



London
Stock Exchange

London Stock Exchange

MIT501 - Guide to Testing Services

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Disclaimer

The London Stock Exchange Group has taken reasonable efforts to ensure that the information contained in this publication is correct at the time of going to press, but shall not be liable for decisions made in reliance on it. The London Stock Exchange Group will endeavour to provide notice to customers of changes being made to this document, but this notice cannot always be guaranteed. Therefore, please note that this publication may be updated at any time. The information contained is therefore for guidance only.

1.0 Introduction

The London Stock Exchange provides a range of testing services to customers developing and testing software applications for use on its Millennium Exchange Live Service¹.

1.1 Purpose

The purpose of this document is to provide an overview of the Customer Testing Services available on Millennium Exchange and how to access them.

When read in conjunction with the Millennium Technical Specifications² and the other available testing documentation, it is intended that these documents provide all of the necessary information customers require to develop, test and trial their software before connecting to the Live Service.

1.2 Readership

This document is relevant to software developers, system testers and other technical staff who are involved in testing and developing applications for use in the Live Service. It is also relevant to customers who want to use the Customer Development Service (CDS)³ for testing trading strategies or for training purposes.

1.3 Document Series

This document is part of a series of Customer Testing documents that are available to customers. The other documents are:

- MIT 502 Guide to Application Certification
- MIT 503 Certification Report
- GTP005 Testing Services Guide

These documents form part of a series of technical documentation available to customers who are developing software to connect to the Live Services. For reference, the full range of documents available at the following location: <http://www.londonstockexchange.com/products-and-services/millennium-exchange/technicalinformation/technicalinformation.htm>

¹ The London Stock Exchange Millennium Exchange Live Trading Service is referred to throughout this document as 'The Live Service'.

² The Millennium Technical Specifications includes all protocols including Group Ticker Plant.

³ The London Stock Exchange Millennium Exchange Customer Development Service is referred to throughout this document as 'CDS'.

1.4 Document History

This document has been through the following iterations:

Issue	Date	Description
8.0	23 May 2011	Eighth issue of this document published via the London Stock Exchange's website and distributed to customers.
8.1	4 July 2011	Minor update to previous issue to include Section 11 – Testing Services on Production IP Addresses.
9.0	23 September 2011	Ninth issue of this document published via the London Stock Exchange's website and distributed to customers.
10.0	20 March 2011	Tenth issue of this document published via the London Stock Exchange's website and distributed to customers. Minor revisions to several sections.
10.1	09 August 2012	Minor update to previous issue Section 9.2. Heartbeat Generator and TCP Responder now available on the RNS service.
11	25 October 2012	Minor revisions to several sections. Due to the amount of formatting changes, this version will not have amendments marked with a side bar as described below.
12	1 February 2013	Updated LCON policy
13	15 March 2013	Removed reference to FIX/FAST market data. Added clarification to LCON policy section for NSP clients.
14	15 January 2014	Section 3.4.7 Added references to CDS EDSP Auction schedule.
15	07 July 2014	Section 3.4.4 Added behaviour description of sponsored access enabled native IDs
16	31 October 2014	Amended to reflect rebranding of ITCH to MITCH

17	5 December 2017	<p>Added change for MiFID II:</p> <p>4.0 – Added section for production-like CDS environment.</p> <p>5.1 – Updated LSE Certification policy</p> <p>5.2 – Added section on Algorithm conformance</p>
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In subsequent issues, where amendments have been made to the previous version, these changes will be identified using a series of side bars as illustrated opposite.

1.5 Contacts

Please contact your Technical Account Manager if you have any questions about the Testing services outlined in this document. If you are unsure who your Technical Account Manager is please use the details below:

- Telephone: +44 (0)20 7797 3939
- Email: londontam@lseg.com

2.0 Service Overview

The London Stock Exchange offers a wide range of testing services. Customers can use the testing services to:

- Test the functional interface between their software applications and the London Stock Exchange Millennium Gateways.
- Certify their software applications for use on the Live Service
- Test trading strategies against a simulation of the Live Service
- Provide market participants with a safe training environment away from the Live Service
- Test that their market data applications can successfully process peak message volumes
- Test their application's ability to recover from service disruptions
- Test after normal market hours

All of the above service offerings are available on the CDS which is described in the next section.

In addition to the CDS, the London Stock Exchange provides a Live Service connectivity service and participant test weekends which are also described in this document.

3.0 Customer Development Service

3.1 Service Description

The CDS provides a fully functioning live simulation of the Live Service against which our customers can develop, test, and run their Trading and Information applications.

The CDS also provides model based testing scenarios to help customers with their development efforts.

3.2 Access to the Customer Development Service

To access the CDS customers will be required to complete a CDS Order Form and Customer Request Form. Customers will then be sent a CDS Configuration Form (CF) showing full technical details of their CDS configuration. Amendments can be requested through the London Stock Exchange's Technical Account Management team.

Full IP address information is provided in the MIT1001 Connectivity Guide at the link below:

<http://www.londonstockexchange.com/products-and-services/technical-library/millennium-exchange-technical-specifications/millennium-exchange-technical-specifications.htm>

CDS sessions can be pre-booked and allowed access to the service for a full trading day including extended hours. For those customers that test regularly or appreciate the convenience of uninterrupted access, a Continuous Access Service is offered as a cost effective and efficient means of testing.

The CDS Order Form and Price List can be found on the London Stock Exchange website at:

<http://www.londonstockexchange.com/products-and-services/technical-library/customer/customerdevelopmentsservice/customerdevelopmentsservice.htm>

3.3 Live Simulation Service

The Live simulation service replicates the full market structure of the Live Service, including all segments, sectors and trading sessions. Market maker registrations and participant details may vary from the Live Service. Customers should note that instruments on the CDS environment are updated on an ad hoc basis only which means that both environments might not be fully synchronised.

All Trading Services available on the Live Service are replicated on the CDS. The full range of Trading Services are detailed on the London Stock Exchange Website at

<http://www.londonstockexchange.com/products-and-services/trading-services/trading-services.htm>

Market hours are the same as the live service with the addition of four segments that are available for an extended period at the end of the day. See section 3.5 for more information.

3.4 Model Based Testing

The CDS environment has been enhanced to model specific scenarios on a more frequent basis than customers will encounter on the Live Service, such as service disruptions. Other

scenarios are added from time to time to support the introduction of new features such as the recently added Closing Price Crossing session. Customers can use these scenarios to assist with their testing and development. This section describes the modifications.

3.4.1 Market Data Failover and Recovery Testing

In order to help ensure customers can develop to the Replay and Recovery services, the London Stock Exchange will deliberately create:

- a gap in the sequence numbers of the market data messages and
- a failure of the Primary (A) feed gateway

Sequence Number Gaps - Every Monday to Thursday at 10:00

Channels affected: Level 2-MITCH channel A and FIX/FAST RNS

Event	Correct Customer Behaviour
Primary (A) feed sequence number gap simulated	Pick up the multicast messages from the Secondary (B) feed, and do not send a request to the Replay or Recovery services.
Restore Primary (A) feed	Pick up the multicast messages from the primary (A) feed, and do not send a request to the Replay or Recovery services.
Primary and Secondary sequence number gap simulated	No action until sequence number gap is detected.
Restore Primary and Secondary feeds	Detect the sequence number gap (on the next message received) and connect to the primary Replay service and request the missed messages.

Failure of Primary Gateway - Every Friday at 10:00

Channels affected: Level 2-MITCH channel A and FIX/FAST RNS

Event	Correct Customer Behaviour
Stop the primary services including Replay and Recovery forcing the Secondary to resume as master with sequence numbers reset to 1 and order book views cleared within the market data	Take the new feed and handle reset sequence numbers and reset order book views within the market data system. Connectivity to the secondary Replay and

system	Recovery services should be tested.
Post service recovery a sequence number gap will be simulated on the New-Primary	No action until sequence number gap is detected
Restore New-Primary MDG path	Detect the sequence number gap (on the next message received) and connect to the New-Primary Replay service and request the missed messages.

3.4.2 Trading Gateway Failover and Recovery

In order to support customers with their disaster recovery testing, every Friday, between 15:00 and 15:45, the following components will be failed in turn, in sequence:

- Primary FIX Trading Gateways
- Primary FIX Post Trade Gateways
- Primary FIX Drop Copy Gateways
- Selected Native Trading Gateways

Customers connected to a Primary Gateway during these times can detect the disconnection and re-connect to their designated secondary gateway. Technical information regarding failover and recovery is provided in MIT601 – Guide to Disaster Recovery.

Customers will remain connected to the Secondary Gateway for the remainder of the day.

3.4.3 Service Interruption on the Native Interface Recovery Channel

In order for customers to test receipt of the System Status message, a service interruption will be simulated for one minute, every hour, on the hour from 08:00 - 16:00 for every trading day.

In case of Service Interruption on the Native Gateway Recovery Service a new 'System Status' message will be sent to all logged in clients to indicate the unavailability and subsequent availability of the partition.

Clients submitting a new "Missed Message Request" during that time will receive a 'Missed Message Request Ack' with 'ResponseType' = 3 (service unavailable) from the Native Gateway.

3.4.4 Service Interruption during Own Order Book Download on the Drop Copy Service

In order to support customer testing of the unsolicited Execution Report, a service interruption will be simulated for one minute, every hour on the hour from 08:00 - 16:00 and for every trading day. Customers will receive an unsolicited Execution Report if the Drop Copy gateway was servicing their Order Mass Status Request during the interruption.

Sponsored access enabled Native ID's will be logged out from the Native Real Time channel, even if order cache instances of other partitions are up and running. The string "System unavailable (to sponsored users)" will be sent as the reason in the log out message.

Any new logins will be rejected via a logon response message with the reject code 9905 (System unavailable (to sponsored users)) until the order cache instances of that partition are up. This lasts for approximately 1 minute in simulation after which, sponsored access enabled Native ID's can reconnect.

3.4.5 Optimised MITCH Market Data Delivery

The optimised MITCH Market Data delivery structure provides delivery of MITCH Market Data in a single message per UDP packet. This service is available to those customers with sufficient bandwidth to take the service.

To support customer testing of the Optimised MITCH Market Data delivery, Market Data Channel B has been configured to disseminate single message per UDP packet. The Market Data Channels A, C, D, E, F & G are all configured to deliver multiple messages per UDP packet.

The full list of CDS Market Data services and IP addresses are provided in Appendix A of this document.

3.4.6 Post Close Cross

The post close crosses (CPX) were introduced in April 2012. To help customers test this functionality the CPX sessions for the following four instruments will run for 30 minutes, instead of the default 5 minutes. Please note that if there is not a crossed book at the end of the closing auction the instrument will not transition to the CPX session.

ID	Description	Sedol	TIDM	Segment	ISIN
4031	Pace	667278	PIC	STMM	GB0006672785
4116	Redrow	728238	RDW	STMM	GB0007282386
5209	Booker	B01TND9	BOK	STMM	GB00B01TND91
6043	Connaught	B139BQ3	CNT	STMM	GB00B139BQ35

3.4.7 EDSP Auctions

FTSE 100 and FTSE 250 expiry auctions will be held in CDS based on the following schedule:

Index	Day of Expiry	Auction Call
FTSE 100	Weekly every Thursday	10:10 GMT
FTSE 250	3 rd Thursday of every month	10:10 GMT

3.5 Service Hours

The service hours for the CDS match those on the Live Service, with identical trading session timings. These are detailed in the Millennium Exchange Business Parameters document available on the London Stock Exchange website at:

<http://www.londonstockexchange.com/products-and-services/trading-services/millennium-exchange-business-parameters.xls>

The Service hours for the SETS service is shown below for reference.

Time (GMT)	Description
07:00-07:50	Start of Trading
07:50-08:00	Open Auction Call
08:00-16.30	Continuous Trading
16:30-16.35	Closing Auction Call
(After Closing Auction)	Closing Price Publication (CPP)
(After CPP)	Closing Price Crossing (CPX)
(After CPX)	Post Close Session

There are four segments which support extended trading hours. These are shown below:

Segment Code	Description	Definition	Period Schedule		
ESQX	Extended hours SETSQX (based on SSQ3 SQQ3)	Quote book	Start Of Trading	07:00:00	07:50:00
			Pre-Mandatory	07:50:00	08:00:00
			Mandatory	08:00:00	19:35:00
			Post-Mandatory	19:35:00	20:00:00
ESQX	Extended hours SETSQX (based on SSQ3 SQQ3)	Order book	Start Of Trading	07:00:00	07:50:00
			Opening Auction Call	07:50:00	08:00:00

			Periodic Auction Call 1	08:00:00	11:00:00
			Periodic Auction Call 2	11:00:00	15:00:00
			Closing Auction Call	15:00:00	19:35:00
			Post Close	19:35:00	20:00:00
ESET	Extended Hours SETS (based on SET0 FE00)	SETS	Start Of Trading	07:00:00	07:50:00
			Opening Auction Call	07:50:00	08:00:00
			Continuous Trading 1	08:00:00	19:30:00
			Closing Auction Call	19:30:00	20:00:00
			Closing Price Publication (CPP)	(After Closing Auction)	(Last 1 second)
			Closing Price Crossing (CPX)	(After CPP)	(Last up to 5 mins)
			Post Close	(After CPP & CPX)	20:00:00
EIOB	Extended Hours IOB (based on IOBE LLHE)	SETS-IOB	Start Of Trading	07:00:00	08:00:00
			Opening Auction Call	08:00:00	08:15:00
			Continuous Trading 1	08:15:00	19:25:00
			Closing Auction Call	19:25:00	19:35:00
			Closing Price Publication (CPP)	(After Closing Auction)	(Last 1 second)
			Closing Price Crossing (CPX)	(After CPP)	(Last up to 5 mins)
			Post Close	(After CPP & CPX)	20:00:00

3.6 Maintenance Days

On occasion the Exchange will have to close the CDS to perform upgrades or maintenance activities. Customers will be informed of maintenance days and early CDS closures via Service Announcements. Furthermore, customers should also note that on occasions where the CDS environment has to be shut down and restarted, message sequence numbers may be reset for both Trading interfaces and Market Data interfaces. The Logon Reply message may contain the message sequence number of '1'.

3.7 Reference Data

An FTP & SFTP flat-file based Reference Data download service has been introduced as part of Millennium Exchange. All customers will also be required to test against this service prior to go-live. Further information is available in MIT401 – Guide to Reference Data Services.

3.8 Instrument Synchronisation with the Live Service

Customers should note that instruments on the CDS environment are updated on an ad hoc basis only which means that both environments might not be fully synchronised.

3.9 End to End Testing

The CDS does not send trades to a clearing house during normal operation. Trades executed on the CDS may be sent to a clearing house but this will need to be pre-arranged well in advance. Please liaise with your Technical Account Manager for more information.

4.0 Production-Like CDS Environment

London Stock Exchange plans to introduce a production-like CDS environment in Q1 2018. The production-like CDS environment will be continuously aligned with the live service in terms of software version and reference data (instrument, participants, etc.). Instrument reference data will be updated on a daily basis.

All Trading Services available on the Live Service will be replicated on the production-like CDS environment.

5.0 Conformance Testing

5.1 Application Conformance Testing

Before connecting to the Live Service, customers are required to certify that their software applications fully conform to the London Stock Exchange's Millennium Technical Specifications. Customers should use the CDS to complete the certification test.

Customers are required to recertify their software in accordance with the London Stock Exchange Certification policy:

- whenever the customer modifies the software in anyway that directly impact a London Stock Exchange interface;
- the exchange venue upgrades its production environment to a later version of software;
- the customer is requested to re-certify their application by the relevant venue.

Full details of the certification process are available in the following documents:

- **MIT502** - Guide to Application Certification

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- **MIT503** - Certification Report

5.2 Algorithm Conformance Testing

From 3 January 2018, London Stock Exchange will require firms to self certify that all algorithms used on London Stock Exchange have been tested. In accordance with the revised MiFID II release of the London Stock Exchange rulebook, any Order message specifying the use of an algorithm as the decision maker for that order by way of a short code will be taken as confirmation from a Member that the algorithm has been adequately tested. Member Firms will be required to populate the long code associated with the short code, complete with a description of the testing undertaken, in the Member Portal by the end of the next trading day. Firms may, but are not required to, use the London Stock Exchange CDS environment to self certify their algorithms. London Stock Exchange will not perform conformance testing of client algorithms.

6.0 Sponsored Access Test Service

Sponsored Access Customers have additional mandatory testing requirements for Sponsored Users (Native Gateway) and Sponsoring Firms (Drop Copy Gateway).

Sponsored Users and Sponsoring Firms will need to ensure they are using certified software on the Native Gateway for Order Entry (Sponsored User) and the Drop Copy Gateway (Sponsoring Firm). Both User and Firm will need to demonstrate they tested the functions associated with a Daily Life Cycle (DLC) of the service on the CDS environment prior to go-live on production. The DLC test is conducted with the Sponsoring Firm, the Sponsored User and a member of the Market Access team.

Full details of the testing services and requirements can be found in the document MIT 701 – Guide to Sponsored Access. The document can be found at the following link:

<http://www.londonstockexchange.com/products-and-services/millennium-exchange/technicalinformation/technicalinformation.htm>

7.0 Group Ticker Plant Testing Service

In early 2012, the London Stock Exchange Group announced its intention to launch a Group Ticker Plant (GTP) which is designed to revolutionise the real-time market data services, delivering ultra low latency feeds through new technologies and facilitating the launch of new products and services.

In preparation for the phased launch of the Group Ticker Plant, the London Stock Exchange has launched a testing service in the CDS environment. The testing service will allow customers the ability to interact with the GTP multicast data prior to accessing the Live Service environment. Further information on the GTP testing services can be found in the GTP005 – Testing Services Guide found at the below link.

<http://www.londonstockexchange.com/products-and-services/millennium-exchange/documentation/documentation.htm>

8.0 Production Test Instruments Service

The Production Test Instruments (PTIs) test facility allows customers to enter test transactions in live service test segments, using their Production systems.

The following table details the test segments that are available for entering test transactions:

Market Type	Market Segment	Market Sector
Order driven	ODTT	ODTT
Quote driven	TEST	DOTS

By entering a small volume of transactions in PTI instruments on the live service, customers can verify live system configurations without the need to enter “real” transactions. Testing is confined to 39 test securities that are available during the hours below:

ODTT Segment:

07:01 to 07:45 (Continuous Trading)

07:45 to 17:15 (Post Close)

TEST Segment:

07:01 to 17:15 (Continuous Trading)

Customers are allowed to enter all applicable trade reports in those segments. Please note that PTI is not intended for performance testing and must not be used to enter large volumes of transactions.

Full details of the instruments can be found within the daily reference data flat-file available from the FTP/SFTP site.

**As a rule testing is not permitted in the London Stock Exchange’s production environment. This service is available to customers to enter test transactions prior to the start of the trading day*

9.0 Live Connectivity Testing Services

9.1 Production Heartbeat Generator

A Market Data Heartbeat Generator is activated from 18.30-23.00 from Monday to Thursday following the Production service shutdown at 18.25 and will use the existing Production IP addresses. The Heartbeat Generator will also be activated every weekend from Saturday 22:00 to Sunday 22:00.

A Market Data Heartbeat Generator generates Heartbeat Poll messages every 2 seconds on both the Primary and Backup feeds for MITCH (Channels A-G), MITCH Prime (Channels A-D and G) and FIX/FAST RNS (35=0). Please note that the Production Heartbeat Generator for RNS is activated during weekends only.

9.2 Production TCP Responder

The TCP Responder is activated from 18.30-23.00 from Monday to Thursday following the Production service shutdown at 18.25 and will use the existing Production IP addresses. The TCP Responder will also be activated every weekend from Saturday 22:00 to Sunday 22:00.

The TCP Responder responds to customer TCP messages such as Telnet to all Primary and Backup Trading Gateways in addition to MITCH and FIX/FAST RNS.

The Production IP addresses referenced above can be found on the website at the link below:

<http://www.londonstockexchange.com/products-and-services/millennium-exchange/technicalinformation/technicalinformation.htm>

Please note that the Production TCP Responder for RNS is activated during weekends only.

10.0 Participant Test Weekends

During a Participant Test Weekend (PTW) the Exchange offers customers the opportunity to test their trading and information systems in the Live service. The service is designed where performance is the main driver for customer testing or if customers wish to test their own disaster recovery or other business continuity scenarios. Each PTW provides access during a Saturday for a shortened trading day. Please contact your Technical Account Manager (TAM) for details on Trading and Support hours. Please note that RNS Market Data Channels are not available during a PTW.

The PTW sessions are scheduled on a regular basis throughout the year. Firms wishing to participate in the PTW should pre-book their session at least one week in advance by emailing londontam@lseg.com.

Available dates as well as the Customer Testing Services Prices List, which contains the applicable fees, can be found at the following link:

<http://www.londonstockexchange.com/products-and-services/technical-library/customer/participanttestweekends/participanttestweekends.htm>

Please be aware that all advertised dates are subject to change throughout the year. However, the London Stock Exchange will endeavour to provide as much notice as possible for any changes to these dates.

Customers are reminded that the London Stock Exchange may broadcast test data from its Production environment at the weekends which should be discarded and not processed.

Appendix A: CDS Connectivity

1. Connectivity

Physical access to the Millennium Exchange CDS service is available via the following ways:

- Extranex backup circuit
- Exchange Hosting
- VPN Developer service
- Network Service Provider (NSP)
- Vendor Access Network (VAN)
- Customer Managed Connectivity (CMC)

2. Trading Gateway Connectivity

The FIX Trading, Post Trade and Drop Copy interfaces have one IP address acting as a Primary and one IP address acting as a Backup. The Backup can only be connected for failover testing between 15:00 and 15:45 on a Friday or if there is a failure of one of the Primary interfaces.

Native Trading customers can choose an IP for their Primary connection and an IP for their Secondary.

3. Market Data Gateway Connectivity

Customers can request to have MITCH and GTP Market Data channels enabled on their CDS connectivity. All feeds will be disseminated on multicast channels. Additionally, clients can request Replay and Recovery CompID's in order to test the ability to re-request messages and recover from large-scale data loss. Clients can request CompID's to connect to relevant Replay and Recovery Services. Each CompID will be allocated a Primary and Secondary IP.

4. CDS IP Addressing

CDS IP addresses can be found in the Connectivity Guide at the following link:

<http://www.londonstockexchange.com/products-and-services/millennium-exchange/millennium-exchange-migration/londonstockexchangeconnectivityguidev6.pdf>

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