UNICOS Vacuum Package

The vacuum control of the Large Hadron Collider and its injectors is based on PLC and SCADA off-the-shell 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 ISOLDE 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 fit the vacuum systems, while offering the advantages of using a widespread and well-supported framework.

### UNICOS Vacuum Package

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VP_TD</td>
<td>Turbomolecular Pump instrument</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>VG_PT</td>
<td>Passive Gauges (TPG300) instrument</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>VR_GT</td>
<td>TPG300 Controller</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>VP_I</td>
<td>Ion Pump (Profibus interface) instrument</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>VV_S</td>
<td>Sector Valve (Profibus interface) instrument</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>VG_F</td>
<td>Full Range Gauge instrument</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>widget VP_P</td>
<td>Primary pump widget (OnOff field object)</td>
<td>Widget panel</td>
<td></td>
</tr>
<tr>
<td>VR_PI</td>
<td>Ion Pump controller (Profibus interface)</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>VR_AH</td>
<td>Hardware Alarm (generated by field controller)</td>
<td>Field Object</td>
<td></td>
</tr>
<tr>
<td>VP_G</td>
<td>Pumping Group Process</td>
<td>Process Object</td>
<td></td>
</tr>
<tr>
<td>Auto Synoptic</td>
<td>Automatic synoptic Panel</td>
<td>Functionality</td>
<td></td>
</tr>
<tr>
<td>State History</td>
<td>State history panel</td>
<td>Functionality</td>
<td></td>
</tr>
<tr>
<td>Profile</td>
<td>Pressure profile (with Leak detection mode)</td>
<td>Functionality</td>
<td></td>
</tr>
<tr>
<td>Trending</td>
<td>Vacuum trending panel</td>
<td>Functionality</td>
<td></td>
</tr>
<tr>
<td>Device List</td>
<td>Device list panel</td>
<td>Functionality</td>
<td></td>
</tr>
<tr>
<td>Monitoring List</td>
<td>Piquet Monitoring device panel</td>
<td>Functionality</td>
<td></td>
</tr>
</tbody>
</table>

### Presentation: UNICOS Vacuum in a nutshell

- [https://edms.cern.ch/file/1886998/1/unVacuum_in_1_Slide.pptx](https://edms.cern.ch/file/1886998/1/unVacuum_in_1_Slide.pptx)
- [https://edms.cern.ch/file/1920319/1/UNICOS-CPCVacuumPackage.pptx](https://edms.cern.ch/file/1920319/1/UNICOS-CPCVacuumPackage.pptx)
UNICOS Vacuum objects

UNICOS framework is very flexible because it manages I/O generic field objects. These objects combined together are able to control most of the instruments installed in an accelerator. But for complex instruments the implementation is very heavy and it is not possible to control the instrument as a whole. The development of vacuum dedicated objects solved this problem. Vacuum instruments are represented in synoptic as widgets. The widgets have been developed according to UNICOS standard and vacuum control user requirements.

- Developer guideline for UNICOS Vacuum Objects

UNICOS Vacuum functionality

In addition to the development of new device types for vacuum instruments, some SCADA features have been developed. Five essential features for a vacuum application have been developed in SET1: automatic synoptic, state history, pressure profile, trending for vacuum instrument values, device list and monitoring list. SCADA features 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.

- Automatic synoptic documentation
- State history documentation
- Pressure profile documentation
- Vacuum trending documentation
- Device list documentation
- Monitoring list documentation

External Widget Object

The SCADA functionality panels are using Qt external widget, the C++ code documentation is available below:

- Unicos Vacuum Trending EWO documentation
- Unicos Vacuum Profile EWO documentation
- Unicos Vacuum Value Color EWO Converter documentation

Download Package

https://repository.cern.ch/nexus/#nexus-search;quick~vacuum

Nexus Group / Artifact:
- cern.uab.resources.cpc.vacuum / vacuum-recources-package
- cern.unicos.cpc / ucpc-plc-siemens-vacuum
- cern.unicos.cpc / ucpc-wincc-ao-vacuum

Jenkins Jobs

- https://icejenkins.cern.ch/job/unVacuum_git_winccoa_component/
- https://icejenkins.cern.ch/job/PLC_S7_300_Vacuum_git_Baseline/
- https://icejenkins.cern.ch/job/RP_CPC_Vacuum_git/

Applications in Production

Training Lab Application: https://gitlab.cern.ch/UCPCVac/WCCOA-TrainingLab

ISOLDE Application:
- CCM Name: unicosHMI_VacIsl
- Project : vac_isl_1@cs-ccr-vacisl

REX-ISOLDE Application:
- CCM Name: unicosHMI_VacRex
- Project : vac_rex_1@cs-ccr-vacisl

HIE-ISOLDE Application:
CCM Name: unicosHMI_VacHIEIsl
Project : vac_hieisl_1@cs-ccr-vacisl

MEDECIS Application:
CCM Name: unicosHMI_VacMedicis
Project : vac_medicis_1@cs-ccr-vacm02

ISOLDE OFFLINE2 Application:
CCM Name: unicosHMI_VacOffline2
Project : vac_offline2_1@cs-ccr-vacm02

ATLAS VT Application:
CCM Name: N/A
Project : vac_atl_vt_1@cs-ccr-vacm03

Training Lab Application:
CCM Name: unicosHMI_VacTrainingLab
Project : vac_traininglab_1@cs-ccr-vactest

Framework Sources Directories
SCADA WinCC OA Baseline: https://gitlab.cern.ch/ucpc/Externals/Vacuum/unVacuum
PLC Simatic Manager Baseline: https://gitlab.cern.ch/ucpc/Externals/Vacuum/PLC_S7_300_Vacuum
Resources Package: https://gitlab.cern.ch/ucpc/Externals/Vacuum/RP_CPC_Vacuum

C++ Libraries: https://gitlab.cern.ch/UCPCVac/unVacQtCode
Vacuum trending EWO: https://gitlab.cern.ch/UCPCVac/unVacTrendEwo

Application WinCCOA Developments Directory
Training Lab Application: https://gitlab.cern.ch/UCPCVac/WCCOA-TrainingLab
ISOLDE Application:
REX-ISOLDE Application:
HIE-ISOLDE Application:
MEDECIS Application:
ISOLDE OFFLINE2 Application:

Application PLC Project and UAB Directory
Training Lab Application: https://ics-svn.web.cern.ch/repo/trunk/applications/vacuum/%5bVAC-UNICOS%5d%20TrainingLab/
ISOLDE Application: https://svnicmdev.web.cern.ch/repo/MACHINES/CPS/ISOLDE
REX-ISOLDE Application: https://svnicmdev.web.cern.ch/repo/MACHINES/CPS/REX_ISOLDE
HIE-ISOLDE Application: https://svnicmdev.web.cern.ch/repo/MACHINES/CPS/HIE_ISOLDE
MEDECIS Application: https://svnicmdev.web.cern.ch/repo/MACHINES/CPS/MEDICIS
ISOLDE OFFLINE2 Application: https://svnicmdev.web.cern.ch/repo/MACHINES/CPS/ISOLDE_OFFLINE2