

TU16

UTILITY DRIVER

MD-11-DZTUE-D

EP-DZTUE-D-DL-A

OCT 1976

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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZTUE-D-D

PRODUCT NAME: TUI6 UTILITY DRIVER

DATE CREATED: 21 APRIL 76

MAINTAINER: DIAGNOSTIC ENGINEERING

AUTHOR: R. B. BARNES

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TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 2
DZTUED.P11 16-SEP-76 15:24

:TABLE OF CONTENTS

PARAGRAPH	SUBJECT	PAGE
1	ABSTRACT	1
2	REQUIREMENTS	1
3	LOADING PROCEDURE	1
4	STARTING PROCEDURE	1
5	CONSOLE SWITCHES	1
6	OPERATION	1
7	PROGRAM DESCRIPTION	5
8	LISTING	

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(PAGE 1)

1. ABSTRACT

THIS PROGRAM IS INTENDED AS A BRUTE FORCE ROUTINE TO EXECUTE AN OPERATION OR SERIES OF OPERATIONS, CONTINUOUSLY REGARDLESS OF THE RESULTS OF THE OPERATION. BECAUSE OF THE COMPLEXITY OF THE TU16 MAG TAPE SYSTEM AS OPERATED ON THE MASSBUS, IT IS NOT ALWAYS POSSIBLE TO PROVIDE FOR EVERY CONTINGENCY IN THE NORMAL PROGRAMS. THEREFORE THIS UTILITY DRIVER WILL ALLOW AN OPERATOR TO EXECUTE ANYTHING DESIRED IN ANY ORDER. THERE ARE NO ERROR CHECKS OR PRINTOUTS MADE, AND ANY VARIATION FROM PRESET SEQUENCES AND VALUES ARE MADE BY CHANGING THE APPROPRIATE MEMORY LOCATIONS.

2. REQUIREMENTS

2.1 HARDWARE:

- A. ANY PDP-11 PROCESSOR - WITH OR WITHOUT HARDWARE SWITCH REGISTER.
- B. RH MASSBUS CONTROLLER
- C. TMO2 MAG TAPE CONTROLLER
- D. AT LEAST ONE (1) TU16 SLAVE

2.2 STORAGE:

THIS PROGRAM REQUIRES AT LEAST 3K OF CORE

3. LOADING PROCEDURE:

USE STANDARD BINARY LOADING PROCEDURE

4. STARTING PROCEDURE

THE PROGRAM IS ALWAYS STARTED AT LOCATION 200 (8)

***LOC. 176 (SWREG) IS DEFINED AS THE SOFTWARE SWITCH REGISTER
 (REFER TO SECTION 5 FOR MORE DETAIL)

***IF THE SOFTWARE SWITCH REGISTER IS USED THE DIAGNOSTIC TYPES OUT THE FOLLOWIN
 MESSAGE: SWR=XXXXXX NEW= (REFER TO SECTION 5 FOR OPERATOR OPTIONS)
 AT THE START OF THE PROGRAM.

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5. CONSOLE SWITCH SETTINGS

IF THE DIAGNOSTIC IS RUN ON A CPU WITHOUT A SWITCH REGISTER THEN A SOFTWARE SWITCH REGISTER IS USED WHICH ALLOWS THE USER THE SAME SWITCH OPTIONS AS THE HARDWARE SWITCH REGISTER. IF THE HARDWARE SWITCH REGISTER DOES NOT EXIST OR IF ONE DOES AND IT CONTAINS ALL ONES (177777) THEN THE SOFTWARE SWITCH REGISTER (LOC. 176) IS USED.

CONTROL:

THIS PROGRAM ALSO SUPPORTS THE DYNAMIC LOADING OF THE SOFTWARE SWITCH REGISTER (LOC. 176) FROM THE TTY. THIS CAN BE ACCOMPLISHED BY DOING THE FOLLOWING:

- 1) TYPE CONTROL G (<↑G>); THIS WILL ALLOW THE TTY TO ENTER DATA INTO LOC. 176 AT SELECTED POINTS WITHIN THE PROGRAM.
- 2) THE MACHINE WILL THEN TYPE: SWR=XXXXXXNEW= (XXXXXX IS THE OCTAL CONTENTS OF THE SOFTWARE SWITCH REGISTER.)
- 3) AFTER THE ''NEW='' HAS BEEN TYPED THEN THE OPERATOR CAN DO ONE OF THE FOLLOWING AT THE TTY:
 - A) TYPE A NUMBER TO BE LOADED INTO LOC. 176 FOLLOWED BY A <CR>. (ONLY NUMBERS BETWEEN 0-7 WILL BE ACCEPTED AND ONLY 6 NUMBERS WILL BE ALLOWED)
IF A <CR> IS THE FIRST KEY DEPRESSED THE SOFTWARE SWITCH REGISTER CONTENTS WILL NOT BE CHANGED.
 - B) IF A CONTROL U (<↑U>) IS DEPRESSED THEN THE PROGRAM WILL SEND YOU BACK TO STEP 2.

SW15(100000): 1=STOP AFTER EACH OPERATION
0=PROCEED

SW14(040000): 1=STOP AT THE END OF THE OPERATION SEQUENCE
0=PROCEED

SW13(020000): 1=IGNORE END OF TAPE (EOT)
0=REWIND AT END OF TAPE (EOT)

5.1 HALT
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***TO CHANGE THE CONTENTS OF SWREG TYPE (<↑G>) BEFORE PRESSING CONTINUE AFTER A HA

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(PAGE 2)

6. OPERATION

THE PROGRAM OPERATION IS QUITE SIMPLE, BUT DOES REQUIRE THE OPERATOR TO HAVE KNOWLEDGE OF THE TU16 TAPE SYSTEM AS OPERATED ON THE RH MASSBUS CONTROLLER. THE OPERATOR MUST BE ABLE TO DECIDE WHICH SEQUENCE OF OPERATION IS REQUIRED, AND WHAT VALUES TO ASSIGN TO THE VARIOUS PARAMETERS REQUIRED TO EXECUTE THEM. THE OPERATION SEQUENCE IS SET UP BY LOADING A TABLE WITH THE FUNCTION CODES OF THE DESIRED OPERATIONS AND SETTING THE NUMBER OF OPERATIONS IN A COUNTER. THE PROGRAM IS SET UP TO DO A WRITE OF TEN (8) WORDS OF ALL ONES DATA TO SLAVE ZERO (0) ON DRIVE ZERO (0) IN PE (1600 BPI) WITH A NINE TRACK NORMAL DATA FORMAT. THE DATA ADDRESS IS 3000 (8). THE OPERATION SEQUENCE IS SET TO DO A SINGLE WRITE. IF LOADED AND STARTED AT 200 (8) WITH NO CHANGES MADE AND SWITCH 14 AND 15 SET TO A ZERO (0), THIS OPERATION WILL BE EXECUTED CONTINUOUSLY. THE FOLLOWING IS THE LIST OF PARAMETERS WHICH MAY BE VARIED AND A DESCRIPTION OF EACH ALONG WITH THEIR CORE LOCATION:

PARAMETER	LOCATION	DESCRIPTION
RH ADDRESS	600	ADDRESS OF RH (THE FIRST REGISTER ADDRESS: CS1)
DRIVE NUMBER	700	SET TO SELECT TMO2 NUMBER ADDRESS 0-7
UNIT DESCRIPTION	702	SET SELECTED SLAVE NUMBER (0-7) IN BITS 0,1,2 SELECT PARITY IN BIT 3 (0=ODD 1=EVEN) SELECT DATA FORMAT IN BITS 4,5,6,7 SELECT DENSITY IN BITS 8,9,10
FRAME COUNT	704	SET NUMBER OF FRAMES TO WRITE PER WORD COUNT AND IN TWOS' COMPLIMENT
WORD COUNT	706	SET NUMBER OF WORDS TO BE TRANSFERRED IN TWOS' C
READ ADDRESS	710	SET DESIRED ADDRESS FOR START OF READ BUFFER.
WRITE ADDRESS	712	SET DESIRED ADDRESS FOR START OF WRITE BUFFER.
READY DELAY	714	THIS DELAY VALUE IS USED BY THE PROGRAM TO ESTAB A MAXIMUM TIME TO AWAIT THE COMPLETION OF AN OPE BEFORE PROCEEDING TO THE NEXT. ** (DEFAULT IS APP
READY MULTIPLIER	716	IF THE VALUE SET INTO 714 DOES NOT ALLOW ENOUGH INCREASE THE SIZE OF THE MULTIPLIER. EACH INCRE MULTIPLIER WILL CAUSE THE 714 DELAY TO BE EXECUT THAT MANY MORE TIMES.

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OPERATION DELAY 720

THIS DELAY IS USED TO ALLOW FOR SOME AMOUNT OF TIME BETWEEN THE EXECUTION OF EACH OPERATION. I LOADED AND USED JUST AS IN THE READY DELAY(714) ** (DEFAULT IS APPROX 54 MS FOR PDP-11/20) **

OPER MULTIPLIER 722

THIS IS USED JUST AS THE READY DELAY MULTIPLIER

OPERATION NUMBER 724

THIS IS THE NUMBER OF OPERATIONS TO BE PERFORMED IN A SEQUENCE AND SHOULD REFLECT THE NUMBERS OF OPERATIONS SET INTO THE OPERATION TABLE.

OPERATION TABLE 740-770

THIS TABLE (CONSISTING OF 15 LOCATIONS) IS TO BE LOADED WITH THE FUNCTION CODES FOR EACH OPERATION TO BE PERFORMED IN SEQUENCE. THE NUMBER OF ENTI MAY BE FROM ONE (1) TO FIFTEEN (15). MAKE SURE THE NUMBER OF FUNCTION CODES SET IN THE TABLE IS BY THE NUMBER IN LOCATION 724 (OPNUM)

6.1 FUNCTION CODES

20=READ IN PRESET
02=REWIND-OFF LINE
06=REWIND
10=DRIVE CLEAR
26=WRITE TAPE MARK
24=ERASE
30=SPACE FORWARD
32=SPACE REVERSE
50=WRITE CHECK FORWARD
56=WRITE CHECK REVERSE
60=WRITE FORWARD
70=READ FORWARD
76=READ REVERSE

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TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 8
DZTUED.P11 16-SEP-76 15:24

(PAGE 4)

6.2 DATA FORMATS (BIT 7,6,5,4 OF UNIT DESCRIPTION)

14=NINE TRACK NORMAL: 2 FRAMES PER WORD
15=CORE DUMP: 4 FRAMES PER WORD

6.3 DENSITY (BITS 10,9,8 OF UNIT DESCRIPTION)

4=1600 BPI:PE (PE USES ONLY ODD PARITY)
3=800 BPI:NRZI
2=800 BPI:NRZI
1=556 BPI:NRZI
0=200 BPI:NRZI

6.4 PARITY (BIT 3 OF UNIT DESCRIPTION)

1=EVEN PARITY
0=ODD PARITY

6.5 SLAVE SELECT (BITS 2,1,0 OF UNIT DESCRIPTIONS)

SET TO DEVICE SLAVE ADDRESS (0-7)

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(PAGE 5)

7. PROGRAM DESCRIPTION

IN ORDER TO MAINTAIN THE CONTINUOUS EXECUTION OF
THE OPERATIONS DESCRIBED THE PROGRAM IS ORGANIZED AS
FOLLOWS:

START
INITIALIZE THE RH
SET UP TAPE PARAMETERS (DENSITY, PARITY, FORMAT: WORD COUNT, FRAME COUNT, BUS AD
SELECT DEVICE TO TEST (DRIVE NUMBER, SLAVE NUMBER)
EXECUTE OPERATION (SET FUNCTION AND FROM OP TABLE AND SET GO=1)
AWAIT END OF OPERATION (READY DELAY)
STOP IF SWITCH 15=1
DO OPERATION DELAY (OP DELAY)
STOP IF LAST OPERATION IN SEQUENCE AND SWITCH 14=1
POINT TO NEXT FUNCTION CODE IN OP TABLE
JUMP BACK TO START

7.1 FLOW: START: HOUSEKEEPING
INIT: CLEAR MASSBUS AND TMO2
SET UP: SET UP REQUIRED REGISTERS
EXECUTE: SET FUNCTION AND GO=1
AWAIT END: LOOP ON DRY=1 AS LONG AS ALLOWED BY READY DELAY
STOP: IF SWITCH 15=1
DELAY: PER OP DELAY
END OF RSEQUENCE? IF NOT JUMP TO START
STOP: IF SWITCH 14=1
JUMP TO START RESTART SEQUENCE

7.2 VARIATIONS: THERE ARE TWO VARIATIONS MADE FROM THIS FLOW.
BOTH ARE CAUSED BY A PARTICULAR FUNCTION CODE.
IF A READ REVERSE IS TO BE EXECUTED, THEN THE
BUS ADDRESS IS INCREMENTED BY THE SIZE OF THE
RECORD BECAUSE THE DATA IS LOADED INTO MEMORY
IN REVERSE (I.E: HIGH ADDRESS TO LOW ADDRESS)
THE SECOND VARIATION IS CAUSED BY A SPACE (FORWARD OR REVERSE)
OPERATION AND IT IS THAT THE FRAME COUNTER IS SET TO A -1
SO THAT ONLY ONE (1) RECORD IS SPACED OVER. IF YOU WISH
TO SPACE OVER MORE THAN ONE (1) RECORD, SET LOCATION 1100 (8)
TO THE TWOS' COMPLIMENT OF THE NUMBER OF RECORDS DESIRED.

8. LISTING

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.TITLE TU16 UTILITY DRIVER
:MAINDEC-11-DZTUE-D-D
:15 FEB 75
:R. BARNES
:REVISED APRIL 1976 BY S. CARPENTER
:1) SUPPORTS SOFTWARE SWITCH REGISTER
:2) SUPPORTS THE DYNAMIC LOADING OF THE SOFTWARE SWITCH REGISTER
:ABS

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000046 000046
000046 000170

000176 000176
000176 000000

000200 000200 001110
000200 000167
000600 000600

000600 172440
000602 172442
000604 172444
000606 172446
000610 172450
000612 172452
000614 172454
000616 172456

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;CONSOLE SWITCHES
;SW 15=1(100000) STOP ON EACH OPERATION
;          0 CONTINUE
;SW 14=1(040000) STOP AT END OF SEQUENCE
;          0 CONTINUE
;SW 13=1(020000) IGNORE END OF TAPE (EOT)
;          0 REWIND AT END OF TAPE (EOT)

;REGISTER EQUIVES
R0=%0
R1=%1
R2=%2
R3=%3
R4=%4
R5=%5
SP=%6
PC=%7

.=46
RESTART:      170      ;ALLOW RESTART WHEN <LF> IS PRESSED
                  ;DURING CHANGING OF SWREG IF SOFTWARE SWITCH
                  ;REGISTER IS USED.

;SOFTWARE SWITCH REGISTER*****

.=176
SWREG:  0      ;SOFTWARE SWITCH REGISTER

;*****
;THIS PROGRAM SUPPORTS THE SOFTWARE SWITCH REGISTER LOC.176.
;REFER TO SECTION 5 OF DOCUMENT FOR DESCRIPTION
;*****

;STARTING ADDRESS

.=200
JMP      SETUP
.=600

;TM02 REGISTERS
C1:      172440
WC:      172442
BA:      172444
FC:      172446
CS:      172450
DS:      172452
ER:      172454
AS:      172456
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TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 11
DZTUED.P11 16-SEP-76 15:24

380 000620 172460
381 000622 172462
382 000624 172464
383 000626 172466
384 000630 172470
385 000632 172472

CC: 172460
DB: 172462
MR: 172464
DT: 172466
SN: 172470
C2: 172472

;PROCESSOR ADDRESSES

388
389 000634 177776
390 000636 177570

PSW: 177776
SWR: 177570

;PROCESSOR STATUS
;SWITCH REGISTER

;TTY REGISTERS

393
394 000640 177560
395 000642 177562
396 000644 177564
397 000646 177566

TKS: 177560
TKB: 177562
TPS: 177564
TPB: 177566

;TTY READER STATUS
;TTY READ BUFFER
;TTY PUNCH STATUS
;TTY PUNCH BUFFER

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TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 13
DZTUED.P11 16-SEP-76 15:24

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TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 14
 DZTUED.P11 16-SEP-76 15:24

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455          001000          .=1000
456                                     ;START OF PROGRAM*****
457
458 001000 012706 000500 START: MOV #500,SP
459 001004 012777 000340 177622 MOV #340,SPSW
460
461 001012 016700 177706 MOV OPNUM,R0 ;SET COUNTER
462 001016 012701 000740 MOV #OPTBL,R1 ;SET POINTER
463 001022 012777 000040 177560 A: MOV #40,ACS ;INIT
464 001030 016777 177644 177552 MOV DRVN,ACS ;DRIVE NUMBER
465 001036 016777 177640 177556 MOV UDES,ACS ;UNIT DESCRIPTION
466 001044 016777 177636 177530 MOV WCNT,AWC ;WORD COUNT
467 001052 016777 177626 177526 MOV FCNT,AWC ;FRAME COUNT
468 001060 012102 MOV (R1)+,R2 ;SET OP CODE
469 001062 022702 000030 CMP #30,R2 ;SEE IF SPACE FORWARD
470 001066 001403 BEQ AA ;IF SO: BR
471 001070 022702 000032 CMP #32,R2 ;SEE IF SPACE REVERSE
472 001074 001003 BNE AO ;IF NOT: BR
473 001076 012777 177777 177502 AA: MOV #-1,AWC ;SET TO SPACE ONE RECORD
474 001104 022702 000060 AO: CMP #60,R2 ;SEE IF READ OP
475 001110 103404 BLO A1 ;IF SO: BR
476 001112 016777 177574 177464 MOV WADDR,AWA ;SET WRITE ADDRESS
477 001120 000413 BR A3
478 001122 016777 177562 177454 A1: MOV RADDR,AWA ;SET READ ADDRESS
479 001130 022702 000070 CMP #70,R2 ;SEE IF READ OPERATION
480 001134 001405 BEQ A3 ;IF SO: BR
481 001136 016703 177542 MOV FCNT,R3 ;GET FRAME COUNT
482 001142 005403 NEG R3
483 001144 060377 177434 ADD R3,AWA ;SET BUS ADDRESS FOR READ REVERSE
484 001150 052702 000001 A3: BIS #1,R2 ;SET GO BIT
485 001154 000240 NOP
486 001156 000240 NOP
487 001160 010277 177414 MOV R2,AC1 ;START OPERATION
488 001164 000240 NOP
489 001166 000240 NOP
490 001170 016704 177522 MOV RDYDX,R4 ;SET DELAY MULTIPLIER
491 001174 016703 177514 BO: MOV RDYDLY,R3 ;SET READY DELAY
492 001200 032777 000200 177404 B: BIT #200,ADS
493 001206 001005 BNE C ;IF DRY: BR
494 001210 005303 DEC R3
495 001212 001372 BNE B
496 001214 005304 DEC R4
497 001216 001366 BNE BO ;DELAY FOR DRIVE READY
498 001220 000240 NOP
499 001222 005777 177410 C: TST ASWR ;SEE IF STOP ON OPERATION
500 001226 100001 D BPL D ;IF NOT: BR
501 001230 000000 HALT
502 001232 004767 000302 D: JSR PC,CKSWR ;CHECK FOR CNTL G
503 001236 000240 NOP
504 001240 000240 NOP
505 001242 016704 177454 EO: MOV OPDX,R4 ;SET DELAY MULTIPLIER
506 001246 016703 177446 E: MOV OPDLY,R3 ;SET OPERATION DELAY
507 001252 005303 DEC R3
508 001254 001376 E BNE E
509 001256 005304 DEC R4
510 001260 001372 E: BNE EO ;DELAY BETWEEN OPERATIONS

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511 001262 004767 000152 JSR PC,RWND ;GO SEE IF REWIND
512 001266 005300 DEC RO
513 001270 001254 BNE A ;IF SEQUENCE NOT DONE: BR
514
515 001272 032777 040000 177336 BIT #40000,JSWR ;SEE IF HALT ON SEQUENCE
516 001300 001401 BEQ 1$
517 001302 000000 HALT
518 001304 004767 000230 1$: JSR PC,CKSWR ;CHECK FOR CNTL G
519 001310 000167 177464 JMP START
520
521 ;RH REGISTER SETUP*****
522
523 001314 000240 SETUP: NOP
524 001316 016701 MOV C1,R1 ;GET ADDRESS OF CS1
525 001322 012700 MOV #15,RO ;SET NUMBER OF REGISTERS
526 001326 012702 MOV #WC,R2 ;GET FIRST ADDRESS
527 001332 062701 SETA: ADD #2,R1 ;INCREMENT
528 001336 010122 MOV R1,(R2)+ ;LOAD ADDRESS
529 001340 005300 DEC RO ;SEE IF DONE
530 001342 001373 BNE SETA ;IF NOT: BR
531 001344 012706 MOV #500,SP
532 001350 013746 SUSWR: MOV @#6,-(SP) ;SAVE VECTORS
533 001354 013746 MOV @#4,-(SP)
534 001360 012737 MOV #1$,@#4 ;SET UP FOR TIMEOUT
535 001366 022777 177777 177242 CMP #-1,JSWR ;REFERENCE HARDWARE SWITCH REGISTER
536 001374 001402 BEQ 2$
537 001376 000404 BR 3$
538 001400 022626 1$: CMP (SP)+,(SP)+ ;ADJUST STACK
539 001402 012767 000176 177226 2$: MOV #SWREG,SWR ;POINT TO SOFTWARE SWITCH REG
540 001410 012637 000004 3$: MOV (SP)+,@#4 ;RESTORE VECTORS
541 001414 012637 000006 MOV (SP)+,@#6
542 001420 023727 000636 000176 CMP @#SWR,#SWREG ;IS SOFTWARE REG USED
543 001426 001002 BNE GO ;BRANCH IF NO
544 001430 004767 000156 JSR PC,CNTLU ;ALLOW SOFTWARE SWITCH REGISTER TO BE CHANGED
545 001434 000167 177340 GO: JMP START ;ELSE GO START EXECUTION
546
547 ;REWIND FROM EOT (PER SW13)
548
549 001440 032777 020000 177170 RWND: BIT #20000,JSWR ;SEE IF IGNORE EOT
550 001446 001033 BNE RWNDX ;IF SO: BR
551 001450 032777 002000 177134 BIT #2000,ADS ;SEE IF AT EOT
552 001456 001427 BEQ RWNDX ;IF NOT: BR
553 001460 012777 000040 177122 MOV #40,DCS ;INIT
554 001466 016777 177206 177114 MOV DRVN,DCS ;SET DRIVE NUMBER
555 001474 016777 177202 177130 MOV UDES,DC2 ;SET SLAVE NUMBER
556 001502 012777 000007 177070 MOV #7,DC1 ;START REWIND
557 001510 032777 000200 177074 RWNDA: BIT #200,ADS ;SEE IF DRY
558 001516 001774 BEQ RWNDA ;IF NOT: BR
559 001520 032777 020000 177064 RWNDB: BIT #20000,ADS ;SEE IF PIP RESET
560 001526 001374 BNE RWNDB ;IF NOT: BR
561 001530 005726 TST (SP)+ ;RESET STACK
562 001532 000167 177242 JMP START ;RESTART SEQUENCE
563 001536 000207 RWNDX: RTS PC ;RETURN
564
565 ;CKSWR ROUTINE THAT ALLOWS THE LOADING OF LOC.176, SWREG*****
566 ;FROM THE TTY AT SELECTED POINTS WITHIN THE PROGRAM*****

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TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 16
DZTUED.P11 16-SEP-76 15:24

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567
568 001540 022767 000176 177070 CKSWR: CMP      #SWREG,SWR      ;SOFTWARE SWITCH REG PRESENT
569 001546 001041      BNE      OUT      ;NO GET OUT
570 001550 105777 177064      TSTB     JTKS      ;YES WAIT FOR
571 001554 100036      BPL      OUT      ;READY GET CHARACTER
572 001556 017767 177060 177142      MOV     JTKB,TIB      ;AND STRIP OFF
573 001564 042767 177600 177134      BIC     #177600,TIB      ;THE GARBAGE
574 001572 022767 000007 177126      CMP     #7,TIB      ;IS IT A <1G>
575 001600 001024      BNE      OUT
576 001602 012704 002512      MOV     #SCNTG,R4
577 001606 004767 000242      JSR     PC,TTOUT
578 001612 012704 002516      CNTLU:  MOV     #MSWR,R4
579 001616 004767 000232      JSR     PC,TTOUT
580 001622 017703 177010      MOV     JSWR,R3
581 001626 004767 000354      JSR     PC,OCPE
582 001632 012704 002525      MOV     #SMNEW,R4
583 001636 004767 000212      JSR     PC,TTOUT
584 001642 005037 000736      CLR     J#TEMPST
585 001646 004767 000002      JSR     PC,$READ
586 001652 000207      OUT:      RTS      ;GO READ A LINE
                                           ;RETURN TO MAIN BODY OF PROGRAM
587
588 001654 005067 177056      $READ:  CLR     TEMPST
589 001660 012767 000007 177044      MOV     #7,COUNT
590 001666 004767 000546      1$:    JSR     PC,TTIN
591 001672 042767 177600 177026      BIC     #177600,TIB
592 001700 122767 000025 177020      CMPB    #25,TIB
593 001706 001002      BNE      2$
594 001710 005726      3$:    TST     (SP)+
595 001712 000737      BR CNTLU
596 001714 122767 000015 177004      2$:    CMPB    #15,TIB
597 001722 001013      BNE      4$
598 001724 012767 000200 177002      MOV     #200,RDSW
599 001732 004767 000150      JSR     PC,TCRLF
600 001736 022767 000007 176766      CMP     #7,COUNT
601 001744 001037      BNE      7$
602 001746 005726      8$:    TST     (SP)+
603 001750 000740      BR      OUT
604 001752 122767 000060 176746      4$:    CMPB    #60,TIB
605 001760 003004      BGT     5$
606 001762 122767 000067 176736      CMPB    #67,TIB
607 001770 003005      BGT     6$
608 001772 012704 002535      5$:    MOV     #SQUEST,R4
609 001776 004767 000052      JSR     PC,TTOUT
610 002002 000742      BR      3$
611 002004 006367 176726      6$:    ASL     TEMPST
612 002010 006367 176722      ASL     TEMPST
613 002014 006367 176716      ASL     TEMPST
614 002020 142767 000060 176700      BICB    #60,TIB
615 002026 156767 176674 176702      BICB    TIB,TEMPST
616 002034 005367 176672      DEC     COUNT
617 002040 001754      BEQ     5$
618 002042 000711      BR      1$
619 002044 016777 176666 176564      7$:    MOV     TEMPST,JSWR
620 002052 000735      BR      8$
621
622

```

;START OVER IF NOT LEGAL CHARACTER

;GET NITTY-GRITTY

;ONLY WANT 6 DIGITS

;CHANGE SWITCH REGISTER CONTENTS

623 ;TTY OUTPUT SUBROUTINE*****
624

625	002054	112467	176650		TTOUT:	MOVB	(R4)+,TOB	
626	002060	122767	000043	176642		CMPB	#43,TOB	
627	002066	001446				BEQ	TEX	
628	002070	122767	000045	176632		CMPB	#45,TOB	
629	002076	001403				BEQ	TCRLF	
630	002100	004767	000064			JSR	PC,TOG	
631	002104	000763				BR	TTOUT	
632	002106	112767	000015	176614	TCRLF:	MOVB	#15,TOB	
633	002114	004767	000050			JSR	PC,TOG	
634	002120	012703	000004			MOV	#4,R3	
635	002124	005067	176600		TCRLFA:	CLR	TOB	
636	002130	004767	000034			JSR	PC,TOG	
637	002134	005303				DEC	R3	
638	002136	001372				BNE	TCRLFA	;DO FILLERS
639	002140	112767	000012	176562		MOVB	#12,TOB	
640	002146	004767	000016			JSR	PC,TOG	
641	002152	105767	176556			TSTB	RDSW	
642	002156	100401				BMI	IS	
643	002160	000735				BR	TTOUT	
644	002162	005067	176546		IS:	CLR	RDSW	
645	002166	000406				BR	TEX	
646	002170	105777	176450		TOG:	TSTB	ATPS	
647	002174	100375				BPL	TOG	
648	002176	116777	176526	176442		MOVB	TOB,ATPB	
649	002204	000207			TEX:	RTS	PC	

;OCTAL OUTPUT SUBROUTINE*****

653	002206	012767	000001	000222	OCTPE:	MOV	#1,OFL	
654	002214	010304				MOV	R3,R4	
655	002216	000410				BR	OCTPO	
656	002220	005067	000212		OCTP:	CLR	OFL	;CLEAR FLAG FOR LEADING ZERO
657	002224	010304			OCTPE1:	MOV	R3,R4	;SEE IF NUMBER IS ZERO
658	002226	001004				BNE	OCTPO	;IF NOT ZERO: BR
659	002230	004767	000162			JSR	PC,OCTPG1	;ELSE PRINT ZERO
660	002234	000167	000120			JMP	OCTP3	;SPACE AND EXIT
661	002240	032704	100000		OCTPO:	BIT	#100000,R4	;SEE IF MSD = 1
662	002244	001406				BEQ	OCTP1	;IF NOT: BR
663	002246	012704	000001			MOV	#1,R4	
664	002252	004767	000116			JSR	PC,OCTPG	;PRINT 1
665	002256	000167	000006			JMP	OCTP2	
666	002262	005004			OCTP1:	CLR	R4	
667	002264	004767	000104			JSR	PC,OCTPG	;PRINT 0
668	002270	010304			OCTP2:	MOV	R3,R4	
669	002272	006004				ROR	R4	
670	002274	006004				ROR	R4	
671	002276	006004				ROR	R4	;POSITION DIGIT
672	002300	006004				ROR	R4	
673	002302	000304				SWAB	R4	
674	002304	004767	000064			JSR	PC,OCTPG	;PRINT DIGIT 2
675	002310	010304				MOV	R3,R4	
676	002312	006004				ROR	R4	
677	002314	000304				SWAB	R4	
678	002316	004767	000052			JSR	PC,OCTPG	;PRINT DIGIT 3

E02

TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 18
 DZTUED.P11 16-SEP-76 15:24

679	002322	010304			MOV	R3,R4	
680	002324	006104			ROL	R4	
681	002326	006104			ROL	R4	
682	002330	000304			SWAB	R4	
683	002332	004767	000036		JSR	PC,OCTPG	;PRINT DIGIT 4
684	002336	010304			MOV	R3,R4	
685	002340	006004			ROR	R4	
686	002342	006004			ROR	R4	
687	002344	006004			ROR	R4	
688	002346	004767	000022		JSR	PC,OCTPG	
689	002352	010304			MOV	R3,R4	
690	002354	004767	000014		JSR	PC,OCTPG	;PRINT DIGIT 5
691	002360	012767	000240	176342	MOV	#240,T0B	
692	002366	004767	177576		JSR	PC,T0G	;PRINT SPACE
693	002372	000207			RTS	PC	;EXIT
694	002374	042704	177770		OCTPG:	BIC #177770,R4	
695	002400	001004			BNE	OCTPG0	
696	002402	005767	000030		TST	OFL	
697	002406	001001			BNE	OCTPG0	
698	002410	000207			RTS	PC	
699	002412	005267	000020		OCTPG0:	INC OFL	
700	002416	052704	000260		OCTPG1:	BIS #260,R4	
701	002422	010467	176302		MOV	R4,T0B	
702	002426	004767	177536		JSR	PC,T0G	
703	002432	010304			MOV	R3,R4	
704	002434	000207			RTS	PC	
705	002436	000000			OFL:	0	;FIRST CHAR FLAG
706							
707							
708							;TTY READ SUBROUTINE*****
709	002440	005077	176174		TTIN:	CLR @TKS	
710	002444	005077	176172			CLR @TKB	
711	002450	005067	176252			CLR TIB	
712	002454	005277	176160			INC @TKS	
713	002460	105777	176154		TTIN1:	TSTB @TKS	
714	002464	100375				BPL TTIN1	
715	002466	017767	176150	176232		MOV @TKB,TIB	
716	002474	105777	176144		TTIN2:	TSTB @TPS	
717	002500	100375				BPL TTIN2	
718	002502	116777	176220	176136		MOVB TIB,@TPB	
719	002510	000207			RTS	PC	
720							
721	002512	057045	021507		\$CNTG:	.ASCII /%IG#/ /MSWR= #/	
722	002516	051445	051127	020075	\$MSWR:	.ASCII	
723	002524	043					
724	002525	040	047040	053505	\$MNEW:	.ASCII / NEW= #/	
725	002532	020075	043				
726	002535	077	021445		\$QUEST:	.ASCII /?%#/ .=4000 .REPT 100 0 .ENDR	
727		004000					
728		000100					
729							
730							
731							
732		005000				.=5000 .REPT 100	
733		000100					
734						177777	

F02

TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 19
DZTUED.P11 16-SEP-76 15:24

735
736
737

000001

.ENDR

.END

G02

TU16 UTILITY DRIVER MACY11 27(1006)

16-SEP-76 18:13 PAGE 21
CROSS REFERENCE TABLE -- USER SYMBOLS

A	001022	463#	513						
AA	001076	470	473#						
AS	000616	379#							
AO	001104	472	474#						
A1	001122	475	478#						
A3	001150	477	480	484#					
B	001200	492#	495						
BA	000604	374#	476*	478*	483*				
BO	001174	491#	497						
C	001222	493	499#						
CC	000620	380#							
CKSWR	001540	502	518	568#					
CNTLU	001612	544	578#	595					
COUNT	000732	414#	589#	600	616*				
CS	000610	376#	463*	464*	553*	554*			
C1	000600	372#	487*	524	556*				
C2	000632	385#	465*	555*					
D	001232	500	502#						
DB	000622	381#							
DRVN	000700	401#	464	554					
DS	000612	377#	492	551	557	559			
DT	000626	383#							
E	001252	507#	508						
ER	000614	378#							
EO	001246	506#	510						
FC	000606	375#	467*	473*					
FCNT	000704	403#	467	481					
GO	001434	543	545#						
MR	000624	382#							
OCTP	002220	656#							
OCTPE	002206	581	653#						
OCTPE1	002224	657#							
OCTPG	002374	664	667	674	678	683	688	690	694#
OCTPG0	002412	695	697	699#					
OCTPG1	002416	659	700#						
OCTP0	002240	655	658	661#					
OCTP1	002262	662	666#						
OCTP2	002270	665	668#						
OCTP3	002360	660	691#						
OFL	002436	653*	656*	696	699*	705#			
OPDLY	000720	409#	506						
OPDX	000722	410#	505						
OPNUM	000724	411#	461						
OPTBL	000740	440#	462						
OUT	001652	569	571	575	586#	603			
PSW	000634	389#	459*						
RADDR	000710	405#	478						
RDSW	000734	415#	598*	641	644*				
RDYDLY	000714	407#	491						
RDYDX	000716	408#	490						
RESTAR	000046	346#							
RWNO	001440	511	549#						
RWNOA	001510	557#	558						
RWNOB	001520	559#	560						
RWNOX	001536	550	552	563#					
SETA	001332	527#	530						

H02

TU16 UTILITY DRIVER MACY11 27(1006) 16-SEP-76 18:13 PAGE 22
 DZTUED.P11 16-SEP-76 15:24 CROSS REFERENCE TABLE -- USER SYMBOLS

SETUP	001314	367	523#												
SN	000630	384#													
START	001000	458#	519	545	562										
SUSWR	001350	532#													
SWR	000636	390#	499	515	535	539*	542	549	568	580	619*				
SWREG	000176	354#	539	542	568										
TCRLF	002106	599	629	632#											
TCRLFA	002124	635#	638												
TEMPST	000736	416#	584*	588*	611*	612*	613*	615*	619						
TEX	002204	627	645	649#											
TIB	000726	412#	572*	573*	574	591*	592	596	604	606	614*	615	711*	715*	
		718													
TKB	000642	395#	572	710*	715										
TKS	000640	394#	570	709*	712*	713									
TOB	000730	413#	625*	626	628	632*	635*	639*	648	691*	701*				
TOG	002170	630	633	636	640	646#	647	692	702						
TPB	000646	397#	648*	718*											
TPS	000644	396#	646	716											
TTIN	002440	590	709#												
TTIN1	002460	713#	714												
TTIN2	002474	716#	717												
TTOUT	002054	577	579	583	609	625*	631	643							
UDES	000702	402#	465	555											
WADDR	000712	406#	476												
WC	000602	373#	466*	526											
WCNT	000706	404#	466												
\$CNTG	002512	576	721#												
\$MNEW	002525	582	724#												
\$MSWR	002516	578	722#												
\$QUEST	002535	608	726#												
\$READ	001654	585	588#												
.	= 005200	345#	353#	366#	368#	398#	455#	727#	732#						

. ABS. 005200 000

ERRORS DETECTED: 0
 DEFAULT GLOBALS GENERATED: 0

DZTUED, DZTUED.SEG/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DZTUED.P11
 RUN-TIME: 24.4 SECONDS
 RUN-TIME RATIO: 22/7=2.8
 CORE USED: 6K (11 PAGES)

Spooler runtime 3 Seconds, 16 KCS, 65 disk reads, 4 disk writes, 20 pages

Sho. for Runtime 5 Seconds, RDS, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 8

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