HDX-600P: I²C Serial Bus Interface:

1.0 General: The power supply shall be capable of communicating with the system via an I^2C bus using signal identifiers SCLK(pin 40) & SDA(pin 38). This document describes the I^2C devices and formats for communicating with the power supply. This ability to communicate will allow a remote user to interrogate (query) the status of the power supply, and retrieve specific I/O and FRU related information for the purpose of diagnosing the operational status of the supply. The supply will contain stored information unique to each power supply, and also monitor parameters within the power supply. The monitoring and storage of information will provide a user with the ability to check power availability before enabling the insertion of new hardware. The capabilities & formatting fall into two categories; Power Supply Monitoring, and EEPROM Format for Storing Power Supply related Data. To provide these abilities, all I^2C devices located within the power supply shall be operated from an internal auxiliary voltage that is always on, provided the AC power is applied.

Two external address lines (GA0 and GA1) are employed allowing up to four supplies to be addressed on a single I^2C bus. Module addressing is achieved through hard wiring the address lines to 0V or +5V output via a 100 ohm resistor on the system back-plane.

1.1 Power supply Monitoring: (Per Tables 2 - 5) Specifically, the power supply shall monitor the following items listed, and provide this information to the system via the I^2C bus. The addressing, control bytes, and channel information, will conform to Table 1- 5. The specific devices being used are listed in Table 1. To measure each of the desired parameters, two 8 bit A/D converters(PCF8591) and one 8 bit digital register(PCF8574) will be used, where the reference voltage for all A/D converters will be 4.230V +/-1%, or 16.5mV per bit, over the entire line, load, and temperature range of the supply.

1.1.1 V1, V2 ,V3 Voltages: (Per Tables 4 - 5) The Power supply shall monitor the V1,V2, and V3 outputs on the source side of its óOringô diode. The accuracy of the A/D converter will be 8 bits (256 steps). The accuracy of the voltage measurement will be ±2%. The range of the voltage measurement will be from 0 volts to its maximum voltage Per Table 5, the resolution, or scale of the reading, will be linear over the entire range of the reference voltage for the A/D converter (0 - 4.230V)), which in turn provides a linear output on the A/D converter of 00h to FFh..

1.1.2 V1, V2 ,V3 Currents: (Per Tables 4 - 5) The Power supply shall monitor the output current of the V1-V3 outputs. The accuracy of the A/D converter will be 8 bits (256 steps). The accuracy of the current measurement will be ±10%. The range of the current measurement will be from 0 Amps to the maximum limit specified in Table 5. Per Table 5, the resolution, or scale of the reading, will be linear over the entire range of the reference voltage for the A/D converter (0 - 4.224V)), which in turn provides a linear output on the A/D converter of 00h to FFh..

NOTE: DUE TO PRELOAD WITHIN THE SUPPLY THE V1, V2V3 CURRENTS WILL NOT DISPLAY WITHIN +/-10% ACCURACY BELOW 10% LOAD ON EACH OUTPUT.

1.1.3 Digital Status functions: (Per Tables 2 - 4) The Power supply shall monitor : AC input(Input Power Fail signal), DC outputs(Output Power Good signal V1,V2) are within specified limits, Internal heat sink temperature with Temperature Warning and Temperature Alarm signals.

1.1.4 Power_Supply_Inlet_Temperature: (Per Tables 3) The Power supply shall monitor the ambient temperature as it enters the power supply and provide this information with 12 bits of accuracy at a resolution of 0.0625°C. The accuracy of the temperature sensor will be +/- 2°C maximum from -20°C to +85°C.

2.1 EEPROM Format for Storing Power Supply Specific Information: (Formatted Per Table 1) Information unique to each power supply will be stored in a permanent non-volatile storage device (EEPROM), requiring 256 bytes in all.

TABLE 1

ADDRESS RANGE	DATA
0-15	Model #
16-31	Manufacturing Part#
32-47	Serial#
48-63	Revision Level
64-79	Manufacturer
80-95	Country of Origin
96-255	Not Used

I²C CONFIGURATION (TABLES 2 — 5)

Table 2 – I²C Devices Used : The following table lists all of the I²C devised used in this power supply.

Devices	Quantity	Function	Purpose in Power Supply
PCF 8591	2	8 Bit A/D Converter	For monitoring
PCF 8574	1	8 Bit A/D I/O Expander	For monitoring
MAX6633	1	TEMP Sensor	Monitor Inlet Temperature
24C02	1	EE PROM	For Storing Power Supply Information

Table 3 - Addressing of the I²C Devices: The following addresses will apply to the devices located within the power supply, via the I²C Bus. Byte A_2 will be permanently addressed within each power supply. Bytes D_0-D_3 are coded per agreement of I²C standards and are specific to each device (i.e. for all PCF 8591 D_3-D_0 is always 1001). Two external address lines (GA0 and GA1) are employed allowing up to four supplies to be addressed on a single I²C bus. Module addressing is achieved through hard wiring the address lines to 0V or +5V supply via a 100 ohm resistor on the system back-plane.

I²C Devices	Addressing Bytes							
	MSB							LSB
	D_3	D_2	D_1	D_0	A_2	A_1	A_0	R/W
PCF 8591 #1	1	0	0	1	1	GA1	GA0	X
PCF 8591 #2	1	0	0	1	0	GA1	GA0	X
PCF 8574	0	1	0	0	0	GA1	GA0	X
MAX 6633	1	0	0	0	0	GA1	GA0	X
24C02	1	0	1	0	0	GA1	GA0	X

I ² C CONFIGURATION (Continued)

Table 4 - I²C Control Configuration: Control words required to read the channels of the I²C devices. These control bytes are transmitted via SDA and SCLK.

I ² C Device	Chan	Description
PCF 8591 #1	0	V1 Voltage
	1	V2 Voltage
	2	V3 Voltage
	3	Not used (tied low)
PCF 8591 #2	0	V1 Current
	1	V2 Current
	2	V3 Current
	3	Not used (tied low)
PCF 8574	1-8	Reads all 8 I/O channels at once

BIT	FUNCTION	GOOD STATE	MEANING
0	Input Power Fail	0	Provides 5msec of warning of input AC loss [1]
1	Output Power Good	1	V1 and V2 are within 90% of their rating
2	Temperature Warning	1	Internal Heat Sink temperature exceeds 115°C, provides min. 2 sec warning before supply shuts down and activates Temp Alarm signal.
3	Not Used(Tied High)	1	
4	Not Used(Tied High)	1	
5	Not Used(Tied High)	1	
6	Not Used(Tied High)	1	
7	Temperature Alarm	1	Supply switches off.

Note 1: Requires use of the interrupt line to provide warning time specified.

Table 5 - Resolution I²C of Monitoring Devices: This table defines the resolution of the devices used to monitor the power supply and communicate this information via the I ² C bus.. The output of the A/D converter will read FF when the maximum range listed in the last column is reached. The reference voltage for A/D converters is 4.230V, or 16.5mV per bit. The accuracy of the reference used for the A/D converter will be at least 1% over the entire line, load, and temperature range of the supply.

Device	Channel	Description	Data Format				
	Information		A/D Bits	# Steps	Resolution	Units	Range
	(Analog)						
A/D #1 PCF 8591	0	V1 Voltage(+5V)	8	256	0.023	V/Bit	0-6V
	1	V2 Voltage(+3.3V)	8	256	0.0165	V/Bit	0-4.2V
	2	V3 Voltage(+12V)	8	256	0.051	V/Bit	13V
	3	Not Used(Tied low)	Spare	Spare	Spare	Spare	0V
A/D #2 PCF 8591	0	V1 Current	8	256	0.3125	A/Bit	0-80A
	1	V2 Current	8	256	0.1563	A/Bit	0-40A
	2	V3 Current	8	256	0.078	A/Bit	0-20A
	3	Not Used(Tied low)	Spare	Spare	Spare	Spare	0V