

# ELECTRONICS



33502A  
Analog Electronics Lab Set Up  
(M00001 to M00012)



33501A  
Digital Electronics Lab Set Up  
(M00001, 00010, 00011, 00013 to 00017)



33517A  
Power Electronics Lab Set Up  
(M00001, 00010, 00011, M00018 to 31)



Exercises Book

[WWW.TESCAGLOBAL.COM](http://WWW.TESCAGLOBAL.COM)

Note: Specifications are subject to change.

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The course in Basic Analogue Electronics is an excellent introduction to electronics. The Laboratory Package consists of the Base Unit and five laboratory cards.

The Base Unit serves as a card holder and as a power supply with fuses for the laboratory cards. The Laboratory Package covers the basics in electronics, with special emphasis on the system method.

Laboratory card 4 is the most intricate and contains a power supply with which the student can learn the difference between component functions and to practice trouble shooting (fault finding), in order to get a better understanding of the system.

The educational package in Basic Analogue Electronics includes a Laboratory Exercise Book. Every effort has been put into the layout and teaching methods.

The course objectives are:

- To understand the function of the components, identify them and connect them in simple circuits.
- To complete fault finding and to be able to use the measurement exercises using Lab Card 5.
- To complete a construction set which, after completing successive stages results in a DC voltage unit.

### TOPICS COVERED

Basic Electronics covers the following topics using the M00002-M00006 as indicated in brackets:

- Identifying and measuring resistors (M00002) and capacitors (M00003)
- The diode (M00004)
- Full and half wave rectification (M00005)
- Filtering (M00005)
- Voltage stabilisation (M00005)
- The light emitting diode, LED (M00005)
- Transistor currents and voltages (M00006)
- Current amplification with transistors (M00005)
- The transistor as a regulating component (M00005)
- Current limitation (M00005)
- Fault detection (M00006)

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### BASE UNIT - Order Code - M00001



The Base Unit is used throughout the system M00001. The unit supplies different output voltages suitable for the different lab cards used in the system. The Lab Cards put in slots and are automatically powered via a D-sub connector. The base unit is accepted by CE standards.

### TECHNICAL SPECIFICATIONS

**Supply voltage** : 220 - 240V AC 50 - 60 Hz

The unit has 6 outputs with following data:

**Output 1 - 3** : DC 12 V / 3 A with LED indication and fuse

**Output 4 - 6**: AC 12 V / 3 A with LED indication and fuse

**Dimension**: 200 x 300 x 73mm

**Weight**: 4 kg Approx

### RESISTOR MODULE - Order Code - M00002



On Resistor Module there are 12 different hole mounted resistors, 2 potentiometers and 2 surface mounted (SMD) resistors.

With this card, measurement of components can be made, also recognition of values from the resistor code.

### TECHNICAL SPECIFICATIONS

**Dimension**: 190 x 110 mm

**Weight**: 1Kg Approx

### CAPACITOR MODULE - Order Code - M00003



On Capacitor Module there are 15 different hole mounted capacitors, 1 trimming capacitor and 4 surface mounted (SMD) capacitors.

With this card measurement of components can be made, recognition of different types of capacitor.

### TECHNICAL SPECIFICATIONS

**Dimension**: 190 X 110 mm

**Weight**: 1Kg Approx

### DIODE MODULE - Order Code - M00004



Diode Module is used for measurement and documentation of the characteristics of diodes. A variable resistor 100 ohm is required to complete the exercises.

### TECHNICAL SPECIFICATIONS

**Dimension**: 190 X 110 mm

**Weight**: 1Kg Approx

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**VOLTAGE REGULATOR MODULE - Order Code - M00005**

This is a stabilised DC voltage unit having different possibilities for connection. Measurement exercises include full and half wave rectifiers, zener diodes, light emitting diodes (LED's), transistors and electronic current limiters. There is also possibility to train in fault finding.

**TECHNICAL SPECIFICATIONS**

**Variable output voltage approx. :** 7-12V DC. 250 mA.

**Dimension:** 190 x 110 mm

**Weight:** 1Kg Approx



**TRANSISTOR MODULE - Order Code - M00006**

This card is used for measurement of the transistors current, voltage, power development, and function control.

**TECHNICAL SPECIFICATIONS**

**Dimension:** 190 X 110 mm



**STORAGE RACK 1 ROW**

**Order Code - M00010**

Storage rack for safe storage of the lab cards. It is constructed of hard plastic and very durable.

**Technical Data:**

**Dimension:** 150 x 250mm Approx

**Weight:** 1.4 kg Approx



**RHEOSTAT MODULE - Order Code - M00009**

The rheostat is enclosed in a robust metal case. The back, bottom and top of the case are perforated to provide optimum cooling.

Two glass fuses protect the resistor against excessive current and incorrect connection. A scale having 100 divisions indicates the resistance setting.

**TECHNICAL SPECIFICATIONS**

**Power:** 100W, **Resistance:** 100 Ohms,

**Max Current:** 1 A

**Dimension:** 000 x 000 x 000 mm



**DIGITAL CONNECTION BOARD - Order Code - M00007**

This breadboard is easily connected to 2 contact plugs. The board is suitable for projects where the student connects up circuits on this unit for testing.

**TECHNICAL SPECIFICATIONS**

**Dimension:** 190 x 110 mm

**Weight:** 1Kg Approx

Note: Specifications are subject to change.

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### POWER AMPLIFIER MODULE - Order Code - M00008

The topics covered by Lab Card Operational Amplifier, are the following exercises and experiments:

- Operational Amplifier
- Voltage Follower
- Comparator
- Inverting Amplifier
- Non Inverting Amplifier
- Inverting Adder
- Non Inverting Adder
- Different Amplifiers

#### Technical data:

**Dimension:** 190 X 110 mm **Weight:** 0.2 kg



### LAB FLEX SET SHROUDED PATCH CORDS

#### Order Code - M00011

Set of 100 leads in 5 different colours, red, yellow, blue and yellow/green. 5 each of 4 different lengths, 25, 50, 100 and 200 cm.

Area: 1.5 mm<sup>2</sup>

The pin is protected by a plastic sleeve when the flex is not connected. The plastic sleeve is pushed in to the flex when the plug is connected to the equipment.



### MANUAL FOR 33502A - Order Code - M00012

Contents:

- Identification & measurement of resistors
- Identification & measurement of capacitors
- The diode
- Half wave rectifiers
- Filtering
- Full wave rectifiers
- Voltage stabilising with a Zener diode
- Light emitting diode (LED)
- Transistor, current and voltage amplification
- Current amplification with transistor
- Transistor as a regulator component
- Current limiters
- Function test

### OPTIONAL ACCESSORIES



### DIGITAL OSCILLOSCOPE - Order Code - DSO-1102

Digital Storage Oscilloscope 100MHz, 2 CH, Coloured LCD 7, 1GS/s, USB+Software



### DIGITAL MULTIMETER - Order Code - 17702C

AC Current - 20A  
AC Voltage - 750V  
DC Current - 20A  
DC Voltage - 1000V

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<b>ORDER DETAILS ANALOG ELECTRONICS LAB</b>			
<b>Item</b>	<b>Description</b>	<b>Pcs</b>	<b>Page</b>
M00001	Base Unit	1	4
M00002	Resistor Module	1	4
M00003	Capacitors Module	1	4
M00004	Diodes Module	1	4
M00005	Voltage Regulator Module	1	5
M00006	Transistors Module	1	5
M00010	Storage Rack 1 row	1	5
M00009	Rheostat	1	5
M00007	Connection Board (Bread Board)	1	5
M00008	Power Amplifier Module	1	6
M00011	Lab Flex Set Shrouded Patch Cords	1	6
M00012	Manual for 33502A	1	6
<b>Optional</b>			
DSO-1102	Digital Oscilloscope	1	6
17702C	Digital Multimeter - Professional	2	6

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**Digital Electronics** - Basic deals with the basic logical elements, number system, combination circuits and switches. The practical exercises are carried out on the connection board and on a completed printed circuit board connected as a house alarm. Fault finding is also possible with the house alarm.

### TOPICS COVERED

Digital Electronics-Basic covers:

- ❖ The transistor as a switch
- ❖ The AND, OR, NOT, NAND, and NOR gates
- ❖ Logic families (S24), different types of outputs
- ❖ NAND synthesis
- ❖ Combinatory circuits
- ❖ XOR AND XNOR
- ❖ The comparator
- ❖ Decoder
- ❖ BCD Decoder and BCD to 7 segment decoder
- ❖ The demultiplexer
- ❖ Encoder
- ❖ The multiplexer
- ❖ The Schmitt trigger
- ❖ Astable multivibrator (6) and monostable multivibrator
- ❖ The 555
- ❖ Bistable multivibrator
- ❖ D-multivibrator
- ❖ JK and T-multivibrator
- ❖ Registers
- ❖ Counters
- ❖ Fault detection



### BASE UNIT - Order Code - M00001

The Base Unit is used throughout the system M00001. The unit supplies different output voltages suitable for the different lab cards used in the system. The Lab Cards put in slots and are automatically powered via a D-sub connector.

The base unit is accepted by CE standards.

### TECHNICAL SPECIFICATIONS

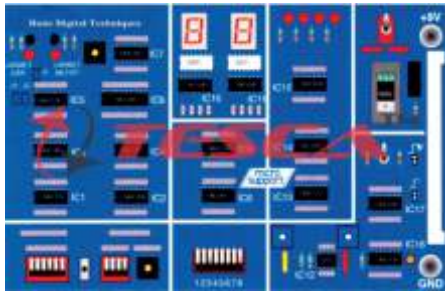
**Supply voltage :** 220-240V AC 50-60 Hz  
The unit has 6 outputs with following data:  
**Output 1 - 3 :** DC 12 V / 3 A with LED indication and fuse  
**Output 4 - 6:** AC 12 V / 3 A with LED indication and fuse  
**Dimension:** 200 x 300 x 73mm  
**Weight:** 4 kg Approx

Note: Specifications are subject to change.

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**HOUSE ALARM MODULE - Order Code - M00013**

Contains all the functions of a house alarm. The functions of an alarm system are learned step by step so making fault finding more easy to understand. Altogether 8 faults can be simulated. The alarm connections are built around normal digital components, e.g. logic gates, comparators, shift registers, counters, different types of switches and decoders. The lab card is connected to the Base Unit.

**TECHNICAL SPECIFICATIONS**

**Dimension:** 190 x 110 mm

**Weight:** 1Kg Approx



**COMPONENT SET - Order Code - M00014**

The component set is delivered in a hard plastic box with ESD protection

**TECHNICAL SPECIFICATIONS**

**Digital IC :** 25      **Trim potentiometers :** 2

**Diodes :** 2      **Resistors :** 13

**Transistors :** 2      **Capacitors :** 4

**Dimension :** 190 x 110 mm

**Weight :** 1 kg Approx



**DIGITAL PCB - Order Code - M00015**

Digital PCB is a printed circuit board with similar functions as the S24 above. The lab card is connected to the Base Unit and is ordered separately.

**TECHNICAL SPECIFICATIONS**

**Dimension:** 190 X 110 mm

**Weight:** 1 Kg Approx



**DIGITAL CONNECTION BOARD - Order Code - M00016**

This breadboard is easily connected to 2 contact plugs. The board is suitable for projects where the student connects up circuits on this unit for testing.

Connection leads 4mm sockets: 4

Connection lead BNC contact: 1

**TECHNICAL SPECIFICATIONS**

**Voltage Outputs:** (+5V, +12V, and -12V)

**Dimension:** 190 X 110 mm

**Weight:** 1 Kg Approx



**LAB FLEX SET SHROUDED PATCH CORDS**

**Order Code - M00011**

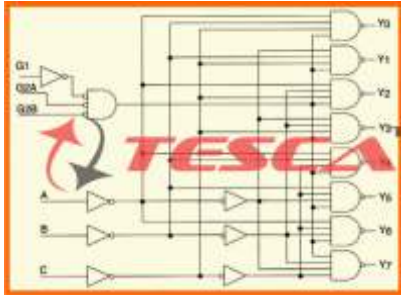
Set of 100 leads in 5 different colours, red, yellow, blue and yellow/ green. 5 each of 4 different lengths, 25, 50, 100 and 200 cm. Area: 1.5 mm<sup>2</sup>

The pin is protected by a plastic sleeve when the flex is not connected. The plastic sleeve is pushed in to the flex when the plug is connected to the equipment.

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**MANUAL FOR 33502A - Order Code - M00017**

In the diagram below G1 is used as a data input where G2A=G2B=L. How should A,B and C be set if the data at G1 shall be sent out on the lead connected to Y5?

As can be seen in the diagram, an extra function has been added, LED that will indicate when the alarm is active. The LED has a self blinking action built into the circuit.



If the Base Unit is used, the lab-card shall be inserted into the contact plinth where it will receive the correct voltage supply.

- On the lab-card, measurements will be made on an alarm system constructed from digital circuits. First an easy alarm function and then additional functions as each circuit has been understood.
- Start by inserting the circuit 74HCT08 in the socket marked IC2 on lab card 6. If another card is already there, remove it temporarily.
- Remove the jumpers between sockets 1 and 2 at J3, with IC1 and IC2 as shown in diagram.
- All connections are made on the card.



**STORAGE RACK 1 ROW  
Order Code - M00010**

Storage rack for safe storage of the lab cards. It is constructed of hard plastic and very durable.

**Technical Data:**

Dimension: 150 x 250mm Approx  
Weight: 1.4 kg Approx

**OPTIONAL ACCESSORIES**



**DIGITAL OSCILLOSCOPE  
Order Code - DSO-1102**

Digital Storage Oscilloscope 100MHz, 2 CH, Coloured LCD 7, 1GS/s, USB+Software

ORDER DETAILS DIGITAL ELECTRONICS			
Item	Description	Pcs	Page
M00001	Base Unit	1	8
M00013	House Alarm	1	9
M00014	Component Set	1	9
M00015	Digital PCB	1	9
M00016	Digital Connection Board	1	9
M00011	Lab Flex Set Shrouded Patch Cords	1	9
M00017	Manual for 33501A	1	10
M00010	Storage Rack 1 row	1	10
<b>Optional</b>			
DSO-1102	Digital Oscilloscope	1	10

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Power Electronics is a very important field within the industry worldwide.

It is of utmost importance that students in the engineering branch have access to good laboratory equipment.

Within Power Electronics, Tesco has a complete set of educational equipment, covering different components e.g. diode, thyristor, triac, diac, different transistors, amplifiers, etc., up to advanced AC- and DC drives.

Beyond the Basic Power Electronics Programme we present a package for traditional "Motor Control" covering Contactor Control, AC- and DC Converters, which also can be controlled by PLC.  
Se Catalog: Basic Electricity and motor control

Besides our Power Electronics we have more advanced AC- and DC drives complete with motors, generators, loads etc.  
Se Catalog: Basic Electrical Machine Laboratory

#### **BASE UNIT - Order Code - M00001**

The Base Unit is used throughout the system M00001. The unit supplies different output voltages suitable for the different lab cards used in the system. The Lab Cards put in slots and are automatically powered via a D-sub connector. The base unit is accepted by CE standards.



#### **TECHNICAL SPECIFICATIONS**

Supply voltage : 220 - 240V AC 50 - 60 Hz  
The unit has 6 outputs with following data:  
Output 1 - 3 : DC 12 V / 3 A with LED indication and fuse  
Output 4 - 6: AC 12 V / 3 A with LED indication and fuse  
Dimension: 200 x 300 x 73mm  
Weight: 4 kg Approx

Note: Specifications are subject to change.

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**HELP FUNCTION MODULE - Order Code - M00018**

The Help Function Card, serves as additional power supply and function generator. The Kit slots into the Base Unit, and the power regulator to 6 slots into this kit.



**Technical data:**

**DC Output 1:** 0 - +15 V, (5 V/1.6 A 10V/1.0 A 15 V/0,1 A)

**DC Output 2:** 0 - -15 V, (5 V/1.6 A 10V/1.0 A 15 V/0,1 A)

**Sinus wave:** 1Hz to 10 kHz in 4 steps

**Square wave:** 1Hz to 10 kHz in 4 steps

**Amplitude:** 0-15 V / 8 Watt

**Dimension:** 190 X 110 mm

**Weight:** 1 Kg Approx

**POWER REGULATOR MODULE - Order Code - M00019**

The topics covered by M00019 Power Regulator, are the following exercises and experiments:

- Rectification, half bridge and full bridge
- Ripple Smoothing
- Voltage Stabilising with Zener Diode and IC
- Thyristor parameters
- Triac and Diac regulation with a lamp



**Technical data:**

**Dimension:** 190 X 110 mm,

**Weight:** 1 Kg Approx

**TRANSISTOR MODULE - Order Code - M00020**

The topics covered by M00020 Transistors, are the following exercises and experiments:

- Power Transistors
- Bipolar Transistor
- MOSFET
- MOSFET Bridge
- IGBT
- Filters



**Technical data:**

**Output P1:** DC 0 – 24 V

**Output P2:** PWM Amplitude 24 V / Modulation 0 – 95% Powered from Base Unit 2000 via connector.

**Dimension:** 190 x 110 mm,

**Weight:** 1 Kg Approx

**OPERATIONAL AMPLIFIER - Order Code - M00021**

The topics covered by Lab Card Operational Amplifier, are the following exercises and experiments:

- Operational Amplifier
- Voltage Follower
- Comparator
- Inverting Amplifier
- Non Inverting Amplifier
- Inverting Adder
- Non Inverting Adder
- Different Amplifiers



**Technical data:**

**Dimension:** 190 X 110 mm

**Weight:** 1 Kg Approx

Note: Specifications are subject to change.

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### STATIC CONVERTER - Order Code - M00022

The topics covered by M00022 Static Converter, are the following exercises and experiments:

- Current Converter
- DC Motor Drive
- Opto Switch
- Fault finding
- Speed Control

Lab Card IK 4 will also be used together with the DC-Motor



#### Technical data:

- 4 mm panel sockets
- Powered from Base Unit via connector
- Size: 190 x 110 mm
- Weight: 1 kg Approx

### AD/DA CONVERTER - Order Code - M00023

The topics covered by Lab AD/DA Converter, are the following exercises and experiments.

- Resolution 8 bits
- AD/DA Converter Reference Voltage 5 V

#### Technical data:

- 4 mm panel sockets
- Powered from Base Unit via connector
- Size: 190 x 110 mm
- Weight: 1 kg Approx



### COMPONENT SET - Order Code - M00024

This Load Module consists of potentiometer, resistors, inductor and lamp holder with four lamps.

#### Technical data:

**Dimension:** 220 x 140 mm  
**Weight:** 1 kg Approx



### DC MOTOR - Order Code - M00025

DC-Motor with tachometer generator and rpm meter. The motor can be connected to Converter.

This DC-motor shall be slot into the Base Unit when doing experiments together with the Static Converter (DC-motor Drive). For these experiments two Base Units are needed.

#### Technical data:

**DC-Motor:** 24V / 10 W  
**Dimension:** 190 X 110 mm  
**Weight:** 1 kg Approx



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### FREQUENCY CONVERTER - Order Code - M00026

Lab Card Frequency Converter is a single phase frequency converter, to be used together with the AC-Motor.

It covers the following exercises and experiments.

- Frequency speed control of an AC-Motor
- Regulation
- Distortion
- Fault finding

#### Technical data:

**Output Voltage** : 12 V, 2 A,

**Adjustable** : 10 – 90 Hz

**Dimension**: 190 X 110 mm,

**Weight**: 0.2 kg



### AC MOTOR - Order Code - M00027

AC-Motor with tachometer generator and rpm meter. The motor can be connected to Frequency generator.

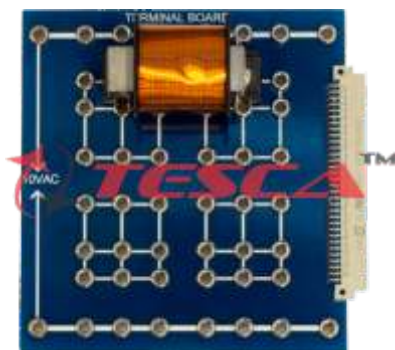
This AC-motor shall be slot into the Base Unit when doing experiments together with the Frequency Converter (AC-motor Drive). For these experiments two Base Units are needed.

#### Technical data:

**AC Motor**: 12V / 10W

**Dimension**: 190 X 110 mm

**Weight**: 0.2 kg



### TERMINAL BOARD - Order Code - M00028

Used as coupling table for component connections and for calculating impedance (coil).

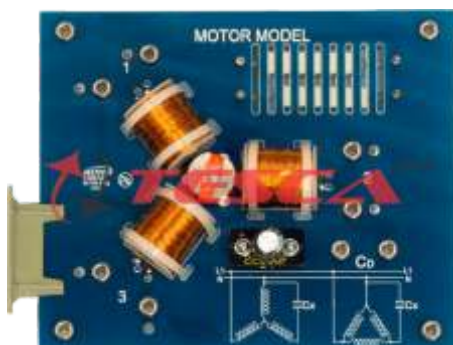
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#### Technical data:

**panel socket** : 4mm

**Dimension**: 220 x 140 mm

**Weight**: 0.4 kg



### MOTOR MODEL - Order Code - M00029

Used as control model together with AC Motor module Frequency Converter.

#### Technical data:

**panel socket** : 4mm

**Dimension**: 220 x 140 mm

**Weight**: 0.4 kg

Note: Specifications are subject to change.

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**STORAGE RACK 2 ROW**  
**Order Code - M00030**

The storage rack will protect the Lab Card against electrical and mechanical damage.

**Technical Data:**

Dimension: 300 x 250mm Approx  
Weight: 2 kg Approx



**LAB FLEX SET SHROUDED PATCH CORDS**  
**Order Code - M00011**

Set of 100 leads in 5 different colours, red, yellow, blue and yellow/ green. 5 each of 4 different lengths, 25, 50, 100 and 200 cm.

Area: 1.5 mm<sup>2</sup>

The pin is protected by a plastic sleeve when the flex is not connected. The plastic sleeve is pushed in to the flex when the plug is connected to the equipment.



**STORAGE RACK 1 ROW**  
**Order Code - M00010**

Storage rack for safe storage of the lab cards. It is constructed of hard plastic and very durable.

**Technical Data:**

Dimension: 150 x 250mm Approx  
Weight: 1.4 kg Approx

**MANUAL POWER ELECTRONICS, LABORATORY EXERCISES**

**Contents:**

- Rectifications
- Smoothing
- Voltage Stabilising
- Thyristors
- Triac and Diac
- Transistors
- Filters
- Opto Switches
- Operation Amplifiers
- Static Current Converter
- AD/DA Transducers
- Measuring Semiconductors with a Digital Multimeter
- Measuring Components with an Oscilloscope
- Trouble shooting



Measuring experiments may be performed with a voltage lower than 50V when using equipment specified in this brochure. The fault searching training is done with help of the laboration card.

**After the course the student should be able to:**

- Measure voltage and signals to and from circuit boards as applied in industrial- and/or power electronic systems.
- Interpret and use connection diagrams as they occur in electronic systems within production.
- Explain the principles of rectification, filtering and stabilization and perform simple trouble shooting in a power supply.
- Describe operation amplifiers and thyristor functions and their use in different industrial applications.
- Measure Semi-conductors with a Digital Multimeter.
- Measure Components with an Oscilloscope.

Note: Specifications are subject to change.

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**OPTIONAL ACCESSORIES**



**DIGITAL OSCILLOSCOPE - Order Code - DSO-1102**

Digital Storage Oscilloscope 100MHz, 2 CH, Coloured LCD 7, 1GS/s, USB+Software



**DIGITAL MULTIMETER  
Order Code - 17702C**

AC Current - 20A  
AC Voltage - 750V  
DC Current - 20A  
DC Voltage - 1000V



**DIGITAL CLAMP METER  
Order Code - 17706C**

Digital Clampmeters / Tongtesters  
(DC / AC / TRMS) : 3 ¾ Digit  
Count : 6000  
DC Current : 2000A  
AC Current : 2000A



**DIGITAL MULTIMETER  
Order Code - 17701C**

AC Current - 10A  
AC Voltage - 750V  
DC Current - 10A  
DC Voltage - 1000V



**ANALOG MULTIMETER - Order Code - AM-890**

Special Functions: Dry battery test, continuity buzzer test, decibel, diode test, transistor hFE test Widely used for measuring voltage, current and electrical resistance  
ACV Test Range: 10-50-250-1000V

Note: Specifications are subject to change.

**Tesca Technologies Pvt. Ltd.**

IT-2013, Ramchandrapura Industrial Area, Sitapura Extension,  
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ORDER DETAILS POWER ELECTRONICS			
Item	Description	Pcs	Page
M00001	Base Unit	2	11
M00018	Help Function Card	1	12
M00019	Power Regulator	1	12
M00020	Transistor	1	12
M00021	Operational Amplifier	1	12
M00022	Static Converter	1	13
M00023	AD/DA Converter	1	13
M00024	Component Set	1	13
M00025	DC-Motor	1	13
M00026	Frequency Converter	1	14
M00027	AC-Motor	1	14
M00028	Terminal Board	1	14
M00029	Motor Model	1	14
M00030	Storage Rack 2 row	1	15
M00011	Lab Flex Set Shrouded Patch Cords	1	15
M00010	Storage Rack 1 row	1	15
M00031	Manual Basic Power Electronics, Laboratory Exercises 3517A	1	15
<b>Optional</b>			
DSO-1102	Digital Oscilloscope	1	16
17702C	Digital Multimeters - Professional	1	16
17701C	Digital Multimeter - Plam	1	16
AM-890	Analogue Multimeter	1	16
17706C	Digital Clampmeters / Tongtesters (DC / AC / TRMS)	1	16

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