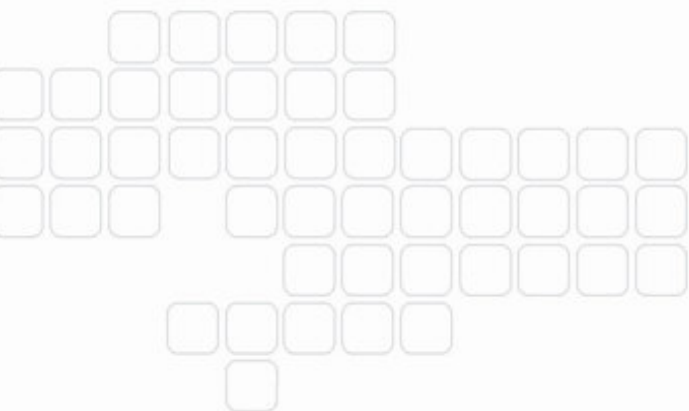
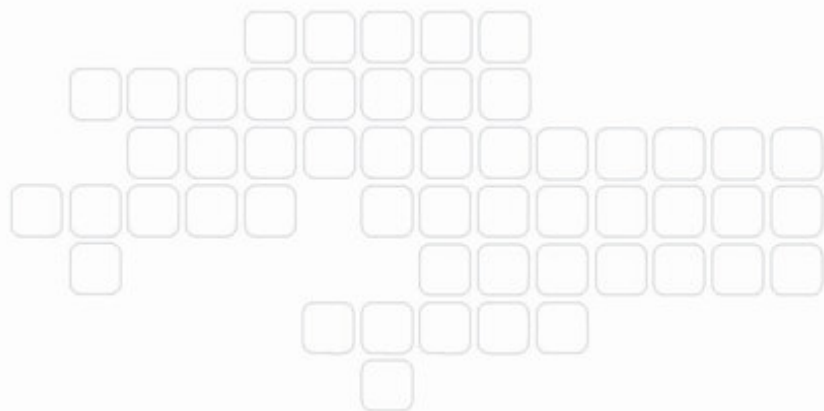




USER'S MANUAL

FireSync Network Devices, Generation 1

Version 4.10.0.1



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1 Overview

The Generation 1 FireSync Network devices are wall mount hardware components used to distribute power, data, safety interlock, and synchronization information to all devices in a FireSync sensor network.

A FireSync Network consists of the Master (as a minimum), Slave (optional), and Station (optional) hardware to support an application requiring two or more sensors.

1.1 FireSync Master

The FireSync Master switch provides sensor power, safety interlock, routes Gigabit Ethernet data, and broadcasts system-wide synchronization information (ie. time, encoder and digital I/O states) to all devices on a sensor network.

The Master is a wall-mount device, which is held in place by a wall-mount bracket (see Section 5.1 for more information).

There is one FireSync Master per sensor network.

1.2 FireSync Slave

The FireSync Slave performs the same sensor power and data routing functions as the FireSync Master, but it does not broadcast its own synchronization information. Instead, it forwards sync information received from the Master to which it is connected.

The Slave is a wall-mount device, which is held in place by a wall-mount bracket (see Section 5.1 for more information).

The FireSync Slave switch is used in a system where there are more than 13 devices.

The FireSync Slave safety interlock control is independent from the FireSync Master's safety interlock control.

There can be as many FireSync Slaves in a network as is required by the application.

1.3 FireSync Station

The FireSync Station offers dedicated, real-time processing of sensor data. It is intended to operate as a FireSync server. It is the primary interface between a client application and the sensor network, using the FireSync Host Protocol.

The Station is a wall-mount device, which is held in place by a wall-mount bracket (see Section 5.1 for more information).

A Station is connected to either a Master or a Slave via an open sensor port.

Multiple Stations can be added to a sensor network to boost processing power as required by the application. However, there is a maximum of five Stations allowed per sensor network.

There are currently 2 models of the FireSync Station, which share the same functionality:

- FireSync Station – Single core processor, 2 GB RAM, 512 MB compact flash storage drive, +48VDC power supply
- FireSync Station 1000 – Single core processor, 2 GB RAM, 512 MB compact flash storage drive, +12VDC power supply

NOTE: After the Station has been installed into a system and the proper settings have been loaded, it is highly recommended to perform a Backup of these files.

See the FireSync Host Protocol manual for information on Backups and Restores.

1.4 FireSync Cordsets

All FireSync devices connect to each other through FireSync cordsets. The names of the cordsets used in this manual along with a description of each cordset are listed below:

1.4.1 Sensor Cordset

The Sensor cordset carries the power, safety interlock*, sync, and data signals between a FireSync sensor and the Master or Slave.

***NOTE:** see Section 4.1 “Features, Master” for an explanation of the safety interlock

1.4.2 Station Cordset

The Station cordset is used to connect sensor data from a Master or Slave to the Station. It connects from any sensor port on a Master or Slave to the IN port on a Station. See Section 2.4 “Network Switches” for routing options with this cordset.

1.4.3 Master to Slave Cordset

The Master to Slave cordset is used to sync a Master to a Slave. It carries data and sync information between a Master and a Slave.

1.4.4 Ethernet Cable

Standard CAT5e Gigabit Ethernet cable is used to connect a Station to a client PC. This cable will connect to the Station OUT port. See Section 2.4 “Network Switches” for routing options for this cable.

NOTE: Cable drawings for all FireSync Cordsets are available on the LMI Technologies Partners download site.

2 Network Configurations

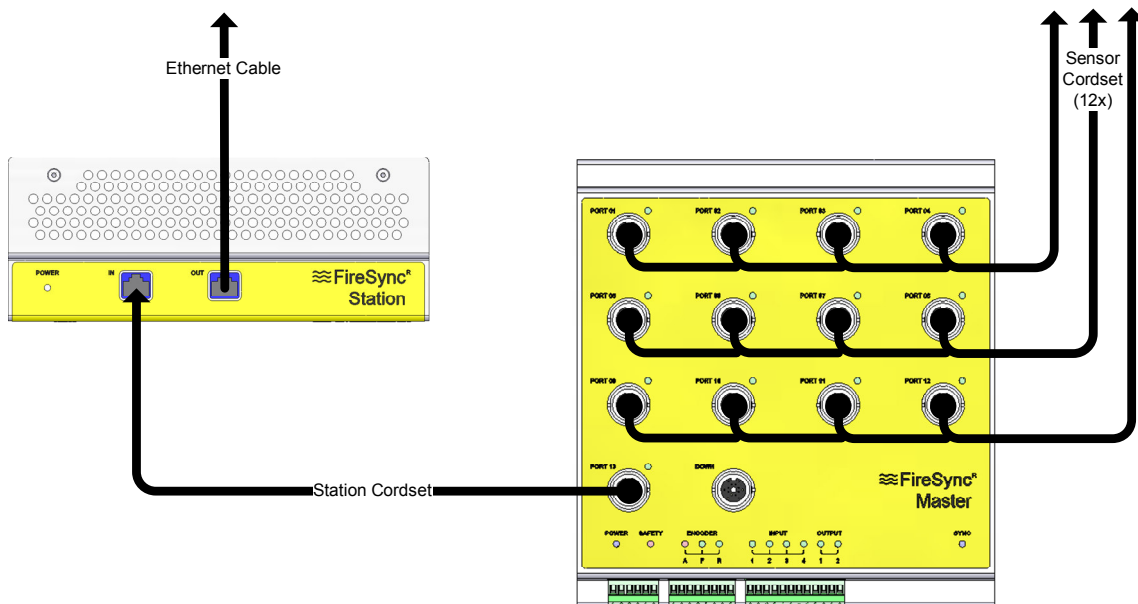
The FireSync Network components can be connected in many different configurations to suit the needs of a sensor application. Six common configurations are described in this section.

2.1 Typical

Some sensor applications require few sensors and minimal data processing. The simplest FireSync Network is illustrated below:

- Single Master, Single Station (Up to 12 sensors)

This configuration is used in simple sensor applications requiring 12 or fewer sensors in a sensor network.

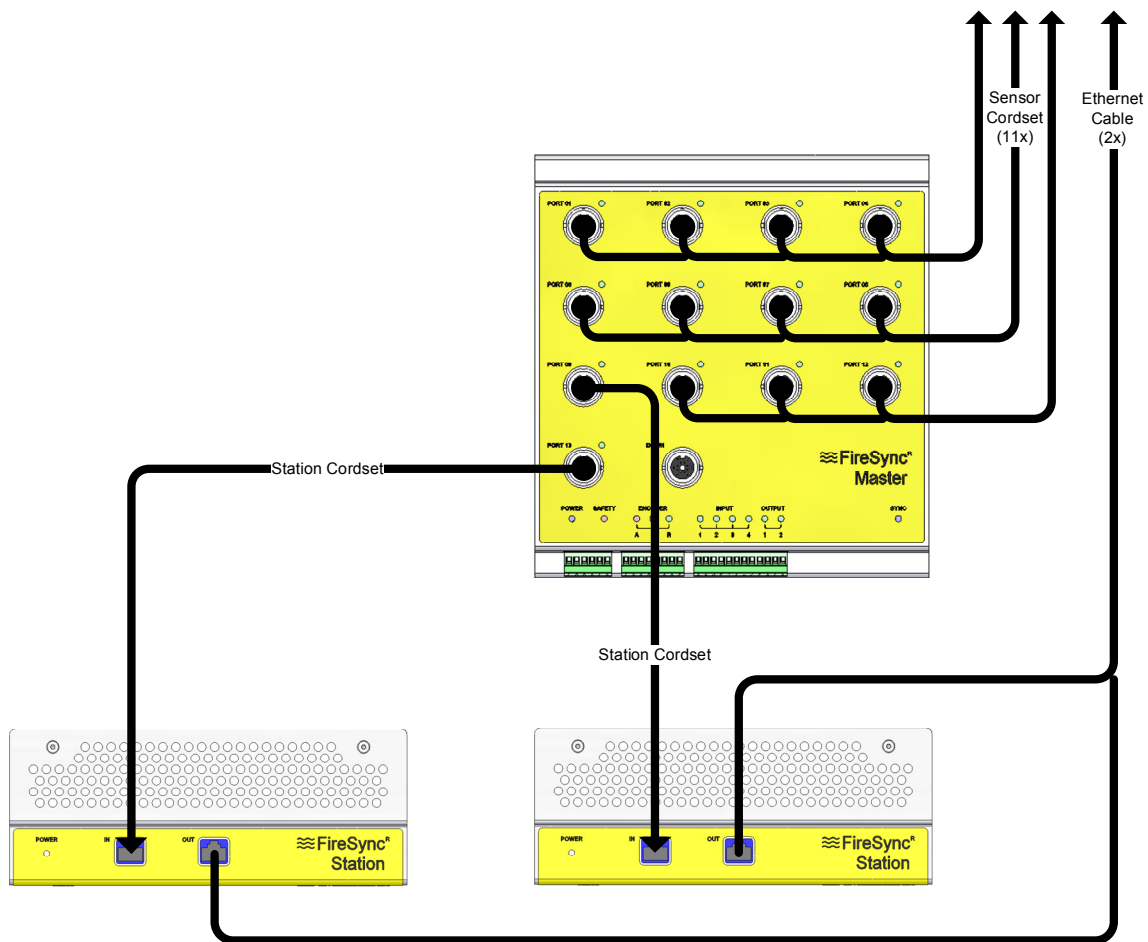


2.2 Advanced (Single Network Subnet)

Certain sensor applications may require more sensors or more data processing than can be provided by a simple single Master/single Station network. A few advanced network configurations are described and illustrated below:

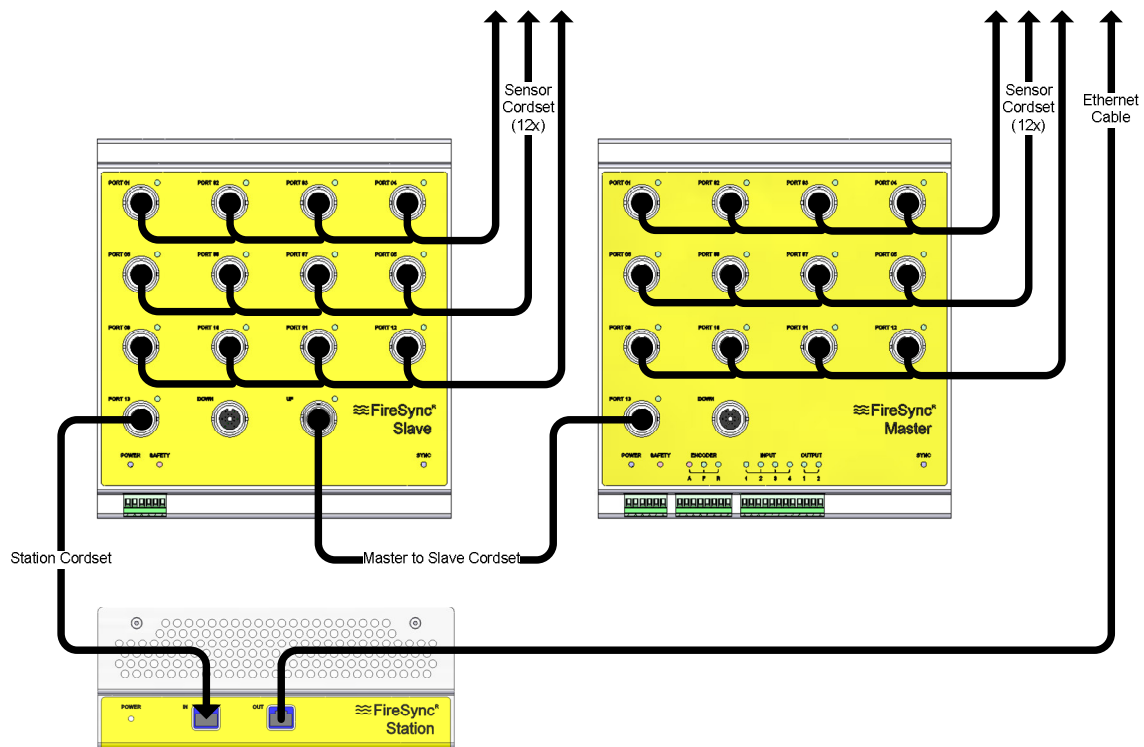
- Single Master and multiple Stations (Up to 12 sensors)

This configuration is used when the application requires few sensors but more processing power than a single Station can provide. Note that for every Station added, there will be one fewer Sensor port available to connect a sensor.



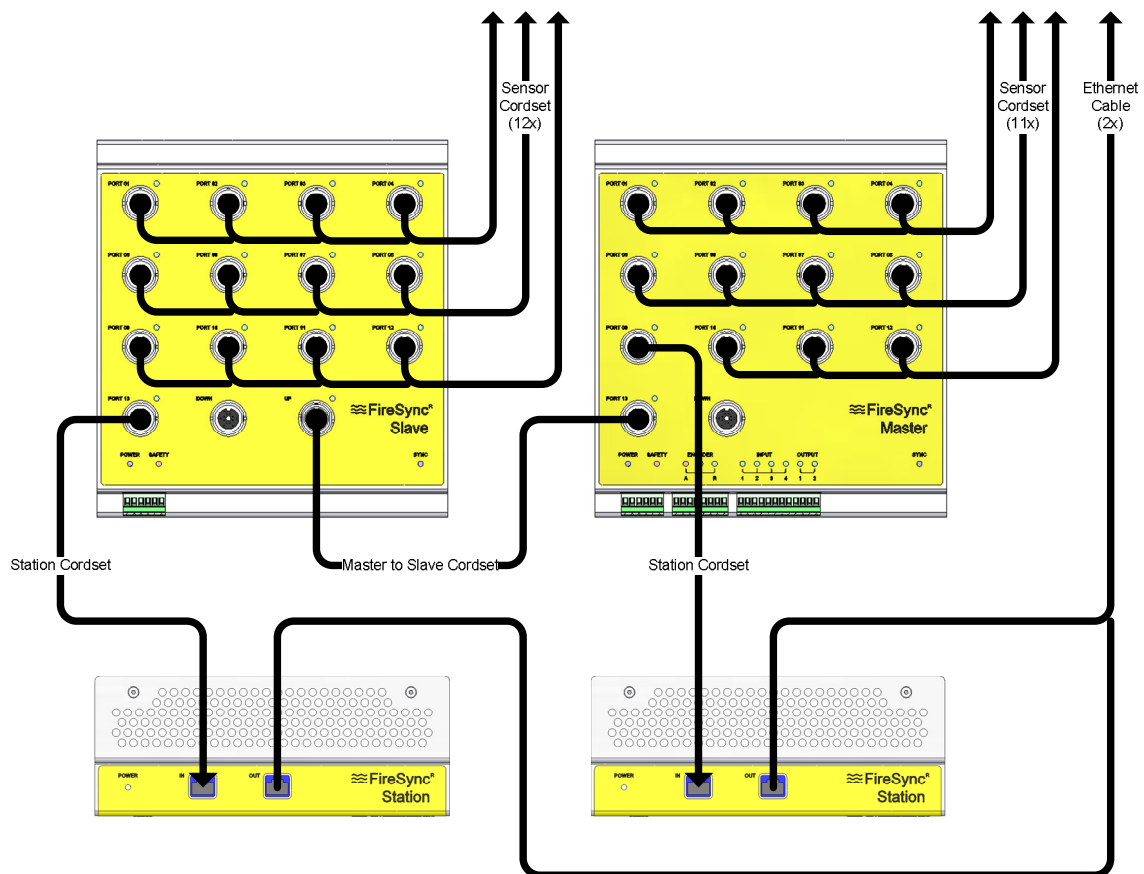
- Master, Slave, and Station (Up to 24 sensors)

This configuration is used when the application requires more than 12 sensors in the system. A Slave is added to expand the number of available sensor ports.



- Master, Slave, and multiple Stations (Up to 23 sensors)

This configuration is used when the application requires more than 12 sensors and increased data processing than a single Master/Station configuration can provide.



2.3 Advanced (Multiple Network Subnets)

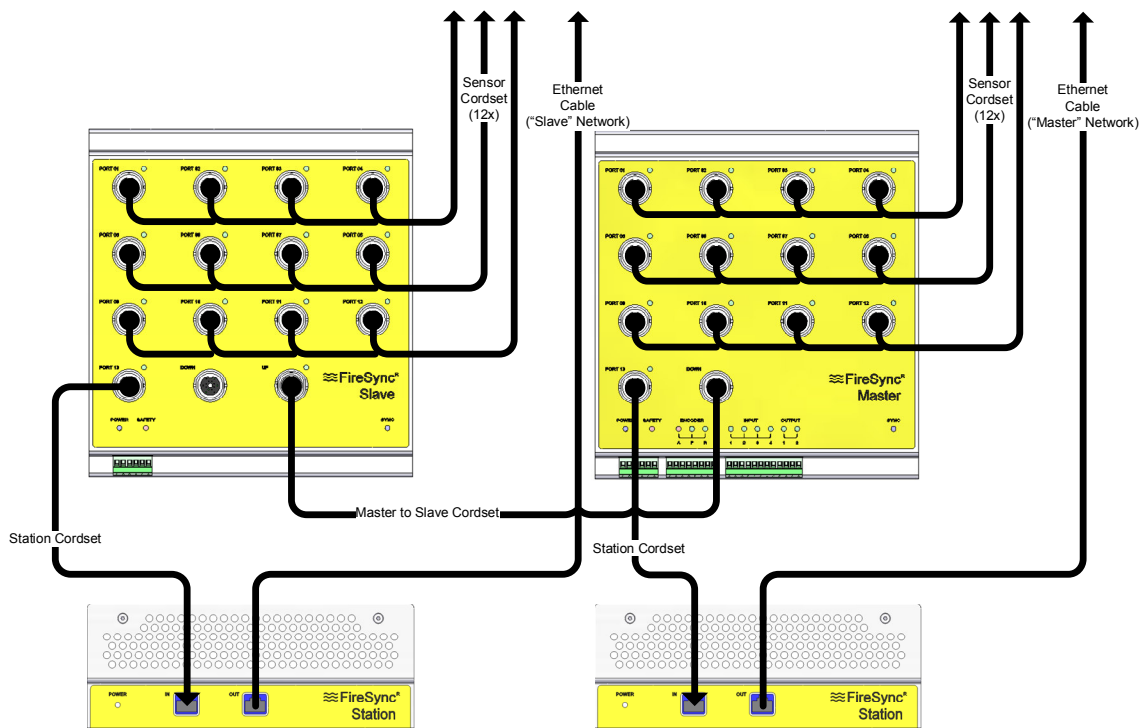
In applications where aggregate sensor data bandwidth exceeds a Gigabit network's capacity (ie in Vision systems), the Master and Slave networks must be separated into different subnets.

A solution to this problem is to separate the data networks that the Master and Slave operate on. The following network configuration explains and illustrates this solution:

- Master, Slave, and multiple Stations

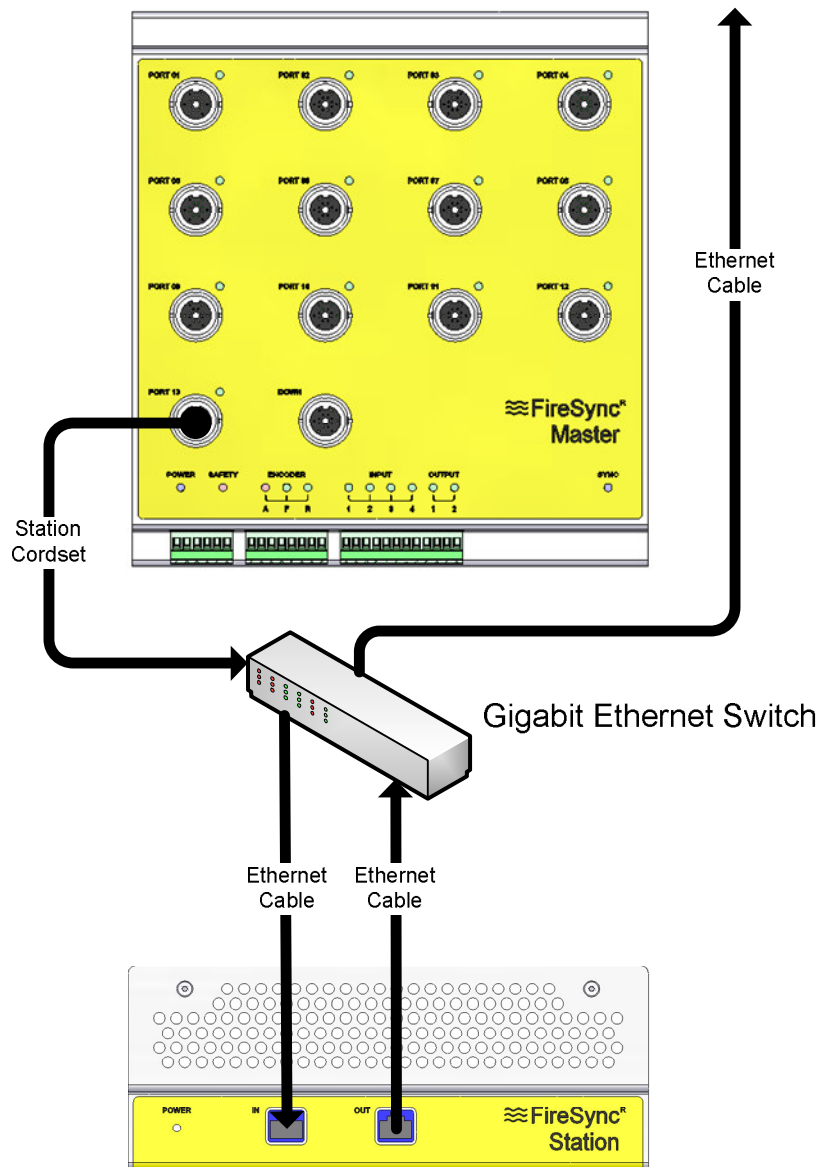
In this configuration, the "Master to Slave" cordset connects the Master's DOWN port to the Slave's UP port. This will stop sensor data from streaming between the Master and Slave, however the Master will continue to forward sync information.

Note that this configuration allows for up to 24 sensors.



2.4 Network Switches

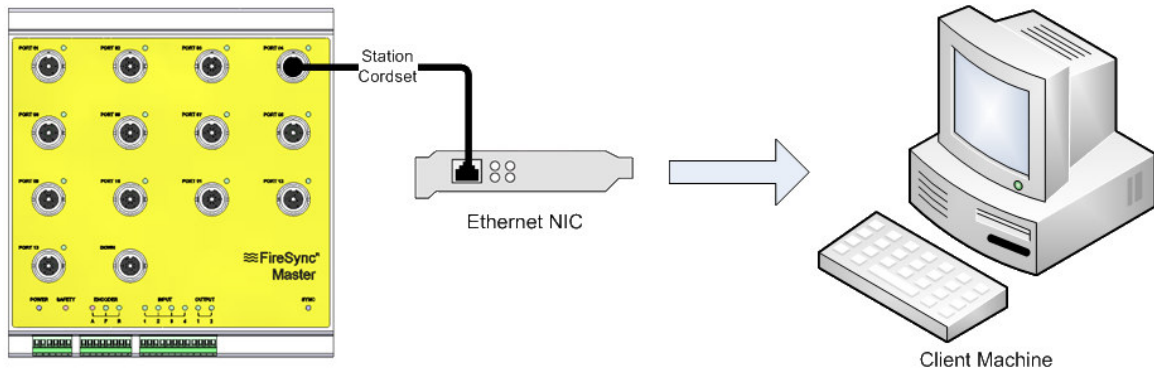
All FireSync Network devices communicate using Ethernet. Therefore, Stations can be connected to Masters and Slaves through a standard gigabit Ethernet switch. The connection from the Station's OUT port can also go through a gigabit Ethernet switch. An example of this is illustrated below:



NOTE: To ensure proper system operation, there should be a maximum of **ONE** switch between any connection from the Master, Slave, or Station.

2.5 Event Channel Connections

In order to use the Event channel, a connection from an open sensor port on the Master or Slave to a dedicated network interface card (NIC) on the client machine must be made:



Note that this NIC must be configured to the 90.X.X.X subnet in order to use the Event channel. If a Slave is to be used for the Event channel connection, it must be on the same data network as the Master, ie **not** connected using the Master's Down port.

2.6 Adding Extra Stations

Whenever an extra Station is required in a sensor network, simply take any unused sensor port from a Master or Slave, and use that port to connect to the new Station's IN port via a Station cordset. Keep in mind that this will reduce the number of sensor ports available for sensors.

NOTE: All Stations are shipped from LMI Technologies with the same IP addresses. The User must connect to each Station individually to change both the Private and Public IPs of a Station before it can be introduced in to a sensor network with another Station.

See the FireSync Host Protocol manual for instructions on how to change the IP addresses of a Station.

3 System Operation

This section outlines the steps required to power up and connect a Master, Slave, or Station to a sensor network.

3.1 Electrical Connections

Each FireSync Network device has electrical input(s) that must be connected in order for the system to power up and operate properly.

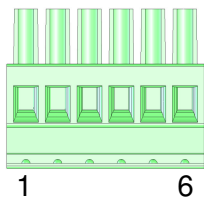
NOTE: It is recommended to use 22AWG cable when wiring these connectors.

3.1.1 Master

The Master uses three Phoenix Contact (MC 1.5/ series) terminal plugs:

- CON1 - Power and Safety
- CON2 - Encoder interface
- CON3 - Digital I/O interface

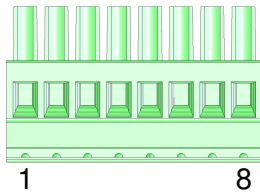
CON1 – Power and Safety (6-pin connector)



Pin	Signal
1	+48VDC
2	+48VDC
3	GND(48V)
4	GND(48V)
5	Safety Control +
6	Safety Control -

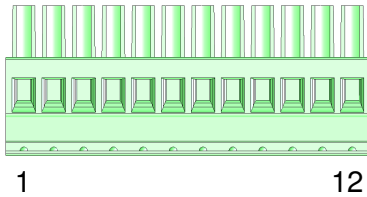
NOTE: The +48VDC power supply must be isolated from AC ground. This means that AC ground and DC ground are not connected.

CON2 – Encoder (8-pin connector)



Pin	Signal
1	A+
2	A -
3	B+
4	B -
5	Z+
6	Z -
7	GND
8	+5VDC

CON3 – Digital I/O (12-pin connector)



Pin	Signal
1	Input 1
2	Input 1 GND
3	Input 2
4	Input 2 GND
5	Input 3
6	Input 3 GND
7	Input 4
8	Input 4 GND
9	Output 1
10	Output 1 GND
11	Output 2
12	Output 2 GND

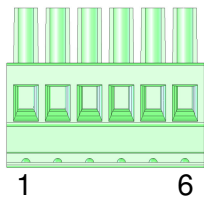
NOTE: This connector does not need to be wired up for proper system operation.

3.1.2 Slave

The Slave uses one Phoenix Contact (MC 1.5/ series) terminal plug:

- CON1 - Power and Safety

CON1 – Power and Safety (6-pin connector)



Pin	Signal
1	+48VDC
2	+48VDC
3	GND(48V)
4	GND(48V)
5	Safety Control +
6	Safety Control -

NOTE: The +48VDC power supply must be isolated from AC ground. This means that AC ground and DC ground are not connected.

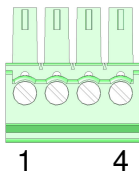
NOTE: The Slave has its own safety interlock control input which operates independently from the Master's safety interlock input

3.1.3 Station

The Station uses one Phoenix Contact (MC 1.5/ series) terminal plug:

- CON1 – Power

CON1 – Power and Safety (6-pin connector)



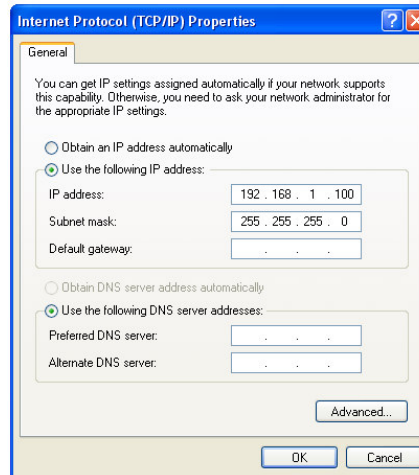
Pin	Signal	
	Station	Station 1000
1	+48VDC	+12VDC
2	+48VDC	+12VDC
3	GND(48V)	GND(12V)
4	GND(48V)	GND(12V)

3.2 Connecting a Windows XP PC* to the FireSync Network

In order to connect to the FireSync Network, attach a PC with an open Gigabit Ethernet port to the OUT port of the Station, using a CAT5e cable. If you have multiple Stations in your system, the Station and the PC Ethernet cables need to be connected to a Gigabit Ethernet switch.

Your PC IP address will have to be configured to the same subnet as the Station:

- Go to the control panel, select “Network Connections”
- Double-click on the name of the connection you are using
- Click “Properties”, and double-click on “Internet Protocol (TCP/IP)”. This window will show up:



- Select “Use the following IP address”, and input the Subnet mask shown above. The IP you enter must be on the same subnet as the Station’s (the IP address shown above is appropriate for a Station on the default IP of 192.168.1.10). Click OK.
- Click OK on the Connection properties window. Your computer has now been configured to connect to a FireSync Station.

After this procedure is complete, you can connect to the Station using the appropriate version of FireSync Client specific to the sensor type that is used in your sensor network. Consult that sensor’s User’s Manual to learn how to use FireSync Client.

- The first time you connect to the Station with kClient, the error log will display two messages stating that it was unable to connect to the Server and Management ports, and the Station’s serial number will be displayed as “SN 0”. This is expected behaviour, and will go away after an upgrade.

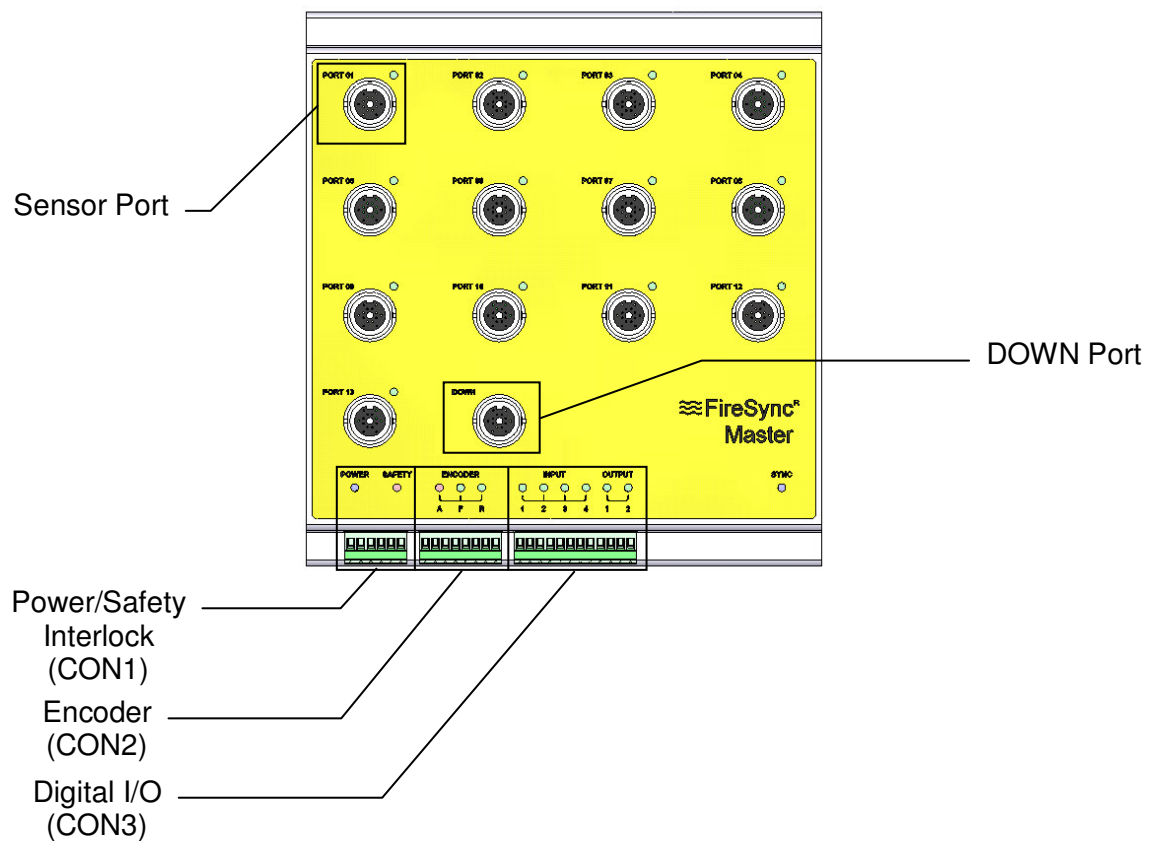
***NOTE:** This procedure outlines taken to connect a Windows XP PC to the FireSync Network. Any computer running on an OS that supports the TCP/IP interface will be able to connect to the FireSync Network.

4 Features

This section describes the various physical features of each network device.

4.1 FireSync Master

- 13 FireSync sensor ports
- Safety interlock interface
- Encoder interface
- Digital I/O interface (four inputs, two outputs)
- DOWN port



Sensor Ports

The sensor ports are used to interface to FireSync sensors or FireSync Stations. When connected to a sensor (via a sensor cordset), they provide power, safety interlock, sync, and data routing; when connected to a Station (via a Station cordset), they provide sensor data to the Station.

A sensor port can also be used to synchronize a Master to a Slave, using the Master to Slave cordset.

Devices can be connected to sensor ports in any order, as the ports are addressed logically, not electrically.

Safety Interlock Interface

The safety interlock is a +48VDC signal that goes to all sensors on the Master to enable the use of lasers and LEDs. To enable this signal, the user must short pins 5 and 6 of CON1 together, and the sensors in the network must be connected using sensor cordset Version 2.

NOTE: Safety Interlock is only to be used on sensors that support this safety feature. Consult your sensor user's manual for this feature.

Encoder Interface

The encoder interface provides differential, quadrature signal input to the Master from an encoder. It also provides +5VDC and GND lines to power an encoder. The user must connect an encoder that provides differential quadrature output. The encoder interface provides X4 quadrature decoding, and supports a maximum encoder frequency of 300 kHz (after quadrature decoding).

Choose an optical encoder with the appropriate number of pulses per revolution to match the transport mechanism speed, and one that meets your resolution requirement

Digital I/O Interface

The digital I/O interface provides a means of connecting external devices to the Master. The interface has four inputs and two outputs, all of which are optically isolated. The signaling type on these pins is *single-ended*, ie one pin provides the signal while the other provides signal ground.

The input states can be read from the "Digital I/O States" indicator in the Event and Health channel; see the FireSync Host Protocol manual for more information on these channels. The update rates of these channels are 2Hz for the Health channel, and 100Hz for the Event channel.

Control of the output pins is reserved for future use.

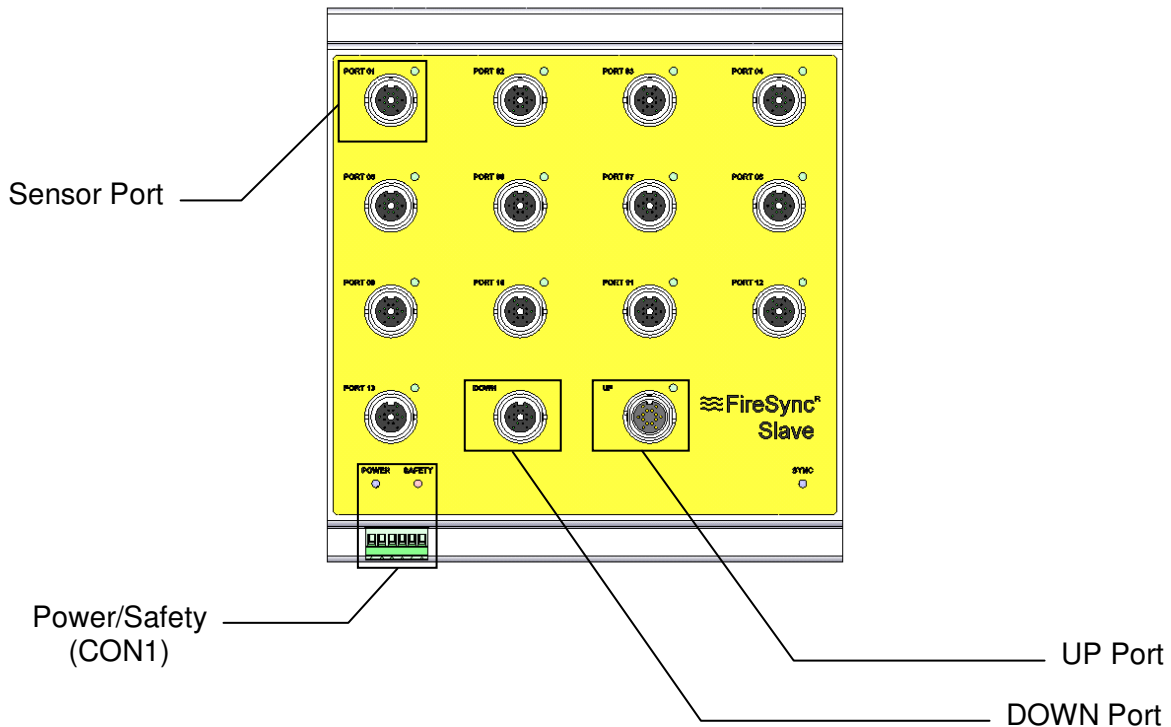
DOWN Port

The DOWN port on the Master is used to synchronize a Slave to the Master, using a Master to Slave cordset. Using the DOWN port for this function will separate the data networks on which the Master and Slave operate.

NOTE: Do not plug a sensor into the DOWN port. The sensor will not power up.

4.2 FireSync Slave

- 13 FireSync sensor ports
- Safety Interlock interface
- DOWN port
- UP port



FireSync Sensor Ports

The sensor ports on the Slave are identical in operation to those on the Master.

Safety Interlock Interface

This feature is identical to the Master safety interlock Interface. Note that its operation is independent from the Master.

DOWN Port

The DOWN port on the Slave is used to synchronize another Slave in a network, using the Master to Slave cordset. This will separate the next Slave data network.

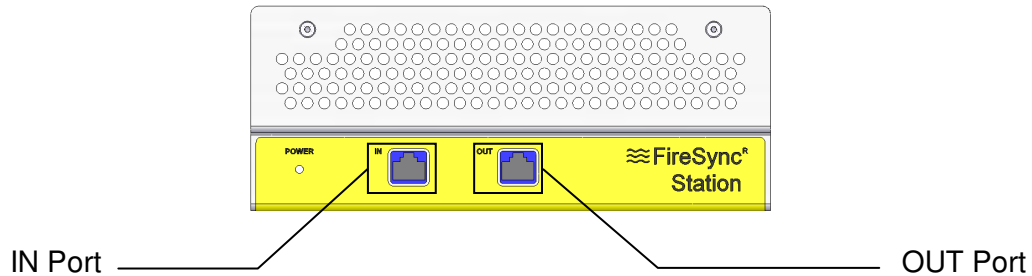
UP Port

The UP port on the Slave is used to connect the Slave to a Master, or to another Slave. The port receives the sync signal, and sends data between the Master and Slave.

NOTE: The UP port will always be connected when a Slave is in a system.

4.3 FireSync Station

- IN Port
- OUT Port



IN Port

The IN port is a Gigabit Ethernet link to a Master or a Slave. It communicates on the sensor (Private) network.

The IN port IP address will always be on the 90.X.X.X subnet. This address can be changed by sending a “Set Private IP” command to the Station. The valid addresses are 90.0.0.1 to 90.0.0.5.

Out Port

The OUT port is a gigabit Ethernet link to the client (Public) network. It is the gateway through which the user communicates with the sensor network.

The OUT port can be set to any IP address except addresses belonging to the 90.X.X.X subnet. The default IP is 192.168.1.10.

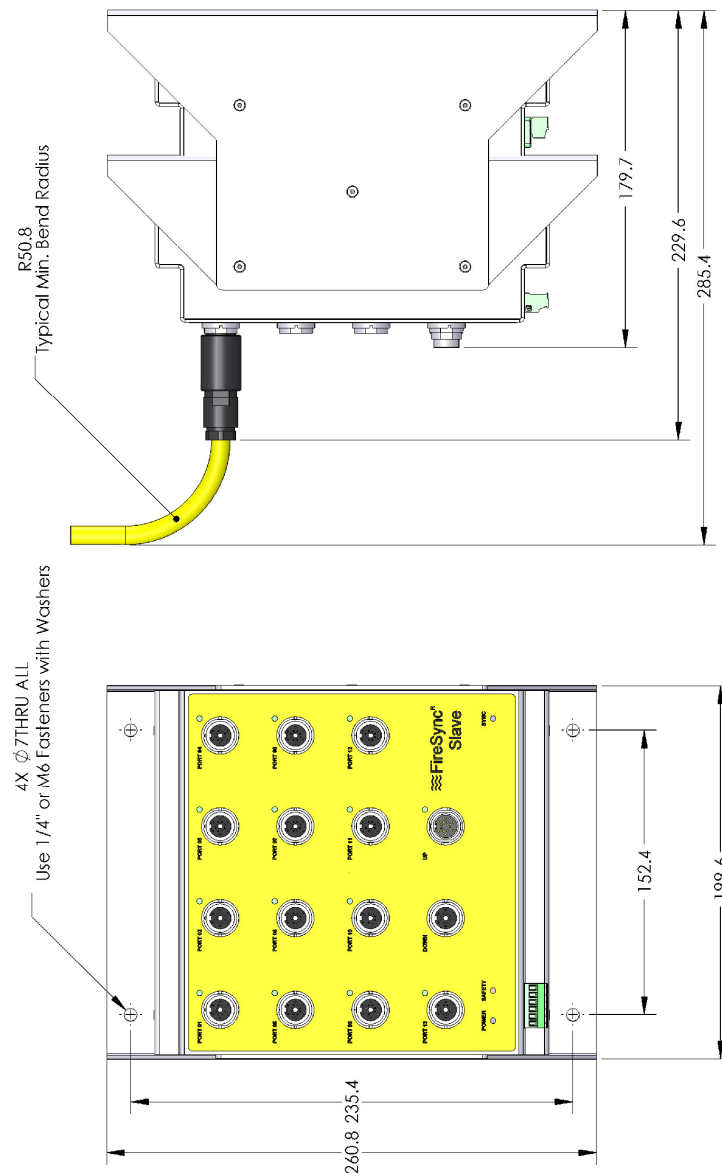
NOTE: If you wish to use Windows Remote Desktop to connect to the Station, the default username is “administrator”, and the password is “admin”.

5 Technical Information

5.1 Mounting Dimensions

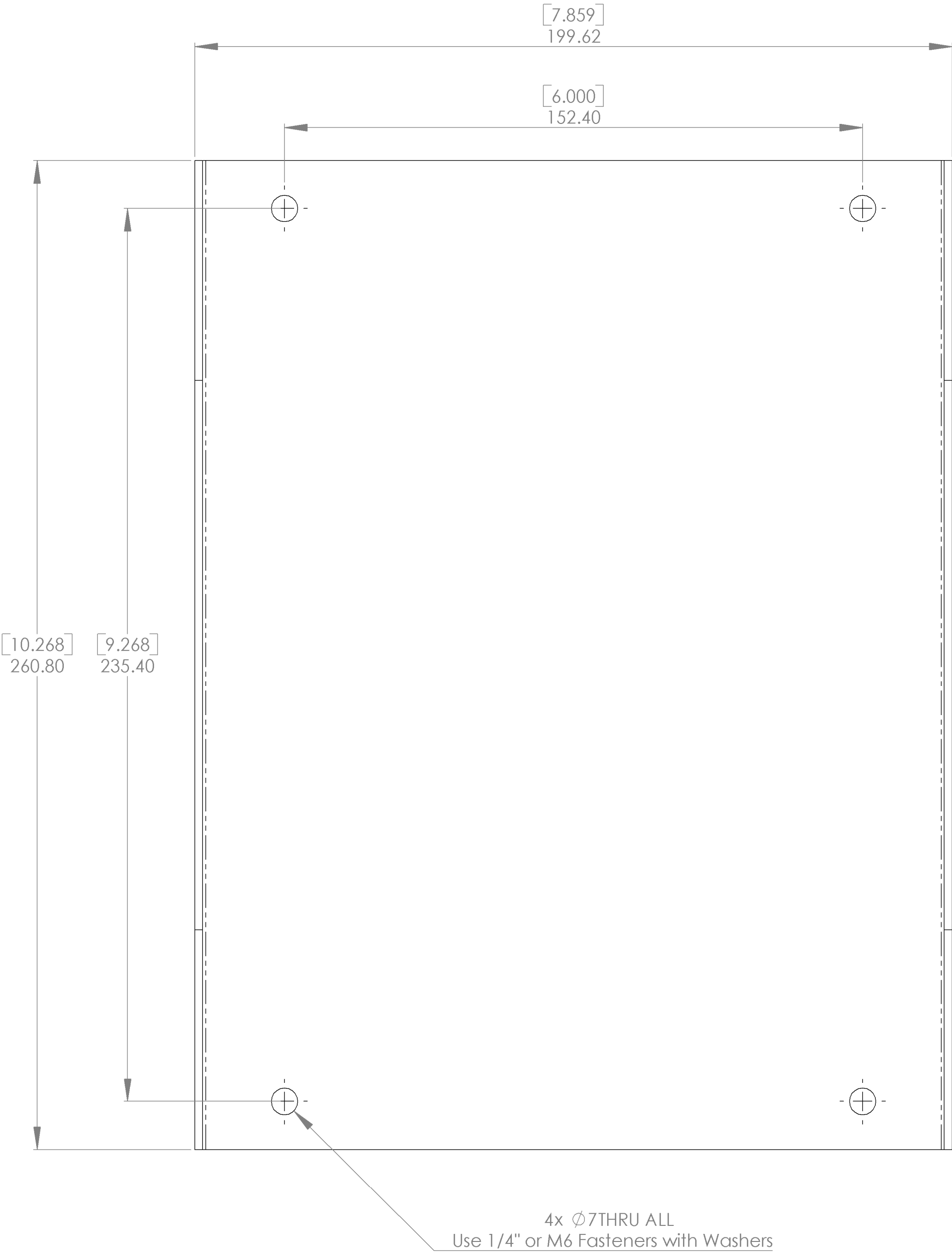
Special mounting brackets are available for the FireSync Network devices. The single bracket can hold one device, while the double bracket can hold one Master/Slave and one Station, or two Stations.

Shown here are the dimensions of the largest combination, one Slave and one Station:



5.2 Drilling Layout for Mounting Bracket

Print this page out on 11" x 17" paper (without resizing) to get a properly scaled drilling layout diagram for the Network device mounting bracket.



5.3 Connector Information

5.3.1 Master and Slave

Sensor, DOWN, UP ports	Binder 423 series
CON1	Phoenix Contact MCVW 1,5/6-ST-3,81
CON2 (Master only)	Phoenix Contact MCVW 1,5/8-ST-3,81
CON3 (Master only)	Phoenix Contact MCVW 1,5/12-ST-3,8,1

5.3.2 Station

IN and OUT Port	RJ45
CON1	Phoenix Contact MC 1,5/4-ST-3,81

5.4 Environmental Information

The FireSync Network devices must be mounted in:

- A dust-free (minimum IP61) and temperature-controlled (0°C to 40°C, non-condensing) environment
- A 12-type electrical box (based on NEMA 250). This box must be grounded to the frame it is installed on (see NEC250.8, 250.12, and 250.122 for proper grounding requirements).

5.5 Electrical Specifications

5.5.1 Master and Slave

Input voltage	+48 VDC
Input current (Max.)	10A
Encoder voltage range	+0.475 VDC to +18 VDC
Digital Input voltage range	+5 VDC to +15 VDC

NOTE: The +48VDC power supply must be isolated from AC ground. This means that AC ground and DC ground are not connected.

NOTE: If the user wishes to connect a higher voltage signal to the Digital Inputs, an external current limiting resistor must be used. The input already has an internal 1K Ω resistor. Add an external resistor of the appropriate value such that the current to this input is **less than 15mA**.

5.5.2 Station

Input voltage	+48 VDC
Input current (Avg.)	2.0A

5.5.3 Station 1000

Input voltage	+12 VDC
Input current (Avg.)	4.5A

5.6 LED Indicators

5.6.1 Master

Indicator LED	Description
Power	Device is powered on
Safety	Indicates the status of the Safety Interlock circuitry. The "On" state indicates that all sensor light sources are active
Encoder A	Encoder alarm: The encoder alarm is turned on when one of the encoder's differential voltage signals (A, B or Z) fall below 0.475 volts
Encoder F	On continuously: Forward motion with no indexing is detected Blinking: Forward motion with indexing is detected.
Encoder R	On continuously: Reverse motion with no indexing is detected

	Blinking: Reverse motion with indexing is detected.
In 1	Digital input port 1 active
In 2	Digital input port 2 active
In 3	Digital input port 3 active
In 4	Digital input port 4 active
Out 1	Digital output port 1 active
Out 2	Digital output port 2 active
Sync	Synchronization message is broadcast by the Master.
Sensor port (PORT 01 to PORT 13)	On: Ethernet connection established Blinking: Ethernet traffic

5.6.2 Slave

Indicator LED	Description
Power	Device is powered on
Safety	Indicates the status of the Safety Interlock circuitry. The “On” state indicates that all sensor light sources are active.
Sync	Synchronization message is received from the Master
Sensor port (PORT 01 to PORT 13)	On: Ethernet connection established Blinking: Ethernet traffic
UP port	On: Ethernet connection established Blinking: Ethernet traffic

5.6.3 Station

Indicator LED	Description
Power	Device is powered on

5.7 Cordsets

5.7.1 Sensor Cordset

- Maximum length 100m (328')
- Binder 423-series 14-pin connectors (male and female)
- FireSync cable – dual, stranded CAT5e

5.7.2 Station Cordset

- Maximum 100m (328')
- Binder 423 series 14-pin connector (male)
- RJ45 connector (male)
- CAT5e cable

5.7.3 Master to Slave Cordset

- Maximum length 100m (328')
- Binder 423-series 14-pin connectors (male and female)
- FireSync cable – dual, stranded CAT5e

5.7.4 Ethernet Cable

- Maximum length 100m (328')
- RJ45 connectors
- CAT5e cable

5.8 Default Network Settings

5.8.1 Station IN Port

- IP address : 90.0.0.1
- Subnet Mask 255.0.0.0

5.8.2 Station OUT Port

- IP address : 192.168.1.10
- Subnet Mask 255.255.255.0

5.8.3 Remote access

5.8.3.1 Station

- Windows Remote Desktop
 - Username : administrator
 - Password : admin

6 FireSync Blade

This appendix contains all the relevant information about the FireSync Blade processing node. A FireSync Blade functions the same as any other FireSync Station, except that it has a different form factor (1U rack-mount), and the hardware it is based on is much faster.

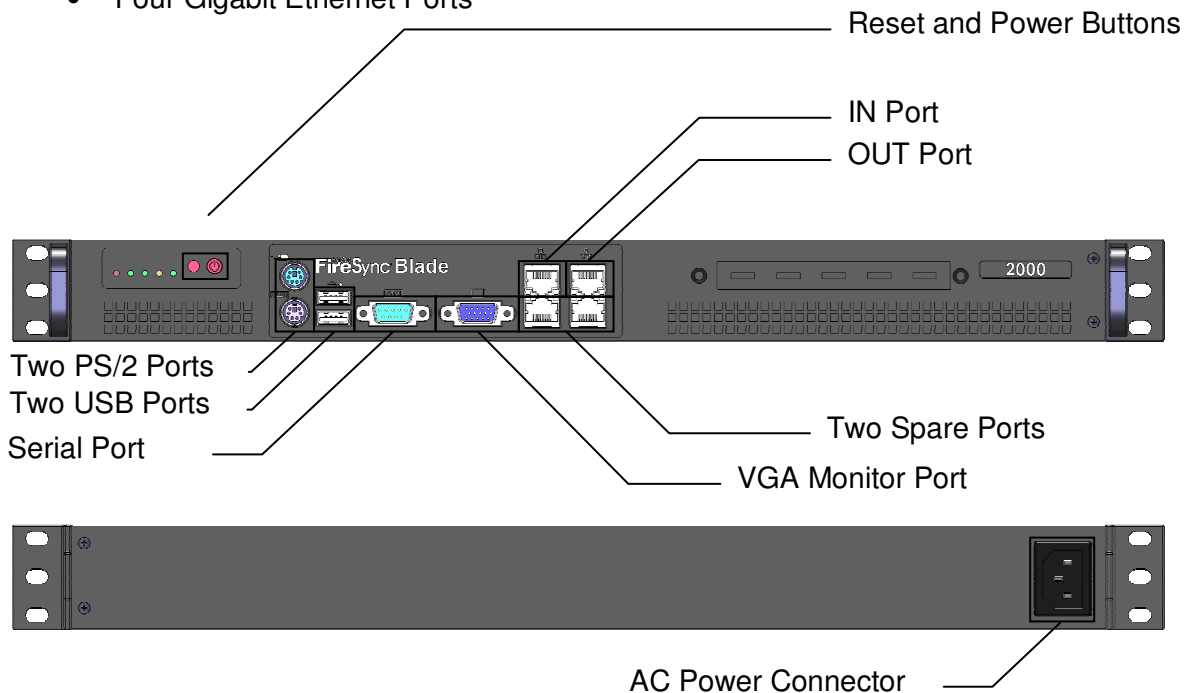
6.1 Models

Blade 2000:

- FireSync Blade 2000 – Intel Core Duo 2.5+ GHz processor, 4 GB RAM, 2+ GB USB flash disk, 4 GigaBit Ethernet ports, 120-240 VAC power supply.

6.2 Features

- Reset and Power Buttons
- Two PS/2 Ports
- Two USB 2.0 Ports
- VGA Monitor Port
- Serial Port
- Four Gigabit Ethernet Ports



Reset Button

This button will immediately reboot the Blade. Avoid use of this button.

Power Button

This button is used to turn the Blade on or off. When it is on, press it once, and the Blade will execute a proper shutdown. Holding this button for 5 seconds will force an immediate shutdown. Avoid forcing immediate shutdowns.

PS/2 Ports*

Standard PS/2 ports for a keyboard and mouse.

USB Ports*

Standard USB 2.0 ports.

Serial Port*

Standard serial port.

VGA Monitor Port*

Standard port to connect a VGA monitor.

NOTE: *Connections to these ports are not required to operate a FireSync Network

IN Port

The IN port is a Gigabit Ethernet link to a Master or a Slave. It communicates on the sensor (Private) network.

The IN port IP address will always be on the 90.X.X.X subnet. This address can be changed by sending a “Set Private IP” command to the Station. The valid addresses are 90.0.0.1 to 90.0.0.5.

Out Port

The OUT port is a gigabit Ethernet link to the client (Public) network. It is the gateway through which the user communicates with the sensor network.

The OUT port can be set to any IP address except addresses belonging to the 90.X.X.X subnet. The default IP is 192.168.1.10.

Spare Ethernet Ports

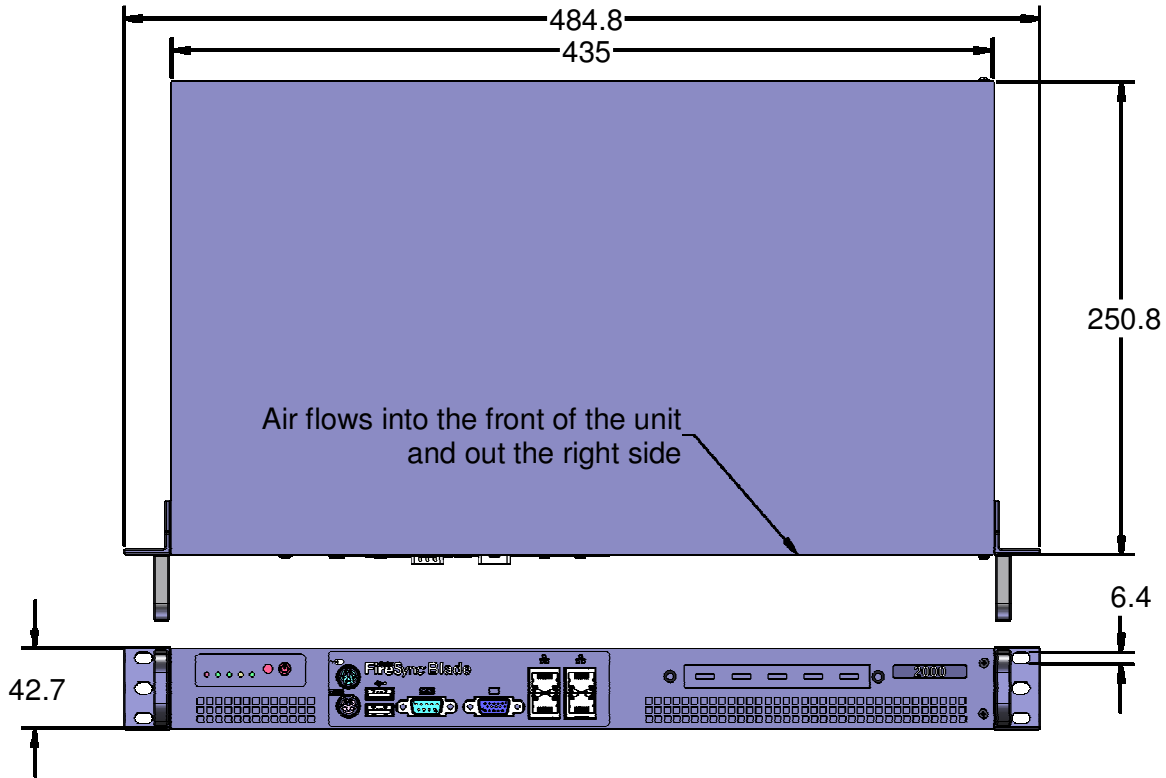
These two ports are not designated for any specific use in a FireSync Network. To configure either to act as the IN or OUT port, configure the port to the desired static IP.

AC Power Connector

IEC Type-14 connector for provided AC power cable (North American Type-B). See Section 6.5 for this connector’s electrical requirements.

6.3 Mounting Dimensions

The Blade 2000 will fit into a standard 19" rack, using either M5 or #10 screws. All dimensions are in millimeters:



6.4 Connector Information

Power Connector	IEC Type 14
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6.5 Electrical Information

Input voltage	100 - 240 VAC, 50 - 60 Hz
Input current (Avg.)	2 - 4 A

6.6 LED Indicators

Indicator LED	Description
Temperature Alarm	CPU is overheating
LAN 2	Ethernet traffic on LAN connection 2
LAN 1	Ethernet traffic on LAN connection 1
Hard Disk	Hard disk is being accessed
Power	Device is powered on
Ethernet Port 'X' Left LED	Ethernet traffic detected
Ethernet Port 'X' Right LED	Ethernet connection speed: Off – No Connection or 10 Mbps connection detected Green – 100 Mbps connection detected Yellow – 1 Gbps connection detected

6.7 Default Network Settings

IN Port:

- IP address : 90.0.0.1
- Subnet Mask : 255.0.0.0

OUT Port:

- IP address : 192.168.1.10
- Subnet Mask : 255.255.255.0

6.8 Remote Access

- Windows Remote Desktop
 - Username : administrator
 - Password : admin

7 Warranty

7.1 Warranty policies

These products are warranted for one year from the date of purchase from LMI Technologies Inc. Products that are found to be non-conforming during their warranty period are to be returned to LMI Technologies Inc. The shipper is responsible for covering all duties and freight for returning the sensor to LMI. It is at LMI's discretion to repair or replace sensors that are returned for warranty work. LMI Technologies Inc. warranty covers parts, labor and the return shipping charges. If the warranty stickers on the sensors are removed or appear to be tampered with, LMI will void the warranty of the sensor.

7.2 Return policy

Before returning the product for repair (warranty or non-warranty) a Return Material Authorization (RMA) number must be obtained from LMI. Please call LMI to obtain this RMA number. Carefully package the sensor in its original shipping materials (or equivalent) and ship the sensor prepaid to your designated LMI location. Please insure that the RMA number is clearly written on the outside of the package. With the sensors, include the address you wish this shipment returned to, the name, email and telephone number of a technical contact should we need to discuss this repair, and details of the nature of the malfunction. For non-warranty repairs, a purchase order for the repair charges must accompany the returning sensor. LMI Technologies Inc. is not responsible for damages to a sensor that is the result of improper packaging or damage during transit by the courier.

8 Getting Help

If you wish further help on a component or product, contact your distributor or LMI directly. Visit our website at www.lmitechnologies.com for the agent nearest you.

For more information on Safety and Laser classifications, contact:

Center for Devices and Radiological Health, FDA
Office of Compliance (HFZ-305)
Attn: Electronic Product Reports
2098 Gaither Road
Rockville, Maryland 20850