REMOTE CONTROL OF RS232 AND RS485 BASED RF AMPLIFIERS AT IUAC HCI FACILITY

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Abstract

Solid State RF amplifiers are increasingly being used for the RF systems in particle accelerators. High Power RF amplifier system is an integral part of a particle accelerator required for energizing the Resonating structures. Particles to be accelerated are made to propagate through these resonating structures and RF amplifier system creates required electromagnetic field inside this resonating structure which in turn accelerates the particles to desired energy level and also compensate synchrotron radiation loses. The aim is to control each individual RF Amplifier to power the DTL cavity with a provision of remote access from Control room computer server under Linux platform with the existing HCI control system at IUAC.

Introduction

The Remote monitoring of Various control parameters of RF amplifier such as forward power, reflected power, Alarm status, Interlock check, which indicates that all interlocks are on, if any faults that occur and a Reset function signals of RF Amplifiers which are installed in the   High Current Injector (HCI) accelerator system is necessary from control room. Two different Models of RF amplifier Remote control through RS 232 server and One RS485 based RF Amplifier Remote control are explained in this paper.

QEI Corporation V28K97M Solid State RF Amplifier [2] for (DTL:#4, DTL:#5)

Serial operation of the system is accomplished by connecting a three wire serial interface connector to the RS232 Connector (DB9) on the top of the cabinet. The serial connection requires 19200 Baud Rate, 8 Bit, 1 Stop Bit, No Parity, No handshake/flow control.
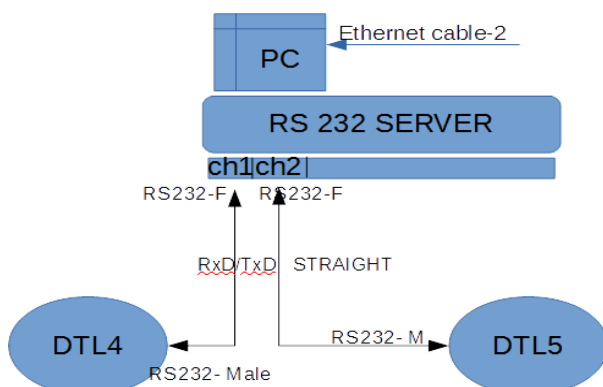
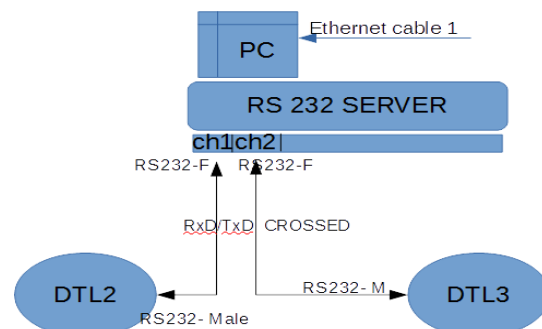Serial Commands are listed in the following table.

Serial Command	Description
PWR+	Turns power supplies on
PWR-	Turns power supplies off
RF+	Turns RF on
RF-	Turns RF off
SET	Make a set point
RES	Generate a reset
ALM	Returns the state of the alarm bus as a decimal.
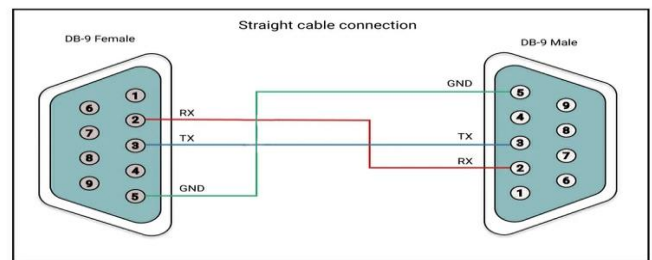
(RF Amplifier DTL:#4, DTL:#5)

DB Science 20 kW CW Solid State RF Amplifier [1] for (DTL: #2, DTL:#3)

RS-232 command set of 20kW RF Amplifiers corresponding to DTL:#2, DTL:#3 (M/s. DB Science, Italy) are included in the Control server program.
Control through DB-9 RS232 connection-Normal Setting values with RS-232 (cross) cable are Baud rate 115200, Data bits 8,Parity ODD,STOP Bit 1,Flow Control NONE.
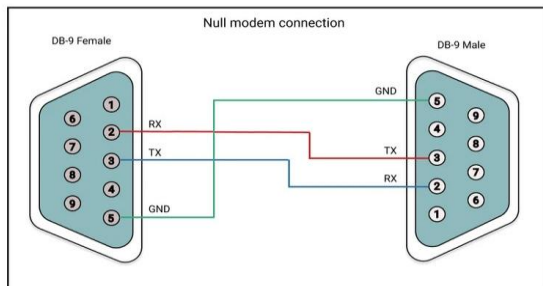
RS-232 command set of 20KW RF Amplifiers corresponding to DTL:#2, DTL:#3 (M/s. DB Science, Italy). The commands are different from 28KW.
Serial Commands are listed in the following
%01$RCX**[CR]
%01#RCSY0004**[CR] Amplifier ON state STATUS
%01$RCX**[CR]
%01#RCSY0003**[CR] Amplifier STANDBY
etc.

(RF Amplifier DTL:#2, DTL:#3)

Orange PI and PIC Micro controller based RS232 Server

It's an open-source single-board computer. It can run Android 4.4, Ubuntu, Debian, Raspbian Image. It uses the All Winner H3 SoC, and has 1GB DDR3 SDRAM. Dedicated firmware has been developed and Orange-Pi single board Computer with 1GB RAM is used. RS232 server consists of tiny SBC (Raspberry Pi or Orange Pi) which boots up with OS image. The application program (PSERV) compiles and runs on it. On the basis of database file the program communicate with beam line component and RF Amplifiers.

Programming Microcontrollers with MPLAB® X(IDE) Software.

MPLAB® X Integrated Development Environment (IDE) is an expandable, highly configurable software program that incorporates powerful tools to help you discover, configure, develop, debug and qualify embedded designs for most of our microcontrollers.

The PIC Micro Controller board consists of a Micro-Controller board that multiplexes 12 numbers of RS232 Ports to a USB port. This board is connected to a single board Computer running GNU/LINUX. A server program manages the communication to the RS232 and RS485 based RF Amplifiers in response to the commands received over a TCP/IP network. The system has been designed to make it compatible with the existing PSERV and PCLI software based accelerator control system.

PIC Microcontroller programmed for DTL:#2, DTL:#3 (M/s. DB Science, Italy) Baud Rate 115200.
PIC Microcontroller programme for DTL:#4, DTL:#5 (M/s. QEI-RF, USA) Baud Rate 19200.

View of the HCI Remote control system

Remote Control of DTL #1 6kW amplifier(RS485 based RF power amplifier)[3]

The remote control of RS485 based RF Amplifier using the commands given by M/s. Db Science, Italy for status remote control and monitoring of RF power amplifier controls. The USB 2.0 to RS485 Serial Converter is used for Orange PI server USB port ISDN terminal adapter with over 1Mbps data transfer rate. This USB 2.0 to RS485 Converter is small and compact in size.Dedicated firmware has been developed with Orange-Pi single board Computer. The system has been successfully installed and tested in High Current Injector (HCI) facility at IUAC with the existing control system.

Acknowledgements

CONCLUSION

The Remote control system for RF Amplifiers described in this paper has been developed and tested successfully. The system has been successfully installed and tested in High Current Injector (HCI) facility at IUAC. The system has undergone a successful time testing. User suggestions and comments have been adapted to enhance the system performance.

REFERENCES

[1] User Manual: 20 kW CW Solid State Amplifier .
[2] User Manual: KDP 20000/L CW Solid State Amplifier.Release1.1
[3] User Manual: KFG 6K 6000W FM Power Amplifier.Release1.1.1

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