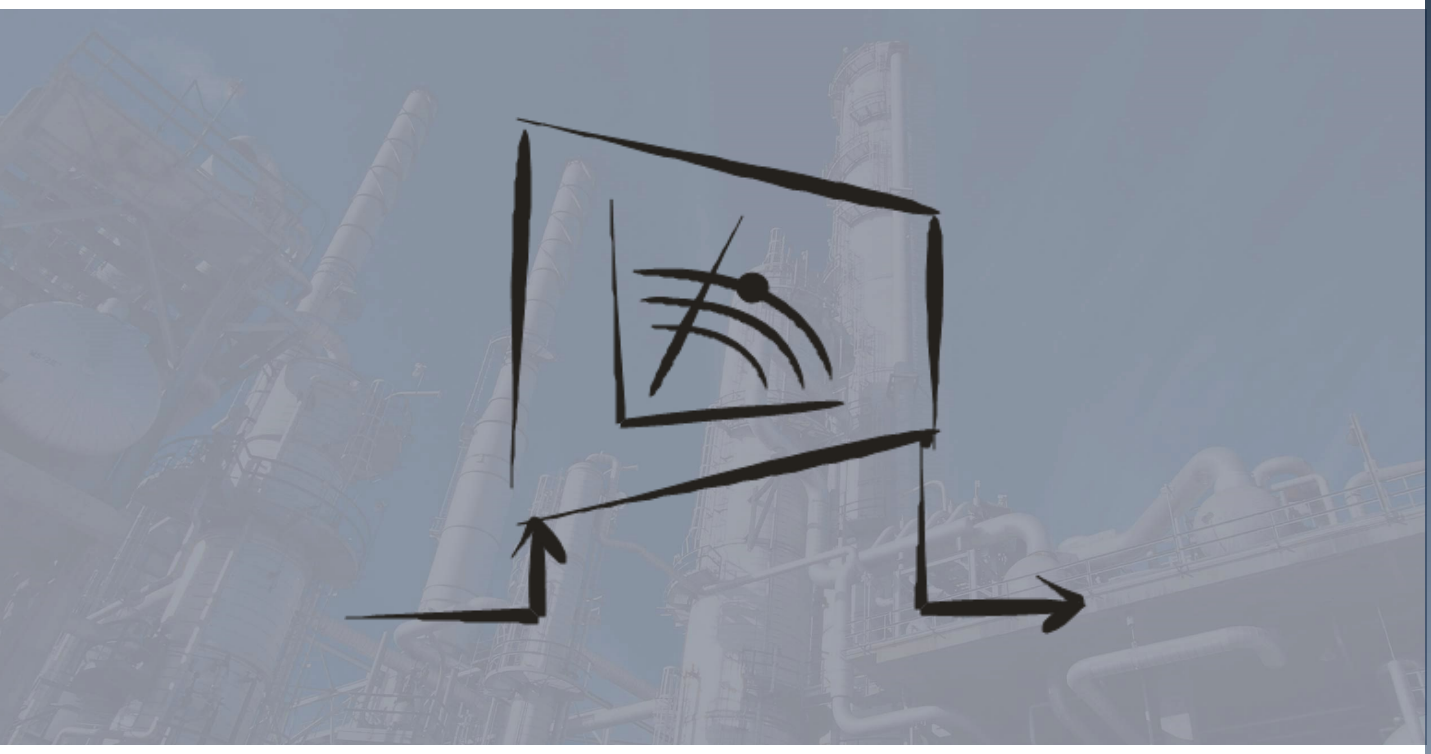
MCL CONTROL

Sentinel



CompressorSentinel™

Compressor Protection and Control System

www.mclcontrol.com

2022

DESCRIPTION

CompressorSentinel is a comprehensive integral solution targeted to satisfy the protection and control requirements of centrifugal and axial compressors, in both stand- alone and networked configurations, which combines specific safety, high speed control strategies, and sequencing of each compression train, with the global requirements of machines integration, production strategies, monitoring facilities, information supervision, and centralization. As a result, **MCL Control** provides a smart flexible solution at a very competitive cost that decreases when the same architecture is extended to the rest of associated production processes. The global concept of **CompressorSentinel** offers answers that reach all production related areas (operation, maintenance, supervision, management, administration, etc.). Based on current API, ISA/ANSI, IEC, as well as equipment manufacturers' safety standards requirements, **CompressorSentinel** complies with the concept of having Safety and Control separated in independent Modules as described below. Furthermore, **CompressorSentinel** is based upon commercial Programmable Logic Controllers (PLCs) platforms for both control and sequencing, and upon IEC-61508 compliant TÜV certified Programmable Electronic Systems (PES or Safety PLC) for process safety. The architecture of a system based in this product can be adjusted to comply with the required *Safety Integrity Level (SIL)* and availability for your process. **CompressorSentinel** also offer the flexibility of combining both control and protection of the equipment in the same controller (PLC) when allowed by applicable regulations and standards.

> "The global concept of **CompressorSentinel** offers answers that reach all production related areas (operation, maintenance, supervision, management, administration, etc.)"

BENEFITS

Platform independence: Based on the *IEC-61131 standard*, **CompressorSentinel** can be adapted to many PLC platforms with a minimum effort.

Investment: High Benefits/Costs relationship.

Reduced Differed Production Costs: These are totally proven solutions that guarantee the availability of a completely operational equipment in minimum time.

Reduced Maintenance Costs: Overall costs are decreased through a lower maintenance time compared to conventional PLC based solutions that make necessary periodic system manual diagnostics to fulfill *ISA S84, IEC 61508, IEC 61511* requirements which involve plant shutdowns.

Package Benefits:

- Open architecture.
- Redundancy available for Safety and Process Control.
- API 670 and IEC 61508 / 61511 compliant solution for Safety.
- High speed control strategies.
- High Benefits/Costs relationship.

The implementation of state of the art automation technologies provides valuable data that can be used as a main source of information for preventive maintenance plans, reducing the risk of undesired shutdowns and system failures that can affect the plant production.

Engineering tools: **CompressorSentinel** algorithms can be configured either through the **CompressorSentinel** Toolbox or through configuration parameters via Modbus TCP and OPC.

FUNCTIONALITIES

Start up and Protection sequences: This is implemented on Control Modules based on the latest versions of PLCs or Hybrid Controllers, depending on customer's best interests and preferences. The I/0 modules can share the chassis with the processor or use the distributed I/0 concept (located near the process) to reduce installation costs, thus preserving system reliability and logic execution time.

The protection logic is based on the most demanding international standards. All the Safety instrumented Functions (**SIFs**) are included. If the compressor driver is a gas turbine, MCL Control's **TurbineSentinel** can be used to handle the start up sequence.

Control Strategies: Flow control and discharge or suction pressure control are included, as well as the decoupling of the Antisurge algorithm. The load sharing algorithm, if necessary, is performed on the same controller.

Anti-Surge Control: Included, runs on digital controllers for each compressor stage. The controllers are configured to execute the control, surge and stonewall protections, their functions are limited to handle the recycling valves of each compressor stage in order to keep them at a safe distance from "the surge and antistonewall lines".

Protection and Emergency Shutdown: **CompressorSentinel** algorithm adapts to the requirements of the different phases of the unit loading process to provide protection in each of them, performing an early and effective detection of surge events or any anomaly in the compression process and, if necessary, request to the emergency stop system the immediate shutdown of the machine. Likewise, **CompressorSentinel** acts immediately upon an emergency shutdown request from an external entity (emergency stop system, fire and gas protection system, fuel control system, vibration monitoring system, etc.) by opening instantly the associated recirculation valves and thus allowing a safe stop of the machinery.

Comprehensive solution: As a global solution for a group of plants conforming a gas compression complex, **CompressorSentinel** can be integrated with a distributed control system or any other supervisory system, providing concentration of information and operational data from the different subsystems that monitor and control the individual plants, besides handling the control loops related with Plant production, advanced process control strategies, such as optimum compressor load sharing, maximizing availability and benefits. This algorithm not only takes into account the proximity to the surge line to decide what compressor to decrease velocity or recycle but its efficiency too. The distance to the surge line will be taken into consideration only once a referenced line is crossed.

Flexibility: Easy adaptation to the specific requirements of any compressor, or compressor arrangement.

OPERATION

Human-Machine Interface:
All Operations Schematics are included. Special emphasis was made in developing an interface composed with friendly displays and commands, based on the point of view of the operator, making him or her feel as part of the automation process and using the tools offered by the supervisory software, such as, security and access level control, alarm management, graphics presentation, etc. This can be implemented in a local station close to the equipment or in a PC in the control room.

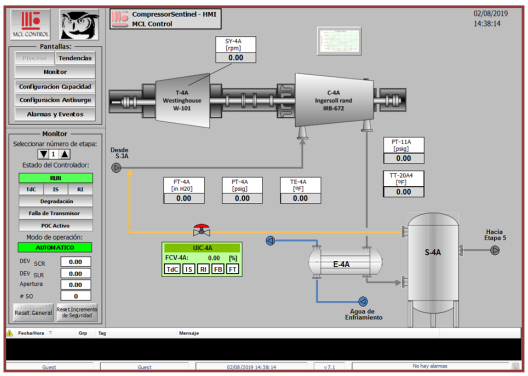
The local station has the same functionality as the control room station.

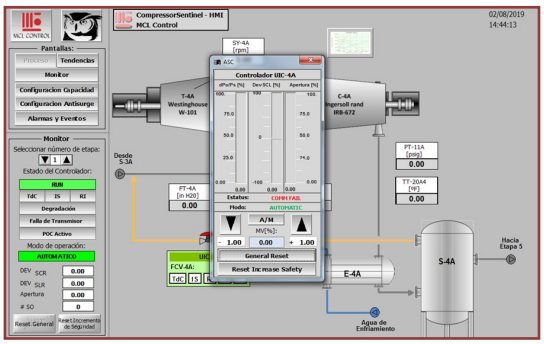
CompressorSentinel Provides a series of already built-in standard displays based on our experience with this type of applications. Also custom displays can be configured based on the client's requirements and special conditions existing in each application. The HMI is OPC compliant, allowing the integration with other systems. The screens listed below are part of our standard displays:

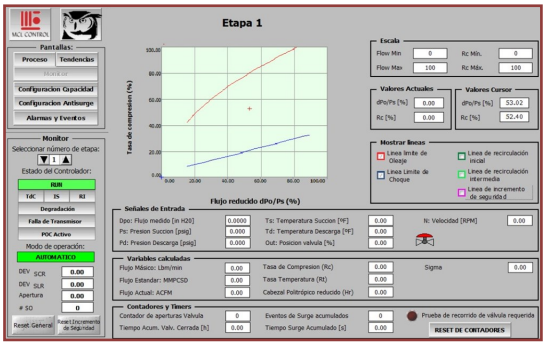
- **Overview:** Displays main compressor values and allows navigation to detailed screens.
- **Monitor:** Provides access to the main variables of the compression process stage by stage, showing the operating point real time value on the compressor curves.
- **Performance Configuration:** allows access to the performance controller setup (restricted for user with suitable security level).
- **Antisurge Configuration:** allows access to the antisurge controller setup (restricted for user with suitable security level).
- **Trends:** allows the user to graphically visualize the process variables both in real time and historical mode.
- **Alarm summary:** Shows alarms details, online and historical.

Remote Operation/Monitoring:

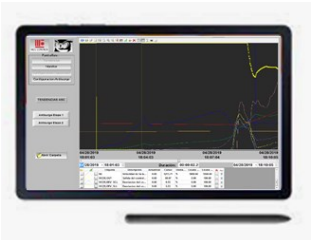
Available through portable wireless devices.







Typical HMI Displays



Remote Operation/Monitoring

MCL CONTROL

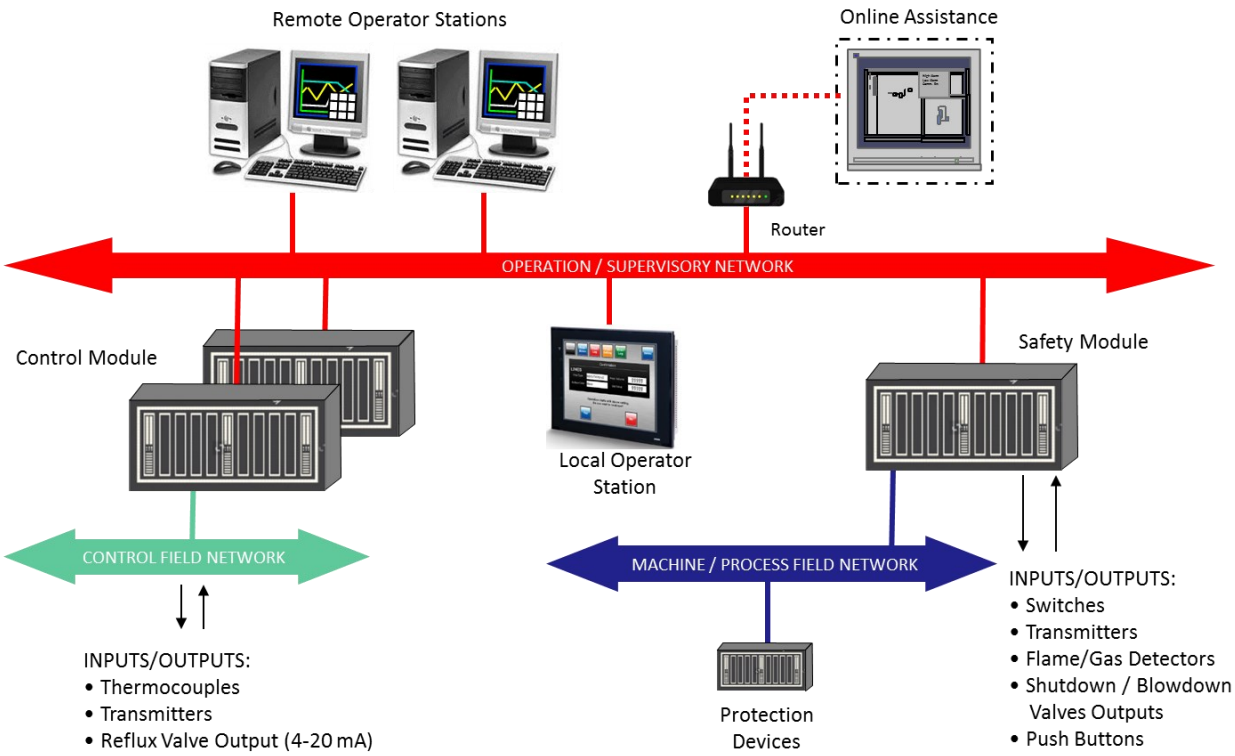
ARCHITECTURE

The architecture design is based on the latest proven technology, following open networks market trends such as Ethernet-IP, OPC-UA, etc. In full accordance with current *API*, *IEC* and *ISA* safety standards, the solution accounts for an independent safety system for each equipment to implement the required Safety Instrumented Functions (**SIF**) to achieve the required Safety Integrity Level (**SIL**).

Each Safety **PLC** can be single, redundant, or **TMR**, depending on SIL and fault tolerance requirements.

For control loops such as pressure control and load control, a single or redundant **PLC** of practically any customer preferred commercial brand may be used (please see the MCL Control's "Experience" Information). Alternatively, and at customer's request, all the applications may be implemented in the safety PES.

When requested, **MCL Control** can supply both Central and Local Panel Human Machine Interfaces (**HMIs**), based on the best available industrial computers and software. These include many features, and they are easily integrated with any PLC or stand-alone systems through available communication drivers.



SCOPE OF SUPPLY

Depending of the client requirements, **MCL Control** can supply the whole range of technical services required for this type of projects, from a simple configuration/installation of applications on the client platform, to a fully integrated system, including hardware (both PES/PLC and local/remote HMI), selection/sizing/configuration, design/procurement/cabinet assembly, field instrumentation (if requested by Customer), operator/maintenance/engineering training as per Customer needs, integrated FAT/SAT and system start-up assistance. Also, if required by the client, MCL Control can perform hazard and risk studies, including: HAZOP, SIL-LOPA, Safety Specifications (SRS), SIL verification, F&G detector placement studies.

SUPPORT

Documentation:
All technical documentation necessary for engineering, operation and maintenance is provided in English or Spanish. Includes all control strategies and protection sequences.

Where applicable, documentation for supplied electronic components will be included, and P&IDs, PFDs, and wiring diagrams will be provided to Customer in AutoCAD® files to allow Customer to modify at Customer's discretion convenience. An optional Internet-based update service is offered to incorporate new developments as well as new versions of hardware and software.

P**ost-sale Technical Support:**
Local and online through the Internet.

EXPERIENCE

MCL Control has been in the process automation and safety business since 1989, becoming a solution provider for the Oil & Gas industry, specializing in processes related to combustion and heating such as steam generation and heating processes (including simulations of superheated steam boilers and the water vapor distribution networks of one of the largest refineries in the world), turbomachinery and other safety areas such as Emergency Shutdown Systems and Fire and Gas detection systems. Particular references will be given upon request.

From a technical point of view, and as mentioned above, MCL Control products are platform independent. In fact, this solution has been installed and integrated with many platforms, as follows:

PLC: Rockwell Automation, HIMA, GE Fanuc, Modicon, Regul, Hollysys, Siemens and others.
DCS: Honeywell TDC-3000 & Experion, Rockwell Automation ProcessLogix, Emerson Fisher Provox & DeltaV, Foxboro, and others.
HMI: Indusoft, Wonderware, Intellution, Wizcon, Simplicity, RSView, Visual Basic, and others.
Safety Systems: HIMA, Triconex, ICS Triplex, Siemens and others.
Others: SCADA systems, Compressor Controls Corporation, Bently Nevada, Metrix, Prosoft Technologies, and others.

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