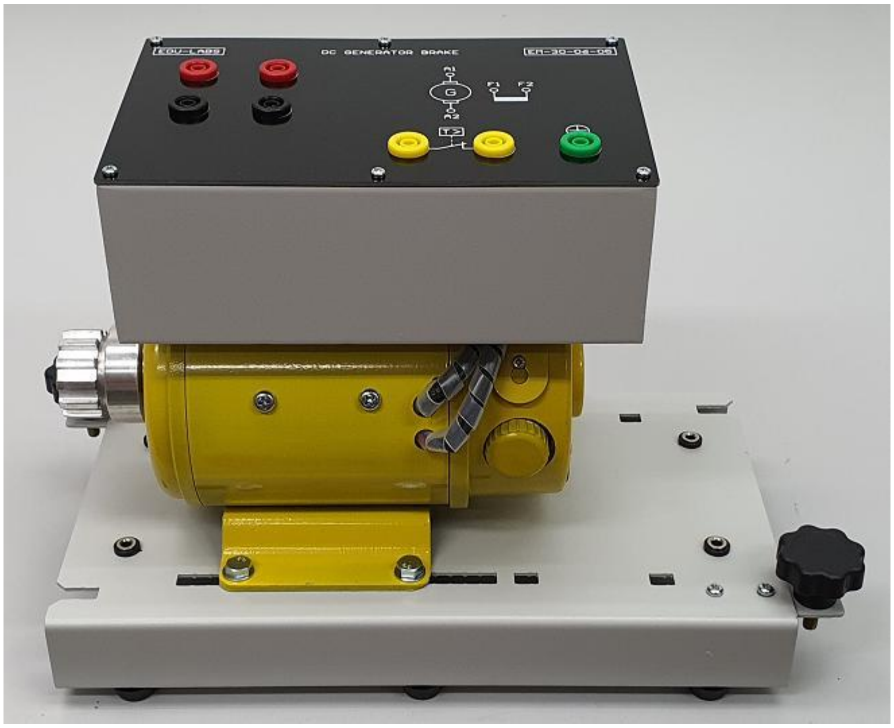
EDULABS DIDACTIC

DC GENERATOR BRAKE

EM-30-06-05

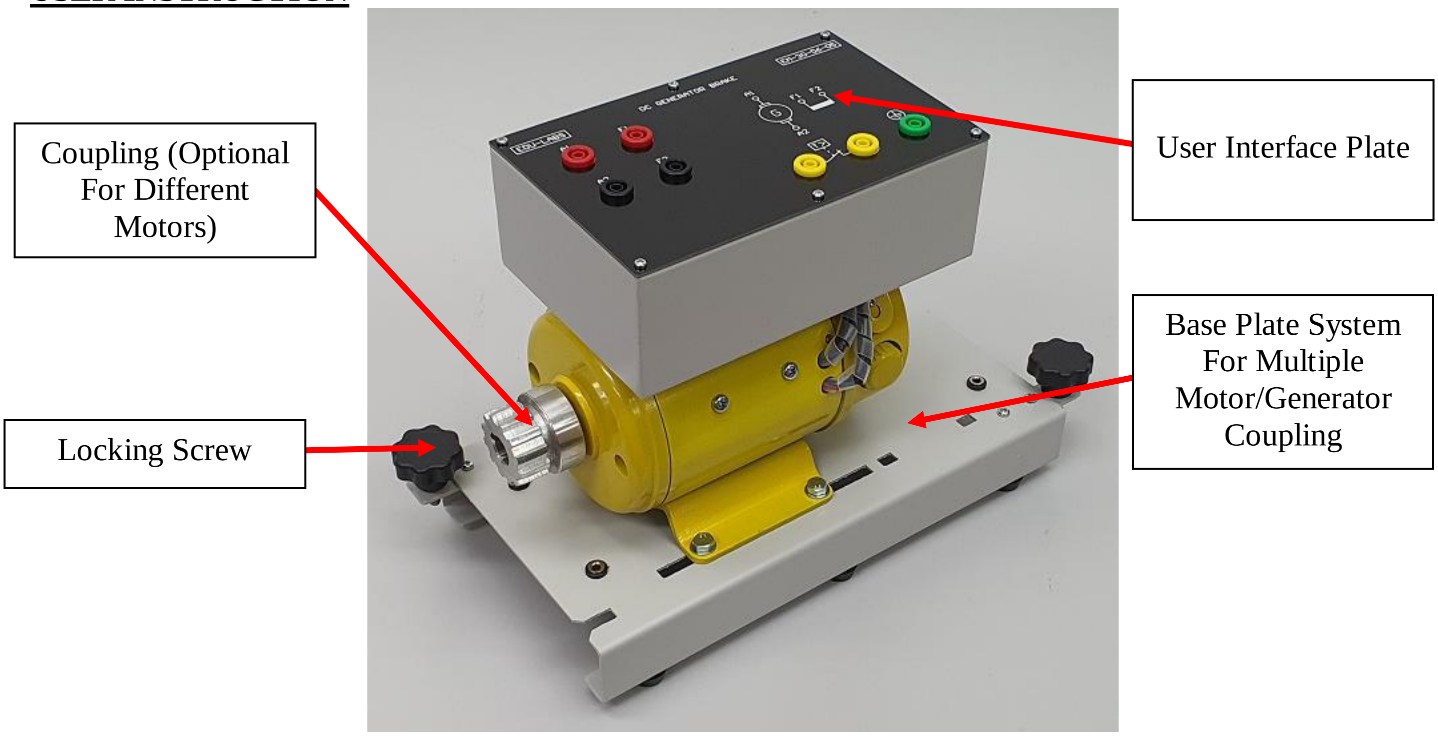


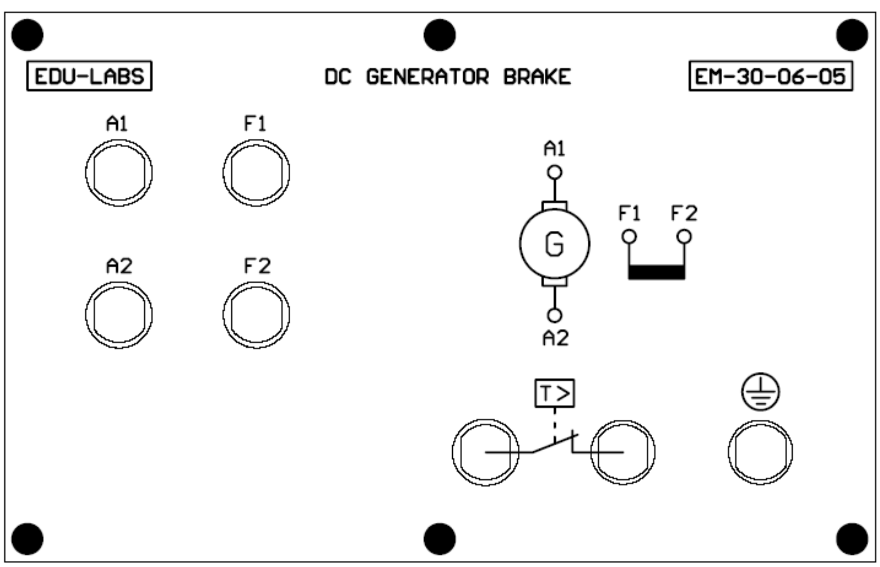
INSTRUCTION MANUAL

Technical characteristics:

DC GENERATOR BRAKE			
MODEL : EM-30-06-05			
Power:	370W	**Current:**	2.65A
Rotor Type	Shunt Field	**Protection**	Thermostat Sensor
Voltage Output:	1500rpm : 150VDC 3000rpm : 400VDC	**Output Voltage Rotation Direction:**	Counter Clockwise (CCW)

<u>USER INSTRUCTION</u>





PANEL LAYOUT

INTRODUCTION

DC MACHINES

DC machine is the earliest machines to be used for power generation, until year 1890. DC machine can be used as either a motor or a generator. However, applications requiring operation of the DC machine as a generator are limited, while applications requiring the DC machine as a motor are commonplace.

DC motors are the obvious choice in applications where DC sources are all that is available (e.g., automotive systems). For special applications, where only AC sources are available, such as in steel mills, mines, and electric trains, it is sometimes advantageous to transform the AC into DC in order to use DC motors. One capability that DC machines possess that induction and synchronous machines do not is precise speed and/or torque control. The torque-speed characteristics of DC motors can be varied over a wide range while retaining high efficiency.

DC Machines Construction

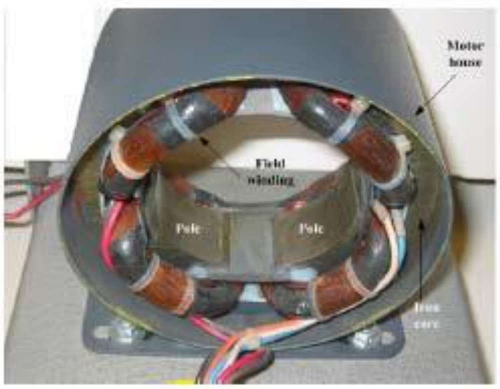


Fig 2: The rotor

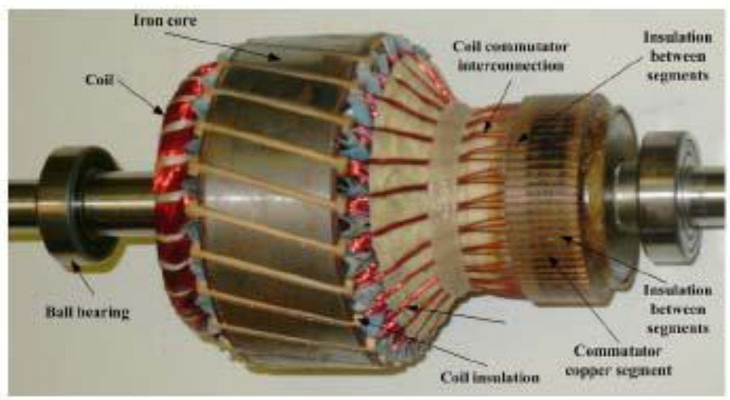


Fig 1: The stator

The Stator

- This part of the machine does not move and normally is the outer frame of the machine.
- The stator has poles, which are excited by dc current to produce magnetic fields.

The Rotor

- This part of the machine is free to move and normally is the inner part of the machine.
- The Rotor in DC machines is called Armature.
- Armature has slots and the conductors mounted into the slots.

The Commutator

- The commutator consists of insulated copper segments mounted on an insulated tube

Principle of operation of a Simple 2-Pole DC Machine

As the conductor rotates in a uniform magnetic filed with a constant speed, it will cut the magnetic field lines. Therefore, a voltage (e.m.f) proportional to the rate of change of flux is induced (Faraday's Law).

$$e.m.f = -N\frac{d\phi}{dt}$$

Where N is the no. of turns

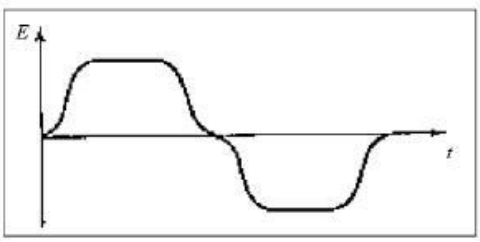


Fig 4: induced e.m.f.

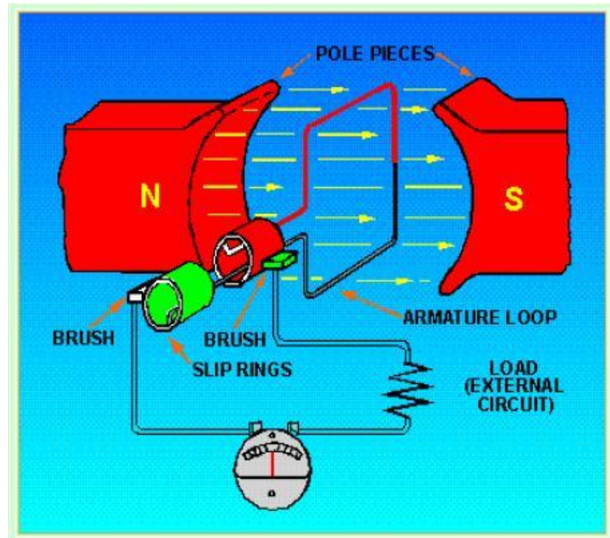


Fig 3: DC Generator.

Commutation Action

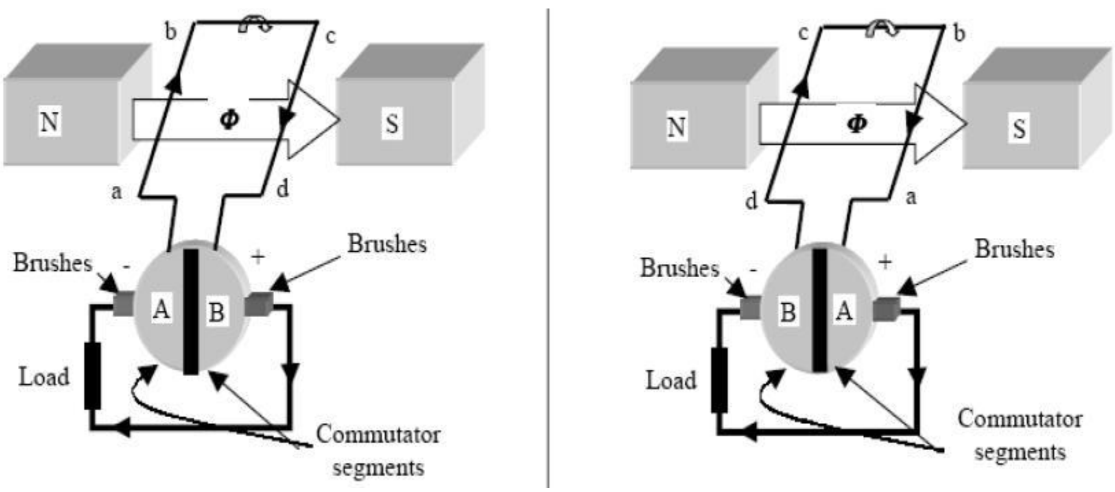


Fig 5: Commutation action

During the commutation process, the current direction in the conductor is reversed as the conductor position is moved from the one pole to another .

Therefore, the induced e.m.f is rectified by using the commutator.

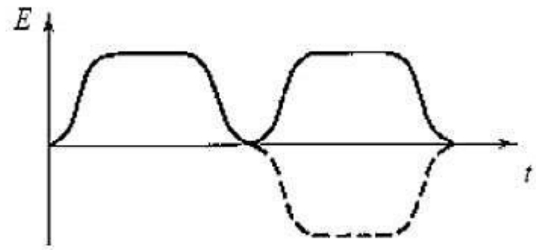


Fig 6: Rectified e.m.f.

In an actual machine a large number of turns are placed in several slots around the periphery of the rotor to reduce the ripple in emf.

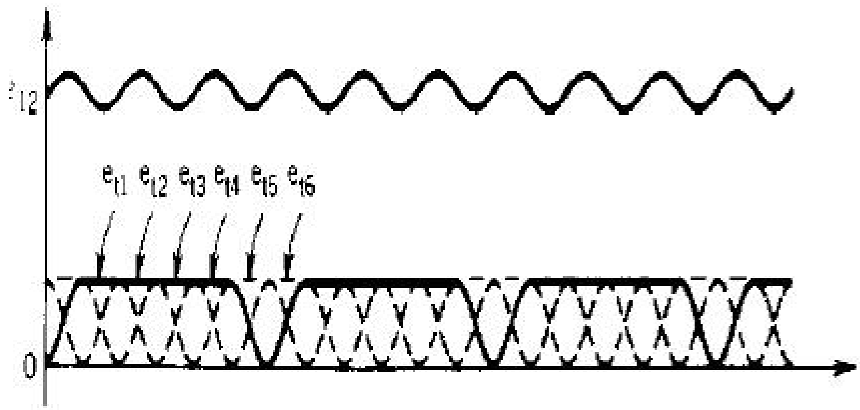


Fig 7: Ripple filtering.

Armature Voltage

Let

p – number of poles of the machine
φ – flux per pole in Wb
n – the speed of the machine in rpm

The total flux cut by the conductor in *n* revolutions:
(i.e. in one minute) = *p* φ*n*

Hence the induced voltage:
e = rate of change of flux linkage (flux cut by the conductor in one second)
= *p* φ*n/60* V

If there is a total of Z conductors connected in ‘a’ parallel paths, then the effective number of conductors in series per parallel path is Z/*a*. Hence the total emf induced:

$$E_a = \frac{p\phi n}{60} \cdot \frac{Z}{a} \quad \text{V}$$

As $\omega_m = \frac{2\pi n}{60}$, hence:

$$E_a = \frac{p\phi\omega_m Z}{2\pi a} \qquad \text{V}$$

For a DC machine

Ea = Ka φ ωm (V) or **Ea = K φ n (V)**

Where:

$$K_a = \frac{Zp}{2\pi a} \quad \text{and} \quad K = \frac{Zp}{60a}$$

Magnetization (or Saturation) Curve of a DC Machine

A dc machine has two distinct circuits, a field circuit and an armature circuit. The mmf's produced by these two circuits are at quadrature – the field mmf is along the direct axis and the armature mmf is along the quadrature axis.

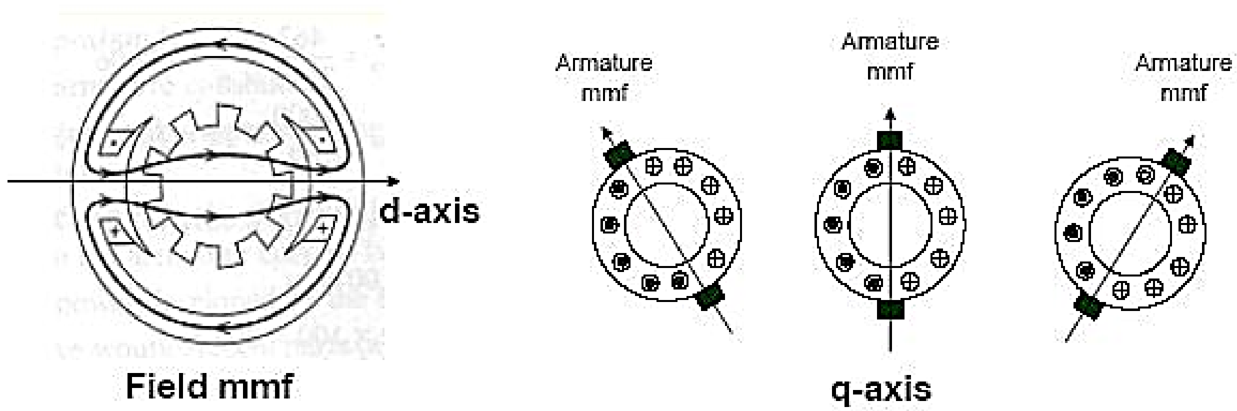


Fig 8: field and armature mmf

A simple schematic representation of the dc machine is shown:

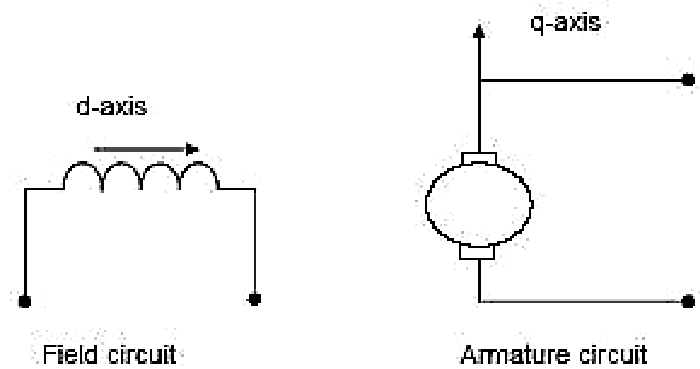


Fig 9: DC machine representation

The flux per pole of the machine will depend on the ampere turns *F*p provided by one or more field windings on the poles and the reluctance R of the magnetic path. The magnetic flux Φ that crosses the air gap under each pole depends on the magneto motive force *F*p and hence the field current of the coils on each pole. At low values *F*p the flux is low and is proportional to magneto motive force. If *F*p is increased, flux Φ will increase and saturation will occur in various parts of the magnetic circuit, particularly in the rotor teeth.

The relationship between field excitation mmf *F*p and flux Φ in each pole is shown. This curve is known as magnetization curve. Initial portion of the curve is linear.

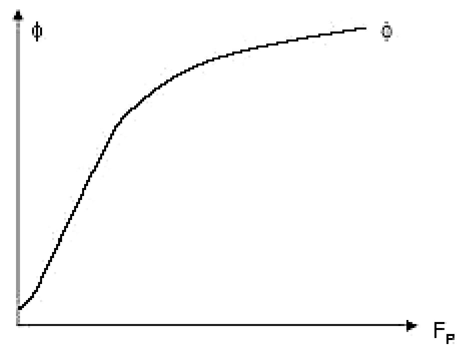


Fig 10: Flux-mmf relation in a DC machine

It is assumed here that the armature mmf has no effect on the pole flux (d-axis flux) because the armature mmf acts along the q-axis. The induced voltage in the armature winding is proportional to flux times speed. It is more convenient if the magnetization curve is expressed in terms of armature induced voltage *E*a at a particular speed. This is shown for two speeds.

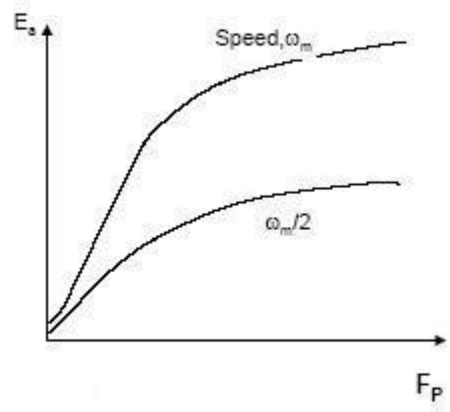


Fig 11: Magnetization curves.

Classification of DC Machines

The field circuit and the armature circuit can be interconnected in various ways to provide a wide variety of performance characteristics. The poles can be excited by two field windings namely a *shunt field winding* and a *series field winding*. The shunt winding - large number of turns and small current, connected across the armature. The series winding has fewer turns, large current, connected in series with the armature.

DC machines are classified on the basis of the interconnections between the field and armature windings as follows:

- Separately excited generator
- Self excited generator
    - Shunt generator
    - Series generator
    - Compound generator

The various connections of the field circuit and armature circuit are shown in the figure. In the *separately excited* dc machine, the field winding is excited from a separate source. In the *self-excited* dc machine, the field winding can be connected in three different ways: *Shunt, series or compound.*

For field winding connected *shunt:* the field winding is connected across the armature. For field winding connected *series:* the field winding is connected in series with the armature. When both shunt and series windings are used, a *compound* machine is formed. If the shunt winding is connected across the armature, it is known as *short shunt compound machine*. If the shunt winding is connected across the series connection of the armature and series winding, it is known as *long shunt compound machine*.

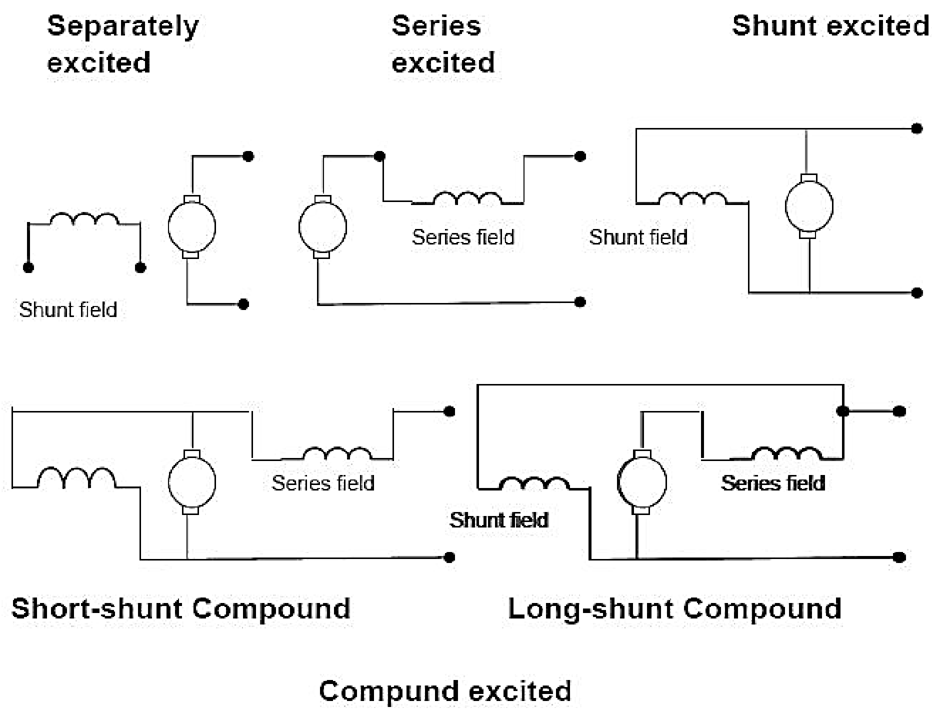


Fig 13: Different connections of dc machines: (a) Separately excited dc machine. (b) Series dc machine. (c) Shunt dc machine. (d) Compound dc machine.

DC GENERATORS

The dc machine operating as a generator is driven by a prime mover at a constant speed and the armature terminals are connected to a load. The variation of the terminal voltage with load current, known as the *external* or (*terminal*) characteristic.

Shunt (Self-Excited) Generator

In the shunt or self-excited generator, the field is connected across the armature so that the armature voltage can supply the field current. The circuit for the shunt generator under no-load conditions is shown. If the machine is to operate as a self-excited generator, some residual magnetism must exist in the magnetic circuit of the generator.

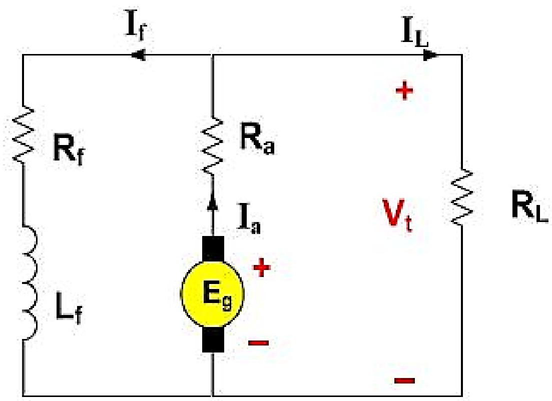


Fig 14: Shunt generator equivalent circuit.

A simple explanation of the voltage buildup process in the self-excited dc generator is as follows:
Figure 15 shows the magnetization curve of the dc machine. Also shown in this figure is the *field resistance line*, which is a plot of RfIf versus If.

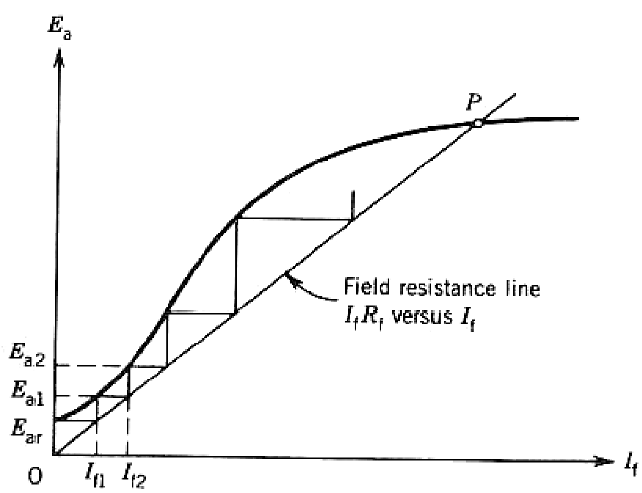


Fig 15: Voltage build-up in a self-excited dc generator

Due to the residual magnetism there is a small voltage generated (Ear) as the armature is driven at some speed. This voltage drives a small current through the field winding. If this small current develops a field, which aids the residual magnetism, the induced voltage will become larger.
This in turn increases the field current and the build-up process continues. Due to magnetic saturation this cumulative build-up process stops at a finite induced voltage or at the point of intersection of the field resistance line and the magnetic saturation curve. In steady state, the generated voltage causes a field current to flow that is sufficient to develop a flux required to the generated emf that causes the field current to flow.

The value of the field-circuit resistance that makes the field-resistance line tangent to the magnetization curve is called the *critical (field) resistance*. It can be seen from the figure that if the field resistance is greater than the critical resistance *Rfcrit* the voltage will not build up.

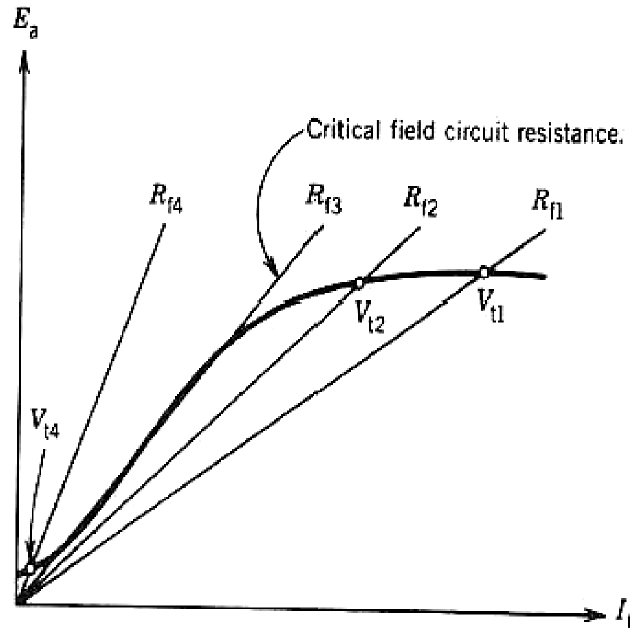


Fig 16: critical field resistance.

Therefore the conditions for voltage build-up are:

- Residual magnetism should be present in the machine.
- The connection of the field winding and the speed of rotation of the armature should be in such a way so that the field current produced by the residual magnetism should aid the residual flux.
- The shunt field resistance should be less than the critical resistance.
- The load resistance should be greater than the critical load resistance.

Self-Excited Shunt DC Generator calculations

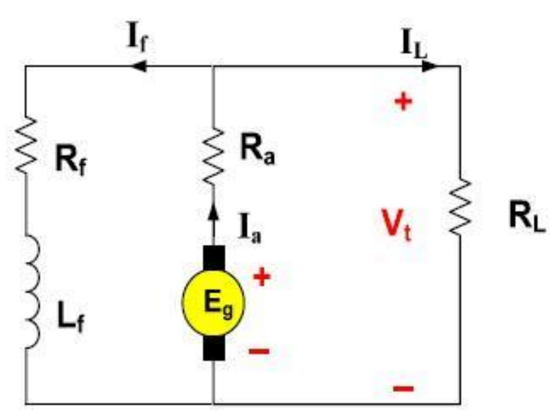
$$I_a = I_f + I_L$$

$$I_f = \frac{V_t}{R_f} \quad , \quad \text{and} \quad I_L = \frac{V_t}{R_L}$$

$$\therefore I_a = \frac{V_t}{R_f} + \frac{V_t}{R_L} = V_t\left(\frac{1}{R_f} + \frac{1}{R_L}\right)$$

$$V_t = E_g - I_a R_a$$

$$E_g = K_g \varphi \, \omega_m$$



CAUTION!
HIGH VOLTAGE!!

HANDLE THE EQUIPMENT WITH EXTREME CARE AS HIGH VOLTAGES ARE PRESENT AT SOME SOCKETS AND EXPOSED TERMINAL.

RECOMMENDATION FOR SAFE AND EFFICIENT OPERATION:

Owing to the versatility and characteristics of this electrical machine training aid, the following measures must be adhered to:
1) The supply to the machines must be protected by earth leakage;
2) All connections must be terminated correctly at both ends before power is connected.
3) No exposed conductive parts of connection must be visible after the connection.
4) No connections must be disconnected whilst power is still connected.
5) Brushes must not be observed or adjusted whilst power is still connected.
6) Coupling must be done before power is connected,
7) Instructions specified in individual assignments must be adhered to.
8) Further experiments or variation must be done only after the teacher consent.

EXPERIMENTS LISTS

1. **To study the Voltage Speed Characteristic of DC Generator Brake connection to Three Phase Induction Motor control by AC Variable Frequency Drive**
2. **To study the Voltage Characteristic of DC Generator Brake connection to DC Shunt Wound Machine**
3. **To study the Voltage Characteristic of DC Generator Brake connection to DC Series Wound Machine**
4. **To study the Voltage Characteristic of DC Generator Brake connection to DC Compound Wound Machine in Short shunt and long shunt configuration**
   a) **DC Compound Wound Motor in Shunt Connection**
   b) **DC Compound Wound Motor in Series Connection**
   c) **DC Compound Wound Motor in Long Shunt Connection**
   d) **DC Compound Wound Motor in Short Shunt Connection.**
5. **To study the Torque-Speed characteristics of a DC Compound Wound Machine in shunt and compound configuration using torque sensor and DC Generator Brake with Brake Controller. (Optional by using torque sensor and torque speed meter)**
   a) **DC Compound Wound Motor in Shunt Connection**
   b) **DC Compound Wound Motor in Long Shunt Connection**
   c) **DC Compound Wound Motor in Short Shunt Connection.**

1) To study the Voltage Speed Characteristic of DC Generator Brake connection to Three Phase Induction Motor control by AC Variable Frequency Drive

EQUIPMENT REQUIRED

Item	Description	Qty	Model
1	AC/DC Variable Power Supply	1	EM-30-09-04-01
2	DC Voltmeter	1	EM-30-13-01
3	DC Ammeter	1	EM-30-13-02
4	Three Phase Induction Motor (3000RPM)	1	EM-30-02-01
4	DC Generator Brake (Shunt Field)	1	EM-30-06-05
5	Digital Tachometer	1	DT-2234C
6	Laboratory Table	1	EM-30-16-01-02
7	Experimental Panel Frame	1	EM-30-16-02-02
8	4mm Safety Stackable Leads Set	1	EM-30-15-01
9	AC Variable Frequency Drive	1	EM-30-14-02

PROCEDURE:

Construct the following circuit:

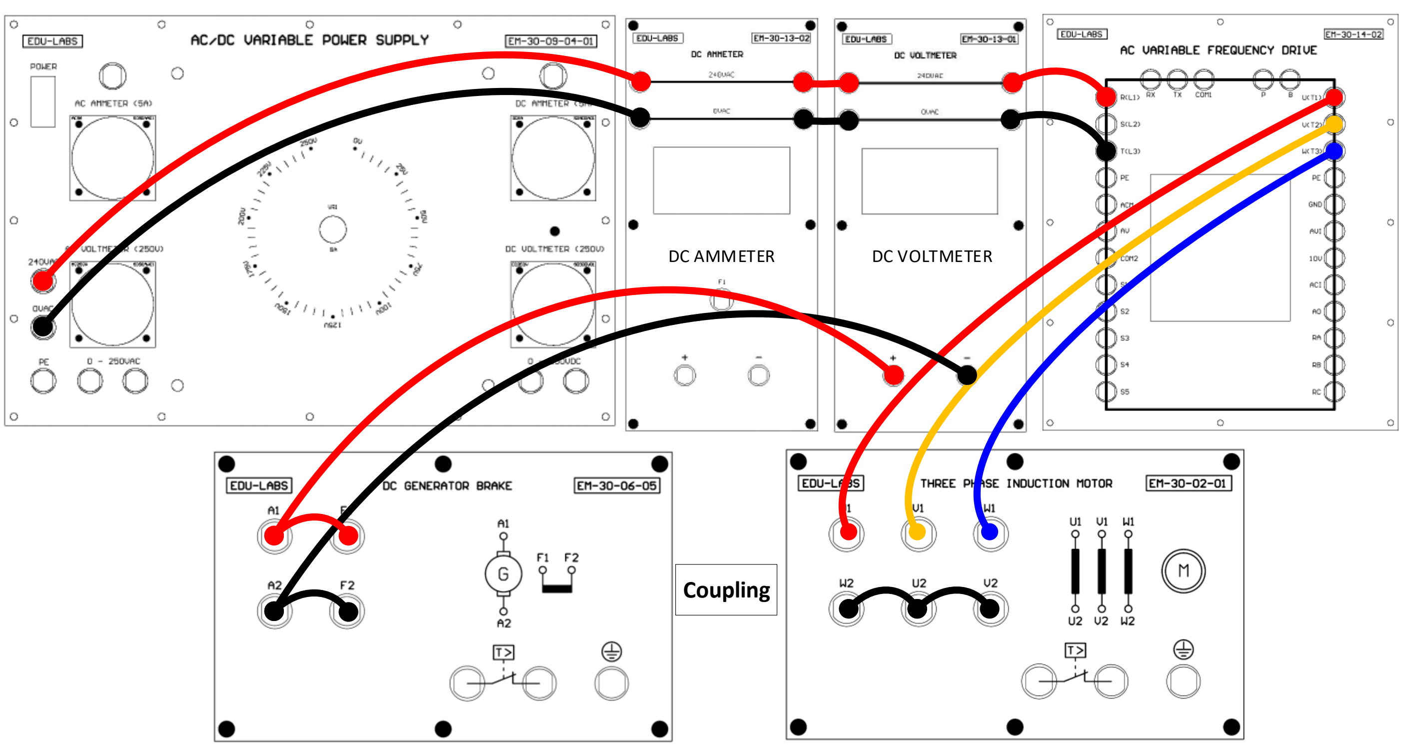


Fig 1.

1. Construct the circuit as Fig 1. Switch ON the AC/DC Variable Power Supply, adjust the Frequency Knob at AC Variable Frequency Drive, measured and record the values in the Table 1.

RESULT

NO	FREQ	FREQ (MANUAL SETTING)	Speed (RPM)	DC GENERATOR Output Voltage (VDC)
1	**10**	9.9	588.9	8
2	**15**	15.0	893.6	17
3	**20**	19.9	1186	75
4	**25**	25.1	1495	154
5	**30**	30.0	1787	206
6	**35**	35.1	2090	257
7	**40**	40.3	2400	310
8	**45**	45.3	2698	361
9	**50**	50.0	2977	409

Table 1: Voltage Speed Characteristic

2) To study the Voltage Speed Characteristic of DC Generator Brake connection to Three Phase Slip Ring Machine control by AC Variable Frequency Drive

EQUIPMENT REQUIRED

Item	Description	Qty	Model
1	AC/DC Variable Power Supply	1	EM-30-09-04-01
2	DC Voltmeter	1	EM-30-13-01
3	DC Ammeter	1	EM-30-13-02
4	Three Phase Slip Ring Machine (4 Pole - 1500RPM)	1	EM-30-02-02
4	DC Generator Brake (Shunt Field)	1	EM-30-06-05
5	Digital Tachometer	1	DT-2234C
6	Laboratory Table	1	EM-30-16-01-02
7	Experimental Panel Frame	1	EM-30-16-02-02
8	4mm Safety Stackable Leads Set	1	EM-30-15-01

PROCEDURE:

Construct the following circuit:

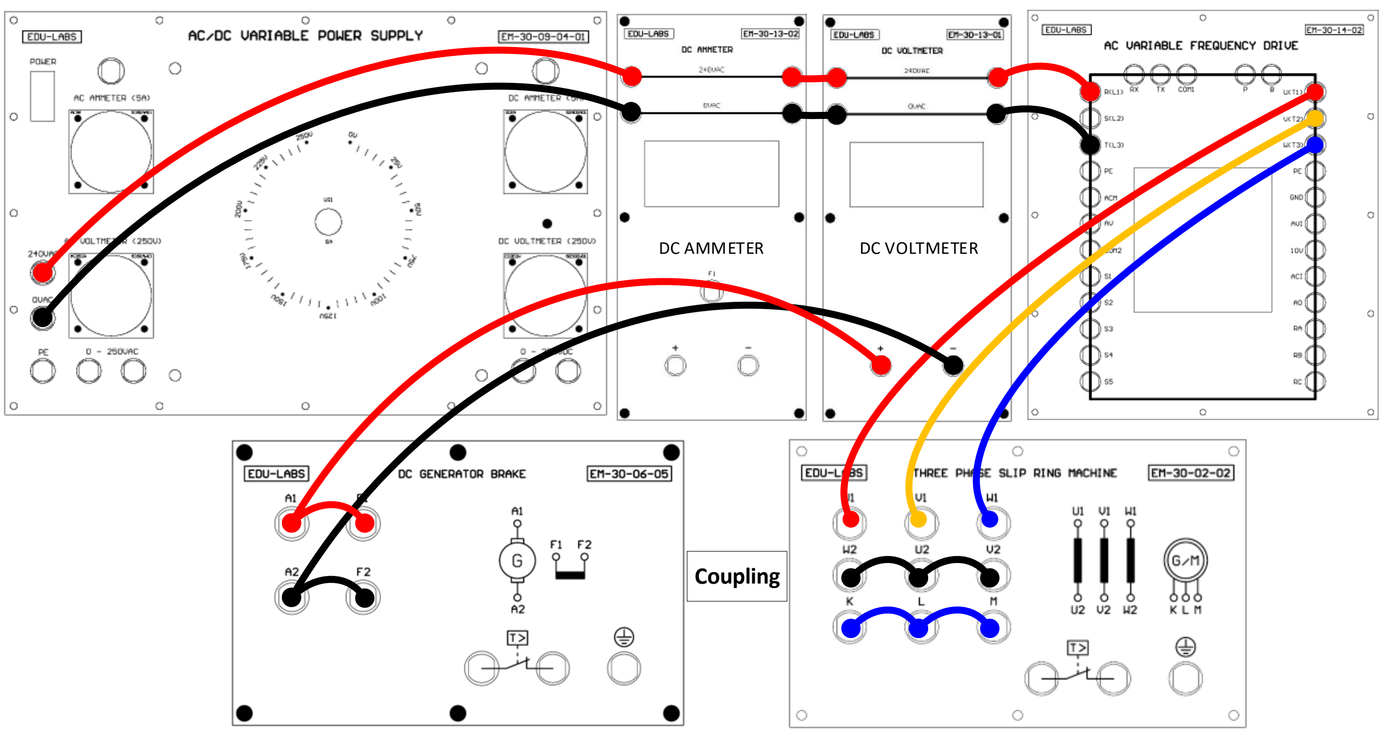


Fig 2.

2. Construct the circuit as Fig 2. ON the AC/DC Variable Power Supply, adjust the Frequency knob of the AC Variable Frequency Drive, measured and record the values in the Table 2.

NO	FREQ	FREQ (MANUAL SETTING)	Speed (RPM)	DC GENERATOR
				Output Voltage (VDC)
1	**10**	10.0	286.2	3
2	**15**	15.1	438.4	5
3	**20**	20.0	585.5	8
4	**25**	25.0	735.2	12
5	**30**	30.3	893.5	17
6	**35**	35.3	1043	26
7	**40**	40.3	1190	67
8	**45**	45.2	1333	117
9	**50**	50.0	1474	149

Table 2: Voltage Speed Characteristic

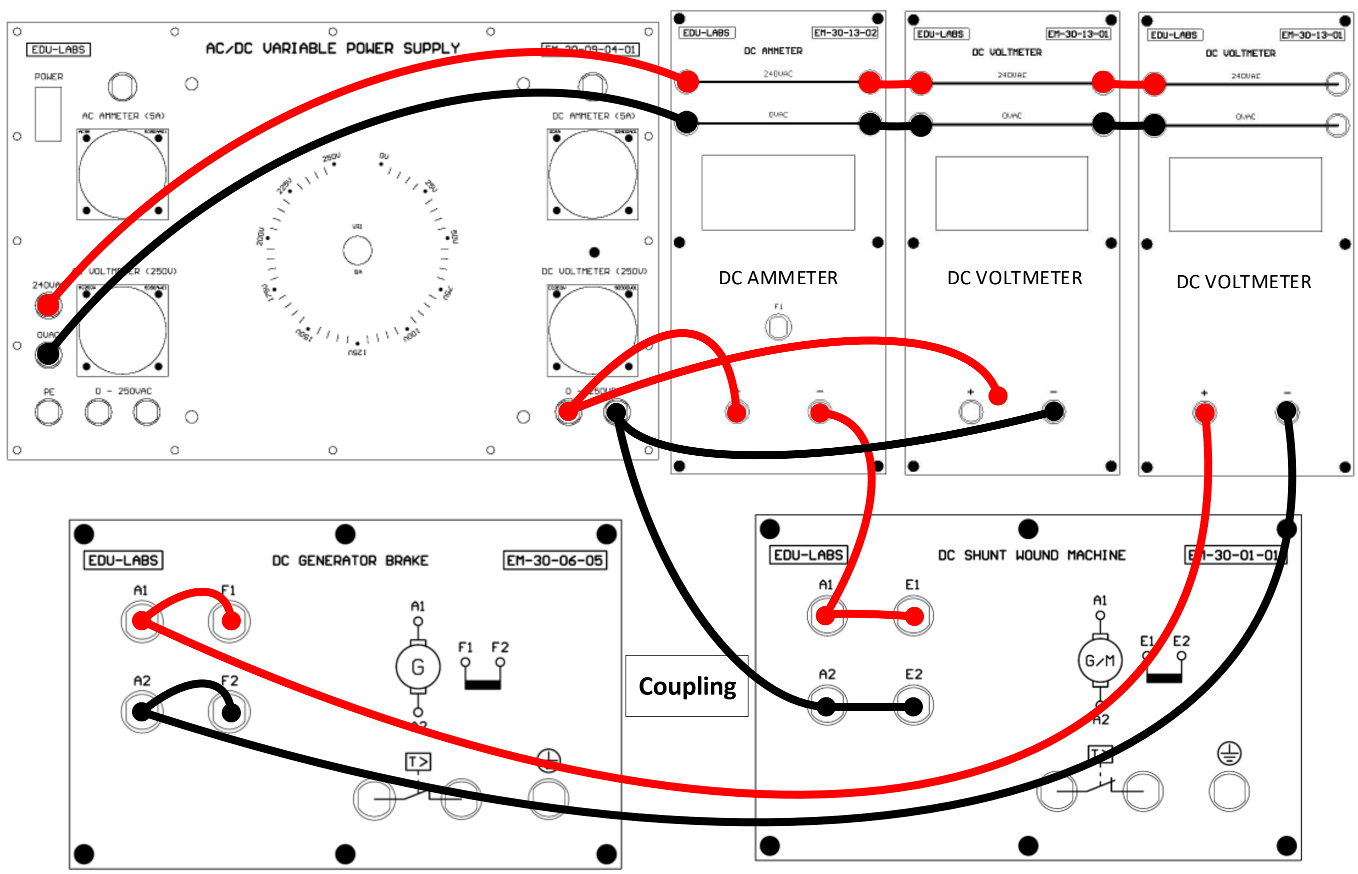
3) To study the Voltage Characteristic of DC Generator Brake connection to DC Shunt Wound Machine

EQUIPMENT REQUIRED

Item	Description	Qty	Model
1	AC/DC Variable Power Supply	1	EM-30-09-04-01
2	DC Voltmeter	2	EM-30-13-01
3	DC Ammeter	1	EM-30-13-02
4	DC Shunt Wound Machine	1	EM-30-01-01
4	DC Generator Brake (Shunt Field)	1	EM-30-06-05
5	Digital Tachometer	1	DT-2234C
6	Laboratory Table	1	EM-30-16-01-02
7	Experimental Panel Frame	1	EM-30-16-02-02
8	4mm Safety Stackable Leads Set	1	EM-30-15-01

PROCEDURE:

1. Connect as shown in Fig 3.



3. Connections follow the circuit. Supply 220VDC power supply to the circuit. Measure the speed and the torque. Enter the measured values in the Table 3.

	DC MOTOR		**DC GENERATOR**	
No	**Voltage Supply (VDC)**	**Current (ADC)**	**Voltage (VDC)**	**Speed (RPM)**
1	30			
2	60			
3	90			
4	120			
5	150			
6	180			
7	210			

Table 3: Voltage Characteristic

4) To study the Voltage Characteristic of DC Generator Brake connection to DC Series Wound Machine

EQUIPMENT REQUIRED

Item	Description	Qty	Model
1	AC/DC Variable Power Supply	1	EM-30-09-04-01
2	DC Voltmeter	2	EM-30-13-01
3	DC Ammeter	1	EM-30-13-02
4	DC Series Wound Machine	1	EM-30-01-02
4	DC Generator Brake (Shunt Field)	1	EM-30-06-05
5	Digital Tachometer	1	DT-2234C
6	Laboratory Table	1	EM-30-16-01-02
7	Experimental Panel Frame	1	EM-30-16-02-02
8	4mm Safety Stackable Leads Set	1	EM-30-15-01

PROCEDURE:

1. Connect as shown in Fig 2

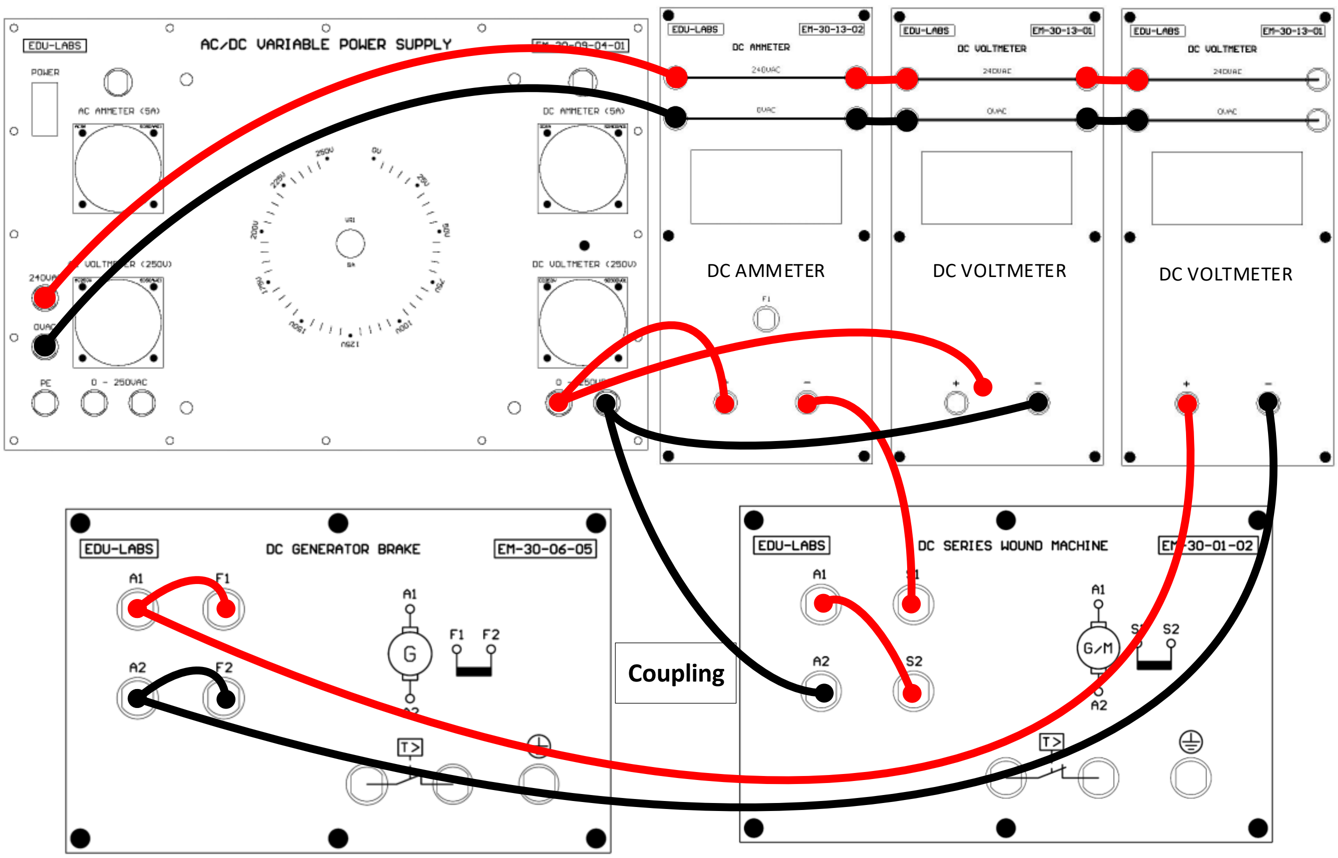


Fig 2: Wiring Diagram

2. Adjust the DC supply voltage to from 20V to 50VDC and record the following table. **(DO NOT above 50V to prevent runaway condition in NOTE 1:)**

	DC SERIES WOUND MACHINE		DC GENERATOR BRAKE	
No	**DC Voltage Supply (VDC)**	**DC Current (ADC)**	**DC Voltmeter (VDC)**	**Speed (RPM)**
1	20	1.83	52	463.8
2	30	1.86	103	912.9
3	40	1.92	155	1378
4	50	1.97	205	1822

Expected Result

	DC SERIES WOUND MACHINE		DC GENERATOR BRAKE	
No	**DC Voltage Supply (VDC)**	**DC Current (ADC)**	**DC Voltmeter (VDC)**	**Speed (RPM)**
1	20	1.83	52	463.8
2	30	1.86	103	912.9
3	40	1.92	155	1378
4	50	1.97	205	1822

5) To study the Voltage Characteristic of DC Generator Brake connection to DC Compound Wound Machine in Shunt, Series, Short shunt and long shunt configuration.

EQUIPMENT REQUIRED

Item	Description	Qty	Model
1	AC/DC Variable Power Supply	1	EM-30-09-04-01
2	DC Voltmeter	2	EM-30-13-01
3	DC Ammeter	1	EM-30-13-02
4	DC Compound Wound Machine	1	EM-30-01-03
4	DC Generator Brake (Shunt Field)	1	EM-30-06-05
5	Digital Tachometer	1	DT-2234C
6	Laboratory Table	1	EM-30-16-01-02
7	Experimental Panel Frame	1	EM-30-16-02-02
8	4mm Safety Stackable Leads Set	1	EM-30-15-01

a. DC Compound Wound Motor in Shunt Connection

PROCEDURE:

1. Connect as shown in Fig 5-1

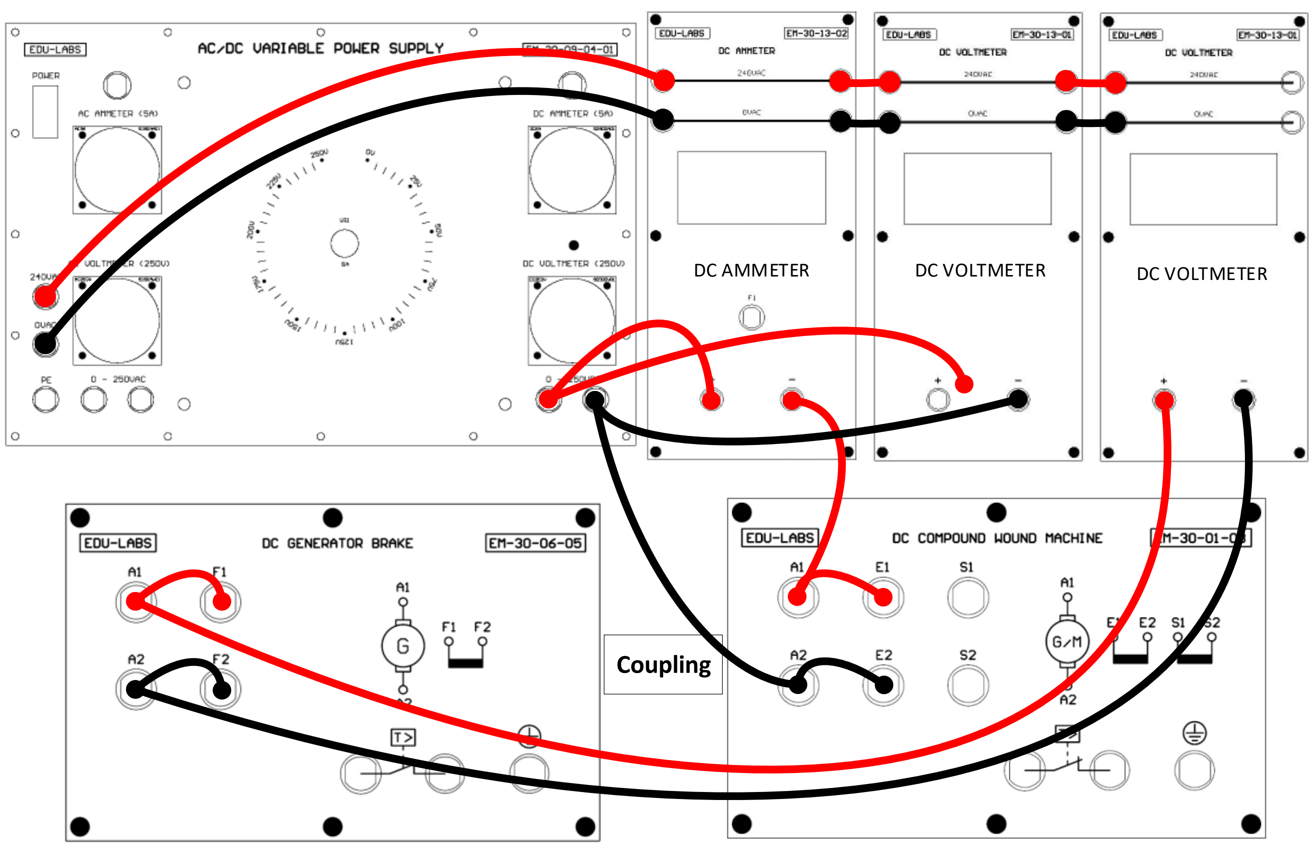


Fig 5-1: Wiring Diagram

2. Connections follow the circuit. Supply 220VDC power supply to the circuit. Measure the speed and the torque. Enter the measured values in the Table 5-1.

No	DC MOTOR		DC GENERATOR	
	Voltage Supply (VDC)	**Current (ADC)**	**Voltage (VDC)**	**Speed (RPM)**
1	30			
2	60			
3	90			
4	120			
5	150			
6	180			
7	210			

b. DC Compound Wound Motor in Series Connection

PROCEDURE:

1. Connect as shown in Fig 5-2

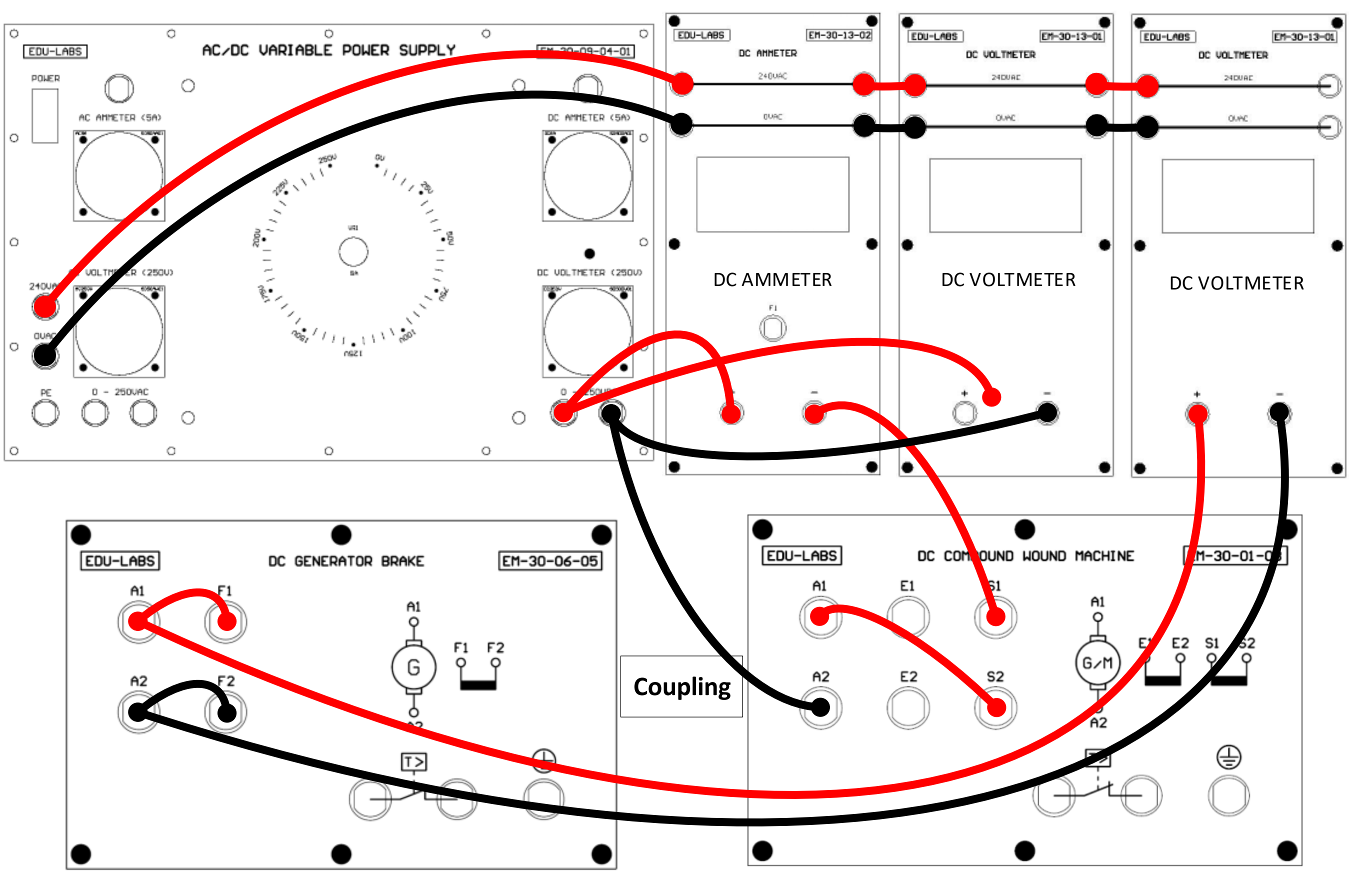


Fig 5-2: Wiring Diagram

2. Adjust the DC supply voltage to from 20V to 50VDC and record the following table. **(DO NOT above 50V to prevent runaway condition in NOTE 1 of DC Series Wound Machine EM-30-01-02)**

	DC SERIES WOUND MACHINE		DC GENERATOR BRAKE	
No	DC Voltage Supply (VDC)	DC Current (ADC)	DC Voltmeter (VDC)	Speed (RPM)
1	20			
2	30			
3	40			
4	50			

Table 5-2: Voltage Characteristic

c. DC Compound Wound Motor in Long Shunt Connection

PROCEDURE:

2. Connect as shown in Fig 5-3

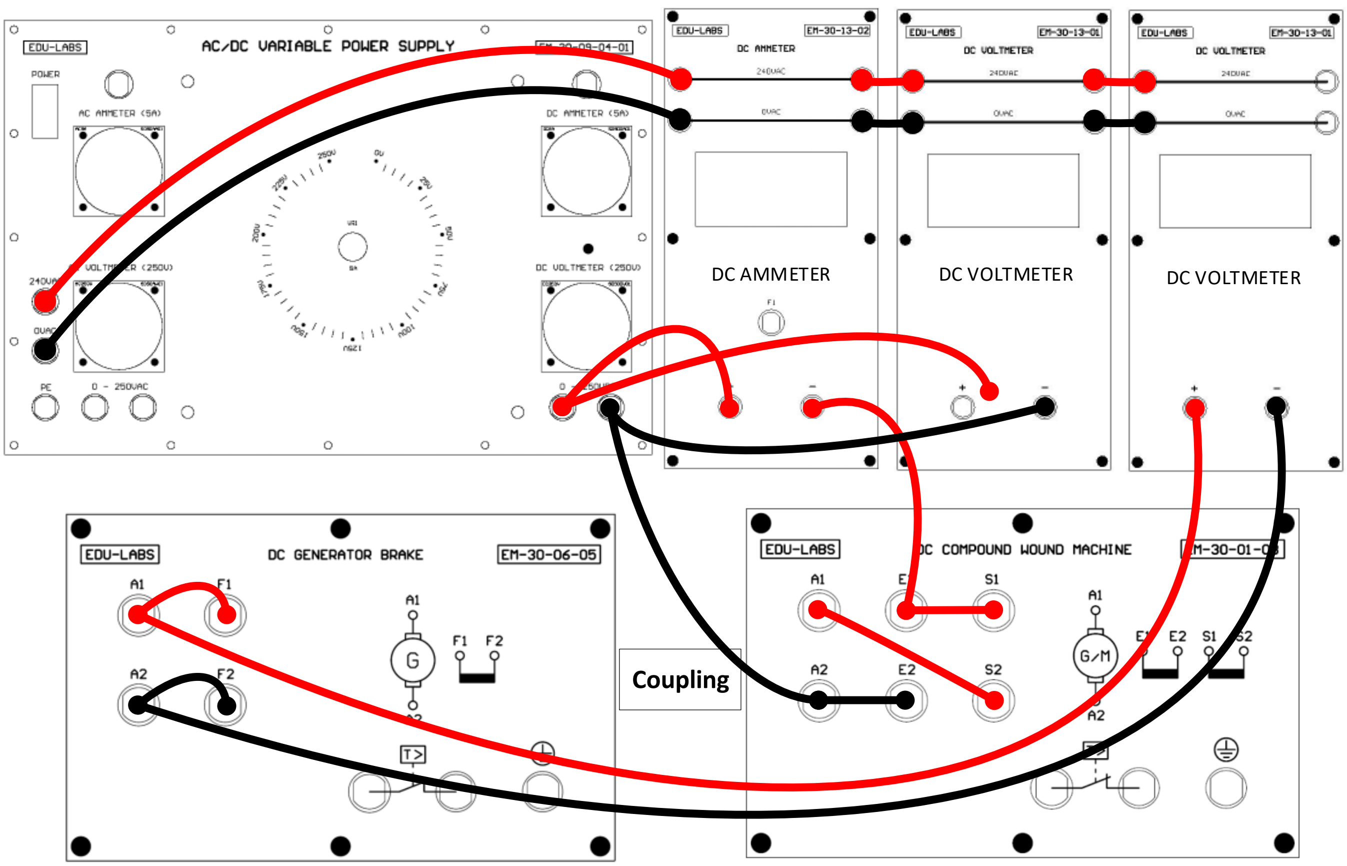


Fig 5-3: Wiring Diagram

3. Connections follow the circuit. Supply 220VDC power supply to the circuit. Measure the speed and the torque. Enter the measured values in the Table 5-3.

No	DC MOTOR		DC GENERATOR	
	Voltage Supply (VDC)	**Current (ADC)**	**Voltage (VDC)**	**Speed (RPM)**
1	30			
2	60			
3	90			
4	120			
5	150			
6	180			
7	210			

Table 5-3: Voltage Characteristic

d. DC Compound Wound Motor in Short Shunt Connection.

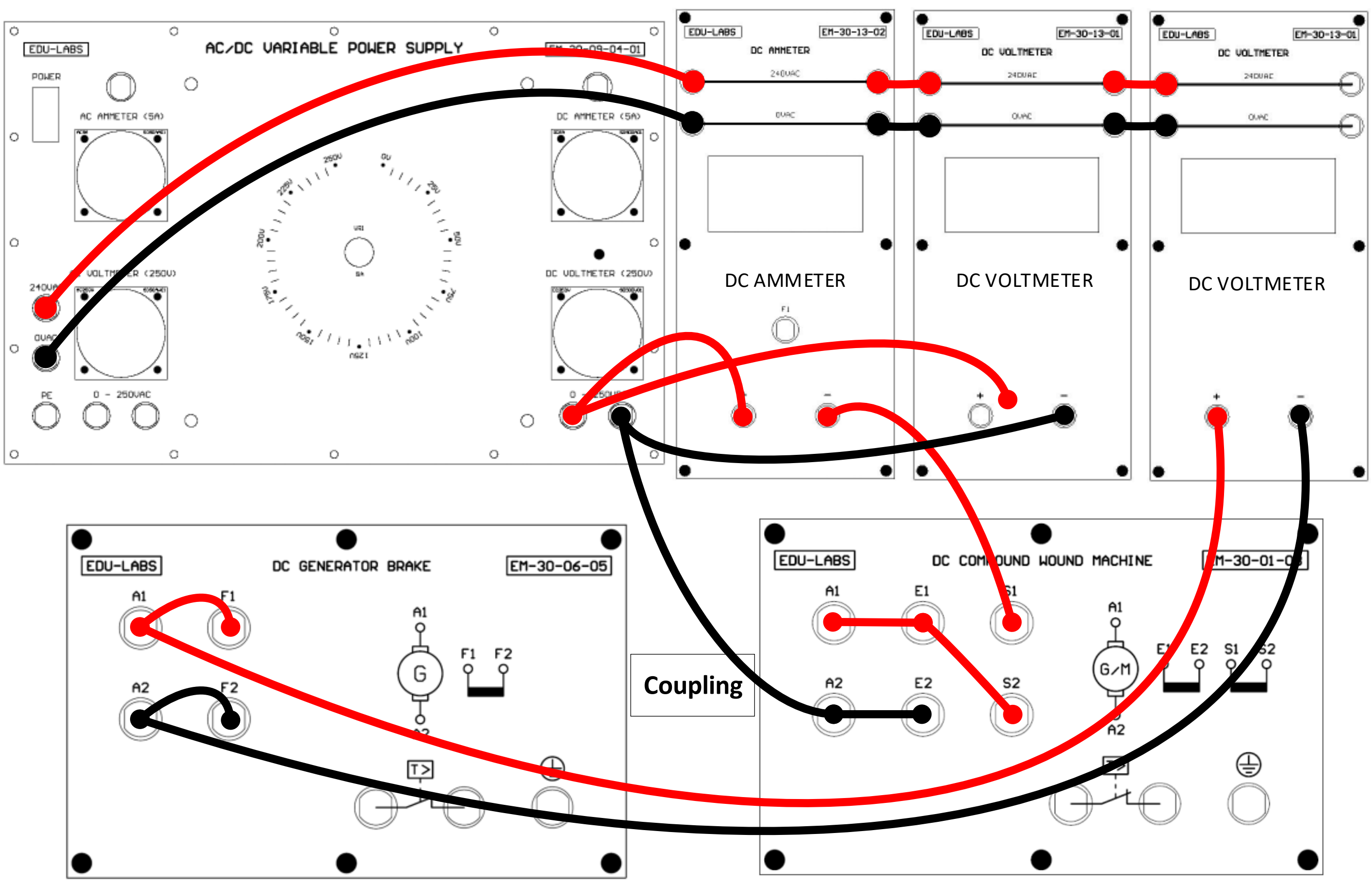


Fig 5-4: Wiring Diagram

1. Connections follow the circuit. Supply 220VDC power supply to the circuit. Measure the speed and the torque. Enter the measured values in the Table 5-4.

	DC MOTOR		DC GENERATOR	
No	**Voltage Supply (VDC)**	**Current (ADC)**	**Voltage (VDC)**	**Speed (RPM)**
1	30			
2	60			
3	90			
4	120			
5	150			
6	180			
7	210			

Table 5-4: Voltage Characteristic

6) To study the Torque-Speed characteristics of a DC Compound Wound Machine in shunt and compound configuration using torque sensor and DC Generator Brake with Brake Controller. (Optional by using torque sensor and torque speed meter)

EQUIPMENT REQUIRED

Item	Description	Qty	Model
1	AC/DC Variable Power Supply	1	EM-30-09-04-01
2	DC Voltmeter	2	EM-30-13-01
3	DC Ammeter	2	EM-30-13-02
4	DC Compound Wound Machine	1	EM-30-01-03
5	DC Generator Brake (Shunt Field)	1	EM-30-06-05
6	Torque Sensor Module	1	EM-30-06-18
7	Torque Speed Measurement Module	1	EM-30-06-19
8	4mm Safety Stackable Leads Set	1	EM-30-15-01

PROCEDURE:

1. Connect as shown in Fig 6.1.

a. DC Compound Wound Motor in Shunt Connection

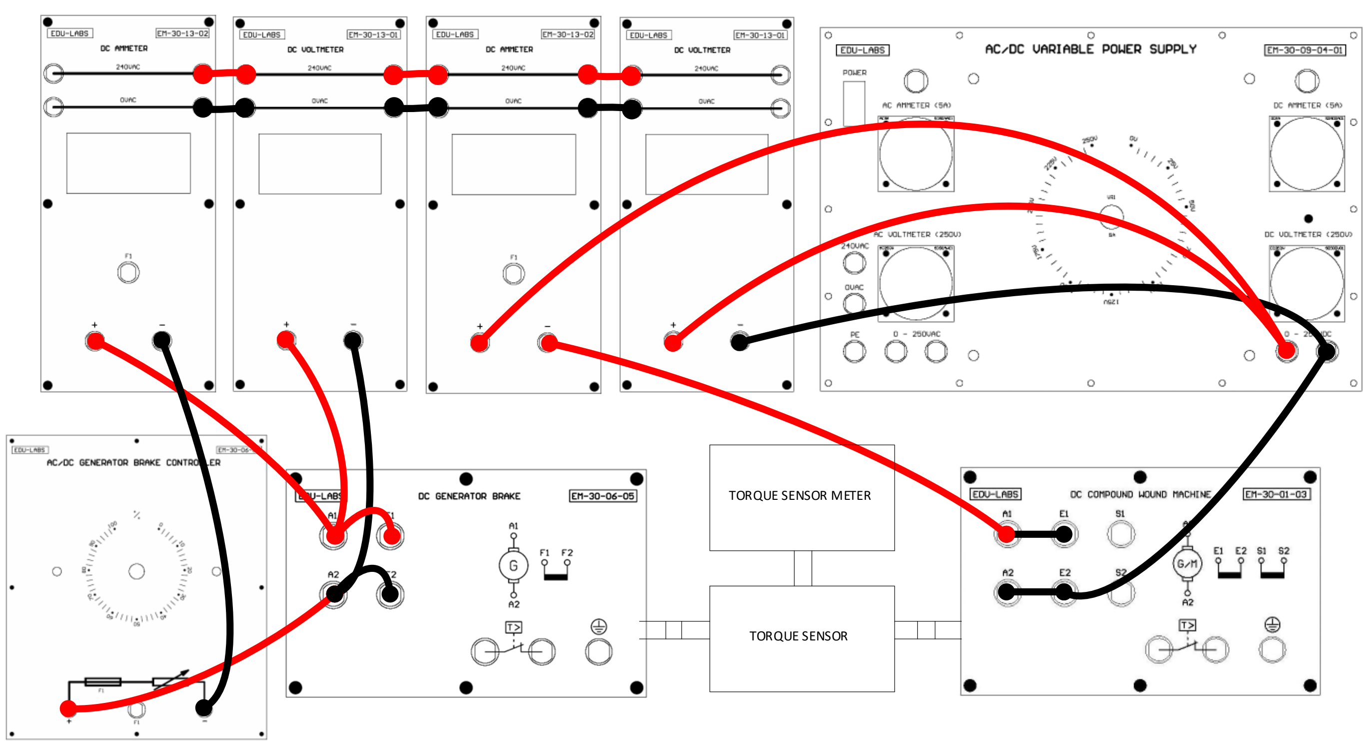


Fig 6.1: Wiring Diagram

2. Connections follow the circuit. Supply 220VDC power supply to the circuit. Measure the speed and the torque. Enter the measured values in the table 6.1

DC MOTOR CONNECTION	NO.	AC/DC GENERATOR BRAKE CONTROLLER %	DC MOTOR		DC GENERATOR		SPEED (RPM)	TORQUE (Nm)
			V	A	V	A		
SHUNT CONNECTION WITH FIXED DC POWER SUPPLY 220V	1	0						
	2	20						
	3	40						
	4	60						
	5	70						
	6	80						

Table 6.1

b. DC Compound Wound Motor in Long Shunt Connection.

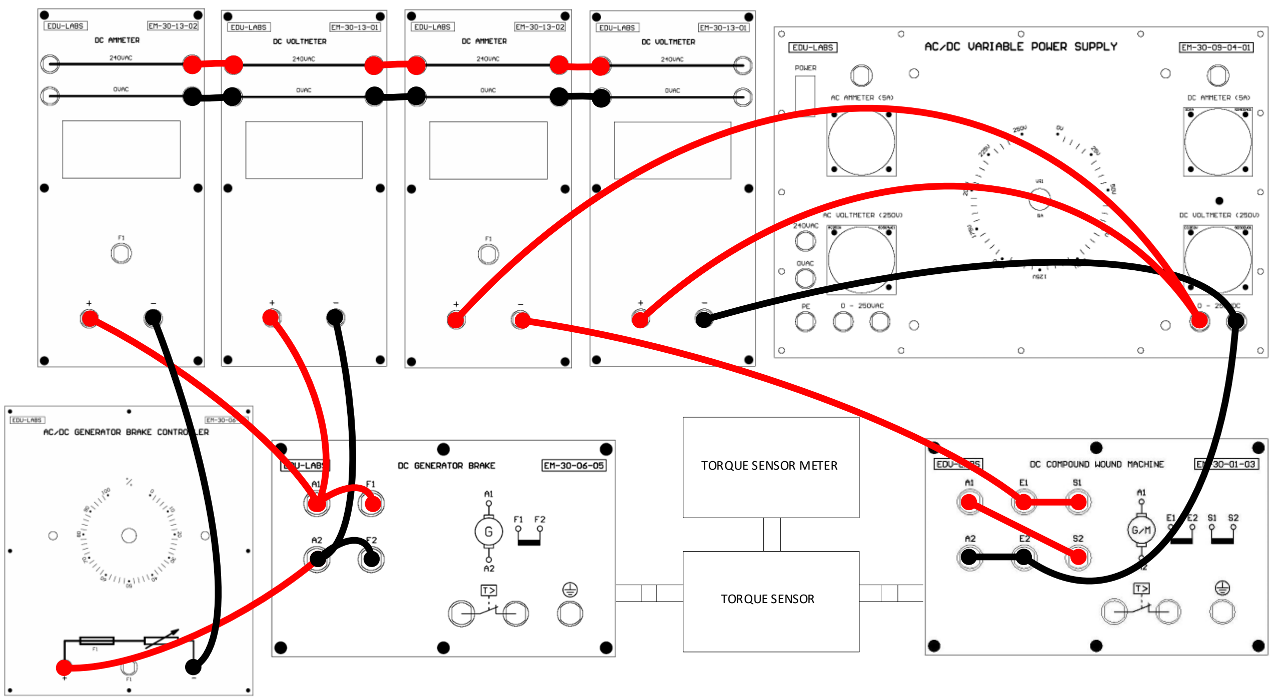


Fig 6.2: Wiring Diagram

1. Connections follow the circuit. Supply 220VDC power supply to the circuit. Measure the speed and the torque. Enter the measured values in the table 6.2

DC MOTOR CONNECTION	NO.	AC/DC GENERATOR BRAKE CONTROLLER %	DC MOTOR		DC GENERATOR		SPEED (RPM)	TORQUE (Nm)
			V	A	V	A		
LONG SHUNT CONNECTION WITH FIXED DC POWER SUPPLY 220V	1	0						
	2	20						
	3	40						
	4	60						
	5	70						
	6	80						

c. DC Compound Wound Motor in Short Shunt Connection.

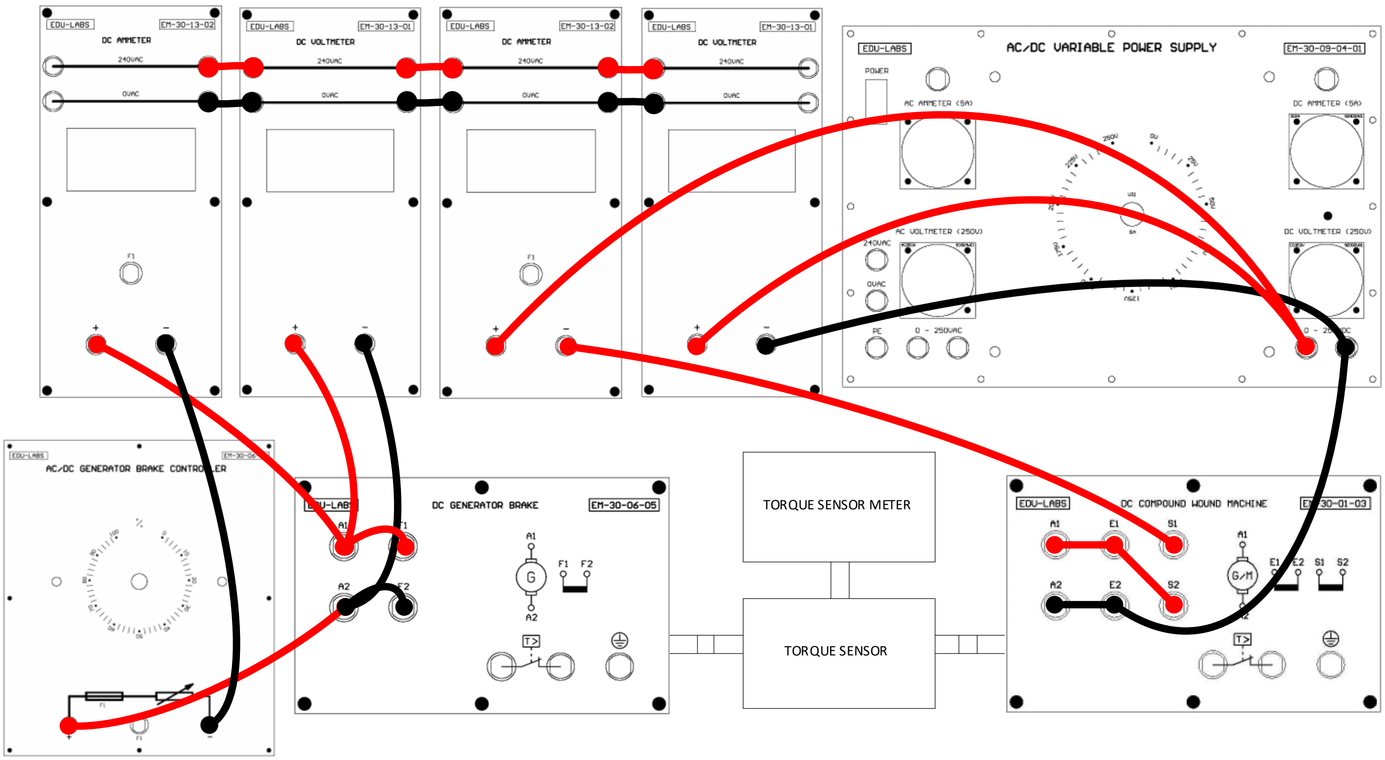


Fig 6.3: Wiring Diagram

1. Connections follow the circuit. Supply 220VDC power supply to the circuit. Measure the speed and the torque. Enter the measured values in the table 6.3

DC MOTOR CONNECTION	NO.	AC/DC GENERATOR BRAKE CONTROLLER %	DC MOTOR		DC GENERATOR		SPEED (RPM)	TORQUE (Nm)
			V	A	V	A		
SHORT SHUNT CONNECTION WITH FIXED DC POWER SUPPLY 220V	1	0						
	2	20						
	3	40						
	4	60						
	5	70						
	6	80						

Table 6.3

WARRANTY AND STANDARD CONDITIONS OF SALE

The Seller warrants to the Purchaser that any equipment manufactured by it and bearing its name plate to be free from defects in material or workmanship, under proper and normal use and service, as follows: If, at any time within one (1) year from the date of shipment, the Purchaser notifies the Seller that in his opinion, the equipment is defective, and returns the equipment to the Seller's originating factory prepaid, and the Sellers inspection finds the equipment to be defective in material or workmanship **except part like switches, knob, push button, lighting, etc.** the Seller will promptly correct it by either, at its option, repairing any defective part or material or replacing it free of charge and return shipping lowest cost transportation prepaid by purchaser (if Purchaser requests premium transportation, Purchaser will be billed for difference in transportation costs). If inspection by the Seller does not disclose any defect in material or workmanship, the Seller's regular charges will apply. This warranty shall be effective only if use and maintenance is in accordance with Seller's instructions and written notice of a defect is given to the Seller within such period. **THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY OTHER WARRANTIES, WRITTEN, ORAL OR IMPLIED. SPECIFICALLY, WITHOUT LIMITATION, THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE**. The liability of the Seller shall be limited to the repair or replacement of materials or parts as above set forth.

LIMITATION OF LIABILITY

The Seller shall not be liable for any claim or consequential or special loss or damage arising or alleged to have arisen from any delay in delivery or malfunction or failure of the equipment. The Seller's liability for any other loss or damage arising out of or connected with the manufacture or use of the equipment sold, including damage due to negligence, shall not in any event exceed the price of the equipment supplied by Seller.

GENERAL CONDITIONS

All orders are subject to acceptance by Seller at its Main Office. Stenographic and clerical errors are subject to correction. No oral or subsequent modification or any other foregoing general provisions or of any term or condition of any order shall be binding unless agreed to in writing by the Seller and Purchaser.

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