

Nasdaq Futures, Inc (NFX)

CONNECTIVITY GUIDELINES

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TABLE OF CONTENTS

TABLE OF CONTENTS	3
1 INTRODUCTION	4
2 CONNECTIVITY	5
2.1 INFRASTRUCTURE	5
2.2 CONNECTIVITY OPTIONS	5
3 PROTOCOL SUPPORT	8
3.1 INTRODUCTION	8
3.2 ORDER EXECUTION	8
3.3 MARKET DATA	8
3.4 RECOMMENDED BANDWIDTH	8
3.4.1 Market Data Flow	9
3.4.2 FIX Order Execution Flow	9
3.5 CONFORMANCE	9
3.6 IP ADDRESSING	10
3.6.1 Production (Primary Site)	10
3.6.2 Production (DR Site)	10
3.6.3 Nasdaq Testing Facilities	11
4 SYSTEM REDUNDANCY AND FAILOVER	11
4.1 PRIMARY AND SECONDARY SITES.....	11
4.2 SYSTEM FAILOVER PROCEDURES.....	12
4.2.1 FIX	12
4.2.2 ITCH and AMD	12
5 CONTACTS	13
5.1 TECHNICAL SUPPORT	13
5.2 MARKET OPERATIONS	13
6 REVISION HISTORY	13

1 INTRODUCTION

This document includes the main procedures and information to prepare client infrastructure and connectivity to the Nasdaq Futures (NFX) trading platform.

Never hesitate to contact NFX if you have any questions. All support information can be found at the end of this document.

2 CONNECTIVITY

2.1 INFRASTRUCTURE

NFX will have its primary site in Chicago with close proximity to other major futures market centers. The DR site will be co-located with Nasdaq's U.S. market centers in Carteret, New Jersey.

Access to the NFX primary site at Equinix Chicago Data Center or the NFX DR site at the Nasdaq Carteret Data Center can be obtained through a variety of different connectivity providers, either through local cross-connects, or an approved telecommunications provider or an approved Extranet provider or ISV.

Customers should first contact NFX for an initial setup meeting to discuss the preferred connectivity solution. Please see contact details in Section 5.

The customer owns the relationship, and costs associated, with the connectivity provider and data center for any cross-connects or direct connects. For final verification and access to the platform, the participant needs to contact NFX.

At the Chicago data center, NFX offers 1Gbps handoffs via either single-mode or multi-mode fiber. In Carteret, NFX offers single-mode or multi-mode fiber for either 1Gbps or 10Gbps bandwidth speeds. However, in both data centers, customers may utilize their existing production connections to gain access to any of the Nasdaq markets.

2.2 CONNECTIVITY OPTIONS

2.2.1 Production Site Addresses

Primary:

Equinix CH4
350 East Cermak Rd
Chicago, IL, 60616

DR:

1400 Federal Blvd
Carteret, NJ, 07008

2.2.2 Production – Chicago (Primary) / Carteret (Secondary)

- **Leased Lines**
 - Chicago: This connectivity is established by the customer ordering dedicated leased line circuits via their preferred provider to the 350 E Cermak facility. Cross-connects will be provided by Equinix and will terminate directly on our client extranet switches on the 8th floor within the Equinix CH4 space.
 -
 - Carteret: This connectivity is established by the customer ordering dedicated leased line circuits via their preferred provider to the 1400 Federal Blvd. facility. Cross-connects will be provided by Nasdaq and will terminate directly on our client extranet switches. Multiple telco provider options are available on the link below.

https://www.nasdaqtrader.com/content/ProductsServices/Trading/direct_connect_providers.pdf

- **Extranet**
 - Chicago: We plan on having multiple extranet vendor options for connectivity into our trading systems, e.g. Savvis, IDC/7ticks, TMX/Atrium, Verizon/VFN, BTRadianz, SFTI etc.
 - Carteret: We currently have multiple extranet vendor options into our Carteret data center. The extranet providers will coordinate the installation and connectivity testing together with the Nasdaq technology teams. The most common extranet vendors are listed above and mentioned on the link below.

<https://www.nasdaqtrader.com/content/ProductsServices/Trading/extranets.pdf>

- **Colocation**
 - Chicago: Customers will be able to connect via colocation / FIX gateways by extending cross-connects into our client extranet edge, if they have presence in the 350 E Cermak, Chicago facility. All cross-connects will be ordered through and maintained by Equinix. For co-location or other hosting services at the data center, Equinix or another provider within the facility, would be involved in the order and install.
 - Carteret: Current Nasdaq CoLo customers in Carteret, can utilize their existing Nasdaq handoffs to reach the NFX ports. Requests for new CoLo handoffs will be made through the [Nasdaq Co-Lo and Connectivity Console](#) (client portal) which will route the handoff installation to the Nasdaq technology and support teams for completion.

- **SSL VPN – Internet Access**
 - Currently in development. Not available yet.

2.2.3 NTF - (Carteret)

The NTF is a separate environment from the production environment within Nasdaq's Carteret data center. The Carteret NTF currently houses the test environments for both the Equities (Nasdaq, BX, and PSX) and NFX markets. Customers will not be able to utilize an existing production connection to access the NTF, but there are several options for connectivity:

- **Leased Lines**
 - Carteret: This connectivity is established by the customer ordering dedicated leased line circuits via their preferred provider to the 1400 Federal Blvd. facility. Cross-connects will be provided by Nasdaq and will terminate directly on our client extranet switches. Multiple telco provider options are available on the link below.

https://www.nasdaqtrader.com/content/ProductsServices/Trading/direct_connect_providers.pdf

- **Extranet**
 - We have the following extranet vendors, connected into the NTF environment: Savvis, IDC/7ticks, TMX/Atrium, and SFTI. The extranet providers will coordinate the installation and connectivity testing together with the Nasdaq technology teams.
- **Colocation (Carteret only)**
 - Current Nasdaq CoLo customers in Carteret, can utilize their existing Nasdaq handoffs to reach the NFX ports. Requests for new CoLo handoffs will be made through the [Nasdaq Co-Lo and Connectivity Console](#) (client portal) which will route the handoff installation to the Nasdaq technology and support teams for completion.

- **VPN**

- Full Access: Customers that want to connect to the NTF via VPN for testing both market data and order entry must use TMX/Atrium. This will require VPN termination equipment. The TMX/Atrium contact is below:

Jim Gregory

US Sales Director

TMX - Toronto Stock Exchange

Phone: 917-848-3718

Email: jim.gregory@tmxatrium.com

- Nasdaq VPN (limited): This method would comply according to our InfoSec requirements in regards to internet connectivity. VPN tunnels would need to be created between the client site and our B2B region where the VPN would terminate. This will require VPN termination equipment. Customers wanting to access the test environment via VPN should contact the Nasdaq Subscriber Services team subscriber@nasdaq.com +1 (212) 231-5180 (Option #3). **Please note that the Nasdaq VPN connection doesn't support multicast.**

2.2.4 Ports

Ordering FIX ports for the primary site can be done by contacting NFXOps@nasdaq.com.

ITCH feeds for the primary site is done through the Nasdaq Subscriber Services team subscriber@nasdaq.com +1 (212) 231-5180 (Option #3).

3 PROTOCOL SUPPORT

3.1 INTRODUCTION

NFX offers market participants and ISVs Application Programming Interfaces (APIs) to create custom applications and services to suit specific needs, including customized algorithmic trading, risk management, data services and straight through processing

NFX supports order management through FIX while market data can be obtained through the ITCH protocol.

Orders & Quotes	FIX 5.0 SP2	Order and Quote Management, Trade Reporting	NFX FIX.pdf
Market Data	FIX 5.0 SP2	Reference Data	NFX FIX Reference Data.pdf
	ITCH	MBO & Reference Data	NFX ITCH.pdf
		Trade Reports, Market Statistics, etc.	NFX Auxiliary Market Data.pdf

3.2 ORDER EXECUTION

Order executions are done through a FIX 5.0 gateway. The FIX implementation also includes FIX reference data, as well as a FIX drop copy service. You receive primary ports on the primary datacenter, additional ports on the primary datacenter for intra-site failover and separate ports on the backup site. Customers are not able to utilize backup ports if primary is available

3.3 MARKET DATA

Market data is available through an ITCH and AMD “NFX Auxiliary Market Data” feed. The ITCH feeds are taken straight off the matching engine to achieve ultra-low latency and full depth of market by order. Basic reference data, orders, trades and the net order imbalance indicator is distributed via the ITCH feed while reported trades, trade cancels, settlement prices, open interest etc. is distributed via the Auxiliary Market Data feed.

You will receive single ITCH and AMD feeds on the primary site and on the secondary site, and you may also be able to receive two redundant feeds for both ITCH and AMD from the primary site based on preference.

In order to support customers to quickly recover the MBO status in the event that they have had issues in regards to their ITCH feed, GLIMPSE is a point-to-point data feed connection that provides direct data feed customers with a snapshot of the current state of the order books. GLIMPSE uses the same message formats as ITCH. At the end of the GLIMPSE snapshot it will provide a sequence number that can be used to connect and sync up with the real-time ITCH feed.

3.4 RECOMMENDED BANDWIDTH

The figures below are recommendations only. Each participant should analyze the recommended minimum bandwidth requirement and determine if current leased lines or cross-connects are sufficient, or if an upgrade is necessary.

3.4.1 Market Data Flow

The highest network load is imposed by the ITCH market data flow. The ITCH service is provided as an IP Multicast flow only.

The following bandwidth demand is recommended as minimum:

- ITCH sent out as IP Multicast flow: 10 Mbps

These recommendations are based on transaction flow expectations. Bearing in mind the side effects (such as re-requests needed by the application and the time it takes to retrieve all lost messages) when network congestion causes dropped messages, the above recommended value should be used as a bandwidth minimum. To some extent, this value also takes into account that “micro-bursts” may be possible.

3.4.2 FIX Order Execution Flow

Depending on the number of transactions per second needed for each participant, the bandwidth need may vary.

- FIX order execution session: 1Mbps

Please note that unforeseen or unusual behavior in the market can result in higher throughput requirements.

3.5 CONFORMANCE

Conformance testing is vital for determining whether an ISV or member-produced software application will interact correctly with the NFX platform markets prior to accessing the live production environment.

Testing is carried out in test environments for all new applications and for major upgrades of the trading interfaces. The primary aim of the exchange is to protect the integrity of the NFX markets for market participants and to provide a basic level of testing that minimizes the possibility of product failure. While the exchange offers a basic conformance test, all firms integrating to the platform are expected to thoroughly test their applications independent of the conformance process. It is possible to request exclusion of selected test cases where functions are not used.

3.6 IP ADDRESSING

NFX uses public registered IP addresses. Each FIX session will be individually addressed and will be provided through customer port-requests.

3.6.1 Production (Primary Site)

Site A Primary	IP / MC Address	Port-Range	Purpose
FIX Order entry	206.200.219.0/24	TCP 17000-17999	
FIX Order entry failover	206.200.219.0/24	TCP 17000-17999	
FIX Reference Data	206.200.219.13	TCP 19000-19999	
FIX Reference Data failover	206.200.219.14	TCP 19000-19999	
FIX Drop Copies	206.200.219.13	TCP 18000-18999	
FIX Drop Copies failover	206.200.219.14	TCP 18000-18999	
Nasdaq-Port	Extranet1.qport.nasdaq.com 206.200.219.223	HTTP 8082	
TradeGuard (PTRM)	Extranet1.tradeguard.nasdaq.com 206.200.219.223	HTTPS 8443	

Channel/Purpose	IP / MC Address	Port-Range	Source IP Address
ITCH group A	233.187.20.225	UDP 31040	206.200.219.225
Rerequest		UDP 31540	206.200.219.13
Glimpse	206.200.219.13	TCP 21800-21900	
ITCH group At	233.187.20.226	UDP 31041	206.200.219.225
Rerequest		UDP 31541	206.200.219.13
A/At multicast RP	207.251.255.97		
ITCH group C	233.187.20.241	UDP 31042	206.200.219.241
Rerequest		UDP 31542	206.200.219.14
Glimpse	206.200.219.14	TCP 21800-21900	
ITCH group Ct	233.187.20.242	UDP 31043	206.200.219.241
Rerequest		UDP 31543	206.200.219.14
C/Ct multicast RP	207.251.255.98		

3.6.2 Production (DR Site)

Site B (DR site)	IP / MC Address	Port-Range	Purpose
FIX Order entry	206.200.129.0/24	TCP 17000-17999	
FIX Reference Data	206.200.129.13	TCP 19000-19999	
FIX Drop Copies	206.200.129.13	TCP 18000-18999	

Channel/Purpose	IP / MC Address	Port-Range	Source IP Address
ITCH group B	224.0.23.129	UDP 31140	206.200.129.225
Rerequest		UDP 31640	206.200.129.13
Glimpse	206.200.129.13	TCP 21800-21900	
ITCH group Bt	224.0.23.130	UDP 31141	206.200.129.225
Rerequest		UDP 31641	206.200.129.13

B/Bt multicast RP	207.251.255.55		
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3.6.3 Nasdaq Testing Facilities

Nasdaq Test Environment	IP / MC Address	Port-Range	Purpose
FIX Order entry	206.200.30.11	TCP 17000-17999	Fix Order Entry
FIX Order entry failover	206.200.30.12	TCP 17000-17999	Fix Order Entry failover
FIX Reference Data	206.200.30.11	TCP 19000-19999	Reference Data
FIX Reference Data failover	206.200.30.12	TCP 19000-19999	Reference Data failover
FIX Drop Copies	206.200.30.11	TCP 18000-18999	Drop Copies
FIX Drop Copies failover	206.200.30.12	TCP 18000-18999	Drop Copies failover
TradeGuard (PTRM)	Extranet2.qport.nasdaq.com 206.200.129.223	HTTP 8082	
Nasdaq-Port	Extranet2.tradeguard.nasdaq.com 206.200.129.223	HTTPS 8443	

Channel/Purpose	IP / MC Address	Port-Range	Source IP Address
ITCH group A1	233.56.159.225	UDP 31011	206.200.30.97
Rerequest		UDP 31511	206.200.30.11
Glimpse	206.200.30.11	TCP 21800-21900	
ITCH group At1	233.56.159.229	UDP 31015	206.200.30.97
Rerequest		UDP 31515	206.200.30.11
ITCH group B1	233.56.159.228	UDP 31014	206.200.30.113
Rerequest		UDP 31514	206.200.30.12
Glimpse	206.200.30.12	TCP 21800-21900	
ITCH group Bt1	233.56.159.232	UDP 31018	206.200.30.113
Rerequest		UDP 31518	206.200.30.12
A/B multicast RP	207.251.255.40		

4 SYSTEM REDUNDANCY AND FAILOVER

The NFX systems are designed to provide redundancy and failover functionality. The failover solution depends on the type of system and component involved.

4.1 PRIMARY AND SECONDARY SITES

The NFX primary product system is located in Chicago and the architecture includes a number of redundant components to ensure internal site fail-over capabilities without affecting the operation of the market.

The secondary site acts as disaster recovery site, where systems and processes can be promoted to run as primary.

Customers are able to connect to either/both the primary or secondary site, and are thus able to reduce their risk, and lessen the impact of a system disturbance affecting one site. While the primary site is active, the secondary site will not accept any FIX connections.

4.2 SYSTEM FAILOVER PROCEDURES

In the event of a serious system disturbance, making the primary site unable to continue operating, the operation of the system will need to failover to the secondary site. Failover functionality is divided into failover of backend systems or components thereof, and failover of customer connections.

Under normal operation the NFX central system components run on the primary site and the central systems on the secondary site are in standby mode.

Site failover of the NFX central system contains some manual processes and will not be immediate.

4.2.1 FIX

FIX failover is available in two phases, 1) between FIX gateways on the primary site, and 2) if the primary site is unavailable, to the secondary site.

The FIX order entry gateway on the primary site is configured in a pair. Both FIX gateways in a pair are hosting primary connections. Customers are only able to connect to the primary port. In the event of a FIX gateway failure, a secondary port will be enabled for connection. The FIX sequence numbers are shared between the FIX gateways.

In the event of a primary site failure, the FIX gateways on the secondary site will be enabled for customer connections. The FIX gateways are in warm standby mode, meaning that sequence numbers from the primary site are known.

4.2.2 ITCH and AMD

Under normal circumstances ITCH and AMD offers concurrent feeds on the primary as well as the secondary site (Groups A, At, B, Bt). Market data messaging can be received on all feeds. Customers are advised to use the feeds on the primary site for the lowest latency (Group A, At).

Customer may also have access to additional feeds on the primary site (Groups C, Ct) for redundancy.

5 CONTACTS

5.1 TECHNICAL SUPPORT

Support and questions on connectivity, FIX, ITCH and AMD for the NFX production or test systems and certification support. Please contact Technical Support at +1 212-231-5990 /

technicalsupport@nasdaq.com

5.2 MARKET OPERATIONS

Requests for trading IDs for the NFX production or test systems.

For questions regarding setup of participants and users in test please contact Market Operations at

NFXOps@nasdaq.com

6 REVISION HISTORY

DATE	REVISION	CHANGE DESCRIPTION
July 1, 2013	1.0	Initial version for NFX
December 4, 2014	1.01	IP details added for (3.6.3) Nasdaq Testing Facilities Additional information added on how to connect via VPN
December 10, 2014	1.02	Updated IP addresses for test environment, these are now permanent IPs. Additional summary information included at beginning of the document.
February 3, 2015	1.03	Updated Connectivity Section, 2.2.
February 13, 2015	1.04	Updated Test IP Table to include Glimpse
March 31, 2015	1.08	Updated IP / MC Address for Production & Pre-production
April 13, 2015	1.10	Added multicast RP info for production and test environments, Section 3.6

April 21, 2015	1.11	Fixed typo of multicast At RP IP address
May 5, 2015	1.12	Added PTRM and Nasdaq-Port IPs



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