```
'{$STAMP BS2}
'{$PBASIC 2.5}
'Program solar1.bs2 MPPT program for solar panels
'=======================Constants, pin assignments=====================
P0_zad7clk     CON 0
p1_zad1cs      CON 1
p2_zad5_6dio   CON 2
p4_zpwm7cs     CON 4
p5_zpwmlinc    CON 5
p6_zpwm2dir    CON 6
p10_lcd        CON 10
'============================Variables=================================
z_adconfig     VAR Nib
z_adval        VAR Word
z_adstartb     VAR z_adconfig.BIT0
z_adsigdif     VAR z_adconfig.BIT1
z_adoddsign    VAR z_adconfig.BIT2
z_admsbf       VAR z_adconfig.BIT3
z_cnt          VAR Byte
z_voltage      VAR Word
z_current      VAR Word
b_powerprev    VAR Word
z_p  ernew     VAR Word
b_powerdelta   VAR Word
z_powerdir     VAR Bit    'CCW = 0, CW = 1
z_poweradj     VAR Byte
z_potposn      VAR Byte
b_cnt          VAR Byte
z_sampleno     VAR Byte
z_dispv        VAR Byte
A_START:'==================initialise=====================================
'DEBUG "A_START wait", CR
PAUSE 1000           'wait for stability
'reset pot to zero, CCW 100 steps
z_poweradj = 100
z_powerdir = 0
GOSUB Z2_POWERSET
z_potposn = 0
'set pot CW 5 steps on rising curve
z_poweradj = 5
z_powerdir = 1
GOSU  Z2_POWERSET
'take the first current, voltage and power reading
GOSUB Z1_READPOWER
b_powerprev = 0
GOSUB Z3_LCDDISP
B_MAIN:'=======main LOOP, do while voltage excceds about 7v=============
B1_POWER_DIR:'=======calc power delta and adjust direction==============
DO WHILE z_voltage > 300
  b_powerdelta = z_powernew - b_powerprev
  b_powerprev = z_powernew
  IF ABS(b_powerdelta) > 1  THEN     'adjust power if not on flat top of curve
    B2_POWERADJ:'==========adjust power, display readings, pause==========
    SELECT b_powerdelta
    CASE >1024          'power delta neg change to direction of power trend
      z_powerdir = z_powerdir + 1
      'DEBUG "case0 neg chg", SDEC b_powerdelta, "  "
    CASE <1024          'power delta pos no change to direction of power trend
      z_powerdir = z_powerdir + 0
      'DEBUG "case 1 pos nochg", SDEC b_powerdelta, "   "
    ENDSELECT
    z_poweradj = 2        'the step value for adjusting the pot
    GOSUB Z2_POWERSET
```

```
    ENDIF
    PAUSE 1000
    B2_POWER_READ:'=======read, calculate and display the new power========
    GOSUB Z1_READPOWER
    GOSUB Z3_LCDDISP
  LOOP
  C_END:'=========voltage has dropped below 7v, WAIT AND start again=======
  'DEBUG "C_END wait", CR
  PAUSE 5000
  GOTO A_START
  Z1_READPOWER:'===Subroutine to READ the voltage AND current OUTPUT=======
  Z1_START:
  z_current = 0
  z_voltage = 0
  Z1_MAIN:'==================Take 50 samples, average and scale===========
  FOR z_sampleno = 1 TO 50
    HIGH p1_zad1cs
    PAUSE 5
    HIGH p2_zad5_6dio
    PAUSE 5
    FOR z_adoddsign = 0 TO 1
      GOSUB Z1A_CONVERT
      SELECT z_adoddsign
      CASE =0             'Channel 0 - current
        z_current = z_adval + z_current
      CASE =1             'Channel 1 - voltage
        z_voltage = z_adval + z_voltage
      ENDSELECT
    NEXT
  NEXT
  z_current = z_current/z_sampleno
  z_voltage = z_voltage/z_sampleno
  z_voltage = z_voltage*11
  z_current= 11*z_current/20
  z_powernew = z_voltage/10
  z_powernew = z_powernew*z_current
  z_powernew = z_powernew/100
  RETURN
  Z1A_CONVERT:'========interface TO the LTC1298 FOR channel 0 OR 1=========
  z_adconfig = z_adconfig|%1011
  LOW p1_zad1cs
  PAUSE 5
  SHIFTOUT p2_zad5_6dio, P0_zad7clk, LSBFIRST,[z_adconfig\4]
  SHIFTIN p2_zad5_6dio, P0_zad7clk, MSBPOST, [z_adval\12]
  HIGH p1_zad1cs
  PAUSE 5
  RETURN
  Z2_POWERSET:'========Subroutine to adjust the power via DS1804_1 pot======
  LOW p4_zpwm7cs                'select DS1804
  SELECT z_powerdir
    CASE =0                     '0 = CCW
      LOW p6_zpwm2dir
      z_potposn = z_potposn - z_poweradj
    CASE =1                     '1 = CW
      HIGH p6_zpwm2dir
      z_potposn = z_potposn + z_poweradj
  ENDSELECT
  FOR z_cnt = 1 TO z_poweradj
    HIGH p5_zpwm1inc
    LOW p5_zpwm1inc
  NEXT
  RETURN
  Z3_LCDDISP:'====Subroutine lcd, DEBUG and plot data for plot program======
```

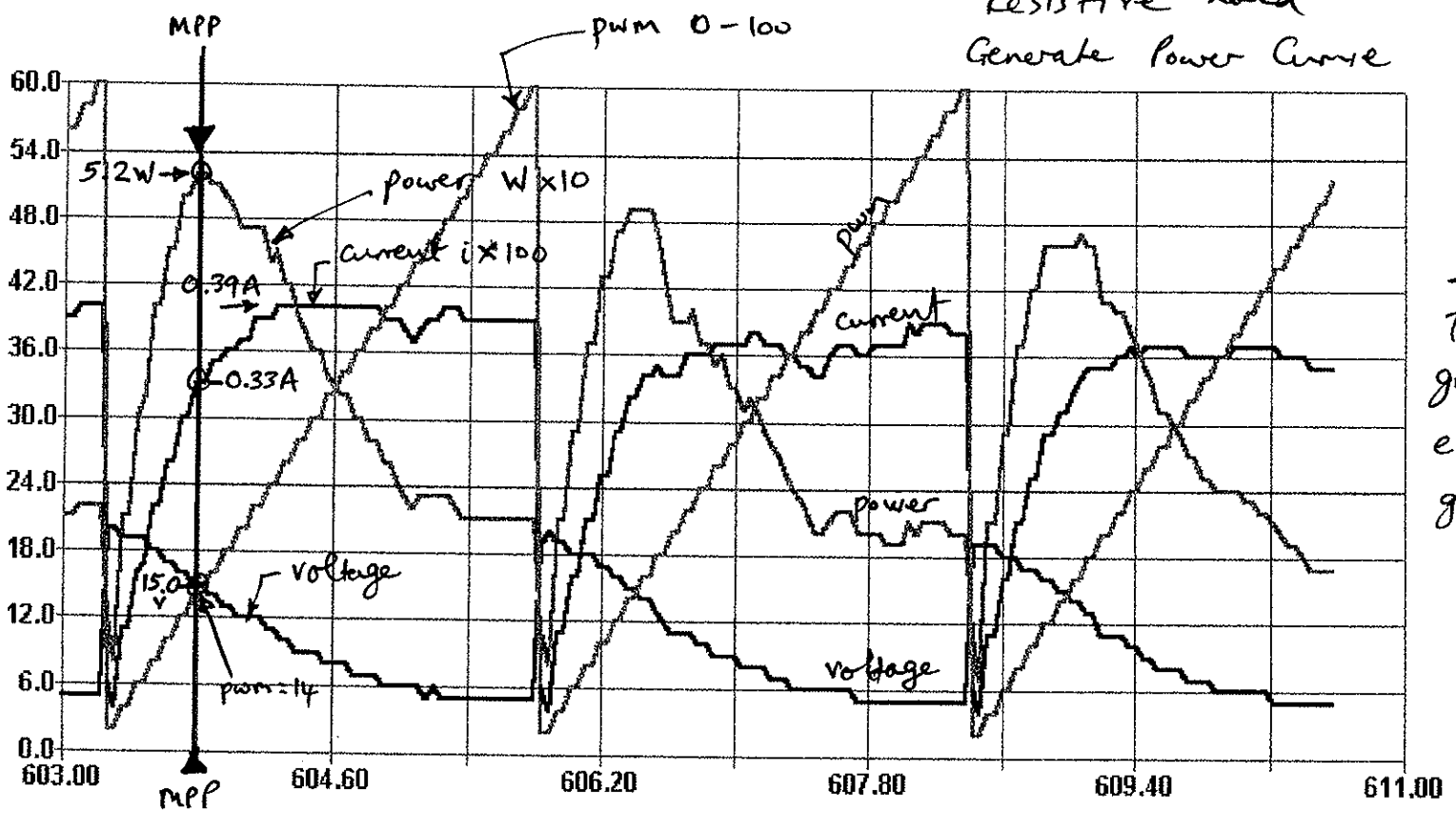
```
SEROUT p10_lcd,16780,[$FE,1]
SEROUT p10_lcd,16780,[$FE,128,"v", DEC4 z_voltage]
'DEBUG "v", DEC z_voltage
z_dispv = z_voltage/100
SEROUT p10_lcd,16780,[$FE,134,"i", DEC3 z_current]
'DEBUG " i", DEC z_current
SEROUT p10_lcd,16780,[$FE,139,"p", DEC4 z_powernew]
'DEBUG " p", DEC z_powernew
SEROUT p10_lcd,16780,[$FE,192,"pp", DEC4 b_powerprev]
'DEBUG " pp", DEC b_powerprev
SEROUT p10_lcd,16780,[$FE,199,"pa", DEC2 z_potposn]
'DEBUG " potp", DEC z_potposn
SEROUT p10_lcd,16780,[$FE,204,"pd", DEC1 z_powerdir]
'DEBUG " dir", DEC z_powerdir, CR
DEBUG DEC z_dispv, ",", DEC z_current, ",", DEC z_powernew, ",", DEC z_potposn, ",",  CR
RETURN
```

```
'{$STAMP BS2}
'{$PBASIC 2.5}
'Program solar2.bs2 manual cyling of PWM to develop the panel power curve
'======================Constants, pin assignments=======================
P0_zad7clk     CON 0
p1_zad1cs      CON 1
p2_zad5_6dio   CON 2
p4_zpwm7cs     CON 4
p5_zpwm1inc    CON 5
p6_zpwm2dir    CON 6
p10_lcd        CON 10
'============================Variables=====================================
z_adconfig     VAR Nib
z_adval        VAR Word
z_adstartb     VAR z_adconfig.BIT0
z_adsigdif     VAR z_adconfig.BIT1
z_adoddsign    VAR z_adconfig.BIT2
z_admsbf       VAR z_adconfig.BIT3
z_cnt          VAR Byte
z_voltage      VAR Word
z_current      VAR Word
b_powerprev    VAR Word
z_powernew     VAR Word
b_powerdelta   VAR Word
z_powerdir     VAR Bit    'CCW = 0, CW = 1
z_poweradj     VAR Byte
b_total        VAR Byte
b_cnt          VAR Byte
z_sampleno     VAR Byte
z_dispv        VAR Word
A_START:'====================initialise=====================================
'reset pot to zero, CCW 100 steps
z_poweradj = 100
z_powerdir = 0
b_total = 0
HIGH p1_zad1cs
PAUSE 20
HIGH p2_zad5_6dio
PAUSE 20
B_MAIN:'=====main program loop, perform until PWM setpoint achieved=======
GOSUB Z2_POWERSET
'set pot CW 1 steps each loop
z_poweradj = 1
b_total = b_total + z_poweradj
z_powerdir = 1
GOSUB Z2_POWERSET
PAUSE 300
'DEBUG "ahoy new power setting", CR
'take the current, voltage and power reading twice
FOR b_cnt = 1 TO 1
  GOSUB Z1_READPOWER
  GOSUB Z3_LCDDISP
  PAUSE 20
NEXT
b_powerprev = 0
IF b_total < 30  THEN
  GOTO B_MAIN
ENDIF
GOTO A_START
Z1_READPOWER:'=====Subroutine to READ the voltage AND current OUTPUT======
Z1_START:
z_current = 0
z_voltage = 0
```

-StampPlot Pro V3 at 10/31/04 13:09:22
User Status

Resistive load
Generate Power Curve

Chart 1



Notes

This chart shows a good example of even power curves good strong sun.

10Ω dummy load
5W nominal BP sample panel
Mid-day

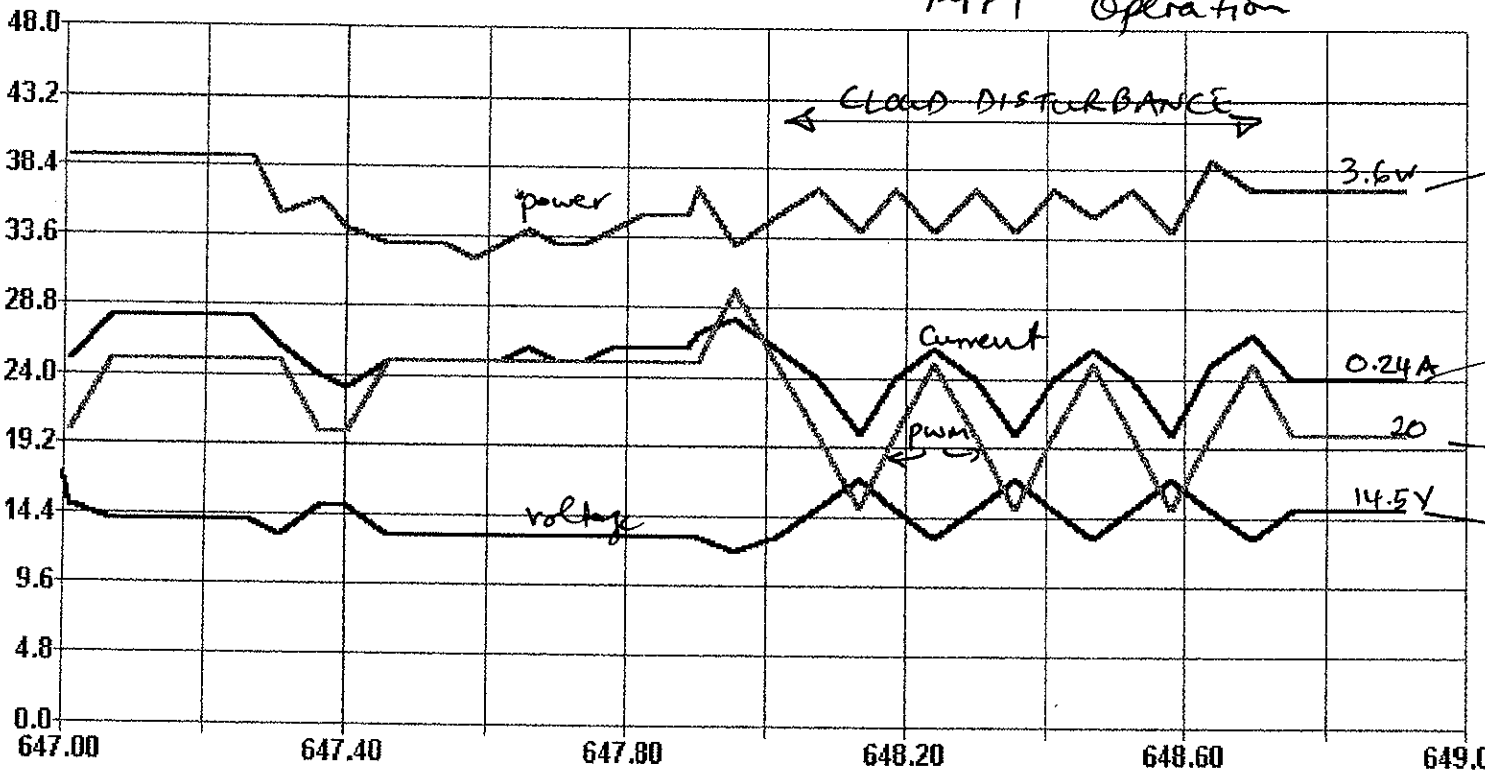
solar2.pbt
solar2.bs2

```
 FOR z_sampleno = 1 TO 50
   HIGH p1_zad1cs
   PAUSE 5
   HIGH p2_zad5_6dio
   PAUSE 5
   Z1_MAIN:
   FOR z_adoddsign = 0 TO 1
     GOSUB Z1A_CONVERT
     SELECT z_adoddsign
     CASE =0            'Channel 0 - current
       z_current = z_adval + z_current
     CASE =1            'Channel 1 - voltage
       z_voltage = z_adval + z_voltage
     ENDSELECT
   NEXT
 NEXT
 z_current = z_current/z_sampleno
 z_voltage = z_voltage/z_sampleno
 z_voltage = z_voltage*11
 z_current = 11*z_current/20
 z_powernew = z_voltage/10
 z_powernew = z_powernew*z_current
 z_p   rnew = z_powernew/100
 RETURN
 Z1A_CONVERT:'========interface TO the LTC1298 FOR channel 0 OR 1=========
 z_adconfig = z_adconfig|%1011
 LOW p1_zad1cs
 PAUSE 5
 SHIFTOUT p2_zad5_6dio, P0_zad7clk, LSBFIRST,[z_adconfig\4]
 SHIFTIN p2_zad5_6dio, P0_zad7clk, MSBPOST, [z_adval\12]
 HIGH p1_zad1cs
 PAUSE 5
 RETURN
 Z2_POWERSET:'=====Subroutine to adjust the power via DS1804_1 pot=========
 LOW p4_zpwm7cs                'select DS1804
 SELECT z_powerdir
   CASE =0                    '0 = CCW
   LOW p6_zpwm2dir
   CASE =1                    '1 = CW
   HIGH p6_zpwm2dir
 ENDSELECT
 FOR   cnt = 1 TO z_poweradj
   HIGH p5_zpwm1inc
   LOW p5_zpwm1inc
 NEXT
 RETURN
 Z3_LCDDISP:'===Subroutine for lcd, DEBUG, plot data for plot program=======
 SEROUT p10_lcd,16780,[$FE,1]
 SEROUT p10_lcd,16780,[$FE,128,"v", DEC4 z_voltage]
 'DEBUG "v ", DEC z_voltage
 SEROUT p10_lcd,16780,[$FE,134,"i", DEC3 z_current]
 'DEBUG "   i ", DEC z_current
 SEROUT p10_lcd,16780,[$FE,139,"p", DEC4 z_powernew]
 'DEBUG "   power ", DEC z_powernew
 SEROUT p10_lcd,16780,[$FE,192,"pp", DEC4 b_powerprev]
 'DEBUG DEC b_powerprev
 SEROUT p10_lcd,16780,[$FE,199,"pa", DEC2 b_total]
 'DEBUG "  pot posn ", DEC b_total
 SEROUT p10_lcd,16780,[$FE,204,"pd", DEC1 z_powerdir]
 'DEBUG "   dir ", DEC z_powerdir, CR
 z_dispv = z_voltage/100
 DEBUG DEC z_dispv, ",", DEC z_current, ",", DEC z_powernew, ",", DEC b_total, ",", CR
 RETURN
```

-StampPlot Pro V3 at 10/31/04 12:41:27
User Status

Chart 2

Resistive load
MPPT Operation



power W x10 watts

current i x 100 amps

pot pwm posn. 0-100

voltage volts

Notes

MPPT working in a very stable way strong steady sun, some cloud disturbance

10Ω dummy load

5W nominal BP sample panel

mid-day

Solar1.plt
Solar1.bs2

FIG-1: MPPT BLOCK DIAGRAM