



LS-28M Modular Receiver Products

Field Support Manual



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1 Introduction

1.1 General

The following document contains field support information for the Lumistar LS-28M multi-mode modular receiver product line. The intent is to familiarize the user with connecting the device to a network, performing firmware updates, and performing updates to device licensing.

This document is not intended to educate the user on the communications messaging of the LS-28-DRSM, the use of the primary LS-28-DRSM application software, or the physical interfaces of the device. Consult the related product documents listed in section 1.3 below which cover topics not discussed within this document.

1.2 Document Outline

This document contains the following sections:

- Section 1 provides a document overview
- Section 2 provides information performing network communications setup, firewall provisions and USB connectivity
- Section 3 provides information on updating device firmware
- Section 4 provides information on updating device licensing
- Section 5 provides information on running encrypted command files

1.3 List of Referenced Documents

A number of documents related to the LS-28-DRSM product line have been created. A list of these documents follows:

- Lumistar LS-28M Interface Control Document: (DOC-28M-01-ICD-06)
- Lumistar LS-28M Alternate Control Interface Document: (DOC-28M-01-ACI-02)
- Lumistar LS-28-DRSM User's Manual (DOC-28M-01-USM-06)

Consult the web site for the most recent release of all related product documentation.

2 Network Interfaces and Firewall Procedures

2.1 Network Interface Setup

The LS-28-DRSM is delivered configured with a **Static IP Address**. The default address is **192.168.16.220**. If the user desires that the unit be switched to a different static IP address or to Dynamic Host Configuration Protocol (DHCP) mode, a controlling host set to the same sub-net mask will be required so the setup can be completed.

Configuring hosts communication between various network configurations is operating system dependent and will be generally outlined below. Slight operating system variations in functional screens may exist and will be up to the user to interpret. An example of how to configure a common Windows network Host Controller to operate in either Static mode which is necessary to change the delivered mode of operation is described in section 2.1.1. An example of how to set a Windows network host to DHCP mode follows in section 2.1.1.1.

**Information:**

Network configuration, connection and security typically require consent and access privileges from a network system administrator. The sections that follow attempt to describe the necessary steps that need to be taken in a rather "Open" network environment. Specific requirements in terms of network security and connection routing are the user's responsibility. Please contact your system administrator before going further.

2.1.1 Modification of a Windows Host controller to Static IP mode

To modify the controlling host's network configuration to static IP mode, perform the following steps:

Step 1: Connect the LS-28-DRSM to the target host machine either directly with a Ethernet crossover cable or by connecting both the device and the host to an Ethernet switch using standard Ethernet cables.

Step 2: On the target host application machine, access the Windows Control Panel.

Step 3: From Windows Control Panel, select the Network and Sharing Center.

Step 4: From Network and Sharing Center, select the "Change adapter settings" option from the left-hand menu. See [Figure 2-1](#).

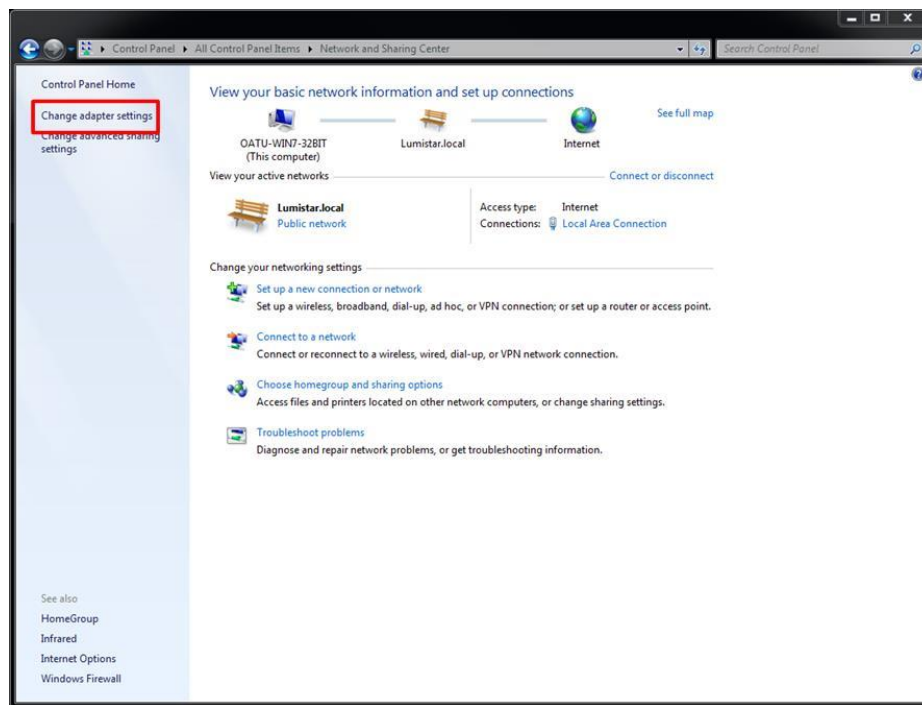


Figure 2-1 Windows Network and Sharing Page

Step 5: The Network Connections window shows the available connections the target host can use. Right-click on the local area connection attached to the LS-28-DRSM and select "Properties". See Figure 2-2.

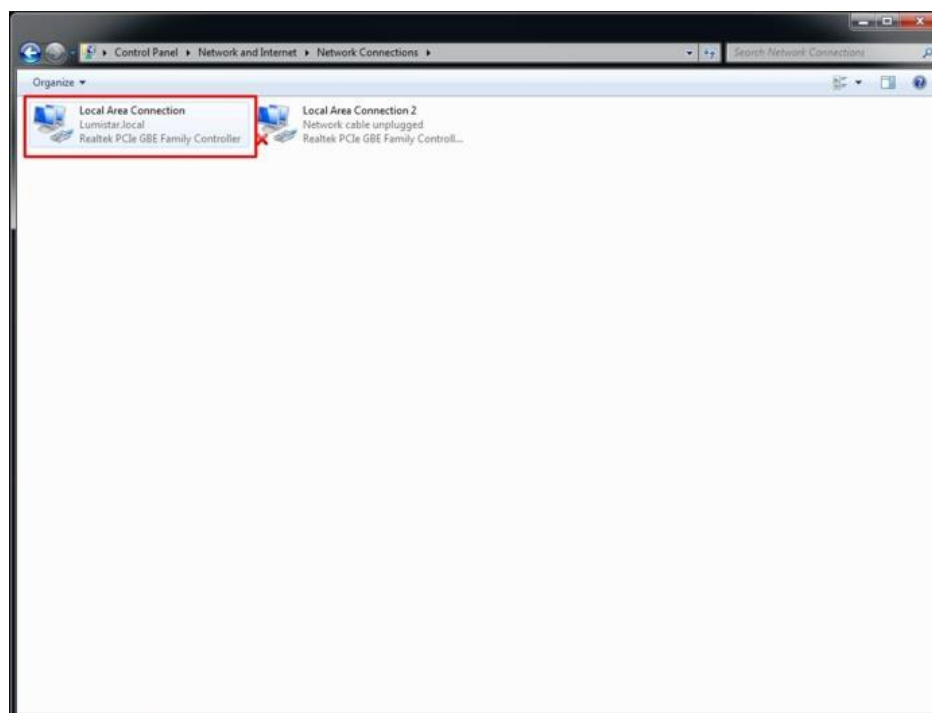


Figure 2-2 Windows Network Connections Page

Step 6: From the Local Area connection Properties window, double-click on "Internet Protocol Version 4 (TCP/IPv4)". See [Figure 2-3](#).

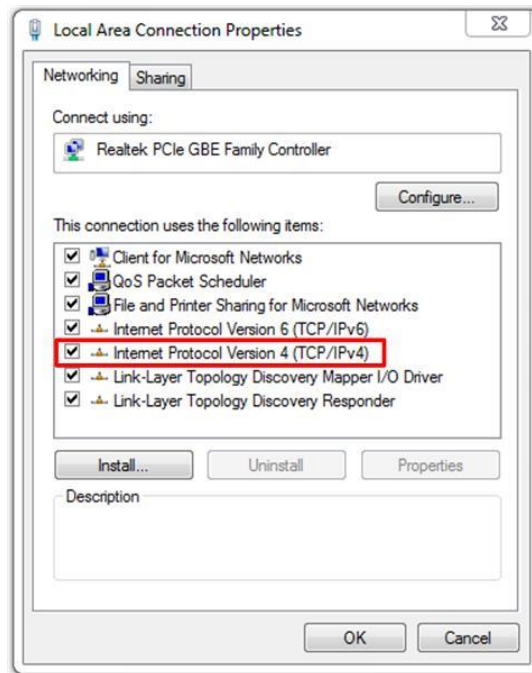


Figure 2-3 Windows Network Connections properties page

Step 7: To set the unit to a static IP address, select the "Use the following IP address:" option. Then enter the desired IP address in the designated field. A suggestion is to use the IP address 192.168.16.200 as shown below. Once the IP address is filled, the Subnet mask field will automatically populate. See [Figure 2-4](#).



Warning:

The static IP address of the host machine cannot be set identically to any device on the connected network.

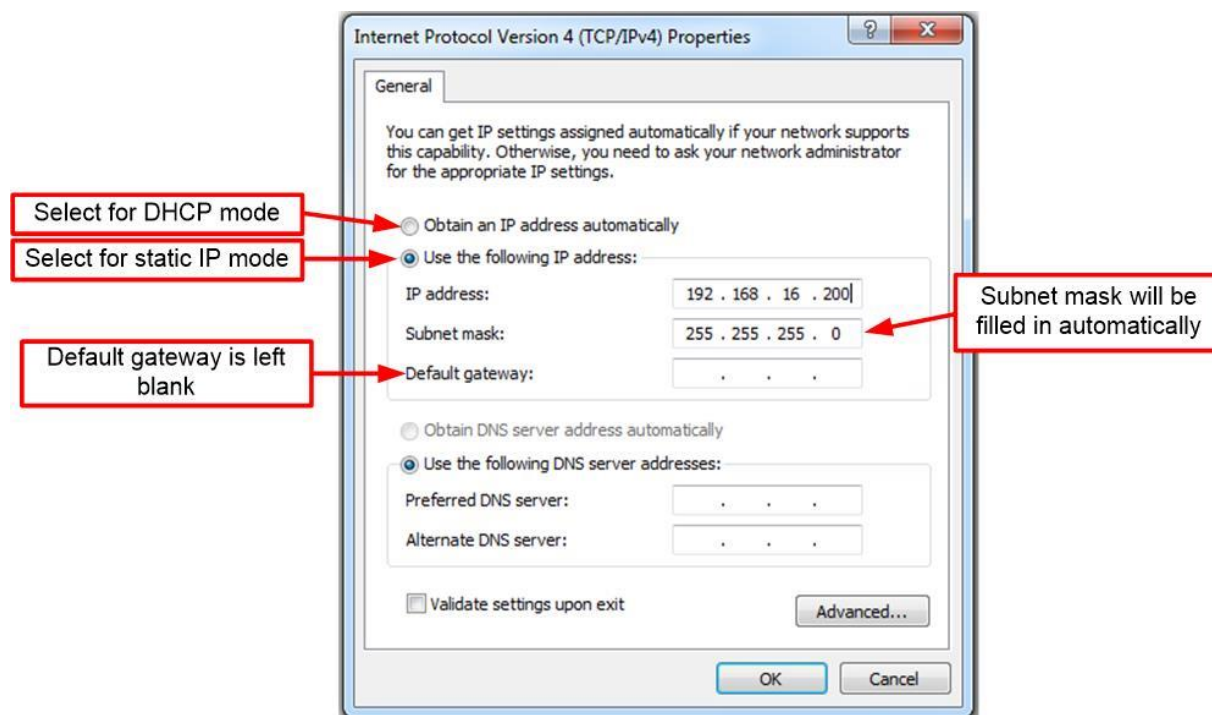


Figure 2-4 Windows Network Connections IPv4 properties page –Static IP

Step 8: From the Internet Protocol Version 4 (TCP/IPv4) Properties window, click "OK".

Step 9: From the Local Area Connection Properties window, click "OK".

2.1.1.1 Modification of a Windows Host controller to DHCP Mode

To modify the unit to operate under DHCP network configuration, perform the following steps:

Step 1: Connect the target host to a DHCP enabled network.

Step 2: On the target host application machine, access the Windows Control Panel.

Step 3: From Windows Control Panel, select the Network and Sharing Center.

Step 4: From Network and Sharing Center, select the "Change adapter settings" option from the left-hand menu. See [Figure 2-1](#).

Step 5: The Network Connections window shows the available connections the target host can use. Right-click on the local area connection connected to the DHCP enabled network and select "Properties". See [figure 3-3](#).

Step 6: From the Local Area connection Properties window, double-click on "Internet Protocol Version 4 (TCP/IPv4)". See [Figure 2-3](#).

Step 7: To set the unit to DHCP mode, select the "Obtain an IP address automatically" option. See [Figure 2-5](#).

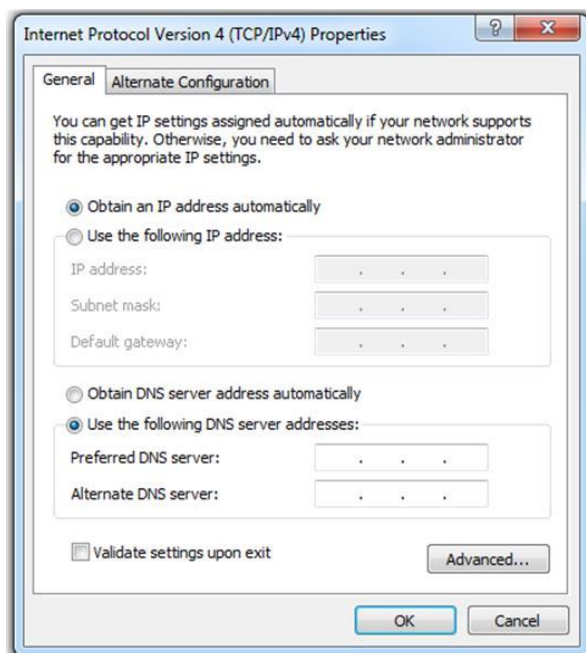


Figure 2-5 Windows Network Connections IPv4 properties page - DHCP

Step 7: From the Internet Protocol Version 4 (TCP/IPv4) Properties window, click "OK".

Step 8: From the Local Area Connection Properties window, click "OK".

2.1.2 Modification of the network configuration from the factory defaults

To modify the LS-28-DRSM to any other network configuration from the factory set static IP address, perform the following steps:

Step 1: Perform the steps to create a Windows network host controller with subnet mask access to 192.168.16.220 as described in section 2.1.1.

Step 2: Interconnect a standard RJ45 network cable between the Windows network host and the LS-28-DRSM unit.



Information:

On network hosts which contain 1000Mbps (1Gbps) Ethernet connections, direct RJ45 cabling is possible due to a feature included with all "Fast Ethernet" controllers called MDI-X (Medium Dependent Interface - Crossover) which provides the necessary auto-detection signal support.



Caution:

If the network host contains a 100Mbps network interface, **who use is strongly discouraged**, cabling between the host and the LS-28-DRSM will likely require the use of a cross-over style Ethernet cable. Consult the manufacturer of the host device for the presence of MDI-X capabilities in the Ethernet adapter.

Step 3: Ensure that both the host platform and the LS-28-DRSM are powered and allow the unit to enter the fully operational state which is indicated by both LEDS flashing Green at a 1Hz rate.

Step 4: On a host machine connected to the same network as the LS-28-DRSM, launch a web browser window and enter the IP address in the address bar of the browser. The factory default IP address is **192.168.16.220**. This will result in web browser page display similar to the one shown in [Figure 2-6](#). The tab provides network information to the user (as indicated) and the ability to administrative access controls. To set an administrative password, enter a password in the indicated box, select the ENABLE check box and click the UPDATE button at the bottom of the page.

**Warning:**

If the administrator password for the LS-28-DRSM is set and then forgotten, the unit will require return to the Lumistar factory for repair.

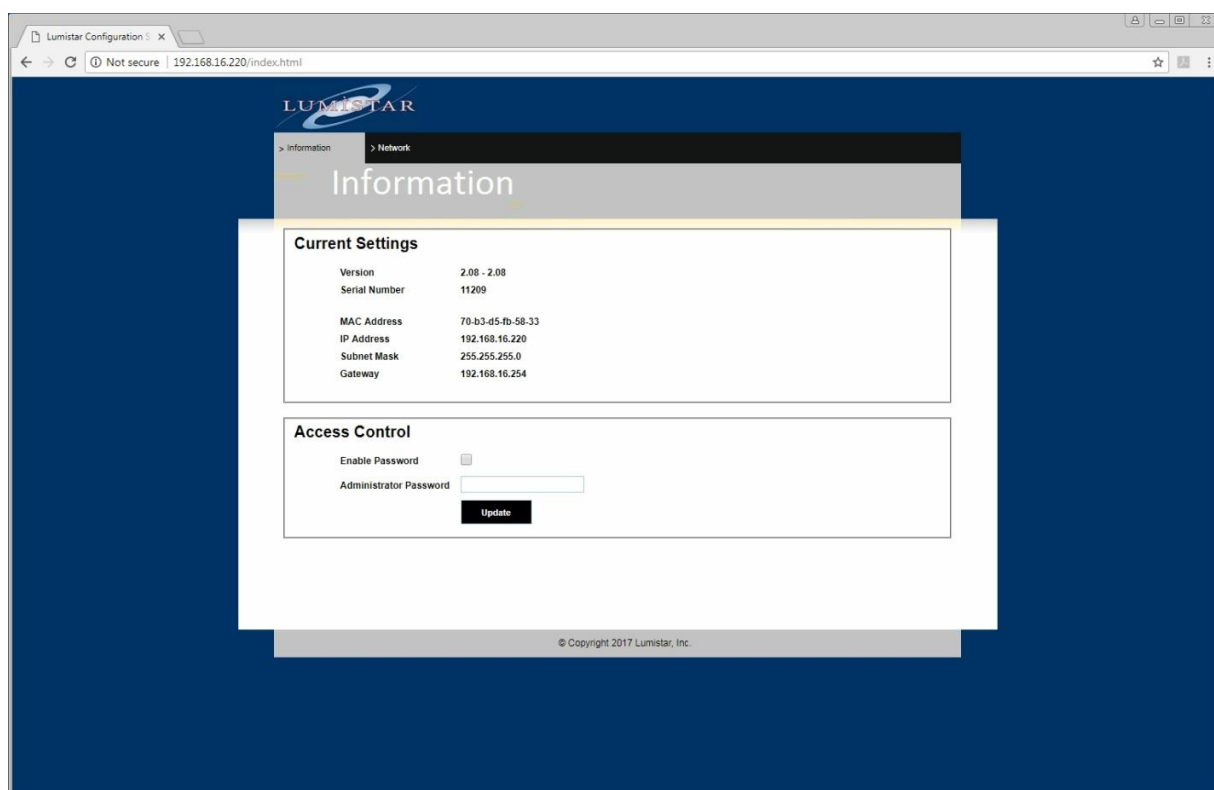


Figure 2-6 LS-28-DRSM Network Setup: Web Browser Information Setup Tab

Step 5: To change any of a number of other network parameters, select the NETWORK tab on the web browser page. This will bring up web page similar to the one shown in [Figure 2-7](#).

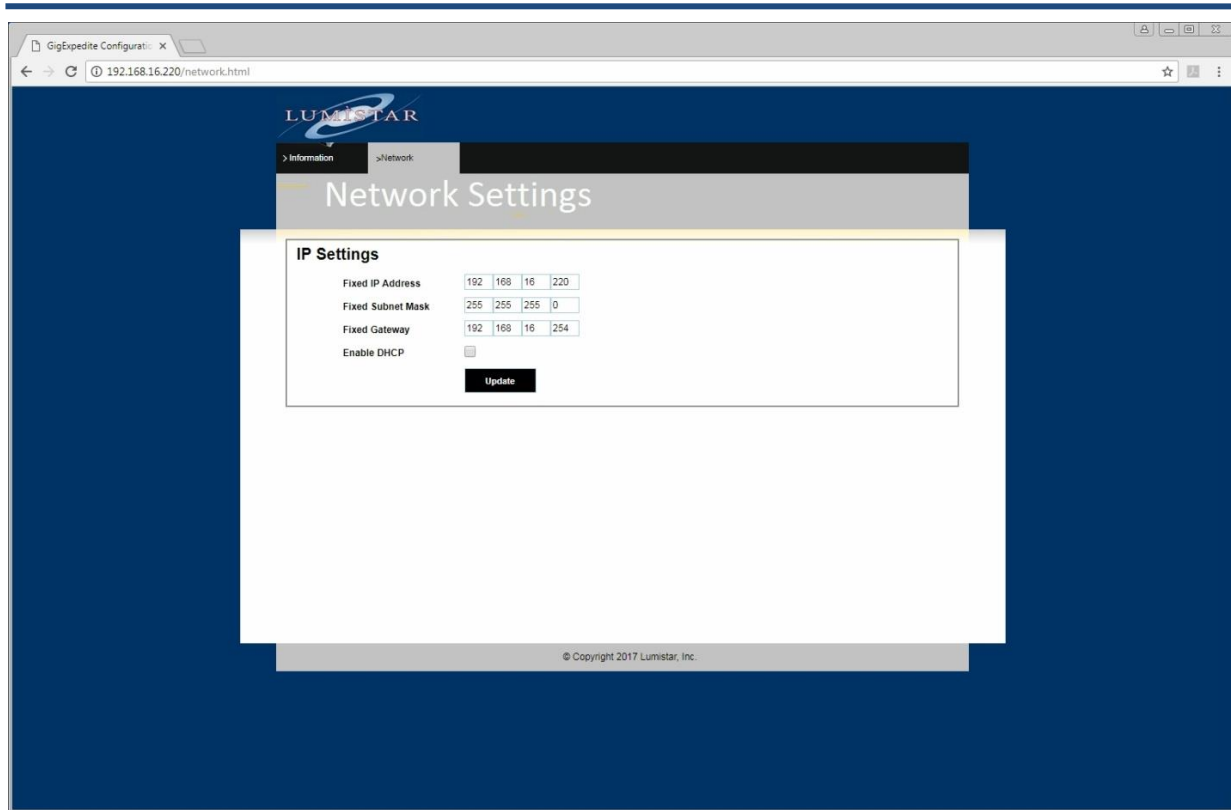


Figure 2-7 LS-28-DRSM Network Setup: Web Browser Network Setup Tab

Settings can be entered in the provided spaces and then updated by clicking the UPDATE button.

The DHCP checkbox allows the DHCP mode to be enabled and disabled. If the DHCP mode is enabled, the fixed IP address fields will be ignored and addressing will be assigned by another controlling network source. **If no such host is available to assign the unit an address, all network functions will be prohibited.**

Deselecting the DHCP box will place the device in static IP mode using the address field setting set on this tab. Be sure to press the UPDATE button prior to closing this page to make the settings active. Settings will be retained between power cycles.

2.1.3 Modification of Windows Firewall Settings

The supplied user application requires access to several ports as well as the ability to receive UDP packets. Primary Windows Firewall settings, as a rule, allow the TCP connections and block the UDP transactions. To allow the standard Windows 7 or Windows 10 operating system installs to receive UDP transactions, firewall settings typically need to be altered.

**Caution:**

Without the proper firewall privileges for the UDP transactions, no graphic instrumentation displays will be available and no streaming data will be provided by the LS-28-DRSM

There are two means of modifying the firewall settings: using an application provided by Lumistar, or by setting the system firewall settings manually. To simplify the firewall requirements, Lumistar provides an application to open the firewall for the necessary functions. You can find the **OpenFirewall(ADMIN).exe** file in the main application installation directory. To run this application, you will need to have administrative privileges on the machine containing the application installation. Consult your IT administration personnel if you do not. To launch the application in administrative mode, right-click the application title in the LS28 installation directory and select the "Run As Administrator" from the Windows menu. Upon completion, the application will provide a note with status on its success.

To configure the firewall settings manually, perform the following steps:

Step 1: On the target host application machine, access the Windows Control Panel.

Step 2: From Windows Control Panel, select the Windows Firewall control.

Step 3: From Windows Firewall control, select the "Advanced Settings" option from the left-hand menu. See [Figure 2-8](#).

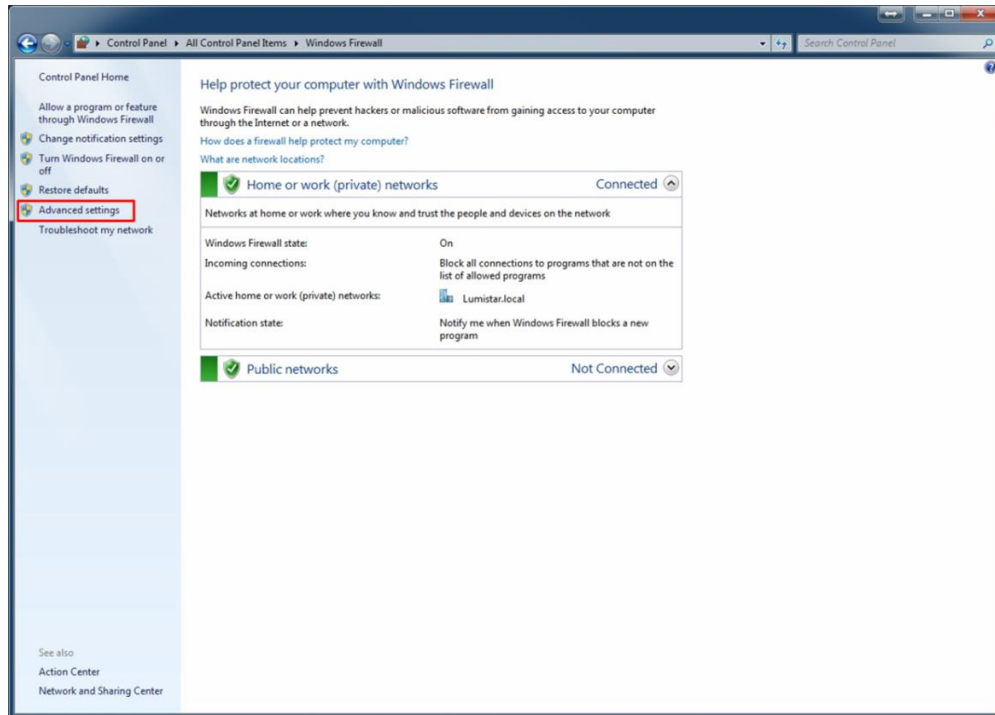


Figure 2-8 Windows Firewall – Advanced Setting Tab

Step 4: From the window shown in Figure 2-9, select the “Inbound Rules” from the left-hand menu.

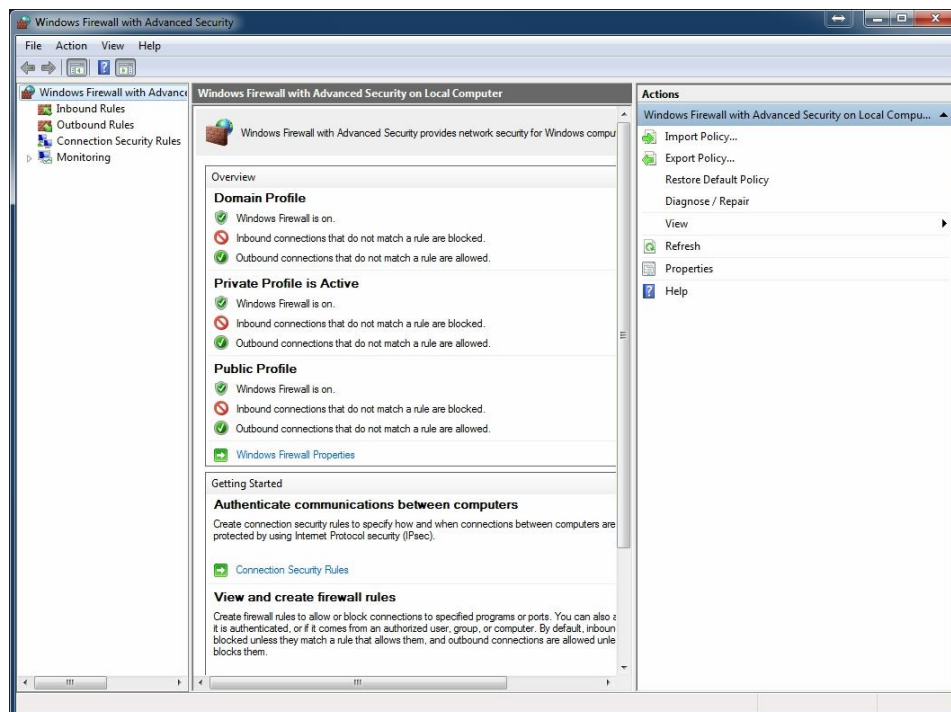


Figure 2-9 Windows Firewall – Advanced Security Inbound Rules

Step 5: From the window below, select the “New Rule” option under the ACTIONS window pane on the right. Refer to Figure 2-10.

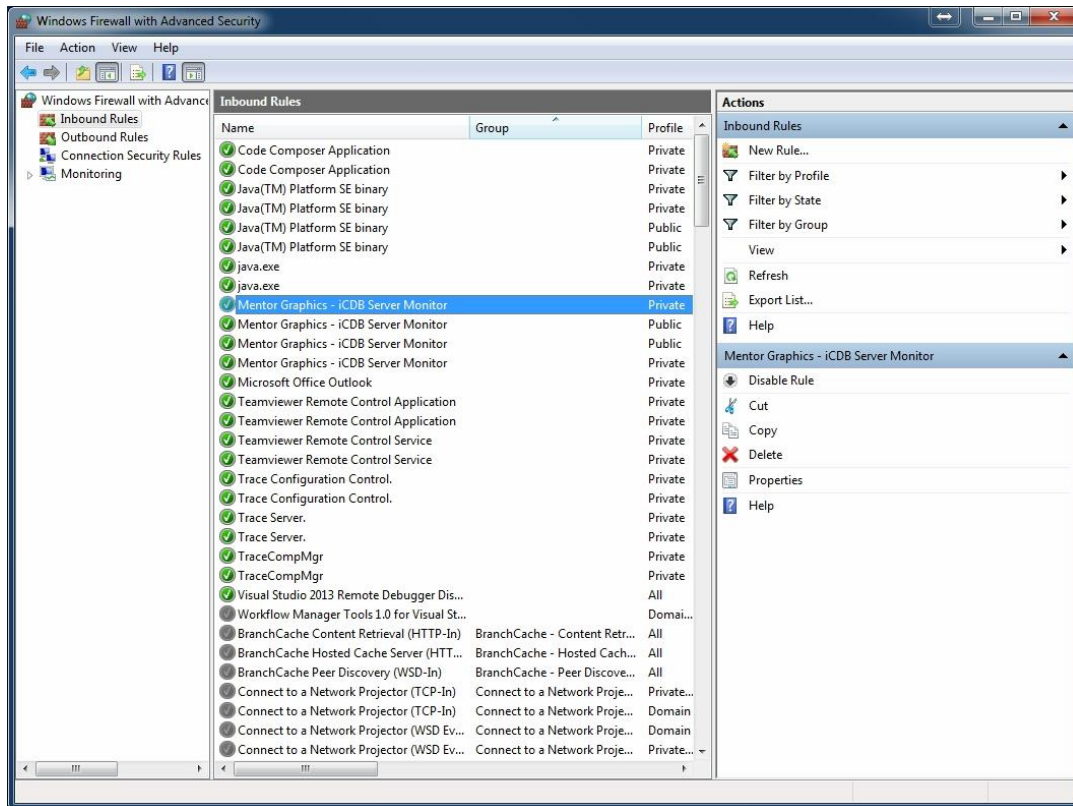


Figure 2-10 Windows Firewall – Advanced Security New Rule

Step 6: The “New Rule” process will begin with the RULE TYPE menu as shown in Figure 2-11.

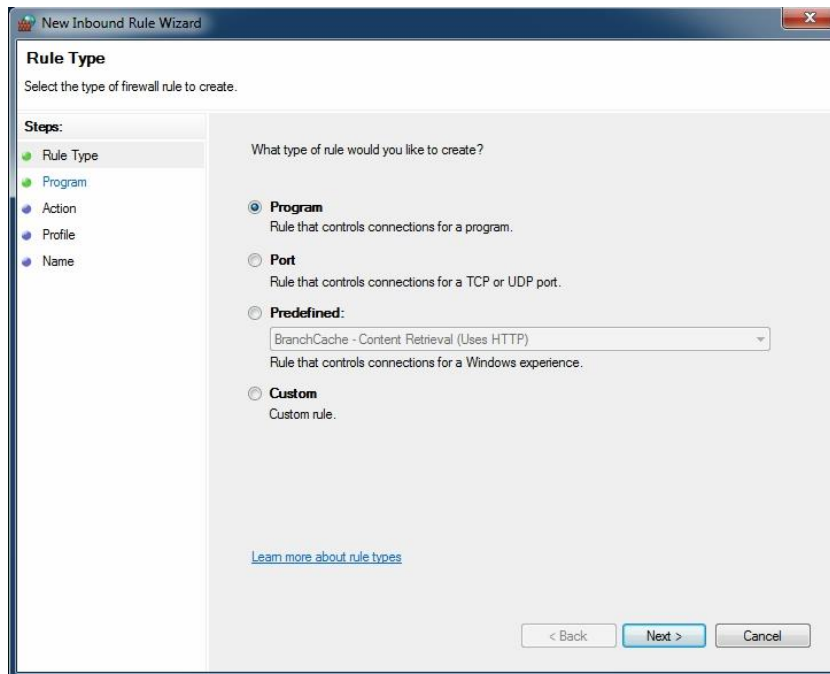


Figure 2-11 Windows Firewall – Advanced Security New Rule: Type

Step 7: The “New Rule” process will continue with the PROGRAM menu, browse to the route of the LS-28-DRSM installation and select the EXE file that is found there. The application will typically be located as shown in the following Figure 2-12.

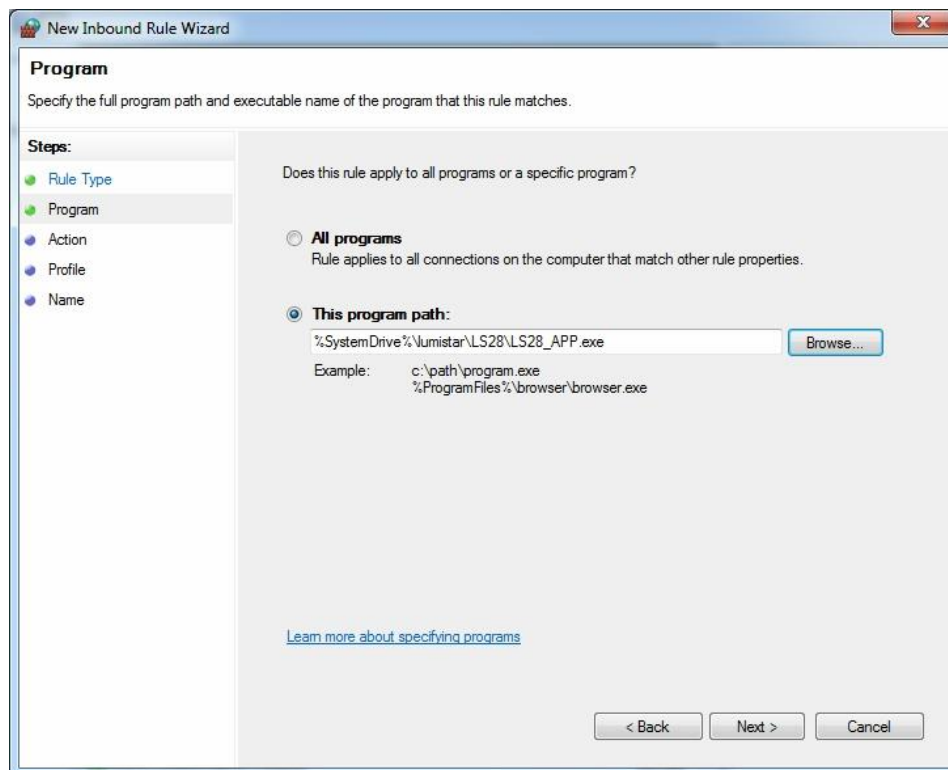


Figure 2-12 Windows Firewall – Advanced Security New Rule: Program

Step 8: On the ACTION menu, select "Allow the connection". Consult [Figure 2-13](#).

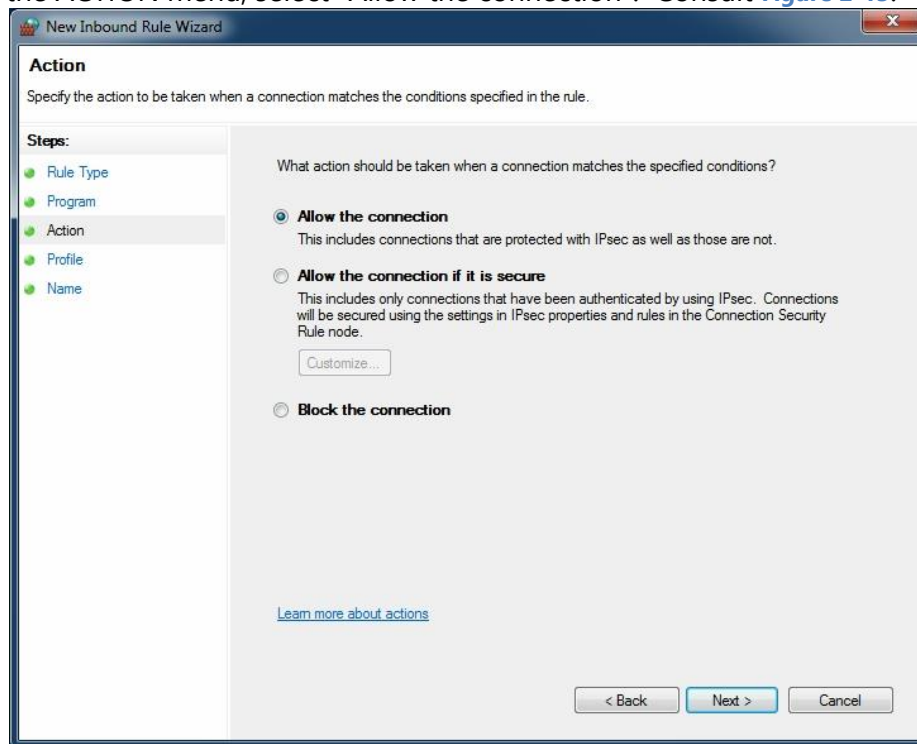


Figure 2-13 Windows Firewall – Advanced Security New Rule: Allow Connections

Step 9: On the PROFILE menu, select the domains that the rule will apply to as shown in [Figure 2-14](#).

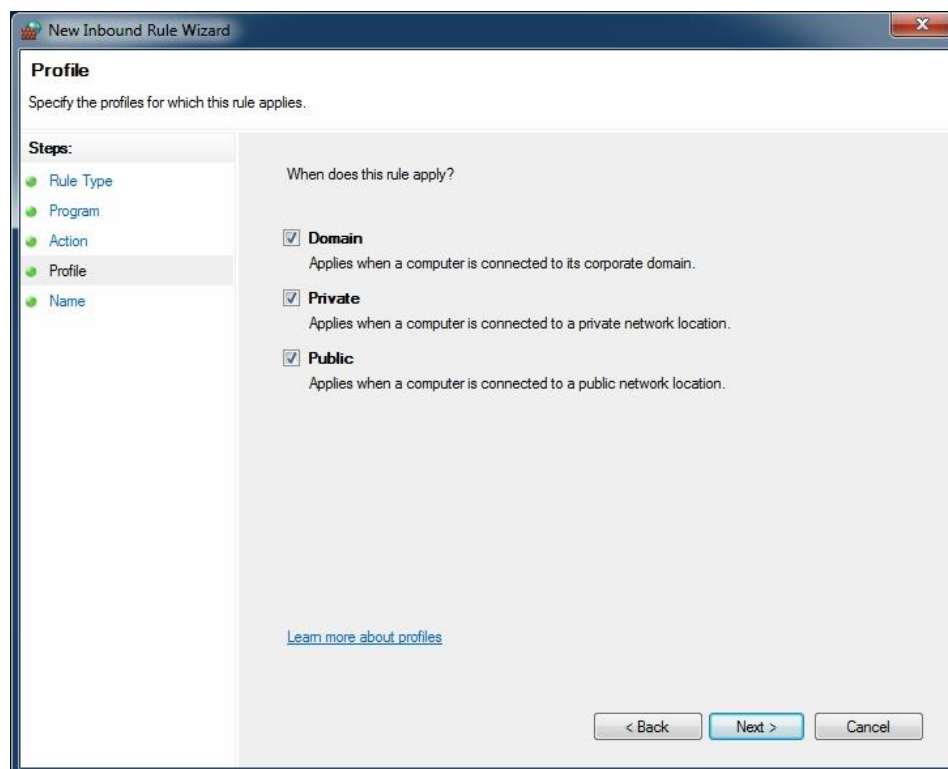


Figure 2-14 Windows Firewall – Advanced Security New Rule: Domains

Step 10: Finally, name the rule for easy identification and select the FINISH button as shown in Figure 2-15.

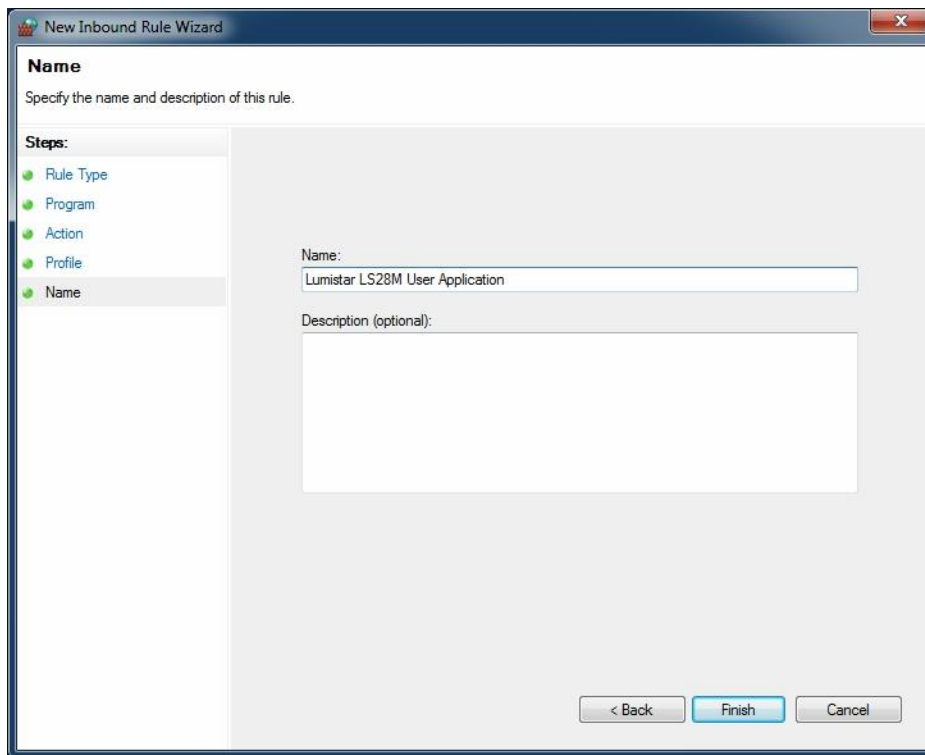


Figure 2-15 Windows Firewall – Advanced Security New Rule: Name

2.1.4 Establishing USB Connectivity

USB 2.0 connectivity may be necessary for device firmware testing and some versions of updates. USB connections are provide to the LS-28-DRSM devices through USB-B Female ports that reside on the rear IO panel of 19-inch industrial rack mount units or USB-B female pigtailed located on the LS-28-M P12 cable included with the desktop chassis deliveries.

Most Windows operating systems beyond Windows 7 contain a default driver that can be used to communicate with the LS-28-DRSM. However, some limited version of more modern OS distributions as well as older distributions of the Windows OS may not include the default driver installation. For these cases, the distribution of the main user application [LS28_App.exe](#) contains driver installation software for the USB interface devices used in the LS-28-DRSM design. Included in the C:\lumistar\LS28M\DriverTools directory is an installation application: [PL2303_Prolific_DriverInstaller_v1190.exe](#). If the OS installation does not automatically recognize the LS-28-DRSM USB port, launch this installation. Once the driver installation is complete, it may be necessary to remove the USB plug from the host PC and reinstall it to engage the “plug-n-play” auto discovery process within Windows.

The driver, once installed on the host platform, will appear in the Windows device manager. **Error! Reference source not found.** illustrates a typical installation. COM port assigned numbers will be dependent upon other COM ports already present on the host. The [Prolific USB-to-Serial Comm Port](#) tag

will identify the installed port assignment. It will be necessary to know the proper port assignment number to operate the update utility software in section 3 of this document.

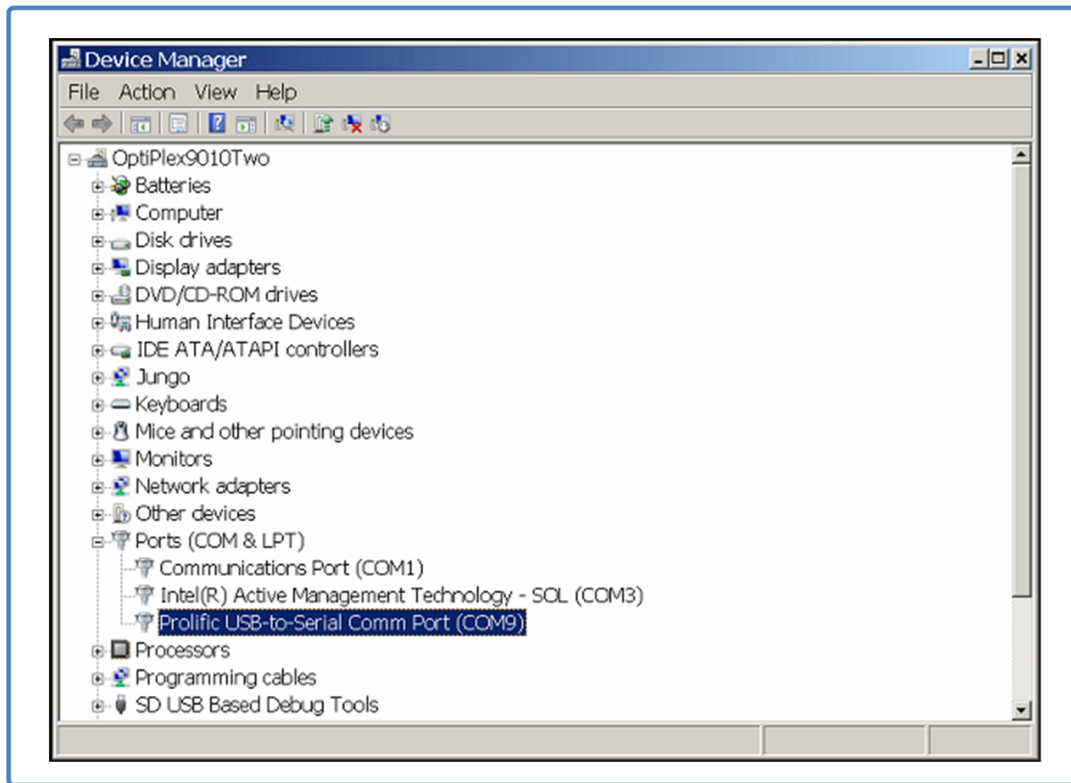


Figure 2-16 LS28M User Application – USB Prolific COM driver installation

3 Updating Device Firmware

The LS-28-DRSM design is a hybrid "Software Defined Radio" (SDR). This design allows the fundamental operations of the device to be modified or added too via "firmware" updates. It is possible to perform these modifications and enhancements without the need for the device to be physically returned to the factory.

The primary focus of updates is the firmware code installed in the two real-time processing engines: the calculation and control engine which is composed of two Digital Signal Processors (DSPs), and the real-time signal processing engine which is composed of a Field Programmable Gate Array (FPGA) with a multiple storage array. Some functional updates require the update of one of the processing engines, some require that both updates be performed. For devices that contain multiple "operational modes", updates for each in the FPGA processing engine array may be required.

Lumistar provides a utility specifically capable of performing updates to the real-time engines. This utility is distributed along with the distribution of the primary user application software, [LS28_App.exe](#). This user application automatically installs a copy of a utility named [LS28M.exe](#) in the following directory: C:\lumistar\LS28M\UserTools.

If you have received an update package from Lumistar Support group, it may include an update to the [LS28M.exe](#) update utility in instances where the existing install is too old. If this is the case, please utilize the provided utility. If the is no attached [LS28M.exe](#) utility in the update package, use the one included in the [LS28_App.exe](#) installation directory.

3.1 General LS28M.exe Utility Operations

This section details the general operations of the LS28M.exe update utility. Specific use of the utility to update either of the real-time processing engines will follow in related subsections.



Before embarking on firmware updates, there are some precautions and guidelines that must be clearly noted.

- 1.) IT IS POSSIBLE TO PERFORM FIELD UPDATES INCORRECTLY CAUSING THE UNIT TO BECOME NON-FUNCTIONAL, REQUIRING A RETURN OF THE UNIT TO THE FACTORY FOR REPAIR. PLEASE FOLLOW ALL INSTRUCTIONS CAREFULLY.**
- 2.) The update process can require a significant amount of time. DSP processor engine updates will require 3 minutes or more for each DSP processor. FPGA processing engine updates will require up to 17 minutes for each operational mode being updated. The update process can total more than 45 minutes. Allow for enough time to complete this task before starting the process.
- 3.) DO NOT REMOVE POWER DURING THE UPDATE PROCESS. Depending on the state of the update process at the time of power loss, the only corrective measures that can be performed to repair this would include returning the unit to the factory for repair.
- 4.) There are cases where performing field updates of firmware require special instructions in addition to the ones being detailed in this document. Be sure to follow all instructions provided by Lumistar Support.

- 5.) Power cycling is required for DSP firmware updates. This typically means a physical presence near the system being updated.
- 6.) Updating the unit firmware will require a host PC running any version of Windows Operating system of Windows 7 or later. This host PC will need a RJ45 Ethernet connection.
- 7.) Connect the RJ45 Ethernet interface to a switched network which allows access for the updating host PC or connect the RJ 45 cable directly between the unit being updated and the host PC. Networking access will be required. See section 2.1.2 (and potentially 2.1.3) of this manual to establish this connection.
- 8.) Due the criticality of these types of updates, the host PC should ensure the following:
 - a. Ensure that the updating Host PC does not have a pending system reboot
 - b. Ensure that the updating Host PC is not presently downloading Windows OS updates and that none are scheduled for at least two hours
 - c. Ensure that the updating Host PC is not enabled for power-down or sleep modes
 - d. If possible, disable host PC Malware/Antivirus/Firewall software applications that may interfere with the update process
 - e. It is optimal to ensure that the Host PC has minimal active applications during the update process
 - f. Once the process has begun, it is best not to move the mouse as to lose "Window Focus" on the **LS28M.exe** application.
 - g. Operate the **LS28M.exe** utility in "Administrator" mode within the OS
 - h. Do not operate the unit being modified with the primary software application (LS28_App) while the firmware updates are being performed

3.1.1 DSP Firmware Updates

DSP firmware updates affect critical functionality within the unit being modified. Please read these warnings and cautions and follow the instructions closely.

	<p>!!!!!!!!!!!!!!!!!!!! CRITICAL Warning !!!!!!!!!!!!!!!!!!!!!</p> <p>Updating the DSP firmware incorrectly can result in a non-functional unit that must be returned to the factory for repair.</p> <p>FOLLOW ALL INSTRUCTIONS PRECISELY</p>	
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- 1.) Updates to the two internal digital signal processors are always done as a pair. It is never the case that one DSP processor will be updated and the other is not. At the end of the update process, the firmware versions for both DSPs will match.
- 2.) **Depending on the version number of the existing DSP firmware, field upgrades may not be possible. This possibility is remote but can be the case. Provide Lumistar support with existing firmware version information so that field update capabilities can be assessed.**

**Warning:**

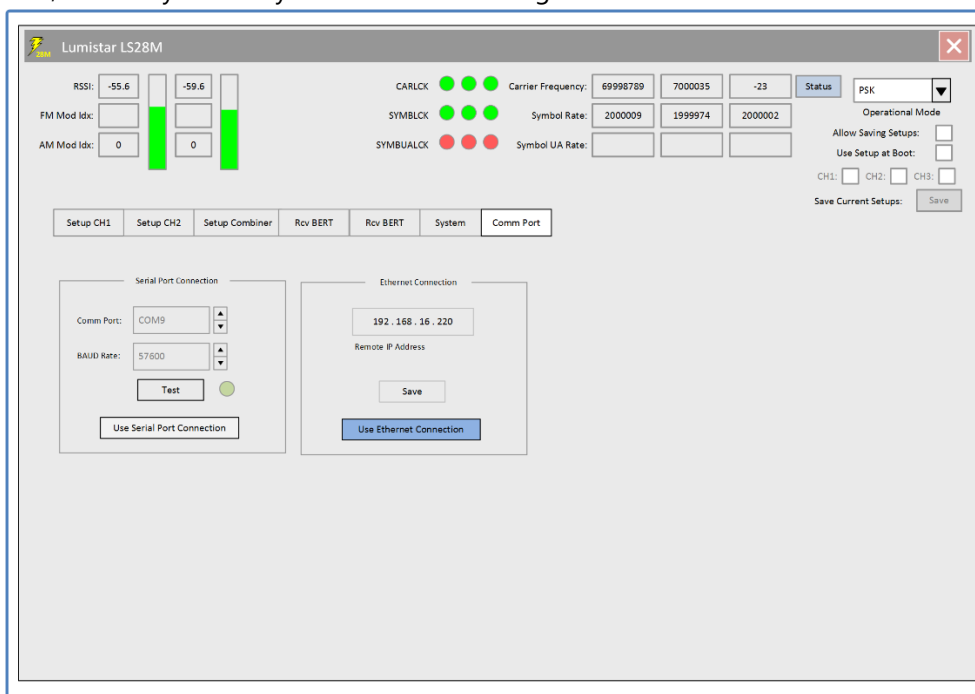
Field updates of DSP firmware may not be able to be performed if version disparity is too great. Be sure that Lumistar support has been informed of the present DSP firmware versions prior to performing updates.

- 3.) Updating firmware may take a significant amount of time, depending on the configuration of the unit being configured. Plan accordingly.

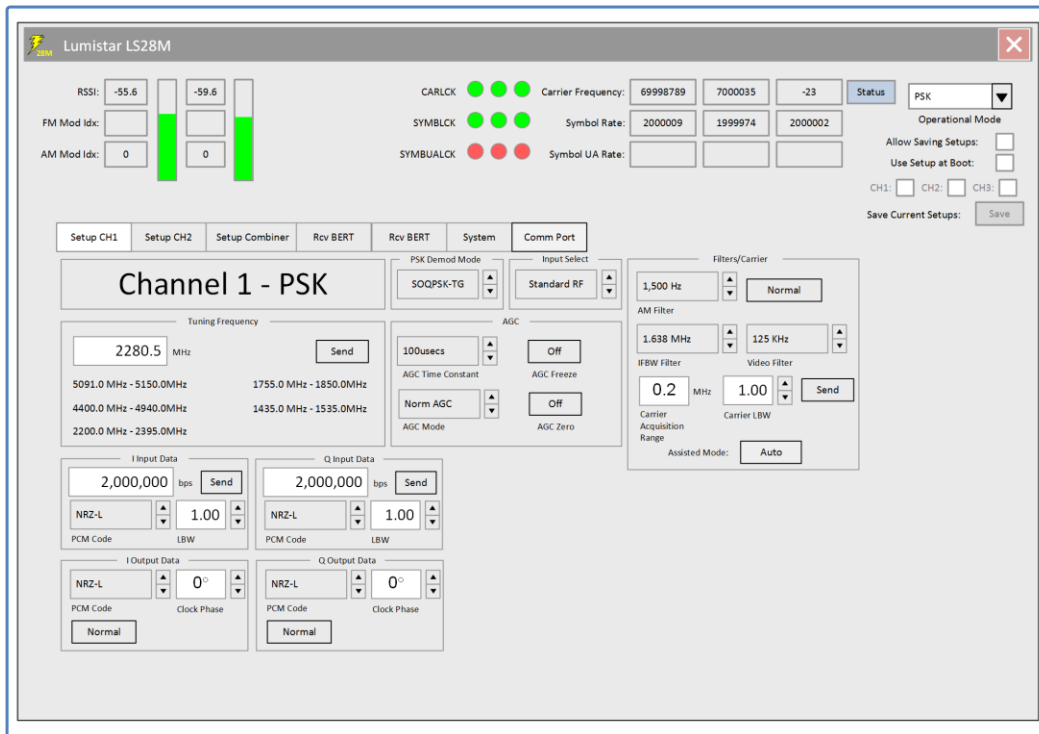
**Information:**

Field updates may require significant amounts of time to complete. DSP firmware updates require 10-12 minutes each. FPGA firmware updates take 15-17 minutes each. Plan accordingly.

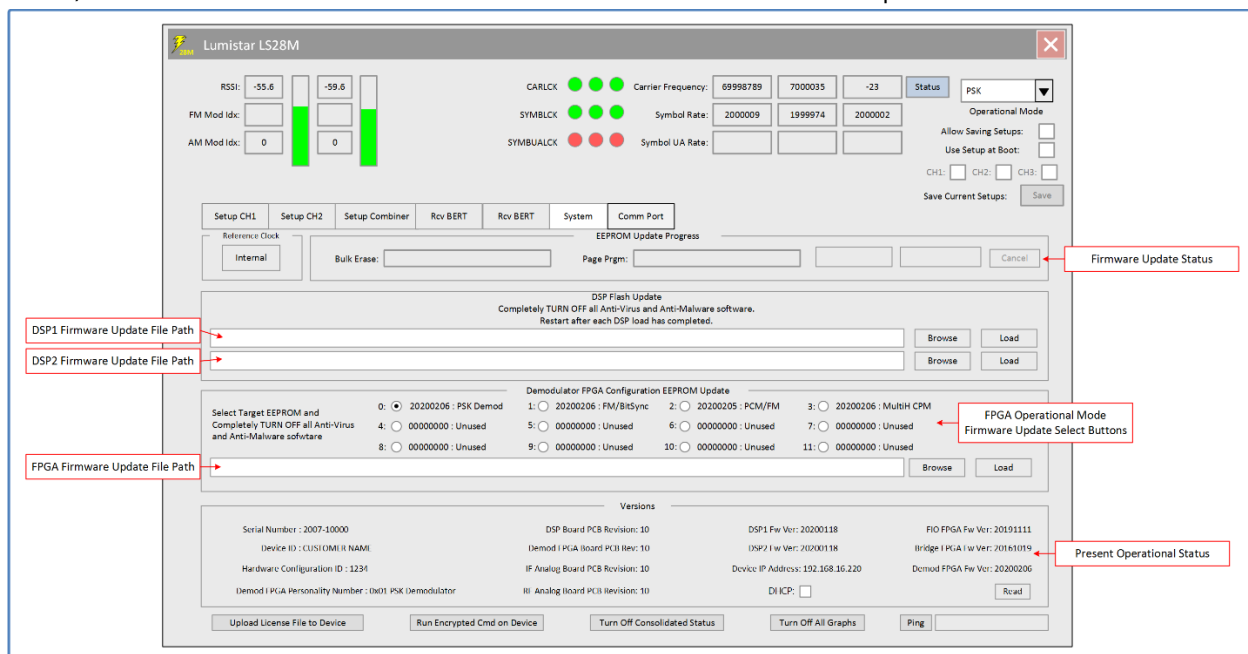
- 4.) Prior to performing any updates, ensure the host PC has the settings as specified in section 3.1 9.).
- 5.) Updating the DSP firmware should be done using the Ethernet interface. Ensure that this interface is connected.
- 6.) Launch the **LS28M.exe** utility using administrative privileges. If this is the first launch of the application, the utility will likely result in the following window.



- 7.) For the DSP updates, you will need to first select the "Use Ethernet Connection" button on the COMM tab of the utility, enter the IP address of the unit being updated, select the SAVE button and close the application.
- 8.) Close and then relaunch the **LS28M.exe** utility. A window will appear similar to the one shown below:



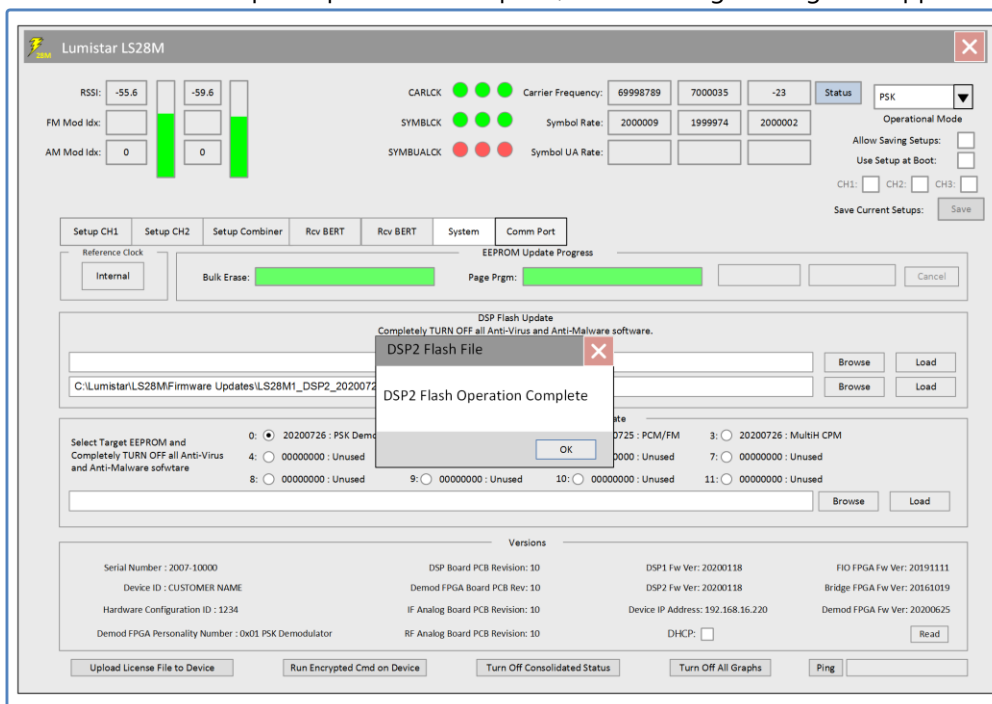
9.) Select the SYSTEM tab. A window similar to the one below will be presented.



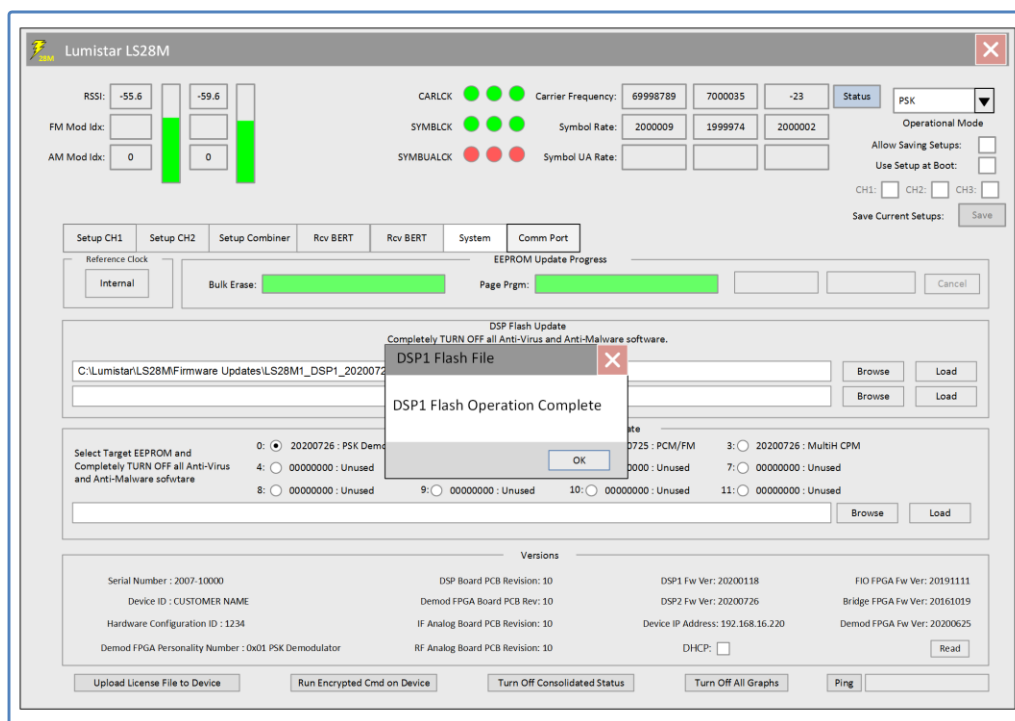
10.) The callouts shown in the figure above indicate areas of interest on this tab. These include the path title bars for the two DSPs being updated.

DSP2 will need to be updated first. To perform the update, select the BROWSE button next to the DSP 2 Path title bar and select the DSP2 firmware file that was provided from Lumistar Support. The DSP2 update file will take a format as follows: LS28M1_DSP2_<YYYYMMDD>_FLASH.bin.

- 11.) Ensure that this is for DSP2 and not DSP1.
- 12.) Once the file is confirmed that it is for DSP2, select the LOAD button next to the DSP2 update bar. Once this button is selected, no longer interact with the host PC until the process has completed. During the update process, the Bulk Erase and Page Prgm status bars may or may not update.
- 13.) Once the firmware update process is complete, the following message will appear:



- 14.) Once the DSP update message appears, wait for a minimum of 60 seconds and then reboot power to the device.
- 15.) Once the LEDs on the front of the receiver are both blinking green, communications can be reestablished with the device.
- 16.) Relaunch the **LS28M.exe** utility and select the SYSTEM tab again.
- 17.) Repeat the steps performed above for DSP1. Select the BROWSE button next to DSP1 title bar and select the provided DSP1 update file. The DSP1 update file will take a format as follows: LS28M1_DSP1_<YYYYMMDD>_FLASH.bin.
- 18.) Once the file is confirmed that it is for DSP1, select the LOAD button next to the DSP1 update bar. Once this button is selected, no longer interact with the host PC until the process has completed. During the update process, the Bulk Erase and Page Prgm status bars may or may not update.
- 19.) Once the firmware update process is complete, the following message will appear:



- 20.) Once the DSP update process message appears, wait for a minimum of 60 seconds and then reboot power to the device.
- 21.) Once the LEDs on the front of the receiver are both blinking green, communications can be reestablished with the device.

This completes the DSP firmware updates.

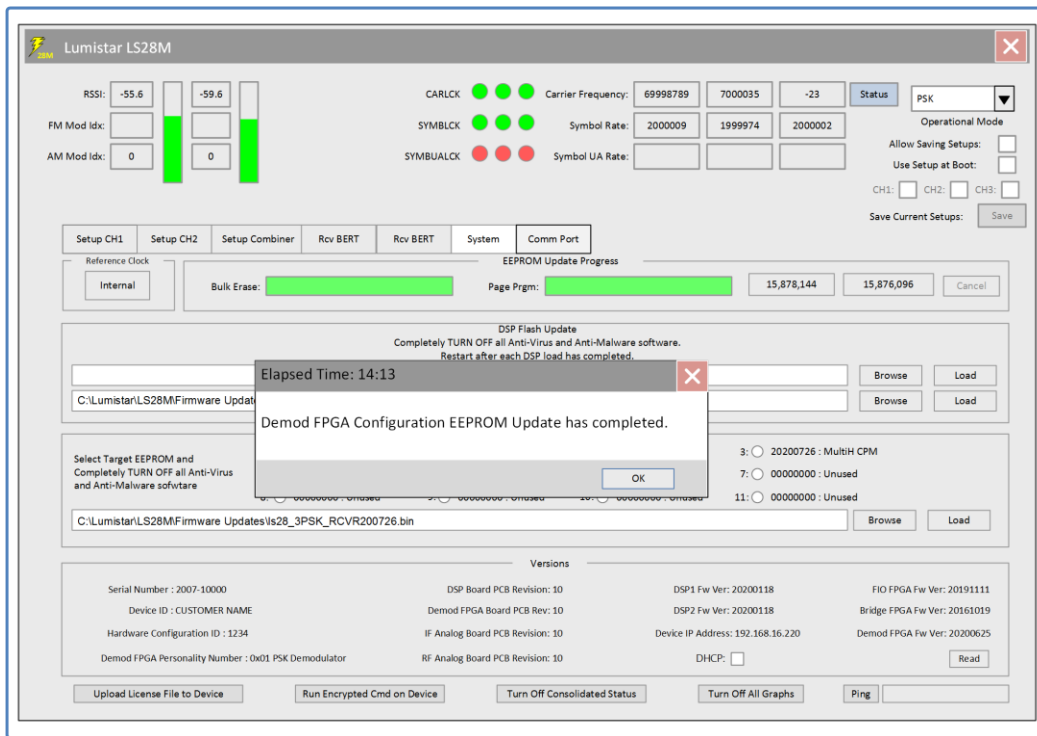
3.1.2 FPGA Firmware Updates

FPGA Firmware updates are quite large and would take a great deal of time using the slower USB interface. For the FPGA firmware updates, you will want to disconnect the USB connection, if connected, and ensure that there is a network connection between the host PC and the unit to be updated. Please read and follow the instructions closely.

- 1.) Typically, if the unit to be updated contains more than one FPGA processing engine operational mode, the process that will be described in the following steps will need to be repeated for each mode.
- 2.) Although a FPGA firmware update is still a critical update process, it is unlikely that issues during the update process will affect the ability of the device to be corrected in the field. Corrections make require additional efforts and time, but they will likely not require returning the device to the factory for corrective actions.
- 3.) Launch the **LS28M.exe** utility.
- 4.) For the FPGA updates, you will need to first select the "Use Ethernet Connection" button on the COMM tab of the utility, enter the IP address of the unit being updated, select the SAVE button and close the application. Reference the following figure:



- 5.) Relaunch the **LS28M.exe** utility and select the SYSTEM tab.
- 6.) Once the SYSTM tab is open, select the existing FPGA firmware button that most closely matches the name of the file that you are updating. As an example, if it is a PSK firmware operational mode that is being updated, select the button next to the existing PSK firmware load that has an older date. If the firmware functionality is new, select the first "Unused" button for firmware storage.
- 7.) Use the BROWSE button next to the FPGA path bar and select the FPGA update file name. The FPGA mode update file(s) will take a format as follows: `Is28M_<rcvrmode><YYMMDD>.bin`.
- 8.) Select the load button. Once selected, the status bars at the top of the tab will start to progress and numbers will fill the two boxes directly to the right of the Page Prgm status bar.
- 9.) Once complete, a message window similar to the following will appear:



- 10.) No power cycling is required between FPGA updates. If there are additional firmware loads to update, repeat steps 6 thru 9 above for the remaining loads.

4 Updating Device Licensing

As customer requirements evolve, it may be desirable to add new functionality to the existing platform. If new functionality is desired that involves a number of data processing functions, or involves the signal processing engine, this can be accomplished in the field without returning it to the factory for upgrade. Only hardware upgrades (ie. the addition of an additional RF band or the addition of recording memory) require that the device be returned for hardware modifications.

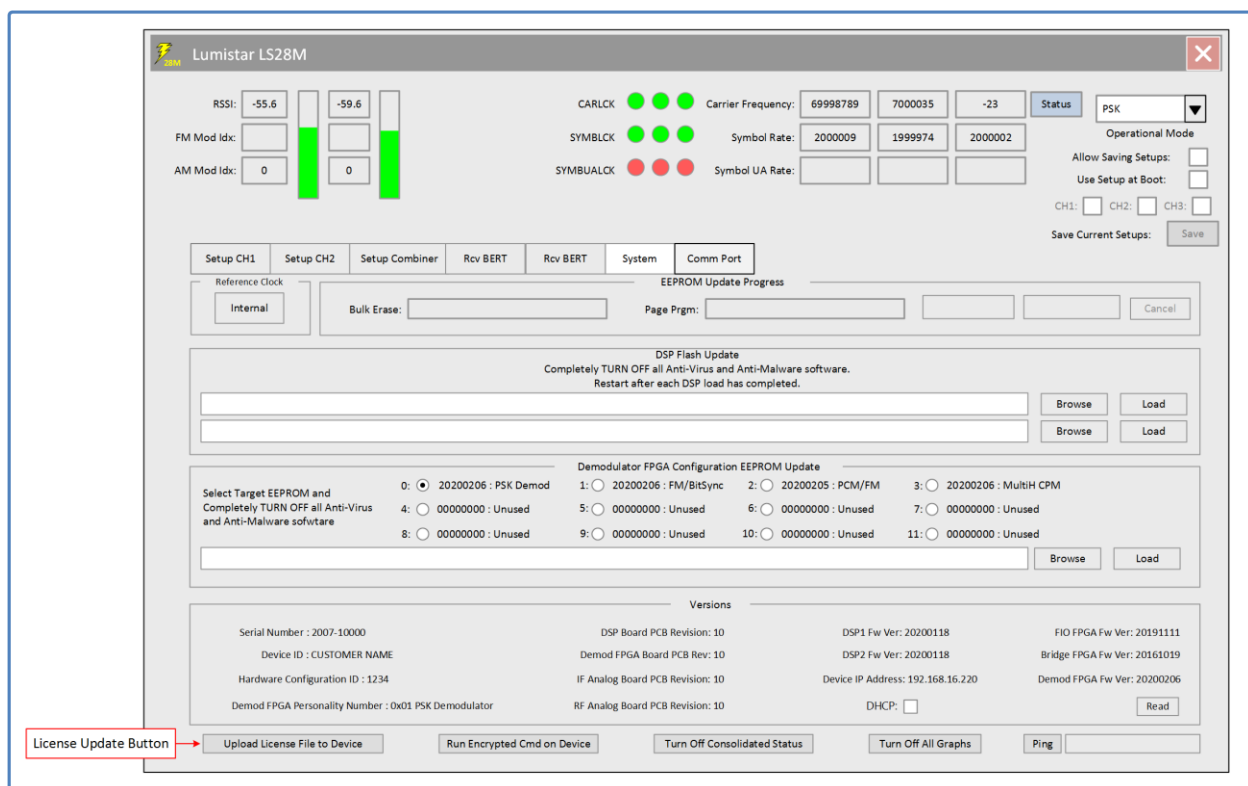
Functionality updates will always include a license file update and may include the combination of DSP firmware updates and additional FPGA firmware loads. If Lumistar support indicates that firmware must be modified, follow the procedures and precautions called out in in section 3 of this document. Perform the firmware updates prior to license updates.

To provide license updates, the user will need to supply Lumistar Support with the exact device ID of the unit being enhanced. Licenses are directly tied to unit prefixes and serial numbers. This device ID appears as a hyphenated number that is available on the main software user application's (*LS28_App.exe*) INFO-ENV tab, in the upper left-hand corner.

Lumistar Support will provide a license update file which will take a format as follows: *LS28M_<device prefix>-<device serial#>-<license date>_LicenceFile.bin*.

To update the license file, either the USB interface or the Ethernet interface of the *LS28M.exe* utility can be used.

- 1.) Launch the *LS28M.exe* utility application.
- 2.) Select the SYSTEM tab.
- 3.) Select the "Upload License File to Device" button in the lower left-hand corner of the SYSTEM tab. This will launch a browse window. Select the provided file and activate the license by selecting the OPEN menu option. Reference the diagram below:



4.) Once selected, the license information is immediately active.

5 Encrypted Command Updates

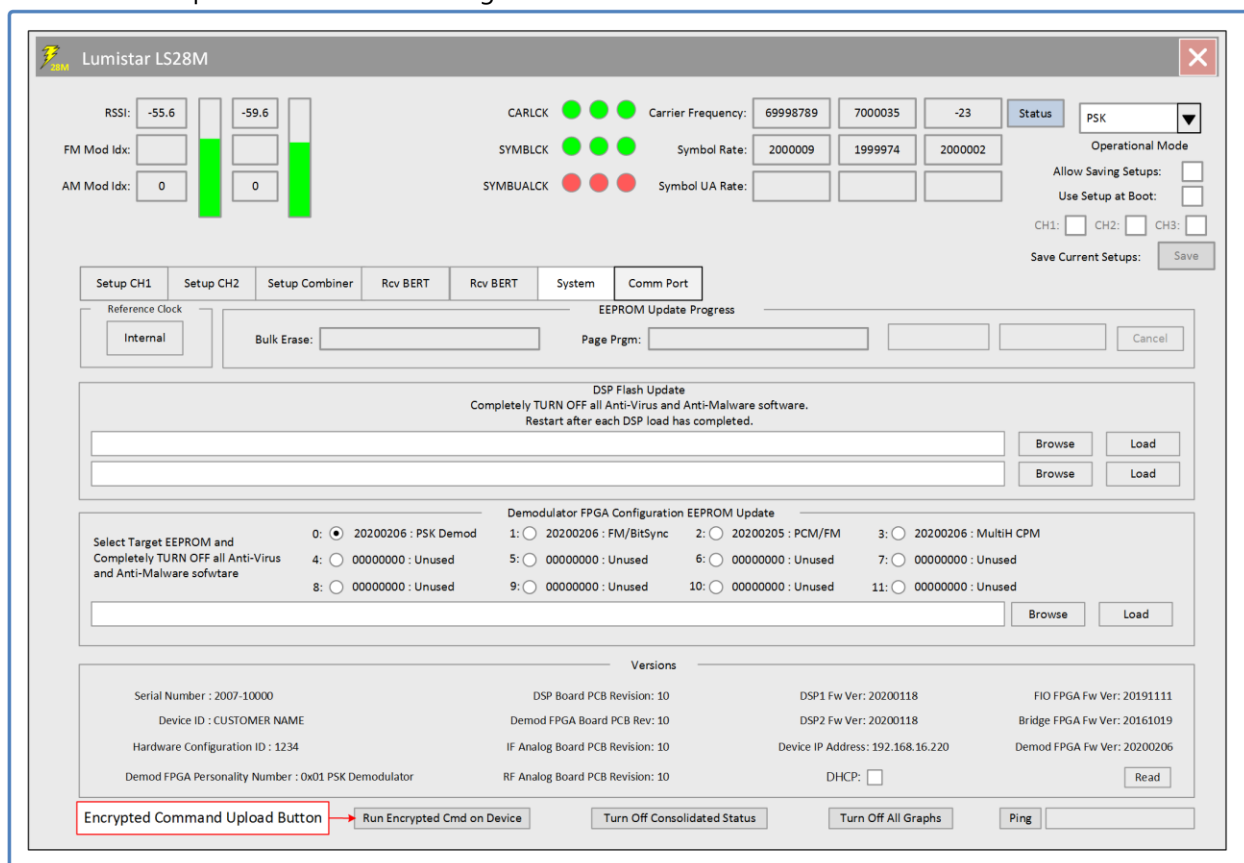
On very rare occasions, it may become necessary to provide a script file of commands to the LS-28-DRSM to perform some internal changes. If Lumistar support indicates that this is necessary, they will provide a file that can be loaded via the **LS28M.exe** utility.

To provide scripted updates, the user will need to supply Lumistar Support with the exact device ID of the unit being enhanced. The device ID appears as a hyphenated number that is available on the main software user application's (**LS28_App.exe**) INFO-ENV tab, in the upper left-hand corner.

Lumistar Support will provide a command file which will take a format as follows: LS28M_<device prefix>-<device serial#>_<commandfiledate>_GeneralCmdFile.bin.

To upload the scripted command file, either the USB interface or the Ethernet interface of the **LS28M.exe** utility can be used.

- 1.) Launch the **LS28M.exe** utility application.
- 2.) Select the SYSTEM tab.
- 3.) Select the "Run Encrypted Cmd on Device" button in the lower center of the SYSTEM tab. This will launch a browse window. Select the provided file and activate the license by selecting the OPEN menu option. Reference the diagram below:



- 4.) Once selected, the command sequence is immediately activated.
- 5.) Wait for a period of 5 minutes.
- 6.) Cycle power to the unit to cause the changes to become active.