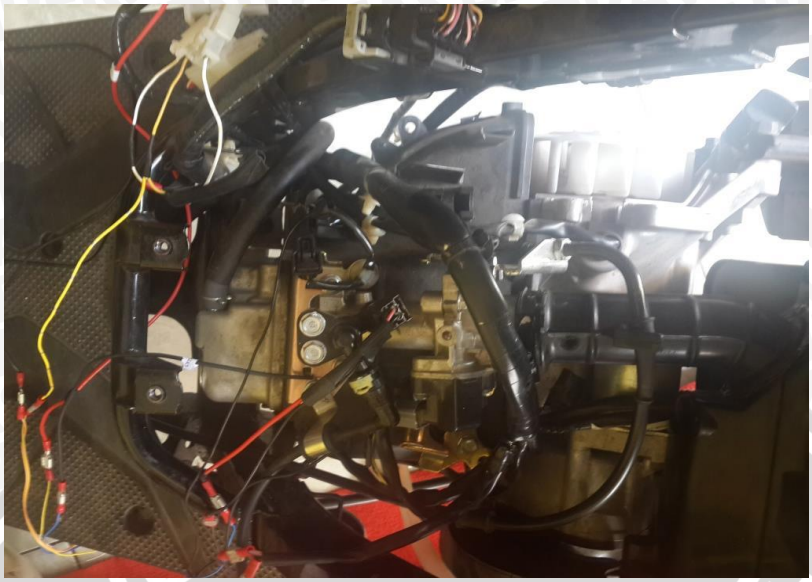
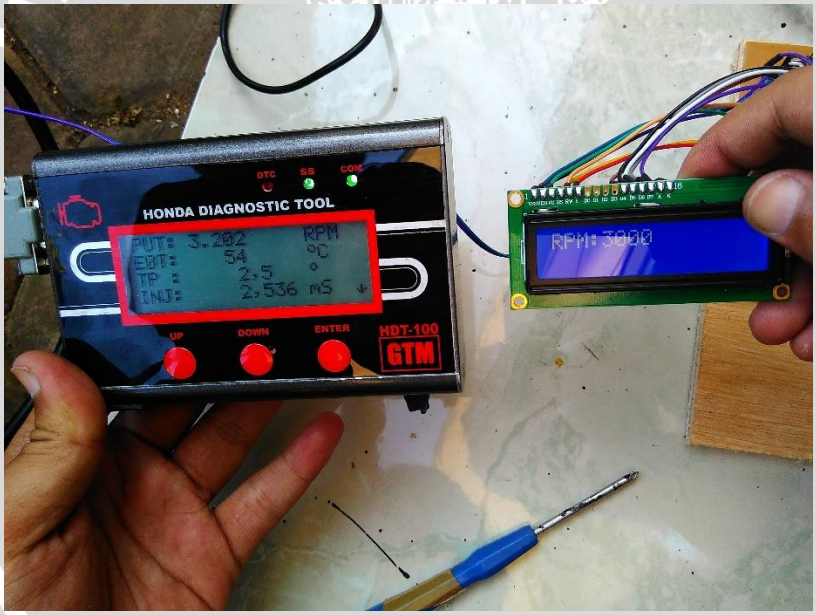
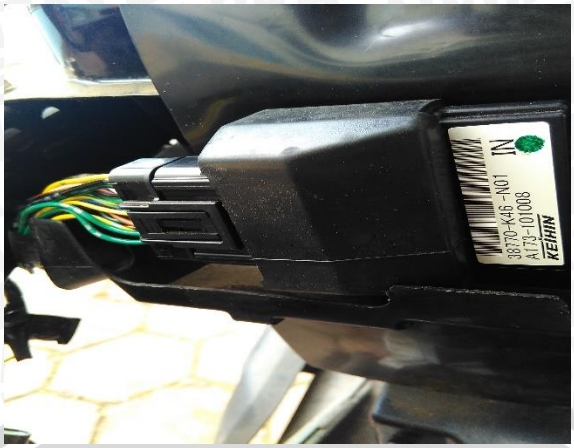
LAMPIRAN



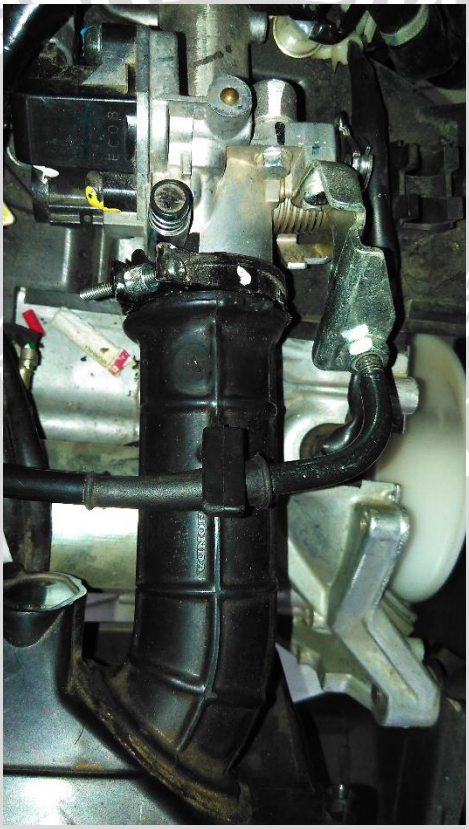
Gambar Mesin Honda Vario 110 FI



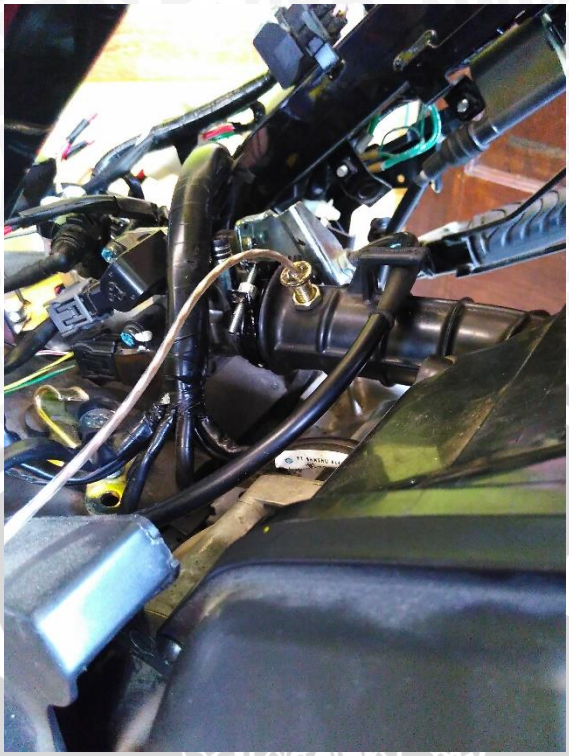
Honda Diagnostic Tool dan LCD



***Engine Control Unit* Vario 110 FI**

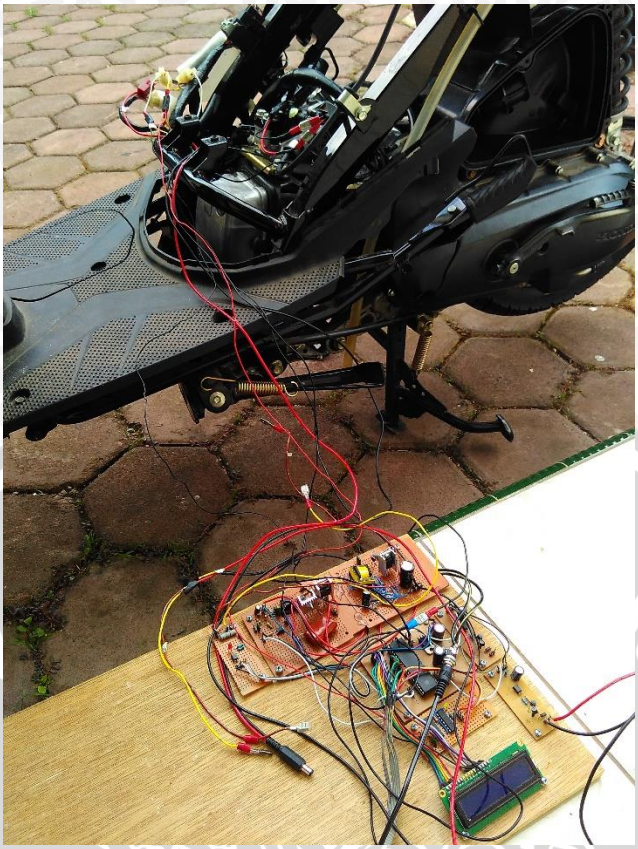


Saluran *Intake Manifold*

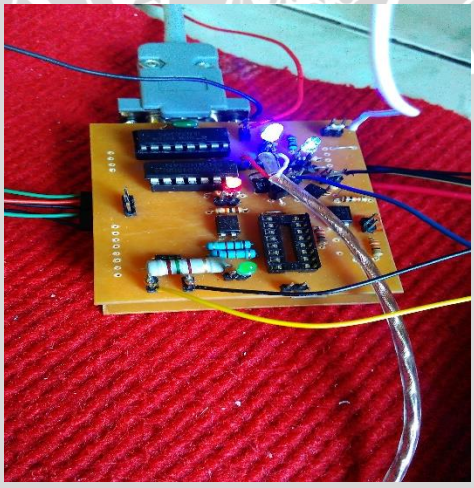


Saluran *Intake Manifold* yang Telah Terpasang Sensor

Perancangan Sensor LM35 untuk Saluran *Intake Manifold*



Pemasangan Rangkaian Elektrik pada Plant



Rangkaian Mikrokontroler (yang Telah Disederhanakan)

Listing Program

```
'$sim
$regfile = "M32def.dat"
$crystal = 12000000
'$crystal = 8000000
$hwstack = 80                                                '
default use 32 for the hardware stack
$swstack = 80                                                '
default use 10 for the SW stack
$framesize = 80                                              '
default use 40 for the frame space


$baud = 57600

Declare Function Konversi_ke_tcnt(byval Nilai As Single) As Integer
Declare Function Set_rpm_by_throtle(byval Posisi As Single) As
Integer

Const Vcc = 4.9
Const Max_adc = 1024
Const Rl = 10000
Const Min_rpm = 1300
Const Max_rpm = 9000

Const Resolusi_timer2 = 0.00008533

'label membership terhadaperror
Const Nb_suhu = -1
Const Zero_suhu = 0
Const Ps_suhu = 1
Const Pb_suhu = 2

Const Nb = -50
Const Ns = -25
Const Zero = 0
Const Ps = 25
Const Pb = 50

Burn Alias 1
Inject Alias 0
```

```
Injector Alias Portc.2
Fuel_pump Alias Portc.3
Ignition Alias Portd.4

True Alias 1
False Alias 0
Lm35 Alias 3

Set Injector
Set Fuel_pump
Set Ignition

Indikator Alias Portc.0
Config Indikator = Output
Config Injector = Output
Config Fuel_pump = Output
Config Ignition = Output

Dim Hitungan As Integer

Config Lcdpin = Pin , Db4 = Portb.2 , Db5 = Portb.3 , Db6 = Portb.4
, Db7 = Porta.0 , E = Portb.1 , Rs = Portb.0

Config Lcd = 16 * 2
'configure lcd screen
Config Portd.2 = Input

Config Adc = Single , Prescaler = Auto
Start Adc

Config Timer0 = Timer , Prescale = 1024
Stop Timer0
Config Timer1 = Timer , Prescale = 256

Config Timer2 = Timer , Prescale = 1024
Stop Timer2

Tcnt1h = &H0B
Tcnt1l = &HDC
On Ovf1 Tim1_isr
```

```
On Ovf2 Tim2_isr

Config Int0 = Falling
Enable Int0                                          'enable
the interrupt
On Int0 Interupt                                     'jump to
label2 on INT0

Config Int1 = Falling
Enable Int1                                          'enable
the interrupt
On Int1 Pulse_inject                                 'jump to
label2 on INT0
Config Portd.3 = Input

Dim Rpm As Single , Tempr As Single , Pulser As Single , K As
Integer
Dim Drpm As Integer , Pulsa As Long , Pulsa_low As Long , Pulsa_high
As Long
Dim Periode As Bit , First_start As Bit , Starting As Bit
Dim T_high As Single , Counter_pulse As Integer , Count As Integer
Dim Temp As Single , Vout_sensor As Single , I As Integer , Data_adc
As Word
Dim Posisi_throtle As Single , Minscope As Integer , Maxscope As
Integer
Dim Set_rpm As Integer , Vout_lm35 As Single

Dim De As Single , A As Byte
Dim Snbe As Single , Snme As Single , Szee As Single , Spme As
Single , Spbe As Single
Dim Nbe As Single , Nme As Single , Zee As Single , Pme As Single ,
Pbe As Single
Dim Nbd As Single , Nmd As Single , Zed As Single , Pmd As Single ,
Pbd As Single
Dim Nbo As Word , Nmo As Word , Zeo As Word , Pmo As Word , Pbo As
Word
Dim Nbc(10) As Word , Nmc(10) As Word , Zec(10) As Word , Pmc(10) As
Word , Pbc(10) As Word
Dim Z(5) As Word , J As Word , Suhu As Single
Dim Kp As Single , Dstr_inj As String * 15 , Dstr_suhu As String *
15
```

```
Dim E As Single , Elst As Single , Flag As String * 2
Dim Setpoint As Single , Pv As Single , Selisih As Integer
Dim Kalkulasi As Single , Timer_injector As Integer , E_suhu As
Single
Dim Tempk1 As Single , Tempk2 As Single , Durasi As Single , Temp2
As Single
Cls
Cursor Off Noblink
Reset Indikator
Wait 1
Enable Timer1                                          ' enable
the timer interrupt
Enable Timer2                                          ' enable
the timer interrupt

Dim Data_throtle(16) As Single
Dim Data_rpm(16)as Integer
'(
Data_throtle(1) = 3.6
Data_throtle(2) = 3.8
Data_throtle(3) = 4.2
Data_throtle(4) = 4.5
Data_throtle(5) = 5
Data_throtle(6) = 5.5
Data_throtle(7) = 6
Data_throtle(8) = 9
Data_throtle(9) = 10
Data_throtle(10) = 10.5
Data_throtle(11) = 11
Data_throtle(12) = 12
Data_throtle(13) = 15
Data_throtle(14) = 21
Data_throtle(15) = 25
Data_throtle(16) = 94
')
Data_throtle(1) = 5.6
Data_throtle(2) = 5.8
Data_throtle(3) = 5.2
Data_throtle(4) = 5.5
Data_throtle(5) = 6
Data_throtle(6) = 6.5
```

```
Data_throtle(7) = 8
Data_throtle(8) = 9
Data_throtle(9) = 10
Data_throtle(10) = 10.5
Data_throtle(11) = 11
Data_throtle(12) = 12
Data_throtle(13) = 15
Data_throtle(14) = 21
Data_throtle(15) = 25
Data_throtle(16) = 94

Data_rpm(1) = Min_rpm
Data_rpm(2) = 1800
Data_rpm(3) = 2100
Data_rpm(4) = 3000
Data_rpm(5) = 3500
Data_rpm(6) = 4000
Data_rpm(7) = 4500
Data_rpm(8) = 5000
Data_rpm(9) = 5500
Data_rpm(10) = 6000
Data_rpm(11) = 6500
Data_rpm(12) = 7000
Data_rpm(13) = 7500
Data_rpm(14) = 8000
Data_rpm(15) = 8500
Data_rpm(16) = Max_rpm



Pulsa_low = 1000
Pulsa_high = 0
Pulsa = 0
Enable Interrupts
Start Timer1
Tcnt0 = &H0
First_start = True
Starting = True
Tcnt2 = &HEA
Cls
Lcd "Ready"
```

```
Periode = Inject
Counter_pulse = 0
Reset Ignition
Periode = Burn
Count = 1

Do
   Gosub Baca_trotle
'      Locate 1 , 1
 '  Lcd Fusing(vout_sensor , "#.#") ; ":" ; Fusing(posisi_throtle ,
"#.#") ; " "

'   Waitms 500
  ' Loop
'   Do
'(
    Set_rpm = Set_rpm_by_throtle(posisi_throtle)
   If Set_rpm >= Min_rpm And Set_rpm < 2000 Then
      Minscope = Konversi_ke_tcnt(1.5)
      Maxscope = Konversi_ke_tcnt(1.9)
   Elseif Set_rpm >= 2000 And Set_rpm < 4500 Then
      Minscope = Konversi_ke_tcnt(2.0)
      Maxscope = Konversi_ke_tcnt(2.7)
   Elseif Set_rpm >= 4500 And Set_rpm < 7000 Then
      Minscope = Konversi_ke_tcnt(2.8)
      Maxscope = Konversi_ke_tcnt(3.8)
   Elseif Set_rpm >= 7000 And Set_rpm <= 10000 Then
      Minscope = Konversi_ke_tcnt(3.9)
      Maxscope = Konversi_ke_tcnt(4.5)
   End If
')
   Gosub Baca_suhu
   If Count = 70 Then
      Tempk1 = 256 - Timer_injector
      Tempk2 = Tempk1 * Resolusi_timer2
      Durasi = Tempk2 * 1000
      Dstr_inj = Fusing(durasi , "#.#")
      Dstr_suhu = Fusing(suhu , "#.#")
      Drpm = Int(rpm)
      Locate 1 , 1
```

```
      Lcd "SR:" ; Set_rpm ; "|R:" ; Drpm ; "  "              ';
E_suhu
      Locate 2 , 1
      Lcd "T:" ; Dstr_suhu ; "|I:" ; Dstr_inj ; "   "
      Count = 0 .
'      Print "= RPM:" ; Rpm ; "|Set RPM:" ; Set_rpm ; "|Suhu:" ;
Suhu ; "|Injeksi:" ; Dstr_inj ; "|"

      Count = 0 .
   End If
   Incr Count
Loop


Baca_suhu:
   Temp2 = 0
   For I = 1 To 20
         Data_adc = Getadc(lm35)
         Temp2 = Temp2 + Data_adc
       '  Waitms 1
   Next
   Vout_lm35 = Temp2 / 20
   'koversi ke tegangan Vin ADC
   Temp2 = Vout_lm35 * Vcc
   Vout_lm35 = Temp2 / Max_adc
   Suhu = Vout_lm35 / 0.01
Return

Actuator_inject:
   If Kp = 0 Then
   Tempr = Minscope
   Elseif Kp < 1 Then                                    'RPM <
set
      Selisih = Minscope - Maxscope
      Tempr = Kp
      Kalkulasi = Tempr / 1
      Kalkulasi = Kalkulasi * Selisih
      Tempr = Minscope - Kalkulasi
   End If
   Timer_injector = Int(tempr)
```

```
    If Szee = True Then
       Timer_injector = Int(tempr)
    Elseif Snbe = True Then
       Timer_injector = Minscope
    Elseif Spme = True Then
       Kalkulasi = Tempr - Maxscope
       Selisih = Kalkulasi / 2
       Tempr = Minscope + Selisih
       Timer_injector = Int(tempr)
    Elseif Spbe = True Then
       Timer_injector = Maxscope
    End If

      ' Timer_injector = Int(tempr)

Return

Baca_trotle:
   Temp = 0
   For I = 1 To 30
         Data_adc = Getadc(2)
         Temp = Temp + Data_adc
'         Waitms 1
   Next
   Vout_sensor = Temp / 30
   'koversi ke tegangan Vin ADC
   Vout_sensor = Vout_sensor * Vcc
   Vout_sensor = Vout_sensor / Max_adc
   Temp = Vout_sensor - 0.3
   Temp = Temp / 4.2
   Posisi_throtle = Temp * 100
Return


'the following code is executed when the timer rolls over
Tim1_isr:
   Stop Timer1
   Rpm = Pulser / 9                                    'jumlah
triger 9 step
   Rpm = Rpm * 5                                       '1detik
putaran (200ms timer x 5 = 1detik)
```

```
   Rpm = Rpm * 60                                          '1menit
putaran
   Tcnt1 = &HDB61
   Start Timer1
   Pulser = 0
Return

Tim2_isr:
   Stop Timer2
   Set Injector
   Set Indikator
Return

Pulse_inject:
   Pulsa = 3
   Reset Injector
   Disable Int1
   Reset Indikator
   If Rpm >= Min_rpm Then
      Tcnt2 = Timer_injector
      Start Timer2
   Else
      Bitwait Pind.3 , Set
      Set Injector
      Set Indikator
   End If
   Enable Int1
Return
'generates a RET because it is the second RETURN

Interupt:
   Disable Int0
   If Pulsa = 5 Then
      Gosub Baca_pv_suhu
      Gosub Member_error_suhu
   End If

   If Pulsa = 8 Then

'   Set_rpm = Set_rpm_by_throtle(posisi_throtle)
    Set_rpm = 1500
```

```
    If Set_rpm >= Min_rpm And Set_rpm < 2000 Then
       Minscope = Konversi_ke_tcnt(1.8)
       Maxscope = Konversi_ke_tcnt(2.3)
    Elseif Set_rpm >= 2000 And Set_rpm < 4500 Then
       Minscope = Konversi_ke_tcnt(2.4)
       Maxscope = Konversi_ke_tcnt(2.8)
    Elseif Set_rpm >= 4500 And Set_rpm < 7000 Then
       Minscope = Konversi_ke_tcnt(2.9)
       Maxscope = Konversi_ke_tcnt(3.8)
    Elseif Set_rpm >= 7000 And Set_rpm <= 10000 Then
       Minscope = Konversi_ke_tcnt(3.9)
       Maxscope = Konversi_ke_tcnt(4.5)
    End If
    Setpoint = Set_rpm
       Gosub Baca_pv
       Gosub Member_error
       Gosub Member_del_error
       Gosub Rule_base
       Gosub Implikasi
       Gosub Defusifikasi
       Gosub Actuator_inject

       Elst = E                                          'error
disimpan sebagai error sebelumnya
    End If
    Incr Pulsa
    Incr Pulser
    Enable Int0

Return
'generates a RET because it is the second RETURN

End

Function Konversi_ke_tcnt(byval Nilai As Single) As Integer
Local Tempd As Single , Nilai_t As Single
    Tempd = Nilai / 1000                                 'koversi
ke ms
    Nilai_t = Tempd / Resolusi_timer2                    'data ms
/ resolusi timer 2
```

```
   Konversi_ke_tcnt = 256 - Int(nilai_t)
'konversi ke nilai TCNT
End Function


Function Set_rpm_by_throtle(byval Posisi As Single) As Integer
Local Sterm1 As Single , Sterm2 As Single , Sterm3 As Single , Hasil
As Single
Local Tempd As Single , Tempd2 As Single

  ' Check throtle terhadap nilai tertinggi dan terrendah RPM
  If Posisi >= Data_throtle(16) Then
   Set_rpm_by_throtle = Max_rpm
   Exit Function
  End If

  If Posisi <= Data_throtle(1) Then
   Set_rpm_by_throtle = Min_rpm
   Exit Function
  End If

  For K = 1 To 16                                          'cek
nilai trhotle terhadap array RPM
    If Posisi <= Data_throtle(k) Then Exit For
  Next

  If Posisi = Data_throtle(k) Then
    Set_rpm_by_throtle = Data_rpm(k)                       'jika
sama, data array RPM = array Trotle
   Exit Function
  End If

  Sterm1 = Posisi - Data_throtle(k)

  Sterm2 = Data_rpm(k) - Data_rpm(k -1)
  Sterm3 = Data_throtle(k) - Data_throtle(k - 1)
  Tempd = Sterm1 * Sterm2
  Tempd2 = Tempd / Sterm3
  Hasil = Data_rpm(k ) + Tempd2
  If Hasil > Max_rpm Then Hasil = Max_rpm
  If Hasil < Min_rpm Then Hasil = Min_rpm
```

```
  Set_rpm_by_throtle = Hasil

End Function


'====================baca SP & AV via adc============
Baca_pv_suhu:
   Pv = Suhu
   Setpoint = 25
   E_suhu = Setpoint - Pv
Return

'====================program member input1/error===========
Member_error_suhu:
'error - suhu naik
If E_suhu <= Nb_suhu Then
   Snbe = 1
   Snme = 0
   Szee = 0
   Spme = 0
   Spbe = 0
Elseif E_suhu <= Zero_suhu Then
   Snbe = 0
   Snme = 0
   Szee = 1
   Spme = 0
   Spbe = 0
Elseif E_suhu <= Ps_suhu Then
   Snbe = 0
   Snme = 0
   Szee = 0
   Spme = 1
   Spbe = 0
Elseif E_suhu <= Pb_suhu Then
   Snbe = 0
   Snme = 0
   Szee = 0
   Spme = 0
   Spbe = 1
Else
   Snbe = 0
```

```
    Snme = 0
    Szee = 0
    Spme = 0
    Spme = 0
    Spbe = 1
End If
Return

'====================baca SP & AV via adc============
Baca_pv:
    Pv = Rpm
'    Setpoint = Set_point_keypad
    E = Setpoint - Pv                                    '- Sp
    De = E - Elst
Return

'====================program menber input1/error============
Member_error:
If E <= Nb Then
    Nbe = 1
    Nme = 0
    Zee = 0
    Pme = 0
    Pbe = 0
Elseif E <= Ns Then
    'nbe=-(1/0.5)*(e+0.5)
    Nbe = -e
    Nbe = Nbe - 0.5
    Nbe = Nbe * 2
    'nme=(1/0.5)*(e+1)
    Nme = E + 1
    Nme = Nme * 2
    Zee = 0
    Pme = 0
    Pbe = 0
Elseif E <= Zero Then
    Nbe = 0
    'nme=-(1/0.5)*(e)
    Nme = -e * 2
    'zee=(1/0.5)*(e+0.5)
    Zee = E + 0.5
```

```
    Zee = Zee * 2
    Pme = 0
    Pbe = 0
Elseif E <= Ps Then
    Nbe = 0
    Nme = 0
    'zee=-(1/0.5)*(e-0.5)
    Zee = -e
    Zee = Zee + 0.5
    Zee = Zee * 2
    'pme=(1/0.5)*(e)
    Pme = E * 2
    Pbe = 0
Elseif E <= Pb Then
    Nbe = 0
    Nme = 0
    Zee = 0
    'pme=-(1/0.5)*(e-1)
    Pme = -e
    Pme = Pme + 1
    Pme = Pme * 2
    'pbe=(1/0.5)*(e-0.5)
    Pbe = E - 0.5
    Pbe = Pbe * 2
Else
   Nbe = 0
    Nme = 0
    Zee = 0
    Pme = 0
    Pme = 0
    Pbe = 1
End If
Return

'====================program menber input2/delta error==========
Member_del_error:
If De <= Nb Then
    Nbd = 1
    Nmd = 0
    Zed = 0
    Pmd = 0
```

```
    Pbd = 0
Elseif De <= Ns Then
    'nbe=-(1/0.5)*(de+0.5)
    Nbd = -de
    Nbd = Nbd - 0.5
    Nbd = Nbd * 2
    'nme=(1/0.5)*(de+1)
    Nmd = De + 1
    Nmd = Nmd * 2
    Zed = 0
    Pmd = 0
    Pbd = 0
Elseif De <= Zero Then
    Nbd = 0
    'nme=-(1/0.5)*(de)
    Nmd = -de
    Nmd = Nmd * 2
    'zee=(1/0.5)*(de+0.5)
    Zed = De + 0.5
    Zed = Zed * 2
    Pmd = 0
    Pbd = 0
Elseif De <= Ps Then
    Nbd = 0
    Nmd = 0
    'zee=-(1/0.5)*(de-0.5)
    Zed = -de
    Zed = Zed + 0.5
    Zed = Zed * 2
    'pme=(1/0.5)*(de)
    Pmd = De * 2
    Pbd = 0
Elseif De <= Pb Then
    Nbd = 0
    Nmd = 0
    Zed = 0
    'pme=-(1/0.5)*(de-1)
    Pmd = -de
    Pmd = Pmd + 1
    Pmd = Pmd * 2
    'pbe=(1/0.5)*(de-0.5)
```

```
    Pbd = De - 0.5
    Pbd = Pbd * 2
Else
   Nbd = 0
    Nmd = 0
    Zed = 0
    Pmd = 0
    Pmd = 0
    Pbd = 1
End If
Return

'=========================program rule=======================
'    \ E   |   NB |   NS |   Z   |   PS |   PB |
' dE \     |      |      |       |      |      |
'-------------------------------------
'   NB     | PB   | PB   | PB    | PS   | Z    |
'   NS     | PB   | PS   | PS    | Z    | NS   |
'   Z      | PB   | PS   | Z     | NS   | NB   |
'   PS     | PS   | Z    | NS    | NS   | NB   |
'   PB     | Z    | NS   | NB    | NB   | NB   |
'=========================program rule=======================
Rule_base:
'Nbe
'1
If Nbe < Nbd Then
      Nbc(1) = Nbe * 100
Else
      Nbc(1) = Nbd * 100
End If
'2
If Nbe < Nmd Then
      Nbc(2) = Nbe * 100
Else
      Nbc(2) = Nmd * 100
End If
'3
If Nbe < Zed Then
      Nmc(1) = Nbe * 100
Else
```

```
        Nmc(1) = Zed * 100
End If
'4
If Nbe < Pmd Then
        Nmc(2) = Nbe * 100
Else
        Nmc(2) = Pmd * 100
End If
'5
If Nbe < Pbd Then
        Zec(1) = Nbe * 100
Else
        Zec(1) = Pbd * 100
End If

'Nme
'1
If Nme < Nbd Then
        Nbc(3) = Nme * 100
Else

        Nbc(3) = Nbd * 100
End If
'2
If Nme < Nmd Then
        Nmc(3) = Nme * 100
Else
        Nmc(3) = Nmd * 100
End If
'3
If Nme < Zed Then
        Nmc(4) = Nme * 100
Else
        Nmc(4) = Zed * 100
End If
'4
If Nme < Pmd Then
        Zec(2) = Nme * 100
Else
        Zec(2) = Pmd * 100
End If
```

```
'5
If Nme < Pbd Then
      Pmc(1) = Nme * 100
Else
      Pmc(1) = Pbd * 100
End If

'Zed
'1
If Zee < Nbd Then
      Nmc(5) = Zee * 100
Else
      Nmc(5) = Nbd * 100
End If
'2
If Zee < Nmd Then
      Nmc(6) = Zee * 100
Else
      Nmc(6) = Nmd * 100
End If
'3
If Zee < Zed Then
      Zec(3) = Zee * 100
Else
      Zec(3) = Zed * 100
End If
'4
If Zee < Pmd Then
      Pmc(2) = Zee * 100
Else
      Pmc(2) = Pmd * 100
End If
'5
If Zee < Pbd Then
      Pmc(3) = Zee * 100
Else
      Pmc(3) = Pbd * 100
End If

'Pme
'1
```

```
If Pme < Nbd Then
      Nmc(7) = Pme * 100
Else
      Nmc(7) = Nbd * 100
End If
'2
If Pme < Nmd Then
      Zec(4) = Pme * 100
Else
      Zec(4) = Nmd * 100
End If
'3
If Pme < Zed Then
      Pmc(4) = Pme * 100
Else
      Pmc(4) = Zed * 100
End If
'4
If Pme < Pmd Then
      Pmc(5) = Pme * 100
Else
      Pmc(5) = Pmd * 100
End If
'5
If Pme < Pbd Then
      Pbc(1) = Pme * 100
Else
      Pbc(1) = Pbd * 100
End If

'Pbe
'1
If Pbe < Nbd Then
      Zec(5) = Pbe * 100
Else
      Zec(5) = Nbd * 100
End If
'2
If Pbe < Nmd Then
      Pmc(6) = Pbe * 100
Else
```

```
      Pmc(6) = Nmd * 100
End If
'3
If Pbe < Zed Then
      Pmc(7) = Pbe * 100
Else
      Pmc(7) = Zed * 100
End If
'4
If Pbe < Pmd Then
      Pbc(2) = Pbe * 100
Else
      Pbc(2) = Pmd * 100
End If
'5
If Pbe < Pbd Then
      Pbc(3) = Pbe * 100
Else
      Pbc(3) = Pbd * 100
End If
Return


'====================implikasi================================
Implikasi:
Nbo = Max(nbc(1))
Nmo = Max(nmc(1))
Zeo = Max(zec(1))
Pmo = Max(pmc(1))
Pbo = Max(pbc(1))

J = Nbo + Nmo
J = J + Zeo
J = J + Pmo
J = J + Pbo
Return

'==================defuzifikasi==============================
Defusifikasi:
Z(1) = Nbo * 0
Z(2) = Nmo * 0.25
```

```
Z(3) = Zeo * 0.5
Z(4) = Pmo * 0.75
Z(5) = Pbo * 1

Z(1) = Z(1) + Z(2)
Z(1) = Z(1) + Z(3)
Z(1) = Z(1) + Z(4)
Z(1) = Z(1) + Z(5)
Z(1) = Z(1)
Kp = Z(1) / J

Return
```