



## MM5762 financial calculator general description

The single-chip MM5762 Business and Financial Calculator was developed using a metal-gate, P-channel enhancement and depletion mode MOS/LSI technology with low end-product cost as a primary objective. A complete calculator as shown in *Figure 1* requires only the MM5762, a keyboard, DS8864 digit driver, NSA1298 LED display, 9V battery and appropriate hardware.

Keyboard decoding and key debounce circuitry, all clock and timing generation and 7-segment output display encoding are included on-chip and require no external components. Segments can usually be driven directly from the MM5762, as it typically sources about 8.5 mA of peak current. [Note: The typical duty cycle of each digit is 0.104; average LED segment current is therefore approximately 0.104 (8.5 mA), or 0.9 mA average. Correspondingly, the worse-case average segment current is 0.104 (5.0 mA), or 0.52 mA.] The ninth digit (left-most) is used for the negative sign, or the decimal point of a number less than unity.

An internal power-on clear circuit is included that clears all registers, including the memory, when  $V_{DD}$  and  $V_{SS}$  are initially applied to the chip.

Trailing zero suppression allows convenient reading of the left justified display, and conserves power. The DS8864 digit driver is capable of sensing a low battery voltage and providing a signal during Digit 9 time that can be used to turn on one of the segments as an indicator. Typical current drain of a complete calculator displaying five "5's" is 30 mA. Automatic display cutoff is included. If no key closure occurs for approximately 35 seconds, all numbers are blanked and all decimal points are displayed.

The Ready output signal is used to indicate calculator status. It is useful in providing synchronization information for testing or applications where the MM5762 is used with other logic or integrated circuits; e.g., with the MM5765 Programmer (*Figure 3*).

Thirty-two keys are arranged in a four-by-nine matrix as shown in *Figure 1*. There are the standard four function keys (+, -,  $\div$ , x), Change Sign, Exchange, three accumulating memory control keys plus ten unique business or financially oriented computation keys: three keys for entering interest rate per period, number of periods and amount, three keys for computing present and future values, sinking funds, saving and loan payments and other time/money factors, two keys for computing per cent and delta per cent, a sum-of-digits key and a power key. There is an automatic constant feature.

The user has access to six registers designated X, Y, A, I, N and M. The X-register is used for keyboard entry and display. The Y and A-registers are used in multiply/divide and add/subtract calculations, respectively. Interest values are held in the I-register and the N-register stores

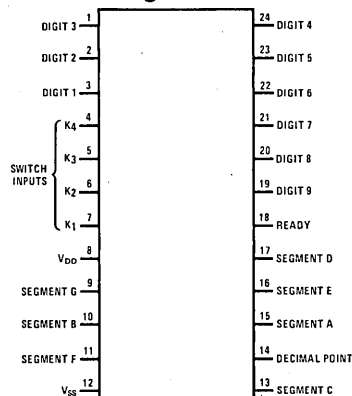
the number of time periods in financial calculations. M is an accumulating storage memory and is completely independent of the others.

Data is entered into the calculator in floating point business notation. All entries and results are displayed left justified with insignificant zeros to the right of the decimal point suppressed. All intermediate results of a chain calculation are floating point. Terminating keys (such as equal, per cent, etc.) round the displayed result to two decimal positions.

### features

- Complete business and financial capability
  - Arithmetic functions: +, -, x,  $\div$
  - Power function:  $Y^X$
  - Percent: both live percent *and* delta percent keys
  - Sum-of-digits capability for computing depreciation or "Rule of 78's" loan costs
  - Financial functions:
    - ▲ "n" key, enters number of periods
    - ▲ "i" key, enters interest rate per period
    - ▲ "AMT" key, enters given amount
    - ▲ "VAL" key, computes PV or FV
    - ▲ "SAV" key, computes deposit or sinking fund amounts
    - ▲ "LOAN" key, computes payment or loan amounts
- Accumulating memory
- Automatic constant
- Convenient business (adding machine) entry notation
- Eight full digits
- Power-on clear
- Automatic display cutoff
- Low system cost

### connection diagram (DIP Top View)



Order Number MM5762N  
See Package 22

**absolute maximum ratings**

Voltage at Any Pin Relative to $V_{SS}$ . (All other pins connected to $V_{SS}$ .)	$V_{SS} + 0.3V$ to $V_{SS} - 12V$
Ambient Operating Temperature	$0^{\circ}C$ to $+70^{\circ}C$
Ambient Storage Temperature	$-55^{\circ}C$ to $+150^{\circ}C$
Lead Temperature (Soldering, 10 seconds)	$300^{\circ}C$

**operating voltage range**

$$6.5V \leq V_{SS} - V_{DD} \leq 9.5V$$

$V_{SS}$  is always defined as the most positive supply voltage.

**dc electrical characteristics**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Current ( $I_{DD}$ )	$V_{DD} = V_{SS} - 9.5V$ , $T_A = 25^{\circ}C$		8.0	16.0	mA
Keyboard Scan Input Levels (K1, K2, K3 and K4)					
Logical High Level	$V_{SS} - 6.5V \leq V_{DD} \leq V_{SS} - 9.5V$	$V_{SS} - 2.5$			V
Logical Low Level	$V_{DD} = V_{SS} - 6.5V$ $V_{DD} = V_{SS} - 9.5V$			$V_{SS} - 5.0$ $V_{SS} - 6.0$	V
Digit Output Levels					
Logical High Level ( $V_{OH}$ )	$R_{LOAD} = 3.2 k\Omega$ to $V_{DD}$ $V_{SS} - 6.5V \leq V_{DD} \leq V_{SS} - 9.5V$	$V_{SS} - 1.5$			V
Logical Low Level ( $V_{OL}$ )	$V_{DD} = V_{SS} - 6.5V$ $V_{DD} = V_{SS} - 9.5V$			$V_{SS} - 6.0$ $V_{SS} - 7.0$	V
Segment Output Current (Sa through Sg and Decimal Point)	$T_A = 25^{\circ}C$ $V_{OUT} = V_{SS} - 3.6V$ , $V_{DD} = V_{SS} - 6.5V$ $V_{OUT} = V_{SS} - 5V$ , $V_{DD} = V_{SS} - 8V$ $V_{OUT} = V_{SS} - 6.5V$ , $V_{DD} = V_{SS} - 9.5V$	-5.0	-8.5 -10.0	-15.0	mA mA mA
Ready Output Levels					
Logical High Level ( $V_{OH}$ )	$I_{OUT} = -0.4$ mA	$V_{SS} - 1.0$			V
Logical Low Level ( $V_{OL}$ )	$I_{OUT} = 10\mu A$			$V_{DD} + 1.0$	V

**ac electrical characteristics**

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Word Time (Figure 2)		0.32	0.75	2.0	ms
Digit Time (Figure 2)		36	83	220	$\mu s$
Segment Blanking Time (Figure 2)		2	4.5	14	$\mu s$
Digit Output Transition Times ( $t_{RISE}$ and $t_{FALL}$ )	$C_{LOAD} = 100$ pF, $R_{LOAD} = 9.6 k\Omega$		2		$\mu s$
Keyboard Inputs High to Low Transition Time After Key Release	$C_{LOAD} = 100$ pF		4		$\mu s$
Ready Output Propagation Time (Figure 4)					
Low to High Level ( $t_{PDH}$ )	$C_{LOAD} = 100$ pF	10		50	$\mu s$
High to Low Level ( $t_{PDL}$ )	$C_{LOAD} = 100$ pF			1	ms
Key Input Time-out (Figure 5)					
Key Entry		2.8	7.0	18	ms
Key Release		5.1	12	32	ms
Display Cutoff Time (The time after the last valid key closure that all numbers will be blanked and all decimal points displayed.)		15	35	92	sec

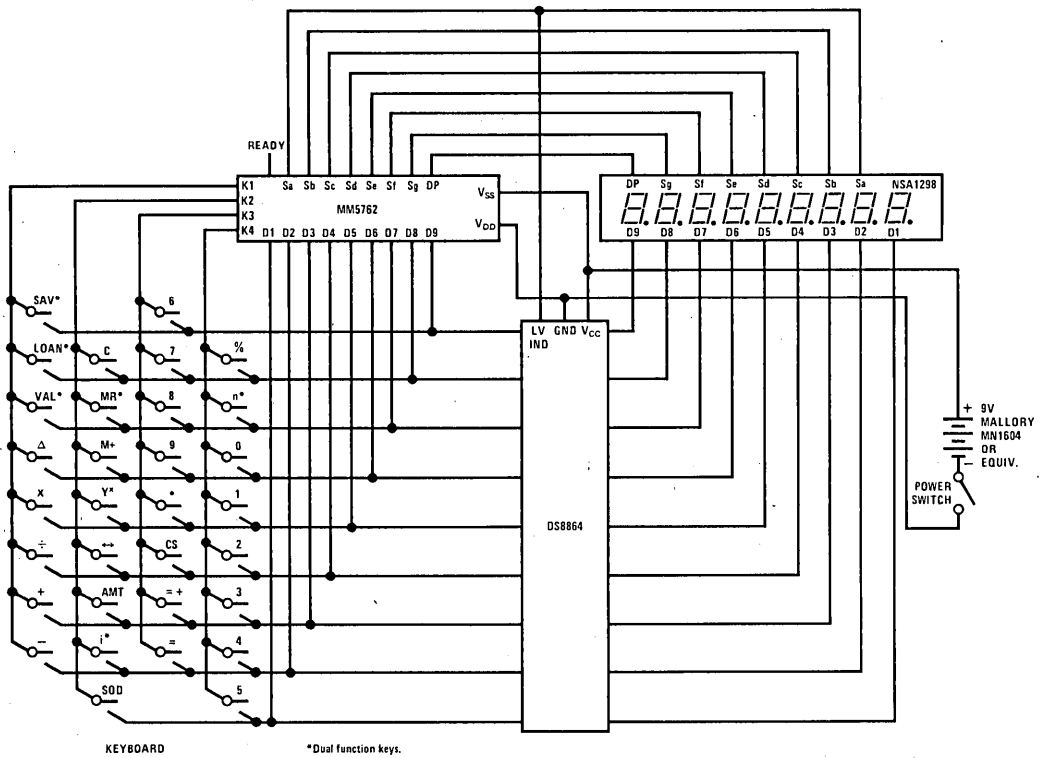


FIGURE 1. Complete Calculator Schematic

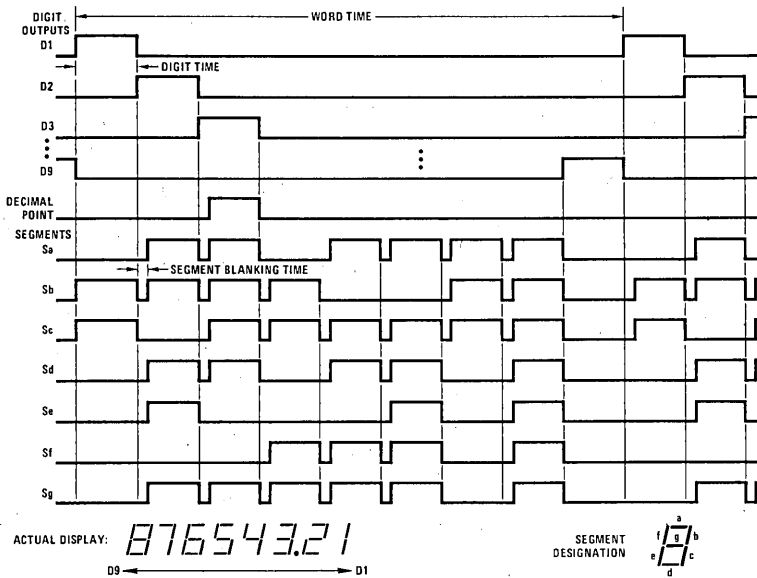


FIGURE 2. Display Timing Diagram

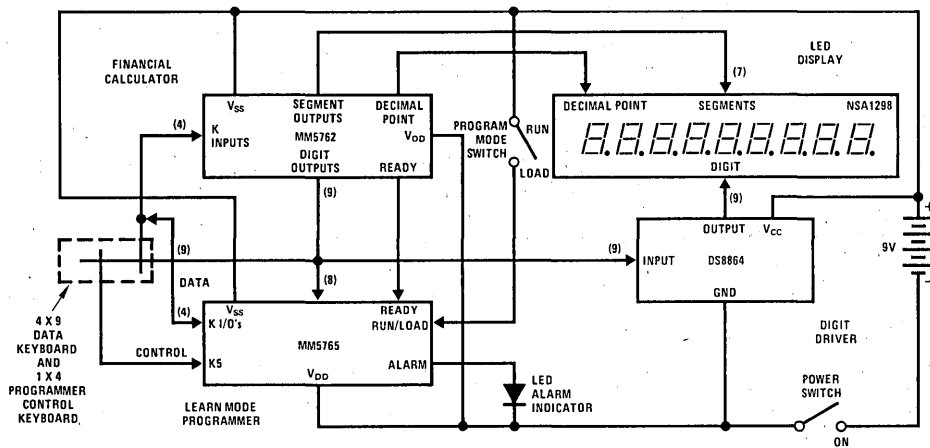


FIGURE 3. Low Cost Hand Held Programmable Financial Computer using the MM5762 Calculator and MM5765 Programmer

### KEYBOARD BOUNCE AND NOISE REJECTION

The MM5762 is designed to interface with most low cost keyboards, which are often the least desirable from a false or multiple entry standpoint.

A key closure is sensed by the calculator chip when one of the key inputs, K1, K2, K3 or K4 are forced more positive than the Logical High Level specified in the electrical specifications. An internal counter is started as a result of the closure. The key operation begins after nine word times if the key input is still at a Logical High Level. As long as the key is held down (and the key input remains high) no further entry is allowed. When the key input changes to a Logical Low Level, the internal counter starts a sixteen word time-out for key release. During both entry and release time-outs the key inputs are sampled approximately every other word time for valid levels. If they are found invalid, the counter is reset and the calculator assumes the last valid key input state.

One of the popular types of low-cost keyboards available, the elastomeric conductor type, has a key pressure versus contact resistance characteristics that can generate continuous noise during "teasing" or low pressure key depressions. The MM5762 defines a series contact resistance up to 50 k $\Omega$  as a valid key closure, assuring a reliable interface for that type of keyboard.

### AUTOMATIC DISPLAY CUTOFF

If no key is depressed for approximately thirty-five seconds, an internal automatic display cutoff circuit will blank all segments and display nine decimal points. Any key depression will restore the display; to restore the display without modifying the status of the calculator, use two Change Sign key depressions.

### READY SIGNAL OPERATION

The Ready signal indicates calculator status. When the calculator is in an "idle" state the output is at a Logical High Level (near  $V_{SS}$ ). When a key is closed, the internal key entry timer is started. Ready remains high until the time-out is completed and the key entry is accepted as valid, then goes low as indicated in *Figures 4 and 5*. It remains at a Logical Low Level until the function initiated by the key is completed and the key is released. The low to high transition indicates the calculator has returned to an idle state and a new key can be entered.

### ERROR INDICATION

In the event of an operating error, the MM5762 will display all zeros and all decimal points. The error indication occurs if division by zero is attempted or either a result or intermediate value exceeds 99999999.

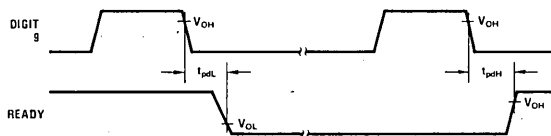


FIGURE 4. Ready Timing

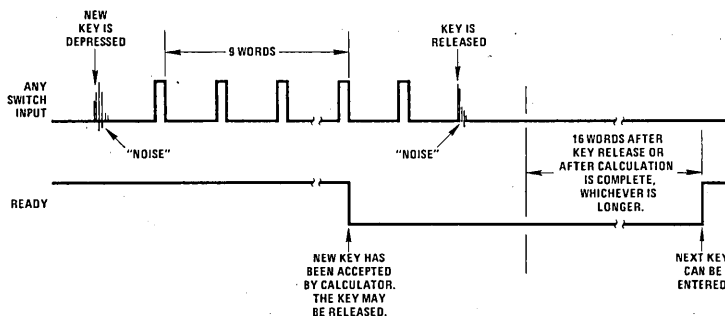


FIGURE 5. Functional Description of Ready Signal and Key Entry

The indication is cleared by depressing any key.

If an error results from a "+" or "-" key, the X-register is cleared and the last entry is saved in the A-register; all other registers are not effected. An error condition during "x" or "÷" operations clears X without changing any of the other registers.

Overflow as a result of the "Y<sup>x</sup>," "VAL," "SAV" or "LOAN" keys clears the X-register and destroys the values in N, I and A. Y is not changed.

An attempt to raise a negative number to a power will cause the error indication to appear, the X-register will be cleared and the exponent will be stored in Y. The other registers are not changed.

Overflow as a result of "M+" destroys the value stored in M, clears X and displays the error indication. Calculations are immediately stopped and other registers are not cleared.

#### AUTOMATIC CONSTANT

The MM5762 retains as a constant the first factor of a multiplication calculation or the second factor of a division calculation, when that calculation is terminated by an "=" key, "%" key or "= +" key. Subsequent calculations using the stored constant are made by entering a number and operating upon it with the

appropriate terminator ("=", "%", or "= +" key). The Y-register is used to store the constant in the constant mode of operation.

The calculator automatically changes to the chain mode when an "x" or "÷" key occurs in the calculation. In the chain mode, the result of each "x" or "÷" key is stored in both X and Y-registers. A new entry replaces X without altering Y. At the completion of a chain calculation, the Y-register will contain the value used as first factor of the last multiply, or the latest entry if the last operation was a divide.

Table I summarizes the four modes.

#### KEY OPERATIONS

(Note: Register X is always displayed.)

##### Clear Key, "C"

Following a number entry or a "MR" key, it clears the X-register only (clear entry). Following any other key it clears registers X, Y and A.

##### Number Entries

The first entry clears the X-register and enters the number into the LSD of X. Second through eighth entries (excluding a decimal point) are entered one

digit to the right of the last number. The ninth, and subsequent entries are ignored. First entry after a "+," "-", or "M+" following a "+" or "-" key causes the number in the X-register to be transferred to the A-register before clearing and placing the new entry in X.

#### Decimal Point, "."

As the first depression of a number entry, it clears the X-register and places a point in the leftmost digit. If the previous key was a number, it enters a decimal point to the right of the last number entered. Following a "+," "-", or those keys preceding a "M+" key, the X-register is transferred to A, cleared and a decimal point entered in the leftmost digit. The last decimal point depression in a single number entry is accepted as the valid point.

#### Change Sign Key, "CS"

Changes sign of register X.

#### Addition Key, "+"

If the previous key was not a "+" or "-" key, the number in the A-register is added to the X-register, X is transferred to A, and the sum is stored in X. When the last key was a "+" or "-" key, the number in A is added to the number in X without destroying the value of A. The sum is stored in X.

#### Subtraction Key, "-"

If the previous key was not a "+" or "-" key, the number in the X-register is subtracted from the number in the A-register, X is transferred to A, and the difference is stored in X. When the last key was a "+" or "-" key, the number in A is subtracted from X without destroying the value of A. The result is stored in X.

#### Multiplication Key, "x"

If there has not been a "x" or "÷" key since the last terminator key ("=", "= +", or "%"), the value of the X-register is copied into the Y-register and the calculator is set to the chain multiply mode. In a chain calculation in which there has been a "x" key since the last terminator or "÷" key, X is multiplied by Y and the resulting product is stored in both X and Y; if a "÷" key has occurred since the last terminator or "x" key, depression of "x" will divide the Y-register by the X-register, with the quotient stored in both X and Y.

#### Division Key, "÷"

If there has not been an "x" or "÷" key since the last terminator key ("=", "= +", or "%"), the value of the X-register is copied into the Y-register and the calculator is set to the chain divide mode. In a chain calculation if an "x" key has occurred since the last terminator or "÷" key, X is multiplied by Y and the product is stored in both X and Y; if a "÷" key has occurred since the last terminator or "x" key, depression of "÷" will divide the Y-register by the X-register, with the quotient stored in both X and Y.

TABLE 1. Mode Summary

MODE	KEYS THAT SET MODE	DESCRIPTION (See Calculation Examples)
CONSTANT MULTIPLY	CLEAR = % Δ Y <sup>x</sup> SOD VAL SAV LOAN	Depression of an "=", "= +", or "%" key will multiply the X-register by the Y-register and replace X with the product. Y remains unchanged.
CHAIN MULTIPLY	x, Following a terminator or "÷" or "x" operation	Depression of an "=", "= +", or "%" key will multiply the X-register by the Y-register and place the product in X. Y remains unchanged.
CONSTANT DIVIDE	= } = + } With calculator % } previously in chain divide mode.	Depression of an "=", "= +", or "%" key will divide the X-register by the Y-register and replace X with the quotient. Y is unchanged.
CHAIN DIVIDE	÷, Following a terminator or "÷" or "x" operation	Depression of an "=", "= +", or "%" key will divide the Y-register by the X-register, transfer X to Y, and place the quotient in X.

**Equal Key, "="**

In the chain multiply mode, the value in the X-register is multiplied by the Y-register with the product stored in X. Register Y remains unchanged. In the chain divide mode, depression of "=" will divide Y by X, transfer X to Y, and place the quotient in X. If the calculator is in constant multiply, "=" will multiply X by Y, place the product in X and retain Y. For constant divide, the X-register is divided by Y, the quotient is stored in X; Y is unchanged.

The "=" key always rounds the answer stored in X to two places to the right of the decimal point, and clears register A.

**Percent Key, "%"**

This key acts exactly like the "=" key except the value of X is divided by 100 and copied into register A before performing the required operation. Register A is not cleared. The result stored in the X-register is rounded to two decimal positions.

**Automatic Accumulation Key, "= +"**

It acts just like the "=" key in all modes. After the result is stored in X, the value of X is added to the number in the M-register. The result stored in X and accumulated into M is rounded to two decimal places. Register A is cleared.

**Memory Plus Key, "M+"**

The number in the X-register is accumulated into the M-register. Registers X and A are not changed, so the repeat addition or subtraction conditions that existed before accumulation to memory are still valid.

**Memory Recall/Memory Clear Key, "MR"**

Following any key except "MR," the value of the M-register is copied into the X-register. If the preceding key was "+," "−," or "M+" following "+" or "−," the number in the X-register is transferred to the A-register before M is recalled. Following another "MR" key, the M-register is transferred to X, then cleared.

**Delta Percent Key, "Δ"**

The value of X is subtracted from the Y-register, the difference is divided by the value of X and placed in X. The new value of X is multiplied by 100 and rounded to two digit places. Y retains the difference between the original values of X and Y; register A is unchanged. Calculator mode is set to constant multiply.

**Power Key, "Y<sup>x</sup>"**

When the calculator is in either the chain or constant multiply modes, depression of "Y<sup>x</sup>" raises the number in the Y-register to the power of the X-register and replaces X with the result. (Thus, to raise two to the fifth power, use the sequence: "2," "x," "5," "Y<sup>x</sup>.") If the calculator is in the constant or chain divide modes, the value of Y is raised to the inverse of X power; i.e., the key sequence "5," "÷," "2," "Y<sup>x</sup>," results in the calculation of 5 raised to the 1/2 power. The original value of X is retained in Y and register A is cleared. The calculator is set to the constant multiply mode. Results computed with the "Y<sup>x</sup>" key are rounded to five places.

**Exchange Key, "↔"**

The X and Y-registers are exchanged. No other registers are effected.

**Interest Entry Key, "i"**

If the sign of the number in the X-register is positive, "i" divides the number by 100 and stores the quotient in X and the I-register. If the value of X is initially negative, "i" changes the sign, divides by 1200 and stores the quotient in both X and I; i.e., the interest will be compounded monthly.

**Number of Periods Entry Key, "n"**

If the sign of the number in the X-register is positive, X is copied into register N. A negative value of X is changed to a positive number, multiplied by 12 and the product stored in N and X.

**Amount Entry Key, "AMT"**

The value of the X-register is copied into the Y-register. No other registers are effected.

**Value Key, "VAL"**

If the number in the X-register is positive, the "VAL" key will compute *future value*: the sum of money available at the end of n periods from the present date (N-register) that is equivalent to the present amount (Y-register) with interest i (I-register). When the sign of the number in X is negative, the "VAL" key will compute *present value*: the sum of money necessary today to accumulate the future amount contained in Y over the n periods of N at the interest rate per interest period that is stored in I. Thus, to compute *future value*, simply enter i, n and amount in any order and press "VAL." For *present value*, precede "VAL" with "CS," setting a negative sign in X. Registers Y, N and I are not altered; X is replaced by the computed value and register A is cleared. The calculator is set to the constant multiply mode. The result is rounded to two decimal places.

### Savings Deposit Key, "SAV"

If the number in the X-register is negative, the "SAV" key will compute the amount to be deposited at the end of each period in a *sinking fund* for the number of periods,  $n$ , contained in register N, at an interest rate,  $i$ , contained in register I, compounded each time period, to accumulate the desired amount, contained in register Y. When the sign of the number in X is positive, the "SAV" key will compute the amount in a sinking fund if the number in Y is deposited at the end of  $n$  time periods (N-register) at an interest rate per time period  $i$  (I-register), compounded each time period. Thus, to compute the required *sinking fund deposit* to accumulate a desired amount over a given period of time, enter  $i$ ,  $n$  and the amount in any order using the "i," "n" and "AMT" keys, then "CS" and "SAV." To find the amount in the *sinking fund*, simply enter  $i$ ,  $n$  and the periodic amount of deposit and press "SAV." Registers N, I or Y are not altered by the calculation, register A is cleared and register X contains the computed value. The calculator is set to the constant multiply mode. Results are rounded to two decimal places.

### Loan Installment Key, "LOAN"

If the number in the X-register is negative, the "LOAN" key will compute the end-of-period payment or receipt required over the number of time periods contained in the N-register at an interest rate per time period equal to the value in the I-register to support a loan equal to the amount stored in the Y-register. When the sign of the X-register is positive, "LOAN" computes the amount that can be loaned for a given end-of-period payment stored in Y over the number of time periods contained in N at the interest rate per time period of I, compounded each time period. Thus, to compute the required installment on a given loan, enter the amount of the loan using the "AMT" key, the interest rate using "i" and the number of periods with "n," press "CS" to enter a negative sign in register X, then "LOAN." To compute how much can be borrowed given a fixed payment, enter the payment amount, number of periods and interest rate, then "LOAN." "AMT," "i" or "n" can always be entered in any order. Registers N, I or Y are not altered by the calculation; register A is cleared and register X will contain the computed value. The calculator is set to the constant multiply mode. The result is rounded to two decimal places.

### Sum-of-Digits Key, "SOD"

Following a "+" or "-" key, it transfers the number in register X to register A and computes a first *sum-of-digits* depreciation on that number by multiplying it by the ratio of the number in the N-register to the sum-of-digits of N. The result is rounded to two decimal places and stored in X; the difference between the initial and final values of X, the *depreciable value*, is stored in registers Y and A. N is decremented by one. (Therefore, to find depreciable value, simply use the "←" key.) Subsequent depressions of the "SOD" key will compute successive

depreciation and depreciable value amounts using the original value of N and present values stored in N and A. N is decremented by one after each computation. The number to be depreciated (or the loan amount in a "Rule of 78's" interest calculation) is always entered with a "+" or "-" key and the number of periods with the "n" key, without regard to key order. If the key preceding "SOD" is not "+" or "-", the sum-of-digits computation is performed on the number in the A-register without the number in X first being transferred to A. The result will be rounded to two decimal places; calculator mode is set to constant multiply.

### EXAMPLES

1. Addition or subtraction	2.0
	3.2
	-12.3
	<hr/>

KEYS	DISPLAY	COMMENTS
2	2	
+	2.	
3	3	
.	3.	
+	3.2	
+	5.2	
1	1	
2	12	
.	12.	
3	12.3	
-	-7.1	Note adding machine notation

### 2. Repeat add or subtract

KEYS	DISPLAY	COMMENTS
3	3	
.	3.	
1	3.1	
+	3.1	
+	6.2	
+	9.3	
-	6.2	

### 3. Chain multiplication or division

KEYS	DISPLAY	COMMENTS
a) 1	1	
x	1.	
2	2	
x	2.	
3	3	
.	3.	
1	3.1	
x	6.2	
4	4	
.	4.	
2	4.2	
=	26.04	



**EXAMPLES (continued)**

**3. (continued)**

	KEYS	DISPLAY	COMMENTS
b)	1	1	
	0	10	
	÷	10.	
	2	2	
	÷	5.	
	1	1	
	0	10	
	÷	.5	
	2	2	
	=	.25	

	KEYS	DISPLAY	COMMENTS
c)	2	2	
	0	20	
	x	20.	
	4	4	
	÷	80.	
	8	8	
	÷	10.	
	7	7	
	x	14285714	
	4	4	
	=	5.71	"=" rounds to two decimal places.

**4. Constant multiplication or division.**

	KEYS	DISPLAY	COMMENTS
a)	3	3	
	x	3.	
	2	2	
	=	6.	
	4	4	
	=	12.	First factor in constant multiply
	5	5	
	.	5.	
	2	5.2	
	=	15.6	
	=	46.8	15.6 is re-entered and multiplied by constant
b)	5	5	
	÷	5.	
	2	2	
	=	2.5	
	4	4	
	=	2.	Second factor in constant divide
	5	5	
	.	5.	
	2	5.2	
	=	2.6	
	=	1.3	2.6 is re-entered and divided by constant

**5. To perform products of sums.**

$(5 + 4) \times (3 + 2) / (6 + 7) = ?$

	KEYS	DISPLAY	COMMENTS
	5	5	
	+	5.	
	4	4	
	+	9.	
	x	9.	Chain multiply mode is set
	3	3	
	+	3.	
	2	2	
	+	5.	
	÷	45.	$(5 + 4) \times (3 + 2)$ is executed
	6	6	
	+	6.	
	7	7	
	+	13.	
	=	3.46	$45 \div (6 + 7)$ is executed

**6. Calculate percentage.**

	KEYS	DISPLAY	COMMENTS
	3	3	
	0	30	
	0	300	
	.	300.	
	2	300.2	
	5	300.25	
	x	300.25	
	5	5	
	%	15.01	"Live %" key

**7. Perform add on and discount**

	KEYS	DISPLAY	COMMENTS
a)	Add-On: \$125 plus 5%		
	1	1	
	2	12	
	5	125.	
	x	125.	
	5	5	
	%	6.25	5% of 125 is displayed
	+	131.25	125 + 5% is displayed
b)	Discount: \$532.10 by 6%		
	5	5	
	3	53	
	2	532	
	.	532.	
	1	532.1	
	x	532.1	
	6	6	
	%	31.93	6% of 532.1 is displayed
	-	500.17	532.1 - 6% is displayed

**8. Perform change sign.**

	KEYS	DISPLAY	COMMENTS
	1	1	
	2	12	
	CS	-12	{ Change sign does not terminate entry.
	3	-123	
	.	-123.	
	CS	123.	
	5	123.5	
	CS	-123.5	
	6	-123.56	

**9. Perform exchange registers (X ↔ Y).**

	KEYS	DISPLAY	COMMENTS
a)	5	5	
	x	5.	
	3	3	
	=	15.	5 is initially constant multiplier
	4	4	
	↔	5.	4 is now constant multiplier
	=	20.	
b)	6	6	
	÷	6.	
	3	3	
	↔	6.	{ Numerator and denominator are exchanged
	=	.5	

**10. Accumulate in memory, recall and clear memory**

	KEYS	DISPLAY	COMMENTS
a)	3	3	
	M+	3.	Accumulate in memory
	4	4	
	M+	4.	Accumulate in memory
	5	5	
	MR	7.	Recall memory
	MR	7.	Recall and clear memory
	MR	0.	Recall and clear memory



EXAMPLES (continued)

10. (continued)

KEYS	DISPLAY	COMMENTS
b) 5	5	
+	5.	
6	6	
+	11.	
M+	11.	Accumulate in memory
7	7	
+	18.	
M+	18.	11 + 18 is accumulated in M
+	25.	Repeat add
3	3	
2	32	
.	32.	
2	32.2	
CS	-32.2	
M+	-32.2	29 - 32.2 is accumulated in M
9	9	
+	34.	
MR	-3.2	Accumulated value of M is recalled
+	30.8	
MR	-3.2	Accumulated value of M is recalled
MR	-3.2	M is cleared
MR	0.	

11. Accumulate in memory with the use of the "="+ key.

KEYS	DISPLAY	COMMENTS
5	5	
x	5.	
3	3	
=+	15.	5 x 3 = 15 is added to M
4	4	
.	4.	
2	4.2	
x	4.2	
3	3	
=+	12.6	12.6 is added to M
6	6	
÷	6.	
7	7	
=+	.86	{ Rounded to 2 decimal places and added to memory
9	9	
CS	-9	{ Note method of multiplying negative number
x	-9.	
4	4	
=+	-36.	-36. added to memory
MR	-7.54	

12. Raising a number to a power.

KEYS	DISPLAY	COMMENTS
a) 2 <sup>5</sup> = 32		
2	2	
x	2.	
5	5	
Y <sup>x</sup>	32.	
b) 5 <sup>1.5</sup> = 11.18		
5	5	
x	5.	
1	1	
.	1.	
5	1.5	
Y <sup>x</sup>	11.18	Rounded to five digits; trailing zero is suppressed
c) 3 <sup>-5</sup> = 0.00412		
3	3	
x	3.	
5	5	
CS	-5	
Y <sup>x</sup>	.00412	Rounded to five digits

13. Raising a number to a fractional power.

KEYS	DISPLAY	COMMENTS
a) 5 <sup>1/2</sup> = 2.2361		
5	5	
÷	5.	
2	2	
Y <sup>x</sup>	2.2361	Rounded to five digits
b) 6 <sup>1/3</sup> = 1.8171		
6	6	
÷	6.	
3	3	
Y <sup>x</sup>	1.8171	Rounded to five digits

FINANCIAL EXAMPLES

1. Future Value Computations

To find the accumulated amount in a savings account at the end of 9 years when a) \$2500.00 is deposited at 5.25% interest compounded monthly. b) \$3000. c) \$3000 at 5.00% interest. d) \$3000 at 5.00% interest for 10 years.

KEYS	DISPLAY	COMMENTS
a) 9	9	Number of years
CS	-9	Compounded monthly
n	108.	Store 9 x 12 in N
5.25	5.25	Interest
CS	-5.25	Compounded monthly
i	.004375	Store 5.25/1200 in I
2500	2500	Original deposit
AMT	2500	Store in Y
VAL	40058.7	Rounded to two decimal places
b) 3000	3000	
AMT	3000.	New deposit stored in Y
VAL	48070.4	
c) 5	5	
CS	-5	
i	.00416666	New interest rate in I
VAL	47005.3	
d) 10	10	
CS	-10	
n	120.	Enter 10 x 12 in N
VAL	49410.2	

2. Present Value Computations

To find the amount to be deposited to accumulate a) \$5000 in 7 years at 4.5% interest compounded monthly. b) \$10,000. c) \$10,000 in 7.5 years.

KEYS	DISPLAY	COMMENTS
a) 7	7	Number of years
CS	-7	Compounded monthly
n	84.	Enter 7 x 12 in N
4.5	4.5	Interest
CS	-4.5	Compounded monthly
i	.00375	Enter 4.5/1200 in I
5000	5000	Future value
AMT	5000.	Enter amount in Y
CS	-5000.	
VAL	3651.1	Present value required
b) 10000	10000	
AMT	10000.	New future value in Y
CS	-10000.	
VAL	73021.9	Present value required
c) 7.5	7.5	
CS	-7.5	
n	90.	New time period in N
CS	-90.	
VAL	71400.3	Present value required

**FINANCIAL EXAMPLES (continued)**

3. To find the amount that a) must be deposited monthly in a savings account at an interest rate of 5.5% compounded monthly for 5 years to accumulate \$15,000. b) compounded, and deposited quarterly.

KEYS	DISPLAY	COMMENTS
a) 5.5	5.5	Interest
CS	-5.5	Compounded monthly
i	.00458333	Enter 5.5/1200
5	5	Number of years
CS	-5	Compounded monthly
n	60.	Ent 5 x 12 in N
15000	15000.	Future value
AMT	15000.	Entered in Y
CS	-15000.	
SAV	217.77	Monthly deposit required
b) 5.5	5.5	Interest
÷	5.5	
4	4	Compound quarterly
÷	1.375	Use "÷" instead of "÷" for maximum accuracy
i	.01375	Enter 5.5/400
C		Terminate chain calculation
5	5	Number of years
x	5.	
4	4	Compound quarterly
=	20.	
n	20.	Enter 5 x 4 in N
15000	15000	Re-enter FV in Y
AMT	15000.	Amount
CS	-15000.	
SAV	656.71	Quarterly deposit required

4. To find the amount accumulated a) if \$100 is deposited at the end of each month for 6 years in a savings account at an interest rate of 4.75%, compounded monthly, b) at 7.5%, c) at 4.75% for 9 years.

KEYS	DISPLAY	COMMENTS
a) 4.75	4.75	Interest
CS	-4.75	Compounded monthly
i	.00395833	4.75/1200 entered in I
6	6	
CS	-6	
n	72.	
100	100	
AMT	100.	
SAV	8311.93	Accumulated sinking fund
b) 7.5	7.5	
CS	-7.5	
n	90.	
SAV	10786.37	
c) 4.75	4.75	
CS	-4.75	
i	.00395833	
9	9	
CS	-9	
n	108.	
SAV	13443.17	

5. To find the monthly payments of a loan of \$5,000 at an annual percentage rate of a) 18% for 5 years, b) 12%.

KEYS	DISPLAY	COMMENTS
a) 18	18	Interest
CS	-18	Compounded monthly
i	.015	18/1200 entered in I
5	5	Number of years
CS	-5	Compounded monthly
n	60.	5 x 12 entered in N
5000	5000	Loan amount
AMT	5000.	Entered in Y
CS	-5000.	
LOAN	126.97	Required monthly installment; rounded to two decimal places

5. (continued)

KEYS	DISPLAY	COMMENTS
b) 12	12	
CS	-12	
i	.01	New interest entered in I
CS	-0.1	
LOAN	111.22	New monthly installment

6. To find the amount of a loan with monthly payments of \$125, and an interest rate of 9% for 3 years. b) 4 years. c) \$120 for 4 years.

KEYS	DISPLAY	COMMENTS
a) 9	9	Interest
CS	-9	Compounded monthly
i	.0075	9/1200 entered in I
3	3	Number of years
CS	-3	Compounded monthly
n	36.	3 x 12 entered in N
125	125	
AMT	125.	Payment amount entered in Y
LOAN	3930.85	Loan amount is computed
b) 4	4	
CS	-4	
n	48.	New number of periods entered in N
LOAN	5023.1	
c) 120	120	
AMT	120.	New payment amount entered in Y
LOAN	4822.17	

7. To find the amount of change and the percent change of a house now valued at \$56,500 which was previously purchased for \$49,750. b) present value of \$30,000.

KEYS	DISPLAY	COMMENTS
a) 56500	56500	Present value
AMT	56500.	Enter in Y
49750	49750	Past value
Δ	1357	% change
↔	6750.	Amount change
b) 30000	30000	New present value
AMT	30000.	
49750	49750	
Δ	-397	Negative % change
↔	-19750.	Amount change

8. Performing a sum-of-digits depreciation. Find the depreciating and depreciable value for each year, on an item with an initial cost of \$3,500.00 and a salvage value at the end of 8 years of \$675.00

KEYS	DISPLAY	COMMENTS
3500	3500	
+	3500	Enter initial value
675	675	Enter salvage value
-	2825.	Calculate change
8	8	
n	8.	Enter period in N
SOD	627.78	1st year depreciation. Rounded to two decimal places
↔	2197.22	Depreciable value
SOD	549.31	2nd year depreciation
↔	1647.91	Depreciable value
SOD	470.83	3rd year depreciation
↔	1177.08	Depreciable value
SOD	392.36	4th year depreciation
↔	784.72	Depreciable value
SOD	313.89	5th year depreciation
↔	470.83	Depreciable value
SOD	235.42	6th year depreciation
↔	235.41	Depreciable value
SOD	156.94	7th year depreciation
↔	78.47	Depreciable value
SOD	78.47	8th year depreciation
	0.	Depreciable value