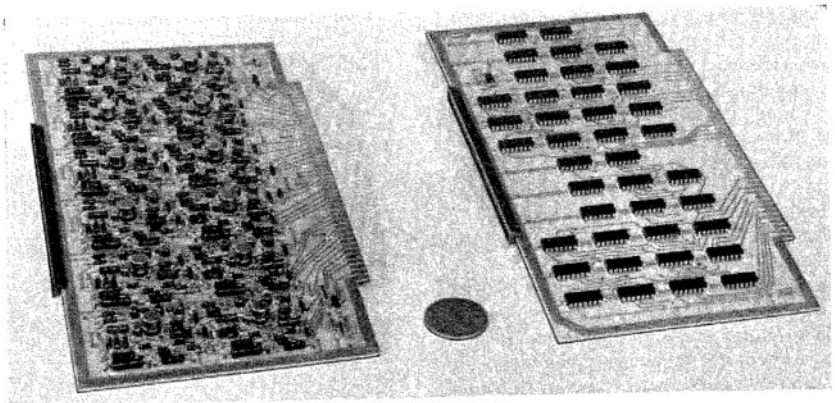
Marconi Automatic Relay System 'MARS'

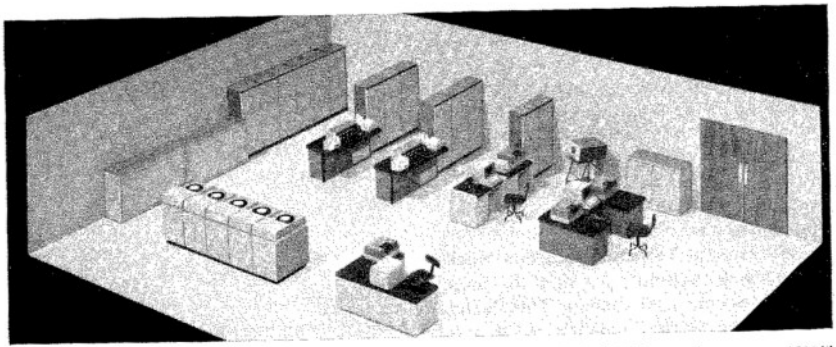
The Marconi Automatic Relay System (MARS) is designed to provide automatic relay of messages, in accordance with any prescribed procedures and formats between communications centres in a Telecommunications network.

The equipment uses the latest techniques of digital communication and particular stress has been placed upon the need for reliability, especially in those terms of equipment which are common to every message passing through the system.

The heart of the system is the Central Processor which handles all messages and provides control for every item in the system. The unit uses the MYRIAD digital computer (described on pages 351 and 352), which has been designed specifically for message switching and similar real-time applications. Since this unit organizes and controls the message handling throughout the system, its reliability is of vital importance and full use has therefore been made of the latest techniques of integrated planar silicon micro-circuits.



On the left, a high density board using solid-state components on the right, a five unit serializer board using dual-in-line microcircuits V1010



A typical medium sized message switching centre, utilizing 2 Myriad 1 Computers, teleprinters and digital electronic displays. V1011

Although extensive precautions have been taken to acheive the highest reliability for each part of the system, the complete system, apart from the individual channel input and output equipment, is duplicated. Two identical message switching systems operate in parallel. Should any failure or discrepancy be found, the faulty system will be disconnected automatically and the correctly operating system will continue to provide uninterrupted service. This duplication ensures continuous operation under all conditions, even while extensions, modifications, and servicing are being carried out.

Full facilities are provided for the supervision and monitoring of messages in the system and for service and engineering requirements, utilizing the Marconi Tabular Displays described on page 357, or standard teleprinters.

A block diagram of the main items of equipment in the system is shown in Fig. 1.

It will be seen that a completely duplicated system is provided. Since the systems are identical and both are normally carrying out the same program, it will be adequate to describe briefly the equipment comprising one system, and then to indicate how this is used to handle messages.

System Operation

The guiding principle in the operation of both automatic and torn-tape systems is exactly the same, i.e. the system must always present an 'open door' to all incoming messages and then route them as speedily as possible to the required outgoing route.

During normal operation the two computer systems (Central Processors and peripheral equipment) operate in parallel. Both processors service the input channel termination units, assemble and process the received messages, maintain message logs, and record a copy of each message in the disc file store. The processor servicing the output channel termination units is designated the 'Main' and the other the 'Standby', each processor being capable of operating in either capacity as determined by the Channel Selection Control Unit.

Normally, on reception, messages are completely examined to ensure that they are suitable for onward relay before being made available for retransmission. However, should operational requirements so demand, retransmission can commence before the message has been completely received.

A standard system provides for three operators per shift; a supervisor is also

neer and an intercept operator. Through the facilities of electronic digital displays or standard teleprinters this small number of people can completely control, intercept, correct and monitor all messages passing through the system. The engineer can perform diagnostic test routines, and initiate test transmission through these facilities and it can thus be seen that operation of the system requires no additional skills above those of a communications centre operator of supervisory calibre.

Whilst the standard application of MARS is to the automation of Telegraph communications centres, it will be apparent that the design philosophy can be related to many other multi-access applications of the Myriad computer and covers the whole field of automated communications. Typical of such additional applications are Message Translation Systems (i.e. changes of speed or format), seat reservation systems (Airline, etc.) Meteorological Data Systems, etc.

Progress of a Message through the System. Fig. 2 shows the passage of a message from an incoming channel through the system to an outgoing channel. For simplicity this diagram does not indicate the duplication, but the operation of both systems is, of course, identical. The basic sequence of events in the receipt and retransmission of a message is as follows:

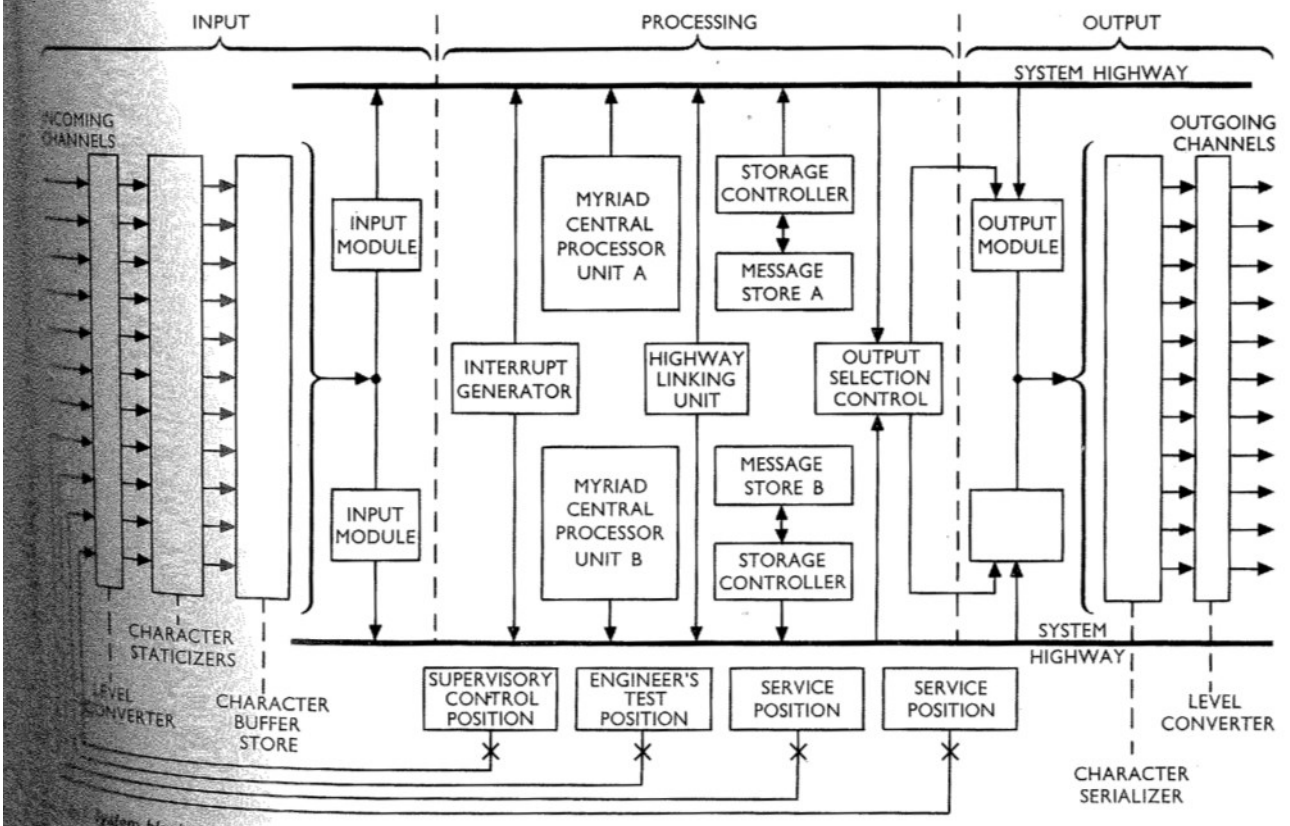
Initially, groups of characters are assembled in input buffer areas of the Central Processor Store and after each group has been subjected to a number of examinations, they are transferred to the disc file where they form complete messages.

Upon detection of an End of Message (EOM) sequence, a reference determined during the character examination routine, which identifies the message, is placed in the route output queue(s).

When the message reference reaches the head of a route output queue and a channel of that route becomes free, transmission of the message to line commences.

The detail of Fig. 2 illustrates the breakdown of the above sequence by the actual handling of the appropriate format, and indicates the relationship between the significant items of hardware and the actual message progress through the system.

Separate programs also control the various ancillary features of the system, some being required at regular time intervals and others on demand from the Supervisor or other personnel. A specific program ensures that a copy of each message transmitted together with a reference to its incoming identity is stored in the Disc File. A similar program provides for the recall of messages which, when requested, will be presented in an average time of agout 85 milli-seconds. The message may then be checked and retransmitted if so desired.



System block diagram

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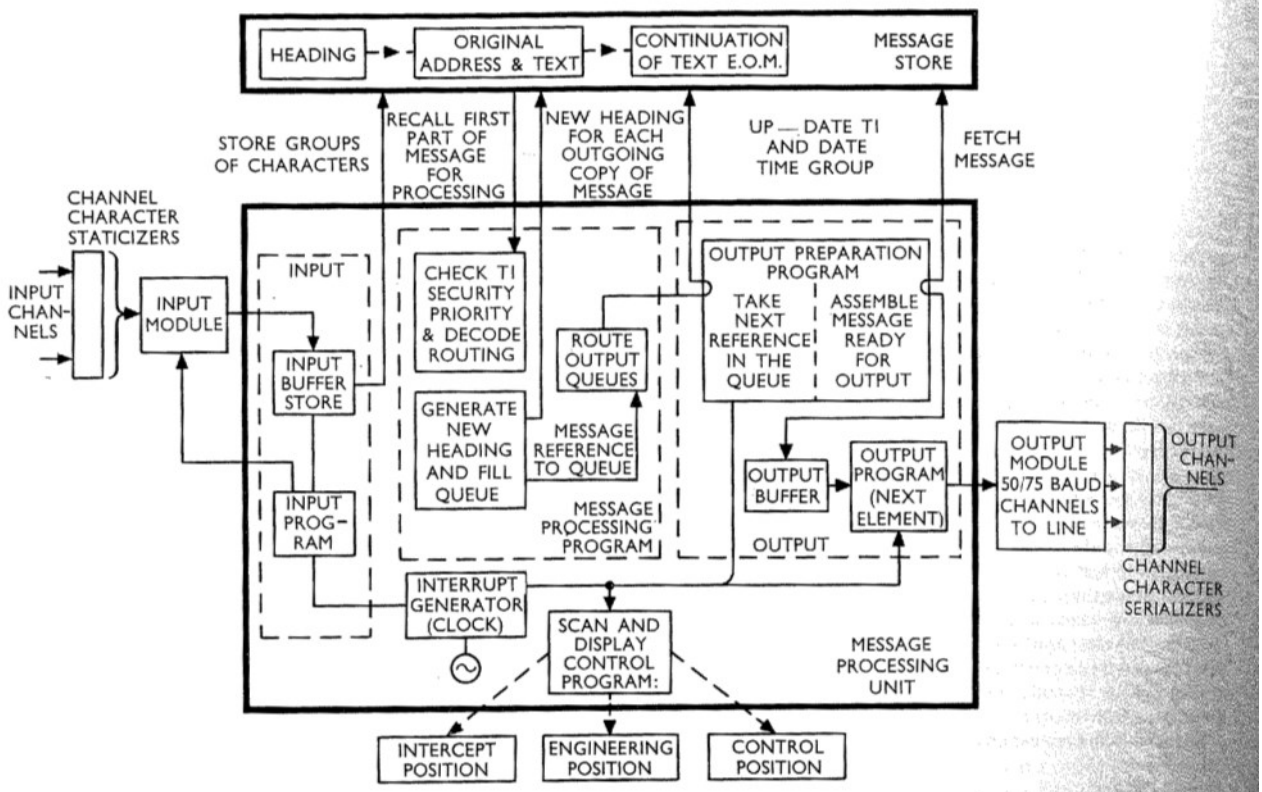

Fig. 2 Progress of message through the system

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FEATURES

Fully Automatic—manual intervention or paper tape is unnecessary for normal message flow.

High Reliability—Attained by advanced design concepts using microelectronics and high quality components.

Continuous Operation — Uninterrupted operation is guaranteed by parallel operation.

Flexibility—Programmed computers ensure complete flexibility of message handling techniques.

Adaptability—MARS deals with mixed traffic speeds, precedence levels, and formats.

Low Operating Costs—Man-power requirements reduced. Size can be regulated to conform with requirements.

High Speed Throughput—Capable of handling messages at the rate of at least 5 per second.

Expandability—The MARS system can be extended and modified without interruption to service.

Simplicity of Control—MARS is specifically designed to require no special operating skills.

Small Size—Microcircuitry contributes to the compactness of the MARS system, reducing the floor space required.

DATA SUMMARY

Telegraph Channels

Capacity: Capacity is dependent on complexity of system, typically 120, 75 baud channels.

Transmission speed: Standard Telegraph speeds, from 45 bauds to 2400 bauds or special speeds.

Margin: (Maximum Acceptable Distortion) on incoming channels 45% Distortion on outgoing channels not more than 1%.

Input/output signals: Nominally 6 volt double current working to CCITT recommendations. Other requirements can also be satisfied.

Operating Procedure

Type: Any prescribed procedure or format.

Method of Implementation: Stored program digital computer acts as message processing unit.

Traffic statistics: Automatic accumulation and printout of statistics can be provided if required.

System supervision: Teleprinters or electronic digital displays.

Operating speed

Cross office time: Average 300 milliseconds from receipt of end of message (or end of routing information) to transmission of start of message per outgoing channel.

Central Processor

Type: Marconi Myriad.

Word length: 24-bit.

Operating mode: Parallel.

Typical order times: 1·4 μS to 3·9 μS.

Storage capacity: 4000 to 32000 words in discrete steps. As required by complexity of system.

Basic components: Ultra-reliable integrated silicon microcircuits.

Message Storage

Type: Magnetic Disc File.

Method of use: One common store for all incoming and outgoing channels.

Capacity: The size of the store is calculated to meet the message throughput and recall requirements.

Transfer rate: About 200,000 characters second to and from Central Processor.

Reliability

Method: Duplicated operation of [illegible] cal systems.

Constructional practice: DEF 5600 vironment.

Temperature: 0 to 40°C.

Humidity: Up to 88%.

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