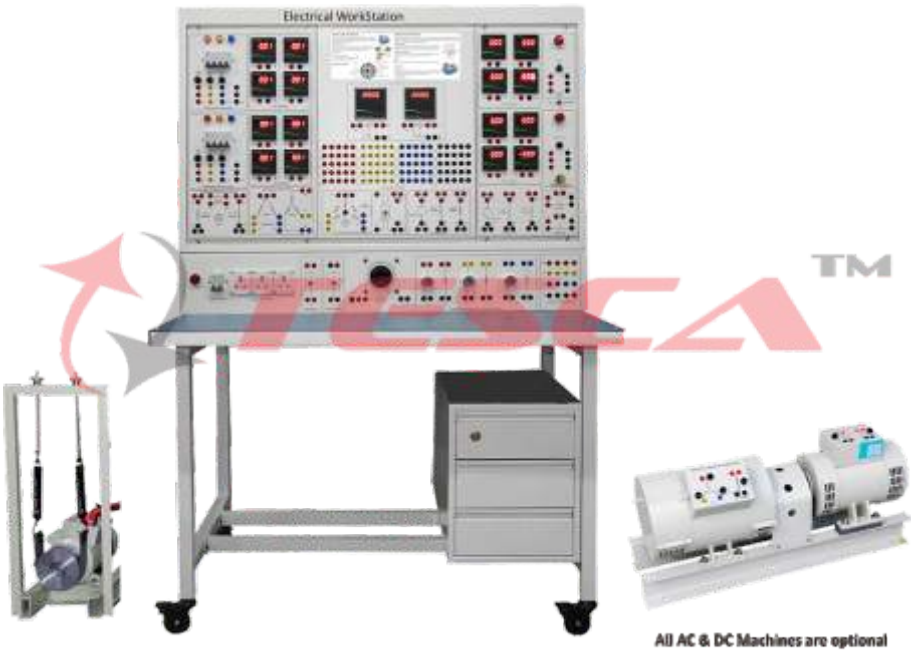

46968 Electrical Workstation offers an excellent approach to the teaching of Electrical Machines principles by introducing a unique modular designed control unit. It provides flexibility for the students to carry out experiments over AC and DC Machines using a large selection of Industry standard inbuilt components.

Electrical Machines is one of the most important area of study as it helps users to understand the operational characteristics and working of AC and DC Machines. 46968 enables user to put their theory knowledge into practice with ease. There is an additional facility to make wireless connection on workstation with computer and to monitor real time electrical parameters using computer interfacing software. Users can also observe a real time graph between any of the AC and DC electrical parameters on computer.

Workstation comprises of separate AC and DC measuring sections equipped with all the necessary instruments such as digital meters, facility to connect AC and DC Supplies along with protection devices such as Fuses, MCB's, Supply Indicators, etc. There are multiple buses provided on the Workstation to make external connections while performing AC and DC Machines Experiments.

The design of the control unit ensures to get the highest quality practical experience to user. All the necessary protective measures are taken to avoid fault or danger.

Note: All AC & DC Machines along with supporting accessories are available optionally

Features

- Compatible for Machines upto 2HP
- Equipped with Measurement Facilities for Experimentation on AC Machines, DC Machines and Transformers
- Separate AC and DC Measuring Sections
- Diagrammatic representation of AC and DC Machines for better understanding
- Rust Free Powder Coating Paint
- Standard BS-10 terminals, patch cords for safety purpose
- Terminals provided to obtain Three Phase Fixed as well as Variable AC and DC Supplies with suitable protection
- High Quality Digital Tachometer for RPM Measurement
- Motors provided with standard Mechanical Loading Arrangement Facility
- Motors with "aluminum" casted Brake-Drum/Pulley with heat suppression facility
- Machines with Class "B" Insulation
- Flexible shaft coupling arrangement (Lovejoy) for Motor Generator (MG) Sets
- Machines provided with Heavy Duty Base/Channel with suitable interconnection
- Machines provided with suitable protections such as MCB's, Fuses, Motor Generator (MG) Sets provided with coupling protective cover
- Generator with Electrical Loading Arrangement Facility
- Durable good quality spring balance
- Designed by considering all the safety measures

Note: Specifications are subject to change.

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Technical Specifications

Electrical Measuring Instruments

AC Ammeter (4 Nos.)

Type	:	Digital
Range	:	10A

AC Voltmeter (4 Nos.)

Type	:	Digital
Range	:	450Vrms

DC Ammeter (4 Nos.)

Type	:	Digital
Range	:	20A

DC Voltmeter (4 Nos.)

Type	:	Digital
Range	:	300V

Single Phase Wattmeter (2 Nos.)

Type	:	Digital
Range	:	4kW

DC Supply (for excitation purpose only)

Voltage	:	300V ± 10%
Current	:	2Amp

DC Power Supply

DC Output Voltage (Fixed)	:	220V ± 10%, 2A
DC Output Voltage (Variable)	:	220V ± 10%, 15A

Protective Devices

Three Phase MCB (TPN)	:	2 Nos.
Interconnections	:	4mm BS-10 Safety Terminals

Object

DC Machines (optional)

DC Shunt Wound Motor

01. Study of Operational Working and Principle of DC Shunt Motor
02. Study of running and reversing phenomenon of DC Shunt Motor
03. Study of No Load Characteristic of DC Shunt Motor
04. Study of Load Characteristic of DC Shunt Motor
05. Study of speed control of DC Shunt Motor using armature voltage control and flux field control method
06. Study and Determine the losses of DC Machine and correspondingly calculate the efficiency of DC Machine by Swinburn's Test Method

DC Series Wound Motor

07. Study of Operational Working and Principle of DC Series Motor
08. Study of running and reversing phenomenon of DC Series Motor
09. Study of Load Characteristic of DC Series Motor
10. Study of speed control of DC Series Motor using armature voltage control and flux field control methods

DC Compound Wound Motor

11. Study of Operational Working and Principle of DC Compound Motor
12. Study of running and reversing phenomenon of DC Compound Motor
13. Study of Load Characteristic of DC Cumulative-Compound Wound Motor
14. Study of Load Characteristic of DC Differential-Compound Wound Motor

DC Shunt Wound Generator

15. Study of Operational Working and Principle of DC Shunt Generator
16. Study and measurement of Open Circuit Characteristic of DC Shunt Generator
17. Study and measurement of External Characteristic of DC Shunt Generator
18. Study and measurement of Internal Characteristic of DC Shunt Generator

DC Series Wound Generator

19. Study of Operational Working and Principle of DC Series Wound Generator
20. Study and measurement of Open Circuit Characteristic of DC Series Generator
21. Study and measurement of Load Characteristic of DC Series Generator
22. Study and verify the Field Test of DC Series Machine and correspondingly determine the efficiency of DC Series Motor and Generator at any desire load

DC Compound Wound Generator

23. Study of Operational Working and Principle of DC Compound Wound Generator

Note: Specifications are subject to change.

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24. Study and verify the Load Characteristics of Long Shunt Cumulatively Compound Generator
25. Study and verify the Load Characteristics of Short Shunt Cumulatively Compound Generator
26. Study and verify the Load Characteristics of Long Shunt Differentially Compound Generator
27. Study and verify the Load Characteristics of Short Shunt Differentially Compound Generator

AC Machines (optional)

Single Phase Capacitor Start Induction Motor

- Study of Operational Working and Principle of Single Phase Induction Motor
- Study of Running and Reversing of Single Phase Induction Motor
- Study of the No-Load Test in a Single Phase Induction Motor
- Study of the Blocked Rotor Test in a Single Phase Induction Motor
- Study of Load Test in a Single Phase Induction Motor

Three-phase Squirrel Cage Induction Motor

- Study of Operational Working and Principle of Three Phase Squirrel Cage Induction Motor
- Study of Running and Reversing of Three Phase Induction Motor
- Study of No Load Test performed in a Three Phase Induction Motor
- Study of Block Rotor Test performed in a Three Phase Induction Motor
- Measurement of Slip in a Three Phase Induction Motor
- Study of Speed-Torque characteristics in a Three Phase Induction Motor

Three Phase Salient Pole Synchronous Motor

- Study of Operational Working and Principle of Three Phase Synchronous Motor
- Study of V curve of Three Phase Synchronous Motor
- Study of Inverse V curve of the Three Phase Synchronous Motor

Three Phase Salient Pole Synchronous Generator

- Study of Operational Working Principle of Three Phase Synchronous Generator
- Study and Measurement of Positive Sequence Impedance of Three Phase Synchronous Generator
- Study and Measurement of Negative Sequence Impedance of Three Phase Synchronous Generator
- Study and Measurement of Zero Sequence Impedance of Three Phase Synchronous Generator
- Study of short circuit characteristics (SCC) of three Phase Synchronous Generator
- Study of open circuit characteristics (OCC) of three Phase Synchronous Generator
- Study and measure of voltage regulation of Three Phase Synchronous Generator using EMF Method

Single Phase Transformer:

- Study of Single-Phase Isolation Transformer
- Study of Single-Phase Step Up Transformer
- Study of Single-Phase Step Down Transformer
- Study of Subtractive Polarity of Single Phase Transformer
- Study of Additive Polarity of Single-Phase Transformer
- Study of Open Circuit test of Single-Phase Transformer
- Study of Short Circuit Test of Single-Phase Transformer

To determine the Efficiency and Voltage Regulation of a Single-Phase Transformer by direct loading at different loading condition.

Three Phase Transformer:

- Study of Open Circuit test of Three-Phase Transformer
- Study of Short Circuit Test of Three-Phase Transformer
- Study of Three Phase Configurations in Three Phase Transformer

****More than 70 Experiments can be performed in 46967**

****Also suitable for performing experiments on basic Electrical Measurements**

Technical Specifications of Optional Machines

DC Motors (optional)

Machine Specification Type - Shunt

Power Rating	:	Available with 1/2HP, 1HP& 2HP
Voltage Rating	:	220V DC ± 5%
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2Nos.(Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel

Note: Specifications are subject to change.

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Protection	:	Fuses (mounted at the terminal box of the Machines)

Machine Specification Type - Series

Power Rating	:	Available with 1HP&2HP
Voltage Rating	:	220V DC ± 5%
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box
of the Machines)		

Machine Specification Type - Compound

Power Rating	:	Available with 1HP & 2HP
Voltage Rating	:	220V DC ± 5%
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2Nos.(Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

AC Motors (optional)

Machine Specification - Single Phase Induction Motor

Type	:	Single phase Capacitor Start Induction Motor
Power Rating	:	Available with 1HP
Voltage Rating	:	230V AC ± 5%, 50Hz
Rated Speed	:	1440RPM ± 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2 Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

Machine Specification - Three Phase Squirrel Cage Induction Motor

Type	:	Three Phase Squirrel Cage Induction Motor
Power Rating	:	Available with 1HP & 2HP
Voltage Rating	:	415V AC ± 5%, 50Hz
Rated Speed	:	1440RPM ± 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2 Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression Facility
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

Single Phase Transformer (optional)
Transformer Specifications

Mains Supply	:	Single Phase, 230V AC ±10%, 50Hz
Rating	:	1kVA
Primary Voltage	:	0-125V, 0-125V
Secondary Voltage	:	0-125V, 0-125V
Rated Current	:	5A

Three Phase Transformer (optional)
Transformer Specifications.

Mains Supply	:	415V ±10%, 50Hz
Type	:	Three Phase

Note: Specifications are subject to change.

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Power Rating	:	1kVA
Primary Voltage	:	415V
Secondary Voltage	:	230V
Rated Current	:	4A

DC Generators (optional)

Machine Specification

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover)

Type	:	Shunt
Voltage Rating	:	220V DC ± 5%
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'

DC Machine (acts as generator)

Type	:	Shunt
Power Rating	:	Available with 0.5HP, 1HP & 2HP
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Shaft extension	:	Single Sided
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

Machine Specification

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover)

Type	:	Shunt
Voltage Rating	:	220V DC ± 5%
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'

DC Machine (acts as generator)

Type	:	Series
Power Rating	:	Available with 1HP & 2HP
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Shaft extension	:	Single Sided
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses(mounted at the terminal box of the Machines)

Machine Specification

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine (acts as prime mover)

Type	:	Compound
Voltage Rating	:	220V DC ± 5%
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'

DC Machine (acts as generator)

Type	:	Compound
Power Rating	:	Available with 1HP & 2HP
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Shaft extension	:	Single Sided
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

Note: Specifications are subject to change.

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AC Generators (optional)

Machine Specification

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

Three Phase Synchronous Machine

Type	:	Salient Type
Power Rating	:	3 HP
Voltage Rating	:	415V AC ± 10%, 50Hz
Configuration	:	"Delta" Connected
Rated Speed	:	1500RPM ± 5%
Insulation	:	Class 'B'
Excitation Voltage	:	180Vdc ± 10%

DC Machine (acts as generator)

Type	:	Shunt
Power Rating	:	2HP
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

Machine Specification

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

DC Machine

Type	:	Shunt
Power Rating	:	2HP
Voltage Rating	:	220V DC ± 5%
Rated Speed	:	1500RPM ± 5%
Insulation	:	Class 'B'

Three Phase Synchronous Machine

Type	:	Salient Type
Configuration	:	"Star" Connected
Power Rating	:	3HP
Voltage Rating	:	415V AC ± 5%, 50Hz
Rated Speed	:	1500RPM ± 7.5%
Insulation	:	Class 'B'
Excitation Voltage	:	180Vdc ± 10%
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

Other Supporting Optional Items

Single and Three Phase Resistive Load

Single Phase Operation

Voltage	:	240V AC ±10%, 50Hz
Current	:	15A
Power	:	3.5kW
Loading steps	:	15

Three Phase Star Operation

Voltage	:	415V AC ±10%, 50Hz
Current	:	5A (per Phase)
Power	:	3.5kW
Loading steps	:	5 (per Phase)

Three Phase Delta Operation

Voltage	:	415V AC ±10%, 50Hz
Current	:	15A (per Phase)
Power	:	10.5kW
Loading steps	:	5 (per Phase)
Switching Technique	:	Star/Delta Switch, 415V, 25A
Mains MCB	:	16A (TPN)

Note: Specifications are subject to change.

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Three Phase Inductive Load

Three Phase Star Operation		
Voltage	:	415V AC ±10%, 50Hz
Current	:	10A (per Phase)

Single and Three Phase Capacitive Load

Single Phase Operation

Voltage	:	230V AC ±10%, 50Hz
Current	:	14A (Approx.)
Loading steps	:	30

Three Phase Star Operation

Voltage	:	415V AC ±10%, 50Hz
Current	:	4.6A (per Phase)
Loading steps	:	10 (per Phase)

Three Phase Delta Operation

Voltage	:	415V AC ±10%, 50Hz
Current	:	13A (per Phase)
Loading steps	:	10 (per Phase)
Switching Technique	:	Star/Delta Switch, 415V, 25A
Mains MCB	:	16A (TPN) 10A (One Pole) 30 Nos.

Thyristorized DC Regulated Power Supply

Input Mains	:	415VAC ± 10%, 50Hz
Rated Output Voltage	:	220VDC (Fixed) ± 5%,
Rated Output Current	:	50ADC
Regulation	:	Less than 3% at full load condition.

Measuring Instruments

AC Voltmeter	:	1 No. (with voltage selector switch)
DC Ammeter	:	1 No.
DC Voltmeter	:	1 No.

Protection with its indicators

Overload Protection
Short Circuit Protection
Phase Sequence Indicator

Single Phase Variac

Type : Close Type		
Operating Rating	:	230V AC ±10%, 50Hz
Output Voltage	:	0 - 270V AC ±10%, 50Hz
Current	:	10A (Also available in different Current Ratings)

Three Phase Variac

Type	:	Close Type
Operating Rating	:	415V AC ±10%, 50Hz
Output Voltage	:	0 - 470V AC ±10%, 50Hz
Current	:	10A (Also available in different Current Ratings)

- Rheostats
- AC Starters
- DC Starters

Single and Three Phase Capacitive Load

Three Phase Inductive Load

Single and Three Phase Resistive Load

Note: Specifications are subject to change.

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Electrical Data Acquisition System is a versatile solution that allows high quality measurements for all Electrical Parameters and is suited for all types of Engineering Laboratories. Electrical Data Acquisition System provides wireless measurements of Single and Three Phase AC as well as DC Parameters measurements with high accuracy.

Electrical Data Acquisition System includes three inputs each for Voltage and Current, two inputs each for DC Voltage and DC Current to measure an entire Three Phase Parameters and DC Parameters such as AC and DC Voltage, AC and DC Current, Active Power, Reactive Power, Apparent Power, Power Factor, Frequency, etc. along with Over Load Protection Indicators and buzzer at the same time. All these parameters will be displayed on the PC Software screen provided with the product.

Electrical Data Acquisition System is compatible for three phase/three wire and three phase/four wire configurations. User can also plot a real time graph between any of these parameters on computer through the facility of wireless connectivity.

Features

1. Electrical Data Acquisition System is compatible for Motors upto 2HP
2. Real Time monitoring of electrical parameters using computer Interface Software
3. Curve can be plotted between any of the two electrical parameters along with its calculation done on computer
4. Facility to store plotting curve reading for further reference
5. Microcontroller based accurate and reliable design
6. Singe Phase Parameters Measurement
   - 3 AC Voltage Inputs
   - 3 AC Current Inputs

   Corresponding Active Power, Reactive Power, Apparent Power, Frequency, Power Factor and Angle
   - 2 DC voltage Inputs
   - 2 DC current Inputs
7. Three Phase Parameters Measurement
   - Line to Neutral Voltage
   - Line to Line Voltage
   - Line Current
   - Active Power
   - Reactive Power
   - Apparent Power
   - Frequency
   - Power Factor
8. CT is used as Current Transducer
9. Fully isolated measurement

Real Time monitoring of electrical parameters using computer interface software

Technical Specifications

Communication Frequency	:	2.4GHz
RF Power	:	1mWatt
Range	:	10Mtr.
Measurement Ranges		
AC Voltage Range	:	25-450Vrms, accuracy ±1%
AC Current Range	:	0.20-10Amp, accuracy ±1%
DC Voltage Range	:	25-300Vrms, accuracy ±1%
DC Current Range	:	0.20-15Amp, accuracy ±1%
Frequency	:	45-55Hz, accuracy ±0.5Hz
Active Power	:	50-3000Watts, accuracy ±2%
Reactive Power	:	50-3000Watts, accuracy ±2%
Apparent Power	:	50-3000Watts, accuracy ±2%
Power Factor	:	0.30 to 0.99 both Lead and Lag, accuracy ±3º Electrical
Speed	:	Up to 2500 RPM
Torque	:	0 - 25 N-m
Auxiliary Supply	:	230V AC± 10%, 50Hz

Wireless connectivity with computer

Speed Measurement Device

Note: Specifications are subject to change.

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