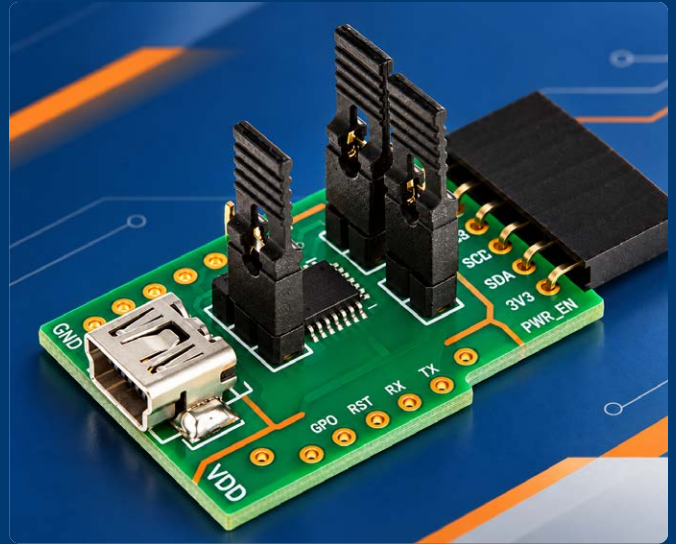


PMBUS COMMUNICATION
MEAN WELL NCP-3200 SERIES

PMBus Prototyping Setup Guide

Configuring, addressing and monitoring a PMBus system using the MCP-2221 Breakout Module and NCP-3200



Document Information

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Applies To	MEAN WELL NCP-3200 24V / 48V / 380V Models
Prepared By	Nicholas DePaolis TRC Engineering Dept.

Safety Precautions



HIGH VOLTAGE HAZARD

Caution – Dangerous high voltage output on 380V systems.



CIRCUIT BREAKER / DISCONNECT SWITCH RECOMMENDED

Install a circuit breaker or disconnect switch between AC inputs to rack shelf.



DO NOT CONNECT AC INPUTS TO RACK SHELF

Do not connect AC inputs to rack shelf until all connections have been verified.

Overview

This application note describes how to establish and use PMBus™ communication. The Power System Focused is the MEAN WELL NCP-3200-380 Rack-Mountable power supply installed in a DHP-1UT-BHV rack shelf.

We cover - wiring, device addressing, the PMBus command set relevant to this platform, data formatting and example transactions.

This document serves as a starting reference — always verify all register-level details against the current MEAN WELL NCP-3200 / DHP-1UT-B(HV) instruction manual.

IMPORTANT

Incorrect setup can cause damage to downstream equipment - always verify connections prior to energizing the system

What You Will Need

Hardware

- USB / PMBus Adapter Module
- Windows PC
- NCP-3200 Module
- DHP-1UT-B/(HV)
- Signal wires with RJ45 cable
- AC input cabling

Software / Tools

- Microchip software
- Reference utility / manual



Full Hardware Kit - cabling and RJ45 connectorization not shown

Hardware Setup

Each DHP-1UT-B/HV shelf accepts up to four NCP-3200 modules. The shelf backplane carries the PMBus SDA/SCL lines, device-address select lines, remote On/Off, and status signals (DC-OK, AC-OK, T-ALARM) on the rear connector for connection to the host controller. Multiple shelves can be ganged together and paralleled for active current share.

IMPORTANT

Do NOT connect AC in this example as that will energize the rack shelf and the inserted modules. Only energize when all connections have been verified and confirmed.

01 Determine / Set Address of Power Supply

The Connector for Remote On/Off, DC-OK, AC-OK and T-ALARM is on the rear and is denoted by CN1.

The DIP Switches are used to set different PMBus Addresses for the NCP Units within.

Please Refer to Section 4.4 of Installation Manual for Additional Detail!

JK1 denotes the connector socket that contains the SDA and SCL lines. You must have an RJ45 connector to interface with these pins.



ADDRESS SETTING (HEXIDECIMAL)

[0x40-0x43]
SW1 [ON]
SW2 [ON]
SW3 [ON]
SW4 [ON]

Hardware Step 1 - JK1 and CN1 shown in red

02 Connect RJ45 Cabling to JK1 Port on Rear of Rack Shelf

In order to communicate with the rack shelf - you must have an RJ45 Connector (with SDA, SCL and Ground Connected Properly).

It is also critical to ensure that the run of your cable is not longer than ~28 inches - as this can cause communication issues when working with PMBus

It is always recommended to keep your communication lines as short as possible and utilize twisted pair to minimize noise pickup

Note: Modules are assigned addresses 0-63 depending on DIP Switch Positions. Addresses must be converted to hexadecimal

ADDRESS SETTING

Modules are assigned addresses 0-63 depending on DIP Switch Positions. Addresses must be converted to hexadecimal



Hardware Step 2: [Ensure SDA, SCL and GND are properly connected / spliced between MCP2221A Module and DHP-1UT-B/HV Rack Shelf]

Hardware Setup

03 Wire MCP-2221A data lines to power supply connector.

The cabling between MCP2221A and JK1 of Rack Shelf:

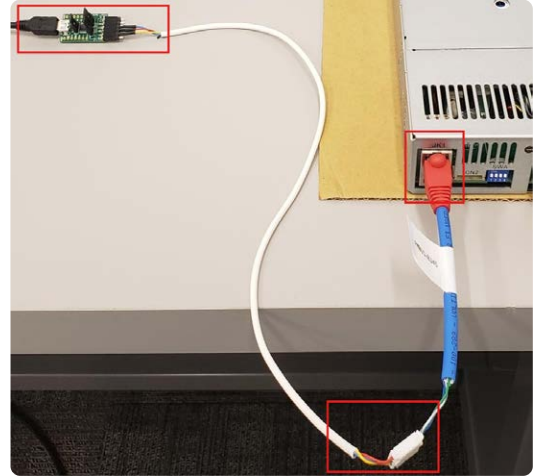
JK1:

- Pin 6: SDA
- Pin 7: SCL
- Pin 8: GND-AUX

[GND-AUX is required as both SDA and SCL are referenced to GND-AUX]

IMPORTANT NOTE

Improper Indexing of JK1 pins can be interpreted as a communication failure. Please ensure all wired connections are correct and verified prior to power up!



Example wiring of MCP-2221A to DHP-1UT-B/HV

04 Connect MCP-2221A Module to Computer

Using the included USB Cable -
Connect the PC to the MCP-2221A Module

This connection must be made when the Microchip Software is opened. (The device will be read on startup)

Note: Each NCP module in the rack shelf must be assigned a unique 7-bit address. With all DIP SW ON - the following addresses are true.

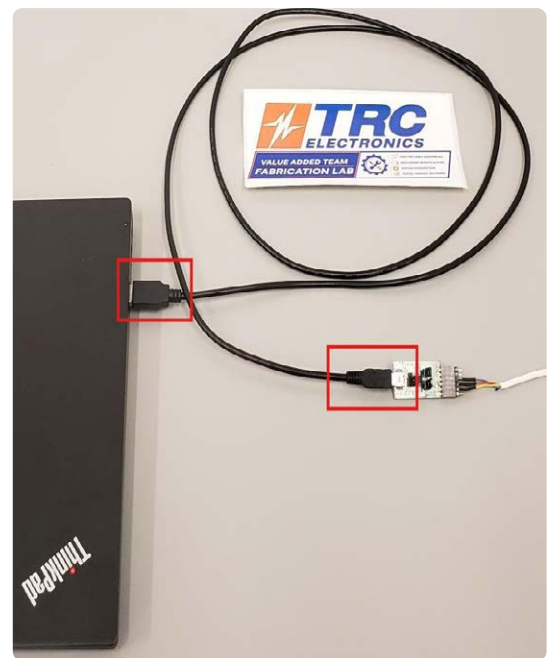
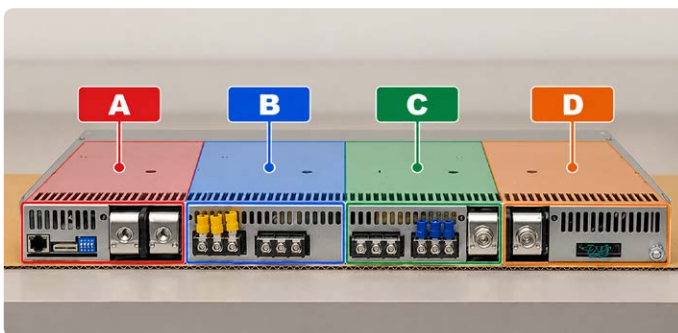
Module A: 0x40

Module B: 0x41

Module C: 0x42

Module D: 0x43

Note (See Section 4.4 of the installation manual for additional detail with respect to rack and device addressing)



MCP-2221A wired from rack shelf and PC

Control Priority & Timeout Considerations

Control priority is typically:

- 1. PMBus Communication ---- (This is the one we want to use in this guide)
****Note: Enabling PMBus Control will disable Analog and SVR Control****
- 2. Analog PV/PC Programming
- 3. SVR (Potentiometer) Adjustment

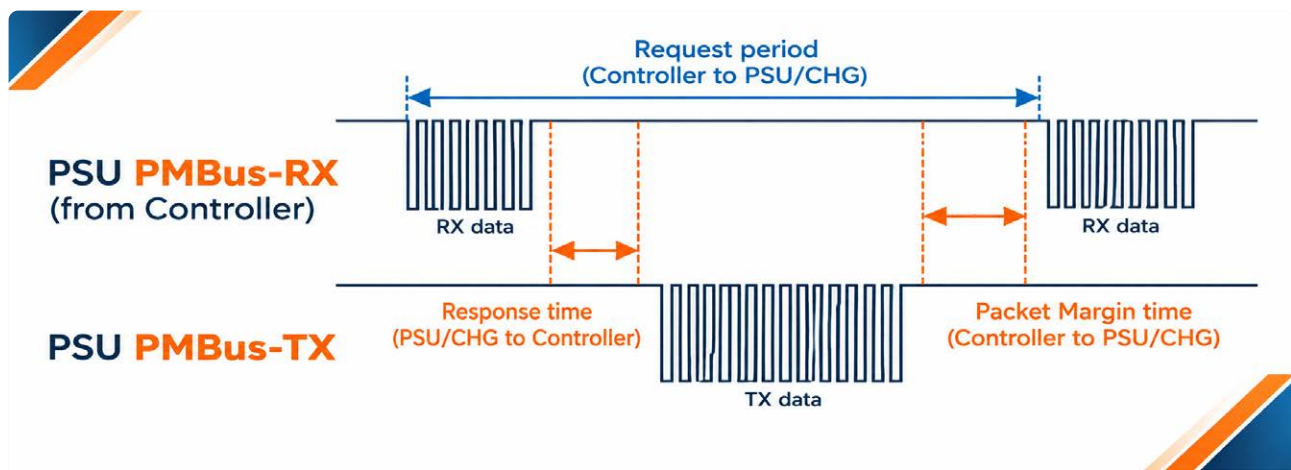
Note:

Note: It is important to allow for a inter-command delay between consecutive PMBus transactions

Minimum Request Period: 50ms

Maximum Response Time: 12.5ms

Minimum Packet Margin Time: 12.5ms



Example Below: Digital Control Mode Setting, Master Status Read and Voltage Trim for NCP-3200-380
[Quick Example Commands to Trim Output Voltage of NCP-3200-380 Rack Unit]

Example PMBus Commands

Step	Op	Bytes (Addr / CMD / Data)	Purpose
1	WRITE	40 W BE 03,00	Set Module in Slot A to Digital Control Mode Repeat for each module *Must Remote Recycle Unit or Recycle AC for Change to Stay*
2	READ	40 R BE 2	Read back 2 bytes of Register Index "BE" 02 00 = Analog Control 03 00 = Digital Control
3	READ	40 R BF 2	Read Status of Module A - Check Master Status 16 00 = Slave Unit 17 00 = Master Unit Repeat with each address until Master Unit identified
4	WRITE	40 W 22 00,00	Trim Voltage of Module in Slot A to 380V (Assuming A is Master)
5	WRITE	40 W 22 00,F1	Trim Voltage of Module in Slot A to 350V
6	WRITE	40 W 22 00,BF	Trim Voltage of Module in Slot A to 250V
7	WRITE	40 W 22 00,9C	Trim Voltage of Module in Slot A to 180V

CRITICAL

You must ensure all units in the rack shelf are in digital control mode before attempting to trim voltages!

Software Setup

01 The Software Used: MCP2221 I2C/SMBus Terminal (Microchip)

The software used in this guide is provided by Microchip. It is free to download and to use. For the purposes of this guide - a link is provided below for you to download and install the software onto your machine.

DOWNLOAD

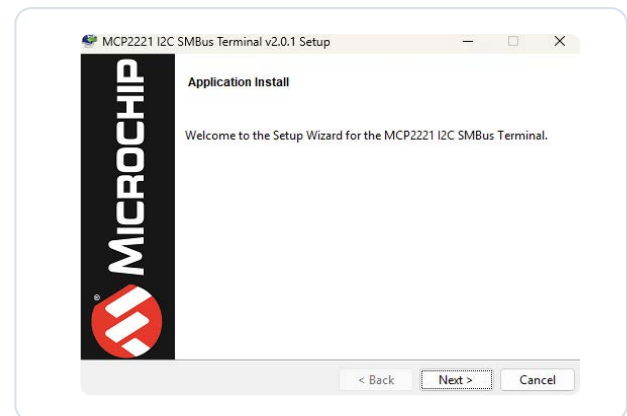
<https://ww1.microchip.com/downloads/aemDocuments/documents/APID/ProductDocuments/SoftwareLibraries/Firmware/MCP2221Terminal.zip>

02 Install the Terminal Software

Download, unzip, and run the executable file to install the terminal software we are using in this guide.

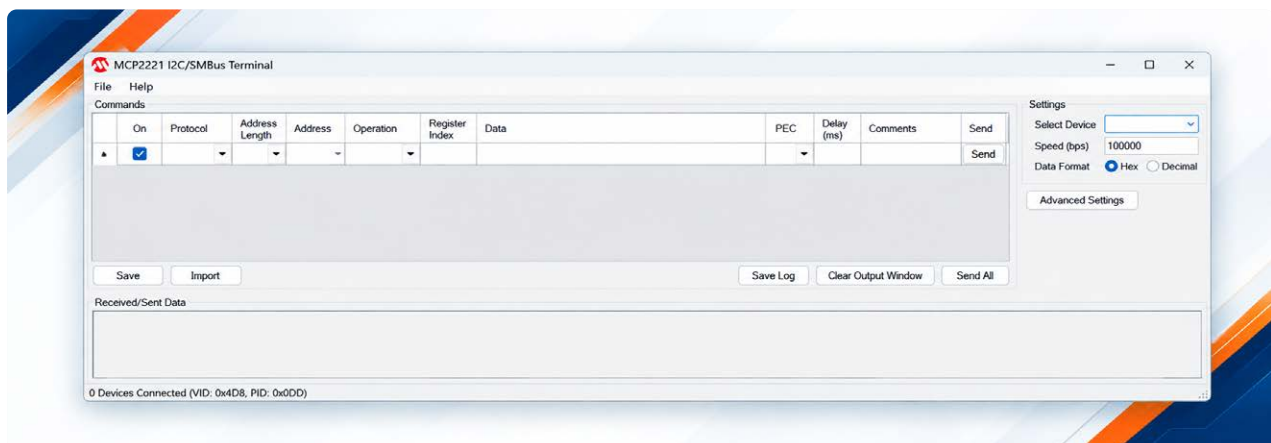
Download Zip File:

<https://ww1.microchip.com/downloads/aemDocuments/documents/APID/ProductDocuments/SoftwareLibraries/Firmware/MCP2221Terminal.zip>



Install screen of terminal software.

03 Run the Microchip I2C SMBus Terminal Software



Software: MCP2221 I2C/SMBus Terminal Software Screen

Important Commands to Get Started

VOUT_TRIM / SYSTEM_CONFIG / SYSTEM_STATUS -

[Command Codes reflect the standard PMBus command set as generally implemented across MEAN WELL's NCP / DBU / DBR-3200 platforms. **Always confirm exact supported command list via instruction manual before finalizing host firmware**

Code	Command	Type	Bytes	Description
22h	VOUT_TRIM	R/W	2	Output Voltage Trim Offset
BEh	SYSTEM_CONFIG	R/W	2	System Configuration
BFh	SYSTEM_STATUS	R	2	System Status

IMPORTANT

You must ensure all units in the rack shelf are in digital control mode before attempting to trim voltages!
*****The Output Voltage Will Only Change When Trim Commands are Sent to the Master Unit*****

```
> SMBus Read,PEC = On, Address = 43, Register Index = BF, Read 2 bytes, Delay = 0
OK
< 17 00 ← MASTER
> SMBus Read,PEC = On, Address = 40, Register Index = BF, Read 2 bytes, Delay = 0
OK
< 16 00 ← SLAVE
```

Definition of Command BEh SYSTEM_CONFIG :

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
High byte	-	-	-	-	-	EEP_OFF	-	-
Low byte	-	-	-	-	-	OPERATION_INIT		PM_CTRL

Definition of Command BFh SYSTEM_STATUS :

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
High byte	-	-	-	-	-	-	-	-
Low byte	-	EEPER	INITIAL_STATE	ADL_ON	-	PFC_OK	DC_OK	M/S

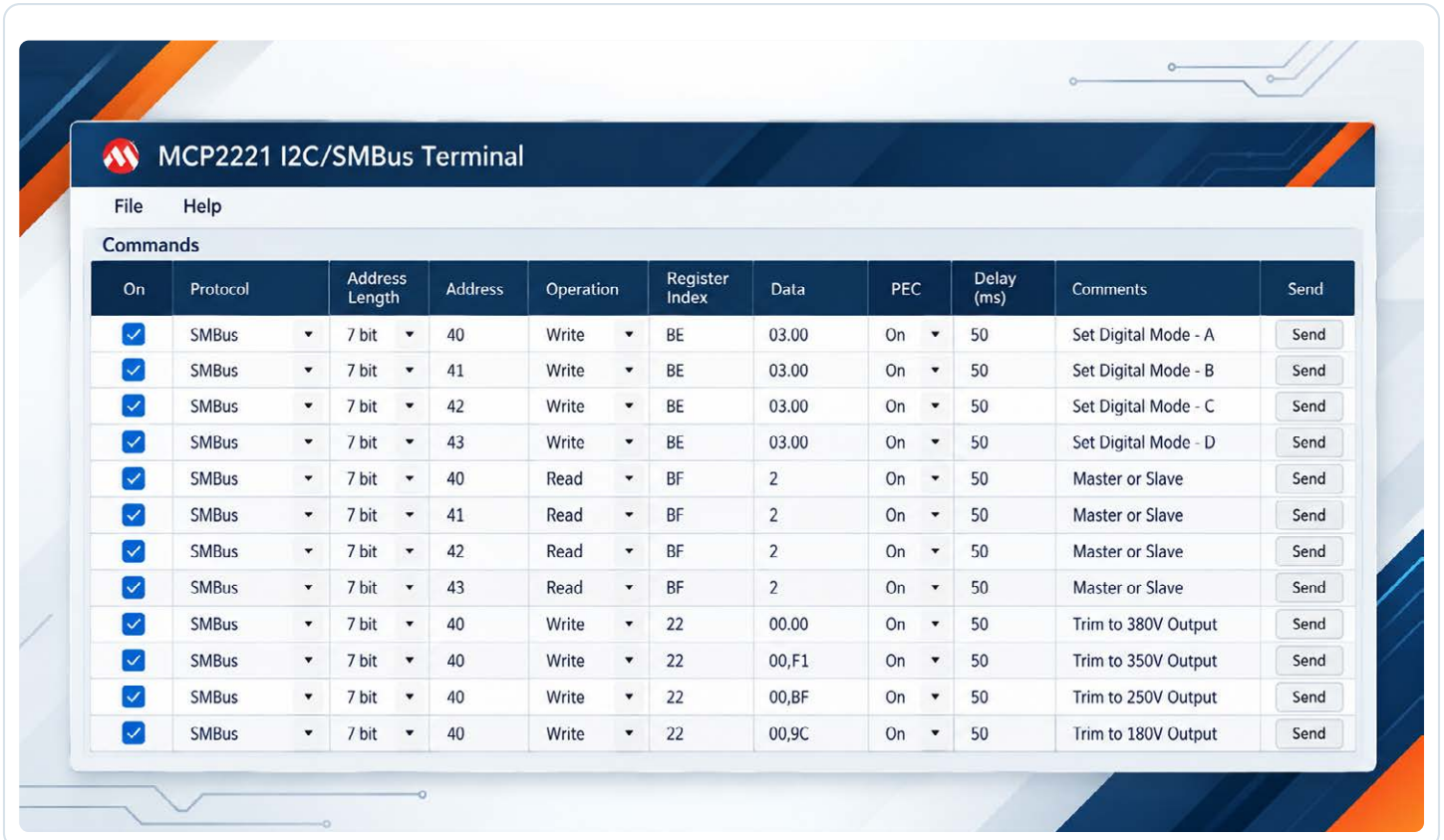
Register Index: [Definition of SYSTEM_CONFIG and STATUS]

Example Communications: Using the Microchip software tool.

Note:

All values used are hexadecimal. [Whenever you see 0x notation or an 'h' after data.]

****Commas are used to separate the bytes of data - do not use spaces or periods in MCP "Data" Field****



The screenshot displays the MCP2221 I2C/SMBus Terminal application window. It features a menu bar with 'File' and 'Help'. Below the menu is a 'Commands' section containing a table of commands. Each row in the table includes a checkbox, protocol, address length, address, operation, register index, data, PEC, delay, comments, and a 'Send' button.

On	Protocol	Address Length	Address	Operation	Register Index	Data	PEC	Delay (ms)	Comments	Send
☒	SMBus	7 bit	40	Write	BE	03.00	On	50	Set Digital Mode - A	Send
☒	SMBus	7 bit	41	Write	BE	03.00	On	50	Set Digital Mode - B	Send
☒	SMBus	7 bit	42	Write	BE	03.00	On	50	Set Digital Mode - C	Send
☒	SMBus	7 bit	43	Write	BE	03.00	On	50	Set Digital Mode - D	Send
☒	SMBus	7 bit	40	Read	BF	2	On	50	Master or Slave	Send
☒	SMBus	7 bit	41	Read	BF	2	On	50	Master or Slave	Send
☒	SMBus	7 bit	42	Read	BF	2	On	50	Master or Slave	Send
☒	SMBus	7 bit	43	Read	BF	2	On	50	Master or Slave	Send
☒	SMBus	7 bit	40	Write	22	00.00	On	50	Trim to 380V Output	Send
☒	SMBus	7 bit	40	Write	22	00,F1	On	50	Trim to 350V Output	Send
☒	SMBus	7 bit	40	Write	22	00,BF	On	50	Trim to 250V Output	Send
☒	SMBus	7 bit	40	Write	22	00,9C	On	50	Trim to 180V Output	Send

Microchip Software: [Example Command Page (380V System)]

Calculating Trim Command Data

Trim Voltage Calculation (PMBus)

1 Formula

$$\frac{V_{Difference}}{2^N}$$

2 Trim to 180V Example

- Per manual: N = -7 (380V System)

3 Calculate Voltage Difference

$$V_{Difference} = 180V - 380V = -200V$$

4 Apply Formula

$$\frac{-200V}{2^{-7}} = -25,600$$

5 Convert to Hex (Signed 2's Complement, 4 digits)

$$-25,600_{10} = 9C\ 00_{16}$$

6 Swap Byte Positions (Little Endian)

$$9C\ 00 \rightarrow 00\ 9C$$

7 Data to Send Via PMBus

Data to Send Via PMBus:
00,9C
NOTE

*The value for V-Difference is your Desired Voltage Setting minus the nominal voltage of the module***

Additional Reference Materials Reference Materials

References

- MEAN WELL NCP-3200 / DHP-1UT-B(HV) Series Instruction Manual (Latest Revision)
- Downloaded from MEAN WELL USA Website
- MEAN WELL NCP-3200 Datasheet
- System Management Interface Forum
- PMBus Power System Management Protocol Specification (Parts I & II)

Links - Datasheets, Manuals, and References

PSU Datasheet:

[URL]: <https://www.meanwellusa.com/webapp/product/search.aspx?prod=NCP-3200>

Rack Shelf Datasheet:

[URL]: <https://www.meanwellusa.com/webapp/product/search.aspx?prod=DHP-1UT-B&pdf>

[Module / PMBus Adapter] Datasheet:

[URL]: <https://ww1.microchip.com/downloads/aemDocuments/documents/OTH/ProductDocuments/UserGuides/50002282A.pdf>

[Adapter / Tool]: MCP2221A Module

[URL]: <https://www.microchip.com/en-us/development-tool/adm00559>

Need Help?

Contact TRC Electronics Technical Support at 1-888-612-9514

