

- 1. IDENTIFICATION
- 1.1 Digital-8-15-U-Sym
- 1.2 Binary-to-Binary-Coded-Decimal Conversion (Four Digit)
- 1.3 June 7, 1965



## 2. ABSTRACT

This subroutine extends the method used in Digital-8-14-U-Sym so that binary integers from 0 to 4095 contained in a single computer word may be converted to four binary-coded-decimal characters packed in two computer words.

## 3. REQUIREMENTS

### 3.1 Storage

This subroutine uses 53 (decimal) storage locations.

### 3.3 Equipment

Standard PDP-8

## 4. USAGE

### 4.2 Calling Sequence

This subroutine is called by the JMS instruction with the binary number to be converted in the accumulator (AC).

This subroutine will return to the location immediately following that containing the calling JMS. The format of the result is discussed in Section 8.2 below.

## 5. RESTRICTIONS (Not Applicable)

## 6. DESCRIPTION

### 6.1 Discussion

This program is essentially Digital-8-14-U-Sym extended to allow for integers in the range of 1000 to 4095.

## 7. METHOD

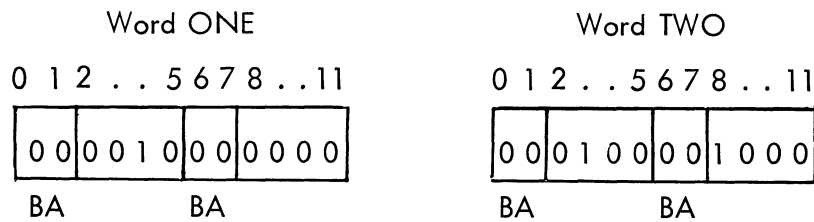
### 7.1 Discussion

See Digital-8-14-U-Sym.

## 8. FORMAT

### 8.2 Core Data

Results appear in core as:



The decimal coding for 2048 is illustrated.

#### 8.4 Miscellaneous

Note that bits 0, 1 and 6, 7 are set so that they may be regarded as zone B and zone A bits required for IBM BCD mode compatible 6-bit numerical characters.

In this mode of recording, the character 1010 is used for zero instead of code 0000 which this subroutine produces. Therefore to use this routine in conjunction with IBM-compatible mag tape recording, it is necessary to write a short auxiliary routine to make this substitution.

It may also be necessary to generate the even parity required by such recording if this is not accomplished in the tape control hardware.

### 9. EXECUTION TIME

#### 9.3 Average

Execution time will vary from 304.5 to 328.5  $\mu$ sec.

### 10. PROGRAM

#### 10.4 Program Listing

```

/BINARY TO BCD CONVERSION 6/7/65
/ENTER WITH BINARY NUMBER IN ACCUMULATOR
/EXIT WITH 4 SIX-BIT BCD CHARACTERS
/PACKED TWO TO A WORD IN REGISTERS
/ONE AND TWO OR IN A BUFFER.
/USED FOR WRITING MAG-TAPE IN BCD FORMAT
/IN ADDITION TO BCD PARITY
/OUTPUT FORMAT:
/      ONE 0-1   A,B BITS
/      ONE 2-5  1000 DECADE
/      ONE 6-7   A,B BITS
/      ONE 8-11  100 DECADE
/      TWO 0-1   A,B BITS
/      TWO 2-5  10 DECADE
/      TWO 6-7   A,B BITS
/      TWO 8-11  1 DECADE
/STORAGE  -53 (10) REGISTERS
/TIME     304.5-328.5 MICRO-SECONDS PDP-8

```

0200	0000	BCD,	0	
0201	3223		DCA INPUT	/STORE BINARY
0202	1225		TAD CONTRL	/SET UP TABLE
0203	3240		DCA POINTR	/POINTER
0204	1226		TAD COUNT1	/SET COUNT
0205	4234		JMS STEP	/CONVERT
0206	7106		CLL RTL	
0207	4234		JMS STEP	/CONVERT NEXT
0210	1232		TAD BITS1	/A,B BIT PATTERNS
0211	3230		DCA ONE	/OR DCA I AUTO (10-17)
0212	1227		TAD COUNT2	/SET-UP COUNT
0213	4234		JMS STEP	
0214	7106		CLL RTL	
0215	7006		RTL	
0216	7006		RTL	
0217	1223		TAD INPUT	/LEAST SIGNIFICANT BITS
0220	1233		TAD BITS2	/A,B BIT PATTERMS
0221	3231		DCA TWO	/OR DCA I AUTO (10-17)
0222	5600		JMP I BCD	/EXIT
0223	0000	INPUT,	0	
0224	0000	NUMBER,	0	
0225	1252	CONTRL,	TAD TABLE	
0226	1010	COUNT1,	1010	
0227	0400	COUNT2,	0400	
0230	0000	ONE,	0	
0231	0000	TWO,	0	
0232	0000	BITS1,	0	/OR ANY BIT PATTERN
0233	0000	BITS2,	0	/OR ANY BIT PATTERN
0234	0000	STEP,	0	/ACTUAL CONVERSION SUBROUTINE
0235	7100		CLL	
0236	3224		DCA NUMBER	
0237	1223		TAD INPUT	
0240	1252	POINTR,	TAD TABLE	/OR TABLE+1, TABLE+2, ETC.
0241	7430		SZL	/ IF C(L)=1; INPUT>-TABLE
0242	3223		DCA INPUT	/IF SO: INPUT=INPUT+TABLE
0243	7200		CLA	
0244	1224		TAD NUMBER	/ROTATES WILL BRING
0245	7004		RAL	/COUNT BIT INTO LINK
0246	2240		ISZ POINTR	
0247	7430		SZL	
0250	5634		JMP I STEP	/STEP DONE
0251	5236		JMP POINTR-2	
0252	0140	TABLE,	-7640	/-4000 (10)
0253	4060		-3720	
0254	6030		-1750	
0255	6340		-1440	
0256	7160		-0620	
0257	7470		-0310	

0260 7634 -0144  
 0261 7660 -0120  
 0262 7730 -0050  
 0263 7754 -0024  
 0264 7766 -0012

/EXAMPLE: INPUT 7777 (8)  
 / OUTPUT: ONE 00 0100/ 00 0000 =4095 (10)  
 / TWO 00 1001/ 00 0101

BCD 0200  
 BITS1 0232  
 BITS2 0233  
 CONTRL 0225  
 COUNT1 0226  
 COUNT2 0227  
 INPUT 0223  
 NUMBER 0224  
 ONE 0230  
 POINTR 0240  
 STEP 0234  
 TABLE 0252  
 TWO 0231

- 11. DIAGRAMS (Not Applicable)
- 12. REFERENCES
- 12.1 Other Library Programs  
 Digital-8-14-U-Sym.