HC-EVE

HC-EVE is an advanced event logger system add-on option to the standard HMI offering by Holland-Controls.

Standard event history logging

Gas turbine packages have many instruments which are monitored by the PLC of the HC-CORE3 control system. For example, if the lube oil pressure (tag - 63QM) drops below the alarm setpoint, the PLC sets the alarm tag LLA63QM to true. One or more HMIs looking at this tag detect its changing state, and each HMI will then display this as an alarm in the alarm summary. The timestamp shown in the alarm summary is derived from the clock on the HMI PC.

Each HMI is also equipped with an event history logger. Alarms are timestamped and stored in a database, recording when they occur, are acknowledged, and cleared. Additionally, the database also logs events without an associated alarm such as pump running signal, using simple On/Off states

Due to HMI-based timestamping, it poses two potential issues:

- Different HMIs may display the same event with varying timestamps. To overcome this issue, it is typically possible to assign one HMI as a master, but at the expense of losing redundancy. Only complex cross-synchronising servers can solve the redundancy issue but provides no resolution in case of plant network collapse.

- The communication granularity to the HMI is typically in the order of 500 milliseconds or higher. This leads to sequential alarms and events being timestamped identically, obscuring their actual order. This significantly hinders troubleshooting, as it becomes difficult to determine the relationship between the alarms/events, such as whether a valve closure triggered a shutdown or vice versa. While a 'first-out' detection mechanism, implemented on the PLC, can identify the initial alarm that stopped the machine, the exact order of subsequent events remains lost/unknown.

Note that these concerns primarily apply to the event history. For the summary the exact timestamping is not critical as that is not used for order-of-event analysis.

HC-EVE event history logging

In HC-EVE, the HMI event history timestamping issues are a thing of the past. The PLC code is extended so that every alarm and event is logged and timestamped. An SQL insert query is then generated on the PLC to write that alarm or event to one or more Microsoft SQL-server(s) running on the HMI or on a dedicated server. The HMI event client queries that same SQL-server and then displays an accurate alarm and event list. The sequence of alarms and events is thus fully accurate with a resolution of 50 milliseconds or lower.

The PLC maintains a large queue for each SQL server. If a server is offline and subsequently reconnects, the last 1000 queued events are synchronised accordingly.

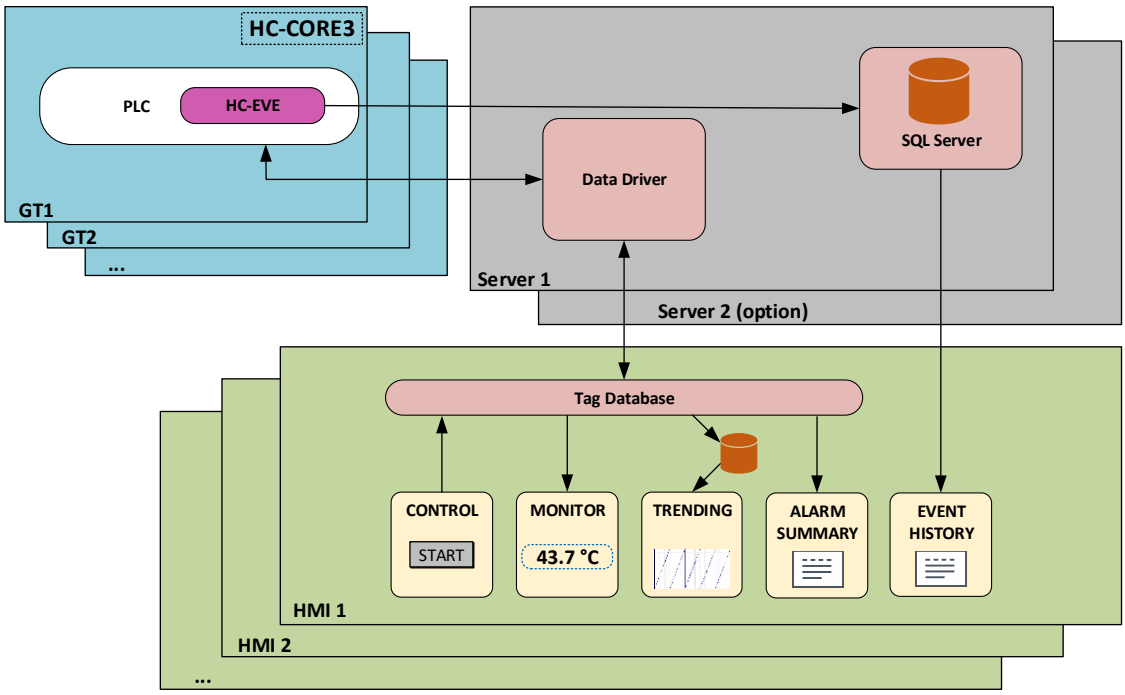
Below a simplified architecture example is shown with several HC-CORE3 gas turbine control systems, two redundant data-servers, and several HMI clients. Each HMI client can be used to operate and monitor each turbine package.

Data is exchanged with the PLC via a communication driver. In this example the driver is running on server hardware, but for small applications this can also reside on each HMI. Each HMI also provides historical trending whereby the data can be stored on the respective HMI (as shown) or on the servers. It also provides an alarm summary, using its own clock, based on currently active alarm tags.

In traditional systems each HMI also builds its own event history database – stored either locally or on the servers – with the above-mentioned disadvantages.

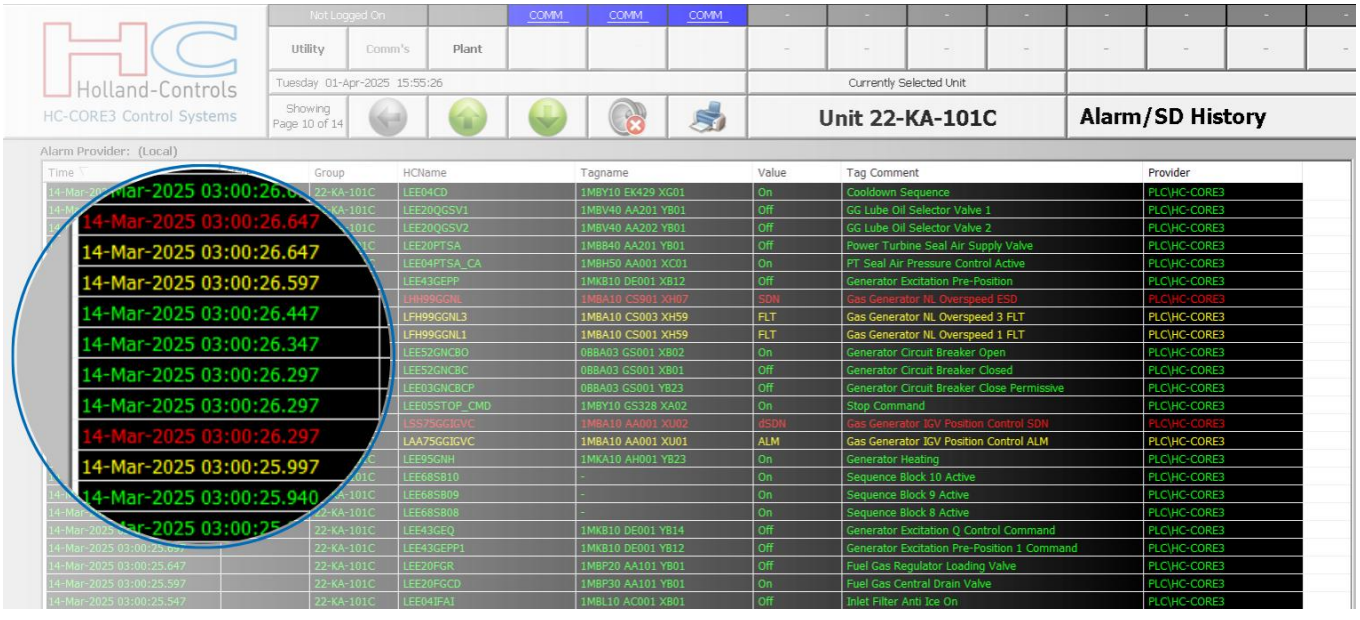
With HC-EVE, a sophisticated piece of PLC code inserts the alarms/events directly into the SQL database running on each server. Alarms and events are buffered for each connected server, time-stamped by the PLC clock at the pace of the PLC's alarms/events.

Alternatively, SQL servers can be run directly on each HMI, eliminating the need for dedicated server hardware – HC-EVE supports up to 10 SQL servers simultaneously.



Architecture of HC-EVE in a typical setup

For the operator everything looks as before – except that the time resolution is much better and consistent on all HMIs!



HC-EVE alarm history example

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Benefits of HC-EVE

- True order display of historical events with 50 milliseconds resolution.
- All HMIs show the same events with the same timestamp and in the same order.
- Storage of the event database can be on redundant server hardware or on individual local HMI or both.
- If a connection is lost – or even if the complete network is down for a period of time, no event information is lost because a large buffer is available on the PLC.

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