


BOURNS®

## Features

- 24-bit isolated shunt current sensor with CANbus interface
- 1500 VDC reinforced galvanic isolation
- 16-bit microcontroller (rated to +150 °C)
- 24-bit ADC with buffered analog inputs
- ECC flash memory with autocorrect single bit errors
- Internal and external CRC data error detection
- Non-linear temperature compensation
- AEC-Q–compliant component assembly option
- RoHS compliant*

# SSD-CANbus Series – Digital Current Sensor with CANbus Interface

## Specifications

| Characteristic | SSD-100A | SSD-250A | SSD-500A | SSD-1000A |
|---|---|---|---|---|
| Nominal Current (A) | ±100 | ±250 | ±500 | ±1000 |
| Peak Current (No Clipping) | +2 kA / -1 kA | +5 kA / -2.5 kA | +10 kA / -5 kA | +20 kA / -10 kA |
| Shunt Resistance (μΩ)<br>Excluding primary termination resistance | 300 | 120 | 60 | 30 |
| Initial Accuracy | < ±0.1 % | | | |
| Linearity Over Current Range | < ±0.1 % + 5 mA | < ±0.1 % + 13 mA | < ±0.1 % + 25 mA | < ±0.1 % + 50 mA |
| Bandwidth | 5 kHz | | | |
| ADC Resolution | 24 bits | | | |
| Speed (readings per second) | up to 1100 rps (0.9 - 4200 ms per reading) | | | |
| Supply Voltage | 5 - 60 VDC | | | |
| Typical Supply Voltage<br>(See Shunt Supply Voltage Requirements on Page 2) | *@ 5.0 V, 55 mA typical | | **@ 24 V, 15 mA typical | |
| DC Bus Voltage Range | ±1200 VDC max. (10 M input impedance) | | | |
| CAN Interface | CAN 2.0 A Speeds: 125 K, 250 K, 500 K (default), 1 M baud | | | |
| Long Term Stability | < ±0.3 % 1000 hours 115 °C terminal temperature | | | |
| Galvanic Isolation | 1500 VDC 1000 VAC RMS (maximum continuous working voltage) | | | |
| Dielectric Strength | 3500 VAC RMS 1 minute | | | |
| Operating Temperature | -40 °C to +115 °C ambient<br>-40 °C to +125 °C primary conductor (see derating curve on page 2) | | | |
| Storage Temperature | -55 °C to +125 °C | | | |
| Assembled using AEC-Q Compliant Components | – | – | – | ✔ |

## Materials (RoHS Compliant)

Resistance Element.....CuMnNi
Current Terminal[1]....Nickel-plated copper
Electronics Housing.....94-V0 rated

Note:
1 Suitable for copper, copper-clad aluminum or aluminum conductors

**CALIFORNIA WARNING:** Can expose you to lead, a carcinogen and reproductive toxicant.
See www.P65Warnings.ca.gov

## Product Safety Notice

The SSD Series Digital Current Sensor must be used in a manner specified by this data sheet, otherwise the protection provided by the equipment may be impaired. The SSD Series should not be treated as a structural part of the installation and must be properly supported on both ends.

## Additional Information

Click these links for more information:

PRODUCT | TECHNICAL LIBRARY | INVENTORY | SAMPLES | CONTACT

*RoHS Directive 2015/863, Mar 31, 2015 and Annex.
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## Applications

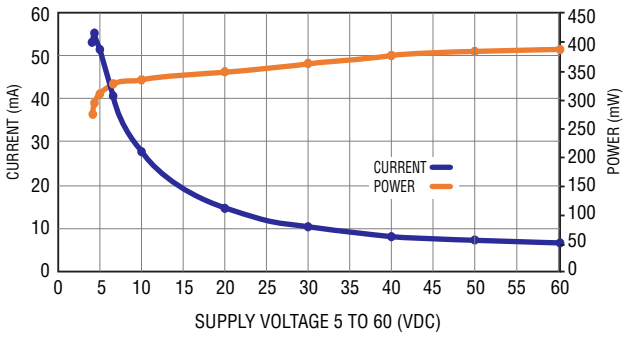
- EV charging stations
- Battery systems
- Renewable energy systems
- Motor drives



### Specifications (continued)

| Model | Typical Noise (mA RMS) per ADC Reading Interval (ms), 1.25X Range, Zero Current | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.9 | 1.6 | 3.2 | 4.8 | 6.4 | 7.2 | 9 | 13 | 26 | 51 | 102 | 205 | 410 | 820 | 1640 | 3280 |
| SSD-100A | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | <1 | <1 | <1 | <1 | <1 |
| SSD-250A | 8 | 7 | 6 | 5 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | <1 | <1 |
| SSD-500A | 15 | 13 | 12 | 11 | 10 | 9 | 7 | 7 | 5 | 4 | 3 | 2 | 2 | 1 | 1 | 1 |
| SSD-1000A | 31 | 27 | 24 | 21 | 19 | 17 | 15 | 13 | 11 | 9 | 6 | 4 | 3 | 2 | 2 | 1 |

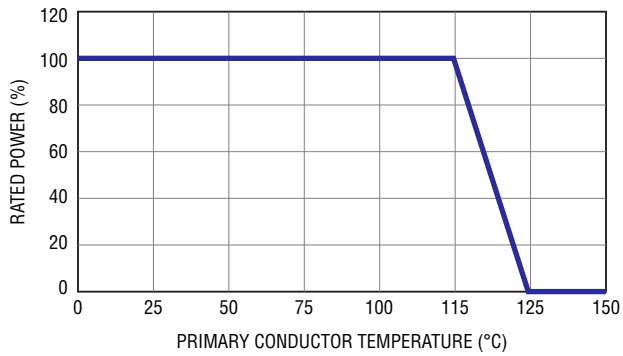
### Shunt Supply Voltage Requirements



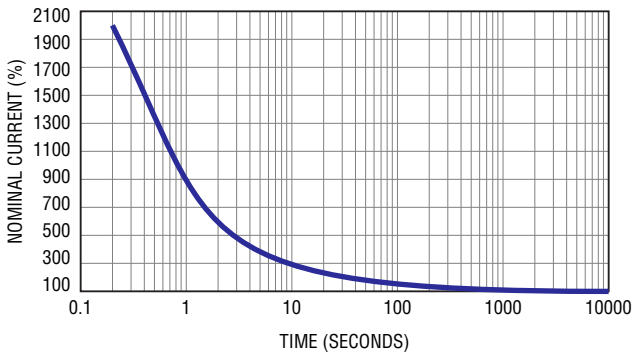

* @5.0 V, 55 mA (SSD-100A and SSD-250A only)

** @24 V, 15 mA (SSD-500A and SSD-1000A only)

### Derating Curve




### Overcurrent vs. Time




### Connectors

| SSD Connector | Mating Connector | Molex Nano-Fit Part Number |
|---|---|---|
| 4-Pin Male | 4-Pin Female | 1053071204 |
| | 0-22 AWG Female Contacts* | 1053002200 |
| | 4-Pin TPA Strain Relief | 1053251004 |
| 2-Pin Male Vbus | 2-Pin Female | 1053071202 |
| | 20-22 AWG Female Contacts* | 1053002200 |
| | 2-Pin TPA Strain Relief | 1053251002 |

* Use Gold (Au) plated contacts for 115 °C temperature rating.

### How to Order

**SSD - 100A - C - T**

Model

Amps

100A = 100 A 250A = 250 A 500A = 500 A 1000A = 1000 A

Interface

C = CANbus (Industrial Version)

CA = CANbus (Assembled Using AEC-Q Compliant Components - Model SSD-1000A Only)

Option

Blank = Standard

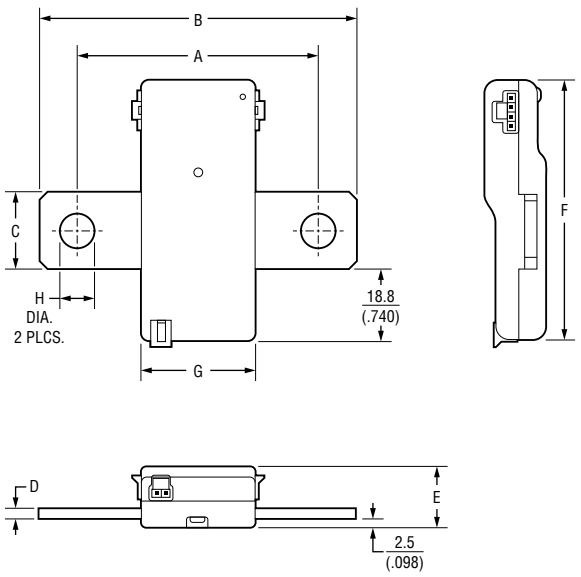
-T = Internal 120 Ω Termination Resistor (Industrial Version Only)

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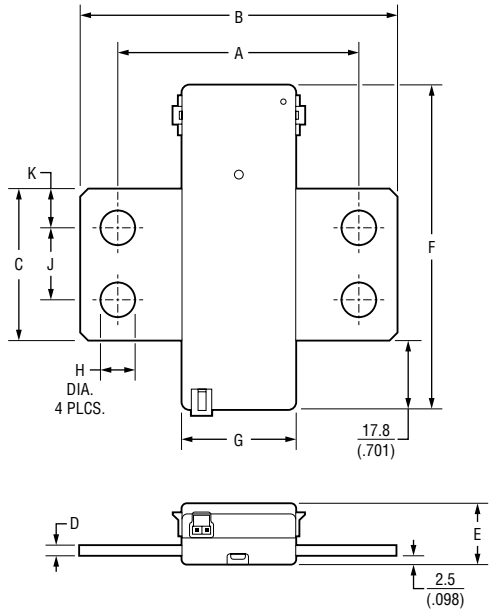
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## Product Dimensions

### SSD-100A to SSD-500A




### SSD-1000A




| Model | SSD-100A | SSD-250A | SSD-500A | SSD-1000A |
|---|---|---|---|---|
| A | 63.5 ± 0.5 (2.50 ± .020) | | | |
| B | 84 ± 0.5 (3.307 ± .020) | | | |
| C | 20 ± 0.5 (.787 ± .020) | | | 40 ± 0.5 (1.575 ± .020) |
| D | 3 ± 0.5 (.118 ± .020) | | 4 ± 0.5 (.157 ± .020) | |
| E | 16.4 ± 0.5 (.646 ± .020) | | 17.4 ± 0.5 (.685 ± .020) | |
| F | 68.8 ± 0.5 (2.709 ± .020) | | | 85.8 ± 0.5 (3.378 ± .020) |

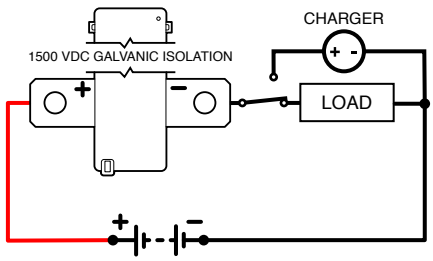
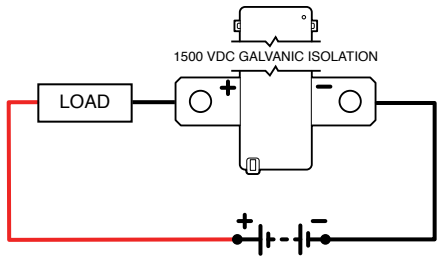
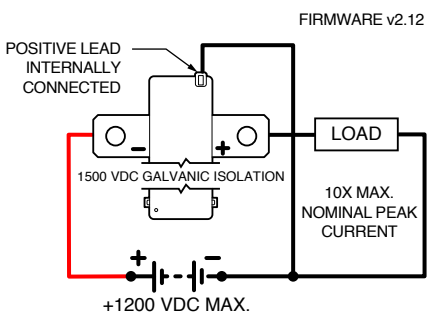
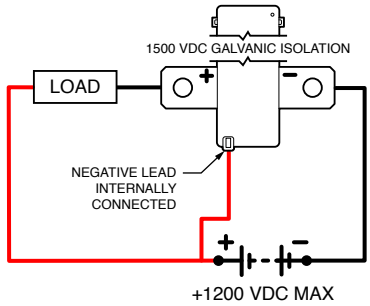
| Model | SSD-100A | SSD-250A | SSD-500A | SSD-1000A |
|---|---|---|---|---|
| G | 30.8 ± 0.5 (1.213 ± .020) | | | |
| H | 8.7 ± 0.5 (.343 ± .020) | | | |
| J | - | - | - | 19 ± 0.3 (.748 ± .012) |
| K | - | - | - | 10.5 ± 0.3 (.413 ± .012) |

DIMENSIONS: MM (INCHES)

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## Installation

| Electrical Wiring | | |
|---|---|---|
| | **High Side** | **Low Side** |
| Current Only<br>±1500 VDC<br>MAX. |  |  |
| Bus Voltage<br>Measurements<br><br>±1200 VDC | <br>Use SETMODE Command to Invert Current and Voltage.<br>Keep Positive DC Connection Short<br>to Minimize Bus Voltage Drop Errors. | <br>Keep Negative DC Connection Short<br>to Minimize Bus Voltage Drop Errors. |

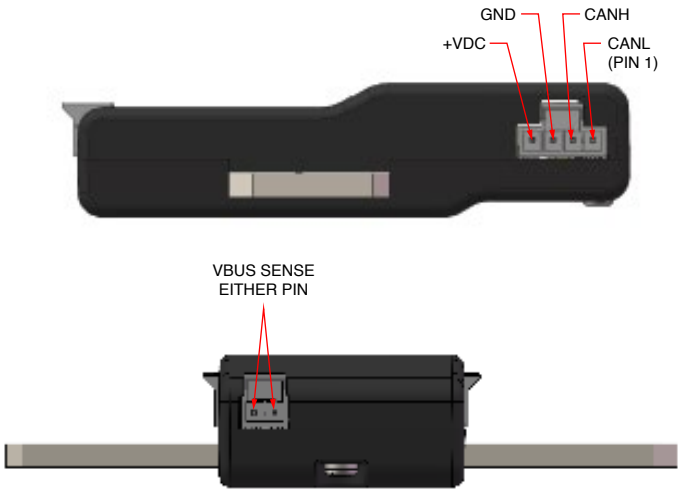
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## Connectors

Connectors on both sides have same pinout. Either or both connectors can be used.

### CANbus

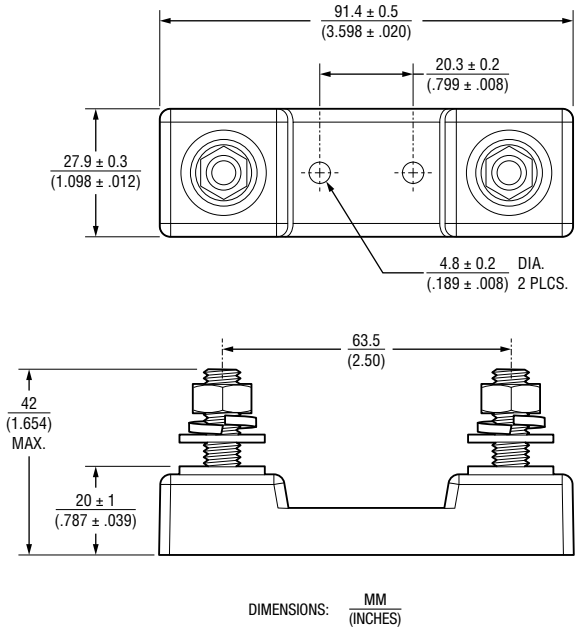



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## Optional Base Mounting Fixtures

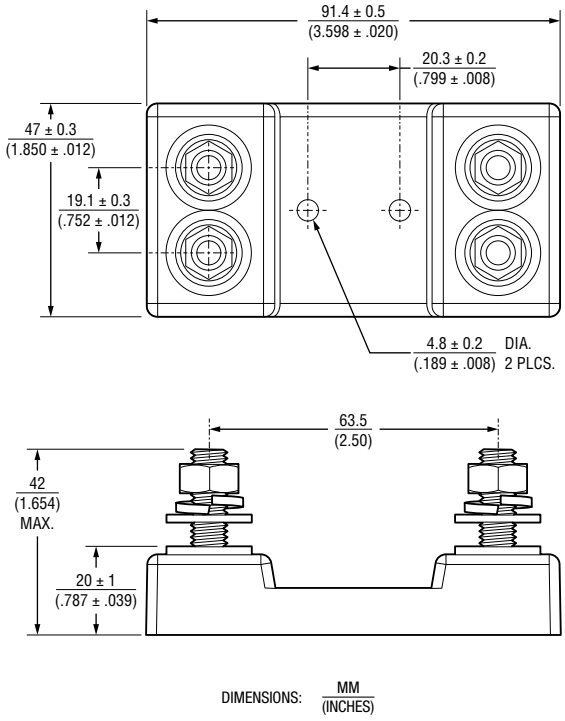
### SSA-BASE




DIMENSIONS: MM (INCHES)



### SSA-BASE-1K




DIMENSIONS: MM (INCHES)

- Robust design
- 5/16-18 Stainless Steel Hardware
- Torque Nuts:
  11-13 ft-lb (15-17.6 N-m)
- UL 94-V0 rated materials

## Optional SS-CABLE Power / Serial Connection

### SS-CABLE-1M



| Serial Output | | |
|---|---|---|
| White | CANL / 485A | Pin 1 |
| Yellow | CANH / 485B | Pin 2 |
| Black | Ground | Pin 3 |
| Red | +5 to 60 VDC | Pin 4 |

- For all SSD models
- Color-coded 22 ga wire
- Two twisted pairs
- 1 meter standard length

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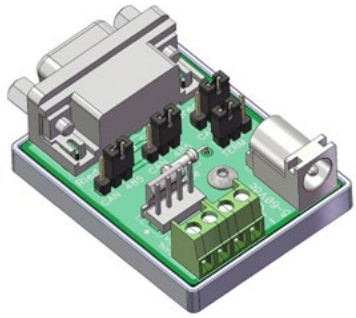
## Optional SSD Connector Sets

**SSD-CONN-SET**

| Standard Connector Set | | |
|---|---|---|
| **Includes** | **Molex P/N** | **Description** |
| 1 pc. | 1053071204 | 4-Pin Female |
| 1 pc. | 1053071202 | 2-Pin Female |
| 6 pcs. | 1053002200 | 20-22 AWG Female Crimp Terminals |
| 1 pc. | 1053251004 | 4-Pin TPA |
| 1 pc. | 1053251002 | 2-Pin TPA |

## Optional SSD Serial Connection Kit

**SSD-SERKIT**



| Serial Connection Kit | |
|---|---|
| **Includes** | **Description** |
| 1 pc. | SSD to DB-9F Serial Adapter |
| 1 pc. | 5 VDC USB Power Cable |
| 1 pc. | 4-Pin Programming Cable (1 m Length) |

The SSD serial connection kit simplifies the initial setup of the SSD Series Digital Current Sensor. It includes the necessary components to connect USB to CAN and USB to RS-485 serial adapters that have a 9-pin DB-9 male output connector. It includes jumpers to switch from RS-485 to CANbus and enable a termination resistor. USB to serial adapter not included.

USB to RS-485 Adapter - From DTEK, StarTech and others with RS-485 on DB9 pins 1 and 2 and the ground on pin 5. Note: Some adapters have the 485A and 485B pins reversed.

USB to CANbus adapter - From PEAK, Kvaser and others with CAN on DB9 pins 2 and 7 and the ground on pin 3.

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## Frequently Asked Questions

**Q: Is it necessary to install the SSD Series on the low side of the circuit?**

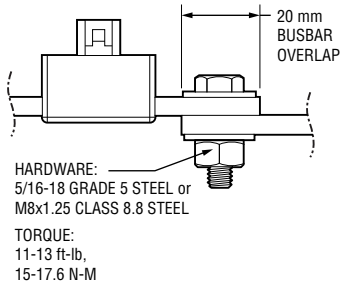
**A:** The SSD Series Digital Current Sensor is completely isolated, so it may be installed in either the low or high side of the circuit.

**Q: The sensor is only sending whole Coulombs and Watt-hours, how precise are these?**

**A:** Internally, micro-coulombs and micro-joules are counted; so very short ADC timing intervals and very low currents are accurately counted.

**Q: What is the best way to connect to the SSD Series terminals?**

**A:** Make sure connections are clean and well prepared. Bolts to be torqued to the hardware manufacturer's recommendations. There should be sufficient clamping force to ensure proper connection. Overlap shown below should be taken as a minimum. Suitable for Copper, Copper-Clad Aluminum or Aluminum conductors.




**Q: What is the best way to cool the SSD Series Digital Current Sensor?**

**A:** A majority of the heat generated by the SSD Series is dissipated through the primary conductors. Care should be taken to ensure that the primary conductors are sized appropriately given expected amperage and conductor length. Bourns recommends a 115 °C maximum conductor temperature at rated current. If there are thermal concerns, oversizing the conductors will help minimize the operating temperature of the Digital Current Sensor.

**Q: When should I use the SSD version with the internal 120 Ω termination resistor (-T)?**

**A:** The -T version includes a built-in 120 Ω resistor between CANH/CANL or 485A/485B. Typical RS485 or CANbus networks require termination at two endpoints. Use the -T version accordingly. Avoid using more than two termination points to ensure proper communication.

**Q: What size wire is suitable for the SSD Series?**

**A:**

| Copper Conductor Ampacity Ratings (continuous) | | | | | |
|---|---|---|---|---|---|
| **mm²** | **AWG** | **Amps (75 °C)** | **mm²** | **AWG** | **Amps (75 °C)** |
| 13.3 | 6 | 65 | 107 | 0000 (4/0) | 230 |
| 21.2 | 4 | 85 | 127 | 250 MCM | 255 |
| 33.6 | 2 | 115 | 152 | 300 MCM | 285 |
| 42.4 | 1 | 130 | 203 | 400 MCM | 335 |
| 54 | 0 (1/0) | 150 | 253 | 500 MCM | 380 |
| 67 | 00 (2/0) | 175 | 380 | 750 MCM | 475 |
| 85 | 000 (3/0) | 200 | 887 | 1500 MCM | 625 |

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## SSD Interface Manual

**SSD CAN IDs for Settings (Defaults)** **Default Baud 500 kbp/s**

| | | | |
|---|---|---|---|
| SET COMMAND ID | 0x3FA | Motorola | Used to Write values |
| GET COMMAND ID | 0x3FB | Motorola | Used to Read values |
| REPLY ID | 0x3FC | Motorola | Returned Data from Get Command |

**CAN IDs for Sensor Readings (Defaults)**

| | | | |
|---|---|---|---|
| CURRENT | 0x3F1 | Intel | Sensor Current |
| TEMPERATURE | 0x3F2 | Intel | Sensor Temperature |
| VBUS | 0x3F3 | Intel | Bus Voltage |
| COULOMB | 0x3F4 | Intel | Coulomb Counter |
| POWER | 0x3F5 | Intel | Power |
| ENERGY | 0x3F6 | Intel | Energy Counter |
| ERRORS/ALERT | 0x3F7 | Intel | Errors or Alerts |

**Intel (Data Byte 0 = LSB) data format for Sensor Readings**
**Motorola (Data Byte 0 = MSB) data format for all Settings to improve legibility with setup**

| Name | Size | Units | Range | Format |
|---|---|---|---|---|
| Current | Signed int32 | 1 mA | ± 20 X Nominal | Intel |
| Temperature | Signed int32 | 0.1 °C | -40 °C to +125 °C* | Intel |
| Bus Voltage (Vbus) | Signed int32 | 1 mV | ± 1200 $V_{DC}$ | Intel |
| Coulomb | Signed int64 | 1C (A•s) | ± $2^{60}$ | Intel |
| Power | Unsigned int32 | 0.1 W | 0 to $2^{32}$ | Intel |
| Energy | Unsigned int64 | W•h | 0 to $2^{60}$ | Intel |

**COMMAND LIST**

| | | | |
|---|---|---|---|
| GET ALL ENABLED | 0x00 - Read Only | VBUS UNDER LIMIT | 0x1B |
| GET CURRENT | 0x01 - Read Only | VBUS OVER LIMIT | 0x1C |
| GET TEMPERATURE | 0x02 - Read Only | POWER OVER LIMIT | 0x1D |
| GET VBUS | 0x03 - Read Only | SHUNT NANO-OHM | 0x1E |
| GET COULOMB | 0x04 - Read Only | CURRENT ZERO OFFSET | 0x21 |
| GET POWER | 0x05 - Read Only | VBUS FACTOR | 0x22 |
| GET ENERGY | 0x06 - Read Only | VBUS ZERO OFFSET | 0x23 |
| GET ERRORS | 0x07 - Read Only | TEMP OFFSET | 0x24 |
| RESET COMMAND | 0x10 - Write Only | T0 TEMP COMPENSATION | 0x25 - Read Only |
| SET CAN IDS | 0x11 - Write Only | T1 TEMP COMPENSATION | 0x26 - Read Only |
| SETMODE | 0x12 | T2 TEMP COMPENSATION | 0x27 - Read Only |
| BAUDRATE | 0x14 | RESET CAUSES | 0x28 - Read Only |
| READING DELAY | 0x16 | FIRMWARE VERSION | 0x30 - Read Only |
| A2D CONFIG | 0x17 | SERIAL NUMBER | 0x31 - Read Only |
| CURRENT UNDER LIMIT | 0x18 | | |
| CURRENT OVER LIMIT | 0x19 | | |
| TEMP OVER LIMIT | 0x1A | | |

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## SSD Interface Manual (continued)

**0x00** – Command GET ALL ENABLED – Read Only

Used to get all enabled readings in the SETMODE command. Current, Temperature, Vbus, etc…

| | Message ID | Length | Data Fields (LSB First) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x00 | | | | | |
| RECEIVE | Multiple replies from all enabled readings in the SETMODE Command | | | | | | | |

**0x01** – Command GET CURRENT – Read Only

Used to get the last sensor current reading in milliamps.

Reply is 4 bytes from CAN ID 0x3F1 (default) - Intel Format (Data Byte 0 = LSB)

| | Message ID | Length | Data Fields (LSB First) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x01 | | | | | |
| RECEIVE | 0x3F1 | 0x04 | 0xXX | 0xXX | 0xXX | 0xXX | | |

**0x02** – Command GET TEMPERATURE – Read Only

Used to get the last sensor temperature reading in 0.1 centigrade.

Reply is 4 bytes from CAN ID 0x3F2 (default) - Intel Format (Data Byte 0 = LSB)

| | Message ID | Length | Data Fields (LSB First) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x02 | | | | | |
| RECEIVE | 0x3F2 | 0x04 | 0xXX | 0xXX | 0xXX | 0xXX | | |

**0x03** – Command GET VBUS – Read Only

Used to get the last external bus voltage reading in milli-Volts.

Reply is 4 bytes from CAN ID 0x3F3 (default) - Intel Format (Data Byte 0 = LSB)

| | Message ID | Length | Data Fields (LSB First) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x03 | | | | | |
| RECEIVE | 0x3F3 | 0x04 | 0xXX | 0xXX | 0xXX | 0xXX | | |

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## SSD Interface Manual (continued)

**0x04** – Command GET COULOMB – Read / Write

Used to get or set the last coulomb count which is continuously updated with current.

Note: The coulomb reading can overflow! It is up to the user to check if very large values (> $\pm 2^{60}$) are expected. See 0x07 command to read overflow bit.

Reply is 8 bytes from CAN ID 0x3F4 (default) - Intel Format (Data Byte 0 = LSB)

Note: Writing a new value is limited to signed int32 values.
Example: Write 500,000 (0x7A120) to coulomb counter

**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x05 | 0x04 | 0x00 | 0x07 | 0xA1 | 0x20 | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields (LSB First) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x04 | | | | | | | |
| RECEIVE (int64) | 0x3F4 | 0x08 | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX |

**0x05** – Command GET POWER – Read Only

Used to get the last power reading in 0.1 watts.

Reply is 4 bytes from CAN ID 0x3F5 (default) - Intel Format (Data Byte 0 = LSB)

| | Message ID | Length | Data Fields (LSB First) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x05 | | | | | |
| RECEIVE | 0x3F5 | 0x04 | 0xXX | 0xXX | 0xXX | 0xXX | | |

**0x06** – Command GET ENERGY – Read Only

Used to get the last energy count in Watt-hours (Wh) which is continuously updated.

Note: The energy reading can overflow! It is up to the user to check if very large values (> $2^{60}$) are expected. See 0x07 command to read overflow bit.

Reply is 8 bytes from CAN ID 0x3F6 (default) - Intel Format (Data Byte 0 = LSB)

| | Message ID | Length | Data Fields (LSB First) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x06 | | | | | | | |
| RECEIVE (int64) | 0x3F6 | 0x08 | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX | 0xXX |

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## SSD Interface Manual (continued)

**0x07** – Command GET ERRORS/Alerts – Read Only

Used to get any errors or alerts which are continuously updated.
Reply is 2 bytes from CAN ID 0x3F7 (default) - Motorola Format (Big Endian)

| | Message ID | Length | Data Fields (LSB First) | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x07 | | | | | |
| RECEIVE | 0x3F7 | 0x02 | 0xXX | 0xXX | | | | |

| Returned ERROR / ALERT bits | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| N/A | 1 = ECC Single Bit | 1 = EEPROM Corrupt | 1 = EEPROM R/W | 1 = ADC Initialization | 1 = ADC CRC Read | 1 = Energy Overflow | 1 = Coulomb Overflow | 1 = Power Over Limit | 1 = Vbus Over Limit | 1 = Vbus Under Limit | 1 = Temp Over Limit | 1 = Current Over Limit | 1 = Current Under Limit | 1 = Current Range Over | 1 = Vbus Range Over |

Bit0 Vbus Range Over – Bus Voltage exceeds the MAX voltage for the range selected, see **0X17** command.

Bit1 Current Range Over – Peak current exceeded the range selected, see **0X17** command.

Bit2 Current Under Limit – Current is below the limit set, see **0X18** command.

Bit3 Current Over Limit – Current is above the limit set, see **0X19** command.

Bit4 Temp Over Limit – Temperature is above +125 °C or the limit set, see **0X1A** command.

Bit5 Vbus Under Limit – Bus Voltage is below the limit set, see **0X1B** command.

Bit6 Vbus Over Limit – Bus Voltage is above the limit set, see **0X1C** command.

Bit7 Power Over Limit – Power is above the limit set, see **0X1D** command.

Bit8 Coulomb Overflow – Coulombs have exceeded the range of $\pm 2^{47}$.

Bit9 Energy Overflow – Energy has exceeded $2^{48}$.

Bit10 ADC CRC Read – The ADC's CRC doesn't match the calculated CRC of the returned data.

Bit11 ADC Initialization – The ADC's initialized registers don't match the written values.

Bit12 EEPROM R/W – Error reading or writing to the internal EEPROM.

Bit13 EEPROM Corrupt – The EEPROM CRC doesn't match saved value.

Bit14 ECC Single Bit Error – Flash Memory had an Auto-Correctable Error.

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## SSD Interface Manual (continued)

**0x10** – Command RESET COMMAND – Write Only

Rebooting will restore previously saved settings if current settings are not saved. This will prevent baud rate or address errors since you will need to connect with the new values before you can issue the save to EEPROM command.

0x0001 – Reset Coulomb and Energy counters
0x0004 – Reset Errors
0x000F – Save settings to EEPROM
0X00AA – Reset settings to defaults (command must be sent 3X in a row)

Example: To save settings to EEPROM

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x10 | 0x00 | 0x0F | | | |
| RECEIVE | (none) | | | | | | | |

**0x11** – Command SET IDs – Write Only

Used to change the default SSD CAN bus IDs to different ID numbers.

Example: To change the default CURRENT CAN ID from 0x03F1 (1009) to 0x04B0 (1200)

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x05 | 0x11 | 0x03 | 0xF1 | 0x04 | 0xB0 | |
| RECEIVE | ( none ) | | | | | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x12** – Command SETMODE – Read / Write

Used to change the sensor options.

Bit0 Invert Current – This will flip the Current and Coulomb signs if necessary.

Bit1 Autorange – Sensor will switch to high range if reading exceeds 85 % of standard range. It will switch back when reading drops to below 50 % of standard range. See A2D CONFIG for more info.

Bit2 Modbus Enable – Not used on CANbus version.

Bit3 Auto Reset Errors – Self clears errors once sent or read, the error will re-enable if it persists.

Bit4 Invert Voltage – Use for Highside Voltage Measurements.

Bit7 Send on Conversion – The sensor will send the latest data as soon as available per A2D CONFIG.

Bit8 Autosend – The sensor will send readings at the Read Delay timer interval unless Bit7 is enabled.

Bit9 to Bit15 – Enable the readings to be automatically sent. Otherwise read them manually.

| SETMODE Configuration Bytes | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEXCODE: 0000<br>Check boxes below to calculate HEX value | | | | | | | | | | | | | | | |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| 1 = Send Errors/Alerts | 1 = Send Energy Cnt | 1 = Send Power | 1 = Send Coulomb Cnt | 1 = Send Vbus | 1 = Send Temperature | 1 = Send Current | 1 = Autosend | 1 = Send on Conversion | N/A | N/A | 1 = Invert Voltage | 1 = Auto Reset Errors/Alerts | Reserved | 1 = Autorange | 1 = Invert Current |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x12** (Continued) - Command SETMODE - Read / Write

SETMODE default is: 0x0002.

Example: To enable Autosend, Send Current, Send Errors, Auto Reset Errors (0x8308)

**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x12 | 0x83 | 0x08 | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x12 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x12 | 0x83 | 0x08 | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x14** – Command BAUD RATE – Read / Write

Used to set the SSD CAN bus Baud Rate. Values other than the following are ignored.

| HEX Value | Baud Rate (kbit/s) |
|---|---|
| 0x0009 | 125 |
| 0x000A | 250 |
| 0x000B | 500 |
| 0x000C | 1000 |

Notes: Baud rate is changed immediately so you may get an error after change. Connect using new baud rate and use Command RESET MODE (0x10 0x000F) to save current settings to EEPROM. If unable to connect, reboot to restore the previous setting. BAUD RATE is defaulted to: 0x000B (500 kb/s).

Example: To set Baud Rate to 250 kbps

**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x14 | 0x00 | 0x0A | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x14 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x14 | 0x00 | 0x0A | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x16** – Command SET READING DELAY - Read / Write

Used to set the delay between readings automatically sent to the CANbus. Autosend must be enabled (see SETMODE bit8). Note: If the Conversion Time is greater than the reading delay, the sensor will send the same value until the next set of readings is available. For readings faster than 5 ms use SETMODE Bit7 Send on Conversion. This will send the data as soon as it's available.

Delay value from 5 to 60000 milli-seconds. READING DELAY default is: 0x03E8 (1 s).

Example: To set delay to 1 second between readings, 1 s = 1000 = 0x03E8




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x16 | 0x03 | 0xE8 | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x16 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x16 | 0x03 | 0xE8 | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
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## SSD Interface Manual (continued)

**0x17** – Command A2D CONFIG – Read / Write

| A2D Configuration Register | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEXCODE: 0000<br>Check boxes below to calculate HEX value | | | | | | | | | | | | | | | | |
| N/A | Bus Voltage MAX Voltage | | | N/A | High Range MAX Current | | | N/A | Normal Range MAX Current | | | Reading Interval | | | | Time (ms) |
| | ☐ | ☐ | ☐ | | ☐ | ☐ | ☐ | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| | 0 0 0<br>1200 VDC | | | | 0 0 0<br>40X Nominal | | | | 0 0 0<br>40X Nominal | | | 0 | 0 | 0 | 0 | 0.9 |
| | | | | | | | | | | | | 0 | 0 | 0 | 1 | 1.6 |
| | 0 0 1<br>600 VDC | | | | 0 0 1<br>20X Nominal | | | | 0 0 1<br>20X Nominal | | | 0 | 0 | 1 | 0 | 3.2 |
| | | | | | | | | | | | | 0 | 0 | 1 | 1 | 4.8 |
| | 0 1 0<br>300 VDC | | | | 0 1 0<br>10X Nominal | | | | 0 1 0<br>10X Nominal | | | 0 | 1 | 0 | 0 | 6.4 |
| | | | | | | | | | | | | 0 | 1 | 0 | 1 | 7.2 |
| | 0 1 1<br>150 VDC | | | | 0 1 1<br>5X Nominal | | | | 0 1 1<br>5X Nominal | | | 0 | 1 | 1 | 0 | 9 |
| | | | | | | | | | | | | 0 | 1 | 1 | 1 | 13 |
| | 1 0 0<br>75 VDC | | | | 1 0 0<br>2.5X Nominal | | | | 1 0 0<br>2.5X Nominal | | | 1 | 0 | 0 | 0 | 26 |
| | | | | | | | | | | | | 1 | 0 | 0 | 1 | 51 |
| | 1 0 1<br>37.5 VDC | | | | 1 0 1<br>1.25X Nominal | | | | 1 0 1<br>1.25X Nominal | | | 1 | 0 | 1 | 0 | 102 |
| | | | | | | | | | | | | 1 | 0 | 1 | 1 | 205 |
| | 1 1 0<br>18.7 VDC | | | | 1 1 0<br>0.63X Nominal | | | | 1 1 0<br>0.63X Nominal | | | 1 | 1 | 0 | 0 | 410 |
| | | | | | | | | | | | | 1 | 1 | 0 | 1 | 820 |
| | 1 1 1<br>9.37 VDC | | | | 1 1 1<br>0.31X Nominal | | | | 1 1 1<br>0.31X Nominal | | | 1 | 1 | 1 | 0 | 1640 |
| | | | | | | | | | | | | 1 | 1 | 1 | 1 | 3280 |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x17** (Continued) – Command A2D CONFIG – Read / Write

Set the bits required for the application.

Notes:

High Range must be greater than or equal to the Normal Range. If SETMODE Bit1 (Autorange) is not set High Range will be ignored. If it is set, the sensor will automaitcally switch between the two ranges specified when necessary.

Reading intervals 13 ms and below utilize hardware averaging, 26 ms and above start using software averaging with a 13 ms hardware interval time. If it is necessary to capture and report fast current spikes, use fast reading intervals otherwise they will be averaged out.

Set the Vbus MAX voltage to the highest peak voltage expected. If using the sensor on the highside with voltage measuring, use 300 VDC range or lower.

A2D CONFIG default is: 0x035D.

Example: Vbus Max Voltage 1200 VDC, High Range 5X Nominal, Normal Range 1.25X Nominal, Reading Interval 820 ms (0x035D)

**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x17 | 0x03 | 0x5D | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x17 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x17 | 0x03 | 0x5D | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x18** – Command CURRENT UNDER LIMIT – Read / Write

Used to configure the optional lower limit for current readings. Currents below this value will cause an error that can be read with the 0x07 GET ERRORS command if errors aren't automatically sent. A zero value disables this alert, non-zero values enable alert.

Value is a signed Int16 in amps. Default CURRENT UNDER LIMIT: 0x0000 (Disabled).

Example: Set the lower limit to 25 amps (0x0019)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x18 | 0x00 | 0x19 | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x18 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x18 | 0x00 | 0x19 | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x19** – Command CURRENT OVER LIMIT – Read / Write

Used to configure the optional upper limit for current readings. Currents above this value will cause an error that can be read with the 0x07 GET ERRORS command if errors aren't automatically sent. A zero value disables this alert, non-zero values enable alert.

Value is a signed Int16 in amps. Default CURRENT OVER LIMIT: 0x0000 (Disabled).

Example: Set the upper limit to 620 amps (0x026C)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x19 | 0x02 | 0x6C | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x19 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x19 | 0x02 | 0x6C | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x1A** – Command TEMP OVER LIMIT – Read / Write

Used to configure the temperature limit for the error. Temperatures above this value will cause an error that can be read with the 0x07 GET ERRORS command if errors aren't automatically sent.

Value is an unsigned Int16 in centigrade. Default TEMP OVER LIMIT: 125 °C (0x007D, Cannot Disable)

Valid Range: 0 °C to +125 °C (MAX)

Example: Set the upper limit to 90 °C (0x005A)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x1A | 0x02 | 0x5A | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x1A | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x1A | 0x00 | 0x5A | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x1B** – Command VBUS UNDER LIMIT – Read / Write

Used to configure the optional lower limit for the bus voltage readings. Voltages below this value will cause an error that can be read with the 0x07 GET ERRORS command if errors aren't automatically sent. A zero value disables this alert, non-zero values enable alert.

Value is a signed Int16 in volts. Default VBUS UNDER LIMIT: 0x0000 (Disabled).

Example: Set the lower limit to 29 Volts (0x001D)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x1B | 0x00 | 0x1D | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x1B | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x1B | 0x00 | 0x1D | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x1C** – Command VBUS OVER LIMIT - Read / Write

Used to configure the optional upper limit for bus voltage readings. Voltages above this value will cause an error that can be read with the 0x07 GET ERRORS command if errors aren't automatically sent. A zero value disables this alert, non-zero values enable alert.

Value is a signed Int16 in Volts. Default VBUS OVER LIMIT: 0x0000 (Disabled).

Example: Set the upper limit to 70 Volts (0x0046)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x1C | 0x00 | 0x46 | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x1C | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x1C | 0x00 | 0x46 | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x1D** – Command POWER OVER LIMIT – Read / Write

Used to configure the optional upper limit for power readings. Power above this value will cause an error that can be read with the 0x07 GET ERRORS command if errors aren't automatically sent. A zero value disables this alert, non-zero values enable alert.

Value is an unsigned Int32 in Watts. Default POWER OVER LIMIT: 0x00000000 (Disabled).

Example: Set the upper limit to 22000 Watts (0x000055F0)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x05 | 0x1D | 0x00 | 0x00 | 0x55 | 0xF0 | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x1D | | | | | |
| RECEIVE | 0x3FC | 0x05 | 0x1D | 0x00 | 0x00 | 0x55 | 0xF0 | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x1E** – Command SHUNT NANO-OHMS - Read / Write

Used to override the resistance of the Model SSD Series from the factory calibration. This is typically not necessary and the correct equipment is essential to properly set it. Value can be reset back to factory defaults.

Value is an Int32

Example: To set SHUNT NANO-OHMS to 300156 (0x0004947C) nano-ohms




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x05 | 0x1E | 0x00 | 0x04 | 0x94 | 0x7C | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x1E | | | | | |
| RECEIVE | 0x3FC | 0x05 | 0x1E | 0x00 | 0x04 | 0x94 | 0x7C | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x21** – Command CURRENT ZERO OFFSET – Read / Write

Used to override the sensor zero offset current. Value can be reset back to factory defaults.

Value is a signed Int16.

Example: To set CURRENT OFFSET to +8 (0x0008) mA.




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x21 | 0x00 | 0x08 | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x21 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x21 | 0x00 | 0x08 | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x22** – Command VBUS FACTOR – Read / Write

Used to adjust the Bus Voltage reading from the factory calibration. This is typically not necessary and the correct equipment is essential to properly set it. See reset command to set the value back to factory default. Voltage is calibrated at 25 °C. Power and Energy values are scaled appropriately.

Value is an Int16. Value is divided by 10000 in firmware to create the factor.

Example: To set VBUS FACTOR to 10023 (0x2727)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x22 | 0x27 | 0x27 | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x22 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x22 | 0x27 | 0x27 | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x23** – Command VBUS ZERO OFFSET – Read / Write

Used to override the bus voltage zero offset. Value can be reset back to factory defaults.

Value is a signed Int16.

Example: To set VBUS OFFSET to -6 (0xFFF9) mV.




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x23 | 0xFF | 0xF9 | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x23 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x23 | 0xFF | 0xF9 | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x24** – Command TEMP OFFSET – Read / Write

Used to adjust the Temperature reading from the factory calibration. This is typically not necessary and the correct equipment is essential to properly set it. See reset command to set the value back to factory default. Value is an Signed Int16.

Example: To set TEMP OFFSET to -2.2 °C send -22 (0xFFEA)




**Write Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FA | 0x03 | 0x24 | 0xFF | 0xEA | | | |
| RECEIVE | (none) | | | | | | | |

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x24 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x24 | 0xFF | 0xEA | | | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x25** – Command GET T0 TEMPERATURE COMPENSATION – Read Only
**0x26** – Command GET T1 TEMPERATURE COMPENSATION – Read Only
**0x27** – Command GET T2 TEMPERATURE COMPENSATION – Read Only

Used to get the factory calibrated settings for the temperature compensation constants.

T0 - unsigned int16
T1 - signed int32
T2 - signed int32
Example: The following shows T1 compensation constant of FFBE E23D (-4267459)

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x26 | | | | | |
| RECEIVE | 0x3FC | 0x05 | 0x26 | 0xFF | 0xBE | 0xE2 | 0x3D | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

**0x28** – Command GET RESET CAUSES – Read Only
Used to get the reasons for the last four SSD sensor restarts.
Example: The following shows abnormal restarts (0x0140)

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x28 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x28 | 0x01 | 0x40 | | | |

0x0140

4th Last Reason: Normal
3rd Last Reason: Brown-out
2nd Last Reason: Watchdog
Last Reason: Normal

**Reason Codes**
0 - Normal Power-on Reset
1 - Brown-out Reset
4 - Watchdog Timer Time-Out Reset
6 - Software RESET Instruction
7 - Master Clear Pin Reset
9 - Configuration Mismatch Reset
E - Illegal Condition Device Reset
- Illegal Opcode Reset
- Uninitialized W Register Reset
- Security Reset
F - Trap Conflict Reset

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## SSD Interface Manual (continued)

**0x30** – Command GET FIRMWARE VERSION – Read Only
Used to get the SSD firmware version. Data Returned: Version (byte) and subversion (byte)
Example: The following shows version (v1.2)

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x30 | | | | | |
| RECEIVE | 0x3FC | 0x03 | 0x30 | 0x01 | 0x02 | | | |

**0x31** – Command GET SERIAL NUMBER – Read Only
Used to get the SSD serial number.
Example: The following shows SN:00012345 (0x3039)

**Read Message**

| | Message ID | Length | Data Fields | | | | | |
|---|---|---|---|---|---|---|---|---|
| SEND | 0x3FB | 0x01 | 0x31 | | | | | |
| RECEIVE | 0x3FC | 0x05 | 0x31 | 0x00 | 0x00 | 0x30 | 0x39 | |

**NOTE: No settings are saved until a save settings to EEPROM command is issued!**
**Power cycling will restore previous settings. See command 0x10 0x000F.**

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## SSD Interface Manual (continued)

Firmware Revisions-

v2.10
Added Invert Bus Voltage bit to SETMODE command for highside sensor mounting.

v2.11
Updated internal ADC settings to reduce noise. This reduces some of the fixed ADC reading intervals.
Fixed reading Coulombs and Energy manually after changing CAN IDs.
v2.12
Bus Voltage is now signed int32, ±1200 VDC.
Current and Voltage Under and Over limits are now signed int16.
Can now write Coulomb value to sensor and the sensor will count from there.
Get all enabled readings changed from register 0x08 to 0x00.

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