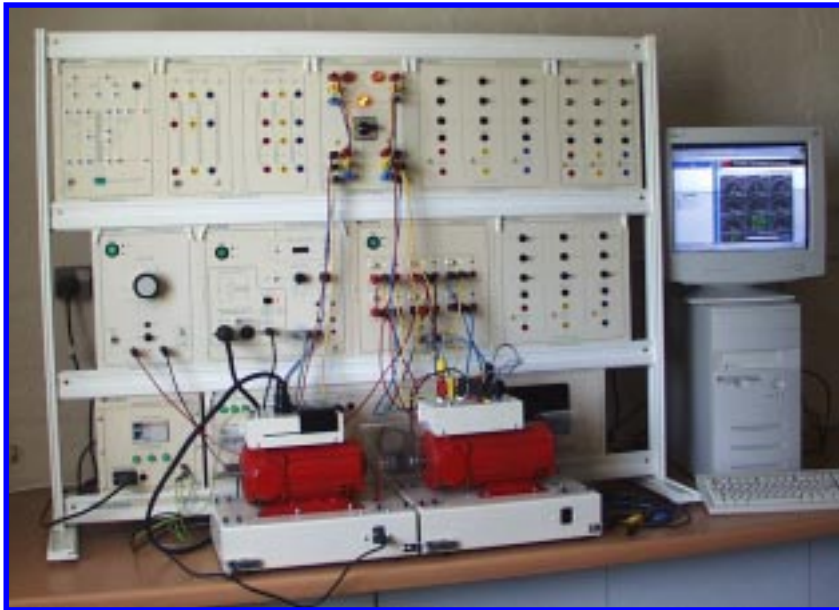


PowerLab Components



Subject Coverage

The components, when assembled in the specified systems, cover the most generally taught electrical machines principles. They are:

- **Magnetic & Electromagnetic principles**
- **Electrical Technology**
- **Single & Three phase Transformers**
- **Dissectible Machines**
- **ac/dc Motors & Generators**
- **Electromagnetic Motor Control**
- **Three phase Motor Speed Control**
- **dc Motor Speed Control**

The component based PowerLab system provides a flexible and cost-effective way to build a Power and Machines laboratory facility. It is a free standing, bench-top frame system designed to accommodate components from the Feedback PowerLab range.

All components are fully protected and use shrouded connectors for extra safety protection.

Single and Three Phase and ac/dc systems can be easily constructed in one or more frames. PowerLab allows complex multi-unit systems to be set up.

The PowerLab systems can be specified from a number of Complete Teaching Packages, or chosen from the component list to meet a particular training requirement. The complete systems are available with Virtual or Conventional Instrumentation that cover the following areas of study:

ac/dc Motors & Generators	Virtual 60-006	Conventional 60-006-1
PowerLab - Machines & Transformers	Virtual 60-007	Conventional 60-007-1
Single & Three Phase Transformers	Virtual 61-007	Conventional 61-007-1
Single Phase Transformers	Virtual 61-008	Conventional 61-008-1
Three Phase Transformers	Virtual 61-009	Conventional 61-009-1
Electrotechnology Trainer	Virtual 61-016	Conventional 61-016-1
Magnetic & Electromagnetic Circuits	Virtual 61-010	Conventional 61-010-1
Dissectible Machine System		Conventional 62-005

In addition to the standard systems, a number of extension kits are available for PowerLab that extend study into other areas. They are:

Magnetic & Electromagnetic Principles	61-400
Electromagnetic Motor Control	65-020
Three Phase Motor Speed Control	66-010
dc Motor Speed Control	66-020

There are also stand alone trainers:

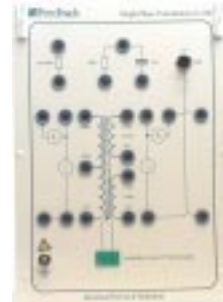
Magnetic and Electromagnetic Trainer	61-022
Variable Frequency Drive Trainer	66-003

Individual Modules



Universal Power Supply 60-105

- Comprehensive Power Supply.
- Circuit breaker protection.
- 3-phase: nominally 0-400V ac line at 4A.
- 3 x Single Phase: each nominally 0 - 230V ac line to neutral at 4A dc nominally 0 - 270V at 6A.
- Three Phase 400V line, 230V Single Phase, fixed dc 220V 10A.
- Single Phase power distribution.
- Safety earth connection provided.



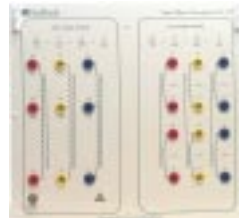
Single Phase Transformer 61-106

- Multi-windings for series and parallel connection.
- 400V, 230V and 2 x 115V windings.
- Power rating 100VA.
- Mimic panel of transformer windings.
- Frame or bench mounting.
- Safety earth connection provided.



Variable ac/dc Supply 5A 60-121

- A variable ac/dc supply using a variable transformer and a silicon bridge rectifier circuit.
- Provides up to 240V ac or 220V dc at up to 5A.
- Equipped with ON/OFF switch, variable voltage control, ac/dc selector and current overload protection.
- Nominal voltage 220/240V ac, 50/60Hz 5A.
- Safety earth connection provided.



Three Phase Transformer 61-107

- Primaries for 380/415V ac Star or Delta connection.
- 2 x 115V, 0.43A secondaries per phase.
- Power rating 300VA.
- Connects via 4mm colour coded shrouded safety sockets on mimic panel.
- Frame mounting.
- Safety earth connection provided.



Three Phase Supply 60-132

The 60-132 can be configured to provide the desired single phase or three phase power to the 70-220.

- Overcurrent power switch.
- 600VA output on single and 3-phase at 200VA per phase.
- Star or delta 3-phase configuration.
- 2 x 100V windings per phase.
- Input requirement: 380 - 415V 5 wire. 3 x line, neutral and earth.



Three Phase Earth Leakage Breaker 61-140-1

- For use in systems where earth leakage breakers are not provided as part of the electrical installation but overcurrent protection has been installed.
- Suitable for connection to 3-phase, five wire systems.
- Provides a termination point for mains power on frame systems.
- 4 pole, 30mA trip, earth leakage breaker.
- Three phase power 'on' indicators.
- Single phase outlets on front and rear.
- Safety earth terminals.
- Input 380/415V 3-phase 50.60Hz with neutral and earth connections.
- User connection terminal block provided internally.
- Output 220/240V single phase from IEC shuttered sockets, fuse protected at 10A.
- 3-phase on rear panel connector for use with frames supplies 60-105 and 60-125.
- Provides additional protection against the hazard of electric shock.

Individual Modules



Magnetic and Electromagnetic Principles 61-400

- An add on to the PowerLab configuration, comprises: a frame mounted panel and a series of magnetic and electromagnetic components.
- Allows the investigation of a wide range of magnetic and electromagnetic principles eg. flux paths of cores, Motor and Generator principles and Transformer concepts.
- Supply required 120 or 230V ac.



Dissectible Machines Tutor 62-100

- A fully dissectible experimental machines kit.
- Build, operate and test over 50 different ac, dc and 3-phase machine assemblies.
- Well protected rotating parts.
- Operates at low power levels minimising the risk of accidents.



Dissectible Machines Storage Panel 62-101

- Holds coils and components for the Dissectible Machine.
- Provides easy inventory control.
- Clearly identified positions for components.
- Can be mounted in a System Frame, or wall-mounted.



Rotatable Brush Gear 62-102

- Replaces the Dissectible Machine static brush gear.
- Easily fitted to non drive-end mounting.
- Can be rotated to any angle with respect to the neutral axis.
- Scale calibrated in 5° increments.
- Thumbscrew locking.



Series Universal Motor 63-100

- Rated at 250W continuous.
- Maximum speed 6,000 rev/min.
- Power Requirement 220V dc or Single Phase ac 50Hz supply.
- Double ended shaft with 12mm dia.
- Safety earth connection provided.



dc Shunt Machine 63-110

- Rated at 250 watt with separately wound shunt field.
- Nominal supply 180/220V dc armature and field.
- Suitable for operation with separately excited or self-excited connections.
- Can be used as dc motor or generator.
- Nominal speed 3,000 rev/min.
- Double ended shaft with 12mm dia.
- Safety earth connection provided.



dc Compound Wound Machine 63-120

- Rated at 250W continuous.
- Nominal speed 2,000 rev/min.
- Maximum speed 6,000 rev/min.
- Power requirement 220V dc.
- Operates as a dc series, shunt and compound motor or generator.
- Double ended shaft with 12mm dia.
- Safety earth connection provided.

Individual Modules



dc Variable Speed Drive 63-500

Comprises a 250W horsepower dc motor mounted on a base unit compatible with all the machines in the PowerLab range. Contained in the base of the motor is a thyristor-controlled power supply which provides a shaft speed range from zero to 4250 rev/min, with all controls and fuses brought out to a front panel. It has constant current overload limiting electronic control to give good regulation, and a fool-proof soft-start to ensure safe run-up to full speed. A built-in tachogenerator with integral metering is also provided for indication of shaft speed. Drive shaft diameter $\frac{5}{8}$ inch.



Capacitor Start Single Phase Induction Run - 64-110

- Rated 250W continuous.
- Rotates at up to 2850rev/min at 50Hz.
- Power requirement 220V Single Phase ac.
- 12mm shaft diameter.
- Double ended shaft.
- Safety earth connection provided.



Three Phase Induction Motor - Squirrel Cage, Dual Voltage 64-501

- Dual voltage machine, 380/415V, Star, 220/240V Delta.
- Rated at 250W.
- Rotates at up to 2980 rev/min at 50Hz.
- Power requirement 380/415V, 50Hz, Three Phase ac or 220/240V delta.
- 12mm shaft diameter.
- Double ended shaft.
- Safety earth connection provided.



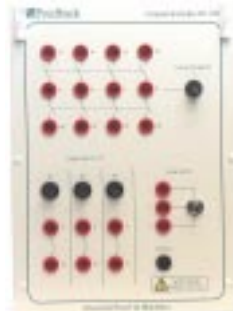
Three Phase Synchronous Motor/Generator - Wound Rotor 64-510

- Can be used as a motor or generator.
- Rated at 415/240V 300W max.
- Synchronous speed 3,000 rev/min@50Hz.
- Power Requirement 380/415V Three Phase ac star or 220/240V delta.
- Rotor supply 100V dc.
- 12mm shaft diameter.
- Double ended shaft.
- Safety earth connection provided.



Contactor Panel 65-123

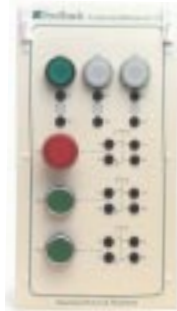
- 3-phase isolating switch, fused at 5A.
- Power control pushbutton connecting 24V ac to contactors, relay and speed control circuit.
- Contactor with thermal overload relay.
- 2 contactors mechanically interlocked.
- Control relay fitted with pneumatic timer.
- Speed relay with adjustable speed threshold to 4,000 rev/min.
- Three 50 ohm 100W power resistors.
- Supply requirements 230V or 120V ac 50/60Hz.
- Safety earth connection provided.



Control Switches 65-130

- Heavy duty power switches used in measurement and electrical circuit switching.
- Multipoint metering.
- Component selection.
- Switches are:- 1 x 3way, 3 x 1way, 1 x 4way.
- Switch ratings 240V ac 10A.
- Used with 62-100 Dissectible Machine.
- Safety earth connection provided.

Individual Modules



Control Pushbuttons 65-132

- Three pushbuttons with contacts, 1 N/O and 1 N/C. One button mushroom head type, two flush head type.
- Three indicator lamps, two white, one green - 24V/0.12A.
- For use with Contactor Panel 65-123.
- Safety earth connection provided.



Motor Switches 65-133

- Three pushbuttons with contacts, 1 N/O and 1 N/C. One button mushroom head type, two flush head type.
- Three position selector switch, 1/OFF/2. 1 and 2 positions have 1 N/O and 1 N/C contacts.
- For use with Contactor Panel 65-123.
- Safety earth connection provided.



Variable Frequency Drive 66-110

- A Three Phase variable frequency output voltage to vary the speed of the Three Phase Induction Motor 64-501.
- Basic control functions are provided for:
 - Maximum & minimum speed settings.
 - Acceleration & deceleration times.
 - Torque boost.
 - Variable Frequency Control.
- Protection is provided for overcurrent & overvoltage. Output power 0.4kW.
- Supply: 180-250V ac at 5A 50/60Hz single phase.
- Motor earth terminal.



dc Motor Speed Controller 66-120

- Suitable for use with 63-110 and 63-120 dc motors.
- Speed range 0 to 3,000 rev/min. Provides 300W output.
- Adjustable IR compensation control for improved speed regulation.
- Used as a drive when testing generators.
- Acceleration & deceleration control.
- Supply 200-240V ac at 5A 50/60Hz.
- Motor earth terminal.



Variable Resistance 200Ω 3A 67-113

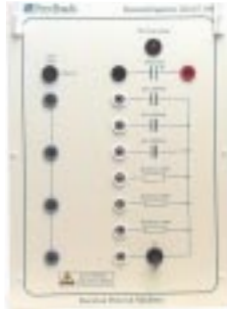
- High power variable resistance element for use where short-term dissipation is required in applications such as:-
 - Generator loading
 - Motor starting
 - Motor speed control applications
- Fuse protected at 3.15A.
- Safety earth connection provided.



Switched 3-phase Resistance Load 230/380V 67-142

- Three resistor switched load banks.
- Seven resistor values per bank.
- 547 - 3770Ω per bank. 100W per bank.
- Total Three Phase loading for Star@ 400V or Delta@230V, 300 watts.
- Fuse protected at 0.5A.
- Safety earth connection provided.

Individual Modules



Resistor/Capacitor Unit 67-190

- Low power resistive/reactive component unit.
- Resistive elements 3 x 68 ohms.
- Capacitive elements: 2 μ F, 4 μ F and 8 μ F.
- Nominal ratings:
Resistance 50W each.
Capacitors 400V (63V for 10 μ F).
- Fuse protected at 3.15A.
- Specifically for use with 62-100 Dissectible Machine components.
- Safety earth connection provided.



Inductive Load 700mH 67-300

- A load consisting of a variable 700mH inductive component.
- Variation is obtained by means of a infinitely variable sliding iron core.
- Fused at 1.5A, 250V max.
- Rated at 1A 220V max 50Hz.
- Safety earth connection provided.



Switched Capacitive Load 50 μ F 67-201

- Three capacitive switched load.
- Five capacitive values.
- 10 - 50 μ F.
- 976 VAR@250V ac, 50Hz.
- Fuse protected at 4A.
- Safety earth connection provided.



Switched 3-phase Inductive Load 230/380V 67-312

- Three inductive switched load banks.
- Seven inductive values per bank.
- 1.7H - 12H per bank.
- 100 VAR@230V, 50Hz per bank.
- Total Three Phase loading for Star@ 400V or Delta@230V, 300VAR.
- Fuse protected at 0.5A per bank.
- Safety earth connection provided.



Switched 3-phase Capacitive Load 230/380V 67-212

- Three capacitive switched load banks.
- Seven capacitive values per bank.
- 1 - 7 μ F per bank.
- 116 VAR@230V ac, 50Hz per bank.
- Total Three Phase loading for star @400V or Delta@230V, 348 VAR.
- Fuse protected at 0.8A per bank.
- Safety earth connection provided.



Inertia Wheel 67-450

- Used with the Electrical Machine.
- Fits onto non drive end of shaft to increase existing rotor inertia on synchronous generators and dc machines.
- Provides additional inertia load on control system behaviour in 2, 4, 8 or 12 pulse converter drives.
- Mass 2kg.
- Fits 12mm shaft diameter.

Individual Modules



Friction (Prony) Brake 67-470

- Fits directly onto the shaft of Feedback machines.
- Provides direct loading with integral measurement of the torque output of various motor assemblies.
- Indicates torque output in either direction.
- Fits 12mm, $\frac{1}{2}$ and $\frac{5}{8}$ inch shafts.
- Torque range $\pm 2\text{Nm}$.



Swinging Field Dynamometer 67-500

- Alternative machine for use with 68-441-1 Control Panel.
- Movable frame and field assembly.
- Higher accuracy torque output than Armature Current Machine 63-110.
- Strain gauge gives an output proportional to load torque in both torque and speed modes.
- Lock rotor test facility for stall torque measurements.
- Powered directly from 68-441-1 Control Panel.
- Permanently mounted dc Tachogenerator



Electronic Single and Three Phase Measurements 68-100

- Measures voltage, current, power, power factor, watts, KVA, KVAR and KWH etc. on 3 to 4 wire, balanced/unbalanced 3-phase systems.
- Rated at 750V ac at 5A per phase.
- Supply 230 or 120V ac 50/60Hz.
- Digital readout of values.
- Programmable setting.
- Simple connections by 4mm shrouded connecting leads.



dc Voltmeter and Ammeter 68-110

- Moving coil dc voltmeter.
- Voltmeter ranges 0-50, 0-250, and 0-500V dc.
- Ammeter range 0-1A, 0-5A & 0-10A dc.
- Ammeter is fuse protected.
- Meters are to DIN standard 96 x 96mm.
- Safety earth connection provided.



ac Voltmeter and Ammeter 68-111

- A rectifier voltmeter and moving iron ammeter.
- Suited to the measurement of variable frequency drives and ac supplies.
- Rectifier voltmeter range 0-250V and 0-500V ac.
- Moving iron ammeter range 0-3A.
- Meters are DIN standard 96 x 96mm.
- Safety earth connection provided.



dc Milliammeter, Centre Zero 68-113

- Ideal instrument for use in:-
- Electrical circuit investigations.
- Motor/generator set-ups.
- Provides direct indication of polarity and polarity reversal.
- Ranges:- $\pm 1\text{mA}$, $\pm 1\text{A}$ and $\pm 5\text{A}$.
- Meters are to DIN standard 96 x 96mm.
- Safety earth connection provided.

Individual Modules



Moving Iron Voltmeter and Ammeter 68-114

- For use on ac circuits.
- Voltage ranges up to 500V.
- Current range to 2A.
- Ammeter is fuse protected.
- Meters are to DIN standard 96 x 96mm.
- Safety earth connection provided.



Synchronising Lamps 68-120

- Basic synchronising by phase indicator lamps grouped in a triangle.
- Uses lamps-bright or lamps-dark technique.
- A power switch is provided to connect the systems together.
- Accommodates Single or Three Phase.
- Safety earth connection provided.
- 380 - 415V operation.



ac/dc Voltmeter and Ammeter 68-116

- A frame mountable multi-range digital meter used to carry-out a wide range of measurements.
- Measurements:
- dc voltage in ranges 2, 20, 200 & 1,000V.
 - ac voltage in ranges 2, 200 & 750V.
 - dc current in ranges 2, 20, 200 & 2,000mA.
 - Fuse rated at 2A (T) 20 x 5mm for the 2,000 mA range.
 - Single standard 9V battery.



ac Volt and Frequency Meter 68-121

- Used with synchronous machines single and Three phase.
- Frequency and voltage measurements.
- Ideally suited to the application of synchronising generators and supplies.
- Voltage range 0 - 500V.
- Frequency range 45 - 65Hz.
- Safety earth connection provided.



Rectifier Voltmeter and Ammeter 68-117

- Ideally suited to ac measurements over a wide range of voltages and currents with good accuracy.
- Voltmeter ranges 0-50V, 0-250V, 0-500V.
- Ammeter ranges 0-1, 0-5A and 0-10A.
- The ammeter is fuse protected for all ranges, 1A, 5A and 10A (T) size '0'.
- Module has earth terminal post.



Voltage and Current Monitor 68-150

- For use where current waveform measurements are required.
- Precision 4 terminal shunt current monitor.
- Output from shunt isolated via voltage probe.
- Probe's output connects directly to a scope for safe monitoring and display.
- Current monitor output 100mV/A.
- Isolated voltage probe input 1000V dc or 700V ac rms.
- Switched attenuation 1/200 and 1/20 dc to 15MHz bandwidth.
- Battery powered or external 6V dc power adapter.
- Fully shrouded 4mm connections with BNC to scope.

Individual Modules



Differential Voltage Probe 68-151

- Differential isolation probe.
- Probes output connects directly to an oscilloscope allowing safe conditions for monitoring & display.
- Requires 4x6V batteries AA size.
- Switched attenuation 1/200 & 1/20 dc to 15MHz bandwidth.
- Shrouded 4mm plugs for circuit connection with BNC connector to oscilloscope.
- Maximum input 1,000V dc 700V RMS.



dc Tachogenerator 68-430

- Fits to base of 63 and 64 series electrical machines.
- Provides dc output proportional to shaft speed.
- Output 2V dc/1,000 rev/min⁻¹.



Magnetic Pick-up 68-431

- Provides a single pulse train suitable for speed measurement.
- Attaches to motor base and shaft on 63 and 64 series electrical machines.
- Provides dc voltage or current output.
- Output 64 pulses/rev.
- Connects via 5 pin DIN 180° connector.
- For use with Contactor Panel 65-123.



ac/dc Electronic Wattmeter 68-200

- Selectable voltage and current ranges up to 1,000V 10A.
- Measurement up to 10kW.
- Ideally suited for use at frequencies of 20Hz to 20kHz.
- Multi-scaled analogue meter displays measured power value.
- Meters are to DIN standard 96 x 96mm.
- Supply requirement 230 or 120V ac 50/60Hz.
- Fuse protected current range.
- Overload indicators.



Torque and Speed Control 68-441

- Used with machines 63-110 or 67-500.
- Provides manual control of torque and speed.
- Constant torque and torque proportional with speed controls.
- Digital display for speed or torque.
- Can be used with 63-500 virtual instrumentation panel.
- Speed range $\pm 4,000$ rev/min.
- Torque range ± 3 Nm.
- Supply 220-250V ac 50Hz.



ac/dc Electrodynamic Wattmeter 68-204

- Selectable voltage and current ranges up to 500V 0.5A/1A.
- Measurement up to 500W.
- Ideally suited for use at mains supply frequencies of 50/60Hz and dc.
- Multi-scaled analogue meter displays measured power value.
- Meters are to DIN standard 96 x 96mm.
- Fuse protected current ranges.
- Safety earth connection provided.



Hand-held Digital Optical/Contact Tachometer 68-470

- Versatile measuring of shaft speed.
- Non-contact by photo sensing.
- Direct shaft contact through conical rubber drive.
- Measurement range 99,999 rev/min non-contact, 20,000 rev/min contact.

Individual Modules



Multi-channel I/O Unit 68-500 with I/O board and software

- Used with software to evaluate the behaviour of electrical systems.
- Software provides on-screen instrumentation of:
 - ac and dc Voltmeters and ammeters.
 - dc Wattmeter.
 - Single and Three phase Wattmeter.
 - Phase Meter
- Six isolated channels.
- 3 voltage and 3 isolated channels.
- Supply 230 or 120V ac 50/60Hz.



Shaft Couplings and Keys

Couples 63 & 64 series motors to motor/generator for multi-machine experiments.

- 68-703** 12mm shaft to 12mm shaft.
- 68-704** 12mm to $\frac{5}{16}$ inch.
- 68-705** $\frac{1}{2}$ inch to $\frac{5}{8}$ inch.



Standard set of Patch leads 68-800

For interconnections between panels and bench mounted equipment. Leads are fitted with 4mm stackable shrouded safety connectors made from double insulated cable. Thirty-three leads of various colours and lengths.



5 pin DIN-DIN lead 68-810

1M long, this lead is used to connect between the tachogenerator unit 68-430 or Magnetic Pick-up 68-431 to the appropriate control panel.



Lead Storage 91-245

The storage rack is designed to take the three lengths of patch lead used in the 68-800 lead set. Frame or wall mounting.



Dissectible Machines Storage System 90-100

The storage system holds all coils, leads and components for the Complete Dissectible Machines System 62-005. It has clearly identified positions for components for easy inventory control, with two extra bins for further storage.



System Frame 91-200

- Easy "lift-in/out" panel removal.
- Maximises bench space.
- Provides clear view of multi-panel experiments.
- Made from non-conductive fibre-glass reinforced resin loaded material.



Storage Bin 91-240

- Holds items associated with the PowerLab system.
- Can be used in either landscape or portrait format.



Oscilloscope/Computer Housing 91-210

- Suitable for conventional desktop computer and oscilloscope cases.
- Can be positioned anywhere in the A4 area of the frame.

Size:- W: 410mm, H: 200mm, D: 495mm.

Individual Modules



GDM-393A 3³/₄ digits

- 4,300 counts circulating record for MAX/ MIN AVG and normal.
- Capacitance, frequency measurement.
- Continuity beeper/diode test.
- High energy fused for 10A range.
- Auto-hold, relative and relative set.
- Temperature and inductance measurement.
- Auto power off.



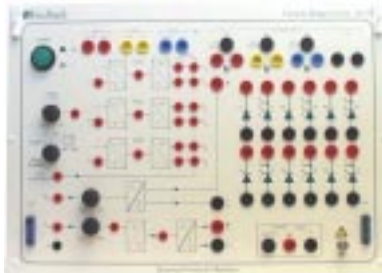
SCR and Diodes 70-100

The unit extends the use of the Firing and Bridge circuits panel by providing a second set of power diodes and thyristors. From these, a thyristor converter can be interconnected to form, with the Bridges panel, a dual converter, either Single or 3-Phase, to control power to a passive or active load such as a dc motor. The front panel mimic shows six diode and six thyristors together with voltage and current probes.

Supply requirements

- Three Phase five wire connection at the rear panel, L1, L2, L3, neutral and earth supplied via the Bridges panel from the Three Phase Supply 60-132.
- Operating voltage nominally 170V 50/60Hz Three Phase.

Power Electronic Modules

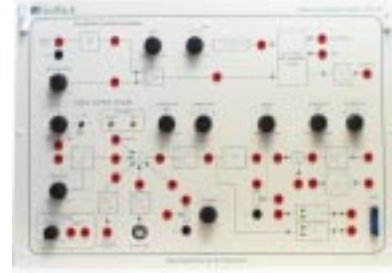


Firing and Bridge circuits 70-220

The Firing & Bridges panel contains the diode and thyristor devices required for Single and Three Phase uncontrolled and controlled rectification together with the firing circuits for the thyristors. The panel also contains the power supplies required for operating the firing circuits, and isolated voltage and current probes for use in waveform observation and control purposes.

The unit contains

- Front panel mimic diagram of circuits and devices.
- Six power diodes and six thyristors that can be connected into various circuit configurations with 4mm plug leads.
- Three individual firing pulse circuits that produce firing pulses for Single & Three Phase circuits; 1, 2, 4 & 6 pulse options.
- Firing pulse selector, 0-180° or 180° and 360° or overlap firing pulses can be selected.
- Reference voltage output control, 0-10V.
- Supply requirements - 120 or 240V ac and Three Phase output from the power supply unit 60-132.



Motor Control circuits 70-310

Designed to be used with Firing Circuits and Bridges panel, this unit provides the control circuits for motor control and zero crossing burst fire study. A mimic diagram depicts the available circuits for motor control. These can be interconnected to perform different control options. A second circuit is shown for burst fire control that is connected to the bridge circuits for study of ac power control. Monitor sockets are provided at various points on the circuit for a voltmeter or an oscilloscope to be used for measurement.

Burst fire circuit controls

- Set power level
- Error amplifier gain
- Pulse interval time control

Motor control circuit controls

- Reference voltage control 0-10V, ±10V or OFF by selector switch.
- Acceleration/deceleration time.
- Speed controller proportion gain.
- Speed controller Integral action time.
- Current controller proportional gain.
- Current controller Integral action time.
- Current limit variable control.
- Separate variable attenuator.

Ordering Information

60-105	Universal Power Supply	67-500	Swinging Field Dynamometer
60-121	Variable ac/dc Supply 5A	68-100	Electronic Single and Three Phase Measurements
60-132	Three Phase Supply (Power Electronics)	68-110	dc Voltmeter and Ammeter
61-106	Single Phase Transformer	68-111	ac Voltmeter and Ammeter
61-107	Three Phase Transformer	68-113	dc Milliammeter, Centre Zero
61-140-1	Three Phase Earth Leakage Breaker	68-116	ac/dc Voltmeter and Ammeter
61-400	Electromagnetic and Magnetic Principles	68-114	Moving Iron Voltmeter and Ammeter
62-100	Dissectible Machines Tutor	68-117	Rectifier Voltmeter and Ammeter
62-101	Dissectible Machines Storage Panel	68-120	Synchronising Lamps
62-102	Rotatable Brush Gear	68-121	ac Volt and Frequency Meter
63-100	Series Universal Motor	68-150	Voltage and Current Monitor
63-110	dc Shunt Machine	68-151	Differential Voltage Probe
63-120	dc Compound Wound Machine	68-200	ac/dc Electronic Wattmeter
63-500	dc Variable Speed Drive	68-204	ac/dc Electrodynamic Wattmeter 0.5/1A
64-110	Capacitor Start Single Phase Induction Run	68-430	dc Tachogenerator
64-501	3-Phase Induction Motor - Squirrel Cage, Dual Voltage	68-431	Magnetic Pick-up
64-510	3-Phase Synchronous Motor/ Generator - Wound Rotor	68-441	Torque and Speed Control Panel
65-123	Contactors Panel	68-470	Hand-held Digital Optical/Contact Tachometer
65-130	Control Switches	68-500	Multi-channel I/O Unit with I/O board & software
65-132	Control Pushbuttons	68-703	Shaft Coupling 12mm to 12mm and Key
65-133	Motor Switches	68-704	Shaft Coupling 12mm to $\frac{5}{8}$ inch and Key
66-110	Variable Frequency Drive	68-705	Shaft Coupling $\frac{1}{2}$ inch to $\frac{5}{8}$ inch and Key
66-120	dc Motor Speed Controller	68-800	Standard set of Patch leads
67-113	Variable Resistance 200W 3A	68-810	5 pin DIN-DIN lead
67-142	Switched 3-phase Resistance Load 230/380V	90-100	Dissectible Machines Storage System
67-190	Resistor/Capacitor Unit	91-200	System Frame
67-201	Switched Capacitive Load 50 μ F	91-210	Oscilloscope/Computer Housing
67-212	Switched 3-phase Capacitive Load 230/380V	91-240	Storage Bin
67-300	Inductive Load 700mH	91-245	Lead Storage
67-312	Switched 3-phase Inductive Load 230/380V	70-100	SCR and Diodes
67-450	Inertia Wheel	70-220	Firing and Bridge circuits
67-470	Friction (Prony) Brake	70-310	Motor Control circuits
		9999-01745	GDM-393A 3 $\frac{3}{4}$ digits

For further information on these and other equipment in the Feedback range please contact

 **Feedback**

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