THE UNICOS-CPC VACUUM CONTROLS PACKAGE

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Abstract

The vacuum control of the Large Hadron Collider and its injectors is based on PLC and SCADA off-the-shelf components. Since late '90s, CERN's vacuum group has developed a dedicated control framework to drive, monitor and log the more than 10 000 vacuum instruments. Also, in 1998, CERN's industrial controls group developed the UNICOS framework (UNified Industrial Control System), becoming a de facto standard of industrial control systems and gradually deployed in different domains at CERN (e.g. Cryogenics, HVAC...). After an initial prototype applying the UNICOS-CPC (Continuous Process Control) framework to the controls of some vacuum installations, both teams have been working on the development of vacuum-specific objects and their integration, together with new features, into the UNICOS framework. Such convergence will allow this generic framework to better fit the vacuum systems, while offering the advantages of using a widespread and well-supported framework. This paper reports on the experience acquired in the development and deployment of vacuum specific objects in running installations, as a prototype for the vacuum controls convergence with UNICOS.

Vacuum CPC Objects

List of Vacuum objects developed:

Symbol	Name	Description	Type
	VP_TP	**Turbomolecular Pump**	Field Object
09	VG_PT	**Passive Gauges (TPG300)**	Field Object
VRGP	VR_GT	**TPG300 Controller**	Field Object
	VP_I	**Ion Pump (Profibus interface)**	Field Object
	VV_S	**Sector Valve (Profibus interface)**	Field Object
	OnOff, widget VP_P	**Primary pump widget (OnOff field object)**	Widget panel
VRPI	VR_PI	**Ion Pump controller (Profibus interface)**	Field Object
	VR_AH	**Hardware Alarm (generated by field controller)**	Field Object
Start VVR open Accelerating	VP_G	**Pumping Group**	Process Object

Why do vacuum apps require specific objects?:

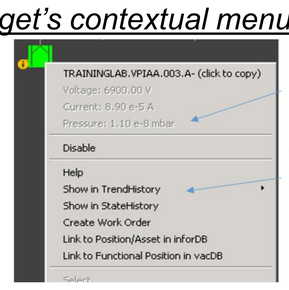
UNICOS-CPC only

6 Objects

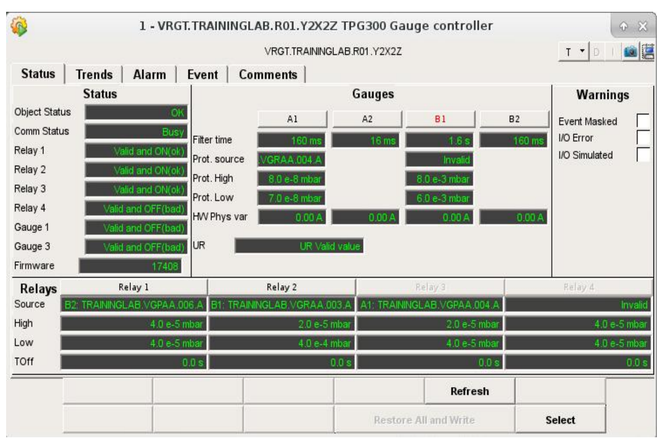
unVacuum package

1 Object

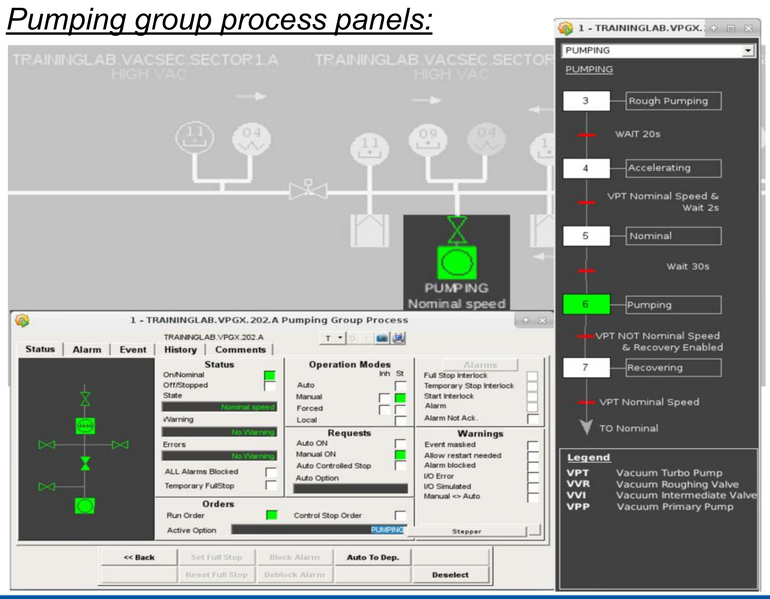
Widget's contextual menu:



Gauge controller faceplate:



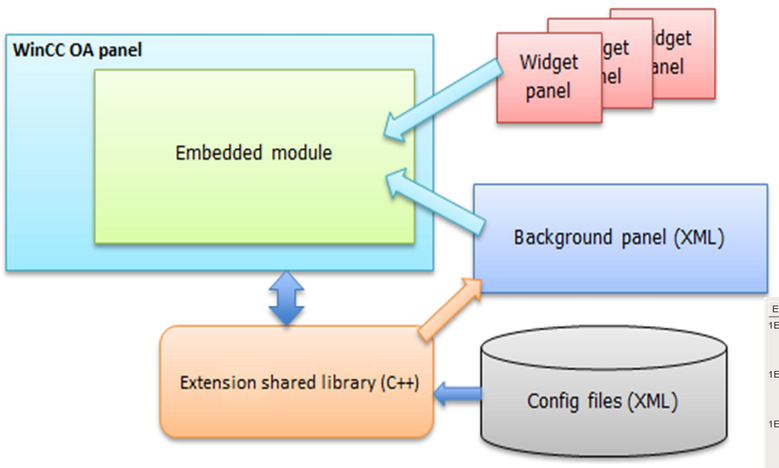
Pumping group process panels:



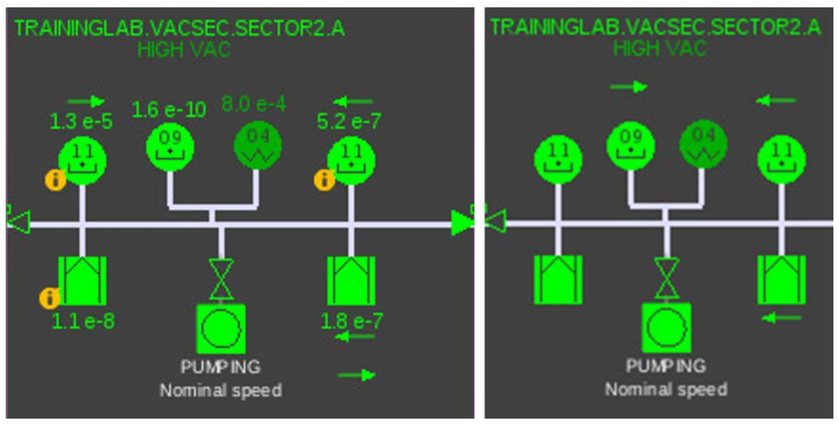
SCADA Features

Implementation of automatic synoptic:

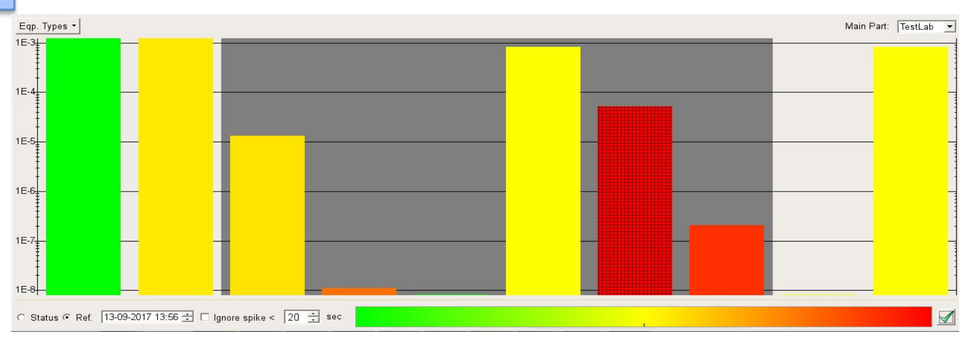
WinCC-OA allows to write extension shared libraries, in C++, within functions that can be called from WinCC-OA CTRL language. First, the extension library function initializes geograph-ical information for machine by reading and parsing XML configuration files. Resulting geographical information is stored in memory of shared library for fast access during synoptic building. Then WinCC-OA panel calls extension library function to prepare synoptic, supplying geography range for syn-optic and which natures of device shall be shown in the synoptic.



Automatic synoptic panel with different widget types:

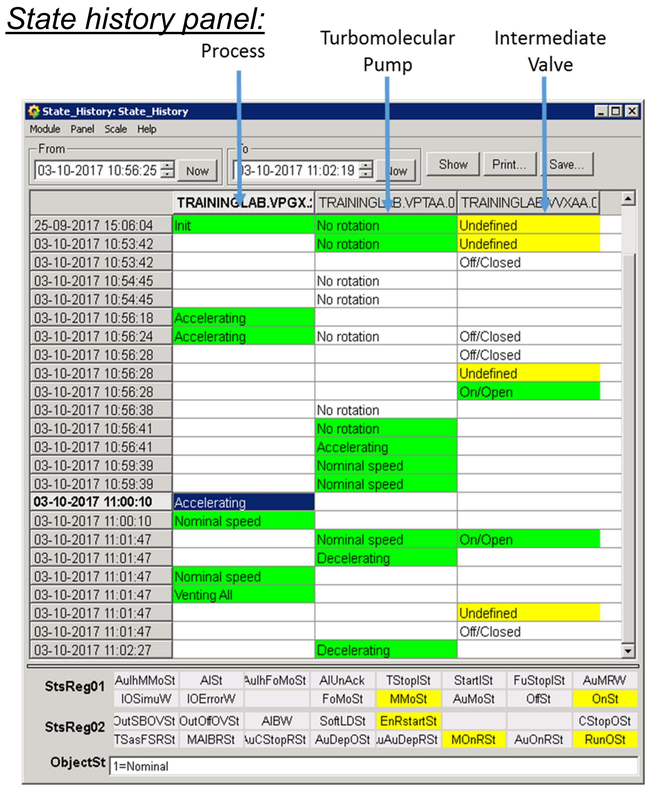


Profile panel in pressure raised detection mode:



In the pressure raised detection mode of profile panel, The colour of each bar corresponds to the maximum growth since a chosen moment in the past and current time.

State history panel:



The state history panel is an advanced tool for post mortem analysis. User has a fast look of meaningful device events and their chronology without any minor events reported.

Conclusion

The first set of vacuum objects has been developed jointly by the vacuum control team and the Industrial Controls and Safety group. The widgets have been developed according to UNICOS standard and vacuum control user requirements. SCADA features – i.e. automatic synoptic, state history panel and pressure profile panel – have been redesigned from vacuum framework in a more portable version and compatible with UNICOS-CPC objects. All the features are scalable. They have not only been refactored but upgraded with new functionalities. The goal is to provide a smooth migration to UNICOS and limit the impacts for users. The only change for users is relative to standardization of widget's animation and panel layout. The new SCADA panels remain user friendly with same look as vacuum framework panels. The first version of the UNICOS vacuum control package has been tested, it will be released soon after a review with vacuum control users. In order to migrate large vacuum system to UNICOS framework, the vacuum control package needs to be complemented with additional CPC device types (ion gauge, fast valve, bake-out cabinet, mobile pumping group…) and SCADA features (device list, vacuum trending, replay…).

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Unified Industrial Control System
UNICOS

Institute for High Energy Physics