Modernization of Control Systems for 5 MV Tandem Accelerator

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NEWER HISTORY
CHANGING HISTORY
PRESENT
Control System Architecture

Automation system runs under virtual network
Control Layer

Currently Installed:
- DIGITAL INPUT CHANNELS: 204
- DIGITAL OUTPUT CHANNELS: 216
- ANALOG INPUT CHANNELS: 166
- ANALOG OUTPUT CHANNELS: 78
  Analog Channels 15 bit + sign
PLC CODE

WE USE ONLY STL AND FBD
We use Rslnix Classic Gateway OPC SERVER. It allows us to have multiple OPC Clients performing data collection without having RSLinx Classic installed on each machine. Have worked very well after we have find right parameters.
The complete HMI for 5 MV tandem Accelerator is a Labview Project. The computer where it runs can be called as DATA SERVER. All the data is handled by DATA SERVER computer. Network-published shared variables are used. All important control is handled by PLC and NI hardware and SW. DATA SERVER collects data from PLC tags and NI hardware and serves all data to Historian Database and HMI panels. There are no limits how many panels there are or where they are located.
HMI panels are composed of Labview XControl objects which are reusable. If similar control is needed elsewhere, to reuse we copy XControl with new name and change shared variable bindings.
Main Problems faced

Lack of man power

Work force available during this project

1 Engineer (SW programming, HW design with ACAD Electrical)
1 Technician (SW programming, HW design with ACAD Electrical)
1 Technician (Graphical designer, 3D design with ACAD Inventor, Cabling)
1 External Cabling Guy (9 months)
Various Vocational School Students for short time cabling works
We use as much as possible off the shelf commercial components from selected manufacturers (standardization of components).

We make reusable HW design (drawings). HW built must be easily maintained by few people. Strict wiring conventions are crucial in this.

We make reusable well tested and easily maintained software. SW built must be easily maintained by few people.
Reusing design HW example

Mechanical structure is always similar
Din Rails and supports (two sides of cabinet is used)
Ducts
GND bar
Ventilation and its control

In Basic construction 230VAC and 24VDC distribution is always the same
With this approach new HW design always starts with copying ACAD project with new name.
Only small changes have to be made to mechanical drawings and many electrical drawings can be copied from existing designs and changing only text and references.
Problems encountered during use

- No problems with ALLEN BRADLEY, everything works perfectly
- Charging HV Supply (Glassmann MJ Series) broken due to 4 MV Tank Spark→ HV Supply was repaired and Spark Protection was improved by making adjustable Spark Gap and inserting a load Resistor
- One Flex Rack 4000 Vacuum Gauge controller module was broken
Spark Protections

Focus Lens HV Supply protection with Load resistor and 3 Gas discharge tubes (GDTs) in series

Charging HV Supply feedthrough Spark protection in the bottom of the Tank
SOME PICTURES
SOME PICTURES

ION PUMP CTRL RACK

VACUUM GAUGE CTRL NEUTRON RAD. MONITOR CONTROLLER

MAIN CPU

TERMINAL POTENTIAL STABILIZER NMR

ANALYSIS MAGNET POWER SUPPLY
THANK YOU, QUESTIONS?