



Full Level Book Market Data

API Document

Table of Contents

Introduction.....	2
1) Welcome to BO	2
Messaging Overview	3
1) Message header	3
2) Application Messages	3
3) Message Types.....	4
Symbol Enums	5
1) Symbol Enum Description.	5
2) Current Instruments supported by BO and their corresponding Symbol Enums	5
BOClient Logon/Logout to Market Data Admin Server (MDAS)	5
1. BOClientLogon -- Client Sending.....	5
3) BOClientLogon/Logout -- Server Response	7
4) Possible Login/Logout Reject Codes.....	9
BOClientLogin to the Full Level Book Market Data Server (FLBS).....	9
1) BOClientLogon -- Client Sending.....	9
2) BOClientLogon/Logout -- Server Response	11
3) Possible Login/Logout Reject Codes	13
Successful login to FLBS.....	13
1) BOInstrumentRequest	13
2) Possible BOInstrumentRequest Reject Codes.....	15
3) BOInstrument – Server Response to BOInstrumentRequest.....	15
BOMDSubscribe Msg	17
1) Order Types not included in the market data	17
2) BOMDSubscribe Message	18
FLBS Level Updates.....	18
1) BOLevelUpdate Msg	19
2) BOExecReport Message.....	20

Introduction

1) Welcome to BO.

This document is intended to familiarize the user with the BO Binary API. The BO API uses a Binary Messaging Protocol. Binary messaging protocols allow for lower bandwidth usage and faster data processing and higher throughput.

Messaging Overview

1) Message header

1. Each message in the API is preceded by a 4 byte header. This header conveys the following information
 - 1.1. Message type. The first byte of the header is always a character indicating the type of message to follow. Example: data[0] = 'T'. The second byte is reserved to accommodate double character message types.
 - 1.2. Immediately following the 2 byte message type is a 2 byte short integer containing the total length of the message including the 4 byte message header. The length is a short integer (2 bytes) and is found in the 3rd and 4th bytes of the header.

Field Name	Data type	Data length	Buffer offset	Example Value	Notes
Msg1	Char	1	0	'H'	
Msg2	Chart	1	1		
MsgLength	Short	2	2	161	

2) Application Messages

2. Application messages contain the data necessary to perform the operations indicated by the message type. Application messages always contain the 4 byte header followed by the actual data message. The type of message which follows the header is always found in the 1st byte of the header as described above. The length of the message including the header is always found in the 3rd and 4th bytes of the header as described above.
3. Excel spreadsheets for each message in the API are included with the documentation. All spreadsheets include:
 - 3.1. Message name
 - 3.2. Field names
 - 3.3. Data type of each field
 - 3.4. Buffer offset of each field in the message buffer for sending/receiving.
 - 3.5. Total length of the message
 - 3.6. Required fields for client and server
 - 3.7. The following messages are included in the API
 - 3.7.1. BOClientLogon
 - 3.7.2. BOHeartbeat

- 3.7.3. BOTestrequest
- 3.7.4. BOInstrumentRequest
- 3.7.5. BOInstrument
- 3.7.6. BOInvalidMsg
- 3.7.7. BOReject
- 3.7.8. BOTransaction

3) Message Types

Enum name: MessageType	Enum Value	Notes
ORDER_NEW	1	
CANCEL_REPLACE	2	
MARGIN_CANCEL_REPLACE	3	Note 1
MARGIN_EXECUTE	4	Note 2
ORDER_STATUS	5	
ORDER_CANCEL	6	
MARGIN_CANCEL	7	Note 1
EXECUTION	8	
EXECUTION_PARTIAL	9	
MARGIN_EXECUTION	10	Note 2
MARGIN_PARTIAL_EXECUTION	11	
REJECT	12	Note 3
ORDER_REJECT	13	Note 3
ORDER_ACK	14	
CANCELLED	15	
REPLACED	16	
QUOTE_FILL	17	Note 4
QUOTE_FILL_PARTIAL	18	
MARGIN_REPLACED	19	Note 1
CANCEL_REPLACE_REJECT	20	
MD_SUBSCRIBE	21	

Symbol Enums

1) Symbol Enum Description.

Symbol Enums are replacements for the character based instrument name to a short integer. Symbols enums are included in almost all BO messages pertaining to orders and risk management and market data reporting. Symbol Enums are used to replace hashing functions necessary to find either orders, instrument data or risk information normally associated with instruments in most other trading systems. It is essential they be included in the messages which require them. Failure to include them will result in a reject of the message and wrong symbol enums will result in undefined behavior. After the login is complete, the user can send a BOInstrumentRequest message to the FLBS (Full Level Book Market Data Server) and will receive back a BOInstrument message which contains all information for each instrument including the symbol name and the symbol enum for that symbol name. The BOInstrumentRequest and BOInstrument messages will be covered in detail in a subsequent section.

2) Current Instruments supported by BO and their corresponding Symbol Enums

Instrument Name	Symbol Enum
BTCUSD	1
USDUSDT	2
FLYUSDT	3
BTCUSDT	4

3)

BOClient Logon/Logout to Market Data Admin Server (MDAS)

1. BOClientLogon -- Client Sending

1. The BOClientLogon message must be sent to the MDAS in order to initiate the logon process (please contact your BO Representative for the IP address and port).
2. Please refer to the BOClientLogon excel spreadsheet for exact fields, datatypes and buffer offsets.
3. The MDAS will respond with a BOClientLogon with logon status and if logon was successful the IP Address and Port of the FLBS (Full Level Book Market Data Server).
4. Only one login session is permitted for a unique account ID and UserName.
5. BO requests that if they user is going to close the connection a BOClientLogon message should be sent with the LogonType set to 2 prior to closing the connection in order to allow the FLBS to close the connection gracefully.
6. BOClientLogon Example Message - Client Sending

Field name	Data Type	Data Length	Buffer Offset	Required Field	Required Value	Example Value	Note#
Msg1	char	1	0	X	H	H	Header
Msg2	char	1	1				Header
MsgLength	short	2	2	X	143	143	Header
LogonType	Short	2	4	X		1	Note 1
Account	Int	4	6	X		253336	Note 2
2FA	char[]	6	10	X		1F6A	Note 4
UserName	char[]	6	16	X		BOU1	Note 2
TradingSessionID	Int	4	22	*			Note 2
PrimaryOESIP	char[]	24	26	*			Note 3
SecondaryOESIP	char[]	24	50	*			Note 3
PrimaryMDIP	char[]	24	74				Not used
SecondaryIP	char[]	24	98				Not used
SendingTime	Long	8	122				Note 5
MsgSeqNum	Int	4	130			1500201	
Key	Int	4	134			432451	
LoginStatus	Short	1	138				
RejectReason	Short	2	140				
RiskMaster	Char	1	142				

1. Notes:

Note 1: LogonType is a short enum, values:

Login	1	
Logout	2	

If the value is not one of the values above, a logout message will be sent and the connection closed.

Note 2: Value assigned by BO. If this is a logout, the TradingSessionID must be supplied.

Note 3: IP address and port of the FLBS will be sent in the server response BOClientLogon message.

Note 4: 2FA is disabled for the testing phase

Note 5: Sending times are in nanoseconds from the epoch, January 1, 1970

3) BOClientLogon/Logout -- Server Response

- 1.1. Upon Receipt of a client logon, the server will respond with a BOClientLogon message.
- 1.2. The status of the logon will be in the LoginStatus field, a value of 1 indicates the logon was successful, a value of 2 indicates the login failed and the server will then close the connection. The reason for the unsuccessful login will be in the RejectReason field. Possible values for the reject will be detailed in a section below.
- 1.3. The IP address and port of the FLBS (Full Level Book Market Data Server) will be supplied in the message in order to allow the user to make the connection to the FLBS. Login to the FLBS will be covered in a subsequent section.
- 1.4. Upon Receipt of a client logon, the server will respond with a BOClientLogon message.
- 1.5. The status of the logon will be in the LoginStatus field, a value of 1 indicates the logon was successful, a value of 2 indicates the login failed and the server will then close the connection. The reason for the unsuccessful login will be in the RejectReason field. Possible values for the reject will be detailed in a section below.
- 1.6. The IP address and port of the FLBS (Full Level Book Market Data Server) will be supplied in the message in order to allow the user to make the connection to the FLBS. Login to the FLBS will be covered in a subsequent section.
- 1.7. The server may initiate logout messages in the following circumstances:
 - 1.7.1. Malformed messages which cannot be processed.
 - 1.7.2. BO initiated shutdown of the FLBS
- 1.8. In the event the FLBS becomes unavailable, the user should reconnect to the secondary FLBS for which the IP Address and Port is supplied in the message.
- 1.9. In the event the client sends a logout message, the server will not respond with a logout message but will instead proceed to close the connection.
- 1.10.

Field name	Data Type	Data Length	Buffer Offset	Required Field	Required Value	Example Value	Notes
Msg1	char	1	0	X	H	H	Header

Msg2	char	1	1				Header
MsgLength	short	2	2	X	143	143	Header
LogonType	Short	2	4			1	Note 1
Account	Int	4	6	*		253336	Note 2
2FA	char[]	6	10	X		1F6A	Note 3
UserName	char[]	6	16	X		BOU1	Note 2
TradingSessionID	Int	4	22	X		505	Note 2
PrimaryOESIP	char[]	24	26	*		192.0.0.1:4300 5	Note 4
SecondaryOESIP	char[]	24	50	*		113.50.1.1:430 05	Note 4
PrimaryMDIP	char[]	24	74				Not used
SecondaryIP	char[]	24	98				Not used
SendingTime	Long	8	122				Note 5
MsgSeqNum	int	4	130	X		1500201	
Key	Int	4	134			432451	
LoginStatus	short	1	138				Not used
RejectReason	short	2	140	*			Note 6
RiskMaster	char	1	142				Note 7
		Total Length	143				

1.11.

1. Notes:

Note 1: LogonType is a short enum (see Client logon above for possible values)

Note 2: TradingSessionID, UserName and Account number included in logon response but may or may not be included in logout messages.

Note 3: Disabled for testing

Note 4: Not included in logout messages (LogonType = 2)

Note 5: Sending times are in nanoseconds from the epoch, January 1, 1970

Note 6: If the login was rejected, the reject reason will be in the field RejectReason

Note 7: Not currently used, for future expansion

4) Possible Login/Logout Reject Codes

ERROR CODE	Value
USER_NOT_FOUND	2
ACCOUNT_NOT_FOUND	3
INVALID_KEY	4
ACCOUNT_DISABLED	5
RISK_ACCOUNT_NOT_FOUND	7
MES_NOT_AVAILABLE_TRADING_DISABLED	9
OES_NOT_AVAILABLE_TRADING_DISABLED	10
MDS_NOT_AVAILABLE_TRADING_DISABLED	11
MSG_TYPE_INVALID	12
NO_RISK_DATA	44
MSG_SEQ_NUM_INVALID	52
USER_ALREADY_LOGGED_IN	53
MALFORMED_MSG	54

5)

BOClientLogin to the Full Level Book Market Data Server (FLBS)

After successfully logging into the MDAS, the user should log into the FLBS using the IP address and port provided in the MDAS login response.

1) BOClientLogon -- Client Sending

7. The BOClientLogon message must be sent to the FLBS in order to initiate the logon process. The IP address and port were provided to the user during the MDAS login.
8. Please refer to the BOClientLogon excel spreadsheet for exact fields, datatypes and buffer offsets.
9. Only one login session is permitted for a unique account ID and UserName.
10. BO requests that if they user is going to close the connection a BOClientLogon message should be sent with the LogonType set to 2 prior to closing the connection in order to allow the FLBS to close the connection gracefully.
11. BOClientLogon Example Message - Client Sending

Field name	Data Type	Data Length	Buffer Offset	Required Field	Required Value	Example Value	Note#
Msg1	char	1	0	X	H	H	Header
Msg2	char	1	1				Header
MsgLength	short	2	2	X	143	143	Header
LogonType	Short	2	4	X		1	Note 1
Account	Int	4	6	X		253336	Note 2
2FA	char[]	6	10	X		1F6A	Note 4
UserName	char[]	6	16	X		BOU1	Note 2
TradingSessionID	Int	4	22	*			Note 2
PrimaryOESIP	char[]	24	26	*			Note 3
SecondaryOESIP	char[]	24	50	*			Note 3
PrimaryMDIP	char[]	24	74				Not used
SecondaryIP	char[]	24	98				Not used
SendingTime	Long	8	122				Note 5
MsgSeqNum	int	4	130			1500201	
Key	Int	4	134			432451	
LoginStatus	short	1	138				
RejectReason	short	2	140				
RiskMaster	char	1	142				

2. Notes:

Note 1: LogonType is a short enum, values:

Login	1	
Logout	2	

Note 2: Value assigned by BO. If this is a logout, the TradingSessionID must be supplied.

Note 3: IP address and port of the FLBS will be sent in the server response BOClientLogon message.

Note 4: 2FA is disabled for the testing phase

Note 5: Sending times are in nanoseconds from the epoch, January 1, 1970

2) BOClientLogon/Logout -- Server Response

- 2.1. Upon Receipt of a client logon, the server will respond with a BOClientLogon message.
- 2.2. The status of the logon will be in the LoginStatus field, a value of 1 indicates the logon was successful, a value of 2 indicates the login failed and the server will then close the connection. The reason for the unsuccessful login will be in the RejectReason field. Possible values for the reject will be detailed in a section below.
- 2.3. The IP address and port of the FLBS (Full Level Book Market Data Server) will be supplied in the message in order to allow the user to make the connection to the FLBS. Login to the FLBS will be covered in a subsequent section.
- 2.4. Upon Receipt of a client logon, the server will respond with a BOClientLogon message.
- 2.5. The status of the logon will be in the LoginStatus field, a value of 1 indicates the logon was successful, a value of 2 indicates the login failed and the server will then close the connection. The reason for the unsuccessful login will be in the RejectReason field. Possible values for the reject will be detailed in a section below.
- 2.6. The IP address and port of the FLBS (Full Level Book Market Data Server) will be supplied in the message in order to allow the user to make the connection to the FLBS. Login to the FLBS will be covered in a subsequent section.
- 2.7. The server may initiate logout messages in the following circumstances:
 - 2.7.1. Malformed messages which cannot be processed.
 - 2.7.2. BO initiated shutdown of the FLBS
- 2.8. In the event the FLBS becomes unavailable, the user should reconnect to the secondary FLBS for which the IP Address and Port is supplied in the message.
- 2.9. In the event the client sends a logout message, the server will not respond with a logout message but will instead proceed to close the connection.
- 2.10.

Field name	Data Type	Data Length	Buffer Offset	Required Field	Required Value	Example Value	Notes
Msg1	Char	1	0	X	H	H	Header

Msg2	Char	1	1				Header
MsgLength	Short	2	2	X	143	143	Header
LogonType	Short	2	4			1	Note 1
Account	Int	4	6	*		253336	Note 2
2FA	char[]	6	10	X		1F6A	Note 3
UserName	char[]	6	16	X		BOU1	Note 2
TradingSessionID	Int	4	22	X		505	Note 2
PrimaryOESIP	char[]	24	26	*		192.0.0.1:4300 5	Note 4
SecondaryOESIP	char[]	24	50	*		113.50.1.1:430 05	Note 4
PrimaryMDIP	char[]	24	74				Not used
SecondaryIP	char[]	24	98				Not used
SendingTime	Long	8	122				Note 5
MsgSeqNum	Int	4	130	X		1500201	
Key	Int	4	134			432451	
LoginStatus	Short	1	138				Not used
RejectReason	Short	2	140	*			Note 6
RiskMaster	Char	1	142				Note 7
		Total Length	143				

2.11.

2. Notes:

Note 1: LogonType is a short enum (see Client logon above for possible values)

Note 2: TradingSessionID, UserName and Account number included in logon response but may or may not be included in logout messages.

Note 3: Disabled for testing

Note 4: Not included in logout messages (LogonType = 2)

Note 5: Sending times are in nanoseconds from the epoch, January 1, 1970

Note 6: If the login was rejected, the reject reason will be in the field RejectReason, see section below for possible values

Note 7: Not currently used, for future expansion

3) Possible Login/Logout Reject Codes

ERROR CODE	Value
USER_NOT_FOUND	2
ACCOUNT_NOT_FOUND	3
INVALID_KEY	4
ACCOUNT_DISABLED	5
RISK_ACCOUNT_NOT_FOUND	7
MES_NOT_AVAILABLE_TRADING_DISABLED	9
OES_NOT_AVAILABLE_TRADING_DISABLED	10
MDS_NOT_AVAILABLE_TRADING_DISABLED	11
MSG_TYPE_INVALID	12
NO_RISK_DATA	44
MSG_SEQ_NUM_INVALID	52
USER_ALREADY_LGGGED_IN	53
MALFORMED_MSG	54
SENDING_TIME_INVALID	21

4)

Successful login to FLBS

After a successful login to the FLBS the user should request the instrument data.

1) BOInstrumentRequest

2.1. The BOInstrumentRequest message should be sent to receive the parameters necessary to trade any instrument supported by BO. The FLBS will respond with a BOInstrument message.

Field name	Data Type	Data Length	Buffer Offset	Required Field	Required Value	Example Value	Notes
Msg1	Char	1	0	X	Y	Y	Header
Msg2	Char	1	1				Header
MsgLength	Short	2	2	X	62	62	Header

MessageType	Short	2	4				Not used
RejectReason	Int	4	6	*			Note 7
Account	int	4	8	X		100700	Note 1
RequestType	short	2	12	X		2	Note 2
Key	Int	4	14	X			Note 2
SymbolName	char[]	24	18				Note 3
SymbolType	short	2	42				Note 4
SymbolEnum	short	2	44				Note 5
TradingSessionID	int	4	46			506	
SendingTime	Long	8	50	x			Note 6
MsgSeqNum	Int	4	58	X		1500201	
		Total Length	62				

2.2.

Note 1: TradingSessionID, UserName and Account number supplied by BO to the user.

Note 2: RequestType is an enum with the following values:

Enum Name	Enum Value (short int)	
ALL	1	Request all instruments
SYMBOL_ENUM	2	Individual instrument

Note 3: Character string name representation an individual instrument if known, if not known the name will be provided in the BOInstrument response

Note 4: SymbolType is a short integer enum with the following possible values:

Enum Name: SymbolType	Enum Value	Enum Data Type: short
SPOT	1	

Msg1	Char	1	0	X	Y	Y	Header
Msg2	Char	1	1				Header
MsgLength	Short	2	2	X	62	62	Header
MessageType	Short	2	4	*	Y	Y	Note 6
Padding	Short	2	6	*			Not used
ResponseType	Short	2	8	X		2	Note 1
SymbolEnum	short	2	10	X		1	Note 2
SymbolName	Char[]	24	12	X		BTCUSD	Note3
SymbolType	Short	2	36			1	Note 2
PriceIncrement	double	2	38			.5	Note 4
MinSize	double	2	46			.00001	
MaxSize	double	4	54			1000	
SendingTime	Long	8	62	x			Note 5
MsgSeqNum	Int	4	70	X		1500201	
		Total Length	74				

2.4.

Note 1: ResponseType is a short enum with the following possible values. If the ResponseType is set to SYMBOL_ENUM, the SymbolEnum field must be set to the value of the symbol enum being requested.

ResponseType Enum	Enum Value (short int)	
SNAPSHOT	1	
SNAPSHOT_START	2	Multi message responses
SNAPSHOT_CONTINUATION	3	Continuation of response
SNAPSHOT_FINISH	4	Last message of the response
UPDATE	5	
UNSOLICITED	6	

POSS_DUP	7	
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Note 2: Please see preceding section for possible values for the SymbolEnum and SymbolType

Note 3: Character representation of the instrument name

Note 4: PriceIncrement is the minimum price movement of the instrument.

Note 5: Sending times are in nanoseconds from the epoch, January 1, 1970

Note 6: MessageType is not really required since a message of this type is defined in the first byte of the header.

BOMDSubscribe Msg

BOMDSubscribe message is used to subscribe to instruments for which market data is provided. The subscribe message will result in a snapshot of the symbol requested. Upon completion of the subscribe message normal updates will be sent to the user. It is the responsibility of the user to maintain the order book upon receiving the snapshot data and the normal messages. Normal updates will be provided as a BOTransaction message.

1) Order Types not included in the market data

1. Hidden order types
2. ICE order types will be provided as limit orders with the order quantity set to the size increment
3. Peg and Peg Hidden order types
4. Stop Market and Stop limit order types
5. Trailing stop market and limit order types
6. Sniper market and limit order types
7. OCO orders will be sent as regular LMT order types

2) BOMDSubscribe Message

Field name	Data Type	Data Length	Buffer Offset		Required Field	Required Value	Example Value	Notes
Msg1	Char	1	0		X	s	s	Header
Msg2	Char	1	1					Header
MsgLength	Short	2	2		X	34	34	Header
MessageType	Short	2	4		*		MD_SUBSCRIBE	Note 1
SymbolEnum	Short	2	6					Note 2
SubscribeType	Short	2	8					Note 3
Account	Int	4	10		X		100700	
Key	Int	4	14		X		468321	
TradingSessionID	Int	4	18		X		200	
SendTime	UInt64_t	8	22		X		184232029271	Note 3
SeqNum	Int	4	30		X		52488131	

Note 1: Subscribe types

- a. TOB = 1
- b. THREELAYERS = 2
- c. FIVELAYERS = 3
- d. TENLAYERS = 4
- e. TWENTYLAYERS = 5
- f. THIRTYLAYERS = 6
- g. FOB_DATA = 7
- h. FLB_DATA = 8

FLBS Level Updates

BOLevelUpdate and BOExecReport messages are used to indicate changes in price levels and to convey execution information.

1) BOLevelUpdate Msg

Field name	Data Type	Data Length	Buffer Offset	Required Field	Required Value	Example Value	Notes
Msg1	Char	1	0	X	T	T	Header
Msg2	Char	1	1				Header
MsgLength	Short	2	2	X	94	94	Header
MessageType	Short	2	4	*		ORDER_NEW	Note 1
Padding	Short	2	6				
SymbolEnum	Short	2	8	X			
SymbolType	Short	2	10	X			
LastTradePrice	Double	8	12	X			
Last24Vol	Double	8	20	X			
High	Double	8	28	X			
Low	Double	8	36	X			
Price	Double	8	44	X			
Volume	Double	8	52	X			
NumOrders	Double	8	60	X			
SendTime	UInt64_t	8	68	X			
MsgSeqNum	Int	4	76	X			
Side	Short	2	80	X			
BOSymbolName	Char[]	12	82	x			

2)

Note 1: The valid side fields are:

Enum Name: SIDE	Enum Value	
BUY	1	
SELL	2	

2) BOExecReport Message

Field name	Data Type	Data Length	Buffer Offset	Required Field	Required Value	Example Value	Notes
Msg1	Char	1	0	X	V	V	Header
Msg2	Char	1	1				Header
MsgLength	Short	2	2	X	54	54	Header
MessageType	Short	2	4	*			Note 1
Padding	Short	2	6				Not used
SymbolEnum	Short	2	8	X		4	Note 2
SymbolType	Short	8	10	X		SPOT	
Price	Double	2	12	X		60000.5	
Volume	Double	2	20	X		1.3	
SendTime	UInt64_t	2	28	X		18338102818181	
MsgSeqNum	int	8	36	X		52	
Side	Short	2	40	X		BUY	
SymbolName	Char[]	8	42	X		BTCUSDT	

Note 1: Message types must be valid according to the values listed in the Message Type table above. Since in this example we would like to place a new order on the book, the MsgType field must be set to ORDER_NEW.

Note 2: Please see previous sections for valid values for the symbol enum.

Enum Name: SIDE	Enum Value	
BUY	1	
SELL	2	