TECHNICAL REFERENCE NOTE

ARTESYN DS1200 SERIES

1200 Watts Distributed Power System

PRODUCT DESCRIPTION

Advanced Energy's Artesyn DS1200 series is Artesyn Embedded Power' high power, high density bulk front end AC-DC power supply in the industry standard 1U x 2U form factor. It accepts a wide range 90 to 264Vac input and provides a main 12V output plus a 3.3V or optional 5.5V standby output. Rated at 1200 watts, it has a high half-load efficiency of 91%. Housed in an industry standard 1U x 2U rack-mounting package, the power supply is designed for servers and similar space-constrained applications. This series comes in two airflow versions – dc-connector to ac-connector and vice versa.

AT A GLANCE

Total Power:

1000 to 1200 Watts

Input Voltage:

90 to 264 Vac

# of Outputs:

Main and Standby

SPECIAL FEATURES

- Active AC inrush control
- 1U x 2U form factor
- No minimum load required
- Internal OR'ing fets
- EN61000-3-2 harmonic compliance
- 21.71W/in^3
- +12Vdc output
- +3.3Vdc (+5Vdc) stand-by
- Internal fan speed control
- Full digital control
- N+1 redundant
- Internal OR'ing fets
- Hot plug operation
- Active current sharing (10% to 100% load)
- PMBus™ compliant
- EEPROM for FRU data
- Two years warranty
- INTEL, SSI Std. logic timing
- INTEL, SSI Std. FRU data format

SAFETY

- UL/cUL62368 (UL Recognized)
- NEMKO + CB Report EN60950
- EN62368
- CE Mark
- China CCC
- UKCA Mark

TYPICAL APPLICATIONS

- Industrial

MODEL NUMBERS

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

Options

None

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	Models	Symbol	Min	Typ	Max	Unit
Input Voltage AC continuous operation	All models	$V_{IN,AC}$	90	-	264	Vac
Maximum Output Power (Main + Stand-by) $V_{IN,AC}$ ≤ 180Vac $V_{IN,AC}$ > 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		 - - -	 - - -	 2121 2121 500	 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	°C °C °C °C
Storage Temperature	All models	T_{STG}	-40	-	85	°C
Humidity (non-condensing) Operating Non-operating	 All models All models		 20 10	 - -	 90 95	 % %
Altitude Operating Non-operating	 All models All models		 - -	 - -	 10000 30000	 Feet Feet

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

ELECTRICAL SPECIFICATIONS

Input Specifications

Table 2. Input Specifications

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, AC	All	$V_{IN,AC}$	90	115/230	264	Vac
Input Vac Source Frequency		$f_{IN,AC}$	47	50/60	63	Hz
Maximum Input Current ($I_O = I_{O,max}$, $I_{SB} = I_{SB,Max}$)	$V_{IN,AC}$ = 90Vac	$I_{IN,max}$	-	-	15	A
Standby Input Current (V_O Off, I_{SB} = 0A)	$V_{IN,AC}$ = 90Vac $V_{IN,AC}$ = 180Vac	$I_{IN,standby}$	- -	- -	400 300	mA
No Load Input Current (V_O On, I_O = 0A, I_{SB} = 0A)	$V_{IN,AC}$ = 90Vac $V_{IN,AC}$ = 180Vac	I_{IN,no_load}	- -	- -	800 450	mA
Harmonic Line Currents	All	THD	Per IEC1000-3-2			
Power Factor	All		-	0.99	-	
Startup Surge Current (Inrush)[1] @ 25°C	$V_{IN,AC}$ = 264Vac	$I_{IN,surge}$	-	-	40	A
Input Fuse	Internal, L and N 5x20mm, Quick Acting 16A, 250V		-	-	16	A
Leakage Current to Earth Ground	$V_{IN,AC}$ = 240Vac $f_{IN,AC}$ = 50/60Hz		-	-	1.4	mA
Operating Efficiency @ 25°C	$I_O = I_{O,max}$ $V_{IN,AC}$ = 100Vac $V_{IN,AC}$ = 200Vac	η	85 89	- -	- -	% %
System Stability Phase Margin Gain Margin			 45 6	 - -	 - -	 ∅ dB

ELECTRICAL SPECIFICATIONS

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_{SB}	3.13	3.30	3.47	V
	DS1200-3-002 DS1200-3-004		V_{SB}	4.75	5.00	5.25	V
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 DS1200-3-002 DS1200-3-003 DS1200-3-004		V_{SB}	-	-	50	mV_{PK-PK}
Output Current	All models	$V_{I,AC} \leq 180Vac$ $V_{I,AC} > 180Vac$	I_O	0 0	- -	81.7 98.4	A
	DS1200-3 DS1200-3-003		I_{SB}	0.5	-	6.0	A
	DS1200-3-002 DS1200-3-004		I_{SB}	0.5	-	4.0	A
V_O Current Share Accuracy		40% to 100% I_O 10% to 40% I_O		- -	- -	5 20	$\%I_O$
Minimum Current Sharing Loading				10	-	-	$\%I_{O,max}$
Number of Parallel Units[1]		Main output current share connected		4	-	-	
Main Output Load Capacitance		Start up	C_O	0	-	100	uF/A
Main Output Dynamic Response[2] Peak Deviation Settling Time		50% load change Slew rate = 1A/us	$\pm\%V_O$ T_S	- -	- -	5 -	% mSec
Main Output Long Term Stability (Max change over 24 hours)		After thermal equilibrium (30mins)	$\pm\%V_O$	-	-	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.
Note 2 - Recommend to test with 4700uF capacitive load at the V_O output and 470uF at V_{SB} output.

ELECTRICAL SPECIFICATIONS

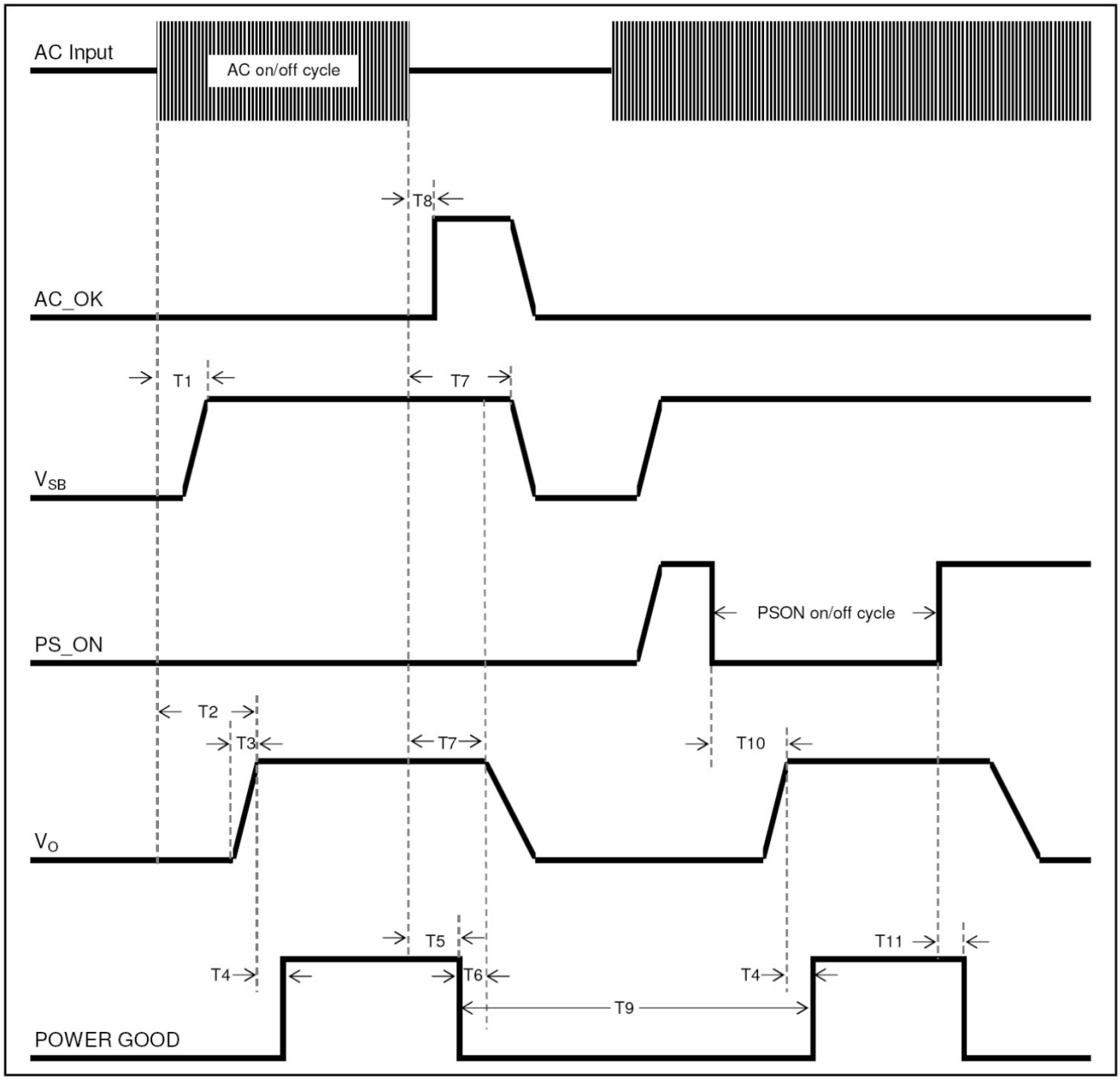
System Timing Specifications

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 high	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

ELECTRICAL SPECIFICATIONS

System Timing Diagram



ELECTRICAL SPECIFICATIONS

DS1200-3 Performance Curves

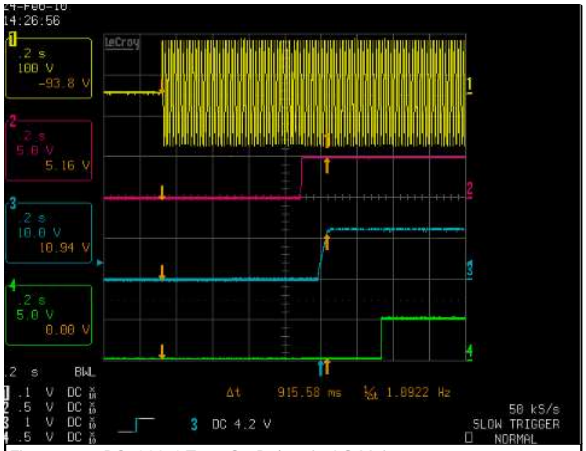


Figure 1: DS1200-3 Turn-On Delay via AC Mains
Vin = 90Vac Load: I_O = 81.7A I_{SB} = 4A (5V)
Ch 1: AC Mains Ch 2: V_{SB} Ch 3: V_O Ch 4: POWER GOOD

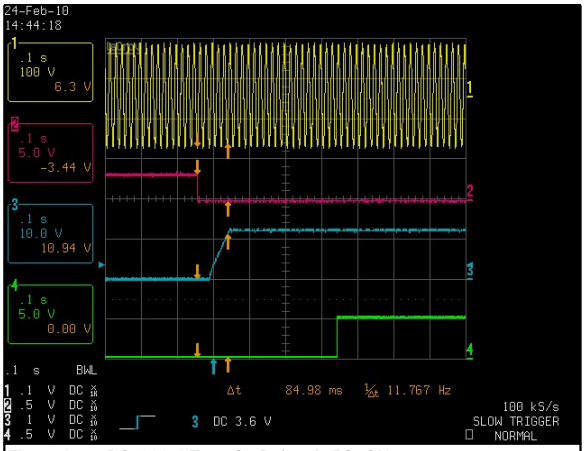


Figure 2: DS1200-3 Turn-On Delay via PS_ON
Vin = 90Vac Load: I_O = 81.7A I_{SB} = 4A (5V)
Ch 1: AC Mains Ch 2: PS_ON Ch 3: V_O Ch 4: POWER GOOD

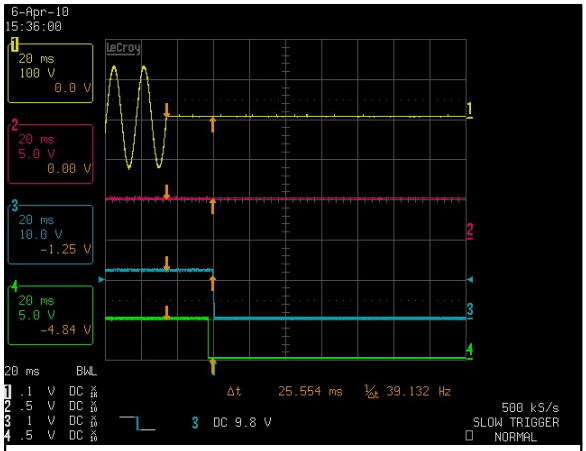


Figure 3: DS1200-3 Hold-up Time
Vin = 90Vac Load: I_O = 81.7A I_{SB} = 4A (5V)
Ch 1: AC Mains Ch 2: V_{SB} Ch 3: V_O Ch 4: POWER GOOD

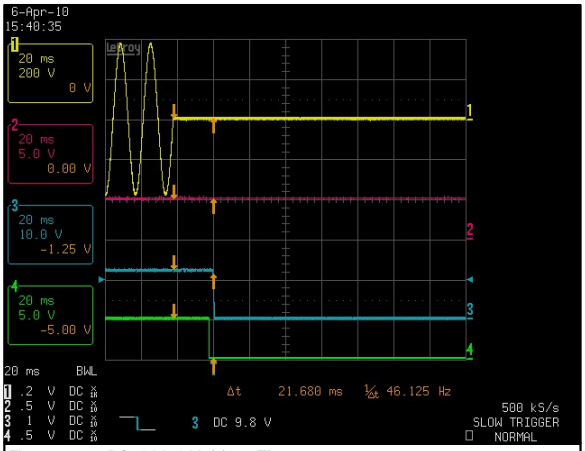


Figure 4: DS1200-3 Hold-up Time
Vin = 264Vac Load: Io = 81.7A I_{SB} = 4A (5V)
Ch 1: AC Mains Ch 2: V_{SB} Ch 3: V_O Ch 4: POWER GOOD

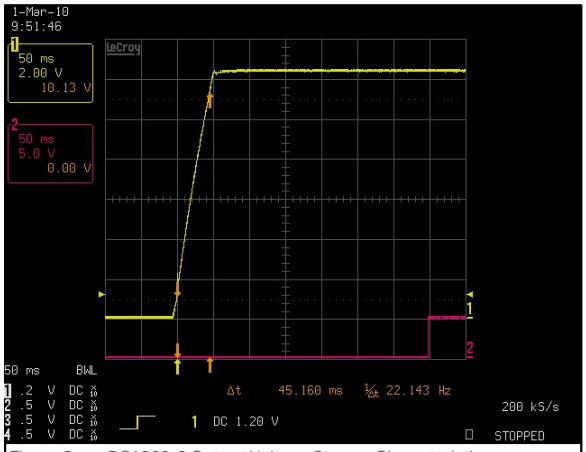


Figure 5: DS1200-3 Output Voltage Startup Characteristic
Vin = 90Vac Load: I_O = 81.7A I_{SB} = 4A (5V)
Ch 1: V_O Ch 2: POWER GOOD

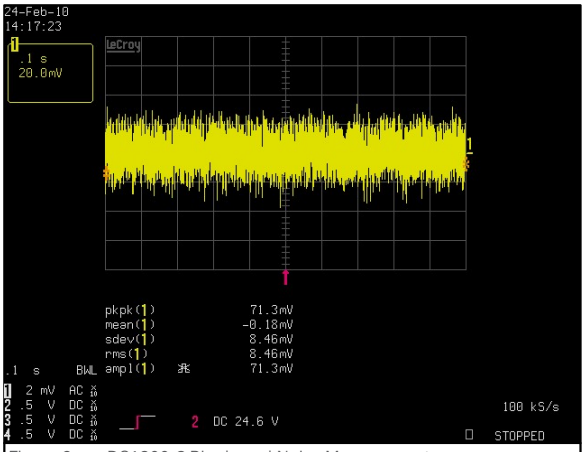


Figure 6: DS1200-3 Ripple and Noise Measurement
Vin = 90Vac Load: I_O = 81.7A I_{SB} = 4A (5V)
Ch 1: V_O

ELECTRICAL SPECIFICATIONS

DS1200-3 Performance Curves

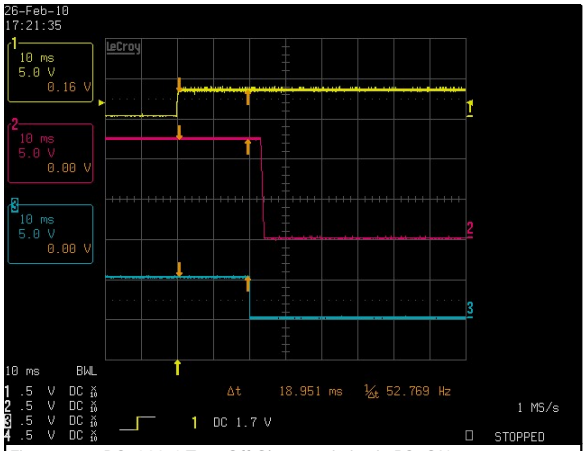


Figure 7: DS1200-3 Turn Off Characteristic via PS_ON
Load: I_O = 81.7A I_{SB} = 4A (5V)
Ch 1: PS_ON Ch 2: V_O Ch 3: POWER GOOD

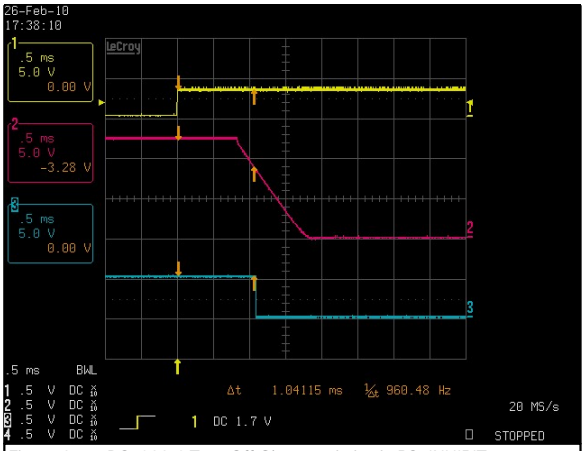


Figure 8: DS1200-3 Turn Off Characteristic via PS_INHIBIT
Load: I_O = 81.7A I_{SB} = 4A (5V)
Ch 1: PS_INHIBIT Ch 2: V_O Ch 3: POWER GOOD

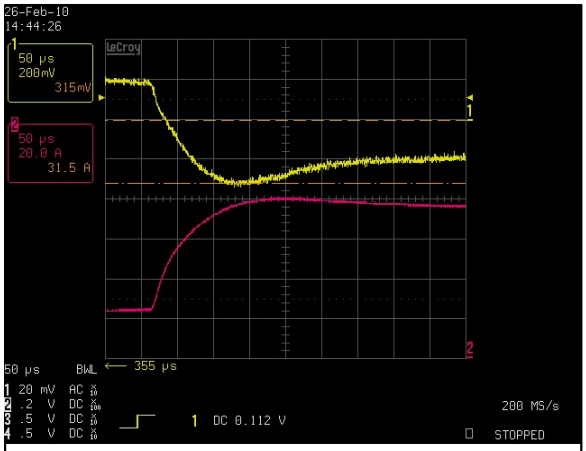


Figure 9: DS1200-3 Transient Response - V_O Deviation
25% to 75% load change 1A/uS slew rate Vin = 230Vac
Ch 1: V_O Ch 2: I_O

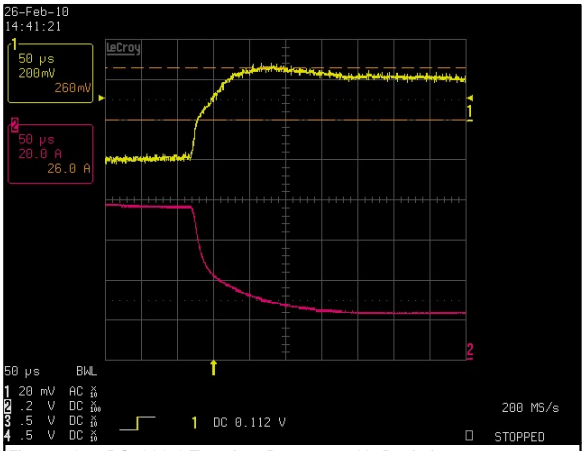


Figure 10: DS1200-3 Transient Response - V_O Deviation
75% to 25% load change 1A/uS slew rate Vin = 230Vac
Ch 1: V_O Ch 2: I_O

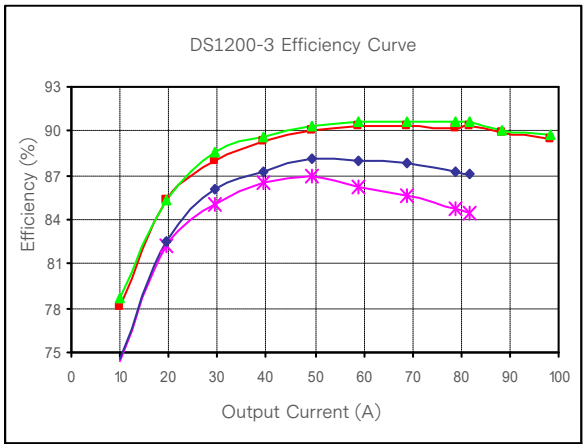


Figure 11: DS1200-3 Efficiency Curve @ 25°C
90Vac 115Vac 230Vac 264Vac
Loading: I_{o_main} = 81.7A = 10%$I_{o,max}$ increment to 98.4A, I_{SB} = 0A (5V)

ELECTRICAL SPECIFICATIONS

Protection Function Specifications

Input Fusing

DS1200-3 series is equipped with an internal non user serviceable 16A High Rupturing Capacity (HRC) 250Vac 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 V_{SB} Output Overvoltage	3.76	/	4.30	V
5V V_{SB} 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 power supply includes internal current limit circuitry to prevent damage in the event of overload or short circuit. Recovery must be 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	180-264Vac	118	/	147.6	A
	90-179Vac	98	/	122.4	A
3.3V V_{SB} Output Overvoltage	90-264Vac	6.6	/	9	A
5V V_{SB} Output Overvoltage	90-264Vac	4.4	/	6	A

ELECTRICAL SPECIFICATIONS

Short Circuit Protection (SCP)

The DS1200-3 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 0.1ohms.

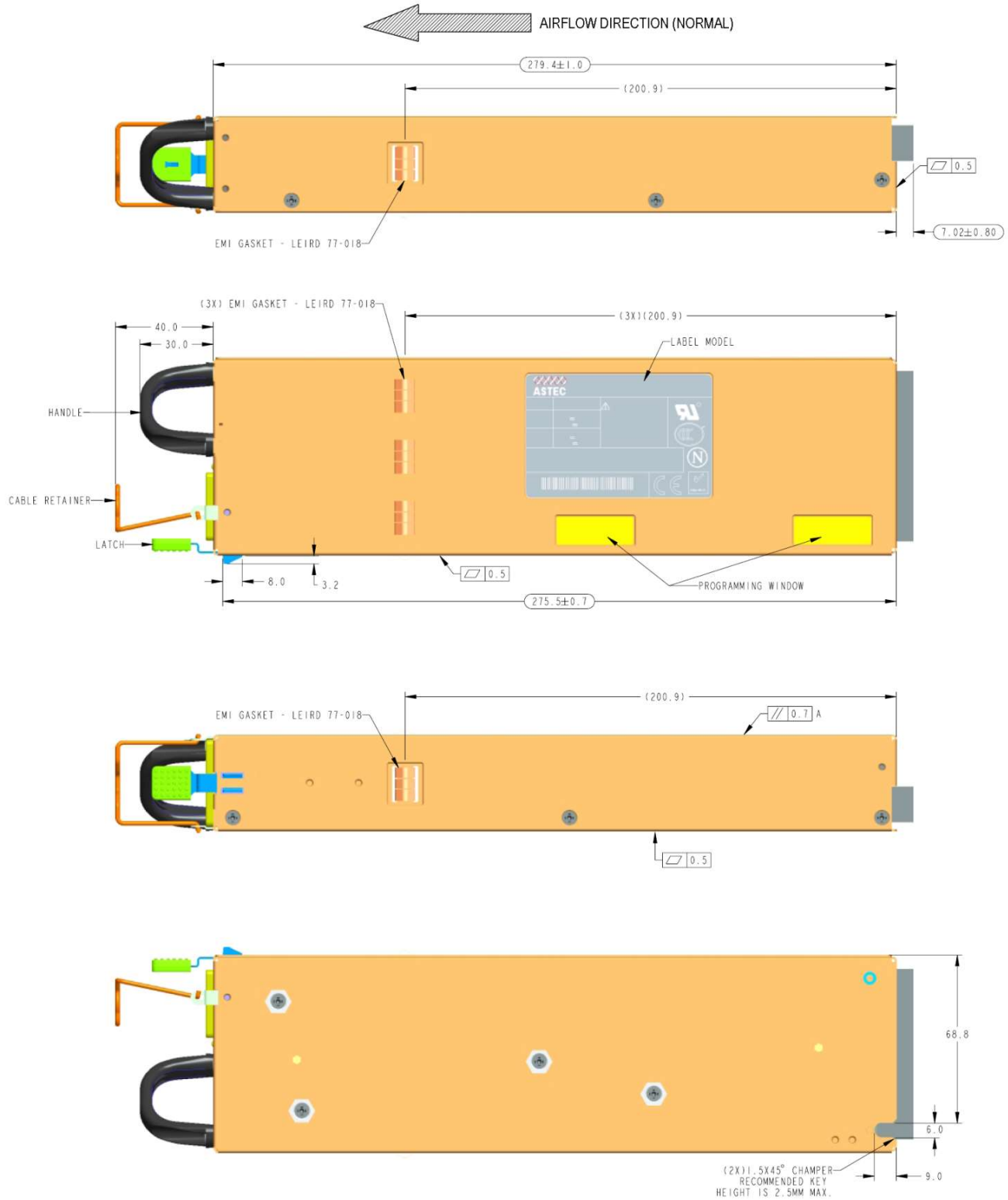
When the standby output V_{SB} is shorted the output will go into “hiccup mode”. When the V_{SB} attempts to restart, the maximum peak current from the V_{SB} output will be less than 9.0A peak (3.3V) or 6.6A (5.0V). The maximum average current, taking into account the “hiccup” duty cycle, is less than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



MECHANICAL SPECIFICATIONS

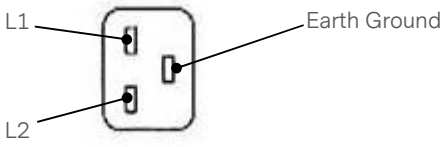
Connector Definitions

AC Input Connector

Pin 1 – L1

Pin 2 – L2

Pin 3 – Earth Ground



Output Connector - Power Blades

PB1 – Main Output Return

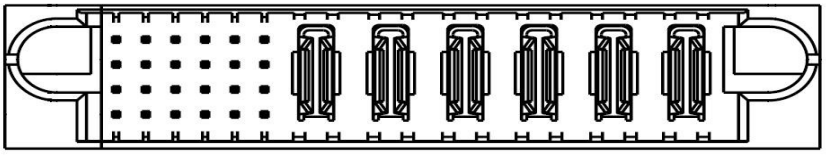
PB2 – Main Output Return

PB3 – Main Output Return

PB4 – +Main Output (V_O)

PB5 – +Main Output (V_O)

PB5 – +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

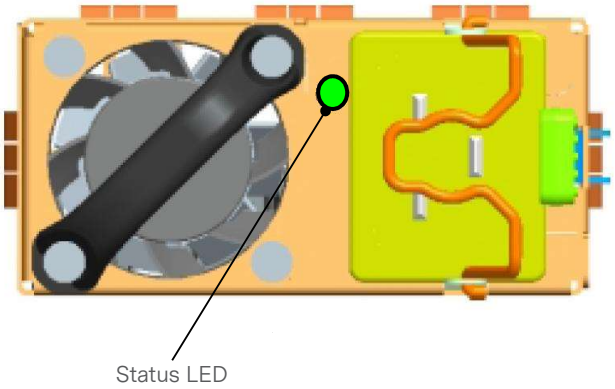
MECHANICAL SPECIFICATIONS

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

MECHANICAL SPECIFICATIONS

LED Indicator Definitions



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

Conditions	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

MECHANICAL SPECIFICATIONS

Weight

The DS1200-3 series power supply 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 Part 15 Subpart J Class B/ EN55022, Level B	Conducted and Radiated EMI Limits
EN61000-3-2	Harmonics
EN61000-3-3	Voltage Fluctuations
IEC/EN61000-4-2	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Electrostatic discharge immunity test: +/-15KV air, +/-8KV contact discharge. Performance - Criteria B
IEC/EN61000-4-3	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.
IEC/EN61000-4-4	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Electrical fast transient/burst immunity test: 2KV for AC power port. Performance - Criteria B 1KV for DC ports, I/O and signal ports. Performance - Criteria B
IEC/EN61000-4-5	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Surge test: 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/EN61000-4-11, Edition 1.1, 2001-04	Electromagnetic Compatibility (EMC) - Testing and measurement techniques - Voltage dips and interruptions: Criteria A: >95% reduction for 10mS; Criteria B: >30% reduction for 500mS, or Criteria C: >95% reduction for 500mS.
EN55024	Information Technology Equipment - Immunity Characteristics, Limits and Method of Measurements

ENVIRONMENTAL SPECIFICATIONS

Safety Certifications

The DS1200 series 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

Document	File #	Description
UL62368-1	E186249 V1 S284	US and Canada Requirements
IEC62368-1	392496	International Requirements
EN62368-1	P20224428	European Requirements
CB Certificate and Report	NO102924	(All CENELEC Countries)
CHINA CCC Approval	2009010907324565	China Requirements
UKCA Mark		UK Requirements

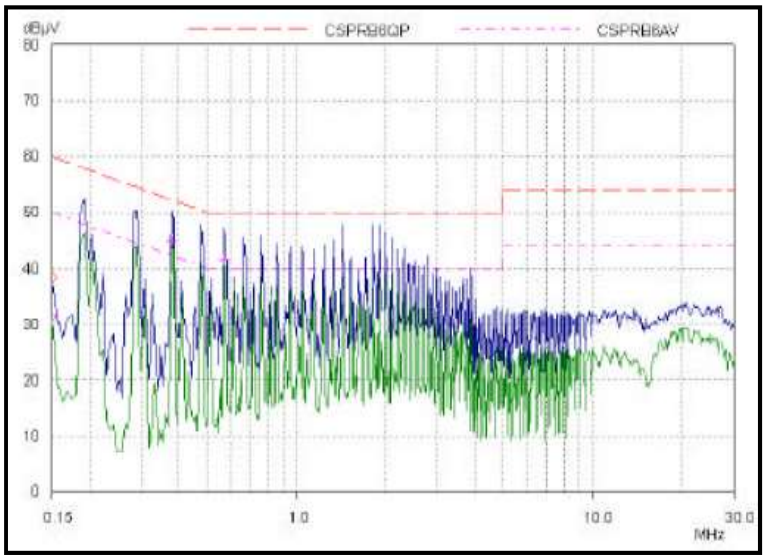
ENVIRONMENTAL SPECIFICATIONS

EMI Emissions

The DS1200 series has been designed to comply with the Class B limits of EMI requirements of EN55032 (FCC Part 15) and CISPR 22 (EN55032) for emissions and relevant sections of EN61000 (IEC61000) 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 EN55032 (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 f-ilters to ensure the convertors' conducted EMI levels comply with EN55032 (FCC Part 15) Class B and EN55032 (CISPR 22) Class B limits. The EMI measurements are performed with resistive loads at maximum rated loading.

Sample of EN55032 Conducted EMI Measurement at 100Vac input

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

Table 8. Conducted EMI Emission Specifications of The DS1200-3 Series Power Supply

Parameter	Model	Symbol	Min	Typ	Max	Unit
FCC Part 15, class B	All	Margin	6	-	-	dB
CISPR 22 (EN55032) class B	All	Margin	6	-	-	dB

ENVIRONMENTAL SPECIFICATIONS

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 EN55032 Class A (FCC Part 15). Testing AC-DC convertors as a stand-alone component to the exact requirements of EN55032 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.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature

The DS1200-3 series power supply will start and operate within stated specifications at an ambient temperature from -10^{O}C to 50 ^{O}C under all load conditions with internal fan. DS1200-3-002 can operate up to 70^{O}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)	
	110Vac	230Vac
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

ENVIRONMENTAL SPECIFICATIONS

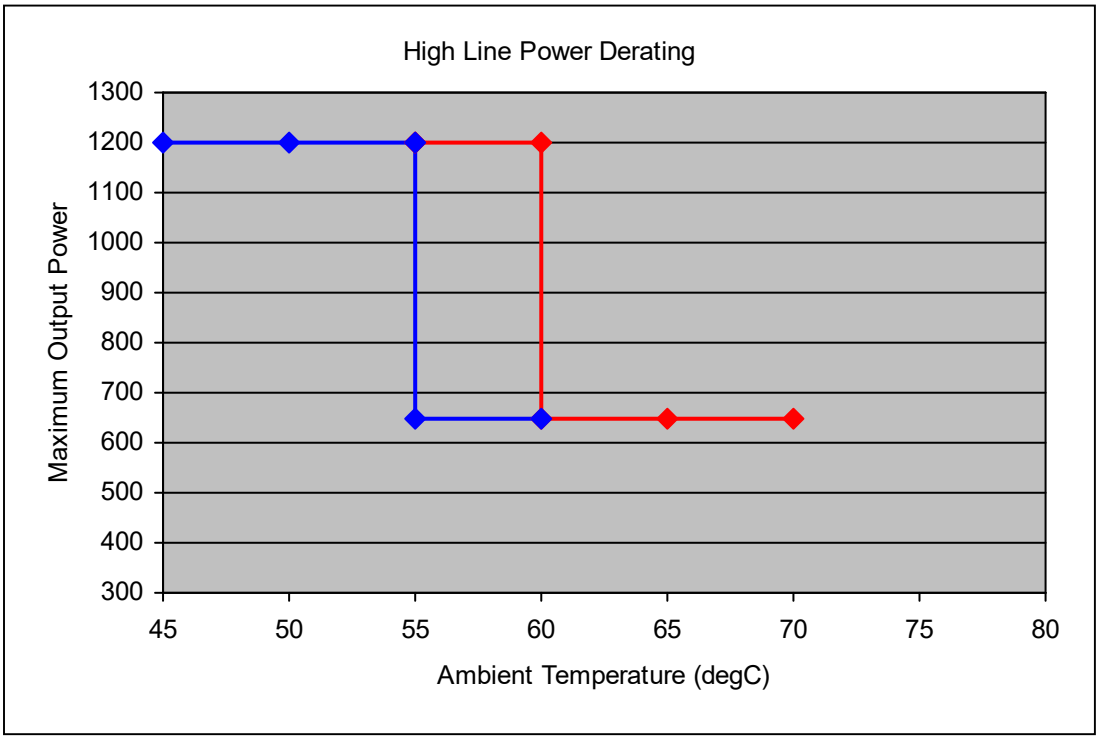
Power Derating Curves

DS1200-3-002 can operate up to a maximum ambient temperature of 70°C with derating. Power derating starts when ambient reaches 60°C. Beyond 60°C, 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 55°C, DS1200-3-002 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 > 60°C)
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

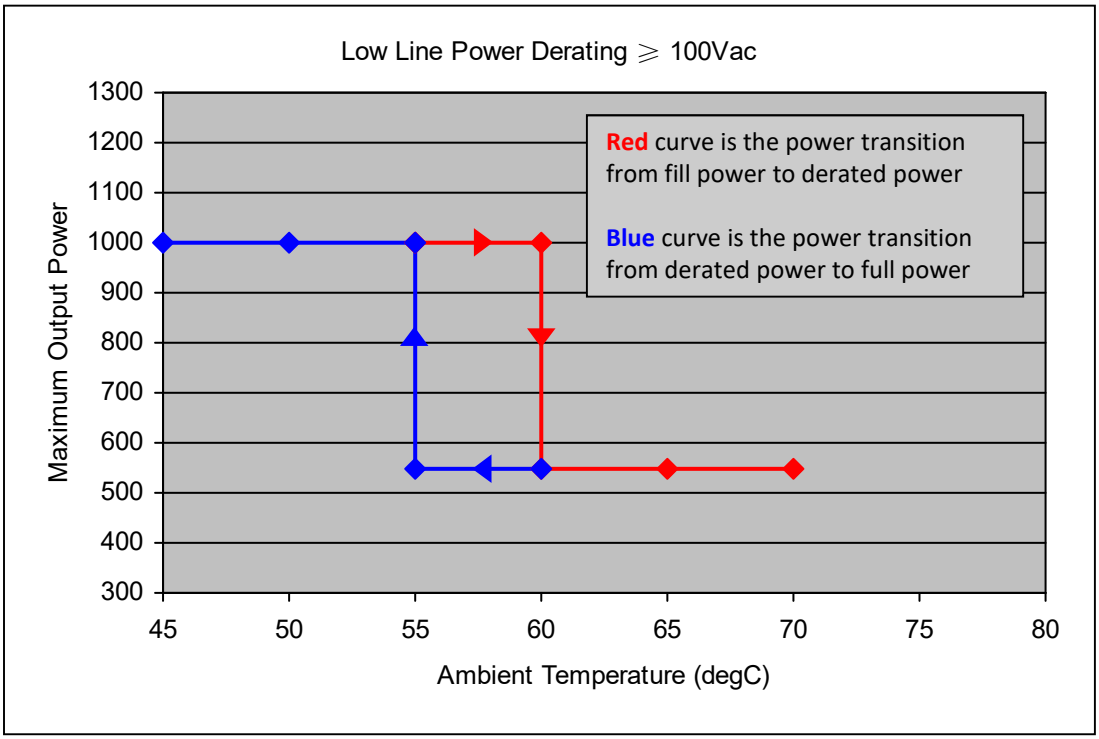
Output	Input AC line	OCP Limit (T_A > 60°C)
V_O Output	All	58A to 65A
3.3V Standby	All	4.4A to 9A
5V Standby	All	3A to 9A

High Line Power Derating Hysteresis



ENVIRONMENTAL SPECIFICATIONS

Low Line Power Derating Hysteresis[1]



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°C ambient temperature.

ENVIRONMENTAL SPECIFICATIONS

Storage and Shipping Temperature

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

Humidity

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

Vibration

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

Non-Operating Random Vibration

Acceleration	2.7		gRMS
Frequency Range	10 to 2000		Hz
Duration	20		Mins
Direction	3 mutually perpendicular axis		
PSD Profile	FREQ (Hz)	SLOPE (db/oct)	PSD (g^2/Hz)
	10 to 190	/	0.01
	190 to 210	-31.213	/
	210 to 2000	/	0.003

Operating Random Vibration

Acceleration	1.0		gRMS
Frequency Range	10 to 500		Hz
Duration	20		Mins
Direction	3 mutually perpendicular axis		
PSD Profile	FREQ (Hz)	SLOPE (db/oct)	PSD (g^2/Hz)
	10 - 500	/	0.002

ENVIRONMENTAL SPECIFICATIONS

Shock

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

Non-Operating Half-Sine Shock

Acceleration	30	G
Duration	18	mSec
Pulse	Half-Sine	
Number of Shock	3 shocks in each of 6 faces	

Operating Half-Sine Shock

Acceleration	4	G
Duration	22	mSec
Pulse	Half-Sine	
Number of Shock	3 shocks in each of 6 faces	

POWER AND CONTROL SIGNAL DESCRIPTIONS

AC Input Connector

This connector supplies the AC Mains to the DS1200-3 series 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 series power supply. 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 series 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 power supply 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 0.8V. 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.

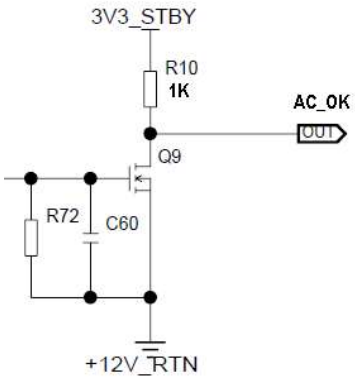
POWER AND CONTROL SIGNAL DESCRIPTIONS

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 3.75 and 4.25V. At 98.4A output current, this signal will be between 7.75 and 8.25V.

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).

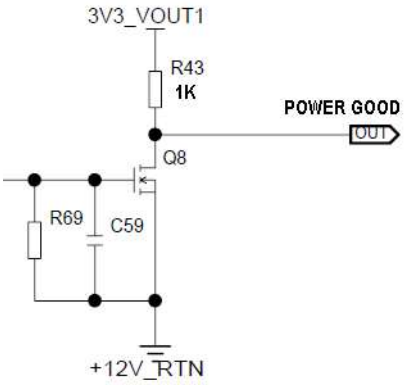
SDA, SCL and S_INT - (Pins C1, C2, D3)

Please refer to "Communication Bus Descriptions" section.

POWER AND CONTROL SIGNAL DESCRIPTIONS

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 1Kohm 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 up to 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.

COMMUNICATION BUS DESCRIPTIONS

I²C Bus Signals

The DS1200-3 series power supply contains enhanced monitor and control functions implemented via the I²C bus. The DS1200-3 series 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 (i.e. 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) - (Pins C1, C2)

I²C serial data and clock bus - these pins are internally pulled up to internal 3.3V supply with a 39K ohm resistor. These pins must be pulled-up in the system by an 1Kohm 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) - (Pins 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 must be at least 50ms to ensure proper monitoring functionality.

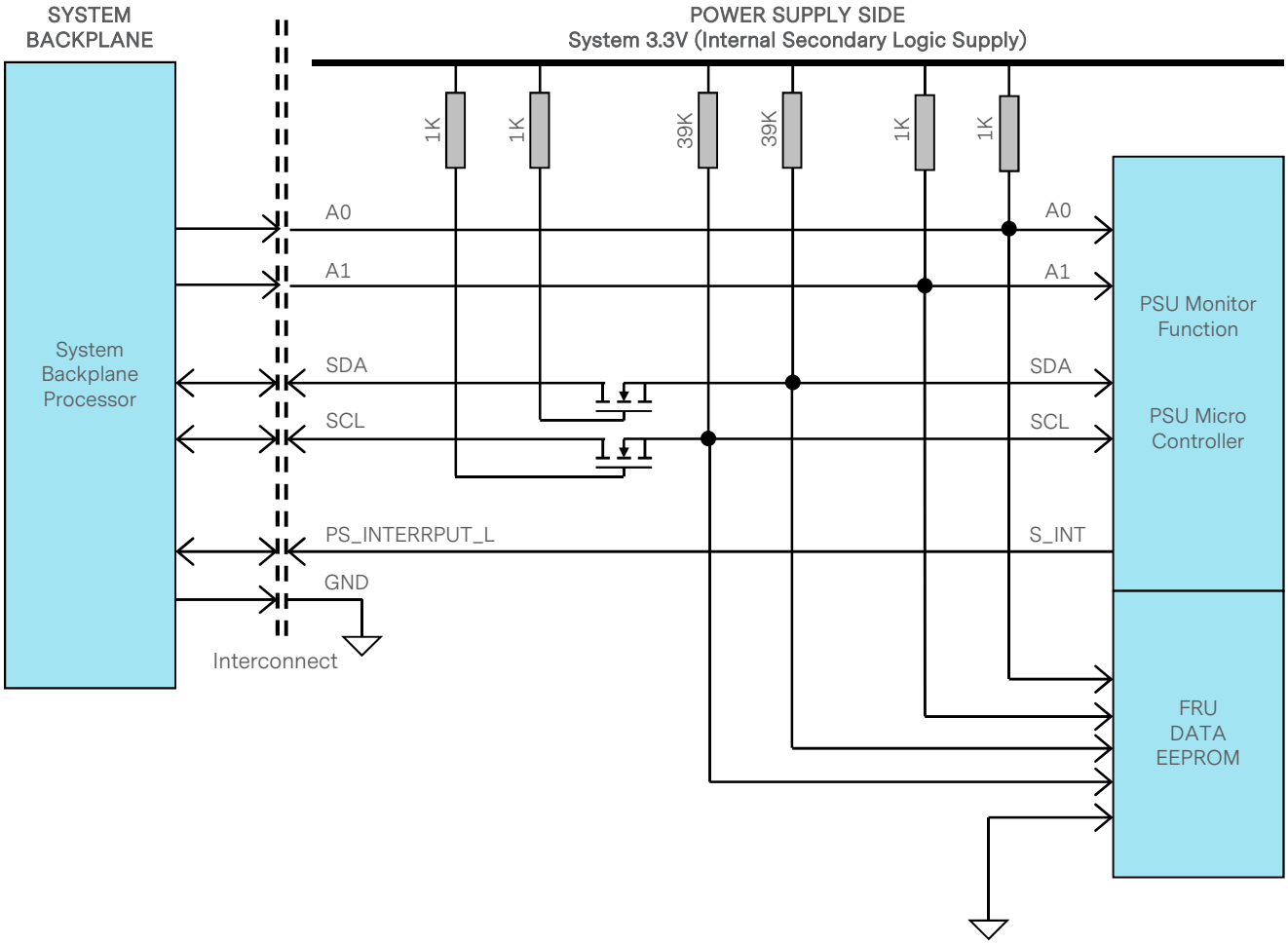
I²C Bus Signal Integrity

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 must be made at the power supply output connector with 3.2Kohm 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.

COMMUNICATION BUS DESCRIPTIONS

I²C Bus Internal Implementation, Pull-ups and Bus Capacitances



I²C Bus - Recommended external pull-ups

Electrical and interface specifications of I²C signals (referenced to standby output return pin, unless otherwise indicated):

Parameter	Condition	Symbol	Min	Type	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 to 4 PSU	R_{ext}	-	1.0	-	Kohm

COMMUNICATION BUS DESCRIPTIONS

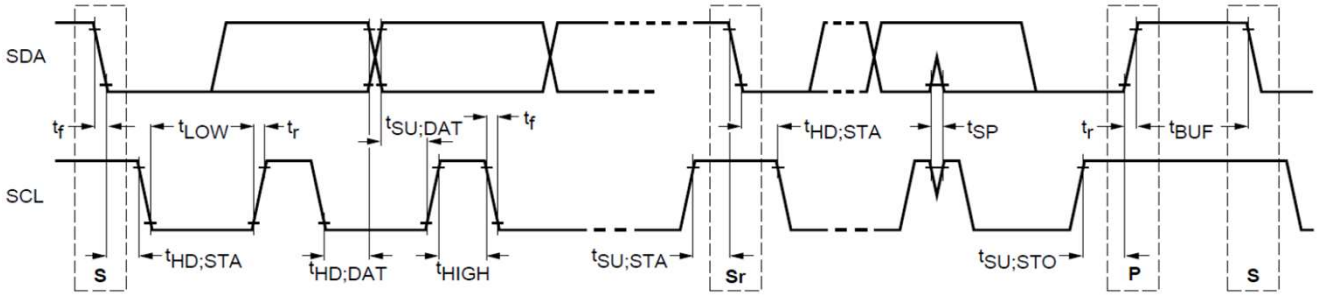
Logic Levels

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

Logic High: 3.3V nominal (Spec is 2.1V to 5.0V)**
Logic Low: 500mV nominal (Spec is 800mV max)**

**Note: Artesyn 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		uS
LOW period of SCL clock	t_{LOW}	4.7	-	13.5		uS
HIGH period of SCL clock	t_{HIGH}	4.0	50	4.4		uS
Setup time for repeated START condition	$t_{SU;STA}$	4.7	-	5.83		uS
Data hold time	$t_{HD;DAT}$	0	3.45	1.87		uS
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		uS
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	100***		mS

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

COMMUNICATION BUS DESCRIPTIONS

Device Addressing

The DS1200-3 series will respond to supported commands on the I²C 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 1Kohm 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) Address
	A1	A0		
1	0	0	0x78	0xA9
2	0	1	0x7A	0xAB
3	1	0	0x7C	0xAD
4	1	1	0x7E*	0xAF*

*Note - Default address when A0 and A1 are left open.

COMMUNICATION BUS DESCRIPTIONS

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
  - Output 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 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.

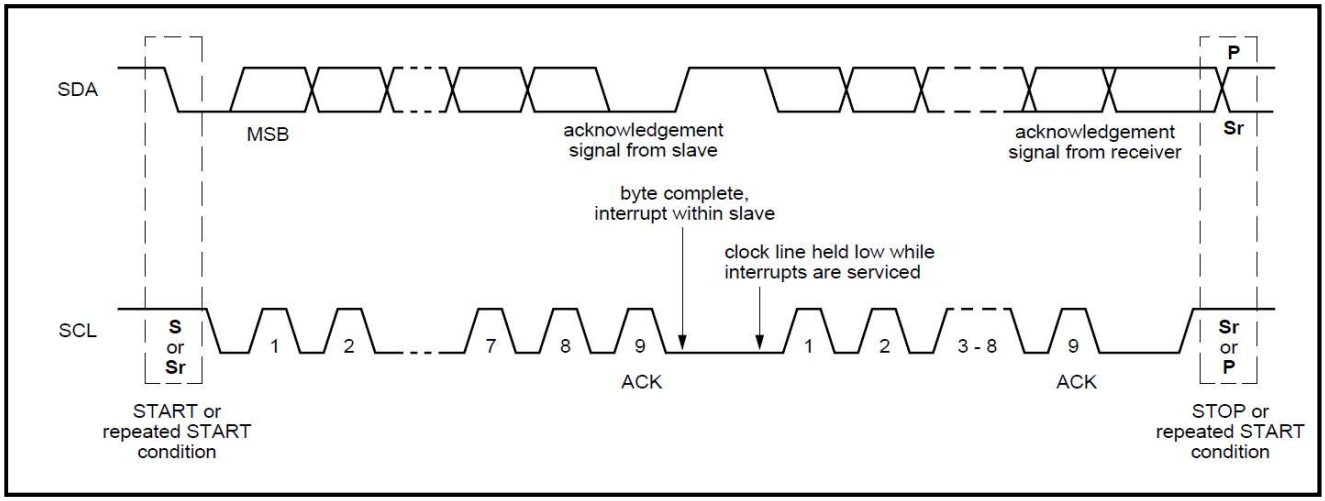
Status Register Code		
Signal Name	**Code (Binary)**	**Code (Hex)**
Normal / 12V ON	00011111	1F
Normal / 12V OFF	00011110	1E
OCP	10011111	9E
UVP	01011110	5E
OVP	00111110	3E
Fan Fault	00001110	0E
Low Input / No AC	00010100	14
Over Temp Fault	00011010	1A

COMMUNICATION BUS DESCRIPTIONS

I²C Clock Synchronization

The DS1200-3 series power supply applies clock stretching. An addressed slave power supply holds 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 series is 100 milliseconds.



COMMUNICATION BUS DESCRIPTIONS

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. The one 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 series 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	17 18 19 1A 1B 1C 1D 1E 1F	**CHASSIS SERIAL NUMBER BYTES,** default value is 0.	0 0 0 0 0 0 0 0 0	00 00 00 00 00 00 00 00 00

COMMUNICATION BUS DESCRIPTIONS

DS1200-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
32 33 34 35 36 37	20 21 22 23 24 25	**CHASSIS SERIAL NUMBER BYTES,** default value is 0.	0 0 0 0 0 0	00 00 00 00 00 00
38	26	**End Tag** (0C1h if used)	193	C1
39	27	**CHKSUM** (Zero CHKSUM if used) (256 - (Sum of bytes 8 to 38)	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
		MANUFACTURER'S NAME 5 bytes sequence		
44 45 46 47 48	2C 2D 2E 2F 30	“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 bytes 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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
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
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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		Low End Input Voltage Range 1(10mV), (90V / 10mV) 9000 = 2328H 2 bytes sequence		
107 108	6B 6C	In Decimal = 040, 035 In Hex = 28H, 23H	40 35	28 23
		High End Input Voltage Range 1(10mV), (264V/10mV) 26400 = 6720H 2 bytes sequence		
109 110	6D 6E	In Decimal = 032, 103 In Hex = 20H, 67H	32 103	20 67
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
		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:		
119 120	77 78	In Decimal: 008, 023 In Hex: 08H, 17H	8 23	08 17
		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		
121 122 123	79 7A 7B	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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		12V DC 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
135 136	87 88	**Maximum Positive Voltage Deviation (10mV),** 1260 = 04ECH 2 bytes sequence In Decimal: 236, 004 In Hex: ECH, 04H	236 4	EC 04
137 138	89 8A	**Ripple and Noise pk-pk (mV),** 120 = 78H 2 bytes sequence In Decimal: 120, 000 In Hex: 78H, 00H	120 0	78 00
139 140	8B 8C	**Minimum Current Draw (10mA),** 0000 = 0000H 2 bytes sequence In Decimal: 000, 000 In Hex: 00H, 00H	0 0	00 00
141 142	8D 8E	**Maximum Current Draw (10mA),** 10000 = 2710H 2 bytes sequence In Decimal: 016, 039 In Hex: 10H, 27H	16 39	10 27
		3V3SB OUTPUT RECORD HEADER		
143 144 145 146 147	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 13 223 17	01 02 0D DF 11
		3V3SB OUTPUT RECORD		
148	94	**Output Information,** 002 = 02H Bit 7: Standby Information = 1B Bits 6-4: Reserved, write as 000B Bits 3-0: Output Number 2 = 010B	130	82
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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		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
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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3 series FRU (EEPROM) Data:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
197	C5	PAD (reserved), default value is 0.	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
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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3-002 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
PRODUCT INFORMATION AREA, 56 BYTES				
		PRODUCT NAME BYTES (12 bytes 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

COMMUNICATION BUS DESCRIPTIONS

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
145	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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3-003 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		PRODUCT NAME BYTES (12 bytes 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) (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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3-003 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
		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
145	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)	169	A9
147	93	Header CHECKSUM of 3V3SB Output Record Header (Zero CHECKSUM) (256-(sum of bytes 143 to 146)	71	47
		3V3SB OUTPUT RECORD		
		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
		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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3-004 FRU (EEPROM) deviations:

OFFSET		DEFINITION	SPEC VALUE	
(DEC)	(HEX)	(REMARKS)	(DEC)	(HEX)
PRODUCT INFORMATION AREA, 56 BYTES				
		PRODUCT NAME BYTES (12 bytes 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

COMMUNICATION BUS DESCRIPTIONS

DS1200-3-004 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
145	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

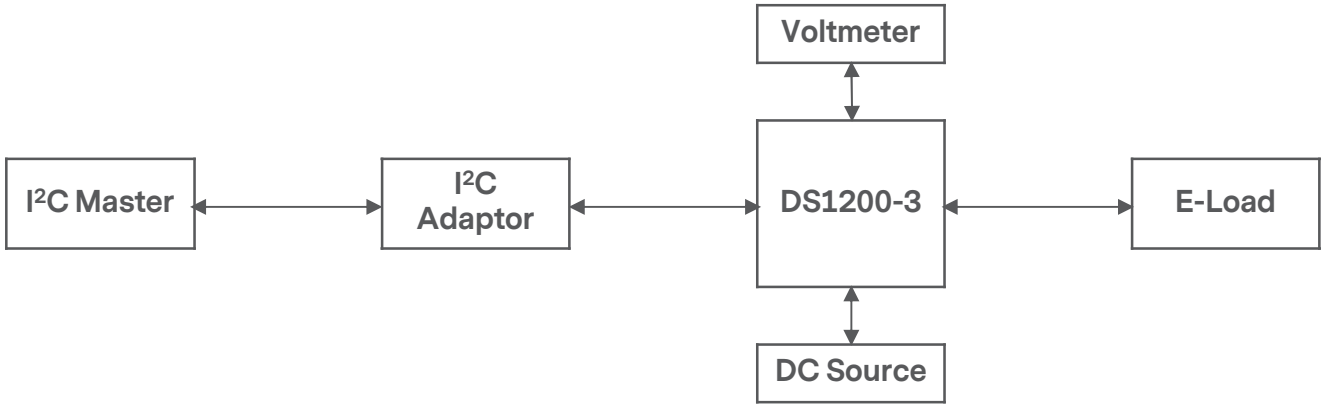
PMBus™ SPECIFICATIONS

The DS1200-3 series is compliant with the industry standard PMBus™ protocol for monitoring and control of the power supply via the I²C interface port.

DS1200-3 Series PMBus™ General Instructions

Equipment Setup

The following is typical I²C 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 commends

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.

PMBus™ SPECIFICATIONS

The 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	10				00 - Immediate Turn OFF (no sequencing) 01 - Soft Turn OFF (with sequencing) 10 - PSU ON
	b5:2	0000				
	b1:0	00				Reserved
02h	ON_OFF_CONFIG	1C	R	1		Configures the combination of CONTROL pin and serial communication commands needed to turn the unit ON/OFF.
	b7:5	000				Reserved
	b4 - Enable CONTROL pin and serial communication control.	1				0 - Unit powers up any time power is present regardless of the state of CONTROL pin. 1 - Unit powers up as dictated by CONTROL 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 CONTROL 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 CONTROL pin. (ON/OFF controlled by OPERATION command). 1 - Unit requires CONTROL 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_ON 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.

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
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.
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	0				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 5	0002				R byte
	byte 4:3	0000				b low byte, b high byte
	byte 2:1	0501				m low byte, m high byte
31h	POUT_MAX	070B	R	2	Linear	Sets the operating power limit condition. 1550W

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
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.
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 to 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. (13.0V)
43h	VOUT_UV_WARN_LIMIT	4C04	R/W	2	Direct	Sets under-voltage warning threshold. (11.0V)
44h	VOUT_UV_FAULT_LIMIT	FC03	R/W	2	Direct	Sets under-voltage fault threshold. (10.2V)

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
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/W	2	Direct	Secondary ambient temperature fault threshold, in degree C. (58degC)
50h	OT_FAULT_RESPONSE	B8	R	1	Linear	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. (55degC)
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)
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.

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
78h	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.
7Ah	STATUS_VOUT	00	R	1		Output voltage related faults and warnings
	b7	-				VOUT over-voltage fault
	b6	-				VOUT over-voltage warning

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Ah	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	-				IOUT Overcurrent Warning
	b4	-				IOUT Undercurrent Fault
	b3	-				Current Share Fault Set if Ishare level is much greater or lower than the actual output current. Refer to output specifications (Table 3) for current sharing limits.
	b2	-				Power Limiting
	b1	-				POUT Overpower Fault
	b0	-				POUT Overpower Warning
7Ch	STATUS_INPUT	-	R	1		Input related faults and warnings.
	b7	-				VIN Overvoltage Fault
	b6	-				VIN Overvoltage Warning
	b5	-				VIN Under-voltage Warning
	b4	-				VIN Under-voltage Fault
	b3	-				Unit is OFF for insufficient input voltage.
	b2	-				IIN Over Current Fault
	b1	-				IIN over current warning
	b0	-				PIN overpower warning
7Dh	STATUS_TEMPERATURE	-	R	1		Temperature related faults and warnings.
	b7	-				Over-temperature Fault
	b6	-				Over-temperature Warning
	b5	-				Under-temperature Warning
	b4	-				Under-temperature 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

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
7Eh	b3	-				
	b2	-				
	b1	-				
	b0	-				
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 - de-asserted
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 Revision 0000 - Revision 1.0 0001 - Revision 1.1
99h	MFR_ID	"ALL"	BR, ASCII	4		Abbrev or symbol of manufacturers name.

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
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	"xxxx"	BR, ASCII	4		Manufacturers facility, ASCII format
9Dh	MFR_LOCATION	"xxxxxxx"	BR	7		Manufacture date, ASCII format structure: YYMMDD
9Eh	MFR_DATE	"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)
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) (50degC)
A9h	MFR_TAMBIENT_MIN	0000	R	2	Direct	Minimum Operating Ambient Temperature (Secondary Ambient) (0degC)
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 x 10 = 25V = 09C4hex)
D2h	Min Fan Speed	3923	R	2	L	Standby Fan Speed, (13200rpm / 20% Duty Cycle)
D3h	Max Fan Speed	5832	R	2	L	Normal Operation Fan Speed (38400rpm / 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	-	

PMBus™ SPECIFICATIONS

The DS1200-3 Series Supported PMBus™ Command List:

Command Code	Command Name	Default Value	Access Type	Data Bytes	Data Format	Description
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
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

APPLICATION NOTES

Current Sharing

The DS1200-3 series' main output V_O is equipped with current sharing capability. This will allow up to 4 power supplies to be connected in parallel for higher power application. Current share accuracy is typically 5% of full load. When supplying light loads between 10% and 40% of its rated load, the power supplies will share within 20% accuracy. Below 10% total loading, there is no guarantee of output current sharing.

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.

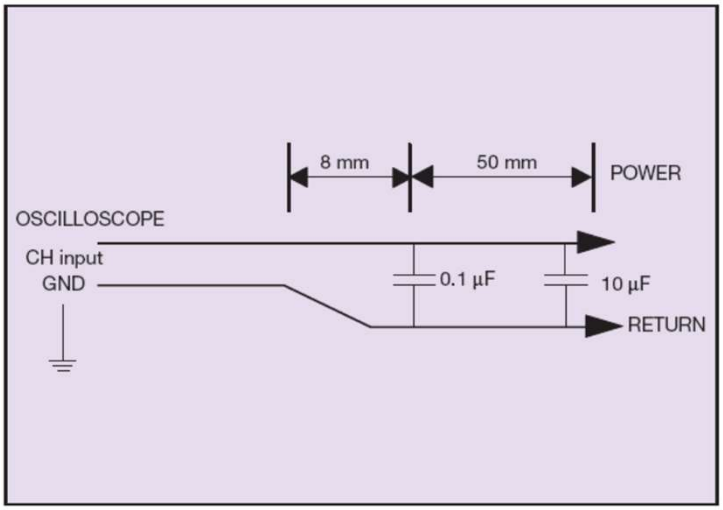
Any failure of one power supply in parallel as well as hot swapping shall not cause more than a 5% change in any output. The failure of one or more supplies will not cause the remaining supplies to violate any of the input or output specifications noted in this specification including all status signals.

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.

APPLICATION NOTES

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 10uF tantalum capacitor will be used. Oscilloscope can be set to 20MHz bandwidth for this measurement.



RECORD OF REVISION AND CHANGES

Issue	Date	Description	Originators
1.8	06.05.2017	Latest update	K. Wang
1.9	04.16.2020	Updated the description for 30h command	K. Wang
2.0	05.27.2020	Update safety cert 60950 to 62368	K. Wang
2.1	03.03.2021	Update cover and back cover	C. Liu
2.2	04.16.2022	Add UKCA Mark	C. Liu

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

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For international contact information,
visit advancedenergy.com.

powersales@aei.com (Sales Support)
productsupport.ep@aei.com (Technical Support)
+1 888 412 7832

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