



# Scratch Market Data Specification

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## 0 Introduction

This document describes the two protocols used by Direct Edge to distribute depth of book information:

**Scratch Session Management Protocol:** The Scratch Session Management Protocol provides a framework to authenticate clients and to distribute sequenced, discrete application level messages from the server to the client.

**Scratch Book Protocol:** The Scratch Book Protocol provides the application level messages necessary for clients to build the full depth of book information for Direct Edge.

Collectively, these protocols are referred to as “Scratch”. In the production environment, market data clients are authenticated with the Scratch Session Management Protocol and are sent a series of sequenced data messages. The payload of these sequenced data messages are Scratch Book Protocol messages. These protocols are similar (but not identical) to market data protocols used by other ECNs and market centers.

# 1 SCRATCH Session Management Protocol

## 1.0 General Operation

The Scratch Session Management Protocol is used to distribute sequenced messages from a server to a number of clients over TCP/IP. The server maintains one or more ordered sequences of messages called sessions. Clients join a particular session when they connect to the server, and receive sequenced messages in real-time as they are generated.

## 1.1 Data Types

Name	Valid Values	Description
Integer	0x40 – 0x49, 0x20	ASCII coded integer. Integer fields are right justified and left padded with spaces.
Character	0x00 – 0x09 0x0B – 0xFF	One or more ASCII coded characters. Must not contain 0x0A (ASCII Line Feed).
Message Terminator	0x0A	Indicates the end of a message.

## 1.2 Server to Client Messages

### 1.2.1 Debug Message

Field Name	Offset	Size	Type	Remarks
Message Type	0	1	Character	0x2B ('+') distinguishes a Debug Message.
Payload	1	var	Character	The payload must not contain 0x0A (LF).
Message Terminator	var	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

Debug messages are sent unsolicited from the server to the client. They contain a variable length payload string which may be ignored by the client application.

### 1.2.2 Login Accepted Message

Field Name	Offset	Size	Type	Remarks
Message Type	0	1	Character	0x41 ('A') distinguishes a Login Accepted Message.
Session	1	10	Integer	The session number that the client has joined.
Sequence Number	11	10	Integer	The sequence number of the next Sequenced Data Message.
Message Terminator	21	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

One Login Accepted Message will be sent from the server to the client in response to a Login Request Message if the client is successfully authenticated. The Login Accepted Message indicates which session the client has joined as well as the sequence number of the next Sequenced Data Message to be sent from the server to the client.

### 1.2.3 Login Rejected Message

Field Name	Offset	Size	Type	Remarks
Message Type	0	1	Character	0x4A ('J') distinguishes a Login Rejected Message.
Reason	1	1	Character	0x41 ('A'): Not Authorized 0x53 ('S'): Invalid Session
Message Terminator	2	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

One Login Rejected Client will be sent from the server to the client in response to a Login Request Message if the client is not able to be authenticated. After sending this message, the server will immediately close the client socket.

### 1.2.4 Sequenced Data Message

Field Name	Offset	Size	Type	Remarks
Message Type	0	1	Character	0x53 ('S') distinguishes a Sequenced Data Message.
Payload	1	var	Character	The payload must not contain 0x0A (LF).
Message Terminator	var	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

Sequenced Data Messages are sent unsolicited from the server to the client. The payload field of a Sequenced Data Message contains an application-specific message. Each Sequenced Data Message has an implicit sequence number. Upon joining a session, the sequence number of the first Sequenced Data message is known, and the sequence number for each subsequent message increases by one.

### 1.2.5 Server Heartbeat Message

Field Name	Offset	Size	Type	Remarks
Message Type	0	1	Character	0x48 ('H') distinguishes a Server Heartbeat Message.
Message Terminator	1	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

Server Heartbeat Messages are sent to indicate to the client that the server is still active in the absence of Sequenced Data Messages. The server will send a heartbeat to each client after no more than one second of inactivity.

### 1.2.6 End of Session

A Scratch session is closed with a zero-length sequenced data message (0x53 0x0A). No more sequenced data messages may be sent after the session is closed. A client that receives such a message may disconnect knowing that there are no more messages in that particular session.

## 1.3 Client to Server Messages

### 1.3.1 Login Request Message

Login Name and Password fields are left justified and right-padded with spaces. Session number and initial sequence number fields are right justified and left-padded with spaces.

Field Name	Offset	Size	Type	Type
Message Type	0	1	Character	0x4C ('L') distinguishes a Login Request Message.
Login Name	1	6	Character	The login name used by each Scratch client is assigned by the Direct Edge Operations staff. Login names shorter than 6 characters should be left-justified and right-padded with spaces.
Password	7	10	Character	The password used by each Scratch client is assigned by the Direct Edge Operations staff. Passwords shorter than 10 characters should be left-justified and right-padded with spaces.
Session Number	17	10	Integer	The session number that the client wishes to join.
Initial Sequence Number	27	10	Integer	The sequence number of the first Sequenced Data Message that the server will send to the client.
Message Terminator	37	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

### 1.3.2 Logout Request Message

Field Name	Offset	Size	Type	Remarks
Message Type	0	1	Character	0x4F ('O') distinguishes a Logout Request Message
Message Terminator	1	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

A Logout Request Message indicates that a Scratch Session Management client wishes to disconnect from the server. Upon receiving this message, the server will immediately close client's TCP socket.

### 1.3.3 Client Heartbeat Message

Field Name	Offset	Size	Type	Type
Message Type	0	1	Character	0x52 ('R') distinguishes a Client Heartbeat Message.
Message Terminator	1	1	Message Terminator	0x0A (LF) terminates a Scratch Session Management message.

Client Heartbeat Messages are used to indicate that a Scratch Session Management client is still active in the absence of other client to server communication. Clients will send a Client Heartbeat Message to the server after no more than 1 second of inactivity.

## 2 SCRATCH Book Protocol

### 2.0 General Operation

Book Protocol messages carry information about the Direct Edge ECN book.

To receive the Direct Edge ECN book feed, connect to the Direct Edge ECN Book Server using the SCRATCH Session Management protocol. In the login request message, the client should request session 0 (the default session). Each Book Protocol message will be carried inside of a Session Management Protocol sequenced data message (section 1.2.4).

Timestamps are expressed milliseconds past midnight, US Eastern Time.

### 2.1 Data Types

Type Name	Valid Values	Type Description
Character (Base-26)	0x41 – 0x5A, 0x20	Character or character string. Multi-character fields are left-justified and right-padded with spaces
Integer (Base-10)	0x30 – 0x39, 0x20	ASCII coded integer. Integer fields are right justified and left-padded with spaces.
Alphanumeric (Base-36)	0x30 – 0x39, 0x41 – 0x5A, 0x20	ASCII coded string of characters and/or integers. Alphanumeric fields are left justified and right-padded with spaces.
Extended	0x20 – 0x7E	ASCII coded string. Extended fields are left-justified and right-padded with spaces.

### 2.2 Scratch Book Messages

#### 2.2.1 System Event Message

Field Name	Offset	Size	Type	Remarks
Time Stamp	0	8	Integer	Expressed in millisecond past midnight, US Eastern Time.
Message Type	8	1	Character	0x53 ('S') distinguishes a System Event Message.
Event Code	9	1	Character	0x53 ('S'): Start of Day. Indicates that Direct Edge ECN will accept and match subscriber orders. 0x45 ('E'): End of Day. Indicates that Direct Edge ECN has stopped accepting and matching orders.

## 2.2.2 Add Order Message

Field Name	Offset	Size	Type	Remarks
Time Stamp	0	8	Integer	Expressed in milliseconds past midnight, US Eastern Time.
Message Type	8	1	Character	0x41 ('A') distinguishes an Add Order Message.
Order Reference Number	9	12	Alphanumeric	Order reference numbers may be re-used after an order has left the Direct Edge book.
Side Indicator	21	1	Character	0x42 ('B') indicates a Bid. 0x53 ('S') indicates an Offer.
Order Qty	22	6	Integer	Orders with a displayed quantity of 1,000,000 shares or more will be capped at 999,999 shares in the Scratch feed.
Security	28	6	Extended	The ticker symbol of the security. Symbol suffix translation scheme is given in Symbology (section 2.3).
Price	34	10	Integer	All prices are given in US Dollars.
Display	44	1	Character	0x41 ('A') indicates an attributed quote. 0x59 ('Y') indicates a non-attributed quote.
MMID (Optional)	45	4	String	The MMID field is only present for an attributed quote.

The Add Order message indicates that a new limit order has been added to the Direct Edge book. The price field is a 10 digit ASCII encoded integer with 4 digits to the right of the implied decimal point. All prices are given in US Dollars.

## 2.2.3 Order Executed Message

Field Name	Offset	Size	Type	Remarks
Time Stamp	0	8	Integer	Expressed in milliseconds past midnight, US Eastern Time.
Message Type	8	1	Character	0x45 ('E') distinguishes an Order Executed message.
Order Reference Number	9	12	Alphanumeric	The order reference number of the order that has executed.
Executed Shares	21	6	Integer	The number of shares that have executed. The quantity remaining on the indicated order has been reduced by this amount.
Match Number	27	21	Alphanumeric	A day-unique string that identifies this execution. If the execution is subsequently broken, a Broken Trade Message (section 2.2.7) will be sent with this match number.

The Order Executed message indicates that a limit order already in the Direct Edge book has executed. The visible quantity of the indicated order has been reduced by the number of shares in the "Executed Shares" field. When the visible quantity of the order reaches 0 it has been removed from the Direct Edge book.

## 2.2.4 Order Canceled Message

Field Name	Offset	Size	Type	Remarks
Time Stamp	0	8	Integer	Expressed in milliseconds past midnight, US Eastern Time.
Message Type	8	1	Character	0x58 ('X') distinguishes an Order Canceled message.
Order Reference Number	9	12	Alphanumeric	The order reference number of the order that has been canceled.
Cancelled Shares	21	6	Integer	The number of shares that have been canceled. The quantity remaining on the indicated order has been reduced by this amount.

The Order Canceled Message indicates that an order in the Direct Edge book has been canceled in whole or in part. The visible quantity of the indicated order is reduced by the number of shares in the "Cancelled Shares" field. When the visible quantity of the order reaches 0 it has been removed from the Direct Edge book.

## 2.2.5 Trade Message

Field Name	Offset	Size	Type	Remarks
Time Stamp	0	8	Integer	Expressed in milliseconds past midnight, US Eastern Time.
Message Type	8	1	Character	0x50 ('P') distinguishes a Trade Message
Order Reference Number	9	12	Alphanumeric	The order reference number of the liquidity adding order.
Side Indicator	21	1	Character	Indicates the liquidity adding side of the trade. 0x42 ('B') indicates a Bid. 0x53 ('S') indicates an Offer.
Shares	22	6	Integer	The number of shares that executed.
Security	28	6	Extended	The ticker symbol of the order that executed. Symbol suffix translation scheme is given in Symbology (section 2.3).
Price	34	10	Integer	The price at which the execution occurred.
Match Number	44	21	Alphanumeric	A day-unique string that identifies this execution. If the execution is subsequently broken, a Broken Trade Message (section 2.2.7) will be sent with this match number.

The Trade Message indicates that shares which were not shown on the Direct Edge book have executed. The Order Reference Number of the liquidity adding order is obfuscated – multiple partial executions of the same hidden order will be published with different order reference numbers.

## 2.2.6 Broken Trade Message

Field Name	Offset	Size	Type	Remarks
Time Stamp	0	8	Integer	Expressed in milliseconds past midnight, US Eastern Time.
Message Type	8	1	Character	0x42 ('B') distinguishes a Broken Trade Message.
Match Number	9	21	Alphanumeric	Uniquely identifies the trade to be broken. See the Order Executed Message (2.4) and Trade Message (2.6).

The Broken Trade Message indicates that a previously published trade has been broken by Direct Edge ECN. The broken trade is identified by the Match Number field.

## 2.2.7 Security Status Message

Field Name	Offset	Size	Type	Remarks
Time Stamp	0	8	Integer	Expressed in milliseconds past midnight, US Eastern Time.
Message Type	8	1	Character	0x48 ('H') distinguishes a Security Status Message.
Security	9	6	Extended	The ticker symbol whose status is changing. Symbol suffix translation scheme is given in Symbology (section 2.3).
Halted State	15	1	Character	0x56 ('T') indicates the security is now trading. 0x47 ('F') indicates the security is now halted.

The Security Status Message indicates a change in the trading status of an individual security. All securities should be assumed to be in the "trading" state at the start of the day.

## 2.3 Symbology

The CQS and CMS representations of certain NYSE and AMEX listed symbol / suffix combinations may be longer than the 6 character symbol field in the Scratch protocol. Scratch uses the symbol suffix translation scheme shown in the table below to guarantee that all symbol names are 6 characters or less.

Suffix Description	CQS Suffix	CMS Suffix	Scratch Suffix
Called	/CL	CL	*
Class A	/A	A	.A
Class B	/B	B	.B
Class A Called	/A/CL	ACL	.A*
Class B Called	/B/CL	BCL	.B*
Class A When Issued	/Aw	AWI	.A#
Class B When Issued	/Bw	BWI	.B#
Convertible	/CV	CV	%
Class A Convertible	A/CV	ACV	.A%
Class B Convertible	B/CV	BCV	.B%
Preferred	p	PR	-
Preferred Class A	pA	PRA	-A
Preferred Class B	pB	PRB	-B
Preferred Class A Called	pA/CL	PRACL	-A*
Preferred Class B Called	pB/CL	PRBCL	-B*
Preferred Class A Convertible	pA/CV	PRACV	-A%
Preferred Class B Convertible	pB/CV	PRBCV	-B%
Preferred Class A When Issued	pAw	PRAWI	-A#
Preferred Class B When Issued	pBw	PRBWI	-B#
Preferred When Issued	pw	PRWI	-#
Preferred Class A When Distributed	pA/WD	PRAWD	-A\$
Preferred Class B When Distributed	pB/WD	PRBWD	-B\$
Preferred When Distributed	p/WD	PRWD	-\$
Partial Paid	/PP	PP	@
Convertible Called	/CV/CL	CVCL	%*
Rights	r	RT	^
Rights When Issued	rt	RTWI	^#
Test	/TEST	TEST	~
Units	/U	U	=
Warrants	/WS	WS	+
Warrants Class A	/WS/A	WSA	+A
Warrants Class B	/WS/B	WSB	+B
Warrant When Issued	/WSw	WSWI	+#
When Distributed	/WD	WD	\$
When Issued	w	WI	#

The Direct Edge order entry API requires symbol suffixes in CMS format in FIX field 65.

### 3 Revision History

- 1.00: (2006-08-29)
  - Initial Revision
- 1.01: (2007-03-06)
  - Added Extended Data Type
  - Changed Stock/Symbol fields from Character String to Extended
  - Added Symbology Section
  - Scratch timestamps no longer accurate to the second only
  - Changed "Symbol" to "Stock" in section 2.4 and 2.8
  - Changed numbering of sections 2.5 – 2.8 (typo)
- 1.02: (2008-01-15)
  - Symbology Update: Added Convertible Suffixes
  - Symbology Update: Changed the translation of "Convertible Called"
  - Marked MMID as optional in Add Order Message
- 1.03: (2008-05-21)
  - Section 2.6: Trade messages are now sent.
  - Section 2.7: Broken Trade messages are now sent.
  - Section 2.8: Stock Trading/Halted messages are now sent.
- 1.04 (2008-08-11)
  - Added section 0 (Introduction).
  - Added section 1.0 (General Operation).
  - Added section 2.0 (General Operation).
  - All Sections: Improved description text.
- 1.05 (2008-08-29)
  - Section 2.2.5: Trade messages no longer have data in the OrderRef and Side fields.
- 1.06 (2008-11-24)
  - Section 2.2.5: Trade messages now have an obfuscated OrderRef.