Integrating Siemens Programmable Logic Controller with the Experimental Physics and Industrial Control System

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This note presents an overview of the software required to interface a Siemens Programmable Logic Controller (PLC) with Experimental Physics and Industrial Control System (EPICS) and details of a development test station to evaluate the implementation of the software.

The instrumentation and controls (I&C) for the Hall A Møller magnets are being developed and components are being evaluated. The Siemens S7-1500 series PLC of the I&C will interface between the sensors and magnet power supplies. The EPICS driver to interface with Siemens PLC, S7NODAVE, was developed by aquenos GmbH. The S7NODAVE driver was based on the LIBNODAVE library; however, due to bugs in this library, specifically with newer PLC controllers, the driver was changed to use the SNAP7 library. For EPICS to use this driver, it needs to be compiled, which in turn requires the ASYN driver (which provides asynchronous driver support), which itself needs EPICS base. The PLC controller is directly connected to a Windows computer (as the Siemens software only runs under Windows), which means that for this test stand, EPICS needs to run on Windows.

Since no binary releases are available for Windows, the EPICS related software would need to be compiled for Windows. Due to compilation issues unique to the specific build chosen, the solution selected was to use the Windows Subsystem for Linux 2 (WSL 2), which allowed a Linux environment to be run under Windows without a Virtual Machine or dual booting.

After the needed EPICS software was compiled, a softIOC was created to test communication between the PLC and EPICS via process variables (PVs). The first test of the softIOC was unsuccessful since some of the access settings on the PLC controller needed to be changed from their default settings, namely enabling the GET/PUT communication, Fig. 1, since only global data blocks can be accessed, optimized block access must be disabled, access level must be set to full access, and permit access with GET/PUT must be enabled.

After the PLC settings were changed to match the requirements for the included SNAP7 library, manually communicating with a PV using the caget/caput/camonitor commands indicated PVs communicating successfully with the PLC tags. To more easily view the values of the PVs, a CSS Phoebus screen was created to monitor the PVs, Fig. 2.

EPICS base and Siemens PLC were successfully compiled and configured to support communication via Ethernet between a Phoebus screen and a controller. This proof of principle gives confidence that the Siemens hardware can be integrated into the existing EPICS software infrastructure.

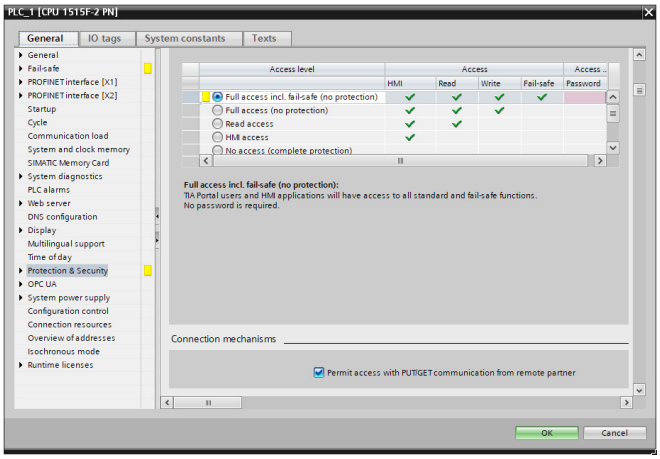

FIG. 1. Enabling GET/PUT connection mechanism on PLC controller; the default is disabled.

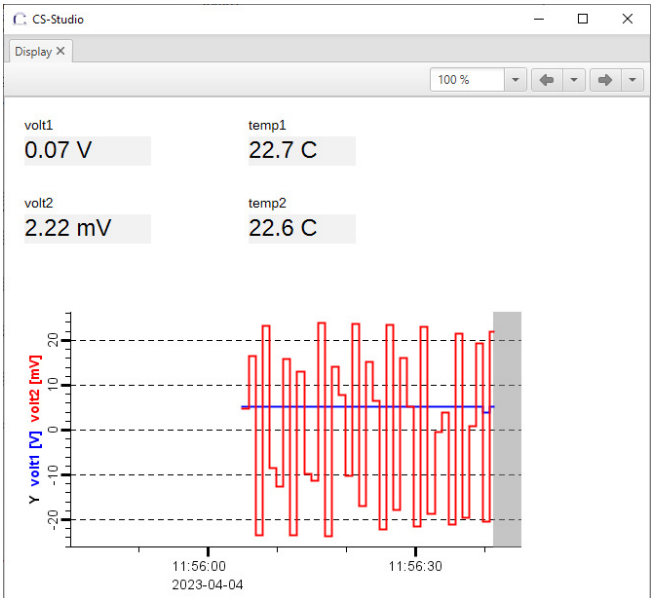

FIG. 2. Test CSS Phoebus screen showing PVs associated with PLC tags.