Mr R Davis
c/o E2/M16

POST OFFICE

telecommunications

JOURNAL

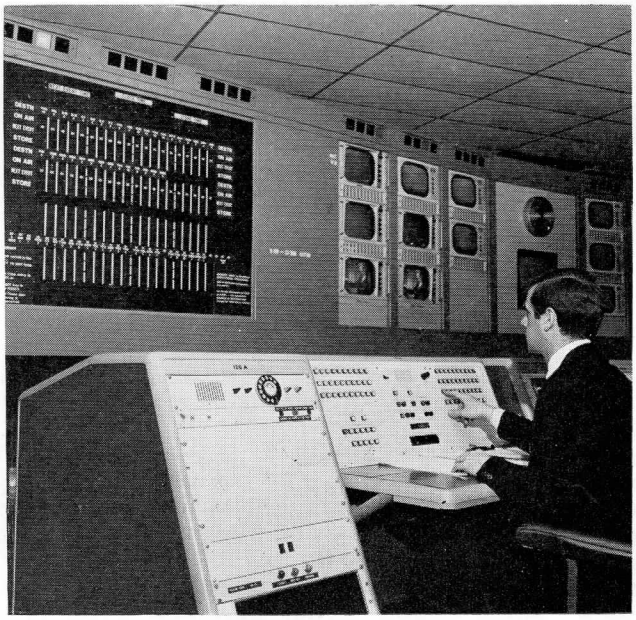
ONE SHILLING
AND
SIXPENCE

WINTER 1968

This article describes what is involved in one of the Post Office's little-known but vital tasks—providing the links and handling the . . .

NETWORK SWITCHING FOR THE ITA

By R. A. SIMMONDS



The operating console and display panel in the TV control room at the London TV Switching Centre at the Post Office Tower.

NEW equipment designed for handling Independent Television Authority sound and vision traffic has just completed its first operational year with the Post Office.

The use of this complex electro-mechanical equipment has created a number of maintenance problems which have been satisfactorily resolved and the equipment has functioned well.

The Post Office provides a network of vision and sound links for the ITA linking the studios and programme switching centres of the Independent Television companies and ITA's broadcast transmitters. These links are terminated in Post Office Network Switching Centres (NSCs) which have been established in the main population areas where studios and transmitters are located.

The Independent Television service is provided by the companies who produce and interchange programmes. This means that the pattern of connections at the major NSCs changes frequently in accordance with requirements which are scheduled daily by the ITA and that the Post Office has to interconnect the links to establish the required patterns. Switching equipment of various types has been provided since 1956 at the four major NSCs—London, Birmingham, Manchester and Carlisle—to meet this requirement.

Basically, switching equipment provides for the

interconnection of sources (incoming) to destinations (outgoing) so that any source can be connected to any destination; that more than one source is not connected to one destination at the same time and that transmission suffers only minimal distortion due to the switching equipment.

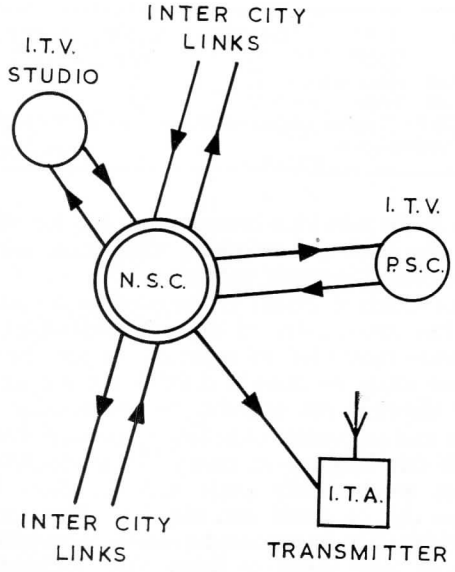
The equipment originally provided at the provincial NSCs for 405-line monochrome transmission was in the form of a manually-operated crossbar matrix, with interlocking push buttons. Each operation has to be performed manually at the required time by the operation of the appropriate control. In London, however, switching requirements increased rapidly and so, in 1958, the Post Office installed and commissioned a semi-automatic switching equipment which ultimately had a capacity of 16 sources and 15 destinations. This was known as Automatic Network Distribution Equipment (ANDE).

This equipment stored information for two consecutive switches and performed the switching operation automatically under the control of an electronic clock, synchronised to the Speaking Clock. The equipment was programmed by the operator and had three information stores, each of which passed through a complete cycle of the functions—*Store*, *Next Event* and *On Air*—in three switching operations.

The main limitations of this equipment were that inadvertent operation of the controls of the pattern *On Air* interfered with programme-carrying links; that connections remaining unchanged, that is "carried through" during a switching operation, were liable to interruption unless special action was taken by the operator; and that sound and vision links were controlled separately.

Nevertheless, this equipment functioned very well in service, but extensions to the Independent Television network, an increase in the number of switching operations required, and the need to provide for programmes in colour on 625-lines led to a decision in 1962 to replace the 405-line equipment at all four NSCs with new and larger capacity equipment designed to 625-line colour standards.

A contract was placed with the Marconi Company for new switching equipment to a Post Office specification. The equipment for London was to provide, initially, for 30 sources and 40 destinations and ultimately for 40 sources and 80 destinations, and the equipment for Birmingham, Manchester and Carlisle to provide, initially for



Above: A simplified schematic diagram of the television links in a typical city where the studios and transmitters are located.

	Start	*1st Switch*	*2nd Switch*	*3rd Switch*
On Air	A	B	C	A
Next Event	B	C	A	B
Store	C	A	B	C
ANDE 1	Sequence of store functions			

	Destination 1	*Destination 2*
Start	Source 1	Source 4
1st Switch	Source 2	Source 4
2nd Switch	Source 1	Source 4
ANDE 1	Typical "carried through" operation on Destination 2	

15 sources and 15 destinations and ultimately for 25 sources and 30 destinations. The specification also required that vision and the associated sound should be switched and programmed simultaneously by one control and that "carried through" operations by the operator should not be necessary.

In December, 1967, the new equipment, ANDE2, was put into service in London followed in January, 1968, by the three provincial equipments.

It is in four basic parts. In all four NSCs two parts—the control panel and visual display panel

OVER

Time		*Destn 1*	*Destn 2*	*Destn 3*
	On air	*01*	*12*	*12*
1039.50	Next event	22	11	
1121.00	Store	13	13	

ANDE 11. Typical display including "carried through" on Destination 3

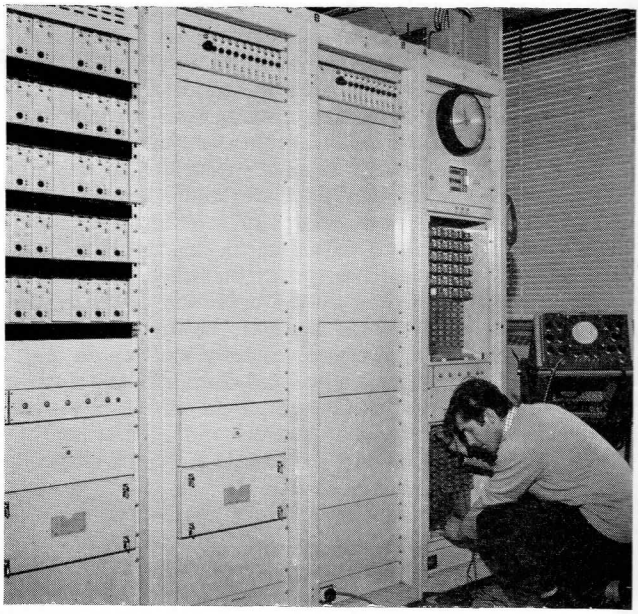
—are in the television control room and the other two—the clock and switching equipment—are in the television repeater station.

The **Control Panel** is mounted in a console and has two modes of operation—Monitor or Operate—controlled by a master switch. In the operate mode all console controls are energised, thus allowing the operator to programme the stores and to control switching operations manually if this becomes necessary. All programming entries are normally made into the *Store* but entries can be made into the *Next Event* store enabling amendments to be made to switching patterns and times to meet late programme changes. The monitor mode enables the operator to monitor vision and sound on all sources and destinations from the console. In this mode all other control functions are de-energised to prevent inadvertent misoperation of the equipment.

The **Visual Display Panel** is mounted on a picture monitor framework in front of the console and gives a digital display of all patterns programmed on the equipment. Each destination has three displays, each showing a two-digit number corresponding to *On Air*, *Next Event* and *Store* connections and indicating which sources are *On Air* and which will be connected to that destination in the next two switching operations.

If no change is required for a particular connection on a switching operation no entry is made and the store display remains blank. As each switch occurs the information moves up one stage —*Next Event* to *On Air*, *Store* to *Next Event* and the *Store* display is extinguished ready for a new entry to be made. Three times are also displayed on this panel. The *Real Time* display shows the actual time of day to one second; the *Next Event* and *Store* time displays show the required switching times for those two patterns.

The **Clock** is in two sections. A Post Office designed and manufactured electronic unit generates a very stable supply of 1 sec. and 10 sec. pulses derived from a 500 Hz tuning fork and synchronised with the Speaking Clock. The second section is the Marconi clock and logic unit which is almost

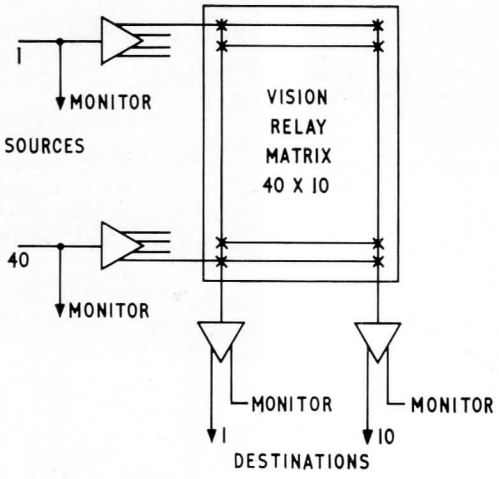


The clock and part of the vision transmission path equipment in the TV repeater station at the Post Office Tower.

entirely electro-mechanical in operation and uses the 10 sec. pulse generated by the Post Office unit to drive chains of Post Office Type-4 uniselectors which form the Real Time clock. This clock is in two identical parts—Real Time and Real Time Comparison—which must be exactly in step with each other for an automatic switch to take place. Two more chains of uniselectors—*Next Event* and *Store Time*—provide the switching time stores and a further chain—*Next Event alarm*—is arranged to give a pre-switch warning three minutes before the *Next Event* time to warn the operator that a switching operation is imminent.

When time coincidence occurs between the Real Time clock and the *Next Event* time store a control signal is sent to the switching equipment and a switching operation takes place.

The **Switching Equipment** consists of electronic transmission path equipment and electromechanical control and storage equipment. The latter uses motor uniselectors (MUS) because of their high rate of search (200 steps a second). Each destination has three MUS *On Air*, *Next Event* and *Store*. The *Next Event* and *Store* MUS are programmed by the operator from the console and



Left: A bank of motor uniselectors in the TV repeater Station which form part of the switching equipment. Above: Simplified diagram of the ANDE 11 vision path and (below) of the ANDE 11 sound path.

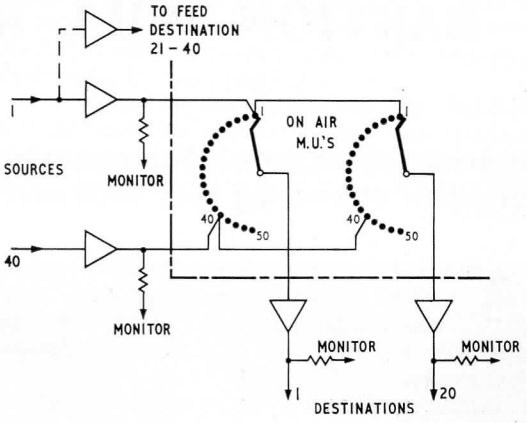
perform direct current display and control functions on their banks and wipers. The *On Air* MUS switch sound links on two bank levels which have gold-plated contacts to ensure low contact resistance and control the relays in the vision matrix over a further bank level.

The sound transmission path is switched on the banks of the *On Air* uniselectors and consists of a source amplifier which can feed up to 20 destinations (two amplifiers with paralleled inputs are necessary if more than 20 destinations are provided) and a destination output amplifier to restore the signal level

The vision transmission path is somewhat different. Each source has an input distribution amplifier with four outputs, each capable of feeding one relay crossbar matrix. The matrix is built up with miniature-sealed relays mounted in strips, one strip per source and each strip having one video input and ten outputs. A matrix can be assembled to accommodate up to 40 sources with 10 destinations but to increase the number of destinations additional matrices must be added.

The operation of this equipment requires logical action to translate the switching schedule requirements into the minimum practical number of switching operations. The entry of amended connections due to last minute programme changes can be very complex and a single incorrect operation could affect millions of viewers.

It is hoped that it will give a service as reliable as the original ANDE and thus maintain and even improve upon, the very high standard of performance that the Post Office has given in the past.



THE AUTHOR

Mr. R. A. Simmonds is an Assistant Executive Engineer in the Systems Performance and Maintenance Branch of the Service Department in Telecommunications Headquarters. He joined the Post Office as a Youth-in-Training in the London North West Telephone Area and also served in the London Centre Area before taking up his present post which is concerned with day-to-day maintenance of the inland television network.