CUSTOMER ENGINEERING TESTS
FOR THE 1401 DATA PROCESSING SYSTEM

Block No. 0350A

ZONE ADD

Purpose of Test

To test the Zone Add circuitry by adding one field to another with alphabetic or special characters in the high-order positions and comparing the result with the Result Should Be Field. For unequal conditions the machine either stops to permit console checking or prints the results depending upon the setting of Sense Switch E.

The Zone Adder by itself can add up to a maximum of 3 either as a result of adding zone bits in alphabetic or special characters in the high-order positions, or as a result of normal carry to signal an overflow condition. These zones, or A-B bit configurations, in combination with digits 1-9, makes 39 the maximum number than can be represented or accumulated in the high-order position of an accumulator. The following table shows the numerical values of zones or A-B bit configurations:

Card Zones	Zone Bits	Value
No	No	0
0	A	1
11	B	2
12	A-B	3 (limit of zone adder)

The A-B bit configurations are handled by the Zone Adder in the following manner:

Bits		Bits		Bits	
No (0)	+	No (0)	=	No (0)	
No (0)	+	A (1)	=	A (1)	
No (0)	+	B (2)	=	B (2)	
No (0)	+	A-B(3)	=	A-B(3)	
A (1)	+	A (1)	=	B (2)	
A (1)	+	B (2)	=	A-B(3)	
A (1)	+	A-B(3)	=	No (0)	Zone Adder overflow lost
B (2)	+	B (2)	=	No (0)	Zone Adder overflow lost
B (2)	+	A-B(3)	=	A (1)	
A-B(3)	+	A-B(3)	=	B (2)	

The A-B bit configurations in the Zone Adder may be further modified by normal carry as a result of true arithmetic additions of digits 1-9 in the high-order position of a number. Examples:

Normal Addition	Zone Adder Equivalent	
9 + 5 = 14	9 + 5 = U (A4)	
9 + 9 = 18	9 + 9 = Y (A8)	
7 + 18 = 25	7 + Y = N (B5)	
14 + 25 = 39	U + N = I (AB9)	limit of high order position
39 + 14 = 53	I + U = T (A3)	

Note that the alphabetic characters and their numerical equivalents are the same as those used for addressing storage locations 10-- to 39--. Thus, overflow conditions recognized by the Zone Adder can be used for address modification.