

DEVELOPMENT OF AN ETHERNET ENABLED MICROCONTROLLER BASED MODULE FOR SUPERCONDUCTING CYCLOTRON ECR BEAM LINE CONTROL

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A web based, general purpose control as well as data acquisition module developed for Superconducting Cyclotron Beam line elements control and monitoring.



Figure 1: ECR Ion Source and Horizontal Injection Line

ECR Ion Source and Beam Line Elements.

The Electron Cyclotron Resonance Ion Source (ECRIS) plays a major role in generation and injection of the different ions to be accelerated by the Superconducting Cyclotron. ECR ion source develops multiply charged ions which are transported to the cyclotron through the injection line.

A large number of beam line equipments including various types of magnets, beam diagnostics elements, vacuum system components etc are required to be monitored and controlled for efficient transportation of the ion species

Ethernet Enabled Control Module

An Ethernet enabled control and data acquisition module has been developed for the beam line elements. This is a general purpose control module which can be used for most of the beam line element control and monitoring. Figure 2 shows the schematic of the module.

General Features of the Module:

- An Embedded Web server communicates to client PC over LAN.
- IP address of the server configurable from client PC and stored in internal EEPROM.
- User Authentication implemented for access of control and configuration page.
- Web page refreshes every 5s.
- Web server can be booted either with the default or the new IP selectable from jumper switch.
- Microchip TCP/IP stack implemented with CCS modifications.
- Stack includes ARP,IP,ICMP,TCP and HTTP.

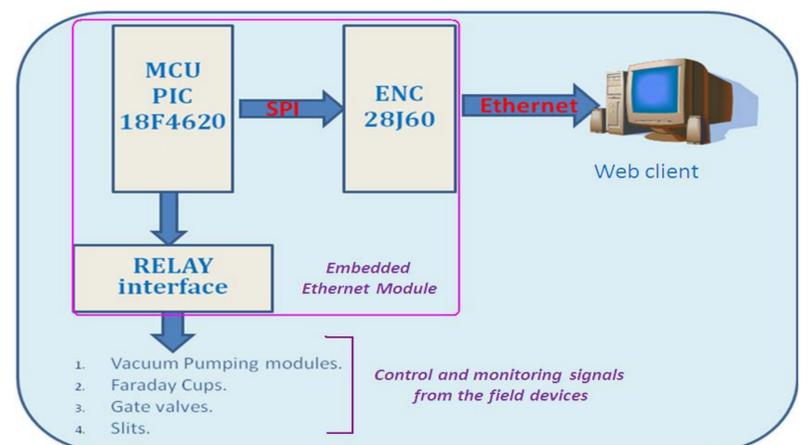


Figure 2: Schematic of the system architecture.

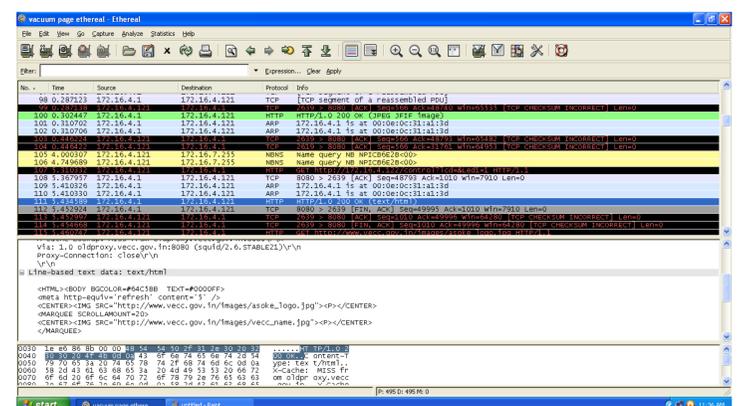


Figure 4: Ethernet File showing the frames captured..



Figure 3: Assembled Ethernet Module

Hardware Overview

- Microchip PIC18F4620 used as the main controller.
- Microchip ENC28J60 used as Ethernet controller.
- Two controllers communicate over SPI.
- Relay interface used to interface field signals to main controller.
- 3 digital input, 3 digital output and 3 analog inputs are available in the module.
- Internal 10 bit ADC of the microcontroller is used to convert the analog signals to digital.
- Temperature sensor (AD22100KT) with internal ADC, monitors the temperature of the field device.
- Local LCD provided for IP address and status display.

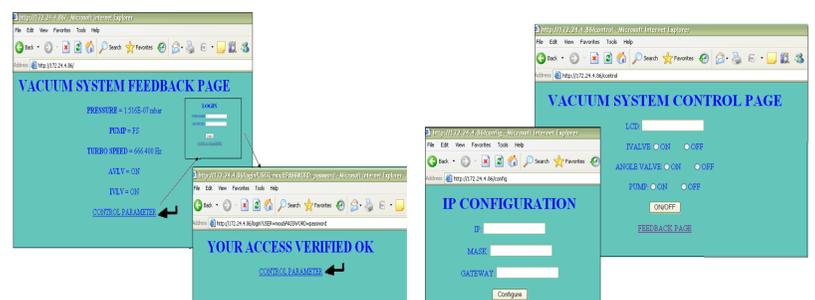


Figure 5: Vacuum system Feedback, Log In, Access verification successful, IP Configuration and Control web page.

Conclusion

- One set of Ethernet based control and data acquisition module has been installed in the ECR beam line.
- It is being used to control and monitor one set of Scroll pump, Turbo Molecular pump, Angle valve, Isolation gate valve, and the Vacuum gauge. It is successfully operational for about one year.
- In future, more number of these type of modules are planned to be installed to control and monitor the other beam line elements such as Faraday Cup, Gate valve etc.