

**A New Technical Center for Automatically Controlled
International Broadcasting Programmes**

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Rundfunk- und Fernsehtechnisches Zentralamt
der Deutschen Post, Berlin
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(with W. Hoeg and K.P. Scholz)

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AN AUDIO ENGINEERING SOCIETY PREPRINT

A NEW TECHNICAL CENTER FOR AUTOMATICALLY CONTROLLED INTERNATIONAL BROADCASTING PROGRAMMES

by

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Abstract: For the short-wave broadcasting programme "Radio Berlin International" a new technical studio center (continuity suite complex) has been developed. The technological main aspects and the structure of the digitally controlled modules of the equipment are explained.

1. Introduction

Many Broadcasting and Television Organizations are used - for a multitude of reasons - to "tailor" their sound studio equipment to suit their specific applications and requirements.

When typifying sound control equipment, a distinction is generally made between

- programme continuity equipment and
- programme production equipment.

The latter comprise a broad field of applications ranging from sound systems to speech and music production equipment for live and multitrack technology which have been realized up to now by means of "non-automated" equipment. Advanced music production equipment (among others also sound reinforcement equipment for theaters!) require a relatively high degree of automation and considerable expenditure in technical equipment.

With regard to equipment for broadcasting run control however, several broadcasting and television organizations have made attempts for automation (up to a very large scale) whose results and experience appeared to be rather differing, and apparently are no stimulus for a general satisfactory introduction in daily programme transmission.

Considering that the RFZ of the Deutsche Post is responsible for the provision of technical equipment in broadcasting and television it was necessary to think about system solutions for a new sound studio equipment generation which permits the implementation of various types of applications as well as different levels of automation by means of an appropriate module (building block) system.

The second generation equipment system S 700 hitherto used (i.e. an equipment technique using discrete semiconductor components but which are not suited for automation, analogue) was

not able to meet the increased requirements of operation technology but should be taken into account when new equipment systems are designed.

But in this respect it is essential that the concept chosen for the relevant equipment type is feasible from the economic point of view, i.e. the material-technical basis should be used carefully without the need of special solutions (which can be produced by the component industry on a large scale only).

In general, for studio equipment, the following complicating boundary conditions exist:

- high engineering labor, but small numbers of the equipment required,
- long life time of the equipment required but high rate of development in the field of electronic components,
- new equipment generations imply complex and specialized equipment systems but on the other hand versatility of the equipment is needed,
- a modular equipment design appears to be a fundamental prerequisite for broadcasting and television operation and repairing, but the design of equipment for different applications (above all with regard to "degree of automation") is primarily a question of quality.
- high costs for automated sound studio engineering on the one side frequently reveal only limited economic effects on the other side.

These premises, in relation with the investment funds available, imply for all broadcasting and television organizations compromises with regard to operational technology.

Some time ago, the RFZ decided in favour of the consequent development of a so-called third generation sound studio technique permitting a high flexibility of technology and which, above all, is characterized by the following aspects:

- use of digital and analogue integrated circuits,
- subdivision of the equipment structure into an analogue sound signal processing domain and a digital control domain,
- use of microcomputer technique for the purpose of "automating" processes of operation technology.

Presently, only few systems of such type can be found on the market. (For reasons of costs, analogue control is often still predominant inspite of its disadvantages.) The advance into this generation was already repeatedly made by developing autonomous equipment systems such as level control complexes and filter complexes which can subsequently be assigned to control equipment as central units, thus considerably enhancing their technological potentials. Meanwhile, some manufacturers use these equipment (functional) complexes to build up new highly versatile equipment with stronger application of computer engineering.

This confirms that the way we took some time ago was right, especially because the use thus given of computer engineering together with newly opened potentials of operation technologies will not only ensure a remarkable quality jump as compared with the technique used until now but because the (digital) control domain available in the further developmental work, at least concerning operation and indication, will permit the logical transition from the third to the fourth (entirely digital) generation, if this appears to be rational and necessary for certain types of equipment. By "domain of control" we understand in this connection the whole superstructure of sound signal processing, including:

- all control and indicating units designed for communication between the operator and the equipment,
- special digital assemblies designed for the control of the sound channel function blocks,
- the computer and interface systems used.

Another essential feature of the third generation audio engineering is that the function blocks for control and indication have been separated from those designed for sound signal processing and that central operating fields and computer-dialogue-systems, if required, have been realized.

For the introduction of the third generation audio engineering, preference was given to a programme continuity suite for operational reasons (as compared with production equipment). For this new equipment and device system (S 2000), more than 70 types of modules for audio, control, communication, operation and indication have been developed.

2. Technological structure of the programme continuity system

For the use of a technique with high automation degree, the following structural features are decisive:

- handling of programmes for multilanguage international broadcasts comprising a relatively uniform (rigid) structure in time and content (in this case 30 or 45 min of length) and a high portion of real-time action and a great number of repetition contributions (leading and trailing tape, identification signal, national hymn),
- handling of several (about 3 - 6) programmes by one operator, elimination of routine work by centralisation of technique, alleviation of stress situations by avoiding real-time activities, rational handling of live speech contributions and use of a small number of speaker's booths for several programmes, preferred use of 19 cm/s tape speed for reducing costs of tape.

Essential features which have been realized in the system, are already contained in the concept of the Study Group II of the OIRT Technical Commission, for technological requirements to programme continuity suites /2/ and /3/.

Technological main features of the solution chosen for the international broadcasts in the GDR (Radio Berlin International):

- dialogue operation with data monitor for continuity programming (manually) by means of a function-related input keyboard. Indications on the data monitor (optionally) of the long-term transmission scheme, indications and release of certain service functions and indications of the error list permit a control and discharge for the operator to be made.
- microcomputer-aided preparation of pre-programmed programme sources, in this case among others use of 80 bit time and control codes for identification of magnetic tapes and, if required, changing of speed,
- reduction of conventional sound channel (main and standby path) by electronic commutation or fade-over of the small number of sound functional units required (microphone amplifier with control-voltage amplifier (limiter), summation amplifier, buffer amplifier, attenuators (only for rapid switch-on and switch-off function by VCA with different selectable fader characteristics), + 6 dB signal sources such as tape recorders and motive storage, special control amplifiers (limiters) for AM transmission, etc.) and the necessary operating and indicating devices (indication of programme level for the simultaneous monitoring of 4 points of the equipment is already integrated into the data monitor),
- handling of repetition contributions, such as leading and trailing motives (standard announcements), identification signals and national hymn in form of endless loops from the computer-controlled motive storage being a decisive component for reducing expenditure in operation.
- to each continuity unit are assigned the following sound signal sources:
 - 2 tape recorders, 1 speaker's studio, incoming lines (for programme acceptance) and the (unique) motive storage.
- for the continuity units, standby tape recorders are available.
- the computer-aided programme continuity offers the following potentials:
 - . timed start (according to preset time)
 - . follow-up start (on ending of the preceding contribution)
 - . automatic switching-on of the speaker as well as additional manual intervention.
- a concept for failures envisages automatically and manually switchable facilities for standby connections and solutions in several steps.

3. Structure of equipment and control technique

(see figures 1 and 2)

- The entire system consists of several completely independent continuity units each unit comprising all technico-technological facilities necessary for handling one programme,
- 3 continuity units are spatially and constructionally grouped to one operating unit consisting of control console and rack section for several blocks, with a strict separation between operating and indicating modules on the console and the functional units proper of the sound channel and the control in the racks. For each block, one common operating and indicating field is envisaged (including communication, monitoring and interphone),
- the central motive storage is designed for all programmes and includes 64 endless loop cassette decks with up to four motives (with 4 min overall length) and internal commutation.
- all continuity units are connected via a central serial control bus with the motive storage,
- the internal control system of a continuity unit consists of two coupled microcomputers (type K 1520, computer circuitry family U 800 equivalent to Z 80, which communicate with the studio hardware via a parallel process interface PI 2000), having an information flow of 24 bits = 8 ADR/ 8 output data/ 8 input data (DATE)/.
- Particularities of the intelligent components having each an own microcomputer, i.e. the equipment parts
 - . motive storage
 - . sound storage operator's positionrelate to the use of the 80 bit time code (in the code leader) for identity control and a positioning system using special solutions (for instance, it is possible to select contributions (up to 9) ready for broadcasting from so-called "composite tapes"; these are broadcasting tapes consisting of several sections.
- the software is of modular design. A real-time operating system manufactured by the industry which may be expanded by modules is used together with universal programmes for process drivers.
- for the console and rack design system new concepts have been developed having recourse to solutions already standardized (EGS III, RGW 834, 19" technique).
- an essential integral part of the automated technology are further computer-aided control and auxiliary functions for monitoring, repair and maintenance of the system (using the internal dialogue system).

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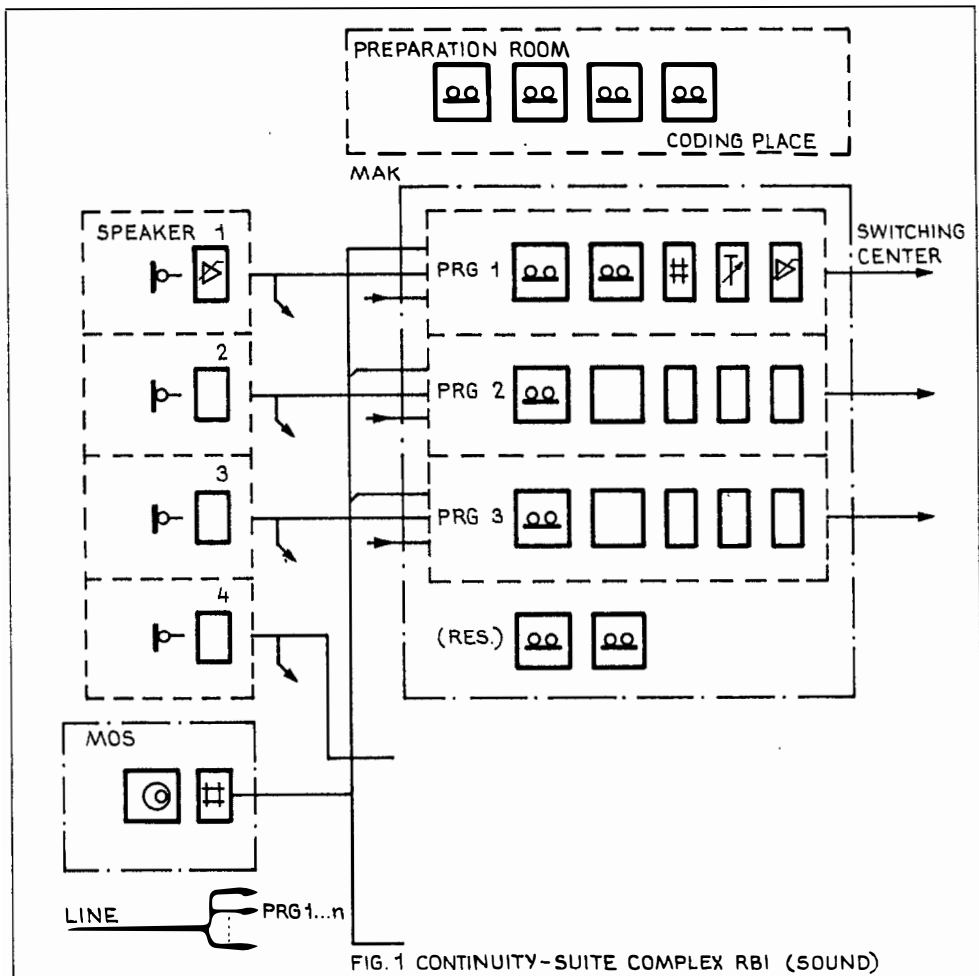


FIG.1 CONTINUITY-SUITE COMPLEX RBI (SOUND)

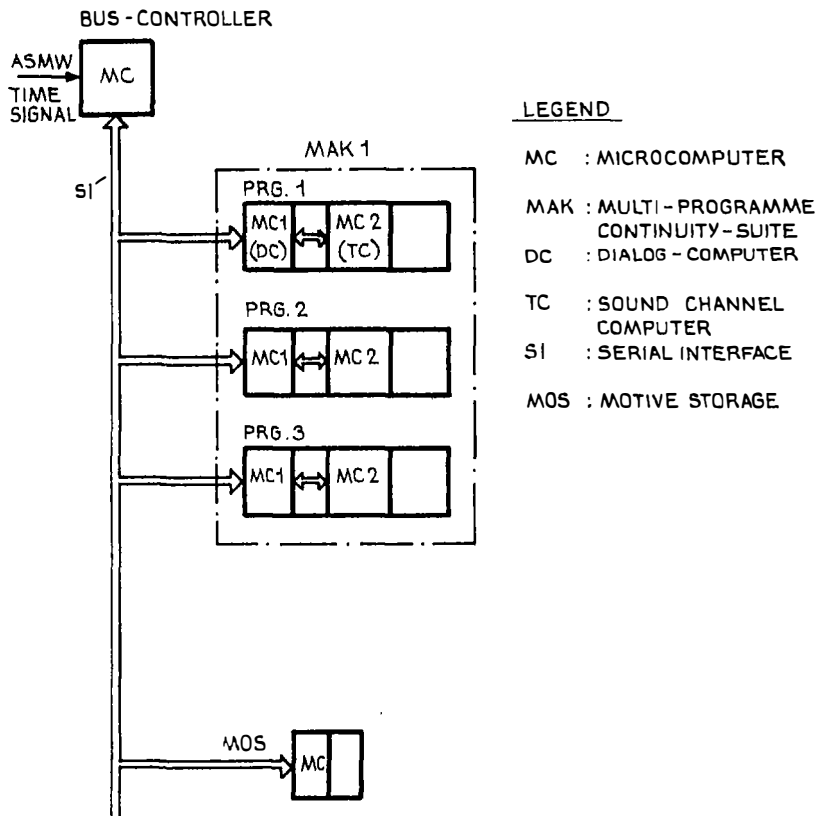


FIG. 2 CONTINUITY-SUITE COMPLEX RBI
(HIERARCHY OF CONTROL SIGNALS)