



10GbE Network Configuration Guide for SM200C and SM435C Operation.

10GbE Network Configuration Guide

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1 Introduction

The purpose of this document is to

- Outline hardware requirements for 10GbE networks interfacing the Signal Hound SM200C and SM435C networked devices.
- Provide recommendations for 10GbE networking components.
- Provide a brief overview of 10GbE networking for customers new to the interface.

1.1 10GbE Networking Overview

Signal Hound 10GbE devices operate over a single 10GbE link. Commands and data are sent using a proprietary format over UDP at rates up to 6.4Gb/s. 10GbE is full duplex and can operate over a number of physical channels. The two most common are copper and fiber cables. In addition to cabling there are a number of interfaces and connector types used in 10GbE networking, the most common is the SFP+ module. This connector form factor is what the reciever uses and what we recommend customers use for their networks.



Figure 1: SFP+ 10GBASE-SR (fiber optic) module

Standard 10GbE network copper cables are terminated with two SFP+ connectors and can be seen in the picture below. Copper cables are ideal for local applications where cable distances don't need to exceed more than a few meters. Copper cables are less complex than fiber alternatives but will have data reliability issues at longer lengths.



Figure 2: 10GbE copper cable. Terminated with two non detachable SFP+ modules.

Fiber cables are constructed from a length of fiber cabling and two detachable SFP+ transceiver modules. The type of fiber cabling and paired SFP+ module must be compatible for the assembled cable to work. The type of fiber cable used will depend on the SFP+ transceiver module. There are a number of SFP+ fiber transceiver standards, some of the most common and the ones recommended by Signal Hound are the 10GBASE-SR, LR, ER, and ZR. Each standard uses a different light wavelength, fiber cable type, and has a different reach (maximum cable length).

Standard Name	Wavelength	Cable Type	Reach in km
10GBASE-SR	850nm	OM3/4 multi-mode*	0.3/0.4
10GBASE-LR	1310nm	OS2 single-mode	10
10GBASE-ER	1550nm	OS2 single-mode	40
10GBASE-ZR	1550nm	OS2 single-mode	80

Figure 3: *While compatible with several other fiber types, we recommend OM3/4.

The two types of optical fiber used for 10GbE networks are single-mode and multi-mode. Single mode is commonly used for long distance communications while multi-mode is used for distances less than 0.3km. Single-mode cables are typically yellow while multi-mode cables are orange/aqua. Long runs of single mode fiber can have increase data reliability issues causing increased disconnection issues with your Signal Hound device. If you experience this, we recommend moving to a higher range module.



Figure 4: Multi-mode fiber cable with two SFP+ SR modules, one attached and one not.

The networked SM device has an SFP+ interface on the front panel. A cable will be connected from the device to a PC. The two most common ways to connect a 10GbE SFP+ cable to a PC is through a PCIE 10GbE network interface card (NIC) or a Thunderbolt 3 to SFP+ adapter. We provide recommendations for both in this document.



Figure 5: Left to right, Thunderbolt 3 to SFP+ adapter and 2xSFP+ 10GbE NIC adapter card.

The SM200C/SM435C is a network device and has a network address that includes a media access control (MAC) address, (internet protocol) IP address, and Port address.

The MAC address uniquely identifies a network device. No two network devices will have the same MAC address. Customers cannot change the MAC address and should never need to know the devices MAC address, although it is used by your computer in the address resolution protocol (ARP) table which correlates MAC address with IP addresses.

The IP address is a label assigned to each device on a given network. Each Signal Hound device is configured with a default IP address of 192.168.2.10. This address can be changed using the API or with the network configuration utility in Spike. When interfacing a networked device, the IP address of the device must be specified to establish communication.

The port address is another important number used in networking. The default port number is 51665. Its purpose is to ensure the data is delieved to the right application on the two network devices (in this case, your PC and the Signal Hound device).

The SM200C/SM435C uses UDP to transmit information over the network. One of the main factors in determining network speed is the maximum transmission unit (MTU) size. MTU refers to the largest packet that can be sent of the network. MTU often defaults to 1500 bytes, and must be set to 9000 bytes (also referred to as jumbo packets) for correct SM200C operation. This document outlines how to do this. There are operating system specific settings that must also be configured and they are detailed in the OS setup sections below.

The Signal Hound networked devices run a bare bones 10GbE interface that only responds to ARP requests and proprietary commands. The devices do not support ping requests or any other device discovery methods.

Signal Hound networked devices do not support TCP.

2 10GbE Network Compatibility Guide

This section outlines the hardware requirements for networking the recievers and includes several recommendations for each of the hardware components.

2.1 Adapters and Cables

Signal Hound recommends fiber cables with SFP+ fiber adapters. The SM200C/SM435C will work with single and multi-mode fiber cables with appropriate transceiver modules.

The devices has also been tested with passive copper cables up to 2 meters. Longer passive cables may have increased data reliability issues.

Tested Transceivers and Cables

- FS SFP-10GSR-85
- FS SFP-10GLR-31
- FS SFP-10GZR-55
- FS-OM3 50/125 multi-mode fiber patch cables
- FS 9/125 single mode fiber path cable
- 10GTek CAB-10GSFP-P2M (passive copper cable 2-meters)
- Ubiquiti UniFi direct attach copper cable, 0.5m, (UC-DAC-SFP+)

2.2 Recommended 10GbE Network Interface Cards

- Intel X722-DA2/4 adapter cards
- Intel X520*DA2 adapter cards
 - ZR modules may have issues with this card on Windows 10.
 - One example of such a card, 10Gtek 2 port SFP+ to PCIE
 - <u>https://www.amazon.com/10Gtek-E10G41BTDAG1P5-Ethernet-Converged-X520-DA1/dp/B01DCZCA30?th=1</u>

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- Intel X710
 - Signal Hound has not tested these NICs, but customers have reported success in using them.
 - Only Intel branded SFP+ modules are supported. The provided SFP+ modules will not work on X710 NICs.
- Asus 10Gbps PCIE Adapter (XG-C100F)
 - Signal Hound has not tested this adapter. Customers have reported success in using them.
 - https://www.amazon.com/gp/product/B07VLC7LT3/ref=ppx_od_dt_b_asin_title_s00?ie=U TF8&psc=1

2.3 Recommended Thunderbolt To 10GbE Adapters

- QNAP Thunderbolt 3 to 10GbE Adapter (QNA Series) (Recommended)
- Sonnet Solo10G SFP+ (Thunderbolt 3 Edition)

2.4 Alternative Connection Methods

It is possible to adapt an M.2 key to a PCI-E X4 interface, followed by a standard PCI-E network interface card (listed above). Conversion from M.2 to PCI-E can be performed with a part such as

https://www.amazon.com/gp/product/B074Z5YKXJ/ref=ppx_od_dt_b_asin_title_s00?ie=UTF8& psc=1

PCI-E can be extended with a part like

https://www.amazon.com/gp/product/B07QRP65M1/ref=ppx_od_dt_b_asin_title_s00?ie=UTF8& psc=1

2.5 **Operating Systems**

Signal Hound recommends the following operating systems.

- Windows 10/11
- Linux
 - o Ubuntu 18.04
 - o Ubuntu 20.04
 - CentOS 7
 - o Red Hat 7

2.6 Processor Requirements

All measurement capabilities other than the 200MS/s I/Q streaming have modest processor requirements. Typical i5/i7 processors will have the necessary performance. For 200MS/s I/Q streaming, single threaded CPU performance is critical. Signal Hound recommends CPUs that can sustain 4GHz single threaded performance and 8th generation or newer Intel processors.

The use of Thunderbolt 3 to SFP+ adapters has shown to reduce processor requirements and, in many cases, standard laptop processors can be sufficient.

2.7 Recommended PCs

This section recommends specific PCs and processors that Signal Hound and its customer have had success with, as well as some that have been reported to have issues.

2.7.1 PCs with Reported Success

- Dell XPS 15 9570 (laptop) using both SFP+ to TB3 adapters (Win).
- Dell XPS 8930 (desktop) with Intel i7-8700 and X722-2 NIC (Win).
- Dell Precision 7570 (DEP-7550-X99KC)
- Dell 7540 and 7740. (Linux)
- Intel NUC NUC6iKYK using SFP+ to TB3 adapters (Win/Linux).
- Desktop with i7-6700 CPU and Intel X520-2 NIC (Win).
- Desktop with i7-4700 CPU and Intel X722 NIC (Linux).
- Intel NUC NUC7i7DNHE with m.2 to PCIEx4 to NIC adapter (Win).
- GIGABYTE AERO 15 YB laptop with Intel i9-10980HK using both QNAP and SONNET SFP+ adapters (Win).

2.7.2 PCs With Reported Issues

- GIGABYTE Aero 15 YC laptop with Intel i9-10980HK (Please note the YC model here vs the YB model above)
 - This laptop was able to be used once following most of the steps in the troubleshooting section.
- HP Omen laptops (Win)
 - Customers have reported issues with these laptops using the SFP+ to TB3 adapters.
- Intel Core i7-6820HQ processor in laptop form factor (Win).
- Intel Core i7-7820HQ processor in laptop form factor (Win).
- Intel Core i7-5820K processor in desktop form factor (Win).
 - This CPU worked for all measurements except full 200MS/s I/Q streaming.

3 Windows 10 Setup

This section guides you in setting up your Windows 10 machine for 10GbE operation.

These instructions assumes you have already installed a 10GbE NIC or are using a thunderbolt to SFP+ adapter. If using an adapter, you have already installed the proper drivers and enabled the thunderbolt device.

The Signal Hound device should be powered up and connected to the network interface via provided fiber cable and SFP+ connectors.

This section will step you through the three main steps in configuring the 10GbE network interface.

- Specifying a fixed IP for the network interface.
- Increasing the MTU size, (enable jumbo packets)
- Verifying remaining network parameters.

The default IP address for the device is 192.168.2.10 and uses port 51665. These instructions assume you have not modified the default network configuration of the device.

3.1 Configuration Steps

First, you must navigate to the network settings. Start by going to the system settings and select "Network and Internet".

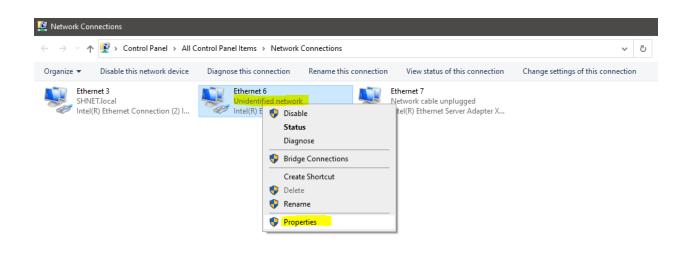
Settings							-	×
			W	indows Settings				
			Find a setting		Q			
	口	System Display, sound, notifications, power		Devices Bluetooth, printers, mouse		Phone Link your Android, iPhone		
		Network & Internet Wi-Fi, airplane mode, VPN	Ą	Personalization Background, lock screen, colors		Apps Uninstall, defaults, optional features		
	8	Accounts Your accounts, email, sync, work, other people	(凸, A字	Time & Language Speech, region, date	⊘	Gaming Game bar, captures, broadcasting, Game Mode		
	ŀ	Ease of Access Narrator, magnifier, high contrast	Q	Search Find my files, permissions	0	Cortana Cortana language, permissions, notifications		
	≙	Privacy Location, camera, microphone	$\langle \rangle$	Update & Security Windows Update, recovery, backup				

← Settings		-	×
命 Home	Status		
Find a setting	Network status		
Network & Internet	□— □ — ⊕		
Status	Ethernet 3 SHNET.Jocal		
🖫 Ethernet	You're connected to the Internet		
ි Dial-up	If you have a limited data plan, you can make this network a metered connection or change other properties.		
% VPN	Change connection properties		
🕒 Data usage	Show available networks		
Proxy	Change your network settings		
	Change adapter options View network adapters and change connection settings.		
	Sharing options For the networks you connect to, decide what you want to share.		
	▲ Network troubleshooter Diagnose and fix network problems.		
	View your network properties		
	Windows Firewall		

Once in the Network and Internet settings, select "Change adapter options"

You should now see the "Network Connections" dialog. You should see your 10GbE network interfaces listed here.

When a device is connected powered on and connected, one of the 10GbE interfaces will report "Unidentified network". Right click that interface and select properties to configure the interface.



First, we must configure the network adapter settings. In the network interface properties press the "Configure" button. This will bring up the 10GbE adapter settings.

🕴 Ethernet 6 Pro	operties	×					
Networking Sha	iring						
Connect using:							
Intel(R) Et	themet Server Adapter X520-2						
	Configure						
This connection	uses the following items:						
 Client for Microsoft Networks File and Printer Sharing for Microsoft Networks Npcap Packet Driver (NPCAP) Npcap Packet Driver (NPCAP) (Wi-Fi) QoS Packet Scheduler Internet Protocol Version 4 (TCP/IPv4) Microsoft Network Adapter Multiplexor Protocol 							
Install	Uninstall Properties						
Description Allows your co network.	omputer to access resources on a Microsoft	el					

In the adapter properties dialog, select the "Advanced" tab and configure the adapter with the following settings. If any are missing, move on. When finished press OK.

Flow Control – **Rx & Tx Enabled** Interrupt Moderation – **Enabled** Interrupt Moderation Rate – **Adaptive** Jumbo Packet – **9014 Bytes** Receive Buffers – **4096** Transmit Buffers – **4096** Any checksum offloads – **Enabled** And Large Send/Receive offloads – **Enabled** Speed & Duplex – **10Gbps Full Duplex**

Intel(R) Ethernet Server Adapter X520-2 Properties									
General	Advanced	Driver	Details	Event	ts P	ower Mana	agement		
	owing propert oerty you wan ight.								
Property	<i>I</i> :			_	Value	e:			
Interru IPsec (IPv4 C Jumbo Large s Locally Log Lir Maximu Packet Receiv	ontrol ot Moderation of Moderation Offload hecksum Offl Packet Send Offload Send Offload Administered ik State Ever um Number of Priority & VL re Buffers re Side Scalin	Rate oad V2 (IPv4 V2 (IPv6 I Address nt f RSS Qu AN)		901	14 Bytes		~	
						ОК	Can	icel	

The next step is to setup the TCP/IPv4 IP address and subnet mask. Re-enter the interface properties menu and select the Internet Protocol Version 4 (IPv4) line and press properties to bring up the IPv4 properties dialog. In this dialog, select "Use the following IP address" and manually fill out the highlighted lines with the corresponding values. Select OK when done.

Ethernet 6 Properties	× nections
Networking Sharing	ename this connection View status of this connection Change
Connect using:	Internet Protocol Version 4 (TCP/IPv4) Properties X
Configure This connection uses the following items: Client for Microsoft Networks File and Printer Sharing for Microsoft Networks Npcap Packet Driver (NPCAP) Npcap Packet Driver (NPCAP) Os Packet Scheduler Alternet Protocol Version 4 (TCP/IPv4) Microsoft Network Adapter Multiplexor Protocol Install Uninstall Properties	You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings. Obtain an IP address automatically IP address: IP address: IP address: Subnet mask: 255 , 255 , 255 , 0 Default gateway:
Description Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks. OK Cancel	Obtain DNS server address automatically Image: Use the following DNS server addresses: Preferred DNS server: Image: Addresse the text of the text of the text of tex of tex of text of tex of text of text of text of tex
	OK Cancel

At this point the interface should be properly configured and the device can be connected in Spike. Use the File->Manage Ethernet Devices menu in Spike, add a new device using the default network parameters, and connect to the device using the File->Connect menu.

3.2 **ARP**

As a troubleshooting step, the arp command can be used to verify the network and device are partially configured. In an administrative command prompt, ping the device with the command

ping 192.168.2.10

Assuming the default IP address on the device. The device will not respond to the ping request, but the PC will also update the ARP table in response to the ping. Once the ping command completes (it will end in request timed out), the ARP table can be viewed with

arp -a

The arp table under interface 192.168.2.2 should list the SM200C/SM435C device.

Interface: 192.168.2.2	0x8	
Internet Address	Physical Address	Туре
192.168.2.10	64-62-66-b0-00-61	dynamic

This verifies partial configuration. The device may still not connect properly if other settings such as jumbo packets/etc are not configured properly.

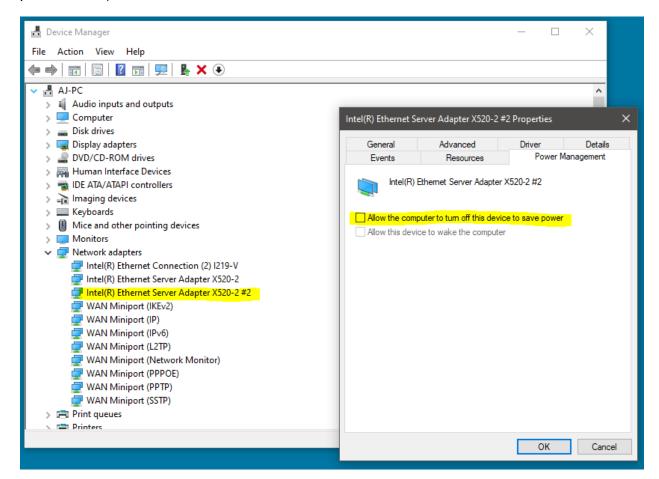
3.3 Troubleshooting

If you are having difficulties connecting to the Signal Hound device in Windows, or are having issues with continuous uninterrupted operation, here are some additional troubleshooting steps.

- Verify the device is connected to the correct network interface, the devices power cable is plugged in and the LED on the device is solid green. The LED should be solid green ~12 seconds after power is applied if a valid network connection is detected.
- In the Network Connections dialog, you should see "Unidentified Network" listed next to the network interface that the device is connected to.
- Double check that the network interface that the device is connected to has been configured properly and no settings were missed or reverted from prior configuration.
- Ensure the high performance power plan is enabled. (See picture below)

🗃 Edit Plan Settings	– 🗆 X
All Control Panel > All Control Panel Items > Power Options > Edit Plan Settings Edit Plan Settings All Control Panel Items > Power Options > Edit Plan Settings All Control Panel Items > Power Options > Edit Plan Settings All Control Panel Items > Power Options > Edit Plan Settings All Control Panel Items > Power Options > Edit Plan Settings All Control Panel Items > Power Options > Edit Plan Settings All Control Panel Items > Power Options > Edit Plan Settings All Control Panel > All Control Panel Items > Power Options > Edit Plan Settings All Control Panel > All Control Panel Items > Power Options > Edit Plan Settings All Control Panel > All Control Panel Items All Control Panel > All Control Panel Items All Control Panel > All Control Panel Items All Control Panel > Power Options All Control Panel > All Control Panel Items All Control Panel + All Control Panel All Control Panel + All Control Panel + All Control Panel + All	✓ O Search Control Pa
Change settings for the plan: High performance Choose the sleep and display settings that you want your computer to use.	
Some settings are managed by your system administrator. <u>Why can't I change some settings?</u>	Power Options
 Turn off the display: Never ~ Put the computer to sleep: Never ~ 	Advanced settings Select the power plan that you want to customize, and then choose settings that reflect how you want your computer to manage power.
Change advanced power settings Restore default settings for this plan	High performance [Active]
Save changes Cancel	Desktop background settings Wireless Adapter Settings USB settings Desk Settings Power buttons and lid PCIC Express Descence on were management
	Restore plan defaults OK Cancel Apply

- Disable any anti-virus software temporarily. Anti-virus software has been known to scan network traffic increasing CPU substantially which might limit network throughput or introduce network data loss.
- Verify proper power management settings for the adapter/NIC. This is more important for adapters on laptops. Find your adapter/NIC in the device manager, and right-click and view properties for that device. Under the power management tab, verify the PC is not allowed to turn off the device to save power (unchecked). If check, the PC might disable this device during operation which will cause data loss and the device to disconnect. (See picture below)



 If your device is having difficulty connecting, try enabling only the necessary network subsystems in the Ethernet properties menu. (See picture below) Uncheck all items except QoS packet scheduler and Internet Protocol Version 4 (IPv4). Once unchecked press OK and attempt to connect the device again. If not successful, try checking Internet Protocol Version 6 (IPv6) and trying again. Some customers have reported IPv6 needing to be check before connection occurs.

🏺 Ethernet 6 Proper	ties		×					
Networking Sharing								
Connect using:								
🚽 Intel(R) Ethem	et Server Adapter X520-2	2						
		Config	gure					
This connection uses	the following items:							
File and Prin File and Prin Procap Pack Proca	crosoft Networks iter Sharing for Microsoft ket Driver (NPCAP) ket Driver (NPCAP) (Wi-Fi Scheduler cocol Version 4 (TCP/IPv etwork Adapter Multiplexo	ì) 4)	× >					
Install	Uninstall	Prope	erties					
Description Allows your computer to access resources on a Microsoft network.								
	0	К	Cancel					

 For unstable connections, low throughput, or latency spikes, try increasing the IRPStackSize. This registry setting increases the number of stack locations available for the Input/Output Request Packet (IRP) stack. Increasing this number might lead to improved network performance and throughput.

Using the registry editor, locate the registry subkey

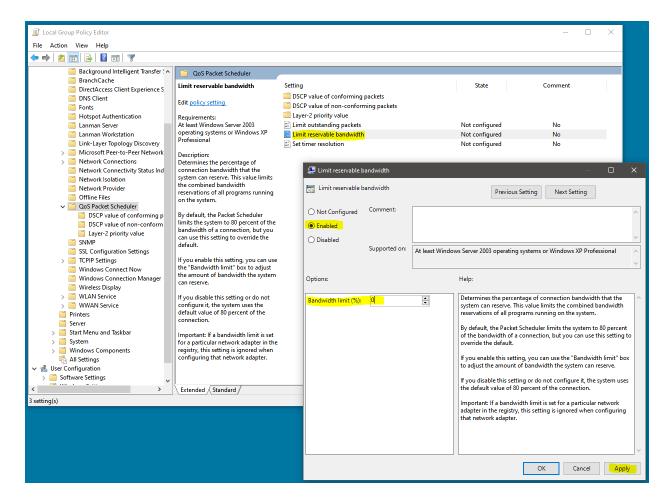
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\LanmanServer\Par ameters

If the IRPStackSize entry is not present, create a DWORD value with the name IRPStackSize. If it is present, simply modify it. The default stack size is 15 (decimal), and the maximum is 50. Microsoft recommends no using values between 33 and 38. Consider trying values such as 20, 30, 32, 45, and 50. Once modified, the system must be restarted to take effect. See picture below.

🏥 Registry						
		Favorites Help				
Computer\l	HKEY_LC	OCAL_MACHINE\SYSTEM\CurrentControlSet\Serv	ices\L	anmanServer\Parameters	1	
		IPNAT	^	Name	Туре	Data
	>	IPT		(Default)	REG_SZ	(value not set)
	>	lpxlatCfgSvc		BableAuthenticateUserSharing	REG_DWORD	0x00000000 (0)
	>	isapnp		BableForcedLogoff	REG_DWORD	0x00000001 (1)
	2	iScsiPrt ItSas35i		8 EnableSecuritySignature	REG_DWORD	0x00000000 (0)
	2	ixgbn		80 Guid	REG_BINARY	28 cf b6 64 01 ff 6a 4e a2 e1 7e 00 19 99 0d 28
		ihi service		80 LmAnnounce	REG_DWORD	0x00000000 (0)
	1	JTAGServer		ab NullSessionPipes	REG_MULTI_SZ	
	>	kbdclass		3 RequireSecuritySignature	REG_DWORD	0x00000000 (0)
	Ś	kbdhid		3 RestrictNullSessAccess	REG_DWORD	0x00000001 (1)
	1	kbldfltr		ab ServiceDII	REG_EXPAND_SZ	%SystemRoot%\system32\srvsvc.dll
	>	kdnic		BerviceDIIUnloadOnStop	REG_DWORD	0x00000001 (1)
	>	Keylso		🗰 Size	REG_DWORD	0x00000001 (1)
	-	KeysightCommunicationsFabric		1 IRPStackSize	REG_DWORD	0x00000000 (0)
		KeysightInstrumentDiscoveryService				
		KSecDD				
		KSecPkg		Edit DWORD (32-bit) Valu	e	×
	>	ksthunk				
	-	ktBoot		Value name:		
	>	KtmRm		IRPStack Size		
	~	ktRun LanmanServer		Value data:	Base	
	× I	Aliases		32	Hexadecimal	
					Decimal	
		- Certs				
					OK	Cancel
		Parameters				
		ShareProviders				
		Shares				

- For unstable connections, low throughput, or latency spikes, decrease the reservable bandwidth. By default, Windows can reserve up to 80% of the available network bandwidth.

To modify this, open the group policy editor and navigate to *Computer Configuration -> Administrative Templates -> Network -> QoS Packet Scheduler.* Find the "Limit reservable bandwidth" setting and double click it. Select enabled and enter a smaller value or simply 0. Press apply. If left as not configured or disabled, the default value of 80 is used. See picture of configuration below.



 For unstable connections, low throughput, or latency spikes, disable the network throttling index. Windows implements a throttling mechanism to restrict processing of nonmultimedia traffic. This can be disabled in the registry.

Use the registry setting at **HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Multimedia\SystemProfile\NetworkThrottlingIndex** and set the value to 0xFFFFFFF to disable. See picture below of this configuration.

File Edit View Favorites Help Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\Current\Version\Multimedia\SystemProfile Data Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\Current\Version\Multimedia\SystemProfile Data DefaultProductKey DefaultProductKey2 REG_SZ (value not set) DeviceDisplayObjects DiskDiagnostics REG_DWORD 0x0000000 (10) DiskDiagnostics drivers.desc Drivers32 EditIonVersion REG_DWORD 0x00000014 (20) EFS EditIonVersion EFS How of ThrottlingIndex REG_DWORD 0x00000014 (20) Font Drivers3 Font Drivers3 Font Management Hexwork ThrottlingIndex Base Mexadecimal Mexa	📫 Registry Editor										
Solution CorruptedFileRecovery Name Type Data DefaultProductKey DefaultProductKey2 REG_SZ (value not set) DeviceDisplayObjects REG_DWORD 0x0000000a (10) DiskDiagnostics drivers.desc 0 Drivers32 EditionVersion EFS EditionVersion Edit DWORD (32-bit) Value EFS EMDMgmt Event Viewer Network ThrottlingIndex Font Drivers Font Management Metwork ThrottlingIndex Base FontDPI FontMapper OK Cancel	File Edit View Fav	orites Help									
DefaultProductKey Ope Otd DefaultProductKey2 DefaultProductKey2 REG_SZ (value not set) DeviceDisplayObjects DiskDiagnostics REG_DWORD 0x0000000 a (10) DiskDiagnostics Drivers32 EditionVersion REG_DWORD 0x00000014 (20) EditionVersion EFS MDMgmt Value name: Value name: Value name: Event Viewer Font Drivers Font Management DefaultPic Metwork ThrottlingIndex Base FontDPI FontMapper FontMapper OK Cancel	Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Multimedia\SystemProfile										
		CorruptedFileRecovery DefaultProductKey DefaultProductKey2 DeviceDisplayObjects DiskDiagnostics drivers.desc Drivers32 EditionVersion EFS EMDMgmt Event Viewer Font Drivers Font Management FontManagement FontIntensityCorrection FontLink FontMapper		Name (Defa (Defa	ult) orkThrottlingIndex mResponsiveness Edit DWORD (32-bit) Value Value name: NetworkThrottlingIndex Value data:	Base I Hexa Decir	REG_SZ REG_DWORD REG_DWORD A decimal nal	(value not set) 0x0000000a (10) 0x00000014 (20)			

Disable hyperthreading. If you find that during operation (such as I/Q streaming) one of the CPU cores is at or near 100%, this could be the source of data loss. Network traffic is handled on a single thread in the kernel. If that thead is saturated, and unable to handle the transfer rates of the SM200C, data loss can occur leading to device disconnection events. Disabling hyper threading could increase the single threaded performance of the PC alleviating this issue. You can disable hyperthreading in the BIOS of some PCs. If this has no effect, Signal Hound recommends re-enabling hyperthreading as it can impact the performance other other heavily threaded applications.

4 Linux Setup

This section guides you in setting up an Ubuntu 18.04, Ubuntu 20.04, CentOS 7, or Red Hat 7 machine for SM200C/SM435C operation.

These instructions assumes you have already installed a 10GbE NIC or are using a thunderbolt to SFP+ adapter. If using an adapter, you have already installed the proper drivers and enabled the thunderbolt device.

In testing, Ubuntu 18.04 and Ubuntu 20.04 did not require driver installations, but required operating system updates and restarts before detecting the 10 GbE NIC. Red Hat 7.9 did not require any driver installation, and detected the NIC out of the box.

The device should be powered up and connected to the network interface via provided fiber cable and SFP+ connectors.

This section will step you through

- Specifying a fixed IP for the network interface.
- Increasing the MTU size (enable jumbo packets)
- Setting socket/network buffer sizes and ring parameters.

The default IP address for the device is 192.168.2.10 and uses port 51665. These instructions assume you have not modified the default network configuration of the device.

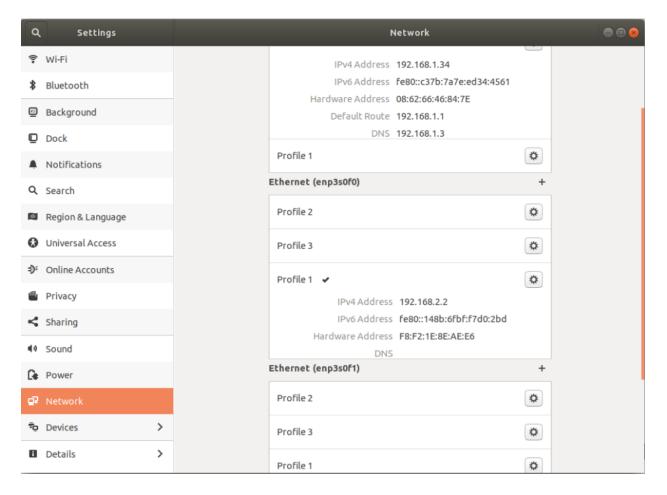
The steps outlined in the Configuration Steps section will allows you to permanently set the network configuration, meaning the configuration is not lost after a network interface restart. For a more temporary approach, see the network configuration commands.

4.1 Configuration Steps

4.1.1 Static IP and MTU Size

These instructions are for systems running the GNOME desktop.

With the device connected to a valid 10GbE network interface, navigate to the Network Settings.



Find the 10GbE network interface in the list, and create a new profile using the '+' button located to the right of the interface name. Please note the interface name (enp3s0f0 in the picture above) as it will be used in the commands documented here.

In the new profile, under the IPv4 tab, set a manual IPv4 address of 192.168.2.2 and netmask of 255.255.255.0.

٩	Settings			Network		• • •
()-	Wi-Fi		10GbE Port #1			\$
*	Bluetooth	_	Ethernet (enp3s0f0)		_	+
	Background	Cancel	10GbE Port #1		Apply	\$
Q	Dock	Details Identity IPv	4 IPv6 Security		G	\$
	Notifications	IPv4 Method	O Automatic (DHCP)	 Link-Local Only Disable 		
۹	Search		- manuat			\$
	Region & Language	Addresses	Netmask	Gateway	_	
0	Universal Access	192.168.2.2	255.255.255.0		0	
Ðs	Online Accounts					+
-	Privacy	DNS		Automatic ON		\$
4	Sharing	Separate IP addresses w	ith commas			\$
4 1)	Sound	Routes		Automatic ON		
Ge	Power	Address	Netmask	Gateway Metric		¢
9 2			VPN	_	0	+
÷o	Devices	>	Not set up			
8	Details	>				

Set the MTU size to 9000 bytes in the Identity tab. Also set a profile name here (if desired).

٩	Settings	Network 😑 📾 🖉				
(i=	Wi-Fi	10GbE Port #2				
*	Bluetooth	Profile 3 🖌				
0	Background	Cancel 10GbE Port #1 Apply				
Ū	Dock	Details Identity IPv4 IPv6 Security				
	Notifications	Name 10CbE Port #1				
۹	Search	MAC Address				
	Region & Language	Cloned Address				
0	Universal Access	MTU 9000 – + bytes +				
€Ds	Online Accounts					
4	Privacy					
<	Sharing					
40	Sound					
Ge	Power					
ġ2	Network	DNS				
÷	Devices	> Ethernet (enp3s0f1) +				
٨	Details	> 10GbE Port #2				

Hit apply when finished, and verify the new profile is selected. The profile will have a checkmark next to its name when selected.

4.1.2 Ring Parameters, Flow Control, and Transmit Queue Length

The rx/tx ring parameters must also be updated. Signal Hound recommends setting the rx/tx ring entries to 4096.

Flow control and transmit queue length can optionally be set.

4.1.2.1 Ubuntu 18.04 (ifupdown)

Modify the /etc/network/interfaces file by appending the following lines:

```
pre-up /sbin/ethtool -G iface-name rx 4096 tx 4096
pre-up /sbin/ethtool -A iface-name rx on tx on
```

txqueuelen can be set with ip or ifconfig.

Using *ip*: up /sbin/ip link set dev enp3s0f0 txqueuelen 10000

Using *ifconfig*: up /sbin/ifconfig *iface-name* txqueuelen 10000

This modification will run the proper ethtool command to modify the ring parameters the next time the network interface is restarted. It will also turn on flow control and set the txqueuelen.

4.1.2.2 Ubuntu 20.04 (systemd)

Create a file called /etc/systemd/network/10-sm200c.link ("sm200c" is arbitrary and can be changed to whatever you prefer).

Edit the file as follows, using the MAC address of your interface (which could be found with the command "ip a" or similar):

[Match] MACAddress=XX:XX:XX:XX:XX:XX

[Link] MTUBytes=9000 RxBufferSize=4096 TxBufferSize=4096 RxFlowControl=On TxFlowControl=On TransmitQueueLength=10000

This will set the ring parameters.

It also contains entries to set flow control, MTU size (which is also set in the GUI), and the txqueuelen. However, these entries did not have an effect during Ubuntu 20.04 testing. They have been left here for documentation purposes.

4.1.3 Socket Buffer Sizes

Next is to configure the read and write socket buffer sizes. The Signal Hound device can keep up to 32MB of UDP traffic in flight at any given time. We will configure the maximum buffer sizes to 50MB. To do this, edit the /etc/sysctl.conf file and add the following lines at the end of the file,

```
net.core.rmem_default=10000000
net.core.rmem_max=50000000
```

net.core.wmem_default=10000000
net.core.wmem_max=50000000
net.core.netdev_max_backlog=100000

These settings will take effect the next time the network interface/PC is restarted.

Restart the computer for all settings to take effect. Use the commands in the next section to verify the settings have been applied properly upon restart. The device should now be able to be interfaced.

4.2 Network Configuration commands

The following commands can be used from the terminal to configure the network interface. The changes that occur for all of the following commands is temporary and will not persist through a network interface restart. See the main configuration steps for permanent methods. Also included are commands that can be used to verify the network settings are configured properly.

These commands can be used in a configuration script that is run on program startup or run manually as needed. For all commands, replace *iface-name* with the name of the network interface the device is connected to.

4.2.1 MTU Size

Set the MTU size.

\$ sudo ip link set *iface-name* mtu 9000

View the current MTU sizes.

\$ ip link show | grep "mtu"

4.2.2 Socket Buffer Sizes

Set the socket buffer sizes.

```
$ sudo sysctl -w net.core.rmem_default=10000000
$ sudo sysctl -w net.core.rmem_max=50000000
$ sudo sysctl -w net.core.wmem_default=10000000
$ sudo sysctl -w net.core.wmem_max=50000000
$ sudo sysctl -w net.core.netdev_max_backlog=100000
```

Read the socket buffer sizes.

\$ cat /proc/sys/net/core/rmem default

- \$ cat /proc/sys/net/core/rmem max
- \$ cat /proc/sys/net/core/wmem default
- \$ cat /proc/sys/net/core/wmem max
- \$ cat /proc/sys/net/core/netdev max backlog

4.2.3 Ring Parameters

Set rx/tx ring parameters for a network interface.

\$ sudo ethtool -G *iface-name* rx 4096 tx 4096

Read rx/tx ring parameters for network interface.

\$ ethtool -g *iface-name*

4.2.4 Flow Control

Set the flow control variables.

\$ sudo ethtool -A *iface-name* rx on tx on

Read the current flow control variables.

\$ ethtool -a *iface-name*

4.2.5 Trasmit Queue Length

```
4.2.5.1 ip
```

Set txqueuelen.

\$ sudo ip link set dev iface-name txqueuelen 10000

Read the txqueuelen.

\$ ip link show iface-name

4.2.5.2 ifconfig

Set txqueuelen.

\$ sudo ifconfig iface-name txqueuelen 10000

Read the txqueuelen.

\$ ifconfig iface-name

4.3 Troubleshooting

If you are having difficulties connecting to the device on Linux, quickly verify proper setup with the following steps.

- Verify the device is connected to the correct network interface, the device power cable is plugged in and the LED on the device is solid green. The LED should be solid green ~12 seconds after power is applied if a valid network connection is detected.
- Verify the correct profile is selected in the Network Settings for the given network interface.
- Use the commands in the Network Configuration commands section to view and verify all network parameters have been properly set.
- Use the following commands to determine if any network errors or overruns have occurred.

\$ netstat -su \$ netstat -i \$ ip -s link

Disable hyperthreading. If you find that during operation (such as I/Q streaming) one of the CPU cores is at or near 100%, this could be the source of data loss. Network traffic is handled on a single thread in the kernel. If that thead is saturated, and unable to handle the transfer rates of the device, data loss can occur leading to device disconnection events. Disabling hyper threading could increase the single threaded performance of the PC alleviating this issue. You can disable hyperthreading in the BIOS of some PCs. If this has no effect, Signal Hound recommends re-enabling hyperthreading as it can impact the performance other other heavily threaded applications.