WYLE SCIENTIFIC SYSTEM
Model WSS-5

INTRODUCTION

The Model WSS-5 extends the capability of the basic Wyle Scientific Calculator through the addition of supplemental data storage registers. The WSS-5 includes features which allow easy upgrading of the WSS-5 to the more powerful WSS-10. The additional data storage registers simplify programming, increase the speed of program operation, and allow the system to handle more complex problems.

The Model WSS-5 is truly modular, since the customer's existing Calculator and PC-01 Punched Card Programmer can be incorporated directly into the system. Any of the major system components can be directly replaced by another unit of the same type.

SYSTEM DESCRIPTION

A block diagram of the WSS-5 system is shown in Figure 1. The basic element of the system is the Wyle Scientific Calculator, Model WS-02. This unit performs all arithmetic functions and provides the basic memory of the system, with three working registers and three storage registers. Basic manual controls and a CRT display of the registers' contents are also part of the WS-02.

Programming capability is provided by the Model PC-01 Punched Card Programmer. The Model PC-01 provides a means of rapidly programming special applications and of building a large library of programs.

Programs for the Punched Card Programmer are now available which permit signed algebraic multiplication and division. The operation is fully automatic, requiring no decision or interference by the machine operator.

A Supplemental Memory Unit, Model SM-01, provides eight additional data storage registers, each with a capacity of 24 decimal digits. Data may be freely transferred between these registers and the six basic registers of the WS-02. This transfer of information can be controlled by either the Punched Card Programmer or by the operator, via the Model KB-01 Peripheral Input Keyboard.

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Two additional Supplemental Memory Units, Model SM-02, can be added, to provide a total of 24 supplemental registers.

The Model KB-01 Peripheral Input Keyboard provides a channel for the flow of data and instructions between the various units, and the Model KB-01 provides additional control keys for manual addressing of the supplemental registers.

The Supplemental Memory is mounted in the pedestal section of the desk console. The WS-02, the PC-01, and the KB-01 are free-standing units which are placed on the desk, as shown in the photograph.

TECHNICAL SPECIFICATIONS

1. CALCULATOR Model WS-02

MEMORY — Six basic registers. Three (MQ, Entry and Accumulator) working registers and three (R1, R2, and R3) data storage registers. Each register has a capacity of 24 decimal digits.
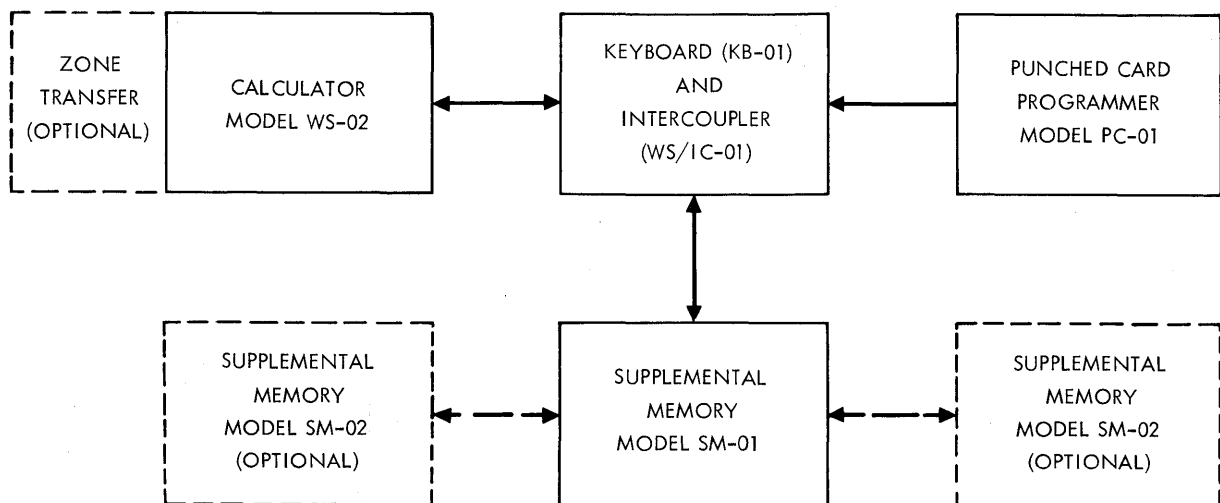
FIGURE 1: MODEL WSS-5 BLOCK DIAGRAM

DECIMAL POINT

Decimal locations selectable from 21 digits, 3 decimal places to 3 digits, 21 decimal places, in increments of 3 digits.

OPERATIONS

In the operations list which follows, register designations are read as if preceded by "Contents of" or "results appear in", as the case may be. For example (ACC) + (Entry) → ACC is read as, "Contents of Entry are added to contents of Accumulator and results appear in Accumulator".

ARITHMETIC OPERATIONS

Add	$(ACC) + (Entry)$	$\rightarrow$ ACC
Sub	$(ACC) - (Entry)$	$\rightarrow$ ACC
Clear & Mult	$(MQ) \times (Entry)$	$\rightarrow$ ACC
Mult +	$(ACC) + [(MQ) \times (Entry)]$	$\rightarrow$ ACC
Mult -	$(ACC) - [(MQ) \times (Entry)]$	$\rightarrow$ ACC
Divide	$[(ACC) / (Entry)]$	$\rightarrow$ MQ
$\sqrt{}$	$\sqrt{(ACC)}$	$\rightarrow$ MQ

REGISTER ADDRESSING

Six instructions allow TO and FROM addressing of each of the six basic registers. The TO addressing designates the register receiving data, whether the source is the keyboard, or the programmers, or another register. The FROM addressing designates the source of data for register transfer operations.

"HOUSEKEEPING"

Shift Right, Shift Left — The contents of the register addressed TO are shifted one decimal place in the indicated direction.

Forward Space, Back Space — The position where the next data digit is to be entered is shifted one place right or left. This allows correction of any single digit in a 24-digit word.

Transfer — Contents of the register addressed FROM are copied into the register addressed TO.

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Clear MQ, Clear Entry, Clear ACC	The contents of the indicated register are erased and that register is automatically addressed TO.

DATA ENTRY

Eleven instructions (or keys), representing digits 0 - 9 and decimal point, allow entry of numeric data. Numbers are entered in the register addressed TO starting with the most significant digit. When the decimal point instruction is received, the digits previously entered align on the proper decimal point location.

Negative results of computation are represented in 10's complement form. As an example: -2 = 999----98.

MODE SELECT SWITCHES

Three slide switches on the WS-02 keyboard allow manual selection of various operating modes.

1. ADD ANY REGISTER. In the OFF position, Entry is added to the ACC when the ADD key is depressed. In the ON position, the contents of the register addressed FROM are added to ACC when ADD key is depressed. Subtraction operates in a similar fashion.

2. OVERFLOW LOCK OFF. With overflow lock on, the machine "hangs up" when results of a computation exceed capacity of a register. With lock off, the machine loses the most significant digits but does not hang up.

3. KEEP REMAINDERS. Remainders are retained after division and square root operations. See WS-02 Operation Manual for detailed discussion.

| KEYBOARD/DISPLAY	The basic keyboard and display are part of the WS-02. The keyboard allows manual control of all operations previously described. The CRT display gives a continuous visual indication of the contents of the six basic registers and, in conjunction with the Peripheral Input Keyboard Model KB-01, an "on demand" display of the contents of supplemental registers.

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II. PERIPHERAL INPUT KEYBOARD Model KB-01

KEYBOARD

The KB-01 provides an auxiliary manual keyboard used for addressing the supplemental storage registers and for controlling peripherals.

A decimal keyboard is provided for keying in numerics.
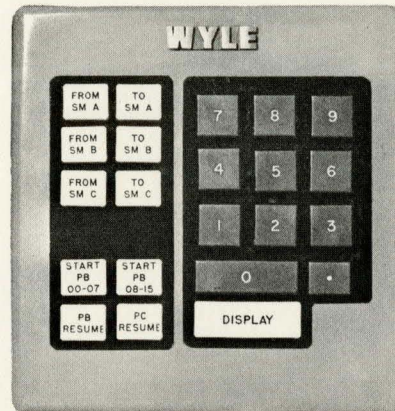
SUPPLEMENTAL REGISTER ADDRESSING

Six keys at the upper left of the KB-01 keyboard (one pair for each Supplemental Memory unit) are used, in conjunction with the numeral keys, to address supplemental registers. As an example, TO SM A and numeral 1, addresses TO the first of the 8 registers in the SM-01.

The DISPLAY key provides an "on command" display of the supplemental registers. The register of interest is addressed FROM and the DISPLAY key is depressed. The contents of the addressed register are displayed in the Calculator's R3 register as long as the key is held down. When the key is released, the display of R3 is resumed. The contents of both registers are unchanged.

PROGRAM CONTROL

The STOP instruction of the PC-01 causes the PC-01 to halt, allowing manual data entry of intervention in the program via the keyboard. The PC-01 can then be restarted by the PC RESUME key.

HALT INDICATOR

An indicator on the KB-01 is illuminated by a STOP instruction from the PC-01.

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SYSTEM EXPANSION   If the WSS-5 is upgraded to the WSS-10 by the addition of a Patch Board Programmer (Model PB-02), no additional controls are required. The keys which control the PB-02 are provided on the basic KB-01 Peripheral Input Keyboard. Additional memory modules, an optional feature, can also be controlled from the KB-01.

III. PUNCHED CARD PROGRAMMER Model PC-01

PUNCHED CARDS   The Model PC-01 reads a standard size, 40-column punched card. Prescored cards can be prepared with a simple stylus. Unscored cards can be prepared on conventional keypunch equipment.

CARD FORMAT   Cards are read a row at a time. Usually only one column is punched on each row. Thirty-eight of the columns correspond to the 38 manual keys on the WS-02 keyboard. One column is punched in all rows, and this column is used as a "read enable" strobe. The 40th column is a STOP instruction, which causes the programmer to halt until a resume command is received, thus allowing operator intervention in a program. There are 12 rows per card. Any number of cards may be taped together for long programs.

MULTIPLE INSTRUCTIONS   Some instructions use more than one column punched in a row, as in the following examples. A complete transfer operation is punched in one row:

FROM R1 - TO ACC - TRANSFER

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A complete add (or subtract) operation in the ADD
ANY REGISTER mode occupies one row:

FROM R2 - ADD

Data may then be simultaneously entered in up to
three basic registers, one of which may be a storage
register:

TO MQ - TO ENTRY - TO R1

SUPPLEMENTAL REGISTER
ADDRESSING

This is a multiple instruction technique. A simultaneous
FORWARD SPACE and a numeral (1 - 8) addresses TO
one of the registers in the SM-01's group of 8. BACK
SPACE and a numeral (1 - 8) addresses FROM one
register in the group of 8.

SPEED

The PC-01 reads a row at a time and will not read a new
instruction until the previous instruction has been exe-
cuted. Maximum read rate is 8 rows per second.

IV. SUPPLEMENTAL MEMORY Model SM-01

CAPACITY

The Model SM-01 provides 8 data storage registers,
each with a capacity of 24 decimal digits.

DECIMAL POINT

Identical to basic registers. Set by the same switch.

TRANSFER

Data may be transferred between SM registers and the
six basic registers. Data cannot be transferred between
SM registers directly, only via the six basic registers.
Data cannot be entered directly into SM registers. It
must first be entered in one of the six basic registers and
transferred to an SM register.
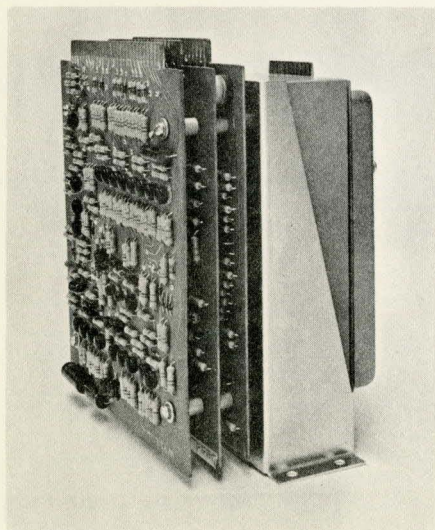
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ADD, SUB., OPERATIONS	In the ADD ANY REGISTER mode, the data stored in SM registers can be directly added to or subtracted from ACC. The SM register is addressed FROM and an ADD or SUB instruction executed. The contents of the SM register are unchanged.
ADDRESSING	The 8 registers contained in SM-01 can be addressed from the keyboard of the KB-01 and from the PC-01.

V. OPTIONAL FEATURES

SUPPLEMENTAL MEMORY Model SM-02	Each SM-02 provides 8 additional data storage registers identical to those in the SM-01. One or two SM-02's can be added for a total of 16 or 24 additional data storage registers.
	The SM-02's can be addressed by the KB-01 keyboard but not by the PC-01.
ZONE TRANSFER	Allows selective transfer of the contents of any register. Addressing of registers is as previously explained. However, a numeric command is used with the TRANSFER instruction. Each register is assumed to be composed of 4 zones.

    Zone 1: Right hand 6 digits. Digits 0 - 5

    Zone 2: Digits 6 - 11

    Zone 3: Digits 12 - 17

    Zone 4: Left hand 6 digits. Digits 18 - 23

The following simultaneous instructions will transfer the block of data shown.

TRANSFER only	All 24 digits
TRANSFER and numeral 1	Zone 1
TRANSFER and numeral 2	Zone 2
TRANSFER and numeral 3	Zone 3
TRANSFER and numeral 4	Zone 4

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Data thus transferred will probably not be properly located with respect to the decimal point. To speed this alignment operation, a special shifting operation is part of the Zone Transfer option.

The operator may program the following multiple instructions.

SHIFT RIGHT and numeral   (0 - 9)
SHIFT LEFT and numeral   (0 - 9)

The instruction shifts the contents of the TO register n decimal places in the indicated direction where n is the numeral which accompanies the SHIFT instruction. This eliminates the need for several successive SHIFT instructions to align data. Numeral 0 causes a shift of 10 decimal places in the indicated direction.

VI. SYSTEM UPGRADING

The Model WSS-5 can easily and quickly be converted to the more powerful Model WSS-10 by the addition of the Patch Board Programmer, Model PB-02, and the associated power supply. The WS/IC-01 Intercoupler is wired to accept the PB-02 and control keys are built into the KB-01 Peripheral Input Keyboard.

The PB-02 can therefore be added to the system as workload requirements increase.

VII. GENERAL SPECIFICATIONS

PACKAGE CONFIGURATION

WS-02	Table top, free-standing
PC-01	Table top, free-standing
KB-01	Table top, free-standing
SM-01	Rack-mounted in desk pedestal

POWER   115 ± 10 volts, 60 cps. Approximately 215 watts.

FLOOR SPACE   28 inches wide by 50 inches long. Desk is 30 inches high. WS-02 adds 10-1/4 inches.

NOTE: All options and the PB-02 may be added in the basic desk console. No additional space is required.

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