STANDARD CONTROL COMPONENT TO COMPUTER CONTROL BY SIN CYCLOTRON

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ABSTRACT

Speaking of the SIN Control System, we can summarize its properties. The System is modular and based on:
- Control computer (control room)
- Operator's console computer (control room)
- Private manual setpointsettings connected to the ROAD (control room and local)
- ROAD-System (parallel time/address division multiplexing)
- Standard Control Components (local connected to ROAD).

INTRODUCTION

After initial studies, we began the design of a "computerized" control system in 1970. This control system should represent for us in a technical and economical way the optimum solution for an accelerator to be put into operation in 1973/74.

The physical structure of our accelerator - two isochron cyclotrons in series - and the layout of experimental areas could be described from the control point of view as a number of controlled parameters (over 300), a number of measured values (over 500) and controlled status conditions (over 2000). All of these signals are remotely controlled from a central control, located in the operations building, requiring cable connections from 30 to 500 meters in length. (Fig. 1)

Since most of the power supplies are SCR (silicon controlled rectifier) - controlled and the RF - power stages are several hundreds of kilowatts, the noise level was at a level that made the transmission of the precise analog signal very difficult.

The control system has been built up around the control computer (IBM-1800 32k 3 DISK-Drives) (Fig. 2). The control computer talks to the operator over a console computer system (interactive-display/push button/ thumb-wheel-switches, etc.).

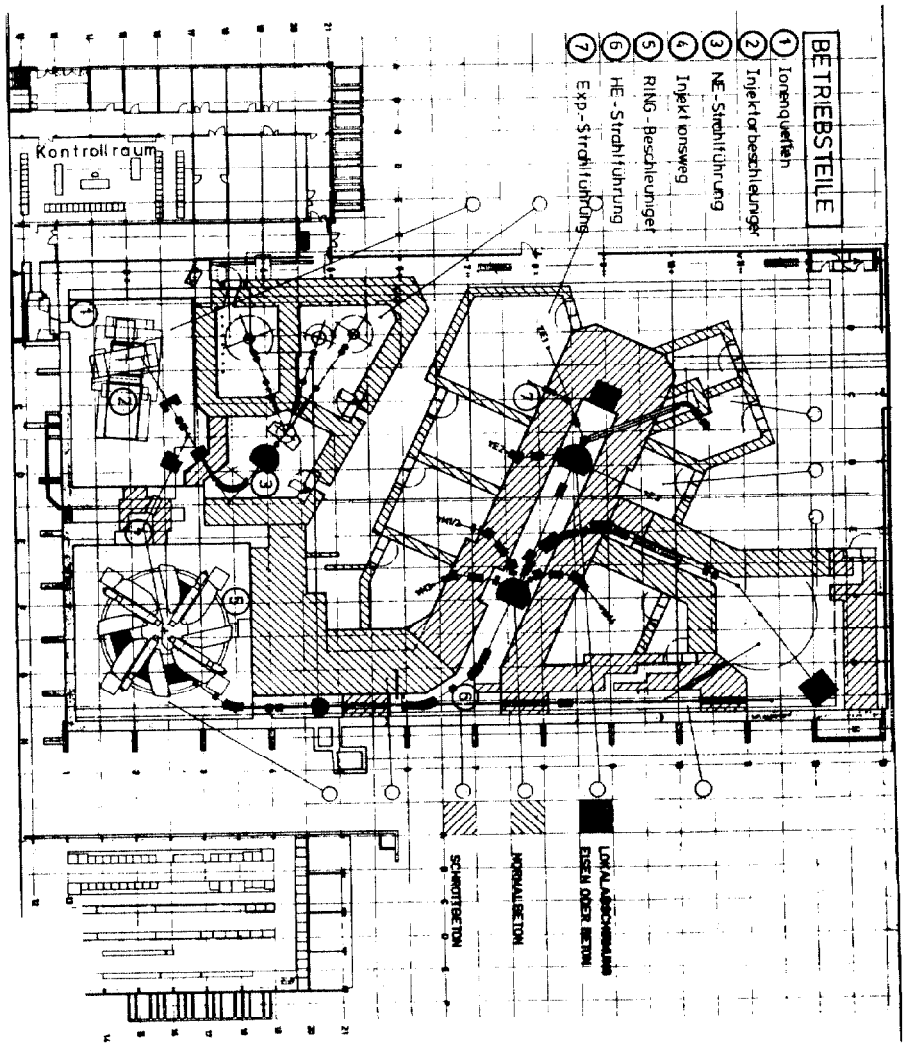

Fig. 1 SIN-CYCLOTRON + EXP. AREAS

The control electronic are placed "locally", near the accelerator components. The use of home developed standard control components such as Setpoint Reference Units, ADC's, Scanners, Digital/in/out-units, etc. with various accuracy classes allows one to have a great deal of uniformity in the equipment, economic spare parts depot and reliable operation of the accelerator.

All of these components are connected to the central control by such money saving orinciples as line shared transmission.

The signal transmission system called ROAD (Rapid Operation and Acquisition Dataway) insures safe information flow for both control + monitor information. The system is completely modular, using only professional grade components, wire-wrap and crimping techniques. The transmission lines have been designed with balanced twisted pairs and additionnal galvanic seperation between local stations to ensure reliable operation even in a very aggressive environment (noise, earth problems). The ROAD-transfer consists of 16 Data bits + 11 Address bits and 5 Mode bits (Subfunctions). The time sequencing for each Data transfer is as high as 10 - 20 microseconds.

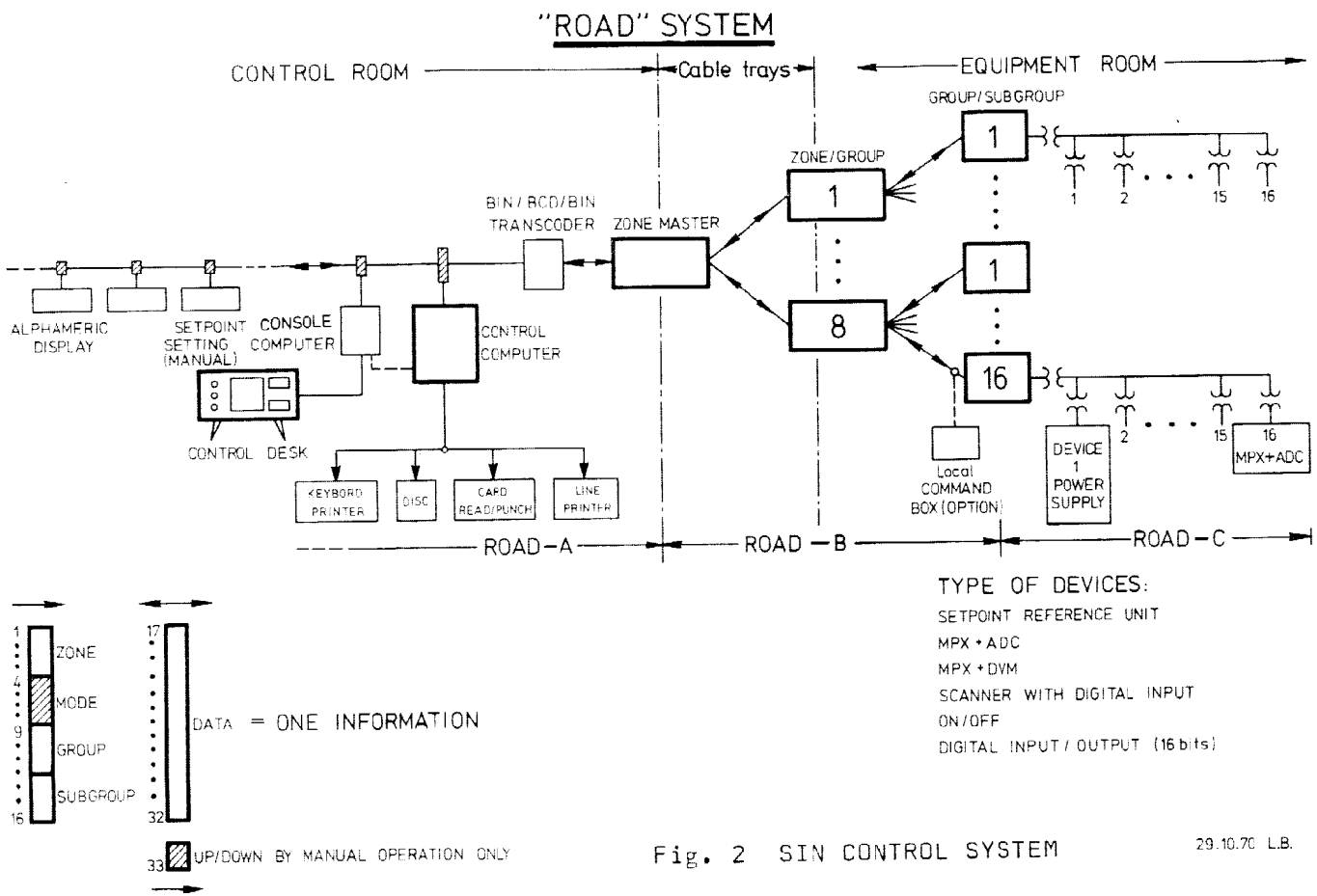

Fig. 2 SIN CONTROL SYSTEM

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A complete set of standard control components, have been developed such as

i SETPOINTREFERENCES (10^{-3}, 10^{-4}, 10^{-5})
ii DIGITALVOLTMETERS (10^{-3}, 10^{-4}, 10^{-5}, 10^{-6})
iii MECHANICAL SCANNER (192 INPUTS)
iv DIGITAL OUTPUT RELAY-DRIVER (16 bits)
v DIGITAL IN/OUT-FAST (TTL)
vi CAMAC INTERFACE

By means of the above components the control computer can handle remotely anything interfaced to the central control.

The accuracy and the speed of these components were developed to cover the full range of accelerator duties (field + r.f. parameters, beam handling, beam observation, etc.). The components are galvanic isolated ($\geq$ 300 V =) and shielded against capacitive transients.

Before any component becomes operational, it will be tested on a signal transmission check-line. The control computer will send and receive digital test patterns and will print out automatically any trouble.

The mechanical construction is based on the 19" rack system and plug-ins with 3 units height and 18" depth.

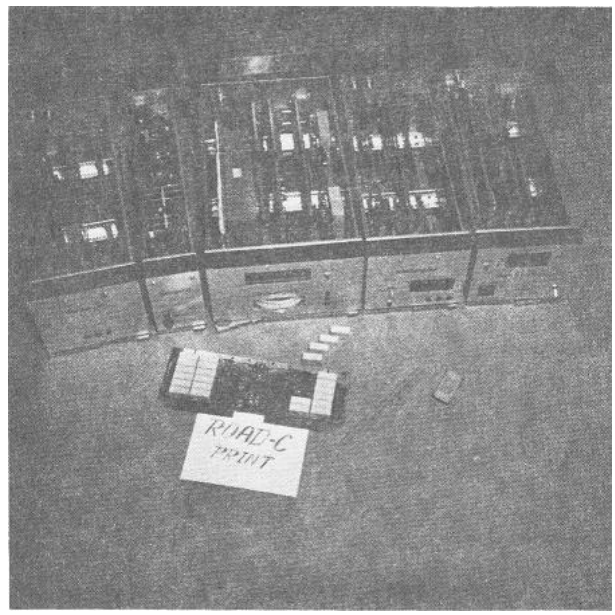

Fig. 3 STANDARD CONTROL COMPONENTS