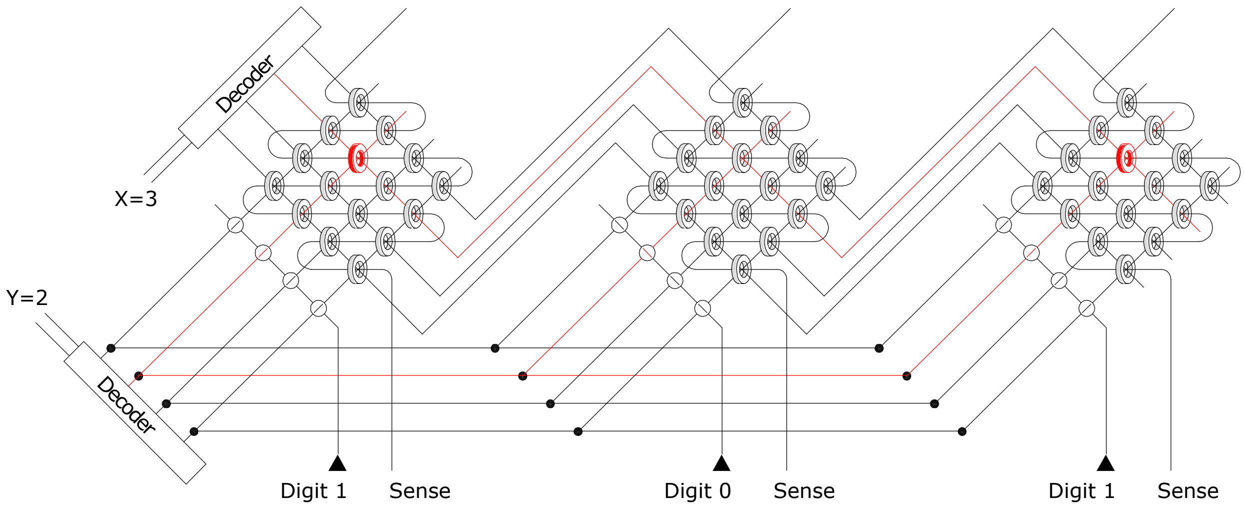
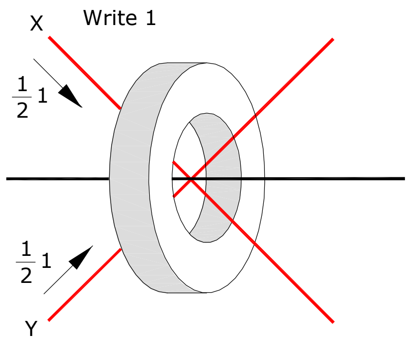
Core Memory

In the 1940s the ferrites were developed, a group of compounds that are magnetic, good insulators, hard, durable, and workable into precise shapes. They are made by combining magnetic iron oxide (Fe203) with oxides of other metals, such as magnesium oxide (MgO), manganese oxide (MnO), and zinc oxide (ZnO), at moderate temperatures. Ferrite cores are made by grinding this fairly soft material to a powder to break up the larger crystal domains, pressing the powder to the requisite shape, and sintering it at about 1200 degrees C. By 1955 ferrite core stores for computers were coming on the market.
Each individual ferrite core is a small ring of about 1.3mm (1/20 Inch) diameter with a hole of about 0.75mm (3/100 Inch). As is well known, a wire carrying a current is surrounded by concentric circles of magnetic lines of force. If a wire threading a ferrite core is given a suitable current, the core becomes magnetized and stays like that. A current in the reverse direction changes the direction of this magnetization. Thus a core has three stable states: unmagnetized (unwritten) and two directions of magnetization (written). A core magnetized in one direction can be said to be storing a 1, and one magnetized in the other direction a 0. The unwritten state is not used for storing information.
Reading is done by threading another wire through the cores and sending a current through the write wires of any particular core. If this current causes the direction of magnetization of the core to be reversed, the burst of energy liberated during this change induces a current pulse in the read wire that can be sent to an output terminal or wherever else it is needed. Reading is thus destructive and, once read, a core must be rewritten.
In practice each core is not usually afforded the luxury of its own separate write and read wires. To save space and to simplify the wiring, the cores are positioned at the intersections made by two sets of write wires set at right angles to each other (see: diagram). With such a 'square array' a very economical way of magnetizing any particular core exists. This makes use of brief electric pulses that are a little more than half the strength needed to change the magnetization of a core. Suppose the chosen core is in the third X-row and second Y-row.
One half-write pulse is sent along the third X wire and another is sent simultaneously along the second y row wire. As a result the chosen core becomes magnetized (or its magnetization is changed) and all the other cores are unchanged. One read wire threads all the cores diagonally across the array and this detects whether two experimental half-write pulses in the writing wire change the magnetization of the relevant core; if the magnetization changes, the read wire carries a pulse, and the inference is that the core value was 1 (but is now 0).





The diagram above shows three square arrays of cores arranged as described in the text. In practice there are as many arrays as bits in each computer word (usually 16 to 48). Red indicates half-write pulses flowing in wires and change in direction of magnetization of cores. The closed gate switches of the central array prevent two half-write pulses meeting at the selected core, which therefore continues to store a 0.
The enlargement at left shows a 1 being written on a core previously storing a 0

(Source: Information Retrieval, The Essential Technology)