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OPERATING DEVISIONS: Counting Devices, Inc. - Rotoguard III - Acousticlean

Model PRX 120 Installation and Operation Manual

1.0 DESCRIPTION

The Model PRX Speed switch is a micro-controlled, field adjustable, multi-setpoint speed / rate monitor that provides 4 character alpha-numeric visual indication and relay output. The unit offers many versatile features that provide flexibility in application and confidence in sensing. Full diagnostic functions including alarm condition (over-speed or under-speed), auto scaling (eliminates out of range parameters) and error detection. Features include Overspeed and Underspeed simultaneous monitoring, programmable relay action, and non-contacting sensing. This unit is packaged in a NEMA 4/5 enclosure with a transparent Lexan cover for dust and moisture protection.

2.0 OPERATING THEORY

The speed monitor unit utilizes a microcontroller and proprietary internal software routines to precisely monitor the speed or rate of the process. The pulses are converted to an electrical signal. The microcontroller calculates the integral time between the pulses, then compares that value mathematically to the pre-programmed settings selected by the user. The microcontroller has the ability to execute 4-million instruction cycles per second. The fast execution allows it to accurately monitor very fast or very slow speed / rate conditions. The microcontroller also provides flexibility while offering many options found only in high-priced computer controlled systems.

3.0 SPECIFICATIONS

Enclosure: NEMA 4/5 Dust & Moisture proof, cast aluminum, epoxy powder coated housing with transparent Lexan cover, with 1 (1/2-NPT) endwall conduit entry.

Conduit Entry: (1) 1/2” NPT

Power Input: 120 VAC (other options available)

Sensor: 10-30VDC NPN 18mm (3/4") Shielded NO proximity sensor w/6.5' long axial cable. 0.315" (8mm) sensing distance with LED indicator light. (other options available)

Supply Current: 100mA Max.

Output: Relay 5A SPDT 250VAC UL / CSA (1-form C contact)

Temperature Range: -40 to +158F (-40 to 70C)

Memory: Nonvolatile, 10-year retention minimum.

Frequency Range: 0.1Hz to 1000Hz

Setpoint Range: 20% to 199% of full speed (LSPD low-speed & HSPD High-speed). Internal Autoscaling eliminates out of range parameters.

Relay Reaction Time: Independently Programmable 0 to 255 seconds (Energized ADLY & De-energized CDLY)

Start-Delay: Programmable 0 to 255 seconds, activated by initial power applied to the device.

Will not re-occur until power is removed & re-applied.

Programming Setup: INCR (Increment) and ENTER pushbuttons in conjunction with an onboard 4 character alpha-numeric LED display and STATUS & RELAY LED's.

Program Settings: SDLY (start-up delay), LSPD (low-speed alarm setting), HSPD (high-speed alarm setting), RYFS (Relay failsafe condition), ADLY (Relay energize delay), CDLY (Relay De-energized delay), OKAY (condition indicator), ERR 0-9 (diagnostic information). See Programming / Display Parameters for additional information.

Alarm Indicators: 4-character alpha numeric display provides <MIN & >MAX display for alarm condition and ERROR codes for diagnostic. STATUS LED provides pulse indication, RELAY LED indicates condition of relay (energized or de-energized)

4.0 PROGRAMMING / FUNCTIONS:

INCREMENT

The Increment button "*INCR*" is used to sequence through the parameter values. It is also used to increase or increment the input value. The value will increment faster (by 10's) if the button is held down. For single increment (ones), the button can be pressed & released and count will increment by one. If button is held down, value will loop or cycle back and repeat.

ENTER

The "*ENTER"* button is used to sequence through the main menu items. It is also used to "accept" or "ENTER" any programming input values. The *INCR* and *ENTER* buttons are used in conjunction to manipulate the parameter values. *Values will not be committed to memory unless ENTER is pressed when "SAVE" is displayed. The follow-up prompt "SURE" will follow.* Depressing "*ENTER"* again will commit the parameters to memory. This feature is provided so inadvertent values will not overwrite the memory, unless prompted to do so. Depressing "INCR" will default back to previous settings. Depressing ENTER will also display all the existing parameters that are currently programmed within the memory.

4.1 INDICATORS:

STATUS LED: Indicates microcontroller response to incoming data.

BLINKING: Proportional to input pulse frequency below 1Hz. Blinking rate remains at 1Hz as input pulse frequency increase.

OFF: During storage of input data to memory, loss of pulses or delay between pulses.

ON: During Start up delay (SDLY) routine. Delay between pulses,

RELAY LED: Indication of Relay condition.

OFF: Relay de-energized or "Cleared".

ON: Relay energized or "Activated".

4.2 DISPLAY PARAMETERS:

SDLY: Start-up Delay: Programmable from 0~255 seconds. Activated when power is initially applied to the unit. Sets the relay to a predetermined (RYFS, see below) condition and disables alarm monitoring during the delay period. This may be enabled if equipment requires additional time to reach running speed, eliminating the alarm / monitoring device from shutting it down before speed is attained. Once power is applied, SDLY will not reoccur until power is removed, then again reapplied.

ADLY: Activate Relay (Energize) Delay, programmable from 0~255 seconds, factory default set to 1. This variable provides a delay to the relay action when the monitor energizes the relay. The value is in seconds, and will delay the condition until the internal timer has expired. Condition must be present throughout the delay, else timer will reset.

CDLY: Clear-Relay Delay or de-activate (De-Energize), programmable from 0~255 seconds, factory default set to 1. This variable provides a delay to the relay action when the monitor de-energizes the relay. The programmed value is in seconds, and will delay the condition until the internal timer has expired. Condition must be present throughout the delay, else timer will reset.

HSPD: High-Speed alarm set-point: programmable from 101% ~ 199%. (Default 125%). Value is a percentage, based on the full-speed calibrated (CALS) running rate. HSPD value is for overspeed monitoring (free-wheeling or loss of load).

LSPD: Low-Speed alarm set-point: programmable from 20% ~ 99%. (Default 75%). Value is a percentage based on the full-speed calibrated (CALS) running rate. LSPD value is for underspeed monitoring (overloading or drive breakage).

RYFS: Relay Failsafe condition, programmable for “ON” or “OFF” when alarm occurs.

ON: Relay activated (energized) under normal “OKAY” condition. De-energizes or clears during an alarm condition.

OFF: Relay De-activated (de-energized or clears) under normal “OKAY condition. Energizes or activates during an alarm condition.

NOTE: *Alarm conditions can be caused by speed / rate outside the selected parameters (slow down or excessive speed) or power-failure etc.*

CALS: Calibration Speed procedure, activated by depressing the ENTER & INCREMENT buttons simultaneously, performed *ONLY* while process is running at desired speed or rate. The CALS procedure can be performed anytime power is applied to the device, regardless of the alarm status of the monitor. During the calibration (CALS) procedure:

“Status” LED will turn-off during sequence. CALS is displayed while calibration information is stored in memory. “*OKAY”* is displayed after value has been accepted. If value is not accepted, NCAL (no calibration) is displayed. NCAL can be a result of operating speeds outside of the sensing range or improper procedure. Relay may or may not change states depending on if CALS was initiated during an alarm condition or normal (OKAY) condition. ERROR codes may be displayed if a fault occurs. (See Calibration section 6.0)

4.30 DISPLAY INDICATORS:

Display indicators are visual representations of how the monitor is responding to the information it is processing.

OKAY: Indication of normal operation. Unit has been properly calibrated. Running speed or rate is within the HSPD & LSPD parameters.

CALS: Displayed during calibration procedure as values are entered into memory to represent the current running speed or rate as ideal.

NCAL: Displayed if operation speed or rate is outside of the units sensing range (0.1Hz~2500Hz) after a CALS attempt. Indicates the calibration procedure was not accepted. Also indicates if memory has no reference to a previous calibration value (unit never calibrated).

WPUL: (Waiting for pulses). Displayed if pulses are not sensed by the microcontroller. Causes: Process has ceased (no rotation or rate). Defective or incompatible proximity switch / sensor. Improper wiring of sensor to monitor.

>MAX: Greater than Maximum speed or rate above (HSPD) High-speed set-point: Displayed if the monitored speed or rate exceeds the HSPD pre-set value.

<MIN: Less than Minimum speed or rate below (LSPD) Low-speed set-point: Displayed if the monitored speed or rate falls below the LSPD pre-set value.

4.31 ERROR CODES:

ERR0: Power-up delay timed out.
ERR1: Pulse input frequency too high. (In excess of 1000Hz)
ERR2: No-Pulse time-out. (Proximity sensor not picking up or sending a signal back to the board. Check sensing distance or wiring)
ERR3: Calibration Error. (Try re-calibrating)
ERR4: LSPD percentage too low for calibrated value.
ERR5: HSPD percentage too high for calibrated value.
ERR6: EEprom read error. (Software problem contact the factory)
ERR7: EEprom write error. (Software problem contact the factory)
ERR8: Switch error. (Try re-calibrating)
ERR9: EEprom or Display data corrupt. (Software problem contact the factory)

5.0 INITIAL SET-UP:

1. Mount the Monitor unit & proximity-switch in an appropriate manner.
2. Connect the proximity switch to the SW1 terminal block if it has not been done so at the factory (Note +, - & L (Load))

3. Connect proper power supply to terminals marked L1(line 1), L2 (Line 2) and G (Ground).
4. Connect relay to operating / alarm system per terminal designation C (common) NO (Normally Open) and NC (Normally Closed).
5. Most parameters can be programmed upon power-up, and prior to calibrating the running speed (see Sections 4.0~4.31)

6.0 CALIBRATION:

Running speed calibration (CALS) is performed with process running at normal speed and power applied to the switch. If the speed switch relay contacts are wired Normally Closed (NC) like you would do for a shut-off, lock-out or stop switch during alarm conditions, it may impede the initial calibration process by shutting the system down before calibration is completed.

Options are as follows:

(A) Disconnect the relay contacts from the operating system. Perform the calibration (CALS) procedure. Reconnect relay contacts.

(B) Increase the value of SDLY to allow the necessary time for the system to attain running speed and perform CALS procedure. Calibration (CALS) can be performed during the SDLY routine by following the CALS calibration procedure. Be sure to re-configure SDLY to an appropriate value once calibration is complete.

LSPD (low-speed set-point) and HSPD (high-speed set-point) are factory default set to 75% & 125% respectively. These values represent the percentage slow-down or increase the speed or rate must be subjected to before alarm (relay action) occurs. These set-points should be adjusted to a value that reflects safe & practical operating parameters, that also characterize the system that is being monitored.

6.1 Program Example:

Overview:

Conveyor Belt System: Normal (loaded) running speed of 200-RPM. Speed monitor device is powered-up at the same time the conveyor motor receives power. Normal start-up time (to achieve 200RPM) is about 10 seconds. Motor overload occurs if beltload is too heavy, and speed falls to 180-RPM. Sometimes initial loading slows the process for a few seconds, this is normal, and should not activate the alarms. Prefer Relay to be failsafe, so contacts change at alarm and/or power-loss.

Selected Values:
SDLY= 12 seconds (initially set higher to 25 to accommodate the start-up calibration)
ADLY= No preference, (default=1)
CDLY= 3 seconds, to accommodate the “few-second” initial loading w/o alarming.
HSPD= Does not apply here, (default =125%).

Calculate desired speed:

Alarm Speed ***X 100 = Set-point Value***
Running Speed

(Be sure to use same "speed" units (RPM or Hz) when calculating set-point Value)

LSPD= 90% (180RPM divided by 200-RPM x 100 = 90% of Full-Speed for alarm)
RYFS= ON (Relay energized under normal conditions, so de-energizes at alarm or power-loss).
Prior to starting the system, SDLY is re-adjusted to 25 seconds. Upon power-up, the SDLY activates the relay for 25 seconds, forcing a "normal" condition to the relay while the system attains normal running or operating speed. This will allow the necessary time for the system to attain speed, and provide additional time to allow the Calibration (CALS) procedure.

During this time (25 seconds) while SDLY is displayed, simultaneously depress the "ENTER" and "INCR" switches, and hold until "CALS" is displayed on the menu. Release the switches. STATUS LED does not blink during SDLY of CALS routines. OKAY is then displayed while calibration value is stored in memory. Although SDLY is no longer displayed, the internal timer is still counting the 25 seconds. When internal SDLY time is depleted, the STATUS LED will begin blinking. System is now operational. SDLY value can now be changed to 12-seconds, without affecting monitoring. Be sure to press "ENTER" to "SAVE" and 'ENTER" again when "SURE?" is displayed to commit the new value to memory.

Low-Speed (LSPD) Alarm (<MIN) will occur if RPM falls below 180 RPM, after 3-seconds.

6.2 Options for Over-Speed sensing to above example: (belt breakage, loss of load etc)
200-RPM normal running speed, 250-RPM light-loaded (+/- 10%), faster running speed is potential problems and must not exist!

Calculate Overspeed alarm point: 250-RPM + 10% (25-RPM) = 275-RPM or greater.

(275/200) x 100 = 137.5% over-speed. Select 138%

HSPD=138%, Alarm (>MAX) will occur if rotation exceeds 275 RPM after 3-seconds.

All alarm conditions are self-clearing once speed / rate returns within the setpoint values.

7.0 PROGRAMMING CONCERNS

- Both HSPD & LSPD are percentage variables, based on the normal calibrated running speed of 100%. Under-Speed value range is 20%~99% of Full-Speed. Over-Speed value range is 101%~199%. Values outside this range will not be accepted.

- Although programming values allow 20%~199%, values entered must be within the overall operating parameters of the device .1Hz to 1000Hz

- Values cannot be entered outside the operating parameters of the device. Attempts will be auto-scaled to the allowable sensing range.

Example: Running speed of 800Hz, HSPD=199%.

Under these conditions, High-Speed (HSPD), >MAX alarm would not occur until 1592Hz (800 x 199%). That value is outside of the device operating range (1000Hz Maximum). The Auto-Scaled Value would automatically be (1000/800 x 100) = ***125%*** entered into the HSPD parameter. This process applies for HSPD & LSPD values.

(*Value may vary slightly depending on actual sensing & other uncontrolled tolerances*).

8.0 SPEED CONVERSION & RANGE CALCULATIONS:

Operating range, and conversion calculations from Hz to RPM are dependant upon the number of pulses or triggers per 1-revolution. With only 1-pulse per revolution, 1Hz is equal to 60-RPM (*1-pulse per second, X 60 seconds per minute = 60 RPM*). Under-speed limit is 0.1Hz, which would then equate to *6 RPM*.

This is not a limiting factor since pulses can be mechanically manipulated by adding or subtracting vanes, bolt heads, spokes, holes, etc in the monitoring device wheel or hub. The Inductive proximity sensor detects ferrous (iron) metals best, but can sense other metals also. Sensing distance may vary depending on the metal & trigger configuration.

A sensing wheel / hub with 6 triggers allows the speed to be reduced by a factor of 6, which then equates to 1-RPM, even though the monitoring device is still limited to 0.1Hz. 60 triggers, or holes per revolution would allow speeds reduced near 0.1-RPM.

1 pulse per revolution would allow over-speed monitoring to values in excess of (*1000Hz x 60seconds*) 60,000 RPM! The same wheel with 6 triggers would be reduced to 10,000 RPM. Whereas 60 triggers would allow monitoring speeds around 1000 RPM.

9.0 APPLICATION CONSIDERATIONS

- Verify that the unit is compatible with the process, voltage, temperature, construction, and area classification.
- Proximity switch sensing distance must be correct, secure & maintained for consistent operation (see proximity sensor data sheet enclosed)
- Proximity switch detects the presence and absence of metals, and should be located near the rotational process being monitored.
- Always install according to the National Electrical Code or local standards.
- Do not use this device in hazardous areas.
- Seal all conduit entries to the enclosure.
- Close transparent cover immediately once programming is completed to minimize exposure to dust & weather.

10.0 TROUBLESHOOTING

Troubleshooting the **monitor**:

- Verify input power with an accurate volt meter. The accepted tolerance is ±10%.
- Confirm proximity sensor is positioned within tolerance and is providing output. Slower speeds can be monitored with a DVM (voltmeter), otherwise an oscilloscope may be

required. STATUS LED should flash, as well as proximity LED on body of sensor (if applicable)

- Verify device has been properly calibrated, and running speed has not changed since calibration. Recalibrate (CALS) if necessary.
- Confirm HSPD or LSPD has proper tolerance for non-concentric or non-linear rates or rotation. Incrementing ADLY or CDLY may offset random / nuisance alarms.

11.0 ASSISTANCE

If you encounter problems after reviewing the manual, contact your Sales Representitive or distributor. Additional support can be obtained by e-mailing the factory Engineering department at controlconcepts@sbcglobal.net , referring to WWW.Speedswitch.com or by calling 1 (800) 745-6551, 8:00 AM-4:30 PM EST.

Please have your model-number and serial-number available when calling.

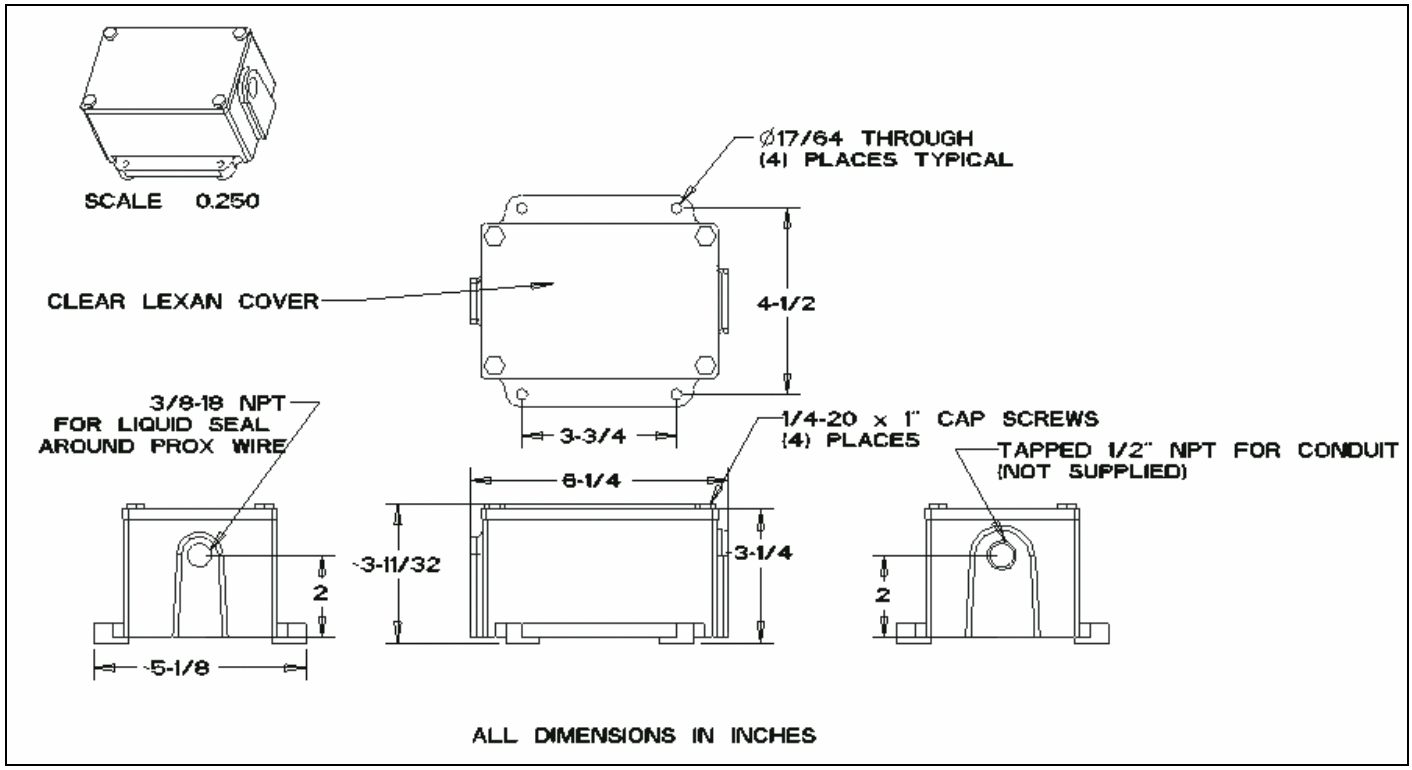
12.0 WARRANTY & PARTS

12.1 Control Concepts' warranty for this unit for 24 month from the date of sale.

12.2 Replacement boards, proximity sensors, seals, gaskets, and covers can be obtained from Control Concepts. Call us at 1 (800) 745-6551 or order on-line WWW.Speedswitch.com

13.0 DRAWINGS

13.1 Overall Dimensions of Control Box



13.2 Wiring details of plug: