MC100 Series RF Multi-Coupler

User's Guide

200 MHz to 5250 MHz Wide-Band RF Multi-Coupler

Submitted to:

Telemetry Ground Station Operations

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SIGNATURES

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REVISIONS

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A2524-003	Rear panel connector update	04/04/2024
A2524-004	Added Devolinx Ethernet-to-Serial Converter setup section (§3.3.1) with screenshots and settings tables	05/29/2026

SAFETY SUMMARY

System Weight and Handling Restrictions - Depending upon the specific system and configuration, each MC110 series multi-coupler chassis weighs approximately 15 pounds. The MC110 series is housed in a 1U rack-mount enclosure designed for installation in Telemetry Ground Station equipment racks.

Electrical – The MC110 series is designed to operate on 115/230 VAC 50/60 Hz, and complies with all U.S. and International safety codes and regulations required for safe operation and use of commercial equipment. Use standard and accepted safety practices with respect to operating commercial electrical equipment at all times to avoid the risk of personal injury or death.

EMI/EMC – The MC110 series complies with all FCC and CE regulations regarding electromagnetic interference and compatibility. There are no personnel hazards or safety issues with respect to EMI/EMC when operating the system.

Exposure to Radio Frequency (RF) Signals – The MC110 series is not an RF transmission device, but does pass transmitted RF signals from 200 MHz to 5250 MHz at levels of +10 dBm to noise threshold levels. These signal levels are well below the minimum safe exposure levels prescribed by both U.S. and International standards.

Table of Contents

1 – INTRODUCTION

1.1. Scope

This User's Guide provides the necessary information for the operation of SEMCO's MC100 series RF Multi-Coupler, which is used to receive and distribute RF signals from antennas operating in the 200 MHz to 5250 MHz frequency spectrum. The most common use of the MC100 series RF Multi-Coupler is the distribution of these antenna RF signals to telemetry receivers installed downstream in telemetry ground stations in support of aircraft, missile and weapon system flight tests.

1.2. Purpose and Description

This User's Guide provides detailed information to allow for operation of the MC10o series RF Multi-Coupler (Figure 1-1).

Section 2, Getting Started briefly describes and lists the standard and optional hardware features of the MC100 series system and then describes how to install and apply power to the MC100 series hardware.

Section 3, Hardware I/O and Software Controls describes system hardware and software I/O interface and provides instructions for setting up system operation and control, both locally and remotely via Ethernet The standardized hardware I/O description facilitates MC100 series RF Multi-Coupler operation in a typical Telemetry Ground Station environment.

Section 4, RF Multi-Coupler Operation provides instructions for MC100 series operation, including set-up and status monitoring of all RF Multi-Coupler operating features and parameters.

Figure 1-1
MC100 series RF Multi-Coupler

2 – GETTING STARTED

2.1. System Description

The MC100 series RF Multi-Coupler is a 1U rack mount device designed for receiving antenna RF signals and distributing these signals to multiple telemetry receivers or other desired devices in a telemetry ground station. We can differentiate 2 main types of RF Multi-Couplers: ones with a single RF input that provides copies of that signal to up to 8 outputs and ones with dual RF inputs that provides copies to up to 4 outputs per input. In both cases, there are a maximum of 8 output channels which have each +/- 5 dB individual gain control. The MC100 series RF multi-couplers are wideband and operate from 200 MHz to 5250 MHz.

The MC100 series multi-coupler design includes selective wide band RF LNAs, precision power splitters and programmable attenuators to provide unprecedented linear RF coverage from 200 MHz to 5250 MHz. User-friendly front panel control provides for RF frequency band selection as well as balancing the output of each of the 8 output channels. Isolation between output ports is >70 dB.

New: All MC100 series RF Multi-couplers have 2 spectrum monitoring output ports (one per RF input channel). The port connector is always of SMA-type (i.e. the option for N-type is not available for the spectrum monitoring port).

Remote (network) control is also standard with the MC100 series RF Multi-Coupler, using SEMCO's MCCS Network Software

Table 2-1 provides the MC100 series Specifications.

Table 2-1
MC100 series Specifications

Features	Specifications
Electrical	
Input Ports	1 for single RF input configuration 2 for dual RF input configuration Ports are “N” type or “SMA” type connectors
Output Ports	up to 8 outputs for single RF input configuration up to 4 outputs / input for dual RF inputs configuration Ports are “N” type or “SMA” type connectors
Frequency Range	P = 200 MHz to 500 MHz
	CIF = 300 MHz to 1150 MHz
	L1 = 1415 MHz to 1585 MHz
	L2 = 1650 MHz to 1850 MHz
	E = 2185 MHz to 2485 MHz
	C = 4400 MHz to 5250 MHz
VSWR	<1.5:1
Noise Figure	<8 dB
Gain Controls	+/-5 dB per output channel in 0.2 dB steps
Linearity	+/-1 dB across each selected channel
P1 Compression Point	Begins compressing at 0 dBm input power
Isolation	>70 dB between RF output ports
Spectrum Monitoring	1 port per RF input – SMA-type connector
Communications	
Local Control	Front Panel
Remote Control	Ethernet (RJ45) and SEMCO MCCS Software
Power Requirements	
Input Power	90 to 265 VAC; 50-60 Hz; Auto Ranging
Physical and Environmental	
Size and Weight	1U rack-mount; 17” W x 20” D x 1.75” H; <15 lbs
Operating Temperature	-20 to +50 degrees C
Storage Temperature	-20 to +70 degrees C
Humidity	Up to 95% non-condensing
Altitude	Up to 30,000 feet
EMI	Designed to meet MIL-STD 461

2.2. System Configurations and Options

The MC100 series RF multi-coupler is available in various configurations in terms of number of Input channels, Output channels per input, Frequency bands, spectrum monitoring, connector types (SMA or N or both). Contact your SEMCO sales POC for more info and quotes.

2.3. Initial System Hardware Set-up and Operation

The user should read this User's Guide and become familiar and comfortable with the overall features, options and configuration of the specific MC100 series system that will be used.
Figure 2-1 below depicts the MC100 series front panel (with simple ON/OFF power button, front panel gain controls and frequency channel selection).
Figure 2-2 below depicts the rear panel of a dual channel RF input configuration (with 2 RF inputs, 4 RF output / input, 1 monitoring port / input, 115/230 VAC 50/60Hz power input and Ethernet connection).
Figure 2-3 below depicts the rear panel of a single channel RF input configuration (with 1 RF inputs, 8 RF output, 1 monitoring port, 115/230 VAC 50/60Hz power input and Ethernet connection).
Figure 2-4 below depicts a display of the remote-control software GUI.

Figure 2-1
MC100 series RF Multi-Coupler front panel (8 channel output configuration shown)

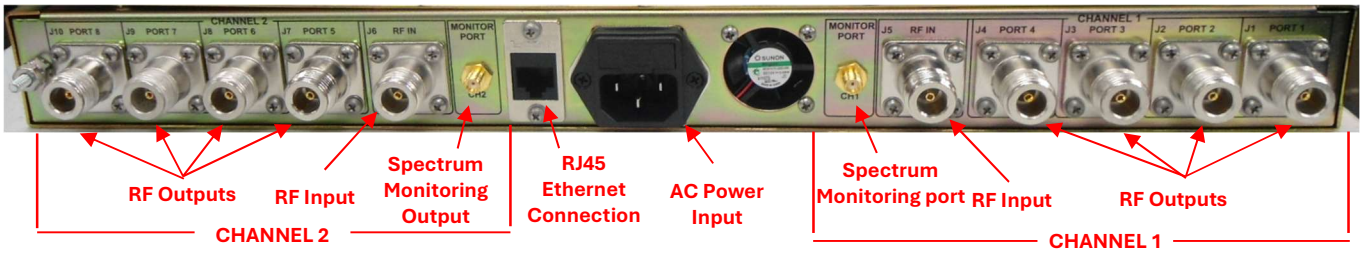


Figure 2-2
MC100 series dual channel RF input Multi-Coupler rear panel

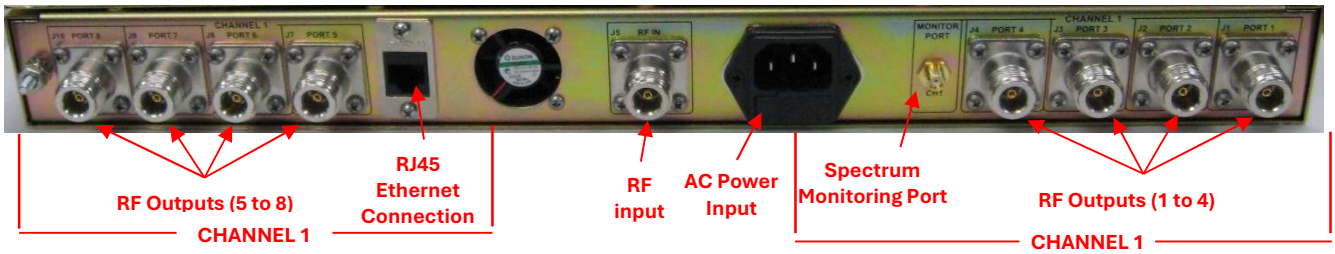
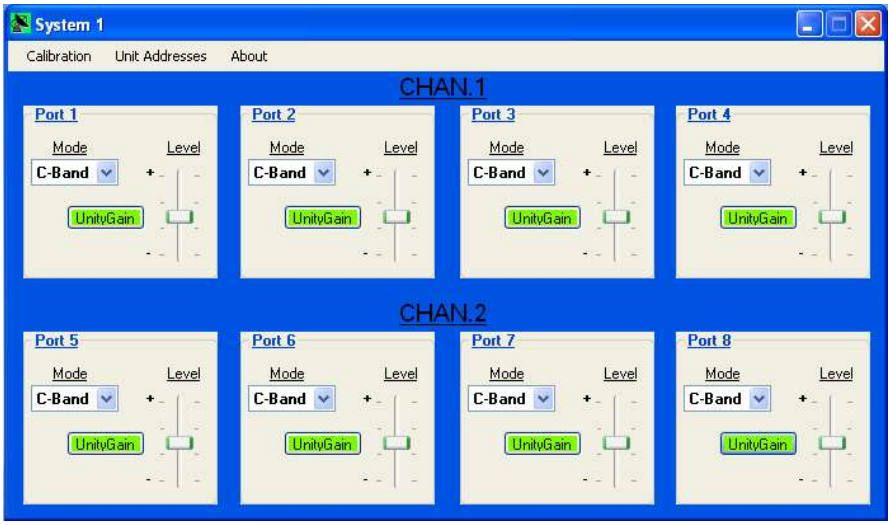


Figure 2-3
MC100 series single channel RF input Multi-Coupler rear panel



Software Remote Control Panel

Figure 2-4
MC100 series RF Multi-Coupler I/O and Operator Controls

3 – RF MULTI-COUPLER OPERATION

3.1. Overview

This section describes all steps and features required for RF Multi-Coupler operation. The front panel controls and software remote control panel described herein are applicable to all delivered MC100 series systems. These controls and displays are described in subsequent paragraphs.

3.2. Front Panel Controls

Figure 3-1 depicts the MC100 series front panel controls.

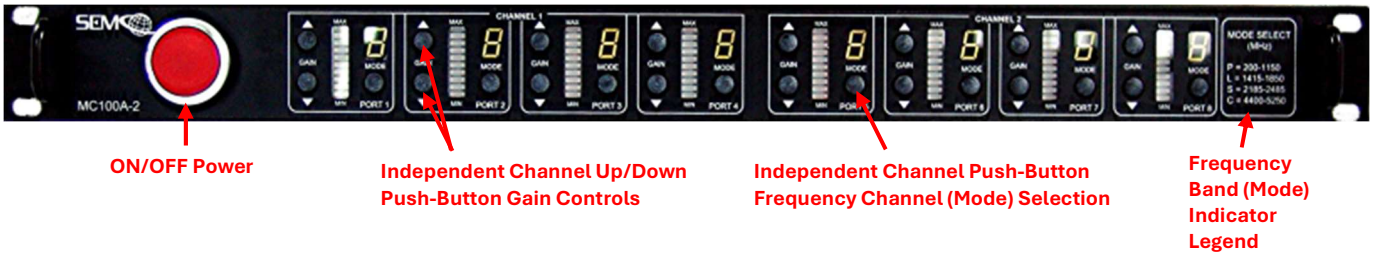


Figure 3-1
RF Multi-Coupler Front Panel Controls

As shown in Figure 3-1, the MC100 series Front Panel is divided into three sub-panels:

- Power ON/OFF__
  - Red Push Button
- Channel Gain Controls_
  - Up/Down Bush Buttons
  - Max-Min Level Indicator
- Frequency (Mode) Selection
  - P Band (200-1150 MHz)
  - L Band (1415-1850 MHz)
  - S (E) Band (2185-2485 MHz)
  - C Band (4400-5250 MHz)

Power ON/OFF – This push button applies 115/230 VAC power to the MC100 series.

Channel Gain Controls – Each output channel has Up/Down push button gain controls that provides for +/- 5 dB gain adjustments.

Frequency (Mode) Selection – Each output channel has a bush button that selects P, L, S or C Band.

Note:

The MC100 series multi-coupler will effectively distribute RF outputs from 200 MHz to 5250 MHz regardless of the Frequency (Mode) selected. Selecting the Frequency (Mode) provides for optimized linear gain balance between output channels.

3.3. Software Remote Control

The MC100 series Software Control panel (Figure 3-2) is used for remote control via Ethernet and SEMCO's MCCS Network Software. All functional front panel controls are controlled remotely via this software.

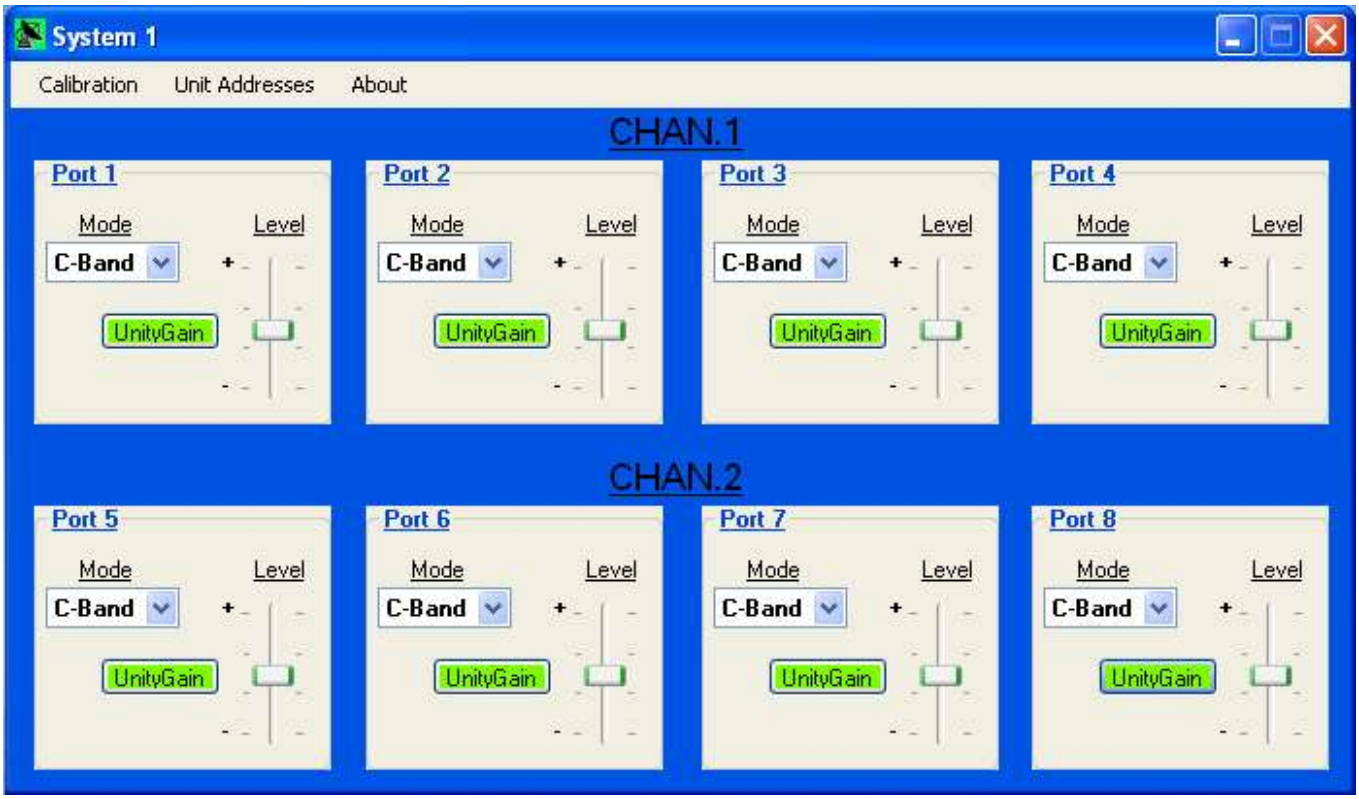


Figure 3-2
Software Remote Control Panel

3.3.1. Devolinx Ethernet-to-Serial Converter Setup

The MC100 series RF Multi-Coupler uses a Devolinx (Antaira) STE-502C Ethernet-to-Serial Server as the network interface between the multi-coupler's internal RS-232 serial bus and the customer's Ethernet network. The Devolinx must be configured with the settings described in this section before the SEMCO MCCS Network Software can communicate with the multi-coupler. The Devolinx is accessed for configuration via its built-in web interface using a standard web browser. The factory default IP address is 10.0.50.100.

The Devolinx is factory-configured at SEMCO with the settings shown below. These settings should not be changed except for the IP Address, which may be reassigned by the user as required for the local network. After any configuration change, click Save Configuration on the web interface for the change to take effect.

Networking Setup

Figure 3-7 shows the Devolinx Overview screen, which displays the general device information including the model name, IP address, and firmware versions. The Link Status field uses a single-character code per COM port (S = TCP Server listening, A = TCP Server connected, c = TCP Client not connected, C = TCP Client trying to connect, B = TCP Client connected, U = UDP mode).

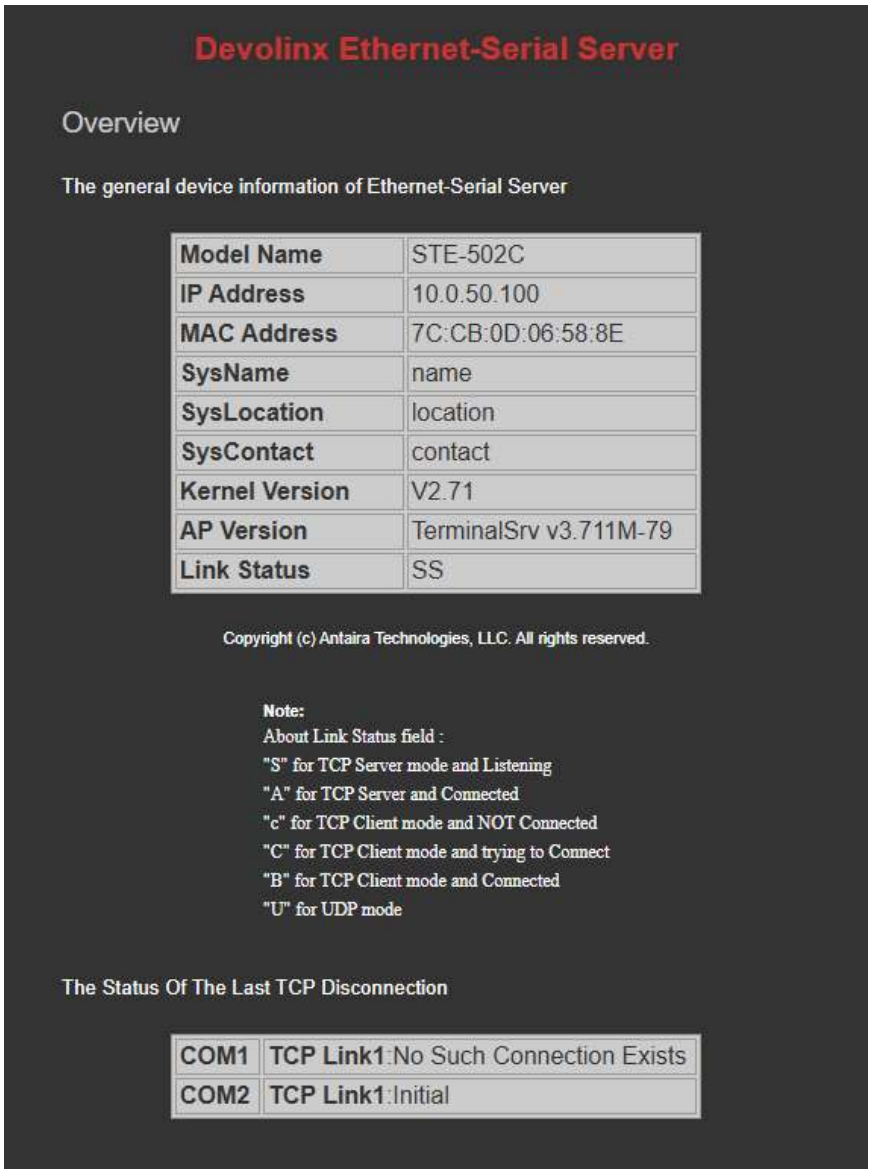


Figure 3-7
Devolinx Networking Setup (Overview) Screen

Field	Value
Model Name	STE-502C
IP Address (factory default)	10.0.50.100
Kernel Version	V2.71
AP Version	TerminalSrv v3.711M-79

Security Setup

Figure 3-8 shows the Devolinx Security screen. The factory reset password is required only if the unit is restored to factory defaults **(factory reset password=default)**. The SEMCO password is the user-defined password used to log into the Devolinx web interface; it is shipped as a null (empty) string.

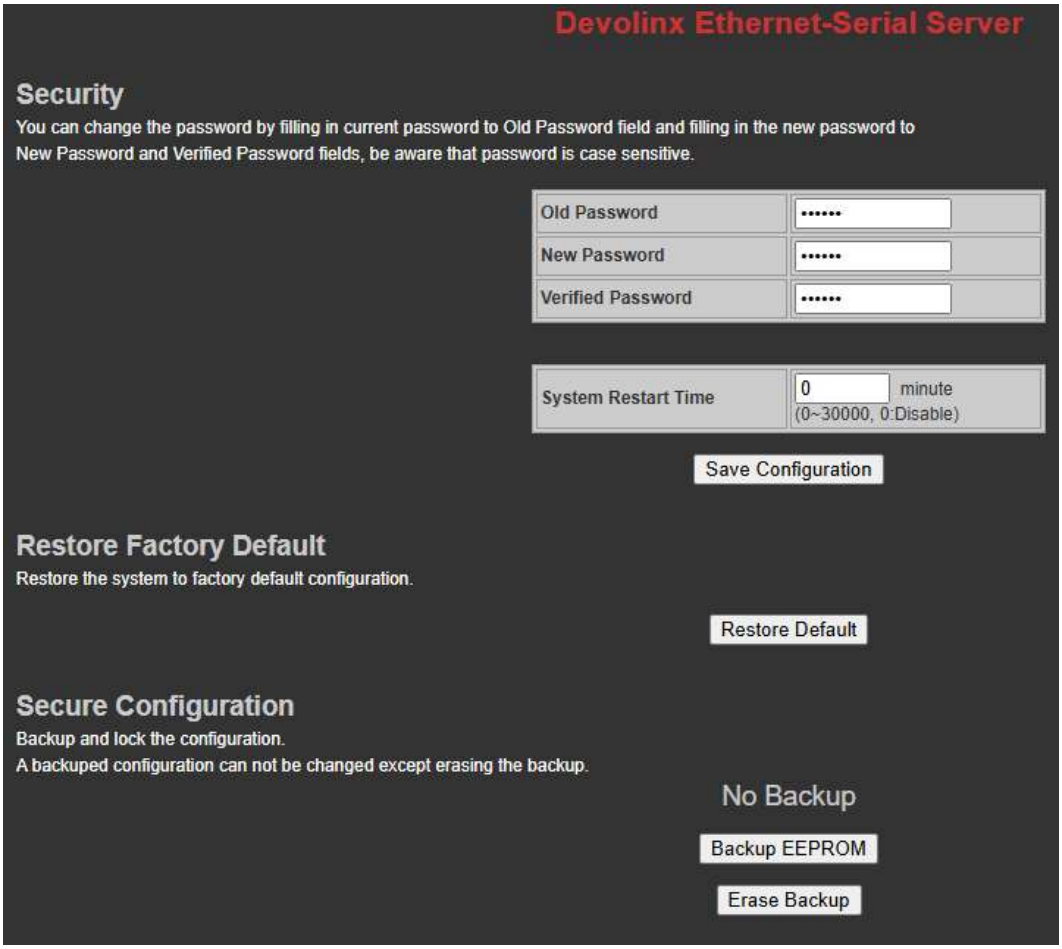


Figure 3-8
Devolinx Security Setup Screen

Parameter	Setting
Factory Reset Password	default
SEMCO Password	(null string — leave blank)
System Restart Time	0 (Disable)
Secure Configuration	No Backup

COM1 Setup

Figure 3-9 shows the Devolinx COM1 (LINK1) setup screen. COM1 is configured as a TCP Server on Local Listening Port 4660 and is paired with the multi-coupler's internal RS-232 control bus. All COM1 parameters must match the values listed below for the MCCS software to communicate correctly with the multi-coupler.

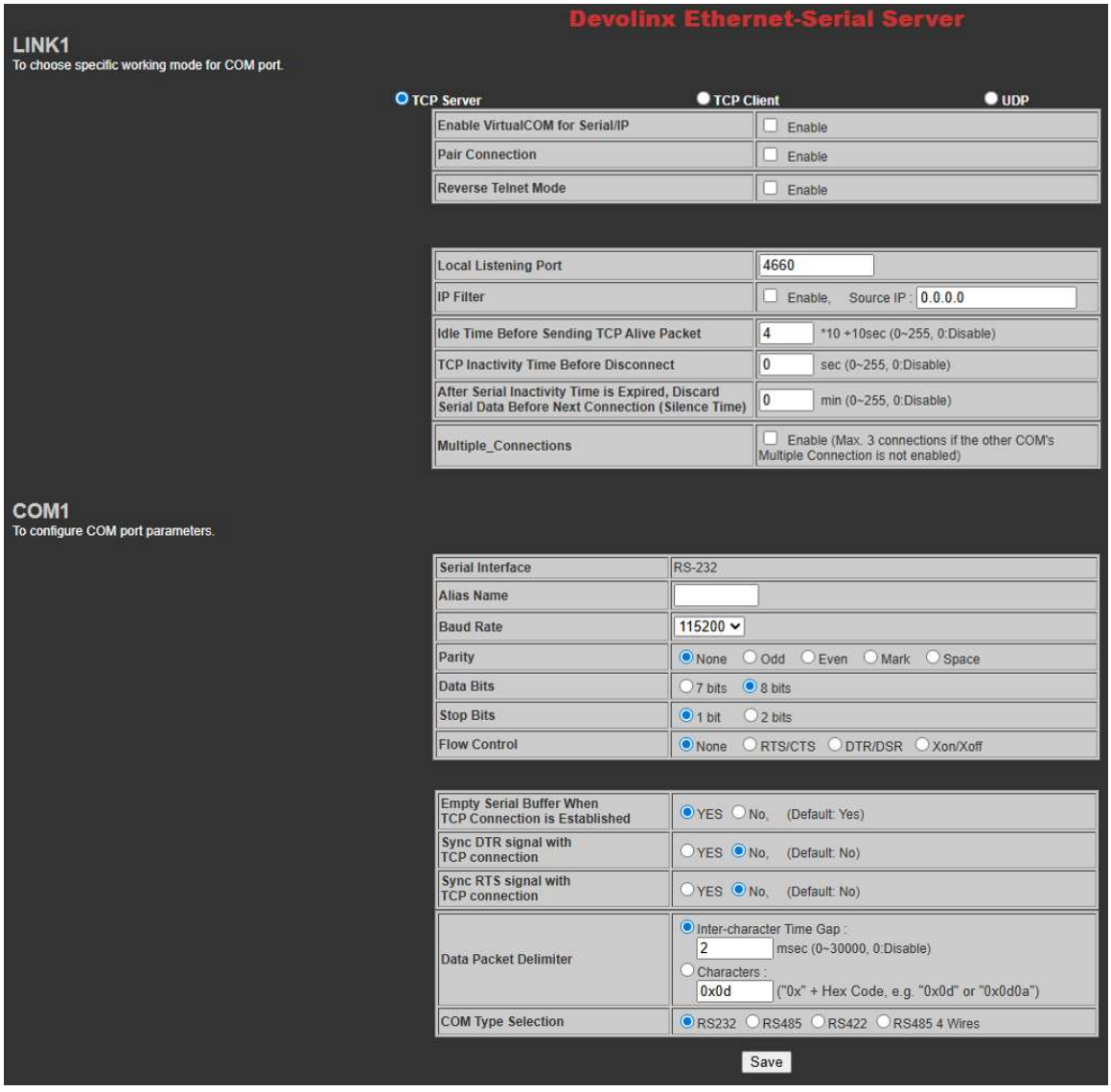


Figure 3-9
Devolinx COM1 (LINK1) Setup Screen

Parameter	Setting
LINK1 — Working Mode	TCP Server
Enable VirtualCOM for Serial/IP	Disabled
Pair Connection	Disabled
Reverse Telnet Mode	Disabled
Local Listening Port	4660
IP Filter	Disabled (Source IP 0.0.0.0)
Idle Time Before Sending TCP Alive Packet	4 (×10 + 10 sec)
TCP Inactivity Time Before Disconnect	0 (Disable)
Silence Time	0 (Disable)
Multiple Connections	Disabled
COM1 — Serial Interface	RS-232
Baud Rate	115200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None
Empty Serial Buffer When TCP Connection Established	Yes
Sync DTR signal with TCP connection	No
Sync RTS signal with TCP connection	No
Data Packet Delimiter — Inter-character Time Gap	2 msec
COM Type Selection	RS232

COM2 Setup

Figure 3-10 shows the Devolinx COM2 (LINK2) setup screen. COM2 settings are identical to COM1 except for the Local Listening Port, which is 4661. On single-RF-input MC100 configurations, COM2 is reserved for future use; on dual-RF-input configurations, COM2 services the second RF input channel.

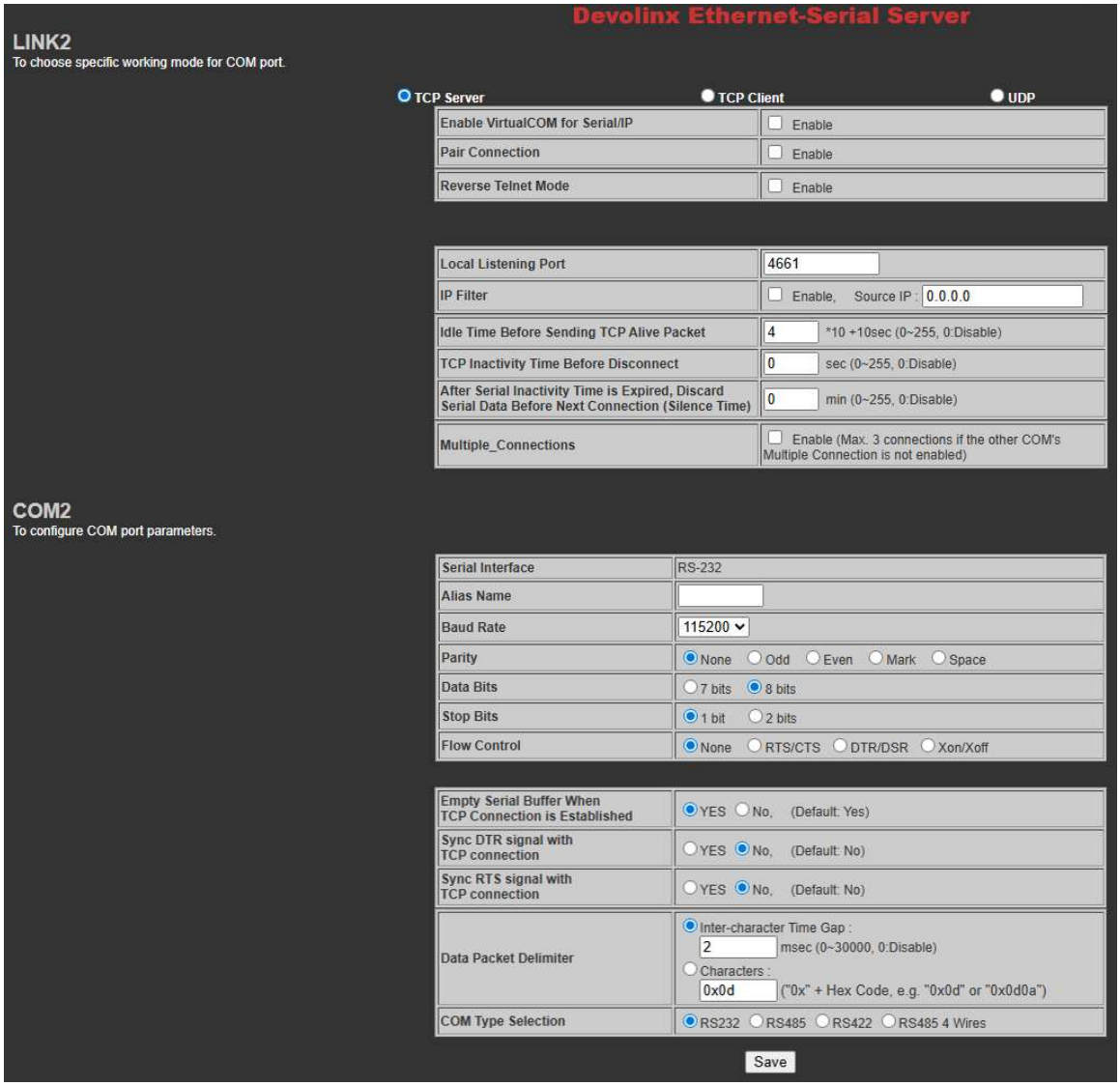


Figure 3-10
Devolinx COM2 (LINK2) Setup Screen

Parameter	Setting
LINK2 — Working Mode	TCP Server
Enable VirtualCOM for Serial/IP	Disabled
Pair Connection	Disabled
Reverse Telnet Mode	Disabled
Local Listening Port	4661
IP Filter	Disabled (Source IP 0.0.0.0)
Idle Time Before Sending TCP Alive Packet	4 (×10 + 10 sec)
TCP Inactivity Time Before Disconnect	0 (Disable)
Silence Time	0 (Disable)
Multiple Connections	Disabled
COM2 — Serial Interface	RS-232
Baud Rate	115200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None
Empty Serial Buffer When TCP Connection Established	Yes
Sync DTR signal with TCP connection	No
Sync RTS signal with TCP connection	No
Data Packet Delimiter — Inter-character Time Gap	2 msec
COM Type Selection	RS232

The steps for connecting and establishing a remote-control capability are as follows:

Step 1 – Connect an Ethernet cable to the RJ45 connector on the MC100 series rear panel. Connect the other end of the Ethernet cable to any commercially available router (network router). Connect the router to the remote PC that will be the remote server for controlling the MC100 series.

Step 2 – Install the SEMCO MCCS Network Software on the remote PC. The following two icons (Figure 3-11) will appear on the remote PC desktop:

Figure 3-11
Remote Control PC Desktop Icons

Step 3 – Launch the **Monitor** program by clicking on the **Shortcut to monitor** Icon. The screen shown in Figure 3-12 will pop up listing the IP addresses of all MC100 series devices that are connected via the network router to the remote PC. To configure each MC100 series multi-coupler network address, double click on each individual device's **IP Address** as shown in Figure 3-12. The corresponding **Dialog** window will appear.

Step 4 - In the **Dialog** window, check the **Auto IP** address. When **Auto IP** is selected, the network router automatically assigns an IP address, GateWay and Mask to the device. These can also be entered manually if **Auto IP** is not selected. A **User ID** and **Password** can also be entered at this time if desired. Once the device has been configured, click on **Config Now** to program each device and store all of the settings. Write down these IP addresses for use in the next step.

Step 5 – Repeat this step for each MC100 series connected to the network and close the **Monitor** program.

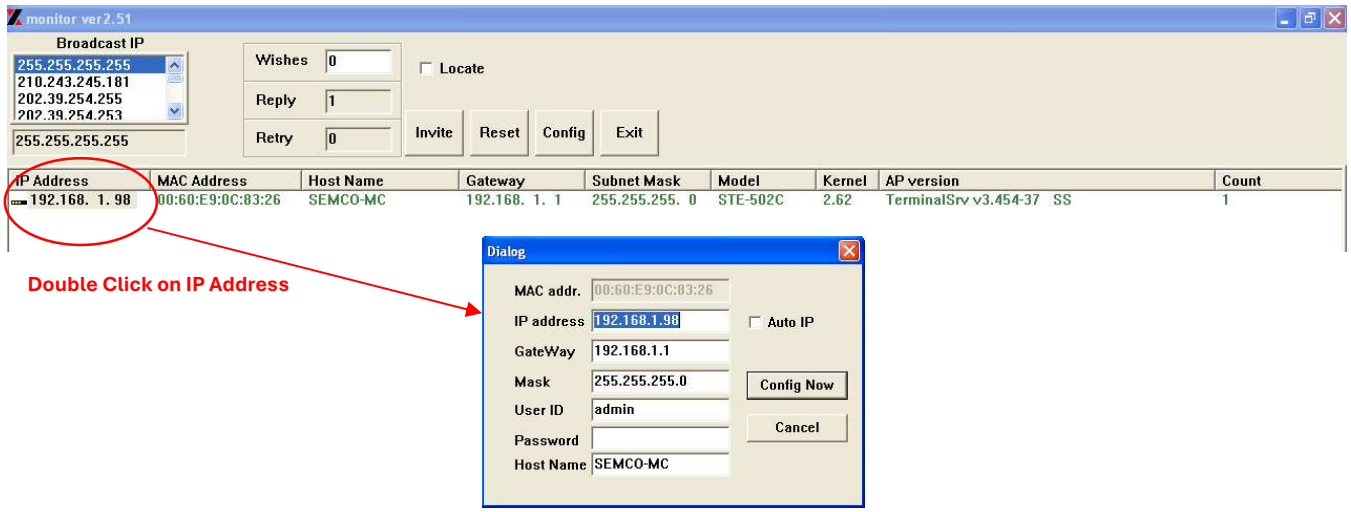


Figure 3-12
Configuring MC100 series IP Addresses

Step 6 – Launch the **SEMCO MCCS** program by clicking on the icon. The window shown in Figure 3-13 will pop up. Follow the instructions as shown in this window and type in the required information as shown in Figure 3-13 for each device connected to the network. As an example:

"System 1" is the name of the first system listed in the example. This can be whatever name is desired, with some character limitations.

The number after "System 1" is the number of output ports of each device.
Enter the IP address of each device as recorded from Steps 3 and 4. This will tell the MCCS network software which IP addresses to look for. Close the window and save the changes.

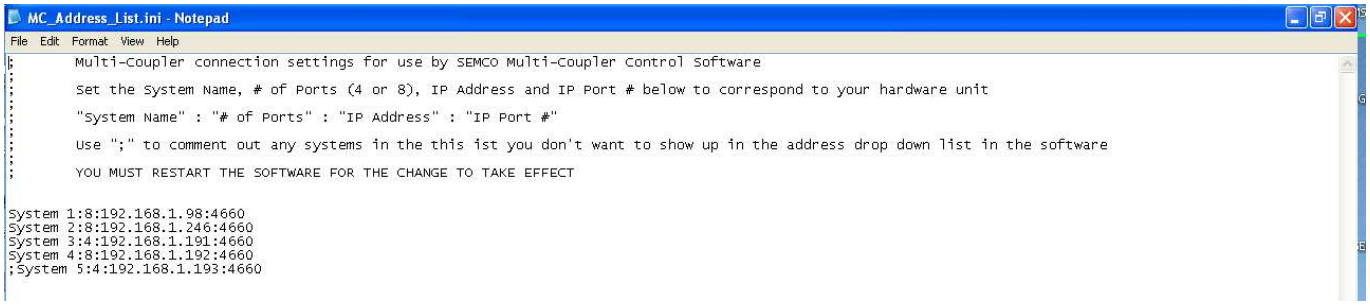


Figure 3-13
Configuring the SEMCO MCCS Network Software

Step 7 – Click on the **SEMCO MCCS** Icon to launch the remote network software. The software control panel depicted in Figure 3-14 will appear.

As shown in Figure 3-14, there are 3 controls per channel:

Mode – A pull-down menu for selection of desired frequency (**Mode**) band

Level – A slide bar allowing for +/-5 dB gain adjust

Unity Gain – an active button that, when clicked, will reset each channel to **Unity Gain** (turns green). It will also indicate **Unity Gain** (turn green) using the slide bar.

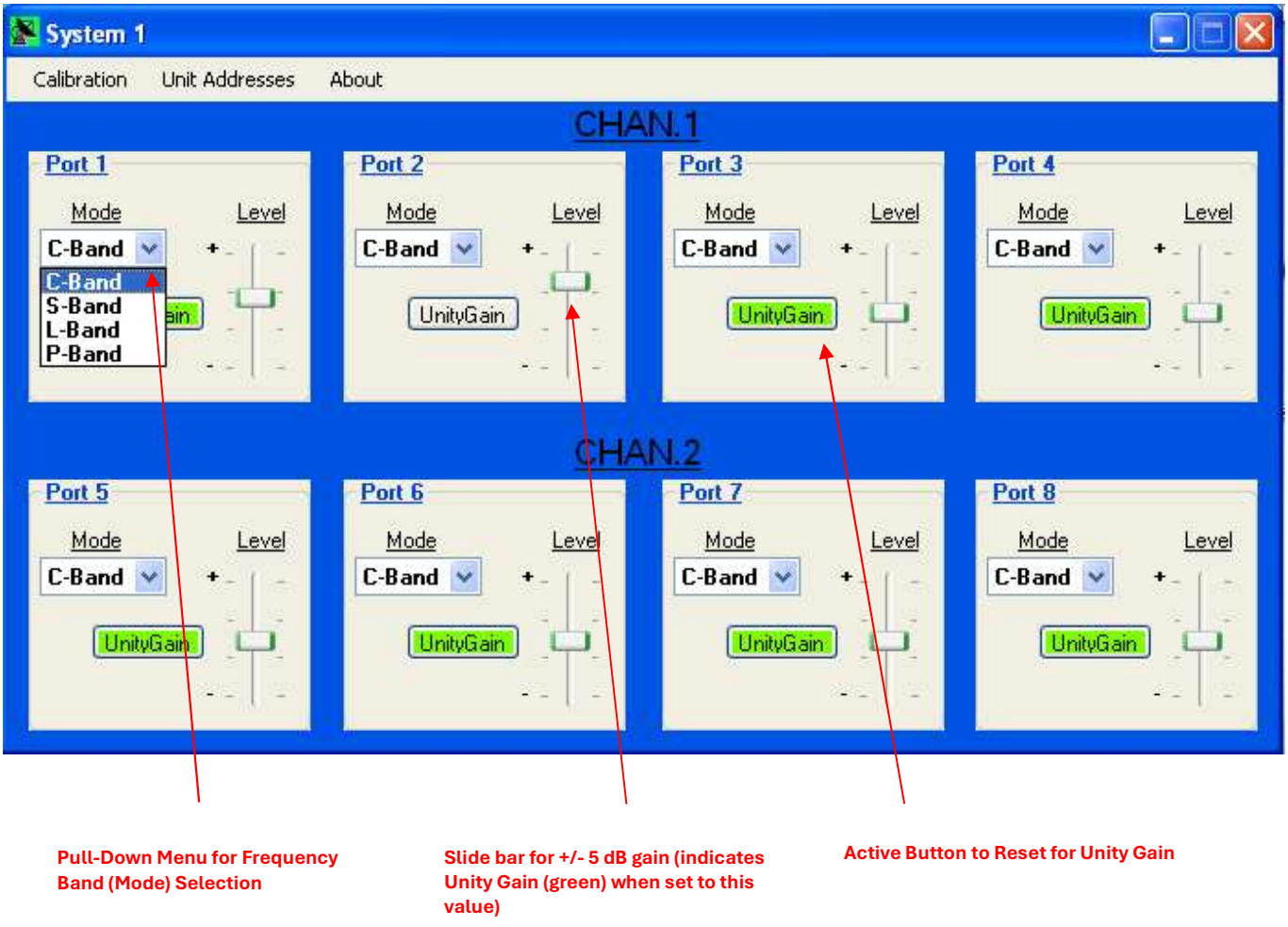


Figure 3-14
Remote Software Control Panel Showing Control Functions

3.3.1. MCCS GUI Toolbar Selections

The MCCS GUI provides the user with the following selections on the Tool bar:

A. **Calibration**
B. **Unit Addresses**
C. **About**

3.3.1.1. Calibration Screens

The MC100 series can be more precisely calibrated per frequency band (**Mode**) as required to optimize balanced output signal levels between all output ports. This is accomplished by the following procedure.

Step 1 - Click **Calibration** on the Toolbar. The **Select Port and Mode** calibration screen (**Step 1**) shown in Figure 3-15 will pop up.

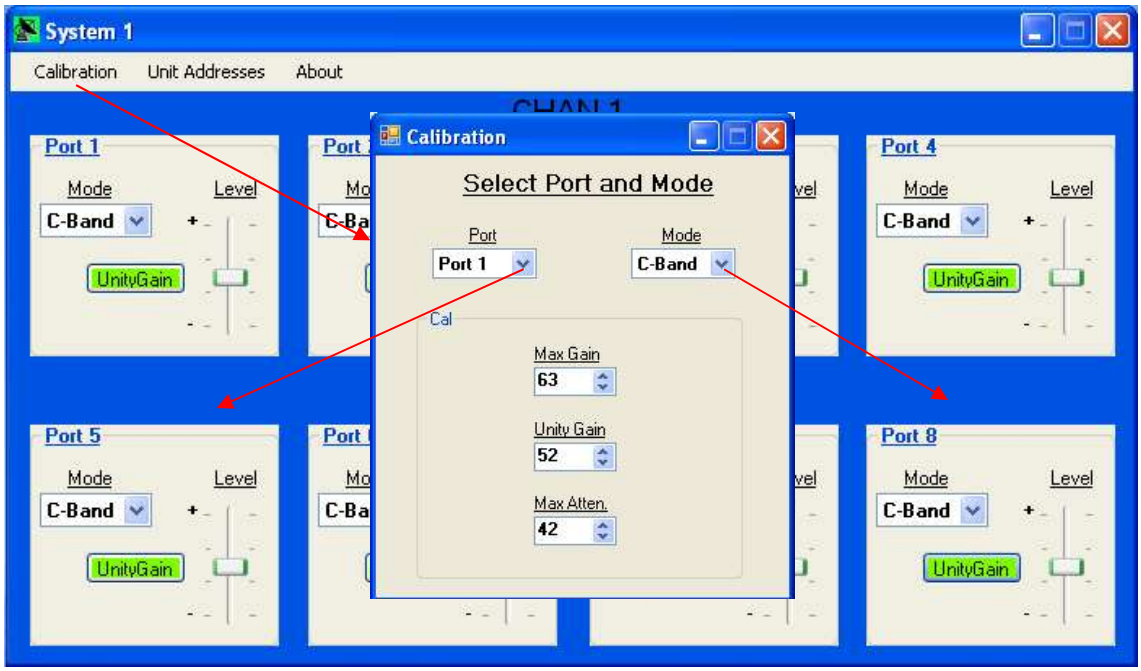


Figure 3-15
Calibration Screens

Step 2 - Inject a calibrated RF signal level at the mid-point frequency band of interest into CH1 RF Input. From the **Port** Pull-Down menu (Figure 3-15 **Step 2**), select the RF output port to be calibrated and connect a Spectrum Analyzer or similar device capable of monitoring the RF output level to the selected output port.

Step 3 - From the **Mode** Pull-Down menu (Figure 3-15 **Step 3**), select the frequency band to be calibrated, corresponding to the frequency band of the RF signal level input.

Step 4 - Using the **Unity Gain** Up/Down (▲▼) keys, monitor the selected port RF output level and adjust **Unity Gain** for the same RF output level as the calibrated RF input.

Step 5 - Using the **Max Gain** Up/Down (▲▼) keys, increase the output on the Spectrum Analyzer (or similar device being used) by +5 dB. The **Max Gain** readout should be 5 dB +/- 0.5 dB higher than the **Unity Gain** value.

Step 6 - Using the **Max Atten.** Up/Down (▲▼) keys, decrease the output on the Spectrum Analyzer (or similar device being used) by -5 dB. The **Max Atten.** readout should be 5 dB +/- 0.5 dB lower than the **Unity Gain** value.

Step 7 - Repeat Steps 2 thru 6 for all other output ports and frequency (**Mode**) bands.

3.3.1.2. Unit Addresses

Selecting **Unit Addresses** on the Toolbar provides for a display of the information as shown in Figure 3-16. This information lists all device IP Addresses on the network and also provides the ability to edit this list.

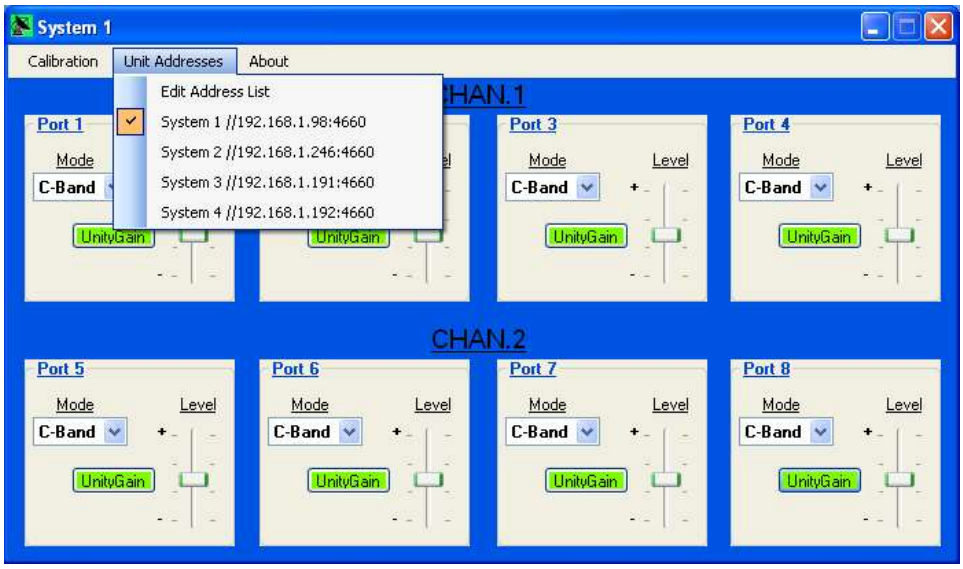


Figure 3-16
Unit Addresses Window

3.3.1.3. About

Selecting **About** on the Toolbar provides information about both the hardware and software configuration of the device, as well as a log of network events (Figure 3-17).

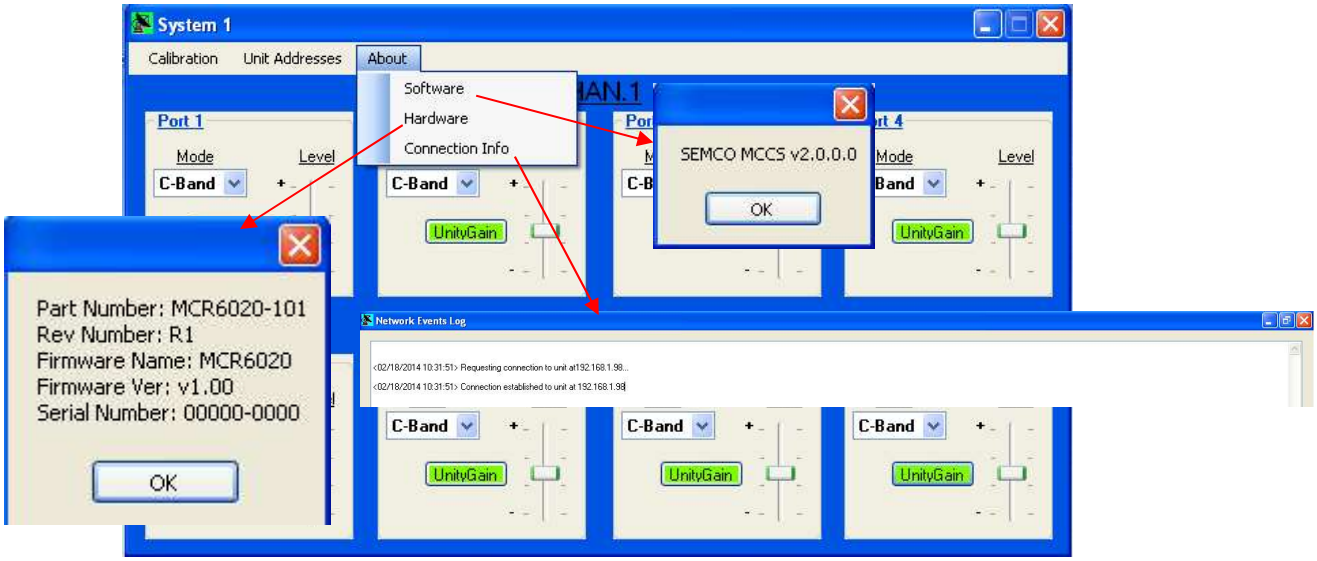


Figure 3-17
About Windows