Systems architecture of the BTM 1200 series computers.

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1.History of the early HEC, BTM and ICT computers.

The British Tabulating Machine Co. Ltd. (BTM) became interested in stored-program digital computers in 1951. The initial aim was to supplement BTM's existing, and thriving, business of selling electro-mechanical office equipment based on the Hollerith type of punched cards. In March 1951, a three-man team of engineers from BTM visited Dr Andrew Booth, to see a research computer called APE(R)C – the *All-purpose Electronic Computer,* the (R) signifying that it was being built for the British Rayon Research Association. Andrew Booth was a lecturer at Birkbeck College, London, where he had been experimenting with designs for small computers since 1947 – (see reference 1 in section T1X5.

The BTM engineers produced a copy of APE(R)C which they called HEC1 – *Hollerith Electronic Computer number 1.* It was a 32-bit word machine with 256 words of magnetic drum storage. HEC1 was working by the end of 1951. An improved version called HEC2, with a 512-word drum, was demonstrated at the Business Efficiency Exhibition in 1953.

Then a re-engineered production version called HEC2M was delivered to the first customer in 1955. It is believed that a total of seven HEC2M computers were sold. HEC2M was applied to various applications in science and engineering. Full details have not yet come to light but it is believed that the following deliveries were made – (see reference 6 in section T1X5):

early 1955	GEC Research Laboratories, Wembley
July 1955	ESSO Refinery, Fawley, Hampshire
(date?)	Royal Aeronautical Establishment, Twinwood, Bedford
(date?)	Aeronautical Research Association, Manton Lane, Bedford
(date?)	Ministry of Aviation, St Giles Court, London
(date?)	Royal Aeronautical Establishment, Boscombe Down, Wiltshire
(date?)	Indian Statistical Institute, Calcutta (?)

Then came the HEC4 computer, which was a radically enhanced HEC2M so as to make it more suitable for business data processing, the main market area of interest to BTM. The word length was increased to 40 bits, the clock rate was increased from 30 kHz to 40 kHz and the instruction set was extended. In particular, hardware assistance was provided for the handling of simple records and the conversion of alphanumeric characters to/from binary. The capacity of the drum store remained at 1024 words. The first HEC4 was

delivered to a customer in November 1956. It is believed that over 100 of these computers were eventually sold.

The HEC4 was soon re-named the BTM 1201. Then from late 1957 the capacity of the drum store was doubled and the resulting upgraded machine was known as a BTM 1202. After the merger of BTM and Powers-Samas to form International Computers and Tabulators in 1959, the machines became known as the ICT 1201 and ICT 1202.

2. Basic architecture of the HEC2M and the HEC4/BTM 1200 series computers.
All these machines had magnetic drum stores, with a (1+1)-address instruction format that included the address of the next instruction. The facility of being able to specify the location of the next instruction was intended to allow programmers to place instructions optimally on the drum store. The idea was to try and align the logical sequence of instructions to the physical times at which locations became available as the drum rotated. So-called *optimum* programming or *minimum latency* programming strove to maximise the speed of execution, so as to make the best of the essentially serial (sequential) nature of drum stores.

The following Table compares the two sets of computers, as marketed by BTM. The information is based on references 2 and 4 in section T1X5.

	BTM HEC 2M	***BTM HEC4 ICT 1201, 1202***
Word length, bits	32	40
Instruction length, bits	32	40
Instruction format	1 + 1	1 + 1
Instruction set: number of ops, *See note (a)*	16	32
Primary store size	1024	1024 for the 1201 2048 for the 1202
Primary store type –	Drum	Drum
Secondary store size	-	-
Secondary store type	-	-
ADD time, min., millisecs. ADD time. max., millisecs.	1.25 21.25	1.25 21.25
MULTIPLY time, min., millisecs. MULTIPLY time, max., millisecs.	3.75 50.0	3.75 50.0
Digit period, microseconds	30	25
Main type of vacuum tube	6J6	6J6
Approx. number of vacuum tubes (including thermionic diodes)	Approximately 700 ?	1100
Input medium	Card reader (CDR)	CDR
Output medium	Card punch (CDP); printer	CDP; printer
Approx. cost of a production model	£20,000	£30,000 for the 1201; £35,000 for the 1202.

Note (a). This is the number of effective distinct functions, as would be recognised by a modern programmer.

3. Additional details of the HEC4 (BTM 1201 and 1202).
The following information is taken from reference 2 in section T1X5.

The magnetic drum is 5 inches in diameter, has 64 tracks with sixteen 40-bit words per track, with an 8 digit gap between words. (This defines a 'word-time' as approximately 1.25 milliseconds). The drum spins at 3,000 rpm and the CPU is synchronised to the drum. The total capacity was 1024 words for the BTM 2101 and 2048 words for the BTM 1202.

Input is via standard 80-column punched cards, at a rate of 125 cards/minute. Output is either via punched cards at about 100 cards/minute or via a line-at-a-time printer. See section T1/X3 for more details on the input/output facilities, which include hardware assistance for conversion to/from binary of values expressed in a variety of practical formats such as decimal, sterling, weight, etc.

4. Central registers visible to programmers.
There are four 40-bit shift registers, known as:

A	accumulator
Q	temporary working space
M	multiplier register and temporary working space
B	temporary working space.

The use of these is explained in section T1/X3 when describing the BTM 1200 series instruction set.