



London
Stock Exchange Group

LONDON STOCK EXCHANGE GROUP

GROUP TICKER PLANT

GTP 005 - TESTING GUIDE

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Guide Disclaimer

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For further information, please contact your usual London Stock Exchange Group contact.

1. Documentation

1.1 This Guide

The purpose of this document is to provide an overview of the testing services available to customers, provisioned as part of the Group Ticker Plant project. This includes an overview of the Group Ticker Plant Customer Development Service (CDS) and Legacy CDS (LCDS) environments.

It will be updated and reissued when appropriate to do so.

1.2 Readership

This document is particularly relevant to technical and service introduction teams within member firms, information vendors and other market participants who currently receive or are interested in receiving London Stock Exchange Group market data from the Group Ticker Plant.

When read in conjunction with other Group Ticker Plant documents it is intended to provide all required information to fully test customer systems ahead of Production service access.

1.3 Document Series

This guide, **GTP005 – Testing Services Guide**, forms part of the documentation library supporting those clients interacting with the Group Ticker Plant. For information, the full series of currently available documentation is outlined below:

- GTP001 – Product Guide;
- GTP002 – Technical Guide;
- GTP003 – Statistics Guide;
- GTP004 – Parameters Guide;
- GTP005 – Testing Services Guide (this document);
- GTP006 – External Sources Guide;
- GTP007 – GTP Lite Guide.

Further documentation to support displaying our data will be released in due course.

The full library of Group Ticker Plant documentation can be found at:

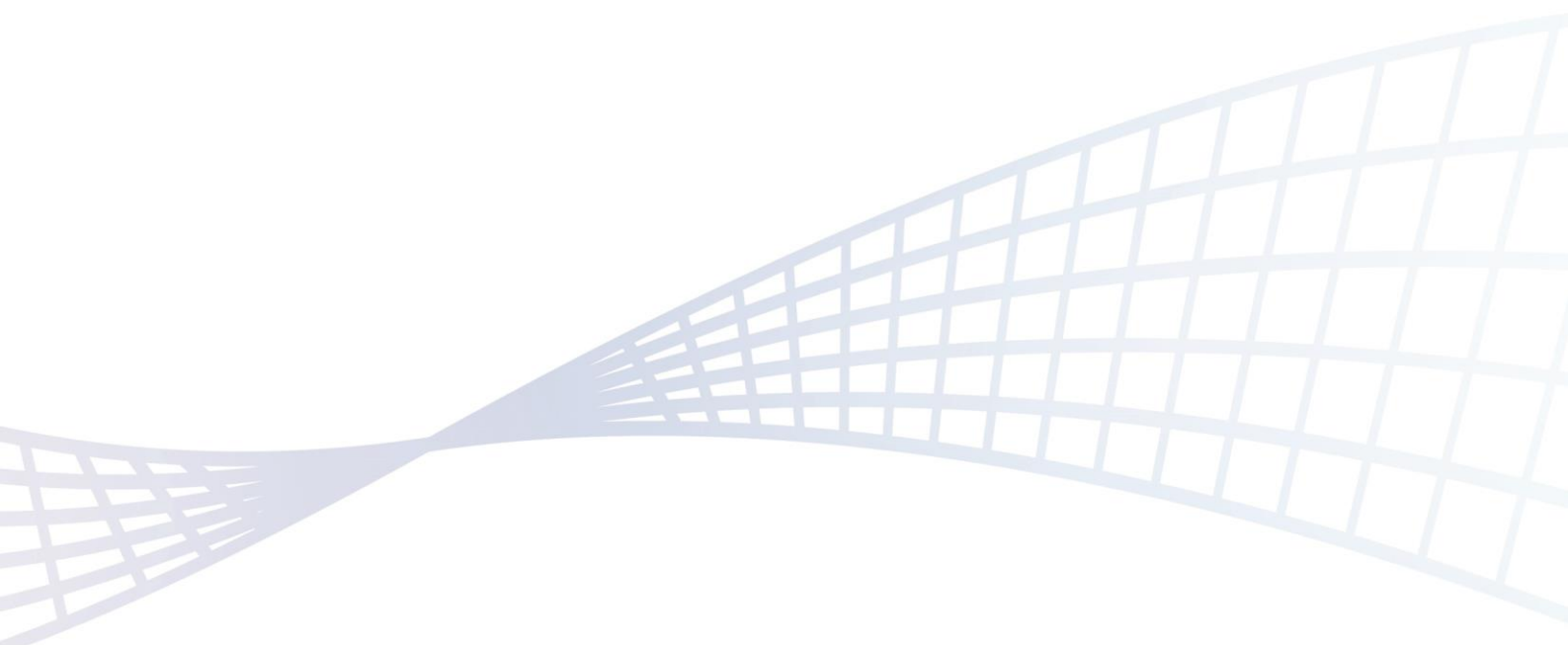
www.londonstockexchange.com/oneproductinfinitepossibilities

1.4 Document History

This document has been subject to the following iterations:

| Issue | Date | Description |
|-------|-------------------|--|
| 1.0 | 27 July 2012 | First issue of this document. |
| 2.0 | 14 September 2012 | Second issue of this document, with the following iterations: 2.4.1 – Inclusion of sequence number forced failure; 2.4.2 – Inclusion of forced gateway failure; 3 – Inclusion of detailed testing requirements. |
| 3.0 | 29 October 2012 | Third issue of this document confirming expected customer behaviour during Forced Failure. |
| 4.0 | 15 November 2012 | 2.4.2 - Minor correction to wording. |
| 5.0 | 30 November 2012 | 3.2 – Inclusion of test scripts to assist customers with Certification. |
| 6.0 | 8 February 2013 | 2.4.1 and 2.4.2 – Update to timings; 3.0 – Clarification to Certification policy; 3.3 – Update to contact details; 4.3 – Updated to include details of Heartbeat generator and TCP responder. |
| 7.0 | 13 August 2013 | Updated to reflect changes to the Group's certification policy. |
| 8.0 | 17 April 2014 | Updated to include GTP Lite testing requirements. |
| 9.0 | 10 January 2017 | Updated to reflect the launch of TradEcho test services. |
| 9.1 | 4 October 2017 | 3 - Updated recertification policy 3.3 – Updated Certification contacts (Italy) |
| 9.2 | 30 April 2018 | Added references to Legacy CDS (LCDS) Environment |
| 9.3 | 9 March 2020 | 4.3 – Updated availability of Heartbeat generator and TCP responder |
| 10 | 10 August 2020 | <u>Changes for Release 1.4.5.0</u> 2.4.2 – Added a clarification based on the improvements made to resiliency of Level 2 incremental services for FPGA based markets. |
| 10.1 | 01 December 2020 | All sections – Removed content related to Borsa Italiana and associated venues |
| 10.2 | 25 March 2021 | 4.3 - Heartbeat Generator and TCP Responder to be made available regularly on the CDS environment for customer testing. |

In subsequent issues of this document, where amendments have been made, these changes will be indicated through the use of **red text** and sidebars (example left).



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1.5 Enquiries

For further information on Group Ticker Plant, please contact either your Technical Account Manager or the Client Technology Services (UK):

- Telephone: (+44) 207 797 3939
- Email: londontam@londonstockexchange.com

Further information can also be found on our project websites:

www.londonstockexchange.com/oneproductinfinitepossibilities

2. Service Overview

The Customer Development Service (CDS) is the Group's primary testing environment. It provides clients an opportunity to test internal systems and the ability of those systems to interact with the Group Ticker Plant multicast market data prior to accessing the Production environment. As the Group works towards enhancement of trading platforms and products, the new product releases are made available in the CDS environment in advance of Production launch, allowing clients to adapt their application to the forthcoming releases of the products.

In addition to the standard CDS environment, a separate Legacy CDS (LCDS) environment is provisioned, mirroring the same code as the Production environment at any given time.

Both CDS and LCDS environments are fully functional services. They are not, however, performant systems and clients should not expect to execute performance tests of their applications on the CDS services.

Future references to CDS environment present in this document are also applicable to Legacy CDS, unless stated otherwise.

Access to the CDS service is granted upon completion of a Customer Request Form (CRF). Clients can request a CRF from their Technical Account Manager or download one from the project websites. Connectivity to CDS can be granted to clients on Customer Managed Connectivity (CMC), Extranex, BltNet, NSP and Exchange Hosting connectivity packages. Full network topology information, including IP addressing and port details are provided in GTP004 – Parameters Guide.

2.1 Service Structure

For each market the Exchange provides customers with CDS and, where available, Legacy CDS environments which are fully functioning simulation of the Exchange's forward and current Production releases, against which our customers can develop, test, and run their Trading and Information applications. As part of this project these test environments will be connected to a test version of the Group Ticker plant which will allow customers to receive their market data either directly from the Group Ticker plant or from one of the pre existing market data channels.

Exchange CDS environments will be connected to Group Ticker Plant CDS environment. Similarly, when available, the Legacy CDS Exchange environment will be connected to the Group Ticker Plant Legacy CDS environment.

2.2 Reference Data

The Group Ticker Plant does **not** maintain a distinct set of reference data. As the Group Ticker Plant disseminates a rich reference data set, a separate reference data package is not maintained. Clients should rely on the information as disseminated in the Instrument Directory messages to build a reference data package. Further information is contained in GTP001 – Product Guide and GTP002 – Technical Guide.

All instruments configured on upstream CDS environments will be configured on the Group Ticker Plant CDS instance.

2.3 Load Injection

The Group will provision load injectors to the CDS environment. These will assist those clients, particularly information vendors, who cannot input orders directly to our systems.

2.4 Forced Failure

The Group has provisioned forced failure on the CDS environment. Our forced failure, occurring at advertised times during the day, will assist clients in their testing of an application's ability to recover from data loss or product failure.

2.4.1 Sequence Number Forced Failure

The Group forces a gap in application message sequence numbers every **Monday to Thursday at 1400hrs Local London Time**. The full sequence of events and expected customer behaviour is detailed below:

| Event | Customer Behaviour |
|--|---|
| Market data channels (A) and (2) primary feed sequence number gap simulated; | Customers should retrieve missing multicast messages from the secondary market data feed. |
| Primary feeds (A) and (2) restored; | Customers should continue to process data from the primary (A) and/or (2) feed without sending a replay request. |
| Primary market data channels (A) and (2) and secondary market data channels (a) and (6) sequence number gap simulated; | Customers should connect to the primary feed (A) and/or (2) replay service to retrieve the missed application messages. |
| Primary feeds (A) and (2) and secondary feeds (a) and (6) restored; | Customers should continue to process data following receipt of updates from the replay service. |

Customers should note that further information on client data recovery using the replay service can be found in section 4 of GTP002 – Technical Guide.

2.4.2 Market Data Gateway Forced Failure

The Group forces two primary gateways to fail every **Friday at 1400hrs Local London Time**. The full sequence of events and expected customer behaviour is detailed below:

| Event | Customer Behaviour |
|-------|--------------------|
|-------|--------------------|

| | |
|---|---|
| Primary market data gateways (A) and (2), including replay and recovery services, forced failure; | Customers should identify the primary market data gateway failure. |
| Secondary market data gateways (a) and (6) resume as master, including sequence number reset and order book clear down; | In this scenario, for Level 2 Incremental Services of LSE and Turquoise MTF, both the primary and the secondary multicast feeds will continue to be issued to clients. For all other services the primary feed will become unavailable after failure of the Primary Market Data Gateway. For all services, unicast services will be available on the secondary feed. On failover the sequence number will be reset, order book cleared and repopulated. |
| Secondary market data gateways (a) and (6) to publish real-time market data; | Customers should continue to process data from both feeds for Level 2 Incremental Services of LSE and Turquoise MTF and the secondary (a) and (6) feeds for all other services. |
| Market data channels (a) and (6) sequence number gap simulated; | Customers should connect to the secondary feed (a) and/or (6) replay service to retrieve the missed application messages. |
| Market data gateways (A) and (2) restored to service as slave gateways; | Customers should continue to process data from the master gateways (a) and/or (6), arbitraging if applications are able to do so. |

Customers should note that further information on client data recovery using the recovery service be found in section 4 of GTP002 – Technical Guide.

2.5 Daily Lifecycle

The daily lifecycle of the CDS environment will mirror that of our existing CDS services.

2.6 Maintenance Days

On rare occasions, the Group may be forced to close our CDS environment for an advertised period – this closure is usually necessary to ensure code sets can be promoted to the environment cleanly and without customer impact or for hardware upgrades to take place. When a closure is required the maximum possible notice will always be provided to clients. Maintenance days will be advertised to clients through the project mailing list.

2.7 Release Notes

The Group's CDS environment should be accessed following familiarization with the library of Group Ticker Plant documentation available from the project website. In addition to these documents, the Group will make available a release note to clients. This release note details any known variations in the code set versus the published documentation. All content of the release note is provided on a best endeavors basis.

3. Application Testing

Clients are required to certify that their software conforms to the London Stock Exchange Group Ticker Plant product and technical guides prior to accessing any of the Production Group Ticker Plant systems. This will be validated through a process called Certification. Certification is mandated for all client applications that will connect to the replay, recovery and GTP Lite services on the Group Ticker Plant Production service lines. Those customer applications which will not connect to either replay, recovery or GTP Lite, and will instead only process real-time multicast data, are in any case required to self-certify that their application correctly receives and manages all the market data messages the customer is interested in receiving and managing. Please note that an application cannot be certified for replay only or recovery only.

Clients should use the Customer Development Service (CDS) environment to undertake the certification process. Clients can gain access to the CDS environment by following the process described in section 2 of this document.

Clients using software provided by an Independent Software Vendor (ISV) should ensure that it has been accredited by the relevant Exchange as unaccredited software applications will not be permitted in Production.

Please note that the Group's policy on re-certification applies to the Group Ticker Plant. Specifically, that if a client makes a code alteration to any of the previously certified software components they will be required to re-certify their application before deploying to a system interacting with Production. Should the Group upgrade the Group Ticker Plant Production system, re-certification may be required. Please note, that the Group reserves the right to request customer re-certification at any time. If no certifications have been performed during a solar year (because any of the previous conditions occurred), the customer will be asked to self-certify (by sending an email to the relevant Trading Venue team that look after certifications) that no changes have been applied to the application since the last certification..

Customer confirms that the certified application is fully conformant to all aspects of the GTP Technical Specifications and technically behaves as described in the GTP002 document.

Customer also confirms that its application correctly receives and manages all the market data messages the customer is interested in receiving and managing.

3.1 Certification Requirements

Clients should fully test their software on CDS and when ready proceed to certification testing.

Clients' software applications will be required to complete the following mandatory test cycles on CDS:

- Successfully login to a Group Ticker Plant replay service;
- Successfully submit a replay request – the level of the request is not validated;
- Successfully login to a Group Ticker Plant recovery service;
- Successfully submit a recovery request – the level or type of request is not validated;
- Verify logon following Suspension and subsequent Un-suspension of a CompID.

Please note that the above tests are designed to be as lightweight as possible. The mandatory test cycles are designed to test the software's ability to login to Group Ticker Plant systems and submit requests – they are not designed to test a software's ability to process data following successful submission of a request.

In addition to the above test cycles, those customers wishing to access the GTP Lite services are required to:

- Successfully login to a GTP Lite service;
- Receive and acknowledge GTP Lite data.

All customer software must be identifiable by a software name and version number. Software applications without a name and version number will not be certified.

The Group is pleased to confirm that upon successful certification against one multicast or GTP Lite channel, should appropriate contractual obligations be in place, the certified application will be permitted to access any of the Group Ticker Plant service lines.

Certification will be free from commercial charging for the duration of the Group Ticker Plant project.

3.2 Certification Scripts

3.2.1 Replay Service

| Type: Replay | ID: GTP-001 | Mandatory: Yes | Co-Ordinated: No |
|--|--|--|------------------|
| Description: Logon and send Replay Request. | | | |
| Comments: None | | | |
| Prerequisites: None | | | |
| | Test Steps | Expected Results | |
| 1 | Establish a connection and logon to the replay service. (Please choose any one channel to connect to and provide details in the comments section of the Certification report). | Successful logon. | |
| 2 | Send a Replay Request message. (Please provide the details as described in section 3.3 of this document in the Certification report). | Receive a successful Replay Response message. Receive requested messages. Receive a Replay and Recovery Complete message to indicate completion of the retransmission. | |
| 3 | | User will be disconnected after 5 seconds of inactivity. | |

3.2.2 Recovery Service

| Type: Recovery | ID: GTP-002 | Mandatory: Yes | Co-Ordinated: No |
|--|--|---|------------------|
| Description: Logon and send Recovery Request. | | | |
| Comments: None | | | |
| Prerequisites: None | | | |
| | Test Steps | Expected Results | |
| 1 | Establish a connection and logon to the recovery service. (Please choose any one channel to connect to and provide details in the comments section of the Certification Report). | Successful logon. | |
| 2 | Send a Recovery Request message. (Please provide the details as described in section 3.3 of this | Receive a successful Replay Response message. Receive requested messages. | |

| | | |
|---|--|---|
| | document in the Certification Report). | Receive a Replay and Recovery Complete message to indicate completion of the retransmission. |
| 3 | | User will be disconnected after 5 seconds of inactivity. |

3.2.3 Error Handling

| Type: Error Handling | ID: GTP-003 | Mandatory: Yes | Co-Ordinated: Yes |
|---|--|--|-------------------|
| Description: Verifying Logon after Suspension and Un-suspension of CompID. | | | |
| Comments: None | | | |
| Prerequisites: None | | | |
| | Test Steps | Expected Results | |
| 1 | Ensure you are logged off and request the request the Group to suspend the CompID. | CompID is suspended. | |
| 2 | Establish a connection and login to the applicable replay or recovery service. | Login is rejected. | |
| 3 | Terminate all client-server connections. | All client-server connections are terminated. | |
| 4 | Verify application behaviour conforms to the Connectivity Policy as outlined by the Group. | Connectivity conforms to the Connectivity Policy as outlined by the Group. | |
| 5 | Request Group to un-suspend CompID. | CompID un-suspended. | |
| 6 | Establish connection and login to the replay or recovery service. | Successful login. | |

3.2.4 GTP Lite

| Type: GTP Lite | ID: GTP-004 | Mandatory: Yes | Co-Ordinated: Yes |
|--|---|---|-------------------|
| Description: Login to GTP Lite service, process and acknowledge data. | | | |
| Comments: This test is only applicable to those customers connecting to the GTP Lite service lines. | | | |
| Prerequisites: None | | | |
| | Test Steps | Expected Results | |
| 1 | Establish a connection and send a non-compressed Login Request to the GTP Lite service. | Successful logon. | |
| 2 | Receive, acknowledge and process data disseminated by the GTP Lite service. | Receive at least 15 Add Order or Add Order Incremental messages and one Trade message in real-time. | |
| 3 | Provide and confirm messages are received. | User should remain connected for the duration of the test. | |

| | | |
|---|--|---|
| 4 | Customer is force disconnected by the Group. | User should confirm disconnection from the service and attempt a single reconnection. |
|---|--|---|

3.3 Certification Process

Customers confident that their application is performant should proceed to certify their application. The process to achieve Group Ticker Plant certification is outlined below:

- Clients should complete the two mandatory test cycles as detailed in sections 3.2.1 and 3.2.2 of this document. These requests can be performed against any replay or recovery service;
- Clients should notify the certification team on the same day of successful completion of test cycles. Clients should provide the following information, by email, for both the replay and recovery request: time of the request, the CompID used, targeted channel, and the values for the first message, the Count, and the RequestID field, completing the Certification Report template;
- The certification team will review the logs to confirm the behaviour of the client's application.
- Customers will be then be guided through the coordinated test cycle as detailed in section 3.2.3, and if subscribing to the GTP Lite services, the GTP Lite test as detailed in section 3.2.4.
- If the application is successful in passing requirement, the certification team will confirm success by email. Customers are required to sign and return the GTP Certification report. This customer confirmation will also confirm that the application is conformant to all information as provided in GTP002 – Technical Guide. If the application is unsuccessful, the certification team will contact the client with further guidance.

Further information, including the Certification Report template and the Group's connectivity policy can be requested from Technical Account Managers.

3.3 Certification Contacts

Please use the following contacts points to book, alter or enquire about certification:

| Enquiry | Contact Point |
|-------------------------|--|
| Certification Enquiries | London Stock Exchange Client Technology Services (UK) Telephone: (+44) 207 797 3939 Email: londontam@londonstockexchange.com |
| Certification Bookings | London Stock Exchange Certification Team Market Access Telephone: (+44) 207 797 1500 Email: marketaccess@londonstockexchange.com |

4. Additional Testing Services

4.1 High-Volume Testing (HVS)

The Group will not provision a High-Volume Service (HVS) service as part of the Group Ticker Plant project. Instead, customers will be able to performance test and load balance solutions during advertised periods of High Volume throughput, artificially stimulated by the Group during our Customer Dress Rehearsals.

4.2 Production Environment Testing

The Group does not plan to make the Production environment available ahead of Production go-live during normal trading hours.

For certain application releases customer readiness is anticipated to include Dress Rehearsal weekends if deemed necessary by LSEG. The schedule for these Dress Rehearsals will be communicated as soon as possible.

4.3 Heartbeat Generator and TCP Responder

The Group Ticker Plant **CDS and** Production environments in London support the Group's Heartbeat generator and TCP responder.

The Heartbeat generator and TCP responder will be activated on the published **CDS and** Production environment multicast channels as in the table below

| Site | Monday – Thursday | Saturday | Sunday |
|--------------------------|--|------------------------------------|------------------------------------|
| GTP London Production | 20.15 – 23.59.59 GMT/BST 20.15 – 22.59.59 GMT/BST | 22.00 – 23.59.59 GMT/BST | 00.00 – 21.59.59 GMT/BST |
| GTP London CDS | 20.15 – 22.59.59 GMT/BST | 22.00 – 23.59.59 GMT/BST | 00.00 – 21.59.59 GMT/BST |

The Heartbeat generator will broadcast Heartbeat messages across all primary and secondary multicast channels.

The TCP responder responds to customer TCP messages, such as Telnet, across all replay and recovery services, on both primary and secondary gateways.