



ASX Trade Failover and Recovery Guide

June 2024

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1. Introduction

1.1. Purpose

The purpose of this document is to provide an overview of the expected behaviour of ASX Trade on failure, or unavailability, of some or all components of the architecture.

Participants are expected to follow the guidance provided in relation to application session recovery and service resiliency. Participants are responsible for regularly validating connectivity to ASX systems and ensuring they have adequate business continuity management (BCM) arrangements in place to recover and reconcile their systems.

ASX strongly encourages all participants, vendors and AMOs to attend ASX Trade BCP and Industry Wide Test (IWT) events to regularly test their business continuity plans, practice recovery strategies or switching to alternative arrangements for critical dependencies.

1.2. Readership

This document is primarily relevant to technical staff within ASX Trade participants, information vendors and other market participants that connect directly to ASX Trade. It outlines the technical behaviour of the system and should be read in conjunction with the detailed specifications of the components that may be impacted.

- ASX Trade Transactions
- ASX Trade Broadcasts
- ASX Trade Open Interface Function Calls
- ASX Trade Queries
- ASX Trade OUCH Message Specification
- ASX Trade ITCH Message Specification
- ASX Trade Introduction and Business Information
- ASX Trade Connectivity Guide
- Order and Trade Download Service

These documents can be found in the [ASX Trade Documentation Library](#).

1.3 Document History

| Version | Date | Description |
|---------|-----------|---------------|
| 1.0 | June 2024 | First Release |

1.4 Terminology

This section provides information on key terminology used throughout this document.

| Term/Acronym | Description |
|---------------------------|--|
| ALC | The Australian Liquidity Centre (primary data centre) |
| ASX Net | ASX fully managed private network |
| BCM | Business Continuity Management |
| BCP | Business Continuity Plan |
| CANCEL_ONLY Session State | Session state used in the event of a production market outage where the market will not re-open for the remainder of the trading day |
| ENQUIRE Session State | Session state used for a comprehensive freeze on order book activity |
| FOT | Fair, Orderly and Transparent |
| Glimpse | ITCH multicast snapshot (TCP/IP) |
| ITCH | Premium ultra-low latency multicast market data protocol |
| IWT | Industry Wide Test |
| LCC | Liquidity Cross Connect |
| MIR | ASIC Market Integrity Rules (Securities Markets) 2017 |
| ODS | Order Download Service |
| OI | OMNet Open Interface protocol |
| OUCH | Premium ultra-low latency order handling protocol |
| Rewinder | ITCH multicast recovery service |
| SDC | Secondary Data Centre |
| TDS | Trade Download Service |

2. Major Incident Playbook

This section outlines ASX actions in the event of a major incident.

2.1. ENQUIRE Session State

If a critical market impacting event occurs, ASX may place the market into the ENQUIRE session state which freezes the market by halting order management and trade reporting. ASX freezes the market for a number of reasons:

1. To prevent the chance of any incomplete, inaccurate or duplicated data being disseminated
2. To prevent the situation getting worse
3. To provide a static environment for initial root cause analysis and investigation

Conditions where ASX will place the market into an ENQUIRE session state could include but are not limited to:

- Double matching engine failure
- Delayed, incomplete or incorrect market data
- Significant loss of connectivity across multiple participants
- Events impacting ASX's statutory obligation to ensure the FOT (Fair, Orderly & Transparent) operation of the ASX Trade Market

The above conditions are in respect to ASX's overriding statutory obligations, to the extent that it is reasonably practicable, to do all things necessary to ensure that its licensed market is FOT.

2.2. Market Closure Assessment (Done for Day)

Once the market has been moved into an ENQUIRE session state, ASX will conduct regular assessments when considering if it is appropriate to unfreeze the ASX market and move to ADJUST, or alternatively, if the Market will be closed for the remainder of the day (done for day).

A market closure assessment will be made every 45 minutes following a major incident with a final cut off time for a decision (if needed) at 13:30. ASX will always make a decision on whether the market cannot be reopened on the day at the earliest practicable opportunity, and will not wait until the cut-off time if it becomes clear prior that the market cannot be unfrozen/resumed.

If the decision is taken that the market can be re-opened, a minimum of 40 minutes notice will be given to the market prior to resuming trading, which in most circumstances will include 20 minutes notification prior to the Pre-Open session state and 20 minutes of Pre-Open.

2.3. Closing Auction

ASX will not move or extend the time of the ASX closing auction (CSPA) session state as a result of a major market incident. There may be circumstance where the CSPA will not be run and the alternate closing price determination process will be followed.

Where there are no trades executed in the daily CSPA, the closing price will instead be the last trade executed on ASX during the continuous trading window or reported to ASX as an NBBO crossing. Where there were no trades in a security that day, the closing price will be the last traded price recorded on ASX Trade. In all but a few exceptional circumstances the market and settlement closing prices will be identical. Further details can be found in the [ASX Closing and Settlement Price Determination](#).

2.4. Market Communications

ASX will use the [System Status Page](#) as its primary method of communication during major incidents, market disruptions or incidents. ASX will provide an update every 30 minutes with additional updates if there is new information.

During an incident and where possible, the content of updates to the System Status Page in relation to ASX Trade will include:

- The current state of the ASX market
- The current state of ASX Trade and, where possible and as it becomes available, information relating to:
 - Any known impacts to ASX Trade, including:
 - services impacted
 - users impacted
 - nature of impact
 - The status of executed trades – including where relevant, the results of any FOT review
 - The status of current orders
 - The results of market closure assessments

Participants are strongly advised to [subscribe to System Status Alerts](#) to receive timely notifications related to key system incidents via SMS and/or email.

2.5. Cancel on Disconnect

ASX Trade supports Cancel on Disconnect for both OI and OUCH sessions. This functionality is configured at the session level. Please note that Cancel on Disconnect functionality is not available during ENQUIRE but will be available in CANCEL_ONLY and all other order management session states.

Participants must advise Trading Operations (tradingoperations@asx.com.au) of their preferences when ordering new sessions or when a change is requested.

Full details and configuration options for Cancel on Disconnect can be found in the [ASX Trade Introduction and Business Information](#) Guide.

2.6. Order Download Service

The intention of the ODS service is to provide Trading Participants with an alternative method of validating order data in the event that existing ASX Trade protocols are not available.

ODS is an SFTP facility, which Trading Participants can access to download their respective private order files. Participant order files will be generated in the event of a major ASX Trade incident and under specific circumstances when possible to do so (refer sections 2.6.1), in order to provide participants with a definitive list of all on-book orders to support customer reconciliation activities in a major incident scenario.

ODS files are sourced direct from the ASX Trade matching engine processes, which have historically not been impacted during outages. As the service directly accesses the ASX Trade matching engine, executing this service outside of an incident would affect the functioning of the ASX Trade platform. Due to this impact, the ODS will only ever be available in a major incident scenario, and will not be available during normal operations.

Participants are encouraged to regularly validate connectivity to the ODS SFTP folder to ensure they can access the file location should it be needed in the event of a major market incident.

More details on the ODS Service can be found [here](#).

2.6.1 Availability

ODS Files

ODS files will only be generated and made available if a major incident occurs on the ASX Trade platform and these conditions are true:

- The market is in the ENQUIRE session state
- ASX has confirmed it will not be re-opening the market that day
- Order data cannot be accessed via the normal protocols
- The ODS data source is not impacted by the incident

ODS files will be placed on ASX's SFTP site in a directory which is accessible only by the respective Participant's authorised SFTP login and key.

ASX will inform Participants that the ODS files are available via an update to ASX System Status Page.

ODS Server

- Participants with ASX Trade network connectivity (ALC Cross-Connect or ASX Net) connect to the SFTP servers and retrieve and process all ODS files for internal reconciliation.
- Participants exclusively using third party provider infrastructure can obtain ODS files manually by following the [request process here](#).
- Telnet and login availability is 24/7, subject to maintenance.

2.7. Trade Download Service

The intention of the TDS service is to provide Trading Participants with an alternative method of validating trade data in the event that existing ASX Trade protocols are not available.

TDS is an SFTP facility, which Trading Participants can access to download their respective private trade files. Participant trade files will be generated in the event of a major ASX Trade incident and under specific circumstances when possible to do so (refer sections 2.7.1), in order to provide participants with a definitive list of all executed trades to support customer reconciliation activities in a major incident scenario.

After completion of a FOT assessment ASX will generate a subsequent file set which will confirm which trades will stand, and which trades, if any, will be cancelled (i.e. ASX will ensure that the TDS files reflect the then current FOT review of trades).

Participants are encouraged to regularly validate connectivity to the TDS SFTP folder to ensure they can access the file location should it be needed in the event of a major market incident.

More details on the TDS Service can be found [here](#).

2.7.1 Availability

TDS Files

TDS files will only be generated and made available for the current trading day if a major incident occurs on the ASX Trade platform and these conditions are true;

- The market is in the ENQUIRE session state
- Trade data cannot be accessed via the normal protocols or disseminated trade data was erroneous

- The TDS data source is not impacted by the incident

TDS files will be placed on ASX's SFTP site in a directory which is accessible only by the respective Participant's authorised SFTP login and key.

ASX will inform ASX Participants that the TDS files are available via an update to ASX System Status page.

ASX will also generate previous trading day TDS files on a daily basis. This set of TDS files is for TDS service validation purposes and will be made available for download by participants via the SFTP service each morning at approximately 05:00am. This set of TDS files will contain the previous day's trades and any trade cancellations for the respective participant PID and partition.

File availability is 05:00 – 21:00 on trading days for trades pertaining to the prior trading date.

TDS Server

- Participants with ASX Trade network connectivity (ALC Cross-Connect or ASX Net) connect to the SFTP servers and retrieve and process all TDS files for internal reconciliation. Noting that this action will be required again once the FOT assessment is completed.
- Participants exclusively using third party provider infrastructure can obtain TDS files manually by following the [request process here](#).
- Telnet and login availability is 24/7, subject to maintenance.

2.8. CANCEL_ONLY Session State

The CANCEL_ONLY session state is designed only for use during a major market incident where ASX has determined that the ASX Trade market will remain closed for the rest of the day. CANCEL_ONLY session state will provide an alternative to the ENQUIRE session state and allow Participants to cancel their orders. It is intended for scenarios where it is not viable to move from ENQUIRE to ADJUST. In these cases, the processes broadcasting erroneous market data may be shut down. The market would then move to CANCEL_ONLY providing participants with a means to 'cancel back' orders and optionally place them on an alternate venue. In scenarios where broadcasted market data is not impacted, the ADJUST session state may instead be used. CANCEL_ONLY will only be invoked when it has been determined that the market would not be re-opened for the remainder of the trading day.

The CANCEL_ONLY session state can be used in conjunction with the ODS and TDS.

As normal system broadcasts may not be available in a CANCEL_ONLY scenario, participants should instead make use of the OMNet Transaction Acknowledgement as confirmation of order cancellations. See [ASX Trade Introduction and Business Information](#) for further details.

2.9. Session State Table

See [ASX Operating Rules](#), specifically ASX Operating Rules Procedure Appendices, Section 4, Appendix 4013, 'Part 1 Session States and Parameters' for a full list of session states and their parameters with allowable actions.

2.10. Market Components and Functionality

In a critical incident that is impacting the ASX Trade platform, the recovery process may require certain ASX Trade functionality to be disabled (temporarily or permanently).

ASX recognises that the unavailability of ASX functionality within ASX Trade may impact operational and technical processes for ASX Participants and other stakeholders.

ASX will provide at least 30 minutes notification to the market via the System Status page before the commencement of work to disable one or more market components

Specific order types and/or system functionality may be disabled where continued use may adversely impact:

- The stability of the ASX Trade platform
- The ability of ASX to operate a FOT market
- The accuracy of ASX Trade disseminated private and/or public market data

The below table provides a summary describing the high-level functionality that ASX is capable of wholly or partially disabling, and the minimum time period ASX would require to complete disablement:

| Function | Description | Intraday or Overnight | Comments | Minimum time for Disablement |
|--------------------------------|--|-----------------------|---|------------------------------|
| Order Types and Controls | Settings controlling order behaviour such as execution, pricing, time validity and quantity disclosure | Intraday | ASX will request that Trading Participants remove any existing orders | 30 minutes |
| Centre Point | Order types that are available for 'dark execution' | Intraday | ASX will request that Trading Participants remove any existing orders | 2 hours |
| Tailor-Made Combinations (TMC) | Creation and entry of orders into user defined combination instruments | Intraday | ASX will request that Trading Participants remove any existing TMC orders | 1 hour |
| Quotes | Two sided quotation messages used for market making | Intraday | Quotes and Quote Requests will be unavailable | 1 hour |
| Trade Reporting | Facility for the reporting and publication of off market trades | Intraday | Existing trade reports for that trading day would be assessed along with any on market trades under the FOT framework | 30 minutes |

In the event of an issue affecting other order types or market components, ASX will make an assessment on the best path to recovery in order for ASX to meet its statutory and licence obligations.

3. ASX Trade OI

3.1. Architecture and Resiliency

3.1.1 Colocation

ASX operates a 3 active gateway pod configuration per LCC connection, each OMNet session has access to 3 gateways, 2 located at ALC and 1 at SDC. Participants are assigned a specific IP address and port based on the assigned gateway pod. ALC gateways should be used as the primary connection path.

3.1.2 ASX Net and Gateway-in-Cabinet

ASX installs a pair of OMNet gateways for ASX Net and Gateway-in-Cabinet configurations. Operating 4 active ports 15024, 15025, 15026 and 15027.

Port 15024 and 15025 connect to ALC and port 15026 and 15027 connect to SDC. Ports 15024 and 15025 should be used as the primary connection paths and participants are encouraged to load balance across the two ports.

3.2. Gateway Failure and Recovery

In the event of an OI gateway failure, participants will need to connect to one of their alternative active OI gateways. ASX requires that participants incorporate a 5 second delay between reconnection attempts, and a maximum retry limit (10) for each gateway. Once the retry limit is reached, participant's connection attempts should cease and contact [ASX Customer Technical Support](#) for assistance.

After a loss of connection to an OI gateway, participants should reinitialise their application via their usual start of day procedures, to perform queries to obtain reference data and order and trade status. For additional information, refer to the [ASX Trade Intro and Business Information Guide](#).

3.2.1 Order Entry Recovery

Applications should use the MQ92 (Own Orders) query to download a baseline set of order information. Then proceed to maintain their real-time orders from the BO5 (Firm Order Book) broadcasts.

BO5 broadcasts that are missed, may be recovered for the current and the previous trading day with the MQ151 (Query Order Broadcast) using the sequence numbers from the broadcast. These sequence numbers are unique per ASX Trade partition and per participant. Some participant applications will be dependent on recovering ASX Trade reference data in order to process the results from MQ92 and BO5. Participants should note that MQ151 may not retrieve all missing BO5's in the event of a major incident and recoverability is specific to the nature of the failure event

In the event of broadcasts such as BO5 not being available (i.e. in the CANCEL_ONLY Session State), the OMNet transaction acknowledgement can be used to confirm cancellations during the CANCEL_ONLY session state. The participant's application should process the return code 'cstatus' and 'txstat' that offers definitive information about the success (or otherwise) of the transaction along with additional details.

- A negative value: the transaction was unsuccessful, the value indicates the reason for failure
- Zero: the transaction was successful but the order was not found
- A positive value: the transaction was successful, the value in txtstat indicates the quantity deleted
- ASX recommends to perform single order cancels during this state

3.2.2 Market Data Recovery

Application should execute these queries to recover the current view of ASX Trade market and reference data:

- DQ120 Delta Underlying
- DQ122 Delta Instrument Class
- DQ124 Delta Instrument Series
- DQ126 Combination Series
- IQ12 Total Equilibrium Prices
- IQ18 Total Volumes and Prices (for derivatives – 5 levels depth)
- IQ19 Total Volumes and Prices (for equities – 1 level depth)
- UQ14 BI81 Broadcasts Sent
- UQ15 Instrument Status
- UQ20 BI73 Signals Sent.

3.3. Interface Availability

- Login is available 02:25 – 20:30 on trading days.
- On Sundays from 15:00, OMNet TCP target IPs and ports are available for telnet testing only, login attempts will be rejected.
- Outside of those times connectivity is not available.

4. ASX Trade OUCH

4.1. Architecture and Resiliency

ASX operates a 3 active gateway configuration per OUCH family, each OUCH session has access to 3 gateways, 2 located at ALC and 1 at SDC. ALC gateways should be used as the primary connection path.

4.2. Gateway Failure and Recovery

In the event of an OUCH gateway failure or loss of connectivity, participants should attempt to reconnect to their primary OUCH gateway, and if unsuccessful, then attempt connection to the secondary gateway (ALC), followed by the gateway located at the SDC.

ASX requires that participants incorporate a 5 second delay between reconnection attempts, and a maximum retry limit (10) for each gateway. Once the retry limit is reached, participant's connection attempts should cease and the participant should contact [ASX Customer Technical Support](#) for assistance.

4.2.1 Order Entry Recovery

OUCH applications are expected to reconnect from the last sequence number received in the Requested Sequence Number field when submitting the Login Request Packet.

Alternatively, OUCH applications can recover all messages from start of day and should discard duplicates using Requested Sequence Number = 1 in the Login Request Packet.

Requested Sequence Number = 0 should only be used at the start of the day or before any application messages have been submitted to ASX. This method does not recover any data and is not recommended for intraday recovery.

4.3. Interface Availability

- Login is available 02:25 – 20:30 on trading days.
- Target IPs and ports are not available for login outside those times, however participants can expect "Connection refused" as a successful telnet test result outside of these times.

5. ASX Trade ITCH

5.1. Architecture and Resiliency

Participants are permitted to obtain market data from ASX Trade from the primary and/or secondary site. Primary site ITCH gateways are in the ALC, secondary ITCH gateways are located at SDC.

The ITCH gateway model is Active/Active with the feeds designed to be received and processed concurrently.

ASX ITCH operates the following channels:

ALC

- Channel A & B & D

SDC

- Channel C & E

Participants are reminded that the ITCH backup (Channel C and E) feeds are only available to participant ASX Net sites, and not to participant equipment in the ALC.

5.2. Gateway Failure and Recovery

To support intra-day connection or reconnection, ITCH offers services to allow participants to establish the current market position through a combination of snapshot and applying the real-time feeds. Further details are provided in the [ASX Trade ITCH Specification](#).

In the event of a multicast failure co-located participants are advised to subscribe as follows:

- Failure of A > subscribe to B
- Failure of B > subscribe to A
- Failure of A & B > subscribe to C (ASX Net participants only)

If both feeds at ALC are unavailable, participants will be unable to receive ITCH market data from ASX Trade, unless participants have subscribed to the backup ITCH service via ASX Net (Service Access Feed D - ASX Net - ASX ITCH Backup Connection).

In the event of a multicast failure ASX Net Global participants are advised to subscribe as follows:

- Failure of D > subscribe to E
- Failure of E > subscribe to D

Snapshot

Application submits a Glimpse login request, ensure session id set to all spaces and sequence is set to 1 within the Login Request Packet message, and the Glimpse server will send the current snapshot.

Missed Packets

If a packet loss is detected by the application, it can re-request that packet from the MoldUDP64 rewind server, and it will be resent as a UDP unicast to that application.

5.2.1 Market Data Recovery

Participants are advised to subscribe to both multicast feeds A and B at ALC. SDC ITCH is available via ASX Net where Participants subscribe to an ASX Net ITCH feed. The next expected sequence message is to be processed, with duplicates ignored. If a gap in sequence is detected, utilise the Rewind service to fill in any gaps. In the event of a large gap, it may be more efficient to re-establish the market picture by utilising Glimpse to obtain a snapshot of the current market.

ASX recommends that, on recovery, participants:

- Establish a real time connection and buffer, but not apply, any received messages.
- Glimpse to obtain a known snapshot of the order book state.
- Apply the buffered real-time messages from the sequence number stated in the (G) snapshot message.
- If any gaps are detected, issue a Rewind request to obtain missing data.

Where possible, participants should implement feed arbitration across channels (A&B or D&E), by processing both multicast feeds to mitigate any possible packet loss. Sequence numbers are interchangeable across channels. ASX Trade does not guarantee that the same packets contain the same payload across ITCH multicast feeds.

5.3. Interface Availability

Glimpse, Rewinder, and multicast:

- 02:25 – 20:30 on trading days.
- Outside of those times data is not available.
- Participants can expect “Connection refused” as a successful telnet test result to Glimpse targets outside of these times.
- A heartbeat service is available on the production ITCH network 10:00 – 20:00 on Saturdays, on multicast group addresses at the end of the multicast range, separate to the production multicast addresses.

6. Other Components

ASX Trade consists of a number of components, the failure models for which can vary. The following situations may occur in the event of component failure:

- A temporary increase in message latency, potentially including a brief pause in message flow, as a primary process fails to its secondary.

ASX may undertake various remedial technical and market management actions as the circumstances of the incident require. Any such action, and progress on resolution of the issue will be communicated via the [System Status Page with SMS and/or email alerts for subscribers that have opted in](#).

6.1. Primary Matching Engine Failure

ASX operates hot standby matching engines at the primary site (ALC) and a warm standby matching engine at the secondary site (SDC).

In the event of the failure of a primary matching engine, the hot standby matching engine will be automatically promoted to primary status. Depending on the failure, there is the potential that message latency will increase for the affected partitions, this latency increase would impact all participants.

6.2. Double Matching Engine Failure

In the event of a double matching engine failure, the warm standby matching engine at the secondary site (SDC) will require manual promotion. Due to the asynchronous replication to the emergency matching engine, there can be circumstances where messages in flight at the time of failover may not be known to the warm standby matching engine. As there could be potential for lost messages, ASX recommends that all users logout of OI and OUCH sessions, perform message recovery and re-establish an ITCH session with a fresh snapshot.

Prior to the warm standby matching engine promotion, the market will be placed in an ENQUIRE session state and transition through the relevant post incident session states. Participants should reconnect all sessions to obtain a current state for all protocols.

7. Partial or Full Loss of Primary Site

The ASX Trade SDC environment operates in asynchronous warm standby mode.

There are two types of loss of ALC scenario events covered by this guide:

- Partial - ASX Trade is unavailable from ALC, while participant colocation racks are operational
 - E.g. a switch failure that results in no access to ALC gateway services
- Full - ASX Trade ALC and participant-colocation racks are unavailable
 - E.g. total power loss of ALC

In the event of a Partial or Full loss of the ALC, ASX will promote the SDC site to primary. Communication regarding transition through the relevant post incident session states will be provided via the [System Status Page](#).

Participants should note that while the SDC gateways are available concurrently, there is a potential for lost messages. ASX recommends that all users logout and recover OI and OUCH sessions, and re-establish an ITCH session with a Glimpse snapshot for Feed C (available via ASX Net).

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