DS1200

1200 Watts

Distributed Power System

Total Power: 1000-1200 Watts
Input Voltage: 90-264 Vac
# of Outputs: Single Main

Special Features

- Active power factor correction
- EN61000-3-2 harmonic compliance
- Active AC inrush control
- 1U X 2U form factor
- 21.71 W / in^3
- +12 Vdc Output
- +3.3 Vdc stand-by (+5 Vdc stand-by)
- No minimum load required (main output only)
- Hot plug operation
- N + 1 redundant
- Internal OR'ing fets
- Active current sharing (10 - 100% load)
- I^2C communication interface bus
- PMBus^{TM} compliant
- EEPROM for FRU data
- Internal fan speed control
- INTEL, SSI Std. logic timing
- INTEL, SSI Std. FRU data format
- Full digital control
- 2 year warranty

Safety

UL/cUL 60950 (UL Recognized)
NEMKO+ CB Report EN60950
EN60950
CE Mark
China CCC

Product Descriptions

The DS1200-3 power supply features a very wide 90 to 264 Vac input voltage range and employ active power factor correction to minimize input harmonic current distortion and to ensure compliance with the international EN61000-3-2 standard – they have a power factor of 0.99 typical. The power supplies also feature active ac inrush control, to automatically limit inrush current at turn-on to 55 A maximum.

The power supply employs a new patent-pending ultra high efficiency conversion topology, together with an innovative power transformer and rectifier construction that further improves power density and reduces interconnect power losses. The power supply's main +12 Vdc payload output is digitally programmable over the range 11.4 to 12.6 Vdc, and users have a choice of standard I^2C or advanced PMBus^{TM} communications. The control software runs under Windows® on any standard PC, and uses a highly intuitive graphical user interface to simplify power supply set-up.

The DS1200-3 can deliver up to 98.4 A from its main +12 Vdc payload output, and up to 6 A from its +3.3 Vdc auxiliary output. The supply has a 1U x 2U form factor – it measures 10.9 x 3.3 inches, with a height of 1.6 inches – and has a power density of more than 21 watts per cubic inch. When fed with a 180 to 264 Vac input, the DS1200-3 can achieve a very high – 91 percent typical – conversion efficiency at 50 percent full load.

EMERSON
Network Power

Model Numbers

Standard	Output Voltage	Minimum Load	Maximum Load	Stand-By Supply	Air Flow Direction
DS1200-3	12.0Vdc	0A	98.4A	3.3V@6A	Normal (DC Connector to Handle)
DS1200-3-002	12.0Vdc	0A	98.4A	5V@4A	Normal (DC Connector to Handle)
DS1200-3-003	12.0Vdc	0A	98.4A	3.3V@6A	Reversed (Handle to DC Connector)
DS1200-3-004	12.0Vdc	0A	98.4A	5V@4A	Reversed (Handle to DC Connector)

Options

AC Cord Retainer

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the “Absolute Maximum Ratings” may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply’s reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage: AC continuous operation	All models	$V_{IN,AC}$	90	-	264	Vac
Maximum Output Power (Main + Stand-by) $V_{IAC} \leq 180Vac$ $V_{IAC} > 180Vac$	All models	$P_{O,max}$	- -	- -	1000 1200	W W
Isolation Voltage Input to outputs Input to safety ground Outputs to safety ground	All models All models All models		- - -	- - -	2500 2500 50	Vdc Vdc Vdc
Ambient Operating Temperature	DS1200-3 DS1200-3-002 DS1200-3-003 DS1200-3-004	T_A	-10	-	+50 +70[1] +50 +50	ºC ºC ºC ºC
Storage Temperature	All models	T_{STG}	-40	-	+85	ºC
Humidity (non-condensing) Operating Non-operating	All models All models		20 10	- -	90 95	% %
Altitude Operating Non-operating	All models All models		- -	- -	10,000 30,000	feet feet

Note 1 With power derating (see page 22 power derating curve)

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, AC		V_{IAC}	90	115/230	264	Vac_{RMS}
Input Vac Source Frequency		f_{IAC}	47	50/60	63	Hz
Maximum Input Current ($I_O = I_{O,max}$, $I_{VSB} = I_{VSB,Max}$)	$V_{IAC} = 90V_{AC}$	$I_{I,max}$	- -	- -	15	A_{RMS}
Standby Input Current (V_O Off, $I_{VSB} = 0A$)	$V_{IAC} = 90V_{AC}$ $V_{IAC} = 180V_{AC}$	$I_{I,standby}$	- -	- -	400 300	mA_{RMS}
No Load Input Current (V_O On, $I_O = 0A$, $I_{VSB} = 0A$)	$V_{IAC} = 90V_{AC}$ $V_{IAC} = 180V_{AC}$	I_{I,no_load}	- -	- -	800 450	mA_{RMS}
Harmonic Line Currents	All	THD	Per IEC1000-3-2			
Power Factor	All		-	0.99	-	
Startup Surge Current (Inrush) @ 25°C	$V_{IAC} = 264V_{AC}$		-	-	40	A_{PK}
Input Fuse	Internal, L and N 5x20mm, Quick Acting 16A, 250V		-	-	16	A
Isolation – Input to Output			-	2500	-	Vdc
Isolation – Input to Chassis			-	2500	-	Vdc
Leakage Current to earth ground	$V_{IAC} = 240V_{AC}$ $f_{IAC} = 50/60$ Hz		-	-	1.4	mA
PFC Switching Frequency	All	$f_{SW,PFC}$	70	-	80	KHz
DCDC Switching Frequency	All	$f_{SW,DC-DC}$	105	-	115	KHz
Operating Efficiency @ 25°C	$I_O = I_{O,max}$ $V_{IAC} = 100V_{AC}$ $V_{IAC} = 200V_{AC}$	η	85 89	- -	- -	% %
System Stability: Phase Margin Gain Margin			45 10	-	-	Ø dB

Output Specifications

Table 3. Output Specifications:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Output Regulation	All models	Inclusive of set-point, temperature change, warm-up drift and dynamic load	V_O	11.4	12.0	12.6	V
	DS1200-3 DS1200-3-003		V_{VSB}	3.13	3.30	3.47	
	DS1200-3-002 DS1200-3-004		V_{VSB}	4.75	5.00	5.25	
Output Ripple, pk-pk	All models	Measure with a 0.1µF ceramic capacitor in parallel with a 10µF tantalum capacitor, 0 to 20MHz bandwidth	V_O	-	-	120	mV_{PK-PK}
	DS1200-3 DS1200-3-003		V_{VSB}	-	-	50	
	DS1200-3-002 DS1200-3-004		V_{VSB}	-	-	50	
Output Current	All models	$V_{IAC} \leq 180Vac$ $V_{IAC} > 180Vac$	I_O	0 0	-	81.7 98.4	A
	DS1200-3 DS1200-3-003		I_{VSB}	0.5	-	6.0	
	DS1200-3-002 DS1200-3-004		I_{VSB}	0.5	-	4.0	
V_O Current Share Accuracy		40% to 100% I_O 10% to 40% I_O		- -	- -	5 20	$\%I_O$
V_O Minimum Current Share Loading				20	-	-	$\%I_{O,max}$
Number of Parallel Units[1]		Main Output Current Share connected		8	-	-	
V_O Load Capacitance		Start up	-	0	-	100	µF/A
V_O Dynamic Response	Peak Deviation Settling Time	50% load change, slew rate = 1A/µs	$\pm\%V_O$ T_s	- -	- -	5 -	% mSec
V_O Long Term Stability Max change over 24 hours		After thermal equilibrium (30 mins)	$\pm\%V_O$			0.2	%

Note 1 - V_{SB} output do not use active current sharing. On paralleled units, maximum current on V_{SB} output rail should not exceed the current of one unit.

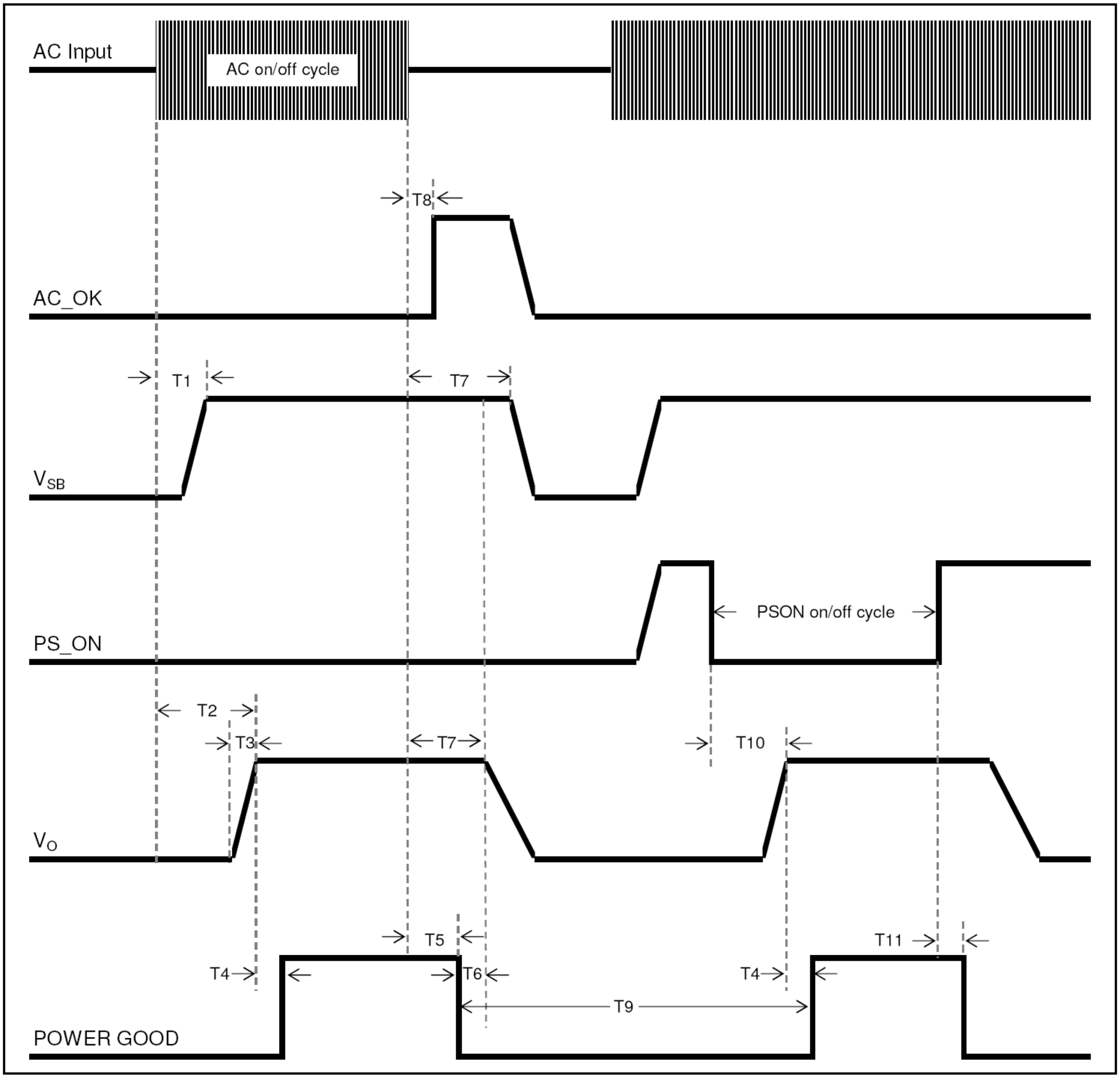
System Timing Specifications

Table 4. System Timing Specifications:

Label	Parameter	Min	Typ	Max	Unit
T1	Delay from AC being applied to V_{SB} being within regulation	-	-	1000	mSec
T2	Delay from AC being applied to output voltages being within regulation with PS_ON asserted low.	-	-	2000	mSec
T3	V_O rise time, 0V to V_O in regulation.	5	-	50	mSec
T4	Delay from output voltages within regulation limits to POWER GOOD asserted high.	100	-	1000	mSec
T5	Delay from loss of AC to de-assertion of POWER GOOD.	11	-	-	mSec
T6	Delay from POWER GOOD de-asserted to output voltages dropping out of regulation limits.	1			mSec
T7	Hold up time - time all output voltages, including V_{SB}, stay within regulation after loss of AC.	12	-	-	mSec
T8	Delay from loss of AC input to AC_OK going to low.	5	-	-	mSec
T9	Duration of POWER GOOD being in the de-asserted state during an off/on cycle using AC or the PS_ON signal	100	-	-	mSec
T10	Delay from PS_ON active to output voltages within regulation limits.	10	-	300	mSec
T11	Delay from PS_ON deactive to POWER GOOD de-asserted low.	-	-	50	mSec

System Timing Specifications

Figure 1. System Timing Diagram:



DS1200-3 Performance Curves

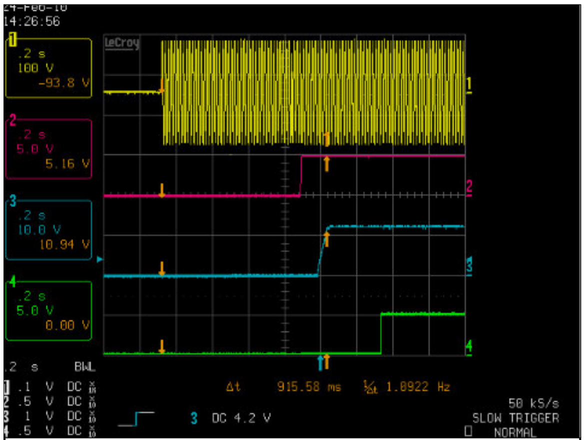


Figure 1: DS1200-3 Turn-on delay via AC mains – Vin = 90Vac

Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

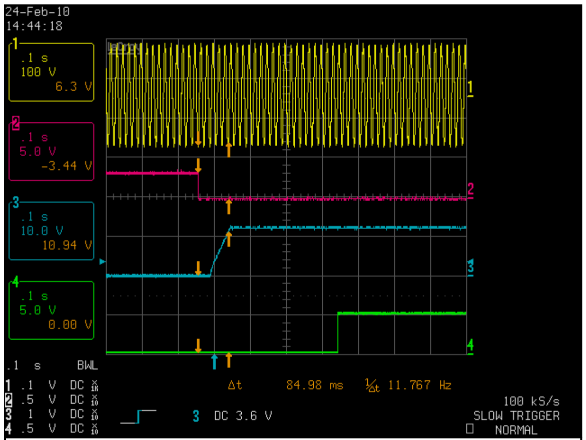


Figure 2: DS1200-3 Turn-on delay via PS_ON – Vin = 90Vac

Ch 1: AC Mains Ch 2: PS_ON Ch 3: Vo Ch 4: POWER GOOD

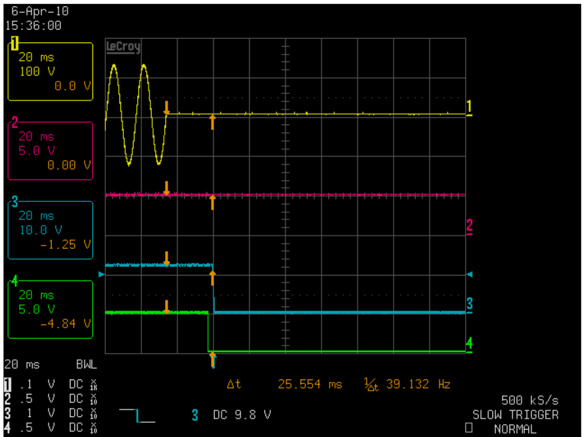


Figure 3: DS1200-3 Hold-up Time – Vin = 90Vac / 63Hz / 0°
Full Load: Vo = 81.7A, VSB = 4A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

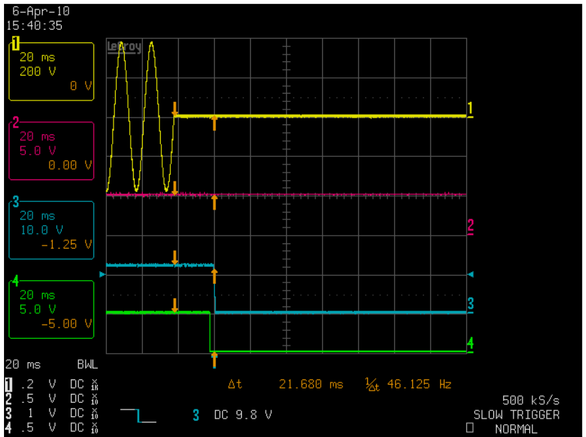


Figure 4: DS1200-3 Hold-up time – Vin = 264Vac / 47Hz / 0°
Full Load: Vo = 98.4A, VSB = 4A (5V)
Ch 1: AC Mains Ch 2: VSB Ch 3: Vo Ch 4: POWER GOOD

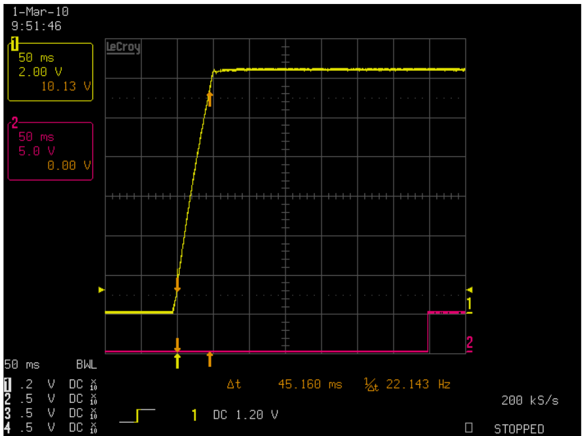


Figure 5: DS1200-3 Output Voltage Startup Characteristic – Vin = 90Vac
Full Load: Vo = 81.7A, VSB = 4A (5V)
Ch 1: Vo Ch 2: POWER GOOD

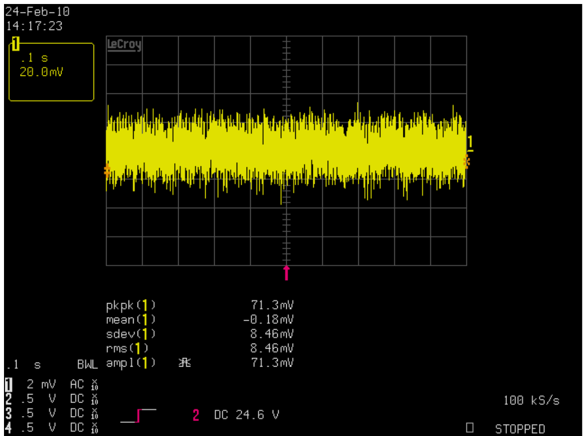


Figure 6: DS1200-3 Ripple and Noise Measurement – Vin = 90Vac
Full Load: Vo = 81.7A, VSB = 4A (5V)
Ch 1: Vo

DS1200-3 Performance Curves

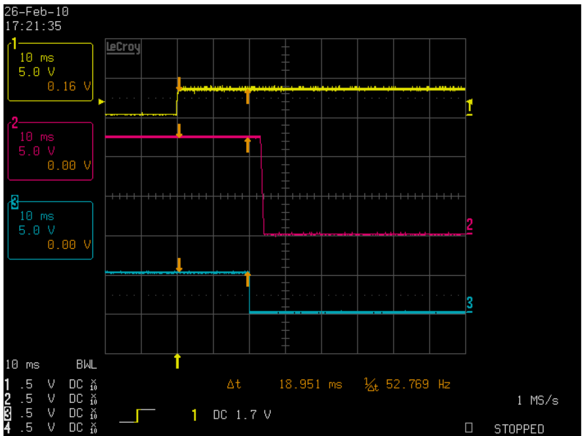


Figure 7: DS1200-3 Turn Off Characteristic via PS_ON
Full Load: Vo = 81.7A, VSB = 4A (5V)
Ch 1: PS_ON Ch 2: Vo Ch 3: POWER GOOD

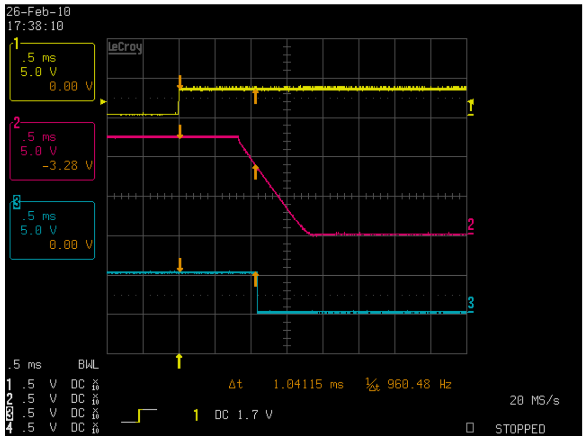


Figure 8: DS1200-3 Turn Off Characteristic via PS_INHIBIT
Full Load: Vo = 81.7A, VSB = 4A (5V)
Ch 1: PS_INHIBIT Ch 2: Vo Ch 3: POWER GOOD

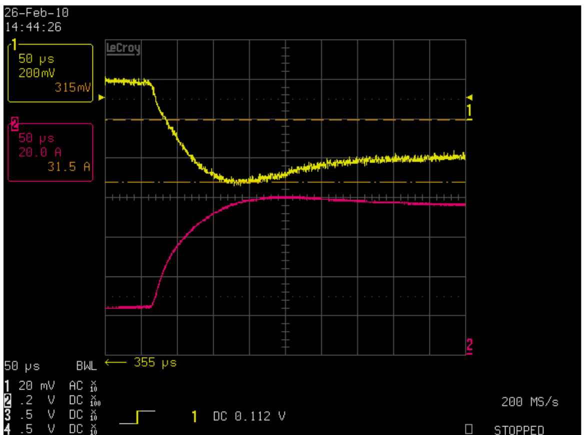


Figure 9: DS1200-3 Transient Response – Vo Deviation (low to high)
25% to 75% load change, 1A/μS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

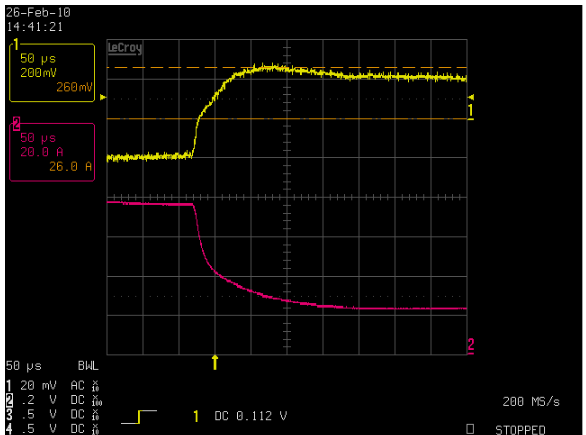


Figure 10: DS1200-3 Transient Response – Vo Deviation (high to low)
75% to 25% load change, 1A/μS slew rate, Vin = 230Vac
Ch 1: Vo Ch 2: Io

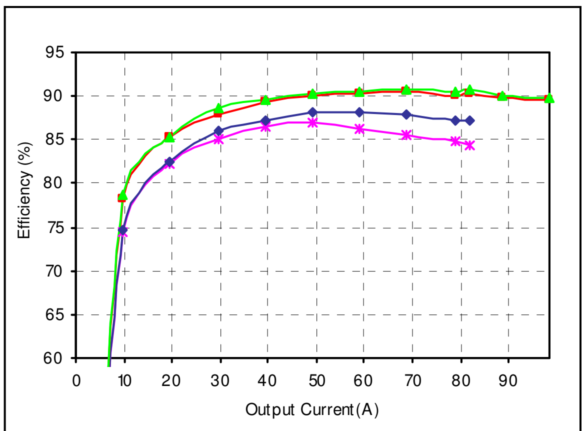


Figure 11: DS1200-3 Efficiency Curves @ 25 degC
90 Vac 115 Vac 230 Vac 264 Vac
Loading: Vo = 10% increment to 98.4A, VSB = 0A (5V)

Protection Function Specification

Input Fusing

DS1200-3 series is equipped with an internal non user serviceable 16A High Rupturing Capacity (HRC) 250 Vac fuse to IEC 127 for fault protection in both the L1 and L2 lines input.

Over Voltage / Under Voltage Protection (OVP / UVP)

The power supply latches off during output overvoltage with the AC line recycled to reset the latch.

OVP

Parameter	Min	Nom	Max	Unit
V_O Output Overvoltage	13.2	/	14.4	V
3.3V Standby Output Overvoltage	3.76	/	4.30	V
5V Standby Output Overvoltage	5.75	/	6.50	V

UVP

Parameter	Min	Nom	Max	Unit
V_O Output Undervoltage	9.0	/	10.8	V

Over Current Protection (OCP)

DS1200-3 series includes internal current limit circuitry to prevent damage in the event of overload or short circuit. Recovery is automatic when the overload is removed, if the overload lasts for 1 second or less, and if it is less than or equal to 150% of rated load. If the overload is > 150% of rated load, the power supply will latch off immediately. In addition, if the overload fault is presented for longer than 1 second, the power supply will also latch off, requiring AC power or PS_ON recycling to restart the power supply.

Parameter	Input Voltage	Min	Nom	Max	Unit
V_O Output Overcurrent	180-264 Vac	118	/	147.6	A
	90-179 Vac	98	/	122.4	A
3.3V Standby Output Overcurrent	90-264 Vac	6.6	/	9	A
5V Standby Output Overcurrent	90-264 Vac	4.4	/	6	A

Short Circuit Protection (SCP)

The DS1200 power supply will withstand a continuous short circuit with no permanent damage, applied to its main output during start-up or while running.. A short is defined as impedance less than 0.1 ohms.

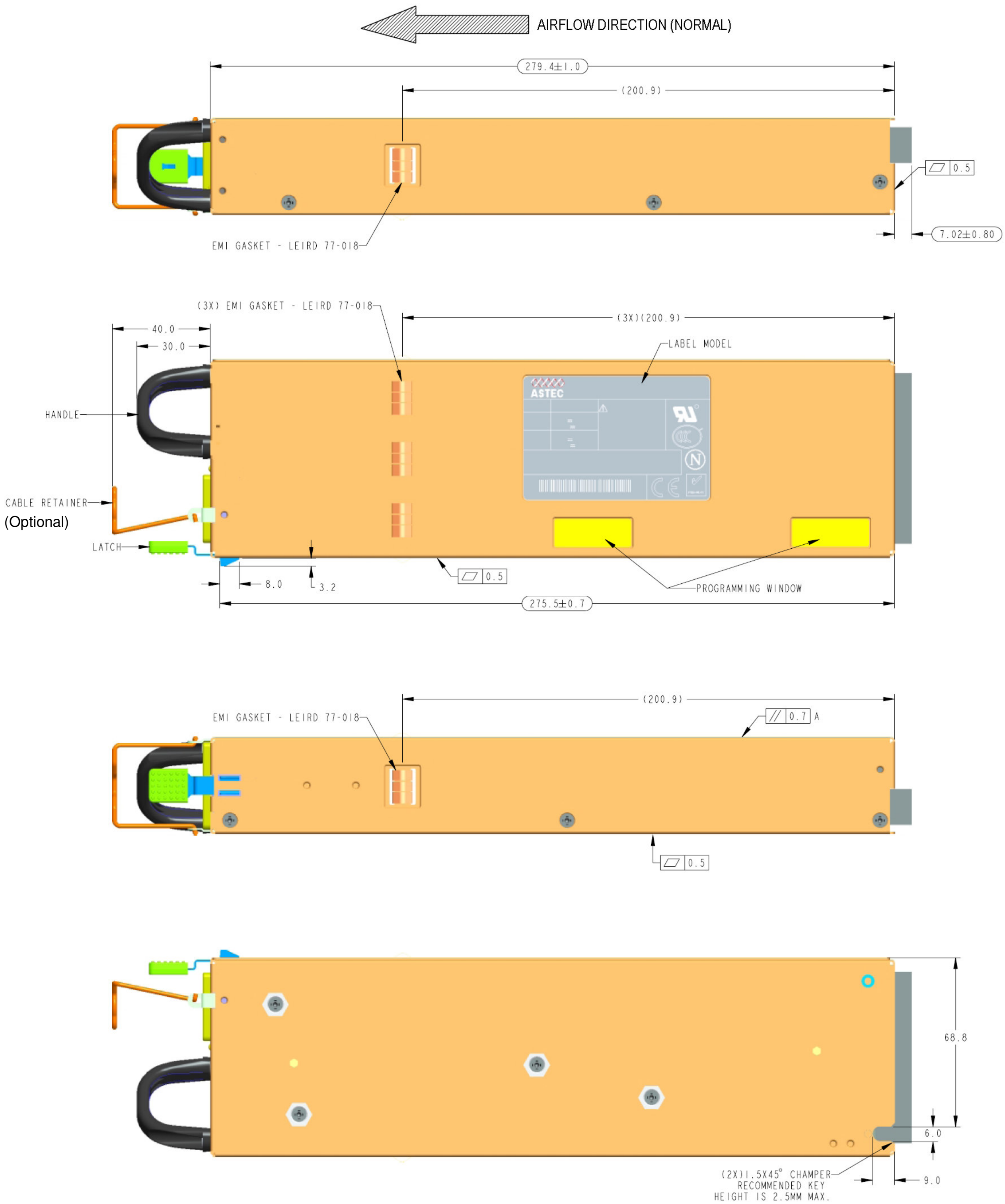
When the standby output V_{SB} is shorted the output will go into “hiccup mode”. When the V_{SB} attempts to restart, the maximum peak current from the V_{SB} output will be less than 9.0A peak (3.3V) or 6.6A (5.0V). The maximum average current, taking into account the “hiccup” duty cycle, is less than 4.9A.

Over Temperature Protection (OTP)

The power supply is internally protected against over temperature conditions. When the OT circuit is activated, the power supply will latch off, requiring AC power or PS_ON recycling to restart the power supply.

Mechanical Specifications

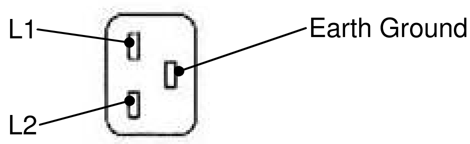
Mechanical Outlines



Connector Definitions

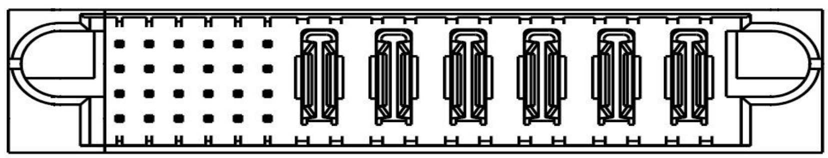
AC Input Connector

Pin 1 – L1
Pin 2 – L2
Pin 3 – Earth Ground



Output Connector – Power Blades

PB1 – Main Output Return
PB2 – Main Output Return
PB3 – Main Output Return
PB4 – + Main Output (V_O)
PB5 – + Main Output (V_O)
PB6 – + Main Output (V_O)



View from power supply output connector end

D1	D2	D3	D4	D5	D6	PB1	PB2	PB3	PB4	PB5	PB6
C1	C2	C3	C4	C5	C6						
B1	B2	B3	B4	B5	B6						
A1	A2	A3	A4	A5	A6						

Output Connector – Control Signals

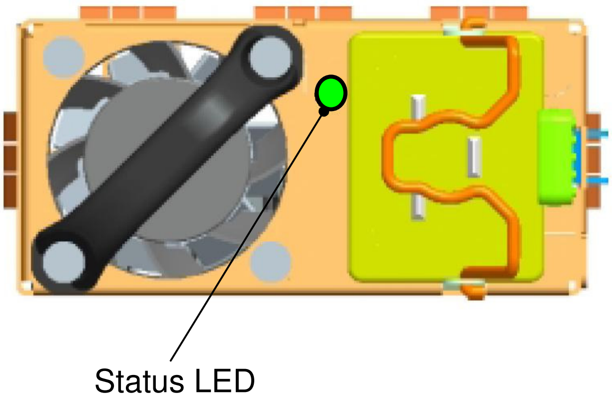
A1 – PS_ON
A2 – Main Output Remote Sense Return
A3 – Spare
A4 – PS_SEATED
A5 – StandBy Output
A6 – StandBy Output Return
B1 – AC_OK
B2 – Main Output Remote Sense
B3 – Main Output Current Share
B4 – PS_INHIBIT
B5 – StandBy Output
B6 – StandBy Output Return
C1 – SDA (I^2C Data Signal)
C2 – SCL (I^2C Clock Signal)
C3 – POWER GOOD
C4 – Spare
C5 – StandBy Output
C6 – StandBy Output Return
D1 – A0 (I^2C Address BIT 0 Signal)
D2 – A1 (I^2C Address BIT 1 Signal)
D3 – S_INT (Alarm)
D4 – StandBy Remote Sense
D5 – StandBy Output
D6 – StandBy Output Return

Power / Signal Mating Connectors and Pin Types

Table 5. Mating Connectors for DS1200-3 series

Reference	On Power Supply	Mating Connector or Equivalent
AC Input Connector	IEC320-C19	IEC320-C20
Output Connector	FCI Power Blade 51721-10002406AA or Molex Power Connector 87667-7002	FCI Power Blade 51741-10002406CC Straight Pins
		FCI Power Blade 51761-10002406AALF Right Angle Pins

LED indicator Definition



One bi-color (green/red) LED at the power supply front provides status signal. The status LED conditions are shown on the below table.

Condition	LED Status
V_{SB} = ON, V_O = OFF, AC Input = ON	Blinking Green
V_{SB} = ON, V_O = ON	Solid Green
V_O = OCP / UVP / OVP	Blinking Amber
FAN_FAULT / OTP / V_{SB} = OCP/UVP	Solid Amber

Weight

The DS1200-3 series weight is 2.9 lbs. maximum.

Environmental Specifications

EMC Immunity

DS1200-3 series power supply is designed to meet the following EMC immunity specifications:

Table 6. Environmental Specifications:

Document	Description
FCC Docket No. 20780 Part 15 Subpart J Class B/ EN55022, Level B	Conducted and Radiated EMI Limits
EN61000-3-2	Harmonics
EN61000-3-3	Voltage Fluctuations
IEC/EN 61000-4-2, Edition 1.2, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques – Electrostatic discharge immunity test. +/-15KV air, +/-8KV contact discharge, performance Criteria B
IEC/EN 61000-4-3, 2002, Amendment 1, 2002-08	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Radiated, radio-frequency, electromagnetic field immunity test
IEC/EN 61000-4-4, 1995, Amendment 2, 2001-07	Electromagnetic Compatibility (EMC) - Testing and measurement techniques, Electrical Fast Transient/Burst Immunity Test. 2KV for AC power port, 1.0KV for DC ports, I/O and signal ports performance Criteria B
IEC/EN 61000-4-5, Edition 1.1, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques – 2KV common mode and 1KV differential mode for AC ports and 0.5kV differential mode for DC power, I/O and signal ports, performance criteria B.
IEC/EN 61000-4-11, Edition 1.1, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques : Voltage Dips and Interruptions: 30% reduction for 500ms-Criteria B>95% reduction for 10mS, Criteria A, >95% reduction for 5000mS, Criteria C
EN55024:1998	Information Technology Equipment-Immunity Characteristics, Limits and Method of Measurements

Safety Certifications

The DS1200-3 power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 7. Safety Certifications for DS1200-3 series power supply system

Document	File #	Description
UL 60950 No.	E186249	US and Canada Requirements
CSA 22.2 No. 60950		Information Technology Equipment - Safety - Part 1: General Requirements (Bi-National standard, with UL 60950-1)
EN60950		European Requirements
EN60950 Deviations		International Requirements
CB Certificate and Report	109053	(All CENELEC Countries)
CHINA CCC Approval	2009010907324565	China Requirements

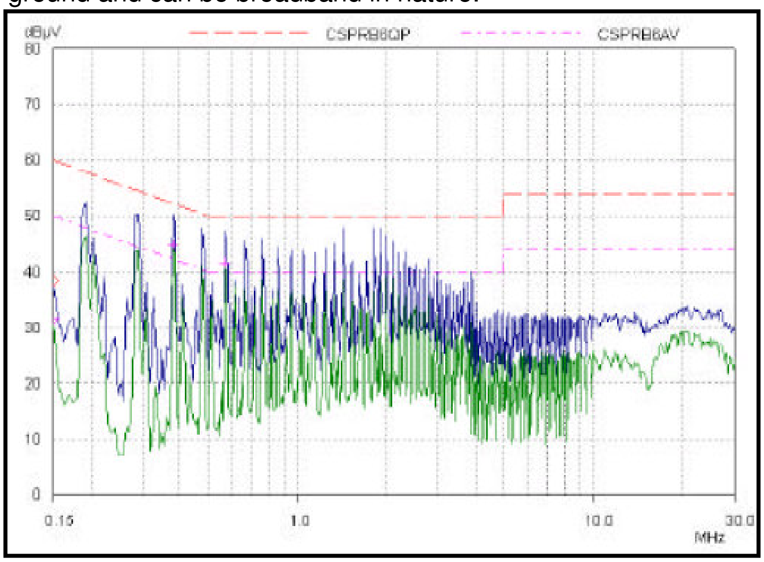
EMI Emissions

The DS1200 series has been designed to comply with the Class B limits of EMI requirements of EN55022 (FCC Part 15) and CISPR 22 (EN55022) for emissions and relevant sections of EN61000 (IEC 61000) for immunity.

The unit is enclosed inside a metal box, tested at 1200W using resistive load with cooling fan.

Conducted Emissions

The applicable standard for conducted emissions is EN55022 (FCC Part 15). Conducted noise can appear as both differential mode and common mode noise currents. Differential mode noise is measured between the two input lines, with the major components occurring at the supply fundamental switching frequency and its harmonics. Common mode noise, a contributor to both radiated emissions and input conducted emissions, is measured between the input lines and system ground and can be broadband in nature.



The DS1200-3 power supplies have internal EMI filters to ensure the convertors' conducted EMI levels comply with EN55022 (FCC Part 15) Class B and EN55022 (CISPR 22) Class B limits. The EMI measurements are performed with resistive loads at maximum rated loading.

Sample of EN55022 Conducted EMI Measurement at 100Vac input

Note: Red Line refers to Emerson Quasi Peak margin, which is 6dB below the CISPR international limit. Pink Line refers to the Emerson Average margin, which is 6dB below the CISPR international limit.

Conducted Emissions

Table 6. Conducted EMI emission specifications of the DS1200-3 series

Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, class B	All	Margin	-	-	6	dB
VCCI Class II	All	Margin	-	-	6	dB
EN 60601-1-2: 2001	All	Margin	-	-	6	dB
CISPR 22 (EN55022) class B	All	Margin	-	-	6	dB

Radiated Emissions

Unlike conducted EMI, radiated EMI performance in a system environment may differ drastically from that in a stand-alone power supply. The shielding effect provided by the system enclosure may bring the EMI level from Class A to Class B. It is thus recommended that radiated EMI be evaluated in a system environment. The applicable standard is EN55022 Class A (FCC Part 15). Testing ac-dc convertors as a stand-alone component to the exact requirements of EN55022 can be difficult, because the standard calls for 1m leads to be attached to the input and outputs and aligned such as to maximize the disturbance. In such a set-up, it is possible to form a perfect dipole antenna that very few ac-dc convertors could pass. However, the standard also states that ‘an attempt should be made to maximize the disturbance consistent with the typical application by varying the configuration of the test sample.

Operating Temperature

The DS1200-3 series power supplies will start and operate within stated specifications at an ambient temperature from -10 °C to 50°C under all load conditions with internal fan. DS1200-3-002 and DS1200-3-401 can operate up to 70 °C with derated power.

Forced Air Cooling

The DS1200-3 series power supplies included internal cooling fans as part of the power supply assembly to provide forced air-cooling to maintain and control temperature of devices and ambient temperature in the power supply to appropriate levels. The standard direction of airflow is from the DC connector end to the AC connector end of the power supply.

The cooling fan is a variable speed fan. The fan speed is controlled by the PWM duty cycle of the fan supply voltage depending on the main output 12V load condition per below table:

Fan PWM Duty Cycle	Main Output (12V) Load (A)	
	110 Vac	230 Vac
100%	81.6	98.4
77%	75.5	93.5
73%	69.4	88.5
62%	63.2	83.6
54%	57.1	78.7
41%	51.0	73.8
38%	44.88 and below	68.9 and below
38%	Stand-By Mode	Stand-By Mode

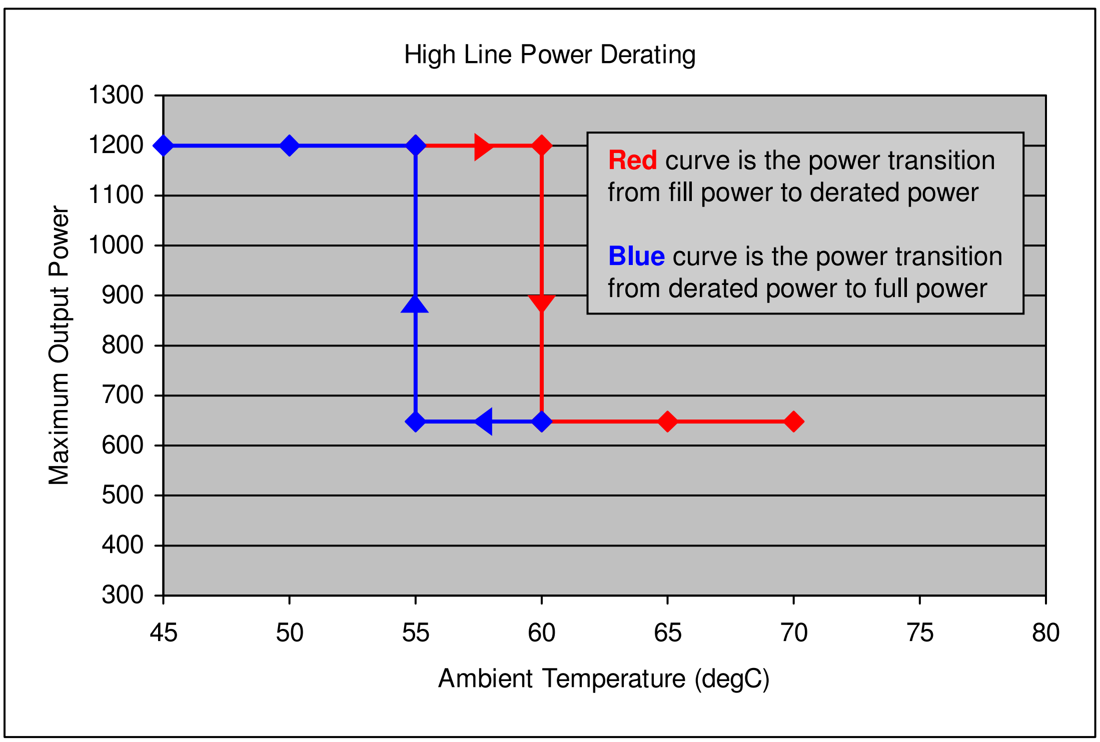
Power Derating Curves

DS1200-3-002 and DS1200-3-401 can operate up to a maximum ambient temperature of 70ºC with derating. Power derating starts when ambient reaches 60ºC. Beyond 60ºC, nominal power reduced to 650W for high line and 550W for low line (shown in Red Curve in the Power Derating Curves below). When ambient temperature drops back down to 55ºC, DS1200-3-002 and DS1200-3-401 will able to deliver full rated power again (shown by the Blue Curve in the Power Derating Curves). See tables below for nominal output current / power and OCP limits at high temperature operation.

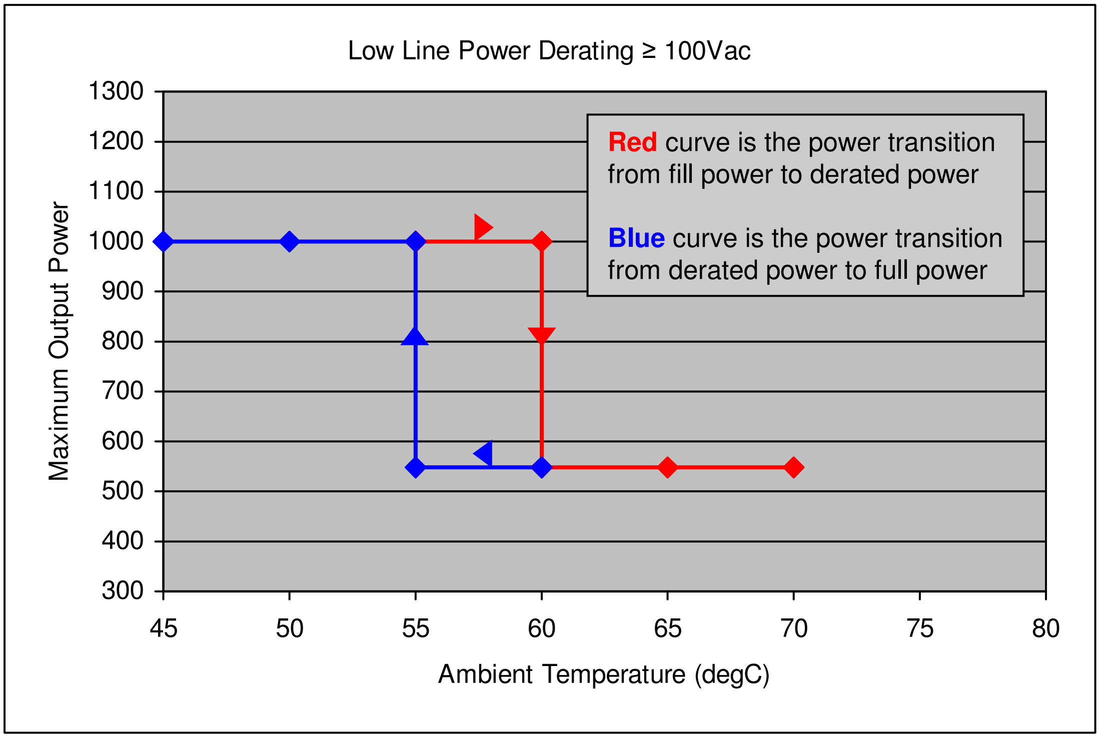
Output	**Input AC line**	**Nominal Output Current /Power (T_A > 60ºC)**
V_O Output	Low Line (90 to 179Vac) High Line (180 to 264Vac	46A / 550W 55A / 650W
3.3V Standby	All	4A
5V Standby	All	2.5A

Output	**Input AC line**	**OCP Limit (T_A > 60ºC)**
V_O Output	All	58A - 65A
3.3V Standby	All	4.4A - 9A
5V Standby	All	3A - 9A

High Line Power Derating Hysteresis



Low Line Power Derating Hysteresis



Note 1: Rated output power 1000W at 100Vac line condition, for lower line voltage derate output power to 550W (thermal limitation due to OTP Protection) for 56 to 60^{o}C ambient temperature

Storage and Shipping Temperature / Humidity

The DS1200-3 series power supplies can be stored or shipped at temperatures between –40 °C to +85 °C and relative humidity from 5% to 95% non-condensing.

Altitude

The DS1200-3 series will operate within specifications at altitudes up to 10,000 feet above sea level. The power supply shall not be damaged when stored at altitudes of up to 30,000 feet above sea level.

Humidity

The DS1200-3 series will operate within specifications when subjected to a relative humidity from 20% to 90% non-condensing. The DS1200-3 series can be stored in a relative humidity from 10% to 95% non-condensing.

Vibration

The DS1200-3 power supply will pass the following vibration specifications:

Non-Operating Random Vibration

Acceleration	2.7		gRMS
Frequency Range	10-2000		Hz
Duration	20		mins
Direction	3 mutually perpendicular axis		
PSD Profile	**FREQ** 10-190 Hz 190-210 Hz 210-2000 Hz	**SLOPE dB/oct** --- -31.213dB/oct ---	**PSD g^2/Hz** 0.01 g^2/Hz --- 0.003 g^2/Hz

Operating Random Vibration

Acceleration	1.0		gRMS
Frequency Range	10-500		Hz
Duration	20		mins
Direction	3 mutually perpendicular axis		
PSD Profile	**FREQ** 10-500 Hz	**SLOPE dB/oct** ---	**PSD g^2/Hz** 0.002 g^2/Hz

Shock

The DS1200-3 power supply will pass the following vibration specifications:

Non-Operating Half-Sine Shock

Acceleration	30	G
Duration	18	msec
Pulse	Half-Sine	
No. of Shock	3 shock on each of 6 faces	

Operating Half-Sine Shock

Acceleration	4	G
Duration	22	msec
Pulse	Half-Sine	
No. of Shock	3 shock on each of 6 faces	

AC Input Connector

This connector supplies the AC Mains to the DS1200-3 power supply.

Pin 1 - L1
Pin 2 - L2
Pin 3 - Earth Ground

Output Connector – Power Blades

These pins provide the main output for the DS1200-3. The + Main Output (V_O) and the Main Output Return pins are the positive and negative rails, respectively, of the V_O main output of the DS1200-3 power supply. The Main Output (V_O) is electrically isolated from the power supply chassis.

PB1 - Main Output Return
PB2 - Main Output Return
PB3 - Main Output Return
PB4 - + Main Output (V_O)
PB5 - + Main Output (V_O)
PB6 - + Main Output (V_O)

Output Connector - Control Signals

The DS1200-3 series contains a 24 pins control signal header providing an analogue control interface, standby power and i^2C interface signal connections.

PS_ON – (pin A1)

This signal input pin controls the normal turning ON and Off of the Main Output of the DS1200-3 power supply. The power supply main output (V_O) will be enabled when this signal is pulled low, below 0.8 V. The Power supply output (except V_{SB} output) will be disabled when this input is driven higher than 2.4V, or left open circuited.

Main Output Remote Sense Return, Main Output Remote Sense – (pins A2, B2)

The main output of the DS1200-3 is equipped with a Remote Sensing capability that will compensate for a power path drop around the entire loop of 1 volt. This feature is implemented by connecting the Main Output Remote Sense (pin B2) and the Main Output Remote Sense Return (pin A2) to the positive and negative rails of the main output, respectively, at a location that is near to the load. Care should be taken in the routing of the sense lines as any noise sources or additional filtering components introduced into the voltage rail may affect the stability of the power supply. The DS1200-3 will operate appropriately without the sense lines connected; however it is recommended that the sense lines be connected directly to the main output terminals if remote sensing is not required. This remote sense circuit will not raise the power supply's output voltage to the OVP trip level.

Main Output Remote Sense has no effect on the Standby Output (V_{SB}).

PS_SEATED – (pin A4)

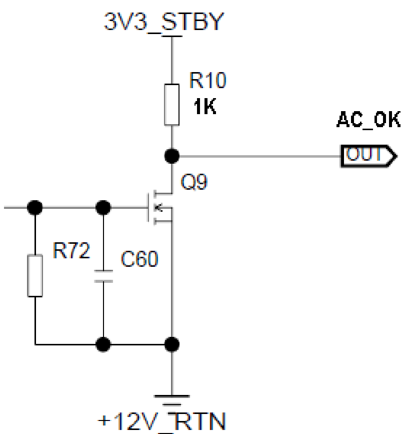
This signal pin is connected to Main Output Return inside the power supply via a 220 ohm resistor. This pin is to be pull high on the system side by a resistor of 4.7K or higher. A TTL logic LOW indicates the power supply is inserted and seated into the system power supply connector. A Logic HIGH indicated the removal of the power supply.

StandBy Output, StandBy Output Return – (pins A5, A6, B5, B6, C5, C6, D5, D6)

The DS1200-3 provides a regulated 3.3 volt 6 amp (or 5.0 volt 4 amp) auxiliary output voltage to power critical circuitry that must remain active regardless of the on/off status of the power supply's main output. The Standby Output (V_{SB}) voltage is available whenever a valid AC input voltage is applied to the unit. The StandBy Output is independently short circuit protected and is referenced to the StandBy Output Return pins (A6, B6, C6, D6).

AC_OK – (pin B1)

The AC_OK signal is a normally LOW level TTL logic signal when the AC input voltage is within the allowable limits. A TTL logic HIGH level, with a 5mS early warning will be sent before the main output loses regulation. This signal is an open drain output internally pulled up in the power supply to StandBy Output via a 1K ohm resistor. It is capable of driving the output below 0.4V with a load of 4mA.



Main Output Current Share – (pin B3)

The DS1200-3 supports active current sharing through a single wire connection between the power supplies. This input/output signal pin allows two or more power supplies to share the main output load current to increase the overall power capability or to operate the units in a N+1 configuration for redundancy purposes.

The voltage of this signal will be a linear slope from no load to full load. At 49.2A, the output of the Main Output Current Share pin will be between 3.90 and 4.10V. At 98.4A output current, this signal will be between 5.90 and 6.10V.

When two or more power supplies are connected and operating in parallel and each is delivering 40-100% of its rated output to the load, the power supplies will current share within 5% accuracy. When supplying light loads between 10% and 40% of its rated load, the power supplies will share within 20% accuracy. (Below 10% load, there is no guarantee of output current sharing). If any power supply is hot swapped, no glitch will occur that violates the regulation limits of the power supply defined in this specification.

PS_INHIBIT – (pin B4)

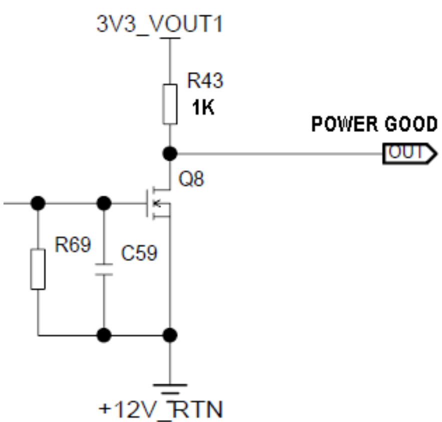
This signal pin should be grounded in the system. If left open, power supply operation will be inhibited (StandBy V_{SB} output will remain on).

SDA, SCL and S_INT – (pin C1, C2, D3)

Please refer to "Communication Bus Descriptions" section.

POWER GOOD– (pin C3)

The POWER GOOD is an output signal driven high, by the power supply to indicate that all outputs are valid. If any of the power supply outputs fails below its regulation limits, this output will be driven low. The output signal is an open drain output internally pulled up in the power supply to internal standby supply (anode side of StandBy Output or'ing circuit) via a 1K ohm resistor. It is capable of driving the output below 0.4V with a load of 4mA.



A0, A1 – (pins D1, D2)

Please refer to "Communication Bus Descriptions" section.

StandBy Remote Sense – (pin D4)

The StandBy Output of the DS1200-3 is also equipped with a Remote Sensing capability that will compensate upto 50mV of voltage drop for the positive rail. The StandBy Output Remote Sense pin should be connected as close to the load as possible, or connected to the StandBy Output pins at the base of the output connector if not used. If left open, the remote sense might not work properly and the voltage level of StandBy Output can be lower than the guaranteed spec.

I²C Bus Signals

The DS1200-3 power supply contains enhanced monitoring and control functions implemented via the I²C bus. The DS1200-3 I²C functionality (PMBus™ and FRU data) can be accessed via the output connector control signals. The communication bus is powered either by the internal 3.3V supply or from an external power source connected to the StandBy Output (ie: accessing an unpowered power supply as long as the StandBy Output of another power supply connected in parallel is on).

If units are connected in parallel or in redundant mode, the StandBy Outputs must be connected together in the system. Otherwise, the I²C bus will not work properly when a unit is inserted into the system without the AC source connected.

Note: PMBus™ functionality can be accessed only when the PSU is powered-up.
Guaranteed communication I²C speed is 100KHz.

SDA, SCL (I²C Data and Clock Signals) – (pin C1, C2)

I²C serial data and clock bus - these pins are internally pulled up to internal 3.3V supply with a 39K resistor. These pins must be pulled-up in the system by an 1K ohm resistor to the StandBy Output.

S_INT (Alarm) – (pin D3)

S_INT is used to send a signal to the system that a fault in the power supply occurred. This signal is normally logic level HIGH. It will go to a LOW logic level when a fault bit has been set in the power supply's status register. To reset the S_INT signal back to normal (logic HIGH level), perform one of the following actions - (1) recycle input AC power, (2) toggle PSON signal and (3) issuance of a CLEAR_FAULTS PMBus™ command.

A0, A1 (I²C Address BIT 0, BIT1 Signals) – (pin D1, D2)

These two input pins are the address lines A0 and A1 to indicate the slot position the power supply occupies in the power bay and define the power supply addresses for FRU data and PMBus™ data communication. This allows the system to assign different addresses for each power supply. During I²C communication between system and power supplies, the system will be the master and power supplies will be slave.

They are internally pulled up to internal 3.3V supply with a 1K resistor.

I²C Bus Communication Interval

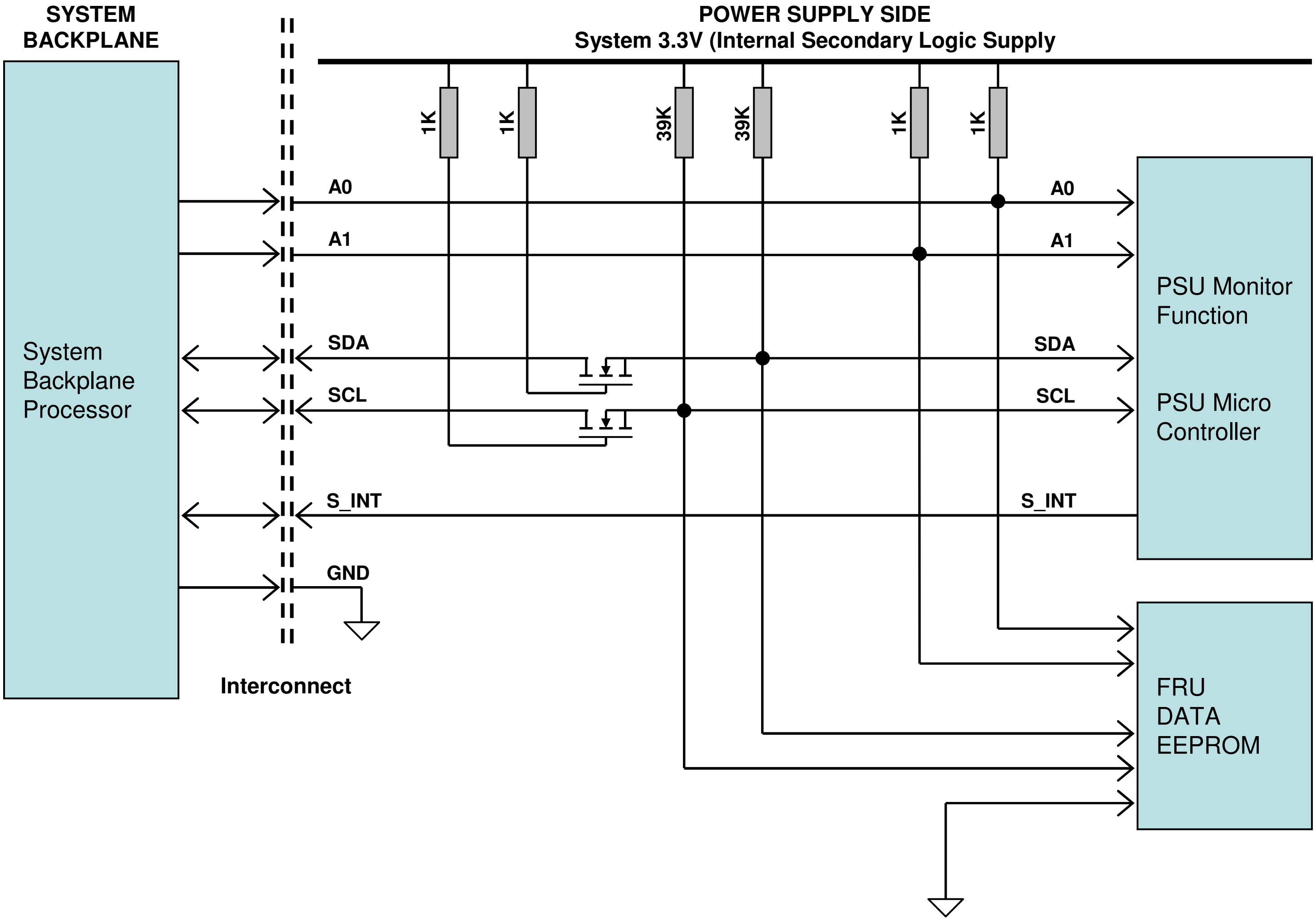
The interval between two consecutive I²C communications to the power supply should be at least 50ms to ensure proper monitoring functionality.

I²C Bus Signal Integrity

The noise on the I²C bus (SDA, SCL lines) due to the power supply will be less than 500mV peak-to-peak. This noise measurement should be made with an oscilloscope bandwidth limited to 100MHz. Measurements should be make at the power supply output connector with 3.2K ohm resistors pulled up to StandBy Output and 20pf ceramic capacitors to StandBy Output Return.

The noise on the address lines A0 and A1 will be less than 100mV peak-to-peak. This noise measurement should be made at the power supply output connector.

I^2C Bus Internal Implementation, Pull-ups and Bus Capacitances



I^2C Bus - Recommended external pull-ups:

Electrical and Interface specifications of I^2C signals (referenced to StandBy Output Return pin, unless otherwise indicated):

Parameter	Condition	Symbol	Min	Typ	Max	Unit
SDA, SCL internal pull-up resistor		R_{int}	-	39	-	Kohm
SDA, SCL internal bus capacitance		C_{int}	-	0	-	pF
Recommended external pull-up resistor 1 PSU	1 PSU	R_{ext}	-	1.0	-	Kohm
	4 PSU		-	0.25	-	Kohm

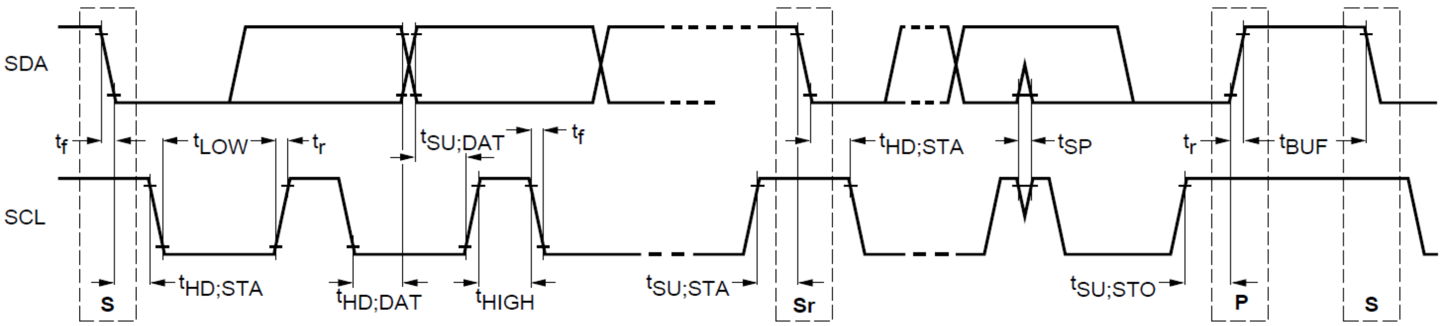
Logic Levels

DS1200-3 series power supply I²C Communication Bus will respond to logic levels as per below:

Logic High: 3.3V Nominal (Specs is 2.1V to 5.5V)**
Logic Low: 500mV nominal (Specs is 800mV max)**

** Note: Emerson 73-769-001 I²C adapter was used.

Timings



Parameter	Symbol	Standard-Mode Specs		Actual Measured		Unit
		Min	Max			
SCL Clock Frequency	f_{SCL}	0	100	96.8		KHz
Hold time (repeated) START condition	$t_{HD;STA}$	4.0	-	4.3		µS
LOW period of SCL clock	t_{LOW}	4.7	-	13.5		µS
HIGH period of SCL clock	t_{HIGH}	4.0	-	4.4		µS
Setup time for repeated START condition	$t_{SU;STA}$	4.7	-	5.83		µS
Data hold time	$t_{HD;DAT}$	0	3.45	1.87		µS
Data setup time	$t_{SU;DAT}$	250	-	5765		nS
Rise time	t_r	-	1000	SCL = 972	SDA = 986	nS
Fall time	t_f	-	300	SCL = 148.5	SDA = 148	nS
Setup time for STOP condition	$t_{SU;STO}$	4.0	-	6.36		µS
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	100		µS

*** Note Emerson 73-769-001 I²C adapter (USB-to-I²C) and Universal PMBus™ GUI software was used

Device Addressing

The DS1200-3 series will respond to supported commands on the I^2C bus that are addressed according to pins A1 and A0 pins of output connector.

Address pins are held HIGH by default via pulled up to internal 3.3V (5V)supply with a 1K resistor. To set the address as “0”, the corresponding address line should be pulled down to logic ground level. Below tables show the address of the power supply with A0 and A1 pins set to either “0” or “1”.:

PSU Slot	Slot ID Bits		PMBus™ Address	EEPROM (FRU) Read Address
	A1	A0		
1	0	0	0x78	0xA9
2	0	1	0x7A	0xAB
3	1	0	0x7C	0xAD
4	1	1	0x7E*	0xAF*

* Default PMBus™ address when A0 and A1 are left open

Power Supply Status Register, PMBus™ Register 0xEFh

Power supply status monitoring can be done via the PMBus™ register 0xEFh or as I/O expander Detailed explanation of functions is given below:

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
OCP	UVP	OVP	FAN_OK	AC_OK	TEMP_OK	V_{SB} OK	V_O OK

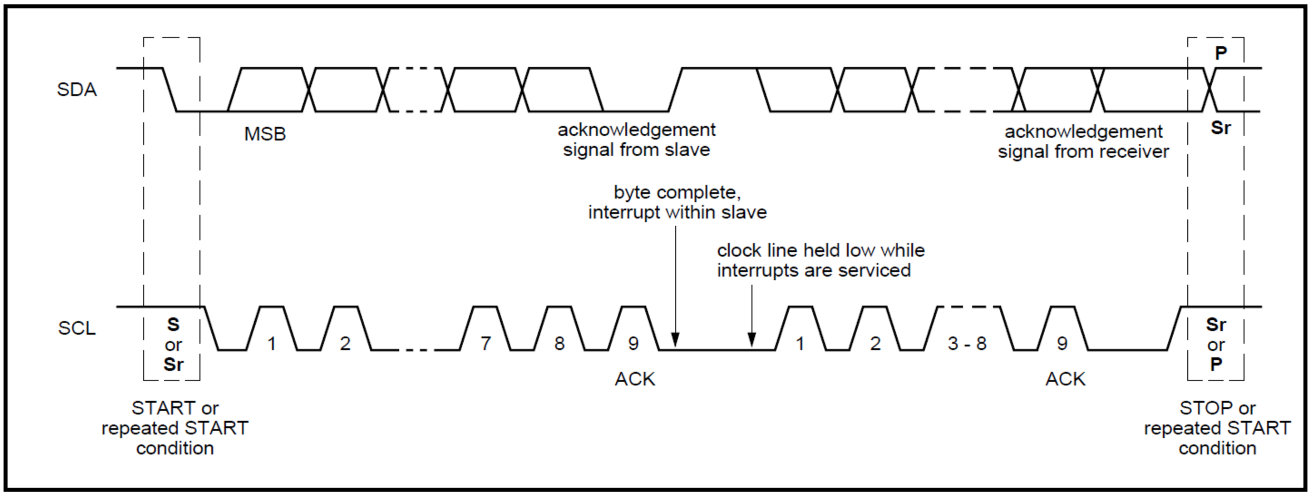
- OCP
  - Over Current Protection
  - This bit will be set when the power supply outputs have been disabled due to an over current event.
- UVP
  - Under Voltage Protection
  - This bit will be set when the power supply outputs have been disabled due to an under voltage event.
- OVP
  - Over Voltage Protection
  - This bit will be set when the power supply outputs have been disabled due to an over voltage event.
- FAN_OK
  - Fan Status
  - Any abnormalities on the fan will clear this bit. Normal fan operation, this is set to high.
- AC_OK
  - AC line voltage status
  - This bit is an image of the AC_OK signal coming out the power supply to the system. A logic HIGH, if the input voltage is within allowable limits. This bit will be cleared when the power supply line voltage is past the trip limit.
- TEMP_OK
  - Over temperature status.
  - A logic HIGH, when the power supply is operating within allowable temperature range. This bit will be cleared when the power supply temperature is past the trip limit.
- V_{SB} OK
  - StandBy Output (V_{SB}) status.
  - This bit is set when the StandBy Output (V_{SB}) is within regulation limits. This bit will be cleared when the V_{SB} voltage is out of regulation.
- V_O OK
  - Main Output (V_O) status.
  - This bit is set when the Main Output (V_O) is within regulation limits. This bit will be cleared when the V_O voltage is out of regulation.

Status Register Code		
Signal Name	**Code (Binary)**	**Code (Hex)**
Normal / 12V ON	00011111	1F
Normal / 12V OFF	00011110	1E
OCP	10011111	9E
UVP	01011110	5E
OVP	00111110	3E
Fan Fault	00001110	0E
Low AC / No AC	00010100	14
Over Temp Fault	00011010	1A

I²C Clock Synchronization

The DS1200-3 power supply might apply clock stretching. An addressed slave power supply may hold the clock line (SCL) low after receiving (or sending) a byte, indicating that it is not yet ready to process more data. The system master that is communicating with the power supply will attempt to raise the clock to transfer the next bit, but must verify that the clock line was actually raised. If the power supply is clock stretching, the clock line will still be low (because the connections are open-drain).

The maximum time out condition for clock stretching for DS1200-3 is 100 microseconds.



FRU (EEPROM) Data

The FRU (Field Replaceable Unit) data format is compliant with the Intel IPMI v1.0 specification.

The DS1200-3 uses 1 page of EEPROM for FRU purpose. A page of EEPROM contains up to 256 byte-sized data locations.

Where: OFFSET - The OFFSET denotes the address in decimal format of a particular data byte within DS1200-3 EEPROM.

VALUE - The VALUE details data written to a particular memory location of the EEPROM.

DEFINITION - The contents DEFINITION refers to the definition of a particular data byte.

DS1200-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		COMMON HEADER, 8 BYTES		
0	00	**FORMAT VERSION NUMBER** (Common Header) 7:4 - Reserved, write as 0000b 3:0 - Format Version Number = 1h for this specification	1	01
1	01	**INTERNAL USE AREA OFFSET**	27	1B
2	02	**CHASSIS INFO AREA OFFSET**	1	01
3	03	**BOARD INFO AREA OFFSET**	0	00
4	04	**PRODUCT INFO AREA OFFSET**	5	05
5	05	**MULTI RECORD AREA OFFSET**	12	0C
6	06	**PAD** (reserved) Default value is 0.	0	00
7	07	**ZERO CHECK SUM** (256 – (Sum of bytes 0 to 6))	210	D2
		CHASSIS INFO AREA(32 BYTES) This area will be filled by the Mfg. Diag. or by the OS if used		
8	08	**FORMAT VERSION NUMBER** 7:4 - Reserved, write as 0000b 3:0 - Format Version Number = 1h for this specification	1	01
9	09	**CHASSIS INFO AREA LENGTH** in multiple of 8 bytes	4	04
10	0A	**CHASSIS TYPE** (Default value is 0.)	0	00
11	0B	**CHASSIS PART NUMBER** Type/Length CAh (if used) Type = “ASCII+LATIN1” = (11)b Length = 10 Bytes = (001010)b	202	CA
12 13 14 15 16 17 18 19 20 21	0C 0D 0E 0F 10 11 12 13 14 15	**CHASSIS PART NUMBER BYTES** (Default value is 0.)	0 0 0 0 0 0 0 0 0 0	00 00 00 00 00 00 00 00 00 00
22	16	**CHASSIS SERIAL NUMBER Type/Length** CFH (if used) Type = “ASCII+LATIN1” = (11)b Length = 15 Bytes = (001111)b	207	CF
23 24 25 26 27 28 29 30 31 32	17 18 19 1A 1B 1C 1D 1E 1F 20	**CHASSIS SERIAL NUMBER BYTES,** Default value is 0.	0 0 0 0 0 0 0 0 0 0	00 00 00 00 00 00 00 00 00 00

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
33 34 35 36 37	20 22 23 24 25	CHASSIS SERIAL NUMBER BYTES, Default value is 0.	0 0 0 0 0	00 00 00 00 00
38	26	**End Tag** (0C1h if used)	193	C1
39	27	**CHKSUM** (Zero CHKSUM if used)	161	A1
		PRODUCT INFORMATION AREA, 56 BYTES		
40	28	**FORMAT VERSION NUMBER** (Product Info Area) 7:4 - Reserved, write as 0000b 3:0 - Format Version Number = 1h for this specification	1	01
41	29	**PRODUCT INFO AREA LENGTH** (In multiples of 8 bytes)	7	07
42	2A	**Language (English)**	25	19
43	2B	**MANUFACTURER NAME TYPE / LENGTH** (0C5H) Type "ASCII+LATIN1" 5 Bytes.	197	C5
 44 45 46 47 48	 2C 2D 2E 2F 30	**MANUFACTURER'S NAME** 5 byte sequence "E"= 41h "M"= 53h "R"= 54h "S"= 45h "N"= 43h	 65 83 84 69 67	 41 53 54 45 43
49	31	**PRODUCT NAME** Type/Length (CCH) Type = "ASCII+LATIN1" = (11)b Length = 12 Bytes = (001100)b	204	CC
50 51 52 53 54 55 56 57 58 59 60 61	32 33 34 35 36 37 38 39 3A 3B 3C 3D	**Product Name,** 12 Byte sequence **"DS1200-3 "** In Decimal = 068, 083, 049, 050, 048, 048, 045, 051, 032, 032, 032, 032, In Hex = 44H, 53H, 31H, 32H, 30H, 30H, 2DH, 33H, 20H, 20H, 20H, 20H	68 83 49 50 48 48 45 51 32 32 32 32	44 53 31 32 30 30 2D 33 20 20 20 20
62	3E	**PRODUCT PART/MODEL NUMBER** Type/Length (CCH) Type = "ASCII+LATIN1" = (11)b Length = 12 Bytes = (001100)b	204	CC
63 64 65 66 67 68 69 70 71 72 73 74	3F 40 41 42 43 44 45 46 47 48 49 4A	**Part / Model Number** "DS1200-3 " In Decimal = 068, 083, 049, 050, 048, 048, 045, 051, 032, 032, 032, 032, In Hex = 44H, 53H, 31H, 32H, 30H, 30H, 2DH, 33H, 20H, 20H, 20H, 20H,	68 83 49 50 48 48 45 51 32 32 32 32	44 53 31 32 30 30 2D 33 20 20 20 20
75	4B	**PRODUCT VERSION NUMBER** Type/Length (C2h) Type = "ASCII+LATIN1" = (11)b Length = 2 bytes = (000010)b	194	C2
76 77	4C 4D	Refer to Section 1.2 Product Revision History (Model Revision) in latest IPS Eg. "0A" In Decimal = 048, 065 In Hex = 30H, 41H	XX XX	XX XX

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
78	4E	**PRODUCT SERIAL NUMBER** Type/Length Type = “ASCII+LATIN1” = (11)b Length = 13 bytes = (001101)b	205	CD
79 80 81 82	4F 50 51 52	**Model ID** “G087” for DS1200-3 In Decimal = 071, 048, 056, 055 In Hex = 47H, 30H, 38H, 37H	71 48 56 55	47 30 38 37
83 84	53 54	**MANUFACTURING YEAR AND WEEK CODE** “WW” In Decimal = 087, 087 In Hex = 57H, 57H	87 87	57 57
85 86 87 88	55 56 57 58	**Unique Serial Number** “SSSS” In Decimal = 083, 083, 083, 083 In Hex = 53H, 53H, 53H, 53H	83 83 83 83	53 53 53 53
89 90	59 5A	**MODEL REVISION** Astec Model Rev, See Latest Model Rev in IPS Sec 1.2 Eg. “0A“ In Decimal = 048, 065 In Hex = 30H, 41H	XX XX	XX XX
91	5B	**MANUFACTURING LOCATION** “P” In Decimal = 080 In Hex = 50H	80	50
92	5C	**End Tag** In Decimal: 193 In Hex: 0C1H	193	C1
93 94	5D 5E	PAD (reserved), Default value is 0.	0 0	00 00
95	5F	**ZERO CHECK SUM (256 – (Sum of bytes 40 to 94))** Zero Check Sum :Should follow check sum calculation as per IPMI v1.1 specs	193	C1
		Multi Record Area, 88 Bytes		
96 97 98 99 100	60 61 62 63 64	**Power Supply Record Header** Record type = 00 for Power supply End of List /Record Format Version Number Record Length of Power Supply Record Record CHECKSUM of Power Supply Record (Zero CHECKSUM) 256-(sum of bytes 101 to 124) Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM) (256-(sum of bytes 96 to 99)	0 2 24 118 112	00 02 18 76 70
		Power Supply Record		
101 102	65 66	**Overall Capacity of the Power Supply**, 1200W = 04B0H 2 Bytes Sequence In Decimal = 176, 004 In Hex = B0H, 04H	176 4	B0 04
103 104	67 68	**Peak VA,** 1348W = 0544H 2 Bytes Sequence In Decimal = 068, 005 In Hex = 44H, 05H	68 5	44 05
105	69	**Inrush Current**, 40A In Decimal = 040 In Hex = 28H	40	28
106	6A	**Inrush Interval**, 10mS In Decimal = 010 In Hex = 0AH	10	0A
107 108	6B 6C	**Low End Input Voltage Range 1(10mV),** (90V / 10mV) 9000 = 2328H 2 Bytes Sequence In Decimal = 040, 035 In Hex = 28H, 23H	40 35	28 23
109 110	6D 6E	**High End Input Voltage Range 1(10mV),** (264V/10mV) 26400= 6720H 2 Bytes Sequence In Decimal = 032, 103 In Hex = 20H, 67H	32 103	20 67

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
111 112	6F 70	**Low End Input Voltage Range 2(10mV)** Not Applicable (Autoswitch)	0 0	00 00
113 114	71 72	**High End Input Voltage Range 2(10mV)** Not Applicable (Autoswitch)	0 0	00 00
115	73	**Low End Input Frequency Range**, 47Hz = 2FH	47	2F
116	74	**Low End Input Frequency Range**, 63Hz = 3FH	63	3F
117	75	**AC Dropout Tolerance in ms,** 10mS= 0AH	10	0A
118	76	**Binary Flags**, 1 indicates function supported and a 0 indicates function not supported. Bits 7-5: RESERVED, WRITE AS 000B Bit 4: Tachometer Pulses Per Rotation / Predictive Fail Polarity BIT = 0 Bit 3: Hot Swap / Redundancy Support BIT = 1 Bit 2: Auto switch Support BIT = 1 Bit 1: Power Factor Correction Support BIT = 1 Bit 0: Predictive Fail Support BIT = 0	14	0E
119 120	77 78	**Peak Wattage Capacity and Holdup Time**, 1800W = 708H 1 Second=01H Bits 15-12: Holdup Time in Seconds 1 = 01H Bits 11- 0: Peak Capacity in Watts 1800 = 708H 2 Bytes sequence: In Decimal: 008, 023 In Hex: 08H, 17H	8 23	08 17
121 122 123	79 7A 7B	**Combined Wattage,** Not Applicable Byte 1 00110000B =30H=48d Bits 7-4: 0011B --->(3.3v) Bits 3-0: 0000B --->(12v) Byte 2 and Byte 3: 1200W =04B0H byte 2 (LSB) = B0h =176d , byte 3 (MSB) =04h = 04d 3 Bytes Sequence In Decimal = 048d, 176d, 04d In Hex = 30H, B0H, 04H	48 176 4	30 B0 04
124	7C	**Predictive Fail Tachometer Lower Threshold,** Not Applicable. Predictive Failure is not Supported.	0	00
		12V DC OUTPUT RECORD HEADER		
125 126 127 128 129	7D 7E 7F 80 81	Record type = 01 for DC Output Record End of List /Record Format Version Number for 12V DC Output Record Record Length of 12V DC Output Record Record CHECKSUM of 12V DC Output Record (Zero CHECKSUM) (256-(sum of bytes 130 to 142) Header CHECKSUM of 12V DC Output Record Header (Zero CHECKSUM) (256-(sum of bytes 125 to 128)	1 2 13 52 188	01 02 0D 34 BC
		12V OUTPUT RECORD		
130	82	**Output Information,** 001 = 01H Bit 7: Standby Information = 0B Bits 6-4: Reserved, Write as 000B Bits 3-0: Output Number 1 = 001B	1	01
131 132	83 84	**Nominal Voltage (10mV), (12V / 10mV)** 1200 = 04B0H 2 Bytes Sequence In Decimal: 176, 004 In Hex: B0H, 04H	176 4	B0 04
133 134	85 86	**Maximum Negative Voltage Deviation (10mV),** 1140 = 0474H 2 Bytes Sequence In Decimal: 116, 004 In Hex: 74H, 04H	116 4	74 04

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		Maximum Positive Voltage Deviation (10mV), 1260 =04ECH 2 Bytes Sequence		
135	87	In Decimal: 236, 004	236	EC
136	88	In Hex: ECH, 04H	4	04
		Ripple and Noise pk-pk (mV), 120 = 78H 2 Bytes Sequence		
137	89	In Decimal: 120, 000	120	78
138	8A	In Hex: 78H, 00H	0	00
		Minimum Current Draw (10mA), 0000 = 0000H 2 Bytes Sequence		
139	8B	In Decimal: 000, 000	0	00
140	8C	In Hex: 00H, 00H	0	00
		Maximum Current Draw (10mA), 10000 = 2710H 2 Bytes Sequence		
141	8D	In Decimal: 016, 039	16	10
142	8C	In Hex: 10H, 27H	39	27
		3V3SB OUTPUT RECORD HEADER		
143	8F	Record type = 01 for DC Output Record	1	01
144	90	End of List /Record Format Version Number for 3V3SB Output Record	2	02
154	91	Record Length of 3V3SB Output Record	13	0D
146	92	Record CHECKSUM of 3V3SB Output Record (Zero CHECKSUM) (256-(sum of bytes 148 to 160)	223	DF
147	93	Header CHECKSUM of 3V3SB Output Record Header (Zero CHECKSUM) (256-(sum of bytes 143 to 146)	17	11
		3V3SB OUTPUT RECORD		
		Output Information, 002 = 02H Bit 7: Standby Information = 1B Bits 6-4: Reserved, Write as 000B		
148	94	Bits 3-0: Output Number 2 = 010B	130	82
		Nominal Voltage (10mV), (3.3V / 10mV) 330 = 014AH 2 Bytes Sequence		
149	95	In Decimal: 074, 001	74	4A
150	96	In Hex: 4AH, 01H	1	01
		Maximum Negative Voltage Deviation (10mV), (3.14V/10mV) 314= 013AH 2 Bytes Sequence		
151	97	In Decimal: 058, 001	58	3A
152	98	In Hex: 3AH, 01H	1	01
		Maximum Positive Voltage Deviation (10mV), (3.46V/ 10mV) 346 =015AH 2 Bytes Sequence		
153	99	In Decimal: 090, 001	90	5A
154	9A	In Hex: 5AH, 01H	1	01
		Ripple and Noise pk-pk (mV), 50 = 0032H 2 Bytes Sequence		
155	9B	In Decimal: 050, 000	50	32
156	9C	In Hex: 32H, 00H	0	00
		Minimum Current Draw (10mA), (0.5A / 10mA) 50 = 0032H 2 Bytes Sequence		
157	9D	In Decimal: 050, 000	50	32
158	9E	In Hex: 32H, 00H	0	00
		Maximum Current Draw (10mA), (6.0A / 10mA) 600 = 0258H 2 Bytes Sequence		
159	9F	In Decimal: 88, 002	88	58
160	A0	In Hex: 58H, 02H	2	02
		OEM RECORD HEADER		
161	A1	Record type = C0H for OEM Record	192	C0
162	A2	End of List /Record Format Version Number for 3.3Vsb output Record	130	82

DS1200-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
163	A3	Record Length of OEM Record	50	32
164	A4	Record CHECKSUM of OEM Record (Zero CHECKSUM)	0	00
165	A5	Header CHECKSUM of OEM Record Header (Zero CHECKSUM) (256-(sum of bytes 161 to 164)	140	8C
		OEM RECORD		
166	A6	**Manufacturer ID** (3 bytes, Default is 0)	0	00
167	A7		0	00
168	A8		0	00
169	A9	RESERVED	0	00
170	AA	RESERVED	0	00
171	AB	RESERVED	0	00
172	AC	RESERVED	0	00
173	AD	RESERVED	0	00
174	AE	RESERVED	0	00
175	AF	RESERVED	0	00
176	B0	RESERVED	0	00
177	B1	RESERVED	0	00
178	B2	RESERVED	0	00
179	B3	PAD (reserved), Default value is 0.	0	00
180	B4		0	00
181	B5		0	00
182	B6		0	00
183	B7		0	00
184	B8		0	00
185	B9		0	00
186	BA		0	00
187	BB		0	00
188	BC		0	00
189	BD		0	00
190	BE		0	00
191	BF		0	00
192	C0		0	00
193	C1		0	00
194	C2		0	00
195	C3		0	00
196	C4		0	00
197	C5		0	00
198	C6		0	00
199	C7		0	00
200	C8		0	00
201	C9		0	00
202	CA		0	00
203	CB		0	00
204	CC		0	00
205	CD		0	00
206	CE		0	00
207	CF		0	00
208	D0		0	00
209	D1		0	00
210	D2		0	00
211	D3		0	00
212	D4		0	00
213	D5		0	00
214	D6		0	00
215	D7		0	00

DS1200-3 FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
INTERNAL USE AREA, 40 BYTES				
216	D8	RESERVED, Default value is 0.	0	00
217	D9		0	00
218	DA		0	00
219	DB		0	00
220	DC		0	00
221	DD		0	00
222	DE		0	00
223	DF		0	00
224	E0		0	00
225	E1		0	00
226	E2		0	00
227	E3		0	00
228	E4		0	00
229	E5		0	00
230	E6		0	00
231	E7		0	00
232	E8		0	00
233	E9		0	00
234	EA		0	00
235	EB		0	00
236	EC		0	00
237	ED		0	00
238	EE		0	00
239	EF		0	00
240	F0		0	00
241	F1		0	00
242	F2		0	00
243	F3		0	00
244	F4		0	00
245	F5		0	00
246	F6		0	00
247	F7		0	00
248	F8		0	00
249	F9		0	00
250	FA		0	00
251	FB		0	00
252	FC		0	00
253	FD		0	00
254	FE		0	00
255	FF	Zero CHECKSUM of Internal Use Area (if used). Default Value=0	0	00

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	**(HEX)**	**(REMARKS)**	**(DEC)**	**(HEX)**
		PRODUCT INFORMATION AREA, 56 BYTES		
		PRODUCT NAME BYTES (12 Byte sequence)		
50	32	"D" = 44h	68	44
51	33	"S" = 53h	83	53
52	34	"1" = 31h	49	31
53	35	"2" = 32h	50	32
54	36	"0" = 30h	48	30
55	37	"0" = 30h	48	30
56	38	"-" = 2Dh	45	2D
57	39	"3" = 33h	51	33
58	3A	"-" = 2Dh	45	2D
59	3B	"0" = 30h	48	30
60	3C	"0" = 30h	48	30
61	3D	"2" = 32h	50	32
		PRODUCT PART/MODEL NUMBER BYTES		
63	3F	"D" = 44h	68	44
64	40	"S" = 53h	83	53
65	41	"1" = 31h	49	31
66	42	"2" = 32h	50	32
67	43	"0" = 30h	48	30
68	44	"0" = 30h	48	30
69	45	"-" = 2Dh	45	2D
70	46	"3" = 33h	51	33
71	47	"-" = 2Dh	45	2D
72	48	"0" = 30h	48	30
73	49	"0" = 30h	48	30
74	4A	"2" = 32h	50	32
		PRODUCT SERIAL NUMBER BYTES		
		Model ID = H884		
79	4F	"H" = 48h	72	48
80	50	"8" = 38h	56	38
81	51	"8" = 38h	56	38
82	52	"4" = 34h	52	34
		Multi Record Area, 88 Bytes		
		Power Supply Record Header		
96	60	Record type = 00 for Power supply	0	00
97	61	End of List /Record Format Version Number	2	02
98	62	Record Length of Power Supply Record	24	18
99	63	256-(sum of bytes 101 to 124)	134	86
100	64	Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM) (256-(sum of bytes 96 to 99)	96	60
		Combined Wattage, Byte 1: 0010 0000 = 20H =32d Bits 7-4: 0010B --->(5v --voltage 1) Bits 3-0: 0000B --->(12v ---voltage 2) Byte 2 and Byte 3: 1200W =4B0H byte 2 (LSB) = B0h =176d byte 3 (MSB) =04h = 04d		
121	79	3 Bytes Sequence	32	20
122	7A	In Decimal = 32d, 176d, 04d	176	B0
123	7B	In Hex = 20h,B0h,04h	4	04

DS1200-3-002 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		5VSB OUTPUT RECORD HEADER		
143	8F	Record type = 01 for DC Output Record	1	01
144	90	End of List /Record Format Version Number for 5VSB Output Record	2	02
154	91	Record Length of 5VSB Output Record	13	0D
146	92	Record CHECKSUM of 5VSB Output Record (Zero CHECKSUM) (256-(sum of bytes 148 to 160)	169	A9
147	93	Header CHECKSUM of 5VSB Output Record Header (Zero CHECKSUM) (256-(sum of bytes 143 to 146)	71	47
		5VSB OUTPUT RECORD		
  149 150	 95 96	**Nominal Voltage (10mV),** (5.0V / 10mV) 5000 = 01F4h 2 Bytes Sequence In Decimal: 244, 001 In Hex: F4h, 01h	 244 1	 F4 01
  151 152	 97 98	**Maximum Negative Voltage Deviation (10mV),** (4.75V/10mV) 475 = 01DBh 2 Bytes Sequence In Decimal: 219, 001 In Hex: DBh, 01h	 219 1	 0B 01
  153 154	 99 9A	**Maximum Positive Voltage Deviation (10mV),** (5.25V/ 10mV) 525 = 020Dh 2 Bytes Sequence In Decimal: 013, 002 In Hex: 0DH, 02H	 13 2	 0D 02
  159 160	 9F A0	**Maximum Current Draw (10mA),** (4.0A / 10mA) 400 = 0190H 2 Bytes Sequence In Decimal: 144, 001 In Hex: 90H, 01H	 144 1	 90 01

DS1200-3-003 FRU (EEPROM) deviations :

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		PRODUCT NAME BYTES (12 Byte sequence)		
50	32	"D" = 44h	68	44
51	33	"S" = 53h	83	53
52	34	"1" = 31h	49	31
53	35	"2" = 32h	50	32
54	36	"0" = 30h	48	30
55	37	"0" = 30h	48	30
56	38	"-" = 2Dh	45	2D
57	39	"3" = 33h	51	33
58	3A	"-" = 2Dh	45	2D
59	3B	"0" = 30h	48	30
60	3C	"0" = 30h	48	30
61	3D	“3" = 33h	51	33
		PRODUCT PART/MODEL NUMBER BYTES		
63	3F	"D" = 44h	68	44
64	40	"S" = 53h	83	53
65	41	"1" = 31h	49	31
66	42	"2" = 32h	50	32
67	43	"0" = 30h	48	30
68	44	"0" = 30h	48	30
69	45	"-" = 2Dh	45	2D
70	46	"3" = 33h	51	33
71	47	"-" = 2Dh	45	2D
72	48	"0" = 30h	48	30
73	49	"0" = 30h	48	30
74	4A	“3" = 33h	51	33
		PRODUCT SERIAL NUMBER BYTES		
		Model ID = H884		
79	4F	“I " = 49h	72	48
80	50	"8" = 38h	56	38
81	51	“7" = 37h	55	37
82	52	“7" = 37h	55	37
		Multi Record Area, 88 Bytes		
		Power Supply Record Header		
96	60	Record type = 00 for Power supply	0	00
97	61	End of List /Record Format Version Number	2	02
98	62	Record Length of Power Supply Record	24	18
99	63	256-(sum of bytes 101 to 124)	134	86
100	64	Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM)	96	60
		(256-(sum of bytes 96 to 99)		
		Combined Wattage,		
		Byte 1: 0010 0000 = 20H =32d		
		Bits 7-4: 0010B --->(5v --voltage 1)		
		Bits 3-0: 0000B --->(12v ---voltage 2)		
		Byte 2 and Byte 3:		
		1200W =4B0H		
		byte 2 (LSB) = B0h =176d		
		byte 3 (MSB) =04h = 04d		
121	79	3 Bytes Sequence	32	20
122	7A	In Decimal = 32d, 176d, 04d	176	B0
123	7B	In Hex = 20h,B0h,04h	4	04

DS1200-3-003 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		3V3SB OUTPUT RECORD HEADER		
143 144 154 146 147	8F 90 91 92 93	Record type = 01 for DC Output Record End of List /Record Format Version Number for 3V3SB Output Record Record Length of 3V3SB Output Record Record CHECKSUM of 3V3SB Output Record (Zero CHECKSUM) (256-(sum of bytes 148 to 160) Header CHECKSUM of 3V3SB Output Record Header (Zero CHECKSUM) (256-(sum of bytes 143 to 146)	1 2 13 169 71	01 02 0D A9 47
		3V3SB OUTPUT RECORD		
  149 150	 95 96	**Nominal Voltage (10mV),** (3.3V / 10mV) 330 = 014AH 2 Bytes Sequence In Decimal: 074, 001 In Hex: 4AH, 01H	 74 1	 4A 01
  151 152	 97 98	**Maximum Negative Voltage Deviation (10mV),** (3.14V/10mV) 314= 013AH 2 Bytes Sequence In Decimal: 058, 001 In Hex: 3AH, 01H	 58 1	 3A 01
  153 154	 99 9A	**Maximum Positive Voltage Deviation (10mV),** (3.46V/ 10mV) 346 =015AH 2 Bytes Sequence In Decimal: 090, 001 In Hex: 5AH, 01H	 90 1	 5A 01
  159 160	 9F A0	**Maximum Current Draw (10mA),** (6.0A / 10mA) 600 = 0258H 2 Bytes Sequence In Decimal: 88, 002 In Hex: 58H, 02H	 88 2	 58 02

DS1200-3-004 FRU (EEPROM) deviations :

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		PRODUCT INFORMATION AREA, 56 BYTES		
		PRODUCT NAME BYTES (12 Byte sequence)		
50	32	"D" = 44h	68	44
51	33	"S" = 53h	83	53
52	34	"1" = 31h	49	31
53	35	"2" = 32h	50	32
54	36	"0" = 30h	48	30
55	37	"0" = 30h	48	30
56	38	"-" = 2Dh	45	2D
57	39	"3" = 33h	51	33
58	3A	"-" = 2Dh	45	2D
59	3B	"0" = 30h	48	30
60	3C	"0" = 30h	48	30
61	3D	"4" = 34h	52	34
		PRODUCT PART/MODEL NUMBER BYTES		
63	3F	"D" = 44h	68	44
64	40	"S" = 53h	83	53
65	41	"1" = 31h	49	31
66	42	"2" = 32h	50	32
67	43	"0" = 30h	48	30
68	44	"0" = 30h	48	30
69	45	"-" = 2Dh	45	2D
70	46	"3" = 33h	51	33
71	47	"-" = 2Dh	45	2D
72	48	"0" = 30h	48	30
73	49	"0" = 30h	48	30
74	4A	"4" = 34h	52	34
		PRODUCT SERIAL NUMBER BYTES		
		Model ID = H884		
79	4F	"I " = 49h	73	49
80	50	"8" = 37h	55	37
81	51	"2" = 32h	50	32
82	52	"8" = 38h	56	38
		Multi Record Area, 88 Bytes		
		Power Supply Record Header		
96	60	Record type = 00 for Power supply	0	00
97	61	End of List /Record Format Version Number	2	02
98	62	Record Length of Power Supply Record	24	18
99	63	256-(sum of bytes 101 to 124)	134	86
100	64	Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM) (256-(sum of bytes 96 to 99)	96	60
		Combined Wattage, Byte 1: 0010 0000 = 20H =32d Bits 7-4: 0010B --->(5v --voltage 1) Bits 3-0: 0000B --->(12v ---voltage 2) Byte 2 and Byte 3: 1200W =4B0H byte 2 (LSB) = B0h =176d byte 3 (MSB) =04h = 04d		
121	79	3 Bytes Sequence	32	20
122	7A	In Decimal = 32d, 176d, 04d	176	B0
123	7B	In Hex = 20h,B0h,04h	4	04

DS1200-3-004 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		5VSB OUTPUT RECORD HEADER		
143 144 154 146 147	8F 90 91 92 93	Record type = 01 for DC Output Record End of List /Record Format Version Number for 5VSB Output Record Record Length of 5VSB Output Record Record CHECKSUM of 5VSB Output Record (Zero CHECKSUM) (256-(sum of bytes 148 to 160) Header CHECKSUM of 5VSB Output Record Header (Zero CHECKSUM) (256-(sum of bytes 143 to 146)	1 2 13 169 71	01 02 0D A9 47
		5VSB OUTPUT RECORD		
  149 150	 95 96	**Nominal Voltage (10mV),** (5.0V / 10mV) 5000 = 01F4h 2 Bytes Sequence In Decimal: 244, 001 In Hex: F4h, 01h	 244 1	 F4 01
  151 152	 97 98	**Maximum Negative Voltage Deviation (10mV),** (4.75V/10mV) 475 = 01DBh 2 Bytes Sequence In Decimal: 219, 001 In Hex: DBh, 01h	 219 1	 0B 01
  153 154	 99 9A	**Maximum Positive Voltage Deviation (10mV),** (5.25V/ 10mV) 525 = 020Dh 2 Bytes Sequence In Decimal: 013, 002 In Hex: 0DH, 02H	 13 2	 0D 02
  159 160	 9F A0	**Maximum Current Draw (10mA),** (4.0A / 10mA) 400 = 0190H 2 Bytes Sequence In Decimal: 144, 001 In Hex: 90H, 01H	 144 1	 90 01

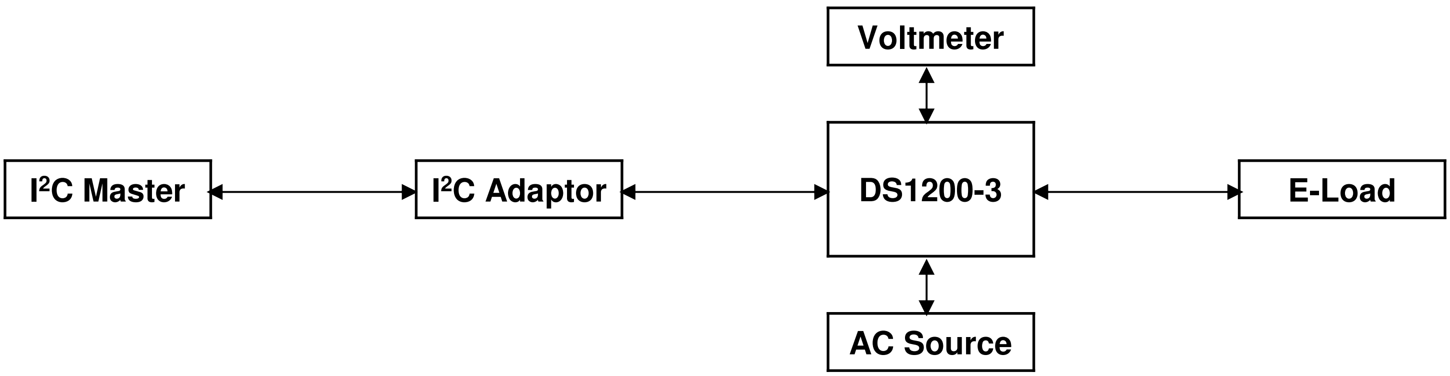
PMBus™ Interface Support

The DS1200-3 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I^{2}C interface port.

DS1200-3 Series PMBus™ General Instructions

Equipment Setup

The following is typical I^{2}C communication setup:



PMBus™ Writing Instructions

When writing to any PMBus™ R/W registers, ALWAYS do the following:

Disable Write Protect (command 10h) by writing any of the following accordingly:

Levels: 00h – Enable writing to all writeable commands

20h – Disables write except 10h, 01h, 00h, 02h and 21h commands

40h – Disables write except 10h, 01h, and 00h commends

80h – Disable write except 0x00h

To save changes on the USER PMBus™ Table:

Use send byte command: 15h STORE_USER_ALL

To save changes on the DEFAULT PMBus™ Table:

Use send byte command: 11h STORE_DEFAULT_ALL

Wait for 5 seconds, turn-off the PSU, wait for another 5 seconds before turning it on.

DS1200-3 Series Support PMBus™ Command List

The DS1200-3 is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the i²C interface port.

DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
01h	OPERATION	80	R/W	1		Used to turn the unit ON/OFF in conjunction with the input PS_ON pin.
	b7:6	10b				00 – Immediate Turn OFF (No Sequencing) 01 – Soft Turn OFF (With Sequencing) 10 – PSU ON
	b5:4	00b				
	b3:2	00b				
	b1:0	00b				Reserved
02h	ON_OFF_CONFIG	1C	R	1		Configures the combination of PS_ON pin and serial communication commands needed to turn the unit ON/OFF.
	b7:5	000				Reserved
	b4 – Enable PS_ON pin and Serial communication control.	1				0 – Unit powers up any time power is present regardless of the state of PS_ON pin. 1 – Unit powers up as dictated by PS_ON pin and OPERATION command (b3:0) .
	b3 – Serial communication Control	1				0 – Unit Ignores ON/OFF portion of the OPERATION command. 1 – Enables Serial communication ON/OFF portion of OPERATION command. Requires PS_ON pin to be asserted for the unit to start and energize the output.
	b2 – Sets how the unit responds to PS_ON pin	1				0 – Unit ignores PS_ON pin. (ON/OFF controlled by OPERATION command). 1 – Unit requires PS_ON pin to be asserted to start the unit.
	b1 – PS_ON pin polarity	0				0 – Active Low (Pull Low to start the unit). 1 – Active high (Pull high to start the unit).
	b0 – PS_ONL pin action	0				0 – Use programmed turn ON/OFF delay. 1 – Turn OFF the output and stop transferring energy to the output as fast as possible.
03h	CLEAR_FAULTS	0	S			
10h	WRITE_PROTECT	00	R/W	1		Used to Control Writing to the PMBus Device 80h - Disables write except 10h 40h – Disables write except 10h, 01h, 00h 20h – Disables write except 10h,01h,00h,02h and 21h commands 00 – Enables write to all writeable commands.
11h	STORE_DEFAULT_ALL	-	S	0		Copies the Value of the Operating memory table to the matching DEFAULT non-volatile memory.
12h	RESTORE_DEFAULT_ALL	-	S	0		Copies the entire contents of the DEFAULT non-volatile memory to the Operating memory table.
15h	STORE_USER_ALL	-	S	0		Copies the Operating memory table to the matching USER non-volatile memory.
16h	RESTORE_USER_ALL	-	S	0		Copies the entire USER non-volatile memory to the Operating memory table.

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
19h	CAPABILITY	00	R	1		Provides a way for the hosts system to determine some key capabilities of a PMBus™ device.
	b7 - Packet Error Checking	0				0 - PEC not supported 1 - PEC supported
	b6 - Maximum Bus Speed	1				0 - Maximum supported bus speed, 100khz 1 - Maximum supported bus speed, 400khz
	b5 - SMBALERT#	0				0 – SMBus Alert Pin *not supported* 1 – SMBus Alert Pin *supported*
	b4:0	00000				Reserved
20h	VOUT_MODE	40	R	1		Specifies the mode and parameters of Output Voltage related Data Formats
21h	VOUT_COMMAND	B004	R/W	2	Direct	Sets the Output Voltage Reference Vout command sends discreet value to change or trim output voltage. The value acts as Digital reference of the Power supply after additional operations are performed (to make the representation compatible). Affects OVP_WARNING and FAULT LIMIT, as well as POWER_GOOD_ON/OFF level.
22h	VOUT_TRIM	0000	R/W	2		0
23h	VOUT_CAL_OFFSET	XXXX	R/W	2		Variable. Used by Factory to trim Vout Default before trimming, 0000.
24h	VOUT_MAX	6405	R	2	Direct	Sets the max adjustable output voltage limit. 13.8V.
30h	COEFFICIENTS		BR	6		Use to retrieve the m, b and R coefficients, needed for DIRECT data format
	byte 0:1	0501				m low Byte, m high byte
	byte 2:3	0000				b low Byte, b high byte
	byte 4:5	0002				R byte
31h	POUT_MAX	070B	R	2	Linear	Sets the operating power limit condition. 1550W
35h	VIN_ON	C0EA	R	2	Linear	Sets the value of input, in volts, at which the unit should start. ACGOOD 88Vac
36h	VIN_OFF	9EF8	R	2	Linear	Sets the value of input, in volts, at which the unit should stop power conversion. ACBAD 79Vac
38h	IOUT_CAL_GAIN	FF7F	R	2		The ratio of voltage across the Current Sense to actual current.
39h	IOUT_CAL_OFFSET	0000	R	2		Used to null any offsets in the current sensing circuit. Normally used in conjunction with the IOUT_SCALE to minimize current sensing error.

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
3Ah	FAN_ CONFIG_1_2	90	R	1		Used to configure up to 2 fans associated with one PMBus device
	b7	1				1 – Fan is installed in position 1 0 – No Fan is installed in position 1
	b6	0				1 – Fan is commanded in RPM 0 – Fan is commanded in DC
	b5:4	01				00 – 1 pulse per revolution 01 – 2 pulses per revolution 10 – 3 pulses per revolution 11 – 4 pulses per revolution
	b3	0				1 – Fan is installed in position 2 0 – No Fan is installed in position 2
	b2	0				1 – Fan is commanded in RPM 0 – Fan is commanded in DC
	b1:0	00				00 – 1 pulse per revolution 01 – 2 pulses per revolution 10 – 3 pulses per revolution 11 – 4 pulses per revolution
3Bh	FAN_COMMAND_1	6400	R/W	2	Direct	Adjusts the operation of the Fans. The device may override the command, if it requires higher value, to maintain proper device temperature. RPM Control – Commands Speeds from 0-65535 RPM. Duty cycle Control – Commands Speeds from 0 to 100%
40h	VOUT_OV_FAULT_LIMIT	6405	R/W	2	Direct	Sets Output Over voltage threshold. (13.8V)
41h	VOUT_OV_FAULT_RESPONSE	80	R	1		Unit Latches OFF. Resets on PSON or CONTROL pin recycle or AC recycle.
42h	VOUT_OV_WARN_LIMIT	1405	R/W	2	Direct	Sets Over-voltage Warning threshold. (13V)
43h	VOUT_UV_WARN_LIMIT	4C04	R/W	2	Direct	Sets Under-voltage Warning threshold. (11V)
44h	VOUT_UV_FAULT_LIMIT	FC03	R/W	2	Direct	Sets Under-voltage Fault threshold. (10.2V)
45h	VOUT_UV_FAULT_RESPONSE	80	R	1		Turn PSU OFF
46h	IOUT_OC_FAULT_LIMIT	D430 High 4826 Low	R	2	Direct	Sets the Over current threshold in Amps. (125A for Hi Line and 98A for Low Line)
47h	IOUT_OC_FAULT_RESPONSE	C0	R	1		OCP ride through. If OCP persists.
4Ah	IOUT_OC_WARN_LIMIT	C02B high 6022 Low	R	2	Direct	Sets the Over Current Warning threshold in Amps. (112A for Hi Line and 88A for Low Line)
4Fh	OT_FAULT_LIMIT	A816	R	2	Direct	Secondary ambient temperature Fault threshold, in degree C. (58degC)
50h	OT_FAULT_RESPONSE	B8	R	1		Turn PSU OFF and will retry indefinitely
51h	OT_WARN_LIMIT	70E3	R	2	Direct	Secondary ambient temperature warning threshold, in degree C. Operating limit. refer to section 3.1. (55 degC)
55h	VIN_OV_FAULT_LIMIT	26FA	R	2	Linear	Sets input over-voltage threshold. (275Vac)
56h	VIN_OV_FAULT_RESPONSE	00	R	1		No interruption.
57h	VIN_OV_WARN_LIMIT	26FA	R	2	Linear	Sets the threshold of input voltage that triggers high voltage warning. (275Vac)
58h	VIN_UV_WARN_LIMIT	90EA	R	2	Linear	(82Vac)
59h	VIN_UV_FAULT_LIMIT	80EA	R	2	Linear	(80Vac)
5Ah	VIN_UV_FAULT_RESPONSE	00	R	1		
5Bh	IIN_OC_FAULT_LIMIT	40D3	R	2	Linear	Sets the threshold for input current that causes over-current fault within 100ms. (13A)

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
5Ch	IIN-OC-FAULT_RESPONSE	00	R	1		Turn PSU OFF. cleared upon AC recycle.
5Eh	POWER_GOOD_ON	9804	R	2	Direct	Sets the threshold by which the Power Good signal is asserted. (11.76V)
5Fh	POWER_GOOD_OFF	FC03	R	2	Direct	Sets the threshold by which the Power Good signal is de-asserted. (10.2V)
60h	TON_DELAY	C300	R	2	Direct	Sets the time (sec), from start condition (Power ON) until the output starts to rise. (2sec)
61h	TON_RISE	8813	R	2	Direct	Sets the time (ms), for the output rises from 0 to regulation. (50ms)
64h	TOFF_DELAY	FC08	R	2	Direct	Sets the time (ms), from a stop condition (Power OFF) until the output starts to drop (converter OFF).(23ms)
78h	STATUS_BYTE		R	1		Returns the summary of critical faults
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under--voltage fault has occurred
	b2 - TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE OF THE ABOVE					A Fault Warning not listed in bits[7:1] has occurred.
79h	STATUS_WORD		R	2		Summary of units Fault and warning status.
	b15 – VOUT					An output voltage fault or warning has occurred
	b14 – IOUT/POUT					An Output current or power fault or warning has occurred.
	b13 – INPUT					An input voltage, current or power fault or warning as occurred.
	b12 – MFR					A manufacturer specific fault or warning has occurred.
	b11 – POWER_GOOD#					The POWER_GOOD signal is de-asserted
	b10 - FANS					A fan or airflow fault or warning has occurred.
	b9 – OTHER					A bit in STATUS_OTHER is set.
	b8 – UKNOWN					A fault type not given in bits [15:1] of the STATUS_WORD has been detected.
	b7 – BUSY					A fault was declared because the device was busy and unable to respond.
	b6 – OFF					Unit is OFF
	b5 – VOUT_OV					Output over-voltage fault has occurred
	b4 – IOUT_OC					Output over-current fault has occurred
	b3 - VIN_UV					An input under-voltage fault has occurred
	b2 – TEMPERATURE					A temperature fault or warning has occurred
	b1 – CML					A communication, memory or logic fault has occurred.
	b0 – NONE_OF_THE_ABOVE					A fault or warning not listed in bits[7:1] of this byte has occurred.

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Ah	STATUS_VOUT	-	R	1		Output voltage related faults and warnings
	b7					VOUT Over--voltage Fault
	b6					VOUT Over-voltage warning
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved
7Bh	STATUS_IOUT		R	1		Output Current related faults and warnings
	b7					IOUT Over current Fault
	b6					IOUT Over current And Low Voltage shutdown Fault
	b5					VOUT Under-voltage Warning
	b4					VOUT Under-voltage Fault
	b3					VOUT_MAX Warning, an attempt has been made to set output to a value higher that the highest permissible voltage.
	b2					TON_MAX_FAULT
	b1					TOFF_MAX Warning
	b0					reserved
7Ch	STATUS_INPUT	-	R	1		Input related faults and warnings
	b7					VIN Overvoltage Fault
	b6					VIN Overvoltge Warning
	b5					VIN Undervoltage Warning
	b4					VIN Undervoltage Fault
	b3					Unit is OFF for insufficient Input Voltage
	b2					IIN Overcurrent Fault
	b1					IIN Overcurrent Warning
	b0					PIN overpower Warning
7Dh	STATUS_TEMPERATURE	-	R	1		Temperature related faults and warnings
	b7					Overtemperature Fault
	b6					Overtemperature Warning
	b5					Undertemperature Warning
	b4					Undertemperature Fault
	b3:0					reserved
7Eh	STATUS_CML	-	R	1		Communications, Logic and Memory
	b7					Invalid or unsupported Command Received
	b6					
	b5					Packet Error Check Failed
	b4					Memory Fault Detect, CRC Error
	b3					
	b2					
	b1					
	b0					

DS1200-3 Series Supported PMBus^{TM} Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
80h	STATUS_MFR_SPECIFIC	-	R	1		Manufacturer Status codes
	b7					Bulk OK, 1- Bulk is within range and is ready for use
	b6					Not Used
	b5					Not Used
	b4					Not Used
	b3					Not Uesd
	b2					Not Uesd
	b1					Standby Fault, 1 If there's a standby fault.
	b0					PS_ON Pin Status 1 – asserted, 0 - deasserted
81h	STATUS_FANS_1_2	-	R	1		
	b7					Fan 1 Fault
	b6					Fan 2 Fault
	b5					Fan 1 Warning
	b4					Fan 2 Warning
	b3					Fan_1 Speed Overridden
	b2					Fan_2 Speed Overridden
	b1					
	b0					
88h	READ_VIN	-	R	2	Linear	Returns input Voltage in Volts ac.
89h	READ_IIN	-	R	2	Linear	Returns input Current in Amperes
8Ah	READ_VCAP	-	R	2	Linear	Returns Bulk Capacitor voltage in Volts
8Bh	READ_VOUT	-	R	2	Direct	Returns the actual, measured voltage in Volts.
8Ch	READ_IOUT	-	R	2	Direct	Returns the output current in amperes.
8Eh	READ_TEMPERATURE_2	-	R	2	Direct	PSU Air inlet temp (inside PSU)
90h	READ_FAN_SPEED_1	-	R	2	Linear	Speed of Fan 1
96h	READ_POUT	-	R	2	Linear	Returns the output power, in Watts.
97h	READ_PIN	-	R	2	Linear	Returns the input power, in Watts.
98h	PMBUS_REVISION	11	R	1		Reads the PMBus revision number
	b7:5	0001				Part 1 Revision 0000 – Revision 1.0 0001 – Revision 1.1
	b4:0	0001				Part 2 Revision0000 – Revision 1.00001 – Revision 1.1
99h	MFR_ID	"ALL"	BR, ASCII	4		Abbrev or symbol of manufacturers name.
9Ah	MFR_MODEL	"DS1200-3"	BR, ASCII	8		Manufacturers Model number, ASCII format
9Bh	MFR_REVISION	"1.0"	BR, ASCII	3		Manufacturers, revision number, ASCII format
9Ch	MFR_LOCATION	"xxx"	BR, ASCII	4		Manufacturers facility, ASCII format
9Dh	MFR_Data	"xxxxxxx"	BR	7		Manufacture Date, ASCII format structure : YYMMDD
9Eh	MFR_Serial	"xxxxxxxxxxxxx"	BR	13		Unit serial number, ASCII format.
A0h	MFR_VIN_MIN	B4F8	R	2	Linear	Minimum Input Voltage (90Vac)
A1h	MFR_VIN_MAX	10FA	R	2	Linear	Maximum Input Voltage (264Vac)
A2h	MFR_IIN_MAX	18F8	R	2	Linear	Maximum Input Current (12A)

DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
A3	MFR_PIN_MAX	A20A^{HI} 4C0A^{LO}			Linear	Maximum Input Power (1348W for High Line and 1176W for Low Line)
A4h	MFR_VOUT_MIN	7404	R	2	Direct	Minimum Output Voltage Regulation Window. (11.4V)
A5h	MFR_VOUT_MAX	EC04	R	2	Direct	Maximum Output Voltage. Regulation Window (12.6V)
A6h	MFR_IOUT_MAX	7026^{HI} E01F^{LO}	R	2	Direct	Maximum Output Current (98.4A for High Line and 81.6 for Low Line)
A7h	MFR_POUT_MAX	580A^{HI} E803^{LO}	R	2	Linear	Maximum Output Power (1200W for High Line and 1000 For Low Line)
A8h	MFR_TAMBIENT_MAX	8813	R	2	Direct	Maximum Operating Ambient Temperature (Secondary Ambient) (50 degC)
A9h	MFR_TAMBIENT_MIN	0000	R	2	Direct	Minimum Operating Ambient Temperature (Secondary Ambient) (0 degC)
D1h	STBY_UV	C409	R	2	Direct	Standby Under-voltage Level (2.5V, For conversion decimal value should be multiplied by 10, eg. 2.5V x10 = 25V = 09C4hex)
D2h	Min Fan Speed	3923	R	2	L	Standby Fan Speed, (13200 rpm / 20% Duty Cycle)
D3h	Max Fan Speed	5832	R	2	L	Normal operation Fan Speed (38400 rpm / 100% Duty Cycle)
E2h	Ishare Offset		R/W	2		Variable. Used by Factory to trim Ishare Voltage Offset. Default before tirmming, 0000
E3h	Ishare Slope		R/W	2		Variable. Used by Factory to trim Ishare Voltage Slope. Default before tirmming, FF7F
EAh	ENTER_BOOTLOAD		W	2		
EEh	FIRMWARE_VERSION		BR	11	ASCII	
EFh	I/O_EXPANDER		R	1		See Section 5.24.6 – Power Supply Status Register
F0h	MFR_PASSWORD		W	2		
F1h	MFR_DATE_WRITE		BW	6	-	
F2h	MFR_SERIAL_WRITE		BW	13	-	
D0h	Fault Register		R	2		Summary of units Fault and warning status.
	b15 – 12Vout_sckt					An output short circuit fault has occurred.
	b14 – 12Vout_ocw					+12V Over Current Warning Flag
	b13 – 12Vout_ocp2					+12V Fast OCP (High Level OCP) fault occurred (1ms)
	b12 – 12Vout_ocp					+12V Normal OCP fault occurred (1sec).
	b11 – 12Vout_ovp2					+12V Second level OVP fault occurred.
	b10 - 12Vout_ovp					+12V OVP fault occurred.
	b9 – 12Vout_uvp					+12V UVP fault occurred.
	b8 – NA					Not Used
	b7 – NA					Not Used
	b6 – Ocp_ride_through_flag					PSU is in 1second ride-through because +12V OCP level is reached.
	b5 – stby_uvp					Standby UVP fault occurred.
	b4 – fanfail					A fan or airflow fault or warning has occurred.
	b3 – otp_secondary					Secondary OTP (Ambient) fault occurred.
	b2 – otp_primary					Primary OTP fault occurred.
	b1 – PwrLimit_Enabled.					PSU is on Derated Output Power
	b0 – Save Last Known State IFF "1" - default "0"					Saves Last Known Fault that Occurred. Under Development

DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
F7h	Calibration Register		R	1		PSU is Calibrated and Passed all Functional Tests
	b7 – PSU Calibrated and Tested					Bit is set if PSU Calibrated and has Passed all Functional Tests. This is to ensure that all PSUs exiting the factory have been calibrated.
	b6 – NA					Not Used
	b5 – NA					Not Used
	b4 – NA					Not Used
	b3 - NA					Not Used
	b2 - NA					Not Used
	b1 – NA					Not Used
	b0 – NA					Not Used

Redundancy / Fault Tolerance

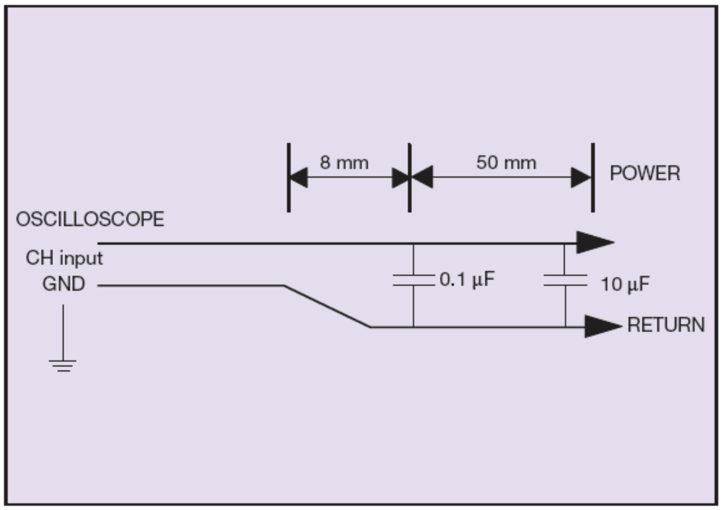
The DS1200-3 series power supplies will allow up to 4 power supplies to be connected in an N+1 redundant load.

Any failure of one power supply in parallel as well as hot swapping shall not cause more than a 5% change in any output. Current share accuracy is typically 5% of full load. The Failure of one or more supplies will not cause the remaining supplies to violate any of the input or output specifications noted in this specification including all status signals.

The latch of the DS1200-3 power supply is designed to prevent the latch from depressed if the AC cord is attached to the power supply. In order to remove the power supply from system chassis, the AC cord must be removed first so the power supply will always be in the powered off state during the removal from system chassis.

Output Ripple and Noise Measurement

The setup outlined in the diagram below has been used for output voltage ripple and noise measurements on the DS1200-3 Series. When measuring output ripple and noise, a scope jack in parallel with a 0.1uF ceramic chip capacitor, and a 10 uF aluminum electrolytic capacitor should be used. Oscilloscope should be set to 20 MHz bandwidth for this measurement.



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