MIAX Pearl Options Exchange

User Manual

Modified November 2020

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1. Introduction

MIAX Pearl (MIAX Pearl or the Exchange) created this User's Manual to assist Members and users of its Exchange in understanding the operation of the Exchange. The User's Manual discusses, and in some cases, summarizes various MIAX Pearl Rules. MIAX Pearl's complete and official Rulebook is available at www.miaxoptions.com/rulebook/pearl. In the event of a conflict between the User's Manual and the Rules set forth in the official Rulebook, the Rulebook shall prevail.

MIAX Pearl operates a fully automated electronic options trading platform for the purpose of buying and selling securities with a continuous, automated matching function. Liquidity is derived from orders to buy and sell. Orders are submitted to the Exchange electronically by Members from remote locations. MIAX Pearl does not maintain a physical trading floor. There are two categories of Members on MIAX Pearl – Market Makers, and all other Members which are known as Electronic Exchange Members (EEMs).

Access to the Exchange is maintained by way of Trading Permits issued to the Members. Trading Permits are not transferable except in the event of a change in control of a Member.

Members are subject to fees for executions and services on the Exchange as set forth in the Exchange's Fee Schedule. A link to a copy of the complete MIAX Pearl Fee Schedule is available on the Exchange's website under the Fee Summary tab: www.miaxoptions.com/fees/pearl.

2. How to Become a Member of MIAX Pearl

How to become a member of MIAX Pearl

Holders of MIAX Options Exchange Trading Permits. A holder of a MIAX Options Exchange Trading Permit in good standing is eligible to receive one MIAX Pearl Trading Permit. A holder of a MIAX Options Exchange Trading Permit who wishes to apply to the Exchange is not required to complete and submit an Exchange application. Instead, only Exchange forms concerning election to trade on the Exchange, submitting to Exchange jurisdiction, and operational matters need to be completed and tendered.

Firms that are not holders of MIAX Options Exchange Trading Permits. A prospective member firm must be registered as a broker-dealer, must be a member of at least one other registered options exchange or FINRA, must be able to clear option trades or must clear through a clearing firm and must meet certain additional criteria described by the Exchange and set forth in the Exchange's Rules.

Further information on membership at MIAX Pearl, is available on the Exchange's website: www.miaxoptions.com/membership/pearl.

3. Types of Membership

Market Makers

To register as a Market Maker, a Member must file an application in writing on such forms as the Exchange may prescribe. The Exchange reviews applications and considers an applicant's market making ability and such other factors as the Exchange deems appropriate in determining whether to approve an applicant's registration as a Market Maker.

Each registered Market Maker must appoint a qualified person to act as a "Market Maker Authorized Trader" or "MMAT". An MMAT is an authorized trader who performs market making activities and fulfills market making responsibilities on behalf of the Market Maker.

Each MMAT must self-assign appointments on a full class or series-by-series basis. Series assignments may be entered using the MEO interface, each day before 09:00 ET.

Electronic Exchange Members (EEM)

An EEM is an Exchange Member representing as agent Public Customer Orders or Non- Customer Orders on the Exchange and those non-Market Maker Members conducting proprietary trading.

4. Access by Non-Members

Non-Members may access the Exchange pursuant to Rules governing "sponsored access" to the Exchange. The Exchange permits access by entities (Sponsored Users) whose access is authorized in advance by entering into an arrangement with a Member (Sponsoring Member) in accordance with Exchange Rules.

Sponsored Users must agree to comply with all applicable Rules of the Exchange governing the entry, execution, reporting, clearing and settling of orders in securities eligible for trading on the Exchange. Further information about Sponsored Access can be found in MIAX Pearl Rules, Chapter II.

5. How MIAX Pearl Works

Architecture

Market Makers and EEMs can send orders to the Exchange's System through the MIAX Pearl Express Order Interface (MEO) or the MIAX Pearl FIX Order Interface (FOI) gateway. The MIAX Pearl Trading System is designed to be highly scalable, efficient, fast, reliable, robust and flexible.

The Exchange deploys multiple matching engines, each engine performing the trade match function for a defined set of option classes.

Market Makers and EEMs may connect to the System via the MIAX Pearl Express Order Interface (MEO) using a proprietary binary protocol for the transmission of orders and other messages to and from the Exchange. Several types of MEO ports are available:

MEO supports the following port types:
- **Full Service Port Bulk (FSPB)** – Supports all MEO input message types and bulk binary order entry.
- **Full Service Port Single (FSPS)** – Supports all MEO input message types and binary order entry on a single order by order basis.
- **Limited service port (LSP)** – Supports all MEO input message types, but has the following limitations:
  o LSPs do not support bulk order entry.
  o LSPs support the use of IOC or ISO orders only.
- **Priority Purge Port (PPP)**
  o Supports only MEO Mass Cancel messages.

All MEO output message types are supported on all of these port types (FSPB, FSPS and LSP).

Limitations on the number and combinations of ports exist. Refer to the MIAX Pearl Fee Schedule for more details on available firm port configurations. Participants utilizing the binary MEO Interface are required to connect separately to each matching engine as the Exchange offers no routing capability via this interface.

In addition to MEO, Market Makers and EEMs may also connect to the System via the MIAX Pearl FIX Order Interface (FOI) gateway using the industry standard FIX protocol with MIAX Pearl specific extensions for the transmission of orders and other messages to and from the Exchange. The MIAX Pearl FOI validates incoming orders and forwards them to the appropriate matching engine. Executions and cancelation notifications are provided through these same interfaces.

The matching engines of the Exchange each handle a defined set of option classes, which may be reallocated on a periodic basis in order to ensure that system load is balanced across the MIAX Pearl System. Each matching engine compares the price of all incoming orders with those orders already resting on the MIAX Pearl Book. The matching engine matches liquidity as available, calculates the MIAX Pearl Best Bid and Best Offer (the PBBO), monitors the other markets' displayed prices and determines when, and if, a trade can occur. If a newly arrived order is marketable against the existing MIAX Pearl Book, and the PBBO is equal to or better than the best consolidated quote, an immediate match is made and allocations are communicated back to the trade participants.

If another market is disseminating a price superior to MIAX Pearl's displayed price, orders may be routed to the better priced market(s). Orders may be managed within the MIAX Pearl System so as not to lock the prices displayed on other markets.

Network Infrastructure

The MIAX Pearl network was designed to complement the MIAX Pearl Trading System and was built from the ground up to address the performance and security needs of a high speed trading platform. The MIAX Pearl network infrastructure utilizes fully diverse and redundant 40Gbps backbones and 10/40Gbps switch technology for maximum throughput and minimal latency.

Data Center Services

- MIAX Pearl has partnered with Equinix, a world-class provider of data center services, to host the Trading System's data center infrastructure in its NY4 location.
- Customers with very low latency demands can cross-connect to the MIAX PearlSystem from elsewhere within the Equinix facility. MIAX Pearl cross-connects are latency equalized to ensure each participant's cross-connect is the same physical distance from the MIAX Pearl System regardless of their location in the Equinix facility.
- **Notable Data Center Services**
  - SSAE16 compliant Data Centers
  - Redundant power feed sourced from district substations
  - Redundant power and cooling distribution paths within the facility
  - Concurrently maintainable (N+1 for greater resiliency)
  - On-site backup power generation
- **Enhanced Security Services**
  - State of the art security
  - Hand Scanners
  - Card Readers
  - Cameras
- Buildings designed to withstand fires, earthquakes, hurricanes and other environmental threats.
- Manned 24/7.
- A second Data Center is located in Chicago (CH4) for Disaster Recovery.

Connectivity Choices

- MIAX Pearl offers truly diverse, redundant 1 Gigabit, 10 Gigabit and 10 Gigabit ULL connectivity options in data center facilities and supports direct attachment of customer/provider network equipment or direct attached host systems. Users are strongly encouraged to establish dual connections to the primary facility in NY4 and connection to the disaster recovery system located in Chicago (CH4) to minimize the possibility of service disruption. Certain Members of MIAX Pearl will have mandatory participation requirements in the Exchange's annual Disaster Recovery (DR) test and will therefore be required to establish a connection to the disaster recovery system located in Chicago (CH4). MIAX Pearl supports the following connectivity options:
    - o **Cross-Connect.** Users that are co-located in the Equinix NY4 data center may request an in-house cross-connect from the User's Point of Entry (POE) to MIAX Pearl.
    - o **Point-to-point.** Users may connect point-to-point using leased lines or other network methods (e.g. Ethernet, etc.). (Users are responsible for providing colocation space for independently owned equipment.)
    - o **Metro Ethernet/Dark Fiber.** Users may connect via Metro Ethernet or a dark fiber provider.

Trading System Features

The MIAX Pearl Trading System was developed specifically for the unique functional and performance demands of derivatives trading. The System provides the proper protections, low latency and high throughput that is essential to the success of the trading community. The MIAX Pearl System provides extreme performance and scalability with best in class customer interface features and performance over the following interfaces:

- **MIAX Pearl FIX Order Interface (FOI) gateway for orders**
    - o Each FOI is capable of processing more than 7,700 order messages per second.
- **MIAX Pearl FIX Drop (FXD)**
    - o For clearing trade drops normally sent over FIX.
    - o Available only to submitting EEMs.
    - o Echoes trade fills, trade adjustments, trade corrections and trade cancellations from orders submitted via FIX.
    - o Does not include other FIX information such as order cancellations or order adjustments.
    - o Multiple MPIDs can be configured to use a single FIX Drop Interface.
- MIAX Pearl Express Order Interface (MEO) offers direct connections to the matching engine for the high-speed mass messaging of orders.
    - o Each full service MEO Interface is capable of processing more than 200,000 orders per second.
- MIAX Pearl Top of Market (ToM) provides low latency access to MIAX Pearl market data.
    - o The MIAX Pearl ToM data feed service produces market data across 12 multicast channels. Each channel is capable of transmitting more than 1,200,000 messages per second during peak periods.
- MIAX Pearl Clearing Trade Drop (CTD) is a low-latency, real-time feed providing clearing trade information to the parties of a trade, Clearing Firms and/or other entitled designated recipients. Recipients connect to the CTD using a proprietary protocol and one or more CTD connections for each Exchange matching engine.
    - o The MIAX Pearl CTD interface is capable of processing more than 20,000 clearing trade messages per second.

- MIAX Pearl Liquidity Feed (PLF) provides information about orders in the MIAX Pearl markets over a multicast feed.
- The MIAX Pearl System uses a next-generation highly-automated Quality Assurancemplatform that runs a full battery of tests against the System every night to ensure a high level of reliability and unprecedented confidence in System updates.
    - State-of-the-art monitoring and systems security.
    - A software and hardware architecture that results in minimizing the demands on power, space and cooling while allowing for rapid scalability, standard setting resiliency and superior fault isolation.

Further information on the Top of Market feed and the MIAX Pearl Liquidity Feed is listed below. For additional details about connecting to the MIAX Pearl trading platform, please see the Interface Connectivity Specifications on the MIAX Pearl website: www.miaxoptions.com/connectivity.

Top of Market (ToM)

Top of Book and Trade Data is made available over the MIAX Pearl Top of Market data feed (ToM). ToM is available to all MIAX Pearl participants. ToM specific information:
- MIAX Pearl Best Bid and Offer information with sizes
- Indications of Public and Priority Customer at the PBBO
    - When present, the size of the Priority Customer interest is also indicated
- Last sale information
- Post-Halt Notifications

ToM also includes information about other real-time Exchange System functions. Recipients connect to ToM using a proprietary protocol and for the purpose of redundancy may subscribe to two identical connections (ToM "A" and ToM "B") for each Exchange matching engine.

MIAX PEAL Liquidity Feed (PLF)

The MIAX Pearl Liquidity Feed provides information about orders on the MIAX Pearl order book over a multicast feed.

The following updates are transmitted over PLF when an order is received or when an order state changes.
- **Published Order information**
    - Time stamp
    - Action
    - Product ID
    - Order ID
    - Order Side
    - Order Type
    - Order Price
    - Original Order Size

- o Open Order Size
- o Time in Force
- o Origin
- o Open or Close
- o Route Instruction
- The following will not be disseminated
  - o Order States
    - Pending Replace
    - Rejected
  - o Order with time in Force of
    - IOC
  - o Child orders related to routing are not published

MIAX Pearl Information and Performance Reports

MIAX Pearl Information and Performance Reports provide Member Firms with details of their trading and activities on the Exchange. Reports include key information about transaction fees, marketing fees, the NBBO and PBBO at the time of transaction, as well as volume, clearing and risk information. This information is intended to assist firms in monitoring and evaluating their trading activity on MIAX Pearl.

Further information on the availability of MIAX Pearl Information and Performance Reports can be obtained by contacting MIAX Pearl Trading Operations at: TradingOperations@MIAXOptions.com.

Classes Listed on MIAX Pearl

A complete list of all Option Classes traded on MIAX Pearl is maintained in the Listings section of the Exchange's website at this address: www.miaxoptions.com/listings/pearl.

The All Classes Listed on MIAX Pearl file is updated daily and is available in CSV format. The file contains detailed information on each Class including:
- Underlying Symbol
- Underlying Security Name
- Option Symbol
- Minimum Price Variation
- Closing Time
- Information on Expiration Programs
- Information on Price Programs
- An indication if the Class is Closing Only
- MIAX Pearl Cloud Number (equivalent to Matching Engine Number)

Options Listed on MIAX Pearl

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The All Options Listed on MIAX Pearl file is updated daily and is available in CSV format. The file contains detailed information on each listed Option including:

- Underlying Symbol
- Option Symbol
- Expiration Date
- Strike Price
- Deliverable
- An indication if the Option is Closing Only

6. Order Information

Order Types

The following are some of the order types described in the MIAX Pearl Rules that, except as may be described below, are available for use on the Exchange as of the date of this Manual:

- **Market**. An order to buy or sell a stated number of options contracts at the best price available at the time of execution.
- **Limit**. An order to buy or sell a stated number of options contracts at or better than a specified price.
- **Immediate-or-Cancel (IOC)**. An order to be executed in whole or part upon receipt with any unexecuted portion cancelled. An Immediate-or-Cancel order is not valid during the opening rotation process described in Rule 503.
- **Intermarket Sweep Order (ISO)**. A limit order designated by the submitting member as an ISO trades without regard to MIAX Pearl price protections or protected quotations on other markets.
- **Do Not Route (DNR)**. An order that will never be routed outside of MIAX Pearl regardless of the prices displayed by away markets. A DNR order will never execute at a price inferior to the NBBO and when necessary, its display price will be managed so as not to lock or cross the NBBO.
- **Day Limit**. An order to buy or sell which, if not executed, expires at the end of trading in the security on the day on which it was entered.
- **Good 'Til Cancelled (GTC)**. An order to buy or sell, which if not executed, remains in effect until cancelled or until the underlying option expires.
- **Cancel-Replacement Order**. A Cancel-replacement order is a single message for the immediate cancellation of a previously received order and the replacement of that order with a new order with new terms and conditions.
- **Post Only Order**. Post-Only Orders are orders that will not remove liquidity from the Book. Post-Only Orders are to be ranked and executed on the Exchange pursuant to Rule 514 (Priority on the Exchange), or handled pursuant to Rule 515, as appropriate, and will never route away to another trading center.
- **Marketable Limit Order**. A marketable limit order is a limit order to buy (sell) at or above (below) the best offer (bid) on the Exchange.

Each of these types of orders is described in detail in MIAX Pearl Rule 516. The Exchange maintains a full audit trail of every order submitted to the Exchange's System. Members may receive status reports regarding orders submitted to the Exchange or change or cancel an order at any time before that order is executed on the Exchange.

Routing to Other Exchanges

Routing services are provided for routing to all Options Exchanges in the United States and are fully compliant with the Options Locked and Crossed Markets Plan (the Plan). The MIAX Pearl System routes Public Customer Orders received via the FIX Order Interface (FOI) to away markets displaying liquidity at the NBBO when required to satisfy a protected quotation under the Plan. Orders received through MEO are not eligible for routing by the MIAX Pearl System and will be managed if locking or crossing the NBBO.
A full description of MIAX Pearl routing functionality is available in MIAX Pearl Rule 529.

Order Protections Based on Size and Quantity

The MIAX Pearl System offers protections from potentially erroneous executions or obvious errors based on the size of orders, number of open orders and number of open contracts.

Members are required to submit global default settings for their firm as a part of the MIAX Pearl Membership Application process for all protections based on size or quantity.

Firms may provide updated settings by contacting the MIAX Pearl Trading Operations staff. The most recent settings will remain effective in the MIAX Pearl System until a subsequent update is received by the Exchange. All settings are put in place on a firm-wide basis and are not individually selectable by FOI connection or MPID. The following protections are available:

- Maximum size for a single order.
- Maximum number of open orders.
    - This includes partially filled orders.
- Maximum number of open contracts.
    - This Includes any contracts remaining from unfilled and partially filled orders.

Interfaces and Liquidity Types

MIAX Pearl has both a FIX Order Interface (FOI) and MIAX Pearl Express Orders Interface (MEO). The FOI allows standard orders in FIX format. The MEO Interface allows the submission of Cancel-Replacement orders or Standard orders in a binary format. A Cancel- Replacement order replaces an existing order for a given MPID on the same product and side. A Standard order is always treated as a new order and does not cancel or replace any existing order. A Standard order can be canceled or replaced using the respective message types.

A bulk order packet can contain one or more Cancel-Replacement orders, Standard orders, Standard order cancels or Standard order replacements. The maximum number of such orders in a packet is conveyed in the MEO Interface specification: www.miaxoptions.com/interface- specifications/pearl.

Quoting Requirements (Order Submission)

Further information regarding order submission requirements for Market Makers can be found in MIAX Pearl Rules 604 and 605 and on the Exchange's website: www.miaxoptions.com/rulebook/pearl.

7. Trading on MIAX Pearl

Penny Pilot Program

MIAX Pearl participates in the Penny Pilot program, which provides for the quoting and trading of certain option classes in penny increments. A list of the classes participating in the Penny Pilot Program is available along with other listing information on the Exchange's website at this address: www.miaxoptions.com/listings/pearl.

Minimum Trading and Pricing Increments on MIAX Pearl

Options in classes not in the Penny Pilot Program have a Minimum Price Variation (MPV) for PBBO display in $0.05 increments if the affected series has a price of under $3.00, and in $0.10 increments if the affected series has a price of $3.00 or higher.

Options in classes in the Penny Pilot Program have an MPV for PBBO display in $0.01 increments under $3.00 and $0.05 increments for prices of $3.00 or greater. Options overlying the PowerShares QQQ™ ("QQQ"), SPDR® S&P 500® ETF (SPY), and iShares® Russell 2000 ETF (IWM), however, are quoted and traded in minimum increments of $0.01 for all series regardless of the price.

Allocation of Trades

MIAX Pearl supports price-time trade allocation. Within each price level, if there are two or more orders at the best price, trading interest will be executed in time priority.

MIAX Pearl Opening Process

The MIAX Pearl Opening Process begins when the quoting requirements and other provisions of MIAX Pearl Rule 503(b)(1) have been satisfied.

Once the Opening Process begins, if there are no orders that lock or cross each other, the System will open by disseminating the Exchange's best bid and offer among orders that exist in the System at that time including orders marked Post-Only. If there are orders that lock or cross each other for a particular option series, the System will determine a single price at which such option series will be opened (the Opening Price). Under MIAX Pearl Rule 503(b)(2)(i) the Opening Price of a series will be the midpoint of the Valid Width NBBO, and will be rounded up if necessary to achieve a proper MPV.

After establishing an Opening Price, orders in the System that are priced equal to or more aggressively than the Opening Price will be matched based on price-time priority. Matches will occur until there is no remaining volume or there is an imbalance of orders. All orders or portions thereof that are matched pursuant to the Opening Process will be executed at the Opening Price. Orders marked Post-Only may participate in the opening without regard to the

normal function of the Post-Only instruction. An imbalance of orders on the buy side or sell side may result in orders that are not executed in whole or in part. Such orders will be handled in time sequence, beginning with the order with the oldest time stamp and may, in whole or in part, be placed on the MIAX Pearl Book, cancelled, executed, or routed in accordance with MIAX Pearl Rule 529.

After all possible interest has been traded at the Opening Price, free trading will begin. Any interest from the Opening that was priced equal to, or through, the Opening Price, along with any new interest received during the Opening, will be introduced into the System in sequence based upon the time of order receipt. Post-Only Orders that are introduced into the System will now function under the normal free trading Post-Only handling instructions.

More information regarding Opening on the Exchange can be found in MIAX Pearl Rule 503.

System Settings

All current System settings are posted in the Regulatory Circulars located under the Regulatory tab on the Exchange's website: www.miaxoptions.com/regulatory-circulars/pearl. Changes to System settings are also published by the Exchange as either Regulatory Alerts or Regulatory Circulars, as required. Please be sure to check the Exchange's website for the most current information.

Trading Halts and Trading Pauses

The System automatically halts trading when the primary market for the underlying security disseminates a halted or paused condition. Under certain circumstances, in the interest of a fair and orderly market, the Exchange may elect to manually halt trading in an individual option class, a group of option classes or all option classes Exchange wide.

The Opening Process will not begin if the underlying security is halted or paused. If the Opening Process is in progress at the time of the halt, the System will interrupt the Opening Process prior to its completion, will halt trading in options already opened and will prevent unopened options from opening. After a trading halt on MIAX Pearl, the System will reopen following the same processes as the Opening Process, except that the Primary Listing Exchange for the underlying security will be used in place of the any other exchange that may have been designated as the MIAX Pearl Exchange for Opening. The designated MIAX Pearl Exchange for Opening is disseminated via Regulatory Circular and is available on the Exchange's website.

Notifications Prior to Re-Opening:
- The Post Halt Notification period is the length of time prior to reopening after a manual trading halt prior to which a System notice is distributed over the Exchange's data feeds.
    - 20 Seconds
- The Reopening Delay period is the length of time prior to reopening after an automatic trading halt (a System initiated interruption of trading resulting from a halt or pause in the underlying security on its primary listing exchange) prior to which a System notice is distributed over the Exchange's data feeds.
    - 5 Seconds

Limit Up/Limit Down (LULD)

LULD functionality on MIAX Pearl is in effect when the underlying NMS Stock has entered into a Limit State or Straddle State. Once an NMS Stock has entered either a Straddle State or Limit State:

- The Exchange will not open an affected option.
- If an LULD state is entered after the opening, the Exchange will:
    - reject all incoming market orders submitted into the Exchange System, and
    - cancel all unexecuted market orders existing within the Exchange System, except that market orders to sell an option received when the national best bid is zero and the Exchange's disseminated offer is equal to or less than $0.10 that have been converted to limit orders to sell pursuant to Rule 519(a) will not becancelled by the Exchange's System.

In addition, once an NMS Stock has entered either a Limit or Straddle State, the Exchange shall relieve Exchange Market Makers from the following quotation obligations for options on the affected underlying NMS Stock:

- the minimum size requirement set forth in MIAX Pearl Rule 605(a);
- the requirement to submit two-sided quotes set forth in MIAX Pearl Rule 605(b); and
- the continuous quoting obligation set forth in MIAX Pearl Rule 605(d).

When an underlying NMS Stock is subject to a Trading Pause, the Exchange System will halt trading in options overlying the affected NMS Stock pursuant to MIAX Pearl Rule 504(c).

Market Wide Circuit Breakers (MWCB)

MWCB halts are treated by the System in the same fashion as a Regulatory Trading Halt on the Primary Listing Market.

8. MIAX Pearl Trade Protections

MIAX Pearl Order Monitor (MOM)

In order to reduce the incidence of potential obvious or catastrophic errors on the Exchange, the MIAX Pearl System includes the MIAX Pearl Order Monitor (MOM), as described in Exchange Rule 519. The MIAX Pearl Order Monitor prevents certain orders that violate certain pre-defined price limits from executing or being placed on the MIAX Pearl Book. These price protections include:

- Market orders to sell will be converted to limit orders to sell with a limit price of one Minimum Trading Increment when the national best bid is zero and the Exchange's disseminated offer is equal to or less than $0.10.
- Rejection of market orders to buy or sell when the NBBO is $5.00 wide or greater.
- Rejection of limit orders priced though the opposite side NBBO by an amount greater than 50% of the NBBO or $2.50, whichever is less, with the exception of
  - When the NBO is less than or equal to $0.50, the Exchange will only reject orders to buy with a price that is greater than the NBO by $0.25 or more
  - When the NBB is less than or equal to $0.25, the Exchange will accept any properly submitted limit order to sell

Protections under the MIAX Pearl Order Monitor do not apply to orders received prior to, or during the Opening Process, or to incoming orders marked as Intermarket Sweep Orders (ISO).

MIAX Pearl Variable Price Protection (MVP)

The System applies a price protection process, as described in MIAX Pearl Rule 515(c), to all orders (other than ISO orders which are handled in accordance with subsection (f) of MIAX Pearl Rule 515), limiting executions to no more than a specified number of MPVs through the NBBO as captured at time of order receipt. (If the Pearl best bid (offer) on the same side as the liquidity being evaluated is crossed by the National best offer (bid), the Pearl best bid (offer) will be used as the starting point for the MIAX Pearl Variable Price protection in place of the National best offer (bid)).

If size remains from a limit order priced though the NBBO (at the time of receipt) by more than the specified number of MPVs or a market order, and the order has exhausted its ability to execute on the NBBO within the MVP limit, the balance of the order will be cancelled back to the submitting member.

The number of MPVs through the NBBO at the time of order receipt that the order will be allowed to execute may be specified in the order at the time it is submitted to the Exchange though the MIAX Pearl FIX Order Interface.

The acceptable value range for MIAX Pearl Variable Price Protection is:

- 0 to 20
  - A selection of 0 will indicate that the order will not be allowed to trade at a price inferior to the NBBO at the time the order was received.

In the absence of a specified MVP value in the order at the time of submission, an Exchange default value for MVP will be applied. The MVP Exchange default value is five (5) MPVs.

Orders that participate in the MIAX Pearl Opening Process will always use an MVP value of zero (0) regardless of whether another value has been specified in the order at the time of submission.

MIAX Pearl Aggregate Risk Manager (ARM)

The MIAX Pearl Aggregate Risk Manager (ARM) protects Market Makers and EEMs who choose to participate (collectively ARM Participants) by limiting the number of contracts executed for a submitting MPID as a result of orders entered through MEO in a single class within a brief period of time as described in Exchange Rules 517A and 517B.

MIAX Pearl ARM tracks the number of contracts traded by an ARM Participant (represented as a percentage of their bid or offer size) in an assigned option class within a specified time period. The ARM Participant establishes a percentage of the number of contracts that they are bidding for or offering (Allowable Engagement Percentage) and the time period for each option class. When an execution against an ARM Participant's ARM Eligible Order occurs, the System looks back over the specified time period to determine whether the execution is of sufficient size to trigger the Aggregate Risk Manager. As described in Exchange Rules 517A and 517B, the Market Maker and EEM Counting Programs include all orders submitted by a Market Maker or EEM with the exception of Immediate-or-Cancel (IOC) orders.

The System engages the Aggregate Risk Manager when it has determined that an ARM Participant has traded a number of contracts equal to or above their Allowable Engagement Percentage during the time period. The Aggregate Risk Manager then automatically cancels and removes the ARM Participant's orders from the Exchange's disseminated quotation in all series of that particular option class and rejects new orders by the ARM Participant in all series of that particular option class submitted using the MEO Interface until the ARM Participant sends an ARM Protection Reset Message and submits a new order in the affected class. Orders submitted through FIX are not counted or cancelled by the Aggregate Risk Manager.

ARM[2]

ARM[2] is an enhancement to the existing ARM functionality. ARM[2] further protects MIAX Pearl Market Maker firms with two additional ARM-derived counting programs, ARM[2] Class Protection and ARM[2] Firm Protection.

- **ARM[2] Class Protection**. ARM[2] Class Protection counts the number of ARM protectionsin a Class for a Market Maker MPID over an ARM[2] Counting Period specified by the firm. If the ARM[2] Class Protection Rate is met by a number of ARM Triggers in any Class, ARM[2] will trigger ARM[2] Class Protection for that MPID in the affected Class. ARM[2] Class Protection will prevent automated re-entry of MEO orders. Protections will remain until a manual re-enablement is accomplished by MIAX Pearl Trading Operations, allowing an ARM Protection Reset Message to be submitted

- **ARM[2] Firm Protection**. ARM[2] Firm Protection counts the total number of unique Classes that trigger ARM for a firm over a Counting Period specified by the firm. If the number of unique Classes that trigger Primary ARM meets or exceeds the ARM[2] Firm Protection Rate, ARM[2] will trigger Secondary ARM protection for all Classes for the Market Maker firm. Secondary ARM protection will prevent the automated entry or re-entry of

MEO orders. Protections will remain until a manual re-enablement is accomplished by MIAX Pearl Trading Operations allowing an ARM Protection Reset Message to be submitted.

- o ARM^2 Market Maker Firm Protection applies to all of a Market Making firm's MPIDs across all classes.
- **Configuration of ARM^2 Settings**
    - o As with ARM settings, ARM^2 Class Protections are entered into the System via that MIAX Pearl Express Order Interface (MEO). Using MEO, the firm can at any time create, edit or delete:
        - The settings for how many Primary ARM protections are required to trigger ARM^2 for any Class/MPID combination.
        - The Counting Period settings for any Class/MPID combination.
    - o To create, edit or delete ARM^2 Firm Protections, the firm must submit a completed Protection Template to MIAX Pearl Trading Operations describing the ARM^2 Firm Protection settings desired including the following:
        - The total number of unique Classes that must be protected by ARM across all MPIDs in the firm required to trigger ARM^2 Firm Protection.
        - The Counting Period setting for ARM^2 Firm Protection.

Single Side Protection (SSP) for binary orders

MIAX Pearl Single Side Protection removes the risk of trading multiple MEO orders on the same side of the market for an option. In order for protection to be in effect, SSP must be enabled for an MPID by contacting MIAX Trading Operations. A single setting will enable (or disable) SSP.

If enabled, SSP will be triggered when the full remaining size of a MEO order is exhausted by a trade.

Once triggered, the Member will be notified and the following actions affecting that Member will be taken:
- Any MEO order on that side of that option for that Member will be cancelled
- All new MEO orders on that side of that option for that Member will be blocked
- A reset message will be required before the Member can reenter MEO orders on that (sell or buy) side of that option.
- ISO orders are unaffected (are not cancelled or blocked) and will never cause a protection to be triggered.

SSP Operates separately from any other MIAX Pearl trade protection and requires a separate reset to re-enable trading for that MPID for that side of the affected option.

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MIAX Pearl Risk Protection Monitor (RPM)

The MIAX Pearl Risk Protection Monitor (RPM) is responsible for monitoring risk from the transmission and execution of an EEM's orders, submitted by a specific order interface (FOI or MEO), Exchange-wide. FIX RPM will operate separately from MEO RPM. When an order is received or an execution from an order occurs, RPM will look back over the specified time frame and calculate the number of orders or executed contracts for that firm on that interface. When the number of orders or executed contracts from orders for that firm on that interface exceeds a predetermined level, RPM will automatically trigger RPM Safeguards for the firm on that interface as described in Exchange Rules 519A and 519B.

All members who enter orders on the Exchange may establish basic risk protections for trading on MIAX Pearl. A participating Member may establish specified time periods for both an Allowable Order Rate and an Allowable Contract Execution Rate. The maximum duration of each specified time period will be established by the Exchange and announced via Regulatory Circular.

When a Member's order is entered, or when an execution of a Member's order occurs, the System will look back over the specified time period to determine whether the order entered or the execution that occurred triggers the Risk Protection Monitor.

- Members may establish whether the Risk Protection Monitor, when triggered, will:
  - prevent the System from receiving any new orders in all series in all classes from the Member; or
  - prevent the System from receiving any new orders in all series in all classes from the Member and cancel all existing Day orders in all series in all classes from the Member; or
  - send a notification that the Risk Protection Monitor has been triggered without any further preventative or cancellation action by the System

RPM Groups
- Members may also elect to group with other Members to enable the Risk Protection Monitor to apply collectively to the Group. The Members in the Group must designate a Group owner. Members may elect to group provided that either:
  - there is at least 75% common ownership between the firms as reflected on each firm's Form BD, Schedule A; or
  - there is written authorization signed by all Members in the Group and the Group owner maintains exclusive control of all orders sent to the Exchange from each MPID within the Group.
- A clearing firm may also elect to group several Members to enable the Risk Protection Monitor to apply collectively to the Group with the clearing firm designated as the Group owner, provided that the clearing firm serves as the clearing firm for all the MPIDs of the Group and there is written authorization signed by the clearing firm and each Member of the Group. A clearing firm that has grouped several Members may only receive warning messages, unless one Member of the Group maintains exclusive control of all orders sent to the Exchange from each MPID within the Group.
- The Risk Protection Monitor for Groups will operate in the same manner as described above, except that: (i) the counting program will count the number of orders entered and the number of contracts traded resulting from an order entered by all MPIDs in the Group collectively; (ii) the System will trigger the Risk Protection Monitor when the Group collectively exceeds either the Allowable Order Rate or Allowable Contract Execution Rate for the Group; (iii) once engaged, the Risk Protection Monitor will then either automatically prevent the System from receiving any new orders in all series in all classes from each MPID in the Group, and, if designated by the Group owner's instructions, cancel all existing Day orders in all series in all classes from

the Group or send a notification without any further preventative or cancellation action by the System; and (iv) only the designated Group owner may request the Exchange to enable the acceptance of new orders for all the Members of the Group.

- o Subject to the above, a Member may establish more than one Group.

RPM Warnings

- Members may also elect to receive warning notifications indicating that a specific percentage of an Allowable Order Rate or an Allowable Contract Execution Rate has been met for all metrics.

For further information on the configuration and operation of the Risk Protection Monitor, please contact MIAX Pearl Trading Operations: TradingOperations@MIAXOptions.com.

FIX Auto Cancel on Disconnect Protection (FIX ACOD)

FIX ACOD allows MIAX Pearl EEMs to limit their exposure during all losses of FIX connectivity other than MIAX Pearl induced losses by instructing MIAX Pearl to automatically cancel designated FIX orders upon a loss of connectivity with the MIAX Pearl FIX Order Interface (FOI).

FIX ACOD protection can be specified on a per-session (the MIAX Pearl System will automatically mark all new FIX orders received during that session for ACOD protection) or on a per-order basis. When operating on a per-order basis, the user will mark only those orders to be protected when the order is submitted to the Exchange though the MIAX Pearl FOI or the MIAX Pearl MEO.

GTC orders are not eligible for MIAX Pearl FIX ACOD protection and will not be cancelled when FIX ACOD protection is invoked, even if the order was marked for ACOD protection at the time of delivery or submitted during a session for which ACOD protection has been specified.

FIX ACOD protection is not invoked during a MIAX Pearl induced loss of connectivity. During a MIAX Pearl induced loss of connectivity, users may contact MIAX Pearl Trading Operations to status or cancel open orders.

For more details on FIX ACOD functionality, please see the MIAX Pearl FIX Order Interface Functional Specification on the MIAX Pearl website: www.miaxoptions.com/interface- specifications/pearl.

MEO Auto Cancel on Disconnect Protection (MEO ACOD)

The MEO ACOD provides MIAX Pearl Members using the MEO Interface to a way limit their exposure during connectivity outages by instructing the MIAX Pearl System to automatically cancel all MEO orders upon a loss of connectivity with the MIAX Pearl MEO Interface.

- The behavior is always on for all members for all MEO connections.
- The default behavior is that all MEO orders entered by a firm to an engine will be removed upon disconnect of that firm's last MEO connection to that engine.
- All orders received for any MPIDs that send orders on a port group, will be purged when the last port in that port group is disconnected
- Firms may request custom configurations by delivering MPID and port combinations.

For more details on MEO ACOD functionality, please see the MIAX Pearl MEO Order Interface Functional Specification on the MIAX Pearl website: www.miaxoptions.com/interface-specifications/pearl.

Mass Cancellation Trading Interest

A Member may cancel all of its quotations and/or all or any subset of its orders in the System by contacting the MIAX Pearl Trading Operations Desk. The MIAX Pearl Trading Operations Desk will manually execute the Member's request.

Self-Trading Protection

The MIAX Pearl System contains certain protections to prevent Market Makers and protected EEM MPIDs from interacting with their own orders.

Market Makers may choose to have self-trade protection implemented at the MPID level or at the Firm level. In the event that a Market Maker sends an order priced at a limit that would allow it to interact with another order from that same Market Maker Firm (if Firm level protection is selected) or MPID (if MPID level protection is selected) that is resting on the opposite side of the market, the appropriate resting order identified with that Market Maker MPID or Firm will be cancelled by the System and the new order will be accepted by the System. Self-Trade Protection is available for all Market Maker orders entered via the MEO Interface without regard as to whether the other orders involved were received over the MIAX Pearl FOI or MEO Interfaces.

EEMs who use the MEO Interface may request Self-Trade Protection. Orders from the protected EEM MPID entered via the MEO Interface will not be executed against orders entered on the opposite side of the market by the same EEM using the same MPID via the MEO Interface. The resting order for the protected EEM MPID will be cancelled by the System and the new order will be accepted by the System.

Order Purges
- **Firm Initiated and firm Requested Purges**
  - Firms may initiate order purges via MEO with a single request
    - **Underlying Security Purges**. Purge all orders in a class or classes associated with a specific underlying security for a given MPID.
      - A Reset Message is required to resume the submission of any orders in that Class
    - **Hybrid Underlying Security Purges**. Purge all orders with a time in force of Day in a class or classes associated with a specific underlying security for a given MPID. IOC and ISO are not affected.
      - A Reset Message is required to resume the submission of Day orders in affected classes.
      - IOC and ISO orders are not blocked and continue to be accepted without the requirement of a Reset Message
    - **MPID (Wildcard) Purge**. Purge every order for all classes on a specified matching engine for a given MPID.
      - Hybrid Wildcard Mass Cancellations are not supported.

- o MIAX Pearl Trading Operations has the ability to quickly cancel all orders by firm request for the following categories
  - Underlying security and MPID.
  - Globally by MPID.
  - Globally by firm.
- **MIAX Pearl Initiated and Automatic Purges**
  - o **Port Disconnect Purges**
    - **Default Behavior.** If all ports for a given firm on a specific matching engine disconnect, all orders for all of that firm's MPIDs will be purged for that matching engine.
      - **Port Grouping.** Allows firms to specify custom port groupings and regulate automatic purge behavior by group. Contact MIAX Pearl Trading Operations for details.
  - o **Loss of Heartbeat**
    - If all MEO applications on a specific matching engine fail for a given firm, all orders are purged for all of that firm's MPIDs on that matching engine.
      - **Port Grouping.** Allows firms to specify custom port groupings and regulate automatic purge behavior by group. Contact MIAX Pearl Trading Operations for details.

ABBO Crossing Protection (Management of Non-Routable Liquidity)

The MIAX Pearl Exchange System will not disseminate a locked or crossed market unless such dissemination is done in accordance with Exchange Rules or a National Market System plan (NMS) governing locked and crossed markets. When the System receives a non-routable order that would lock or cross an away market, the System will display the non-routable order at a price that is one MPV away from the current opposite side NBBO and book the order at an undisplayed price that will lock the current opposite side NBBO. Should the NBBO price change to a price that is inferior to the price of the undisplayed booked order, the order's undisplayed price will continuously re-price to lock the new NBBO, and the order's displayed price will continuously re-price one MPV away from the new NBBO until the order reaches its MIAX Pearl Variable Price Protection limit or its original limit price, is fully executed, or is cancelled.

9. MIAX Pearl Member Firm Portal

The Member Firm Portal (MFP) is a member-facing application available via the internet. The MFP provides members with the tools needed to search for trade data, apply same-side clearing trade corrections and perform market maker symbol self-assignments.

The Member Firm Portal is available for search queries at all times. The trade information clearing correction function is available from 09:30 AM ET until System shutdown which occurs at approximately 5:15 PM ET. Market maker symbol self-assignments entered via the Member Firm Portal prior to 6:00 PM are effective for the following trading day. Use of the Member Firm Portal for symbol assignment changes is mandatory. Same day self-assignments are not available through the Member Firm Portal.

Additional information regarding the Member Firm Portal can be obtained by contacting MIAX Trading Operations at: TradingOperations@MIAXOptions.com.

10. MIAX Pearl RULES

A copy of the complete MIAX Pearl Rulebook is available in the Regulatory Section of the Exchange's website: www.miaxoptions.com/rulebook/pearl.

Throughout this User's Manual reference is made to MIAX Pearl Rules, in the event of any conflict between a description or discussion of a Rule in this User's Manual and the Rules set forth in the MIAX Pearl Rulebook, the Rulebook shall prevail.

11. MIAX Pearl Fees

MIAX Pearl Fee Schedule

MIAX Pearl operates under a maker-taker fee structure in which the Exchange generally pays its Members a rebate to provide liquidity and generally charges Members a fee to remove liquidity. MIAX Pearl may choose apply volume discounts or other incentives to some of its transaction fees.

MIAX Pearl also charges membership fees, application fees, market data fees, connectivity fees, bandwidth fees and testing fees. A link to a copy of the complete MIAX Pearl Fee Schedule is available on the Exchange's website under the Fee Summary tab: www.miaxoptions.com/fees/pearl.

12. Clearly Erroneous Executions Policy

The Exchange's Erroneous Execution Policy is set forth in Exchange Rule 521 and 522.

Participants who believe they may have been a party to an erroneous transaction are encouraged to contact MIAX Pearl Regulation immediately at www.miaxoptions.com/regulatory-forms/pearl. MIAX Pearl Regulatory Control (MRC) will review the transaction to determine whether, in fact, the transaction was the result of an obvious or catastrophic error. Upon final Exchange official action, the MRC, in conjunction with the MIAX Pearl Operations Center, where appropriate, will promptly notify both parties to the trade and will either nullify or adjust the execution price of the transaction if it qualifies as an obvious or catastrophic error. A Member may appeal the decision by Exchange officials to the Chief Regulatory Officer (CRO).

13. Hours of Operation

Normal Trading Hours

Pre-Opening System Availability   7:00 am to 9:30 am Eastern Time
Regular Trading Session (Equity options)   9:30 am to 4:00 pm Eastern Time
Regular Trading Section (Defined list of ETF options)   9:30 am to 4:15 pm Eastern Time

Holiday Schedule and Altered Trading Hours

The Holiday Schedule and any deviations from the Normal Trading Hours listed above can be found on the Exchange's website: www.miaxoptions.com/trade-hours-calendar/pearl.

14. Contact MIAX Pearl

Miami International Holdings, Inc.

Address: 7 Roszel Road, Suite 5-A

                             Princeton, NJ 08540

Phone: (609) 897-7300

Area of Interest	Department	Email
Investor Inquiries	Investor Relations	Investor.Relations@Miami-Holdings.com
Business Development	Business Development	info@MIAXOptions.com
Regulatory	Regulatory	Regulatory@MIAXOptions.com Primary: (609) 897-7309
Membership	Membership	Membership@MIAXOptions.com
Market Operations	Trading Operations	TradingOperations@MIAXOptions.com Primary: (609) 897-7302
Connectivity	Trading Operations	TradingOperations@MIAXOptions.com Primary: (609) 897-7302
Certification Testing	Trading Operations	TradingOperations@MIAXOptions.com Primary: (609) 897-7302
Interface Development	Trading Operations	TradingOperations@MIAXOptions.com Primary: (609) 897-7302
Market Data Requests	Market Data	MarketData@MIAXOptions.com
Market Data Usage Reporting	Market Data	MarketDataUsage@MIAXOptions.com
Listings	Listings	Listings@MIAXOptions.com Primary: (609) 897-7308
Sales and Marketing	Business Development	Sales@MIAXOptions.com Primary: (609) 897-8177
Billing	Billing	Billing@MIAXOptions.com

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