KUMARAGURU COLLEGE OF TECHNOLOGY
COIMBATORE-6.
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

p-1361

This is to certify that the Report entitled

AUTOMATION OF TRANSFORMER TESTING

has been submitted by

R.ASHOK KUMAR
R.MOHAN RAJ
N.NARAYANAN
J.RAMESH KANNAN

IN PARTIAL FULFILMENTS OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF
BACHELOR OF ENGINEERING
IN ELECTRONICS AND COMMUNICATION ENGINEERING
OF THE BHARATHIYAR UNIVERSITY

During the academic year 1999-2000

Guide **Head of the Department**

Date:

Certified that the candidate with University Register No. ________________
was examined in Project work viva-voce on ______________

Internal Examiner **External Examiner**

Automation of Transformer Testing

PROJECT REPORT

Submitted By

R.ASHOK KUMAR

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Guided by,

Prof.S. Govindaraju, M.E., MISTE
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MARCH, 15,2000

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Mr. R. ASHOK KUMAR final year Electronics & Communication Engineering student of KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE has completed his project titled "AUTOMATION OF TRANSFORMER TESTING" at our factory from 01-07-99 to 15-03-2000.

During this period his character and conduct were found to be good.

We wish him success in all his future endeavors..

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This is to certify that Mr. J. RAMESHKANNAN final year Electronics & Communication Engineering student of KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE has completed his project titled "AUTOMATION OF TRANSFORMER TESTING" at our factory from 01-07-99 to 15-03-2000.

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This is to certify that Mr. R. MOHANRAJ final year Electronics & Communication Engineering student of KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE has completed his project titled "AUTOMATION OF TRANSFORMER TESTING" at our factory from 01-07-99 to 15-03-2000.

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V.SARABESWARAN
ENGINEER R&D

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We have pleasure in expressing our gratitude to **Dr.K.K.PADMANABAN,Bsc.(Engg)M.Tech.,PhD.,** **PRINCIPAL**, Kumaraguru College of Technology, Prof **M. RAMASAMY M.E. MIEEE (USA) MISTE,** Head, Department of Electronics and Communication Engineering and Prof **K.RAMPRAKASH M.E., MISTE**, Assistant Professor, for providing all the required facilities for completion of this project.

We are extremely grateful to **Mr.JANARTHANAN** Executive Director, **UMS** Radio Factory Private Ltd. Coimbatore for sponsoring this project. We also record our special thanks to **Ms. SUJATHA**, Manager, and Human Resource Department for having permitted us to carry this project.

It is our pleasant duty to express our gratitude and thanks to our guide **Mr.S.GOVINDARAJU M.E** Assistant Professor, Department of Electronics and Communication Engineering, Kumaraguru College of technology, for his able guidance, constant encouragement and kind Co-operation. Without his helpful suggestions, valuable criticism and meticulous guidance at every stage, this work would not have attained fruition.

We are especially thankful to **Mr.SARABESWARAN**, Research and Development Department Ums Radio Factory Private Ltd, for his able guidance, constant support and encouragement in seeing the project through.

We are also thankful to **Mr.Ponnkiannan,** lecturer, Department of Electrical Engineering for his helpful suggestions. Ultimately we appreciate the support of the other faculty members, non-teaching staff and student friends.

SYNOPSIS

The concept of process Automation has gained momentum in the recent past. The primary advantages of automation are reduced production cost; improved quality isolated human errors and optimized use of available facilities.

The Transformer is the most widely used component in almost all Electrical and Electronics purposes. So the Quality and efficiency plays an important role in the usage. The testing of Transformers is done manually by means of various tests .The voltage and the current ratings are verified with rated values.

Our project completely removes all these problems by the process of Automation. The analog voltage from the Transformer is converted into digital data, which is processed by means of an Analog to Digital Interface card, which is connected to IBM PC or PC/AT address space

Software is written to access this digital data for different testing and storage of the same. The number of Transformers checked and the number of fault ones are recorded in the database for future references.

CONTENTS

PART III - SOFTWARE

****

CHAPTER 1

INTRODUCTION

UMS manufactures complete range of stabilizers, antennas, boosters and all range of communication equipment like modulators, demodulators, and receivers has been honored with the coveted mark. **UMS** radio factory has become the leading electronics goods manufacturing company in the south

.

NATURE OF WORK:

The project work deals with the Automation of the transformer testing. In the transformer test, the electrical characteristics of transformers are tested. The electrical test involves subjecting the transformer to test its voltage rating, and current rating. Other factor involves such as power factor measurement and resistance.

In the present test procedure, the transformers are tested manually for voltage rating and current rating. If a transformer faults the voltage at which the transformer fault and the deviation in the current value cannot be recorded. These are some of the shortcomings in the present test procedure.

The project aims at automating the transformer test. Automation involves transformers standard and current consumption.

1.2. OBJECTIVES OF THE WORK:

- The project primarily targets at
- Completely automated testing of transformers
- On line value for the parameter current
- On line value for the parameter voltage
- Updating current values for every transformer tests
- Providing user friendly environment
- On line fault analysis
- MS-ACCESS compatible report generation after process exhaustion

CHAPTER 2

INTRODUCTION TO TRANSFORMER AND ITS OPERATION

2.1 INTRODUCTION:

The transformer uses the important principle of mutual inductance. The transformer has the primary winding inductance L_P connected to a voltage source that produces alternating current, while the secondary winding inductance L_S is connected across the load resistance R_L as shown in fig.2.1.

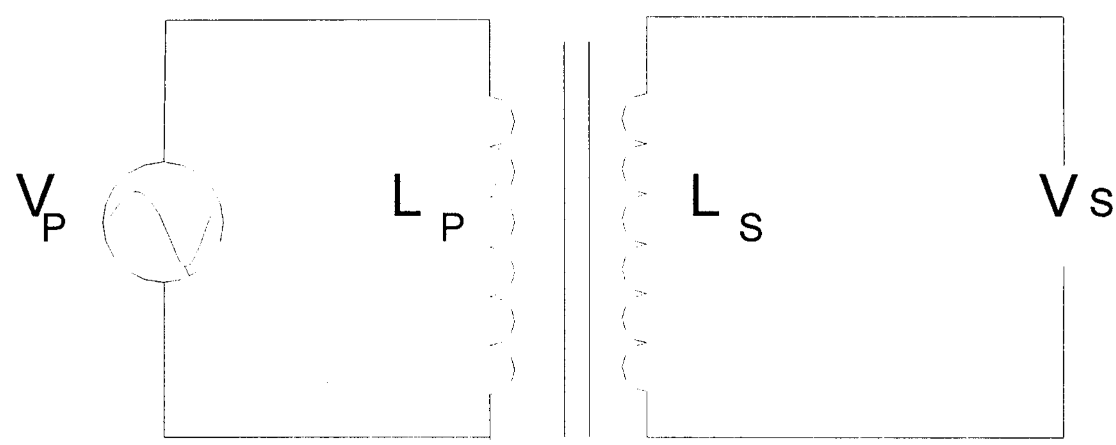


Fig.2.1

The purpose of the transformer is to transfer power from the primary, where generator is connected, to the secondary, where the induced secondary voltage can produce current in the load resistance that is connected across L_S.

Although the primary and secondary are not physically connected to each other, power in the primary is coupled into the secondary by the magnetic field linking the two windings. The transformer is used to provide power for the load resistance R_L. Instead of connecting R_L directly across the generator, whenever the load requires an AC voltage higher or lower than the generator voltage by having more or fewer turns in L_S compared with L_P, the transformer can step up or step down the generator voltage to provide the required amount of secondary voltage. It should be noted that a steady dc voltage cannot be stepped up or down by a transformer, because a steady current cannot produce induced voltage.

2.2 TURNS RATIO:

The ratio of the number of turns in the primary to the number in the secondary is the turns ratio of the transformer:

$$\text{Turns ratio} = N_P / N_S$$

where N_P = number of turns in the primary and Ns =number of turns in the secondary.

2.3 VOLTAGE RATIO:

With unity coupling between primary and secondary, the voltage induced in each turns of the secondary is the same as the self-induced voltage of each turn in the primary. Therefore, the voltage ratio is in the same proportion as the turns ratio:

$$V_P / V_s = N_P / N_S$$

When the secondary has more turns than the primary, the secondary voltage is the higher than the primary voltage and the primary voltage is said to be stepped up, When the secondary has fewer turns the voltage is stepped down.

In either case, the ratio is in terms of the primary voltage, which may be stepped up or down in the secondary winding. This calculations is applied only to iron-core transformers with unity coupling. Air core transformers for RF circuits are generally tuned to resonance. In this case, the resonance factor is considered instead of turns ratio.

2.4 SECONDARY CURRENT:

By Ohm's law, the amount of secondary current equals the secondary voltage divided by the resistance in the secondary circuit. i.e. $I_S = V_S / R_L$.

2.5 POWER IN THE SECONDARY:

The power dissipated by R_L in the secondary is $I_S^2 * R_L$ or $V_S * I_S$. The secondary draws power from the generator in the primary can be explained as follows:

With current in the secondary winding, its magnetic field opposes the varying flux of the primary current. The generator must then produce more primary current to maintain the self-induced voltage across L_P and secondary voltage developed in L_S by mutual induction. If the secondary current doubles, for instance, because the load resistance is reduced one-half, the primary current will also double in value to provide the required power for the secondary. Therefore, the effect of the secondary-load power on the generator is the same as though R_L were in the primary, except that in the secondary the voltage for R_L is stepped up or down by the turns ratio.

Power transformer with two secondary winding L_1 and L_2 with a primary voltage source is shown in fig.2.2.

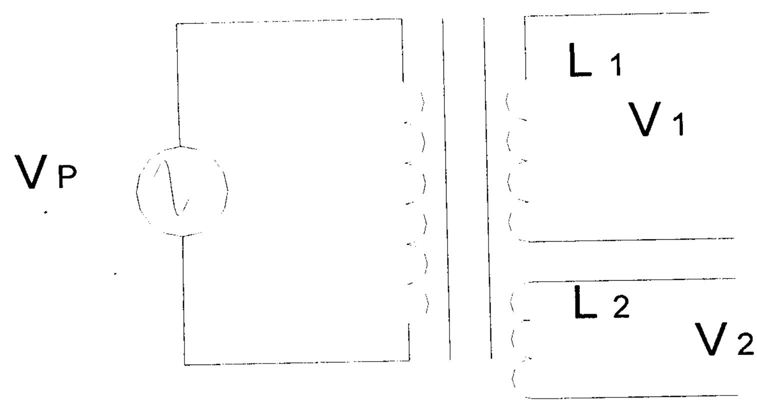


Fig.2.2

There can be one, two or more secondary windings with unity coupling to the primary as long as all the windings are on the same iron core. Each secondary winding has induced voltage in proportion to its turns ratio with primary winding, which is connected across the voltage source.

2.6 CURRENT RATIO:

With zero losses assumed for the transformer, the power in the

Secondary equals the power in the primary:

$V_S * I_S = V_P * I_P$

$I_S / I_P = V_P / V_S$

The current in the inverse of the voltage ratio i.e. voltage step-up in the secondary means current step-down, and vice versa. The secondary does not generate power but only takes it from the primary. Therefore, the current step-up or step-down is in terms of the secondary current I_S, which is determined by the load resistance across the secondary voltage. Remember that the side with the higher voltage has the lower current. The primary and secondary V and I are in the same proportion as the number of turns in the primary and secondary.

2.8 ISOLATION FOR THE SECONDARY:

In a transformer with a separate winding for L_S, as in the fig.2.3, the secondary load is not connected directly to the ac power line in the primary.

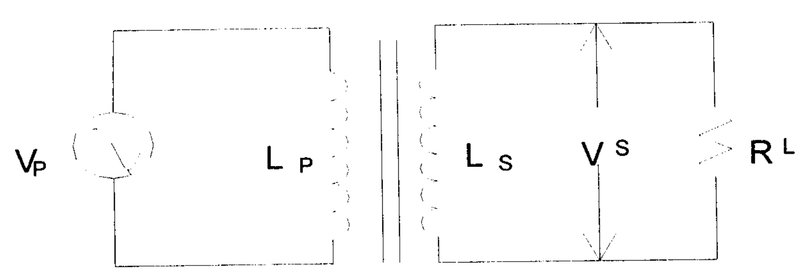


Fig.2.3

This isolation is an advantage in reducing the chance of electric shock. With an autotransformer, the secondary is not isolated. Another advantage of an isolated secondary is the fact that any direct current in the primary is blocked from the secondary. Sometimes a transformer with a 1:1 ratio is used just for isolation from the ac power line.

2.9 TRANSFORMER EFFICIENCY:

Efficiency is defined as the ratio of power out to power in. stated as a formula,

$$\text{Efficiency} = P_{out} / P_{in} * 100\ \%$$

Assuming zero losses in the transformer, power out equals power in and the efficiency is 100 percent. Actual power transformers, however, have efficiency slightly less than 100 percent. The efficiency is approximately 80 to 90 % for transformers that have high power ratings. Transformers for higher power are more efficient because they require thicker wire, which has less resistance, in a transformer that is less than 100 percent efficient, the primary supplies more than the secondary power. The primary power is lost by heat dissipation because of the I^2R in the conductors. The R of the primary winding is generally about 10 ohms or less, for power transformers.

2.10 TRANSFORMERS COLOR CODES:

- Black – primary leads without tap
- Black with yellow – tap on primary
- Red – high voltage secondary to rectifier in power supply
- Red with yellow – tap on high-voltage secondary
- Green-yellow—low-voltage secondary

2.11 TRANSFORMER RATINGS:

Like other components the transformers also have voltage, current and power ratings, which must not be exceeded. Exceeding this rating will destroy the transformer operation.

2.12 VOLTAGE RATINGS:

Manufactures of transformer always specify the voltage rating of the primary and secondary windings. Under no circumstance should the primary voltage rating be exceeding. In many cases the rated primary and secondary voltages are printed right on the transformer. For example, consider the transformer shown in figure. Its rated primary voltage is 120v, and its secondary voltage is 12.6 – 0 - 12.6,which indicates that the secondary is center tapped. The notation 12.6 – 0 – 12.6 indicates that 12.6v is available between the center tap connection and either outside secondary lead. The total secondary voltage available is 2 * 12.6 v or 25.2 v .

It should be noted that manufacturers might specify the secondary voltages of a transformer differently. For example, the secondary may be specified as 25.2v CT, where CT indicates a center-tapped secondary. Another way to specify the secondary voltage in fig. Would be 12.6v each side of center

Regardless of how the secondary voltage of a transformer is specified, it should be noted that the rated value is always specified under full load conditions with the rated primary voltage applied. A transformer is considered fully loaded when the rated current is drawn from the secondary. When unloaded, the secondary voltage will measure a value, which is approximately 5 to10 percent higher than its rated value. Let's use the transformer rated secondary current of 2A. If 120V is connected to the primary and no load is connected to the secondary, each half of the secondary will measure somewhere between 13.2V to 13.9V approximately. However, with the rated current of 2A drawn from the secondary, each half of the secondary will measure approximately 12.6V.

As we know, transformer can have more than one secondary winding; they can also have more than one value of primary voltage. A transformer that has two separate primaries and a single secondary. This transformer can be wired to work with a primary voltage of either 120 V or 230V. For either value of primary voltage, the secondary voltage is 24V.

2.13 CLASSIFICATION OF TRANSFORMERS:

The transformers are classified according to their transformation ratio .The transformation ratio is defined as ratio of the secondary emf to that of the primary applied voltage.

i.e. transformation ratio is $=E_2/V_1$.

In an ideal transformer $V_1=E_1$

And so, E2/V1=E2/E1

STEP UP TRANSFORMER:

When the transformation is greater than one, the secondary emf is greater than the primary voltage; the transformer then step-up the supply voltage and so it is known as a step up transformer. for this to happen, the secondary turns N_2 must be greater than the primary turns N_1.

STEP DOWN TRANSFORMER:

Conversely, if the secondary turns are smaller in number than the primary turns, the transformer output voltage is smaller than the supply voltage and it is a step down transformer.

AUTO TRANSFORMER:

It is a transformer with one winding only, part of this being common to both primary and secondary. Obviously, in this transformer the primary and secondary are not electrically isolated from each other as is the case with a 2- winding transformer. But its theory and operation are similar to those of a two winding transformer. Because of one winding, it uses less copper and hence is cheaper. It is used where transformation ratio differs little from unity.

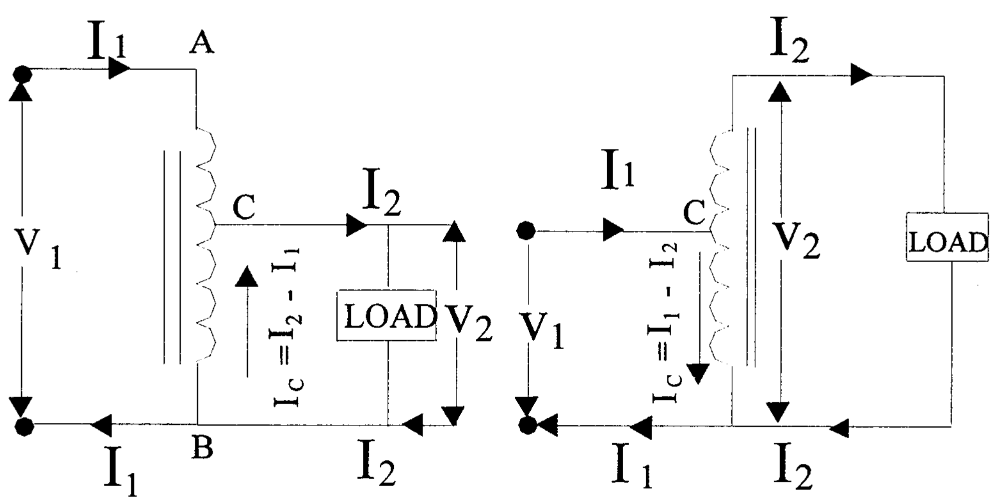


fig.4.4

The above figure shows both step up and step down autotransformers. As shown in figure AB is primary winding having N_1 turns and BC is secondary winding having N_2 turns. Neglecting iron losses and no load current,

$V_2/V_1 = N_2/N_1 = I_1/I_2 = K$

The current in section CB is vector difference of I_1 and I_2. But as the two currents are practically in phase opposition, the resultant current is $(I_2 - I_1)$ where I_2 is greater than I_1. According to an ordinary two winding transformer of same output, an auto – transformer has higher efficiency but smaller size. Moreover, its voltage regulation is also superior.

CHAPTER 3

BLOCK DIAGRAM OF AUTOMATED TRANSFORMER TESTING

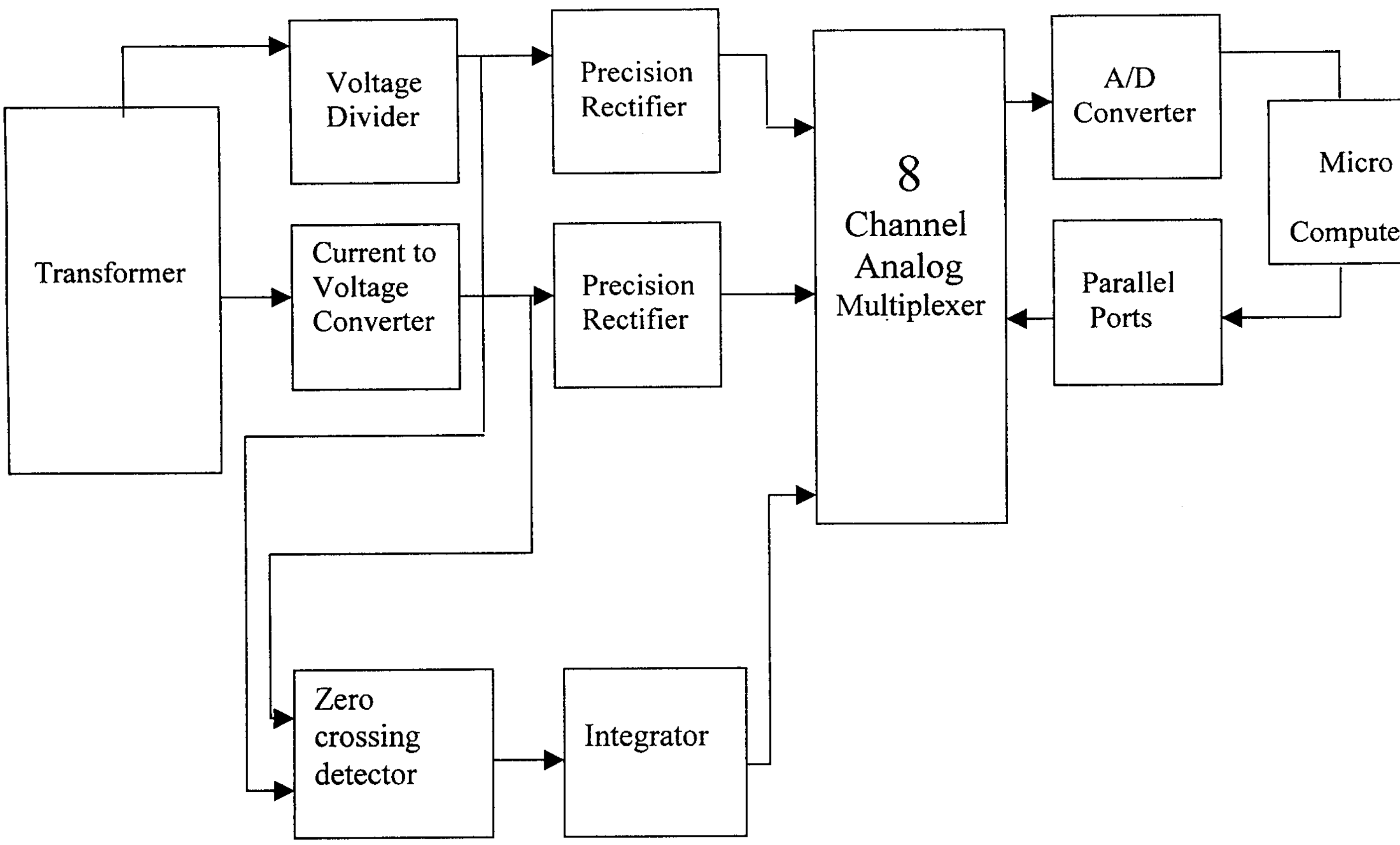


Fig 3.1

The general block diagram of the automation of transformer testing is shown in the fig 3.1

The important blocks of the automation process are:

- Voltage Divider
- Precision Rectifier
- Current to Voltage Converter
- Analog channel multiplexer
- A/D Converter
- Zero crossing detector and integrator

The transformer is device, which transfers the electric power from one circuit to another. The primary winding of the transformer is connected to the voltage source that produces an alternating current. The output from the secondary is an analog voltage normally in the rated value of transformer output.

3.1 VOLTAGE DIVIDER:

The analog voltage from the secondary of the transformer is reduced to specific range by means of a voltage divider circuit. The divider circuit is designed in such a way that the analog voltage does not exceed the pre-determined range.

3.2 PRECISION RECTIFIER:

Rectifier is a device, which converts a.c. to d.c. in general sense. Technically it may be defined as a device, which converts a fluctuating current of zero mean value into a fluctuating current of finite mean value. If both the positive and negative cycles are used to produced a pulsating d.c. Then the process is called full wave rectification however the output d.c. is fluctuating .to reduce this, normally a high inductance choke or reactor is put in the output circuit .the precision rectifier gives a exact output voltage that is applied in the input side.

The analog output voltage from the divider circuit is allowed to pass through the precision rectifier stage. The precision rectifier normally converts the analog voltage into a DC signal, which the A/D converter can accept.

3.3 CURRENT TO VOLTAGE CONVERTOR:

In order to measure the flow of the current in the transformer the resistance of very less value is connected across the transformer's primary winding and the voltage drop across the resistance is noted. From the above the value of the rated current is measured and converted into its equivalent voltage rating.

3.4 ZERO CROSSING DETECTOR:

The basic comparators can be used as a zero crossing detector provided that V_{ref} is set to zero. An inverting zero crossing detector is shown in figure below and the output wave form for a sinusoidal input signal will be a square wave. The circuit is also called a sine to square wave generator.

3.5 INTEGRATOR:

A simple low pass RC circuit can also work as an integrator when time constant is very large. This requires very large values of R and C.The components R and C cannot be made infinitely large because of practical limitations. However, in the op-amp integrator of figure shown here the effective input capacitance becomes $C_f(1-A_v)$ where A_v is the gain of the op-amp. The gain A_v is infinite for an ideal op-amp, so the effective time constant of the op-amp integrator becomes very large which results perfect integration. The power factor corresponding to the integrator output is obtained from the lookup table.

3.6 MULTIPLEXER:

Multiplexing means transmitting a large number of information units over a smaller number of channels or lines. The selection of particular input line is controlled by asset of selection lines. Normally there are 2^n input lines and n selection lines whose bit combinations determine which input is selected. The multiplexer is an analog 8– to-1- line multiplexer. Each of the eight input lines, I_0 to I_7 is applied to one input of an AND gate. Selection lines A_0, A_1 and A_2 are decoded to select a particular AND gate.

A_2	A_1	A_0	Y
0	0	0	I_0
0	0	1	I_1
0	1	0	I_2
0	1	1	I_3
1	0	0	I_4
1	0	1	I_5
1	1	0	I_6
1	1	1	I_7

The size of a multiplexer is specified by the number 2^n of its input lines and the single output line. It is then implied that it also contains n selection lines. A multiplexer is often abbreviated as MUX.A multiplexer is also called as data selector, since it selects one of many inputs and steers the information to the output lines. The parallel port from the microcomputer controls the address lines

3.7 A/D CONVERTOR:

It accepts an analog input voltage V_a and produces an output binary word $d_1d_2...d_n$ of functional value D. the term d_1 is the most significant bit and d_n is the least significant bit. Integrating type ADC s perform conversion in an indirect manner by first changing the analog input signal to a linear function of time or frequency and then to a digital code. The integrating type converter is used in applications such as digital meter, panel meter and monitoring systems where conversion accuracy is critical.

The analog signal is converted to its respective digital signal by means of an A/D converter. The converted digital value is sent to microcomputer by means of an I/O expansion slot bus.

The digital data is being processed by the microcomputer through the software program written in C and VISUAL BASIC 6.0 to control and calculate various testing procedures of the transformer.

CHAPTER 4

CIRCUIT DESCRIPTIONS

4.1 REGULATED POWER SUPPLY:

4.1.1 Power supply for +5v and –5v:

Operation:

In this circuit (fig 4.1) the bridge rectifier rectifies the A.C supply voltage to specified range .the rectified A.C voltage is then regulated by allowing it through a positive regulator to get a positive voltage of +5v and through a negative regulator to get a negative regulated voltage of –5v .The regulated output is filtered by a capacitor filter.

4.1.2 Power supply for +12v and –12v:

Operation:

In this circuit (fig 4.1) the bridge rectifier rectifies the A.C supply voltage to specified range .the rectified A.C voltage is then regulated by allowing it through a positive regulator to get a positive voltage of +5v and through a negative regulator to get a negative regulated voltage of –5v. A capacitor filter filters the regulated output.

CIRCUIT DIAGRAM:

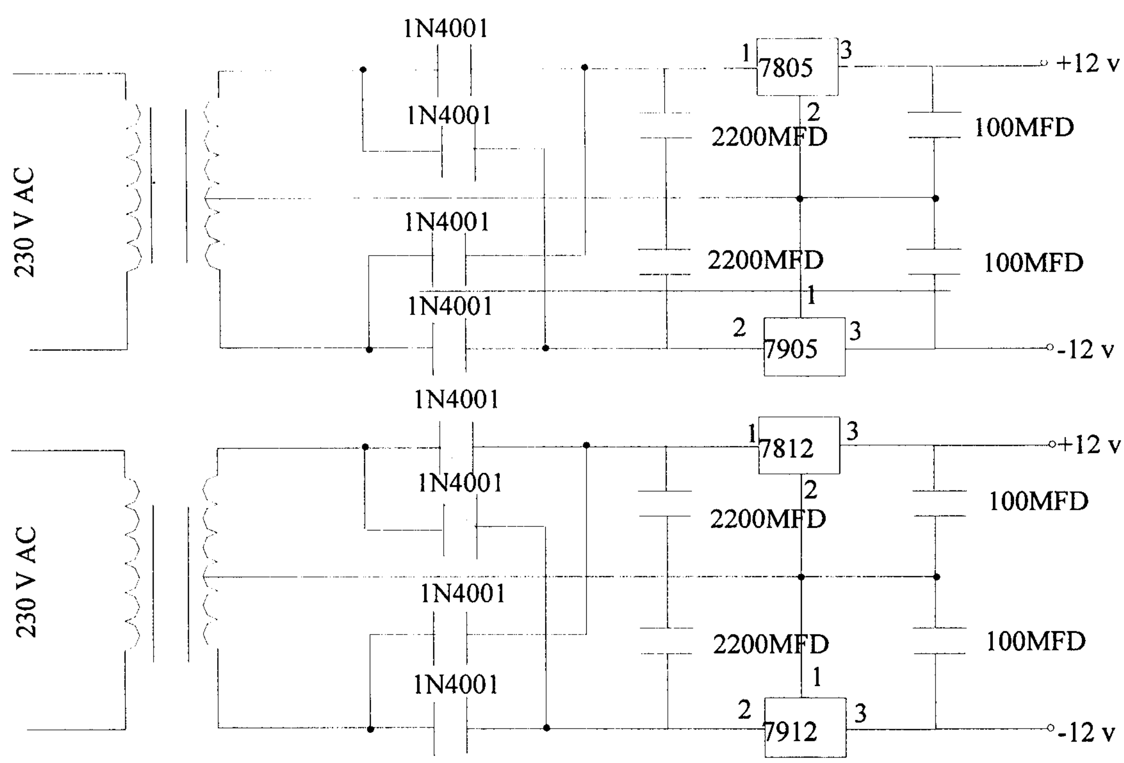


Fig 4.1

4.2 VOLTAGE DIVIDER:

Operation:

In this voltage divider circuit the two resistances R_1 and R_2 are connected across the analog voltage, which is to be divided. The divider circuit is designed in such a way that the analog voltage does not exceed the pre-determined range.

The voltage drop across the resistor R_2 is = $V_{in} (R_1)/(R_1+R_2)$

4.3 PRECISION RECTIFIER:

CIRCUIT DIAGRAM:

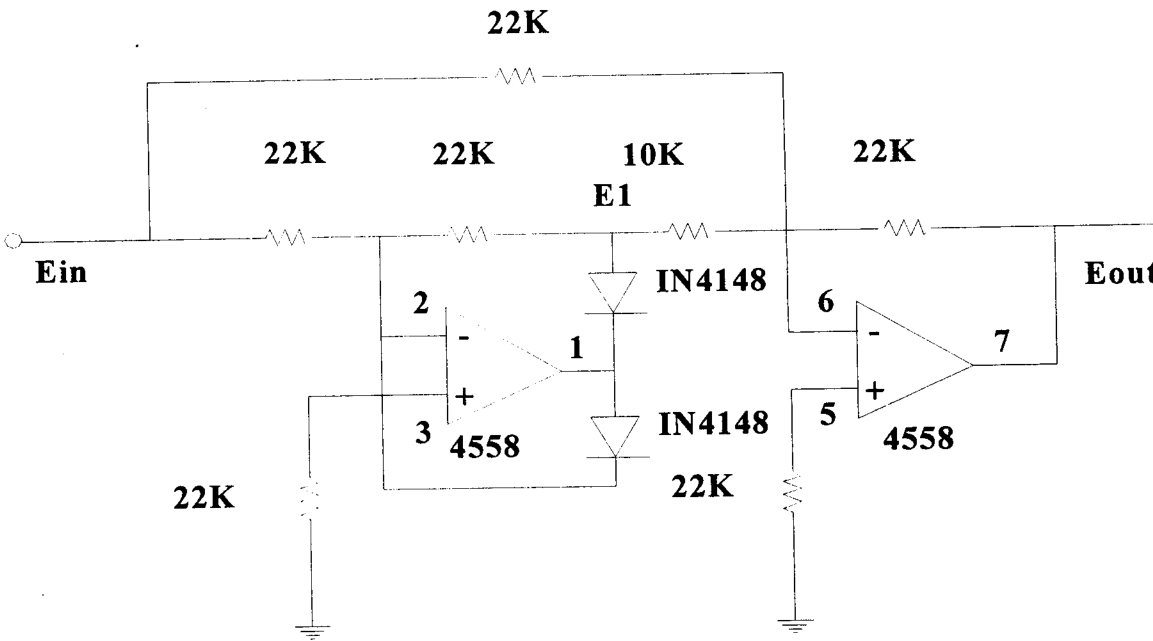


Fig 4.2

OPERATING PRINCIPLE:

A full-wave precision rectifier can be implemented by summing the half-wave rectifier and its input with the proper phase and amplitude relations. Such a circuit in its basic form is shown in figure 4.2.

In this circuit A_1 is an inverting rectifier .The output from $A_1$is added to the original input signal in A_2 (a summing mixer), with the signal amplitude and phase relations shown. Negative alterations of E_{IN} result in no output at E_1 due to the rectification. E_{IN} feeds A_2 through a 20Kohm resistor, and E_1 feeds A_2 through a 10Kohm resistor. The net effect of the scaling is that, for equal amplitudes of E_{IN} and E_1, E_1 will provide twice as much current into the summing point. This fact is used to advantage here, as the negative alterations of e_1 produces twice as the input current of that caused by the positive alteration of E_{IN}. This causes a current of precisely half the amplitude, which E_1 alone would generate due to the subtraction of E_{IN}.

It's the equivalent of having E_1 feed through a 20-Kohm input resistor and having E_{IN} nonexistent during this half cycle, and it results in a positive going output at A_2. During negative alterations of $E_{IN,}$ E_1 produces the alternate positive output swing which, in summation, produces the desired full-wave rectified response. As before, operation with the opposite polarity is possible by reversing the diode D_1 and D_2.

The general purpose dual-741 type indicated can be replaced with higher speed units or FETS types, as appropriate .The resistor R_6 can be used as an overall gain trim or for scaling to net gains of other than unity, with high impedances, low leakage diodes are suggested.

4.4 CURRENT TO VOLTAGE CONVERTER:

CIRCUIT DIAGRAM:

The current to voltage convertor circuit diagram is shown in the fig 4.3

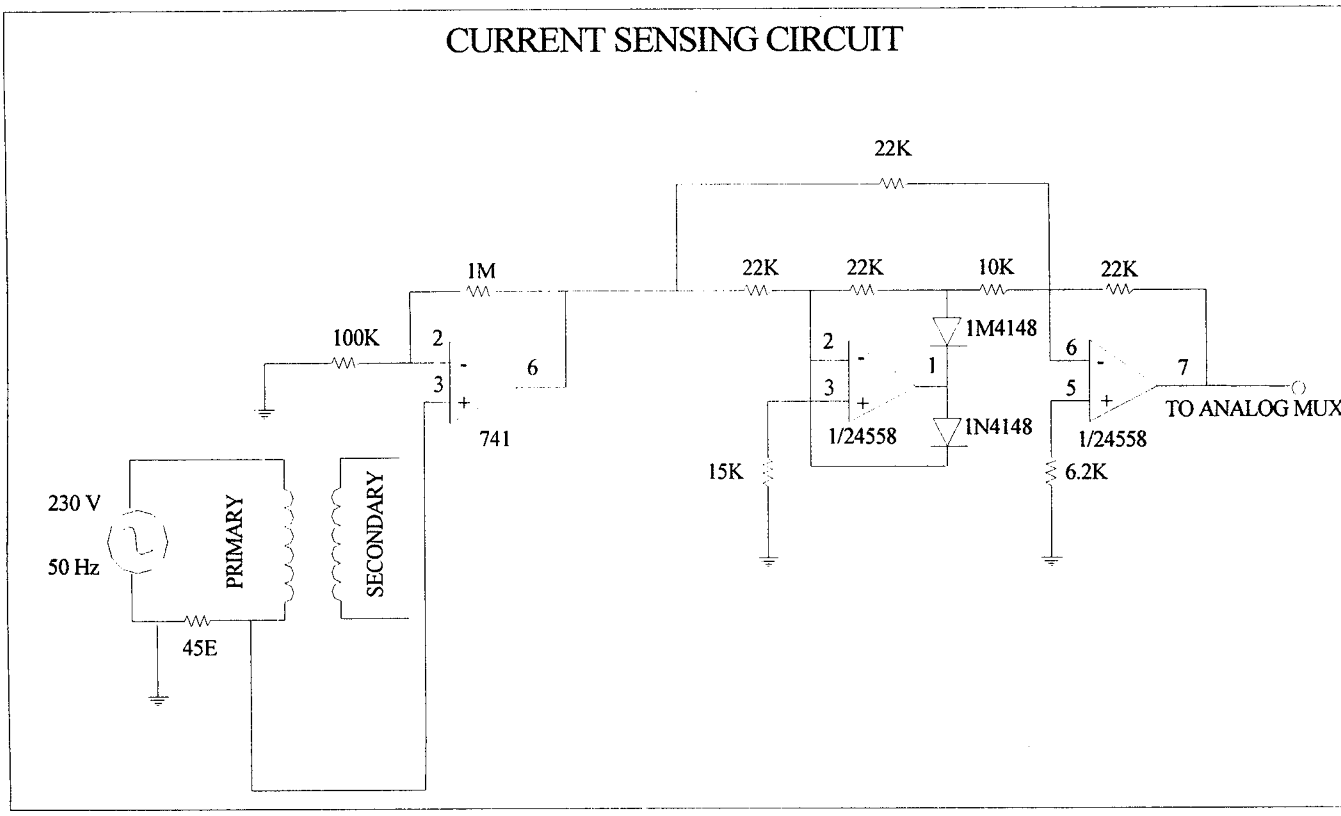


Fig 4.3

OPERATION:

The figure shows an op-amp used as I to V converter. Since the (-) input terminal is at virtual ground, no current flows through R_S and current I_S flows through the feedback resistor R_F. Thus the output voltage $V_o = -I_s R_F$. It may be pointed out that the lowest current that this circuit can measure will depend upon the bias current I_H of the op-amp. This means that 741 (I_H = 3 nA) can be used to detect lower current. The resistor R_F is sometimes shunted with a capacitor C_F to reduce high frequency noise and the possibility of oscillations.

4.5 ZERO CROSSING DETECTOR:

A comparator is a circuit, which compares a signal voltage applied at one input of an op-amp with a known reference voltage at the other input. The important applications of the comparator circuit are zero crossing detectors. The basic comparators can be used as a zero crossing detector provided that V_{ref} is set to zero. An inverting zero crossing detector is shown in figure below and the output wave form for a sinusoidal input signal will be a square wave. The circuit is also called a sine to square wave generator.

4.6 INTEGRATOR:

A simple low pass RC circuit can also work as an integrator when time constant is very large. This requires very large values of R and C.The components R and C cannot be made infinitely large because of practical limitations. However, in the op-amp integrator of figure shown here the effective input capacitance becomes C_f $(1-A_v)$ where A_v is the gain of the op-amp. An integrator circuit with zero crossing detector is shown in fig 4.4

MEASUREMENT OF POWER FACTOR

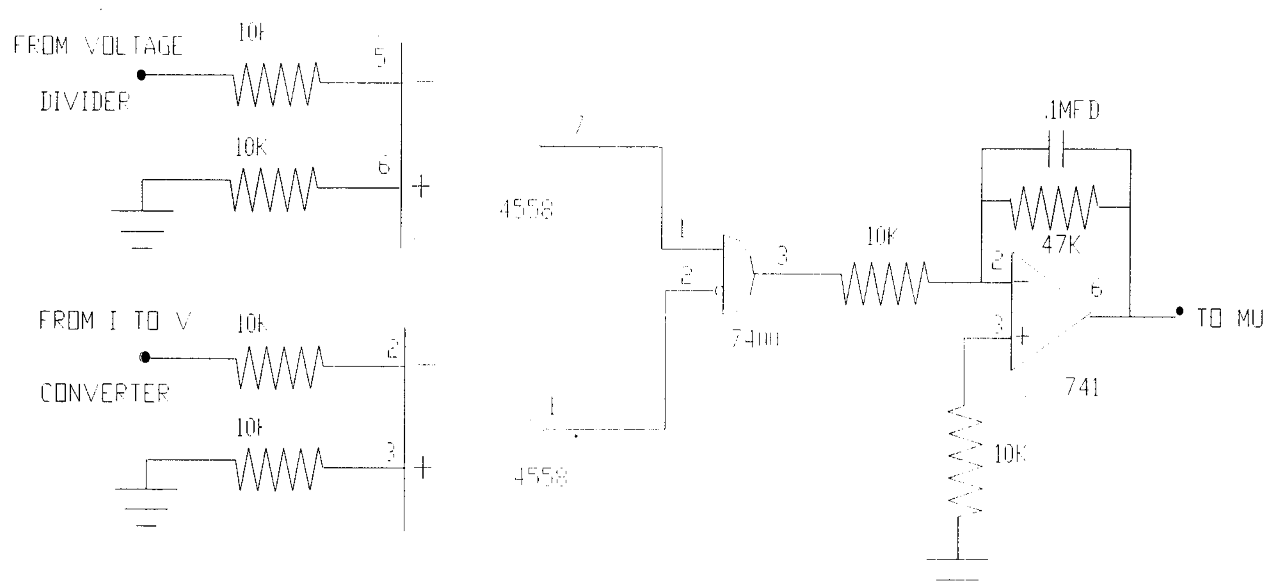
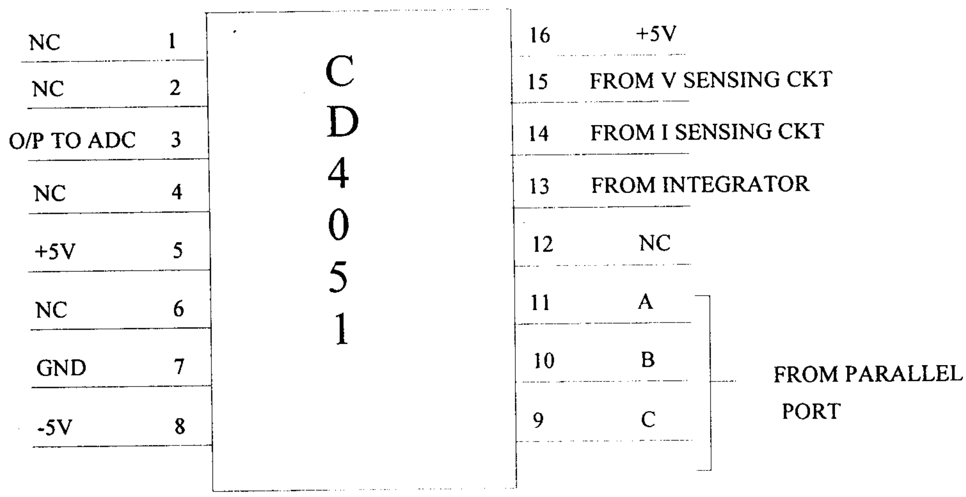


Fig.4.4

The gain A_v is infinite for an ideal op-amp, so the effective time constant of the op-amp integrator becomes very large which results perfect integration. Here the gain of the integrator decreases with frequency. Thus integrator circuit does not have any high frequency problem unlike a differentiator circuit. However at low frequencies such as at dc ($w \sim 0$) the gain becomes infinite. The op-amp saturates, i.e., the capacitor is fully charged and it behaves like an open circuit .the gain of the integrator at low frequency (dc) can be limited to avoid the saturation problem if the feedback capacitor is shunted by a resistance R_f as shown .the parallel combination of R_f and C_f behaves like a practical capacitor which dissipates power unlike an ideal capacitor .the resistor R_f limits the low frequency gain to R_f / R_1 (generally $R_f = 10R_1$) and thus provides dc stabilization.

4.7 MULTIPLEXER:

CIRCUIT DIAGRAM:



The 4052 is a 8 channel multiplexer/demultiplexer with common channel select logic. Each multiplexer has eight independent inputs/outputs (Y_0 to Y_7) and a common input/output (z). The common channel select logic includes two address inputs (A_0, A_1, and A_2) and an active low enable input (E).

Both multiplexer/demultiplexers contain eight bi-directional analogue switches, each with one side connected to an independent input/output(Y_0 to Y_7) and the other side connected to a common input/output (z).

With E LOW, one of the eight switches is selected (low impedance ON state) by A_0 and A_1. With E HIGH, all switches are in the high impedance off state, independent of A_0 ,A_1.and A_2.

V $_{DD}$ and V_{SS} are the supply voltage connections for the digital inputs (A_0, A1, A2 and E). The V $_{DD}$ to V_{SS} range is 3 to 15v. The analogue inputs/outputs (Y_0 to Y_3 and Z) can swing between V_{DD} as a positive limit and V_{EE} as a negative limit. V_{DD}-V_{EE} may not exceed 15v.

4.8 ANALOG TO DIGITAL CONVERTER:

OPERATING PRINCIPLE:

The ICL 7109 is an Integrating 12 bit A/D Converter that can accept voltages in the range –5V to +5V. The voltages above these

limits will have no effect and ADC will read the maximum value for those voltages and these voltages will be indicated by a over range bit, which would be read.

The ADC is set to bipolar operation .The polarity of the input is indicated by a POLARITY bit. For an analog voltage of range 0 to 5 Volts a digital value of 0 to FFF H is available at the ADC output with sign bit SET to 1.

For an analog voltage output of 0 to –5V a digital value of 0 to FFF H is available at the ADC output with sign bit RESET to 0.

ICL 7109 is an integrating ADC with THREE signals with which the conversions can be monitored. These signals are absolutely necessary since this chip does not have START OF CONVERSION and END OF CONVERSION. Once the input of the ADC has been converted the STATUS goes LOW.

If the input voltage exceeds the permissible range, then the OVERRANGE bit will be SET. As mentioned earlier, the POLARITY will be SET for negative input to the ADC. These can be viewed thro LED's. The pulsating output of the ADC's STATUS indicates that ICL 7109 is working all right.

Since it's a 12-bit ADC, the data can be only read in two steps. The LOWER order 8 bits are collectively latched through a 74LS374 which is mapped at (BASE + 2) and the higher order 4 bits along with STATUS, OVER-RANGE and POLARITY will be latched through another 74LS374 mapped at (BASE +3). The BASE depends on the address selection, which has been done during installation.

CHAPTER 5
IC DESCRIPTION

5.1 ICL 7109:

The ICL 7109 is an Integrating 12 bit A/D Converter that can accept voltages in the range –5V to +5V. The voltages above these limits will have no effect and ADC will read the maximum value for those voltages and these voltages will be indicated by a over range bit, which would be read.

Features:

Input range	+5 V or -5V
Input channel	Single channel
Accuracy	+/- 0.8 % max at 25^0 C Input
Output low level	max 0.5 V at 14 Ma
Output high level	max 2.0 V at 15 mA

A total of 8 digital output lines are available.

OPERATING PRINCIPLE:

The ADC is set to bipolar operation .The polarity of the input is indicated by a POLARITY bit. For an analog voltage of range 0 to 5 Volts a digital value of 0 to FFF H is available at the ADC output with sign bit SET to 1. For an analog voltage output of 0 to –5V a digital value of 0 to FFF H is available at the ADC output with sign bit RESET to 0.

ICL 7109 is an integrating ADC with THREE signals with which the conversions can be monitored. These signals are absolutely necessary since this chip does not have START OF CONVERSION and END OF CONVERSION. Once the input of the ADC has been converted the STATUS goes LOW. If the input voltage exceeds with permissible range, then the OVERRANGE bit will be SET. As mentioned earlier, the POLARITY will be SET for negative input to the ADC. These can be viewed thro LED's. The pulsating output of the ADC's STATUS indicates that ICL 7109 is working all right.

Since it's a 12-bit ADC, the data can be only read in two steps. The LOWER order 8 bits are collectively latched through a 74LS374 which is mapped at (BASE + 2) and the higher order 4 bits along with STATUS, OVER-RANGE and POLARITY will be latched through another 74LS374 mapped at (BASE +3). The BASE depends on the address selection, which has been done during installation.

ANALOG SECTION:

When the RUN/HOLD input is left open or connected to v+, the circuit will perform the conversions at a rate determined by the clock frequency (8192 clock periods per cycle). Each measurement cycle is divided into three phases.

They are:

Auto-zero (AZ)

Signal integrate (INT)

De-integerate (DE)

AUTO-ZERO PHASE:

During auto-zero three things happen. First, input high and low are disconnected from their pins and internally shorted to analog COMMON. Second the reference capacitor is charged to the reference voltage. Third, a feedback loop is closed around the system to charge the auto-zero capacitor C_{AZ} to compensate for offset voltages in the buffer amplifier, integrator, and comparator. Since the comparator is included in the loop, the AZ accuracy is limited only by the noise of the system. In any case, the offset referred to the input is less than 10 Microvolt.

SIGNAL INTEGRATE PHASE:

During signal integrate the auto-zero loop is opened, the internal short is removed and the internal high and low inputs are connected to the external pins. The converter then integrates the differential voltage between IN HI and IN LO for a fixed time of 2048 clock periods. Note that this differential voltage must be within the common mode range of the inputs. At the end of this phase, the polarity of the integrated signal is determined.

DE-INTEGRATE PHASE:

The final phase is de-integrated, or reference integrates. Input low is internally connected to analog common and input high is connected across the previously charged (during auto-zero) reference capacitor. Circuitry within the chip ensures that the capacitor will be connected with the correct polarity to cause the integrator output to return to zero crossing (established in Auto-Zero) with a fixed slope. Thus the time for the output to return to zero (represented by the number of clock periods counted) is proportional to the input signal.

PIN CONFIGURATION:

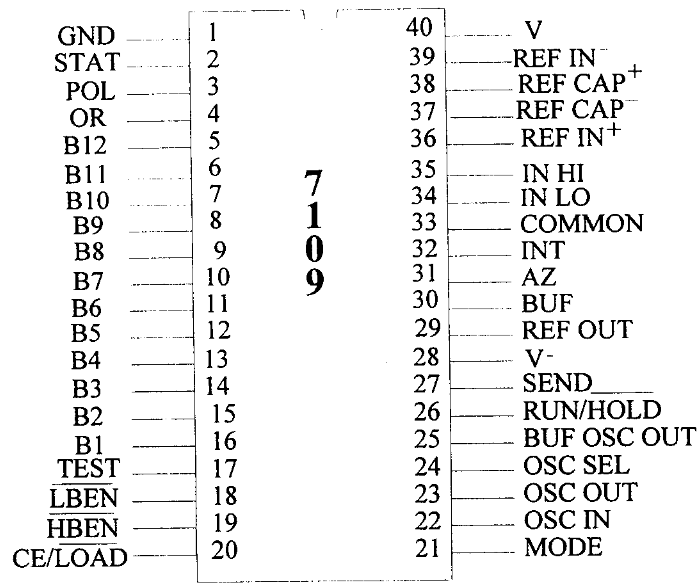


Fig 5.1

DETAILED DESCRIPTION

DIGITAL SECTION:

The digital selection includes the clock oscillator and Scaling circuit, a 12-bit binary counter with output latches and TTL-compatible three state output drivers,

Throughout the description logic levels will be referred to as "low" or "high". The actual logic levels are defined in the Electrical Characteristics Table. For minimum power consumption, all inputs should swing from GND (low) to V^+

(high), Inputs driven from TTL gates should have 3-5Kohms pull up resistors added for maximum noise immunity.

MODE INPUT:

The MODE input is used to control the output mode of the converter. When the MODE pin is low or left open (this input is provided with a pull down resistor to ensure a low level when the pin is left open), he converter is in its "direct" output mode, where the output data is directly accessible under the control of the chip and byte enable inputs. When the MODE input is pulsed high, the converter enters the UART handshake mode and outputs the data in two bytes, then returns to "direct" mode.

When the MODE input is left high, the converter will output data in the handshake mode at the end of every conversion cycle.

STATUS OUTPUT:

During a conversion cycle, status output goes high at the beginning of signal integrate (phase II), and goes low one-half clock period after new data from the conversion has been stored in the output latches. This signal may be used as a "data valid" flag (data never changes while STATUS is low) to drive interrupts, or for monitoring the status of the converter.

RUN /HOLD INPUT:

When the RUN/$\overline{HOLD}$ input is high, or left open, the circuit will continuously perform conversion cycles, updating the output latches after zero crossing during the deintegrate (phase III) portion of the conversion cycle .In this mode of operation, the conversion cycle will be performed in 8192 clock periods, regardless of resulting value.

If RUN/HOLD goes low at any time during Deintegrate (Phase III) after the zero crossing had occurred, the circuit will immediately terminate Deintegrate and jump to auto zero. This feature can be used to eliminate the time spent in Deintegerate after the zero crossing. If RUN/$\overline{HOLD}$ goes low stays or goes low, the converter will ensure minimum Auto-Zero time, and then wait in Auto-Zero until the RUN/$\overline{HOLD}$ input goes high. The converter will begin the Integrate (Phase II) portion of the next conversion (and the STATUS output will go high) seven clock periods after the high level is detected at RUN/$\overline{HOLD}$.

Using the RUN/$\overline{HOLD}$ input in this manner allows an easy "convert on demand" interface to be used. The converter may hold idle in Auto-Zero with RUN/$\overline{HOLD}$ low. When RUN/$\overline{HOLD}$ goes high conversion is started, ands when the STATUS output goes low the new data is valid (or transferred to the UART-see the hand shake mode). RUN/HOLD may now be taken low which the terminate de-integrate and ensures a minimum Auto-Zero time before the next conversion.

Alternately, RUN/$\overline{\text{HOLD}}$ can used to minimize the conversion time to ensuring that it goes low during de-integrate, after zero crossing, and goes high after the hold point is reached. The required activity on the RUN/$\overline{\text{HOLD}}$ input can provide by connecting it to the Buffered Oscillator Output. In this mode the conversion time is dependent on the input value measure.

If the RUN/$\overline{\text{HOLD}}$ input goes low and stays low during Auto-Zero (Phase I), the converter will simply stop at the end of the Auto-Zero and wait for RUN/$\overline{\text{HOLD}}$ to go high. As above, Integrate (Phase) begins seven periods after the high level is detected.

DIRECT MODE:

When the MODE pin is left at a low level the data outputs (bits 1 through 8 low order byte, bits 9 through 12, polarity and over range higher order byte) are accessible under control of the byte and chip enable terminals as inputs. These three inputs are all active low, and are provided with pull up resistor to ensure an inactive high level when left open. When the chip enable pin is low, taking a byte enable input low will allow the outputs of that byte to become active (three stated on). This allows a variety of parallel data accessing techniques to be used, as shown in the section hen the entitled “interfacing “.

OSCILLATOR:

When the OSCILLATOR SELECT input is low a feedback device and output and input capacitors are added to the oscillators. Taking the oscillator select input low also inserts a fixed divider 58 circuits between the BUFFERED OSCILLATOR OUTPUT and the internal clock. Using an expensive 3.58 MHz TV crystal, this provides integration time given by 33.18 ms. This is very close to two 60 Hz period or 33.33ms .the error is less than one percent, which will give better than 40db 60 Hz rejection. The converter will operate reliably at conversion rates of up to 30 per seconds, which corresponds to a clock frequency of 245.8 KHz.

If at any time the oscillator is to be over driven, the over driving signal should be applied at the OSCILLATOR OUTPUT should be left open .the internal clock will be of the same frequency, duty cycle, and phase as the input signal when OSCILLATOR SELESCT is at GND, the clock will be a factor of 58 below the input frequency.

TEST INPUT:

When the TEST input is taken to a level halfway between V^+ and GND, the counter output latches are enabled, allowing the counter contents to be examined anytime.

When the TEST input is connected to GND, the counter outputs are all forced into the high state, and the internal clock is disabled. When the input returns to the ½ (V^+ - GND) voltage (or to V^+) and one clock is applied, all the counter outputs will be clocked to the low state. This allows easy testing of the counter and its outputs.

5.2 DM 74LS374:

FEATURES:

- Tristate bus driving outputs.
- Full parallel access for loading.
- Buffered control input.
- Pwd inputs reduce dc loading on data lines.

PIN CONFIGURATION:

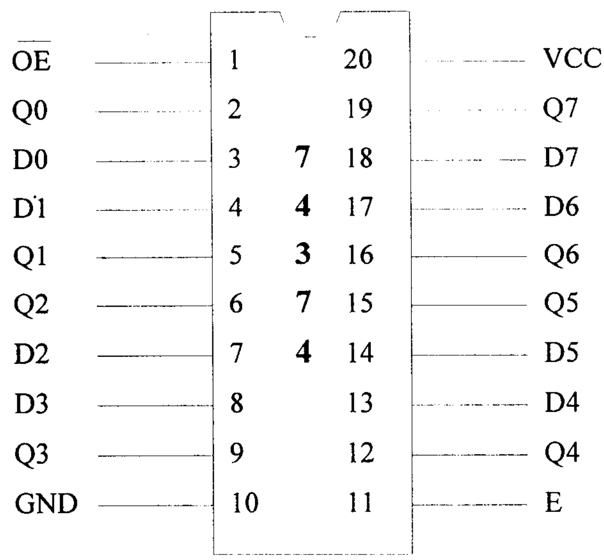


Fig 5.2

DESCRIPTION:

These 8 bits register features Totem-pole TRI-STATE Output designed specifically for driving highly capacitive or relatively low Impedance loads. The high impedance TRI-STATE and increased high logic level drive provide registers with the capability of being connected directly to and driving the bus lines in a bus organized system without need for interface or pull-up components. They are particularly attractive for implementing buffer registers, I/O ports, bi-directional bus drivers, and working registers.

The 8 flip flops of DM74LS374 are edge-triggered D- type flip flops on the positive transition of the clock, the Q output will be set to the logic states that were set up at the D inputs.

The buffered output control input can be used to place the 8 outputs in either a normal logic state or a high impedance state. In the high impedance state the outputs neither load nor drive the bus lines significantly.

The output control does not affect the internal operation of the flip flops. That is the old data can be retained or new data can be entered even while the outputs are off.

5.3 CD 74273:

The RCA CD74HC273 is the high speed octal D Type Flip-flops with a direct clear input are manufactured with silicon-gate CMOS Technology. They posses the low power consumption of standard CMOS integrated circuits.

Information at the d input is transferred to the q outputs on the positive-going edge of the clock pulse.

PIN CONFIGURATION:

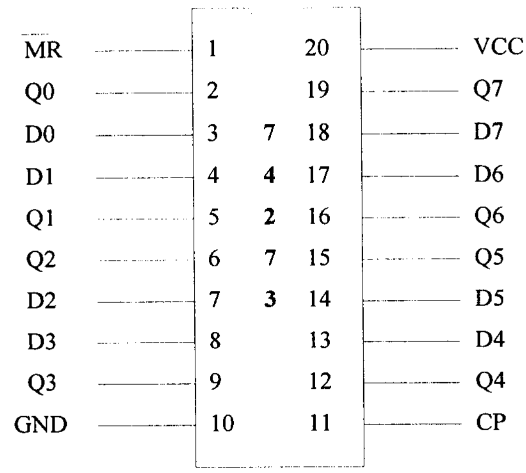


Fig.5.3

All eight flip-flops are controlled by a common clock (cp) and a common reset (MR). Reading is accomplished by allow voltage level independent of the clock. All eight Q outputs are reset to logic 0.

5.4 CD74688:

FEATURES:

- Fan out
- Standard outputs-10 LSTTL loads.
- Bus Driver outputs-15 LSTTL loads.
- Wide operating temperature range: -40 to 80 ^{0}C
- Balanced propagation delay and transition times.

- ➢ Significant power reduction compared to LSTTL logic ICs.
- ➢ 2 to 6v operations.
- ➢ High Noise Immunity: N_{IL}=30%, NIH= 30 % of Vic @ Vic=5V.

PIN CONFIGURATION:

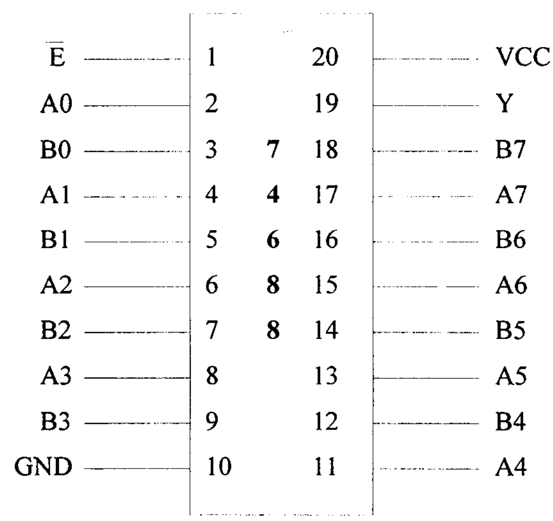


Fig.5.4

DESCRIPTION:

The RCA-CD74HCT688 is 8-bit magnitude comparator designed for use in computer and logic applications that require the comparison of two 8-bit binary words. When the compared words are equal the output (Y) is low and can be used as the enabling input for the next device in a cascade application.

5.5 74F125:

FEATURES:

- High impedance NPN base inputs for reduced loading (20 micro amp in HIGH and LOW states.
- Typical propagation delay of 5.0 ns.

PINCONFIGURATION:

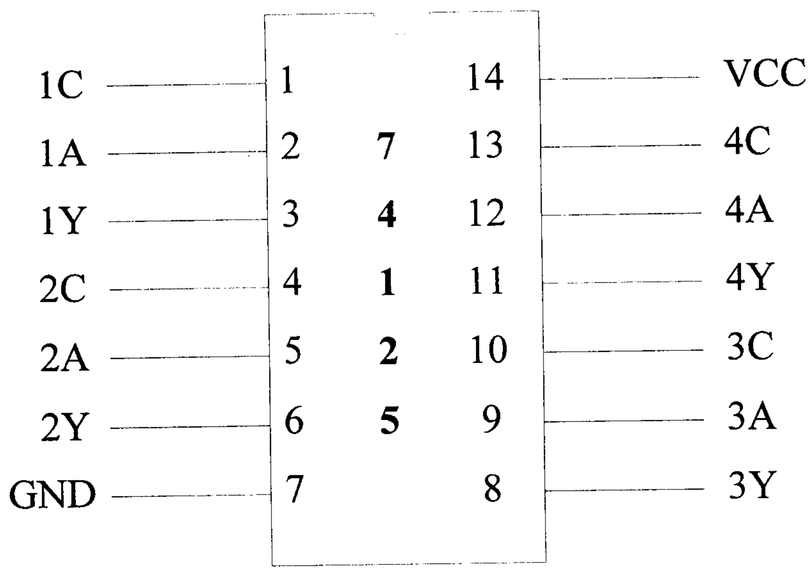


Fig 5.5

5.6 74F138:

FEATURES:

- Demultiplexing capability
- Multiple input enable for easy expansion

- Ideal for memory chip select decoding
- High speed replacement for Intel 3205

PIN CONFIGURATION:

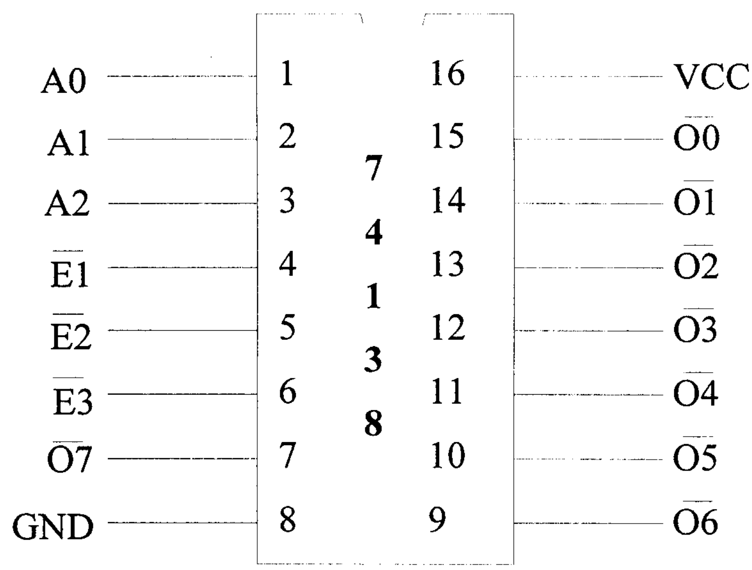


Fig 5.6

DESCRIPTION:

The component 74F138 is a 1-of-8 Decoder /Demultiplexer. The 74F138 decoder accepts three binary weighted inputs (A0, A1, A2) and when enabled, provides eight mutually exclusive, active LOW outputs (Q0-Q7). The device features three Enable inputs:

Two active LOW (E1, E_2)

One active HIGH (E_3).

Every output will be HIGH unless E_1, E_2 are LOW and E_3 is HIGH. This multiple enable function allows easy parallel expansion of the device to a 1-of –32 (5 lines to 32 lines) decoder with just four F138's and one inverter.

The device can be used as an eight-output demultiplexer by using one of the active LOW enable inputs as the data input and the remaining enable inputs as strobes. Enable inputs not used must be permanently tied to their appropriate active HIGH or active LOW state.

5.7 74F260:

FEATURES:

- Typical propagation delays 3.5 ns.
- Typical supply current 6 mA.

PIN CONFIGURATION:

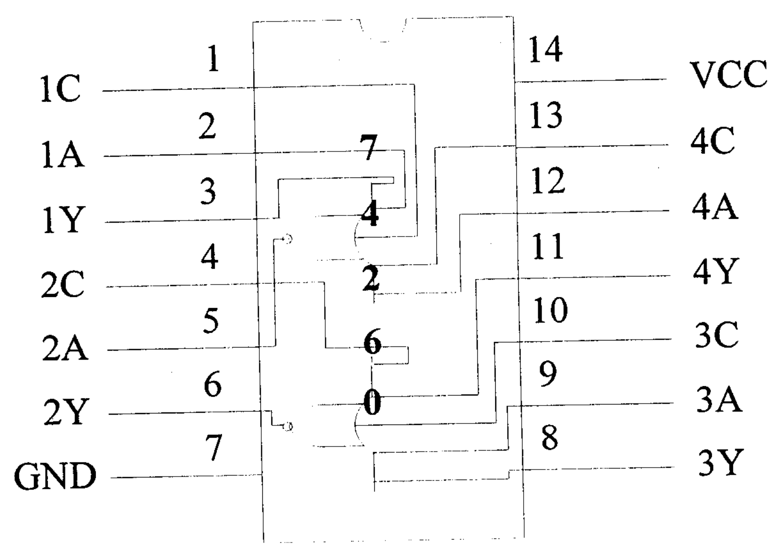


Fig 5.7

DESCRIPTION:

The pins A-E are the data inputs. The pin Y is the data output. The supply voltage ranges from –0.5 to +7.0 volts. The voltage applied to output in HIGH output state is –0.5 to $+V_{CC}$.The current applied to the output in LOW output state is 40mA.

5.8 74F04:

FEATURES:

- Typical propagation delay is 3.5ns.
- Typical supply current is 6.9 mA.

PIN COFIGURATION:

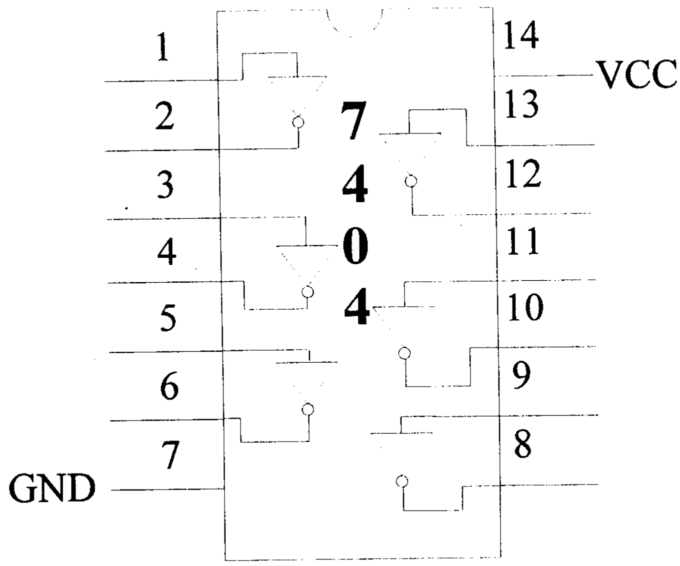


Fig 5.8

DESCRIPTION:

The pin A is an input. The pin Y is an output. If the input is LOW the output is HIGH.A HIGH input results in a LOW output.

5.9 7406:

FEATURES:

- It has 8-single input/single output inverter/buffer stages.
- Typical delays time 12.5ns.
- High level output voltage is 30 volts.
- Low level output current 40 mA.

DESCRIPTION:

The 7406 like the 7404 contains 8-single input buffer stages/single output inverter buffer stages. Only the power supply connections are in common. The differences offered by the 7406 are that of open-collector-type outputs are used and heftier amplification is supplied, hence the driver designation.

As logic elements are combined in series to perform complex logic functions, voltage levels tend to degrade. At some point, the circuitry might not be able to reliably distinguish between HIGH and LOW states. Thus amplifiers are sometimes needed to restore voltages or currents to the proper levels. In the case of 7406, an inversion function is added to the basic buffer. A LOW input results in a HIGH output and a HIGH input results in a LOW output. The inverter/buffer is often simply referred to as an inverter.

5.10 7800 SERIES +Ve REGULATOR:

PIN CONFIGURATION:

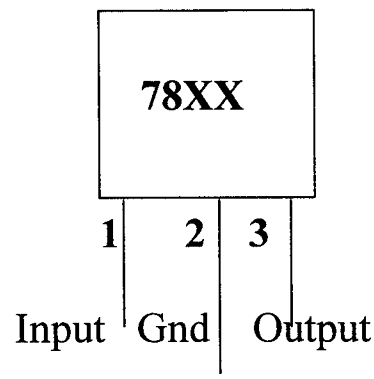


Fig 5.10

DESCRIPTION:

The 78xx is a popular and easy to use voltage regulator IC. It has just three pins.

The 78xx is designed for a well regulated output voltage. For a regulated voltage of 5v, 7805 is used. Similarly for regulated output voltage of 12v, 7812 is used. This can handle current over 1.5A if adequate heat sink is provided. Power dissipation is limited internally.

5.11 79XX SERIES –Ve REGULATOR:

PIN CONFIGURATION:

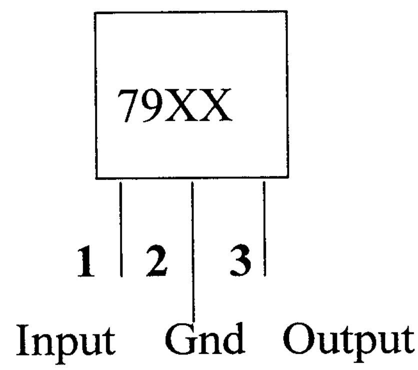


Fig 5.11

DESCRIPTION:

The 79xx series of fixed voltage regulator are essentially negative voltage versions of popular 7800 series. These devices are simple to use, with 3 pins.

They are available in variety of standard output voltages and can deliver output greater than 1.0 A.

It features internal short circuit protection and overload protection. They are so complete that no external components are required for basic operation. The 7905 IC is used for regulated voltage of –5V.similarly 7912 is used for an regulated output of –12V.

5.12 CD 4051:

FEATURES:

- Analog multiplexing and demultiplexing.
- Digital multiplexing and demultiplexing.
- Signal gating.

DESCRIPTION:

The 4051 is a 8 channel multiplexer/demultiplexer with common channel select logic. Each multiplexer has eight independent inputs/outputs (Y_0 to Y_7) and a common input/output (z). The common channel select logic includes two address inputs (A_0 and A_2) and an active low enable input (E).

Both multiplexer/demultiplexers contain eight bi-directional analogue switches, each with one side connected to an independent input/output (Y_0 to Y_7) and the other side connected to a common input/output (z).

With E LOW, one of the four switches is selected (low impedance ON state) by A_0, A_1 andA_3. With E HIGH, all switches are in the high impedance off state, independent of A_0, A_1 and A_2.

V_{DD} and V_{SS} are the supply voltage connections for the digital inputs (A_0, A_1, A_2 and E). The V_{DD} to V_{SS} range is 3 to 15v. The analogue inputs/outputs (Y_0 to Y_7 and Z) can swing between

V_{DD} as a positive limit and V_{EE} as a negative limit. V_{DD}- V_{EE} may not exceed 15v.

PIN DIAGRAM:

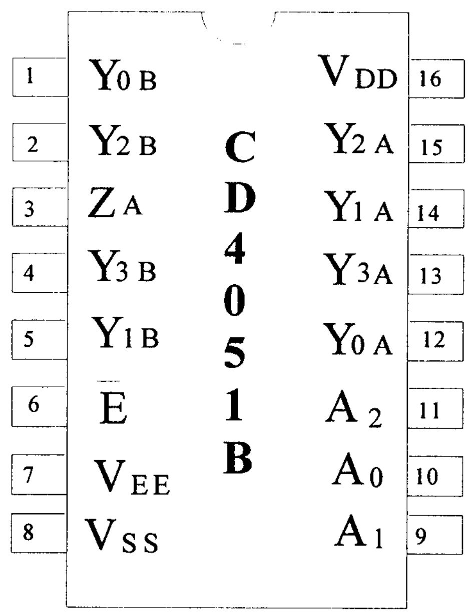


Fig 5.12

5.13 ISA BUS:

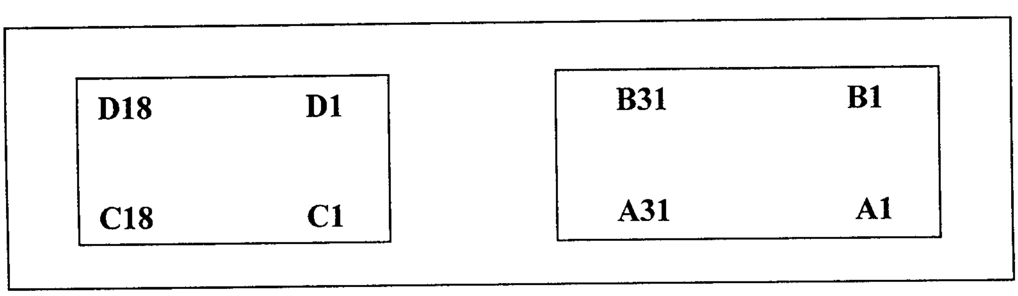
ISA is an acronym for industry Standard Architecture [5]. ISA is the basis of the modern personal computer and the primary architecture used in vast majority of PC systems. Two versions of ISA Bus exist.

- 8 bit version
- 16 bit version

Both these versions operate at an 8Mhz cycle rate with data transfer requiring anywhere from to eight cycles. The theoretical maximum data rate on ISA bus is 8M per second as the following shows:

- 8Mhz x 16 bits = 128 megabits/second
- 128 megabits per second / 2 cycles = 64 megabits/second
- 64 megabits per second / 8 = 8M/second.

Fig. 7.14 shows how the pins are oriented in the expansion slot.



Expansion Slot

Fig. 7.14 16-bit ISA Bus connector

It is possible to plug an older 8-bit card into the forward part of the slot or a newer 16-bit card into both parts of the slot. The second part of each expansion slot adds 36 connector pins to carry the extra signals necessary to implement the wider data path. In addition, one or two of the pins in the base portion of the connector (used for ISA cards) serve different purposes.

The table 7.15 describes the pin outs for the above 16-bit ISA expansion slot.

Pin	Signal Name	Pin	Signal Name
B1	Ground	A1	I/O CH CK
B2	reset drv	A2	D7
B3	+5v	A3	D6
B4	+IRQ 2	A4	D5
B5	-5Vdc	A5	D4
B6	+DRQ2	A6	D3
B7	-12v	A7	D2
B8	RESERVED	A8	D1
B9	+12V	A9	D0
B10	GND	A10	I/O CHRDY
B11	-MEMW	A11	AEN
B12	-MEMR	A12	A19
B13	-IOW	A13	A18
B14	-IOR	A14	A17
B15	-DACK3	A15	A16
B16	+DRQ3	A16	A15
B17	-DACK 1	A17	A14
B18	+DRQ1	A18	A13
B19	+DACK0	A19	A12

Pin	Signal name	Pin	Signal name
B20	CLOCK	A20	A11
B21	IRQ7	A21	A10
B22	IRQ6	A22	A9
B23	IRQ5	A23	A8
B24	IRQ4	A24	A7
B25	IRQ3	A25	A6
B26	-DACK2	A26	A5
B27	+T/C	A27	A4
B28	+ALE	A28	A3
B29	+5V	A29	A2
B30	OSC	A30	A1
B31	GND	A31	A0

CHAPTER 6

ALGORITHM

I. Start the process.

II. Read the rating of a transformer with the help or the keyboard or mouse.

III. Generate the transcode that corresponds to the transformer rating from the stored value.

IV. If the rating is not selected wait for selection.

V. Enter into the routine to turn the voltage switch and then read the analog voltage and store it in variable.

VI. Compare this voltage with the data stored in the database.

VII. If the voltage is within the tolerance then send message as **transformer is accepted.** Go to step IX.

VIII. If the voltage is out of range send message, as **transformer is not accepted.**

IX. Enter into the routine to turn on the current switch and then read the current in terms of voltage.

X. Convert this voltage into current.

XI. Then compare this current with the data stored in the database.

XII. If out of range send the message as **transformer is accepted** otherwise send the message as **transformer is not accepted.**

XIII. Enter into the routine to turn on the power factor switch.

XIV. Enter into the subroutine to read the power factor in terms of analog voltage.

XV. Then get the angle corresponding to the voltage from the database.

XVI. Calculate the power of the transformer using power factor VI cos.

XVII. If user wants to know about the present-day status then select the data corresponding to sysdate and display it.

XVIII. Similarly for a week and month display.

XIX. It will also display the total number of pieces accepted and the total number of pieces rejected.

XX. If user want hard copy output then it will be printed from the notepad.

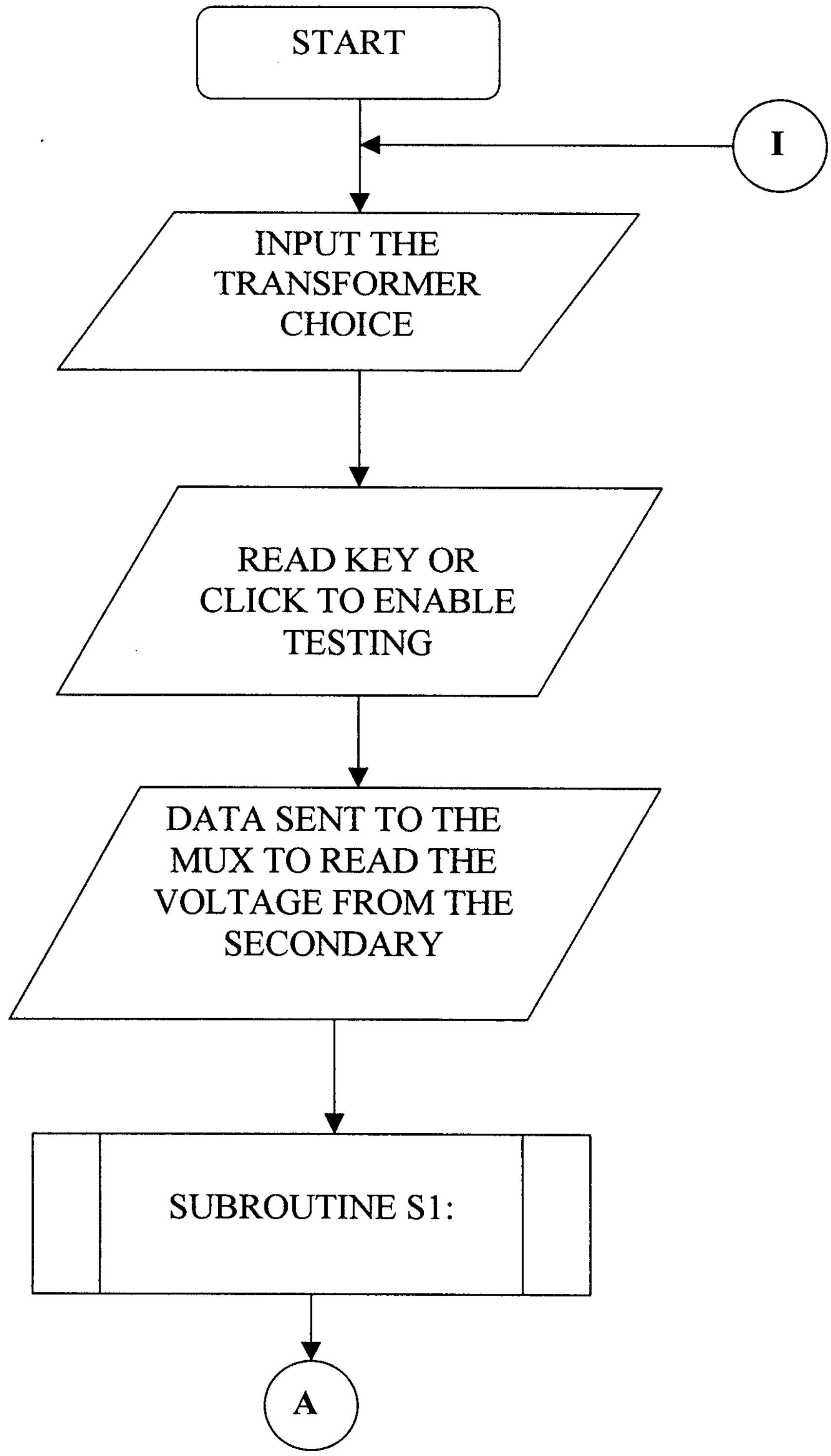
XXI. If user like to check another transformer go to step 1

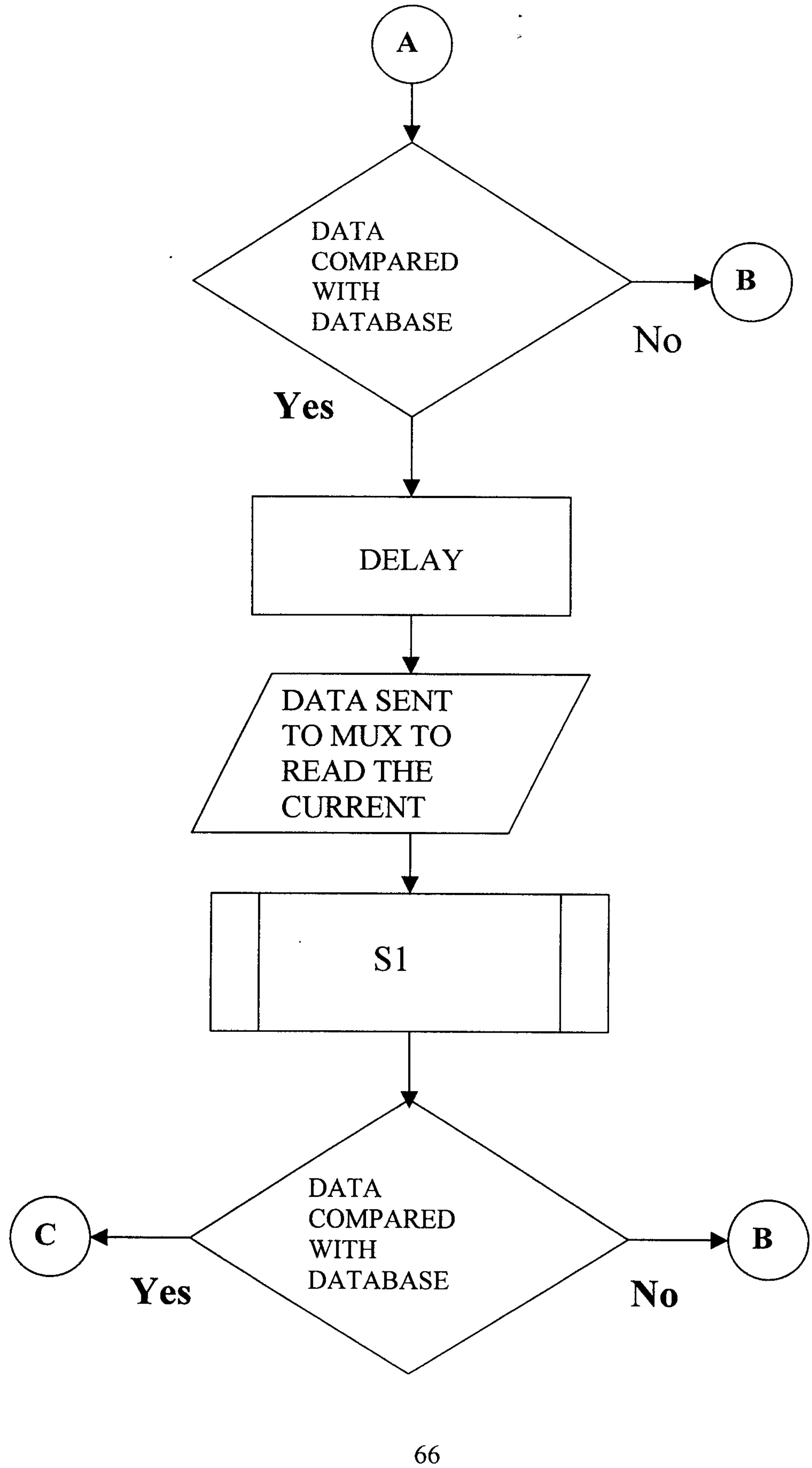
XXII. Otherwise stop the process.

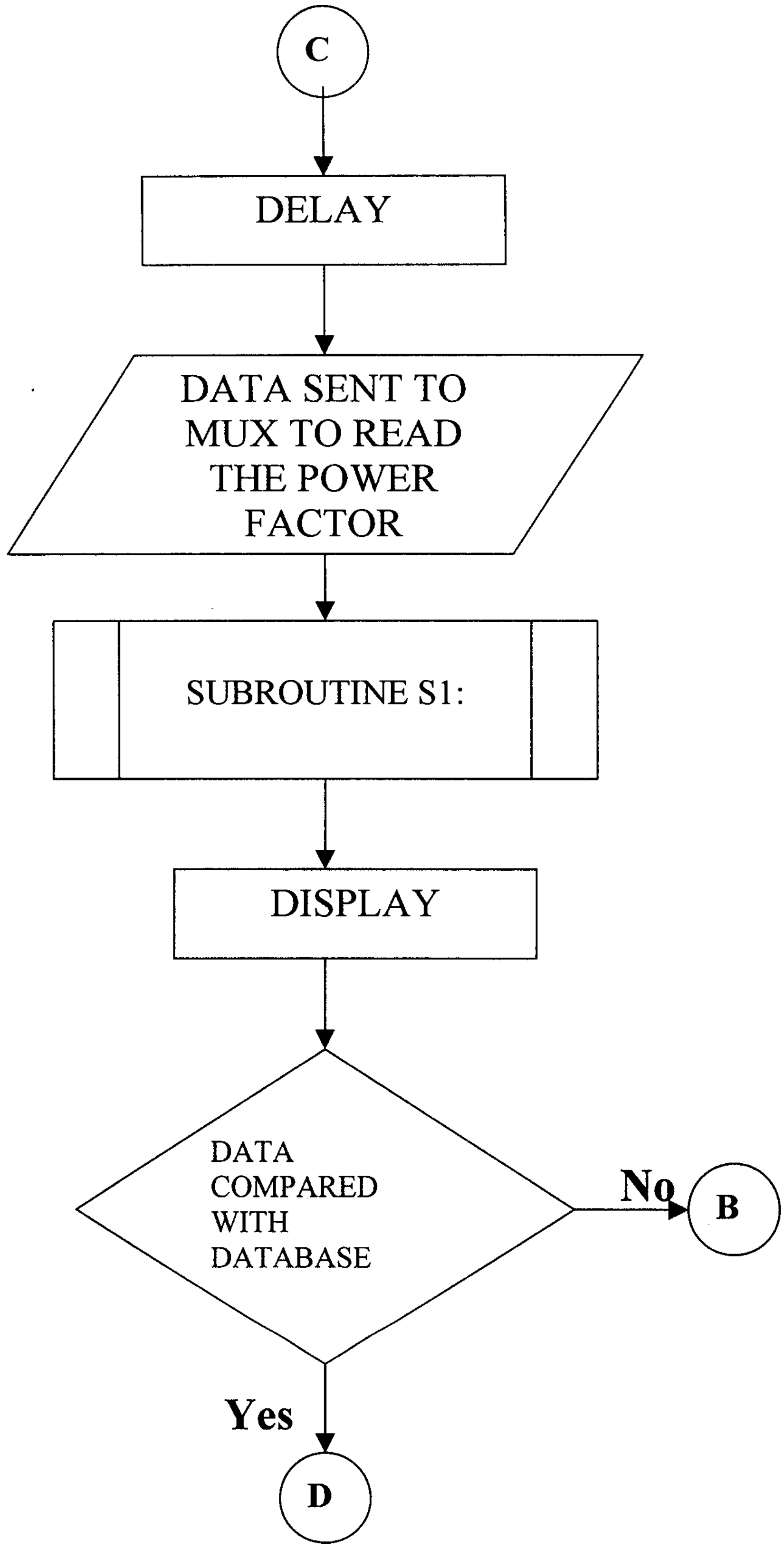
SUBROUTINE:

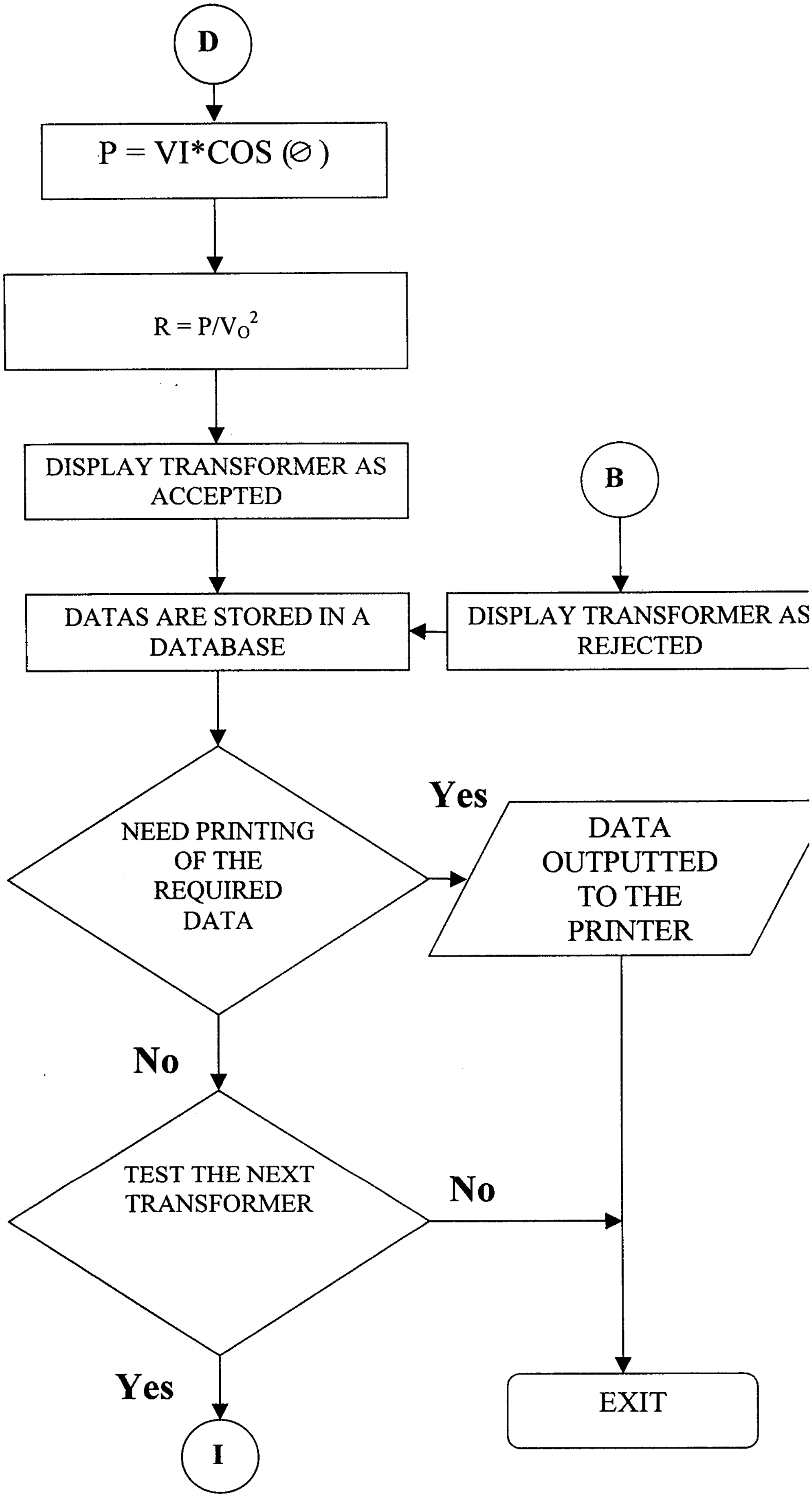
- Check for the status of A/D becomes high to low. (start of conversion).
- Check for low to high.
- Check for high to low. (end of conversion).
- Check for the sign bit and assign data as negative when it is zero.
- Else the data is positive.
- Read the higher byte and mask it with **0F**.
- Read the lower byte.
- Convert this into its equivalent decimal value.
- Return to main.

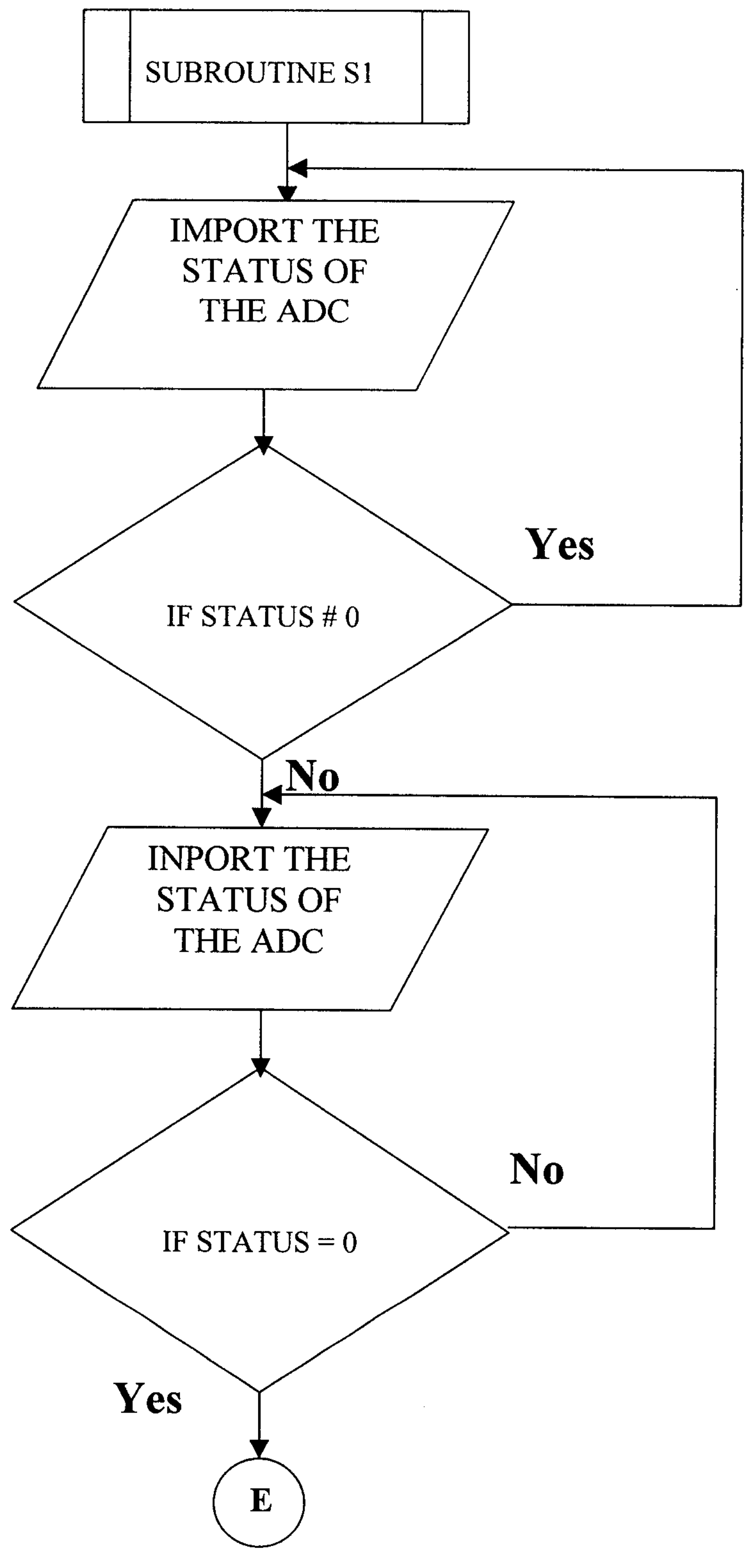
CHAPTER 7
FLOWCHART



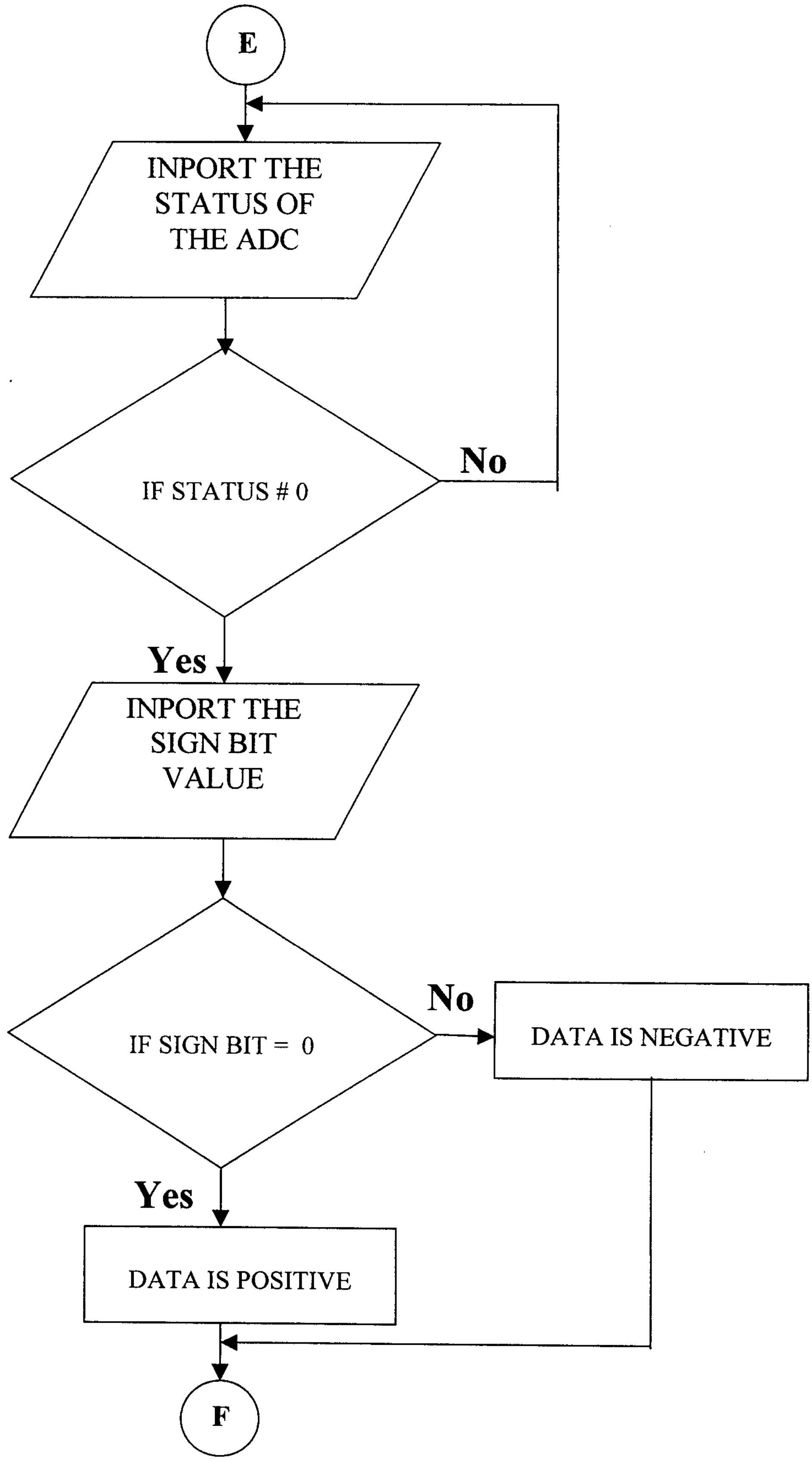

A
DATA COMPARED WITH DATABASE
B
No
Yes
DELAY
DATA SENT TO MUX TO READ THE CURRENT
S1
DATA COMPARED WITH DATABASE
C
Yes
B
No

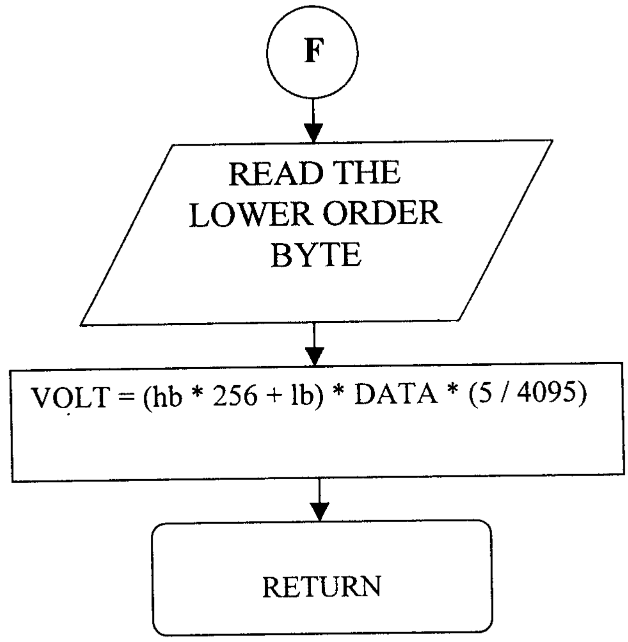

C
DELAY
DATA SENT TO MUX TO READ THE POWER FACTOR
SUBROUTINE S1:
DISPLAY
DATA COMPARED WITH DATABASE
No
B
Yes
D


D
P = VI*COS (⊘)
R = P/V_O^2
DISPLAY TRANSFORMER AS ACCEPTED
B
DATAS ARE STORED IN A DATABASE
DISPLAY TRANSFORMER AS REJECTED
NEED PRINTING OF THE REQUIRED DATA
Yes
DATA OUTPUTTED TO THE PRINTER
No
TEST THE NEXT TRANSFORMER
No
Yes
EXIT
I



SUBROUTINE S1
IMPORT THE STATUS OF THE ADC
IF STATUS # 0
Yes
No
INPORT THE STATUS OF THE ADC
IF STATUS = 0
No
Yes
E


E
INPORT THE
STATUS OF
THE ADC
IF STATUS # 0
No
Yes
INPORT THE
SIGN BIT
VALUE
IF SIGN BIT = 0
No
DATA IS NEGATIVE
Yes
DATA IS POSITIVE
F


F
READ THE LOWER ORDER BYTE
VOLT = (hb * 256 + lb) * DATA * (5 / 4095)
RETURN

CHAPTER 8
SOFTWARE

Splash screen code:

```
Option Explicit

Private Sub Form_Load()
    Me.Show
   Call connect
End Sub

Private Sub Timer1_Timer()

   Static timeElapsed%
   timeElapsed = timeElapsed + 1

   If timeElapsed <= 10 Then
      pb1.Value = pb1.Value + 1
   Else
      lblLoad.Caption = "Loaded !"
   End If

   If timeElapsed >= 13 Then
     Unload Me
      Timer1.Interval = 0
      Timer1.Enabled = False
      frmTranTest.Show vbModal
   End If

End Sub
```

Test Screen Code:

Option Explicit

```
Const VMF = 14.9525156597292 'VMF -- Voltage Multiplying
Factor
Const CMF = 1 / 450        'CMF -- Current Multiplying Factor
Const pi = 22 / 7
Const Title = "Transformer Test"

Dim cnStr As String

Dim rs As New ADODB.Recordset
Dim rs1 As New ADODB.Recordset

Dim rsRating As New ADODB.Recordset
Dim KeyPressed As Boolean
Dim TimeKilled As Integer

Private Type VoltAngle
   Volt As Single
   Angle As Single
   Index As Integer
   Diff As Single
End Type

Private VA() As VoltAngle

Private Sub Form_Load()
Dim i%, rc%
   Set rs1 = Cn.Execute("Select * from tbPowerFactor")
   If rs1.RecordCount > 0 Then
      rc = rs1.RecordCount
```

```
      ReDim VA(rc)
      For i = 1 To rc
        VA(i).Volt = Val(rs1.Fields("sngVoltage"))
        VA(i).Angle = Val(rs1.Fields("sngAngle"))
        rs1.MoveNext
      Next i
   End If
End Sub

Private Sub Form_Activate()
   Call RefreshDC
   Me.dcTranRating.SetFocus
End Sub


Private Sub cmdDelete_Click()

If MsgBox("Are You Sure To Delete All Test Information   Stored
In Database" & vbCrLf & "You Cant Retrive Data If Deleted",
vbQuestion + vbOKCancel, Title) = vbOK Then
      cn.Execute("Delete from tbTranTestreport")
End If

End Sub

Private Sub cmdExit_Click()

If MsgBox("This Will End Your Transformer Testing",
vbInformation + vbOKCancel, "Transformer Test") = vbOK Then
End
End Sub
```

Private Sub dcTranRating_Click(Area As Integer)

```
Dim Vmax As Single, Vmin As Single, ActVolt As Single, p As
Single
Dim Imax As Single, Imin As Single, ActCurrent As Single
   If Area = 2 Then

      If Val(Trim(Me.dcTranRating.BoundText)) = 0 Then
         MsgBox "Reselect Transformer Rating", vbInformation,
Title
         Me.dcTranRating.SetFocus
         Exit Sub
      End If

Set rs1 = Cn.Execute("Select * from TbMastTran where
intTranCode = " & Val(Me.dcTranRating.BoundText))

      ActVolt = rs1.Fields("sngTranOPVolt")
      ActCurrent = rs1.Fields("sngTranOPCurrent")
      p = rs1.Fields("sngOPVoltToler")

       Vmax = ActVolt + ActVolt * p / 100: Vmin = ActVolt -
      ActVolt     * p / 100
      Imax = ActCurrent + ActCurrent * p / 100: Imin = ActCurrent
      - ActCurrent * p / 100

      Vmn.Caption = Vmin: Vmx.Caption = Vmax
      Cmn.Caption = Imin: Cmx.Caption = Imax

   End If
```

End Sub

```
Private Sub dcTranRating_Validate(Cancel As Boolean)
  If Val(Me.dcTranRating.BoundText) = 0 Then
    Cancel = True
    MsgBox "Select A Tranformer To Test", vbInformation, Title
  End If
End Sub

Private Sub RefreshDC()

  Set rsRating = Nothing
  Set rsRating = Cn.Execute("Select * from TbMastTran")
  Set Me.dcTranRating.RowSource = rsRating

  Me.dcTranRating.Text = ""
  Me.dcTranRating.ListField = "txtTranRating"
  Me.dcTranRating.BoundColumn = "intTranCode"
  Me.dcTranRating.Refresh
  Me.dcTranRating.ReFill

End Sub


Private Sub cmdTestTrans_Click()

'This sub executes the transformer test

Dim FilePath As String, Volt As String, PrgID As Double
Dim Currrent As String, V As Single, i As Single, resistance As
Single
Dim phi As Single, power As Single

  FilePath = "C:\Program Files\Microsoft Visual
  Studio\VB98\Volt.txt"

  If Val(Me.dcTranRating.BoundText) = 0 Then
```

```
    MsgBox "Select Transformer Rating", vbCritical, "Trans
    Info"
   Me.dcTranRating.SetFocus
   Exit Sub
End If


lblVD.Caption = ""
lblCD.Caption = ""
lblRD.Caption = ""
lblPower.Caption = ""
lblPF.Caption = ""

lblResult.Caption = ""
lblResult.BackColor = vbWhite


'Retriving Voltage from ADC via text file
                          KillTime 1
SwitchVoltage

PrgID = Shell("c:\tc\volt.exe")
DoEvents
Open FilePath For Input As #1
   Input #1, Volt
   Me.lblVD.Caption = Val(Volt) * VMF
Close #1
```

```
'Retriving Current from ADC
  KillTime 1
  SwitchCurrent

  PrgID = Shell("c:\tc\volt.exe")
  Open FilePath For Input As #1
     Input #1, Currrent
     Me.lblCD.Caption = Val(Currrent) * CMF
  Close #1


 'Power and Power Calculation Calculation
  KillTime 1
  SwitchPowerFactor

  PrgID = Shell("c:\tc\volt.exe")
  Open FilePath For Input As #1
     Input #1, Volt
     V = Val(Volt)
  Close #1

  i = Val(Me.lblCD.Caption)
  phi = AngleDeg(V) * pi / 180
  lblPF.Caption = Cos(phi)
  power = 230 * i * Cos(phi)
  lblPower.Caption = power

      resistance = power / (Val(Me.lblVD.Caption) *
      Val(Me.lblVD.Caption))

  Call SaveData
  Me.cmdExit.SetFocus
End Sub
```

```
Private Sub SwitchVoltage()
Dim PrgID As Double, FilePath As String
   FilePath = "c:\TC\VSwitch.exe"
   PrgID = Shell(FilePath)
End Sub


Private Sub SwitchCurrent()
Dim PrgID As Double, FilePath As String
   FilePath = "c:\TC\CSwitch.exe"
   PrgID = Shell(FilePath)
End Sub

Private Sub SwitchPowerFactor()
Dim PrgID As Double, FilePath As String
   FilePath = "c:\TC\PSwitch.exe"
   PrgID = Shell(FilePath)
End Sub

Private Function AngleDeg(ByVal Volt As Single) As Single

'This sub returns the phase angle in degrees getting voltage
as 'input
Dim i%, Diff As Single, temp() As VoltAngle, minDiff As Single
Dim indx%

   ReDim temp(UBound(VA))

   For i = 1 To UBound(VA)
      Diff = Volt - VA(i).Volt
      temp(i).Angle = VA(i).Angle
      temp(i).Diff = Diff
      temp(i).Index = i
   Next i
```

```
minDiff = 1000

For i = 1 To UBound(temp)
   If temp(i).Diff >= 0 Then
     If minDiff > temp(i).Diff Then
       minDiff = temp(i).Diff
       indx = i
     End If
   End If
Next i

If indx > 0 Then
   AngleDeg = VA(indx).Angle
Else
   AngleDeg = 35
End If
```

End Function

Private Function VoltageTest() As Boolean

```
'This function returns True if the output VOLTAGE of the
'transformer is within tolerance range otherwise it returns
'False

Dim V%, Vmax As Single, Vmin As Single, ActVolt As Single
Dim p As Single

V = Val(Me.lblVD.Caption)
Set rs1 = Cn.Execute("Select * from tbMastTran where
intTranCode = " & Val(dcTranRating.BoundText))

   ActVolt = rs1.Fields("sngTranOPVolt")
   p = rs1.Fields("sngOPVoltToler")
```

```
  Vmax = ActVolt + ActVolt * p / 100
  Vmin = ActVolt - ActVolt * p / 100
  VoltageTest = False
  Select Case V
        Case Vmin To Vmax
           VoltageTest = True
        Case Else
             MsgBox "Voltage Test Fails" & vbCrLf & "Output
            Votage Out of Range" & vbCrLf & "Reject This
            Transformer", vbCritical
           VoltageTest = False
   End Select
```
End Function

Private Function CurrentTest() As Boolean

'This function returns True if the output CURRENT of the
'transformer is'within tolerance range otherwise it returns
'False

```
Dim i%, Imax As Single, Imin As Single, ActCurrent As Single,
Dim p As Single

   i = Val(Me.lblCD.Caption)

       Set rs1 = Cn.Execute("Select * from tbMastTran where
       intTranCode = " & Val(dcTranRating.BoundText))

   ActCurrent = rs1.Fields("sngTranOPCurrent")
   p = rs1.Fields("sngOPVoltToler")

   Imax = ActCurrent + ActCurrent * p / 100
   Imin = ActCurrent - ActCurrent * p / 100
```

```
    Vmax = ActVolt + ActVolt * p / 100
    Vmin = ActVolt - ActVolt * p / 100
    VoltageTest = False
    Select Case V
          Case Vmin To Vmax
             VoltageTest = True
          Case Else
                MsgBox "Voltage Test Fails" & vbCrLf & "Output
               Votage Out of Range" & vbCrLf & "Reject This
               Transformer", vbCritical
             VoltageTest = False
     End Select
End Function
```

Private Function CurrentTest() As Boolean

'This function returns True if the output CURRENT of the
'transformer is'within tolerance range otherwise it returns
'False

```
Dim i%, Imax As Single, Imin As Single, ActCurrent As Single,
Dim p As Single

    i = Val(Me.lblCD.Caption)

        Set rs1 = Cn.Execute("Select * from tbMastTran where
        intTranCode = " & Val(dcTranRating.BoundText))

    ActCurrent = rs1.Fields("sngTranOPCurrent")
    p = rs1.Fields("sngOPVoltToler")

    Imax = ActCurrent + ActCurrent * p / 100
    Imin = ActCurrent - ActCurrent * p / 100
```

```
Select Case i
   Case Imin To Imax
         CurrentTest = True
   Case Else
         MsgBox "Current Test Fails" & vbCrLf & "Output
         Current Out of Range" & vbCrLf & "Reject This
         Transformer", vbCritical
         CurrentTest = False
End Select

End Function
```

```
Private Sub SaveData()
'This sub saves the results of test
'  1.output voltage
'  2.output current
'  3.status indicating if the transformer is accepted or rejected
'  4.resistance
'  5.date of test
'  6.transformer code
      Dim dte  As String, Accepted As Boolean
dte = Format(Now, "mm/dd/yyyy") 'This value isInserted into
table

   Accepted = VoltageTest And CurrentTest
   With Me.lblResult
     .Caption = IIf(Accepted, "Accepted", "Rejected")
     .BackColor = IIf(Accepted, vbWhite, vbRed)
   End With

     If rs.State = adStateOpen Then rs.Close
```

```
    rs.Open "tbTranTestReport", Cn, adOpenKeyset,
    adLockOptimistic, adCmdTable
    rs.AddNew

    rs.Fields("intTranCode") =
Val(Me.dcTranRating.BoundText)
    rs.Fields("sngTranOPVolt") = Val(Me.lblVD.Caption)
    rs.Fields("sngTranOPCurrent") = Val(Me.lblCD.Caption)
    rs.Fields("sngTranOPResist") = 10
    rs.Fields("blnAccepted") = Accepted
    rs.Fields("TestDay") = Day(Date)
    rs.Fields("TestMonth") = Month(Date)
    rs.Fields("TestYear") = Year(Date)
  rs.Update
End Sub


Private Sub cmdAddModifyRating_Click()
  'code to add / modiffy rating
  frmAddModifyRating.Show vbModal
End Sub

Private Sub cmdView_Click()
  'code  to view test data form  database
  frmTestReport.Show vbModal
End Sub

Private Sub KillTime(TimeToKill As Integer)

'this sub is called to kill a specific interval of time after
'multiplexer is switched to read voltage or current
'the time interval elapsed is the respone time of the multiplexer

Dim InitialTime As Variant
```

```
   InitialTime = Now
   If TimeToKill = 0 Then Exit Sub
   Do While Format(Now - InitialTime, "SS") < TimeToKill
     'do nothing
   Loop

End Sub
'The following Gotfocus events are used to display
'help messages to the user

Private Sub cmdTestTrans_GotFocus()
   Help.Caption = "Click To Test The Connected Transformer"
End Sub

Private Sub cmdView_GotFocus()
   Help.Caption = "Click To View Test Reports"
End Sub

Private Sub cmdDelete_GotFocus()
   Help.Caption = "Click Here To Delete Test Data . You Cant
   Retrive Data If Deleted"
End Sub

Private Sub cmdExit_GotFocus()
   Help.Caption = "Click To Exit"
End Sub

Private Sub dcTranRating_GotFocus()
   Help.Caption = "Tranformer Rating"
End Sub

Private Sub cmdAddModifyRating_GotFocus()
   Help.Caption = "Click To Add New Tranformer Rating Or
Modify Existing Tranformer rating"
End Sub
```

```
Private Sub cmdTestTrans_LostFocus()
 Help.Caption = ""
End Sub

Private Sub cmdView_LostFocus()
  Help.Caption = ""
End Sub

Private Sub cmdDelete_LostFocus()
  Help.Caption = ""
End Sub

Private Sub cmdAddModifyRating_LostFocus()
  Help.Caption = ""
End Sub

Private Sub Form_KeyDown(KeyCode As Integer, Shift As
Integer)
  KeyPressed = True
End Sub
```

Report Form Coding

```
Option Explicit

Const Title = "Transformer Test Report"
Dim rs As New ADODB.Recordset
Dim rsGen As New ADODB.Recordset
Dim acpT As Long, rejT As Long, totT As Long
Dim sql As Variant

Private Sub Form_Load()
  Call BuildGrid
End Sub
```

```
Private Sub BuildGrid()
 Dim i%
  With Me.msfReport
    .Cols = 7
    .RowHeight(0) = 400
      For i = 0 To 6
            .ColWidth(i) = Choose(i + 1, 600, 1000, 1500, 1500,
            1500, 1500, 1350)
            .ColAlignment(i) = 4
             .TextMatrix(0, i) = Choose(i + 1, "S.No", "Rating",
            "O/P Volt", "O/P Current", "Resistance", "Status",
            "Test Date")
      Next
  End With
End Sub
Private Sub cmdrangeReport_Click()
Dim i%
   acpT = 0: rejT = 0: totT = 0
   If ValidDate Then
     For i = 1 To opt.Count
         Me.opt(i).Value = False
      Next i
      Call ClearGrid
      Call DateRangeData
   End If
End Sub

Private Sub opt_Click(Index As Integer)

   Select Case Index
      Case 1
         CDData
      Case 2
         CMData
```

```
    Case 3
        CYData
  End Select

Set rs = Cn.Execute(sql)
Call LoadGrid

End Sub

Private Sub CDData()
        sql = "Select * from tbTranTestReport where TestDay =" &
        Day(Date) & "And" & _" TestMonth =" & Month(Date) &
        "And" & _" TestYear =" & Year(Date)
End Sub


Private Sub CMData()
        sql = "Select * from tbTranTestReport where  TestMonth ="
        &  Month(Date) & "And" & " TestYear =" & Year(Date)
End Sub

Private Sub CYData()
   sql = "Select * from tbTranTestReport where TestYear =" &
   Year(Date)
End Sub


Private Sub DateRangeData()
Dim sql1, sql2, sql3, dteFr, dteTo
Dim FD%, FM%, FY%
Dim TD%, TM%, TY%

dteFr = CDate(Me.txtFromDate.Text)
dteTo = CDate(Me.txtToDate.Text)
```

```
FD = Day(dteFr): FM = Month(dteFr): FY = Year(dteFr)
TD = Day(dteTo): TM = Month(dteTo): TY = Year(dteTo)

Me.msfReport.Rows = 1

Select Case TM – FM
Case 0

 'same Month

sql1 = "Select * from tbTranTestReport where TestDay >= " &
FD & " and" & _" TestDay <= " & TD & " and" & _" TestMonth
= " & FM & " and" & _" TestYear = " & FY
 Set rs = Cn.Execute(sql1)
 Call LoadRageData
   sql2 = "": sql3 = ""

Case 1

sql1 = "Select * from tbTranTestReport where TestDay >= " & FD
& " and" & _" TestMonth = " & FM & " and" & _" TestYear = " &
FY

sql2 = "Select * from tbTranTestReport where TestDay <= " & TD
& " and" & _" TestMonth = " & TM & " and" & _" TestYear = "
& TY
   Set rs = Cn.Execute(sql1)
   Call LoadRageData
   Set rs = Cn.Execute(sql2)
   Call LoadRageData
   sql3 = ""

Case Is > 1
```

```
sql1 = "Select * from tbTranTestReport where TestDay >= " & FD
& " and" & _" TestMonth = " & FM & " and" & _" TestYear = " &
FY

sql2 = "Select * from tbTranTestReport where TestMonth >= " &
FM + 1 & " and" & _" TestMonth <= " & TM - 1 & "and" & _"
TestYear = " & FY

sql3 = "Select * from tbTranTestReport where TestDay <= " & TD
& " and" & _" TestMonth = " & TM & " and" & _" TestYear = "
& TY

   Set rs = Cn.Execute(sql1)
   Call LoadRageData
   Set rs = Cn.Execute(sql2)
   Call LoadRageData
   Set rs = Cn.Execute(sql3)
   Call LoadRageData

Case Else
   MsgBox "Verify Date Entered", vbCritical, "Tranformer
Report"

End Select
```

End Sub

Private Function ValidDate() As Boolean

```
Dim dt As Date

With Me.txtFromDate

   If Trim(.Text) = "" Then
```

```
    MsgBox "Invalid From Date", vbExclamation, Title
    ValidDate = False
   .SetFocus
    Exit Function
 End If

If IsDate(.Text) = False Then
   MsgBox "Invalid From Date", vbExclamation, Title
   ValidDate = False
  .SetFocus
   Exit Function
 End If

 If Val(Left(Trim(.Text), 2)) > 12 Then
      MsgBox "Enter Date in MM/DD/YYYY
      Format",VbExclamation, Title
     ValidDate = False
  .SetFocus
   Exit Function
 End If

 dt = CDate(Me.txtFromDate.Text)
 If dt > Date Then
       MsgBox "From date Cannot be greater than Today's Date",
      vbExclamation, Title
      ValidDate = False
     .SetFocus
      Exit Function
  End If
End With


With Me.txtToDate

   If Trim(.Text) = "" Then
```

```
    MsgBox "Invalid To Date", vbExclamation, Title
    ValidDate = False
   .SetFocus
    Exit Function
  End If

 If IsDate(.Text) = False Then
    MsgBox "Invalid To Date", vbExclamation, Title
    ValidDate = False
   .SetFocus
    Exit Function
  End If

  If Val(Left(Trim(.Text), 2)) > 12 Then
       MsgBox "Enter Date in MM/DD/YYYY Format",
       vbExclamation, Title
       ValidDate = False
   .SetFocus
    Exit Function
  End If

  dt = CDate(Me.txtFromDate.Text)
  If dt > Date Then
       MsgBox "To date Cannot be greater than Today's Date",
       vbExclamation, Title
       ValidDate = False
      .SetFocus
       Exit Function
  End If

End With

If CDate(Me.txtFromDate.Text) > CDate(Me.txtToDate.Text)
Then
```

```
MsgBox "From Date Should Be Less than To Date",
vbExclamation, Title

End If

ValidDate = True

End Function
```

Private Sub LoadGrid()

```
Dim rc%, i%
acpT = 0: rejT = 0: totT = 0
Call ClearGrid
 rc = rs.RecordCount
 totT = rc
  With Me.msfReport
      If rs.RecordCount > 0 Then
        .Rows = rc + 1
         RefreshSno
         For i = 1 To rc
             Set rsGen = Cn.Execute("Select txtTranRating from
             tbMastTran where intTranCode =" &
             Val(rs.Fields("intTranCode")))
            . TextMatrix(i, 1) = rsGen.Fields(0)
             .TextMatrix(i, 2) = rs.Fields("SngTranOPVolt")
             .TextMatrix(i, 3) = rs.Fields("sngTranOPCurrent")
             .TextMatrix(i, 4) = rs.Fields("sngTranOPResist")
             .TextMatrix(i, 5) = IIf(rs.Fields("blnAccepted") = True,
             Accepted", "Rejected")
            If rs.Fields("blnAccepted") = True Then acpT = acpT +
            1 Else rejT = rejT + 1
             .TextMatrix(i, 6)
             =Format(DateSerial(Val(rs.Fields("TestYear")),
```

```
            Val(rs.Fields("TestMonth")),
            Val(rs.Fields("TestDay"))), "mm/dd/yyyy")
          rs.MoveNext
        Next i
      End If
    End With

    Me.txtAcpT = acpT
    Me.txtRejT = rejT
    Me.txtTotT = totT
```

End Sub

Private Sub LoadRageData()

```
Dim rc%, i%, StartRow%, EndRow%

 rc = rs.RecordCount
 totT = totT + rc
   With Me.msfReport
     If rs.RecordCount > 0 Then

       StartRow = .Rows: EndRow = rc + StartRow - 1

       .Rows = .Rows + rc
        RefreshSno
         For i = StartRow To EndRow
            Set rsGen = Cn.Execute("Select txtTranRating from
tbMastTran where intTranCode =" &
Val(rs.Fields("intTranCode")))
           .TextMatrix(i, 1) = rsGen.Fields(0)
           .TextMatrix(i, 2) = rs.Fields("SngTranOPVolt")
           .TextMatrix(i, 3) = rs.Fields("sngTranOPCurrent")
           .TextMatrix(i, 4) = rs.Fields("sngTranOPResist")
```

```
            .TextMatrix(i, 5) = IIf(rs.Fields("blnAccepted") = True,
"Accepted", "Rejected")

            If rs.Fields("blnAccepted") = True Then acpT = acpT +
1 Else rejT = rejT + 1

            .TextMatrix(i, 6) =
Format(DateSerial(Val(rs.Fields("TestYear")),
Val(rs.Fields("TestMonth")), Val(rs.Fields("TestDay"))),
"mm/dd/yyyy")
            rs.MoveNext
         Next i
      End If
   End With

Me.txtAcpT = acpT
Me.txtRejT = rejT
Me.txtTotT = totT
End Sub

Private Sub ClearGrid()
   With Me.msfReport
      .Rows = 1
      .Rows = 2
   End With
End Sub

Private Sub RefreshSno()
Dim i%, j%
With Me.msfReport
   For i = 1 To .Rows - 1
      .TextMatrix(i, 0) = i
   Next i
End With
End Sub
```

```
Private Sub cmdExit_Click()
   Unload Me
End Sub

Private Sub cmdSaveRep_Click()
   Call SaveReport
End Sub

Private Sub SaveReport()

'This part saves the report in a text file (TranRep.txt)

Dim i%, j%, head As String, ln%, id As Double
Dim txt As Variant

   head = "TRANSFORMER TEST RESULTS"
   ln = Len(head)

   head = Space(50 - ln / 2) & head & Space(40 - ln / 2)
   Open "C:\TranRep.txt" For Output As #1

   'Header
      Print #1, ""
      Print #1, head
      Print #1, ""
   'Body

   With msfReport

        For i = 0 To .Rows - 1

           For j = 0 To .Cols - 1

               txt = .TextMatrix(i, j)
               If i > 0 Then
```

```
                If j <> 5 Then txt = Right(Space(FieldLen(j)) &
Trim(txt), FieldLen(j))
              End If

              If j < .Cols - 1 Then
               Print #1, Tab(FieldPos(j)); txt;
              Else
               Print #1, Tab(FieldPos(j)); txt
              End If

          Next j

           If i = 0 Then
              Print #1, String(90, "_")
              Print #1, ""
           End If

       Next i


    End With

    'Footer
    Print #1, ""
    Print #1, ""

    Print #1, Space(15) & "Total Accepted Transformers  = ";
Right(Space(6) & Trim(Me.txtAcpT.Text), 6)
    Print #1, Space(15) & "Total Rejected Transformers  = ";
Right(Space(6) & Trim(Me.txtRejT.Text), 6)
    Print #1, Space(15) & "Total Transformers           = ";
Right(Space(6) & Trim(Me.txtTotT.Text), 6)
    Print #1, ""
    Print #1, ""
    Close #1
```

```
'The following code is to open Notepad and display
TranRep.txt

  id = Shell("c:\Windows\Notepad.exe", vbMaximizedFocus)
  SendKeys "%{F}"
  SendKeys "O"
  SendKeys "C:\TranRep.txt"
  SendKeys "%{O}"

End Sub

Private Function FieldPos(ByVal Index As Integer) As Integer
Dim i%, ln%

  For i = 1 To Index
    ln = ln + FieldLen(i)
  Next i

  If Index = 0 Then
    FieldPos = 5
  Else
    FieldPos = ln + 3 * (Index)
  End If

End Function

Private Function FieldLen(ByVal Index As Integer) As Integer
  FieldLen = Choose(Index + 1, 5, 10, 10, 10, 10, 10, 10)
End Function
```

```
Option Explicit

Dim rsSave As New ADODB.Recordset
Dim rsGen As New ADODB.Recordset
Dim rsRating As New ADODB.Recordset

Private Sub cmdExit_Click()
   Set rsSave = Nothing
   Set rsGen = Nothing
   Set rsRating = Nothing
   Unload Me
End Sub

Private Sub dcTranRating_Click(Area As Integer)

   If dcTranRating.MatchedWithList = False Then Exit Sub

   If Area = 2 Then

  Set rsGen = Cn.Execute("Select * from  TbMastTran Where
   intTranCode = " & Val(dcTranRating.BoundText))
  Me.txtTranRating.Text = rsGen.Fields("txtTranRating")
  Me.txtTranOPVolt.Text = rsGen.Fields("sngTranOPVolt")
  Me.txtTranOPCurrent.Text = rsGen.Fields("sngTranOPCurrent")
  Me.txtOPToler.Text = rsGen.Fields("sngOPVoltToler")

   End If

End Sub

Private Sub dcTranRating_Validate(Cancel As Boolean)
   If Trim(Me.dcTranRating.Text) = "" Then
      Cancel = True
      MsgBox "Select A Rating", vbInformation, "Tranformer
       Test"
```

```
  End If
    If Me.dcTranRating.MatchedWithList = False Then
    Cancel = True
    MsgBox "Invalid Rating", vbInformation, "Tranformer Test"
  End If
End Sub

Private Sub Form_Load()
  Call RefreshDC
End Sub

Private Sub optAddNew_Click()
  Me.lblDc.Visible = False
  Call ClearScreen
  Me.dcTranRating.Visible = False
  Me.txtTranRating.SetFocus
  Me.dcTranRating.Text = ""

End Sub

Private Sub optModify_Click()
  Me.lblDc.Visible = True
  Call ClearScreen
  Call RefreshDC
  Me.dcTranRating.Visible = True
  Me.dcTranRating.SetFocus
End Sub
Private Sub cmdSave_Click()
    If ValidData Then

      If optAddNew.Value = True Then
        Call SaveNewRating
        Call ClearScreen
     Else
        Call ModifyRating
```

```
        Call ClearScreen
        Call RefreshDC
      End If
    End If

End Sub
```

Private Function ValidData() As Boolean

```
Dim Unable As String, Rating As Object
      Unable = "Unable to Save" & vbCrLf

      If optAddNew.Value = True Then
        Set Rating = Me.txtTranRating
     Else
        Set Rating = Me.dcTranRating
     End If

     If Trim(Rating.Text) = "" Then
        MsgBox Unable & "Invalid Transformer Rating",
        vbCritical, "Transformaer Master"
        Rating.SetFocus
        ValidData = False
        Exit Function
     End If

   If Trim(txtTranOPVolt.Text) = "" Then
      MsgBox Unable & "Invalid Output Votage", vbCritical,
     "Transformaer Master"
      txtTranOPVolt.SetFocus
      ValidData = False
      Exit Function
   End If

   If Trim(txtTranOPCurrent.Text) = "" Then
```

```
    MsgBox Unable & "Invalid Output Current", vbCritical,
   "Transformaer Master"
    txtTranOPCurrent.SetFocus
    ValidData = False
    Exit Function
  End If

  If Trim(txtOPToler.Text) = "" Then
    MsgBox Unable & "Invalid Output Current", vbCritical,
   "Transformaer Master"
    txtOPToler.SetFocus
    ValidData = False
    Exit Function
  End If

  'Check to find if the rating already exists in the database
 If optAddNew.Value = True Then

     Set rsGen = Cn.Execute("Select * from  TbMastTran Where
      txtTranRating = '" & UCase(Trim(Me.txtTranRating.Text))
       & "'")
   If rsGen.RecordCount > 0 Then
       MsgBox "Transformer Rating Already Exists In The
       Database", vbCritical, "Transformer Master"
       With Me.txtTranRating
            .SetFocus
            .SelStart = 0
            .SelLength = Len(.Text)
       End With
       ValidData = False
       Exit Function
   End If
End If
  ValidData = True
End Function
```

```
Private Sub txtOPToler_KeyPress(KeyAscii As Integer)
   KeyValidation KeyAscii
End Sub

Private Sub txtTranOPCurrent_KeyPress(KeyAscii As
Integer)
   KeyValidation KeyAscii
End Sub

Private Sub txtTranOPVolt_KeyPress(KeyAscii As Integer)
   KeyValidation KeyAscii
End Sub


Private Sub KeyValidation(KeyAscii As Integer)
   Select Case KeyAscii
      Case 13, 8, 32, 47 To 58, 46
         'no problem
      Case Else
         KeyAscii = 0
   End Select
End Sub

Private Sub SaveNewRating()
Dim code%

     Set rsGen = Cn.Execute("Select max(intTranCode) from
     TbMastTran")
    If IsNull(rsGen.Fields(0)) Then code = 1 Else code =
    Val(rsGen.Fields(0)) + 1

   If rsSave.State = adStateOpen Then rsSave.Close
     rsSave.Open "TbMastTran", Cn, adOpenKeyset,
     adLockOptimistic, adCmdTable
```

```
rsSave.AddNew
 rsSave.Fields("intTranCode") = code
 rsSave.Fields("txtTranRating") =
                    Trim(Me.txtTranRating.Text)
  rsSave.Fields("sngTranOPVolt") =
                    Val(Me.txtTranOPVolt.Text)
rsSave.Fields("sngTranOPCurrent") =
                         Val(Me.txtTranOPVolt.Text)
rsSave.Fields("sngOPVoltToler") = Val(Me.txtOPToler.Text)


rsSave.Update
 rsSave.Close
```

End Sub

Private Sub ModifyRating()

```
Dim code%, sql As String
    code = Val(Me.dcTranRating.BoundText)

  If code = 0 Then
    MsgBox "Invalid Transformer Rating", vbCritical,
    "Transformer Master"
    Exit Sub
  End If

     sql = "Update TbMastTran set txtTranRating ='" &
Me.txtTranRating.Text & "'," & _
                  " sngTranOPVolt = " &
Val(Me.txtTranOPVolt.Text) & "," & _
                  " sngTranOPCurrent = " &
Val(Me.txtTranOPCurrent.Text) & "," & _
                  " sngOPVoltToler = " &
```

```
Val(Me.txtOPToler.Text) & _
                                " Where" & _
                         " intTranCode = " & code

   Cn.Execute sql

End Sub

Private Sub ClearScreen()
Dim ctrl As Control
         For Each ctrl In Me.Controls
        If TypeOf ctrl Is TextBox Or TypeOf ctrl IsDataCombo
       Then ctrl.Text = ""
         Next
End Sub


Private Sub RefreshDC()
     Set rsRating = Cn.Execute("Select intTranCode ,
     txtTranRating       from TbMastTran")
   Set Me.dcTranRating.RowSource = rsRating
   Me.dcTranRating.ListField = "txtTranRating"
   Me.dcTranRating.BoundColumn = "intTranCode"
End Sub

Private Sub dcTranRating_GotFocus()
   Help.Caption = "Select A Rating To Modify"
End Sub

Private Sub txtTranRating_GotFocus()
  Help.Caption = "Enter Transformer Rating"
End Sub
```

```
Private Sub txtTranOPVolt_GotFocus()
  Help.Caption = "Enter Output Voltage Rating"
End Sub

Private Sub txtTranOPCurrent_GotFocus()
  Help.Caption = "Enter Primary Current Rating in Milli Amphs"
End Sub

Private Sub txtOPToler_GotFocus()
  Help.Caption = "Enter Tolerance In Percentage"
End Sub

Private Sub cmdSave_GotFocus()
  Help.Caption = "Click Here To Save Entry In Database"
End Sub

Private Sub cmdExit_GotFocus()
  Help.Caption = "Click Here To Exit This Menu"
End Sub

Private Sub optModify_GotFocus()
  Help.Caption = "Choose This Option To Modify Existing rating"
End Sub

Private Sub optAddNew_GotFocus()
  Help.Caption = "Choose This Option To Add A New Rating"
End Sub
```

```
Option Explicit
Public Cn As New ADODB.Connection
Public Declare Function Beep Lib "kernel32" (ByVal dwFreq As
                    Long, ByVal dwDuration As Long) As Long

Public Sub connect()
 Dim cnStr  As String
        If Cn.State = adStateOpen Then Cn.Close
   cnStr = "Provider=Microsoft.Jet.OLEDB.3.51;Persist Security
    Info=False;Data Source=C:\Tran Test\Trans.mdb"
   'cnStr = "Provider=Microsoft.Jet.OLEDB.4.0;Data
    Source=C:\Tran Test\Trans1.mdb;Persist Security Info=False"
   Cn.ConnectionString = cnStr
   Cn.CursorLocation = adUseClient
   Cn.Open
End Sub
```

MULTIPLEXER SELECTION

Voltage Swiching

```
#include<stdio.h>
#define volt 0x378
void main ( )
 {
        outport(volt,0x02);
 }
```

Current Switching

```
#include<stdio.h>
#define volt 0x378
void main ( )
 {
        outport(volt,0x04);
 }
```

Power Factor Switching

```
#include<stdio.h>
#define volt 0x378
void main ( )
 {
        outport(volt,0x01);
 }
```

CONVERSION OF A/D

```
#include <stdio.h>
#include <dos.h>
#include <conio.h>
#include <graphics.h>
#include <stdlib.h>
#define base 0*100
unsigned int hb,lb,s;
float stat,dat,volt,i;
main( )
{
 FILE *fp;
  labl1:
  hb = inportb(base+3);
  stat = hb & 0*80;
  if (stat!= 0)
  goto labl1;

  labl2:
  hb =inportb(base+3);
  stat = hb & 0*80;
  if (stat ==0)
```

```
goto labl2;
labl3:
hb = inportb(base+3);
stat =hb & 0*80;
if (stat!=0)
goto labl3;
hb= inportb(base+3);
s=hb & 0*20;
hb= hb&0xf;
lb= inportb(base +2);
dat =hb*256.0+lb;
if (s==0)dat =-dat;
volt= (5/4095.0)*dat;
fp=fopen("tout.txt","w");
fprintf(fp,"%1.3 f",i);
fclose(fp);
}
```

CONCLUSION

Automation of transformer testing process has been done and implemented. Microcomputer controls the entire process. This project gives an automation process in which the transformer parameter like voltage, current and power is measured and displayed. The value measured by this process is very accurate and free from manual errors. By the implementation of this process the testing process of transformer are improved and also useful for future references.

SUGGESTION FOR FUTURE DEVELOPMENT:

In future, this test can be extended to all higher rating transformers and for testing of other equipments also.

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