

ArcaBook

For the Archipelago Exchange and ArcaEdge

September 24, 2004

Version 1.81

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Revision History

<i>Date</i>	<i>Version</i>	<i>Change Made by:</i>	<i>Synopsis of Change</i>
<i>December 5, 2002</i>	<i>1.0</i>	<i>FLJ, JP</i>	<i>Original document</i>
<i>January 8, 2003</i>	<i>1.1</i>	<i>FLJ</i>	<ul style="list-style-type: none"> - <i>Modified note descriptions for price and shares in section 6.2.4.</i> - <i>Changed beginning delivery time of imbalance message to 8:00 a.m EST.</i>
<i>January 29, 2003</i>	<i>1.2</i>	<i>FLJ</i>	<ul style="list-style-type: none"> - <i>Added exchange code and system code to all sequenced messages.</i> - <i>Added additional auction type flag and projected auction time to imbalance message.</i>
<i>February 13, 2003</i>	<i>1.3</i>	<i>FLJ</i>	<ul style="list-style-type: none"> - <i>Added market imbalance to imbalance message.</i> - <i>Changed order of fields in imbalance message.</i> - <i>Added note about negative imbalance.</i>
<i>March 7, 2003</i>	<i>1.4</i>	<i>FLJ, MH</i>	<ul style="list-style-type: none"> - <i>Added stock field to modify and delete messages.</i> - <i>Added quote id field to add, modify, and delete messages.</i> - <i>Added padding field to all sequenced messages.</i> - <i>Rearranged field order of sequenced messages.</i> - <i>Added auctions, imbalance info.</i> - <i>Added TCP/IP buffer note.</i>
<i>May 19, 2003</i>	<i>1.5</i>	<i>FLJ, MH</i>	<ul style="list-style-type: none"> - <i>Added System Event message type "V".</i> - <i>Added symbology section.</i>
<i>July 2, 2003</i>	<i>1.6</i>	<i>MH</i>	<ul style="list-style-type: none"> - <i>Replaced ArcaBook with ARCABOOK</i>
<i>July 17, 2003</i>	<i>1.7</i>	<i>MH</i>	<ul style="list-style-type: none"> - <i>Added Buy/Sell Indicator to Modify and Delete messages.</i>
<i>February 23, 2004</i>	<i>1.8</i>	<i>MH, MMW</i>	<ul style="list-style-type: none"> - <i>Added Closing Auction details.</i> - <i>Updated definitions of System Code P (ArcaEx OTC) and E (ArcaEx Listed).</i> - <i>Eliminated Exchange Code O (ECN).</i>
<i>September 24, 2004</i>	<i>1.81</i>	<i>MMW</i>	<ul style="list-style-type: none"> - <i>Added details on unattributed quotes for ArcaEdge symbols.</i> - <i>Added bandwidth requirements.</i>

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1 Introduction

ArcaBook is a real-time data feed that disseminates Archipelago order book information to subscribing vendors.

ArcaBook includes the details of all open orders and order changes. The primary purpose of this service is to provide subscribers with the data needed to display the Archipelago open order book and the Archipelago ticker on their systems. Order routing algorithms can also use this data.

2 Access

ArcaBook is a TCP/IP server that will accept connections on a predefined address and port. It will accept a primary and backup connection to assist recovery on the subscriber's end. Archipelago will be the Server and the subscriber will connect as the Client.

A login is required before ArcaBook will broadcast data to subscribers.

Archipelago will supply the Subscriber with the following parameters:

- An IP address
- A port
- A username
- A password

The Subscriber will supply Archipelago with the following:

- The IP address of their connecting machine

ArcaBook is generally accessible from 7:00 am EST to 8:00 pm EST. These times may vary depending on start and end of day processing.

3 Session

ArcaBook will accept connections at the beginning of Archipelago's trading day and shut down after the close of Archipelago's market. Once the Archipelago market center begins accepting orders, they will be broadcasted out to ArcaBook subscribers.

Once successfully connected, the subscriber will immediately receive data starting from the sequence number specified in the login message. This sequence number must be between zero (0) and the last current sequence update generated on Archipelago's system. Valid sequence numbers are 0 – 9999999999. A starting sequence of zero (0) indicates a request to begin receiving current updates.

If the TCP/IP connection breaks for any reason, the subscriber must reconnect. During the re-login, the subscriber can specify the last sequenced message received or any recovery sequence point to ensure data integrity.

After the close of the Archipelago market, the ArcaBook server will no longer broadcast sequenced data. Subscribers will be allowed to connect until the ArcaBook server is shut down during Archipelago's end of day process. Once shut down, the server will not be available until the next day's opening.

4 Data Types

All numeric fields are composed of a string of ASCII characters (0-9), left justified and NULL padded. All alpha fields are left justified and NULL padded.

Prices are given in decimal format, left justified and NULL padded. The decimal portion of the price can go back up to 4 decimal places. Examples; "25.222", "0.125", "100.6", "2.30".

The Sequence Number (on the order, modify, and delete messages) is a sequential number that identifies the message. This number will start the trading session at one (1) and increment by one (1) for each new message.

There are two timestamp fields: one specifying seconds and the other specifying milliseconds associated with that second. The second timestamps are in seconds since midnight (00:00:00) of the trading day.

5 Symbology

The Comstock symbology is embedded in the Stock field for orders with System Code = "E". Nasdaq symbology will be used for orders with System Code = "P" and "B".

6 Testing

Subscribers must schedule system testing with Archipelago. Archipelago will provide an IP address, port number, username, and password to be used for testing. Send an e-mail to fix@archipelago.com or call 888-689-7739 to arrange a test.

7 Messages

The message feed is an ASCII data feed containing a stream of messages delimited by the ASCII <ETX> character. All fields are left justified and NULL padded. Fields should not be assumed to be NULL terminated since they may fill the entire field length leaving no room for a NULL pad.

Each ArcaBook message has:

- A single byte header which indicates the message type
- Variable length message contents
- A terminating ACSII <ETX> character

Message Type	Variable-length message contents	Terminating <ETX> Character
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ArcaBook Message Structure

The messages sent by the subscribers are:

Message	Message Type Character
Login	L
Logoff	O
Test Request	T

The messages sent by the ArcaBook server are:

Message	Message Type Character
Add Order	A
Modify Order	M
Delete Order	D
Imbalance	I
Heartbeat	H

Message	Message Type Character
Test Response	S
Login Accepted	Q
Login Rejected	R
System Event	V

7.1 Messages sent by Subscribers

7.1.1 Login

The login message is sent by the subscriber to authenticate the subscriber and specify a starting message sequence. If the starting sequence number field is left blank (NULL), populated with all blanks, or greater than Archipelago's current sequence number, a starting sequence number of zero (0) is assumed and the subscriber will begin receiving current updates. If a negative starting sequence is specified, the ArcaBook server will send a login rejection message and close the connection.

After a connection is established between the subscriber and the ArcaBook server, the subscriber will have 30 seconds to send a login request message. If the login request message is not sent within 30 seconds after a connection is established, the ArcaBook server will send a login rejection message and close the connection.

Login Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"L"	Login request
Username	1	8	Alpha	Username
Password	9	10	Alpha	Password
Sequence Number	19	10	Number	Recovery sequence number or 0 to receive current updates. 0 - 9999999999.

7.1.2 Logoff

The logoff message is sent by the subscriber to disconnect the session. The logoff message will have only a message type header.

Logoff Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"O"	Logoff request

7.1.3 Test Request

The test request message is sent by the subscriber. The subscriber can specify a text message to be echoed back. Upon receiving the test request message, the ArcaBook server will send back a test response message with the exact same text.

Test Request Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"T"	Test request
Test Message	1	20	Alpha	Text to be echoed

7.2 Messages sent by ArcaBook server

7.2.1 Add Order

The add order message communicates the details of a new order added to Archipelago's open order book. The order reference number will be a unique identifier per system code for this order.

Add Order Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"A"	Add new order
Sequence #	1	10	Numeric	1-9999999999
Order Reference Number	11	8	Numeric	The unique reference number per system code assigned to this new order
Exchange Code	19	1	Alpha	P-ArcaEx, B-BB
Buy/Sell Indicator	20	1	Alpha	B-Buy order, S-Sell order
Shares	21	9	Numeric	Show size of order
Stock	30	8	Alpha	Stock symbol
Price	38	10	Price	The limit price of the order
Seconds	48	5	Numeric	Seconds Timestamp
Milliseconds	53	3	Numeric	Milliseconds timestamp
System Code	56	1	Alpha	P-ArcaEx OTC, E-ArcaEx Listed, and B-BB
Quote ID	57	5	Alpha	'A'+MMID if attributed, ARCAX if non-attributed ArcaEx quote, or ARCBB if non-attributed BB quote
Padding	62	8	Alpha	Not used

If an order is to be attributed, ArcaBook will display the appropriate MMID in the Quote ID field of the Add Order message (this is derived from the first four letters of a firm's ETPID). For example, if Broker Dealer XXXXZ designated an order to be attributed, ArcaBook will display AXXXX for the order. If the order is not attributed, it will display as ARCAX for ArcaEx symbols and as ARCBB for ArcaEdge (BB) symbols.

7.2.2 Modify Order

The modify order message is sent when an order on the Archipelago book is modified. When an order is modified, the order reference number will reference the original order sent in the add order message. The following events will trigger the transmission of a modify order message.

- The price of an order changes
- The size of an order changes
- An order is partially filled

Modify Order Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"M"	Modify order
Sequence #	1	10	Numeric	1-9999999999
Order Reference Number	11	8	Numeric	The unique reference number per system code assigned to the original order
Shares	19	9	Numeric	Order size
Price	28	10	Price	The limit price of the order
Seconds	38	5	Numeric	Seconds timestamp
Milliseconds	43	3	Numeric	Milliseconds timestamp
Stock	46	8	Alpha	Stock symbol
Exchange Code	54	1	Alpha	P-ArcaEx, B-BB
System Code	55	1	Alpha	P-ArcaEx OTC, E-ArcaEx Listed, and B-BB
Quote ID	56	5	Alpha	'A'+MMID if attributed, ARCAX if non-attributed ArcaEx quote, or ARCB B if non-attributed BB quote
Buy/Sell Indicator	61	1	Alpha	B-Buy order, S-Sell order
Padding	62	7	Alpha	Not used

7.2.3 Delete Order

The delete order message is sent when an order is taken off of the Archipelago open order book. The following events will trigger the transmission of a delete order message.

- An order is cancelled
- An order expires
- An order is filled

Delete Order Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"D"	Delete the order
Sequence #	1	10	Numeric	1-9999999999
Order Reference Number	11	8	Numeric	The unique reference number per system code assigned to the original order
Seconds	19	5	Numeric	Seconds timestamp
Milliseconds	24	3	Numeric	Milliseconds timestamp
Stock	27	8	Alpha	Stock symbol
Exchange Code	35	1	Alpha	P-ArcaEx, B-BB
System Code	36	1	Alpha	P-ArcaEx OTC, E-ArcaEx Listed, and B-BB
Quote ID	37	5	Alpha	'A'+MMID if attributed, ARCAEX if non-attributed ArcaEx quote, or ARCB B if non-attributed BB quote
Buy/Sell Indicator	42	1	Alpha	B-Buy order, S-Sell order
Padding	43	7	Alpha	Not used

7.2.4 Imbalance

The imbalance message is sent in response to orders submitted during pending auctions. The message is sent between 8:00 am ET and the conclusion of the Opening Auction for orders designated for the Opening Auction, and between 8:00 am ET and the conclusion of the Market Order Auction for orders designated for the Market Order Auction. ArcaEx will disseminate Closing Auction messages between 3:00 pm EST and the conclusion of the Closing Auction at 4:00 pm EST (times are subject to change).

ArcaBook will also disseminate imbalance information for Halt Auctions.

For auctions, the total imbalance volume and market imbalance volume will be negative for a sell imbalance.

Imbalance Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"I"	Imbalance message
Sequence #	1	10	Numeric	1-9999999999
Stock	11	8	Numeric	The stock symbol
Price	19	10	Price	The indicative match price
Shares	29	9	Numeric	The indicative match volume
Total Imbalance	38	9	Numeric	The total imbalance volume
Seconds	47	5	Numeric	Seconds timestamp
Milliseconds	52	3	Numeric	Milliseconds timestamp
Market Imbalance	55	9	Numeric	The market imbalance volume
Auction Type	64	1	Alpha	O-Open, M-Market, H-Halt, C-Closing
Auction Time	65	4	Numeric	Projected Auction Time (hhmm)
Exchange Code	69	1	Alpha	P-ArcaEx, B-BB
System Code	70	1	Alpha	P-ArcaEx OTC, E-ArcaEx Listed, and B-BB
Padding	71	8	Alpha	Not used

Market Order Imbalance

The Market Order Imbalance is the imbalance of any remaining Market Orders that are not going to be executed in a Market Order Auction. Calculation of match size and indicative match price remain unchanged.

Total Imbalance

The total imbalance is the net imbalance of orders at the indicative match price for all orders eligible for the next upcoming Auction. This includes Market and Limit Orders. Display of match size and indicative match price remain unchanged.

7.2.5 Heartbeat

Some firewalls will time out a TCP/IP connection if there is no activity in a given time frame. For this reason, a heartbeat message will be sent every 60 seconds. The heartbeat message will have only a message type header.

Heartbeat Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"H"	Heartbeat

7.2.6 Test Response

The test response message is sent by the ArcaBook server. It is sent in response to a test request message.

Test Response Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"S"	Test Response
Test Message	1	20	Alpha	Text sent in Test Request message

7.2.7 Login Accepted

The login accepted message is sent by the ArcaBook server to indicate a valid authentication.

Login Accepted Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"Q"	Login Accepted
Version ID	1	5	Alpha	Version of ArcaBook protocol (vv.vv)

7.2.8 Login Rejected

The login rejected message is sent by the ArcaBook server to indicate an invalid authentication, maximum connection limit, invalid sequence, or a timed out connection. Rejection code "A" indicates that the subscriber has specified an invalid username, password, or doesn't have correct permissions (per permission file). Rejection code "M" indicates the ArcaBook server instance has reached it maximum connection load and will no longer accept connections on the assigned ip address and port. Rejection code "S" indicates that the subscriber has requested an invalid sequence. Rejection code "T" indicates that the subscriber did not send a login message within 30 seconds of establishing connection. Please note that after sending a rejection message with a reject code of "A", "M", "S", or "T", the ArcaBook server will close the socket connection.

Login Rejected Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"R"	Login rejected
Reject Code	1	1	Alpha	A=Not Authorized, M=Maximum Server Connections Reached, S=Invalid Sequence, T=Timeout

7.2.9 System Event Message

The system event message is sent by the ArcaBook server to indicate a special system event and corresponding event code.

Login Accepted Message				
Name	Offset	Len	Value	Notes
Message Type	0	1	"V"	System Event Message
Sequence #	1	10	Numeric	1-9999999999
Expected Sequence #	11	10	Numeric	1-9999999999
Seconds	21	5	Numeric	Seconds timestamp
Milliseconds	26	3	Numeric	Milliseconds timestamp
Event Code	29	1	Alpha	"C" Clear Book
System Code	30	1	Alpha	P-ArcaEx OTC, E-ArcaEx Listed, and B-BB
Padding	31	16	Alpha	Not Used

The system event message with Event Code = "C" indicates that all orders in the book for the corresponding System Code should be cancelled, i.e. that it should be treated like a new day. The message will also include the next expected sequence number. In most cases this will be the Sequence # + 1 although it is possible that the system has been reset and the sequence numbers will restart at 1.

The possible System Codes are "P" for ArcaEx OTC, "E" for ArcaEx Listed, and "B" for Bulletin Board.

8 Bandwidth Requirements

The recommended minimum bandwidth for ArcaBook is 3 Mbps (equivalent of two T1s).

Archipelago offers connectivity to its Chicago and New York data centers and strongly recommends that ArcaBook subscribers implement a redundant connectivity solution for receiving ArcaBook data. By connecting to both of Archipelago's data centers, an ArcaBook subscriber will be able to continue to receive market data in the event that there are issues with the subscriber's primary connection.