

MTL83xC Modbus

PC software manual



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1 INTRODUCTION

The MTL83xC is a temperature (and mV) measuring system. It consists of an MTL838C or MTL838C-MBT and one or two MTL831C modules. See the datasheet EPS830C and installation manuals INM838C and INM831C for these modules for further details. The main interface on the MTL838C which concentrates the data from the MTL831Cs is Modbus® RTU (RS485). The MTL838C-MBT communicates Modbus TCP over the single RJ45 Ethernet connector. A separate document covers the MTL838C Modbus® implementation (INM MTL838C-MBF).

This document covers the operation of the PC software that is used to configure and monitor the system. For the remainder of this document MTL838C will refer to both the RTU and TCP versions unless stated otherwise.

1.1 PC Requirements:

The MTL83xC PC software will run on a Windows® 7, 8, or 10 computer. This is a small application that doesn't require a lot of space, memory, or processor speed. A USB cable is used to connect to the MTL838C (USB-C) – not part of the MTL838C – purchase separately.

Modbus is a trademark of Schneider Automation Inc., North Andover, MA.

2 QUICKSTART GUIDE

This quickstart guide is written for an MTL83xC system based on an MTL831C temperature input multiplexer transmitter with an MTL838C multiplexer receiver.

Before the actual installation, it is recommended that new users initially set up a simple system on the bench to become familiar with the MTL83xC system. The minimum hardware required for a test system is as follows:

MTL831C Analog transmitter

MTL838C Receiver

MTL5553 Isolator (for hazardous area installations only).

In order to run a test the following equipment will be required:

A PC loaded with MTL83xC Configuration software, Power supply 20- 35V @ 500mA, together with suitable cabling for the following requirements:

Data highway connections (see INM831C / INM838C)

Power supply connections

USB cable

The user will also need the following documentation for wiring information:

INM831C - MTL831C Installation Manual

INM838C - MTL838C Installation Manual

INM838C-MBT - MTL838C-MBT Installation Manual

Connect at least one sensor to an MTL831C.

Refer to chapter 5 to configure and test the system.

3 BACKGROUND TO THE MTL838C

3.1 The analog-input multiplexer system

The MTL838C is an analog multiplexer receiver that is used with the MTL831C hazardous area millivolt input multiplexer transmitter. The status of up to 32 analog inputs may be communicated from the hazardous area to the safe area via a data highway, comprised of a simple twisted pair- over distances up to 2000m.

Each data highway must be protected by an MTL5553 digital isolator when the inputs are located in a Zone 0,1 hazardous area. The MTL831C is typically used with thermocouple and RTD inputs and is intrinsically safe. It can be mounted in a Zone 0,1 hazardous area and will accept 16 inputs. For systems that do not require Zone 0 or Zone 1 installation, the MTL5553 can be eliminated.

Up to two MTL831C transmitters can be combined on a single MTL838C receiver input- up to a total of 32 analog inputs- as shown in Figure 1.

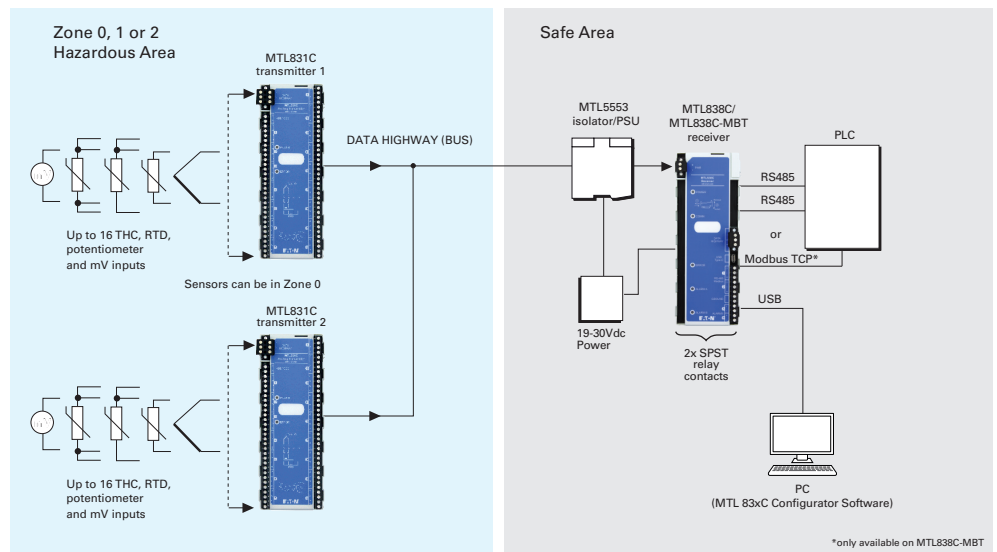


Figure 1 - MTL838C/MTL831C System Diagram

The MTL838C acts as a Modbus slave. It may be connected into any standard Modbus network, with up to 31 MTL838C slaves on each network. If each unit has its full complement of 32 analog inputs, the status of a total of 992 analog inputs may be passed to a Modbus master using a single RS485 network. For the MTL838C-MBT the single Ethernet connection allows for up to 32 analog inputs.

3.2 Configuring the MTL838C

The MTL838C must first be configured using software on a PC and the USB connection. This configures things such as the slave address and communication parameters. After the initial configuration, the MTL838C is ready to communicate with the Modbus host. At this point, the remaining configuration may be done in one of two ways:

- on-line via the Modbus link, direct from the host
- off-line using the PC software and USB connection

Using the PC software is required for initial configuration and recommended for first time configuration of the measuring channels.

3.3 On-line Configuration

Configuring the unit via the Modbus master and the network might seem to be the simplest method at first sight, but there are a number of practical difficulties with this configuration technique. This approach means that the user must deal with a number of complex aspects which require a significant investment of the configurer's time before they are understood fully. A further difficulty may be a lack of the necessary memory space within the Modbus master. If the configuration is likely to be changed frequently it could even be necessary for the system designer to design specific 'user interface' screens, such as those used by the PC software, to allow changes to be made by operators. This would be a time consuming and costly task.

For most users, the attraction of being able to use the Modbus master to configure the unit is that the configuration can be re-sent if the slave's memory becomes corrupted. Whilst this is true, it is not possible to avoid the difficulties (and costs) outlined earlier and the decision to adopt a strategy of configuring via the Modbus master should be arrived at only after due consideration.

A cost effective compromise would be to perform the initial configuration via the PC software, and then read the configuration parameters stored in the MTL838C via the host. The stored parameters could then be re-written to the MTL838C should the configuration database ever become corrupt.

If a user intends to adopt the on-line configuration method, the calculation of configuration parameters for storage in the master can be simplified, and the possibility of 'human error' reduced, by using the PC software to input the required data and data format, and then reading the stored values (encoded correctly in the required data format) back from the MTL838C via Modbus. The user should still realize that any subsequent alterations of the parameters will require further use of the PC software.

3.4 Off-line Configuration

Off-line configuration requires the use of the PC software briefly described below. Once configured, the configuration parameters are stored in non-volatile memory within the unit.

3.5 The PC software

By far the simplest method of configuring the MTL838C is using the PC software. This software has been specifically designed to perform all of the complex calculations that must be carried out, in order to configure the unit. These calculations are transparent to the user, and this method provides a convenient and time efficient method.

Alternatively, as explained before, the master could read the configured parameters after initial off-line configuration and these may then be stored within the host for use in the event of a database failure.

3.6 Interconnection of the MTL838C

The MTL838C may be connected to a Modbus host in a number of ways.

Two RS485 outputs, Link 1 and Link 2, are provided on the MTL838C. As there are two outputs the unit can either be connected to a single Modbus master, with dual redundancy, or connected to two separate Modbus hosts.

The MTL838C will respond on whichever RS485 connection the query is received, and there is no restriction placed on the simultaneous use of both interfaces. The Modbus addresses for each Link may only be set by using the PC software.

For the MTL838C-MBT there is only one Ethernet connection over which all Modbus TCP traffic flows to/from the MTL838C-MBT at its given IP address. Connect the Ethernet port to your Modbus TCP network using a standard Ethernet cable (RJ45 connections). Section 7 will cover the configuration of the Ethernet module.

3.7 Initialization mode

The MTL838C has two distinct modes of operation - normal and initialization.

It will always enter initialization mode during power-up. It can also be triggered by the detection of internal hardware or software faults, or after receiving an instruction from the host to reset some or all of the configuration registers.

During initialization, the unit will ignore all commands from the master.

The initialization period will take several seconds to complete all the necessary operations and calculations. Following successful initialization, the unit will automatically enter, or return to, normal operation mode.

If a corrupted configuration database is detected during initialization the unit will revert to a set of default values, and on entering normal operation mode, will issue exception responses when requested by the host to read input values. Exception responses will continue to be issued until the unit is re-configured. The need to re-configure the unit will remain even if the MTL838C is powered down and back up.

If a corrupted configuration is detected, the slave address may be reset. If this occurs, the user must use the PC software to set the slave address.

Also, when the PC software is communicating with the MTL838C, Modbus communications are disabled. This is to prevent the possibility of writing to the configuration database simultaneously from two sources.

3.8 Slave, Transmitter and Input addressing

The following discusses the allocation of addresses to the slaves on the Modbus network- including the MTL838C - and the allocation of addresses for the transmitters and inputs connected to each MTL838C.

3.8.1 Addressing MTL838C slaves

Modbus allows slave addresses in the range 1 to 247. JBUS allows slave addresses in the range 1 to 255. This is the only difference between the two protocols. The MTL838C will accept addresses in the range 1 to 255 for each Link. Care should be taken when setting the addresses for each Link using the PC software. For example, if both Links are connected to the same Host, the addresses should probably be different.

The Modbus address for each MTL838C slave is set via the PC software. For reasons of security, it is not possible to set the address of the slave via the Modbus host.

Modbus TCP (Ethernet) does not allow multiple slaves on the same IP address. For this reason the address becomes somewhat unimportant except that it is still used. The address on the MTL838C-MBT which is set using the PC software must match what the Master is using.

3.8.2 Addressing the transmitters of each MTL838C

Each MTL831C transmitter accepts up to 16 sensor inputs and there can be one or two MTL831C transmitters connected to a single MTL838C. The address of the MTL831C as seen by the MTL838C is determined by whether a jumper wire is installed on the MTL831C. A jumper wire not installed gives the MTL831C an address of '1' and a jumper installed gives it an address of '2'. The following shows the sensor numbers used by the MTL838C for a given MTL831C address.

MTL831C Address	Sensor Numbers
1	0 - 15
1	32 CJC
2	16- 31
2	33 CJC

Addressing of the MTL831C transmitters affects which sensor is given which address in the MTL838C. For example, if only one MTL831C is connected to the MTL838C but its address jumper is installed, it will be at transmitter address '2' and the sensor range will be 16 – 31, 33.

It is also important that with two MTL831Cs connected to a single MTL838C, that one and only one of them has the jumper installed. Otherwise they will both be at the same address and communication between the MTL831s and the MTL838C will fail. Likewise, there can be no more than two MTL831Cs connected to a single MTL838C.

CJC stands for Cold Junction Compensation and reports the average temperature of the MTL831C circuit board. This is an average of two temperature sensors and should not be used by the Modbus Host to cold junction compensate thermocouples. Instead the thermocouple channels should be compensated by the MTL831C by selecting the correct Input Type.

4 PC SOFTWARE INSTALLATION

The MTL83xC Configuration Software is only available from the Eaton (MTL) website. Direct your browser to www.mtl-inst.com and then locate the MTL83xC product page. There will be a link on that page to download and install the software. The following window should then pop up:

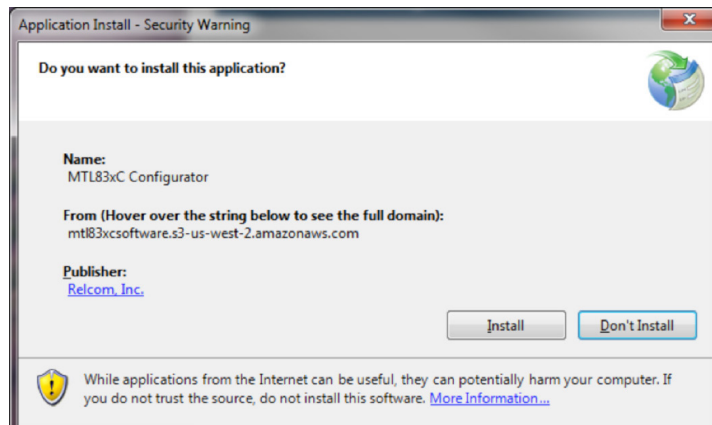


When you click on the link, your computer will likely warn about the file (setup.exe) as it is an executable. Allow it to Run the file.



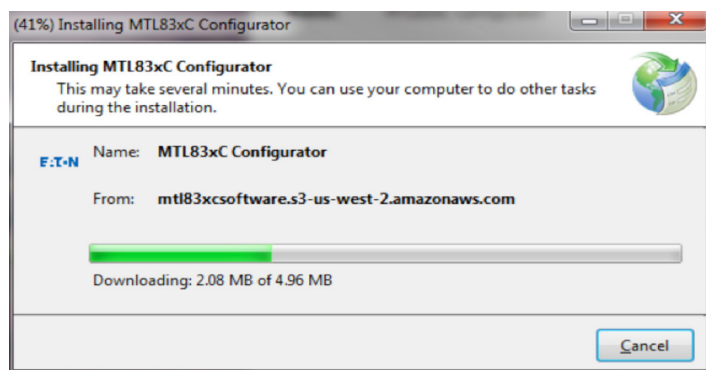
Anti-virus software on your computer may also complain about not knowing whether the file is safe or not. Tell it to Allow the execution of the file.

Finally, Windows will want confirmation that you want to install the application. The following is a sample screen shot of the warning. Notice that Relcom, Inc. is the publisher of the software as they wrote it for Eaton (MTL).



Allow the installation to proceed.

The application will be downloaded, installed, and will start running.



5 SOFTWARE OPERATION

This section covers the operation of the MTL83xC Configurator software. For detailed operation of the hardware, please see the relevant installation manuals.

The following is the screen that appears when the software opens:

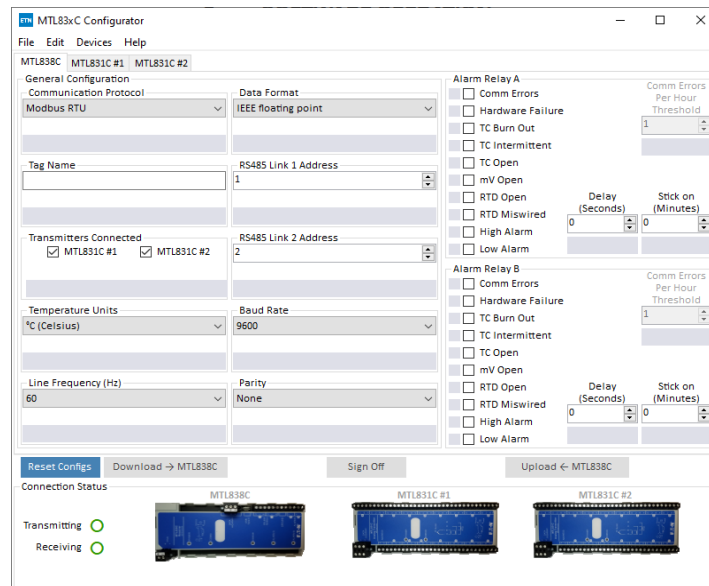


Figure 2 - The MTL838C Tab

This is a standard Windows application that incorporates a typical Menu system and Tabs to organize the information. The three Tabs cover the three possible pieces of hardware in an installation (seen in the images at the bottom of the screen). Data relevant to the associated piece of hardware is on that Tab. For example, information specific to the MTL838C is on the MTL838C Tab.

It should be noted, however, that the configuration data for the entire system is actually stored on the MTL838C. This allows an MTL831C to be replaced without requiring re-configuration. When an MTL831C powers up, the MTL838C recognizes it and sends it the correct configuration.

The Connection Status section at the bottom is below the tabs and provides visual information on the status of the components. In the image above, the PC software is not communicating with the MTL838C. This is indicated by the Transmitting and Receiving LEDs being OFF and the MTL838C word being grayed out.

After connecting a USB cable to the MTL838C and providing it power, the Connection Status changes to:



Figure 3 - Connection status

This Connection Status indicates that the PC software is communicating over the USB cable with the MTL838C – both LEDs are ON and the MTL838C word is green. The MTL838C is not communicating with the MTL831Cs in the above image.

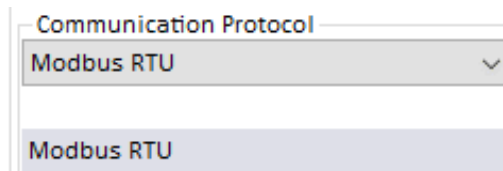
Once MTL831Cs are connected to the MTL838C, then their titles will turn green as well.

As explained in the Background section for the MTL831C, #1 means Address 1 (no address jumper on terminals 7 & 8) and #2 is Address 2 (a wire jumper between terminals 7 & 8). There can be one or two MTL831Cs connected to a single MTL838C and if there are two, they MUST have different address settings. The address determines which MTL831C belongs to which Tab in the software. Mixing them up or changing the jumpers may result in an unexpected configuration.

5.1 Configuration Overview

It's worth taking a minute to understand the overall philosophy of the MTL83xC Configurator software.

To allow offline configuration (not being connected to the MTL838C while entering the configuration data), we created two fields on the screen for every configuration point. One of the fields is editable and the other is the displayed value from the unit the PC software is communicating with. If it is not communicating with a unit, then that field is blank. An example field is shown below. The dropdown is the PC software setting and the gray box below it is the value read back from the connected MTL838C. Not all tabs use the same color scheme but the principle is the same.



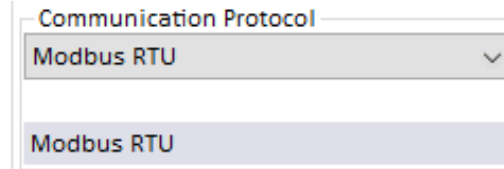
There is a way to load and store configuration settings to your computer (see the Menu Command section). With this capability, configurations can be carried out ahead of time and stored until the units are installed and ready to program. The configuration is then loaded from your computer and downloaded to the unit.

When a small change needs to be made to an already configured unit, you can first connect to the unit and Upload its configuration, make the necessary modifications, and then Download the updated configuration to the unit.

5.2 The MTL838C Tab

The items on this tab allow you to configure the MTL838C. Some of these parameters affect the entire system – others only specific aspects of the MTL838C. We will cover them in detail below:

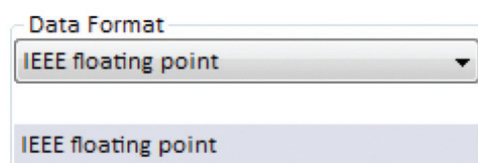
5.2.1 Communication Protocol



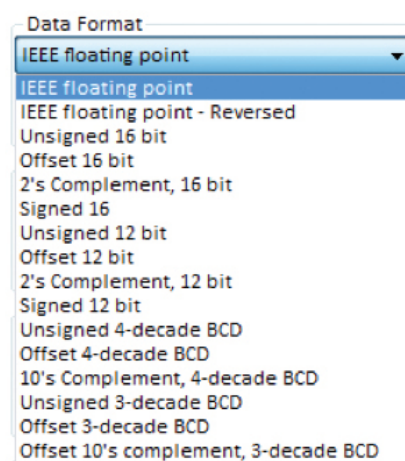
Two communication protocols for the RS485 Links are supported by the MTL838C (Modbus RTU and LLMUX). This manual does not cover the LLMUX protocol which is Honeywell specific. Please see the INM MTL83xC LLMUX manual for that protocol. The other Modbus protocol (Modbus TCP) is only supported on the MTL838C-MBT and is covered in this manual. Note that attempting to download to the MTL838C when an incorrect protocol is selected will result in an error since the protocols are hardware dependent.

The protocol is selected by using the dropdown. Make sure the Modbus RTU or Modbus TCP protocol (whichever is appropriate for your hardware) is selected and programmed into the unit. Modbus RTU is the default value for this field.

5.2.2 Data Format



Several different formats for the data in the Modbus Registers are supported by the MTL838C. The list is indicated below. Select the format desired with the dropdown. Note that changing the Data Format results in several parameters being reset to their defaults on the MTL831 tabs. Further details on the Modbus implementation may be found in the document INM838C-MBF. The default Data Format is IEEE floating point.



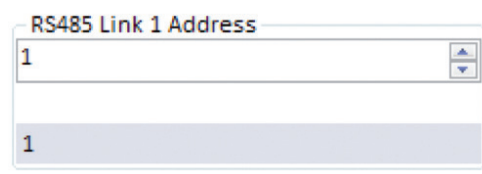
5.2.3 Tag Name



The screenshot shows a rectangular input field with a light blue background and a thin border. The text "Tag Name" is positioned at the top left of the field. The field is currently empty.

This field is user defined. When properly filled in it may be used to identify this particular MTL838C in the plant. It is available via the Modbus interface as well. Up to 24 alphanumeric characters may be entered in this field. The field is blank by default.

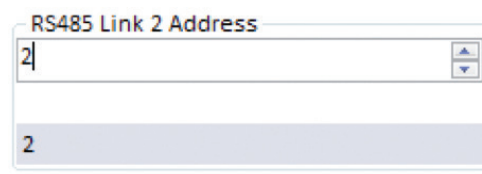
5.2.4 RS485 Link 1 Address



The screenshot shows a rectangular input field with a light blue background and a thin border. The text "RS485 Link 1 Address" is positioned at the top left of the field. The number "1" is entered in the field. To the right of the field are two small arrows, one pointing up and one pointing down, indicating a spinner control.

The Modbus address for Link 1 is selected or entered in this field. Use the up or down arrows to increment or decrement the number, or type in the desired number. Valid entries are in the range 1 through 255 and the default value is 1.

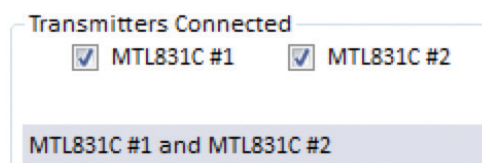
5.2.5 RS485 Link 2 Address (Modbus RTU only)



The screenshot shows a rectangular input field with a light blue background and a thin border. The text "RS485 Link 2 Address" is positioned at the top left of the field. The number "2" is entered in the field. To the right of the field are two small arrows, one pointing up and one pointing down, indicating a spinner control.

The Modbus address for Link 2 is selected or entered in this field. Use the up or down arrows to increment or decrement the number, or type in the desired number. Valid entries are in the range 1 through 255 and the default value is 2.

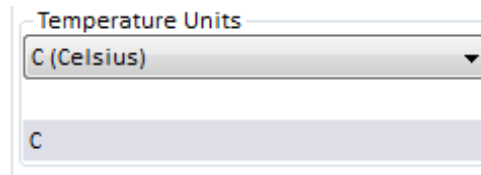
5.2.6 Transmitters Connected



The screenshot shows a rectangular input field with a light blue background and a thin border. The text "Transmitters Connected" is positioned at the top left of the field. Below the text are two checkboxes, both of which are checked. The first checkbox is labeled "MTL831C #1" and the second is labeled "MTL831C #2". Below the checkboxes, the text "MTL831C #1 and MTL831C #2" is displayed.

This pair of checkboxes tell the MTL838C what is supposed to be connected to it. There are three possibilities. #1, #2, or both #1 and #2. You cannot unselect both checkboxes as it makes no sense to have a system with no MTL831C in it. This information is used to report an error condition to the Modbus Host if an MTL831C is not connected but is supposed to be. The default condition is that two MTL831Cs are connected to the MTL838C.

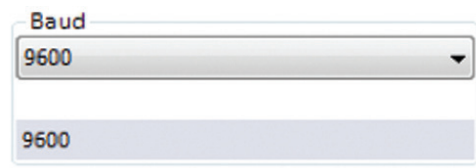
5.2.7 Temperature Units



A screenshot of a web interface showing a dropdown menu titled "Temperature Units". The selected option is "C (Celsius)". Below the dropdown, the value "C" is displayed in a light blue box.

Select the Units that should be used to report temperature. The dropdown allows for Celsius (the default), Fahrenheit, or Kelvin.

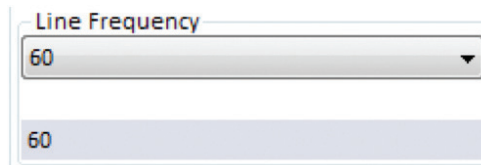
5.2.8 Baud Rate (Modbus RTU only)



A screenshot of a web interface showing a dropdown menu titled "Baud". The selected option is "9600". Below the dropdown, the value "9600" is displayed in a light blue box.

Select the Baud rate for the two RS485 Links. 9600 is the default.

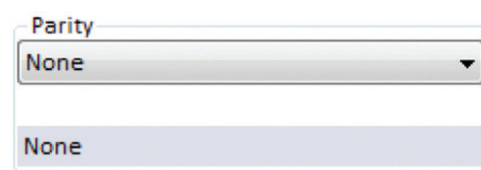
5.2.9 Line Frequency



A screenshot of a web interface showing a dropdown menu titled "Line Frequency". The selected option is "60". Below the dropdown, the value "60" is displayed in a light blue box.

The line frequency where the MTL83xC system is installed should be correctly selected from this dropdown box. It may be either 50 or 60 Hertz. The default is 60 Hertz. This is to allow the system to improve the rejection of line frequency noise.

5.2.10 Parity (Modbus RTU only)



A screenshot of a web interface showing a dropdown menu titled "Parity". The selected option is "None". Below the dropdown, the value "None" is displayed in a light blue box.

The Parity for the two RS485 Links is selected with this dropdown. The choices are None, Odd, and Even with the default being None. The MTL838C always uses 1 Stop bit.

5.2.11 Alarm Relay A

Alarm Relay A		Comm Errors Per Hour Threshold
<input type="checkbox"/>	Comm Errors	1
<input type="checkbox"/>	Hardware Failure	1
<input type="checkbox"/>	TC Burn Out	
<input type="checkbox"/>	TC Intermittent	
<input type="checkbox"/>	TC Open	
<input type="checkbox"/>	mV Open	
<input type="checkbox"/>	RTD Open	
<input type="checkbox"/>	RTD Miswired	
<input type="checkbox"/>	High Alarm	
<input type="checkbox"/>	Low Alarm	
	Delay (Seconds)	Stick on (Minutes)
	0	0
	0	0

There are 10 alarm conditions that can be used to trigger the alarm relay. If multiple conditions are selected, then they are logically OR'd together. Check the checkbox of the condition(s) that you want to trigger the alarm. The gray box to the left of the checkbox indicates the way the currently connected MTL838C is configured.

If the "Comm Errors" condition is selected, the "Comm Errors Per Hour Threshold" is enabled. Once programmed, the MTL838C will turn the relay ON when the selected number of Comm Errors Per Hour is exceeded.

Use the "Delay" field to require that the alarm condition must exist for this number of seconds BEFORE the alarm will be triggered. If "Comm Errors" or "Hardware Failure" is checked and one of these occurs in the unit, the alarm will trip immediately (the Delay is ignored for these error conditions).

The "Stick on" parameter forces the relay to stay ON this number of minutes AFTER the alarm condition has cleared.

The following table describes the different alarm conditions:

Comm Errors	Comm Errors are caused by the MTL838C getting CRC errors in transmissions from the MTL831C(s) or the MTL831C(s) miss responding to a command 3 times in a row (this triggers a Comm re-initialization with that MTL831C).
Hardware Failure	Two possible conditions will cause this condition. First, every minute the 838C verifies that the CRC of the configuration data is good. A difference causes the error to be set – it is never reset. Secondly, there are two board temperature sensors that are used for cold junction compensation (CJC) for thermocouples. If they are different by more than 5°C, the error is set – otherwise it is reset.
TC Burn Out	If a thermocouple (TC) has increased in resistance by 50 ohms, it is considered close to burning out and this error is set. See the diagnostic tab to see what the TC resistances are.
TC Intermittent	A thermocouple is intermittently opening (could be a bad connection or it is broken).
TC Open	A channel configured as thermocouple is open.
mV Open	A channel configured as mV is open.
RTD Open	A channel configured as RTD (2 wire, 3 wire, or 4 wire) is open.
RTD Miswired	A 3 wire or 4 wire RTD is not wired correctly. Note that some ways of miswiring 3 and 4 wire RTDs cannot be detected (typically read near zero ohms in this case).
High Alarm	A channel reading exceeds the High Alarm threshold (see MTL831C #1 or #2 tabs).
Low Alarm	A channel reading is below the Low Alarm threshold (see MTL831C #1 or #2 tabs).

5.2.12 Alarm Relay B

See the explanation for Alarm Relay B. The possible settings for both alarm relays are the same. However, you can set each relay differently to get different errors to trip the two relays.

5.2.13 Action Buttons

At the bottom of the channel area, there are four (4) buttons. Only one of them is active (blue) because there is no MTL838C currently communicating. This is the Reset Configs button. If pressed, it will reset all of the parameters in the current tab to their defaults – which are as shown in Figure 2 above.

When there is a connected MTL838C the Download and Upload buttons are active (blue). Pressing the Download button would send the configuration on the screen to the MTL838C and pressing the Upload button would bring the configuration in the MTL838C into the PC software.

The Sign Off button is not active. This means that the configuration is considered valid. A configuration becomes invalid when the Data Format on this tab is changed and downloaded to the unit. The sign-off must then be initiated by this button in the PC software or by the Modbus Host via a Coil Write. See the COIL STATUS FLAGS section of the INM838C-MBF document for more information.

5.3 The MTL831C #1 Tab

This tab contains the configuration for the MTL831C at address #1 (the unit without the address jumper). Below is what the tab looks like when not connected to the PC.



Figure 3 - Configuration for 831C at Address #1 screen

This tab is arranged in rows and columns. Each row is a different channel – ranging from 1 through 16 plus a 17th row labeled CJ (Cold Junction). Each numbered row corresponds to that numbered channel on the MTL831C unit. The following explains the column items for channels. In each row, the white rectangular boxes would contain the current setting in the unit that is being communicated with. They are blank because no unit is currently connected.

5.3.1 Input Type

This dropdown is used to select the type of sensor that is connected to the channel. The following are the different options available.

mV		
2W Ω	3W Ω	4W Ω
2W RTD Cu50	3W RTD Cu50	4W RTD Cu50
2W RTD Cu53	3W RTD Cu53	4W RTD Cu53
2W RTD Ni100	3W RTD Ni100	4W RTD Ni100
2W RTD PT100	3W RTD PT100	4W RTD PT100

TC, B, Temp, CJC	TC, E, Temp, CJC	TC, K, Temp, CJC	TC, R, Temp, CJC	TC, T, Temp, CJC
TC, B, Temp, no CJC	TC, E, Temp, no CJC	TC, K, Temp, no CJC	TC, R, Temp, no CJC	TC, T, Temp, no CJC
TC, B, mV, CJC	TC, E, mV, CJC	TC, K, mV, CJC	TC, R, mV, CJC	TC, T, mV, CJC
TC, C, Temp, CJC	TC, J, Temp, CJC	TC, N, Temp, CJC	TC, S, Temp, CJC	TC, XK, Temp, CJC
TC, C, Temp, no CJC	TC, J, Temp, no CJC	TC, N, Temp, no CJC	TC, S, Temp, no CJC	TC, XK, Temp, no CJC
TC, C, mV, CJC	TC, J, mV, CJC	TC, N, mV, CJC	TC, S, mV, CJC	TC, XK, mV, CJC

Definitions:

2W – 2 wire (RTD)

3W – 3 wire (RTD)

4W – 4 wire (RTD)

TC – Thermocouple.

CJC – Cold Junction Compensated

5.3.2 Safety Drive

Safety Drive specifies what value should be returned (to the Modbus Host) if the sensor reading is out of range. The options are None, Upscale, and Downscale. See the chapter on HOLDING REGISTERS in the INM838C-MBF manual for more information.

5.3.3 High Alarm

The number in this field will determine when a High Alarm is triggered (current reading is above the High Alarm setting). This can be used for the MTL838C alarm relays and is available to the Modbus Host.

5.3.4 Low Alarm

A current reading below the value in this box triggers a Low Alarm. Like the High Alarm, this data is available for the MTL838C alarm relays and the Modbus Host.

5.3.5 Input Zero, Output Zero, Gain

These three fields are used to scale the reading that is made available via Modbus. These fields are normally used with non-IEEE data formats. See the chapter on SCALING in the INM838C-MBF manual for more information.

Numbers may be directly entered in these fields or you may use the Input Calculator to do some calculations for you and transfer the results to these fields for the selected channel. The Input Calculator will be covered in a later section.

5.3.6 Reading

This field shows the current reading from a unit if one is connected and properly communicating. The reading status will be shown below the box (OK, Open, Miswired, etc.).

If the Input Zero, Output Zero, and Gain (Scaling Factors) are changed from the default (0, 0, 1 respectively) the Reading will be affected by those Scaling Factors. The units (mV, °C, etc.) shown after the reading are before any Scaling Factors are applied.

For non-IEEE Data Formats, the Reading will be shown as an integer and limited to the range of the Data Format. Readings that are out of range will be shown in red text. The intent is that the Reading should match the value available via Modbus.

5.3.7 The CJ Channel

The CJ row displays the average temperature of the MTL831C board (there are 2 temperature sensors on the board).

5.3.8 Moving around the Channel List:

A scroll bar is provided on the right side which allows you to scroll through all 16 channels plus the "CJ" row. You can also use the mouse wheel to scroll the list of channels.

Channels may be "selected" by clicking anywhere within the rectangular area that defines the row. A selected row is highlighted blue. Several standard Windows features are implemented to facilitate working with the channels. These things are:

Copy	-	Ctrl C
Paste	-	Ctrl V
Select All	-	Ctrl A
Toggle Row selection	-	Ctrl Click
Update Row Range selection	-	Shift Click

In addition, right clicking on a row will pop up a menu that allows you to select Copy, Paste, or launch the Input Calculator. The Edit Menu may also be used to select some of these features.

5.4 Action Buttons

At the bottom of the channel area, there are four (4) buttons. Only one of them is active (blue) because there is no MTL838C currently communicating. This is the Reset Configs button. If pressed, it will reset all 16 channels in the current tab to their defaults – which are as shown in Figure 3 above (Input Type = mV, Safety Drive = None, Gain = 1, the remaining fields = 0).

The following figure (4) shows what the tab would look like when communicating with an MTL838C that has one MTL831C connected to it that has been configured with all channels as “TC, K, Temp, CJC”. Notice that no channels are connected (the Open status and high invalid reading). The Calibration status of the MTL831C is shown below it and should always be “Good” as they are factory calibrated. Channel 1 is the only selected channel as it is highlighted (blue).

Now that there is a connected system the Download and Upload buttons are active (blue). Pressing the Download button would configure all of the channels on the MTL831C as mV – and pressing the Upload button would bring the configuration in the MTL838C (for the MTL831C #1) into the PC software. See the results of pressing these buttons in figures 5 and 6 respectively.

The Sign Off button is not active. This means that the configuration is considered valid. A configuration becomes invalid when the Data Format on the MTL838C tab is changed and downloaded to the unit. The sign-off must then be initiated by this button in the PC software or by the Modbus Host via a Coil Write. See the COIL STATUS FLAGS section of the INM838C-MBF document for more information.

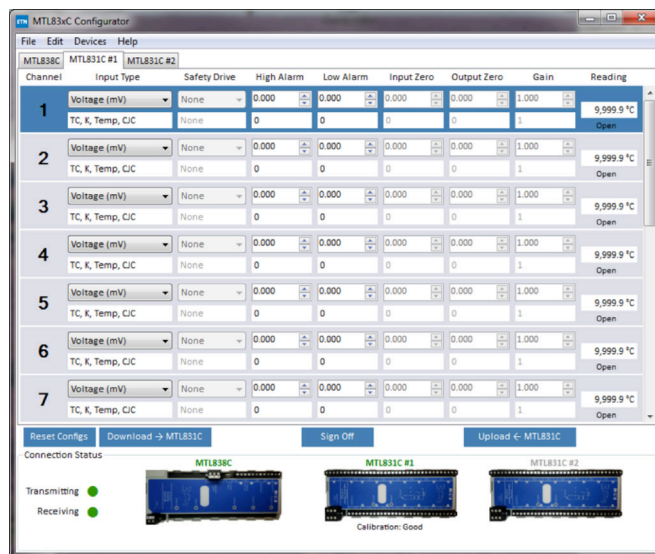


Figure 4- MTL838C with one MTL831C connected configured TC, K, Temp, CJC



Figure 5

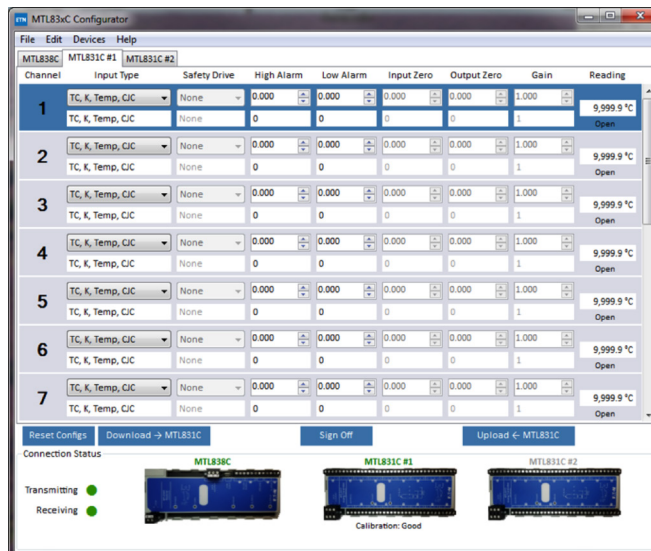
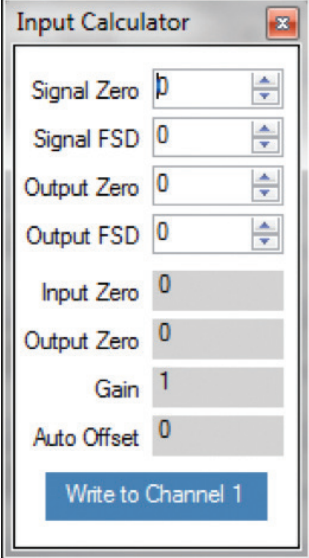


Figure 6

5.5 Input Calculator

The Input Calculator is used to assist in calculating the Input Zero, Output Zero, and Gain values. The calculator is shown below:



Signal Zero	0
Signal FSD	0
Output Zero	0
Output FSD	0
Input Zero	0
Output Zero	0
Gain	1
Auto Offset	0

Write to Channel 1

Enter the appropriate data in the top 4 fields. As you do this and tab or move from one field to the other, the values in the gray boxes are updated. When finished, click the blue button to write to the indicated channel. Note that if multiple channels are selected when you bring up the Input Calculator, only one of them will actually be written to. If you have multiple channels that have similar configuration, it is best to configure one channel then copy the entire channel to the other similar channels.

NOTE

Changing the Data Format on the MTL838C tab will reset the Input Zero, Output Zero, and Gain back to defaults.

See the chapter on SCALING in the INM838C-MBF manual for more information.

5.6 The MTL831C #2 Tab

This tab functions exactly the same as the MTL831C #1 tab. The only difference is that it contains the configuration data for the #2 MTL831C. The channel numbers are different so the Modbus system can distinguish the two units. MTL831 #1 shows up as channels 1-16 and MTL831 #2 shows up as channels 17-32. So the channel numbers in the tabs are identified by their Modbus channel number. To make it easier to identify the channel on the physical unit, we have put a number in parenthesis under the channel number which corresponds to the physical channel on the MTL831C #2(1-16).

The figure below shows what the MTL831C #2 tab looks like when connected to an MTL838C and MTL831C #1. Notice that there is no Reading because there is no MTL831C #2 connected. However, the live configuration data is populated in the white rectangles because it is stored in the MTL838C and downloaded to the MTL831C when the MTL838C detects it.

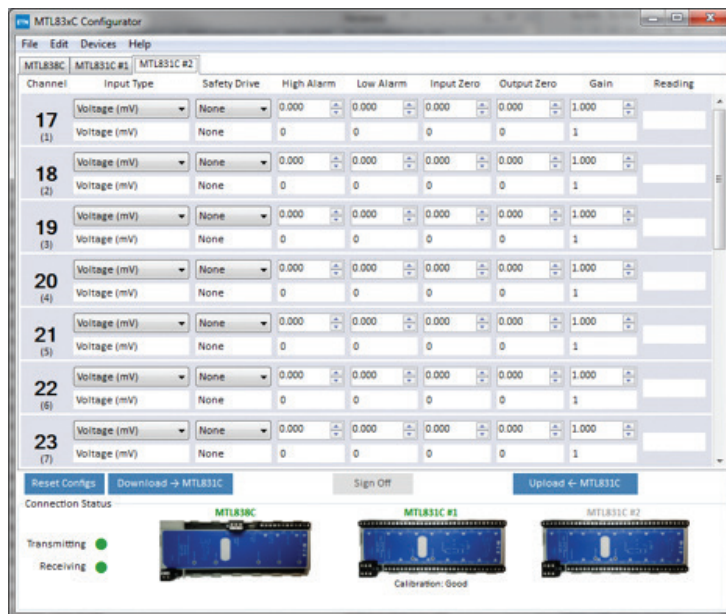
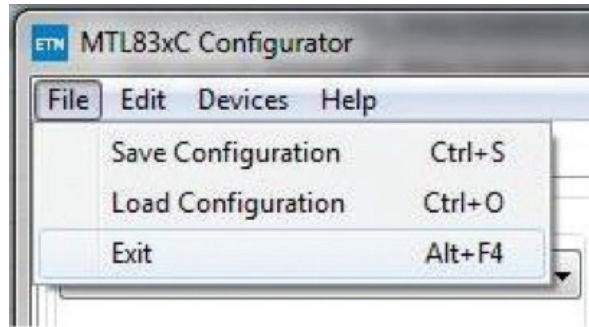


Figure 7 - MTL831C#2 tab connected to an MTL838C and MTL831C #1

6 THE MENU

At the top of the MTL83xC Configurator window is a menu that contains the following items: File, Edit, Devices, and Help. Click on the menu name to drop its menu down and then click on the menu item to execute that function. The Menu items are explained below. Notice that the menu also shows the shortcut keys to access the function without using the menu.

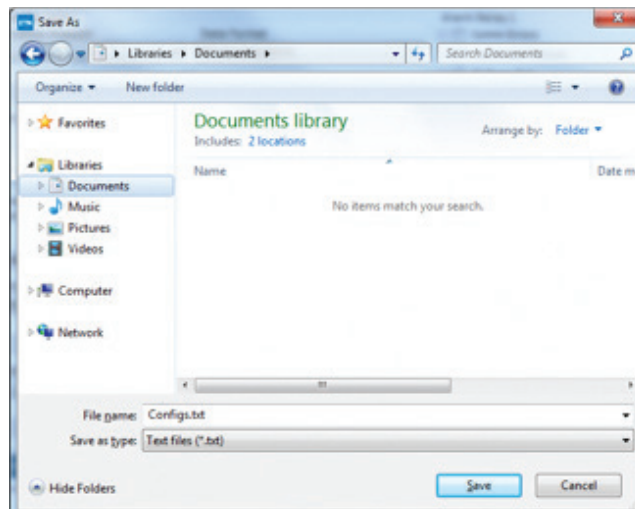
6.1 File



The File menu allows you to Save and Load the current configuration as well as Exit the program.

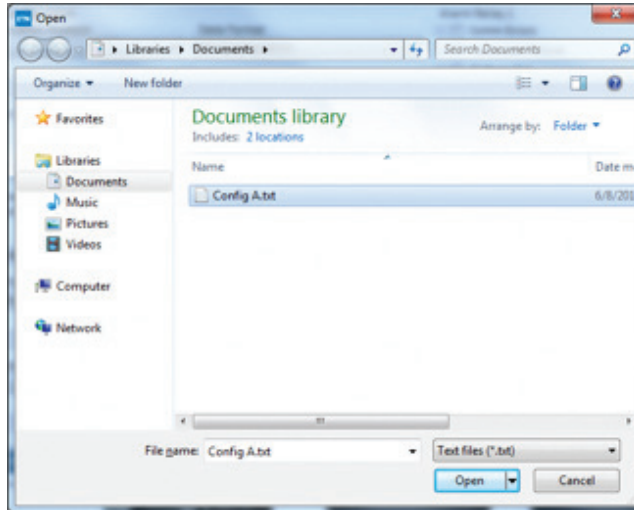
Saving and loading the MTL83xC configuration is very useful. It allows you to pre-configure systems and save that configuration to your computer. When the systems are then installed the configuration can be loaded from the computer disk and downloaded to the units. This also allows you to keep a backup of the configuration of a system in case an MTL838C needs to be replaced or for some reason gets inadvertently altered. Note that all configuration data is stored in the MTL838C, so replacing MTL831Cs does not require downloading of the configuration. It is a good idea to consider where the configurations will be stored on the computer and how they will be named so they may easily be identified with a particular system.

The following window appears when you select "Save Configuration"



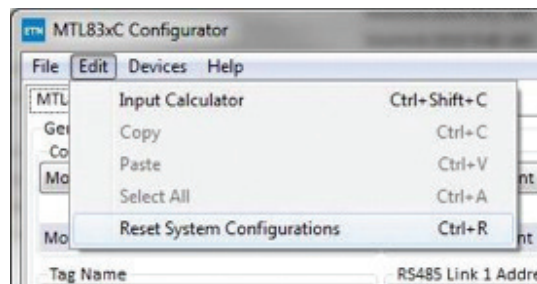
The default file name is "Configs.txt". Change its name to something more meaningful and press the Save button. We recommend keeping the ".txt" file type so the program can easily access the files. Also, although these are text files which are easily viewed and manipulated by standard Windows software, we do not recommend altering them in this manner. It is likely that text files may already exist on your computer. For this reason it is recommended that a new folder be created to save MTL83xC configurations in.

When you select "Load Configuration", the following window appears.

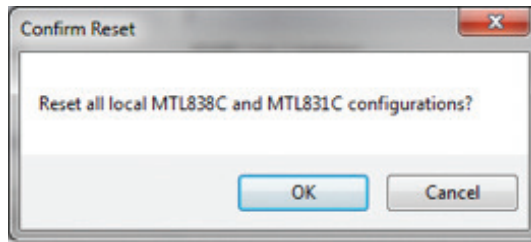


Using the window features, browse to the location of the configuration data you are looking for and select the appropriate file. Press the Open button to load the configuration. This populates the configuration data on all 3 tabs. It may then be downloaded to the MTL838C.

6.2 Edit

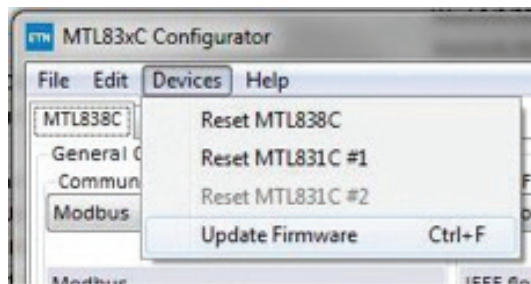


The Edit menu is shown above. The functions of all of the items listed except the last one has been covered in the MTL831C #1 Tab section. The last one, "Reset System Configurations", will reset the entire system configuration to the default settings. This includes the configuration on the MTL838C, MTL831C #1, and MTL831C #2 tabs. Selecting this option will present the following screen:



This allows you to confirm your intention to clear all configuration data to the defaults. Press OK to continue with the reset or Cancel to abort.

6.3 Devices



The Devices menu contains functions specific to the MTL83xC devices. The first three are commands to reset the respective pieces of hardware and the fourth item launches the window allowing firmware updates of the connected devices.

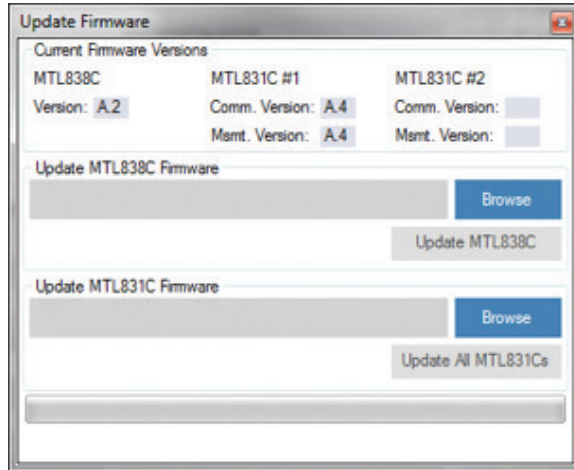
All three Reset functions send a command to the selected device that tells it to reset itself (firmware reset). This will only work if the devices are functioning well enough to receive and execute the command.

A Reset MTL838C command not only causes the MTL838C to reset (assuming it is successful), **but it also may reset the connected MTL831Cs**. If the MTL831Cs are powered by the MTL838C (non-hazardous installation), then resetting the MTL838C will also reset the connected MTL831Cs. However, if the MTL831Cs are powered by an isolator such as the MTL5553, then a reset to the MTL838C will not reset the MTL831Cs.

The other two reset commands are for the MTL831C #1 and MTL831C #2 respectively. Again, assuming the MTL838C is functioning properly the command will be routed to the appropriate MTL831C. Then if that MTL831C is also functioning well enough, it will reset itself.

The reset commands may be used if you feel that a unit is not functioning correctly and it may save a trip into the field.

Selecting the Update Firmware option brings up the following window:



CAUTION

Updating firmware will cause the units to reboot which disrupts data transmission from the units.

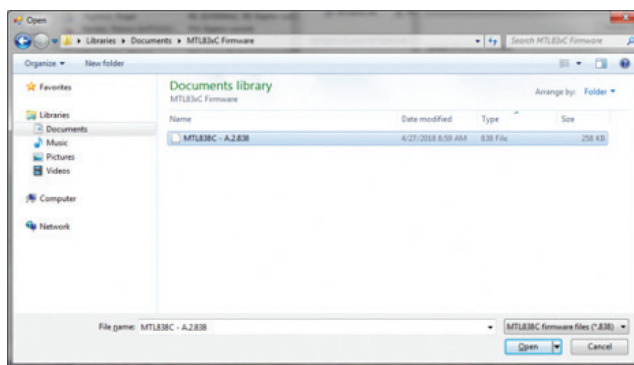
At the top of the window the current firmware versions are displayed for the units. If a unit is not connected, then the version information is blank (as is the case above with the MTL831C #2). The latest firmware will be available on the Eaton (MTL) website www.mtl-inst.com. If you suspect that the unit has become corrupted (functionally – not just configuration data), then it may make sense to reload the same version of firmware. Otherwise it's only recommended to update firmware when a newer version is available.

NOTE

Calibration and configuration data are not disturbed by a firmware update.

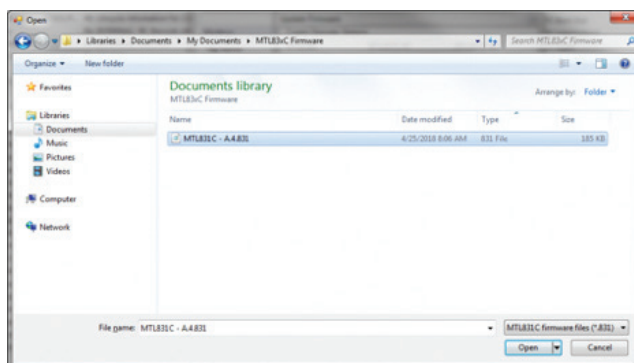
The recommended procedure is to download and save the newer firmware on your computer. You will download a single compressed ZIP file that contains both firmware files. Extract the files from the compressed file into a folder on your computer. Files that end in "838" are firmware files for the MTL838C and files that end in "831" are firmware files for the MTL831C. The file name will contain the product name followed by the firmware version. We recommend that you don't rename the files.

When you are ready to update the firmware for the MLT838C, click on the Browse button in the Update MTL838C Firmware box. The following file selection window will appear:



Select the firmware version you wish to update your unit to and click on Open. The gray box next to the Browse button will be populated with the filename (with its full path). This will also cause the Update MTL838C button to become active (blue). Press the Update MTL838C button to start the firmware update process. This will take a minute or so and a progress bar with status messages will update at the bottom of the window. When complete, the version at the top of the window should update to the version just applied to the unit. If any errors occur, they will be displayed at the bottom of the window. If you get an error, try again. If that is unsuccessful, contact Eaton (MTL) for assistance.

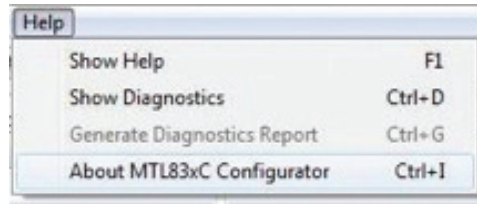
A similar process is used for the MTL831C firmware update. There is a separate box labeled Update MTL831C Firmware that contains the same Browse and Update buttons. Use the same procedure to select a file and update the MTL831Cs. The following window is displayed after selecting the Browse button for updating MTL831C firmware:



As with the MTL838C, select the file you wish to use for the firmware update and click the Open button. The gray box next to the Browse button will be populated with the filename (with its full path). This will also cause the Update All MTL831Cs button to become active (blue). Press the Update All MTL831Cs button to start the firmware update process. This will take up to 6 minutes and a progress bar with status messages will update at the bottom of the window. When complete, the version at the top of the window should update to the version just applied to the unit. If any errors occur, they will be displayed at the bottom of the window. If you get an error, try again. If that is unsuccessful, contact Eaton (MTL) for assistance.

Notice that update process for the MTL831C will update ALL MTL831Cs connected to the MTL838C.

6.4 Help



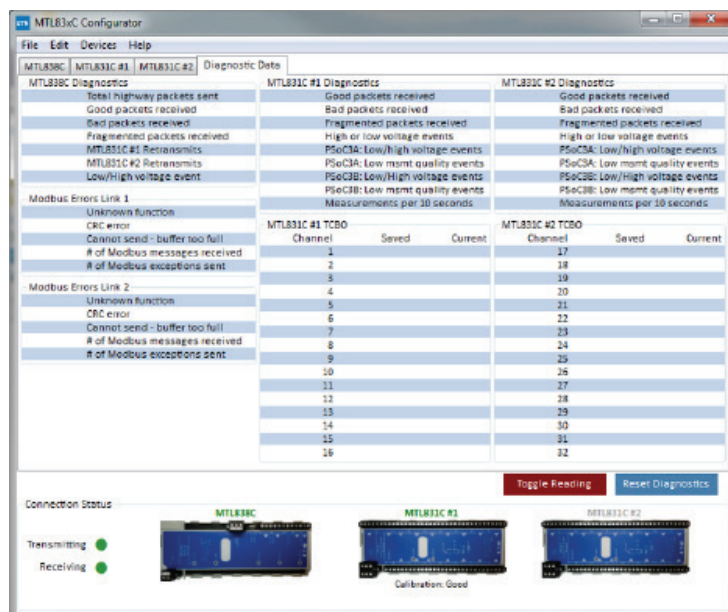
The last menu is the Help menu. Selecting Show Help or pressing F1 opens the instruction manual for the PC software (this document). This will open the PDF document for the mode that the software is currently in (Modbus RTU, Modbus TCP, etc.). If you get the wrong document, change to the mode you wish the documentation for on the MTL838C tab and try again.

The About MTL83xC Configurator option brings up the following window:

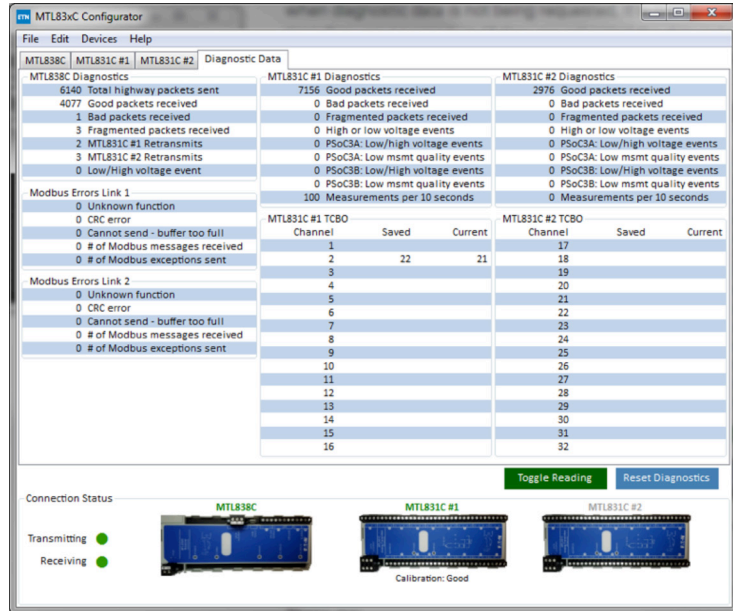


This is where you can find the version of the PC software that you are currently running. As long as you are connected to the internet, the software will automatically download and install any updates.

The last two options have to do with diagnostic information. The first option "Show Diagnostics" causes a fourth (4th) tab to appear that contains diagnostic information. When the Diagnostic Data tab is displayed, then the menu option changes to "Hide Diagnostics". Clicking on this will remove the diagnostic tab. The following is what the Diagnostic Data tab looks like when it is first opened:



Initially the request for diagnostic data from the MTL83xC system is OFF as indicated by the red Toggle Reading button and no diagnostic data (numbers) being listed. To begin receiving diagnostic data, press the Toggle Reading button. It will change to a green color and data from the units will be received. Note that even when diagnostic data is not being requested, it is being collected by the units any time they are powered up (if they are rebooted the data is lost). The following shows the screen when diagnostics are being requested and updated live:



Notice that there are several fields where non-zero information is a good thing. These are:

Total highway packets sent	A running total of the number of packets of data sent to either MTL831C
Good packets received	Tracked on each unit and is useful when comparing to Bad or Fragment packets to see what percentage of errors there are.
Measurements per 10 seconds	This is a count of the number of measurements received by the MTL838C from the given MTL831C. It should be 100 as the MTL838C requests measurements from both MTL831Cs every 100ms.

The MTL831C #1 TCBO and MTL831C #2 TCBO tables are also not considered errors. They contain resistance measurements of any Thermocouple channels. TCBO stands for ThermoCouple Burn Out and is when a thermocouple has increased in resistance by 50 ohms or more. The Saved value is the resistance measurement of the thermocouple when the MTL831C was power up or rebooted, a Thermocouple was connected to a channel configured as a thermocouple after previously being open, or a channel was configured as a Thermocouple when previously configured as mV or RTD. This saved value is then compared to a periodic measurement of the thermocouple resistance (shown in the Current column). If the resistance difference is greater than 50 ohms, then the Thermocouple status is set to "Burn-Out". This burnout status is also available via Modbus (not the resistance measurements). In the example above, only one thermocouple is connected and it is on channel 2 of the MTL831C #1. Its Saved and Current readings are 22 and 21 ohms respectively.

There are some errors shown in the example above. This is because the MTL831C #1 was disconnected from the Data Highway and then re-connected. It is typical in this case to see a few errors. The Bad and Fragment packets received at the MTL838C are due to Data Highway transitions due to unplugging and plugging in the MTL831C #1. Similar things can occur if the MTL831C is reset via the PC Software as described in the Devices section. Retransmits occur when an MTL831C is disconnected from the Data Highway. A few of the Low msmt (measurement) quality occur on the MTL831C whenever it is powered up. The following table provide details on the diagnostic items:

MTL838C Diagnostics

Total highway packets sent	A running total of the number of packets of data sent to either MTL831C.
Good packets received	Number of good (no CRC error) packets received from the MTL831Cs.
Bad packets received	The number of packets that had a CRC error. Caused by connecting or disconnecting MTL831Cs or by noise.
Fragmented packets received	A count of the number of incomplete packets received. This is usually noise or connect/disconnect of an MTL831C.
MTL831C #1 Retransmits	Number of times the MTL831C did not respond to a command (the MTL838C is the bus master) and the command had to be retransmitted. After 3 consecutive missed responses the MTL831C is 'dropped' and must go through re-initialization if it starts communicating again.
MTL831C #2 Retransmits	Same as above but for the MTL831C with the Address Jumper (#2).

MTL831C #x Diagnostics (x = 1 or 2)

Good packets received	Number of good (no CRC error) packets received from the MTL838C or other MTL831C if connected..
Bad packets received	The number of packets that had a CRC error. Caused by connecting or disconnecting MTL831Cs or by noise.
Fragmented packets received	A count of the number of incomplete packets received. This is usually noise or connect/disconnect of an MTL831C.
High or low voltage events	High or low voltage events detected by the main microprocessor. Multiple events can be recorded for a single voltage event.
PSoC3A: Low/high voltage events	High or low voltage events detected by the A measurement microprocessor. Multiple events can be recorded for a single voltage event.
PSoC3A: Low msmt quality events	The main microprocessor detected a low number of measurements per second from the A microprocessor.
PSoC3B: Low/high voltage events	High or low voltage events detected by the B measurement microprocessor. Multiple events can be recorded for a single voltage event.
PSoC3B: Low msmt quality events	The main microprocessor detected a low number of measurements per second from the B microprocessor.

Modbus Errors Link 1 (or 2)


Unknown function	The Modbus Host sent a function code not supported by the MTL838C
CRC Error	A CRC error occurred on a Modbus packet.
Cannot send – buffer too full	Data is put in a buffer while waiting for the UART to transmit to the Modbus Host. More data was ready to go in the buffer but there was not room for it. This should not normally happen.
# of Modbus messages received	Number of Modbus messages received from the Modbus Host.
# of Modbus exceptions sent	Number of Modbus exception messages sent to the Modbus Host by the MTL838C.

7 ETHERNET MODULE CONFIGURATION – MTL838C-MBT only

Initially, the MTL838C-MBT is configured to get its IP address from a DHCP server. For most installations, the IP address will need to be set to a known value so that it may be easily identified on the network.

Configuration of the MTL838C-MBT Ethernet port settings is done with a Telnet connection to port 9999. The IP address and several other parameters may be set using this method. The procedure is:

1. Connect the MTL838C-MBT to a small network with a DHCP server.
2. Use an IP scanning tool such as Advanced IP Scanner to find the MTL838C-MBT. You can make sure you have the right device by verifying the MAC address which is printed on top of the RJ45 connector. Note that the Manufacturer will show up as Lantronix – they make the RJ45 module.
3. Use a Telnet program such as PuTTY to connect to the IP address you determined at port 9999. Something similar to the following will be the device response:

 10.0.0.65 - PuTTY

```
Modbus/TCP to RTU Bridge
MAC address 0080A3DA26EA
Software version V3.3.0.1GC (131213) XPTEXE
Press Enter for Setup Mode
```

4. To continue, press Enter within 5 seconds or the connection will be closed. Pressing Enter displays the Setup options:

```

10.0.0.65 - PuTTY
Model: Device Server Plus+! (Firmware Code:YM)
Modbus/TCP to RTU Bridge Setup
1) Network/IP Settings:
   IP Address ..... - 0.0.0.0/DHCP/BOOTP/AutoIP
   Default Gateway ..... --- not set ---
   Netmask ..... --- not set ---
2) Serial & Mode Settings:
   Protocol ..... Modbus/RTU,Slave(s) attached
   Serial Interface ..... 9600,8,N,1,RS232
3) Modem/Configurable Pin Settings:
   CP1 ..... GPIO (In)
   CP2 ..... GPIO (In)
   CP3 ..... GPIO (In)
4) Advanced Modbus Protocol settings:
   Modbus/TCP Port ..... 00502
   Slave Addr/Unit Id Source .. Modbus/TCP header
   Modbus Serial Broadcasts ... Disabled (Id=0 auto-mapped to 1)
   MB/TCP Exception Codes .... Yes (return 00AH and 00BH)
   Char, Message Timeout ..... 00050msec, 05000msec
5) Preset Automated Scan Table:

7) Security
   SNMP ..... Enabled
   SNMP Community Name ..... public
   Telnet Setup ..... Enabled
   Telnet Debug ..... Enabled
   TFTP Download ..... Enabled
   Port 77FEh ..... Enabled
   Web Server ..... Enabled
   Web Setup ..... Enabled
   ECHO ..... Disabled
   Enhanced Password ..... Disabled

D)efault settings, S)ave, Q)uit without save
Select Command or parameter set (1..5) to change: █

```

5. Pressing 1 through 5 or 7 allows modification of the indicated parameters. Pressing “D” resets the parameters to their defaults. “S” or “Q” saves any changes or quits without saving changes.

CAUTION
Some changes to parameters will disable the ability to configure the Ethernet port further!

WARNING
Do not change parameters in options 2, 3, or 5!

Details of the Ethernet Port Parameters:

1. Option "1" allows you to set the IP address, Default Gateway, and Netmask. The following shows the questions asked and results of the data entry. The IP address was set to 10.0.0.65 with no other changes. Notice that it also asked if the Telnet password should be changed (it was not). Setting a Telnet password prevents unauthorized changes to the Ethernet port. Note that the password is only 4 characters and it does not require double entry (validation). A better option is to set an Enhanced Password (16 character maximum) in the Security options (7).

```
IP Address (000) 10.(000) 0.(000) 0.(000) 65
Set Gateway IP Address (N) ?

Set Netmask (N for default) (N) ?

Change Telnet/Web config password (N) ?

Modbus/TCP to RTU Bridge Setup
1) Network/IP Settings:
   IP Address ..... 10.0.0.65
   Default Gateway ..... --- not set ---
   Netmask ..... --- not set ---
```

Setting the IP address back to 0.0.0.0 will cause it to request its address from a DHCP server.

2. DO NOT CHANGE OPTION 2.
3. DO NOT CHANGE OPTION 3.
4. Option "4" contains settings for Modbus TCP. We recommend using the defaults, but they may be changed if needed for your environment. Below is a capture of the questions and options where <Enter> was pressed to accept the default for each option:

```
Modbus/TCP Port (502)
Slave address (0 for auto, or 1..255 fixed otherwise) (0) ?
Allow Modbus Broadcasts (1=Yes 2=No) (2) ?
Use MB/TCP 00BH/00AH Exception Responses (1=No 2=Yes) (2) ?
Disable Modbus/TCP pipeline (1=No 2=Yes) (1) ?
Character Timeout (0 for auto, or 10-6950 msec) (50)
Message Timeout (200-65000 msec) (5000)
Serial TX delay after RX (0-1275 msec) (0)
Swap 4x/0H to get 3x/1x (N) ?
```

5. DO NOT USE OPTION 5.
7. Option "7" contains settings for the Security of the device. Exercise caution with changes here as some can make the device inaccessible to further parameter changes! The following is a capture of the default security settings:

```
SNMP ..... Enabled
SNMP Community Name ..... public
Telnet Setup ..... Enabled
Telnet Debug ..... Enabled
TFTP Download ..... Enabled
Port 77FEh ..... Enabled
Web Server ..... Enabled
Web Setup ..... Enabled
ECHO ..... Disabled
Enhanced Password ..... Disabled
```

The table below explains each of these settings:

SNMP	This setting allows you to disable the SNMP protocol on the unit for security reasons.
SNMP Community Name	The SNMP Community Name is a required field for NMS to read or write to a device. Enter a string of 1 to 13 characters.
Telnet Setup	This setting defaults to the N (No) option. The Y (Yes) option disables access to Setup Mode by Telnet (port 9999) – NOT RECOMMENDED.
Telnet Debug Port	This is enabled by default, but may be disabled.
TFTP Download	By default a TFTP client may be used to download firmware to the Ethernet Module. Disable this to prevent firmware updates.
Port 77FEH	Port 77FE is a setting that allows custom programs to configure the unit remotely. You may wish to disable this capability for security purposes.
Web Server	No web server in this device.
Web Setup	No web server in this device.
ECHO	This setting controls whether port 7 echoes characters it receives.
Enhanced Password	The Enhanced Password setting allows you to set a password of up to 16 characters for protecting Telnet access. We recommend that you select the Y (Yes) option and enable the enhanced password setting.

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