JAYASHREE ELECTRON

Monitoring Rotary and Linear motion

Electronic Speed Switches

Technical Bulletin 221-08

JAYASHREE ELECTRON

PIONEERS IN ELECTRONIC SPEED SWITCHES

Over 2,00,000 units in operation Since 1980

INTRODUCTION

Monitoring Speed is essential in any automation process. Speed of any equipment driven by an electric motor can change due to a variety of reasons e.g. overload, under load, breakage of transmission parts etc. This change should be monitored continuously for corrective action and to save costly equipment from damage. In case of a 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 35 years. We have more than 50 different models to suit individual applications. Over 2,00,000 units are in operation throughout the world.

By continuously upgrading to the latest technology, our speed monitoring units keep pace with time. With over 2000 satisfied customers we are committed to maintain high quality, reliability of product 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 : Underspeed / Zero Speed monitoring for conveyors. Useful for Sequential starting / stopping of conveyors, overspeed safety for downhill conveyors.

Cement/Fertilizer : Conveyor Belts, Agitators, Stacker-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.

Ports / 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 recognised house Certificate for Gas Group IIA,IIB and IIC.

Supply Voltage : 12/24/110/240 V 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 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 available are 1NO+1NC, 2NO+2NC, 1C/O or 2C/O.

Output Signals : a) 0-10 V / 4-20 mA Proportional to specified speed range b) RS 485/RS 232 / MODBUS

Display : a) Dot LED for supply ON / Relay ON b) Speed Pulses c) Digital Seven Segment LED display up to 6 digits 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 55/65	Robust CA/CI/ABS
	Flame Proof	CA/CI/as per Requirement
Flush / Panel Front	IP30	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 size 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 0.5 sq. mm. size.

These pulses are digital in nature and the circuit is designed to work in electrically noisy area. An 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 can be connected as specified for the individual sensor.

The units are designed by using new advance Microcontroller 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)

For 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 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 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% hysterisis 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
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

Some technical specifications are common for all models as given below. For detailed 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.

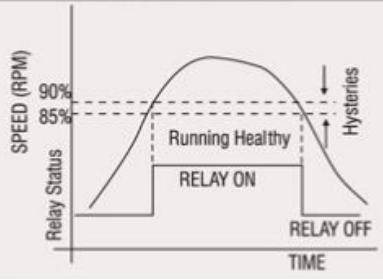
Contact Rating : 5A resistive at 240 V AC./8 A on request
Speed Range / No. of flags : The units are calibrated to work for the following calibration as per our standard.

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. flags can be used for 10-100 RPM with 2 flags.

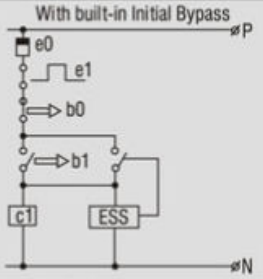
Under Speed Switch : Characteristics and Typical Schematics

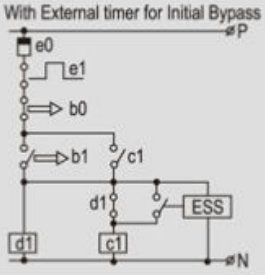
Relay Operation



OPERATION
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.

Recommended Schematics





NOMENCLATURE

b0 : Stop PB
e0 : Control Fuse
e1 : Thermal O/L
c1 : Control Contactor
b1 : Start PB
d1 : ON delay Timer
ESS : Electronic Speed Switch

MONITORING UNITS : Specif




Series	RM E21x	RM E26x	RM 221x	RM 221x /
Duty	Under/Over/Dual Speed	Under/Over/Dual Speed	Under/Over/Dual Speed	Under/Over/D
Enclosure	CA / CI	CA / CI	Robust CA / CI	CA for Gr-IIA, and CI for Gr-I
Protection Grade	IP-65	IP-65	IP-65	IP-65
Dimensions	200H x 135W x 88D	200H x 135W x 88D	280H x 155W x 125D	272H x 272W x
Contact Combination	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, 2N 1C/O, 2C/O
Speed Setting	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 ran for 0.1 RPM to
Display	Red LED for Supply ON and Green LED for Relay ON	Red LED for Supply ON Green LED for Relay ON Digital 7-Segment Red LED	Red LED for Supply ON and Green LED for Relay ON	Red LED for S Green LED for
Terminals	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 ter upto 2.5 Sq.m Moulded
Sensor Probe Type	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Induc
Setting Accuracy	+/- 5%	+/- 5%	+/- 5%	+/- 5%
Additional Features	1) Multi range Selection 2) 4-20mA for remote signal	1) Multi range Selection 2) Digital Display 3) 4-20mA for remote signal	1) Multi range Selection 2) Digital Display 3) 4-20mA for remote signal 4) Nuisance & Initial bypass delays	1) Multi range 2) 4-20mA for 3) Nuisance &

SENSOR PROBE

		INDUCTIVE							MAGNETIC			
		Standard Tubular Models				CA Enclosure with IP 55 Protection		Probe with Extension Stand	Magnetic Sensors for High Temp. Applications			
												
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 PVC 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.

ations for Standard Models

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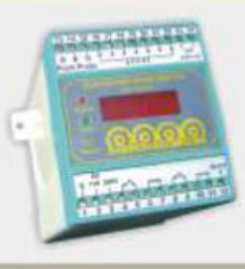
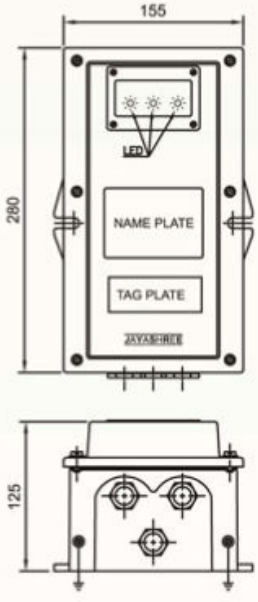


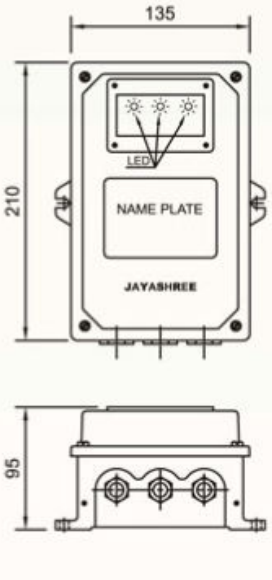

	RM P21x / FP	RM 226x	RM P26x	RM D15x / RM D13x
Speed	Under/Over/Dual Speed	Speed Indication only	Under/Over/Dual Speed	Under Speed
& IIC	CA for Gr-IIA, IIB, & IIC and CI for Gr-I	MS	Plastic-DIN Rail	Brass / SS tube
	IP-65	IP-30	IP-30	IP-67
0D	304H x 175W x 160D	96H x 96W x 160D	75H x 80W x 122D	M30 x 1.5P x 100L
- 2NC,	1NO + 1NC, 1C/O, 2C/O	N/A	1NO + 1NC, 1C/O, 2C/O	Static Output
n 1:10 Ratio 00 RPM	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 100 to 1000 RPM
ly ON and ay 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	LED for Healthy Speed Indication
ate wires of Built-on	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 PCV cable 2 m long / 0.4 Sq.mm.
	2/3 Wire Inductive	2/3 Wire Inductive	2/3 Wire Inductive	N/A
	+/- 5%	N/A	+/- 1%	+/- 10%
ction ote signal al bypass delays	1) Multi range Selection 2) 4-20mA for remote signal 3) Nuisance & Initial bypass delays	1) 4-20mA for remote signal 2) RS 485 / Modbus	1) 4-20mA for remote signal 2) Nuisance & Initial bypass delays 3) RS 485 / Modbus	1) Also available in higher dia with additional protective enclosures 2) SS housing for aggressive Environment

DIMENSION DETAILS FOR STANDARD MODELS

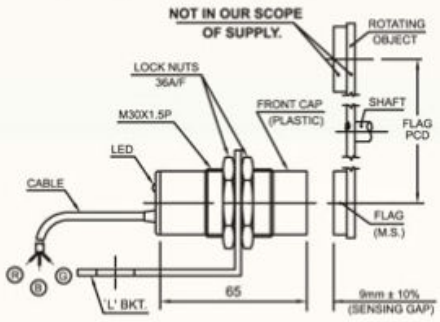
RM 221x



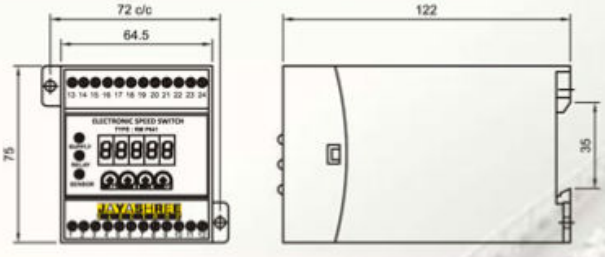
RM E21x / RM E26x



SENSOR PROBE M30 SIZE

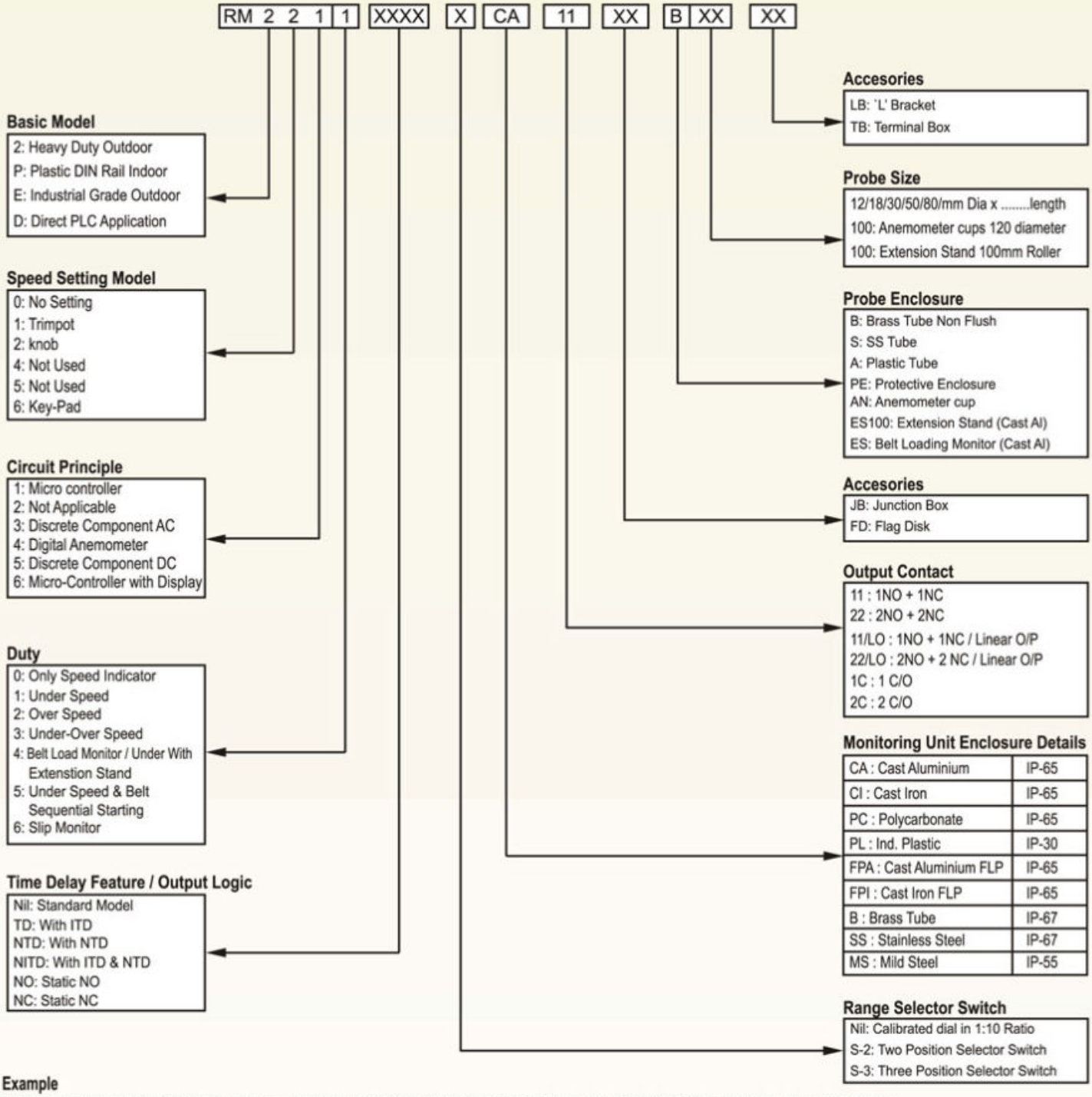


RM P26x



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 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 switch of the 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 stops giving pulses.

iv) Defense Applications : A very high precision (12 bit-microcontroller) unit for measuring and display speed of a bullet of 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 E214BL 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 off due to sharp metal prices and stray objects and can lead to heavy losses it 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 mtrs. 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 RM313 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 aluminum IP65 grade enclosure.

The unit has a Zero and span adjustment facility. The conversion accuracy is within ± 2%

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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 or 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 of 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 a 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.

Ultrasonic Level Sensor Series SW 305

The Ultrasonic Level Sensors of the Series SW 426 are very useful for sensing high levels (up to 10 – 20mtrs.) of Liquids or slurry material. The Sensor gives a 4 – 20mA output signal to the controller and it will operate relays at preset high and Low Levels. Separate probes are available for sensing water levels of 5/10/15/20 mtrs.

PROXIMITY SWITCHES

Inductive, Capacitive, Optical, Magnetic, Ultrasonic

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

Special models for :

- High Temperature
- High pressure
- Welding application

PACE / ESS / Aug14 / 3000

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