

HC-EVE

HC-EVE is an advanced high-resolution 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.

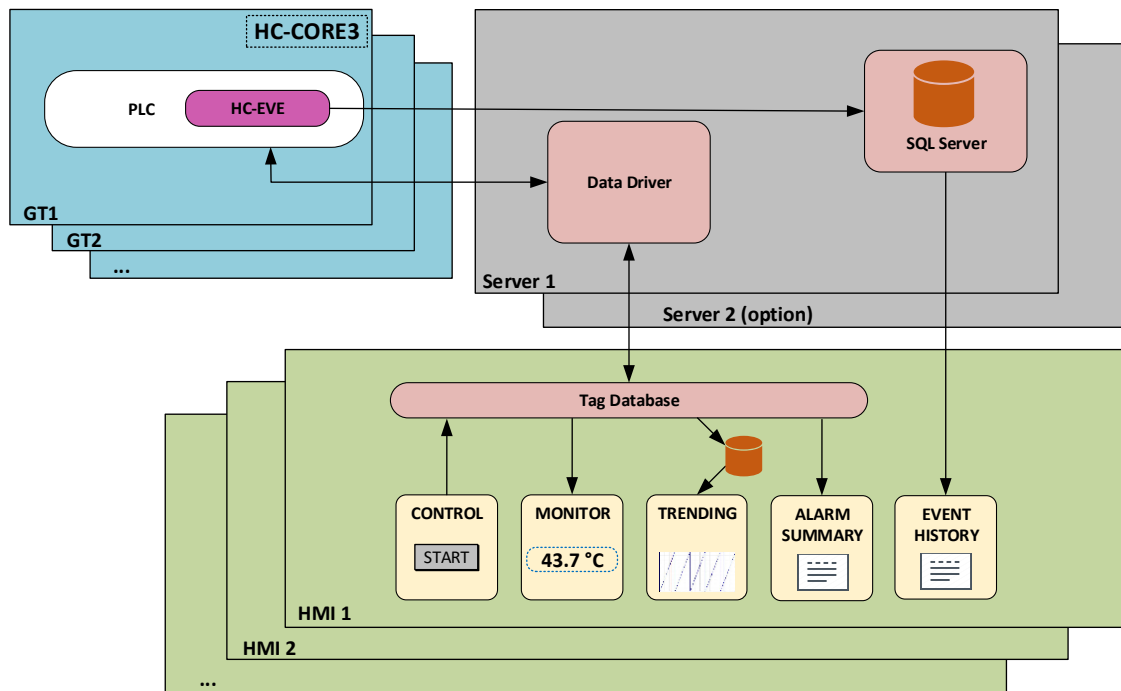
Below a simplified architecture example is shown with several HC-CORE3 gas turbine control systems, two redundant data-servers, and several HMI clients. Each HMI client can be used to operate and monitor each turbine package.

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!



Holland-Controls
HC-CORE3 Control Systems

Not Logged On

Utility Comm's Plant

COMM COMM

Tuesday 01-Apr-2025 15:55:26

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Currently Selected Unit

Unit 22-KA-101C

Alarm/SD History

Alarm Provider: (Local)

Time	Group	HCName	Tagname	Value	Tag Comment	Provider
14-Mar-2025 03:00:26.647	22-KA-101C	LEE04CD	1MBY10 EK429 XG01	On	Cooldown Sequence	PLCHJC-CORE3
14-Mar-2025 03:00:26.647	22-KA-101C	LEE20QGSV1	1MBV40 AA201 YB01	Off	GG Lube Oil Selector Valve 1	PLCHJC-CORE3
14-Mar-2025 03:00:26.647	22-KA-101C	LEE20QGSV2	1MBV40 AA202 YB01	Off	GG Lube Oil Selector Valve 2	PLCHJC-CORE3
14-Mar-2025 03:00:26.647	22-KA-101C	LEE20PTSA	1MBB40 AA201 YB01	Off	Power Turbine Seal Air Supply Valve	PLCHJC-CORE3
14-Mar-2025 03:00:26.597	22-KA-101C	LEE04PTSA_CA	1MBH50 AA001 XC01	On	PT Seal Air Pressure Control Active	PLCHJC-CORE3
14-Mar-2025 03:00:26.597	22-KA-101C	LEE43GEPF	1MKB10 DE001 XB12	Off	Generator Excitation Pre-Position	PLCHJC-CORE3
14-Mar-2025 03:00:26.447	22-KA-101C	LFH99GGNL1	1MBA10 CS001 XH07	SDN	Gas Generator NL Overspeed ESD	PLCHJC-CORE3
14-Mar-2025 03:00:26.447	22-KA-101C	LFH99GGNL3	1MBA10 CS003 XH59	FLT	Gas Generator NL Overspeed 3 FLT	PLCHJC-CORE3
14-Mar-2025 03:00:26.347	22-KA-101C	LFH99GGNL1	1MBA10 CS001 XH59	FLT	Gas Generator NL Overspeed 1 FLT	PLCHJC-CORE3
14-Mar-2025 03:00:26.347	22-KA-101C	LEE52GNCB0	08BA03 GS001 XB02	On	Generator Circuit Breaker Open	PLCHJC-CORE3
14-Mar-2025 03:00:26.297	22-KA-101C	LEE52GNCB0	08BA03 GS001 XB01	Off	Generator Circuit Breaker Closed	PLCHJC-CORE3
14-Mar-2025 03:00:26.297	22-KA-101C	LEE03GNCB0	08BA03 GS001 YB23	Off	Generator Circuit Breaker Close Permissive	PLCHJC-CORE3
14-Mar-2025 03:00:26.297	22-KA-101C	LEE05STOP_CMD	1MBY10 G5328 XA02	On	Stop Command	PLCHJC-CORE3
14-Mar-2025 03:00:26.297	22-KA-101C	LAG55GIGV1	1MBA10 AA001 XU02	SDN	Gas Generator IGV Position Control SDN	PLCHJC-CORE3
14-Mar-2025 03:00:26.297	22-KA-101C	LAG55GIGV2	1MBA10 AA001 XU01	ALM	Gas Generator IGV Position Control ALM	PLCHJC-CORE3
14-Mar-2025 03:00:25.997	22-KA-101C	LEE95GMH	1MKA10 AH001 YB23	On	Generator Heating	PLCHJC-CORE3
14-Mar-2025 03:00:25.997	22-KA-101C	LEE68SB10	-	On	Sequence Block 10 Active	PLCHJC-CORE3
14-Mar-2025 03:00:25.997	22-KA-101C	LEE68SB09	-	On	Sequence Block 9 Active	PLCHJC-CORE3
14-Mar-2025 03:00:25.997	22-KA-101C	LEE68SB08	-	On	Sequence Block 8 Active	PLCHJC-CORE3
14-Mar-2025 03:00:25.997	22-KA-101C	LEE43GEQ	1MKB10 DE001 YB14	Off	Generator Excitation Q Control Command	PLCHJC-CORE3
14-Mar-2025 03:00:25.997	22-KA-101C	LEE43GEPF1	1MKB10 DE001 YB12	Off	Generator Excitation Pre-Position 1 Command	PLCHJC-CORE3
14-Mar-2025 03:00:25.647	22-KA-101C	LEE20FCR	1MBP20 AA101 YB01	Off	Fuel Gas Regulator Loading Valve	PLCHJC-CORE3
14-Mar-2025 03:00:25.597	22-KA-101C	LEE20FCDC	1MBP30 AA101 YB01	On	Fuel Gas Control Drain Valve	PLCHJC-CORE3
14-Mar-2025 03:00:25.547	22-KA-101C	LEE04BFLA	1MBH50 AA001 YB01	Off	Turbine Exhaust Air Flow On	PLCHJC-CORE3

HC-EVE alarm history example

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.
- For Aveva InTouch no changes to the application are required.