PMBus™ Communication Protocol

ACAN-76 Application Note

This application note describes PMBus™ Digital Communications Protocol for the **D1U86P-W-2200-12-HxxDC-xxx** series power supplies.

Compatible Models				
Murata Model	Address	Main Output	Stanby Output	Airflow
D1U86P-W-2200-12-HB3DC	ADDR_SEL (External resistor)	$12V_{DC}$	$12V_{DC}$	Front to Back
D1U86P-W-2200-12-HB4DC		$12V_{DC}$	$12V_{DC}$	Back to Front

Standard PMBus™ Introlductory Notes

- All data communicated over the PMBus™ interface uses PEC (Packet Error Checking) as defined by the standard for PMBus™ Power Systems Management Protocol Part 1 – General Requirements Rev 1.2. To avoid setting CML errors when issuing "write" commands including "Page", PEC protocol must be followed.
- Linear data formatting is used for all passed parameters.
- Block reads (where the loose byte received denotes the remaining byte to be clocked out) are not supported on this product series.
- A minimum of 300µs delay between transactions (between the STOP of one command and the START of the next command) is
- 400KHz I^2C communications is supported for the PMBus™ interface.
- The PMBus™ slave controller does "clock stretch" on ACK or NAK.
- "Page" is supported, generally, page "0"contains main output parameters and page "1" contains the standby output parameters.

Device Details

Power Supply Controllers			
Vendor	MFG Part Number	Package	Description
Microchip Technology Inc.	DSPIC33FJ64GS606T-50I/PT	TQFP64	(Secondary) IC Dig SMT Microcontroller PIC33 TQFP64 64k 9kB 50MHz
Microchip Technology Inc.	DSPIC33FJ16GS504T-50I/PT	TQFP44	(Primary) IC Dig SMT Controller PWM Industrial PIC33 TQFP44 40MHz

Power Supply External EEPROM			
Vendor	MFG Part Number	Package	Description
Microchip Technology Inc.	24AA024T-I/MS	MSOP8	IC Dig SMT EEPROM CMOS Serial I2C AT24CXX MSOP8 2kB

Device Addressing Methods

There are two methods whereby the three lower order address bits of the seven bit address structure of the internal addressable devices can be assigned (for the secondary microcontroller and the EEPROM device A0, A1 & A2; see the PMBus™ standard). These are as follows:

1. Using the ADDR signal pin of the power supply in digital mode by either:
   a. Un-terminating (leaving open circuit); this will set a default setting of "111" for the last three addressable bits (A0, A1 & A2) of the seven bit address byte, resulting in PSU/EEPROM addresses of BEh & AEh respectively.
   b. Terminating the pin to RTN/ground (Pin numbers A2/B2); this method will set a default address of "000" for the last three addressable bits (A0, A1 & A2) of the address byte, resulting in PSU/EEPROM addresses of B0h & A0h respectively.
2. Using the ADDR signal pin in analogue mode by connection of an external resistance to RTN/ground (pin numbers A2/B2). For the possible external resistance values this will result in the address combinations listed:

HEX Address Combinations by Analogue Method; ADDR External Resistance Values		
ADDR External Resistance to RTN/Ground (KΩ; ±5% Tolerance)	Power Module Secondary Main Controller (Serial Slave Address)*	Power Module EEPROM (Serial Slave Address)*
0.82	0xB0	0xA0
2.7	0xB2	0xA2
5.6	0xB4	0xA4
8.2	0xB6	0xA6
15	0xB8	0xA8
27	0xBA	0xAA
56	0xBC	0xAC
180	0xBE	0xAE

*The D1U54P-W-1500-12-HxxTC uses 7-bit left shifted" device addressing; the EEPROM addressing follows a similar convention (commences at base address 0xA0); the lowest order bit of the address is the Read/Write bit. It is assumed that the Read Write bit is set to logic "0" (for addresses shown in the table above).

PMBus™ Command List

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
00	PAGE	R/W	All	1			Command to provide ability to configure, control & monitor multiple outputs.	YES
01	OPERATION Link to Settings	R/W	All	1	5:0		Set output margin high/low voltages	NO
					7:6		Turn the unit on/off in conjunction with digital input from PSON_H	YES
02	ON_OFF_CONFIG Link to Settings	Send	All	1	0	ON_OFF_DELAY	Set when Turn off immediately (default) / 0 = Use delay @ turn-off	YES
					1	ON_OFF_POLARITY	Set when Power on processing is active high (default)	YES
					2	USE_CONTROL	Set when Use CONTROL pin for on/off power processing (default)	YES
					3	USE_OPERATION	Set when Use OPERATION command for on/off power processing (defult)	YES
					4	USE_CNTL_AND _OP	Set when Use both CONTROL pin & OPERATION command (default)	YES
					5	RESERVED		NO
					6	RESERVED		NO
					7	RESERVED		NO
03	CLEAR_FAULTS	W	All	0			Write only command clears all faults that have been set in all the STATUS_XXXX registers simultaneously	YES
04	PHASE	R/W	All	1			Command to provide the ability to configure, control, and monitor multiple phases on one PMBus unit.	NO
10	WRITE_PROTECT	R/W	All	1			Command to provide ability to configure, control & monitor multiple outputs	YES
11	STORE_DEFAULT_ALL	Send	All	0			Command instructs PMBus device to copy contents of Operating Memory to matching NVM	NO
12	RESTORE_DEFAULT_ALL	Send	All	0			Command instructs PMBus device to copy contents of NVM to matching Operating Memory	NO
13	STORE_DEFAULT_CODE	W	All	1			Command instructs the PMBus device to copy the parameter whose Command Code matches value in the data byte, from Operating Memory to matching NVM	NO
14	RESTORE_DEFAULT_CODE	W	All	1			Command instructs the PMBus device to copy the parameter whose Command Code matches value in the data byte, from NVM to matching Operating Memory	NO
15	STORE_USER_ALL	Send	All	0			Command instructs the PMBus device to copy the entire contents of Operating Memory to matching NVM	NO
16	RESTORE_USER_ALL	Send	All	0			Command instructs the PMBus device to copy the entire contents of NVM to matching Operating Memory	NO
17	STORE_USER_CODE	W	All	1			Command instructs the PMBus device to copy the parameter whose Command Code matches value in the data byte from Operating Memory to matching NVM User Store memory	NO
18	RESTORE_USER_CODE	W	All	1			Command instructs the PMBus device to copy the parameter whose Command Code matches value in the data byte from NVM to matching Operating Meory Store memory	NO
19	CAPABILITY	R	All	1	0:3	RESERVED		NO
					4	SMBALERT_L	Set when device has SMBALERT_L pin which supports the SMBus Alert Response protocol	YES
					6:5	MAX_BUS_SPEED	01 = Max supported bus speed = 400kHz; 00 Max supported bus speed = 100kHz	NO
					7	PEC	Set when packet error checking is supported	YES
1A	QUERY	Block Write / Block Read Process Call	All	1	1:0	RESERVED		NO
					4:2	DATA FORMAT	PMBus 1.2 Spec Section 11.13 Table 8.	NO
					5	READ_SUPPORT	1 = Supported ; 0 = not Supported	NO
					6	WRITE_SUPPORT	1 = Supported ; 0 = not Supported	NO
					7	COMMAND_SUPPORT	1 = Supported ; 0 = Not Supported	NO
20	VOUT_MODE	R	0	1	4:0	Returned: 11010 (N=-6)	Single data byte sets the READ_VOUT sensor to linear mode data format and supplies N exponent for translation to volts	YES
					7:5	000 (linear mode)	PMBus Spec - Part II - Revision 1.2 - Sections 8.1-8.3	
20	VSTBY_MODE	R	1	1			Single data byte sets the READ_VSTBY sensor to linear mode data format and supplies N exponent for translation to volts	YES
							PMBus Spec - Part II - Revision 1.2 - Sections 8.1-8.3	

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
21	VOUT_COMMAND	R/W	0	2			Manual override main output setpoint command - Voltage range setting 11.5V - 12.75V Command speed formatted in Linear as per command 0x8B - VOUT_COMMAND	YES
21	VSTBY_COMMAND	R/W	1	2			Manual override standby output setpoint command - Voltage range setting x. Command speed formatted in Linear as per command 0x8B - VOUT_COMMAND	NO
22	VOUT_TRIM	R/W	0	2			Command used to apply a fixed offset voltage to the output voltage command value	NO
23	VSTBY_TRIM	R/W	1	2			Command used to apply a fixed offset voltage to the output voltage command value	NO
23	VOUT_CAL_OFFSET	R/W	0	2			Command used to apply a fixed offset voltage to the output voltage command value	NO
23	VSTBY_CAL_OFFSET	R/W	1	2			Command used to apply a fixed offset voltage to the output voltage command value	NO
24	VOUT_MAX	R/W	0	2			Command sets upper limit output voltage can be set regardless of other command/combination	NO
24	VSTBY_MAX	R/W	1	2			Command sets upper limit output voltage can be set regardless of other command/combination	NO
25	VOUT_MARGIN_HIGH	R/W	0	2			Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin High"	NO
25	VSTBY_MARGIN_LOW	R/W	1	2			Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin High"	NO
26	VOUT_MARGIN_HIGH	R/W	0	2			Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin Low"	NO
26	VSTBY_MARGIN_LOW	R/W	1	2			Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin Low"	NO
27	VOUT_TRANSITION_RATE	R/W	0	2			Command sets the rate in mV/µs at which the output should change voltage	NO
27	VSTBY_TRANSITION_RATE	R/W	1	2			Command sets the rate in mV/µs at which the output should change voltage	NO
28	VOUT_DROOP	R/W	0	2			Command sets the rate (mV/A) which output voltage decreases (or increases) with increasing (or decreasing) output current (in Adaptive Voltage Positioning/passive current sharing)	NO
28	VSTBY_DROOP	R/W	1	2			Command sets the rate (mV/A) which output voltage decreases (or increases) with increasing (or decreasing) output current (in Adaptive Voltage Positioning/passive current sharing)	NO
29	VOUT_SCALE_LOOP	R/W	0	2			PMBus Spec - Part II - Revision 1.2 - Section 13.10	NO
29	VSTBY_SCALE_LOOP	R/W	1	2			PMBus Spec - Part II - Revision 1.2 - Section 13.10	NO
2A	VOUT_SCALE_MONITOR	R/W	0	2			PMBus Spec - Part II - Revision 1.2 - Section 13.11	NO
2A	VSTBY_SCALE_MONITOR	R/W	1	2			PMBus Spec - Part II - Revision 1.2 - Section 13.11	NO
30	COEFFICIENTS	Block Write / Block Read Process Call	All	5			Command used to retrieve the m, b and R coefficients needed by data in the DIRECT format	NO
31	POUT_MAX	R/W	All	2			Commands sets output power (watts) which unit starts regulating in constant power mode	NO
32	MAX_DUTY	R/W	All	2			Command sets maximum duty cycle (%) of the unit's powerconversion stage	NO
33	FREQUENCY_SWITCH	R/W	All	2			Command sets switching frequency (kHz) of a PMBus device	NO
35	VIN_ON	R/W	All	2			Command sets value of input voltage (Vdc/Vrms) at which unit should start power conversion	NO
36	VIN_OFF	R/W	All	2			Command sets value of input voltage (Vdc/Vrms) at which unit should stop power conversion	NO
37	INTERLEAVE	R/W	All	2			PMBus Spec - Part II - Revision 1.2 - Section 14.7	NO
38	IOUT_CAL_GAIN	R/W	All	2			Command used to set the ratio of the voltage at the current sense pins to the sensed current	NO
39	IOUT_CAL_OFFSET	R/W	All	2			Command used to null out any offsets in the output current sensing circuit	NO

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
3A	FAN_CONFIG_1_2	R	All	1	0	FAN_2_TACH_PULSES	Fan 2 Tachometer pulses per revolution (lower bit)	NO
					1	FAN_2_TACH_PULSES	Fan 2 Tachometer pulses per revolution (upper bit)	NO
					2	FAN_2_SETTING_MODE	Set when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	NO
					3	FAN_2_INSTALLATION	Set when fan is installed in position 2	NO
					4	FAN_1_TACH_PULSES	Fan 1 Tachometer pulses per revolution (lower bit)	YES
					5	FAN_1_TACH_PULSES	Fan 1 Tachometer pulses per revolution (upper bit)	YES
					6	FAN_1_SETTING_MODE	Set when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	YES
					7	FAN_1_INSTALLATION	Set when fan is installed in position 1	YES
3B	FAN_COMMAND_1	R/W	All	2			Manual fan override command fan speed value in Duty Cycle	YES
						Link To Manual Fan speed notes	Command speed formatted in Linear as per command 0x90 - READ_FAN_SPEED_1	
3C	FAN_COMMAND_2	R/W	All	2			Manual fan override command fan speed value in Duty Cycle	NO
							Command speed formatted in Linear as per command 0x91 - READ_FAN_SPEED_2	
3D	FAN_CONFIG_3_4	R	All	1	0	FAN_4_TACH_PULSES	Fan 4 Tachometer pulses per revolution (lower bit)	NO
					1	FAN_4_TACH_PULSES	Fan 4 Tachometer pulses per revolution (upper bit)	NO
					2	FAN_4_SETTING_MODE	Set when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	NO
					3	FAN_4_INSTALLATION	Set when fan is installed in position 4	NO
					4	FAN_3_TACH_PULSES	Fan 3 Tachometer pulses per revolution (lower bit)	NO
					5	FAN_3_TACH_PULSES	Fan 3 Tachometer pulses per revolution (upper bit)	NO
					6	FAN_3_SETTING_MODE	Set when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	NO
					7	FAN_3_INSTALLATION	Set when fan is installed in position 3	NO
3E	FAN_COMMAND_3	R/W	All	2			Manual fan override command fan speed value in Duty Cycle	NO
							Command speed formatted in Linear as per command 0x92 - READ_FAN_SPEED_3	
3F	FAN_COMMAND_4	R/W	All	2			Manual fan override command fan speed value in Duty Cycle	NO
							Command speed formatted in Linear as per command 0x93 - READ_FAN_SPEED_4	
40	VOUT_OV_FAULT_LIMIT	R	0	2		Link to: Details	Main Output Overvoltage Fault Limit	YES
40	VSTBY_OV_FAULT_LIMIT	R	1	2			Standby(Auxilliary) Output Overvoltage Fault Limit	YES
41	VOUT_OV_FAULT_RESPONSE	R	0	1			Main Output Overvoltage Fault Response Actions	YES
41	VSTBY_OV_FAULT_RESPONSE	R	1	1			Standby(Auxilliary) Output Overvoltage Fault Response Actions	YES
42	VOUT_OV_WARN_LIMIT	R	0	2			Main Output Overvoltage Warning Limit	YES
42	VSTBY_OV_WARN_LIMIT	R	1	2			Standby(Auxilliary) Output Overvoltage Warning Limit	YES
43	VOUT_UV_WARN_LIMIT	R	0	2			Main Output Undervoltage Warning Limit	YES
43	VSTBY_UV_WARN_LIMIT	R	1	2			Standby(Auxilliary) Output Undervoltage Warning Limit	YES
44	VOUT_UV_FAULT_LIMIT	R	0	2			Main Output Undervoltage Fault Limit	YES
44	VSTBY_UV_FAULT_LIMIT	R	1	2			Standby(Auxilliary) Output Undervoltage Fault Limit	YES
45	VOUT_UV_FAULT_RESPONSE	R	0	1			Main Output Undervoltage Fault Response Actions	YES
45	VSTBY_UV_FAULT_RESPONSE	R	1	1			Standby(Auxilliary) Output Undervoltage Fault Response Actions	YES
46	IOUT_OC_FAULT_LIMIT	R	0	2			Main Output Overcurrent Fault Limit (Vin > 160Vrms)	YES
46	IOUT_OC_FAULT_LIMIT	R	1	2			Main Output Overcurrent Fault Limit (160Vrms > Vin > 100Vrms)	YES
46	IOUT_OC_FAULT_LIMIT	R	2	2			Main Output Overcurrent Fault Limit (Vin < 100Vrms)	YES
46	ISTBY_OC_FAULT_LIMIT	R	3	2			Standby(Auxilliary) Output Overcurrent Fault Limit	YES
47	IOUT_OC_FAULT_RESPONSE	R	0	1			Main Output Overcurrent Fault Response Actions	YES
47	ISTBY_OC_FAULT_RESPONSE	R	1	1			Standby(Auxilliary) Output Overcurrent Fault Response Actions	YES
48	IOUT_OC_LV_FAULT_LIMIT	R	0	2			Main Output Overcurrent Foldback Fault Limit	NO
48	ISTBY_OC_LV_FAULT_LIMIT	R	1	2			Standby(Auxilliary) Output Overcurrent Foldback Fault Limit	NO
49	IOUT_OC_LV_FAULT_RESPONSE	R	0	1			Main Output Overcurrent Foldback Fault Response Actions	NO
49	ISTBY_OC_LV_FAULT_RESPONSE	R	1	1			Standby(Auxilliary) Output Overcurrent Foldback Fault Response Actions	NO
4A	IOUT_OC_WARN_LIMIT	R	0	2			Main Output Overcurrent Warning Limit (Vin > 160Vrms)	YES
4A	IOUT_OC_WARN_LIMIT	R	1	2			Main Output Overcurrent Warning Limit (160Vrms > Vin > 100Vrms)	YES
4A	IOUT_OC_WARN_LIMIT	R	2	2			Main Output Overcurrent Warning Limit (Vin < 100Vrms)	YES
4A	ISTBY_OC_WARN_LIMIT	R	3	2			Standby(Auxilliary) Output Overvoltage Warning Limit	YES

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
4B	IOUT_UC_FAULT_LIMIT	R	0	2			Main Output Undercurrent Fault Limit	NO
4B	ISTBY_UC_FAULT_LIMIT	R	1	2			Standby(Auxilliary) Output Undercurrent Fault Limit	NO
4C	IOUT_UC_FAULT_RESPONSE	R	0	1			Main Output Undercurrent Fault Response Actions	NO
4C	ISTBY_UC_FAULT_RESPONSE	R	1	1			Standby(Auxilliary) Output Undercurrent Fault Response Actions	NO
4F	AIRFLOW_1_OT_FAULT_LIMIT	R	0	2			Airflow 1 Overtemperature Fault Limit	YES
4F	HOTSPOT_1_OT_FAULT_LIMIT	R	1	2			Hotspot 1 Overtemperature Fault Limit	YES
4F	AIRFLOW_2_OT_FAULT_LIMIT	R	2	2			Airflow 2 Overtemperature Fault Limit	YES
4F	HOTSPOT_2_OT_FAULT_LIMIT	R	3	2			Hotspot 2 Overtemperature Fault Limit	YES
50	AIRFLOW_1_OT_FAULT_RESPONSE	R	0	1			Airflow 1 Overtemperature Fault Response Actions	YES
50	HOTSPOT_1_OT_FAULT_RESPONSE	R	1	1			Hotspot 1 Overtemperature Fault Response Actions	YES
50	AIRFLOW_2_OT_FAULT_RESPONSE	R	2	1			Airflow 2 Overtemperature Fault Response Actions	YES
50	HOTSPOT_2_OT_FAULT_RESPONSE	R	3	1			Hotspot 2 Overtemperature Fault Response Actions	YES
51	AIRFLOW_1_OT_WARN_LIMIT	R	0	2			Airflow 1 Overtemperature Warning Limit	YES
51	AIRFLOW_2_OT_WARN_LIMIT	R	1	2			Airflow 2 Overtemperature Warning Limit	YES
51	HOTSPOT_1_OT_WARN_LIMIT	R	2	2			Hotspot 1 Overtemperature Warning Limit	YES
51	HOTSPOT_2_OT_WARN_LIMIT	R	3	2			Hotspot 2 Overtemperature Warning Limit	YES
52	AIRFLOW_1_UT_FAULT_LIMIT	R	0	2			Airflow 1 Undertemperature Fault Limit	NO
52	AIRFLOW_2_UT_FAULT_LIMIT	R	1	2			Airflow 2 Undertemperature Fault Limit	NO
52	HOTSPOT_1_UT_FAULT_LIMIT	R	2	2			Hotspot 1 Undertemperature Fault Limit	NO
52	HOTSPOT_2_UT_FAULT_LIMIT	R	3	2			Hotspot 2 Undertemperature Fault Limit	NO
53	AIRFLOW_1_UT_FAULT_RESPONSE	R	0	1			Airflow 1 Undertemperature Fault Response Actions	NO
53	AIRFLOW_2_UT_FAULT_RESPONSE	R	1	1			Airflow 2 Undertemperature Fault Response Actions	NO
53	HOTSPOT_1_UT_FAULT_RESPONSE	R	2	1			Hotspot 1 Undertemperature Fault Response Actions	NO
53	HOTSPOT_2_UT_FAULT_RESPONSE	R	3	1			Hotspot 2 Undertemperature Fault Response Actions	NO
55	VIN_OV_FAULT_LIMIT	R	All	2			Input Overvoltage Fault Limit	YES
56	VIN_OV_FAULT_RESPONSE	R	All	1			Input Overvoltage Fault Response Actions	YES
57	VIN_OV_WARN_LIMIT	R	All	2			Input Overvoltage Warning Limit	YES
58	VIN_UV_WARN_LIMIT	R	All	2			Input Undervoltage Warning Limit	YES
59	VIN_UV_FAULT_LIMIT	R	All	2			Input Undervoltage Fault Limit	YES
5A	VIN_UV_FAULT_RESPONSE	R	All	1			Input Undervoltage Fault Response Actions	YES
5B	IIN_OC_FAULT_LIMIT	R	All	2		Link to: Details	Input Overcurrent Fault Limit	YES
5C	IIN_OC_FAULT_RESPONSE	R	All	1			Input Overcurrent Fault Response Actions	YES
5D	IIN_OC_WARN_LIMIT	R	All	2			Input Overcurrent Warning Limit	YES
5E	POWER_GOOD_ON	R	All	2			Power Good On Main Output Voltage Limit	YES
5F	POWER_GOOD_OFF	R	All	2			Power Good Off Main Output Voltage Limit	YES
60	TON_DELAY	R	All	2			Sets the time (mSec) from when a start condition is received (as programmed by the ON_OFF_CONFIG command) until the output voltage starts to rise	NO
61	TON_RISE	R	All	2			Sets the time (mSec) from when the output starts to rise until the voltage has entered the regulation band.	NO
62	TON_MAX_FAULT_LIMIT	R	All	2			Command sets an upper limit (mSec) on how long the unit can attempt to power up the output without reaching the output undervoltage fault limit	NO
63	TON_MAX_FAULT_RESPONSE	R	All	1			Command instructs the device on what action to take in response to a TON_MAX fault	NO
64	TOFF_DELAY	R	All	2			Sets the time (mSec) from a stop condition is received (as programmed by the ON_OFF_CONFIG command) until the unit stops transferring energy to the output	NO
65	TOFF_FALL	R	All	2			Sets the time (mSec) from the end of the turn-off delay time until the voltage is commanded to zero.	NO
66	TOFF_MAX_WARN_LIMIT	R	All	2			Command sets an upper limit(mSec), on how long unit can attempt to power down output without reaching 12.5% of the output voltage programmed at the time the unit is turned off	NO
68	POUT_OP_FAULT_LIMIT	R	0	2			Output Overpower Fault Limit (Vin > 160Vrms)	YES
68	POUT_OP_FAULT_LIMIT	R	1	2			Output Overpower Fault Limit (160Vrms > Vin > 100Vrms)	YES
68	POUT_OP_FAULT_LIMIT	R	2	2			Output Overpower Fault Limit (Vin < 100Vrms)	YES
69	POUT_OP_FAULT_RESPONSE	R	All	1			Output Overpower Fault Response Actions **Note:** Pout faults reported however Iout is the mechanism that acts to protect	NO
6A	POUT_OP_WARN_LIMIT	R	0	2			Output Overpower Warning Limit (Vin > 160Vrms)	YES
6A	POUT_OP_WARN_LIMIT	R	1	2			Output Overpower Warning Limit (160Vrms > Vin > 100Vrms)	YES
6A	POUT_OP_WARN_LIMIT	R	2	2			Output Overpower Warning Limit (Vin < 100Vrms)	YES
6B	PIN_OP_WARN_LIMIT	R	0	2			Input Overpower Warning Limit (Vin > 160Vrms)	YES
6B	PIN_OP_WARN_LIMIT	R	1	2			Input Overpower Warning Limit (160Vrms > Vin > 100Vrms)	YES

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
6B	PIN_OP_WARN_LIMIT	R	2	2			Input Overpower Warning Limit (Vin < 100Vrms)	YES
78	STATUS_BYTE	R	All	1	0	NONE_F_W	Set when a fault not listed in [7:1] occurred	NO
					1	CML_F	Set when a communications, memory, or logic fault has occurred	YES
					2	TEMPERATURE_F_W	Set when an overtemperature fault or warning has occurred	YES
					3	INPUT_UV_F	Set when an input undervoltage fault has occurred	YES
					4	OUTPUT_OC_F	Set when an output overcurrent fault has occurred	YES
					5	OUTPUT_OV_F	Set when an output overvoltage fault has occurred	YES
					6	UNIT_OFF	Set when unit not providing power to the output	YES
					7	BUSY_F	Assserted when device busy and unable to respond fault	YES
79	STATUS_WORD	R	All	2	0	NONE_F_W	Set when a fault not listed in [7:1] occurred	NO
					1	CML_F	Set when a communications, memory, or logic fault has occurred	YES
					2	TEMPERATURE_F_W	Set when an overtemperature fault or warning has occurred	YES
					3	INPUT_UV_F	Set when an input undervoltage fault has occurred	YES
					4	OUTPUT_OC_F	Set when an output overcurrent fault has occurred	YES
					5	OUTPUT_OV_F	Set when an output overvoltage fault has occurred	YES
					6	UNIT_OFF	Set when unit not providing power to the output	YES
					7	BUSY_F	Assserted when device busy and unable to respond fault	YES
					8	UNKNOWN_F_W	Set when a fault not listed in [15:1] has occurred	NO
					9	STATUS_OTHER_F_W	Set when a bit in command STATUS_OTHER set	NO
					10	FANS_F_W	Set when a fan fault or warning has occurred	YES
					11	POWER_GOOD_L	Set when the POWER_GOOD signal is negated	YES
					12	MFR_SPECIFIC_F_W	Manufacturer specific fault or warning has occurred	YES
					13	INPUT_F_W	Set when an Input voltage/current/power fault or warning has occurred	YES
					14	IOUT_POUT_F_W	Set when an output current / output power fault or warning has occurred	YES
					15	VOUT_F_W	Set when an output voltage fault or warning has occurred	YES
7A	STATUS_VOUT	R	0	1	0	VOUT_TRACKING_E	Set when an error in the output voltage during power-up/down has occurred	NO
					1	TON_MAX_W	Set when the output turn-on timing has exceeded the TON_MAX warning timing	NO
					2	TON_MAX_F	Set when the output turn-on timing has exceeded the TON_MAX fault timing	NO
					3	VOUT_MAX_F	Set when the output is set higher than the commanded VOUT_MAX limit	NO
					4	VOUT_UV_F	Set when an output undervotlage fault has occurred	YES
					5	VOUT_UV_W	Set when an output undervotlage warning has occurred	YES
					6	VOUT_OV_W	Set when an output overvoltage warning has occurred	YES
					7	VOUT_OV_F	Set when an output overvoltage fault has occurred	YES
7A	STATUS_VSTBY	R	1	1	0	VOUT_TRACKING_E	Set when an error in the output voltage during power-up/down has occurred	NO
					1	TON_MAX_W	Set when the output turn-on timing has exceeded the TON_MAX warning timing	NO
					2	TON_MAX_F	Set when the output turn-on timing has exceeded the TON_MAX fault timing	NO
					3	VOUT_MAX_F	Set when the output is set higher than the commanded VOUT_MAX limit	NO
					4	VOUT_UV_F	Set when an output undervotlage fault has occurred	NO
					5	VOUT_UV_W	Set when an output undervotlage warning has occurred	YES
					6	VOUT_OV_W	Set when an output overvoltage warning has occurred	YES
					7	VOUT_OV_F	Set when an output overvoltage fault has occurred	YES
7B	STATUS_IOUT	R	0	1	0	POUT_OP_W	Set when an output overpower warning has occurred	YES
					1	POUT_OP_F	Set when an output overpower fault has occurred	YES
					2	POWER_LIMIT_MODE	Set when the unit has entered output power limiting mode	NO
					3	CURRENT_SHARE_F	Set when an output current share fault has occurred	NO
					4	IOUT_UC_W	Set when an output undercurrent fault has occurred	NO
					5	IOUT_OC_W	Set when an output overcurrent warning has occurred	YES
					6	IOUT_OC_SHUTDOWN	Set when an output overcurrent and low voltage shutdown fault has occurred	YES
					7	IOUT_OC_F	Set when an output overcurrent fault has occurred	YES

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
7B	STATUS_ISTBY	R	1	1	0	POUT_OP_W	Set when an output overpower warning has occurred	NO
					1	POUT_OP_F	Set when an output overpower fault has occurred	NO
					2	POWER_LIMIT_MODE	Set when the unit has entered output power limiting mode	NO
					3	CURRENT_SHARE_F	Set when an output current share fault has occurred	NO
					4	IOUT_UC_W	Set when an output undercurrent fault has occurred	NO
					5	IOUT_OC_W	Set when an output overcurrent warning has occurred	YES
					6	IOUT_OC_SHUTDOWN	Set when an output overcurrent and low voltage shutdown fault has occurred	YES
					7	IOUT_OC_F	Set when an output overcurrent fault has occurred	YES
7C	STATUS_INPUT	R	All	1	0	PIN_OP_W	Set when an input overpower warning has occurred	YES
					1	IIN_OC_W	Set when an input overcurrent warning has occurred	YES
					2	IIN_OC_F	Set when an input overcurrent fault has occurred	YES
					3	VIN_UV_OFF	Set when the Unit is OFF for insufficient input voltage	YES
					4	VIN_UV_F	Set when an input undervoltage fault has occurred	NO
					5	VIN_UV_W	Set when an input undervoltage warning has occurred	YES
					6	VIN_OV_W	Set when an input overvoltage warning has occurred	YES
					7	VIN_OV_F	Set when an input overvoltage fault has occurred	YES
7D	STATUS_TEMPERATURE	R	All	1	0	RESERVED	Reserved	NO
					1	RESERVED	Reserved	NO
					2	RESERVED	Reserved	NO
					3	RESERVED	Reserved	NO
					4	TEMPERATURE_UT_F	Set when an undertemperature fault has occurred	NO
					5	TEMPERATURE_UT_W	Set when an undertemperature warning has occurred	NO
					6	TEMPERATURE_OT_W	Set when an overtemperature warning has occurred	YES
					7	TEMPERATURE_OT_F	Set when an overtemperature fault has occurred	YES
7E	STATUS_CML	R	All	1	0	OTHER_MEMORY_F	Set when another memory or logic fault has occurred	NO
					1	OTHER_COMM_F	Set when a communication fault not listed in [7:3] has occurred (example: UART or SPI)	YES
					2	RESERVED	Reserved	NO
					3	PROCESSOR_F	Set when a processor fault is detected	NO
					4	MEMORY_F	Set when a memory fault is detected (example: Checksum errors during bootload)	NO
					5	PEC_ERROR_F	Set when a packet error checking (PEC) failed has occurred	YES
					6	DATA_ERROR_F	Set when invalid or unsupported data is received	YES
					7	COMMAND_ERROR_F	Set when an invalid or unsupported command is received	YES
7F	STATUS_OTHER	R	All	1	0	RESERVED	Reserved	NO
					1	ORING_OUTPUT_F	Set when output ORing device fault occurs	NO
					2	ORING_INPUT_B_F	Set when input B ORing device fault occurs	NO
					3	ORING_INPUT_A_F	Set when input A ORing device fault occurs	NO
					4	FUSE_INPUT_B_F	Set when input B fuse/breaker fault occurs	NO
					5	FUSE_INPUT_A_F	Set when input A fuse/breaker fault occurs	NO
					6	RESERVED	Reserved	NO
					7	RESERVED	Reserved	NO
80	STATUS_MFR_SPECIFIC	R	All	1	0	VINT_RANGE_F	Set when an internal voltage (VCC2, VCC4, or VDD) out-of-range fault has occurred	YES
					1	IIN_CH1_OC_F	Set when main output primary CH1 switch current OC fault detected	YES
					2	IIN_CH2_OC_F	Set when main output primary CH2 switch current OC fault detected	YES
					3	VBUS_SOFTSTART_F	Set when the primary boost output bus does not reach regulation in specified time	YES
					4	VBUS_UV_F	Set when the primary boost output bus undervoltage fault has occurred	NO
					5	VBUS_UV_W	Set when the primary boost output bus undervoltage warning has occurred	YES
					6	VBUS_OV_W	Set when the primary boost output bus overvoltage warning has occurred	YES
					7	VBUS_OV_F	Set when the primary boost output bus overvoltage fault has occurred	YES

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
81	STATUS_FANS_1_2	R	All	1	0	FAN_AIRFLOW_W	Airflow warning	NO
					1	FAN_AIRFLOW_F	Airflow fault	NO
					2	FAN_2_OVERRIDE	Fan 2 speed overridden	NO
					3	FAN_1_OVERRIDE	Fan 1 speed overridden	YES
					4	FAN_2_W	Fan 2 warning	NO
					5	FAN_1_W	Fan 1 warning	YES
					6	FAN_2_F	Fan 2 fault	NO
					7	FAN_1_F	Fan 1 fault	YES
82	STATUS_FANS_3_4	R	All	1	0	FAN_AIRFLOW_W	Airflow warning	NO
					1	FAN_AIRFLOW_F	Airflow fault	NO
					2	FAN_4_OVERRIDE	Fan 4 speed overridden	NO
					3	FAN_3_OVERRIDE	Fan 3 speed overridden	NO
					4	FAN_4_W	Fan 4 warning	NO
					5	FAN_3_W	Fan 3 warning	NO
					6	FAN_4_F	Fan 4 fault	NO
					7	FAN_3_F	Fan 3 fault	NO
88	READ_VIN	R	All	2		Link to: Sensor data and resolution	Input Voltage Sensor Reading	YES
89	READ_IIN	R	All	2			Input Current Sensor Reading	YES
8A	READ_VCAP	R	All	2			PFC Output Voltage Sensor Reading	YES
8B	READ_VOUT	R	0	2			Main Output Voltage Sensor Reading	YES
8B	READ_VSTBY	R	1	2			Standby(Auxilliary) Output Voltage Sensor Reading	YES
8C	READ_IOUT	R	0	2			Main Output Current Sensor Reading	YES
8C	READ_ISTBY	R	1	2			Standby(Auxilliary) Output Current Sensor Reading	YES
8D	READ_TEMPERATURE_1	R	All	2			Airflow 1 Temperature Sensor Reading	YES
8E	READ_TEMPERATURE_2	R	All	2			Airflow 2 Temperature Sensor Reading	YES
8F	READ_TEMPERATURE_3	R	0	2			Hotspot 1 Temperature Sensor Reading	YES
8F	READ_TEMPERATURE_3	R	1	2			Hotspot 2 Temperature Sensor Reading	YES
90	READ_FAN_SPEED_1	R	All	2			Fan 1 Speed Sensor Reading	YES
91	READ_FAN_SPEED_2	R	All	2			Fan 2 Speed Sensor Reading	NO
92	READ_FAN_SPEED_3	R	All	2			Fan 3 Speed Sensor Reading	NO
93	READ_FAN_SPEED_4	R	All	2			Fan 4 Speed Sensor Reading	NO
94	READ_DUTY CYCLE	R	All	2			Command returns the duty of the PMBus device's main power converter in percent	NO
95	READ_FREQUENCY	R	All	2			Command returns the switching frequency of PMBus device's main power converter in KHz	NO
96	READ_POUT	R	All	2		Link to: Sensor data and resolution	Output Power Sensor Reading	YES
97	READ_PIN	R	All	2			Input Power Sensor Reading	YES
98	PMBUS_REVISION	R	All	1			PMBus Specfication Revision	YES
99	MFR_ID	ASCII BLOCK READ	All	10			Power Supply Company Name Retuned results: 'MURATA-PS'	YES
9A	MFR_MODEL	ASCII BLOCK READ/	All	32 Max			Power Supply Model Number Retuned results format: 'Mxxx'	YES
9B	MFR_REVISION	ASCII BLOCK READ	0	17			Power Supply Firmware Revision Retuned results format: '9151000000-00-00'	YES
9B	MFR_REVISION	ASCII BLOCK READ	1	17			Power Supply Firmware Revision Retuned results format: '9157000000-00-00'	YES
9B	MFR_REVISION	ASCII BLOCK READ	2	17			Power Supply Firmware Revision	NO
9C	MFR_LOCATION	ASCII BLOCK READ	All	16 Max			Power Supply Manufacture Location Retuned results example: 'China'	YES
9D	MFR_DATE	ASCII BLOCK READ	All	16 Max			Power Supply Manufacture Date Retuned results format: '1400'	YES
9E	SERIAL_NUMBER	ASCII BLOCK READ	All	16 Max			Power Supply Serial Number Retuned results fomrat: 'QEyywwR1xxxxx'	YES

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
A0	MFR_VIN_MIN	R	All	2			Power Supply Input Voltage Minimum Specification	YES
A1	MFR_VIN_MAX	R	All	2			Power Supply Input Voltage Maximum Specification	YES
A2	MFR_IIN_MAX	R	All	2			Power Supply Input Current Maximum Specification	YES
A3	MFR_PIN_MAX	R	All	2			Power Supply Input Power Maximum Specification	YES
A4	MFR_VOUT_MIN	R	All accept 1	2			Power Supply Main Output Voltage Minimum Specification	YES
	MFR_VSTBY_MIN	R	1					
A5	MFR_VOUT_MAX	R	All accept 1	2		Link To: General Manufactuerer's parametric Data	Power Supply Main Output Voltage Maximum Specification	YES
	MFR_VSTBY_MAX	R	1					
A6	MFR_IOUT_MAX	R	All	2			Power Supply Main Output Current Maximum Specification	YES
A7	MFR_POUT_MAX	R	All	2			Power Supply Output Power Maximum Specification	YES
A8	MFR_TAMBIENT_MAX	R	All	2			Power Supply Operating Ambient Temperature Maximum Specification	YES
A9	MFR_TAMBIENT_MIN	R	All	2			Power Supply Operating Ambient Temperature Minimum Specification	YES
AA	MFR_EFFICIENCY_LL	R	All	2			Power Supply Low-Line Input Voltage Specification	YES
				2			Power Supply Low-Line Low Power Specification	YES
				2			Power Supply Low-Line Low Power Efficiency Specification	YES
				2			Power Supply Low-Line Medium Power Specification	YES
				2			Power Supply Low-Line Medium Power Efficiency Specification	YES
				2			Power Supply Low-Line High Power Specification	YES
				2			Power Supply Low-Line HIgh Power Efficiency Specification	YES
AB	MFR_EFFICIENCY_HL	R	All	2			Power Supply High-Line Input Voltage Specification	YES
				2			Power Supply High-Line Low Power Specification	YES
				2			Power Supply High-Line Low Power Efficiency Specification	YES
				2			Power Supply High-Line Medium Power Specification	YES
				2			Power Supply High-Line Medium Power Efficiency Specification	YES
				2			Power Supply High-Line High Power Specification	YES
				2			Power Supply High-Line HIgh Power Efficiency Specification	YES
B0	USER_DATA_00	R/W	All	24			Customer text data block 00	NO
B1	USER_DATA_01	R/W	All	24			Customer text data block 01	NO
B2	USER_DATA_02	R/W	All	24			Customer text data block 02	NO
B3	USER_DATA_03	R/W	All	24			Customer text data block 03	NO
E0	PS_STATUS	R	All	2	0	CALIBRATION	Set when the unit is in Calibration mode	YES
					1	VSTBY_SELECT	Set when Vstby set to 5V; de-Set when Vstby set to 3.3V	NO
					2	PS_KILL	Set when the PS_KILL pin is defeated and the unit is properly seated in the chassis	YES
					3	VIN_OK	Set when the input voltage is within operating specification	YES
					4	VIN_RANGE	Set when input voltage range is high; de-Set when input voltage range is low	YES
					5	PFC_BUS	Set when the PFC BUS is within operating specification	YES
					6	PS_ON	Set when the PS_ON logic set to enable the main output	YES
					7	POWER_GOOD	Set when main output power delivered to unit is OK; mirrors the digital output signal	YES
					8	POWER_DOWN	Set when bootloader is taking control and the main output and PFC need to be shutdown	YES
					9	BOOTLOAD_COMPLETED	Set when the bootloader has completed and system reset needs to be Set	YES
					10	UNUSED		NO
					11	UNUSED		NO
					12	UNUSED		NO
					13	UNUSED		NO
					14	WARNING	Set when power supply warning has occurred; tracks 'WARNING' status LED	YES
					15	FAULT	Set when power supply fault has occurred; tracks 'FAULT' status LED	YES
E1	EEPROM_WP	R/W	All	1			Byte to enable (write 0x9A) or disable (write 0x56) writes to the external EEPROM	YES
E2	READ_HOURS_USED	BLOCK READ	All	3			Power Supply Accumulated Main Output Power-On Hours	YES

Command Code (Hex)	Command Name	Read / Write	Page	# of Bytes	Bit #	Bit Name	Definition	Supported ?
EE	PMBUS_CONFIG Link to retruned results: example	R	All	2	0	DATA_FORMAT	0 = Linear data format 1 = Direct data format	NO
					1	SMBALERT_L	0 = SMBALERT_L implemented & supported 1 = SMBALERT not implemented	YES
					2	MAX_BUS_SPEED	0 = 100kHz 1 = 400kHz	NO
					3	PEC	0 = PEC not supported 1 = PEC supported	YES
					4:7	RESERVED		NO
					8:15	CMD_KEY	Command activation/verification key = 0x5A	NO
EF	LED_CONTROL Example	R	All	1	0:2	LED_MODE	LED mode change bits	YES
					3:6	RESERVED		NO
					7	LED_CONTROL	LED manual/auto control toggle bit	NO
F0	READ_RESETS	R	All	2			RCON register status flags for troubleshooting	YES
							RCON2 register status flags for troubleshooting	
F8	BOOTLOAD_RESTART	R/W	All	1			Bootloader completion and application restart request command	YES
FA	BOOTLOAD_REQUEST	R/W	All	6			Bootloader request command	YES
FB	BOOTLOAD_STATUS	R	All	2	0	BOOTLOADING_PRI	Set when primary uC bootloading in process	YES
					1	BOOTLOADING_FLOAT	Set when floating uC bootloading in process	YES
					2	BOOTLOADING_SEC	Set when secondary uC bootloading in process	YES
					3	BOOTLOADED_PRI	Set when primary uC bootloading completed; reset required	YES
					4	BOOTLOADED_FLOAT	Set when floating uC bootloading completed; reset required	YES
					5	BOOTLOADED_SEC	Set when secondary uC bootloading completed; reset required	YES
					6	RESET_PRI	Set when primary uC reset	YES
					7	RESET_FLOAT	Set when floating uC reset	YES
					8	RESET_SEC	Set when secondary uC reset	YES
					9	RESERVED		NO
					10	RESERVED		NO
					11	RESERVED		NO
					12	RESERVED		NO
					13	RESERVED		NO
					14	RESERVED		NO
					15	RESERVED		NO

The following tables represents typical results / responses returned from respective command code entries and is provided as an illustration of what should be expected. These examples are based model D1U86P-W-2200-12-HB3DC.

RETURNED RESULTS: OPERATION SETTINGS

Link back to: Commands list, CMD_01

Bit # / Bit Description								Valid Values		Power Supply On/Off Mode
7	6	5	4	3	2	1	0	Dec	Hex	
On/off 1	On/off 0	Margin on/off/high /low 1	Margin on/off/high /low 0	Margin fault control 1	Margin fault control 0	not used	not used			
0	0	x	x	x	x	x	x	0 - 63	0 - 3F	Disable power supply when OPERATION command supported
1	0	x	x	x	x	x	x	128 - 191	80 - BF	Enable power supply when OPERATION command supported - **DEFAULT**

RETURNED RESULTS: ON_OFF CONFIG

Link back to: Commands list, CMD 02

Bit # / Bit Description								Valid Values		Power Supply On/Off Mode
7	6	5	4	3	2	1	0	Dec	Hex	
reserved	reserved	reserved	CONTROL pin / OPERATION command PS on/off	OPERATION command on/off	CONTROL pin on/off	CONTROL pin polarity	CONTROL pin action			
0	0	0	1	0	1	0	1	21	15	Control pin only ; active low polarity
0	0	0	1	0	1	1	1	23	17	Control pin only ; active high polarity
0	0	0	1	1	0	x	1	25 or 27	19 or 1B	Operation command only
0	0	0	1	1	1	0	1	29	1D	Operation command and control pin ; active low polarity - DEFAULT
0	0	0	1	1	1	1	1	31	1F	Operation command and control pin ; active high polarity

RETURNED RESULTS : **Parameters, Limts and Response**, based on model **D1U86P-W-2200-12-HB3DC.** Different models will return different results.

Link back to: Commands List

Command Code (Hex)	Command Name	Read / Write	Page	Format	# of Bytes	Units	Scaling Coefficients				Bit #	Reading	Comments
							N	m	R	b			
40	VOUT_OV_FAULT_LIMIT	R	0	Linear Data Format	2	Vdc	-6					14	
40	VSTBY_OV_FAULT_LIMIT	R	1	Linear Data Format	2	Vdc	-6					14	
41	VOUT_OV_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
41	VSTBY_OV_FAULT_RESPONSE	R	1	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
42	VOUT_OV_WARN_LIMIT	R	0	Linear Data Format	2	Vdc	-6					13.1	
42	VSTBY_OV_WARN_LIMIT	R	1	Linear Data Format	2	Vdc	-6					13.5	
43	VOUT_UV_WARN_LIMIT	R	0	Linear Data Format	2	Vdc	-6					11.4	
43	VSTBY_UV_WARN_LIMIT	R	1	Linear Data Format	2	Vdc	-6					11.3	
44	VOUT_UV_FAULT_LIMIT	R	0	Linear Data Format	2	Vdc	-6					10.9	
44	VSTBY_UV_FAULT_LIMIT	R	1	Linear Data Format	2	Vdc	-6					11.1	
45	VOUT_UV_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
45	VSTBY_UV_FAULT_RESPONSE	R	1	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared

Command Code (Hex)	Command Name	Read / Write	Page	Format	# of Bytes	Units	Scaling Coefficients				Bit #	Reading	Comments
							N	m	R	b			
46	IOUT_OC_FAULT_LIMIT	R	0	Linear Data Format	2	Adc	-2					201.5	High - Vin > 160Vrms
46	IOUT_OC_FAULT_LIMIT	R	1	Linear Data Format	2	Adc	-2					105.5	Mid - 160 Vrms > Vin > 100Vrms
46	IOUT_OC_FAULT_LIMIT	R	2	Linear Data Format	2	Adc	-2					91.5	Low - Vin < 100Vrms
46	ISTBY_OC_FAULT_LIMIT	R	3	Linear Data Format	2	Adc	-8					3.12	
47	IOUT_OC_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	7	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Continuous restart (self-recovery)
47	ISTBY_OC_FAULT_RESPONSE	R	2	Bit Flags	1						2:0	0	Delay Time - None
											5:3	7	Response - Continuous restart (self-recovery)
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
4A	IOUT_OC_WARN_LIMIT	R	0	Linear Data Format	2	Adc	-2					192.5	High - Vin > 160Vrms
4A	IOUT_OC_WARN_LIMIT	R	1	Linear Data Format	2	Adc	-2					100.5	Mid - 160 Vrms > Vin > 100Vrms
4A	IOUT_OC_WARN_LIMIT	R	2	Linear Data Format	2	Adc	-2					87.5	Low - Vin < 100Vrms
4A	ISTBY_OC_WARN_LIMIT	R	3	Linear Data Format	2	Adc	-8					2.88	
4F	AIRFLOW_1_OT_FAULT_LIMIT	R	0	Linear Data Format	2	°C	0					75	Primary Airflow - Inlet
4F	AIRFLOW_2_OT_FAULT_LIMIT	R	1	Linear Data Format	2	°C	0					95	Secondary Airflow - Outlet
4F	HOTSPOT_1_OT_FAULT_LIMIT	R	2	Linear Data Format	2	°C	0					120	Secondary Hotspot - Main output hotspot
4F	HOTSPOT_2_OT_FAULT_LIMIT	R	3	Linear Data Format	2	°C	0					125	Primary Hotspot - PFC
50	AIRFLOW_1_OT_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
50	AIRFLOW_2_OT_FAULT_RESPONSE	R	1	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
50	HOTSPOT_1_OT_FAULT_RESPONSE	R	2	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
50	HOTSPOT_2_OT_FAULT_RESPONSE	R	3	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared

Command Code (Hex)	Command Name	Read / Write	Page	Format	# of Bytes	Units	Scaling Coefficients				Bit #	Reading	Comments
							N	m	R	b			
51	AIRFLOW_1_OT_WARN_LIMIT	R	0	Linear Data Format	2	°C	0					70	Primary Airflow - Inlet
51	AIRFLOW_2_OT_WARN_LIMIT	R	1	Linear Data Format	2	°C	0					90	Secondary Airflow - Outlet
51	HOTSPOT_1_OT_WARN_LIMIT	R	2	Linear Data Format	2	°C	0					110	Secondary Hotspot - Main output hotspot
51	HOTSPOT_2_OT_WARN_LIMIT	R	3	Linear Data Format	2	°C	0					110	Primary Hotspot - PFC
55	VIN_OV_FAULT_LIMIT	R	0	Linear Data Format	2	Vrms	-1					275	Recoverable
56	VIN_OV_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
57	VIN_OV_WARN_LIMIT	R	0	Linear Data Format	2	Vrms	-1					270	Recoverable
58	VIN_UV_WARN_LIMIT	R	0	Linear Data Format	2	Vrms	-1					80	Recoverable
59	VIN_UV_FAULT_LIMIT	R	0	Linear Data Format	2	Vrms	-1					72	Recoverable
5A	VIN_UV_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
5B	IIN_OC_FAULT_LIMIT	R	0	Linear Data Format	2	Arms	-5					18	(POUT_OP_F_MID_DETECT / 0.84) / 85Vrms
5C	IIN_OC_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
5D	IIN_OC_WARN_LIMIT	R	0	Linear Data Format	2	Arms	-5					17	
5E	POWER_GOOD_ON	R	0	Linear Data Format	2	Vdc	-6					10.9	
5F	POWER_GOOD_OFF	R	0	Linear Data Format	2	Vdc	-6					10.9	
68	POUT_OP_FAULT_LIMIT	R	0	Linear Data Format	2	Watts	2					2420	High - Vin > 160Vrms (Main output only)
68	POUT_OP_FAULT_LIMIT	R	1	Linear Data Format	2	Watts	2					1272	Mid - 160 Vrms > Vin > 100Vrms (Main output only)
68	POUT_OP_FAULT_LIMIT	R	2	Linear Data Format	2	Watts	2					1100	Low - Vin < 100Vrms (Main output only)
69	POUT_OP_FAULT_RESPONSE	R	0	Bit Flags	1						2:0	0	Delay Time - None
											5:3	0	Retry Setting - Unit does not attempt to restart & output remains disabled until fault clear
											7:6	3	Response - Ouput disabled while fault is present & remains disabled until fault cleared
6A	POUT_OP_WARN_LIMIT	R	0	Linear Data Format	2	Watts	2					2312	High - Vin > 160Vrms (Main output only)
6A	POUT_OP_WARN_LIMIT	R	1	Linear Data Format	2	Watts	2					1212	Mid - 160 Vrms > Vin > 100Vrms (Main output only)
6A	POUT_OP_WARN_LIMIT	R	2	Linear Data Format	2	Watts	2					1052	Low - Vin < 100Vrms (Main output only)
6B	PIN_OP_WARN_LIMIT	R	0	Linear Data Format	2	Watts	2					2600	High - Vin > 160Vrms (POUT_OP_WARN_LIMIT / 0.90)
6B	PIN_OP_WARN_LIMIT	R	1	Linear Data Format	2	Watts	2					1340	Mid - 60 Vrms > Vin > 100Vrms (POUT_OP_WARN_LIMIT / 0.90)
6B	PIN_OP_WARN_LIMIT	R	2	Linear Data Format	2	Watts	2					1172	Low - Vin < 100Vrms (POUT_OP_WARN_LIMIT / 0.90)

RETURNED RESULTS : SENSOR DATA AND RESOLUTION, THAT CAN BE EXPECTED FROM READ COMMAND DATA

Link back to: Commands list_CMD_88

Command Code (Hex)	Command Name	Description	Page	Format	Units	Scaling Coefficient "N"	Raw Sensor		PMBus Reporting Sensor		
							Full-scale / Range	Resolution	Full-scale / Range	Resolution	Accuracy
88	READ_VIN	Input Voltage Sensor Reading	All	Linear Data Format	Vrms	-1	327.4	0.32	511.5	0.5000	+ / - 2% of Reporting Full-Scale
89	READ_IIN	Input Current Sensor Reading	All	Linear Data Format	Arms	-5	33.3	0.0326	31.97	0.0313	+ / - 5% of Reporting Full-Scale
8A	READ_VCAP	PFC Output Voltage Sensor Reading (Uncalibrated primary sensor)	All	Linear Data Format	Vdc	-1	455.6	0.4454	511.5	0.5000	+ / - 5% of Reporting Full-Scale
8B	READ_VOUT	Main Output Voltage Sensor Reading	0	Linear Data Format	Vdc	-6	14.77	0.0144	15.98	0.0156	+ / - 2% of Reporting Full-Scale
8B	READ_VSTBY	Standby(Auxilliary) Output Voltage Sensor Reading	1	Linear Data Format	Vdc	-6	14.8	0.0145	15.98	0.0156	+ / - 2% of Reporting Full-Scale
8C	READ_IOUT	Main Output Current Sensor Reading	0	Linear Data Format	Adc	-2	238.9	0.2336	255.8	0.2500	+ / - 5% of Reporting Full-Scale
8C	READ_ISTBY	Standby(Auxilliary) Output Current Sensor Reading	1	Linear Data Format	Adc	-8	4.330	0.0042	3.996	0.0039	+ / - 5% of Reporting Full-Scale
8D	READ_TEMPERATURE_1	Temperature Sensor Reading - Inlet (Secondary Side)	All	Linear Data Format	°C	0	-40 to 150		-40 to 150	1	+ / - 5°C
8E	READ_TEMPERATURE_2	Temperature Sensor Reading - Outlet (Primary Side)	All	Linear Data Format	°C	0	-40 to 150		-40 to 150	1	+ / - 5°C
8F	READ_TEMPERATURE_3	Temperature Sensor Reading - Main Output Hotspot (Secondary Side)	0	Linear Data Format	°C	0	-40 to 150		-40 to 150	1	+ / - 5°C
8F	READ_TEMPERATURE_3	Temperature Sensor Reading - PFC Hotspot (Primary Side)	1	Linear Data Format	°C	0	-40 to 150		-40 to 150	1	+ / - 5°C
90	READ_FAN_SPEED_1	Fan 1 Speed Sensor Reading	All	Linear Data Format	RPM	5	24, 000		32736	32	+ / - 5% of Reporting Full-Scale
96	READ_POUT	Output Power Sensor Reading	All	Linear Data Format	Watts	2			4092	4	+ / - 5% of Reporting Full-Scale
97	READ_PIN	Input Power Sensor Reading	All	Linear Data Format	Watts	2			4092	4	+ / - 5% of Reporting Full-Scale

MANUFACTURER'S GENERAL PARAMETRIC DATA,

RETURNED RESULTS : Command Codes A0-ABh

Based on model D1U86P-W-2200-12-HB3DC. Other models will vary based on standby output voltage, example is 12VDC:

Link back to: Commands list

Command Code (Hex)	Command Name	Page	Reeal World Value	Units	N	MSB (hex)	LSB (hex)	Notes
A0	MFR_VIN_MIN	ALL	90	V	-1	F8	B4	
A1	MFR_VIN_MAX	ALL	264	V	-1	FA	10	
A2	MFR_IIN_MAX	ALL	14.2	A	-5	D9	C6	
A3	MFR_PIN_MAX	ALL	2400	W	2	12	58	
A4	MFR_VOUT_MIN	All Accept 1	11.4	V	-6	2	DA	v_out mode
	MFR_VSTBY_MIN	ALL	11.38	V	-6	D2	D8	Not v-out mode
A5	MFR_VOUT_MAX	All Accept 1	12.61	V	-6	3	27	v_out mode
	MFR_VSTBY_MAX	1	12.58	V	-6	D3	25	Not v-out mode
A6	MFR_IOUT_MAX	All Accept 1	183.3	A	-2	F2	DD	
	MFR_ISTBY_MAX	1						
A7	MFR_POUT_MAX	ALL	2200	W	1	12	26	
A8	MFR_TAMBIENT_MAX	ALL	50	C	0	0	32	
A9	MFR_TAMBIENT_MIN	ALL	0	C	0	0	0	
AA	MFR_EFFICIENCY_LL_LENGTH	ALL	14			0	E	
	MFR_EFFICIENCY_LL_VIN		110	V	-1	F8	DC	
	MFR_EFFICIENCY_LL_POUT1		440	W	2	10	6E	
	MFR_EFFICIENCY_LL_EFF1		0.9		-10	B3	9A	
	MFR_EFFICIENCY_LL_POUT2		1100	W	2	11	13	
	MFR_EFFICIENCY_LL_EFF2		0.94		-10	B3	C3	
	MFR_EFFICIENCY_LL_POUT3		1150	W	2	11	20	
	MFR_EFFICIENCY_LL_EFF3		0.91		-10	A4	B3	
AB	MFR_EFFICIENCY_HL_LENGTH	ALL	14			0	E	
	MFR_EFFICIENCY_HL_VIN		230	V	-1	F9	CC	
	MFR_EFFICIENCY_HL_POUT1		440	W	2	10	6E	
	MFR_EFFICIENCY_HL_EFF1		0.9		-10	B3	9A	
	MFR_EFFICIENCY_HL_POUT2		1100	W	2	11	13	
	MFR_EFFICIENCY_HL_EFF2		0.94		-10	B3	C3	
	MFR_EFFICIENCY_HL_POUT3		2200	W	2	12	26	
	MFR_EFFICIENCY_HL_EFF3		0.91		-10	B3	A4	

RETURNED RESULTS : EEPROM DATA IS POEW SUPPLY DEPENDENT AND VARIES WITH UNIT. **D1U86P-W-2200-12-HB3DC** Shown for illustration purposes. Differ. EEPROM data follows IPMI format.

Product Info Area Field Name	Product Info Area Field Contents	Static or Dynamic Register? (S/D)	Description	Label Markings	Label Part Number
Manufacturer name	Murata-PS	S	Manufacturer name		
Model name	D1U86P-W-2200-12-HB3DC	D	Product / project number (Mxxxx)	D1U86P-W-2200-12-HB3DC	D9790231830-x
Part/product number		S		0	n/a
Version	XXX	D	Not used	D1U86P-W-2200-12-HB3DC	D9790231830-x
Serial number	Mxxxxxxx	D	Serial number	Mxxxxxxx	D9790231830-x
Asset tag		N/A	Not used	n/a	n/a
FRU File ID		N/A	Not used	n/a	n/a
Custom field 1	100	N/A		n/a	n/a
Custom field 2	01	N/A		n/a	n/a
Custom field 3	01	N/A		n/a	n/a
Custom field 4		N/A	Not used	n/a	n/a

RETURNED RESULTS : **PMBUS Configuration Bits**

Command Code EEh

Link back to: Command List EEh

Parameter	Bit#	Bit	Function	
Data Format	Bit 0	1	Direct Data Format	
		0	Linear Data Format	Default
SMBALERT	Bit 1	1	PS does not have SMBALERT pin or does not support SMBus alert protocol	
		0	PS does have SMBALERT pin and supports SMBus alert protocol	Default
Bus Speed	Bit 2	1	Maximum supported bus speed = 400kHz	Default
		0	Maximum supported bus speed = 100kHz	
PEC support	Bit 3	1	Packed error checking supported	Default
		0	Packed error checking not supported	

RETURNED RESULTS : **LED CONTROL**

Command Code EFh

Link back to: Commands list CMD_EF

Bit # / Bit Description								Valid Values		Read / Write	LED Status & Control
7	6	5	4	3	2	1	0				
CONTROL Bit	reserved	reserved	reserved	reserved	LED Mode Bit 2	LED Mode Bit 1	LED Mode Bit 0	Dec	Hex		
0	0	0	0	0	0	0	0	0	0	Read	Auto - LED off (default)
0	0	0	0	0	0	0	1	1	1	Read	Auto - LED solid green (default)
0	0	0	0	0	0	1	0	2	2	Read	Auto - LED blinking green (default)
0	X	X	X	X	0	1	1	3	3	Read	Auto - LED solid red (default)
1	0	0	0	0	1	0	0	4	4	Read	Auto - LED blinking red (default)
1	0	0	0	0	1	0	1	5	5	Read	Auto - LED solid yellow (default)
1	0	0	0	0	1	1	0	6	6	Read	Auto - LED blinking yellow (default)
0	X	X	X	X	X	X	X	0 - 127	0 - 7F	Write	Set to auto LED control
1	0	0	0	0	0	0	0	128	80	Read / Write	Set to manual - LED off
1	0	0	0	0	0	0	1	129	81	Read / Write	Set to manual - LED solid green
1	0	0	0	0	0	1	0	130	82	Read / Write	Set to manual - LED blinking green
1	0	0	0	0	0	1	1	131	83	Read / Write	Set to manual - LED solid red
1	0	0	0	0	1	0	0	132	84	Read / Write	Set to manual - LED blinking red
1	0	0	0	0	1	0	1	133	85	Read / Write	Set to manual - LED solid yellow
1	0	0	0	0	1	1	0	134	86	Read / Write	Set to manual - LED blinking yellow

x=don't care

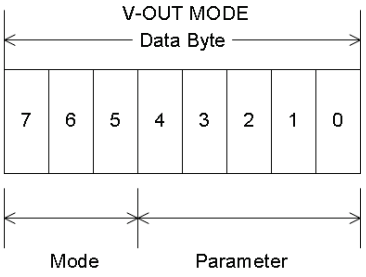
Command Code 20h (V_Out mode) returned results:

Link back to CMD_20 list

V-OUT Mode Protocol:

Commanding and/or reading output voltage related parameters requires two steps and applies to this product except as noted:

1) CMD_20 (V-OUT MODE) defines which of the three formats (LINEAR, VID OR DIRECT) is used:



Mode definition			Retruned results for CMD_20h				
Mode	Bits (7:5)	Bits (4:0) (Parameter)	Command Code (Hex)	Command Name	Value	Bit#	Value
Linear **(Default)**	000b	Five bit two's complement exponoent for the mantissa delivered as the data bytes for an output voltage command. Bits 4:0 returned= 11010b = N=-6 **(Default)**	**20**	VOUT_MODE	1Ah	Bit 7	0
						Bit 6	0
						Bit 5	0
						Bit 4	1
						Bit 3	1
						Bit 2	0
						Bit 1	1
						Bit 0	0

2) The Command Bytes, or mantissa can then be used to calculate real world values for the output voltage commands and parameters:

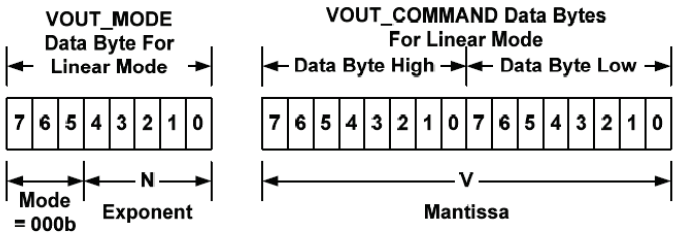


Figure 6. Linear Format Data Bytes

The Mode bits are set to 000b.

The Voltage, in volts, is calculated from the equation:

$$Voltage = V \cdot 2^{N}$$

Where:

Voltage is the parameter of interest in volts;

V is a 16 bit unsigned binary integer; and

N is a 5 bit two's complement binary integer.

V-OUT Mode Protocol cont'd:

All other pramaters and commands use Linear mode and associated real world values are caluculated as follows:
Link back to introductory notes

Linear Data Format

The Linear Data Format is typically used for commanding and reporting the parameters such as (but not only) the following:

- Output Current,
- Input Voltage,
- Input Current,
- Operating Temperatures,
- Time (durations), and
- Energy Storage Capacitor Voltage.

The Linear Data Format is a two byte value with:

- An 11 bit, two's complement mantissa and
- A 5 bit, two's complement exponent (scaling factor).

The format of the two data bytes is illustrated in Figure 4.

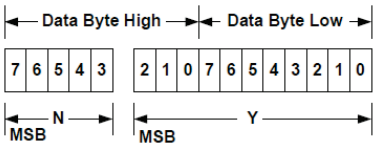


Figure 4. Linear Data Format Data Bytes

The relation between *Y*, *N* and the "real world" value is:

$X = Y \cdot 2^N$

Where, as described above:

X is the "real world" value;

Y is an 11 bit, two's complement integer; and

N is a 5 bit, two's complement integer.

Devices that use the Linear format must accept and be able to process any value of *N*.

RETURNED RESULTS : Command Code 3Bh **(FAN_COMMAND_1)** Link Back to Commands List: Commands_3B

Manual fan speed control via PMBus™is a linear data mode two byte command, speed expressed as fan duty cycle. This table below contains the manual fan speed command data in 1% increments, for illustration purposes.

The power supply automatically cancels manual fan sped control and enters automatic fan speed control by any of the following conditions or methods:

1) Writing the command “03h”(CLEAR_FAULTS).
2) Any overtemperature fault or warning (manual fan speed control mode can be resumed after the faults and warnings have ended)
3) Recycling of AC input voltage
4) Toggling PS_ON signal
5) Issuing a fan command that is outside the normal maximum limits, i.e., writing a fan speed of 110% duty cycle.

CMD 3B(h)	“Fan_COMMAND_1” (2 bytes)			CMD 3B(h)	“Fan_COMMAND_1” (2 bytes)			CMD 3B(h)	“Fan_COMMAND_1” (2 bytes)			CMD 3B(h)	“Fan_COMMAND_1” (2 bytes)		
% Duty Cycle	MSB(h)	LSB(h)	n(d)	% Duty Cycle	MSB(h)	LSB(h)	n(d)	% Duty Cycle	MSB(h)	LSB(h)	n(d)	% Duty Cycle	MSB(h)	LSB(h)	n(d)
0	B0	0	-10	26	B1	A	-10	51	B2	A	-10	76	B2	9	-10
1	B0	A	-10	27	B1	14	-10	52	B2	14	-10	77	B2	14	-10
2	B0	14	-10	28	B1	E1	-10	53	B2	1E	-10	78	B2	1E	-10
3	B0	1F	-10	29	B1	29	-10	54	B2	28	-10	79	B2	28	-10
4	B0	29	-10	30	B1	33	-10	55	B2	33	-10	80	B3	32	-10
5	B0	33	-10	31	B1	3D	-10	56	B2	3D	-10	81	B3	3D	-10
6	B0	3D	-10	32	B1	47	-10	57	B2	47	-10	82	B3	47	-10
7	B0	48	-10	33	B1	52	-10	58	B2	51	-10	83	B3	51	-10
8	B0	52	-10	34	B1	5C	-10	59	B2	5C	-10	84	B3	5B	-10
9	B0	5C	-10	35	B1	66	-10	60	B2	66	-10	85	B3	66	-10
10	B0	66	-10	36	B1	70	-10	61	B2	70	-10	86	B3	70	-10
11	B0	71	-10	37	B1	7B	-10	62	B2	7A	-10	87	B3	7A	-10
12	B0	7B	-10	38	B1	85	-10	63	B2	84	-10	88	B3	84	-10
13	B0	85	-10	39	B1	8F	-10	64	B2	8F	-10	89	B3	8E	-10
14	B0	8F	-10	40	B1	99	-10	65	B2	99	-10	90	B3	99	-10
15	B0	99	-10	41	B1	A3	-10	66	B2	A3	-10	91	B3	A3	-10
16	B0	A4	-10	42	B1	AE	-10	67	B2	AD	-10	92	B3	AD	-10
17	B0	AE	-10	43	B1	B8	-10	68	B2	B8	-10	93	B3	B7	-10
18	B0	B8	-10	44	B1	C2	-10	9	B2	C2	-10	94	B3	C2	-10
19	B0	C2	-10	45	B1	CC	-10	70	B2	CC	-10	95	B3	CC	-10
20	B0	CD	-10	46	B1	D7	-10	71	B2	D6	-10	96	B3	D6	-10
21	B0	D7	-10	47	B1	E1	-10	72	B2	E1	-10	97	B3	E0	-10
22	B0	E1	-10	48	B1	EB	-10	73	B2	EB	-10	98	B3	EB	-10
23	B0	EB	-10	49	B1	F5	-10	74	B2	F5	-10	99	B3	F5	-10
24	B0	F6	-10	50	B2	0	-10	75	B2	FF	-10	100	B3	FF	-10
25	B1	0	-10												

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