

REMOTE CONTROL SYSTEM FOR TANDEM ACCELERATOR

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This report describes some devices for a system of data communication between ground potential and high voltage terminal (HVT) of the electrostatic accelerator.

For the purpos of signal transmission between different electric potential, light link device which is composed of a pair of light transmitter and receiver should be very adequate means, and recent development of optical data communication technique, using optical fiber cable makes possible to construct a very reliable remote control system for electrostatic accelerator. Recently such a system has been used successfully in several machines, and the optical fiber cables are set along the indulation columns.

The light link system in the kyushu University Tandem accelerator however has not been used any light guide materials such as optical fiber, and the light path was taken to radial direction of the column axis, and light link transmitters and receivers are faced each other through pressure vessel window and a slit of 2cm width on the shell of HVT. The relative Position of HVT and pressure vessel window changes a few mm following the gas pressure, and to insure the operation of the remote control system in any gas pressure, the syze of light spot at the receiver sets about 8mm dia. The term "remote control system" is used in this report as a general name of remote operation system and telemeter system, the former has light transmitters at ground potential and operating the devices in HVT, e.g. vacuum pump, stripper foil changer, charge inductor etc, the latter has light transmitters in HVT and the data are transmitted to control desk.

Remote Operation System

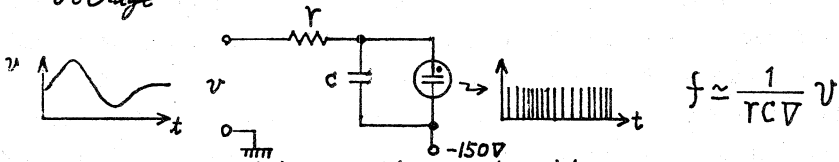
Four laser light sources (1 mW He-Ne laser tubes were placed at the out side of the pressure vessel and corresponding four photo-transistor receivers were mounted in a small case placed in HVT. To avoid the affect of environmental light, the receiver case has four small aperture collimator (1mm dia., 10mm thick) faced each light source. These collimator drop the laser hight intensity about 1/50, however, high efficiency photo-transistor (NEC PD32) can drive small power relay directry. This system operates as a channel selector by the order of four light sources turn on time sequence. Each light source has a shutter of light path and if one make one of the remote control switches

at the control desk, the shutters are opened one by one following the coded ordering. When the third shutter is opened, receiver circuit in HVT can select out one channel out of 24 channels (${}^4P_3=24$), and wither the fourth shutter is opened or not double the selectable channel number. Then the remote operation system can make any one of 48 different circuits at a time.

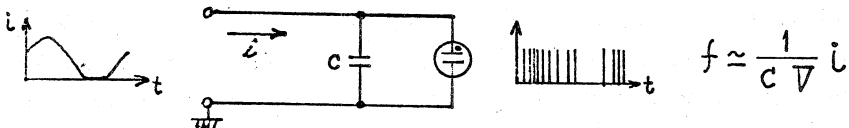
Telemeter system

Gas discharge tube (NEC-R1168) have been used for the signal converter to the light. This tube works rather wide frequency range and then dc and low frequency signals are converted to modulated signals of high frequency (PCM or AM modes) for preventing the disturbance of environmental light, i.e. lightning of discharge and lighting in the vessel. Principle of the signal converter to the light are shown in figure.

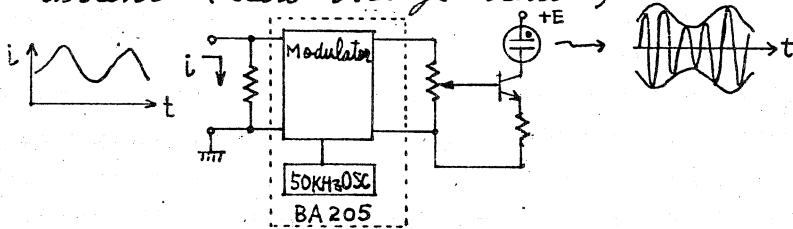
1) voltage



2) current (high voltage circuit)



3) current (low voltage circuit)



f; pulse counts/sevond at PCM mode

$0 < f < 5000$ Hz

v; (gas discharge starting voltage)-(discharge quenching voltage)