



Hinz Automation Inc.

Manitoba Hydro

The Client:

Manitoba Hydro is a provincial crown corporation charged with supplying electricity to the province of Manitoba. They operate several hydroelectric generating stations along the Saskatchewan, Nelson, Winnipeg, and Laurie Rivers. They have sufficient Hydro reserve to be a net exporter of power to neighboring provinces and states. Their Grand Rapids Generating Station is a 4 generating unit, 480 MW

hydroelectric station located on the Saskatchewan River between Cedar Lake and Lake Winnipeg. It is accessible by Provincial Highway 6. The Grand Rapids station is an important station on their grid not only for the power it supplies, but also for the reactive power balancing and grid voltage control it provides.

The Requirement:

Manitoba Hydro was undergoing a rebuild at their Grand Rapids Generating Station. The capability to operate the generating units in condense mode - i.e., a unit operates like a motor and provides pure reactive power compensation - was being added.

Extensive physical renovations are required to accomplish this, as the water around the unit's turbine blades must be forced out by compressed air to allow it to motor. Along with the renovations, a Unit Control & Monitoring System (UCMS) was required. In addition

to control and monitoring of the condense and generate operation of the units, the station was required to provide Joint VAR Control JVC - that is, sharing of total station reactive power among the operating units according to their individual capability. The UCMS had to provide this JVC capability, detailed alarming at a local level, and summary alarming to System Control Center (SCC) in Winnipeg. A high level of redundancy in order to maintain control and alarming at all times was required.

The Design Solution:

The solution consisted of a joint HMI-PLC combination.

The HMI selected was GE Fanuc's Cimplicity HMI operating on Windows NT Ver. 4.0. Included in the software was Microsoft SQL Server and Excel. The configuration was a redundant host system which allows for two operating stations yet maintaining data consistency and fault tolerance.

Significant HMI features includes:

- Dual heads on one workstation allow the operator a larger than normal working area for plant monitoring display.
- Predefined alarms trigger data changes of pre-analyst alarm data for later analysis.
- The HMI detects and switches automatically to the active PLC of a redundant pair, at the driver level.

The PLC selected was GE Fanuc's 90-70. The particular model used implemented Genius Hot Standby redundancy. The required control functions were shared among 3 redundant pairs of PLCs, as follows:

- Station PLC pair - controls Station Bus voltage and balances Station MVARs
- Unit 1 & 2 PLC pair - controls Units 1 & 2, including condense/generate operation and generator excitation
- Unit 3 & 4 PLC pair - controls Units 3 & 4, including condense/generate operation and generator excitation

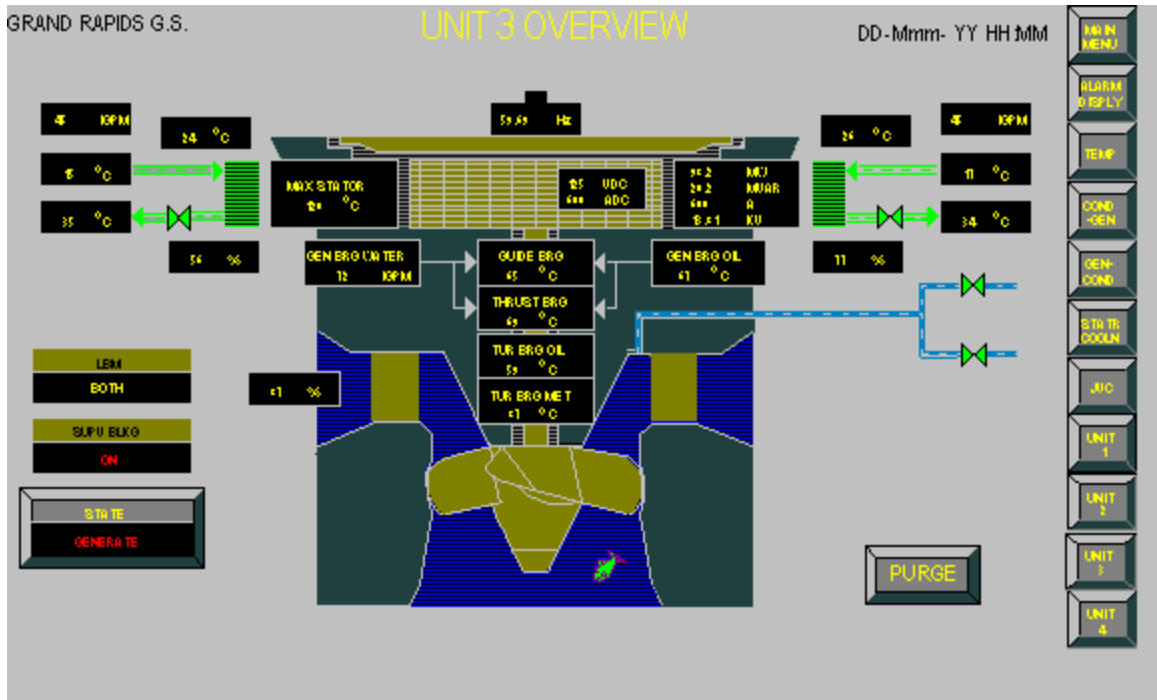
Significant PLC features includes:

- recalculating MVAR limits for each generator dynamically, as a function of power
- alarm chatter logic, which looks for alarms to chatter and removes them, for up to 2000 points/PLC
- switching of active/standby PLC roles if I/O or Ethernet communication to a unit should be lost
- tracking of active PLCs and re-aiming Ethernet communication when active and standby roles switch

The PLCs communicate among themselves, and with the HMIs, over a redundant 10BaseT Ethernet link.



Grand Rapids Generating System Unit Control & Monitoring System



System Specifications:

1 Primary HMI, 1 Secondary HMI

Hewlett-Rand Pentium 133 MHz, 96 MB RAM, a 1.1 GB and a 2.1 GB hard drive, Tape back-up, dual Matrox MGA Millennium video cards and 2-20" Viewsonic monitors (dual video on primary only)

Points - 7481 Alarms - 6052 Screens - 50

1 Station PLC and 2 Unit PLCs

- 780 CPU Central Processing Units
- 741 CMM Ethernet modules
- 713 Bus Transmitters
- 711 RCM Redundancy Communication Module
- 731 Genius Bus Controller, with Genius
- Existing 90-30 PLCs

Total installed I/O

Discrete I/O - 736 pts
 Analog inputs - 84 pts
 Analog outputs - 12 pts
 RTD inputs - 180 pts
 90-30 I/O - 364 pts

Communications

- Redundant 10BaseT
- 8 - AUI to redundant 10BaseT
 - 2 - 16 port 10BaseT Hubs in redundant connection

For further information or to contact a Hinz Automation office near you, please check our Web site at

WWW.HINZ.COM