

This application note describes the PMBus™ digital communications protocol features of **MW0CP74-3000** series of power modules.

### Standard PMBus™ characteristics

- Complies with PMBus™ Power Systems Management Protocol Part 1 – General Requirements Rev 1.2 including use of PEC (Packet Error Checking).
- [Linear data](#) format is used for all supported parameters unless noted.
- A minimum of 300µs delay between transactions (between the STOP of one command and the START of the next command) is required.
- 100KHz I<sup>2</sup>C communications is supported for the PMBus™ interface.

### Internal PSU Device Details

Power Supply Controllers			
Vendor	MFG Part Number	Package	Description
Texas Instruments	UCD3138128PFC	TQFP80	(Secondary) IC Dig SMT Microcontroller UCD3138 TQFP80 31.25MHz
Texas Instruments	UCD3138064RMH	QFN40	(Primary) IC Dig SMT Controller PWM Industrial UCD3138 QFN40 31.25MHz
ROHM	BR24G02-3		Power Supply EEPROM

### Device Addressing:

The power module employs “left shifted” 7-Bit address where bit “0” of the address is the Read/Write bit. Three address pins are provided on the power module to configure the address of the internal slave devices and correspond to address bits A0 (least significant bit), A1, and A2”. The address listed below assume the Read/Write bit is logic level “0”.

Power Supply Module’s Internal Slave Device Serial Addresses					
Microcontroller	External EEPROM	Bit / Pin# Logic			
		A2 / B6	A1 / B7	A0 / B8	
0xB0	0xA0	0	0	0	
0xB2	0xA2	0	0	1	
0xB4	0xA4	0	1	0	
0xB6	0xA6	0	1	1	
0xB8	0xA8	1	0	0	
0xBA	0xAA	1	0	1	
0xBC	0xAC	1	1	0	
0xBE	0xAE	1	1	1	

PMBus™ Command List: Pg. 0 (12Vdc Main Output)

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
00	PAGE	R/W Byte	1	All			Command to provide ability to configure, control & monitor multiple outputs Value= 0 or 1	YES
01	OPERATION	R/W Byte	1	All	7		Turn the unit on/off in conjunction with digital input from PSON_H	YES
03	CLEAR_FAULTS	Send Byte	0	All			Write only command clears all faults that have been set in all the STATUS_XXXX registers in all pages simultaneously	YES
05	PAGE_PLUS_WRITE	Write Block	Variable	All			Set the page within a device, send a command, and send the data for the command in one packet. Support the following command codes: 01, 3B, 3C, 46, 4A, 51, 5D, 6A, 6B, 7A, 7B, 7C, 7D, 7E, 80, 81	YES
06	PAGE_PLUS_READ	Block Write - Block Read Process Call	Variable	All			Set the page within a device, send a command, and read the data returned by the command in one packet. Support the following command codes: 01, 19, 20, 3A, 3B, 3C, 46, 4A, 51, 5D, 6A, 6B, 78, 79, 7A, 7B, 7C, 7D, 7E, 80, 81, 88, 89, 8B, 8C, 8D, 8E, 8F, 90, 91, 96, 97, 9F, A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, C0, C1, C2	YES
19	CAPABILITY	Read Byte	1	All			This command provides a way for a host system to determine some key capabilities of a PMBus device.. Always read 90h	YES
1A	QUERY	Block Write - Block Read Process Call	1	All			Used to ask a PMBus device if it supports a given command, and if so, what data formats it supports for that command.	YES
					7	CMD_SUPPORTED	Command is supported	YES
					6	CMD_SUPPORTED_WRITE	Command is supported for write	YES
					5	CMD_SUPPORTED_READ	Command is supported for read	YES
					4:2	CMD_FORMAT	Data format - 0 = Linear data format, 011 = Direct mode format, 111 = Non numeric data	YES
					1	RESERVED	Reserved	NO
0	RESERVED	Reserved	NO					
1B	SMBALERT_MASK	Write Word/Block Write - Block Read Process Call	2 / Variable	All			Used to prevent a warning or fault condition from asserting the SMBALERT# signal. Support the following Status_x command code: 7A and 7B (for main output), 7C, 7D, 7E, 80 and 81 (for both main and standby output)	YES
20	VOUT_MODE	Read Byte	1	0			Single data byte sets the READ_VOUT sensor to linear mode data format and supplies N = -9 exponent for translation to volts. Always read 17h	YES
30	COEFFICIENT	Block Write - Block Read Process Call	5	All			Used to retrieve the m, b and R coefficients needed by data in the DIRECT format. Support the following command codes: 86, 87 Always read m = 1, b = 0, R= 0	YES

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
3A	FAN_CONFIG_1_2	Read Byte	1	All			Show the config of fan. Always read 99h	YES
					7	FAN_1_INSTALLATION	Asserted when fan is installed in position 1	YES
					6	FAN_1_SETTING_MODE	Asserted when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	YES
					5	FAN_1_TACH_PULSES	Fan 1 Tachometer pulses per revolution (upper bit)	YES
					4	FAN_1_TACH_PULSES	Fan 1 Tachometer pulses per revolution (lower bit)	YES
					3	FAN_2_INSTALLATION	Asserted when fan is installed in position 2	YES
					2	FAN_2_SETTING_MODE	Asserted when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	YES
					1	FAN_2_TACH_PULSES	Fan 2 Tachometer pulses per revolution (upper bit)	YES
					0	FAN_2_TACH_PULSES	Fan 2 Tachometer pulses per revolution (lower bit)	YES
3B	FAN_COMMAND_1	R/W Word	2	All			Manual fan override command fan speed value in Duty Cycle (0-100) Command speed formatted in Linear (N = 0)	YES
3C	FAN_COMMAND_2	R/W Word	2	All			Always keep same value as FAN_COMMAND_1 Read/write both 3B and 3C command get the same result Command speed formatted in Linear (N = 0)	YES
46	IOUT_OC_FAULT_LIMIT	R/W Word	2	0			Sets the value of the output current, in amperes, that causes the overcurrent detector to indicate an overcurrent fault protection. The value should be within 0 to default value (305A - High line AC or DC input, 163A - Low line AC)	YES
4A	IOUT_OC_WARN_LIMIT	R/W Word	2	0			Sets the value of the output current, in amperes, that causes the overcurrent detector to indicate an overcurrent warning. The value should be within 0 to default value (256A - High line AC or DC input, 154A - Low line AC)	YES
51	OT_WARN_LIMIT (Hot Spot)	R/W Word	2	All			Set the temperature, in degrees Celsius, of the unit at which it should indicate an Overtemperature Warning alarm. The value should be within 0 to default value (120°C)	YES
5D	IIN_OC_WARN_LIMIT	R/W Word	2	All			Sets the value of the input current, in amperes, that causes a warning that the input current is high. The value should be within 0 to default value (24A)	YES
6A	POUT_OP_WARN_LIMIT	R/W Word	2	All			Sets the value of the output power, in watts, that causes a warning that the output power is high. The value should be within 0 to default value (3600W High line AC or DC input and 2200W Low line AC)	YES
6B	PIN_OP_WARN_LIMIT	R/W Word	2	All			Sets the value of the input power, in watts, that causes a warning that the input power is high. The value should be within 0 to default value (3800W)	YES
78	STATUS_BYTE	Read Byte	1	0	7	BUSY_F	Asserted when device busy and unable to respond fault	NO
					6	UNIT_OFF	Asserted when unit not providing power to the output	YES
					5	OUTPUT_OV_F	Asserted when an output overvoltage fault has occurred	YES
					4	OUTPUT_OC_F	Asserted when an output overcurrent fault has occurred	YES
					3	INPUT_UV_F	Asserted when an input undervoltage fault has occurred	YES
					2	TEMPERATURE_F_W	Asserted when an overtemperature fault or warning has occurred	YES
					1	CML_F	Asserted when a communications, memory, or logic fault has occurred	YES
					0	NONE_F_W	Asserted when a fault not listed in [7:1] occurred	NO

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
79	STATUS_WORD	Read Word	2	0	7	VOUT_F_W	Asserted when an output voltage fault or warning has occurred	YES
					6	IOUT_POUT_F_W	Asserted when an output current / output power fault or warning has occurred	YES
					5	INPUT_F_W	Asserted when an Input voltage/current/power fault or warning has occurred	YES
					4	MFG_SPECIFIC_F_W	Manufacturer specific fault or warning has occurred	YES
					3	POWER_GOOD_L	Asserted when the POWER_GOOD signal is negated	YES
					2	FANS_F_W	Asserted when a fan fault or warning has occurred	YES
					1	STATUS_OTHER_F_W	Asserted when a bit in command STATUS_OTHER set	NO
					0	UNKNOWN_F_W	Asserted when a fault not listed in [15:1] has occurred	NO
					7	BUSY_F	Asserted when device busy and unable to respond fault	NO
					6	UNIT_OFF	Asserted when unit not providing power to the output	YES
					5	OUTPUT_OV_F	Asserted when an output overvoltage fault has occurred	YES
					4	OUTPUT_OC_F	Asserted when an output overcurrent fault has occurred	YES
					3	INPUT_UV_F	Asserted when an input undervoltage fault has occurred	YES
					2	TEMPERATURE_F_W	Asserted when an overtemperature fault or warning has occurred	YES
					1	CML_F	Asserted when a communications, memory, or logic fault has occurred	YES
					0	NONE_F_W	Asserted when a fault not listed in [7:1] occurred	NO
7A	STATUS_VOUT	R/W Byte	1	0	7	VOUT_OV_F	Asserted when an output overvoltage fault has occurred (Assert threshold 13.6V)	YES
					6	VOUT_OV_W	Asserted when an output overvoltage warning has occurred (Assert threshold 13.5V, recover 12.5V)	YES
					5	VOUT_UV_W	Asserted when an output undervoltage warning has occurred (Assert threshold 11V, recover 12V)	YES
					4	VOUT_UV_F	Asserted when an output undervoltage fault has occurred (Assert threshold 10V)	YES
					3	VOUT_MAX_F	Asserted when the output is set higher than the commanded VOUT_MAX limit	NO
					2	TON_MAX_F	Asserted when the output turn-on timing has exceeded the TON_MAX fault timing	NO
					1	TON_MAX_W	Asserted when the output turn-on timing has exceeded the TON_MAX warning timing	NO
					0	VOUT_TRACKING_E	Asserted when an error in the output voltage during power-up/down has occurred	NO
7B	STATUS_IOUT	R/W Byte	1	0	7	IOUT_OC_F	Asserted when an output overcurrent fault has occurred (Assert threshold refer to the setting of command 0x46 IOUT_OC_FAULT_LIMIT)	YES
					6	IOUT_OC_SHUTDOWN	Asserted when an output overcurrent and low voltage shutdown fault has occurred	NO
					5	IOUT_OC_W	Asserted when an output overcurrent warning has occurred (Assert threshold refer to the setting of command 0x4A IOUT_OC_WARN_LIMIT, recover threshold = IOUT_OC_WARN_LIMIT - 4A)	YES
					4	IOUT_UC_W	Asserted when an output undercurrent fault has occurred	NO
					3	CURRENT_SHARE_F	Asserted when an output current share fault has occurred	NO
					2	POWER_LIMIT_MODE	Asserted when the unit has entered output power limiting mode	NO
					1	POUT_OP_F	Asserted when an output overpower fault has occurred (High input line assert threshold 3900W) (Low input line assert threshold 2340W)	YES
0	POUT_OP_W	Asserted when an output overpower warning has occurred (Assert threshold refer to the setting of command 0x6A POUT_OP_WARN_LIMIT, recover threshold = POUT_OP_WARN_LIMIT - 300W)	YES					

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
7C	STATUS_INPUT	R/W Byte	1	All	7	VIN_OV_F	Asserted when an input overvoltage fault has occurred (AC assert threshold 310V, recover 303V) (DC assert threshold 410V, recover 403V)	YES
					6	VIN_OV_W	Asserted when an input overvoltage warning has occurred (AC assert threshold 305V, recover 302V) (DC assert threshold 405V, recover 402V)	YES
					5	VIN_UV_W	Asserted when an input undervoltage warning has occurred (AC assert threshold 86V, recover 89V) (DC assert threshold 170V, recover 179V)	YES
					4	VIN_UV_F	Asserted when an input undervoltage fault has occurred, only when input voltage change from normal to undervoltage. (AC assert threshold 77V, recover 85V) (DC assert threshold 176V, recover 186V)	YES
					3	VIN_UV_OFF	Asserted when the Unit is OFF for insufficient input voltage. (Assert threshold 77V, recover 85V) (DC assert threshold 176V, recover 186V)	YES
					2	IIN_OC_F	Asserted when an input overcurrent fault has occurred	NO
					1	IIN_OC_W	Asserted when an input overcurrent warning has occurred (Assert threshold refer to the setting of command 0x5D IIN_OC_WARN_LIMIT, recover threshold = IIN_OC_WARN_LIMIT - 2A)	YES
					0	PIN_OP_W	Asserted when an input overpower warning has occurred (Assert threshold refer to the setting of command 0x6B PIN_OP_WARN_LIMIT, recover threshold = PIN_OP_WARN_LIMIT - 300W)	YES
7D	STATUS_TEMPERATURE	R/W Byte	1	All	7	TEMPERATURE_OT_F	Asserted when an overtemperature fault has occurred (assert when TEMPERATURE_OT_W is set for 10 seconds)	YES
					6	TEMPERATURE_OT_W	Asserted when an overtemperature warning has occurred (One of the temperature sensors is over their corresponding set threshold for 1 second)	YES
					5	TEMPERATURE_UT_W	Asserted when an undertemperature warning has occurred	NO
					4	TEMPERATURE_UT_F	Asserted when an undertemperature fault has occurred	NO
					3	RESERVED	Reserved	NO
					2	RESERVED	Reserved	NO
					1	RESERVED	Reserved	NO
					0	RESERVED	Reserved	NO
7E	STATUS_CML	R/W Byte	1	All	7	CML_COMMAND_E	Asserted when an invalid or unsupported command is received	YES
					6	CML_DATA_E	Asserted when invalid or unsupported data is received	YES
					5	CML_PEC_E	Asserted when a packet error checking (PEC) failed has occurred	YES
					4	CML_MEMORY_F	Asserted when a memory fault is detected (example: Checksum errors during bootload)	YES
					3	CML_PROCESSOR_F	Asserted when a processor fault is detected (primary-secondary UART error)	YES
					2	RESERVED	Reserved	NO
					1	CML_COMM_F	Asserted when a communication fault not listed in [7:3] has occurred, such as timeout	YES
					0	CML_OTHER_F	Asserted when another memory or logic fault has occurred (example: UART error)	NO
80	STATUS_MFR_SPECIFIC	R/W Byte	1	All	7	RESERVED		NO
					6	RESERVED		NO
					5	RESERVED		NO
					4	I_SENSE_FAIL	Current sensor reading error	YES
					3	TEMP_SENSE_FAIL	Temperature sensor reading error	YES
					2	WRONG_PID	Primary product ID incorrect	YES
					1	RESERVED		NO
					0	ORING_FAULT	Oring FET fault	YES

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
81	STATUS_FANS_1_2	R/W Byte	1	All	7	FAN_1_F	Fan 1 fault (Assert threshold - fan 1 RPM 3000, recover 4000)	YES
					6	FAN_2_F	Fan 2 fault (Assert threshold - fan 2 RPM 3000, recover 4000)	YES
					5	FAN_1_W	Fan 1 warning (Assert threshold - (fan 1 RPM error > 4000, recover 2500) or (fan RPM error < -8000, recover -4500))	YES
					4	FAN_2_W	Fan 2 warning (Assert threshold - (fan 2 RPM error > 4000, recover 2500) or (fan RPM error < -8000, recover -4500))	YES
					3	FAN_1_OVERRIDE	Fan 1 speed overridden	YES
					2	FAN_2_OVERRIDE	Fan 2 speed overridden	YES
					1	FAN_AIRFLOW_F	Airflow fault	NO
					0	FAN_AIRFLOW_W	Airflow warning	NO
86	READ_EIN	Block Read	6	All			Input Energy count, Rollover count and Sample count Direct data format, coefficients supplied by command COEFFICIENT Energy count Resolution: 1W	YES
87	READ_EOUT	Block Read	6	All			Output Energy count, Rollover count and Sample count Direct data format, coefficients supplied by command COEFFICIENT Energy count Resolution: 1W	YES
88	READ_VIN	Read Word	2	All			Input Voltage Sensor Reading in Vrms PMBus Sensor Data Format : Linear (N= -2 or -1) PMBus Sensor Resolution: 0.25Vrms Full-scale : 359Vac / 506Vdc Accuracy: +/-2%	YES
89	READ_IIN	Read Word	2	All			Input Current Sensor Reading in Arms PMBus Sensor Data Format : Linear (N= 0 to -7) PMBus Sensor Resolution: 0.0078Arms Full-scale : 28.3Arms / 40 Adc Accuracy: +/-5% @10-20% load, +/-2% @>20% load	YES
8B	READ_VOUT	Read Word	2	0			Output Voltage Sensor Reading in Vdc PMBus Sensor Data Format : Linear (N = -9) supplied by command VOUT_MODE PMBus Sensor Resolution: 0.00195Vdc Full-scale : 16 Vdc Accuracy: +/-2%	YES
8C	READ_IOUT	Read Word	2	0			Output Current Sensor Reading in Adc PMBus Sensor Data Format : Linear (N= -4 to -1) PMBus Sensor Resolution: 0.125 Adc Full-scale : 350 Adc Accuracy: +/-5% @10-20% load, +/-2% @>20% load	YES
8D	READ_TEMPERATURE_1	Read Word	2	All			Temperature Sensor reading in °C PMBus Sensor Data Format : Linear (N = -3) PMBus Sensor Resolution: 0.125 °C Range : -128°C to 128°C Accuracy: +/-3°C	YES

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
8E	READ_TEMPERATURE_2	Read Word	2	All			Temperature Sensor reading in °C	YES
							PMBus Sensor Data Format : Linear (N = -3)	
							PMBus Sensor Resolution: 0.125 °C	
							Range : -128°C to 128°C	
							Accuracy: +/-3°C	
8F	READ_TEMPERATURE_3	Read Word	2	All			Temperature Sensor reading in °C	YES
							PMBus Sensor Data Format : Linear (N = -3)	
							PMBus Sensor Resolution: 0.125 °C	
							Range : -128°C to 128°C	
							Accuracy: +/-3°C	
90	READ_FAN_SPEED_1	Read Word	2	All			Fan Speed Sensor reading in RPM	YES
							PMBus Sensor Data Format : Linear (N = 5 RPM_MAX <= 32736)	
							PMBus Sensor Resolution: 32 RPM (N=5)	
							Full-scale : 32736 RPM	
							Accuracy: +/-5% of full-speed	
91	READ_FAN_SPEED_2	Read Word	2	All			Fan Speed Sensor reading in RPM	YES
							PMBus Sensor Data Format : Linear (N = 5 RPM_MAX <= 32736)	
							PMBus Sensor Resolution: 32 RPM (N=5)	
							Full-scale : 32736 RPM	
							Accuracy: +/-5% of full-speed	
96	READ_POUT	Read Word	2	0			Output Power Sensor reading in watts	YES
							PMBus Sensor Data Format : Linear (N = 2 to -2)	
							PMBus Sensor Resolution: 0.25 Watts	
							Full-scale : 4095W	
							Accuracy: +/-5% @10-20% load, +/-2% @>20% load	
97	READ_PIN	Read Word	2	All			Input Power Sensor reading in watts	YES
							PMBus Sensor Data Format : Linear (N = 2 to -2)	
							PMBus Sensor Resolution: 0.25 Watts	
							Full-scale : 4095W	
							Accuracy: +/-5% @10-20% load, +/-2% @>20% load	
98	PMBUS_REVISION	Read Byte	1	All			Reading of the PMBus revision to which the power supply is compliant	YES
							Always read 22h	
99	MFR_ID	Block Read	1+9	All			Manufacturer's ID (ASCII code): MURATA	YES
9A	MFR_MODEL	Block Read	1+17	All			Manufacturer's Model Number (ASCII code) : MW0CP74-3000-A-RM	YES
9B	MFR_REVISION	Block Read	1+8	All			Primary Side Major Firmware Revision	YES
							Primary Side Minor Firmware Revision	
							Secondary Side Major Firmware Revision	
							Secondary Side Minor Firmware Revision	
							Bootloader Major Firmware Revision	
							Bootloader Minor Firmware Revision	
							Major Hardware Revision	
							Minor Hardware Revision	
9C	MFR_LOCATION	Block Read	1+5	All			Identify the facility that manufactured the unit (ASCII code) : NNI	YES
9D	MFR_DATE	Block Read	1+4	All			Identify the unit's date of manufacture (ASCII code: YYWW, e.g. 1535, 15-> year, 35 -> week)	YES
9E	MFR_SERIAL	Block Read	1+12	All			Serial Number	YES

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
<b>A0</b>	MFR_VIN_MIN	Read Word	2	All			Minimum rated value of the input voltage = 90V. Always read F8B4h. Minimum rated value of the input voltage = 180V. Always read F2D0h when the input line operation mode is high range only	<b>YES</b>
<b>A1</b>	MFR_VIN_MAX	Read Word	2	All			Maximum rated value of the input voltage = 300V. Always read FA58h.	<b>YES</b>
<b>A2</b>	MFR_IIN_MAX	Read Word	2	All			Maximum rated value of the input current = 25Amps. Always read DB20h.	<b>YES</b>
<b>A3</b>	MFR_PIN_MAX	Read Word	2	All			Maximum rated value of the input power = 3300W. Always read 1339h.	<b>YES</b>
<b>A4</b>	MFR_VOUT_MIN	Read Word	2	0			Minimum rated value of the output voltage = 11.7V. Linear (N = -9) supplied by command VOUT_MODE. Always read 1766h.	<b>YES</b>
<b>A5</b>	MFR_VOUT_MAX	Read Word	2	0			Maximum rated value of the output voltage = 12.9V. Linear (N = -9) supplied by command VOUT_MODE. Always read 19CCh.	<b>YES</b>
<b>A6</b>	MFR_IOUT_MAX	Read Word	2	0			Maximum rated value of the output current = 244A. Always read F3D0h.	<b>YES</b>
<b>A7</b>	MFR_POUT_MAX	Read Word	2	All			Maximum rated value of the output power = 3000W. Always read 12EEh.	<b>YES</b>
<b>A8</b>	MFR_TAMBIENT_MAX	Read Word	2	All			Maximum ambient temperature: 50degC. Always read 32h	<b>YES</b>
<b>A9</b>	MFR_TAMBIENT_MIN	Read Word	2	All			Minimum ambient temperature: 0degC. Always read 0	<b>YES</b>
<b>AA</b>	MFR_EFFICIENCY_LL	Block Read	1+14	All			Retrieves information about the efficiency of the device while operating at a high line condition. Vin =115V, LP = 360W, Leff = 92%, MP = 900W, Meff = 94%, HP = 1800W, Heff = 90%. Always read 0x98, 0xEB, 0xD0, 0xFA, 0xE0, 0xEA, 0x84, 0x03, 0xF0, 0xEA, 0x84, 0x0B, 0xD0, 0xEA	<b>YES</b>
<b>AB</b>	MFR_EFFICIENCY_HL	Block Read	1+14	All			Retrieves information about the efficiency of the device while operating at a high line condition. Vin =230V, LP = 600W, Leff = 94%, MP = 1500W, Meff = 96%, HP = 3000W, Heff = 91%. Always read 0x98, 0xF3, 0x58, 0x02, 0xF0, 0xEA, 0xEE, 0x0A, 0x00, 0xEB, 0xEE, 0x12, 0xD8, 0xEA	<b>YES</b>
<b>C0</b>	MFR_MAX_TEMP1 (Ambient)	Read Word	2	All			Maximum rated temperature (Ambient): 50degC. Always read 32h	<b>YES</b>
<b>C1</b>	MFR_MAX_TEMP2 (Hot-spot secondary)	Read Word	2	All			Maximum rated temperature (hot-spot secondary): 120degC. Always read 78h	<b>YES</b>
<b>C2</b>	MFR_MAX_TEMP3 (Hot-spot primary)	Read Word	2	All			Maximum rated temperature (hot-spot primary): 115degC. Always read 73h	<b>YES</b>
<b>EB</b>	INPUT_MODE	R/W Byte	1	All	0		Asserted when the input line operation mode is high range only	<b>YES</b>

## PMBus™ Command List: Pg. 1 (12Vsb output)

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
00	Same as page 0							
01	Same as page 0							
03	Same as page 0							
05	Same as page 0							
06	Same as page 0							
19	Same as page 0							
1A	Same as page 0							
1B	SMBALERT_MASK	Write Word/Block Write - Block Read Process Call	2 / Variable	All			Used to prevent a warning or fault condition from asserting the SMBALERT# signal. Support the following Status_x command code: 7A and 7B (for standby output), 7C, 7D, 7E, 80 and 81 (for both main and standby output)	YES
20	VOUT_MODE	Read Byte	1	1			Single data byte sets the READ_VOUT sensor to linear mode data format and supplies N = -9 exponent for translation to volts. Always read 17h	YES
30	Same as page 0							
3A	Same as page 0							
3B	Same as page 0							
3C	Same as page 0							
46	IOUT_OC_FAULT_LIMIT	R/W Word	2	1			Sets the value of the output current, in amperes, that causes the overcurrent detector to indicate an overcurrent fault condition. The value should be within 0 to default value (4A)	YES
4A	IOUT_OC_WARN_LIMIT	R/W Word	2	1			Sets the value of the output current, in amperes, that causes the overcurrent detector to indicate an overcurrent warning. The value should be within 0 to default value (3.6A)	YES
51	Same as page 0							
5D	Same as page 0							
6A	Same as page 0							
6B	Same as page 0							
78	Same as page 0							
79	Same as page 0							

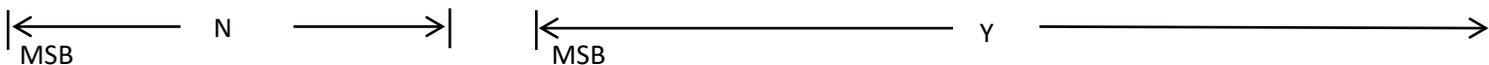
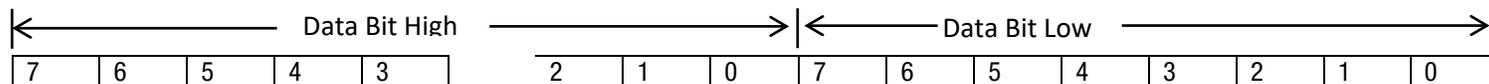
Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
7A	STATUS_VOUT	R/W Byte	1	1	7	VOUT_OV_F	Asserted when an output overvoltage fault has occurred (Assert threshold 14.5V)	YES
					6	VOUT_OV_W	Asserted when an output overvoltage warning has occurred (Assert threshold 13.5V, recover 12.5V)	YES
					5	VOUT_UV_W	Asserted when an output undervoltage warning has occurred (Assert threshold 11V, recover 12V)	YES
					4	VOUT_UV_F	Asserted when an output undervoltage fault has occurred (Assert threshold 10.5V)	YES
					3	VOUT_MAX_F	Asserted when the output is set higher than the commanded VOUT_MAX limit	NO
					2	TON_MAX_F	Asserted when the output turn-on timing has exceeded the TON_MAX fault timing	NO
					1	TON_MAX_W	Asserted when the output turn-on timing has exceeded the TON_MAX warning timing	NO
					0	VOUT_TRACKING_E	Asserted when an error in the output voltage during power-up/down has occurred	NO
7B	STATUS_IOUT	R/W Byte	1	1	7	IOUT_OC_F	Asserted when an output overcurrent fault has occurred (Assert threshold refer to the setting of command 0x46 IOUT_OC_FAULT_LIMIT)	YES
					6	IOUT_OC_SHUTDOWN	Asserted when an output overcurrent and low voltage shutdown fault has occurred	NO
					5	IOUT_OC_W	Asserted when an output overcurrent warning has occurred (Assert threshold refer to the setting of command 0x4A IOUT_OC_WARN_LIMIT, recover threshold = IOUT_OC_WARN_LIMIT - 0.75A)	YES
					4	IOUT_UC_W	Asserted when an output undercurrent fault has occurred	NO
					3	CURRENT_SHARE_F	Asserted when an output current share fault has occurred	NO
					2	POWER_LIMIT_MODE	Asserted when the unit has entered output power limiting mode	NO
					1	POUT_OP_F	Asserted when an output overpower fault has occurred	NO
					0	POUT_OP_W	Asserted when an output overpower warning has occurred	NO
7C	Same as page 0							
7D	Same as page 0							
7E	Same as page 0							
80	Same as page 0							
81	Same as page 0							
86	Same as page 0							
87	Same as page 0							
88	Same as page 0							
89	Same as page 0							
8B	READ_VOUT	Read Word	2	1	Output Voltage Sensor Reading in Vdc			YES
					PMBus Sensor Data Format : Linear (N = -9) supplied by command VOUT_MODE			
					PMBus Sensor Resolution: 0.00195Vdc			
					Full-scale : 16 Vdc			
8C	READ_IOUT	Read Word	2	1	Output Current Sensor Reading in Adc			YES
					PMBus Sensor Data Format : Linear (N = -6)			
					PMBus Sensor Resolution: 0.15625 Adc			
					Full-scale : 16 Adc			
Accuracy: +/-5% @10-20% load, +/-2% @>20% load								
8D	Same as page 0							
8E	Same as page 0							
8F	Same as page 0							
90	Same as page 0							

Command Code	Command Name	Read / Write	# of Bytes	Byte Name	Bit(s) Number	Bit Name	Definition	Supported Y/N
91	Same as page 0							
96	READ_POUT	Read Word	2	1			Output Power Sensor reading in watts PMBus Sensor Data Format : Linear (N = 1 to -2) PMBus Sensor Resolution: 0.25 Watts Full-scale : 2047W Accuracy: +/-5% @10-20% load, +/-2% @>20% load	YES
97	Same as page 0							
98	Same as page 0							
99	Same as page 0							
9A	Same as page 0							
9B	Same as page 0							
9C	Same as page 0							
9D	Same as page 0							
9E	Same as page 0							
9F	Same as page 0							
A0	Same as page 0							
A1	Same as page 0							
A2	Same as page 0							
A3	Same as page 0							
A4	MFR_VOUT_MIN	Read Word	2	1			Minimum rated value of the output voltage = 11.6V. Linear (N = -9) supplied by command VOUT_MODE. Always read 1733h.	YES
A5	MFR_VOUT_MAX	Read Word	2	1			Maximum rated value of the output voltage = 12.8V. Linear (N = -9) supplied by command VOUT_MODE. Always read 1999h.	YES
A6	MFR_IOUT_MAX	Read Word	2	1			Maximum rated value of the output current = 2.5A. Linear (N = -3) Always read E814h.	YES
A7	MFR_POUT_MAX	Read Word	2	All			Maximum rated value of the output power = 30W. Always read DBC0h.	YES
A8	Same as page 0							
A9	Same as page 0							
AA	Same as page 0							
AB	Same as page 0							
C0	Same as page 0							
C1	Same as page 0							
C2	Same as page 0							
EB	Same as page 0							

## Linear Data Format

[Link to front page](#)

Telemetry sensor and output voltage readings follow linear format as defined by PMBus Power System Mgmt. Protocol Specification – Part II – Revision 1.2 (summarized below)



The Relationship 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 compliment integer; and

N is a 5 bit, two’s compliment integer.

## VOUT\_MODE:

### [Link to command list](#)

Output Voltage returned readings and parameters are expressed in Linear VOUT\_MODE format described below.

### Step one:

Read VOUT\_Mode (CMD\_20h) to determine the exponent and format - results are as follows:

Mode definition			Returned 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 exponent for the mantissa delivered as the data bytes for an output voltage command.  Bits 4:0 returned= 10111b = N=-9 (Default)	20	VOUT_MODE	17h	Bit 7	0
						Bit 6	0
						Bit 5	0
						Bit 4	1
						Bit 3	0
						Bit 2	1
						Bit 1	1
						Bit 0	1

**Step Two:**

**Convert the high and low data bytes known as the Mantissa into real world output voltage:**

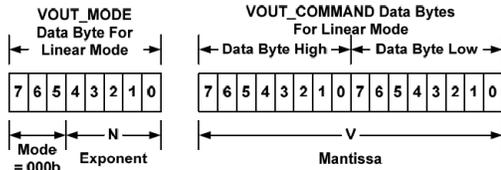


Figure 6. Linear Format Data Bytes

The Mode bits are set to 000b.

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

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

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.

