

Automatic Charging Relay with Emergency Parallel Capacity PN 9112

Features

- Automatic control for charging dual battery banks
- Voltage sensing for charge source on either battery bank
- Hermetically sealed contact assembly
- Vaporproof, Ignition Protected
- Pulse circuit requires very low current draw when contact is closed
- UL Recognized - UL 508 Industrial Control Equipment
- Meets SAE J1171 - External Ignition Protection Requirements
- CE marked for EC applications

Specifications

Automatic Pick-up	13.6, 27.2 Volts
Automatic Drop Out	12.6, 25.2
Automatic Over Voltage Drop Out	15, 30
ON Time Delay	30 Seconds
<u>Coil Circuit:</u>	
Input Voltage:	9 to 36V DC
Power Consumption:	
Coil Inrush, 130ms:	3.8 Amperes@12-36V DC
Holding 12 Volts:	0.13 Amperes@12V DC 0.07 Amperes@24V DC

Main Power Contacts:

Voltage Rating	60 Volts DC
Stud Terminal Size	M8 (accepts 5/16" terminals)
Contact Form	SPST-NO
Inrush Rating: 250ms (10 repeats)*	2000 Amperes
Cranking Rating: 9.75s (10 repeats)*	500 Amperes
Intermittent Rating: 300s (UL 1107)	275 Amperes
Continuous Rating: (UL 1107)	250 Amperes
Mechanical Life	1 Million Cycles
Make Current@10,000 Cycles:	2000 Amperes@28V
Break Current@10,000 Cycles:	2000 Amperes@28V

* Blue Sea Systems Engine Starting Standard

Switch Ratings

The issue of switch ratings for engine starting is a tricky one. The reason is that Underwriter's Laboratories (UL), the only agency that establishes standards for marine battery switch ratings, does not establish a standard appropriate to engine starting situations. There are two ratings in the UL marine battery switch standard, Intermittent and Continuous. Intermittent is a 5 minute rating and is based on temperature rise of various sections of the switch as the rated current is applied over a 5 minute period. The Continuous rating is the same, but the time period is 1 hour.

As these standards demonstrate, there are three variables involved in rating battery switches: time, current and temperature. For any given switch the relationship of the variables is $TEMPERATURE = TIME \times CURRENT$. Clearly, neither of these ratings is applicable to engine starting situations where the current draw is very high but the time period is very short, typically 10 seconds or less. You will see some manufacturers rating their switches at very high amperages, but close inspection will show that they either fail to specify the time period or the time period is very short.

To correct this problem Blue Sea Systems has created an additional standard to which its battery switches are rated. This standard is called the Engine Start Standard and consists of ten 10-second cycles with a 2 second rest between each cycle. The first .25 seconds of the cycle is the Inrush Current and the last 9.75 seconds of the cycle is the Cranking Current. The Engine Start Standard is designed to represent a worst case engine starting event in which the engine is cranked for 10 seconds, the ignition switched off for 2 seconds to rest the battery and then repeated another 9 times.

Guarantee

Any Blue Sea Systems product with which a customer is not satisfied may be returned for a refund or replacement at any time.

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Installation

Select a mounting location for the charging relay near the battery banks or the battery switches. Mount the relay securely with screws through the flanges at the base. Hole size is 0.22 inches suitable for a #10, #12, or 5mm screw.

Electrical Connections

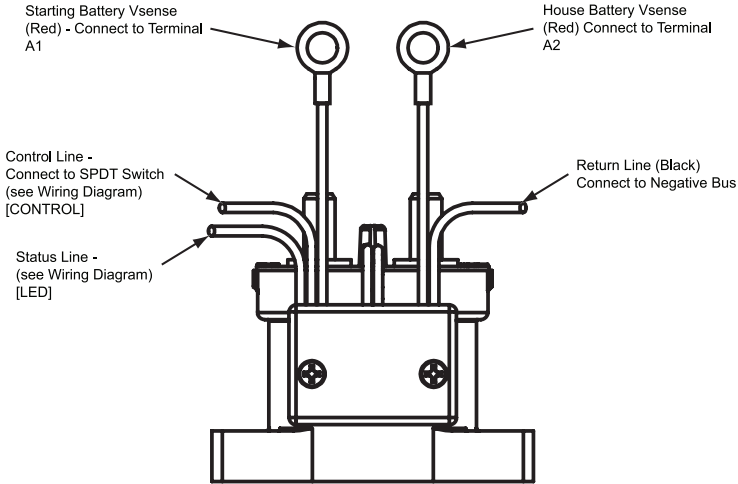
1. Disconnect the positive battery connection before beginning the installation. If there is a possibility of tools causing a short, disconnect the negative terminals before disconnecting the positive battery terminals. The illustration on the following page is general in nature and is not meant to be a guide for the wiring any specific vessel. There is a wide range of wiring configurations possible. Consult your marine electrical professional for the wiring system applicable to your boat.
2. Make electrical connections based on the wiring diagram shown in Illustration A. Consult a wire sizing chart to determine the appropriate wire sizes. If a manual control is installed to permit using this device for emergency paralleling of batteries for engine starting, no fusing is required in the main circuit, but wire sizes should be chosen for the full starting currents. If starting service is not included, choose circuit protection according to wire capacity. If a charging source is present and the relay is closed in automatic mode when an engine is started, starting currents can flow through this circuit. This can result in blowing of protection fuses if the wiring system does not limit the currents.
3. Voltage Sensing
The 9112 ACR is designed to sense and operate from the voltage supplied by either battery. In a typical application with the ACR, the engine driven alternator would be connected to the starting battery, and once the starting battery is sufficiently charged, the ACR will close and share charging with the house battery. If a shore charger is supplying the house battery, when it has brought the house battery up to voltage the ACR will close and share with the starting battery. This function can be disabled by removing the red sense wire from the main connection A1 or A2 associated with the battery that you don't want to

have control. If the wire is removed, insulate the ring terminal and fold it out of the way in case it is needed in the future.

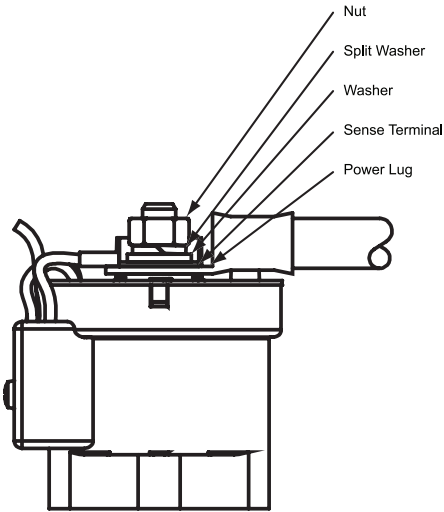
Warning: Battery cable terminals must go at the bottom of the stack under the sensing wire terminals, then the flat washer, the lock washer and the nut. Tighten securely.

4. Make the negative (black wire) connection from the relay as short as possible to the battery negative. Because the built in coil economizer causes current pulses in the control circuit, there may be noise present on the black wire and it should not be run with sensitive wires from other circuits.
5. The control switch is a Single Pole, Double Throw, Center Off switch. When the control line is connected to a positive supply, the relay is closed whenever the voltage is greater than about 9 volts at either terminal. When the switch is set to connect the control line to the negative supply line, the relay will be held open. When the switch is in the center position, with no command to the relay, it will operate automatically to close and open the relay when it senses charging voltages are present. The control signal passes very little current and can be supplied from any fused positive source.
6. An indicator lamp connection is marked LED. The internal connection is a 1000 Ohm resistor to a transistor which connects the line to the negative (black) line when the relay is energized. A suitable indicator is Blue Sea Systems PN 8033 (amber), PN 8171 (red), or PN 8172 (green). Connect the red wire to a suitable positive source and the yellow wire to the LED wire from the relay. When using the internal LED of the 8232 or 8283 contactor switch, connect the [LED] line to Pin 7 of the switch.
7. When all wiring is complete and has been checked, restore battery connections. The relay may momentarily energize when power is first applied. The automatic charging circuit has a 30 second time delay to reduce cycling caused by noise in the system.

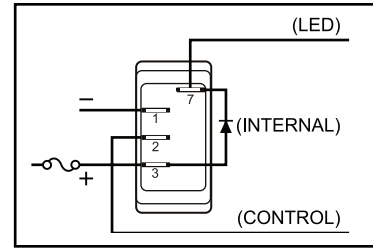
Installation (continued)



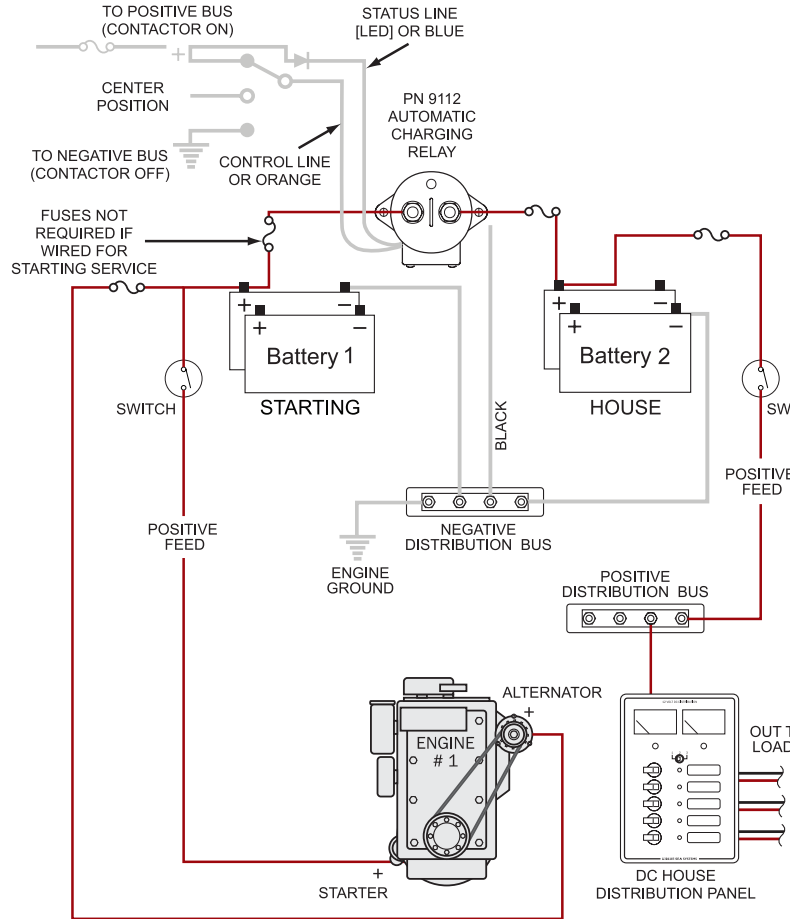
Wiring Identification



Lug Installation Diagram



PN 8232/PN8283 Contura Switch



Wiring Diagram

	Control Line	PN 9112 Contacts	Starting Battery Vsense	House Battery Vsense
Relay ON (Manual)	>9V	Closed	>9	Anything
	>9V	Closed	Anything	>9
Relay Pickup (Auto) Conditions to turn relay on	Open	Open	<13.6, 15 to 27.2,>30	<13.6, 15 to 27.2,>30
	Open	Closed	13.6 to 15, 27.2 to 30	<Starting Battery
	Open	Closed	< House Battery	13.6 to 15, 27.2 to 30
Relay Dropout (Auto) Conditions to turn relay off	Open	Closed	12.6 to 15, 25.2 to 30	12.6 to 15, 25.2 to 30
	Open	Open	<12.6, 15 to 25.2, >30	<12.6, 15 to 25.2, >30
Relay Off (Manual)	<1V	Open	Anything	Anything
	Anything	Open	<6	<6

Table of Operation

Installation (continued)

PN 9112 Automatic Charging Relay

	Units	Min	Nom	Max
AUTOMATIC MODE@25C				
Pickup Voltage (PU ₁)	V DC	13.5	13.6	13.7
Drop-out Voltage (DO ₁)	V DC	12.5	12.6	12.7
Over Voltage (OV ₁)	V DC	14.8	15	15.2
Pickup Voltage (PU ₂)	V DC	27.0	27.2	27.4
Drop-out Voltage (DO ₂)	V DC	25.0	25.2	25.4
Over Voltage (OV ₂)	V DC	29.6	30	30.4
Over Voltage Hysteresis	V DC		.35	
Coil				
Inrush Current	A	1.5	2.8	3.5
Inrush Time	s	.80	.100	0.13
Hold Current, Ave	A	.03	.110	.160
PWM Frequency	kHz		20	
Time Delay on Close	s	25	30	35

MANUAL MODE				
Maximum Input Voltage	V DC	-	-	36
Pickup Voltage	V DC	8	8.5	9
Drop-out Voltage	V DC	6	6.5	7

Current Draw When Contactor is "Off"	mA	.05	1	2
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Status Line (Open Collector with 1k Limiting Resistor)				
Voltage, Maximum	V DC	-	-	36
Current, Maximum	mA	-	-	36

Relay Cycling

If the system is configured with a charging source that cannot supply the full load current being drawn from the receiving battery a cycling process can occur. With the ACR open and the charging source supplying the first battery, its voltage will rise until the ACR senses sufficient voltage to indicate charging and combine the two batteries.

If the second battery has connected loads drawing greater current than the capacity of the charging source, the voltage will drop because there is a net discharge on the system. The ACR will respond to the low voltage and open, disconnecting the second battery and its load. This action preserves the charge in the first battery.

The voltage will again rise as the first battery recovers and the ACR will close after a delay. It is symptomatic of a situation in which the charge source is insufficient to supply the load, and if the load continues at that level, the second battery will eventually be discharged even though a charge source is present.

Wire sizing chart

Use the wire sizing chart below to determine the proper branch and feed circuit wire sizes.

Allowable Amperage of Conductors

Wire Size (AWG)	Outside Engine Spaces	Inside Engine Spaces
10	60.0	51.0
8	80.0	68.0
6	120.0	102.0
4	160.0	136.0
2	210.0	178.5
1	245.0	208.3
0	285.0	242.3
00	330.0	280.5
000	385.0	327.3
0000	445.0	378.3

Note: For wire with 105°C insulation rating and no more than 2 conductors are bundled. Not suitable for sizing flexible shore power cords.