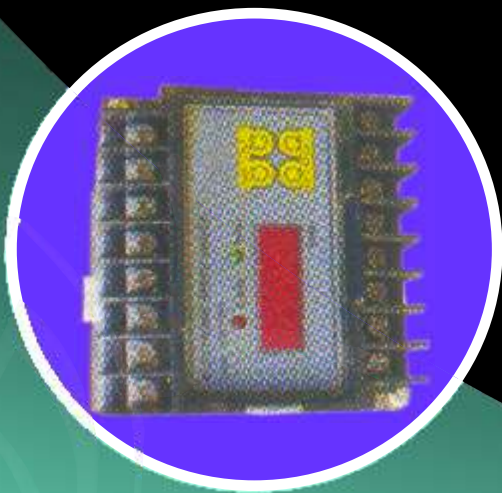


# BEE INSTRUMENTS

PROXIMITY SWITCHES



## *Electronic Speed Switches*



Monitoring Rotary and  
Linear Motion

# Electronic Speed Switches

## INTRODUCTION

Monitoring Speed is essential in any automation process. Speed of any equipment driven by an electric motor can vary due to variety of reasons e.g. overload, underload, breakage of transmission parts etc. 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.

Bee Instruments has been manufacturing Electronic Non-Contact type speed switches and speed monitoring systems for over 25 years. We have more than 50 different models to suit individual's requirement. More than 1,00,000 units are in operation throughout the country.

With continuously adopting latest technology, our speed monitoring units are keeping pace with time. With over 500 satisfied customers we are committed to maintain high quality, reliability and prompt after sales service.

## TYPICAL APPLICATIONS

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 :** Sequential starting / stopping of conveyors, overspeed safety for downhill conveyors.

**Cement / Fertilizer :** Conveyor Belts, Agitators, Stack-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, synchronisation, safety interlocks etc.

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

## FEATURES

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

**Duty -** Underspeed / Overspeed / Zerospeed

**Enclosures :** IP 30 / IP 55 / IP 65 in Plastic, CA, CI, Polycarbonate. Flameproof enclosures with CMRI certificate for Gas Group IIA, IIB and IIC.

**Supply voltage :** 12/24/110/240 V AC / DC.

**Speed Setting Range :** Single range in 1:10 ratio for specific application with fixed running speed.

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 5RPM to 5000RPM (multirange) is available for specific application.

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

➤ **Output Contacts :** Standard combinations of 1No+1NC, 2NO+2NC, 1C/O or 2C/O.

➤ **Output Signals :** a) 0-10 / 4-20 mA Proportionate to specified speed range b) RS485/RS232 / MODBUS

➤ **Display :** a) Dot LED for supply ON / Relay ON b) Digital Seven segment LED display up to 6 digits

➤ **Speed setting options :** By potentiometer / Thumbwheel / keypad

## CONSTRUCTION

I. **Series RM 221/ RM E21 / RM C21 :** 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 variety of enclosures suitable for projection / flush mounting below :

Mounting Style	Protection Grade	Enclosure Material
Projection / Wall	IP 30	Plastic / MS
	IP 55/65	Robust CA/CI/Polycarbonate
	Flame Proof	CA/CI/as per Requirement
Flush / Panel Front	IP30	MS

b) **Speed Sensing Probe :** The sensing probes are available with different operating principle. Please refer our Proximity Switches bulletin for general operating features and specifications of individual type e.g. Inductive, Magnetic, Optical.

For standard application, we offer M 30 size Inductive type sensor. This is having a Ni-Cr plated brass threaded tube totally epoxy sealed to render IP 67 grade of protection. The probe is provided with built in 2 m long PVC flexible cable of 0.4 sq mm size. Different types of robust protective enclosures are available to provide additional mechanical Protection.

II) **Special Model Type RM D15 / D17 :** This is a very compact and convenient type of speed switch suitable for monitoring 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 it's 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.

These pulses are led to the monitoring unit via a separate interconnecting cable. The sensor Probe can be mounted up to maximum distance of 100 meters from the monitoring unit.

These pulses are digital in nature and the circuit is designed to work in electrically noisy area. However, the interconnecting cable should be of minimum 0.5sq. mm. Size. A LED provided on rear side of the probe gives visual indication for sensing of the flag. In case of sensors other than Inductive type the pulses generated are to be connected as specified for the individual sensor.

The monitoring units are available in different in different types of circuits as per requirement. Standard units consists of our own design HYBRID circuit incorporating digital ICs. The speed dependent pulse generated by Sensor Probe are compared with a reference frequency generator and an effective output signal is produced to drive a output relay at the preset speed value.

The new advance models incorporate **Microcontroller** based circuit. The total operating features e.g. time delay, speed comparison, speed delay, output relay operation are controlled precisely by the controller.

Some parameters, related to design / operation of a speed switch, are as explained below.

### Relay Logic

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

### Initial by-pass time del ay(ITD)

For monitoring under speed conditions it is essential to have a by pass arrangement during starting of machine. The output relay of speed monitor is 'OFF' during starting / under speed condition and is 'ON' (energized) during healthy running speed. Hence it is essential to bypass(override) the relay contacts during starting. This can be achieved by using either a external timer unit, by programming thru PLC or by using a built in by-pass time delay (ITD).

with the built in ITD feature 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 continues 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 running.

### Nuisance Tripping Time Del ay(NTD)

During running, equipment may lose its speed momentarily due to various reasons. To avoid 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 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

The different series have basic difference in construction and circuit design. However, some standard models in each series are as described below

Model	Enclosure / Features
RM2211	Robust CA / Separate Terminals
RME211	Industrial CA / Single PCB with built on terminal / Relay etc.
RME261	Industrial CA with digital display
RM D151	Brass / SS Tubular enclosure for directly working with PLC.

## GENERAL SPECIFICATIONS

The different models have some specifications in common as below. For detailed specifications refer datasheet of individual product.

Power consumption : 5 VA max  
 Working Temperature : 0° To 55° C  
 Repeat Accuracy : Better than  $\pm 1\%$  of set value.

**Contact Rating** : 6A resistive at 240 V AC

**Speed Range / No. of flags** : The units are calibrated to work for the following calibration as 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. flags can be used for 10-100 RPM with 2 flags

## Under Speed Switch : Characteristics and Typical Schematics

Relay Operation	Recommended Schematics
<b>OPERATION</b> 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> b0 : Stop PB    c1 : Control Contactor    ESS : Electronic Speed Switch e0 : Control Fuse    b1 : Start PB e1 : Thermal O/L    d1 : ON delay Timer

# SENSOR PROBES

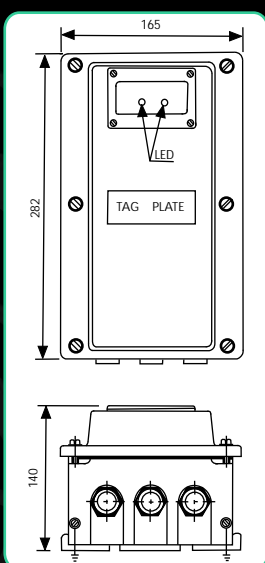
INDUCTIVE				MAGNETIC											
Standard Tubular Models				CA Enclosure with IP 55 Protection		CA Enclosure with Extension Stand		Magnetic Sensors							
															
TYPE				SP 12 B XX		SP 12 PE XX		SP 12 ES100		MSP XX					
				18	30	50	80	30	50	To be Used for Sensing Linear Speed of Belt		12	18	50	75
Sensing Gap. mm	Noml.	6	15	20	35	10	15	5	3			50	90		
	Effct.	3	8	12	25	6	10								
Termination				Built on 2 m 3 Core PVC. Flex. Cable		Built on Terminals		Built on Terminals		Built on 2 m 2/3 Core PVC Cable Teflon cable For Temp. Upto 250°C					

## Installation and Operation

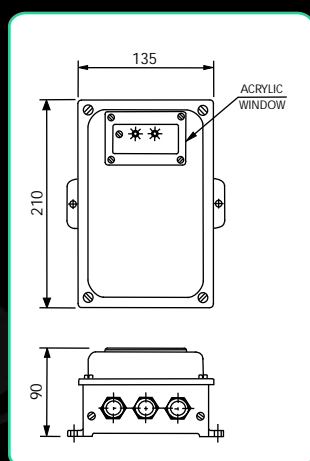
**1) Installation of probe and Rotating flag :** The probe is to be mounted in front of rotating object. Specified no. of metallic flags should be mounted on rotating object. The flag size(dia) should be same as probe dia to achieve the specified sensing gap. The flags should be mounted on specified PCD at exactly equidistance. Square or odd shape flags can affect the performance of unit. The signal from probe should be connected to monitoring unit via a separate shielded / armoured cable of minimum 0.5sq. 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.

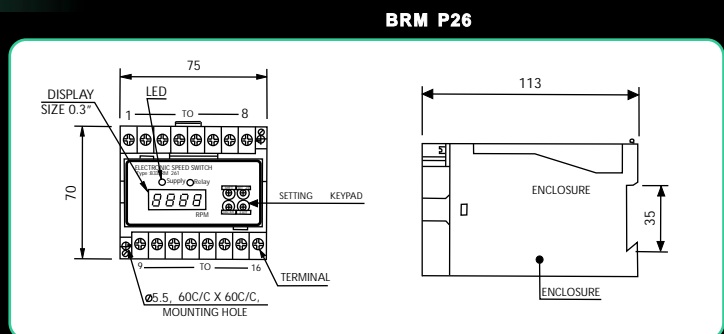
## Dimension details for standard models



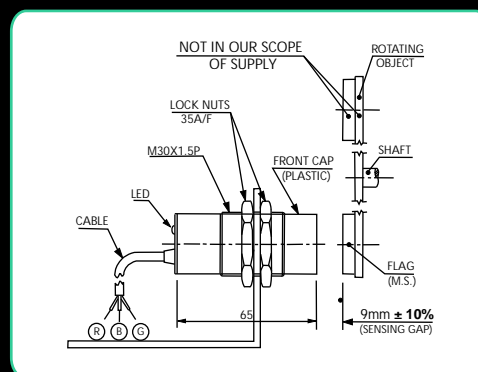
**BRM 221**



**BRM E21**



**BRM P26**






**SENSOR PROBE**

**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.



# MONITORING UNITS

## Specifications for Standard Models

								
<b>Series</b>	<b>BRM 221</b>	<b>BRM E21</b>	<b>BRM P21</b>	<b>BRM C21</b>	<b>BRM P21-FP</b>	<b>BRM 2060</b>	<b>BRM P26</b>	<b>BRM D15/BRM D17</b>
<b>Circuit Technique</b>	Hybrid Circuit with Digital IC	Hybrid Circuit	Hybrid Circuit	Hybrid Circuit	Hybrid Circuit	Micro-controller	Micro-controller	Discrete circuit With Digital IC
<b>Duty</b>	Under/Over/Dual speed	Under/Over/Dual speed	Under/Over/Dual speed	Under/Over/Dual speed	Under/Over/Dual speed	Speed Indication only	Under/Over/Dual speed	Under speed
<b>Enclosure</b>	Robust CA / CI	CA / CI	Plastic-DIN Rail	Ind. Plastic (Velox)	CA for Gr-IIA, IIB & IIC and CI for Gr-I	MS	Plastic-DIN Rail	Brass / SS tube
<b>Protection Grade</b>	IP-65	IP-65	IP-30	IP-65	IP-65	IP-30	IP-30	IP-67
<b>Dimensions</b>	282Hx165Wx140D	210Hx135Wx88D	70Hx60Wx113D	222Hx146Wx100D	304Hx175Wx160D	96Hx96Wx160D	70Hx75Wx113D	M30x1.5Px100D
<b>Contact Combination</b>	1NO+1NC,2NO+2NC,1C/O, 2C/O	1NO+1NC,2NO+2NC,1C/O, 2C/O	1NO+1NC, 1C/O, 2C/O	1NO+1NC, 2NO+2NC,1C/O 2C/O	1NO+1NC,2NO+2NC,1C/O, 2C/O	NA	1NO+1NC, 1C/O, 2C/O	Static Output
<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	Any single range in 1:10 ratio for 0.1 RPM to 5000 RPM	0 to 10000 RPM Speed Indication only	5 to 5000 RPM	10 to 100 RPM 100 to 1000 RPM
<b>Display</b>	Red LED for Supply ON and Green LED for Relay ON	Red LED for Supply ON and Green LED for Relay ON	Red LED for Supply ON and Green LED for Relay ON	Red LED for Supply ON and Green LED for Relay ON	Red LED for Supply ON and Green LED for Relay ON	7-segment Red LED	Red LED for Supply ON. Green LED for Relay ON. Digital 7-segment Red LED Display.	LED for Healthy speed indication
<b>Terminals</b>	Suitable to terminate wires of upto 2.5 sq mm-Built-on screwed type	Suitable to terminate wires of upto 2.5 sq mm PCB mounted	Suitable to terminate wires of upto 2.5 sq mm-Built-on molded	Suitable to terminate wires of upto 2.5 sq mm-Built-on molded	Suitable to terminate wires of upto 2.5 sq mm stud type	Suitable to terminate wires of upto 2.5 sq mm	Suitable to terminate wires of upto 2.5 sq mm-Built-on molded	Integrated 2/3 core PVC cable 2 m long and 0.4 sq mm conductor size.
<b>Sensor Probe type</b>	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Inductive	NA
<b>Setting Accuracy</b>	+/-5%	+/-5%	+/-5%	+/-5%	+/-5%	NA	+/-1%	+/-10%
<b>Additional Features</b>	1) Multirange selection. 2) Digital Display 3) 4-20mA for remote signal 4)Nuisance & Initial bypass delays	1) Multirange selection. 2) Digital Display 3) 4-20mA for remote signal 4)Nuisance & Initial bypass delays	1) Multirange selection. 2) 4-20mA for remote signal 3) Nuisance & Initial bypass delays	1) Multirange selection. 2) 4-20mA for remote signal. 3) Nuisance & Initial bypass delays	1) Multi range selection. 2) 4-20mA for remote signal. 3) Nuisance & Initial bypass delays	1) 4-20mA for remote signal.	1) 4-20mA for remote signal. 2) Nuisance & Initial bypass delays	1) Also available in higher dia with additional protective enclosure 2) SS housing for aggressive environment.

# ORDERING INFORMATION

RM 2 2 1 1 XXXX XX X CA 11 B XX

## Basic Model

2 : Heavy Duty Outdoor  
P : Plastic DIN Rail Indoor  
E : Industrial Grade Outdoor  
C : Plastic IP-65 Outdoor  
D : Direct PLC application

## Speed Setting Method

0 : No Setting  
1 : Trimpot  
2 : Knob  
3 : Thumbwheel  
4 : Not Used  
5 : Not Used  
6 : Key-pad

## Circuit Principle

1 : Discrete Electronics  
2 : Digital Anemometer  
3 : Discrete Component AC  
4 : Micro-controller based  
5 : Discrete Component DC

## Duty

0 : Only Speed Indicator  
1 : Under Speed  
2 : Over Speed  
3 : Under-Over Speed  
4 : Under with EXT STAND  
5 : Under-speed & belt sequential starting  
6 : Slip Monitor  
7 : Belt Load Monitor / Output logic

## Time Delay Feature / Output Logic

Nil : Standard Model  
TD : With ITD  
NTD : With NTD  
NITD : With ITD & NTD  
NO : Static NO  
NC : Static NC

## Display Facility

Nil : No Display  
DD : Digital Display

## Probe Size

12/18/30/50/80/mm dia x 65mm length  
01 : Anemometer cups 120 diameter  
02 : Extension Stand 100mm Roller  
03 : Belt Loading Monitor 100mm Roller

## Probe Enclosure

B : Brass tube Non Flush  
S-SS Tube  
A : Plastic tube  
PE : Protective enclosure  
W : Anemometer Cup  
ES : Extension Stand (Cast Al)  
BLM : Belt Loading Monitor (Cast Al)

## Output Contacts

11 : Ino + 1NC  
22 : 2ND + 2NC  
1C : 1C/0  
2C : 2C/0

## Monitoring Unit Enclosure Details

MS : Mild Steel	IP-30
CA : Cast Aluminium	IP-65
CI : Cast Iron	IP-65
PC : Polycarbonate	IP-65
PL1 : Ind. Plastic	IP-65
PL2 : ABS Plastic	IP-30
FPA : Cast Aluminium FLP	IP-65
FPI : Cast Iron FLP	IP-65
B : Brass Tube	IP-67

## Range Selector Switch

Nil : Calibrated dial in 1:10 Ratio  
S-2: Two position selector switch  
S-3: Three position selector switch

## 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

**BRM E211-TD CA-11-B30**

## Special Applications

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 of rotating object near zero speed and switches off 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 signal if any of the sensor stops giving pulses.

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