OPTICALLY ISOLATED REMOTE OPERATION AND DATA ACQUISITION SYSTEM FOR ECR ION SOURCE BEING DEVELOPED FOR LEHIPA

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Abstract

An optically isolated remote operation and data acquisition system has been designed and developed for ECR Ion source required for LEHIPA. There are various sub-systems of ECR ion source like three no. of High Voltage supplies, two solenoid coil supplies, a microwave generator, vacuum controller and a LCW plant. A fiber optic ring topology was implemented to connect different sub-systems. This paper describes the components of optical network and the development of software for remote operation and data acquisition.

SYSTEM DESCRIPTION

There was a need to isolate ground of different sub-systems and operate the system in EMI noise environment generated by high voltage supplies, solenoid supplies and microwave generator. So, optical link based data acquisition system was designed and developed for isolating each sub-system and still monitor and control them. A RS-232 to Optical duplex converter, TCF 142M [2], Make: MOXA, was used for forming a optical ring and connecting to different sub-systems.

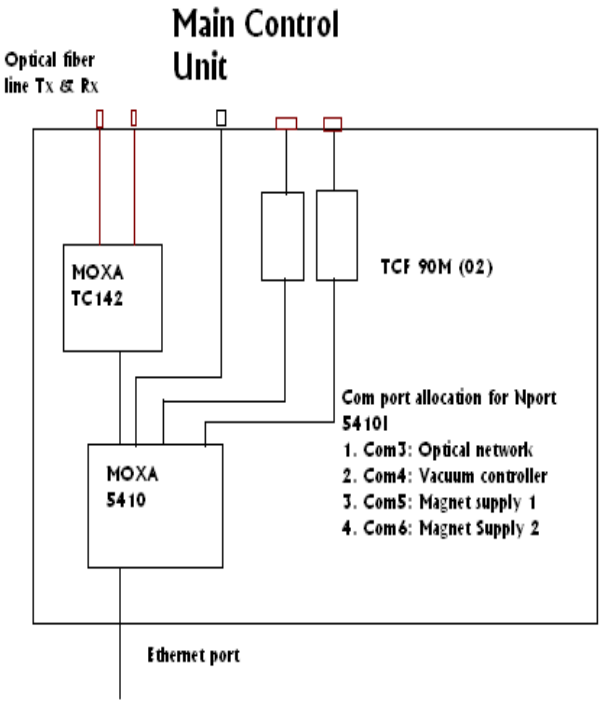

Fig.1. Block diagram of Main control unit

The optical network has two main units, a "Main control unit", connecting to PC. And the other unit is "Data acquisition unit", connecting to sub-systems.

Main Control Unit

The block diagram of the main control unit is shown in Fig.1. The main control unit is connected to PC on Ethernet port using Nport 5410I, MOXA (Ethernet to Isolated four port RS-485/232 converter). One RS-485 port is converted to optical signal using TCF-142M [2] (RS-485/232 to optical duplex converter with Ring formation feature). The TCF 142M converts RS-485 signal to optical signal and vice versa.

The two number of Solenoid coil supplies have RS-232 ports. The two COM port of Nport 5410I is used for controlling solenoid supplies. An optical converter TCF 90 and TCF 142M is used for optically isolating the RS-232 port. There are two sets of optical converter for two supplies. Optical converter TCF 90 does not need extra power source as it takes power from the COM port.

The Vacuum control unit and LCW plant are directly connected on COM port of Nport 5410I and COM1 port of PC respectively.

Data Acquisition Unit

The block diagram of data acquisition unit is shown is Fig. 2. There are two such units being used in the system, which can be further increased as per any future need.

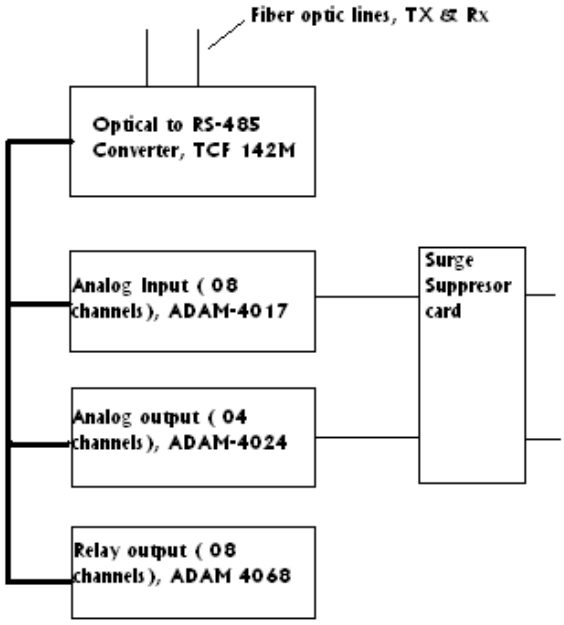

Fig.2: The block diagram of Data acquisition unit

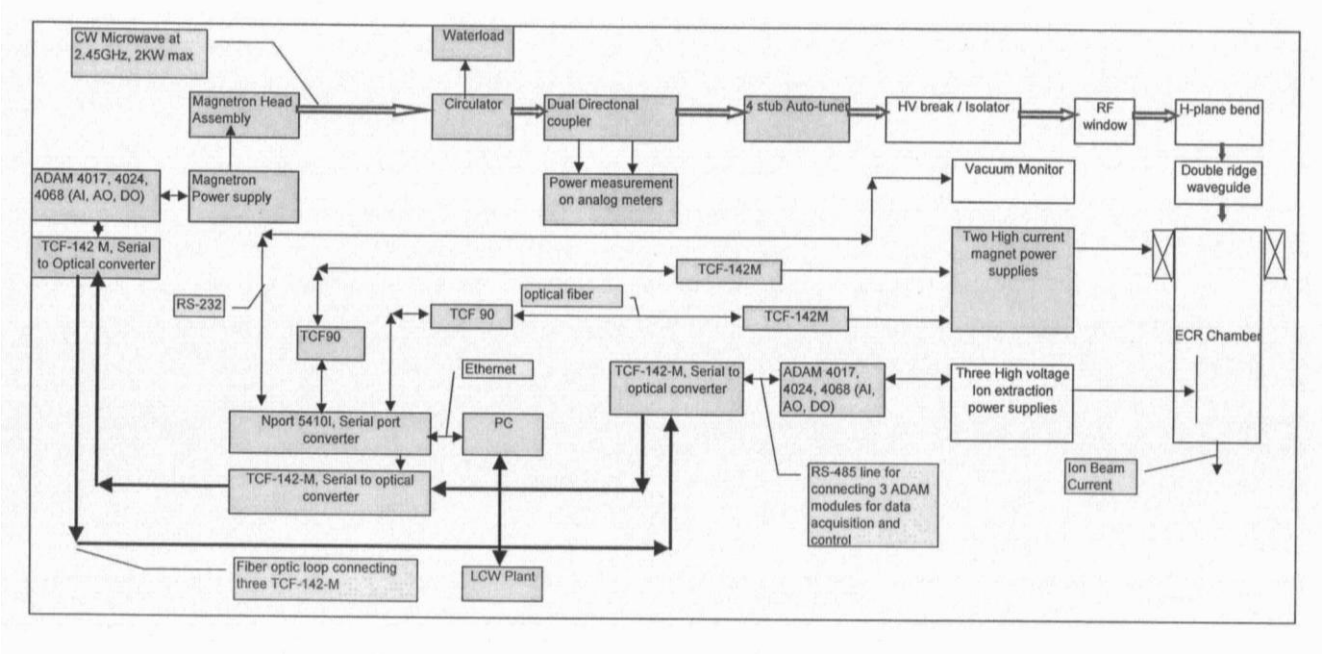

Fig.3: Block diagram of full control system along with sub-systems of ECR ion source

One unit is used for accessing data from HV power supplies and other unit is used for Microwave generator. Each unit consist of TCF 142M (Optical to RS-232/485 duplex converter), ADAM 4024 [1] (04 AO channels), ADAM 4017+(8 AI channels), ADAM 4068 (8 Relay) and TCF 142 M. The ADAM modules are connected in parallel on RS-485 line. The analog signals from sub-system are connected through a surge suppressor card consisting of MOV and TVS.

All the ADAM modules of both the units are assigned different addresses. The ADAM modules operate in Master and slave mode. The modules respond only when they are addressed by command from PC. Thus multiple ADAM modules (up to 256) can be connected in parallel. So the system has large scope for expansion for any future need. The data transfer rate on RS-485 line has been set as 115kbps for faster access and control.

The whole DAQ system was installed and integrated with the system. The block diagram of the whole DAQ system integrated with the ECR ion source is shown in Fig.3. Individual systems were gradually tested for remote operation. Now all the sub-systems are being remotely operated and it is being used for regular operation. The system has been designed such that even if control system is not operating, the individual sub-system can be operated from local panel.

CONTROL SOFTWARE

The software for controlling various Power Supplies is developed in VB 6.0. NI CWSerial ActiveX Control is used for communication over RS-232 between PC and the Power Supplies. CWSerial.Write (Data) is used to write the data to the Power Supplies and CWSerial.Read( ) is used for reading the data form the power supplies. Feature of Local/Remote was implemented in High Voltage & High Current Power supplies. Program for reading the vacuum from Vacuum Controller is also developed.

FUTURE PLANS

The existing control system for ECR ion source has to be integrated with the main control system of LEHIPA. The existing operating software has been developed using VB on Windows OS. The new software will be developed on QNX operating system for real time control as well as to integrate other parts of LEHIPA. Few more control signals will be integrated for safety. As the system has sufficient scope for expansion, other extra signals can be added later as per system requirement.

CONCLUSION

This DAQ system has many advantages like ground isolation, noise immunity and modularity. Whole control system is connected to Ethernet port of PC, so any computer on LAN can also be used for operating the system. From maintenance point of view, if the control PC is not operating, then another PC can be very easily connected and system can be operated. The Modules are readily available, thus enabling convenient maintenance and expansion.

REFERENCES

[1] http://www.advantech.com/products/RS-485-I-O-Modules-ADAM-4000/sub_1-2MLKHT.aspx

[2] http://www.moxa.com/product/TCF-142.htm