

ZONE ADD

REPRODUCTION

A. PURPOSE

TO TEST THE ZONE ADDER CIRCUITRY

NOTE: THE ZONE ADDER OPERATES ONLY DURING TRUE-ADD AND THEN ONLY IF THE B FIELD LENGTH IS GREATER THAN ONE. IT OPERATES ON THE B CYCLE IN WHICH THE B FIELD WM IS SENSED, AND A NUMERIC CARRY AT THIS TIME WILL BE ADDED BY THE ZONE ADDER.

ANY ZONE BITS IN THE A FIELD THAT CORRESPONDS TO THE B FIELD WORD MARK (PLUS ANY CARRY) THAT RESULTS FROM AN EQUAL OR LONGER A FIELD WILL ADD.

B. LOADING PROCEDURES

1. PLACE TEST IN 1402 READ HOPPER AND DEPRESS LOAD KEY.
2. NO SELECTION DIGIT IS REQUIRED WHEN TEST IS RUN FROM TAPE.

C. PROGRAM CONTROL

1. SENSE SWITCHES

- B. ON TO REPEAT FOR SCOPING
OFF TO CONTINUE
- C. ON TO PRINT CORRECT RESULTS
OFF TO CONTINUE
- D. ON TO REPEAT SAME DETAIL CARD
OFF TO CONTINUE
- E. ON TO STOP ON ERROR
OFF TO PRINT ERROR

2. COUNTER.

A COUNTER (LOCATION 967-970) IS USED TO ALLOW THE PROGRAM TO REPEAT 90 TIMES FOR EACH DETAIL CARD. WHEN SENSE SWITCH C IS ON, ONLY ONE CORRECT PRINTOUT OCCURS PER DETAIL CARD. AN ERROR TEST IS MADE EACH TIME THE PROGRAM IS REPEATED. AN ERROR PRINTOUT OCCURS FOR EACH FAILURE.

D. TEST PROCEDURE

FIELDS A, B, AND RESULT SHOULD BE ARE LOADED INTO THE PRINT AREA FOR PRINTING PURPOSES. COLUMN 2 IS THEN TESTED FOR A BLANK. IF NO BLANK A 2-POSITION A FIELD (COLUMNS 1-2) IS ADDED TO A 2-POSITION B FIELD (COLUMNS 21-22). IF COLUMN 2 IS BLANK A 1-POSITION A FIELD (COLUMN 1) IS ADDED TO A 1-POSITION B FIELD (COLUMN 21). THE RESULT IS THEN COMPARED TO THE RESULT SHOULD BE FIELD (COLUMNS 41-42). IF THE COMPARISON IS UNEQUAL, THE PROGRAM BRANCHES TO THE ERROR PRINT ROUTINE.

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|---------------|--------|---------|---------|--|--|--|--|--|
| DATE | 2-2-61 | 3-17-63 | 10.5.63 | | | | | |
| ENG. CHG. NO. | 110378 | 116745 | TA-1844 | | | | | |

DIAGNOSTIC FUNCTION TEST REPRODUCTION

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 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.

IN ADDITION TO THE DETAIL CARDS FURNISHED WITH THE TEST DECK, YOU MAY USE OTHER DETAIL CARDS WITH DIFFERENT COMBINATIONS OF HIGH-ORDER CHARACTERS IN FIELDS A, B, AND RESULT SHOULD BE. THE HIGH-ORDER CHARACTER IN THE RESULT SHOULD BE FIELD MAY BE DETERMINED AS FOLLOWS:

| | | | | | | | |
|---------------|--------|---------|---------|--|--|--|--|
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REPRODUCTION

1. CONVERT THE HIGH-ORDER CHARACTER IN FIELDS A AND B TO THEIR NUMERICAL EQUIVALENTS.
2. ADD THE TWO FIGURES.
3. SUBTRACT 40 IF THE TOTAL IS MORE THAN 39.
4. CONVERT THE RESULT TO AN ALPHABETIC OR SPECIAL CHARACTER.

| | FIELD | HIGH-ORDER CHARACTER | NUMERICAL EQUIVALENT |
|------------|------------------|----------------------|----------------------|
| EXAMPLE 1: | A | L | 23 |
| | B | S | 12 |
| | RESULT SHOULD BE | E | 35 |
| EXAMPLE 2: | A | F | 36 |
| | B | T | 13 |
| | RESULT SHOULD BE | 9 | 9 |
| EXAMPLE 3: | A | P | 27 |
| | B | A | 31 |
| | RESULT SHOULD BE | Y | 18 |

THE ABOVE EXAMPLES ASSUME THAT THE HIGH-ORDER CHARACTERS IN FIELDS A AND B ARE NOT THE UNITS' POSITIONS; IN OTHER WORDS, FIELDS A AND B EACH HAVE A MINIMUM OF AT LEAST TWO CHARACTERS. EXAMPLE

TWO-CHARACTER FIELDS

$$M O + M O = 8 0$$

NUMERICAL EQUIVALENT $(24)0 + (24)0 = (48)0 - (40) = 8 0$

WHEN FIELDS A AND B ARE SINGLE-CHARACTER FIELDS, ZONE BITS IN EITHER OR BOTH CHARACTERS ARE TREATED AS ALGEBRAIC SIGNS, THE ZONE ADDER IS NOT EMPLOYED, AND NORMAL ALGEBRAIC SIGN CONVENTIONS ARE OBSERVED. EXAMPLE:

SINGLE-CHARACTER FIELDS

$$M + M = Q$$

NUMERICAL EQUIVALENT $I + I = 8$

$$I + I = H$$

NUMERICAL EQUIVALENT $9 + 9 = 8$

| | | | | | | | |
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REPRODUCTION

E. STOPS

920 IN STORAGE ADDRESS REGISTER: ERROR WITH SENSE E ON.

F. PRINTOUTS

1. CORRECT

| A FIELD | B FIELD | RESULT SHOULD BE | RESULT IS |
|---------|---------|------------------|-----------|
| 40 | 40 | 80 | 80 |
| Z0 | R0 | 80 | 80 |
| M0 | M0 | 80 | 80 |
| 9 | 9 | 8 | 8 |
| H | H | Q | Q |

2. ERROR

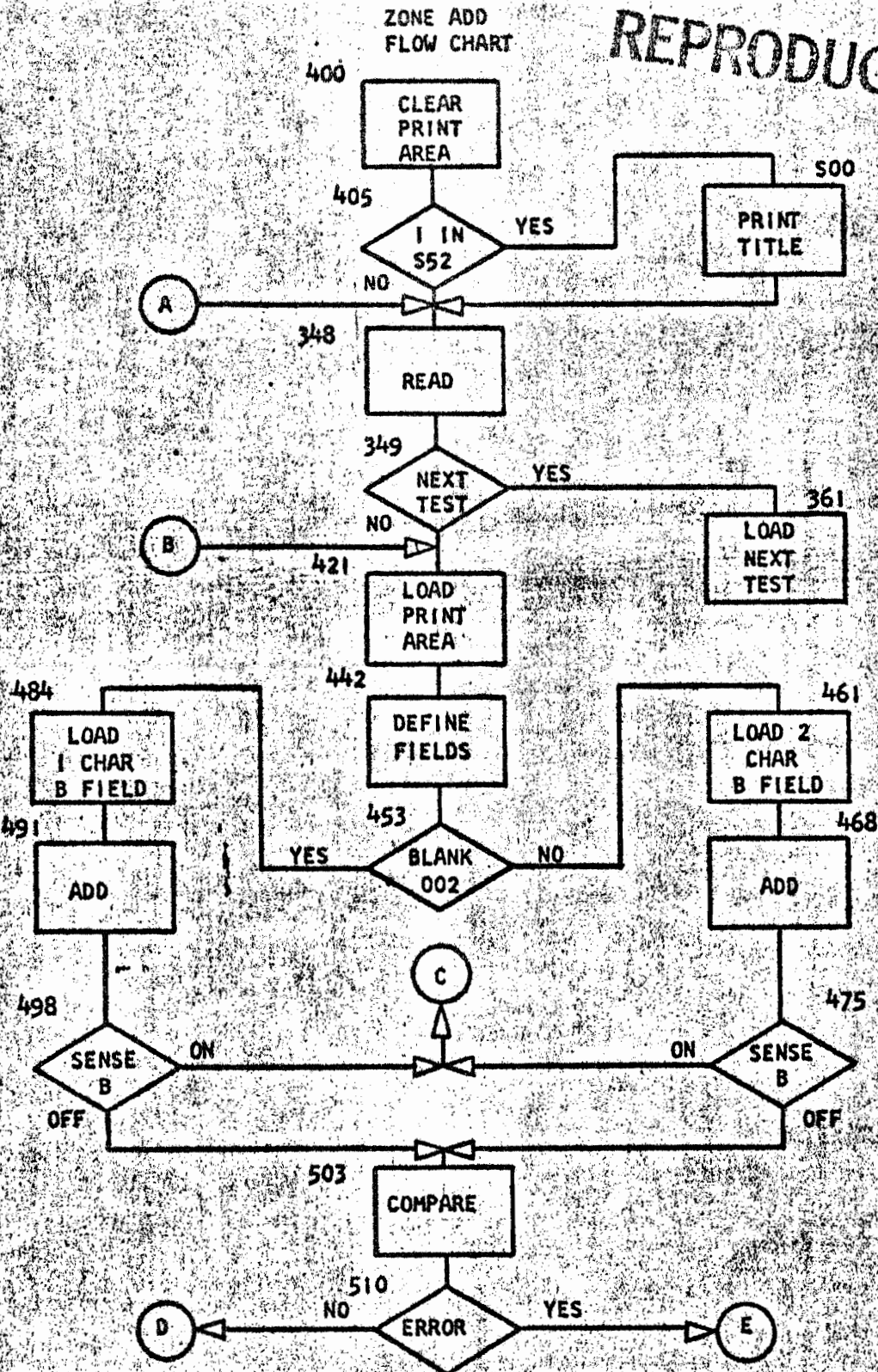
| A FIELD | B FIELD | RESULT SHOULD BE | RESULT IS | |
|---------|---------|------------------|-----------|-------|
| 40 | 40 | 80 | 40 | ERROR |
| Z0 | R0 | 80 | IO | ERROR |
| M0 | M0 | 80 | Q0 | ERROR |
| 9 | 9 | 8 | Y | ERROR |
| H | H | Q | 8 | ERROR |

G. COMMENTS

THE BRANCH INSTRUCTION AT LOCATION 927 CAN BE CHANGED MANUALLY TO CAUSE THE PROGRAM TO LOOP AS FEW AS 1 OR AS MANY AS 9,000 TIMES PER DETAIL CARD. THE PROGRAM CALLS FOR 90 LOOPS PER CARD.

| | | | | | | | |
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DIAGNOSTIC FUNCTION TEST

REPRODUCTION

PROGRAM LISTING FOR USE WITH FLOW CHART

ZONE ADD 03508

| INSTRUCTION ADDRESS | QP | A | B | REMARKS |
|---------------------|-----|---|----------|---------------------------------------|
| 377 | 377 | B | 389 | USE WHEN TESTS ARE RUN FROM TAPE |
| 385 | 385 | B | 588 | '' |
| 389 | 389 | N | 000 | '' |
| 393 | 393 | M | 360 392 | '' |
| 400 | 400 | / | 332 | START TEST |
| 404 | 404 | / | | '' |
| 405 | 405 | B | 500 5521 | BR TO TITLE PRINT ROUTINE IF 1 IN 552 |
| 413 | 413 | / | 080 | CLEAR READ AREA |
| 417 | 417 | B | 348 | BRANCH TO PROGRAM CHAINING ROUTINE |
| 421 | 421 | . | 001 078 | LOAD PRINT AREA |
| 428 | 428 | L | 080 299 | '' |
| 435 | 435 | L | 072 272 | '' |
| 442 | 442 | . | 221 241 | DEFINE B FIELD + COMPARE FIELD |
| 449 | 449 | N | 000 | NOTHING |
| 453 | 453 | B | 484 002 | GO TO 484 IF SINGLE CHARACTER FIELDS |
| 461 | 461 | L | 222 262 | LOAD 2 CHAR B FIELD |
| 468 | 468 | A | 202 262 | ADD 2 CHAR FIELDS |
| 475 | 475 | B | 935 B | LOOP ON SW B SS |
| 480 | 480 | B | 503 | GO TEST RESULT |
| 484 | 484 | L | 221 261 | LOAD SINGLE CHAR B FIELD |
| 491 | 491 | A | 201 261 | ADD SINGLE CHAR FIELDS |
| 498 | 498 | B | 935 B | LOOP ON SW B SS |
| 503 | 503 | C | 262 242 | COMPARE B FIELD TO CORRECT RESULT |
| 510 | 510 | B | 900 / | BRANCH ERROR |
| 515 | 515 | B | 920 | GO TO CORRECT ROUTINE |
| 900 | 900 | L | /14 285 | BEGIN ERROR PRINT ROUTINE |
| 907 | 907 | B | 916 E | E ON TO ERROR STOP SS |
| 912 | 912 | 2 | 920 | ERROR PRINT |
| 916 | 916 | . | 920 | ERROR STOP |
| 920 | 920 | A | 920 970 | ADD ONE TO OPERATION COUNTER |
| 927 | 927 | B | 944 9699 | BRANCH AFTER 90 OPERATIONS C FOR TA |
| 935 | 935 | / | 332 | CLEAR PRINT AREA |
| 939 | 939 | / | | '' |
| 940 | 940 | B | 421 | BRANCH TO REPEAT |
| 944 | 944 | S | 970 | RESET OPERATION COUNTER |
| 948 | 948 | B | 957 C | C ON FOR CORRECT PRINT SS |
| 953 | 953 | B | 958 | BRANCH TO SENSE D |
| 957 | 957 | 2 | | PRINT CORRECT RESULTS |
| 958 | 958 | B | 421 D | D ON TO REPEAT SS |
| 963 | 963 | B | 348 | BRANCH TO PROG. CHAINING ROUTINE |
| 967 | 967 | O | 00+ | OPERATION COUNTER |
| 1110 | /10 | E | RR0 R | CONSTANTS |

| | | | | | | | |
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DIAGNOSTIC FUNCTION TEST

PART NO. 451415
SHEET 8 OF 10
BLOCK NO. 03508

1115 /15
1120 /20 FI ELD
1140 /40 FI ELD
1160 /60 R ESU LT SHOULD BE
1180 /80 R ESU LT IS

REPRODUCTION

| | | | | | | | |
|---------------|--------|---------|---------|--|--|--|--|
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TABLE OF UNPRINTABLE CHARACTERS

| | | | | | |
|----------------------|--------|-----------------|--------|--------------|--------|
| LP-LEFT PARENTHESIS | 12 5 8 | SE-SEMICOLON | 11 6 8 | DE-DELTA | 11 7 8 |
| WS-WORD SEPARATOR | 0 5 8 | LT-LESS THAN | 12 6 8 | PZ-PLUS ZERO | 12 0 |
| TS-TAPE SEGMENT MARK | 0 7 8 | GT-GREATER THAN | 6 8 | TM-TAPE MARK | 7 8 |
| GM-GROUP MARK | 12 7 8 | MZ-MINUS ZERO | 11 0 | CO-COLON | 5 8 |
| RP-RIGHT PARENTHESIS | 11 5 8 | AP-APOSTROPHE | 0 6 8 | | |

| | | | |
|---|---------------------------|---------------------|----------|
| ,008015,022029,033033N | 1001 | ZONE ADD | 0350B00A |
| ,008015,022029,033033N | 1001 | SET WORDMARK CARD | 0350B 02 |
| L067367,340344,348349,3573611001,008012,0011001 | 18361080A8421/340080 | | 0350B 03 |
| L069404,377385,389393,4004041001 | B389 BS88N000M360392/332/ | | 0350B 04 |
| L069441,413417,421428,435442100185005521/080B348,001078L080299L072272 | | | 0350B 05 |
| L070479,449453,461468,4754801001,221241N000B484002 | L222262A202262B9358 | | 0350B 06 |
| L072519,484491,498503,5105151001B503L221261A201261B9358C262242B900/B920 | | | 0350B 07 |
| L071938,907912,916920,9279351001L/14285B916E2920.920A92097089449699/332 | | | 0350B 08 |
| L056962,940944,948953,9579581001/B421S9708957CB958284210 | | | 0350B 09 |
| L040970,967971,971971,9719711001B348000P | | | 0350B 10 |
| L065/39□/07/07,/10/15,/20/401001 | ERROR | A FIELD | 0350B 11 |
| L072/79,/60/80,/80/80,/80/801001B | FIELD | RESULT SHOULD BE | 0350B 12 |
| L070517,S00S01,S05S12,S13S171001 | RESULT IS | 2,049L0772772/2772 | 0350B 13 |
| L059S44,S25S29,S36S37,S41S451001□/40/60□/80L/892702/2702413 | | | 0350B 14 |
| /333080N | | CLEAR WORDMARK CARD | 0350B 15 |
| L031/991001 | RESULT IS | | 0350B 16 |
| ,019027,031,038042B031T98G8400L046352BW04BS88 | | ZONE ADD | 0350B 17 |

DETAIL CARDS

| | | | |
|----|----|----|----------|
| 40 | 40 | 80 | 0350B 18 |
| 1H | 90 | 8P | 0350B 19 |
| Z | | Z | |
| Z0 | R0 | 80 | 0350B 20 |
| U0 | D0 | 80 | 0350B 21 |
| H0 | M0 | 80 | 0350B 22 |
| 40 | U0 | Y0 | 0350B 23 |
| 90 | 90 | Y0 | 0350B 24 |
| Z0 | I0 | Y0 | 0350B 25 |
| R0 | R0 | Y0 | 0350B 26 |
| D0 | M0 | Y0 | 0350B 27 |
| 40 | M0 | Q0 | 0350B 28 |
| Z0 | 90 | Q0 | 0350B 29 |
| U0 | U0 | Q0 | 0350B 30 |
| R0 | I0 | Q0 | 0350B 31 |
| D0 | D0 | Q0 | 0350B 32 |
| 40 | D0 | H0 | 0350B 33 |
| R0 | 90 | H0 | 0350B 34 |
| U0 | M0 | H0 | 0350B 35 |
| Z0 | Z0 | H0 | 0350B 36 |
| I0 | I0 | H0 | 0350B 37 |

| | | | | | | | |
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DIAGNOSTIC FUNCTION TEST REPRODUCTION

PART NO. 451415
SHEET 10 OF 10
BLOCK NO. 03508

| | | | |
|----|---|----|----------|
| 4 | 4 | 8 | 03508 38 |
| 9 | 9 | 8 | 03508 39 |
| M | M | 0 | 03508 40 |
| I | I | H | 03508 41 |
| U | U | Y | 03508 42 |
| J | J | H | 03508 43 |
| 1 | 9 | A | 03508 44 |
| 9 | R | H | 03508 45 |
| R | J | Q | 03508 46 |
| /9 | I | 7J | 03508 47 |
| | M | | |
| /9 | Z | 7J | 03508 48 |
| | R | | |
| /9 | Z | 7J | 03508 49 |
| | Z | | |
| | Z | | |

| | | | | | | | |
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