

# MONITORING ROTARY AND LINEAR MOTION



## ELECTRONIC SPEED SWITCHES

Making in India since 1982

# PIONEERS IN ELECTRONIC SPEED SWITCHES

Over 4,00,000 units in operation Since 1980

## INTRODUCTION

Monitoring Speed is essential in any automation process. Speed of any equipment driven by electric motor can vary due to a variety of reasons. e.g. overload, underload, breakage of transmission parts etc. This change should be monitored continuously for corrective action and to save costly equipment from damage. In case of open loop control, a speed monitoring device is useful to either give an alarm or to 'switch off' the motor. In case of a closed loop control, e.g. D.C. drive or V/F drive, a feedback is required (4-20 mA or 0-10 V) to take corrective action.

Jayashree Electron has been manufacturing **Electronic non-contact Type Speed Switches** and **Speed Monitoring Systems** for over **42 years**. We have more than **50 different models** to suit individual applications. Over **4,00,000 units are in operation** throughout the world.

By continuously upgrading to the latest technology, our speed monitoring units keep pace with time. With **over 3000 satisfied customers** we are committed to maintain high quality, reliability of product and prompt after sales service.

## TYPICAL APPLICATION

The Electronic Speed Switches (Zero Speed, Under Speed or Over speed), Speed Indicators and Speed Transducers find wide applications in different industries. Some typical applications are as below.

**Thermal Power Plants, Steel Plants** : Underspeed / Zero Speed monitoring for conveyors. Useful for Sequential starting / stopping of conveyors, Over speed safety for downhill conveyors.

**Cement/ Fertilizers** : Conveyor Belts, Agitators, Stackers-reclaimer, Mixers, Crushers, Bucket Elevators, Fans.

**Sugar, Chemical and Process Industries** : Centrifuge Machines, Fluid Couplings.

**Large Machines** : Locked Rotor Protection.

**Textile, Paper, Packaging and Automatic**

**Manufacturing Lines** : Speed Feedback

**Textile, Paper, Packaging and Automatic**

**Manufacturing Lines** : Speed Feedback, Synchronization, Safety Interlocks etc.

**Parts/ Docks** : Conveyor Safety, Auto Routing.

## FEATURES

Following operational features are available for different models. Appropriate model with relevant features should be selected as per application requirement.

**Duty : Underspeed / Overspeed / Zerospeed**

Enclosures : IP 30 / IP 55 / IP 65 / IP 67 in Plastic, CA, CI, Polycarbonate, Flameproof Enclosures with Government Recognized House Certificate for gas group IIA, IIB and IIC.

**Supply Voltage** : 12/24/110/240V AC/DC

**Speed Setting** : The desired speed value can be set by means of potentiometer / keypad / trim pot. The potentiometer type units have a calibrated dial in 1:10 ratio.

**Standard Speed ranges are**

|                 |                 |
|-----------------|-----------------|
| 1 to 10 RPM     | 5 to 50 RPM     |
| 10 to 100 RPM   | 50 to 500 RPM   |
| 100 to 1000 RPM | 500 to 5000 RPM |

Non-standard ranges can be provided on request. A single unit covering from 5 RPM to 5000 RPM (multirange) is available for specific application.

**Time Delay** : Built in initial by pass or nuisance tripping time.

**Output Contacts** : Standard combinations available are 1NO+1NC, 2NO+2NC, 1C/O or 2C/O.

**Output Signals** : **a)** 0-10 v / 4-20 mA Proportional to specific speed range **b)** RS 485/RS 232/MODBUS.

**Display** : **a)** Dot LED for supply ON / Relay ON **b)** Speed Pulse **c)** Digital seven segment LED display up to 6 digit for speed.

## CONSTRUCTION

**I) Series RM 221 / RM E21 / RM P21** : These units consist of two parts namely the Monitoring unit and the Non-contact type speed sensor probe.

**a) Monitoring Unit** : These are available in a variety of enclosures suitable for projection / flush mounting as below

| Mounting Style    | Protection Grade | Enclosure Material         |
|-------------------|------------------|----------------------------|
| Projection / Wall | IP 30            | Plastic / MS               |
|                   | IP 55/66         | Robust CA / CI / ABS       |
|                   | Flame Proof      | CA / CI as per requirement |
| Flush / Panel     | IP 30            | MS / Plastic               |

**b) Speed Sensing Probe** : The speed sensing probes are Specially designed to sense specified rotating flags. The probes are available in standard M12 / M18 / M30 / M50 / M80 sizes with sensing gaps from 1mm to 50mm. The probes have a special frequency response characteristic to match the monitoring unit.

**II) Special Model Type RM D13 / D15** : This is a very compact and convenient type of speed switch suitable for monitoring zero speed and to give signal to PLC / DCS. It consists of only a tubular enclosure. Like standard sensor probe with built on cable. The flag sensing circuit, The pulse rate comparing circuit and the output driving circuit are all incorporated in one housing.

## PRINCIPLE OF OPERATION

The speed / motion of rotating / moving object is sensed by a non-contact Inductive type sensor. The sensor probe is installed with its sensing face in close vicinity of rotating object. The metallic pieces (flags) with specified dimensions are to be mounted on the rotating object. When these flags pass across the face of the probe, the frontally radiated electromagnetic field of the probe is damped which is converted to a corresponding output pulse. The pulse can also be generated by any other types of probes. These pulses are led to the monitoring unit via a separate interconnecting cable. The sensor probe can be mounted up to a maximum distance of 100 meters from the monitoring unit. The interconnecting cable should be of minimum 0.5sq. mm. size. These pulses are digital in nature and circuit is designed to work in electrically noisy area. An LED provided on rear side of a probe gives visual indication for sensing of the flag. In case of sensors other than Inductive type, the pulses generated can be connected as specified for the individual sensor. The units are designed by using new advance micro controller based circuit. All operating features e.g. time delay, speed comparison, speed display, output relay operation are controlled precisely by the micro controller. Some parameters, related to design / operation of a speed switch, are as explained below.

## RELAY LOGIC

Different options of relay operation logic are available. For monitoring under speed it is recommended to have the relay energised at healthy speed (fail safe logic) and to drop out in case the speed drops. However, reverse or different operational logic can be provided on request.

## INITIAL BY-PASS TIME DELAY (ITD)

The monitoring under speed conditions it is essential to have a by-pass arrangement during starting of the machine. The output relay of the speed monitor is 'OFF' during starting / under speed condition and is 'ON' (energised) during healthy running speed. Hence it is essential to bypass (override) the relay contacts whilst starting. This can be achieved by using either an external timer unit, by programming through PLC or by using a built in by-pass time delay (ITD). With the built in ITD features the output relay switches 'ON' with 'Supply ON' condition and remains ON till the set time delay. If the equipment speed reaches its normal healthy speed during this time then the

relay continuous to remain ON. The relay drops out if the speed has not reached the set value or when the speed drops below set value during run

## NUISANCE TRIPPING TIME DELAY (NTD)

During run, the equipment may lose its speed momentarily due to various reasons. To avoid unnecessary tripping due to this, a built in time delay is provided. The output relay will drop out after the preset time delay after the speed has dropped below the set value. If the equipment speed recovers during this, then the relay continues to remain ON.

## HYSTERESIS

The output relay has an inherent operating hysteresis characteristic (differential between relay ON/OFF) as given in Fig. 1. All standard models are provided with about 5% hysteresis value.

## STANDARD MODELS

Models from a different classifications are distinct in construction and circuit design. There are however some standard models in each series, which are as described below.

### Model Enclosure / Features

|         |                                                                |
|---------|----------------------------------------------------------------|
| RM 2211 | Robust CA / Separate Terminals                                 |
| RM E211 | Industrial CA / Single PCB with built on terminal / Relay etc. |
| RM E261 | Industrial CA with Digital display                             |
| RM D151 | Brass / SS tubular enclosure for directly working with PLC     |

## GENERAL SPECIFICATIONS

Some technical specifications are common for all models as given below. For details specifications refer data sheets of individual products.

**Power consumption :** 5 VA max.

**Working Temperature :** -25° To 70° C

**Repeat Accuracy :** Better than +/-1 % of set value.

**Contact Rating :** 5A resistive at 240V AC / 8A on request

**Speed Range / No. of flags :** The units are calibrated to work for the following calibration as per our standard.

| Operating Range, RPM | 1-10 | 5-50; 10-100 | 50-500; 100-1000 | 500-5000 |
|----------------------|------|--------------|------------------|----------|
| No. of Flags         | 8    | 4            | 2                | 1        |

The monitoring unit is calibrated for specific no. of pulses per minute. A unit calibrated for range 5-50 RPM with 4 No. flagscan be used for 10-100 RPM with 2 flags.

### Under Speed Switch : Characteristic and Typical Schematics

| Relay Operation                                                                                                                                                                                          | Recommended Schematics                                                                                                                                                          |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                                                                                                                                                                                          |                                                                                                                                                                                 |  |
| <b>OPERATION</b><br>The output relay actuates with supply and drops out after set time. However, if the equipment speed reaches its normal value within this time, the relay will continue to remain ON. | <b>NOMENCLATURE</b><br>b0 : Stop PB<br>e0 : Control Fuse<br>e1 : Thermal O/L<br>c1 : Control Contactor<br>b1 : Start PB<br>d1 : ON Delay Timer<br>ESS : Electronic Speed Switch |  |

# MONITORING UNITS : Specifications for Standard Models

|                            |                                                                                   |                                                                                   |                                                                                                                      |                                                                                                |
|----------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                            |  |  |                                    |             |
| <b>Series</b>              | <b>RM E21x</b>                                                                    | <b>RM E26x</b>                                                                    | <b>RM 221x</b>                                                                                                       | <b>RM 221x / FP</b>                                                                            |
| <b>Duty</b>                | Under/Over/Dual Speed                                                             | Under/Over/Dual Speed                                                             | Under/Over/Dual Speed                                                                                                | Under/Over/Dual Speed                                                                          |
| <b>Enclosure</b>           | CA / CI                                                                           | CA / CI                                                                           | Robust CA / CI                                                                                                       | CA for Gr-IIA, IIB, & IIC and CI for Gr-I                                                      |
| <b>Protection Grade</b>    | IP-65                                                                             | IP-65                                                                             | IP-65                                                                                                                | IP-65                                                                                          |
| <b>Dimensions</b>          | 210H x 135W x 95D                                                                 | 210H x 135W x 95D                                                                 | 285H x 165W x 125D                                                                                                   | 272H x 272W x 160D                                                                             |
| <b>Contact Combination</b> | 1NO + 1NC, 2NO + 2NC, 1C/O, 2C/O                                                  | 1NO + 1NC, 2NO + 2NC, 1C/O, 2C/O                                                  | 1NO + 1NC, 2NO + 2NC, 1C/O, 2C/O                                                                                     | 1NO + 1NC, 2NO + 2NC, 1C/O, 2C/O                                                               |
| <b>Speed Setting</b>       | Any single range in 1:10 Ratio for 0.1 RPM to 5000 RPM                            | Any single range in 1:10 Ratio for 0.1 RPM to 5000 RPM                            | Any single range in 1:10 Ratio for 0.1 RPM to 5000 RPM                                                               | Any single range in 1:10 Ratio for 0.1 RPM to 5000 RPM                                         |
| <b>Display</b>             | Red LED for Supply ON and Green LED for Relay ON                                  | Red LED for Supply ON<br>Green LED for Relay ON<br>Digital 7-Segment Red LED      | Red LED for Supply ON and Green LED for Relay ON                                                                     | Red LED for Supply ON and Green LED for Relay ON                                               |
| <b>Terminals</b>           | Suitable to terminate wires of upto 2.5 Sq.mm. PCB mounted                        | Suitable to terminate wires of upto 2.5 Sq.mm. PCB mounted                        | Suitable to terminate wires of upto 2.5 Sq.mm-Built-on screwed type                                                  | Suitable to terminate wires of upto 2.5 Sq.mm. Built-on Moulded                                |
| <b>Sensor Probe Type</b>   | 2/3 Wire Inductive                                                                | 2/3 Wire Inductive                                                                | 2/3 Wire Inductive                                                                                                   | 2/3 Wire Inductive                                                                             |
| <b>Setting Accuracy</b>    | +/- 5%                                                                            | +/- 5%                                                                            | +/- 5%                                                                                                               | +/- 5%                                                                                         |
| <b>Additional Features</b> | 1) Multi range Selection<br>2) Digital Display<br>3) 4-20mA for remote signal     | 1) Multi range Selection<br>2) Digital Display<br>3) 4-20mA for remote signal     | 1) Multi range Selection<br>2) Digital Display<br>3) 4-20mA for remote signal<br>4) Nuisance & Initial bypass delays | 1) Multi range Selection<br>2) 4-20mA for remote signal<br>3) Nuisance & Initial bypass delays |

## SENSOR PROBE

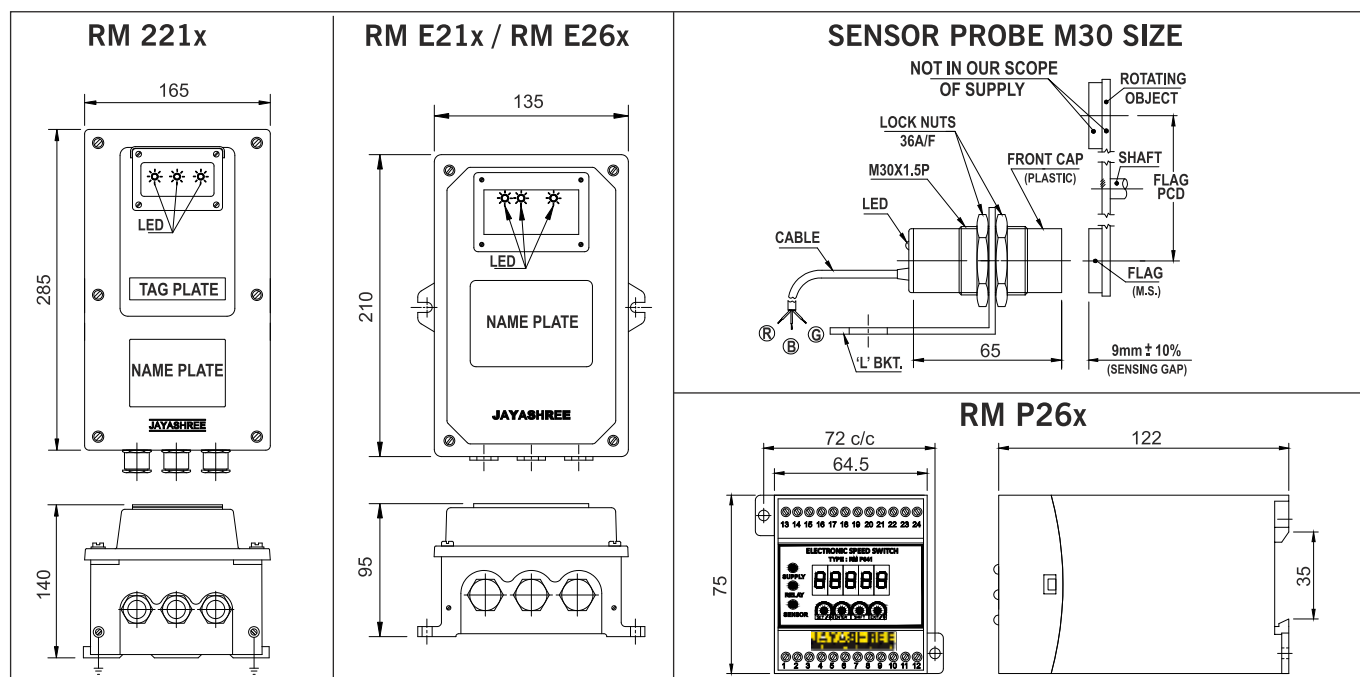
|                |        | INDUCTIVE                                                                           |    |    |    |                                                                                     |    | MAGNETIC                                                                             |  |                                                                                       |    |    |    |
|----------------|--------|-------------------------------------------------------------------------------------|----|----|----|-------------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------|----|----|----|
|                |        | Standard Tubular Models                                                             |    |    |    | CA Enclosure with IP 55 Protection                                                  |    | Probe with Extension Stand                                                           |  | Magnetic Sensors                                                                      |    |    |    |
|                |        |  |    |    |    |  |    |  |  |  |    |    |    |
| TYPE           |        | SP 12 B xx                                                                          |    |    |    | SP 12 PE xx                                                                         |    | SP 12 ES 100                                                                         |  | MSP xx                                                                                |    |    |    |
|                |        | 18                                                                                  | 30 | 50 | 80 | 30                                                                                  | 50 | TO be used for Sensing Linear Speed of Belt                                          |  | 12                                                                                    | 18 | 50 | 75 |
| Sensing Gap mm | Noml.  | 6                                                                                   | 15 | 20 | 35 | 10                                                                                  | 15 |                                                                                      |  |                                                                                       |    |    |    |
|                | Effct. | 3                                                                                   | 8  | 12 | 25 | 6                                                                                   | 10 |                                                                                      |  | 5                                                                                     | 3  | 50 | 90 |
| Termination    |        | Built on 2 m 3 Core PVC. Flex. Cable                                                |    |    |    | Built on Terminals                                                                  |    | Built on Terminals                                                                   |  | Built on 2 m 2/3 Core PCV Cable Teflon Cable for Temp. Upto 250 C                     |    |    |    |

**Installation and Operation :** 1) **Installation of probe and Rotating flag :** The probe should be mounted in front of the rotating object. Specified no. of metallic flags should be mounted on the rotating object. The flag size (dia) should be same as the probe dia to achieve the specified Sensing gap. The flags should be mounted on specified PCD and should be exactly equidistant. Square & Odd shaped flags can affect the performance of the unit. The signal from probe should be connected to the monitoring unit via a separate shielded / armoured cable of minimum 0.5 Sq.mm. size. 2) **Monitoring Unit :** Connect specified control supply voltage to correct terminals. For general under speed monitoring duty set the trip speed value at about 90% of normal running speed



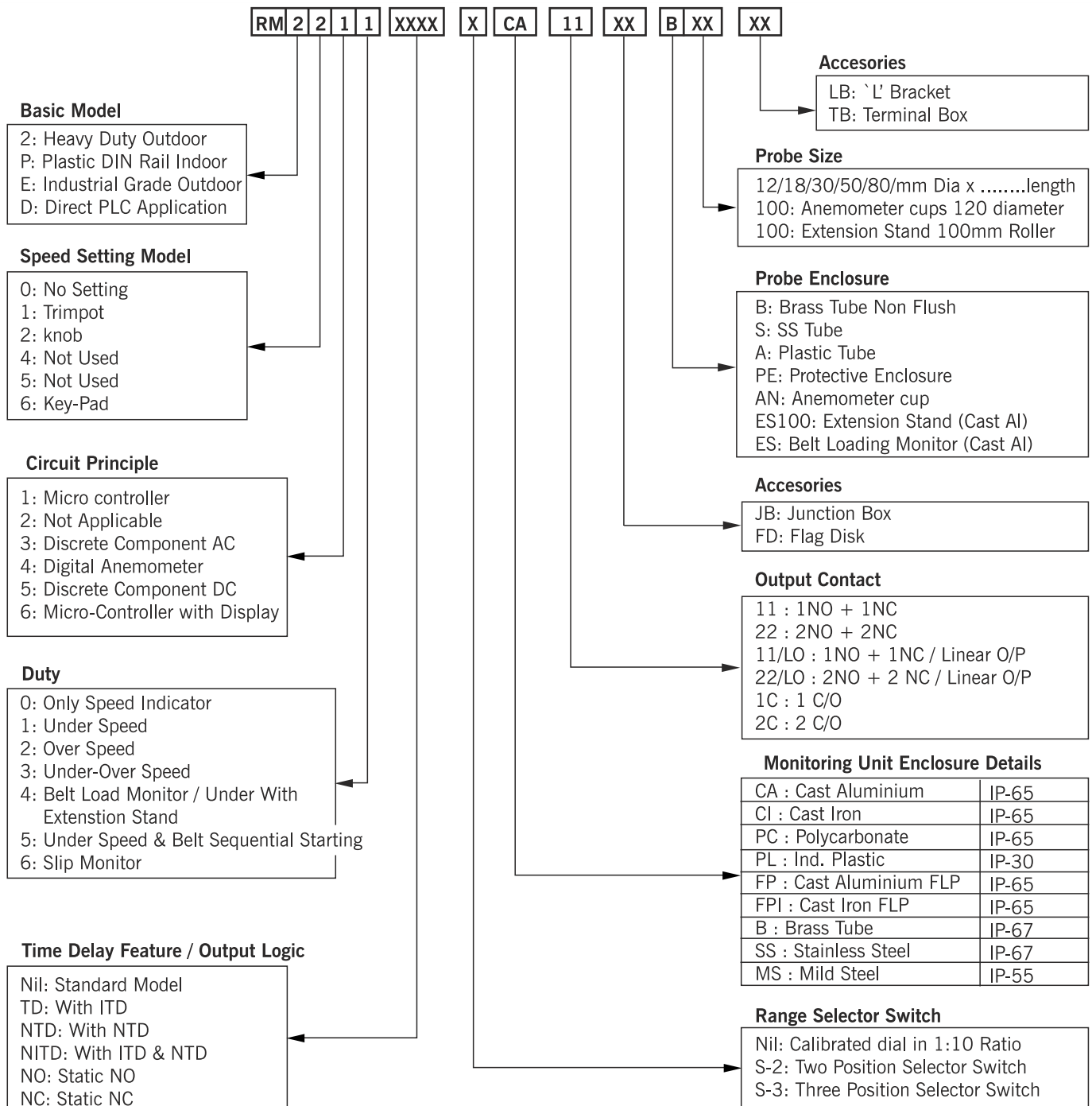
| Series              | RM P21x                                                                                        | RM 226x                                           | RM P26x                                                                                  | RM D15x / RM D13x                                                                                                 |
|---------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Duty                | Under/Over/Dual Speed                                                                          | Speed Indication only                             | Under/Over/Dual Speed                                                                    | Under Speed                                                                                                       |
| Enclosure           | CA for Gr-IIA, IIB, & IIC and CI for Gr-I                                                      | MS                                                | Plastic-DIN Rail                                                                         | Brass / SS tube                                                                                                   |
| Protection Grade    | IP-65                                                                                          | IP-30                                             | IP-30                                                                                    | IP-67                                                                                                             |
| Dimensions          | 75H x 80W x 122D                                                                               | 96H x 96W x 160D                                  | 75H x 80W x 122D                                                                         | M30 x 1.5P x 100L                                                                                                 |
| Contact Combination | 1NO + 1NC, 1C/O, 2C/O                                                                          | N/A                                               | 1NO + 1NC, 1C/O, 2C/O                                                                    | Static Output                                                                                                     |
| Speed Setting       | Any single range in 1:10 Ratio for 0.1 RPM to 5000 RPM                                         | 10 to 10000 RPM Speed Indication only             | 5 to 5000 RPM                                                                            | 10 to 100 RPM<br>100 to 1000 RPM                                                                                  |
| Display             | Red LED for Supply ON and Green LED for Relay ON                                               | 7-Segment Red LED                                 | Red LED for Supply ON<br>Green LED for Relay ON<br>Digital 7-Segment Red LED             | LED for Healthy Speed Indication                                                                                  |
| Terminals           | Suitable to terminate wires of upto 2.5 Sq.mm. PCB mounted                                     | Suitable to terminate wires of upto 2.5 Sq.mm.    | Suitable to terminate wires of upto 2.5 Sq.mm.                                           | Integrated 2/3 core PVC cable 2 m long / 0.4 Sq.mm.                                                               |
| Sensor Probe Type   | 2/3 Wire Inductive                                                                             | 2/3 Wire Inductive                                | 2/3 Wire Inductive                                                                       | N/A                                                                                                               |
| Setting Accuracy    | +/- 5%                                                                                         | N/A                                               | +/- 1%                                                                                   | +/- 10%                                                                                                           |
| Additional Features | 1) Multi range Selection<br>2) 4-20mA for remote signal<br>3) Nuisance & Initial bypass delays | 1) 4-20mA for remote signal<br>2) RS 485 / Modbus | 1) 4-20mA for remote signal<br>2) Nuisance & Initial bypass delays<br>3) RS 485 / Modbus | 1) Also available in higher dia with additional protective enclosures<br>2) SS housing for aggressive Environment |

## DIMENSION DETAILS FOR STANDARD MODELS



**Cable Glands :** The IP-65 grade units are provided without any cable glands. Suitable cable glands (single compression or double compression type) to be used as per individual requirement.

## ORDERING INFORMATION



Example : The model with industrial CA grade enclosure and having under-speed duty and initial time delay with standard M30 sensor probe is as given below

**RM E211-TD-CA-11-B30**

### Special Application

Speed switches for specific applications as below are available. Please refer works for more details.

- I) **Crane Application** : Special models are available for over speed safety of hoist crane.
- II) **Plugging Duty** : Model with specific operation of output relay for plugging duty application. The speed switch senses the speed switch of rotating object near zero speed and switches of the reverse sequence supply connected to the motor.

III) **Cable Winding Machine** : Special controller unit to take inputs from multiple no. of probes are available for monitoring multiple shaft machine. The unit has got a single output relay which gives a signal if any of the sensors stop giving pulses.

IV) **Defence Applications** : A very high precision (12 bit-micro controller) unit for measuring and display speed of a bullet of a high speed projectile launcher. The unit incorporates a special optical / magnetic type sensor.

## PRODUCTS FOR CONVEYOR BELT SAFETY

### BELT LOAD MONITOR

For a bulk material handling conveyor it is essential to know the loaded condition of the belt. This helps to save energy or to actuate safety devices, like belt sprinkles for conveyors handling coal. The series RM E214-BL is specially designed to sense the belt load condition (full loaded or empty) by sensing the vertical displacement of belt and also running speed of the belt.

It gives separate output signals for belt load condition and for healthy running speed. The unit is adjustable to sense belt defection of 5-30 mm.

The RPM range is selectable as per the standard RM series models. Digital display for speed is available as an option.



### BELT TEAR MONITOR

The conveyor belt can get torn of due to sharp metal pieces and stray objects and can lead to heavy losses if not detected in time. The series OBS 605 is an infra - red optical barrier system which detects the falling material from the bottom of a running conveyor.

This is available in different sensing beam channels as 6/8/10/12/16 depending upon the type of material. The transmitter and receiver units are to be mounted at a gap of 0.5 to 2 meters depending upon conveyor size and load.

The monitoring unit operates an output relay whenever material spillage is sensed. The monitoring unit can be mounted at a distance up to 10 mtrs. from the sensor pair.

### SPEED TRANSDUCER

The series RM 313 are precise speed to current transducers. The unit gives a 4 -20 MA output signal proportionate to the input speed signal.

The units are available in standard 35mm DIN rail mounting style and also with a special cast aluminium IP-65 grade enclosure.

The unit has a zero and span adjustment facility. The conversion accuracy is within  $\pm 2\%$ .



## LEVEL MONITORS FOR SOLIDS / LIQUIDS

### RF Point level Sensor Disc Series SW 620



**The RF Point Level Sensor** - This is a most rugged and proven sensor for monitoring level in a chute. This is very useful for monitoring chute blockage. It is a special heavy duty disc / flange mounted probe. The probe senses only the steady level of coal lumps and does not actuate due to falling material, dust and humidity. The effect of cable capacitance and drift with temperature is eliminated by using a driven shield arrangement. The controller unit operates an output relay when the coal level reaches near the sensor face.

The probes are available for working temp. up to 200°C. Probes are different types are available for specific application like Telescopic, Teflon coated etc.

### Tilt Switch Series SW 421

The **Tilt Switch Level Sensor** is a very rugged and proven instrument for monitoring top level of bulk material stored in an open space or in a bunker /silo. It has a special level detecting probe which beyond a preset angle due to piling of material.

The sensor probe is available in robust MS tube for solids and a light duty plastic tube for food grains and fertilizer. Special models for use in Hazardous environment are available.



## WIND SPEED MONITOR



### Wind Speed Monitor Series RM E241

The **Robust Industrial Grade Sensor** designed as per IS 13436 : 9997 is useful for sensing wind speed. The unit can work in Heavy Rains / Sea Shove Storms / Dusty environment. It can Sustain vibration / shocks.

The digital pulses generated by the sensor can be monitored on a remote control unit up to 100 Meters for Display / Control action.

## PROXIMITY SWITCHES

### Inductive, Capacitive, Optical, Magnetic

For Speed / Position Sensing

Available in sizes for 4mm to 150mm with sensing gap up to 100mm for Inductive Switches.

Special models for :

- High Temperature
- High Pressure
- Welding Application



**JAYASHREE**  
E L E C T R O N

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