

A Complete Solution to Industrial Alarm Problems

GoalArt offers a unique and complete solution to the alarm problems of industrial plants.

Alarm problems usually have four main causes:

- Bad sensor and alarm placement
- Wrongly tuned alarm limits
- Irrelevant alarms for certain operating states
- Consequential alarm cascades

Sensor Placement Analysis

Problem: Sensors and alarms may have been wrongly placed during the design of the process. Some may actually be unnecessary, while others are missing. The solution to this problem is to redesign the sensor and alarm placement.

Solution: GoalArt offers a service called *sensor placement analysis*. This algorithm calculates which sensors are needed and where they should be placed, in order to *observe all possible faults* while keeping the number of sensors as small as possible. This algorithm is based on an MFM description of the process.

Alarm Cleanup

Problem: Alarms and events are created by comparing analog signals to decision limits. If these limits are too tight, false alarms are generated, so called *nuisance alarms*. If the limits are too wide, faults may go undetected, so called *silent alarms*.

Solution: GoalArt offers a service called *alarm cleanup*. This algorithm suggests alarm limits and filter parameters, which are used to retune the existing alarm system's parameters. The algorithm is based on analog trend data, which are logged over 1-2 weeks at the plant. There is also an on-line algorithm, which monitors alarms and detects when a new alarm cleanup is needed.

State-Based Alarm Priority

Problem: Some alarms are only relevant for specific operating states. In other states, the alarms are irrelevant and disturbing. Typical examples of this are alarm bursts that appear during startup and shutdown, and alarms from shut down equipment.

Solution: GoalArt offers a product called *state-based alarm priority*. This algorithm reads real-time data from the existing control system, tracks

its current operating state, and gives each alarm a *dynamic priority* depending on the current operating state. This includes complete suppression of irrelevant alarms.

Root Cause Analysis

Problem: The most difficult alarm problem concerns consequential alarm cascades and root cause analysis. In a process, a fault usually leads to several consequential faults. This means that a single fault can create a large number of alarms, a so-called *alarm cascade*. Because of timing effects, alarm limit tuning, and physical properties of the process, the root cause seldom appears first. Alarm cascades can be very difficult to analyze, which often means that operators cannot easily figure out what is actually wrong with the process.

Solution: GoalArt offers a product called *root cause analysis*. This algorithm calculates the root cause (or causes) of any alarm cascade, and thereby helps the operators to understand the current fault situation. The algorithm can handle all theoretically possible combinations of root causes and consequential faults. It reads real-time data from the control system and uses an MFM model for its analysis.

About GoalArt

GoalArt specializes in alarm handling and automated fault diagnosis for industrial plants. We are located in Lund, Sweden. Among our customers are:

- The *Swedish National Grid*, where a system has been monitoring the entire Swedish transmission grid since January 2009.
- *Chevron*, where we have delivered systems for the oil and gas industry.
- *Teracom*, where a GoalArt system monitors the transmission network for radio, TV, and data communication in Sweden.
- *Lunds Energi*, at a conventional heating and power plant called Återbruket.
- *Barsebäck, Forsmark, Fortum, Ringhals, Oskarshamn, and TVO*, (nuclear power plants), where we performed a project using root cause analysis and state-based alarm priority for a simulator of the Forsmark 3 nuclear power plant.

GoalArt also has customers producing complex technical products, such as *Gambro* (dialysis machines) and *Dräger* (ventilators).

Our Technology

Several of our algorithms use MFM descriptions of the plant. MFM means *multilevel flow models* and is a simple way of describing the causality of a system. The method is well suited for describing heating and power plants, chemical and petrochemical processes, pulp and paper, power grids, local heating grids, gas, and several other process types but also systems like communication networks, and baggage handling.

Today there is no good competitor to GoalArt's systems. Control system suppliers have no existing products, and the few international companies that exist offer solutions using older techniques, such as fault trees and rule-based expert systems.

The advantages of MFM and GoalArt's other algorithms are:

- Can do everything that older techniques can, such as fault trees and expert systems.
- Very cost effective to build the system. Orders of magnitude faster than other techniques.
- Very cost effective to test and validate, and to maintain and upgrade.
- Handles complex cases such as multiple root causes and circular dependencies. Other methods cannot handle such cases.
- Easy to build descriptions of even very large plants.

Integration

GoalArt's system needs data from the existing control system. The integration can be different, depending on the algorithm and the control system.

- *Sensor placement analysis* demands no integration at all.
- *Alarm cleanup* demands that the customer logs analog trend data over 1-2 weeks, puts these on a CD, and sends it to GoalArt.
- *State-based alarm priority* and *root cause analysis* demands integration to the existing control system. This can be performed using OPC or another similar interface.

The results from state-based alarm priority and root cause analysis can be shown on a separate screen in the control room. This is usually a good solution, since the control room already contains several screens and the operators are used to this working environment.

If the existing control system allows it, the results can also be transmitted back and shown in the existing alarm lists and process diagrams. GoalArt can deliver this solution for *soft PLC systems* such as Citect, Fix, WonderWare, etc.

Advantages

GoalArt's products and services allow for a complete solution to the alarm problems of industrial plants. In turn, this gives the following advantages:

- Decreased number of disturbances and stops
- Increased productivity
- Increased safety
- Less risk of emissions and environmental problems
- Better work environment for operators
- Possibility of adding more alarms without the risk of overloading the personnel
- Possibility of operating more plants from the same control room without more operators

Who Needs Better Alarm handling?

An improved alarm handling is useful for most industrial process types and complex technical products, but especially for:

- Industrial plants with high demands on availability
- Control rooms where several plants are remotely controlled
- Plants with many new operators and service technicians
- All plants with badly working alarm system

Return of Investment

GoalArt's systems can solve alarm problems at a reasonable cost. The price depends on the size of the plant, but a medium-sized power plant or similar should be able to recoup the investment in 0.5 – 3.0 years.

A Complete and Unique Solution

Together, GoalArt's algorithms provide a complete and unique solution to the alarm problems of industrial plants. GoalArt is the only company that can offer this today.