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ABSTRACT and CONTENTS

This document is a description of the MNODT microcode board for use with the microscheduler.

MNODT is a variation of ODT for use with the microscheduler. It has two data items, an address (ADR) and a data object (OBJ), both stored in holding registers. Both items are stored and typed by MNODT as 8 (octal) digit numbers. The additional holding registers are used for flags (FLAG and XFLAG). Entry to MNODT occurs when the reset button on the microscheduler is pressed. A kludge on the MNODT ROM board (location 1700B - 1777B) forces a branch to 1777 from instruction \emptyset . 1777 contains a branch to 1700, the entry point for MNODT. It initializes OBJ to \emptyset . At 1700, FLAG is initialized to 4B7. As octal digits are typed, they are assembled into OBJ until a control character is typed. The control characters and their actions are:

SLASH: Type '/ \sqcup '
 ADR \leftarrow OBJ
 Fetch [ADR]
 OBJ \leftarrow [ADR]
 Type OBJ
 Type ' \sqcup '
 FLAG \leftarrow 4B7

CR: [ADR] \leftarrow OBJ
 Type 'CR, LF'
 FLAG \leftarrow 4B7

LF: [ADR] \leftarrow OBJ
 Type 'CR, LF'
 ADR \leftarrow OBJ \leftarrow ADR +1
 Type OBJ
 GO TO SLASH

G: X \leftarrow OBJ, BRANCH TO X

P: MERGE BIT 4 INTO OBJ

This is for private memory referencing. An address without bit 4 set is to central memory

```
↑:      [ADR] ← OBJ
        Type '↑'
        ADR ← ADR -2
        GO TO LF + 1
```

The main loop gathers TTY input and branches to one of the routines described above if the character is a control character. If the character is an octal digit, it is merged into the low order 3 bits of OBJ (after cycling OBJ left by 3). FLAG is set by the routines which handle the control characters. If the main loop encounters a negative flag when a digit is input, it clears the flag and clears OBJ before merging the new digit into OBJ. Three subroutines are used. STORE stores OBJ at ADR, APRINT prints single characters (in M), and TOBJ types OBJ as an 8-digit octal number. TOBJ suppresses up to 7 leading zeros. The routines are organized such that when they return to the main loop, the data in M, Q and Z is arbitrary, with one exception - APRINT leaves 7 in Q for use by the main loop, and leaves M undisturbed. The MICRO input and compilation of the code follows:

- * MNØDT PROGRAM
- * DECLARATIONS
- * MACRBS

```
MACRO PM\DEFINE PARAMETER *1*\*2*;  
MACRO REG\DEFINE REGISTER *2* AS *1*;
```

- * PARAMETERS

```
PM(SLSH,57B);* CHARACTER '/'  
PM(CRT,15B);* CARRIAGE RETURN  
PM(LFD,12B);* LINE FEED  
PM(GG,107B);* CHARACTER 'G'  
PM(PP,120B);* CHARACTER 'P'  
PM(SPACE,40B);* SPACE  
PM(UPARW,136B);* CHARACTER '||'
```

- * REGISTER DEFINITIONS

```
REG(ADR,R0);  
REG(ØBJ,R2);  
REG(FLAG,R3);  
REG(XFLAG,R4);
```

- * BRANCH CONDITIONS

```
DEFINE BCØNDITION BL=Ø,BLNZ\23B,();
```

- * SPECIAL CONDITIONS

```
DEFINE SCØNDITION ALERT\14B,(),NØVCY;  
DEFINE SCØNDITION PØT\15B,(BRM XPØT),NØVCY;  
DEFINE SCØNDITION PIN\16B,(BRM XPIN);
```

- * PROGRAM PRØPER

```
ØRG 1777B;  
GØTØ START, ØBJØ;  
ØRG 1700B;
```

```
START: FLAG\4B;
```

```
LOOP: Z\4B, ALERT;  
PIN, Z\2, Q\2;  
GØTØ LOOP ØN Z AND Q=Ø;  
Z\4B+2, ALERT;  
PIN, M\2, Q\177B;  
M\M AND Q, Q\SLSH;  
GØTØ SLASH ØN M EØR Q=Ø, Q\CRT;  
GØTØ CR ØN M EØR Q=Ø, Q\LFD;  
GØTØ LF ØN M EØR Q=Ø, Q\GG;  
GØTØ BRANCH ØN M EØR Q=Ø, Q\PP;
```

GØTØ MERGE ØN M EØR Q=0, QVUPARW;
GØTØ UPAR ØN M EØR Q=0, QV17ØB;
ZVM AND Q, QV6ØB;
GØTØ LOOP ØN Z EØR Q=0; *Go to loop if M not an octal digit*
CALL APRINT; *Echo the character; APRINT leaves 7 in M*
ZVM AND Q, GØTØ ++3 ØN FLAG>=0;
FLAGV0;
ØBØVZ, GØTØ LOOP;
MØØBØ, QV7B7;
QVM AND NØT Q LCY 3;
ØBØVQ ØR Z, GØTØ LOOP;

MERGE: MØPP, CALL APRINT;
ØBØVØBØ MRG 2B6, GØTØ LOOP;

CR: CALL STRE;
MØCRT, CALL APRINT;
MØLFD, CALL APRINT;
FLAGV4B7, GØTØ LOOP;

LF: CALL STRE;
MØCRT, CALL APRINT;
MØLFD, CALL APRINT;
ØBØVADRØADR+1, CALL TØBØ;

SLASH: MØSLSH, CALL APRINT;
MØSPACE, CALL APRINT;
FETCH ØBØ;
ØBØVM, CALL TØBØ;
MØFLAGV4B7+SPACE, CALL APRINT;
GØTØ LOOP;

BRANCH: MØGG, CALL APRINT;
MØØBØ;
GØTØ M;

UPAR: CALL STRE;
MØUPARW, CALL APRINT;
MØADR, QV2, DGØTØ LF+1;
ADRVM=Q;

STRE: MØØBØ, DRETURN;
STØRE;

APRINT: ZV4B7, ALERT;
PIN, ZVE2, QV4;
GØTØ APRINT ØN Z AND Q=0;
ZV4B7+4, ALERT, DRETURN;
ZVM, PØT, QV7;

TØBØ: XFLAGVØS; *Save the link & set XFLAG positive*
FLAGV=1ØB; *The digit count*
XLOOP: MØØBØ;
ØBØVMVM LCY 3, QV7;

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MVM AND Q MRG 60B, GØTØ PRIN IF BL#0; Fall through if digit is non-zero
GØTØ PRIN ØN FLAG+1>=0; Print the character if 7 digit have been considered for output
GØTØ PRIN+2 ØN XFLAG>=0; Flag is positive until at least 1 digit has been printed
PRIN: CALL APRINT;
MVXFLAGVXFLAG MRG 4B7;
GØTØ XLØØP ØN FLAGVFLAG+1<0;
GØTØ M;

END;

- * MNØDT PRØGRAM
- * DECLARATIONS
- * MACRØS

MACRØ PMVDEFINE PARAMETER *1*V*2*;
MACRØ REGVDEFINE REGISTER *2* AS *1*;

- * PARAMETERS

DEFINE PARAMETER SLSHV57B)* CHARACTER '/';
DEFINE PARAMETER CRTV15B)* CARRIAGE RETURN
DEFINE PARAMETER LFDV12B)* LINE FEED
DEFINE PARAMETER GG107B)* CHARACTER 'G';
DEFINE PARAMETER PPV120B)* CHARACTER 'P';
DEFINE PARAMETER SPACEV40B)* SPACE
DEFINE PARAMETER UPARWV136B)* CHARACTER '||'

- * REGISTER DEFINITIONS

DEFINE REGISTER R0 AS ADR;
DEFINE REGISTER R2 AS ØBJ;
DEFINE REGISTER R3 AS FLAG;
DEFINE REGISTER R4 AS XFLAG;

- * BRANCH CONDITIONS

DEFINE BCONDITION BL#0,BLNZV23B,()

- * SPECIAL CONDITIONS

DEFINE SCONDITION ALERTV14B,(),NØVCY;
DEFINE SCONDITION PØTV15B,(BRM XPØT),NØVCY;
DEFINE SCONDITION PINV16B,(BRM XPIN);

- * PRØGRAM PRØPER

ØRG 1777B;

1777: GØTØ START, ØBJVØ

•TXW = 1 47

•LRN = 2 70

•MC = 1 5

~~•VCY = 1 86~~

~~•B = 1526 8,9,11,13,15,16~~

•B = 1700 8,9,10,11

ØRG 1700B;

1700: START: FLAGV4B7

•TCX = 1 43

•TXW = 1 47

•LRN = 3 71,70

~~VCY = 1 86~~
C = 40000000 18,

1701: LOOP: ZV4B7, ALERT

MS = 14 ,63,62
TCX = 1 43
LZX = 1 76
~~VCY = 1 86~~
C = 40000000 18,

1702: PIN, ZVE2, QV2

MS = 16 ,64,63,62
TCX = 1 43
LQX = 1 74
LZY = 1 77
TE2Y = 1 89
~~B = 756 9,10,11,12,14,15,16,~~
~~C = 345,4575 18,22,23,25,27,28,31,32,34,40,41,~~
C = 2 40

1703: GBT0 LOOP BN Z AND Q=0

BL = 10 ,78
TAX = 1 49
MC = 2 ,4
~~B = 756 9,10,11,12,14,15,16,~~
~~C = 345,4575 18,22,23,25,27,28,31,32,34,40,41,~~
B = 1701 8,9,10,11,17

1704: ZV4B7+2, ALERT

MS = 14 ,63,62
TCX = 1 43
LZX = 1 76
~~VCY = 1 86~~
C = 37777776 18,40,

1705: PIN, MVE2, QV177B

MS = 16 ,64,63,62
TCX = 1 43
LMY = 1 73
LQX = 1 74
TE2Y = 1 89
C = 177 35,36,37,38,39,40,41,

1706: MVM AND Q, QVSLSH

BR = 10 ,82
TCY = 1 44
TAX = 1 49
LMX = 1 72
LQY = 1 75

~~VCY = 1 86~~
•C = 57 36,38,39,40,41,

1707: GØTØ SLASH ØN M EØR Q=0, QVCRT

•BR = 10 ,82
•BL = 16 ,80,79,78
•TCY = 1 44
•TAX = 1 49
•LQY = 1 75
•MC = 2 ,4
•B = 1740 8,9,10,11,12,
•C = 15 38,39,41,

1710: GØTØ CR ØN M EØR Q=0, QVLFØ

•BR = 10 ,82
•BL = 16 ,80,79,78
•TCY = 1 44
•TAX = 1 49
•LQY = 1 75
•MC = 2 ,4
•B = 1730 8,9,10,11,13,14,
•C = 12 38,40,

1711: GØTØ LF ØN M EØR Q=0, QVGG

•BR = 10 ,82
•BL = 16 ,80,79,78
•TCY = 1 44
•TAX = 1 49
•LQY = 1 75
•MC = 2 ,4
•B = 1734 8,9,10,11,13,14,15,
•C = 107 35,39,40,41,

1712: GØTØ BRANCH ØN M EØR Q=0, QVPP

•BR = 10 ,82
•BL = 16 ,80,79,78
•TCY = 1 44
•TAX = 1 49
•LQY = 1 75
•MC = 2 ,4
•B = 1746 8,9,10,11,12,15,16,
•C = 120 35,37,

1713: GØTØ MERGE ØN M EØR Q=0, QVUPARW

•BR = 10 ,82
•BL = 16 ,80,79,78
•TCY = 1 44
•TAX = 1 49
•LQY = 1 75

.MC = 2 ,4
.B = 1726 8,9,10,11,13,15,16,
.C = 136 35,37,38,39,40,

1714: GØTØ UPAR ØN M EØR Q=0, QV17ØB

.BR = 10 ,82
.BL = 16 ,80,79,78
.TCY = 1 44
.TAX = 1 49
.LQY = 1 75
.MC = 2 ,4
.B = 1751 8,9,10,11,12,14,17,
.C = 170 35,36,37,38,

1715: ZVM AND Q, QV6ØB

.BR = 10 ,82
.TCY = 1 44
.TAX = 1 49
.LQY = 1 75
.LZX = 1 76
~~.VCY = 1 86~~
.C = 60 36,37,

1716: GØTØ LØØP ØN Z EØR Q=0

.BR = 16 ,84,83,82
.BL = 10 ,78
.TAX = 1 49
.MC = 3 5,4
.B = 1701 8,9,10,11,17,

1717: CALL APRINT

.MCØNT = 1 7
.MC = 20 ,1
~~.VCY = 1 86~~
.B = 1757 8,9,10,11,12,14,15,16,17,

1720: ZVM AND Q, GØTØ *+3 ØN FLAG>=0

.RRN = 3 68,67
.BR = 10 ,82
.THY = 1 46
.TAX = 1 49
.LZX = 1 76
.MC = 7 5,4,3
.B = 1723 8,9,10,11,13,16,17,

1721: FLAGVØ

.TXW = 1 47
.LRN = 3 71,70

~~VCY = 1 86~~

1722: 0BJVZ, G0T0 L00P

.BR = 4 ,83
.BL = 10 ,78
.TXW = 1 47
.TAX = 1 49
.LRN = 2 ,70
.MC = 1 5

~~VCY = 1 86~~

.B = 1701 8,9,10,11,17,

1723: MV0BJ, QV7B7

.RRN = 2 ,67
.TCX = 1 43
.THY = 1 46
.LMY = 1 73
.LQX = 1 74
~~VCY = 1 86~~

.C = 10000000 18,19,20,

1724: QVM AND N0T Q LCY 3

.BR = 10 ,82
.BL = 14 ,79,78
.MS = 3 65,64
.LQX = 1 74
~~VCY = 1 86~~

1725: 0BJVQ 0R Z, G0T0 L00P

.BR = 6 ,84,83
.BL = 10 ,78
.TXW = 1 47
.TAX = 1 49
.LRN = 2 ,70
.MC = 20 ,1

~~VCY = 1 86~~

.B = 1701 8,9,10,11,17,

1726: MERGE: MVPP, CALL APRINT

.MC0NT = 1 7
.TCX = 1 43
.LMX = 1 72
.MC = 1 5
~~VCY = 1 86~~

.B = 1757 8,9,10,11,12,14,15,16,17,
.C = 120 35,37,

1727: ØBJVØBJ MRG 286, GØTØ LOOP

•RRN = 2 67
•TCY = 1 44
•THY = 1 46
•TYW = 1 48
•LRN = 2 70
•MC = 20 1
~~•VCY = 1 86~~
•B = 1701 8,9,10,11,17,
•C = 2000000 22,

1730: CR; CALL STRE

•MCØNT = 1 7
•MC = 1 5
~~•VCY = 1 86~~
•B = 1755 8,9,10,11,12,14,15,17,

1731: MJCRT, CALL APRINT

•MCØNT = 1 7
•TCX = 1 43
•LMX = 1 72
•MC = 20 1
~~•VCY = 1 86~~
•B = 1757 8,9,10,11,12,14,15,16,17,
•C = 15 38,39,41,

1732: MVLFD, CALL APRINT

•MCØNT = 1 7
•TCX = 1 43
•LMX = 1 72
•MC = 1 5
~~•VCY = 1 86~~
•B = 1757 8,9,10,11,12,14,15,16,17,
•C = 12 38,40,

1733: FLAGV487, GØTØ LOOP

•TCX = 1 43
•TXW = 1 47
•LRN = 3 71,70
•MC = 20 1
~~•VCY = 1 86~~
•B = 1701 8,9,10,11,17,
•C = 40000000 18,

1734: LF; CALL STRE

•MCØNT = 1 7
•MC = 1 5

~~VCY = 1 86~~
•B = 1755 8,9,10,11,12,14,15,17,

1735: MVCRT, CALL APRINT

•MC0NT = 1 7
•TCX = 1 43
•LMX = 1 72
•MC = 20 ,1
~~VCY = 1 86~~
•B = 1757 8,9,10,11,12,14,15,16,17,
•C = 15 38,39,41,

1736: MVLF0, CALL APRINT

•MC0NT = 1 7
•TCX = 1 43
•LMX = 1 72
•MC = 1 5
~~VCY = 1 86~~
•B = 1757 8,9,10,11,12,14,15,16,17,
•C = 12 38,40,

1737: 0BJVADRJVADR+1, CALL T0BJ

•MC0NT = 1 7
•IHR = 1 42
•THY = 1 46
•TYW = 1 48
•LRN = 2 ,70
•LRO = 1 58
•MC = 20 ,1
~~VCY = 1 86~~
•B = 1764 8,9,10,11,12,13,15,

1740: SLASH: MVSLSH, CALL APRINT

•MC0NT = 1 7
•TCX = 1 43
•LMX = 1 72
•MC = 1 5
~~VCY = 1 86~~
•B = 1757 8,9,10,11,12,14,15,16,17,
•C = 57 36,38,39,40,41,

1741: MVSPACE, CALL APRINT

•MC0NT = 1 7
•TCX = 1 43
•LMX = 1 72
•MC = 20 ,1
~~VCY = 1 86~~
•B = 1757 8,9,10,11,12,14,15,16,17,

.C = 40 36,

1742: FETCH ROVØBJ

.RRN = 2 ,67
.MS = 44 ,63,60
.THY = 1 46
.TYW = 1 48
.LRO = 1 58
~~.VCY = 1 86~~

1743: ØBJVM, CALL TØBJ

.MCØNT = 1 7
.BR = 10 ,82
.BL = 4 ,79
.TXW = 1 47
.TAX = 1 49
.LRN = 2 ,70
.MC = 1 5
~~.VCY = 1 86~~
.B = 1764 8,9,10,11,12,13,15,

1744: MVFLAGV4B7+SPACE, CALL APRINT

.MCØNT = 1 7
.TCX = 1 43
.TXW = 1 47
.LMX = 1 72
.LRN = 3 71,70
.MC = 20 ,1
~~.VCY = 1 86~~
.B = 1757 8,9,10,11,12,14,15,16,17,
.C = 37777740 18,36,

1745: GØTØ LOOP

.MC = 1 5
~~.VCY = 1 86~~
.B = 1701 8,9,10,11,17,

1746: BRANCH: MVGG, CALL APRINT

.MCØNT = 1 7
.TCX = 1 43
.LMX = 1 72
.MC = 20 ,1
~~.VCY = 1 86~~
.B = 1757 8,9,10,11,12,14,15,16,17,
.C = 107 35,39,40,41,

1747: MVØBJ

.RRN = 2 ,67
.THY = 1 46
.LMY = 1 73
~~.VCY = 1 86~~

1750: G8T8 M
.MC8NT = 3 7,6
.BR = 10 ,82
.BL = 4 ,79
.TAX = 1 49
.MC = 1 5
~~.VCY = 1 86~~

1751: UPAR: CALL STRE
.MC8NT = 1 7
.MC = 20 ,1
~~.VCY = 1 86~~
.B = 1755 8,9,10,11,12,14,15,17,

1752: MVUPARW, CALL APRINT
.MC8NT = 1 7
.TCX = 1 43
.LMX = 1 72
.MC = 1 5
~~.VCY = 1 86~~
.B = 1757 8,9,10,11,12,14,15,16,17,
.C = 136 35,37,38,39,40,

1753: MVADR, Q/2, DG8T8 LF+1
.TCX = 1 43
.THY = 1 46
.LMY = 1 73
.LQX = 1 74
.MC = 20 ,1
.DG8 = 1 87
~~.VCY = 1 86~~
.B = 1735 8,9,10,11,13,14,15,17,
.C = 2 40,

1754: ADRVM=Q
.BR = 15 85,83,82
.BL = 4 ,79
.L8C = 1 50
.TXW = 1 47
.TAX = 1 49
.LRO = 1 58

1755: STRE: MVØBJ, DRETURN

•MCØNT = 2 ,6
•RRN = 2 ,67
•THY = 1 46
•LMY = 1 73
•MC = 1 5
•DGB = 1 87
~~•VCY = 1 86~~

1756: STØRE

•MS = 42 ,64,60
~~•VCY = 1 86~~

1757: APRINT: ZV4B7, ALERT

•MS = 14 ,63,62
•TCX = 1 43
•LZX = 1 76
~~•VCY = 1 86~~
•C = #40000000 18,

1760: PIN, ZVE2, QV4

•MS = 16 ,64,63,62
•TCX = 1 43
•LQX = 1 74
•LZY = 1 77
•TE2Y = 1 89
~~•B = 756 9,10,11,12,14,15,16,
•C = #34514575 18,22,23,25,27,28,31,32,34,40,41,
•C = 4 39~~

1761: GØTØ APRINT ØN Z AND QØØ

•BL = 10 ,78
•TAX = 1 49
•MC = 2 ,4
~~•B = 756 9,10,11,12,14,15,16,
•C = #34514575 18,22,23,25,27,28,31,32,34,40,41,
•B = 1757 8,9,10,11,12,14,15,16,17~~

1762: ZV4B7+4, ALERT, DRETURN

•MCØNT = 2 ,6
•MS = 14 ,63,62
•TCX = 1 43
•LZX = 1 76
•MC = 20 ,1
•DGB = 1 87
~~•VCY = 1 86~~
•C = #37777774 18,39,

1763: ZVM, P8T, QV7

.BR = 10 ,82
.BL = 4 ,79
.MS = 15 65,63,62
.TCY = 1 44
.TAX = 1 49
.LQY = 1 75
.LZX = 1 76
~~.VCY = 1 86~~
.C = 7 39,40,41,

1764: T8BJ: XFLAGV8S

.TYW = 1 48
.LRN = 4 ,69
~~.VCY = 1 86~~
.T8SY = 1 57

1765: FLAGV=108

.TCX = 1 43
.TXW = 1 47
.LRN = 3 71,70
~~.VCY = 1 86~~
.C = 10 18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,

1766: XLOOP: MVB8BJ

.RRN = 2 ,67
.THY = 1 46
.LMY = 1 73
~~.VCY = 1 86~~

1767: 8BJVMVM LCY 3, QV7

.BR = 10 ,82
.BL = 4 ,79
.MS = 3 65,64
.TCY = 1 44
.TXW = 1 47
.LMX = 1 72
.LQY = 1 75
.LRN = 2 ,70
~~.VCY = 1 86~~
.C = 7 39,40,41,

1770: MVM AND Q MRG 60B, G8T8 PRIN IF BL#0

.BR = 10 ,82
.TCX = 1 43
.TAX = 1 49
.LMX = 1 72
.MC = 23 5,4,1

.B = 1773 8,9,10,11,12,13,14,16,17,
.C = 60 36,37,

1771: GØTØ PRIN ØN FLAG+1>=0
.RRN = 3 68,67
.IHR = 1 42
.THY = 1 46
.MC = 7 5,4,3
.B = 1773 8,9,10,11,12,13,14,16,17,

1772: GØTØ PRIN+2 ØN XFLAG>=0
.RRN = 4 ,66
.THY = 1 46
.MC = 7 5,4,3
.B = 1775 8,9,10,11,12,13,14,15,17,

1773: PRIN: CALL APRINT
.MCØNT = 1 7
.MC = 1 5
~~.VCY = 1 86~~
.B = 1757 8,9,10,11,12,14,15,16,17,

1774: MVXFLAGVXFLAG MRG 4Ø7
.RRN = 4 ,66
.TCY = 1 44
.THY = 1 46
.TYW = 1 48
.LMY = 1 73
.LRN = 4 ,69
~~.VCY = 1 86~~
.C = 40000000 18,

1775: GØTØ XLØØP ØN FLAGVFLAG+1<0
.RRN = 3 68,67
.IHR = 1 42
.THY = 1 46
.TYW = 1 48
.LRN = 3 71,70
.MC = 10 ,2
.B = 1766 8,9,10,11,12,13,15,16,

1776: GØTØ M
.MCØNT = 3 7,6
.BR = 10 ,82
.BL = 4 ,79
.TAX = 1 49
.MC = 20 ,1
~~.VCY = 1 86~~

EXPANDED LISTING OF CPU MNOTD

Holding Register Assignments

ADR = R0

OBJ = R2

FLAG = R3

XFLAG = R4

GLOP = R5

Input Special Character Codes

SLSH = 57B

CRT = 15B

LFD = 12B

gg = 107B

UPARW = 136B

SPACE = 40B

Location Addresses

START: 1700

LOOP: 1701

SLASH: 1735

CR: 1725

LF: 1731

BRANCH: 1743

UPAR: 1746

APRINT: 1754

STRE: 1752

TOBJ: 1761

PRIN: 1771

CPU MNODT

```

1700: start: flag ← 47B, clabcd
           .MS = 70      60, 61, 62
           .TCX = 1      43
           .LRN = 3      70, 71
           .C = 4B7      18

1701: loop: z ← 4B7, alert
           .MS = 14      62, 63
           .TCX = 1      43
           .LZX = 1      76
           .C = 4B7      18

1702:      pin, m ← e2, q ← 2
           .MS = 16      62, 63, 64
           .TCX = 1      43
           .LQX = 1      74
           .LMY = 1      73
           .TE2Y = 1     89
           .C = 2        40

1703:      goto loop on z and q = 0
           .BR = 10      82
           .TAX = 1      49
           .MC = 22      1, 4
           .B = 1701     8, 9, 10, 11, 17

1704:      z ← 4B7 + 2, alert
           .MS = 14      62, 63
           .TCX = 1      43
           .LZX = 1      76
           .C = 4B7 + 2  18, 40

```

CPU ODT (2)

1705: pin, m ← e2, q ← 177B
 .MS = 16 62, 63, 64
 .TCX = 1 43
 .LMY = 1 73
 .LQX = 1 74
 .TEZY = 1 89
 .C = 177B 35, 36, 37, 38, 39, 40, 41

1706: m ← glop ← m and q, q ← slsh
 .BR = 10 82
 .TCY = 1 44
 .TAX = 1 49
 .LMX = 1 72
 .LQY = 1 75
 .TXW = 1 47
 .LRN = 5 69, 71
 .C = 57 36, 38, 39, 40, 41

1707: goto slash on m eor q = 0, q ← crt
 .BR = 10 82
 .BL = 16 78, 79, 80
 .TCY = 1 44
 .TAX = 1 49
 .LQY = 1 75
 .MC = 22 1, 4
 .B = 1735 8, 9, 10, 11, 13, 14, 15, 17
 .C = 15 38, 39, 41

1710: goto cr on m eor q = 0, q ← lfd
 .BR = 10 82
 .BL = 16 78, 79, 80
 .TCY = 1 44
 .TAX = 1 49
 .LQY = 1 75
 .MC = 22 1, 4
 .B = 1725 8, 9, 10, 11, 13, 15, 17
 .C = 12 38, 40

CPU ODT (3)

1711: goto lf on m eor q = 0, q ← gg
 .BR = 10 82
 .BL = 16 78, 79, 80
 .TCY = 1 44
 .TAX = 1 49
 .LQY = 1 75
 .MC = 22 1, 4
 .B = 1731 8, 9, 10, 11, 13, 14, 17
 .C = 107 35, 39, 40, 41

1712: goto branch on m eor q = 0, q ← uparw
 .BR = 10 82
 .BL = 16 78, 79, 80
 .TCY = 1 44
 .TAX = 1 49
 .LQY = 1 75
 .MC = 22 1, 4
 .B = 1743 8, 9, 10, 11, 12, 16, 17
 .C = 136 35, 37, 38, 39, 40

1713: goto upar on m eor q = 0, q ← 170B
 .BR = 82
 .BL = 16 78, 79, 80
 .TCY = 1 44
 .TAX = 1 49
 .LQY = 1 75
 .B - 1746 8, 9, 10, 11, 12, 15, 16
 .C = 170 35, 36, 37, 38

1714: m ← m and q, q ← 60B
 .BR = 10 82
 .TCY = 1 44
 .TAX = 1 49
 .LQY = 1 75
 .LMX = 1 72
 .C = 60 36, 37

CPU ODT (4)

1715: goto loop on m eor q ≠ 0, m ← glop
 .BR = 10 82
 .BL = 16 78, 79, 80
 .THY = 1 46
 .TAX = 1 49
 .LMY = 1 73
 .RRN = 5 66, 68
 .MC = 23 1, 4, 5
 .B = 1701 8, 9, 10, 11, 17

1716: call aprint
 .MCONT = 1 7
 .MC = 20 1
 .B = 1754 8, 9, 10, 11, 12, 14, 15

1717: z ← m and q, goto * + 2 on flag < 0
 .BR = 10 82
 .THY = 1 46
 .TAX = 1 49
 .LZY = 1 76
 .RRN = 3 67, 68
 .MC = 53 0, 2, 4, 5
 .B = 1721 8, 9, 10, 11, 13, 17

1720: m ← obj, q ← 7B7, goto * + 3
 .TCY = 1 43
 .THY = 1 46
 .LMY = 1 73
 .LQX = 1 74
 .MC = 1 5
 .RRN = 2 67
 .B = 1723 8, 9, 10, 11, 13, 16, 17
 .C = 7B7 18, 19, 20

CPU ODT (5)

```

1721:      flag ← 0
          .TXW = 1      47
          .LRN = 3      70, 71

1722:      obj ← z, goto loop
          .BR = 4      83
          .BL = 10     78
          .TXW = 1     47
          .TAX = 1     49
          .LRN = 2     70
          .MC = 20     1
          .B = 1701    8, 9, 10, 11, 17

1723:      q ← m and not q LCY 3
          .BR = 10     82
          .BL = 14     78, 79
          .LQX = 1     74
          .MS = 3      64, 65
          .C = 16B4    26, 27, 28

1724:      obj ← q or z, goto loop
          .BR = 6      83, 84
          .BL = 10     78
          .TXW = 1     47
          .TAX = 1     49
          .LRN = 2     70
          .MC = 1      5
          .B = 1701    8, 9, 10, 11, 17

1725: CR:  call stre
          .MC = 20     1
          .MCONT = 1  7
          .B = 1752    8, 9, 10, 11, 12, 14, 16

```


CPU ODT (6)

```

1726:      m ← crt, call aprint
           .TCX = 1      43
           .LMX = 1      72
           .MC = 1       5
           .MCONT = 1    7
           .B = 1754     8, 9, 10, 11, 12, 14, 15
           .C = 15       38, 39, 41
           .THY = 1      46
           .RRN = 2      67

1727:      m ← lfd, call aprint, R1 ← 0
           .TCX = 1      43
           .LMX = 1      72
           .MC = 20       1
           .MCONT = 1    7
           .B = 1754     8, 9, 10, 11, 12, 14, 15
           .C = 12       38, 40
           .LRN = 1      71

1730:      flag ← 4B7, goto loop
           .TCX = 1      43
           .TXW = 1      47
           .LRN = 3      70, 71
           .MC = 1       5
           .B = 1701     8, 9, 10, 11, 17
           .C = 4B7      18

1731: 1f:   call stre
           .MC = 20       1
           .MCONT = 1    7
           .B = 1752     8, 9, 10, 11, 12, 14, 16

```

CPU ODT (7)

```

1732:      m ← crt, call aprint
           .TCX = 1      43
           .LMX = 1      72
           .MC = 1       5
           .MCONT = 1    7
           .B = 1754     8, 9, 10, 11, 12, 14, 15
           .C = 15       38, 39, 41

1733:      m ← lf, call aprint
           .TCX = 1      43
           .LMX = 1      72
           .MC = 20      1
           .MCONT = 1    7
           .B = 1754     8, 9, 10, 11, 12, 14, 15
           .C = 12       38, 40

1734:      obj ← adr ← adr + 1, call tobj
           .IHR = 1      42
           .THY = 1      46
           .TYW = 1      48
           .LRO = 1      58
           .LRN = 1      70
           .MC = 1       5
           .MCONT = 1    7
           .B = 1761     8, 9, 10, 11, 12, 13, 17

1735: slash: m ← slsh, call aprint
           .TCX = 1      43
           .LMX = 1      72
           .MC = 20      1
           .MCONT = 1    7
           .B = 1754     8, 9, 10, 11, 12, 14, 15
           .C = 57       36, 38, 39, 40, 41

```

CPU ODT (8)

1736: m ← space, call aprint
 .TCX = 1 43
 .LMX = 1 72
 .MC = 1 5
 .MCONT = 1 7
 .B = 1754 8, 9, 10, 11, 12, 14, 15
 .C = 40 36

1737: fetch adr ← obj
 .RRN = 2 67
 .MS = 44 60, 63
 .THY = 1 46
 .TYW = 1 48
 .LRO = 1 58

1740: obj ← m, call tobj, set A
 .TXW = 1 47
 .TAX = 1 49
 .LRN = 2 70
 .BR = 10 82
 .BL = 4 79
 .MC = 20 1
 .MCONT = 1 7
 .MS = 30 61, 62
 .B = 1761 8, 9, 10, 11, 12, 13, 17

1741: m ← flag ← 4B7 + space, call aprint, clabcd
 .TCX = 1 43
 .TXW = 1 47
 .LMX = 1 72
 .LRN = 3 70, 71
 .MC = 1 5
 .MCONT = 1 7
 .MS = 70 60, 61, 62
 .B = 1754 8, 9, 10, 11, 12, 14, 15
 .C = 40000040 18, 36

CPU ODT (9)

```

1742:      goto loop
           .MC = 20      1
           .B = 1701    8, 9, 10, 11, 17

1743:  branch: m ← gg, call aprint
           .TCX = 1     43
           .LMX = 1     72
           .MC = 1      5
           .MCONT = 1   7
           .B = 1754    8, 9, 10, 11, 12, 14, 15
           .C = 107     35, 39, 40, 41

1744:      m ← obj
           .RRN = 2     67
           .THY = 1     46
           .LMY = 1     73
           .C = 1B5     26  ?

1745:      goto m
           .BR = 10     82
           .BL = 4      79
           .TAX = 1     49
           .MC = 20     1
           .MCONT = 3   6, 7

1746:  upar: call stre
           .MC = 1      5
           .MCONT = 1   7
           .B = 1752    8, 9, 10, 11, 12, 14, 16

1747:      m ← uparw, call aprint
           .TCX = 1     43
           .LMX = 1     72
           .MC = 20     1
           .MCONT = 1   7
           .B = 1754    8, 9, 10, 11, 12, 14, 15
           .C = 136     35, 37, 38, 39, 40

```

CPU ODT (10)

1750: m ← adr, q ← 2, dgoto 1f + 1
 .TCX = 1 43
 .THY = 1 46
 .LMY = 1 73
 .LQX = 1 74
 .MC = 1 5
 .DGO = 1 87
 .B = 1732 8, 9, 10, 11, 13, 14, 16
 .C = 2 40

1751: adr ← m - q
 .BR = 15 82, 83, 85
 .BL = 4 79
 .LOC = 1 50
 .TXW = 1 47
 .TAX = 1 49
 .LRO = 1 58

1752: stre: m ← obj, dreturn
 .THY = 1 46
 .LMY = 1 73
 .RRN = 2 67
 .MC = 20 1
 .MCONT = 2 6
 .DGO = 1 87

1753: store
 .MS = 42 60, 64

1754: aprint: glop ← m, z ← 4B7, alert
 .TCY = 1 44
 .TXW = 1 47
 .TAX = 1 49
 .LZY = 1 77
 .LRN = 5 69, 71
 .BR = 10 82
 .BL = 4 79
 .MS = 14 62, 63
 .C = 4B7 18

CPU ODT (11)

1755: pin, m ← e2, q ← 4
.TCX = 1 43
.LQX = 1 74
.LMY = 1 73
.TE2Y = 1 89
.MS = 16 62,63,64
.C = 4 39

1756: m ← glop, goto aprint on m and q = 0
.BR = 10 82
.THY = 1 46
.TAX = 1 49
.LMY = 1 73
.RRN = 5 66, 68
.MC = 22 1, 4
.B = 1754 8, 9, 10, 11, 12, 14, 15

1757: z ← 4B7 + 4, alert, dreturn
.TCX = 1 43
.LZX = 1 76
.MC = 1 5
.MCONT = 2 6
.MS = 14 62, 63
.DGO = 1 87
.C = 4B7+4 18, 39

1760: z ← m, pot, q ← 7
.BR = 10 82
.BL = 4 79
.TCY = 1 44
.TAX = 1 49
.LQY = 1 75
.LZX = 1 76
.MS = 15 62, 63, 65
.C = 7 39, 40, 41

CPU ODT (12)

1761: tobj: xflag ← os
 .TYW = 1 48
 .LRN = 4 69
 .TOSY = 1 57

1762: flag ← -10B
 .TCX = 1 43
 .TXW = 1 47
 .LRN = 3 70, 71
 .C = -10B 18, 19, 20, 21, 22, 23, ..., 37, 38

1763: xloop: m ← obj
 .RRN = 2 67
 .THY = 1 46
 .LMY = 1 73

1764: m ← obj ← m lcy 3, q ← 7
 .TCY = 1 44
 .TXW = 1 47
 .LMX = 1 72
 .LQY = 1 75
 .BR = 10 82
 .BL = 4 79
 .LRN = 2 70
 .MS = 3 64, 65
 .C = 7 39, 40, 41

CPU ODT (13)

```

1765:      m ← MANDQ MRG 60B, z ← flag + 1
          goto prin if BL ≠ 0
          .TCX = 1      43
          .IHR = 1      42
          .THY = 1      46
          .TAX = 1      49
          .LMX = 1      72
          .LZY = 1      77
          .BR = 10      82
          .RRN = 3      67, 68
          .MC = 23      1, 4, 5
          .B = 1771     8, 9, 10, 11, 12, 13, 14, 17
          .C = 60      36, 37

1766:      z ← xflag, goto prin on z ≥ 0
          .THY = 1      46
          .RRN = 4      66
          .MC = 5      3, 5
          .B = 1771     8, 9, 10, 11, 12, 13, 14, 17
          .LZY = 1      77

1767:      goto prin on A = 1
          .MC = 33      1, 2, 4, 5
          .B = 1771     8, 9, 10, 11, 12, 13, 14, 17

1770:      goto prin + 2 on z ≥ 0
          .MC = 5      3, 5
          .B = 1773     8, 9, 10, 11, 12, 13, 14, 16, 17

1771: prin: call aprint
          .MC = 20      1
          .MCONT = 1    7
          .B = 1754     8, 9, 10, 11, 12, 14, 15

```


CPU ODT (14)

```

1772:      m ← xflag ← xflag mrg 4B7
           .RRN = 4      66
           .TCY = 1      44
           .THY = 1      46
           .LMY = 1      73
           .LRN = 4      69
           .C = 4B7      18

1773:      goto xloop on flag ← flag + 1 < 0
           .IHR = 1      42
           .THY = 1      46
           .TYW = 1      48
           .RRN = 3      67, 68
           .LRN = 3      70, 71
           .MC = 53      0, 2, 4, 5
           .B = 1763     8, 9, 10, 11, 12, 13, 16, 17

1774:      goto m
           .TAX = 1      49
           .BR = 10     82
           .BL = 4      79
           .MC = 1      5
           .MCONT = 3   6, 7
           .C = 1B5     26      ?

1775:      ?
           .RRN = 1      68      ?
           .LRN = 1      71      ?

1776:

1777:      goto start, obj ← 0
           .TXW = 1      47
           .LRN = 2      70
           .MC = 1      5
           .B = 1700     8, 9, 10, 11

```