Inspiring Motion
Since 1988

Mini Etude
User Guide

August 2015 (Ver. 1.001)

www.elmomc.com

Elmo
Motion Control

Notice

This guide is delivered subject to the following conditions and restrictions:

- This guide contains proprietary information belonging to Elmo Motion Control Ltd. Such information is supplied solely for the purpose of assisting users of Elmo's servo drive(s) in their installation.
- The text and graphics included in this manual are for the purpose of illustration and reference only. The specifications on which they are based are subject to change without notice.
- Elmo Motion Control and the Elmo Motion Control logo are trademarks of Elmo Motion Control Ltd.
- Information in this document is subject to change without notice.

Elmo Motion Control and the Elmo Motion Control logo are registered trademarks of Elmo Motion Control Ltd.

EtherCAT Conformance Tested. EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

CANopen compliant. CANopen® is a registered trademark and patented technology, licensed by CAN in Automation (CiA) GmbH, Kontumazgarten 3, DE-90429 Nuremberg, Germany.

Document no. MAN-METUDE-UG (Ver. 1.001)

Catalog Number

Part Number
MINIETUDE-DEMOCASE

Note: There is also a CAN communication version available (consult factory).

Revision History

Version	Details
1.000	Initial release
1.001	Updated release

Chapter 1: Safety Information

In order to achieve the optimum, safe operation of the Mini Etude, it is imperative that you implement the safety procedures included in this user guide. This information is provided to protect you and to keep your work area safe when operating the Mini Etude and accompanying equipment.

Before you start, ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

Only qualified personnel may install, adjust, maintain and repair the Mini Etude. A qualified person has the knowledge and authorization to perform tasks such as transporting, assembling, installing, commissioning and operating motors.

The Mini Etude contains electrostatic-sensitive components that can be damaged if handled incorrectly. To prevent any electrostatic damage, avoid contact with highly insulating materials, such as plastic film and synthetic fabrics. Place the product on a conductive surface and ground yourself in order to discharge any possible static electricity build-up.

To avoid any potential hazards that may cause severe personal injury or damage to the product during operation, keep all covers and cabinet doors closed.

The following safety symbols are used in this manual:

Warning:
This information is needed to avoid a safety hazard, which might cause bodily injury.

Caution:
This information is necessary for preventing damage to the product or to other equipment.

1.1. Warnings

- To avoid electric arcing and hazards to personnel and electrical contacts, never connect/disconnect the Mini Etude while the power source is on.
- Power cables can carry a high voltage, even when the Mini Etude is not in motion. Disconnect the Mini Etude from all voltage sources before it is opened for servicing.
- The Mini Etude contains grounding conduits for electric current protection. Any disruption to these conduits may cause the instrument to become hot (live) and dangerous.
- After shutting off the power and removing the power source from your equipment, wait at least 1 minute before touching or disconnecting parts of the equipment that are normally loaded with electrical charges (such as capacitors or contacts). Measuring the electrical contact points with a meter, before touching the equipment, is recommended.

1.2. Cautions

- The Mini Etude contains electrical components during operation.
- The maximum DC power supply connected to the instrument must comply with the parameters outlined in this guide.
- When connecting the Mini Etude to an approved isolated 100–240 VAC auxiliary power supply, connect it through a line that is separated from hazardous live voltages using reinforced or double insulation in accordance with approved safety standards.
- Before switching on the Mini Etude, verify that all safety precautions have been observed and that the installation procedures in this manual have been followed.
- Do not clean any of the Mini Etude drive's soldering with solvent cleaning fluids of pH greater than 7 (8 to 14). The solvent corrodes the plastic cover causing cracks and eventual damage to the drive's PCBs.

  Elmo recommends using the cleaning fluid Vigon-EFM which is pH Neutral (7).

  For further technical information on this recommended cleaning fluid, select the link:

  http://www.zestron.com/fileadmin/zestron.com-usa/daten/electronics/Product_TI1s/TI1-VIGON_EFM-US.pdf

1.3. Warranty Information

The products covered in this manual are warranted to be free of defects in material and workmanship and conform to the specifications stated either within this document or in the product catalog description. All Elmo drives are warranted for a period of 12 months from the time of installation, or 18 months from time of shipment, whichever comes first. No other warranties, expressed or implied — and including a warranty of merchantability and fitness for a particular purpose — extend beyond this warranty.

Chapter 2: Introduction

This user guide describes the Mini Etude and contains all essential information for the user to make full use of the product. This manual includes a description of the Mini Etude functions and capabilities, modes of operations, and step-by-step procedures for its use.

2.1 Product Description

The Mini Etude is a standalone mobile testing station that can run up to three AC servo motors simultaneously.

Each motor is controlled by Elmo's Gold DC Whistle, a compact digital servo drive. The Mini Etude has up to three Gold DC Whistles, all controlled by a single GMAS Controller.

2.2 Gold DC Whistle Digital Servo Drive

The Gold DC Whistle is an advanced high power density servo drive. It provides top servo performance, advanced networking and built-in safety, all in a compact package. The Gold DC Whistle has a fully featured motion controller and local intelligence.

The Gold DC Whistle operates from a DC power source. The drive can operate as a standalone device or as part of a multi-axis system in a distributed configuration on a real-time network.

The Gold DC Whistle drive is easily set up and tuned using Elmo Application Studio (EAS) software tools. As part of the Gold product line, it is fully programmable with the Elmo motion control language. For more about software tools, refer to the Elmo Application Studio Software Manual

The Gold DC Whistle can also operate with a 24 VDC auxiliary power supply as a back-up power supply.

Feature	Units	1/100	2.5/100	5/100	10/100	15/100	20/100
Minimum supply voltage	VDC	12					
Nominal supply voltage	VDC	85					
Maximum supply voltage	VDC	95					
Maximum continuous power output	W	80	200	400	800	1200	1600
Efficiency at rated power (at nominal conditions)	%	> 99					
Maximum output voltage		> 95% of DC bus voltage at f = 22 kHz					
Auxiliary power supply	VDC	12 – 95 VDC (up to 6 VA inc. 5 V/2 x 200 mA for encoder)					
Amplitude sinusoidal/DC continuous current	A	1.0	2.5	5	10	15	20
Sinusoidal continuous RMS current limit (Ic)	A	0.7	1.8	3.5	7	10.6	14.1
Peak current limit	A	2 x Ic					
Weight	g (oz)	267 (9.42 oz)					
Dimensions	mm (in)	115 x 75 x 25.8 mm (4.5" x 3.0" x 1")					
Digital in		6					
Digital out		4					
Analog in		1					
Mounting method		Wall Mount / Book Shelf					

2.3 The Gold Maestro Multi-axis Controller

Elmo's multi-axis controller, the Gold Maestro, connects to all the Gold DC Whistle servo drives via EtherCAT communications.

The Gold Maestro is a distributed multi-axis network controller that controls up to 100 axes with a high level of synchronization and accuracy.

The main features of the Gold Maestro appear below:

- Communications:
  - EtherCAT real-time device networking (CoE)
  - CANopen DS-301, DS-305, DS-401(I/O device profile), DS-402 (Drives and motion control device profile)
- Fast and efficient program execution with a large amount of memory:
  - Native application 'C' programming on the target
  - IEC 61131-3, PLCopen
- PLCopen motion API
- Isolated communications:
  - Ethernet/EtherCAT
  - CAN bus
- Large variety of host communication protocols:
  - Ethernet, TCP/IP, UDP (fast binary protocols, Modbus, Ethernet/IP, Telnet, FTP, HTTP)
  - USB 2.0
- Real-time extension for the Linux operating system
- Application templates for common applications
- Mounting options:
  - Panel mount
  - Board mount
  - Embedded core (soldering)
- DC powered: 12 V to 196 V

2.4 System Architecture

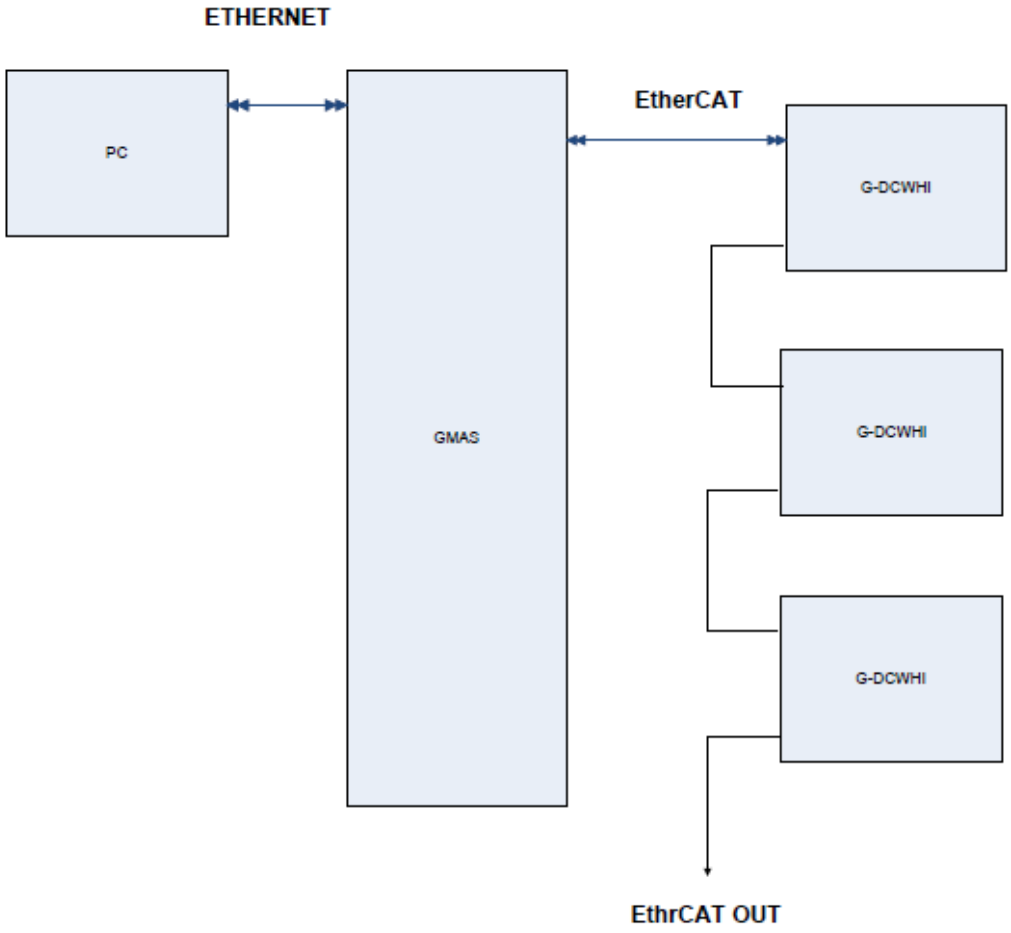


Figure 1: Mini Etude System Block Diagram

2.5 How to Use this Guide

In order to operate your Elmo Mini Etude, safety and operation instructions are available in this documentation. After carefully reading the safety instructions in the first chapter, the following chapters provide you with operation instructions.

Upon completing the instructions in this guide, you should be able to use Elmo's Mini Etude

.

Chapter 3: The Mini Etude System Main Parts

The Mini Etude kit is comprised of the following products:

Quantity	Description
3	Gold DC Whistle Elmo Part Number: G-DCWHI2.5/100EE
1	Gold Maestro Elmo Part Number: GOLD-MAESTRO01
3	AC Servo Motors 30 W Komotek P/N KANZ-A3BF5N2
1	Power Supply: 100 VAC~240 VAC to 24 VDC MEAN WELL P/N MDR-20-24
1	Power Supply: 100 VAC~240 VAC to 48 VDC MEAN WELL P/N MDR-60-48
1	Control Panel
18	Cables
2	Gantry cables P/N CBL-GDCWHIGANTC-B

Figure 2: Gold Maestro

Figure 3: 30 W AC Servo Motor

Figure 4: 48 VDC Power Supply

Figure 5: Gold DC Whistle 2.5/100

3.1 Unpacking the Drive Components

Before you begin working with the Mini Etude, verify that you have all the items listed in the Bill of Materials (BOM):

Quantity	Item Number	Item Description
1	APMINIETUDE	ATP Mini Etude Democase
1	TOO-HE0001	Allen Key 3 mm Round Head
1	TOO-SUITCASE2	Suitcase Plastic Mini Etude + Drilling + Pocket
2	P/N CBL-GDCWHIGANTC-B	Gantry Cables
1	CBL-POWCORD	CABLE ISRAEL POWER CORD 3X1.5MM 1.8M

The Mini Etude is shipped in a cardboard box with Styrofoam protection.

To unpack the Mini Etude:

1. Carefully remove the Mini Etude from the box and the Styrofoam.
2. Check the Mini Etude to ensure that there is no visible damage to the device. If any damage has occurred, report it immediately to the carrier that delivered your drive.
3. To ensure that the Mini Etude you have unpacked is the appropriate type for your requirements, locate the part number sticker on the side of the Mini Etude. It looks like this:

MINIETUDE001A

4. Verify that the Mini Etude is the one that you ordered.

3.2 Cable Catalog Numbers

The catalog numbers of the cables are listed in the following table:

Elmo P/N	Cable Quantity
CBL-GMAS01	1
CBL-COM110E	2
CBL-RUNNER01-M	3
CBL-GSTOMINIETUDE	3
CBL-IOMINIETUDE	1
CBL-POWCORD	1
CBL-POWIOINT	1

3.3 Preparations

Before powering-up the Mini Etude, do the following:

1. Ensure that all the switches on the control panel are off.
2. Connect the power cord to the input power inlet.
3. Connect the power cord to the mains (230 VAC/110 VAC).
4. Check that the STO switches are in the “off” position.
5. Make sure that the motor cover is closed.

3.4 Powering Up

After the Mini Etude suitcase is connected to the AC outlet via its cable, it is ready to be powered up.

Caution: Before applying power, ensure that the AC supply is within the specified range.

3.5 Initializing the System

After the Mini Etude has been connected, the system must be set up and initialized. This is accomplished using the Elmo Application Studio (EAS), Elmo’s Windows-based software application. Install the application and then perform setup and initialization according to the directions in the *EAS Software Manual*.

Note: If you do not have the Elmo Application Studio (EAS) installed in your computer, you can download the application from Elmo’s website.

Chapter 4: Operating Instructions

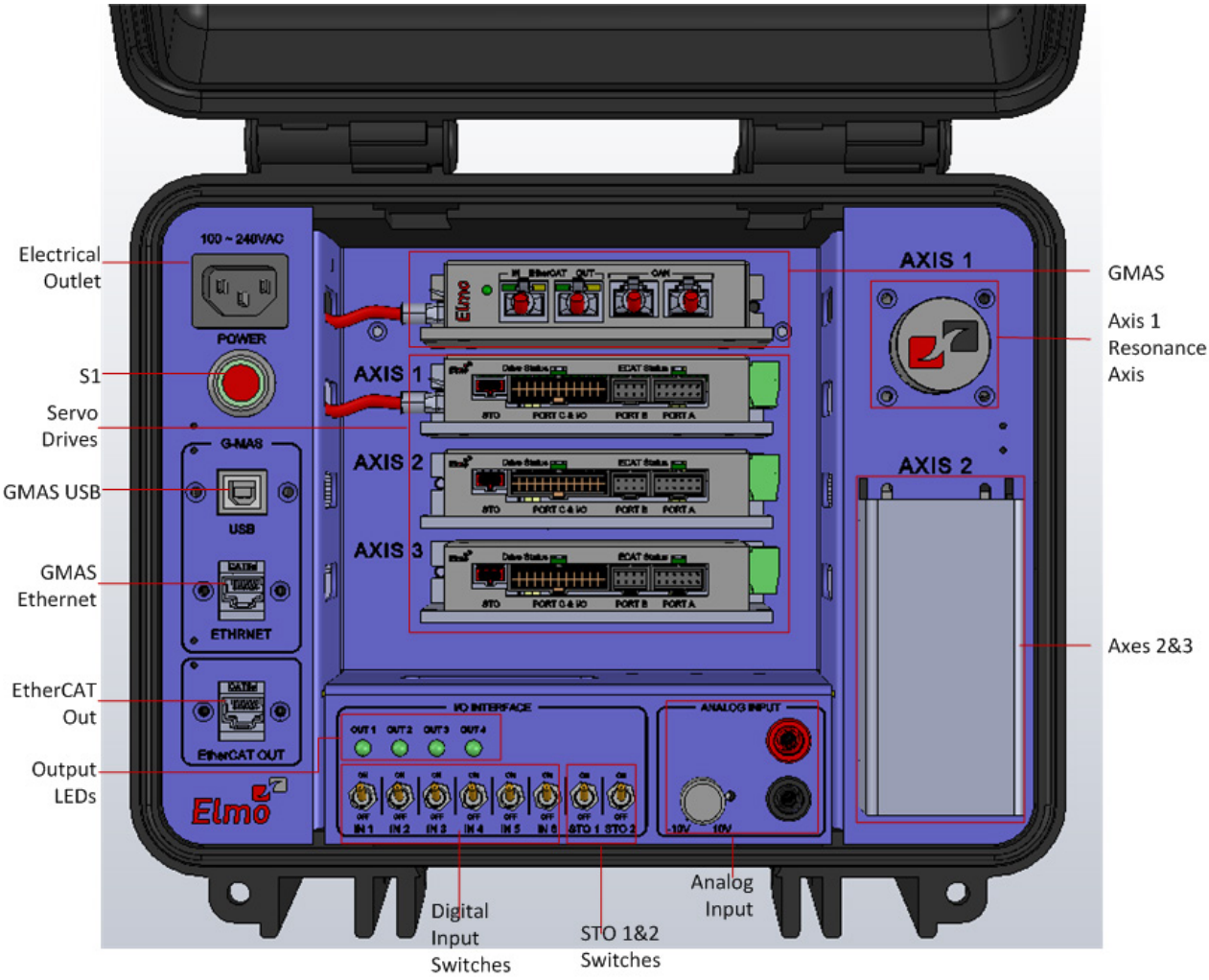


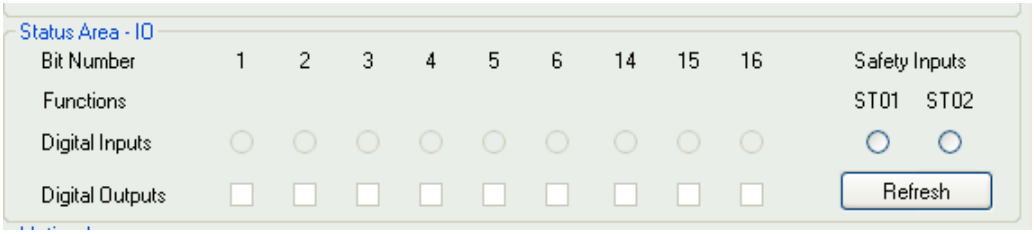
Figure 6: Mini Etude Control Panel

4.1 The Mini Etude Components

The Mini Etude suitcase consists of the following components:

- Power supply outlet – connect the AC supply cable here
- S1 main switch – Press the button to switch the Mini Etude On/Off
- GMAS ports – supports up to 100 axes
  - GMAS USB port
  - GMAS Ethernet port
- GMAS Controller – the Gold Maestro controller
- Servo drives – 3x G-DCWHI2.5/100EE
- EtherCAT OUT port

- Axes
  - Axis 1 – the resonance axis that gives or shows the pressure of the axis
  - Axes 2 and 3 – axes with different parameters, the axis button is concealed under a cover.
- I/O Interface
  - OUT 1, OUT 2, OUT 3, OUT 4 LEDs – Digital output LEDs, the LED is green when the respective digital output interface is On
  - IN 1, IN 2, IN 3, IN 4, IN 5, IN 6 – Digital input switches that you can turn on/off manually. You can view whether the digital input is active/inactive through the EAS (Drive Setup and Motion > Expert Tools > Motion > Status Area –I/O).

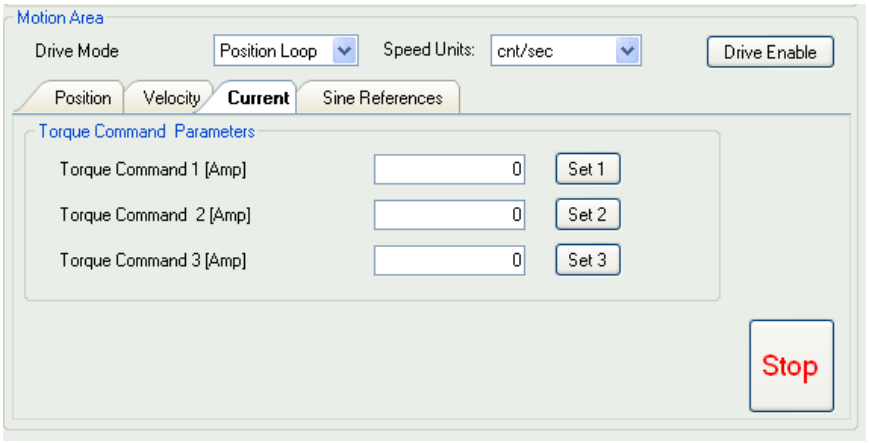


The Digital Input LED representation turns green on the EAS when the related digital switch input is On.

  - STO 1 and STO 2 switches – STO 1/STO 2 is On if the EtherCAT status LED in the Gold DC Whistle servo drive is green; it is Off if the EtherCAT status LED in the Gold DC Whistle servo drive is red. In EAS, the Safety Inputs radio button is marked when the STO is On and not marked when STO 1/STO 2 is Off.
- Analog Input

Analog Input is a function that gives the user the opportunity to convert DC volts from analog to digital with a special power supply that produces artificial DC volts from -10 V to 10 V or vice versa (artificial voltage to test the inputs). The user can connect the Mini Etude to a voltmeter to view the linearity of the voltage (see image below) and the user can compare the linearity of the DC input voltage from the EAS.

The user can view the linearity of the voltage under the **Current** tab (**Drive Setup and Motion > Expert Tools > Motion > Motion Area > Current** tab) in the EAS.



To connect the voltmeter to the Analog Input:

1. Switch off the Mini Etude.
2. Switch off the voltmeter.
3. Insert the red probe (positive probe) to the voltmeter analog input (red) on one end and insert the other end of the red probe to the Mini Etude monitor terminal analog input.
4. Insert the black probe (negative probe) to the voltmeter analog input (black) on one end and insert the other end of the black probe to the Mini Etude monitor terminal analog input.
5. Switch on the Mini Etude.
6. Switch on the voltmeter.
7. To monitor the voltage of the analog input command, turn/rotate the potentiometer.

4.2 Operating the Mini Etude

To operate the Mini Etude:

1. Press the S1 switch to turn the Mini Etude on.

   The system is now powered by the auxiliary voltage.

2. Check that the red LEDs on the Gold DC Whistle servo drives are on.

3. Check that the Gold DC Whistle servo drive's Drive Status LED is green and that it is On.

   The Mini Etude is ready for use.

4.2.1 Checking Connections

Ensure that the Gold Maestro Controller is connected to the computer as follows:

1. Open your laptop.

2. Connect the laptop's power cable to the AC power outlet.

3. Connect the network cable to the RJ-45 (Ethernet) connector.

   The diagram below shows how the PC, Gold Maestro and Gold DC Whistle are connected.

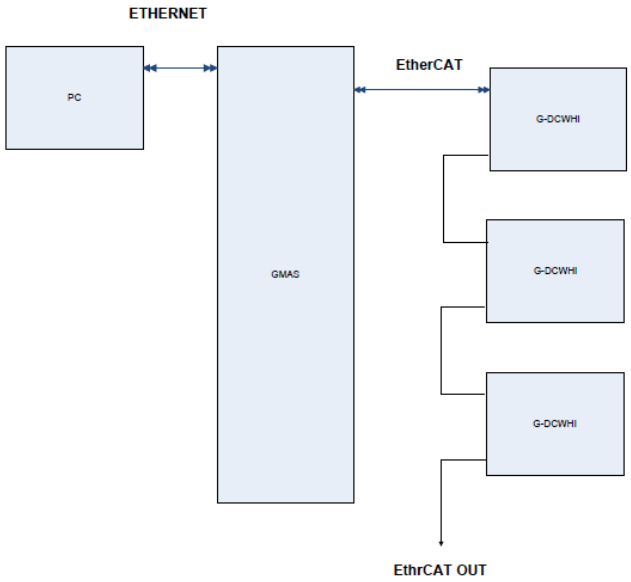


Figure 7: Mini Etude System Block Diagram

4.3 Getting Started

1. Connect to the GMAS Controller by connecting between the GMAS USB Port in the Mini Etude suitcase and a computer with the EAS installed in it.

Notes:

- If you do not have a computer with the EAS application installed in it, download the EAS application from the Elmo website.
- When installing EAS, the application automatically place the drivers in the *C:\Windows* directory. If you are prompted by the application for any driver at any stage of the installation or configuration, just direct it to the *C:\Windows* directory.

2. Download the firmware to the Gold Maestro. For more details, refer to Chapter 5: Configurations.
3. Set and download the Gold Maestro resource file via the EASII (Elmo Application Studio) according to the requirements (e.g., number of axes, baud rate, etc.). For more details, refer to Chapter 5: Configurations.
4. Set the required baud rate for the drivers via the EAS while using the Gold Maestro Controller as a gateway. The default baud rate is 500 Mbps.
5. To run the GMAS program, connect via Telnet to the GMAS IP 192.168.1.3 and set User=User, Password=User.

4.4 Mini Etude Connection Diagrams

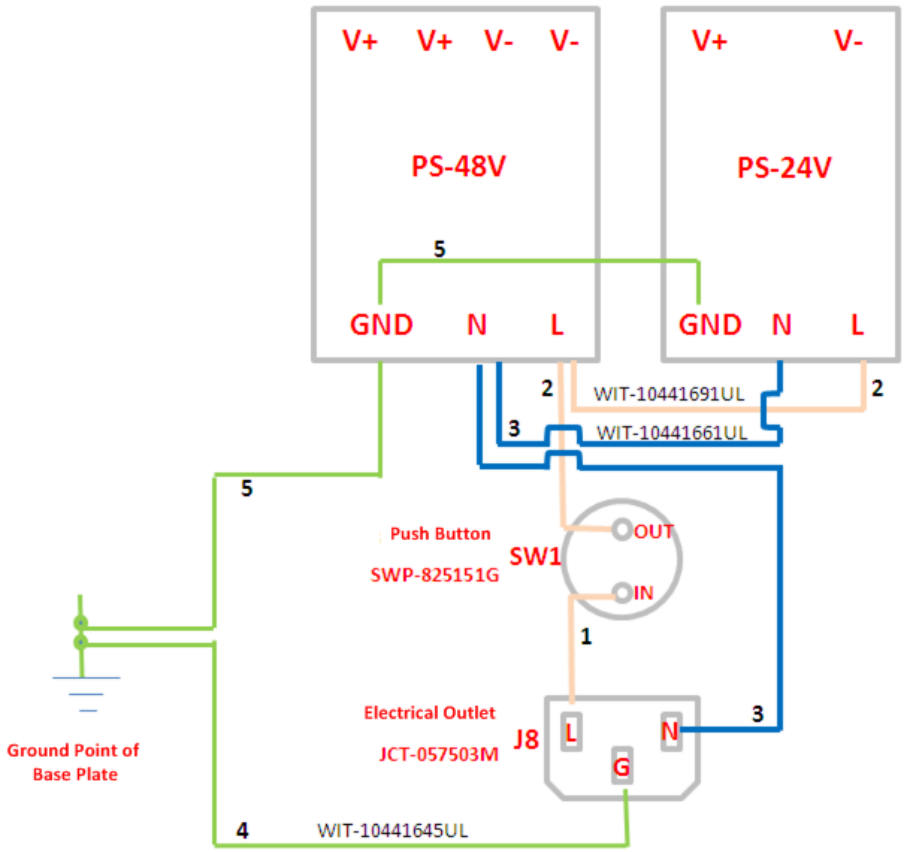


Figure 8: Mini Etude Electrical Diagram

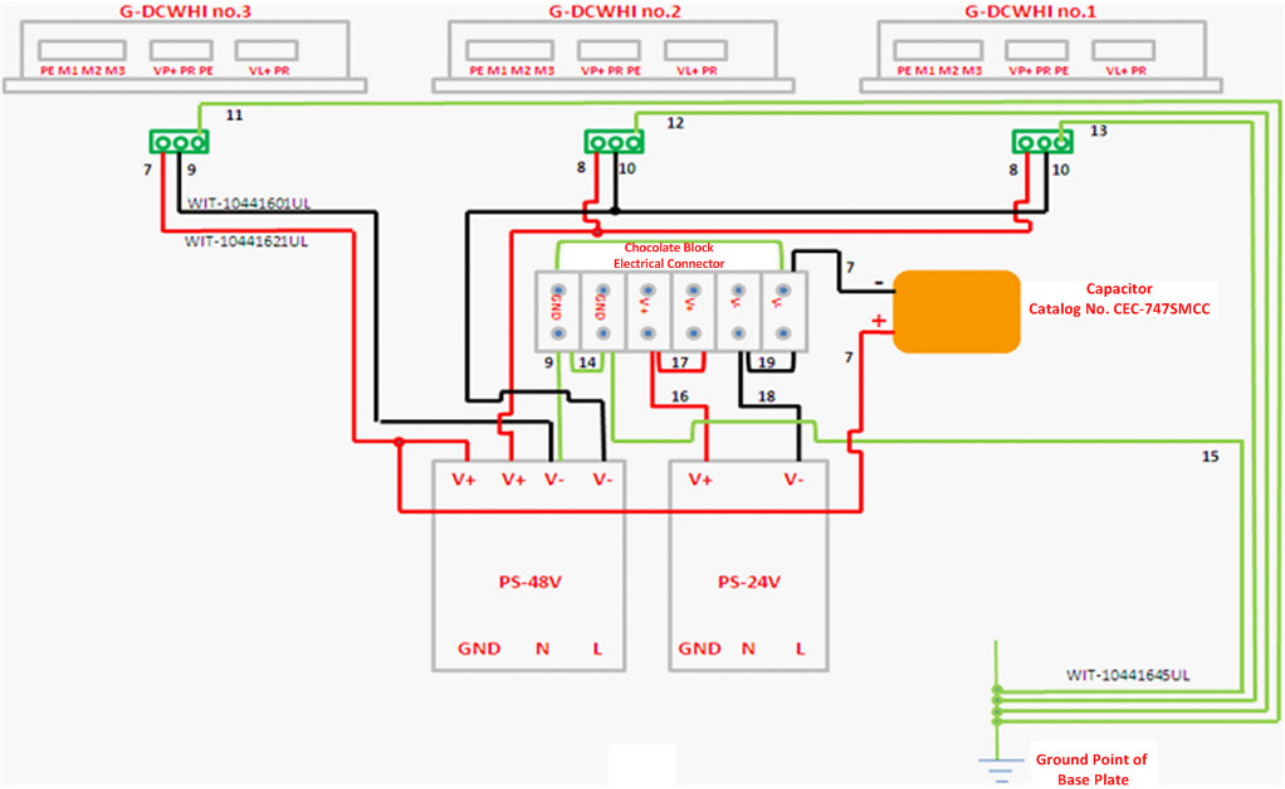


Figure 9: Mini Etude Connection Diagram

4.5 Turning the Mini Etude Off

Press the S1 red button to turn the Mini Etude off; the green light will turn off slowly and the three Gold DC Whistle servo drive motors will come to a stop.

Warning:
When a dangerous or unexpected situation occurs such as overheating, any type of malfunction or when smoke is visible, immediately press the **Emergency Stop** button.
The user is recommended to have the **Emergency Stop** button nearby.

Chapter 5: Configurations

5.1 G-MAS USB Connection

This section describes how to communicate with the G-MAS when connected via a USB connection from a host system to allow the GMAS ports to be configured and operate via the LAN. This connection imitates a COM port connection at a COM Port. Therefore, if an RS-232 Terminal connection is opened at the host system, *udev* execution opens a terminal from which it is possible to perform the following basic operations.

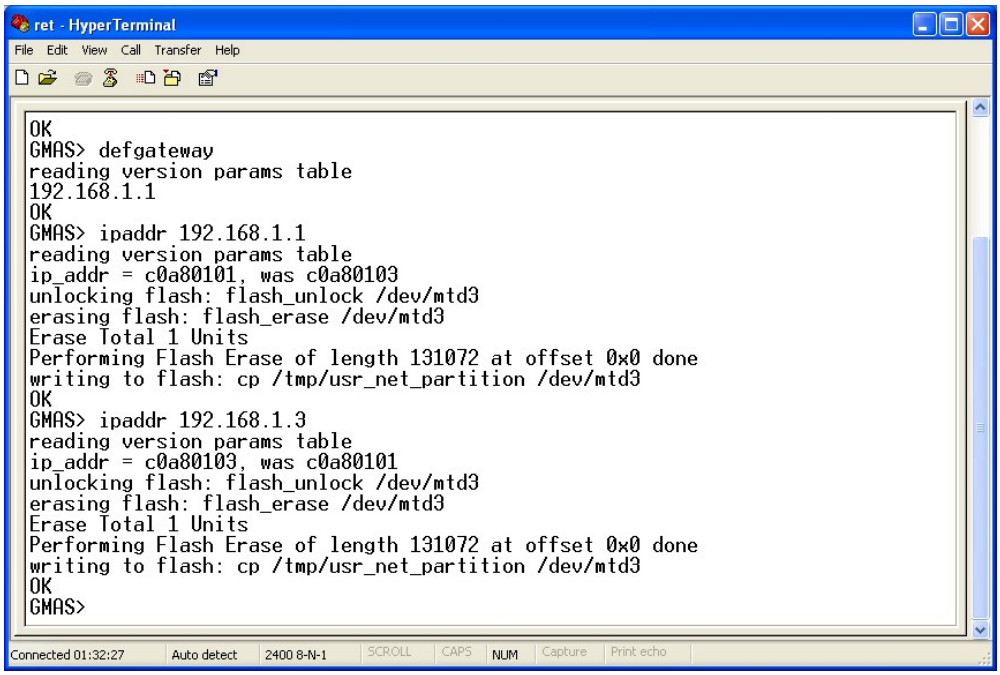
- Change / Read IP Address.
- Change / Read Gateway.
- Change / Read Subnet mask.
- Change / Read Server IP.
- Change / Read download version path.
- Change / Read DHCP

5.1.1 Connection Procedure

The following procedure describes how to connect the host system to the G-MAS via USB connection and configure the communication parameters of the G-MAS.

1. Make sure that the G-MAS is powered on.
2. Connect the USB connection from the host system to the G-MAS. The G-MAS should emit a sound signifying that a connection is made.
3. Open the Device Manager and locate the Ports section in the hierarchal structure. Verify which COM port is defined for the Elmo GMAS.
4. At the host computer, open a communications Terminal to a COM port.

The prompt should display *GMAS>*.



5. At the prompt, enter any command detailed in sections **5.1.1.2** - **5.1.1.5** to perform the appropriate operation at the G-MAS.
   For example; to request the IP address enter *ipaddr*.
   The G-MAS IP address is returned.

Note: **By default, the G-MAS IP address is set to 192.168.1.3. However, the customer may prefer to integrate the G-MAS with his network system and therefore may wish to change the default value. Use this procedure to perform this action.**

5.1.2 dhcp – Static / Dynamic IP

Purpose	1. Set DHCP mode. 2. Request display DHCP mode.			
Syntax	dhcp			
Parameters	None or integer			
Attributes	**Type**	**Source**	**Default values**	**Range**
	Parameter, integer	Interpreter	N/A	0 – Static IP 1 – Dynamic IP
Examples				
	Input	**Output**		
	dhcp	*Static IP*		
	dhcp1	*OK*		

Purpose	1. Set DHCP mode. 2. Request display DHCP mode.	
	dhcp	*Dynamic IP*

5.1.3 ipaddr – GMAS IP Address

Purpose	1. Set a new IP address. 2. Request display of GMAS's IP address.			
Syntax	ipaddr			
Parameters	None or string			
Attributes	**Type**	**Source**	**Default values**	**Range**
	Parameter, string	Interpreter	N/A	N/A
Examples				
	Input	**Output**		
	ipaddr	*10.10.10.1*		
	Ipaddr 10.10.20.2	*OK*		

5.1.4 ipmask – GMAS IP Subnet Mask

Purpose	1. Set a new IP subnet mask. 2. Request display of GMAS's IP subnet mask.			
Syntax	ipmask			
Parameters	None or string			
Attributes	**Type**	**Source**	**Default values**	**Range**
	Parameter, string	Interpreter	N/A	N/A
Examples				
	Input	**Output**		
	ipmask	*255.255.255.0*		
	ipmask 255.255.255.0	*OK*		

5.1.5 defgateway – GMAS Default Gateway

Purpose	1. Set a new default gateway. 2. Request display of GMAS's default gateway.

Purpose	1. Set a new default gateway. 2. Request display of GMAS's default gateway.			
Syntax	defgateway			
Parameters	None or string			
Attributes	**Type**	**Source**	**Default values**	**Range**
	Parameter, string	Interpreter	N/A	N/A
Examples				
	Input		**Output**	
	defgateway		*10.10.10.1*	
	Defgateway 10.10.10.2		*OK*	

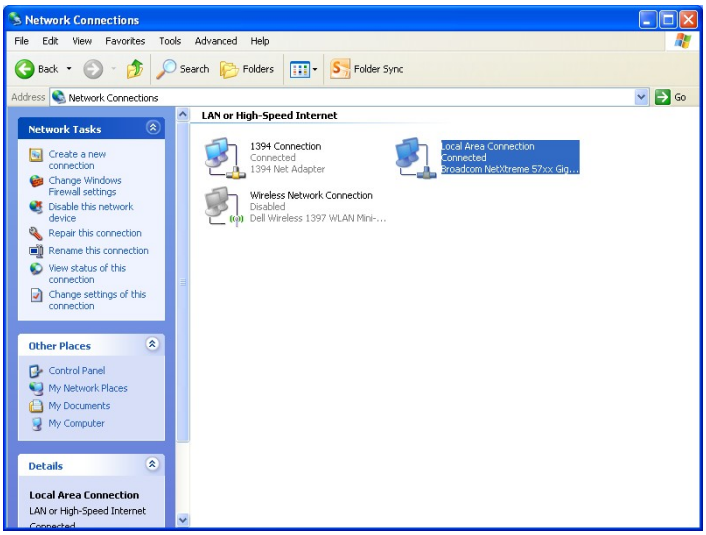
5.2 G-MAS PC Configuration

This Windows setup configuration covers Windows XP, and Windows 7

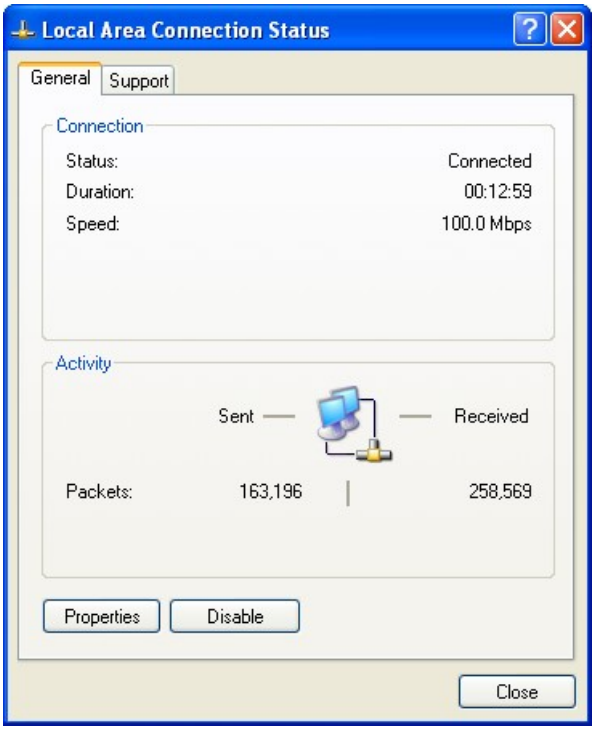
5.2.1 Windows XP Setup

To set the PC configuration in Windows XP:

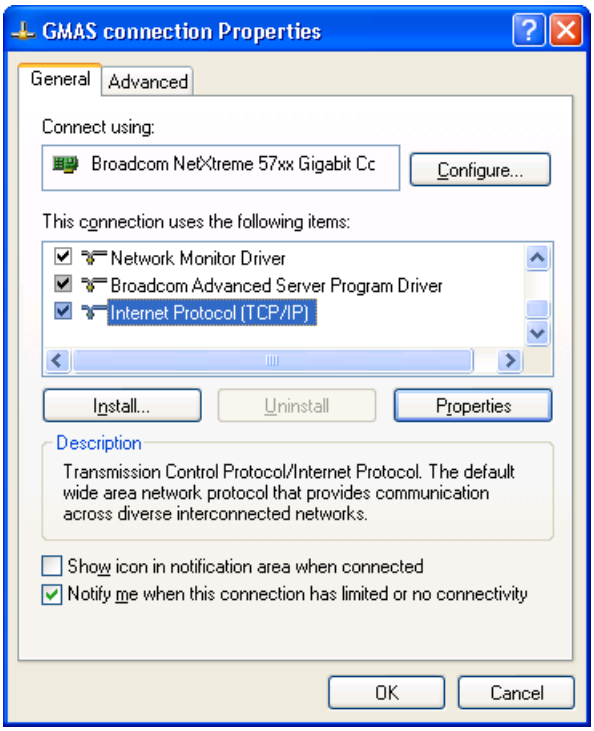
1. On your desktop, go to Start > Settings > Control Panel, click Network Connections then double-click on the Local Area Connection icon.



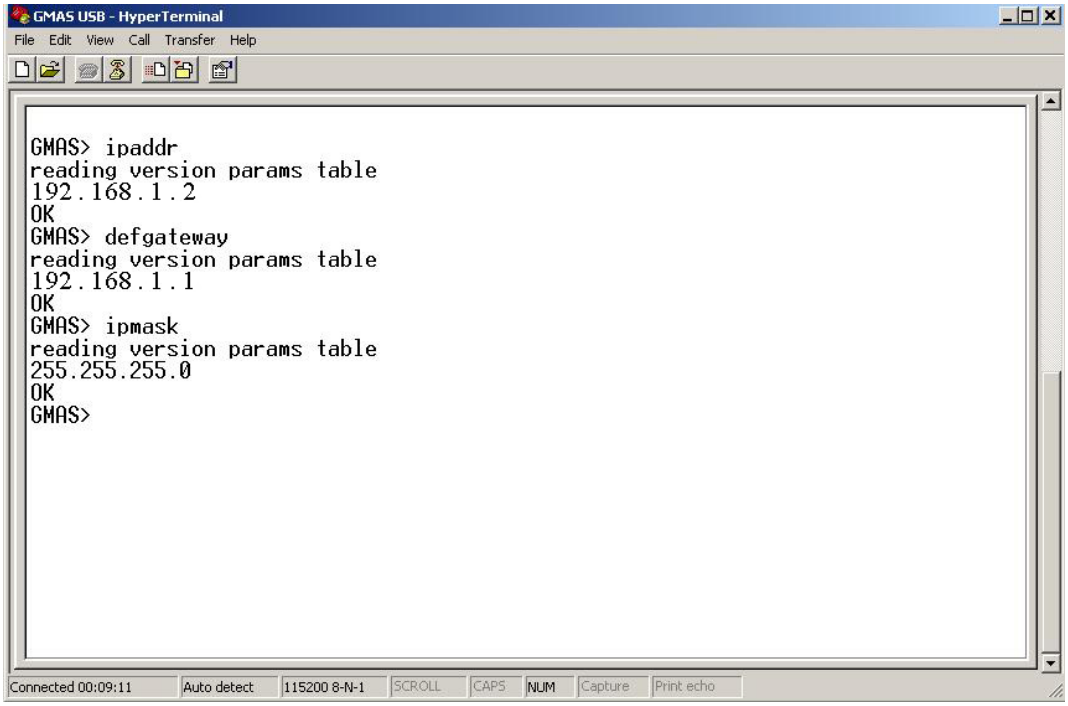
2. On the Local Area Connection Status dialog box, go to the General tab and click on the Properties button.



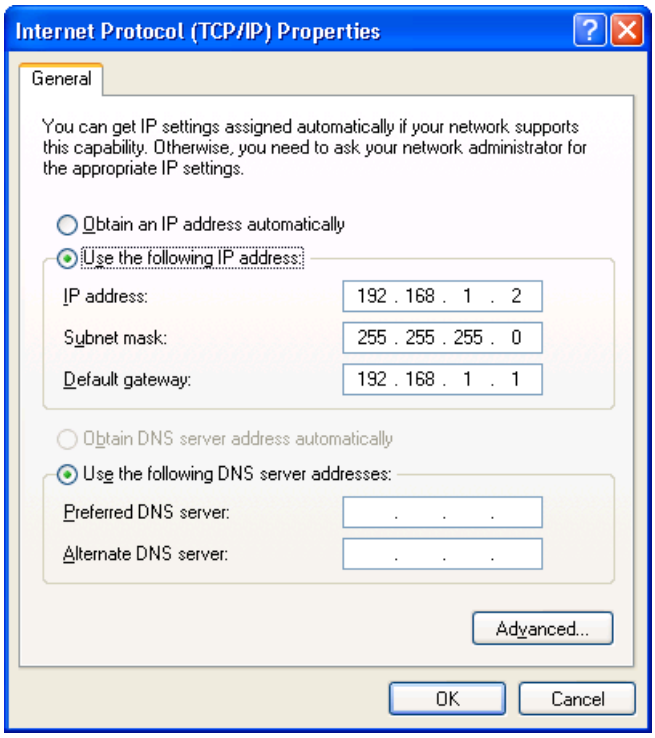
3. In the **GMAS Connection Properties**, click the **General** tab window and select the **Internet Protocol (TCP/IP)** option from the list of connections and click OK.

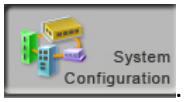


4. Perform the USB Connection procedure as described in the section above **0.**
5. From the terminal window, check the IP Address, Default Gateway, and Subnet Mask, of the G-MAS.

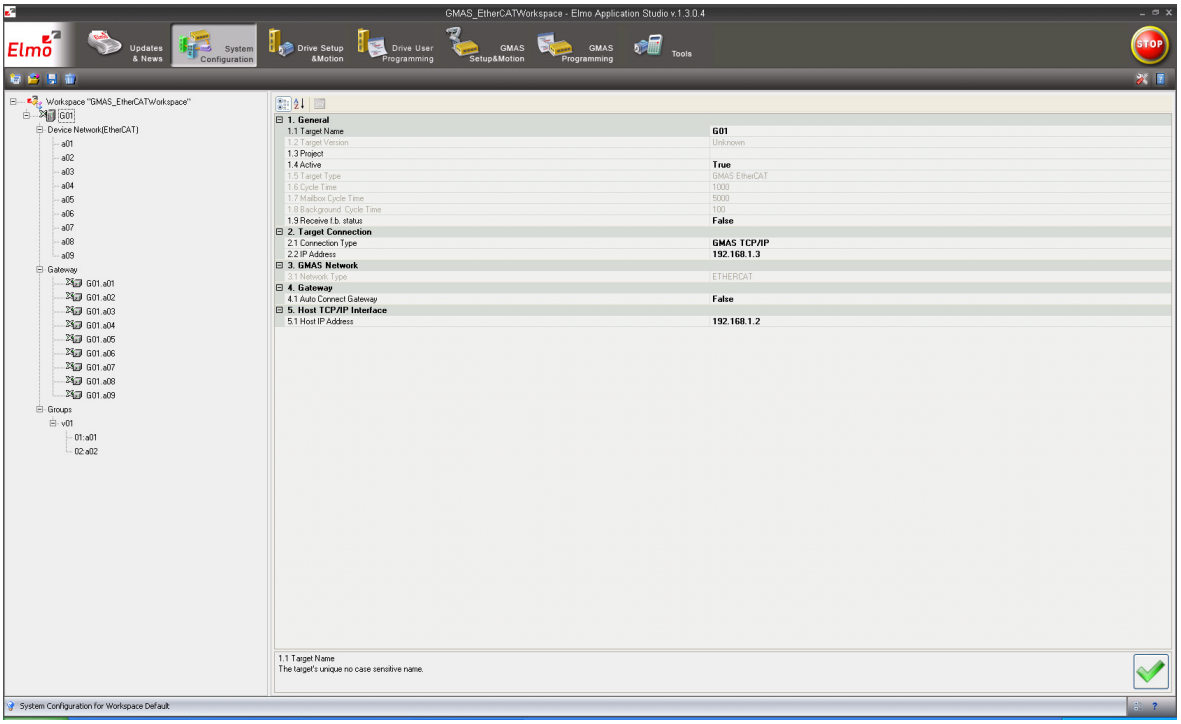


6. Click Pr**operties** and select the radio button. *Use the following IP Address*.



7. Enter the IP Address, Default Gateway, and Subnet Mask from the terminal window.
8. Click **OK**.
9. Open the EAS application.
10. Click System Configuration 

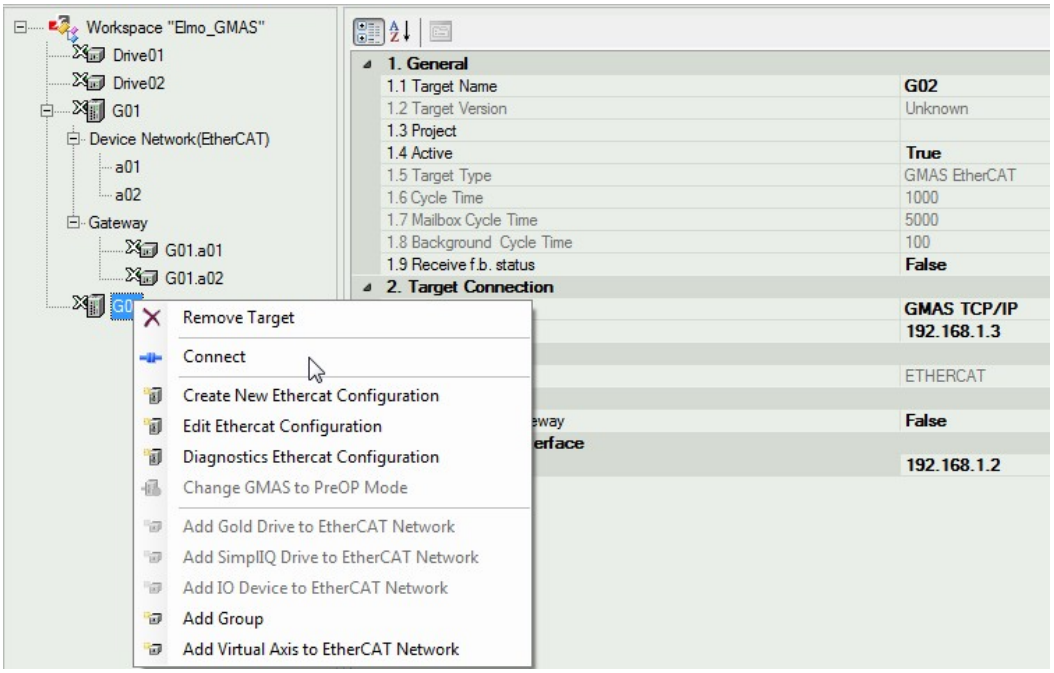
.
11. In the Connection type select **GMAS TCP/IP**.



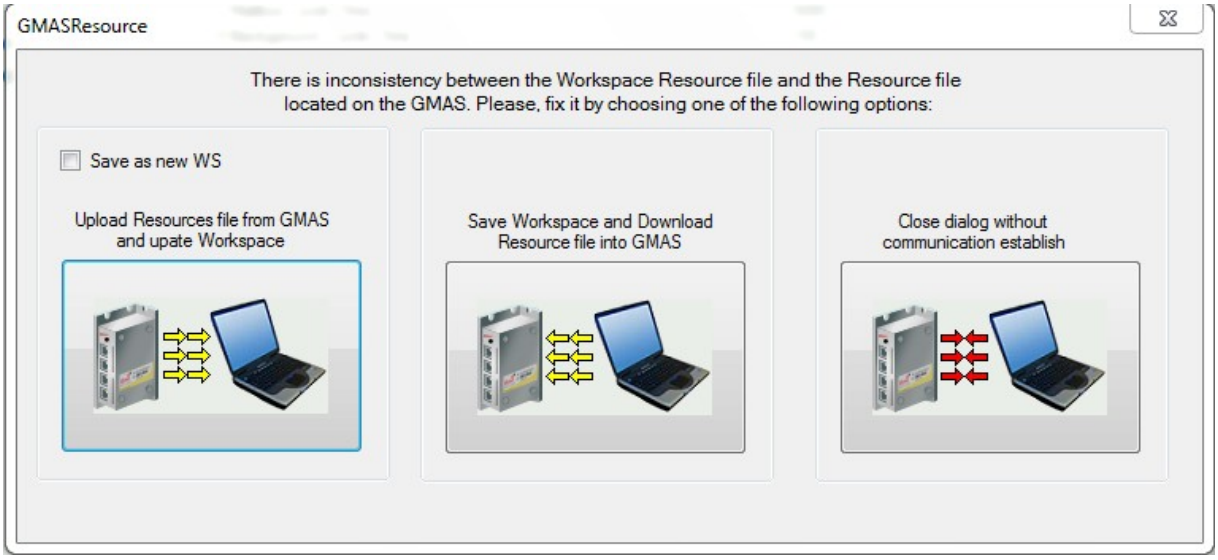
12. In **IP Address**, select the same addresses entered to the Internet Protocol Properties window above.

13. Click **Apply**  to save the drive's properties.

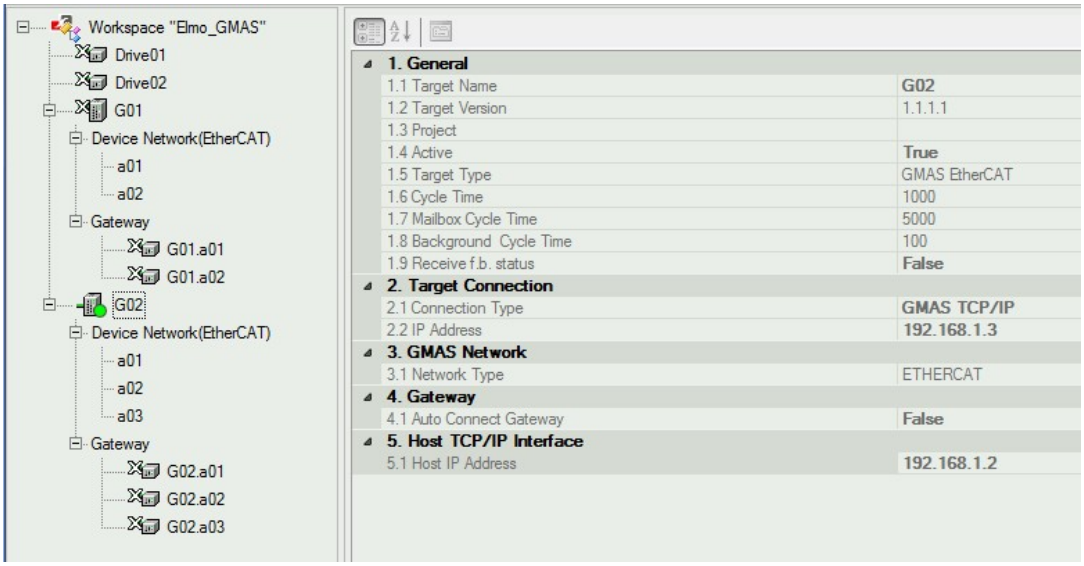
14. Right-click the drive's name and click **Connect**. The GMASResource data window opens.



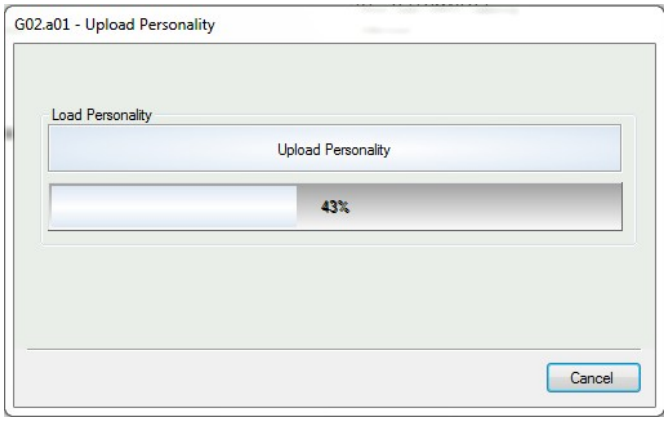
15. In the GMASResource, select **Upload Resource file from GMAS and update Workspace**. The Resource file is uploaded to the host system.



On completion the G-MAS is connected (green marker), and drives connected to the G-MAS appear.



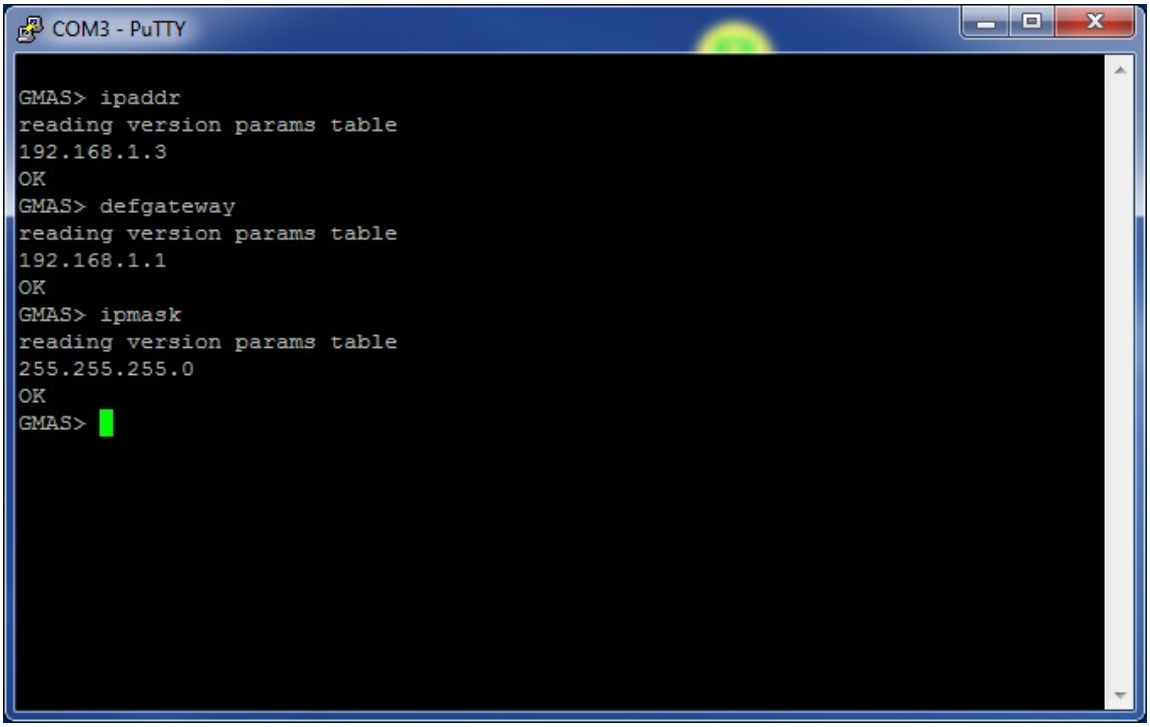
16. Select the first drive and right-click to choose **Connect**. The drive Personality is uploaded, and the drive is connected. Connect the other drives linked to the G-MAS.



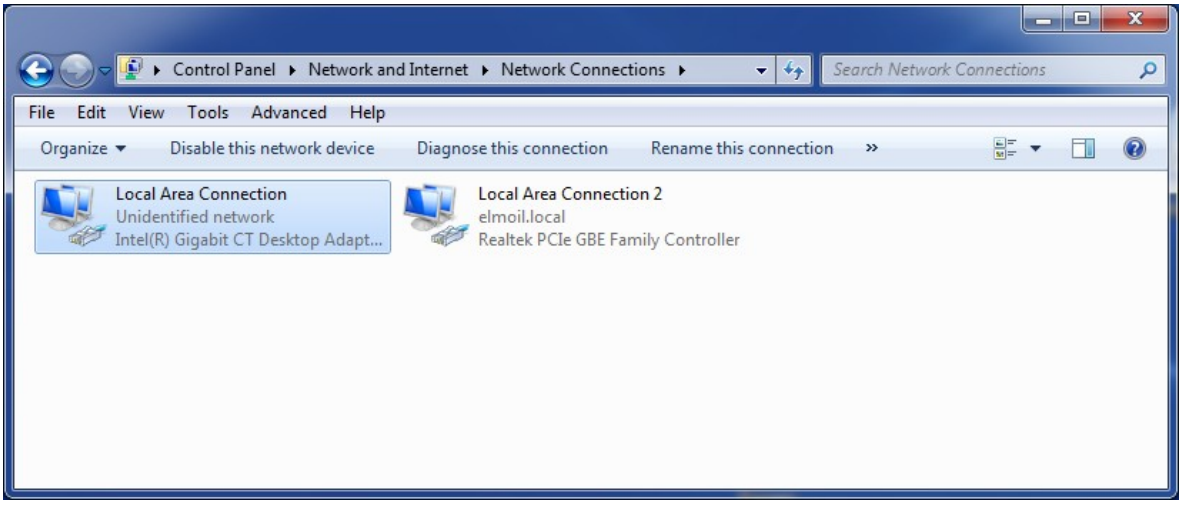
5.2.2 Windows 7 Setup

To set the PC configuration in Windows 7

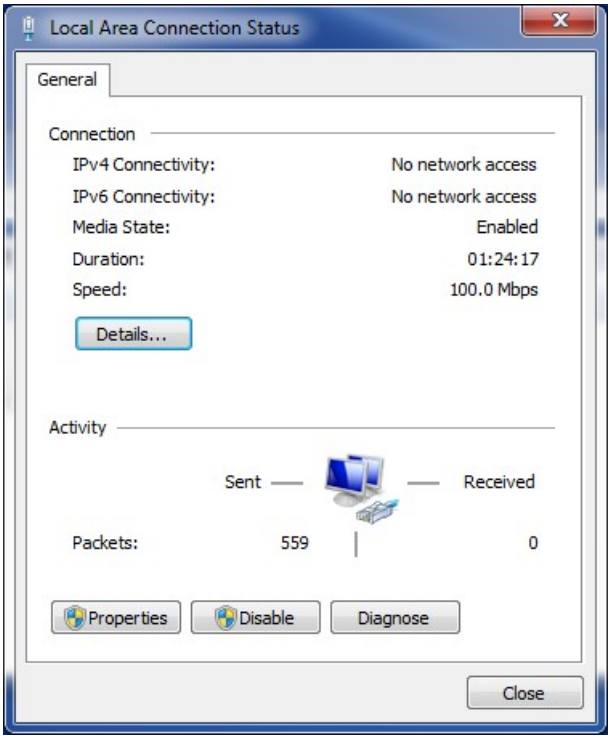
1. Connect the USB connection from the Host system to the G-MAS.
2. Perform the USB Connection procedure as described in the section above **5.1.1.**
3. From the terminal window, check the IP Address, Default Gateway, and Subnet Mask, of the G-MAS.



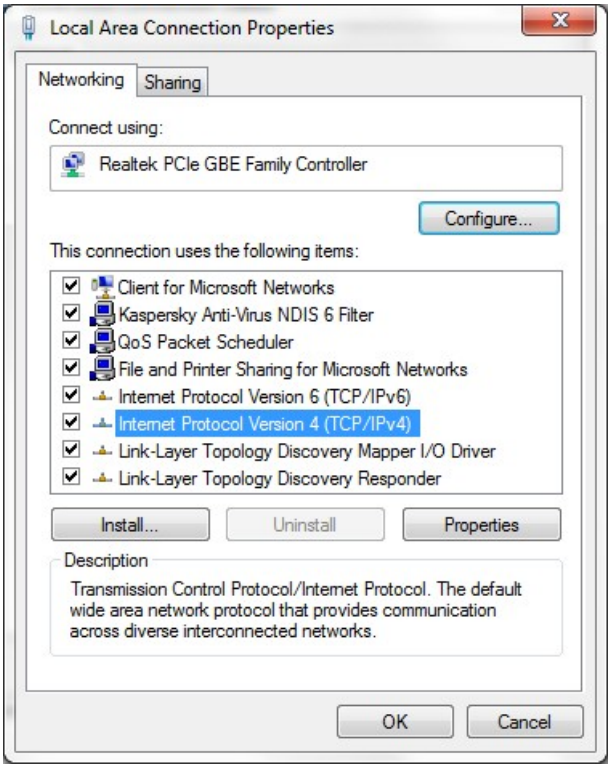
4. Open the Network Connection window, and locate the Local Area Connection to the G-MAS.



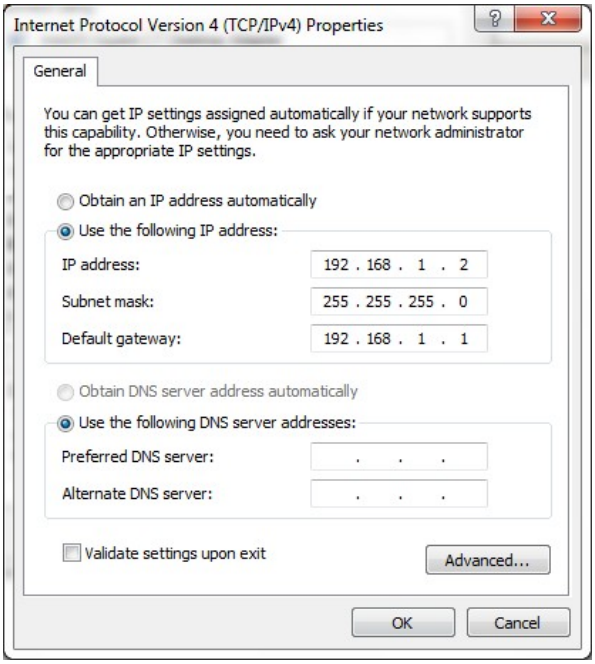
5. Right-click on the Connection, and select **Status**. Make sure that the IPv4 and IPv6 Connectivity show **No network access**.



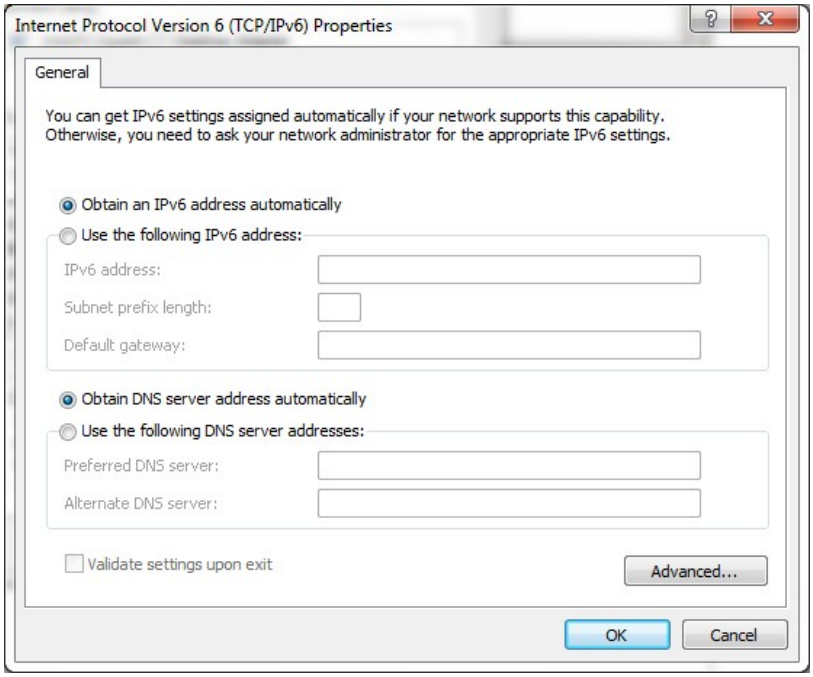
6. Click Properties, and select Internet Protocol Version 4 (TCP/IPv4).



7. Select **Properties** and enter the Default Gateway, and Subnet Mask obtained from the Telnet window.

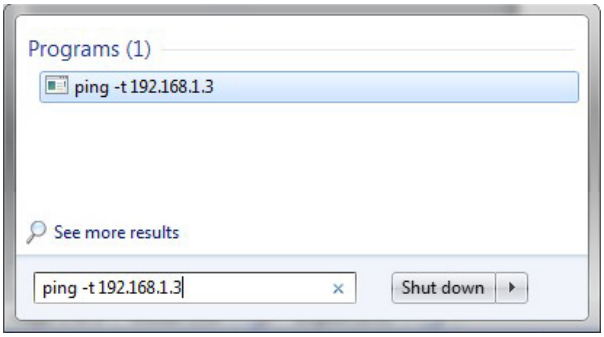


8. In the Internet Protocol Version 4 (TCP/IPv4 Properties window, Insert an **IP Address** similar to the G-MAS own address but different at the fourth set of digits, as shown, e.g., **192.168.1.2**, and then click **OK**.
9. In the Local Area Connection Properties window, select Internet Protocol Version 6(TCP/IPv6).
10. In the Internet Protocol Version 6(TCP/IPv6) Properties window, click the radio button next to **Obtain an IPv6 address automatically** as shown below, and click **OK**.

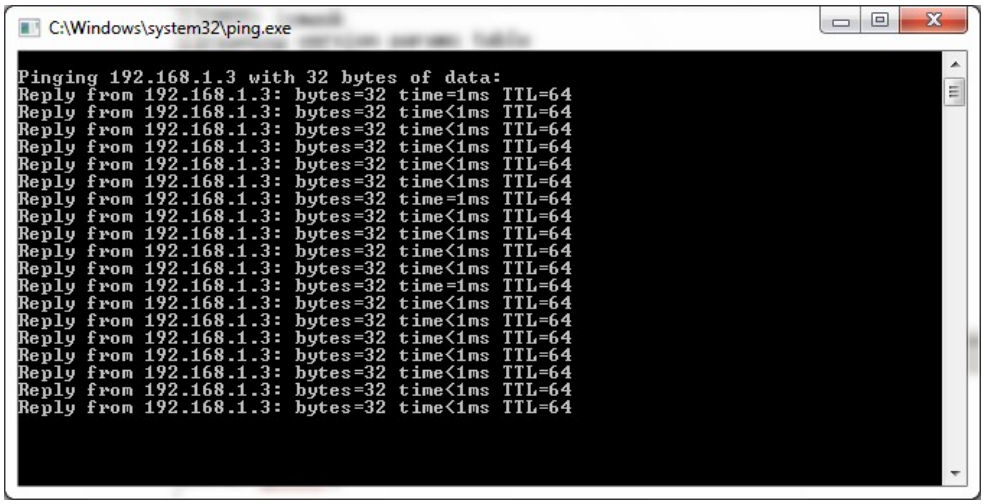


11. Check the connection to the G-MAS by pinging it. Enter the following at the Windows prompt:

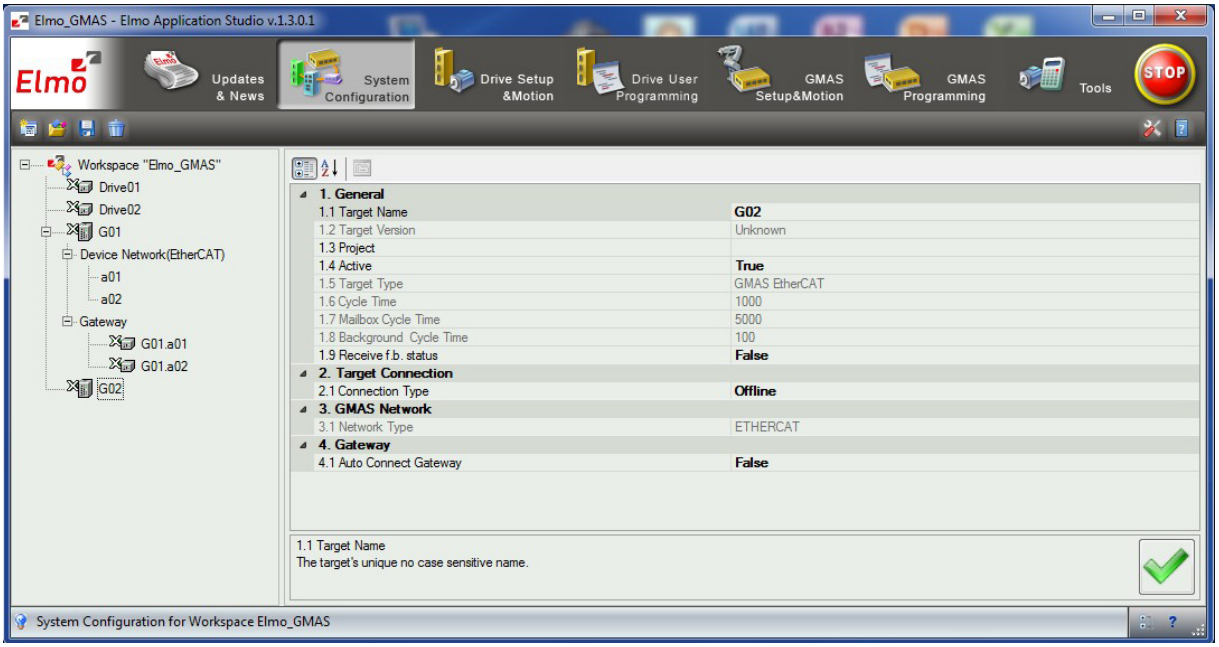
Ping –t <G-MAS IP Address>, e.g., 192.168.1.3



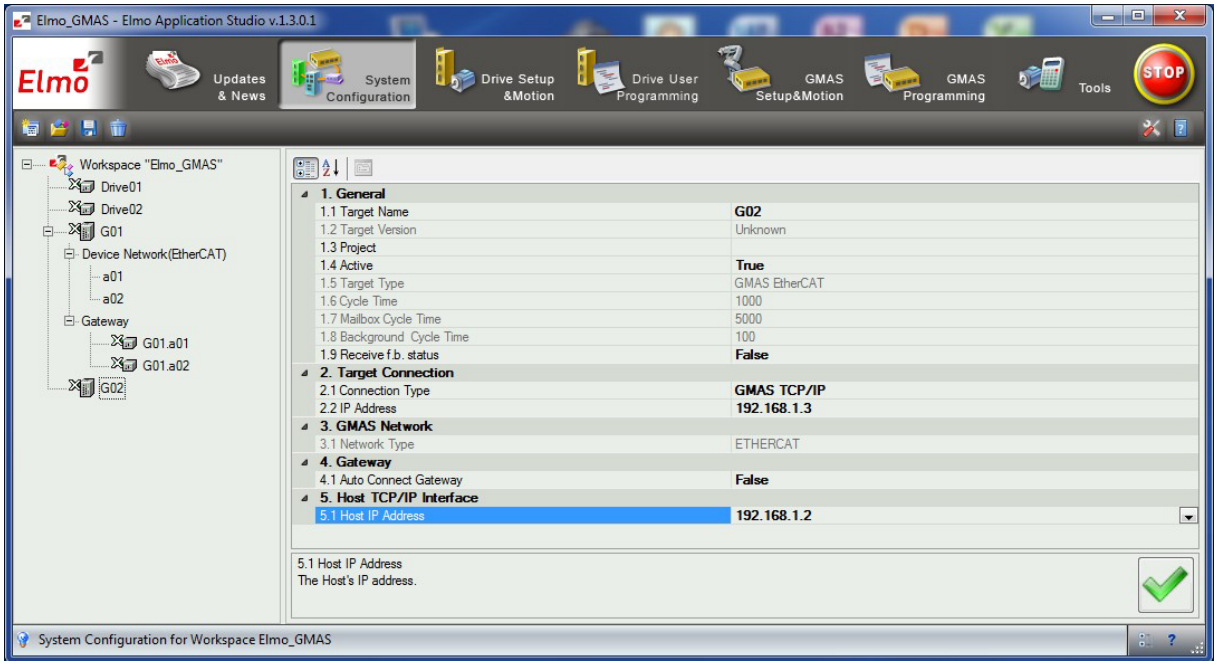
A Command Prompt should open with the reply results demonstrating a connection to the G-MAS.



12. Open the EAS Application at the System Configuration window and right-click on the Workspace to setup a new G-MAS.

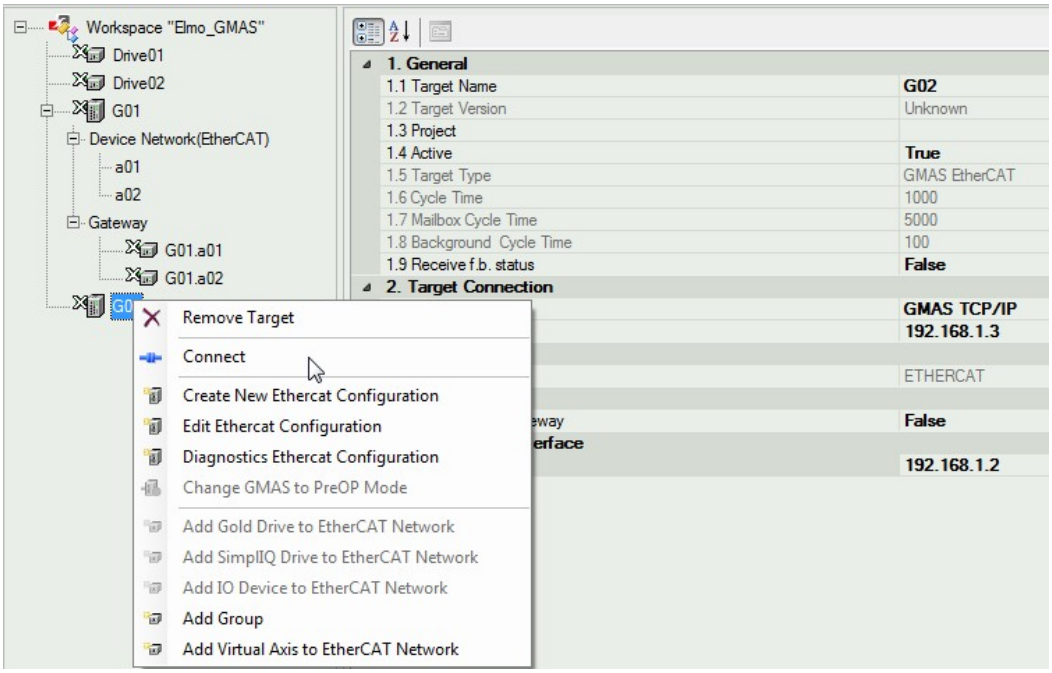


13. Setup the EtherCAT configuration of the G-MAS with the respective TCP/IP addresses setup in the Windows configuration and from the Terminal feedback.

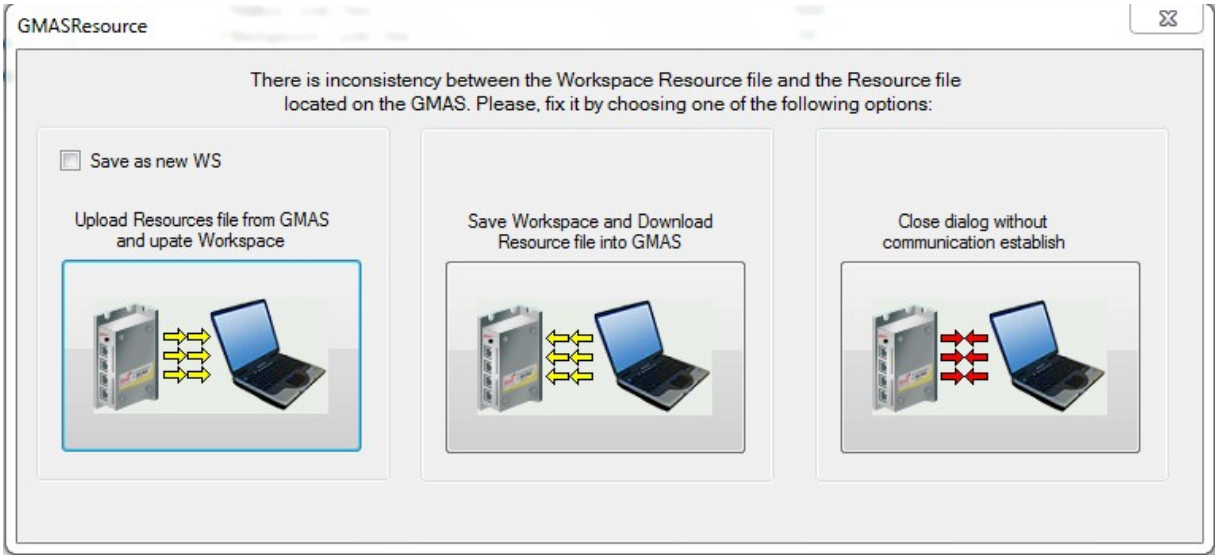


14. Click **Apply**  to save the drive's properties.

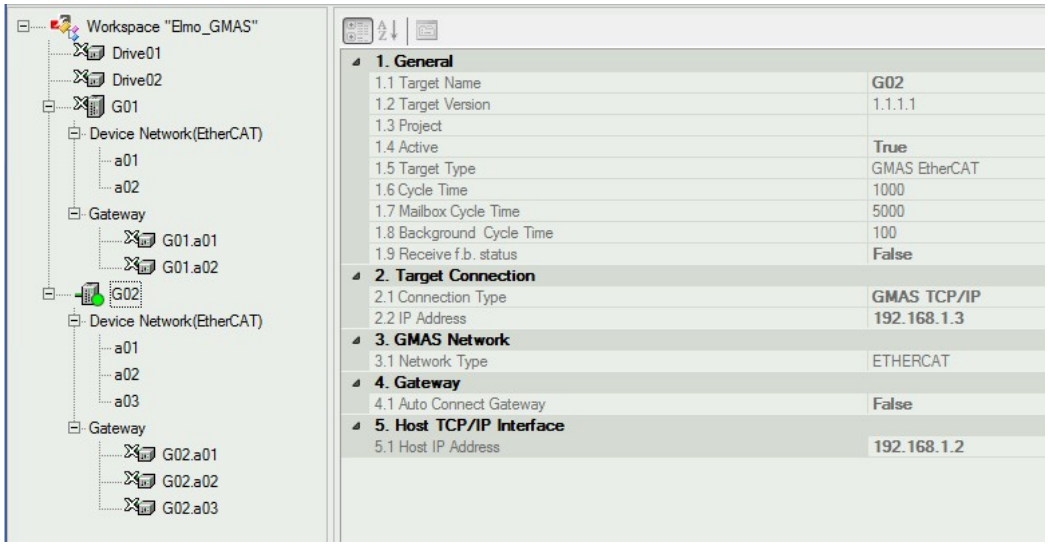
15. Right-click the drive's name and click **Connect**. The GMASResource data window opens.



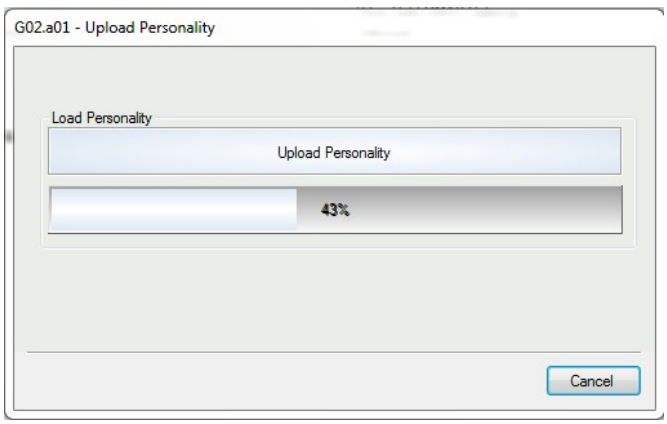
16. In the GMASResource, select **Upload Resource file from GMAS and update Workspace**. The Resource file is uploaded to the host system.



On completion the G-MAS is connected (green marker), and drives connected to the G-MAS appear.



17. Select the first drive and right-click to choose Connect. The drive Personality is uploaded, and the drive is connected. Connect the other drives linked to the G-MAS.



Note: When using a static IP address and a wireless network, verify that the network attributes on the two networks are not the same (different gateways). Alternatively, disconnect the wireless network.

5.3 Installing the firmware to GMAS

Note: To install the GMAS firmware, refer to the *Elmo Application Studio (EAS) User Manual*.

5.4 EtherCAT Configuration

Note: To configure EtherCAT, refer to the *Elmo Application Studio (EAS) User Manual*.

5.5 Installing the Firmware to the Gold DC Whistle Servo Drives

Note: To install the firmware to the Gold DC Whistle servo drives, refer to the *Elmo Application Studio (EAS) User Manual*.

5.6 Installing PAL Firmware

Note: To install the PAL firmware, refer to the *Elmo Application Studio (EAS) User Manual*.

5.7 Installing the Servo Drive Parameters

Note: To install the Servo Drive parameters, refer to the *Elmo Application Studio (EAS) User Manual*.

5.8 Motion Test

Note: To perform Motion tests, refer to the *Elmo Application Studio (EAS) User Manual*.


Inspiring Motion
Since 1988
For a list of Elmo's branches, and your local area office, refer to the Elmo site www.elmomc.com
Elmo
Motion Control