# EXPERIMENT NO.6

**Objective:** To control the DC motor using CHOPPER Module & SCR CONVERTER module, GUI & Mimic on PC screen, Commands and monitoring from screen.

**Apparatus required:**

1. PC based DC Motor control unit (Powercon Make)
2. Serial Link (both side female) cable
3. PMDC motor with 4 pin Jone's Plug
4. PC with VB 6 and windows XP / win 98 system, serial ports COM-1 and COM-2 with 9 pin D type connectors
5. SOFTWARE CD- WITH VB PROGRAM –PRJLS.EXE
6. UNEARTHED C.R.O. with probes.
7. Motor load. (PMDC motor)

**Theory:**

In this section the op-amp 2/IC-4 generates line synchronised linear ramp [TP7] line rectified full wave input signal [TP6]. With this ramp, the dc control signal [TP4] is compared by comparator [IC-4]. The compared o/p is a square wave with variable edge, which decides the firing angle for SCRs in controlled rectifier configurations. The synchronization of Ramp with line facilitates to generate firing position at same time in every half cycle of AC input cycle. An Astable multivibrator is designed using IC 555 for chopping the gate pulses. The o/p of comparator is given to reset pin of IC-555 [TP8] for chopping the gate pulse. This chopped [TP9] is amplified by SL100 & given to pulse transformer for isolation purpose. The pulse transformer generates two pulses in its two secondaries.

The AC mains is rectified using diode bridge rectifier, and given to high values capacitor. Because of high values of capacitor, voltage has been increased to some high extent. This high voltage is given to chopper circuit.

A protection circuit is provided to avoid the damage to the MOSFET Bridge and converter card due to various fault conditions like excessive over- under voltage variation, excessive load variation etc. In a comparator LM 339 three feedback signals are taken from over-under voltage sensing, R-sense resistance which is connected in series of the DC link

PC Based DC Drive using Chopper
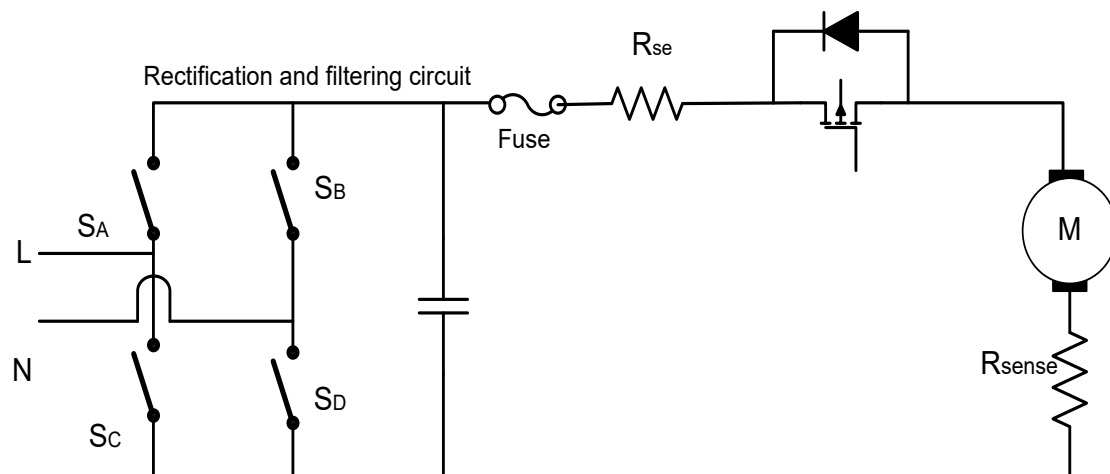


voltage and C.T. feedback. These feedback signals are compared with the reference voltages (variable according to the need of application). Whenever any of the fault conditions exceeds the set limit O/P of the comparator changes from high to low cause the dc link supply and the control signals break. After the fault condition is removed user can continue the operation by pressing the start push button (indicated by red LED).

**Procedure:**

**Step-1: pc setup**

1. Select a PC with 9 pin serial ports working and free for use with external hardware. It is possible that Mouse is used on one port and other port has 25 pins. You may look out for a little old hardware configuration having free serial ports.

2. Insert POWERCON, CD and copy folder on DESKTOP.

3. Try to run prjls.exe from CM1 folder. It uses Serial port-1 for communication. If this port is not free use prjls.exe file from CM2 folder. It should show Control Panel form on Screen. If it gives any error message then contact your Computer Hardware Lab technician for hardware problems.

4. You may try to load VB from a CD provided with unit. For this - Insert POWERCON, CD and run SETUP file.

**Step 2: hardware connections**

1. Connect MAINS cord to 230V ac.

2. Connect Motor to unit at Front Panel 4 pin connector.

3. Connect one end of Serial Cable to back panel of Unit.

4. Connect other end of Serial Cable to PC COM 1 or 2 whichever available. (Chose VB program CM! or CM2 according to your connections).

5. Insert a 25 /40W lamp into Back panel holder.

6. Take a CRO without Earth PIN (UNEARTHED CRO OR POWERSCOPE) & connect a CRO Probe X10 mode to TP 10 – TP 11.

**Caution note:**

**Ordinary cro with earth-pin will cause short circuit of mains and blow fuses. It can damage the unit or cro permanently.**

**Step 3: running program, commands and observations**

1. Keep toggle switch on front panel in **Converter** position.

2. Switch ON Mains.

3. Switch ON PC and RUN (double click) prjls.exe file. FORM-1 window appears.

4. Enter a number into 'set speed' window. It should be a number in 4 digits from 00 to 1500.

5. Press 'set speed' Button.

6. Press" START" BUTTON.

7. Observe motor speed.

8. Try to Put another value into o/p and see the effect. for this- ENTER No. PRESS 'set speed' and then press 'START'.

9. Repeat the process by keeping the switch to **Chopper** position.

10. Switch off the unit.

**Observation table:**

| S. no | SET speed | ACTUAL FIRING ANGLE (OBSERVED ON C.R.O.) | Output voltage (V) | Output current (A) | MOTOR SPEED RPM |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
| 5. | | | | | |
| 6. | | | | | |

**Test points:**

| | | |
|---|---|---|
| TP 1 | : | Ref pot voltage 0 to -10 volt. |
| TP 2 | : | Soft start signal 0 to+10 volt. (After start) |
| TP 3 | : | Voltage controller o/p 0 to –10volt. (After start) |
| TP 4 | : | INV of voltage controller 0 to+10 volt. (After start) |
| TP 5 | : | Feedback voltage from o/p: 0 - to - 5 voltages |
| TP 6 | : | Full wave lines synch signal 21 V peak |
| TP 7 | : | Ramp 0-10 volt line synch |
| TP 8 | : | Ramp- control voltage comparator o/p |
| TP 9 | : | Pulse AMP o/p transistor |
| TP10 | : | ZCD pulse. |
| TP11 | : | Dout signal (Used for set speed for PC). |
| TP12 | : | +5V dc (used for 8051 supply) |
| GND | : | Control card GND |

**Power test points:**

**Caution:  use ÷10 probes. For observation of power test points.**

        **TP 13 w.r.t. TP14:**        **ac mains, supply voltage.**

        **TP 15 w.r.t TP 16:**        **chopper o/p.**

        **TP 17 w.r.t TP 18:**        **Converter o/p.**