Fox is a device used to control the movement of industrial machinery when in need of measuring the movement on the basis of the rotation angle and/or of the number of shaft revolutions. Fox is made up by a gearmotor which transfers the movement to the cams and to the other movement detection devices placed inside it through a primary input reduction step (worm gear and helical toothed gear) and one or more secondary output steps (pairs of straight toothed gears).

Fox is used on wind turbines to control the position of the nacelle or the pitch angle of the blades. The motor that controls the rotation of a wind turbine on the yaw axis (or of the blade around its longitudinal axis) transfers the movement to the limit switch. A rotary encoder reads the rotation of the shaft, and its pulses are sent to a PLC which controls the position of the nacelle or of the blade. The movement of the shaft is also transferred, through a gearmotor, to a series of cam switches: the appropriate setting of the actuating point of the cams can signal up to four critical positions of the movement of the nacelle or of the blade.

## FEATURES

Revolution ratios, ranging from 1:3 to 1:2870, result from the combination of different secondary output steps. Each cam can be set with great accuracy thanks to the cam adjusting screws. The auxiliary switches are of a positive opening type, thus suitable for safety functions.

## RロTARY LIMIT SWITCH

## DPTIGNS

Fox can be fitted with different combinations of actuators and motion detectors: sets of cams and microswitches (max. 5), potentiometers or encoders (max. 1), absolute encoder Yankee 1 for set of cams and microswitches (max. 1).
It is possible to fit together sets of cams and microswitches, potentiometers, encoder and Yankee 1, thus creating a device featuring redundancy and diversity.
The limit switch is available with a flange for direct coupling to the motor. Different labels and colors are also available.

## MATERIALS

Fox features transmission and gear driving shafts made of stainless steel AISI 430F or AISI 303, worm gear
transmission shaft rotating on ball bearings, self-lubricating of stainless steel AISI 430F or AISI 303, worm gear
transmission shaft rotating on ball bearings, self-lubricating techno-polymer gears and driving bushes, techno-polymer base and cover. All techno-polymers used for the enclosure are wear resistant and protect the equipment against water and dust. and dust.

－Conformity to Community Directives：
2006／95／CE：Low Voltage Directive
2006／42／CE：Machinery Directive
－Conformity to Standards：
EN 60204－1 Safety of machinery－Electrical equipment of machines EN 60204－32 Safety of machinery－Electrical equipment of machines
－Requirements for hoisting machines

EN 60947－1 Low－voltage switchgear and controlgear
EN 60947－5－1 Low－voltage switchgear and controlgear－Control circuit devices and switching elements－Electromechanical control circuit devices
EN 60529 Degrees of protection provided by enclosures
－Regulations for the prevention of accidents BGV C 1 （only for Germany）
－CAN／CSA－C22．2 No 14－10－Industrial Control Equipment
－UL 508 －Industrial Control Equipment

## GENERAL TECHNICAL SPECIFICATIGNS

－Storage ambient temperature：$-40^{\circ} \mathrm{C} /+80^{\circ} \mathrm{C}$
－Operational ambient temperature：$-40^{\circ} \mathrm{C} /+80^{\circ} \mathrm{C}$
－Protection degree：
IP 66 ／IP 67 ／IP 69K
－Insulation category：Class II
－Cable entry：cable clamp M20，M20＋M16，M20＋M20
－Rotation speed：
revolution ratios $\geq 1: 16$ ：max． $800 \mathrm{rev} . / \mathrm{min}$ ． revolution ratios＜1：16：max． $200 \mathrm{rev} . / \mathrm{min}$ ．
－HALT test（data available on request）
－Markings and homologations：$(\epsilon \underset{\substack{\text {（pending）}}}{\text {（MII }}$ SIL 1

TECHNICAL SPECIFICATIGNS DF THE MICROSWITCHES
－Utilisation category： AC 15 ／ $250 \mathrm{~V} / 3$ A max． DC 13 ／ $60 \mathrm{~V} / 0.5 \mathrm{~A}$ max．
－Rated thermal current： 10 A max．
－Rated insulation voltage： 300 Vac
－Mechanical life： $1.5 \times 10^{6}$ operations max．
－Terminal referencing：according to EN 50013
－Connections：screw－type terminals
－Markings and homologations：
PRSL0100XX：C $\epsilon$ ）
PRSL0110XX－PRSL0111XX：（ $\epsilon$（1）（6）
－The snap action switch PRSL0100XX has 1 NO +1 NC change over contacts．
－The snap action switch PRSL0110XX has 1 NO＋ 1 NC change over contacts，double break．
－The slow action switch PRSL0111XX has 1 NC contact，double break．
All NC contacts are of the positive opening operation type The switches have the following reference for internal wiring．


PRSL0100XX


PRSL0110XX


PRSL0111XX

ロVERALL DIMENSIDNS（MM）


## Passible Assemblies

With set of cams， Yankee 1 absolute encoder


Yankee 1 absolute encoder


TECHNICAL sPECIFICATIGNS QF THE MICROSWITCHES

| Code | PRSLロ1ロロXX | PRSLロ11ロXX | PRSLロ111 1 X |
| :---: | :---: | :---: | :---: |
| Utilisation category | AC 15 <br> DC13 | AC 15 |  |
| Rated operational voltage | $\begin{aligned} & 125 \mathrm{~V} / \mathrm{AC} 15 \\ & 230 \mathrm{~V} / \mathrm{AC} 15 \\ & 60 \mathrm{~V} / \mathrm{DC} 13 \end{aligned}$ | 250 V |  |
| Rated operational current | $\begin{aligned} & 2 \mathrm{~A} / 125 \mathrm{~V} / \mathrm{AC} 15 \\ & 1 \mathrm{~A} / 230 \mathrm{~V} / \mathrm{AC} 15 \\ & 0,5 \mathrm{~A} / 60 \mathrm{~V} / \mathrm{DC} 13 \end{aligned}$ | 3 A |  |
| Rated thermal current | 6 A | 10 A |  |
| Rated insulation voltage | $250 \mathrm{~V} \sim$ | $300 \mathrm{~V} \sim$ |  |
| Mechanical life | $1,5 \times 10^{6}$ operations | $1 \times 10^{6}$ operations |  |
| Terminal referencing | According to EN 50013 | According to EN 50013 |  |
| Connections | screw－type terminals with self－lifting pads | screw－type terminals with self－lifting pads |  |
| Wires | 0，25 mm ${ }^{2}-1,5 m^{2}$ | $1 \times 2.5 \mathrm{~mm}^{2}, 2 \times 1.5 \mathrm{~mm}^{2}$ <br> （UL：copper conductor（CU） $60^{\circ} \mathrm{C}$ or $75^{\circ} \mathrm{C}$ with soft or stiff wire 14－16 AWG） |  |
| Tightening torque | 0，5 Nm－0，6 Nm | 0，5 Nm |  |
| Switch type | Single break，snap action | Double break，snap action | Double break，slow action |
| Contacts | 1NO＋1NC change over <br> （All NC contacts are of the positive opening operation type | 1NO＋1NC change over （All NC contacts are of the positive opening operation type - ） | 1NC <br> （All NC contacts are of the positive opening operation type |
| Scheme |  |  |  |
| Markings and homologations |  （general purpose） | （（1＋）（1） |  |

## TECHNICAL SPECIFICATIGNS QF THE PQTENTIGMETERS

| Code with support | PAロZロロロ1 | PAロZロロロZ |
| :---: | :---: | :---: |
| Ohmic value | $10 \mathrm{k} \Omega$ | $10 \mathrm{k} \Omega$ mechanical stop |
| Resolution | Infinite |  |
| Independant linearity | $\pm 1 \%$ |  |
| Life time | $10 \times 10^{6} \mathrm{movements}$ |  |
| Operational ambient temperature | $-55^{\circ} \mathrm{C} /+105^{\circ} \mathrm{C}$ |  |
| Continuos rotation（without stop） | $360^{\circ}$ |  |
| Continuos rotation（with stop） | $333^{\circ} \pm 5^{\circ}$ |  |
| Actual electrical angle | $310^{\circ} \pm 5^{\circ}$ |  |
| Ohmic value tolerance | $\pm 20 \%$ |  |


| Code with support | PAロZロロロ3 | PAロ2ロロロ4 | PAロ2ロロロ5 |
| :---: | :---: | :---: | :---: |
| Ohmic value | $10 \mathrm{k} \Omega$ | $10 \mathrm{k} \Omega$ | $5 \mathrm{k} \Omega$ |
| Connections | 4 turrets | 3 turrets | 4 turrets |
| Indipendent linearity（over AEA $-3^{\circ}$ ） | $\leq \pm 1 \%$ | $\leq \pm 0,35 \%$ | $\leq \pm 1 \%$ |
| Life time |  | $5 \times 10^{6} \mathrm{movements}$ |  |
| Operational ambient temperature | $-55^{\circ} \mathrm{C} /+125^{\circ} \mathrm{C}$ |  |  |
| Mechanical angle | $360^{\circ}$ continuous |  |  |
| Actual Electrical Angle（AEA） | $340^{\circ} \pm 5^{\circ}$ |  |  |
| Ohmic value tolerance | $\max \pm 20 \%$ at $20^{\circ} \mathrm{C}$ | $\max \pm 10 \%$ at $20^{\circ} \mathrm{C}$ | $\max \pm 20 \%$ at $20^{\circ} \mathrm{C}$ |

TECHNICAL SPECIFICATIGNS QF THE ENCODERS

| Code with support | PAロ3ロロロ 1 | PAロ3ロロロ2 |
| :---: | :---: | :---: |
| Resolution | 36 pulses／rev． | 150 pulses／rev． |
| Operational ambient temperature | $-40^{\circ} \mathrm{C} /+85^{\circ} \mathrm{C}$ |  |
| Code | Incremental |  |
| Supply voltage | $4,5 \mathrm{Vdc}$ min．to 30 Vdc max．（ 35 mA max．－no load） |  |
| Output voltage | Low： 500 mV max．at 10 mAHigh：（Vin $-0,6$ ）at $-10 \mathrm{~mA}($ Vin $-1,3)$ at -25 mA |  |
| Output current | 25 mA max．load per output channel |  |
| Output format | Two channel（A，B）quadrature with Index（Z） |  |
| Phase sense | A leads B clockwise（CW）from the mounting end of the encoder |  |
| Accuracy | ＋／－0，8 arc－min． |  |
| Outputs | Push pull |  |
| Electrical protection | Reverse polarity and output short circuit protected |  |

TECHNICAL sPECIFICATIGNG QF THE ABSGLUTE ENCDDER YANKEE 1

| Code | PAD 1 AAD 1 | PAD 1 ABC 1 | PAD 1 ACD 1 |
| :---: | :---: | :---: | :---: |
| Analog Output | Current $4 \div 20 \mathrm{~mA}$ | Voltage 0 $\div 10 \mathrm{~V}$ | PWM 0 $100 \%$ |
| Operational ambient temperature | $-40^{\circ} \mathrm{C} /+80^{\circ} \mathrm{C}$ |  |  |
| Power supply | $12 \div 48 \mathrm{VDC} / 12 \div 48 \mathrm{Vac}$ |  |  |
| Protection against polarity inversion | yes |  |  |
| Absorption | 50 mA |  |  |
| Resolution | 12 bit |  |  |
| Linearity | ＋／－0，5 |  |  |
| Max．hysteresis | $0,1^{\circ}$ |  |  |
| Setting Zero Point | through button／wire |  |  |
| Signal increment direction | CW（standard）／CCW（on request） |  |  |
| Connections | terminal board |  |  |



WITH FLANGE



SWITCHES

| Ref． | DRAWING | DESCRIPTIGN | Scheme | CロDE |
| :---: | :---: | :---: | :---: | :---: |
| 4 | 景 | $1 \mathrm{NO}+1 \mathrm{NC}$ switch double break，snap action | $\int_{14}^{13} \int_{22}^{21}$ | PRSL0110XX |
|  |  | 1NC switch double break，slow action |  | PRSL0111XX |
| 6 | [ovic | 1NO＋1NC switch single break，snap action |  | PRSL0100XX |

REF．

|  |  |  | CAM REFERENCE CHART |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |

gengare, PロTENTIロMETERE AND ENCDDERE
PEF.

## PINIDN GEARS

| REF. | DRAWING | DESCRIPTIAN | Cade |
| :---: | :---: | :---: | :---: |
| 17 |  | Pinion gear M10 Z12 with pin | PRSL0911PI |
|  |  | Pinion gear M12 Z10 with pin | PRSL0912PI |
|  |  | Pinion gear M14 Z10 with pin | PRSL0913PI |
|  |  | Pinion gear M16 Z10 with pin | PRSL0914PI |
|  |  | Pinion gear M20 Z8 with pin | PRSL0915PI |
|  |  | Pinion gear M5 Z12 with pin | PRSL0916PI |
|  |  | Pinion gear M6 Z11 with pin | PRSL0917PI |
|  |  | Pinion gear M8 Z12 with pin | PRSL0918PI |
|  |  | Pinion gear M12 Z12 with pin | PRSL0944PI |

[^0]REF.

## REMARKS

All standard limit switches are equipped with cams PRSL7194PI for PRSL0110XX and PRSL0111XX switches，PRSL7124PI for PRSL0100XX switches and shafts made of stainless steel AISI 430F．

| Rated REVGLUTIGN RATIC | REAL REVILUTIGN RATID | Number af CAMS AND switches |  | Switches |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | PRSLロ1םロXX | $\begin{aligned} & \text { PRSLロ } 1 \text { ロXX } \\ & 1 \mathrm{Na}+1 \mathrm{NC} \end{aligned}$ |  |
|  |  |  | Code | Code | Code |
| 1：15 | 1：16 | 2 | PFB9067A0016002 | PFB9067L0016010 | PFB9067L0016012 |
|  |  | 3 | － | PFB9067L0016011 | PFB9067L0016013 |
|  |  | 4 | PFB9067A0016003 | PFB9067L0016008 | PFB9067L0016014 |
| 1：20 | 1：20，21 | 2 | PFB9067A0020001 | PFB9067L0020006 | PFB9067L0020008 |
|  |  | 3 | － | PFB9067L0020007 | PFB9067L0020009 |
|  |  | 4 | PFB9067A0020002 | PFB9067L0020004 | PFB9067L0020010 |
| 1：25 | 1：27，27 | 2 | PFB9067A0027007 | PFB9067L0027007 | PFB9067L0027017 |
|  |  | 3 | － | PFB9067L0027016 | PFB9067L0027018 |
|  |  | 4 | PFB9067A0027008 | PFB9067L0027014 | PFB9067L0027019 |
| $1: 50$ | $1: 62$ | 2 | PFB9067A0062006 | PFB9067L0062033 | PFB9067L0062045 |
|  |  | 3 | － | PFB9067L0062044 | PFB9067L0062046 |
|  |  | 4 | PFB9067A0062009 | PFB9067L0062003 | PFB9067L0062025 |
| 1：75 | $1: 75,48$ | 2 | PFB9067A0075005 | PFB9067L0075008 | PFB9067L0075010 |
|  |  | 3 | － | PFB9067L0075009 | PFB9067L0075004 |
|  |  | 4 | PFB9067A0075006 | PFB9067L0075006 | PFB9067L0075011 |
| 1：100 | 1：103，44 | 2 | PFB9067A0103009 | PFB9067L0103037 | PFB9067L0103038 |
|  |  | 3 | － | PFB9067L0103049 | PFB9067L0103027 |
|  |  | 4 | PFB9067A0103008 | PFB9067L0103030 | PFB9067L0103050 |
| 1：150 | 1：162，52 | 2 | PFB9067A0162006 | PFB9067L0162007 | PFB9067L0162008 |
|  |  | 3 | － | PFB9067L0162006 | PFB9067L0162009 |
|  |  | 4 | PFB9067A0162007 | PFB9067L0162003 | PFB9067L0162002 |
| 1：200 | 1： 222,58 | 2 | PFB9067A0222005 | PFB9067L0222011 | PFB9067L0222014 |
|  |  | 3 | － | PFB9067L0222013 | PFB9067L0222015 |
|  |  | 4 | PFB9067A0222001 | PFB9067L0222010 | PFB9067L0222016 |
| 1：250 | $1: 254,57$ | 2 | PFB9067A0254003 | PFB9067L0254019 | PFB9067L0254010 |
|  |  | 3 | － | PFB9067L0254020 | PFB9067L0254021 |
|  |  | 4 | PFB9067A0254004 | PFB9067L0254008 | PFB9067L0254022 |



Fox rotary limit switch is an electromechanical device for low voltage control circuits (EN 60947-1, EN 60947-5-1) to be used as electrical equipment on machines (EN 60204-1) in compliance with the fundamental requirements of the Low Voltage Directive 2006/95/CE and of the Machine Directive 2006/42/CE.
The limit switch is designed for use in industrialal environments under even severe climatic conditions (operational temperature from $-40^{\circ} \mathrm{C}$ to $+80^{\circ} \mathrm{C}$, suitable for use in tropical environment). The equipment is not suitable for use in environments with potentially explosive atmosphere, corrosive agents or a high percentage of sodium chloride (saline fog). Oils, acids or solvents may damage the equipment; avoid using them for cleaning. Do not connect more than one phase to each switch. Do not oil or grease the control elements or the switches.

The limit switch is supplied with a bag of accessories including: 2 fixing feet (9), 2 self-locking nuts ( 7 ), 2 metric screws (1), 1 no-drop wire (2), 1 self-tapping screw (3),

1 cable clamp (4). Furthermore, accessories may include, in addition to the above-mentioned parts and instead of the cable clamp (4), 1 double cable clamp holder (14), 2 cable clamps M20 (15) or 1 cable clamp M20 (15) and 1 cable clamp M16 (16).

The installation of the limit switch shall be carried out by expert and trained personnel. Wiring shall be properly done according to the current instructions.

Prior to the installation and the maintenance of the limit switch, the main power of the machinery shall be turned off.
Steps for the proper installation of the limit switch

- place the self-locking nuts (7) in their seats in the enclosure (6)
- insert one end of the no-drop wire (2) into the self-tapping screw (3) and tighten the screw into its hole on the enclosure (6)
- insert the fixing feet (9) into their seats in the lower part of the enclosure (6)
- connect the limit switch shaft (08) and the reduction gear shaft avoiding any misalignment between the two shafts
- fix the limit switch tight in order to avoid vibrations of the equipment during operation; for fixing operations use only the feet (9) with metric screws M4 or M5 and their washers
- in case a single multicore cable is employed, screw the cable clamp (4) to the enclosure (6); when two multicore cables are employed, use the cable clamp holder $(14)$, then screw cable clamps $(15,16)$ to the cable clamp holder
- insert the cable into the limit switch through the cable clamp $(4,15,16)$
- strip the multipole cable to a length suitable for stripping the single poles; we suggest the use of pin terminals
- clamp the wire into the cable clamp $(4,15,16)$
- when PRSL0110XX and PRSL0111XX switches are used connect the switches according to the contact scheme printed on the switches or to the wiring scheme on the back of the instructions (tighten the wires into the terminals with a torque equal to 0.5 Nm ; (UL (c) UL: use $60^{\circ} \mathrm{C}$ or $75^{\circ} \mathrm{C}$ copper (CU) conductors and stiff or flexible wire 14-16 AWG); insertability of wires into the terminals $2 \times 0.5 \mathrm{~mm}^{2} 2 \times 1.5 \mathrm{~mm}^{2} 1 \times 2.5 \mathrm{~mm}^{2}$ ) - when PRSL0100XX switches are used connect the terminals according to the contact scheme printed on the label placed on the cam set (tighten the wires to the terminals with a torque of $50 / 60 \mathrm{cNm}$; insertability of wires into the terminals $0.25 / 1.5 \mathrm{~mm}^{2}$ )
- adjust the operating point of the cams; for proper adjustment, loosen the central screw (12) of the cam set, adjust the operating point of each single cam by turning its adjusting screw (11) (the numbers on the screws refer to the cams counting from bottom to top of the set), then tighten the central screw (12)
- insert the free end of the no-drop wire (2) into one of the metric screws (1), then tighten the metric screws (1) to close the limit switch; check the proper positioning of the rubber in the cover (5) and tighten the screws (1) with a torque of $80 / 100 \mathrm{cNm}$


## Steps for routine maintenance

- check the proper tightening of the screws (1) of the cover (5)
- check the proper tightening of the switch terminal screws
- check the proper tightening of the central screw (12) holding the cams (11)
- check the wiring conditions (in particular where wires clamp into the terminals)
- if there is an anti-moisture plug, check its conditions
- check the conditions of the rubber fit into the cover ( 5 ) and check the tightening of the cable clamp $(4,15,16$ ) around the cable
- check that the limit switch enclosure $(5,6)$ is not broken
- check the alignment between the limit switch shaft (8) and the reduction gear shaft
- check that the limit switch is properly fixed

Any change to parts of the limit switch will invalidate the rating plate and identification data of the device, and render the warranty null and void. In case of replacement of any part, use original spare parts only.

TER declines all responsibility for damages caused by the improper use or installation of the equipment.

## Technical Specifications UL with PRSL0110XX and PRSL0111XX switches

Code Fox certified UL = PFB9U67L XXXX XXX
= PFB9U67M XXXX XXX

Contact Blocks Rating $=$ A600, Q600
Environmental Rating = Type 1
Cord diameter range $=0.51$ in ( 13 mm )
Cord type = flexible, type minimum S or SJ (ZJCZ/7)
Wire size range $=$ 14-16 AWG stranded or solid
Conductors = Copper (CU) $60 / 75^{\circ} \mathrm{C}$
Terminal tightening torque $=4.50 \mathrm{lb}$.in $(0.5 \mathrm{Nm})$
Marking $=$ (Lllus


Accessory bag

Cam set with PRSL0110XX or PRSL0111XX switches


Cam set with PRSL0100XX switches


Image for illustrative purpose the number and type of cams is different according to the model


Wiring Layout Switches PRSL0110XX


Wiring Layout Switches PRSL0100XX


[^0]:    Other pinion gears available: see "Gears and pinion gears" catalog

