

This application note describes the PMBus™ digital communications protocol features of **MW0CP68-3600** 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 I²C 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 |
| ST | M24C02-WMN6TP | | 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 / B3 | A1 / B4 | A0 / B5 | |
| 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 (Main Output)

| Command Code | Command Name | Read / Write | # of Bytes | Page | 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, E0, E2, E4 | 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, 8A, 8B, 8C, 8D, 8E, 8F, 90, 91, 96, 97, 9F, A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, C0, C1, C2, D0, D1, D2, D8, E0, E2, E3, E4 | 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_WR | Command is supported for write | YES |
| | | | | | 5 | CMD_SUPPORTED_RD | 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 | Page | 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 | YES |
| | | | | | | | Read/write both 3B and 3C command get the same result | |
| | | | | | | | Command speed formatted in Linear (N = 0) | |
| 46 | IOU_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 condition. The value should be within 1A to default value (87A) | YES |
| 4A | IOU_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 1A to default value (70A) | YES |
| 51 | OT_WARN_LIMIT (Hot Spot) | R/W Word | 2 | All | | | Set the temperature, in degrees Celsius, of the secondary hot spot (READ_TEMPERATURE_2) at which it should indicate an Overtemperature Warning alarm. The value should be within 0 to default value (100degC) | 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 (25A) | 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 (4500W) | 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 (4500W) | 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 | Page | 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 58.8V) | YES |
| | | | | | 6 | VOUT_OV_W | Asserted when an output overvoltage warning has occurred (Assert threshold 56.1V, recover 55V) | YES |
| | | | | | 5 | VOUT_UV_W | Asserted when an output undervoltage warning has occurred (Assert threshold 52.8V, recover 54V) | YES |
| | | | | | 4 | VOUT_UV_F | Asserted when an output undervoltage fault has occurred (Assert threshold 45V) | 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 - 2A) | 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 (Assert threshold 4680W) | 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 - 50W) | YES |

| Command Code | Command Name | Read / Write | # of Bytes | Page | 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 315V, recover 310V) (DC assert threshold 410V, recover 403V) | YES |
| | | | | | 6 | VIN_OV_W | Asserted when an input overvoltage warning has occurred (AC assert threshold 308V, recover 302V) (DC assert threshold 405V, recover 402V) | YES |
| | | | | | 5 | VIN_UV_W | Asserted when an input undervoltage warning has occurred (AC assert threshold 173V, recover 178V) (DC assert threshold 178V, recover 188V) | 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 168V, recover 178V) (DC assert threshold 176V, recover 186V) | YES |
| | | | | | 3 | VIN_UV_OFF | Asserted when the Unit is OFF for insufficient input voltage. (AC assert threshold 168V, recover 178V) (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 - 1A) | 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 - 50W) | YES |
| 7D | STATUS_TEMPERATURE | R/W Byte | 1 | All | 7 | TEMPERATURE_OT_F | Asserted when an overtemperature fault has occurred (Assert when one of the temperature sensors is over their corresponding set threshold for 11 second) | YES |
| | | | | | 6 | TEMPERATURE_OT_W | Asserted when an overtemperature warning has occurred (Assert when one of the temperature sensors is over their corresponding set threshold for 1 second) | YES |
| | | | | | 5 | TEMPERATURE_UT_W | Asserted when an under temperature warning has occurred | NO |
| | | | | | 4 | TEMPERATURE_UT_F | Asserted when an under temperature 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 | PRI_TEMP_OT | LLC primary temp sensor over temperature fault | YES |
| | | | | | 5 | ORING_TEMP_OT | Oring temp sensor over temperature fault | YES |
| | | | | | 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 | Page | 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 5400, recover 6000) | YES |
| | | | | | 6 | FAN_2_F | Fan 2 fault (Assert threshold - fan 2 RPM 5400, recover 6000) | 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 |
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| 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 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| 8A | READ_VCAP | Read Word | 2 | All | | | Bulk Capacitor Voltage Sensor Reading in Vdc PMBus Data Format : Linear (N= 0 to -1) PMBus Sensor Resolution: 0.5Vdc Full-scale : 1023 Vdc Accuracy: +/-2% | 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 : 61.5 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 : 182 Adc Accuracy: +/-5% @10-20% load, +/-2% @>20% load | YES |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

| Command Code | Command Name | Read / Write | # of Bytes | Page | Bit(s) Number | Bit Name | Definition | Supported Y/N |
|--------------|--------------------|--------------|------------|------|---------------|----------|---|---------------|
| 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 |
| 8E | READ_TEMPERATURE_2 | 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 |
| 8F | READ_TEMPERATURE_3 | 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 |
| 90 | READ_FAN_SPEED_1 | Read Word | 2 | All | | | Fan Speed Sensor reading in RPM 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 | YES |
| 91 | READ_FAN_SPEED_2 | Read Word | 2 | All | | | Fan Speed Sensor reading in RPM 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 | YES |
| 96 | READ_POUT | Read Word | 2 | 0 | | | Output Power Sensor reading in watts PMBus Sensor Data Format : Linear (N = 3 to -3) PMBus Sensor Resolution: 0.125 Watts Full-scale : 8184W Accuracy: +/-5% @10-20% load, +/-2% @>20% load | YES |
| 97 | READ_PIN | Read Word | 2 | All | | | Input Power Sensor reading in watts PMBus Sensor Data Format : Linear (N = 3 to -3) PMBus Sensor Resolution: 0.125 Watts Full-scale : 8184W Accuracy: +/-5% @10-20% load, +/-2% @>20% load | YES |
| 98 | PMBUS_REVISION | Read Byte | 1 | All | | | Reading of the PMBus revision to which the power supply is compliant Always read 22h | YES |
| 99 | MFR_ID | Block Read | 1+9 | All | | | Manufacture's ID (ASCII code): Murata-PS | YES |
| 9A | MFR_MODEL | Block Read | 1+17 | All | | | Manufacture's Model Number (ASCII code) : MW0CP68-3600-D-RM | YES |
| 9B | MFR_REVISION | Block Read | 1+14 | All | | | Manufacturer's model revision (ASCII code). XXXX-YYYY-0000 XXXX - Primary FW version/revision, YYYY- Secondary FW version/revision | YES |
| 9C | MFR_LOCATION | Block Read | 1+5 | All | | | Identify the facility that manufactured the unit (ASCII code) : China | 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 : TBD | YES |
| A0 | MFR_VIN_MIN | Read Word | 2 | All | | | Minimum rated value of the AC input voltage = 180V. Always read F2D0h. Minimum rated value of the DC input voltage = 192V. Always read F300h. | YES |
| A1 | MFR_VIN_MAX | Read Word | 2 | All | | | Maximum rated value of the AC input voltage =305V. Always read FA62h. Maximum rated value of the DC input voltage =400V. Always read FB20. | YES |

| Command Code | Command Name | Read / Write | # of Bytes | Page | Bit(s) Number | Bit Name | Definition | Supported Y/N |
|--------------|------------------------------------|--------------|------------|------|---------------|----------|--|---------------|
| A2 | MFR_IIN_MAX | Read Word | 2 | All | | | Maximum rated value of the input current = 25Amps. Always read DB20h. | YES |
| A3 | MFR_PIN_MAX | Read Word | 2 | All | | | Maximum rated value of the input power = 3900W. Always read 13CFh. | YES |
| A4 | MFR_VOUT_MIN | Read Word | 2 | 0 | | | Minimum rated value of the output voltage = 52.865V. Linear (N = -9) supplied by command VOUT_MODE. Always read 69BBh. | YES |
| A5 | MFR_VOUT_MAX | Read Word | 2 | 0 | | | Maximum rated value of the output voltage = 56.135V. Linear (N = -9) supplied by command VOUT_MODE. Always read 7045h. | YES |
| A6 | MFR_IOUT_MAX | Read Word | 2 | 0 | | | Maximum rated value of the output current = 66A. Always read EA10h. | YES |
| A7 | MFR_POUT_MAX | Read Word | 2 | All | | | Maximum rated value of the output power = 3600W. Always read 1384h. | YES |
| A8 | MFR_TAMBIENT_MAX | Read Word | 2 | All | | | Maximum ambient temperature: 50degC. Always read 32h | YES |
| A9 | MFR_TAMBIENT_MIN | Read Word | 2 | All | | | Minimum ambient temperature: 0degC. Always read 0 | YES |
| AB | 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 = 720W, Leff = 94%, MP = 1800W, Meff = 96%, HP = 3600W, Heff = 91%. Always read 0x98, 0xF3, 0xD0, 0x02, 0xF0, 0xEA, 0x84, 0x0B, 0x00, 0xEB, 0x84, 0x13, 0xD8, 0xEA | YES |
| C0 | MFR_MAX_TEMP1 (Ambient) | Read Word | 2 | All | | | Maximum rated temperature (Ambient): 55degC. Always read 37h | YES |
| C1 | MFR_MAX_TEMP2 (Hot-spot secondary) | Read Word | 2 | All | | | Maximum rated temperature (hot-spot secondary): 100degC. Always read 64h | YES |
| C2 | MFR_MAX_TEMP3 (Hot-spot primary) | Read Word | 2 | All | | | Maximum rated temperature (hot-spot primary): 110degC. Always read 6Eh | YES |
| D0 - FF | RESERVED | | | | | | Reserved for manufacturer | |

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

| Command Code | Command Name | Read / Write | # of Bytes | Page | 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 | IOOUT_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 1A to default value (4A) | YES |
| 4A | IOOUT_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 1A to default value (3.5A) | 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 | | | | | | | |
| 7A | STATUS_VOUT | R/W Byte | 1 | 1 | | | | |
| | | | | | 7 | VOUT_OV_F | Asserted when an output overvoltage fault has occurred (Assert threshold 14V) | YES |
| | | | | | 6 | VOUT_OV_W | Asserted when an output overvoltage warning has occurred (Assert threshold 12.6V, recover 12.4V) | YES |
| | | | | | 5 | VOUT_UV_W | Asserted when an output undervoltage warning has occurred (Assert threshold 11.4V, recover 11.6V) | 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 |

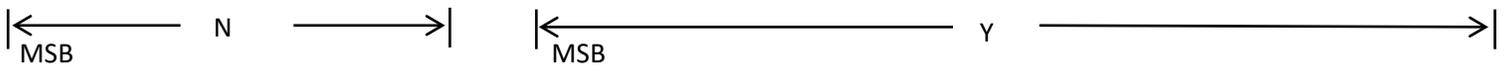
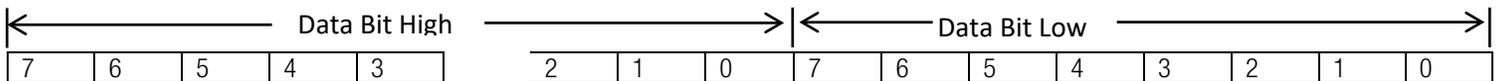
| Command Code | Command Name | Read / Write | # of Bytes | Page | Bit(s) Number | Bit Name | Definition | Supported Y/N |
|--------------|----------------|--------------|------------|------|---------------|------------------|--|---------------|
| 7B | STATUS_IOUT | R/W Byte | 1 | 1 | 7 | IOUT_OC_F | 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 - 0.1A) | 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 | | | | | | | |
| 8A | Same as page 0 | | | | | | | |
| 8B | READ_VOUT | Read Word | 2 | 1 | | | 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 | 1 | | | Output Current Sensor Reading in Adc PMBus Sensor Data Format : Linear (N = -7) PMBus Sensor Resolution: 0.0078125 Adc Full-scale : 8 Adc Accuracy: +/-5% @10-20% load, +/-2% @>20% load | YES |
| 8D | Same as page 0 | | | | | | | |
| 8E | Same as page 0 | | | | | | | |
| 8F | Same as page 0 | | | | | | | |
| 90 | Same as page 0 | | | | | | | |
| 91 | Same as page 0 | | | | | | | |
| 96 | READ_POUT | Read Word | 2 | 1 | | | Output Power Sensor reading in watts PMBus Sensor Data Format : Linear (N = -5) PMBus Sensor Resolution: 0.03125 Watts Full-scale : 32W 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 | | | | | | | |

| Command Code | Command Name | Read / Write | # of Bytes | Page | Bit(s) Number | Bit Name | Definition | Supported Y/N |
|--------------|----------------|--------------|------------|------|---------------|----------|---|---------------|
| 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 = 11.64V. Linear (N = -9) supplied by command VOUT_MODE. Always read 1748h. | YES |
| A5 | MFR_VOUT_MAX | Read Word | 2 | 1 | | | Maximum rated value of the output voltage = 12.36V. Linear (N = -9) supplied by command VOUT_MODE. Always read 18B8h. | 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 | | | | | | | |

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:

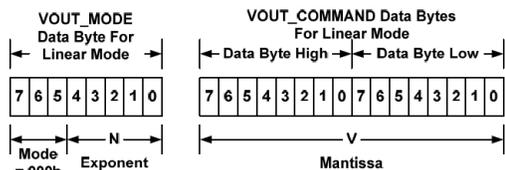


Figure 6. Linear Format Data Bytes

The Mode bits are set to 000b.

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

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

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.

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