The Faber-Castell Taschenrechner (TR): A Pocket Calculator Combined with a Slide Rule

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Introduction

It is interesting to consider when the major slide rule makers first recognized the threat posed by the electronic pocket calculator, and how these firms responded to that threat. This is the story of one such firm's response.

Background

From 1950 to 1975, the slide rule experienced its golden era in Asia, the USA, and Europe. There were years during this time when many major makers produced up to a million slide rules. However, by the end of the sixties a development of great consequence, i.e., the introduction of the electronic microprocessor, signaled the end of the slide rule era.

The microprocessor was first used to make electronic pocket calculators around 1967. Hewlett-Packard (HP) pioneered this application, but HP was later followed by Texas Instruments (TI) and other firms. At first, pocket calculators were limited to the four functions: addition, subtraction, multiplication, and division. Soon percentage and memory functions were added. These early electronic calculators were very expensive, more than ten times the price of a slide rule. Because these calculators were so expensive, the number sold was initially very small. Moreover, the capacity to make chips and accessories was not adequate to satisfy larger demand. These factors and the consequences of the further development of the pocket calculator for slide rule makers, are described in Rodger Shepherd's concise report of interviews with Hans Dennert about the end of slide rule production at Aristo. [1] Aristo's experience was representative of a range of consequences that included going out of business. Large firms disappeared within a short time if they specialized only in slide rules, or could only make small steps toward diversification.

Faber-Castell's Response

Faber-Castell made its first efforts to produce pocket calculators on its own around 1972. Faber-Castell was trying to get a USP-factor (Unique Selling Proposition) by combining the pocket calculator with a slide rule.

In the beginning that made very good sense, because at that time only four-function calculators were available. [2] Although Hewlett-Packard had already brought its famous HP 35 (meaning 35 mathematical functions and one memory) on the market, HP did not sell these chips to other competitors. At the time that Faber-Castell was introducing the TR1 and TR2 (c 1972), Texas Instruments was making and selling only a simple four-function chip. Only later (1974) could TI offer its "scientific pocket calculator", the SR 50. In 1974, Faber-Castell bought TI's more advanced chips and produced the TR3 and TR4 (see below). Up to that time the combination of a slide rule and an electronic calculator offered a real advantage, i.e. , the basic four functions could be carried out on the electronic calculator, and the important positive and negative e-functions could be calculated on the slide rule. [2,3]

The F-C TR: the Slide Rule Side.

The slide rule had the following scales on the front: LL03, LL02, LL01, K, A/B, BI, CI, C/D, L, LL1, LL2, LL3. The following scales were on the reverse: T1, ST, S, P, C. The slide was turned over to use the scales on the reverse.

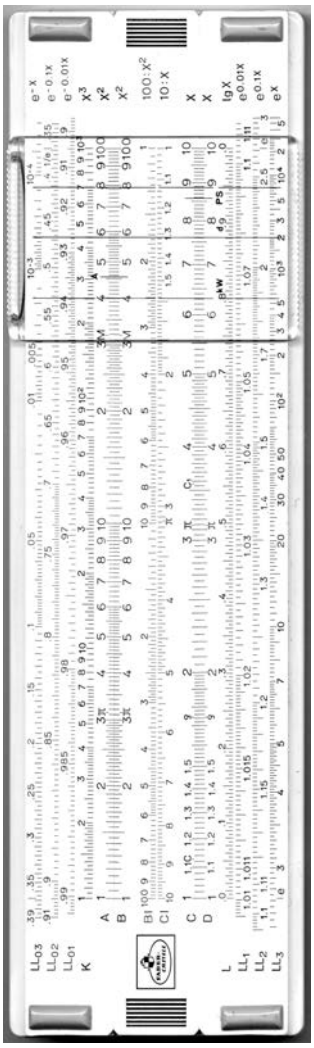

Figure 1. The front of the Faber-Castell Taschenrechner TR1.

The F-C TR: the Calculator Side

The calculator was housed in an oblong box measuring 12x56x170mm. The calculator consisted of the calculator body with the electronic chips, a keyboard with keys, key springs, a window with display, a sliding switch and some further small parts. The heart of the calculator was the printed circuit board with its 4-bit central processing unit (CPU). The CPU processed all digits serially, one digit after the other, similar to the way it would be done by hand on paper, and stored the result in the scratchpad memory. That took some time for the 4-bit CPU, but the power consumption was low. That was important, because of the low capacity of batteries at that time.

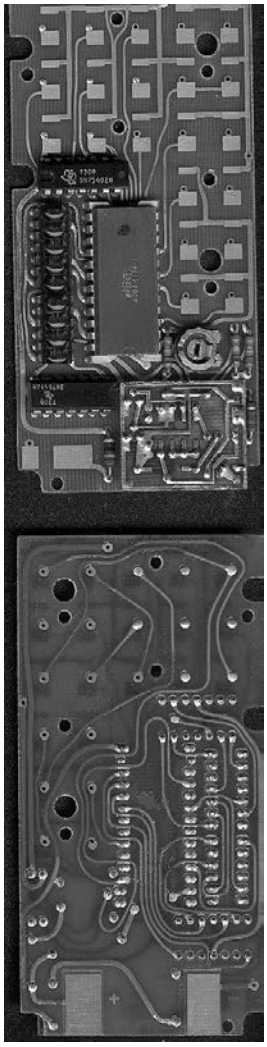

Figure 2. Printed circuit board, front and back.

The quality of the keys was very important to prevent bouncing, which resulted in unwanted multiple input of the same digit. Faber-Castell developed its own patent-protected key-spring to achieve excellent mechanical "de-bouncing". To buy such keys of good quality would have been expensive. Furthermore, Faber-Castell trusted its own quality control, and did not want to be dependent on an outside source for such an important item. Therefore, these keys were made in-house.

The initial display (in TR1) was composed of eight red light emitting diodes (LEDs). They were very expensive to produce, and their efficiency was only 1% (compared with today's 30-40%). Later models used green LEDs with approximately 5% efficiency.

Each digit of the display had seven segments plus the dot. Combinations of these seven segments were used to produce numbers 0-9. The power consumption per segment was 3 to 5 mA, so it was very important to strobe the segments and all eight digits, in order to average and reduce the current drain of the display, regardless what number was displayed. Nevertheless, the consumption of power was very high, and the initial exchangeable batteries did not last long. They were eventually replaced by rechargeable nickel-cadmium batteries, but they lasted only about 1000 charging cycles. (These Ni-cad batteries were recharged with an external charger known as the TRL. They were available for 110V or 220V. The charging time was 10 to 12 hours.) [4]

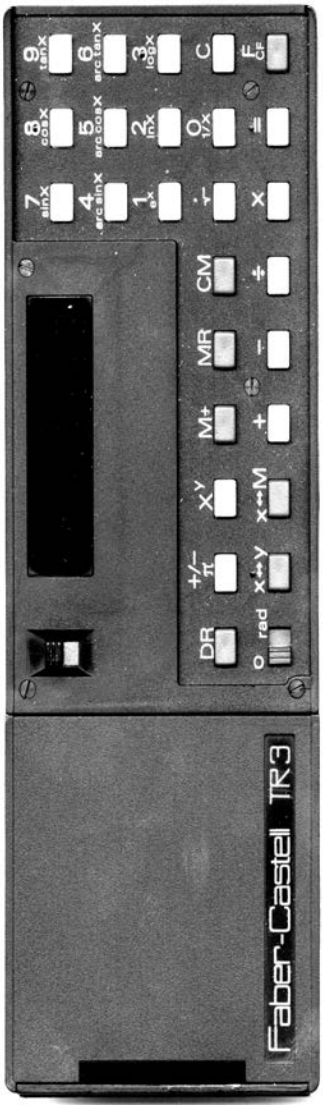

Figure 3. The Faber-Castell Taschenrechner TR3, back

Dating Specimens

Each TR specimen has a blind-stamped serial number at the right end of the body. In the case of the TR1 the serial number has eight digits, beginning with 1. The TR2 has nine digits beginning with 02; the TR3 has nine digits, beginning with 03. The numbers on the TRX begin with 00. The three digits to the right of the model designator indicate the lot's year and month of production. The last four digits indicate the specimen's unique serial number within the dated lot.

For example, a TR with code number 14040003 means a TR1 (1) from 1974 (4) fourth month (04) serial number 0003 (the third made item, authors collection). A TR with code number 025110789 means a TR2 (02) from 1975 (5) eleventh month (11) serial number 0789. A TR with code number 007010224 means a TRX from 1977(7) first month (01) serial number 0224. [5]

The TR Models

There were five TR models that were made as TR-slide rule combinations. (See Table 1). In addition, three models were offered without a slide rule: The TR4 was identical to TR3 (but without a slide rule). The TRX included x, :, -, + %, memory functions, and was powered by two micro-cells or directly from a line adapter (for continuous use). The Johann Faber 76 was identical to the TR1N, and was available in three colors (green, yellow, or orange).

Table 1. The TR Slide Rule Combinations

	TR1 initial serie 1972	TR1 1973-1975	TR1N 1973-1975	TR2	TR3	TRX
8-digits red LED display	Yes	Yes	No	No	Yes	No
8-digits green LED display	No	No	Yes	Yes	No	Yes
+ − x $\frac{a}{b}$	Yes	Yes	Yes	Yes	Yes	Yes
%	No	Yes	Yes	Yes	Yes	Yes
x^2 $\frac{1}{x}$	No	Yes	Yes	Yes	Yes	No
1 memory function	Yes	Yes	Yes	No	No	Yes
Additional memory functions MS, MR, M-, M+, parenthesis ( )	No	No	No	Yes	Yes	No
"Scientific calculator" double function per key sin x, cos x, tan x arcsin x, arccos x, arctan x e^x, ln x and log x	No	No	No	No	Yes	No
With 2 micro-cells or directly powered from a line adapter (for continous use)	No	No	No	No	No	Yes

Conclusion

The Faber-Castell pocket calculators discussed in this article did not succeed in the market. Their advantage was brief and insufficient. Furthermore, it was impossible for slide rule manufacturers who did not make their own computer chips (e.g., Faber-Castell, Aristo, etc.) to keep producing state-of-the-art electronic components, and to cope with the rapid fall in the price of such components. Faber-Castell stopped the production of its pocket calculators around 1977. [6] Thus, these devices were in production for only four years, and today Faber-Castell pocket calculators (with or without slide rules) are very rare and much sought after by collectors.

Acknowledgement

The author acknowledges his gratitude to Rodger Shepherd for translation of the manuscript from German, and for editorial assistance with the English version.

References and Additional Notes

[1] Shepherd, R., "The End of the Aristo Slide Rule: A Case Study" *Journal of the Oughtred Society,* 2:2, p5, October 1993.

[2] In 1999 Peter M. Hopp wrote in (*Slide Rules,* Astragal Press) p98: "Later from the early 1970s, to fight off the calculator for as long as possible, the company (Faber-Castell, *author note*) produced a design that incorporated an electronic calculator. This in some cases appears sensible, as the slide rule has log-log scales which are not available on the four-function calculator. In other cases the slide rule is rendered totally redundant." In the end, it is still valid to argue today that the slide rule beats the pocket calculator in table calculation and the rule of three proportions.

[3] This outline of the development of pocket calculators is clearly much simplified; however, a more complete and accurate description is beyond the scope of this article.

[4] These technical details were assembled with the kind assistance of Eugen Paulin.

[5] This information about the TR serial numbers was kindly called to my attention by Günter Kugel.

[6] Of course Faber-Castell survived the loss of the slide rule and TR product lines, and is today the largest manufacturer of lead pencils in the world.