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Research Center

REPORT

CONVERSION OF

SHERVIN ELECTRIC Co.

HOT CHAMBER

FINAL REPORT

Contract No. 99/133P

UNIDO's PROJECT No. MP/IRA/98/087

30 Oct 99

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SYNOPSIS

Under supreme supervision of **UNIDO** the **CFC** phase project has been implemented in Iran to phase out 100 % ODS in some Iranian White Industries

The project No. **MP/IRA/98/087** has been nominated to Islamic Republic of Iran for the Multilateral Fund for the implementation of The Montreal Protocol Financing.

The project was approved by Montreal Protocol Multilateral Fund executive committee. The project was actually started in November 1994, but the implementation of the project has been already started from January 1994, by recommendation of Montreal Protocol and request of Government of Islamic Republic of Iran, the refrigerant R134a was finally approved and selected by **UNIDO** as an alternative for refrigerant R12.

Shervin Electric Co. As a home appliance manufacturer in Iran the main activities of ***Shervin Electric Co.*** , is producing refrigerators and freezers,

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INTRODUCTION

According to **UNIDO** contract No. **99/133P** with Industrial Control Research Center Co. **(ICRC)** the existing ***Shervin Electric Co.*** hot chambers facilities shall be converted and modified to phase out CFC-12 and suitable for **R134a** refrigerant to perform functionality and performance test of converted refrigerators and complying with ISO standards 7173, 8187, and 5155.

1 This proposal has been prepared based on the requirements of Islamic Republic of Iran indicated in the country program no ***UNEP/OZL.PRO/EX COM/10/24*** dated 27 May 1993 prepared by **UNDP**.

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2 The **CFC** phase out project in ***Shervin Electric Co.*** will enable ***Shervin Electric Co.*** to convert the existing production line facilities and existing hot chambers into Non CFC production line, using **R134a** refrigerant.

3 The converted Hot Chamber Installations will provide more than 20 data points in the refrigeration circuit this means more information and the ability of analyzing refrigeration system and new refrigerant effect.

4 The reconstructed Hot Chamber will be able to check and test 2 refrigerator and/or ref.-freezers units at the same time. The same equipment and data processing system, as will be used at plant test room will be installed in this chamber.

5 The immediate effect of this project at ***Shervin Electric Co.*** is to perform all required check and tests, suitable for Refrigerator & Freezers using Ozone Friendly Gases. The existing test facilities in ***Shervin Electric Co.*** are not adequate for check and testing, converted ref. and freezer units, in addition to that the hot rooms are not able to perform Energy Consumption and Optimization Program.

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ICRC Hot Chamber Characteristics

In order to convert ***Shervin Electric Co.*** hot rooms facilities , ICRC shall provide following services:

- Supply of new equipment.
- Redesign of old equipment
- Delivery of technical drawings and software.
- Installation and commissioning.
- Start-up of the equipment and the technology.
- On-the-job training of the plant personnel.

With respect to **ISO** standards test requirements, and for the purpose of functionality and performance tests of the new redesigned Refrigerator and Ref.-Freezers using R134a refrigerants. The existing hot room in ***Shervin Electric Co.*** is being converted and equipped in such a way to enable ***Shervin Electric Co.*** to check and test at least one different models of refrigerators and freezers at ambient temperature 32 to 43 degree centigrade at one hot room chambers . In addition to these services is providing. But the hot room is capable to test eight refrigerators and freezers in case of adding more transducers and sensors in the main panel in the hot room:

a) Procurement of new test measurement and data processing equipment.
b) Redesign and rebuilding of presently used equipment and installation.
c) Installation, commissioning, trial operation, start-up and on-the-job training

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SHERVIN ELECTRIC
HOT CHAMBER
TECHNICAL SPECIFICATION

As previously mentioned , ***Shervin Electric Co.***'s plant is producing 50 refrigerator daily . And subsequently the hot chamber should have been able to cover plant daily test requirement as well as other activities. Therefore, the converted hot chamber should respond to all test requirement and be able to meet ISO standards numbers 7371, 5155, 8187 as set forth in the contract and IJISI, Iranian standards numbers 254, 2482, 2818. The plant hot chamber technical specification are as follows:

- Hot Chamber Dimension about 3 mt. by 3 mt.
- Refrigerator test ability simultaneously, 2 units and ability to test 6 sample out of the room
- Ability to perform following operational tests and report:

1 - Pull down test.
2 - Continuous run test.
3 - Cyclic run test.
4 - Ice Freeze test.
5 - Energy consumption test

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- 20 Measuring points, including. (for each applia.)

1 - Humidity, one point for one hot room.
2 - Compressor Power, 2 point
3 - Motor current, 2 point.
4 - Supply Voltage, 2 point.
5 - Hot chamber air temperature reading, one point.

- The ability to measure 160 points for eight models in case of improving the system by spending very low costs.

- Computerized graphical diagram of the refrigerator performance data sheet.

- Test measurement tolerance for temperature reading 0.3 degree centigrade.

- Computerized data processing system.

- Full color test sheet system reporting.

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- On screen and data reporting system ability with following characteristics;

1 - Test number.
2 - Product name.
3 - Product model
4 - Product internal volume
5 - Compressor name
6 - Compressor model
7 - Compressor cooling capacity
8 - Compressor current
9 - Thermostat setting
10 - Thermostat type.
11 - Total test running time.
12 - Ambient temperature.
13 - Voltage rating
14 - Working percentage

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15 - Evaporator mean air temperature
16 - Cabin mean temperature
17 - Evaporator bulb temperature
18 - Crisper temperature.
19 - Actual compressor running time
20 - Energy consumption
21 - Compressor motor winding temperature
22 - Compressor shell temperature.
23 - Compressor discharge temperature.
24 - Condenser inlet temperature.
25 - Condenser out let temperature.
26 - Condenser mid temperature
27 - Evaporator inlet temperature
28 - Evaporator outlet temperature.
29 - Freezing temperature.
30 - Refrigeration system condition display.

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ACTIVITIES

The following activities were accomplished so far toward achievement of the contract requirement as set forth by **UNIDO** and the counterpart.

1 - Planning for;

a) Hot chambers system management.
b) Hot chambers graphic display management.
c) Hot chambers calibration setting parameters.
d) Hot chambers test standards management

2 - Preparing material requirement list.

3 - Component and material supply source evaluation.

4 - Technical data collecting.

5 - Engineering drawing for electronic and electrical system

6 - Hot chamber design review.

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7 - Data processing software planning.

8 - Data processing hardware planning.

9 - Thermal amplification electronic cart design

10 - Preparation of timer 1 flow chart..

11 - Initial test of data loggers electronic cart.

12 - Initial connection of data loggers to the computers.

13 - Interface electronic cart design for PC and operating system.

14 - RTX3 electronic diagram design.

15 - RTX electronic diagram design.

16 - UNIDO, CRC - 386 design.

17 - UNIDO, TC- 100 design.

18 - UNIDO, in-out CRC design.

19 - Preparation of operating system display flow chart.

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20 - Visits and coordination;

20/1 :

-Visiting plant One day, One engineer, one time.
-Visiting and coordinating with UNDP office .
-Technical negotiation with ***Shervin Electric Co.*** engineers and hot chamber in order to coordinate activities.
-Advising for the necessary modification on the Room .

20/2 :

-Visiting plant 3 days , 5 engineer and Technician, one time.
-Installation Electronic Panel
-Installation Electrical Panel
-Completing The Room
-Starting Test
-Controlling Condition Of the Room
-Testing 2 Samples for Energy Consumption
-Testing 2 Samples for Performance Test
-Testing 2 Samples for Fume Quality
-Teaching the technical Test

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-Visiting and coordinating with **UNDP office .**
-Technical negotiation with ***Shervin Electric Co.*** engineers and hot chamber in order to coordinate activities.
-Advising for the necessary modification on the Samples .

21 - Soft Ware :

-data gathering
-calibrating
-printing
-editing
-humidi curving
- self checking

All software are installed and Started

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SUPPLY PARTS AND MATERIALS

In order to fabricate components and electronic kits following material and parts have been purchased so far.

1 - Semiconductor sensors for measuring temperature from - 30 to + 110 degree centigrade. 32 each

2 - Electronic humidity measurement sensor 1 each

3 - Electronic data logger cart for temperature measurement 2 each

4 - Electronic data logger cart for humidity Calibration 1 each

5 - ADC912 Converter IC for system conversion management.

6 - Electronic parts consist of resistor. IC, capacitor, and diode.

7 - Main Electronic Data Log

8 - (2*24) Electronic Sensors for Thermal Measuring

9 - (2*4) Electronic Sensors for Thermal Measuring of Condenser

10 -Heater Controller contractors

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```
Dim Black, Blue, Green
Dim Cyan, red, Magenta, YELLOW
Dim gray, L_Blue, L_Green
Dim L_cyan, L_red, L_Magenta, L_yellow

Dim prn_color As Integer 'False=Black & White ; True=Color

Dim printcolor As Integer
Dim Y, Repstr$, Rot_Txt_no%
Dim printerdrawwidth As Integer
Dim offset, PageNo
Dim Lb_Tmp As Label
Dim FirstKey

Dim Rec_Max%
Dim SegEn
Dim ActiveFrame      As Integer
Dim ActiveLabel      As Integer
Dim Seg_n            As Integer

Dim PrnPageNo        As Integer
Dim ActivePage       As Integer


Dim sl%, st%, sw%, sh%, dw%
Dim a30 As String * 30

Dim rr() 'Extracted Results
```

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```
'
Sub cmd_click (Index As Integer)

    Select Case Index
        Case 0                          'print
            screen.MousePointer = 11
            Cmd(0).Enabled = False
            Cmd(1).Enabled = False
            DoEvents
            Call Print_All
            Call Save_Spec
            screen.MousePointer = 0
            Cmd(0).Enabled = True
            Cmd(1).Enabled = True
            'Unload Me

        Case 1                          'Save
            nn = Variable("Prnt", "Write")
            nn = Variable("Prnt", "Read")
        Case 2                          'cancel
            Unload Me
        Case 3
            Me.Hide
            Paper.Show
    End Select
    Exit Sub
End Sub
```

```
'
Sub Color_chk_Click (Value As Integer)

   ' If color_chk.Value = False Then
   '     prn_color = False
```

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```
'      color = 0
'        Black = color
'        Blue = color
'        Green = color
'        Cyan = color
'        red = color
'        Magenta = color
'        YELLOW = color
'        gray = color
'        L_Blue = color
'        L_Green = color
'        L_cyan = color
'        L_red = color
'        L_Magenta = color
'        L_yellow = color
'
'   Else
        prn_color = True
        Black = QBColor(0)
        Blue = QBColor(1)
        Green = QBColor(2)
        Cyan = QBColor(3)
        red = QBColor(4)
        Magenta = QBColor(5)
        YELLOW = QBColor(6)
        gray = QBColor(8)
        L_Blue = QBColor(9)
        L_Green = QBColor(10)
        L_cyan = QBColor(11)
        L_red = QBColor(12)
        L_Magenta = QBColor(13)
        L_yellow = QBColor(14)
'   End If

End Sub
```

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```
'
Sub crv (mode$, Rec1, Rec2)

  Select Case mode$
    Case "prn"
        printer.ForeColor = Black
        printer.FontName = "Arial"
        printer.FontSize = 10
        obj = ActiveObj

        'print x_axis
        printer.DrawWidth = 3 * printerdrawwidth
        printer.Line (Rec1, 0)-(Rec2, 0)'axis
        printer.DrawWidth = 1
        printer.DrawStyle = 2'=DOt 3=Dash-Dot 4=Dash_Dot_Dot
        For i = -300 To 1000 Step 100
            printer.Line (Rec1, i)-(Rec2, i)
        Next i
        rec = zoom(Seg_n).X1
        printer.DrawWidth = 3 * printerdrawwidth
        printer.ForeColor = IIf(prn_color = False, Black,
         zoom(Seg_n).BorderColor)
        printer.Line (rec, -300)-(rec, 1000)
        printer.DrawStyle = 0 'Solid
        printer.DrawWidth = 1 * printerdrawwidth

        printer.CurrentX = rec - RecLb(Seg_n).Width / 2
        printer.CurrentY = 1030
        printer.Print RecLb(Seg_n).Caption

        n = -1
        R1 = (Rec1 \ 10 + 1) * 10
        R2 = (Rec2 \ 10) * 10
```

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```
printer.FontSize = 5
        printer.ForeColor = Black
        For rec = R1 To R2 Step 10
            printer.Line (rec, 10)-(rec, -10), Black
            n = n + 1
            If n Mod 3 = 0 Then
                b$ = Right$("0" & rec \ 60, 2) & ":" & Right$("0" &
         rec Mod 60, 2)
                printer.CurrentX = rec - 2'offset / 13
                printer.CurrentY = -12
                printer.Print b$
            End If
        Next rec

        'graph
        For n = 0 To 1
            For d = 1 To 6
                If curve_Item(n, d) < 50 Then
                    z = curve_Item(n, d)
                    If curve_color(n, d) = 15 Then col = 0 Else col =
         curve_color(n, d)
                    printer.ForeColor = IIf(prn_color = False, Black,
         QBColor(col))
                    For rec = Rec1 To Rec2 - 1
                        bool1 = grf(26, rec) = 789
                        bool2 = grf(26, rec + 1) = 789
                        If bool1 And bool2 Then
                            Y1 = grf(z, rec)
                            Y2 = grf(z, rec + 1)
                            printer.Line (rec, Y1)-(rec + 1, Y2)
                        End If
                    Next rec
                End If
            Next d
        Next n
```

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```
Case "grfall"
      On Error Resume Next 'Note:Karim
      obj = ActiveObj
      grafall.Cls
      grafall.DrawMode = 7                              '(7=xor 13=copy)
      RecAll_End = UBound(grf, 2) - 1
      If Err = 9 Then
          Rec_Max = 0
          Exit Sub
      End If
      Rec_Max = RecAll_End
      screen.MousePointer = 11
      sw = IIf(RecAll_End < 100, 100, RecAll_End)
      grafall.ScaleWidth = sw'+ recall_end \ 10
      grafall.ScaleLeft = 0
      recall_start = 1
      grafall.Line (recall_start, 0)-(RecAll_End, 0), QBColor(3)


      For n = 0 To 1
      For d = 1 To 6
        If curve_Item(n, d) < 50 Then
          z = curve_Item(n, d)
          If Hr.lbt(z).Visible = True Then
            grafall.ForeColor = QBColor(curve_color(n, d))
            For rec = recall_start To RecAll_End - 1
              If grf(26, rec) = 789 And grf(26, rec + 1) = 789 Then
                grafall.Line (rec, grf(z, rec))-(rec + 1, grf(z, rec
 + 1))
              End If
            Next rec
          Else
              curve_Item(n, d) = 50
              Hr.lbt(z).ForeColor = QBColor(0)
```

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```
            End If
          Next d
        Next n
        screen.MousePointer = 0
    Case "grfzoom"
        On Error Resume Next
        obj = ActiveObj

        zoomarea = 30
        zoomarea2 = zoomarea \ 2
        grafzoom.ScaleWidth = zoomarea
        'X = Int(zoom.X1 + .5)
        'If X > Rec_Max Then Stop
        grafzoom.ScaleLeft = X - zoomarea2

        Rec_Start = IIf(X - zoomarea2 > 0, X - zoomarea2, 0)
        Rec_end = IIf(X + zoomarea2 < Rec_Max, X + zoomarea2, Rec_Max)

        'Rec_Start = Seg(ActiveSeg).Left
        'Rec_End = Rec_Start + Seg(ActiveSeg).Width
        'grafzoom.ScaleWidth = Seg(ActiveSeg).Width
        'grafzoom.ScaleLeft = Rec_Start

        grafzoom.Cls
        grafzoom.DrawMode = 7                          '(7=xor 13=copy)
        grafzoom.Line (Rec_Start, 0)-(Rec_end, 0), QBColor(3)
        For n = 0 To 1
        For d = 1 To 6
          If curve_Item(n, d) < 50 Then
            z = curve_Item(n, d)
            If Hr.lbt(z).Visible = True Then
              grafzoom.ForeColor = QBColor(curve_color(n, d))
              For rec = Rec_Start To Rec_end - 1
                If grf(26, rec) = 789 And grf(26, rec + 1) = 789 Then
                  grafzoom.Line (rec, grf(z, rec))-(rec + 1, grf(z,
```

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```
rec + 1))
                End If
              Next rec
            Else
                curve_Item(n, d) = 50
                Hr.lbt(z).ForeColor = QBColor(0)
                Hr.lbt(z).BackColor = &H202020
            End If

            End If
          Next d
        Next n
        screen.MousePointer = 0
        Call ResultsGrf_click
    End Select

End Sub

'
'
Sub CrvZoom ()

    On Error Resume Next
    grafzoom.Cls
    If ActivePage < 1 Then
        Call ResultsGrf_click
        Exit Sub
    End If
    obj = ActiveObj
    zoomarea = 30
    zoomarea2 = zoomarea \ 2
    grafzoom.ScaleWidth = HourPerPage * 60
    grafzoom.ScaleLeft = Seg(ActivePage).Left
    Rec_Start = grafzoom.ScaleLeft + 1
```

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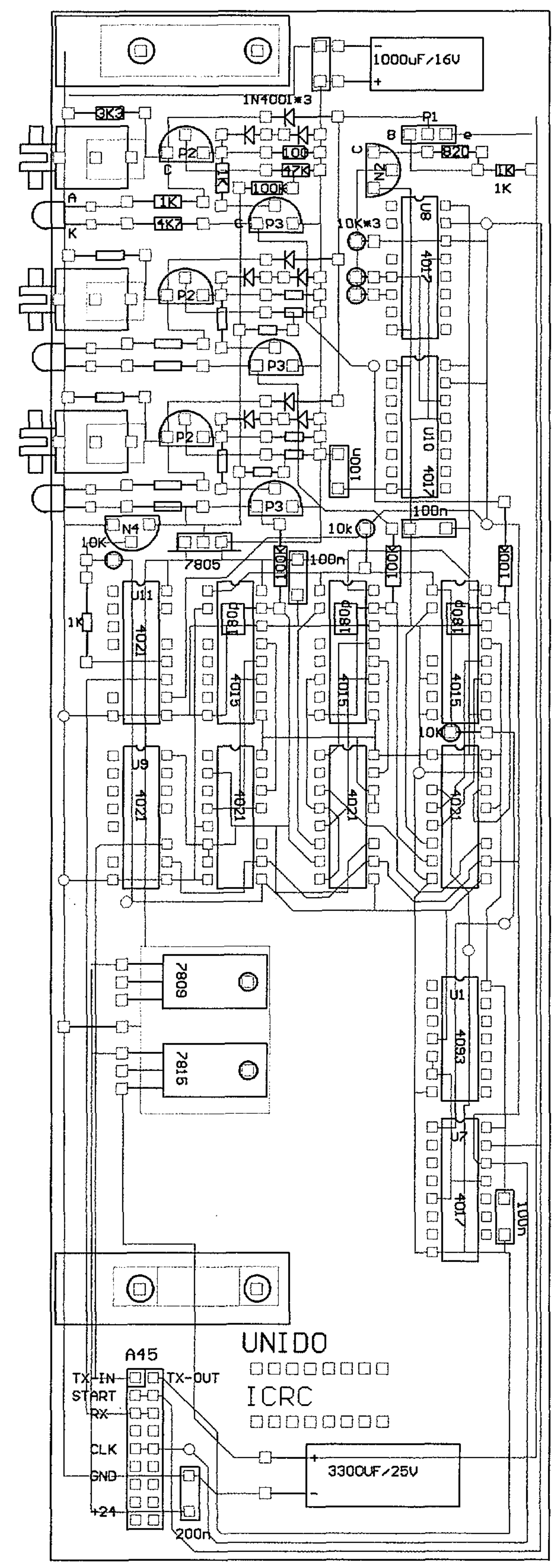
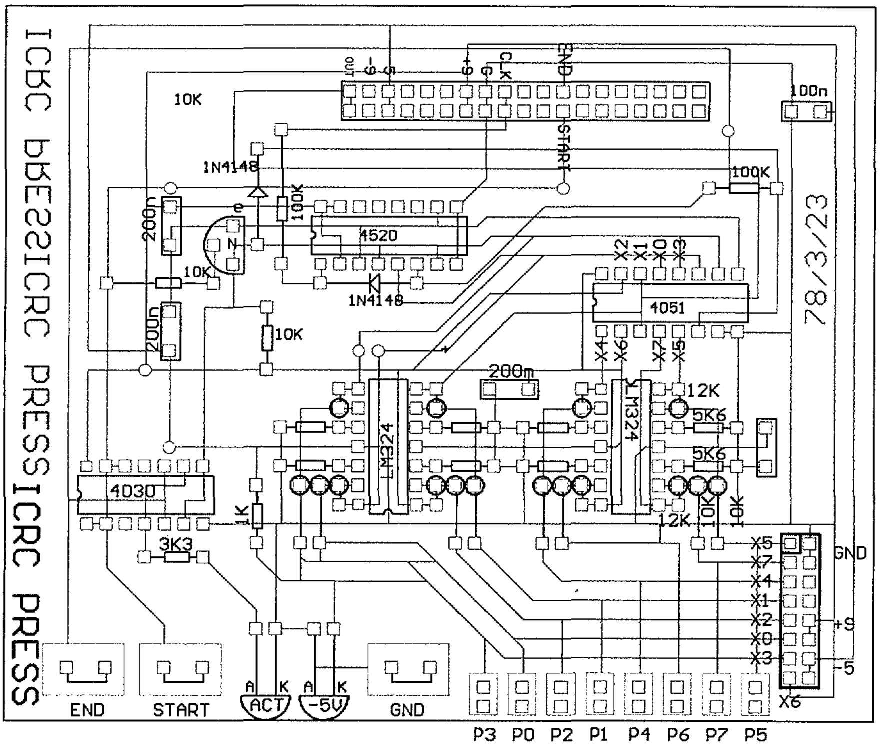
```
Rec_end = Rec_Start + grafzoom.ScaleWidth - 1
  If Rec_end > UBound(grf, 2) Then Rec_end = UBound(grf, 2)
  grafzoom.Cls
  grafzoom.DrawMode = 7                          '(7=xor 13=copy)
  grafzoom.Line (Rec_Start, 0)-(Rec_end, 0), QBColor(3)
  For n = 0 To 1
      For d = 1 To 6
          If curve_Item(n, d) < 50 Then
              z = curve_Item(n, d)
              If Hr.lbt(z).Visible = True Then
                  grafzoom.ForeColor = QBColor(curve_color(n, d))
                  If Rec_Start < 1 Then Rec_Start = 1
                  For rec = Rec_Start To Rec_end - 1
                      bol1 = (grf(26, rec) = 789)
                      bol2 = (grf(26, rec + 1) = 789)
                      If bol1 And bol2 Then
                          Y2 = grf(z, rec + 1)
                          Y1 = grf(z, rec)
                          grafzoom.Line (rec, Y1)-(rec + 1, Y2)
                      End If
                  Next rec
              Else
                  'curve_Item(n, d) = 50
                  'hr.lbt(z).ForeColor = QBColor(0)
                  'hr.lbt(z).BackColor = &H202020
              End If
          End If
      Next d
  Next n
  z = Int(zoom(ActivePage).X1)
  zoomzoom.X1 = z
  zoomzoom.X2 = z
  zoomzoom.BorderColor = zoom(ActivePage).BorderColor
  Grfzoom_pnl.BackColor = zoomzoom.BorderColor
  a$ = Right$(("0" & z \ 60), 2) & ":" & Right$(("0" & z Mod 60), 2)
  RecLb(ActivePage).Caption = a$
  Call ResultsGrf_click
```



1000uF/16V
1N4001*3
3K3
R1
B
e
820
1K
100
47K
100K
A
K
4K7
P2
P3
N2
U8
4017
10K*3
U10
100n
N4
10K
10k
7805
U11
4021
4081
4015
U9
7809
7815
U1
4093
U7
UNIDO
ICRC
A45
TX-IN
TX-OUT
START
RX
CLK
GND
+24
200n
3300UF/25V


ICRC PRESS
ICRC PRESS
78/3/23
10K
1N4148
100K
4520
200n
10K
1N4148
4051
100K
100n
END
START
CLK
200m
LM324
LM324
12K
5K6
5K6
10K
10K
12K
4030
1K
3K3
X5
X7
X4
X1
X2
X0
X3
X6
GND
+9
-5
END
START
ACT
-5V
GND
P3
P0
P2
P1
P4
P6
P7
P5