RMA PLUS

User Guide

WATLOW®

Powered by Possibility

TOTAL CUSTOMER SATISFACTION 3 Year Warranty

ISO 9001 Registered Company Winona, Minnesota USA

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Technical Support

Contacting Technical Support

If you encounter a problem with your Watlow controller, review the configuration of inputs, outputs, alarms, limits, etc. to verify that the selections are consistent with your application. Often that's all that is needed to resolve an issue.

If the problem persists, e-mail wintechsupport@watlow.com or call +1 (507) 494-5656 from 7am - 5pm Central Time and ask for an Application Engineer. Please have the following information available:

- Complete model number
- All configurations
- User's Guide
- Factory Page

3-Year Product Warranty

The RMA PLUS is warranted by Watlow for a period of 36 months in accordance with the terms and conditions set forth on Watlow's website, which may be accessed at www.watlow.com/terms.

Returning a Product

1. Obtain a Return Material Authorization (RMA) Number.

This RMA number is REQUIRED to return a product for any reason.

- If you do not know why the product failed, call +1 (507) 494-5656 to speak to an Application Engineer.
- After discerning the reason for the return, call Watlow Customer Service at +1 (507) 454-5300 for the RMA number.
- When you call, you must provide:
  - Your P.O. number
  - Ship-to address
  - Bill-to address
  - Detailed description of the problem
  - Any special instructions
  - Name and phone number of person returning the product
  - Method of return shipment

2. Ship the Return

- Clearly indicate the RMA number on the outside of the carton and on all paperwork returned.
- Ship on a *Freight Prepaid* basis.

3. We will examine the returned product and RMA number to verify the reason for return.

- In cases of manufacturing defect, we will enter a repair order, replacement order or issue credit for material returned. In cases of customer misuse, we will provide repair costs and request a purchase order to proceed with the repair work.
- To return products that are not defective, goods must be in new condition, in the original boxes and they must be returned within 120 days of receipt. A 20 percent restocking charge is applied for all returned stock controls and accessories.
- If the unit cannot be repaired, you will receive a letter of explanation. and be given the option to have the unit returned to you at your expense or to have us scrap the unit.
- Watlow reserves the right to charge for no trouble found (NTF) returns.

Chapter 1 | About the RMA PLUS

The RMA PLUS is a remote access, high-speed communication gateway that provides access to all Watlow RM control modules in a system, using up to four busses via Ethernet, USB or serial.

RMA PLUS routes standard bus transactions over Ethernet and USB to all devices connected to the intermodule bus network to allow for easy system configuration and monitoring. All units come standard with a built-in managed Ethernet switch and two Ethernet jacks. RMA PLUS also connects to third-party and legacy devices, acting as a gateway between Modbus® TCP and Modbus® RTU. Up to three Modbus® TCP sessions, three standard bus over Ethernet sessions and one standard bus over USB session are available.

- Built-in Ethernet switch offers port mirroring for troubleshooting
- Built-in Ethernet switch protects from broadcast and multicast storms
- Integrated USB provides real-time communication to PC
- Modbus® TCP and Modbus® RTU allow you to build tables based on your unique needs and manage custom data sets asynchronously to fieldbus activity
- Modbus® TCP and Modbus® RTU connect to third-party and legacy devices

Conceptual Overview

- On initialization, the RMA PLUS reads the file "nor:\Setup.csv" (from the included USB drive) for feature configuration and file paths.
- Gateway busses and enabled features (i.e. Modbus® TCP, Data Logging, etc) are instantiated.
- Delivery and transfer speeds for discovery are mere seconds.
- Gateway busses interact with target devices to read/write data points. RMA PLUS logs any data point in the system, available as .csv files for easy access.Standard units are equipped to handle 16GB of data.
- Fieldbusses interact with gateway bus data sets, not directly with the target device.

Specifications

Feature	Specification

EZ-ZONE Product Compatibility	• Any Watlow product with high-speed or low-speed bus capabilities, i.e.:
	  • EZ-ZONE RM (C, E, H, L, S) version 9.0+ intermodule bus
	  • EZ-ZONE PM, RUI, ST standard bus
	  • EZ-ZONE RM (F, G, UH, Z) intermodule bus
	  • POWERGLIDE intermodule bus

Supply Voltage	• 24V
Power	• 4W, 9VA
Ethernet Communication	• 10/100 Ethernet with managed switch
Standard Communication	• Ethernet • USB • Serial ('C' connector) • Modbus® TCP over Ethernet
Additional Communication Options	• Isolated EIA 232/485, Modbus® RTU
USB	• USB 2.0 device • Mini USB connector • Composite device: vendor specific and mass storage classes
Real Time Clock with Battery Backup	• Battery typical lifetime rating of 10 years

Feature	Specification
	• Lithium battery
Data Logging	• Maximum of 2000 data points • Maximum of 500 unique data points per bus and zone • File storage on embedded micro SD memory • .CSV log files accessed via USB device port
Memory Card	• Micro SDHC (4-32GB) • 4GB class 4 SDHC on standard models (operating temperature: -25 to 85C) • 16GB class 10 SDHC on data log models (operating temperature: -40 to 85C) • -4 to 185F (-20-85C) ambient rating, non-volatile memory • All module parameters are backed up in memory
Gateway	• Modbus® TCP to standard bus or intermodule bus • Modbus® TCP to Modbus® RTU • Modbus® RTU to standard bus or intermodule bus • Modbus® RTU to Modbus® RTU
Software Compatibility	Via USB, Serial, or Ethernet • Watlow Dashboard • Watlow EZ-ZONE COMPOSER • LabVIEW (by National Instruments) Via Serial only • Watlow EZ-ZONE Configurator

RMA PLUS Safety Compliance

c(UL)us LISTED 93RL PROCESS CONTROL EQUIPMENT	Device has been evaluated to United States and Canadian requirements for Process Control Equipment and listed at Underwriters Laboratories® as CCN: QUYX, QUYX7 File E185611 to UL/EN 610101-1, CSA C22.2 #61010-1 and and recognized as CCN: QUYX2, QUYX8 File E185611 UL/EN 61010-1, CSA C22.2 #61010-1.
c(UL)us LISTED 2S81 PROC. CONT. EQ. FOR HAZARDOUS LOCATIONS	Device has been evaluated to United States and Canadian requirements and listed at Underwriters Laboratories® as CCN: QUZW, QUZW7 File E184390 to ANSI/ISA 12.12.01, CSA C22.2 NO. 213-17 Class I, Division 2, Groups A, B, C, and D for Hazardous Locations. See:www.ul.com

Ordering Part Numbers

Configuration Code

Module for communications, data logging and storage. Comes standard with Modbus® TCP, standard bus over Ethernet, USB device, internal storage and SD card.

① ② ③ ④ Rail Mount Access Module	⑤ Additional Communication Protocols	⑥ Ultra High Density Thermocouple Input Card	⑦ Data Logging	⑧ Wireless Connectivity	⑨ Future Option	⑩ Future Option	⑪ ⑫ Additional Options
RMAP	_			_	A	A	

⑤	Additional Communication Protocols
A =	None
2 =	Modbus® RTU 232/485
5 =	DeviceNet™ (future option)

⑥	Ultra High Density T/C Input Card
A =	None
1 =	18 T/C scanner inputs (future option)
2 =	18 T/C limit inputs with one global relay output (future option)

⑦	Data Logging
A =	None
D =	Data logging to 16G SD card

⑧	Wireless Connectivity
A =	None
B =	Bluetooth® (future option)
W =	Wi-Fi (future option)

⑨	Future Option
A =	Future option

⑩	Future Option
A =	Future option

⑪ ⑫	Additional Options
AA =	Standard
XX =	Custom/locked code application specific

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Modbus® is a registered trademark of Schneider Automation Incorporated.
Windows® is a registered trademark of the Microsoft Corporation.
Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc.
POWERGLIDE™ is a trademark of Watlow Electric Manufacturing Company.
DeviceNet™ and EtherNet/IP™ are trademarks of Open DeviceNet Vendors Association.

Figure 1: RMA PLUS Configuration Codes for Ordering

Chapter 2 | Mounting and Wiring

Mounting (DIN Rail or Chassis)

You can mount the RMA PLUS to a standard DIN rail or mount to a panel with a #8 3/4" screw and torque to 10-15 in.-lb. The RMA PLUS can be interconnected with other RM modules via the modular interconnection points on the back panel of all EZ-ZONE units. See "Wiring Power and Communications" on the next page.

> ⚠ CAUTION: If you drop the product from 20" or higher when mounted on the X-axis, malfunction may result.

Rail Mount

Figure 2: Mounting Dimensions
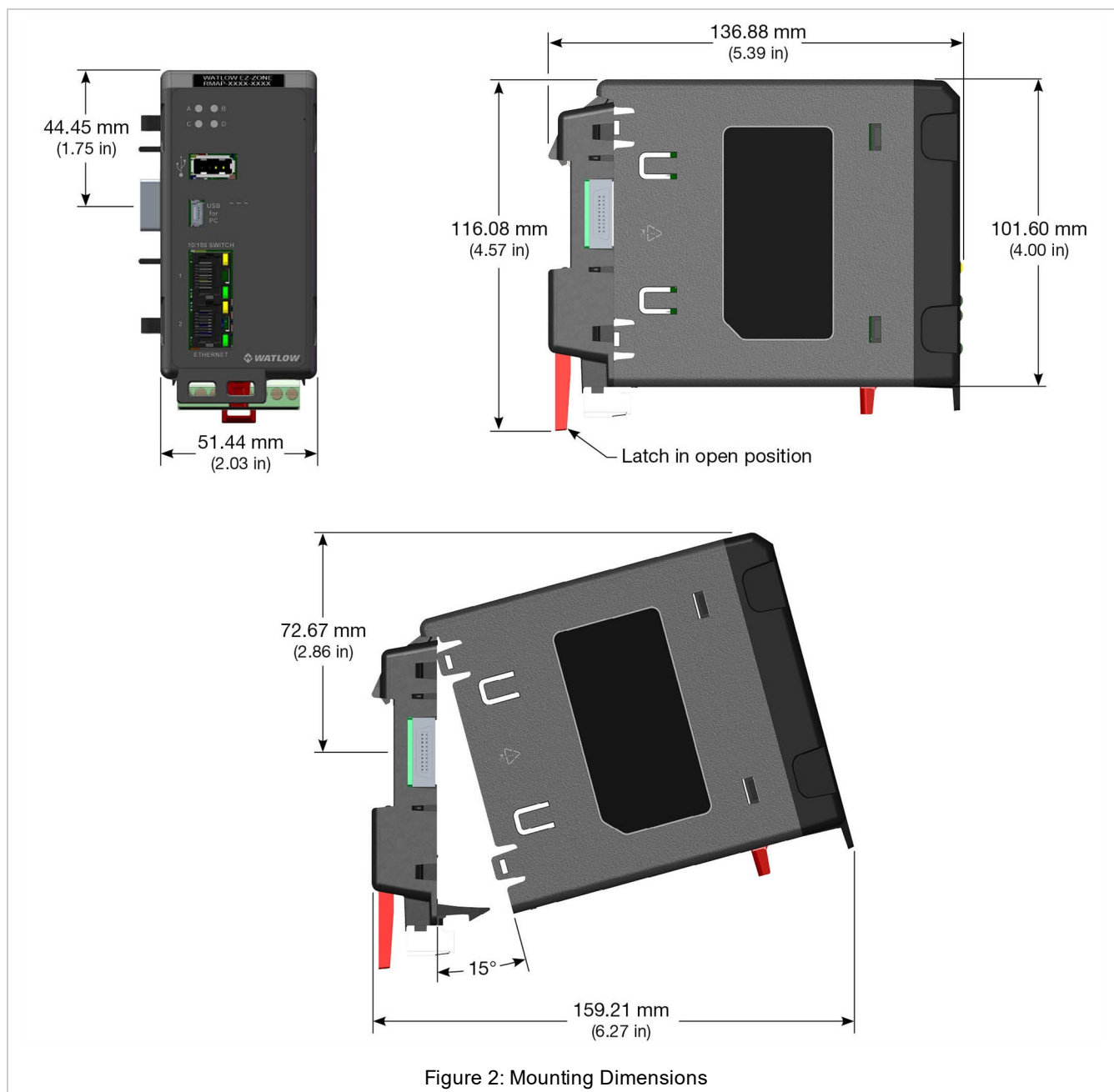
Chassis Mount

With no DIN rail, mount the removable backplane to a panel using a #8 3/4 screw, no washers of any kind, and torque to 10-15 lbs. This illustrates the backplane dimensions and screw position of three modules mounted side by side.
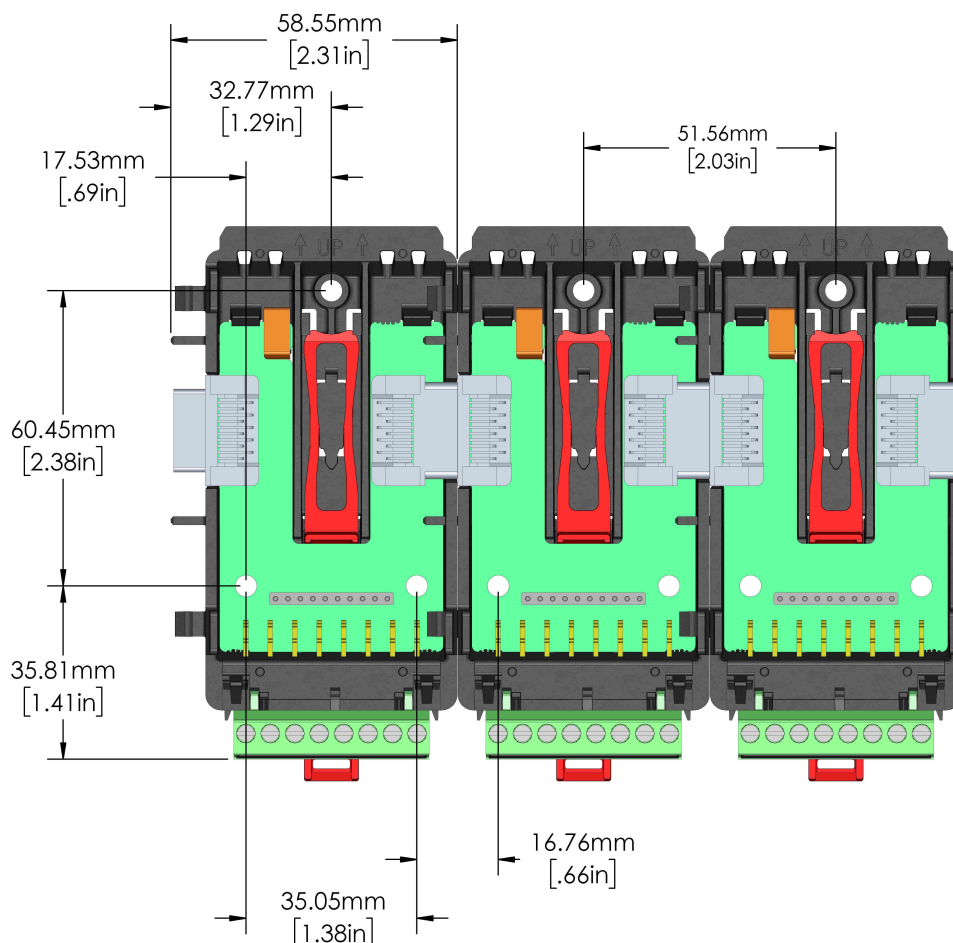
Figure 3: Back Plane Dimensions (illustrating 3 connected units)

Wiring Power and Communications

The RMA PLUS module can be installed as a stand-alone module or interconnected with other RM modules on the DIN rail via the standard EZ-ZONE modular interconnection point.

Slot C Power and Communications

Slot C on the bottom rear of the device provides connections for power, standard bus, and inter-module bus communications.

Low Power Input Requirements (same for all RM models)

- 20.4 to 30.8 VAC ~(ac)/ m (dc) 14VA
- 47 to 63Hz
- Controller module power consumption: 7 watts maximum
- 31 Watts maximum power for power supply part # 0847-0299-0000
- 60 Watts maximum power for power supply part # 0847-0300-0000
- 91 Watts maximum power for power supply part # 0847-0301-0000
- Class 2 or safety extra low voltage (SELV) power source required to comply with UL® standards

Power and Communication Slots

Slot	Terminal Function	Configuration	Power In
98, 99	Power input AC or DC+	Only needed on one module; shared on back-plane	
CF, CD, CE	Standard bus EIA-485 Common Standard bus EIA-485 T-/R-(A) Standard bus EIA-485 T+/T+ (B)	EIA-485 connection for EZ-ZONE CONFIGURATOR	
CZ, CX, CY	Intermodule bus	Wire for split-rail configurations	

Earth Ground for USBH and USBD Connectors

The USB Host and USB D connector bodies are grounded to earth using the wire trap on the bottom of the case. To ground the connectors, insert a ground wire into the trap from the case bottom. Use 18 – 26 AWG Solid or Stranded, Trim Length 3.5 ± 0.5mm (0.138 ± .02"). This earth ground is not connected to the power.
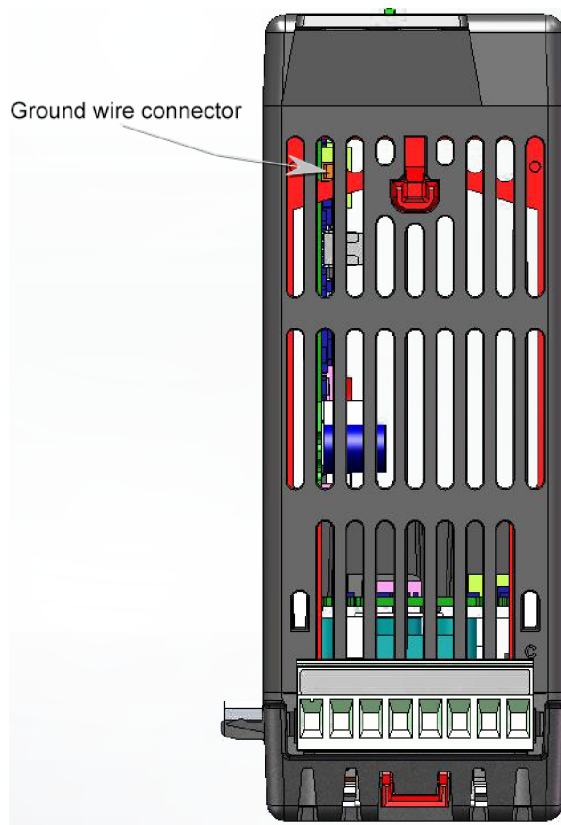
Figure 4: Ground Wire Connection Point

RMA PLUS Communications Options

RMAP-AAXX-XXXX: Standard Options Model

RMAP-AAXX-XXXX: stand-alone RMA PLUS in slot A/D is the basic model with Ethernet, USB only. You can use either or both Ethernet jacks simultaneously for any downstream or upstream.
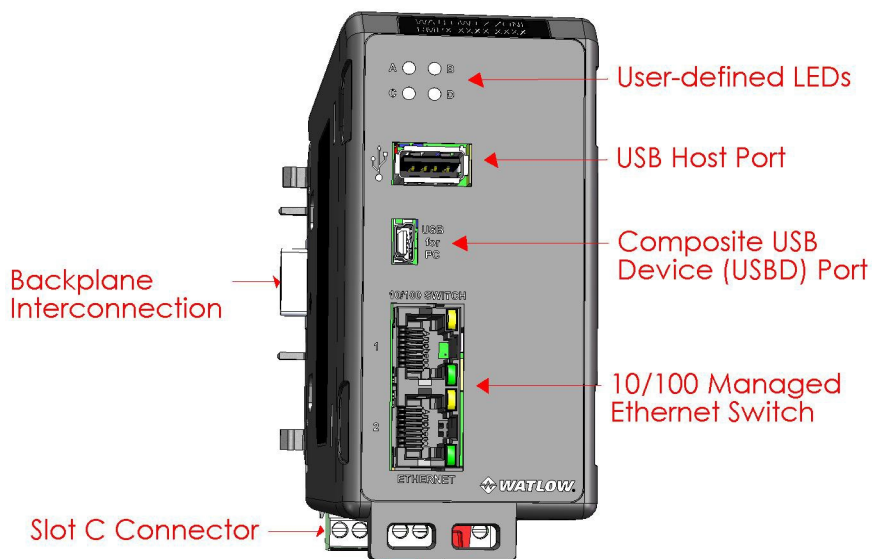
Figure 5: RMAP-Axxx-xxxx Models

RMA PLUS with Communication Options RS-232/RS-485

RMAP-2XXX-XXXX: models include current communication options: RS-232 / RS-485 module in slot B/E. Note that the 6 and 7 Ethernet ports are separate, so you need to specify the port when configuring Modbus® RTU.
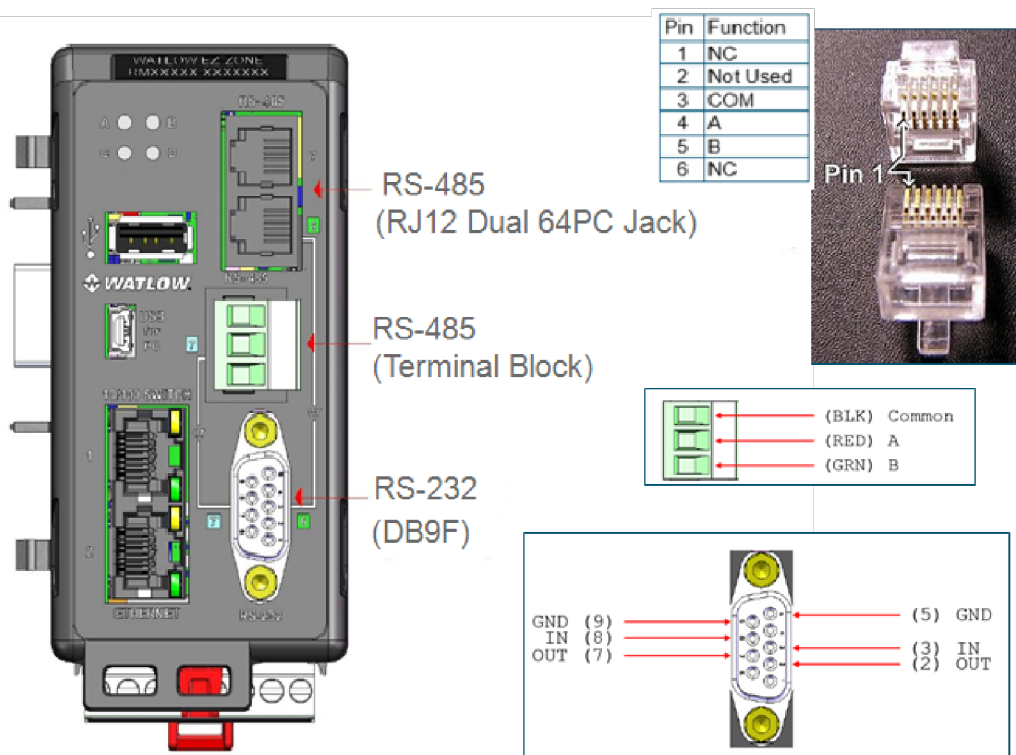
Figure 6: RMAP-2XXX-XXXX

System Wiring

The RMA PLUS module can be interconnected with other RM modules on the DIN rail via the standard EZ-ZONE modular interconnection point on the back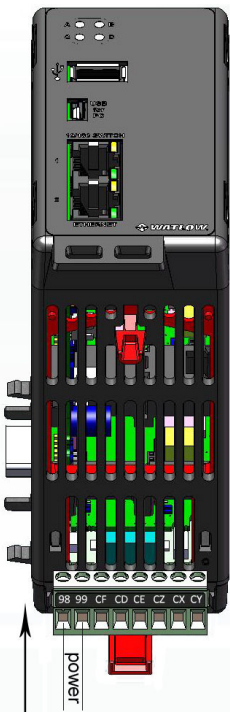plane, which is a standard feature on every device in the EZ-ZONE RM family. You may run power and communications for the entire system of connected RM devices through the RMA PLUS.
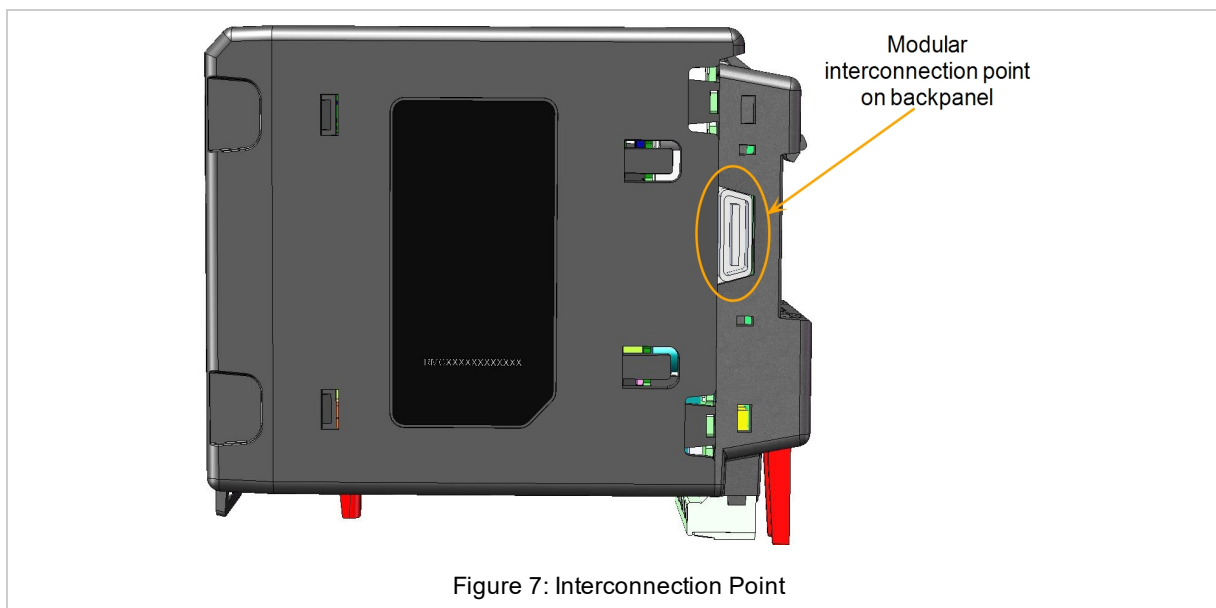
Figure 7: Interconnection Point

Ground Wire Connection Point

Split Rail Power Needs

You may have a single power supply designated for two separate DIN rails with interconnected RM modules. When designing your hardware layout for a split rail system, consider the available power supply and the loading effect of all modules used.

Watlow provides three options for power supplies:

- 90-264VAC to 24VDC @ 31 watts (Part #: 0847- 0299-0000)
- 90-264VAC to 24VDC @ 60 watts (Part #: 0847- 0300-0000)
- 90-264VAC to 24VDC @ 91 watts (Part #: 0847- 0301-0000)

Note the maximum power for each individual module of 7 watts/14VA, and consider the total of all combined units when planning power to your split rail system:

- RMCxxxxxxxxxxxx @ 7 watts / 14VA
- RMEx-xxxx-xxxx @ 7 watts / 14VA
- RMHx-xxxx-xxxx @ 7 watts / 14VA
- RMLx-xxxx-xxxx @ 7 watts / 14VA
- RMSx-xxxx-xxxx @ 7 watts / 14VA

Chapter 3 | Getting Started

About the USB Drives

Files necessary for configuration, operations, and data logging are loaded onto three drives on your RMA PLUS. The specific contents of these files vary per model number and features purchased, but all RMA PLUS devices contain these three drives:

- NOR Flash drive – to configure internal settings of the RMA
- Micro SD drive – user data i.e. data logs and supporting utilities
- RAM Disk drive – dynamic data for system confirmation, i.e. network status

You may connect your RMA PLUS to your PC with a mini-B USB cable and access the files on these drives to configure your RMA PLUS only after you install the USB Drivers. (If you have previously installed Watlow USB drivers using COMPOSER, you do not need to reinstall the drivers).

Installing Device Drivers

You must install Watlow USB device drivers before using the Micro SD, NOR FLASH, and RAM Disk drives included with your RMA PLUS. (If you already use a Watlow RM product and have Watlow USB drivers installed, you do not need to reinstall the drivers and may proceed to Configuration).

1. Connect your PC to the mini USB Device connector on the RMA PLUS. Windows will attempt to install the drivers, but the RMA PLUS device driver will not be found.

2. Open **My Computer** (Windows key + 'E') and look under the "**Devices and Drives**" group. With your RMA PLUS connected via the USB cable, you should see its three drives listed. In this image, the drives are labeled with letters E, D, and F, but your computer may have different letters for the drives.

> If the drives do not appear, check the "View" settings of Windows Explorer. Click the **View** tab of Windows Explorer, then make sure "**Hidden Items**" is checked, and/or uncheck "**Hide empty drives in the computer folder**" (if using Windows 7) or uncheck "**Hide empty drives**" (if using Windows 10).
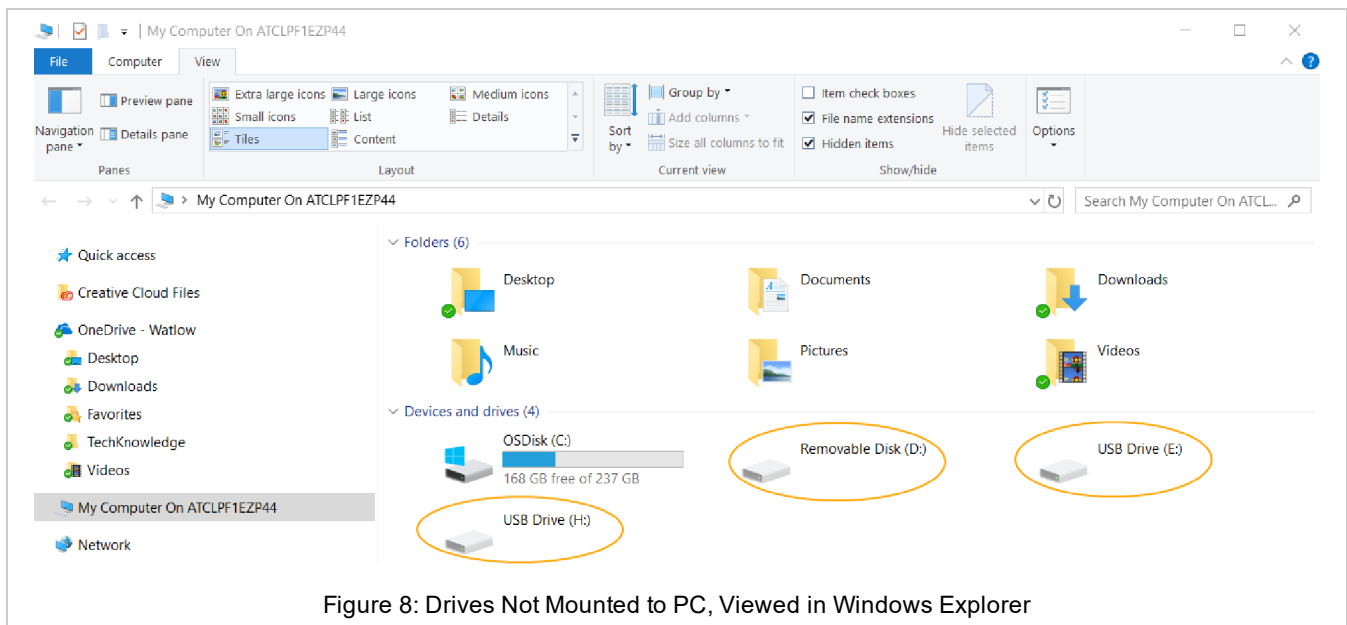
Figure 8: Drives Not Mounted to PC, Viewed in Windows Explorer

3. Right-click each drive and select the "**Eject**" option. "Eject" is used to mount and unmount the drives from the PC.

NOTE: There is an issue with certain versions of Windows 10 OS where you cannot eject one drive without the other drives being affected. If you notice this happening, use the CSV Creator tool to mount and unmount the drives. You'll be using CSV Creator to configure the drives, and it has mount/unmount buttons for each of the drives in it.
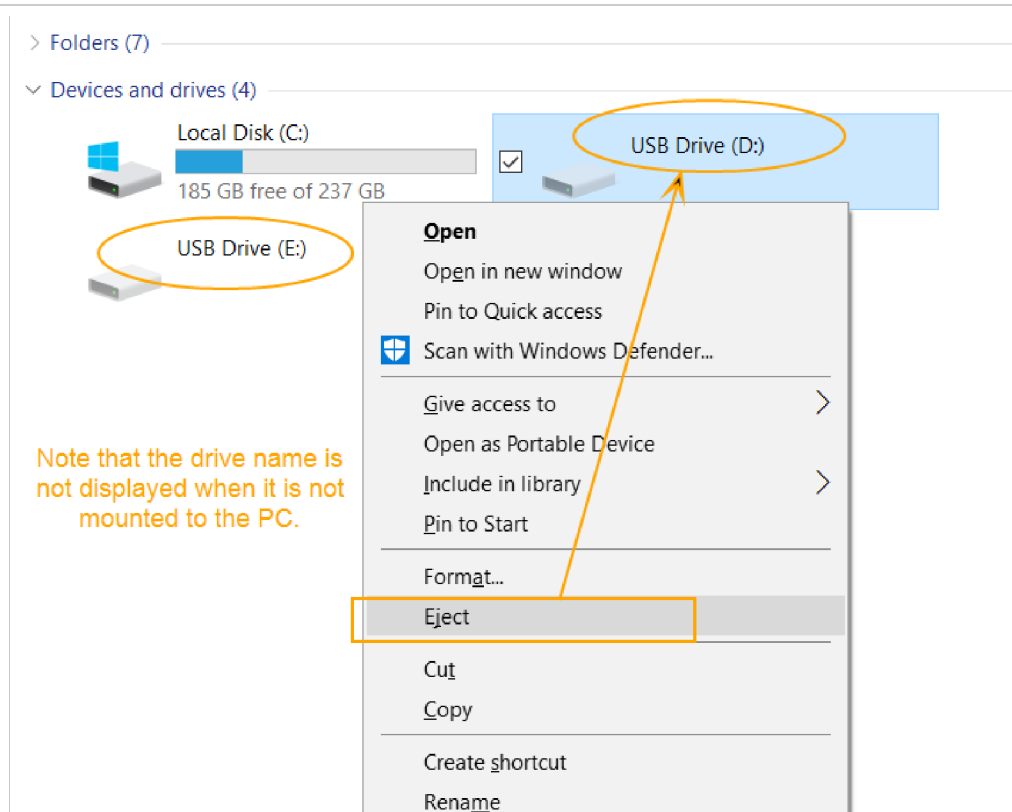
Figure 9: Use the Eject menu option to mount a drive to the PC

When the drive is mounted to the PC, you'll see the name of the drive recognized, and the PC will have exclusive control of the drives. In the image below, all three drives have been "ejected" or mounted to the PC. You can now see the drive names for each: MICRO SD; NOR FLASH; and RAM DISK.
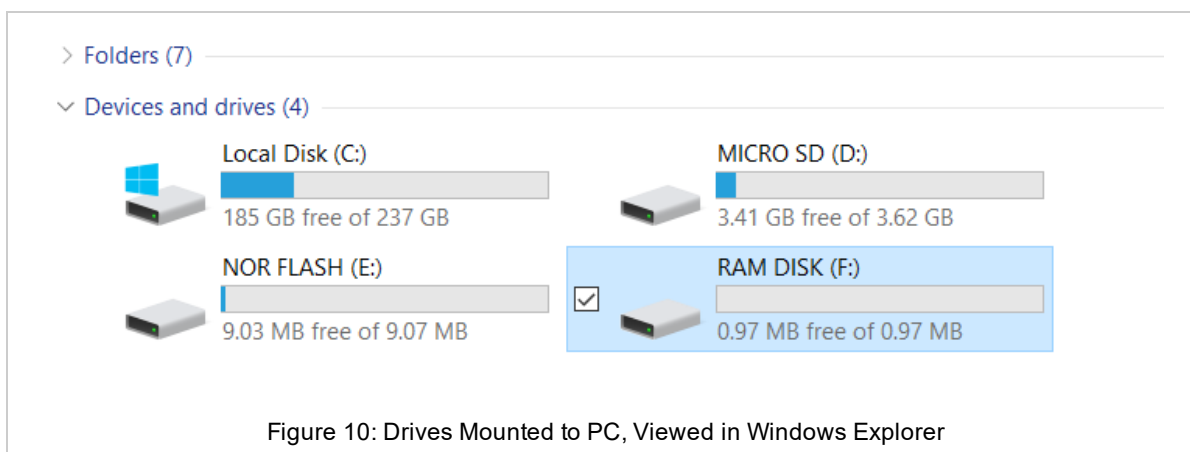
Figure 10: Drives Mounted to PC, Viewed in Windows Explorer

- Note: If your computer is set up to automatically open the drive to view the directories on the drive, you may close it. It is not necessary at this time to view any files on the drives

4. After you have mounted all three drives, from your computer's start menu, open the **Device Manager**.

5. Right-click "**RMA PLUS**" under "**Other devices**" and then select **Update Driver Software**.
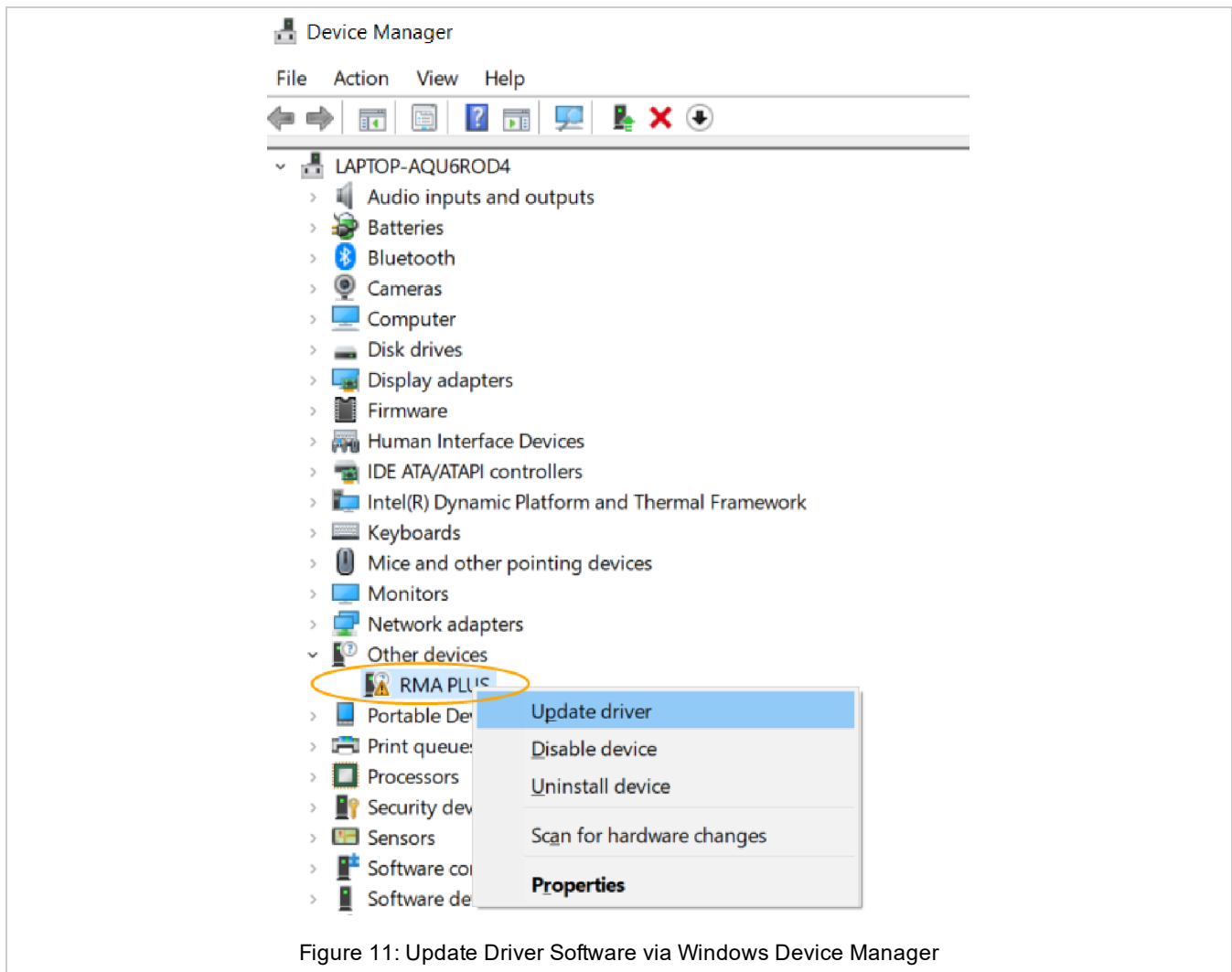
Figure 11: Update Driver Software via Windows Device Manager

6. Select "**Browse my computer for driver software**".
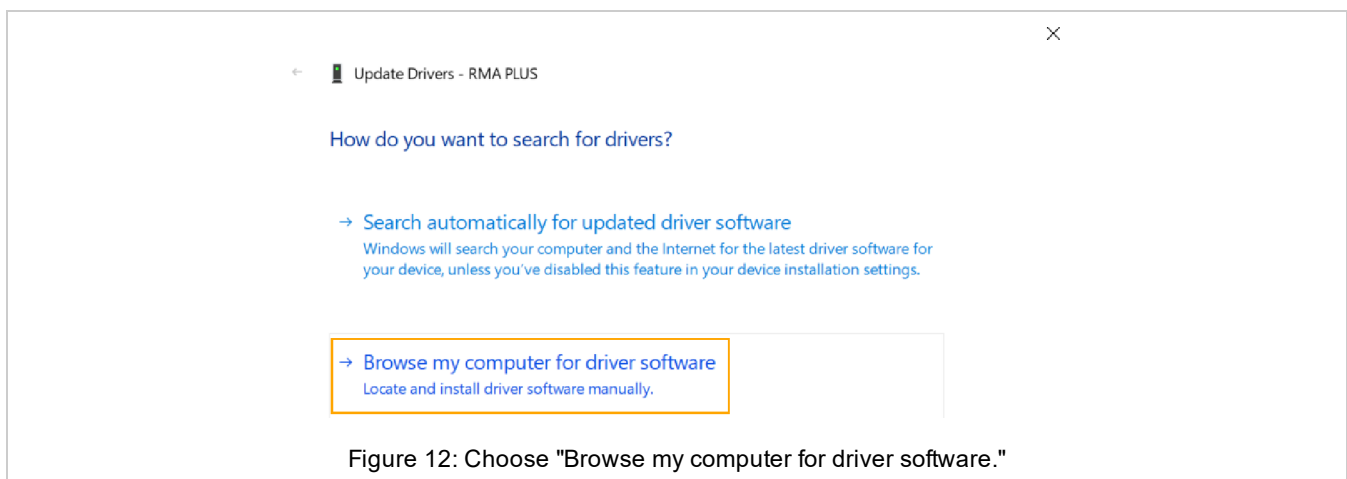
Figure 12: Choose "Browse my computer for driver software."

7. Browse to the drive labeled "**MICRO SD**" and press the "**OK**" button
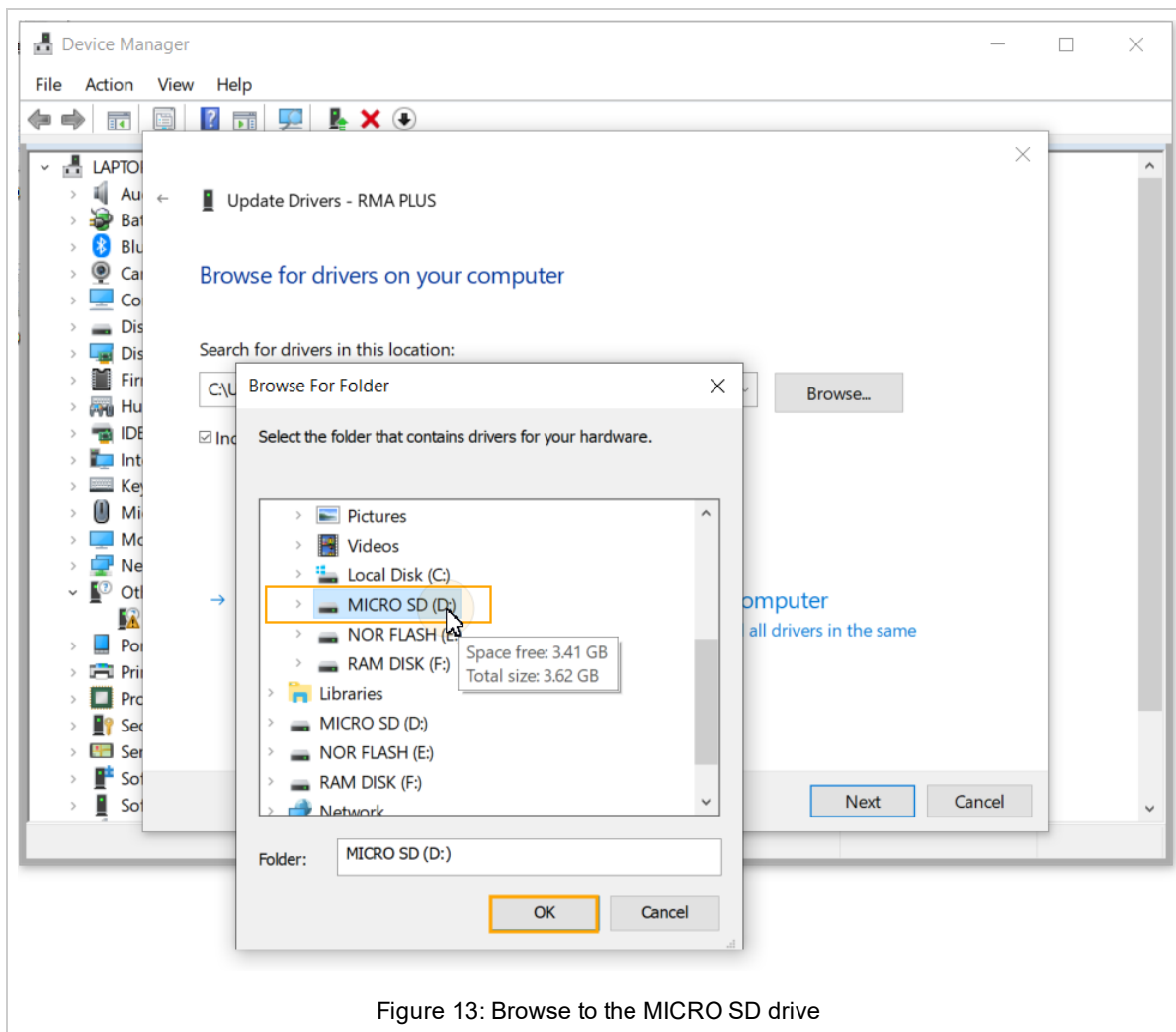
Figure 13: Browse to the MICRO SD drive

8. Ensure "**Include subfolders**" is checked and press the "**Next**" button.

- Note that the full path to the driver in this example is "E:\Software\S19 Flashloader\USB Drivers".

9. Select "**Install**."
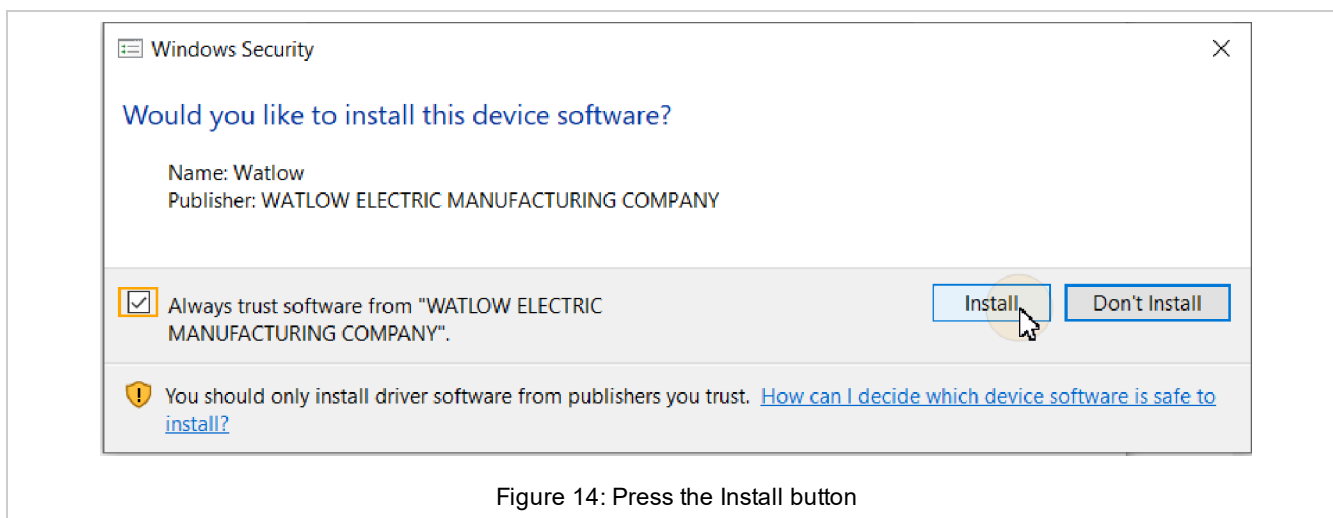
Figure 14: Press the Install button

The following is displayed upon successfully installing the driver.
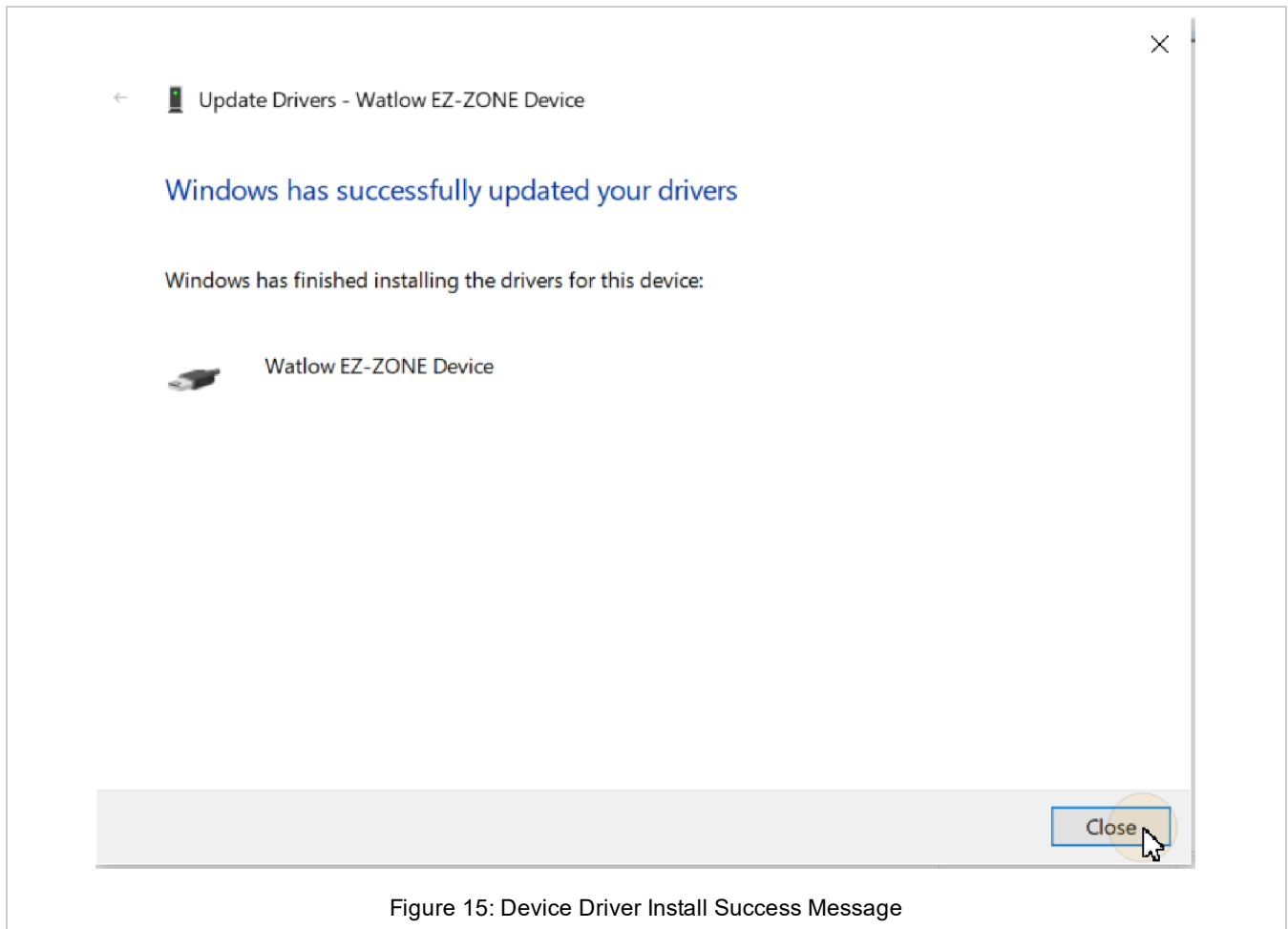
Figure 15: Device Driver Install Success Message

10. Return to Windows Explorer, select the drive, right-click, and select "**Eject**" to unmount the drive from the PC. This returns exclusive control of the drive to the firmware.

Repeat the above steps for each drive on the RMA PLUS.

Accessing and Working with Files on the USB Drives

1. Connect the Mini-B USB cable to the RMA PLUS.
2. Open **My Computer** (Windows key + 'E') and look under the "**Devices and Drives**" group. The removable drives are shown here. Note that the drive letter and order may vary by computer.
3. Right-click each drive and select **Eject** to give your PC exclusive access to the drives. This sends a start/stop command to the device. When the PC mounts a drive, all firmware services that use that drive are suspended.

Figure 16: Windows Devices View: All Drives Mounted to the PC
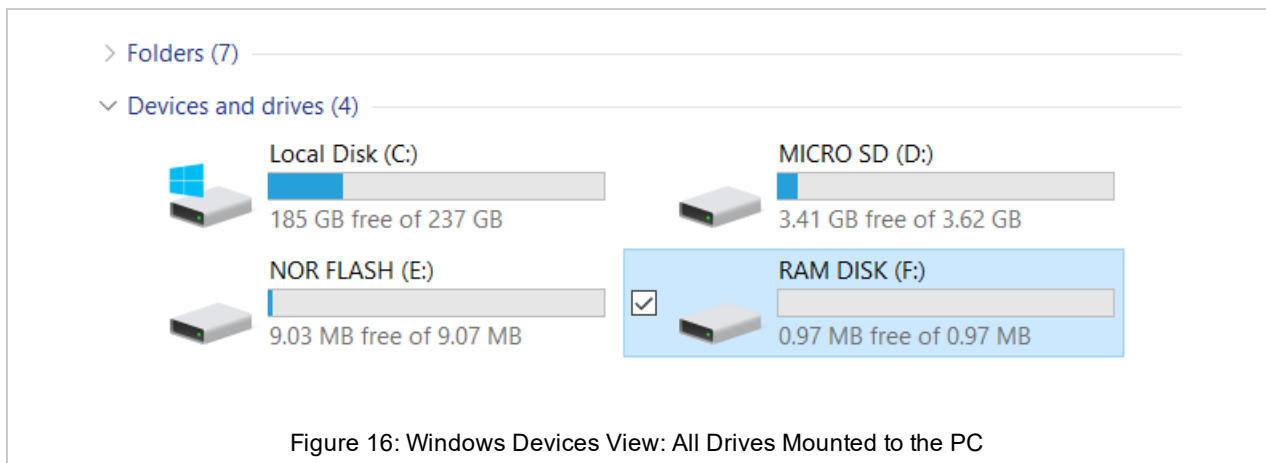
> NOTE: There is an issue with some versions of Windows 10 OS where you cannot eject one drive without the other drives being affected. If you notice this happening, use the CSV Creator tool to mount and unmount the drives. You'll be using CSV Creator to configure the drives, and it has mount/unmount buttons for each of the drives in it.

- Do not disconnect the USB cable without first ejecting or unmounting the drives via CSV Creator. If the USB cable is disconnected, the RMA PLUS will regain access to the drives after a several second timeout, but removing the USB cable while the drives are mounted on the PC could result in corruption.
- When a drive is mounted to your PC, the PC has exclusive access to that drive. All firmware features that require the drive are suspended. The default drive state is ejected (unmounted) to prevent unintentional suspension of firmware services.
- Changes made to a drive take effect after the RMA PLUS regains full control of the drive.
- LEDs on the unit change to indicate the drive state. GREEN = RMA PLUS has access to the drive. ORANGE = RMA PLUS has access, and a USB cable is connected. RED = RMA PLUS has no access to the drive because it is mounted to the PC via the USB port.

4. After you finish working with a drive, close all files and folders and press "**Eject**" to unmount the drive from the PC. When all drives are unmounted, you may safely remove the USB cable.
   - Note that the drive names are no longer displayed on your Explorer window, and the LEDs change from orange to green about five seconds after the cable is removed.
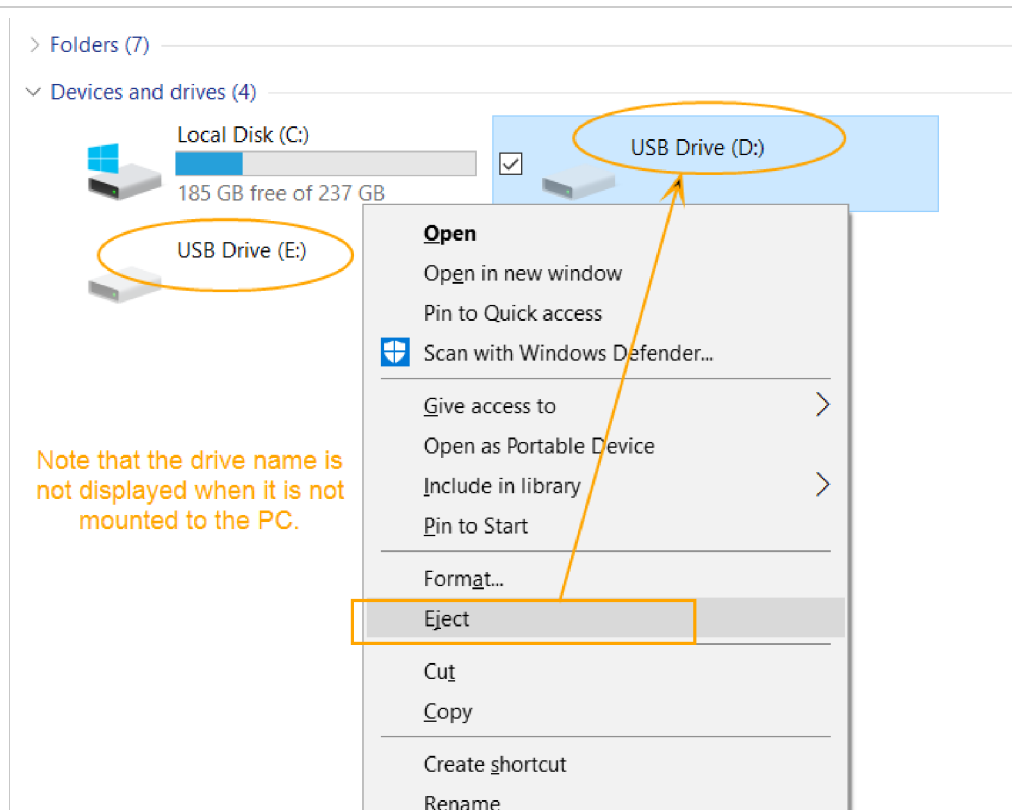
Figure 17: Eject the Drives to Unmount from PC

Chapter 4 | Configuration

Overview

Product features like data logging, Modbus, etc. are configured via .csv files on the drives on your RMA PLUS. When you connect to the device via USB, you can access these three drives: MICRO SD, NOR FLASH, and RAM DISK, which each contain files for configuration or operation of the RMA PLUS. For configuration help, see CSV Creator.

> NOTE: CSV Creator is provided to help you edit the default configurations over a USB connection. (Files can be read over Ethernet, but not written). We recommend that you do not manually edit the files, to prevent corruption of data. Configuration files are only read upon initialization. You must reset the RMA PLUS for a change to take effect.

Configuration File Formats

Each row in the file constitutes a record. Record elements are separated by commas. Header rows indicate what is in the column below, but header rows and empty rows are ignored by the parser.

This example shows the data for a Modbus® TCP configuration file. Field bus or application information is in the first column. The bus number follows and dictates the remainder of the record. Busses 1 and 2 are standard bus records with the same format. Bus 0 records are ignored by the parser to disable a record without deleting it. Any trailing information is disregarded.

Modbus® TCP Register Config Example

Register	Bus	Segment	Zone	Class	Instance	Member	Refresh Count	
0	0	0	0	1	1	1	0	DEV 1 Hardware ID
2	1	0	1	1	1	1	0	DEV 1 Hardware ID
4	2	4	1	1	1	1	0	DEV 1 Hardware ID

The setup configuration file, **setup.csv** is found at the root of the NOR FLASH drive at **nor:\Setup.csv**. This is the first file read by the RMA PLUS upon reset. Each line is a record of a key, value pair. The key is a string value must match a key string in the firmware or it is disregarded. The value data type is specified in the setup key.

Setup.csv Default Values

Key	Value
EventLog	ram:\EventLog.txt
SysCfg	nor:\Gateway\SysCfg.csv
ModbusTCP	nor:\Gateway\ModbusTcp.csv
ModbusRtu6	nor:\Gateway\ModbusRtu6.csv
ModbusRtu7	nor:\Gateway\ModbusRtu7.csv
UART7	0
DataLog	nor:\Gateway\DataLog.csv
LogIntervalSec	5

Configure Ethernet with Dashboard

Before you begin

If you do not already have Dashboard on your machine, you will find it on the SD: drive of your RMA PLUS. Connect a Mini-B USB cable to the RMA PLUS, eject the SD: drive to mount it to your PC, open the Software folder, open Dashboard folder, and then extract the Dashboard .zip files to a new directory on your PC. You may then launch Dashboard.exe from there.

1. Launch Dashboard. The discovered RMA PLUS should be under the "USB Devices" tree node.
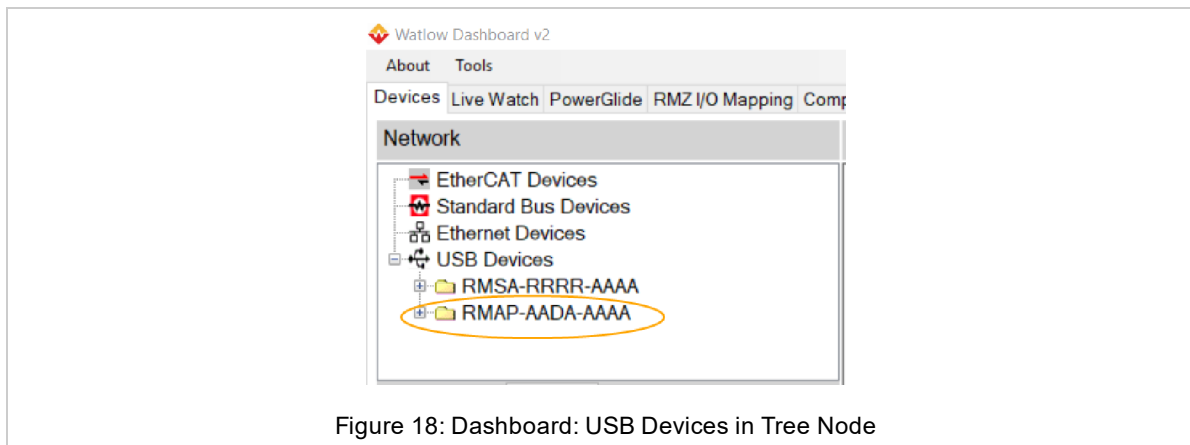
Figure 18: Dashboard: USB Devices in Tree Node

2. Expand the **RMA PLUS** to see basic device information.
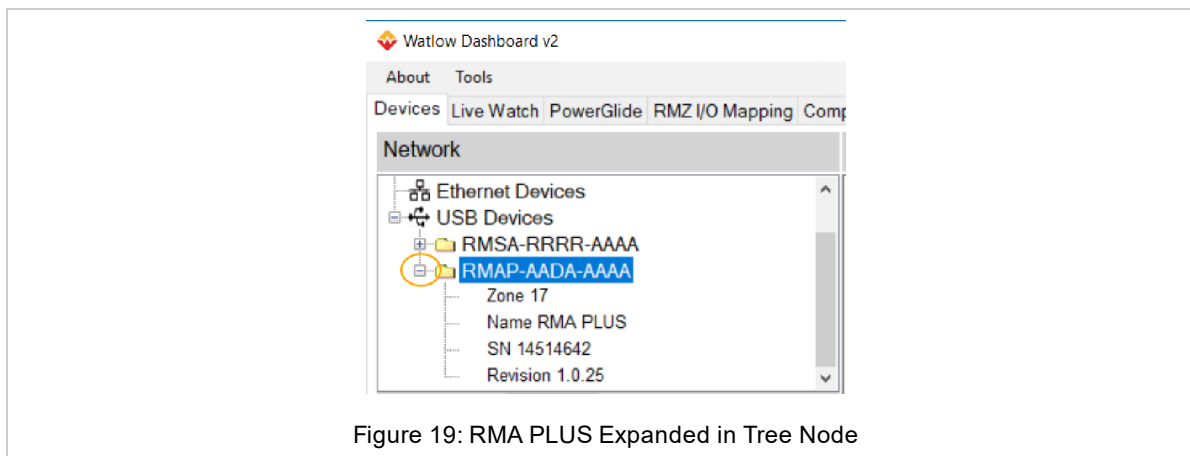
Figure 19: RMA PLUS Expanded in Tree Node

3. Drag and drop the RMA PLUS tree node onto the Device Data pane to upload all parameters.
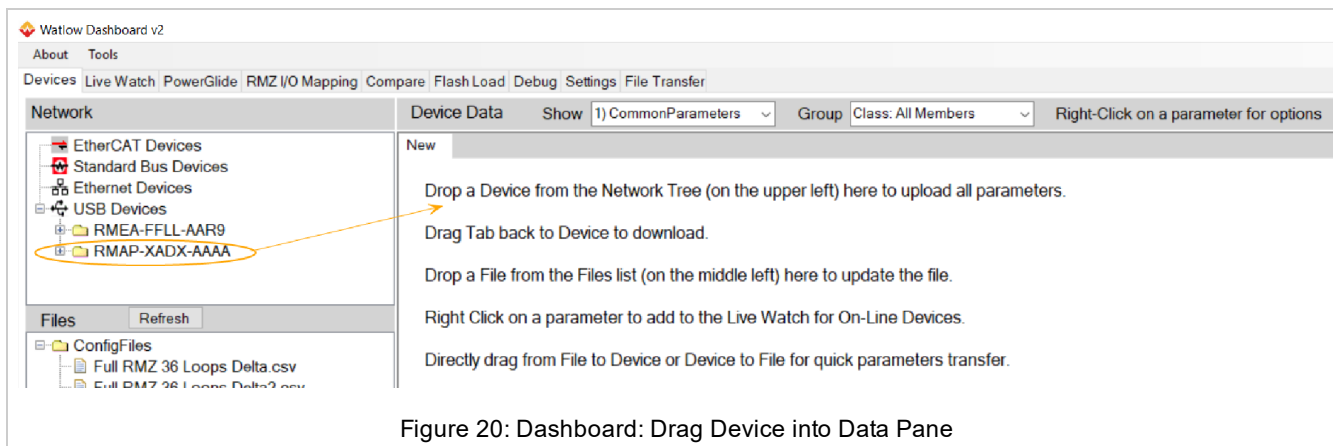
Figure 20: Dashboard: Drag Device into Data Pane

Dashboard displays the progress while it discovers all parameters. If the progress window does not automatically closs, press the "Close Now" button after the transfer statuses read "complete."

5. On the newly discovered device tab, expand the **Ethernet** and **Ethernet 2** tree nodes.
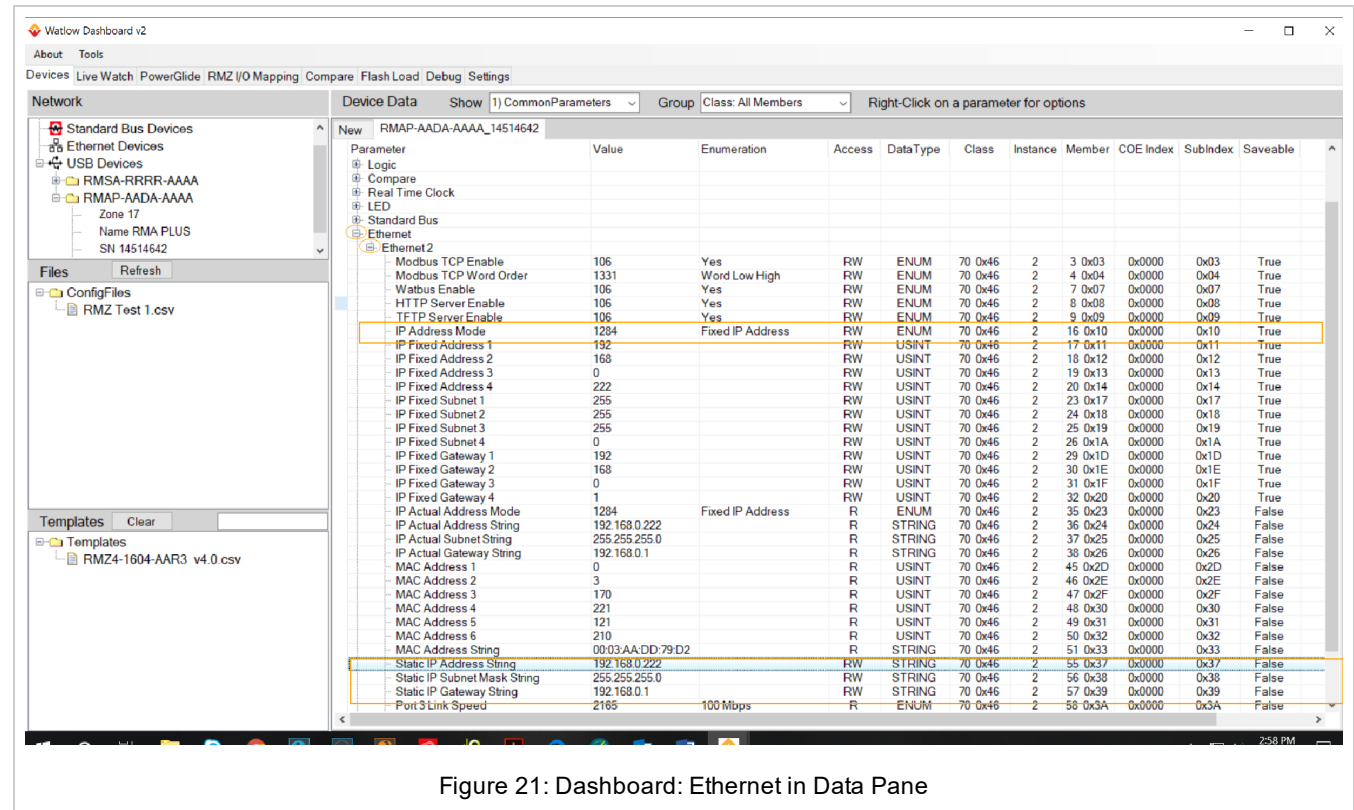
Figure 21: Dashboard: Ethernet in Data Pane

6. Change the following members as necessary:

Ethernet 70 (0x46) Instance 2								
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments
16	0x10	IP Address Mode	ENUM16	RW	F			1284	1281: DHCP 1284: FIXED
55	0x37	Statis IP Address String	STRING	RW	F			192.168.0.100	
56	0x38	Statis IP Subnet Mask String	STRING	RW	F			255.255.255.0	
57	0x39	Static IP Default Gateway String	STRING	RW	F			192.168.0.1	

NOTE: We recommend using static IP addressing and a private network for your system.

For each desired change…

- Double-click the member in the tree view.
- Enter a new value in the "Value" field.
- Press the "**Write To Grid and Device**" button.
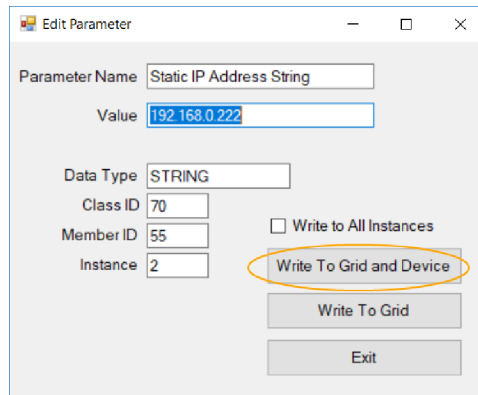
Figure 22: Dashboard: Edit Static IP Address

7. Wait at least three seconds for non-volatile data to save.

8. Select the **Settings** tab.

9. Set **Use Ethernet** to **True** and press the **Save Settings** button.
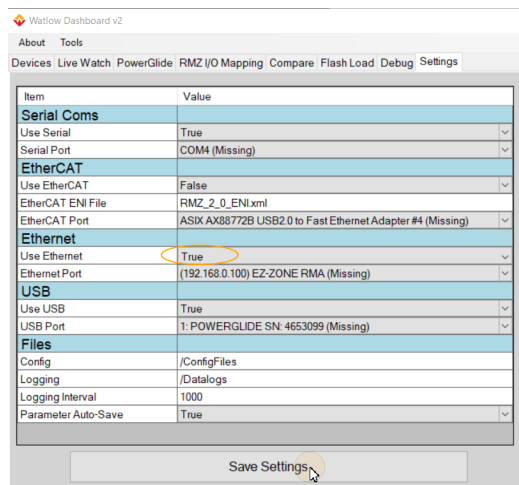
Figure 23: Dashboard: Set Ethernet to True

10. Close Dashboard and remove the USB cable from the RMA PLUS.

11. Reset the RMA PLUS.

12. Connect an Ethernet cable from your PC to either port of the RMA PLUS.

> NOTE: The PC's network interface configuration is outside the scope of this document. It should be configured for a static IP address on the same subnet taking care to avoid addresses 192.168.0.xxx (where xxx = 1, 100 or 255 for the last octet in this example). NetBIOS is also recommended.

13. Launch Dashboard to view the RMA PLUS and any devices connected to the high-speed standard bus network under the "**Ethernet Devices**" tree node. Expand the RMA PLUS to see device information including the Ethernet address.

Configuring RMA PLUS with CSV Creator

Overview

CSV Creator is used to configure Modbus, data logging, and other settings on an installed RMA PLUS and its connected devices.

CSV Creator discovers the configuration parameters on your installed RMA PLUS and connected devices to ensure that the created data log and Modbus® configurations are valid for your RMA PLUS and any connected devices. This discovery is accomplished via USB or Ethernet connection. Note that with a USB connection your PC can mount drives to the RMA PLUS, allowing you to save your configuration files directly to the device. If you connect via Ethernet, you will have to save the configuration files to your PC rather than to the device itself.

Initial Setup

You will find the newest version of CSV Creator on www.watlow.com.

1. Download the CSV Creator .zip file from watlow.com onto your PC and then extract the files to a directory on your PC.

2. Open the newly created CsvCreator directory and double-click **CsvCreator.exe** to open the application.

3. Note that the On-Line Params tab is shown by default and displays your discovered devices.

   - If your devices are not listed in the On-line Params tab, click the **Settings** tab to set USB and/or Ethernet values to **True**, then close and restart CSV Creator.
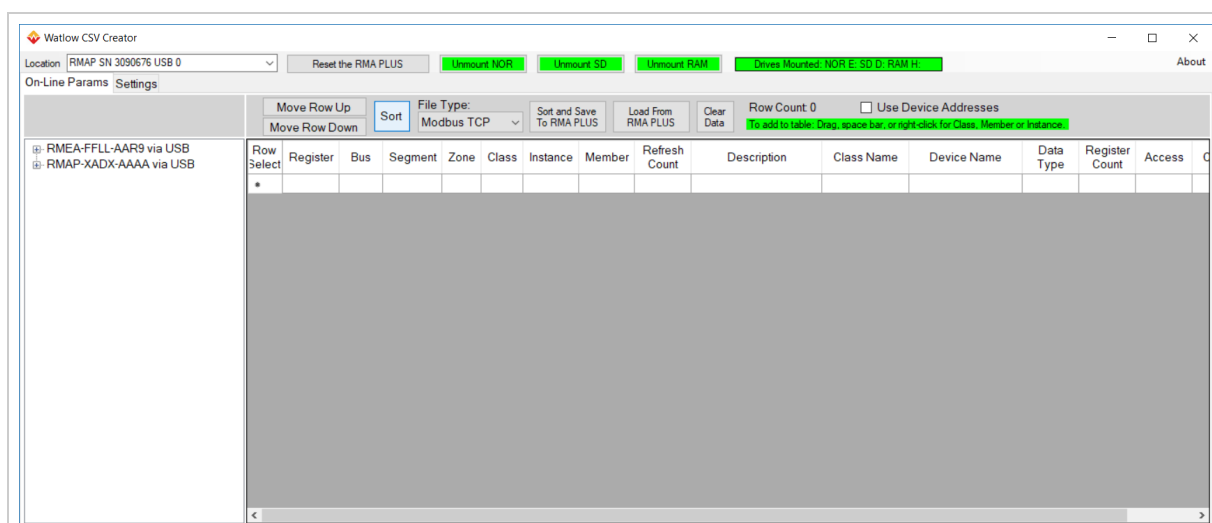
Figure 24: Online Parameters Tab Open

4. Select Serial connection options:

   - If you'll use a serial connection, click the **Settings** tab and set *Use Serial* to **true** and select the serial port to use.

   - If you need to change the serial port, disable it, save the settings, restart CSV Creator, and then select a new serial port.

   - If you are not using the serial port, disable the serial port, save settings, and then restart the application. If the serial port is enabled but not being used, your initial device discovery will be slow.

5. After your settings are configured, click the *Save Settings* button, shut down, and restart CSV Creator.

NOTE: When CSV Creator is initially invoked, and every time the RMA PLUS is reset, CSV Creator will discover the RMA PLUS and all devices connected to it via the configured communications interfaces. Thus, to discover new devices, restart CSV Creator, or click the **Reset the RMA PLUS** button to reset the RMA PLUS and restart CSV Creator. All data in the table view is removed during a reset operation, so be sure to save any in-progress files before a reset.
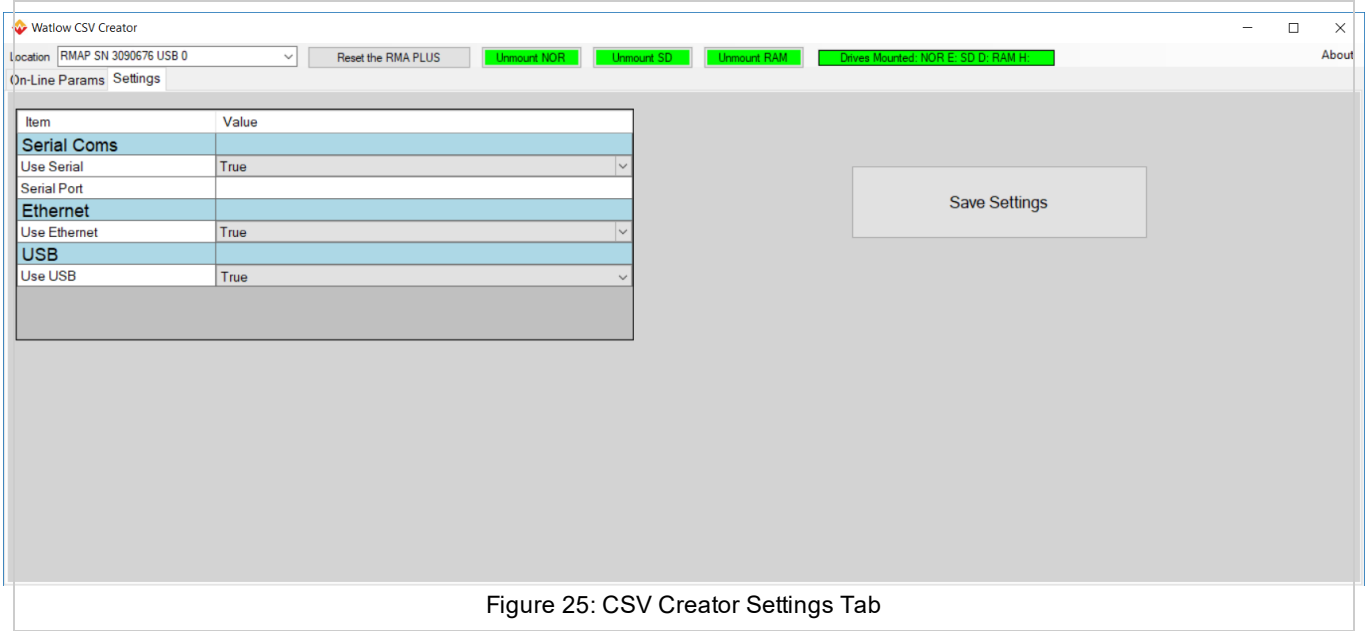
Figure 25: CSV Creator Settings Tab

General Usage of CSV Creator

Device Tree

The tree on the left shows the list of discovered devices associated with the RMA PLUS, and indicates indicates which interface the device is discovered on, with a "**via USB**" or "**via Etherne**t" label after the device part number. Hover over the device name in the tree to see information related to the device zone number and the IP address of the device if it is on Ethernet. Hovering over an instance field displays the initial or current value read from the control for that parameter. Each time you hover over or move off of a parameter, the parameter value is refreshed. If the parameter is an enumeration, the enumeration text is shown in addition to the numeric value. Showing the value helps identify correct parameters.

Location Dropdown

The location dropdown above the device tree indicates a specific connection point to an RMA PLUS and all connected devices. If you connect multiple interfaces to the same RMA PLUS, you will get multiple locations for the same device. The location pulldown ensures that you can differentiate which set of devices are attached to a single location, i.e. RMA PLUS via a single interface. Having multiple RMA PLUS devices connected during configuration is not recommended.

File Type Dropdown

Select the file type you wish to configure using the dropdown menu above the data table. Always save the table data to a file or clear the data from the table before switching file types. CSV Creator will not allow you to change file types until you either save or clear the data, to make sure data is not lost.

Drive Status Buttons

A status bar above the data table indicates the mounted or unmounted state of each of the drives on the RMA PLUS.

• Yellow = all drives are unmounted from the PC

• Green = one or more of the drives is mounted to the PC. Text on the bar shows which drives are mounted, and indicates the drive letter given to the drive by your PC.

Individual yellow or green color coded buttons next to this status bar may be used to mount or unmount each drive.

The NOR Flash drive must be mounted in order to save files to it. When the NOR Flash drive is mounted to the PC, the **Sort and Save** button is directed to the NOR FLASH drive. When the NOR Flash drive is unmounted, the **Sort and Save** function is directed to the PC. After selecting Sort and Save button you can change the path and filename in the save dialog.
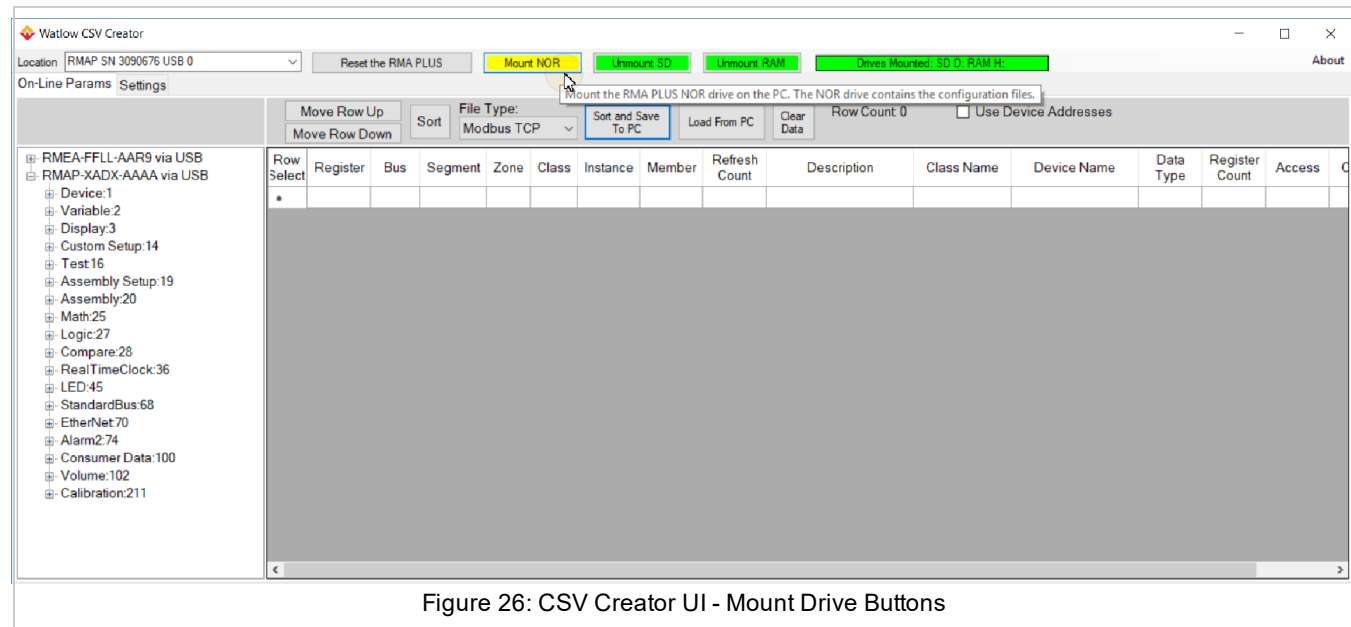
Figure 26: CSV Creator UI - Mount Drive Buttons

Saving Configuration Files

You may save files to the NOR FLASH drive of the RMA PLUS, or to your PC, or both. To save files to the RMA PLUS you must have a USB connection and the device must be mounted to the PC. To save a backup copy of the configuration files to your PC, unmount the NOR Flash drive, select **Sort and Save to the PC**, and choose the desired path, or use Windows File Explorer to copy the file to or from the RMA PLUS.

Configuring Modbus® Registers

CSV Creator allows the user to build a Modbus® configuration file by selecting File Type "Modbus® TCP", "Modbus® RTU 6", or "Modbus® RTU 7". These settings are stored in a file called "ModbusTcp.csv", "ModbusRTU6.csv", or "ModbusRTU7.csv" on the "NOR FLASH" drive of the RMA PLUS. In order to configure Modbus® TCP, parameters for the RMA PLUS, and any slave devices, using user-assigned Modbus® register addresses, the default File Type is used (See File Type pulldown menu). The menu also contains options to configure either of the Modbus® RTU interfaces via different files on the RMA PLUS. The application is initially setup to configure Modbus® TCP via the File Type pulldown menu, as shown in the image below.

Selecting Parameters for Modbus® and Data Logging

Use the device tree on the left side to view the classes, members, and instances available for Modbus® and data logging configurations. Configuration parameters are read directly from the devices.

You may select an entire class (including its members and instances) by dragging the item from the device tree into the data table area on the right side of the screen, or by selecting the class name and clicking the space bar. You may likewise select all instances of one member by dragging the member name into the data table or selecting the member name and pressing the space bar. To add a single instance to the table, drag the instance over, or select it and press the space bar.

Some parameters have performance advantages when being read from the devices. These parameters have a green background when displayed in the tree and a tooltip that says "Producer."

Figure 27: Modbus® TCP and Data Logging Example

Modbus® Default Register Addressing

By default, register addresses are automatically incremented as items are added to the table. You may override the register addressing by typing a new address. To change the register in a row or group of rows, use the leftmost **Row Select** column to select the desired rows. (To select multiple rows, select the first row in the group and drag down the **Row Select** column, or hold the shift key while you select all the rows).

- "**Delete Selected Rows**" is a permanent deletion
- "**Renumber Selected Rows**" is used with a group of contiguous rows and renumbers the selected rows, starting with the register address of the first selected row.
- "**Add Separator Below Current Row**" allows you to add a separator to the table view for readability.

If there is duplicate data in the register column in the Modbus® files, the RMA PLUS will use the first occurrence.

Note that the RMA PLUS requires the Modbus® files to be sorted by register address (Register column), so CSV Creator sorts the rows by register addresses upon saving. You may also manually sort the rows using the **Sort** button. These Modbus® configuration files must always contain incrementing Modbus® configuration data for proper functioning of the RMA PLUS. (This sorting functionality is disabled for other file types that do not require sorted data).

All the data to the right of the Description column will only be available upon initial load of the parameters, and will not be saved to the configuration file, to minimize file size and improve performance. When the file is saved or reopened, these columns will be blank, as the data is not saved to the files.
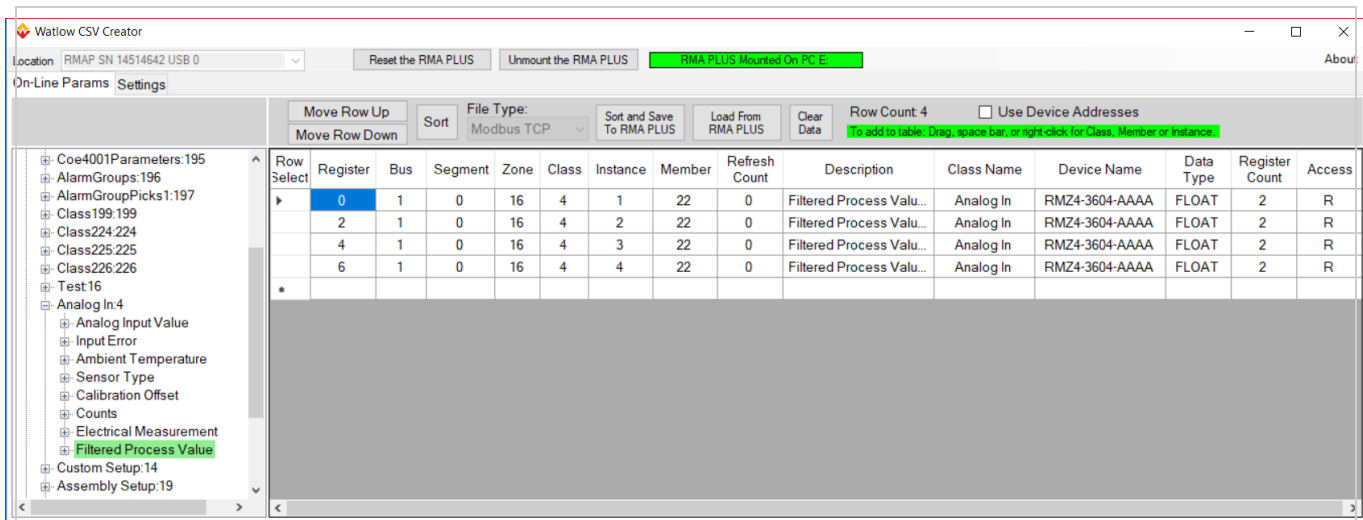
Figure 28: Modbus® TCP Address Register

Legacy Modbus® Register Addressing

To reuse existing Modbus® applications, select the *Use Device Addresses* option in the tool bar above the data table, then restart the application. Once this is done, the tree view on the left side of the screen will show the legacy registers of the connected devices to the right of the instance number.

This mode extracts the legacy register map from each control and adds the legacy register to the file, instead of just incrementing the Modbus® register as items are added to the table. If the product (RMC, RME) has more than one set of Modbus® maps, be sure to configure the product with the correct map prior to starting the CSV Creator application. This will allow the CSV Creator application to pull the intended legacy Modbus® map from the control. The legacy register addressing mode will persist between application executions, so you only need to change the setting once.

For non-legacy devices, or where the legacy decoder information is not found, the application will insert the new parameters as the next available location in the current list of parameters in the table. In the event of any duplicate registers (Register column), in the Modbus® files, the RMA PLUS will use the first occurrence in the file.
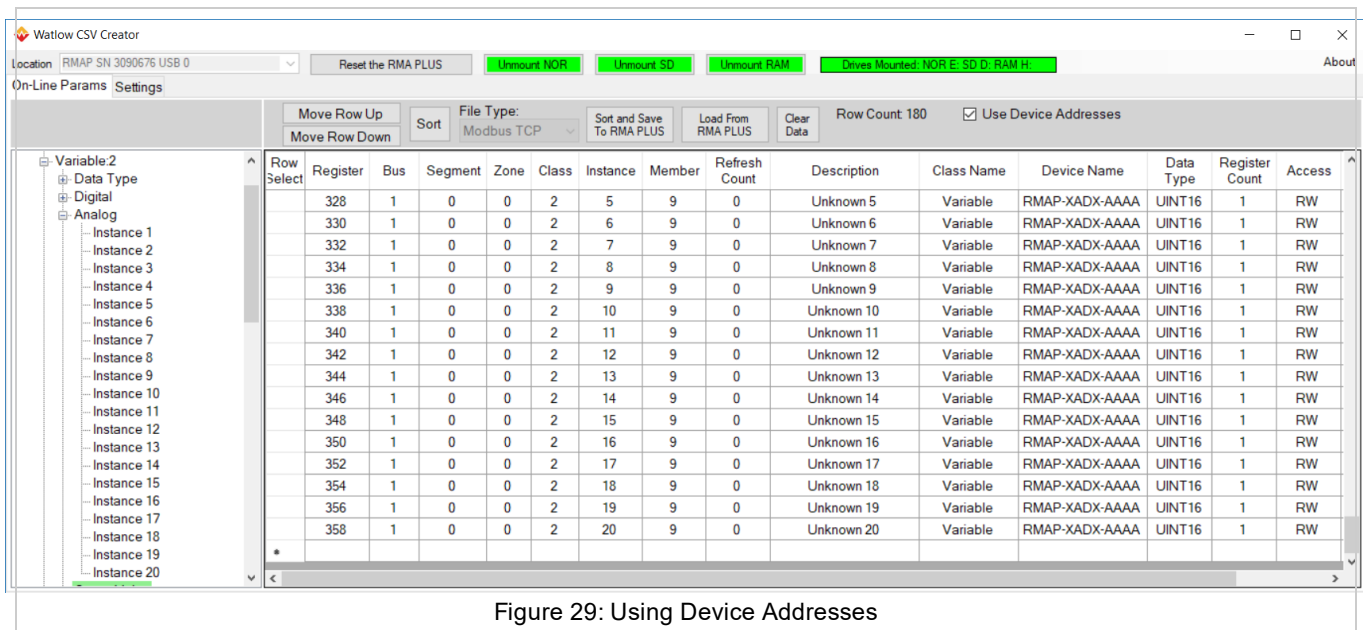
Figure 29: Using Device Addresses

System Configuration Settings

System settings are stored in the Setup.csv file on the NOR FLASH drive, which you can view in CSV Creator. To configure these system settings:

1. Clear or save any previous data shown in the data table.
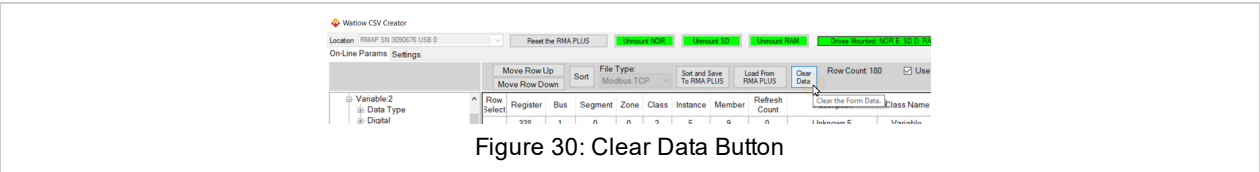
Figure 30: Clear Data Button

2. Select **Setup** from the File Type dropdown menu.
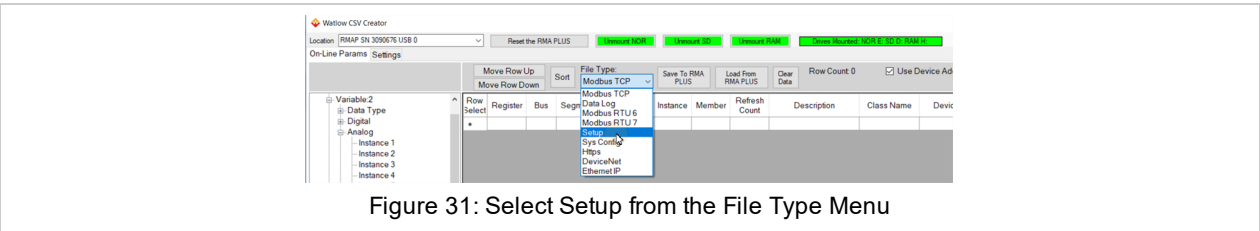
Figure 31: Select Setup from the File Type Menu

3. If it is not already mounted, mount the NOR Flash Drive to your PC using the **Mount NOR** button. (When the device is mounted, this button will be green. The status bar will also be green and will state the drive letter represents the NOR FLASH drive on the PC).

4. Select the **Load from RMA PLUS** button.
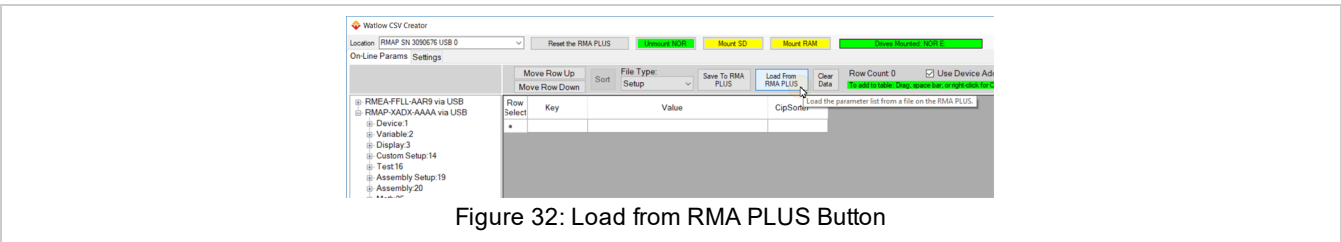
Figure 32: Load from RMA PLUS Button

Note: Do not corrupt this setup.csv file or your RMA PLUS will not operate correctly.

Data Log Configuration

CSV Creator may be used to configure data logging for the RMA PLUS. The parameter selection available is the same as shown for the Modbus® configurations above. Parameters for the RMA PLUS and all connected devices will be available for data logging. Like on the Modbus® table, all parameters to the right of the description column will only be shown on the initial load of the parameters from the device, as they are not saved in the file.
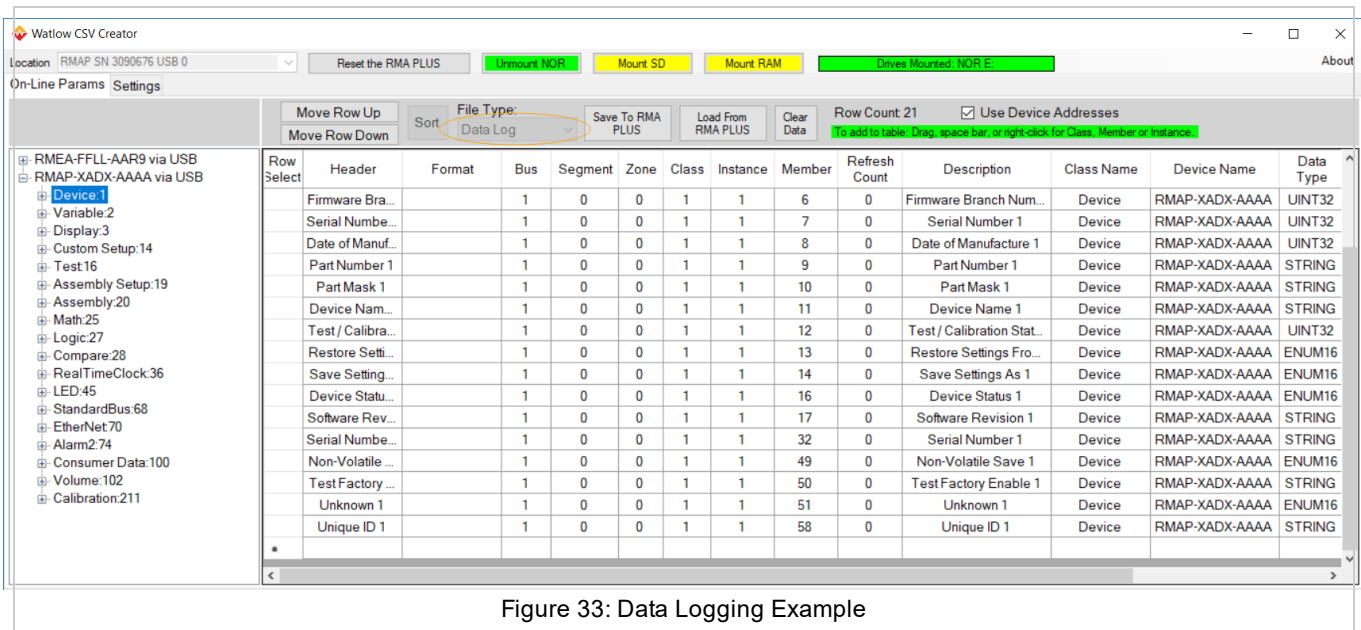
Figure 33: Data Logging Example

HTTPs Web Server Configuration

CSV Creator will pull a list of parameters from the RMA PLUS and connected devices so you can configure a read-only web server in the RMA PLUS.

- Select **Https** from the File Type pulldown.

- Add the desired parameters to the grid by dragging them from the list on the left, in the same manner as used for the other file types. A unique token will be generated by the application using the following information: zone, partial class name, class number, parameter name, parameter number, and instance number, i.e. Z16Mat25OutputValue22I2 corresponds to zone 16, Math class 25, Parameter 22 "Output Value", Instance 2.

  See HTTPs for more information about this feature.

Applying Configuration Changes to the RMA PLUS

For the RMA PLUS to accept and start using the changes to the files after they are written to the RMA PLUS' internal drives, the RMA PLUS either needs to be power cycled, or reset via the "**Reset the RMA PLUS**" button at the top of the application. ***Save all files before pressing the reset button***, as this button resets the RMA PLUS and restarts the application, and you will lose any information not previously saved to either the RMA PLUS or your PC. You also need to save the table data or clear the table prior to switching file types.

Data Types for Configuration Files

Data Type	Value	Description
UINT8	1	unsigned 8-bit integer
SINT8	2	signed 8-bit integer
UINT16	3	unsigned 16-bit integer
SINT16	4	signed 16-bit integer
UINT32	5	unsigned 32-bit integer
SINT32	6	signed 32-bit integer
ENUM8	7	enumeration (8-bit)
FLOAT	8	single-precision floating point
STRING	9	string

Data Type	Value	Description
PARAM	12	parameter (C|M|I)
ENUM16	15	enumeration (16-bit)

Busses

The RMA PLUS must be a master on a given bus to acquire data. It is a master by default on standards bus 1 and 2. It may optionally be a master on Modbus® RTU (bus 4 and 5) if configured by the user.

Bus 0: Nothing

Disregard entry. This tells the file parser to disregard this entry / record.

Bus 1: Inter-Module Bus

This is the preferred bus for accessing data. It is the fastest and most efficient bus available. Any EZ-ZONE RM (9+) module may be connected to this bus.

IMPORTANT: Do not attempt to access the Subroutine class (0x05) or Profile Step class (0x15) from the intermodule bus. This will cause unpredictable results due to timing restrictions.

Bus 2: Standard Bus

This bus is used to access legacy EZ-ZONE devices that do not support intermodule bus: EZ-ZONE RM, PM (15+). Do not use this bus if bus 1 is available. NOTE: The EZ-ZONE ST and RUI do not currently implement the required services necessary to talk to the RMA PLUS.

Bus 4, 5: Modbus® RTU Master

If the model number is RMAP-2AXX-XXXX, then the device will have a card in the adjacent slot that provides two additional serial ports for connection to Modbus® RTU devices via RS-232 or RS-485. Bus 4 goes with Modbus® instance 6. Bus 5 goes with Modbus® instance 7.

Producer / Consumer Data

Producer / consumer data is used on intermodule bus. This subscription service allows devices (zones) to share data with their network peers. It is analogous to multicast traffic in Ethernet in that it is produced by devices at regular intervals and heard by all on the network, but only devices that subscribe to published data points consume these received frames.This is the most efficient way to obtain data in the system and reduces the overhead for request frames, queuing, data packing, etc.

This table documents the relationship between the source name (Text ID) and intermodule busaddress (Class ID, Member ID) for all producers. Produced data points are outputs of software objects (function blocks).

Producer/Consumer Data Subscription Reference

	Text ID	Class ID		Member ID		A (analog) / D (digital)
61	None					A/D
142	Analog Input	4	0x04	22	0x16	A
22	Current	15	0x0F	1	0x01	A
179	Current Read	15	0x0F	7	0x07	A
161	Cool Power	8	0x08	14	0x0E	A
160	Heat Power	8	0x08	11	0x0B	A

73	Power	8	0x08	33	0x21	A
238	Linearization	34	0x22	7	0x07	A
240	Math	25	0x19	22	0x16	A
241	Process Value	26	0x1A	22	0x16	A
242	Set Point Closed	7	0x07	7	0x07	A
243	Set Point Open	7	0x07	8	0x08	A
245	Variable	2	0x02	4	0x04	A/D
6	Alarm	9	0x09	24	0x18	D
230	Compare	28	0x1C	10	0x0A	D
231	Counter	30	0x1E	10	0x0A	D
1142	Digital I/O	6	0x06	11	0x0B	D
233	Profile Event Out	22	0x16	14	0x0E	A/D
234	Profile Event Out	22	0x16	15	0x0F	A/D
235	Profile Event Out	22	0x16	16	0x10	A/D
236	Profile Event Out	22	0x16	17	0x11	A/D
247	Profile Event Out	22	0x16	18	0x12	A/D
248	Profile Event Out	22	0x16	19	0x13	A/D
249	Profile Event Out	22	0x16	20	0x14	A/D
250	Profile Event Out	22	0x16	21	0x15	A/D
1001	Function Key	3	0x03	24	0x18	D
239	Logic	27	0x1B	34	0x22	D
244	Timer	31	0x1F	10	0x0A	D
1532	Special Function	35	0x23	10	0x0A	A/D
1533	Special Function	35	0x23	12	0x0C	D
1534	Special Function	35	0x23	14	0x0E	D
1535	Special Function	35	0x23	16	0x10	D
126	Limit	12	0x0C	7	0x07	D
1577	Time of Day	36	0x24	1	0x01	A
1578	Day of Week	36	0x24	2	0x02	A
1696	Module Limit	101	0x65	10	0x0A	D
1619	Produced Set Point 1	79	0x4F	38	0x26	A
1620	Produced Set Point 2	79	0x4F	39	0x27	A
1621	Produced Set Point 3	79	0x4F	40	0x28	A
1622	Produced Set Point 4	79	0x4F	41	0x29	A
184	Heater Error	15	0x0F	38	0x26	D
1697	Wattage	29	0x1D	14	0x0E	A
1699	Load Voltage	29	0x1D	13	0x0D	A
1183	Load Resistance	29	0x1D	16	0x10	A

142	Analog Input	55	0x37	4	0x04	A
142	Analog Input	56	0x38	4	0x04	A
142	Analog Input	57	0x39	4	0x04	A
161	Cool Power	75	0x4B	42	0x2A	A
160	Heat Power	75	0x4B	41	0x29	A
73	Power	75	0x4B	43	0x2B	A
242	Set Point Closed	75	0x4B	44	0x2C	A
243	Set Point Open	75	0x4B	45	0x2D	A
6	Alarm	74	0x4A	11	0x0B	D
1142	Digital I/O	61	0x3D	11	0x0B	D
1142	Digital I/O	60	0x3C	11	0x0B	D

Chapter 5 | Features

USB Composite Device

The RMA PLUS is a USB composite device that implements multiple classes over the same physical connection with multiple sets of endpoints. The USB Device connection is intended for short-term configuration and monitoring. After you install Watlow USB device drivers, the RMA PLUS is recognized in your PC Device Manager under "**Watlow**," and the drives are listed under Disk Drives.

Figure 34: RMA PLUS in Windows device manager
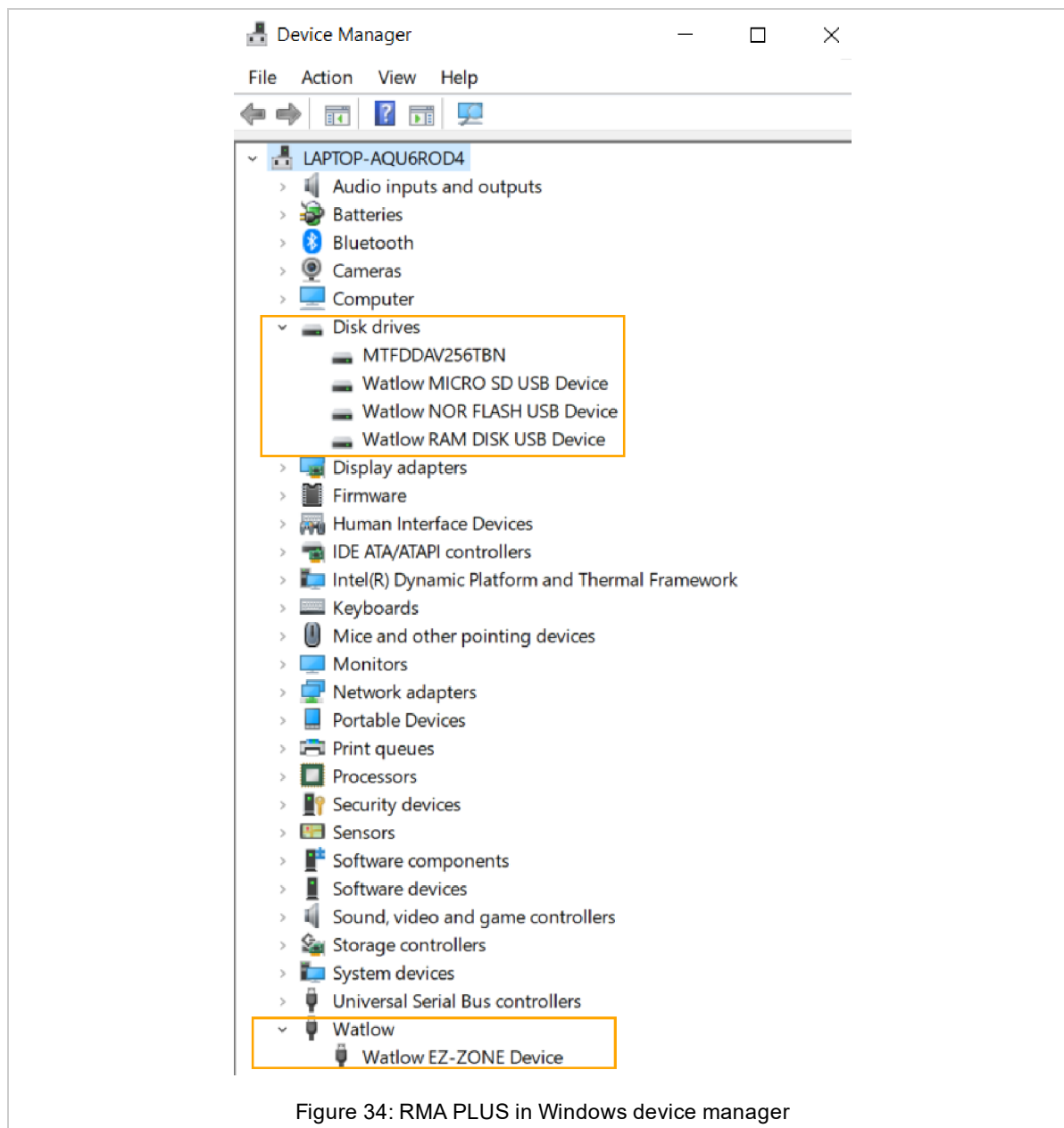
Mini-B USB Connection for Fast Communication to RM Devices

The vendor specific class implements a single USB to the intermodule bus gateway. This connection provides access to the RMA PLUS and all devices connected to the intermodule bus network. Transactions intended for remote devices are proxied (routed) through the RMA PLUS.

Three Drives in Mass Storage Class

The RMA PLUS provides three disk drives for user access. Upon connection, the firmware has control of the drives. Pressing the **Eject** button in Windows® Explorer mounts the drive to the PC, giving the PC exclusive access to the device. When a drive is mounted to the PC, all firmware services that use this drive are suspended. It is important to eject/unmount the drive from the PC and give control back to the device firmware when you are finished. It is also important to eject/unmount the drives from the PC before removing the USB cable to prevent data corruption.

Each disk drive is enumerated with a Logical Unit Number (LUN). Windows® may mount them in any order, but they are enumerated as follows in the firmware:

LUN 0: MICRO SD

Volume: (sd:)

LED Instance 1 (A) indicates the drive state by default.

The Micro SD drive is a 4 GB class 4 micro SDHC card (FAT32) for standard models and a 16 GB class 10 micro SDHC card (FAT32) for data logging models. It is an extension of the product's memory and not removable at runtime. The SD card is primarily used for data logging, serving web pages, software and documentation distribution.

NOTE: The RMA PLUS will not function properly without the SD card inserted. If necessary, you may upgrade the SD card to a larger capacity and / or class if the new card is high capacity (SDHC). Extended capacity micro SD cards (SDXC) are not supported by this device.

LUN 1: NOR FLASH

Volume: (nor:)

LED Instance 2 (B) indicates the drive state by default.

The NOR Flash drive is a 10 MB FAT16 partition on the internal flash memory. Its primary use is for product configuration because of its speed and persistence compared to the SD card. This is where configuration files live by default.

LUN 2: RAM DISK

Volume: (ram:)

LED Instance 3 (C) indicates the drive state by default.

The RAM disk is a 1 MB FAT12 partition on the external SDRAM chip. This is volatile memory. Any files directed here will be lost when the product resets. By default, only the event log is stored here.

Data Logging

The data logging feature is only available for model number RMAP-XX**D**X-XXXX.

Data logging allows you to log any data points in the system at a specified interval. Log files are stored on the MICRO SD drive (sd:\DataLog). This path cannot be changed by a setup file key.

To use this feature, add the setup keys DataLog and LogIntervalSec to the setup.csv file.

Setup Key: Data Log

Key	Value	Feature	Definition
DataLog	nor:\Gateway\DataLog.csv	Data logging	Applies only to model number RMAP-XX**D**X-XXXX. This provides the full file name / path where the data log configuration file lives. Elements in this file will be written to a log file at a pre-defined interval.

Setup Key: LogIntervalSec

Key	Value	Feature	Definition
LogIntervalSec	integer of 1-86,400 5 by default	Data Logging	This applies to models RMAP-XX**D**X-XXXX. This key defines the data log interval in seconds, entered as an integer with a range of 1 – 86,400 seconds. Any value outside this range is clipped.

Setup Key: LogKeepDays

Key	Value	Feature	Definition
LogKeepDays	integer 1 - 365 10 by default	Data log-ging	This key only applies if the model number is RMAP-XX**D**X-XXXX. This key defines the number of log files (days) to keep. It is interpreted as an integer with a range of 1 – 365 days. A value greater than 365 days will disable this feature. The default value is ten days.

The data logging configuration is user-defined. A sample file exists in the path defined by the DataLog key. Add records to this file as necessary, keeping the following in mind:

- A new file is created every day. Mount the MICRO SD drive to access / manage log files.
- Maximum of 2000 valid records.
- Maximum of 500 unique data points per standard bus and zone.
    - "(Z:C.M.I)" for standard and intermodule bus records where Z = Zone ID, C = Class ID, M = Member ID, I = Instance ID
    - "(A:R.N)" for Modbus® records where A = Address, R = Register, N = Number of Registers
- Headers are only appended once, when the file size equals zero.
- The format column may be used to override the default numeric data format for the given record. Standard printf style format strings may be used i.e. %f, %i, %X, etc. Leave this field empty to use the default data format.
- The format of the log file name is "YYYY-MM-DD.csv."
- Files with a creation date older than LogKeepDays are deleted. Folders, read-only files, and hidden files are excluded.
- File maintenance is triggered when a new file is created (file size is zero).
- All Data Types are supported.
- Unsupported data types are blank. This may be observed in a log file if the RMA PLUS cannot read the data type of a member. This will be the case if the target device is not present or the bus hasnot acquired the member attributes.
- If the file nor:\Text.csv exists, enumerations will be logged as strings. If not, they will be logged as their integer equivalent.
- Producer / consumer data points will display 99999 if an error exists.

DataLog.csv default configuration

Header	Format	Bus	Segment	Zone	Class	Instance	Member	Refresh Count
DEV 1 Hardware ID		1	0	0	1	1	1	0
TST 1 Tick		1	0	0	16	1	6	0
RTC 1 Timestamp		1	0	0	36	1	19	0

Time	DEV 1 Hardware ID	TST 1 Tick	RTC 1 Timestamp
0:00:00	118	224660111	570175200
0:00:05	118	224665131	570175205
0:00:10	118	224670111	570175210
0:00:15	118	224675081	570175215
0:00:20	118	224680101	570175220
0:00:25	118	224685121	570175225
0:00:30	118	224690096	570175230
0:00:35	118	224695116	570175235
0:00:40	118	224700081	570175240
0:00:45	118	224705106	570175245

Ethernet

The RMA PLUS embeds a 3-Port 10/100 Managed Ethernet switch. Therefore, you do not need a switch or router to create a simple network of devices. You may connect your PC directly to the RMA PLUS on either port. The other port can connect to another device (HMI, PC, RMA PLUS, etc.).

3-Port 10/100 Managed Ethernet Switch

Setup keys: SnifferPort

The RMA PLUS embeds a 3-Port 10/100 Managed Ethernet switch. It maintains a 100 Mbps, full duplex connection to port 3 of the switch (internal connection). Ports 1 and 2 are for user connections.

IMPORTANT: The embedded switch will reset along with the RMA PLUS breaking connection to downstream device (s). Therefore, carefully consider whether to daisy-chain the Ethernet connection in your system or make the RMA PLUS a drop, leaving one port open for diagnostics.

Notable Features:

- MDI/MDI-X Auto Crossover

· Auto-Negotiation (Speed and Duplex) (ports 1 and 2)

- Broadcast Storm Protection (all ports)
- Multicast Storm Protection (all ports)
- Port Mirroring (see SnifferPort)

Broadcast Storm Protection

The embedded switch in the RMA PLUS has an intelligent option to protect the switch from receiving too many broadcast packets. As broadcast packets are forwarded to all ports except the source port, an excessive number of switch resources (bandwidth and available space in transmit queues) may be utilized. Broadcast packets in excess of the preset storm rate will be dropped protecting both the switch and attached devices, namely the RMA PLUS.

Without storm protection, all broadcast packets would be received by the other switch ports (and RMA PLUS) consuming valuable resources.

Multicast Storm Protection

Multicast storm protection is enabled for the same reason as broadcast storm protection. IP phones and some industrial networks such as EtherNet/IP generate significant multicast traffic.

Port Mirroring

Port mirroring is an advanced switch feature disabled by default. To use this feature, you must add the key SnifferPort to the setup file. The configured port will mirror all packets received and transmitted on port 3 (internal switch connection to RMA PLUS). Connect a PC running Wireshark on the sniffer port to capture all traffic seen by the RMA PLUS.

MAC Filter

The RMA PLUS implements unicast Source Address (SA) filtering. If configured, it will filter out all MACs except those configured in the acceptance filters MACA(1-3) . Use MAC filtering to add a layer of anonymity to your network.

Setup Key: MACA 1-3

Key	Values	Feature	Definition
MACA1 MACA2 MACA3	C8:5B:76:F2:6F:06 C8:5B:76:F2:6F:07 C8:5B:76:F2:6F:08	Ethernet MAC filtering	MAC address(es) for Ethernet MAC filtering. Each MAC address is a string consisting of six hexadecimal octets separated by a colon. The MAC will only allow requests from the MAC addresses specified in this file. These records are not members of the default file, and therefore, the feature is disabled. If you wish to use this feature, you must add one or more records to the setup file.

Addressing

The RMA PLUS currently implements IPV4 static and DHCP addressing. Static addressing is the preferred method.

If DHCP is selected and the device does not get an address from the server, the RMA PLUS will fail to the static IP address after a timeout period.

NetBIOS Name Service

The RMA PLUS implements NetBIOS-NS. This means the RMA PLUS may be addressed by its IP address or NetBIOS / host name. The format of the NetBIOS name is RMA-<Serial Number>. Ensure that NetBIOS is enabled in the network adapter settings for this feature to work. Example: RMA-1894854 (where 1894854 is the device serial number)

Intermodule Bus Over Ethernet

Software tools use this feature to discover Watlow devices on an Ethernet network. The RMA PLUS provides up to three (priority based) intermodule bus Ethernet gateway sessions. Each connection provides access to the RMA PLUS and all devices connected to the intermodule bus network. Transactions intended for remote devices are proxied (routed) through the RMA PLUS.

The keep-alive feature is enabled on all accepted sockets. This prevents socket leaks if a socket is not closed properly. Typical causes include application hang / crash, loss of link, severed network, half close, etc.

This service is enabled by default for all model numbers. It may be disabled by writing "No" on the "Watbus Enable" member. If you disable discovery, you must specify the IP address or host name to make a connection with PC software. NOTE: A reset is required for this change to take effect.

Key	Value	Feature	Definition
Discover	0 = disabled 1 = enabled	intermodule bus over Ethernet discovery	This key is enabled by default. It enables or disables the intermodule bus over Ethernet discovery feature. When discovery is disabled (the value is set to 0), software tools will not discover the device. This record is not in the setup.csv file by default. To use this feature, add this key and value to the setup.csv file.

Ethernet 70 (0x46), Instance 2

Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
7	0x07	Watbus Enable	ENUM16	RW	F	--	--	-- 106	59: No 106: Yes

Modbus® TCP Server

Key	Value	Feature	Definition
ModbusTCP	nor:\Gateway\ModbusTcp.csv	Modbus® TCP Server	Full file name / path where the Modbus® TCP field bus gateway file lives. This file associates Modbus® TCP registers with data points from any of the four local busses.

The RMA PLUS is a Modbus® TCP server and provides up to three (priority based) Modbus® TCP sessions. This service is enabled by default for all model numbers. It may be disabled by writing "No" to the Modbus® TCP Enable member. NOTE: A reset is required for this change to take effect.

Modbus® TCP does not proxy requests and there is virtually no delay between request and response. A keep-alive feature is enabled on all accepted sockets to prevent leaks if a socket is not closed properly after an applicationcrash, loss of link, severed network, half-close, etc.

The RMA PLUS implements the following Modbus® function codes:

- 3: Read Holding Registers
- 4: Read Input Registers
- 6: Write Single Register
- 16: Write Multiple Registers

Modbus® TCP supports all integer data types, floats, enums, and parameter types, but not strings.

The 16-bit word / register order of multi-register data types may be changed. By default, the word order is low, high.

Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments
3	0x03	Modbus® TCP Enable	ENUM16	RW	F			106	59: no; 106: yes
4	0x04	Modbus® TCP Word Order	ENUM16	RW	F			1331	1331: Low High; 1330: High Low

The object model for the Modbus® TCP server is user-defined. A sample file (shown below) exists in the path defined by the key ModbusTCP. Add records to this file as necessary keeping the following in mind:

- The Modbus® register is user-defined. It is an unsigned 16-bit integer with a range of 0 – 65535.
- Records must be sorted in ascending order by Modbus® register (Column A).
- The file may contain a maximum of 2000 valid records.
- There is currently a maximum of 500 unique data points per bus and zone.
- Respect the data type of the target element, i.e. 32-bit integers, floats and parameters consume 2 registers, so you must skip a register number before starting the next custom data point. In this example, additional records may be added starting at registers 2 and 1002 because both elements are 32-bit values.
- A value of 0 will be returned for registers that are not explicitly defined in the table.
- An exception will be returned if a request exceeds the limits of the table i.e. Register > 1001 in this example.
- Writing will not return an exception unless the above condition is violated.

Register	Bus	Segment	Zone	Class	Instance	Member	Refresh Count	--
0	1	0	0	1	1	1	0	Dev 1 Hardware ID
1000	1	0	0	36	1	19	0	RTC 1 Timestamp

HTTP Server

The RMA PLUS implements a custom HTTP server that interacts asynchronously with a user-defined data model loaded on initialization and configured with a USBD gateway file.
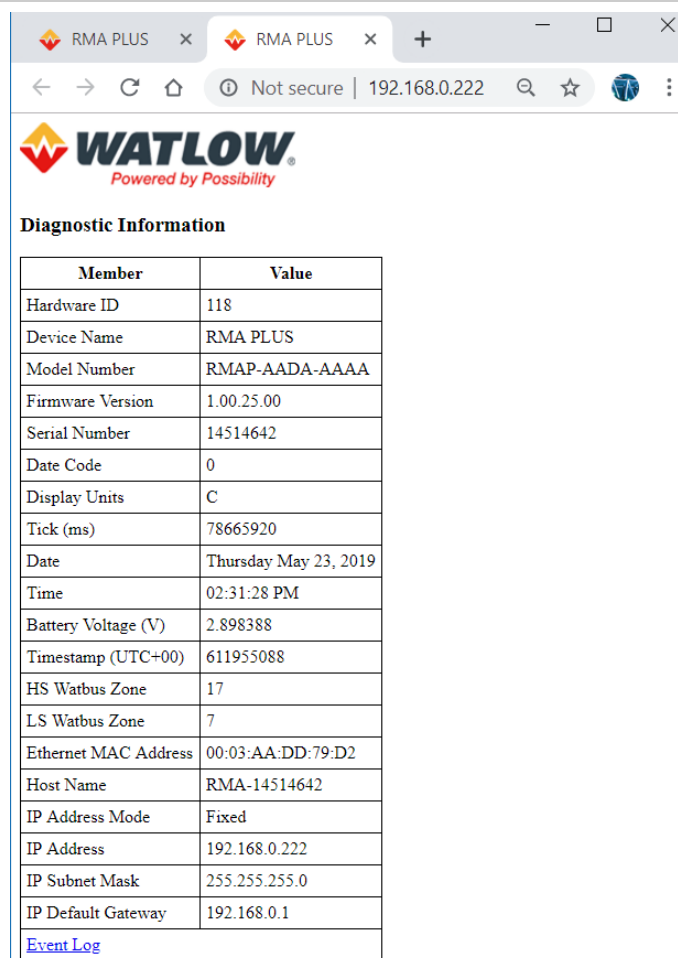
You may create custom web content for the RMA PLUS by replacing the default HTTPs files and / or adding new ones.

This service is enabled by default for all model numbers. It may be disabled by writing "No" on the HTTP Server Enable member in your configuration software (COMPOSER or Dashboard) and then resetting the RMA PLUS.

Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments
8	0x08	HTTP Server Enable	ENUM16	RW	F	--	--	106	59: No; 106: Yes

Configuring Read Only Diagnostic Web Page

1.Open a web browser and navigate to the RMA PLUS using the IP address or host name (i.e. http://rma-<Serial Number>/ or http://192.168.0.100/). The default web page "Index.html" displays with basic information about the device and a link to the Event Log.

Figure 35: Default Diagnostics Web Page

2. Mount the SD drive to the PC (by right-clicking the drive and selecting **Eject**) to view or mdify the HTTPs files.

- HTTP server files are in the "sd:\Https" directory. Index.html is the default file returned when you navigate to the RMA PLUS and no file is supplied. You are free to modify or replace the files in this directory.
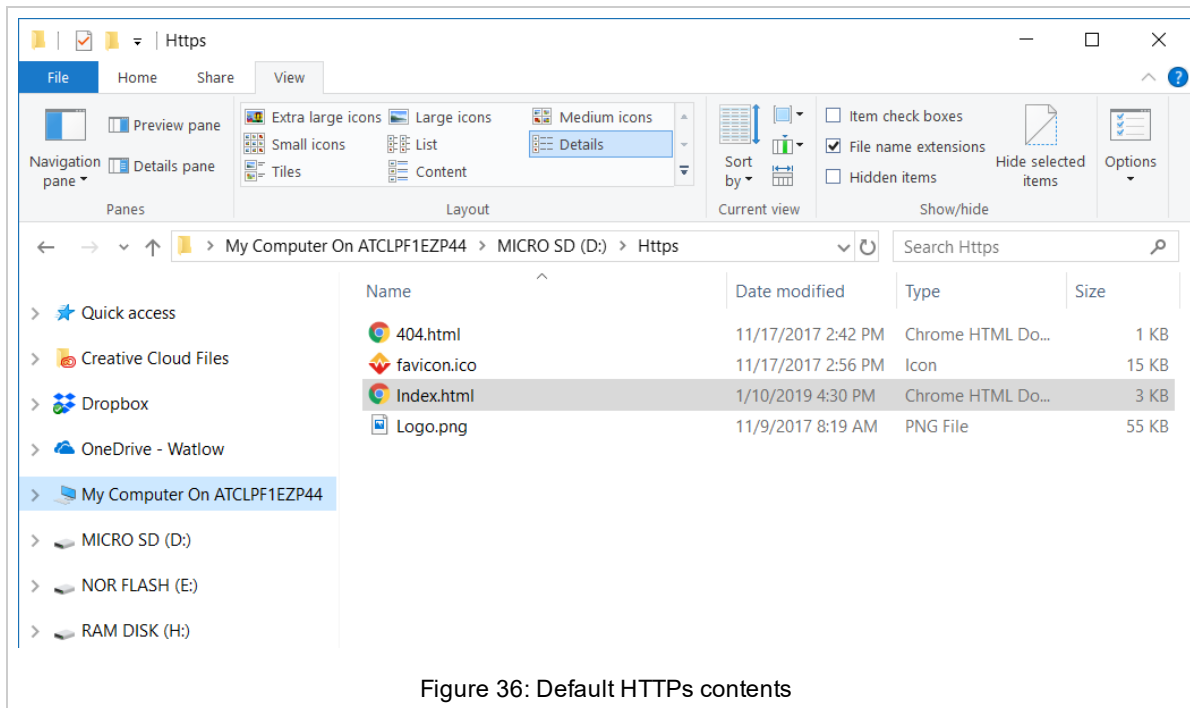
Figure 36: Default HTTPs contents

3. Mount the **NOR FLASH** drive.

4. Add the HTTPs key and value to the **setup.csv** file.

Setup Key: HTTPs

Key	Value	Feature	Definition
HTTPs	nor:\Gateway\Https.csv	HTTP Server	Full file name / path of the HTTP server configuration file. Elements in this file are used to display system parameters on custom web pages. To use this feature, add this record to the setup file.

5. Create the file defined by the newly-created HTTPs key referencing data points you wish to display in the web page.

- Open **Index.html** to observe the syntax before token insertion. View the HTML source to learn more about tokens and their format.
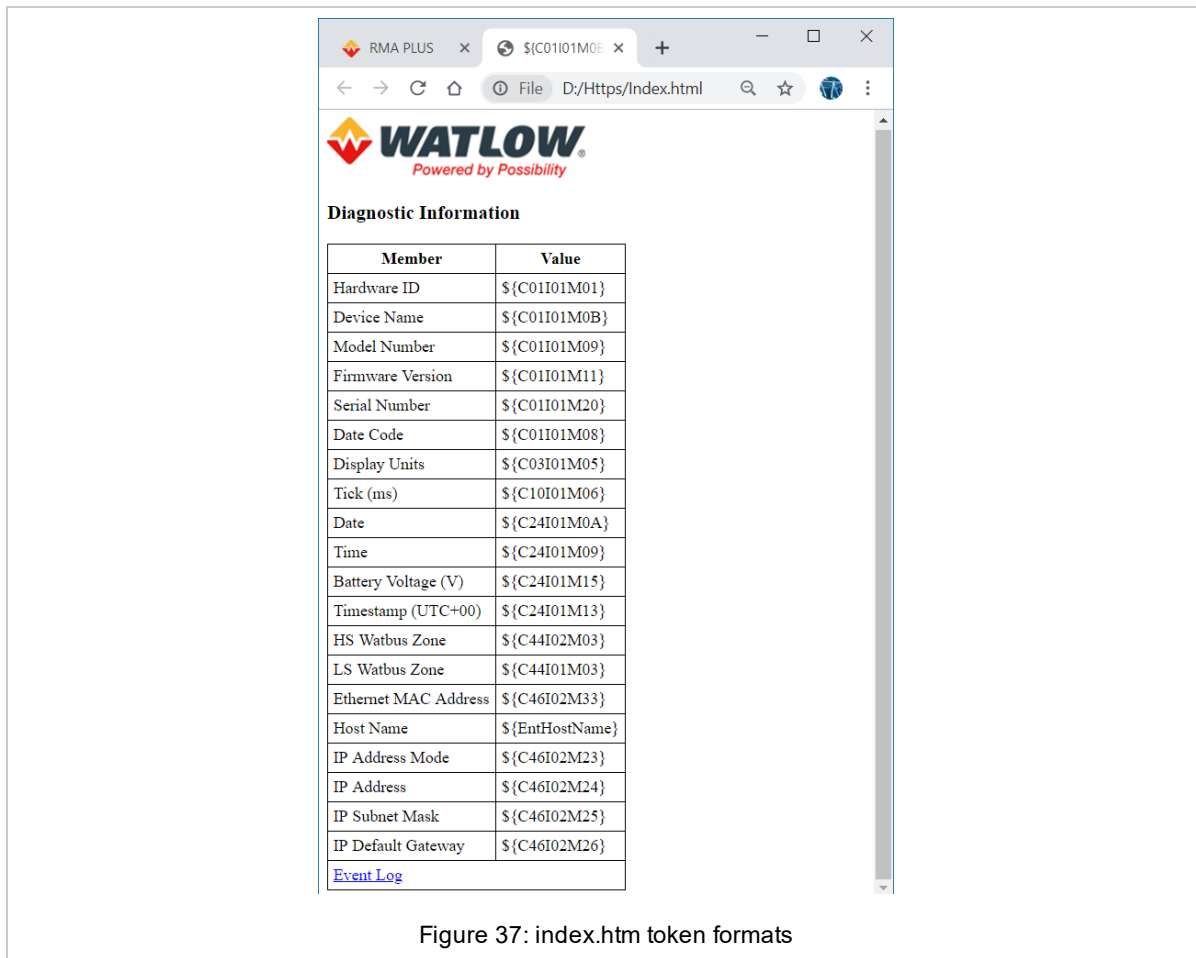
Figure 37: index.htm token formats

- Tokens are user-defined strings. The remainder of the record elements are bus dependent as before.

Token Format

HTML files (*.html, *.htm) replace tokens with live data when streaming pages from the micro SD card to the browser. The format of a token is ${TokenKey}. When the parser encounters a token, it searches for a match. If a match is found, the token key is replaced with the token value. If a match is not found, the token key is replaced with a question mark. The parser supports three token key formats and searches them in the following order:

1. If the format is **${CxxIxxMxx}**, then the value is expected to be a member of the RMA PLUS where *Cxx* is the standard bus Class ID (hexadecimal), *Ixx* is the standard bus Instance ID (hexadecimal), and *Mxx* is the standard bus Member ID (hexadecimal) i.e. ${C01I01M01} for the Hardware ID.

2. Next, it searches user-defined tokens from the configuration file defined by the key HTTPs in the setup file.

3. Finally, it searches a hardcoded token table.

HTTPs hardcoded tokens

Key	Value
EntHostName	Ethernet host name i.e. RMA-<Serial Number>
FileNameEventLog	Event log file name / path defined by setup key EventLog

Example Custom HTTPs Table

Token	Bus Segment Zone Class Instance Member Refresh Count

Z1_DEV1_HardwareId	1	0	1	1	1	1	0	DEV 1 Hardware ID
Z1_DEV1_DateCode	1	0	1	1	1	8	0	DEV 1 Date Code
Z1_DEV1_ModelNumber	1	0	1	1	1	9	0	DEV 1 Model Number
Z1_DEV1_DeviceName	1	0	1	1	1	11	0	DEV 1 Device Name
Z1_DEV1_FirmwareVersion	1	0	1	1	1	17	0	DEV 1 Firmware Version
Z1_DEV1_SerialNumber	1	0	1	1	1	32	0	DEV 1 Serial Number
Z1_VAR1_Type	1	0	1	2	1	1	0	VAR 1 Type
Z1_VAR1_Digital	1	0	1	2	1	2	0	VAR 1 Digital
Z1_VAR1_Analog	1	0	1	2	1	3	0	VAR 1 Analog
Z1_DSP1_DisplayUnits	1	0	1	3	1	5	0	DSP 1 Display Units
Z1_TST1_Tick	1	0	1	16	1	6	0	TST 1 Tick
Z1_TST1_EventLog	1	0	1	16	1	8	0	TST 1 Event Log
Z1_AST1_Member1	1	0	1	19	1	1	0	AST 1 Member 1

7. Create a new HTML page **"sd:\Https\Zone01.html"** using the user-defined tokens above to display information about the intermodule bus device at Zone 1. Use the default HTML page "Index.html" as a guide. Open the web page from the Https directory to validate the design (but without live data)..

8. Save and close all files on the **MICRO SD** and **NOR FLASH** drives. **Eject** both drives to unmount them from the PC

9. Reset the RMA PLUS.

10. Now you should be able to open a web browser and navigate to the RMA PLUS using the IP address or host name i.e. http://rma-<Serial Number>/Zone01.html or http://192.168.0.100/Zone01.html and see the new HTML page with live data for Zone 1.

Notes

- HTML files are stored on the micro SD card by default. This path cannot be changed at run time with a setup file key.
- The HTTP server cannot return web pages if the SD drive is mounted to the PC.
- Dynamic token replacement only occurs in HTML files (*.html, *.htm).
- The current implementation provides for 15 connections. Each file requires a connection. Using the default web page as an example, there should be a maximum of three connections created by the request for Index.html: 1) indext.html; 2) favicon.ico; 3) logo.png. This, of course, varies by browser, caching, timing, etc.
- The HTTP Server supports all data types
- You may download or create links to any file on any of the RMA PLUS drives via HTTP. See the event log example on the default HTML page. Valid drive names are "sd:", "nor:" and "ram:"
- Only read operations are supported via HTTP Server.
- Tested with Internet Explorer and Chrome

TFTP Server

The RMA PLUS implements a Trivial File Transfer Protocol (TFTP) server for accessing files on the RMA PLUS in a similar fashion to USB.

This service is enabled by default for all model numbers. It may be disabled by writing "No" on the TFTP Server Enable member, and then resetting the RMA PLUS.

Ethernet 70 (0x46) Instance 2

Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments
9	0x09	TFTP Server Enable	ENUM16	RW	F	--	--	106	59: No 106: Yes

Notes

- Read-only files cannot be written via TFTP
- Binary image transfer mode [-i] is recommended to prevent data loss in some strings

Command Format using Windows® 7 native TFTP client

```
TFTP [-i] host [GET | PUT] source [destination]
```

Sample Read

Read the Modbus® TCP configuration file (ModbusTcp.csv) from the NOR FLASH drive and place it in a folder in the temporary directory.

```
TFTP -i rma-1894854 GET nor:\Gateway\ModbusTcp.csv %TEMP%\TFTP\ModbusTcp.csv
```

Sample Write

Write the Modbus® TCP configuration file (ModbusTcp.csv) from a folder in the temporary directory to the NOR FLASH drive.

```
TFTP -i rma-1894854 PUT %TEMP%\TFTP\ModbusTcp.csv nor:\Gateway\ModbusTcp.csv
```

SNTP Client

SNTP Address

Key	Value	Feature	Definition
SntpAddress	216.239.35.4	SNTP Client	Ethernet IPV4 address of a SNTP server as a string. This record is not a member of the default file, and therefore, the feature is disabled. If you wish to use this feature, you must add this record to the setup file.

The RMA PLUS implements a Simple Network Time Protocol (SNTP) client. If the configuration key SntpAddress is present, the RMA PLUS will attempt to synchronize its time with the configured SNTP server once per day. If the connection fails, the RMA PLUS will try again at a faster interval until the connection is successful.

Wireshark

Wireshark is an Ethernet network analyzer. If you are trying to diagnose an Ethernet issue, Wireshark is an invaluable tool. The factory may ask for a network capture to help diagnose problems.

If the problem is between PC software and the RMA PLUS, you can install Wireshark on the PC with no additional configuration. If the problem is between a device without Wireshark and the RMA PLUS, you can activate the port mirroring feature of the embedded switch to obtain a network capture.

Ethernet Members in RMA PLUS

Ethernet 70 (0x46), Instance 2								
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
3	0x03	Modbus® TCP Enable	ENUM16	RW	F	--	--	106	59: No; 106: Yes
4	0x04	Modbus® TCP Word Order	ENUM16	RW	F	--	--	1331	1331: Low High; 1330: High Low
7	0x07	Watbus Enable	ENUM16	RW	F	--	--	106	59: No; 106: Yes
8	0x08	HTTP Server	ENUM16	RW	F	--	--	106	59: No; 106: Yes

		Ethernet 70 (0x46), Instance 2							
		Enable							
9	0x09	TFTP Server Enable	ENUM16	RW	F	--	--	106	59: No; 106: Yes
16	0x10	IP Address Mode	ENUM16	RW	F	--	--	1284	1281: DHCP; 1284: Fixed
17	0x11	IP Fixed Address Octet 1	UINT8	RW	F	0	255	192	--
18	0x12	IP Fixed Address Octet 2	UINT8	RW	F	0	255	168	--
19	0x13	IP Fixed Address Octet 3	UINT8	RW	F	0	255	0	--
20	0x14	IP Fixed Address Octet 4	UINT8	RW	F	0	255	100	--
23	0x17	IP Fixed Subnet Mask Octet 1	UINT8	RW	F	0	255	255	--
24	0x18	IP Fixed Subnet Mask Octet 2	UINT8	RW	F	0	255	255	--
25	0x19	IP Fixed Subnet Mask Octet 3	UINT8	RW	F	0	255	255	--
26	0x1A	IP Fixed Subnet Mask Octet 4	UINT8	RW	F	0	255	0	--
29	0x1D	IP Fixed Default Gateway Octet 1	UINT8	RW	F	0	255	192	--
29	0x1D	IP Fixed Default Gateway Octet 2	UINT8	RW	F	0	255	168	--
29	0x1D	IP Fixed Default Gateway Octet 3	UINT8	RW	F	0	255	0	--
29	0x1D	IP Fixed Default Gateway Octet 4	UINT8	RW	F	0	255	1	--
35	0x23	IP Actual Address Mode	ENUM16	R	F	--	--	--	1281: DHCP; 1284: Fixed
36	0x24	IP Actual Address String	STRING	R	--	--	--	"192.168.0.100"	--
37	0x25	IP Actual Subnet Mask String	STRING	R	--	--	--	"255.255.255.0"	--
38	0x26	IP Actual Default Gateway String	STRING	R	--	--	--	"192.168.0.1"	--
45	0x2D	MAC Address Octet 1	UINT8	R	--	--	--	0x00	--
46	0x2E	MAC Address Octet 2	UINT8	R	--	--	--	0x03	--
47	0x2F	MAC Address Octet 3	UINT8	R	--	--	--	0xAA	--
48	0x30	MAC Address Octet 4	UINT8	R	--	--	--	0xXX	--
49	0x31	MAC Address Octet 5	UINT8	R	--	--	--	0xYY	--
50	0x32	MAC Address Octet 6	UINT8	R	--	--	--	0xZZ	--
51	0x33	MAC Address String	STRING	R	--	--	--	"00:03:AA:XX:YY:ZZ"	--
55	0x37	Static IP Address String	STRING	RW	F	--	--	"192.168.0.100"	--
56	0x38	Static IP Subnet	STRING	RW	F	--	--	"255.255.255.0"	--

Ethernet 70 (0x46), Instance 2									
		Mask String							
57	0x39	Static IP Default Gateway String	STRING	RW	F	--	--	"192.168.0.1"	--
58	0x3A	Port 3 Link Speed	ENUM16	R	F	--	--	--	1457: Down;;; 2164: 10 Mbps;; 2165: 100 Mbps;;; 2166: 1000 Mbps;;; 10: Auto
59	0x3B	Port 3 Link Duplex	ENUM16	R	F	--	--	--	1457: Down;;; 2162: Half-Duplex;;; 2163: Full-Duplex;;; 10: Auto

Modbus® RTU

This feature is only available if the model number is RMAP-2XXX-XXXX.

The RMA PLUS model RMAP-2XXX-XXXX enables two Modbus® RTU channels on an adjacent RS-232 / RS-485 companion module. These channels may be independently configured as masters or slaves. Modbus® RTU does not proxy requests. It interacts asynchronously with a user-defined data model loaded on initialization and configured by way of a USBD gateway file.

As a Modbus® RTU slave, the RMA PLUS only implements these Modbus® function codes:

- 3: Read Holding Registers
- 4: Read Input Registers
- 6: Write Single Register
- 16: Write Multiple Registers

As a Modbus® RTU master, the RMA PLUS only implements the following Modbus® function codes:

- 3: Read Holding Registers
- 6: Write Single Register – only if key RtuFc6 is enabled
- 16: Write Multiple Registers

Modbus® RTU supports all integer data types: floats, and enums, but not strings.

The 16-bit word / register order of multi-register data types is low-high by default, but may be changed to suit the client application. See Modbus® for member documentation.

The object model for the Modbus® RTU slave is user-defined. A sample file exists in the path defined by the keys ModbusRtu6 and ModbusRtu7. Add records to these files as necessary keeping the following in mind:

- The Modbus® register is user-defined. It is an unsigned 16-bit integer with a range of 0 – 65535.
- Records must be sorted in ascending order by Modbus® register (Column A).
- The file may contain a maximum of 2000 valid records.
- There is currently a maximum of 500 unique data points per standard bus and zone.
- Respect the data type of the target element i.e. with 32-bit integers, floats and parameters consume two registers, so you must skip a register number before starting the next custom data point. In the default Modbus® RTUX.csv configuration, additional records may be added starting at registers 2 and 1002 because both elements are 32-bit values.
- A value of 0 will be returned for registers that are not explicitly defined in the table.
- An exception will be returned if a request exceeds the limits of the table, i.e. register > 1001 in this example.
- Writing will not return an exception unless the above condition is violated.

Modbus® RtuX.csv default configuration

Register	Bus	Segment	Zone	Class	Instance	Member	Refresh Count	--
0	1	0	0	1	1	1	0	Dev 1 Hardware ID

Register	Bus	Segment	Zone	Class	Instance	Member	Refresh Count	--
1000	1	0	0	36	1	19	0	RTC 1 Timestamp

Use these setup keys to configure Modbus® RTU.

Setup Key: Modbus® RTU6

Key	Value	Feature	Definition
ModbusRtu6	nor:\Gateway\ModbusRtu6.csv	Modbus® RTU	This is only available if the model number is RMAP-2XXX-XXXX. Full file name / path where the Modbus® RTU 6 field bus gateway file lives. This file associates Modbus® RTU registers with data points from any of the 3 remaining busses when Modbus® RTU 6 is configured as a slave.

Setup Key: Modbus® RTU7

Key	Value	Feature	Definition
ModbusRtu7	nor:\Gateway\ModbusRtu7.csv	Modbus® RTU	This is only available if the model number is RMAP-2XXX-XXXX. Full file name / path where the Modbus® RTU 7 field bus gateway file lives. This file associates Modbus® RTU registers with data points from any of the three remaining busses when Modbus® RTU 7 is configured as a slave.

Setup Key: RTU Fc6

Key	Values	Feature	Definition
RtuFc6	0 (FALSE) = Master uses Function Code 16 exclusively 1 (TRUE) = Master uses Function Code 6 for single register writes	Modbus® RTU Function Code 6	This is only available for model number RMAP-**2X**XX-XXXX. This is used to enable Modbus® RTU Function Code 6 (Write Single Register) on master channels for devices that do not implement Modbus® Function Code 16 (Write Multiple Registers). It is only necessary if the RMA PLUS does not negotiate this requirement on its own. This record is not a member of the default file, and therefore, the feature is disabled. To enable the feature, you must add this record to the setup file.

Testing Modbus® RTU Communications

To perform test read / write operations on the data you may use the Modbus® RTU test program included on the MICRO SD drive (sd:\Software\Modbus® RTU). In the following example, the RMA PLUS's Hardware ID (32-bit Integer) is returned for registers 0, 1. Registers 2 and 3 were not specified so they return 0s.
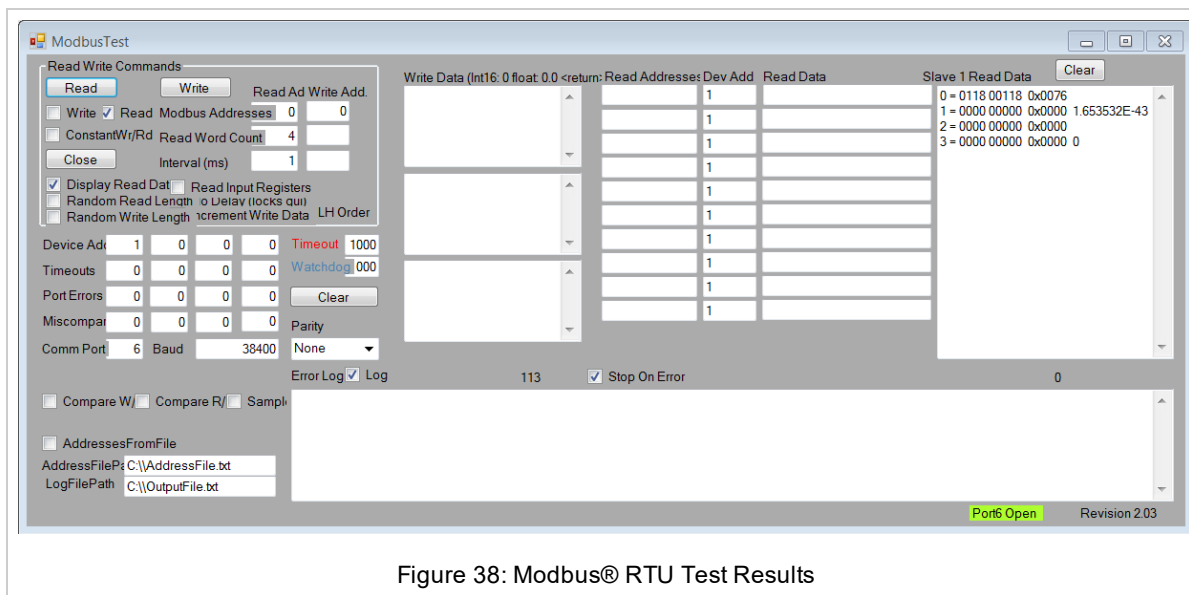
Figure 38: Modbus® RTU Test Results

Also see Bus specifications .

Non-Volatile Memory

Software objects that contain non-volatile elements are stored in files in a protected partition of memory on the NOR FLASH drive that cannot be accessed directly by users. Software tools such as Dashboard may be used to modify these files indirectly.

Objects that have been changed are only saved to non-volatile memory after three seconds of inactivity. This feature prevents prematurely wearing out nonvolatile memory due to constant writes. However, this also means that you must wait at least three seconds before resetting the RMA PLUS to prevent losing recent changes.

Since the protected volume and customer volume exist on the same device, changes cannot be saved to non-volatile memory if the NOR FLASH drive is mounted (locked).

Standard Bus and Intermodule Bus Addressing

The RMA PLUS uses a proprietary RS-485 token-passing network of both masters and slaves. The RMA PLUS is a master on both channels. Standard Bus Instance 1 is low-speed standard bus and Standard Bus Instance 2 is intermodule bus. The logical address is independently software selectable for each bus.

Address Segmentation

The standard bus is segmented and thus requires an additional configuration parameter to address data points. Therefore, when you purchase an EZ-ZONE RUI and EZ-ZONE PM, and configure it with a PC, they are all at address 1 yet there is no address conflict.

Standard Bus Address Segmentation

Value	Segment
0	No segmentation of the physical address (i.e. intermodule bus)
1	Masters: PCs
2	Masters: EZ-ZONE RUI, RMZ, RMA PLUS
3	Masters: Legacy field communication cards

Value	Segment
4	Slaves: EZ-ZONE ST, PM, RM (A, C, E, F, G, H, L, S UH), et al.

There may be up to 33 devices (zones) on bus 2, each with a unique physical address used by the bus. The logical address is what the user is presented. By default, the RMA PLUS occupies logical address 7 of segment 2. You must ensure that each device on this bus has a unique logical address within its segment. Segment 2 devices may include EZ-ZONE RUIs and a sole EZ-ZONE RMZ (always address 8).

The segment field only applies to bus 2 records.

Standard Bus Address Space

Segment	Logical	Physical	--	
1	1	0	PCs (software)	Masters
	2	1		
	3	2		
	4	3		
2	1	4	EZ-ZONE RUI, RMZ, RMA PLUS	
	2	5		
	3	6		
	4	7		
	5	8		
	6	9		
	7	10		
	8	11		
3	1	12	Field Communications Cards	
	2	13		
	3	14		
	4	15		
4	1	16	Slaves (EZ-ZONE ST, PM, RM, ...)	
	2	17		
	3	18		
	4	19		
	5	20		
	6	21		
	7	22		
	8	23		
	9	24		
	10	25		
	11	26		
	12	27		
	13	28		
	14	29		
	15	30		
	16	31		
	17	32		

Intermodule Bus

There may be up to 17 devices (zones) on bus 1. All are masters, so they may initiate requests to their peers. By default, the RMA PLUS occupies address 17, which does not conflict with any other EZ-ZONE RM module. The segment field should be set to 0 (not segmented) for any bus 1 record.

The logical address is software selectable and may be changed using one of the PC software tools. It is recommended to leave the RMA PLUS at address 17 as this is a reserved address space.

Intermodule Bus Address Space

Segment	Logical	Physical	--
0	1	0	Masters
	2	1	
	3	2	
	4	3	
	5	4	
	6	5	
	7	6	
	8	7	
	9	8	
	10	9	
	11	10	
	12	11	
	13	12	
	14	13	
	15	14	
	16	15	
	17	16	

System Configuration File

Setup Key: SysCfg

Key	Value	Feature	Definition
SysCfg	nor:\Gateway\SysCfg.csv	System Configuration	Full file name / path where the system configuration file lives. Elements in this file will be written to the system upon initialization.

This feature is used to write configuration parameters to system devices when the RMA PLUS is initialized. The sample file contains Ethernet configuration parameters for this device.(Note that the bus is set to 0 for all records, so they are ignored by the parser). Zone is a 1-based number. Zone 0 denotes "self" or the RMA PLUS in this case. Using Zone 0 is agnostic of changes to the standard bus logical address. If you wish to use the system configuration file to set your Ethernet parameters, change the bus to 1 for each record and verify the elements in the value column.

Add records to the file as necessary keeping the following in mind:

- Unless otherwise specified, all numeric fields are base 10 (decimal).
- The file may contain a maximum of 2000 valid records.
- There is currently a maximum of 500 unique data points per standard bus and zone.
- Writing to the parameters in this example will require two resets. The first reset writes the new value to the Ethernet object, the second reset uses the new value to initialize communications. NOTE: There are other parameters that will behave this way.

SysCfg.csv default configuration

Bus	Segment	Zone	Class	Instance	Member	Representation	Value	
0	0	0	70	2	16	15	1284	ETH 2 IP Address Mode (DHCP=1281 Fixed=1284)

Bus	Segment	Zone	Class	Instance	Member	Representation	Value	
0	0	0	70	2	55	9	192.168.0.100	ETH 2 Static IP Address
0	0	0	70	2	56	9	255.255.255.0	ETH 2 Static IP Subnet Mask
0	0	0	70	2	57	9	192.168.0.1	ETH 2 Static IP Default Gateway

Chapter 6 | Standard Objects Reference

The RMA PLUS implements the following software objects.

	Class ID		Qty	Comment
1	0x01	Device	2	If RMAP-(5,8)AXX-XXXX
2	0x02	Variable	20	
3	0x03	Display	1	
4	0x04	Analog Input	4	If RMAP-8AXX-XXXX
12	0x0C	Limit	4	If RMAP-8AXX-XXXX
14	0x0E	Custom Setup	2	
16	0x10	Test	1	
19		Assembly Setup	2	
20		Assembly	2	
25		Math	20	
26		Process Value	4	If RMAP-8AXX-XXXX
27		Logic	20	
28		Compare	20	
36		Real Time Clock	1	
45		LED	4	
68		Standard Bus	2	
69		Modbus	2	If RMAP-2AXX-XXXX
70		Ethernet	1	
74		Alarm 2	10	
75		Control Loop 2	4	If RMAP-8AXX-XXXX
100		Consumer Data	16	
101		Module Limit	1	If RMAP-8AXX-XXXX
102		Volume	3	
210		Optic Sensing	4	If RMAP-8AXX-XXXX
211		Calibration	4	If RMAP-8AXX-XXXX

New objects and deviations from standard EZ-ZONE objects are documented here. Other standard EZ-ZONE object documentation may be found in other EZ-ZONE RM family manuals or the EZ-ZONE COMPOSER® software manual.

Alarm 2

Alarm 2 member 1 (0x01), "Alarm Type," includes an additional enumeration. You may now choose "Percent" for a deviation alarm. If the process value exceeds the user-defined limits as a percent of the set point, the alarm will become active.

Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments
1	0x01	Type	ENUM16	RW	F			62	62: Off 76: Process Alarm

Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments
									24: Deviation Alarm
									70: Deviation Percent

Calibration

The Calibration objects contain factory and user calibration parameters, nothing else. They complement other objects and features. The instance is a 1:1 correlation to an object needing calibration data.

Instance 1 is always available. Only the following members apply if the model number is NOT RMAP-8AXX-XXXX. These members are used to calibrate the Real Time Clock battery voltage.

Calibration 211 (0xD3), Instance 1: RTC Battery Voltage -- -- -- -- -- -- -- --									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
84	0x54	Factory Gain	FLOAT	R	F	-3.40E+38	3.40E+38	3.223443E-03	--
85	0x55	Factory Offset	FLOAT	R	F	-3.40E+38	3.40E+38	0.7	Volts
86	0x56	User Gain	FLOAT	RW	F	-3.40E+38	3.40E+38	1.0	--
87	0x57	User Offset	FLOAT	RW	F	-3.40E+38	3.40E+38	0.0	Volts

Consumer Data

The consumer data object may be used to read any produced data point (value and error) in the system. There are currently (16 sources per instance) * (16 instances) = 256 sources max. These are useful for monitoring remote data, and efficiently retrieving and aggregating this data for standard bus access. There are five members per source.

Consumer Data 100 (0x64)									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments
1	0x01	Source	ENUM16	RW	F			62	61: None 142: Analog Input 243: Set Point Open 242: Set Point Closed 160: Heat Power 161: Cool Power 22: Current 73: Power 245: Variable 240: Math 241: Process Value 238: Linearization 179: Current Read 1697: Wattage 1699: Load Voltage 1183: Load Resistance 6: Alarm 233: Profile Event Out A 234: Profile Event Out B 235: Profile Event Out C 236: Profile Event Out D 247: Profile Event Out E 248: Profile Event Out F 249: Profile Event Out G 250: Profile Event Out H 126: Limit 1142: Digital I/O 1001: Function Key 239: Logic 230: Compare 231: Counter 244: Timer 1532: Special Function Output 1 1533: Special Function Output 2 1534: Special Function Output 3 1535: Special Function Output 4 1696: Module Limit 184: Heater Error
2	0x02	Source Instance	UINT8	RW	F	1	250	1	
3	0x03	Source Zone	UINT8	RW	F	0	24	0	
4	0x04	Source Value	FLOAT	R		-99999.0	99999.0		
5	0x05	Source Error	ENUM16	R					61: None 65: Open 127: Shorted 140: Measurement Error 139: Bad Calibration Data 9: Ambient Error 141: RTD Error 32: Fail 1423: Math Error 246: Not Sourced 1617: Stale

Device

Device member 13, "**Load Parameter Set**," includes an additional enumeration for applying factory defaults. You may now choose to restore factory defaults with or without communication objects (and others).

- Choose the "**Factory**" option (default level 0) to exclude: Assembly, Calibration, Standard Bus, Ethernet, Modbus® and Real Time Clock.
- Choose the "**Communications**" option to include the above objects (default level 1).

Device member 50, "**Command**," is a special device command parameter. Writing the strings below will result in the specified action.

Device member 51, "**Re-Confi**g," will issue a re-config command to the RMA PLUS. This will bind all object sources to their specified producers whether local or remote.

Device 1 (0x01), Instance 1								
Member ID	--	Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
13	0x0D	Load Parameter Set	ENUM16	RW	--	--	--	61	61: None; 31: Factory; 1234: Communications
50	0x32	Command	STRING	RW	--	--	--	""	"" - Empty String; "reset" - Issue a soft reset (5 sec)
51	0x33	Re-Config	ENUM16	RW	--	--	--	59	59: No; 106: Yes

LED

There are four user-defined, bi-color LEDs on the face of the device. By default, three of the LEDs indicate the state of a USB Device drive, but this is configurable.

Functions

- **Off**: The LED will be OFF.
- **Output**: Choose a source, color (red, green or yellow), and fixed time-base to indicate the state of any produced data point connected to the intermodule bus. Analog values are a percentage. Anything greater than 100 is full ON.
- **C**: Choose a color for the LED. It will be ON if the display units are °C, OFF otherwise.
- **F**: Choose a color for the LED. It will be ON if the display units are °F, OFF otherwise.
- **State**: Choose a source, color and value for each of the eight states (if desired) and fixed time-base. If the source value equals the value in one of the states, the LED will be assigned the state color.
- **MICRO SD**: Indicates the state of LUN 0 (see state table below).
- **NOR FLASH**: Indicates the state of LUN 1 (see state table below).
- **RAM DISK**: Indicates the state of LUN 2 (see state table below).

USBD LED States		
LED	**MSC State**	**Description**
GRN	Disconnected	Disconnected from host
RED Flashing	Start	Start the LUN (request lock)
RED	Ready	LUN ready (host locked)
YEL Flashing	Stop	Stop the LUN (request unlock
YEL	Stopped	LUN stopped / ejected (firmware locked)

LED 45 (0x2D), Instances 1-4								
Member ID	Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description

1	0x01	Function	ENUM16	RW	F	--	--	Instance 1: 2180 Instance 2: 2181; Instance 3: 2182 Instance 4: 62;	62: Off 68: Output 15: °C 30: °F 1515: State 2180: MICRO SD 2181: NOR FLASH 2182: RAM DISK
2	0x02	Fixed Time Base (s)	FLOAT	RW	F	0.1	60.0	1.0	--
3	0x03	Color	ENUM16	RW	F	--	--	1718	1718: Red 1719: Green 1720: Yellow
8	0x08	Source	ENUM16	RW	F	--	--	61	61: None 142: Analog Input; 243: Set Point Open 242: Set Point Closed 160: Heat Power 161: Cool Power 22: Current 73: Power 245: Variable 240: Math 241: Process Value 238: Linearization 1697: Wattage 1699: Load Voltage 1183: Load Resistance 6: Alarm 233: Profile Event Out A 234: Profile Event Out B 235: Profile Event Out C 236: Profile Event Out D 247: Profile Event Out E 248: Profile Event Out F 249: Profile Event Out G 250: Profile Event Out H 126: Limit 1142: Digital I/O 1001: Function Key 239: Logic 230: Compare 231: Counter 244: Timer 1532: Special Function Output 1 1533: Special Function Output 2 1534: Special Function Output 3 1535: Special Function Output 4 1696: Module Limit 184: Heater Error
9	0x09	Source Instance	UINT8	RW	F	1	250	1	--
10	0x0A	Source Zone	UINT8	RW	F	0	24	0	--
11	0x0B	Source Value	FLOAT	R	--	-99999.0	99999.0	0.0	--
12	0x0C	Value 1	FLOAT	RW	F	-	99999.0	0.0	--

							99999.0		
13	0x0D	Color 1	ENUM16	RW	F	--	--	62	
14	0x0E	Value 2	FLOAT	RW	F	-99999.0	99999.0	0.0	--
15	0x0F	Color 2	ENUM16	RW	F	--	--	62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
16	0x10	Value 3	FLOAT	RW	F	-99999.0	99999.0	0.0	--
17	0x11	Color 3	ENUM16	RW	F	--	--	62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
18	0x12	Value 4	FLOAT	RW	F	-99999.0	99999.0	0.0	--
19	0x13	Color 4	ENUM16	RW	F	--	--	62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
20	0x14	Value 5	FLOAT	RW	F	-99999.0	99999.0	0.0	--
21	0x15	Color 5	ENUM16	RW	F	--	--	62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
22	0x16	Value 6	FLOAT	RW	F	-99999.0	99999.0	0.0	--
23	0x17	Color 6	ENUM16	RW	F	--	--	62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
24	0x18	Value 7	FLOAT	RW	F	-99999.0	99999.0	0.0	--

25	0x19	Color 7	ENUM16	RW	F	--	--	62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
26	0x1A	Value 8	FLOAT	RW	F	-99999.0	99999.0	0.0	--
27	0x1B	Color 8	ENUM16	RW	F	--	--	62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
28	0x1C	GUI Location X	UINT16	RW	F	0	65535	0	Object X location on GUI canvas
29	0x1D	GUI Location Y	UINT16	RW	F	0	65535	0	Object Y location on GUI canvas

Real-Time Clock

The RMA PLUS implements a real-time clock (RTC) with battery backup. The primary use of the time is for the file system. You may optionally synchronize the RTC by using the SNTP client feature.

Key Features:

- The RTC epoch begins 2000-01-01 00:00:00 UTC and ends 2135-12-31 23:59:59 UTC.
- Supports time zone offset from UTC±00:00 (±12 hours, 15-minute increments).
- If enabled and the RMA PLUS is powered-up, the RTC will automatically adjust the clock for Daylight Saving Time (DST) following the currently established rules.
- The battery voltage may be monitored periodically via communications, but should not be logged or actively accessed. This may pre-maturely drain the battery.
- Keeps track of the power-off time (seconds) in battery-backed RAM.

Real-Time Clock 36 (0x24), Instance 1									
Member ID	--	Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Time of Day (s)	UINT32	R	--	0	86399	--	--
3	0x03	Hour	UINT8	RW	B	0	23	0	--
4	0x04	Minute	UINT8	RW	B	0	59	0	--
5	0x05	Seconds	UINT8	RW	B	0	59	0	--
6	0x06	Month	UINT8	RW	B	1	12	1	--
7	0x07	Day	UINT8	RW	B	1	31	1	--
8	0x08	Year	UINT16	RW	B	2000	2135	2018	--
9	0x09	Current Time	STRING	R	--	--	--	--	Format "HH:MM:SS AM|PM"
10	0x0A	Current Date	STRING	R	--	--	--	--	Format "Day Month DD, YYYY"
13	0x0D	Power Off Time (s)	UINT32	R	--	--	--	--	--
15	0x0F	GUI Location X	UINT16	RW	F	0	65535	0	Object X location on GUI canvas
16	0x10	GUI Location Y	UINT16	RW	F	0	65535	0	Object Y location on GUI canvas
17	0x11	Time Zone Offset (hrs)	SINT8	RW	F	-12	12	0	--
18	0x12	DST	ENUM16	RW	F	--	--	62	62: Off; 63: On
19	0x13	Timestamp	UINT32	R	--	--	--	--	Number of seconds elapsed since 00:00 hours,

Real-Time Clock 36 (0x24), Instance 1								
								January 1, 2000 (TZ = UTC±00:00)
20	0x14	Time Zone Off-set (min)	UINT8	RW	F	0	59	0	Only: 0, 15, 30, 45
21	0x15	Battery Voltage (V)	FLOAT	R	--	1.65	3.6	--	--

Standard Bus and Intermodule Bus

Standard Bus 68 (0x44), Instance 1 (Standard Bus)									
Member ID	--	Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Units	ENUM16	RW	F	--	--	15	30: °F;;; 15: °C
2	0x02	Non-Volatile Save	ENUM16	RW	F	--	--	106	59: No; 106: Yes
3	0x03	Logical Address	UINT8	RW	F	1	8	7	--
4	0x04	Physical Address	UINT8	R	--	0	32	10	--
5	0x05	RS-485 Master / Slave	ENUM16	R	--	--	--	1277	1277: Master; 1278: Slave
6	0x06	Local / Remote	ENUM16	R	--	--	--	1329	1328: Local; 1329: Remote

Standard Bus 68 (0x44), Instance 2 (Intermodule Bus)									
Member ID	--	Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Units	ENUM16	RW	F	--	--	15	30: °F; 15: °C
2	0x02	Non-Volatile Save	ENUM16	RW	F	--	--	106	59: No; 106: Yes
3	0x03	Logical Address	UINT8	RW	F	1	17	17	--
4	0x04	Physical Address	UINT8	R	--	0	16	16	--
5	0x05	RS-485 Master / Slave	ENUM16	R	--	--	--	1277	1277: Master; 1278: Slave
6	0x06	Local / Remote	ENUM16	R	--	--	--	1329	1328: Local; 1329: Remote

Volume

Volume is used to obtain information about each of the three volumes. This information is only updated upon request by way of the Refresh member.

IMPORTANT: Use caution with the Format member. All data on this volume will be lost upon execution of this command!

Volume 102 (0x66), Instances 1-3									
Member ID	--	Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Name	STRING	R	--	--	--	1: "sd:" 2: "nor:" 3: "ram:"	Volume name
2	0x02	Label	STRING	RW	F	0	11	1: "MICRO SD" 2: "NOR FLASH" 3: "RAM DISK"	Volume label
3	0x03	File System	STRING	R	--	--	--	--	File system
4	0x04	Used Space	UINT32	R	--	--	--	--	Used space (bytes)
5	0x05	Free Space	UINT32	R	--	--	--	--	Free space (bytes)
6	0x06	Capacity	UINT32	R	--	--	--	--	Capacity (bytes)
7	0x07	Percent Used	FLOAT	R	--	--	--	--	Used space (%)
8	0x08	Percent Free	FLOAT	R	--	--	--	--	Free space (%)
11	0x0B	State	ENUM16	R	--	--	--	--	2211: Disconnected 1782: Start 1662: Ready 1638: Stop 2212: Stopped
12	0x0C	Error	UINT16	R	--	--	--	--	Last error

Volume 102 (0x66), Instances 1-3										
16	0x10	Refresh	ENUM16	RW	--	--	--	59	59: No 106: Yes
17	0x11	Start / Stop	ENUM16	RW	--	--	--	59	59: No 106: Yes
18	0x12	Format	ENUM16	RW	--	--	--	59	59: No 106: Yes

Appendix 1   RMA PLUS Setup Keys Reference

This is an alphabetical reference of the setup keys used in the configuration files that enable and configure product features for the RMA PLUS. For complete details about configuring the various features, refer to each individual feature. The key is not case sensitive, but must match the key string implemented in the product.

Setup Key: Data Log

Key	Value	Feature	Definition
DataLog	nor:\Gateway\DataLog.csv	Data logging	Applies only to model number RMAP-XX**D**X-XXXX. This provides the full file name / path where the data log configuration file lives. Elements in this file will be written to a log file at a pre-defined interval.

Setup Key: Discover

Key	Value	Feature	Definition
Discover	0 = disabled 1 = enabled	intermodule bus over Ethernet discovery	This key is enabled by default. It enables or disables the intermodule bus over Ethernet discovery feature. When discovery is disabled (the value is set to 0), software tools will not discover the device. This record is not in the setup.csv file by default. To use this feature, add this key and value to the setup.csv file.

Setup Key: Event Log

Key	Value	Feature	Definition
EventLog	ram:\EventLog.txt	Event Log	Full file name / path where the event log will be written. If there are issues with the product, you may be asked to provide this file or move it to one of the non-volatile volumes ("sd:" or "nor:"). The (*.txt) extension is recommended.

Setup Key: HTTPs

Key	Value	Feature	Definition
HTTPs	nor:\Gateway\Https.csv	HTTP Server	Full file name / path of the HTTP server configuration file. Elements in this file are used to display system parameters on custom web pages. To use this feature, add this record to the setup file.

Setup Key: LogKeepDays

Key	Value	Feature	Definition
LogKeepDays	integer 1 - 365 10 by default	Data logging	This key only applies if the model number is RMAP-XX**D**X-XXXX. This key defines the number of log files (days) to keep. It is interpreted as an integer with a range of 1 – 365 days. A value greater than 365 days will disable this feature. The default value is ten days.

Setup Key: LogIntervalSec

Key	Value	Feature	Definition
LogIntervalSec	integer of 1-86,400 5 by default	Data Logging	This applies to models RMAP-XX**D**X-XXXX. This key defines the data log interval in seconds, entered as an integer with a range of 1 – 86,400 seconds. Any value outside this range is clipped.

Setup Key: Modbus® RTU6

Key	Value	Feature	Definition
ModbusRtu6	nor:\Gateway\ModbusRtu6.csv	Modbus® RTU	This is only available if the model number is RMAP-2XXX-XXXX. Full file name / path where the Modbus® RTU 6 field bus gateway file lives. This file associates Modbus® RTU registers with data points from any of the 3 remaining busses when Modbus® RTU 6 is configured as a slave.

Setup Key: Modbus® RTU7

Key	Value	Feature	Definition
ModbusRtu7	nor:\Gateway\ModbusRtu7.csv	Modbus® RTU	This is only available if the model number is RMAP-2XXX-XXXX. Full file name / path where the Modbus® RTU 7 field bus gateway file lives. This file associates Modbus® RTU registers with data points from any of the three remaining busses when Modbus® RTU 7 is configured as a slave.

Setup Key: Modbus® TCP

Key	Value	Feature	Definition
ModbusTCP	nor:\Gateway\ModbusTcp.csv	Modbus® TCP Server	Full file name / path where the Modbus® TCP field bus gateway file lives. This file associates Modbus® TCP registers with data points from any of the four local busses.

Setup Key: RTU Fc6

Key	Values	Feature	Definition
RtuFc6	0 (FALSE) = Master uses Function Code 16 exclusively 1 (TRUE) = Master uses Function Code 6 for single register writes	Modbus® RTU Function Code 6	This is only available for model number RMAP-**2X**XX-XXXX. This is used to enable Modbus® RTU Function Code 6 (Write Single Register) on master channels for devices that do not implement Modbus® Function Code 16 (Write Multiple Registers). It is only necessary if the RMA PLUS does not negotiate this requirement on its own. This record is not a member of the default file, and therefore, the feature is disabled. To enable the feature, you must add this record to the setup file.

Setup Key: SnifferPort

Key	Value	Feature	Definition
SnifferPort	SnifferPort 2	Port Mirroring	This key defines the port that will mirror all packets received and transmitted on port 3 (internal switch connection to RMA PLUS). Acceptable values are 1 and 2 as labeled on the front of the RMA PLUS. Zero is the default value which disables this feature. This record is not a member of the default file, and therefore, the feature is disabled. If you wish to use this feature, you must add this record to the setup file.

SNTP Address

Key	Value	Feature	Definition
SntpAddress	216.239.35.4	SNTP Client	Ethernet IPV4 address of a SNTP server as a string. This record is not a member of the default file, and therefore, the feature is disabled. If you wish to use this feature, you must add this record to the setup file.

Setup Key: SysCfg

Key	Value	Feature	Definition
SysCfg	nor:\Gateway\SysCfg.csv	System Configuration	Full file name / path where the system configuration file lives. Elements in this file will be written to the system upon initialization.

Setup Key: UART7

Key	Values	Feature	Definition
UART7	0 1	Modbus® RTU	This key only applies if the model number is RMAP-2AXX-XXXX. This key defines the physical port used by UART7 with the Modbus® RTU protocol. It is false (0) by default. Set the port connected to UART7 as follows: 0 (FALSE) F-terminals (RS-485) or DB9F (RS-232) pins 7,8,9 1 (TRUE) RJ45 Top (RS-485)

Appendix 2   Declaration of Conformity

Declaration of Conformity

EZ Zone Series RM

WATLOW Electric Manufacturing Company
1241 Bundy Blvd.
Winona, MN 55987 USA

Declares that the following Series RM (Rail Mount) products:

Model Numbers:	**Access Models** – RMA (A, F or S) – A (A, 2, 3, 5 or 6) (A or B) (A, B, U, Y or D) – AA (**XX**)
	Enhanced Access Modules – RMAP – (A, 2, 5 or 8)(A, 1 or 2) **X** A – A A **XX**
	Control Models – RMC (#) – (A, B, U, D, E, F, G, H, J, K, L, M, N, P, R, S, T, Y or Z) (A, R, P or #) (A, B, U, D, E, F, G, H, J, K, L, M, N, P, R, S, T, Y or Z) (A, R, P or #) (A, B, U, D, E, F, G, H, J, K, L, M, N, P, R, S, T, Y or Z) (A, R, P or #) (A, B, U, D, E, F, G, H, J, K, L, M, N, P, R, S, T, Y, Z or C) – (A or F) (A or 1)(**XX**)
	Expansion Models – RME (A, F, R or S) – (A, C, J, F, L, K or T) (A, C, F, L, J or T) (A, J, C, F, L, K or T) (A, C, F, L or T) – A (A or 1)(**XX**)
	Fiber Optic Models – RMFA – (A or 1 to 8) (A or T) AA – A A (**XX**)
	High Density Models – RMH (A, F or S) – (1, 2 or T) (A, 1, 2 or T) (A, 1, 2, J, F, L, C or T) (A, 1, 2, J, F, L, C or T) – A (A or 1) (**XX**)
	Limit¹ Models – RML (A, F or S) – (5 or 6) (A, 5 or 6) (A, 5, 6, J or C) (J or B) – A (A or 1) (**XX**)
	Scanner Models – RMS (A, F or S) – (R, P or T) (A, R, P or T) (A, R, P, J, C, D, F, L or T) (A, R, P, J, C, B, F, L or T) – A (A or 1) (**XX**)
	EtherCat Models – RMZ4 – (AA or 00 to 48) (AA or 00 to 04) – (A or B²) A (**XX**)
	Line Heating Models RMG (L) – (AA or 00 to 18)(AA or 00 to 18)(AA or 00 to 18) – (AA or 00 to 08) A (**XX**)
	Ultra-High Density Input Models – RMUH – (AA or 00 to 36)(AA or 00 to 36) – (AA or 00 to 36) (**XX**)
	# = Any number 0 to 9, **XX** = Any two letters or number combinations.
Classification:	Temperature control, Installation Category II, Pollution degree 2
Voltage and Frequency:	SELV 24 to 28 V ⎓ ac 50/60 Hz or dc
Power Consumption:	RMA, RMG and RMUH models 4 Watts, any other RM model 7 Watts
Environmental Rating:	IP20

¹Have not been evaluated for safety limit applications. Is considered an independent monitor device.

Meet the essential requirements of the following European Union Directives by using the relevant standards show below to indicate compliance.

2014/30/EU Electromagnetic Compatibility Directive

EN 61326-1:2013	**Electrical equipment for measurement, control and laboratory use – EMC requirements, Industrial Immunity, Class A Emissions.** *CAUTION: This equipment not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.*
IEC 61000-4-2:2008	Electrostatic discharge immunity
IEC 61000-4-3:2007 +A1/2008, A2/2010	Radiated, radio-frequency electromagnetic field immunity, 10 V/m 80 MHz to 1 GHz 3 V/m 1.4 GHz to 2.7 GHz
IEC 61000-4-4:2012	Electrical fast-transient / burst immunity
IEC 61000-4-5:2014 +A1/2017	Surge immunity
IEC 61000-4-6:2013 + Corrigendum 2015	Immunity to conducted disturbances induced by radio-frequency fields
IEC 61000-4-11:2004 +A1/2017	Voltage dips, short interruptions and voltage variations immunity
EN 61000-3-2:2014	Limits for harmonic current emissions for equipment ≤ 16 Amps per phase

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Declaration of Conformity

EN 61000-3-3³:2013   Voltage fluctuations and flicker ≤ 16 Amps per phase
SEMI F47-0812   Specification for semiconductor sag immunity Figure R1-1
³NOTE: To comply with flicker requirements cycle time may need to be up to 160 seconds if load current is at 15A, or the maximum source impedance needs to be < 0.13Ω. Control power input of RM models complies with 61000-3-3 requirements.

2014/35/EU Low-Voltage Directive

EN 61010-1:2010   Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements

Compliant with 2011/65/EU RoHS Directive

Per 2012/19/EU W.E.E.E Directive ☒ Please Recycle Properly

Models RMAx-xxBx-xxxx contain a type BR1225 coin cell battery, Models RMAP and RMUH and RMGx-(any 4 numbers) may use coin cell type BR2032 battery which shall be recycled at end of life per 2006/66/EC Battery Directive as amended by 2013/56/EU Directive.

²*2014/53/EU Radio Equipment Directive*

Only applies to Bluetooth Module equipped version Model RMZ4-XXXX-BXXX (X = any letter or number)

EN 300 328 V 2.1.1   Wideband transmission systems; data transmission equipment operating in the 2.4 GHz ISM band and using wideband modulation techniques. Covering essential requirements under article 3.2 of the R&TTE directive.
EN 301 489-1 V 2.1.1   EMC standard for radio equipment and services; Part 1: Common technical requirements
EN 301 489-17 V3.1.1   Part 17: Specific condition for 2.4 GHz wideband transmission systems.
EN 60950-1:2006 +A11/2009, A1/2010, A12:2011, A2:2013   Information Technology Equipment - Safety
EN 62479:2010   Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)

Contains FCC ID: X3ZBTMOD5 2.400 to 2.4835 GHz, -5 dBm
           IC: 8828A-MOD4
           QDID: B019224

Doug Kuchta
Name of Authorized Representative

Winona, Minnesota, USA
Place of Issue

Director of Operations
Title of Authorized Representative

March 2019
Date of Issue

Signature of Authorized Representative

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Appendix 3   List of RMA PLUS Figures