

# Using process automation systems for turbomachinery controls

Integrating process controls provide multiple benefits.

By Tom Langezaal

**W**hen replacing or upgrading (obsolete) turbomachinery control systems, integrating turbomachinery controls with process controls has many benefits. It increases the reliability of a customer's machinery and process. A single hardware platform provides several benefits, such as a smaller footprint, the ability to train and focus on one system and integrated architecture, which can create reductions of spare inventory.

Integrating all machines and sensors on one screen and having remote access allows users to view the same information from every control screen around the plant. Alarms and sequence of events are supported by a common time stamp. Other advantages of integrating turbomachinery control systems to a distributed control system are improved obsolescence management; lifecycle management; cybersecurity (fewer points of entry for cyberattacks); remote diagnostics; services and troubleshooting; and a reduced number of investments. The total cost of ownership is also lower compared with a third-party vendor or black box solution.

Before the computerization of turbomachinery control systems,



**FIGURE 1** Turbomachinery control applications developed for DCS systems

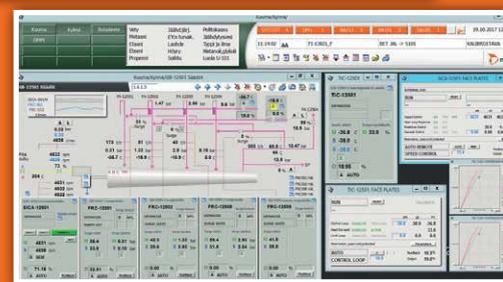
the control of valves was firmly based in mechanical engineering via a set of hydro-mechanical governors, with each responsible for some aspect of control or limiting.

## A shift in control

With the rapid advancement of microprocessor technology, we are seeing a shift in process control and turbomachinery control towards a software-based solution. And the emergence of fast and flexible distributed control systems means that firms specializing in turbomachinery control will gradually move away from proprietary hardware and instead focus on software and expertise.

Suppliers often differ on the best way to control turbomachinery. Some advocate plant-wide controls operated by programmable logic controllers (PLC) and distributed control systems (DCS), while others opt for proprietary black box or software-based solutions. In any case, choosing a controller is a challenge for users because the applications have become more demanding as the technology improves.

For years, DCSs were used primarily in continuous process operations where



**FIGURE 2** Example of an integrated compressor & turbine control system on a DCS

precise sequences of control were necessary, such as optimizing a petroleum refinery. PLCs, on the other hand, tended to be employed more often in discrete manufacturing, where variable control based on temperature or pressure was usually not an issue. Recently the lines have blurred. DCSs and PLCs are now found in turbomachinery control applications.

Many plants have decades-old turbomachinery control hardware, which is costly to upgrade or replace. In the past, these types of systems have been supplied as stand-alone unit control panels (UCPs).

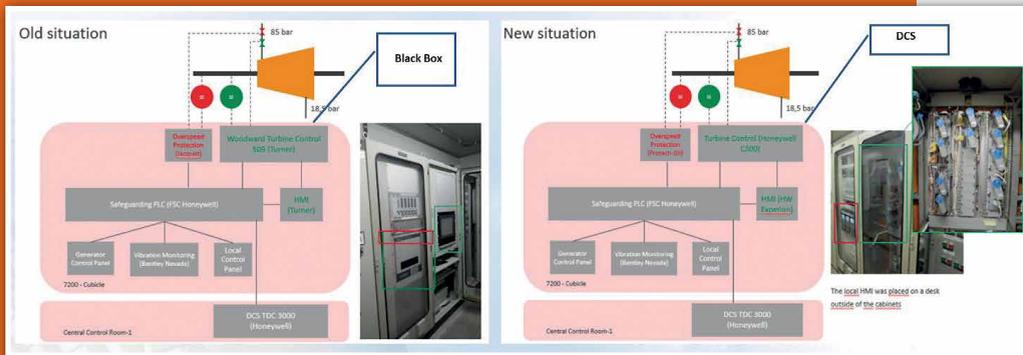
## A revolution in control

The original DCS began a revolution in industrial process control. Operators and

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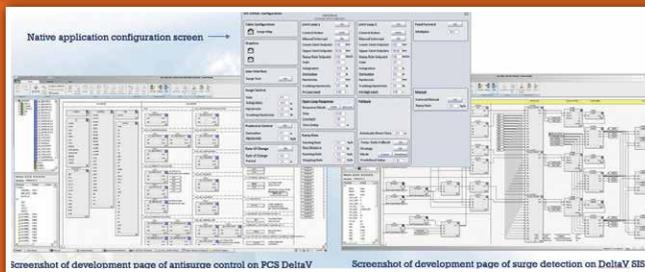




**FIGURE 3**  
Turbine control system upgrade from a black box to a plant DCS

with custom-designed controllers.

Processes vary and require control solutions tailored to meet specific requirements. An open platform is the best match for a turbomachinery controller. Dedicated turbomachinery controllers are designed as a unified hardware and software package to address the specific needs of a given turbine or compressor (see figures 2 and 3).



**FIGURE 4**  
Compressor surge control and surge protection on DCS

### Trending toward DCS

The (end) user can select DCS suppliers and various turbomachinery applications suppliers. DCSs will not capture the entire market of turbomachinery control. But technological trends and end users who have become increasingly sensitive to costs and black box/PLC solutions will be more inclined to standard DCS solutions. This trend will progress just as rapidly as the development of the technologies. Competition of algorithmic and software solutions, in terms of control quality, completeness and depth, will only intensify.

pneumatic control systems slowly began to migrate into a microprocessor-based control chassis. The history and evolution of turbomachinery control followed this progression, but it also took its own course with specialists emerging who focused solely on turbomachinery control, regulation and protection.

PLC and DCS companies are hardware specialists that are used to addressing an entire plant control system. They are generally not experts with turbomachinery and software applications for turbomachinery, which is a small portion of the whole package. PLC and DCS type systems are often distinguished by speed. The PLC is traditionally used for startup and shutdown activities, especially in safety

applications because of the faster response. Most available turbomachinery controllers are expensive and tie the user to the vendor for service.

### A tale of two providers

Turbomachinery control development comes from two types of providers: Turbomachinery original equipment manufacturers (OEMs) and independent industrial control and automation companies. OEMs offer turn-key solutions, including turbine and compressor anti-surge control.

However, OEMs often are not concerned with the protection or control of the entire process. Independent solution providers are specialized in turbomachinery control and protection, as well as process technology

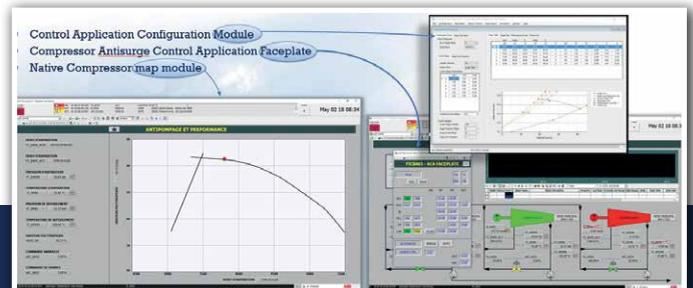
Turbomachinery controls can be deployed and integrated DCSs. Examples include ABB, Honeywell, Emerson, Valmet and Yokogawa (see figures 4 and 5 for DCS solution examples).

Turbomachinery controls included in DCS/BOP (balance of plant) integration benefits engineering with less error and better availability. This results in a smaller footprint; an integrated tag database; an integrated dashboard; and an enhanced maintenance strategy with an optimized single-system service contract (see figure 6).

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**FIGURE 5** Compressor control upgrade from a PLC to a DCS.



**FIGURE 6** Compressor surge control application on a plant DCS