



# Rotary Limit Switches Driver FRM Series

 **ravioli**<sup>TM</sup>

# Limit Switches

## Driver FRM Series

### Main Features

The rotary limit switch is a device which allows you to control the movement of industrial and building machines.

The shaft is connected to the motor, so that, after a precise number of turns, the cams cause the intervention of the internal contacts.

The innovative and thorough regulation of the cams allows you to set the microswitches working point linearly and micrometrically.

The limit switch ranges several ratios and you can assemble different kinds of sensors realizing various linear outputs. Contacts are positive-opening (EN 60947-5-1), which improves the workers' safe. This series includes a great number of different accessories, which make easier the use of the limit switch.

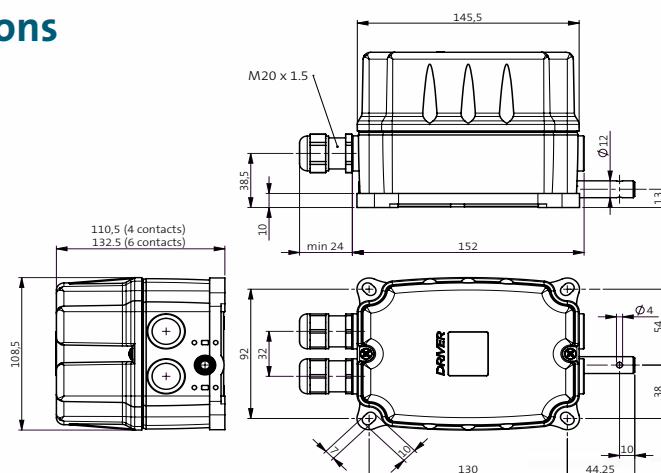
For years Ravioli has been focusing its production on renewable energy. Driver FRM limit switches, which are also used in wind turbines and in solar trackers, are included in our **Green e-motion** Program. They represent a significant step in our project and our participation to sustainability.



### Technical features

|                                     |   |              |        |
|-------------------------------------|---|--------------|--------|
| Compliance with EEC Directives      | 2006/42/CE  | 2006/95/CE   | RoHS   |
| Compliance with rules               | EN 60947-1  | EN 60947-5-1 |        |
| Insulation voltage                  | EN 60204-1  | EN 60529     | UL 508 |
| Maximum operating voltage           | 250V~   |              |        |
| Black lower casing                  | 250V~   |              |        |
| Yellow cover                        | reinforced nylon                                    |              |        |
| Operating temperature               | high mechanical and thermal resistant thermoplastic |              |        |
| Drive                               | -20 °C + 60 °C                                      |              |        |
| Cable entries                       | -40 °C + 60 °C (on demand)                          |              |        |
| Protection degree                   | worm screw  |              |        |
| Protection against contact voltages | standard: 2 glands M20x1,5                          |              |        |
| Max. rotation speed                 | Option: more glands                                 |              |        |
| Homologation                        | IP 66 EN 60529                                      |              |        |
| Weight                              | double insulation EN 60439-1                        |              |        |
| Product                             | 500 rpm   |              |        |
|                                     | CE  |              |        |
|                                     | UL - (c)UL execution on demand                      |              |        |
|                                     | approximately 800 g                                 |              |        |
|                                     | made in Italy - covered by a registered design      |              |        |

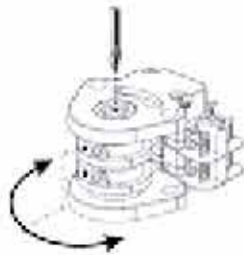
### Dimensions



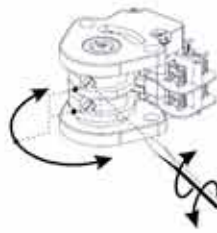


# Contacts and regulation cams

Each cam is equipped with its own micrometrical regulation screw. Regulation can be easily carried out through a screwdriver.



1. Optional basic regulation
  - loosen the upper screw
  - rotate the cams manually
  - tighten the upper screw (torque 1 Nm)



2. Fine regulation
  - rotate the regulation screw of each cam
  - suggested screwdriver 4,0 x 0,8



A particular clutch system ensures regulation rapidity and precision as well as stability, steadiness and reliability.

## Contacts features

|                              |  |
|------------------------------|--|
| Microswitch                  | 1NO 1NC rapid positive-opening, self-cleaning contacts |
|                              | <b>T</b> type - blue colour (standard)                 |
|                              | <b>R</b> type - white colour (fingerproof)             |
|                              | <b>D</b> type - golden contacts (on demand)            |
| Compliance with rules        | EN 60947-5-1   |
| Insulation voltage           | 250V~  |
| Test voltage                 | 2000V~   |
| Category of usage            | AC-15, $U_e$ 250V, $I_e$ 3A                            |
| Thermal current $I_{th}$     | 10A  |
| Breaking power               | according to EN 60947-5-1                              |
| Insulation                   | according to EN 60947-5-1                              |
| Mechanical lifetime          | $10 \cdot 10^6$ manoeuvres                             |
| Terminals                    | with screws - with fingerproof screw (on demand)       |
| Terminals identification     | according to EN 50013                                  |
| Protection fuse              | 6A gl  |
| Lifetime on resistive charge | 250V~ 6A: $10^5$ cycles                                |
| Lifetime on inductive charge | 250V~ 3A: $0,3 \cdot 10^5$ cycles                      |
| Lifetime in d.c.             | 24V= 20W L/R 40ms: $3 \cdot 10^5$ cycles               |
| Homologations                | CE - on demand: UL - (c)UL                             |



## Standard cams profiles

| Type     |              |  |       | Type     |           |  |       |
|----------|--------------|--|-------|----------|-----------|--|-------|
| <b>A</b> | pointed      |  | white | <b>D</b> | semi-turn |  | white |
| <b>B</b> | sector       |  | grey  | <b>E</b> | circular  |  | white |
| <b>C</b> | quarter-turn |  | red   | <b>F</b> | 10 point  |  | white |

Unless other specifications, the limit switches are supplied with the white pointed cams (type A). Other profiles on demand

# Executions

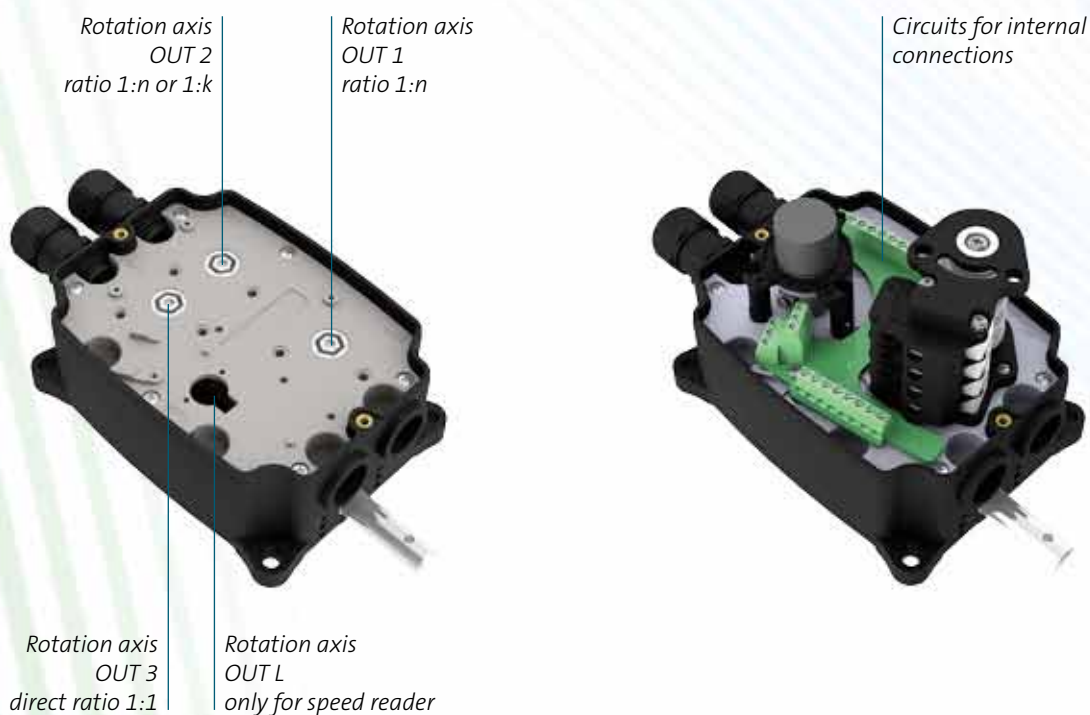
FRM limit switch is equipped with 3 internal rotation axes, named:

- **OUT 1** Output for different ratios 1:n
- **OUT 2** Output for different ratios 1:n or 1:k
- **OUT 3** Output for direct ratio 1:1

It is possible to use max 2 internal rotary axes simultaneously: OUT 1 is always available, while either OUT 2 or OUT 3 can be used (they cannot be used at the same time).

The fourth rotation axis OUT L is available for the application of a speed reader.

Some printed, pre-wired circuits, provided with terminal blocks, can be inserted, on demand, to help the connections between the internal components.



## Standard ratios

1 : 1 direct ratio OUT 3 for sensors

1 : 1 - 5 - 15 - 25 - 50 - 75 - 100 - 150 - 200 - 300 up to 900 for either OUT 1 or OUT 2

Several ratios are available on demand and according to the requested quantity.

Standard executions are with 2, 4, 6 contacts; executions with 3, 8, 10, 12 contacts are available in consideration of the quantity.

## Customized executions

- shaft of different lengths
- twin-shaft executions with passing shaft
- different kinds of contacts
- front or lateral gland
- cams with various profiles
- customized labels

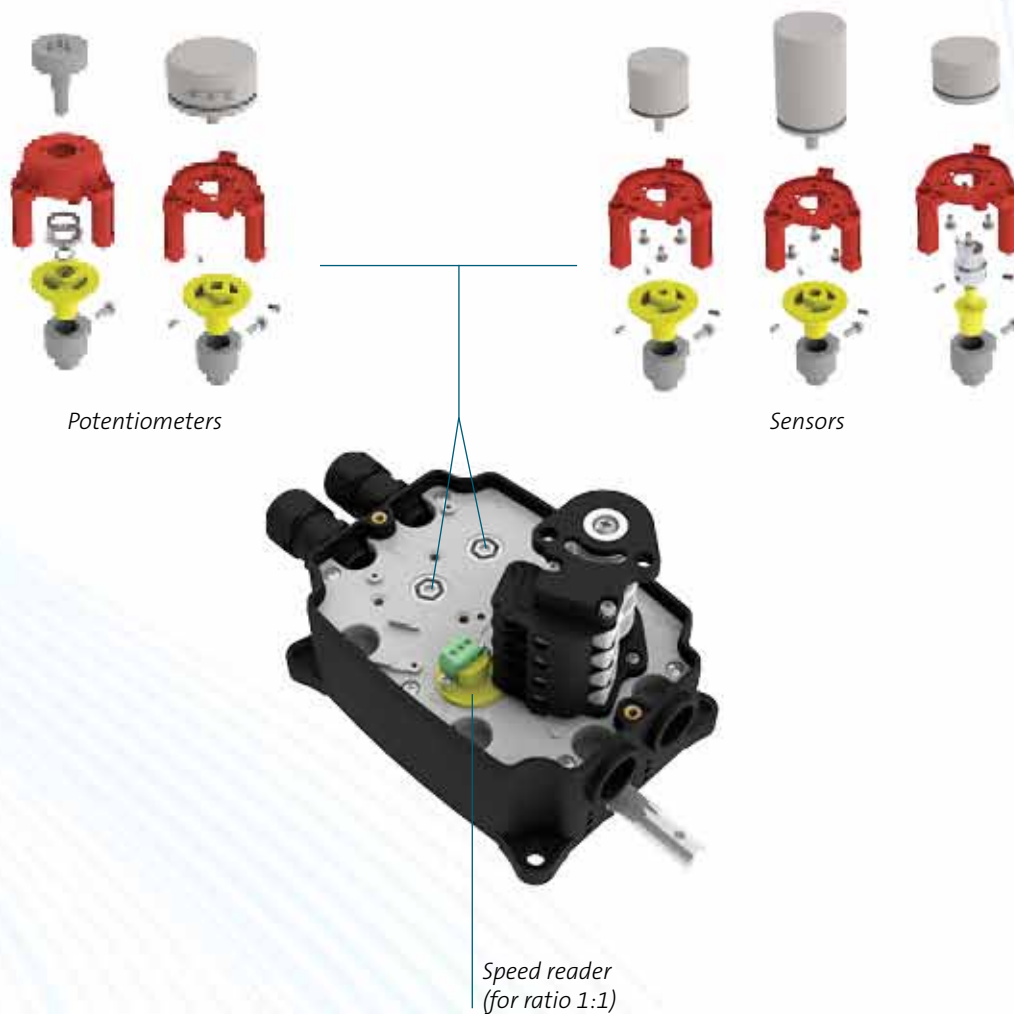
# Sensors and speed reader

The experience we have developed cooperating with several manufacturers of sensors has allowed us to realize the interfaces which are necessary to assemble different marks of sensors, according our customers' inquiries.

The application of encoders, potentiometers or some other sensors, in addition to the groups of microswitches, produces in the same device an analogic or digital output, which can be properly read.

Moreover, a rotation speed reader can be inserted as an option.

Do not hesitate to contact us to indicate your needs.



## Accessories

The series ranges several accessories, which make easier the use of the limit switches, and meet some particular needs.

A number of cog wheels, the male shaft and the flexible shaft have been studied to convey easily the motion from the shaft of the motor to the shaft of the limit switch.

Further details and codes are specified on page 7 and 8.



# For your safety

Driver FRM limit switches comply with the following Directives and Norms:

|              |   |
|--------------|---|
| 2006/42/CE   | Machine Directive                         |
| 2006/95/CE   | Low Voltage Directive                     |
| 2002/95/CE   | RoHS Directive                            |
| 1907/2006    | REACH                                     |
| EN 60947-1   | Low-voltage switchgears and control gears |
| EN 60947-5-1 | Control circuit devices                   |
| EN 60204-1   | Safety of machinery                       |
| EN 60529     | Protection degrees                        |
| UL 508       | Industrial control equipment              |



Driver FRM limit switches are guaranteed by our EC Certificate of Conformity, available upon request, where it is declared that such product has been created by Ravioli in accordance to defined and acknowledged Safety Regulations, and in compliance with the Quality standards stated in our ISO 9001:2008 Quality System Certificate.

## Respect for people and environment

Ravioli is focusing its activity on products in the respect of people, following the standards which are defined in our Code of Ethic Behaviour. Such products have been studied in order to improve the working safety for people who use them. Moreover, Ravioli products are free from any harmful substances, in the respect of environment.

## Installation and maintenance requirements

### INSTALLATION AND WIRING

The limit switch must be installed by qualified personnel, in compliance with the current safety norms. Before wiring, the machine power supply must compulsorily be interrupted. Correct installation calls for working temperatures from -20°C to +60°C (optionally from -40°C to +60°C). The limit switch must not be used in any areas which turn out to be potentially explosive, corrosive or with high sodium chloride contents. Acid, oil and solvent may cause the device deterioration; the limit switch is lubricated "for life", therefore it is recommended not to use either oil or fat to lubricate any part of it. The wiring installation must be achieved and tested according to the current norms, in conformity with the electrical wiring diagram of the machine. In case the limit switch is supplied in a version with internal wiring, do not modify any of them, unless warranty validity. After the installation, it is compulsory to check if both the limit switch and the machine it controls work correctly.

#### Operations for limit switch installation

- Remove the cover by loosening the retaining screws
- Connect the limit switch shaft to the external drive element by using a flexible joint, the male connection or the cog wheels (page 8), in order to avoid any misalignment between the shafts
- Fix firmly the limit switch by using the baseplates or the optional flange (page 8) to prevent it from anomalous vibrations.

#### Wiring operations:

- introduce a multipolar cable into the special cable entry
- strip the cable for electrical connection to the microswitches
- tape the initial part of the cable
- lock the cable in the cable entry
- carry out the electrical connections by tightening the microswitch screws to max torque of 0,5 Nm.
- in case a potentiometer as well as any other sensors are present, introduce another multipolar cable in the second cable entry, tape and lock the cable in the gland; then, connect properly the wires to their preset clamps (max torque: 0,5 Nm.)
- set the position of the cams by adjusting the regulation screws (page 3); in case of great displacements, the whole group can be loosened by operating on the central screw and moving manually the cams. After this approximate regulation, tighten the central screw again and operate on the lateral screws to obtain a fine regulation
- regulate your optional potentiometer or other sensor according to the specific instructions which are enclosed to the product that you can ask us directly for.

### MAINTENANCE

#### Maintenance operations:

- check if both the screws on the cover and the inner clamps are correctly tightened
- check if the multipolar cable is secured in the cable entry
- check the wiring conditions
- check the integrity of the gasket inside the cover
- check that the drive system is functioning correctly and that the shafts are in alignment
- check that the limit switch is safely assembled
- check the integrity of the case

**Ravioli S.p.a. declines any responsibility for damage deriving from incorrect installation or improper use of the product.**

## Purchase codes

## Purchase codes for standard limit switches

The purchase code for standard limit switches is composed as follows:

**B FRM XXX Y NN Z**

Ratio (pag. 4) \_\_\_\_\_

Type of cam (pag. 3)

Type of contact (pag. 3) \_\_\_\_\_

Number of contacts (pag. 4)

## Special limit switches

To purchase non standard limit switches, please choose the composition you want:

Note: the use of **OUT 2** excludes the employ of **OUT3** and viceversa.

Note: the use of **OUT 2** excludes the employ of **OUT 3** and viceversa.

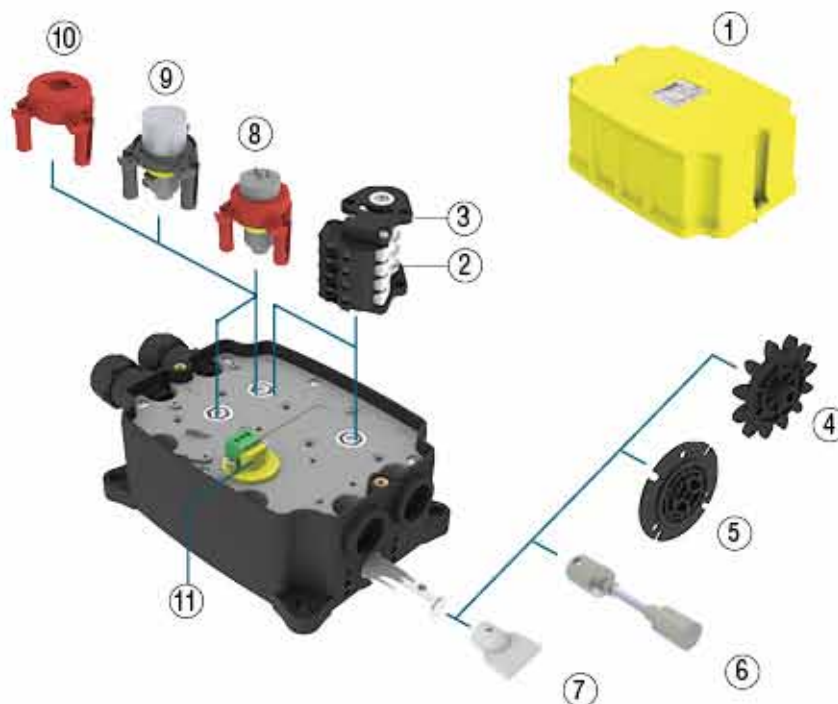
|                              |     |                 |             |                 |             |               |  |  |  |
|------------------------------|-----|-----------------|-------------|-----------------|-------------|---------------|--|--|--|
| <b>Cams</b>                  |     |                 |             |                 |             |               |  |  |  |
| A                            |     |                 | Type of cam |                 | Type of cam | Ratio 1:1     |  |  |  |
| B                            |     |                 |             |                 |             |               |  |  |  |
| C                            |     |                 |             |                 |             |               |  |  |  |
| D                            |     | Potentiometer   |             | Potentiometer   |             | Potentiometer |  |  |  |
| E                            |     |                 |             |                 |             |               |  |  |  |
| F                            |     | Sensor          |             | Sensor          |             | Sensor        |  |  |  |
| <b>Cog wheels</b>            |     |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M5  | Z12 | <b>OUT 1</b>    |             | <b>OUT 2</b>    |             | <b>OUT 3</b>  |  |  |  |
| <input type="checkbox"/> M6  | Z11 | ratio 1 : _____ |             | ratio 1 : _____ |             | ratio 1 a 1   |  |  |  |
| <input type="checkbox"/> M8  | Z12 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M10 | Z12 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M12 | Z10 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M12 | Z12 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M14 | Z10 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M16 | Z10 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M18 | Z10 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M18 | Z11 |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M20 | Z8  |                 |             |                 |             |               |  |  |  |
| <input type="checkbox"/> M20 | Z11 |                 |             |                 |             |               |  |  |  |

Cross the elements you desire. For each contact, specify the type of cams you want. Define the ratio you require for each rotation axis. Define the kind of the sensor.

Type of sensor: \_\_\_\_\_

Further information: \_\_\_\_\_

# Spare parts and Accessories



## Spare Parts

| Pos. | Code   | Description                                   |
|------|--------|---|
| 1    | B51792 | Cover up to 4 microswitches                   |
|      | B51793 | Cover for 5-6 microswitches                   |
| 2    | BT11FR | Contact T - 1NO 1NC rapid blue (standard)     |
|      | BR11FR | Contact R - 1NO 1NC rapid white (fingerproof) |
|      | BD11FR | Contact D - 1NO 1NC golden (on demand)        |

| Pos. | Code    | Description          |
|------|---------|----------------------|
| 3    | BCAMAFR | Cam A - pointed      |
|      | BCAMBFR | Cam B - sector       |
|      | BCAMCFR | Cam C - semi-turn    |
|      | BCAMDFR | Cam D - quarter-turn |
|      | BCAMEFR | Cam E - circular     |
|      | BCAMFFR | Cam F - 10 point     |

## Accessories

| Pos. | Code      | Description       |
|------|-----------|-------------------|
| 4    | BMOD5FC   | Cog wheel M5 Z12  |
|      | BMOD6FC   | Cog wheel M6 Z11  |
|      | BMOD8FC   | Cog wheel M8 Z12  |
|      | BMOD10FC  | Cog wheel M10 Z12 |
|      | BMOD12Z10 | Cog wheel M12 Z10 |
|      | BMOD12Z12 | Cog wheel M12 Z12 |
|      | BMOD14FC  | Cog wheel M14 Z10 |
|      | BMOD16Z10 | Cog wheel M16 Z10 |
|      | BMOD18Z10 | Cog wheel M18 Z10 |
|      | BMOD18Z11 | Cog wheel M18 Z11 |
|      | BMOD20Z8  | Cog wheel M20 Z8  |
|      | BMOD20Z11 | Cog wheel M20 Z11 |

| Pos. | Code     | Description                                      |
|------|----------|--|
| 5    | BFLANFRM | Flange   |
| 6    | BAFLESFC | Flexible shaft                                   |
| 7    | BINNEFC  | Male connection                                  |
| 8    | -        | Potentiometers (on demand)                       |
| 9    | -        | Encoder (on demand)<br>Other sensors (on demand) |
| 10   | -        | supports for sensors assembly<br>(on demand)     |
| 11   | -        | speed reader (on demand)                         |

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