Rotary Thumbwheel Switches for Digital Applications

By JAMES R. SQUIRES

Applications and characteristics—the prices of these switches have dropped substantially due to improved manufacturing techniques.

CONVENTIONAL in-line rotary selector switches have been around the electronics industry for some eighty years. There have been some changes in these switches but none as significant as those made possible through the application of new materials and manufacturing techniques. Development was speeded in part by a growing demand by a computer-oriented industry for smaller and more reliable switches. New plastics, new methods of molding, the use of precious metals, and new printed-circuit techniques have combined to produce a new version of this component—the modern rotary thumbwheel switch (Fig. 1).

Construction of Switch

Basically, the thumbwheel switch consists of two parts. The first is the finger- or thumb-rotated shaft assembly and the second is the printed circuit. The printed circuit used in one form or another is one of the basic new differences. Another is the shaft which is mounted parallel to the front panel and drives rotating metal fingers that wipe against the printed-circuit pads. Very low torque is required to turn the switch. The wheel, molded so that little ears extend from it, can be rotated readily by the finger or thumb. Many designs provide bezels that limit finger rotation of the wheel to one position per click. Switch positions are marked on the thumbwheel itself and are visible, one position at a time, through a window.

Beryllium copper metal fingers attached to the thumbwheel are in constant physical contact with the printed circuit. The contacts wipe in a series of concentric circles over the printed-circuit configuration (Fig. 2). Output terminals at the rear of the PC board are connected to the metal fingers *via* printed wiring on one or both sides of the circuit card.

Many thumbwheel switches offer you a choice of one of three methods of connecting external circuit wiring to the switch. First, you can solder wires directly to pads or terminals on the PC board. Second, you may select a connector especially designed to mate with lugs printed onto the PC board. Wires molded into the molded thumbwheel housing comprise the third method. These wires are color-coded and connected directly to the printed board which is associated with the thumbwheel switch.

To compare a rotary thumbwheel switch with a standard

Fig. 1. Exploded schematic view of rotary thumbwheel switch.

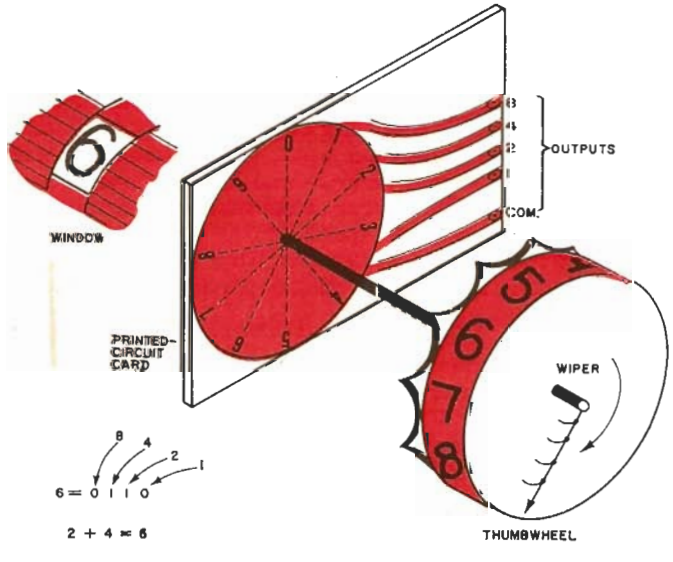
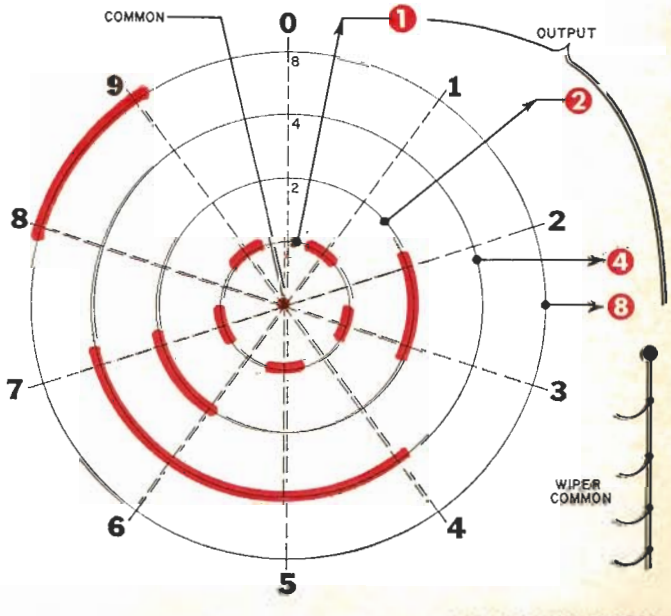
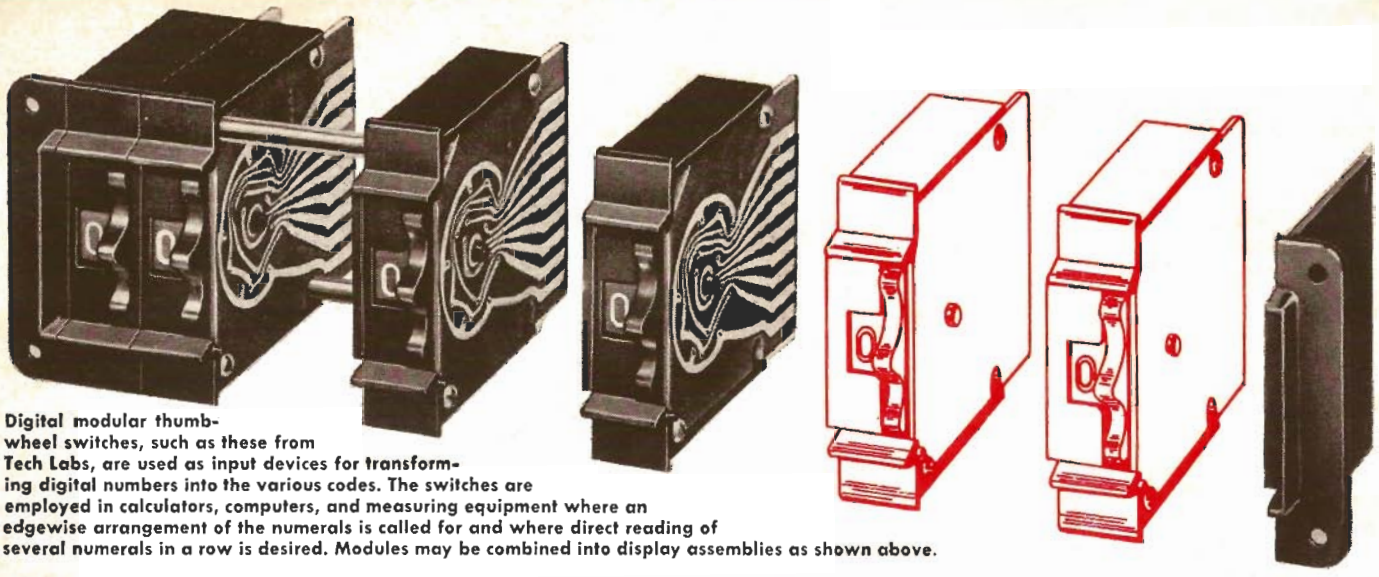


Fig. 2. Printed-circuit configuration for thumbwheel switch.





Digital modular thumbwheel switches, such as these from Tech Labs, are used as input devices for transforming digital numbers into the various codes. The switches are employed in calculators, computers, and measuring equipment where an edgewise arrangement of the numerals is called for and where direct reading of several numerals in a row is desired. Modules may be combined into display assemblies as shown above.

in-line rotary selector switch, let us wire a decimal-to-binary, 0 to 9 (10-position) switch. Assume that we want a front-panel indication of any number between 0 and 9. Also, the switch must form the binary equivalent of that panel number. Fig. 3A indicates the equivalency between binary and decimal numbers.

What About Cost?

Let us consider the cost of the switch necessary to perform this function. With an eye for minimum size, we consider a miniature phenolic in-line rotary switch with four decks and 2 to 11 positions. For this application, we can set the indexing for the 10 positions required. This switch costs us about $4. A standard off-the-shelf thumbwheel switch will cost about $5 to perform the same function. However, there is more to the comparison story than meets the pocketbook.

The cutting and soldering of the 19 or 20 wires required to assemble a switch that will provide a binary output for a decimal setting will take about 20 minutes' time and cost additionally for the wire, solder, and electricity. See Fig. 4. What is more, an additional 5 or 10 minutes would be spent in checking the wiring. All this adds up to a cost of over $6 for the conventional in-line selector switch. The thumbwheel switch, on the other hand, is prewired and tested, ready to mount and connect into the circuit.

The in-line switch requires a simple-to-cut round hole and perhaps, if desired, a smaller guide hole. To mount a thumbwheel switch, a square hole will be needed. This can be difficult to cut without the proper punches. Some of the newer thumbwheel models have flanges molded into the switch module to cover up not-quite-square openings.

The in-line switch, while easier to mount, requires more of the valuable cabinet space than the space-saving thumbwheel switch. What is more, the conventional in-line rotary selector switch must have some kind of panel markings or plates to indicate its position, while the thumbwheel switch is already marked and ready to use.

Some manufacturers of thumbwheel switches are giving you more of a bargain than you (*Continued on page* 64)

This precision voltage reference from General Resistance uses six rotary thumbwheel switches for direct digital readout as well as to provide for a dialable voltage selection.

DECIMAL NUMBER	BINARY EQUIVALENT			
	8	4	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

(A)

DIAL	10-POSITION BCD COMMON C CONN. TO TERMINALS: 8	4	2	1
0				
1				●
2			●	
3			●	●
4		●		
5		●		●
6		●	●	
7		●	●	●
8	●			
9	●			●

(B)

Fig. 3. (A) Decimal-to-binary conversion. (B) Dot chart.

Fig. 4. Wiring 4-deck switch for binary coded decimal.