

IMPROVEMENTS TO THE CRYOGENIC CONTROL SYSTEM ON DIII-D*

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The cryogenic facility that is part of the DIII-D tokamak system supplies liquid nitrogen and liquid helium to the superconducting magnets used for electron-cyclotron heating, the D₂ pellet injection system, cryopumps in the DIII-D vessel, and cryopanel in the neutral beam injection system. The liquid helium is generated on site using a Sulzer's liquefier which has a 150 l/h liquefaction rate. Control of the cryogenic facility at DIII-D was initially accomplished through the use of three different Programmable Logic Controllers (PLCs). Recently, two of those three PLCs, a Sattcon PLC controlling the Sulzer's liquefier and a Westinghouse PLC, were removed and all their functionality was merged into the remaining PLC, a TI555. This replacement was originally undertaken because the removed PLCs were obsolete and unsupported. However, there have been additional benefits from the replacement. The replacement of the RS-232 serial links between the graphical user interface and the old PLCs with a high speed Ethernet link allows for real-time display and historical trending of nearly all the cryosystem's data. This has greatly increased the ability to troubleshoot problems with the system, and has permitted optimization of the cryogenic's system's performance because of the increased system integration. To move the functionality of the Sattcon control loops into the TI555 an extensive modification of the basic PID control was required. These modifications allow for better control of the control loops and are now being incorporated in other control loops in the system.

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Prefer:

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