

MIAAX Pearl Options Exchange

Clearing Trade Drop for Options CTD Interface Specification

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Version 1.2e

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1. Overview

MIAX Pearl Clearing Trade Drop (**CTD**) is a messaging interface that provides real-time clearing trade information to the parties of a trade (and/or entitled designated recipients) on the MIAX Pearl Options Market.

CTD Features:

CTD messaging and the system architecture is designed to benefit its recipients by providing low latency and high throughput messaging. Some of the key features of the interface are:

- CTD uses binary numeric fields and fixed length ASCII fields to utilize bandwidth efficiently and assist in achieving low latency.
- CTD requires the use of the TCP IP based MIAX Pearl proprietary SesM protocol in order to provide a guaranteed delivery mechanism for the CTD sourced messages.
- CTD messages support entitlements by:
 - OCC Number
 - CMTA
 - MPID (This is the clearing member MPID and not the introducing broker MPID)

This specification is intended for the use for MIAX Pearl Member firms and authorized subscribers of CTD only. MIAX Pearl will be referred to as Pearl for the rest of this document.

1.1 Exchange Related Information

1.1.1 Hours of Operation for Pearl Options Exchange

Please refer to MIAX website at <http://www.MIAXGlobal.com> for details about times for each of these events. Note: Times specified below are in United States Eastern Time zone.

7:00 am	Firm Interface Start up time Firms are allowed to connect
9:30 am to 4:00 pm	Trading Session for Equity Options (ends at 1:00 pm on early closing days) Note that Pearl may still send queued executions, cancels or corrections even after the end of this time range
9:30 am to 4:15 pm	Trading Session for ETF and Index Options (ends at 1:15 pm on early closing days) Note that Pearl may still send queued executions, cancels or corrections even after the end of this time range
5 pm (approx)	End of Session (ends at 2 pm on early closing days) CTD has completed sending all messages and Firms will soon be disconnected

1.1.2 Obtaining more information

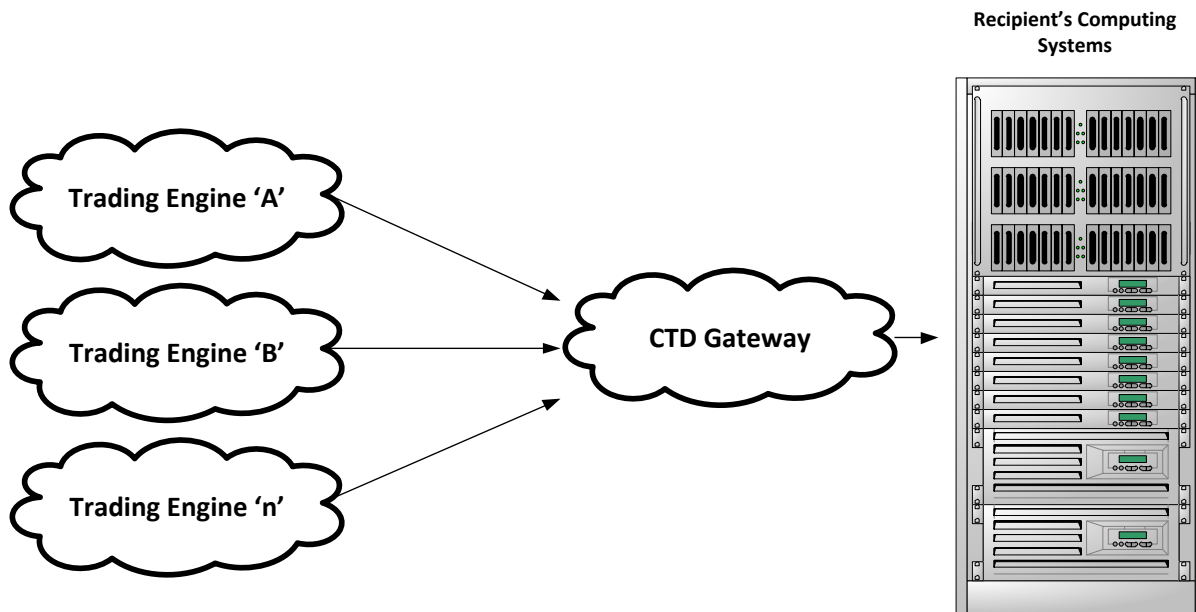
Information such as membership, rules, data feeds, fees and support can be obtained by sending an email to MIAX Trading Operations or by referring to MIAX website at <http://www.MIAXGlobal.com>.

1.2 Certification for Connecting to and Receiving Data from CTD

Please contact MIAX Trading Operations to obtain more information about certification testing and the details about the test environment.

In order for the firms to connect to production, they must certify their application with Pearl. This certification testing is a manual process. In order to schedule a certification test, please email Trading Operations.

1.3 CTD Architecture



Highlights:

- Pearl trading architecture is highly scalable and consists of multiple trade engines. Each trading engine handles trading for all options for a set of underlyings. The underlying sets may not be contiguous ranges of underlyings and could be organized in any manner as assigned by the exchange. The CTD acts as a gateway by collecting the trades from each trading engine and providing a consolidated flow of trades to the recipients of the CTD output.
- CTD clients must have a backup connection for the purposes of handling service interruptions to the primary connection point if necessary.
- This architecture offers low latency, high throughput, small fault domains and high resiliency.

1.4 FAQs

Failure Recovery: If there is a problem with the primary connection, firms can connect to the primary again if it is available or switch to the corresponding backup connection if primary is not available.

When reconnecting to the primary connection, Firms are recommended to login with the next sequence number expected based on the last sequence number received before they disconnected.

When connecting to the backup, Firms must login with a request to receive messages starting with a sequence number of 1 given that the SesM sequence numbers (and ordering of messages) may be different on the backup session. This ensures that firms do not miss any trades. Firms must be able to handle retransmitted trades and can use a combination of *TradeID*, *CorrectionNumber*, *Side* and *Trade Action* as a unique key to know if a given message is a retransmitted message.

In order to facilitate easy recoverability and continuity in sequenced message delivery, SesM protocol supports a store on the server side where it keeps all messages for a trading session regardless of the client's connection state.

Retransmission of Trade messages: Pearl may choose to retransmit trade messages in response to an interruption of the CTD service. Pearl will work to coordinate with the firms before initiating such retransmissions. Firms may be recommended to login with a request to receive messages starting with a sequence number of 1. Firms can use a combination of *TradeID*, *CorrectionNumber*, *Side* and *Trade Action* as a unique key to know if a given message is a retransmitted message.

1.5 Data Types

The following table describes the data types used in CTD messaging:

Note: Time fields in all messages are as per timings of United States Eastern Time zone.

Data Type	Description
BinaryU	Unsigned, Intel x86 byte-ordered (little-endian), binary encoded numbers
BinaryPrc4U	BinaryU Field with the last 4 (right most) digit places being decimal places
NanoTime	BinaryU field that contain transaction time in nanoseconds since past midnight
Alphanumeric	Each place can contain characters or numbers. Left justified and space-padded on to the right

1.6 Configuration

Entitlements: Recipients are required to submit their entitlement information to Trading Operations for submission to the system.

CTD Port Assignments/Connections: Recipients will be required to maintain a primary and secondary port connection to CTD.

Risk Protection Monitoring: Firms participating in Pearl Risk Protection Monitoring can manage Risk Notification messages on a per session basis. The configuration of notification messages can be coordinated with MIAX Trading Operations. Each notification type (solicited or un-solicited) is independently configurable to be forwarded or dropped.

2. Session Management Messages

Please refer to latest TCP session management protocol document (available at MIAX website at <http://www.MIAXGlobal.com>) for details about Pearl proprietary **SesM session management Protocol**. This protocol layer offers session management capabilities such as authentication, application messaging over TCP/IP, sequencing of messages, heartbeats and gap fills.

3. Application Messages

This section consists of application level messages.

3.1 System State

This message format is used to notify firms of the state changes of the system. Firms can use notifications as triggers in their system to ensure electronic synchronization of systems.

Field Name	Length	Data Type	Notes
SesM Protocol Data			<i>Sequenced Pkt; Refer to SesM Protocol Specification</i>
Message Type	1	Alphanumeric	S
Notification Time	8	NanoTime	Time at which this was generated by Pearl system.
CTD Version	8	Alphanumeric	Eg: CTD1.0
Session ID	4	BinaryU	Pearl assigned ID for the current trading session
System Status	1	Alphanumeric	Current system status: “C” = End of Application Messages “1” = Start of Test Session (sent before tests). “2” = End of Test Session.

Points to note:

- From time to time, Pearl will conduct off-hours testing. Such tests will be preceded by a System State Message indicating the start of test and close with a System State Message indicating the end of the test. Firms must ensure that messages sent on this feed from the beginning of “start of test session” to the end of “end of test session” will not affect their production systems.
- A change in Session ID will mean that restarting at message sequence number 1. Firms must be able to handle more than one trading sessions in a single trading day.
- The CTD Version field value for this release will be CTD1.0. Firms are advised to send CTD1.0 in the SesM Login Request.

3.2 Trade Message

This is the message format that will be used to disseminate all Pearl trade related content for entitled parties. Pearl sends trades, trade corrections and trade cancels using this message.

Field Name	Length	Data Type	Notes
SesM Protocol Data			<i>Sequenced Pkt; Refer to SesM Protocol Specification</i>
Message Type	1	Alphanumeric	T
Processing Time	8	NanoTime	Time at which Pearl system (Matching Engine) processed this trade.

Field Name	Length	Data Type	Notes
Trade Time	8	NanoTime	Automatic Trades: Time at which the Matching Engine created this trade. Will be same as Processing Time. Manual Trades: Trade Time of the new manual trade. Trades cancels, corrections: Trade Time of the original trade.
Trade As-of Date	4	BinaryU	As-of Date for As-of Trades. Format: YYYYMMDD. Zero for non As-of Trades.
Trade Action	1	Alphanumeric	Possible values: N = New trade C = Trade Correction X = Trade Cancel Note that New trades and Trade Cancel messages can also be generated due to a Clearing changing correction. See Correction Type field for details.
Trade Type	1	Alphanumeric	A = Automatic execution by the system M = Manual trade that Traders requested Pearl personnel to enter
Trade ID	4	BinaryU	Pearl assigned unique Trade ID for the day. For corrections and cancels, this is the trade ID of the original trade. When used in conjunction with Correction Number, Side and Trade Action, this is a unique identifier for each clearing trade.
Execution ID	8	BinaryU	Pearl assigned unique Execution ID. Each side of the Clearing trade will have a unique Execution ID.
Correction Number	1	BinaryU	Trade correction number. Used to identify version of the trade being corrected or canceled. Increments by 1 for each subsequent correction. While this is 0 for new trades, new trades resulting from corrections may have a non-zero number.
Transaction ID	4	BinaryU	All clearing trades generated from a single Engine transaction will have the same transaction ID
Reference Trade Time	8	NanoTime	Time of the <u>parent trade (version of this trade that was active prior to this correction)</u> in case of a correction or a new trade generated due to correction. 0 otherwise.
Reference Trade ID	4	BinaryU	Trade ID of the parent trade in case of a correction or a new trade generated due to correction. 0 otherwise.

Field Name	Length	Data Type	Notes
Reference Correction Number	1	BinaryU	Correction Number of the parent trade in case of a correction or a new trade generated due to correction. 0 otherwise.
Correction Type	1	Alphanumeric	Gives more information to the user when this is a correction. Possible Values: 1 = Not Applicable (Used when message is generated due to a transaction other than Trade corrections) 2 = Price and/or Size change 3 = This side Clearing change (Could affect size for Trade splits) 4 = Contra side Clearing change 5 = Both side Clearing change
Reserved	20	BinaryU	* Reserved for future use *
Symbol information			
Product ID	4	BinaryU	Pearl Product ID mapped to a given option. It is assigned per trading session and is valid for that session.
Underlying Symbol	11	Alphanumeric	Stock Symbol for the option.
Underlying Type	1	Alphanumeric	Possible Values: F = ETF I = Index E = Equity
Security Symbol	6	Alphanumeric	Option Security Symbol
Expiration Date	4	BinaryU	Expiration date of the option in YYYYMMDD format
Strike Price	4	BinaryPrc4U	Explicit strike price of the option. Refer to data types for field processing notes
Call or Put	1	Alphanumeric	Option Type C = Call P = Put
Reserved	8	BinaryU	* Reserved for future use *
Trade price/size Information			
Side	1	Alphanumeric	The side of the trade on which this receiver was involved in. Possible values: B = Buy S = Sell
Price	4	BinaryPrc4U	Trade price. This is the corrected trade price if that price changed in a trade correction.
Size	4	BinaryU	Number of contract traded in this clearing trade

Field Name	Length	Data Type	Notes														
			This is the corrected trade size if that size changed in a trade correction.														
Trade condition	1	Alphanumeric	See Appendix A for list of possible values This is the corrected trade condition if that condition changed in a trade correction.														
Reserved	8	BinaryU	* Reserved for future use *														
Additional Billing parameters																	
Class Fee Type	1	Alphanumeric	Possible values: M = Maker/Taker Fee Based														
Pearl BBO Posting Increment Indicator	1	Alphanumeric	This is the Minimum Price Variation as agreed to by the Options industry (penny pilot program) and as published by Pearl <table><tr><th rowspan="2">Indicator</th><th colspan="2">BBO Increments</th></tr><tr><th>Price <= \$3</th><th>Price > \$3</th></tr><tr><td>P</td><td>Penny (0.01)</td><td>Penny (0.01)</td></tr><tr><td>N</td><td>Penny (0.01)</td><td>Nickel (0.05)</td></tr><tr><td>D</td><td>Nickel (0.05)</td><td>Dime (0.10)</td></tr></table>	Indicator	BBO Increments		Price <= \$3	Price > \$3	P	Penny (0.01)	Penny (0.01)	N	Penny (0.01)	Nickel (0.05)	D	Nickel (0.05)	Dime (0.10)
Indicator	BBO Increments																
	Price <= \$3	Price > \$3															
P	Penny (0.01)	Penny (0.01)															
N	Penny (0.01)	Nickel (0.05)															
D	Nickel (0.05)	Dime (0.10)															
Execution Exchange	1	Alphanumeric	Market where a customer order was traded after routing from Pearl A = NYSE Amex N = NYSE Arca B = BOX C = CBOE W = C2 (from CBOE) I = ISE H = ISE Gemini J = ISE Mercury Q = NASDAQ OMX Options Market X = NASDAQ OMX PHLX Options Market T = NASDAQ BX Z = BATS E = EDGX Options Market M = MIAX D = MIAX Emerald U = MEMX Options S = MIAX Sapphire V = IEX Options G = MX2 Options ' ' (space) = Traded at Pearl														
Routed Order Quantity	4	BinaryU	This contains 0 (zero) for trades at Pearl. For trades resulting from Orders routed to other exchanges, this contains total routed quantity that will be useful in calculating away-exchange block size billing rate.														

Field Name	Length	Data Type	Notes
Market State	1	Alphanumeric	Possible values: T = FreeTrading O = Opening ' ' (space) = Not applicable (for eg: not applicable for manual trades) ** (asterisk) = downgraded for older version
Free Trading Condition	1	Alphanumeric	Possible values: 1 = Regular 2 = ABBO Uncrossed ' ' (space) = Not applicable ** (asterisk) = downgraded for older version
Reserved	20	BinaryU	* Reserved for future use *
This side Liquidity information			
Executing MPID	4	Alphanumeric	For Trades due to FIX Orders: MPID of the EEM/OFP (SenderSubID field in FIX order; Note that this will be different than Clearing MPID for MM FIX orders). For Trades due to Binary Orders: Delivering MPID.
Order Date	4	BinaryU	For Trades due to FIX Orders: Format: YYYYMMDD For Binary orders: zero.
FIX Order ID	30	Alphanumeric	For Trades due to FIX Orders: Firm assigned Order ID sent via the ClOrdID FIX field For Trades due to Binary Orders: Spaces.
Client Order ID	4	BinaryU	For Trades due to Binary Orders: Firm assigned Client Order ID For Trades due to FIX Orders: zero.
Client Message ID	4	BinaryU	For Trades due to Binary Orders: Firm assigned Client Message ID of the bulk liquidity message For Trades due to FIX Orders: zero.
Bulk Liquidity Index	1	BinaryU	For Trades due to Binary orders: Index assigned by Pearl to each liquidity unit in bulk liquidity message (Index = liquidity unit position in the bulk liquidity message) For Trades due to FIX Orders: zero.
Open/Close Indicator	1	Alphanumeric	Possible Values: O = Opening position C = Closing position
Liquidity Type	1	Alphanumeric	Pertains to this side. Possible values: F = FIX Order B = Binary Order

Field Name	Length	Data Type	Notes
			' ' (space) = N/A (Not Applicable) (eg: Manual Trade) '*' (asterisk) = downgraded for older version
Liquidity Indicator	1	Alphanumeric	Pertains to this side. Possible values: M = Maker T = Taker ' ' (space) = N/A (Not Applicable)
TimeInForce	1	Alphanumeric	0 = DAY 1 = GTC (Good Till Canceled) 3 = IOC (Immediate or Cancel) '*' (asterisk) = downgraded for older version
Reserved	20	BinaryU	* Reserved for future use *
This side Clearing Information			
Clearing MPID	4	Alphanumeric	Clearing MPID of the member
Member Type	1	Alphanumeric	Possible Values: E = Electronic Exchange Member (EEM) M = Market Maker R = Routing Broker
Origin	1	Alphanumeric	C = Priority Customer N = Non-Priority customer F = Firm B = Broker/Dealer P = Pearl member Market Maker A = Away Exchange Market Maker
Clearing Number	4	BinaryU	OCC Clearing number of this side
CMTA	4	BinaryU	CMTA in case of a give-up trade
Multi Account	5	Alphanumeric	Sub or multi account ID specified in order
Account ID	10	Alphanumeric	Account ID that is supplied in the order
Supplementary ID	13	Alphanumeric	Supplementary ID supplied in the Text field of the FIX order and Additional Text field of MEO orders
Reserved	16	BinaryU	* Reserved for future use *
Contra side (opposite side) clearing information			
MPID	4	Alphanumeric	MPID of the member
Member Type	1	Alphanumeric	Possible Values: E = Electronic Exchange Member (EEM) M = Market Maker R = Routing Broker
Origin	1	Alphanumeric	C = Priority Customer N = Non-Priority customer F = Firm B = Broker/Dealer P = Pearl member Market Maker A = Away Exchange Market Maker

Field Name	Length	Data Type	Notes
Clearing Number	4	BinaryU	OCC Clearing number
CMTA	4	BinaryU	CMTA in case of a give-up trade
ContraTimeInForce	1	Alphanumeric	0 = DAY 1 = GTC (Good Till Canceled) 3 = IOC (Immediate or Cancel) ** (asterisk) = downgraded for older version
Reserved	15	BinaryU	* Reserved for future use *

Points to note:

- This is a sequenced message. Please refer to SesM protocol specification as to the features extended by sequenced messages.
- Important:** Pearl may choose to retransmit trade messages in response to an interruption of the CTD service. Pearl will work to coordinate with the firms before initiating such retransmissions. Firms can use a combination of *TradeID*, *CorrectionNumber*, *Side* and *Trade Action* as a unique key to know if a given message is a retransmitted message.

3.3 Risk Notification Message

Firms configured to use Risk Protection Monitoring will receive User Notification communicating the status of Risk checks. Field “Event Type” is used to determine the reason for the notification.

The following message will be used to disseminate all Pearl Risk Protection Monitor (RPM) related notifications.

Field Name	Length	Data Type	Notes
SesM Protocol Data			<i>Sequenced and UnSequenced Pkt based on Event Type; Refer to SesM Protocol Specification</i>
Message Type	1	Alphanumeric	R
Processing Time	8	NanoTime	Time at which Pearl system (Matching Engine) processed this notification.
MPID Group ID	32	Alphanumeric	Firm Assigned Group ID
Metric ID	32	Alphanumeric	Metric ID for the group
Route ID	32	Alphanumeric	ID used to route to this session.
Metric Type	1	Alphanumeric	“C” = Rate of Executed Order Contracts “O” = Rate of New/Replace Orders Received ** (asterisk) = downgraded for older version
Protection Type	1	Alphanumeric	“B” = Block all MPIDs for this MPID Group ID “M” = Block all MPIDs for this MPID Group ID and also mass-cancel all day orders for MPIDs in the group “W” = Warning only ** (asterisk) = downgraded for older version
Event Type	1	Alphanumeric	“S” = Period Status/Pulse Notification “T” = Safeguard Trigger “R” = Reset Risk Metric

Field Name	Length	Data Type	Notes
			“W” = Warning Only “D” = “Metric Deleted” “A” = “Metric Added” “P” = “Metric Paused” “U” = “Metric Un-Paused” “*” (asterisk) = downgraded for older version
Event ID	4	Binary4U	Unique ID assigned by Pearl for this event. Can be used to order events. Event Type “S” Event ID will equal zero
Configured Counting Time Period	4	Binary4U	Configured time period in milliseconds which is used to consider events for this Metric ID
Configured Max Quantity	4	Binary4U	Configured max threshold of counted items for the Configured Counting Time interval for this Metric ID. Defines rate for the counting time period.
Current Quantity	4	Binary4U	Current counted quantity at the time of the event for this Metric ID.
Max Peak Quantity	4	Binary4U	Max peak for Current Quantity during pulse interval
Percentage Level	1	BinaryU	Current Percentage for the Counted Quantity in relationship to Configured Max Quantity. Valid values from 0 to 255%. Actual percentages greater than 255 will be reported as the max (255)
Reserved	32	Binary4U	Reserved for future use.

Points to note:

- Event Types are treated as solicited (T, R, W, D, A, P, U) or unsolicited (S). See configuration section on how to control what types are published on the session.
- Status Notifications are sent periodically on a best effort basis at one minute intervals. Intra-day configurations may delay updates one interval.
- Pearl will deliver warnings on a best effort basis. If a metric rapidly produces multiple warnings, initial or older warning levels may be dropped. The latest, or most current, warning will be delivered. Solicited messages are considered “Sequenced” messages at the SesM protocol level and recoverable. Unsolicited messages are considered “Unsequenced” at the SesM protocol level and not recoverable.
- If a new Event Type is published using an older App Protocol version, it will be mapped to a “*” (asterisk) for backward compatibility purposes. They will be published as unsolicited or solicited based on the new event type and are unsequenced in SesM protocol level.

Appendix A: Trade Conditions

Note that the trade conditions below are intended to be aligned with the OPRA trade conditions as a convenience. However, this is not a fixed requirement and, as such, they may digress at times.

Trade conditions applicable to the trade message:

Condition Code	Description
Space	Regular
A	Cancel of Trade previously reported other than as the last or opening for the particular Option
B	Trade that is Late and is out of sequence
C	Cancel of the last reported Trade for the particular Option
D	Trade that is Late and is in correct sequence
E	Cancel of the first (opening) reported Trade for the particular Option
F	Trade that is late report of the opening trade and is out of sequence
G	Cancel of the only reported Trade for the particular Option
H	Trade that is late report of the opening trade and is in correct sequence
I	Auto
J	Trade due to reopening of an Option in which trading has been previously halted; process as a regular transaction.
K	* Reserved for future use *
L	* Reserved for future use *
M	* Reserved for future use *
N	* Reserved for future use *
O	* Reserved for future use *
P	* Reserved for future use *
Q	* Reserved for future use *
R	Trade was the execution of an order which was “stopped” at a price that did not constitute a Trade-Through on another market at the time of the stop. Process like a normal transaction except don’t update “last”.
S	Trade was the execution of an order identified as an Intermarket Sweep Order (ISO).
T	* Reserved for future use *
X	Trade that is Trade Through Exempt. The trade should be treated like a regular sale.
a	Trade from a Paired PRIME transaction
b	* Reserved for future use *
c	Trade from PRIME Customer to Customer Cross or PRIME QCC transaction
d	* Reserved for future use *
e	* Reserved for future use *
f	Trade from a Complex transaction that is not Complex stock-tied and does not involve legging

g	Trade from a Complex PRIME transaction that is not Complex stock-tied and does not involve legging
h	Trade from a Complex PRIME Customer to Customer Cross or Complex PRIME QCC transaction that is not Complex stock-tied
i	* Reserved for future use *
j	Trade from a Complex legging transaction that is not Complex stock-tied
k	Trade from a Complex PRIME stock-tied transaction that does not involve legging
l	Trade from a Complex PRIME legging transaction that is not Complex stock-tied
m	* Reserved for future use *
n	Trade from a Complex stock-tied transaction that does not involve legging
o	Trade from Complex Customer to Customer Cross stock-tied or Complex QCC stock-tied transaction
p	* Reserved for future use *
q	* Reserved for future use *
r	* Reserved for future use *
s	* Reserved for future use *
t	* Reserved for future use *

NOTE: The list of trade conditions above is a superset of those supported by the MIAX Exchange Group for Options. Individual exchanges may or may not emit certain trade conditions depending on the related supported functionality.

Appendix B: Contact List

Please visit MIAX website at <http://www.MIAXGlobal.com> for obtaining most up-to-date contact list and other such information.

Appendix C: Revision History

Revision Date	Version	Description
Sep 30 th , 2016	1.0	First draft.
Jan 11 th , 2017	1.0a	Added a “not applicable” value for FreeTradingCondition. Added “*” to Market State to allow future upgrades.
Feb 27 th 2017	1.0b	System startup time moved up
Apr 24 th 2018	1.1	Trade Message: Added support for MIAX Emerald market
Jun 10, 2019	1.2	Added new Trade Conditions to Appendix A
July 25, 2019	1.2a	Corrected Appendix A
July 13 th , 2020	1.2b	Fixed note for Supplementary ID in Trade Message to show Additional Text will also be reflected for MEO orders.
May 23 rd , 2023	1.2c	ExecutionExchange: Added ‘U’(MEMX Options)
Jul 25 th , 2023	1.2d	ExecutionExchange: Added ‘S’(MIAX Sapphire)
Aug 4 th , 2026	1.2e	ExecutionExchange: Added ‘V’(IEX Options) and ‘G’(MX2 Options)



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