Ai Technical Overview

EBS Spot Ai©™ Version 4.0

Support for Depth of Book, plus new Ai XML and Ai FIX protocols

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1 EBS Spot Ai

1.1 What is it?

EBS Spot Ai®™ is a single-access automated trading tool that provides a direct two-way interface between the customer's trading system and the EBS®™ Spot market, thereby enabling model/program trading and the maintenance of a 24-hour book.

EBS Spot Ai utilizes a message-based interface that supports two-way message exchange between the Service Provider (ICAP) and the Service Consumer (the EBS Spot Ai customer) via an XML or FIX messaging protocol.

Uses include:

- Mathematical models
- Arbitrage models
- Risk management models
- Streaming executable prices

1.2 Business benefits

The customer benefits of EBS Spot Ai include:

- Efficient, automated trading in all time zones and all currencies at any hour of the day.
- Maximized trading opportunities from the maintenance of a true 24-hour book, in all time zones and across all major currencies.
- Offsetting of an organization's risk position without human intervention.
- Increased liquidity in the overall market.

2 EBS Lab

To enable EBS®™ Spot Ai customers to test and refine their trading models before implementing a new trading strategy, ICAP developed the EBS Lab.

Once a customer codes their trading application to the EBS Spot Ai Server application and installs the appropriate networking technology, customers use the EBS Lab to test connectivity, timing and price integrity. Customers analyze trading application performance in the lab using EBS Spot market data.

2.1 True View of the Market

EBS is the definitive source of reliable, transactional spot FX market data for the professional FX community, derived from the transactional volume of the EBS Spot market (daily average over USD 110 billion). Customers receiving EBS market updates via EBS Spot Ai in the EBS Lab can have confidence in the results they generate from testing scenarios.

2.2 Optimal Test Environment

The EBS Lab provides a safe and secure test environment to help customers test potential FX Spot market performance for:

- Mathematical models
- Arbitrage models
- Risk management models
- Streaming executable prices

The EBS Lab also provides the ability to test technical aspects of implementation including:

- Connectivity
- Timing
- Price integrity
- Depth of Book
- Multiple Ai XML protocol versions and Ai FIX protocol

3 Component Overview

Program trading through EBS Spot Ai enables the development of sophisticated computerized trading strategies, including those that are launched without human intervention.

EBS Spot Ai consists of the following basic components, as illustrated in Figure 1 below:

- **Ai API** – The API provides a two-way messaging interface allowing secure connection from the customer's trading model application(s) into the ICAP FX market. It enforces the EBS Spot Dealing Rules, validates inputs, and returns the status of all orders. Full trading capability is exposed using extensible markup language (XML) or Financial Information eXchange (FIX) messages, which can be accessed directly from the customer's model application(s).
- **EBS Spot Ai Server** – Provider server for Ai application processes, validates XML input from consumer, and returns status and data to consumer.
- **Customer Trading Application** – Customer owned and managed with application code that submits orders to the Ai Server.

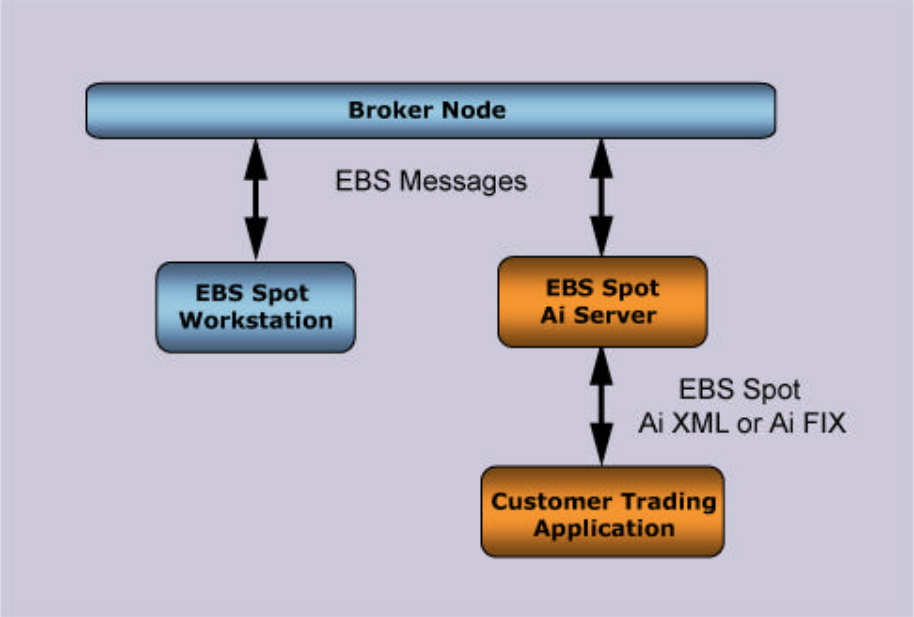

Figure 1: Component overview

4 Network Diagram

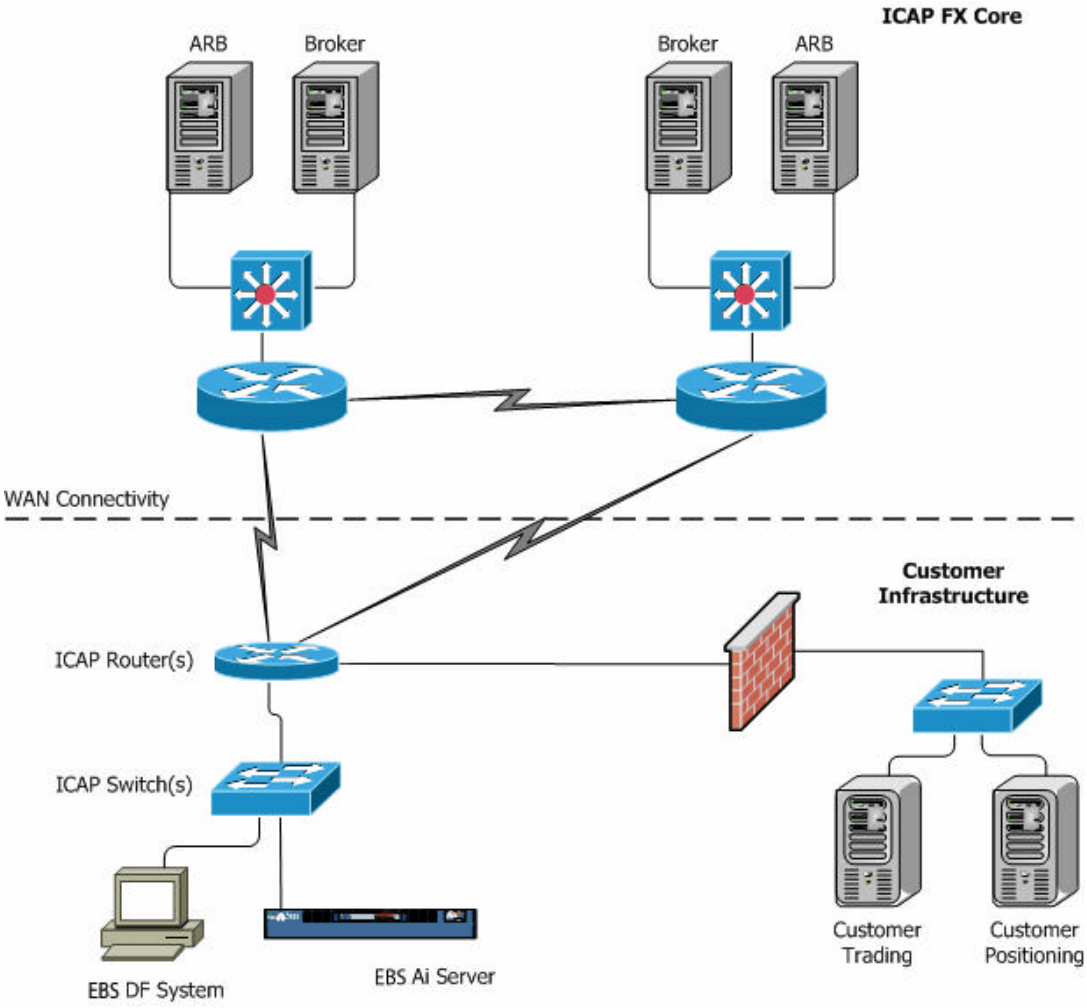

Figure 2: ICAP FX core network

5 How EBS Works

5.1 Logical Processing Flow

The Ai Server acts as a gateway between the customer application and the EBS Spot trading system, converting Ai XML or Ai FIX messages into the ICAP's EBS proprietary message format. The Ai Server also protects the EBS Spot trading system by validating orders submitted, detecting communication failures and limiting the number of orders placed by using throttling parameters. An Ai server handles submitted orders in the same manner as those entered through any EBS Spot trading system manual workstation. [1]

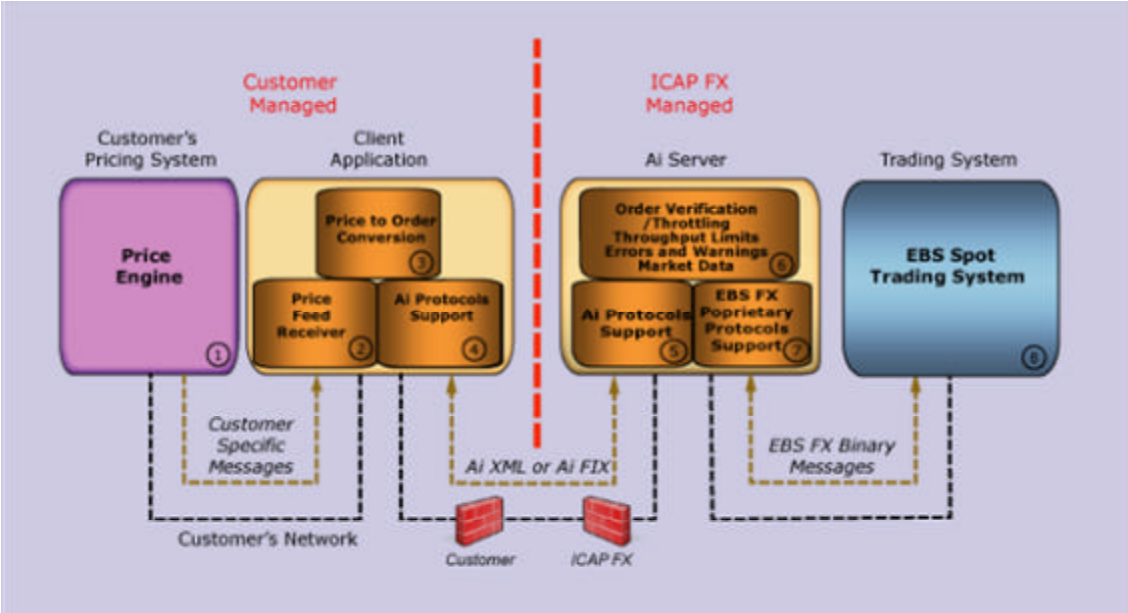

Figure 3: EBS Spot Ai logical processing flow

Should we add the potential use of a FIX Engine to the diagram?

Following are descriptions of the components and the processes depicted in Figure 3:

1. **Price Engine (Market Data Source/s)** – Additional market data information or other data (e.g., risk management, position keeping) required to support trading logic.
2. **Price Feed Receiver** – Customer's application that incorporates received market data information into the trading model.
3. **Price to Order Conversion (Trading Logic)** – Customer's application/trading model that generates orders.
4. **Ai Protocol Support (client side)** – Component responsible for creating the order, based on the EBS Ai XML message protocols or the new Ai FIX protocol, which is passed on to the Ai Server.
5. **Ai Protocol Support (Ai Server side)** – Component responsible for handling Ai XML or Ai FIX messages received form the client application.

[1] Please refer to the *Brokernet Spot Dealing User Guide* for more information.

6. **Order Verification and Throttling** – The Ai Server rejects invalid order details. It communicates the acknowledgement message back to the customer based on the Ai XML or Ai FIX message protocol. The Ai Server monitors for an excessive number of orders submitted and rejects them if they exceed the maximum number for a given time interval.
7. **EBS Proprietary Protocol Support** – Upon order validation by the Ai server, it converts the order to one of the appropriate available protocol versions and submits it to the trading system for processing.
8. **EBS Spot Trading System** – The EBS Spot trading system matches the order submitted by the trading floor and communicates all deals created for the order back to the Ai customer application.

5.2 Managing Multiple Ai Application Models

The intent of this section to give generalized overview of one possible scenario for designing a trading system consisting of Ai trading application/models, an order management component, and a position keeping/back office application. This method might be one of many possible ways to integrate your system with the EBS Spot trading system.

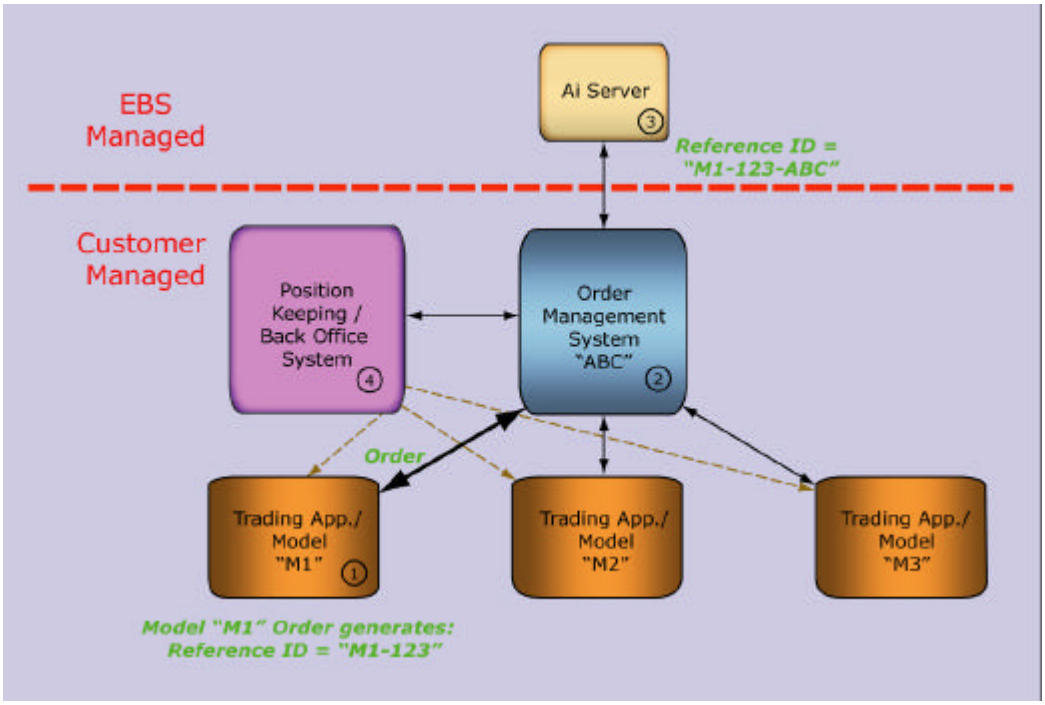

Figure 4: Customer system suggested order flow

Following are descriptions of the components and the processes depicted in Figure 4:

1. **Customer Trading Application/Model** – The customer's Ai application/model generates orders. Customers may use the Order Reference ID to track orders generated by different applications/models. In our example, the Order Reference ID (M1-123) is composed of "M1" for the Ai Model 1, followed by a unique identifier (a number, timestamp or other unique ID can be used) "-123".
2. **Order Management System** – The Ai model passes orders to the Order management system, which can modify the Order Reference ID or append additional information ("ABC" in our example). The order's resulting Order Reference ID = "M1-123-ABC".
3. **Ai Server** – The EBS Ai server receives the orders, sends them to the Spot trading system, and returns order acknowledgements with the EBS Quote ID (a unique order ID generated by the

EBS trading system) and Order Reference ID (a unique order ID generated by the customer's system) to the customer's order management system. The Ai server sends EBS Quote ID and Order Reference ID with every Order/Deal status message.

4. **Trading System** – The EBS trading system receives the Ai Server orders, and arbitrates deals. Successful deals are provided to the Deal Feed system.
5. **Deal Feed System** – The DF system receives information from the trading system and passes deal tickets (which include the customer's Order Reference IDs) on to the customer.
6. **Tickets** – Tickets generated by DF system are feed to the customer's position keeping/back office system.
7. **Position Keeping/Back Office System** – The customer's order management system passes order/deal status information to the position keeping and/or back office system(s), which in turn updates the customer Ai application/model.

5.3 Order/Deal Processing

EBS Spot trading system is a "Deal-based" system, i.e., it persists only deal information, unlike "order-based" systems, which persists order information. EBS Spot treats orders as temporary objects with a limited lifespan. Spot maintains order information in memory until the order lifecycle completes, then cleans it out.

Use Order IDs and Order Reference IDs, which persist as part of Deal information, for reference purposes only. Since Order Reference IDs are customer generated identifiers, ICAP cannot guarantee them to be unique. EBS generated Quote IDs are guaranteed to be a unique identifiers. Use both IDs for transactional accounting.

For discovering or recovering deal status information after a network disconnect or client system failure, the Deal Status Query provides deal query capabilities within a limited timeframe (= two hours). The query provides the ability to retrieve the deal information by Customer Order Reference ID, EBS Order ID or Deal ID.

To update position keeping and/or back office systems, client systems should use the following guidelines:

- Do all order-based accounting outside of the EBS Spot trading system. Order event messages sent by the Ai application should be used for verification purposes, i.e., to ensure that the order status, reported by Ai throughout the lifecycle of the order, matches the status of the order in the external accounting system.
- Order event messages contain a snapshot of the order status at the time Ai generated the message. Ai sends the last snapshot of the order when the order us considered completed. The final state in the order lifecycle is either "Order Done" or "Order Cancelled." The EBS trading system will not send any order information after the order lifecycle is completed.
- Use Deal event messages to update position keeping and back office systems. EBS trading system does not guarantee filling orders 100%; therefore, partially filled orders must be expected and handled.
- When the EBS trading system is queried using Order ID or Reference ID, it will return deal(s) associated with the order. There is no guarantee that the total amount of all deals returned is equal to the original order amount.
- If querying the EBS trading system on an order that generated no deals, it returns an empty data set. Note that if querying an invalid Reference ID, the system returns an empty data set as well.
- When queried by Order or Reference ID, the EBS trading system does not return information on "failed" ("missed," completed for zero) deals. Clients can query the EBS trading system using a specific Deal ID if they need to get information about "failed" deals.

- Deals returned in the query result set with status = “unverified” and a size that is not equal to zero, should be treated as a liability. These deals will go through the verification process and may complete for the size specified (or less) or fail (complete for zero).

6 Ai Application Details

6.1 Ai Server

The Ai Server has features that include:

- Facilitates automated trading via your choice of XML or FIX interfaces to the EBS Spot Trading System
- Ensures secure client access and user authentication
- Provides Trading and Non-Trading (Market view only) Access
- Manages the integrity of the client/server connections
- Protects the EBS internal systems with throttling and throughput controls
- Offers application options to Ai customers through customized configuration parameters
- Provides periodic market information for any subscribed instrument which includes active orders in the EBS Market, depth of book and completed EBS deals.
- Protects Ai customers when protocol violations or network/systems failures occur by immediately interrupting all active orders and breaking connection
- Maintains a set of rules for message exchange with Ai XML or Ai FIX protocol.
- Handles error conditions and customer notification

6.2 Ai Client

EBS Spot Ai supports client applications written in any language and on any platform that can support standard XML or FIX messaging over TCP/IP. Customers develop their own programs to interact with the EBS Spot trading system via the Ai Server and the published Ai XML and Ai FIX protocols.

Using this interface, the client program has access to all the functions needed to deal on the EBS Spot Trading System including:

- Submit orders (bids, offers, buys and sells)
- Receive deal and order status messages
- Receive Depth of Book Market Views for select currency pairs
- Receive Market Views for selected currency pairs
- Receive Market Views for EBS Deals paid and given
- Interrupt individual active orders
- Interrupt ALL active orders (immediately remove all orders from market)
- Query pending and done deals following a disconnect

6.3 Ai Configuration Parameters

The Ai Server incorporates a number of configuration parameters that establish system controls in handling the Ai trading session. A number of the parameters are system controlled and fixed. Selected parameters are configurable for clients. All Ai Server configuration parameters that are related to the trading session are described in the next two sections.

6.3.1 Configuration Options for Ai Customer

Ai customers should review these options for use with their Ai client applications.

- **NDF Trading** [2]

  In order to trade NDFs, two parameters must be entitled. On the floor, entitle "**use_ndf_pairs**" to "True". On the Ai Server configuration file, you also must entitle the "**use_ndf_pairs**" to "True".

- **NDF Pairs**

  Parameter "**use_ndf_pairs**" to enable NDF trading and allow subscription to Market Views for NDF currency pairs. May be used in conjunction with other trading instruments (i.e., Spot). Default value is "False".

  This and the previous should be merged. **use_ndf_pairs** is used where a floor is entitled to NDFs but the TFA wants to configure the Ai as a SPOT only machine. Same for use_spot_pairs. In order to use this, the floor must be enabled for these currency pairs, either SPOT or NDF.

- **Spot Pairs**

  Parameter "**use_Spot_pairs**" to enable Spot trading and allow subscription to Market Views for NDF currency pairs. May be used in conjunction with other trading instruments (i.e., NDF). Default value is "True".

  not client configurable

- **Trading Enabled or Market View Only**

  The "**trading_enabled**" parameter is used to identify the Ai Server as a trading model or as market view only. If parameter is enabled, all trading activities and functionality are effective for the Ai session. If disabled, no trading activity is allowed, but market view update messages are sent to client for all subscribed currency pairs. The default is enabled.

- **Maximum Order Throughput**

  The submission of orders to the EBS Spot Ai trading system is limited to 10 orders within any five (5) second period. Orders exceeding the throughput limit are rejected.

- **Maximum Active Orders**

  The Ai Server limits the number of active orders currently in the market to 20. Once the limit is reached, new orders are rejected until (at least) one order completes. This limit is imposed to protect against "runaway" client applications that could potentially flood a market with out-of-market orders.

- **Maximum Trade Size**

  Single orders of up to 5 million (base currency) units are allowed by the Ai application as a default configured order amount. Orders exceeding that limit are rejected.

- **Maximum Trade Size (Metals)**

  For Metals Pairs, a configurable parameter to limit the maximum trade size by Metals pairs.

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[2] The EBS NDF trading system currently is in a Pilot test program limited to the Asian regions.

- **Send Prime Deal Indicator**

  The Prime Deal Indicator Flag (PDI) is used to identify Prime Deals. If the parameter is **enabled**, the client receives a flag in the deal event message indicating when a deal is a Prime deal. This setting is requested by the client, but managed by ICAP. The default value for this parameter is **disabled**. Not available to Prime clients.

- **Non-Standard End of Day**

  Non-Standard End of Day values (other than 5:00PM New York Time) are required for some currency pairs. By enabling the "**send_nonstandard_EOD**" configuration parameter, the client receives individual Currency Trade Date messages, in addition to the Global Trade Date messages. The default value for this parameter is **disabled**.

6.3.2 Client Configurable Options at Login

Using XML 3.0 or FIX 1.0 protocol, the following parameters can override the current default Ai Server configuration file. Setting these parameters are optional in the login message. Effect of the parameter setting is during the active Ai session. Descriptions of the parameters are described above.

- **Send Confirmed Deal Status Message**

  An Ai client may request to receive or prevent the notification of a deal when confirmed. If this parameter is **enabled**, a client receives a "pending," "confirmed" and "done" sequence of messages for deal processing. If **disabled**, the "confirmed" message is not sent. The default is disabled.

- **Dealable Price Masking**

  Clients have the option to mask non-dealable prices in market views with a parameter called "**masking_enabled**". The parameter default is disabled. When masking is **disabled**, the market event message will display a non-dealable price. When masking is **enabled**, the market event message will not display non-dealable price to the client.

- **Local Price Display**

  Local prices are prices in the market from a client's own trading floor. The Ai server provides an option to display local prices in market views with a parameter "**local_price_display**". When local price display is **enabled**, local bid and offer prices are displayed in Market Views. When **disabled**, the prices are suppressed and the actual local price is replaced with a "?". The default is enabled.

- **Hide Local User ID**

  If an Ai trader chooses to hide his local user ID from other traders on his floor, the Ai configuration file parameter, "**hide_my_prices**," must be **enabled**. This setting is requested by the client, but managed by ICAP. This feature is only in effect if the TFA has already allowed traders on the floor to select this option. If hide local prices is in effect, TID will not appear for local price of that trader.

- **Price Check**

  When a bid/offer is submitted, a check is performed to determine if the price is inverted. In the EBS Spot trading system, this is known as "Bid Greater than Offer," but applies to both sides of an order. This check ensures the price is within an acceptable range.

- **Wide Spread Check**

  If Wide Spread check is **enabled**, Ai server will ensure that a bid price less than the current Dealable Best Offer by more than the wide spread pips is rejected and an offer price that exceeds the current Dealable Best Bid by more than the wide spread pips is rejected. If Wide Spread is **disabled**, no restriction in effect and order accepted. The default is enabled.

- **Large Difference Check**

  If Large Difference check is **enabled**, Ai server will reject a bid price that varies (higher or lower) from the current Dealable Best Bid by more than the large difference pips for the currency pair. Also rejected is an offer price that varies (higher or lower) from the current

Dealable Best Offer by more than the large difference pips for the currency pair. If Large Difference check is **disabled**, no restriction in effect and order accepted. The default is enabled.

6.3.3 System-Wide Parameters

The following parameters are established for optimal system performance and overall stability and control of the server and client sessions.

- **Ai Protocol Version**

  Ai Server version 3.4 only supports Ai XML 2.0 protocol. Ai Server version 4.0 supports Ai XML 2.0, Ai XML 3.0 and Ai FIX 1.0 protocols.

- **Quiet Time Interval**

  An interval is set to provide a window for the EBS system and Ai Server to complete necessary activities at logoff. This is set to five seconds, preventing a subsequent login until the time has elapsed. This does not apply if the client is using XML 3.0 or FIX 1.0

- **Maximum Query Retrieval Timeframe**

  A two-hour interval is set for Deal Status Query retrieval of deal information from the EBS Spot Trading database. This limit is established to prevent an overload of data during an active trading session.

- **Heartbeat Interval**

  When the network is idle for a specific amount of time, the Ai Server will issue a Heartbeat message to the client to see if the client is still connected. Default is 500 milliseconds.

6.4 Trading Considerations

All rules and guidelines for using the EBS Spot trading system are described in the *EBS Dealing Rules*.

- **Maximum Orders per Session**

  The EBS Spot system enforces a limit of 65,000 transactions per login session. This is not usually an issue for manual workstation traders, but automated systems can often exceed limit in a session that spans multiple days. Clients should keep track of the number of orders submitted within a session and begin a new session when that number approaches 65,000.

- **Market Views**

  EBS Spot Ai provides an elementized feed of market data called market views. Where an EBS Spot manual trading workstation provides a visual display of EBS Best, Dealable Best and Dealable Regular prices, and Local Prices, Ai sends market information to the client application via **Market** *update* messages for subscribed currency pairs. Ai XML 3.0 and FIX 1.0 protocol provide depth of book market information where applicable.

- **Intra-Floor Dealing (IFD)**

  Controlled by an ICAP internal trading floor setting named “IFD” (Intra-floor Dealing), only ICAP can turn it on or off at the trading floor. Turning on “IFD” permits intra-floor dealing; otherwise, local prices are non-dealable.

- **Self Matching**

  The Ai server restricts clients from submitting orders that match their own previously submitted opposite side orders. The Ai server rejects all orders for self-matching. This conforms to the *EBS Spot Dealing Rules*.

6.5 EBS Spot Ai Monitoring

As part of ICAP' ongoing commitment to maintaining an orderly Global market for the benefit of all participants, EBS monitors Spot Ai user's activity to ensure certain requirements and guidelines are met.

6.5.1 ICAP Monitoring

- **Fill Ratio –** a specific percentage of all quotes submitted into EBS Spot or EBS Prime must result in a successful deal.
- **Premature Quote Interrupts (PQI) –** quote submissions using EBS Spot Ai that are interrupted within 2500 milliseconds are discouraged.

ICAP's EBS operates a globally distributed architecture. Excessive PQI behavior from a particular client's application may raise concerns within the FX marketplace. If excessive PQI activity persists and fill ratio requirements are not met, ICAP enables a feature called Minimum Quote Lifespan (MQL) on that client's trading activity.

The MQL feature requires a quote to remain in the market for a predetermined amount of time (for example, 500 milliseconds) before it can be interrupted. After the MQL time elapses, processing of the interrupt request continues, provided that the quote is not in the process of being dealt.

Details of Fill Ratio and PQI/MQL requirements and guidelines are available upon request from your Customer Support Representative.

Contact Information

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Bahrain	80000375	+ 44 (0) 20 7029 9346		Monaco	N/A	+ 44 (0) 20 7029 9375
Barbados	18005340082	+ 44 (0) 20 7029 9347		Netherlands	08000224174	+ 44 (0) 20 7029 9376
Belgium	080010469	+ 44 (0) 20 7029 9348		New Zealand	0800444226	+ 44 (0) 20 7029 9377
Bermuda	18006230166	+ 44 (0) 20 7029 9349		Norway	80011816	+ 44 (0) 20 7029 9378
Brazil	0008110051994	+ 44 (0) 20 7029 9350		Panama	0018886608293	+ 44 (0) 20 7029 9379
Canada	18005762534	+ 44 (0) 20 7029 9351		Peru	080050793	+ 44 (0) 20 7029 9380
Chile	12300200651	+ 44 (0) 20 7029 9353		Philippines	180014410011	+ 44 (0) 20 7029 9381
China	108004400023	+ 44 (0) 20 7029 9354		Poland	008004411343	+ 44 (0) 20 7029 9382
Colombia	01800 9122064	+ 44 (0) 20 7029 9355		Portugal	800844130	+ 44 (0) 20 7029 9383
Cyprus	N/A	+ 44 (0) 20 7029 9356		Russia	74955809410	+ 44 (0) 20 7029 9384
Czech Republic	N/A	+ 44 (0) 20 7029 9357		Singapore	800 852 3666	+ 44 (0) 20 7029 9385
Denmark	80017779	+ 44 (0) 20 7029 9358		South Africa	0800991174	+ 44 (0) 20 7029 9386
Dubai	N/A	+ 44 (0) 20 7029 9359		South Korea	00308440046	+ 44 (0) 20 7029 9387
Finland	0800114424	+ 44 (0) 20 7029 9360		Spain	900974434	+ 44 (0) 20 7029 9388
France	0800908284	+ 44 (0) 20 7029 9361		Sweden	020792749	+ 44 (0) 20 7029 9389
Germany	08001810598	+ 44 (0) 20 7029 9362		Switzerland (D)	0800558443	+ 44 (0) 20 7029 9390
Greece	0080044129654	+ 44 (0) 20 7029 9363		Switzerland (F)	0800551368	+ 44 (0) 20 7029 9391
Hong Kong	800968580	+ 44 (0) 20 7029 9364		Switzerland (I)	0800551369	+ 44 (0) 20 7029 9392
Hungary	0680014347	+ 44 (0) 20 7029 9365		Taiwan	00801 444125	+ 44 (0) 20 7029 9393
Indonesia	001803440095	+ 44 (0) 20 7029 9366		Thailand	18004410152	+ 44 (0) 20 7029 9394
Ireland	1800409190	+ 44 (0) 20 7029 9367		Turkey	80044942788	+ 44 (0) 20 7029 9395
Israel	18009437368	+ 44 (0) 20 7029 9368		United Kingdom	0800446633	+ 44 (0) 20 7029 9396
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