KASE

FAST protocol specification

Version 1.13.1

Kazakhstan Stock Exchange, 2022

Table of Contents

History of changes

Date	Version	Changes
27.04.2022	1.13.1	1. The new section **3.1.4. Messages in streams** was added - sec. 3.1.4. This section describes which messages are transmitted in each data stream. 2. Broadcasting of **TradingSessionStatus (h)** messages was added to FUT-INFO and OPT-INFO streams - sec. 4.3.3. 3. The **OpenInterest** field (open positions after the trade) was added to **DefaultIncrementalRefreshMessage** message template - sec. 4.3.8. Message identifier was changed from "19" to "22". 4. The **CFICode** field values are detailed in **SecurityDefinition** message - sec. 4.3.1.
20.03.2021	1.12.0	1. The deprecated streams FUT-BOOK-1, FUT-BOOK-5, FUT-BOOK-20, FUT-BOOK-50, OPT-BOOK-1, OPT-BOOK-5, OPT-BOOK-20, OPT-BOOK-50, FUT-TRADES, OPT-TRADES were replaced with new merged streams FO-TRADES, FO-BOOK-1, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50, IQS-TRADES, IQS-BOOK-1, IQS-BOOK-50. 2. The group of fields with **'EventType'=5** (Instrument trading start date) is no longer broadcast in the **SecurityDefinition (d)** message for futures, calendar spreads and options. 3. In FUT-INFO, OPT-INFO streams in **SecurityDefinition (d)** messages, the **MarketSegmentID** field value was replaced with "**D**". 4. The description of market segments was changed (field **MarketSegmentId**) in the following sections: • **Trading Session Status (h)** - sec. 4.3.3 • **News (B)** - sec. 4.3.5 • **Security Definition (d) -** sec. 4.3.1 5. The description of **20008 Flags** field was changed in **SecurityDefinition (d)** message - sec. 4.3.1.

1. Introduction

1.1. Document purpose

This document overviews the FAST protocol specifications.

This document does not cover administrative and technical aspects of network connection. Also, this document does not cover security support aspect.

1.2. Fast Gate — Basic information

The **Fast Gate** system is used for distributing market data in the FAST-format via the UDP protocol in the multicast mode.

This approach combines the FIX protocol structure and message syntax with the FAST protocol dataflow optimization benefits. Also, it provides possibilities for fast and reliable data distribution to multiple clients of the UDP ptotocol.

The FAST (FIX Adapted for STreaming) protocol is a FIX based protocol developed by FIX Market Data Optimization Working Group in order to optimize financial data exchange performance and reduce latency in distributing large amounts of data. Fast Gate uses the protocol version 1.1: https://www.fixtrading.org/packages/fast-specification-version-1-1.

The distributed market data include:

- quotes;
- мarket fundamentals;
- instruments and instruments status;
- trading session status;
- indexes;
- log of anonymous orders;
- log of anonymous quotes.

The servise is used for distributing data to large vendors such as Bloomberg and Thomson Reuters as well as to brokers, traders, etc.

1.2.1. Data streaming approach

Using of the data streaming approach allows to transmit data from sender to recepient without breaking it into separate messages. The new approach allows to combine several events into a single message which leads to higher data transfer speed and reduce latency time.

1.2.2. Incremental messages

Using of incremental messages allows to significantly reduce amount of transmitted data. Only the data changed due to the market events are transmitted; also, minimal number of commands are used for refreshing data: 'add new record', 'change record', 'delete record'.

1.2.3. FIX format

The **Fast Gate** system uses the FIX mesages format and syntax. Each message consists of header, message body and trailer. Fields are separated with the ASCII symbol — <SOH>.

For more information see sec. 4.

1.2.4. Encoding in the FAST format

The FAST (FIX Adapted for STreaming) protocol is the FIX based protocol developed by FIX Market Data Optimization Working Group in order to optimize financial data exchange performance and reduce latency in distributing large amounts of data.

The following features are used for data compression:

- implicit tagging;
- fields encoding options;
- usage of PMap;
- stop-bit encoding;
- usage of binary encoding method.

In most cases, the FAST format encoding rules are negotiated between counterparties by exchanging XML-templates.

For more information see sec. 3.2.

1.2.5. Data receicing via Multicast

For data distribution, the UDP protocol is used in order to distribute data to more than one client at once.

A single UDP packet may contain several FIX messages in the FAST format. Although, currently the system does not provide a possibility to send more than one FAST-coded message via a single UDP packet. In order to match the restriction, FAST messages are generated in a size not bigger then that of the MTU parameter, i.e. 1500 bytes, which is typical for Ethernet networks.

1.2.6. Data recovery

It is extremely important to clients to be able to recover data instantly in case of any data loss.

Fast Gate provides 2 methods of data recovery:

- recovering big amounts of data by sending snapshots (for example, for the clients connected to the system after the trading session start);
- recovering small amounts of data via TCP-connection (for example, in case of message loss during sending).

2. Scenarios of client interactions with Market Data Multicast

This section covers different scenarios of clients connection to the Market Data Multicast feeds. Also, this section covers loss data recovery procedures details.

2.1. Connect client

When client starts listening to Market Data Multicast FIX/FAST Platform, it should keep the following procedure:

1. Download the actual multicast IP addresses configuration file from ftp. Configuration file is the XML - file describing the connectivity parameters (feeds, multicast addresses, ports, etc.).
2. Download the FAST template from ftp.
3. Receive the instruments list from **Instrument Replay** feed. Start listening to the **Instruments Incremental** feed.
4. Start listening to the **Incremental** feeds and queue received data.
5. Start listening to the **Snapshot** feeds. Receive and apply actual market data snapshot. In each Market Data - *Snapshot/Full Refresh (W)* tag *369-LastMsgSeqNumProcessed* is equal to tag *34-MsgSeqNum* of the last message Market Data - *Incremental Refresh (X)* of the appropriate stream included in the snapshot. The refresh number of each instrument within the tag *83-RptSeq* of the message Market Data - *Snapshot/Full Refresh (W)* is equal to number of incremental refresh in the tag *83-RptSeq* which corresponds to *MDEntry* of the last message Market Data - *Incremental Refresh (X)*, included into the snapshot. For each instrument, it is necessary to omit all messages with numbers through *369-LastMsgSeqNumProcessed* tag number and apply all that are left. The procedure can be both sequential or parallel. I.e., you can either receive snapshots for all instruments and then process the accumulated data or you can process data after receiving each snapshot.
6. Stop listening to the **Snapshot** feeds.
7. Continue receiving and normal processing incremental data.

2.2. Incremental Feeds A and B Arbitration

Data in all UDP Feeds are disseminated in two identical feeds (A and B) on two different multicast IPs. It is strongly recommended that client receive and process both feeds because of possible UDP packet loss. Processing two identical feeds allows one to statistically decrease the probability of packet loss

It is not specified in what particular feed (A or B) the message appears for the first time. To arbitrate these feeds one should use the message sequence number found in Preamble or in tag 34 - MsgSeqNum. Utilization of the Preamble allows one to determine message sequence number without decoding of FAST message.

Processing messages from feeds A and B should be performed using the following algorithm:

1. Listen feeds A and B.
2. Process messages according to their sequence numbers.
3. Ignore a message if one with the same sequence number was already processed before.
4. If the gap in sequence number appears, this indicates packet loss in both feeds (A and B). Client should initiate one of the Recovery process. But first of all client should wait a reasonable time, perhaps the lost packet will come a bit later due to packet reordering . UDP protocol can’ t guarantee the delivery of packets in a sequence .

Example:

Packet order	Feed A	Feed B
1	34-MsgSeqNum = 59	
2		34-MsgSeqNum = 59
3	34-MsgSeqNum = 60	
4		34-MsgSeqNum = 60
5	34-MsgSeqNum = 62	
6		34-MsgSeqNum = 61
7		34-MsgSeqNum = 62
8	34-MsgSeqNum = 62	
9	34-MsgSeqNum = 63	
10	34-MsgSeqNum = 65	
11		34-MsgSeqNum = 65

Messages are received from Feed A and Feed B.

1. Receive message # 59 from Feed A, process it.
2. Receive message #59 from Feed B, discard it, because this message was processed before from Feed A.
3. Receive message # 60 from Feed A, process it.
4. Receive message # 60 from Feed B, discard it, because this message was processed before from Feed A.
5. Receive message # 62 from Feed A, discard it and wait for message #61.
6. Receive message # 61 from Feed B, process it.
7. Receive message # 62 from Feed B, process it.
8. Receive message # 62 from Feed A, discard it, because this message was processed before from Feed B.
9. Receive message # 63 from Feed A, process it.
10. Receive message # 65 from Feed A, discard it and wait for message #64.
11. Receive message # 65 from Feed B, discard it and wait for message #64.
12. Begin recovery process, because gap is detected. Message #64 is missed.

3. System functionality

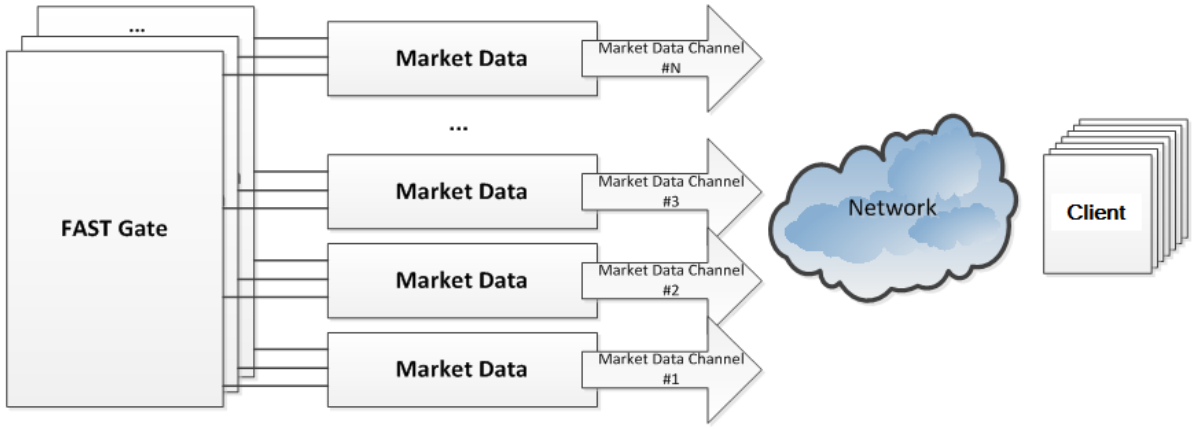
3.1. System architecture

UDP channels used to transfer market data from KASE. UDP channels are also used for recovery process, TCP connection is used to replay sets of lost messages, already published in one of UDP Channels.

Following feeds are used in the system:

1. Basic:
   - Market Data Incremental Refresh feeds;
   - Instrument Definition feed;
   - Data distribution feed for instrument status change and Trading System connection status.
2. Recovery feeds:
   - Market Recovery feed;
   - TCP Replay session.

Data are distributed via group of feeds, each of that contain data for financial instrument group. The instruments are grouped by the Trading System according to particular parameters. The dedicated Market Data Multicast instance is responsible for distribution in each Feed. A single Market Data Multicast instance is responsible for a single Feed data distribution.



Pic. 1. Market Data distribution feeds

Each feed is a) a bunch of several UDP-feeds with continuous data distribution; b) TCP-port which is used for requesting messages missed in the UDP-feed.

All streams are transmitted using the UDP multicast protocol and every stream is transmitted using a dedicated multicast address. The A and B streams transmit the same data in order to decrease the probability for missing UDP-packets.

Apart from transmitting data in UDP streams, Market Data multicast can accept incoming TCP connections for letting clients request missing data. Clients can request missing messages using one of the next UDP streams (data are available for a period of time specified in the configuration file (not earlier than from beginning of the day), number of messages to be sent at one is limited, number of requests per day is limited, too. All limits are specified in the system configuration file.

3.1.1. Main streams (UDP)

The main streams (incr) in the multicast mode with the UDP protocol is used to distribute the following market data:

- Streams FO-TRADES, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50 — aggregate Order-book data refresh;
- Streams FO-TRADES — trade table and Derivatives market statistics data refresh;
- NEWS stream — Derivatives market related news;
- ORDERS-LOG - anonymous orders.

The data are distributed as FIX-messages Market Data - Incremental Refresh (X) coded in the FAST format. Each message may contain refresh data for several financial instruments.

Any change in trading session status will result in issuing a message Trading Session Status (h) into the Incremental Refresh UDP streams: FO-BOOK-1, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50, FO-TRADES.

3.1.2. Recovery streams (UDP)

The Recovery (snap) streams in the multicast mode with the UDP protocol are used to periodically distribute the current snapshot of the corresponding data as FIX-messages Market Data - Snapshot/Full Refresh (W) coded in the FAST format. Each message contains data for a single instrument only.

It is not necessary for clients to be constantly connected to these streams. After receiving the missing data, it is recommended to disconnect from these streams.

Messages Trading Session Status (h), containing data on the trading session status, are transmitted in the end part of each snapshot within the following UDP streams: FO-BOOK-1, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50, FO-TRADES.

3.1.3. Instrument Definitions streams (UDP)

The Instrument Replay (inst replay) streams are used to periodically distribute descriptions of financial instruments as FIX messages coded in the FAST format. Each message contains description for a single financial instrument.

In case of instrument status change, collateral volume change or price limits change, the Instrument Incremental (inst incr) stream transmits the Security Status (f) FIX-messages.

Transmitted data:

- FUT-INFO stream — futures;
- OPT-INFO stream — options.

3.1.4. Messages in streams

This section describes which messages are transmitted in each data stream.

Stream name	Stream type	Message template name
ORDERS-LOG	Incremental	Heartbeat (id="6") SequenceReset (id="7") OrdersLogMessage (id="14")
ORDERS-LOG	Snapshot	Heartbeat (id="6") SequenceReset (id="7") BookMessage (id="15")
ORDERS-LOG	Historical Replay	**From client to gateway:** Logon (FIX MessageType="A") Logout (FIX MessageType="5") Market Data Request (FIX MessageType="V") **From gateway to client:** Heartbeat (id="6") OrdersLogMessage (id="14")
FUT-INFO	Instrument Replay	Heartbeat (id="6") SequenceReset (id="7") SecurityDefinition (id="21") TradingSessionStatus (id="8")
FUT-INFO	Instrument Incremental	Heartbeat (id="6") SequenceReset (id="7") SecurityStatus (id="5") TradingSessionStatus (id="8")
OPT-INFO	Instrument Replay	Heartbeat (id="6") SequenceReset (id="7") SecurityDefinition (id="21")

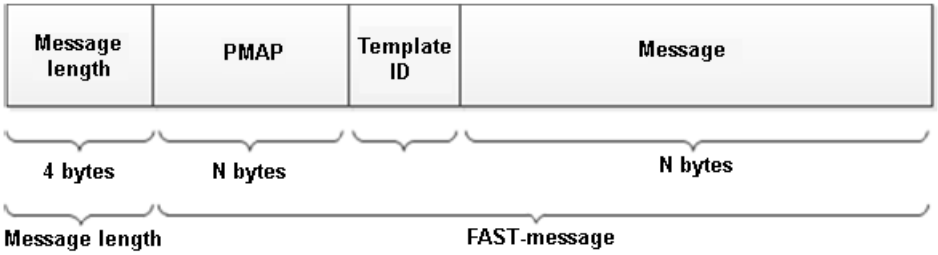
Stream name	Stream type	Message template name
		TradingSessionStatus (id="8")
OPT-INFO	Instrument Incremental	Heartbeat (id="6") SequenceReset (id="7") SecurityStatus (id="5") SecurityDefinitionUpdateReport (id="4) TradingSessionStatus (id="8")
FO-TRADES FO-BOOK-1 FO-BOOK-5 FO-BOOK-20 FO-BOOK-50	Incremental	Heartbeat (id="6") SequenceReset (id="7") DefaultIncrementalRefreshMessage (id="22") TradingSessionStatus (id="8")
FO-TRADES FO-BOOK-1 FO-BOOK-5 FO-BOOK-20 FO-BOOK-50	Snapshot	Heartbeat (id="6") SequenceReset (id="7") DefaultSnapshotMessage (id="20") TradingSessionStatus (id="8")
FO-TRADES	Historical Replay	**From client to gateway:** Logon (FIX MessageType="A") Logout (FIX MessageType="5") Market Data Request (FIX MessageType="V") **From gateway to client:** Heartbeat (id="6") DefaultIncrementalRefreshMessage (id="22") TradingSessionStatus (id="8")
NEWS	Incremental	Heartbeat (id="6") SequenceReset (id="7") News (id="9")
NEWS	Historical Replay	**From client to gateway:** Logon (FIX MessageType="A") Logout (FIX MessageType="5") Market Data Request (FIX MessageType="V") **From gateway to client:** Heartbeat (id="6") News (id="9")

3.1.5. Sessions for requesting missing messages (TCP)

This service allows to request the resend of missing messages within a specified range of numbers.

The request contains a range of message (numbers) to resend. The request is sent as the Market Data Request (V) FIX-message using the client-initiated TCP-connection. The respond messages are sent to the client as FIX-messages coded in the FAST format using the same TCP-connection. Upon completion of sending, Market Data Multicast closes this TCP-connection. Please note, that maximum number of messages to resend is limited.

The first 4 bytes of each message transmitted in a TCP stream contain its length.



Pic. 2. Message structure in TCP stream

When all FAST messages have been sent out, the gateway sends the message Logout to the FAST client, expecting the message Logout from the client in respond. Finishing FIX session also causes TCP session to close.

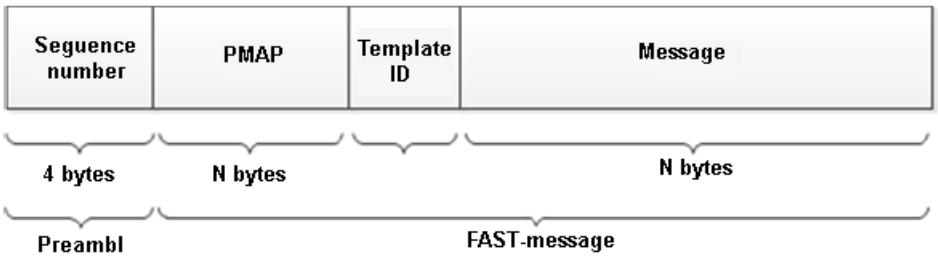
Please also note, that this service should be used only when all other methods are unavailable. This service does not provide high performance and is not available for streams containing aggregated Book-order data.

3.2. FAST format — details

All messages sent by Market Data Multicast are in the FIX-format coded in the FAST (FIX Adapted for STreaming) protocol. The FAST protocol was developed by FIX Market Data Optimization Working Group in order to optimize financial data flow via distributing bigger amounts of data with less latency.

A specific feature of data distribution via the Market Data Multicast streams is, that there is a 4-bytes preamble added before every FAST-message. The preamble contains the 34-th tag (SeqNum) value. The 34-th tag is located right after the preamble.

It allows to receive the message sequence number (both when processing messages from the A and B streams and in case of missing messages) without decoding the FAST-message itself; this leads to time saving during processing of streams.



Pic. 3. Message structure

3.2.1. Stop bit encoding

Encoding stop bit is a constitutive procedure of FAST. The coding allows to exclude redundancy on the data field link layer using the stop bit instead of the standard byte separator. In FAST, stop bit is used instead of the standard FIX-separator (<SOH> byte); therefore, 7 bits of every byte are used for data transmission while the 8th bit indicates the field end.

3.2.2. Implicit tagging

According to the FIX protocol standards, every message is as: **Tag = Value <SOH>**, where:

Tag — number of the field, which is now transmitted;

Value — actual value in this field;

<SOH> – ASCII symbol, used as a separator.

Example:

35=x|268=3 (message header) 279=0|269=2|270=9462.50|271=5|48=800123|22=8 (trade) 279=0|269=0|270=9462.00|271=175|1023=1|48=800123|22=8|346=15 (new bid 1) 279=0|269=0|270=9461.50|271=133|1023=2|48=800123|22=8|346=12 (new bid 2)

FAST allows to avoid this redundancy by using a template which describes the whole message structure. This method is called 'implicit tagging', as FIX tags become implicit parts of the transmitted data. FAST-template exchanges the 'Tag=Value' syntax with 'implicit tagging' according to the following rules:

- tags numbers are not transmitted in message but specified in the template;
- sequence of fields in the message is alike to one of the tags in the template;
- the template specifies a structured bunch of fields with their operators.

3.2.3. Fields encoding options

FAST operates as a state machine, which must 'know' all values to store in memory each moment of time. FAST compares the current field value with the previous one and decides how to act:

- use the constant specified in the template as a new value;
- use the default value (in case of absence of a new field value).

3.2.4. FAST-template

A FAST template corresponds to the FIX message type and uniquely identifies order of fields in each message.

The template also includes syntax indicating the type of field and transfer decoding to apply. Each FAST message contains template ID which is used for decoding.

3.2.5. Decoding overview

Below is the order of decoding procedure:

1. Transport. A client receives an encoded FAST message.
2. Packet decoding:
   - identification of a template;
   - withdrawal of binary encoded bits;
   - determining correspondences between the received bits and template fields.
3. Fields decoding: using operators to determine value according to the template.
4. Generation of FIX-message.
5. Processing the FIX-message.

3.2.6. Message fragmentation

In order to prevent UDP packets from exceeding MTU size of 1500 bytes (typical for Ethernet networks), messages are fragmented into several parts.

If the message Market Data - Snapshot / Full Refresh (W) does not contain the tag 893-LastFragment, it means that snapshot was transmitted as a single message. All fragmented messages except the last one contain the tag 893-LastFragment = 0. The last fragmented messages contains the tag 893-LastFragment = 1. Therefore, receiving a message with the tag 893-LastFragment = 1 indicates that snapshot has been completely transmitted.

If the message Market Data - Incremental Refresh (X) does not contain the tag 893-LastFragment, it means that messages have not been fragmented, and the database is consistent after processing the message. All fragmented messages except the last one contain the tag 893-LastFragment = 0. The last fragmented messages contains the tag 893-LastFragment = 1. Therefore, receiving a message with the tag 893-LastFragment = 1 indicates that the database is consistent.

3.2.7. Data types

A field within a FAST template will have one of the standard Data Types indicating the required decoding action: ASCII string, Unicode string, Signed Integer, Unsigned Integer and Decimal. Decimal exponent and mantissa will be encoded as a single, composite field.

FAST does not natively support timestamps. FAST gate will convert the timestamp to an integer value depending on the field type. The decoding application should convert the integer to the FIX UTC format after decoding. Time is always displayed in UTC.

Samples of timestamps encoding:

FIX Type	FIX Pattern	Sample FIX value	Sample FAST value	FAST field type
UTCTimeOnly	HH:MM:SS.sssssssss (nanoseconds)	18:44:24.123456789	184424123456789	uInt64
	HH:MM:SS.sssssssss (nanoseconds)	07:12:13.012345678	71213012345678	uInt64
UTCDateOnly	YYYYMMDD	20080812	20080812	uInt32
UTCTimestamp	YYYYM-MDD-HH:MM:SS.sss	20080812-18:23:54.213	20080812182354123	uInt64

3.3. Missing data recovery

Market Data Multicast FIX/FAST Platform disseminates Market Data in all feeds over two UDP subfeeds: Feed A and Feed B. In Feeds A and B the identical messages are sent. It lowers the probability of packets loss and provides the first level of protection against missed messages.

Sometimes, messages may be missed on both feeds, requiring a recovery process to take place. Message loss can be detected using the FIX message sequence numbers (tag MsgSeqNum (34)), which are also found in the Preamble. The message sequence number is an incrementing number; therefore, if a gap is detected between messages in the tag MsgSeqNum (34) value, or the Preamble sequence number, this indicates a message h as been missed. In addition, tag RptSeq (83) can be used to detect a gap between the messages at the instrument level. In this case client system should assume that market data maintained in it is no longer correct and should be synchronized to the latest state using one of the recovery mechanisms.

Market Data Multicast FIX/FAST Platform offers several options for recovering missed messages and synchronizing client system to the latest state. Market Recovery process together with Instruments Replay Feed is the recommended mechanism for recovery. TCP Replay provides less performance mechanism recommended only for emergency recovering of small amount of lost messages when other mechanisms cannot be used for some reason. Instrument level sequencing and natural refresh can be utilized to supplement the recovery process.

3.3.1. Recovery missing data using Recovery streams (UDP)

This recovery method is preferable to use for large - scale data recovery and for late joiners. Recovery feeds contains Market Data - Snapshot/Full Refresh (W) messages. The sequence number (LastMsgSeqNumProcessed(369)) in the Market Data - Snapshot/Full Refresh (W) message corresponds to the sequence number (MsgSeqNum(34)) of the last Market Data - Incremental Refresh (X) message in the corresponding feed. Instrument level sequence number (RptSeq(83)) in Market Data - Snapshot/Full Refresh (W) message correspond to the sequence number (RptSeq(83)) in the MDEntry from last Market Data - Incremental Refresh (X) message. Thus, tag MsgSeqNum(34) shows the gap at the messages level, tag RptSeq(83) shows gap at the instrument level.

After value of RptSeq(83) tag from Market Data - Incremental Refresh (X) becomes more than value of RptSeq(83) tag from Market Data - Incremental Refresh (X) , market data becomes actual.

After value of MsgSeqNum(34) from Market Data - Incremental Refresh (X) message becomes more than value of tag LastMsgSeqNumProcessed(369) from Market Data - Snapshot/Full Refresh (W) message, market data becomes actual.

Messages sequence numbers begins from #1 in Market Data - Snapshot/Full Refresh (W) messages in each cycle.

If a message does not contain the tag 893-LastFragment, it means that snapshot was transmitted as a single message. Otherwise, the last fragmented messages contains the tag 893-LastFragment = 1. Therefore, receiving a message with the tag 893-LastFragment = 1 indicates that snapshot has been completely transmitted.

Clients should keep queuing real - time data until all missed data is recovered. The recovered data should then be applied prior to data queued.

Consequence of recovery is equal to that described in sec. 2.1 (steps 4 - 7).

Since clients have retrieved recovery data, it is recommended to stop listening Market Recovery feeds.

3.3.2. Recovering missing data using TCP-connection

If there any market data missing in incremental streams Trades and ORDERS-LOG (anonymous orders and trades), it can be recovered over the TCP historical replay component using the sequence number range. TCP Replay is a low performance recovery option and should only be used if other options are unavailable or for small - scale data recovery. Number of messages which can be requested by client during TCP connection is limited to 1000.

To request missing data, you should do the following:

1. Establish TCP connection with Market Data Multicast.
2. Send FIX message Logon(A) with sequence numder 1 to server. After successful authorization server sends the FAST - encoded Logon(A) message.
3. Send Market Data Request (V) message with:
    a. Range of sequence numbers - ApplBegSeqNum(1182) and ApplEndSeqNum (1183) tags.

If request is correct, server sends FAST messages according to requested sequence numbers.

If request is incorrect, server sends FAST Logout (5) message with reject reason.

After server responses, the connection is closed.

Server will process only first user request, second and others will be ignored. If the server does not receive Market Data Request within an established timeout interval after logon, the connection is closed.

Recovery channel has 1 second incoming request timeout.

3.4. Message sequence reset

Every 24 hours, the Fast Gate is being cleaned up from the last day trading session messages, and its message sequences are being reset. When the message sequences have been reset, a message 'Sequence Reset' with a new value in the field 'NewSeqNo' will be transmitted in the (incr) streams. Upon receiving the message 'Sequence Reset', the client is to set the message number value to that transmitted in the message 'NewSeqNo', and reset 'RptSeq' numbers.

Below is the break time schedule for Fast Gate. In the end of break time, message sequence numbers will be reset:

- Derivatives Market - 0:00 AM till 09:00 AM;

For all the main (incr) streams, excluding the stream FO-TRADES the message sequence number will be set to 1, and 'RptSeq' number will be set to 1. For the main (incr) stream FO-TRADES the message number sequences will be set to a value N>=1, and 'RptSeq' number will be set to a value which is >=1. Also, the message pair 'Sequence Reset' will be transmitted:

- Sequence Reset: MsgSeqNum=N NewSeqNo[36]=1
- Sequence Reset: MsgSeqNum=N NewSeqNo[36]=N

After those messages have been transmitted, the FAST-messages containing trading data of the last evening trading session, with numbers from 1 till N-1 inclusive, will become available through the TCP Recovery service. The initial 'RptSeq' number value can be obtained with one of the following methods:

- request and process messages with numbers from 1 till N-1 available through the TCP Recovery service;
- connect to Recovery (UDP) stream, in accordance with information provided in section 3.3.1 Recovery missing data using Recovery streams (UDP).

4. FIX protocol message specifications

The protocol message specifications description below is based on the standard FIX protocol specification v. 5.0 SP2 (https://www.fixtrading.org/standards/fix-5-0-sp-2). It is recommended for users to read some general information about the protocol before commencing with this specification.

Each field is described below:

- **Tag** – the unique field ID, used for generating a FIX message.
- **Field** – the field name, not used for generating FIX messages and described for your reference only.
- **Mandatory** – a field attribute: specifies whether the field in message is mandatory or optional.
  - Y - mandatory field;
  - N - optional field;
  - C - mandatory, if meets the condition (see 'Details').
- **Details** – detailed description of the field.
- **Allowable values** - additional limitations.

The "*****" symbol - flag of difference from the standard FIX protocol.

4.1. Field groups

Many messages contain the same fields. For example, the 'Standard Message Header' group fields contain some administrative information and are mandatory for every message.

4.1.1. Standard Message Header

The standard header, mandatory for every message.

Tag	Field	Mandatory	Details	Available values
34	MsgSeqNum	Y	Message sequence number	
35	MsgType	Y	Message type	
49	SenderCompID	Y	Message sender ID	'KASE' - Kazakhstan Stock Exchange
52	SendingTime	Y	Message sending time	
1128	ApplVerID	Y	FIX protocol version ID	"9" (FIX50SP2)

4.2. Session layer messages

4.2.1. Logon (A)

A FIX message which is used to initiate a session establishment to the service TCP Recovery.

Tag	Field	Mandatory	Details
8	BeginString	Y	Allowable values: 'FIX.4.4' and 'FIXT.1.1'.
9	BodyLength	Y	Message length.
35	MsgType	Y	'A'
553	Username	N	Any string
554	Password	N	Any string
10	CheckSum	Y	Checksum.

A FAST message which is used to confirm a session establishment to the service TCP Recovery.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'A'.

4.2.2. Logout (5)

A FIX message which is used to initiate a session closure with the service TCP Recovery.

Tag	Field	Mandatory	Details
8	BeginString	Y	Allowable values: 'FIX.4.4' and 'FIXT.1.1'.
9	BodyLength	Y	Message length.

Tag	Field	Mandatory	Details
35	MsgType	Y	'5'
10	CheckSum	Y	Checksum.

A FAST message which is used to confirm a session closure with the service TCP Recovery.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type '5'.

4.2.3. Heartbeat (0)

The message **HeartBeat** is sent by FastGate when there were no messages sent in the stream within a 30 seconds time interval.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type '0'.

4.2.4. Sequence Reset (4)

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type '4'.
36	NewSeqNo	Y	New sequence number.

4.3. Business logic layer messages

This section describes messages of all streams, excluding messages of the anonymous orders and trades stream (ORDERS-LOG) (see sec. 5 below).

The following FIX messages are supported:

- **Security Definition** – Information on instrument.
- **Security Status** – Status and price limit change, change of collateral volume for instrument.
- **Trading Session Status** – Trading session status.
- **Security Definition Update Report** – Volatility and theoretical prices for options.
- **News** – SPECTRA system administrator's messages.
- **Market Data Request** - Missed data request.
- **Market Data - Snapshot / Full Refresh** – Data snapshot (for example, the Order-book full status).
- **Market Data - Incremental Refresh** – Data refresh.

4.3.1. Security Definition (d)

Information on instrument.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'd'
911	TotNumReports	Y	Total messages number in the current list
1301	MarketId*	Y	Exchange MIC
48	SecurityId	C	Instrument unique ID. ID uniqueness is guaranteed within the market segment specified by the field MarketSegmentId.
22	SecurityIdSource	C	"8" - Exchange Symbol
55	Symbol	N	Symbol code of the instrument
107	SecurityDesc	N	Instrument name
167	SecurityType	N	Multileg type - 'MLEG' — calendar spread
461	CFICode	N	Financial instrument class according to ISO-10962. Valid values are shown in the table below.
231	ContractMultiplier	N	Units of underlying asset in instrument.
969	MinPriceIncrement	N	Minimum price step.
1146	MinPriceIncrementAmount	N	Price step cost.
15	Currency	N	Currency

Tag	Field	Mandatory	Details
1148	LowLimitPx*	N	Lower price limit. Futures and calendar spreads only.
1149	HighLimitPx*	N	Upper price limit. Futures and calendar spreads only.
1300	MarketSegmentId*	N	Market segments. Valid values are shown in the table below.
336	TradingSessionId	N*	Trading session type: • '1' — main session • '3' — early session • '5' — evening session
5842	ExchangeTradingSessionId*	N	Trading session ID.
5678	Volatility*	N	Option volatility.
20006	TheorPrice*	N	Option theoretical price.
20007	TheorPriceLimit*	N	Option theoretical price (limits adjusted).
20002	InitialMarginOnBuy*	N	• futures — buyer collateral • options — underlying collateral for buying futures-style option
20000	InitialMarginOnSell*	N	• futures — seller collateral • options — underlying collateral for one uncovered position
20001	InitialMarginSyntetic*	N	Underlying collateral for one uncovered position. Options only.
326	SecurityTradingStatus*	N	Instrument trading status: • '21' — session initiated • '17' — session started • '2' — session paused • '18' — session ended • '19' — not traded on this market
711	NoUnderlyings	N	=1
=> 311	UnderlyingSymbol	N	Underlying asset code
=> 309	UnderlyingSecurityID	N	Futures instrument ID
=> 2620	UnderlyingFutureID	N	ID of the base futures instrument, applicable to options only.
1141	NoMDFeedTypes	N*	Number of duplicated blocks
=>1022 =>264 =>1021	MDFeedType MarketDepth MDBookType	N N N	Feed type. Order-book depth. Order-book type: • '1' — Top of Book • '2' — Price Depth
555	NoLegs	N	=2
=> 600	LegSymbol	N	Symbol code of the multi-leg instrument
=> 602	LegSecurityID	N	Multi-leg instrument code
=> 623	LegRatioQty	N	Quantity ratio. Value of field ‘LegRatioQty’ indicates both amount and direction of a multi leg instrument, i.e. if the field ‘LegRatioQty’ contains a value greater than 0, then the multi leg instrument has the same direction as the multi leg order, while a value less than 0 indicates a direction of this multi leg instrument opposite to that of the multi leg order. The absolute value of the field ‘LegRatioQty’ multiplied by multi leg instrument amount in the order allows to obtain the instrument amount value for field ‘LegSymbol’.
455	SecurityAltID*	N	Instrument symbol code.
456	SecurityAltIDSource*	N	Class for SecurityAltID (455): • '8' — Exchange Symbol

Tag	Field	Mandatory	Details
			• '4' — ISIN number
864	NoEvents	N	• '2' — for futures • '4' — for options
=>865 =>866 =>1145	EventType EventDate EventTime	N	EventType=7. Last trading day.
=>865 =>866 =>1145	EventType EventDate EventTime	N	EventType=100. Instrument exercise start date.
=>865 =>866 =>1145	EventType EventDate EventTime	N	EventType=101. Instrument exercise end date.
541 1079	MaturityDate MaturityTime	N N	Instrument settlement date. Futures only.
870	NoInstrAttrib	N	=3
=> 871 => 872	InstrAttribType InstrAttribValue	N N	=203 Instrument type by SWIFT.
=> 871 => 872	InstrAttribType InstrAttribValue	N N	=204 State registration number.
=> 871 => 872	InstrAttribType InstrAttribValue	N N	=200 Total number of securities by issuer, in units.
202	StrikePrice	N	Strike price.
20005	QuotationList	N	Quotation List.
879	UnderlyingQty	N	Security nominal value.
318	UnderlyingCurrency	N	Code of currency of the security nominal value.

20008	Flags*	N	The field is a bit mask.
			The field can take the following values for futures and calendar spreads:
			• '0x1' - The instrument is traded in the evening or early session
			• '0x10' - Sign of anonymous trading
			• '0x20' - Sign of non-anonymous trading
			• '0x40' - Sign of trading in the main session
			• '0x100' - Sign of multileg-instrument;
			• '0x40000' - Sign of collateral instrument
			• '0x80000' - Execution in in the evening or intraday clearing session:
			  • '0' - evening clearing session
			  • '1' - intraday clearing session
			The field can take the following values for options:
			• '0x1' - The instrument is traded in the evening or early session
			• '0x10' - Sign of anonymous trading
			• '0x20' - Sign of non-anonymous trading
			• '0x40' - Sign of trading in the main session

20040	MinPriceIncrementAmountCurr	N	Value of the minimum increment in USD.

Tag	Field	Mandatory	Details
			The 'nullValue' value is transmitted into the field in the OPT-INFO stream.
20041	SettlPriceOpen	N	Settlement price at the start of the session.

***** - differs from the standard FIX protocol.

Table 1. KASE Exchange MarketSegmentID values

MarketId	MarketSegmentId	CFICode	SecurityType	Description
KASE	D	FXXXSX FFXCSX FCXCSX FXXCSX FFXPSX FCXPSX FXXPSX		Futures: • 'FXXXSX' - undefined type of futures contract (Standardized Unknown Future, Unknown delivery) • 'FFXCSX' - Cash-settled Futures on the stock and money sections of the market (Standardized Financial Future, Cash delivery) • 'FCXCSX' - Cash-settled Futures on the commodity and NAMEX sections of the market (Standardized Commodity Future, Cash delivery) • 'FXXCSX' - Cash-settled Futures otherwise (Standardized Unknown Future, Cash delivery) • 'FFXPSX' - Deliverable Futures on the stock and money sections of the market (Standardized Financial Future, Physical delivery) • 'FCXPSX' - Deliverable Futures on the commodity and NAMEX sections of the market (Standardized Commodity Future, Physical delivery) • 'FXXPSX' - Deliverable Futures otherwise (Standardized Unknown Future, Physical delivery)
KASE	D	FXXXXX	MLEG	Calendar spreads
KASE	D	OCAFPX OPAFPX OCEFPX OPEFPX		Options: • "OCAFPX" — American-style option Call • "OPAFPX" — American-style option Put • "OCEFPX" — European-style option Call • "OPEFPX" — European-style option Put

4.3.2. Security Status (f)

The message is transmitted at change of instrument status, price limits or collateral volume.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'f'
48	SecurityId	C	Instrument numerical code
22	SecurityIdSource	C	'8' — Exchange Symbol
55	Symbol	N	Symbol code of the instrument
326	SecurityTradingStatus*	N	Instrument trading status: • '21' — session initiated • '17' — session started • '2 — session paused • '18' — session ended • '19' — not traded on this market
1148	LowLimitPx*	N	Lower price limit. Futures and calendar spreads only.
1149	HighLimitPx*	N	Upper price limit. Futures and calendar spreads only.
20002	InitialMarginOnBuy*	N	• futures — buyer collateral • options — underlying collateral for buying futures-style option
20000	InitialMarginOnSell*	N	• futures — seller collateral

Tag	Field	Mandatory	Details
			• options — underlying collateral for one uncovered position
20001	InitialMarginSyntetic*	N	Underlying collateral for one covered position. Options only.

4.3.3. Trading Session Status (h)

The message is transmitted at the start and in the end of trading sessions and intraday clearing session.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'h'
336	TradingSessionId	Y	Trading session type: • '1' — main session • '3' — early session • '5' — evening session
5842	ExchangeTradingSessionID*	N	Trading session ID
340	TradSesStatus	Y	Trading session state: • '4' — session initiated • '2' — session started • '1; — session paused • '3' — session ended
1368	TradSesEvent	N	Trading session events: • '0' — Trading resumed after intraday clearing session • '1' — Start and end of trading session • '3' — Trading session status change
1301	MarketId	N*	Exchange MIC: • 'KASE' — Kazakhstan Stock Exchange
1300	MarketSegmentId	N*	Market segments: • 'D' — Futures, Options, Calendar spreads • 'S*' — Securities, Bonds, Commodities
342	TradSesOpenTime	N	Trading session open time and date
344	TradSesCloseTime	N	Trading session close time and date
5840	TradSesIntermClearingStartTime*	N	Intraday clearing session start time
5841	TradSesIntermClearingEndTime*	N	Intraday clearing session end time

***** - differs from the standard FIX protocol.

4.3.4. Security Definition Update Report (BP)

Options volatility and theoretical prices.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	MESSAGE TYPE 'BP'
48	SecurityId	C	Instrument numeric code
22	SecurityIdSource	C	'8' — Exchange Symbol
5678	Volatility*	N	Option volatility.
20006	TheorPrice*	N	Option theoretical price.
20007	TheorPriceLimit*	N	Option theoretical price (limits adjusted)

***** - differs from the standard FIX protocol.

4.3.5. News (B)

SPECTRA system administrator's messages. SKRIN system news.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'B'
893	LastFragment	N	This field indicates whether the message is the last in the series generated for a news message with NewsID. Allowable values: • **0** – last message • **1** – not the last message The field is non-mandatory. When absent, the message packet is considered as non-fragmented.
1472	NewsID	N	News ID
42	OrigTime	N	News date and time
1474	LanguageCode	N	Language
61	Urgency	N	Urgency
148	Headline	Y	Header text
33	NoLinesOfText	Y	=1
=>58	Text	Y	Message text body. The string is transmitted by FAST gate in UTF-8 character set
1301	MarketId	N	Exchange MIC: • 'KASE' — Kazakhstan Stock Exchange
1300	MarketSegmentId	N	Market segments: • 'F' — futures • 'SKRIN'

4.3.6. Market Data Request (V)

A FIX message which is used to request missing data in the session to the service TCP Recovery.

Tag	Field	Mandatory	Details
8	BeginString	Y	Allowable values: • FIX.4.4 • FIXT.1.1
9	BodyLength	Y	Message length
35	MsgType	Y	"V"
262	MDReqId	Y	Request ID
1182	ApplBegSeqNum	N	Sequence number of the first requested message.
1183	ApplEndSeqNum	N	Sequence number of the last requested message. If a single message is requested, then ApplBegSeqNum(1182)=ApplEndSeqNum(1183). If all messages are requested (no more than total messages sent) after a particular message number, then ApplEndSeqNum(1183)=0(infinity).
10	CheckSum	Y	Checksum

4.3.7. Market Data - Snapshot / Full Refresh (W)

Data snapshot.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'W'
893	LastFragment	N	Indicates the last message in the message group for the instrument. Allowable values: • **0** – not the last message • **1** – the last message

Tag	Field	Mandatory	Details
			The field is not mandatory. If a message does not contain this field, it means that the packet with message has not been fragmented.
911	TotNumReports	Y	The number of messages in the snapshot, which have 'LastFragment '= 1
83	RptSeq	Y	The 'RptSeq' number of the last incremental update included in the current market data snapshot for instrument.
369	LastMsgSeqNumProcessed	N	The 'MsgSeqNum' of the last message sent into incremental feed at the time of the current snapshot generation.
48	SecurityId	N	Instrument numeric code.
22	SecurityIdSource	C	'8' — Exchange Symbol
55	Symbol	N	Symbol code of the instrument, currency exchange rate name, index name.
1151	SecurityGroup	N	=OTC
268	NoMDEntries	Y	Number of 'MDEntry' records in the current message.
=>20003	MDEntryTradeType	N	MDEntryTradeType is sent for Spot market trades. The tag value format is <trade type><repo type><trade status>. Possible trade types: • 'Q' - quote-based transaction • 'B' - two-sided transaction • 'A' - auction-based transaction • 'I' - IPO transaction Possible repo types: • ' ' (space) - regular trade • 'R' - repurchase agreement
=>269	MDEntryType	Y	Record type: • '0' — Bid • '1' — Ask • '2' — Trade • '3' — Index Value • '4' — Opening Price • '5' — Closing Price • '6' — Settlement Price • '7' — Trading Session High Price • '8' — Trading Session Low Price • '9' — Trading Session VWAP Price • 'B' — Cumulative Trade Volume • 'C' — Open Interest • 'v' — Total bid volume with synthetic liquidity • 'w' — Total offer volume with synthetic liquidity • 's' — Market Capitalization • 'J' — Empty book • 'x' — Total bid volume without synthetic liquidity • 'y' — Total offer volume without synthetic liquidity
=>5842	ExchangeTradingSessionId*	N	Trading session ID

Tag	Field	Mandatory	Details
=>278	MDEntryID	N	Trade ID
=>264	MarketDepth	N	Market depth
=>270	MDEntryPx	N	Price, rate and index values.
=>271	MDEntrySize	N	Volume, quantity.
=>1023	MDPriceLevel	N	Price level.
=>272	MDEntryDate	N	Record last change date. Value NULL indicates the current date.
=>273	MDEntryTime	N	Record last change time.
=>346	NumberOfOrders	N	• Sell orders quantity (for records with MDEntryType=v (Total bid volume)*). • Buy orders quantity (for records with MDEntryType=w (Total offer volume)*).
=>828	TrdType	C	Trade type: • '0' — Market trade. • '22' — Negotiated trade. • '45' — Option exercise. • '1000' — Futures exercise (standard method). Non-deliverable futures exercise. • '1003' — Option expiration. The field is mandatory for records with MDEntryType=2 (Trade).
=>20017	MDFlags*	N	• '0x1' — Flag of fixing for the main clearing session. • '0x100' — Flag of fixing.
=>15	Currency	N	Currency code
=>10504	OrderSide	N	Side of the aggressive order in trade. Transmitted only for the Derivatives market. Allowable values: • '1' – buy order (Buy); • '2' – sell order (Sell).
20039	MDEntrySyntheticSize	C	Synthetic liquidity volume. The field is mandatory for records in the streams FO-BOOK-1, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50 – aggregate Order-book data refresh.

***** - differs from the standard FIX protocol.

4.3.8. Market Data - Incremental Refresh (X)

Data refresh.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'X'
893	LastFragment	N	Indicates the last message in the message group for the instrument. Allowable values: • '0' – not the last message • '1' – the last message The field is not mandatory. If a message does not contain this field, it means that the packet with message has not been fragmented.
268	NoMDEntries	Y	Number of 'MDEntry' records in the current message.
=>83	RptSeq	Y	Incremental refresh sequence number
=>279	MDUpdateAction	Y	Incremental refresh type:

Tag	Field	Mandatory	Details
			• '0' — New • '1' — Change • '2' — Delete
=>20003	MDEntryTradeType	N	MDEntryTradeType is sent for Spot market trades. The tag value format is <trade type><repo type><trade status>. Possible trade types: • 'Q' - quote-based transaction • 'B' - two-sided transaction • 'A' - auction-based transaction • 'I' - IPO transaction Possible repo types: • ' ' (space) - regular trade • 'R' - repurchase agreement
=>31	LastPx	N	Used for MDUpdateAction=2 only. Last exchange trade price.
=>269	MDEntryType	Y	Record type: • '0' — Bid • '1' — Ask • '2' — Trade • '3' — Index Value • '4' — Opening Price • '5' — Closing Price • '6' — Settlement Price • '7' — Trading Session High Price • '8' — Trading Session Low Price • '9' — Trading Session VWAP Price • 'B' — Cumulative Trade Volume • 'C' — Open Interest • 'v' — Total bid volume with synthetic liquidity • 'w' — Total offer volume with synthetic liquidity • 's' — Market Capitalization • 'J' — Empty book • 'x' — Total bid volume without synthetic liquidity • 'y' — Total offer volume without synthetic liquidity
=>48	SecurityId	N	Instrument numeric code
=>22	SecurityIdSource	C	'8' — Exchange Symbol
=>5842	ExchangeTradingSessionId*	N	Trading session ID
=>278	MDEntryID	N	Trade ID
=>264	MarketDepth	N	Market depth
=>270	MDEntryPx	N	Price, rate and index values.
=>271	MDEntrySize	N	Volume, quantity.
=>1023	MDPriceLevel	N	Price level.

Tag	Field	Mandatory	Details
=>272	MDEntryDate	N	Record last change date. Value NULL indicates the current date.
=>273	MDEntryTime	N	Record last change time.
=>346	NumberOfOrders	N	• Sell orders quantity (for records with MDEntryType=v (Total bid volume)*). • Buy orders quantity (for records with MDEntryType=w (Total offer volume)*).
=>828	TrdType	C	Trade type: • '0' — Market trade. • '22' — Negotiated trade. • '45' — Option exercise. • '1000' — Futures exercise (standard method). Non-deliverable futures exercise. • '1003' — Option expiration. The field is mandatory for records with MDEntryType=2 (Trade).
=>55	Symbol	N	Symbol code of the instrument, currency exchange rate name, index name.
=>20017	MDFlags*	N	• '0x1' — Flag of fixing for the main clearing session. • '0x100' — Flag of fixing.
=>15	Currency	N	Currency code.
=>1151	SecurityGroup	N	=OTC
=>20018	Revision	N	Service field of the replication subsystem. The field is transmitted only for quotations, trades and market fundamentals of the Derivatives market.
=>10504	OrderSide	N	Side of the aggressive order in trade. Transmitted only for the Derivatives market. Allowable values: • '1' – buy order (Buy); • '2' – sell order (Sell).
20039	MDEntrySyntheticSize	C	Synthetic liquidity volume. The field is mandatory for records in the streams FO-BOOK-1, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50 – aggregate Order-book data refresh.
746	OpenInterest	N	Open interest - the number of positions on the instrument in the market after the trade. This field is mandatory for records with MDEntryType = 2 (Trade) in the FO-TRADES stream.

***** - differs from the standard FIX protocol.

4.4. Market Fundamentals

There are several aggregate values reflecting instrument market during a session, which may be changed by market events:

Market Data Entry type	MDEntryType	MDEntryPx	MDEntrySize	Market
Opening Price	4	•	–	SIFOC
Closing Price	5	•	–	SIFOC
Settlement Price	6	•	–	SIFO
Trading Session High Price	7	•	–	SIFOC
Trading Session Low Price	8	•	–	SIFOC
Trading Session VWAP Price	9	•	–	SIFO
Cumulative Trade Volume	B	•	•	SIFOC
Open Interest	C	–	•	FO
Market capitalization	s	•	–	I

Market Data Entry type	MDEntryType	MDEntryPx	MDEntrySize	Market
Total bid volume with synthetic liquidity	v	–	•	FOC
Total offer volume with synthetic liquidity	w	–	•	FOC
Total bid volume without synthetic liquidity	x	–	•	FOC
Total offer volume without synthetic liquidity	y	–	•	FOC

Markets:

- **F** – Futures,
- **O** – Options,
- **C** - Calendar spreads,
- **I** – Indexes,
- **S** – Securities, Bonds, Commodities.

Message **Cumulative Trade Volume** contains **MDEntryPx = 0** for calendar spreads.

Exceptions from FIX standards:

- 'Trade Volume' messages contain:
  - **MDEntrySize** – daily number of shares or contracts traded (standard FIX meaning);
  - **MDEntryPx** – accumulated daily turnover expressed in the currency of the instrument;
- 'Open Interest' messages contain:
  - **MDEntrySize** – number of shares or contracts;
- 'Market capitalization' messages contain:
  - **MDEntryPx** – index equities capitalization;
- 'Total bid volume with synthetic liquidity/ Total offer volume with synthetic liquidity' messages contain:
  - **MDEntrySize** – total number of shares or contracts with synthetic liquidity.
- 'Total bid volume without synthetic liquidity/ Total offer volume without synthetic liquidity' messages contain:
  - **MDEntrySize** – total number of shares or contracts without synthetic liquidity.

4.5. Empty book message (MDEntryType = J)

The message Empty Book obliges a client to delete data on a certain instrument.

The field **SecurityId** contains the instrument ID.

The field **ExchangeTradingSessionID** remains empty.

The message is sent on session's close, or on technical breaks via the main streams (incr): FO-BOOK-1, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50.

The stream Recovery (snap): FO-BOOK-1, FO-BOOK-5, FO-BOOK-20, FO-BOOK-50 transmits the message **J (Empty book)** in case there is no orders added on the certain instrument.

5. Stream of anonymous orders and trades

The service provides the following operations:

- distributing the entire order book using protocol UDP Multicast;
- distributing active orders snapshot book using protocol UDP Multicast;
- rendering service TCP Recovery

The service distributes messages using protocol FAST (see sec. 5.2); all messages are coded according to the templates **OrdersLogMessage**, **BookMessage** (see sec. 5.3).

5.1. Application architecture

5.1.1. Streams

The service distributes data as follows:

- the main streams distribute messages Market Data - Incremental Refresh (X) as incremental refreshes for entire order book;
- the data refresh streams distribute messages Market Data - Snapshot / Full Refresh (W) as actual snapshots containing active orders on instruments;
- the history of entire order book refreshes for the current trading session is available via the missed messages request session (TCP Recovery (Historical Replay)).

The following FIX messages are supported:

- **Market Data Request** - request for missed data;
- **Market Data - Snapshot/ Full Refresh** – active orders snapshot;
- **Market Data - Incremental Refresh** – incremental refresh of entire order book.

5.1.2. Messages fragmentation

The message fragmentation is used when sending data via:

- main streams (Incremental);
- recovery streams (Snapshot).

You can find more information about message fragmentation above (see sec. 3.2.6). Also, the first message in an active orders snapshot contains the tag **7944-RouteFirst** with value **1**.

5.1.3. Instrument IDs

The unique instrument IDs from the trading system SPECTRA are transmitted in fields **SecurityID** of messages **Market Data - Incremental Refresh** and **Market Data - Snapshot/ Full Refresh**.

5.2. Message templates

There are two certain message templates used for distributing the entire order book data:

- **OrdersLogMessage** - see sec. 5.2.1
- **BookMessage** - see sec. 5.2.2

5.2.1. OrdersLogMessage

This template is used for data refresh purpose. Also, it is used by the service TCP Recovery.

```
<template name="OrdersLogMessage" id="14">
        <string name="ApplVerID" id="1128">
            <constant value="9"/>
        </string>
        <string name="MessageType" id="35">
            <constant value="X"/>
        </string>
        <string name="SenderCompID" id="49">
            <constant value="KASE"/>
        </string>
        <uInt32 name="MsgSeqNum" id="34"/>
        <uInt64 name="SendingTime" id="52"/>
```

```
        <uInt32 name="LastFragment" id="893"/>
        <sequence name="MDEntries">
            <length name="NoMDEntries" id="268"/>
            <uInt32 name="MDUpdateAction" id="279"/>
            <string name="MDEntryType" id="269"/>
            <int64 name="MDEntryID" id="278" presence="optional"/>
            <uInt64 name="SecurityID" id="48" presence="optional"/>
            <uInt32 name="SecurityIDSource" id="22">
                <constant value="8"/>
            </uInt32>
            <uInt32 name="RptSeq" id="83" presence="optional"/>
            <uInt32 name="MDEntryDate" id="272" presence="optional"/>
            <uInt64 name="MDEntryTime" id="273"/>
            <decimal name="MDEntryPx" id="270" presence="optional"/>
            <int64 name="MDEntrySize" id="271" presence="optional"/>
            <decimal name="LastPx" id="31" presence="optional"/>
            <int64 name="LastQty" id="32" presence="optional"/>
            <int64 name="TradeID" id="1003" presence="optional"/>
            <uInt32 name="ExchangeTradingSessionID" id="5842" presence="optional"/>
            <int64 name="MDFlags" id="20017" presence="optional"/>
            <uInt64 name="Revision" id="20018" presence="optional"/>
        </sequence>
    </template>
```

5.2.2. BookMessage

This template is used for distributing snapshots.

```
<template name="BookMessage " id="15">
        <string name="ApplVerID" id="1128">
            <constant value="9"/>
        </string>
        <string name="MessageType" id="35">
            <constant value="W"/>
        </string>
        <string name="SenderCompID" id="49">
            <constant value="KASE"/>
        </string>
        <uInt32 name="MsgSeqNum" id="34"/>
        <uInt64 name="SendingTime" id="52"/>
        <uInt32 name="LastMsgSeqNumProcessed" id="369"/>
        <uInt32 name="RptSeq" id="83" presence="optional"/>
        <uInt32 name="LastFragment" id="893"/>
        <uInt32 name="RouteFirst" id="7944"/>
        <uInt32 name="ExchangeTradingSessionID" id="5842"/>
        <uInt64 name="SecurityID" id="48" presence="optional"/>
        <uInt32 name="SecurityIDSource" id="22">
            <constant value="8"/>
        </uInt32>
        <sequence name="MDEntries">
            <length name="NoMDEntries" id="268"/>
            <string name="MDEntryType" id="269"/>
            <int64 name="MDEntryID" id="278" presence="optional"/>
            <uInt32 name="MDEntryDate" id="272" presence="optional"/>
            <uInt64 name="MDEntryTime" id="273"/>
            <decimal name="MDEntryPx" id="270" presence="optional"/>
            <int64 name="MDEntrySize" id="271" presence="optional"/>
            <int64 name="TradeID" id="1003" presence="optional"/>
            <int64 name="MDFlags" id="20017" presence="optional"/>
        </sequence>
    </template>
```

5.3. Messages Market Data - Incremental Refresh (X)

5.3.1. Adding a new order

Adds an order into the pool of active orders.

Tag	Field	Mandatory	Details
279	MDUpdateAction	Y	Incremental refresh type: "**0**" (New).

Tag	Field	Manda-tory	Details
269	MDEntryType	Y	Record type: • **0** - Bid; • **1** - Ask.
278	MDEntryID	Y	Order ID
48	SecurityID	Y	Instrument numeric code.
83	RptSeq	Y	Incremental refresh sequence number.
272	MDEntryDate	N	Record last change date. Value NULL in field MDEntryDate indicates the current date.
273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
270	MDEntryPx	Y	Order price.
271	MDEntrySize	Y	Volume, quantity.
31	LastPx	N	Is missing
32	LastQty	N	Is missing
1003	TradeID	N	Is missing
5842	ExchangeTradingSessionID	Y	Trading session ID
20017	MDFlags	Y	The field is a bit mask: • 0x01 - Day order • 0x02 - IOC order • 0x04 - OTC order • 0x1000 - End of transaction bit • 0x80000 - FOK order • 0x100000 - The record results from replacing the order • 0x4000000 - Negotiated order • 0x8000000 - Multi-leg order • 0x200000000000 - Synthetic order
20018	Revision	Y	Service field (replication system)

5.3.2. Deleting an order

Deletes an order from the pool of active orders according to the order's ID.

Tag	Field	Manda-tory	Details
279	MDUpdateAction	Y	Incremental refresh type: "**2**" (Delete).
269	MDEntryType	Y	Record type: • **0** - Bid; • **1** - Ask.
278	MDEntryID	Y	Order ID
48	SecurityID	Y	Instrument numeric code.
83	RptSeq	Y	Incremental refresh sequence number.
272	MDEntryDate	N	Record last change date. Value NULL in field MDEntryDate indicates the current date.
273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
270	MDEntryPx	Y	Order price.
271	MDEntrySize	Y	Volume to delete.
31	LastPx	N	Is missing
32	LastQty	N	Is missing
1003	TradeID	N	Is missing
5842	ExchangeTradingSessionID	Y	Trading session ID

Tag	Field	Manda-tory	Details
20017	MDFlags	Y	The field is a bit mask: • 0x01 - Day order • 0x02 - IOC order • 0x04 - OTC order • 0x1000 - End of transaction bit • 0x80000 - FOK order • 0x100000 - The record results from replacing the order • 0x200000 - The record results from cancelling the order • 0x400000 - The record results from mass cancelling • 0x4000000 - Negotiated order • 0x8000000 - Multi-leg order • 0x20000000 - Flag of cancelling the left balance of the order because of a cross-trade • 0x100000000 - The record results from cancelling an order via ‘Cancel on Discon-nect’ service.
20018	Revision	Y	Service field (replication system)

5.3.3. Partial order matching

When an order is partly matched into a trade, its attributes in the pool of active order change.

Tag	Field	Manda-tory	Details
279	MDUpdateAction	Y	Incremental refresh type: "**1**" (Change).
269	MDEntryType	Y	Record type: • **0** - Bid • **1** - Ask
278	MDEntryID	Y	Order ID
48	SecurityID	Y	Instrument numeric code.
83	RptSeq	Y	Incremental refresh sequence number.
272	MDEntryDate	N	Record last change date. Value NULL in field MDEntryDate indicates the current date.
273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
270	MDEntryPx	Y	Order price.
271	MDEntrySize	Y	Instrument units left in order
31	LastPx	Y	Matched trade price.
32	LastQty	Y	Trade volume.
1003	TradeID	Y	Trade ID
5842	ExchangeTradingSessionID	Y	Trading session ID
20017	MDFlags	Y	The field is a bit mask: • 0x1 - Trade by Day-order • 0x2 - Trade by IOC-order • 0x4 – OTC-trade including clearing, negotiated, multi-leg • 0x1000 - End of transaction bit • 0x80000 - Trade by Fill-or-kill order • 0x4000000 - Negotiated trade • 0x8000000 - Multi-leg trade. Applied to all multi-leg transactions

Tag	Field	Mandatory	Details
			• 0x20000000000 – The active side in the trade. The order that led to the trade when added to the order-book • 0x40000000000 – The passive side in the trade. The order from the order-book involved in the trade
20018	Revision	Y	Service field (replication system)

5.3.4. Full order matching

After an order is fully matched into a trade, this order will be deleted from the pool of active orders.

Tag	Field	Mandatory	Details
279	MDUpdateAction	Y	Incremental refresh type. If deleted, then "**2**" (Delete).
269	MDEntryType	Y	Record type: • **0** - Bid • **1** - Ask
278	MDEntryID	Y	Order ID
48	SecurityID	Y	Instrument numeric code.
83	RptSeq	Y	Incremental refresh sequence number.
272	MDEntryDate	N	Record last change date. Value NULL in field MDEntryDate indicates the current date.
273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
270	MDEntryPx	Y	Order price.
271	MDEntrySize	N	Is missing
31	LastPx	Y	Matched trade price.
32	LastQty	Y	Trade volume.
1003	TradeID	Y	Trade ID
5842	ExchangeTradingSessionID	Y	Trading session ID
20017	MDFlags	Y	The field is a bit mask: • 0x1 - Trade by Day-order • 0x2 - Trade by IOC-order • 0x4 – OTC-trade including clearing, negotiated, multi-leg • 0x1000 - End of transaction bit • 0x80000 - Trade by Fill-or-kill order • 0x4000000 - Negotiated trade • 0x8000000 - Multi-leg trade. Applied to all multi-leg transactions • 0x20000000000 – The active side in the trade. The order that led to the trade when added to the order-book • 0x40000000000 – The passive side in the trade. The order from the order-book involved in the trade • 0x200000000000 - Synthetic order
20018	Revision	Y	Service field (replication system)

5.3.5. Technical trades

Detailed information on trade types is given in the document **'SPECTRA Plaza-2 gate'** in section **2.4.3. 'Trade types, created upon exercising and expiration of futures and options**'.

Tag	Field	Mandatory	Details
279	MDUpdateAction	Y	Incremental refresh type: "**0**" (New).
269	MDEntryType	Y	Record type: • **0** - Bid • **1** - Ask
278	MDEntryID	Y	Order ID
48	SecurityID	Y	Instrument numeric code.
83	RptSeq	Y	Incremental refresh sequence number.
272	MDEntryDate	N	Record last change date. Value NULL in field MDEntryDate indicates the current date.
273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
270	MDEntryPx	N	Is missing.
271	MDEntrySize	N	Is missing
31	LastPx	Y	Matched trade price.
32	LastQty	Y	Trade volume.
1003	TradeID	Y	Trade ID
5842	ExchangeTradingSessionID	Y	Trading session ID
20017	MDFlags	Y	The field is a bit mask: • 0x4 – OTC-trade including clearing, negotiated, multi-leg • 0x8 – Position transfer between BFs • 0x20 – Option exercise trade • 0x80 – Flag of instrument expiration (exercise for futures, expiration for options) • 0x1000 - End of transaction bit • 0x4000 – Far leg transaction • 0x800000 – Option expiration trade • 0x2000000 – Off-book clearing trade. Applied to all clearing trades • 0x8000000 – Multi-leg trade • 0x40000000 – Futures exercise trade
20018	Revision	Y	Service field (replication system)

5.3.6. Cleaning up active orders pool (specified trading session)

After receiving the message, all orders of the specified trading session are to be deleted on the client side.

Tag	Field	Mandatory	Details
279	MDUpdateAction	Y	Incremental refresh type: "**0**" (New).
269	MDEntryType	Y	Record type: "**J**" (Empty Book).
278	MDEntryID	N	Is missing
48	SecurityID	N	Is missing
83	RptSeq	N	Is missing
272	MDEntryDate	N	Record last change date. Value NULL in field MDEntryDate indicates the current date.
273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
270	MDEntryPx	N	Is missing
271	MDEntrySize	N	Is missing
31	LastPx	N	Is missing
32	LastQty	N	Is missing
1003	TradeID	N	Is missing
5842	ExchangeTradingSessionID	Y	Trading session ID

Tag	Field	Mandatory	Details
20017	MDFlags	N	Is missing
20018	Revision	Y	Service field (replication system)

5.3.7. Cleaning up active orders pool (all trading sessions)

After receiving the message, all orders are to be deleted on the client side. After that, you should perform steps 4-7 in the section **Connect client** - see sec. 2.1.

Tag	Field	Mandatory	Details
279	MDUpdateAction	Y	Incremental refresh type: "**0**" (New).
269	MDEntryType	Y	Record type: "**J**" (Empty Book).
278	MDEntryID	N	Is missing
48	SecurityID	N	Is missing
83	RptSeq	N	Is missing
272	MDEntryDate	N	Record last change date. Value NULL in field MDEntryDate indicates the current date.
273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
270	MDEntryPx	N	Is missing
271	MDEntrySize	N	Is missing
31	LastPx	N	Is missing
32	LastQty	N	Is missing
1003	TradeID	N	Is missing
5842	ExchangeTradingSessionID	N	Is missing
20017	MDFlags	N	Is missing
20018	Revision	N	Is missing

5.4. Messages Market Data - Snapshot / Full Refresh

5.4.1. Active orders snapshot

Snapshots are distributed as one or several messages (for each instrument).

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'W'
369	LastMsgSeqNumProcessed	Y	The 'MsgSeqNum' of the last message sent into incremental feed at the time of the current snapshot generation.
83	RptSeq	Y	The 'RptSeq' number of the last incremental update included in the current market data snapshot for instrument.
893	LastFragment	Y	Indicates the last message in the message group for the instrument. Allowable values: • **0** – not the last message • **1** – the last message
7944	RouteFirst	Y	Indicates whether the message is the first of the ones generated for the given instrument or not. Allowable values: • **0** – not the first message • **1** – the first message
5842	ExchangeTradingSessionId	Y	Trading session ID
48	SecurityId	Y	Instrument numeric code
22	SecurityIdSource	C	**8** - Exchange Symbol
268	NoMDEntries	Y	Number of 'MDEntry' records in the current message.

Tag	Field	Mandatory	Details
=>269	MDEntryType	Y	Record type: • **0** - Bid • **1** - Ask
=>278	MDEntryID	Y	Order ID.
=>272	MDEntryDate	N	Record last change date.
=>273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
=>270	MDEntryPx	Y	Order price.
=>271	MDEntrySize	Y	Volume, quantity.
=>1003	TradeID	C	None if no trade was matched, else contains last trade ID.
=>20017	MDFlags	Y	The field is a bit mask: • 0x01 - Day order • 0x04 - OTC order

5.4.2. When an active orders snapshot is empty

If the active orders snapshot is empty, and a trading session has not yet started, the snapshot will not be distributed. If the active orders snapshot gets empty during a trading session, it will be distributed in the form of the message below.

Tag	Field	Mandatory	Details
<Standard Message Header>		Y	Message type 'W'
369	LastMsgSeqNumProcessed	Y	The 'MsgSeqNum' of the last message sent into incremental feed at the time of the current snapshot generation.
83	RptSeq	Y	The 'RptSeq' number of the last incremental update included in the current market data snapshot for instrument.
893	LastFragment	Y	Indicates the last message in the message group for the instrument. Allowable values: • **1** – the last message
7944	RouteFirst	Y	Indicates whether the message is the first of the ones generated for the given instrument or not. Allowable values: • **1** – the first message
5842	ExchangeTradingSessionId	Y	Trading session ID.
48	SecurityId	Y	Instrument numeric code.
22	SecurityIdSource	C	**8** - Exchange Symbol
268	NoMDEntries	Y	Number of 'MDEntry' records in the current message.
=>269	MDEntryType	Y	Record type: • **J** - Empty Book
=>278	MDEntryID	N	Is missing
=>272	MDEntryDate	N	Record last change date.
=>273	MDEntryTime	Y	Record last change time. Format: **HHMMSSssssssss**.
=>270	MDEntryPx	N	Is missing
=>271	MDEntrySize	N	Is missing
=>1003	TradeID	N	Is missing
=>20017	MDFlags	N	Is missing

6. TCP Recovery (Historical Replay) service limitations

The following limitations are applied to the TCP Recovery service for stream ORDERS-LOG, in order to lower the load:

Parameter	Value	Details
Maximum active connections, per market, per instance, per IP address	2	You can establish no more than indicated number active TCP connection from single IP address. An attempt to make more connections will be rejected
Maximum connections count, per market, per instance, per day, per IP address	1000	You can make no more than indicated number of tcp connections per IP address per day. Extra connection attempts will be rejected
Maximum number of messages to request	1000	TCP replay request is rejected if a number of requested messages is greater than indicated value
Marketdata request timeout, seconds	1	Connection is terminated with logout message if marketdata request is not received within indicated number of seconds since logon message. TCP session is terminated if no confirming logout is received after server-side logout.

The following limitations are applied to the TCP Recovery service for streams FO-TRADES, INDEX, NEWS, in order to lower the load:

Parameter	Value	Details
Maximum active connections, per market, per instance, per IP address	2	You can establish no more than indicated number active TCP connection from single IP address. An attempt to make more connections will be rejected
Maximum connections count, per market, per instance, per day, per IP address	15000	You can make no more than indicated number of tcp connections per IP address per day. Extra connection attempts will be rejected
Maximum number of messages to request	1000	TCP replay request is rejected if a number of requested messages is greater than indicated value
Marketdata request timeout, seconds	1	Connection is terminated with logout message if marketdata request is not received within indicated number of seconds since logon message. TCP session is terminated if no confirming logout is received after server-side logout.