DIMENSIONS®

DC to AC Power Inverters

Pure Sine Wave Output

Owner's Manual

Model: 24NP8V

Sensata Technologies

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INTRODUCTION

Thank you for purchasing a Dimensions Inverter from Sensata Technologies! We think that you will find this product to be extremely reliable and easy to use. We have put a lot of time and resource into this system to make it a product that you will be completely satisfied with.

Please read this manual completely, before installation and operation.

Contact us by phone or email if you need assistance with this product.

We can be reached at:
1-800-553-6418

http://dimensions.sensata.com
inverterinfo@sensata.com

SAFETY INSTRUCTIONS

IMPORTANT
Read this manual before installation, it contains important safety, installation and operating instructions. Save this manual and keep it in a safe place.

Sensata Technologies is an ISO 9001:2008 Registered Company.

Sensata uses the following special notices to help prevent injury and/or damage to equipment.

 DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTE is used to notify of installation, operation, or maintenance information that is important but not hazard related.

Inverter Safety Instructions

⚠**WARNING:** Power Inverters produce hazardous voltages. To avoid risk of harm or fire, the unit must be properly installed.

⚠**WARNING:** There are no user serviceable parts inside, do not remove the cover.

⚠**WARNING:** Power Inverter is Water Resistant, not waterproof.

⚠**WARNING:** Power Inverters should not be installed in a zero clearance enclosure.

⚠**WARNING:** Damage to the Power Inverter will occur if correct polarity is not observed when installing the inverter's DC input cables.

⚠**WARNING:** Damage to the Power Inverter will occur if an external AC power source is applied to the inverter's AC hardwire output.

⚠**WARNING:** Power Inverters contain a circuit breaker and capacitor that may produce a spark upon connection or during normal operation. Do not mount in a confined battery or gas compartment.

⚠**WARNING:** Be sure the Power Inverter is turned OFF during installation.

⚠**WARNING:** Be sure the Power Inverter is turned OFF and AC power is disconnected when batteries are being connected, disconnected, serviced, and replaced or personal injury and/or damage to the inverter could result.

Battery Safety Instructions

⚠**WARNING:** Working in the vicinity of lead-acid batteries is dangerous. There is a risk of acid exposure.

⚠**WARNING:** Batteries generate explosive gases during operation.

⚠**WARNING:** There is risk of high current discharge from shorting a battery that can cause fire and explosion. Use insulated tools during installation.

⚠**WARNING:** Remove all rings, watches, jewelry or other conductive items before working near the batteries.

⚠**WARNING:** Inspect the batteries at least once a year for cracks, leaks or swelling.

⚠**WARNING:** Dispose of the batteries according to local regulations. Do not incinerate batteries; risk of explosion exists.

⚠**WARNING:** Be sure the Power Inverter is turned OFF and AC power is disconnected when batteries are being connected, disconnected, serviced, and replaced or personal injury and/or damage to the inverter could result.

SPECIFICATIONS

	MODEL NUMBER		
INVERTER	**24NP8V**		
Output Power (Watts Cont.)	1200 850 @ 65C		
Output Current (Amps AC Cont.)	Up to 10		
Input Current (Amps DC Cont.)	Up to 60		
Peak Output (Amps AC)	35		
Weight (lbs.)	35		
Dimensions in. (L x W x H)	12.5x9.5x6.7		
Output Voltage (VAC)	120 +/- 3%		
Output Frequency:	60 +/- .05%		
Output Waveform:	Pure Sine < 5% THD		
Input Voltage: (VDC)	21-30		
Operating Temperature:	-20C to 65C (0F to 149F)		
Efficiency:	Up to 88%		
Idle Current (Amps DC)	1.6		
BATTERY CHARGER			
AC Input Voltage Range (VAC)	95-135		
Input Current (Amps AC)	Up To 9		
Output (Amps DC)	Up to 35		
BYPASS RELAY (Amps AC)	15		

OTHER DESIGN FEATURES

Other Design Features: Internal thermally controlled cooling fan, GFCI outlet protection, and Remote "On/Off" switch hookup.

Unit Protection: Automatic electronic short circuit/overload protection, Automatic over temperature shutdown, and AC input/output circuit breakers.

Battery Protection: Automatic low battery shutdown at 21VDC with in-rush delay.

Temperature Compensated Charging: Allows for proper temperature charging across the operating range of the inverter.

THEORY OF OPERATION

Inverter Power Mode

Usage: Any 120 VAC, 60 Hz single phase product within the inverter's power rating.

The "Remote On/Off Input" controls the inverter. A voltage between 8 and 30 volts applied to the purple input wire will enable the inverter.

Operational modes: "External Power (Charger)" mode and "Inverter Power" mode.

The Status LED will blink amber while the inverter is on. The AC power produced by the inverter comes from the energy stored in the battery bank through a sophisticated electronic inversion process. A transformer, Metal Oxide Silicon Field Effect Transistors (MOSFET's), a filter capacitor and microprocessor control are used to generate clean AC power.

The inverter will operate at DC input voltages ranging from 21 to 30 volts. The inverter can tolerate up to 34V DC input. When the input voltage drops to 21volts, the inverter will stop operating due to a low battery condition. When the lead acid battery bank voltage drops to 21 volts, the battery is fully discharged.
Note: The signal output waveform produced by the inverter when in "inverter mode" is pure sinusoidal. It has a total harmonic distortion of less than 5%.

External Power Mode (Charger)

The status LED will blink green indicating that there is a valid external AC power line applied to the inverter AC input.

Bypass Relay: The loads attached to the inverter output will operate directly from the external AC power line independently of the inverter ON/OFF status. If the inverter is left ON (standby mode), the built-in bypass relay will automatically cycle back and forth between "Inverter Power" mode and "External Power" mode depending on the availability of the external AC power line.

Battery Charger: The battery charger cannot be disabled, and will engage automatically independently of the inverter ON/OFF status. The 3-step charging process modes are; Bulk, Acceptance, and Float.

The Status LED light located on front of the inverter will blink green to indicate the charging process mode (1 blink = Bulk, 2 blinks = Accept, 3 blinks = Float).

Note: The battery charger will engage any time AC input voltage is present (95-135VAC).

3 Step Battery Charger Recipes, Voltages with Temp Comp Cable		
Battery type		**Wet**
Bulk charge phase		
Bulk	Bulk charge current limit	35 ADC
	Bulk phase terminates	1. When battery voltage reaches the Acceptance voltage 2. When the bulk timeout is reached
	Bulk phase timeout	8 hours
		Bulk timers will extend when load management reduces charger current below 50% (25A)
Acceptance charge phase		
Acceptance	Acceptance charge voltage @ 77F/25C	31 VDC
	Acceptance voltage temp comp	5mv/cell/°C
	Maximum acceptance voltage at low temps	34 VDC @ -20C
	Acceptance phase terminates	1. When charge current is reduced 2. When the acceptance timeout is reached 3. If the charger can't maintain the Acceptance voltage
	Acceptance phase timeout	8.5 hours
Float charge phase		
Float	Float voltage @ 77F/25C	26.5 VDC
	Float voltage temp comp	5mv/cell/°C
Battery Temperature		
Battery Temp	Charger Warm Battery: output switches to compensated float from Bulk/Accept/Off(hot)	>122F/50C <140F/60C
	Charger High Battery Temp: Output to Off	>140F/60C
	Charger Resumes in previous mode: Bulk/Accept/Float	<112F/45C

Charger operation with temperature compensation cable:

The battery charger temperature compensation cable measures the battery temperature and automatically adjusts the charger output voltage for the fastest and safest charge.

When batteries are cold, their chemical reaction is slowed, so they don't take on charge as easily. A charge voltage optimized for room temperature will not charge the battery at low temperatures. The temp comp cable allows the charger to increase the charge voltage for optimum charging at low temperatures.

When batteries are hot, their chemical reaction is accelerated and they absorb energy too readily. A charge voltage optimized for room temperature will tend to overcharge the batteries and cause gassing. The temp comp cable will cause the charger to decrease the charge voltage to a safe level.

Our charger will switch to a "warm battery" mode in which the charger will only provide a float voltage when the batteries reach 122F/50C -140F/60. If the battery temperature continues to rise over 140F/60C the charger will shut off. The charger will resume charging in the "warm battery" mode when the battery cools to 131F/55C. Further, the charger will resume normal charge modes when the battery cools to 113F/45C.

Charger operation with temp comp bypass dongle:

Proper battery charging is best achieved by the use of the temperature compensation cable. If this is not feasible then the temperature compensation dongle can be used.

If the charger is used with the Temp Comp Cable Bypass Dongle, the charger will lock in to a hot setting for the charge voltages per the table. The bypass dongle may significantly reduce charger effectiveness at low temperatures and will not sense an overheated battery, and may not avoid a hazardous condition.

3 step Battery Charger Recipes, voltages with Temp Comp Bypass Dongle	
Battery type	**Wet**
Bulk charge current limit	35A DC
Acceptance charge voltage	29.5
Float voltage	25.4

Load Management:

Incoming AC power is shared between the AC loads and the charger. The AC loads are given priority; this means the charger will reduce its output with large AC loads. This feature controls the total amperage draw of the system so the input circuit breaker is not tripped. The Load Management feature will return the charger to full output when the AC loads are removed.

Dead battery charging:

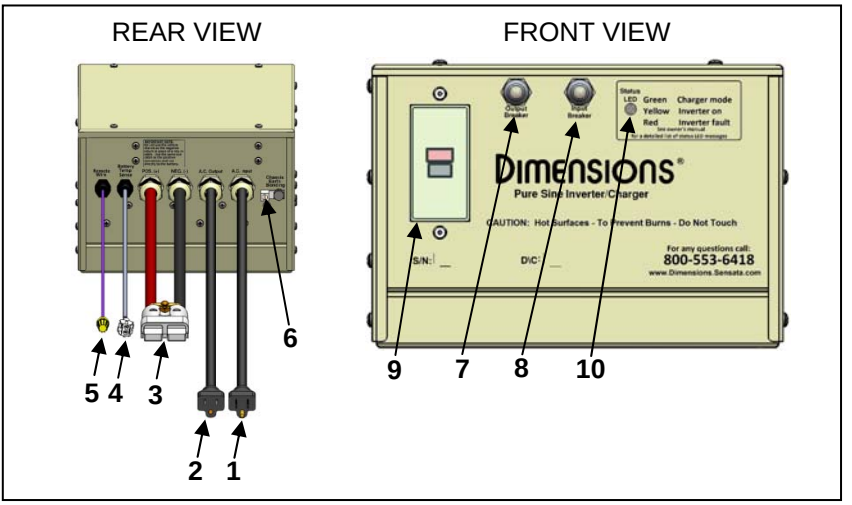
The charger will operate any time the AC line is within the valid range. There is no minimum battery voltage required for the charger to start.

Battery Specifications:

NOTE:

The charger in this inverter is specifically programmed for 4 of the Interstate part number U2200 or GC2-XHD-UTL or Interstate compatible 6 volt batteries. Use of any other battery could lead to improperly charged batteries and damage. Please use only the above listed batteries with this model. Please contact Sensata if other batteries are desired for use.

PHYSICAL DESCRIPTION



(1) **Plug-in AC input cord (NEMA 5-15P):** Connects to a 120VAC non-GFCI outlet.

(2) **AC output cord (NEMA 5-15R):** Provides 120VAC output.

(3) **Quick DC input disconnect:** Connects to the battery bank. This connector is for disconnect use only – not for current interruption.

(4) **Temp. Comp. Connector Port:** Connects to the temp. comp. cable

(5) **Remote On/Off:** Wires to remote power switch.

(6) **Bonding Lug:** Connects to the ground system.

(7) **Output Breaker:** Trips to protect the inverter's internal circuitry from shorted AC loads or overload situations.

(8) **Input Breaker:** Protects the AC input circuitry.

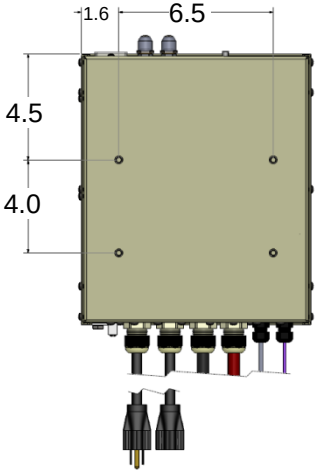
(9) **GFCI:** Provides 120VAC output to the AC output cord.

(10) **System Status LED** See page 15 for legend.

MOUNTING THE INVERTER

Installation Tools

The following tools are required for inverter installation: Crimper, Cable Ties, Cutter, Drill, #2 Phillips Screw Driver, #2 Slotted Screw Driver, Tape Measure, Wire Cutters, and Wire Strippers. Tools and mounting bolts are customer supplied.



Inverter Mounting (Dimensions are in inches)

Inverter Mounting Recommendations

NOTE: The inverter mounting location should provide adequate ventilation and clearance to maintain room temperature during operation. At least ½" of clearance is required on all sides.

⚠CAUTION:

The power unit is to be installed so that it is not likely to be contacted by people as the chassis can become quite hot. To prevent burns – do not touch.

1. Locate a suitable, secure, horizontal mounting surface as close to the batteries as possible without being in the same compartment.

⚠CAUTION:

2. Mount the inverter using four ¼-20 steel bolts with flat and lock washers. Length into chassis should be **less** than ½" or damage to the inverter could result.

DC WIRE GAUGE & FUSING

Inverter Cable

An "Inverter Cable Kit" (positive cable, negative cable, and proper fuse) is needed to connect the inverter to a battery bank. An 8-guage cable is also recommended to connect the inverter's bonding lug to ground.

The inverter cable length and the size of the inverter will determine the cable gauge and the fuse size to use. The maximum inverter cable recommended is 20-ft; it must be fused within 18-in from the positive (+) terminal of the battery.

Use the table below to determine the proper cable gauge and fuse size. An inverter cable kit designed to SAE guidelines can be purchased directly from our factory – call for options.

Minimum Cable and Fusing Guide at 5% Voltage Drop at Full Output				
Inverter Model	Full Load (Amps DC)	Inverter to Battery Estimated Cable Length in Feet		
		1 to 10 feet	**11 to 15 feet**	**16 to 20 feet**
24NP8V	62	6-gauge, 200A Fuse	4-gauge, 200A Fuse	2-gauge, 200A Fuse

NOTE:

- 3' Battery cable assembly is part# 611902
- 3' Temp. Comp. cable is part# 611622-03

Cable Recommendations

To make your own "Inverter Cable Kit," follow below recommendations:

1. Use stranded copper cables in all cases.
2. USE SGX cross-linked polyurethane insulation type that complies with the high temperature insulation requirements (125°C.) of SAE J-1127 and vehicle manufacturer requirements.
3. Mating Anderson type connector parts are available for purchase:
    a. Housing - part# 210080
    b. Strain Relief - part# 250071
    c. Pin - part# 210030

INVERTER REMOTE ON/OFF SWITCH

Mount the switch in a convenient location. Connect the purple wire from the back of the inverter to a terminal on the remote switch. Connect the other terminal of the remote switch to a fused or current limited DC+ power source (8-30VDC). Wiring is typically done with 18awg wire.

TEMP COMP CABLE CONNECTION

Connect the lug end of the temperature compensation cable to the negative post of the most negative point in the battery bank. Connect the two pin connector to the appropriate mating connector located at the back of the inverter labeled "Battery Temp. Sense."

NOTE: If the temp. Comp. Cable or dongle is not connected the battery charger will not function

AC INPUT & OUTPUT CONNECTIONS

⚠**WARNING:** Do not connect another source of AC power directly to the output of the inverter. This will result in damage not covered under warranty.

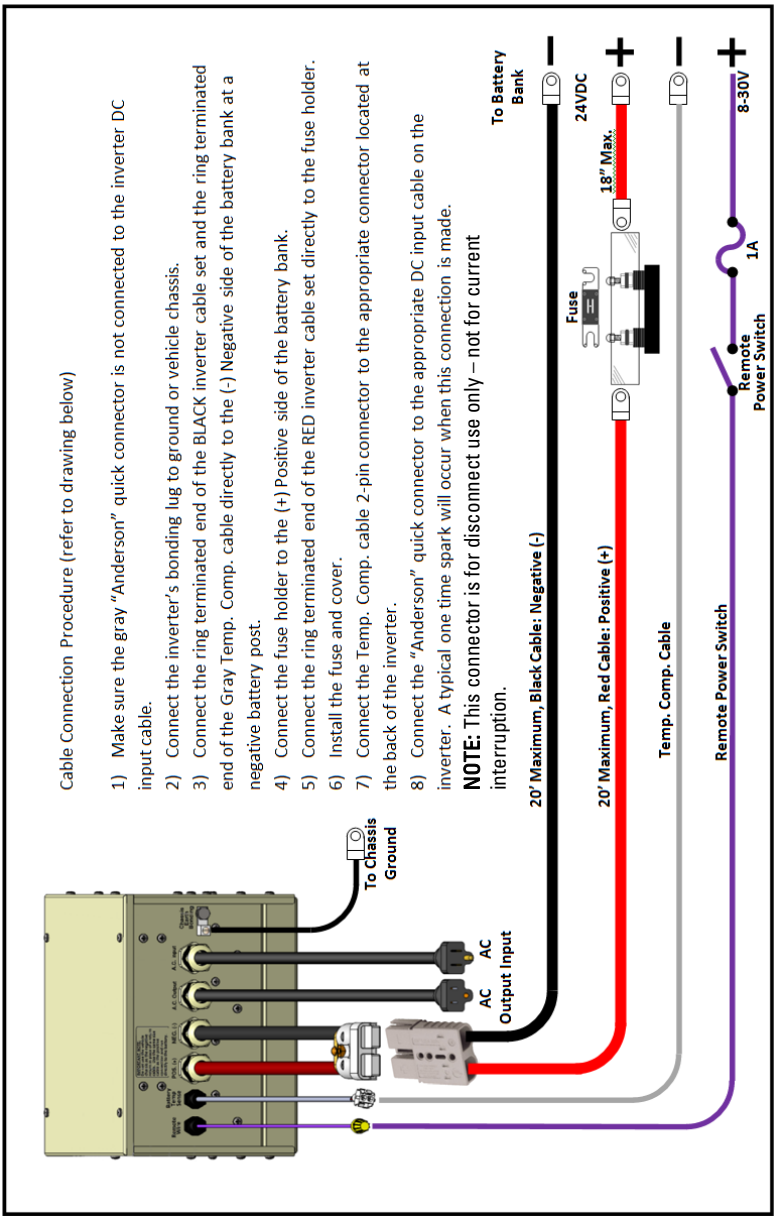
The inverter's 120 VAC output power is provided at the NEMA 5-15R receptacle.

Connect the NEMA 5-15P plug coming from the back of the inverter to a non-GFCI AC outlet for charging.

NOTE: Connecting the plug-in cord to GFCI protected outlets may cause some interference with the inverter's GFCI.

WIRING DIAGRAM

Typical Wiring Diagram for the 24NP8V



INVERTER TROUBLESHOOTING GUIDE

Look at the troubleshooting "LED Status Chart" below for LED descriptions. See also the next page for more troubleshooting information.

Call or e-mail customer service for free consultation during business hours (central time) at 1-800-553-6418 or 1-651-653-7000; fax 1-888-439-3565 or 1-651-653-7600
E-mail: inverterinfo@sensata.com; http://dimensions.sensata.com

LED Status Chart:

Status LED Normal States		
LED Color	LED State	Operating Conditions
Green	1 blink	Bulk Charge
Green	2 blinks	Accept Charge
Green	3 blinks	Float Charge
Green	4 blinks	Load Management Active
Amber	1 blink	Inverting
Status LED Fault States		
None	Off	No power to unit or internal fault
Any	Constant ON	Internal fault
Red	1 blink	Inverter Low Battery shut down*
Red	2 blinks	Inverter Overload shut down
Red	3 blinks	Transformer High Temp*
Red	4 blinks	MOSFET High Temp*
Red	5 blinks	Battery probe open or shorted
Red	6 blinks	Charger high battery temp*
Amber	2 blinks	Charger warm battery*
Amber	3 blinks	High battery voltage*
Amber	4 blinks	System overload, reset required
Faults marked with* will self recover when the condition returns to normal range		

TROUBLESHOOTING

1) **No AC output power during Inverter mode:**

No LED's On:

- Check the in-line fuse which is located within 18" from the battery's positive post.
- DC connections tight and clean?
- Battery voltage to be above 7VDC? LED shuts down around 7VDC.
- Check Remote Power Switch.

LED blinks Amber once: Disconnect all loads and connect a test light to the AC Output cord.

- Check the GFCI to see if it is tripped (Cooper brand GFCI has the LED go on when tripped, other brands are dark)
- If test light is off: Possible failed inverter

LED blinks Green: Repeat above test

LED blinks Red: See "Led Status Chart"

2) **Low Battery**: The use of a battery isolator is not recommended due to excessive voltage drop across terminals.
   - Battery voltage must be above 21VDC for the inverter to be on.
   - Check for proper DC wire gauge (see Wire Gauge & Fusing section)
3) **Overload:** Unplug all loads and reset the inverter On/Off.
   - Overload condition clears, check for short circuits or check load size versus inverter output wattage size.
   - If the overload persists, possible failed inverter
4) **High Temp.:** Let the inverter cool down.
5) **Check Battery:** Reset the inverter (unplug/plug AC Input cord from the utility power) and disconnect DC "Anderson" connector. Turn "on" the inverter for 30 seconds. Turn "off" the inverter. Re-connect the "Anderson" connector.
   - Possible battery cell shorted or corroded/loose DC wires
   - Check battery voltage and current against charger recipe table

ACCESSORIES

Part Number	Item Description
611902	Battery cable assembly, 3’
611622-03	Temp. Comp. cable, 3’
431021	Fuse holder with cover
430010	Fuse 200A, ANN-200
611877	Temp. Comp. Cable Bypass dongle
430001	Faceless GFCI Outlet, Leviton X7590

LIMITED WARRANTY TERMS & CONDITIONS

SHIPPING TERMS: F.O.B. St. Paul Minnesota. Freight prepaid and billed, subject to prior credit approval.

MINIMUM ORDER: $50.00 Net Price

LOSS OR DAMAGE: Loss or damage in transit are the responsibility of the carrier. Any claim should be filed with the delivering transport company. Invoice, Bill of Lading and Delivery receipt with damage noted therein must accompany any claims for freight damage. Claims for shortage and lost shipments must be made in writing to Sensata Technologies within 10 days of date of shipment. Claims not reported within this time frame will not be honored.

PRICES: Prices are subject to change without notice. All orders are subject to acceptance at the factory. We reserve the right to invoice prices in effect at time of shipment.

TERMS: Net 30 days with approved credit, credit card or C.O.D.

RETURN GOODS POLICY:

- No returned materials will be accepted without an accompanying Returned Materials Authorization Number (RMA) from the factory.
- Credit will be issued for returned goods to the original purchaser within 60 days of purchase, provided the inverter is returned to Sensata unused and not mounted. The amount of credit will be issued at Sensata's discretion based on the condition of the product.
- Customer must be in good standing with Sensata Technologies.
- Inverters that are discontinued, high-voltage (over 24vdc), special-order or used are excluded and will not be eligible for credit. Non-inverter items such as cable assemblies, fuses and fuse holders, will not be eligible for credit
- Support components supplied by Sensata vendors will be covered under that manufacturer's credit return policy.
- Customer pays return freight.

PLEASE SHIP AUTHORIZED RETURNS TO:

Sensata Technologies RMA#_____ | 4467 White Bear Parkway | St. Paul, MN 55110

Return Freight Prepaid

LIMITED WARRANTY:

Sensata Technologies extends the following warranty to the original purchaser of those goods subject to the qualifications indicated. Sensata warrants to the original purchaser for use that the goods or any component thereof manufactured by Sensata will be free from defects in workmanship from the date of purchase for the period listed on the product label, provided such goods are installed, maintained and used in accordance with Sensata and the original manufacturer's written instructions. Damages caused by the misuse, undue care or obvious wear through use will not be covered by this warranty.

Components not manufactured by Sensata, but used within the assembly provided by Sensata, are subject to the warranty period as specified by the individual manufacturer of said component, provided such goods are installed, maintained and used in accordance with Sensata and the manufacturer's written instructions.

Sensata's sole liability and the Purchaser's sole remedy for a failure of goods under this limited warranty and for any and all claims arising out of the purchase and use of the goods shall be limited to the repair or replacement of the goods that do not conform to this warranty.

To obtain repair or replacement service under the limited warranty, the purchaser must contact the factory for a Return Material Authorization (RMA) Number. Once obtained, send the RMA Number along with the defective part or goods to:
Sensata Technologies RMA#_____, 4467 White Bear Parkway, St. Paul, MN 55110. Return Freight Prepaid.

THERE ARE NO EXPRESS WARRANTIES COVERING THESE GOODS OTHER THAN AS SET FORTH ABOVE. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN DURATION TO ONE YEAR FROM DATE OF PURCHASE.

SENSATA TECHNOLOGIES ASSUMES NO LIABILITY IN CONNECTION WITH THE INSTALLATION OR USE OF THE PRODUCT, EXCEPT AS STATED IN THIS LIMITED WARRANTY. SENSATA TECHNOLOGIES WILL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

WARNING: **LIMITATIONS ON USE:** DIMENSIONS® brand products are not intended for use in connection with Life Support Systems and for Avionic use. Sensata Technologies makes no warranty or representation in connection with their products for such uses.

NOTES

Sensata
Technologies

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