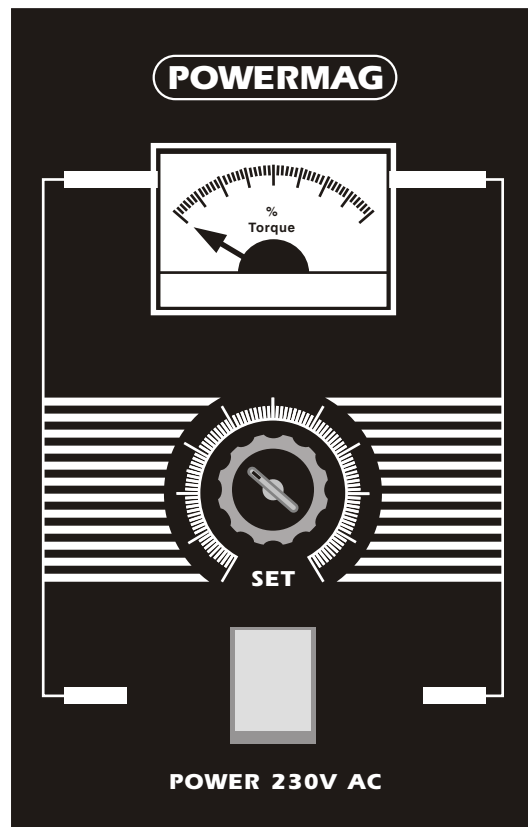


# INSTRUCTION MANUAL

**POWERMAG**

**DYNAMOMETER CONTROLLER**



**MODEL : PM-19**

# INSTRUCTION MANUAL

## FOR EDDY CURRENT POWERMAG LOAD CONTROLLER

### 1 - INTRODUCTION

POWERMAG load controller model PM-19 provides an easy means of torque control of POWERMAG eddy current dynamometer from 0.25 Kgm to 57.6 Kgm torque ratings.

PM-19 is a conventional half wave thyristor controlled DC amplifier with built-in power supply for its control circuit. This is supplied in a compact cabinet suitable for wall/desk mounting. Necessary operator's controls required for torque control of POWERMAG eddy current dynamometer are mounted on its front face.

### 2 - GENERAL DESCRIPTION

PM-19 is a power convertor controlling field excitation of POWERMAG eddy current dynamometer. Its basic functional circuits consists of:

- Thyristor power convertor.
- Firing circuit.
- Surge suppresser, free wheeler and other protective devices.
- Regulated power supply to produce DC control voltage.

The operation of the circuit can be understood with reference to the schematic circuit diagram drawing 1-B.

Load reference input to controller is given from load set potentiometer. A built-in 48 pole AC tachogenerator (optional) mounted integral to the eddy current dynamometer input shaft provides, voltage & frequency proportional to the speed of engine / motor under test.

In order to avoid mechanical shock loading and consequent stress on the driven machine and its related transmissions a built-in feature of PM-19 ensures gradual control of load during acceleration and deceleration. Due to this, even if load command is changed abruptly, the test motor / engine load reaches to its new set value with soft-start action. Setting on preset marked ACC decides the magnitude of soft start action required.

During normal loading condition, excitation to clutch coil of eddy current dynamometer will be around 0-95V DC. With in-built torque limiting facility of PM-19, maximum torque delivered by eddy current dynamometer can be limited to safe value. This is carried out by means of preset marked TORQUE LIMIT.

#### **OPERATORS CONTROLS:**

**POWER ON/OFF SWITCH** : This switch connects incoming supply available at terminals 1 and 2 of controller card to rest of its circuits. Indication lamp provided with the switch glow as soon as power supply is switched on.

**LOAD SET POTENTIOMETER** : Load of eddy current dynamometer can be adjusted and set by means of this potentiometer. Anit-clockwise direction of this potentiometer corresponds to minimum torque setting and vice-versa.

**AMMETER/TORQUE METER** : This is calibrated to read actual excitation current drawn by eddy current dynamometer.

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## PM19 - SPECIFICATIONS

PARAMETER	TERMINAL No.	RATING
Incoming Supply	1-2	230 VAC $\pm$ 10%
Output Voltage	3(+) -4(-)	0 to 95 VDC
Output Current	3(+) -4(-)	0 to 5 Amps, DC
Power Supply for Control Circuit (built-in)	7(+) & 9(-)	1.2 VDC
Speed Reference	8(+) & 9(-)	0-1.2 VDC adjustable
TG (AC voltage per 1000 RPM)	5 & 6	20 VAC
Application		For use with POWERMAG eddy current dynamometer.

## 3 - INSTALLATION PROCEDURES

- PM19 should be mounted in a protected area with ambient temperature within  $-6^{\circ}\text{C}$  to  $40^{\circ}\text{C}$  ( $20.8^{\circ}\text{F}$  to  $104^{\circ}\text{F}$ ).
- Power lines should be 220/240V AC, 50Hz Single Phase.
- The atmosphere should be clean, dry and free of inflammable or combustible vapour, excessive moisture or dust
- Altitude to be under 1,000 meters.
- There should be room around the equipment so as to provide accessibility for inspection and adjustments.

### 3.1 MOUNTING POSSIBILITIES :

Refer to overall dimensions drawings 1-C related to PM19. PM19 can be mounted on wall or control desk. For desk mounting, necessary cut-out required can be referred from drawing 1-C.

**CAUTION :** Do not use any screw having length more than 20mm for mounting the controller cabinet with desk.

### 3.2 INTERCONNECTIONS:

Interconnections between the load controller and the eddy current dynamometer should be done strictly as per the external connection diagram pasted on the cabinet. Two numbers of cable entry holes are provided on the bottom of controller for interconnections.

The interconnections may be carried out by using 1.5/2.0 sq.mm PVC flexible cables copper cables or equivalent, suitably terminated with crimping / soldering terminals.

### IMPORTANT :

An electrical interlock should be done in such a way that supply to the load controller at its terminals 1 and 2 is available only when the test motor/engine is "ON". For this, supply line should be connected at terminal No 1 of the electronic torque controller through auxiliary N.O. contact of the motor starter for DOL type and in case of star/delta starter use auxiliary N.O. of delta contactor. Do not connect line to terminal 1 of controller directly from eddy current dynamometer motor terminals; failing to follow this instruction might result in damage to controller. Suitable starter with protective devices for motor under test to be arranged by the user.

## 4. COMMISSIONING

### 4.1 START-UP PROCEDURES:

- Ensure that POWERMAG eddy current dynamometer is installed as per the guidelines given in relevant instruction manual.
- Ensure that mechanical transmission between eddy current dynamometer and the test machine is installed as per standard engineering practices.

### 4.2 PRESETS DESCRIPTION:

The following presets are provided on controller card.

#### 1. BIAS 2. GAIN 3. TORQUE LIMIT 4. ACC 5. DCC 6. MAX. SPEED 7. CAL

**BIAS :** This preset is provided for interfacing load reference signal with controller output. Factory setting is done such that output of controller is available at around 2<sup>nd</sup> division of load set potentiometer (front clockwise). Adjustment of this preset is required if load is available even at zero position of load set potentiometer.

**ACC/DCC:** The acceleration and deceleration time of the POWERMAG eddy current dynamometer may be varied by adjusting the acceleration and deceleration presets. Higher the setting (clockwise) of this presets, higher is the time taken by the eddy current dynamometer to reach to set load, by means of this presets, desired response time in the range of 0 to 10 seconds can be set. Factory setting is for 0 seconds.

Note : Acceleration and deceleration time for eddy current dynamometer depends on machine characteristics.

**TORQUE LIMIT:** This preset decides the maximum amount of torque which the eddy current dynamometer should transmit within its rated value. It is factory adjusted such that the controller provides maximum excitation of around 95VDC which corresponds to rated torque of eddy current dynamometer. Normal operating conditions generally do not call for rated torque and hence this preset should be adjusted at site based on actual loading conditions during commissioning.

**CAL:** This preset is for calibrating torque meter provided on the face of controller.

**CAUTION:** It is not advisable to start the eddy current dynamometer without electrical interlock as described in the chapter on installation procedures. Failing to follow this instruction might result in damage to eddy current dynamometer and load controller.

### 4.3 COMMISSIONING PROCEDURES:

- Keep torque setting potentiometer on PM-19 to minimum position and power ON/OFF switch in “Off” position. Ensure that there is no supply available at its terminals 1 & 2.
  - Start the test motor/engine and ensure its normal functioning. Supply at the input of controller should be available in this condition.
  - Turn ON supply to controller by means of ON/OFF switch. Indication lamp integral to the switch will glow showing the presence of supply to control circuits of card.
  - Keep ACC/DCC presets at minimum position and gradually turn load set potentiometer from clockwise. At approximately second division of the potentiometer, eddy current dynamometer should just start deliver the load is getting even at minimum or if not getting even beyond the above setting, adjust BIAS preset to get as required.
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## 5. NORMAL VOLTAGES

In this chapter, normal voltages available at terminals of PM-19 is given. A multimeter having sensitivity of 1,000 ohms per volt on AC and 10,000 ohms per volt on DC, or more, should be used while taking the readings. It should be noted that all of the voltages mentioned in this chapter and anywhere else in the instruction manual are within tolerance of  $\pm 10\%$  unless otherwise specified.

TERMINAL No.	NORMAL VOLTAGE	REMARKS
1, 2	240 V AC $\pm 10\%$	Single Phase, 50 Hz Supply voltage.
3(+), 4(-)	0-85 VDC	Output voltage of controller. Depending upon eddy current dynamometer loading.
7(+), 9(-)	1.2 V DC	Highly regulated, built in D.C. power supply.
8(+), 9(-)	0-1.2 V DC	Input speed reference 0 to 1.2 V DC to the controller settable through load set potentiometer.

## 6. TROUBLE SHOOTING

Some of the most frequent causes of eddy current dynamometer malfunctioning are discontinuity in circuit caused by broken wire or loose connection and faulty or damaged insulation, resulting in a short circuit or circuit grounding.

If a eddy current dynamometer system that has been operating properly, suddenly malfunctions, do not make any adjustments or replace any components without first checking:

- All connection for tightness.
- All wiring for breaks
- All wires for faulty or damaged insulation.
- For proper mechanical coupling of the eddy current dynamometer to the driven machine.

If fault persists, the first step is to locate whether the fault is in the eddy current dynamometer or in the control circuit. If the problem is suspected with eddy current dynamometer, consult trouble-shooting instructions or relevant instruction manual of the eddy current dynamometer.

In all of the following discussions, voltage has to be measured with respect to the ground terminal unless otherwise stated.

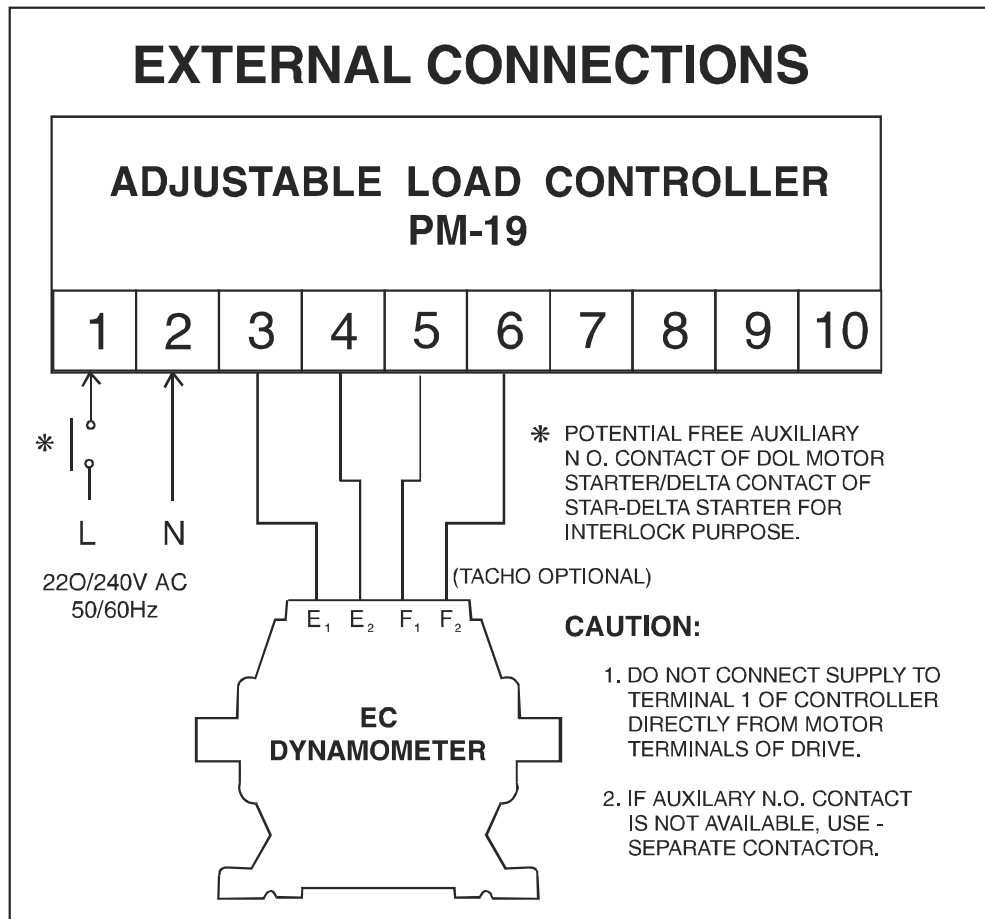
**CAUTION:** All phases of AC power to the control equipment must be disconnected from power unit before it is safe to touch any internal parts of controller.

If fault is suspected in the controller, proceed as follows.

1. Switch off the eddy current dynamometer. Ensure that no supply is available at terminals 1 and 2 of controller.
2. Check firm connection of connectors provided on controller card.
3. Check fuse F1 is intact and healthy.

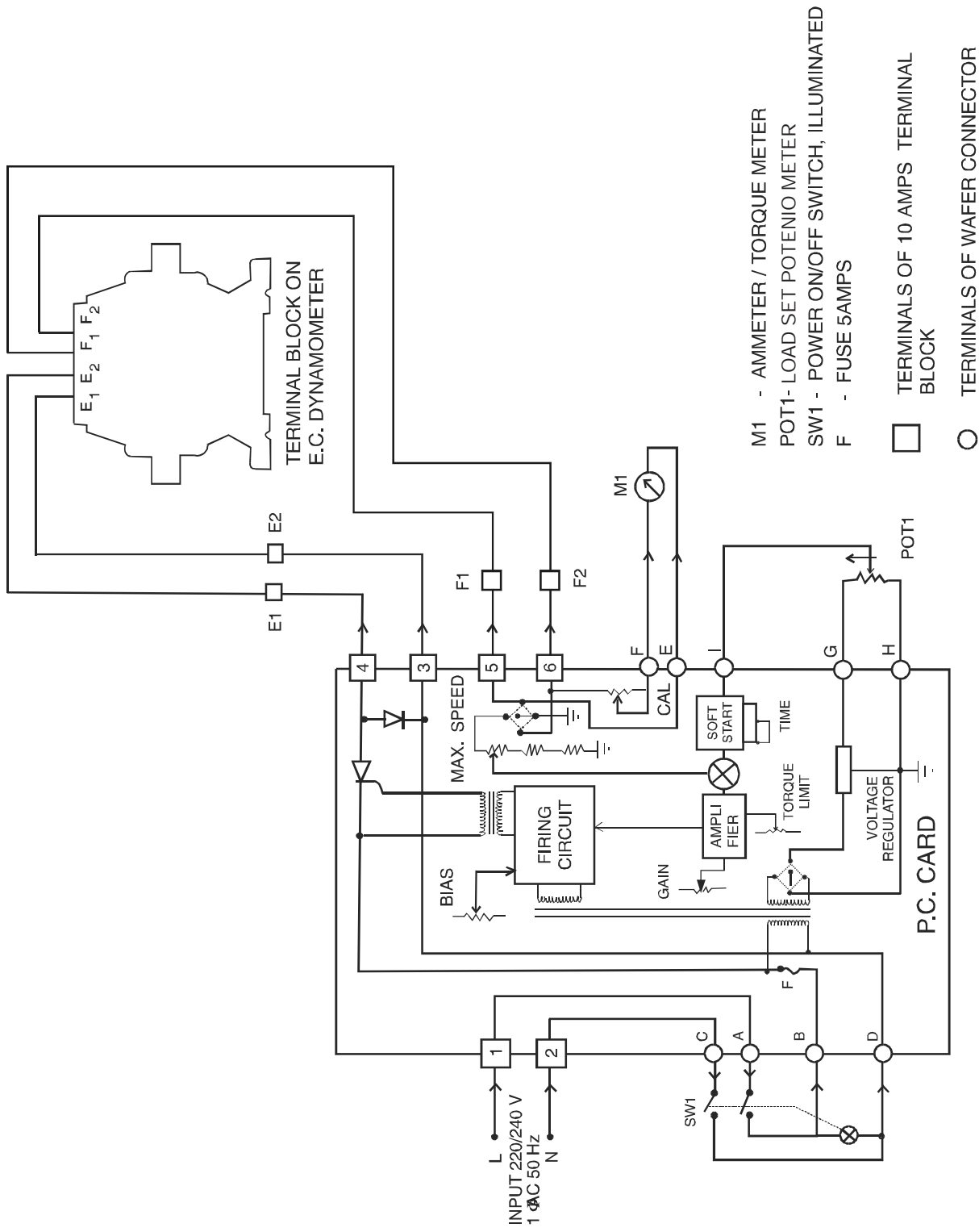
4. Switch on eddy current dynamometer and ensure incoming supply as required is available at terminals 1 and 2 of controller.
5. Check control voltage across terminals 7 (+) and 9 (-) of controller. If expected voltage of 1.2V DC is not available, problem is suspected in the power supply circuit.
6. If voltage as expected at terminals 7 and 9 is available, check for variable voltage in the order of 0-1.2V DC at terminals 8 (+) and 9(-) of controller. If this variable voltage is absent, problem can be suspected with load set potentiometer or its related interconnections.
7. Check for output voltage at terminals 3 and 4 of card. Expected normal voltage is 0-90V DC. (This voltage is limited by means of torque limit preset and any new setting of torque limit will be reflected at the output).
8. If the voltage as expected in above step is not available, problem is suspected in the power conversion circuit of controller.

## MODEL PM-19



Drawing No. : 1-A

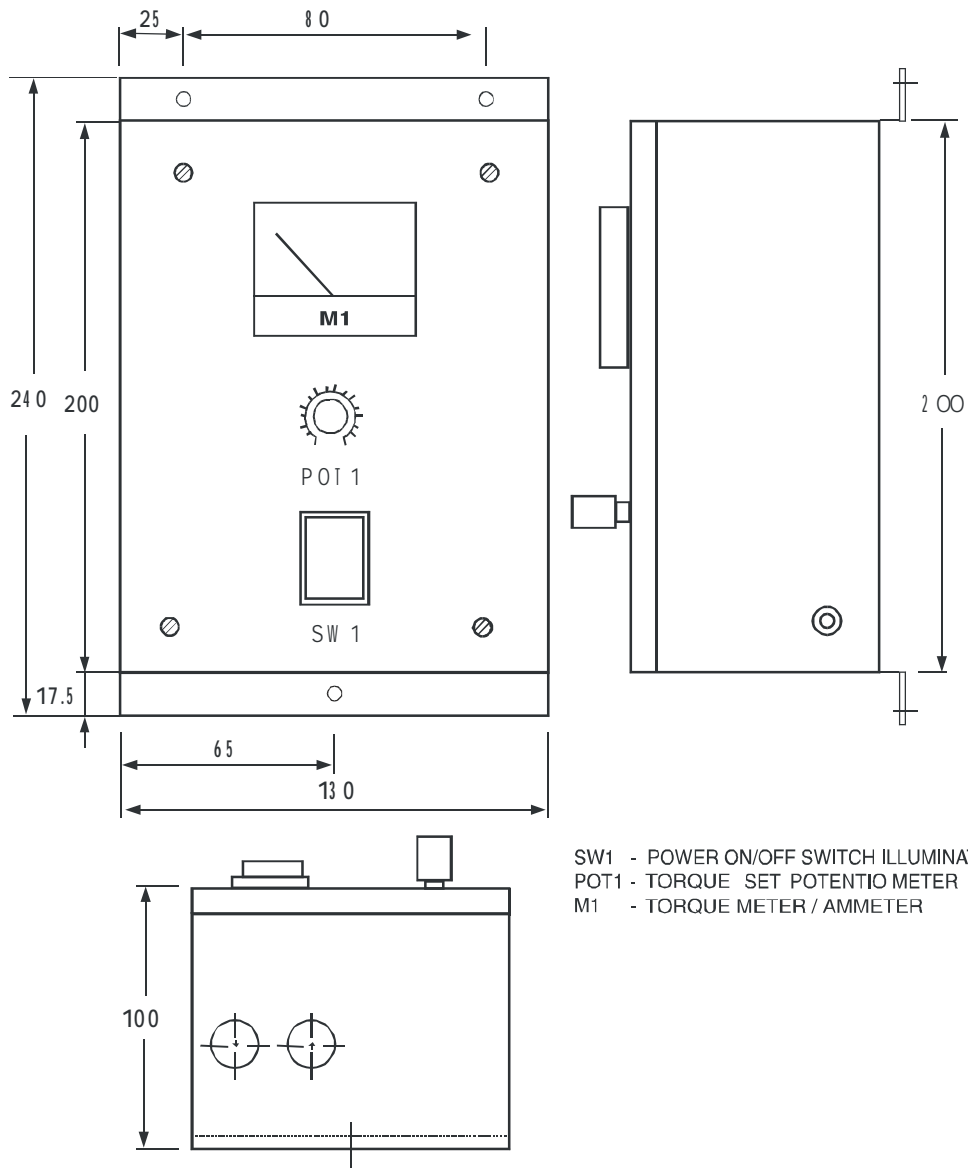
# POWERMAG



Drawing No. : 1-B

**DIMENSIONS**

**ALL MEASUREMENTS ARE IN MM**



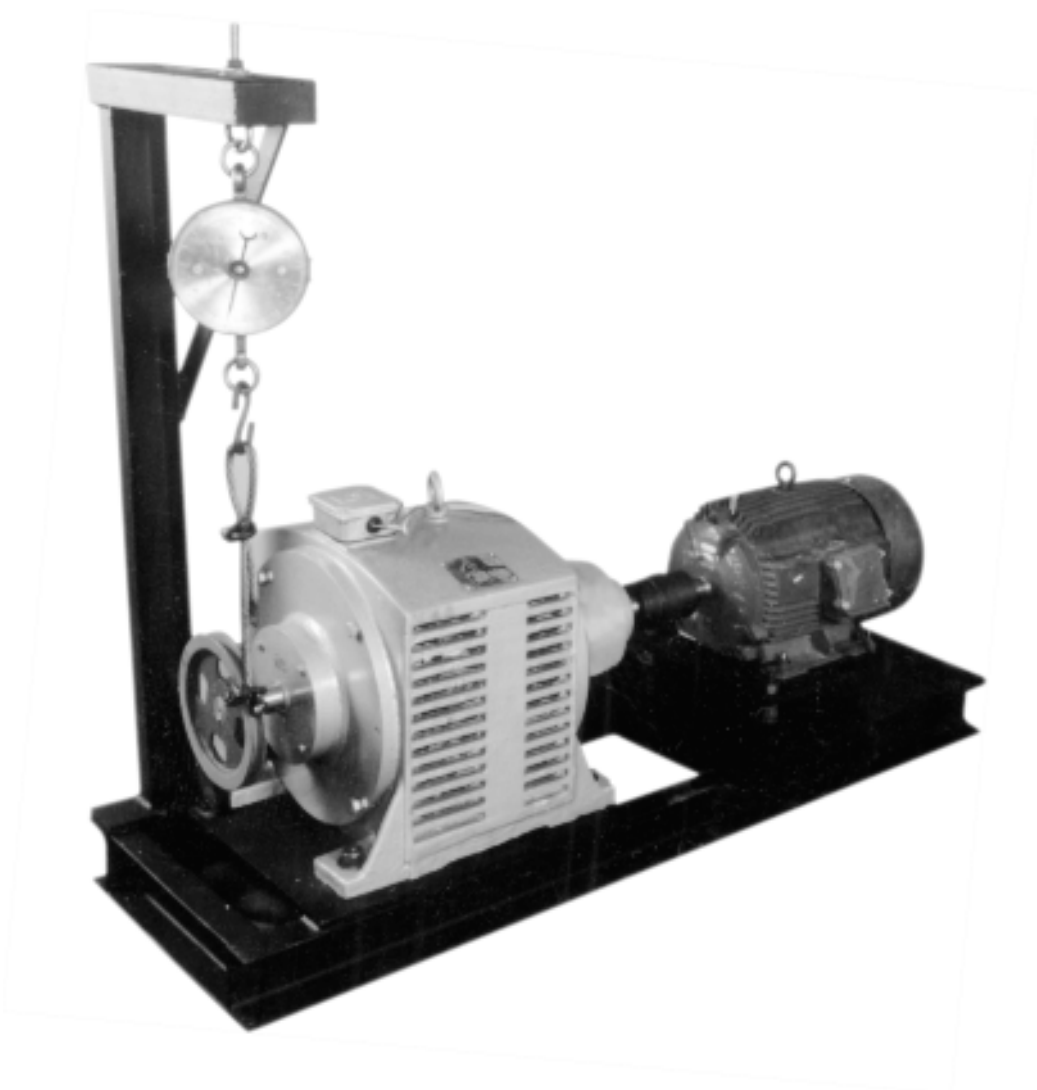
SW1 - POWER ON/OFF SWITCH ILLUMINATED  
POT1 - TORQUE SET POTENTIO METER  
M1 - TORQUE METER / AMMETER

**Drawing No. : 1-C**



# POWERMAG

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Manufactured by :



**POWERMAG CONTROL SYSTEMS (P) LTD.**

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