'ENGLISH ELECTRIC' LEO

KDF 6

office data processing system

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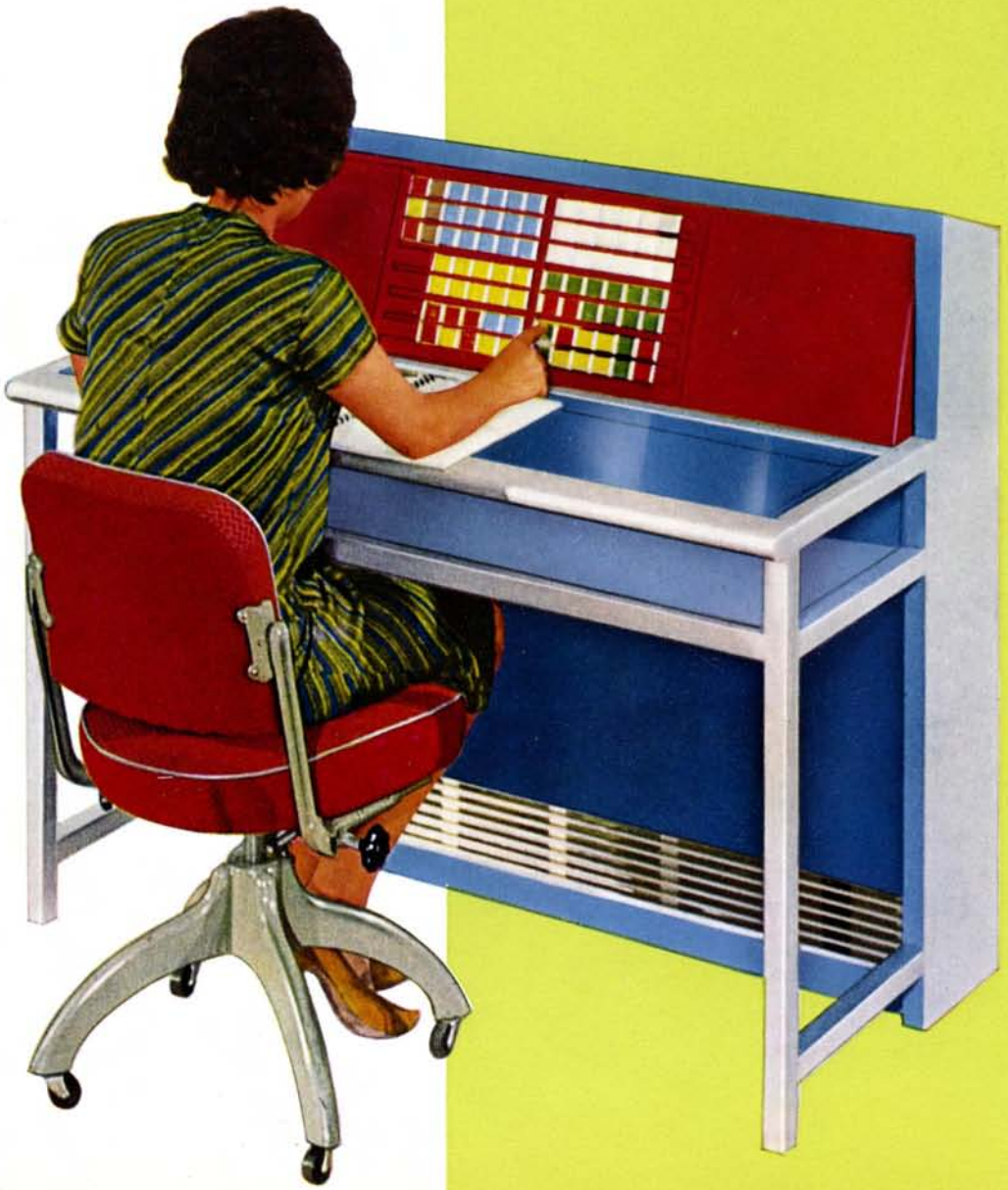


KDF 6

From the early post-war years 'English Electric' have played a decisive role in the design and development of electronic computers in Britain, and in the provision of data processing systems and services for commerce, industry, and science. Outstanding amongst these early digital systems was the 'English Electric' 'DEUCE' of which 30 are in operation in Britain, Europe, and the Commonwealth.

Further landmarks in the office data processing field were created by the introduction of the 'English Electric' KDP 10 and KDF 9 systems. These are expansible systems making full use of transistor and solid state devices, and miniaturisation techniques. The systems are capable of meeting the most stringent requirements of the largest commercial and industrial undertakings.

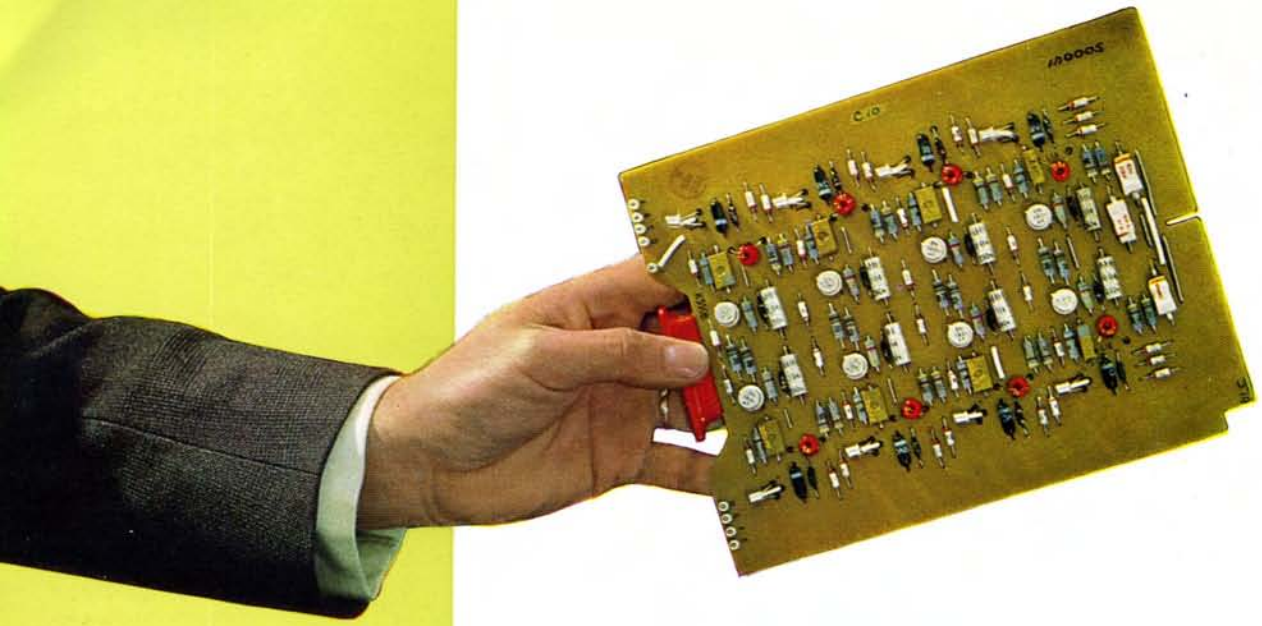
Extensive study of commercial user needs and experience in planning these large systems revealed that there was also a requirement for a system embodying data processing on magnetic tape, but costing no more than a punched card system.

The 'English Electric' KDF 6 has been developed to satisfy this requirement and, for the first time, offers to the commercial user a moderately priced office data processing system having a performance/cost ratio comparing most favourably with that of the very large (and costly) systems.

Developed and manufactured by 'English Electric's' Data Processing and Control Systems Division, KDF 6 is specifically designed to use magnetic tape storage. In addition, KDF 6 has a range of off-line and on-line printing facilities which are unparalleled in any other data processing system.

KDF 6 evolves from the experience of 'English Electric' as designers, manufacturers and USERS of modern data processing systems and has much in common with its contemporaries: KDF 9 and KDP 10. The logical circuitry is based on the same plug-in element design incorporating the latest electronic techniques. The peripheral equipment also is the same as that used with KDF 9 and KDP 10, thus making all these systems compatible.

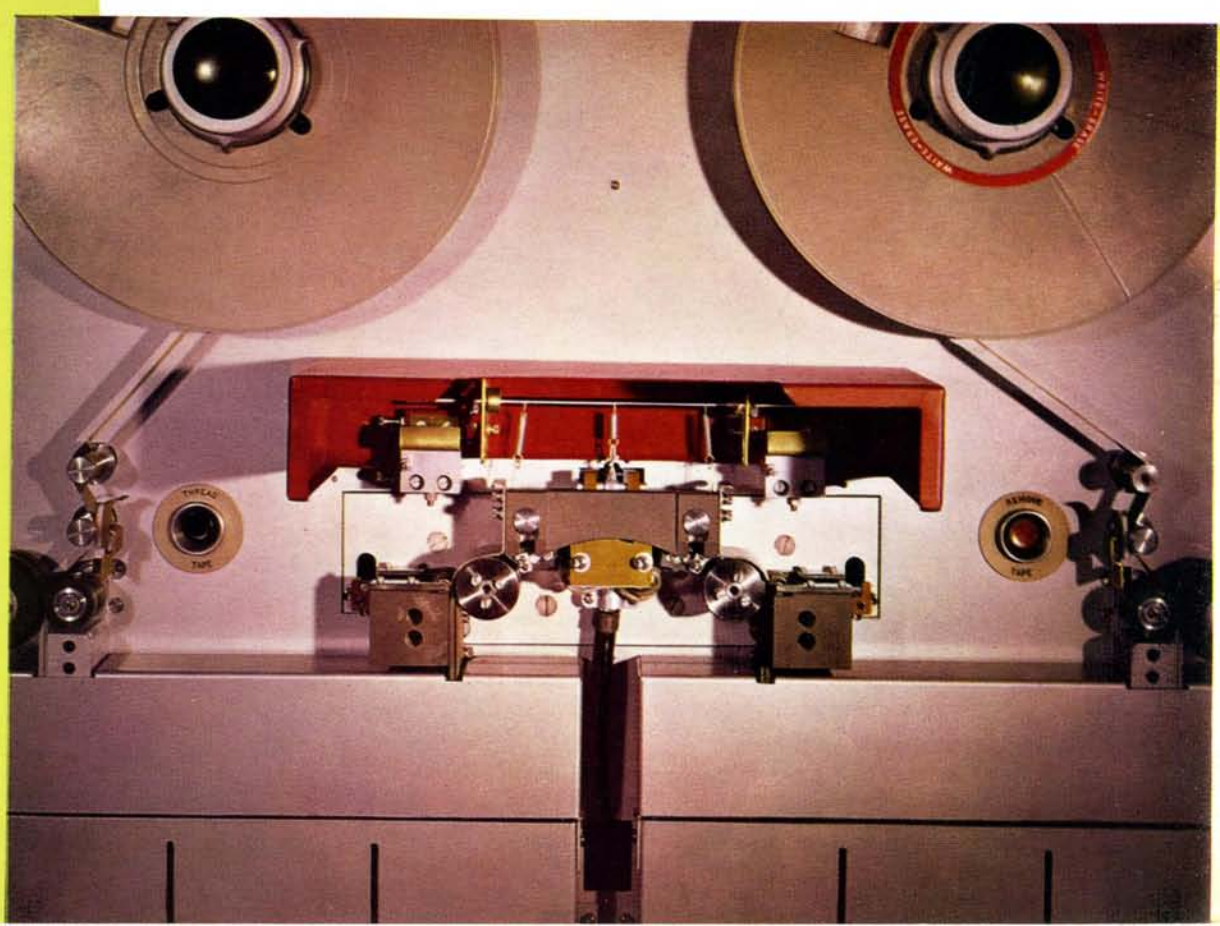
To use fully the power of KDF 6 'English Electric' have written a new automatic programming language for the machine. The new language has been named 'TALK' and by its use computer programs can be written in clearly defined English statements. 'English Electric' TALK has a complete range of procedures.



KDF

CENTRAL

The printed circuits and solid state components are compactly arranged



The reading head of the 40,000 c.p.s. magnetic tape unit

INTERNAL STORAGE

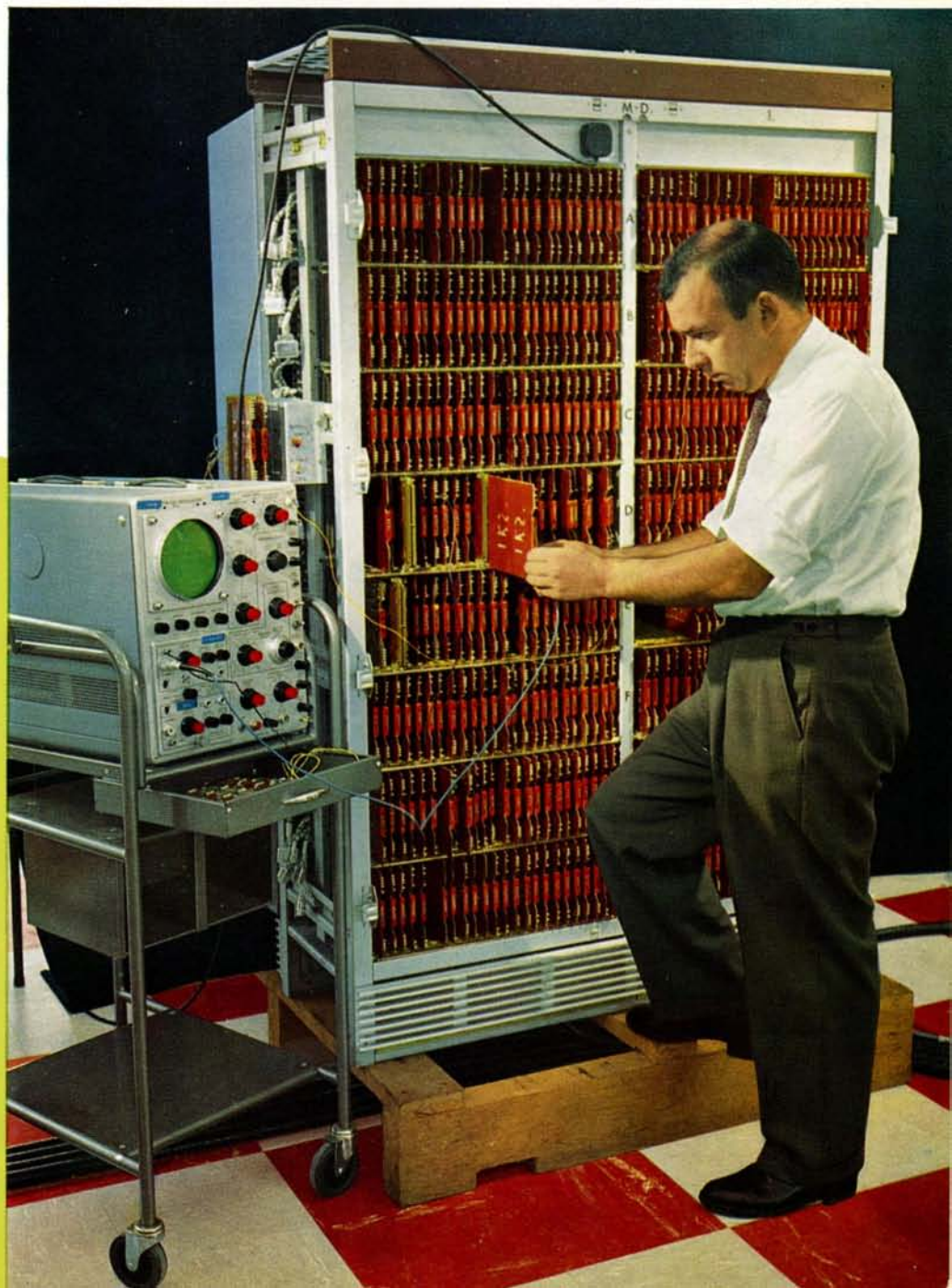
The 'English Electric' KDF 6 is based on a central computer with four registers and a transistor-driven ferrite core store holding a total of 24,576 characters. A variety of input/output and storage devices may be included in a KDF 6 Data Processing System.

Data and instructions are stored in individually addressable groups of three 6-bit characters which are referred to as 'triads'.

INPUT/OUTPUT CONTROL

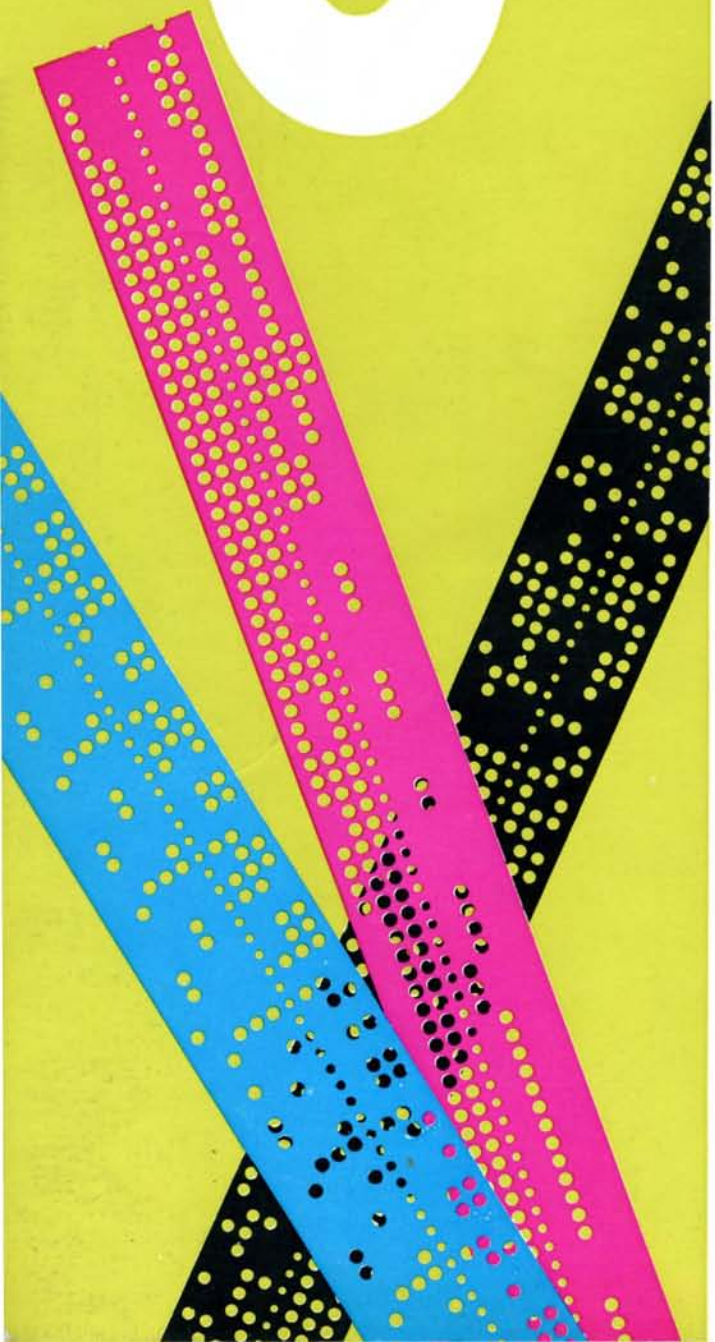
The KDF 6 input/output control allows up to four 'English Electric' 40,000 characters per second magnetic tape units to be individually addressed with provision for variable-length block transfers to be made independently of other computer operations. In addition to the magnetic tape units, up to four other peripheral devices capable of block transfer of data may be added to the system.

6 PROCESSOR



Testing the logical circuitry of the central processor

KDF 6 PERIPHERAL DEVICES



The following peripheral devices are available with KDF 6:

- Magnetic Tape Units
- Paper Tape Punch
- Paper Tape Reader
- Monitor Typewriter
- Line Printer

Other peripheral devices, such as a card reader, may be added as required by the user.

MAGNETIC TAPE UNITS

The fully transistorised magnetic tape units—already field proved in the KDP 10 system—are designed to provide the maximum accuracy and reliability in operation, and special attention has been given to safeguard against flaws or errors. The $\frac{3}{4}$ in. wide magnetic tape contains 16 recording channels. Information is recorded across eight channels and simultaneously duplicated on the other eight channels, thus a correct output is obtained even if a bit from one channel is completely missing. This ensures protection against "drop-outs" due to dust particles or small local imperfections in the tape.

The recording density is 400 characters per inch, the start/write time is 3·5 milliseconds, and inter-block gaps are 0·5 in. average. The units have a reading or writing rate of 40,000 characters per second. Reading is possible in the forward or reverse direction; writing is possible only in the forward direction.

PAPER TAPE PUNCH

KDF 6 is equipped with a 110 characters per second paper tape punch which perforates an eight-channel even-parity binary code in one-inch tape. An eight-inch diameter reel holds 1,000 feet of tape. By suitable output sub-routine, tape may be punched in any code on any of the standard widths of tape.

PAPER TAPE READER

The paper tape reader used with KDF 6 is a development of a standard 'English Electric' high-speed model which has been completely proved in service in numerous installations. Tape can be read continuously at the rate of 1,000 characters per second. An outstanding feature of the tape reader is its ability to stop from full speed in 0·5 millisecond, thus allowing the tape to stop without over-running the next character. The reader can be started and stopped up to 50 times per second.

In KDF 6 the tape reader normally accepts one-inch eight-channel even-parity tape but the reader can be instantaneously adjusted to handle other standard tape widths and suitable input routines allow any code to be handled.

MONITOR TYPEWRITER

The monitor typewriter prints data from the computer store. The printing rate is ten characters per second, and the printer is mainly used for output concerned with program operational control and testing. An integral tape punch produces eight-hole paper tape simultaneously with the printed output.

Up to four magnetic tape units can be individually addressed

The KDF 6 configuration illustrated offers full sort and merge facilities

The high-speed line printer may be used on or off-line

OFF-LINE PRINTING

A study of the needs of a wide range of commercial users showed that many users did not have a requirement for high speed printing. The 110 c.p.s. paper tape punch which is part of the minimum-configuration KDF 6 is intended for these users. Printing may then take place *away* from the computer using an inexpensive character printer.

If the printing requirements are heavy then the 'English Electric' high-speed printer may be used either off-line, or on-line operating in parallel with computing operations. In either case the central computer is not reduced to the speed of the printer, nor is any complicated programming necessary to use the printer simultaneously with other peripheral transfers.

HIGH SPEED PRINTER

The 'English Electric' printer used off-line accepts coded data from magnetic tape on a separate magnetic tape unit, and on-line from its buffer and editing

unit. The printing format is controlled by a plugboard or by a punched tape loop in the printer unit. Off-line operation in the "select mode" enables up to 25 different formats to be produced from the same reel of magnetic tape.

The input is accepted at the rate of 40,000 characters per second, in bursts of one line. Numeric data are printed at the rate of 900 lines per minute and the output speed will always lie between 600 and 900 l.p.m. depending upon the ratio of alphabetical to numerical content of the data. The output is single-spaced copy on continuous blank or pre-printed stationery with a maximum of 120 characters per line.

The printer prints one original and three carbons. Any 51 from 54 printed characters can be selected, comprising 26 English capitals, 10 decimal numbers, and 18 punctuation marks and symbols as under:

,	Comma	)	Close bracket
;	Semi-colon	/	Solidus
:	Colon	&	Ampersand
.	Full stop	£	Pound
'	Apostrophe	%	Per cent
"	Quotes	#	Number
*	Asterisk	+	Plus
—	Minus	=	Equals
(	Open bracket	@	At

Note: A new printer operating at 1,000 l.p.m. with 160 char. per line will be available from September 1963.

KDF 6 PROGRAMMING

'ENGLISH ELECTRIC' TALK

TALK is an automatic programming language developed by 'English Electric' for business users of the KDF 6. It enables users to write their programs, and present them to the computer, in clear, meaningful, English statements. A program known as the *Compiler* reads the TALK programs and automatically translates them into basic machine code.

TALK COMPILER

The function of the *Compiler* is to take a TALK program, known as the *Source Program*, and from it produce an efficient machine code version called the *Object Program*. To do this it must be provided with the *Procedure Statements* and also with *Declarations* and *Data Descriptions*.

TALK PROCEDURE STATEMENTS

These express the action of the program in meaningful English. Each sentence bears a number and may also be named; unless conditional it has an imperative verb (such as MULTIPLY or WRITE) with one or more objects, appropriately connected, and can continue with further verbs and their objects. Objects may be data names chosen by the programmer, or 'literals' where the actual value to be used is given in the instruction; other forms are also provided for various special purposes.

Conditional clauses, introduced by IF or UNLESS, allow alternative courses of action to be specified, depending upon the value of a data field, or the relationship between two fields.

TALK DECLARATION

These enable the user to indicate to the *Compiler* the points at which he wishes an *Object Program* to be segmented, to assign group names to sets of data fields, to introduce temporary names, and to direct the *Compiler* in regard to the use of the core store and peripheral devices.

TALK DATA DESCRIPTION

Here the user names, and describes the format and characteristics of, the data with which the program has to deal. Each file of data may contain many different types of record, each of which must be described in terms of the fields that it may contain. Often, in practice, an actual record will not contain all the fields associated with its type, and a particular field need not occupy the same number of characters in one record as in another of the same type. TALK caters for variable-length fields and records, and for a variable number of occurrences of groups of fields.

KDF 6 USER CODE

KDF 6 User Code is a programming system which combines the natural flexibility of machine coding with the latest advances in "direct programming" techniques: it provides a number of relative and symbolic addressing techniques, together with facilities for automatic conversion of decimal program input, and for insertion of comments and annotations. Storage is automatically allotted when the user code program is being assembled, unless the programmer wishes to specify locations for some parts of the program.

KDF 6 MACHINE CODE

Machine Code programming, where required, is compatible with KDF 6 User Code. Machine Code instructions consist of two octal digits for the function and four octal digits specifying the operand address.

KDF 6 USER SERVICES

COURSES

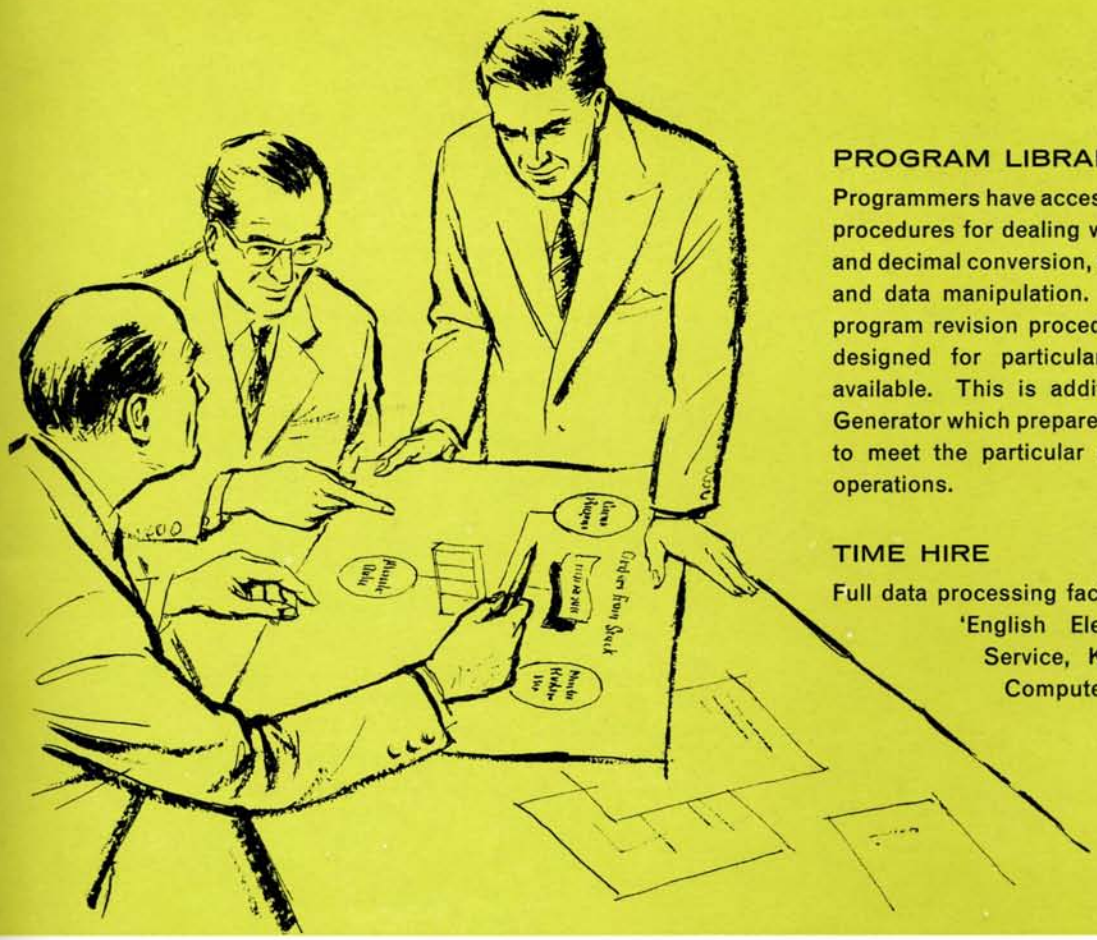
A number of courses are provided which allow first-hand study of the advantages of the KDF 6 office data processing system. These are designed to meet the requirements of Management, Programmers, and Maintenance Engineers.

SYSTEM INVESTIGATION

Systems analysts experienced in the customer's own field are available to analyse application problems, and to work with the customer's staff throughout the changeover period. This cuts to a minimum the interval between the decision to purchase and the full operational use of a KDF 6 office data processing system.

INSTALLATION PLANNING

Site planning engineers advise on the most suitable installation layout. The resources of the 'English Electric' Group are such that stand-by power plants, air conditioning, main switchboards, and all other supporting services can be provided, and their *entire* installation carried out by the Company.



PROGRAM LIBRARY

Programmers have access to a wide range of standard procedures for dealing with such matters as sterling and decimal conversion, control of peripheral devices, and data manipulation. Standard program testing, program revision procedures, and service programs designed for particular standard operations are available. This is additional to the Sort Program Generator which prepares sorting programs designed to meet the particular needs of individual sorting operations.

TIME HIRE

Full data processing facilities are available from the 'English Electric' Central Computing Service, Kidsgrove, and the London Computer Centre.

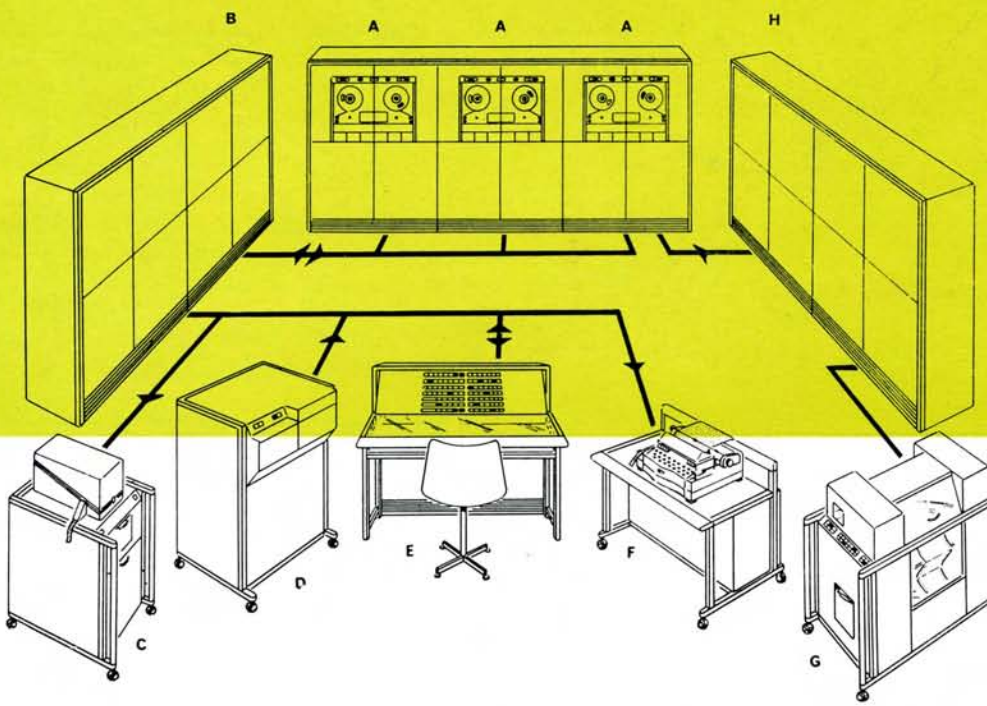
KDF 6 MAINTENANCE SERVICES

'English Electric' were among the pioneers of computer maintenance in the United Kingdom, and are able to remove completely from the user the onus of responsibility for the maintenance of a system. The design of the KDF 6 is such that in normal circumstances a full time on-site engineer is unnecessary. Regular and 'on-demand' service will be provided from our nearest service centre. Daily maintenance can be carried out by the operator but, alternatively, 'English Electric' can provide a first-line maintenance engineer who will also have been trained as an operator and programmer. This unique 'English Electric' service can result in a substantial annual saving to the user. In addition, proposals can be made to cover combinations of the following:

- The provision of a backing service of skilled electronic and mechanical engineers.
- The provision of reserve items of peripheral equipment, held at base.
- The provision of initial spares.
- Any special services which the customer may require.

INPUT/OUTPUT EQUIPMENT

Magnetic Tape Units	Speed	40,000 char/sec.
	Checking	Dual Recording
	Start/Write Time	3·5 mS
Paper Tape Reader	Speed	1,000 char/sec.
	Tape Width	11/16″ to 1″ (17·5 to 25·4 mm)
	Channels:	Five, seven, or eight
	Checking:	Parity
Paper Tape Punch	Speed	110 char/sec.
	Tape Width	11/16″ to 1″ (17·5 to 25·4 mm)
	Channels:	Five, seven, or eight
Monitor Typewriter	Speed	10 char/sec.
Monitoring		Console panel display
Line Printer	Speed	1,000 l.p.m. (160 char/line)
	Total Characters	54
	Max. print width	16 in.



A Magnetic Tape Unit
B Central Processor
C Paper Tape Punch
D Paper Tape Reader
E Central Console
F Monitor Typewriter on Desk
G Line Printer
H Line Printer Electronics

DATA

CONSTRUCTIONAL

Unit	*Height*	*Length*	*Depth*	*Weight*
Central Processor	5 ft. 9 in. *(1·75 m)*	7 ft. 9 in. *(2·36 m)*	1 ft. 7 in. *(0·48 m)*	1,500 lbs. *(681 kg)*
Control Console	3 ft. 5 in. *(1·04 m)*	3 ft 4 in. *(1·02 m)*	2 ft. 3 in. *(0·67 m)*	300 lbs. *(136 kg)*
Magnetic Tape Units (each)	5 ft. 9 in. *(1·75 m)*	3 ft. 8 in. *(1·12 m)*	1 ft. 7 in. *(0·48 m)*	1,000 lbs. *(454 kg)*
Paper Tape Reader	3 ft. 6 in. *(1·07 m)*	2 ft. 0 in. *(0·61 m)*	2 ft. 0 in. *(0·61 m)*	280 lbs. *(127 kg)*
Paper Tape Punch	2 ft. 7 in. *(0·79 m)*	2 ft. 5 in. *(0·74 m)*	1 ft. 6 in. *(0·46 m)*	100 lbs. *(46 kg)*
Monitor Typewriter and Desk	2 ft. 11 in. *(0·89 m)*	3 ft. 7 in. *(1·09 m)*	2 ft. 6 in. *(0·76 m)*	250 lbs. *(114 kg)*
Line Printer	3 ft. 9 in. *(1·14 m)*	4 ft. 2 in. *(1·27 m)*	2 ft. 6 in. *(0·76 m)*	500 lbs. *(227 kg)*
Line Printer Electronics	5 ft. 9 in. *(1·75 m)*	7 ft. 9 in. *(2·36 m)*	1 ft. 7 in. *(0·48 m)*	2,000 lbs. *(908 kg)*

POWER REQUIREMENTS

All units	200 to 250V 50 c/s single phase
Computer and Control Console	1·5 kW
Magnetic Tape Unit	1·4 kW
Paper Tape Reader	0·5 kW
Paper Tape Punch	0·5 kW
Monitor Typewriter	0·5 kW
Line Printer	2·4 kW

Note :- The Company's policy is one of continuous development and improvement of its products and, therefore, the right is reserved to supply products which may differ slightly from those illustrated and described in this publication.

The designations KDF 6, KDF 9, KDP 10 and DEUCE are trademarks of 'English Electric'.

Note: Since this publication was first produced the Data Processing Division of 'English Electric' has formed a new company with Leo Computers Limited. The new company commenced operations on 1st April 1963 under the name of ENGLISH ELECTRIC-LEO COMPUTERS LIMITED. All data processing equipment described in this publication is now manufactured by ENGLISH ELECTRIC-LEO.

'ENGLISH ELECTRIC' LEO

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