

### PMBus™ Commands

This application note is applicable to the following product.  
D1U54P-W-1200-12-HxxxC

### Standard PMBus™ Commands

All data passed over the PMBus™ interface uses PEC per the PMBus™ specification v 1.1 definition. Linear data formatting is used for all passed parameters. It is strongly recommended to make full use of the PEC byte to validate all transactions and repeat if not validated. Block reads (whereby the loose byte received denotes the remaining bytes to be clocked out) are not supported on these 1200W D1U54P-x power supplies. A minimum 100 usec delay between transactions (between START and STOP bits) is recommended for robust PMBus™ communications.

Note: 100kHz I<sup>2</sup>C communication is supported on the PMBus™ interface. These products do not support 400kHz I<sup>2</sup>C communication on the PMBus™ interface.

### D1U54P-W-1200-12-HxxxC

Power Supply Controllers			
Vendor	MFG Part Number	Package	Description
Microchip Technology Inc.	PIC24FJ32GA002T-I/SS	28-pin SSOP	(Primary) 16-bit PIC, 32K flash, 8K SRAM, -40C to 85C
Microchip Technology Inc.	PIC24FJ64GA006T-I/PT	64-pin TQFP	(Secondary) 16-bit PIC, 64K flash, 8K SRAM, -40C to 85C
Power Supply External EEPROM			
Vendor	MFG Part Number	Package	Description
Microchip Technology Inc.	24AA024T-I/MS	8-pin MSOP	2Kbit, 2.5-5.5V 400kHz, 1.8-2.5V 100kHz, 85C serial EEPROM
Standard pin out (D1U54P-W-1200-12-HxxPC)			
APS pin (A3) resistor to GND(KΩ)*	Power Supply Main Controller (Serial Comm Slave Address)	Power Supply External EEPROM (Serial Comm 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 resistor should be ±5% tolerance
Alternate pin out (D1U54P-W-1200-12-HxxC)			
A1 (Serial Address BIT 1)	A0 (Serial Address BIT 0)	Power Supply Main Controller (Serial Comm Slave Address)	Power Supply External EEPROM (Serial Comm Slave Address)
LOW	LOW	0xB0	0xA0
LOW	HIGH	0xB2	0xA2
HIGH	LOW	0xB4	0xA4
HIGH	HIGH	0xB6	0xA6

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Command Code	Command Name	# of Bytes	Read / Write	Access Page	Byte Name	Bit(s) Number	Bit Name	Definition	Supported	Comments
00	PAGE	1	R/W	All				Command to provide ability to configure, control & monitor multiple outputs	YES	
01	OPERATION	1	R/W	0		5:2		Set output margin high/low voltages	NO	Main Output
						7		Turn the unit on/off in conjunction with digital input from PSON_H	YES	
02	ON_OFF_CONFIG	1	R	All		0	ON_OFF_DELAY	1 = Turn off immediately (default) / 0 = Use delay @ turn-off	YES	
						1	ON_OFF_POLARITY	1 = Power on processing is active high (default)	YES	
						2	USE_CONTROL	1 = Use CONTROL pin for on/off power processing (default)	YES	
						3	USE_OPERATION	1 = Use OPERATION command for on/off power processing (default)	YES	
						4	USE_CNTL_AND_OP	1 = Use both CONTROL pin & OPERATION command (default)	YES	
						5	RESERVED		NO	
						6	RESERVED		NO	
03	CLEAR_FAULTS	1	W	All				Write only command clears all faults that have been set in all the STATUS_XXXX registers simultaneously	YES	
20	VOUT_MODE	1	R	0				Single data byte sets the READ_VOUT sensor to linear mode data format and supplies N = -6 exponent for translation to volts PMBus Spec - Part II - Revision 1.1 - Sections 8.1-8.3	YES	Main Output
25	VOUT_MARGIN_HIGH	2	R/W	0				Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin High"	NO	Main Output

Command Code	Command Name	# of Bytes	Read / Write	Access Page	Byte Name	Bit(s) Number	Bit Name	Definition	Supported	Comments
26	VOUT_MARGIN_LOW	2	R/W	0				Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin Low"	NO	Main Output
3A	FAN_CONFIG_1_2	1	R	All		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	Asserted when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	NO	
						3	FAN_2_INSTALLATION	Asserted 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	Asserted when fan is commanded in RPM (Clear when fan is commanded in Duty Cycle)	YES	
3B	FAN_COMMAND_1	2	R/W	All				Manual fan override command fan speed value in RPM	YES	
								Command speed formatted in Linear as per command 0x90 - READ_FAN_SPEED_1		
79	STATUS_WORD	2	R	All	STATUS_BYTE (Lower byte of STATUS_WORD)	0	NONE_F_W	Asserted when a fault not listed in [7:1] occurred	NO	
						1	CML_F	Asserted when a communications, memory, or logic fault has occurred	YES	
						2	TEMPERATURE_F_W	Asserted when an overtemperature fault or warning has occurred	YES	
						3	INPUT_UV_F	Asserted when an input undervoltage fault has occurred	YES	
						4	OUTPUT_OC_F	Asserted when an output overcurrent fault has occurred	YES	
						5	OUTPUT_OV_F	Asserted when an output overvoltage fault has occurred	YES	
						6	UNIT_OFF	Asserted when unit not providing power to the output	YES	
					7	BUSY_F	Asserted when device busy and unable to respond fault	YES		
					STATUS_WORD (Upper byte of STATUS_WORD)	0	UNKNOWN_F_W	Asserted when a fault not listed in [15:1] has occurred	NO	
						1	STATUS_OTHER_F_W	Asserted when a bit in command STATUS_OTHER set	NO	
						2	FANS_F_W	Asserted when a fan fault or warning has occurred	YES	
						3	POWER_GOOD_L	Asserted when the POWER_GOOD signal is negated	YES	
						4	MFG_SPECIFIC_F_W	Manufacturer specific fault or warning has occurred	YES	
						5	INPUT_F_W	Asserted when an Input voltage/current/power fault or warning has occurred	YES	
6	IOUT_POUT_F_W	Asserted when an output current / output power fault or warning has occurred	YES							
7A	STATUS_VOUT	1	R	0		0	VOUT_TRACKING_E	Asserted when an error in the output voltage during power-up/down has occurred	NO	Main Output
						1	TON_MAX_W	Asserted when the output turn-on timing has exceeded the TON_MAX warning timing	NO	
						2	TON_MAX_F	Asserted when the output turn-on timing has exceeded the TON_MAX fault timing	NO	
						3	VOUT_MAX_F	Asserted when the output is set higher than the commanded VOUT_MAX limit	NO	
						4	VOUT_UV_F	Asserted when an output undervoltage fault has occurred	YES	
						5	VOUT_UV_W	Asserted when an output undervoltage warning has occurred	YES	
						6	VOUT_OV_W	Asserted when an output overvoltage warning has occurred	YES	
						7	VOUT_OV_F	Asserted when an output overvoltage fault has occurred	YES	
7B	STATUS_IOUT	1	R	0		0	POUT_OP_W	Asserted when an output overpower warning has occurred	YES	Main Output
						1	POUT_OP_F	Asserted when an output overpower fault has occurred	YES	
						2	POWER_LIMIT_MODE	Asserted when the unit has entered output power limiting mode	NO	
						3	CURRENT_SHARE_F	Asserted when an output current share fault has occurred	NO	
						4	IOUT_UC_W	Asserted when an output undercurrent fault has occurred	NO	
						5	IOUT_OC_W	Asserted when an output overcurrent warning has occurred	YES	
						6	IOUT_OC_SHUTDOWN	Asserted when an output overcurrent and low voltage shutdown fault has occurred	YES	
						7	IOUT_OC_F	Asserted when an output overcurrent fault has occurred	YES	
7C	STATUS_INPUT	1	R	All		0	PIN_OP_W	Asserted when an input overpower warning has occurred	YES	
						1	IIN_OC_W	Asserted when an input overcurrent warning has occurred	YES	
						2	IIN_OC_F	Asserted when an input overcurrent fault has occurred	YES	
						3	VIN_UV_OFF	Asserted when the Unit is OFF for insufficient input voltage	YES	
						4	VIN_UV_F	Asserted when an input undervoltage fault has occurred	YES	
						5	VIN_UV_W	Asserted when an input undervoltage warning has occurred	YES	
						6	VIN_OV_W	Asserted when an input overvoltage warning has occurred	YES	
						7	VIN_OV_F	Asserted when an input overvoltage fault has occurred	YES	

Command Code	Command Name	# of Bytes	Read / Write	Access Page	Byte Name	Bit(s) Number	Bit Name	Definition	Supported	Comments
7D	STATUS_TEMPERATURE	1	R	All		0	RESERVED	Reserved	NO	
						1	RESERVED	Reserved	NO	
						2	RESERVED	Reserved	NO	
						3	RESERVED	Reserved	NO	
						4	TEMPERATURE_UT_F	Asserted when an undertemperature fault has occurred	NO	
						5	TEMPERATURE_UT_W	Asserted when an undertemperature warning has occurred	NO	
						6	TEMPERATURE_OT_W	Asserted when an overtemperature warning has occurred	YES	
	7	TEMPERATURE_OT_F	Asserted when an overtemperature fault has occurred	YES						
7E	STATUS_CML	1	R	All		0	CML_OTHER_F	Asserted when another memory or logic fault has occurred (example: UART error)	YES	
						1	CML_NONE_F	Asserted when a communication fault not listed in [7:3] has occurred	NO	
						2	RESERVED	Reserved	NO	
						3	CML_PROCESSOR_F	Asserted when a processor fault is detected	NO	
						4	CML_MEMORY_F	Asserted when a memory fault is detected (example: Checksum errors during bootload)	NO	
						5	CML_PEC_E	Asserted when a packet error checking (PEC) failed has occurred	YES	
						6	CML_DATA_E	Asserted when invalid or unsupported data is received	YES	
	7	CML_COMMAND_E	Asserted when an invalid or unsupported command is received	YES						
81	STATUS_FANS_1_2	1	R	All		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						
88	READ_VIN	2	R	All			Input Voltage Sensor Reading in Vrms PMBus Sensor Data Format : Linear (N = -1) PMBus Sensor Resolution: 0.5Vrms Sensor Full-scale : 300Vrms Accuracy: +/-2% of Sensor Full-scale	YES		
							Input Current Sensor Reading in Arms PMBus Sensor Data Format : Linear (N = -6) PMBus Sensor Resolution: 0.015625Arms Sensor Full-scale : 16 Arms Accuracy: +/-5% of Sensor Full-scale			
89	READ_IIN	2	R	All			Output Voltage Sensor Reading in Vdc PMBus Sensor Data Format : Linear (N = -6) supplied by command VOUT_MODE PMBus Sensor Resolution: 0.015625Vdc Sensor Full-scale : 14.5 Vdc Accuracy: +/-2% of Sensor Full-scale	YES	Main Output	
							Output Current Sensor Reading in Adc PMBus Sensor Data Format : Linear (N = -3) PMBus Sensor Resolution: 0.125 Adc Sensor Full-scale : 146 Adc Accuracy: +/-2% of Sensor Full-scale			
8B	READ_VOUT	2	R	0			Temperature Sensor reading in °C PMBus Sensor Data Format : Linear (N = 0) PMBus Sensor Resolution: 1 °C Sensor Range : -10°C to 100°C Accuracy: +/-3°C	YES	Secondary Airflow Temperature (Inlet)	
							Temperature Sensor reading in °C PMBus Sensor Data Format : Linear (N = 0) PMBus Sensor Resolution: 1 °C Sensor Range : -10°C to 100°C Accuracy: +/-3°C			
8D	READ_TEMPERATURE_1	2	R	0			Temperature Sensor reading in °C PMBus Sensor Data Format : Linear (N = 0) PMBus Sensor Resolution: 1 °C Sensor Range : -10°C to 150°C Accuracy: +/-3°C	YES	Secondary Hotspot Temperature	
							Temperature Sensor reading in °C PMBus Sensor Data Format : Linear (N = 0) PMBus Sensor Resolution: 1 °C Sensor Range : -10°C to 150°C Accuracy: +/-3°C			
8E	READ_TEMPERATURE_2	2	R	All			Fan 1 Speed Sensor reading in RPM PMBus Sensor Data Format : Linear (N = 5) PMBus Sensor Resolution: 32 RPM Sensor Full-scale : 24,000 RPM Accuracy: +/-5% of full-speed	YES		

Command Code	Command Name	# of Bytes	Read / Write	Access Page	Byte Name	Bit(s) Number	Bit Name	Definition	Supported	Comments
96	READ_POUT	2	R	All				Output Power Sensor reading in watts	YES	
								PMBus Sensor Data Format : Linear (N = 1)		
								PMBus Sensor Resolution: 2 Watts		
								Sensor full-scale : 1500W Accuracy: +/-5% of full-scale		
97	READ_PIN	2	R	All				Input Power Sensor reading in watts	YES	
								PMBus Sensor Data Format : Linear (N = 1)		
								PMBus Sensor Resolution: 2 Watts		
								Sensor full-scale : 1500W Accuracy: +/-5% of full-scale		
98	PMBUS_REVISION	1	R	All				Reading of the PMBUS revision to which the power supply is compliant	YES	
								PMBus Spec - Part II - Revision 1.1 - Section 22.1		
9B	MFR_REVISION	8	R	All	PRI_MAJOR_FW_REV	0		Primary Side Major Firmware Revision	YES	
					PRI_MINOR_FW_REV	1		Primary Side Minor Firmware Revision	YES	
					SEC_MAJOR_FW_REV	2		Secondary Side Major Firmware Revision	YES	
					SEC_MINOR_FW_REV	3		Secondary Side Minor Firmware Revision	YES	
					FLOAT_MAJOR_FW_REV	4		Floating Side Major Firmware Revision	NO	
					FLOAT_MINOR_FW_REV	5		Floating Side Minor Firmware Revision	NO	
					BOOT_MAJOR_FW_REV	6		Bootloader Major Firmware Revision	NO	
					BOOT_MINOR_FW_REV	7		Bootloader Minor Firmware Revision	NO	
E0	PS_STATUS	2	R	All		0	CALIBRATION	Asserted when the unit is in Calibration mode	YES	"Non-sticky" Power Supply Status Bits
						1	VSTBY_SELECT	Asserted when Vstby set to 5V; de-asserted when Vstby set to 3.3V	NO	
						2	PS_KILL	Asserted when the PS_KILL pin is defeated and the unit is properly seated in the chassis	YES	
						3	VIN_OK	Asserted when the input voltage is within operating specification	YES	
						4	VIN_RANGE	Asserted when input voltage range is high; de-asserted when input voltage range is low	YES	
						5	PFC_BUS	Asserted when the PFC BUS is within operating specification	YES	
						6	PS_ON	Asserted when the PS_ON logic set to enable the main output	YES	
						7	POWER_GOOD	Asserted when main output power delivered to unit is OK; mirrors the digital output signal	YES	
						8	UNUSED		YES	
						9	UNUSED		YES	
						10	UNUSED		YES	
						11	UNUSED		YES	
						12	UNUSED		YES	
						13	UNUSED		YES	
						14	WARNING	Asserted when power supply warning has occurred; tracks 'WARNING' status LED	YES	
15	FAULT	Asserted when power supply fault has occurred; tracks 'FAULT' status LED	YES							
E1	EEPROM_WP	1	R/W	All				Byte to enable (write 0x9A) or disable (write 0x56) writes to the external EEPROM	YES	
E2	READ_HOURS_USED	3	R	All				Accumulated fault-free power-on hours of the output in hours	YES	
								PMBus Sensor Data Format : Linear (N = 0)		
								PMBus Sensor Resolution: 1 hour		
								Sensor full-scale : ~ 1,900 Years Accuracy: +/-3%		
E3	READ_UART_P_S	Variable	R	All				Primary to secondary UART data	NO	
E4	READ_UART_S_P	Variable	R	All				Secondary to primary UART data	NO	
E5	READ_RESETS	4	R	All				Read RCON register to aid in troubleshooting	NO	
E6	BOOTLOAD	Variable	R	All				Bootloading commands	NO	

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Command Code	Command Name	# of Bytes	Read / Write	Access Page	Byte Name	Bit(s) Number	Bit Name	Definition	Supported	Comments
20	VSTBY_MODE	1	R	1				Single data byte sets the READ_VOUT sensor to linear mode data format and supplies N = -7 exponent for translation to volts PMBus Spec - Part II - Revision 1.1 - Sections 8.1-8.3	YES	Standby Output
25	VSTBY_MARGIN_HIGH	2	R/W	1				Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin High"	NO	Standby Output
26	VSTBY_MARGIN_LOW	2	R/W	1				Load the unit with the voltage to which the output is to be changed when the OPERATION command set to "Margin Low"	NO	Standby Output
7A	STATUS_VSTBY	1	R	1		0	VOUT_TRACKING_E	Asserted when an error in the output voltage during power-up/down has occurred	NO	Standby Output
						1	TON_MAX_W	Asserted when the output turn-on timing has exceeded the TON_MAX warning timing	NO	
						2	TON_MAX_F	Asserted when the output turn-on timing has exceeded the TON_MAX fault timing	NO	
						3	VOUT_MAX_F	Asserted when the output is set higher than the commanded VOUT_MAX limit	NO	
						4	VOUT_UV_F	Asserted when an output undervoltage fault has occurred	YES	
						5	VOUT_UV_W	Asserted when an output undervoltage warning has occurred	YES	
						6	VOUT_OV_W	Asserted when an output overvoltage warning has occurred	YES	
						7	VOUT_OV_F	Asserted when an output overvoltage fault has occurred	YES	
7B	STATUS_ISTBY	1	R	1		0	POUT_OP_W	Asserted when an output overpower warning has occurred	YES	Standby Output
						1	POUT_OP_F	Asserted when an output overpower fault has occurred	YES	
						2	POWER_LIMIT_MODE	Asserted when the unit has entered output power limiting mode	NO	
						3	CURRENT_SHARE_F	Asserted when an output current share fault has occurred	NO	
						4	IOUT_UC_W	Asserted when an output undercurrent fault has occurred	NO	
						5	IOUT_OC_W	Asserted when an output overcurrent warning has occurred	YES	
						6	IOUT_OC_SHUTDOWN	Asserted when an output overcurrent and low voltage shutdown fault has occurred	YES	
						7	IOUT_OC_F	Asserted when an output overcurrent fault has occurred	YES	
8B	READ_VSTBY	2	R	1			Output Voltage Sensor Reading in Vdc PMBus Sensor Data Format : Linear (N = -7) supplied by command VOUT_MODE PMBus Sensor Resolution: 0.007813Vdc Sensor Full-scale : 4.3V (3.3V Output) ; 6V (5V Output) Accuracy: +/-2% of Sensor Full-scale	YES	Standby Output	
8C	READ_ISTBY	2	R	1			Output Current Sensor Reading in Adc PMBus Sensor Data Format : Linear (N = -7) PMBus Sensor Resolution: 0.007813Adc Sensor Full-scale : 9 Adc (3.3V Output) ; 6Adc (5V Output) Accuracy: +/-2% of Sensor Full-scale	YES	Standby Output	
8F	READ_TEMPERATURE_3	2	R	All			Temperature Sensor reading in °C PMBus Sensor Data Format : Linear (N = -2) PMBus Sensor Resolution: 0.125 °C Sensor Range : -10°C to 150°C Accuracy: +/-3°C	YES	Primary Hotspot Temperature	

### D1U54P-W-1200-12-HxxPC Internal EEPROM

Address (HEX)	Data Length	Register Contents (Hexidecimal Format) Order = Low Address -> High Address Dynamic Data Byte = xx	Register Name	Static or Dynamic Register? (S/D)	R/W	Protected? (Y/N)	Data Type	Description
00 - 0A	11	01 00 00 00 01 00 00 FE 01 09 19	Header	S		N	HEX	
0B - 14	10	C9 4D 75 72 61 74 61 2D 50 53	Manufacturer Bytes	S		N	TEXT	Reads as "Murata-PS"
15 - 1B	7	C6 54 47 31 37 39 32	Product Name	S		N	TEXT	Reads as "TG1792"
1C - 32	23	D5 44 31 55 35 34 50 2D 57 2D 31 32 30 30 2D 31 32 2D 48 43 34 50 43	Part Number	S		N	TEXT	Reads as "D1U54P-W-1200-12-HC4PC"
33	1	C0	Product Version Length	S		N	HEX	Product version, length =0
34-40	13	CC pp pp yy yy ww ww rr rr XX XX XX XX	Product Serial Number	D		N	TEXT	CC = HEX 0xCC length identifier pp = Product Code yy = Serial Number Year ww = Serial Number Week rr = Serial Number Revision Level XX = Serial Number
41-46	6	C0 C0 C0 C0 C0 C0	Custom data	S		N	HEX	Asset tag, Custom data, FRU ID
47	1	C1	END	S		N	HEX	Signifies end of information
48-4E	7	00 00 00 ... 00 00 00	UNUSED EEPROM	S		N	HEX	Fill all unused memory locations with 0x00
4F	1	XX	Checksum	D		N	HEX	XX = 2's complement checksum from 0x08 - 0x46
50-FF	176	00 00 00 ... 00 00 00	UNUSED EEPROM	S		N	HEX	Fill all unused memory locations with 0x00

### Data Format

The Data Format section is entirely redundant. The products use the Linear data format.

Formula:  $X = Y * 2^N$

X = the calculated value

Y = the two-byte value read from PMBus

N = the sensor-specific exponent

Command Name	Page	Sensor name	N	Resolution Per Bit	Minimum Reading	Maximum Reading	Units
READ VIN	0	VIN	-1	0.5	0	300	Vrms
READ IIN	0	IIN	-6	0.015625	0	15.984375	Arms
READ VOUT	0	VOUT	-6	0.015625	0	15.984375	Vdc
READ IOUT	0	IOUT	-3	0.125	0	127.875	Adc
READ VOUT	1	VSTBY	-7	0.0078125	0	7.9921875	Vdc
READ IOUT	1	ISTBY	-7	0.0078125	0	7.9921875	Idc
READ POUT	0	POUT	1	2	0	2046	W
READ PIN	0	PIN	1	2	0	2046	W
READ_FAN_SPEED_1	0	FAN SPEED	5	32	0	32736	RPM
READ_TEMPERATURE_1	0	INLET	0	1	-10	150	C
READ_TEMPERATURE_2	0	OUTLET	0	1	-10	150	C
READ_TEMPERATURE_3	0	SEC HOT SPOT	0	1	-10	150	C
READ_TEMPERATURE_3	1	PRI HOT SPOT	0	1	-10	150	C

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ISO 9001 and 14001 REGISTERED



**This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:**  
Refer to: <http://www.murata-ps.com/requirements/>

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