NO. 2128303
SHEET 0
OF 28

DIAGNOSTIC TEST

TITLE 1620 ERROR CHECK DIAGNOSTIC TEST - CU02
MACH.TYPE 1620 BY J.H.M. APPR. G.I.A. DATE 4-11-62

ENGINEERING CHANGE HISTORY

E/C NO.	DATE	SHEETS AFFECTED
404530	8-15-60	1-22
404568	12-15-60	1,7,10,11,14,16,17
404618	5-15-61	1,1A,2,3,6A,10,13,13A,15, 17,&20
404644-H	6-29-61	5
404675	4-11-62	4,4A,5,6A,7,8,9,12,13,13A, 16,17,18,19,20,21,22
404980	5-7-64	1A,2,3,4A,6A,11,12,13,13A 14,21,22,23,24,25,26,27,28

E/C NO.	404530	404568	404618	404644-H	404675	404980	
DATE	8-15-60	12-15-60	5-15-61	6-29-61	4-11-62	5-7-64	

1620 DIAGNOSTICS
CU02 ERROR CHECKS

A. SCOPE:

This fault detection test is designed to check for the proper functioning of the VRC circuits. Information that should force a VRC is presented to the various checking circuits, and an error typeout, including the routine number, occurs if the proper check light is not turned on. Since the circuits involved in each routine are known,the error typeouts indicate those circuits that are not performing properly. Several typeouts may indicate that only a certain bit configuration does not force a VRC; thus further isolating the defective component(s).

B. SETUP:

CHECK SWITCH Settings:

1. DATA CHECK - PROGRAM
2. OVERFLOW CHECK - PROGRAM
* 3. CE SW 9 - BYPASS (CE REMOTE START MUST BE USED)

CONSOLE SENSE SWITCH Settings:

These four switches should be set as desired. SUGGESTED SETTING- ALL OFF. These switches have the following functions:

SWITCH #1	ON	Bypass error typeout
	OFF	Type out routine number on error
SWITCH #2	ON	Loop in routine
	OFF	Continue to next routine
SWITCH #3	ON	Stop on error
	OFF	Bypass HALT in error routine
SWITCH #4		NOT USED

NORMAL LOAD FROM TAPE READER

1. Set CHECK and CONSOLE SENSE SWITCHES as SUGGESTED.
2. Load paper tape into reader with REEL mode selected and READY reader.
3. Perform the following operations at the 1620 console:

* On A suffix machines set mar check SW to Program - there is no CE SW 9.

NORMAL LOAD FROM CARD I/O:

1. Set check and console sense switches as suggested.
2. Reset 1620.
3. Add two blank cards behind the last card in deck. Place the card deck in the read hopper and depress the load key.

These constants for MAR check of memory capacity are automatically inserted by the program.

1. For 20 K 23456789≠
2. For 40 K 456789≠
3. For 60 K 6789≠
4. For machines with 1311. 6789 +

RESET

INSERT

KEY IN the instructions

36000 00300

RELEASE

START

FOLLOW TYPED INSTRUCTIONS

PRODUCE NEW TAPE

1. Load MASTER TAPE into reader with reader in REEL mode and ready reader.

2. Set check switches to PROGRAM.

3. Perform the following operations at the console:

INSERT: 31 00016 00012
00 00

RELEASE

START

INSTANT STOP (After Memory is cleared)

```
INSERT: 36 13000 00300
        35 13000 00200
        37 01001 00300
        39 01001 00200
        49 00024
R - S
```

C. TEST METHOD

The information in the tape is first loaded into memory. After all instructions are loaded, the program branches to the first instruction (memory location 00828) of the first routine which types out the setting of the console switches, the instruction to set the switches as desired and then halts. Following the typed out instructions, depression of START causes the machine to branch to 04548. Further instructions are typed out. Constants used in the routine that tests the ability of MAR to detect a too large address must be keyed in, followed by a record mark.

Depressing RELEASE terminates the read instructions, and START initiates a branch operation that will send the program to routine 002 after typing out that the routines have been started.

Routine 002 resets all VRC circuits (RC, WC, MBR E, MBR O, MAR) and then checks that any latch is off.

1620 DIAGNOSTICS

CY02 ERROR CHECKS

Routine 003 forces a MBR-E VRC by calling for a read alpha to an even position of memory. On a properly programmed read alpha operation the zone portion of the character is read into MBR-E and the numeric portion is read into MDR. If the read alpha operation is addressed to an even portion, both the zone and the numeric portion are read into MBR-E and nothing is read into MBR-O.

The ten characters used to force the MBR-E VRC are:)A+-/ B K Q Y 8. The bit configurations resulting from the read alpha to an even memory address and the respective addresses are as follows:

Address	Bit Configuration
01272	C and 4
01274	1 and 4
01276	C and 1
01278	C and 2
01280	1 and 2
01282	2 and 4
01284	C, 1, 2, and 4
01286	C, 1, 4, and 8
01288	C, 2, 4, and 8
01290	1, 2, 4, and 8

Routine 004 checks that these ten bit configurations will force a MBR-O VRC. An instruction to transmit the specific digit to an odd memory position is used to force the VRC. The odd memory positions to which these "digits" are sent are 01665, 01667, 01669, 01671, 01673, 01675, 01677, 01679, 01681, 01683.

Routine 005 uses eight of these bit configurations to check that they will force a WC VRC. The other two configurations are not used; as any configuration that contains bits 2-8 will cause the typewriter to hang up on a write numeric operation. The last two configurations are not used.

Routine 006 checks that a record mark will force a MAR VRC. This is checked for all five positions of MAR.

Routine 007 checks that a MAR VRC is forced by the invalid bit configuration generated by the read alpha operation. These bit configurations are checked in the low order position of MAR, then in the tens position of MAR, and on up until they have checked the ten thousand position of MAR.

Note: An Error Typeout for routine 007 will be as follows:

H007 $\overline{0}$291x$\overline{y}$y

where "x" = 5 indicates the error occurred in the units position of the address
= 4 indicates the error occurred in the tens position of the address
= 3 indicates the error occurred in the hundreds position of the address
= 2 indicates the error occurred in the thousands position of the address
= 1 indicates the error occurred in the ten thousands position of the address

and 012yy is the address of the invalid character which caused the error (see routine 003 description).

1620 DIAGNOSTICS

CU02 ERROR CHECKS

Routine 008-011 check that ANY latch is turned on by an MBR-E, MBR-O, and WC VRC.

Routine 012 checks that an address sent to MAR that is larger than the memory capacity of the machine will force a MAR VRC. The constants used for this test must be keyed in at the beginning of this test

Routine 013 is the routine that repeats the above routines twenty times before proceeding to the next routine.

Loader - The loader used in the object decks of this test is of a simplex type which uses just a read and branch. (Tapes are loaded completely with a single instruction) there are two types of cards in the object deck, Loader cards and data cards. The cards alternate through the whole deck. The data cards consist of 75 columns of data and 5 columns for a sequence number. The loader card is set up as follows:

```
Columns 1-12   36 xxxxx 00500
Columns 13-24  36 00000 00500
Columns 25-36  49 00000 00000
Columns 37-48  39 00051 00100
Columns 49-75  48 42007 47900464149534544O≠0
                  I B 49 failed in numeric 1
Columns 76-80  Sequence number
```

The first instruction reads a data card into core storage. The second instruction reads a new load card over the one already in core. The next instruction (which is from the load card just read) branches back to start the cycle all over again. If the branch to 00000 fails, B 49 failed is typed out.

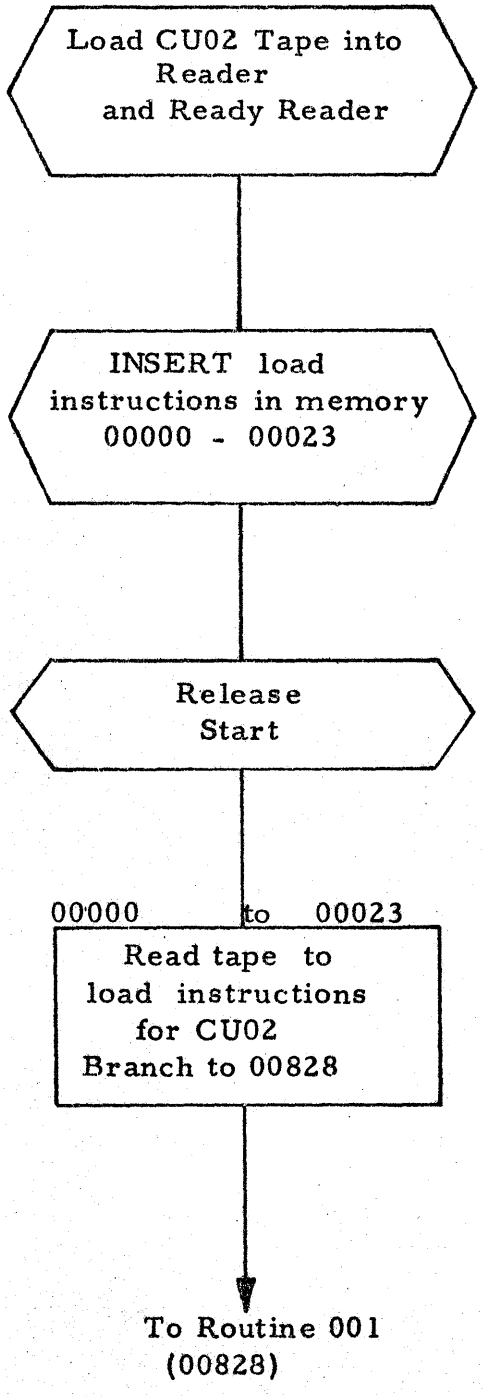
The last load card has a branch to the start of the program in place of the second read instruction.

Routine 014 checks that an invalid character in the tape will force a RC VRC and that this will turn on ANY LATCH.

The complete normal typeout information will be as follows:
(NOTE: The numeric constants keyed in will be determined by the storage capacity of the machine.)

```
SW 1 OFF SW 2 OFF SW 3 OFF SW 4 OFF SET SWS FOR CU02.
 THEN START.  KEY IN CONSTS FOR MAR ADDRESS TEST.  RELE
ASE, START.
23456789≠
START ROUTINES.  ETOS FOLLOW.
-4512367≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4-
-4512367≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4-
-4512367≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4451236 7≠4-
-4512367≠4451236 7≠4-
END OF TEST.  CHECK ERROR TYPEOUTS.  IF SW 1 OFF AND NO
TYPEOUTS, VRC CIRCUITS FUNCTIONING PROPERLY.
```

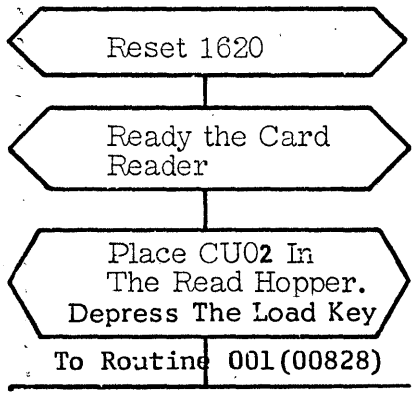
1620 DIAGNOSTICS
CU02
FLOW CHART

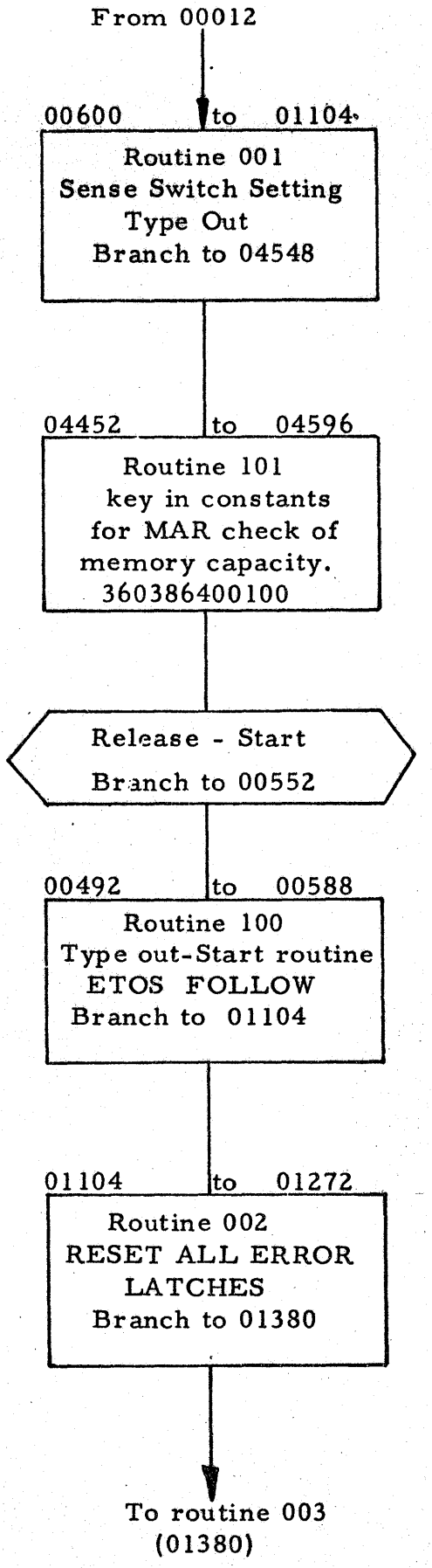


LOAD INSTRUCTIONS ARE:
360009600300
490082800000

CU02 FLOW CHART

WITH 1622 I/O





This routine will indicate whether BI and/or BNI codes are working properly. The 1620 will Halt with 01091 in MAR.

The machine will stop calling for a read from the keyboard. For:

1.) 20K memory - key in 23456789≠
2.) 40K memory - key in 456789≠
3.) 60K memory - key in 6789≠

From Routine 002
(01260)

01272 to 01596

Routine 003
Generate Invalid parity characters by read alpha to even position of memory.
Forces MBR-E VRC
Branch to 01764

Ten invalid characters are generated from the following legitimate characters) A/-/BKQY8. Invalid characters read into memory locations 01272, 01274, 01276, 01278, 01280, 01282, 01284, 01286, 01288, 01290.

01596 to 02136

From times 20 Repeat Routine NO O'FLOW. (04188)

Routine 004
Force MBR-O VRC.
Transfer invalid char. generated in Routine 3 to an odd memory position
Branch to 02208

Odd memory positions are 01665, 01667, 01669, 01671, 01673, 01675, 01677, 01679, 01681, 01683. Invalid characters are:

C	1	C	C	1	2	C	C	C	1
4	4	1	2	2	4	1	1	2	2
						2	4	4	4
						4	8	8	8

02136 to 02412

Routine 005
Force WC VRC
write numeric on typewriter
Branch to 02488

Invalid characters read from memory positions 01665, 01667, 01669, 01671, 01673, 01675, 01677, 01679. Note: A RM bit configuration (2-8) will cause the typewriter to hang up on a WN operation; therefore, characters in 01681 and 01683 are not sent to the typewriter. Type out will be ~~4512367)(~~

02412 to 02700

Routine 006
Force MAR VRC with RM. Check all positions of MAR
Branch to 02796

One position of OR-1 contains RM, others are ones.

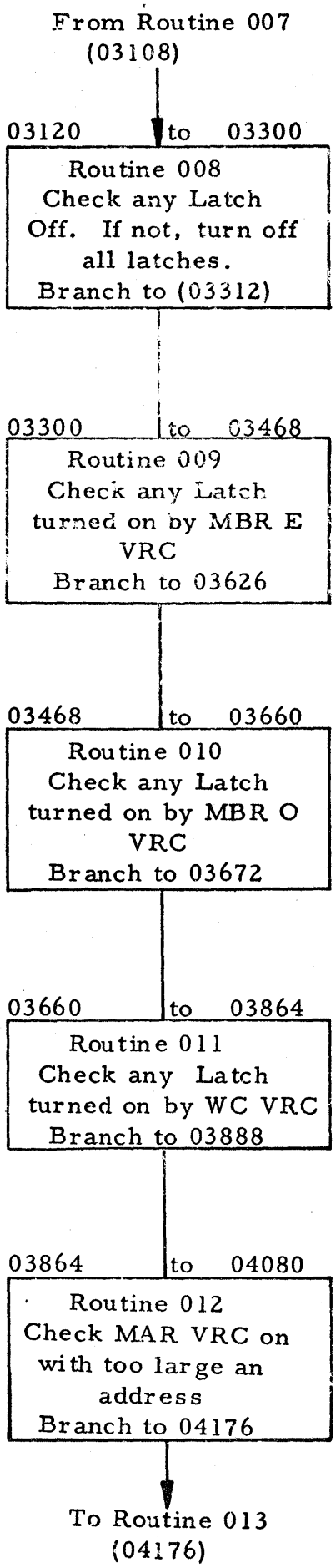
02700 to 03120

Routine 007
Force MAR VRC with invalid parity character.
Branch to 03120

Invalid parity characters force a MAR VRC before proceeding to check of next high order position of MAR. Invalid characters taken from 01276, 01278, 01280, 01282, 01284, 01286, 01288 01290.

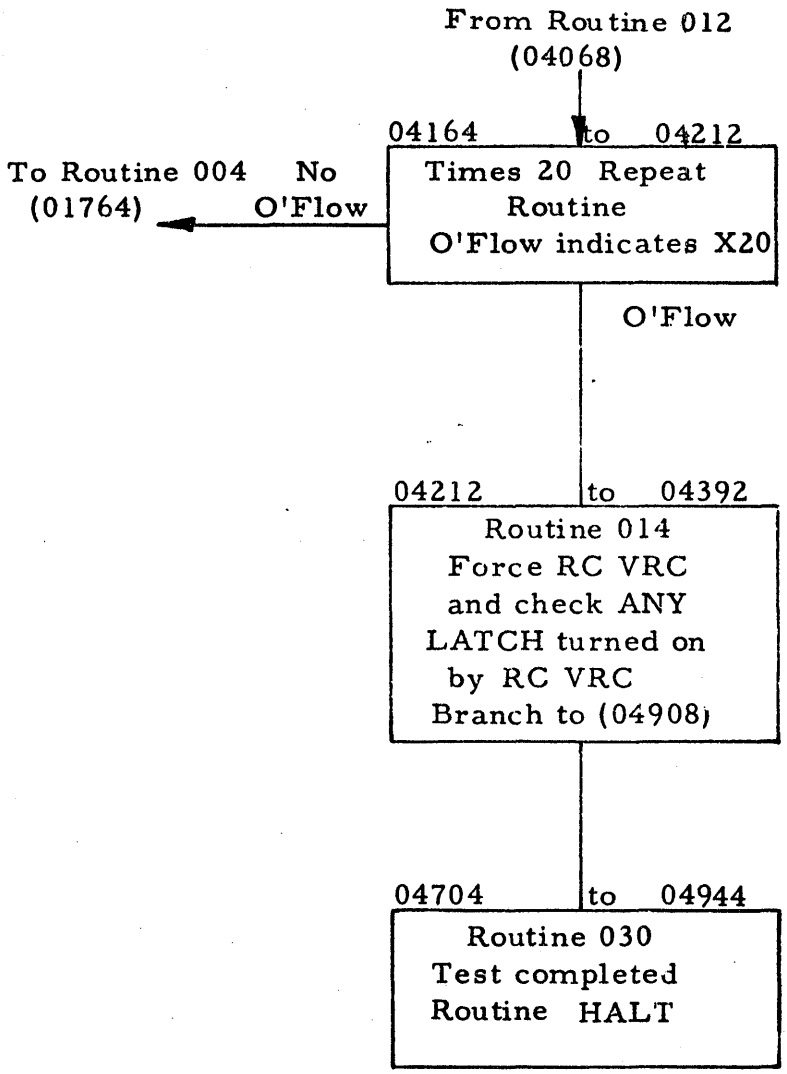
To Routine 008
(03120)

PN 2128303
EC 404675



This routine will cause an invalid character (4) to be typed.

For this routine to be performed correctly, constants must have been keyed in at beginning of test.



Invalid character in paper tape is Bit combination 2C.

This routine is bypassed with card I/O

1620 DIAGNOSTICS CUO2

MEM LOC	00PPPPPQQQQQ 0123456789 01	OP TYP	DESCRIPTION
96	000 00000	X	
108	00 00102 03040	X	
120	00 20406 08000	X	
132	30 60902 10040	X	
144	80 21610 05001	X	
156	51 02006 02181	X	
168	42 00704 11282	X	
180	00 80614 22300	X	
192	90 81726 30000	X	
204	00 00005 06070	X	
216	80 90012 14161	X	
228	81 51811 24272	X	
240	02 42822 36352	X	
252	03 53045 40363	X	
264	24 84455 32494	X	
276	65 36048 46546	X	
288	27 54453 62718	X	
300	01 23456 78912	X	
312	34 56789 02345	X	
324	67 89 0 1 3 45678	X	
336	9 0 1 2 456 7890 1	X	
348	2 3 56789 0 1 2 3 4	X	
360	67 89 0 1 2 3 4 5 78	X	
372	9 0 1 2 3 4 5 6 890 1	X	
384	2 3 4 5 6 7 9 0 1 2 3 4	X	
396	5 6 7 8 7 0 4 36456	X	Name
408	72 07000 0	X	Core locations needed
416	45 00828 18117	BNR	Compatible Dipal Linkage
428	49 06000 00000	B	Dipal
440	450082818117	BNR	Linkage
452	260495518111	TF	
464	490082800000	B	
492	62 63415 963	X	START
504	59 56646 34955	X	ROUTIN
516	45 6203 4563	X	ES. ET
528	56 62 4 65653	X	OS FOL
540	53 56660 3 0	X	LOW.
552	34 00102	K	CARRIAGE RETURN
564	39 00493 00100	WA	START ROUTINES. ETOS FOLLOW
576	49 01104	B	
588		X	

ROUTINE 001
SWITCH SETUP ROUTINE

```
600   62 66  7 1  56    X    TYPEOUT DATA
612   55   0⁄6 266      X    TYPEOUT DATA
624   71   564 646      X    TYPEOUT DATA
636   0⁄ 6266   72      X    TYPEOUT DATA
648   56 55  0 ⁄6266    X    TYPEOUT DATA
660      72  5 64646    X    TYPEOUT DATA
672      0⁄626 6  73    X    TYPEOUT DATA
684      5655   0⁄62    X    TYPEOUT DATA
696   66   73   5646    X    TYPEOUT DATA
708   46   0⁄6 266      X    TYPEOUT DATA
720   74   565 5  0⁄    X    TYPEOUT DATA
732   62 66  7 4  56    X    TYPEOUT DATA
744   46 46  0 ⁄6245    X    TYPEOUT DATA
756   63   626 662      X    TYPEOUT DATA
768   46 5659     43    X    TYPEOUT DATA
780   64 70720 3        X    TYPEOUT DATA
792      63484 555      X    TYPEOUT DATA
804   62 63415 96303    X    TYPEOUT DATA
816   00 0⁄             X    TYPEOUT DATA
828   46 00852 00100    BI   CHECK FOR SW 1 ON
840   47 00876 00100    BNI  CHECK FOR SW 1 OFF
852   39 00601 00100    WA   SW 1 ON
864   49 00888          B
876   39 00619 00100    WA   SW 1 OFF
888   46 00912 00200    BI   CHECK FOR SW 2 ON
900   47 00936 00200    BNI  CHECK FOR SW 2 OFF
912   39 00639 00100    WA   SW 2 ON
924   49 00948          B
936   39 00657 00100    WA   SW 2 OFF
948   46 00972 00300    BI   CHECK FOR SW 3 ON
960   47 00996 00300    BNI  CHECK FOR SW 3 OFF
972   39 00677 00100    WA   SW 3 ON
984   49 01008          B
996   39 00695 00100    WA   SW 3 OFF
1008  46 01032 00400    BI   CHECK FOR SW 4 ON
1020  47 01056 00400    BNI  CHECK FOR SW 4 OFF
1032  39 00715 00100    WA   SW 4 ON
1044  49 01068          B
1056  39 00733 00100    WA   SW 4 OFF
1068  39 00753 00100    WA   SET SWS FOR CUO2 THEN START
1080  *48              H     * Set to 49 00552 If running under
1092  49 05214          B      Dipal control
```

ROUTINE 002
RESET ALL CHECK CIRCUITS

1104	46 01116 00600	BI	RESET READ CHECK
1116	46 01128 00700	BI	RESET WRITE CHECK
1128	46 01140 00800	BI	RESET MAR CHECK
1140	46 01152 01600	BI	RESET MBR EVEN CHECK
1152	46 01164 01700	BI	RESET MBR ODD CHECK
1164	46 01270 01900	BI	CHECK ANY LATCH FOR OFF
1176	46 01200 00800	BI	CHECK RESET OF MAR CHECK
1188	49 01248	B	
			ERROR ROUTINE
1200	46 01224 00100	BI	
1212	38 01237 00100	WA	
1224	47 01248 00300	BNI	
1236	48 70707 2 0≠	H	
1248	46 01104 00200	BI	
1260	49 01380 *	B	For card I/O this inst. is 49 01452 (Page 13A)

* Paper tape dipal modified to 01440

ROUTINE 003
CHECK MBR EVEN VRC
FOR CARD I/O SEE PAGE 13A

1272		X	WORKING AREA
1284		X	WORKING AREA
1296	0≠ 01 272 ≠	X	WORKING AREA AND CONSTANTS
1308	72 74767 88082	X	CONSTANTS
1320	84 86889 00≠	X	CONSTANTS
1332		X	CONSTANTS AND WORKING AREA
1344		X	WORKING AREA
1356		X	WORKING AREA
1368		X	WORKING AREA
1380	31 01346 01308	TR	TRANS ADDRESS CONSTANTS
1392	26 01305 01347	TF	TRANS ADDRESS CONST TO ADDRESS
1404	31 01344 01346	TR	LOOP ADDRESS CONSTANTS
1416	26 01446 01305	TF	GENERATE P FIELD OF RA
1428	26 01444 01303	TF	GENERATE P FIELD OF R A
1440	37 00300(1)	RA	GENERATE INVALID CHARACTER

(1) Modified by dipal to 4906198 paper tape.

ROUTINE 003
CHECK MBR EVEN VRC FOR CARD I/O.
FOR PAPER TAPE I/O, SEE PAGE 13

```
01272                          X
01284                          X
01296                          X
01308                          X
01332                          X
01344                          X
01356                          X
01368                          X
01380                          X
01392                          X
01404                          X
01416                          X
01428                          X
01440                          X
01452    37 01272 00500        RA  *    GENERATE INVALID CHARACTERS
01464    47 01500 01600        BNI      CHECK MBR EVEN ON
01476    47 01536 01700        BNI      CHECK MBR ODD ON
01488    49 01764              B

                               ERROR ROUTINE
01500    46 01524 00100        BI
01512    39 01593 00100        WA
01524    49 01476              B
01536    46 01560 00100        BI
01548    39 01573 00100        WA
01560    47 01584 00300        BNI
01572    48 70707 4  0≠        H
01584    49 01764              B
```

* NOTE: This instruction is set to 49 06168 00000 by the loading linkage if loaded on the 1311 by the Dipal Monitor. This branches to a routine which reads invalid characters from the 1311. The routine is entered via this branch instruction when being run by the Dipal Monitor. The routine then entered will set the branch instruction to 36 05080 00702 which reads the bad record from the 1311.

```
1452    47 01500 01600 *  BNI    CHECK MBR EVEN
1464    46 01476 01700    BI     TURN OFF MBR ODD
1476    45 01392 01347(2) BNR    CHECK FOR LAST ADDRESS
1488    49 01572 01764 *  B      PAPER TAPE
1500                      X
                                 ERROR ROUTINE
1512    46 01548 00100    BI
1524    39 01561 00100    WA
1536    38 01301 00100    WN
1548    47 01572 00300    BNI
1560    48 70707 3  0≠    H
1572    49 01764          B
1584                      X
```

* Modified by Dipal to 36 05080 00702

(2) Paper Tape modified to a NOP (41)

ROUTINE 004
CHECK MBR ODD VRC

```
1596    72 747677 888082  X      CONSTANTS
1608    84 868899 00≠     X      CONSTANTS
1620          0 1272≠     X      CONSTANTS
1632                      X      WORKING AREA
1644                      X      WORKING AREA
1656                   ≠  X      WORKING AREA
1668    ≠  ≠ ≠ ≠  ≠ ≠     X      WORKING AREA
1680    ≠  ≠ ≠ ≠  ≠ ≠0    X      WORKING AREA
1692    16 65 ≠6 567769   X      CONSTANTS
1704    71 737577 779781  X      CONSTANTS
1716    83 0≠             X      CONSTANTS AND WORKING AREA
1728                      X      WORKING AREA
1740                      X      WORKING AREA
1752                      X      WORKING AREA
1764    31 01634 01596    TR     TRANS ADDRESS CONSTANTS
1776    31 01728 01698    TR     TRANS ADDRESS CONSTANTS P FIELD
1788    26 01630 01635    TF     TRANS ADDRESS CONST TO ADDRESS
1800    26 01895 01630    TF     GENERATE Q FIELD OF TD
1812    26 01893 01628    TF     GENERATE Q FIELD OF TD
1824    31 01632 01634    TR     LOOP ADDRESS CONSTANTS
1836    26 01695 01729    TF     TRANS ADDRESS CONST TO ADDRESS
1848    26 01890 01695    TF     GENERATE P FIELD OF TD
1860    26 01888 01693    TF     GENERATE P FIELD OF TD
1872    31 01726 01728    TR     LOOP ADDRESS CONSTANTS
1884    25                TD     SEND INVALID CHAR TO ODD POS
```

```
1896    47 01980 01700    BNI     CHECK MBR ODD VRC
1908    47 02052 01600    BNI     CHECK MBR EVEN
1920    45 01788 01729    BNR     CHECK FOR LAST ADDRESS
1932    49 02112          B
1944                      X
1956                      X
1968                      X
                                  MBR ODD ERROR ROUTINE
1980    46 02016 00100    BI
1992    39 02029 00100    WA
2004    38 01691 00100    WN
2016    47 02040 00300    BNI
2028    48 70707 4  0≠    H
2040    49 01908          B
                                  MBR EVEN ERROR ROUTINE
2052    46 02088 00100    BI
2064    39 02101 00100    WA
2076    38 01691 00100    WN
2088    47 02112 00300    BNI
2100    48 75707 4  0≠    H
2112    46 01764 00200    BI
2124    49 02208          B
```

ROUTINE 005
CHECK WRITE CHECK VRC

```
2136    01 665 ≠  6567    X       CONSTANTS
2148    69 7137 5779      X       CONSTANTS
2160    0≠                X       CONSTANTS
2172                      X       WORKING AREA
2184                      X       WORKING AREA
2196                      X       WORKING AREA
2208    31 02174 02144    TR      TRANS ADDRESS CONSTANTS
2220    26 02140 02175    TF      TRANS ADDRESS CONST TO ADDRESS
2232    31 02172 02174    TR      LOOP ADDRESS CONSTANTS
2244    26 02274 02140    TF      GENERATE P FIELD OF WN
2256    26 02272 02138    TF      GENERATE P FIELD OF WN
2268    38       00100    WN      TYPE OUT INVALID CHAR
2280    47 02328 00700    BNI     CHECK WRITE CHECK VRC
2292    45 02220 02175    BNR     CHECK FOR LAST ADDRESS
2304    49 02388          B
2316                      X
```

ERROR ROUTINE

```
2328    46 02364 00100    BI
2340    39 02377 00100    WA
2352    38 02136 00100    WN
2364    47 02388 00300    BNI
2376    48 70707 5  0≠    H
2388    46 02208 00200    BI
2400    49 02448     7̄    B
```

ROUTINE 006
CHECK MAR FOR VRC ON RM

```
2412    1̄1 11198 765≠     X      CONSTANTS AND WORKING AREA
2424                       X      WORKING AREA
2436                       X
2448    31 02424 02417     TR     SET UP MAR ADDRESS CONSTANTS
2460    25 02502 02424     TD     SET MAR CONSTANT IN MAR ADDRESS
2472    31 02423 02424     TR     SHIFT MAR CONSTANTS
2484    26 02519 02416     TF     RESET MAR ADDRESS WITH 1̄1111
2496    15 0251  ≠   ≠     TDM    SET RM IN MAR ADDRESS
2508    25 02435           TD     FORCE MAR VRC WITH RM
2520    47 02592 00800     BNI    CHECK FOR MAR VRC
2532    45 02460 02424     BNR    CHECK FOR LAST MAR POSITION
2544    49 02676           B
2556                       X
2568                       X
2580                       X
```

ERROR ROUTINE

```
2592    46 02640 00100    BI
2604    39 02653 00100    WA
2616    38 02498 00100    WN
2628    34       00101    K
2640    47 02676 00300    BNI
2652    48 70707 6  0≠    H
2664    49 02460          B
2676    46 02448 00200    BI
2688    49 02748          B
```

ROUTINE 007

CHECK FOR MAR VRC WITH INVALID CHARS

2700	76	78808	89082	X	CONSTANTS AND WORKING AREA
2712	84	72740	≠	X	CONSTANTS AND WORKING AREA
2724				X	WORKING AREA
2736				X	WORKING AREA
2748	45	02772	03870	BNR	TEST FOR 40K MEMORY
2760	16	02711	0000≠	TFM	ADJUST CONSTANTS FOR 40K MEMORY
2772	45	02796	03872	BNR	TEST FOR 20K MEMORY
2784	16	02715	0000≠	TFM	ADJUST CONSTANTS FOR 20K MEMORY
2796	16	02747	02915	TFM	SET UP CONSTS FOR MAR VRC POSITION
2808	31	02720	02700	TR	SET INVALID CHARACTER CONSTANT
2820	26	02903	02721	TF	GENERATE INVALID CHARACTER ADDRESS
2832	31	02720	02722	TR	SHIFT INVALID CHARACTER CONSTANT
2844	26	02898	02747	TF	SET UP ADDRESS WHERE TO SEND VRC
2856	26	03090	02747	TF	SET UP ADDRESS IN ERROR TYPEOUT
2868	26	03092	02903	TF	SET UP ADDRESS IN ERROR TYPEOUT
2880	16	02915	11111	TFM	SET 11111 IN Q OF FORCE MAR INSTRUCTION
2892	25		012	TD	SEND INVALID CHARACTER TO Q OF FORCE MAR INST
2904	25	02741		TD	FORCE MAR VRC
2916	46	02928	01600	BI	TURN OFF MBR EVEN
2928	46	02940	01700	BI	TURN OFF MBR ODD
2940	47	03024	00800	BNI	CHECK FOR MAR VRC
2952	45	02820	02721	BNR	CHECK FOR LAST CHARACTER
2964	14	02747	02911	CM	CHECK FOR LAST POSITION OF MAR
2976	46	03096	01200	BI	CHECK FOR E/Z
2988	12	02747	00001	SM	SUBTRACT ONE FROM MAR POSITION CONSTANT
3000	49	02808		B	START CHECK OF NEXT POSITION OF MAR
3012				X	ERROR ROUTINE
3024	46	03060	00100	BI	
3036	39	03073	00100	WA	
3048	38	03086	00100	WN	
3060	47	02952	00300	BNI	
3072	48	70707	7 0≠	H	
3084	41		≠	NOP	
3096	46	02796	00200	BI	
3108	49	03120		B	

ROUTINE 008
RESET ALL LATCHES

```
3120    47 03276 01900    BNI    CHECK ANY LATCH
3132    46 03144 00600    BI     RESET READ CHECK
3144    46 03156 00700    BI     RESET WRITE CHECK
3156    46 03168 01600    BI     RESET MBR EVEN CHECK
3168    46 03180 01700    BI     RESET MBR ODD CHECK
3180    46 03228 01900    BI     CHECK ANY LATCH FOR OFF
3192    49 03276          B
3204                      X
3216                      X
                          ERROR ROUTINE
3228    46 03252 00100    BI
3240    39 03265 00100    WA
3252    47 03276 00300    BNI
3264    48 70707 8  0≠    H
3276    46 03120 00200    BI
3288    49 03312          B
```

ROUTINE 009
CHECK ANY LATCH ON BY MBR EVEN

```
3300                      X      WORKING AREA
3312    25 03302 01272    TD     FORCE MBR E VRC
3324    46 03336 01700    BI     TURN OFF MBR ODD
3336    47 03396 01900    BNI    CHECK ANY LATCH
3348    46 03360 01600    BI     TURN OFF MBR E
3360    47 03384 01900    BNI    CHECK ANY LATCH
3372    48 03372          H      HALT
3384    49 03444          B
                          ERROR ROUTINE
3396    46 03420 00100    BI
3408    39 03433 00100    WA
3420    47 03444 00300    BNI
3432    48 70707 9  0≠    H
3444    46 03312 00200    BI
3456    49 03480          B
```

ROUTINE 010
CHECK ANY LATCH ON BY MBR ODD VRC

```
3468                          X
3480   25 03305 03302         TD     TRANS INVALID CHAR TO ODD POS
3492   46 03492 01600         BI     TURN OFF MBR EVEN VRC
3504   47 03588 01900         BNI    CHECK ANY LATCH
3516   46 03528 01700         BI     TURN OFF MBR ODD
3528   46 03588 01900         BI     CHECK ANY LATCH
3540   49 03636               B      HALT
3552                          X
                              ERROR ROUTINE
3564                          X
3576                          X
3588   46 03612 00100         BI
3600   39 03625 00100         WA
3612   47 03636 00300         BNI
3624   48 70717 0  0≠         H
3636   46 03480 00200         BI
3648   49 03672               B
```

ROUTINE 011
CHECK ANY LATCH ON BY WC VRC

```
3660                          X      WORKING AREA
3672   38 01665 00100         WA     FORCE WC VRC
3684   46 03696 01600         BI     TURN OFF MBR EVRC
3696   46 03708 01700         BI     TURN OFF MBR VRC
3708   47 03792 01900         BNI    CHECK ANY LATCH ON
3720   46 03732 00700         BI     TURN OFF WC VRC
3732   47 03840 01900         BNI    CHECK ANY LATCH OFF
3744   48 03744               H
3756   49 03840               B
3768                          X
3780                          X
                              ERROR ROUTINE
3792   46 03816 00100         BI
3804   39 03829 00100         WA
3816   47 03840 00300         BNI
3828   48 70717 1  0≠         H
3840   46 03672 00200         BI
3852   49 03888               B
```

ROUTINE 012

CHECK MAR VRC ON TOO LARGE AN ADDRESS

```
3864                                X       WORKING AREA
3876                                X       WORKING AREA
3888    31  03877  03864            TR      SET UP ADDRESS CONSTANTS
3900    31  03876  03877            TR      SHIFT ADDRESS CONSTANTS
3912    25  03931  03876            TD      SET CONST IN HIGH ORDER POS MAR
3924    25  03875   3864            TD      FORCE MAR VRC TOO LARGE ADDRESS
3936    47  03996  00800            BNI     CHECK FOR MAR VRC
3948    45  03900  03877            BNR     CHECK FOR LAST CONSTANT
3960    49  04056                   B
3972                                X
3984                                X
                                            ERROR ROUTINE
3996    46  04032  00100            BI
4008    39  04045  00100            WA
4020    38  03876  00100            WN
4032    47  04056  00300            BNI
4044    48  70717  2  0≠            H
4056    46  03888  00200            BI
4068    49  04104                   B
```

ROUTINE 013

TIMES 20 ROUTINE

```
4080                                X
4092                   00           X       WORKING AREA
4104    11  04103     05           AM      ADD 5 FOR TIMES 20
4116    47  01764  01400           BNI     CHECK FOR OVERFLOW
4128    49  04188                   B       FOR CARD I/O, THIS INSTRUCTION IS
4140                                X       49  04908
4152                                X
4164                                X
4176                                X
```

ROUTINE 014

CHECK ANY LATCH ON BY RC VRC

```
4188    46  04200  01600            BI
4200    46  04212  01700            BI
4212    46  04320  01900            BI
4224    37  04309  00300            RA      READ INVALID CHAR FROM TAPE
4236    46  04248  01600            BI      TURN OFF MBR EVEN
```

```
4248    46 04260 01700    BI      TURN OFF MBR ODD
4260    47 04320 01900    BNI     CHECK ANY LATCH ON
4272    46 04284 00600    BI      TURN OFF RC VRC
4284    46 04320 01900    BI      CHECK ANY LATCH OFF
4296    48 04308          B       BRANCH TO END OF TEST ROUTINE
4308                      X
                                  ERROR ROUTINE
4320    46 04344 00100    BI
4332    39 04357 00100    WA
4344    47 04368 00300    BNI
4356    48 70717 4  0     B
4368    49 04308          B
4380                      X
4392                      X
4404                      X
4416                      X
4428                      X
```

ROUTINE 030

TEST COMPLETE ROUTINE

```
4704    45  5544   5646    X     END OF
4716        63456 26303    X      TEST.
4728        43484 54352    X       CHECK
4740        45595 95659    X       ERROR
4752        63685 74556    X       TYPEO
4764    64  63620 3  49    X     UTS. I
4776    46    626 6  71    X     F SW 1
4788        56464 6  41    X       OFF A
4800    55  44  5 556      X     ND NO
4812    63  68574 55664    X     TYPEOU
4824    63  6223   6559    X     TS, VR
4836    43    434 95943    X     C CIRC
4848    64  49636 2  46    X     UITS F
4860    64  55436 34956    X     UNCTIO
4872    55  49554 7  57    X     NING P
4884    59  56574 55953    X     ROPERL
4896    68  030≠           X     Y.≠
4908    34        00102    K     CARRIAGE RETURN
4920    39  04705 00100    WA    TYPEOUT TEST COMPLETED
4932    48          E      H
                    L
4932    45  0496818117     BNR   MONITOR RUN LINKAGE
4944    16  18111 XXXXX    TFM   REPAIR MONITOR IF NECESSARY
4956    49  18000 00000    B     GO TO MONITOR
4968    48  00000 00000    H     HALT
4980    49  00828 00000    B     RESTART
```

ROUTINE 30A

DETERMINE MEMORY SIZE

```
05200   49  05426 00000    B     GO TO MODIFY ROUTING
05212   53  56565 26200    X     LOOKS
05224   53  49524 50054    X     LIKE M
05236   41  43484 95545    X     ACHIN E
05248   00  48416 20079    X      HAS q
05260   70  00520 05445    X     O K ME
05272   54  56596 80≠23    X     MORY≠23
05284   45  6789   04946   X     456789≠IF
05296   00  71737 17100    X     1311
05308   49  62004 95562    X     IS  INS
05320   63  41535 34544    X     TALLED
05332   00  63685 74500    X      TYPE
05344   68  45620 04946    X     YES IF
05356   00  55566 30063    X      NOT  T
05368   68  57450 05556    X     YPE  NO
05380   00  0≠414 14141    X     ≠AAAA
05392   41  71737 17100    X     A 1311
05404   49  55626 34153    X     INSTALL
05416   53  45550 00≠15    X     LED
05428   00  00000 0016
```

```
05426    15    00000  00000    TDM     SET WORK DIGIT
05438    16    05465  00001    TFM     INITIALIZE
05450    11    05465  00#20    AM      SET UP FOR TEST
05462    31    00999  05458    TR      TEST WRAP AROUND
05474    45    05450  00000    BNR     CHECK IF WRAP AROUND
05486    11    05465  00010    AM      UPDATE FOR TYPE OUT
05498    25    05259  05464    TD      FOR TYPE OUT
05510    34    00000  00102    K       REUTRN CARRIAGE
05522    39    05213  00100    WA      TYPE MEMORY SIZE
05534    34    00000  00102    K       RETURN CARRIAGE
05546    39    05293  00100    WA      IS 1311 INSTALLED
05558    34    00000  00102    K       RETURN CARRIAGE
05570    37    05385  00100    RA      REQUEST
05582    32    05384  00000    SF      ON ANSWER
05594    14    05385  00008    CM      CHECK ANSWER
05606    47    05666  01200    BNI     1311 NOT INSTALLED
05618    34    00000  00102    K       RETURN CARRIAGE
05630    39    05395  00100    WA      1311 INSTALLED
05642    31    03864  05286    TR      SET 6789#
05654    49    05774  00000    B       START
06666    14    05465  00029    CM      20K MACHING
05678    47    05714  01200    BNI     NOT 20K
05690    31    03864  05282    TR      SET 23456789#
05702    49    05774  00000    B       GO TO START
05714    14    05465  00049    CM      40K MACHING
05726    47    05762  01200    BNI     NOT 40K
05738    31    03864  05284    TR      SET 456789#
05750    49    05774  00000    B       GO TO START
05762    31    03864  05286    TR      SET 6789#
05774    45    00552  18117    BNR     DIPAL LINKAGE
05786    26    01086  05804    TF      INITIALIZE
05798    49    00552  00000    B       TO START
05810    52    62005  34952
05822    45    00544  14348
```

ROUTING 31
MODIFY ROUTING
USE ONLY WHEN LOADED
ON 1311 UWDED DIPAL CONTROL

```
06000    26    01451  06155    * SET BRANCH INSTRUCTION
06012    31    05080  19880    SET DISK CONTROL FIELD
06024    11    05085  00182    UP DATE SECTOR ADDRESS
06036    16    05088  00001    SET SECTORT COUNT
06048    37    10000  00500    READ BAR RECORD DATA
06060    16    05093  10000    SET ADDRESS BAD DATA
06072    34    05080  00701    SEEK
06084    38    05080  00702    WRITE BAD RECORD ON 1311
06096    46    06108  01700    TURN OFF MBR-0
06108    46    06120  01600    TURN OFF MBR-E
06120    46    06132  00700    TURN OFF WRITE CK
06132    49    06500  00000    GO TO MONITOR
06144    49    06168  00000    BRANCH FIELD
06156    41    00000  00000    NOP
```

ROUTINE 032

USED BY DIPAL MONITOR WHEN PROGRAM IS RUN UNDER CONTROL OF MONITOR. MODIFICATION ROUTINE

```
06168   34   00000   00102            CARRIAGE RETURN
06180   39   06325   00100            PRINT INSTRUCTIONS
06192   34   00000   00102            CARRIAGE RETURN
06204   39   06373   00100            PRINT INSTRUCTIONS
06216   34   00000   00102            CARRIAGE RETURN
06228   37   01272   00100            KEY IN DATA
06240   46   06228   00400            SW 4 TO DATA ENTERED
06252   26   01463   06419  51   *    SET READ INSTRUCTION
06264   26   01086   06426            SET BRANCH INSTRUCTION
06276   49   01464   00000
06288   41   00000   00000            NOP
06300   41   00000   00000            NOP
06312   41   00000   00000            NOP
06324   52   45680   04955            DATA
06336   00   46565   35356            DATA
06348   66   49554   70044            DATA
06360   41   63410   ‡0000            DATA
06372   04   41102   02142            DATA
06384   52   58687   80‡00            DATA
06396   41   00000   00000            NOP
06408   36   05080   00702            MODIFICATION INSTRUCTION
06420   49   00552   00000            MODIFICATION INSTRUCTION
06432   16   01266   01428*           PAPER TAPE ONLY
06444   15   01477   00001*           PAPER TAPE ONLY
06456   49   18000     *              PAPER TAPE ONLY
```

* PAPER TAPE ONLY

```
 E   E +E -E   E   E
)L  AL  L  L / L  BL X   ALPHA CHARACTERS

 E  E  E  E   E
K  Q  Y  8   2          X  ALPHA CHARACTERS
 L  L  L  LCL
```

```
06500   26   01086   06519
 6512   41   10055   20000
06524   41   00000   00000
06536   49   18000*
```

* PAPER TAPF 06432

80/80 CARD LISTING

```
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```

PN 2128303
EC 404980

```
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