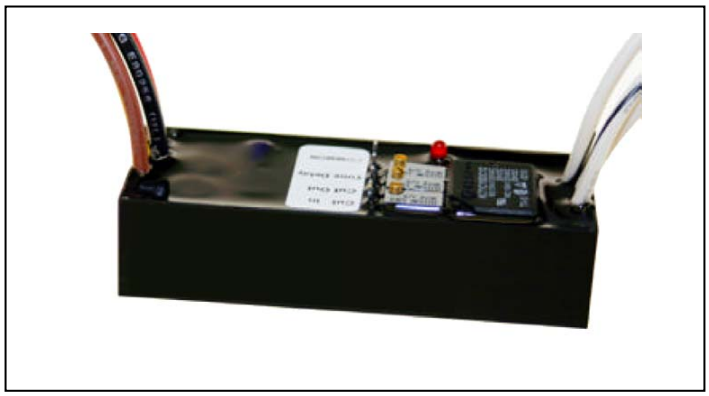
VRDC Series

ADJUSTABLE VDC OR VAC –TO- (1) SPDT, 12 AMP, TIME DELAY RELAY



	POWER:	INPUT SIGNAL:	PAGE:
VRDC/12V/30	10..18 VDC	0..30 VDC or 0..150 VAC	2-5
VRDC/12V/60	10..18 VDC	0..60 VDC or 0..150 VAC	6-9
VRDC/24V/30	18..35 VDC or 24 VAC	0..30 VDC or 0..150 VAC	10-13
VRDC/24V/60	18..35 VDC or 24 VAC	0..60 VDC or 0..150 VAC	14-17

VRDC/12V/30
VOLTAGE SENSITIVE RELAY FOR DC

FEATURES

- **Operates over a power range of 10 to 18V DC**
- **Adjustable thresholds for cut-in and cut-out points between 1 to 30V DC & 0 to 150V AC**
- **12 Amp SPDT relay contact**
- **Automatic reversible action with the cut-in, cut-out adjustments**
- **Adjustable 0 to 255 sec. time delay on cut-in**
- **Compact size eliminates mounting problems**

APPLICATIONS

- **Low voltage cutoff and generator control**
- **HVAC heating & cooling staging**
- **Hydro-electric power shunt**
- **Battery charge controller**

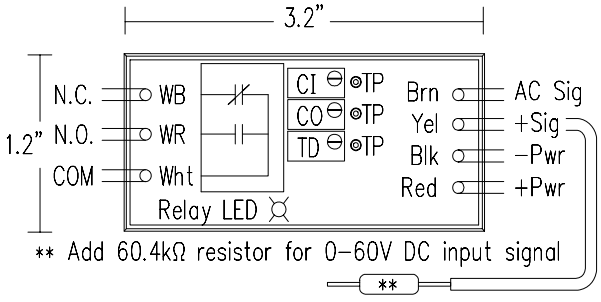
DESCRIPTION

The VRDC12v is an Adjustable Voltage Relay for DC applications. The VRDC can be used in applications where a varying DC voltage is used to switch an adjustable relay such as in generator control or a low battery voltage load disconnect. The “cut-in” voltage, “cut-out” voltage, and the time delay value are adjusted on multi-turn potentiometers by measuring the respective test points and adjusting the potentiometers per the set-up instructions and chart on the back side of last page.

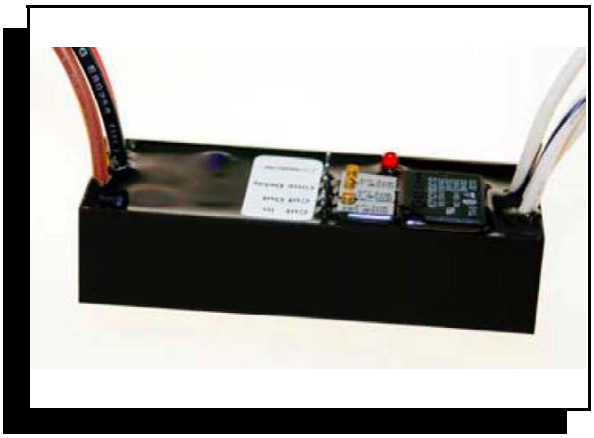
OPERATION

The VRDC12v uses a half-wave rectifier filter circuit which allows the VRDC12v to operate from either a 10 to 18V DC power source. The VRDC's input is internally scaled so that a 0 to 30V DC signal equals 0 to 5V DC as shown in the chart on the back side of this page. An LED lights when the relay is pulled in.

PHYSICAL CONFIGURATION



The test points shown are for field calibration of the “cut-in”, “cut-out”, and time delay potentiometers.



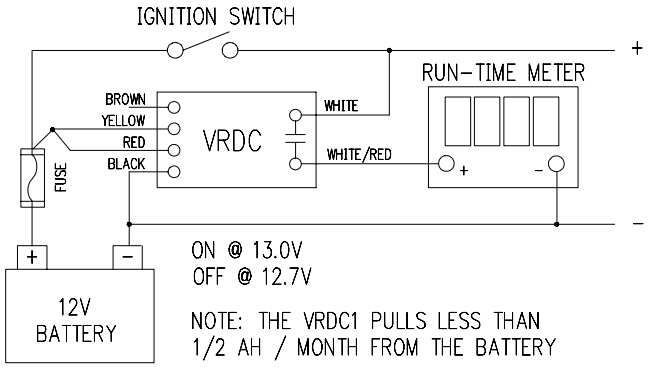
SPECIFICATIONS

SIZE:	3.2"L x 1.2"W x 0.75"H inches
ENCLOSURE:	Epoxy potted in PVC plastic
MOUNTING:	Double stick tape or snap track
POWER:	10 to 18V DC
LOAD CAPACITY:	12 Amps @ 28V DC, SPDT 12 Amps @ 120V AC, SPDT HASCO KLT1C12DC12
INPUT SIGNALS:	0 to 30V DC, 0 to 150V AC, 0 to 60V DC w/ 60.4KΩ resistor
THRESHOLD:	Cut-in @ 1 - 30V DC Cut-out @ 1 - 30V DC 0.25V DC min differential
TIME DELAY: ACTION:	0 - 255 seconds delay on energize Direct - Energizes on increase Reverse - Energizes on decrease
SIGNAL FILTERING:	>2Hz
CURRENT DRAW:	Continuous - less than 1mA Relay energized - 30mA
INDICATION:	LED indicates Relay is energized
TEMPERATURE:	-20 to 75°C
RELAY LIFE:	100 million mechanical operations

ORDERING INFORMATION

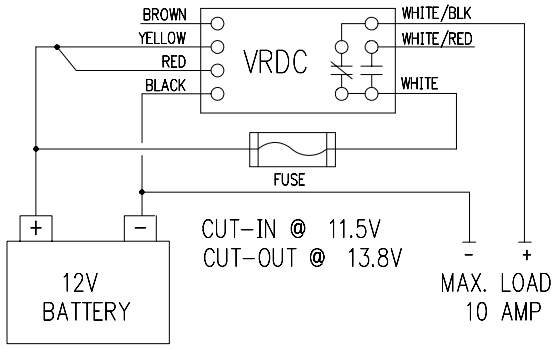
VRDC/12v/30 - Adjustable DC Voltage Relay with 0 to 255 second time delay, Power Supply :12VDC, and an input range of: 0-30vdc

APPLICATION 1 RUN TIME METER CONTROL



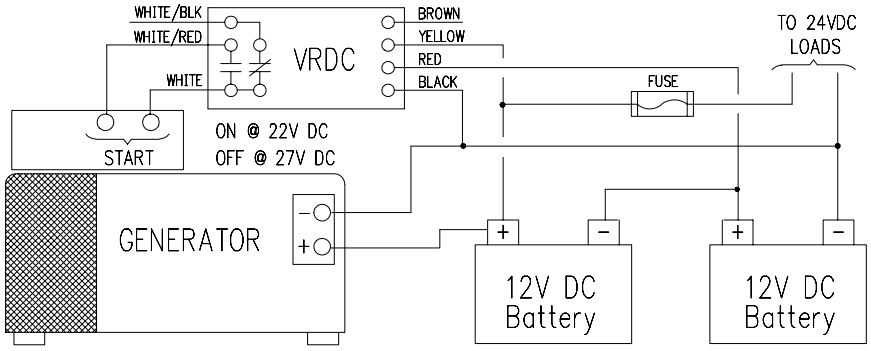
The VRDC12v senses the alternator output and energizes the run-time meter only when the engine is running and the ignition is on. This prevents the meter from running needlessly when the ignition is left on as is often the case with recreational boats.

APPLICATION 2 LOAD DISCONNECT



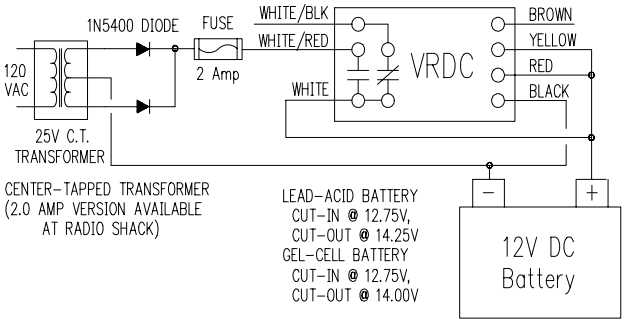
The VRDC12v energizes and disconnects the load (with time delay) below the "off" voltage point to prevent further battery discharge. Use N.O. contacts for de-energize on low battery voltage condition.

APPLICATION 3 GENERATOR CONTROL, BATTERY CHARGING



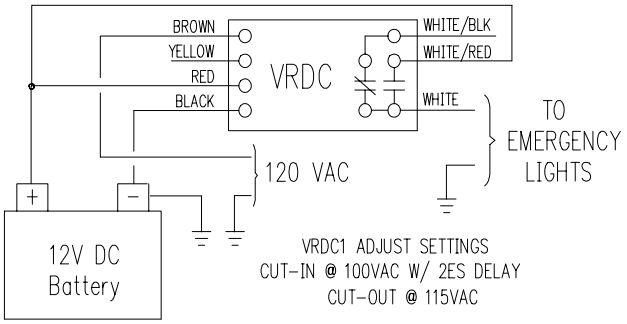
The VRDC12v senses when the battery bank is being discharged below a threshold point and starts the generator to charge the batteries. It shuts off the generator when the desired battery voltage is achieved. The time delay prevents the generator from starting on temporary battery voltage drops. **(The VRDC could also be used for this 24v application)**

APPLICATION 4 BATTERY CHARGE CONTROLLER



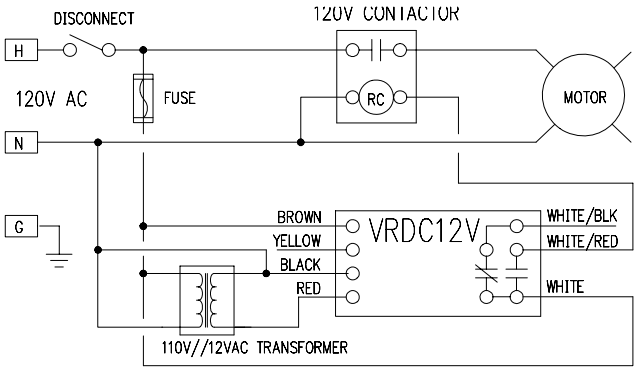
The Emergency battery needs to be charged in a reasonable time after use. The VRDC12v senses the battery voltage, starts the charging current when the voltage drops below a threshold and disconnects the charging current when the battery is fully charged.

APPLICATION 5 AC POWER - EMERGENCY LIGHTS



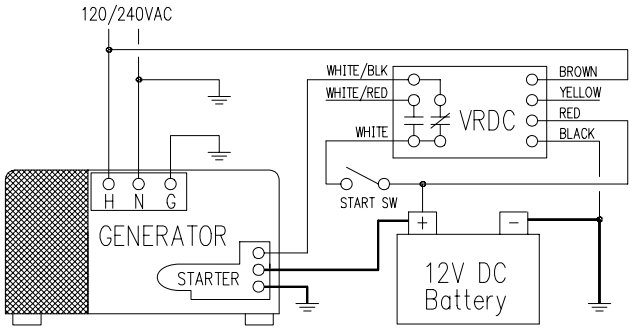
The VRDC12v senses the 120V AC line voltage and switches on the emergency lights with a 2 second delay upon sensing a power failure. The emergency lights turn off when power returns.

APPL. 6 LOW VOLTAGE - BROWN-OUT PROTECTION



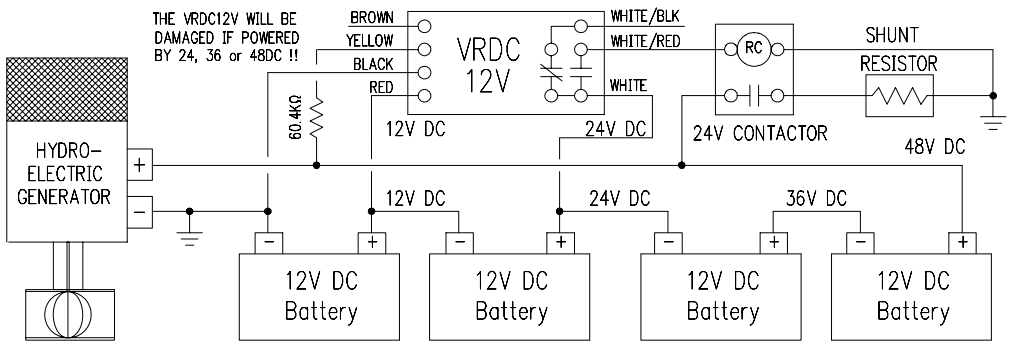
The VRDC12v senses the AC line voltage and disconnects a motor or other sensitive load if the low voltage condition persists past the time delay period. The time delay prevents the VRDC from dropping out the motor due to normal inrush current draw. Cut-out below 105V AC, Cut-in @ 112V AC. **(The VRDC could also be used for this application)**

APPLICATION 7 GENERATOR CRANK DISCONNECT



The VRDC12v senses the AC voltage output from a generator and when the desired threshold is reached, disconnects the starter circuit to prevent excessive cranking. Even though the AC voltage adjustment is 150V AC maximum, the module is not damaged by "seeing" 240V AC on the voltage input wire.

APPLICATION 8 48V DC EXCESSIVE POWER SHUNT



VRDC12v settings:

Cut-in @ 14.4V DC
Cut-out @ 13.4V DC

Cut-in @ 28.8V DC
Cut-out @ 26.8V DC

Cut-in @ 57.6V DC
Cut-out @ 53.6V DC

The VRDC12v senses the battery voltage and activates a contactor to shunt the excessive power thru a load resistor to prevent an over voltage condition. The VRDC12v must be powered by 12 DC from the battery bank even though it senses a higher voltage level thru the series input resistor. **(The VRDC could also be used for this 24v application)**

ADJUSTMENT FORMULAS

0 TO 30V DC - Vadj = Vin X 0.1667
0 TO 60V DC - Vadj = Vin X 0.0833
0 TO 150V AC - Vadj = Vin X 0.0333
TIME DELAY - Vadj = Time Delay (sec) X 0.01961

Vadj - Adjustment voltage at cut-in & cut-out test points
Vin - Input voltage signal
Min. Resolution- 0-5V Adjust voltage / 255 steps = 0.02V DC

ADJUSTMENT PROCEDURES

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
1.0v	2.0v	5.0v	8.5 sec	0.167v
2.0v	4.0v	10.0v	17 sec	0.333v
3.0v	6.0v	15.0v	25.5 sec	0.500v
4.0v	8.0v	20.0v	34 sec	0.667v
5.0v	10.0v	25.0v	42.5 sec	0.833v
6.0v	12.0v	30.0v	51 sec	1.000v
7.0v	14.0v	35.0v	59.5 sec	1.167v
8.0v	16.0v	40.0v	68 sec	1.333v
9.0v	18.0v	45.0v	76.5 sec	1.500v
10.0v	20.0v	50.0v	85 sec	1.667v
11.0v	22.0v	55.0v	93.5 sec	1.833v
12.0v	24.0v	60.0v	102 sec	2.000v
13.0v	26.0v	65.0v	110.5 sec	2.167v
14.0v	28.0v	70.0v	119 sec	2.333v
15.0v	30.0v	75.0v	127.5 sec	2.500v

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
16.0v	32.0v	80.0v	136 sec	2.667v
17.0v	34.0v	85.0v	144.5 sec	2.833v
18.0v	36.0v	90.0v	153 sec	3.000v
19.0v	38.0v	95.0v	161.5 sec	3.167v
20.0v	40.0v	100.0v	170 sec	3.333v
21.0v	42.0v	105.0v	178.5 sec	3.500v
22.0v	44.0v	110.0v	187 sec	3.667v
23.0v	46.0v	115.0v	195.5 sec	3.833v
24.0v	48.0v	120.0v	204 sec	4.000v
25.0v	50.0v	125.0v	212.5 sec	4.167v
26.0v	52.0v	130.0v	221 sec	4.333v
27.0v	54.0v	135.0v	229.5 sec	4.500v
28.0v	56.0v	140.0v	238 sec	4.667v
29.0v	58.0v	145.0v	246.5 sec	4.833v
30.0v	60.0v	150.0v	255 sec	5.000v

1. The “cut-in”, “cut-out” and “time-delay” pot adjustments are measured on the respective test points by a DC voltmeter. The cut-in/out 0 to 5V DC represents 0 to 30V DC, 0 to 60V DC, 0 to 150V AC input signal. The time delay 0 to 5V DC represents 0 to 255 sec delay on energize.

2. If the “cut-in” pot is greater than the “cut-out” pot then the relay energizes when the signal voltage is greater than the “cut-in” point and de-energizes when the signal voltage drops below the “cut-out” point. If the “cut-in” point is less than the “cut-out” point then the relay energizes when the signal voltage drops below the “cut-in” point and de-energizes when the signal voltage rises above the “cut-out” point. If the signal voltage differential between the “cut-in” and “cut-out” adjustments is not at least 0.25V DC in the 0 to 30V range then the relay will not operate.

3. The time delay pot’s 0 to 5V DC represents 0 to 255 seconds. of time delay for the relay to energize on “cut-in” for either reverse or direct mode. The input signal must exceed the “cut-in” point for the time delay value or the timing action will start over. The “cut-out” action is instantaneous.

4. After adjusting the VRDC module, interrupt power (this re-sets the circuitry) to insure that the module operates properly.

VRDC/12V/60
VOLTAGE SENSITIVE RELAY FOR DC

FEATURES

- **Operates over 10 to 18V DC power range**
- **Adjustable thresholds for cut-in and cut-out points between 1 to 60V DC & 0 to 150V AC**
- **12 Amp SPDT relay contact**
- **Automatic reversible action with the cut-in, cut-out adjustments**
- **Adjustable 0 to 255 sec. time delay on cut-in**
- **Compact size eliminates mounting problems**

APPLICATIONS

- **Low voltage cutoff and generator control**
- **HVAC heating & cooling staging**
- **Hydro-electric power shunt**
- **Battery charge controller**

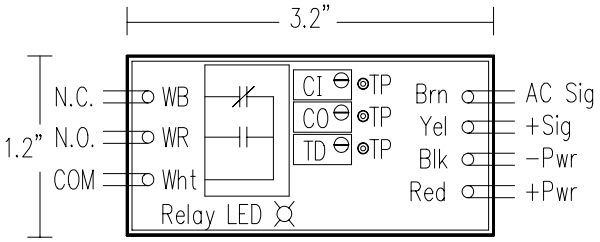
DESCRIPTION

The VRDC-12v/60 is an Adjustable Voltage Relay for DC applications. The VRDC-12v/60 can be used in applications where a varying DC voltage is used to switch an adjustable relay such as in generator control or a low battery voltage load disconnect. The “cut-in” voltage, “cut-out” voltage, and the time delay value are adjusted on multi-turn potentiometers by measuring the respective test points and adjusting the potentiometers per the set-up instructions and chart on the back side of last page.

OPERATION

The VRDC-12v/60 uses a half-wave rectifier filter circuit which allows the VRDC-12v/48 to operate from a range of 10 to 18V DC power source. The VRDC-12v/48's input is internally scaled so that a 0 to 60V DC signal equals 0 to 5V DC as shown in the chart on the back side of this page. An LED lights when the relay is pulled in.

PHYSICAL CONFIGURATION



The test points shown are for field calibration of the “cut-in”, “cut-out”, and time delay potentiometers.

SPECIFICATIONS

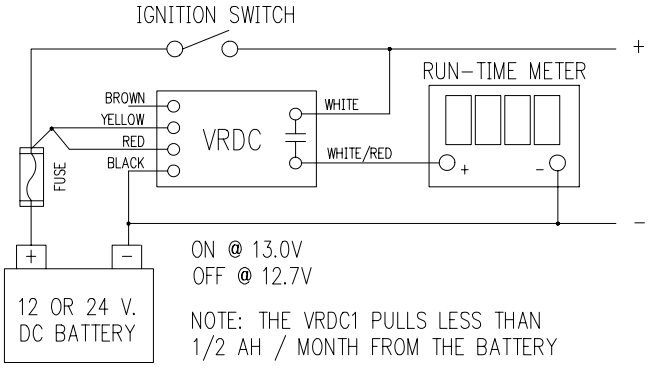
SIZE:	3.2"L x 1.2"W x 0.75"H inches
ENCLOSURE:	Epoxy potted in PVC plastic
MOUNTING:	Double stick tape or snap track
POWER:	10 to 18V DC
LOAD CAPACITY:	12 Amps @ 28V DC, SPDT 12 Amps @ 120V AC, SPDT HASCO KLT1C12DC12
INPUT SIGNALS:	0 to 60V DC, 0 to 150V AC,
THRESHOLD:	Cut-in @ 2 - 60V DC Cut-out @ 2 - 60V DC 0.5V DC min differential
TIME DELAY: ACTION:	0 - 255 seconds delay on energize Direct - Energizes on increase Reverse - Energizes on decrease
SIGNAL FILTERING:	>2Hz
CURRENT DRAW:	Continuous - less than 1mA Relay energized - 30mA
INDICATION:	LED indicates Relay is energized
TEMPERATURE:	-20 to 50°C
RELAY LIFE:	100 million mechanical operations

ORDERING INFORMATION

VRDC/12v/60	-	Adjustable DC Voltage Relay with 0 to 255 second time delay, input range 0-60vdc

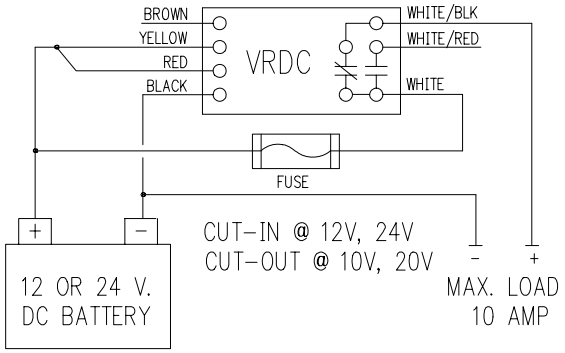
Note: The Applications on the next pages show the VRDC, VRDC-60v, VRDC-12v and VRDC-12v/60 versions of the VRDC. The VRDC-12v should only be powered by 12vdc (10 to 18vdc).

APPLICATION 1 RUN TIME METER CONTROL



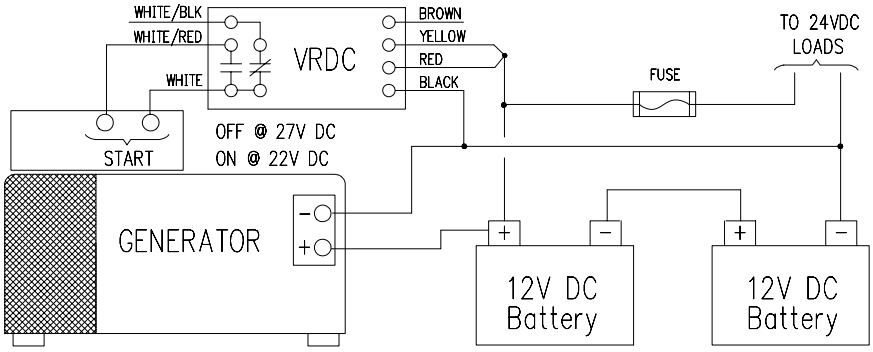
The VRDC senses the alternator output and energizes the run-time meter only when the engine is running and the ignition is on. This prevents the meter from running needlessly when the ignition is left on as is often the case with recreational boats.

APPLICATION 2 LOAD DISCONNECT



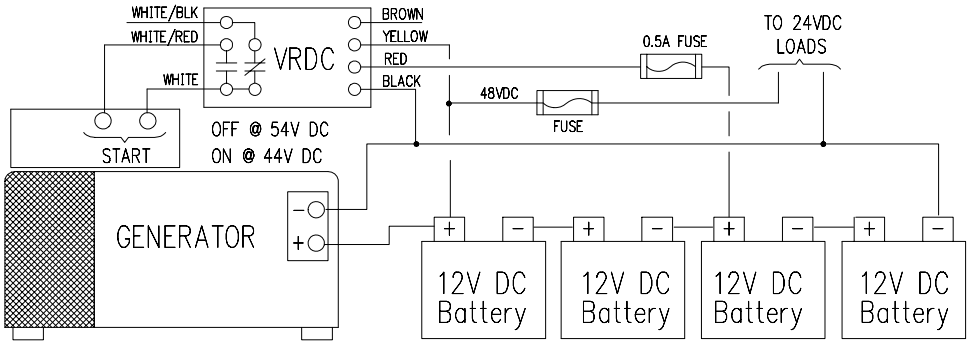
The VRDC energizes and disconnects the load (with time delay) below the "off" voltage point to prevent further battery discharge. Use N.O. contacts for de-energize on low battery voltage condition.

APPLICATION 3 GENERATOR CONTROL, 24V BATTERY CHARGING



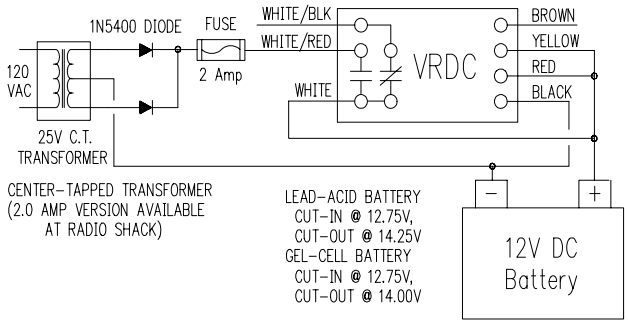
The VRDC senses when the battery bank is being discharged below a threshold point and starts the generator to charge the batteries. It shuts off the generator when the desired battery voltage is achieved. The time delay prevents the generator from starting on temporary battery voltage drops.

APPLICATION 3a GENERATOR CONTROL, 48V BATTERY CHARGING



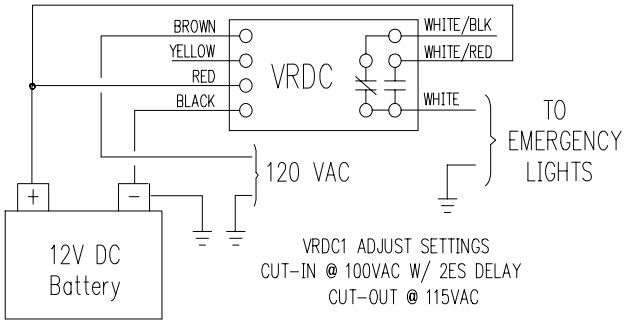
The VRDC/24/60v senses when the battery bank is being discharged below a threshold point and starts the generator to charge the batteries. It shuts off the generator when the desired battery voltage is achieved. The time delay prevents the generator from starting on temporary battery voltage drops.

APPLICATION 4 BATTERY CHARGE CONTROLLER



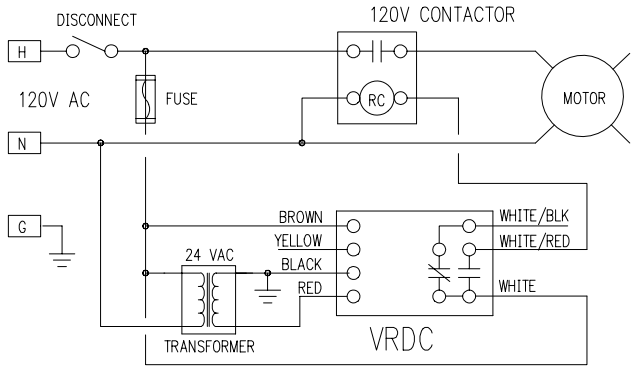
The Emergency battery needs to be charged in a reasonable time after use. The VRDC/12v senses the battery voltage, starts the charging current when the voltage drops below a threshold and disconnects the charge when the battery is fully charged.

APPLICATION 5 AC POWER - EMERGENCY LIGHTS



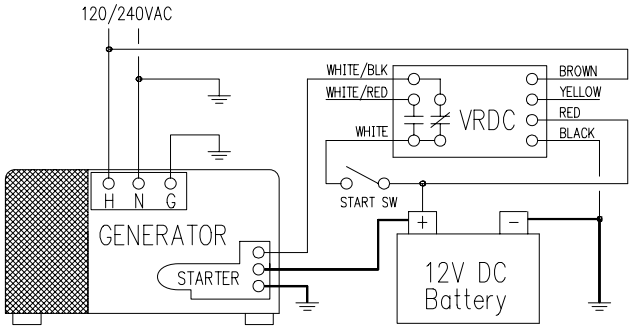
The VRDC/12v senses the 120V AC line voltage and switches on the emergency lights with a 2 second delay upon sensing a power failure. The emergency lights turn off when power returns.

APP. 6 LOW VOLTAGE - BROWN-OUT PROTECTION



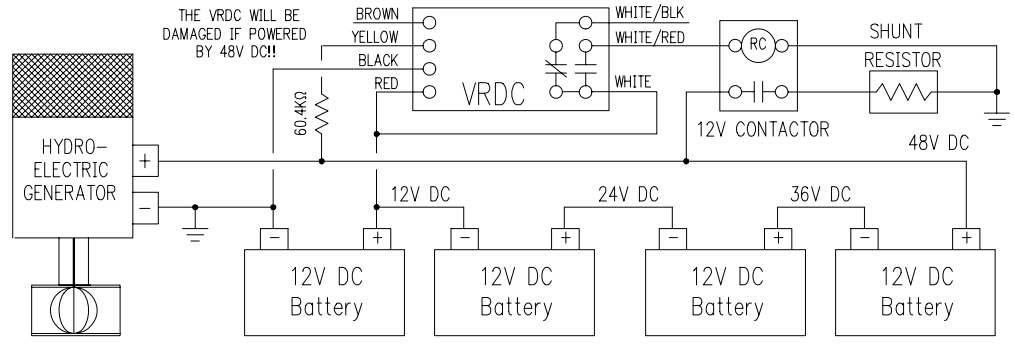
The VRDC/24/30 senses the AC line voltage and disconnects a motor or other sensitive load if the low voltage condition persists past the time delay period. The time delay prevents the VRDC from dropping out the motor due to normal inrush current draw. Cut-out below 105V AC, Cut-in @ 112V AC.

APP. 7 - GENERATOR CRANK DISCONNECT



The VRDC/12v/30 senses the AC voltage output from a generator and when the desired threshold is reached, disconnects the starter circuit to prevent excessive cranking. Even though the AC voltage adjustment is 150V AC maximum, the module is not damaged by "seeing" 240V AC on the voltage input wire.

APPLICATION 8 48V DC EXCESSIVE POWER SHUNT



VRDC/12/60 settings:

Cut-in @ 14.4V DC
Cut-out @ 13.4V DC

Cut-in @ 28.8V DC
Cut-out @ 26.8V DC

Cut-in @ 57.6V DC
Cut-out @ 53.6V DC

The VRDC/12v/60 senses the battery voltage and activates a contactor to shunt the excessive power thru a load resistor to prevent an over voltage condition. The VRDC/12v/30 (w/ 60.4k ohm resistor) must be powered by 12V DC from the battery bank even though it senses a higher voltage level thru the series input resistor.

ADJUSTMENT FORMULAS

0 TO 30V DC - Vadj = Vin X 0.1667
0 TO 60V DC - Vadj = Vin X 0.0833
0 TO 150V AC - Vadj = Vin X 0.0333
TIME DELAY- Vadj = Time Delay (sec) X 0.01961

Vadj - Adjustment voltage at cut-in & cut-out test points
Vin - Input voltage signal
Minimum Resolution- 0-5V Adjust voltage / 255 steps = 0.02V DC

ADJUSTMENT PROCEDURES

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
1.0v	2.0v	5.0v	8.5 sec	0.167v
2.0v	4.0v	10.0v	17 sec	0.333v
3.0v	6.0v	15.0v	25.5 sec	0.500v
4.0v	8.0v	20.0v	34 sec	0.667v
5.0v	10.0v	25.0v	42.5 sec	0.833v
6.0v	12.0v	30.0v	51 sec	1.000v
7.0v	14.0v	35.0v	59.5 sec	1.167v
8.0v	16.0v	40.0v	68 sec	1.333v
9.0v	18.0v	45.0v	76.5 sec	1.500v
10.0v	20.0v	50.0v	85 sec	1.667v
11.0v	22.0v	55.0v	93.5 sec	1.833v
12.0v	24.0v	60.0v	102 sec	2.000v
13.0v	26.0v	65.0v	110.5 sec	2.167v
14.0v	28.0v	70.0v	119 sec	2.333v
15.0v	30.0v	75.0v	127.5 sec	2.500v

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
16.0v	32.0v	80.0v	136 sec	2.667v
17.0v	34.0v	85.0v	144.5 sec	2.833v
18.0v	36.0v	90.0v	153 sec	3.000v
19.0v	38.0v	95.0v	161.5 sec	3.167v
20.0v	40.0v	100.0v	170 sec	3.333v
21.0v	42.0v	105.0v	178.5 sec	3.500v
22.0v	44.0v	110.0v	187 sec	3.667v
23.0v	46.0v	115.0v	195.5 sec	3.833v
24.0v	48.0v	120.0v	204 sec	4.000v
25.0v	50.0v	125.0v	212.5 sec	4.167v
26.0v	52.0v	130.0v	221 sec	4.333v
27.0v	54.0v	135.0v	229.5 sec	4.500v
28.0v	56.0v	140.0v	238 sec	4.667v
29.0v	58.0v	145.0v	246.5 sec	4.833v
30.0v	60.0v	150.0v	255 sec	5.000v

1. The “cut-in”, “cut-out” and “time-delay” pot adjustments are measured on the respective test points by a DC voltmeter. The cut-in/out 0 to 5V DC represents 0 to 30V DC, 0 to 60V DC, 0 to 150V AC input signal. The time delay 0 to 5V DC represents 0 to 255 sec delay on energize.

2. If the “cut-in” pot is greater than the “cut-out” pot then the relay energizes when the signal voltage is greater than the “cut-in” point and de-energizes when the signal voltage drops below the “cut-out” point. If the “cut-in” point is less than the “cut-out” point then the relay energizes when the signal voltage drops below the “cut-in” point and de-energizes when the signal voltage rises above the “cut-out” point. If the signal voltage differential between the “cut-in” and “cut-out” adjustments is not at least 0.25V DC in the 0 to 30V range then the relay will not operate.

3. The time delay pot’s 0 to 5V DC represents 0 to 255 seconds. of time delay for the relay to energize on “cut-in” for either reverse or direct mode. The input signal must exceed the “cut-in” point for the time delay value or the timing action will start over. The “cut-out” action is instantaneous.

4. After adjusting the VRDC module, interrupt power (this re-sets the circuitry) to insure that the module operates properly.

VRDC/24v/30
VOLTAGE SENSITIVE RELAY FOR DC

FEATURES

- **Operates over a wide DC power range (15 to 35V DC, and 24V AC)**
- **Adjustable thresholds for cut-in and cut-out points between 1 to 30V DC & 0 to 150V AC**
- **12 Amp SPDT relay contact**
- **Automatic reversible action with the cut-in, cut-out adjustments**
- **Adjustable 0 to 255 sec. time delay on cut-in**
- **Compact size eliminates mounting problems**

APPLICATIONS

- **Low voltage cutoff and generator control**
- **HVAC heating & cooling staging**
- **Hydro-electric power shunt**
- **Battery charge controller**

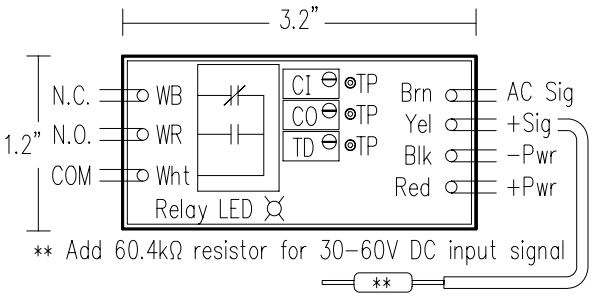
DESCRIPTION

The VRDC/24v/30 is an Adjustable Voltage Relay for DC applications. The VRDC/24v/30 can be used in applications where a varying DC voltage is used to switch an adjustable relay such as in generator control or a low battery voltage load disconnect. The “cut-in” voltage, “cut-out” voltage, and the time delay value are adjusted on multi-turn potentiometers by measuring the respective test points and adjusting the potentiometers per the set-up instructions and chart on the back side of last page.

OPERATION

The VRDC/24v/30 uses a half-wave rectifier filter circuit which allows the VRDC/24v/30 to operate from 15 to 35V DC power source or a 24V AC power supply. The VRDC's input is internally scaled so that a 0 to 30V DC signal equals 0 to 5V DC as shown in the chart on the back side of this page. An LED lights when the relay is pulled in.

PHYSICAL CONFIGURATION



The test points shown are for field calibration of the “cut-in”, “cut-out”, and time delay potentiometers.

SPECIFICATIONS

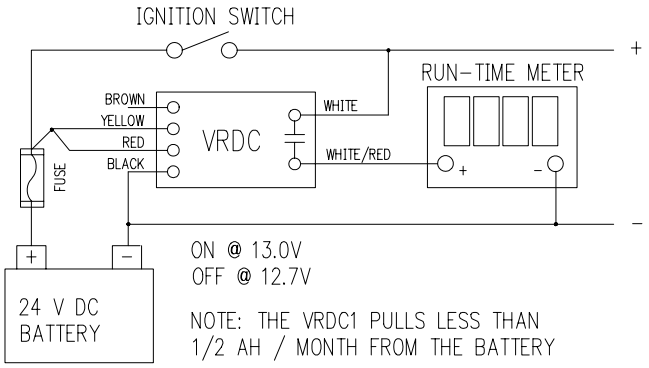
SIZE:	3.2"L x 1.2"W x 0.75"H inches
ENCLOSURE:	Epoxy potted in PVC plastic
MOUNTING:	Double stick tape or snap track
POWER:	15 to 35V DC or 24V AC
LOAD CAPACITY:	12 Amps @ 28V DC, SPDT 12 Amps @ 120V AC, SPDT HASCO KLT1C12DC12
INPUT SIGNALS:	0 to 30V DC, 0 to 150V AC, 0 to 60V DC w/ 60.4KΩ resistor
THRESHOLD:	Cut-in @ 1 - 30V DC Cut-out @ 1 - 30V DC 0.25V DC min differential
TIME DELAY: ACTION:	0 - 255 seconds delay on energize Direct - Energizes on increase Reverse - Energizes on decrease
SIGNAL FILTERING:	>2Hz
CURRENT DRAW:	Continuous - less than 1mA Relay energized - 30mA
INDICATION:	LED indicates Relay is energized
TEMPERATURE:	-20 to 75°C
RELAY LIFE:	100 million mechanical operations

ORDERING INFORMATION

VRDC/24v/30	Adjustable DC Voltage Relay with 0 to 255 second time delay, Power Supply :24VAC/DC, and An input range of: 0-30vdc

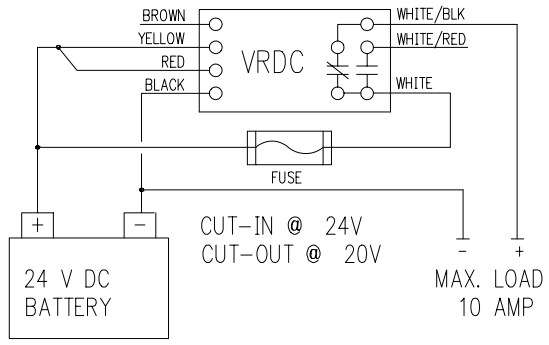
(See VRDC/12V for use with a 10-18vdc power supply)

APPLICATION 1 RUN TIME METER CONTROL



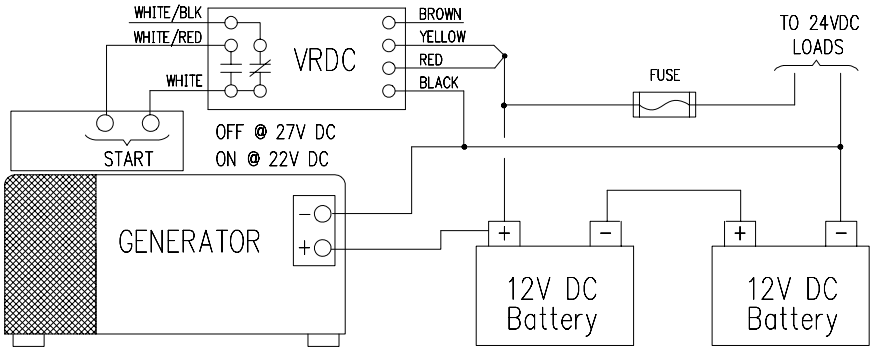
The VRDC/24v/30 senses the alternator output and energizes the run-time meter only when the engine is running and the ignition is on. This prevents the meter from running needlessly when the ignition is left on as is often the case with recreational boats.

APPLICATION 2 LOAD DISCONNECT



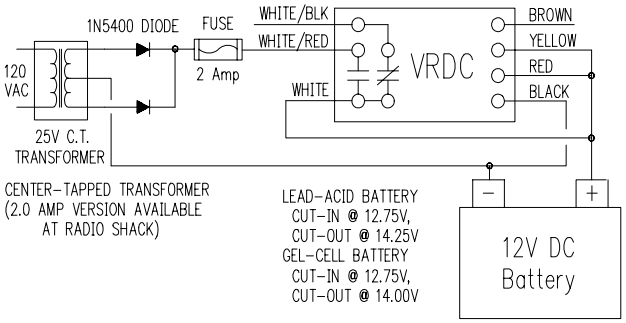
The VRDC/24v/30 energizes and disconnects the load (with time delay) below the "off" voltage point to prevent further battery discharge. Use N.O. contacts for de-energize on low battery voltage condition.

APPLICATION 3 GENERATOR CONTROL, BATTERY CHARGING



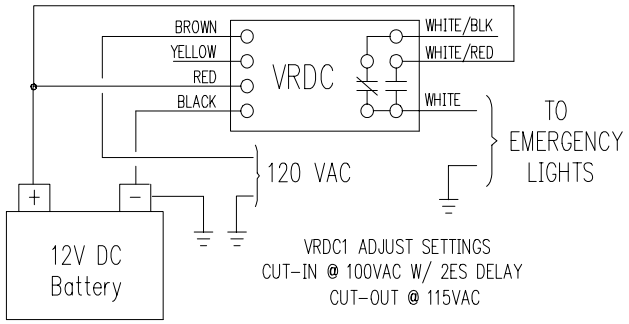
The VRDC/24v/30 senses when the battery bank is being discharged below a threshold point and starts the generator to charge the batteries. It shuts off the generator when the desired battery voltage is achieved. The time delay prevents the generator from starting on temporary battery voltage drops.

APPLICATION 4 BATTERY CHARGE CONTROLLER



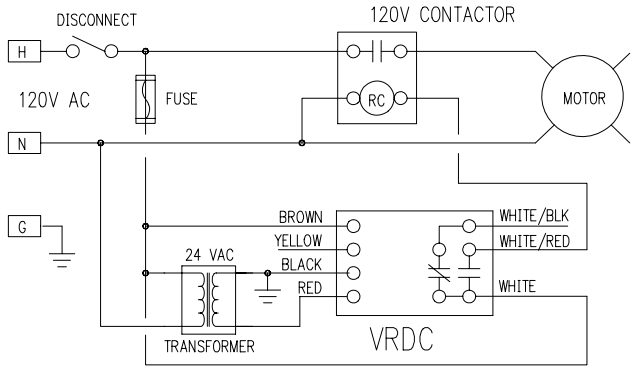
The Emergency battery needs to be charged in a reasonable time after use. The VRDC/12v/30 senses the battery voltage, starts the charging current when the voltage drops below a threshold and disconnects the charging current when the battery is fully charged. **(Use VRDC 12v for this application)**

APPLICATION 5 AC POWER - EMERGENCY LIGHTS



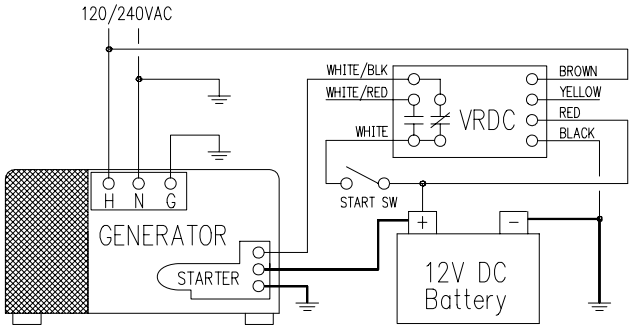
The VRDC/12v/30 senses the 120V AC line voltage and switches on the emergency lights with a 2 second delay upon sensing a power failure. The emergency lights turn off when power returns. **(Use VRDC 12v for this application)**

APPL. 6 LOW VOLTAGE - BROWN-OUT PROTECTION



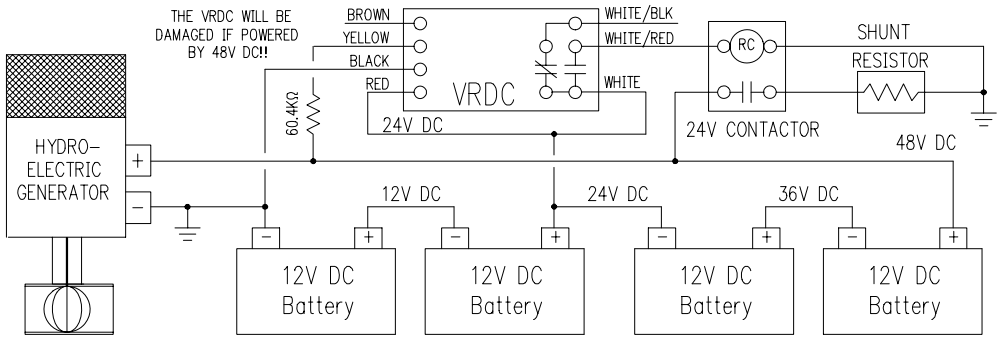
The VRDC/24v/30 senses the AC line voltage and disconnects a motor or other sensitive load if the low voltage condition persists past the time delay period. The time delay prevents the VRDC from dropping out the motor due to normal inrush current draw. Cut-out below 105V AC, Cut-in @ 112V AC.

APPLICATION 7 GENERATOR CRANK DISCONNECT



The VRDC/24v/30 senses the AC voltage output from a generator and when the desired threshold is reached, disconnects the starter circuit to prevent excessive cranking. Even though the AC voltage adjustment is 150V AC maximum, the module is not damaged by "seeing" 240V AC on the voltage input wire. **(Use VRDC 12v for this application)**

APPLICATION 8 48V DC EXCESSIVE POWER SHUNT



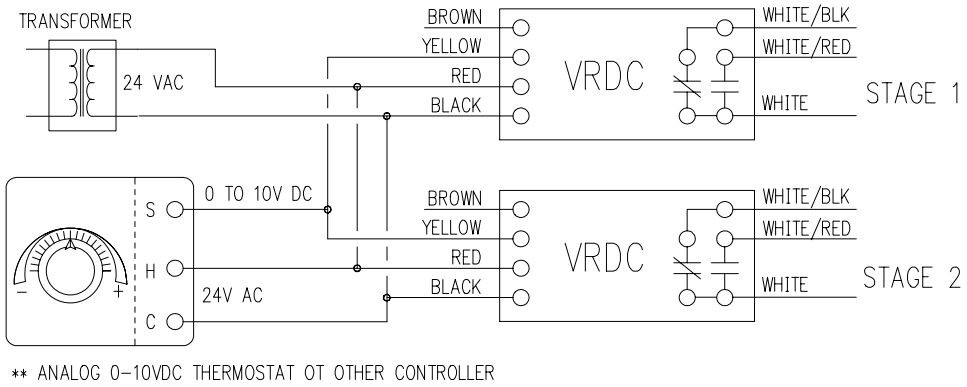
VRDC/24v/30 settings:

Cut-in @ 28.8V DC
Cut-out @ 26.8V DC

Cut-in @ 57.6V DC
Cut-out @ 53.6V DC

The VRDC/24v/30 senses the battery voltage and activates a contactor to shunt the excessive power thru a load resistor to prevent an over voltage condition. The VRDC/24v/30 (w/ 60.4k ohm resistor) must be powered by 24V DC from the battery bank even though it senses a higher voltage level thru the series input resistor.

APPLICATION 9 HVAC 0 TO 10V DC HEATING / COOLING STAGING



VRDC stage 1:

Cut-in @ 5V DC
Cut-out @ 1V DC

VRDC stage 2:

Cut-in @ 10V DC
Cut-out @ 6V DC

An analog thermostat puts out 0 to 10V DC as a function of temperature. The VRDC/24v/30 is adjusted to turn on heating or cooling loads with an adjustable time delay between stages to prevent compressor or other mechanical damage.

ADJUSTMENT FORMULAS

0 TO 30V DC - Vadj = Vin X 0.1667
0 TO 60V DC - Vadj = Vin X 0.0833
0 TO 150V AC - Vadj = Vin X 0.0333
TIME DELAY- Vadj = Time Delay (sec) X 0.01961

Vadj - Adjustment voltage at cut-in & cut-out test points
Vin - Input voltage signal
Minimum Resolution- 0-5V Adjust voltage / 255 steps = 0.02V DC

ADJUSTMENT PROCEDURES

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
1.0v	2.0v	5.0v	8.5 sec	0.167v
2.0v	4.0v	10.0v	17 sec	0.333v
3.0v	6.0v	15.0v	25.5 sec	0.500v
4.0v	8.0v	20.0v	34 sec	0.667v
5.0v	10.0v	25.0v	42.5 sec	0.833v
6.0v	12.0v	30.0v	51 sec	1.000v
7.0v	14.0v	35.0v	59.5 sec	1.167v
8.0v	16.0v	40.0v	68 sec	1.333v
9.0v	18.0v	45.0v	76.5 sec	1.500v
10.0v	20.0v	50.0v	85 sec	1.667v
11.0v	22.0v	55.0v	93.5 sec	1.833v
12.0v	24.0v	60.0v	102 sec	2.000v
13.0v	26.0v	65.0v	110.5 sec	2.167v
14.0v	28.0v	70.0v	119 sec	2.333v
15.0v	30.0v	75.0v	127.5 sec	2.500v

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
16.0v	32.0v	80.0v	136 sec	2.667v
17.0v	34.0v	85.0v	144.5 sec	2.833v
18.0v	36.0v	90.0v	153 sec	3.000v
19.0v	38.0v	95.0v	161.5 sec	3.167v
20.0v	40.0v	100.0v	170 sec	3.333v
21.0v	42.0v	105.0v	178.5 sec	3.500v
22.0v	44.0v	110.0v	187 sec	3.667v
23.0v	46.0v	115.0v	195.5 sec	3.833v
24.0v	48.0v	120.0v	204 sec	4.000v
25.0v	50.0v	125.0v	212.5 sec	4.167v
26.0v	52.0v	130.0v	221 sec	4.333v
27.0v	54.0v	135.0v	229.5 sec	4.500v
28.0v	56.0v	140.0v	238 sec	4.667v
29.0v	58.0v	145.0v	246.5 sec	4.833v
30.0v	60.0v	150.0v	255 sec	5.000v

1. The “cut-in”, “cut-out” and “time-delay” pot adjustments are measured on the respective test points by a DC voltmeter. The cut-in/out 0 to 5V DC represents 0 to 30V DC, 0 to 60V DC, 0 to 150V AC input signal. The time delay 0 to 5V DC represents 0 to 255 sec delay on energize.

2. If the “cut-in” pot is greater than the “cut-out” pot then the relay energizes when the signal voltage is greater than the “cut-in” point and de-energizes when the signal voltage drops below the “cut-out” point. If the “cut-in” point is less than the “cut-out” point then the relay energizes when the signal voltage drops below the “cut-in” point and de-energizes when the signal voltage rises above the “cut-out” point. If the signal voltage differential between the “cut-in” and “cut-out” adjustments is not at least 0.25V DC in the 0 to 30V range then the relay will not operate.

3. The time delay pot’s 0 to 5V DC represents 0 to 255 seconds. of time delay for the relay to energize on “cut-in” for either reverse or direct mode. The input signal must exceed the “cut-in” point for the time delay value or the timing action will start over. The “cut-out” action is instantaneous.

4. After adjusting the VRDC module, interrupt power (this re-sets the circuitry) to insure that the module operates properly.

VRDC/24V/60
VOLTAGE SENSITIVE RELAY FOR DC

FEATURES

- **Operates over a wide DC power range (18 to 35V DC, and 24V AC)**
- **Adjustable thresholds for cut-in and cut-out points between 1 to 60V DC & 0 to 150V AC**
- **12 Amp SPDT relay contact**
- **Automatic reversible action with the cut-in, cut-out adjustments**
- **Adjustable 0 to 255 sec. time delay on cut-in**
- **Compact size eliminates mounting problems**

APPLICATIONS

- **Low voltage cutoff and generator control**
- **HVAC heating & cooling staging**
- **Hydro-electric power shunt**
- **Battery charge controller**

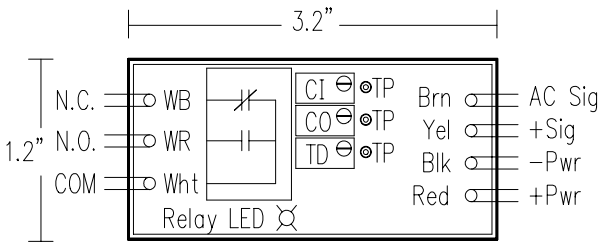
DESCRIPTION

The VRDC/24v/60 is an Adjustable Voltage Relay for DC applications. The VRDC24v/60 can be used in applications where a varying DC voltage is used to switch an adjustable relay such as in generator control or a low battery voltage load disconnect. The “cut-in” voltage, “cut-out” voltage, and the time delay value are adjusted on multi-turn potentiometers by measuring the respective test points and adjusting the potentiometers per the set-up instructions and chart on the back side of last page.

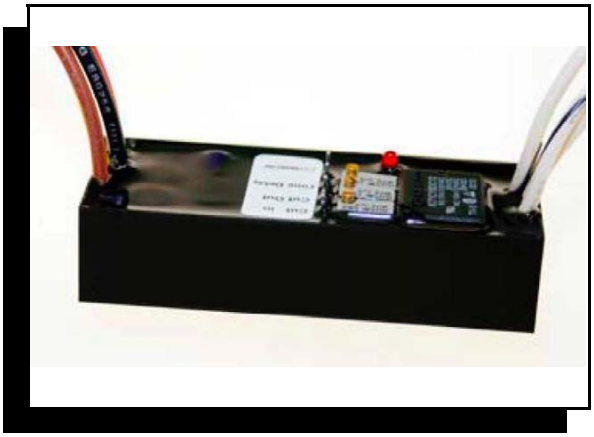
OPERATION

The VRDC24v/60 uses a half-wave rectifier filter circuit which allows the VRDC24v/60 to operate from a range of 18 to 35V DC power source or a 24V AC power supply. The VRDC24v/60's input is internally scaled so that a 0 to 60V DC signal equals 0 to 5V DC as shown in the chart on the back side of this page. An LED lights when the relay is pulled in.

PHYSICAL CONFIGURATION



The test points shown are for field calibration of the “cut-in”, “cut-out”, and time delay potentiometers.



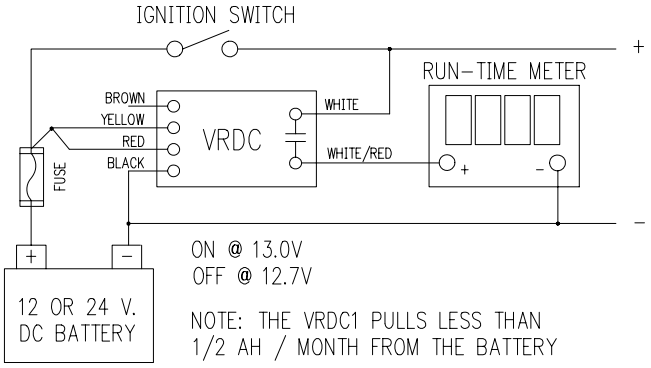
SPECIFICATIONS

SIZE:	3.2"L x 1.2"W x 0.75"H inches
ENCLOSURE:	Epoxy potted in PVC plastic
MOUNTING:	Double stick tape or snap track
POWER:	18 to 35V DC or 24V AC
LOAD CAPACITY:	12 Amps @ 28V DC, SPDT 12 Amps @ 120V AC, SPDT HASCO KLT1C12DC12
INPUT SIGNALS:	0 to 60V DC, 0 to 150V AC,
THRESHOLD:	Cut-in @ 2 - 60V DC Cut-out @ 2 - 60V DC 0.5V DC min differential
TIME DELAY: ACTION:	0 - 255 seconds delay on energize Direct - Energizes on increase Reverse - Energizes on decrease
SIGNAL FILTERING:	>2Hz
CURRENT DRAW:	Continuous - less than 1mA Relay energized - 30mA
INDICATION:	LED indicates Relay is energized
TEMPERATURE:	-20 to 50°C
RELAY LIFE:	100 million mechanical operations

ORDERING INFORMATION

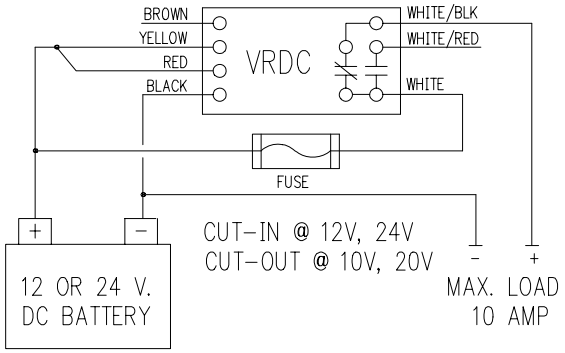
VRDC/24v/60 - Adjustable DC Voltage Relay with 0 to 255 second time delay, Power Supply :24VAC/DC, and an input range of: 0-60vdc

APPLICATION 1 RUN TIME METER CONTROL



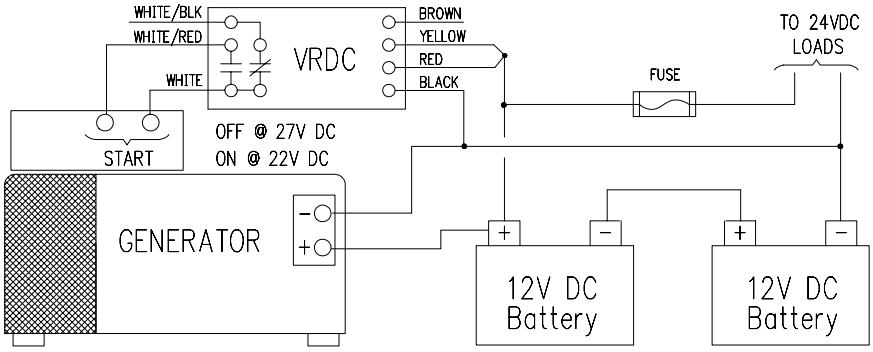
The VRDC/12 or 24v/30 senses the alternator output and energizes the run-time meter only when the engine is running and the ignition is on. This prevents the meter from running needlessly when the ignition is left on as is often the case with recreational boats.

APPLICATION 2 LOAD DISCONNECT



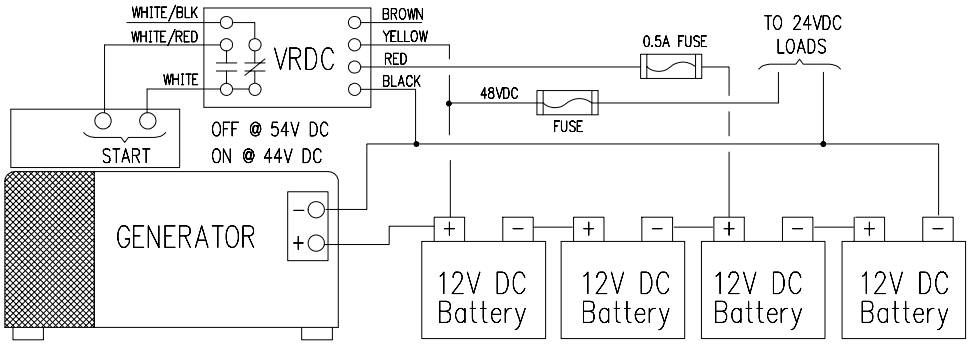
The VRDC/12 or 24v/30 energizes and disconnects the load (with time delay) below the "off" voltage point to prevent further battery discharge. Use N.O. contacts for de-energize on low battery voltage condition.

APPLICATION 3 GENERATOR CONTROL, 24V BATTERY CHARGING



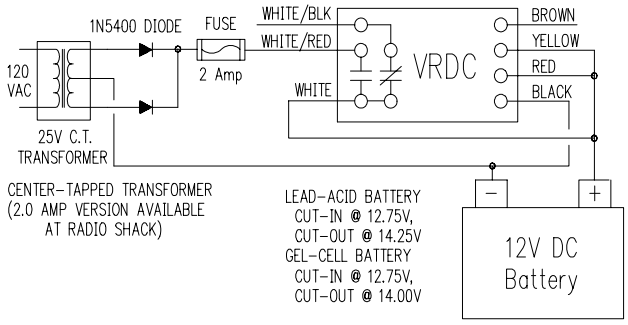
The VRDC/24v/30 senses when the battery bank is being discharged below a threshold point and starts the generator to charge the batteries. It shuts off the generator when the desired battery voltage is achieved. The time delay prevents the generator from starting on temporary battery voltage drops.

APPLICATION 3a GENERATOR CONTROL, 48V BATTERY CHARGING



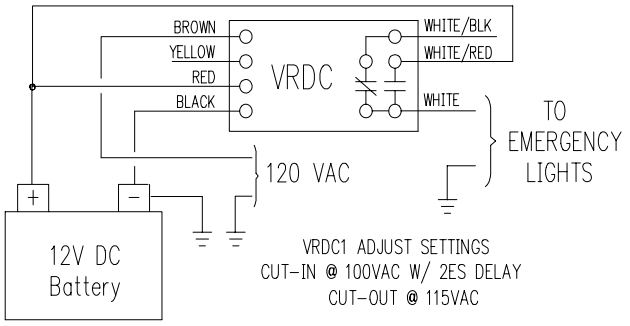
The VRDC/24v/60v senses when the battery bank is being discharged below a threshold point and starts the generator to charge the batteries. It shuts off the generator when the desired battery voltage is achieved. The time delay prevents the generator from starting on temporary battery voltage drops.

APPLICATION 4 BATTERY CHARGE CONTROLLER



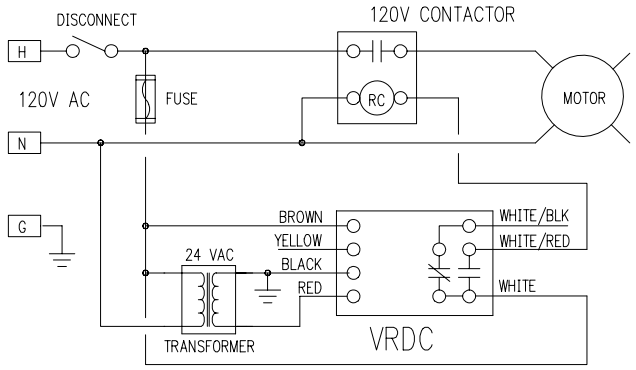
The Emergency battery needs to be charged in a reasonable time after use. The VRDC/12v/30 senses the battery voltage, starts the charging current when the voltage drops below a threshold and disconnects the charge when the battery is fully charged.

APPLICATION 5 AC POWER - EMERGENCY LIGHTS



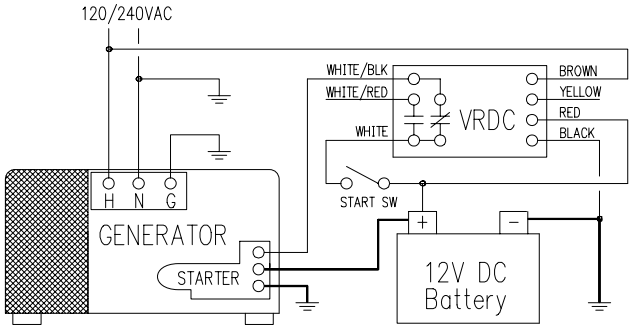
The VRDC/12v/30 senses the 120V AC line voltage and switches on the emergency lights with a 2 second delay upon sensing a power failure. The emergency lights turn off when power returns.

APP. 6 LOW VOLTAGE - BROWN-OUT PROTECTION



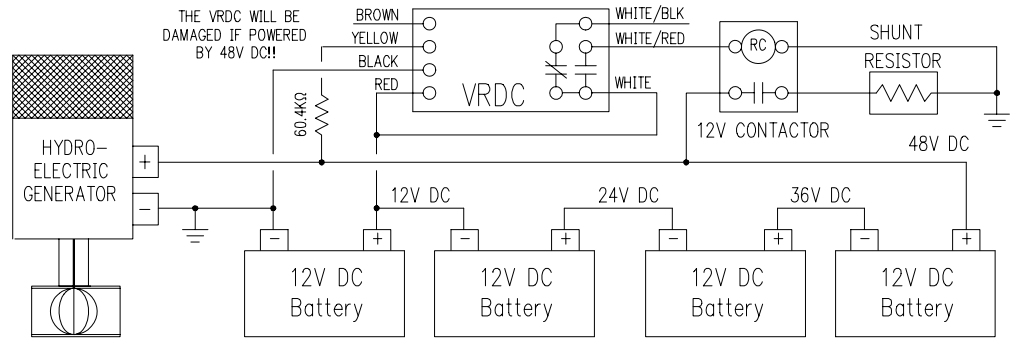
The VRDC/24v/30 senses the AC line voltage and disconnects a motor or other sensitive load if the low voltage condition persists past the time delay period. The time delay prevents the VRDC from dropping out the motor due to normal inrush current draw. Cut-out below 105V AC, Cut-in @ 112V AC.

APP. 7 - GENERATOR CRANK DISCONNECT



The VRDC/12v/30 senses the AC voltage output from a generator and when the desired threshold is reached, disconnects the starter circuit to prevent excessive cranking. Even though the AC voltage adjustment is 150V AC maximum, the module is not damaged by “seeing” 240V AC on the voltage input wire.

APPLICATION 8 48V DC EXCESSIVE POWER SHUNT



VRDC/12v/30 settings:

Cut-in @ 14.4V DC
Cut-out @ 13.4V DC

Cut-in @ 28.8V DC
Cut-out @ 26.8V DC

Cut-in @ 57.6V DC
Cut-out @ 53.6V DC

The VRDC/12v/30 (as shown) senses the battery voltage with a series 60.4k ohm resistor and activates a contactor to shunt the excessive power thru a load resistor to prevent an over voltage condition. The either VRDC/12v/60 or VRDC/24v/60 can be used to sense the battery voltage with out the series resistor but must be powered by 12 or 24V DC from the battery bank even though it’s input can accept 0-60vdc.

ADJUSTMENT FORMULAS

0 TO 30V DC - Vadj = Vin X 0.1667
0 TO 60V DC - Vadj = Vin X 0.0833
0 TO 150V AC - Vadj = Vin X 0.0333
TIME DELAY- Vadj = Time Delay (sec) X 0.01961

Vadj - Adjustment voltage at cut-in & cut-out test points
Vin - Input voltage signal
Minimum Resolution- 0-5V Adjust voltage / 255 steps = 0.02V DC

ADJUSTMENT PROCEDURES

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
1.0v	2.0v	5.0v	8.5 sec	0.167v
2.0v	4.0v	10.0v	17 sec	0.333v
3.0v	6.0v	15.0v	25.5 sec	0.500v
4.0v	8.0v	20.0v	34 sec	0.667v
5.0v	10.0v	25.0v	42.5 sec	0.833v
6.0v	12.0v	30.0v	51 sec	1.000v
7.0v	14.0v	35.0v	59.5 sec	1.167v
8.0v	16.0v	40.0v	68 sec	1.333v
9.0v	18.0v	45.0v	76.5 sec	1.500v
10.0v	20.0v	50.0v	85 sec	1.667v
11.0v	22.0v	55.0v	93.5 sec	1.833v
12.0v	24.0v	60.0v	102 sec	2.000v
13.0v	26.0v	65.0v	110.5 sec	2.167v
14.0v	28.0v	70.0v	119 sec	2.333v
15.0v	30.0v	75.0v	127.5 sec	2.500v

Input Voltage Ranges			Time Delay	cut-in/out & delay Tp volts
1-30VDC	2-60VDC	5-150VAC	0-255 Sec	0-5VDC
16.0v	32.0v	80.0v	136 sec	2.667v
17.0v	34.0v	85.0v	144.5 sec	2.833v
18.0v	36.0v	90.0v	153 sec	3.000v
19.0v	38.0v	95.0v	161.5 sec	3.167v
20.0v	40.0v	100.0v	170 sec	3.333v
21.0v	42.0v	105.0v	178.5 sec	3.500v
22.0v	44.0v	110.0v	187 sec	3.667v
23.0v	46.0v	115.0v	195.5 sec	3.833v
24.0v	48.0v	120.0v	204 sec	4.000v
25.0v	50.0v	125.0v	212.5 sec	4.167v
26.0v	52.0v	130.0v	221 sec	4.333v
27.0v	54.0v	135.0v	229.5 sec	4.500v
28.0v	56.0v	140.0v	238 sec	4.667v
29.0v	58.0v	145.0v	246.5 sec	4.833v
30.0v	60.0v	150.0v	255 sec	5.000v

1. The “cut-in”, “cut-out” and “time-delay” pot adjustments are measured on the respective test points by a DC voltmeter. The cut-in/out 0 to 5V DC represents 0 to 30V DC, 0 to 60V DC, 0 to 150V AC input signal. The time delay 0 to 5V DC represents 0 to 255 sec delay on energize.

2. If the “cut-in” pot is greater than the “cut-out” pot then the relay energizes when the signal voltage is greater than the “cut-in” point and de-energizes when the signal voltage drops below the “cut-out” point. If the “cut-in” point is less than the “cut-out” point then the relay energizes when the signal voltage drops below the “cut-in” point and de-energizes when the signal voltage rises above the “cut-out” point. If the signal voltage differential between the “cut-in” and “cut-out” adjustments is not at least 0.25V DC in the 0 to 30V range then the relay will not operate.

3. The time delay pot’s 0 to 5V DC represents 0 to 255 seconds. of time delay for the relay to energize on “cut-in” for either reverse or direct mode. The input signal must exceed the “cut-in” point for the time delay value or the timing action will start over. The “cut-out” action is instantaneous.

4. After adjusting the VRDC module, interrupt power (this re-sets the circuitry) to insure that the module operates properly.