A CONTRIBUTION NETWORK FOR ILR

*C.W.B. Reis, **R. Francis and *B.F. Davies

*Independent Broadcasting Authority, UK
**London Broadcasting Company (LBC), UK

INTRODUCTION

The overall configuration of the Independent Local Radio (ILR) network falls neatly into three discrete categories. The first, which might be termed the 'transmitter network', consists of all the separate connections that link the studios of the different companies to their appropriate transmitting stations. It should be noted that, within the service area allocated to it, each ILR programme company provides a duplicated service in two bands - a high quality stereo service in VHF, and a bandwidth-limited mono service in MF. Hence, there is normally a single mono line to an MF transmitting station, and a pair of stereo lines to a VHF transmitting station at which is located the associated stereo encoder. This situation is shown in Fig. 1. The use of two separate lines for carrying the A and B components of the stereo signal avoids the difficulty and cost of equalising a single circuit for carrying encoded stereo. Further, it affords a measure of protection in that the service can be maintained in mono should there be a failure of either line. In the MF case, a reserve programme feed is available from a dedicated receiver tuned to the associated VHF transmitter, thus forming a rebroadcast link (RBL).

However, the gathering of national and international news is an expensive and highly specialised industry, and it would be very uneconomical if each programme company separately were to gather its own news. For this reason it was made an essential part of the London Broadcasting Company (LBC) contract that it should gather the news on behalf of ILR as a collective body. Therefore, a means had to be provided for disseminating news material from a part of LBC, known as Independent Radio News (IRN), in London to all the other ILR companies, and this takes the form of a system of Post Office mono circuits radiating outwards from IRN. It is known as the 'distribution network' and constitutes the second category of the complete network. The distribution network has been built up, and indeed will continue to expand, with the growth of the ILR service. By the end of 1981, it is expected that it will embrace 34 operating companies.

NEWS GATHERING

A little more than a year ago the proposal was made to establish a second system of Post Office mono circuits similar in configuration to the distribution network but working in the opposite direction. In other words, instead of it being a network diverging from London it can be thought of as one converging towards London. Its purpose is to enable individual companies to contribute to IRN information concerning events occurring locally but having more than merely local interest. Such information can then be used immediately by IRN for inclusion in the news output of the LBC from the London transmitters. Also, it can be passed on to any or all of the other companies via the distribution network. This constitutes the third category of the network and is referred to logically as the 'contribution network'. It is still very much in the course of being established; and, as with the distribution network, will continue to grow in accordance with the needs of ILR as a whole.

BASIC PRINCIPLES

The most straightforward way of fulfilling this need is to provide a separate line from each company to IRN, but as these lines are required only for use singly rather than collectively this method would be somewhat extravagant. A scheme has therefore been devised whereby all companies excluding Capital Radio will be connected to one of possibly 12 trunk circuit routes or spurs into IRN. Capital Radio, the company which provides general entertainment programmes in the London area, is excluded for the obvious reason that news of events in and around London is covered directly by IRN/LBC. Figures 2 and 3 show the contribution network as it is expected to appear by the end of 1981 and early 1983 respectively, and Table 1 shows the list of abbreviations used for the locations indicated. From these it will be seen that, for contributions to be received in London from some of the more remote companies, a switching operation is necessary at one or more points along the route. A system for doing this, and believed to be entirely novel, is currently under development. It will comprise special apparatus that will need to be installed in the premises of each programme contractor and which will operate in conjunction with a dedicated exchange line (DEL) and a telephone available at the news desk. In each case, the telephone instrument will be fitted with an automatic call-maker whereby calls can be made to IRN only. Apparatus will be needed also at IRN, but of a type essentially different from the rest; and, in this case, there will be eight dedicated exchange lines available at three positions each provided with a key-and-lamp unit, a telephone instrument and a Post Office 'XL' call-maker capable of storing 46 dialling codes. From any one of these three instruments it will be possible for STD calls to be made exclusively to any of the corresponding telephone instruments at the other companies. The eight IRN exchange lines will be numbered consecutively to allow automatic 'group hunting'. In this way a (Post Office) mono call-maker is all that is required at the premises of each company. That part of the system comprising the STD telephones is known as the 'co-ordination network'.

METHOD OF OPERATION

The switching of the contribution network will be controlled exclusively from IRN. The

system makes use of self-routing tones or tone codes; and, once these have been initiated at IRN, the switching action at all points between the contributing programme company and IRN is entirely automatic.

The modus operandi can probably best be explained by considering an example. Suppose that an event taking place in Glasgow is thought to be of general interest, and that the local company, Radio Clyde, wishes to offer it as a news item for general dissemination to the other programme companies. Using the dedicated telephone, details are exchanged with the news room at IRN and, if the item is accepted, the switching process is initiated simply by operating a key pad associated with the IRN source selection system to be described later. By so doing, a signal comprising a duplicated triple-tone switching code is applied to the public subscriber trunk network (PSTN). Individually, each tone code consists of a short burst of three tones between 1 and 2 kHz, occurring in a particular order and occupying approximately 50 ms in total. To produce any response at the receiving end (Radio Clyde in the example being considered) two such triple tone sequences must be detected within a time gate of 250 ms. This tone code sequence has been chosen specifically to afford the detectors a high degree of immunity to any speech or music signals. The security of the system depends on this feature.

Upon detection of the switching tone code, two further triple-tone sequences are automatically generated locally and fed to the contribution network. The first, which is transmitted as two triple-tone bursts as before, is known as the routing code and is based on the same three frequencies. Its purpose is to initiate a switching action at the nearest switching unit in the circuit towards London. In this case it is a 4-way switcher forming part of the apparatus at Radio Clyde where the other three inputs are the connections incoming from Belfast, Edinburgh and Dundee/Perth. On receipt of the routing code the switch operates in such a way as to favour the circuit carrying the tones. Any previously made switching connection favouring any of the other three sources is automatically cancelled and the local studio connected via the switcher to the next destination which, in this case, is IRN. On arrival there it is used to initiate a momentary audible buzz as a confirmation to the operator that the switching action has been completed.

The second tone code generated at Radio Clyde is the station identification code which is unique to that station. This tone code is transmitted as a single triple-tone sequence only. It includes one frequency that is different from any of the three previously used, though still within the 1 to 2 kHz band. It is produced about one second after the routing code, thereby allowing sufficient time for successive switching actions to have completed the path to IRN where its detection activates an appropriate Light Emitting Diode (LED) indicator identifying Radio Clyde as the company making the contribution. Thus, the traffic can then be passed via the network from Radio Clyde, for IRN to use as required, and the circuit will remain switched through from Radio Clyde until such time as a different switching pattern is initiated by IRN.

To take a somewhat more complicated example, the case of Metro Radio in Newcastle-upon-Tyne will now be considered (Figures 2 and 3). This, it will be noticed, is at the extreme end of a spur. After having made contact with IRN by using the dedicated telephone, and after the switching tone code has been sent via the PSTN as in the first example, the locally generated routing tone code from Metro Radio passes via the network from Newcastle to the nearest switching unit in the direction of London. This is to be found at Radio Tees, in Stockton-on-Tees; and, on detection of the switching signal from Newcastle, it operates in favour of Metro Radio. It also applies a re-generated routing tone code to the next section of the network which terminates as an input of an 8-way switcher located at Piccadilly Radio, Manchester. As before, this switcher operates to favour the route from Metro Radio and the routing tone code is once again re-generated. This is applied to the next and final section of the network and, on arrival at IRN in London, its detection confirms by means of a momentary audible buzz that the switching action is complete. One second later the station identification tone code from Metro Radio, having passed along the now completed network, is also received at IRN and is used to activate an LED indicator providing continuous confirmation that the circuit is complete from Metro Radio. Block diagrams illustrating the arrangement of the equipment and its method of operation are shown in Figures 4, 5 and 6.

It will be appreciated that the system will allow IRN to receive more than one contribution at any time provided that the contributing companies are on different spurs of the network incoming to London. Such is the case with Radio Clyde and Metro Radio, and therefore the two examples quoted above could occur simultaneously.

EMERGENCY SWITCHING AND TESTING

Mention should also be made of the arrangements for dealing with emergency switching in the event of equipment failure. In the case of the last example, should the switcher at either Radio Tees or Piccadilly Radio develop a fault condition, it would normally be possible, provided that staff were available, to patch the lines at a jackfield and so establish manually the required network configuration. However, for convenience and to cover those occasions when technical staff are not available, it has been decided that the lines in and out of the switchers should be routed through an emergency by-pass switching panel. This will provide for simple push-button operation. It will be available for use by news room staff, but only upon express direction from IRN. A suitable key-operated lock will be incorporated such as to preclude access by unauthorized personnel.

An integral part of the equipment supplied to each programme company will be a test module which may be used either as a detector or as a generator of tone code signals; but, once again, there must be strict discipline to prevent the sending of tones to line unless with the full knowledge and consent of IRN. To this end, the ON/OFF switch on this module also will be key-operated. The module can be used for checking the tone codes from all incoming sources including the switching tone code from the dedicated exchange line. It will also provide a means of testing the local tone code generator and will enable application

of tone codes to the outgoing music circuit. With the aid of a similar test module at IRN it will be possible to localise any fault on the contribution network.

Physically, it is expected that the apparatus of each company will be accommodated in a single 19-inch frame occupying 7-inches of rack height, but space must be provided also for associated jackfield facilities.

THE WORKING ENVIRONMENT

To engineering and editorial staffs at IRN, the proposed system will be of great advantage. At present, incoming contributions from regional companies are received either by telephone or via an occasional programme (OP) circuit specially rented from the Post Office. Although an STD telephone call can usually be established fairly quickly, the quality of transmission, being much below broadcast standards, is generally un-satisfactory. On the other hand, a temporary music circuit that would give adequate quality can be obtained only after a formal booking procedure has been followed, which is hardly ideal for a news service. It would also involve much clerical work.

All news reports incoming to IRN must be routed to the 'audio intake' area where they are recorded and prepared for later distribution on the network. However, with the expanding scale of the IRN news service a complex situation is now anticipated. At present there are 24 outside studios or reporter sites and a further 12 are being planned. With the introduction of the contribution network, and with the new programme companies now in prospect, the eventual number of possible news sources is likely to be at least 78. Hence, it is envisaged that unless suitable precautions are taken difficulties might easily arise if more than one of the IRN editorial teams, possibly in an external location, should simultaneously attempt to make contact with the same news source. To overcome these difficulties engineers at IRN/LBC have developed an audio switching system based on a microprocessor that will assist in controlling the selection of the various sources of news and in routing the signals into IRN.

Basically, each potential news source is allocated a code comprising a letter followed by two numerals. By means of a key pad combined with a display panel the studio engineer is able to use the code for selecting a desired source and allocating it to a spare channel on the studio mixer. Provided that the source has not already been selected for allocation to another technical area within IRN, confirmation of its availability will be indicated by the illuminating of a lamp above the appropriate channel fader and by a read-out of the code appearing on the display panel. Moreover, where appropriate, the selection of a source will automatically make available the associated cue, programme, talkback, override and other facilities which the operator may require. But, should the desired source already be assigned to another studio, a suitable indication will be made available to the operator who then will merely be given access to a 'listen' feed until such time as the source has been de-selected at the other studio.

This procedure applies equally when the desired source is an ILR company. Included among the inputs to the switching matrix are the incoming spurs of the contribution network. On being offered a news item from a regional company, all that the studio engineer need do is to 'punch' the corresponding code on the key pad and, provided that the appropriate spur is available, the microprocessor will automatically apply the triple-tone switching code to the PSTN. The switching action then takes place as already described; and, if the station identification code is received correctly at IRN, the processor will allow registration of the appropriate indications. A block schematic of the IRN audio switching and control system is shown in Figure 7.

In most normal cases the dedicated exchange line will suffice as a control circuit allowing inter-communication between the respective news rooms while the news item is being taken; but, should a two-way interview be required between, say, a reporter at the remote end and an IRN interviewer, an output from the local studio would be passed back to the regional company for cue purposes via the distribution network.' Here again, the processor would first explore the availability of this circuit before allocating it to this use.

As already mentioned, and illustrated in Figure 4, there will be three access points at IRN/LBC. One will be in the news room, one in the master control room (MCR) and one in the audio intake area, but MCR will have the option of extending its selection to an adjacent studio and then acting as a liaison point. Moreover, the news room will be provided with a conference unit designed to allow simultaneous telephone communication with any of a maximum of eight locations. This will make for great convenience and save much time when a news item calls for joint agreement with several companies before being passed to the audio intake area.

DISTRIBUTING THE NEWS

On completion of a contributed news item the STD call is terminated and the contribution circuit is de-selected by operation of the key pad thereby releasing the network spur. The news item is then edited, dubbed on to a cartridge, given a title, reference number and suitable cues. The news editor informs all companies, by teleprinter, of the cueing and other relevant details; and, at the next scheduled time for a news feed (usually on the hour) the material is fed to the appropriate outgoing networks following a 30 second burst of 1 kHz tone which automatically starts the tape recorders in the studios of the various companies.

Each receiving company then dubs the material from tape to a cartridge, collects the appropriate cue information from its own teleprinter, and the news item is ready for transmission.

ACKNOWLEDGEMENT

The authors would like to acknowledge the assistance of colleagues in the preparation of this paper and to thank the Director of Engineering of the Independent Broadcasting Authority for permission to publish it.

TABLE 1

LIST OF ABBREVIATIONS USED FOR THE LOCATIONS INDICATED ON FIGS. 2 AND 3

INV	INVERNESS
AB	ABERDEEN
DE	DUNDEE
PH	PERTH
GW	GLASGOW
EH	EDINBURGH
AY	AYR
BE	BELFAST
LD	LONDONDERRY
NT	NEWCASTLE
MI	MIDDLESBROUGH
MR	MANCHESTER
PR	PRESTON
BIC	BLACKPOOL
BD	BRADFORD
LS	LEEDS
BY	BARNSLEY
SF	SHEFFIELD
LV	LIVERPOOL
DS	DEESIDE
WX	WREXHAM
NG	NOTTINGHAM
LE	LEICESTER
WV	WOLVERHAMPTON
BM	BIRMINGHAM
CV	COVENTRY
WR	WORCESTER
HR	HEREFORD
PE	PETERBOROUGH
BF	BEDFORD
LOL	LUTON
BN	BURY ST EDMUNDS
IH	IPSWICH
CL	CHELMSFORD
SMU	SOUTHEND
L	LONDON
CU	CANTERBURY
DR	DOVER
GI	GUILDFORD
RG	READING
PT	PORTSMOUTH
BH	BOURNEMOUTH
SWP	SWINDON
BS	BRISTOL
GR	GLOUCESTER
NE	NEWPORT
CF	CARDIFF
SX	SWANSEA
EX	EXETER
TA	TORBAY
PY	PLYMOUTH

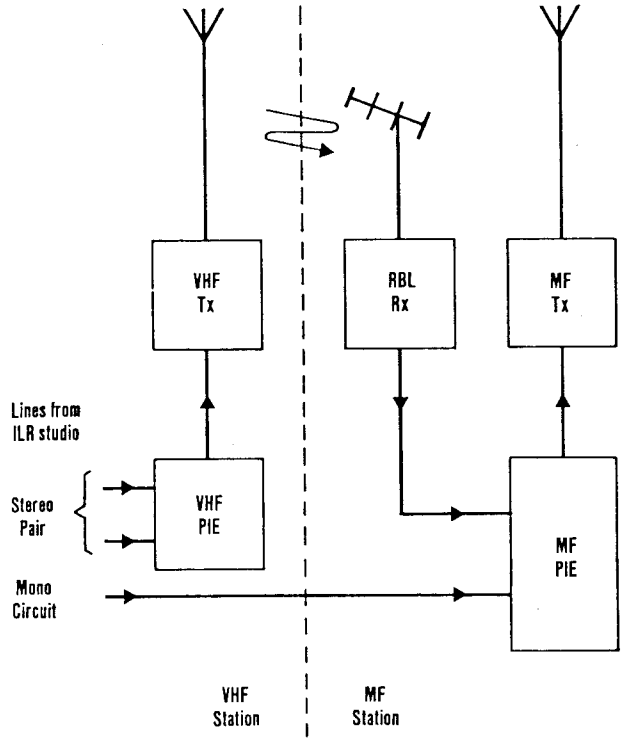

Figure 1 ILR signal paths

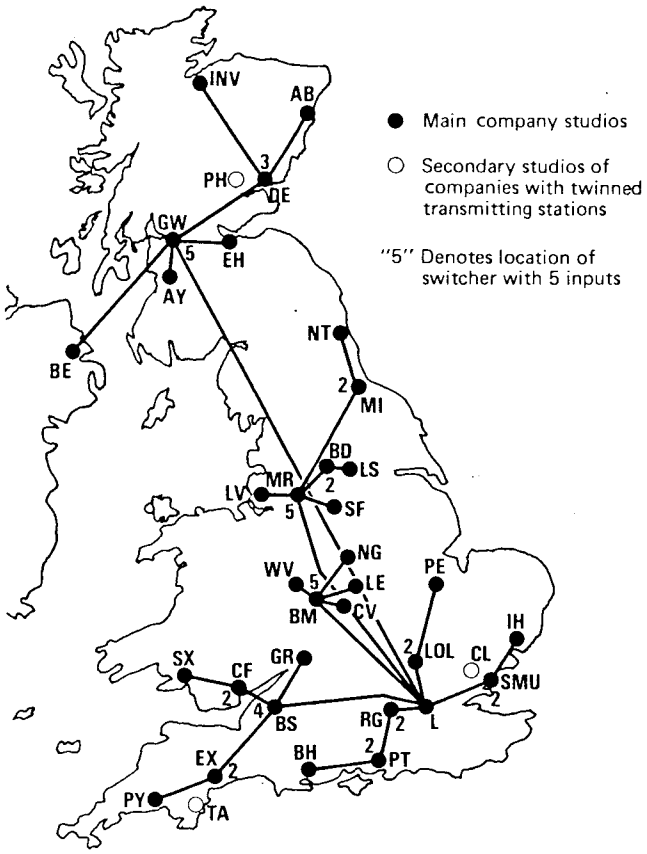

Figure 2 Contribution network at end of 1981 (34 companies)

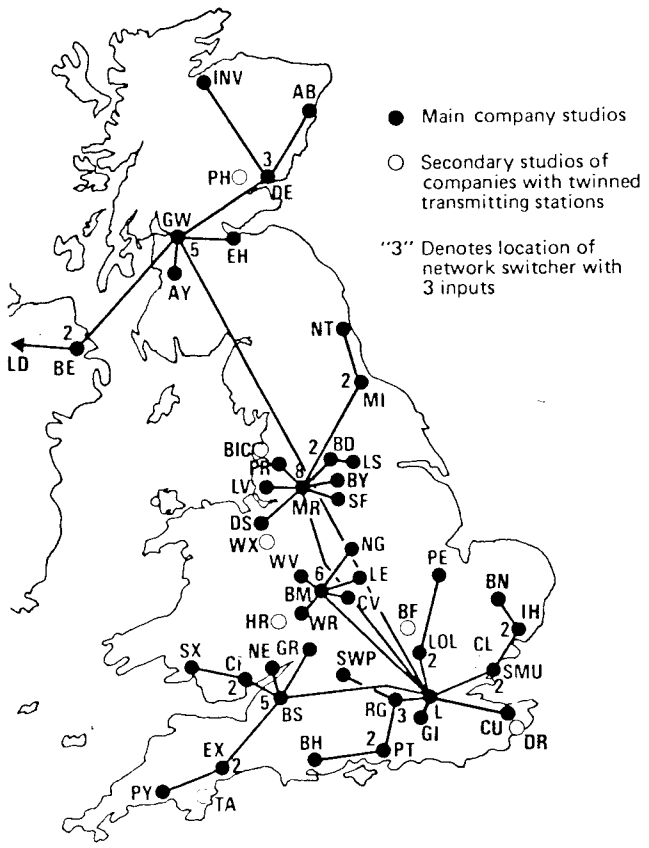

Figure 3 Contribution network at end of 1983 (44 companies)

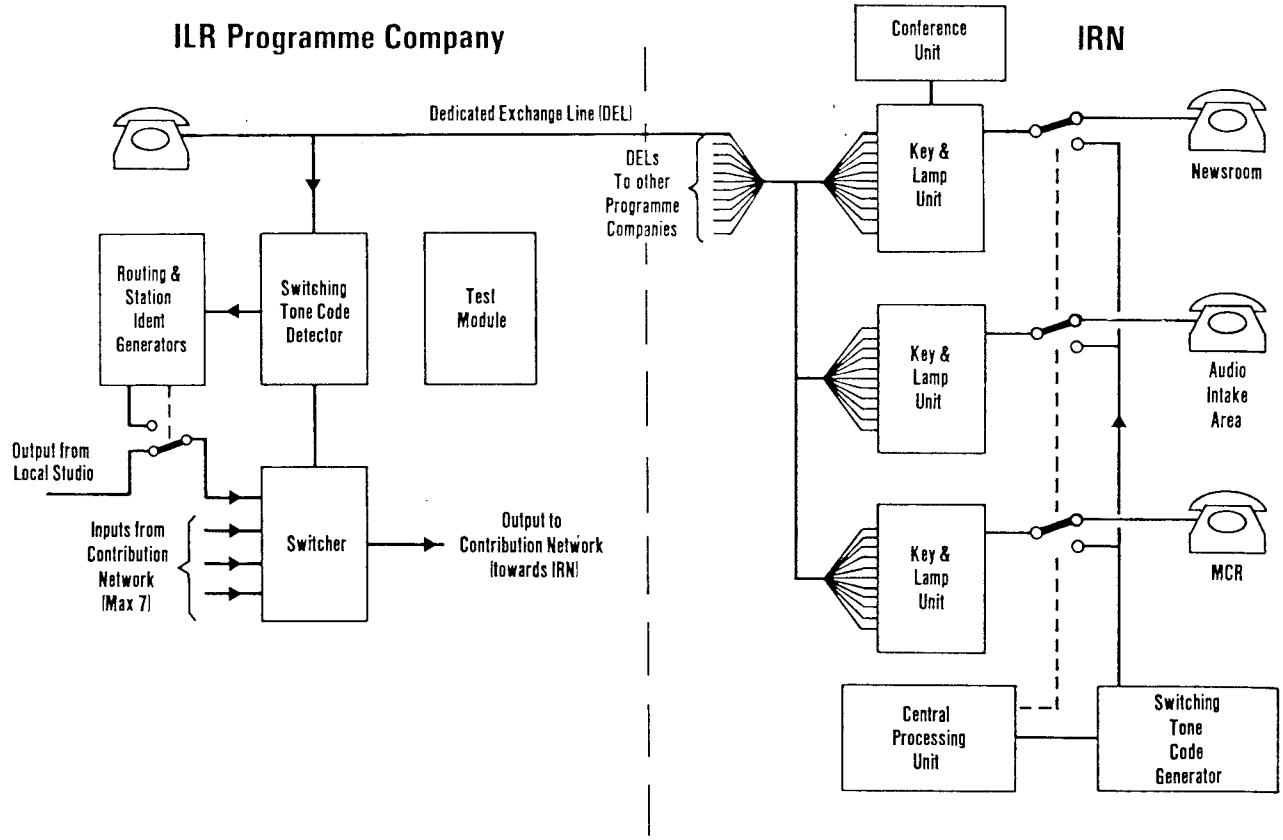

Figure 4 Overall control facilities for the contribution network switching system

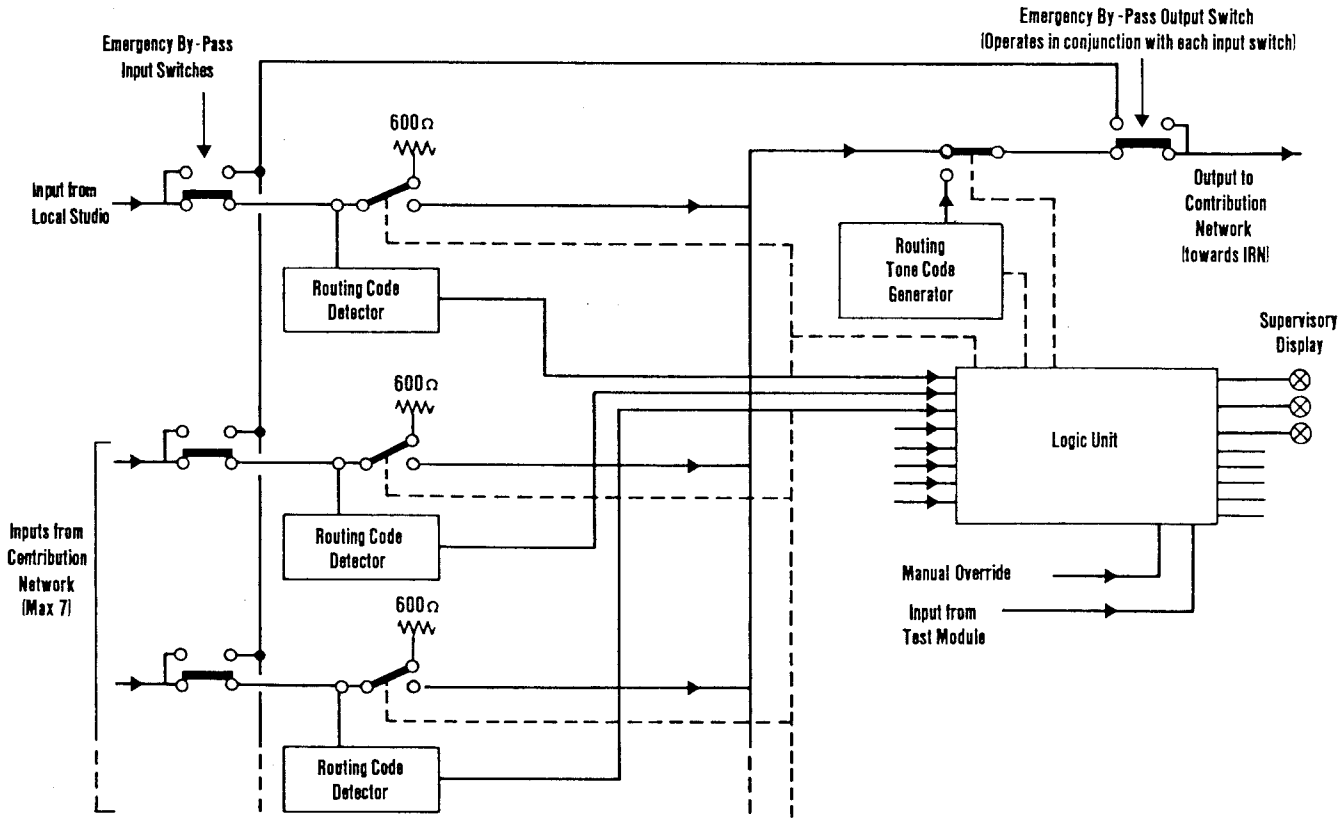

Figure 5 Block diagram of tone-code controlled switcher

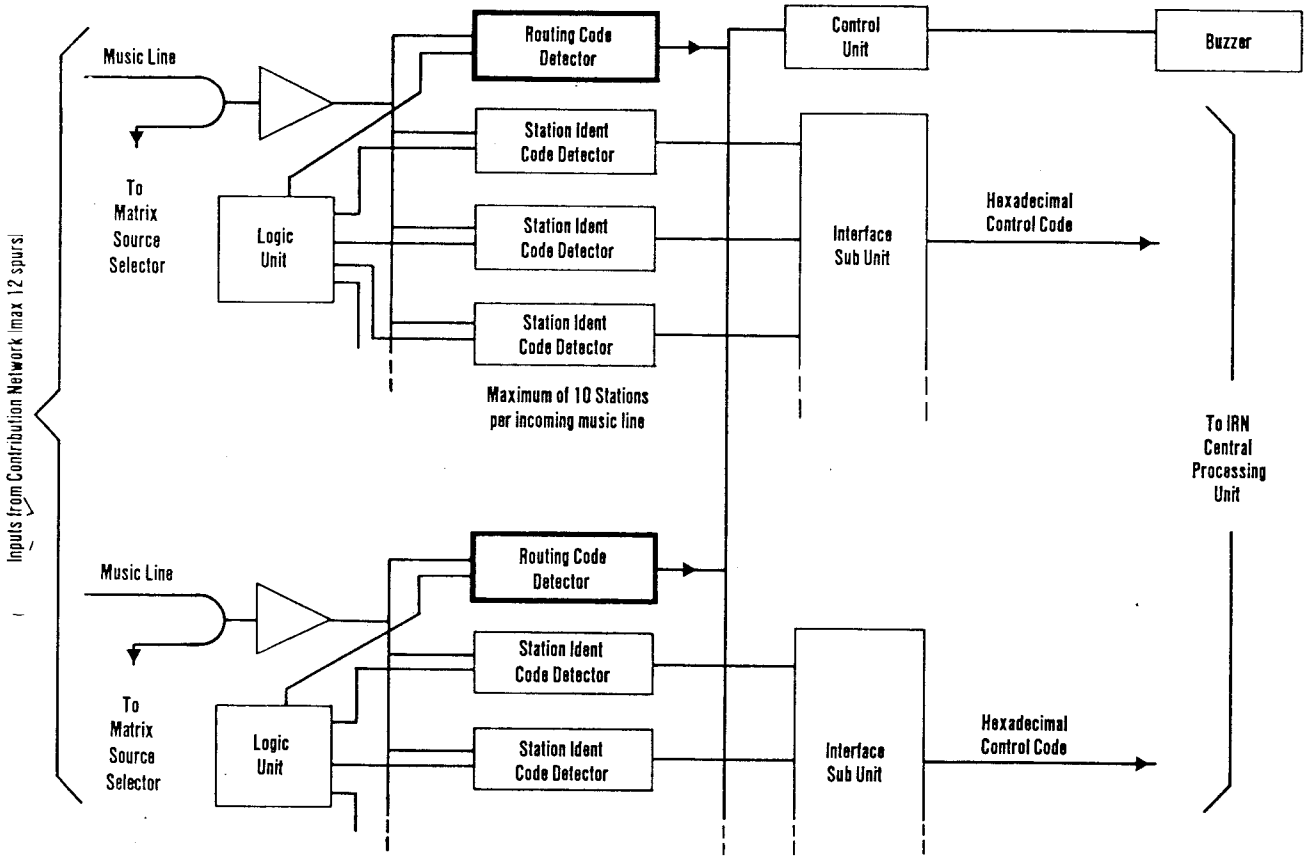

Figure 6 Block diagram of tone-code detectors and supervisory facilities at IRN

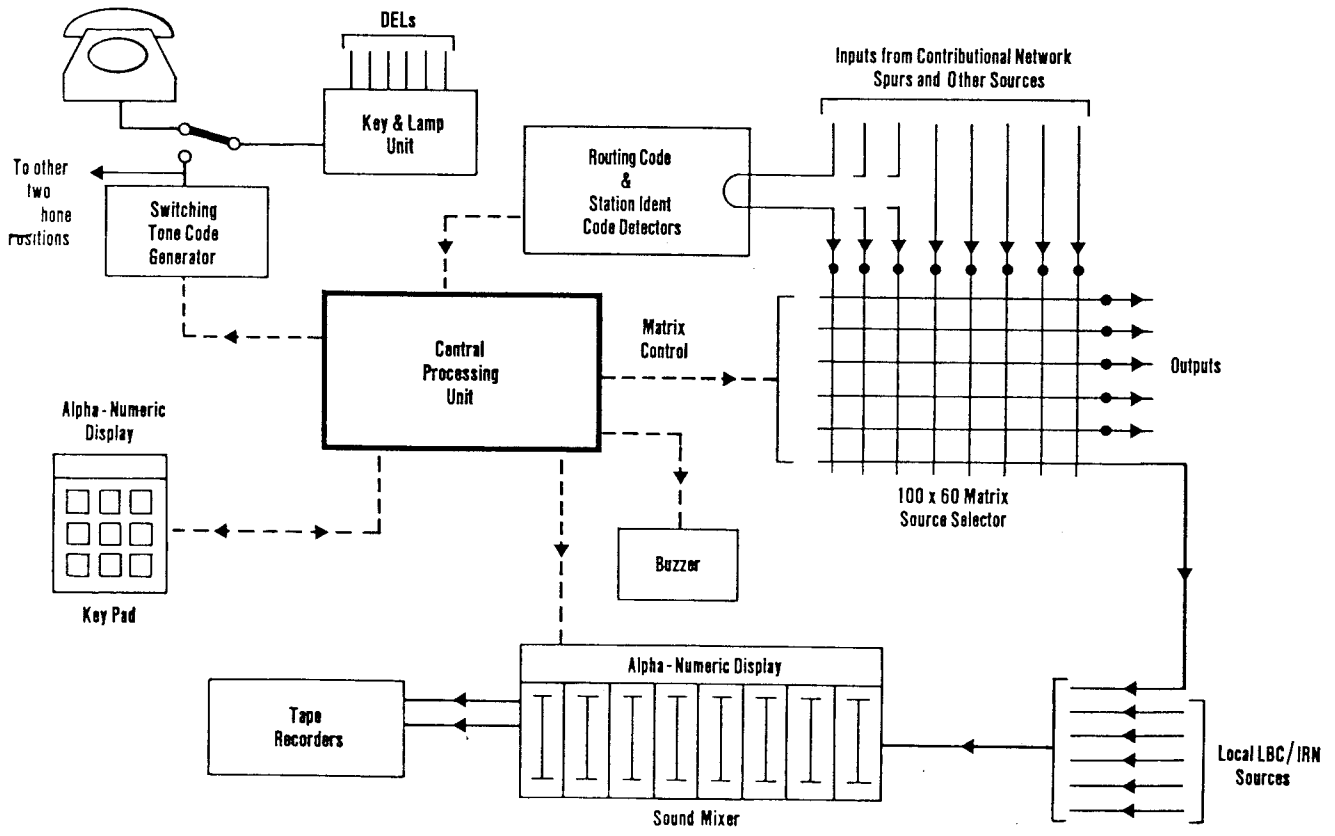

Figure 7 Schematic diagram of IRN source selection and switching control system