A TO D TEST

IDENTIFICATION

PRODUCT CODE:	MAINDEC 12-D6CB-D (D)
PRODUCT NAME:	A TO D TEST
DATE CREATED:	OCTOBER 24, 1969
MAINTAINER:	DIAGNOSTIC GROUP
AUTHOR:	HAROLD LONG

(OUTDATED)

1. ABSTRACT:

This program may be used to test the knobs for continuity, the basic A-D for monotonicity, and to test and calibrate the preamps for gain and offset. A provision for testing sixteen additional A-D channels is included for the AM12-AG12 multiplex extension.

Three methods are provided for testing the knobs and adjusting the preamps. (NOTE: Adjustment of the latching differential amplifier or the sample and hold is not normally required. For adjustment of these modules see the appropriate maintenance manual.)

2. REQUIREMENTS:

2.1 Equipment

a) A PDP-12 with A-D and VR12 Display.
b) An ASR-33 or equivalent.

2.2 Preliminary Programs:

a) Insure that the binary loader is operating properly.
b) All basic processor tests must have been run successfully before attempting to execute ADTST.

3. LOADING PROCEDURES

3.1 Method

This program may be loaded with the binary loader. If you are unfamiliar with the proper binary loading procedures refer to "Appendix A" of this program, otherwise procede with the following:

a) Set the teletype reader switch to FREE.
b) Open the teletype reader and insert the program tape so that the arrows on the tape are visible to and pointing toward the operator.
c) Close the reader and set the reader switch to START.
d) Set the teletype front panel switch to ON LINE.
e) Set the LEFT switches to 7777.
f) Set the RIGHT switches to 4ØØØ.
g) Set the MODE switch to 8 mode.
h) Depress I/O preset.
i) Depress START LS.
j) When the program tape has been read the ACCUMULATOR must be ØØØØ if it is not, a read-in error has occured and one might try reloading the binary loader.
k) Remove the program tape from the reader.

4. STARTING PROCEDURES.

a) Turn the VR12 on, and allow to warm up for at least one minute.
b) Set the brightness POT on the VR12 to 3/4 maximum. (NOTE: if a bright dot appears on the VR12, shut down the intensity immediately to prevent burning the phosphor)
c) Set the MODE switch on the console to L mode.
d) Depress I/O preset.
e) Set all switches to Ø's. (This will set up the program for the first display)
f) Depress start 20.
g) The program is now running. Adjust the intensity on the VR12 to give a comfortable viewing level. If any difficulty is encountered, it is a hardware problem and must be corrected before proceeding.
h) This program does NOT use fast sample mode.

5. OPERATING PROCEDURES

5.1 Switch Settings

a) SSW = ØØ; CHANNELS ØØ-$17_{(8)}$ are sampled and displayed.

b) SSW = 4Ø; CHANNELS 2Ø-$37_{(8)}$ are sampled and displayed. These channels are optional on the PDP-12; if not installed, the value displayed for each channel will be $-777_{(8)}$.

c) SSW = 2Ø; The channel selected by bits Ø7-11 of the left switches will be displayed as a full oscilloscope type display. The routine used for display will trigger (SYNC) to the input if it is an AC signal with at least 2 bits (.4 MV) of change within 15 MS.

d) SSW = 1Ø; CHANNELS Ø-7 are sampled and displayed as a segmented oscilloscope display. Each channel has triggering capability as in (C) above.

e) SSW = Ø4; CHANNELS 1Ø-17 are sampled and displayed as a segmented oscilloscope display. Each channel has triggering capability as in (C) above.

f) SSW = Ø2; CHANNELS 2Ø-27 are sampled and displayed as a segmented oscilloscope display. Each channel has triggering capability as in (C) above.

g) SSW = Ø1; CHANNELS 3Ø3-37 are sampled and displayed as a segmented oscilloscope display. Each channel has triggering capability as in (C) above.

5.2 Adjustment Procedures

For adjustment of the AD12/AM12/AG12 A to D converter, refer to the checks and adjustments section of the PDP-12 maintenance manual.

5.3 Error Routine

This test has no error routines; if difficulty is encountered with the SAM instruction, check the A to D control. If difficulty is encountered with the potentiometers, it will most likely be either the multiplexer or the pots themselves. If difficulty is encountered with the external analog channels, check the preamplifiers.

```
0000                    *20
0001                    /POP-12 A TO D TEST, MAINDEC 12-D6[illegible]
0002                    /COPYRIGHT 1969, DIGITAL EQUIPMENT [illegible]RP., MAYNARD, MASS.
0003                    /THIS TEST IS DESIGNED TO DISPLAY ALL AVAILABLE
0004                    /ANALOG INPUT CHANNELS ON THE VR12 DISPLAY
0005                    /
0006                    /SENSE SWITCH 0 DETERMINES WHAT CHANNELS TO DISPLAY
0007                    /
0010                    /SENSE SWITCH 1 GIVES AN OSCILLOSCOPE DISPLAY
0011                    /FOR THE CHANNEL ENTERED IN THE LEFT SW
0012                    /
0013                    /SENSE SWITCHES 2 THRU 5 GIVE AN OVERALL
0014                    /OSCILLOSCOPE OF CHANNELS 0-7, 10-17, 20-27,
0015                    /AND 30-37, RESPECTIVELY.
0016                    /
0017                    /I/O PRESET, START 20 LINC MODE.
0020                    /
0021                    /TYPING CTL-"D" RETURNS USER TO DIAL
0022                    /
0023                    /MAJOR START 4020
0024                    /
0025                    /TAGS AND CONSTANTS
0026                    /
0027                    *0001
0030        0001  0000  H1,     0000                    /HORIZONTAL COORDINATE STORAGE
0031                    *0016
0032        0016  0701  DIAL,   RCG
0033        0017  7300          7300
0034                    EJECT
```

```
0036                    /TO HERE IF FIRST TIME THROUGH
0037                    /
0040    0020    0461    B7,     SNS I   1               /CHECK FOR OPTIONS
0041    0021    6275            JMP     D5              /TRIGGERED SCOPE DISPLAY
0042    0022    0462            SNS I   2               /CHANNELS 0-7
0043    0023    6356            JMP     J6
0044    0024    0463            SNS I   3               /CHANNELS 10-17
0045    0025    6360            JMP     J6+2
0046    0026    0464            SNS I   4               /CHANNELS 20-27
0047    0027    6363            JMP     J6+5
0050    0030    0465            SNS I   5               /CHANNELS 30-37
0051    0031    6366            JMP     J6+10
0052                    /
0053                    /BASIC CHANNEL SAMPLE AND DISPLAY
0054                    /LIFT SSW 0 FOR CHANNELS 20-37
0055    0032    0024            SFA                     /GET SPECIAL FUNCTIONS REGISTER
0056    0033    1620            BSE I                   /SET FOR FULL SIZE CHARACTERS
0057    0034    0200            0200
0060    0035    0004            ESF                     /ENABLE SPECIAL FUNCTIONS
0061    0036    1020            LDA I                   /SET FLOW TAG FOR 20 CHANNEL DISPLAY
0062    0037    1020            LDA I
0063    0040    1040            STA
0064    0041    0067            E1+25                   /END OF SINGLE DISPLAY
0065                    EJECT
```

```
0066                    /
0067                    /DISPLAY CHANNEL NO.
0070                    /
0071    0042    1000    E1,     LDA             /GE. CHANNEL NUMBER
0072    0043    0244            A1
0073    0044    1040            STA             /SAVE IT
0074    0045    0245            T1
0075    0046    0241            ROL     1       /GET LAST BIT
0076    0047    1540            BCL             /SAVE BITS 8,9,10
0077    0050    0247            M1
0100    0051    2246            ADD     G1      /ADD POINTER
0101    0052    4011            STC     11      /SAVE FIRST ADDRESS AND CLEAR AC
0102    0053    2245            ADD     T1      /ADD BASIC CHANNEL NUMBER
0103    0054    0302            ROR     2
0104    0055    1540            BCL             /SAVE BITS 8,9,10
0105    0056    0247            M1
0106    0057    2246            ADD     G1      /ADD POINTER
0107    0060    4010            STC     10      /SAVE SECOND ADDRESS AND CLEAR AC
0110    0061    2250            ADD     V1      /PICK UP VERTICAL COORDINATE
0111    0062    1750            DSC     10      /DISPLAY HALF CHARACTER
0112    0063    1770            DSC I   10      /DISPLAY SECOND HALF CHARACTER
0113    0064    6216            JMP     X1      /GO INSERT SPACE BETWEEN CHARACTERS
0114    0065    1751            DSC     11      /DISPLAY HALF CHARACTER
0115    0066    1771            DSC I   11      /DISPLAY SECOND HALF CHARACTER
0116    0067    1020            LDA I           /DECREMENT HORIZONTAL COORDINATE
0117    0070    7737            -40
0120    0071    1140            ADM
0121    0072    0001            H1
0122                    EJECT
-
```

```
0123                    /
0124                    /SAMPLE CHANNEL JUST LABELED
0125                    /
0126        0073  0011          CLR
0127        0074  2244          ADD     A1              /GET CHANNEL NUMBER
0130        0075  1620          BSE I                   /SET FOR SAM X
0131        0076  0100          100
0132        0077  4100          STC     .+1             /STORE FOR EXECUTION
0133        0100  0000          0000                    /EXECUTE SAM X
0134                    /
0135                    /CONVERT SAMPLE
0136                    /
0137        0101  0451          APO                     /POSITIVE?
0140        0102  6106          JMP     .+4             /NO, SET POINTER FOR NEGATIVE PREFIX
0141        0103  0070          SET I   10              /YES, SET POINTER FOR POSITIVE PREFIX
0142        0104  0271          T2+20
0143        0105  6111          JMP     .+4
0144        0106  0070          SET I   10
0145        0107  0273          T2+22
0146        0110  0017          COM                     /COMPLEMENT NEGATIVE SAMPLE
0147        0111  1040          STA                     /SAVE SAMPLE
0150        0112  0245          T1
0151        0113  0241          ROL     1               /FIND AND STORE TABLE ADDRESSES FOR DISPLAY
0152        0114  1540          BCL
0153        0115  0247          M1
0154        0116  2246          ADD     G1
0155        0117  4013          STC     13              /LAST DIGIT
0156        0120  2245          ADD     T1
0157        0121  0302          ROR     2
0160        0122  1040          STA
0161        0123  0245          T1
0162        0124  1540          BCL
0163        0125  0247          M1
0164        0126  2246          ADD     G1
0165        0127  4012          STC     12              /SECOND DIGIT
0166        0130  2245          ADD     T1
0167        0131  0303          ROR     3
0170        0132  1540          BCL
0171        0133  0247          M1
0172        0134  2246          ADD     G1
0173        0135  4011          STC     11              /FIRST DIGIT
0174                    EJECT
-
```

```
0175                    /
0176                    /DISPLAY DIGITS
0177                    /
0200    0136    1120            ADA I                   /DECREMENT VERTICAL TO DISPLAY BELOW CHAN NO.
0201    0137    7737            -40
0202    0140    2250            ADD     V1              /ADD BASIC VERTICAL COORDINATE
0203    0141    1750            DSC     10              /DISPLAY PREFIX (+ OR -)
0204    0142    1770            DSC I   10
0205    0143    6216            JMP     X1              /INCREMENT HORIZONTAL
0206    0144    1751            DSC     11              /DISPLAY DIGITS
0207    0145    1771            DSC I   11
0210    0146    6216            JMP     X1              /INCREMENT HORIZONTAL
0211    0147    1752            DSC     12              /DISPLAY DIGITS
0212    0150    1772            DSC I   12
0213    0151    6216            JMP     X1              /INCREMENT HORIZONTAL
0214    0152    1753            DSC     13              /DISPLAY DIGITS
0215    0153    1773            DSC I   13
0216                    /
0217                    /IS ROW ENDED?
0220                    /
0221    0154    1000            LDA                     /FIND CHANNEL NUMBER
0222    0155    0244            A1
0223    0156    1560            BCL I                   /SAVE LOW-ORDER 2 BITS
0224    0157    7774            7774
0225    0160    1460            SAE I                   /DISPLAY 4 CHANNELS PER LINE
0226    0161    0003            0003
0227    0162    6224            JMP     P1              /NOT END OF ROW, INCREMENT HORIZONTAL AND CHANNEL
0230                    /
0231                    /IS DISPLAY ENDED?
0232                    /
0233    0163    1000            LDA                     /FIND CHANNEL NUMBER
0234    0164    0244            A1
0235    0165    1560            BCL I                   /SAVE LOW-ORDER 4 BITS
0236    0166    7760            7760
0237    0167    1460            SAE I                   /DISPLAY 17 OCTAL CHANNELS PER FRAME
0240    0170    0017            0017
0241    0171    6235            JMP     U1              /NOT END OF DISPLAY, DECREMENT VERTICAL, INCREMENT CHANNEL
0242                    EJECT
-
```

```
0243                    /
0244                    /END OF DISPLAY
0245                    /
0246        0172  1020          LDA I                   /RESET COORDINATES
0247        0173  0300          0300
0250        0174  4250          STC     V1              /VERTICAL TOP OF FRAME
0251        0175  4001          STC     H1              /HORIZONTAL LEFT EDGE
0252        0176  0440          SNS     0               /WHICH SET?
0253        0177  6203          JMP     .+4
0254        0200  1020          LDA I                   /CHANNELS 20-37
0255        0201  0020          0020
0256        0202  6204          JMP     .+2
0257        0203  0011          CLR                     /CHANNELS 0-17
0260        0204  4244          STC     A1              /RESET CHANNEL NUMBER
0261        0205  0415          KST                     /KEYBOARD?
0262        0206  6020          JMP     B7              /BACK TO START
0263        0207  0500          IOB                     /READ KEYBOARD
0264        0210  6036          6036
0265        0211  1460          SAE I
0266        0212  0204          0204                    /CONTROL D?
0267        0213  6020          JMP     B7
0270        0214  0643          LDF     03              /RESET DATA FIELD
0271        0215  6016          JMP     DIAL            /YES, BACK TO DIAL
0272        0216  0221  X1,      XSK I   H1              /INCREMENT HORIZONTAL TO SPACE CHARCTERS
0273        0217  0221          XSK I   H1
0274        0220  0221          XSK I   H1
0275        0221  0221          XSK I   H1
0276        0222  0016          NOP
0277        0223  6000          JMP     0
0300                    EJECT
-
```

```
0301                    /
0302                    /NOT END OF ROW
0303                    /
0304    0224    1020    P1,     LDA I           /INCREMENT HORIZONTAL TO SPACE CHANNELS
0305    0225    0077            0077
0306    0226    1140            ADM
0307    0227    0001            H1
0310                    /
0311                    /INDEX CHANNEL NUMBER
0312                    /
0313    0230    1020    Q1,     LDA I           /INCREMENT CHANNEL NUMBER (NOT END OF ROW
0314    0231    0001            0001            /OR NOT END OF DISPLAY)
0315    0232    1140            ADM
0316    0233    0244            A1
0317    0234    6042            JMP     E1      /GET NEXT CHANNEL AND DISPLAY
0320                    /
0321                    /NOT END OF DISPLAY
0322                    /
0323    0235    1000    U1,     LDA             /DECREMENT VERTICAL TO SPACE ROWS
0324    0236    0250            V1
0325    0237    1120            ADA I
0326    0240    7577            -200
0327    0241    4250            STC     V1
0330    0242    4001            STC     H1
0331    0243    6230            JMP     Q1      /GO INCREMENT CHANNEL NUMBER
0332                    /
0333                    /TAGS AND REGISTERS
0334                    /
0335    0244    0000    A1,     0000            /CONTAINS CHANNEL NUMBER
0336    0245    0000    T1,     0000            /TEMPORARY STORAGE
0337    0246    0251    G1,     T2              /MATRIX POINTER
0340    0247    7761    M1,     7761            /BCL CONSTANT
0341    0250    0000    V1,     0               /VERTICAL COORDINATE STORAGE
0342                    EJECT
```

```
0343                    /
0344                    /DISPLAY MATRICIES
0345                    /
0346        0251  4136  T2,       4136                    /ZERO
0347        0252  3641             3641
0350        0253  2101             2101                    /ONE
0351        0254  0177             0177
0352        0255  4523             4523                    /TWO
0353        0256  2151             2151
0354        0257  4122             4122                    /THREE
0355        0260  2651             2651
0356        0261  2414             2414                    /FOUR
0357        0262  0477             0477
0360        0263  5172             5172                    /FIVE
0361        0264  0651             0651
0362        0265  1506             1506                    /SIX
0363        0266  4225             4225
0364        0267  4443             4443                    /SEVEN
0365        0270  6050             6050
0366        0271  0404             0404                    /PLUS
0367        0272  0437             0437
0370        0273  0404             0404                    /MINUS
0371        0274  0404             0404
0372                    EJECT
-
```

```
0373                    /
0374                    /TRIGGERED SCOPE DISPLAY
0375                    /
0376        0275  0517  D5,     LSW                     /FIND CHANNEL NUMBER
0377        0276  1560          BCL I
0400        0277  7740          7740
0401        0300  1040          STA
0402        0301  0244          A1                      /CHANNEL NO. TO A1
0403        0302  1620          BSE I                   /SET FOR SAMPLE
0404        0303  0100          0100
0405        0304  4462          STC     E6              /STORE FOR EXECUTION
0406        0305  1020          LDA I                   /GET FLOW TAG
0407        0306  0064          SET I   4
0410        0307  4340          STC     C5-2            /SAM SET-UP
0411        0310  1020          LDA I                   /GET FLOW TAG
0412        0311  6322          JMP     A5
0413        0312  4067          STC     E1+25           /REINITIALIZE AFTER CHANNEL NUMBER DISPLAY
0414        0313  1020          LDA I                   /CHANNEL NUMBER HORIZONTAL COORDINATE
0415        0314  0100          100
0416        0315  1040          STA
0417        0316  0001          H1
0420        0317  0017          COM
0421        0320  4250          STC     V1              /CHARACTER DISPLAY VERTICAL COORDINATE
0422        0321  6042          JMP     E1              /SET V,H
0423                    /
0424                    /TRIGGERING ROUTINE (EQUIVALENT TO AUTO TRIG, INTERNAL SYNC, DC POSITIVE).
0425                    /
0426        0322  0074  A5,     SET I   14              /START TIMER
0427        0323  1000          1000
0430        0324  6462          JMP     E6              /GO SAMPLE CHANNEL
0431        0325  0451          APO                     /POSITIVE?
0432        0326  6331          JMP     .+3             /NO, TRY AGAIN
0433        0327  0234          XSK I   14              /INCREMENT TIMER
0434        0330  6324          JMP     .-4             /WAIT
0435        0331  0074          SET I   14
0436        0332  1000          1000
0437        0333  6462          JMP     E6              /SAMPLE CHANNEL
0440        0334  0471          APO I                   /NEGATIVE?
0441        0335  6340          JMP     .+3             /NO, TRIGGER NOW FIRES
0442        0336  0234          XSK I   14              /WAIT SOME MORE
0443        0337  6333          JMP     .-4
0444                    EJECT
-
```

```
0445                    /
0446                    /DISPLAY A TRACE TO HERE IF TRIGGERED, OR NOT TRIGGERED AND
0447                    /
0450    0340  0064              SET I   4               /START DISPLAY AT LEFT SIDE
0451    0341  1000              1000
0452    0342  6462    C5,       JMP     E6              /SAMPLE CHANNEL
0453    0343  0144              DIS     4               /DISPLAY CHANNEL
0454    0344  0011              CLR
0455    0345  0144              DIS     4               /DISPLAY 0V REFERENCE
0456    0346  1020              LDA I
0457    0347  0377              377
0460    0350  0144              DIS     4               /DISPLAY +.5V REFERENCE
0461    0351  0017              COM
0462    0352  0144              DIS     4               /DISPLAY -.5V REFERENCE
0463    0353  0224              XSK I   4               /INCREMENT HORIZONTAL
0464    0354  6342              JMP     C5              /CONTINUE TRACE
0465    0355  6206              JMP     X1-10           /GO CHECK KEYBOARD
0466                    /
0467                    /TRIGGERED PREAMP DISPLAY
0470                    /
0471    0356  0011    J6,       CLR                     /TO HERE IF SSW2=1
0472    0357  6370              JMP     K6
0473    0360  1020              LDA I                   /TO HERE IF SSW3=1
0474    0361  0010              10
0475    0362  6370              JMP     K6
0476    0363  1020              LDA I                   /TO HERE IF SSW4=1
0477    0364  0020              20
0500    0365  6370              JMP     K6
0501    0366  1020              LDA I                   /TO HERE IF SSW5=1
0502    0367  0030              30
0503    0370  1040    K6,       STA                     /STORE CHANNEL NUMBER
0504    0371  0244              A1
0505    0372  4464              STC     B6              /WE NOW HAVE CHANNEL
0506    0373  1020              LDA I                   /SET FLOW TAG
0507    0374  6407              JMP     A6
0510    0375  4067              STC     E1+25
0511    0376  1020              LDA I                   /INITIALIZE DISPLAY
0512    0377  7600              -177
0513    0400  4250              STC     V1              /SET VERTICAL COORDINATE FOR CHANNEL NUMBER DISPLAY
0514    0401  1020              LDA I
0515    0402  0014              14
0516    0403  4001              STC     H1              /SET HORIZONTAL COORDINATE FOR LEFT SIDE
0517    0404  0064              SET I   4               /PRESET HORIZONTAL FOR SAMPLE DISPLAY
0520    0405  1000              1000
0521    0406  6042              JMP     E1              /GO DISPLAY CHANNEL NUMBER
0522                    EJECT
-
```

```
0523                    /
0524                    /DISPLAY CHANNEL NUMBERS
0525                    /
0526    0407  1020  A6,     LDA I                /INCREMENT CHANNEL NUMBER
0527    0410  0001           1
0530    0411  1140           ADM
0531    0412  0244           A1
0532    0413  1560           BCL I              /SAVE LOW-ORDER 3 BITS
0533    0414  7770           7770
0534    0415  0470           AZE I              /IF 0, WE JUST DISPLAYED LAST CHANNEL IN FRAME
0535    0416  6424           JMP      D6        /NOW DISPLAY ANALOG INPUTS
0536    0417  1020           LDA I              /INCREMENT HORIZONTAL
0537    0420  0034           34
0540    0421  1140           ADM
0541    0422  0001           H1
0542    0423  6042           JMP      E1        /DISPLAY NEXT CHANNEL NUMBER
0543    0424  1020  D6,      LDA I              /BEGIN DISPLAY
0544    0425  6436           JMP      F6        /SET FLOW TAG TO PREVENT OVERLAP OF CHANNELS
0545    0426  4340           STC      C5-2
0546    0427  2464           ADD      B6        /GET CHANNEL
0547    0430  1620  G6,      BSE I              /SET FOR SAM X
0550    0431  0100           100
0551    0432  4462           STC      E6        /INITIALIZED
0552    0433  0075           SET I    15        /SET WIDTH OF CHANNEL DISPLAY
0553    0434  7677           -100
0554    0435  6322           JMP      A5        /GO LOOK FOR TRIGGER IF AVAILABLE
0555    0436  6462  F6,      JMP      E6        /GO SAMPLE CHANNEL
0556    0437  0144           DIS      4         /DISPLAY CHANNEL
0557    0440  1020           LDA I              /DISPLAY +.5V REFERENCE
0560    0441  0377           377
0561    0442  0144           DIS      4
0562    0443  0017           COM                /DISPLAY -.5V REFERENCE
0563    0444  0144           DIS      4
0564    0445  0011           CLR                /DISPLAY 0V REFERENCE
0565    0446  0144           DIS      4
0566    0447  0235           XSK I    15        /END OF SAMPLE DISPLAY?
0567    0450  6457           JMP      H6        /NO, GO INCREMENT HORIZONTAL
0570    0451  1020           LDA I              /END OF SEGMONT
0571    0452  0001           1
0572    0453  1140           ADM                /INCREMENT CHANNEL NUMBER
0573    0454  0464           B6
0574    0455  0224           XSK I    4         /INCREMENT HORIZONTAL
0575    0456  6430           JMP      G6        /DISPLAY NEXT SAMPLE
0576    0457  0224  H6,      XSK I    4         /INCREMENT HORIZONTAL
0577    0460  6436           JMP      F6        /DISPLAY SAMPLE
0600    0461  6206           JMP      X1-10     /GO CHECK KEYBOARD
0601    0462  0000  E6,      0                  /EXECUTE SAM X
0602    0463  6000           JMP      0         /RETURN
0603    0464  0000  B6,      0                  /HOLDS CHANNEL NUMBER
```

0000 ERRORS

```
A1      4244
A5      4322
A6      4407
B6      4464
B7      4020
C5      4342
DIAL    4016
D5      4275
D6      4424
E1      4042
E6      4462
-
```

F6	4438
G1	4246
G6	4430
H1	4001
H6	4457
J6	4356
K6	4370
M1	4247
P1	4224
Q1	4230
T1	4245
T2	4251
U1	4235
V1	4250
X1	4216

-