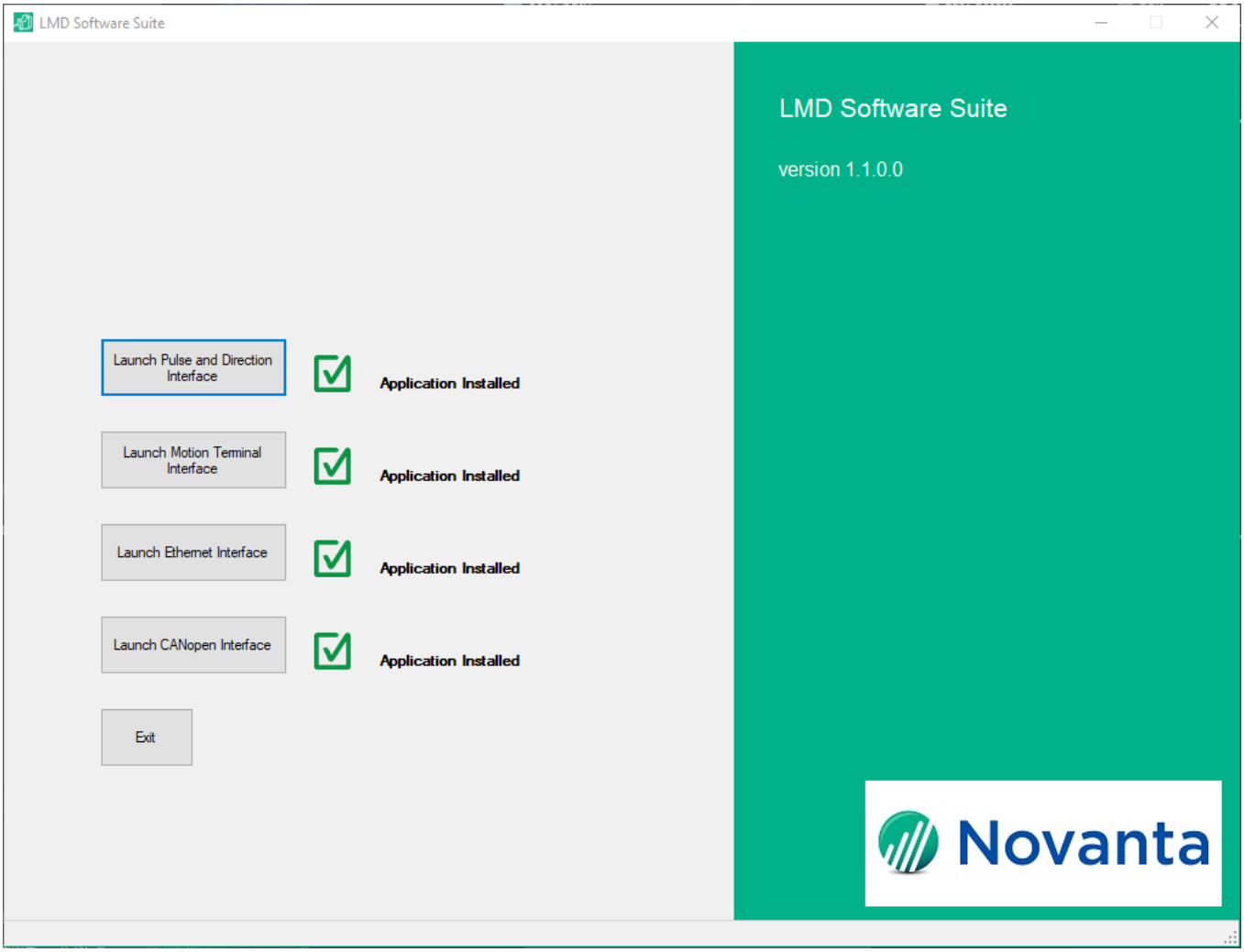
Software Manual

LMD Software Suite V1.1.0.0

Programming and Configuration Utilities Manual

Publication LMD-SWSuite-REV-J

03/2022



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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Novanta IMS software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

For information on the availability of products, go to https://novantaims.com/

The information contained in the present document is subject to change without notice. The technical characteristics of the devices described in the present document also appear online. The characteristics that are presented in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If there is a difference between the document and online information, use the online information as reference. All details provided are technical data which do not constitute warranted qualities.

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Table of Contents

Safety Information

Important Information

NOTICE Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label or message indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert of potential personal injury hazards. Obey all safety messages and labels that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result** in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

CyberSecurity Standards and Certification

Novanta IMS follows local regulations and uses additional industry established frameworks to conform to cyber security standards. Novanta IMS also takes an active part in the evolution of today’s industrial cyber security standards, contributing to these standards and frameworks.

In accordance with US California Senate Bill No. 327, and under direct guidance from Novanta, Novanta IMS has implemented a level of cyber-secure protection in the LMD Ethernet-based MDrive product line in order to protect these devices from outside cyber attacks. By choosing to disable these features, the user is acknowledging their acceptance of potential unauthorized outside access.

Qualification of Personnel

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Novanta IMS for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electro-mechanical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Intended Use

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, ensure the safety of persons by means of the design of this entire system (e.g., machine design).

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts. The product must NEVER be operated in explosive atmospheres (e.g., hazardous locations, Ex areas).

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

Product Related

⚠ DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH

Remove all power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions will result in death or serious injury.

When the system is started, the drives are usually out of the operator's view and cannot be visually monitored.

⚠ DANGER

EQUIPMENT OPERATION

Only start the system if there are no persons in the zone of operation.

Failure to follow these instructions will result in death or serious injury.

Drives may perform unintended movements because of incorrect wiring, incorrect parameter settings, incorrect data, user programming bugs, or other errors. Further, interference (e.g., electromagnetic interference (EMI)) may cause unpredictable responses in the system.

⚠WARNING

UNINTENDED MOVEMENT

- Carefully install the wiring in accordance with the electromagnetic compatibility (EMC) requirements.
- Do not operate the drive system with unknown parameter settings or data.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop, overtravel stop, power outage, and restart.

⚠WARNING

LOSS OF CONTROL

- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines. [1]
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

1 For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1, (latest edition), “Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems”

Drives may perform unintended movements due to mechanical damage to connectors. Mechanical damage to the connectors may cause erratic or uncontrolled operation. Installation with a bent or broken mounting flange, motor shaft, or misaligned coupling may cause unintended behavior and possible destruction of system components as a result.

⚠WARNING

LOSS OF CONTROL, ERRATIC OPERATION AND DESTRUCTION OF MECHANICS

- Do not drop product.
- Leave product in protective packaging until ready for use.
- Carefully inspect connectors prior to installation in a system for mechanical damage.
- Carefully inspect motor shaft and ensure shaft rotates freely without binding.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Opening LMD heat sinks can affect factory-set encoder alignment and impact Hybrid Motion Technology (hMT) performance. Tamper seals are used to ensure factory hardware settings remain unaltered and match the encoder alignment set during the manufacturing process. If a seal is broken, the LMD product warranty is void.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not open the LMD housing for any reason.
- Contact a Novanta IMS Applications representative if the product exhibits unexplained, erratic, or incorrect operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

When working on the wiring, inserting or removing connectors may cause unintended behavior and possible destruction of the system components.

⚠CAUTION

UNINTENDED EQUIPMENT OPERATION

Remove all power before working on the wiring.

Failure to follow these instructions can result in injury or equipment damage.

Radial (side) loading or axial (thrust) impacts on the shaft may result in premature bearing wear and eventual inoperability.

NOTICE

EXCESSIVE RADIAL OR AXIAL LOADS

- Do not exceed the maximum radial or side loads on motor shaft.
- Do not apply force that will pull the shaft from the motor as that may compress the pre-load washer, causing the motor to move.
- Do not allow the shaft to be subject to impact forces or otherwise struck by external objects.

Failure to follow these instructions can result in equipment damage.

About this Manual

Source Documents and Software

The latest versions of the manuals and software can be downloaded from the Internet at:
https://novantaims.com/dloads/

Writing Conventions and Symbols

Work Steps

If work steps must be performed consecutively, this sequence of steps is represented as follows:

- ■ Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Specific response to this work step
- ▶ Step 2

If a response to a work step is indicated, this allows verification that the work step has been performed correctly.

Unless otherwise stated, the individual steps must be performed in the specified sequence.

Bulleted Lists

The items in bulleted lists are sorted alphanumerically or by priority. Bulleted lists are structured as follows:

- Item 1 of bulleted list
- Item 2 of bulleted list
  - Subitem for 2
  - Subitem for 2
- Item 3 of bulleted list

Making Work Easier

Information on making work easier is highlighted by this symbol:

Sections highlighted this way provide supplementary information on making work easier.

Parameters

Parameters are shown as follows

RC Motor Run Current

Units of Measure

Measurements are given in both imperial and metric values. Metric values are given in parenthesis.

Examples:

1.00 in (25.4 mm)
100 oz-in (70.6 N-cm)

Website Directory

NOTE: Direct links are subject to change as website updates occur. Each of the websites below can also be accessed through menu options on the Novanta IMS Main Page: https://novantaims.com/

Downloads:
https://novantaims.com/dloads/

Resources:
https://novantaims.com/resources/

Certifications and Listing Information:
https://novantaims.com/dloads/certificationssustainability/

Contact and Support:
https://novantaims.com/contacts/

CyberSecurity Information:
https://novantaims.com/all-products/cybersecurity/

Knowledge Based Solutions:
https://knowledge.imshome.com/s/

Chapter 1
Introduction

What's in this Chapter?

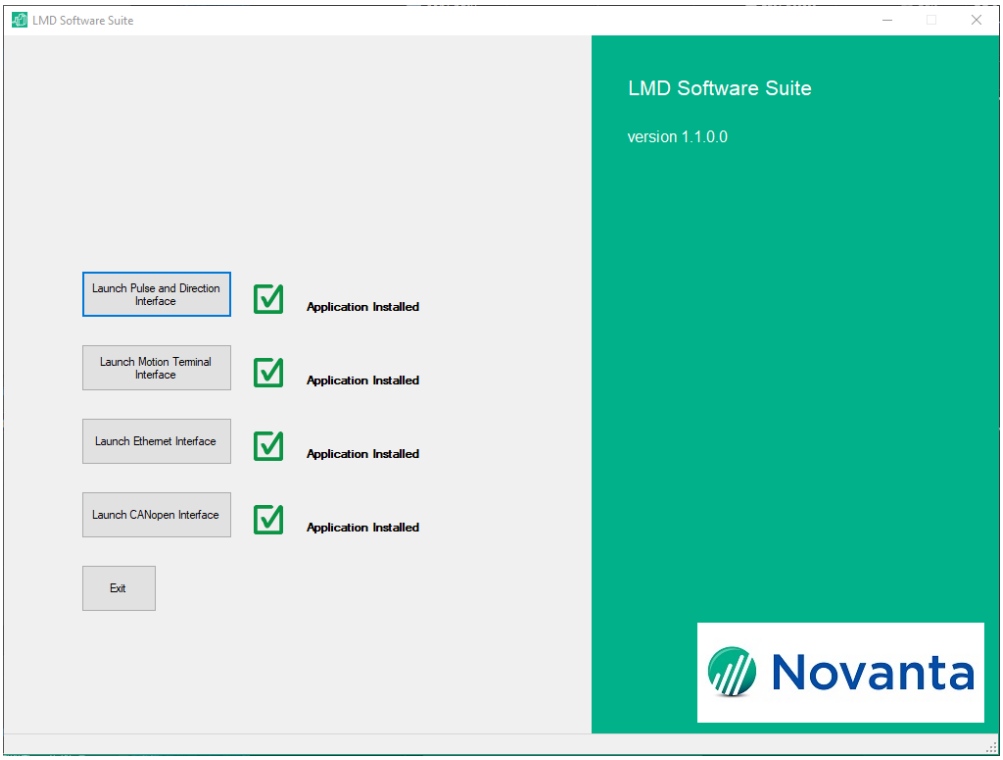
This chapter includes the following topics:

General Features

The LMD Software Suite (LSS)is a software application for Windows® based PCs that facilitates the configuration, programming and diagnostics of LMD products.

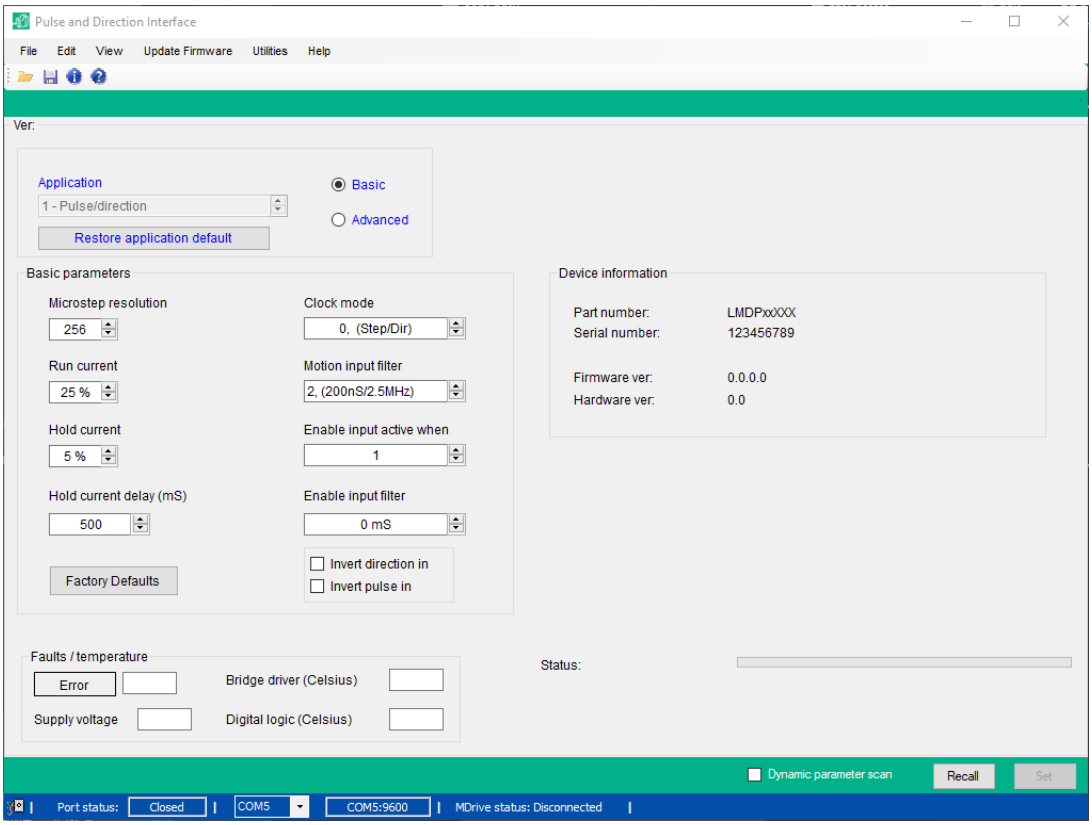
The LSS contains the following modules:

- Pulse/Direction Configuration Utility
- Motion Control Interface
- Ethernet Configuration Utility
- CANopen Configuration Utility



The main screen, or start page, of the Software Suite acts as an installer/launcher for the program modules.

Pulse/Direction Configuration Utility



Description and Features

NOTE: The LSS is required to perform an application firmware update.

The Pulse/Direction configuration utility is used to configure the parameters for the LMD Pulse/Direction models (P/N. **LM**xx**P**).

- Establish a connection to the device
- Set parameters for and set the following modes:
  - Step/direction mode
  - Torque mode (encoder equipped models only)
  - Speed control mode
  - Velocity mode
- Set the device parameters by functional grouping:
  - hMT settings (encoder equipped models only)
  - Analog input settings
  - Communication bus settings
  - I/O settings
  - Motion settings
- Display device status and version information
- Archive and duplicate device parameters
- Display error information
- Upgrade product application firmware

Supported Devices

The LSS supports all models of LMD Pulse/Direction products. See the device's hardware manual for wiring and connection information.

The software and all associated product documents are available for download from:

https://novantaims.com/dloads/

Familiarity with Windows® operating systems is required to use the LSS Programming and Configuration Utilities.

MD-CC404/405-000: USB to RS-422 Converter

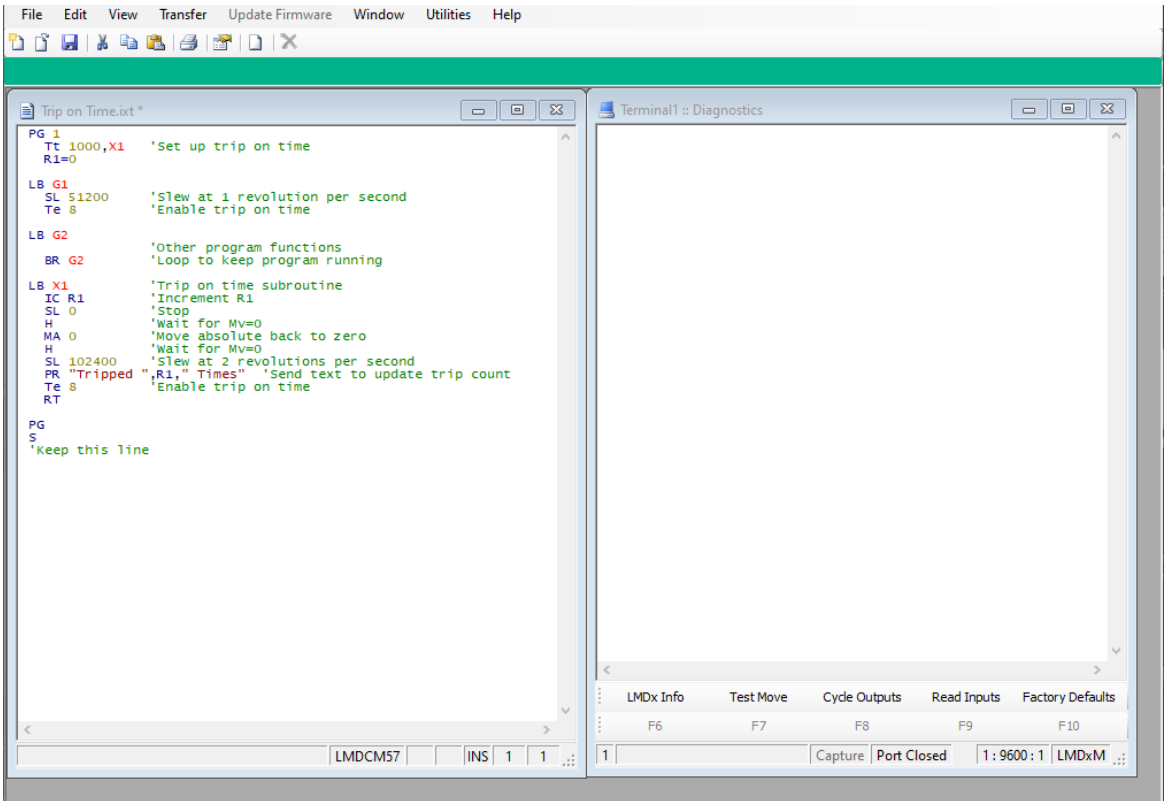
The MD-CC404-000 and MD-CC405-000 are USB-pluggable converters to set/program communication parameters in 32 or 64-bit. A pre-wired DB9 mating cable is included.

Description	Part number
USB to RS-422/485 Communication Converter	MD-CC404-000
USB to RS-422/485 Communication Converter	MD-CC405-000

MD-CC404-000

MD-CC405-000

Motion Control Interface



Description and Features

NOTE: The LSS is required to perform an application firmware update.

The Motion Control Interface is a software utility used to write, simulate and transfer programs to and from the LMD Motion Control products.

MCode programs, are developed using intuitive mnemonic codes in a color coded program editor window. Multiple simultaneous windows are allowed. Real time streaming commands may be entered into an ASCII/ANSI terminal emulator tab. Multiple terminal windows may be simultaneously connected to different LMD Motion Control devices for system development.

Features include:

- Color coded program editor
- Multiple program editor windows and terminal windows may be used simultaneously
- Display device status and version information
- Archive and duplicate device parameters
- Display error information
- Upgrade product application firmware

Supported Devices

The software supports the following products:

- LMD Motion Control (P/N: **LMD**x**M**xxx and **LMH**x**M**xxx)
- LMD Motion Module Motion Control (P/N: **LMM-15-M**)
- LMD TCP/IP products when used in MCode/TCP - or configuration (connected through port 503) (P/N: **LMD**x**E**xxx, **LMD**x**D**xx**C**, **LMH**x**E23**x, and **LMH**x**D23**x**C** and associated linear drives.)

See the device hardware manual for wiring and connection information.

The software and all associated product documents are available for download from:

https://novantaims.com/dloads/

Familiarity with Windows® operating systems is required to use the LSS Programming and Configuration Utilities.

MD-CC404/405-000: USB to RS-422 Converter

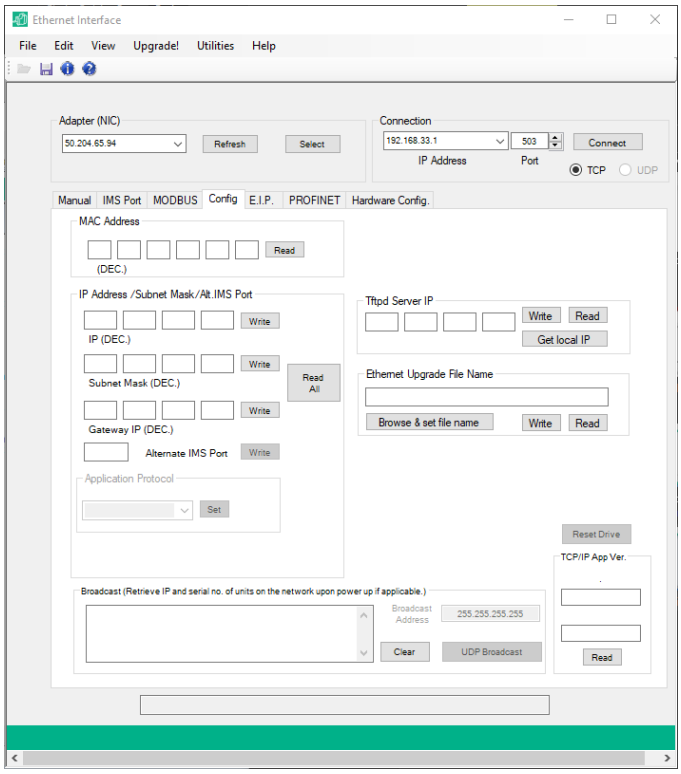
The MD-CC404-000 and MD-CC405-000 are USB-pluggable converters to set/program communication parameters in 32 or 64-bit. A pre-wired DB9 mating cable is included.

Description	Part number
USB to RS-422/485 Communication Converter	MD-CC404-000
USB to RS-422/485 Communication Converter	MD-CC405-000

MD-CC404-000

MD-CC405-000

Ethernet Interface



Description and Features

NOTE: The LSS is required to perform an application firmware update.

The Ethernet Configuration Utility is a software interface used to configure and perform functional testing on LMD Ethernet TCP/IP products.

The primary configuration parameters are:

- Load desired application: MODBUS/TCP (default), Ethernet/IP or Profinet IO
- Set the device IP address
- Set the Subnet mask and gateway address.

Features include:

- Functional Test for MODBUS/TCP
- User-defined mapping of the Ethernet/IP assembly object
- User-defined mapping of the Profinet IO Input and Output slots
- Upgrade Ethernet application firmware

Supported Devices

The software supports the following products:

- LMD Ethernet (P/N: **LMD**x**E**xxx,**LMD**x**D**xx**C**, **LMH**x**E23**x,and **LMH**x**D23**x**C**)

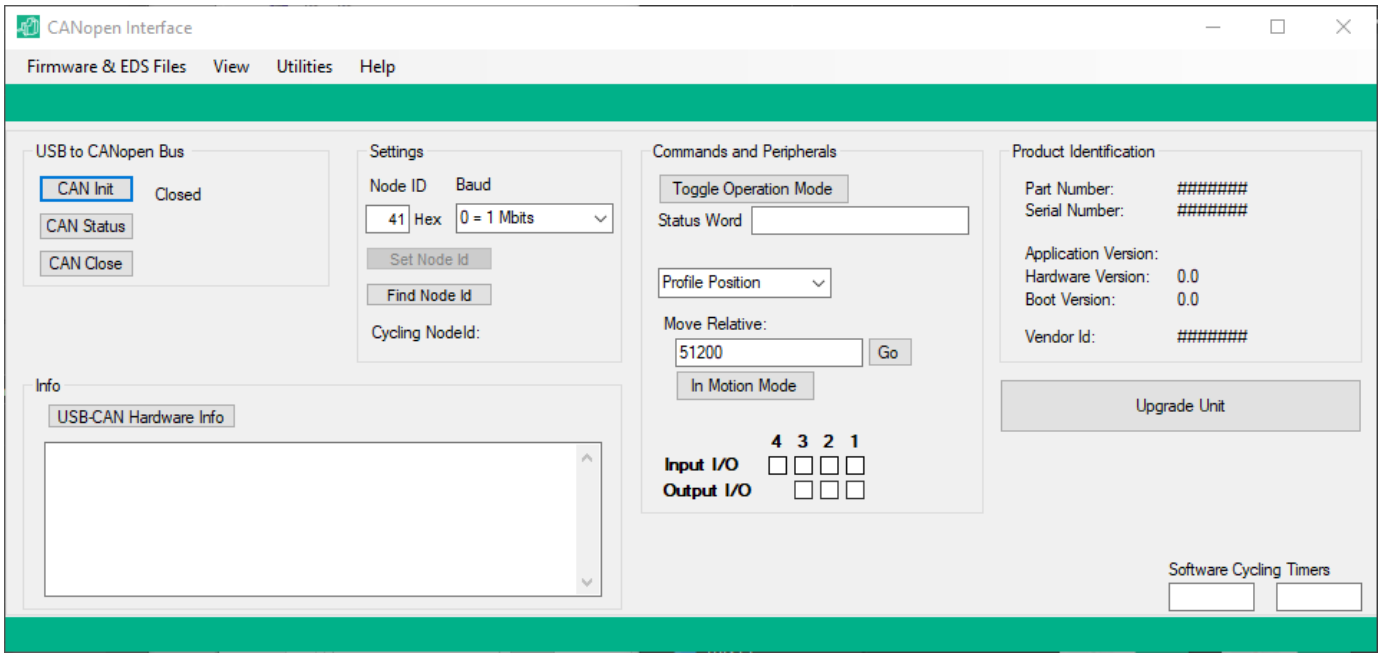
See the device hardware manual for wiring and connection information.

The software and all associated product documents are available for download from:

https://novantaims.com/dloads/

Familiarity with Windows® operating systems is required to use the LSS Programming and Configuration Utilities.

CANopen Configuration Utility



Description and Features

NOTE: The LSS and related USB-to-CANopen adapter are required to perform an application firmware update.

The CANopen Configuration Utility is a software interface used to configure and perform functional testing on LMD CANopen products. Refer to “Chapter 6 CANopen Interface” on page 88

The primary configuration parameters are:

- Node ID (Default 41h)
- BAUD rate (Default 1 Mbps)

Features include:

- Functional test motion in profile position and profile velocity
- Functional test read inputs
- Functional test write outputs
- Read device information
- Upgrade application firmware

Supported Devices

The software supports the following products:

- LMD CANopen (P/N: **LMD**x**A**xxx, **LMH**x**A**xxx, and linear drives)
- LMD Motion Module CANopen (P/N: **LMM-15-A**)

See the device hardware manual for wiring and connection information.

The software and all associated product documents are available for download from:

https://novantaims.com/dloads/

Familiarity with Windows® operating systems is required to use the LSS Programming and Configuration Utilities.

MD-CC501/502-000 USB to CANopen Converter

The CANopen Configuration Utility works with the MD-CC500-000 USB to CANopen converter or an equivalent PEAK/Phytec CANopen adapter.

The adapter kit includes the USB to CANopen converter, a 6’ adapter cable and a termination resistor block.

See Section 7 For installation instructions.

Description	Part number
USB to CANopen Communication Converter	MD-CC501-000
USB to CANopen Communication Converter	MD-CC502-000

MD-CC501-000

MD-CC502-000

Chapter 2
Installation

What's in this Chapter?

This chapter includes the following topics:

Source Programming and Configuration Utilities

The latest version of the Programming and configuration utilities is available for download from: https://novantaims.com/dloads/

The LSS is required to define the functionality of the device.

PC Requirements

System Requirements

The minimum hardware requirements for installation and operation of the software are:

- IBM compatible PC
- Windows 8 or higher
- Monitor with minimum 1024 x 768 resolution
- Available USB port
- Internet connection (for software download and updates)

Accessories

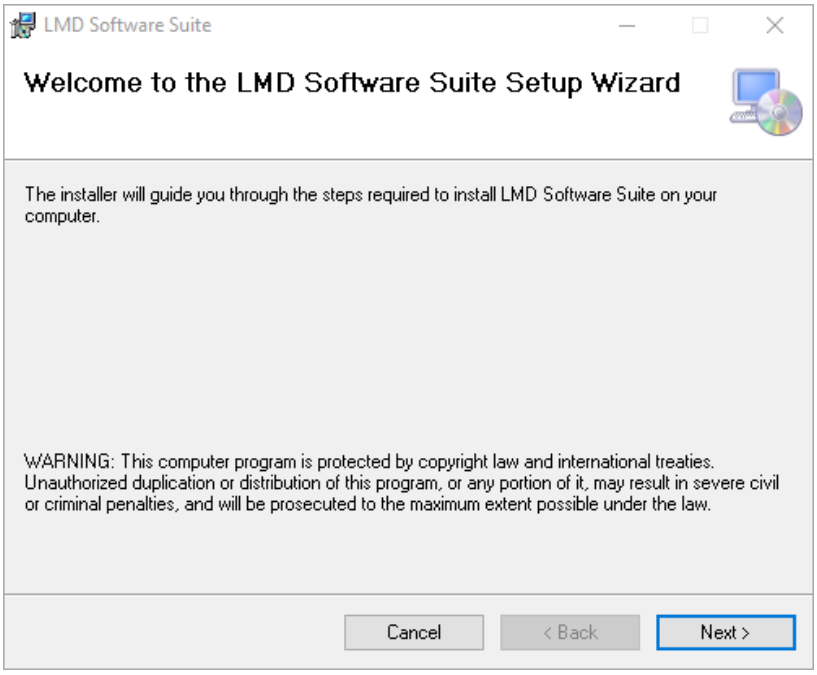
Interface Connector	Fieldbus	PC Interface	Communication Interface Kit Part Number
DB9 Male	RS-422/485 (IP20)	USB	MD-CC404-001
M12 Female 5-pos A-coded	RS-422/485 (IP65)	USB	MD-CC405-001
DB9 Male	CANopen (IP20)	USB	MD-CC501-001
M12 Male 5-pos A-coded	CANopen (IP65)	USB	MD-CC502-001
RJ45	Ethernet (IP20)	RJ45	Standard CAT5 or newer cable
M12 Male 4-pos D-coded	Ethernet (IP65)	RJ45	MD-CS640-000

Installation Procedure

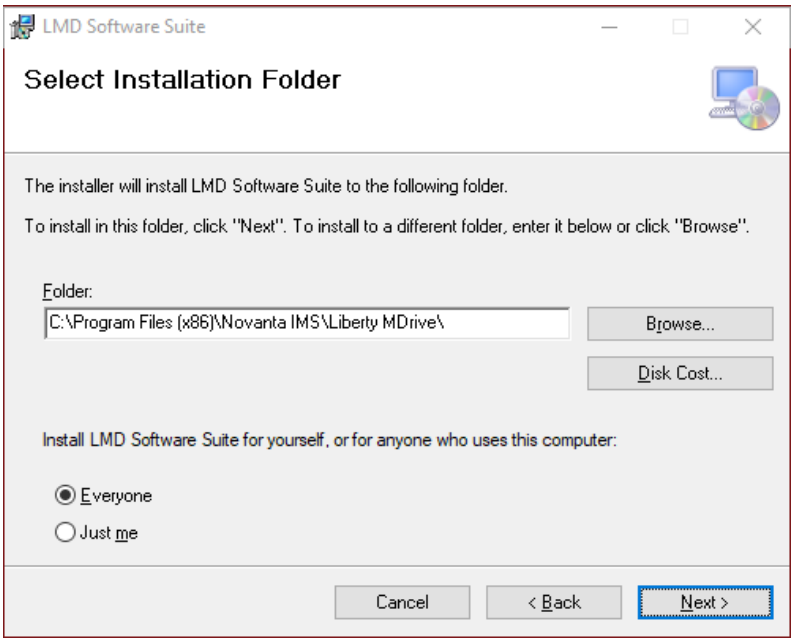
NOTE: Back up important data regularly and always before installing new software or firmware.

1. Verify the PC meets the requirements.
2. Download the “LMD Software Suite” installation file. The file will be in a compressed format.
3. Extract the compressed file to a file location on the computer’s hard drive.

4. Double-click the file “setup.exe” to begin the installation of the LSS. The following dialog box is displayed:

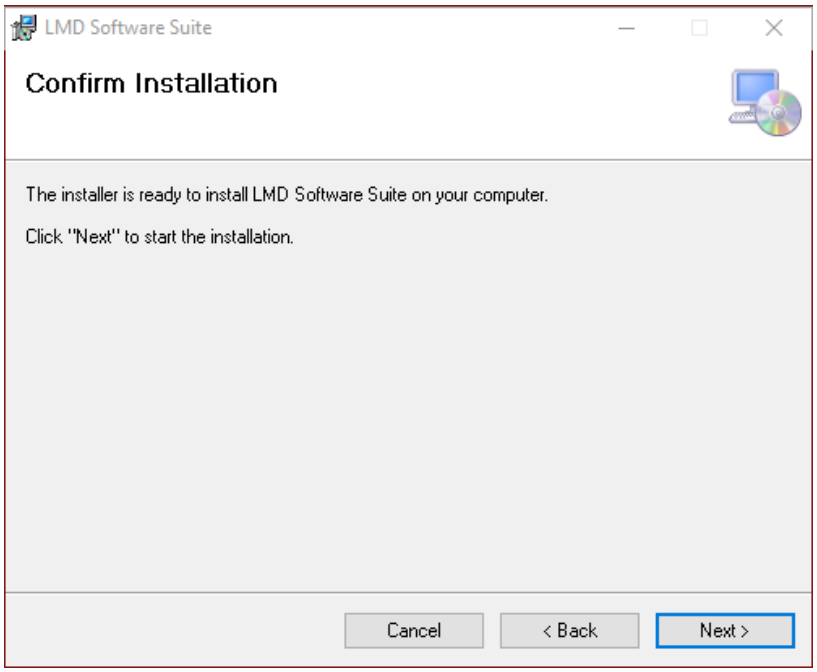


5. Click the button labeled “Next”. The following dialog box is displayed:



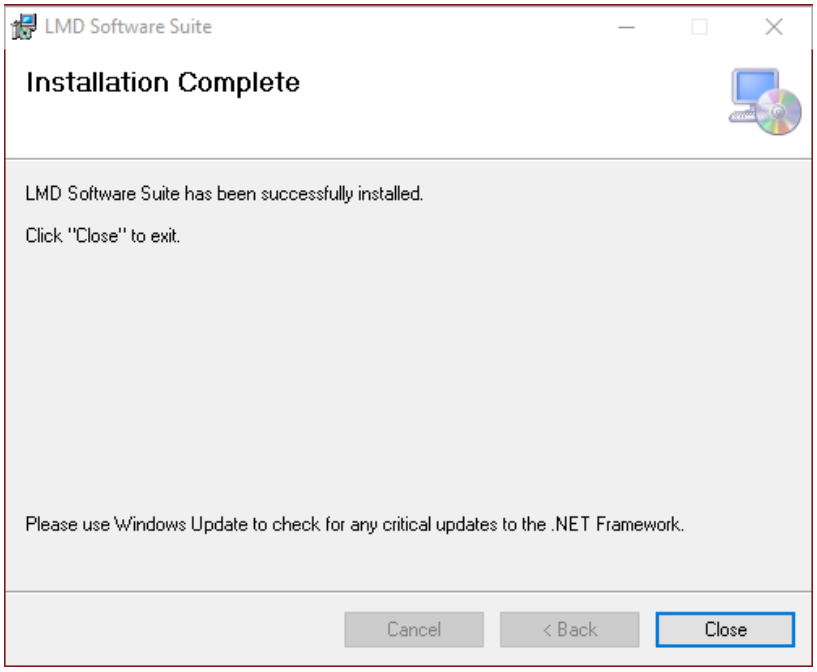
6. Ensure that the file location for the installation is correct. Use the “Browse” button to select a different location if desired.
7. If the installation is to be accessible to all users of the computer, click the “Everyone” selection button. If the installation is to be used by the current user only, click the “Just me” selection button.

8. Click the button labeled “Next”. A “Confirm Installation” screen will be displayed.



9. Click “Next”. Depending on the operating system installed on the computer, a “User Account Control Warning” may be displayed. If this screen appears, click “Yes” to continue the installation.

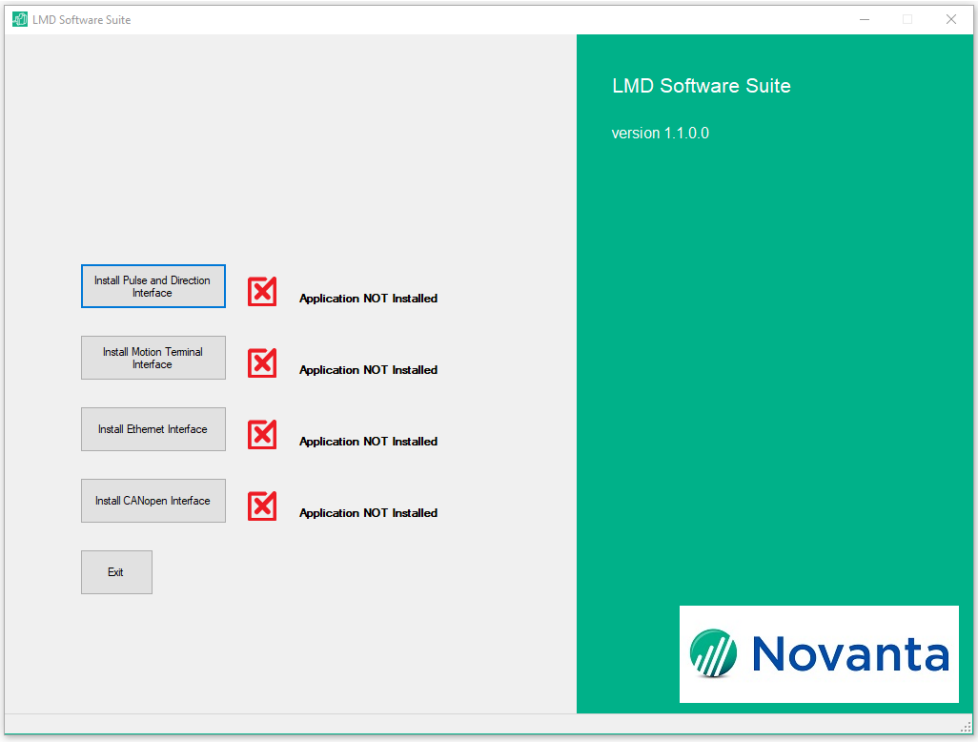
10. The LSS will install and an “Installation Complete” screen will be displayed. Click “Close”.



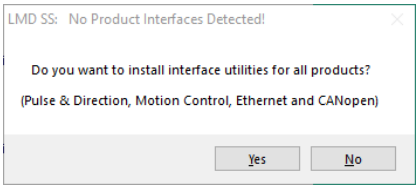
An LMD Software Suite icon will be placed on the Windows desktop.

To launch the software, select LMD Software Suite from the start menu or launch using the desktop icon.

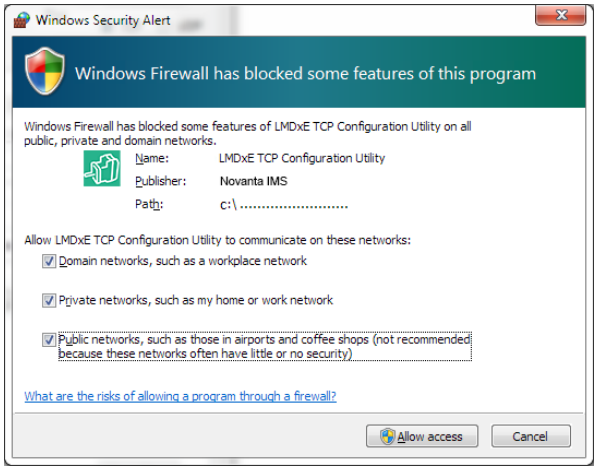
Once launched, the following screen will be displayed.



When first launched, a popup will be displayed indicating that no interfaces are currently installed and asking if all interface utilities should be installed. This is optional to the user. To install all interfaces, select Yes. To install a specific application, click No and select the application on the main screen that is appropriate to the device being used and follow the prompts for installation. Not all applications need to be installed.



Depending on the security protocols for the computer running the LSS, a firewall message may be displayed when launching the software for the first time. If this occurs, be sure that all three (3) check boxes are selected to allow the LSS to communicate over the computer's network.



Refer to the following sections for specific information on usage instructions on the application appropriate to the Liberty MDrive (LMD) model being used.

◁ Pulse and Direction Interface on page 26

◁ Motion Terminal Interface on page 47

◁ Ethernet Interface on page 69

◁ CANopen Interface on page 88

Chapter 3
Pulse and Direction Interface

The Pulse/Direction Configuration Utility is launched via the LSS startup window.

This section assumes the LSS's Pulse and Direction Interface has been installed and is ready to use. If the software has not been installed, refer to "Installation" on page 20

What's in this Chapter?

This chapter includes the following topics:

The product is unable to detect an interruption of the network link.

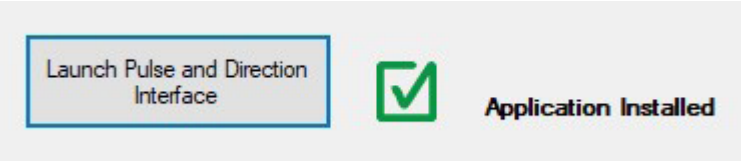
⚠WARNING

LOSS OF CONTROL OR UNINTENDED OPERATION

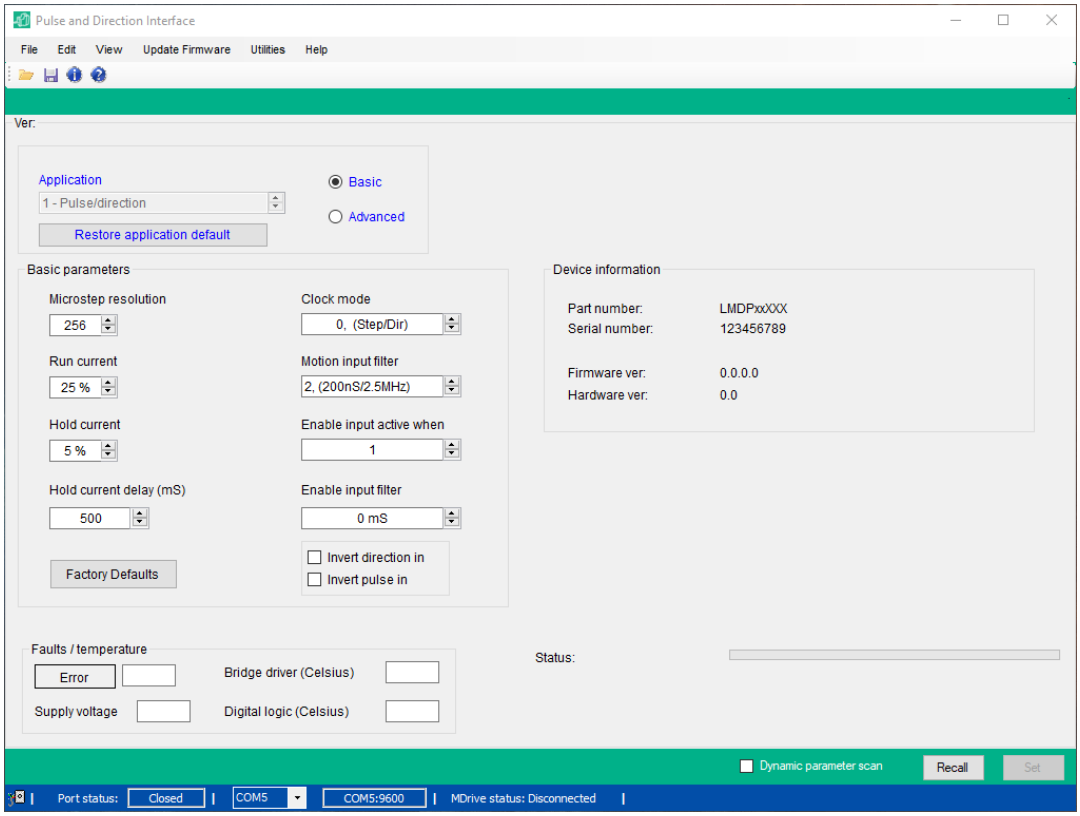
- Verify that connection monitoring is on.
- The shorter the time for monitoring, the faster the detection of the interruption.
- Do not write values to reserved parameters.
- Do not write values to parameters unless the function is fully understood.
- Run initial tests without coupled loads.
- Verify that the system is free and ready for the movement before changing parameters.
- Verify the use of the word sequence with fieldbus communication.
- Do not establish a fieldbus connection unless the communication principals are fully understood.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Launching the Pulse and Direction Interface



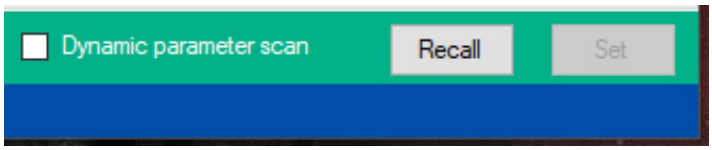
Click on the “Launch Pulse and Direction interface” button on the LSS startup screen to launch the Pulse and Direction Interface. The following screen will be displayed:



Operational Modes

The Pulse and Direction configuration utility has the ability to run in basic or advanced operational modes.

The mode options (Dynamic Parameter Scan, Recall, and Set) are available on the bottom right-hand corner of the screen.



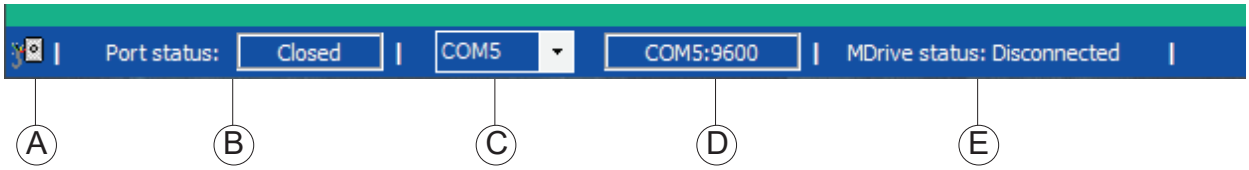
Dynamic Parameter Scan	Click this check box to automatically update the screen to show the settings for the connected device.
Recall	Click to retrieve the previously stored settings
Set	Click to save and download changes to the LMD memory. **NOTE:** This button is only available after changes have been made.

Connect to the LMD Pulse/Direction Unit

The Pulse/direction Configuration Utility requires an active connection to a Pulse/direction product via the RS-422/485 bus. Ensure that the recommended Communication Interface Kit or equivalent is installed and functioning.

Communication Status Bar

The communication status/properties bar indicates and gives access to the COM port status and settings. The status bar will be the same for Basic or Advanced modes.



A. Connected/disconnected indicator

B. Port status: gives indication that the Port specified in (C) is closed or open. Clicking this will change the state if available. NOTE: This indicates whether or not the COM port is open or closed. It does not indicate if communication with the device is active.

C. Communication port selector

D. COM port: BAUD rate. Shows the selected port and BAUD rate set.

E. MDrive connection status. Displays the connection status of the LMD product.

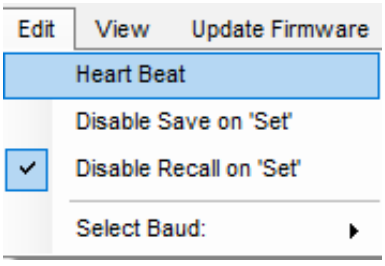
Connection Procedure

Use the diagram above as a reference for the following process:

1. Verify all cabling is securely connected to the LMD. (See product hardware manual).
2. Verify that the communications converter is connected and working.
3. Apply power to the LMD.
4. Select the COM port used from the COM Port selector (C) on the status bar.
5. Click (B) [Closed] on the port status field of the Status Bar.

Indicator should change to open and the MDrive status (E) should change to N/A

From the Menu, select ⇨Edit ⇨Heart Beat

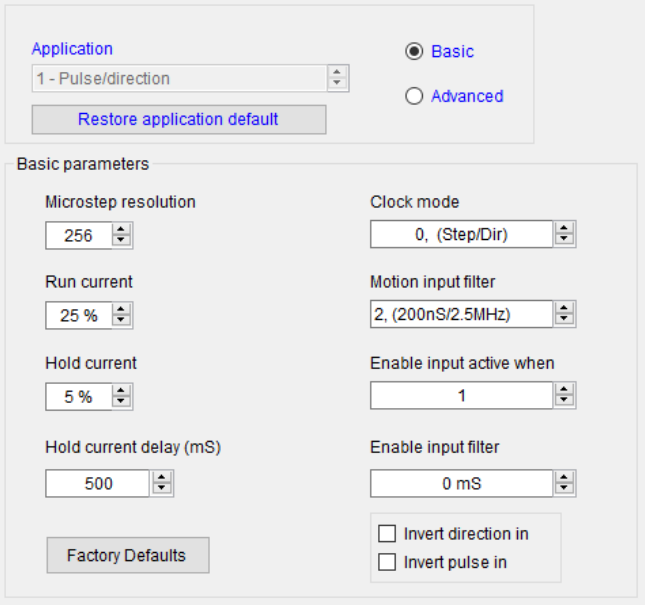


MDrive status (E) should change to Connected.

Basic Mode

The utility will launch in basic mode on initial startup. Communications may be established, advanced modes selected, and parameters set at that time. When in Basic Mode, the radio button marked “Basic” will be selected.

Basic mode will only display the parameters needed for basic functionality in Pulse and Direction mode, the device speed and direction will be based upon the input signal seen on the hardware inputs. Clicking the Factory Defaults button returns all Basic settings to the Factory Default settings.



Basic Parameters

Microstep Resolution: Sets the microstep resolution in microsteps/fullstep.
ASCII: MS
Default: 256
Range: See tables below

Binary	
Microsteps/Step	**Steps/Revolution**
1	200
2	400
4	800
8	1600
16	3200
32	6400
64	12800
128	25600
256	51200
Additional Resolution Settings	
180	36000 (0.01°/µstep)
108	21600 (1 arc-min/µstep)
127	25400 (0.001 mm/µstep)

Decimal	
Microsteps/Step	**Steps/Revolution**
5	1000
10	2000
25	5000
50	10000
100	20000
125	25000
200	40000
250	50000

Run Current: Motor running current in percent.
ASCII: RC
Default: 25%
Range: 1 – 100%

Hold Current: Motor holding (reduction) current in percent.
ASCII: HC
Default: 5%
Range: 0 – 100%

Hold Current Delay Time: Represents the time delay in milliseconds between the last motion input and the shift to the commanded holding current.
ASCII: HT
Default: 500
Range: 0 – 65000

Clock Mode: Sets the clock input mode to pulse/direction, quadrature or CW/CCW inputs.
ASCII: CM
Default: 0
Range: 0 – 2 (See table below for setting details)

Value	Meaning
0	Step/direction mode
1	Quadrature or A/B mode
2	CW/CCW or up/down mode

Motion Input Filter: Sets the filtering for the Pulse and Direction inputs.
ASCII: FM
Default: 2
Range: 0 – 9 (See table below for setting details)

Value	Meaning	Value	Meaning
0	50 ns/10 MHz	5	900 ns/555 kHz
1	150 ns/3.3 MHz	6	1.7 µs/294 kHz
2	200 ns/2.5 MHz	7	3.3 µs/151 kHz
3	300 ns/1.67 MHz	8	6.5 µs/76.9 kHz
4	500 ns/1.0 MHz	9	12.9 µs/37.8 kHz

Enable Active: Sets the active logic state of the enable input.
ASCII: EA
Default: 1
Range: 0/1 (See table below for setting details)

Value	Meaning
0	Input is active when logic LOW
1	Input is active when logic HIGH

Enable Input Filter: Filter enable input in milliseconds.
ASCII: FE
Default: 0
Range: 0 – 255 (See table below for setting details)

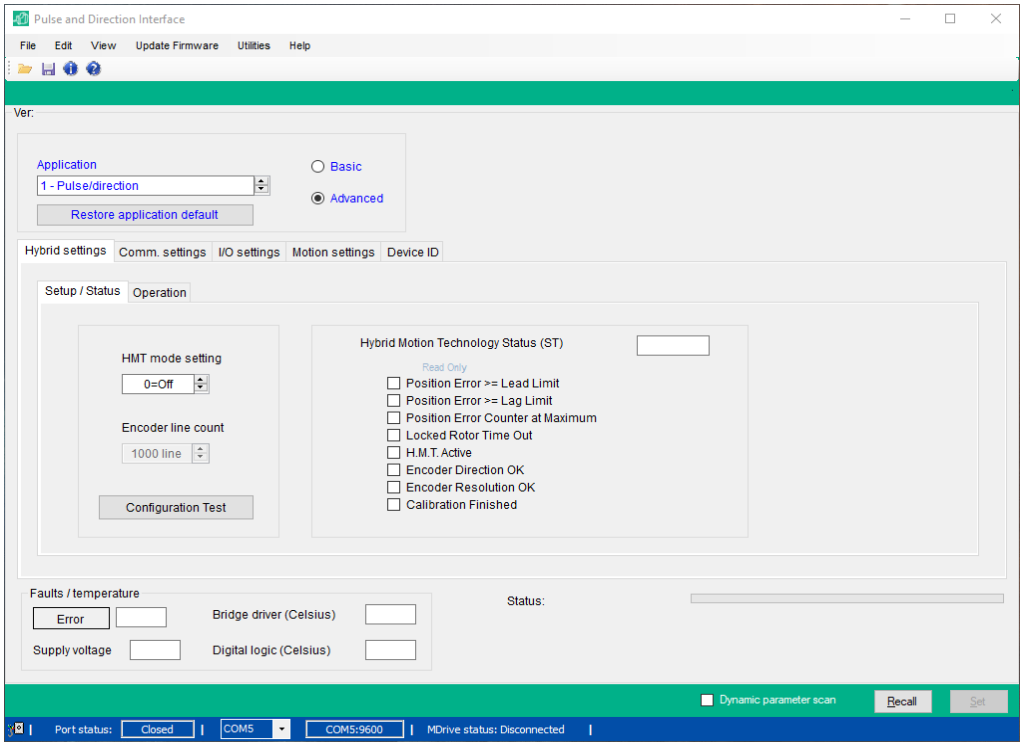
Value	Meaning
0	No filtering of input
1 - 255	Input filter time in milliseconds

Advanced Mode

NOTE: This device will operate differently in each mode of operation. It is critical that all documentation be read completely. A clear understanding of how the device is to be employed be present before attempting to install or commission the device.

To access Advanced Mode, select the radio button marked “Advanced”. The following parameter tabs will be displayed.

Parameters available in Advanced mode will vary depending on Application selected. See “Applications” on page 31 for additional details.

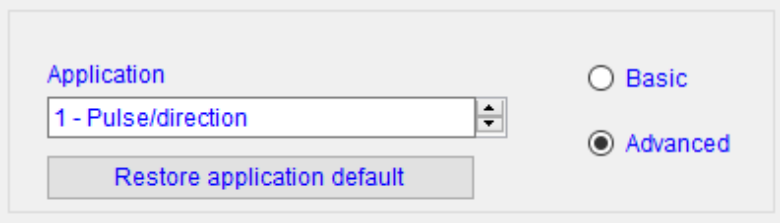


Applications

Advanced mode allows for the selection of the different operating applications of the device which include:

- Pulse/direction (P)
- Speed Control (S)
- Torque Mode (T)
- Velocity Control (V)

Select the desired operating application using the up and down arrows in the Application parameter section.



The parameter details of this section are organized by application. Parameter descriptions that are common to multiple applications are repeated as the defaults may change between applications.

All screen captures show the factory defaults and available parameters for that specific mode.

Use the Subsection appropriate to the used application for setup details.

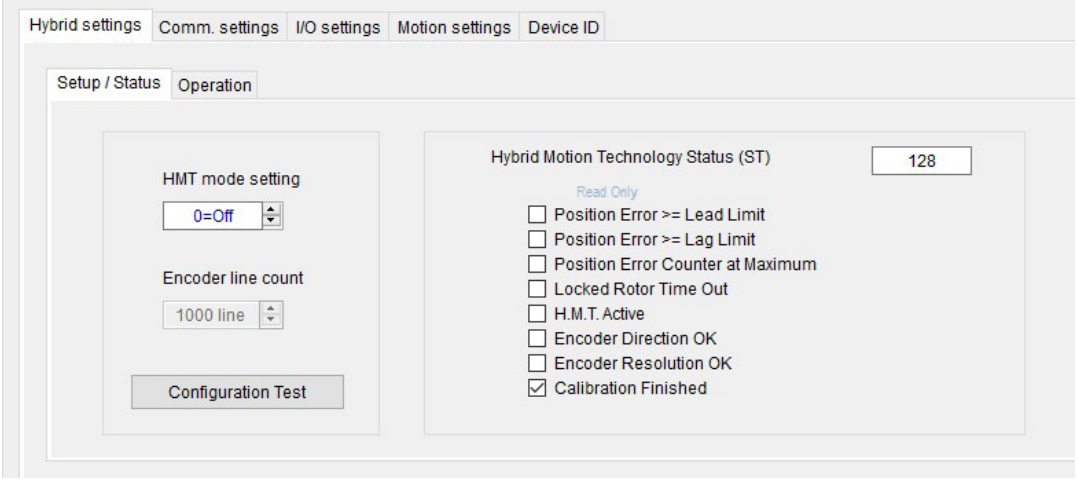
Parameterization Methods

The parameters may be set/changed using an ANSI Terminal emulator program and two character mnemonic commands representing the parameter followed by a value.

Application Specific Parameters

Some parameters are application specific. When using this software, unavailable parameters will be disabled or hidden.

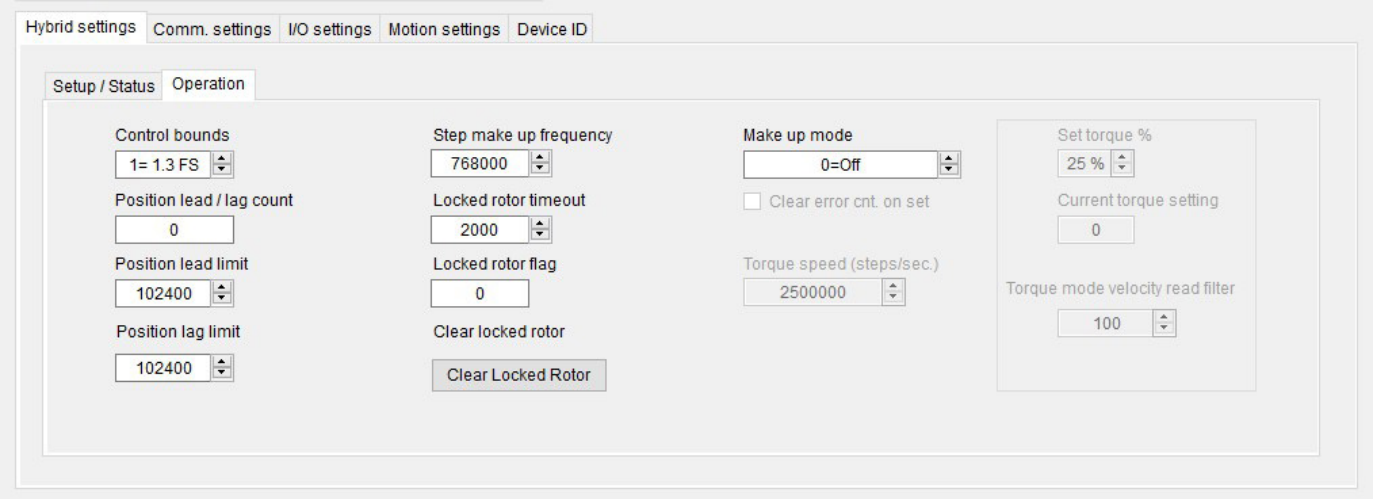
Hybrid Settings: Setup/Status (Encoder Equipped Products Only)



NOTE: hMT is only available on LMD Pulse/direction units with an internal encoder. These tabs will not be visible on units without an encoder.

Name	ASCII	Description / Value	Range	Default	Mode Availability			
					P	S	T	V
hMT Mode Setting	AS	hMT mode defines the enable/disable state of the hMT and the current mode. 0 - hMT disabled, anti-stall and encoder functions unavailable 1 - hMT enabled, current control at fixed run current (RC) and hold current (HC), as set on the Motions Settings tab. 2 - hMT enabled, current control varies as needed to perform the move. 3 - hMT enabled in Torque mode. This option is only available when in Torque Control mode.	0 ... 3	0	✓	✓	—	✓
				1	✓	✓	—	✓
				2	✓	✓	—	✓
				3	—	—	✓	—
Hybrid Motion Technology Status	ST	Read-only fields display the status of the hMT block. Active conditions will display as checked, and as a BCD integer in the text field on the upper right.						

Hybrid Settings: Operation (Encoder equipped products only)



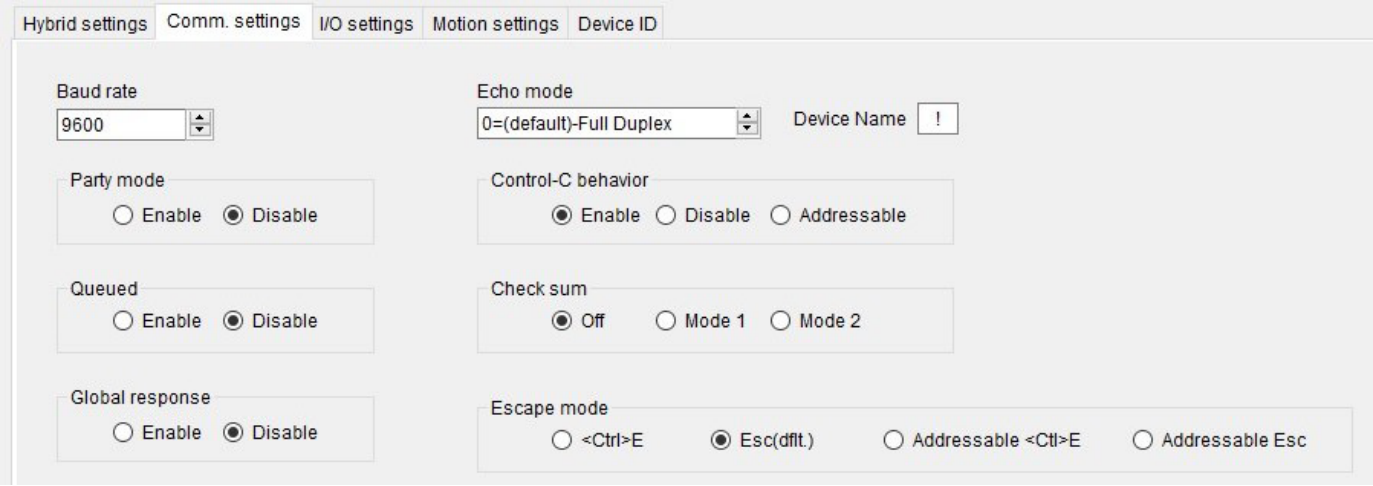
Name	ASCII	Description / Value	Range	Default	Mode Availability			
					P	S	T	V
Control bounds	CB	Control bounds defines the limits in which hMT will maintain the rotor-stator relationship in full motor steps to eliminate a stall. 0 — 1.1 — highest torque 1 — 1.3 — high torque, medium speed (Best overall performance) 2 — 1.5 — high speed, medium torque 3 — 1.7 — highest speed	0 ... 3	1	✓	✓	✓	✓
Position lead/ lag count	LL	Read-only field displays the position lead/lag step count. To clear, select a value for MU, check “Clear Error Cnt.” Click set, then click Recall. The count will be zero. Calibrating will also reset the count.	—	—	✓	✓	✓	✓
Position lead limit	LD	Sets the position lead limit in counts at which position a locked rotor condition will assert.	31-bits	102400	✓	✓	✓	✓
Position lag limit	LG	Sets the position lag limit in counts at which position a locked rotor condition will assert.	31-bits	102400	✓	✓	✓	✓
Step make up frequency	MF	Make up frequency sets the velocity during position make up when make up mode MU=1.	367 – 2560000	768000	✓	✓	—	✓
Locked rotor timeout	LT	Locked rotor time-out in milliseconds. This is the time from the locked rotor flag activates to the disabling of the output bridge.	2 – 65535	2000	✓	✓	✓	✓
Locked rotor flag	LF	Read-only field indicating the free/locked state of the rotor. 0 — Rotor is not locked 1 — Rotor is locked	—	—	✓	✓	✓	✓
Clear locked rotor	CF	Clicking this button will clear the locked rotor error (LR).	—	—	✓	✓	—	✓

<table>
<tr><th rowspan="2">Name</th><th rowspan="2">ASCII</th><th rowspan="2">Description / Value</th><th rowspan="2">Range</th><th rowspan="2">Default</th><th colspan="4">Mode Availability</th></tr>
<tr><th>P</th><th>S</th><th>T</th><th>V</th></tr>
<tr><td rowspan="2">Make-up mode</td><td rowspan="2">MU</td><td>Make up selection for position make up.
<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>Position make-up disabled</td></tr><tr><td>1</td><td>Use make-up speed (MF) as make-up speed</td></tr><tr><td>2</td><td>Use internal system speed as make-up speed (3000 rpm max.)</td></tr></table></td><td>0 ... 2</td><td>0</td><td>✓</td><td>✓</td><td>—</td><td>✓</td></tr>
<tr><td>Clear error count. If checked, LL count will be cleared on an MU change and set.
<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>Unchecked</td><td>Do not clear lead/lag counter (LL)</td></tr><tr><td>Checked</td><td>Clear lead/lag counter (LL)</td></tr></table></td><td>0/1</td><td>0</td><td>✓</td><td>✓</td><td>—</td><td>✓</td></tr>
<tr><td>Torque speed</td><td>TS</td><td>Torque speed sets maximum response frequency for torque mode.</td><td>0 ... 5000000</td><td>2500000</td><td>—</td><td>—</td><td>✓</td><td>—</td></tr>
<tr><td>Torque percent</td><td>TQ</td><td>Sets the percentage of motor torque the device will maintain.</td><td>0 ... 100</td><td>25</td><td>—</td><td>—</td><td>✓</td><td>—</td></tr>
<tr><td>Current torque setting</td><td>T</td><td>Read-only field displays the current motor torque.</td><td>0 ... 100</td><td>—</td><td>—</td><td>—</td><td>✓</td><td>—</td></tr>
<tr><td>Torque mode velocity read filter</td><td>VF</td><td>VF takes a value of 0 to 1000. It can be defined as 0 = no filtering and 1000 = most filtering. Because the Torque Velocity is computed and the encoder is sampled every mSec there can be fluctuation in the result.
The filtering compensates for this fluctuation.</td><td>0 ... 1000</td><td>100</td><td>—</td><td>—</td><td>✓</td><td>—</td></tr>
</table>

Communication Settings

The advanced communication settings are available but in many cases may not be required for use in typical applications outside changing the BAUD rate if required.

The LMD Pulse/direction may be used in RS-422/485 networks in party mode. This would be set up using this tab. Communication settings for Data Bits (8), Parity (None), and Stop Bits (1) are fixed values that can not be altered for this mode.

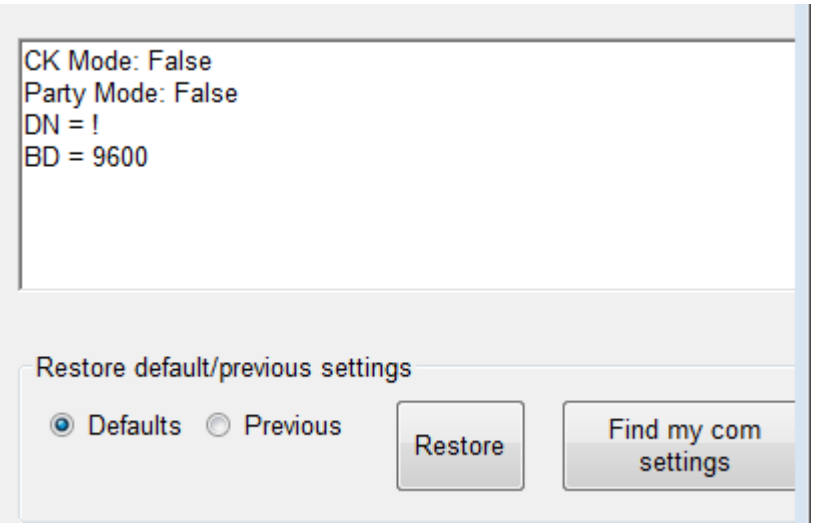


Name	ASCII	Description / Value	Range	Default
BAUD rate	BD	Sets the communication BAUD rate 4800 9600 19200 38400 115200	—	9600
Party mode	PY	Enable/disable party mode operation 0 = disable 1 = enable	0/1	0
Queued	QD	Allows multiple queued devices to respond to the caret “^” address character. 0 = disabled 1 = enabled	0/1	0
Global response	DG	The DG flag enables or disables device response to global commands made while in party mode. 0 = disabled 1 = enabled 2 = addressable	0 ... 2	0
CTRL+C behavior	CE	Configure the device to respond or not respond to a CTRL+C software reset, or if the device will respond to an addressable reset in party mode. 0 = disabled 1 = enabled 2 = addressable	0 ... 2	0

Name	ASCII	Description / Value	Range	Default
Checksum	CK	Puts the device into Check Sum Mode. When enabled, all communications with the device require a Check Sum to follow the commands. 0 = disabled 1 = ack/nak cksum+error 2 = ack/nak cksum only	0 ... 2	0
Echo mode	EM	The Echo Mode Flag will set the full/ half duplex configuration of the RS- 485 channel. 0 = full duplex 1 = half duplex 2 = list/print only 3 = Queue immediate 4 = computer friendly	0 ... 4	0
Device name	DN	Set the device name for party mode operation. Valid names A-Z, a-z, 0-9	—	!

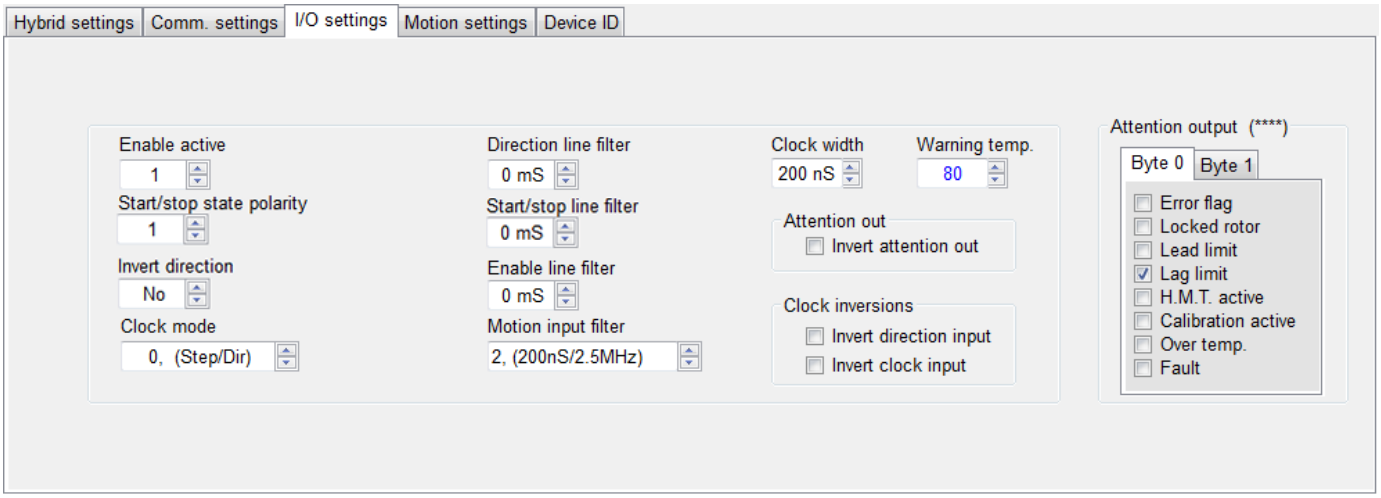
Procedure: Changing the BAUD Rate

1. In the Baud selector on the Comm. Settings tab, select the desired BAUD rate: 4800, 9600, 19200, 38400 or 115200.
2. Click “Set”. A dialog will open instructing a power cycle of the device.
3. Cycle power to the device and click OK on the dialog box.
4. Click on the “Device ID” tab.
5. Click the button “Find my com settings”. The software will cycle through a detection sequence and set itself to the set BAUD rate.



The settings may also be reset to either the default settings or the settings previously stored to non-volatile memory (NVM).

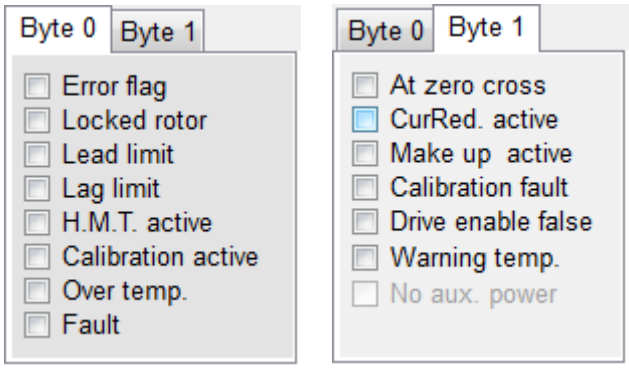
I/O Settings



Name	ASCII	Description / Value	Range	Default	Mode Availability			
					P	S	T	V
Enable active	EA	Sets the active logic state of the enable input. Value: 0 — Input is active when logic LOW; 1 — Input is active when logic HIGH	0/1	0	✓	✓	✓	✓
Stop/start state polarity	—	Allows the user to invert the stop/start input Value: 0 — Input is active when logic LOW; 1 — Input is active when logic HIGH	0/1	0	—	✓	✓	✓
Invert direction	—	Allows the user to invert the direction input Value: 0 — Do not invert direction; 1 — Invert direction	0/1	0	—	✓	✓	✓
Clock mode	CM	Sets the clock input mode to pulse/direction, quadrature or CW/CCW inputs. Value: 0 — Step/direction mode; 1 — Quadrature or A/B mode; 2 — CW/CCW or up/down mode	0 ... 2	0	✓	—	—	—
Direction line filter	—	Filter direction input in milliseconds Value: 0 — No filtering of input; 1 - 255 — Input filter time in milliseconds	0 ... 255	0	✓	✓	✓	✓
Stop/start line filter	—	Filter stop/start input in milliseconds Value: 0 — No filtering of input; 1 - 255 — Input filter time in milliseconds	0 ... 255	0	—	✓	✓	✓
Enable line filter	FE	Filter enable input in milliseconds Value: 0 — No filtering of input; 1 - 255 — Input filter time in milliseconds	0 ... 255	0	✓	✓	✓	✓

<table>
<tr><th rowspan="2">Name</th><th rowspan="2">ASCII</th><th rowspan="2">Description / Value</th><th rowspan="2">Range</th><th rowspan="2">Default</th><th colspan="4">Mode Availability</th></tr>
<tr><th>P</th><th>S</th><th>T</th><th>V</th></tr>
<tr><td>Filter motion</td><td>FM</td><td>Sets the filtering for the velocity generator.<table><tr><th>Value</th><th>Meaning</th><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>50 ns/10 MHz</td><td>5</td><td>900 ns/555 kHz</td></tr><tr><td>1</td><td>150 ns/3.3 MHz</td><td>6</td><td>1.7 µs/294 kHz</td></tr><tr><td>2</td><td>200 ns/2.5 MHz</td><td>7</td><td>3.3 µs/151 kHz</td></tr><tr><td>3</td><td>300 ns/1.67 MHz</td><td>8</td><td>6.5 µs/76.9 kHz</td></tr><tr><td>4</td><td>500 ns/1.0 MHz</td><td>9</td><td>12.9 µs/37.8 kHz</td></tr></table></td><td>—</td><td>2</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Clock width</td><td>—</td><td>Sets the maximum response time for the system</td><td>100 to 1285 nS</td><td>100</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Warning temp</td><td>WT</td><td>Set the temperature level at which an error will be generated.</td><td>0...84</td><td>80</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Invert attention output</td><td>—</td><td>When checked, will invert the active state of the attention output</td><td>—</td><td>—</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Clock inversions</td><td>CI</td><td>When checked, will invert the active state of the step and direction inputs independently.</td><td>—</td><td>—</td><td>✓</td><td>—</td><td>—</td><td>—</td></tr>
<tr><td>Stop/start line filter</td><td>—</td><td>Filter stop/start input in milliseconds<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>No filtering of input</td></tr><tr><td>1 - 255</td><td>Input filter time in milliseconds</td></tr></table></td><td>0 ... 255</td><td>0</td><td>—</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Enable line filter</td><td>FE</td><td>Filter enable input in milliseconds<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>No filtering of input</td></tr><tr><td>1 - 255</td><td>Input filter time in milliseconds</td></tr></table></td><td>0 ... 255</td><td>0</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Filter motion</td><td>FM</td><td>Sets the filtering for the velocity generator.<table><tr><th>Value</th><th>Meaning</th><th>Value</th><th>Meaning</th></tr><tr><td>0</td><td>50 ns/10 MHz</td><td>5</td><td>900 ns/555 kHz</td></tr><tr><td>1</td><td>150 ns/3.3 MHz</td><td>6</td><td>1.7 µs/294 kHz</td></tr><tr><td>2</td><td>200 ns/2.5 MHz</td><td>7</td><td>3.3 µs/151 kHz</td></tr><tr><td>3</td><td>300 ns/1.67 MHz</td><td>8</td><td>6.5 µs/76.9 kHz</td></tr><tr><td>4</td><td>500 ns/1.0 MHz</td><td>9</td><td>12.9 µs/37.8 kHz</td></tr></table></td><td>—</td><td>2</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Clock width</td><td>—</td><td>Sets the maximum response time for the system</td><td>100 to 1285 nS</td><td>100</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Warning temp</td><td>WT</td><td>Set the temperature level at which an error will be generated.</td><td>0...84</td><td>80</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Invert attention output</td><td>—</td><td>When checked, will invert the active state of the attention output</td><td>—</td><td>—</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Clock inversions</td><td>CI</td><td>When checked, will invert the active state of the step and direction inputs independently.</td><td>—</td><td>—</td><td>✓</td><td>—</td><td>—</td><td>—</td></tr>
</table>

I/O Settings: Attention Output



Name	ASCII	Description / Value	Range	Default
Attention output	AO	Configures the attention output to activate on specified condition by checking the box.	0 ... 16383	0

Value	Meaning	Value	Meaning
1	Software error	128	Reserved
2	Locked rotor	256	At zero crossing
4	Lead limit reached	512	Hold current active
8	Lag limit reached	1024	Make-up active
16	hMT active	2048	Calibration fault
32	Calibration active	4096	Drive enable false
64	Over-temperature	8192	Warning Temp

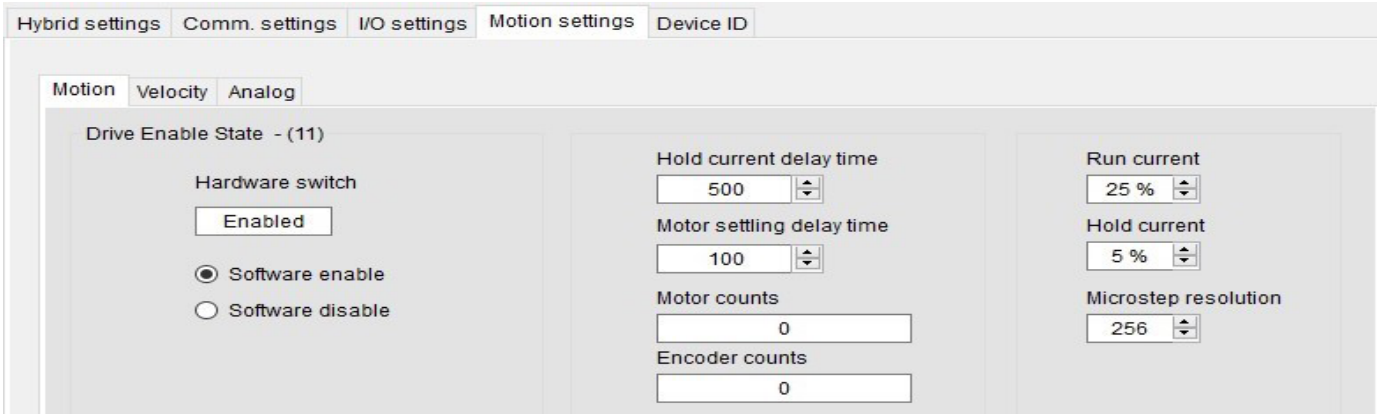
Motion Settings

The Advanced Motion settings tab is used to configure the advanced motion parameters and can consist of three sub tabs depending on the selected mode of operation.

The following table details available parameter options when in each mode.

Sub-Tab	Mode Availability			
	P	S	T	V
Motion	✓	✓	✓	✓
Analog	—	✓	✓	—
Velocity	—	✓	—	✓

Motion Parameters



Name	ASCII	Description / Value	Range	Default	Mode Availability			
					P	S	T	V
Hardware Switch	—	Read-only field displays the state of the enable input	—	Enabled	✓	✓	✓	✓
Hold current delay time	HT	Represents the time delay in milliseconds between the last motion input and the shift to the commanded holding current.	0 ... 65000	500	✓	✓	—	✓
Motor settling delay time	MT	Represents the time delay in milliseconds the shaft is allowed to settle before shifting to hold current.	0 ... 65000	500	✓	✓	—	✓
Motor counts	C1	Read only field displays the motor counts	—	—	✓	✓	✓	✓
Encoder counts	C2	Read only field displays the encoder counts	—	—	✓	✓	✓	✓
Hold current	HC	Motor holding (reduction) current in percent.	0 ... 100	5	✓	✓	—	✓
Run current	RC	Motor running current in percent.	1 ... 100	25	✓	✓	—	✓
Step resolution	MS	Sets the microstep resolution in microsteps/fullstep.	See tables below	256	✓	✓	✓	✓

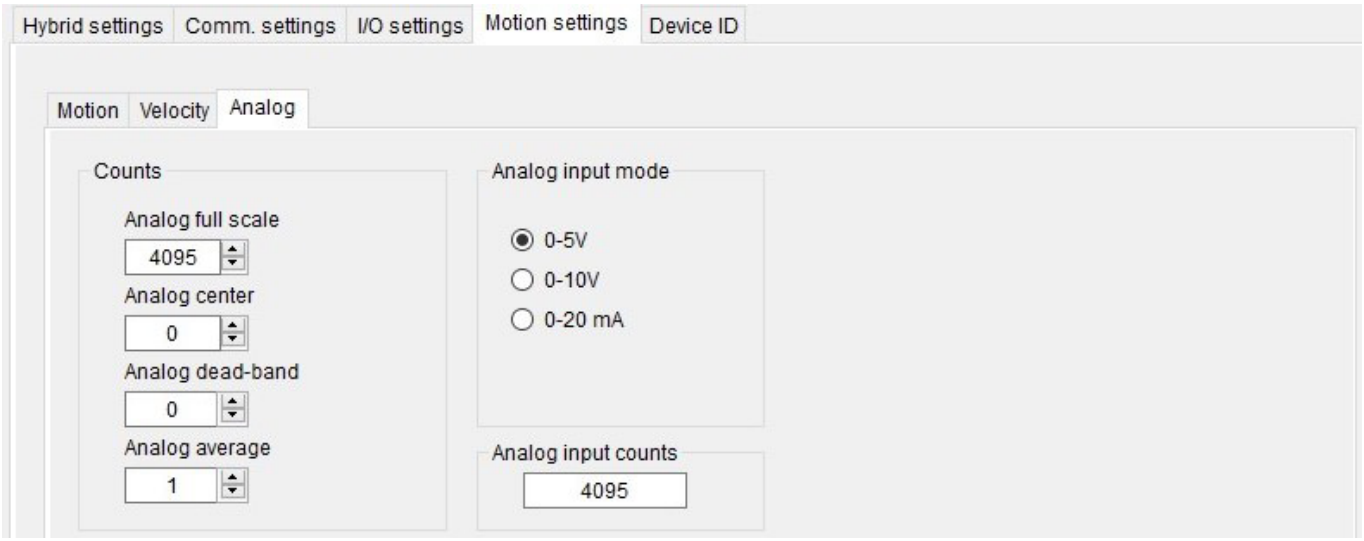
Binary

Microsteps/Step	Steps/Revolution
1	200
2	400
4	800
8	1600
16	3200
32	6400
64	12800
128	25600
256	52100
Additional Resolution Settings	
180	36000 (0.01°/µstep)
108	21600 (1 arc-min/µstep)
127	25400 (0.001 mm/µstep)

Decimal

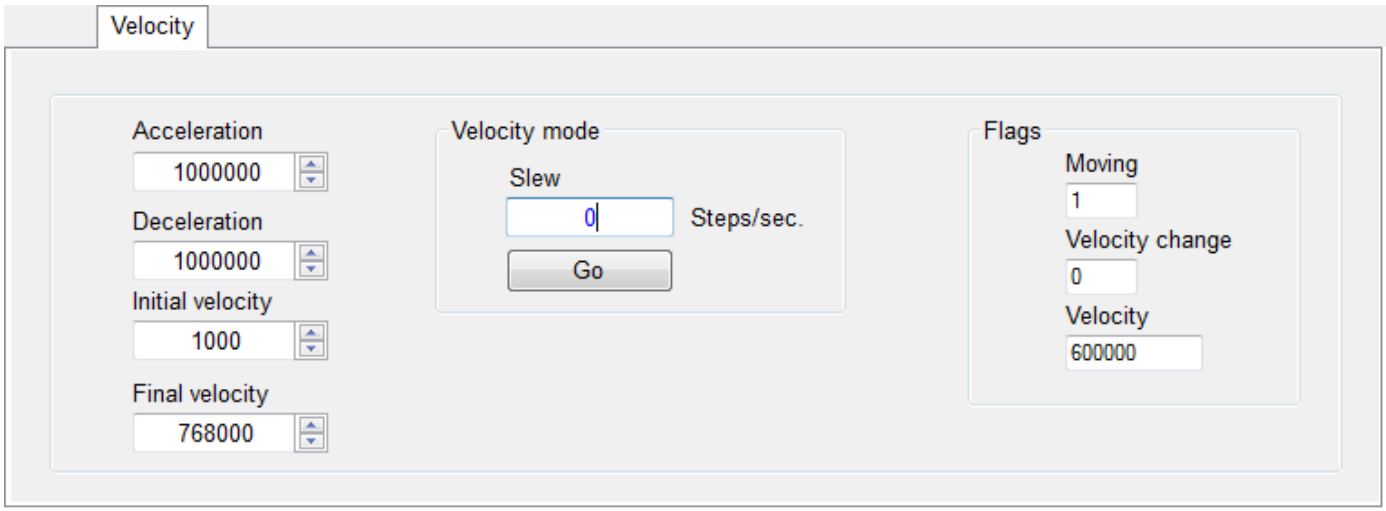
Microsteps/Step	Steps/Revolution
5	1000
10	2000
25	5000
50	10000
100	20000
125	25000
200	40000
250	50000

Analog Parameters



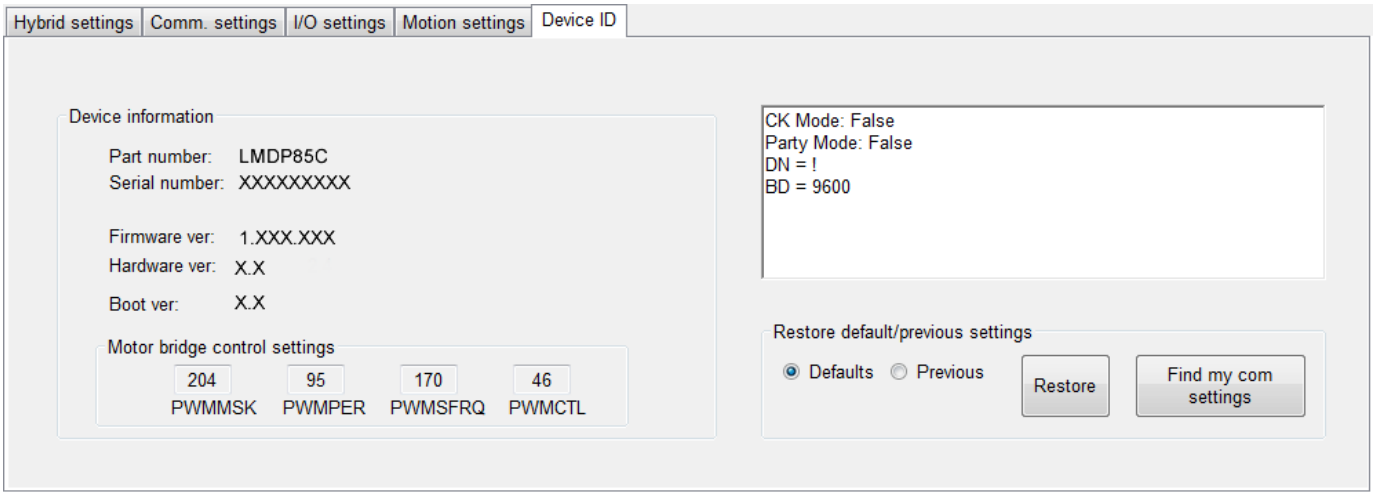
Name	ASCII	Description / Value	Range	Default	Mode Availability			
					P	S	T	V
Analog full scale	AF	Sets the full scale range of the analog input. By default it is at the maximum allowed range. The max voltage of the selected input mode will = 100% of the preset torque or speed.	0 ... 4095	4095	—	✓	✓	—
Analog center	AC	Sets the center point of the analog full scale for directional control using the analog input.	0 ... 4094	0	—	✓	✓	—
Analog deadband	AD	Sets the ± deadband for the analog center (AC).	0 ... 255	1	—	✓	✓	—
Analog average	AA	Input filtering for the analog input.	1 ... 1000	1	—	✓	✓	—
Analog mode	AM	Sets the analog input to respond to: Value / Meaning 0 — 0 to 5 V 1 — 0 to 10 V 2 — 0 to 20 mA	0 ... 2	0	—	✓	✓	—

Velocity Parameters



Name	ASCII	Description / Value	Range	Default	Mode Availability			
					P	S	T	V
Acceleration	A	Motor acceleration in steps/second².	1x106	1000000	—	✓	—	✓
Deceleration	D	Motor deceleration in steps/second².	1x106	1000000	—	✓	—	✓
Initial velocity	VI	Start velocity of the motor. Motor will accelerate from VI to VM based on the voltage measured on the analog input.	1 ... 2560000	1000	—	✓	—	✓
Maximum velocity	VM	Maximum velocity the motor will attain at the maximum voltage measured at the analog input.	VI ... 2560000	768000	—	✓	—	✓
Slew	SL	Command to slew at constant velocity. Slew rate may be changed on the fly. SL=0 will decelerate to stop.			—	—	—	✓
Moving	MV	Read-only status flag indicates whether or not the axis is in motion. Value: 0 — Motor is not moving; 1 — Motor shaft is in motion			—	✓	—	✓
Velocity changing	VC	Read-only status flag indicates wether or not the axis is accelerating or decelerating. Value: 0 — Velocity is not changing; 1 — Velocity is changing			—	✓	—	✓
Current Velocity	V	Read-only register displays the current command velocity of the axis. Actual speed may differ.			—	✓	—	✓

Device ID Tab



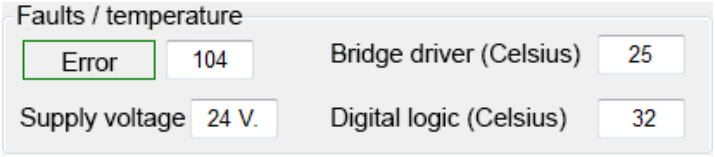
The Device ID tab contains the relevant information such as part number, serial number, and firmware and hardware versions.

A diagnostic window is also present for finding the communications settings and restoring factory defaults

Fault Frame and Device Information

The fault frame is accessible via the Fault Frame option of the View menu. Once enabled, it will be displayed directly below the settings tab window.

The fault frame contains information such as the internal temperature of the device, the power supply voltage, and an error code, if an error exists.



When the Dynamic Parameter Scan item is checked, these parameters will refresh with the heartbeat.

Internal Temps

The internal temp fields display the internal temperature of the device. Two numbers are displayed: the temperature of the output bridge electronics and the temperature of the digital logic.

Supply Voltage

Displays the voltage of the power supply

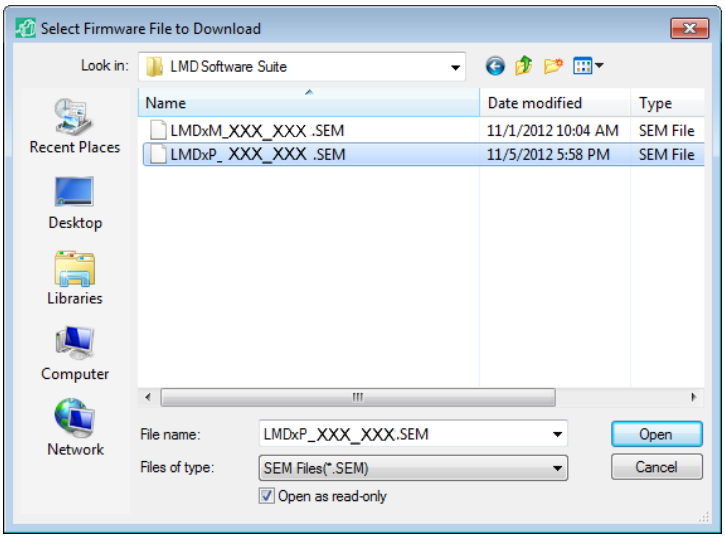
Upgrading Firmware

The firmware for the LMD Pulse/direction is field upgradable via the Pulse/direction configuration utility.

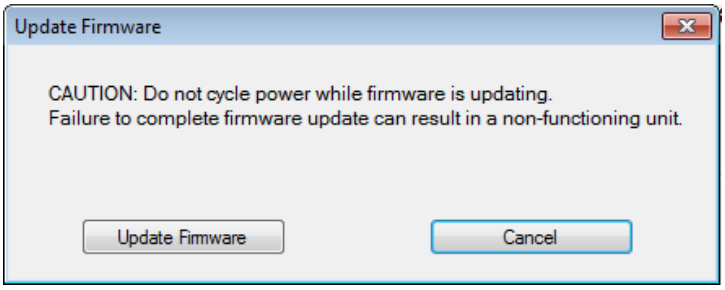
The latest firmware is available for download from:
https://novantaims.com/dloads/

NOTE: During the upgrade process, the devices will change BAUD rate to 19200 bps.

1. Download and extract the latest firmware to a location on the computer hard drive. Ensure that the COM port is connected and communication is active.
2. Select ⇨ Update Firmware from the menu.
3. Select the *.SEM file from the extracted files:



4. Select “Update Firmware” to continue the update, or “Cancel” to abort the upgrade.



Encoder Remap Utility (Closed Loop Models Only)

The LMD must meet several conditions in order to be remapped successfully.

⚠WARNING

UNINTENDED OPERATION

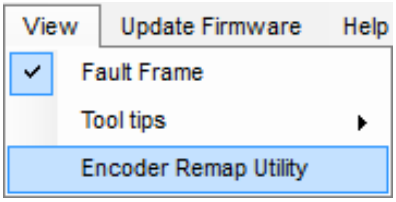
- The unit MUST be uncoupled from any loads, the shaft MUST be free to rotate in both directions
- Do not remap the encoder unless the function is fully understood.

Failure to follow these instructions can result in death, serious injury or equipment damage.

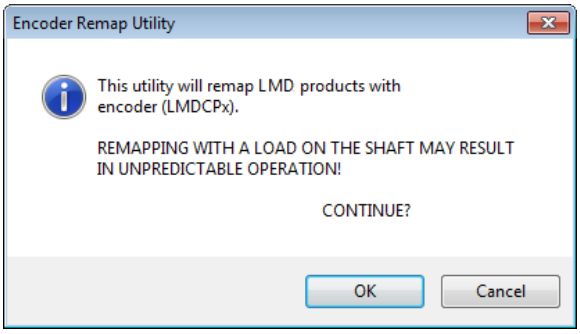
Remap Process

Proper function of the hMT circuitry requires that the precise alignment of the motors rotor and stator be stored in relation to the internal magnetic encoder. This is done at the factory during the manufacturing process and will typically not be required again.

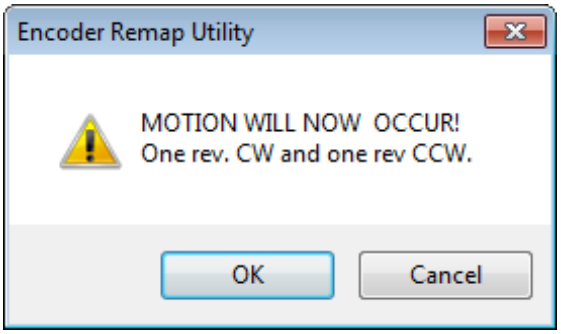
1. Ensure that the motor shaft is uncoupled and able to move freely in both Clockwise and Counterclockwise directions.
2. From the “View” menu select “Encoder Remap Utility”.



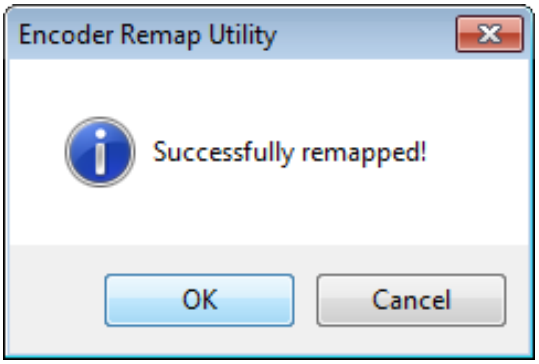
3. If the motor shaft is free to move in both directions, click OK.



4. Verify motor shaft uncoupled from loads and free to move. Once communications is verified, acknowledge the understanding the motion will occur by clicking OK. The motor will turn one revolution clockwise, then one revolution counter-clockwise.



The device has been successfully remapped.



Should remap fail: contact a Novanta IMS Applications Engineer.

Chapter 4
Motion Terminal Interface

IMPORTANT! This section covers the basic functionality of this software with regard to its use with a LMD Programmable Motion Control device.

Use of the LMD MCode Software and Programming Reference manual is required as this document does not cover the MCode programming language.

This section assumes the LSS's Motion Control Interface has been installed and is ready to use. If this has not been accomplished please follow the instructions in Section 3 of this document.

What's in this Chapter?

This chapter includes the following topics:

The product is unable to detect an interruption of the network link

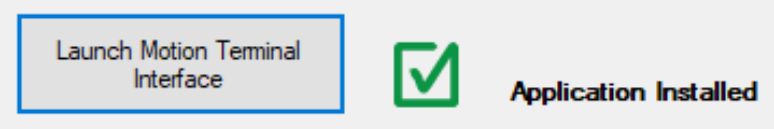
⚠WARNING

LOSS OF CONTROL OR UNINTENDED OPERATION

- Verify that connection monitoring is on.
- The shorter the time for monitoring, the faster the detection of the interruption.
- Do not write values to reserved parameters.
- Do not write values to parameters unless the function is fully understood.
- Run initial tests without coupled loads.
- Verify that the system is free and ready for the movement before changing parameters.
- Verify the use of the word sequence with fieldbus communication.
- Do not establish a fieldbus connection unless the communication principals are fully understood.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Launching the Motion Control Interface



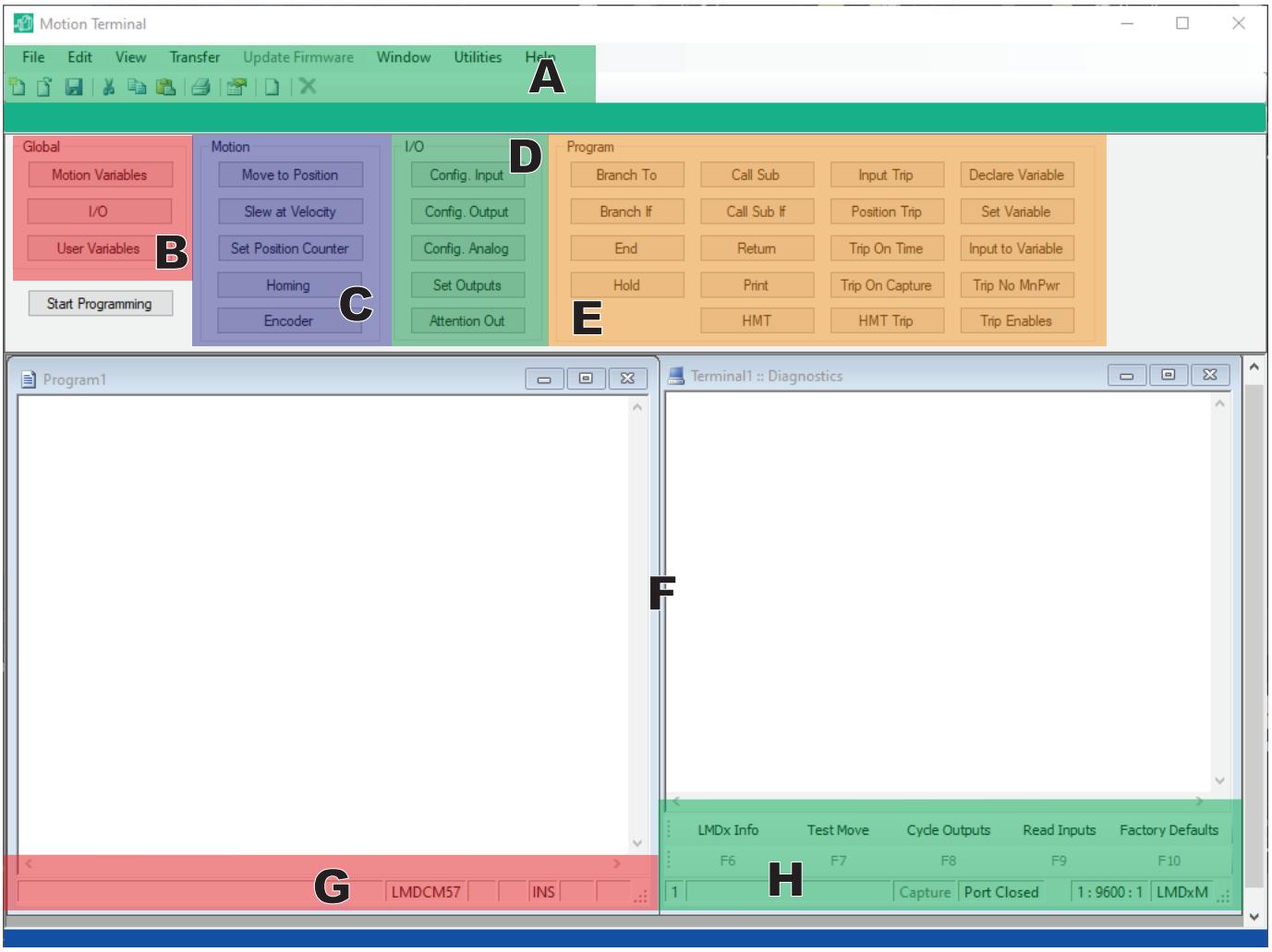
Click on the “Launch Motion Terminal Interface” button on the LSS startup screen to launch the Motion Control Interface.

The Motion Terminal Interface is a self contained programming graphic user interface (GUI) and ASCII/ANSI terminal emulator

Screen and Programming Assistant Overview

To access the Assistant view of the Motion Control interface, select ⇨View ⇨Assistant from the Menu Bar (A).

The Assistant view provides GUI access to the most commonly used MCode commands. These commands and parameters are inserted in the program editor or terminal window. The program can be downloaded to the LMD. Immediate commands are typed in manually via the terminal window.



Menu and Button Bar (A)

Used for standard windows file operation functions such as creating, opening and saving files, setting and changing preferences, and transferring files to and from a connected LMD.

Program Button Groupings (B through E)

NOTE: These buttons configure program commands. A knowledge of MCode is still required to perform advanced programming functions. Detailed information of each MCode command may be accessed via the MCode manual.

B - Global Parameter Settings Frame

Button group used to configure global parameters inside an LMD program. These parameters will be inserted into a Program editor window on the Motion Terminal Interface.

C - Motion Command Frame

Button group used for entering motion commands into an LMD program, setting position counter, homing mode, and encoder related commands. These will be inserted into a Program editor window of the Motion Terminal Interface.

D - I/O Command Frame

Button group used for entering input and output commands into a LMD program, configuring inputs and outputs locally within the program, and setting outputs. These will be inserted into a Program editor window of the Motion Terminal Interface.

E - Program Command Frame

Button group used for entering program related commands into a LMD program, performing unconditional and conditional branches, subroutine calls, and assigning trip functions. These will be inserted into a Program editor window of the Motion Terminal Interface.

Desktop/Work Area (F)

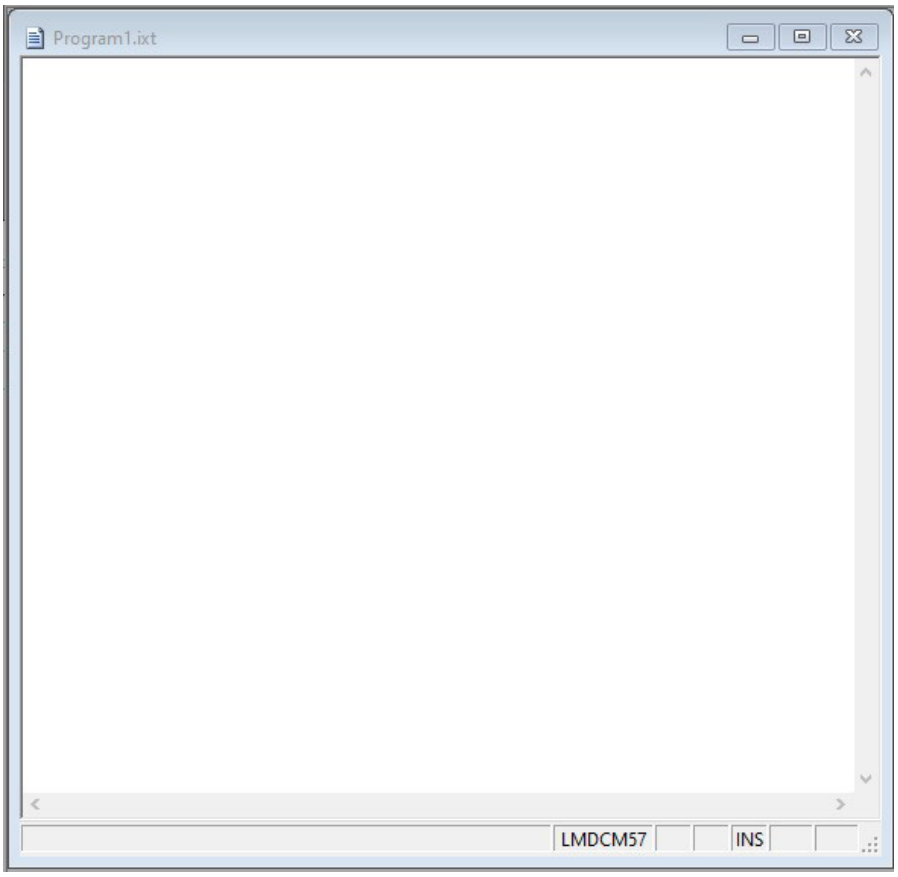
The desktop work area of the Motion Terminal Interface contains these key items:

1. Program editor window
2. Terminal window
3. Simulator area

NOTE: When executing a Save command, confirm the intended window is highlighted. Both the Program Editor and Terminal windows have a save option.

Program Editor Window

The program editor window is the entry area for LMD MCode programs. Commands may be entered by either using the button groupings, or by manually entering the command or parameters.



Key points about the program editor:

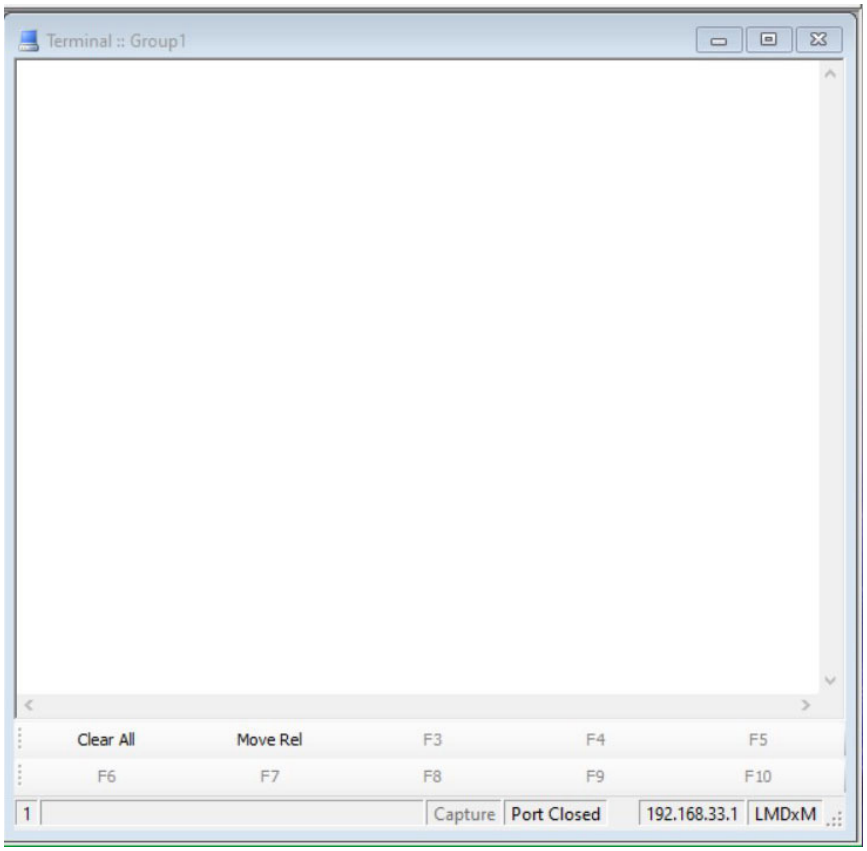
- Multiple program editor windows may be simultaneously open, allowing for multiple programs to be developed and tested
- The items on the lower status bar may be double clicked to open preferences such as the device being programmed.
- Programs generated in the Program Editor window can be saved as text files. The text files created are derived from the device type selected on the settings screen.
  - LMD: .IXT
  - MDrive: .MXT
- Programming displayed in the Program Editor Window will be displayed in the color/font setting associated with specific command types or parameters. The color and font will be automatically applied as the program is written or to an uploaded program.
  These settings can be viewed or changed in the Editor Settings screen, which can be accessed via the Menu Bar, Edit ⇨Preferences ⇨Editor Settings

Terminal Window

The terminal window is basically an ASCII/ANSI Terminal Emulator window configured to be used to communicate directly to LMD products over either RS-422/485 or Ethernet communication interface.

Immediate mode MCode commands may be issued directly to the selected LMD product.

NOTE: The Assistant Programmer button groups will not input commands into the terminal window.



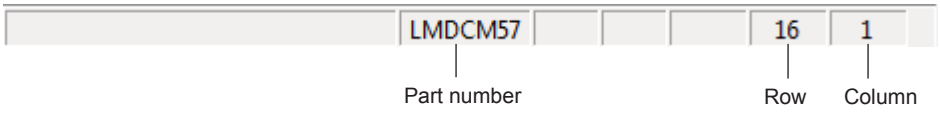
Key points about the Terminal window:

- Multiple terminal window tabs may be simultaneously open, allowing for multiple devices to be connected to different COM ports.
- Function Key groups may be programmed for easy access to desired functions.
- The items on the lower status bar may be double clicked to open preferences and settings, such as the COM Port, BAUD rate and device type.

Program Window Status Bar (G)

The program editor window status bar shows the detail such as:

- Part number being programmed. Different part numbers may have different features available. Selecting the correct part number ensures the availability of the correct features.
- Row and column number display. Displays the row and column position of the cursor.

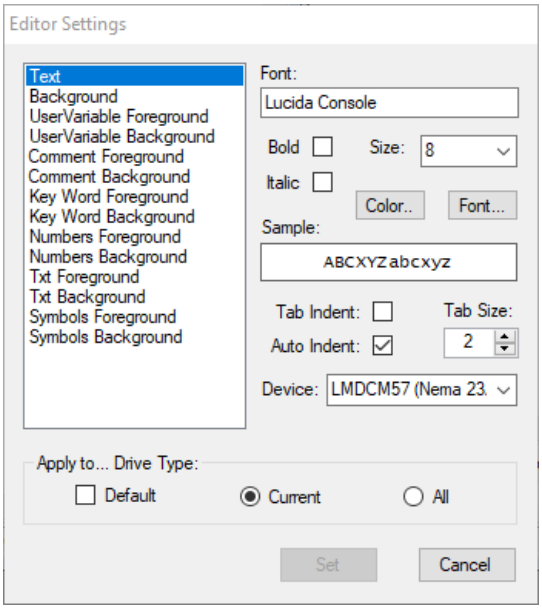


Program Editor Preferences

The Program Editor window preferences may be accessed two ways:

1. From the menu bar, select Edit ⇨Preferences⇨Editor Settings.
2. By double-clicking the Part Number field of the status bar.

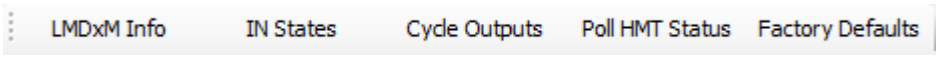
The preferences may be used to set color and font preferences or the product part number.



NOTE: If multiple editor windows are used, the Editor settings are set for each tab individually.

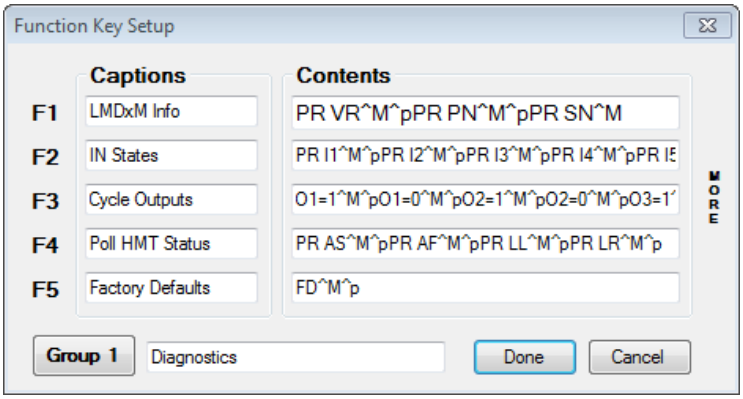
Terminal Status and Function Key Bar (H)

Function key groups may be assigned to specific functions programmable by the user. The function keys are programmed using a string of MCode commands and control codes to define specific actions, such as CR/LF, time delays, etc.



Function Key Setup

Function keys are configured using the Function Key Setup dialog, which may be accessed by right-clicking anywhere on the Function Key bar.



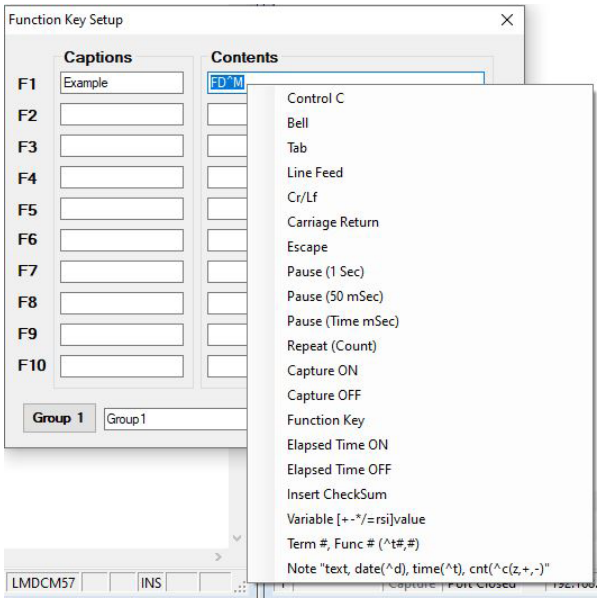
As shown above, function keys are defined by a string of MCode commands and control codes.

For example:

PR VR^M^p**PR PN**^M^p**PR SN**^M

Will display the device information such as Firmware version, Part Number and Serial number using the MCode command, followed by a carriage return (^M) and a 1 second delay (^p)/ (MCode commands are in bold for easier display.)

Available control codes are accessed by right-clicking into a function key setup field, as shown below:

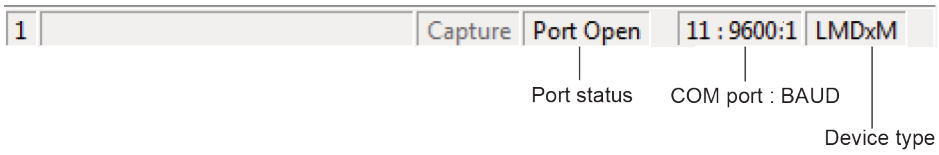


Function keys may be enabled or disabled, and the number of function key groups set in the Terminal Format dialog of the Terminal Settings.

Terminal Window Status Bar

The terminal status bar displays the status of:

- Active function key group. Additional function key groups may be defined in the Terminal Settings dialog under “Terminal Format” and accessed by right-clicking the active group number.
- Port status, shows the open, closed status of the COM port. Double-clicking will open/ close the COM port.
- Connected port and BAUD Rate. Double-clicking will open the Communication Preferences dialog.



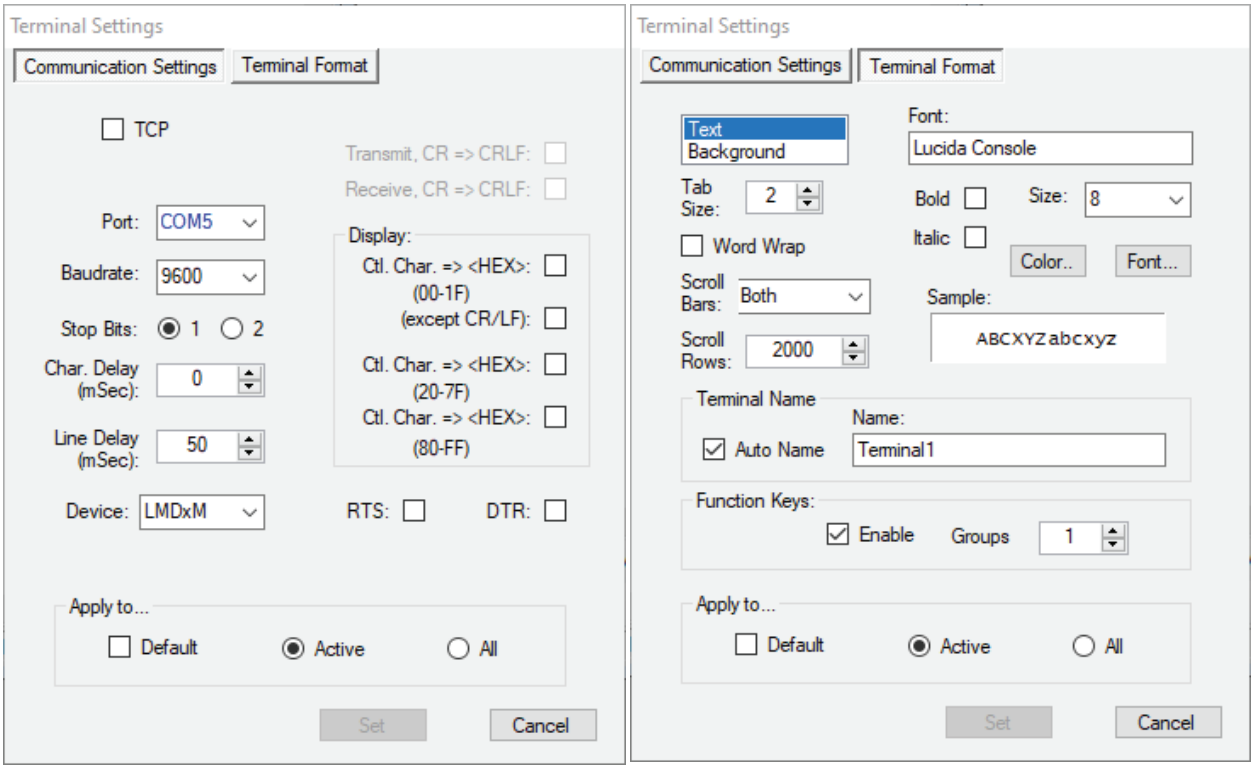
Terminal Preferences

The Terminal Settings dialog consists of two tabs:

1. Communication Settings
2. Terminal Format

It is accessed by:

1. From the menu bar ⇨Edit ⇨Preferences⇨Terminal Settings.
2. By double-clicking the COM port:BAUD field of the status bar.



Communications Settings Tab

The communications settings tab provides basic settings for the active terminal window. These settings are configured to the selected device's factory defaults. Typically the only changes will be to the COM Port used and the BAUD rate.

Terminal Format Tab

Used to set the formatting of the Terminal's colors and fonts.

This dialog is also where Function keys may be enabled or disabled, and the number of function key groups set.

Connecting to the LMD

Requirements

- RS-422/485 converter and drivers installed
- Assigned COM Port number
- LSS and Motion Terminal Interface installed
- LMD connected to RS-422/485 and powered on

Procedure

1. Click the window labeled “Terminal 1”.
2. Open the Terminal Settings dialog by:
   selecting ⇨Edit ⇨Preferences⇨Terminal Settings from the menu or
   double-clicking the COM port:BAUD field of the status bar or
   right click on the Terminal window.
3. Select the device to communicate with:
   LMDxM - LMD
   The communication settings will automatically be set for the device selected.
4. Select the COM port to connect to. (The drop down will only show available ports.)
5. Click “Set”.
6. Connect to the device by clicking the “Port Closed” field on the status bar of the Terminal window.
7. Key in CTRL+C.

The sign-on message below should appear:

```
Copyright© 2010-2022 Novanta IMS
>
```

The sign-on message indicates that the device is up and running. Immediate mode commands and/or program downloads can now be issued to the LMD.

Developing and Transferring a Program

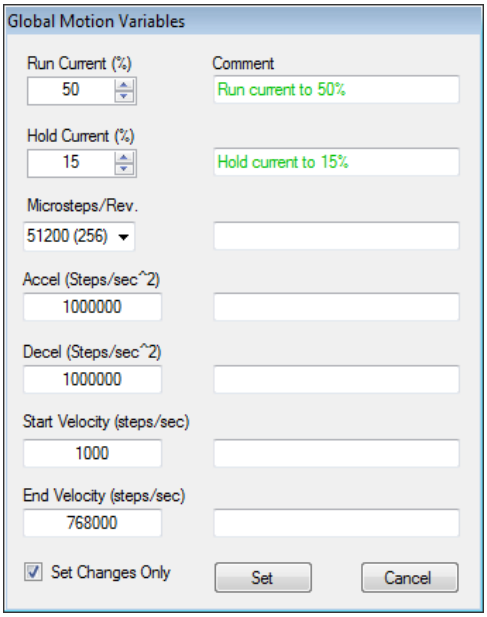
To acclimate to the Motion Control Interface environment, upload an example program or create a short program that will perform some motion profile, then download it to the LMD. Example programs are available from:
https://novantaims.com/resources/example-programs/

Set Global Parameters

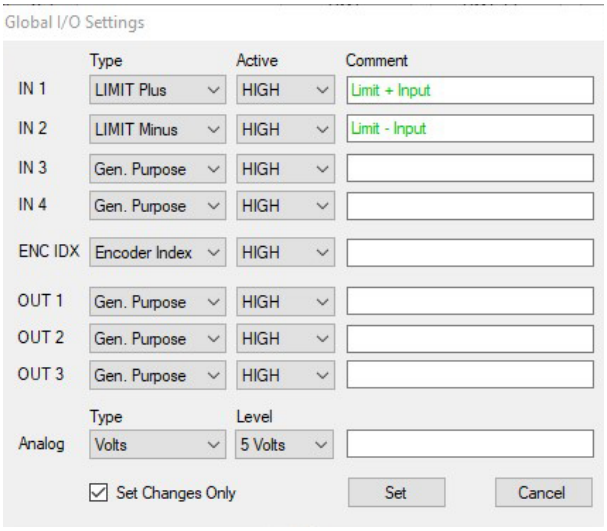
In this subsection the goal is to set some global parameters. Global parameters are set outside of the program and apply universally to the device. To access the Global settings, open the Assistant view by clicking ⇨ View ⇨ Assistant

1. Click the Motion Variables button in the Global frame of the Assistant. The Global Motion Variables dialog will open.
2. Change the Run Current to 50%
3. Change the Hold Current to 15%
4. Check “Set Changes Only”
5. The remaining variables will be left as default.

6. Click Set - The settings will populate in the editor window

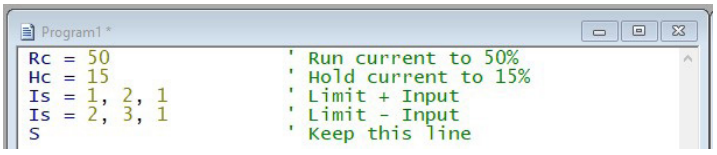


7. Click the I/O Variables button in the Global frame, the Global I/O Settings dialog will open.
   - Select IN 1 as LIMIT Plus
   - Select IN 2 as LIMIT Minus
   - Check “Set Changes Only”
   - The remaining I/O points will be left as default.
8. Click Set - The settings will populate in the editor window



9. Enter a command to save the program
   - Enter S to save the program

The program screen will display the changes that were made as shown below:

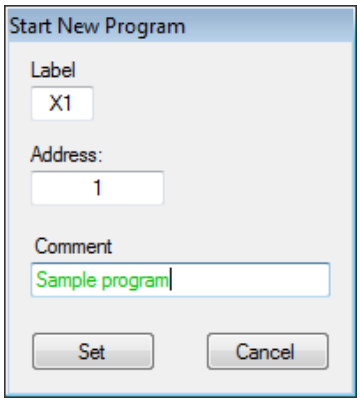


NOTE: If the I/O points are not connected to the LMD the program will still run the motion profile portion of the program.

Write the Program

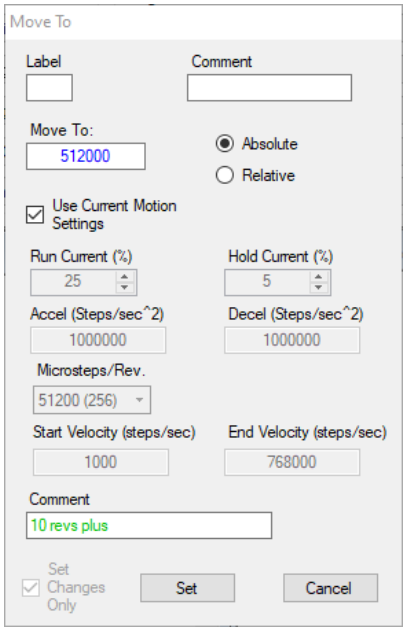
In this subsection, the goal is to write a short program that will perform a move, test for a limit, perform a move in the opposite direction and again test a limit. If a limit is seen, a sub-routine will launch to display a message,

1. Click the Start Programming button on the Assistant. The Start New Program dialog box will be displayed (shown below).
   - Enter the program label: X1
   - Enter the Address: 1
   - Enter an optional comment, if desired
2. Click “Set”



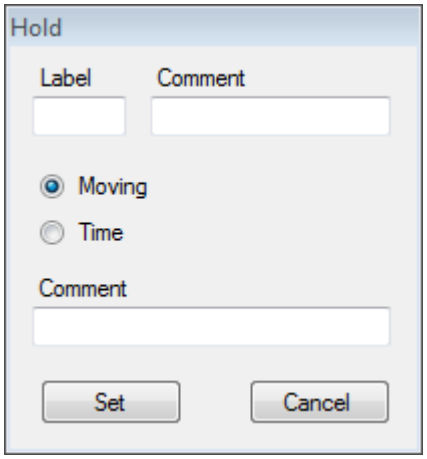
Define the Motion and Limit Response

1. Click the Move to Position button in the Motion frame on the assistant. The Move To dialog will open.
   - Enter 512000 in the Move to field
   - Leave the Absolute radio button selected
   - Leave Use Current Motion Settings checked
2. Click “Set”

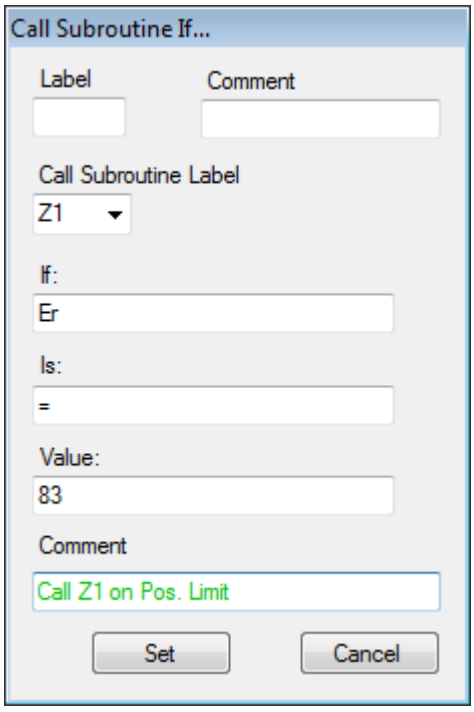


3. Click the Hold button in the Program frame of the Assistant. The Hold dialog window will open.

4. Ensure that the “Moving” radio is selected. Click “Set”

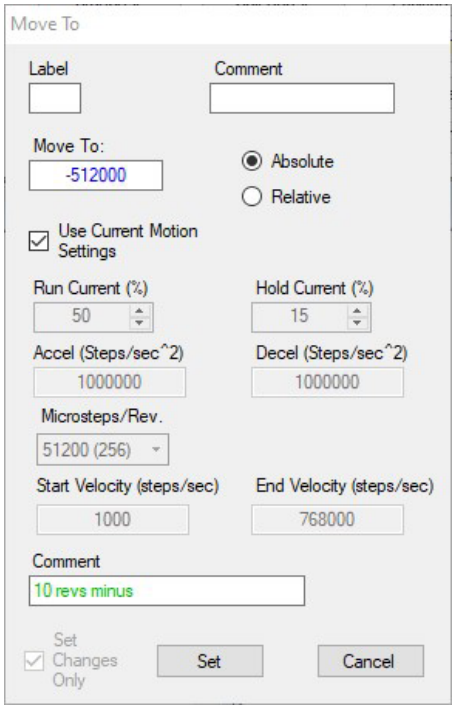


5. Click the Call Sub If button in the Program frame of the Assistant. The Call Subroutine If dialog box will open.
   - Click in the Subroutine Label dropdown area and manually enter “Z1”
   - In the “If:” field, enter Er or right click and select the ER variable from the context menu
   - In the “Is:” field, enter “=” or right click and select “=” from the context menu.)
   - In the “Value:” field enter “83” , to set the error number for positive limit reached.
6. Click “Set”

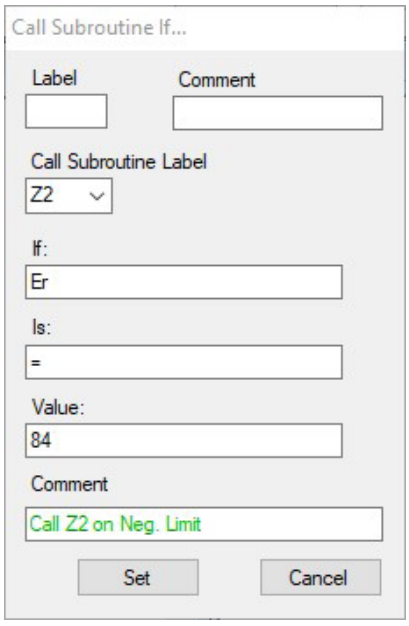


7. Click the Move to Position button in the Motion frame. The Move To dialog will open.
   - Enter -512000 in the Move to field
   - Leave the Absolute radio button checked
   - Leave Use Current Motion Settings checked

8. Click “Set”



9. Click the Hold button in the Program frame. The Hold dialog box will open.
   – Ensure the “Moving” radio button is selected and click “Set”
10. Click the Call Sub If button in the Program frame of the Assistant. The Call Subroutine If dialog box will open.
   – Click in the Subroutine Label dropdown area and manually enter “Z2”
   – In the “If:” field enter Er or right click and select the variable from the context menu.
   – In the “Is:” field enter “=” or right click and select this from the context menu.
   – In the “Value:” field enter “84” to set the error number for negative limit reached.
11. Click “Set”



▶ Click the “Branch To” button in the Program frame.

12. Select X1 from the Destination Label dropdown.

▶ Click “Set”.

13. Click the End button in the Program frame of the Assistant. The character E should appear in the program.

Building the Subroutines

These subroutines will each trigger outputs. Output 1 will be active if the Positive limit is reached, Output 2 will be active if the negative limit is reached. The program will branch back to the beginning of the subroutine until the limit input is cleared.

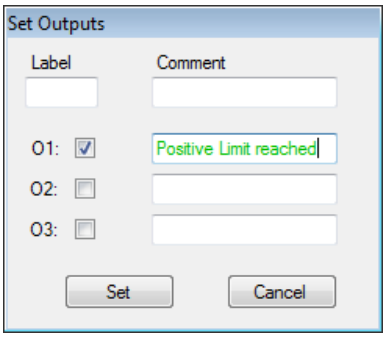
1. In the Editor window, beneath the E:

– Type in LB Z1 and press Return. This identifies the Positive limit subroutine as Z1.

2. Click the “Set Outputs” button in the I/O frame

– Check O1

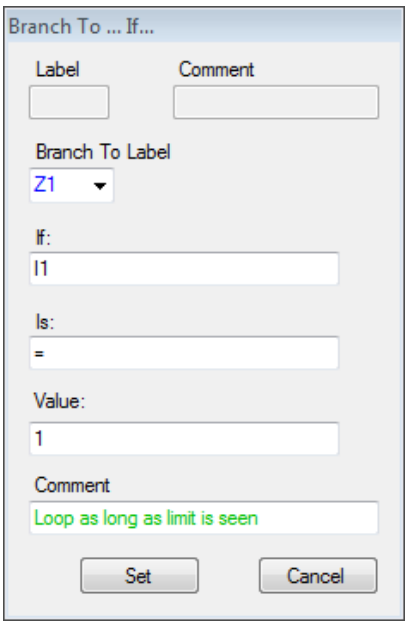
3. Click “Set”



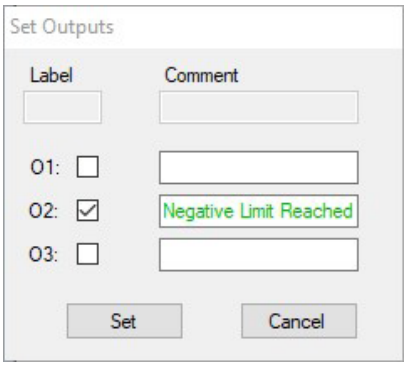
4. Click the “Branch If” button in the Program frame. The Branch To... If dialog will open.

– Enter Z1 in the Branch To Label field.
– Enter I1 in the If field.
– Enter = in the Is field.
– Enter 1 in the Value field.

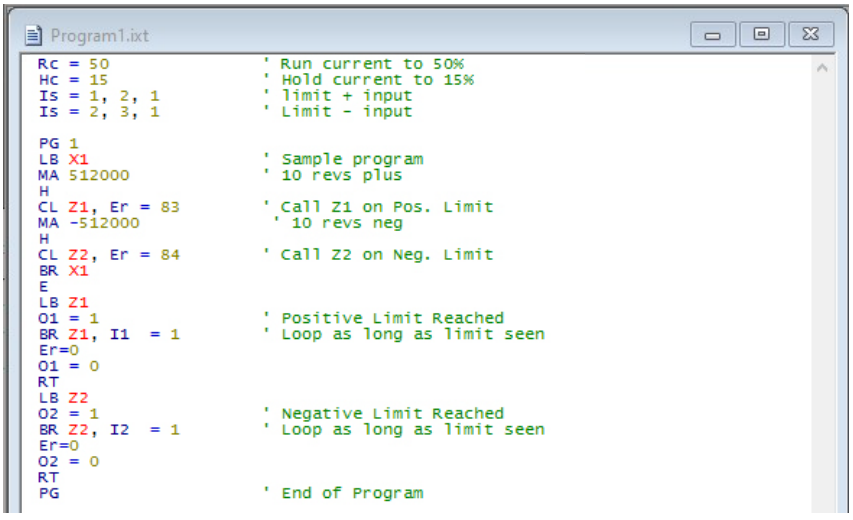
5. Click “Set”.



6. In the Editor window, type in Er=0 after the last line of code and click Return. This will clear the error set by the Positive Limit being reached.
7. Click the “Set Outputs” button in the I/O frame.
   – Uncheck the O1 check box.
8. Click “Set”.
9. Click the “Return” button in the Program frame.
   – Type in LB Z21 and press Return. This identifies the Negative limit subroutine as Z2.
10. Click the “Set Outputs” button in the I/O frame
   – Check O2
11. Click “Set”



12. Click the “Branch If” button in the Program frame. The Branch To... If dialog will open.
   – Enter Z2 in the Branch To Label field.
   – Enter I2 in the If field.
   – Enter = in the Is field.
   – Enter 1 in the Value field.
13. Click “Set”.
14. Click the “End Programming” button. When completed, the program will appear as below:



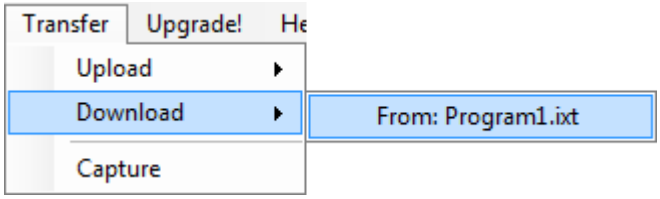
Transfer the Program

- ■ The LMD must be connected to the appropriate communication Port.
- ■ The port must be open.
- ■ The LMD should be in a factory default configuration, which may be accomplished by entering FD in the Terminal window.
- ▶ Verify active communication by entering CTRL+C
- ◁ The sign on message should appear.

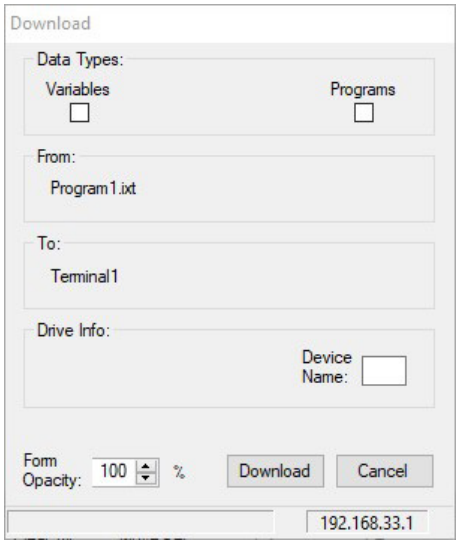
Download the program

The following procedure will step through transferring the program to the device.

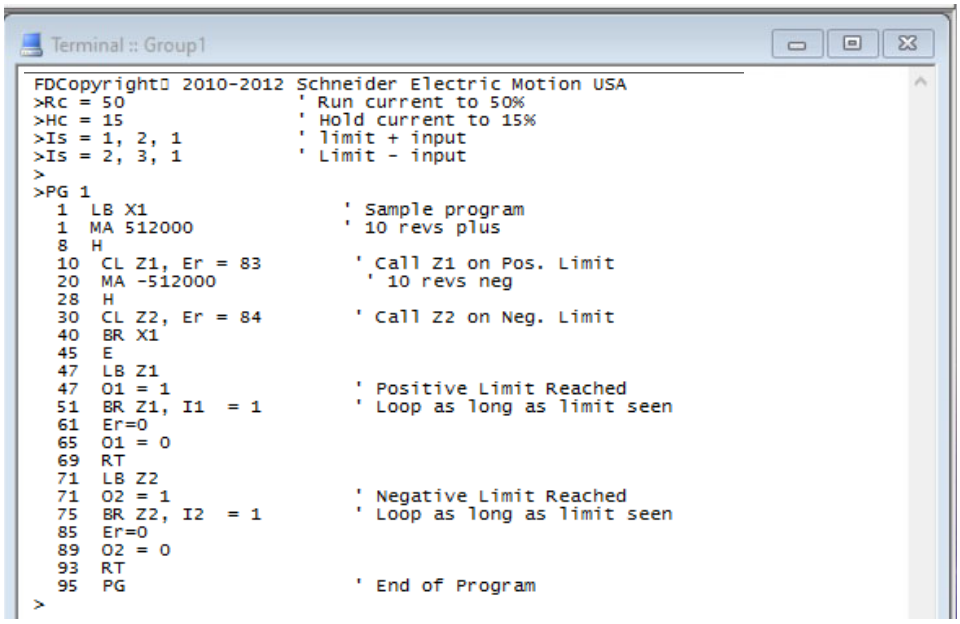
1. With the Terminal window selected: Click ⇨Transfer ⇨Download ⇨From: Program1.ixt
   The Download dialog box will open.



2. Leave Variable and Programs unchecked and click the “Download” button.



3. The program download will be shown in the terminal window, as shown below:



4. Click into the terminal window and enter the save command by typing in the letter “S” then the enter key.
5. The program is stored in memory and ready to run.

Execute the Program

To execute the program, Enter “EX X1” into the terminal.

The motor should begin moving back and forth. When an input switch is activated the appropriate output will activate HIGH, and remain so until the limit is deactivated, whereupon motion will resume.

Upgrading Firmware

Requirements

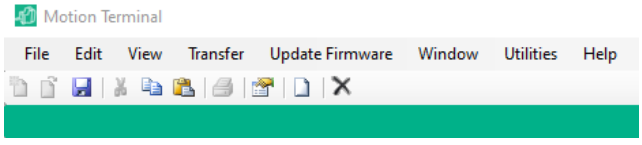
- LSS with Motion Control Interface installed.
- The firmware upgrade *.SEM file
- LMD Motion Control motor, powered and connected to communications,

NOTE: Firmware should be upgraded on an as required basis. Do not upgrade unless the application requires an added feature or unless instructed by Application support.

Once begun the Firmware upgrade process must be completed.

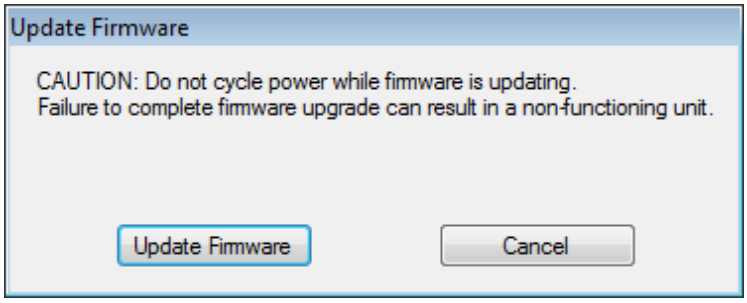
Procedure

1. Click the “Terminal 1” window and establish a connection to the motor to be updated. Refer to “Connecting to the LMD” on page 55.
2. Enter the FD command to reset the drive to factory settings.
3. Click the menu item Upgrade Firmware!

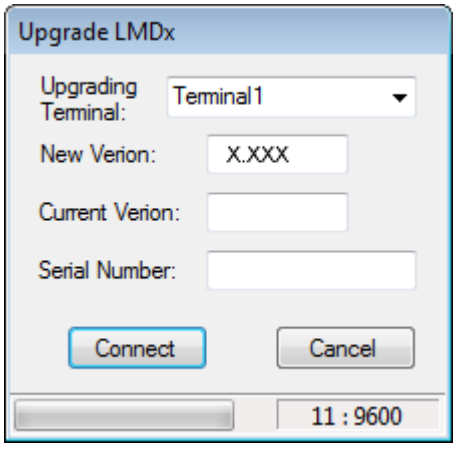


4. Select the *.SEM upgrade file from the folder in which it was extracted.
   - The select file dialog box will open.
   - Select the upgrade file. This file will have a *.SEM extension.
   - Click “Open”

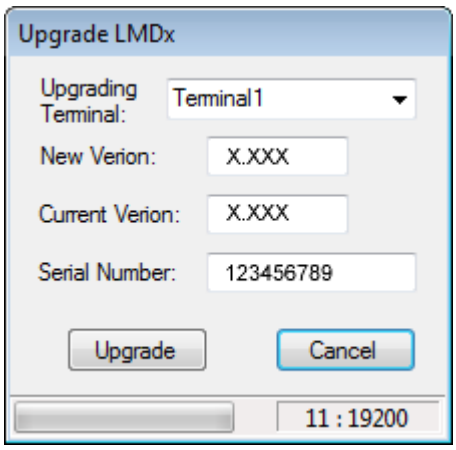
Verify the desire to upgrade by clicking Update Firmware.



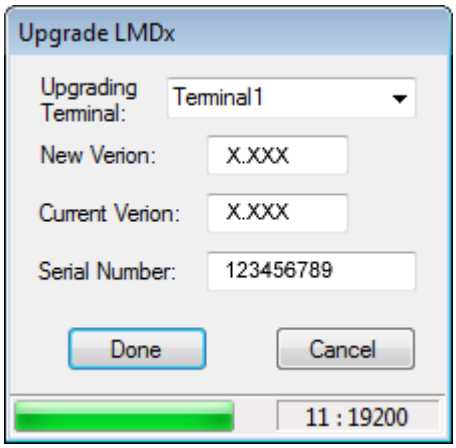
5. On the Upgrade LMDx dialog click “Connect”. The upgrade utility will attempt to connect to the device. If connection is successful, the previous version number will appear in the field.



6. Click “Upgrade”



7. The Upgrade process will run. Progress is noted by the green bar on the lower left of the dialog. Note that this will take 3-4 minutes.



8. When complete, click “Done” The LMD is now ready for use.

Encoder Remap Utility (Closed Loop Models Only)

The LMD must meet several conditions in order to be remapped successfully.

⚠WARNING

UNINTENDED OPERATION

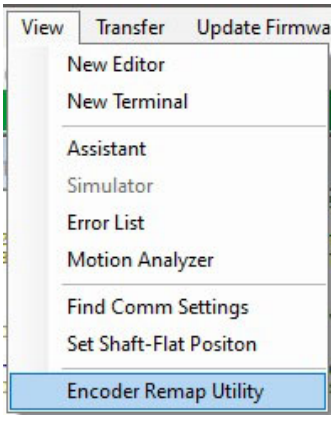
- The unit MUST be uncoupled from any loads, the shaft MUST be free to rotate in both directions
- Do not remap the encoder unless the function is fully understood.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

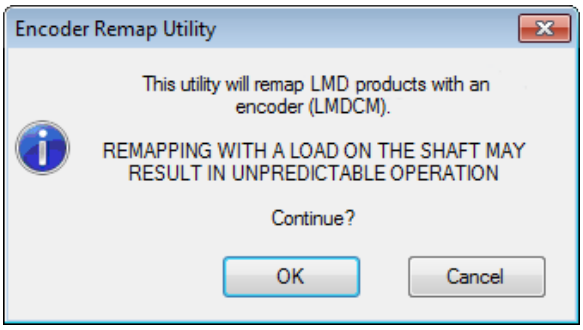
Remap Process

Proper function of the hMT circuitry requires that the precise alignment of the motors rotor and stator be stored in relation to the internal magnetic encoder. This is done at the factory during the manufacturing process and will typically not be required again.

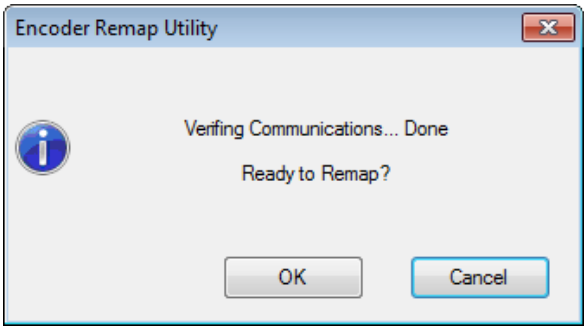
1. Ensure that the motor shaft is uncoupled and able to move freely in both Clockwise and Counterclockwise directions.
2. From the “View” menu select “Encoder Remap Utility”.



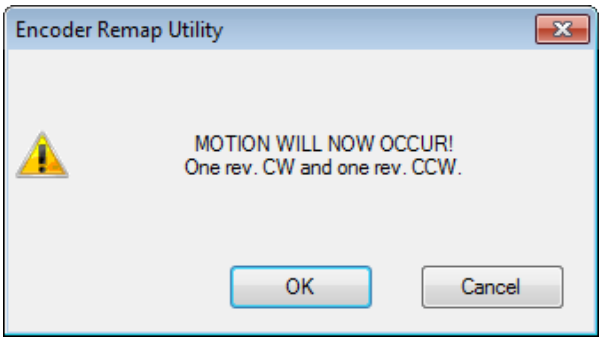
3. If the motor shaft is free to move in both directions, click OK.



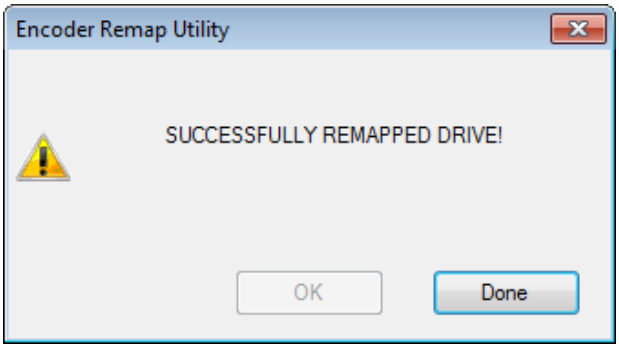
4. The software will verify that the device is communicating. Click OK.



5. Once communications is verified, acknowledge the understanding the motion will occur by clicking OK.



The motor will turn one revolution clockwise, then one revolution counter-clockwise. The device has been successfully remapped.



Should remap fail: contact the factory.

Motion Analyzer Utility

The motion analyzer is a graphing tool that allows the user to plot a move and quickly obtain data on that move, then make adjustments to optimize the motion variables such as acceleration/deceleration, initial and maximum velocity

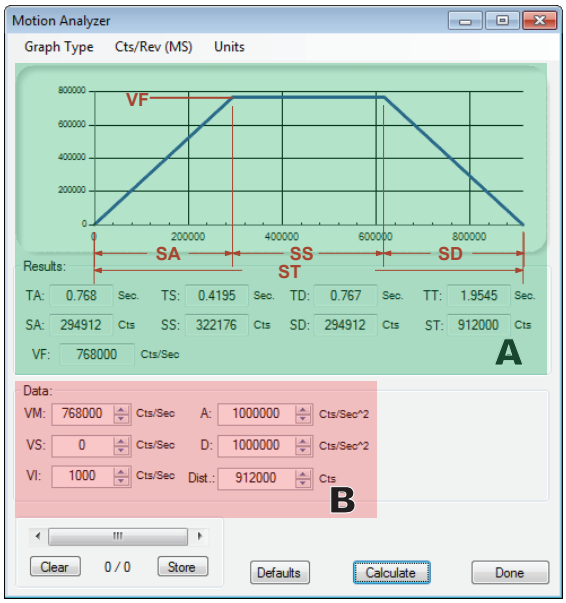
Moves may be shown in three types of graph:

1. Velocity vs position.
2. Velocity vs time.
3. Position vs time.

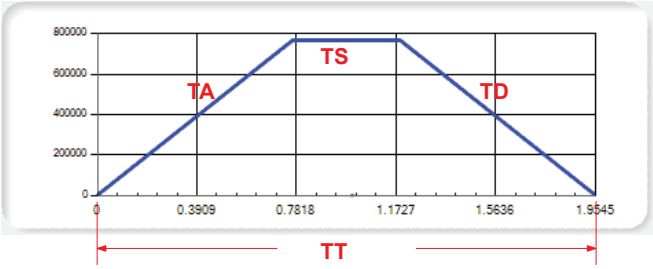
The user may also select the units for the move, either in counts (Steps), shaft revolutions or degrees.

The motion analyzer is an independent utility.

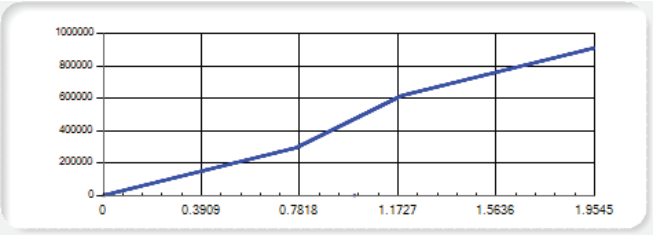
Velocity vs Position



Velocity vs Time



Position vs Time



A Motion analyzer plot contains the graph, which may be viewed as velocity over position, velocity over time, or position over time, and a detailed analysis of the move.

The detailed read-only values are:

TA*	Acceleration time in seconds.
TS*	Slew time in seconds (time at the max velocity of the move).
TD*	Deceleration time in seconds.
TT*	Total time of the move in seconds.
SA*	Acceleration distance in selected unit (counts/degrees/revs).
SS*	Slew distance in the selected unit.
SD	Deceleration distance in the selected unit
ST*	Total distance in the selected unit.
VF*	Maximum shaft velocity achieved during the move.

*** MCode variable**

B Input data, these values represent the MCode motion variable which would be set in a motion profile in a program.

NOTE: that while these may be entered into the analyzer in revolutions or degrees, they will need to be converted back to counts before being entered into a program, or the appropriate mathematics included as part of the program's global variables.

They are:

VM*	Maximum velocity.
VS	Initial velocity for a move-on-move
VI*	Initial velocity.
A*	Acceleration.
D*	Deceleration
Dist	Move distance commanded by a MA (move absolute) or MR (move relative).

***MCode variable**

Accessing the Motion Analyzer

Menubar:

▶ Click the menubar item: View ⇨ Motion Analyzer

Chapter 5
Ethernet Interface

What's in this Chapter?

This chapter includes the following topics:

The product is unable to detect an interruption of the network link

⚠WARNING

LOSS OF CONTROL OR UNINTENDED OPERATION

- Verify that connection monitoring is on.
- The shorter the time for monitoring, the faster the detection of the interruption.
- Do not write values to reserved parameters.
- Do not write values to parameters unless the function is fully understood.
- Run initial tests without coupled loads.
- Verify that the system is free and ready for the movement before changing parameters.
- Verify the use of the word sequence with fieldbus communication.
- Do not establish a fieldbus connection unless the communication principles are fully understood.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Launching the Ethernet Interface

Click on the “Launch Ethernet interface” button on the LSS startup screen to launch the Ethernet Interface.

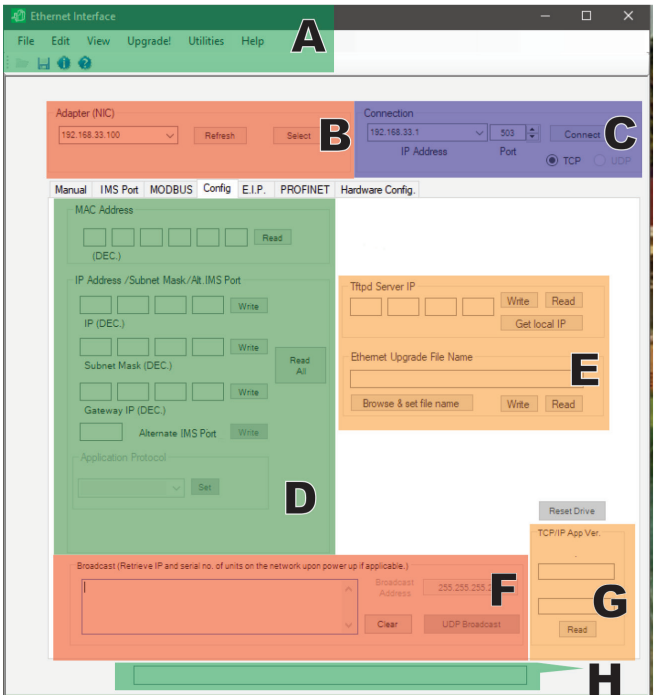
The Ethernet Interface screen will be displayed.

Configuration Screen Overview

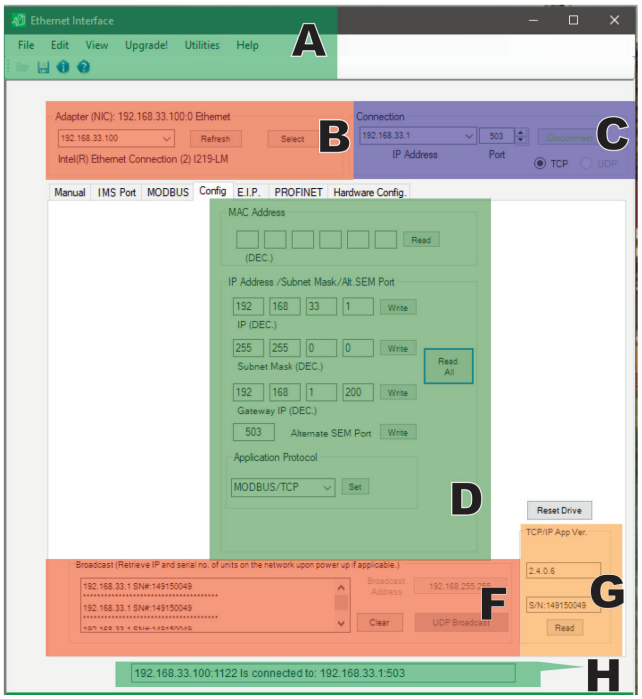
The configuration tab will be the default tab that opens when the program launches. This tab is key to the configuration of the device. The remaining tabs are geared toward functional testing and custom mapping of the EtherNet/IP assembly object and Profinet IO registers.

The graphic below shows the configuration screen before and after connection to the device has been established.

Before Connection - All Versions



After Connection - Version 2.4.X.X and Higher



Menu and Button Bar (A)

Standard windows file operation functions, such as creating, opening and saving files, setting and changing preferences, and transferring files to and from a connected LMD NIC.

Adapter Selection (B)

Area to select the network adapter connected to the LMD Ethernet product. Install a secondary adapter card or use a computer not connected to a network to commission the device to the required IP and SUBNET mask.

Connection (C)

Once selected, the software will scan the network adapter for connected devices. The default settings for the LMD Ethernet are:

- IP: 192.168.33.1
- Port: 503 (Port 503 is the default IMS/Configuration port)
- Subnet mask: 255.255.0.0

Base Configuration (D)

The fields in this section set the basic configuration parameters for the device such as:

- IP address
- Subnet mask
- Gateway address
- Alternate IMS configuration port
- Application selection (EtherNet/IP, MODBUS/TCP, or Profinet/IO). By default the application protocol is MODBUS/TCP

Firmware Upgrade Server (E)

For information on firmware upgrades, refer to section “Upgrading the Application Firmware and Application Code” on page 83

Version 2.3.X.X and Lower

Information in this section is used to upgrade firmware for version 2.3.X.X and lower. TFTP and upgrade file selection is set here before continuing to the upgrade process.

NOTE: The firmware updated using this utility is strictly for the Ethernet Network Interface controller of the LMD and EtherNet/IP, MODBUS/TCP, or Profinet/IO applications. The firmware for the Motion Controller is a application and is upgraded using the Motion Control Interface section of the LSS.

Version 2.4.X.X and Higher

This section is not available once the device has established connection with the application.

Broadcast (F)

UDP Broadcast will send a UDP request over IP 255.255.255.255 and will return the IP address and serial number of all LMD products located on the network.

The LMD Ethernet will also broadcast it’s IP address upon power up (TCP Application version 2.2.0.2 or greater).

Application Version (G)

Displays the version of the Ethernet controller firmware, EtherNet/IP, MODBUS/TCP or Profinet/IO applications and serial number.

Status Bar (H)

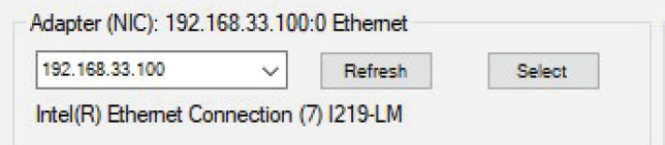
Connection status will display here.

Base Configuration of the Device

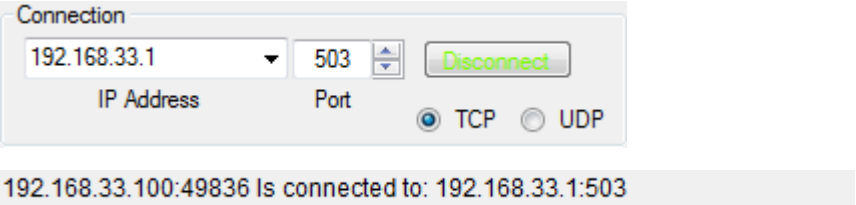
Connect to the Device Using the IMS Factory Defaults

1. Launch the TCP/IP Configuration Utility
2. Select the Adapter (NIC) to which the LMD Ethernet device is interfaced with and click “Select”.

NOTE: The refresh button may be used if the associated NIC IP is not shown on the dropdown. Once selected, the NIC information will display above and below the selector as shown below:.



3. In the section labeled “Connection”, ensure that the default IP Address, 192.168.33.1 is visible in the dropdown box and 503 in the port field.
   Click the “Connect” button. Connection active status will be indicated by the button text turning green, showing “Disconnect”, and the status bar showing a connected status.



The device should now be connected and is ready for configuration of basic parameters.

NOTE: For LSS version 1.0.1.8 and higher, initial password setup is required for CyberSecurity consideration. Refer to “Initial Ethernet Password Setup (LSS Version 1.0.1.8 and Higher)” on page 73.

Initial Ethernet Password Setup (LSS Version 1.0.1.8 and Higher)

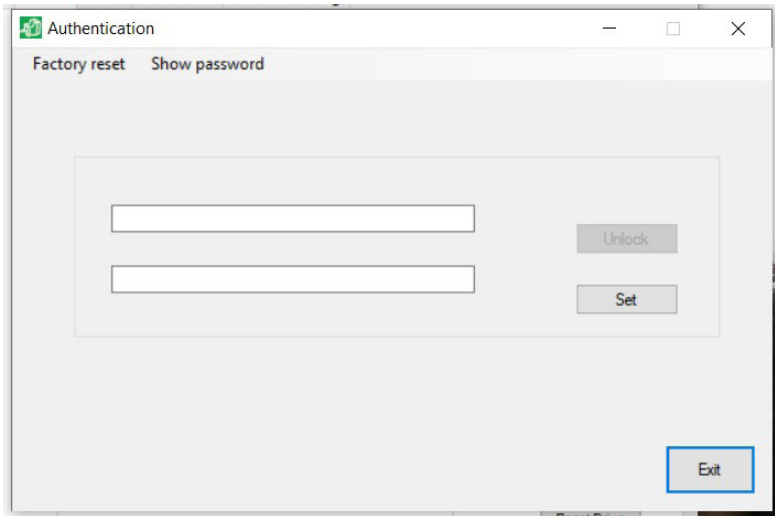
For Ethernet application version 2.4.0.6 and newer, a password is required for initial connection of the ethernet IP application. This password will be required if any ethernet IP settings are changed.

NOTE: New devices that have not been setup previously will not function or communicate on any fieldbus until a password is configured. Once a password is configured, communication with the device can be established. For situations where the password is not required for CyberSecurity, the password requirement can be disabled. Refer to “Disabling the CyberSecurity Password Requirement” on page 75

First Time Password Setup

After clicking “Connect”, an Authentication screen will be displayed, allowing for a password to be setup.

1. Enter a password in the first field of the Authentication dialog box.
   NOTE: The Show password option can be clicked to show the password as it is typed.
2. Enter the same password in the second field of the Authentication dialog box.
3. Click “Set”

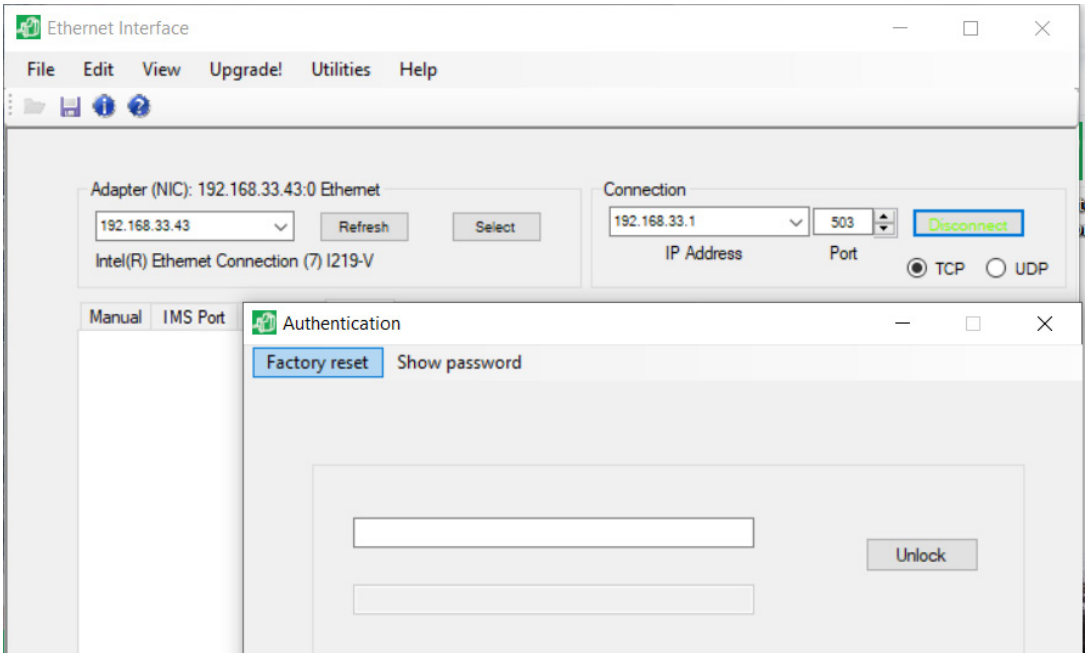


NOTE: If the passwords do not match, a message will be displayed indicating that the passwords do not match and the passwords will have to be entered again.

Resetting the Cyber Security Password

If the password needs to be reset:

1. Click the “Connect” button in the Connection section of the ethernet application.
2. When the Authentication screen is displayed, select “Factory reset”.



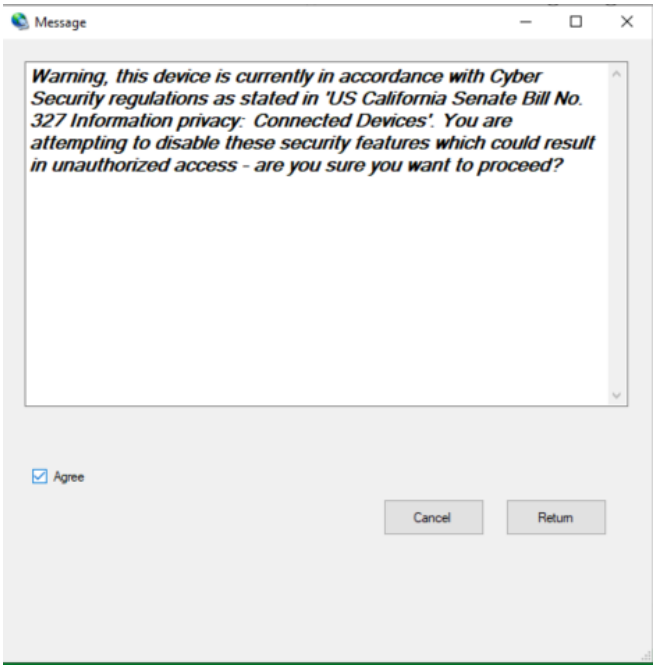
3. A message will be displayed providing information about the reset process. Click the “Agree “ check space and click “Return. The Factory password and IP Configuration reset dialog box will be displayed.
4. On the Factory password and IP Configuration reset dialog box, enter the serial number of the device being reset. Click OK.
5. Click Disconnect in the Connection section. The device’s IP address will be reset to the factory default of 192.168.33.1.

An attempt to reconnect the device will result in an initial password setup as indicated in “First Time Password Setup” on page 73.

Disabling the CyberSecurity Password Requirement

For situations where a cyber security password is not required, this option can be disabled via the Edit menu.

1. In the Edit menu, click Cyber security disable. A checkmark will appear next to the menu option and a message screen will display a cyber security compliance warning.

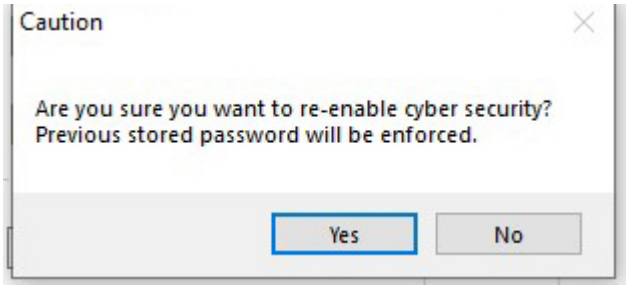


2. To proceed with the disable of the cyber security password option, click the Agree checkbox and the Return button.

Re-enabling the Cyber Security Password

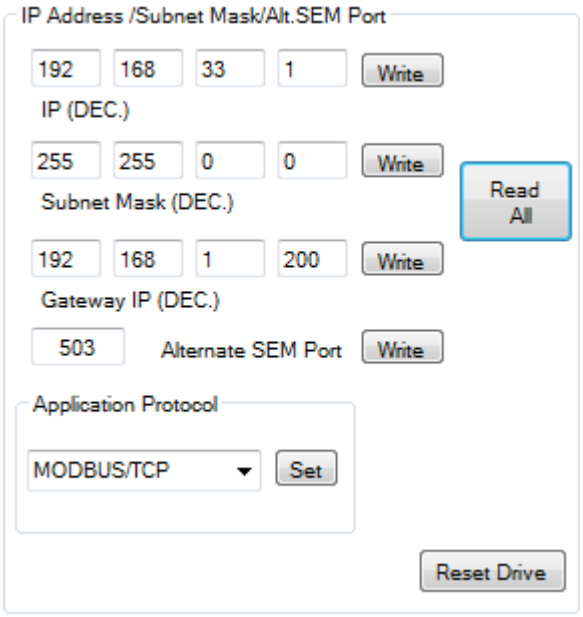
To re-enable the cyber security password option:

1. Deselect Cyber security disable in the Edit menu. The checkmark will be removed from the menu option and a Caution screen will be displayed confirming the re-emable of the cyber security password.



2. Click Yes to proceed with the re-enable of the cyber security password. The password will be re-enabled and set to the previously established password used prior to the disable.

Configuring the Base Parameters



NOTE: The IP address, Subnet Mask and Gateway Address settings may be dependant on the network architecture.
If network configuration is outside the IPv4 Private Network block (192.168.0.0 — 192.168.255.255), a second NIC should be installed onto the machine being used to configure the device.

1. Enter the IP address to the desired IP. Click “Write”.
2. Set the Subnet Mask to the desired mask. Click “Write”.
3. Set the appropriate Gateway IP. This will only be used if the device will be in a building or systems where several networks are present.
4. If desired, an alternate port can be entered to use the device as a programmable controller using MCode/TCP.
5. Disconnect from the device by clicking “Disconnect” in the Connection container.
6. Click the “Reset Drive” button (TCP Application 2.2.0.2 or greater) or cycle power to the device.
7. Select the new IP address in the Connection container and click “Connect”.

The status bar should give connected information to the new IP address.

Application Selection

LMD Ethernet

The LMD Ethernet features three applications or modes of operation:

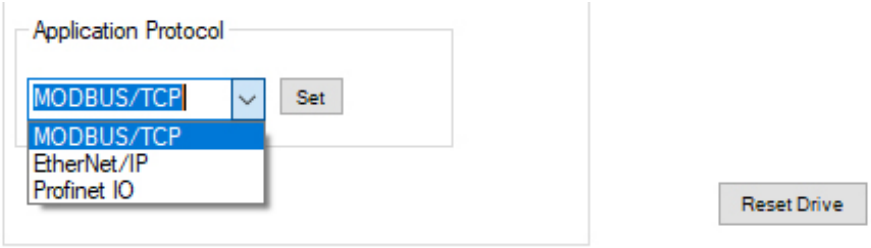
- MODBUS/TCP
- EtherNet/IP
- Profinet IO

By default the MODBUS/TCP application is loaded on the device.

MCode/TCP is available on TCP port 503 regardless of the loaded application.

To change the Ethernet Application:

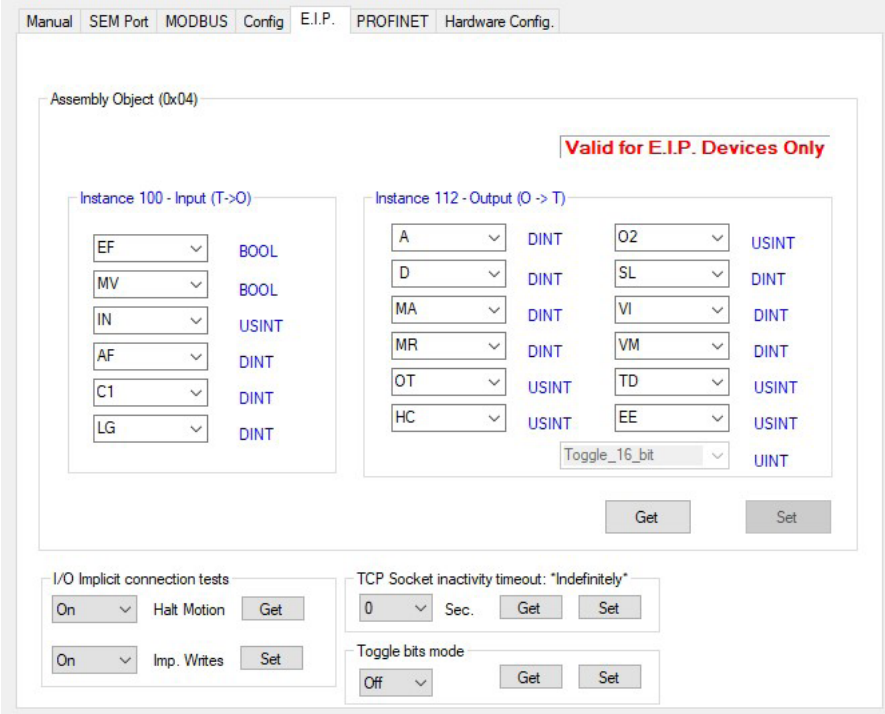
1. Select the desired application in the Application Protocol dropdown.



2. Click “Set”.
3. Click the “Reset Drive” button (TCP Application 2.2.0.2 or greater) or cycle power to the device.

Upon re-connection, the selected application protocol will be available.

EtherNet/IP Application Settings



The EtherNet/IP configuration options contained in the TCP/IP Configuration Utility is variable mapping of the EIP assembly object.

The I/O implicit connection test is used to configure the LMD for use with PLC’s such as the MicroLogix 1400, which are not capable of Implicit messaging. The Assembly object mapping is ignored by such PLC’s.

NOTE: Mapping changes must be reflected in the PLC setup to be valid.

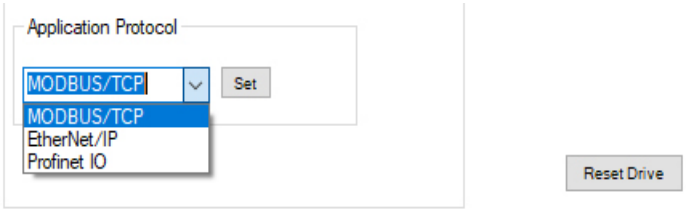
See the LMD EtherNet/IP Fieldbus Manual for Manufacturer supported objects and PLC setup information.

This document is available for download from:
https://novantaims.com/dloads/product-literature/manuals-3/

MODBUS/TCP Application Setting and Functional Test

Setting the MODBUS/TCP Protocol

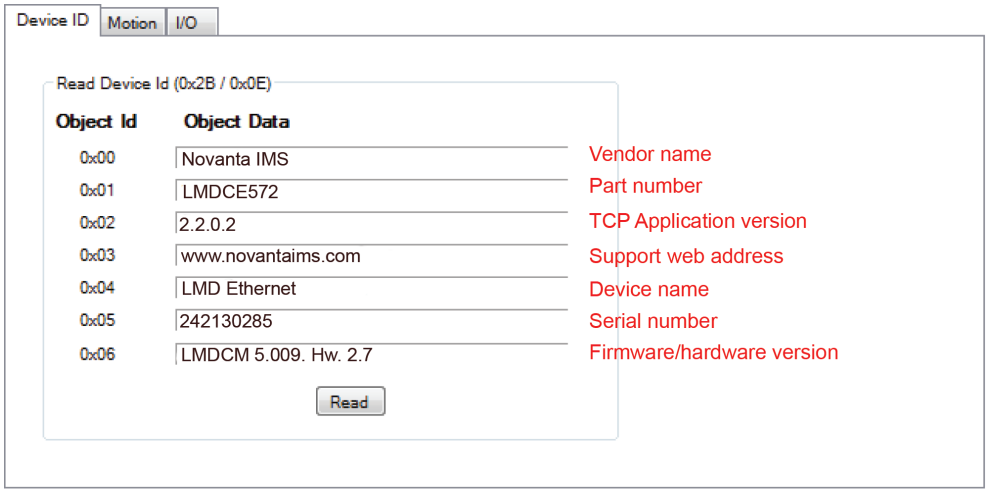
1. Select the MODBUS/TCP application in the Application Protocol dropdown.



2. Click “Set”.
3. Click the “Reset Drive” button (TCP Application 2.2.0.2 or greater) or cycle power to the device. Upon re-connection, the MODBUS/TCP application protocol will be available.
4. Connect to IP.ADDRESS:502 (TCP Port 502) to use the MODBUS/TCP application.

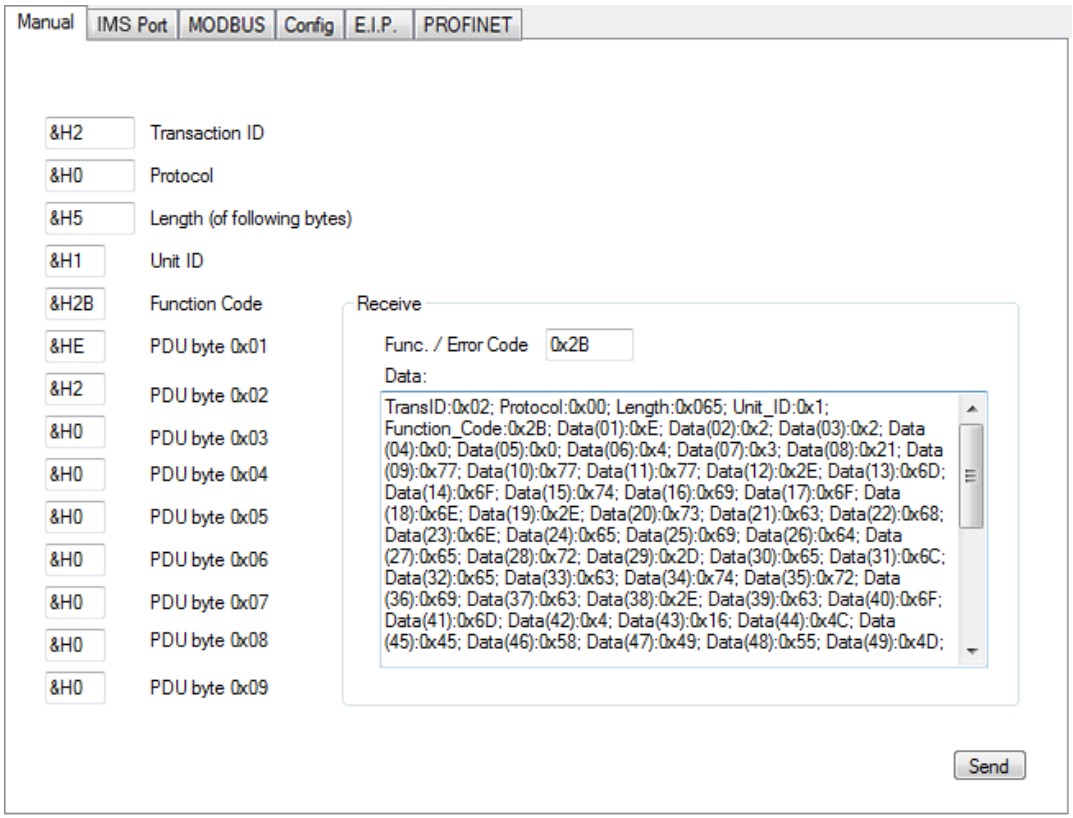
Functional Testing of MODBUS/TCP

1. With the MODBUS/TCP application protocol loaded, connect to the device’s IP address on TCP Port 502.
2. Click the MODBUS tab to access basic MODBUS/TCP Functions.
3. With the Device ID tab visible, click the “Read” button to read the device ID (0x2B) Object data. See below.



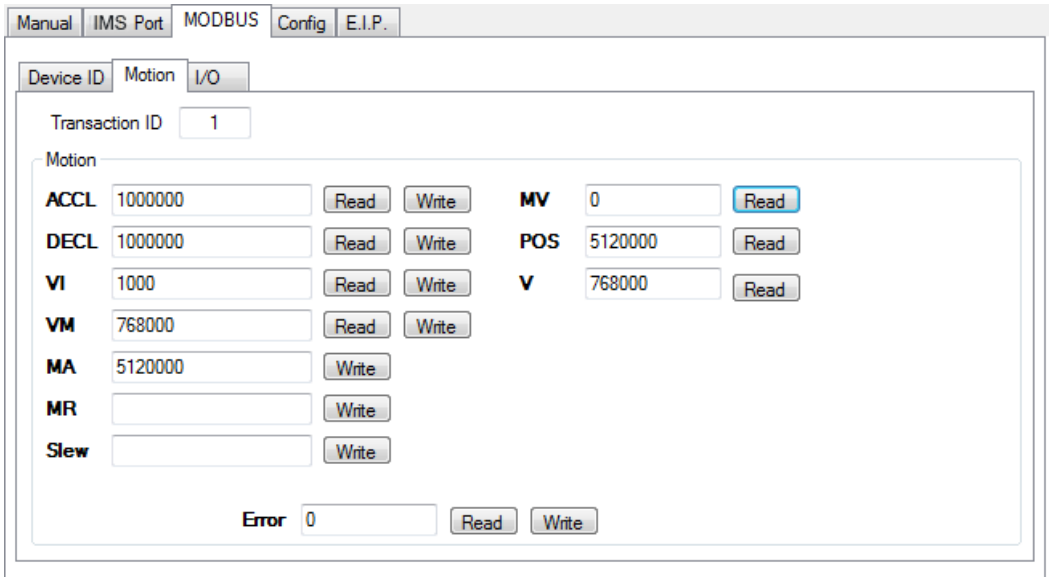
4. Select the “Manual” tab.

This tab displays the raw MODBUS data that was read from the device. In this case, the Device ID Object data which was just read using the MODBUS tab.



Additional MODBUS/TCP functional tests may be exercised using the MODBUS tab of the TCP/IP Configuration Utility.

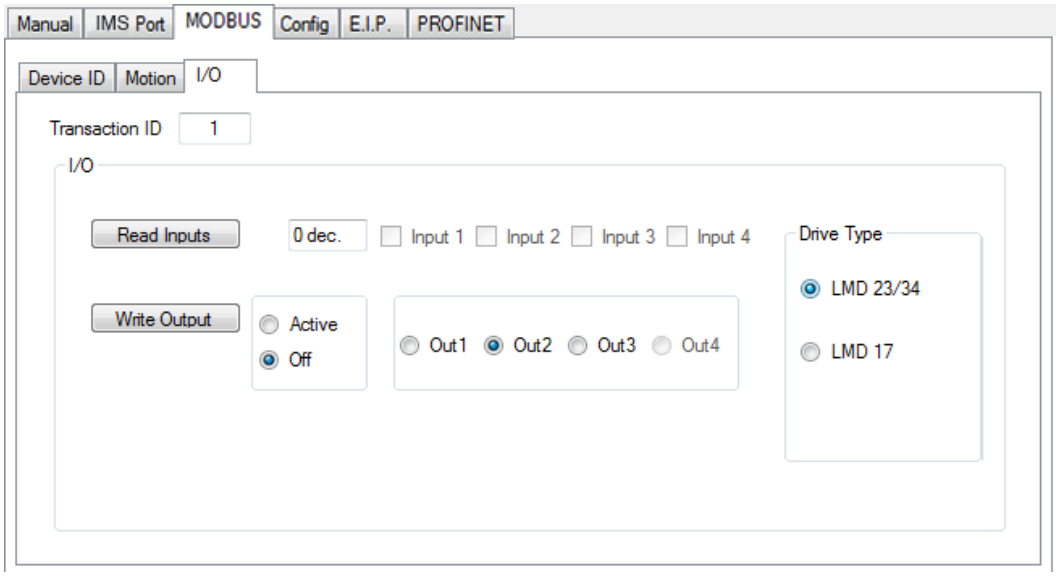
The MODBUS ⇨ Motion tab can be used to read/write a number of Motion variables and perform relative and absolute point-to-point moves, or slew the axis at a specified velocity.



To test a move:

1. Enter 512000 in the MA field.
2. Click “Write”. The axis should move ten revolutions in the positive direction.

The MODBUS ⇨ I/O tab can be used to read the state of inputs and write the state of outputs.



To test an I/O point, Click “Read Inputs”. The binary-coded-decimal state of the inputs will be read to the text field, The active inputs will be checked.

The MODBUS/TCP protocol

For information on the function codes associated with MODBUS/TCP, see the MODBUS/TCP Fieldbus Manual, available for download from:
https://novantaims.com/dloads/product-literature/manuals-3/

MCode/TCP Application Functional Test

MCode/TCP is always available on TCP port 503 regardless of the installed specialty application protocol.

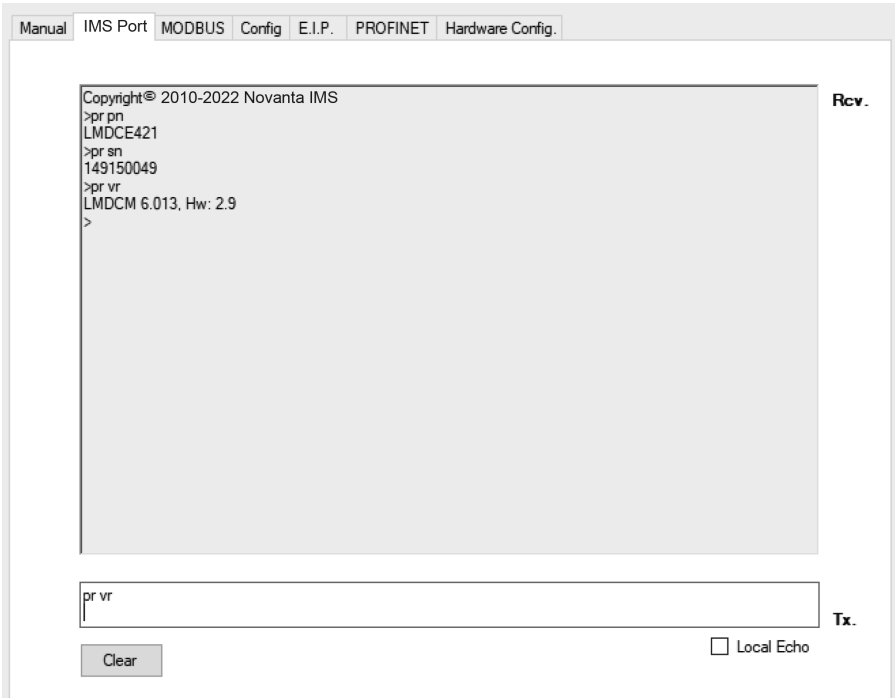
Functional testing via the TCP/IP Configuration Utility uses the IMS Port tab of the program. The tab features a simple Terminal emulator and will only function if TCP port 503 is connected.

To test the functionality of MCode:

1. Connect to the LMD product using IP.ADDRESS:503.
2. Open the IMS Port tab.
3. Click into the bottom text area.
4. Key in CTRL+C on the computer keyboard.

The copyright sign on message should appear in the terminal area on top.

MCode/TCP commands may be run directly from this terminal.



Once configured and tested for MCode/TCP usage, the device may now be programmed using the Motion Control Interface Software Application available as part of the LSS.

NOTE: For Ethernet/IP and Profinet applications, Echo Mode (EM) defaults to option 2 and immediate commands will not be visible. For additional information on Echo Mode, refer to the LMD MCode Manual.

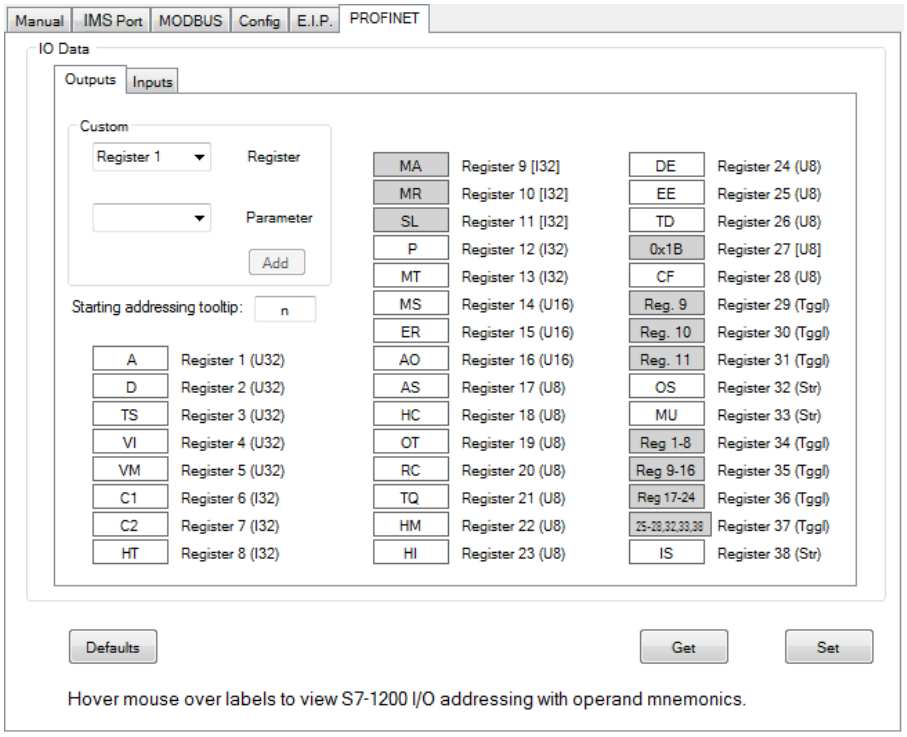
For Additional information on MCode Programming, refer to the LMD MCode Programming and Reference Manual, available for download from:
https://novantaims.com/dloads/product-literature/manuals-3/

Mapping the Profinet IO Registers

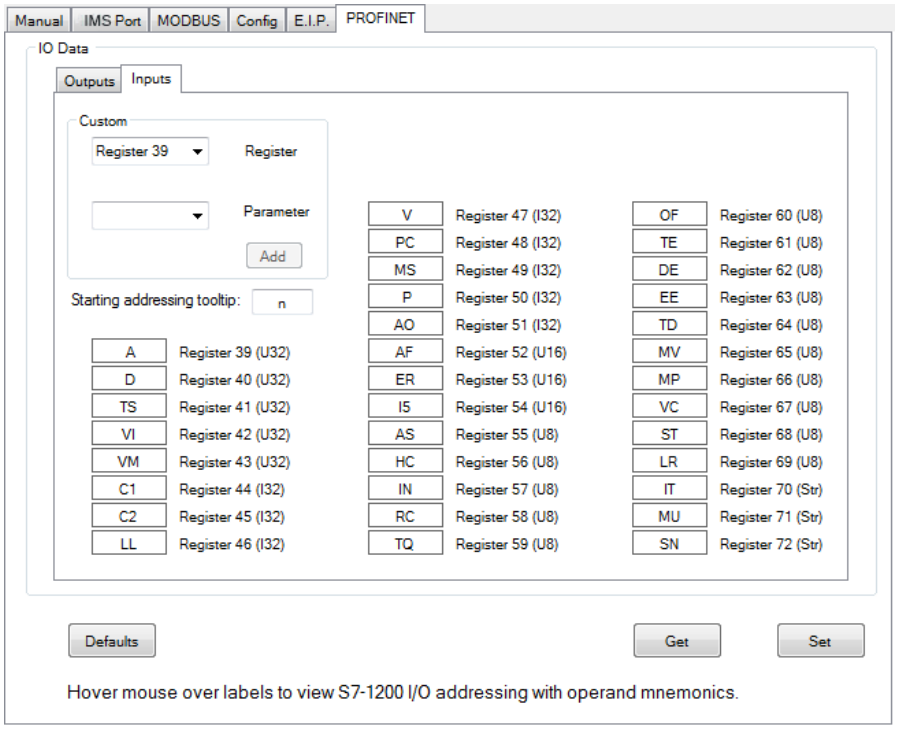
Profinet IO features 38 output registers and 34 input registers. These registers are by default mapped to corresponding MCode mnemonics and can be remapped or set to NULL for increased speed and response time.

As with EtherNet/IP The Profinet LMD is configured using the TCP/IP Configuration utility, but cannot be exercised without an appropriate PLC.

Profinet IO Output Mapping



Profinet IO Input Mapping



Change Parameter Mapping

Each IO register, with the exception of the registers in gray fields, may be remapped to a desired parameter or set to a NULL state based on the parameter data-type.

To change mapping:

1. Select the Register number to be re-mapped. The second dropdown will populate with the available parameters.
2. Select the desired parameter or NULL
3. Click ADD.

Tip: Only set the registers for the parameter's required by the application, set the remaining registers to NULL. This will reduce the time required to cycle the values.

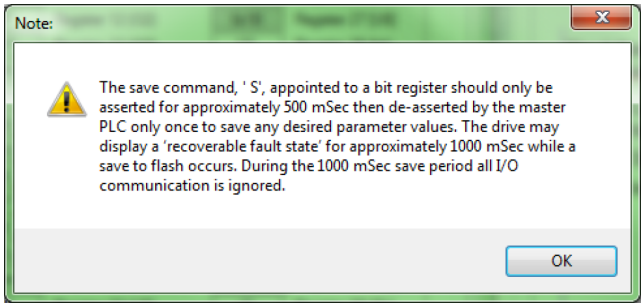
Asserting a SAVE Command (LMD Software Suite version 1.0.1.3 above)

The SAVE (MCode "S") command may be mapped to any single bit register (Output registers 24-26 or 28).

When one of these registers is configured as the save, it is important to note that the save process takes approximately 1000 mS to process, during which time the device will not respond to other IO communications.

When using the option, the register mapped to "Save" should only be asserted for 500mS, then de-asserted by the master PLC.

When mapping the SAVE command to a register the TCP/IP Configuration Utility will launch the following warning dialog:



Upgrading the Application Firmware and Application Code

Application Firmware Upgrade Process

The steps of this process must be completed in sequential order as instructed or the device may become unable to communicate.

- Follow all instructions in this section as stated to ensure proper upgrade.
- Do not update the application firmware unless directed to by IMS Applications support.

Upgrading Ethernet Controller Firmware (Version 2.3.X.X and Lower)

NOTE: In this context the term "Application Firmware" applies ONLY to the Ethernet controller firmware containing the EtherNet/IP, MODBUS/TCP and Profinet application codes. It does not apply to the LMD Firmware. Upgrading the LMD Firmware is accomplished using the Motion Control Interface Software Application.

NOTE: Windows Firewall must be configured to allow inbound and outbound traffic on UDP port 69 in order to perform the upgrade.

See Application Note: Windows Firewall configuration for Ethernet firmware upgrade on the Novanta IMS web site at https://novantaims.com/resources/application-notes/

Preparing for Upgrade

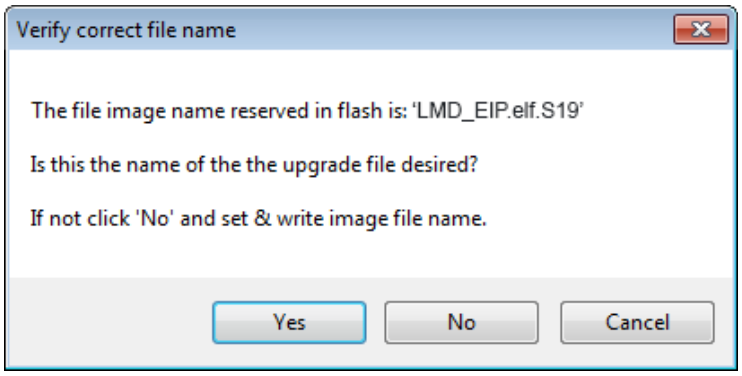
The first step toward performing an upgrade is to ensure the device is connected to TCP port 503, and that the Tftpd server IP and upgrade file location is set and written. Refer to section “Base Configuration of the Device” on page 72.

1. Select the NIC adapter to which the LMD is interfaced
2. Connect to the configured IP address on TCP port 503.
3. Set the Tftpd server IP:
   - Click the button “Get Local IP”
     The IP should match the IP of the connected NIC
4. Click the “Write” button.

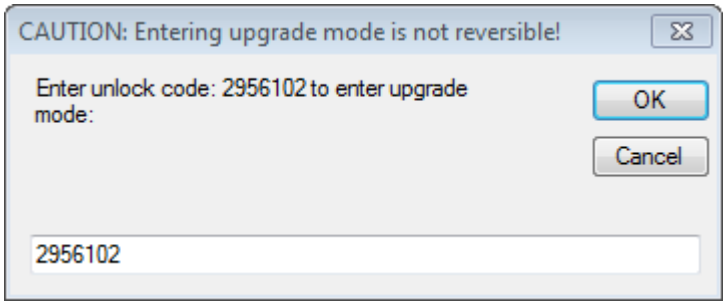
5. In the Ethernet Upgrade File Name container click “Browse & set file name” A file explorer window will be displayed.
6. Select the *.S19 upgrade file.
7. Click the “Write” button
8. Proceed to the Upgrade Process

Upgrade Process

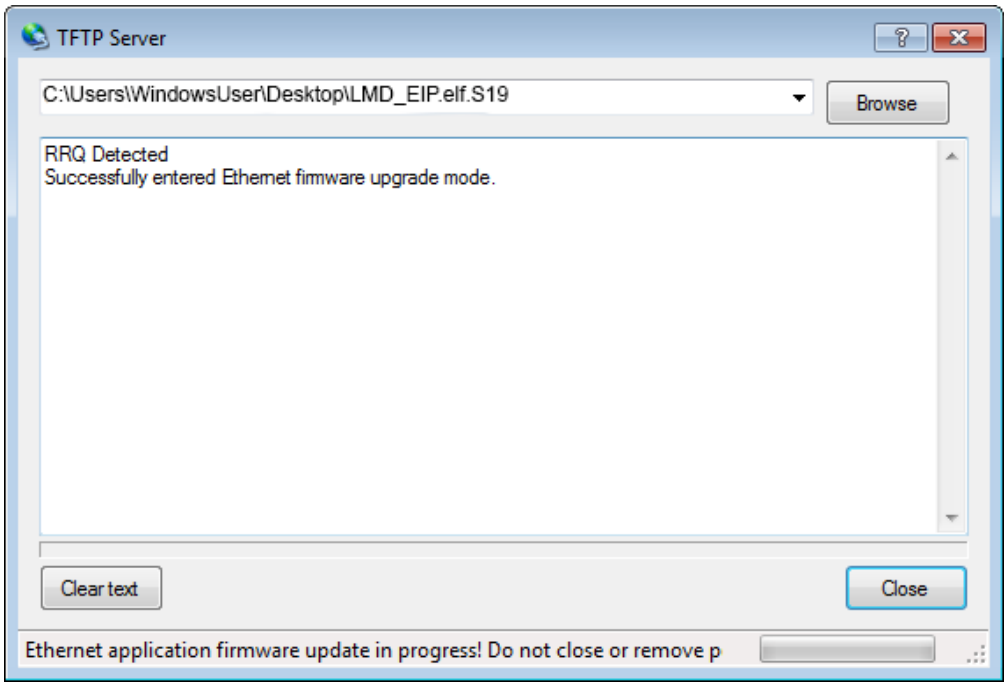
1. On the menu bar, click the “Upgrade!” item.
2. Verify the file name displayed is the desired file.



3. Click “Yes” if valid, click “No” and repeat the last two steps of Section 6.5.1 if not.
4. Enter the Upgrade unlock code requested by the GUI.



5. Click “No” on the select Ethernet Firmware Upgrade file.
6. Cycle power to the LMD as instructed. The software will automatically reconnect on power up and process the upgrade.



7. Once upgrade is complete, close the TFTP Server dialog.
8. Cycle power to the LMD.

NOTE: The Upgrade process will reset the IP address and Subnet Mask to factory default settings. The device must be re-configured to use in a network.

Upgrading Ethernet Controller Firmware (Version 2.4.X.X and Higher)

For version 2.4.X.X and higher, perform the following steps to upgrade the ethernet controller firmware:

1. Establish communication between the device and the Ethernet Interface. (Refer to “Configuring the Base Parameters” on page 76).
   NOTE: If the NIC or IP Address assigned to the device is different from the factory default, enter the current IP address of the device being upgraded.
2. Once connection is established, click Read All on the Config tab of the Base Configuration section. The device information will populate the Config screen.
3. Click on the Upgrade! option in the Menu bar located at the top of the application. A File transfer enable dialog box will be displayed.
4. Enter the unlock code stated in the dialog box into the entry field and click OK.
5. A file explorer window will be displayed on the screen allowing for the firmware upgrade file to be selected. Select the *.srec file for upgrade and click Open.
   NOTE: Current firmware files are available for download from:
   https://novantaims.com/dloads/
6. Once the file is selected, the Ethernet Stack Firmware Upgrade dialog box is displayed.
   IMPORTANT: Do not cycle power or close the application until the upgrade file transfer is complete.
7. Once the file transfer is complete, click Close and cycle power to the device.

8. Re-establish connection to the device The new version of firmware is displayed in the Application Version section of the Ethernet Interface.

Encoder Remap Utility (Closed Loop Models Only)

The LMD must meet several conditions in order to be remapped successfully.

⚠WARNING

UNINTENDED OPERATION

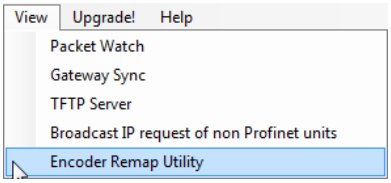
- The unit MUST be uncoupled from any loads, the shaft MUST be free to rotate in both directions.
- Do not remap the encoder unless the function is fully understood.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

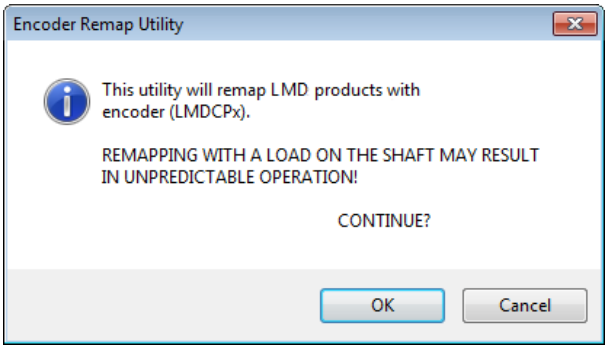
Remap Process

Proper function of the hMT circuitry requires that the precise alignment of the motors rotor and stator be stored in relation to the internal magnetic encoder. This is done at the factory during the manufacturing process and will typically not be required again.

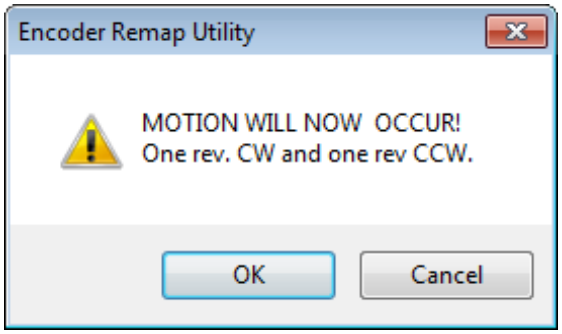
1. Ensure that the motor shaft is uncoupled and able to move freely in both Clockwise and Counterclockwise directions.
2. From the “View” menu, select “Encoder Remap Utility”.



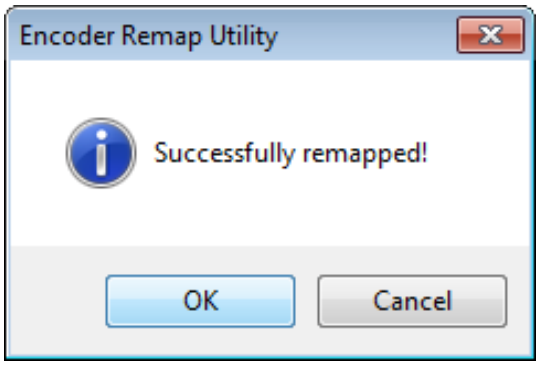
3. If the motor shaft is free to move in both directions, click OK.



4. Once communications is verified, acknowledge the understanding the motion will occur by clicking OK.



5. The motor will turn one revolution clockwise, then one revolution counter-clockwise.
6. The device has been successfully remapped.



Should remap fail, contact the factory.

Chapter 6
CANopen Interface

What's in this Chapter?

This chapter includes the following topics:

The product is unable to detect an interruption of the network link

⚠WARNING

LOSS OF CONTROL

- Verify that connection monitoring is on.
- The shorter the time for monitoring, the faster the detection of the interruption.
- Do not write values to reserved parameters.
- Do not write values to parameters unless the function is fully understood.
- Run initial tests without coupled loads.
- Verify that the system is free and ready for the movement before changing parameters.
- Verify the use of the word sequence with fieldbus communication.
- Do not establish a fieldbus connection unless the communication principals are fully understood.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

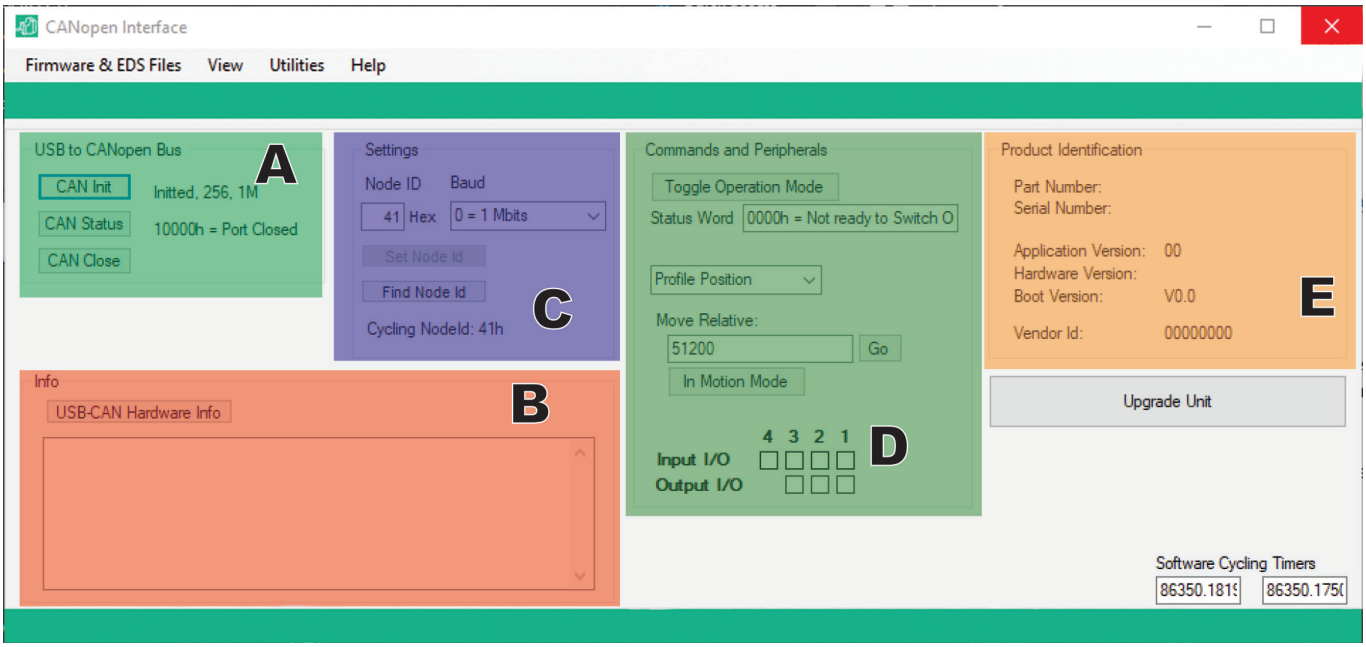
Launching the CANopen Interface

Click on the “Launch CANopen Interface” button on the LSS startup screen to launch the Ethernet Interface.

The CANopen Interface screen will be displayed.

Configuration Screen Overview

The configuration screen will be displayed when the application launches.



The configuration screen is grouped into sections for the various configuration functions.

USB to CANopen Bus (A)

Container used to initialize/monitor status/close the CAN connection to the LMD CANopen.

Info (B)

The info container contains a display text area which will display the data sent to the LMD CANopen.

A button is provided to also read the information on the connected CAN adapter.

Settings (C)

This section used to display/change the BAUD rate and Node ID. The default BAUD is 1 Mbps and the default node ID is 41 hex.

Commands and Peripherals (D)

The controls in this section are used to test functionality of the of the CANopen connection

by allowing the user to page through the states of the CANopen State Machine, Test motion in either Profile Position or Profile Velocity and exercise the I/O points.

Product Identification (E)

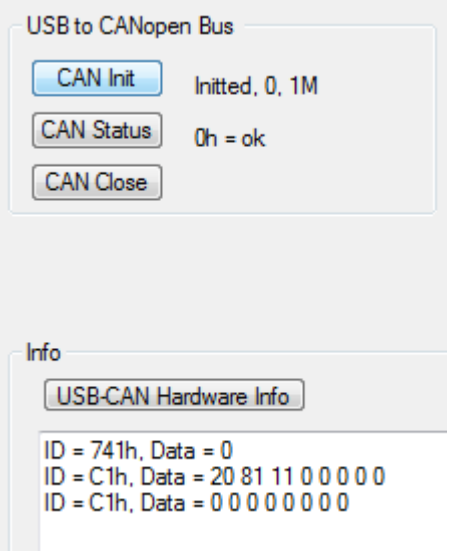
This section contains all the identification information of the product such as Part number, serial number, and version information.

Using the CANopen Configuration Utility

Initialize Communication

1. Connect DC power and the CAN bus connections to the LMD.
2. Open the CANopen Configuration Utility
3. Click the button CAN Init

The USB to CANopen Bus section will display the connection status as shown below. Additionally the LED on the MD-CC501-000 should be blinking rapidly.



Troubleshooting Connection

If the CAN Init fails:

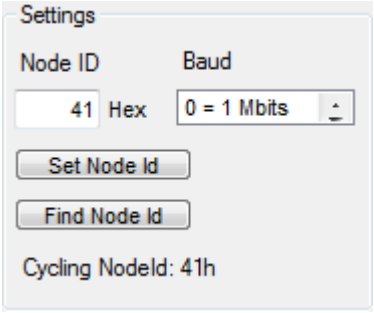
1. Power down the LMD
2. Confirm the CAN cable connections are correct and secure
3. Verify the cable drivers are installed and working. The LED on the MD-CC501-000 should be solid red.
4. Verify BAUD rate and node ID
5. With the CANopen Configuration Utility open, cycle power to the LMD to induce a boot-up message.
6. Click the Find Node Id button in the Settings container.
7. The program will search the node ID and BAUD rate and Init at the correct setting.

Change Node ID/BAUD Rate

The defaults for the LMD are:

- Node ID: 41 hex
- BAUD rate: 1 Mbps

NOTE: When using the CANopen Configuration Utility, changing the Node ID is instantaneously. Changing the BAUD rate requires a power cycle of the LMD.



To change the settings

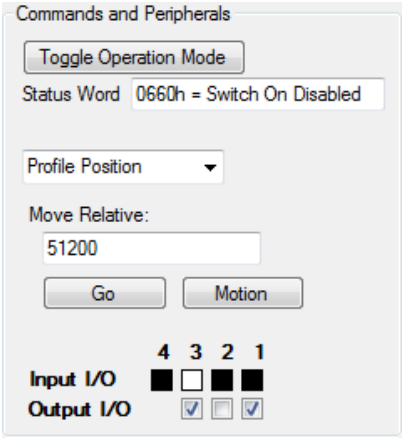
1. Change the default Node ID to the desired ID
2. Change the BAUD rate to the desired setting
3. Click the Set Node Id button
4. Click the CAN Close button to close the connection to the CAN bus.
5. Cycle power to the LMD
6. Click the Find Node Id button

The LMD will be reconnected at the new Node ID/BAUD rate

Perform Functional Testing

The CANopen Configuration Utility provides limited functional testing ability to verify operation. It allows:

- Cycle through the stages of the CANopen state machine
- Exercise motion in DSP402 Profile Position mode
- Exercise motion in DSP402 Profile velocity mode
- Read the state of inputs and write to outputs



Toggle the State Machine

Click the Toggle Operation Mode to cycle through the state machine. When the status word field reads **`0637h - Operation Enabled`** functional testing is ready to be performed.

Move the Motor

1. Select the DSP402 motion profile.

2. Enter a value the field (by default 51200 steps, or one revolution is entered).
3. Click Go

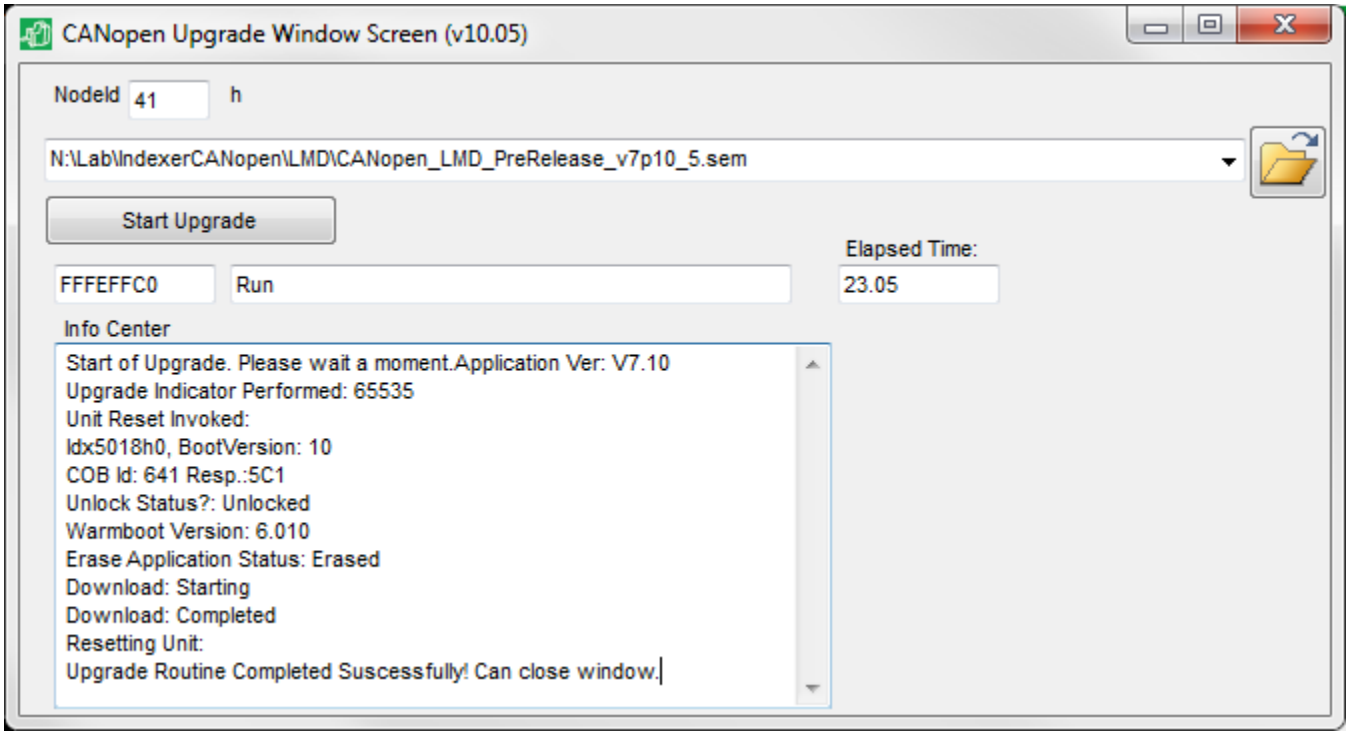
The motor will move, verifying functionality

NOTE: If profile velocity was selected the motor will accelerate to the entered velocity. Motion my be halted by clicking Motion and resumed again by clicking Halt.

Using the I/O

If connected, I/O functionality may be tested. The CANopen Configuration Utility will read the state of inputs and write the state of outputs.

Upgrading Application Firmware



Upgrade Process

1. Download the firmware upgrade zip file from the internet at from https://novantaims.com/dloads/ and extract to the computer desktop.
2. Click the “Upgrade Unit” button. The Upgrade dialog (shown above) will open.

3. Click the  button and browse to the location of the *.SEM firmware file and select it.
4. Click 

The upgrade will process and complete in approximately two minutes.

Encoder Remap Utility (Closed Loop Models only)

The LMD must meet several conditions in order to be remapped successfully.

⚠WARNING

UNINTENDED OPERATION

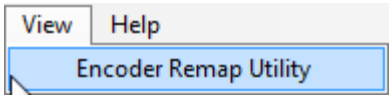
- The unit MUST be uncoupled from any loads, the shaft MUST be free to rotate in both directions
- Do not remap the encoder unless the function is fully understood.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

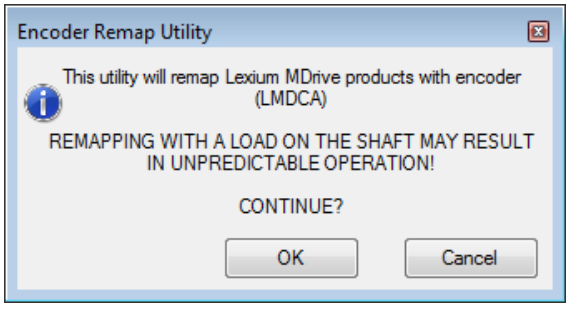
Remap Process

Proper function of the hMT circuitry requires that the precise alignment of the motors rotor and stator be stored in relation to the internal magnetic encoder. This is done at the factory during the manufacturing process and will typically not be required again. In the event a remapping needs to be done, perform the following steps:

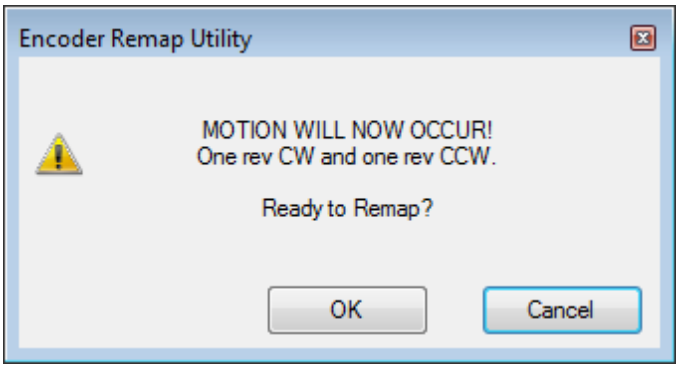
1. Ensure that the motor shaft is uncoupled and able to move freely in both Clockwise and Counterclockwise directions.
2. Open the CANopen Configuration Utility and Init, the CAN bus, toggle operation mode until the Status Word is “Operation Enabled”.
3. From the “View” menu select “Encoder Remap Utility”.



4. If the motor shaft is free to move in both directions, click OK.

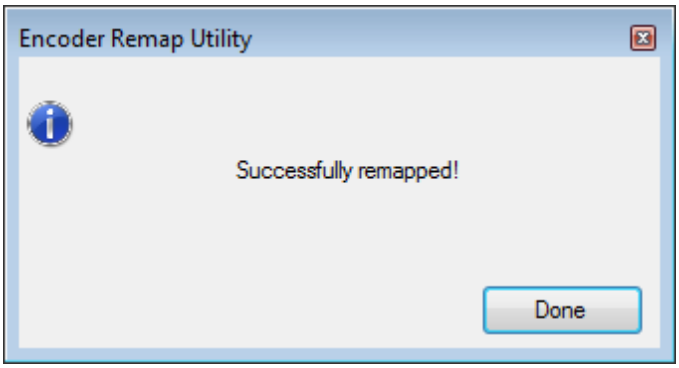


5. The software will verify that the device is communicating. Click OK.



6. Once communications is verified, acknowledge the understanding the motion will occur by clicking OK.

The motor will turn one revolution clockwise, then one revolution counter-clockwise. The device has been successfully remapped.



Should remap fail: contact a Novanta IMS Application Engineer.

Glossary

A

AC: Alternating current

Acceleration: The time rate of change of velocity with respect to a fixed reference frame. The commanded step rate is started at a initial velocity and accelerated at a slew velocity at a defined and controlled rate or rate of changes.

ASCII: American Standard Code for Information Interchange. Standard for coding of characters.

B

Back Electro-Motive Force (Back EMF): Also known as regeneration current, the reversed bias generated by rotation of the magnetic field across a stator's windings. Sometimes referred to as counter EMF.

C

CAN: (Controller Area Network), standardized open fieldbus as per ISO 11898, allows drives and other devices from different manufacturers to communicate.

CANopen: CANopen is a CAN-based higher layer protocol. It was developed as a standardized embedded network with highly flexible configuration capabilities. CANopen was designed motion oriented machine control networks, such as handling systems. It is used in many various fields, such as medical equipment, off-road vehicles, maritime electronics, public transportation, building automation, etc

Closed Loop System: In motion control, this term describes a system wherein a velocity or position (or both) sensor is used to generate signals for comparison to desired parameters. For cases where loads are not predictable, the closed loop feedback from an external encoder to the controller may be used for stall detection, position maintenance or position verification.

D

Daisy Chain: This term is used to describe the linking of several devices in sequence, such that a single signal stream flows through one device and on to another

DC: Direct current

Deadband: A range of input signals for which there is no system response.

Deceleration: The time rate of change of velocity with respect to a fixed reference frame. The commanded step rate is started at the current velocity and decelerated at a slew velocity at a defined and controlled rate or rate of changes.

Default value: Factory setting.

Detent Torque: The periodic torque ripple resulting from the tendency of the magnetic rotor and stator poles to align themselves to positions of minimal reluctance. The measurement is taken with all phases de-energized.

Direction of rotation: Rotation of the motor shaft in a clockwise or counterclockwise direction of rotation. Clockwise rotation is when the motor shaft rotates clockwise while looking at the end of the protruding motor shaft.

DOM: The Date of manufacturing on the nameplate of the device is shown in the format DD.MM.YY,
e.g. 31.12.06 (December 31, 2006).

Duty Cycle: For a repetitive cycle, the ratio of on time to total cycle time.

E

EMC: Electromagnetic compatibility

Encoder: Sensor for detection of the angular position of a rotating component. The motor encoder shows the angular position of the rotor.

Error class: Classification of errors into groups. The different error classes allow for specific responses to faults, e.g. by severity.

F

Fatal error: In the case of fatal error, the drive is not longer able to control the motor, so that an immediate switch-off of the drive is necessary.

Fault: Operating state of the drive caused as a result of a discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.

Fault reset: A function used to restore the drive to an operational state after a detected fault is cleared by removing the cause of the fault so that the fault is no longer active (transition from state “Fault” to state “Operation Enable”).

Forcing: Forcing switching states of inputs/outputs

Full Duplex: The transmission of data in two directions simultaneously. For example, a telephone is a full-duplex device because both parties can talk at the same time.

G

Ground Loop: A ground loop is any part of the DC return path (ground) that has more than one possible path between any two points.

H

Half Duplex: The transmission of data in just one direction at a time. For example, a walkie-talkie is a half-duplex device because only one party can talk at a time.

Half Step: This term means that the motor shaft will move a distance of 0.9 degree (400 steps per shaft revolution) instead of moving 1.8 degree per digital pulse.

Hybrid Motion Technology™ (hMT): A motor control technology representing a new paradigm in brushless motor control. By bridging the gap between stepper and servo performance, hMT offers system integrators a third choice in motion system design.

Hybrid Motors: Hybrid stepper motors feature the best characteristics of PM and VR motors. Hybrid steppers are best suited for industrial applications because of high static and run torque, a standard low step angle of 1.8°, and the ability to Microstep. Hybrid stepper motors offer the ability to precisely position a load without using a closed-loop feedback device such as an encoder.

Holding Torque: The maximum torque or force that can be externally applied to a stopped, energized motor without causing the rotor to rotate continuously. This is also called “static torque”.

I

I/O: Inputs/outputs

Inc: Increments

Index pulse: Signal of an encoder to reference the rotor position in the motor. The encoder returns one index pulse per revolution.

Inertia: A measure of an object’s resistance to a change in velocity. The larger an object’s inertia, the greater the torque required to accelerate or decelerate it. Inertia is a function of an object’s mass and shape. For the most efficient operation, the system-coupling ratio should be selected so that the reflected inertia of the load is equal to or no greater than 10 times the rotor inertia of the stepper motor.

Inertia (Reflected): Inertia as seen by the stepper motor when driving through a speed change, reducer or gear train.

L

Lag: The amount (in microsteps) that the rotor lags the stator. Lag conditions are caused by loading on the motor shaft, as during transient loading or rapid acceleration.

Lead: The amount (in microsteps) that the rotor leads the stator. Lead conditions are caused by an overhauling load, as during periods of rapid deceleration.

Limit switch: Switch that signals overtravel of the permissible range of travel.

Load: Any external resistance (static or dynamic) to motion that is applied to the motor.

Locked rotor: When the lag/lead limit is reached, a timer starts a countdown that is determined by the user. The locked rotor will assert itself by triggering a flag and, depending on the selected mode, by disabling the output bridge.

Loss of synchronization: In traditional stepper systems, when the lead/lag relationship of the rotor and stator reaches two full motor steps, the alignment of the magnetic fields is broken and the motor will stall in a freewheeling state. Hybrid Motion Technology eliminates this.

M

Microstepping: A control electronic technique that proportions the current in a stepper motor's windings to provide additional intermediate positions between poles. Produces smooth rotation over a wide range and high positional resolution. Typically, step resolutions range from 400 to 51,200 steps per shaft revolution.

Motor phase current: The available torque of a stepper motor is determined by the motor phase current. The higher the motor phase current the higher the torque.

Multidrop: A communications configuration in which several devices share the same transmission line, although generally only one may transmit at a time. This configuration usually uses some kind of polling mechanism to address each connected device with a unique address code.

N

NEMA: The acronym for the National Electrical Manufacturer's Association, an organization that sets standards for motors and other industrial electrical equipment.

Node guarding: Monitoring of the connection with the slave at an interface for cyclic data traffic.

O

Open Loop System: An open loop motion control system is where no external sensors are used to provide position or velocity feedback signals, such as encoder feedback of position.

Opto-Isolated: A method of sending a signal from one piece of equipment to another without the usual requirement of common ground potentials. The signal is transmitted optically with a light source (usually a Light Emitting Diode) and a light sensor (usually a photo-sensitive transistor). These optical components provide electrical isolation.

P

Parameter: Device data and values that can be set by the user.

Persistent: Indicates whether the value of the parameter remains in the memory after the device is switched off.

PLC: Programmable logic controller

Position lead/lag: The HMT circuitry continually tracks the position lead or lag error, and may use it to correct position.

Position make-up: When active, the position make-up can correct for position errors occurring due to transient loads. The lost steps may be interleaved with incoming steps, or reinserted into the profile at the end of a move.

Power stage: The power stage controls the motor. The power stage generates currents for controlling the motor on the basis of the positioning signals from the controller.

Pull-In Torque: This is the maximum torque the stepper motor can develop when instantaneously started at that speed.

Pull-Out Torque: This is the maximum torque that the stepper can develop once an acceleration profile has been used to “ramp” it to the target speed.

Q

Quick Stop: Function used to enable fast deceleration of the motor via a command or in the event of a malfunction.

R

Resolution: The smallest positioning increment that can be achieved.

Resonance: The frequency that a stepper motor system may begin to oscillate. Primary resonance frequency occurs at about one revolution per second. This oscillation will cause a loss of effective torque and may result in loss of synchronism. The designer should consider reducing or shifting the resonance frequency by utilizing micro-step techniques or work outside the primary resonance frequency.

Rotor: The moving part of the motor, consisting of the shaft and the magnets. These magnets are similar to the field winding of a brush type DC motor

Rotor Inertia: The rotational inertia of the rotor and shaft.

RS485: Programming and configuration utilities as per EIA-485 which enables serial data transmission with multiple devices.

S

Sinking Current: Refers to the current flowing into the output of the chip. This means that a device connected between the positive supply and the chip output will be switched on when the output is low.

Slew: The position of a move profile where the motor is operating at a constant velocity

Sourcing Current: Refers to the current flowing out of the output of the chip. This means that a device connected between the chip output and the negative supply will be switched on when the output is high.

SSM: Shaft Snap Minimization, a calibration technique to reduce the “clunk” that is characteristic of step motors when powered.

Stall detection: Stall detection monitors whether the index pulse is always correctly triggered at the same angle position of the motor shaft.

Stator: The stationary part of the motor. Specifically, it is the iron core with the wire winding in it that is pressed into the shell of the frame. The winding pattern determines the voltage constant of the motor.

T

Torque ramp: Deceleration of the motor with the maximum possible deceleration, which is only limited by the maximum permissible current. The higher the permissible braking current, the stronger the deceleration. Because energy is recovered up depending on the coupled load, the voltage may increase to excessively high values. In this case the maximum permissible current must be reduced.

V

Variable current control: When active, variable current control will control the motor current as such to maintain the torque and speed on the load to what is required by the profile. This leads to reduced motor heating and greater system efficiency.

W

Warning: If not used within the context of safety instructions, a warning alerts to a potential problem detected by a monitoring function. A warning is not a fault and does not cause a transition of the operating state. Warnings belong to error class 0.

Watchdog: Unit that monitors cyclic basic functions in the product. Power stage and outputs are switched off in the event of faults.

Z

Zero crossing: The point in a stepper motor where one phase is at 100% current and the other is at 0% current.

Warranty

For the latest warranty and product information, visit https://novantaims.com/warranty-and-disclaimer/.

Document Revision History

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Date	**Revision**	**Changes**
02/20/2013	V1.00, 02.2013	Document Creation
08/15/2013	V1.00, 08.2013	Added support for Lexium MDrive TCP/IP and CANopen products
03/03/2014	V1.00, 03.2014	Added support for Encoder Remap Utility
04/29/2014	V1.00, 04.2014	Added support for LMD Software Suite 1.0.0.9, including Lexium MDrive Profinet.
08/14/2014	V1.00, 08.2014	Minor corrections and updates throughout.
02/04/2015	V1.00. 02.2015	Updated to reflect LMD Software Suite 1.0.1.1 release.
05/15/2015	V1.00. 05.2015	Updated to reflect LMD Software Suite 1.0.1.3 release.
05/18/2020	Rev H	Updated overall format, document name, added CyberSecurity feature to the Ethernet application
04/08/2021	Rev I	Update Web Directory, update hyperlinks throughout, add note regarding Echo Mode default for Ethernet and Profinet mode.
03/015/2022	Rev J	Rebrand to Novanta

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