

RAYAN P-10

Over-speed Protection System



AHAR PowerStation Services

Product Data Sheet

Over speed Protection System

IEC 61508-SIL3 certified

Model: RAYAN P-10



Description

The RAYAN P-10 system is designed for protection of rotating machinery such as turbines, compressors, expanders and motors against over speed event, with safety requirements SIL3/IEC61508 and/or API 670.

The RAYAN P-10 consists of three independent modules whose trip outputs are voted in two 2-out-of-3 configuration.

Trip condition can be latched.

The system faults are detected and issue an alarm condition on digital output, system event log and front module LED.

There are several ways to interface RAYAN P-10. The front panel allows the user to view current values, and to perform configuration and test functions.

All of the features and most of the information available from the front panel are also accessible via the Profibus interface. Finally, the Programming and Configuration Tool (Raylink) is a software that is run on a PC to download log files and manage settings files.

Functionality

The system includes three independent Monitoring Modules A, B and C for the calculation of speed input and releasing a trip output if the measured speed, exceeds the user defined set point. Each monitoring module has two trip output relays which are de-energized to trip.

Each trip output contributes in a voting logic and release a voter trip if 2 out of 3 of monitoring modules detect an over speed.

A released trip status can be latched.

Trip is released by shut down of the Trip Circuits (two voter outputs on each over speed set) to the solenoid valve block if:

- 2oo3 monitoring modules detect over speed condition
- 2oo3 monitoring modules detect External Trip Condition by user input

The number of over speed detection sets can be increased to two on one 19" rack. It can be used as a solution for two shaft turbines or multiple devices.

Key Features

- Safety level up to SIL3
- Triple Modular Redundancy
- Fast reaction time <15msec
- Two Internal 2oo3 voting relays
- Automatic testing
- Optional Isolated analogue outputs
- External-trip input
- Free floating sensor signal repeater
- Hot pluggable modules
- Up to two shaft monitoring and trip on one rack
- Alarm management and event logger
- Configuration via PC software (Raylink) and front panel LCD and keypad
- Communication through Profibus

Specifications

Rotating machines, especially high speed ones, are applied in diverse strategic industries. One of the most important parameters to control is the speed parameter. Accordingly, the speed protection is an important protection of rotating machine.

Based on API670 standard, RAYAN P-10 is designed and produced with all necessary functions that can be imagined for an overspeed protection system. High reliability design and compatibility with IEC61508, SIL3 safety level, guarantees the perfect performance of the equipment.

The accuracy of frequency measurement is 1 Hz in all measuring range. Response time to trip condition is less than 15msec, totally compatible on API670.

System Structure

In RAYAN P-10 structure, there are three speed monitoring modules (SM1021). Each module calculates the input frequency speed sensor independent of other modules. The power supply and sensor path of each module is independent. Monitoring modules de-energize two trip relays on detection of an overspeed situation according to saved parameters. The trip relays are force guided type and their contacts participate in 2 independent 2oo3 hardware voting units.

These two voting units are completely hardware base and can provide a 1oo2 voting in output configuration to increase reliability. (Figure 1)

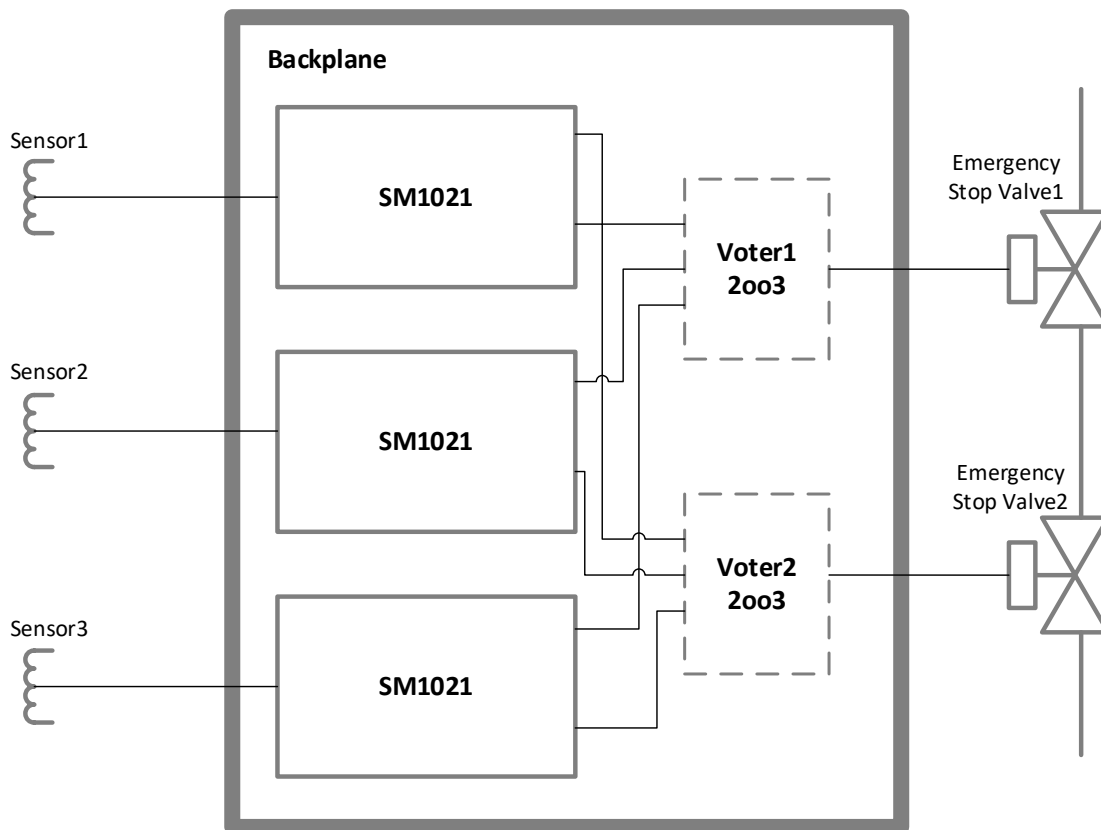


Figure 1: Block diagram of over speed configuration

The system voter can be configured for 1oo2 instead of 2oo3 voting. Also the 4oo6 configuration can be applied to output by inserting 6 monitoring modules on rack.

For two-shaft machines, the rack can be configured for 2 independent sets of overspeed protection, with no need to use another rack.

System is designed in 19" standard rack with 3U height according to IEC60297-3-100 standard. This structure is rack mountable and also can be installed on the panel door.

Monitoring Module

Modules are compatible with various sensor types such as magnetic pickups, proximity sensors and hall Effect sensors.

For increasing the reliability of monitoring modules in safety overspeed tripping, and decreasing the risk of failures, the safety path is completely hardware-based, by using a CPLD of mature technology MAX V, Altera design. All the frequency calculations, comparisons and latching is done on the CPLD, so the probability of processing failures are at minimum.

Each module has a precise analog output according to its input sensor frequency. The analog output is in 4 to 20mA current range.

Each module has a diagnostic processor for monitoring the health of protection path. All module's faults are announced through ALARM outputs. The status of each module also is sent to IM module for detail monitoring and diagnosis.

In addition each monitoring module generates a pulse out of the input sensor, which is called REPEATER output. The frequency of this pulse exactly equals the sensor frequency and it can be used for monitoring or control purposes. This pulse is made independent of processor with high reliability.

Beside the trip contacts which are participate in backplane voting, another contact of trip relays are serried and pulled out on terminals, for user applications. The trip contacts can be defined to be latched.

A ZEROSPEED output signal is considered on terminals, which monitors the stopping of shaft speed. If the shaft speed goes below the detectable limit, this output is activated.

Each module has a diagnostic unit which detects the fault of the module. Main diagnostic functions are:

Sensor fault: sensor faults are detected by frequency comparison of sensors. In sensors that needs power, the sensor fault is also detected by monitoring the sensor current consumption.

MPU check: the processing unit is checked periodically to detects faults as soon as possible and annunciate it as an alarm to user.

Auto-Test: automatic testing of trip path, is done periodically. In this test the simulated frequency is applied to the frequency measuring and protection path and the trip relay status is read. Therefore the main function is tested and alarm will be initiated if a fault is detected.

Interface Module:

In RAYAN P-10 a TFT LCD display with 480*800 resolution is considered. This display besides the special keypad, provide the configuration, system status monitoring, instant speed of modules, alarm and event monitoring.

The alarms and events are logged and can be accessible in future time. All the user commands and inputs, outputs are logged as events. In addition a Profibus communication is there to hand the data to upstream systems.

Interface module is the system port for connecting the RayLink software, which is the configuration software of RAYAN P-10. The connection is through LAN.

RayLink software is a user-friendly environment to communicate with RAYAN P-10. It enables the user to save the settings, reload the settings or copy a system setting to another one.

Defined access levels, protect the system from changing by unauthorized personnel.

Safety Data

IEC61508, SIL3 approved

System type	B
HFT	1
Architecture	2oo3, (also can be used in 1oo2 architecture)
PFDavg	7.13×10^{-5}
SFF	99.2%

Electrical

Supply Voltage

Rated value	24VDC The input power shall compatible with IEC61131-2
No. of power inputs	Independent power for each module
permissible range, upper limit	30VDC
permissible range, lower limit	18VDC
Power consumption	12W for 1 set / 24W for 2 set
Auxiliary Power	24VDC \pm 3VDC

Sensor Input

No. of input per module	1
Input type	AC Voltage
Input range	0.5 to 70 Vrms.
Accuracy	1Hz
Input impedance	33K Ω
Output sensor supply	24VDC \pm 4VDC
Protection	Short circuit protected
Allowed current	120mA

Voters' shutdown output

Number per system	2 independent voters
Status	Energize @ normal condition/ De-energize to trip
Rated Current	4A @ 30VDC
Rated voltage	250VAC
Max. Switching voltage	400 VAC
Contact material	AgSnO2
Min. Recommended contact load	5V/10mA
Contact Resistance	≤100mΩ @ 1A, 24VDC
Frequency of operation, with/without Load	6/150 min-1
Mechanical endurance	10 × 10 ⁶ Operations

External Trip Input

No. of input per system	1
Input type	Contact
Input range	Close for Normal condition/Open to trip
Rated current	250mA
Allowable resistance	<40Ω

Repeater Output

Number per module	1
Rated power source	24 VDC Auxiliaries power supply
Isolated	yes
Min. high level output voltage	16V
high level output current	100mA
Low level output voltage	Open
Short circuit	protected

Zero speed Output

Number per module	1
Status	Low @ zero speed, High @ speeds higher than zero
Rated power source	24 VDC Auxiliaries power supply
Isolated	yes
Min. high level output voltage	16V
high level output current	100mA
Low level output voltage	Open
Short circuit	protected

Alarm Output

Number per module	2
Status	Low @ normal condition, High @ alarm detected
Rated power source	24 VDC Auxiliaries power supply
Isolated	yes
Min. high level output voltage	16V
high level output current	100mA
Low level output voltage	Open
Short circuit	protected

Analog Output

Number per module	1
Resolution	12 bit
Linearity	±0.1%
Isolated	yes
Output range	4 – 20 mA
Over range	4 – 22 mA
Max Load	500Ω
Short circuit	protected

User Interface

LCD Type	TFT 7.0" (diagonal)
Resolution	800x480 pixels
Keypad	HMI type, function described on each page
Monitoring	Speed, Peak speed, Time to test, Status of each module
Logging	Active alarm display, alarm and event display and logging
Configuration	User settings can be entered by keypad

Mechanical

Connection technology	Screw terminals
Rack Dimensions	19" standard rack, 3U compatible with IEC60297-3-100
• Width	480 mm
• Height	140 mm
• Depth	360 mm
weight	5Kg ± 200gr
Installation	Rack mountable/Door mountable
IP degree of protection	20

Programming

Configuration software	
RayLink	Ver 0.9.23.1
Installation Requirements	64 bit operating system
Communications	
Ethernet	For configuration
Profibus	For data monitoring

Environmental conditions

Operating temperature	0 to 55°C
Temperature for storage and transport	-20 to 80°C
Humidity	90% non-condensed

Approval

Safety	IEC61508- SIL3
EMC	IEC61000-6-2
Fast Transient (Burst)	IEC61000-4-4, ±1kV, 5/50ns, 5Khz
Surge immunity	IEC61000-4-5, ±0.5kV, 1.2/50 µs
Electrostatic discharge	IEC61000-4-2, ±4kV contact, ±8kV Air
RF Conducted immunity	IEC61000-4-6, 0.15 to 80 MHz,10V, 80% AM
EMS radiated	IEC61000-4-3, 10V/m, 80MHz to 1GHz 3V/m, 1.4GHz to 6 GHz
Power frequency magnetic field	IEC61000-4-8, 50Hz, 30A/m, 10 min
Temperature	IEC60068-1,2 (0 and 55°C)
Damp heat	IEC60068-30, 55°C and 95%, 24h cycle