



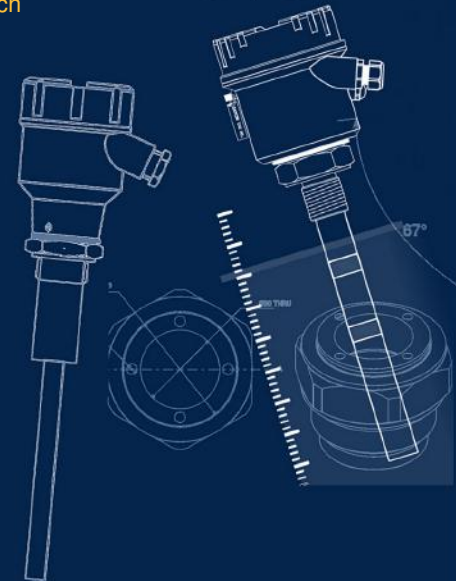
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## INSTRUCTION MANUAL

### ORBIT PADDLE

Stepmatic Rotary Paddle Level Switch

Version 2.1



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## Revision History

| Revision | Date        | Author(s) | Description           |
|----------|-------------|-----------|-----------------------|
| 1.0      | 15 Jan 2014 | RND       | First Version Editing |
| 1.1      | 25 Sep 2014 | MRK       | Applications Revision |
| 1.2      | 20 Apr 2015 | RND       | Features Revision     |
| 1.3      | 23 Dec 2015 | RND       | Specs Revision        |
| 1.4      | 10 Aug 2016 | RND       | Specs Revision        |
| 2.0      | 08 Jan 2017 | BRND      | Revised Format        |
| 2.1      | 17 Sep 2017 | BRND      | Branding Revisions    |

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- The images shown in this manual may differ from the actual instrument / housing in terms of dimensions, color and design. Please refer to GA drawings for dimensional details.
- Values (of performance) described in this manual were obtained under ideal testing conditions. Hence, they may differ under industrial environment and settings.

### General Instructions

- Instrument shouldn't block the material filling inlet.
- Secure the cover of housing tightly. Tighten the cable glands. For side mounting, the cable glands should point downwards.
- For side mounting, provide a baffle to prevent the material from falling on the probe.
- When handling forks, do not lift them using their tines. While using them with solids, ensure that material size is less than 10mm.
- Deforming the shape of the tines may interfere with the fork's operating frequency.
- Make all electrical connections as instructed in the manual. Don't power on the device before verifying the connections.

## 1 Introduction

ORBIT is a rotating paddle level limit switch which uses a unique stepper gear motor drive resulting in highly reliable operation in most of the powders and granular solids. It has a DPDT relay contact output that is configurable for high or low failsafe operation. An adjustable special arrangement of spring is introduced for sensitivity control. We can control the sensitivity by adjusting the spring between indicators.



Figure 1: Orbit Product Image

## 2 Operating Principle

The special arrangement of spring makes the operation easier and simpler. A stepper motor is attached with spring which drives the paddle and rotates it freely in the absence of material. Two sensors are also provided with it which sense the motor action with the help of magnet and starts/stops the motor accordingly. When the material covers the paddle then the spring is stretched backward and the sensor sense the movement with the help of magnet and stops the motor and when material gets empty then again spring come back to its original position and the other sensor sense the action and starts the motor so paddle rotates freely again.

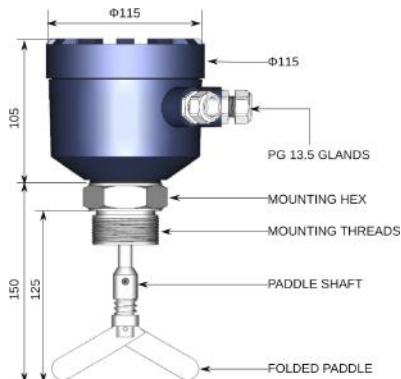


Figure 2: Description of Parts

## 3 Features

- Built-in universal power supply of 90-265 V AC and 24-55 V DC.

- Adjustable RPM and adjustable switching sensitivity.
- Motor fault indication.
- Direct stepper gear motor design, maintenance-free.
- Variable sensitivity control, one paddle for all applications.
- Selectable failsafe operation.
- Foldable paddle mechanism for ease of installation.
- 2 potential free contacts with adjustable time delay.
- Rope probe available for longer lengths.

## 4 Applications

- Chemical and PVC Powders
- Plastic Chips
- Animal Feed Industry
- Cement Industry
- Food Processing
- Pharmaceuticals

## 5 Application Specifications

Please refer to Table for Application Specifications.

| PARAMETER     | VALUE  |
|---------------|--|
| RPM           | 2 - 8  |
| Density       | Minimum $0.5 \text{ gm/cm}^3$                    |
| Material Size | A maximum of 35 mm                               |
| Response Time | 2-3 sec (For both, Covered and Uncovered Delays) |

Table 1: Application Specifications

## 6 Electrical Specifications

Please refer to following Table for Electrical Specifications.

| PARAMETER             | VALUE  |
|-----------------------|--|
| Input Power Supply    | 24 - 55 V DC and 90 - 265 V AC   |
| Output                | DPDT Relay output  |
| Power Consumption     | 4.5W at 24 V   |
| Switching             | Single-point level switching   |
| Switching Indication  | One Green LED shows Motor Status<br>Bi-Color LED on the electronics insert <ul style="list-style-type: none"> <li>• Green-Normal</li> <li>• Red-Alarm</li> </ul> |
| Fail-safe             | Field Selectable <ul style="list-style-type: none"> <li>• Open - Fail-safe High (For High Level)</li> <li>• Close - Fail-safe Low (For Low Level)</li> </ul>     |
| Time Delay Settings   | 1 - 25 seconds (For both, Covered and Uncovered Delays)  |
| Operating Temperature | <ul style="list-style-type: none"> <li>• Ambient Temperature - 0°C - 65°C</li> <li>• Process Temperature - Up to 200°C</li> </ul>                                |
| Relay Rating          | 10 Amp at 275 V AC   |

Table 2: Electrical Specifications

## 7 Mechanical Specifications

Please refer to Table ?? for Mechanical Specifications.

| PARAMETER      | VALUE   |
|----------------|---|
| Housing        | <ul style="list-style-type: none"> <li>• RB: Cast Aluminium weatherproof powder coated paint (Rating IP-65)</li> <li>• FP2A: Cast aluminium weather &amp; flameproof powder coated paint suitable for gas group IIA &amp; IIB as per IS 2148</li> </ul> |
| Cable Entry    | PG 13.5 (Polyamide), 1/2" BSP/NPT DC Gland  |
| Mounting       | <ul style="list-style-type: none"> <li>• Screwed - 1 - 1 1/2" BSP/NPT</li> <li>• Flanged - 1 1/2 - 3" ASA/ANSI</li> </ul>   |
| Motor          | Stepper motor with reduction gear head  |
| Paddle         | SS 316 foldable paddle  |
| Bearing & Seal | Pre-lubricated radial ball bearings. Effective dust seal used for ingress protection.   |

Table 3: Mechanical Specifications

## 8 Installation & Handling Guidelines

The orbit should be installed in horizontal or vertical position via screwed or flange mounting. Due to the collapsible paddle construction, installation is very easy. Just bring the twin vanes together and push them through the threaded female connection. Due to spring action the paddle will flare out after entering the tank. Now the mounting bush can be tightened on to the nozzle. For removing the unit, just loosen the threads and pull the unit out. The specially angled vane design helps in collapsing the paddle while it gets pulled out. No access from inside the vessel is required to install or uninstall the unit. While installing the instrument, please take care of the following points:

- The instrument shouldn't block the material filling inlet.
- Secure the cover of housing tightly. Tighten the cable glands.
- Observe that when installed directly under the material inlet source, a canopy called baffle of appropriate strength and size should be welded right above the orbit as shown.

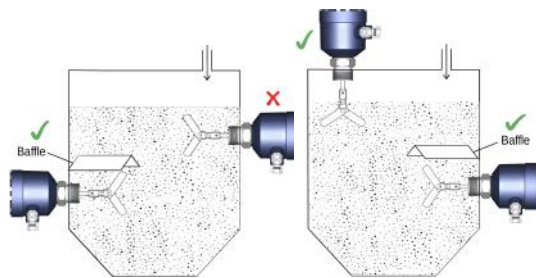


Figure 3: Correct Side Mounting

- When handling orbit, do not lift them using their paddle as shown in Figure .



Figure 4: Correct Handling

- Make all electrical connections as instructed in the manual. Don't power on the device before verifying the connections.
- Weatherproofness of enclosure is guaranteed only if the cover is in place glands adequately tightened. Damage due to accidental entry of water can be avoided if the instrument is installed in a rain shade.
- If the ambient temperature is high, the instrument should not be installed to receive direct sunlight. In case such a position of shade is not available, a heat shield should be fitted above the instrument especially if the operating temperature lies between 60°C and 80°C.

- While screwing the instrument, the hexagonal mounting bush should be turned and not the housing.

**Important** - For vertically installed probes with wire extensions, ensure that the fitting is vertical within plus minus 5 deg. For side entry probes without wire extensions, mounting angle is unimportant.

## 9 Electrical Connections

Please refer to Figure for electrical connections.

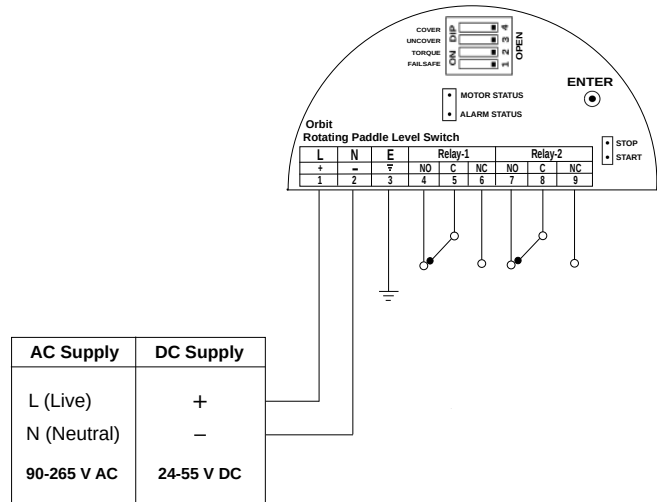


Figure 5: Electrical Connections

## 10 Cover Delay

When the application material covers the paddle, the changeover of the output can be delayed by a pre-determined time. This time is called COVER Delay. For a different value of Cover Delay, the number of blinks can be adjusted as per requirement.

**Note:**

You can set the value of COVER DELAY between 1-25 secs.

**Follow the below procedure for setting Cover Delay**

1. Ensure that all DIP switches are in OPEN position as shown in Figure ?? . Make sure that ALARM STATUS LED is not blinking for Error.

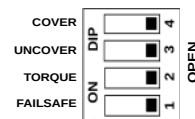


Figure 6: DIP-Switch

2. To set the Cover Delay, set the COVER switch to CLOSE position as shown in Figure ?? . (CLOSE is the opposite of OPEN for a DIP switch.) The ALARM STATUS LED will glow RED.

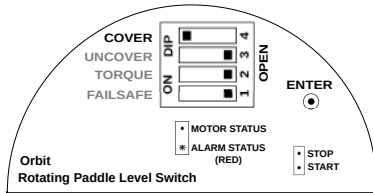


Figure 7: Cover Delay Switch Position

- Press ENTER and keep it pressed as shown in Figure ???. The ALARM STATUS LED will start blinking. Count the number of blinks. After setting the value release the ENTER key.

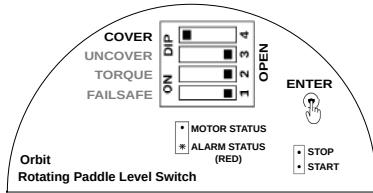


Figure 8: Setting Cover Delay

- Delay is entered, but not saved. To save and test the Cover Delay, set the COVER switch back to OPEN position as shown in Figure ???. The ALARM STATUS LED will come back to its original position.

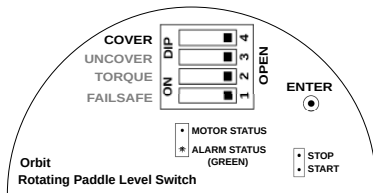


Figure 9: Saving Cover Delay

- To test, dip paddle into the application material until the switching point is reached.

The ALARM STATUS LED will start blinking RED if the switch point is reached. It will blink for the number of seconds for which the cover delay is set. 1 blink is equal to 1 second during switching. A maximum of 25 seconds can be set.

## 11 Uncover Delay

When the application material uncovers paddle, the changeover of the output can be delayed by a pre-determined time. This time is called UNCOVER Delay. For a different value of Uncover Delay, the number of blinks can be adjusted as per requirement.

### Note:

You can set the value of UNCOVER DELAY between 1-25 secs.

### Follow the below procedure for setting Uncover Delay

- Ensure that all DIP switches are in OPEN position as shown in Figure ???. Make sure that ALARM STATUS LED is not blinking for Error.
- To set the Uncover Delay, set the UNCOVER switch to CLOSE position as shown in Figure ???. (CLOSE is the opposite of OPEN for a DIP switch.) The ALARM STATUS LED will glow RED.

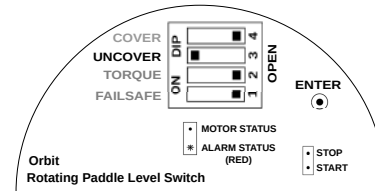


Figure 10: Uncover Delay Switch Position

- Press ENTER and keep it pressed as shown in Figure ???. The ALARM STATUS LED will start blinking. Count the number of blinks. After setting the value release the ENTER key.

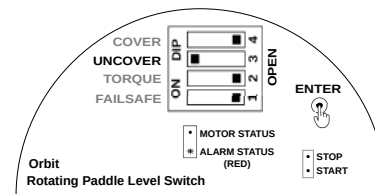


Figure 11: Setting Uncover Delay

- Uncover Delay is entered, but not saved. To save and test the Uncover Delay, set the UNCOVER switch back to OPEN position as shown in figure ???. The ALARM STATUS LED will come back to its original position.

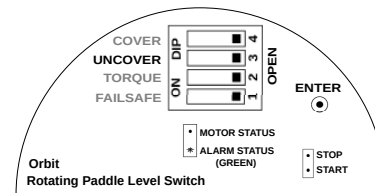


Figure 12: Saving Uncover Delay

- To test, dip paddle into the application material until the switching point is achieved.
- The ALARM STATUS LED will start blinking GREEN if the switch point is achieved. It will blink for the number of seconds for which the Uncover Delay is set.



## 12 Fail-Safe Settings

In a condition of device failure, known errors and input power failure the outputs of the device resemble the ALARM condition. This is meant to prevent overflow or dry run conditions in case of failures.

**Prevent Overflow - High Level Switch** Failsafe High (default) is set by moving the Failsafe switch to OPEN position as shown in Figure ??.

- When not in contact with the material, LED turns GREEN.
- When in contact with the material, LED turns RED.

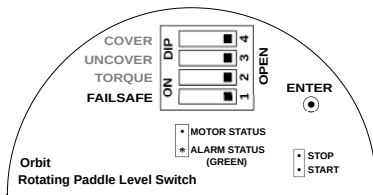


Figure 13: Failsafe High

**Prevent Dry run - Low Level Switch** Failsafe Low is set by moving the Failsafe switch to CLOSE position as shown in Figure .

- When in contact with the material, LED turns GREEN.
- When not in contact with the material, LED turns RED.

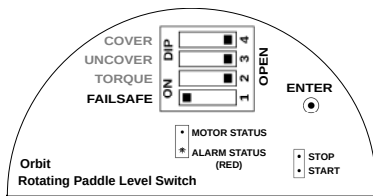


Figure 14: Failsafe Low

## 13 Sensitivity Settings

A special spring mechanism is introduced in the orbit for sensitivity setting. This spring is connected with a motor and a paddle. Values of sensitivity is defined by the hole. Each hole in orbit sets the sensitivity value as per our requirement. The holes are setting the sensitivity according to the material type i.e. Light and Heavy Material.

**Sensitivity for Light Material** - For light material the sensitivity value is between 1-2 as this exert minimum tension across spring to stop the paddle. For setting the sensitivity of low density material, insert the spring on hole 1 or 2. If material is very fluffy connect the spring to hole 1. If material is not too heavy and not light then connect the spring pin to the middle hole which sets the sensitivity value to 3.

**Sensitivity for Heavy Material** - For heavy material set the sensitivity value between 4-5 as this exert maximum tension so it can easily apply largest force to spring to stretched backward to stop the paddle. For setting the sensitivity of high density material, insert the spring on hole 4 or 5. If material is very heavy then connect the spring to hole 5.

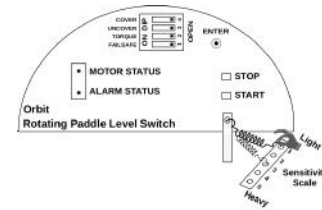


Figure 15: Sensitivity Setting

## 14 RPM Control

The rotation speed of paddle can be set using the DIP Switch. It is adjustable and we can set manually as per our requirement. For setting RPM value follow the points given below -

### Note:

You can set the value of RPM between 2-8

- Ensure that all DIP switches are in OPEN position as shown in Figure ?? . Make sure that ALARM STATUS LED is not blinking for Error.
- To set the RPM, set the COVER and UNCOVER switch to CLOSE position as shown in Figure ?? . (CLOSE is the opposite of OPEN for a DIP switch.) The ALARM STATUS LED will glow RED.

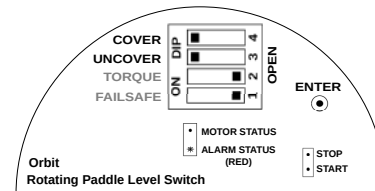


Figure 16: RPM Control Switch Position

- Press ENTER and keep it pressed as shown in Figure ?? . The ALARM STATUS LED will start blinking. Count the number of blinks. After setting the value release the ENTER key.

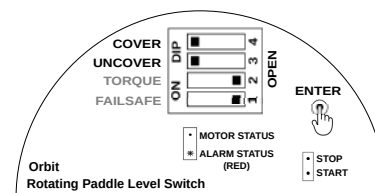


Figure 17: Setting RPM

- RPM is entered, but not saved. To save and test the RPM, set the COVER and UNCOVER switch back to OPEN position as shown in Figure ???. The ALARM STATUS LED will come back to its original position.

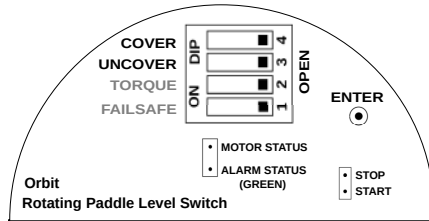


Figure 18: Saving RPM

Please refer to Table ??? for setting value of RPM. As the

| VALUE | RPM             |
|-------|-----------------|
| 1     | 2               |
| 2     | 3               |
| 3     | 4 (Factory set) |
| 4     | 5               |
| 5     | 8               |

Table 4: RPM Control

rotation speed increases, the blinking of MOTOR STATUS LED become fast and if MOTOR STATUS LED becomes stable it means that motor stops.

## 15 Indications

### 15.1 Output Indications

#### Green LED Glows When:

- Paddle is Uncovered and Failsafe is High
- Paddle is Covered and Failsafe is Low

#### Red LED Glows When:

- Paddle is Covered and Failsafe is High
- Paddle is Uncovered and Failsafe is Low

### 15.2 Error Indications

On Error, the ALARM STATUS LED starts blinking RED and GREEN alternately at a faster rate. Normal LED blinks are always at the rate of 1 blink per second, in either RED or GREEN color. This error occurs due to loose connection of motor. To resolve this error connect the motor properly.

## 16 Customer Support

Thank you for going through the instructions given in this manual. To further ease the process of installation and use, we have developed special demo videos which are hosted

on YouTube.

Sapcon's YouTube channel, SAPCON INSTRUMENTS, lists all these videos: <https://goo.gl/dnxfcz>

Should you require further information regarding installation, use or working of the instrument, please don't hesitate to contact us. Kindly provide the following information at the time of contacting:

- Instrument Model and Serial Number
- Purchase Order Number and Date of Purchase
- Description of the query
- Your contact details

In an attempt to serve you better, we are open seven days a week (9:30am to 7:30pm). We are available at:

- [www.sapconinstruments.com](http://www.sapconinstruments.com)
- [sales@sapcon.in](mailto:sales@sapcon.in)
- +91-731-4757575

## 17 Product Selection Order Code

### Product

**RP : Orbit - Stepmatic Rotary Paddle Level Switch (Use in Chemical, PVC Powders, Plastic Chips, Cement etc.)**

#### Type

I : Integral (sensor in same unit)

#### Housing

RB : Cast Aluminium weather proof powder coated paint IP65

FP2A : Cast Aluminium weather flame proof powder coated paint suitable for gas group IIA IIB as per IS 2148

#### Probe Housing Cable Entry

PCPG13 : PG 13.5, Polyamide

PCB5D : 1/2" BSP, DC Gland, Brass

PCN5D : 1/2" NPT, DC Gland, Brass

#### Output

D : 2NO, 2NC DPDT Relay Output (rated at 6 A, 230 V AC for non-inductive load)

#### Power Supply

U2 : Universal (90 To 260 V AC, 50Hz) and 24V DC on same terminals

#### Probe Type

RDP : Rod Probe

ROP : Rope Probe(Probe Length  $\geq$  1001mm)

#### Mounting

MB15S6 : Screwed Thread, BSP 1-1/2", SS 316

MN15S6 : Screwed Thread, NPT 1-1/2", SS 316

F20B15MS : 2" ASA Slip-ON Flange with 1-1/2" BSP Thread, MS Plated

F25B15MS : 2-1/2" ASA Slip-ON Flange with 1-1/2" BSP Thread, MS Plated

F30B15MS : 3" ASA Slip-ON Flange with 1-1/2" BSP Thread, MS Plated

F20B15S4 : 2" ASA Slip-ON Flange with 1-1/2" BSP Thread, SS 304

F25B15S4 : 2-1/2" ASA Slip-ON Flange with 1-1/2" BSP Thread, SS 304

F30B15S4 : 3" ASA Slip-ON Flange with 1-1/2" BSP Thread, SS 304

F20B15S6 : 2" ASA Slip-ON Flange with 1-1/2" BSP Thread, SS 316

F25B15S6 : 2-1/2" ASA Slip-ON Flange with 1-1/2" BSP Thread, SS 316

F30B15S6 : 3" ASA Slip-ON Flange with 1-1/2" BSP Thread, SS 316

#### Extension Material (Probe Length $\geq$ 151mm)

ES4 : SS 304

ES6 : SS 316

R6S4 :  $\phi$ 6 Wire Rope, SS 304 (For Probe Length  $\geq$  1001mm & "ROP")

#### Rope Weight (Only with "ROP")

RWS4 : SS 304

RWS6 : SS 316

#### Operating Temperature

10T : Up to 100°C

25T : Up to 250°C

#### Standoff Material (Except "10T")

STGI : GI (Galvanized Iron)

STS4 : SS 304

STS6 : SS 316

**Probe Length**

1.25H : 125 mm

1.5H : 150 mm

1.75H10H : 175 to 1000 mm

10H30H : 1001 to 3000 mm (Only with "ROP")

Example -

RP-I-RB-PCPG13-D-U2-MB15S6-85T-RDP-1.25H