


REVISIONS				
REV	ECO	DESCRIPTION	DATE	BY
A	3108	Production Release	6/1/00	BF
B	3153	Make corrections to dimensional drawing voltage thresholds, quiescent currents	7/12/00	BF
C	3434	Add Vbat notes	6/29/01	BF
D	3612	Change connection diagram.		

130512 LOW VOLTAGE SWITCH



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM] TOLERANCES ARE: .XX ± .03 [X ± 0.8] .XXX ± [XX ±] < ±		 TUALATIN, OREGON USA 97062	
APPROVALS DRAWN J. B.		DATE 5/15/00	
PRJCT ENGR		TITLE MODEL NO: 130512 LOW VOLTAGE SWITCH, 12V @ 20A SPECIFICATION OUTLINE	
ENGR MNGR		SIZE A	CAGE CODE NO. 55156
SALES/MRKTG		DWG NO. 130512	REV D
		SCALE: NONE	FILE: 130512D
		SHEET 1 OF 8	

PROPRIETARY

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OVERVIEW

The 130512 is a low voltage switch (**LVS**) utilized for limiting the drain due to “key off” loads for 12V systems. The unit disconnects loads that are powered when the ignition key is off before the battery is discharged low enough to prevent a vehicle start. The unit is capable of directly powering loads of up to 20A draw. For loads over 20A, an external solenoid may be used.

THEORY OF OPERATION

The 130512 uses the voltage of the battery as an indication of the state of charge of the battery. The unit continually monitors the battery voltage, and when the battery voltage drops far enough, the unit disconnects the load. Sure Power Industries, Inc. has determined that for most vehicle applications, the ideal voltage setting is 12.1V. At this voltage there should be enough charge remaining in a battery to start the vehicle. Due to the wide range of applications that this unit may be used in, the disconnect voltage is adjustable.

To reduce the false disconnects due to intermittent drops in battery voltage, there is a 45-second delay before the relay is disconnected. If the voltage rises above the disconnect voltage at any time during the 45 seconds delay, the delay is reset.

As the vehicle battery is re-charged, the voltage of the battery rises. The 130512 uses a voltage of 13.0V as an indication of battery recharge. This voltage is above the resting voltage of typical batteries but is far enough below the typical charging voltage to guarantee that the 130512 will reconnect. There is a 1-second delay upon reconnect.

FUNCTIONAL DESCRIPTION

UNIT CONNECTIONS:

The unit has five connections made through a terminal strip. The five connections are:

VBAT:


This connection powers the unit and is used to sense the battery voltage. This terminal is connected to the battery through a fuse in most applications. This connection is required for the unit to function.

GND:

This is the terminal for grounding the unit. All internal operating currents are returned to this terminal.

RELAY COMMON (COM), RELAY NORMALLY OPEN (NO) 2, & RELAY NORMALLY CLOSED (NC):

These are the undedicated relay terminals. Providing undedicated contacts allows the 130512 to be used for high side and low side switching applications with the unit installed either before or after customer switches. The relay is rated at 20A switching and is not over-current protected. Customer provided over-current protection is required.

				
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The unit has two connections for optional functions made through faston tabs on the top of the unit.

IGN (IGNITION):

This terminal can be used to energize the relay coil when the engine is running. Use of this terminal prevents disconnection of the load regardless of the state of the battery. Use of this terminal is highly recommended when the 130512 is used to control vehicle marker lighting to keep it powered in the event of a charging system failure.

Note: If Vbat is not connected, the IGN input will not function.

OR (OVER-RIDE):

This terminal is used for an operator over-ride. Toggling 12V to this terminal energizes the relay for one minute. The unit then defaults to the normal operating state. During the one-minute time interval, all inputs are ignored. After the one minute time interval, the OR function can be reset.

If 12V is applied and maintained to the OR terminal, the relay will energize for a maximum of 30 minutes. Removing the 12V signal at any time between one and 30 minutes places the unit back into normal operation. If 30 minutes has elapsed and 12V is still applied to the OR terminal, the unit de-energizes the relay coil. The unit will not change state until power is toggled to the OR terminal, or power has been removed and the reconnect threshold has been breached. The LED and piezo alarm notifies the operator of a pending switch approximately 29 minutes into the override function.


LED INDICATOR

The 130512 features an LED indicator to indicate the status of the unit. When the relay is closed in normal operation, the LED will be off. When the relay is open, the LED will flash on once every second. When a switch is pending (defined as when the voltage is beyond the threshold but the relay has not yet switched) the LED will flash seven times a second.

ALARM

The 130512 is equipped with a piezo alarm to indicate that the relay is about to be opened. The alarm will sound when the voltage on Vbat is below the disconnect threshold for more than 1 second. The alarm will continue to sound for the remaining minute until the relay is opened or the voltage rises above the threshold. The alarm sounds in a 1 second on, 1/4 second off, 1/4 second on, 1/4 second off repeating pattern.

Note: When power is applied to the unit initially, the LED and Alarm will turn on for 2.5 seconds. The relay defaults to the open state at power application if the OR input is floating. If the voltage is above the disconnect threshold, the relay will close 1 second after the alarm silences. If the OR input is powered up, the unit will power up with the relay closed after one second.

				
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ENVIRONMENTAL SPECIFICATIONS


Characteristic	Parameter	Unit	Notes:
Operational Temperature Range	-40 to +85	°C	@ 20-amp load. Ref SAE J1455
Storage Temperature Range	-55 to +105	°C	
Humidity	0 to 100	%RH	@ 20-amp load.
Vibration			Ref SAE J1399 Class 2
Shock			Ref SAE J1455 Section 4.10
Thermal Shock			Ref SAE J1455 Section 4.1.3.2
Salt Spary	500	hrs	Ref ASTM B117
Sealed			

ELECTRICAL SPECIFICATIONS

MAXIMUM RATINGS:

Maximum ratings establish the maximum electrical rating to which the unit may be subjected without damage.

Characteristic	Symbol	Parameter	Unit	Notes:
Jump Start Voltage	V_{JS}	24	V	Under any combination of inputs and unit states.
Jump Start Time	T_{JS}	5	min	Minimum time input may be subjected may be subjected to the jump start voltage without damage.
Standoff Voltage	V_{SO}	55	V	Applies to any combination of terminals.
Time at Standoff	t_{SO}	10	s	
Reverse Polarity	V_{RP}	-24	V	Applies to any combination of terminals.
Time at Reverse Voltage	t_{RP}	1	min	
Destructive Overvoltage	V_{DST}	48	V	Unit is capable of withstanding 48V continuously without causing flame, smoke, or other hazardous conditions.
Relay Current	$I_{R,MAXC}$	20	A	Continuous
Electrical Isolation	V_{ISO}	500	VAC	All terminals together with respect to ground.

			
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ELECTRICAL CHARACTERISTICS

Unless otherwise stated, conditions apply to full temperature range (-40°C to +85°C) and full voltage range (9V to 16V).

Characteristic	Symbol	MIN	TYP	MAX	Unit	Notes:
Normal Input Voltage	V_{IN}	9		16	V	Unit is guaranteed to function within specification.
Quiescent Current Open	$I_{QUES,O}$		15	20	mA	IGN floating
Quiescent Current Closed	$I_{QUES,C}$		170	250	mA	IGN floating; Vbat = 14.0V
Connect Voltage	V_{CON}	12.6	12.95	13.3	V	@ 25 °C †
Disconnect Voltage Adjust Range (minimum)	V_{DCONR}	9		12.15	V	Factory set to 12.10V @ 25 °C †
Disconnect Voltage Set Point Drift	V_{DCON}			±0.07	V	Over entire temperature range. †
OR Input Low Voltage	V_{INL}	0		2.4	V	Voltage required on the OR to be interpreted as a low.
OR Input High Voltage	V_{INH}	2.9		V_{BAT}	V	Voltage required on the OR to be interpreted as a high.
Processor Input Debounce	t_{DEB}		1.0		s	Required time for processor to sample and recognize a change in unit state.
LED Intensity	I_{LED}	3.6	10		mcd	@ 10 mA forward diode current
Alarm Sound Intensity	S_{PL}			79	dBm	Measured at 10cm
Connect Delay	t_{CD}	0.9	1.0	1.1	s	
Disconnect Delay	t_{DD}	40	45	50	s	Measured from battery voltage drop below threshold until relay operation.
OR Momentary Delay	t_{MOD}	54	60	66	s	Measured from the last rising edge of the OR input until relay operation.
OR Maintained Delay	t_{MAD}		30		min	
Delay to Alarm Output	t_{AD}	0.9	1.0	1.1	s	Measured from battery voltage drop below threshold until alarm output operates.
Alarm Output Long Pulse	t_{1ALRM}	900	1000	1100	ms	
Alarm Output Short Pulse	t_{2ALRM}	225	250	275	ms	
Switch Pending Flash Rate	f_{PFLSH}	6	7	8	Hz	
Relay Open Flash Rate	f_{OFLSH}	0.9	1.0	1.1	Hz	
Terminal Current	I_{TERM}			20	A	
Contact Voltage Drop	V_{IOD}	200		250	mV	
Contact Life	C_{REL}	10^4			Cycles	



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ELECTROMAGNETIC COMPATIBILITY:

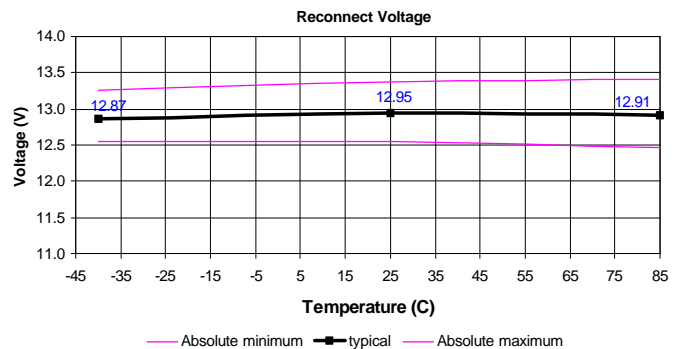
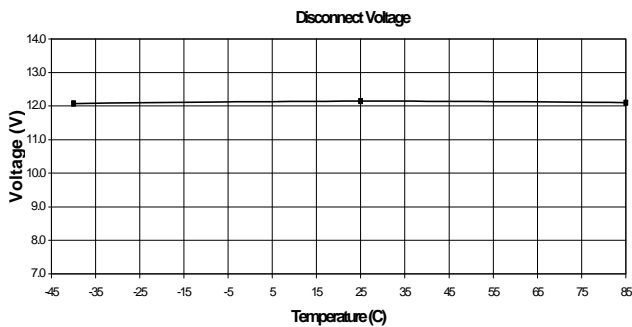
Transient Immunity Tests	Level	Notes:
Load Dump	$14+86e^{t/(0.4)}$	Ref. SAE J1455, Section 4.11.2.2.1, Table 4a.
Inductive Switching Kick	$14\pm 600e^{t/(0.001)}$	Ref. SAE J1455, Section 4.11.2.2.2, Table 4a.
Mutual Inductance	$14\pm 300e^{t/(0.00015)}$	Ref. SAE J1455, Section 4.11.2.2.3, Table 4a.


Electrostatic Discharge Immunity	Level	Notes:
ESD	± 8 kV direct ± 15 kV air	All terminals in any combination and all terminals to case, per test setup SAE J1113/13.

Radiated Immunity Test	Level	Notes:
Absorber Lined Chamber 10kHz to 200MHz 200MHz to 18GHz	50V/m	Ref. SAE J1113/21. Square wave modulation of 1kHz at %100 Sine wave modulation of 1kHz at %100

Emissions Limit Test	Level	Notes:
Radiated Emissions	Per spec	Ref. SAE J1113/41.

⊕ Graphs present the ranges of connect and disconnect voltages as a result of component tolerance and/or temperature.





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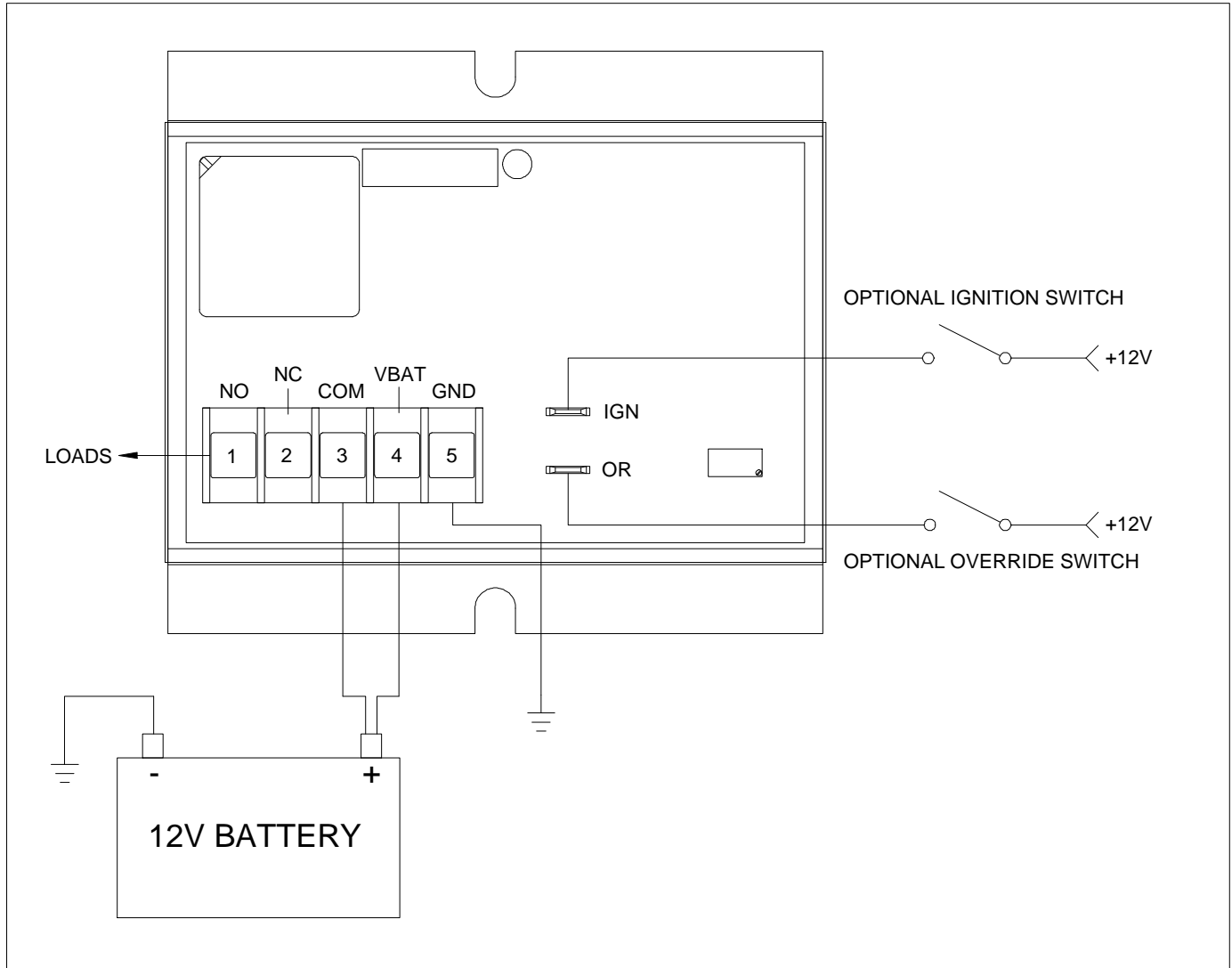
MECHANICAL SPECIFICATIONS

Connector: five pin barrier terminal strip and two faston tabs.

Housing: Blue anodized aluminum with epoxy encapsulation.

Weight: 0.90 lb. / 0.404 kg

CONNECTION DIAGRAM:

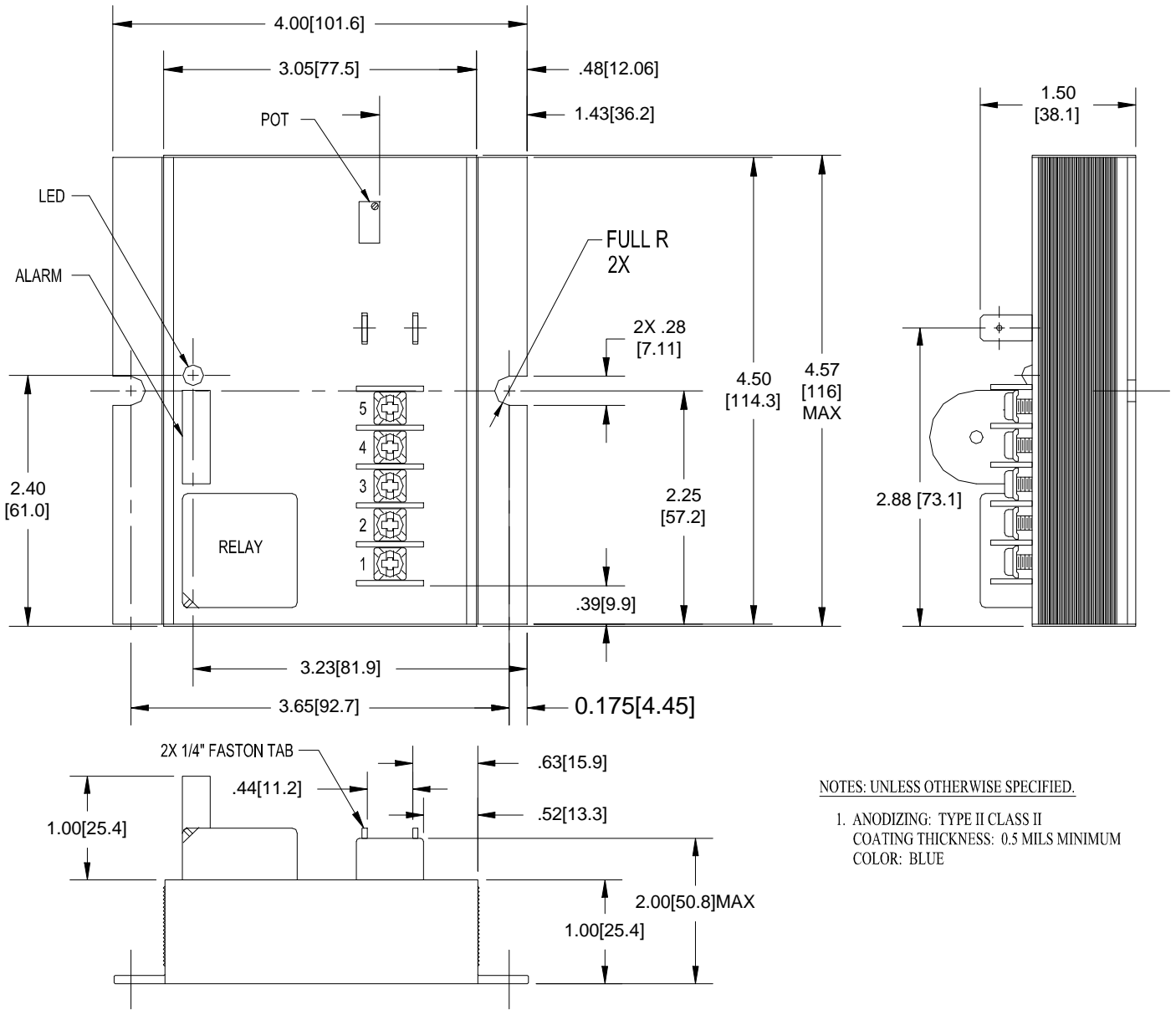


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UNIT DIMENSIONS:



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ANODIZING: TYPE II CLASS II
COATING THICKNESS: 0.5 MILS MINIMUM
COLOR: BLUE

			
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