# POWER SUPPLY APPLICATION NOTE

# VPX56-6 Series I²C Communication Guide

# Overview

I²C Communication is standard on all NAI VPX power Supplies. I²C is used for both monitoring and control of many power supply functions including output health, temperature and ENABLE* / INHIBIT* Control.

## I²C Communication on the VPX56-6 Series

**Hardware Interface**

Electrical interface is based on I²C parameters at 100 kHz. The backplane or I²C master controller should provide pull up resistors on SDA and SCL lines to a 3.3V rail.

**Address**

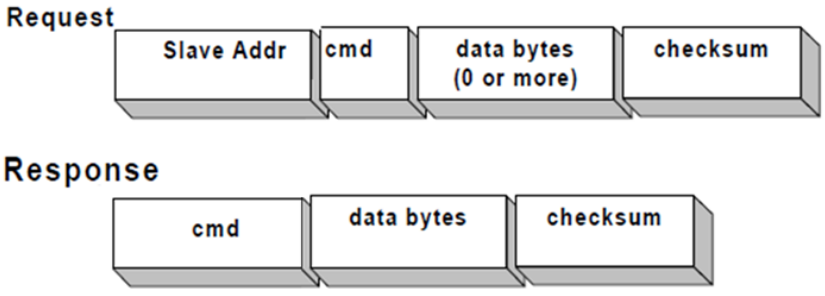
The I²C Hardware Address (per VITA 46.11 Rev 0.15) is 7 bits. The default base address is 0x20. *GA0 through *GA4 provide the 5 LSB's for the address.

The *GA pins have 3.32K pull-up resistors to a 3.3V rail. The resistors and the 3.3V rail are internal to the power supply. When left open, the address will be 0x20, otherwise, the address will be as described in the table below.

| Signal | | | | | | I²C Address |
|---|---|---|---|---|---|---|
| *GAP | *GA4 | *GA3 | *GA2 | *GA1 | *GA0 | |
| Pin A5 | Pin B5 | Pin A4 | Pin B4 | Pin C4 | Pin D4 | |
| Gnd | High | High | High | High | High | 0x20 |
| High | High | High | High | High | Gnd | 0x21 |
| High | High | High | High | Gnd | High | 0x22 |
| Gnd | High | High | High | Gnd | Gnd | 0x23 |
| High | High | High | Gnd | High | High | 0x24 |
| Gnd | High | High | Gnd | High | Gnd | 0x25 |
| Gnd | High | High | Gnd | Gnd | High | 0x26 |
| High | High | High | Gnd | Gnd | Gnd | 0x27 |

If the unit detects an error on the *GAP input setting, it will respond to address 0x20.

**Data Read - Get Sensor Reading results**



| | Byte | Data Field | Data |
|---|---|---|---|
| Request Data | 1 | cmd | See table |
| | 2 to n-1 | Data If Required by cmd or Zero ChkSum* if no Data required. | |
| | n | Zero ChkSum* if Data was required by cmd | |
| | | | |
| Response Data | 1 | Completion Code – Echo cmd Number | |
| | 2 to n-1 | Per cmd Response | |
| | n | Zero ChkSum | |

*Note : Slave address should not be included in Zero Checksum calculation.

**Commands**

| Sensor # | Name | Description |
|---|---|---|
| 21H | Composite Sensor | 64 bytes of scanned sensor data. Data is continually scanned and available for report. Data consists of 2 bytes of data for each of the 11 sensors and FRU data. |
| 55H | Status Write Command | Writes Status byte on Composite Sensor. |
| 44H | Firmware release date | 22 byte response. Month/Day/Year Hr/Min/Sec in ASCII form. |
| 45H | Hardware Address | 3 byte response. Reports address set by GA0*-GA4* |

**Composite Sensor Read Command – 21H**

| Response BYTE # | Data Type | Meaning |
|---|---|---|
| 0 | Completion Code – 21h | Echo of the command |
| 1 | Status Register 0, MS Bit First | Refer to table below |
| 2-3 | Signed Integer, MSB First | Temperature as follows °C = (Reading * 100 / 16384) |
| 4-5 | U Integer, MSB First | Voltage on VS1, 12V = 16384 |
| 6-7 | | Reserved |
| 8-9 | U Integer, MSB First | Voltage on VS3, 5V = 16384 |
| 10-11 | U Integer, MSB First | Voltage on 3.3Aux, 3.3V = 16384 |
| 12-13 | U Integer, MSB First | Voltage on +12V Aux, 12V = 16384 |
| 14-15 | U Integer, MSB First | Absolute Voltage on -12V Aux, 12V = 16384 |
| 16-17 | U Integer, MSB First | Current on VS1, 30A = 16384 |
| 18-19 | | Reserved |
| 20-21 | U Integer, MSB First | Current on VS3, 50A = 16384 |
| 22-23 | U Integer, MSB First | Current on 3.3Aux, 20A = 16384 |
| 24-25 | U Integer, MSB First | Current on +12VAux, 3A = 16384 |
| 26-27 | U Integer, MSB First | Absolute Current on -12VAux, 3A = 16384 |
| 28-29 | U Integer, MSB First | Internal Reference, 2.5V = 16384 |
| 30-31 | | Reserved |
| 32-51 | Character String | Part Number |
| 52-53 | U Integer, MSB First | S/N Hi |
| 54-55 | U Integer, MSB First | S/N Low |
| 56-57 | U Integer, MSB First | Date Code (Year/Week) |
| 58-59 | U Integer, MSB First | Hardware Rev |
| 60-61 | U Integer, MSB First | Firmware Rev. |
| 62 | Reserved | Reserved |
| 63 | Zero Checksum | Value required to make the sum of bytes 0 to 62 add to a multiple of 256 (decimal). |

| Status Reg 0 | | R/Set | R/Set | R/W | R/W | R/W | R | R |
|---|---|---|---|---|---|---|---|---|
| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | x | FAIL | OTWarning | SWPriority | *SW Inh | *SW En | *HW Inh | *HW En |

Bits 5 AND 6 (OTWarning - FAIL) are Read and write. They are clear at startup. User can set them with a Status Write command. Hardware will clear them if there is a fault.
Bit 4 (SWPriority) is Read and write. It is clear at Startup. When clear the unit will be controlled by the hardware enable and inhibit signals. When set, the unit will be controlled by the SW inhibit and enable signals.
Bits 3 and 2 (SWInh SWEn ) are read and write. Their logic works the same as the logic for the hardware Enable and Inhibit.

| *SWEnable | *SWInhibit | OUTPUTS |
|---|---|---|
| 0 | 0 | INHIBIT (3.3V Aux is On, all other outputs are off) |
| 0 | 1 | ON |
| 1 | 0 | OFF |
| 1 | 1 | OFF |

Bits 1 and 0 (HWIn - HWEn) are read only. They show the state of *Enable and *Inhibit pins while SWPriority is low.

**Status Write Command - 55H**

| BYTE # | Data Type | Meaning |
|---|---|---|
| 0 | U Character – 55H | Command |
| 1 | U Character | Data |
| 2 | Zero Checksum | Value required to make the sum of bytes 0 and 1 add to a multiple of 256 (decimal). |

The command to write to Status byte is 55h, followed by 8-bit data then zero checksum.

Example: To send a command to clear the faults and turn on all the outputs, the following sequence must be sent.
55h 78h 33h;

55h is the command needed to write to status byte zero.

78h data for byte zero,

Bit 7 set: don't care bit.
Bit 6 set: FAIL signal is high, software will clear it if unit fails
Bit 5 set: OTWarning signal is high, software will clear it if unit is close to 75 degrees.
Bit 4 set: Software has priority to enable/disable unit.
bit 3 set: SWInhibit is high
bit 2 low: SWEnable is low.

33h Value to achieve a sum of zero.

### Firmware release date – 44H

| Response BYTE # | Data Type | Meaning |
|---|---|---|
| 0 | Completion Code – 44H | Echo of the command |
| 1-20 | Character String | Date |
| 21 | Zero Checksum | Value required to make the sum of bytes 0 to 20 add to a multiple of 256 (decimal). |

### Hardware Address – 45H

| Response BYTE # | Data Type | Meaning |
|---|---|---|
| 0 | Completion Code – 45H | Echo of the command |
| 1 | U Character | $I^2C$ Hardware Address |
| 2 | Zero Checksum | Value required to make the sum of bytes 0 and 1 add to a multiple of 256 (decimal). |

## NAI CARES

North Atlantic Industries (NAI) is a leading independent supplier of Embedded I/O Boards, Single Board Computers, Rugged Power Supplies, Embedded Systems and Motion Simulation and Measurement Instruments for the Military, Aerospace and Industrial Industries. We accelerate our clients' time-to-mission with a unique approach based on a Custom-on-Standard Architecture™ (COSA™) that delivers the best of both worlds: custom solutions from standard COTS components.

We have built a reputation by listening to our customers, understanding their needs, and designing, testing and delivering board and system-level products for their most demanding air, land and sea requirements. If you are experiencing any problems with our products, we urge you to contact us as soon as possible.

Please visit us at: www.naii.com or select one of the following for immediate assistance:

## FAQ

http://www.naii.com/faq/

## Application Notes

http://www.naii.com/appNotes/

## Calibration and Repairs

http://www.naii.com/calibration/

## Call Us

(631) 567-1100