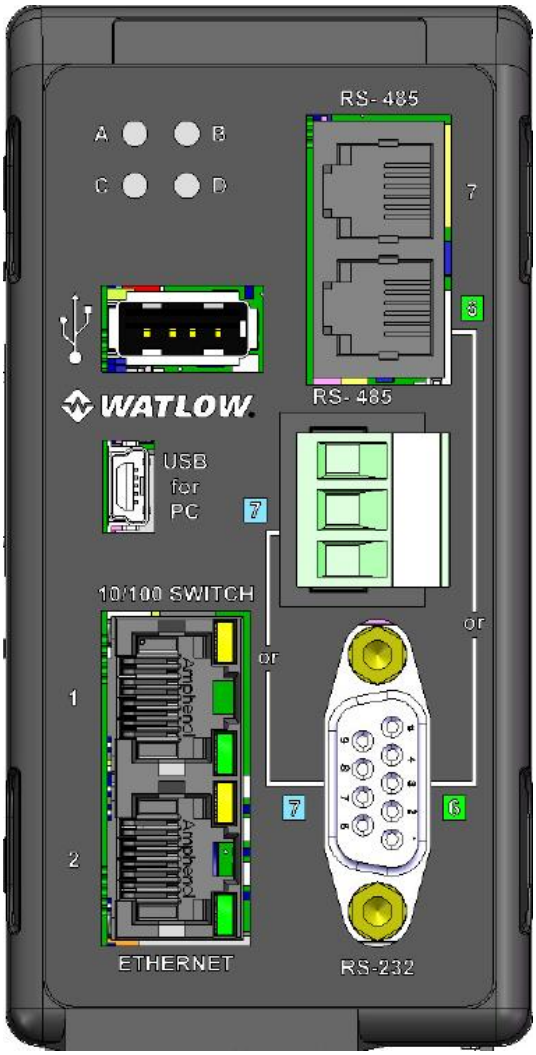
RMA PLUS

User Manual



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Overview

The RMA PLUS is a high-speed communication gateway used to access data from up to four busses via Ethernet, USB or serial. One of the primary features is the ability to proxy (route) Watbus transactions over Ethernet and USB to all devices connected to the high-speed Watbus network. This feature is useful for system configuration and monitoring.

The other core feature is to allow field bus connections to custom data sets managed asynchronous to field bus activity. This same model is used for data logging, system configuration and the HTTP server.

Mounting and Dimensions

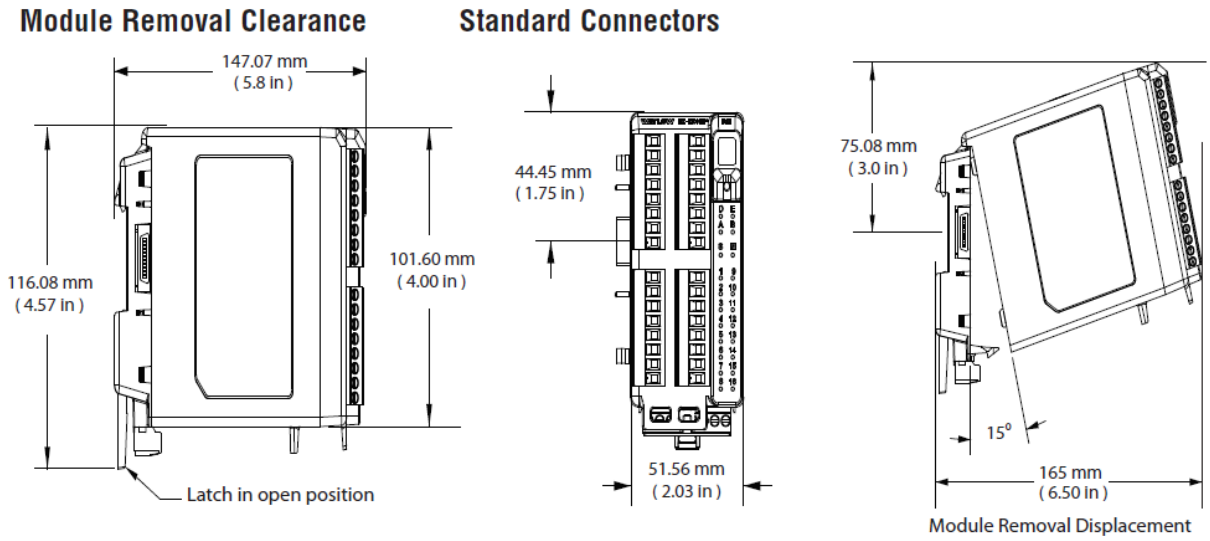
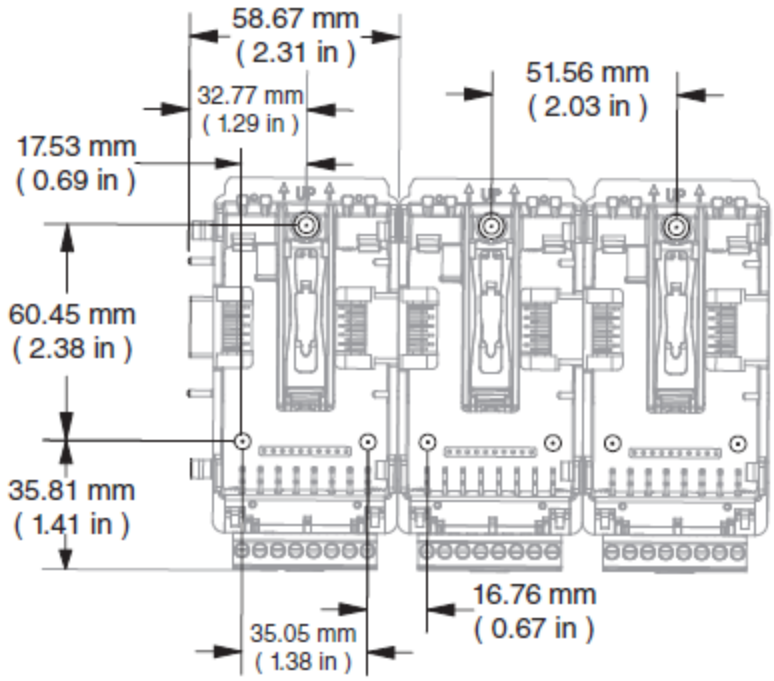


Figure 1 - Dimensions

Chassis Mount Front View (Module Removed) - Screw Connection Pattern



The view above is representative of the modular backplane without the module.

Recommended chassis mount hardware:

1. #8 screw, 3/4" long
2. Torque to 10 -15 in-lb
3. No washers of any kind

Caution: Product must not be dropped from a height of 20” or higher when mounted in the X-axis.

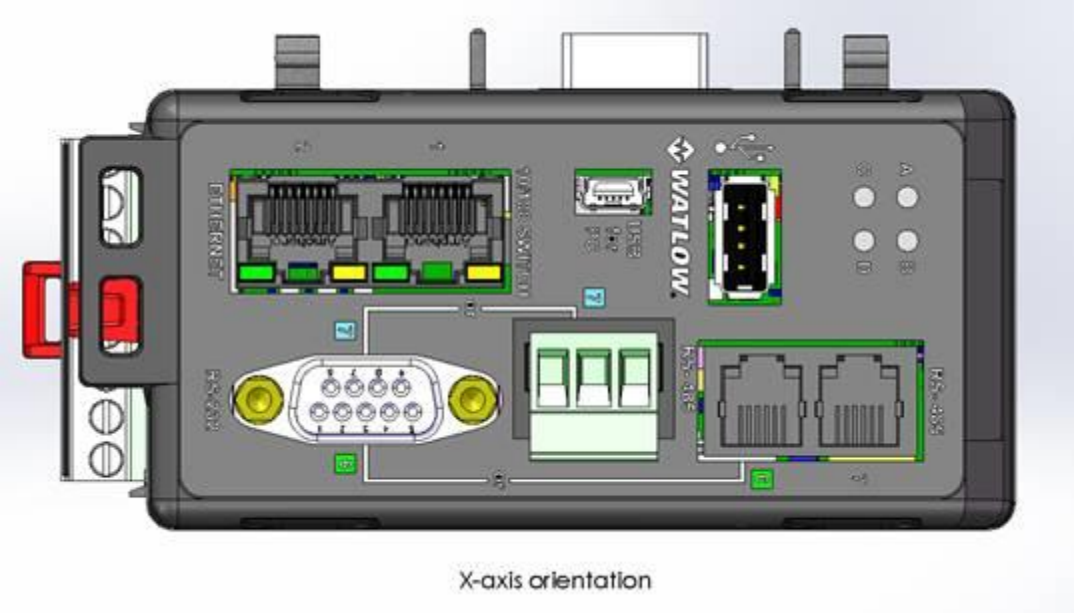
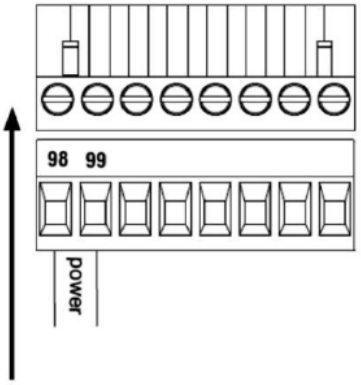


Figure 2 - Horizontal Mounting

Connections and Wiring

Slot C Power Connection

Low Power RM - All Model Numbers



- 20.4 to 30.8 VAC ~ (ac) / ⎓ (dc) 14VA
- 47 to 63Hz
- Controller module power consumption, 7 Watts maximum
- 31 Watts maximum power available for P/S part #:0847-0299-0000
- 60 Watts maximum power available for P/S part #:0847-0300-0000
- 91 Watts maximum power available for P/S part #:0847-0301-0000
- Class 2 or Safety Extra Low Voltage (SELV) power source required to meet UL® compliance standards

Power and Communications		
Slot C	**Terminal Function**	**Configuration**
98 99	Power Input: AC or DC+ Power Input: AC or DC-	Only needed on one module, shared on backplane
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	Inter-module Bus Inter-module Bus Inter-module Bus	Wire for Split-Rail Configurations

Earth Ground

The USBH and USBD connector bodies are grounded to earth using the wire trap found on the bottom of the case. To ground the connectors, insert a ground wire into the trap as viewed from the case bottom. This earth ground is not connected to the power.

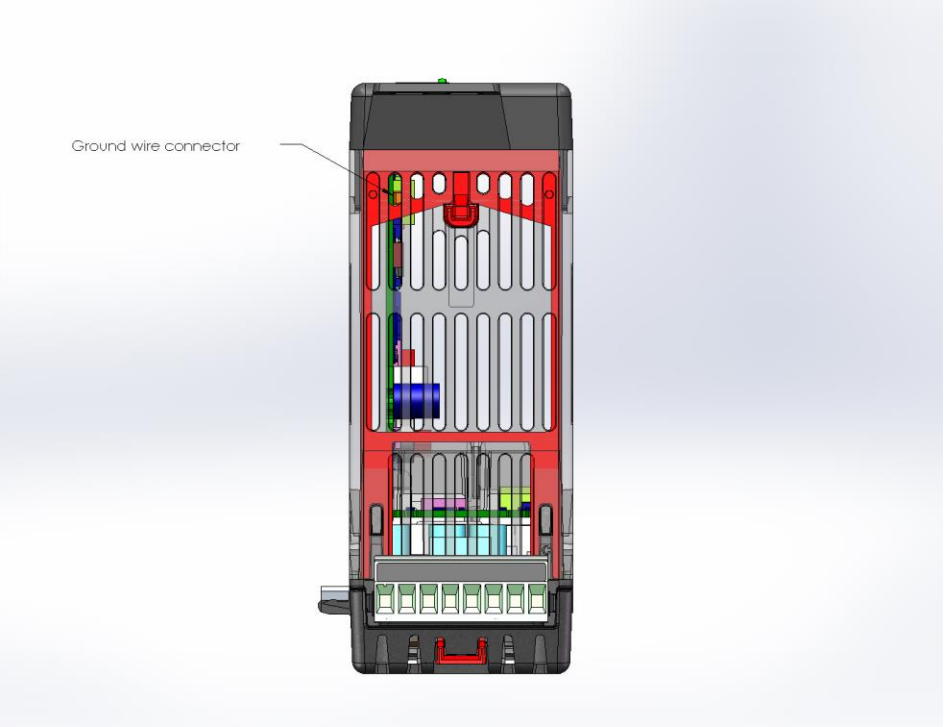


Figure 3 - Ground Wire Location

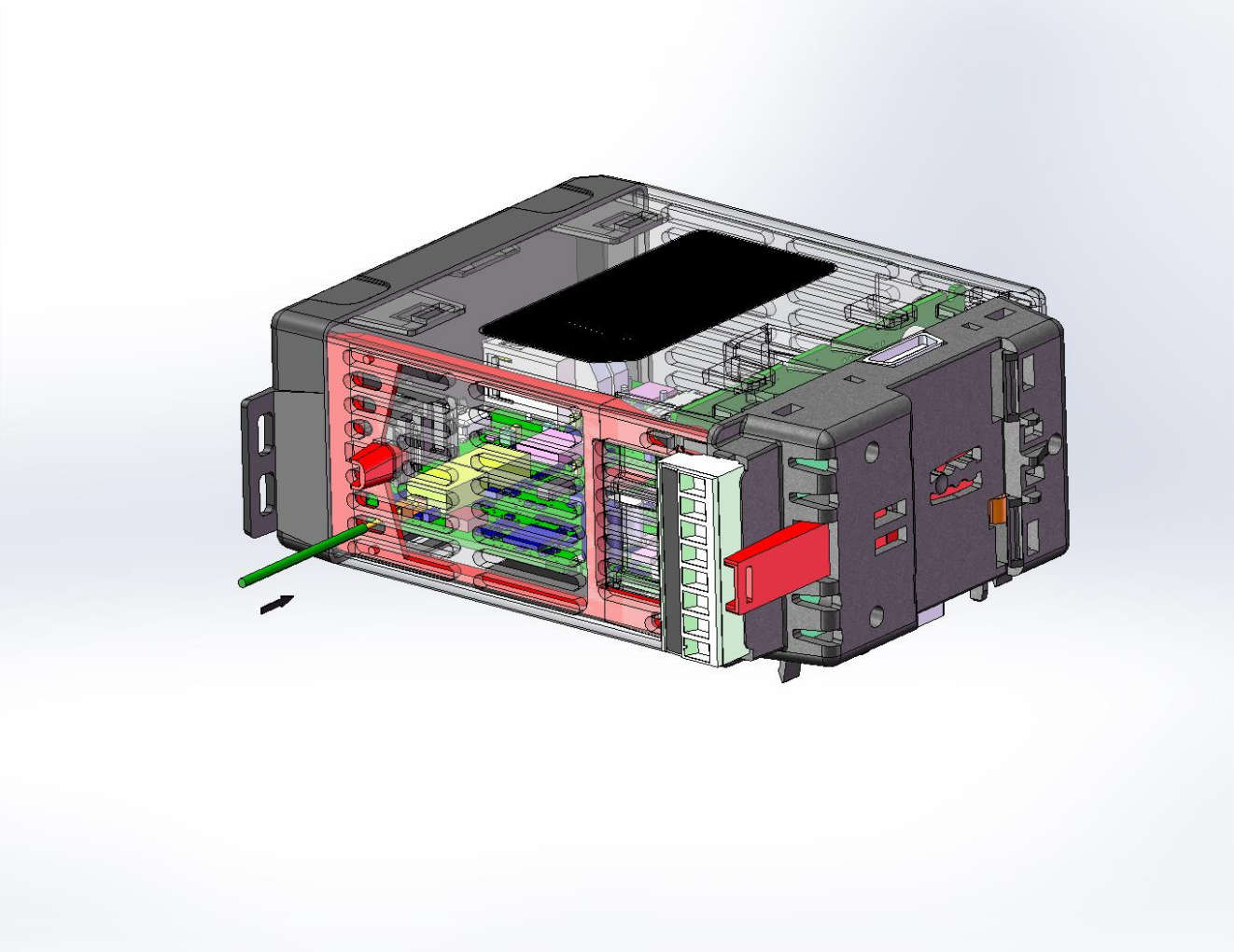
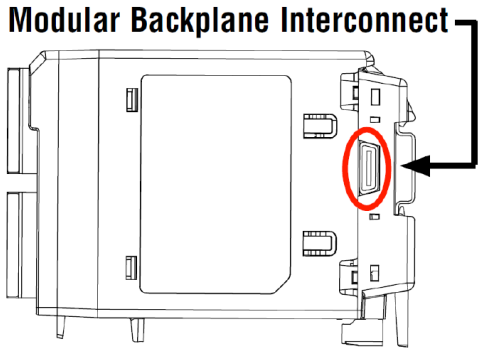


Figure 4 - Ground Wire Insertion

Use 18 – 26 AWG Solid or Stranded, Trim Length 3.5 ± 0.5mm (0.138 ± .02”). Twist wire to remove.

RM System Connections

The RM system accessed by an RMA PLUS module can be installed as stand-alone modules or can be interconnected on the DIN rail as shown below. When modules are connected as shown, power and communications are shared between modules over the modular backplane interconnection. Therefore, bringing the necessary power and communications wiring to any one connector in slot C is sufficient. The modular backplane interconnect comes standard with every module ordered and is generic in nature, meaning any of the RM modules can use it.



The modules can also be mounted in different locations and the backplane connected via wires in a *Split Rail* configuration as shown in the figure. Notice in the split rail system diagram that a single power supply is used across both DIN rails. One notable consideration when designing the hardware layout would be the available power supplied and the loading effect of all the modules used.

Watlow provides three options for power supplies listed below:

- 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)

With regards to the modular loading affect, maximum power for each is listed below:

- RMCxxxxxxxxxxx @ 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

RMAP-AXXX-XXXX: Stand-alone RMA PLUS in slot A/D

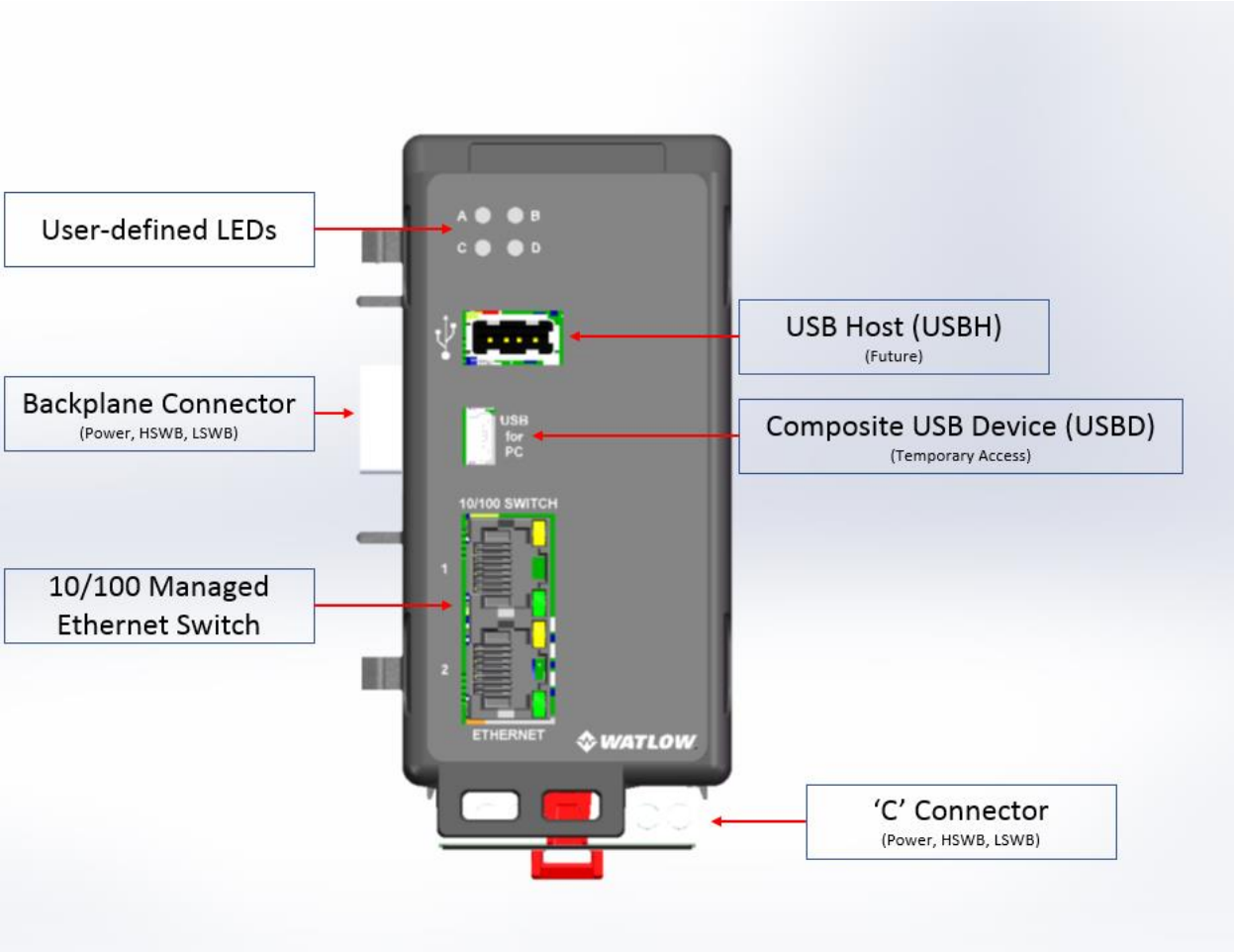


Figure 5 - RMAP-AXXX-XXXX

RMAP-2XXX-XXXX: RS-232 / RS-485 module in slot B/E

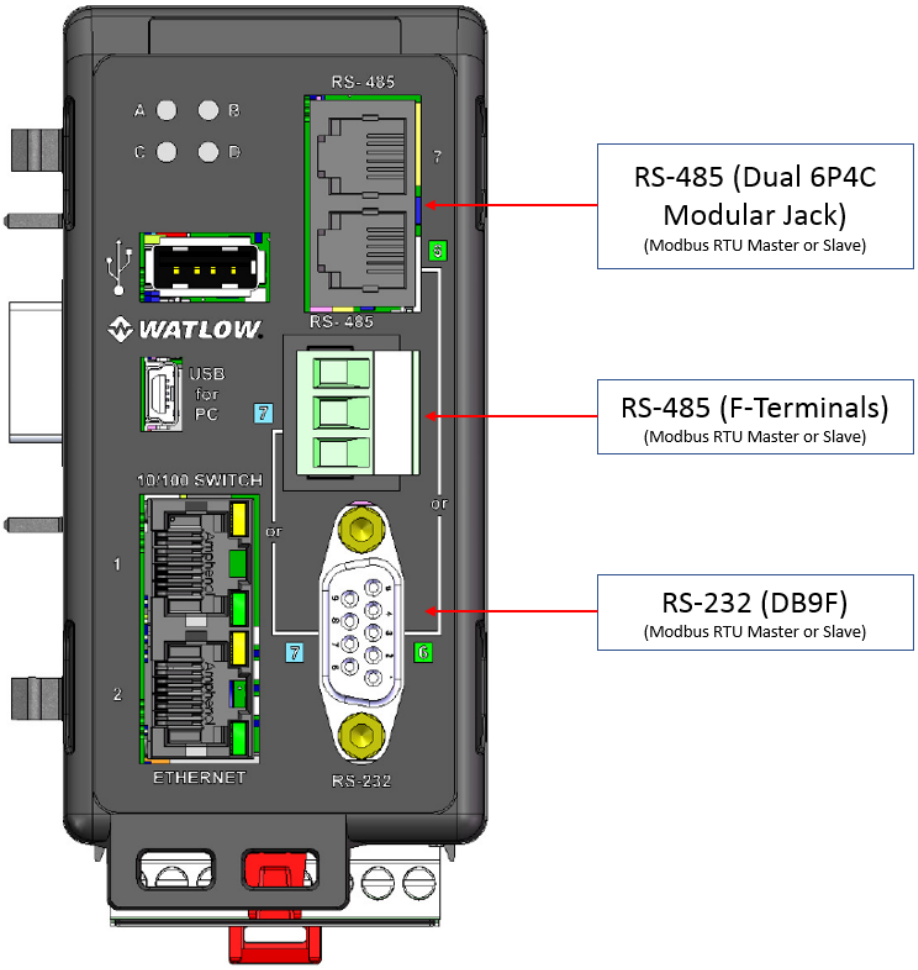


Figure 6 - RMAP-2XXX-XXXX

RS-485 via 6P4C Modular Jack

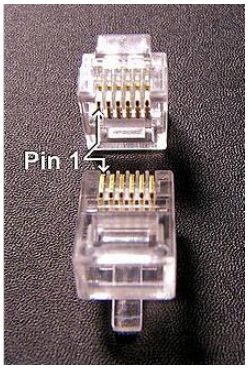


Figure 7 - 6P4C Modular Plug

Pin	Function
~~1~~	~~NC~~
2	COM
3	Not Used
4	A
5	B
~~6~~	~~NC~~

RS-485 via F-Terminals

Figure 8 - 3-Pin Plug

RS-232 via DB9F

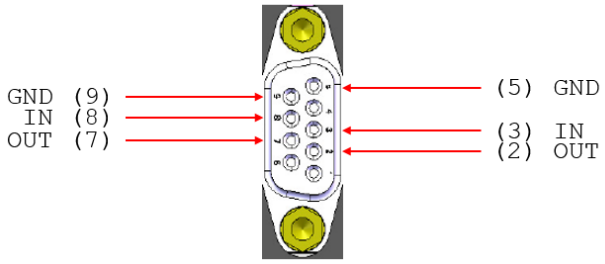
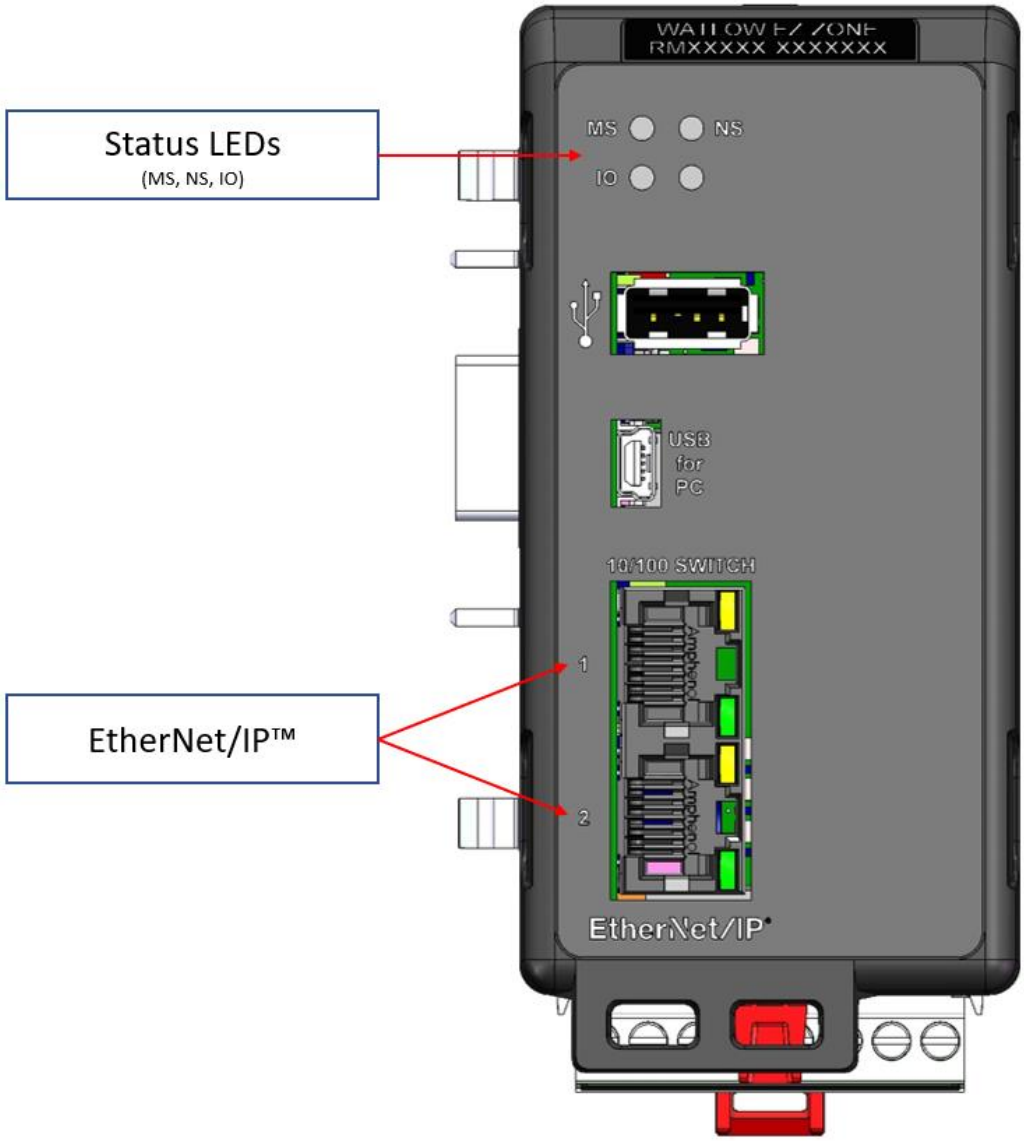
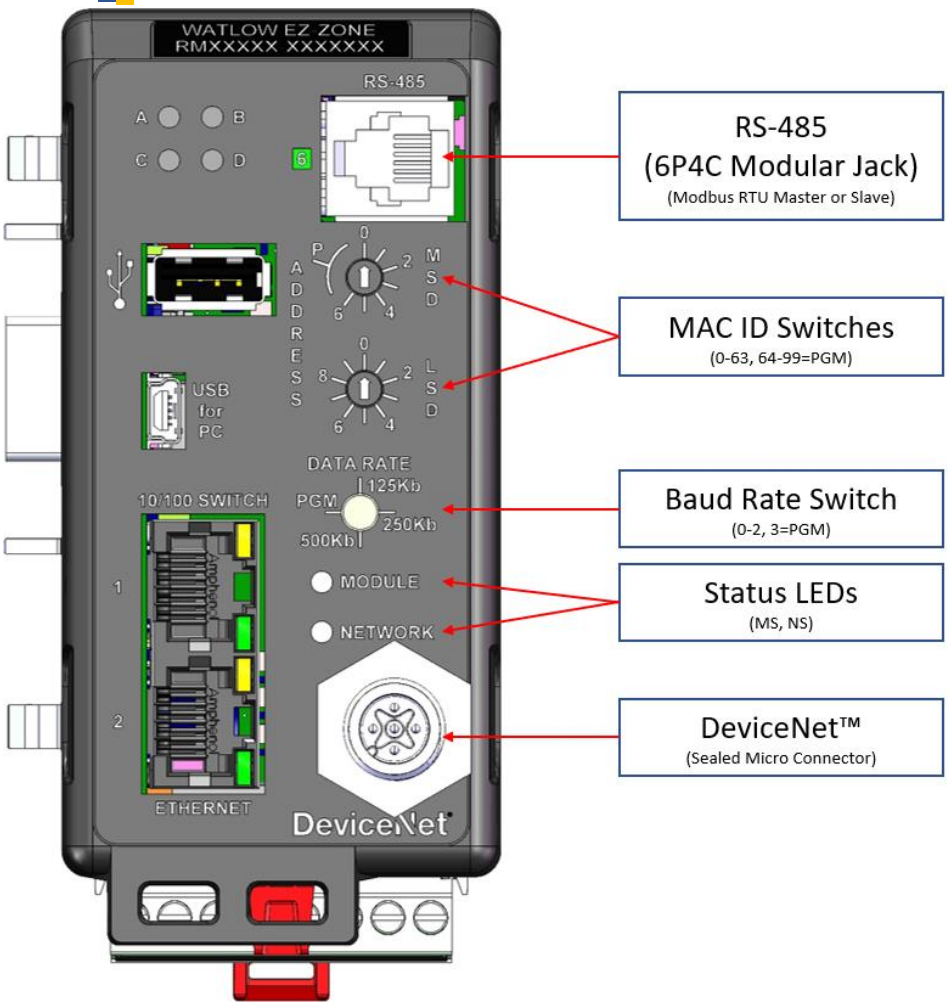


Figure 9 - DB9F

RMAP-X3XX-XXXX: EtherNet/IP™ enabled RMA PLUS in slot A/D



RMAP-5XXX-XXXX: DeviceNet™ module in slot B/E



RS-485 via 6P4C Modular Jack

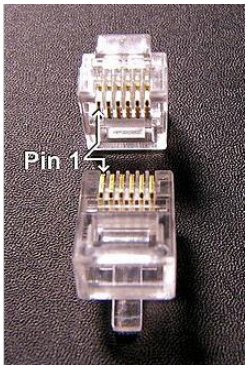


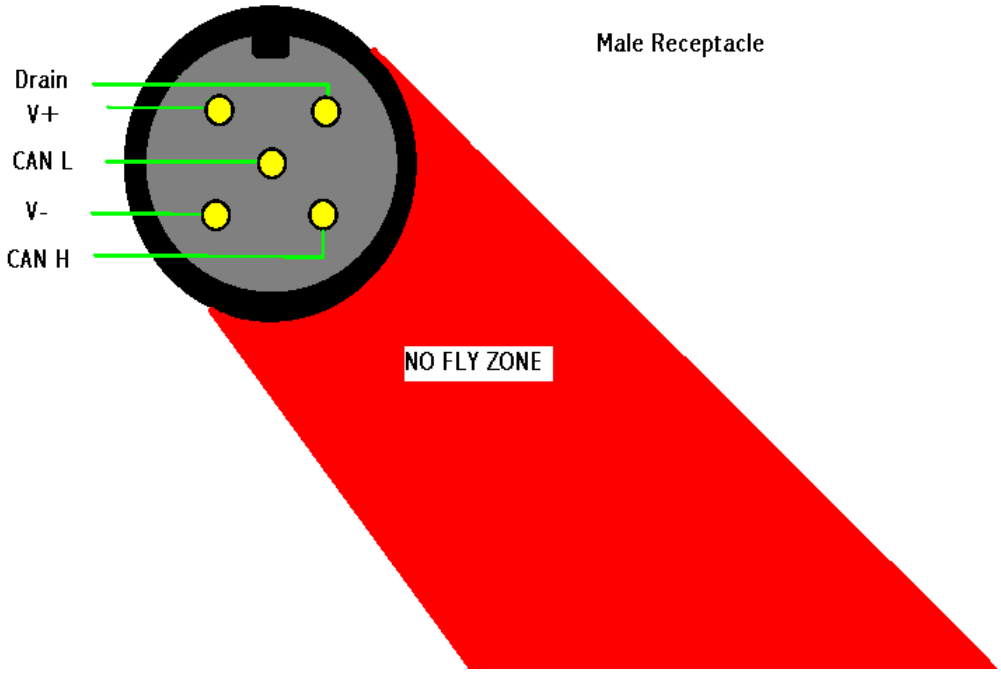
Figure 10 - 6P4C Modular Plug

Pin	Function
~~1~~	~~NC~~
2	COM
3	Not Used
4	A

5	B
6	NC

Sealed Micro Connector

Connect to DeviceNet™ by way of the male, sealed, micro-style connector.



Pin	Function	Color
1	Drain	Bare
2	V+	Red
3	V-	Black
4	CAN_H	White
5	CAN_L	Blue

RMAP-8XXX-XXXX: Fiber optic input module in slot B/E

NOTE: This is a future option.

RMAP-UXXX-XXXX: Ultra high-density analog input module (RMUH) in slot B/E

NOTE: This is a future option.

Theory of Operation

Configuration is accomplished by way of comma separated variable (.csv) files located on the native file system. Based on the model number, configuration and feature availability, various configuration files will be loaded into RAM. Configuration files are only read on initialization. Therefore, when changes are made, the device must be reset for changes to take effect.

When the RMA PLUS comes out of reset, it reads the file “nor:\Setup.csv.” Depending on the model number, the records in this file give the firmware more details about how to proceed with initialization.

Getting Started

Install USB Drivers (Windows® 7, 10)

See the file *RMA PLUS USB Device Driver Installation* for details.

Configure Ethernet

1. Connect a Mini-B USB cable to the RMA PLUS and launch Dashboard. The discovered RMA PLUS should be under the "USB Devices" tree node.

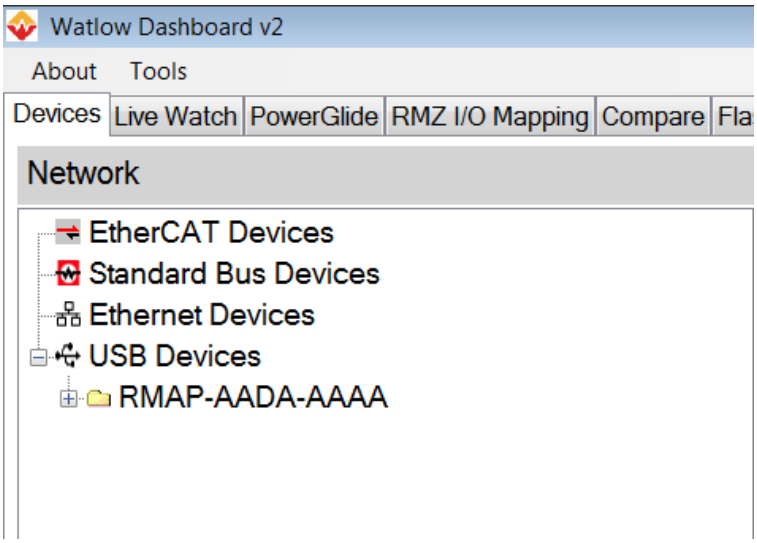


Figure 11 - Dashboard: USB Devices subtree

2. Expand the RMA PLUS to see basic device information.

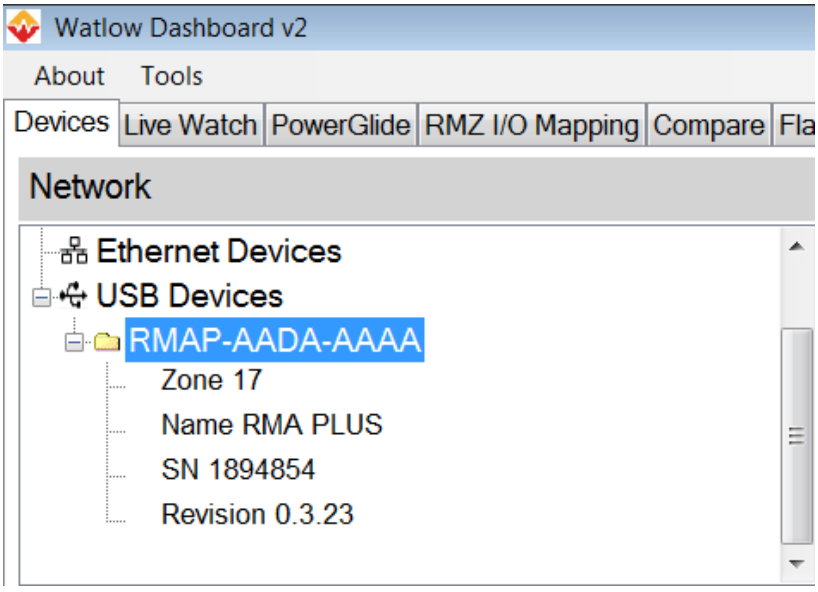


Figure 12 - Dashboard: USB Devices subtree, expanded tree node

3. Drag and drop the RMA PLUS tree node onto the Device Data pane to upload all parameters.

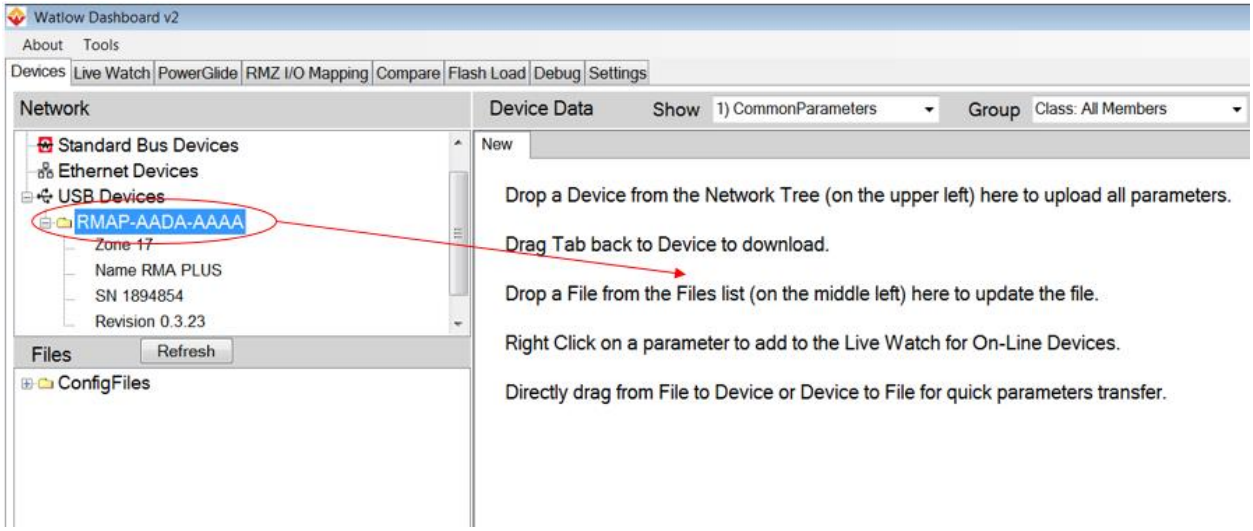


Figure 13 - Dashboard: Discover device

Dashboard discovers all parameters and displays the progress.

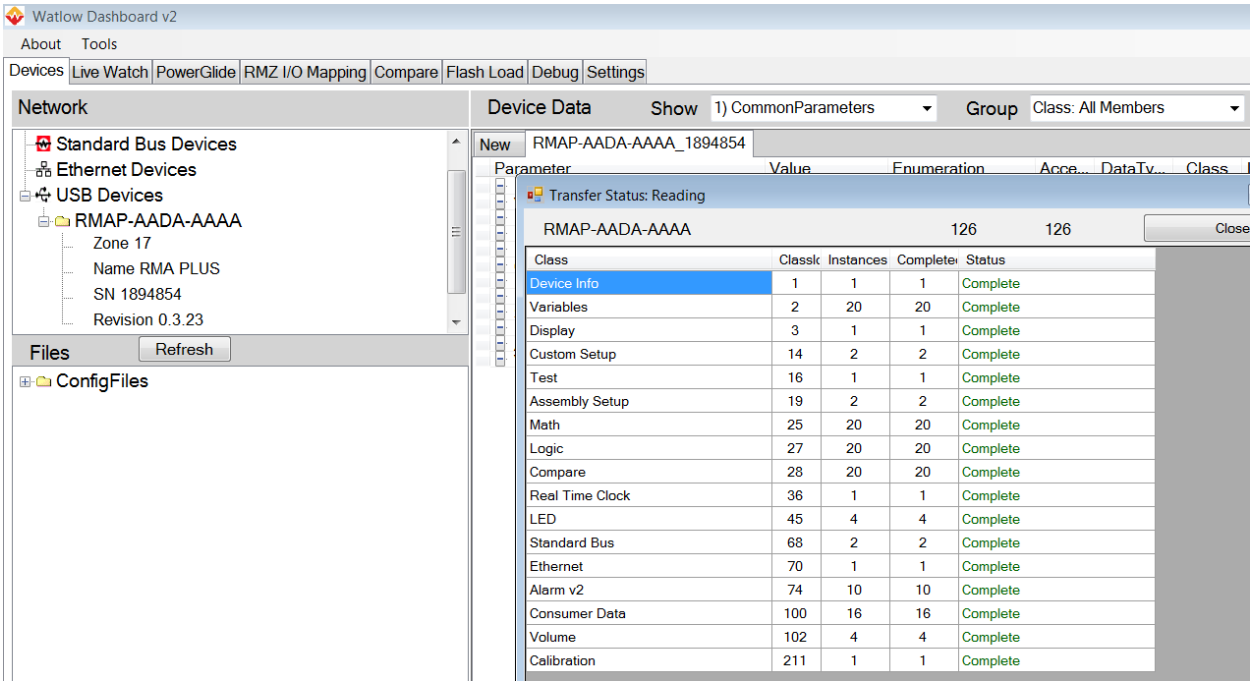


Figure 14 - Dashboard: Discovery complete

4. Press the “Close Now” button on the “Transfer Status” window.
5. On the newly discovered device tab, expand the Ethernet and Ethernet 2 tree nodes.

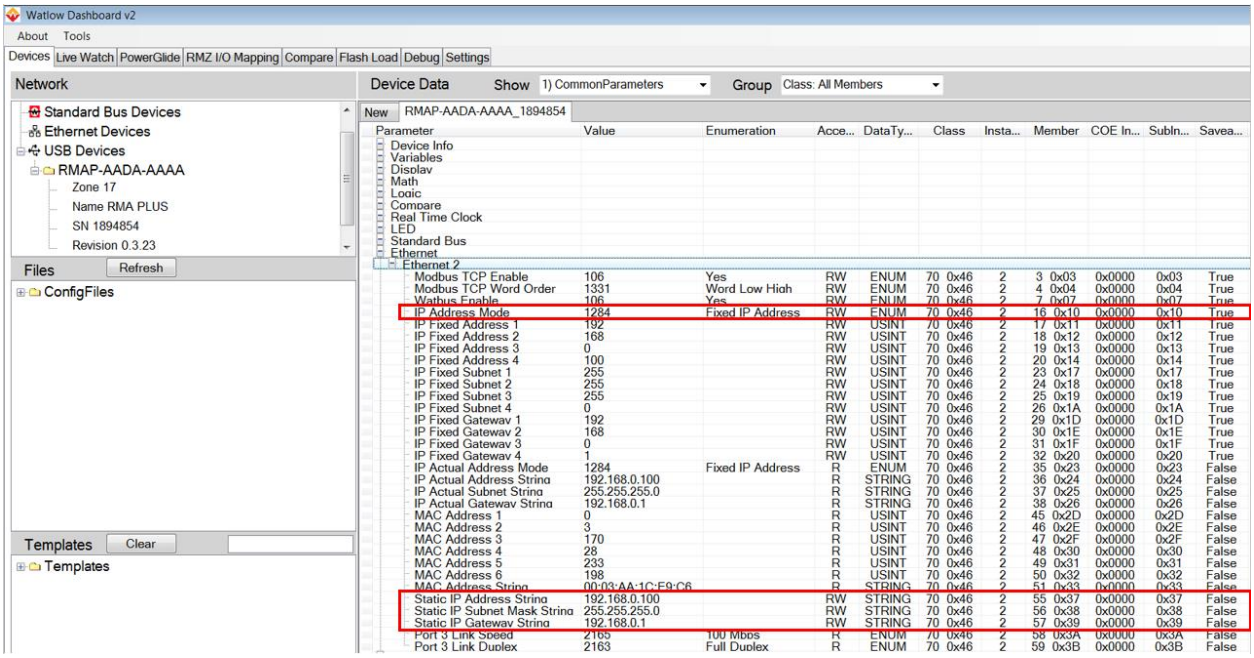


Figure 15 - Dashboard: Device tab, Ethernet subtree

6. Change the following members as necessary:

   NOTE: Watlow recommends using static IP addressing and a private network for your system.

Ethernet 70 (0x46), Instance 2									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
16	0x10	IP Address Mode	ENUM16	RW	F			1284	1281: DHCP 1284: Fixed
55	0x37	Static IP Address String	STRING	RW	F			"192.168.0.100"	
56	0x38	Static 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"	

Figure 16 - Ethernet configuration members

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.

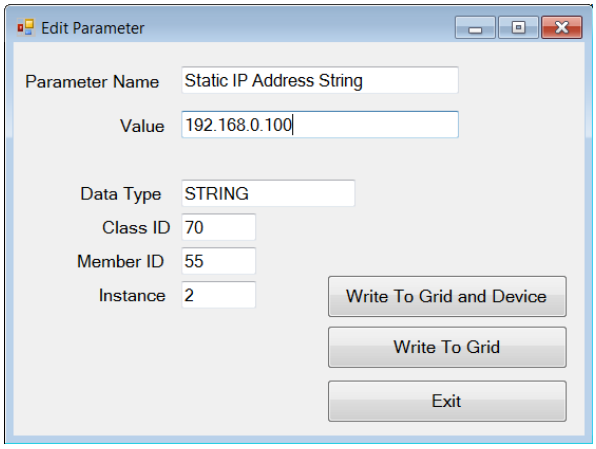


Figure 17 - Dashboard: Change static IP address

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.

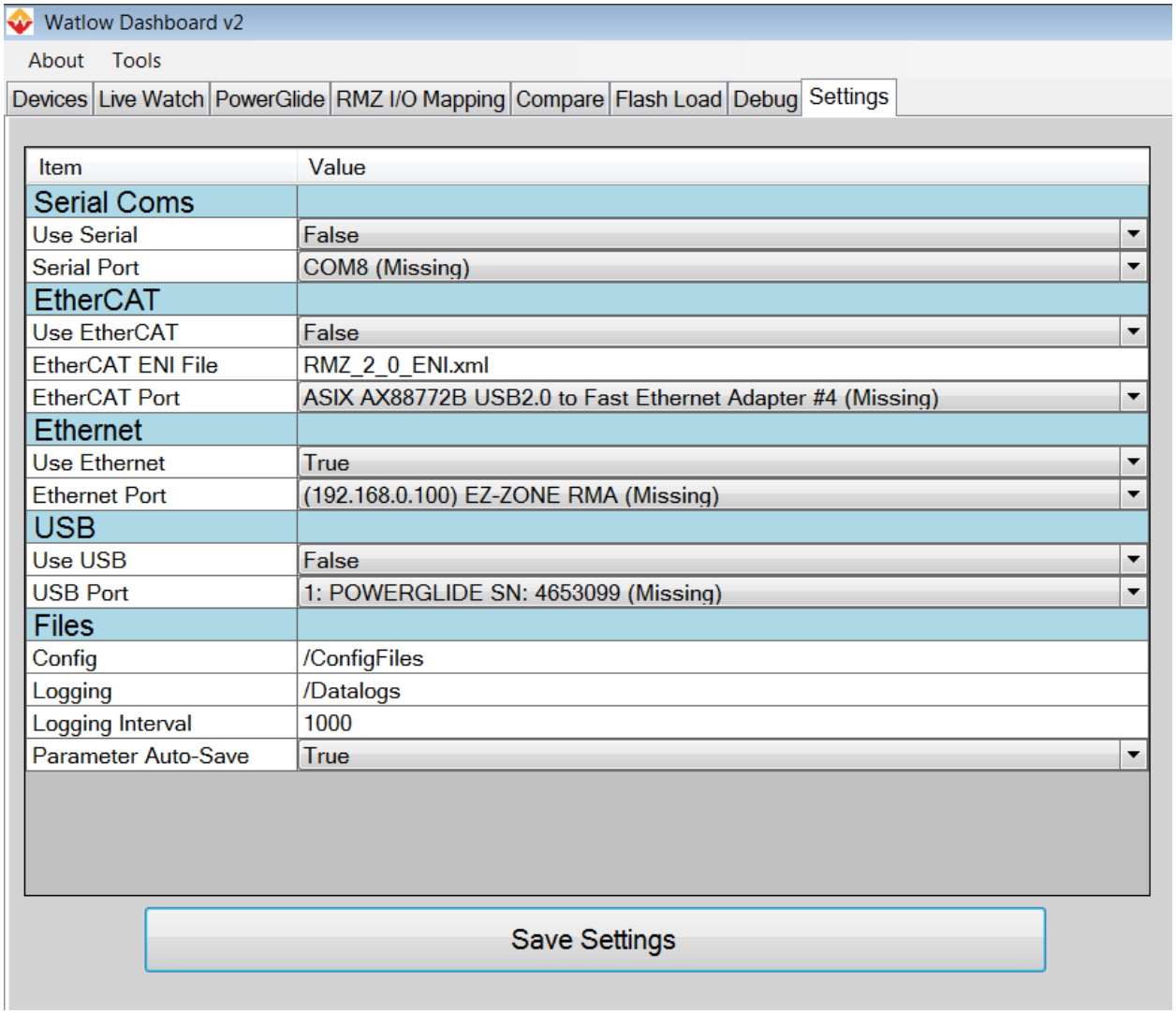


Figure 18 - Dashboard: Settings for Ethernet

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.
14. The RMA PLUS and any devices connected to the high-speed Watbus network are now discovered under the "Ethernet Devices" tree node. Expand the RMA PLUS to see device information including the Ethernet address.

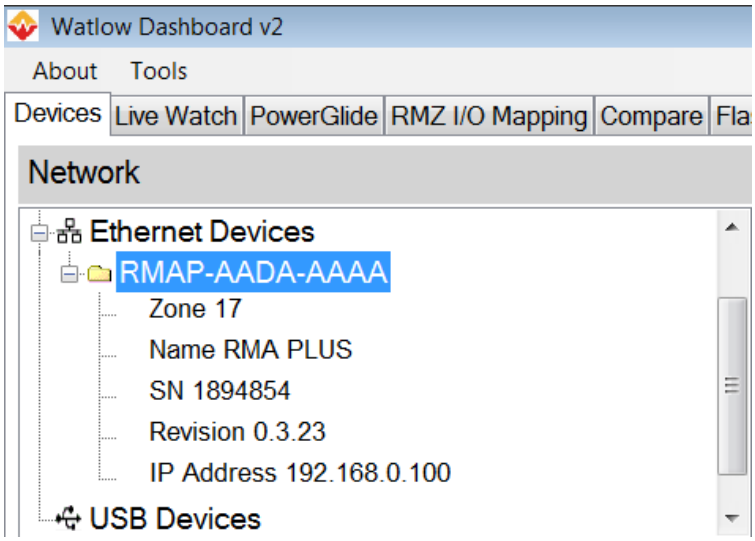


Figure 19 - Dashboard: Ethernet Devices subtree, expanded tree node

Working with Drives

The RMA PLUS provides three drives for user access, each with a dedicated purpose. Drives are accessed via USB. The default drive state is ejected (stopped). This is to prevent unintentional suspension of firmware services.

The procedure for accessing drives is as follows:

1. Connect the Mini-B USB cable to the RMA PLUS. Note that LEDs A, B, C change from green to yellow indicating that USB is connected, and one or more drives may be mounted by the PC.
2. Open My Computer (Windows key + 'E') and look under the "Devices with Removable Storage" group. Three removable drives are available (shown below as drives E, H and I). Note that the drive letter and order may vary by computer.

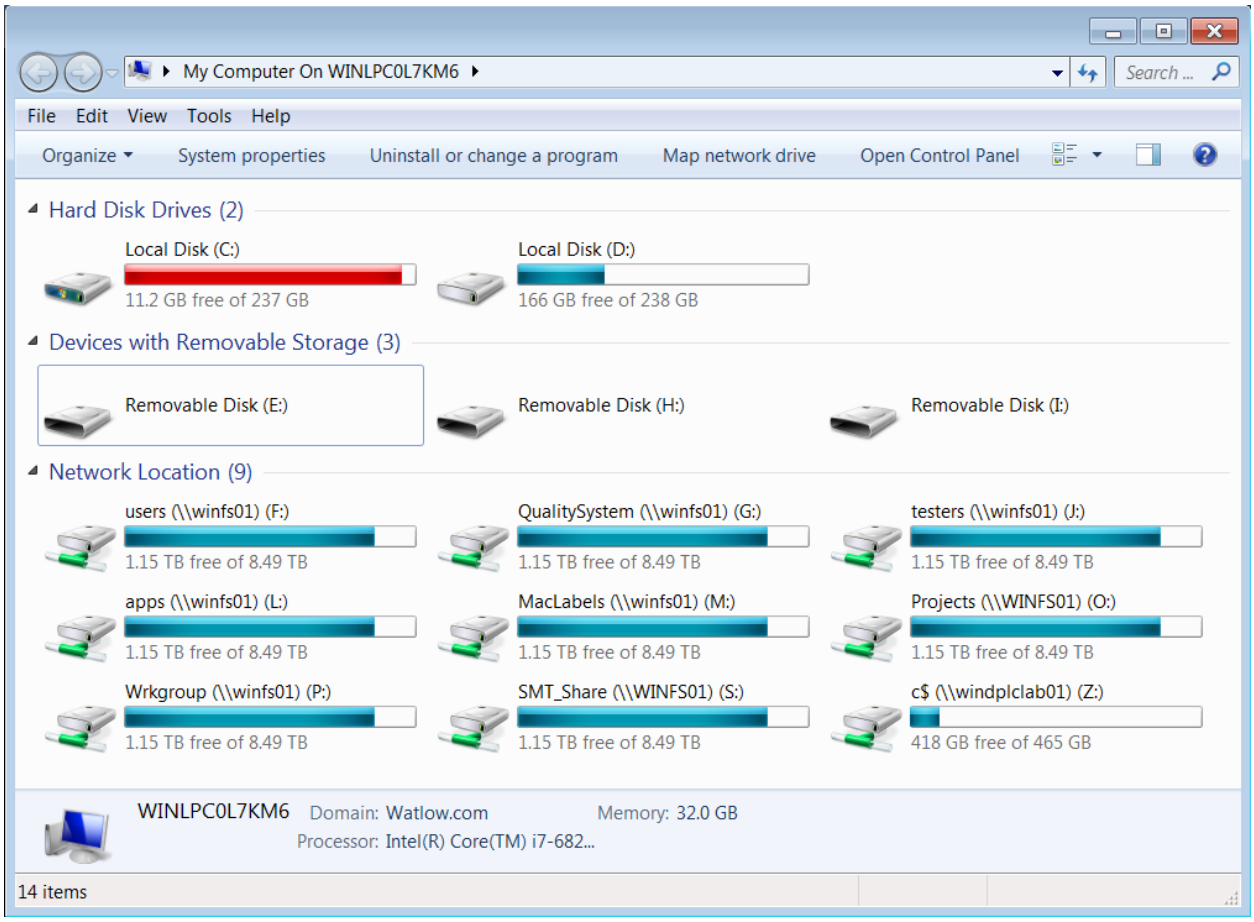


Figure 20 - RMA PLUS via USBD: Drives stopped

3. Press “Eject” to mount (start) the drive. Note that LEDs A, B, C change from yellow to red as you mount each drive.

   IMPORTANT: When the PC mounts a drive, it has exclusive access. All firmware features waiting on this resource will be suspended. In the case of the NOR FLASH drive, non-volatile object storage (parameters) is also inhibited since it is a partition on the same device.

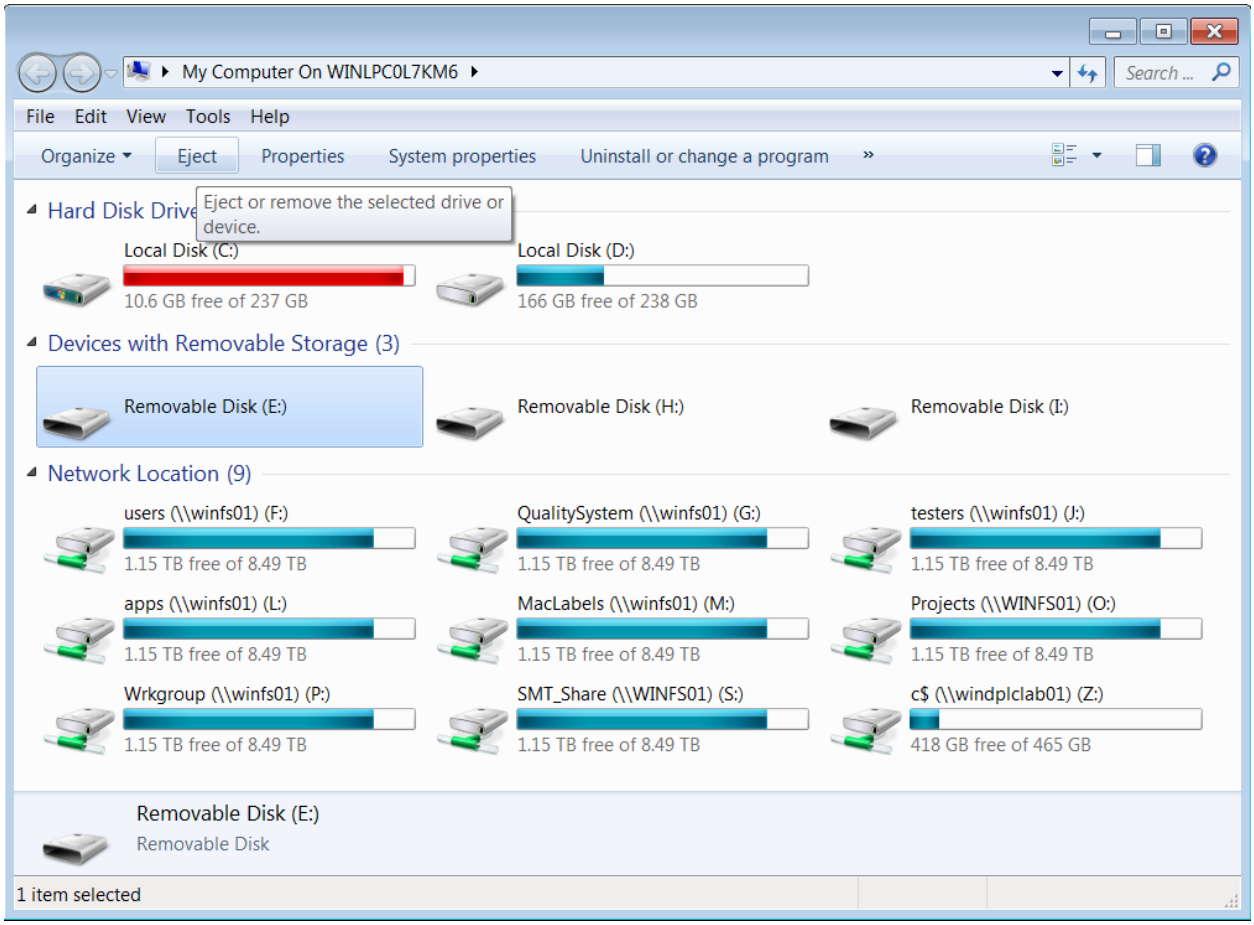


Figure 21 - RMA PLUS via USBD: Eject (start) selected drive

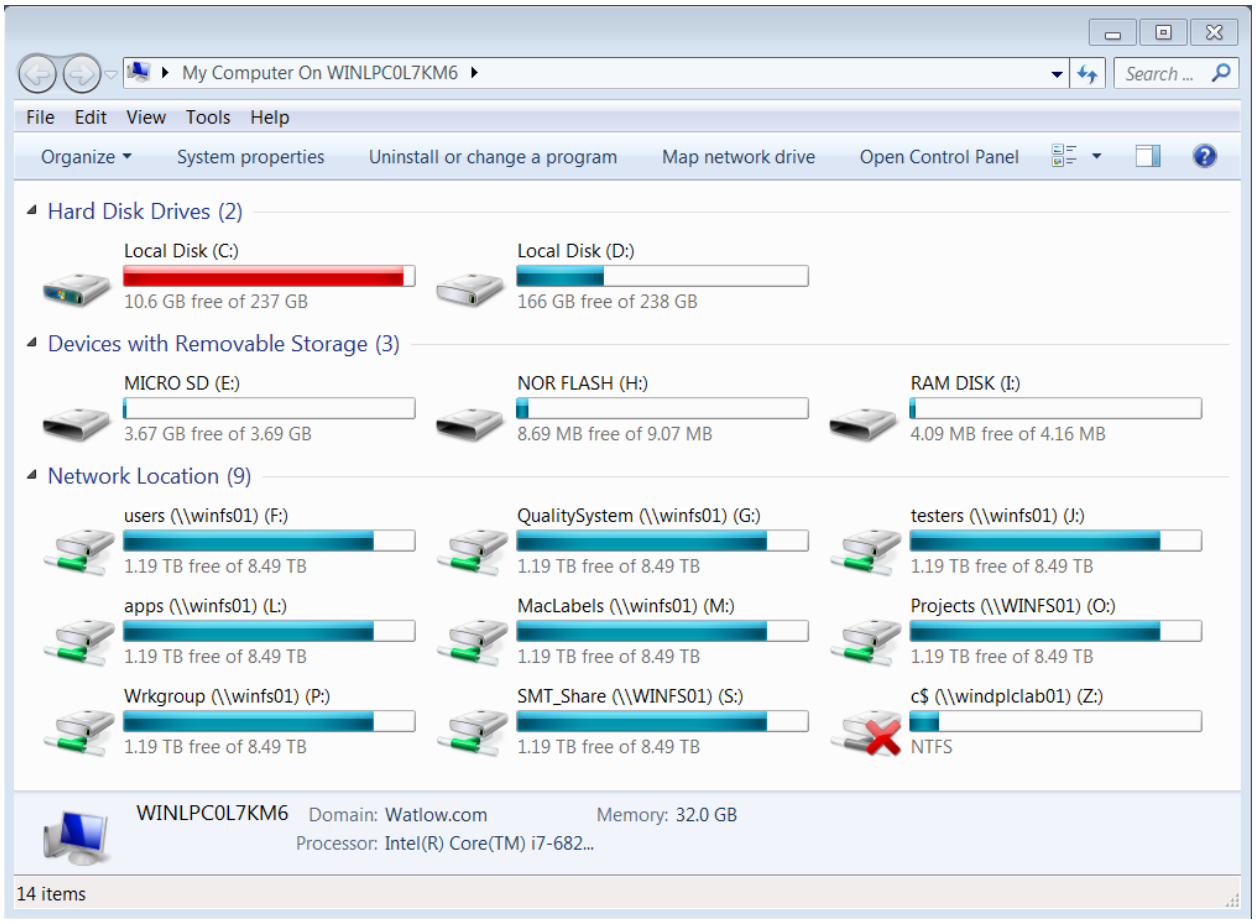


Figure 22 - RMA PLUS via USBD: All drives started

4. Browse each drive to become familiar with the content. Locate the file “nor:\Setup.csv” on the NOR FLASH drive. This file is particularly important as it is the first file read by the system.

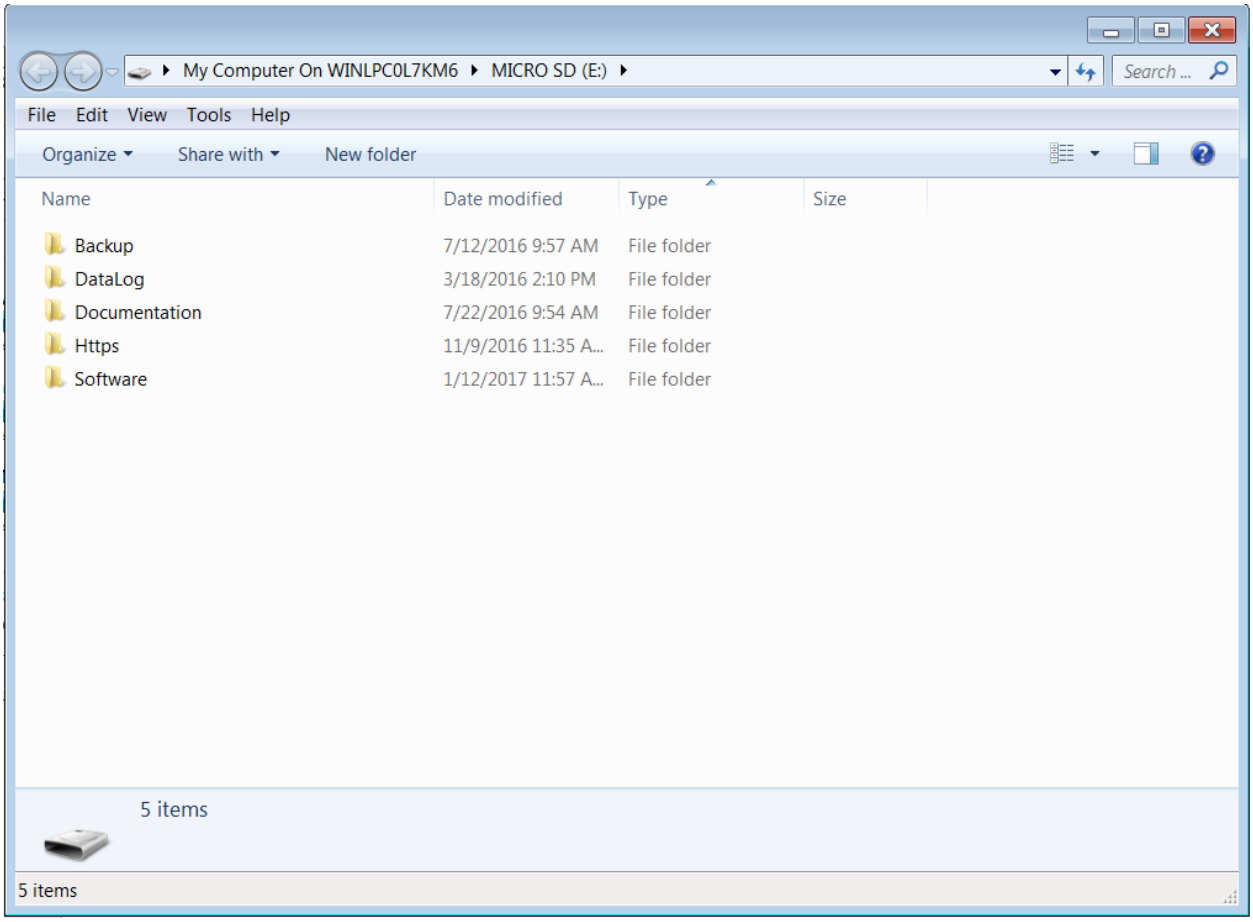


Figure 23 - RMA PLUS via USBD: MICRO SD root

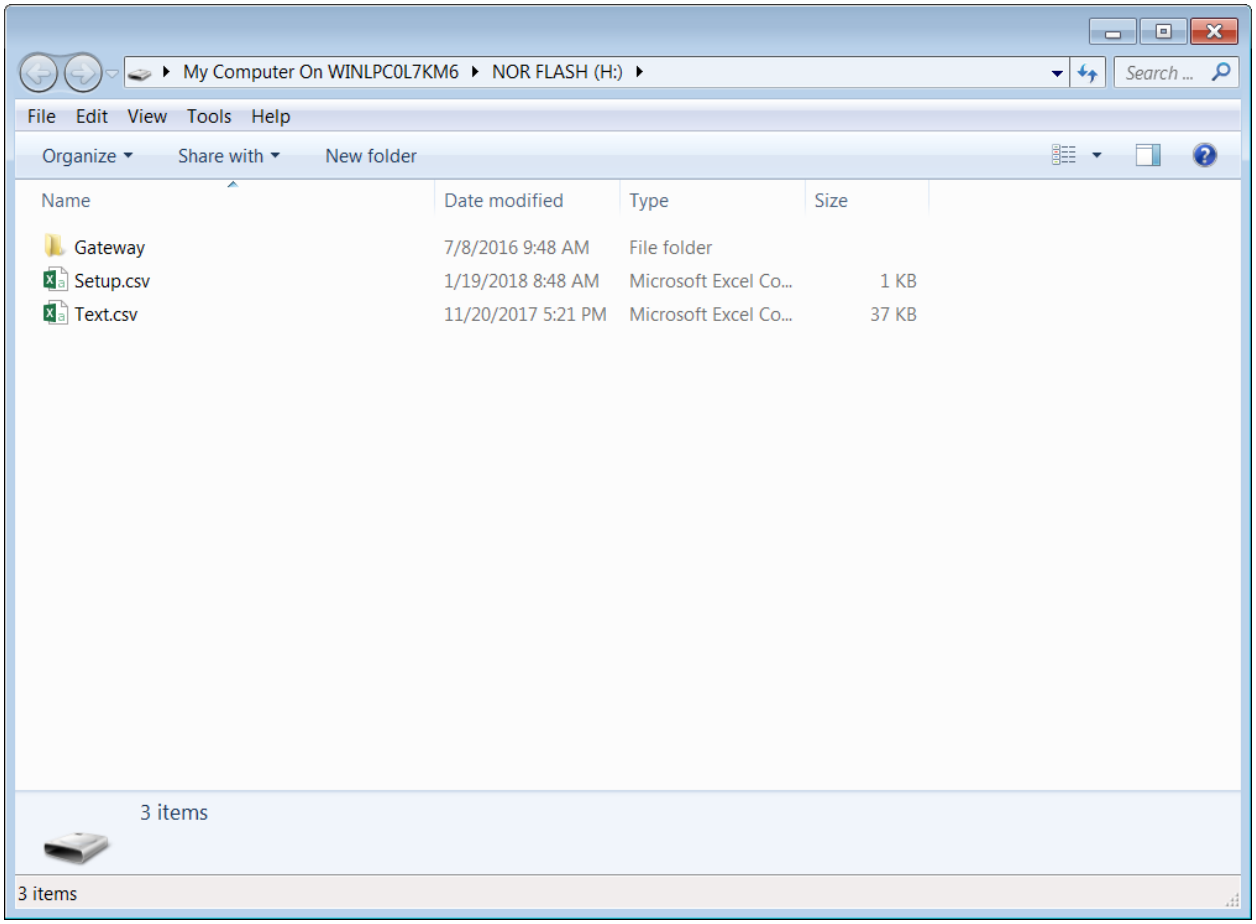


Figure 24 - RMA PLUS via USBD: NOR FLASH root

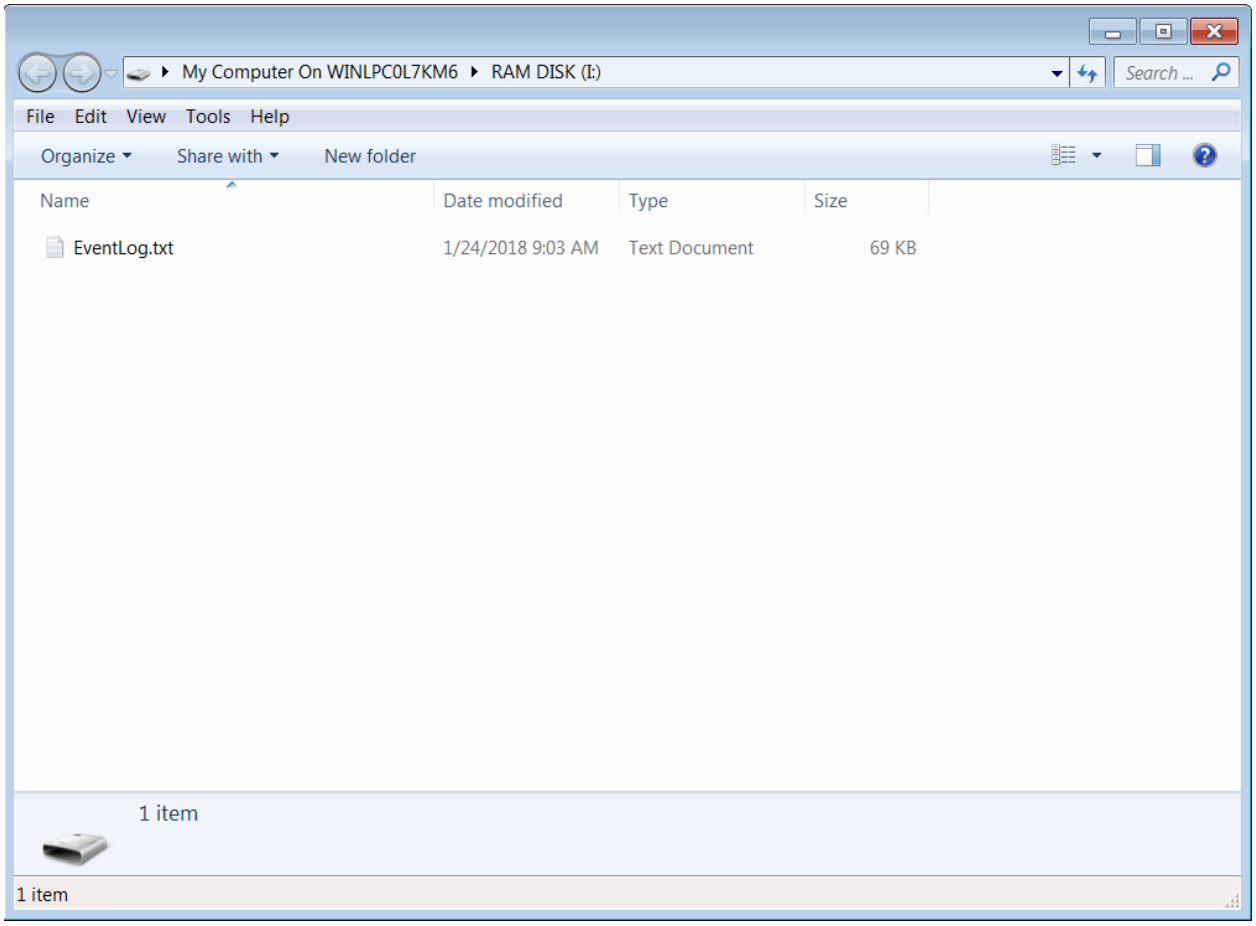


Figure 25 - RMA PLUS via USBD: RAM DISK root

5. When you are finished working with a drive, close all files and folders and press “Eject” to unmount (stop) the drive. Note that LEDs A, B, C change from red back to yellow as you unmount each drive. Unmounting the drive returns control to the firmware. Any suspended features will resume operation.

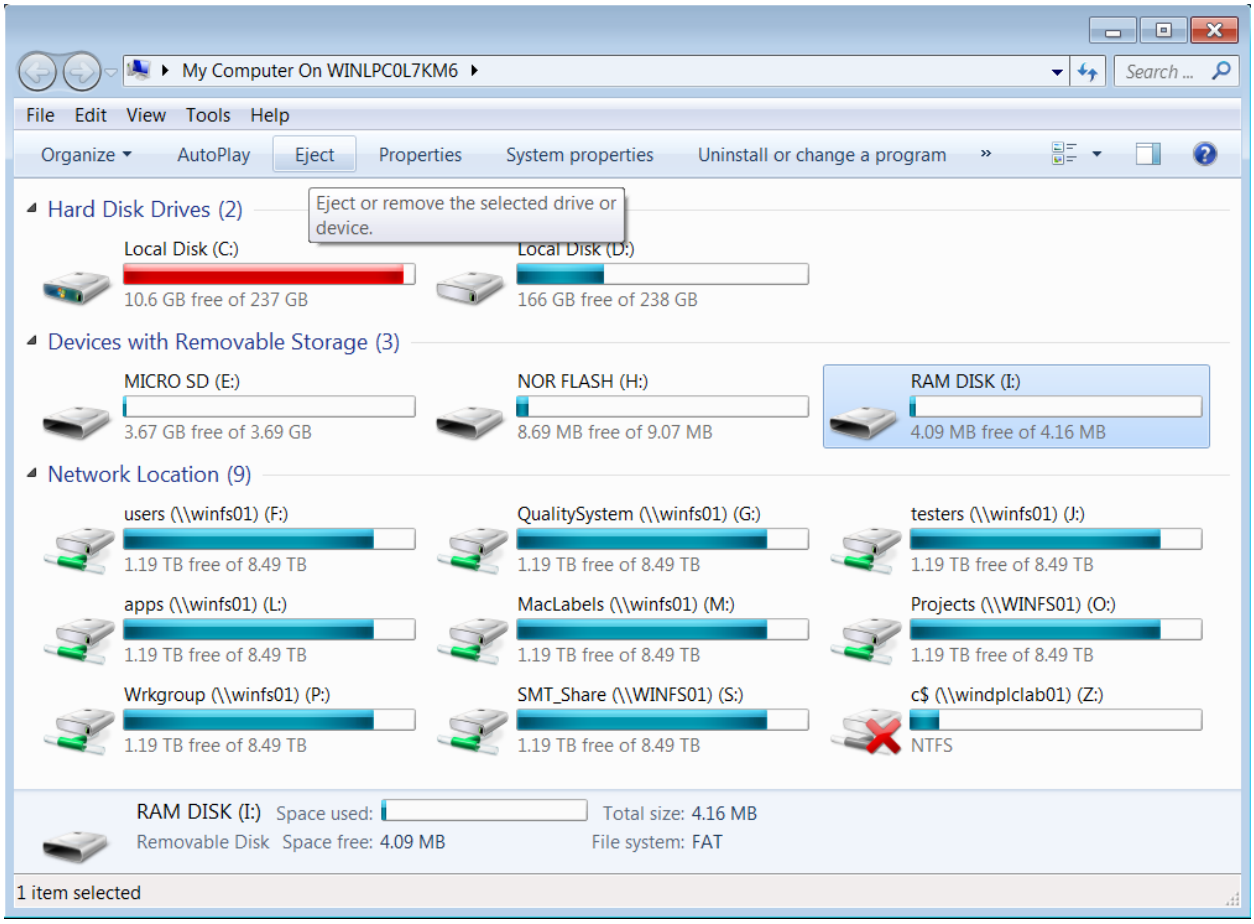


Figure 26 - RMA PLUS via USBD: Eject (stop) selected drive

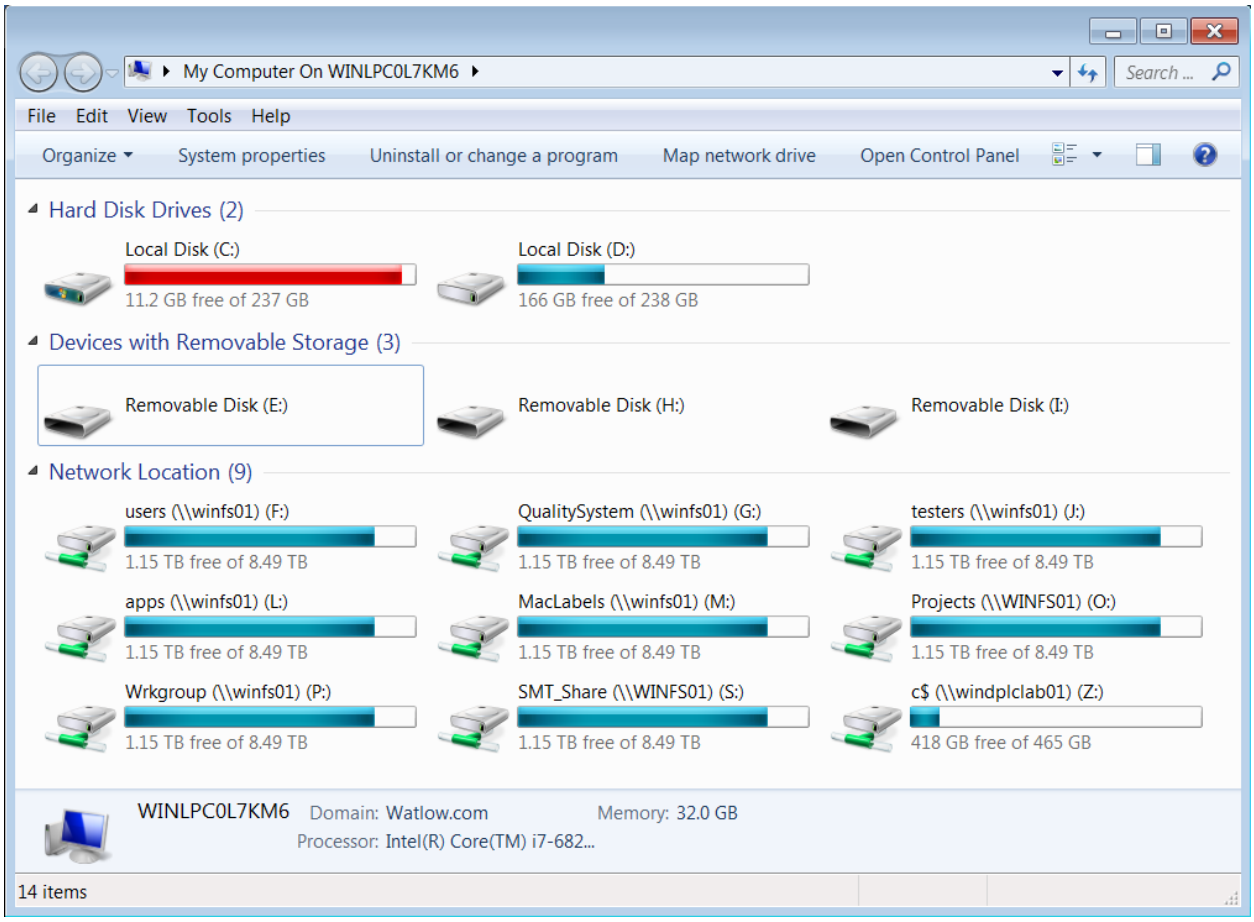


Figure 27 - RMA PLUS via USBD: All drives stopped

6. When all drives are stopped, you may safely remove the USB cable. Note that LEDs A, B, C change from yellow to green about five seconds after the cable is removed.

   IMPORTANT: Removing the USB cable when a drive is owned by the PC could result in drive corruption.

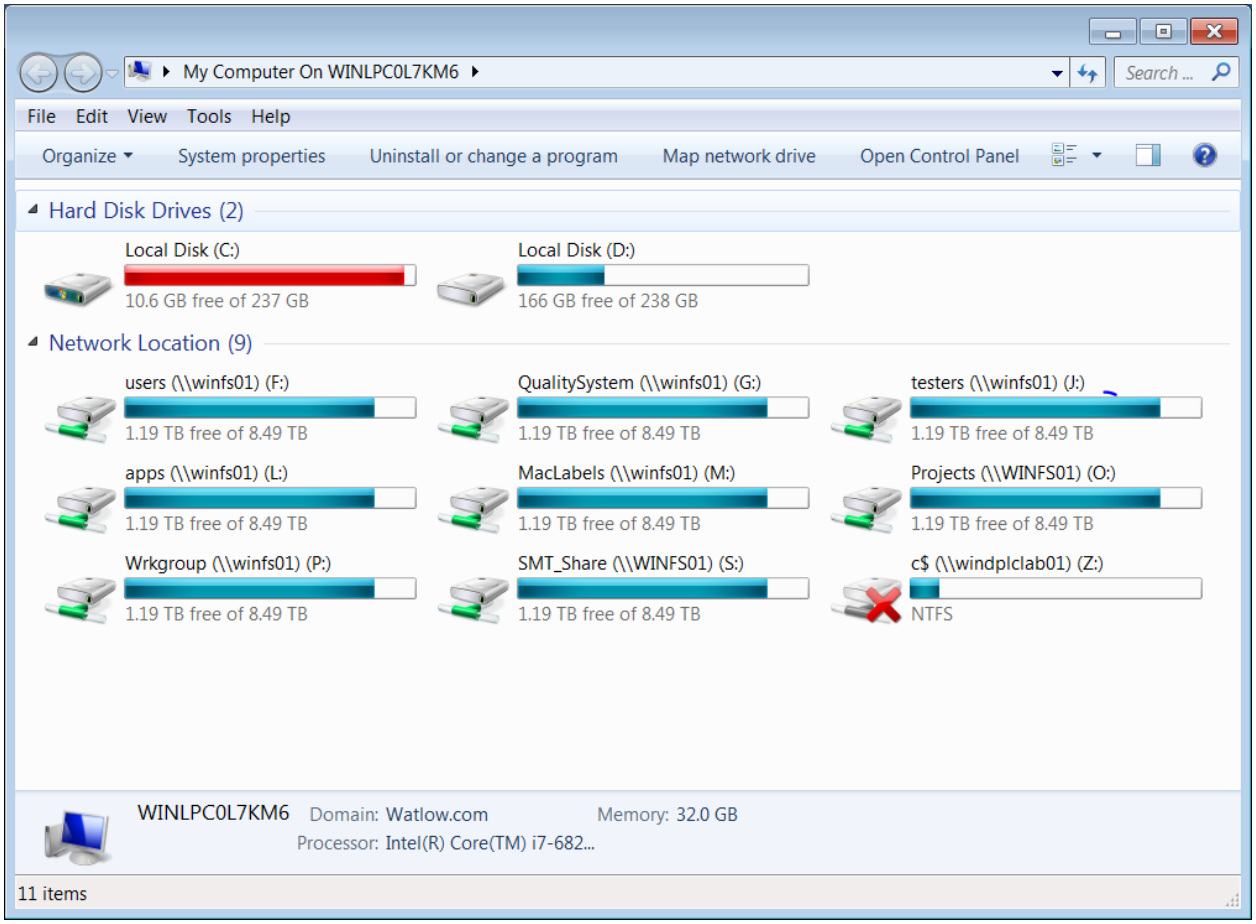


Figure 28 - USBD cable disconnected

Configure Product Features

There are two methods for configuring the RMA PLUS. Both are necessary for different features.

The first method requires one of the Watlow® software tools to access parameters while actively communicating with the product. This is for system configuration and monitoring.

The second method uses (*.csv) and (*.txt) files. This is for field bus configuration, data logging, etc.

There are three drives available to the user for configuration and data storage. When you connect via USBD, all three drives are available for modification. Files may be read over Ethernet, but not written.

Comma separated variable (*.csv) files are associated with Microsoft® Excel® by default. This makes working with files easy by leveraging the table editing features of Excel®. Excel® is the recommended editor for configuration files as opposed to a text editor such as Notepad.

Text (*.txt) files are associated with Microsoft® Notepad by default.

IMPORTANT: Configuration files are only read on initialization. Therefore, you must reset the RMA PLUS after you make a change for it to take effect.

Setup.csv

Open the file “nor:\Setup.csv” at the root of the NOR FLASH drive. This is the first file read by the RMA PLUS out of reset. Each line is a record – a key, value pair. The key is a string value that is not case-sensitive but must match a key string in the firmware or it is disregarded. The data type of the key value depends on the key – most are strings, some are integers. See the section Setup Keys for details about each key. The order of the records in the file is not important.

The following is the default configuration for this file:

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
DataLog	nor:\Gateway\DataLog.csv
DeviceNet	nor:\Gateway\DeviceNet.csv
EtherNetIP	nor:\Gateway\EtherNetIP.csv
LogIntervalSec	5
UART7	0

Figure 29 - Setup.csv default configuration

Working with Files

Features like data logging, Modbus® TCP, Modbus® RTU, etc. are configured via files on the drives. Configuration files are comma separated variable (*.csv) files. Microsoft® Excel® will open these files directly. It is the most efficient way to work with files and is associated with this file type by default.

The format for all files is similar. Each line in the file (row) constitutes a record. Records are terminated by a new line (CRLF). Record elements are separated by commas (not shown in this example as it is captured from Excel®). Header rows (shown below in grey) and empty rows are ignored by the parser.

Field bus or application information (in this case Modbus® TCP / RTU register) is defined in the first column. The bus number follows and dictates how the remainder of the record is parsed. Busses 1 and 2 (shown below in green) are both Watbus records and have the same format. Busses 4 and 5 (shown below in blue) are both Modbus® RTU records and have the same format. Bus 0 records are ignored by the parser to disable a record without deleting it.

Any trailing information is disregarded by the parser but may be included for user documentation.

Integer fields follow the same syntax used for integer constants in C. Decimal is assumed unless the series of digits begins with 0 (specifying octal radix) or “0x” or “0X” (specifying hexadecimal radix).

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
Register	**Bus**	**Address**	**RTU Register**	**Representation**				
6	4	1	0	6				DEV 1 Hardware ID
8	5	1	0	6				DEV 1 Hardware ID

Figure 30 - Field bus gateway record format

Features

USB Device (USBD)

The RMA PLUS is a USB composite device i.e. it implements multiple classes over the same physical connection using multiple sets of endpoints. The RMA PLUS implements the mass storage (MSC) and vendor specific (VSC) classes.

The USBD connection is intended for short-term configuration and monitoring.

It has the following features:

- Connector: Mini-B receptacle
- Full-Speed USB Composite Device (USBD)
    - Vendor Specific Class (VSC)
    - Mass Storage Class (MSC)
        - LUN0: MICRO SD
        - LUN1: NOR FLASH
        - LUN2: RAM DISK

The RMA PLUS will show up under the “Disk drives,” “Portable Devices,” and “Watlow” sections of Device Manager as shown below when the driver is successfully installed:

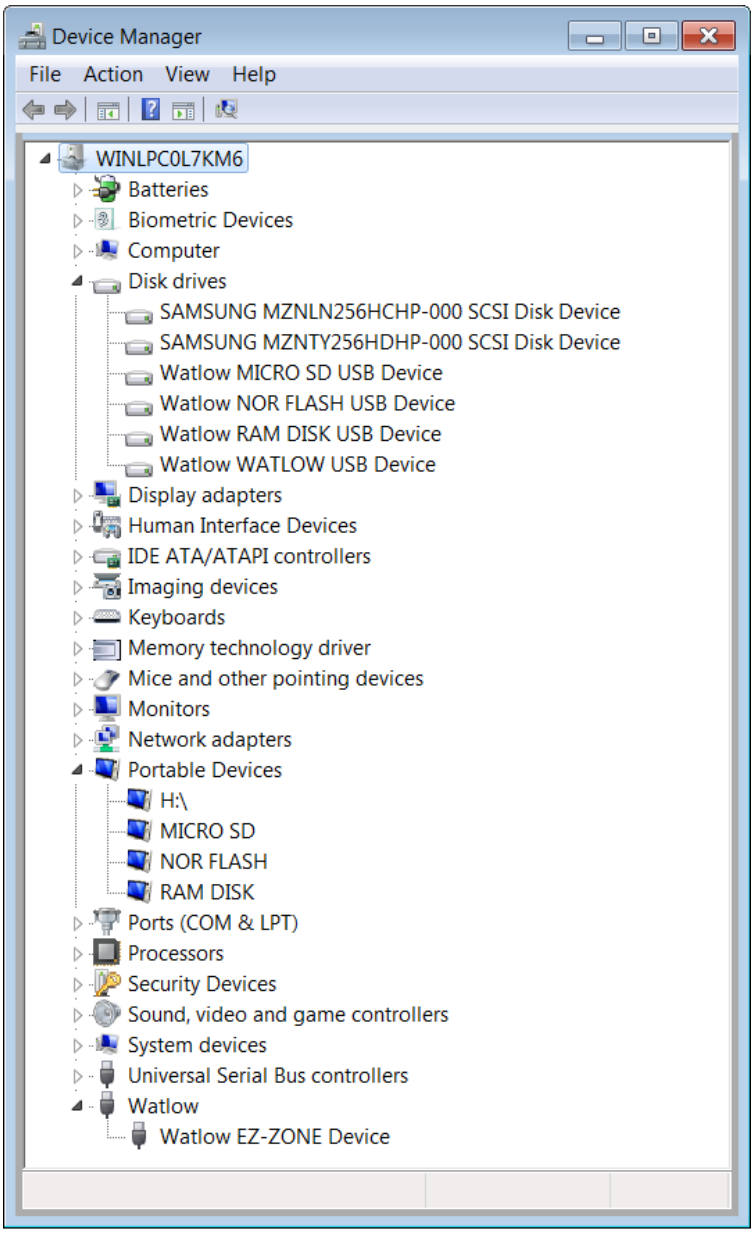


Figure 31 - Device Manager: RMA PLUS connected via USBD

And from “Devices and Printers…”

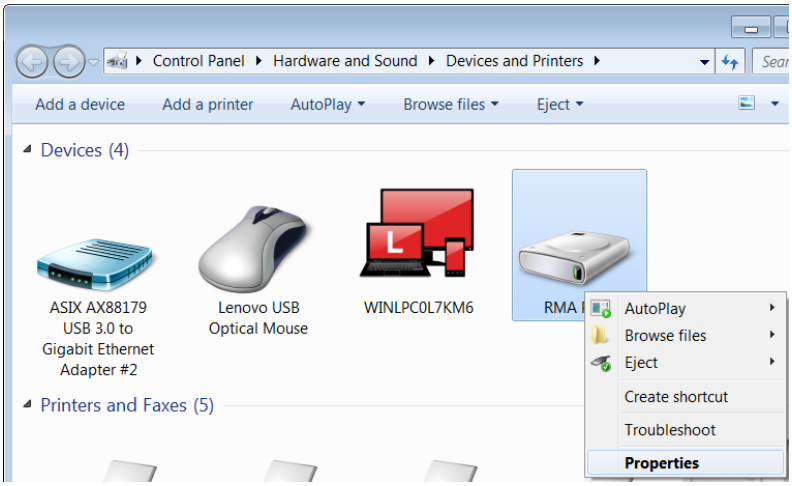


Figure 32 - Devices and Printers: RMA PLUS connected via USBD

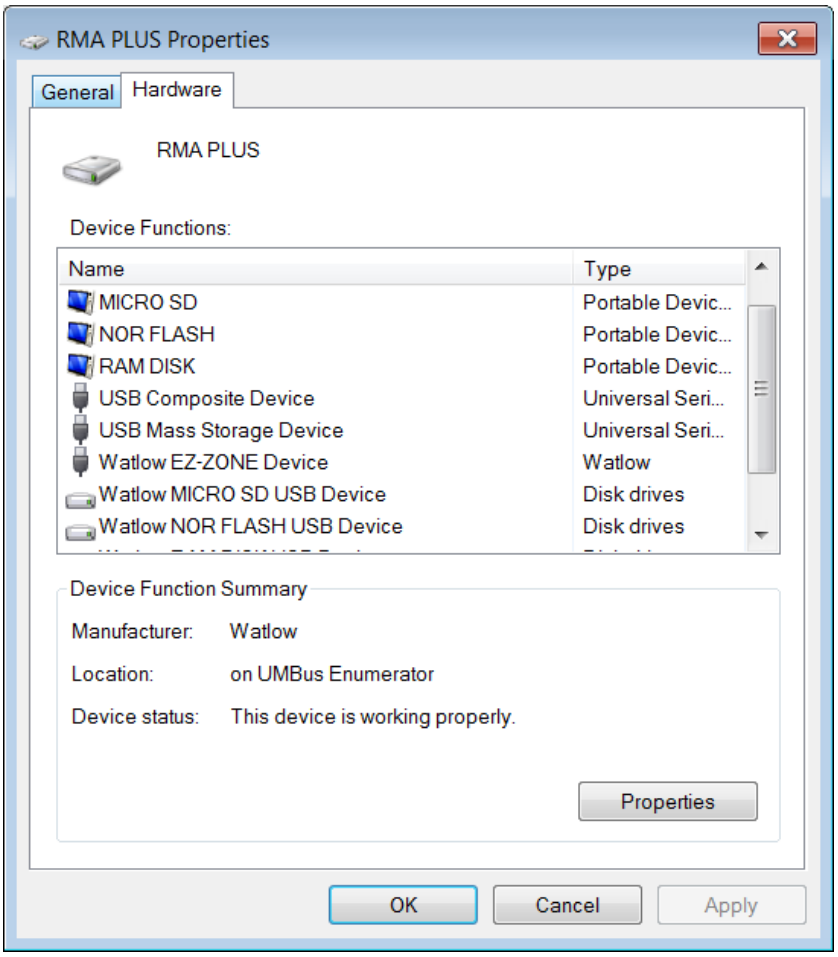


Figure 33 - Devices and Printers Properties: RMA PLUS connected via USBD

Vendor Specific Class (VSC)

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

Mass Storage Class (MSC)

The RMA PLUS provides three disk drives for user access. Upon connection, the drives are stopped. This means the firmware has control of the drive. The user may request exclusive access of the drive by pressing the "Eject" button in Windows® Explorer. This sends a start / stop command to the device. When the PC mounts the drive, all firmware services that use this drive are suspended. For this reason, it is important to use the "Eject" button to stop the drive and give control back to the firmware when you are finished with it. It is also important to stop the drives 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 even though they are enumerated as follows in firmware:

LUN 0: MICRO SD

Volume: (sd:)

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

The product ships with either a 4 or 8 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 intended to be 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, the user may upgrade the SD card to a larger capacity and / or class so long as 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.

This 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.

USB Host (USBH)

NOTE: This is a future option.

It has the following features:

- Connector: Standard Type-A receptacle
- Configuration: Standard Downstream Port (SDP)
- Full-Speed USB Host (USBH)
    - Mass Storage Class (MSC) via (msc:) volume
    - Android™ Open Accessory (AOA)

Bluetooth® Low Energy (BLE)

NOTE: This is a future option.

Wi-Fi

NOTE: This is a future option.

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)

Auto-Negotiation

Auto-negotiation is the preferred method for determining link speed and duplex. If the link partner has a fixed / forced speed and duplex, auto-negotiation will fail. The link speed will be determined via parallel detection, but the duplex cannot be determined. In this case, the duplex will be forced to half duplex.

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. This is an invaluable network diagnostic tool.

MAC Filter

Setup keys: MACA(1-3)

The RMA PLUS implements unicast Source Address (SA) filtering. If configured, the RMA PLUS 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.

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, IP Actual Address Mode indicates “Fail”.

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)

IGMP Snooping

IGMP Snooping is a managed switch feature used to restrict multicast traffic to the set of ports that explicitly subscribe to the multicast data. Without IGMP Snooping, multicast traffic is broadcast to all ports, downgrading the performance. This is important for EtherNet/IP™ because many applications use multicast frames for implicit data.

The embedded switch learns MAC addresses based on a frame’s Source Address (SA). An inbound frame on a given port is added to the switch’s Dynamic MAC Address Table.

Multicast frames have a unicast SA and a multicast Destination Address (DA) and are, therefore, not learned by the switch. They must be manually accounted for by the RMA PLUS.

This implementation of IGMP Snooping listens to IGMP Version 3 membership reports and configures the switch accordingly. There is a limit of 8 table entries. This limit should be considered in the physical network design.

Watbus Over Ethernet (WOE)

Setup keys: Discover

The RMA PLUS provides up to three (priority based) Ethernet to high-speed Watbus gateway sessions. Each connection provides access to the RMA PLUS and all devices connected to the high-speed Watbus network. Transactions intended for remote devices are proxied (routed) through the RMA PLUS to the Watbus network.

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" the Watbus Enable member. NOTE: A reset is required for this change to take effect.

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

You may also disable the Watbus discovery feature. Software tools use this feature to discover Watbus devices on an Ethernet network. By disabling this discovery feature, you must specify the IP address or host name to make a connection with PC software. See key Discover.

Modbus® TCP Server

Setup keys: ModbusTcp

The RMA PLUS provides up to three (priority based) Modbus® TCP sessions. Unlike Watbus, Modbus® TCP 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. Because of this, there is virtually no delay between request and response.

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.

The RMA PLUS is a Modbus® TCP server and only implements the following Modbus® function codes:

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

Software Reset Service

Modbus does not have a native reset service like other field bus protocols. A user-defined service has been implemented to fill this void. The request, response PDU format follows…

Byte	Name	Value	Comments / Description
0	Function Code	0x69	Software Reset
1	Reset Type	0: Reset only 1: Level 0 Factory Defaults + Reset 2: Level 1 Factory Defaults + Reset	

Modbus® TCP supports all integer data types, floats, enums, and Watbus Parameter types. Strings are not implemented. See Data Types for more information.

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.

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

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

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 Watbus bus and zone.
- You must 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

Figure 34 - ModbusTcp.csv default configuration

Perform test read / write operations on the data. A sample Modbus® TCP test program is included on the MICRO SD drive for testing purposes (sd:\Software\Modbus TCP). 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.

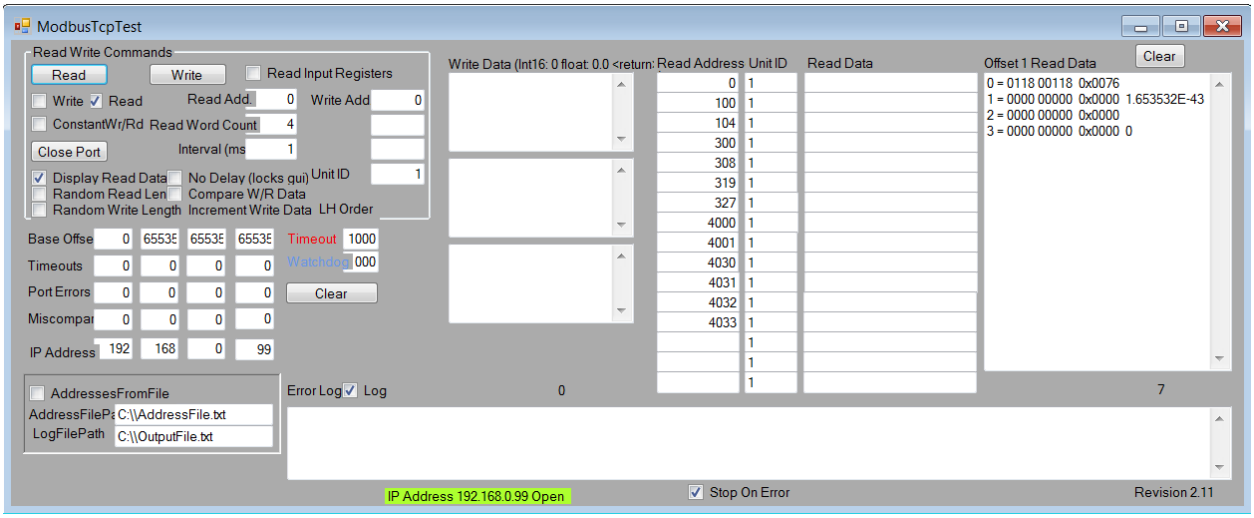


Figure 35 - Example: Modbus TCP client

Attempting to read beyond the ends of the defined table will return an exception.

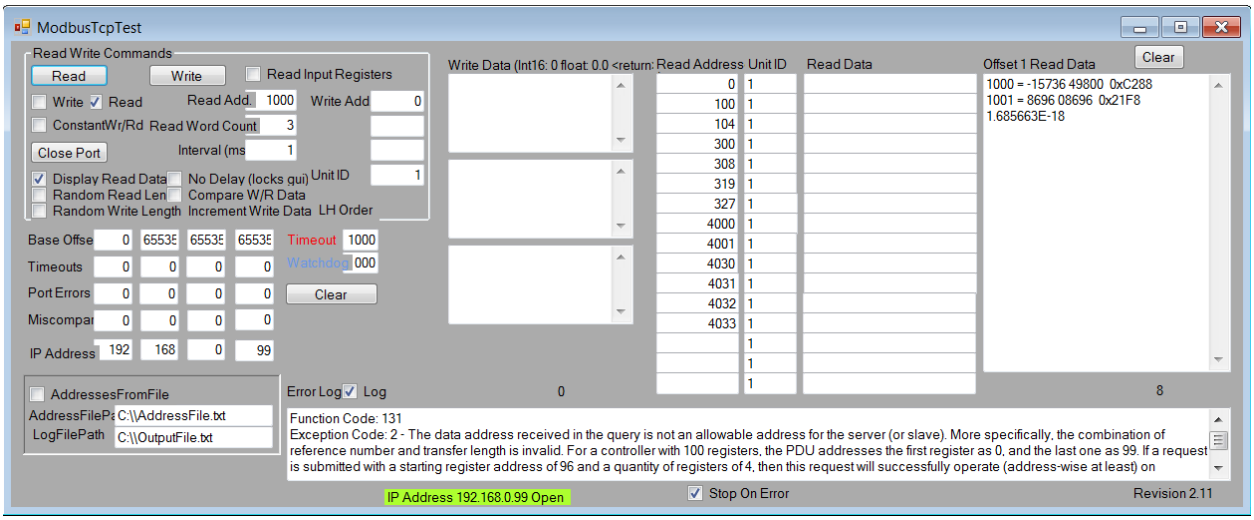


Figure 36 - Example: Modbus TCP client exception response

EtherNet/IP™ Server

This feature is only available if the model number is RMAP-X**3**XX-XXXX.

Setup keys: EtherNetIP

EtherNet/IP™ is CIP™ over Ethernet. Refer to the Common Industrial Protocol (CIP™) section for more detail.

The RMA PLUS provides up to three EtherNet/IP™ encapsulation sessions for explicit messaging, one Class 1 (implicit) connection, and up to two Class 3 (connected explicit) connections per session.

EtherNet/IP™ 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. Because of this, there is virtually no delay between request and response.

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.

EtherNet/IP™ implements an additional feature to manage inactive encapsulation sessions. The Encapsulation Inactivity Timeout feature will close sessions that are inactive for the specified time. A value of 0 disables this feature.

The EtherNet/IP™ server supports all data types. See Data Types for more information.

This service is enabled by default. It may be disabled by writing "No" to the EtherNet/IP Enable member. NOTE: A reset is required for this change to take effect.

Ethernet 70 (0x46), Instance 2									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
5	0x05	EtherNet/IP Enable	ENUM16	RW	F			106	59: No 106: Yes

LEDs

The standard, user-defined LEDs have a definite purpose for this option.

Module Status (MS) LED Indicator	
Indicator state	**Summary**
Steady Off	No power
Steady Green	Operating correctly
Flashing Green	Standby, the device is not configured
Flashing Red	Minor, recoverable fault (for example, an incorrect or inconsistent configuration)
Steady Red	Non-recoverable fault
Flashing Green / Red	Self-test, the device is performing power-up testing

Network Status (NS) LED Indicator	
Indicator state	**Summary**
Steady Off	No power/no IP address
Steady Green	Has at least one connection
Flashing Green	No connections but has obtained an IP address
Flashing Red	Connection timeout
Steady Red	IP address is already in use
Flashing Green / Red	Self-test, the device is performing power-up testing

Input / Output (IO) LED Indicator	
Indicator state	**Summary**
Steady Off	No power
Steady Green	IO connection established
Flashing Green	Standby, no IO connection is established
Flashing Red	Minor, recoverable fault
Steady Red	Non-recoverable fault
Flashing Green / Red	Self-test, the device is performing power-up testing

HTTP Server

Setup keys: HTTPs

The RMA PLUS implements a custom HTTP server. Like Modbus® TCP, it interacts asynchronously with a user-defined data model loaded on initialization and configured by way of a USBD gateway file.

HTML files (*.html, *.htm) use dynamic token insertion to replace tokens with live data when streaming pages from the micro SD card to the HTTP client (browser). Users 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" the HTTP Server Enable member. NOTE: A reset is required for this change to take effect.

Ethernet 70 (0x46), Instance 2									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
8	0x08	HTTP Server Enable	ENUM16	RW	F			106	59: No 106: Yes

Token Format

The format of a token is ${TokenKey}. When the parser encounters one of these tokens, 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 Watbus Class ID (hexadecimal), Ixx is the Watbus Instance ID (hexadecimal), and Mxx is the Watbus 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.

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

Figure 37 - HTTPs hardcoded tokens

Sample Configuration

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" is displayed. It returns basic information about the device and a link to the Event Log.

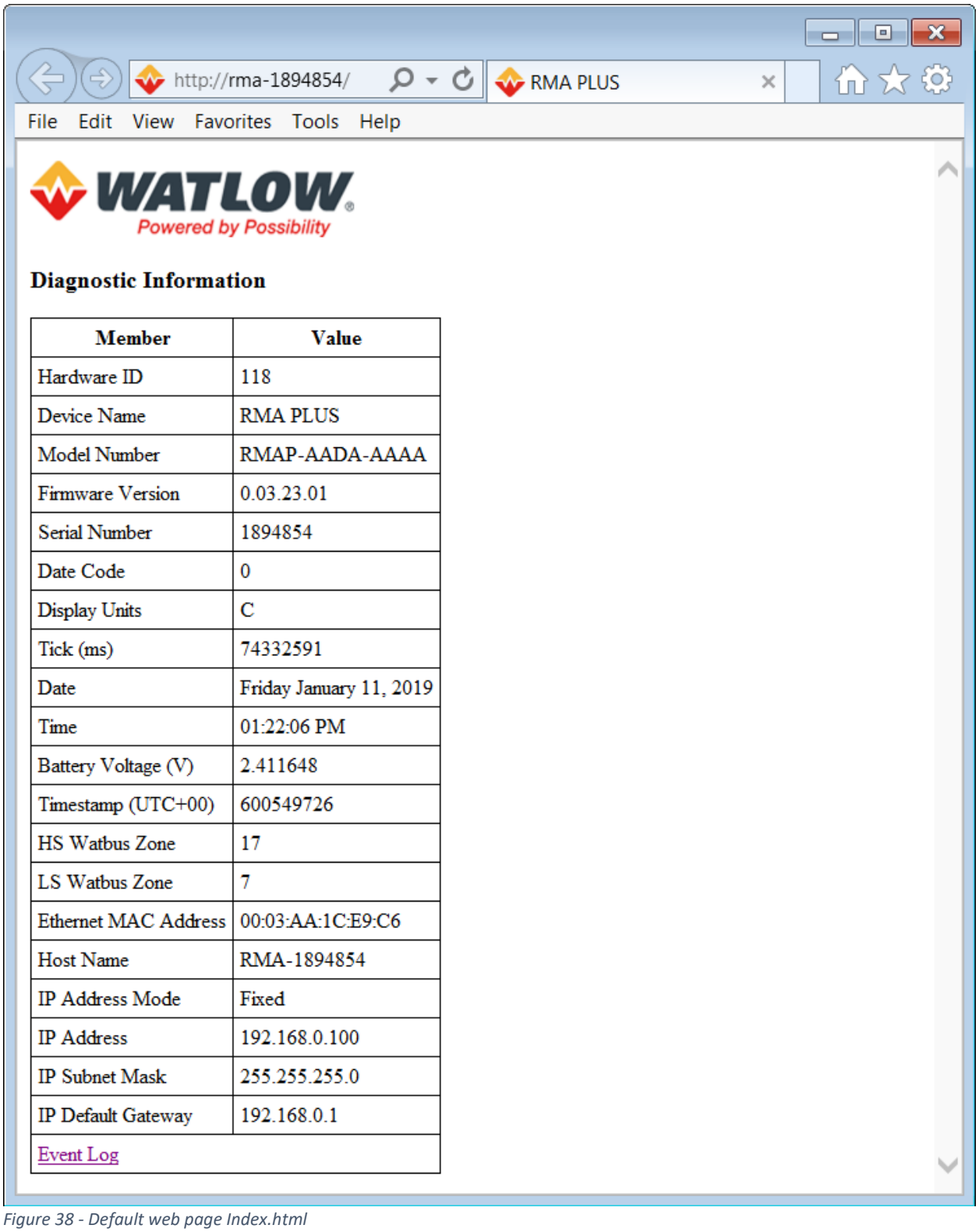


Figure 38 - Default web page Index.html

2. Plug in the USBD cable and mount the MICRO SD drive to view / modify HTTP server files.

   HTTP server files are located 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.

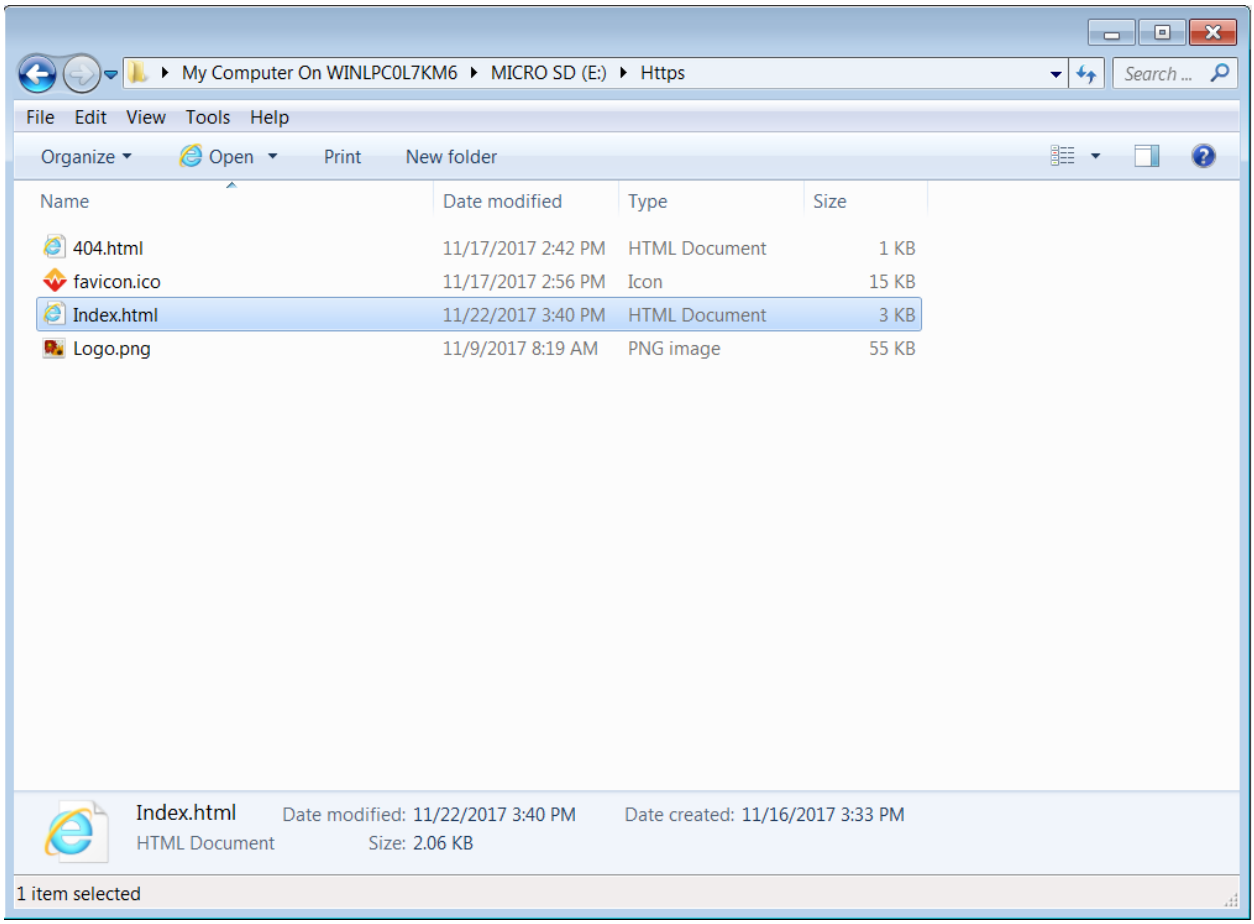


Figure 39 - Default HTTPs location, content

3. Open Index.html and observe the syntax before token insertion. View the HTML source to learn more about tokens and their format.

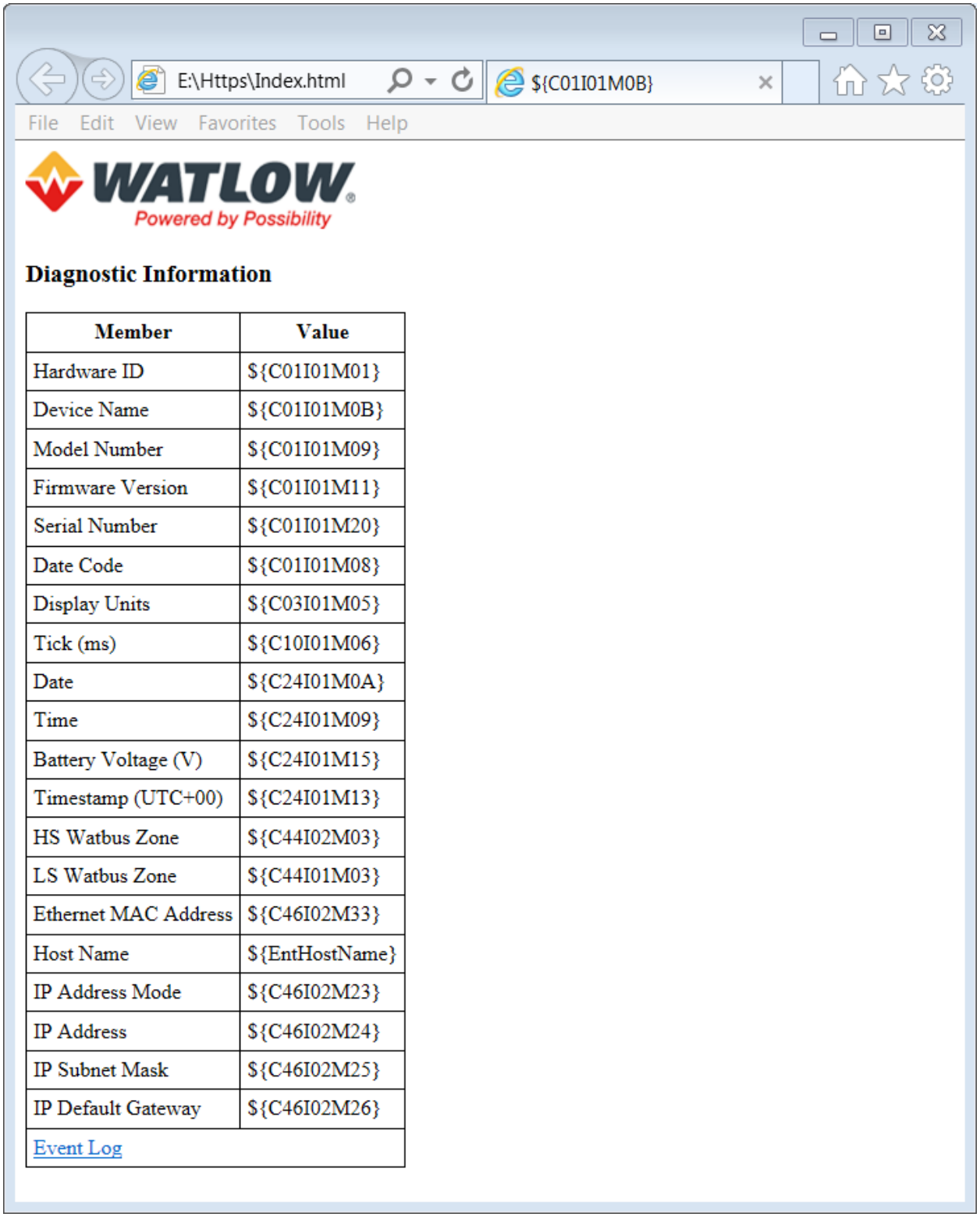


Figure 40 - Index.html source

4. Mount the NOR FLASH drive.
5. Add the HTTPs key to the setup file.

6. Create the file defined by the newly created HTTPs key referencing data points you wish to display in the new web page. Notice the format is very similar to the other gateway files. Compared to Modbus®, the “Token” column replaces the “Register” column. All other elements are the same. Tokens are user-defined strings. The remainder of the record elements are bus dependent as before.

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

Figure 41 - Example: Custom HTTPs table

7. Create a new HTML page “sd:\Https\Zone01.html” using the user-defined tokens above to display information about the high-speed Watbus 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 without dynamic token replacement.

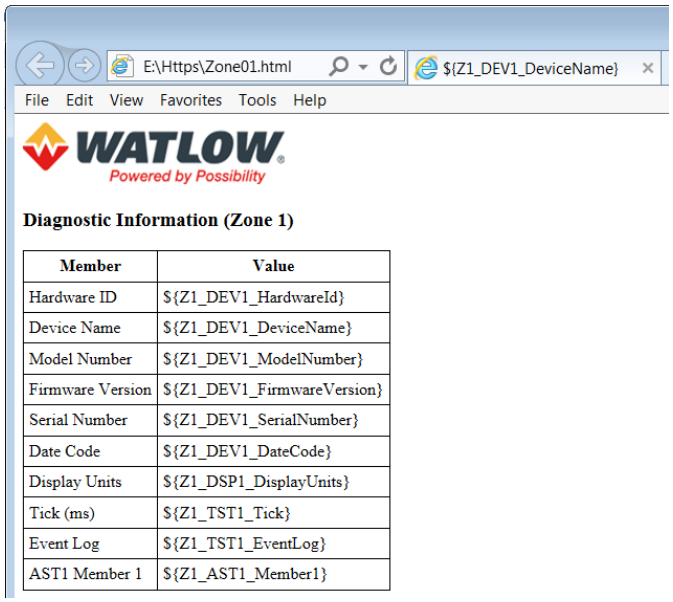


Figure 42 - Example: Zone01.html source

8. Save and close all files on the MICRO SD and NOR FLASH drives. Eject (stop / unmount) both drives.
9. Reset the RMA PLUS.
10. 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. Observe the new HTML page with live data inserted for Zone 1.

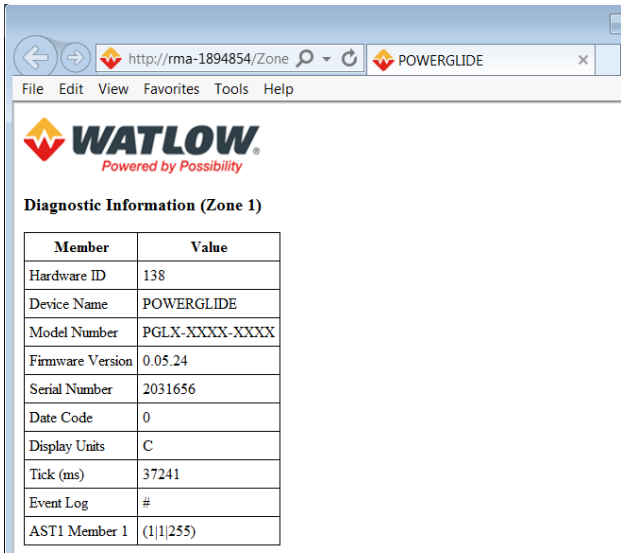


Figure 43 - Example: Zone01.html

Notes

- HTML files live on the micro SD card by default. This path cannot be changed at run time with a setup file key.
- When the MICRO SD drive is owned by the PC (LED A is RED), the HTTP server cannot return web pages, i.e. the (sd:) volume is not accessible to the firmware.
- 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. This, of course, varies by browser, caching, timing, etc.
  1. Index.html
  2. favicon.ico
  3. Logo.png
- The HTTP server supports all Data Types.
- You may download or create links to any file on any drive via HTTP. See the event log example on the default HTML page. Valid drive names are “sd:”, “nor:” and “ram:”.
- The current implementation only supports read operations via HTTP.
- 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” the TFTP Server Enable member. NOTE: A reset is required for this change to take effect.

Ethernet 70 (0x46), Instance 2									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
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

Setup keys: SntpAddress

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.

TFTP Client

This feature is only available if the model number is RMAP-XX**D**X-XXXX.

If the data logging feature is ordered, the RMA PLUS is capable of automatically transferring log files to a TFTP server. The remote IP address of the TFTP server must be set in the Ethernet object (member 54).

The last log file is transferred to the server when a new file is created.

Any TFTP server may be used for this service. You may use Dashboard for this service as well.

See Ethernet object.

MQTT Client

This feature is under development but may be enabled in the field. Contact the factory for more information.

Setup keys: MQTTcCustomerId

The RMA PLUS implements a MQTT client for Internet of Things (IoT) messaging. Currently, a user may monitor the data log remotely (same content as DataLog.csv).

This service is enabled by default (when ordered from the factory). It may be disabled by writing “No” to the MQTT Client Enable member. NOTE: A reset is required for this change to take effect.

Ethernet 70 (0x46), Instance 2

Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
11	0x0B	MQTT Client Enable	ENUM16	RW	F			106	59: No 106: Yes

Notes

- TCP Port 1883 is required

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.

Watbus

Watbus is a RS-485 token-passing network that may contain both masters and slaves. It is a proprietary protocol that all products implement. There are two varieties – high-speed and low-speed. The RMA PLUS is a master on both channels.

The logical address is independently software selectable for each bus. Use Standard Bus Instance 1 to change the logical address for low-speed Watbus. Use Standard Bus Instance 2 to change the logical address for high-speed Watbus.

See Standard Bus for member documentation.

Address Segmentation

The legacy bus (low-speed Watbus) 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. The explanation follows…

Value	Segment
0	No segmentation of the physical address (i.e. high-speed Watbus)
1	Masters: PCs
2	Masters: EZ-ZONE RUI, RMZ, RMA PLUS
3	Masters: Legacy field communication cards
4	Slaves: EZ-ZONE ST, PM, RM (A, C, E, H, L, S), SEMI: EZ-ZONE RM (F, G, UH), et al.

Figure 44 - Watbus address segmentation

Low-Speed Watbus

There may be up to 33 devices (zones) on bus 2, each with a unique physical address. The logical address is what the user is presented. The physical address is what's used on the bus. 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.

Segment	Logical	Physical	
1	1	0	Process Status Master

	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 Comms 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	

Figure 45 - LSWB address space

High-Speed Watbus

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.

Segment	Logical	Physical	
0	1	0	**Masters (EZ-ZONE RM)**
	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

Figure 46 - HSWB address space

Data Logging

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

Setup keys: DataLog, LogIntervalSec, LogKeepDays

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

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

- The configuration file may contain a maximum of 2000 valid records.
- There is currently a maximum of 500 unique data points per Watbus bus and zone.
- The header is a user-defined string with a maximum length of 31 characters. Headers greater than 31 characters will be truncated. If the header field is empty, one will be created in the form of:
  - "(Z:C.M.I)" for Watbus 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."
- A new file is created every day. Mount the MICRO SD drive to access / manage log files.
- Files with a creation date older than LogKeepDays will be 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 will be blank. This may be observed in a log file if the RMA PLUS is not able to read the representation (data type) of a member. This will be the case if the target device is not present or the bus has yet to acquire 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.

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

Figure 47 - DataLog.csv default configuration

The following is a sample from the file “sd:\DataLog\2018-01-25.csv” generated from the configuration file above:

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

Modbus® RTU

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

Setup keys: ModbusRtu6, ModbusRtu7, UART7, RtuFc6

If available, the RMA PLUS 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 the following Modbus® function codes:

- 3: Read Holding Registers
- 4: Read Input Registers
- 6: Write Single Register
- 16: Write Multiple Registers
- 105: Software Reset (See Software Reset Service for more information)

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, enums and Watbus Parameter types. Strings are not implemented. See Data Types for more information.

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

The object model for the Modbus® RTU slave is user-defined. A sample file (shown below) 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 Watbus bus and zone.
- You must respect the data type of the target element i.e. 32-bit integers, floats and parameters consume two 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

Figure 48 - ModbusRtuX.csv default configuration

Perform test read / write operations on the data. A sample Modbus® RTU test program is included on the MICRO SD drive for testing purposes (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.

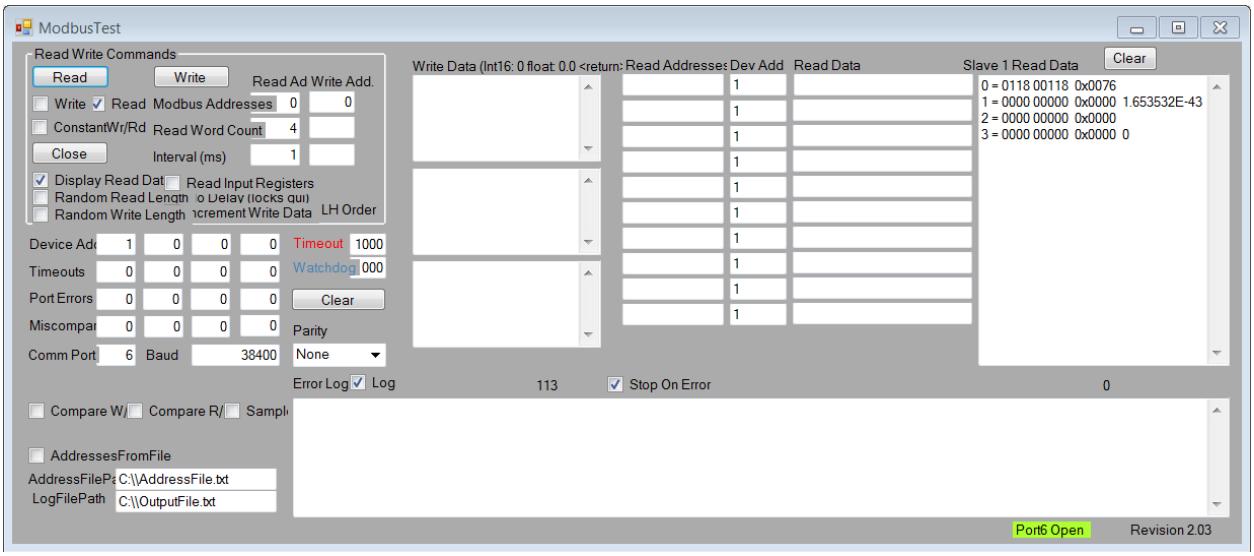


Figure 49 - Example: Modbus RTU client

Attempting to read beyond the ends of the defined table will return an exception.

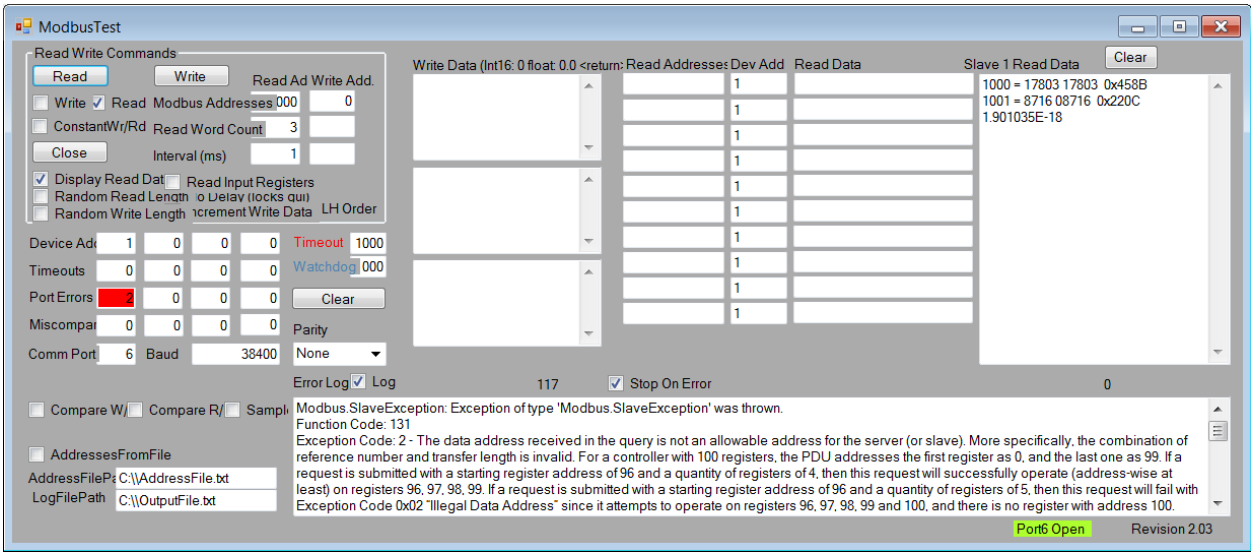


Figure 50 - Example: Modbus RTU client exception response

Controller Area Network (CAN)

The RMA PLUS has an optional CAN hardware interface that may be used for DeviceNet™ applications.

DeviceNet™ Slave

This feature is only available if the model number is RMAP-**5**XXX-XXXX.

Setup keys: DeviceNet

DeviceNet™ is CIP™ over CAN. Refer to the Common Industrial Protocol (CIP™) section for more detail.

The RMA PLUS provides one explicit messaging connection and one implicit connection.

DeviceNet™ 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. Because of this, there is virtually no delay between request and response.

The DeviceNet™ slave supports all data types. See Data Types for more information.

- Isolated physical layer.

Switches

The DeviceNet™ module provides three rotary switches for setting the MAC ID and baud rate. These settings are software settable if the corresponding switch is set to program.

LEDs

The following LEDs refer to those found on the DeviceNet™ hardware module (to the right of the RMA PLUS). These do not take the place of the 4 user-defined LEDs on the RMA PLUS like EtherNet/IP™.

Module Status (MODULE) LED Indicator	
Indicator state	**Summary**
Off	No power
Steady Green	Device Operational
Flashing Green	Device in Standby (The Device Needs Commissioning)
Flashing Red	Recoverable Fault

Steady Red	Unrecoverable Fault
Flashing Green / Red	Device Self Testing

Network Status (NETWORK) LED Indicator	
Indicator state	**Summary**
Off	Not Powered/Not On-Line
Steady Green	On-line, Connected
Flashing Green	On-line, Not Connected
Flashing Red	Connection Time-Out
Steady Red	Critical Link Failure
Flashing Green / Red	Device Self Testing

System Configuration

Setup keys: SysCfg

This feature may be used to write configuration parameters to system devices when the RMA PLUS is initialized. The sample file contains the Ethernet configuration parameters for this device. Note that the bus is currently 0 for all records, so they are ignored by the parser. Also, Zone is a 1-based number. Zone 0 is a special case that denotes "self" or the RMA PLUS in this case. Using Zone 0 is agnostic of changes to the Watbus 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:

- The file may contain a maximum of 2000 valid records.
- There is currently a maximum of 500 unique data points per Watbus 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.

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)
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

Figure 51 - SysCfg.csv default configuration

Common Industrial Protocol (CIP™)

CIP™ is the common application layer among Open DeviceNet Vendors Association (ODVA®) protocols including DeviceNet™ and EtherNet/IP™.

Object Model

The object model consists of required and vendor specific objects. Required objects are specified by ODVA® as a function of the device type. Vendor specific objects are user-defined and identical (by default) among CIP™ protocols.

NOTE: CIP™ byte order is little endian for native data types.

Identity Object

Attributes

Identity Object (0x01 - 1 Instance)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
0	1	Get	Revision	UINT	1		
0	2	Get	Max Instance	UINT	1		
0	3	Get	Number of Instances	UINT	1		
0	4	Get	Optional attribute list number of attributes optional attributes	STRUCT of: UINT ARRAY of UINT	0		
0	5	Get	Optional service list number services optional services	STRUCT of: UINT ARRAY of UINT	0		
0	6	Get	Maximum ID Number Class Attributes	UINT	7		
0	7	Get	Maximum ID Number Instance Attributes	UINT	7		
1	1	Get	Vendor ID	UINT	0x0099		Watlow
1	2	Get	Device Type	UINT	0x000C		Communications Adapter
1	3	Get	Product Code	UINT	0x0076	0x0077	
1	4	Get	Revision Major Revision Minor Revision	STRUCT of: USINT USINT	0x5002 0x02 0x50	0x0B02 0x02 0x0B	
1	5	Get	Status	WORD	varies		
1	6	Get	Serial Number	UDINT	varies		
1	7	Get	Product Name	SHORT_STRING	RMA PLUS		

Services

Reset type 0, 1 implemented.

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x01	No	Yes			Get_Attribute_All
0x05	No	Yes	No	Yes	Reset (0,1)
0x0E	Yes	Yes	Yes	Yes	Get_Attribute_Single

Message Router Object

Attributes

Message Router Object (0x02 - 1 Instance)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
0	1	Get	Revision	UINT	1		
0	2	Get	Max Instance	UINT	1		
0	3	Get	Number of Instances	UINT	1		

0	4	Get	Optional attribute list number of attributes optional attributes	STRUCT of: UINT ARRAY of UINT	 3 1,2,3		
0	5	Get	Optional service list number services optional services	STRUCT of: UINT ARRAY of UINT	 0		
0	6	Get	Maximum ID Number Class Attributes	UINT	7		
0	7	Get	Maximum ID Number Instance Attributes	UINT	3		
1	1	Get	Object_list Number Classes	STRUCT of: UINT ARRAY of UINT	 6 1,2,4,6,245,246		
1	2	Get	Number Available	UINT	7		
1	3	Get	Number active	UINT			

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x01	No	Yes			Get_Attribute_All
0x0E	Yes	Yes			Get_Attribute_Single

DeviceNet Object

Attributes

DeviceNet Object (0x03 - 1 Instance)							
Instance ID	Attribute ID	Access	Name	Data Type	EtherNet/IP	DeviceNet	Description
0	1	Get	Revision	UINT		2	
1	1	Set	MAC ID	USINT		varies	
1	2	Set	Baud Rate	USINT		varies	
1	5	Get	Allocation Information Allocation Choice Master's MAC ID	STRUCT of: BYTE USINT		varies	
1	6	Get	MAC ID Switch Changed	BOOL		varies	
1	7	Get	Baud Rate Switch Changed	BOOL		varies	
1	8	Get	MAC ID Switch Value	USINT		varies	
1	9	Get	Baud Rate Switch Value	USINT		varies	

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E			Yes	Yes	Get_Attribute_Single
0x10			No	Yes	Set_Attribute_Single
0x4B			No	Yes	Allocate_Master/Slave_Connection_Set
0x4C			No	Yes	Release_Master/Slave_Connection_Set

Assembly Object

The EtherNet/IP™ Output Only assembly (197) is a T->O assembly with size = 0 bytes. This is used as a heartbeat when only outputs (O->T) are desired. It may be used in place of the default T->O assembly.

The EtherNet/IP™ Input Only assembly (198) is an O->T assembly with size = 0 bytes. This is used as a heartbeat when only inputs (T->O) are desired. It may be used in place of the default O->T assembly.

The EtherNet/IP™ Listen Only assembly (199) is an O->T assembly with size = 0 bytes. This is used when the master / scanner wishes to listen (subscribe) to an existing multicast T->O connection. It may be used in place of the default O->T assembly.

Attributes

Assembly Object (0x04 - 2 Instances)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
0	1	Get	Revision	UINT	2	2	
0	2	Get	Max Instance	UINT	199	101	
0	3	Get	Number of Instances	UINT	2		
0	4	Get	Optional attribute list number of attributes optional attributes	STRUCT of: UINT ARRAY of UINT	0		
0	5	Get	Optional service list number services optional services	STRUCT of: UINT ARRAY of UINT	0		
0	6	Get	Maximum ID Number Class Attributes	UINT	7		
0	7	Get	Maximum ID Number Instance Attributes	UINT	3		
100	3	Set	Data	ARRAY of octet			O->T
101	3	Get	Data	ARRAY of octet			T->O
197		Get	Data	ARRAY of octet			Output Only
198		Set	Data	ARRAY of octet			Input Only
199		Set	Data	ARRAY of octet			Listen Only

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E	Yes	Yes	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	No	Yes	Set_Attribute_Single

Connection Object

Attributes

Connection Object (0x05 - 2 Instances)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
0	1	Get	Revision	UINT		1	
1	1	Get	State	USINT			0 = Non-existent 1 = Configuring 2 = Waiting For Connection ID 3 = Established 4 = Timed Out 5 = Deferred Delete 6 = Closing
1	2	Get	Instance type	USINT		0	0 = Explicit Messaging 1 = I/O
1	3	Get	Transport class trigger	BYTE		0x83	Direction: 0x80 = Server Production Trigger: 0x00 = Cyclic Transport Class: 0x03 = Class 3
1	4	Get	Produced connection ID	UINT		varies	
1	5	Get	Consumed connection ID	UINT		varies	
1	6	Get	Initial comm. Characteristics	BYTE			
1	7	Get	Produced connection size	UINT		1028	
1	8	Get	Consumed connection size	UINT		1028	

1	9	Set	Expected packet rate	UINT			
1	12	Set	Watchdog time-out action	USINT			
1	13	Get	Produced connection path length	UINT		0	
1	14	Get	Produced connection path	Packet EPATH			
1	15	Get	Consumed connection path length	UINT		0	
1	16	Get	Consumed connection path	Packet EPATH			
2	1	Get	State	USINT			0 = Non-existent 1 = Configuring 2 = Waiting For Connection ID 3 = Established 4 = Timed Out 5 = Deferred Delete 6 = Closing
2	2	Get	Instance type	USINT		1	0 = Explicit Messaging 1 = I/O
2	3	Get	Transport class trigger	BYTE		0x82	Direction: 0x80 = Server Production Trigger: 0x00 = Cyclic Transport Class: 0x02 = Class 2
2	4	Get	Produced connection ID	UINT		varies	
2	5	Get	Consumed connection ID	UINT		varies	
2	6	Get	Initial comm. Characteristics	BYTE			
2	7	Get	Produced connection size	UINT		24	Default
2	8	Get	Consumed connection size	UINT		16	Default
2	9	Set	Expected packet rate	UINT			
2	12	Set	Watchdog time-out action	USINT			
2	13	Get	Produced connection path length	UINT		6	
2	14	Get	Produced connection path	Packet EPATH		20 04 24 65 30 03	
2	15	Get	Consumed connection path length	UINT		6	
2	16	Get	Consumed connection path	Packet EPATH		20 04 24 64 30 03	

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E			Yes	Yes	Get_Attribute_Single
0x10			No	Yes	Set_Attribute_Single

Connection Manager Object

Attributes

Connection Manager Object (0x06 - 1 Instance)							
Instance ID	Attribute ID	Access	Name	Data Type	EtherNet/IP	DeviceNet	Description
0	1	Get	Revision	UINT	1		
0	2	Get	Max Instance	UINT	1		
0	3	Get	Number of Instances	UINT	1		
0	4	Get	Optional attribute list number of attributes optional attributes	STRUCT of: UINT ARRAY of UINT	0		
0	5	Get	Optional service list number services optional services	STRUCT of: UINT ARRAY of UINT	0		
0	6	Get	Maximum ID Number Class Attributes	UINT	7		

0	7	Get	Maximum ID Number Instance Attributes	UINT	0		

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E	Yes	No			Get_Attribute_Single
0x4E	No	Yes			Forward_Close
0x54	No	Yes			Forward_Open
0x5B	No	Yes			Large_Forward_Open

File Object

Attributes

File Object (0x37 - 1 Instance)							
Instance ID	Attribute ID	Access	Name	Data Type	EtherNet/IP	DeviceNet	Description
0	1	Get	Revision	UINT	1		
0	2	Get	Max Instance	UINT	200		
0	3	Get	Number of Instances	UINT	1		
0	32	Get	Directory Instance Number Instance Name File Name	ARRAY of: STRUCT of: UINT STRINGI STRINGI			 Instance attribute 2 Instance attribute 4
200	1	Get	State	USINT			0 = Nonexistent 1 = File Empty (no file loaded) 2 = File Loaded 3 = At least one Transfer Upload initiated 4 = Transfer Download initiated 5 = At least one Transfer Upload in progress 6 = Transfer Download in Progress 7 = Storing 8 - 255 = Reserved
200	2	Get	Instance Name	STRINGI	EDS and Icon Files		
200	3	Get	File Format Version	UINT	1		Vendor Specific
200	4	Get	File Name	STRINGI	EDS.gz		
200	5	Get	File Revision Major Revision Minor Revision	STRUCT of: USINT USINT	0x0101 1 1		
200	6	Get	File Size	UDINT			
200	7	Get	File Checksum	UINT			
200	8	Get	Invocation Method	USINT	255		255 = Not applicable
200	9	Get	File Save Parameters	BYTE	0		0 = Automatic / None
200	10	Get	File Access Rule	USINT	1		1 = Read Only
200	11	Get	File Encoding Format	USINT	1		1 = Compressed file or files.

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E	Yes	Yes			Get_Attribute_Single
0x4B	No	Yes			Initiate_Upload
0x4F	No	Yes			Upload_Transfer

Vendor Specific Object 100

Attributes

Vendor Specific Object (0x64 - 1 Instance)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
1	1	Set	VAR 1 Analog	REAL	varies		
1	2	Set	VAR 2 Analog	REAL	varies		
1	3	Set	VAR 3 Analog	REAL	varies		
1	4	Set	VAR 4 Analog	REAL	varies		

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E	No	Yes	No	Yes	Get_Attribute_Single
0x10	No	Yes	No	Yes	Set_Attribute_Single

Vendor Specific Object 101

Attributes

Vendor Specific Object (0x65 - 1 Instance)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
1	1	Get	CDAT 1 Source 01 Value	REAL	varies		
1	2	Get	CDAT 1 Source 02 Value	REAL	varies		
1	3	Get	CDAT 1 Source 03 Value	REAL	varies		
1	4	Get	CDAT 1 Source 04 Value	REAL	varies		
1	5	Get	CDAT 1 Source 01 Error	UINT	varies		
1	6	Get	CDAT 1 Source 02 Error	UINT	varies		
1	7	Get	CDAT 1 Source 03 Error	UINT	varies		
1	8	Get	CDAT 1 Source 04 Error	UINT	varies		

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E	No	Yes	No	Yes	Get_Attribute_Single

Vendor Specific Object 110

Attributes

Vendor Specific Object (0x6E - 1 Instance)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
17	1	Get	DEV 1 Hardware ID	UDINT	118		
17	2	Get	DEV 1 Serial Number	UDINT	varies		
17	3	Get	DEV 1 Model Number	SHORT_STRING	varies		RMAP-XXXX-XXXX
17	4	Set	DEV 1 Device Name	SHORT_STRING	varies		RMA PLUS
17	5	Get	DEV 1 Firmware Revision	SHORT_STRING	varies		M.mm.BB.bb
17	6	Get	TST 1 Tick	UDINT	varies		Tick (ms)

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x0E	No	Yes	No	Yes	Get_Attribute_Single
0x10	No	Yes	No	Yes	Set_Attribute_Single

TCP/IP Interface Object

Attributes

TCP/IP Interface Object (0xF5 - 1 Instance)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
0	1	Get	Revision	UINT	4		
0	2	Get	Max Instance	UINT	1		
0	3	Get	Number of Instances	UINT	1		
0	4	Get	Optional attribute list number of attributes optional attributes	STRUCT of: UINT ARRAY of UINT	0		
0	5	Get	Optional service list number services optional services	STRUCT of: UINT ARRAY of UINT	0		
0	6	Get	Maximum ID Number Class Attributes	UINT	7		
0	7	Get	Maximum ID Number Instance Attributes	UINT	13		
1	1	Get	Status	DWORD	1		
1	2	Get	Configuration Capability	DWORD	4		
1	3	Set	Configuration Control	DWORD			
1	4	Get	Physical Link Object Path size Path	STRUCT of: UINT Padded EPATH	2 0x20F6 0x2403		
1	5	Get	Interface Configuration IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name	STRUCT of: UDINT UDINT UDINT UDINT UDINT STRING	varies		
1	6	Get	Host Name	STRING	varies		Form: RMA-<SN>
1	13	Set	Encapsulation Inactivity Timeout	UINT	120		0 = Disable timeout 1 - 3600 = timeout in seconds

Services

Service Code	**EtherNet/IP**		**DeviceNet**		**Service Name**
	Class level	**Instance Level**	**Class level**	**Instance Level**	
0x01	No	Yes			Get_Attribute_All
0x0E	Yes	Yes			Get_Attribute_Single
0x10	No	Yes			Set_Attribute_Single

Ethernet Link Object

Attributes

Ethernet Link Object (0xF6 - 3 Instances)							
Instance ID	**Attribute ID**	**Access**	**Name**	**Data Type**	**EtherNet/IP**	**DeviceNet**	**Description**
0	1	Get	Revision	UINT	4		
0	2	Get	Max Instance	UINT	3		
0	3	Get	Number of Instances	UINT	3		
0	4	Get	Optional attribute list number of attributes optional attributes	STRUCT of: UINT ARRAY of UINT	0		
0	5	Get	Optional service list number services	STRUCT of: UINT	0		

			optional services	ARRAY of UINT			
0	6	Get	Maximum ID Number Class Attributes	UINT	7		
0	7	Get	Maximum ID Number Instance Attributes	UINT	11		
1	1	Get	Interface Speed	UDINT	varies		Speed in Mbps (0, 10, 100)
1	2	Get	Interface Flags	DWORD	varies		
1	3	Get	Physical Address	ARRAY of 6 USINTs	varies		00:03:AA:XX:XX:XX
1	10	Get	Interface Label	SHORT_STRING	1		
1	11	Get	Interface Capability Capability Bits Speed/Duplex Options Speed/Duplex Array Count Speed/Duplex Array Interface Sped Interface Duplex Mode	STRUCT of: DWORD STRUCT of: USINT ARRAY of STRUCT of: UINT USINT	 6 0 		
2	1	Get	Interface Speed	UDINT	varies		Speed in Mbps (0, 10, 100)
2	2	Get	Interface Flags	DWORD	varies		
2	3	Get	Physical Address	ARRAY of 6 USINTs	varies		00:03:AA:XX:XX:XX
2	10	Get	Interface Label	SHORT_STRING	2		
2	11	Get	Interface Capability Capability Bits Speed/Duplex Options Speed/Duplex Array Count Speed/Duplex Array Interface Sped Interface Duplex Mode	STRUCT of: DWORD STRUCT of: USINT ARRAY of STRUCT of: UINT USINT	 6 0 		
3	1	Get	Interface Speed	UDINT	100		Speed in Mbps (0, 10, 100)
3	2	Get	Interface Flags	DWORD	varies		
3	3	Get	Physical Address	ARRAY of 6 USINTs	varies		00:03:AA:XX:XX:XX
3	10	Get	Interface Label	SHORT_STRING	Internal		
3	11	Get	Interface Capability Capability Bits Speed/Duplex Options Speed/Duplex Array Count Speed/Duplex Array Interface Sped Interface Duplex Mode	STRUCT of: DWORD STRUCT of: USINT ARRAY of STRUCT of: UINT USINT	 6 0 		

Services

Service Code	EtherNet/IP		DeviceNet		Service Name
	Class level	Instance Level	Class level	Instance Level	
0x01	No	Yes			Get_Attribute_All
0x0E	Yes	Yes			Get_Attribute_Single

Gateway Configuration File

The Vendor Specific CIP™ object model is user-defined. A sample file (shown below) exists in the path defined by the keys EtherNetIP, DeviceNet. Add records to these files as necessary keeping the following in mind:

- The CIP Class ID, Instance ID, Attribute ID, and Implicit columns are user-defined
  - Class ID: UINT8 (100 - 199)
  - Instance ID: UINT8 (1 - 255)

- Attribute ID: UINT8 (1 - 255)
- Implicit: STRING ('P','C','B') where…
  - C = Consumed (O->T) implicit attribute
  - P = Produced (T->O) implicit attribute
  - B = Both produced and consumed implicit attribute
  - <Empty> = Explicit attribute

- Records must be sorted in ascending order by C, I, A (Column A, B, C).
- The order in which implicit attributes are defined is the order they appear in the image.
- Implicit data is packed / aligned to a byte boundary.
- Duplicates entries (for backside bus) are OK.
- The file may contain a maximum of 2000 valid records.
- There is currently a maximum of 500 unique data points per Watbus bus and zone.
- An exception will be returned for attributes not defined in this file.
- Implicit records targeting Watbus members must be valid and accessible at the time the file is loaded in order to determine assembly sizes.

Class ID	Instance ID	Attribute ID	Implicit	Bus	Segment	Zone	Class	Instance	Member	Refresh Count	
100	1	1	C	1	0	0	2	1	3	0	VAR 1 Analog
100	1	2	C	1	0	0	2	2	3	0	VAR 2 Analog
100	1	3	C	1	0	0	2	3	3	0	VAR 3 Analog
100	1	4	C	1	0	0	2	4	3	0	VAR 4 Analog
101	1	1	P	1	0	0	100	1	4	0	CDAT 1 Source 01 Value
101	1	2	P	1	0	0	100	1	9	0	CDAT 1 Source 02 Value
101	1	3	P	1	0	0	100	1	14	0	CDAT 1 Source 03 Value
101	1	4	P	1	0	0	100	1	19	0	CDAT 1 Source 04 Value
101	1	5	P	1	0	0	100	1	5	0	CDAT 1 Source 01 Error
101	1	6	P	1	0	0	100	1	10	0	CDAT 1 Source 02 Error
101	1	7	P	1	0	0	100	1	15	0	CDAT 1 Source 03 Error
101	1	8	P	1	0	0	100	1	20	0	CDAT 1 Source 04 Error
110	17	1		1	0	0	1	1	1	250	DEV 1 Hardware ID
110	17	2		1	0	0	1	1	7	250	DEV 1 Serial Number
110	17	3		1	0	0	1	1	9	250	DEV 1 Model Number
110	17	4		1	0	0	1	1	11	250	DEV 1 Device Name
110	17	5		1	0	0	1	1	17	250	DEV 1 Firmware Revision
110	17	6		1	0	0	16	1	6	0	TST 1 Tick

Figure 52 - EtherNetIP.csv default configuration

This results in an O->T size of 16 bytes , T->O size of 24 bytes. This allows the user to produce and consume four values to / from the connected HSWB system.

Assemblies

Default implicit assemblies defined by the vendor specific object model above:

O->T Static (100)								
	Bits	Data Type	Zone	Class	Instance	Member	Member Description	Notes
	32	FLOAT	0	2	1	3	VAR 1 Analog	-99999 to +99999
	32	FLOAT	0	2	2	3	VAR 2 Analog	-99999 to +99999
	32	FLOAT	0	2	3	3	VAR 3 Analog	-99999 to +99999

	32	FLOAT	0	2	4	3	VAR 4 Analog	-99999 to +99999
Size(Bits)	128							
Size (Bytes)	16							

T->O Static (101)								
	Bits	**Data Type**	**Zone**	**Class**	**Instance**	**Member**	**Member Description**	**Notes**
	32	FLOAT	0	100	1	4	CDAT 1 Source 01 Value	
	32	FLOAT	0	100	1	9	CDAT 1 Source 02 Value	
	32	FLOAT	0	100	1	14	CDAT 1 Source 03 Value	
	32	FLOAT	0	100	1	19	CDAT 1 Source 04 Value	
	16	ENUM16	0	100	1	5	CDAT 1 Source 01 Error	9: Ambient Error 32: Fail 61: None 65: Open 127: Shorted 139: Bad Calibration Data 140: Measurement Error 141: RTD Error 246: Not Sourced 1423: Math Error 1617: Stale
	16	ENUM16	0	100	1	10	CDAT 1 Source 01 Error	"
	16	ENUM16	0	100	1	15	CDAT 1 Source 01 Error	"
	16	ENUM16	0	100	1	20	CDAT 1 Source 01 Error	"
Size(Bits)	192							
Size (Bytes)	24							

EDS Files

The EDS files are located in the Documentation folder of the micro SD card that ships with the product. You may access them from any of the following locations:

- http://watlowsemi.com/
- EtherNet/IP™: sd:\Documentation\RMAP-X3XX-XXXX.eds, File Object
- DeviceNet™: sd:\Documentation\RMAP-5XXX-XXXX.eds

Device Status

Device status elements have been added for each gateway bus (Watbus, Modbus RTU) to monitor device status from a field bus. Each bit represents a gateway device where 1 = Online, 0 = Offline.

In the case of Watbus, this is an array of 32-bit integers where each bit represents the status of the physical address on the bus.

Example 1: SBS 1 Device Status[0] = 0x0000 0400 = LSWB physical address 10

Example 2: SBS 2 Device Status[0] = 0x0001 800F = HSWB physical address 0 - 3, 15, 16

In the case of Modbus RTU, this is an array of 32-bit integers where each bit represents the status of the slave address on the bus.

Example 1: MBS 7 Device Status[0] = 0x8000 0001 = Slave address 1, 32

Example 2: MBS 7 Device Status[1] = 0x0000 0010 = Slave address 37

Example 3: MBS 7 Device Status[7] = 0x0040 0000 = Slave address 247

See Standard Bus and Modbus objects.

Produced Status

New producers were added to the Compare objects to give system devices the ability to react to field bus network events. Field bus protocols that are connected in nature have new producers.

See Ethernet, DeviceNet, and Compare objects.

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 pre-maturely wearing out NV memory due to constant writes. However, this also implies that the user must wait at least three seconds before resetting the RMA PLUS to prevent losing recent changes.

It is also important to note that since the protected volume (described above) and customer volume exist on the same device, changes cannot be saved to non-volatile memory if the user has the NOR FLASH drive mounted (locked).

Key		
Access	R	Read-only
Access	RW	Read-write
NV		Volatile
NV	B	Stored in battery-backed RAM
NV	F	Stored in flash

Standard Objects

The RMA PLUS implements the following software objects. Conditional objects and / or instances are highlighted in yellow.

Class ID			Qty	Comment
1	0x01	Device	2	If RMAP-(5,8)XXX-XXXX
2	0x02	Variable	20	
3	0x03	Display	1	
4	0x04	Analog Input	4	If RMAP-8XXX-XXXX
12	0x0C	Limit	4	If RMAP-8XXX-XXXX
14	0x0E	Custom Setup	2	
16	0x10	Test	1	
19	0x13	Assembly Setup	2	
20	0x14	Assembly	2	
25	0x19	Math	20	
26	0x1A	Process Value	4	If RMAP-8XXX-XXXX
27	0x1B	Logic	20	
28	0x1C	Compare	20	
36	0x24	Real Time Clock	1	
45	0x2D	LED	4	If NOT RMAP-X3XX-XXXX
68	0x44	Standard Bus	2	

69	0x45	Modbus	2	If RMAP-2XXX-XXXX
70	0x46	Ethernet	1	
71	0x47	DeviceNet	1	If RMAP-5XXX-XXXX
74	0x4A	Alarm 2	10	
75	0x4B	Control Loop 2	4	If RMAP-8XXX-XXXX
100	0x64	Consumer Data	16	
101	0x65	Module Limit	1	If RMAP-8XXX-XXXX
102	0x66	Volume	3	
210	0xD2	Optic Sensing	4	If RMAP-8XXX-XXXX
211	0xD3	Calibration	4	If RMAP-8XXX-XXXX

Figure 53 - Standard objects

New objects and deviations from standard EZ-ZONE objects are documented below. Standard EZ-ZONE object documentation may be found in the user manuals for the EZ-ZONE RM family or the EZ-ZONE COMPOSER® software.

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 the following objects: Assembly, Calibration, Standard Bus, DeviceNet, Ethernet, Modbus, and Real Time Clock. Choose the "Communications" option to include the above objects (default level 1).

Choose "Custom" to apply factory and / or user-defined custom defaults. This operation is automatically appended to the end of the "Factory" and "Communication" options.

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

Device member 51, "Re-Config," 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 180: Custom 10172: Configuration
47	0x2F	Hash Code	UINT32	RW		0	4,294,967,295		0x00525354 – Issue a soft reset (5 sec) Other: Consult factory
50	0x32	Command	STRING	RW				""	**""** - Empty String **"reset"** - Issue a soft reset (5 sec)
51	0x33	Resend Configuration	ENUM16	RW				59	59: No 106: Yes

Compare

Additional sources were added to the standard compare object to allow the user to build logic around the field communication status and make it available for the entire system.

Compare 28 (0x1C), Instances 1-20								
Member ID	**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**

1	0x01	Source Function A	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 179: Current Read 1697: Wattage 1699: Load Voltage 1183: Load Resistance 2401: Watbus Explicit Count 2402: Modbus TCP Explicit Count 2403: EtherNet/IP Explicit Count 2404: EtherNet/IP Implicit State 2405: DeviceNet Explicit Count 2406: DeviceNet Implicit State
2	0x02	Source Function B	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 179: Current Read 1697: Wattage 1699: Load Voltage 1183: Load Resistance 2401: Watbus Explicit Count 2402: Modbus TCP Explicit Count 2403: EtherNet/IP Explicit Count 2404: EtherNet/IP Implicit State 2405: DeviceNet Explicit Count 2406: DeviceNet Implicit State

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.

- The RMA PLUS produces its timestamp for other HSWB system devices that do not have an RTC or battery.
- The RMA PLUS may optionally consume a timestamp from another RTC in the HSWB system.

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, January 1, 2000 (TZ = UTC±00:00)
20	0x14	Time Zone Offset (min)	UINT8	RW	F	0	59	0	Only: 0, 15, 30, 45
21	0x15	Battery Voltage (V)	FLOAT	R		1.65	3.6		
22	0x16	Timestamp Source	ENUM16	RW	F			61	61: None 2145: Timestamp
23	0x17	Timestamp Source Instance	UINT8	RW	F	1	250	1	
24	0x18	Timestamp Source Zone	UINT8	RW	F	0	24	0	
25	0x19	Timestamp Source Value	UINT32	R		0	4,294,967,295		
26	0x1A	Timestamp 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
27	0x1B	Sync Now	ENUM16	RW				59	59: No 106: Yes

LED

This feature is only available if the model number is **NOT** RMAP-X3XX-XXXX. For EtherNet/IP™, the LEDs are assigned a fixed function per agency requirements.

The LED object is new with the RMA PLUS. 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 USBD MSC drive. This may be changed to suit the application.

Functions

1. **Off**: The LED will be OFF.

2. **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 high-speed Watbus system. NOTE: Analog values are a percentage. Anything greater than 100 will be full ON.
3. **C**: Choose a color for the LED. It will be ON if the display units are °C, OFF otherwise.
4. **F**: Choose a color for the LED. It will be ON if the display units are °F, OFF otherwise.
5. **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.
6. **MICRO SD**: Indicates the state of LUN 0 (see state table below).
7. **NOR FLASH**: Indicates the state of LUN 1 (see state table below).
8. **RAM DISK**: Indicates the state of LUN 2 (see state table below).

USBD MSC 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 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
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	99999.0	0.0	
13	0x0D	Color 1	ENUM16	RW	F			62	62: Off 1718: Red 1719: Green 1720: Yellow 1721: Flashing Red 1722: Flashing Green 1723: Flashing Yellow 204: Ignore
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

Standard Bus

Standard Bus 68 (0x44), Instance 1: (Low-Speed Watbus)								
Member ID	**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**

1	0x01	Units	ENUM16	RW	F			15	30: °F 15: °C
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
7	0x07	Device Status	UINT32	R					Physical Address 0 - 31
8	0x08	Device Status	UINT32	R					Physical Address 32

Standard Bus 68 (0x44), Instance 2: (High-Speed Watbus)									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
1	0x01	Units	ENUM16	RW	F			15	30: °F 15: °C
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
7	0x07	Device Status	UINT32	R					Physical Address 0 - 16
8	0x08	Device Status	UINT32	R					N/A

Modbus

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

Modbus 69 (0x45), Instances 6,7									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
3	0x03	Baud Rate	UINT32	RW	F	1	65535	19200	Typical: 9600, 19200, 38400
4	0x04	Parity	ENUM16	RW	F			61	61: None 191: Even 192: Odd
5	0x05	Address	UINT8	RW	F	1	247	1	
7	0x07	Modbus Word Order	ENUM16	RW	F			1331	1331: Low High 1330: High Low
9	0x09	RS-485 Master / Slave	ENUM16	RW	F			1278	1277: Master 1278: Slave
10	0x0A	Device Status	UINT32	R					Slave Address 1 - 32
11	0x0B	Device Status	UINT32	R					Slave Address 33 - 64
12	0x0C	Device Status	UINT32	R					Slave Address 65 - 96
13	0x0D	Device Status	UINT32	R					Slave Address 97 - 128
14	0x0E	Device Status	UINT32	R					Slave Address 129 - 160
15	0x0F	Device Status	UINT32	R					Slave Address 161 - 192
16	0x10	Device Status	UINT32	R					Slave Address 193 - 224
17	0x11	Device Status	UINT32	R					Slave Address 225 - 247
18	0x12	RX Count	UINT32	R					Frames received
19	0x13	TX Count	UINT32	R					Frames transmitted
20	0x14	Timeout Count	UINT32	R					Master request timeouts
21	0x15	Exception Count	UINT32	R					Exception responses
22	0x16	Last Error Address	UINT8	R					Address that returned the last exception response
23	0x17	Last Error Function Code	UINT8	R					Function Code of last exception response
24	0x18	Last Error Exception Code	UINT8	R					Exception Code of last exception response
25	0x19	Response Timeout (ms)	UINT16	RW	F	1	60,000	100	Response Timeout (ms)
26	0x1A	Inter-Frame Delay (ms)	UINT16	RW	F	S: t3.5 M: 10	60,000	2	Inter-Frame Delay (ms)

Ethernet

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
5	0x05	EtherNet/IP Enable	ENUM16	RW	F			106 (RMAP-X3XX-XXXX)	59: No 106: Yes
7	0x07	Watbus Enable	ENUM16	RW	F			106	59: No 106: Yes
8	0x08	HTTP Server Enable	ENUM16	RW	F			106	59: No 106: Yes
9	0x09	TFTP Server Enable	ENUM16	RW	F			106	59: No 106: Yes
10	0x0A	Telnet Server Enable	ENUM16	RW	F			106	59: No 106: Yes
11	0x0B	MQTT Client Enable	ENUM16	RW	F			59	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 32: Fail
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"	
52	0x34	IP Version	ENUM16	R				1279	1279: IP Version 4 1280: IP Version 6
54	0x36	Remote IP Address	STRING	RW	F			“0.0.0.0”	Remote IP address (i.e. TFTP server)
55	0x37	Static IP Address String	STRING	RW	F			"192.168.0.100"	
56	0x38	Static 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"	
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
60	0x3C	Watbus Explicit Count	UINT8	R		0	3		Explicit Watbus connection count
61	0x3D	Modbus TCP Explicit Count	UINT8	R		0	3		Explicit Modbus TCP connection count
62	0x3E	EtherNet/IP Explicit Count	UINT8	R		0	3		Explicit EtherNet/IP connection count
63	0x3F	EtherNet/IP Implicit State	UINT8	R		0	2		0: Offline 1: Online, Idle 2: Online, Run
64	0x40	CIP O->T Assembly Instance ID	UINT16	R		100	199	100	
65	0x41	CIP T->O Assembly Instance ID	UINT16	R		100	199	101	
66	0x42	CIP O->T Assembly Size (Bytes)	UINT16	R		0	65535		
67	0x43	CIP T->O Assembly Size (Bytes)	UINT16	R		0	65535		
68	0x44	EtherNet/IP Encapsulation Inactivity Timeout	UINT16	RW	F	0	3600	120	Number of seconds of inactivity before TCP connection is closed. 0: Disabled
69	0x45	SNTP Server	String	RW	F			""	**""** - Empty String
70	0x46	Host Name	String	RW	F	0	15	"RMA-<SN>"	

DeviceNet

This feature is only available if the model number is RMAP-**5**XXX-XXXX.

DeviceNet 71 (0x47), Instance 1									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
3	0x03	DeviceNet Node Address	UINT8	RW	F	0	63	63	MAC ID (programmable)
4	0x04	DeviceNet Baud Rate	ENUM16	RW	F			1351	Baud rate (programmable) 1351: 125K 1352: 250K 1353: 500K
7	0x07	CIP O->T Assembly Instance ID	UINT16	R		100	199	100	
8	0x08	CIP T->O Assembly Instance ID	UINT16	R		100	199	101	
9	0x09	CIP O->T Assembly Size (Bytes)	UINT16	R		0	65535		
10	0x0A	CIP T->O Assembly Size (Bytes)	UINT16	R		0	65535		
11	0x0B	DeviceNet Node Address	UINT8	R		0	99	63	MAC ID switch value 64-99: Programmable
12	0x0C	DeviceNet Node Address	UINT8	R		0	9	6	MAC ID MSD switch value
13	0x0D	DeviceNet Node Address	UINT8	R		0	9	3	MAC ID LSD switch value
14	0x0E	DeviceNet Baud Rate	UINT8	R		0	3	2	Baud rate switch value 0: 125 Kbps 1: 250 Kbps 2: 500 Kbps 3: Programmable
15	0x0F	Bus Power Present	ENUM16	R					59: No 106: Yes
20	0x14	DeviceNet Explicit Count	UINT8	R		0	1		Explicit connection count
21	0x15	DeviceNet Implicit State	UINT8	R		0	2		0: Offline 1: Online, Idle 2: Online, Run

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.

Alarm 2 74 (0x4A)									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Type	ENUM16	RW	F			62	62: Off 76: Process Alarm 24: Deviation Alarm 70: Deviation Percent

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 Watbus access.

There are five members per source. Only the first five are shown below.

Consumer Data 100 (0x64)									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	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 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

Module Limit

This feature is only available if the model number is RMAP-**8**XXX-XXXX.

Module limit is a new object. It produces an output that is the logical AND of all limit objects native to this module that have defined sources. This output can be consumed by any source configured for "Module Limit." For example, an output object in an EZ-ZONE RME could be configured to consume the produced Module Limit signal and open a relay if any limit in the RMA PLUS trips.

Module Limit 101 (0x65), Instance 1									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
1	0x01	GUI Location X	UINT16	RW	F	0	65535	0	Object X location on GUI canvas
2	0x02	GUI Location Y	UINT16	RW	F	0	65535	0	Object Y location on GUI canvas
3	0x03	Name	STRING	RW	F	0	20	""	Object name
4	0x04	Clear Request	ENUM16	RW				204	204: Ignore 129: Clear
10	0x0A	Output Value	ENUM16	R					62: Off 63: On
11	0x0B	Output Error	ENUM16	R					61: None
50	0x32	Reset Source	ENUM16	RW	F			61	61: None 1142: Digital I/O 1001: Function Key 245: Variable
51	0x33	Reset Source Instance	UINT8	RW	F	1	250	1	
52	0x34	Reset Source Zone	UINT8	RW	F	0	24	0	
53	0x35	Reset Source Value	ENUM16	R					62: Off 63: On
54	0x36	Reset 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
55	0x37	Reset Source Active Level	ENUM16	RW	F			37	53: Low 37: High

Volume

Volume is a new object. It 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
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

Optic Sensing

This feature is only available if the model number is RMAP-**8**XXX-XXXX.

Optic sensing objects are used to configure and report status of the inputs in an adjacent fiber optic module.

Optic Sensing 210 (0xD2), Instances 1-4									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Temperature	FLOAT	R					
2	0x02	Status	UINT16	R		0	7		**1: Probe connected, no fault conditions** 2: Probe disconnected, Probe recovery mode 3: Probe connected, Max LED current 4: Probe connected, low light level 6: No signal, possible LED Failure **7: LED current above warning alarm**
3	0x03	LED Current (mA)	FLOAT	R		0	20		
4	0x04	LED Counts	UINT16	R					
5	0x05	Decay Time (µs)	FLOAT	R					
8	0x08	Probe Type	UINT8	RW	F	1	4	1	Class variable
9	0x09	PCB Temperature	FLOAT	R					
10	0x0A	LED Warning Point (mA)	FLOAT	RW	F	0	20	15	Class variable

The Analog Input class provides another view into this class with some additional configuration documented below:

Analog Input 4 (0x04), Instances 1-4									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Process Value							Same as C,M = { 0xD2, 0x01 }
2	0x02	Error Status	ENUM16	R					61: None 65: Open
4	0x04	Ambient Temperature							Same as C,M = { 0xD2, 0x09 }
5	0x05	Input Type							Same as C,M = { 0xD2, 0x08 }
12	0x0C	User Offset							Same as C,M = { 0xD3, 0x53 }
13	0x0D	User Gain							Same as C,M = { 0xD3, 0x52 }
14	0x0E	Filter Time (s)	FLOAT	RW	F	0	60	0	
19	0x13	Counts							Same as C,M = { 0xD2, 0x04 }
20	0x14	Display Precision	ENUM16	RW	F			94	105: Whole 94: Tenths 40: Hundredths 96: Thousandths
21	0x15	Electrical Measurement							Same as C,M = { 0xD2, 0x03 }
22	0x16	Filtered Process Value	FLOAT	R					Process value after filtering (produced)
42	0x2A	Units	ENUM16	RW	F			1540	61: None 1540: Absolute Temperature
45	0x2D	GUI Location X	UINT16	RW	F			0	Object X location on GUI canvas
46	0x2E	GUI Location Y	UINT16	RW	F			0	Object Y location on GUI canvas
48	0x30	Name	STRING	RW	F	0	20	""	Object name

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-**8**XXX-XXXX. These members are used to calibrate the RTC 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

Instances 1 through 4 are available if the model number is RMAP-**8**XXX-XXXX. The following members hold the calibration tables for the various probe types and calibration for the probes themselves.

Calibration 211 (0xD3), Instance 1: OSENSA Table, Input 1									
Member ID		Member Name	Data Type	Access	NV	Min	Max	Default	Comments / Description
1	0x01	Temperature 1	FLOAT	RW	F	-3.40E+38	3.40E+38	139.9854	Temperature (°C)
2	0x02	Temperature 2	FLOAT	RW	F	-3.40E+38	3.40E+38	134.945	Temperature (°C)
3	0x03	Temperature 3	FLOAT	RW	F	-3.40E+38	3.40E+38	124.9712	Temperature (°C)
4	0x04	Temperature 4	FLOAT	RW	F	-3.40E+38	3.40E+38	114.9642	Temperature (°C)
5	0x05	Temperature 5	FLOAT	RW	F	-3.40E+38	3.40E+38	104.943	Temperature (°C)
6	0x06	Temperature 6	FLOAT	RW	F	-3.40E+38	3.40E+38	94.95615	Temperature (°C)
7	0x07	Temperature 7	FLOAT	RW	F	-3.40E+38	3.40E+38	84.95515	Temperature (°C)
8	0x08	Temperature 8	FLOAT	RW	F	-3.40E+38	3.40E+38	74.95615	Temperature (°C)
9	0x09	Temperature 9	FLOAT	RW	F	-3.40E+38	3.40E+38	64.86	Temperature (°C)
10	0x0A	Temperature 10	FLOAT	RW	F	-3.40E+38	3.40E+38	54.96415	Temperature (°C)
11	0x0B	Temperature 11	FLOAT	RW	F	-3.40E+38	3.40E+38	44.97115	Temperature (°C)
12	0x0C	Temperature 12	FLOAT	RW	F	-3.40E+38	3.40E+38	34.98015	Temperature (°C)

13	0x0D	Temperature 13	FLOAT	RW	F	-3.40E+38	3.40E+38	24.953	Temperature (°C)
14	0x0E	Temperature 14	FLOAT	RW	F	-3.40E+38	3.40E+38	15.00415	Temperature (°C)
15	0x0F	Temperature 15	FLOAT	RW	F	-3.40E+38	3.40E+38	5.01915	Temperature (°C)
16	0x10	Temperature 16	FLOAT	RW	F	-3.40E+38	3.40E+38	-4.96385	Temperature (°C)
17	0x11	Temperature 17	FLOAT	RW	F	-3.40E+38	3.40E+38	-14.9449	Temperature (°C)
18	0x12	Temperature 18	FLOAT	RW	F	-3.40E+38	3.40E+38	-24.939	Temperature (°C)
19	0x13	Temperature 19	FLOAT	RW	F	-3.40E+38	3.40E+38	-34.944	Temperature (°C)
20	0x14	Temperature 20	FLOAT	RW	F	-3.40E+38	3.40E+38	-44.966	Temperature (°C)
21	0x15	Temperature 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
22	0x16	Temperature 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
23	0x17	Temperature 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
24	0x18	Temperature 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
25	0x19	Temperature 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
26	0x1A	Temperature 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
27	0x1B	Temperature 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
28	0x1C	Temperature 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
29	0x1D	Temperature 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
30	0x1E	Temperature 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
31	0x1F	Decay Time 1	FLOAT	RW	F	-3.40E+38	3.40E+38	2522.478255	Decay Time (µs)
32	0x20	Decay Time 2	FLOAT	RW	F	-3.40E+38	3.40E+38	2555.046119	Decay Time (µs)
33	0x21	Decay Time 3	FLOAT	RW	F	-3.40E+38	3.40E+38	2620.524263	Decay Time (µs)
34	0x22	Decay Time 4	FLOAT	RW	F	-3.40E+38	3.40E+38	2689.404827	Decay Time (µs)
35	0x23	Decay Time 5	FLOAT	RW	F	-3.40E+38	3.40E+38	2758.863831	Decay Time (µs)
36	0x24	Decay Time 6	FLOAT	RW	F	-3.40E+38	3.40E+38	2831.251857	Decay Time (µs)
37	0x25	Decay Time 7	FLOAT	RW	F	-3.40E+38	3.40E+38	2905.76145	Decay Time (µs)
38	0x26	Decay Time 8	FLOAT	RW	F	-3.40E+38	3.40E+38	2982.52442	Decay Time (µs)
39	0x27	Decay Time 9	FLOAT	RW	F	-3.40E+38	3.40E+38	3061.368555	Decay Time (µs)
40	0x28	Decay Time 10	FLOAT	RW	F	-3.40E+38	3.40E+38	3142.518489	Decay Time (µs)
41	0x29	Decay Time 11	FLOAT	RW	F	-3.40E+38	3.40E+38	3226.397099	Decay Time (µs)
42	0x2A	Decay Time 12	FLOAT	RW	F	-3.40E+38	3.40E+38	3312.109364	Decay Time (µs)
43	0x2B	Decay Time 13	FLOAT	RW	F	-3.40E+38	3.40E+38	3400.41518	Decay Time (µs)
44	0x2C	Decay Time 14	FLOAT	RW	F	-3.40E+38	3.40E+38	3490.374584	Decay Time (µs)
45	0x2D	Decay Time 15	FLOAT	RW	F	-3.40E+38	3.40E+38	3583.29417	Decay Time (µs)
46	0x2E	Decay Time 16	FLOAT	RW	F	-3.40E+38	3.40E+38	3677.436267	Decay Time (µs)
47	0x2F	Decay Time 17	FLOAT	RW	F	-3.40E+38	3.40E+38	3773.42605	Decay Time (µs)
48	0x30	Decay Time 18	FLOAT	RW	F	-3.40E+38	3.40E+38	3872.442094	Decay Time (µs)
49	0x31	Decay Time 19	FLOAT	RW	F	-3.40E+38	3.40E+38	3972.498088	Decay Time (µs)
50	0x32	Decay Time 20	FLOAT	RW	F	-3.40E+38	3.40E+38	4075.384281	Decay Time (µs)
51	0x33	Decay Time 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
52	0x34	Decay Time 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
53	0x35	Decay Time 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
54	0x36	Decay Time 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
55	0x37	Decay Time 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
56	0x38	Decay Time 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
57	0x39	Decay Time 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
58	0x3A	Decay Time 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
59	0x3B	Decay Time 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
60	0x3C	Decay Time 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
80	0x50	Factory Gain	FLOAT	R	F	-3.40E+38	3.40E+38	1.0	
81	0x51	Factory Offset	FLOAT	R	F	-3.40E+38	3.40E+38	0.0	
82	0x52	User Gain	FLOAT	RW	F	-3.40E+38	3.40E+38	1.0	
83	0x53	User Offset	FLOAT	RW	F	-3.40E+38	3.40E+38	0.0	

Calibration 211 (0xD3), Instance 2: Photon Table, Input 2									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
1	0x01	Temperature 1	FLOAT	RW	F	-3.40E+38	3.40E+38	140.1712909	Temperature (°C)
2	0x02	Temperature 2	FLOAT	RW	F	-3.40E+38	3.40E+38	120.1692909	Temperature (°C)
3	0x03	Temperature 3	FLOAT	RW	F	-3.40E+38	3.40E+38	110.2762909	Temperature (°C)

4	0x04	Temperature 4	FLOAT	RW	F	-3.40E+38	3.40E+38	100.1792909	Temperature (°C)
5	0x05	Temperature 5	FLOAT	RW	F	-3.40E+38	3.40E+38	90.2762909	Temperature (°C)
6	0x06	Temperature 6	FLOAT	RW	F	-3.40E+38	3.40E+38	80.2762909	Temperature (°C)
7	0x07	Temperature 7	FLOAT	RW	F	-3.40E+38	3.40E+38	70.2762909	Temperature (°C)
8	0x08	Temperature 8	FLOAT	RW	F	-3.40E+38	3.40E+38	60.2762909	Temperature (°C)
9	0x09	Temperature 9	FLOAT	RW	F	-3.40E+38	3.40E+38	50.2122909	Temperature (°C)
10	0x0A	Temperature 10	FLOAT	RW	F	-3.40E+38	3.40E+38	40.2762909	Temperature (°C)
11	0x0B	Temperature 11	FLOAT	RW	F	-3.40E+38	3.40E+38	30.2762909	Temperature (°C)
12	0x0C	Temperature 12	FLOAT	RW	F	-3.40E+38	3.40E+38	20.2762909	Temperature (°C)
13	0x0D	Temperature 13	FLOAT	RW	F	-3.40E+38	3.40E+38	10.2762909	Temperature (°C)
14	0x0E	Temperature 14	FLOAT	RW	F	-3.40E+38	3.40E+38	0.2872909	Temperature (°C)
15	0x0F	Temperature 15	FLOAT	RW	F	-3.40E+38	3.40E+38	-9.7037091	Temperature (°C)
16	0x10	Temperature 16	FLOAT	RW	F	-3.40E+38	3.40E+38	-39.6817091	Temperature (°C)
17	0x11	Temperature 17	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
18	0x12	Temperature 18	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
19	0x13	Temperature 19	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
20	0x14	Temperature 20	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
21	0x15	Temperature 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
22	0x16	Temperature 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
23	0x17	Temperature 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
24	0x18	Temperature 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
25	0x19	Temperature 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
26	0x1A	Temperature 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
27	0x1B	Temperature 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
28	0x1C	Temperature 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
29	0x1D	Temperature 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
30	0x1E	Temperature 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
31	0x1F	Decay Time 1	FLOAT	RW	F	-3.40E+38	3.40E+38	2611.285	Decay Time (µs)
32	0x20	Decay Time 2	FLOAT	RW	F	-3.40E+38	3.40E+38	2746.356	Decay Time (µs)
33	0x21	Decay Time 3	FLOAT	RW	F	-3.40E+38	3.40E+38	2817.418	Decay Time (µs)
34	0x22	Decay Time 4	FLOAT	RW	F	-3.40E+38	3.40E+38	2890.094	Decay Time (µs)
35	0x23	Decay Time 5	FLOAT	RW	F	-3.40E+38	3.40E+38	2965.334	Decay Time (µs)
36	0x24	Decay Time 6	FLOAT	RW	F	-3.40E+38	3.40E+38	3042.530	Decay Time (µs)
37	0x25	Decay Time 7	FLOAT	RW	F	-3.40E+38	3.40E+38	3122.200	Decay Time (µs)
38	0x26	Decay Time 8	FLOAT	RW	F	-3.40E+38	3.40E+38	3204.055	Decay Time (µs)
39	0x27	Decay Time 9	FLOAT	RW	F	-3.40E+38	3.40E+38	3289.377	Decay Time (µs)
40	0x28	Decay Time 10	FLOAT	RW	F	-3.40E+38	3.40E+38	3376.391	Decay Time (µs)
41	0x29	Decay Time 11	FLOAT	RW	F	-3.40E+38	3.40E+38	3466.227	Decay Time (µs)
42	0x2A	Decay Time 12	FLOAT	RW	F	-3.40E+38	3.40E+38	3558.145	Decay Time (µs)
43	0x2B	Decay Time 13	FLOAT	RW	F	-3.40E+38	3.40E+38	3652.485	Decay Time (µs)
44	0x2C	Decay Time 14	FLOAT	RW	F	-3.40E+38	3.40E+38	3748.929	Decay Time (µs)
45	0x2D	Decay Time 15	FLOAT	RW	F	-3.40E+38	3.40E+38	3846.881	Decay Time (µs)
46	0x2E	Decay Time 16	FLOAT	RW	F	-3.40E+38	3.40E+38	4155.914	Decay Time (µs)
47	0x2F	Decay Time 17	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
48	0x30	Decay Time 18	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
49	0x31	Decay Time 19	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
50	0x32	Decay Time 20	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
51	0x33	Decay Time 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
52	0x34	Decay Time 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
53	0x35	Decay Time 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
54	0x36	Decay Time 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
55	0x37	Decay Time 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
56	0x38	Decay Time 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
57	0x39	Decay Time 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
58	0x3A	Decay Time 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
59	0x3B	Decay Time 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
60	0x3C	Decay Time 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
80	0x50	Factory Gain	FLOAT	R	F	-3.40E+38	3.40E+38	1.0	
81	0x51	Factory Offset	FLOAT	R	F	-3.40E+38	3.40E+38	0.0	

82	0x52	User Gain	FLOAT	RW	F	-3.40E+38	3.40E+38	1.0	
83	0x53	User Offset	FLOAT	RW	F	-3.40E+38	3.40E+38	0.0	

Calibration 211 (0xD3), Instance 3: Watlow 300 °C Table, Input 3									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
1	0x01	Temperature 1	FLOAT	RW	F	-3.40E+38	3.40E+38	300.0	Temperature (°C)
2	0x02	Temperature 2	FLOAT	RW	F	-3.40E+38	3.40E+38	275.0	Temperature (°C)
3	0x03	Temperature 3	FLOAT	RW	F	-3.40E+38	3.40E+38	250.0	Temperature (°C)
4	0x04	Temperature 4	FLOAT	RW	F	-3.40E+38	3.40E+38	225.0	Temperature (°C)
5	0x05	Temperature 5	FLOAT	RW	F	-3.40E+38	3.40E+38	200.0	Temperature (°C)
6	0x06	Temperature 6	FLOAT	RW	F	-3.40E+38	3.40E+38	175.0	Temperature (°C)
7	0x07	Temperature 7	FLOAT	RW	F	-3.40E+38	3.40E+38	150.0	Temperature (°C)
8	0x08	Temperature 8	FLOAT	RW	F	-3.40E+38	3.40E+38	125.0	Temperature (°C)
9	0x09	Temperature 9	FLOAT	RW	F	-3.40E+38	3.40E+38	100.0	Temperature (°C)
10	0x0A	Temperature 10	FLOAT	RW	F	-3.40E+38	3.40E+38	75.0	Temperature (°C)
11	0x0B	Temperature 11	FLOAT	RW	F	-3.40E+38	3.40E+38	50.0	Temperature (°C)
12	0x0C	Temperature 12	FLOAT	RW	F	-3.40E+38	3.40E+38	25.0	Temperature (°C)
13	0x0D	Temperature 13	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
14	0x0E	Temperature 14	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
15	0x0F	Temperature 15	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
16	0x10	Temperature 16	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
17	0x11	Temperature 17	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
18	0x12	Temperature 18	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
19	0x13	Temperature 19	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
20	0x14	Temperature 20	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
21	0x15	Temperature 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
22	0x16	Temperature 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
23	0x17	Temperature 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
24	0x18	Temperature 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
25	0x19	Temperature 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
26	0x1A	Temperature 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
27	0x1B	Temperature 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
28	0x1C	Temperature 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
29	0x1D	Temperature 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
30	0x1E	Temperature 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
31	0x1F	Decay Time 1	FLOAT	RW	F	-3.40E+38	3.40E+38	1661.20	Decay Time (µs)
32	0x20	Decay Time 2	FLOAT	RW	F	-3.40E+38	3.40E+38	1777.97	Decay Time (µs)
33	0x21	Decay Time 3	FLOAT	RW	F	-3.40E+38	3.40E+38	1894.71	Decay Time (µs)
34	0x22	Decay Time 4	FLOAT	RW	F	-3.40E+38	3.40E+38	2017.20	Decay Time (µs)
35	0x23	Decay Time 5	FLOAT	RW	F	-3.40E+38	3.40E+38	2146.94	Decay Time (µs)
36	0x24	Decay Time 6	FLOAT	RW	F	-3.40E+38	3.40E+38	2286.29	Decay Time (µs)
37	0x25	Decay Time 7	FLOAT	RW	F	-3.40E+38	3.40E+38	2436.13	Decay Time (µs)
38	0x26	Decay Time 8	FLOAT	RW	F	-3.40E+38	3.40E+38	2598.20	Decay Time (µs)
39	0x27	Decay Time 9	FLOAT	RW	F	-3.40E+38	3.40E+38	2772.31	Decay Time (µs)
40	0x28	Decay Time 10	FLOAT	RW	F	-3.40E+38	3.40E+38	2960.51	Decay Time (µs)
41	0x29	Decay Time 11	FLOAT	RW	F	-3.40E+38	3.40E+38	3162.83	Decay Time (µs)
42	0x2A	Decay Time 12	FLOAT	RW	F	-3.40E+38	3.40E+38	3380.27	Decay Time (µs)
43	0x2B	Decay Time 13	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
44	0x2C	Decay Time 14	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
45	0x2D	Decay Time 15	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
46	0x2E	Decay Time 16	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
47	0x2F	Decay Time 17	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
48	0x30	Decay Time 18	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
49	0x31	Decay Time 19	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
50	0x32	Decay Time 20	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
51	0x33	Decay Time 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
52	0x34	Decay Time 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
53	0x35	Decay Time 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
54	0x36	Decay Time 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)

55	0x37	Decay Time 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
56	0x38	Decay Time 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
57	0x39	Decay Time 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
58	0x3A	Decay Time 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
59	0x3B	Decay Time 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
60	0x3C	Decay Time 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
80	0x50	Factory Gain	FLOAT	R	F	-3.40E+38	3.40E+38	1.0	
81	0x51	Factory Offset	FLOAT	R	F	-3.40E+38	3.40E+38	0.0	
82	0x52	User Gain	FLOAT	RW	F	-3.40E+38	3.40E+38	1.0	
83	0x53	User Offset	FLOAT	RW	F	-3.40E+38	3.40E+38	0.0	

Calibration 211 (0xD3), Instance 4: Custom Table, Input 4									
Member ID		**Member Name**	**Data Type**	**Access**	**NV**	**Min**	**Max**	**Default**	**Comments / Description**
1	0x01	Temperature 1	FLOAT	RW	F	-3.40E+38	3.40E+38	139.9854	Temperature (°C)
2	0x02	Temperature 2	FLOAT	RW	F	-3.40E+38	3.40E+38	134.945	Temperature (°C)
3	0x03	Temperature 3	FLOAT	RW	F	-3.40E+38	3.40E+38	124.9712	Temperature (°C)
4	0x04	Temperature 4	FLOAT	RW	F	-3.40E+38	3.40E+38	114.9642	Temperature (°C)
5	0x05	Temperature 5	FLOAT	RW	F	-3.40E+38	3.40E+38	104.943	Temperature (°C)
6	0x06	Temperature 6	FLOAT	RW	F	-3.40E+38	3.40E+38	94.95615	Temperature (°C)
7	0x07	Temperature 7	FLOAT	RW	F	-3.40E+38	3.40E+38	84.95515	Temperature (°C)
8	0x08	Temperature 8	FLOAT	RW	F	-3.40E+38	3.40E+38	74.95615	Temperature (°C)
9	0x09	Temperature 9	FLOAT	RW	F	-3.40E+38	3.40E+38	64.86	Temperature (°C)
10	0x0A	Temperature 10	FLOAT	RW	F	-3.40E+38	3.40E+38	54.96415	Temperature (°C)
11	0x0B	Temperature 11	FLOAT	RW	F	-3.40E+38	3.40E+38	44.97115	Temperature (°C)
12	0x0C	Temperature 12	FLOAT	RW	F	-3.40E+38	3.40E+38	34.98015	Temperature (°C)
13	0x0D	Temperature 13	FLOAT	RW	F	-3.40E+38	3.40E+38	24.953	Temperature (°C)
14	0x0E	Temperature 14	FLOAT	RW	F	-3.40E+38	3.40E+38	15.00415	Temperature (°C)
15	0x0F	Temperature 15	FLOAT	RW	F	-3.40E+38	3.40E+38	5.01915	Temperature (°C)
16	0x10	Temperature 16	FLOAT	RW	F	-3.40E+38	3.40E+38	-4.96385	Temperature (°C)
17	0x11	Temperature 17	FLOAT	RW	F	-3.40E+38	3.40E+38	-14.9449	Temperature (°C)
18	0x12	Temperature 18	FLOAT	RW	F	-3.40E+38	3.40E+38	-24.939	Temperature (°C)
19	0x13	Temperature 19	FLOAT	RW	F	-3.40E+38	3.40E+38	-34.944	Temperature (°C)
20	0x14	Temperature 20	FLOAT	RW	F	-3.40E+38	3.40E+38	-44.966	Temperature (°C)
21	0x15	Temperature 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
22	0x16	Temperature 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
23	0x17	Temperature 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
24	0x18	Temperature 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
25	0x19	Temperature 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
26	0x1A	Temperature 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
27	0x1B	Temperature 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
28	0x1C	Temperature 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
29	0x1D	Temperature 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
30	0x1E	Temperature 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Temperature (°C)
31	0x1F	Decay Time 1	FLOAT	RW	F	-3.40E+38	3.40E+38	2522.478255	Decay Time (µs)
32	0x20	Decay Time 2	FLOAT	RW	F	-3.40E+38	3.40E+38	2555.046119	Decay Time (µs)
33	0x21	Decay Time 3	FLOAT	RW	F	-3.40E+38	3.40E+38	2620.524263	Decay Time (µs)
34	0x22	Decay Time 4	FLOAT	RW	F	-3.40E+38	3.40E+38	2689.404827	Decay Time (µs)
35	0x23	Decay Time 5	FLOAT	RW	F	-3.40E+38	3.40E+38	2758.863831	Decay Time (µs)
36	0x24	Decay Time 6	FLOAT	RW	F	-3.40E+38	3.40E+38	2831.251857	Decay Time (µs)
37	0x25	Decay Time 7	FLOAT	RW	F	-3.40E+38	3.40E+38	2905.76145	Decay Time (µs)
38	0x26	Decay Time 8	FLOAT	RW	F	-3.40E+38	3.40E+38	2982.52442	Decay Time (µs)
39	0x27	Decay Time 9	FLOAT	RW	F	-3.40E+38	3.40E+38	3061.368555	Decay Time (µs)
40	0x28	Decay Time 10	FLOAT	RW	F	-3.40E+38	3.40E+38	3142.518489	Decay Time (µs)
41	0x29	Decay Time 11	FLOAT	RW	F	-3.40E+38	3.40E+38	3226.397099	Decay Time (µs)
42	0x2A	Decay Time 12	FLOAT	RW	F	-3.40E+38	3.40E+38	3312.109364	Decay Time (µs)
43	0x2B	Decay Time 13	FLOAT	RW	F	-3.40E+38	3.40E+38	3400.41518	Decay Time (µs)
44	0x2C	Decay Time 14	FLOAT	RW	F	-3.40E+38	3.40E+38	3490.374584	Decay Time (µs)
45	0x2D	Decay Time 15	FLOAT	RW	F	-3.40E+38	3.40E+38	3583.29417	Decay Time (µs)

46	0x2E	Decay Time 16	FLOAT	RW	F	-3.40E+38	3.40E+38	3677.436267	Decay Time (µs)
47	0x2F	Decay Time 17	FLOAT	RW	F	-3.40E+38	3.40E+38	3773.42605	Decay Time (µs)
48	0x30	Decay Time 18	FLOAT	RW	F	-3.40E+38	3.40E+38	3872.442094	Decay Time (µs)
49	0x31	Decay Time 19	FLOAT	RW	F	-3.40E+38	3.40E+38	3972.498088	Decay Time (µs)
50	0x32	Decay Time 20	FLOAT	RW	F	-3.40E+38	3.40E+38	4075.384281	Decay Time (µs)
51	0x33	Decay Time 21	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
52	0x34	Decay Time 22	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
53	0x35	Decay Time 23	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
54	0x36	Decay Time 24	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
55	0x37	Decay Time 25	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
56	0x38	Decay Time 26	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
57	0x39	Decay Time 27	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
58	0x3A	Decay Time 28	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
59	0x3B	Decay Time 29	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
60	0x3C	Decay Time 30	FLOAT	RW	F	-3.40E+38	3.40E+38	-273.0	Decay Time (µs)
80	0x50	Factory Gain	FLOAT	R	F	-3.40E+38	3.40E+38	1.0	
81	0x51	Factory Offset	FLOAT	R	F	-3.40E+38	3.40E+38	0.0	
82	0x52	User Gain	FLOAT	RW	F	-3.40E+38	3.40E+38	1.0	
83	0x53	User Offset	FLOAT	RW	F	-3.40E+38	3.40E+38	0.0	

Product Compatibility

- EZ-ZONE RM (C, E, H, L, S) version 9.0+ (high-speed Watbus)
- EZ-ZONE RM (A, C, E, H, L, S), PM, RUI, ST, field communication cards (low-speed Watbus)
- EZ-ZONE RM (F, G, UH, Z)
- POWERGLIDE™

Software Compatibility

Software	Serial	USB	Ethernet
Dashboard	X	X	X
CSV Creator	X	X	X
EZ-ZONE COMPOSER	X	X	X
EZ-ZONE Configurator	X		
LabVIEW	X	X	X
Watbus DLL	X	X	X

Firmware Updates

The firmware in the RMA PLUS or any “newer” device connected to high-speed Watbus may be updated using the stand-alone Watbus Flash Loader utility or Dashboard from Ethernet, USB or serial.

Some supported devices include: EZ-ZONE RM (A2, Z, F, G, UH), POWERGLIDE, etc.

When the flash load is complete, the RMA PLUS will switch to boot code to complete the firmware update. LED A (solid red) indicates the product is running boot code. LED B (flashing red) indicates the progress of the current update operation. LEDs C and D will be off. When complete, the new application will automatically run. Check the version to ensure the update was successful.

Ordering Matrix

①②③④ 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	⑪⑫ Additional Options
RMAP	–					–	A	A	

⑤	Slot B Options
A =	None
2 =	Modbus® RTU 232/485
5 =	DeviceNet™

⑥	Optional Communication Protocols
A =	None
3 =	EtherNet/IP server

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

⑪⑫	Additional Options
AA =	Standard
XX =	Custom/locked code application specific

More Information

For more information about this device, please visit http://www.watlow.com/rmaplus.

Appendix

Setup Keys

Setup file keys enable and configure product features. The key is not case sensitive, but it must match the key string implemented in the product.

EventLog

Key	Value
EventLog	ram:\EventLog.txt

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 since it is already associated with Notepad.exe.

ModbusTCP

Key	Value
ModbusTCP	nor:\Gateway\ModbusTcp.csv

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. See Modbus TCP Server.

EtherNetIP

Key	Value
EtherNetIP	nor:\Gateway\EtherNetIP.csv

Full file name / path where the EtherNet/IP™ field bus gateway file lives. This file associates CIP Attributes with data points from any of the four local busses. See EtherNet/IP™ Server.

DeviceNet

Key	Value

DeviceNet	nor:\Gateway\DeviceNet.csv

Full file name / path where the DeviceNet™ field bus gateway file lives. This file associates CIP Attributes with data points from any of the four local busses. See DeviceNet™ Slave.

SysCfg

Key	Value
SysCfg	nor:\Gateway\SysCfg.csv

Full file name / path where the system configuration file lives. Elements in this file will be written to the system upon initialization. See System Configuration.

Default

Key	Value
Default	nor:\Default.csv

Full file name / path where the user-defined custom default file lives. Elements in this file will be written to the device after factory defaults (any level) or custom defaults. This record is not a member of the default file. If you wish to use this feature and change the default file name / path, you must add this record to the setup file. See System Configuration. See Device object.

HTTPs

Key	Value
HTTPs	nor:\Gateway\Https.csv

Full file name / path where the HTTP server configuration file lives. Elements in this file are used for displaying system parameters on custom web pages. This record is not a member of the default file. If you wish to use this feature, you must add this record to the setup file. See HTTP Server.

MACA(1-3)

Key	Value
MACA1	C8:5B:76:F2:6F:06
MACA2	C8:5B:76:F2:6F:07
MACA3	C8:5B:76:F2:6F:08

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. See MAC Filter.

SntpAddress

Key	Value
SntpAddress	216.239.35.4

Ethernet IPV4 address or host name 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. See SNTP Client.

SnifferPort

Key	Value
SnifferPort	2

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. See Port Mirroring.

Discover

Key	Value
Discover	1

This key enables or disables the Watbus Over Ethernet (WOE) discovery feature. It is a Boolean option, enabled by default. Setting this value to 0 will prevent software tools from discovering the device. This record is not a member of the default file. If you wish to use this feature, you must add this record to the setup file. Refer to the following table:

Value		Action
0	(FALSE)	Discovery disabled
1	(TRUE)	Discovery enabled

See Watbus Over Ethernet (WOE).

DataLog

Key	Value
DataLog	nor:\Gateway\DataLog.csv

This key only applies if the model number is RMAP-XX**D**X-XXXX.

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. See Data Logging.

LogIntervalSec

Key	Value
LogIntervalSec	5

This key only applies if the model number is RMAP-XX**D**X-XXXX.

This key defines the data log interval in seconds. It is interpreted as an integer with a range of 1 – 86,400 seconds. Any value outside this range will be clipped. The default value if not specified is five seconds. See Data Logging.

LogKeepDays

Key	Value
LogKeepDays	10

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 if not specified is ten days. See Data Logging.

UART7

Key	Value
UART7	0

This key only applies if the model number is RMAP-**2**XXX-XXXX.

This key defines the physical port used by UART7. It is a Boolean option, false (0) by default. Use the following table to determine the physical port connected to UART7:

Value		Physical Port
0	(FALSE)	F-terminals (RS-485) or DB9F (RS-232) pins 7,8,9
1	(TRUE)	RJ45 Top (RS-485)

See Modbus RTU.

ModbusRtu6

Key	Value
ModbusRtu6	nor:\Gateway\ModbusRtu6.csv

This feature is only available if the model number is RMAP-**2**XXX-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. See Modbus RTU.

ModbusRtu7

Key	Value
ModbusRtu7	nor:\Gateway\ModbusRtu7.csv

This feature is only available if the model number is RMAP-**2**XXX-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. See Modbus RTU.

RtuFc6

Key	Value
RtuFc6	1

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

This key 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.

It is a Boolean option, false (0) by default. 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. Refer to the following table:

Value		Action
0	(FALSE)	Master uses Function Code 16 exclusively
1	(TRUE)	Master uses Function Code 6 for single register writes

See Modbus RTU.

MQTTcCustomerId

This feature is only available if MQTT is enabled.

This key is used to uniquely identify devices for a given customer. Devices using the same Customer ID will be visible to client software using the same ID.

Customer ID is a unique alpha-numeric string. This string may be up to 20 characters and include special characters with the following exceptions: '$', '#', '+', '/', '\', ' '. 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.

See MQTT Client.

Busses

The RMA PLUS must be a master on a given bus to acquire data. It is a master by default on Watbus (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: High-Speed Watbus (AKA 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 high-speed Watbus. This will cause unpredictable results due to timing restrictions.

Bus 2: Low-Speed Watbus (AKA Standard Bus)

This bus is used to access legacy EZ-ZONE devices that do not support high-speed Watbus: EZ-ZONE RM, PM (15+). Do not use this bus if bus 1 is available.

Bus 4, 5: Modbus® RTU Master

If the model number is RMAP-2XXX-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.

Data Types

The following table lists the data types (representation) and associated value necessary for some configuration file records.

Data Type	Value	Description	CIP Equivalent
UINT8	1	Unsigned 8-bit Integer	USINT
SINT8	2	Signed 8-bit Integer	SINT
UINT16	3	Unsigned 16-bit Integer	UINT
SINT16	4	Signed 16-bit Integer	INT
UINT32	5	Unsigned 32-bit Integer	UDINT
SINT32	6	Signed 32-bit Integer	DINT
ENUM8	7	Enumeration (8-bit)	USINT
FLOAT	8	Single-Precision Floating-Point	REAL
STRING	9	String	SHORT_STRING
PARAM	12	Parameter (C|M|I)	STRUCT of: USINT (8-bit Class ID) USINT (8-bit Instance ID) USINT (8-bit Member ID)
ENUM16	15	Enumeration (16-bit)	UINT

Figure 54 - Data types

Refresh Count

When the Watbus polling engine advances to a particular device, the refresh count dictates how many times it must be “touched” before issuing a request to refresh the data point.

Setting refresh count to 0 (default) tells the firmware to choose a value. In this case, the firmware sets the refresh count to 1 for all read-only members and 250 for all read / write members.

Depending on the number of gateway members refreshed on the bus, you can improve performance by increasing and / or offsetting the refresh count for members that are less critical or not live data. This will help spread the number of transactions out over time.

- Range: { 0 - 250 }
- Refresh count does not apply to configuration data (i.e. SysCfg.csv)

Producer / Consumer Data

Producer / consumer data is only used on high-speed Watbus. This is a subscription service that 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 everyone on the network. Only devices that subscribe to published data points consume these received frames.

This is the most efficient way to obtain data in the system since you do not have to explicitly request it. This cuts down the overhead for request frames, queuing, data packing, etc.

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

The representation is floating-point for all produced data. This includes digital producers whose values will be either 0.0 (Off) or 100.0 (On). To override this behavior, choose bus 2 (and appropriate segment) for the same data point.

If there is an error in the produced data, the value will be 99,999.0.

Text ID		Class ID		Member ID		A/D
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
2145	Timestamp	36	0x24	19	0x13	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

Declaration of Conformity

EZ Zone Series RM

CE

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

ISO 9001 since 1996.

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

Model Numbers:	**RM** followed by additional letters or numbers describing use of up to four module options of various inputs and outputs or communications.
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 models 4 Watts, any other RM model 7 Watts
Environmental Rating:	IP20

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

2004/108/EC Electromagnetic Compatibility Directive

EN 61326-1	**2013**	**Electrical equipment for measurement, control and laboratory use – EMC requirements, Industrial Immunity, Class A Emissions (*Not for use in a Class B environment without additional filtering).***
EN 61000-4-2	2009	Electrostatic Discharge Immunity
EN 61000-4-3	2010	Radiated Field Immunity
EN 61000-4-4	2012	Electrical Fast-Transient / Burst Immunity
EN 61000-4-5	2006	Surge Immunity (Reviewed to IEC 61000-4-5 2014)
EN 61000-4-6	2014	Conducted Immunity
EN 61000-4-11	2004	Voltage Dips, Short Interruptions and Voltage Variations Immunity
EN 61000-3-2	2009	Harmonic Current Emissions (Reviewed to IEC 61000-3-2 2014)
EN 61000-3-3[1]	2013	Voltage Fluctuations and Flicker
SEMI F47	2000	Specification for Semiconductor Sag Immunity Figure R1-1

[1]NOTE: 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 comply with 61000-3-3 requirements.

2006/95/EC Low-Voltage Directive

EN 61010-1	**2011**	**Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements**

Compliant with 2011/65/EU RoHS Directive

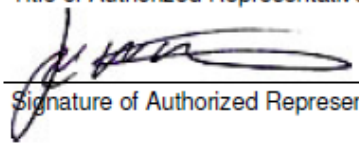
Per 2012/19/EU W.E.E.E Directive  ***Please Recycle Properly***

Joe Millanes
Name of Authorized Representative

Winona, Minnesota, USA
Place of Issue

Director of Operations
Title of Authorized Representative

September 2014
Date of Issue



Signature of Authorized Representative