AHAR
Power Station Services

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CERTIFIED
FUNCTIONAL SAFETY

RAYAN P-10

Rotating Machinery Overspeed Protection System

Description

Rotary machines are the main part of many industries. These machines are designed to work at a certain rated speed depending on the type of application. keeping machine speed, within rated limit is one of the most important roll of machine protection, if the speed exceeds the limits, serious damaged would be happened to the shaft and other parts of machine.

The **overspeed protection system** is responsible for speed detection of machine and comparing it with the user set value, then react and stop the machine in overspeed conditions.

The **Rayan P-10** is an overspeed protection system designed based on **API670** with high level of functional safety (**SIL3**) in accordance with IEC 61508.
High reliability and unique features of this system make it a suitable selection for protecting all types of high level rotating machines such as turbines and generators in the critical industries such as refineries, power plants, and petrochemicals.

Power Plant

Refinery

Petrochemical

Steel Industry

Copper Industry

Other High-Tech Industries

Key features

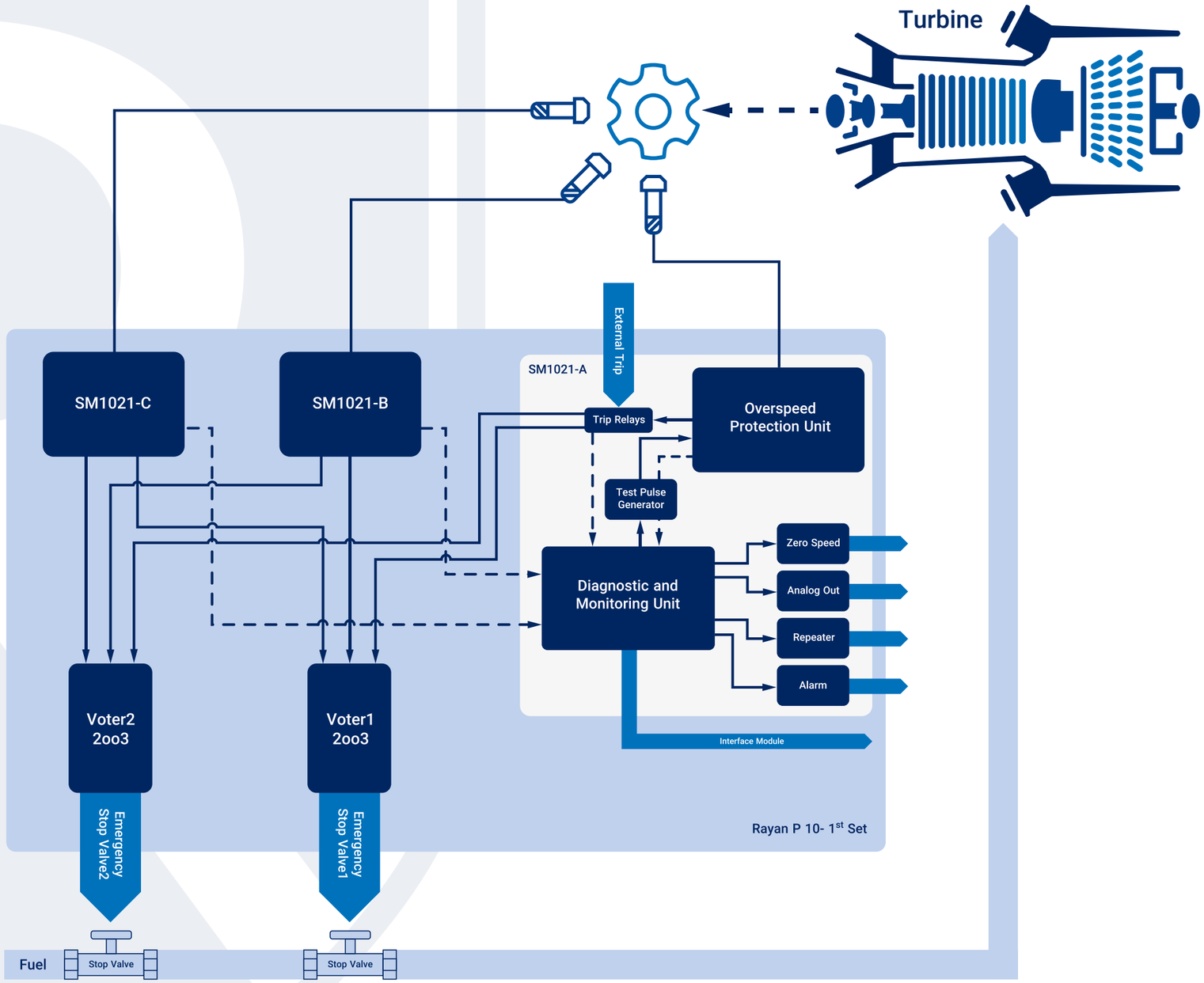
- **SIL3/IEC 61508** certified
- Triple Modular Redundancy (**TMR**)
- Fully Compatible with **API670** standard
- High speed reaction (**Trip < 15ms**)
- High accuracy of frequency measurement (1 Hz in all measuring range)
- 19" rack, standard 3U height according to **IEC60297-3-100**
- The possibility of monitoring and protecting two independent rotating machines in a single rack
- Possibility of configuration with **1oo2, 2oo3, 4oo6** arrangements
- **Automatic test** during system operation
- **Online Repair** with hot pluggable modules
- Alarm management and **event logger**
- Optional Isolated analogue outputs— **4 to 20mA**
- Free floating sensor signal repeater
- **Zero speed detection** and two **alarm relays** outputs
- Configuration via PC software (**RayLink**) and front panel LCD and keypad with password security protection
- **External trip** input
- **multiple communication** platforms such as USB, ProfiBus, ModBus, OPC, Ethernet.

Functionality

In each set of **Rayan P-10**, there are 3 speed modules (SM) that independently measure the speed of the machine and activate their trip output relays if the speed increases more than the limit set by the user.
Each module has 2 trip output relays that are de-energized to trip and trip condition can be latched.

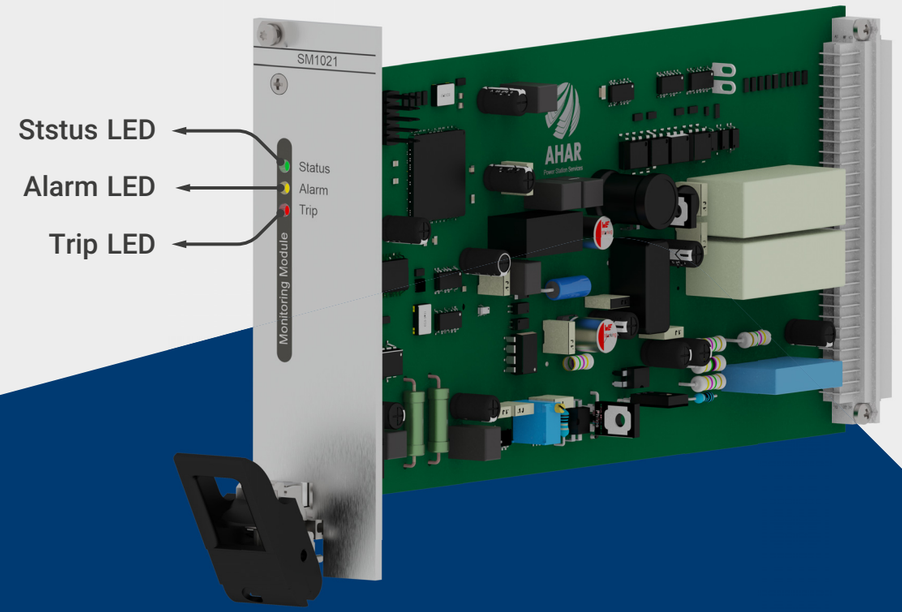
Trip relays are force guided type and their contacts participate in 2 independent 2oo3 hardware voting units. A **2oo3** vote, allows the system to maintain its safe functionality in the event of an error in a module.
If the **1oo2** arrangement is required, the user just needs to remove one of the speed modules from the rack. In addition, the **4oo6** arrangement can be applied to output by inserting 2 set modules (6 speed modules) on the rack.
Each monitoring module has an independent overspeed detection and protection unit, designed completely hardware-based. this results in High reliability and software risks are avoided.

In addition, each module has a diagnostic processor for monitoring the health of protection path. All modules' faults are announced through alarm outputs.



Rayan P-10,
meets your needs

- There are three SM modules in each set and the status of the modules is indicated with the status LEDs
- SM modules are compatible with various sensor types such as magnetic pickups, proximity sensors and hall Effect sensors
- Two independent rotating machine can be protected with one rack



The interface module (IM) is a bridge between the user and speed modules. The interface module can be equipped with an LCD and keypad to communicate with the user (IMP).

Some of the tasks of this module are:

Parameterization:

IM/IMP gets the settings from the user and programs the speed modules, then shows them to the user as current values of settings. The user can enter the settings by Keypad or in RayLink software. Entering settings by the user is password protected.

Logging:

Last 50 alarms and events are logged by Sequence Of Events (SOE) and they can be displayed on LCD or RayLink log window. All the user commands and inputs, outputs are logged as events and the logs can be accessible in the future.

Detection faults:

Detection of some faults such as absence of speed modules, power fault of speed modules, difference between settings of speed modules in a set, etc. is done by the IM/IMP.

*when the settings of speed modules sets, the system can continue overspeed protection function without the presence of IM/IMP.

Analog output:

Each module has a precise analog output according to its input sensor frequency. The analog output is in 4 to 20mA current range. this isolated output is optional and it can be scaled in the user defined range.

Alarm output:

There are two alarm output for each speed module. All modules' faults are announced through ALARM outputs.

Repeater:

Each speed 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.

Zerospeed output:

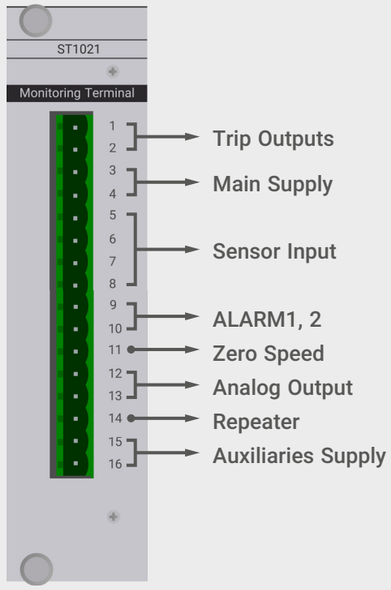
Zerospeed output signal monitors the stopping of shaft speed. If the shaft speed goes below the detectable limit, this output is activated. also user can define the zero detection speed, in the detectable range of module.

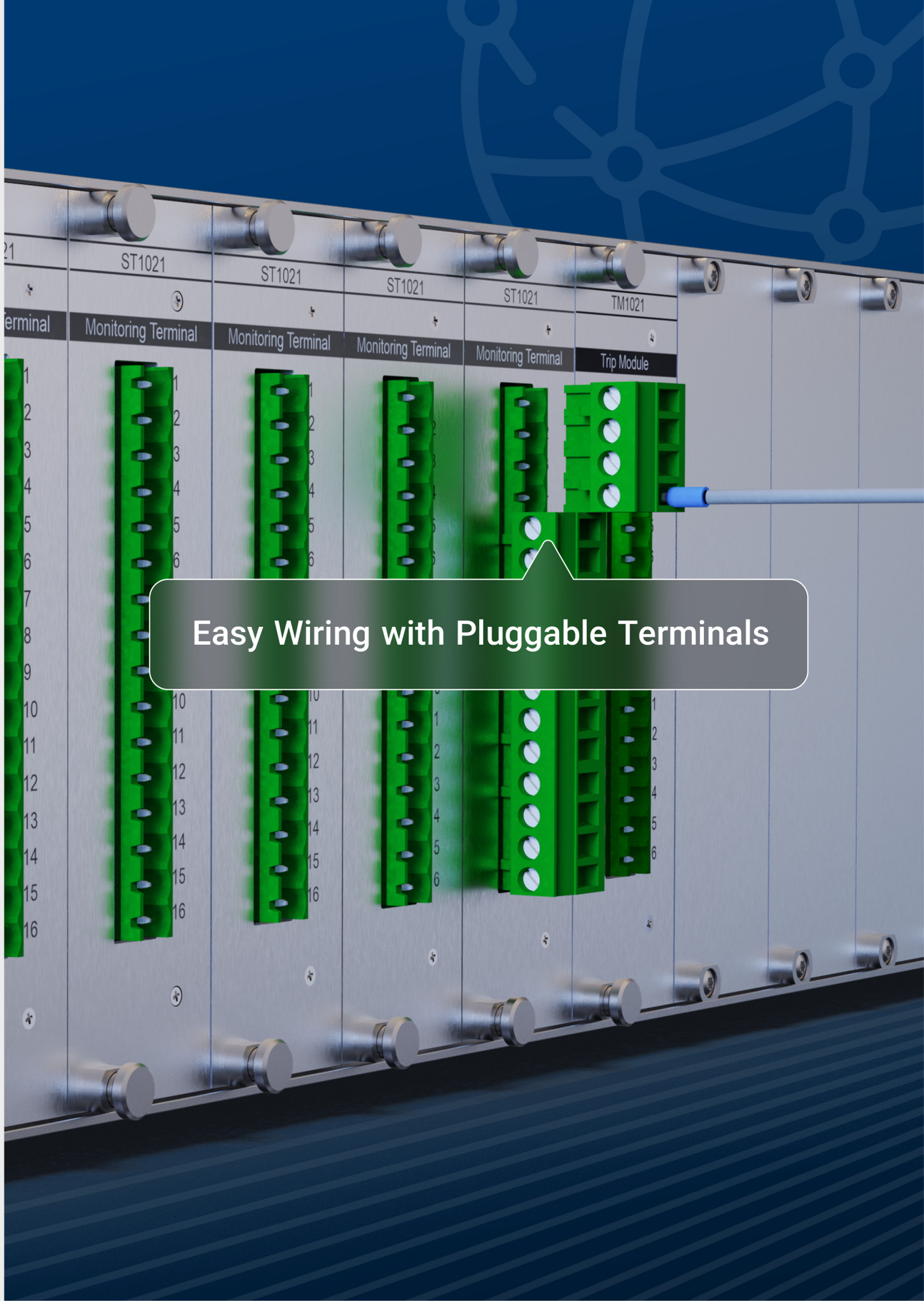
Trip output:

Beside the trip contacts which are participate in voting, another contact is available on terminals for user applications. The trip contacts can be defined to be latched.

Power supply:

there are independent power inputs (18–30 V DC) for each module with a variety of power protection types such as Reverse polarity- Over voltage - Under voltage - Short circuit protection. The Main power has considered for safety path and the auxiliaries included zero speed, analog output, repeater and alarms outputs, are fully independent of safety path and powered with auxiliaries supply. This power can be joined to main power supply or isolated from it.





Voter outputs:

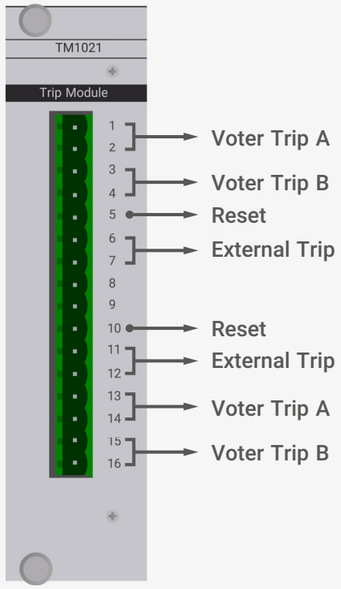
The output of two 2oo3 voters, which will be opened if system trip activated. The outputs are come from independent voters and can be connected redundantly to increase safety.

External Trip input:

This input is a dry contact for force trip function and is independent for each overspeed set. this output trips all three modules of one overspeed set, with the highest priority and independent of processing paths.

Reset input:

The reset command is applied to all three monitoring modules on one set but only the module in trip mode will be affected by it.



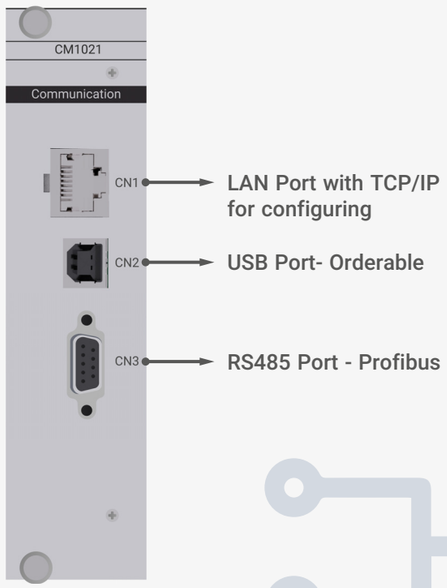
ProfiBus:

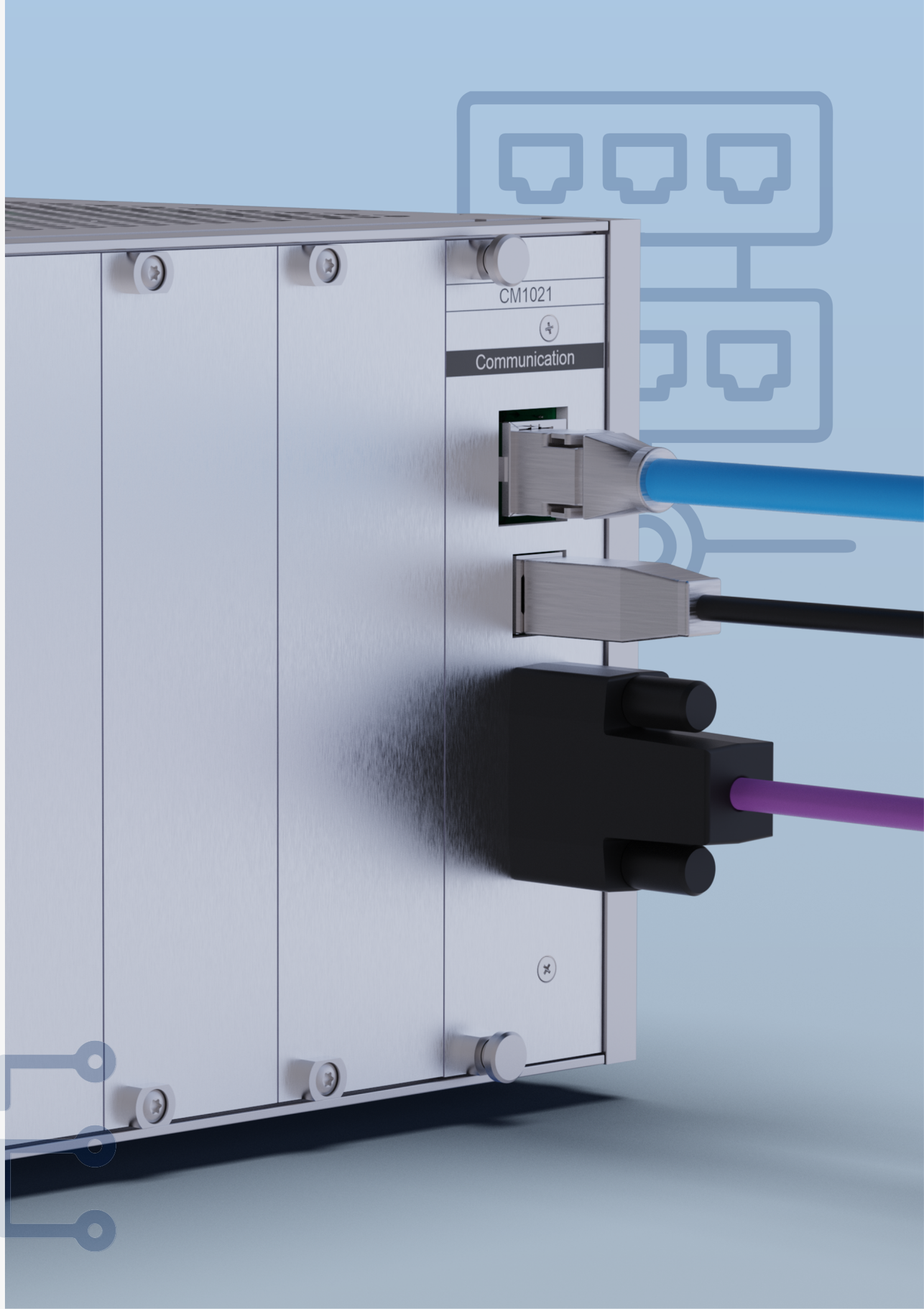
RS-485 port with Profibus for communication with upstream systems such as PLC's, DCS's ,etc. with Optional Modbus RTU communication All the monitoring data of modules are transferred through Profibus.

Etharnet:

LAN Port with TCP/IP for configuring—with optional OPC/UA communication

USB: Orderable USB Port for configuring





Configuration Software

RayLink is a programming and configuration software that is run on a PC to manage log and settings of **Rayan P-10**. The **Rayan P-10** connected to RayLink through LAN port with TCP/IP.

This software is a user-friendly environment and provide this possibilities:

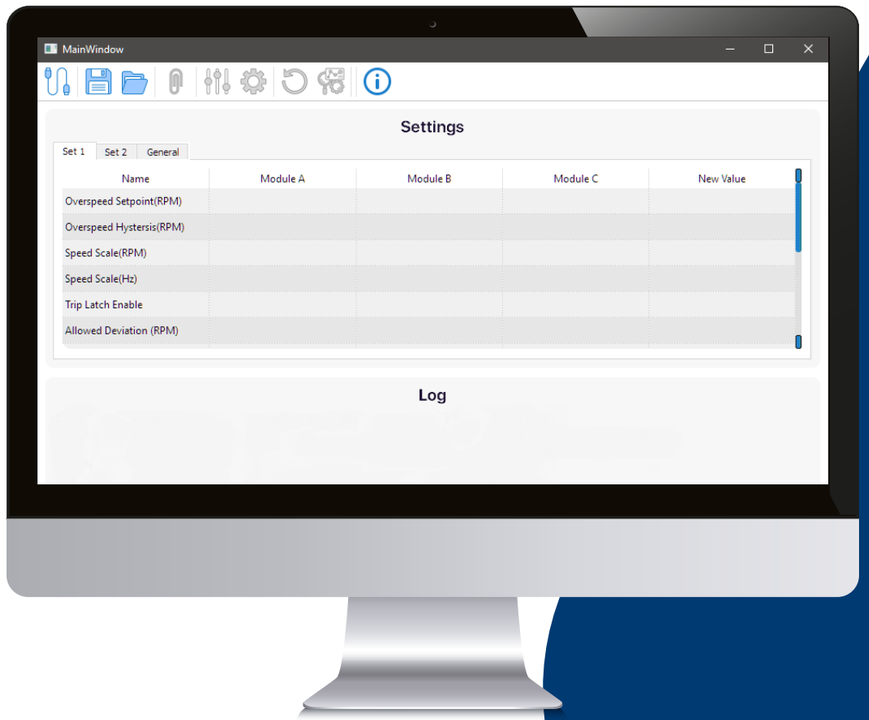
Setting management: save the settings, reload the settings or copy a system setting to another one.

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

Reset Command: this item allows the user to reset the latched alarm and trips.

Auto Test Command: this initiates an auto test process for all three modules of each set.

Log management: there is a Log window that manages events and alarms of system. All the user command and status on software is logged.



User Interface

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

Several pages are displayed in the UI, including:

Home: main data of modules is displayed in this page

Settings: in this page current settings of modules are displayed and user can change the settings too.

Sys Info: in this page product data displayed.

Alarms and Events: active alarms and events log are displayed.

Rayan P-10 protects your machine completely reliably

SIL3/IEC61508 - 2010 Certified

1

PFD_avg = 7.13×10^−5

Once in every **14,025** times that overspeed occurs, **Rayan P-10** will fail to react correctly!

2

Proof Test Interval = 5 years

Rayan P-10 has a 5-year performance guarantee with no testing required!

3

Safe Failure Fraction or SFF = 99.2%

In the **Rayan P-10, 99.2%** of errors do not lead to a dangerous state!

Overspeed Protection Unit Based On Reliable Hardware

In the **Rayan P-10** , safety is very important and critical, so using a high reliable hardware is considered a principle.
Therefore, the safety path of **Rayan P-10** is completely hardware-based, by using a CPLD of mature technology MAX V, Altera design. This chip has a hardware basis and is safe from common programming errors in processors. The compliance documents of all peripherals of this chip with IEC 61508 have been provided by the manufacturer, so it has a good place in safety products.

Rayan P-10, The Perfect Solution for Safety and Availability

Use Of Mature Technologies

The use of new technologies increases the risk of safety product design because they are still being tested and their defects have not been identified. Therefore, in safety products, instead of using new technologies, mature technologies should be used. In the design of **Rayan P-10** products, this important principle has been included in the selection of used parts and technologies.

Independent Fault Detection and Diagnostic Unit

By using a processor unit independent of the safety path, sensor and measurement path errors and other faults are detected and notified to the user in the shortest possible time.

Force Guided Mechanical Relays

The trip relay of each module that participates in 2oo3 voting and issues the trip command is a force-guided type. The mechanical structure of these types of relays provides the possibility to read the correct feedback of the state of the contacts. As a result, any defect in the relay function during system operation can be identified and the user is notified in case of a defect.

Auto Test Based On DDS

To ensure the correct functioning of the modules during operation, the measuring and protection path are tested by a variable frequency generation based on DDS and the trip relay status is read. Therefore the main function is tested and alarm will be initiated if a fault is detected. This test is done for each module in specific time intervals that can be adjusted by users and is coordinated with other modules.

Online Replacement and Repair with Hot Plug Capability

Rayan P-10 is hot pluggable. With this feature, in case of a module failure, the faulty module can be replaced with a healthy one without the need to turn off the system.

Fully Compliant with Multiple Standards

Safety (IEC61508- SIL3)

System Type: B

HFT: 1

Architecture: 2oo3

Service Time: 5 Years

PFD avg: 7.13×10^{-5}

Temperature

IEC60068-2-1 (0°C)

IEC60068-2-2 (55°C)

Damp heat

IEC60068-30, 55°C and 95%, 24h cycle

EMC Standards (IEC 61000-6-2)

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

Rayan P-10, The Perfect Solution for Safety and Availability

Rayan Safety Group in Ahar Company supports this product

Rayan Safety Group, in addition to designing and manufacturing safety products, also provides support services for these products. Whenever and wherever you need our support, you get it…

Ahar is proud to provide customer service

At Ahar Company, we have experienced professional experts to provide all the services needed by the customer, including the purchase and installation of speed sensors, the installation and commissioning of the Rayan P-10 and providing all after-sales services and support for this product.

Customer training is Ahar's priority

After installing and setting up Rayan P-10, you will receive all necessary training to work with this system and its accessories. We believe that proper customer training, ensures Rayan's continued operation.

Safe packing and shipping services

Repair services

Installation and commissioning services

Remote support

Related products

Ahar has **other products** that you can use to implement your desired overspeed protection topology.

Speed measurement sensors

Remote display compatible with Rayan P-10

Vibration Protection and Condition Monitoring System

Further information

For more and detailed information about the product, refer to the following documents:

Rayan P-10 Datasheet

Doc.NO: 349&EDA003V05

Scan to Download

For more information about this, contact Ahar.

We are your trust

Ahar Company started its activities in the field of industrial automation and design of electronic cards in 2000. These activities began with producing power plants electronic cards, and automation projects and over time upgraded to the design of advanced control systems needed in the energy industry.

Ahar companies products are described as follows:

- Design and produce control and protection systems for all turbine types, including gas, steam, and water with various capacities.
- Design and produce generator excitation and protection systems.
- Design and produce synchronous motor drive (SFC)
- Design and produce various protection systems like **overspeed with SIL3 standard**, vibration, etc.

Nowadays Ahar is active in power plants, refineries, petrochemicals, steel industries, etc.

AHAR

Power Station Services

Head Quarter:

Ahar Building, Science & Tech Park, Asian Road, Mashhad, Iran

+98 51 35 42 41 00 +98 51 35 42 41 61

Turkey Office:

No:189 K:2 D:3 Kamara M/ Stiklal Cd/ 34200 Beyo Lu/ Istanbul/ TURKEY

+90 534 836 5219 turkey@aharco.com

www.aharco.com info@aharco.com