51 Features and Options

The RLS-51 geared cam limit switches are universal mechanical switching devices that have been designed for use in conjunction with cam discs on a specific angle of rotation for the indication of a large number of shaft revolutions. These cam discs serve to operate mechanical contacts.

Design features include:

- Low Friction Planetary Gearing with irreversable, self-locking worm adjustment of the cam discs.
- Fixed Cam Adjustment in the housing. The adjusting worms of the cam discs are arranged so that they can be accessed from the same direction as the contact connections for optimal accessibility in confined conditions. Adjustment is possible during operation. The simplicity and accuracy of the cam adjustment is unsurpassed.
- Block Adjustment of all switching contacts jointly is made possible by a single adjusting worm (black) without the switching points of individual switching contacts being altered with respect to each other.
- Large Cam Disc Diameter for good adjustability and high switching point repeat accuracy.
- Reinforced Polycarbonate Housing as standard with IP66 protection and a wide operating temperature range.
- Modular Design allows adaptation to suit individual requirements via intermediate pieces.
- Maintenance Free gearbox components.

Options

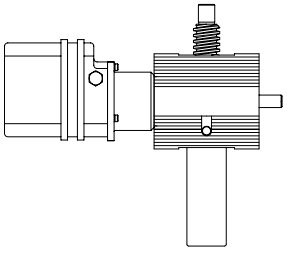
- Position indicating plate for block adjustment.
- Potentiometer feedback drives (2 available) to suit single and multi-turn potentiometers.
- Pulse transmitter with 50 pulses per revolution.
- Anti-condensation heater to prevent condensation and excessively low temperatures in switches.
- Motor driven contact block adjuster.
- Mounting for encoders (incremental and absolute).
- Extended drive shaft for feedback devices.
- Aluminium housing for harsh environments and fitment of large and heavy encoders, IP 65 enclosure.
- Cam discs with a 40^{O} cam angle can be provided at no extra cost. Standard is 15^{O} cam angle. Other angles can be manufactured at extra cost on request. Note different cam angles alter the number of useable revolutions from the standard. The 40^{O} cam has less useable revolutions than a 15^{O} cam, consult Power Jacks.
- Stage Technology Tested Unit can be provided to VBG 70 with test certificates. A 40^{O} angle cam disc is used for this application.

8.1.1.2.1. RLS-51 Coupling Note

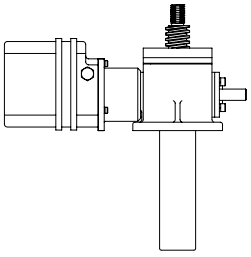
The ideal drive for the limit switch is transmitted by torsionally stiff, flexible coupling with low axial and radial restoring forces. Thereby misalignment and axial displacement are balanced. For radial load rating and coupling advice consult Power Jacks.

8.1.1.3. Screw Jack (Mechanical Actuator) Mounting

The RSL-51 rotary limit switches are ideal for screw jack mounting and actuator systems in general to act as position switches. The switches can be used as over travel protection switches, operation/routine triggers, speed change signals, or other process signals.



Sym-metric (cubic) Screw Jack (refer section 1.2.1.11.)



Metric Machine and Ball Screw Jack (refer section 1.2.2.13.)

For actuator (screw jack) systems refer to section 8.5.1. and/or consult Power Jacks.

8.1.1.4. RLS-51 Performance

Gear Size	Usable revs. selected	Usable revs. theoretical with 15° cam discs	Gear Ratio	Input/ output stage	No of in-term stages	1 rev. of the drive shaft - corresp. to an ang. motion of cam disc =°	Change - over contact reset rev. at driving shaft	Max drive speed (RPM)	Min drive shaft speed (only for change - over contact)
1	4.1	4.16	4.285	-	1 x 4.285	84	0.00714	1000	0.67
	6.5	6.88	7.083	1.653	1 x 4.285	50.8	0.0118	1200	1.1
	11	11.23	11.56	2.698	1 x 4.285	31.14	0.0193	1500	1.8
2	17.5	17.84	18.361	-	2 x 4.285	19.6	0.0306	1800	2.9
	29.0	29.5	30.35	1.653	2 x 4.285	11.86	0.0505	1800	4.7
	48	48.13	49.538	2.698	2 x 4.285	7.27	0.0825	1800	7.7
3	75	76.45	78.678	-	3 x 4.285	4.57	0.131	1800	12.2
	125	126.39	130.054	1.653	3 x 4.285	2.77	0.2166	1800	20.2
	205	206.26	212.272	2.698	3 x 4.285	1.69	0.3536	1800	33
4	323	327.6	337.135	-	4 x 4.285	1.06	0.5616	1800	52
	540	541.5	557.284	1.653	4 x 4.285	0.65	0.9284	1800	87
	880	883.8	909.59	2.698	4 x 4.285	0.4	1.515	1800	141
5	1384	1403.7	1444.62	-	5 x 4.285	0.25	2.406	1800	224
	2288	2320.2	2387.96	1.653	5 x 4.285	0.15	3.978	1800	371
	3735	3787.1	3897.58	2.698	5 x 4.285	0.09	6.493	1800	606
6	5900	6014.77	6190.204	-	6 x 4.285	0.06	10.313	1800	*
	9800	9942.2	10232.407	1.653	6 x 4.285	0.04	17.047	1800	*
	16000	16227.6	16701.17	2.698	6 x 4.285	0.02	27.824	1800	*

* Caution! Due to the slow actuation speed of the switching contacts caused by the high gear reductions, the change-over behaviour of the contacts is affected negatively.

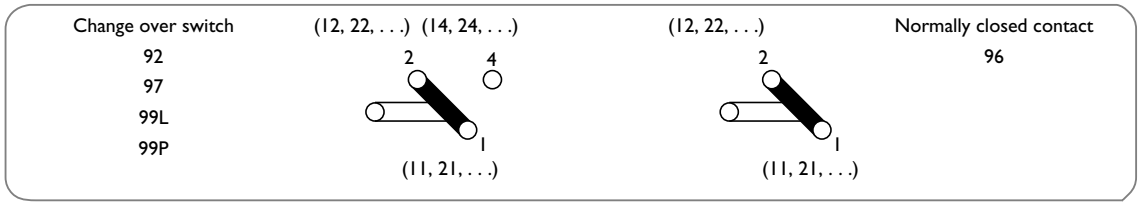
From gear size 6 it is therefore recommended to use only the normally - closed contacts of the switches. Before using analogue feedback systems (e.g. potentiometer) please consult our technical department.

8.1.1.5. Switching Contacts

The contacts can either be connected through screw terminals for a cable cross section of 0.75 mm^2 to 1.5 mm^2 or through flat plugs 6.3 x 0.8 mm or through a printed card with cage tension spring terminals for a cross section of 0.14 to 2.5 mm^2. For contacts with flat-plug connection, insulated flat - plug receptables must be used at voltages above 25V AC and 60 VDC.

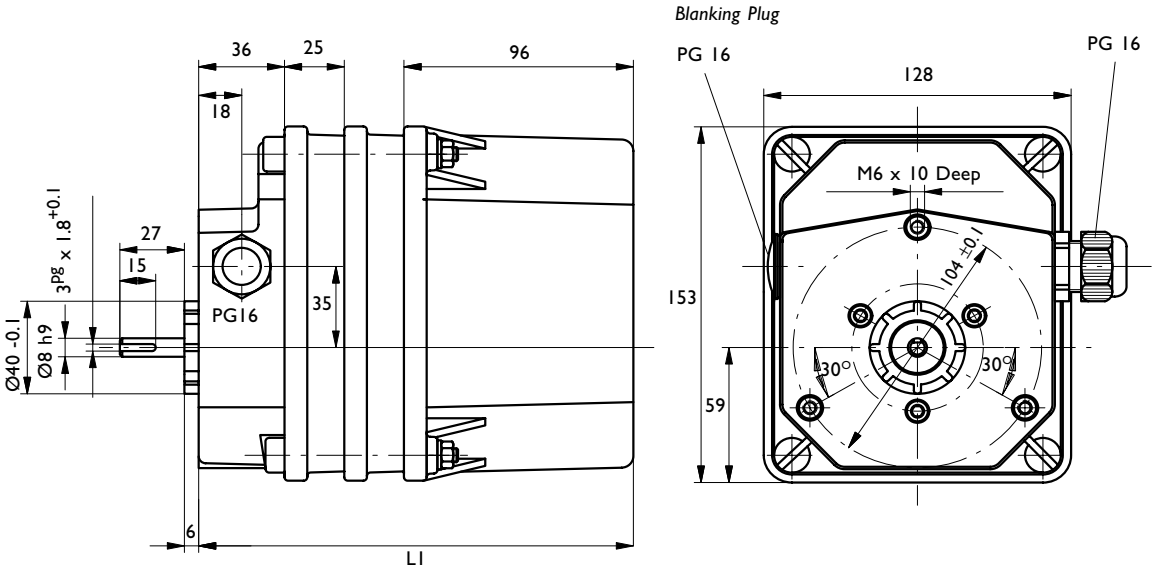
Contact designation	Contact type	Contact material	Switch actuation	Type of contact connection	Positive opening to VDE0660 part 200 from 7.92 EN60947T5-1	Switch Rating				Mec. life in millions of switching operations
						AC		24V DC	80V DC	
						Amps	Volts	Amps	Amps	
92	Change-over switch	Silver	Snap action	Screw terminal	Yes	6	250	6	2	10
97 ②	Change-over switch	Gold	Snap action	Screw terminal	Yes	6	250	6	2	10
99L	Change-over switch	Silver	Snap action	Printed card	Yes	6	250	3	2	10
99P	Change-over switch	Silver	Snap action	Flat plug 6.3	Yes	3	250	3	2	10
96	Normally closed contact	Silver	Snap action	Screw terminal	Yes	6	250	6	2	10

① DC switching capacity with T = 0 ms (pure resistive load) DC switching capacity with inductive load on request
② Contact 97 for SPC applications (gold contacts)

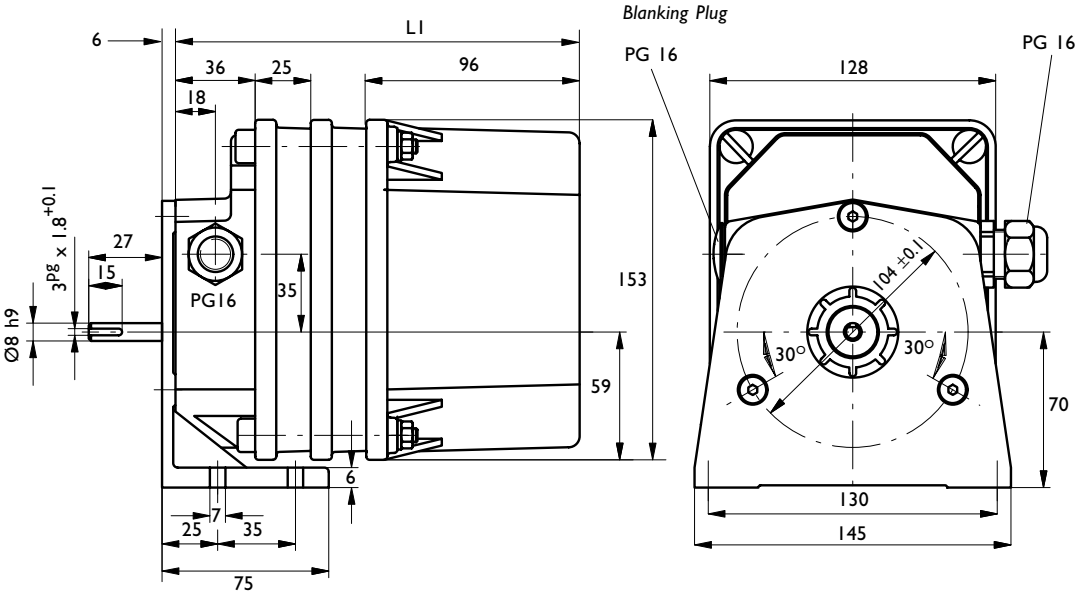


8.1.1.6. RLS-51 Dimensions

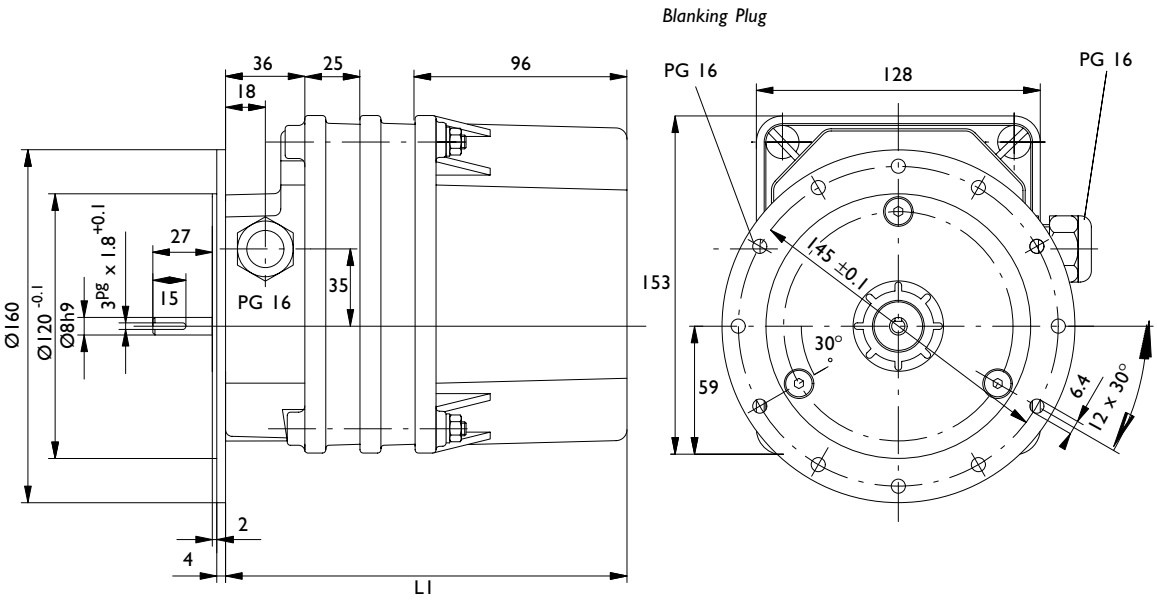
8.1.1.6.1. RLS-51, B14, Face Mounted



8.1.1.6.2. RSL-51, B3, Foot Mounted



8.1.1.6.3. RLS-51, B5, Flange Mounted



General Features:

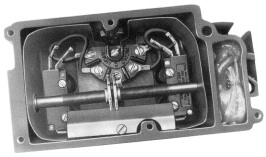
1. Housing made of glass fibre reinforced polycarbonate with IP66 degree of protection.
2. Modular design enables optimal space utilisation. Special types available on request consult Power Jacks.
3. Overall lengths can be extended as required with 25 mm wide intermediate pieces.

8.1.1.6.4. Dimensions Size L1

Model	Gear Size	2 Contacts		4 Contacts		6 Contacts		8 Contacts	
		L1 (mm)	Number of Intermediate Pieces	L1 (mm)	Number of Intermediate Pieces	L1 (mm)	Number of Intermediate Pieces	L1 (mm)	Number of Intermediate Pieces
4.1NM 6.5NM 11NM	1	132	0	132	0	157	1	157	1
17.5BM 29BM 48BM	2	132	0	132	0	157	1	182	2
75BM 125BM 205BM	3	132	0	132	0	157	1	182	2
323BM 540BM 880BM	4	132	0	157	1	182	2	207	3
1384BM 2288BM 3735BM	5	132	0	157	1	182	2	207	3
5900BM 9800BM 16000BM	6	157	1	157	1	182	2	207	3

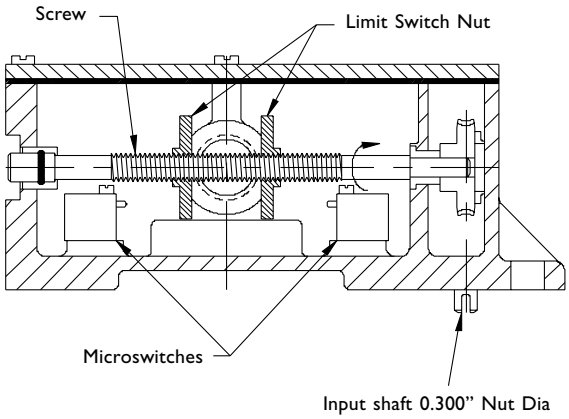
Note *1. More than 8 contacts on request, consult Power Jacks.*
2. Dimensions with more than 8 contacts and with special executions, e.g. potentiometer on request.

8.1.2. SKA Rotary Limit Switches



8.1.2.1. SKA Rotary Limit Switch Features

- 2 Limit Switches.
- Available in three voltage ratings - 250, 480 or 600 Volt.
- Available in three gear ratios.
- Sturdy and compact.
- Constructed of corrosion resistant materials, with housing of anodised aluminium.
- Simple to adjust. Two micro-switches, one for up/stop and one for down/stop, are activated by the adjustable limit switch nuts which travel laterally when the internal screw is rotated through gear reduction.
- Enclosure IP65 (NEMA-4).
- Lifetime lubricated.
- Operating temperature range: -29°C → +65°C (-20°F → +150°F).
- Designed especially for all Power Jacks machine screw and ball screw actuators.
- Bolts on to all Power Jacks actuators except 5kN and 10kN Metric, 1/4, 1/2 and 1 Ton Imperial and Micro-Miniature actuators were the limit switch has to be mounted separately and shaft driven.
- Optional 4-position limit switch available. Consult Power Jacks for details.



8.1.2.2. SKA Limit Switch Ratings

Limit Switch Ratings

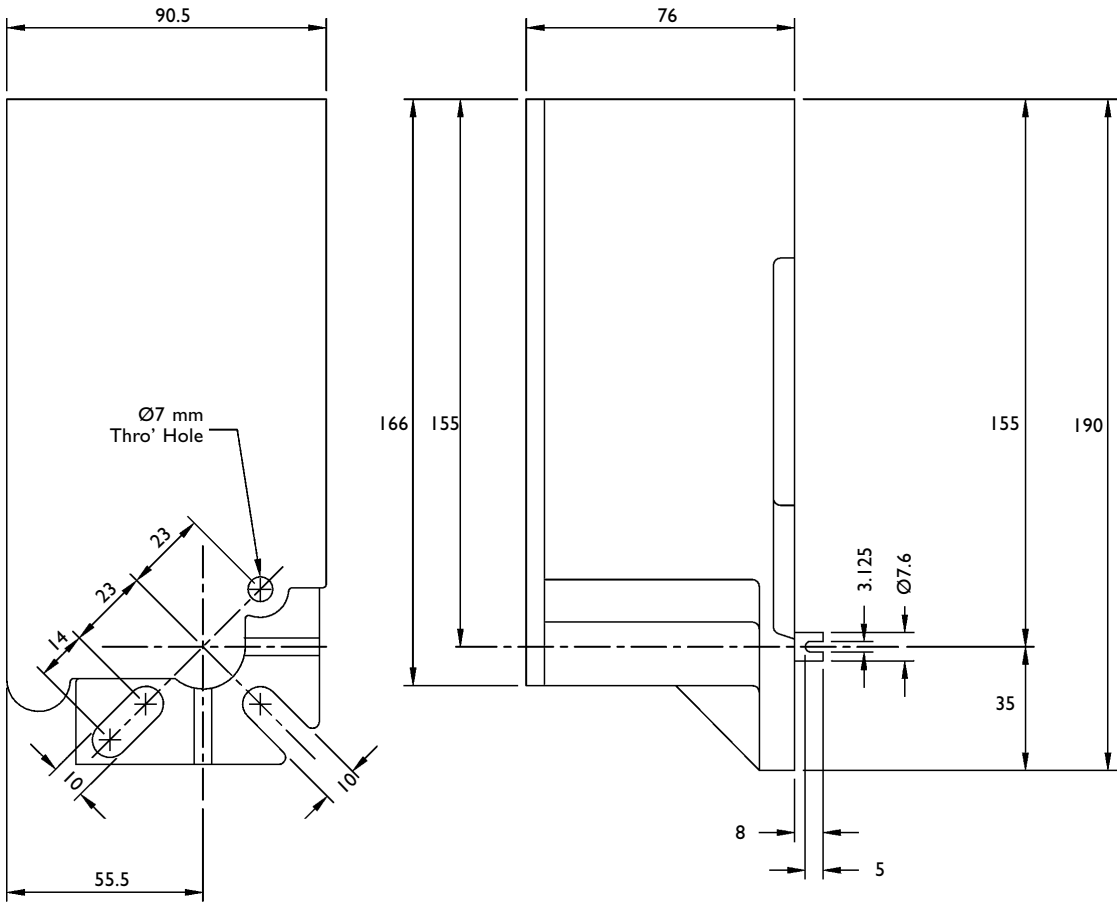
Model No.	Max Voltage		Max Amps	
	AC	DC	AC	DC
SKA-6000-A	250	-	15	-
SKA-6000-B	480	125	15	0.50
	-	250	-	0.25
SKA-6000-C	600	125	15	0.80
	-	230	-	0.40

Limit Switch Worm Gear Ratios

Gear Ratios	Max Input Revolutions		
	SKA-6000-A	SKA-6000-B	SKA-6000-C
10:1	1095	750	675
20:1	2190	1500	1350
40:1	4380	3000	2700

Note *A and B models are SPDT; C model is 2-circuit, double break.*

8.1.2.3. SKA Rotary Limit Switch Dimensions



Note *1. All dimensions in mm unless otherwise stated.*
2. Dimensions subject to change without notice.

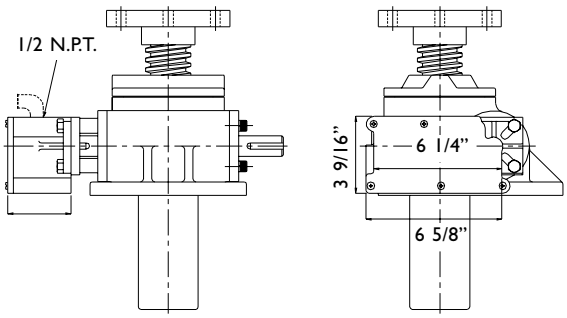
8.1.2.4. SKA Limit Switch Screw Jack (Mechanical Acutator) Mounting

The SKA rotary limit switch is an ideal compact limit switch for mounting on a screw jack (mechanical actuator). The units are typically used for over travel protection. The SKA units can be installed with either "close" or "extended" mountings. Close mounting has to be done at the factory but extended mounting can be done in the field.

For full details on screw jack (mechanical actuator) mounting refer to the following options:

Metric Machine or Ball Screw Jacks - refer section 1.2.1.14.

Imperial Machine or Ball Screw Jacks - refer section 1.2.3.11.



8.1.2.5. Ordering the Right SKA Limit Switch

To ensure that the limit switch has sufficient travel capability for the actuator unit, use the following formula:

$$\text{Max raise of actuator model in mm (inches} = \frac{\text{Max. Input Revolutions}}{\text{Turns of Actuator Worm per mm (inch) of Raise}}$$

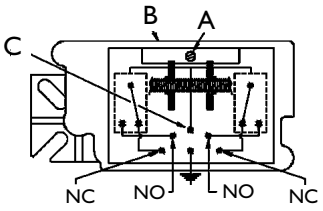
Note *For water-tight connection, use a weather-tight connector and sealant around the threads.*
Limit switches will be damaged if over travelled.
For shipping purposes, the 0.5" NPT hole is closed with a plastic plug, which is not water tight.

8.1.2.5. SKA Electric Limit Switch Specifications

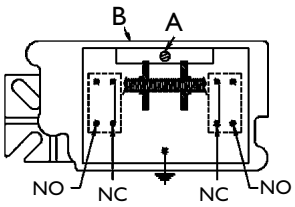
1 **Caution: Disconnect power before making any adjustment.**
2 Check drift before adjusting limits.
3 Remove screw "A" and nut guide keeper "B" to adjust limits.
4 Run actuator unit to desired limit.
5 Rotate appropriate nut until switch clicks, then turn 1/2 turn more.
6 Replace "A" and "B".
7 Run actuator unit to the other limit.
8 Repeat steps 2, 4 and 5 to adjust this nut.

Slight adjustments may be necessary. See chart below for notch adjustment value.

Wiring Diagram "A" & "B" Model



Wiring Diagram "C" Models



Note ***NO*** *= Normally Open* ***NC*** *= Normally Closed*

Electric Limit Switch Specifications

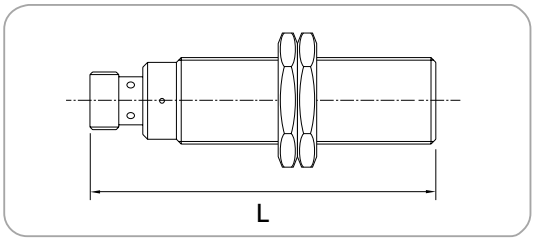
Model No.	Max. Voltage		Max. Amps		Max. Worm Rev.	Max. Raise	Max. Allowable Drift	Notch Adjustment
	AC	DC	AC	DC				
SKA-6000-A-10	250		15		1095	1095/TPU	24/TPU	1/TPU
SKA-6000-A-20					2190	2190/TPU	48/TPU	2/TPU
SKA-6000-A-40					4380	4380/TPU	96/TPU	4/TPU
SKA-6000-B-10	480	125	15	0.50	750	750/TPU	29/TPU	1/TPU
SKA-6000-B-20		250		0.25	1500	1500/TPU	57/TPU	2/TPU
SKA-6000-B-40					3000	3000/TPU	115/TPU	4/TPU
SKA-6000-C-10	120	115	15	0.80	675	675/TPU	38.5/TPU	1/TPU
SKA-6000-C-20	240	230		0.40	1350	1350/TPU	77/TPU	2/TPU
SKA-6000-C-40	480				2700	2700/TPU	154/TPU	4/TPU
	800							

TPU *= Turns Per Unit of raise of actuator model, where Unit = millimetre or inches.*

8.2. Proximity and Contact Limit Switches

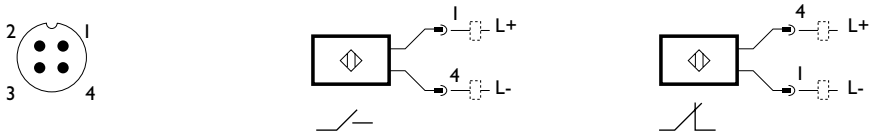
8.2.1. Proximity Sensors

- Inductive Proximity Sensors.
- Non-contact, so no wearing parts.
- 2 Wire sensor for either Normally Closed (NC) or Normally Open (NO) switching.
- Long sensing range.
- Rugged one-piece Metal housing.
- Optical setting aid with 2 LED colour settings:- Red LED indicates just in sensing range. Yellow LED only indicates within 80% safe sensing range.
- M12 Plug in connection for fast change-ability.
- M12 sockets available straight or angled with 5 m cable.
- Full 360° visibility for switching with 4 yellow LED's at 90° offset.
- Flush face as standard, non-flush available.
- Housing plated brass, Stainless Steel available on request.
- Operating voltage 10 → 30 VDC.
- Enclosure IP67.
- Operating temperature -25°C → +70°C
- Other types available on request. Consult power Jacks.
- Ideal for screw jack or linear actuator mounting.



Sensor	M12	M18	M30
Sensing Range (flush)	4 mm	8 mm	15 mm
Overall Length, L	62 mm	72 mm	72 mm

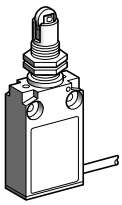
Model	M12	M18	M30
Electrical Design	DC PNP/NPN		
Output	normally open/closed programmable		
Operating Voltage (V)	10 → 36 DC		
Current Rating (mA)	100		
Minimum Load Current (mA)	4		
Short-circuit Protection	Yes		
Reverse Polarity Protection	Yes		
Overload Protection	Yes		
Voltage Drop (V)	< 4.6		
Leakage Current (mA)	< 1		
Operating Distance (mm)	0 → 3.25	0 → 6.48	0 →12.1
Switch-point Drift (%/Sr)			
Hysteresis (%/Sr)	3 → 20		
Switching Frequency (Hz)	400	250	200
Correction Factors (approx.)			
Mild Steel	1	1	1
Stainless Steel	0.7	0.7	0.7
Brass	0.4	0.45	0.5
Aluminium	0.37	0.4	0.5
Copper	0.25	0.33	0.4
Function Display			
Switching Status LED	yellow (4 x 90°)		
Setting Aid LED	red		
Operating Temperature (°C)	-25 → +70		
Protection	IP 67		
EMC	EN 60947-5-2; EN 55011 class B		
Housing Material	brass; special coated; CO-PC		
Connection	M12 connector		



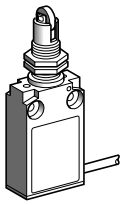
8.2.2. Compact Electro-Mechanical Contact Limit Switches

8.2.2.1. Compact Contact Limit Switch Overview

- Compact electro-mechanical limit switch.
- Study metal enclosure
- Pre-cabled unit.
- High end enclosure protection IP67.
- Available with plug-in connector.
- Other sizes and acutation heads are available on request. Consult Power Jacks.
- Ideal for scew jack or linear actuator mounting.



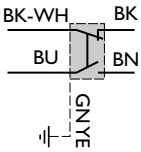
CLS-RPTL
(a)



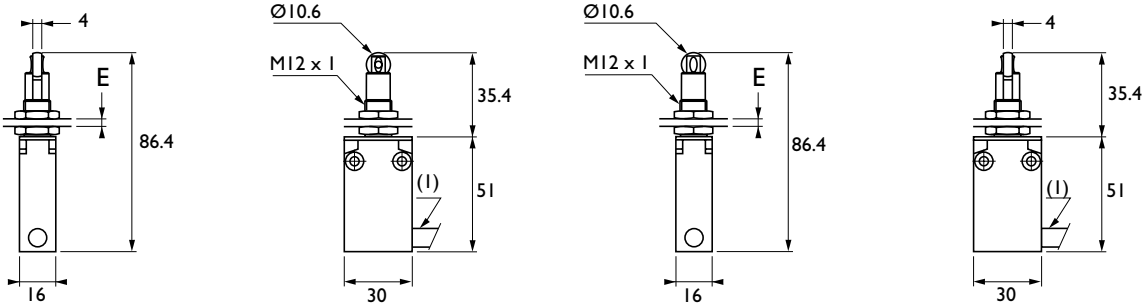
CLS-RPTT
(b)

8.2.2.2. Compact Contact Limit Switch Technical Data

Item	Description
Housing	Metal, compact hosuing, totally enclosed and sealed
Pre-cabled	2m PVC cable 5 x 0.75mm^2 (other cable lengths available on request)
Switch type	Single pole, 1 change-over, snap action
Switch actuation	Steel Roller Plunger a Lateral Cam Approach CSL-RPTL b Travers Cam Approach CSL-RPTT
Max actuation speed	0.5 m/s
Mechanical durability	10 million operating cycles
Ambient temperature Operation Storage	 -25°C → +77°C -40°C → +70°C
Product conformity	IEC947-5-1
Enclosure	IP67
Operating characteristics	AC - 15; B300 (UE = 240V, Ie = 1.5A) DC - 13; R300 (UE = 240V, Ie = 0.1A)
Insulation voltage	Ui = 300V



8.2.2.3. Compact Contact Limit Switch Dimensions



Note
1. *All dimensions in mm unless otherwise stated.*
2. *Dimensions subject to change without notice.*
3. *For dimensions of other switches consult Power Jacks.*
4. *For a full switch data sheet consult Power Jacks.*

E = 8 mm Max, Clearance Diameter Ø12.5 mm
(1) = Ø8 mm Cable

8.2.3. Safety Related Electro-Mechanical Contact Limit Switches

8.2.3.1. Safety Related Contact Limit Switch Overview

- Positive break Normally Closed contacts - will not stick or weld shut.
- Watertight design to IP67 washdown requirements.
- Rugged corrosion resistant housing tolerants hostile environments.
- Safety system approved.
- Thermoplastic enclosure. Double insulated.
- Snap action with positive-break Normally Closed contact, approved for use in safety systems.
- Wiring compartment.
- Alternative actuators heads are available on request. Consult Power Jacks.
- Actuator heads can be repositioned in steps 4 x 90°
- Good resistance to oil and petroleum spirit.
- Actuating force: Min. 9 N.
- Positive break force: 19 N.
- Actuating speed with actuating angle 30° to switch axis. Snap action: Min. 20 mm/min, max. 1 m/s.
- Cable entry: Long Body - 1 cable entry, at end. Short Body - 2 cable entries from sides.
- Ideal for screw jack or linear actuator mounting.

8.2.3.2. Safety Related Contact Limit Switch Specification

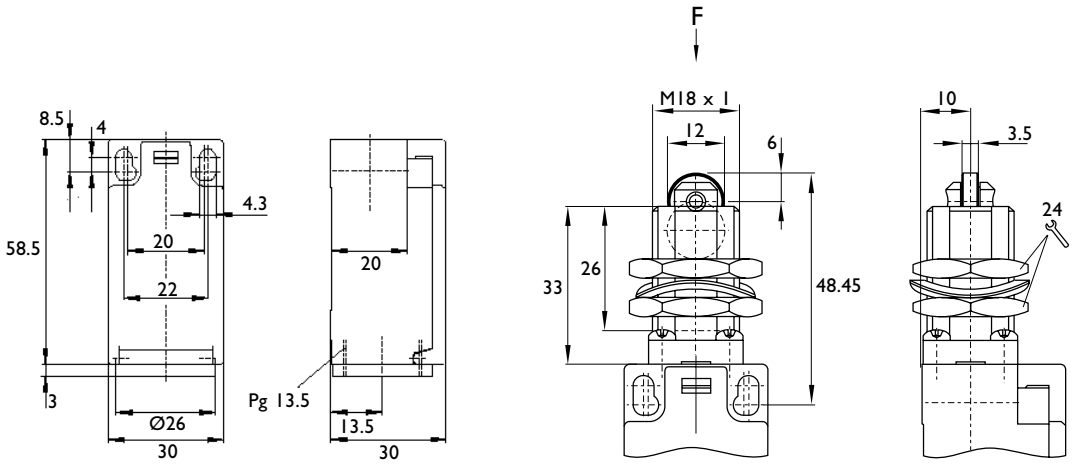
Feature	Description
Standards	IEC/EN 60947-5-1; EN 1088; BG-GS-ET-15
Design	EN 50047
Enclosure material	Glass-fibre reinforced thermoplastic, self-extinguishing
Protection class	IP 67 to IEC/EN 60529/DIN VDE 0470-1
Contact material	Silver
Contact type	Change-over with double break Zb, NC contacts with positive break
Switching system	A IEC 60947-5-1; B BG-GS-ET-15; snap action, NC contacts with positive break
Termination	Screw terminals for max. 2.5 mm^2 cables (including conductor ferrules)
Rated impulse withstand voltage U_{imp}	6 kV
Rated insulation voltage U_i	500 V
Thermal test current I_{th}	10 A
Utilisation category	AC-15; DC-13
Rated operating current/voltage I_e/U_e	4 A/230 VAC; 2.5 A/400 VAC; 1 A/500 VAC; 1 A/24 VDC
Max. fuse rating	10 A (slow blow); 16 A (quick blow), 6 A (slow blow) as positive break position switch
Ambient temperature	-30 °C → +80 °C
Mechanical life	20 million operations
Switching frequency	Max. 5,000/h
Switching point accuracy	-
Actuating speed **	Min. 10 mm/min
Contact break for complete stroke	2 x 2 mm
Bounce duration	< 3 ms
Switchover time	> 5.5 ms

*** For the switch plunger.*

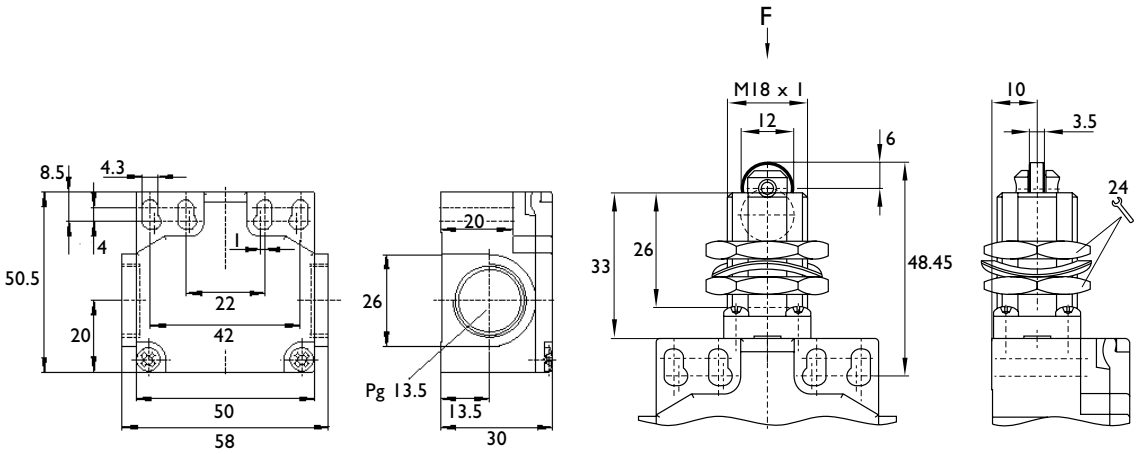
Note *1. Technical Data subject to change without notice.*
2. For a full set of limit switch details consult Power Jacks.

8.2.3.3. Safety Related Contact Limit Switches Dimensions

Long Body



Short Body

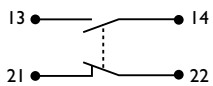


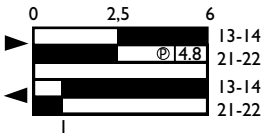
Switch Contacts/Travel

Snap Action

1 NO

1 NC





Note
1. *All dimensions in mm unless otherwise stated.*
2. *Dimensions subject to change without notice.*
3. *For dimensions of other switches consult Power Jacks.*
4. *For a full switch data sheet consult Power Jacks.*

8.3. Encoders

8.3.1. Incremental Encoders

8.3.1.1. Incremental Encoder Features

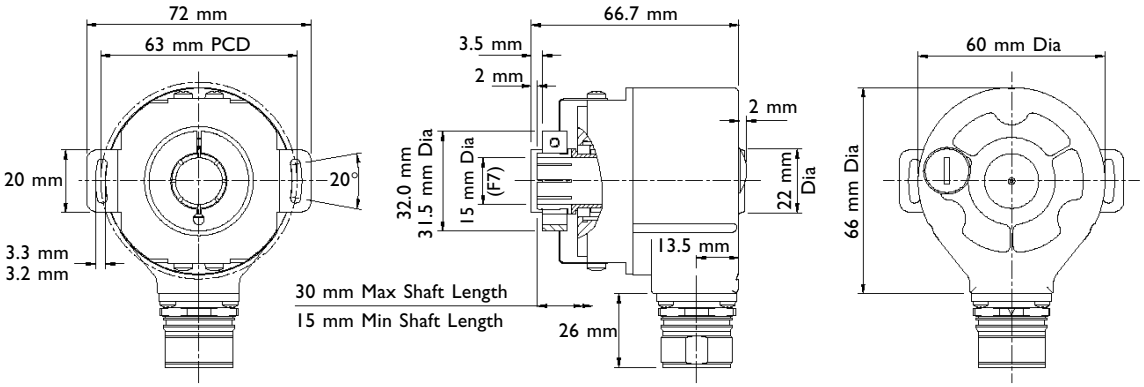
- Simple zero-pulse assignment directly on the Encoder by pressing a button.
- Long service life of the LED by using automatic light regulation.
- Maximum reliability using opto-ASICs with chip-on-board technology.
- Any number of desired lines from 1 → 8192.
- RS422 or push-pull output drivers.
- Servo flange for 6 mm solid shaft.
- Face mount flange for 10 mm solid shaft.
- Connector or cable outlet.
- High degree of protection up to IP66.
- Interchangeable collets for hollow shaft diameters from Ø6 → Ø15 mm and Ø1/4 → Ø1/2 inch.
- Screw Jack and Electro-mechanical Linear Actuator mounting kits available. Consult Power Jacks for details

8.3.1.2. Incremental Encoder Dimensions - Hollow Shaft

Standard BLIND hollow shaft sizes = 6, 8, 10, 12, 15 mm.

Standard THROUGH hollow shaft sizes = 6, 8, 10, 12 mm.

For Through hollow shaft dimensions and cable outlet dimensions consult Power Jacks.



Note *1. Dimensions in mm unless otherwise stated.*
2. Dimensions subject to change without notice.

8.3.1.3. Incremental Encoder Dimensions - Solid Shaft

For solid shaft encoder dimensions please consult Power Jacks.

Standard solid shaft sizes:

Flange mount = Ø10 mm

Servo flange mount = Ø6 mm

8.3.1.4. Incremental Encoder Technical Data

Feature		Description
Number of lines (Z)		1 → 8192
Output driver		RS 422 + push-pull outputs
Mass (kg)	Solid shaft and hollow shaft	approx. 0.3
Moment of inertia of the rotor (gcm^2)	Face mount with 10 mm shaft	54
	Servo flange with 6 mm shaft	48
	Through hollow shaft	see Fig. 1
	Blind hollow shaft	see Fig. 2
Measuring step (Degrees)		90/number of lines
Reference signal	Number	1
	Position	90°or 180° electrical,logically linked to K1 and K2
Error limits (Degrees)	Binary number of lines	0.035
	Non-binary number of lines	0.046
Measuring step deviation (Degrees)	Binary number of lines	0.005
	Non-binary number of lines	0.016
Max. output frequency (kHz)	RS 422	820
	Push-pull output	200
Max. angular acceleration (RAD/S^2)		5×10^5
Max. operating speed (MIN^{-1})	Face mount and servo flange with shaft seal	6000
	Face mount and servo flange without shaft seal*	10000
	Hollow shaft designs	3000
Operating torque (Ncm)	Face mount flange 10 mm shaft	typ. 0.3
	Servo flange 6 mm shaft	typ. 0.2
	Through hollow shaft	typ. 1.6
	Blind hollow shaft	typ. 0.4
Start-up torque (Ncm)	Face mount flange 10 mm shaft	typ. 0.4
	Servo flange 6 mm shaft	typ. 0.25
	Through hollow shaft	typ. 2.2
	Blind hollow shaft	typ. 0.6
Permissible shaft loading, Solid shaft (N)	Radial	20
	Axial	10
Permissible movement of the Drive element for hollow shafts (mm)	Static radial movement	±0.5
	Dynamic radial movement	±0.1
	Static/dynamic axial movement	±0.5
Bearing lifetime (Revolutions)		3.6×10^9
Working temperature range (°C)		-20 → +85
Storage temperature range (°C)		-40 → +100
Permissible relative humidity (condensation not permitted)		90%
EMC to EN 50082-2 and EN 50081-2		
Resistance to shocks (DIN IEC 68 Parts 2-27) (g/ms)		50/11
Resistance to vibration (DIN IEC 68 Parts 2-6) (g/Hz)		20/10 → 150
Protection class,		
Solid shafts	Connector outlet with mating connector fitted	IP 65
Blind hollow shafts	Cable outlet	IP 66
Through hollow shaft		IP 64
Operating voltage range		see output driver
No-load operating current	10 → 32V	typ. 100 mA
	5V	typ. 120 mA
Operation of zero-set (only with shaft stationary)		≥100 ms
Initialisation time after power on		40 ms

* *In case, that shaft seal has been removed by customer.*

Note *1. Technical Data subject to change without notice.*

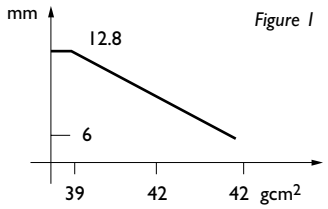


Figure 1

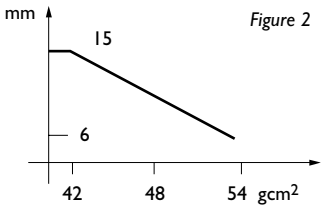


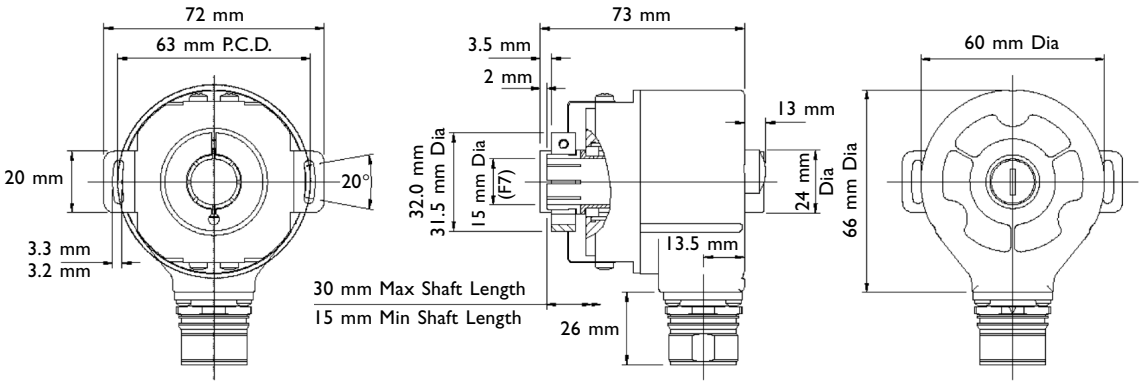
Figure 2

8.3.2. Absolute Encoders

8.3.2.1 Absolute Encoder Features

- Rugged, magnetic pick-up system.
- Rotary multiturn absolute encoder with integral gearbox, therefore **a battery is not necessary**.
- Basic resolution max. 8192 steps, 8192 revolutions.
- SSI, 25 bit (Synchronous Serial Interface).
- RS 422 configurable interface.
- Zero set push button.
- Electronically adjustable configurable interface.
- Compact dimensions.
- Highly shock-proof and vibration-proof.
- High degree of protection IP 67.
- Connector or cable outlet.
- Servo flange for 6 mm solid shaft.
- Face mount flange for 10 mm solid shaft.
- Blind hollow shaft: max. shaft diameter 15 mm. Option of using interchangeable collets, diameters from 6 to 12 mm, and 1/4 inch and 1/2 inch can be realised. Easy to install and no coupling needed.
- Screw Jack and Electro-mechanical Linear Actuator mounting kits available. Consult Power Jacks for details.

8.3.2.2. Absolute Encoder Dimensions - Hollow Shaft



For cable outlet dimensions consult Power Jacks.

Note *1. Dimensions in mm unless otherwise stated.*
2. Dimensions subject to change without notice.

8.3.2.3. Absolute Encoder Dimensions - Solid Shaft

For solid shaft encoder dimensions please consult Power Jacks.

Standard solid shaft sizes:

Flange mount = Ø10mm.

Servo flange mount = Ø6mm.

8.3.2.4. Absolute Encoder Technical Data

Feature	Description	
Shaft Type	Solid Shaft with face mount/servo flange	Blind Hollow Shaft
Communication type	SSI (Synchronous Serial Interface) 25bit	
Programmable code type	Gray / Binary	
Programmable code direction	cw/ccw	
Shaft Size (mm)	Ø6 or Ø10	Ø6 → Ø15
Number of steps per revolution	8192	
Number of revolutions	8192	
Measuring step (degrees	0.043	
Error limits (degrees)	±0.25	
Repeatability (degrees)	0.1	
Operating speed (min^{-1})	6000	3000
Position forming time (ms)	0.15	
Max. angular acceleration (rad/s^2)	5×10^5	
Moment of inertia of the rotor (gcm^2)	35	55
Operational torque with shaft sealing ring (Ncm)	1.8	0.8
Operational torque without shaft sealing ring (Ncm)	0.3	-
Start-up torque with shaft sealing ring (Ncm)	2.5	1.2
Start-up torque without shaft sealing ring (Ncm)	0.5	-
Maximum shaft loading radial/axial (N)	300/500	-
Permissible shaft movement of the drive element		
Radial static/dynamic (mm)	-	±0.3/±0.1
Axial static/dynamic (mm)	-	±0.5/±0.2
Bearing lifetime (revolutions)	3.6×10^9	
Working temperature range (°C)	-20 → +85	
Operating temperature range(°C)	-40 → +100	
Storage temperature range (°C)	-40 → +100	
Permissible relative humidity (%)	98	
Mass (kg)	0.5	0.4
EMC	EN 50081 part 2 and EN 50082 part 2	
Resistance to shocks in the mounted state (DIN IEC 68 part 2-27)	100/(6ms)	
Resistance to vibration in the mounted state (DIN IEC 68 part 2-6)	20 / (10 → 2000 H_z)	
Degree of protection according to IEC 60529		
With shaft sealing ring	IP 67	IP 67
Without shaft sealing ring and encoder flange not sealed	IP43	IP43
Without shaft sealing ring and encoder flange sealed	IP65	-
Operating voltage range (VDC)	10 → 32	
Recommended supply voltage (W)	0.8	
Initialisation time (ms)	1050 (from the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.)	
Signals connection	12-way connector, potential-free with respect to housing.	
Interface signals		
Clock+, Clock-, Data+, Data-	SSI max clock frequency: 1 MHz i.e. min duration of low level (clock+): 500 ns.	
SET (electronic adjustment)	»H« - active (L ≅ 0 → 4.7 V; H ≅ 10 → Us V)	
CW/CCW (step sequence in direction of rotation)	»L« - active (L ≅ 0 → 1.5 V; H ≅ 2.0 → Us V)	

Note *Technical details subject to change without notice.*

8.4. Position Indicators

8.4.1. Digital Position Indicators

8.4.1.1. Programmable Digital Position Indicator T-735

- For use in positioning applications with Power Jacks actuators.
- Displays position of lifting screws in increments of 0.01 mm or 0.001".
- Brilliant 18.5 mm high Dual colour display. Red or Green user defined e.g. Green normal operation and Red position limit reached.
- User-Friendly interface programmable from front panel via four rubber keys with help function on secondary 7 mm high display.
- Non-volatile memory retains all programmed information and count value in the event of power loss.
- Two adjustable up/down output limits (pre-sets), with a 0 → ±99999 range, can act as limit switches.
- Five digit input scaling 0.0001 → 9.9999, programmable decimal point location and lead zero blanking.
- Display convertible to metric, imperial or other units of measurement.
- For position indication on actuator applications Power Jacks recommend feedback from a shaft encoder for precise, reliable and maintenance-free operation.
- Programmable front panel functions may be locked out to prevent unauthorised adjustment.
- Reset capability allows reset to zero from front panel.

Inputs

- Count inputs - 2 channels A and B ideal for encoder connection. Capable of TTL, 30V DC max. at 10 kHz.
- Digital inputs - 2 terminals (NPN) can be used to activate pre-configured functionality e.g. remote reset and security mode.

Outputs

- 2 NPN outputs activated by each pre-set. Two red LED's on panel indicate activation.
- 2 Relay outputs (Normally Closed or Open) activated by each pre-set.
- Sensor power supply 12 VDC (unregulated), 125 mA max., ripple < 0.5V.

User Parameters

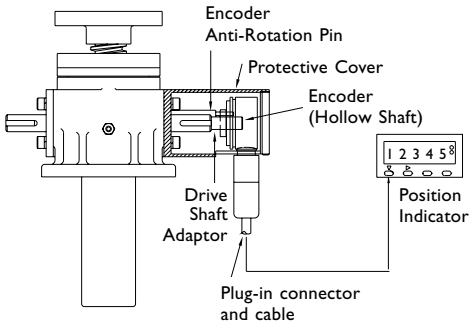
- Up/down travel limits (pre-sets).
- Calibration factor.
- Decimal position.
- Reset value -19999 → 99999 (default is zero).
- Filter speed 20, 200 or 10 kHz.
- Front panel reset enable/disable.
- Voltage/Current output definition and scaling.
- Serial communication settings.
- Display colour settings.
- Pre-set lock on/off.
- Help display on/off.
- Power supply 90 → 264 V AC 50/60 Hz or 20 → 50 V AC/DC.
- DIN housing 48 x 96 mm, mounting depth 100 mm. Panel 45 $^{+0.5}$ mm x 92$^{+0.5}$ mm, 12 mm max. thick.
- Operating temperature 0°C → +55°C. Relative humidity 20% → 90%, non-condensing.
- Protection - front panel IP66.
- CE marked and safety to DIN EN 61010 part 1.

Options

- Linear output 0/4-20mA, 0/1-5 V, 0/2-10 V, 10 bit resolution.
- RS485 Serial interface. Open ASC11, Master-slave up to 99 zones.

The position indicator can be furnished as a complete actuator positioning kit which includes digital position indicator, incremental shaft encoder with flying lead or connector and cable (variable cable length available), actuator coupling and worm shaft adapter (for installing the encoder) and mounting bracket. Electrical connections are made at the rear to the unit to terminal strips.

Example Illustration



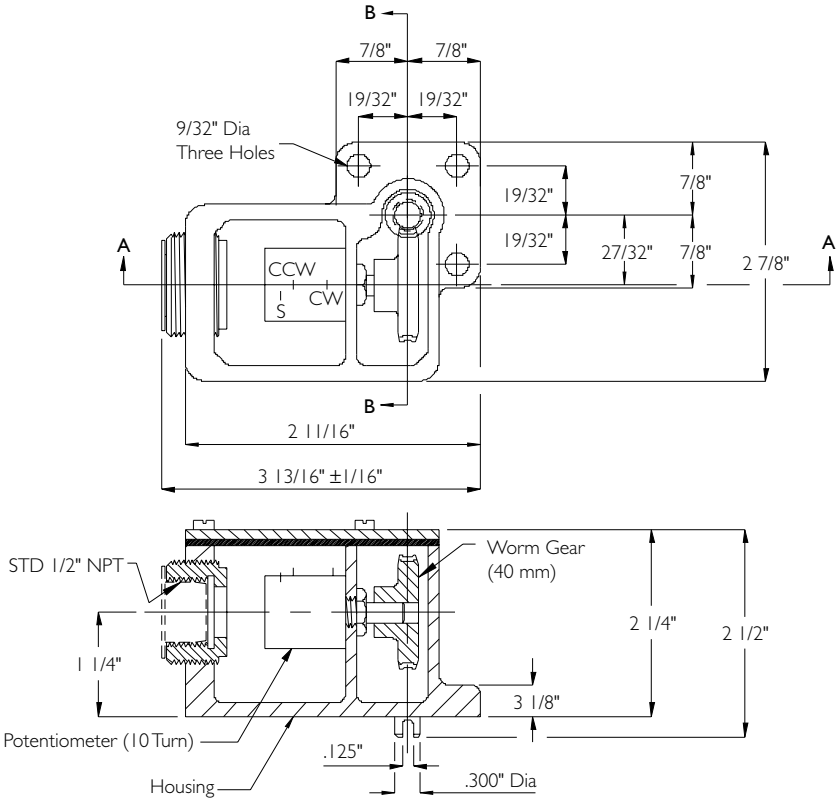
50 kN Metric Actuator

8.4.2. Analogue Postion Indicators

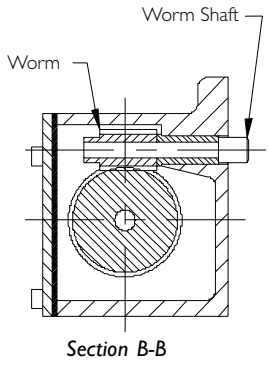
8.4.2.1. Transducer SKA-6200-T Remote Screw Position Indicator

The SKA-6200-T position transducer is designed to mount on the end of any SKA-6000-T limit switch. Its major component is a potentiometer which has a slider tap and a tap at each end of the element.

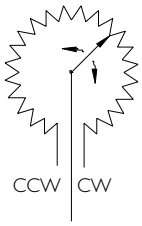
Gear ratios of 10:1, 20:1 and 40:1 allow for a wide range of raises. Total resistance of element is 500 ohms. Other resistance's are available on special order. Consult Power Jacks for additional information.



Section A-A



Section B-B



S (Slider)

CCW and CW refer to worm shaft rotation as viewed from slotted end.

Power Rating: 2 W at 40°C, 0 W at 0°C, Total Resistance = 500 ohms

Note 1. Included with each position transducer are the following mounting parts:
3 socket head cap screws.
3 lock washers.
(position transducer shipped assembled in separate package to be installed at site by customer.)
2. Transducer supplied with black anodised finish as standard.

Position transducer available in following models:

Model No.	Gear Ratio	Max. Turns Transducer Worm Shaft
SKA-6200-T-10	10 :1	100
SKA-6200-T-20	20 :1	200
SKA-6200-T-40	40 :1	400

8.5. Control Panels

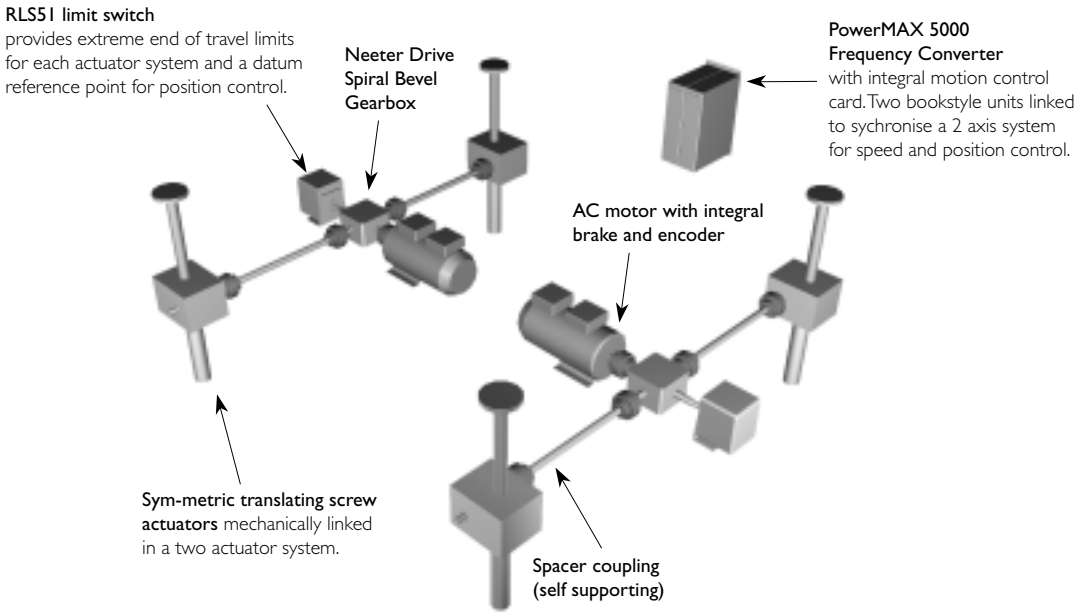
Power Jacks offer control systems for machine screw and ball screw actuators. These control panels provide the option of jogging (inching), or maintained operation, when specified as part of a Power Jacks linear positioning system. The control panels are built to international standards to individual customer requirements with numerous options available, consult Power jacks for details.

8.5.1. Example of Actuator Control System

Two mechanically linked Sym-metric actuator systems are electronically synchronised for speed and position control using the PowerMAX 5000 frequency converter with integral control card. The PowerMAX 5000 controls the systems by controlling the motion of each motor comparing actual and required performance via a closed feedback loop. This is provided by the encoders in each motor feeding back direct to the PowerMAX 5000. Each actuator system is referenced from a datum point signalled by the RLS-51 limit switch on each system. The RLS-51 also provides end of travel limits that are installed for safety. Each frequency converter has an integral motion control card, which are linked together and arranged in a master-slave relationship for control purposes.

This type of system is used where mechanical links to all linear motion components are not possible and where complete motion control is required for a specific process. For example a platform lift where a series of precise positions are required along the actuators stroke where the platform must stop for a specified time with variable speeds at the end of each stroke and a certain number of cycles per complete operation. All of which can be programmed into the unit with key user parameters accessible via the control keypad.

For advice on specifying the best solution for your application consult Power Jacks Ltd.



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