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Market Information System
FLEX Connection Specifications
System Operation

Ver.DS.17.3
Applicable from April 1, 2021.

Tokyo Stock Exchange

JPX
TOKYO STOCK EXCHANGE

FLEX Connection Specifications (System Operation)	Revision History		

No.	Release date	Revision No.	Remarks
1	2019.11.05	Ver.DS.17.0	Newly created. There is no change from Ver.TS.16.3.
2	2020.02.28	Ver.DS.17.1	No change
3	2021.02.01	Ver.DS.17.2	Updated the change to operations for user notification
4	2021.04.01	Ver.DS.17.3	Added new sections in Operations during Failure.

		Sheet No.	1/1
		IT development, Tokyo Stock Exchange	

FLEX Connection Specifications (System Operation)					
Modification	Ver.DS.17.0	Document History			
No.	Subject	Description		Page	Type
1	Newly Created				
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	IT Development, Tokyo Stock Exchange				

FLEX Connection Specifications (System Operation)					
Modification	Ver.DS.17.1	Document History			
No.	Subject	Description		Page	Type
1	No change				
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FLEX Connection Specifications (System Operation)					
Modification	Ver.DS.17.2	Document History			
No.	Subject	Description		Page	Type
1	Change to operations for notifications to users	Notifications regarding system incident, etc. will be changed to announcements on the web page dedicated to system incident, etc. on the JPX website.		2-11, etc.	CHANGE
				Sheet No.	1/1
	IT Development, Tokyo Stock Exchange				

FLEX Connection Specifications (System Operation)		

Modification	Ver.DS.17.3	Document History

No.	Subject	Description	Page	Type
1	Added new sections in Operations during Failure	Newly created "3.6. Recovery operations when FLEX messages are not transmitted due to a failure" and "3.7 Notes on recovery by rebooting the TSE's system".	From 3-8 to 3-14	NEW
2	Clarified description on Operations during Failure	Clarification of description on "3.1.2 Failure in Market Data Feed Server(Issue Basic Information)".	3-2	MODIFY
			Sheet No.	1/1

	IT Development, Tokyo Stock Exchange	

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1. OUTLINE
1.1 Purpose

This document contains information on the system operations for Market Information System under normal condition and failure condition.

2. OPERATION UNDER NORMAL CONDITION

<Assumption>

Market Information Syetem operates 24-hours-a-day.

The output time schedule is set in " 2.1 Time schedule of a business day (1) Output time" for the time being.

2.1. Time schedule of a business day

1) Output Time Schedule

Table. 2.1-1 and 2.1-2 show output times for various information.

Table 2.1-3 show output times for each Issue classification code of statistics (Estimated total trading volume).

Output time schedule may be changed by TSE depending on the trading status of the day.

The events of table 2.1-1 are controlled for each multicast group, so the order of distribution across different multicast groups may be changed.

If there is a change in output time schedule, TSE will notify the users about the change through the JPX website.

Table 2.1-1 Output time zone (Issue realtime information / Issue basic information / ToSTNeT / Index・Statistics / High-speed Index / information)

Time	Event	Standard	Full	Issue basic information	ToSTNeT	Index・Statistics	High-speed Index	Remarks
7:00	Multicast routing maintenance message start	●	●	●	●	●	●	
7:10	Communication Start Messages	●	●	●	●	●	●	
	Health check start (at 1-minute intervals)	●	●	●(*)				* MCG for Base price, Multicast group number
	Acceptance of TCP Retransmission start	●(*)	●	●(*)	●	●		* Issue basic information become available after distributing at the specific time
7:11	Health check start (at 1-minute intervals)			●(*)	●	●	●	* MCG for Issue information
7:38	Issue information(for the trading day)			●				
7:40	Base price information(for the trading day)			●				
	Multicast group number information			●				
8:00	Issue realtime information start(Tokyo, Nagoya)	●	●					
8:20	ToSTNeT by-issue information start (Single issue transaction)				●			
	ToSTNeT by-issue information start (Closing price transaction)				●			
8:30	Issue realtime information start(Fukuoka, Sapporo)	●	●					
8:45	ToSTNeT by-issue information end (Closing price transaction)				●			
9:00	Morning session start(Tokyo, Nagoya, Fukuoka, Sapporo)	●	●					
11:30	Morning session end(Tokyo, Nagoya, Fukuoka, Sapporo)	●	●					
	ToSTNeT by-issue information start (Closing price transaction)				●			

Time	Event	Standard	Full	Issue basic information	ToSTNeT	Index· Statistics	High-speed Index	Remarks
11:35	Issue realtime message (backup)	●						
12:00	Quote Before Opening（Tokyo、Nagoya）		▲ (*)					* If Special quote or Continuous execution quote was displayed at closing in morning session, TSE distributes quote information by setting spaces.
12:05	Issue realtime information start(Tokyo, Nagoya)	●	●					
12:10	Quote Before Opening（Fukuoka、Sapporo）		▲ (*)					* If Special quote or Continuous execution quote was displayed at closing in morning session, TSE distributes quote information by setting spaces.
12:15	Issue realtime information start(Fukuoka, Sapporo)	●	●					
	ToSTNeT by-issue information end (Closing price transaction)				●			
12:30	Afternoon session start(Tokyo, Nagoya, Fukuoka, Sapporo)	●	●					
15:00	Afternoon session end(Tokyo)	●	●					
	ToSTNeT by-issue information start (Closing price transaction)				●			
15:10	Issue realtime message (all-day)(Tokyo)	●						
15:15	Issue realtime message (backup)(Tokyo)	●						
15:30	Afternoon session end(Nagoya, Fukuoka, Sapporo)	●	●					
15:40	Issue realtime message (all-day)(Nagoya, Fukuoka, Sapporo)	●						
	Health check end						●	
	Communication End Messages						●	
15:45	Issue realtime message (backup)(Nagoya, Fukuoka, Sapporo)	●						

Time	Event	Standard	Full	Issue basic information	ToSTNeT	Index· Statistics	High-speed Index	Remarks
16:00	ToSTNeT by-issue information end (Closing price transaction)				●			
17:30	ToSTNeT by-issue information end (Single issue transaction)				●			
17:35	Issue information(the next trading day)			●				
17:37	Base price information(the next trading day)			●				
17:45	ToSTNeT by-issue information (Basket transaction)				●			
18:00	Health check end	●	●	●	●	●		
	Communication End Messages	●	●	●	●	●		
	Multicast routing maintenance message end	●	●	●	●	●		
	Acceptance of TCP Retransmission end	●	●	●	●	●		

Table 2.1-2 Output time zone (Statistics information / Index information / High Speed Index)

No.	Contents		Time	Remarks
1	Statistics Information	Market value, Simple yield, Weighted yield, Simple stock price average, Weighted stock price average, Simple stock price average by industry, Japanese yen CB indicator, Number of up/down, VWAP by market, Ranking by trading volume, Ranking by turnover, Ranking by net change (up/down), Ranking by net change (up/down) rate	9:15-11:15 (at 15 minutes intervals), 11:29, 11:35, 11:44(*), 11:56 12:45-14:45 (at 15 minutes intervals), 14:59, 15:02, 17:55(*)	* Resending the latest statistics information
2		Estimated total trading volume, Estimated total turnover	9:15-11:15 (at 15-minute intervals), 11:29, 11:35, 11:44(*), 11:56 12:32, 12:45-14:45 (at 15-minute intervals),14:59,15:02, 15:13, 17:41 17:55(*)	
3		ToSTNeT statistics	9:00, 11:30, 11:55, 12:30, 15:00, 15:12, 16:15, 17:40	
4	Index Information	Stock index/open, high, low and current price	Refer to "04_Market Information System FLEX Connection Specification Index・Statistics group Attachment_01"	
5		Reserved		
6		Reserved		
7		SQ	Around 15:10	
8	High-speed Index	High-speed stock index	9:00:05-11:30, 12:30:05-15:00	
9		High-speed index(Best Ask Quote), High-speed index(Best Bid Quote)	8:00:00-11:30, 12:05:00-15:00	

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Table 2.1-3 TSE Estimated total trading volume –Relation between issue classification, basic time of calculation and output time-

Item Number	Type	9:15	9:30	9:45	10:00	···	10:45	···	11:15	11:29	11:35	11:44	11:56	12:32	12:45	···	13:45	14:00	···	14:45	14:59	15:02	15:13	17:41	17:55
	Calculation time	9:15	9:30	9:45	10:00	···	10:45	···	11:15	11:29	11:35	11:35	11:56	12:32	12:45	···	13:45	14:00	···	14:45	14:59	15:02	15:13	17:41	17:41
1	First section (Domestic stock)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
2	Second section (Domestic stock)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
3	Total (Stock)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35	○ 11:56	○ 12:32	○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02	○ 15:13	○ 17:41	△ 17:41
4	ToSTNeT stock	○ 9:15									○ 11:35	△ 11:35	○ 11:56	○ 12:32	○ 12:45							○ 15:02	○ 15:13	○ 17:41	△ 17:41
5	Foreign stock *1	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
6	Mothers (Domestic stock)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
7	TOKYO PRO Market (Domestic stock)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
8	JASDAQ Standard (Domestic stock)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
9	JASDAQ Growth (Domestic stock)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
10	CB	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02
11	Total (CB)	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35	○ 11:56	○ 12:32	○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02	○ 15:13	○ 17:41	△ 17:41
12	ToSTNeT CB	○ 9:15									○ 11:35	△ 11:35	○ 11:56	○ 12:32	○ 12:45							○ 15:02	○ 15:13	○ 17:41	△ 17:41
13	EB	○ 9:15	○ 9:30	○ 9:45	○ 10:00	···	○ 10:45	···	○ 11:15	○ 11:29	○ 11:35	△ 11:35			○ 12:45	···	○ 13:45	○ 14:00	···	○ 14:45	○ 14:59	○ 15:02			△ 15:02

Guide Totalization ○:total value, △:Previous output value, ···:output in 15-minute intervals, Space: Not distributed

Note 1 :Time for each section shows the time for calculation per type of security.

* 1 Total trading volume of first section (Foreign stock), Foreign beneficiary certificates, Second section (Foreign stock), Mothers (Foreign stock) ,TOKYO PRO Market (Foreign stock),JASDAQ Standard (Foreign stock),JASDAQ Growth (Foreign stock)

2) Online Start (Multicast Routing Maintenance Messages, Communication Start Messages and Health Check Messages)

Multicast Routing Maintenance Messages are sent from Market Information System at least 10 minutes before Communication Start Message.

After Multicast Routing Maintenance Messages are started, Communication Start Messages are sent by each Multicast Group at the scheduled times.

After Communication Start Messages are sent, Health Check Messages are sent by each Multicast Group.

3) Online End (Health Check Messages, Communication End Messages and Multicast Routing Maintenance Messages)

After afternoon session, Communication End Messages are sent after Health Check Messages are stopped.

After Communication End Messages, Multicast Routing Maintenance Messages are stopped.

Output time for Health Check Messages, Communication End Messages and Multicast Routing Maintenance Messages is different according its Multicast Group.

4) Service Time for TCP Retransmission, Backup Information, Refreshment Information, All-Day Information and Issue Basic Information

All requests are accepted between sending Communication Start Messages and the scheduled times after sending Communication End Messages.

5) Operation after End of On-Line Operation

After the end of online, some messages will be sent during the end of of online to the start of online of next business day(e.g. tests on holidays, during night hours, etc.).

Therefore, users should consider discarding unnecessary messages or other means to prevent adverse effect on user systems.

2.1.1. **Sending Time and Contents of Issue Basic Information**

Sending time and contents of Issue Basic Information (Base Price Information, Issue Information and Multicast Group Number Information) are described as below.
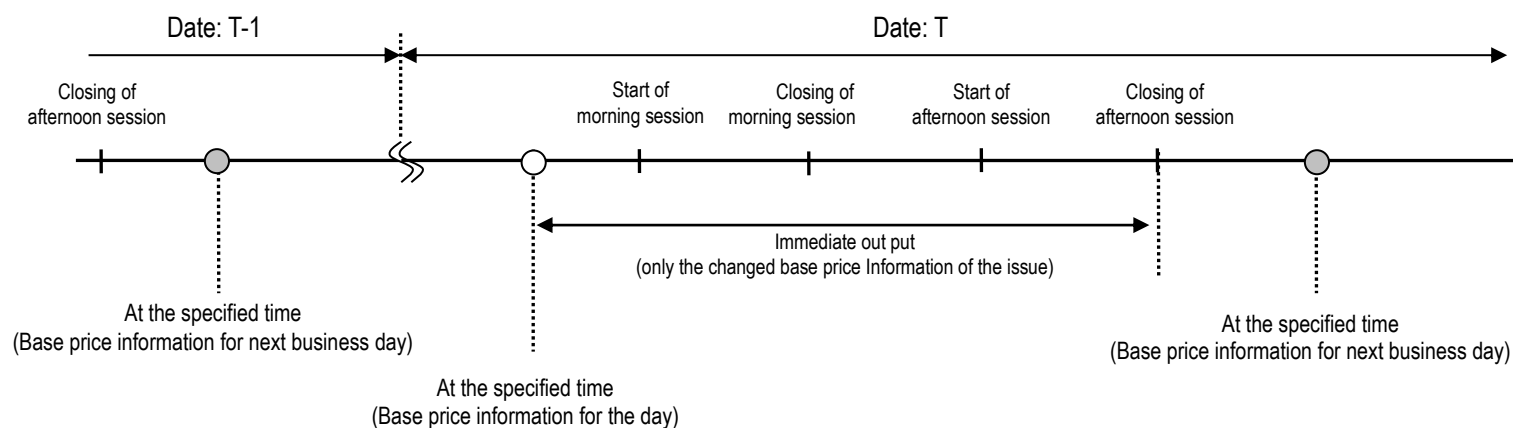
1) Base price information (BP Tag)

Base price information is sent as below.

At the specified time before opening of morning session (the base price information for the day is output)
- Base price information of all issues for each exchange is output.
- After sending base price information for the next business day, the base price information may be changed before the opening of the morning session. In that case, **the base price information for the day will contain the updated information (*).**

* If users use base price information, please use the information disseminated before the opening of the morning session of the day because it will be different from the base price information disseminated on the previous day.

a. Immediate output (when base price information changes)
- If base price of an issue changes after sending the information of the day before the opening of the morning session, only issues for which the base prices have changed is immediately output.

b. After closing of afternoon session (the base price information for the next business day is output)
- Base price Information about all issues for each exchange is output as provisional information.

* Around 17:30 on the business day before the listing date, TSE outputs a tentative value for the net asset value per unit of beneficiary certificate, which is based on the provisional value announced by the ETF asset manager, as Base Price Information. After TSE determines the base price to be used on the listing date, TSE uploads it under "Market News" on the JPX website. This base price is also output as Base Price Information around 7:40 on the date of listing.
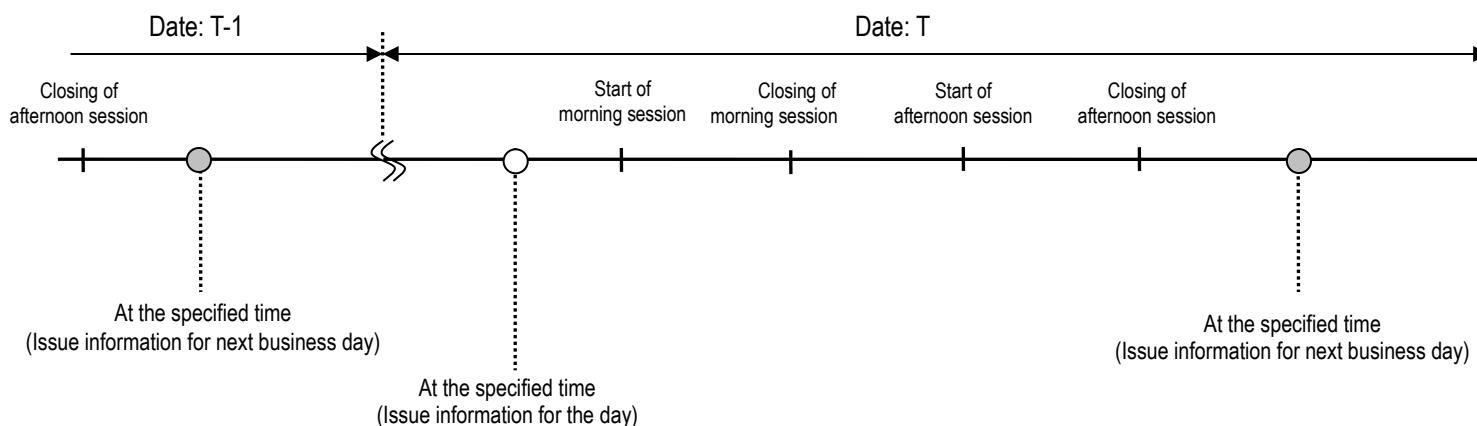
2) Issue Information (II Tag)

Issue Information is sent as below.

a. Before opening of morning session (the issue information for the day is output)
   ・   Issue information of all issues for each exchange is output.
   ・   After sending issue information for the next business day, the issue information may be changed before the opening
      of the morning session. In that case, **the issue information for the day will contain the updated information (*).**

      * If users use issue information, please use the information disseminated before the opening of the morning session of the day
         because it will be different from the issue information disseminated on the previous day.

b. After closing of afternoon session (issue information for the next business day is output)
   ・   Issue information about all issues for each exchange is sent as provisional information.

* There may be cases where, due to the time of occurrence, flags related to decisions listed below are not included in Issue Information that is output around 17:35 and 7:40. Such information can be found on the JPX website.

・Designation/Removal of Securities Under Supervision (Confirmation/Examination), Securities to be Delisted: List of Securities Under Supervision and Securities to be Delisted

・Designation/Removal of Securities on Alert: List of Securities on Alert

・Selection and Disqualification of Standardized Margin/ Loan Trading Issues : List of Standardized Margin/ Loan Trading Issues

3) Multicast Group Number Information (MG Tag)

Multicast Group number information is sent as below.

a. Before opening of morning session (Multicast Group number information for the day is output)
  ・Multicast Group number information of all issues for each exchange is output.
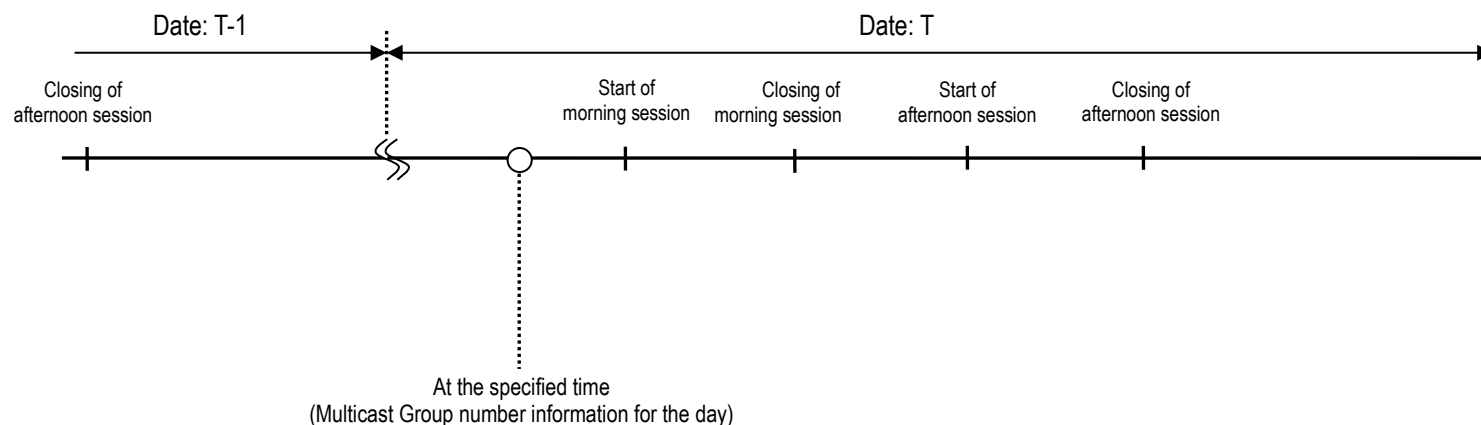
2.2. Others
2.2.1. **Notifications to Users**

Concerning FLEX Connection on the production operation, TSE will send notifications to users through the JPX website when something abnormal occurs.
The notification subjects, contents and where to publish etc. are provided as below.

(1)　Production Environment

Notification subject	Contents of Notification	Publication time	Where to publish
Urgent announcement	If " Test Announcement" doesn't apply Example -System failure -Message ID and issue information lost in TSE network -Correction of market information - Any information TSE regards it necessary.	As needed	JPX website *2
Test Announcement	The details of FLEX connection test for the next three months (Test schedule, Multicast group, issue information, registration procedure for the test)	The last Friday of month	Target
	TSE internal test (The delivery date of test data and time for internal test)	As needed	Target

(2)　Test Environment

Notification subject*1	Contents of Notification	Publication time	Where to publish
Test environment	-FLEX connection test (For test environment users)	As needed	Target

*1 Notification subject is shown.
*2 After updating the JPX website, TSE will also announce its update via Target and the Target system send an automatic email.

2.2.2. **Provision of Message Data File**

(1) Outline

TSE provides the media that contains the output messages of the Market Information System according to users' request.

Additionally, the media recorded FLEX Standard (WB)/Full (WB) data as FLEX Standard/Full.

-   The media storage device will contain at least last two weeks' FLEX data, but data may not be available due to system constraints.
-   The type of media is DVD-R or CD-R

    (Users need to prepare an empty media device to receive the message data file)

    The output messages of Test Environment are not available.

Message data will be provided based on the following process.

A) Dividing a file containing all messages per Multicast Group into a certain amount with sub sequence numbers.

B) Compressing each file per sub sequence number.

C) Writing those files to the media storage device. If one media storage device is insufficient, several devices will be used.

(2) Definition of File

1. Provision of Message Data File

File name is set with following: "Sending Date + Multicast Group Number + sub sequence number".
File is created per Multicast Group, and when volume of data for all messages is larger than volume for one file, such data is divided into several files with sub sequence number.
Sub sequence number always starts from "01", in the case of generating multiple files, they are set in sequence ("02","03").

Multicast Group Number	File Name (Ex.)	Explanation	Notes
001	yyyymmdd_001_01 yyyymmdd_001_02 yyyymmdd_001_03	TSE Issue Realtime Message (Standard)	FLEX Messages with control code are written in sending order. (With Line Feed Code)
072	yyyymmdd_072_01	NSE Issue Realtime Message (Full)	
021	yyyymmdd_021_01	TSE Base Price Information	

2. Compressed File

Compressed file name is set with following: "File Name + .zip".
Provision of Message Data File is compressed with ZIP format per sub sequence number.

Item	Contents
Written Format	Zip Format
File Name	(Provision of Message Data File Name).zip Ex.) yyyymmdd_001_01.zip
File Object	Provision of Message Data File
Remarks	One compressed file has only one message data file.

(3) Provision of Each Service Data

The following types of Message Data File are provided as below.

Service		DVD-R (or CD-R)	
Name	Multicast Group Number	Writing Form	File Object
Issue Realtime Messages (Standard)	001-018,022,024,026	All services are written to one disk (basically). If data volume is too large, it will be written to several disks.	Compressed File (ZIP)
Issue Realtime Messages (Full)	051-068, 072, 074, 076		
Index/Statistics Information	042		
ToSTNeT Information	041		
Issue Basic Information	021,023,025,027,032-035,040, 090		
High-speed Index	046-048		

(4) Data Format

Transmitted message is recorded in one record for each message.
A line feed code is set at the end of each record.

Control Code (DC1)	Service Header	Control Code (DC2)	User Data Section	Control Code (DC1)	Line Feed Code (0x0a)

← Message 1 →

Control Code (DC1)	Service Header	Control Code (DC2)	User Data Section	Control Code (DC1)	Line Feed Code (0x0a)

← Message 2 →

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Control Code (DC1)	Service Header	Control Code (DC2)	User Data Section	Control Code (DC1)	Linefeed Code (0x0a)

← Message n →

System Operation
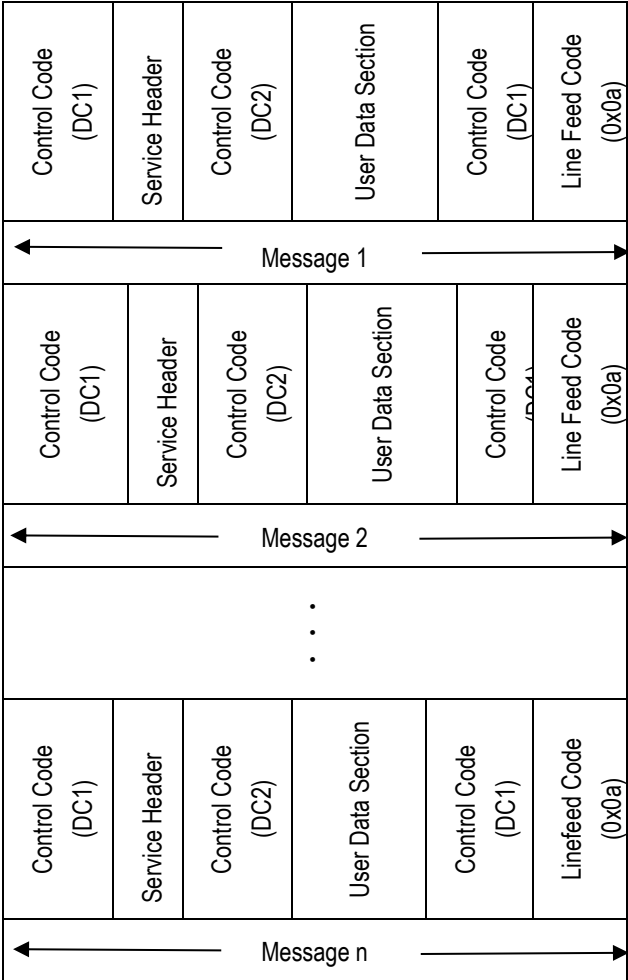
(5)   Procedure for Provision of Message Data File

TSE provides Message Data Files according to the procedure below.
1. User sends "Request form for Provision of Message Data File" to TSE IT Development (Market Information) by e-mail.
2. After sending e-mail, user contacts TSE IT Development (Market Information) by telephone for confirmation.
3. TSE confirms the request form and tells the user about delivery date. (It will take several days to prepare Message Data File)
4. TSE records the data to the media.
5. After recording the data, TSE contacts the user.
6. User collects the media. TSE exchanges the media with the unused media which the user brings.

3. Operations during Failure
3.1. Failure in Market Information System

This section describes the possible impact of and action required when a component of Market Information System (Refer to Common Items '1.4 Market Information System') fails. However, if an actual failure occurs, there are cases that it will not be as the contents of this chapter or additional actions will be required depending on the nature of failure. In such cases, users are advised to confirm the notification posted on the JPX website and take appropriate action as necessary.

For all Connections
- TSE makes contact with users regarding failures via the JPX website by posting notifications to the extent necessary throughout the length the failure from onset to recovery.
- Continuity of message sequence numbers is not guaranteed after system failure. (Refer to "5.3.3 Service Header (2)" of Common Items.)
- UDP Backup/Refresh Information will be transmitted. (including retransmission of index and statistics)
- Base price/ Multicast Group number/Issue information will be transmitted. Then, Message type in Service header is set as "401".
- If users cannot receive messages, users are able to acquire these messages by using TCP transmission function. However, if the target messages are massive, users have to use the 'Provision of Message Data File' service. For more details, please refer to "2.2.2 Provision of Message Data File".
- When users receive TCP backup/refresh during a certain session, the data may not be the latest information. Users have to decide whether that information is the latest or not since the latest issue real-time information (normal information by UDP) may have already been distributed from Market Information System in the midst of receiving with TCP.

For FLEX Standard Only
- If the extent of the failure continues into the next session, the latest information of the previous session will be transmitted.
- Depending on the system failure, Backup information may be transmitted per block (exchange, issue classification or Multicast Group, etc.).

3.1.1. Failure in Market Data Feed Server (Real-time)
(1) Single-server Failure
    a.   Impact
       - FLEX service of multicast groups assigned to the affected DF Server will continue distribution after rolling forward the message sequence number.
       - Depending on the nature of the failure, there may be cases where the message sequence number or update number is incorrect.
    b.   Action
       - Users should continue operation by receiving UDP Backup/Refresh Information after failure.

(2) Server-cluster Failure
    a.   Impact
       - FLEX service cannot distribute any messages of multicast groups assigned to the affected cluster.
         In response to this, TSE will halt trading of the issues within the multicast groups assigned to the affected DF Server cluster in accordance with its contingency plan.
       - For the assigned multicast groups, information that will be distributed at closing auction (i.e. 4P tag or 1P tag for which 'Closing Price Input Flag' is set), Backup information after closing auction, All-day information, etc. cannot be distributed.

b. Action
- Information of the affected multicast groups cannot be acquired by using TCP transmission function, and users cannot send any TCP requests.
- Users have to operate their own systems on the premise that any information from the affected multicast groups will not be distributed.
- If the DF Server cluster recovers on the day, users have to resume operation by receiving UDP Backup/Refresh information that will be distributed after recovery.

3.1.2. Failure in Market Data Feed Server (Issue Basic Information)

(1) Single-server Failure
a. Impact
(Base Price / Multicast Group number)
- No impact on users
(Issue Information)
- FLEX service will continue distribution of multicast groups assigned to the affected DF Server after rolling forward the message sequence number.
b. Action
- No action necessary

(2) Server-cluster Failure
a. Impact
- If the failure occurs before the specified time, Issue Basic Information cannot be distributed.
- Base Price information message that will be distributed at the time of determining the first opening price of a new listing issue or at the time of changing the base price cannot be distributed.
b. Action
- If TCP request function is available, users have to retrieve the information with TCP request function.
- If the failure occurs before the day's information distribution, TSE will post the same information(*) to the JPX website. (Differences from next business day's information distributed in the last business day are indicated.) Users use the information as necessary and have to prepare for the Order Accept Start (morning session).
- If failure occurs before the next business day's information distribution, TSE will post the same information(*) as it to the JPX website. Users use the information as necessary.
(*) The format of the file which is posted on the JPX website is same as "2.2.2. Provision of Message Data File – (4) Data Format". A separate file is provided for each multicast group.

3.1.3. Failure in TCP Transmission Server

(1) Single-server Failure
a. Impact
- No impact on users
If, however, the failure occurs during responding, the connection will be disconnected without completing retransmission.

b.   Action
-   If the failure occurs during responding, users have to send the TCP request message again.

(2) All servers Failure
a.   Impact
-   TCP transmission function will not be available.
b.   Action
-   Upon using FLEX service, users have to connect to Market Information System via 2 Lines (2 circuits). In the event that messages are lost on one line, users have to continue operation by receiving these messages from the other line.

3.1.4. Failure in Trading Server
(1) Single-server Failure
a.   Impact
-   No impact on users (The order of message sequence numbers will not be interrupted.)
b.   Action
-   No action necessary

(2) All-servers Failure
a.   Impact
-   TSE will halt trading of the issues assigned to the affected Trading Server cluster in the event of a Trading Server cluster failure.
-   FLEX service cannot distribute any messages of issues assigned to the affected cluster.
-   For the assigned issues, information that will be distributed at closing auction (i.e. 4P tag or 1P tag for which 'Closing Price Input Flag' is set) cannot be distributed.
b.   Action
-   ST tag of these issues will not be distributed even while trading of the issues is halted. Users need to acquire information posted to JPX website as necessary.
-   Users have to operate their own systems on the premise that information for these issues will not be distributed.

3.1.5. Failure in Network*
(1) Single-line Failure
a.   Impact
-   FLEX service cannot distribute any messages through the affected line.
    Even if the affected service calls for implementation of TSE's contingency plan, TSE will continue trading if it's a single line failure.
-   In case of temporary failure, multiple messages can be lost.

b. Action
- Upon using FLEX service, users have to connect to Market Information System via 2 Lines (2 circuits). If one line becomes unavailable, users have to continue operation by receiving messages from the other line. In the event that messages are lost while operating one line, users have to acquire these messages by using TCP transmission function.
- Depending on the nature of the failure, UDP Backup/Refresh Information will be transmitted.
   In that case, users have to continue operation by receiving UDP Backup/Refresh Information after failure.
- In case of temporary failure, lost messages can be acquired by using TCP transmission function.
   TSE will post the message sequence number of these messages on the JPX website. However, depending on the nature of the failure, there are cases where it may take a significant amount of time to post or positing may not be possible.

(2) Two-line Failure
a. Impact
- FLEX service cannot distribute any messages through the affected service (2 Lines).
   If the affected service calls for implementation of TSE's contingency plan, TSE will halt trading of the issues within the multicast groups assigned to the affected line in accordance with its contingency plan. However, there are cases where it is possible to continue trading from onset of failure until the halt of trading. In such cases, information will be distributed from other normal services.
- For the affected service, information that will be distributed at closing auction (i.e. 4P tag or 1P tag that 'Closing Price Input Flag' of is set), Backup information after closing auction, All-day information, etc. cannot be distributed.
b. Action
- Users have to operate their own systems on the premise that any information from the affected multicast groups will not be distributed.
   If the failure service is FLEX Standard WB or FLEX Full WB, users can join the multicast group of FLEX Standard or FLEX Full for the purpose of operating users' systems stably.
- If the DF Server cluster recovers on the day, users have to resume operation by receiving UDP Backup/Refresh information that will be distributed after recovery.

*This contents of this chapter describe scenarios in the event of a wide-area network failure that can impact all FLEX users.

3.2. User-side Failure

If a failure occurs on the user side, the following actions need to be taken.

A) Upon onset of a failure, the user notifies TSE of the failure by e-mail.
B) Upon recovery, the user notifies TSE of the recovery by e-mail.
C) In the event that TSE notices a failure, TSE will notify the user about the failure through the JPX website.
D) Based on user request, unreceived data regarding the failure will be recovered by any of the following actions.

    a.   Backup/Refresh transmission of latest information
        TSE will transmit the latest information with TCP.
        Backup/Refresh transmission of latest information will be sent when users request by TCP Transmission Message or by e-mail. (Refer to "2.1.2.Selectable Units" in the TCP specifications)

        Note1: If necessary, TSE will transmit backup information with UDP during or between sessions.
        Note2: When users receive TCP backup/refresh during a certain session, the data may not be the latest information. Users have to decide whether that information is the latest or not since the latest issue real-time information (normal information by UDP) may have already been distributed from Market Information System in the midst of receiving with TCP.

    b.   Retransmission of specific messages
        TSE will retransmit specific messages (designated serial numbers) only for those that the user couldn't receive with TCP.

        Note1: There may be cases where TSE cannot provide such information due to TSE system constraints.
        Note2: For more information on the procedure of request for backup and retransmission, refer to "2.2 Request by TCP Control Message" in the TCP specifications.

    c.   Provision of Message Data File

        TSE can supply all FLEX messages that are not received on the user side after online on the day by Provision of message data.

        Note1: For more information on Provision of Message Data, refer to "2.2.2 Provision of Message Data" in this Volume.

3.3. Operation under BCP (Business Continuity Plan)

When operations are switched over to the secondary center due to BCP, the following actions will be taken.

- IP address (Multicast and Unicast) is the same as before BCP.
- After switching over to the secondary center, TSE stops transmitting high speed index and its control messages (Multicast Groups for high speed index(MCG046,MCG047,MCG048) will be unavailable).

3.4. Provision of transmission message record data

If due to a failure in the circuit or client system the client system was not able to receive messages for the day or if it was not able to transmit backup information online, then TSE will provide a record of data output for the day on a media storage device upon request from the user.
However, this may not be possible depending on circumstances in the Market Information System.

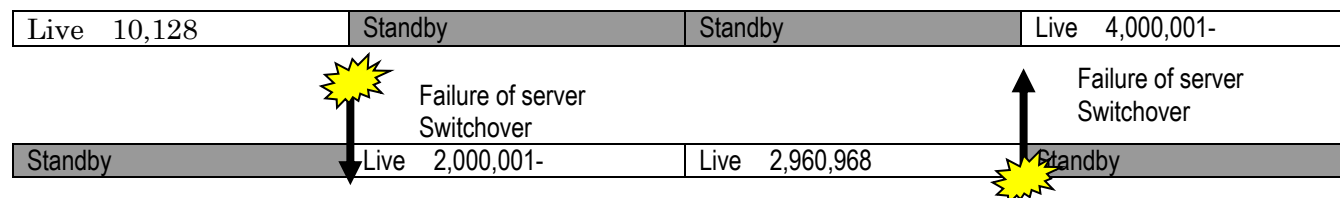## 3.5. Numbering of message sequence number in case of system failure

As a result of a system failure or recovery from system failure, the Market Information System may roll forward the message sequence number.
The timing and rule for rolling forward the number sequence is as follows.

a.   MCG 001-018, 022, 024, 026, 101 (FLEX Standard(WB) / FLEX Standard) *Real-time Message

Immediately after the switchover of the market information system server, the message serial number will be rolled forward by at least "1,000,000" to a round number.

Every time a switchover occurs on the same day, the message sequence number will be increased.

Live 10,128	Standby	Standby	Live 4,000,001-

Failure of server
Switchover

Failure of server
Switchover

Standby	Live 2,000,001-	Live 2,960,968	Standby

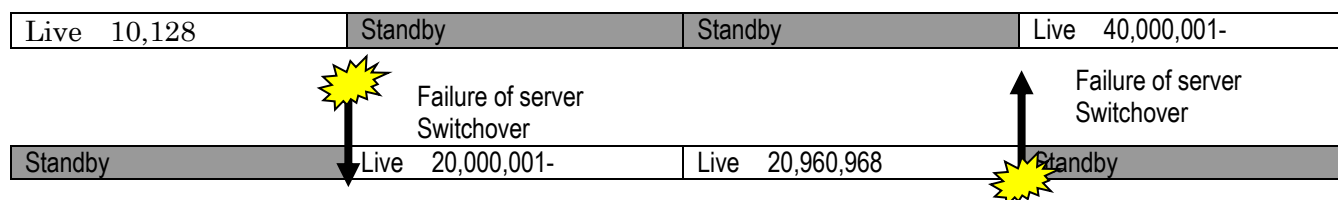b.   MCG 021, 023, 025, 027, 040, 102, 110 (FLEX Standard(WB) / FLEX Standard) *Issue Basic Information Message

Upon a failure in a market information server that sends out information, the message sequence number will not be changed.

c. MCG 032-035(Issue Information), 041-042(ToSTNeT, Index/Statistics)

Immediately after the switchover of the market information system server, the message serial number will be rolled forward to "20,000,001".

Every time a switchover occurs on the same day, the message sequence number will be increased.
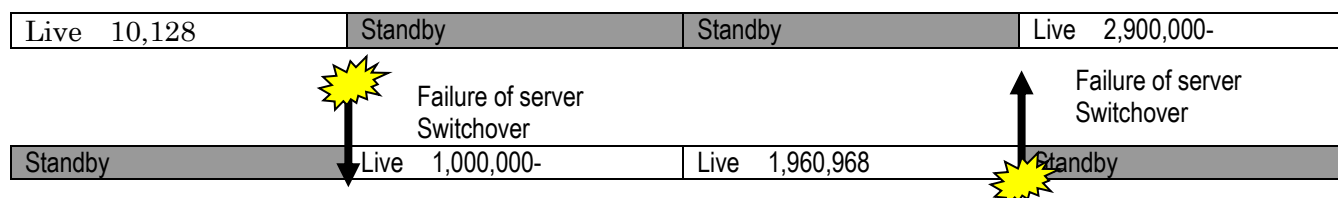
After a switchover occurs, TCP retransmission/back up will not be available for message distributed before switchover.

Live 10,128	Standby	Standby	Live 40,000,001-

Failure of server
Switchover

Failure of server
Switchover

Standby	Live 20,000,001-	Live 20,960,968	Standby

d. MCG 046-048 (High-speed Index)

Immediately after the switchover of the market information system server, the message serial number will be rolled forward by at least "900,000" to a round number.

Every time a switchover occurs on the same day, the message sequence number will be increased.

Live 10,128	Standby	Standby	Live 2,900,000-

Failure of server
Switchover

Failure of server
Switchover

Standby	Live 1,000,000-	Live 1,960,968	Standby

e. MCG 051-068, 072, 074, 076, 090, 111, 120 (FLEX Full(WB)/FLEX Full)

Immediately after the switchover of the market information system server, the message serial number will be rolled forward by at least over "1,000,000" to a round number.

Every time a switchover occurs on the same day, the message sequence number will be increased.

Live 10,128	Standby	Standby	Live 4,000,001-

Failure of server
Switchover

Failure of server
Switchover

Standby	Live 2,000,001-	Live 2,960,968	Standby
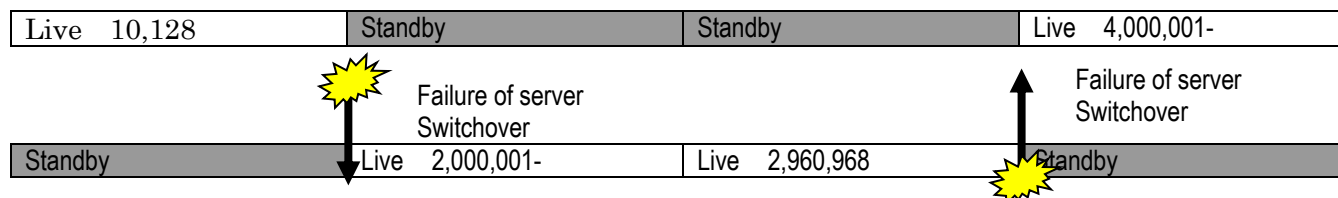
3.6. <u>Recovery operations when FLEX messages are not transmitted due to a failure</u>

This section describes TSE's recovery operations when FLEX messages are not transmitted due to a system failure, etc. When a system failure occurs, FLEX users have to prepare to restart on the premise of operations described in this section.

3.6.1. Premise

Users have to consider the following points regardless of TSE's recovery operations.
- Users are required to join the both lines of UDP multicast. If users detect a failure, etc. in one line, users have to continue operation by receiving messages from the other line without TSE's announcement.
- If Users detect a temporary message lost, etc. in the both lines of UDP multicast, users have to continue operations by retrieving the lost messages using TCP request function.

[Notes on Issue Basic Information]
- If users detect a failure in the both lines of UDP multicast and TCP request function is available, users have to retrieve the information with TCP request function.
- Even if users detect a failure in the both lines of UDP multicast and TCP request function is NOT available, TSE can continue operation considered the necessary information has been provided by posting the same contents as the FLEX information on the JPX website.

3.6.2. Policies of recovery operation

- When a system failure, etc. recovers and UDP multicast becomes available, TSE resumes UDP multicast.
- When TSE resumes UDP multicast, messages are transmitted following the order in the normal time schedule. However, for Realtime Messages by issue, since TSE transmits Back-up messages (for Standard) and Refresh messages (for Full), FLEX messages generated before the recovery are not transmitted.
- The recovery policies and the expected behaviors for each information are shown in the table below.

*Legend for "Recovery Policies" column
A: Information necessary to continue operation.
B: i) Information necessary to continue operation and can be recovered with alternative means, or
   ii) information whose recovery is not required to continue operation depending on conditions.
C: Information that may not be recovered because it has no direct impact on continuing operation.

Types of information	Contents of information	Recovery Policies		Expected behaviors of recovery in UDP multicast
			Notes	
Multicast Routing Maintenance message		C	- If it is recognized as a failure where only Multicast Routing Maintenance messages are not transmitted and TSE announces this situation to FLEX users, TSE may continue operation.	- After recovery, Multicast Routing Maintenance messages will start to be transmitted.

3-8

Types of information	Contents of information	Recovery Policies		Expected behaviors of recovery in UDP multicast
			Notes	
Control message	Communication Start	B	- If Health Check messages are normally transmitted, since this situation can be seen that the communication is normal, TSE may continue operation. (For a process of user-side system that is driven by the Communication Start as a trigger, it is preferable to be able to be driven by manual operation.)	- As to the message sequence number, while the Communication Start is transmitted with the message sequence number of 1 in each multicast group in a normal operation, the message sequence number at the timing of the recovery will be set in the recovery operation.
	Health Check	B	- If it is recognized as a failure where only Health Check message is not transmitted and TSE announces this situation to FLEX users, TSE may continue operation.	- The message sequence number at the timing of the recovery is set and messages will start to be transmitted at regular intervals (every 1 minute).
	Communication End	C	- This message may not be recovered on the day if there is no prospect of early recovery. (For a process of user-side system that is driven by the Communication End as a trigger, it is preferable to be able to be driven by manual operation.)	- The message will be transmitted with message sequence number at the timing of the recovery.
Issue Basic message	The trading day - Issue information - Basic Price information - Multicast Group Number information	B	- Even if TSE announced acquirement with TCP requests or provision of files on the JPX website, the information may be transmitted by UDP multicast after UDP multicast becomes available.	- In the recovery of the issue Basic information, not only the information that was not transmitted but all types of Issue Basic Messages, i.e., Issue information, Base Price information, and Multicast Group Number information, are transmitted in the order of the normal time schedule. - '401: Special' is set in Message Type Code of Service header. - Depending on the situation of the failure, messages with '400: Regular' in Message Type Code of Service header may be transmitted. In such case, messages with '401: Special' in Message Type Code of Service header will be transmitted subsequently.
	The next business day - Issue information - Basic Price information	C	- This message may not be recovered and transmitted over UDP multicast if there is no prospect of early recovery. (It is preferable for users to establish operation procedure in case the alternative files are provided on the JPX website.)	- The message will be transmitted with message sequence number at the timing of the recovery.

Types of information	Contents of information	Recovery Policies		Expected behaviors of recovery in UDP multicast
			Notes	
Realtime message	Quote information, Execution information, etc.	A	- TSE will continue operation without trading halt in case of a single-line failure or a failure of services other than the service in accordance with its contingency plan.	- The latest snapshot will be recovered by transmitting Backup (Standard) and Refresh (Full) over UDP multicast upon recovery.
	(For Standard only) - Backup information - All-day information	C	- This message may not be recovered on the day if there is no prospect of early recovery. (For a process of user-side system that is driven by the Backup information or All-day information as a trigger, it is preferable to be able to be driven by manual operation.)	- The message will be transmitted with message sequence number at the timing of the recovery.
Index/Statistics message	Index information	B	- If Index information cannnot be transmitted, TSE will decide whether to continue the trades of ETFs linked to the index, etc.	- The message will be transmitted with message sequence number at the timing of the recovery. - If UDP multicast does not recover on the day, TSE will publish the closing values of indices on the JPX website.
	Statistics information	C	- TSE will continue operation without trading halt even if Statistics information is not transmitted. - If UDP multicast is not available on the day, the latest value of each tag in Statistics information will not be published. (On user-side system, users are required to deal with it, for example, to store the data before the failure as a reference data or to delete the data on the day, etc.)	- The message will be transmitted with message sequence number at the timing of the recovery.

3.6.3. Samples of TSE's recovery plan

Based on "3.6.1 Premise" and "3.6.2 Policies of recovery operation", some samples of the recovery plan from failure are shown as follows.

Case (1) : This is the case that the order acceptance (morning session) start time has come without transmitting Base Price information and Multicast Group Number information over UDP multicast.

<The point of the recovery plan>
- The order acceptance (morning session) will start on time by providing the same contents as the FLEX information though parts of the Issue Basic information have not been transmitted over UDP multicast due to the failure (at 7:55).
- After the recovery from the system failure, all Issue Basic Information that contains information that had been transmitted once will be transmitted for recovery (after 8:40).

Timeline	Contents	Status	Remarks
7:00	Multicast Routing Maintenance	Succeeded to transmit	
7:10	Communication Start	Succeeded to transmit	
7:38	Issue information	Succeeded to transmit	
7:40	System failure occurs	–	
	Base Price information	Failed to transmit	
	Multicast Group Number information	Failed to transmit	
7:55	User notification about the failure (1)	Posted on the JPX website	- Operation will continue by providing files of the Base Price information and the Multicast Group Number information. - If the information is available by using TCP requests, TSE will announce it.
8:00	Order acceptance start (morning session) [TSE/NSE]	Succeeded to transmit	
8:20	Recovery from the system failure	–	
8:30	User notification about the failure (2)	Posted on the JPX website	- TSE will announce transmissions of the Issue Basic information over UDP multicast.
8:40	Issue information	Succeeded to transmit	- The Issue information had been transmitted normally on time, but it will be retransmitted in accordance with transmissions of the Base Price information and the Multicast Group Number information. - Messages that are set as '401: Special' in Message type Code of Service header will be transmitted.
8:42	Base Price information	Succeeded to transmit	- Messages that are set as '401: Special' in Message type Code of Service header will be transmitted.
	Multicast Group Number information	Succeeded to transmit	- Messages that are set as '401: Special' in Message type Code of Service header will be transmitted.
9:00	morning session start	Succeeded to transmit	

Case (2) : This is the case that the order acceptance (morning session) start time has come without transmitting messages after Communication Start by UDP multicast.

<The point of the recovery plan>
- If a failure has not occurred in order-related systems, the order acceptance may start on time (at 8:00).
- After the recovery from the system failure, FLEX messages that were not transmitted, i.e., information after the Communication Start, are transmitted in the order of the normal time shcedule (after 8:30).
- In case of a FLEX failure, since users were not able to receive information correctly after the order acceptance start, the Backup messages and the Refresh messages are transmitted after the recovery in order for users to recover the latest snapshot (at 8:40).

Timeline	Contents	Status	Remarks
7:00	Multicast Routing Maintenance	Succeeded to transmit	
7:05	System failure occurs	-	
7:10	Communication Start	Failed to transmit	- Health Check messages will also not be transmitted after this.
7:25	User notification about the failure (1)	Posted on the JPX website	- TSE will announce that the Communication Start has not transmitted.
7:38	Issue information	Failed to transmit	
7:40	Base Price information	Failed to transmit	
	Multicast Group Number information	Failed to transmit	
7:55	User notification about the failure (2)	Posted on the JPX website	- TSE will announce that the Issue Basic information has not transmitted. - This case assumes the situation where the same contents as the FLEX information is NOT provided on the JPX website.
8:00	Order acceptance start (morning session) [TSE/NSE]	Succeeded to transmit	- Depending on a failure situation, the order acceptance start may be delayed or temporarily suspended.
8:10	Recovery from the system failure	-	
8:20	User notification about the failure (3)	Posted on the JPX website	- TSE will announce transmissions after the Communication Start over UDP multicast.
8:30	Communication Start	Succeeded to transmit	- After this, Health Check messages will be transmitted every 1 minute.
8:35	Issue information	Succeeded to transmit	- Messages that are set as '401: Special' in Message type Code of Service header will be transmitted.
8:37	Base Price information	Succeeded to transmit	- Messages that are set as '401: Special' in Message type Code of Service header will be transmitted.
	Multicast Group Number information	Succeeded to transmit	- Messages that are set as '401: Special' in Message type Code of Service header will be transmitted.
8:40	Backup information / Refresh information	Succeeded to transmit	- Backup messages (FLEX Standard) and Refresh messages (FLEX Full) will be transmitted.
9:00	morning session start	Succeeded to transmit	

3.7. <u>Notes on recovery by rebooting the TSE's system</u>

This section describes the notes on recovery by rebooting the TSE's system on the day due to unexpected failure of the TSE's system.

(1) Operational Schedule

When the TSE's system is rebooted, all messages that are described in events of '2.1 Time schedule of a business day', that is all information after Multicast Routing Maintenance message, will be distributed. TSE will announce the actual time schedule for the day after the system reboot.

(2) Operation of rolling forward the message sequence number

For the message sequence number in Service header, TSE will operate in accordance with "3.5. Numbering of message sequence number in case of system failure" in order to avoid overlaps of message sequence numbers between the messages that will be transmitted after rebooting and the messages that had been transmitted before the system failure. The message swquence numbers that will be applied after rebooting will be announced on the day. The rolled forward message sequence numbers are applied from the Communication Start messages after the system reboot.

In addition, since the update number of NO tag in Realtime message is not rolled forward, this number will start from 1 and count up one by one each time new information generates.

(3) Clearing the quote information

When the TSE's system is rebooted, the quote information that had been transmitted before the system failure is required to be cleared but TSE may not be able to transmit the information depending on a failure situation. In this case, in order to restart by rebooting, TSE will ask FLEX users to clear the quote information possessing on the user-side system on the notifications.

(4) Values in FLEX messages

When the TSE's system is rebooted, the values that do not include the status information, the execution information, etc. before the system failure will be distributed as Realtime information. Data including both before the system failure and after the reboot will be published on the JPX website as the official values afterwards as follows.

a. Data Definition
  - Files are created by 'Types of data' and information for each stock and index is separated by 'Tags'.
  - All-day information that includes the execution information, etc. before and after the reboot will be published.
  - Depending on the situation, TSE may publish files step by step. (Space is set in unconfirmed fields at the time.)

Types of data	Contents of data	Tags (describes in storage order)	Remarks
Information by stock	OHLC, Trading volume, Turnover, VWAP	4P, VL, VA, VW	- Only 'All-day VWAP' in VW Tag is set. (Space is set in other contents.)
Information by index	Stock index (Closing price)	4I	- Only 'Current Price' in 4I Tag is set. (Space is set in other contents.)

b. Data Format
    One record is created for each stock and index. A line feed code is set at the end of each record.

Control Code (DC1)	Service Header	Control Code (DC2)	User Data Section	Control Code (DC1)	Line Feed Code (0x0a)

← Stock 1 →

Control Code (DC1)	Service Header	Control Code (DC2)	User Data Section	Control Code (DC1)	Line Feed Code (0x0a)

← Stock 2 →

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Control Code (DC1)	Service Header	Control Code (DC2)	User Data Section	Control Code (DC1)	Linefeed Code (0x0a)

← Stock n →