

# Price Improvement XL (PIXL)

## Frequently Asked Questions

### Overview

#### Q: What is PIXL?

Price Improvement XL (PIXL) is the Nasdaq PHLX electronic price improvement mechanism whereby an initiating member submits a two-sided (buy and sell) order into an auction process soliciting price improvement.

#### Q: Who is eligible to submit a PIXL order?

Any PHLX member may electronically submit an order it represents as agent (“PIXL Order”) together with a contra-side principal or agency order (“Initiating Order”). If any one side of an order submitted into the electronic price improvement mechanism is for the account of a public customer, such customer order will be treated as the PIXL Order; this is not applicable to Customer-to-Customer orders entered into the mechanism.

#### Q: How does this differ from other exchange offerings (BOX, CBOE)?

- PIXL auction notifications will be broadcast over the Exchange’s Top of PHLX Options Plus Orders (“TOPO Plus Orders”) data feed and the Specialized Quote Feed (“SQF”).
- All participants may respond to a PIXL Auction.
- PIXL will allow “No-Worse-Than” (“NWT”) price, allowing the Initiating Order to match other interest to a specified price level.
- The PIXL Stop Price and the Initiating Order’s NWT price may be improved, but not cancelled, at any time during the PIXL auction.
- Unrelated Orders that are marketable against interest on the PHLX that are received during a PIXL Auction will not cause the auction to end early. These orders will trade against the book, route to better priced exchanges if marked as routable or post to the book immediately. If there is interest remaining on the PHLX book at the time the PIXL Auction ends, such interest will be considered for execution in the PIXL Auction allocation process.

#### Q: How will market participants be notified of PIXL Auctions?

PIXL Auctions begin as soon as a PIXL Order is accepted by the PHLX system. Real-time PIXL Auction Notifications (PANs) will be sent out over TOPO Plus Orders when a PIXL Order is accepted into the system.

#### Q: What is a “Stop Price”?

The Stop Price is the price at which the PIXL Order is guaranteed an execution by the Initiating Member.

#### Q: What information will a PAN include?

A PAN will include the side and size of the PIXL Order, and the message send time, i.e., the start-time of the PIXL Auction. The end-time of the auction is determined based on the time of receipt of the first PAN message for an Auction Identifier.

#### Q: Is there a participation guarantee in PIXL?

The PIXL Order is guaranteed an execution once it has been accepted into the PIXL mechanism. The Initiating Order is guaranteed a minimum 40% allocation after all customer interest has been satisfied, provided the PIXL Order is executed at a price(s) at which the Initiating Order is willing to trade. The Initiating Order is entitled to a 50% allocation after all customer interest has been satisfied provided the Initiating Order is matching only one other participant at the execution price.

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### Order Functionality

#### Q: What pricing instructions can be sent for the Initiating side of a PIXL Order?

A non-Complex PIXL Order may be submitted in one of three different manners: Single Stop Price Submission, Auto-Match, or Stop Price Submission with a NWT price level. The Initiating Order side of the Non-Complex PIXL Order may have multiple limit prices associated with it based on the manner selected.

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A Complex PIXL Order may be submitted in one of two different manners: Single Stop Price Submission or a Stop Price Submission with a NWT price level. The Initiating Order side a Complex PIXL Order may have multiple limit prices associated with it based on the manner selected. A Complex PIXL Order may NOT be submitted without a limit Stop Price, i.e. MKT.

**Q: What is a Single Stop Price submission in PIXL?**

A Single Stop Price submission in PIXL occurs when an Initiating Order is submitted with a Stop Price at which the Initiating Member is willing to execute the entire PIXL Order.

**Q: What is an Auto-Match Submission in PIXL?**

An Initiating Member may submit a non-Complex Initiating Order into the mechanism specifying that it is willing to match the price and size of all orders and responses to the PIXL Auction at each price level. The non-Complex PIXL Order will be stopped at the better of its limit or the contra-side National Best Bid and Offer ("NBBO") at the time of order receipt.

**Q: What is a No-Worse-Than (NWT) Price?**

A NWT price is a limiting price for the Auto-Match functionality. In other words, the NWT is the price up to which the Initiating Member is willing to

2

Auto-Match PIXL Auction responses and orders.

**Q: What is the Surrender indicator?**

An Initiating Member may submit an Initiating Order (simple or complex) into the PIXL mechanism with a designation of "surrender" specifying that the Initiating Member is forfeiting priority and trade allocation privileges to which the Initiating Member is otherwise entitled to as per the current rules. If surrender is indicated, the Initiating Order will only be eligible for allocation if the Agency order cannot be fully satisfied by other interest at or better than the auction stop price. Surrender is available only for the entire amount, not a partial amount. The surrender feature is not available for customer-to-customer PIXL Orders; such orders will be rejected.

**Q: What types of pricing instructions are compatible with Surrender?**

Only Single Stop Price PIXL Orders may be surrendered. PIXL Orders marked with a surrender indicator as well as an NWT price or auto-match specified will be rejected.

Additionally, PIXL Orders marked with a surrender indicator must have a limit price. PIXL Orders to buy or sell at the market (MKT) with the surrender indicator set to "Y" will be rejected.

**Q: Must the PIXL Order limit equal the Initiating Order limit?**

No. The order limits do not need to be equal; however, the Stop Price will be determined based on the Initiating Order

limit. If the PIXL Order limit is inferior to the Initiating Order limit, the PIXL Order will be rejected upon receipt.

**Q: Is there a size requirement in order to be eligible for the PIXL mechanism?**

No. Orders of any size may be entered into the PIXL mechanism; however, the Initiating Order size must always equal the PIXL Order size.

**Q: How is the non-Complex PIXL Order Stop Price determined?**

The Stop Price of a non-Complex PIXL Order is dependent on the origin of the order.

A non-Complex PIXL Order must be stopped at a price equal to or better than the NBBO on the contra side (or at least .01 better than the NBBO on the same side if there is a limit order on the Order Book at the NBBO). However, if the order is for a nonpublic customer, the non-Complex PIXL Order must also be stopped at a price that improves the PBBO and is equal to or better than the Away Best Bid/ Offer ("ABBO") on the same side.

For PIXL Orders of less than 50 contracts, when the NBBO is \$0.01 wide, the auction must be stopped at a price at least \$0.01 better than the NBBO on the contra side of the PIXL agency Order and at least \$0.01 better than an order on the

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Order Book on the same side as the PIXL agency Order. If at least

\$0.01 of price improvement is not guaranteed by the stop price, the PIXL Order will be rejected. This restriction does not apply to Complex PIXL Orders.

**Q: How is the Complex PIXL Order Stop Price determined?**

The Stop Price of a Complex PIXL Order is determined by the limit of the Initiating Order. A Complex PIXL Order must be stopped at a price that is better than the calculated cPBBO based on the markets for the individual components of the Complex Order as well as a price which is better than the limit of any resting Complex Orders on the Order Book in the same complex strategy. There are no origin or size differentiations for the Stop Price of a Complex PIXL Order.

**Q: Can a PIXL Stop Price be changed?**

Yes. An Initiating Member may modify the Stop Price of a PIXL Order to improve it. Modifications to change the Stop Price to an inferior level will not be allowed. Changes to the Stop Price will not change the duration of the PIXL Auction.

**Q: Can a NWT Price be changed?**

Yes. An Initiating Member may modify the NWT Price of a PIXL Order to improve it. Modifications to change the NWT Price to an inferior level will not be allowed. Changes to the NWT Price will NOT be disseminated over TOPO Plus Orders.

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**Q: Can the surrender indicator be changed?**

No. An order's surrender indicator cannot be changed. Modifications to the surrender indicator will be ignored.

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Additionally, a surrendered order cannot be changed from limit to market price. Such modifications will be rejected.

**Q: What is the Minimum Price Improvement Increment in the PIXL mechanism?**

All PIXL Orders and PAN responses can be entered in one cent increments, excluding customer-to-customer PIXL cross Orders which may only be submitted in normal Minimum Price Variation (MPV) increments allowed in the underlying series.

**Q: Can a PIXL Order and/or an Initiating Order be marked as All-or-None (AON)?**

Yes. A PIXL Order may be marked AON. However, an Initiating Order may not be designated as AON. Initiating Orders marked AON will cause both the PIXL Order and the Initiating Order to be rejected upon receipt.

**Q: What Order types are eligible for PIXL?**

The PIXL mechanism is available for all simple orders and Complex Orders designated as Day, Good-Til-Cancelled (GTC), or Immediate-or-Cancelled (IOC). Opening Only (OPG), Stop, and Stop Limit orders will not be accepted into PIXL.

**Q: Can I submit orders into PIXL prior to the Open?**

No. A PIXL auction may only be initiated during normal trading hours. All PIXL Orders received prior to the opening of trading in the underlying option will be rejected.

**Q: Can a PIXL Order be cancelled or modified?**

A PIXL Order may not be modified or cancelled once it has been accepted by the Exchange. An Initiating Order may be modified to the benefit of the PIXL Order, such as improving the Stop Price or the NWT price, but may not be cancelled.

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## PIXL Auction

**Q: Will a PIXL Auction ever end early?**

Yes. A PIXL Auction will end early if there is a trading halt in the underlying option. In addition, a non-Complex PIXL Auction will end early, if the PBBO crosses the PIXL Order Stop Price on the same side as the PIXL Order. A Complex PIXL Auction will end early if the cPBBO or limit of a Complex Order on the Complex

Order Book crosses the Complex PIXL Order Stop Price on the same side as the Complex PIXL Order.

**Q: At what price will trades occur if the PIXL Auction ends early due to a trading halt?**

If the PIXL Auction ends early due to a trading halt, all PAN responses will be cancelled and the entire PIXL Order will trade against the Initiating Order at the Stop Price.

**Q: At what price will trades occur if interest crosses the Stop Price causing the PIXL Auction to end early?**

For a non-Complex PIXL Auction, if the PBBO crosses the Stop Price on the same side as the PIXL Order, the PIXL Auction will end early and all PAN responses, unrelated orders and quotes will be considered for allocation at their limit prices.

For Complex PIXL Auctions, if the cPBBO or the limit of a Complex Order on the Complex Order Book crosses the PIXL Order Stop Price on the same side as the Complex PIXL Order, the PIXL Auction will end early and all PAN responses and Complex Orders will be considered for allocation at the Stop Price.

**Q: What is the duration of the PIXL Auction?**

PIXL Auctions will last 100 milliseconds, unless the PIXL Auction ends early for a specific reason such as a halt or interest crossing the Stop Price on the same side.

**Q: Can there be more than one PIXL Auction occurring in a given option series at any one time?**

No. Currently there can only be one PIXL Auction outstanding at a time in the same series or the same strategy. If a PIXL Order is received in the same series or the same strategy which already has a PIXL Auction in progress, the new PIXL Order will be rejected.

## PIXL Auction Notification (PAN)

**Q: Will PAN responses be visible?**

No. PAN responses will not be visible and will not be disseminated to either the Options Price Reporting Authority ("OPRA") or on TOPO Plus Orders.

**Q: Can PAN responses be cancelled and/or modified?**

Yes. PAN responses may be cancelled or modified any time prior to the end of the Auction.

**Q: Can a PAN response be sent at any price level?**

No. PAN responses must be priced equal to or better than the NBBO for non-Complex responses or equal to or better than the cPBBO at the time they are received for Complex responses. PAN responses will be rejected if not properly priced.

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**Q: May a participant submit multiple PAN responses during the Auction?**

Yes. A participant may submit PAN responses at multiple price and size levels.

**Q: Can a participant respond to a PAN on the same side as the PIXL Order?**

No. All PAN responses must be on the contra-side of the PIXL Order. All same side PAN responses will be rejected upon receipt.

**Q: Will a Quote Purge affect PAN responses?**

If at any time during the PIXL Auction a member's quotes are purged, all non-Complex PAN sweep responses submitted by

that member will be cancelled. Complex PAN sweep responses will not be cancelled due to a quote purge.

**Q: May an Initiating Member submit a PAN response into a PIXL Auction that they initiated?**

No. This behavior will be considered conduct inconsistent with just and equitable principles of trade and a violation of PHLX Rule 707.

**Q: Are customer-to-customer crossing orders submitted into PIXL subject to the PIXL Auction?**

No. Customer-to-customer crossing orders accepted into PIXL will be executed immediately and not be subject to a 100 millisecond PIXL Auction.

4

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## Allocation

**Q: What will be considered for allocation at the end of a non-Complex PIXL Auction?**

All PAN responses, unrelated orders on the book, quotes, and the Initiating Order will be considered for execution and allocation at their respective limit prices at the end of the PIXL Auction.

**Q: What will be considered for allocation at the end of a Complex PIXL Auction?**

All PAN responses, Complex Orders on the book, quotes comprising the cPBBO at the time of execution, and the Initiating Order will be considered for execution and allocation at their respective limit prices at the end of the PIXL Auction.

**Q: How will allocation be determined at the end of a non-Complex PIXL Auction?**

After customer interest has been satisfied at each price level and the Initiating Order has received its allocation (depending upon the submission manner selected), allocation to unrelated orders, quotes and PAN responses will be done in accordance with Exchange Rule 1014 (g)(vii)(B)(1)(b) and (d). If all interest on the contra-side of the PIXL Order has been satisfied at the final price point, any remaining contracts will be allocated to the Initiating Order.

**Q: How will allocation be determined at the end of a Complex PIXL Auction?**

After Complex customer interest has been satisfied at each price level and the Initiating Order has received its allocation (depending upon the submission manner selected), allocation to PAN responses, Complex Orders, and quotes comprising the cPBBO will be done in the following manner: 1) Market Maker Complex interest, including PAN responses and Complex

Orders, will be satisfied in a size pro-rata fashion; 2) non-Market Maker offfloor broker dealer Complex interest, including PAN responses and Complex Orders, will be satisfied thereafter in a size pro-rata fashion; 3) then, after Complex interest has been satisfied, interest comprising the cPBBO will be executed a) cPBBO interest will be executed with customer priority, b) followed by Market Maker interest in a size pro-rata fashion, and c) lastly to non-Market Maker off-floor broker dealer interest; 4) thereafter, remaining contracts, if any, will be allocated to the Initiating Order.

**Q: How will unrelated marketable orders be handled if they are received during a PIXL Auction?**

Orders that are marketable against the PBBO or cPBBO and are received during a PIXL Auction will trade against Order Book interest, route to better priced exchanges, if applicable, or post to the Order book immediately. If there is order interest remaining on the Order Book at the time the PIXL Auction ends, such interest will be considered for execution in the PIXL Auction allocation process.

**Q: What happens to an unexecuted PAN response after the PIXL allocation process?**

Unexecuted PAN responses will be cancelled at the end of the allocation process.

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## Examples

### Scenario #1: Non-Complex Order and Contra willing to Price Improve with limit

- NBBO is .97-1.02, PHLX is .97-1.03.
- Firm ABC receives CUST order to Buy 70 @ 1.03. Firm ABC will facilitate “no worse than” 1.00
- Firm ABC enters Buy 70 @ 1.03 paired with Contra side of “S70 MKT w/NWT 1.00 limit”.
- CUST is STOPPED @ 1.03
- MM1 response is to S10 @.99
- MM2 response is to S30 @1.00
- Result – MM1 will S10 at .99 LVS 60 to Buy
- Result – MM2 and Firm ABC will split the remaining 60 @ 1.00, 30 each.

### Scenario #2: Complex Order

- cPBBO for strategy AB is .97-1.03
- Firm ABC receives CUST order to B40 AB @ 1.02. Firm ABC will facilitate “no worse than” 1.00
- Firm ABC enters Buy 40 @ 1.02 paired with Contra side of “S40 1.02 w/NWT 1.00 limit”.
- CUST is STOPPED @ 1.02
- MM1 response is to S10 @.99
- MM2 response is to S15 @1.00

- cPBBO moves and is offered @ 1.00
- Result – MM1 will S10 at .99 LVS 30 to Buy
- Result – Firm ABC will S12 at 1.00 LVS 18 to Buy
- Result – MM2 will S15 at 1.00 LVS 3 to Buy
- Result – cPBBO interest will S3 at 1.00

### Scenario #3: Non-Complex Order for less than 50 contracts entered when NBBO is \$0.01 wide and \$0.01 improvement over the contra side NBBO is guaranteed by stop price:

- NBBO is .97-.98, PHLX is .96-.98.
- Firm ABC enters Buy 30 @ .97 paired with Contra side order to Sell 30 at .97.
- CUST is STOPPED @ .97
- MM1 response is to S10 @.97
- Result – MM1 will S10 at .97
- Result – Firm ABC will S20 at .97

### Scenario #4: Non-Complex Order for less than 50 contracts entered when NBBO is \$0.01 wide and \$0.01 improvement over the contra side NBBO is not guaranteed by stop price:

- NBBO is .97-.98, PHLX is .96-.98.
- Firm ABC enters Buy 30 @ .98 paired with Contra side order to Sell 30 at .98.
- The paired PIXL Order is rejected since the minimum price improvement over the contra side NBBO is not guaranteed by a stop price of .98.

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