INTRODUCTION:

In ac circuits the triac can be turned on at any angle α with respect to the applied voltage polarity. The angle α is often called the firing angle. Power controlled by this manner is called full power control. The trial is turned off when current passed through it becomes zero during crossover point of the input cycle. After the SCR the TRIAL is the most widely used device in power control circuits. A trial is similar to two SCRs back to back connected. So as the power through a load is controlled in SCR's circuits by controlling the firing angle, in similar way Trial power controlling is performed. The controlling of firing angle is often called the phase control. There are three basic methods employed in which the R - C, phase shift is in common practice. In phase shift method the firing pulse is delayed by R - C circuit .

Features:

Triac	: One (400V/2A)
AC supply	: Isolated 1:1 @0.5A
Firing circuit	: DIAC , RC with two potentiometer
Load	: Lamp or small fan (optional)
Test points	: Necessary for observations.
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

To study AC phase control using (DIAC) TRIAC

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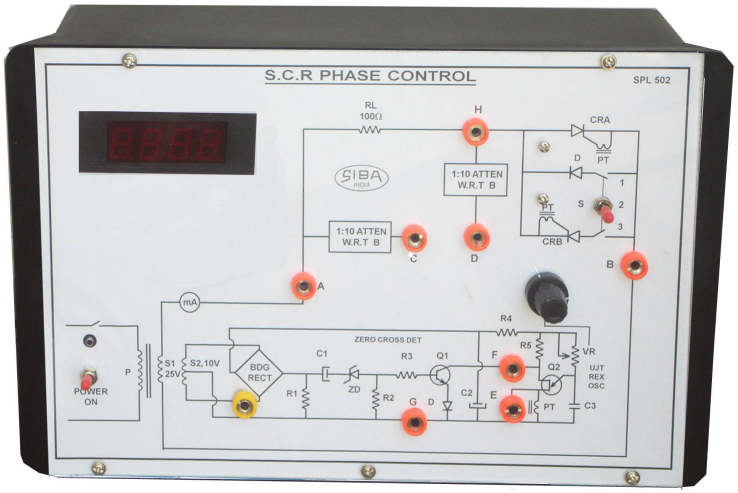
SPL 502
S.C.R. PHASE CONTROL

INTRODUCTION:

The basic function of phase control is to convert an input (ac) voltage to a controllable output (ac/dc) voltage. The basic principle of phase control is to control the point in time at which the thyristors (SCR/TRIAC) are allowed to conduct during each half cycle. In such circuits the thyristors can be turned on at any angle α, with respect to the applied voltage polarity. The angle α, is oftenly called the firing angle. Power controlled by this manner is called half phase control. If another SCR is connected in parallel with the other in such way that both conducts on their respective half cycles then it is called full phase control. The turn off of thyristors is line commutated (at zero cross of input). Zero point switching is highly desirable in many applications because it does not generate EM interference. Another good reason is no wastage of power and modulation (synchronism) of control signal with the input mains cycle.



Features:

S.C.R.	: Two (600V/4A)
Diode	: One(1KV/1A)
AC supply	: 25V AC,10V AC for trigger circuit
Meter	: One for measuring load current.
Load	: Fix value Resistance
Test points	: Necessary for observations on CRO
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

To study S.C.R. phase control circuit.

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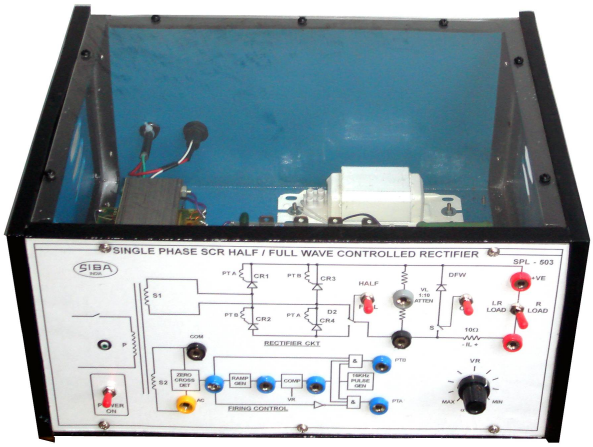
SPL 503

SINGLE PHASE SCR HALF/FULL WAVE FULLY CONTROLLED RECTIFIER

INTRODUCTION:

In ac circuits the phase controlled rectifier can be turned on at any angle a with respect to the applied voltage polarity. The angle a is oftenly called the firing angle. These circuits are characterized as controlled rectifiers or converters. In present model study of such controlled rectifier in bridge configuration is performed. The prime aim of firing circuit to produce trigger pulses to the thyristors at different firing angles. For symmetrical trigger the firing pulse generation must be line synchronized, and thyristors must be trigger at same firing angle in both halves. It is achieved by zero cross detector .



Features:

S.C.R.	: Four(600V/12A)
Switch	: One to select half OR full wave controlled rectifier.
Trigger circuit	: Digital, Ramp/Comparator (α 0-180^0**)**
Freewheeling Diode	: One through switch select
Pulse transformer	: Two (1:1):1
Resistive load	: Wire wound (80W)
Inductive load	: Fixed Inductance (0.3H,0.5A)
AC Supply	: Fixed AC supply (90V)
Trigger supply	: AC 10-0-10V
Cabinet	: Transparent top
Test Points	: Separate for waveforms of trigger and rectifier circuit.
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 325x260x160mm(approx).

EXPERIMENT COVERED

Study single phase half wave fully controlled rectifier output with resistive & inductive load.
Study single phase full wave fully controlled bridge rectifier output with resistive & inductive load.
Study effect of free wheeling diode with inductive load.

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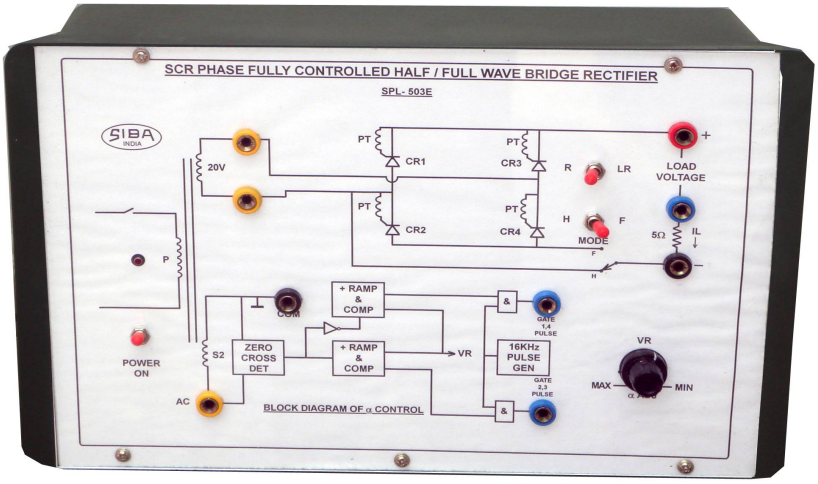
SPL 503E

SINGLE PHASE SCR HALF/FULL WAVE FULLY CONTROLLED RECTIFIER

INTRODUCTION:

In ac circuits the phase controlled rectifier can be turned on at any angle a with respect to the applied voltage polarity. The angle a is oftenly called the firing angle. These circuits are characterized as controlled rectifiers or converters. In present model study of such controlled rectifier in bridge configuration is performed.The prime aim of firing circuit to produce trigger pulses to the thyristors at different firing angles. For symmetrical trigger the firing pulse generation must be line synchronized, and thyristors must be trigger at same firing angle in both halves. It is achieved by zero cross detector .



Features:

S.C.R.	: Four
Switch	: One to select half OR full wave controlled rectifier.
Trigger circuit	: Digital, Ramp/Comparator (α 0-180^0)
Freewheeling Diode	: One through switch select
Pulse transformer	: Two (1:1):1
Resistive load	: Wire wound
Inductive load	: Fixed Inductance
AC Supply	: Fixed AC supply
Trigger supply	: AC 10-0-10V
Test Points	: Separate for waveforms of gate and rectifier circuit.
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 320x160x75mm(approx).

EXPERIMENT COVERED

Study single phase half wave fully controlled rectifier output with resistive & inductive load.
Study single phase full wave fully controlled bridge rectifier output with resistive & inductive load.
Study effect of free wheeling diode with inductive load.

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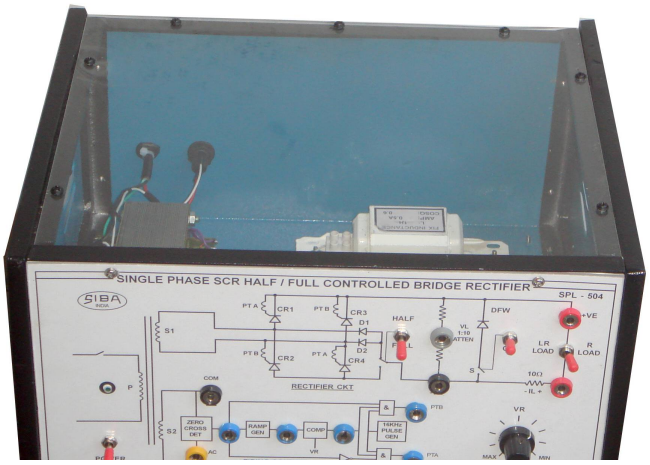
SPL 504
SINGLE PHASE SCR HALF/FULL CONTROLLED BRIDGE RECTIFIER

INTRODUCTION:

In ac circuits the phase controlled rectifier can be turned on at any angle a with respect to the applied voltage polarity. The angle a is oftenly called the firing angle. These circuits are characterized as controlled rectifiers or converters. In present model study of such controlled rectifier in bridge configuration is performed. The prime aim of firing circuit to produce trigger pulses to the thyristors at different firing angles. For symmetrical trigger the firing pulse generation must be line synchronized, and thyristors must be trigger at same firing angle in both halves. It is achieved by zero cross detector .



Features:

S.C.R.	: Four(600V/12A)
Diodes	: Two(400V/4A)
Switch	: One to select half OR full controlled bridge rectifier.
Trigger circuit	: Digital, ramp/comparator **(**α 0-180^0**)**
Freewheeling Diode	: One through switch select
Pulse transformer	: Two (1:1):1
Resistive load	: Wire wound (80W)
Inductive load	: Fixed Inductance (0.3H,0.5A)
AC Supply	: Fixed AC supply (90V)
Trigger supply	: AC 10-0-10V
Cabinet	: Transparent top
Test Points	: Separate for waveforms of trigger and rectifier circuit.
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 325x260x160mm(approx).

EXPERIMENT COVERED

Study single phase half bridge fully controlled rectifier output with resistive & inductive load.
Study single phase full bridge fully controlled rectifier output with resistive & inductive load.
Study effect of free wheeling diode with inductive load.

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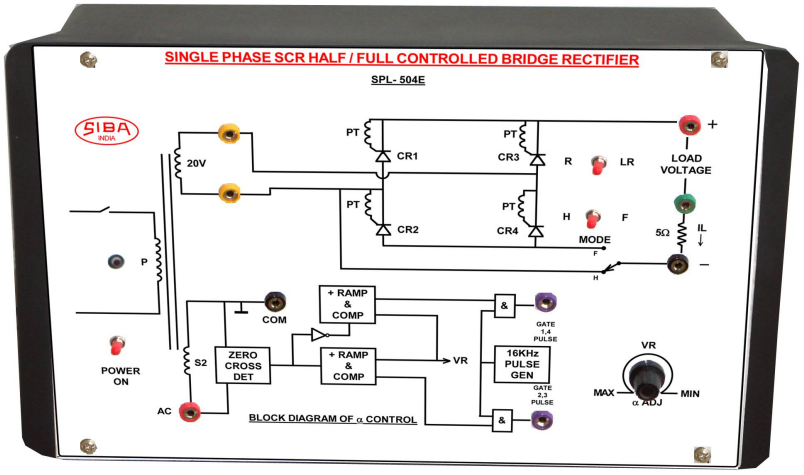
SPL 504E

SINGLE PHASE SCR HALF/FULL CONTROLLED BRIDGE RECTIFIER

INTRODUCTION:

In ac circuits the phase controlled rectifier can be turned on at any angle a with respect to the applied voltage polarity. The angle a is oftenly called the firing angle. These circuits are characterized as controlled rectifiers or converters. In present model study of such controlled rectifier in bridge configuration is performed.The prime aim of firing circuit to produce trigger pulses to the thyristors at different firing angles. For symmetrical trigger the firing pulse generation must be line synchronized, and thyristors must be trigger at same firing angle in both halves. It is achieved by zero cross detector .



Features:

S.C.R.	: Four
Diodes	: Two
Switch	: One to select half OR full controlled bridge rectifier.
Trigger circuit	: Digital, ramp/comparator **(**α 0-180^0**)**
Freewheeling Diode	: One through switch select
Pulse transformer	: Two (1:1):1
Resistive load	: Wire wound
Inductive load	: Fixed Inductance
AC Supply	: Fixed AC supply
Trigger supply	: AC 10-0-10V
Test Points	: Separate for waveforms of gate and rectifier circuit.
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

Study single phase half controlled bridge rectifier.
Study single phase full controlled bridge rectifier

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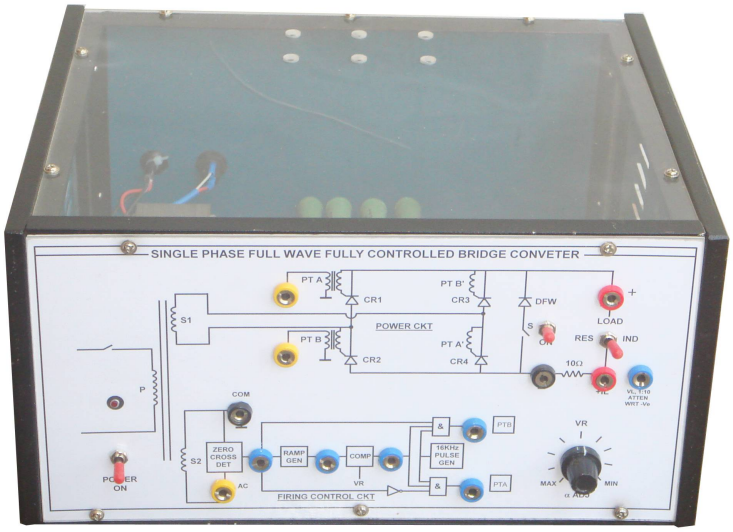
SPL 505
SINGLE PHASE SCR HALF/FULL CONTROLLED BRIDGE CONVERTER

INTRODUCTION:

In ac circuits the phase controlled rectifier can be turned on at any angle a with respect to the applied voltage polarity. The angle a is oftenly called the firing angle. These circuits are characterized as controlled rectifiers or converters. In present model study of such controlled rectifier in bridge configuration is performed. The prime aim of firing circuit to produce trigger pulses to the thyristors at different firing angles. For symmetrical trigger the firing pulse generation must be line synchronized, and thyristors must be trigger at same firing angle in both halves. It is achieved by zero cross detector .



Features:

S.C.R.	: Four(600V/12A)
Switch	: One to select half OR full controlled bridge converter.
Trigger circuit	: Digital, Ramp/Comparator **(**α 0-180^{o}**)**
Pulse transformer	: Two (1:1):1
Resistive load	: Wire wound (80W)
Inductive load	: Fixed Inductance (0.3H,0.5A)
AC Supply	: Fixed AC supply (90V)
Trigger supply	: AC 10-0-10V
Cabinet	: Transparent top
Test Points	: Separate for waveforms of trigger and rectifier circuit.
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 325x260x160mm(approx).

EXPERIMENT COVERED

Study single phase half bridge fully controlled converter output with resistive & inductive load.
Study single phase full bridge fully controlled converter output with resistive & inductive load.
Study effect of free wheeling diode with inductive load.

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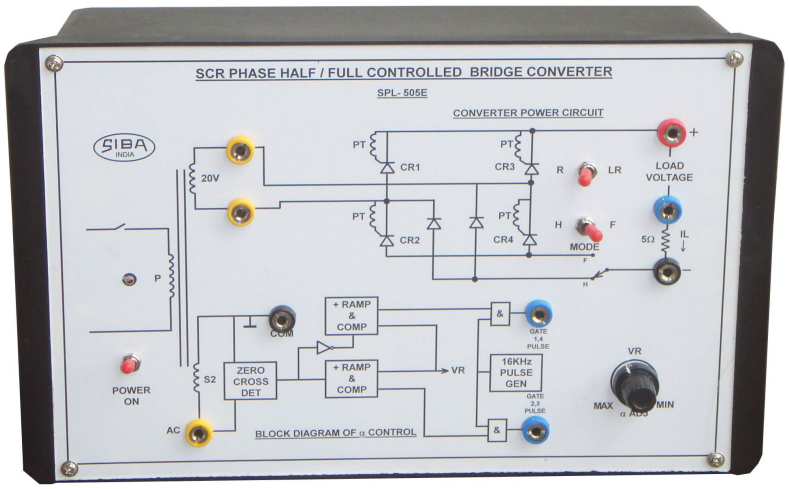
SPL 505E

SINGLE PHASE SCR HALF/FULL CONTROLLED BRIDGE CONVERTER

INTRODUCTION:

In ac circuits the phase controlled rectifier can be turned on at any angle a with respect to the applied voltage polarity. The angle a is oftenly called the firing angle. These circuits are characterized as controlled rectifiers or converters. In present model study of such controlled rectifier in bridge configuration is performed. The prime aim of firing circuit to produce trigger pulses to the thyristors at different firing angles. For symmetrical trigger the firing pulse generation must be line synchronized, and thyristors must be trigger at same firing angle in both halves. It is achieved by zero cross detector .



Features:

S.C.R.	: Four
Switch	: One to select half OR full controlled bridge converter.
Trigger circuit	: Digital,ramp/comparator
Pulse transformer	: Two (1:1):1
Resistive load	: Wire wound
Inductive load	: Fixed Inductance
AC Supply	: Fixed AC supply
Trigger supply	: AC 10-0-10V
Test Points	: Separate for waveforms of gate and rectifier circuit
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 310x210x80mm(approx).

EXPERIMENT COVERED

Study single phase half controlled bridge converter.
Study single phase full controlled bridge converter.

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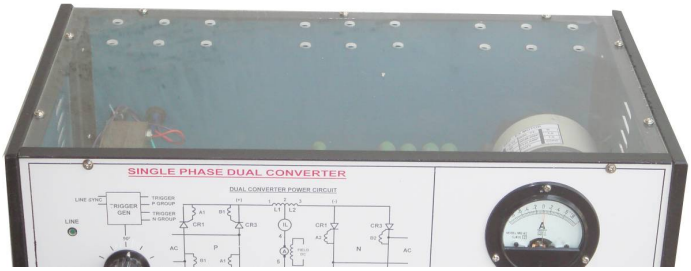
SPL 506
SINGLE PHASE DUAL CONVERTER

INTRODUCTION:

This unit is given to study of single phase dual converter operation. It has inbuilt step down transformers for converters, step down transformer for synchronization, current limiting reactor, two fully controlled bridge converters with output cut - off switches and a small saparately excited dc motor as load. The unit operates on 220Vac. A clear acrylic top is fitted to look the components. The fully controlled converter can produce a direct (& reversible upon large active loads) voltage with direct current in one direction, is said to be operate in two quadrants. The dual converter allows operation in four quadrants, by rectification and inversion.



Features:

S.C.R.	: Eight(600V/12A)
Trigger circuit	: Ramp/comparator ($\alpha_1+\alpha_2 = 180^0$)
Pulse transformer	: 4 nos. (1:1:1)
Inductive load	: Fractional H.P.(60W) DC shunt wound motor or fixed inductance
AC Supply	: Fixed AC supply
Separate DC	: Fixed supply(Field)
Trigger supply	: AC 10-0-10V
Mode	: To run motor in I & III quadrant non-circulating & circulating mode
Ammeter	: One center zero
Cabinet	: Transparent top
Test Points	: Separate for waveforms of gate trigger and power circuit
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 460x260x160mm(approx).

EXPERIMENT COVERED

Study single phase dual converter in circulating mode

To verify $\alpha_1 + \alpha_2 = 180^0$

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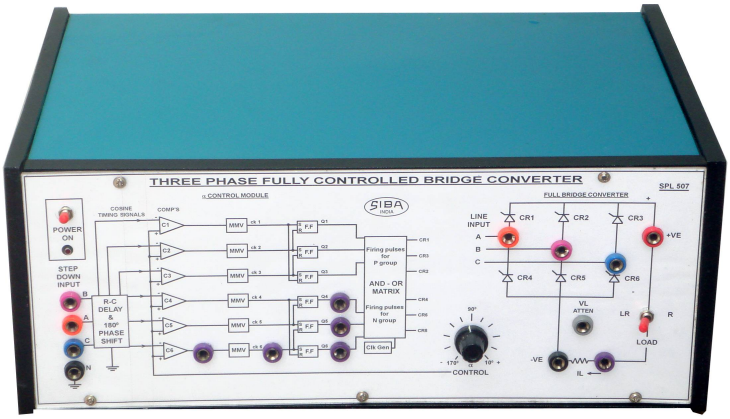
SPL 507
THREE PHASE HALF CONTROLLED BRIDGE CONVERTER/RECTIFIER

INTRODUCTION:

The kit is designed to study three phase full wave fully controlled bridge converter output characteristics. The kit consists isolated three transformers 230 : 120 Vac, 1 amp prewired for star - delta formation, firing angle control circuit having three synchronisation transformers with six 400Vac/6A S.C.R. wired in 3 phase full wave bridge converter configuration. One small time constant inductance added as LR load, and lamp (100W) as resistive load. Sockets are provided at different places to observe the waveform. This type of converter is extensively used in industrial applications. The converter is also called as *three pulse conveter*, since the pulsation in the output voltage is six times the input frequency. The thyristors CR1 to CR6 conducts alternately with each phasor apart 600. Hence in a cycle equal to 2π, the output contains 6 (pulses) ripples which means the output has low harmonics.



Features:

S.C.R.	: Three (400V/6A)
Diodes	: Three (400V/4A)
Firing Angle	: Inverse Cosine(120°)
Trigger circuit	: Digital, Ramp/Comparator
Pulse transformer	: Three (1:1)
Resistive load	: 120W
Inductive load	: Fixed Inductance (0.5H,0.5A)
Switch	: One to select load, Resistive OR Inductive
Relay	: Triple contact relay to connect bridge with line
Input(Isolated)	: Via three step down transformers in star/delta formation(110V line)
Synchronization	: Via three step down transformers (5V each)
Test Points	: Separate for waveforms of trigger and rectifier circuit
Mains	: 415V/50Hz AC
Instruction manual	: One
Size	: 385x260x160mm(approx).

EXPERIMENT COVERED

Study three phase half controlled bridge converter (Rectifier) with resistive and inductive load.

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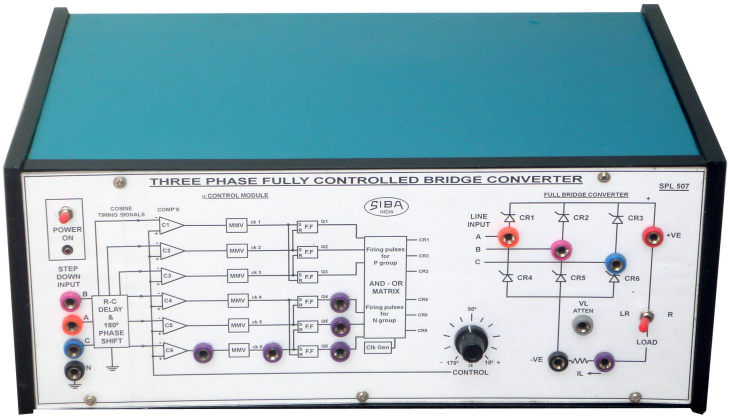
SPL 508
THREE PHASE FULL CONTROLLED BRIDGE CONVERTER/RECTIFIER

INTRODUCTION:

The kit is designed to study three phase full wave fully controlled bridge converter output characteristics. The kit consists isolated three transformers 230 : 120 Vac, 1 amp prewired for star - delta formation, firing angle control circuit having three synchronisation transformers with six 400Vac/6A S.C.R. wired in 3 phase full wave bridge converter configuration. One small time constant inductance added as LR load, and lamp (100W) as resistive load.Sockets are provided at different places to observe the waveform. This type of converter is extensively used in industrial applications. The converter is also called as *six pulse conveter*, since the pulsation in the output voltage is six times the input frequency. The thyristors CR1 to CR6 conducts alternately with each phasor apart 60^0. Hence in a cycle equal to 2π, the output contains 6 (pulses) ripples which means the output has low harmonics. The operation of the circuit may be studied with the help of phasor diagram.



Features:

S.C.R.	: Six (400V/6A)
Firing Angle	: Inverse Cosine(120^o)
Trigger circuit	: Digital, Ramp/Comparator
Pulse transformer	: Six (1:1)
Resistive load	: 120W
Inductive load	: Fixed Inductance (0.5H,0.5A)
Switch	: One to select load**,** Resistive OR Inductive
Relay	: Triple contact relay to connect bridge with line
Input(Isolated)	: Via three step down transformers in star/delta formation(110V line)
Synchronization	: Via three step down transformers (5V each)
Test Points	: Separate for waveforms of trigger and rectifier circuit
Mains	: 415V/50Hz AC

EXPERIMENT COVERED

Study three phase full controlled bridge converter (Rectifier) with resistive and inductive load.

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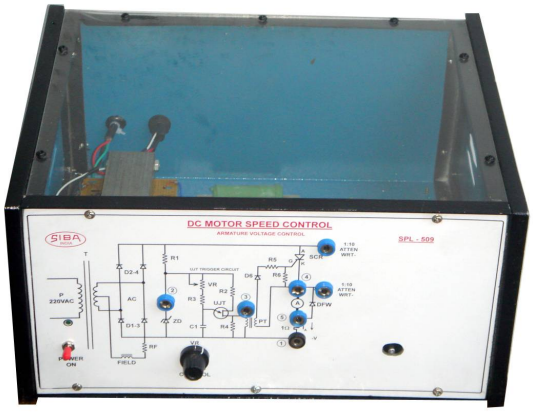
SPL 509
DC MOTOR SPEED CONTROL (ARMATURE VOLTAGE CONTROL)

INTRODUCTION:

In many applications variation in speed of electric drives is essential. As in process industries the speed control of motors in different stages are required. The introduction of thyristors solves these problem efficiently , due to simple control action and capabilities of phase control. The fast response, reliability and less cost dominate this scheme very popular today. This set up is is designed to study of basic speed control of a small shunt wound dc motor using silicone controlled rectifier. The set up has a unit having following features. Fully isolated ac supply for control and motor unit. The isolator(double wound transformer) has capacity of 75VA which is sufficient for the experiment.



Features:

S.C.R.	: One (600V/12A)
Bridge	: Based on four silicon diode (400V/4A)
Trigger circuit	: Based upon U.J.T. relaxation oscillator
Pulse transformer	: One (1:1)
Motor	: One fractional H.P. DC shunt wound motor(60W)
Transformer	: One double wound step down
DC supply	: Fixed (30V/0.5A)for field excitation
Test points	: Necessary for observations.
Cabinet	: Transparent acrylic top
Instruction manual	: One
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Size	: 320x260x160mm(approx).

EXPERIMENT COVERED

Study of Speed control of DC Motor (varying armature voltage) using thyristor.

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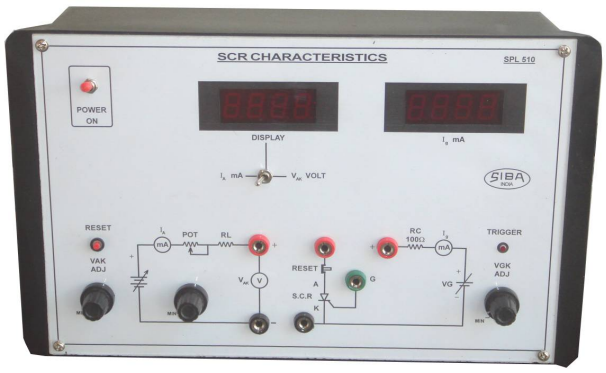
SPL 510
S.C.R. CHARACTERISTICS

INTRODUCTION:

This board is designed to study of silicone controlled rectifier V-I characteristics. The circuit is shown upon the panel. A silicone controlled rectifier is four layer PNPN device. It has provided with main two terminals called the Anode - Cathode and one control terminal as the Gate. It is abbreviated as SCR.



Features:

S.C.R	: 400V/1A
Power supply	: 0-50 Vdc,0.15A for A-K
	: 0-3V power supply for gate - cathode.
Meters	: Two Digital, One calibrated in dual mode operation.
Potentiometer	: One(Variable 1K)
Trigger LED	: One
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Patch cords	: Necessary for experiment
Size	: 320x190x75mm(approx)

EXPERIMENT COVERED

Study V-I Charcteristics of S.C.R.

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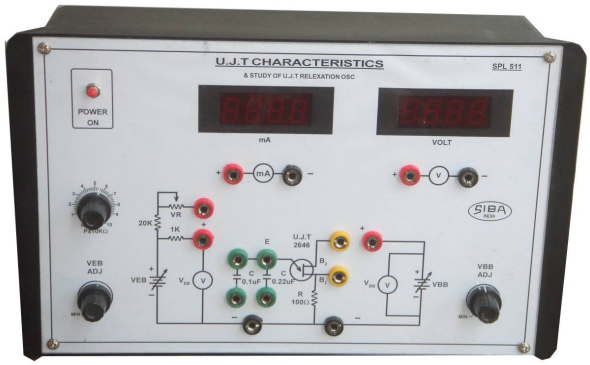
SPL 511
U.J.T. CHARACTERISTICS AND AS RELAXATION OSCILLATOR

INTRODUCTION:

This training board designed to study characteristics of unijunction transistor. The board contains two equally IC regulated dc power supplies for base - bar and emitter. Three meters are provided to take readings of volt and current. An unijunction transistor consists a bar of n - type silicone which is lightly doped, having high ohmic contacts at both side of the bar. These are called as base1 and base 2. A small piece of p - type material is diffused at the bar and an ohmic contact is brought out called the emitter. The whole arrangement is treated as a series combination of two base resistance as RB1 and RB2 called as interbase resistance is equal to RBB and a diode. Under operating conditions the emitter is forward biased with respect to base1as VEB1. Without applying VBB the junction exhibit a p -n junction diode forward - biased characteristics with slightly higher resistance than diode.



Features:

U.J.T.	: One(2N2646)
DC power supply	: Two (0-20V each)
Meters	: Two digital (volt & amp)
Capacitors	: Two Nos.
Potentiometer	: One Variable100KΩ
Resistance	: Four fixed
Power supply	: Short circuit & overload protected
Patch cord	: Provided for Experiment
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

Study of U.J.T. V-I characteristics
Study of U.J.T. as relaxation Oscillator

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SPL 512
DIAC CHARACTERISTICS

INTRODUCTION:

The Diacs are the type of semiconductor devices which are used in industrial and power control electronics. Keeping the view this kit is designed to study Diac static and dynamic characteristics. The kit consists of dc regulated power supply for static char., and a fixed ac supply for dynamic char. Two meters are provided for reading during dc supply usage. R - C circuit in form of R (potentiometer + 2K ohm) and C 0.1uF is provided to form Diac rex oscillator for dynamic behavior. The Diac is a three layer device analogies to a NPN transistor (except the doping), where two terminals are the contact, called at both ends T1 and T2 respectively rather then anode - cathode.

Features:

DIAC	: One(BR300)
DC power supply	: One (0-40V)
AC power supply	: One (40V)
Meters	: Two digital (volt & milliamp)
Capacitors	: One
Potentiometer	: One (Variable 22KΩ)
Resistance	: One fixed
Power supply	: Short circuit & overload Protected
Patch cord	: Provided for Experiment
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 260x190x75mm(approx).

EXPERIMENT COVERED

Study of DIAC V-I characteristics
Study of DIAC relaxation oscillator

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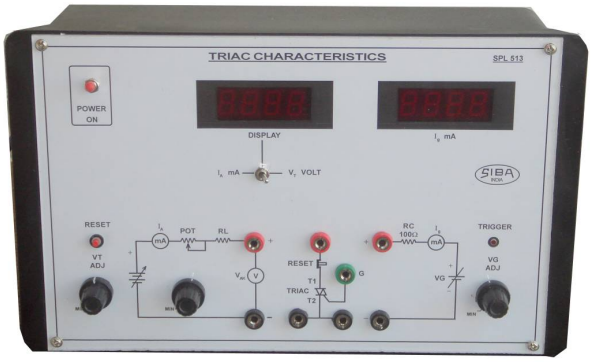
SPL 513
TRIAC CHARACTERISTICS

INTRODUCTION:



This board is designed to study volt - ampere characteristics of given Triac type BT 131. In power control systems the triac is most widely used device after the SCR. The triac is a bilateral device having three terminals. The voltage to be controlled is applied across two main terminals called as main terminals MT1 and MT2. The gate (junction) is near to main terminal MT1. The main property of a triac is to control over both halves of input ac cycle. Because of that the term anode - cathode is not used for triac. When teminal M**T2** is positive than M**T1**, the triac can be turned on by applying positive voltage between gate and terminal MT1. This is called to trigger the triac in quadrent I. The triac can be triggered by applying negative voltage between gate and terminal MT1. This is to trigger triac in quadrent I. When terminal MT2 is negative than terminal MT1, the triac is operated in quadrent III. The triac

Features:

TRIAC	: One(600V/2A)
DC power supply	: 1. 0-50V @0.15A for T1-T2
	2. 0-3V for gate - T2
Meters	: Two digital, one calibrated in dual mode.
Potentiometer	: One (Variable 3W)
Resistance	: One fixed
Trigger LED	: One
Power supply	: Short circuit & overload Protected
Patch cord	: Provided for Experiment
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

Study of TRIAC V-I characteristics in $I^{+},I^{-},III^{+},III^{-}$ quadrants

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SPL 514
S.C.R. BASED JOHN CHOPPER

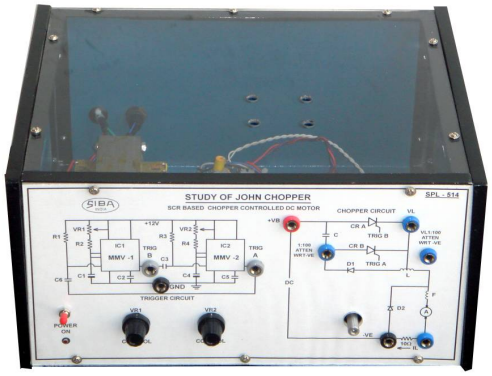
INTRODUCTION:

This set up is designed to study of SCR based Jones chopper system. It has inbuilt trigger source, SCR chopping device with commutation circuit, a fractional HP dc series motor as load and unregulated full wave rectified dc supply for the set up.

VB (The DC supply) : A full wave rectified and filtered dc supply furnish input source. The dc supply is unregulated and swings from a peak value of 140V-110V depends upon line input and load voltage.

The trigger source :

The rate of chopping depends upon the rate of switching pulses. The provided oscillator is a self triggered ,set of two monostable multi-vibrators which generate on and off timing pulses. The on time is varied by VR1 while the off time made varied through VR2, given as front panel controls.



Features:

S.C.R.	: Two(600V/12A)
Inductor	: One center tapped with diode
Diode Bridge	: Silicon diode based with L-C Filter
DC power supply	: From 100 volt AC(unregulated)
Commutation capacitor	: One with free wheeling diode
Firing circuit	: On DC 12V supply for pulse firing
Timing controls	: Separate control for on-off time.
Motor	: A series wound fractional H.P. universal motor (60W) as load
Observation	: Separate points for observations of waveforms.
Cabinet	: Transparent top
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x260x190xmm(approx).

EXPERIMENT COVERED

Study ofJohes Chopper characteristics

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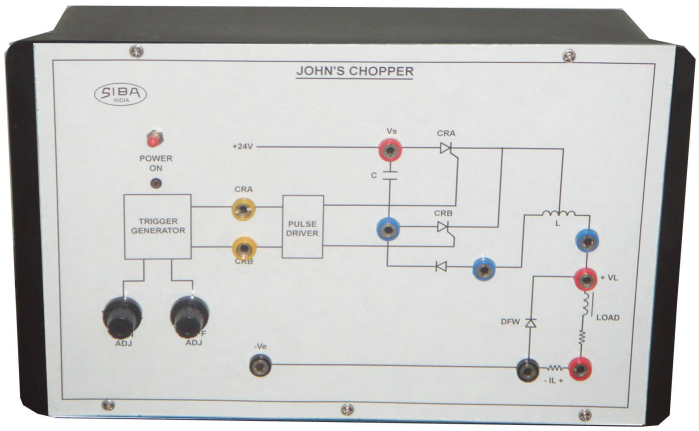
SPL 514E
S.C.R. BASED JOHN CHOPPER

INTRODUCTION:



This set up is designed to study of SCR based Jones chopper system. It has inbuilt trigger source, SCR chopping device with commutation circuit, a fractional HP dc series motor as load and unregulated full wave rectified dc supply for the set up.

VB (The DC supply) : A full wave rectified and filtered dc supply furnish input source. The dc supply is unregulated and swings from a peak value of 140V-110V depends upon line input and load voltage.

The trigger source : The rate of chopping depends upon the rate of switching pulses. The provided oscillator is a self triggered ,set of two monostable multi-vibrators which generate on and off timing pulses. The on time is varied by VR1 while the off time made varied through VR2, given as front panel controls.

Features:

S.C.R.	: Two
Inductor	: One center tapped with diode
DC power supply	: 12 volt dc regulated
Commutation capacitor	: One with free wheeling diode
Firing circuit	: On DC 12V supply for pulse firing
Timing controls	: Control for time ratio
Load	: Fixed inductive load
Observation	: Separate points for observations of Waveforms.
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

Study ofJohes Chopper characteristics

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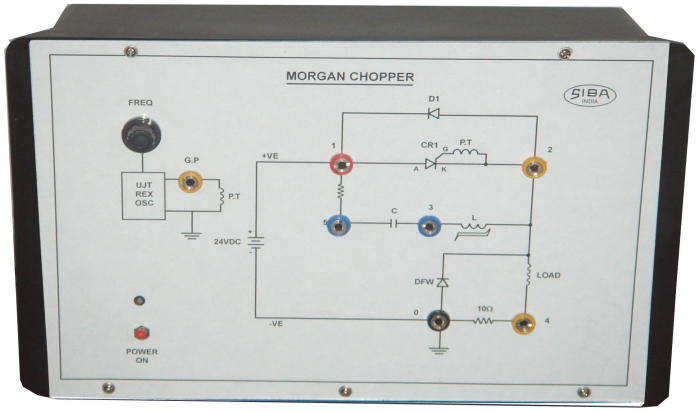
SPL 515
S.C.R. BASED MORGAN CHOPPER

INTRODUCTION:

The control of dc power in a load is carried out by two means, either by regulating it through a series resistance (it may be in form of passive or an active device) or by mean of pulsating currents such as chopper. The advantage of chopper upon series components is small loss of power through it. hence small loss of controlled amount and lesser dissipation in it (in form of heat). The provided chopper is SCR Morgan chopper in which an active device is made ON by trigger pulse and OFF by commutation current. Let assume that Ton is pulse in which SCR is fired. When dc supply VB is applied to the circuit C charge through L1 - L2 (constitute load coil of saturable reactor) and load linearly with the polarity shown. At the instant Ton, SCR (CR1) is triggered by pulse cause to conduct it. The load current is supplied by it.



Features:

S.C.R.	: One(600V/12A)
Inductor	: One saturable inductor
DC power supply	: 12V DC(regulated)
Commutation Capacitor	: One
Firing circuit	: Based on DC 12V supply for pulse firing with P.T.
Load	: Fixed inductive load, with freewheeling diode.
Observation	: Separate points for observations of waveforms.
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

Study of Morgan chopper control characteristics

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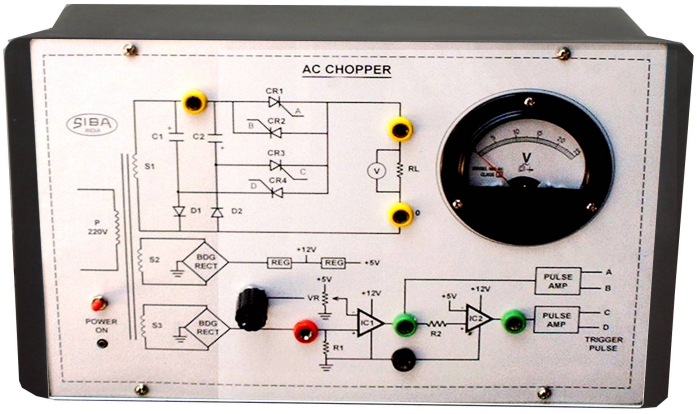
SPL 516
S.C.R. BASED AC CHOPPER

INTRODUCTION:

The low voltage ac voltage (S1 of T) is applied to the pair of two SCRs, CR1 and CR2, connected antiparallel with in series RL. These are the main SCRs. As the SCR is being commutated at the crossover points of ac cycle, but then it becomes a simple phase control circuit. To commutate them earlier at required time two auxiliary SCRs, CR3 and CR4 are used. These SCRs are biased with two diodes D1, D2 and accumulation is carried by two capacitors C1, C2 which get charge with respective cycle.When input ac cycle goes towards peak it is compared at IC1 and a trigger pulse is generated at pulse generator which apply trigger pulses A,B to the CR1 and CR2 simultaneously. The SCR will conduct which has its anode +ve in respect to its cathode. Assume the CR1 fires and +ve half of ac cycle is applied to the load RL. In the meantime capacitor C2 is get charged to peak ac value through D2 since it is forward biased.



Features:

S.C.R.	: Four(600V/12A)
Diodes	: Two
Commutation	
Capacitors	: Two (bipolar)
DC power supply	: 12V DC(regulated) for trigger ckt
Firing circuit	: Through Pulse transformer
AC source	: 25V, 0.5 Amp step down transformer.
Synchronization	: 5V ac transformer.
Load	: Fixed resistive with voltmeter.
Observation	: Separate points for observations of waveforms.
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx).

EXPERIMENT COVERED

Study of AC chopper using S.C.R.

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INTRODUCTION:

Features:

MOSFET	: Four
Diodes	: Four
DC power supply	: 60V DC
Firing circuit	: Through Optoisolators.
Mode Control	: Quadrent 1 & 3,2 & 4 regenerative
Load	: F.H.P. (60W) DC shunt wound motor with small inertial load.
Observation	: Separate points for observations of waveforms.
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x260x160mm(approx).

EXPERIMENT COVERED

Study of MOSFET based four quadrent chopper
speed reversal of dc motor
Study of operation of chopper in all quadrents.

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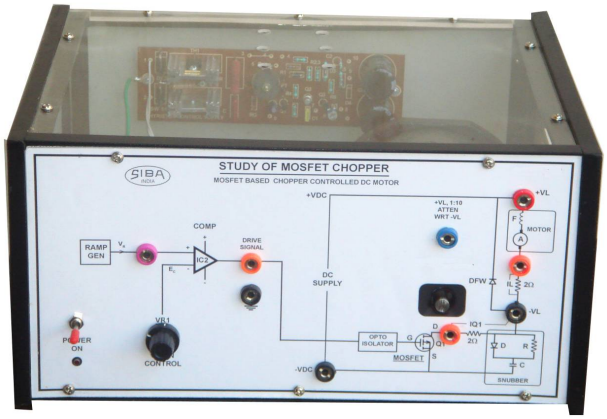
SPL 518
SPEED CONTROL OF FHP DC MOTOR BY MOSFET CHOPPER

INTRODUCTION:

The low voltage ac voltage (S1 of T) is applied to the pair of two SCRs, CR1 and CR2, connected antiparallel with in series RL. These are the main SCRs. As the SCR is being commutated at the crossover points of ac cycle, but then it becomes a simple phase control circuit. To commutate them earlier at required time two auxiliary SCRs, CR3 and CR4 are used. These SCRs are biased with two diodes D1, D2 and accumulation is carried by two capacitors C1, C2 which get charge with respective cycle.When input ac cycle goes towards peak it is compared at IC1 and a trigger pulse is generated at pulse generator which apply trigger pulses A,B to the CR1 and CR2 simultaneously. The SCR will conduct which has its anode +ve in respect to its cathode. Assume the CR1 fires and +ve half of ac cycle is applied to the load RL. In the meantime capacitor C2 is get charged to peak ac value through D2 since it is forward biased.



Features:

MOSFET	: One(600V/8A) with heat sink
DC power supply	: 100V DC thyristor regulated
Gating circuit	: Through Optoisolators
Trigger Generator	: Based upon Ramp comparator
Trigger Frequency	: 400Hz approx.
Snubber	: D-R-C active snubber
Load	: Fractional H.P. universal motor as load
Observation	: Separate points for observations of waveforms.
Cabinate	: Fitted with acrylic top cover
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x260x160mm(approx).

EXPERIMENT COVERED

Speed control dc motor using MOSFET based chopper.

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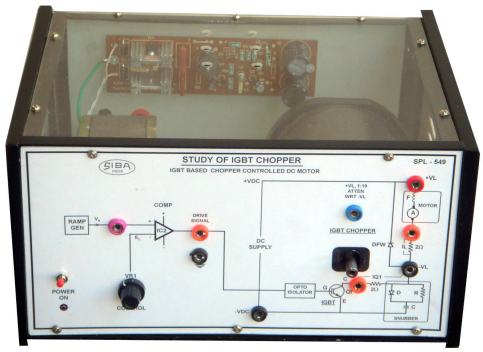
SPL 519
SPEED CONTROL OF FHP DC MOTOR BY I.G.B.T CHOPPER

INTRODUCTION:

A chopper is a (static) device, used to obtain variable dc voltage from a constant voltage source. the variable dc is obtained by on / off operation of chopping device, which can be treated as switch. This device (chopper) is triggered (gated) periodically and is kept conducting for a period Ton, and is kept off for a period Toff. The IGBT (insulated gate bipolar transistor), is such a device, which can be used for this operation successfully, as this does not require commutation circuitry. In present set up, a dc series wound motor (1/12 HP) used as load, and to control the speed IGBT chopper is used. The set up has inbuilt gate drive circuit with pulse generator, regulated dc supply and sockets given to observe / measure the waveforms / voltages.



Features:

IGBT	: One(1200V/15A) with heat sink
DC power supply	: 100V DC thyristor regulated
Gating circuit	: Through Optoisolators
Trigger Generator	: Based upon Ramp comparator
Trigger Frequency	: 400Hz approx.
Snubber	: D-R-C active snubber
Load	: Fractional H.P. universal motor as load
Observation	: Separate points for observations of waveforms.
Cabinate	: Fitted with acrylic top cover
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x260x160mm(approx).

EXPERIMENT COVERED

Speed control of dc motor using IGBT based chopper.

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SPL 520
SPEED CONTROL OF FHP DC MOTOR BY CHOPPER

INTRODUCTION :

The set up is designed to study of SCR based dc chopper system to control and regulate dc motor speed.It has inbuilt trigger (oscillator) source, SCR chopping device with commutation circuit, a fraction HP universal motor with a small dc motor as tacho generator and Unregulated dc supply for the set up. An ac induction motor is used to impose load upon the dc motor to found characteristics of controller. The circuitry is represented in block diagrams printed upon front panel with sockets for observation and measurements of signals. A see through acrylic sheet is fitted upon top of the MS cabinet to observe the components.

Features:

Power supply	: DC 100V supply
Switching device	: POWER MOSFET(600V/8A)
Diode	: Four 400V/4A
Filter Capacitor	: Two (470mfd/250V)
Motor	: One series wound motor of fractional H.P. with free wheeling diode.
Tacho generator	: Optical tacho
Switch	: One for open/close loop
Display	: Digital for RPM & load current(µcontroller based)
Circuitry	: On/off control with time ratio control .
Controller	: Proportional
Loading	: Eddy current breaking
Cabinet	: See through acrylic top
Observation	: Test point for CRO
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 460x210x160mm(approx).

EXPERIMENT COVERED

Study of dc motor speed using chopper in open loop.
Study of dc motor speed using chopper in close loop.

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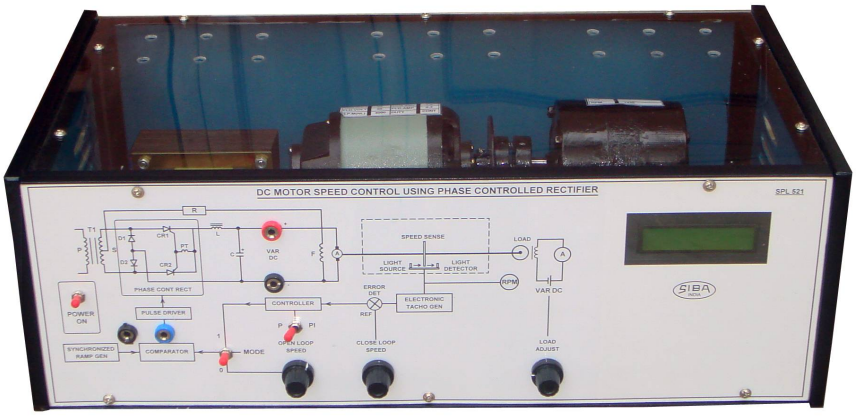
SPL 521
SPEED CONTROL OF FHP DC MOTOR BY PHASE CONTROL RECTIFIER

INTRODUCTION:

This set up is designed to study of speed control (in open & close loop) of DC motor using SCR phase control system. It has inbuilt trigger source, SCR phase control circuit, P & PI controller. A fraction HP dc motor coupled with a small permanent magnet DC motor as tacho generator and an ac induction motor is used to impose load upon the dc motor to found characteristics of controller. The circuit is represented in block diagrams printed upon panel with set of socket for measurements. A see through acrylic sheet is fitted upon top of the MS cabinet to observe the components. Two analog meters are given to read the motor speed (RPM) and the load current flows in ac motor.



Features:

Switching devices	: Two(SCR) as phase controlled rectifier
Inductor	: One inductor(0.4H)
Diodes	: Two (400V/4A)
Motor	: One shunt wound motor of fractional H.P. (60W) field excitation fixed DC.
Controller	: Proportional & Proportional Integral
Tacho generator	: Optical tacho
Switch	: One for open/close loop One for P & PI.
Display	: Digital for RPM & load current(μcontroller based)
Circuitry	: Synchronized ramp/comparator.
Loading	: Eddy current breaking
Cabinet	: See through acrylic top
Observation	: 2 test point for CRO
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 460x210x160mm(approx).

EXPERIMENT COVERED

Study of dc motor speed using phase controlled rectifier in open loop.
Study of dc motor speed using phase controlled rectifier in close loop.

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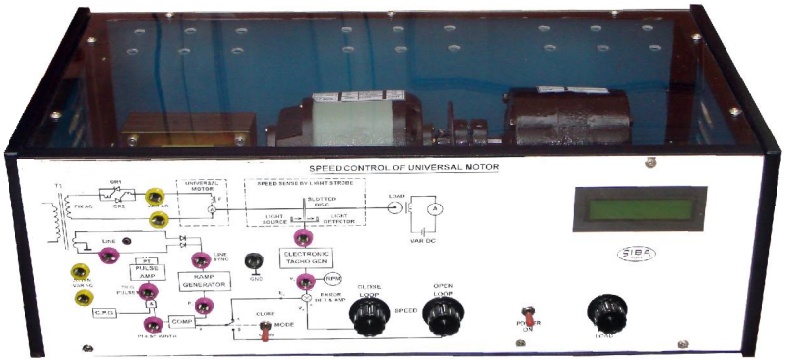
SPL 522
SPEED CONTROL OF UNIVERSAL MOTOR

INTRODUCTION:



This set up is designed to study of speed control (in open & close loop) of universal motor using phase control system. It has inbuilt trigger source, thyristor phase control circuit, speed measurement & tachgeneration .A fraction HP universal motor coupled with an ac induction motor, which is used to impose load to found characteristics of controller. The circuitry is represented in block diagrams printed upon panel with set of socket for measurements. A see through acrylic sheet is fitted upon top of the MS cabinet to observe the components. Two analog meters are given to read the motor speed (RPM) and the dc load current flows in ac motor. A universal motor can be run from either dc or ac (single phase) supply. Basically it is series motor having field and armature windings connected in series. The motor speed is controlled by given terminal voltage (supply) magnitude.

Features:

Switching devices	: Two(Antiparallel SCR)
Motor	: One universal motor fractional H.P. (60W)
Switch	: One for open/close loop
Display	: Digital for RPM & load current(μcontroller based)
Circuitry	: Synchronized ramp/comparator.
Tacho generator	: Optical tacho
Loading	: Eddy current breaking
Cabinet	: See through acrylic top
Observation	: Test point for CRO
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 460x210x160mm(approx).

EXPERIMENT COVERED

Study of speed control using phase
Control of universal motor in open/close loop.
Measurement & speed control by
Stroboscopic(light interrupt) method

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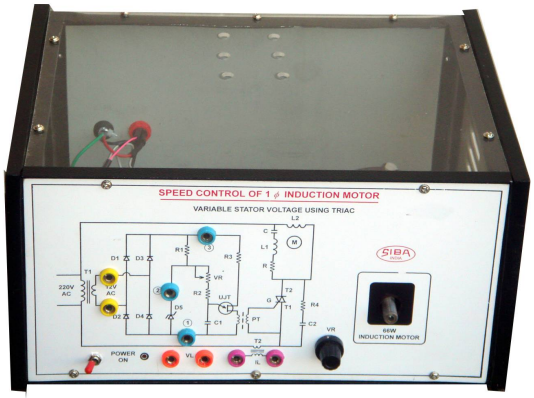
SPL 523
SPEED CONTROL OF INDUCTION MOTOR /VARYING VOLTAGE

INTRODUCTION:

The set up has built in see through top cover in MS powder coated cabinet. The control circuitry is given upon the front panel and sockets are given to observe the motor voltage and current waveforms. Since it is a line operated unit thus isolation is provided by small transformer at the observation points. This demonstration unit use the small induction motor 220V, 4 pole 1300 RPM split wound type rated input - output 24W / 5W , with speed measurement system. The torque produced in the rotor of induction motor due to interaction of the rotating field flux with the current induced in the rotor. Neglecting other parameters of the motor, the torque is proportional to the square of stator supply voltage Vs, at constant frequency and s. The stator voltage control method for speed controlling, is generally employed for fan type loads, which gives a greater range of speed control. For a constant torque load the speed control range narrowed. The voltage Vs can be reduced introducing resistance ,inductance in series with supply and winding.



Features:

Triac : One in power circuit to control load voltage

Triggering : UJT rex oscillator in synchronism of input frequency.

Pulse transformer : One (1:1) for isolation

Motor : One fractional HP(60W) induction motor.

Cabinet : Transparent top

Transformer : One provided to isolate the load voltage waveform and One Current transformer provided for load current waveform

Power supply : Short circuit & overload protected

Mains : 230V/50Hz AC

Instruction manual : One

Size : 320x260x160mm(approx).

EXPERIMENT COVERED

Study of Speed control single phase Induction motor by varying voltage.

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SPL 524
SPEED CONTROL OF INDUCTION MOTOR /VARYING FREQUENCY

INTRODUCTION:

In some industrial applications speed control of motors (ac motors) are required. The speed of an ac motor can be controlled by varying either the amplitude or the frequency of its supply voltage, or both. The variable voltage, fixed frequency technique has the disadvantage that the maximum torque of the motor is proportional to the square of the applied voltage, therefore this control is effective in speed proportional loads (such fans or pumps). The fixed voltage variable frequency is applied to control the 'slip' of the motor and apply restraints to a motor having low torque (generally applied to slip ring motor). The third control is variable voltage and variable frequency is best among all but has few complications such sensing of torque, motoring current. No matter what type of speed control is used the motor must be run to its ratings which gives safe torque and speed limits.

Features:

DC power supply	: Thyristor controlled rectifier to obtain regulated DC for inverter circuit,
Inverter	: Inverter circuit with frequency variation between < 30 upto 100 Hz, with V/f constant control
Pulse transformer	: One (1:1) for isolation
Motor	: One fractional HP induction
Cabinet	: Transparent top
Transformer	: One provided to isolate the load voltage waveform
Display	: Digital for RPM & Voltage (μcontroller based)
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 460x210x160mm(approx).

EXPERIMENT COVERED

Study of Speed control single phase Induction motor by varying frequency(dc link converter)

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SPL 525
SPEED CONTROL OF INDUCTION MOTOR(OPEN/CLOSE LOOP)

INTRODUCTION:

In some applications speed control of ac induction motor is required. The speed of an ac motor can be controlled by varying either the amplitude or the frequency of its supply voltage, or both. The variable voltage, fixed frequency technique has the advantage of its lower cost. When the close loop monitor system is used. The variable voltage for the stator winding is easy to manage by phase controlling of input ac cycle. For given set up a small ac induction motor is used for the speed control purpose, with a solid state control circuit, a speed sensing system and a loading system.

Speed control of induction motor : In an induction motor torque is generated due to the interaction between the air gap flux and rotor currents. If a rotor is rotating at a speed ωs ' the synchronous speed' there will no relative motion between the rotor and air gap flux thus there will be no induced rotor voltage, the rotor current and torque.

Features:

S.C.R.	: Two Antiparallel SCR with phase control circuit.
Speed Sensing	: Opto based speed sensing with RPM meter
Motor	: Small AC induction motor
Load	: Another small AC motor for eddy current break.
Firing angle	: Controller with/without feedback
Display	: Digital for RPM, voltage & load current(μcontroller based)
DC supply	: ± 12V for control circuit
Cabinet	: Transparent top
Observation	: Through Test points
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 460x210x160mm(approx).

EXPERIMENT COVERED

Study of Speed control Induction motor in close/open loop

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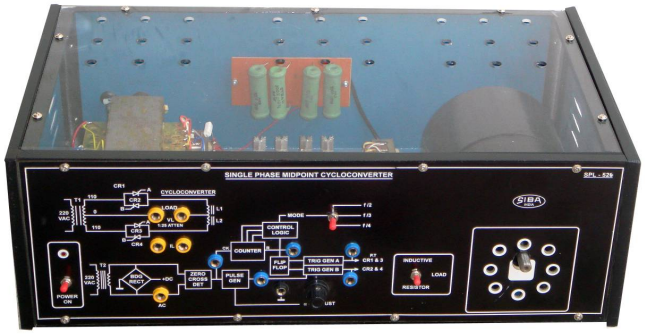
SPL 526
SINGLE PHASE MIDPOINT CYCLOCONVERTER

INTRODUCTION:

A cycloconverter oftenly called as 'cycle converter' changes the frequency of a single (or three phase) alternating power source without the necessity of an intermediate ac to dc conversion stage. A cycloconverter require multiple control device of a single or three phase excitation, and are limited to low output frequency only. The output of a cycloconverter has a relatively large ripple voltages but comparatively small ripple currents, which is what contributes to motor heating. One thing is to be pointed out that higher the output frequency higher the ripple currents will be since there will be fewer supply pulses per output cycle. This practically limit the upper frequency of a cycloconverter to 1/3 if a half converter is used and 1/4 if a full converter is used. The cycloconverter applications are in elevators, traction motors , in aircrafts and some other places where low speed is required without using gears.



Features:

S.C.R.	: Four(600V/4A)
Inductor	: One center tapped()
Transformer	: One midpoint 120-0-120 Vac
Motor	: Inductive (small induction AC motor) and resistive load
Firing angle	: Logically control circuit
Pulse Transformer	: 2 nos. to couple logic signal with thyristors
Switch	: One to obtain 1/2,1/3 & 1/4 of input frequency
DC supply	: + 5V for control circuit
Cabinet	: Transparent top
Observation	: Through Test points
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	**:** One
Size	: 460x210x160mm(approx).

EXPERIMENT COVERED

Study of Single phase midpoint cycloconverter

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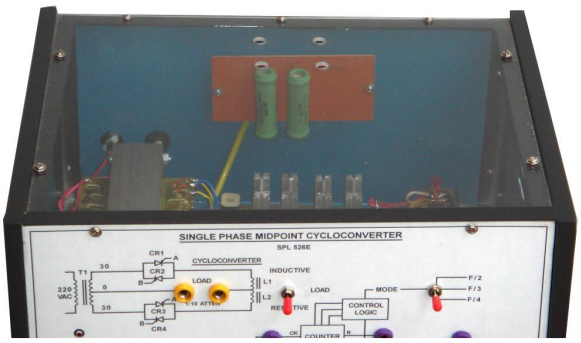
SPL 526E
SINGLE PHASE MIDPOINT CYCLOCONVERTER

INTRODUCTION:

A cycloconverter oftenly called as 'cycle converter' changes the frequency of a single (or three phase) alternating power source without the necessity of an intermediate ac to dc conversion stage. A cycloconverter require multiple control device of a single or three phase excitation, and are limited to low output frequency only. The output of a cycloconverter has a relatively large ripple voltages but comparatively small ripple currents, which is what contributes to motor heating. One thing is to be pointed out that higher the output frequency higher the ripple currents will be since there will be fewer supply pulses per output cycle. This practically limit the upper frequency of a cycloconverter to 1/3 if a half converter is used and 1/4 if a full converter is used. The cycloconverter applications are in elevators, traction motors , in aircrafts and some other places where low speed is required without using gears.



Features:

S.C.R.	: Four
Inductor	: One center tapped
Transformer	: One midpoint 30-0-30 Vac
Load	: Fixed Inductance & Resistance
Firing angle Pulse	: Logically control circuit
Transformer	: 2 nos. to couple logic signal with thyristors
Switch	: One to obtain 1/2,1/3 & 1/4 of input frequency
DC supply	: + 5V for control circuit
Cabinet	: Transparent top
Observation	: Through Test points
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x260x160mm(approx).

EXPERIMENT COVERED

Study of Single phase midpoint cycloconverter

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SPL 527
SINGLE PHASE MIDPOINT BRIDGE CYCLOCONVERTER

INTRODUCTION:

A cycloconverter oftenly called as 'cycle converter' changes the frequency of a single (or three phase) alternating power source without the necessity of an intermediate ac to dc conversion stage. A cycloconverter require multiple control device of a single or three phase excitation, and are limited to low output frequency only. The output of a cycloconverter has a relatively large ripple voltages but comparatively small ripple currents, which is what contributes to motor heating. One thing is to be pointed out that higher the output frequency higher the ripple currents will be since there will be fewer supply pulses per output cycle. This practically limit the upper frequency of a cycloconverter to 1/3 if a half converter is used and 1/4 if a full converter is used. The cycloconverter applications are in elevators, traction motors , in aircrafts and some other places where low speed is required without using gears.

Features:

S.C.R.	: Eight(600V/4A)
Inductor	: One center tapped
Transformer	: One 120V AC
Motor	: Inductive(small AC motor) and resistive load
Firing angle	: Logically control circuit
Pulse Transformer	: 4 nos. to couple logic signal with thyristors
Switch	: One to obtain 1/2,1/3 & 1/4 of input frequency
DC supply	: + 5V for control circuit
Cabinet	: Transparent top
Observation	: Through Test points
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 460x210x160mm(approx).

EXPERIMENT COVERED

Study of Single phase midpoint bridge cycloconverter

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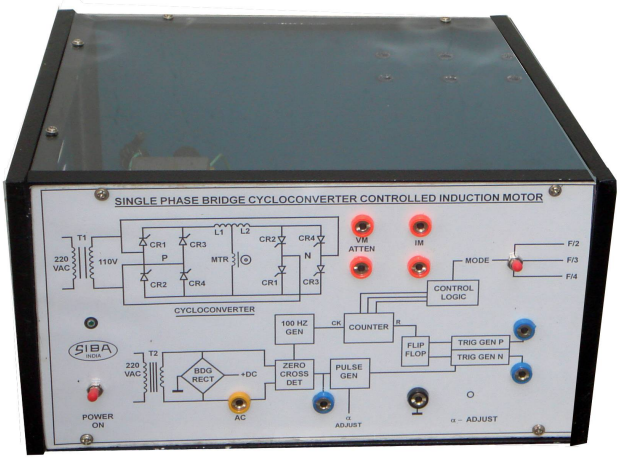
SPL 527E
SINGLE PHASE MIDPOINT BRIDGE CYCLOCONVERTER

INTRODUCTION:

A cycloconverter oftenly called as 'cycle converter' changes the frequency of a single (or three phase) alternating power source without the necessity of an intermediate ac to dc conversion stage. A cycloconverter require multiple control device of a single or three phase excitation, and are limited to low output frequency only. The output of a cycloconverter has a relatively large ripple voltages but comparatively small ripple currents, which is what contributes to motor heating. One thing is to be pointed out that higher the output frequency higher the ripple currents will be since there will be fewer supply pulses per output cycle. This practically limit the upper frequency of a cycloconverter to 1/3 if a half converter is used and 1/4 if a full converter is used. The cycloconverter applications are in elevators, traction motors , in aircrafts and some other places where low speed is required without using gears.



Features:

S.C.R.	: Eight
Inductor	: One center tapped
Transformer	: One 30V AC
Load	: Fixed inductance & resistive
Firing angle Pulse	: Logically control circuit
Transformer	: 4 nos. to couple logic signal with thyristors
Switch	: One to obtain 1/2,1/3 & 1/4 of input frequency
DC supply	: + 5V for control circuit
Cabinet	: Transparent top
Observation	: Through Test points
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x260x160mm(approx).

EXPERIMENT COVERED

Study of Single phase midpoint bridge cycloconverter

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SPL 528
S.C.R. BASED SERIES INVERTER

INTRODUCTION:

This kit is designed to study low capacity SCR series inverter input - output characteristics with variable frequency. The kit consists inverter transformer,2 SCRs, one inductor, one commutation capacitor, one dc ammeter, firing circuit and provision for connection of resistive load in form of 25 watt (maximum) The power source is inbuilt with two meters .The kit rated output is 15 watt.

Features:

S.C.R	: Two (600V/12A)
Inductor	: One tapped
Capacitors	: Two(10uF/200V) for commutation
Pulse generator	: (200-400 Hz) using two UJT rex with separate timing control ,
Potentiometer	: Two for control of frequency & symmetry
Step up transformer	: {1:10}
Lamp load	: 15 watt
Display	: Digital for AC volt & DC amp.
Cabinet	: Transparent top
Input supply	: In form of DC 24V/3A
Power supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	:320x260x160mm(approx).

EXPERIMENT COVERED

Study of S.C.R based modified series inverter circuit

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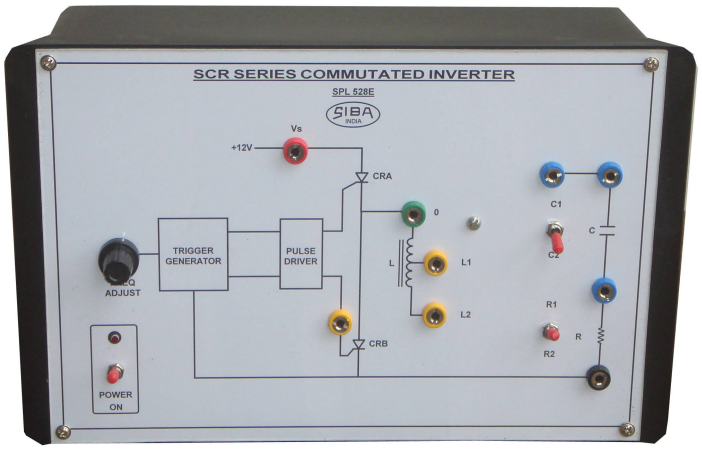
AUTH. DEALER

SPL 528E
S.C.R. BASED SERIES INVERTER

INTRODUCTION:

This kit is designed to study low capacity SCR series inverter input - output characteristics with variable frequency. The kit consists ,2 SCRs, one tapped inductor, two selectable commutation capacitor, two selectable resistors, firing circuit based upon flip flop. The power source is inbuilt dc regulated.



Features:

S.C.R	: Two (400V/2A)
Inductor	: One tapped {0.8:1}
Capacitors	: Two for commutation(selectable)
Pulse generator	: (200-400 Hz)
Potentiometer	: one for control of frequency
Load	: Fixed two resistance(selectable)
Input supply	: In form of DC 12V/0.5A
Power supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	:320x190x75mm(approx).

EXPERIMENT COVERED

Study of S.C.R based modified series inverter circuit

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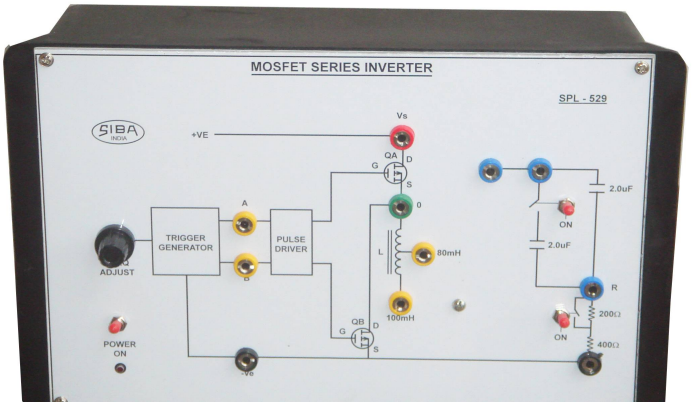
SPL 529
MOSFET BASED SERIES INVERTER

INTRODUCTION:

In series inverter, the resonating elements L - C (commutating elements in thyristor inverter) are introduced in series with the load. This constitutes a series resonate circuit, where the load (R) is purely resistive. This type of inverter produce an approximately sinusoidal waveform at resonating frequency.Because of mosfet (instead of SCRs) does not suffer from the problem 'commutation' , hence the maximum frequency operation can be obtained. The mosfet can be turn - on by applying a positive pulse at its gate - emitter terminals, which must be higher than the threshold voltage The both mosfet are in series across the input dc supply, hence a small delay required in gating signal to avoid short circuit at dc side.



Features:

MOSFET	: Two
Inductor	: One tapped inductor
Commutation capacitors	: Two, selectable
Pulse generator	: 200-400 Hz
Resistive loads	: Two, selectable
Input supply	: In form of DC 24V/1A
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx)

EXPERIMENT COVERED

Study of MOSFET series inverter circuit

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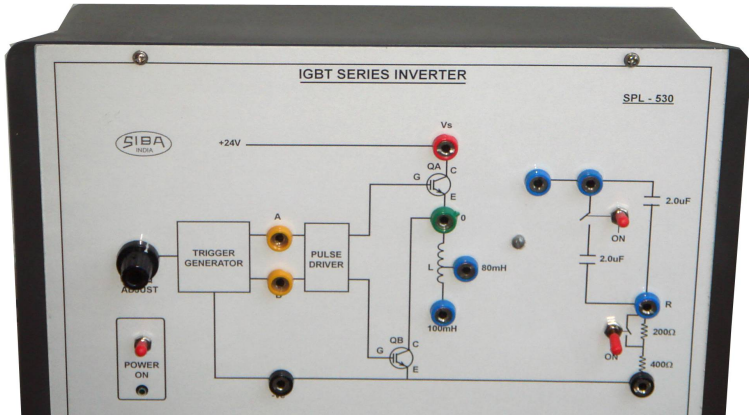
SPL 530
I.G.B.T BASED SERIES INVERTER

INTRODUCTION:

In series inverter, the resonating elements L - C (commutating elements in thyristor inverter) are introduced in series with the load. This constitutes a series resonate circuit, where the load (R) is purely resistive. This type of inverter produce an approximately sinusoidal waveform at resonating frequency. Because of IGBT (instead of SCRs) does not suffer from the problem 'commutation' , hence the maximum frequency operation can be obtained. The IGBT can be turn - on by applying a positive pulse at its gate - emitter terminals, which must be higher than the threshold voltage VGE > VGEth. At turn - off drive signal is removed or pull down to slightly negative. The both IGBT are in series across the input dc supply, hence a small delay required in gating signal to avoid short circuit at dc side. In thyristor inverter, the trigger pulse is blocked after turn - on, to allow proper commutation and some kind of delay between period T/2 to ensure proper commutation of conducting thyristor. The IGBT is not such kind of trigger device.



Features:

IGBT	: Two
Inductor	: One tapped inductor
Commutation capacitors	: Two, selectable
Pulse generator	: 200-400 Hz
Resistive loads	: Two, selectable
Input supply	: In form of DC 24V/1A
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 320x190x75mm(approx)

EXPERIMENT COVERED

Study of IGBT series inverter circuit

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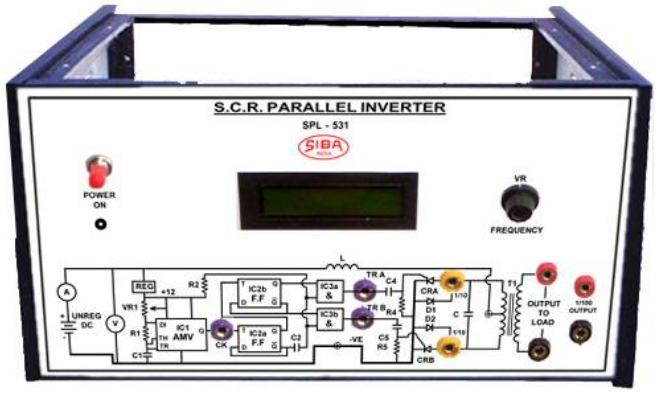
SPL 531
S.C.R. BASED PARALLEL INVERTER

INTRODUCTION:



This kit is designed to study low capacity SCR parallel inverter input -output characteristics. The kit consists inverter transformer, 2 SCRs, one inductor, one commutation capacitor, one dc ammeter, firing circuit and provision for connection of resistive load and on delay circuit. The power source is supplied with the kit and one lamp load which can adopt 3 electric lamps. The kit rated output is 60 watt.

The circuit schematic is divided in two parts

(a) the firing circuit and

(b) the inverter circuit.

The firing circuit has a oscillator, one flip flop and one driver has two AND gates.

Features:

S.C.R.	: Two(600V/12A)
Inductor	: One
Capacitor	: One for Commutation
Pulse generator	: 60-120Hz
Pulse Transformer	: One
Lamp load	: 15W
Input Supply	: In form of DC 24V/3A
Display	: Digital for V&I
Cabinet	: Transparent top
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	**:**320x260x160mm(approx)

EXPERIMENT COVERED

Study of S.C.R. Parallel inverter circuit

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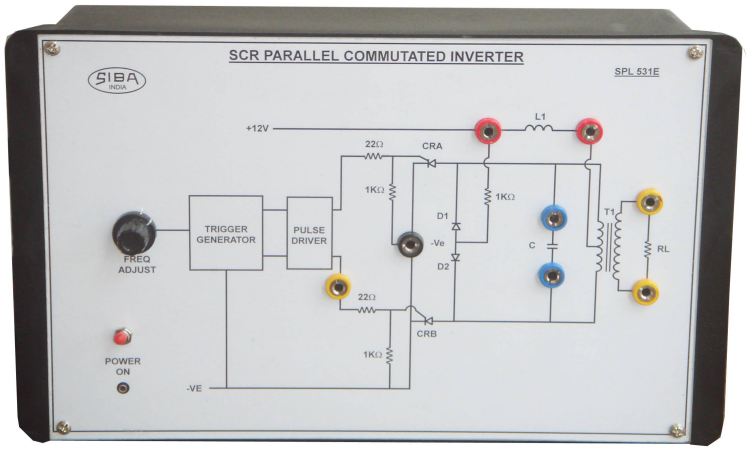
AUTH. DEALER

SPL 531E
S.C.R. BASED PARALLEL INVERTER

INTRODUCTION:



This kit is designed to study low capacity SCR parallel inverter input -output characteristics. The kit consists inverter transformer, 2 SCRs, one inductor, one commutation capacitor, one dc ammeter, firing circuit and provision for connection of resistive load and on delay circuit. The power source is supplied with the kit and one lamp load which can adopt 3 electric lamps. The kit rated output is 60 watt.

The circuit schematic is divided in two parts

(a) the firing circuit and

(b) the inverter circuit.

The firing circuit has a oscillator, one flip flop and one driver has two AND gates.

Features:

S.C.R.	: Two
Inductor	: One
Capacitor	: One for Commutation
Pulse generator	: 100Hz
load	: Fixed resistive
Input Supply	: In form of DC 12V/0.5A
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	:320x190x75mm(approx)

EXPERIMENT COVERED

Study of S.C.R. Parallel inverter circuit

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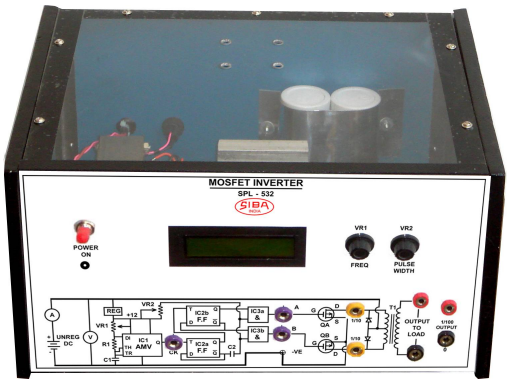
SPL 532
MOSFET BASED PARALLEL INVERTER

INTRODUCTION:

This kit is designed to study of low capacity Mosfet based inverter system. It has inbuilt drive signal source, switching device, fixed resistive load in form of three lamps and dc supply for the set up. The circuitry is represented in two subsystem.The working principal of Mosfet inverter is quite simple. A mosfet is a voltage control device rather than a transistor or SCR which are current control devices. This leads to advantage of simple control circuit and benefits the simple on / off by switching pulses. The mosfet is switched on when its gate is +ve than its source and cut - off when its gate is at source level. When it is on (conducts) its dynamic resistance is very - very low.



Features:

MOSFET	: Two (PMOS 100V/40A) mounted upon heat sink
Pulse generator	: 100-200Hz with variable frequency control
Pulse width control	: Duty factor 0.6-1
Transformer	: One double wound
Lamp load	: 15W
Display	: Digital for V & I
DC Source	: 24 volt 3 Amp
Cabinet	: Transparent top
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	:320x260x160mm(approx)

EXPERIMENT COVERED

Study of MOSFET based parallel inverter circuit

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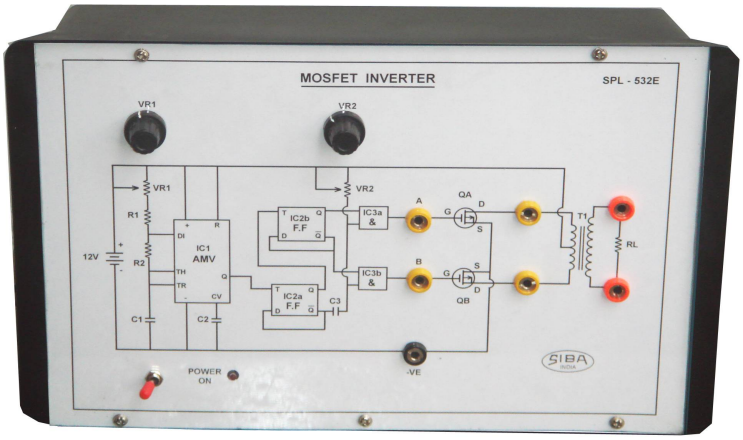
AUTH. DEALER

SPL 532E
MOSFET BASED PARALLEL INVERTER

INTRODUCTION:

This kit is designed to study of low capacity Mosfet based inverter system. It has inbuilt drive signal source, switching device, fixed resistive load in form of three lamps and dc supply for the set up. The circuitry is represented in two subsystem. The working principal of Mosfet inverter is quite simple. A mosfet is a voltage control device rather than a transistor or SCR which are current control devices. This leads to advantage of simple control circuit and benefits the simple on / off by switching pulses. The mosfet is switched on when its gate is +ve than its source and cut - off when its gate is at source level. When it is on (conducts) its dynamic resistance is very - very low.



Features:

MOSFET	: Two (PMOS) mounted upon heat sink
Pulse generator	: 100-200Hz with variable frequency control
Pulse width control	: Duty factor 0.6-1
Transformer	: One double wound
Load	: Fixed resistive
DC Source	: 12 volt 0.5 Amp
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	:320x190x75mm(approx)

EXPERIMENT COVERED

Study of MOSFET based parallel inverter circuit

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SPL 533
S.C.R. BASED BRIDGE INVERTER

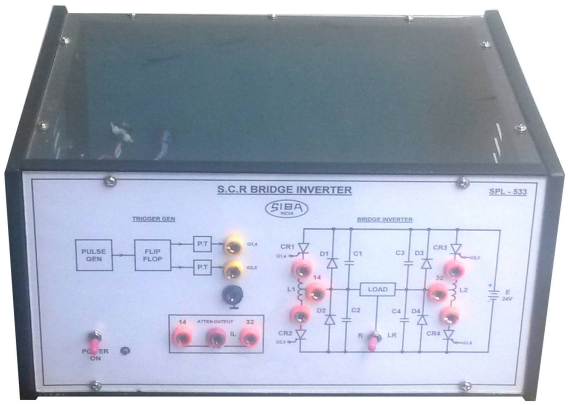
INTRODUCTION:

The kit is designed to study low capacity SCR bridge inverter input - output characteristics. The kit consists 4 SCRs, two inductor, four commutation capacitor, one dc ammeter, firing circuit and provision for connection of resistive load in form of wire wound resistors. The power source is inbuilt with the kit fully regulated and overload/overcurrent protected. The kit rated output is 20W The circuit schematic is divided in two parts

(a) the firing control circuit and

(b) the inverter circuit.

The firing control circuit has back to back connected UJT relaxation oscillator.



Features:

S.C.R.	: Four(600V/12A)
Diodes	: Four(400V/4A)
Commutation capacitor	: Four
Pulse Generator	: Digital
Pulse Transformer	: 2 nos.
Inductors	: Two
Load resistance	: Three fixed
Display	: Digital ammeter
DC Source	: 24V/2A
Cabinet	: Transparent top
Power supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	:320x260x160mm(approx).

EXPERIMENT COVERED

Study of S.C.R. Bridge inverter circuit
(based upon mcmurray bedford inverter)

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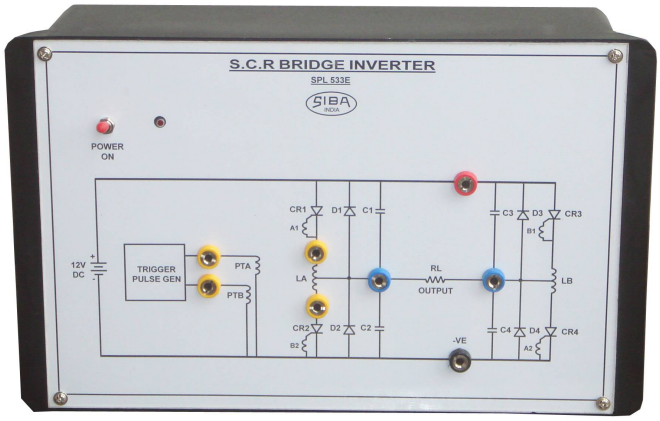
SPL 533E
S.C.R. BASED BRIDGE INVERTER

INTRODUCTION:

The kit is designed to study low capacity SCR bridge inverter input - output characteristics. The kit consists 4 SCRs, two inductor, four commutation capacitor, four diodes, firing circuit and provision for connection of resistive load in form of wire wound resistors. The power source is inbuilt with the kit fully regulated and overload/overcurrent protected. The kit rated output is 10W The circuit schematic is divided in two parts

(a) the firing control circuit block

(b) the inverter power circuit (based upon mcmurray - bedford principle).



Features:

S.C.R.	: Four(400V/2A)
Diodes	: Four(400V/2A)
Commutation capacitor	: Four (MPER)
Pulse Generator	: Digital (fixed frequency)
Pulse Transformer	: 2 nos.
Inductors	: Two (center tapped)
Load resistance	: fixed
DC Source	: 12V/0.5A
Power supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	:320x190x75mm(approx).

EXPERIMENT COVERED

Study of S.C.R. Bridge inverter circuit
(based upon mcmurray bedford inverter)

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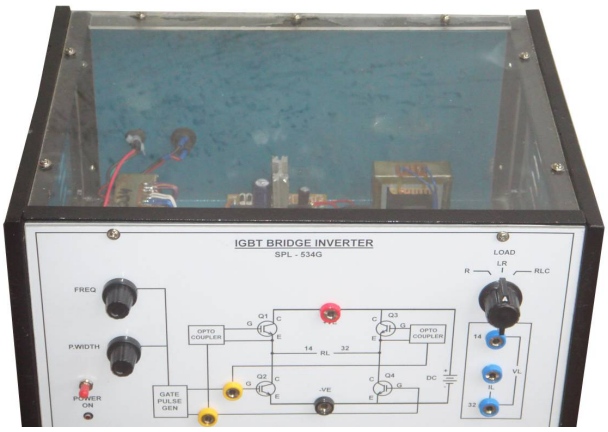
SPL 534
MOSFET/IGBT BASED BRIDGE INVERTER

INTRODUCTION:

The kit is designed to study basic IGBT OR MOSFET bridge inverter characteristics. The inverter run fixed frequency (56 Hz approx). The kit consists 4 No. IGBT (600V 35A) /MOSFET , four optoisolators, pulse gen circuit with R & LR loads. The power source is inbuilt with the kit fully regulated and overload / overcurrent protected. The inverter bridge is formed by four IGBT/MOSFET. Since turn - off system in IGBT/MSOFET is quite simple by removal of gate drive, therefore no commutation circuit required, which leads to simple design.Because of simple turn on - off system in these devices, the output pulse width (hence the output power) can be controlled by varying gating time. Use of IGBT in bridge inverters simplify the requirement of switching scheme (in counter - part thyristors required commutation circuits).



Features:

IGBT/MOSFET	: Four with snubber
Pulse generator	: 100-200 Hz
Pulse width	: Duty factor 0.1-1
Load	: R,LR & RLC
Input supply	: In form of DC 24V/2A
Cabinet	: Transparent top
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	:320x260x160mm(approx)

EXPERIMENT COVERED

Study of IGBT OR MOSFET bridge inverter circuit with different loads.

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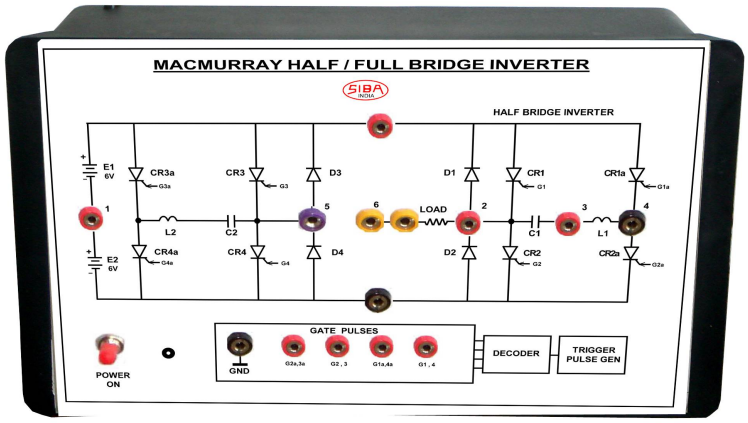
SPL 535
MCMURRAY HALF/FULL INVERTER

INTRODUCTION:

The kit is designed to study Macmurray half/full bridge inverter characteristics. The kit consists 8 SCRs, two inductor, two commutation capacitor, four diodes, firing circuit and load in form of wire wound resistor. The power source is inbuilt & operates at 220 Vac line. Few sockets are given to observe the firing pulse waves and inverter output waveform.

Complete inverter circuitry is well printed on the panel



Features:

S.C.R.	: Eight (400V/4A)
Diodes	: 400V/4A
Capacitor	: Two for commutation
Pulse Transformers	: Four
Pulse Generator	: Logic based at fix frequency
Resistive load	: Fixed
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 310x210x160mm(approx).

EXPERIMENT COVERED

Study of macmurray based half bridge inverter
Study of macmurray based full bridge inverter

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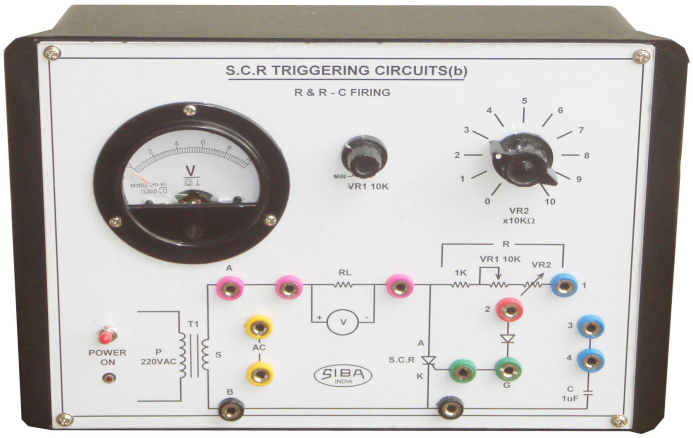
SPL 536
S.C.R. R, R-C TRIGGERING CIRCUIT

INTRODUCTION:

In ac circuits the SCR can be turned on at any angle a with respect to the appllied voltage polarity. The angle α is oftenly called the firing angle. Powercontrolled by this manner is called half control. The control element is calledtrigger circuit. The SCR firing angle may be controlled using passive com-ponents such resistor and resistor - capacitor combination. The SCR maybe triggered by many trigger method, but the most efficient and widely em-ployed is gate trigger. A SCR is trig gered when its anode is +ve with re-spect to its cathode and applying a +ve voltage (smaller magnitude than theanode) at its gate - cathode circuit trigger it to comes in on state. In acphase control this is made by using a variable R in series with load or simplyconnecting a R between its anode and gate.



Features:

S.C.R.	:	One (400V/2A)
Transformer	:	One low voltage transformer 20V &3V
Meter	:	One voltmeter across RL
Capacitor	:	One capacitor for phase delay
Resistance	:	Decade of R with one potentiometer.
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Patch cord	:	Necessary to perform expt.
Manual	:	One.
Size	:	260x190x75mm(approx).

EXPERIMENT COVERED

To study SCR triggering method using R
To study SCR triggering method using R -C delay

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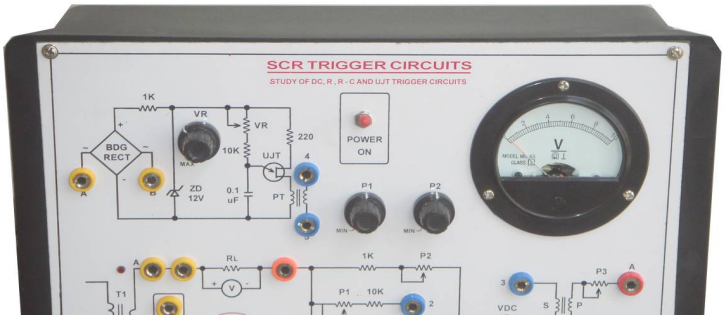
SPL 537
S.C.R. TRIGGERING CIRCUITS

INTRODUCTION:

Switching a thyristor on, is called its triggering or firing. As we know that current flows in a SCR when it is in ON state. There are many methods bywhich a SCR can be triggered, but the most widely used is 'gate trigger method'. The gate triggering is most common in practice. In lab practicals we trigger the SCR at different gate current magnitudes to obtain forward breakover voltage earlier than its VBo. In SCR a positive polarity signal is applied between its gate - cathode junction to force it on at specified break over voltage. In view of practical application (the phase control) the firing angle α is controlled by varying the gate signal or current magnitude.In present board three mothod are given asa. The dc control with superimposed ac.b. The R and R - C phase shift triggering.c. The pulse triggering by a relexation oscillator.The board has inbuilt step down transformer, fixed value load resistor, one dc voltmeter to monitor average load voltage and associated independent circuits for triggering method.



Features:

S.C.R.	:	One
Transformer	:	One low voltage transformer 20V One small with 0-1V DC supply
Meter	:	One voltmeter across RL
Capacitor	:	One capacitor for phase delay
Resistance	:	Continuouslly variable potentiometers for R, RC, Pulse (UJT oscillator) and superimposed AC
Pulse		
Transformer	:	One
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Patch cord	:	Necessary to perform expt.
Manual	:	One.
Size	:	320x190x75mm(approx).

EXPERIMENT COVERED

To study SCR triggering method using R
To study SCR triggering method using R -C
To study SCR triggering method using superimposed AC
To study SCR triggering method using UJT Relexataion oscillator(Pulse triggering)

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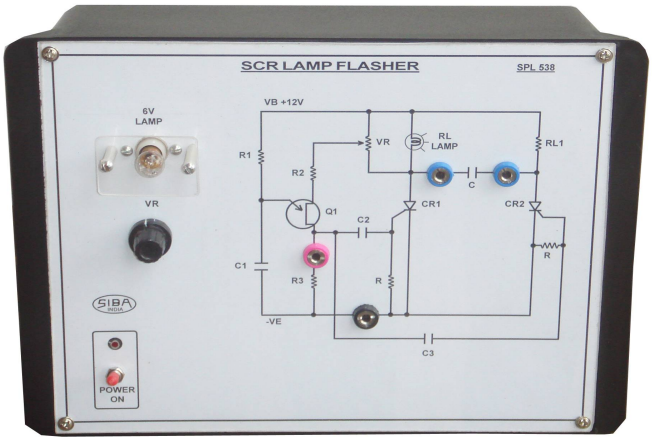
SPL 538
S.C.R. BASED LAMP FLASHER

INTRODUCTION:

A flip - flop is a bistable circuit in which the one's output remain in stable state till the complement stage is triggered to change the state. A bistable is also called the latch. The common SCR is a good latch device and useful to make bistables. But it has a disadvantage that it can't be retriggered to change the state (cut - off). The only way to delatch SCR to bring its anode - cathode current down below holding current or momentarily cut - offits supply. The other way is to fed complemented voltage at its anode(or cathode depends upon which terminal is connected with RL) to bring it in cut - off state. The complemented voltages are achieved by charging - dis-charging a capacitor across both stages RL as shown in fig 3. In fig 3, when trigger pulse applied to the gate of SCR 1, It immediately starts conducting and its anode potential drops to nearly VAK on



Features:

S.C.R.	:	Two (400V/2A)
DC supply	:	One 12V/1A DC
Commutation Capacitor	:	One
Load	:	6V/2.1W lamp load with limiting resistor
Trigger circuit	:	UJT relaxation oscillator
Flashing period	:	1.5s - 0.2s
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Manual	:	One.
Size	:	260x190x75mm(approx).

EXPERIMENT COVERED

To study scr based lamp flasher at different flashing rates
To study complementary voltage commutation.

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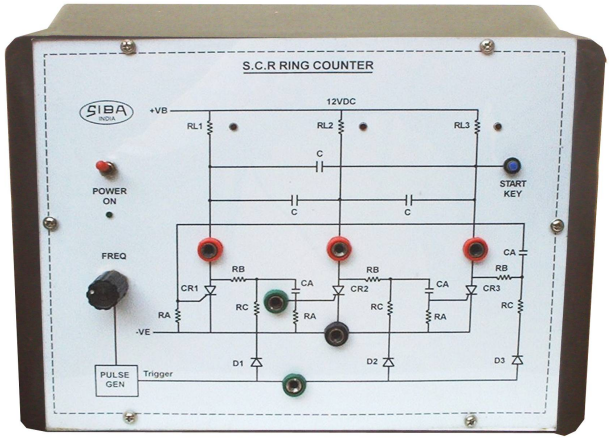
SPL 539
S.C.R. BASED RING COUNTER

INTRODUCTION:

A flip - flop is a bistable circuit in which the one's output remain in stable state till the complement stage is triggered to change the state. A bistable is also called the latch. The common SCR is a good latch device and useful to make bistables. But it has a disadvantage that it can't be retriggered to change the state (cut - off). Compare the circuit shown in fig 1 and 2. The fig 2 circuit is not re triggerable. The only way to delatch SCR to bring its anode - cathode current down below holding current or momentarily cut - offits supply. The other way is to fed complemented voltage at its anode(or cathode depends upon which terminal is connected with RL) to bring it in cut - off state. The complemented voltages are achieved by charging - discharging a capacitor across both stages RL . When trigger pulse applied to the gate of SCR 1, It immediately starts conducting and its anode potential drops to nearly VAK on level.



Features:

S.C.R.	:	Three(600V/12A)
DC supply	:	One 12V/1A DC
Commutation Capacitors	:	Three
Indication	:	Through three LED's to indicate sequence
Key	:	One
Trigger	:	UJT relaxation oscillator with variable frequency and diode sharing network
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Manual	:	One.
Size	:	260x190x75mm(approx).

EXPERIMENT COVERED

To study scr based three stage ring counter
To study complementary voltage commutation .

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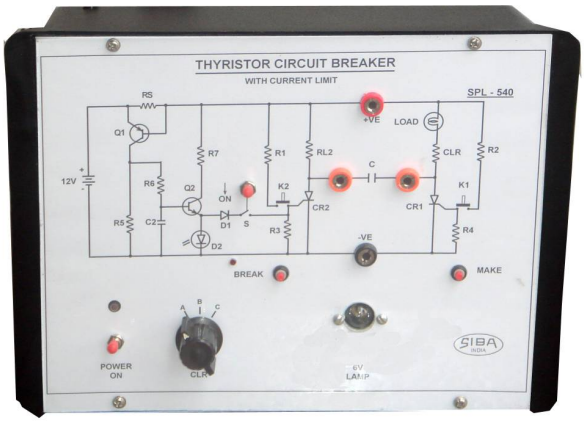
SPL 540
S.C.R. DC CIRCUIT BREAKER WITH CURRENT LIMIT

INTRODUCTION:

In simple circuit breaker system relays are used to control on - off. In these days thyristors are used for the same system. The property of a SCR is to latch, when it can be triggered by an input gate current, when its anode is +ve than its cathode. The SCR get turn off by breaking the anode current producing anode current below a value IH. In AC control circuit it is easy to maintain this operation of circuit making and breaking since SCR can off/ on each successive half cycle. But in DC control circuit SCR does not break since there is no polarity reversal. To break the circuit forced computation is used in which another SCR is used to commutate the main SCR. Thyristor circuit breaker : In DC breaker circuit, shown in fig 2, Cr1 is the main load current carrying SCR and CR2 is auxiliary SCR.



Features:

S.C.R.	:	Two with two keys for make-break operation
Commutation Capacitor	:	One
Load Current	:	Three selectable
Switch	:	One
DC supply	:	12V/1A
Current sensing	:	Two transistors circuitry
Load	:	6V with lamp load and current limit resistor.
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Manual	:	One.
Size	:	260x190x75mm(approx).

EXPERIMENT COVERED

To study thyristor ckt. breaker in dc ckt.
To study current limiter action
To study complementary voltage commutation.

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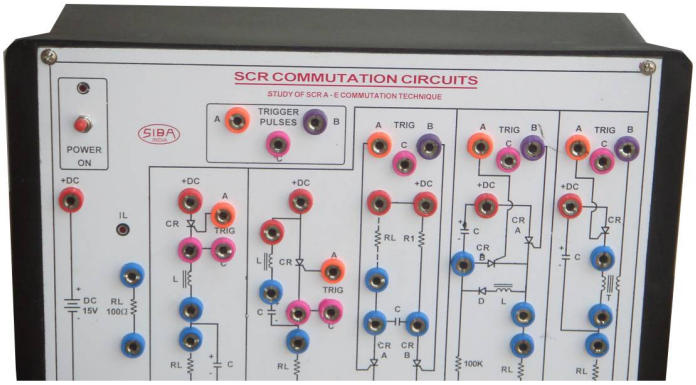
SPL 541
S.C.R. COMMUTATION CIRCUITS CLASS A - E

INTRODUCTION:

In ac circuits the SCR can be turned on at any angle a with respect to the appllied voltage polarity. The angle α is oftenly called the firing angle. Powercontrolled by this manner is called half control. The control element is calledtrigger circuit. The SCR firing angle may be controlled using passive com-ponents such resistor and resistor - capacitor combination. The SCR maybe triggered by many trigger method, but the most efficient and widely em-ployed is gate trigger. A SCR is trig gered when its anode is +ve with re-spect to its cathode and applying a +ve voltage (smaller magnitude than theanode) at its gate - cathode circuit trigger it to comes in on state. In acphase control this is made by using a variable R in series with load or simplyconnecting a R between its anode and gate.



Features:

S.C.R.	:	Seven (400V/1A)
Commutation Capacitors	:	Five
Diodes	:	One (400V/1A)
DC supply	:	12V with resistive load
Commutation method	:	Class A to E configuration through sockets
Load	:	One resistive with LED indicator
Inductors	:	Five
Pulse generator	:	Complementary output
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Patch cord	:	Necessary for expt.
Manual	:	One.
Size	:	320x190x75mm(approx).

EXPERIMENT COVERED

To study forced commutation in thyristorized dc circuit class A-E

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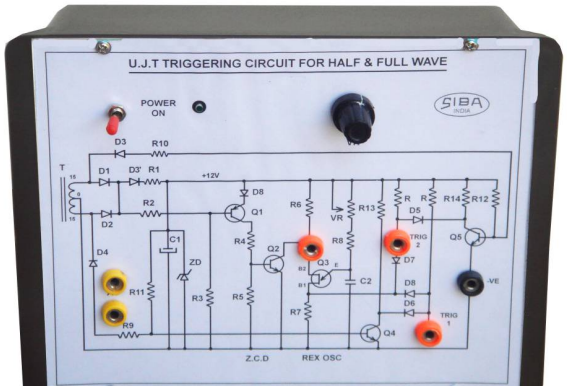
SPL 542
U.J.T. TRIGEERING CIRCUIT

INTRODUCTION:

In ac circuits the SCR can be turned on at any angle α with respect to the applied voltage polarity. The angle α is often called the firing or delay angle. In other words 'in order to control the output voltage of thyristor controlled converter, it is necessary to control the phase of the thyristor firing pulses'. Circuits used for the purpose are called 'triggering circuits'. The UJT applications include relaxation oscillator, used as trigger device in phase control circuits. In these circuits UJT is biased such that a charge current flows through a resistance (VR + R8) to charge capacitor C2. When voltage across C2 is equal to Vp (peak voltage), the emitter - base junction becomes forward - biased and UJT get turns on. The C2 discharge through it cause to produce a sharp current pulse at B1. The repetition rate of pulses at B1, depends upon charge current, which is made variable by mean of VR. In phase control circuits, line synchronized relaxation oscillator used to obtain symmetrical conduction, by mean of position of firing pulse α..



Features:

U.J.T.	:	One
Transistor	:	Four
Diode	:	Six
Timing Capacitor	:	One
Transformer	:	One step down 15-0-15V AC and 0-3V
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Manual	:	One.
Size	:	260x190x75mm(approx).

EXPERIMENT COVERED

To study UJT trigger circuit for half/full converter .

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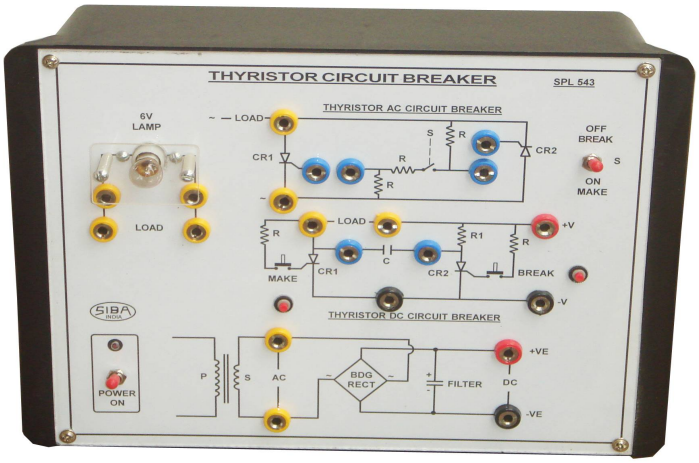
SPL 543
S.C.R. AC/DC CIRCUIT BREAKER

INTRODUCTION:

In simple circuit breaker system relays are used to control on - off. In these days thyristors are used for the same system. The property of a SCR is to latch, when it can be triggered by an input gate current, when its anode is +ve than its cathode. The SCR get turn off by breaking the anode current or reducing anode current below a value IH. In AC control circuit it is easy to maintain this operation of circuit making and breaking since SCR can off/ on each successive half cycle. But in DC control circuit SCR does not break since there is no polarity reversals. To break the circuit forced commutations is used in which another SCR is used to commutate the main SCR.



Features:

S.C.R.	:	Four
Capacitor	:	One for commutation (for dc)
DC supply	:	12V (unregulated)
AC supply	:	12V
Key	:	Two in DC circuit.
Switch	:	One in AC circuit
Load	:	One 6V/2.1W lamp
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Manual	:	One.
Size	:	260x190x75mm(approx).

EXPERIMENT COVERED

To study thyristor AC circuit breaker
To study natural (class F) commutation
To study thyristor DC circuit breaker
To study Complementary voltage commutation

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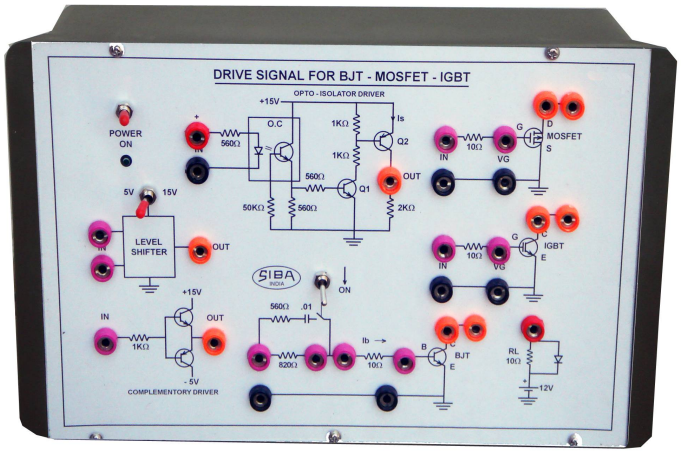
SPL 544
TRIGGER CIRCUIT FOR POWER,BJT,MOSFET,IGBT

INTRODUCTION:

The function of a drive circuit is to switch power device (BJT,MOSFET, IGBT) from the off state to on state and vice versa. In most cases a drive circuit used to minimize the turn - on and turn - off time, so the power device take little time in traversing the active regionto enhance the speed and operating frequency. Taking BJT drive, the first kind of drive is most common in practiceis dc coupled (TTL compatible) drive. At medium operating frequency (1Khz) the device turn - on and turn - off characteristics is quite well, but at high frequency (10Khz) signal the turn on period extended. Therefore this base drive is suitable for low frequency operations only, but it cannot be used in pulse width modulated drive signals.



Features:

B.J.T.	:	One high power mounted on heat sink
I.G.B.T.	:	One high power mounted on heat sink
Mosfet	:	One high power mounted on heat sink
Drive circuit	:	1. Optoisolator driver
		2. Level Shifter
		3. Complementary driver.
DC supply	:	12V with resistive load
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Patch cord	:	Necessary to perform expt.
Manual	:	One.
Size	:	320x190x75mm(approx).

EXPERIMENT COVERED

To study power BJT trigger circuit
To study power IGBT trigger circuit
To study power MOSFET trigger circuit

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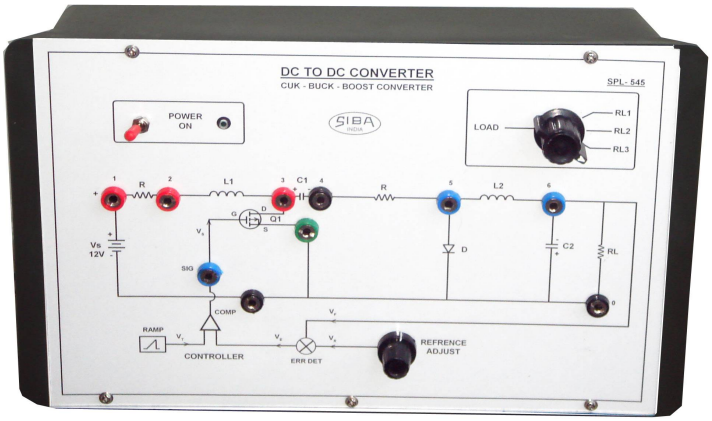
SPL 545
BUCK-BOOST CONVERTER(CUK)[SWITCH MODE REGULATOR]

INTRODUCTION:

A chopper can be used as switched mode regulator, which convert a dc voltage (either from unregulated or fixed dc source) into a variable regulated dc output voltage. The regulation is achieved by pulse width modulation (PWM) at a fixed frequency, and the switching device may be power transistor, Mosfet or IGBT. There are four basic kind of such regulators and 'Cuk regulator' is one of them. The Cuk regulator is similar to a buck - boost regulator, with a difference of energy transfer principle. It is based on the 'capactive energy transfer' principle, where energy stored in a series capacitor is transferred to the load.



Features:

Mosfet	:	One
Capacitors	:	Two
Diode	:	One
Inductors	:	Two
Controller	:	Ramp- comparator technique with variable reference
DC supply	:	12 V/1A
Load	:	Three in form of load resistors
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Patch cord	:	Necessary to perform expt.
Manual	:	One.
Size	:	310x210x80mm(approx).

EXPERIMENT COVERED

To study buck boost cuk converter

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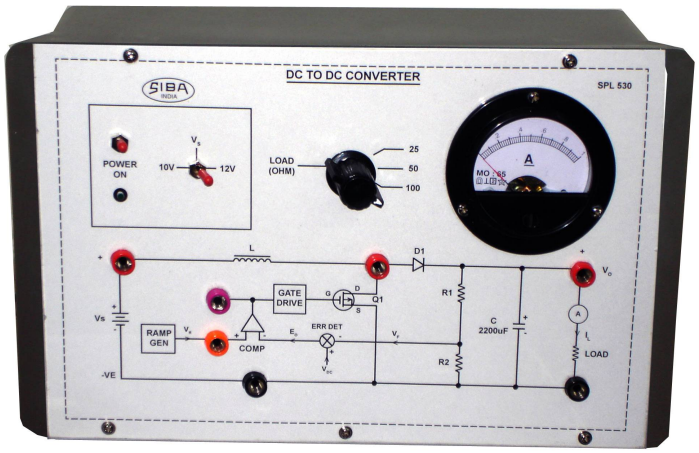
SPL 546
DC TO DC CONVERTER

INTRODUCTION:

DC to DC converters are self commutated choppers in which current extinction, or may be turn off accomplished by gate pulse control of the device. These choppers utilize self - commutated devices such as MOSFET, IGBT, BJT or GTO's to transfrom DC voltage from one level to another. This exp board is designed to study of such step up converter. It has inbuilt control circuitry printed upon panel in blocks, power source, chopper with test points to study of input - output characteristics of such converters. As stated earlier. that these are self commutated choppers, where the average output voltage depends upon the switch on and off duration. Therefore these converters involve pulse width modulation in control circuit. Mostly the switching frequency is constant.



Features:

Mosfet	:	One
Capacitor	:	One
Diode	:	One
Inductor	:	One
Controller	:	Ramp- comparator technique with variable reference
DC supply	:	12V/1A
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Patch cord	:	Necessary to perform expt.
Manual	:	One.
Size	:	320x190x75mm(approx).

EXPERIMENT COVERED

To study dc to dc up/down (buck-boost)converter

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INTRODUCTION:

Features:

S.C.R	:	Two
Capacitor	:	One
Diode	:	Two
Zener	:	Two
AC supply	:	In 5 steps
Mains	:	220V/50Hz AC
Manual	:	One.
Size	:	320x190x75mm(approx).

EXPERIMENT COVERED

To study Thyristor based overvoltage protection circuit.

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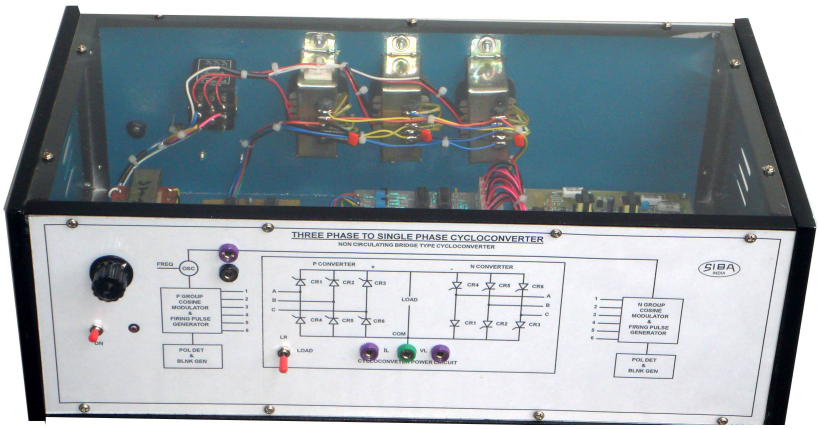
SPL 548
THREE PHASE BRIDGE CYCLOCONVERTER

INTRODUCTION:

A cycloconverter oftenly called as 'cycle converter' changes the frequency of a single (or three phase) alternating power source without the necessity of an intermediate ac to dc conversion stage. A cycloconverter require multiple control device of a single or three phase excitation, and are limited to low output frequency only. The output of a cycloconverter has a relatively large ripple voltages but comparatively small ripple currents, which is what contributes to motor heating. One thing is to be pointed out that higher the output frequency higher the ripple currents will be since there will be fewer supply pulses per output cycle. This practically limit the upper frequency of a cycloconverter to 1/3 if a half converter is used and 1/4 if a full converter is used. The cycloconverter applications are in elevators, traction motors , in aircrafts and some other places where low speed is required without using gears.



Features:

S.C.R.	: Eight
Inductor	: One center tapped
Transformer	: One 30V AC
Load	: Fixed inductance & resistive
Firing angle Pulse	: Logically control circuit
Transformer	: 4 nos. to couple logic signal with thyristors
Switch	: One to obtain 1/2,1/3 & 1/4 of input frequency
DC supply	: + 5V for control circuit
Cabinet	: Transparent top
Observation	: Through Test points
Power supply	: Short circuit & overload protected
Mains	: 230V/50Hz AC
Instruction manual	: One
Size	: 320x260x160mm(approx).

EXPERIMENT COVERED

To study Three phase bridge cycloconverter

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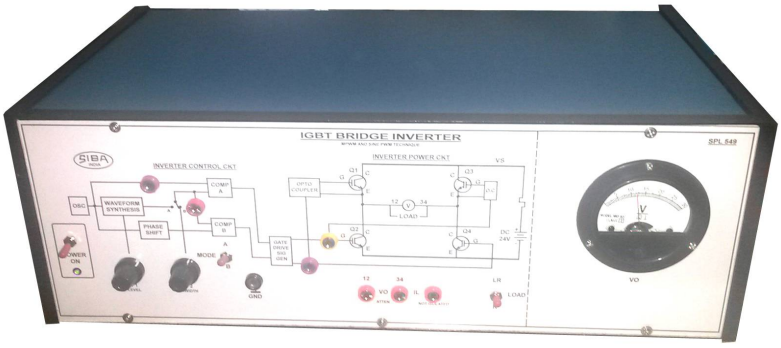
SPL549
I G B T Based PWM INVERTER

INTRODUCTION:

The kit is designed to study basic IGBT bridge inverter characteristics. The inverter run fixed frequency (56 Hz approx). The kit consists 4 No. IGBT (600V 35A) , four optoisolators, pulse gen circuit with R & LR loads. The power source is inbuilt with the kit fully regulated and overload / overcurrent protected. Sine wave pulse modulation (SWPM) : In this technique, a repetitive switching frequency, triangular wave called 'carrier wave' having constant amplitude , Vt, is compared with time varying control signal called reference wave or RW (usually low frequency sine wave, as in present case triangular wave can also be used). The width of each pulse is varied proportional to the amplitude of reference wave, where in MPM case the width is constant. The frequency of reference wave determine the half cycle period (0 - p) of inverter and its peak amplitude determine the modulation index, 'M' , and then in term of output voltage. By varying the reference wave amplitude the output voltage is controlled.



Features:

IGBT	: Four
Pulse generator	: inbuilt to produce triangular carrier and sine/sqaure for modulation
Resistive load	: One fix
Meter	: One analog
Input supply	: In form of DC 24V/2A
DC supply	: Short circuit & overload protected
Observations	: Test points provided at different stages for CRO
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	:310x210x160mm(approx)

EXPERIMENT COVERED

To study PWM controlled inverter (voltage control)characteristics
.To study Multiple PWM controlled inverter characteristics
.To study Sinusoidal PWM controlled inverter characteristics

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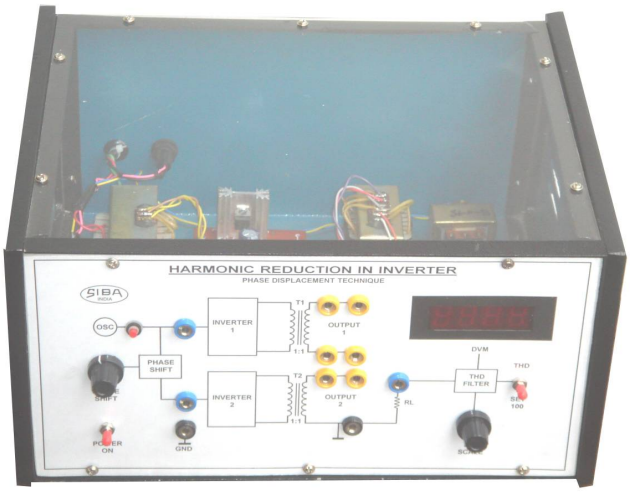
SPL550
HARMONIC REDUCTION IN INVERTER

INTRODUCTION:

This method to have a net output with reduced harmonic current, output voltage from two (or more) inverters can be combined by means of two identical transformers. The essential condition of this method is that the output voltage waveforms from the inverters must be same, but phase shifted from each other. Since third harmonic is the most predominant harmonic in the output of inverter. The circuitry is represented in blocks



Features:

Inverter	: Two identical (MOSFET based)
Pulse Generator	: One
Circuitry	: Phase shift RC from 0-90□ degree approx. by potentiometeric control.
Filter	: A tunned THD (total harmonic distortion) filter, incorporated to read the THD at output,
Meter	: One 3.5 digit panel meter
Cabinet	: See through acrylic top
Observation	: Test point for CRO
DC supply	: Short circuit & overload protected
Mains	: 220V/50Hz AC
Instruction manual	: One
Size	: 460x210x160mm(approx)

EXPERIMENT COVERED

To study harmonic reduction in inverter using transformer connection (by phase displacement method).

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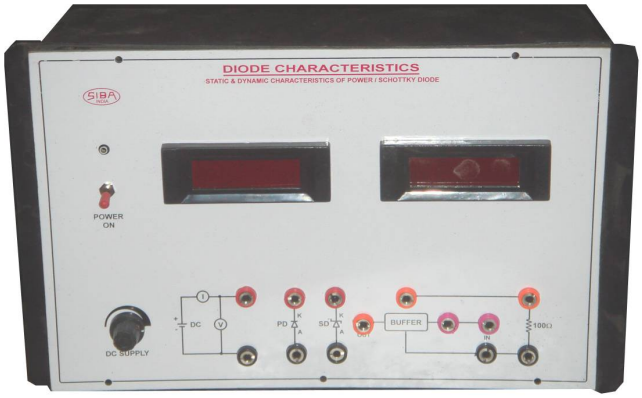
SPL 551
POWER & SCHOTTKY DIODE CHARACTERISTICS

INTRODUCTION:

A diode is a two terminal p - n junction device and normally formed by diffusion, point contact, alloying or epiaxial growth. The modern technology in diffusion and epiaxial process permit to achieve desired effect (charateristics). The diode characteristics : Generally modern diodes (power) are made of silicone wafers, which permit low forward potential (cut - in) and very high reverse breakdown voltage. When a diode's anode terminal is positive with respect to cathode, the diode is said in forward - bias mode (rectifying action).



Features:

Diode	: One Power & One Schottky
DC supply	: 0-5V/500mA variable
Display	: Digital volt & ammeter
Test Points	: Adequate for CRO,Sockets for function generator input & CRO to observe reverse recovery of diodes.
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 310x210x160mm(approx).

EXPERIMENT COVERED

To study V I (static) ch of power and schottky diode.
To study reverse recovery time of power and shottky diode (dynamic).

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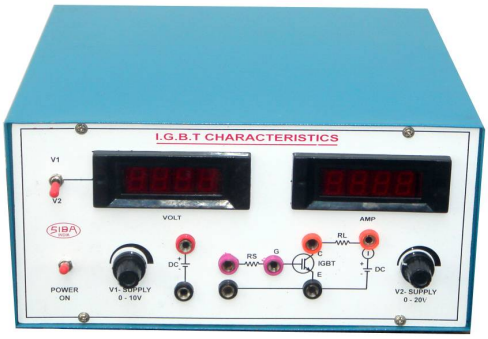
SPL 552
I.G.B.T. CHARACTERISTICS

INTRODUCTION:

The devlopment in power mosfet technology is the insulated gate bipolar transistor or IGBT. These devices has same high input impedance (like mosfets), and in addition low on state voltage like bipolar transistors. How-ever the turn off time of IGBT is superior then that of mosfets. The voltage driven drive (input) ease the drive circuit. The given app has* DC regulated continuously variable power supplies for collector - emitter and gate - emitter, provided on sockets. A 6.6Ω resistor is seriesed withcollector supply to save the device.



Features:

DC power supply : Two dc regulated power supply gate - emitter.

Meters : Two digital panel meters for volt and current.

Test points : Adequate test points for Input / output switching waveform can be observed on CRO by feeding sq wave.

Mains : 220Vac 50 Hz.

Size : 300 x 150 x 250 mm (approx)

EXPERIMENT COVERED

Study of V-I Characteristics of IGBT

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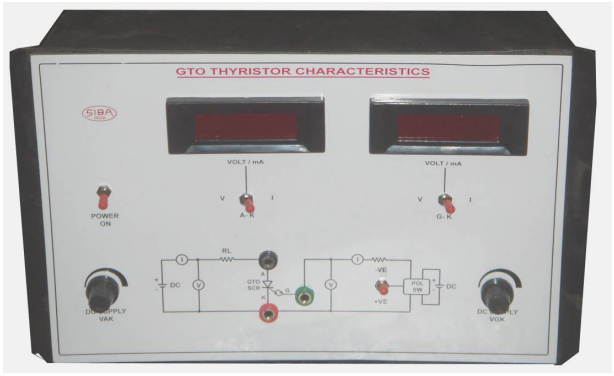
SPL 553
CHARACTERISTICS OF GATE TURN - OFF THYRISTOR (G.T.O.)

INTRODUCTION:

The gate turn - off thyristor (GTO) : It is also a PNPN device (as conventional thyristors), that can be triggered into conduction by applying small gate current (+ve w.r.t cathode) pulse, but it has capability of being turn - off by applying large negative gate current (-ve w.r.t. cathode) pulse. However the turn - off gate currents are very much differ, a few mA at 1V max to turn - on, but large (about 1/ 4 to 1/ 6th time of anode current) current at bigger magnitude (voltage) require to turn - off.



Features:

DC supply	: One 0-25V continuously variable for anode-cathode
	: One 0-20V for gate -cathode with polarity reverse switch
Display	: Two (One meter for voltage/current in anode circuit and one for volt/ current in gate circuit
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 310x210x160mm(approx).

EXPERIMENT COVERED

Study of V-I characteristics of gate turn - off thyristor

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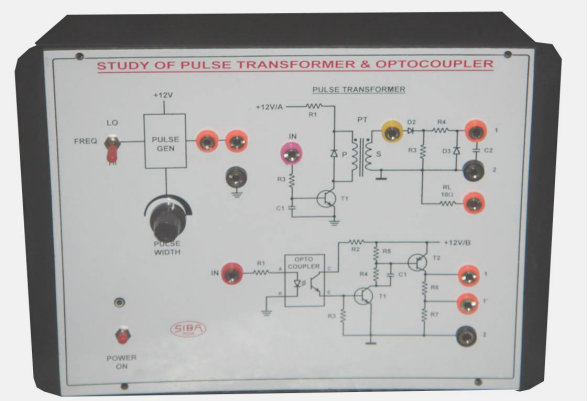
INTRODUCTION:

Pulse transformers are used to couple a trigger pulse generator to a thyristor in order to obtain isolation between two circuits. Generally these are wound upon a ferrite cored bobbin, in 1 : 1 ratio (NP : NS), to couple one thyristor, or 1 : 1 : 1 fashion to couple a pair of thyristors. In given experimental board it is in 1 : 1 form.



Features:

DC supply	: Two 5V & 12V DC
Pulse Generator	: One, Two selectable frequency & variable pulse width
Pulse Transformer	: One ferrite wired 1:1
Optocoupler	: One
Test Points	: Adequate for CRO observations
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 310x210x160mm(approx).

EXPERIMENT COVERED

To study of Firing Circuit based on ICs NE555, 7408 & 3140

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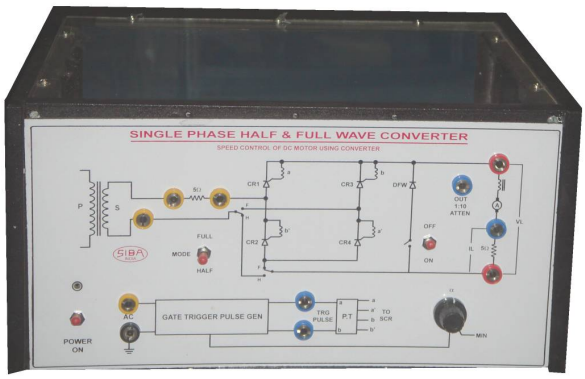
SPL 555

SINGLE PHASE HALF & FULL WAVE FULLY CONTROLLEDCONVERTER

INTRODUCTION:

The kit is designed to study SCR half wave/ full wave (bridge) fully controlled converter output characteristics. The kit consists isolated ac supply, firing angle control circuit with two, 1 : 1 pulse transformer with four 600Vac 10A silicone controlled rectifier wired in half wave/full wave bridge (mode selectable) rectifier/converter configuration. One small dc motor connected at output as load. Effect of free wheeling diode can be realized with given DFW. Sockets are provided at input/output places to observe the waveforms.



Features:

S.C.R.	: 1/4 configured as half or full wave
Trigger circuit	: Based upon logic Ic's
Pulse transformer	: Two
Load	: Small DC motor
Free Wheeling diode	: One
DC supply	: Separate for firing circuit
Test Points	: Adequate for CRO observations
Cabinet	: Transparent top
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 310x210x160mm(approx).

EXPERIMENT COVERED

Speed control of small motor using Single Phase Half wave & Full wave fully controlled Converter

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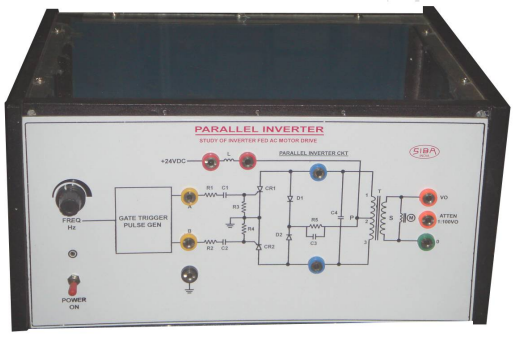
INTRODUCTION:

The kit is designed to study SCR parallel inverter driven small ac induction motor. The kit consists inverter transformer, 2 SCRs, one inductor, one commutation capacitor, one small ac induction motor, trigger circuit with variable frequency .



Features:

S.C.R.	: Two
Inductor	: One
Transformer	**:** One double wound
Capacitor	: One for Commutation
Pulse generator	: 30-80 Hz
Pulse Transformer	: One
L**oad**	: Small AC induction motor
Input Supply	: In form of DC 24V/3A
Cabinet	: Transparent top
DC supply	: Short circuit & overload protected
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 310x210x160mm(approx).

EXPERIMENT COVERED

Study of S.C.R. Parallel inverter circuit

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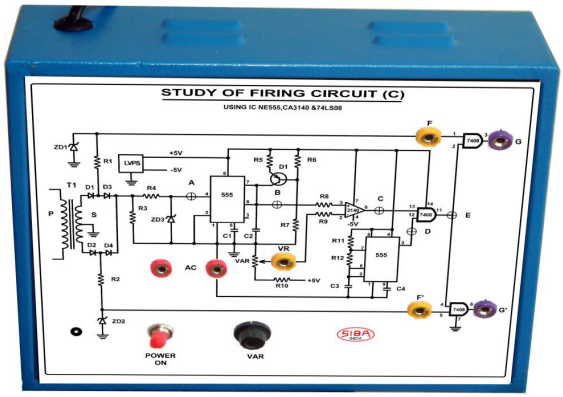
SPL 557
FIRING CIRCUIT BASED ON ICS NE555, 7408 & 3140

INTRODUCTION:

In ac circuits the SCR can be turned on at any angle with respect to the appllied voltage polarity. The angle is oftenly called the firing angle. Power If load is resistive only than there is no need of commutation since SCR is turned off when current passed through it becomes zero during crossover point of the input cycle. Which is called line synchronization. The line synchronization signal is taken from step down transformer T1 secondary and fed to RESET pin of IC1(NE555). This cause to reset 555 at end of each half cycle, thus its output is line synchronized.



Features:

DC supply	: 5V/200mA short circuit & overload protected
Firing circuit	: NE555(2), 74LS08(1), CA3140(1)
Pulse Generator	: One
Test Points	: Adequate for CRO observations
Instruction manual	: One
Mains	: 220V/50Hz AC
Size	: 310x210x160mm(approx).

EXPERIMENT COVERED

To study of Firing Circuit based on ICs NE555, 7408 & 3140

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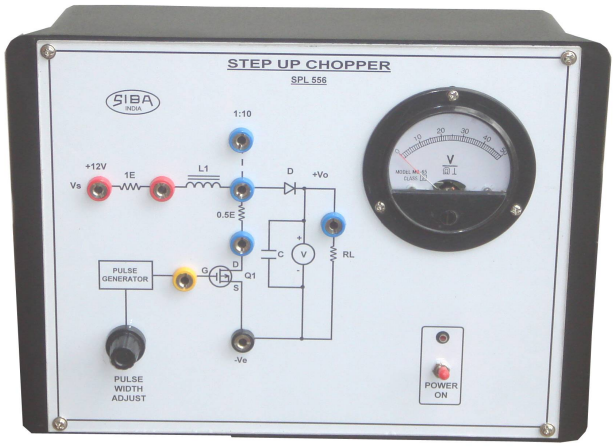
SPL 558
MOSFET BASED CHOPPER CIRCUIT(STEP UP)

INTRODUCTION:

This kit is designed to study step down chopper based upon MOSFET. The power circuitry consists of a mosfet to give dc output < input dc supply. The variable pulse width generator used to control the mosfet switching period, hence to control the output voltage.

The input supply is in form of regulated short circuit protected 12V dc and output is made variable upto 10VDC with pulse width control(gate pulse width control).



Features:

Mosfet	:	One (400V/8A)
Capacitors	:	One for filtrations
Pulse generator	:	One for variable pulse width
Potentiometer	:	One for control of width
Load	:	Fixed resistive
Input supply	:	In form of DC 12V/0.5A
Power supply	:	Short circuit & overload protected
Mains	:	Operable on 220V/50Hz AC
Manual	:	One
Size	:	230x185x75mm(approx).

EXPERIMENT COVERED

To study Step up MOSFET Chopper

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