

一个利用PC-1500A袖珍计算机解决公路测量中的若干问题的实用程序

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【摘要】 本文介绍利用PC-1500A袖珍计算机解决公路测量中的曲线元素计算、中线坐标计算及存贮, 曲线放样过程中的数据检索及放样元素自动计算等若干问题的实用程序。

【Abstract】 An applicable program for soloing the problems of curve element calculation, central line coordinate calculation and memory, data searching in the curve setout and setout elemen, calculation automatically in the highway surveying by PC-1500 is introduced.

1 概述

目前公路测量中的PC-1500计算机应用程序大多只是解决了曲线元素计算和中线坐标的计算和打印, 可能由于: PC-1500计算机内存容量的限制而未考虑其进一步的应用。实际工作中还要用极坐标法放样大量的中线点和曲线主点。常规做法是人工查找控制点数据和放样点坐标数据, 然后用计算器反算放样角度和放样边长。人工查找数据不仅麻烦而且容易出错。特别是现在放样仪器多采用先进的全站仪, 人工查找数据和反算放样元素就成为影响工作效率的主要因素。本文介绍的应用程序进一步采用了作者在《地下管线测量细部坐标记录程序》中使用的数据压缩技术, 实现了在一个PC-1500A计算机中完成曲线计算、中线坐标计算及数据的存贮、数据检索、放样元素计算等功能, 在牛板路、京开公路等公路测量中发挥了作用。

2 程序设计的结构

该应用程序设计成若干个程序块, 每块实现不同的功能, 程序结构如图1。

3 程序的功能及存贮能力

3.1 程序的运行环境:

PC-1500A袖珍计算机要求有一个CE-161模块和CE-150打印机。主程序容量为5KB。

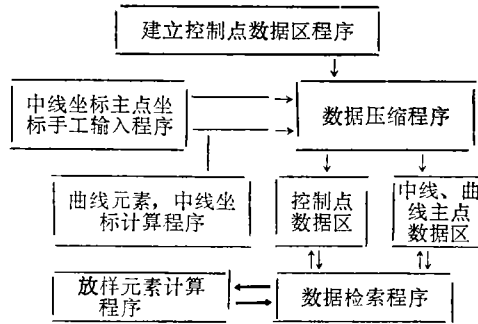


图 1

3.2 控制区的容量为5.0KB, 大约可存放600个控制点的三维坐标, 控制区可以控制的范围为:

$$0 \leq \Delta x, \Delta y \leq 16646 \text{ m} \quad 0 \leq \Delta H \leq 65 \text{ m}$$

存贮到mm。

3.3 中线坐标和曲线主点数据区的容量为10KB, 大约可以存放1700个中线点和曲线主点的坐标数据, 坐标的范围同控制点的范围一样。

3.4 可以完成直线、圆曲线, 对称缓和曲线等常规曲线的曲线元素计算, 曲线主点计算, 中线加桩坐标的计算及存贮。

3.5 可以方便快速地检索放样时所需的控制点数据和中线数据。控制点以点号为一一对应, 而中线数据则以计算曲线元素及中线坐标时所打印的序号为一一对应关系。

3.6 检索到需要的控制点和中线点数据后, 自动反算出放样角度及放样边长, 并打印输

出。

3.7 效率。利用该程序使得放点工作轻松自如,测站上只需一个人便可以方便快速地操作,放一个所需要的数据,不用10s就可检索计算出来。

3.8 该程序也可以应用到其他放点工程中如管线放点、房屋放点等。

4 使用说明:“xu-5”的使用分四个部分

4.1 曲线元素计算部分使用说明

曲线计算的计算参数设置用READ——OATA结构完成,设置的方法和格式如下:

```
4010: DATA F, G, x0, y0, K0
4020: DATA x1, y1, CT1, I01,
      R1, A1, L1, S1, y1$, Q1
      :
      :
4550: DATA xi, yi, CTi, I0i, Ri,
      Ai, Li, Si, yi$, Qi
      :
      :
4998: DATA xn, yn, CTn, I0n,
      Rn, An, Ln, Sn, yn$, Qn
4999: DATA O, O
```

各参数意义说明如下:

4010行中的F, G分别为测区西南角坐标10km以上的大数,这个大数对某一个工程来说是冗余数据。 x_0, y_0, K_0 分别为曲线起点的x坐标, y坐标, 里程桩号, 以m为单位, 小数点后3位。

4020~4998各行中参数: x_i, y_i 分别为第i条曲线折点的x坐标, y坐标, CT_i 为该曲线的曲线类型代号, $CT_i = 1$ 表示直线, $CT_i = 2$ 表示圆曲线, $CT_i = 3$ 表示缓和曲线; I_{0i} 为该曲线的折转角, 其中折转方向为前进方向右转时, I_{0i} 为正值, 折转方向为前进方向左转时, I_{0i} 为负值; R_i 为曲线半径; A_i 为缓和曲线的A值; L_i 为缓和曲线长; S_i 为直线部分的加桩桩距。 $y_i\$$ 为曲线是否加桩选择, $y_i\$ = "y"$ 时计算曲线加桩, $y_i\$ = "N"$

时, 不计算曲线加桩; Q_i 为曲线加桩的桩距。

4999行为结束计算标志, 在任何一行设置O, O为结束计算标志都可以。

设置完曲线参数后, 按DEFJ即自动计算及存贮。

4.2 输入控制模块部分的使用

①RON/ 起动该程序

②F/, G/, H/ 分别输入测区西南角10km以上坐标大数, H为最低点高程大数

③DH/, DH为控制点点号, 为数字, 不得带字符。

④x/, y/, H/ 分别输入控制点x, y, H坐标

反复③~④直到所有控制点输完

按[BREAK]中断

4.3 野外放点部分操作

①DEF Z 起动该程序

②测站号/, 后视号/, 输入测站点, 后视点号

③桩号/, 输入桩号

④序号/, 输入存贮时对应的序号即打印出放样点的角度和边长

返回③~④直到放完本站可以放的点。

换站后反复①~④

4.4 已有放样点坐标时, 将坐标先输入的手动输入法

①DEF M 起动该程序

②桩号/ 输入桩号

③序号/ 输入序号

反复②~③直到输完所有点。

5 源程序

```
5: REM "XU-5"
10: INPUT "Xg="; F, "Yg="; G, "Hg="; H
20: "="; INPUT "D.H="; DH
22: M = 17000 + DH * 8; IF M > STAT
    US 3 PRINT "ERROR POINT";
```

```

GOTO 20
25: INPUT "X="; W
26: W = INT ((W-F)*1000 + .5)
30: GOSUB 700; M = M + 3; INPUT
    "Y="; W
31: W = INT ((W-G)*1000 + .5)
35: GOSUB 700; M = M + 3; INPUT
    "H="; W
36: W = INT ((W-H)*1000 + .5)
38: GOSUB 750; GOTO 20
40: GOSUB 442
50: FOR J = 1 TO 700; M = 17000 + J*
    8; GOSUB 1600
55: LPRINT USING Z 1$; "IN=";
    J; "D.H="; STR$ J; GOSUB 505
60: LPRINT ; LPRINT; NEXT J; GO
    TO 5000
102: "Z"; GOSUB 442; INPUT "Ce Zan
    Hao="; A; "Hou Shi Hao="; AH
110: M = 17000 = A*8; GOSUB 1600
120: X0 = X; Y0 = Y; HA = H1
130: M = 17000 + AH*8; GOSUB 1600
150: X1 = X; Y1 = Y; HB = H1
205: X = X0; Y = Y0; H1 = HA
207: LPRINT "Ce Zan="; STR$ A;
    GOSUB 505; LPRINT
208: X = X1; Y = Y1; H1 = HB
209: LPRINT "Hou Shi="; STR$ A
    H; GOSUB 505; LPRINT ; GOS
    UB 1000; E0 = E
210: LPRINT USING Z5$; "E0="; D
    MS E ; " S="; SS/1000; LPRINT
215: "D"; INPUT "Zuang Hao="; B$
    ; "X U HAO(J)="; J
220: M = 16300 - J*6; GOSUB 1600
235: X1 = X; Y1 = Y; LPRINT "ZUANG
    HAO(k)="; B$; "J="; STR$ J
240: GOSUB 506; LPRINT
300: GOSUB 1000; E1 = E
305: IF E1 > E0 LPRINT USING Z5
    $; "dE="; DMS(E1 - E0);
    ; GOTO 340
310: LPRINT USING Z5$; "dE=";
    DMS(E1 - E0 + 360);
340: LPRINT "S="; SS/1000
350: LPRINT; GOTO 215
442: CSIZE 1; Z5$ = "#####.#
    ###"; Z1$ = "#####.###"
    Z2$ = "#####.###"
445: Z3$ = "#####.###"; Z4
    $ = "#####.###"; Z6$ =
    "#####.###"; RETURN
505: LPRINT USING Z2$; "H="; H1
    /1000 + H
506: LPRINT USING Z3$; "X"; X/1000
    + F; "Y="; Y/1000 + G; ; RETURN
605: "M"; INPUT "Zuang Hao(B$)";
    B$
610: INPUT "XU HAO="; J
620: M = 16300 - J*6; INPUT "X="; W
630: W = INT ((W - F)*1000 + .5); GO
    SUB 700; M = M + 3; INPUT "Y =
    "; W
640: W = INT ((W - G)*1000 + .5);
    GOSUB 700
650: V = V + 1; IF M <= STATUS 2 GO
    TO 605
660: FOR J = 1 TO V; M = 16300 - J*6;
    GOSUB 1600
670: LPRINT USING Z3$; "XU
    HAO (J)="; J; GOSUB 506
680: LPRINT ; LPRINT; NEXT J;
    GOTO 5000
700: GOSUB 1500; GOSUB 1520;
    RETURN
750: GOSUB 1500; GOSUB 1530;
    RETURN
800: REM Ji Suan Zuo BiaO

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810: X = X0 + D * COS E; Y = Y0 +
      D * SIN E; RETURN
850: GOSUB 442; LPRINT USING Z
      6$; "K="; (K + .5)/1000; "V=";
      STR$ V
860: LPRINT USING Z3$; "X=";
      (F + (X + .5)/1000); "Y="; (G + (Y
      .5)/1000); LPRINT; RETURN
900: M = 16300 - V * 6; IF M < (STA
      TUS 2 + 50) PRINT "OVER"; GO
      TO 5000
910: W = INT (X + .5); GOSUB 700
920: M = M + 3; W = INT (Y + .5); G
      OSUB 700
930: RETURN
1000: REM F * S * F * W * J
1010: X = X1 - X0; Y = Y1 - Y0; IF
      X = 0 AND Y > 0 LET E = 90; GOT
      O 1050
1015: IF X = 0 AND Y < 0 LET E = 270;
      GOTO 1050
1020: E = ATN (Y/X); IF X < 0 LET
      E = E + 180; GOTO 1050
1025: IF X > 0 AND Y < 0 LET E = E + 360
1050: SS = SQR (X^2 + Y^2); RET
      URN
1200: "J"; REM IP Dian Ji Suan
1201: V = 1; JD = 0; T = 0; GOSUB 442
1202: RESTORE 4010; READ F, G
1205: "S"; READ X0, Y0, K0
1206: COLOR 1; LPRINT USING "
      # # # "; "JD"; JD; USING Z3$; "
      K="; K0; " V="; STR$ V; LPR
      INT "X="; X0; "Y="; Y0
1210: XE = (X0 - F) * 1000; YE = (Y0
      - G) * 1000; X0 = XE; Y0 = YE;
      X = XE; Y = YE
1215: K0 = K0 * 1000; K = K0; GOSUB
      900; V = V + 1
1220: "G"; READ X1, Y1; IF X1 = 0 AN
      D Y1 = 0 END
1222: X = (X1 - F) * 1000; Y = (Y1 - G)
      * 1000; X1 = X; Y1 = Y
1225: JD = JD + 1; GOSUB 1000
1230: LPRINT USING Z5$; "E0" = , D
      MS E; " S0="; SS/1000; LPRINT
1235: E0 = E; K = K0 + SS; X = X1; Y = Y
      1; KI = K
1237: LPRINT USING " # # # "; "JD"; J
      D; USING Z3$; " K="; KI/1000
      ; " V="; STR$ V; LPRINT "X
      =" ; X1/1000 + F;
1238: LPRINT "Y=" ; Y1/1000 + G; LP
      RINT
1239: GOSUB 900; V = V + 1
1240: READ CT
1250: ON CT GOTO 1255, 1700, 2000,
      3000
1255: T = 0; GOSUB 1260; GOTO 1220
1260: REM Zhi Xian Jia Zuang
1270: READ S
1275: S = S * 1000; IF (SS - T) < S GOTO
      1310
1276: X0 = X0; Y0 = Y0
1280: WW = (INT (K0/S) + 1) * S/1000
      ; Z = (INT (ABS (KI - T)/S))/1000
      * S
1285: COLOR 3; FOR J = WW TO ZST
      EP (S/1000)
1290: D = J * 1000 - K0; K = J * 1000; E =
      E0; GOSUB 4000
1300: NEXT J
1305: IF CT = 1 LET X0 = X1; Y0 = Y1;
      K0 = KI
1310: RETURN
1500: REM ZUN SU
1505: GOSUB 1540; P = QQ; GOSUB 15
      40; O = QQ

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1510: GOSUB 1540; I = QQ; RETURN      2020: READ L
1520: POKE (M), O, P, I; RETURN      2025: R = R/1000
1530: POKE(M), O, P, ; RETURN      2030: IF A = 0 GOTO 2510
1540: R1 = INT (W/255); QQ = W - R1  2040: IF R = 0 GOTO 2570
    *255; W = R1; RETURN            2050: IF L = 0 GOTO 2540
1550: O = PEEK (M); P = PEEK (M + 1  2060: T0 = 206265/3600; B = L/R/2 * T0
    ); I = PEEK (M + 2); RETURN      2070: X = L * (1 - ((L/R) ^ 2) / 40 + (((L/R)
1600: REM QI SU                      ^ 2) ^ 2) / 3456 - (((L/R) ^ 2) ^ 2)
1610: GOSUB 2500; X = W; M = M + 3    ^ 2) / 599040)
1615: GOSUB 2500; Y = W; M = M + 3    2075: U = I0/2
1620: GOSUB 2600; H1 = W; RETURN      2080: Y = L * L / 6 / R * (1 - ((L/R) ^ 2) / 56
1700: REM Yuan QuXian                + (((L/R) ^ 2) ^ 2) / 7040)
1710: GOSUB 2700                      2085: P0 = Y + R * COS B - R
1720: U = I0/2; T = ABS(R * TAN U)    2090: Q0 = X - R * SIN B; T = Q0 + ABS;
1730: A0 = SQR (R ^ 2 + T ^ 2); A = A0  ((R + P0) * TAN U)
    - R; J0 = 90 - ABS U              2100: A0 = 1000 * (R + P0) / COS U; AA =
1735: J0 = J0 * SGN I0; LC = ABS (R * I  (A0 - R * 1000); B = B * SGN I0; L
    0 * 3600 / 206265)                0 = R * ABS (I0 - 2 * B) / T0 + 2 * L
1740: COLOR 2; LPRINT "LC = "; LC /   2105: COLOR 0; LPRINT USING Z5 $
    1000; "TC = "; T / 1000; LPRINT "N  ; "I = "; DMSI0; LPRINT "R = "; R;
    C = "; A / 1000; LPRINT           LPRINT USING Z1 $; "A = "; A
1745: GOSUB 1260                      2110: LPRINT USING Z3 $; "L = "; "L;
1750: GOSUB 2750; K = KI - T          LPRINT "NC = "; AA / 1000; LP
1770: D = R; EH = EB; KB = K; E = EB; C  RINT "LL = "; L0; LPRINT "LC
    OLOR 0                             = "; L0 - 2 * L
1780: LPRINT "ZY"; ; GOSUB 4000       2115: LPRINT " DR = "; P0; LPRINT "
1790: K = KB + LC/2; E = E + U        TC = "; T; LPRINT ; L0 = L ; L0
1800: LPRINT "QZ"; ; GOSUB 4000      = L0 * 1000; T = T * 1000; L = L * 1
1810: K = KB + LC; E = E + U; L = LC  000; R = R * 1000; GOSUB 1260
1820: KE = K; LPRINT "YZ"; ; GOSUB   2120: COLOR 0; LPRINT "ZH"; ; GOS
    4000; XE = X; YE = Y              UB 3000
1830: GOSUB 2830; IF Y $ = "N" GOT    2130: J0 = 90 - ABS U; J0 = J0 * SGN I0;
    O 1890                             GOSUB 2750
1840: IF Z - W < (Q/1000) GOTO 1890   2140: EH = EB + B; D = R; K = KZ + L; E
1880: D = R; GOSUB 2860                = EH
1890: LPRINT ; X0 = XE; Y0 = YE; K0   2150: LC = L0 - 2 * L; KH = K
    = KE; GOTO 1220                    2160: LPRINT "HY"; ; GOSUB 4000
2000: REM Han He Qu Xian Ji Sua n    2170: E = EB + U; K = LC/2 + KH
2010: GOSUB 2700; READ A              2180: LPRINT "QZ"; ; GOSUB 4000

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200: E = EB + 2 * U - B; K = LC + KH;
      KY = K
2210: LPRINT "YH",; GOSUB 4000
2220: KE = KZ + L0; K = KE
2230: XO = X1; YO = Y1; D = T; E = E0 +
      I0
2240: LPRINT "HZ",; GOSUB 4000
2250: XE = X; YE = Y; EE = E; KB = KZ
2260: GOSUB 2830; IF Y$ = "N" GOT
      O 1220
2262: IF (Z - WW) < (Q/1000) GOTO 22
      80
2265: E = E0; GOSUB 3100
2280: XO = XR; YO = YR
2300: KB = KH; WW = Q * (INT (KB/Q
      )) / 1000; Z = Q * (INT ((LC + KB
      / Q)) / 1000
2305: IF (Z - WW) < (Q/1000) GOTO 2320
2310: D = R; I0 = I0 - 2 * B; GOSUB 2860
2320: E = EE - 180; KZ = KE; XX = XE;
      YY = YE; KB = KY; GOSUB 2855
2325: IF Z - WW < (Q/1000) GOTO 2350
2330: GOSUB 3100
2350: X0 = XE; Y0 = YE; K0 = KE; LPRIN
      T; LPRINT ; GOTO 1220
2500: GOSUB 1550; W = 255 ^ 2 * I + O
      * 255 + P; RETURN
2510: A = SQR (L * R); GOTO 2060
2540: L = A * A / X; GOTO 2060
2570: R = A * A / L; GOTO 2060
2600: GOSUB 1550; W = O * 255 + P; RE
      TURN
2700: READ I0, R
2705: R = R * 1000; I0 = DEG I0
2710: RETURN
2750: D = A0; E = J0 + E0 + I0; XO = X1;
      YO = Y1; GOSUB 800
2760: XO = X; YO = Y; E = E - 180; EB =
      E - U; XR = X; YR = Y
2770: RETURN
2830: READ Y$
2840: IF Y$ = "N" LET X0 = XE; Y0
      = YE; K0 = KE; GOTO 2856
2850: READ Q
2852: Q = Q * 1000
2855: WW = Q * (INT (KB/Q)) / 1000; Z
      = Q * (INT ((L + KB)/Q)) / 1000
2856: COLOR 3; RETURN
2860: FOR J = (WW + Q/1000) TO ZST
      EP (Q/1000); K = J * 1000
2870: E = EH + I0 * (K - KB) / LC
2880: GOSUB 4000; NEXT J; RETURN
3000: E = E0 - 180; D = T; K = KI - T
3010: XO = X1; YO = Y1; GOSUB 4000
3015: XX = X; YY = Y; EZ = E; KZ = K
3020: RETURZ
3100: FOR J = (WW + Q/1000) TO ZST
      EP (Q/1000); K = J * 1000
3105: L1 = ABS (K - KZ); L2 = L1 ^ 2; L
      3 = L2 * L1
3110: XO = L1 - L2 * L3 / 40 / R / R / L / L +
      L3 * L3 * L3 / 3456 / R / R / R / R / L / L
      / L / L
3115: YO = L2 * L1 / 6 / R / L - L3 * L3 * L
      1 / 336 / R / R / R / L / L / L
3120: IF ((I0 < 0) AND (K > = KZ)) OR ((
      I0 > 0) AND (K < = KZ)) LET YO = -
      YO; GOTO 3130
3130: X = XX + XO * COS E - YO * SIN
      E; Y = YY + XO * SIN E + YO * C
      OS E
3140: GOSUB 850; GOSUB 900; V = V +
      1; NEXT J; RETURN
4000: GOSUB 800; GOSUB 850; GOSU
      B 900; V = V + 1; RETURN
4010: DATA 400000, 530000, 403702.48,
      537686.925, 0, 403625.750, 537926.
      510, 3

```

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是由于基坑降水,开挖后土体移动所致,管线的不均匀位移超过一定值将产生断裂,煤气泄漏,水管、电缆断裂都将造成重大损失。因此此项位移观测更为重要。考虑到淮海路与陕西南路均是市中心重要交通道路,所以开挖裸露管线设置观测点是不现实的,为此采用间接方法,首先对已有的6个煤气、上水管线的阀门头进行垂直位移观测,其次在陕西路淮海路紧靠施工区的上街沿边布置土体水平、垂直位移观测点,每条观测线布3~4个测点。

5 各项监测点的位置联系(见图2)

如图2所示:

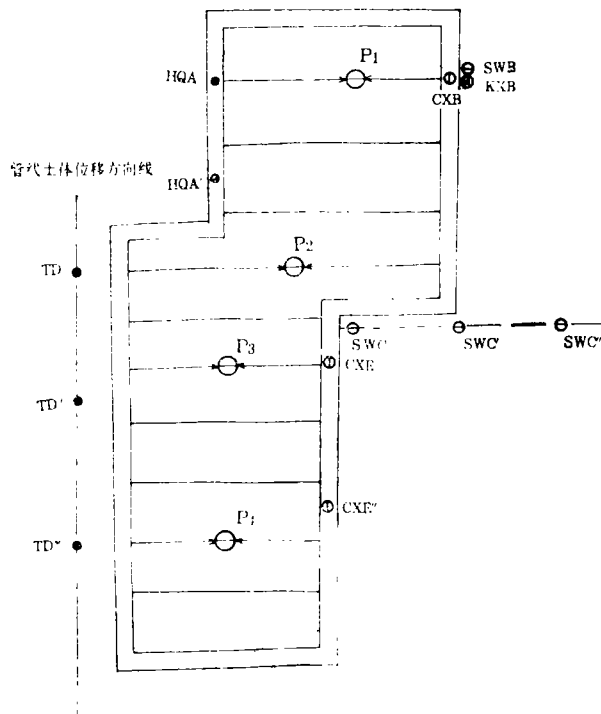


图 2

- (1) HQA 设在支撑线上的支护结构墙位移点,
 HQA' 设在支撑线之间的支护结构墙位移点。
- (2) $C \times B$ 设在支撑处的墙体变形观测孔,
 $K \times B$ 设在支撑处的孔隙水压力观测孔,
 SWB 设在支撑处的水位观测孔。
- (3) SWC 、 SWC' 、 SWC'' 三个基坑不同距离的水位观测孔,其方向线垂直基坑。
- (4) TD 、 TD' 设在支撑线上,
 TD'' 设在支撑线之间。
- (5) $C \times E$ 设在支撑处的墙体变形观测孔,
 $C \times E'$ 设在支撑之间的墙体变形观测孔。

以上5点主要用于不分析同情况下其数据有否差异及其相互关系。

6 监测方法

根据施工进度,采取定时与跟踪相结合观测方法,且现场及时整理观测资料,做到反馈及时,在发生异常突变情况,数值接近报警值时,速与设计、施工单位,甲方联系,以便及时采取有效措施,确保施工安全。

7 结束语

本文所述的监测点布设方法系笔者实施后的一些观点整理,监测点布设方法众多,定有许多更优化合理的方法,真诚希望读者阅后多多指教,共同探讨更好、更经济的设点方法。

(上接第59页)

```
4015: DATA -31.0214,103.586,55,0,1
      00,"Y",50
4020: DATA 403679.045,538152.336,3,
      20.0824,160,70,0,100,"Y",50
```

```
4030: DATA 403643.129,538450.824,3,
      33.4149,260,140,0,100,"Y",50
4040: DATA 403476.861,538645.100,2,
      -4.3718,1600,100,"Y",50,0,0
5000: END
```