

TM02/TU45

UTILITY DRIVER
CZTUMA0

AH-E482A-MC

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MADE IN USA

.NLIST SEQ,LOC,BIN
.REM_

IDENTIFICATION

PRODUCT CODE: AC-E481A-MC
PRODUCT NAME: CZTUMAO TM02/TU45 UTILITY DRIVER
DATE CREATED: 25 MAY 1978
MAINTAINER: COMPUTER SPECIAL SYSTEMS
AUTHOR: R. B. BARNES/R. J. COLLINS

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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 TU45 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
- B. RH MASSBUS CONTROLLER
- C. TMO2 MAG TAPE CONTROLLER
- D. AT LEAST ONE (1) TU45 SLAVE

2.2 STORAGE:

THIS PROGRAM REQUIRES AT LEAST 1K OF CORE

3. LOADING PROCEDURE:

USE STANDARD BINARY LOADING PROCEDURE

4. STARTING PROCEDURE

THE PROGRAM IS ALWAYS STARTED AT LOCATION 200 (8)

5. CONSOLE SWITCH SETTINGS

IF A CONSOLE SWITCH REGISTER IS NOT PRESENT, THE FOLLOWING PROCEDURE MUST BE IMPLEMENTED:

- A) LOAD ADDRESS 636(8) LABELLED "SWR"
- B) DEPOSIT THE VALUE 176(8)
- C) LOAD ADDRESS 176(8)
- D) DEPOSIT THE DESIRED SWITCH VALUE.

SW15: 1=STOP AFTER EACH OPERATION
0=PROCEED

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

SW13: 1=IGNORE END OF TAPE (EOT)

0=REWIND AT END OF TAPE (EOT)

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6. OPERATION

THE PROGRAM OPERATION IS QUITE SIMPLE, BUT DOES REQUIRE THE OPERATOR TO HAVE KNOWLEDGE OF THE TU45 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 FORMAT IN TWOS' COMPLIMENT
WORD COUNT	706	SET NUMBER OF WORDS TO BE TRANSFERRED IN TWOS' COMPLIMENT
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 ESTABLISH A MAXIMUM TIME TO AWAIT THE COMPLETION OF AN OPERATION BEFORE PROCEEDING TO THE NEXT. ** (DEFAULT IS APPROX 435 MS FOR PDP-11/20) **
READY MULTIPLIER	716	IF THE VALUE SET INTO 714 DOES NOT ALLOW ENOUGH TIME, INCREASE THE SIZE OF THE MULTIPLIER. EACH INCREMENT OF THE MULTIPLIER WILL CAUSE THE 714 DELAY TO BE EXECUTED 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. IT IS 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(716)

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 726-756

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 ENTIRES MAY BE FROM ONE (1) TO FIFTEEN (15). MAKE SURE THAT THE NUMBER OF FUNCTION CODES SET IN THE TABLE IS REFLECTED 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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- 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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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 ADDRESS)
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 TWO'S COMPLIMENT OF THE NUMBER OF RECORDS DESIRED.

8. LISTING

```

288 .LIST SEQ,LOC,BIN
289 .TITLE TU45 UTILITY DRIVER
290 :CZTUMAO
291 :25 MAY 1978
292 :R. BARNES/R. J. COLLINS
293
294 .ENABL ABS
295
296 :CONSOLE SWITCHES
297
298 :SW 15=1 STOP ON EACH OPERATION
299 : 0 CONTINUE
300 :SW 14=1 STOP AT END OF SEQUENCE
301 : 0 CONTINUE
302 :SW 13=1 IGNORE END OF TAPE (EOT)
303 : 0 REWIND AT END OF TAPE (EOT)
304
305 :REGISTER EQUIVES
306
307 000000 R0=X0
308 000001 R1=X1
309 000002 R2=X2
310 000003 R3=X3
311 000004 R4=X4
312 000005 R5=X5
313 000006 SP=X6
314 000007 PC=X7
315
316 :STARTING ADDRESS
317
318 000200 .=200
319 000200 000167 001100 JMP SETUP
320 000600 .=600
321
322 :TMO2 REGISTERS
323
324 000600 172440 C1: 172440
325 000602 172442 WC: 172442
326 000604 172444 BA: 172444
327 000606 172446 FC: 172446
328 000610 172450 CS: 172450
329 000612 172452 DS: 172452
330 000614 172454 ER: 172454
331 000616 172456 AS: 172456
332 000620 172460 CC: 172460
333 000622 172462 DB: 172462
334 000624 172464 MR: 172464
335 000626 172466 DT: 172466
336 000630 172470 SN: 172470
337 000632 172472 C2: 172472
338
339 :PROCESSOR ADDRESSES
340
341 000634 177776 PSW: 177776 ;PROCESSOR STATUS
342 000636 177570 SWR: 177570 ;SWITCH REGISTER
343

```

344 000700
345
346
347 000700 000000
348 000702 002300
349 000704 177760
350 000706 177770
351 000710 002000
352 000712 003000
353 000714 100000
354 000716 000001
355 000720 010000
356 000722 000001
357 000724 000001
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381 000726 000060
382 000730 000000
383 000732 000000
384 000734 000000
385 000736 000000
386 000740 000000
387 000742 000000
388 000744 000000
389 000746 000000
390 000750 000000
391 000752 000000
392 000754 000000
393 000756 000000
394
395

. = 700
: SET PARAMETERS DESIRED FOR UNIT UNDER TEST*****
DRVN: 0 : DRIVE NUMBER
UDES: 2300 : SLAVE DESCRIPTION
FCNT: -20 : FRAME COUNT
WCNT: -10 : WORD COUNT
RADDR: 2000 : READ ADDRESS
WADDR: 3000 : WRITE ADDRESS
RDYDLY: 100000 : READY DELAY
RDYDX: 1 : READY DELAY MULTIPLIER
OPDLY: 10000 : OPERATION DELAY
OPDX: 1 : OPERATION DELAY MULTIPLIER
OPNUM: 1 : NUMBER OF OPERATION (1 TO 15)

: OPERATION TABLE*****
: ENTER OPERATION SEQUENCE DESIRED.
: MUST HAVE AT LEAST 1 OPERATION, AND
: MAY HAVE UP TO 15(8).
: SET THE OPERATION COUNTER EQUAL
: TO THE NUMBER OF OPERATIONS IN
: THE SEQUENCE.
:
: 20 = READ IN PRESET
: 02 = REWIND-OFFLINE
: 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

OPTBL: 60
0
0
0
0
0
0 : FILL WITH OPERATION SEQUENCE
0
0
0
0


```

396          001000          . =1000
397          ;START OF PROGRAM*****
398
399 001000 012706 000500      START:  MOV    #500,SP
400 001004 012777 000340 177622      MOV    #340,@PSW
401 001012 016700 177706          MOV    OPNUM,R0          ;SET COUNTER
402 001016 012701 000726          MOV    #OPTBL,R1        ;SET POINTER
403 001022 012777 000040 177560      A:    MOV    #40,@CS          ;INIT
404 001030 016777 177644 177552      MOV    DRVN,@CS        ;DRIVE NUMBER
405 001036 016777 177640 177566      MOV    UDES,@C2        ;UNIT DESCRIPTION
406 001044 016777 177636 177530      MOV    WCNT,@WC        ;WORD COUNT
407 001052 016777 177626 177526      MOV    FCNT,@FC        ;FRAME COUNT
408 001060 012102          MOV    (R1)+,R2        ;SET OP CODE
409 001062 022702 000030          CMP    #30,R2          ;SEE IF SPACE FORWARD
410 001066 001403          BEQ    AA              ;IF SO: BR
411 001070 022702 000032          CMP    #32,R2          ;SEE IF SPACE REVERSE
412 001074 001003          BNE    A0              ;IF NOT: BR
413 001076 012777 177777 177502      AA:   MOV    #-1,@FC        ;SET TO SPACE ONE RECORD
414 001104 022702 000060          A0:   CMP    #60,R2          ;SEE IF READ OP
415 001110 103404          BLO    A1              ;IF SO: BR
416 001112 016777 177574 177464          MOV    WADDR,@BA        ;SET WRITE ADDRESS
417 001120 000413          BR     A3
418 001122 016777 177562 177454      A1:   MOV    RADDR,@BA        ;SET READ ADDRESS
419 001130 022702 000070          CMP    #70,R2          ;SEE IF READ OPERATION
420 001134 001405          BEQ    A3              ;IF SO: BR
421 001136 016703 177542          MOV    FCNT,R3          ;GET FRAME COUNT
422 001142 005403          NEG    R3
423 001144 060377 177434          ADD    R3,@BA          ;SET BUS ADDRESS FOR READ REVERSE
424 001150 052702 000001          A3:   BIS    #1,R2          ;SET GO BIT
425 001154 000240          NOP
426 001156 000240          NOP
427 001160 010277 177414          MOV    R2,@C1          ;START OPERATION
428 001164 000240          NOP
429 001166 000240          NOP
430 001170 016704 177522          MOV    RDYDX,R4          ;SET DELAY MULTIPLIER
431 001174 016703 177514          B0:   MOV    RDYDLY,R3        ;SET READY DELAY
432 001200 032777 000200 177404      B:    BIT    #200,@DS
433 001206 001005          BNE    C              ;IF DRY: BR
434 001210 005303          DEC    R3
435 001212 001372          BNE    B
436 001214 005304          DEC    R4
437 001216 001366          BNE    B0              ;DELAY FOR DRIVE READY
438 001220 000240          NOP
439 001222 005777 177410          C:    TST    @SWR          ;SEE IF STOP ON OPERATION
440 001226 100001          BPL    D              ;IF NOT: BR
441 001230 000000          HALT
442 001232 000240          D:    NOP
443 001234 000240          NOP
444 001236 016704 177460          MOV    OPDX,R4          ;SET DELAY MULTIPLIER
445 001242 016703 177452          E0:   MOV    OPDLY,R3        ;SET OPERATION DELAY
446 001246 005303          E:    DEC    R3
447 001250 001376          BNE    E
448 001252 005304          DEC    R4
449 001254 001372          BNE    E0              ;DELAY BETWEEN OPERATIONS
450 001256 004767 000056          JSR    PC,RWND          ;GO SEE IF REWIND
451 001262 005300          DEC    R0

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452 001264 001256          BNE      A          ;IF SEQUENCE NOT DONE: BR
453
454 001266 032777 040000 177342 BIT      #40000,ASWR ;SEE IF HALT ON SEQUENCE
455 001274 001641          BEQ      START
456 001276 000000          HALT
457 001300 000167 177474    JMP      START
458
459                          ;RH REGISTER SETUP*****
460
461 001304 000240          SETUP:  NOP
462 001306 016701 177266    MOV      C1,R1      ;GET ADDRESS OF CS1
463 001312 012700 000015    MOV      #15,R0     ;SET NUMBER OF REGISTERS
464 001316 012702 000602    MOV      #WC,R2     ;GET FIRST ADDRESS
465 001322 062701 000002    SETA:   ADD      #2,R1 ;INCREMENT
466 001326 010122          MOV      R1,(R2)+   ;LOAD ADDRESS
467 001330 005300          DEC      R0         ;SEE IF DONE
468 001332 001373          BNE     SETA        ;IF NOT: BR
469 001334 000167 177440    JMP      START      ;ELSE GO START EXECUTION
470
471                          ;REWIND FROM EOT (PER SW13)
472
473 001340 032777 020000 177270 RWND:   BIT      #20000,ASWR ;SEE IF IGNORE EOT
474 001346 001033          BNE     RWNDX       ;IF SO: BR
475 001350 032777 002000 177234    BIT      #2000,ADS  ;SEE IF AT EOT
476 001356 001427          BEQ     RWNDX       ;IF NOT: BR
477 001360 012777 000040 177222    MOV      #40,ACS   ;INCR
478 001366 016777 177306 177214    MOV      DRVN,ACS  ;SET DRIVE NUMBER
479 001374 016777 177302 177230    MOV      UDES,AC2  ;SET SLAVE NUMBER
480 001402 012777 000007 177170    MOV      #7,AC1   ;START REWIND
481 001410 032777 000200 177174    RWNDA:  BIT      #200,ADS ;SEE IF DRY
482 001416 001774          BEQ     RWNDA       ;IF NOT: BR
483 001420 032777 020000 177164    RWNDB:  BIT      #20000,ADS ;SEE IF PIP RESET
484 001426 001374          BNE     RWNDB       ;IF NOT: BR
485 001430 005726          TST     (SP)+      ;RESET STACK
486 001432 000167 177342    JMP     START      ;RESTART SEQUENCE
487 001436 000207          RWNDX:  RTS      PC ;RETURN
488
489                          .=2000
490                          .REPT 100
491                          0
492                          .ENDR
493
494                          .=3000
495                          .REPT 100
496                          177777
497                          .ENDR
498
499                          000001
499                          .END
    
```


A	001022	CC	000620	ER	000614	RADDR	000710	START	001000
AA	001076	CS	000610	EO	001242	RDYDLY	000714	SWR	000636
AS	000616	C1	000600	FC	000606	RDYDX	000716	UDES	000702
A0	001104	C2	000632	FCNT	000704	RWND	001340	WADDR	000712
A1	001122	D	001232	MR	000624	RWDA	001410	WC	000602
A3	001150	DB	000622	OPDLY	000720	RWDB	001420	WCNT	000706
B	001200	DRVN	000700	OPDX	000722	RWDX	001436	.	= 003200
BA	000604	DS	000612	OPNUM	000724	SETA	001322		
B0	001174	DT	000626	OPTBL	000726	SETUP	001304		
C	001222	E	001246	PSW	000634	SN	000630		

. ABS. 003200 000

ERRORS DETECTED: 0

,CZTUMA.SEQ/SOL CZTUMA.P11
RUN-TIME: 24.2 SECONDS
RUN-TIME RATIO: 9/7=1.3
CORE USED: 5K (10 PAGES)