



US Equities/Options Connectivity Manual

Version 10.1.4

September 1, 2020

Contents

1	Introduction	3
1.1	Overview	3
1.2	Connectivity Matrix	4
1.3	Physical Interfaces	5
2	Types of Connectivity	5
2.1	IPSec VPN.....	5
2.2	Co-location Cross-connect	5
2.3	Extranet	6
2.4	Directly Connected via Private Line Ethernet	6
3	Ordering a Cross Connect to Cboe	7
3.1	Submit Request via Cboe Portal.....	7
3.2	Required Information.....	7
3.3	LOA-CFA.....	7
3.4	Data Center Provider Request	7
3.5	Latency Equalization.....	7
4	Bandwidth.....	8
4.1	Market Data Feeds.....	8
4.1.1	Multicast PITCH	11
4.1.2	Equities	12
4.1.3	Options	13
4.1.4	Disaster Recovery	14
4.1.5	TCP PITCH.....	14
4.1.6	TOP	14
4.1.7	Last Sale.....	14
4.2	FIX Order Entry	14
5	Telecommunications Providers.....	15
5.1	Extranet Providers.....	15
5.1.1	Cboe Approved Extranet Providers	15
5.1.2	Carriers	16
6	Support.....	17
6.1	Support Hours	17

1 Introduction

1.1 Overview

Cboe's primary trading platforms, BZX Exchange, BYX Exchange, EDGA Exchange, EDGX Exchange, BZX Options Exchange, EDGX Options Exchange, C2 Options Exchange ("C2"), and the Cboe Options Exchange ("C1") are housed in the NY5 Equinix data center in Secaucus, New Jersey. The secondary data center is hosted by Cyxtera ("ORD1") in Chicago, IL for all platforms except for C2 which is located in a managed data center at 350 Cermak, also in Chicago. Customers are strongly encouraged to establish connectivity to both data centers to minimize service disruption in the event of an issue at either data center. Secaucus is the "primary" or "hot" site, with Chicago being "secondary" or "warm". Customers may receive market data from Chicago, and they may connect and heartbeat with order entry systems in Chicago. Orders submitted to Chicago will be rejected until Cboe declares the primary site in Secaucus "down."

Cboe also provides a primary network Point of Presence ("PoP") in the Equinix NY4 data center in Secaucus, NJ and Cyxtera EWR2 data center in Weehawken, NJ. Customers can leverage their EWR2 and NY4/NY5 PoP connectivity to access multicast market data feeds and order entry sessions in the Cboe's primary data center. Customers may access the secondary network via Cyxtera ORD1, Equinix CH1 or 350 Cermak data centers in Chicago, IL.

It is the customer's responsibility for selecting their telecommunications provider and arranging for connections to Cboe's data centers and PoPs.

Cboe supports the following network connectivity choices for access to both Equities and Options:

- **IPSec VPN** via the Internet (only for certification or test sessions);
- **Co-location Cross-connect** (i.e. for customers co-located in the same data center as the Cboe trading platforms or a PoP);
- **Extranet** connectivity (See the [Cboe Approved Extranet Provider](#) section for a list of approved Extranet Providers); and
- **Private line Ethernet** (circuit extension from a carrier to Cboe, see the [Carriers](#) section for a list of Carriers)

1.2 Connectivity Matrix

	NY4/NY5 Latency Equalized	EWR2	ORD1	CH1	350 Cermak
Data Center Role	Primary		Secondary		
Data Center Provider	Equinix	Cyxtera	Cyxtera	Equinix	Cboe
Site Location	Secaucus, NJ	Weehawken, NJ	Chicago, IL	Chicago, IL	Chicago, IL
Site Status	Hot/Primary	PoP for Primary	Warm/Secondary	PoP for Secondary	Warm/Secondary
Accepts Co-location Cross connects?	Yes	Yes	Yes	Yes	Yes
Accepts Circuit Extension from Telco?	Yes	Yes	Telco must be co-located within Telx	Yes	Yes
Access to Production Sessions/feeds?	Yes	Yes	No	No	No
Access to Disaster Recovery Sessions/feeds?	No	No	Yes	Yes	Yes
Access to Certification Sessions/Feeds?	Yes	Yes	No	No	No
Colocation of Network Equipment?	No	No	No	Yes	Yes
1G Monthly Recurring Connectivity Fees	See Cboe Fee Schedule for details				
10G Monthly Recurring Connectivity Fees					
Supported Media Types	SMF	SMF, MMF, Copper	SMF, MMF, Copper	SMF, MMF, Copper	SMF, MMF
Round Trip Time to Production FIX gateways	~11µs	~<100µs	N/A	N/A	N/A
Connectivity Contact	Greg Nelson (312) 994-3906	Bob Luparello (914) 309-2646	Bob Luparello (914) 309-2646	Greg Nelson (312) 994-3906	noc@cboe.com (913) 815-7005

1.3 Physical Interfaces

The following standard physical interface specifications are supported in the EWR2, ORD1, CH1, and 350 Cermak data center and PoPs. For other interface specifications contact noc@cboe.com.

10G	SR (multi-mode) , LR (single-mode) & ER (single-mode)
1G	SX (multi-mode), LX (single-mode) & 1000BaseT

The following standard physical interface specifications are supported in the NY4 and NY5 data center:

10G	ER* (single-mode)
10G	LR (single-mode)
1G	LX (single-mode)

*Contact Cboe NOC for details on ER Optical Transceivers

2 Types of Connectivity

2.1 IPsec VPN

- Customers may connect via an IPsec Virtual Private Network (VPN) over the Internet for access to order entry and unicast market data feeds for certification and test purposes only. LAN-to-LAN IPsec VPN supported.
- IP address of the host presented to Cboe must be registered.
- Customers must contact Cboe NOC for encryption details and to receive their pre-shared key.

Note: Cboe does not offer multicast market data feeds over VPN.

2.2 Co-location Cross-connect

Equities and Options customers may co-locate within the NY5 data center or a data center where a Cboe PoP is located and cross-connect to Cboe.

- Each physical port connection (1Gpbs and 10Gpbs) within the Secaucus, Weehawken, and Chicago data centers/PoPs will be subject to a monthly recurring charge. See the [Cboe Fee Schedule](#) for more information.
- Co-location cross connect requests must come from a demarcation point on the data center floor or Mezzanine level. Roof-top access requests will not be accepted.
- Cboe reserves the right to charge for one-time setup and monthly recurring fees incurred connecting customers or extranets. See the [Cboe Fee Schedule](#) for more information.

With data center co-location, customers can place equipment, terminate communications circuits, and establish a cross-connect to Cboe (or other destinations) in their space. This gives the maximum

amount of control to the Member. This option is neutral for the customer and provides the greatest flexibility for the customer in determining when and to whom to connect. Customers interested in co-location services should contact the data center/PoP Point of Contact (refer to the [Connectivity Matrix](#) section for POC information).

2.3 Extranet

Customers may provision connectivity to Cboe via an extranet.

- Extranets have provisioned redundant connections to Cboe for use by multiple customers.
- Contact information for a variety of extranet providers is found below within the [Cboe Approved Extranet Providers](#) section below.

This method is an attractive alternative when:

- The customer would otherwise have to provision a long-haul private line;
- Outsourcing of network services and network management is an option; or
- The ease and speed of turn-up are important (when both the customer and Cboe have an existing connection to the extranet).

2.4 Directly Connected via Private Line Ethernet

Customers may connect to Cboe via Private Line Ethernet.

- No co-location space is required. Cross-connect from Telco demarcation point to Cboe network via an Ethernet interface.
- Each physical port connections (1Gbps and 10Gbps) within the Secaucus, Weehawken, and Chicago data centers/PoPs will be subject to a monthly recurring charge. See the [Cboe Options Fee Schedule](#) for more information.
- Cboe reserves the right to charge for one-time setup and monthly recurring fees incurred connecting customers or extranets. See the [Cboe Options Fee Schedule](#) for more information.
- Contact your carrier of choice to arrange connectivity to Cboe, see the [Carriers](#) section below.

3 Ordering a Cross Connect to Cboe

3.1 Submit Request via Cboe Portal

A Cboe Customer Web Portal account is required to request a new cross connect or decommission existing connectivity to Cboe. Please see your firm's account administrator or contact the Cboe Trade Desk for an account:

- Cboe Trade Desk - (913) 815-7001
- Email – tradedesk@bats.com

3.2 Required Information

- Location (NY5, NY4, EWR2, ...)
- Number and speed of connections requested (1G or 10G)
- Registered BGP ASN (Cboe NOC can assign a private ASN)
- Networks advertised to Cboe (registered public IP's or Cboe assigned private addresses are accepted)
- Network and billing contact information
- Transit IP address (Public or private range assigned by Cboe NOC)

3.3 LOA-CFA

Upon approval of cross connect request, Cboe NOC will provide a Letter of Authorization - Customer Facility Assignment with the "Z-side" cage, cabinet, panel, and port pair assignment. The customer requesting the cross connect is known as the "A-Side."

3.4 Data Center Provider Request

The requesting customer submits a cross connect request with the appropriate data center provider:

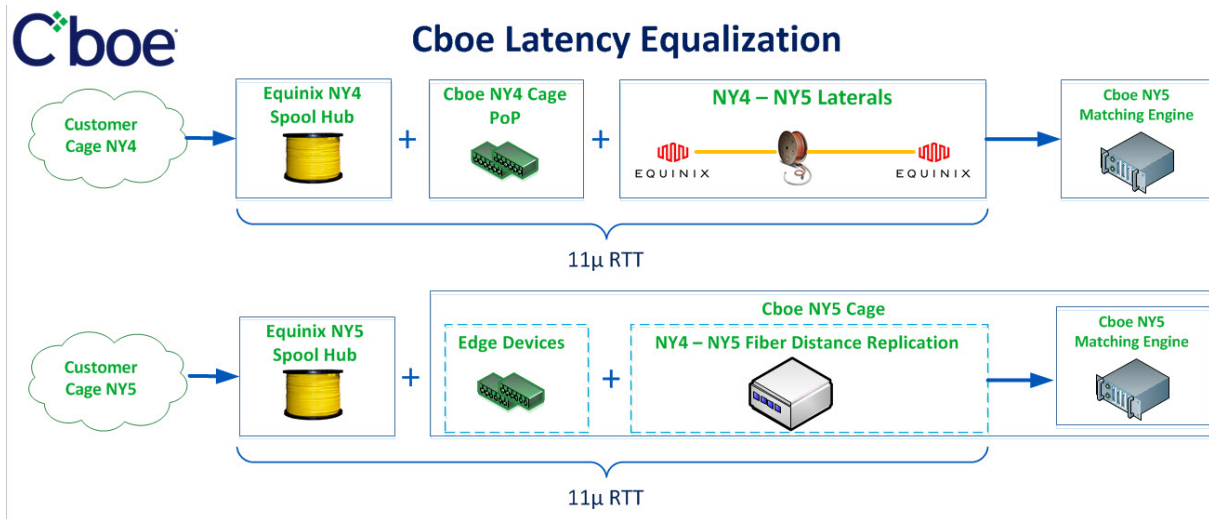
- Equinix – NY5, NY4, and CH1
- Cyxtera – EWR2 and ORD1
- Cboe – 350 Cermak

The data center provider will need the LOA-CFA and the "A-side" details to complete the connection. The "A-Side" customer is responsible for any data center setup fees and monthly recurring costs associated with the cross connect. As the "A-Side" customer, the customer is also responsible for initiating troubleshooting requests with the data center provider in the event of a down cross connect.

3.5 Latency Equalization

Cross connects originating within either NY4 or NY5 data centers will be engineered to provide equivalent latency between member demarcation points and the Cboe's order entry gateways in NY5. Equal fiber pathway latency will be determined by OBR testing. WAN circuits originating outside

Secaucus, NJ will also be subject to latency equalization. For more details, see [Cboe Latency Equalization](#).



4 Bandwidth

4.1 Market Data Feeds

Cboe offers four different types of market data feeds:

- Multicast PITCH
- TCP PITCH
- TOP
- Last Sale

Cboe requires that customers allocate a **minimum** of 10Gb/s per Multicast PITCH 8G or 5G-shaped feed, 1 Gb/s per Gig-Shaped feed and 100 Mb/s per Multicast PITCH WAN-Shaped feed. With respect to TCP PITCH and TOP feeds (not available in options), Cboe understands that firms will have varying levels of sensitivity with respect to latency and as such encourages customers to use the statistics provided below to make a well-informed decision regarding the bandwidth they will require based on their organization's latency sensitivity.

The table below shows the bandwidth statistics for historical highs for Cboe market data feeds. The table shows the bandwidth and Messages Per Second (MPS) peaks for 1, 5, 10, 30, and 60-second intervals. Peaks for 1 and 10 millisecond interval peaks are also included. The TCP statistics include 11 bytes for TCP/IP overhead per packet and do not include the data link layer overhead.

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

Cboe Market	Interval Seconds	Multicast PITCH		TOP		TCP PITCH	
		MPS	Mb/s	MPS	Mb/s	MPS	Mb/s
BZX Exchange	.001	17,421,000	1,951	1,104,000	323	1,953,000	907
	.010	14,625,900	1,665	818,700	225	1,812,300	842
	1	507,227	175	215,627	58	365,278	163
	5	279,462	96	114,477	29	310,585	139
	10	199,607	68	82,389	22	231,262	103
	30	159,833	55	70,997	19	207,030	96
	60	140,200	48	64,124	17	180,113	84
BYX Exchange	.001	17,317,000	1,940	1,102,000	324	1,629,000	750
	.010	11,149,100	1,249	1,009,500	292	1,380,000	540
	1	216,316	69	118,737	31	257,021	119
	5	122,092	40	59,984	16	151,437	68
	10	97,770	33	52,312	14	125,664	57
	30	75,116	25	44,086	11	97,798	45
	60	57,299	19	34,143	9	74,633	35
BZX Options Exchange	.001	24,488,000	2,742	N/A	N/A	N/A	N/A
	.010	22,550,800	2,525	N/A	N/A	N/A	N/A
	1	10,425,511	3,127	N/A	N/A	N/A	N/A
	5	3,802,682	1,183	N/A	N/A	N/A	N/A
	10	2,662,430	914	N/A	N/A	N/A	N/A
	30	1,876,759	636	N/A	N/A	N/A	N/A
	60	1,686,223	573	N/A	N/A	N/A	N/A
EDGA Exchange	.001	18,898,000	2,117	1,012,000	297	1,455,000	536
	.010	11,955,800	1,339	859,100	251	1,250,100	490
	1	209,444	65	118,348	31	194,984	77
	5	92,745	30	57,352	14	95,557	43
	10	69,549	23	46,895	12	82,011	37
	30	55,258	19	39,033	10	67,367	31
	60	41,676	14	30,214	8	51,206	24
EDGX Exchange	.001	17,734,000	1,986	985,000	289	1,530,000	822
	.010	12,206,100	1,367	691,400	185	1,338,900	696
	1	736,097	218	151,055	39	289,494	129
	5	151,131	45	73,459	19	147,909	55
	10	95,667	33	54,575	14	103,760	46
	30	71,178	24	41,414	10	76,779	34
	60	61,160	20	36,474	9	71,229	33
EDGX Options Exchange	.001	23,199,000	6,874	N/A	N/A	N/A	N/A
	.010	19,739,300	5,864	N/A	N/A	N/A	N/A
	1	9,736,504	2,941	N/A	N/A	N/A	N/A
	5	3,434,732	1,071	N/A	N/A	N/A	N/A
	10	2,551,221	941	N/A	N/A	N/A	N/A
	30	1,632,859	552	N/A	N/A	N/A	N/A
	60	1,421,366	481	N/A	N/A	N/A	N/A
C2 Options Exchange	.001	21,310,000	6,308	N/A	N/A	N/A	N/A
	.010	18,502,700	5,488	N/A	N/A	N/A	N/A
	1	9,240,016	2,815	N/A	N/A	N/A	N/A
	5	2,960,109	1,103	N/A	N/A	N/A	N/A
	10	2,261,457	834	N/A	N/A	N/A	N/A
	30	1,420,752	500	N/A	N/A	N/A	N/A
	60	1,339,954	470	N/A	N/A	N/A	N/A
C1 Options Exchange	.001	21,885,000	6,490	N/A	N/A	N/A	N/A
	.010	18,938,000	5,619	N/A	N/A	N/A	N/A
	1	8,303,622	2,511	N/A	N/A	N/A	N/A
	5	3,958,939	1,236	N/A	N/A	N/A	N/A
	10	2,966,312	972	N/A	N/A	N/A	N/A
	30	2,306,667	783	N/A	N/A	N/A	N/A
	60	2,198,491	748	N/A	N/A	N/A	N/A

*Statistics as of 04/02/2020.

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

It should be noted that Cboe data will have microbursts within the one-second interval above, and that these microbursts will exceed the peak rates at the one-second interval. This is demonstrated within the 1 and 10 millisecond interval statistics. The extent to which the network connection to the customer will cope with the microbursts exceeding the available bandwidth without packet loss will depend heavily on the buffers in the end to end path.

During spikes in quote updates, customers using less than sufficient bandwidth will experience queuing of their market data. Customers using the same bandwidth to both receive quotes and transmit orders may expect their orders to be slightly delayed if they have less than sufficient bandwidth. Many customers will find these delays unacceptable and should provision their bandwidth to reduce these delays. The following table demonstrates statistics regarding latency incurred as a result of queuing on Gig-Shaped and WAN-Shaped Multicast PITCH feeds.

Cboe Market	Measurement	5G-Shaped Multicast PITCH Serialization Delay (ms)	Gig-Shaped Multicast PITCH Serialization Delay (ms)	WAN-Shaped Multicast PITCH Serialization Delay (ms)
BZX Exchange	Average	N/A	0.017	1.172
	Standard Deviation	N/A	0.627	18.787
	Historical High	N/A	8.2	552
BYX Exchange	Average	N/A	0.002	0.161
	Standard Deviation	N/A	0.163	8.427
	Historical High	N/A	.004	98.3
BZX Options Exchange	Average	0.00045	16.787	N/A
	Standard Deviation	0.1533	69.581	N/A
	Historical High	.0084	36.371	N/A
EDGA Exchange	Average	N/A	0.003	0.136
	Standard Deviation	N/A	0.138	3.462
	Historical High	N/A	.014	1.035
EDGX Exchange	Average	N/A	0.016	0.947
	Standard Deviation	N/A	0.585	16.976
	Historical High	N/A	.021	1.035
	Average	0.0005	8.936	N/A

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

EDGX Options Exchange	Standard Deviation	0.111	62.114	N/A
	Historical High	.0006	24.004	N/A
Cboe C2 Options Exchange	Average	0.0006	9.813	N/A
	Standard Deviation	0.0534	44.978	N/A
	Historical High	0.0008	9.813	N/A
Cboe Market	Measurement	5G-Shaped Multicast PITCH Serialization Delay (ms)	8G-Shaped Multicast PITCH Serialization Delay (ms)	
Cboe C1 Options Exchange	Average	0.0001	0.000033	
	Standard Deviation	0.05105	0.0467	
	Historical High	0.0001	0.000033	

* Statistics as of 07/07/2020.

As the volume on an exchange increases, the market data feed bandwidth required to accommodate peaks will also grow. Customers can obtain the latest published market data bandwidth and serialization statistics within this Connectivity Manual. Additionally, monthly statistical updates are presented through the FIF Market Data Capacity working group.

4.1.1 Multicast PITCH

Key features include:

- Low latency, up to 50% latency reduction vs. TCP PITCH.
- Bandwidth versions:
 - Gig-Shaped, requires minimum gigabit cross-connect.
 - WAN-Shaped (Equities Only) shaped to 100Mb.
 - 5 Gig-Shaped (Options only) requires a dedicated 10G connection
 - 8 Gig-Shaped (C1 Options only) requires a 10G connection
- Gap Response Proxy to recover small data gaps.
- Spin Server to efficiently recover from intra-day disconnects.
- Efficient binary messaging and new modify order message.

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

Refer to the [US Equities/Options Multicast PITCH](#) specification on the Cboe web site for complete details.

4.1.1.1 Multicast PITCH Feed Availability Matrix

4.1.2 Equities

Cross Connect Data Center & Bandwidth	Equities Full-Depth of Book Multicast Feeds															
	1 Gig-Shaped								WAN-Shaped							
	BZX		BYX		EDGA		EDGX		BZX		BYX		EDGA		EDGX	
	A	B	A	B	A	B	A	B	C	D	C	D	C	D	C	D
Secaucus NY4/NY5 10G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Secaucus NY4/NY5 1G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Secaucus NY4/NY5 Options 10G Primary																
Secaucus NY4/NY5 Options 10G Secondary																
Weehawken EWR2 10G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weehawken EWR2 1G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

4.1.3 Options

Cross Connect Data Center & Bandwidth	Options Full-Depth of Book Multicast Feeds															
	1 Gig-Shaped						5 Gig-Shaped						5 Gig-Shaped		8 Gig-Shaped	
	BZX		EDGX		C2		BZX		EDGX		Cboe C2		Cboe C1		Cboe C1	
	A	B	A	B	A	B	C	D	C	D	C	D	A	B	C	D
Secaucus NY4/NY5 10G	✓	✓	✓	✓	✓	✓										
Secaucus NY4/NY5 1G	✓	✓	✓	✓	✓	✓										
Secaucus NY4/NY5 Options 10G Primary	✓	✓	✓	✓	✓	✓	✓		✓		✓					
Secaucus NY4/NY5 Options 10G Secondary	✓	✓	✓	✓	✓	✓		✓		✓		✓				
Weehawken EWR2 10G	✓	✓	✓	✓	✓	✓										
Weehawken EWR2 1G	✓	✓	✓	✓	✓	✓										
Secaucus NY4/NY5 C1-Only 10G													✓	✓	✓	✓
Secaucus NY4/NY5 C1-Only 1G*																

*C1 1G connections can only subscribe to non-full-depth of book C1 market data products shaped 1G and smaller

4.1.4 Disaster Recovery

Cross Connect Data Center & Bandwidth	Equities				Options			
	WAN-Shaped				1 Gig-Shaped			5 Gig-Shaped
	BZX	BYX	EDGA	EDGX	BZX	EDGX	C2	C1
Chicago 10G	✓	✓	✓	✓	✓	✓	✓	✓
Chicago 1G	✓	✓	✓	✓	✓	✓	✓	✓

4.1.5 TCP PITCH

Refer to the [TCP PITCH](#) specification on the web site for complete details.

4.1.6 TOP

The Cboe TOP feed offers up to 66% reduction in events and 84% reduction in bandwidth compared to the Cboe PITCH market data feed. Refer to the [TOP](#) specification on the Cboe web site for complete details.

4.1.7 Last Sale

The Last Sale feed is ideal for market data distributors. It is a real-time, intraday TCP feed that disseminates matched trade price, volume, and execution time from the Cboe Exchange order book. Users only need 2Mb of bandwidth to take this extremely efficient feed in real-time. Refer to the [Last Sale](#) specification on the Cboe web site for complete details.

4.2 FIX Order Entry

Bandwidth recommended for submitting orders via FIX depends on expected customer order volume. If a customer intends to submit orders to Cboe and will not receive market data, then it is possible that the customer can connect with less than a T1 equivalent connection. The following table shows the maximum number of inbound orders (and/or cancels) per second that can be handled, with no buffering or delay, with different capacity connections.

Example Connection Rates

Order Protocol	256Kb	512Kb	1.5Mb
FIX	75/sec.	150/sec.	450/sec.

5 Telecommunications Providers

Some telecommunications providers available within the Secaucus, Weehawken and Chicago data centers/PoPs are listed below. This list is a summary and is not indicative of Cboe’s preference or recommendation. For telecommunications providers not included on the list, please contact the Cboe NOC to discuss.

5.1 Extranet Providers

Cboe partners with several extranet providers to aggregate customer connectivity and provide low cost, value-added B2B services such as multicast market data feeds. Extranet providers are required to sign Telecommunications Service Provider Agreement after meeting the requirements outlined in the [Extranet Provider Manual](#).

5.1.1 Cboe Approved Extranet Providers

Company	Contact	Phone	Multicast Feeds *	Data Center(s)
BT Radianz www.btradianz.com	Gregory Knopp Gregory.Knopp@bt.com	(212) 205-1849		Secaucus Weehawken Chicago
CenturyLink www.centurylink.com/technology	Danielle Durkin gems@centurylink.com	(973) 650-1107	Z, Y, O, A, X, C	Weehawken Chicago
IPC Systems, Inc. www.ipc.com	John Tarantino john.tarantino@ipc.com	(212) 709-1099	Z, Y, A, X	Secaucus Weehawken Chicago
ICE Data Services – Connectivity www.iceglobalnetwork.com	Connectivity Sales iceglobalnetwork-info@theice.com	US: (770) 661-0010 EU: +44 207 429 4610 APAC +613 9249 2093	Z, Y, O, A, X, C	Secaucus Chicago
Pico www.pico.net	Sales sales@pico.net	(646) 701-6120	Z, Y, A, X, C, O	Secaucus Chicago
TNSi www.tnsi.com	Joanna Nicklas jnicklas@tnsi.com	(703) 453 8473	Z, Y, O, C	Secaucus Chicago

* Z = BZX, Y = BYX, A = EDGA, X = EDGX, C = C1 Options, O = BZX Options, EDGX Options, or C2 Options

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

5.1.2 Carriers

Telecom carriers provide a dedicated circuit between customers in different data centers to a demarcation point in the Secaucus, Weehawken or Chicago data centers/PoPs. The circuit is extended from the demarc to a Cboe’s network device.

It is recommended that customers use redundant connectivity via multiple telecommunications providers to each of the Cboe data centers.

Contact the Cboe NOC for information about circuit ordering details (e.g. NPA-NXX, LOA/CFA requirements, demarcation information, etc.).

Company	Contact	Phone	Data Center
Anova Technologies www.anova-tech.com	Heather Cannon hcannon@anova-tech.com	(312) 540-9594 x1113	Weehawken Chicago
AT&T www.business.att.com	Dale Rife wr7024@att.com	(816)275-2335	Weehawken
Hibernia Atlantic www.hiberniaatlantic.com	Hibernia Sales sales@hibernianetworks.com	(908)516-4200 (888) 774-8080	Weehawken Chicago
Hudson Fiber www.hudsonfiber.com	Thomas Kennedy tkennedy@hudsonfiber.com	(201) 820-8206	Weehawken
Level(3) Communications www.level3.com	William Simmons william.simmons@level3.com	(913) 909-9009	Weehawken Chicago
Lighttower Fiber Networks www.lighttower.com	Christopher J. Schook cschook@lighttower.com Jeffrey Mollica jmollica@lighttower.com	(631) 974-4307 (516) 375-6808	Weehawken Secaucus
NexGen Networks www.nexgen-net.com	Jeffrey Barth jeffrey.barth@nexgen-net.com	(800) 310-2501	Weehawken Chicago
Optimum LightPath www.optimumlightpath.com	Colleen M. Capen ccapen@optimumlightpath.com	(201) 644-9610	Weehawken
Perseus www.perseus.co	Tony Gerace agerace@perseus.co	(347) 325-9416	Secaucus Weehawken Chicago
Sidera Networks www.sidera.net	Stephen Papa stephen.papa@sidera.net	(212) 324-5033	Weehawken Chicago
Spread Networks, LLC www.spreadnetworks.com	Spread Network Sales sales@spreadnetworks.com	(646) 837-0330	Weehawken Chicago
Verizon Financial Network www.verizonbusiness.com/solutions/finance/institutional/servicesnetwork.xml	Verizon Financial Network Sales vfnsales@verizon.com	(800)825-9196	Weehawken Chicago
XO Communications www.xo.com	Robert Bye robert.g.bye@xo.com	(630) 544-8512	Weehawken Chicago
Zayo Fiber Solutions/AboveNet www.abovenet.com	Travis Brown tbrown@above.net	(212) 803-5597	Weehawken Chicago

6 Support

Please e-mail questions or comments regarding this manual to noc@cboe.com. Cboe NOC is a one-call shop that supports U.S. customer and telecommunications providers during initial setup and continuing support of all connectivity issues.

6.1 Support Hours

- Phone – **(913) 815-7005**
- Email – noc@cboe.com
- Core phone support hours are 7:00 AM – 11:00 PM ET Monday – Friday
- Outside of core support hours, to report a network issue that must be addressed prior to market open – leave a voice mail with the firm name, contact number, and the nature of the issue.
- For non-critical issues or for information, please email or NOC and your request will be responded to on the next business day.

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

Revision History

Document Version	Date	Description
7.0.0	04/04/14	Initial version of Manual supporting Cboe/Direct Edge integration changes.
8.0.0	02/21/15	Post-Direct Edge migration changes.
8.1.0	03/16/15	Added bandwidth statistics for EDGA/EDGX.
8.2.0	04/16/15	BZX Options move from NJ2 to NY5. Updated extranet contacts.
8.2.1	04/21/15	Update name change for Cboe Options Exchange to BZX Options Exchange.
8.3.0	05/04/15	Migration of BZX/BYX Exchanges to Secaucus, NJ.
8.3.1	05/07/15	Added to Approved Extranets table.
8.3.2	06/10/15	Updated Statistics Tables.
8.3.3	09/01/15	Updated Statistics Tables.
8.3.4	10/22/15	Updated Carrier Table.
8.3.5	12/03/15	Updated Statistics Tables.
8.4.0	12/07/15	Added section Feed Availability Matrix section 4.1.2.
8.5.0	02/19/16	Cboe branding/logo changes.
8.5.1	03/02/16	Updated Statistics Tables.
8.5.2	06/22/16	Updated Statistics Tables.
8.5.3	08/23/16	Updated Carrier Table.
8.5.4	09/01/16	Updated Statistics Tables.
8.5.5	09/23/16	Updated Carrier Table.
8.5.6	12/01/16	Updated Statistics Tables.
8.5.7	03/01/17	Updated Statistics Tables.
8.5.8	04/24/17	Updated Extranet Table.
8.5.9	06/01/17	Updated Statistics Tables.
8.5.10	08/01/17	Update Statistics Tables.
9.0.0	09/01/17	Added Cboe C2 connectivity information.
9.0.1	10/17/17	Cboe branding/logo changes.
9.0.2	01/02/18	Update Statistics Tables.
9.0.3	03/02/18	Update Statistics Tables.
9.0.4	07/02/18	Updated Statistics Tables.

Cboe US Equity/Options
Connectivity Manual (Version 10.1.4)

9.0.5	07/30/18	Updated contact information for extranet providers.
9.0.6	08/06/18	Updated Statistics Tables.
9.0.7	08/15/18	Updated Statistics Tables.
9.0.8	10/05/18	Updated contact information for data center providers.
9.1.0	11/08/18	Updated Cyxtera data center identifiers. Added Latency Equalization diagram and link.
9.1.1	12/03/18	Updated Statistics Tables.
9.1.2	01/16/19	Updated Statistics Tables.
9.1.3	04/18/19	Updated Statistics Tables.
9.1.4	07/15/19	Updated contact information for extranet providers.
9.1.5	08/09/19	Updated link to Cboe Fee Schedule.
9.1.6	08/13/19	Updated Statistics Tables.
10.0.0	10/07/19	Updated for launch of C1 Options on Bats Tech platform.
10.0.1	01/02/20	Updated Statistics Tables, added C1 statistics.
10.1.0	02/03/20	Added provision for ER Optical Transceivers in NY4/NY5.
10.1.1	03/02/20	Amended Feed Availability Matrix for 1G Shaped Feeds.
10.1.2	04/02/20	Updated Statistics Tables.
10.1.3	07/07/20	Updated Statistics Tables. Added Pico to Extranet Provider Table.
10.1.4	09/01/20	Updated C2 DR location to 350 Cermak.