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Entitled

INSTRUCTION MANUAL
for use with the
SOEMTRON 220
ELECTRONIC CALCULATOR

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It has been published by us to disseminate information about the Soemtron 22x range of electronic desk calculators manufactured by V.E.B. (*1) Büromaschinenwerk Sömmerda, as a project to gather and centralise whatever information can be found about these increasingly rare early electronic calculators.

If you have or know of any information, books, drawings, circuits, hardware, test equipment (prufgerat) or other memorabilia relating to the Soemtron 220, 221, 222 or 224 calculators, their trade names - Daro or Soemtron, manufactured by - V.E.B. Büromaschinenwerk Sömmerda, please email us at - mike@soemtron.org

This document has been scanned from an original book, processed through commercial OCR software to regenerate the original German text and then automatically translated to English and imported into Microsoft Word. Layout has been duplicated in line with the original document as much as possible to retain the flow of the original document. Drawings, circuits and photographs are scans from the original document.

With this effort in mind some of the syntax presented here is a little strange to say the least!. Some portions have been reworked to be more readable English text but there is obviously more to be done. If you can help with this, or indeed have any helpful information or comments, please email us at - mike@soemtron.org

Please use, and hopefully enjoy, this in information in the spirit in which we undertook to generate it - as an information source for an interesting piece of early calculator history before the advent of modern electronics, in the days when “hands on” engineers thought through the problems and challenges of designing equipment with little resources, to produce the best end product they could.

February 2017
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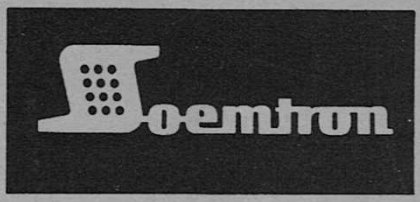
***1 - V.E.B - Volkes Eigener Betrieb = Peoples Owned Company**



220 ELECTRONIC DESK COMPUTER

INSTRUCTION MANUAL
for use with the
SOEMTRON 220
ELECTRONIC CALCULATOR

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FOREWORD

Whether or not you are experienced in the use of modern desk calculators, you will find it beneficial to study this simple manual carefully.

While retaining a conventional logic in basic operations, the SOEMTRON 220 has been specially developed to provide extra working capacity with exceptional flexibility.

By working systematically through the examples which follow, you will acquire a full understanding of the SOEMTRON 220, enabling you to put the calculator to its fullest advantage on your own figurework.

If at any time you would like further advice or instruction, your nearest distributor will be pleased to help.

Additional copies of this Instruction Manual can be obtained on application.

SOEMTRON MODEL 220 ELECTRONIC CALCULATOR

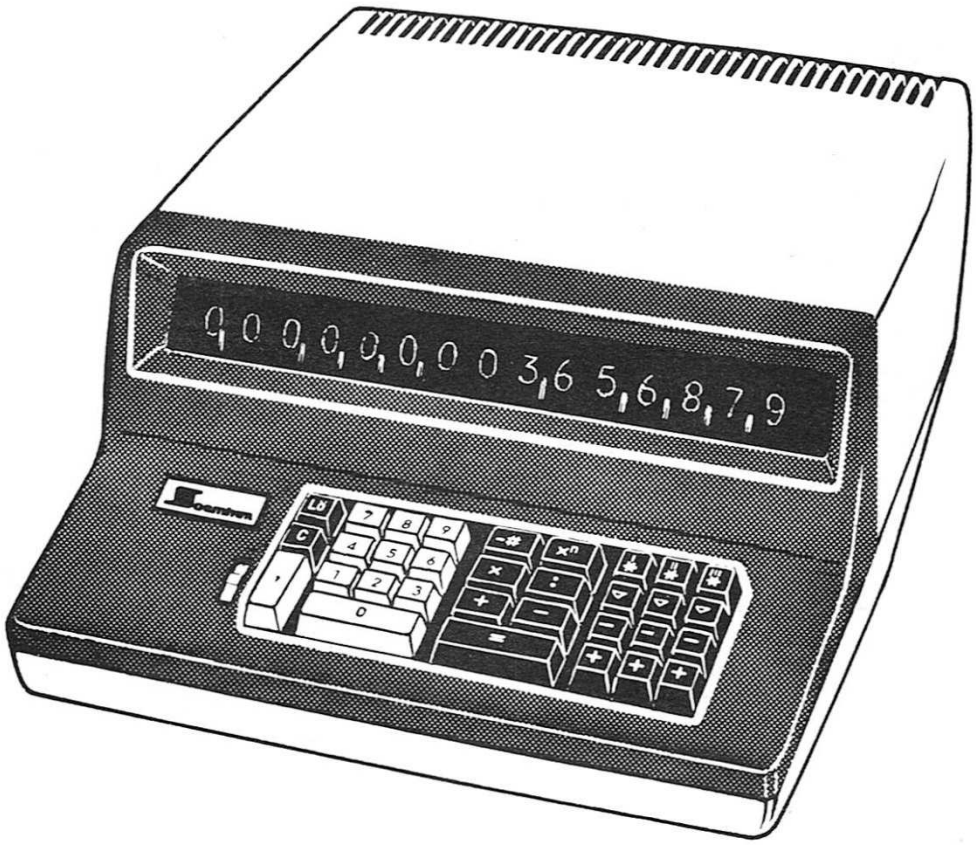
The SOEMTRON Model 220 incorporates :-

1. A simplified numeral keyboard with decimal point key and selector.

2. A fifteen-digit display register giving a check on keyboard entries and results, with automatic decimal point indication.

3. A three-register high speed calculating unit, capable of addition, subtraction, multiplication and division with positive or negative values. A constant can be retained in this unit for repeated use in multiplication.

4. Three accumulating memory-storage registers which can be used independently for addition and subtraction, the accumulation of calculated results, or to retain constant values for any required operation.


0 0 0,0,0,0,0 0 3,6 5,6,8,7,9

ADDITION AND SUBTRACTION IN CALCULATING UNIT.

EXAMPLE

14.25	+
12.00	+
12.00	+
0.75	-
37.50	

DECIMAL SELECTED 2.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö				
B	14 , 25	+				14.25
C	12 ,	+				12.00
D		+				12.00
E	0 , 75	-				00.75
F		=				37.50

Note particularly that it is not necessary to re-enter a repeating number.

In the example the value 12.00 is added twice from a single entry on the numeral keyboard.

The = key clears the calculating registers, and no further clearance operation is required before commencing a new problem.

ADDITION AND SUBTRACTION IN A MEMORY-STORE

EXAMPLE

14.25	+
12.00	+
12.00	+
0.75	-
37.50	

DECIMAL SELECTED 2.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö	*			
B	14 , 25		+			14.25
C	12 ,		+			12.00
D			+			12.00
E	0 , 75		-			00.75
F			*			37.50

Note particularly that it is not necessary to re-enter a repeating number.

In the example the value 12.00 is added twice from a single entry on the numeral keyboard.

The * key totals and clears the Memory-Store.

ADDITION WITH SUB-TOTALS IN CALCULATING UNIT GRAND TOTAL IN A MEMORY-STORE

EXAMPLE

25.63		36.52		
52.41		14.25		
47.85		58.74		
125.89	+	109.51	=	235.40

DECIMAL SELECTED 2.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö	*			
B	25 , 63	+				25.63
C	52 , 41	+				52.41
D	47 , 85	+				47 85
E		=	+			125.89
F	36 , 52	+				36.52
G	14 , 25	+				14.25
H	58 , 74	+				58.74
I		=	+			109.51
J			*			235.40

SIMPLE AND COMPOUND MULTIPLICATIONS

EXAMPLE 1.23 x 4.56 = 5.6088

DECIMAL SELECTED 4.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö				
B	1 , 23	x				1.2300
C	4 , 56	=				5.6088

Note: A decimal setting of 3 places will give a rounded result of 5.609.
A decimal setting of 2 places will give a rounded result of 5.61.

EXAMPLE 1.23 x 4.56 x 7.89 = 44.253432

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö				
B	1 , 23	x				1.230000
C	4 , 56	=				5.608800
D		x				5.608800
E	7 , 89	=				44.253432

SIMPLE AND CONTINUOUS DIVISIONS

EXAMPLE 5.6088 : 1.23 = 4.56

DECIMAL SELECTED 4.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	II	III	
A		Lö				
B	5 , 6088	:				5.6088
C	1 , 23	=				4.5600

EXAMPLE 44.253432 : 1.23 : 4.56 = 7.89

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	II	III	
A		Lö				
B	44 , 253432	:				44.253432
C	1 , 23	=				35.978400
D		:				35.978400
E	4 , 56	=				7.890000

COMBINED MULTIPLICATION AND DIVISION

EXAMPLE 1.23 x 4.56 : 7.89 = 0.710875

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY			
			I	II	III	
A		Lö				
B	1 , 23	x				1.230000
C	4 , 56	=				5.608800
D		:				5.608800
E	7 , 89	=				0.710875

EXAMPLE 4.56 : 7.89 x 1.23 = 0.710875

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY			
			I	II	III	
A		Lö				
B	4 , 56	:				4.560000
C	7 , 89	=				0.577947
D		x				0.577947
E	1 , 23	=				0.710875

MULTIPLICATION AND DIVISION WITH ACCUMULATION OF RESULTS IN A MEMORY-STORE

EXAMPLE

14 x 0.258	=	3.6120
22.33 : 11.222	=	1.9898
1.59 x 0.753 x 3.69	=	4.4180
		10.0198

DECIMAL SELECTED 4.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	II	III	
A		Lö	*			
B	14 ,	x				14.0000
C	0 , 258	=	+			3.6120
D	22 , 33	:				22.3300
E	11 , 222	=	+			1.9898
F	1 , 59	x				1.5900
G	0 , 753	=				1.1973
H		x				1.1973
I	3 , 69	=	+			4.4180
J			*			10.0198

MULTIPLICATION AND DIVISION WITH GROUP TOTALS AND FINAL TOTALS IN MEMORY-STORES

EXAMPLE

3.416 x 9.25	= 31.5980	
2.583 x 8.75 x 0.95	= 21.4712	53.0692
4.583 x 2.083	= 9.5464	
11.258 x 9.852 : 12	= 9.2428	18.7892
		71.8584

DECIMAL SELECTED 4.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	READ OUT
A		Lö	*	*	*	
B	3 , 416	x				3.4160
C	9 , 25	=	+			31.5980
D	2 , 583	x				2.5830
E	8 , 75	=				22.6013
F		x				22.6013
G	0 , 95	=	+			21.4712
H	4 , 583	x				4.5830
I	2 , 083	=		+		9.5464
J	11 , 258	x				11.2580
K	9 , 852	=				110.9138
L		:				110.9138
M	12,	=		+		9.2428
N			*		+	53.0692
O				*	+	18.7892
P					*	71.8584

MULTIPLICATION WITH A CONSTANT VALUE - OPTIONAL ACCUMULATION IN A MEMORY-STORE

EXAMPLE

4.75	x	3.625	=	17.2188
4.75	x	1.45	=	6.8875
4.75	x	2.5	=	11.8750
				35.9813

DECIMAL SELECTED 4.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö	*			
B	4 , 75	x				4.7500
C	3 , 625	x^n	+			17.2188
D	1 , 45	x^n	+			6.8875
E	2 , 5	x^n	+			11.8750
F			*			35.9813

If accumulation of the results is not required, all operations related to Memory-Store "I" can be disregarded.

MULTIPLICATION ACCUMULATING BOTH FACTORS AND TOTALLING RESULTS IN MEMORY-STORES

EXAMPLE

1.23	x	4.56	=	5.6088
3.416	x	9.25	=	31.5980
4.583	x	2.083	=	9.5464
9.229		15.893		46.7532

DECIMAL SELECTED 4.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö	*	*	*	
B	1 , 23		+			1.2300
C		x				1.2300
D	4 , 56			+		4.5600
E		=			+	5.6088
F	3 , 416		+			3.4160
G		x				3.4160
H	9 , 25			+		9.2500
I		=			+	31.5980
J	4 , 583		+			4.5830
K		x				4.5830
L	2 , 083			+		2.0830
M		=			+	9.5464
N			*			9.2290
O				*		15.8930
P					*	46.7532

COMPOUND CALCULATION COMBINING USE OF CALCULATING UNIT AND A MEMORY-STORE

EXAMPLE

$$\frac{6.25 \times 3.125 \times 1.5625}{6.25 + 3.125 - 1.5625} = 3.906250$$

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö	*			
B	6 , 25	x	+			6.250000
C	3 , 125		+			3.125000
D		=				19.531250
E		x				19.531250
F	1 , 5625		-			1.562500
G		=				30.517578
H		:				30.517578
I			*			7.812500
J		=				3.906250

An alternative solution to this problem will be found on the following page.

In both solutions, the repeating values are entered on the numeral keyboard once only.

COMPUTATION RECALLING VALUES FROM THREE MEMORY-STORES TO THE CALCULATING UNIT

EXAMPLE

$$\frac{6.25 \times 3.125 \times 1.5625}{6.25 + 3.125 - 1.5625} = 3.906250$$

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY			
			I	II	III	
A		Lö	*	*	*	
B	6 , 25		+			6.250000
C	3 , 125			+		3.125000
D	1 , 5625				+	1.562500
E			▽			6.250000
F		x		▽		3.125000
G		=				19.531250
H		x			▽	1.562500
I		=				30.517578
J		:	*			6.250000
K		+				6.250000
L				*		3.125000
M		+				3.125000
N					*	1.562500
O		-				1.562500
P		=				3.906250

An alternative solution to this problem will be found on the previous page. In both solutions, the repeating values are entered on the numeral keyboard once only.

CONVERSION OF STERLING, BRITISH WEIGHTS, AND GENERAL FRACTIONS TO DECIMAL FORM WITHOUT REFERENCE TO TABLES OF EQUIVALENTS.

EXAMPLES

A - E	£. s. d. 13. 5. 3¾	=	£13.265625
F - M	T. C. Q. Lb. 13. 5. 1. 7.	=	13.265625 tons
N - R	13 17/64ths	=	13.265625

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	II	III	
A		Lö	*			
B	13 , 25		+			13.250000
C	3 , 75	:				3.750000
D	240 ,	=	+			.015625
E			*			13.265625
F		Lö	*			
G	13 , 25		+			13.250000
H	28 ,	+				28.000000
I	7 ,	+				7.000000
J		=				35.000000
K		:				35.000000
L	2240 ,	=	+			.015625
M			*			13.265625
N		Lö	*			
O	13 ,		+			13.000000
P	17 ,	:				17.000000
Q	64 ,	=	+			.265625
R			*			13.265625

EXTRACTION OF SQUARE ROOT

GENERAL FORMULA $$R = \frac{N + a^2}{2a}$$

EXAMPLE $$\sqrt[2]{630.01} = \frac{630.01 + 25^2}{2(25)}$$

DECIMAL SELECTED 3.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY I	MEMORY II	MEMORY III	
A		Lö	*	*	*	
B	630 , 01		+			630.010
C	25 ,					25
D					+	25.000
E					+	25.000
F		x				25.000
G		x^n		+		625.000
H			∇	+		630.010
I				*		1255.010
J		:			*	50.000
K		=				25.100

The sequence from D to K above can now be repeated. The answer at G will indicate the accuracy of the previous result at K, and when these values are acceptable, the process can be terminated.

In practice, familiarity with the numbers in use will enable accurate results to be derived from the first approximation. It is important to note that no entries are made on the numeral keyboard after the estimated root has been entered, and there is, therefore, no risk of an error being introduced during the progress of the computation.

EXTRACTION OF CUBE ROOT

GENERAL FORMULA $$R = \frac{N + 2a^3}{3a^2}$$

EXAMPLE $$\sqrt[3]{279.48} = \frac{279.48 + 2(6.5)^3}{3(6.5)^2}$$

DECIMAL SELECTED 6.

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY			
			I	II	III	
A		Lö	*	*	*	
B	279 , 48		+			279.480000
C	6 , 5					65
D		x				6.500000
E		x^n				42.250000
F					+	42.250000
G					+	42.250000
H					+	42.250000
I		x^n				274.625000
J				+		274.625000
K				+		274.625000
L			▽	+		279.480000
M				*		828.730000
N		:			*	126.750000
O		=				6.538304

Repetition of the control key sequences from D to O will produce a result of 6.538080, which is the accurate cube root of 279.48.

As in the case of the square root method, which is the same in principle, no risk of error is introduced during the progress of the computation, because no entries are made on the numeral keyboard.

YOUR OWN PROBLEM ANALYSED

JOB DESCRIPTION:

STAGE	NUMERAL KEYBOARD ENTRY	CONTROL KEY				READ OUT
		CALCULATING UNIT	MEMORY			
			I	II	III	
A						
B						
C						
D						
E						
F						
G						
H						
I						
J						
K						
L						
M						
N						
O						
P						
Q						
R						
S						
T						
U						
V						
W						
X						
Y						
Z						
a						
b						
c						
d						
e						
f						
g						