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Daro Soemtron 220

Elektronischer Tischrechenautomat

Bedienungsanleitung

69-220-000-5

We (www.soemtron.org) fully recognise the intellectual property rights of the originating source and will take steps to remove, alter or further acknowledge this document if we are notified of any infringements. It has been presented in good faith to aid in understanding the inner workings of the now vintage Soemtron 22x range of electronic calculators.

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 an on-line OCR software package 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 in the document may be a little strange. 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.

Bedienungsanleitung

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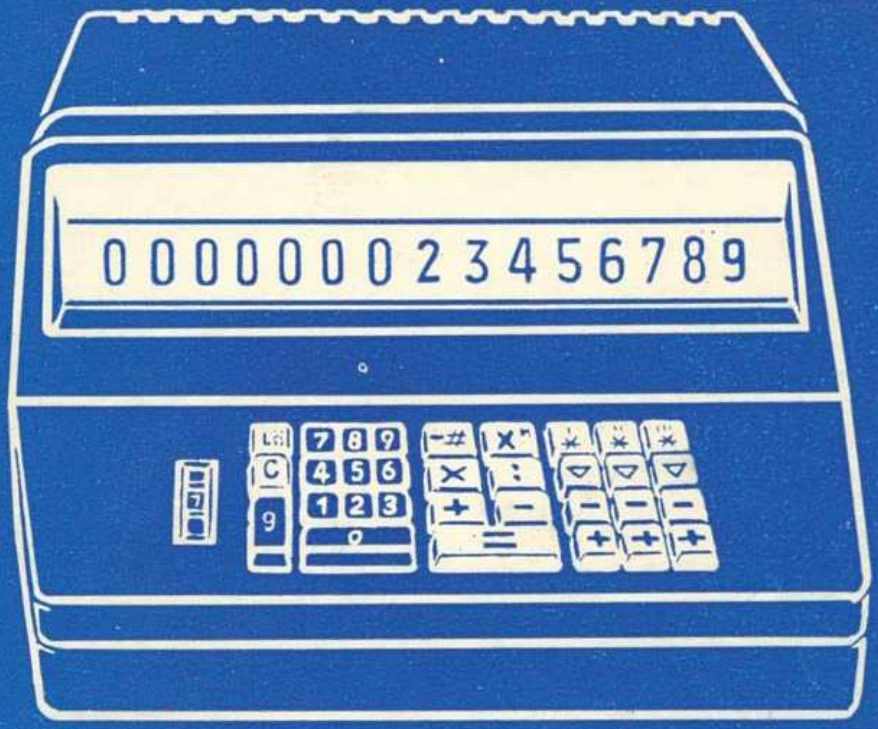

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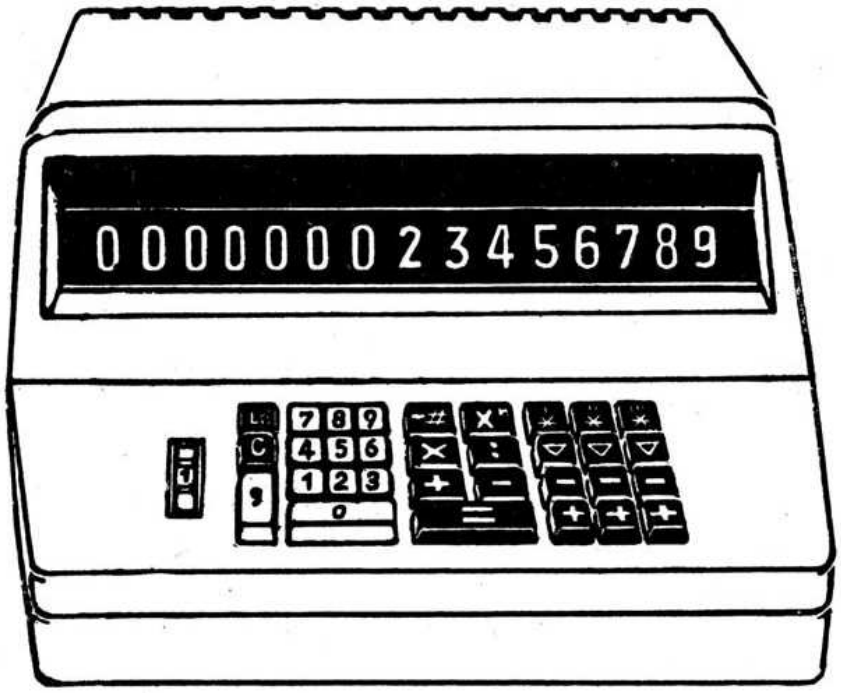

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1. INTRODUCTION

Decades of experience in the design of computing machines have found their expression in the technical design of the electronic desktop calculator "Soemtron 220".

A device was developed with the electronic desktop calculator, which corresponds to the state of the art and significant advantages for its customers.

High computing power, noiseless operation of the arithmetic operations and simple operation are characteristic features of the electronic desktop calculator, with the time compared with the working on an electromechanical base of automatic calculators high economic efficiency can be achieved.

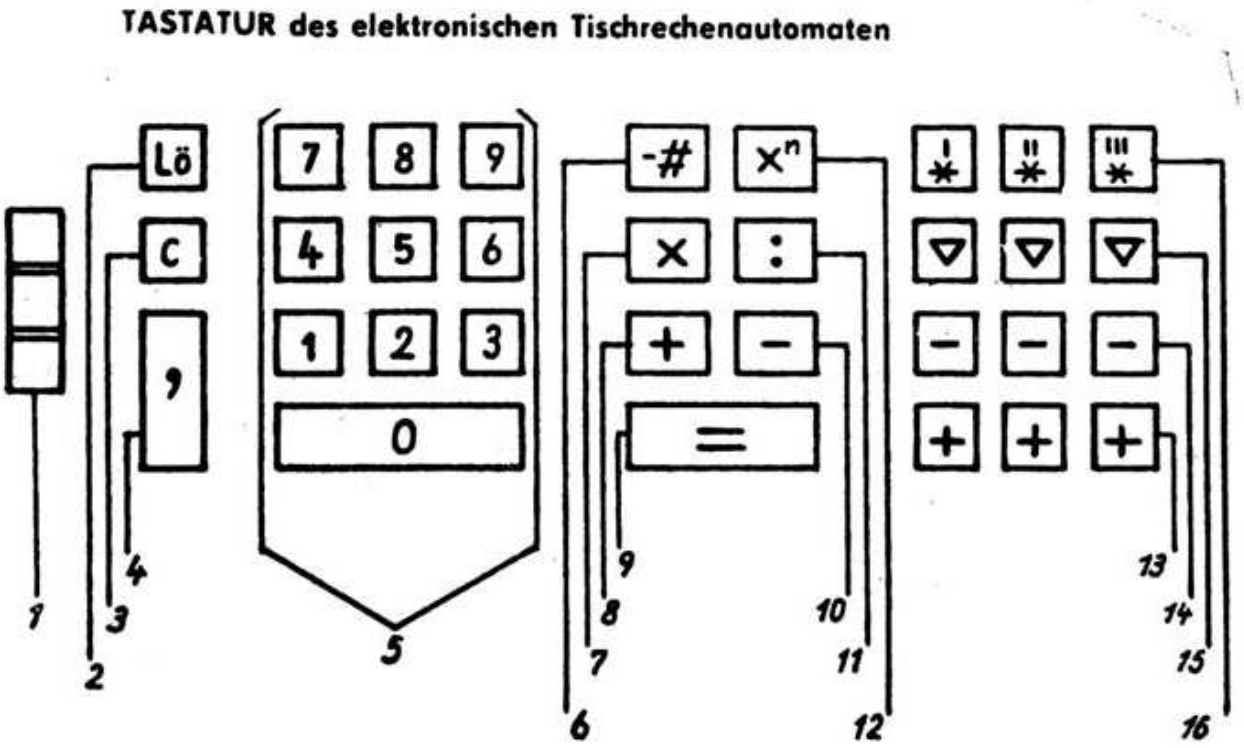
The electronic desktop calculator "Soemtron 220" solves the most varied tasks at all levels of commercial and scientific knowledge in the technical and business-technical sector.

The electronic desktop calculator comes in 2 variants - as type 220/1 with one memory and as type 220/3 with 3 memories – manufactured.

The calculation functions are the same for both models. Only the 220/1 type does not have the 2 rows of buttons for memories II and III. The means that tasks that require more than one memory are not included can be solved with the ETR 220/1.

The electronic table calculator “Soemtron 220” is used as an effective organizational tool for the efficient solution of calculation tasks. Its many variants occupy a decisive position and, thanks to its great performance, proves itself wherever it is used.

KEYBOARD of electronic desktop calculator



1. Decimal point adjustment.
2. Delete key
3. Correction key
4. Decimal point key
5. Numeric Keypad
6. Sign key
7. Multiplication key
8. Addition Key
9. Result key
10. Subtraction
11. Division key
12. Exponentiation
13. Memory Addition
14. Memory subtraction
15. Memory recall without deletion
16. Memory recall with deletion

2. DESCRIPTION OF CONSTRUCTION AND EQUIPMENT

The electronic desktop calculator type 220 is a fully transistorized device. In addition to all the normal operations of elementary calculation, it performs extensive combination calculations and exponentiation tasks quickly and mathematically exact.

The machine is modular in construction, so that a secure maintenance is guaranteed.

The electronic desktop computer consists of the following modules:

Keyboard

The keyboard is arranged clearly and within reach. It is divided into 3 key groups:

Left key group: Numeric keypad

0-9	Digits
	Decimal point dial
Lö	Delete key
C	Correction key
	Decimal point key

Middle button group : Function keys

#	Enter a negative number
Xn	Exponentiation
X	Multiplication
:	Division
+	Addition
-	Subtraction
=	Result

Right button group: Memory function keys

*	Memory recall with deletion
∇	Memory recall without deletion
+	Memory addition
-	Memory subtraction

DISPLAY DEVICE

The input and output values are displayed clearly legible in the display device by means of digital display tubes.

DECIMAL POINT DEVICE

To the left of the keyboard is a thumbwheel for setting decimal numbers. Before starting an arithmetic operation it is required to set the decimal place position. The Decimal point is indicated by a red dot shown in the display.

COMPUTATION UNIT

The "computing unit" assembly comprises all the electronics of the machine, including the ferrite core memory and the control system of the machine display.

POWER ADAPTER

The power supply generates all the necessary voltages of the machine. Form and colour match the modern line.

Dimensions and weight make changing workstations effortless. An advantageous utilization of the workplace is ensured by shifting the weight to 3 feet.

3. COMMISSIONING

The computer is designed for connection to the following mains voltages:

110V +10% 50—60 Hz
-15%

127V +10% 50-60 Hz
-15%

220V +10% 50—60 Hz
—15%

242V +10% 50—60 Hz
—15%

The machine is delivered from the factory for connection to a 220V mains AC voltage, unless there is another delivery agreement. A change may only be carried out by a specialist.

The set mains voltage can be seen from the outside through the ventilation slots on a selector switch located on top of the power supply.

For commissioning, the computer must be connected to the mains using the protective contact cord provided after checking the settings. After operating the power switch on the bottom right side of the cover, the machine's operational readiness is indicated by a red indicator light in the display unit. Before starting the calculation, the delete (Lö) key and the clear (C) key must be pressed. The display tubes reset to the number “0”. The computer is now ready for operation.

Opening the calculator using special tools is only permitted for repair purposes by trained specialists.

4. CALCULATION OPERATIONS

4.1. Addition

Button

Additions are possible in the calculator and in the memories.
Press the (+) button to enter the addend values.
The total is displayed after pressing the (=) button.
The addends are entered into the calculator by (+)

In the memories I, II, III	(+)
Memory recall without deletion I, II, III	(▽)
Memory recall with deletion I, II, III	(*)

4.2. Subtraction

Subtractions are possible in the calculator and in the memories.
The minuend is entered by the (+) button.
Press the (-) button to subtract the entered values.
The total is displayed after pressing the (=) button.
The subtrahends are entered into the calculator by (-)

In the memories I, II, III	(—)
Memory recall without deletion I, II, III	(▽)
Memory recall with deletion I, II, III	(*)

4.3. Multiplication

The multiplicand is entered by the (X) key.
Pressing the (=) key is used to transfer the multiplier to the calculator, the multiplication is triggered and the product is displayed.
If a sum or a difference in the arithmetic unit has been formed before or after entering the multiplicand, this sum or difference becomes a multiplier when the (=) key is pressed.
Example : a X b = c
a(b + c) = d
(a — b) c = d

The displayed product can be processed further (see also Calculation example 7).

4.4. Division

The dividend is entered by pressing the (:) key. After entering the divisor, press the (=) button to start the display process

and the quotient is displayed. If a sum or a difference is formed before or after entering the dividend in the calculator, this sum or difference becomes the divisor when the (=) key is pressed, and with this the division is automatically executed.

Example : a : b = c
a :(b + c) = d
(a — b) : c = d
The calculated quotient, which is displayed, can be processed further (see also calculation example 12).

4.5. Exponentiation

The base is entered by the (X) key. Each further press of the (Xn) key increases the exponent by one. The power is automatically displayed (see also calculation example 8).

4.6. Memories

All input values, results and constant factors can be stored in an additive and subtractive way. Negative values are mathematically processed correctly.

Values stored in the memories can be queried as often as desired by pressing the (∇) key, whereby the value transferred in sequence is retained in the memory. It is possible to transfer values from one memory to another with the correct sign.
Example : (∇) - Memory I, then
(+) - Memory II

By pressing the (*) buttons (*I, *II, *III) the corresponding memory is called up and deleted at the same time.
The value in the calculator can be processed further. Pressing the (Delete Lö) key does not clear the memories.
Should the memory contents be checked during a calculation process. without the last displayed value, eg. If the result or operand is lost, proceed as follows:
The displayed value can be transferred to a calculation register by pressing the (+) key. Thereafter, the memory can be queried, so that the occupancy or content is known. By pressing the (=) - key the value in the calculation register is displayed again..

4.7. Decimal point facility

The number of decimal places is set before the beginning of the calculation by the knurled wheel to the left of the keyboard. When setting the decimal point, the highest decimal place must be used. The following decimal places are adjustable:

1-2-3-4-6-9-10-11-12—14

If the thumbwheel is set to "0", it is calculated without decimal places. The setting "Z" is irrelevant for the type 220.

After pressing the (,) - key (Decimal point key) appears at this point the numbers 0 and 1 on top of each other to indicate the entered Decimal place.

If a function key is pressed, the value automatically moves to the appropriate position.

```
Example :   71,5   X 22,123 = 1 581,795
Decimal point position  3
Enter       71,5   X    71,500
Enter       22,123 = 1 531,795

Example :   4,73 : 2,4 = 1,97
Decimal point position  2
Enter       4,73 : 4,73
Enter       2,4  = 1,97

Example :   720,1 : 11,23 = 64,122 9
Decimal point position  4
Enter       720,1  : 720,1000
Enter        11,23 =  64,1229
```

In the last example, the number of decimal places to set depends on the result, which is desired with 4 decimal places.
After the decimal place zeros are filled up automatically.
The decimal position must be maintained during the computation process, you may be added values in the memory or be returned from the memory.
The results (products and Quotient) are automatically rounded in the last place, IE. from paragraph 5 is rounded up.
The decimal position must be maintained during the computation process, you may have added values to the memory or be returned from the memories.

```
Example :   Decimal point position 6
            1,000000 : 6,000000 = 0,166667
            Decimal point position 3
            2,58 X 3,01 = 7,766 (7,7658 ≈ 7.766)
```

4.8. Constant factors

During multiplication, the exponentiation (Xn key) can be used for the calculation with a constant factor.

By pressing the (X) key, the multiplicand is adopted as a constant factor. After entering the variable multiplier, press the (Xn) key. The respective product is displayed (see also calculation example 6):

4.9. Correction

If you have not yet pressed any function keys, you can delete an entry by pressing the (C) key. If a function key is pressed after entering the digits, the correction is made by pressing the (Delete) key. The bill is to be repeated.

5. INPUT AND OUTPUT CAPACITITY

The capacity of the electronic desktop calculator "Soemtron 220" is an input and output of 15 digits.

Multiplication whole: numbers

The maximum positions of the multiplicand and the multiplier must not exceed 15 in total.

Example: 9 999 999 X 99 999 999 = 999 999 890 000 001

Multiplication of decimal places

When multiplying decimal numbers, the sum of the digits before the decimal place of the multiplier and the multiplicand may not be greater than the digits remaining before the decimal place in the display.

Example: 9,999,999 999 X 99 999,999 999 = 999,999 999,890,000

Division of whole numbers

The digits of the dividend and the divisor to be entered in the division can be a maximum of 15 digits, the quotient always being smaller.

Example : 999 999 999 999 999 : 999 999 999 999 999 = 1

Division of decimal places

When dividing numbers with decimal places, make sure that the quotient increases if the divisor is less than one.

Example : Decimal point position 9

```
456,123 578 000 : 0,051     =   8 943,599 568 627
456,123 578 000 : 0,005 1   =  39 435,995 686 275
456,123 578 000 : 0,000 51  = 894 359,956 862 745
456,123 578 00u : 0,000 051 = Overrun
```

If the capacity is exceeded, the display blanks and the keyboard is electrically locked. The lock is released by pressing the Lö (Delete) and (C) keys.

6. CALCULATION EXAMPLES

1. Addition

Example : 512 + 309 =821

Calculation example

Sequence of the calculation	Function key		Display
1. Decimal point position	0		
2. Enter	512	+	512
3. Enter	309	+	309
4.		=	521

2. Subtraction

Example : 461 - 207 = 254

Calculation example

Sequence of the calculation	Function key		Display
1. Decimal point position	0		
2. Enter	461	+	461
3. Enter	207	-	207
4.		=	254

Example : 397,98 - 612,17 = 214,19 –

Calculation example

Sequence of the calculation	Function key		Display
1. Decimal point position	2		
2. Enter	397,98	+	397,98
3. Enter	612,17	—	612,17
4.		=	214,19 —

3. Addition and subtraction in 3 stores with nett balance

Example :

I	II	III
467	533	650
890	123	—2400
1357 —	656 = 701 + (—1750) = 1049—	

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II, *III	
2. Decimal point position	0		
3. Enter	467	+I	467
4. Enter	890	+I	890
5. Recall		∇I	1357
6. Enter	533	+II	533
7. Enter	123	+II	123
8. Recall		*II	656
9.		−I	656
10. Recall		∇I	701
11. Enter	650	+III	650
12. Enter	2 400	III	2400
13. Recall		*III	1750 −
14.		+I	1750 -
15. Recall		*I	1049 −

4. Multiplication with different decimal points

Example : a) 1 234,56 X 17,5671 = 21 687,639 0
b) 5 678,123 X 0,000 = 11,356
c) 1,1 X 9 576,5432 = 10 364,1975

Calculation example

Sequence of the calculation		Function key	Display
a) 1. Decimal point position	4		
2. Enter	1 234,56	X	1 234,560 0
3. Enter	17,567 1	=	21 687,639 0
b) 1. Decimal point position	3		
2. Enter	5 678,123	X	5 678,123
3 Enter	0,1112	=	11,356
c) 1. Decimal point position	4		
2. Enter	1,1	X	1,100 0
3. Enter	9 876.543 2	=	10 364,197 5

5. Multiplication with different decimal points

Example : 623,3 X 1,22 X 0,031 = 23,573

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	3		
2. Enter	623,3	X	623,300
3. Enter	1,22	=	760,426
4.		X	760,426
5. Enter	0,031	=	23,573

6. Constant factor - average calculation (2 memories)

```
Example :  22 X 2,70            =   59,40
           22 X 2,55            =   56,10
                ----                ------
                5,55 : 2 = 2,63     115,50
```

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II	
2. Decimal point position	22,		22,00
4. Enter	2,7	+I	2,70
5.		Xn	59,40
6.		+II	59,40
7. Enter	2,55	+I	2,55
8.		Xn	56,10
9.		+II	56,10
10. Recall		*I	5,25
11.		:	5,25
12. Enter	2,	=	2,63
13. Recall		*II	115,50

7. Multiplication by a parenthesized expression

Example : 958 X (17,12 + 4,3 — 0,030) = 10 911,620

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	3		
2. Enter	958,	X	958,000
3. Enter	7,12	+	7,120
4. Enter	4,3	+	4,300
5. Enter	0,030	-	0,030
6.		=	10911,620

8. Exponentiation

Example : 13^5 = 371 293

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	0		
2. Enter	13	X	13
3.		Xn	169
4.		Xn	2 197
5.		Xn	28 561
6.		Xn	371 293

9. Division

Example : 225 : 5 = 45

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	0		
2. Enter	225	:	225
3. Enter	5	=	45

10. Division with constant dividend‰

Example : 22 33,44 : 22 = 101,52
22 33,44 : 23 = 97,11
22 33,44 : 24 = 93,06

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memory		*I	
2. Decimal point position	2		
3. Enter	2 233,44	+I	2233,44
4.		:	2233,44
5. Enter	22,	=	101,52
6. Recall		∇I	2233,44
7.		:	2233,44
8. Enter	23,	=	97,11
9. Recall		∇I	2233,44
10.		:	2233,44
11. Enter	24,	=	93,06

11. Division with constant divisor

Example : 1 266,55 : 123 = 10,297
5678,12 : 123 = 46,164

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memory		*I	
2. Decimal point position	3		
3. Enter	1 266,55	:	1 266,550
4. Enter	123,	+I	123,000
5.		=	10,297
6. Enter	5 678,12	:	5 673,120
7. Recall		∇I	123,000
8.		=	46,164

12. Division with a parenthetical expression

Example 750 : (47,623 + 710,21 — 304.1) = 1,653

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	3		
2. Enter	750,	:	750,000
3. Enter	47,623	+	47,623
4. Enter	710,21	+	710,210
5. Enter	304,1	—	304,100
6.		=	1,653

13. Percentage searched

Example : 86 work pieces = 100%
54 work pieces = ?

$$\frac{100 \times 54}{86} = 62{,}8\%$$

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	1		
2. Enter	5 400,	:	5 400,0
3. Enter	86,	=	62,8

14. Number sought

Example : 100% = 86 work pieces
62.8% = ?

$$\frac{86 \times 62.8}{100} = 54 \text{ work pieces}$$

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	1		
2. Enter	86,	X	86,0
3. Enter	62,8	=	5 400,8
4.		:	5 400,8
5. Enter	100,	=	54,0

15. Increased value

The daily standard of A is 54 workpieces, 68 workpieces are produced. By what percentage was the standard exceeded ?
Example : 54 work pieces = 100%
68 work pieces = ?

$$\frac{100 \times 68}{54} = 125{,}9\ \%$$

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	1		
2. Enter	6 800,	-	6 800,0
3. Enter	54,	=	125,9

16. Reduced value

B produces 120 work pieces per day, which corresponds to a standard compliance of 130%. What is the norm?

Example : 130% = 120 work pieces
100% = ?

$$\frac{120 \times 100}{130} = 92 \text{ work pieces}$$

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	0		
2. Enter	12 000	:	12 000
3. Enter	130	=	92

17. Reduced value (Normal operation)

```
Example :  16 m costs 39,00 M
           19 m costs ?
           39 X 19
           -------  = 43,31 M
             16
```

Calculation example

Sequence of the calculation		Function key	Display
1. Kommuslel1ung	2		
2. Enter	39,	X	39,00
3. Enter	19,	=	741,00
4.		:	741,00
5. Enter	16,	=	46,31

18. Interest calculation by days

```
Example :  M 1 695,00 3 3/8 % 45 days
Interest rate divisor from table or 360 : 3,375 = 106,667
           Shortened interest formula :
           Capital X days          1695 X 45
           --------------         -------------     = 7,151
           100 X Interest         100 X 106,667
```

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	3		
2. Enter	1 695,	X	1 695,000
3. Enter	45,	=	76 275,000
4.		:	76 275,000
5. Enter	100,	=	762,750
6.		:	762,750
7. Enter	106,667	=	7,151

19. Distribution task (3 memories)

A has been allocated a budget of 150 375.50 m. The amount is broken down and at the same time the percentage of the loan is calculated.

```
Example :  B  5 640,00 : 150 375,50 =  3,75 %
           C 10 123,50 : 150 375,50 = 15,73 %
           D  1 750,00 : 150 375,50 =  1,16 %
           E 65 865,00 : 150 375,50 = 43,50 %
           F 16 500,00 : 150 375,50 = 10,97 %
           G  9 860,40 : 150 375,50 =  6,56 %
           H 25 650,60 : 150 375,50 = 17,06 %
           I 14 936,00 : 150 375,50 =  9,97 %
           ---------------------------------
            150 375,50              100,00 %
```

Calculation example

Sequence of the calculation		Function key	Display
|. Clear the memories		*I, *II, *III	
2. Decimal point position	4		
3. Enter	5640,	+II	5 640,000 0
4.		:	5 640,000 0
5. Enter	150 375,5	+I	150 375,500 0
6.		=	0,037 5
7.		+III	0,037 5
8. Enter	10123,5	+II	10 123,500 0
9.		:	10 123,500 0
10. Recall		∇I	150 375,500 0
11.		=	0,067 3
12.		+II1	0,067 3
.		.	.
.		.	.
.		.	.
n. Recall		*II	150 375,500 0
n. Recall		*III	1,000 0

If you are reading percent of memory III, multiply the displayed values by 100.

20. Wage settlement with a consonant factor (2 storages)

In the post-calculation, the per-hundred-minute rates of each individual operation must be multiplied by the wage group factor become.

Example :

Wage group	Factor		Min./%		Wage
3	2,23		230		5,13
3	2,23		145		3,23
			---		----
	2,23	X	375	=	3,36
	=====		====		=====

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II	
2. Decimal point position	2		
3. Enter	2,23	X	2,23
4. Enter	2,3	+I	2,30
5.		Xn	5,13
6.		+II	5,13
7. Enter	1,45	+I	1,45
8.		Xn	3,23
9.		+II	3,23
10. Recall		*I	3,75
11.		Xn	8,36
12. Recall		*II	8,36

21. Conversion of English currency

When converting the English currency, shillings and pence must be converted into decimal of pounds.

1 sh = 1/20 = 0.05
1 d = 1/240 = 0.004 166 6 ... (0.0042)

Example : How many Marks are: £ 25.8.11
Exchange: £ 1 = 9.85 M

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memory		*I	
2. Decimal point position	4		
3. Enter	25,	+I	25,000 0
4. Enter	8,	X	8,000 0
5. Enter	0,05	=	0,400 0
6.		+I	0,400 0
7. Enter	11,	X	11,000 0
8. Enter	0,0042	=	0,046 2
9.		+I	0,040 2
10. Recall		*I	25,446 2
11.		X	25,446 2
12. Enter	9,85	=	250,645 1

250.65 M = £25.8.11

22. Insurance calculation (insurance) (premium calculation)

How much **‰** is the premium, if A has insured his house at 95 000,00 M, his furniture at 13 000,00 M and his carriage at 11 500,00 M?
The annual premium is 334.60 M.

Insurance: 95 000 + 13 000 + 11 500 = 119 500 M

$$\frac{334{,}60 \times 1000}{119\,500} = 2{,}8\ ‰$$

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memory		*I	
2. Decimal point position	1		
3. Enter	95 000,	+I	95000,0
4. Enter	13 000,	+I	13000,0
5. Enter	11 500,	+I	11500,0
6. Recall		∇I	119500,0
?. Enter	334,6	X	334,6
8. Enter	1 000,	=	334600,0
9.		:	334600,0
10. Recall		*I	119500,0
11.		=	2,8

23. Weight calculation

How heavy is an oak column of 0.30 m in diameter and 3 m in height?
Specific gravity of oak: 0.72

Formula: r2 X π X h X specific weight
0,19 X 0,19 x 3,14 X 3,00 X 0,72 = 244,845 kg

Calculation example

Sequence of the calculation		Function key	Display
1. Decimal point position	6		
2. Enter	0,38	:	0,380 000
3. Enter	2,	=	0,119 000
4.		X	0,190 000
5.		=	0,036 100
6.		X	0,036 100
7. Enter	3,14	=	0,113 354
8.		X	0,113 354
9. Enter	3,	=	0,340 062
10.		X	0,340 062
11. Enter	0,72	=	0,244 845

The result must then be multiplied by 1000, since it is in kg.

24. Subtraction of two quotients

$$\text{Example} \qquad \frac{(2,604)}{(1,315)} - \frac{(0,342)}{(1,910)} = 1,801$$

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memory		*I	
2. Decimal point position	3		
3. Enter	2,604	:	2,604
4. Enter	1,315	=	1,980
5.		+I	1.900
6. Enter	0,342	:	0,342
7. Enter	1,91	=	0,179
8.		—I	0,179
9. Recall		*I	1,801

$$\text{Example :} \quad \frac{(6 \times 5)}{(2)} - \frac{(3 \times 4)}{(3)} = 11$$

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memory		*I	
2. Decimal point position	0		
3. Enter	6	X	6
4. Enter	5	=	30
5.		:	30
6. Enter	2	=	15
7.		*I	15
8. Enter	3	X	3
9. Enter	4	=	12
10.		:	12
11. Enter	3	=	4
12.		-I	4
13. Recall		*I	11

25. Technical calculation - calculation of the cutting speed

The cutting speed is always given in m / min (grind m/sec).

Example :

v = Speed	141,3
n = speed (rpm, rev/sec)	300
d = diameter of the rotary part	150

$$v = \frac{d \times 3{,}14 \times n}{1000} \qquad n = \frac{1000 \times v}{d \times 3{,}14} \qquad d = \frac{1000 \times v}{3{,}14 \times n}$$

$$v = \frac{150 \times 3{,}14 \times 300}{1000} \qquad n = \frac{1000 \times 141{,}3}{150 \times 3{,}14} \qquad d = \frac{1000 \times 141{,}3}{3{,}14 \times 300}$$

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II	
2. Decimal point position	2		

Sequence of the calculation		Function key	Display
3. Enter	150,	X	150,00
4. Enter	3,14	*I	3,14
5.		=	471,00
6.		X	471,00
7. Enter	300,	=	141 300,00
8.		*II	141 300,00
9.		:	141 300,00
10. Enter	1000,	=	141,30
11. Recall		∇II	141 300,00
12.		:	141 300,00
13. Enter	150,	=	942,00
14.		:	942,00
15. Recall		∇I	3,14
16.		=	300,00
17.		X	300,00
18. Recall		∇I	3,14
19.		=	942,00
20.		+	942,00
21. Recall		*II	141 300,00
22.		:	141 300,00
23.		=	150,00

26. Repayment schedule

Example :

With an initial capital of 45000,00 M, an annual interest rate of 8.50% and a 4% repayment, the following semi-annual repayment based payment scheme.

Constant multiplier is the semi-annual interest rate of 4.25% and repayment of 1.50%.

Capital	Figures	Repayment	Annuity	Time
45 000,00	1 912,50	675,00	2 587,50	1. 1. 66-30. 6. 66
44 325,00	1 503,81	703,69	2 587,50	1. 7. 66—31. 12. 66
43 621,31	usw.			

During these amortization calculations only multiplications with the same folder are performed. The respective capital is multiplied by the factor 4.25 (semi-annual interest rate). The result is the interest, which is subtracted from the annuity. Your calculated repayment is subtracted from the capital so that the residual capital results. From this the new interest amount is again calculated by multiplication by the constant factor (4.25).

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I *II, *III	
2. Decimal point position 2			
3. Enter	45 000,	+II	45 000,00
4.		X	45 000,00
5. Enter	4,25	+I	4,25
6.		=	191 250,00
7.		:	191 250,00
8. Enter	100,	=	1 912,50
9.		-	1 912,50
10. Enter	2 587,5	+III	2 587,50
11.		+	2 587,50
12.		=	675,00
13.		—II	675,00
14. Recall		∇II	44 325,00
15.		X	44 325,00
16. Recall		∇I	4,25
17.		—	188 381,25
18.		:	188 381,25
19. Enter	100,	:	1 883,81
20.		—	1 883,81
21. Recall		*I	2 587,50
22.		+	2 587,50
23.		=	703,69
24.		—II	703,69
25. Recall		∇II	43 621,31
usw.			

27. Invoice control with 3 memories

Invoice Page	Invoice Number	Execution Number	Execution Sheet	Expiration date	Invoice total
				30. 8. 1965	577 209,90

Discount for cash until expiry date: Factor	Good value	Date of issue	Nett amount
5%	521 560,06	12/8/65	551 131,90

Article Number	E	Amount	Article - Designation	Single price	Disc.	Amount
12 345	3	52,21		3 452,00	6%	169 415,10
23 456	3	3,25		32 419,00	4%	101 147,28
34 567	3	112,00		2 359,00	5%	250 997,60

Signing		Tare	Price	Designation	Value	521 560,06
				Packing material	Packaging	1 275,00

Aggregate value		522 835,06
Sales tax I	8%	41 826,80
Sales tax II	30%	41 826,80 / 12 548,04
Invoice sum		577 209,90

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II	
2. Decimal point position	2		
3. Enter	52,21	X	52,21
4. Enter	3452,	=	180 228,92
5.		+I	180 228,92

Sequence of the calculation		Function key	Display
6.		X	180 228,92
7. Enter	0.06	=	10 813,74
8.		—I	10 813,74
9. Recall		*I	169 415,18
10.		+II	169 415,18
11. Enter	3,25	X	3,25
12. Enter	32 419,	=	105 361,75
13.		+I	105 361,75
14.		X	105 361,75
15. Enter	0.04	=	4 214,47
16.		—I	4 214,47
17. Recall		*I	101 147,28
18.		+II	101 147,28
19. Enter	112,	X	112,00
20. Enter	2 359	=	264 200,00
21.		+I	264 208,00
22.		X	264 208,00
23. Enter	0,05	=	13 210,40
24.		—I	13 210,40
25. Recall		*I	250 997,60
26.		+II	250 997,50
27. Recall		∇I	521 560,06
28. Enter	1 275,	+II	1 275,00
29. Recall		∇II	522 835,06
30.		X	522 835,06
31. Enter	0.08	=	41 826,60
32.		+II	41 820,80
33.		X	41 526,80
34. Enter	0,30	=	12 548,04
35.		+II	12 540,04
36. Recall		∇II	577 209,90
37. Enter	521 560,06	X	521 560,06
38. Enter 0,05		=	26 075,00
39.		-II	26 078,00
40. Recall		*II	551 131,90

28. Series Development (Minus Division)

The minus division is still used for the series expansion of the cyclometric functions of π / 4 Leibniz (1676)

$\pi/4 = 1 - 1/3 + 1/5 - 1/7 + 1/9 - 1/11 + - \ldots = 0.744012$

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II	
2. Decimal point position	6		
3. Enter	1,	+II	1,000 000
4.		+II	1,000 000
5.		:	1,000 000
6. Enter	3,	=	0,333 333
7.		−I	
8. Recall		∇II	1,000 000
9.		:	1,000 000
10. Enter	5,	=	0,200 000
11.		+I	0,200 000
12. Recall		∇II	1,000 000
13.		:I	1,000 000
14. Enter	7,	=	0,142 857
15.		−I	0,142 857
16. Recall		∇II	1,000 000
17.		:	1,000 000
18. Enter	9,	=	0,111 111
19.		+I	0,111 111
20. Recall		∇II	1,000 000
21.		:	1,000 000
22. Enter	11,	=	0,090 909
23.		−I	0,090 909
24. Recall		*I	0,744 012

29. Labour statistics

In one establishment, the following figures are available:

Wage group	Wages	Workforce	Wages	Workforce
	(L0)	(Z0)	(L1)	(Z1)
1	300,00	200	330,00	200
2	330,00	300	380,00	400
3	370,00	400	440,00	500
	-	900	-	1 100

For statistical purposes, the indicators should

1. Development of the number of workers
2. Development of the gross payroll
3. Development of the average wage

be calculated

$$\text{Zu 1.:}\quad \frac{\sum Z1}{\sum Z2} = \frac{1\,100}{900} = 122\%$$

$$\text{Zu 2 :}\quad \frac{\sum L1 \times Z1}{\sum L0 \times z)} = \frac{(330 \times 200) + (380 \times 400) + (440 \times 500)}{(300 \times 200) + (330 \times 300) + (370 \times 400)}$$

$$= \frac{438\,000}{307\,000} = 143\%$$

$$\frac{\frac{\sum L1 \times Z1}{\sum Z1}}{\frac{\sum L0 \times Z0}{\sum Z0}} = \frac{\frac{438\,000}{1\,100}}{\frac{307\,000}{900}} = 117\%$$

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memoriesy		*I, *II	
2. Decimal point position	21 100,00		
4. Enter	900,	=	1,22
5. Enter	330,	X	330,00
6. Enter	200,	=	66 000,00
7.		+I	66 000,00
8. Enter	380,	X	380,00
9. Enter	400,	=	152 000,00
10.		+I	152 000,00
11. Enter	440,	X	440,00
12. Enter	500,	=	220 000,00
13.		+I	220 000,00
14. Enter	300,	X	300,00
15. Enter	200,	=	60 000,00
16.		+II	60 000,00
17. Enter	330,	X	330,00
18. Enter	300,	=	99 000,00
19.		+II	99 000,00
20. Enter	370,	X	370,00
21. Enter	400,	=	148 000,00
22.		+II	148 000,00
23. Recall		∇I	438 000,00
24.		:	438 000,00
25. Recall		∇II	307 000,00
26.		=	1,43
27. Recall		*I	438 000,00
28.		:	438 000,00
29. Enter	1 100,	=	398,18

Sequence of the calculation		Function key	Display
30.		+I	
31. Recall		*II	307 000,00
32.		:	307 000,00
33. Enter	900.	=	341,11
34.		+II	341,11
35. Recall		*I	390,18
36.		:	398,18
37. Recall		*II	341,11
33.		=	1,17

The calculated numbers have to be multiplied by 100, since they are percentages.

30. Square root calculation nor the iteration formula

$$\text{Formula:} \qquad Yn + I = \frac{1}{2}\left(\frac{x}{Yn} + Yn\right)$$

In the root calculation with the aid of the iteration formula, it is important to provide an initial solution by estimation so that as few approximation steps as possible are required in order to arrive at the result. In most cases, the result is already obtained with the approximate approximation.

To increase the accuracy of the result. It is necessary to count as many decimals as possible. Therefore, the Decimal point position "6" has been selected in the following examples.

Example : $\sqrt{630,01}$

The Radikand is divided from the left to the left in groups of two digits. In this example, there are two groups.

$$\sqrt{6|30|,01}$$

The number of groups predetermines the number of roots
the Decimal point.

From the extreme left group (even if the outermost group consists of only one digit, as in this example, it is considered a group) the worm! estimated.

The root of 6 is about 2.3. Since there are two groups before the Decimal point , the root value is 23. Now the calculation can be started after the iteration formula.

```
1 (630,01     )
- (------ + 23)              = 25,195 870       1st Approximation
2 (  23       )

1 (  630,01               )
- (---------- + 25,195 870)  = 25,100 183       2nd Approximation
2 (25,195 870             )

1 (  630,01               )
- (---------- + 25,100 183)  = 25,100 000       3rd Approximation
2 (25,100 183             )

Sample: 25,100 000 2 = 630,01
```

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II	
2. Decimal point position	6+II		630,010 000
4.		:	630,010 000
5. Enter	23,	+II	23,000 000
6.		=	27,391 739
7.		+II	27,391 739
8. Recall		*II	50,391 739
9.		:	50,391 739
10. Enter	2,	=	25,195 870
11.		+II	25,195 370
12. Recall		∇I	630,010 000
13.		:	630,010 000
14. Recall		∇II	25,195 870
15.		=	25,004 495
16.		+II	25,004 495
17. Recall		*II	50,200 365
18.		:	50,200 365
19. Enter	2,	=	25,100 103
20.		+II	25,100 153
21. Recall		∇I	630,010 000
22.		:	630,010 000
23. Recall		∇II	25,100 183
24.		=	25,099 817
25.		+II	25,099 817
26. Recall		*II	50,200 000
27.		:	50,200 000
28. Enter	2	=	25,100 000
29. Sample		X	25,100 000
30.		Xn	30,010 000

31. Cubic root calculation without the iteration formula

$$\text{Formula: } Yn + 1 = Yn + \frac{1}{3}\left(\frac{x}{y} - Yn\right)$$

As with the 0uadrat root, it is necessary to have a first Initial approximation is estimated. For this purpose, the Radicandin front of the comma from left to the left in groups of three digits ...

The number of groups again gives you the number of digits before the Decimal point.

Again, it should be noted that the extreme left group only one or two digits can exist, but still be evaluated as a group.

Example : $\sqrt[3]{2\ 847{,}39}$ 2 Triplets and therefore 2 Ask before the Decimal point

Example : $\sqrt[3]{279{,}489}$

Here is a group of three, so that the number of digits before the decimal point is 1 digit.

The cube root of 279 is about 6.5.

Now you can start with the calculation according to the iteration formula.

$$6.5 + \frac{1}{3}\left(\frac{279{,}43}{6{,}5\ 2} - 6.5\right) = 6\ 538\ 304 \quad \text{1st Approximation}$$

$$6{,}538\ 304 + \frac{1}{3}\left(\frac{279{,}48}{6{,}538\ 080\ 2} - 6{,}538\ 3042\right) = 6{,}538\ 080 \quad \text{2nd Approximation}$$

Sample: 6.538 080 3 = 279.48
======

Calculation example

Sequence of the calculation		Function key	Display
1. Clear the memories		*I, *II	
2. Decimal point position	6		
3. Enter	279,45	+II	979,400 000
4. Enter	6,5	+I	6,500 000
5.		X	6,500 000
6.		Xn	42,250 000
7.		+	42,250 000
8. Recall		∇II	279,480 000

Sequence of the calculation		Function key	Display
9.		:	279,430 000
10.		=	6,614 911
11.		+	6,614 911
12.		∇I	6,500 000
13.		—	6,500 000
14.		=	0,114 911
15.		:	0,114 911
16. Enter	3,		0,030 104
17.		+I	0,038 304
18. Recall		∇I	6,538 304
19.		X	6,538 304
20.		Xn	42,749 419
21.		+	42,749 419
22. Recall		∇II	279,480 000
23.		:	279,480 000
24.		=	6,537 633
25.		+	6,537 633
26. Recall		∇I	6,538 304
27.		—	6,538 304
28.		=	0,000 671 -
29.		:	0,000 671 -
30. Enter	3,	=	0,000 224 -
31.		+I	0,000 224 -
32. Recall		∇I	6,538 080
33. Sample		X	6,538 030
34.		Xn	42,746 490
35.		Xn	279,479 971

Technical Datasheet ETR Soemtron 220

The ETR "Soemtron 220" is a fully transistorized four-function calculator with ferrite core memory, input keyboard and digitizer tubes for the value display.

1. Size :	Width: 380 mm Length: 464 mm Height: 194 mm		
2. Mass :	15 kg		
3. Operating voltage :	220 V +10% −15%) 50Hz 110 V +10% −15%) 50Hz		
4. Input power :	50 VA		
5. Clock speed :	25 kHz		
6. Capacity :	Input Display Calculation register Memory	)) 15 digits) plus) sign	
7. Computing time :	Addition Subtraction	) 5 ms)	
	Multiplication Division	) average 0,5 s)	
8. Number of calculation and storage registers :	3 Calculation register 1-3 storage memories		
9. Type of entry :	Number keys		
10. Type of display :	Numeric display tubes		
11. Function facilities :	Addition Subtraction Multiplication Division		

	Exponentiation Memory function with recall and selective deletion
	Constant factor
	Automatic Decimal point (fixed point)
	Signed calculation
	Balance
	Rounding up the last digit
	Control in case of capacity overrun
12. Operating conditions:	Temperature range of +15°C ... +35°C maximum relative humidity 80%

Safety instructions for the operator

There is no danger to the operator of the computer due to its flawless cladding in terms of occupational safety.

Any repairs that become necessary should only be carried out by specially qualified technicians.

When dealing with electrical devices, please refer to the regulations of the respective country.

In the event of extremely unfavorable operational characteristics, the operator must develop operational work and fire protection instructions in accordance with the usual national legal regulations.

Occupational safety instructions in the event of a malfunction

The machine must be switched off when cleaning.

In the event of a malfunction, longer work interruptions or work closure, the machine must be disconnected from the mains by removing the plug.

Hersteller:
VEB Büromaschinenwerk Sömmerda
Stammbetrieb des VEB Kombinat ZENTRONIK
DDR – 523 Sömmerda, Weißenseer Straße 52

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