



**GIOVENZANA  
INTERNATIONAL B.V.**

TECHNO-CONTROL EQUIPMENT



**FGR3**

ROTARY GEAR LIMIT SWITCH

# GIOVENZANA INTERNATIONAL B.V.

The Company



TECHNO-CONTROL EQUIPMENT

## THE PHILOSOPHY

Giovenzana's philosophy is based upon the basic principles of business management, dynamism and the continuous research for the operator's needs in the field of man-machine interaction. These principles, thanks to the experience and professionalism of its staff, guarantees **Giovenzana's** development and growth.

## THE HISTORY

With over 50 years experience in this field and excellent managerial skills, Giovenzana has maintained growth relying upon:

- market research
- product placement
- manufacturing technology, and above all, team work

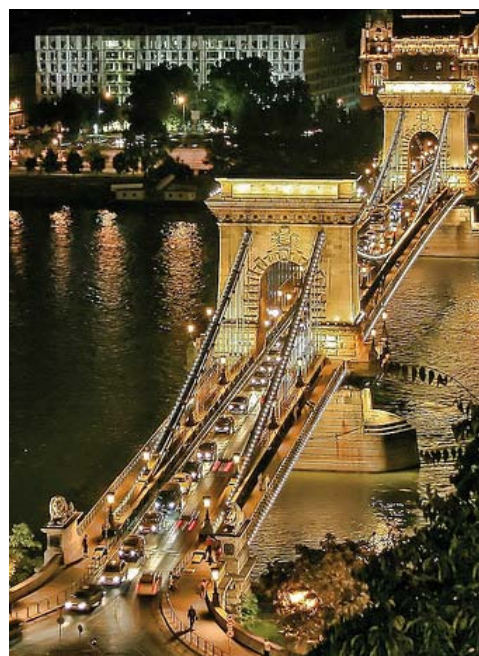
## THE PRODUCTS

Giovenzana, leader in the industrial technology field, is the first choice for:

- handling equipment
  - automation
  - lifting equipment
  - maintenance
  - command and control of moving parts
- Development, design and production are combined together to reach a common aim and cover most

## QUALITY AS A WAY OF LIFE

The commercial success of a product is not by chance, but it is the end result of a combined effort of all human resources operating within an organisational structure devoted to quality. **Giovenzana** is an ISO 9001 certified company.



# GIOVENZANA

## INTERNATIONAL B.V.

The Company

### THE PRODUCTION

The solutions offered by **Giovenzana** are the results of a close examination of the requirements of industrial electrical accessories, in line with all relevant international standards. It comprises three main sectors:  
Industrial automation, lift and lifting equipment.

### AUTOMATION

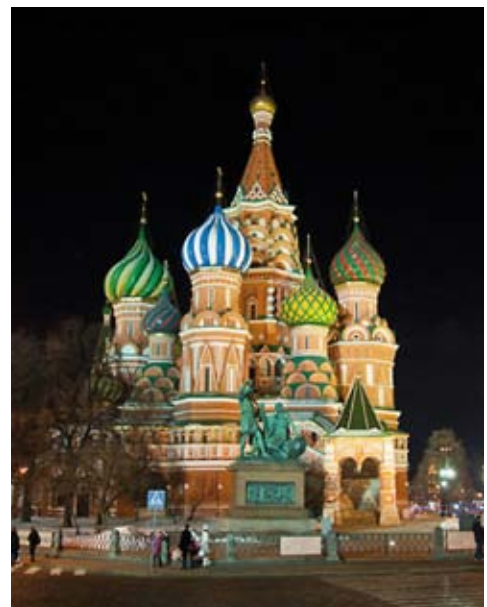
It includes Phoenix cam switches and Regolus switch-disconnectors up to 100A, Pegasus control auxiliaries with screw or spring loaded terminal contact blocks; limit switches with die-cast or moulded casing and safety switches; foot switches and micro switches.

### LIFT

Throughout the years, the continuous technological research and development made Giovenzana the undisputed leader in this field. The range includes: pit bottom push button stations, recall drive control units and inspection boxes.

### LIFTING EQUIPMENT

It comprises single and double row pendant stations up to 14 gang for control and direct switching power circuits, reversing switches, worm screw and rotary limit switches, slip rings, horns, festoon systems and conductor rails.



# GIOVENZANA INTERNATIONAL B.V.

The Company

## QUALITY

**Giovenzana**, leader in the elevator and lifting equipment fields, has gained a prominent position in the automation sector as well with the launch of industrial control accessories on the market. For many years now, all commercial and industrial operations are integrated within the frame of the UNI EN ISO 9001 quality system.

### CSQ certificate No. 9105

Giovenzana has fulfilled its commitment to the quality of its products in 1995.

The quality system is the guarantee to the end user that all production stages are maintained under strict control and adhere to the requirements set by the company both in terms of customer expectations and compliance with the relevant international standards as proved by the various certificates held by Giovenzana for its products.

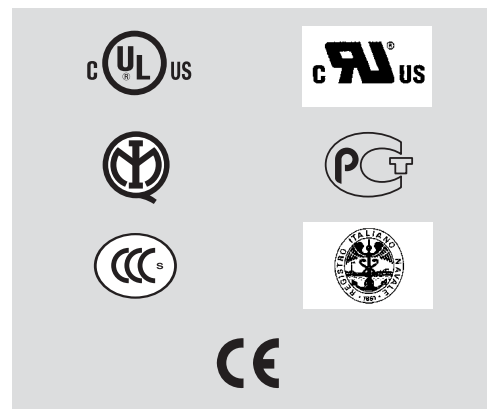


## COMPLIANCE

All **Giovenzana** products are manufactured according to the relevant Cee directives and are provided with a declaration of conformity which certifies their compliance.

## CERTIFICATIONS

For many years, **Giovenzana** has been submitting its products for third party testing to one of the most prestigious independent certification body around the world, the Underwriter Laboratories Inc. in order to obtain the UL mark. Today the number of independent certification bodies approving **Giovenzana's** products is even bigger to signal the high level of quality achieved.



# GIOVENZANA INTERNATIONAL B.V.

The Company

## CEE DIRECTIVES

As from the 1st of January 1997, it is compulsory to CE mark all electromechanical products: this has been outlined by two important regulations: 72/23 CEE and 93/68 CEE Low Voltage Directives.

## CE MARK

European directives, applied to all national regulations, set the minimum requirements in term of safety of all electrical material sold within the EU. The compliance to these requirements is certified to the manufacturer by the CE

## STANDARDS

Giovenzana's products comply with both European EN and American UL standards. These regulations, such as the EN 60024 with regards to the safety requirements of the electrical circuits on board industrial machinery, define the characteristics and performance or the characteristics and use of the products.

## EN EUROPEAN STANDARDS

These standards are the result of the harmonisation among CENELEC (European Committee for Electrotechnical Standardization) member countries. They cover and eliminate existing national standards which may be in contradiction or not up to date. EN European standards usually originate from IEC International standards.

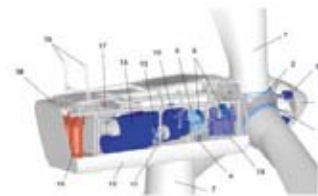


### PROJECT FOCUS AND MARKET AREA

**GIOVENZANA INTERNATIONAL** has developed, during this year, the Rotary gear limit switches to equip the wind energy turbines, with a main characteristic of flexibility to adapt our product to a big range of customization by clients.

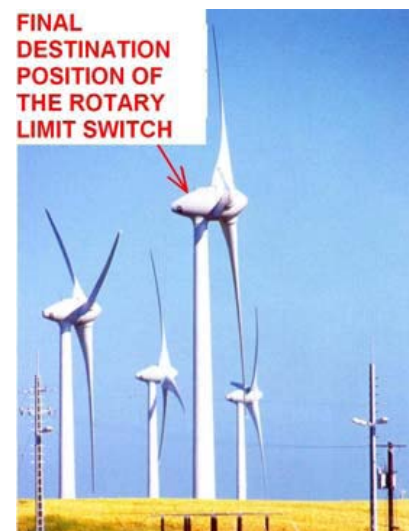
We began to research in this field to manufacture a product deleting the defects of the principal competitors, the actual owner of the limit switches range in the market. Our engineering studies, shoot for supply an high quality standard product in terms of reliability and availability of the equipment. Using advanced technological approaches (i.e. materials, simulation techniques, ...), we aim a developing a product that could become, in short time, a reference system in the market nowadays. The project has been developed to warrant, in the same time, the correct functionalities of the rotary switch and overall the resistance to the high critical working conditions (determined by temperature, humidity and position to hook up the box in its seat), and very high precision to control and regulate the rotation of the nacelle.

We have had a lot of experience and competence in the limit switch products; as a consequence, with the introduction of this innovative product in the market, we have overcome the problems related to this kind of equipment and we are able to warrant the best performances during a long life-time. All above characteristics are not only a paper declaration, but will be shown thanks to the several tests which have the purpose to stress the product in its "real" working conditions. Finally, we are sure to achieve the leadership using the best equipment components and looking for the high quality plastic materials.



1. Base	11. Main bearing frame	21. Transformer
2. Base housing	12. Gear set end	22. Transformer support frame
3. High speed gear assembly	13. Gearbox	23. Top cover
4. High cover	14. Main shaft frame	24. Main shaft
5. Ring	15. Main shaft support frame	25. Main shaft end
6. Motor gear control	16. Control or computer shaft	26. Motor shaft
7. Base	17. Control gear assembly	

Picture 1.: Complete product rendering and position



Picture 2.: Product destination

# FGR3

Rotary gear limit switch for wind turbines



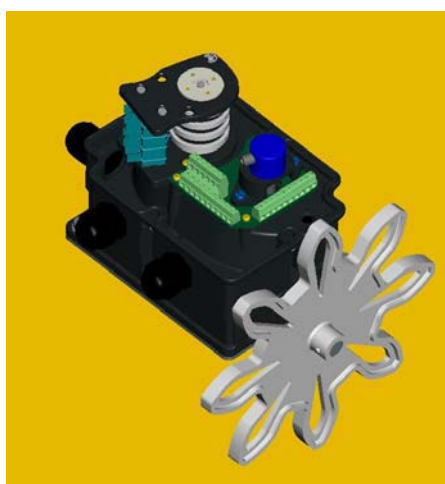
TECHNO-CONTROL EQUIPMENT

## GIOVENZANA'S CODE AND DETAILED DESCRIPTION

The new code of our product will be a "speaking code", in which each single number means a specific functionality. The code provides all the information which can be used for defining the different customization which we'll be able to supply to our customers. In fact, one of the main characteristics of the equipment here shown is its flexibility, as it is possible to state by following examples:

FGR3	X		XXX	X	X		XX	
FGR3	0/1/2		060-999	2/4	1/2		51-66	
	No Optical Reader	Encoder	Potentiometer	Ratio Gear	Nr. of microswitch	Shaft		Pinion type
	0	1	2		2/4	1	2	
	NO, no optical reader equipped with screw's holes to a future equipment.	YES, encoder completed by its support and brass driver.	YES, potentiometer completed by its support and brass driver.	N. ratio gear min 001 to max 999	Number of microswitch and correspondent cams. We have two different configurations: 2 cams or 4 cams.	Single output of the shaft	Double output of the shaft	Two last numbers of the code correspondent of the pinion size (like M14Z10 have "61" from 16020061). <b>In the case without any pinion will be 00</b>

For example, our first prototype which we've manufactured had the following code: FGR310604161 that means the following product description: Rotary gear limit switch for wind turbines, with encoder, gear ratio cams group 1:60, with n.4 microswitches, equipped by single shaft with 50mm length outside from plastic box and mounted a pinion size as Giovanzana code 16020061.



Picture 3.: Rendering of FGR3 inner view the plastic box

# FGR3

## Rotary gear limit switch for wind turbines



TECHNO-CONTROL EQUIPMENT

### GEAR WHEEL AND COMPONENTS SPECIFICATIONS

The main functionalities of our rotary gear limit switch are two;

- ✓ To monitor the position of the nacelle.
- ✓ To manage the safety issues of the nacelle in order to avoid the cables to get twisted.

About the gear wheel, it is possible to find different gear-ratios. For the most common items this ratios can be 1:50 1:100 or 1:150, but in some situations we can have different values (for instance ratio = 1:460 from wheel group to cams group, using "two steps" ratios). In general, we can manage this ratio according to the customer requirements. At the basis of the gear wheel, you find the bushing made by brass which receives the movement by the shaft and drive a set of thermo-plastic gear wheels which are responsible to mechanical drive to the encoder. Simultaneously, you find also the thermo-plastic screw wheels which are responsible to mechanical drive to the cams group. The calculations for the gear-ratio (RE-shaft ro to cam-shaft) are shown in a separate file called "table ratio group.xls", you could see the ATTACHMENT n.02.

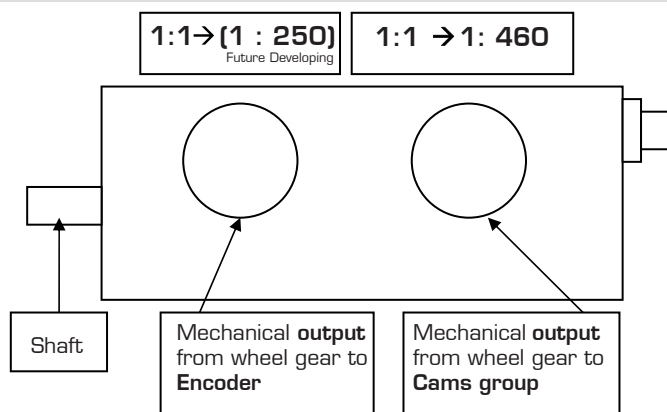


Picture 4.:  
Rendering of gear wheel inner the plastic box

### RATIO IN/OUTPUT FROM THE WHEEL GEAR GROUP

First of all, it is here worth mentioning that the shaft receives the rotation movement from the external pinion coupled with the gear grill.

From Picture 4, it is evident the different gear ratios achievable from this product. More in detail, it is necessary to specify the different needs of component. Encoder needs very high values of precisions, therefore it is necessary to design a ratio = 1:1 (mechanical output from wheel gear to Encoder). However, if customer needs different requirements, it is possible to modify this ratio till 1:250. Cams group does not need high precision but "commercial" precisions are enough. As a consequence, this product allows to achieve ratios till 1:460 (mechanical output from wheel gear to Cams group).



Picture 5.: Ratio in/output scheme



# FGR3

Rotary gear limit switch for wind turbines



TECHNO-CONTROL EQUIPMENT

## PCB BOARDS AND ELECTRICAL COMPONENTS SPECIFICATIONS

The encoder, which is the most important component of our product, aims at providing the precise position corresponding to max wind-power direction, overall gives a signal to measure the exact position of the nacelle which is done by the average of this incremental encoder built in our limit switch. The encoder allows to define the accurate position of the nacelle with a resolution of  $\pm 1^\circ$ . From common knowledge, the possibility to move the nacelle in the suitable direction should improve machine energy performance about 27%. The optical encoder is connected to the stack of four cams in order to establish the rotation angle. The resolution of encoder is determined by the pulse/Rpm, which depends of the sort of encoder required.

For Technical Data Sheet of the incremental encoder, please see the ATTACHED 02



Picture 6.:  
Rendering of the PCB board and mini  
incremental encoder

## MECHANICAL CHARACTERISTICS

### **Overall dimensions**

120X160X145h mm (obviously without pinion) with a weight about 1,5 Kg

### **Fixing**

The product fixing has been developed by four holes to clamp a metal flange. This choice is due to the flexibility of the product since it can be changeable with the products developed by competitors.

We refer to the holes distances of the flanges fixed under the plastic box and overall dimensions.

### **Cables of the product**

The product is equipped by N.3 cable exit with the cable-glande M20.

### **Waterproof**

The limit switch is tested for IP66. This property is warranted by a rubber gasket of all perimeter on the coupling plane between the plastic black box and yellow cover and two "corteco" caps mounted on the side shaft holes. This product is frost smoke - resistant.

### **Mechanical stress**

Max Rpm : 50rpm

Max radial force: 14N

**The shaft is mounted with ball bushing**



# FGR3

Rotary gear limit switch for wind turbines



TECHNO-CONTROL EQUIPMENT

## QUALITY DECLARATION STANDARDS AND PRODUCT'S OMOLOGATIONS

**Omologation:** CE, UL/CSA (US market), on request CCC, Ghost and RINA).

Giovenzana rotary gear limit switch for wind turbines will be applied the most updating laws like:

- Standard 2006/95/CE (Low tension)
- Standard 98/37/CE with reference to 2006/42/CE (Machinery Directive)
- Standard 89/336/CE with reference to 2004/108/CE (Directive electromagnetic compatibility)

The following list the standards which you use to calculate the "failure rate" (FIT) of the components.

- IEC 60319**, Presentation of reliability data on electronic components or parts
- IEC 60300-3-2**, Dependability management Part 3-2: data collection
- IEC 60300-3-5**, Reliability test conditions and statistical test principles
- IEC 60050-191**, International Electrotechnical Vocabulary (IEV) - Part 191; Dependability and Quality of service
- IEC 60721-1**, Classification of environmental conditions - Part 1: Environmental parameters and their severities
- IEC 60706-3**, Verification and collection analysis and presentation of data
- IEC-62380-TR**, - Reliability Data Handbook - Universal model for reliability prediction of electronics components, PCBs and equipment.

**Known the FIT of each components we can calculate the MTBF following:**

- IEC 61709 Electronic components - Reliability - Reference conditions for failure rates and stress models for Converter
- CEI EN 61124 (CEI 56-34): Reliability tests.

Further reliability laws

- IEC 60605-6**, Equipment reliability testing - Part 6: Tests for the validity and estimation of the constant failure rate and constant failure intensity
- EN 60812 (CEI 56-1)** - Analysis method for system reliability. Analysis Failure Mode & Effects Analysis (FMEA)
- CEI EN 61124 - CEI 56-34** - Reliability tests

Preliminary certification tests following the standards:

- EN 61000-6-2 +EC + IS1
- EN 61000-6-3
- EN 60204-1 + A1
- EN 60529 + A1
- EN 62262
- EN 60068-2-1
- EN 60068-2-2
- EN 60068-2-14
- EN 60068-2-30
- EN 60068-2-78
- CISPR 16-2-3
- EN 61000-3-2
- EN 61000-3-3
- CISPR 16-2-1(CA), CISPR 16-1-2(CA), CISPR 16-14-1(CA), CISPR 16-2-1(DC), CISPR 16-1-2(DC)
- CISPR 22

- EN 61000-4-8, EN 61000-4-3, EN 61000-4-2, EN 61000-4-6, EN 61000-4-4, EN 61000-4-5;
- EN 61000-4-6, EN 61000-4-4, EN 61000-4-5 (CC and AC), EN 61000-4-11.



# FGR3

Rotary gear limit switch for wind turbines



TECHNO-CONTROL EQUIPMENT

## MAIN SPECIFICATIONS OF MINI-ENCODER

Output waveform	Incremental A, B, Z and inverted
Zero or index pulse	[Z] one pr./rev.
Supply voltage	Min 4.5V to max 30V Reverse polarity protection
Current (no load)	35 mA
Max load per output	20 mA
V out low	Max 500mV at current out low I=10mA
Operation Temperature	-40°C a +85°C
Storage Temperature	-40°C a +85°C
Max pulse frequency	200KHz
V out high	Min(Vin -0.6)@ I=10mA Min(Vin -1.3)@ I=25mA
Cable Data	5(0.14mm <sup>2</sup> )or 8-leads(0.005mm <sup>2</sup> )shielded
Max Rpm	(Max freq/pulses pr rev. ) * 60
Phase diff.	90° ± 20%
Duty cycle	50° ± 10%
Cable	5x0, 14mm <sup>2</sup> shielded
Output signal	Standard, Inverted or differential
Certified acc.to	EN50081-1 e EN50082-2

More details you could see in the Att.05

## CONNECTING WIRE FOR ENCODER

Colour	wire	function
White	1	Ground.
Brown	2	24V
Yellow	3	B
Green	4	A
Shield	5	Shield

## MAIN SPECIFICATIONS OF MICROSWITCH

Weight appx.	12g
Contacts	Positive opening contacts according with EN60947-5-1
Contact material	Golden contact
Release force	Min. 0.4N
Actuating force	Max. 2.25N
Ith	6A
Terminal leads	Blade terminals quickconnect 6.3mm x 1 or 6.3mm x 2.5 DIN 46247
Operating temperature	-40°C to + 85°C
Protection class	IP40 IPO0(terminals) according with EN60529
N. of micro/cams	Std. from 4 to 6

More details you could see in the Att.05