SIAC

**Securities Industry
Automation Corporation**

Autolink Facility
User Guide

TABLE OF CONTENTS

REVISION HISTORY

Version	Date	Description
1.1	08/27/09	• Initial Version Document
1.2	11/19/09	• Section 3.8: Added system for CTS index messages "CTSI Network A&B"
1.3	01/15/10	• Section 2.5 (Page 6): Revised size of packet between Block Length and ETX • Section 2.6 (page 8 & 9): Added Block Length Field • Section 3.1 (page 11): Added Block Length field description • Section 3.4 (page 11): Added a table reflecting the Multicast Line Number range for each "System" and included the CTS/CQS & OPRA website links to the National Market System (NMS) Common IP Multicast Distribution Network Recipient Interface Specification
1.4	07/14/10	• Appendix 'A' – New Primary/Backup TCP/IP Addresses
1.5	06/18/13	• Section 3.7 (Page 12): Added new Response Code • Appendix A, (Page 13): Support for OPRA Binary Retransmission via backup IP address connection
1.6	4/20/16	• Appendix 'A' – Added New Primary/Backup TCP/IP Addresses • Updated: Reference Material/Resources Information to include OPRA reference information • Updated verbiage to: Section 2.1 Overview, Section 2.2 Retransmission Messages and Section 2.5.1.a Functionality-Dual Connections • Section 2.7 (Page 10): Updated description for "Maximum number of requests per day
1.7	3/27/17	• Appendix 'A' – Added CQS and CTS ports to use new Primary/Backup TCP/IP Addresses

REFERENCE MATERIAL

For CTA Technical Specifications visit www.ctaplan.com - and select Tech Specs tab for the following:

■ CTS and CQS Multicast Output Specification
■ CTS and CQS Input Specification
■ Common IP Multicast Distribution Network Specification
■ Autolink Facility User Guide

For OPRA Technical Specifications visit www.opradata.com and select Output Specs – BINARY for the following:

■ Autolink Facility User Guide
■ Common IP Multicast Distribution Network Specification
■ OPRA Binary DR Specification

FURTHER INFORMATION

■ CTA Announcements including feed enhancements, traffic rates, etc. visit www.ctaplan.com
■ OPRA Announcements including feed enhancements, traffic rates, etc. visit www.opradata.com

FUTURE ENHANCEMENTS

Future enhancements and/or modifications may require system changes for your firm. Please refer to the CTA Plan website www.ctaplan.com to obtain the latest CTA Notifications and Technical Specification documents. To automatically receive these notifications by email, please subscribe at: https://www.ctaplan.com/subscribe. For OPRA Notifications and Technical Specification documents they can be located at: www.opradata.com. To be added into the OPRA distribution list for receipt of future notifications, please submit either your individual email address or a group email address (preferred) to: opra@cboe.com.

RELATED RESOURCES

For customers selecting to initiate Secure Financial Transaction Infrastructure (SFTI) connections:

■ Submit a request at: http://www.nyxdata.com/Connectivity and logging into the Self Service Portal
■ Contact SFTI Sales at: Sales-SFTI@theice.com for assistance with facilitating your request
■ For supporting SFTI® documentation including Customer and Technical guides visit:
   www.nyxdata.com/docs.

SECTION 1: Introduction

1.1 Automated Retransmissions

SIAC supports an Autolink Facility to facilitate automated retransmissions of Consolidated Tape System (CTS), Consolidated Quotation System (CQS), and Options Price Reporting Authority (OPRA) data. Data Subscribers who directly receive from SIAC any of the three data feeds can connect to Autolink via the Secure Financial Transaction Infrastructure (SFTI) Communications Network. For information on how to receive CTS, CQS, and OPRA retransmission data, contact SFTI Net Ops at SFTI-NetOps@TheIce.com. Data Subscribers will be required to provide their source addresses to SFTI to facilitate the required provisioning/entitlement.

In addition to the SFTI provisioning/entitlement requirements, Data Subscribers are also required to obtain from SIAC a unique User ID/User Password by sending your request to the CQS-CTS-OPRA Product Management team at, CQS-CTS-OPRA@siac.com. Only one unique User ID/User Password is provided to direct connect Data Subscribers. Thus, clients of Service Providers would need to contact their provider to determine the mechanism employed for retransmission requests.

SECTION 2: Autolink Facility

2.1 Overview

The Autolink Facility is designed to provide direct users of CTS, CQS and OPRA data with message retransmissions of stored data (not real-time) from the current trading day in the event the originally transmitted messages were not received. Data Subscribers can connect directly through SFTI to the Autolink Facility via TCP/IP Addresses and Ports (see Appendix A).

Data Subscribers will be required to enter User ID/User Password, along with system, line, and sequence number information. Retransmissions will be disseminated over the current dedicated retransmission group multicast feeds.

2.2 Retransmission Messages

CTS, CQS, and OPRA disseminate redundant production data feeds (A&B Streams). In the event a multicast Data Subscriber misses messages on one production data stream, the missing messages are available from the other redundant production stream. If messages are missed from one or both production data streams, retransmissions of the stored data (not real-time) from the current trading day are available from the Autolink Facility. Note: The retransmitted messages will be sent over the retransmission data feeds (single set, no redundant A&B Streams).

For CTS and CQS, originally transmitted messages contain the alphabetic uppercase character 'O', in the Retransmission Requestor field of the Message Header. Originally transmitted OPRA messages contain a 'blank' in the Retransmission Requestor field of the Message Header. All retransmitted CTS, CQS or OPRA messages (sent as a result of a request received by the Autolink Facility) will only contain the alphabetic upper case character 'V' in the

Retransmission Requestor field of the Message Header. As such, no other Retransmission Requestor ID will be supported in this new facility.

2.3 Why TCP vs. UDP?

1. More control is established over retransmissions (preventing a flood of UDP requests).
2. One connection for each requestor at a time is allowed on each server.
3. Return confirmation is provided to the requestor.
4. Verification of 'user ID' and "password" takes place before allowing a connection to be made.
5. Prevents a connection from being made if the maximum number of retransmission requests is exceeded.

2.4 System Diagram

Enhanced Autolink

NMS Network

SFTI

TCP
Retransmissions
Requests

Multicast
Retransmissions

Data Recipients
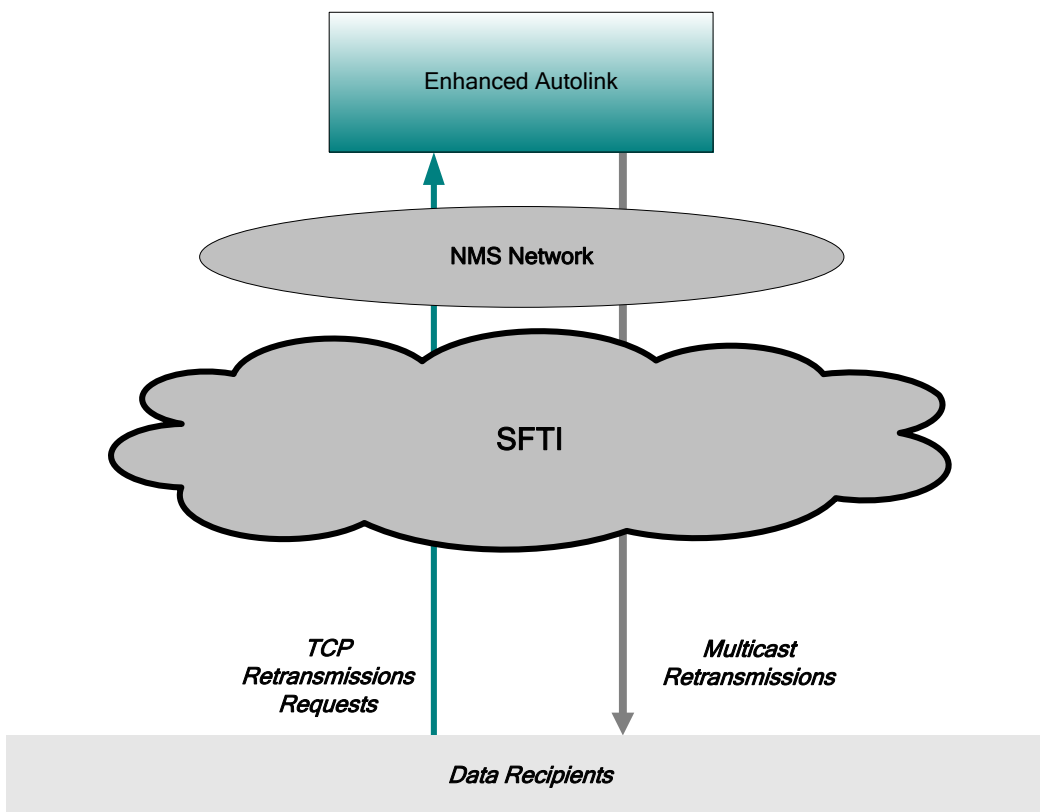
2.5 Functionality

1. Dual Connections

   a) The Autolink Facility supports two redundant servers per active data center to process retransmission requests of stored data (not real-time).   Data Subscribers can connect to both servers simultaneously. Each server supports all three systems; CTS, CQS and OPRA. Only one connection per system is allowed on each server. Simultaneous connections for the same system on each server are not supported (e.g., multiple connections cannot be made to <system = CTS> on the same server).

   b) Requests can be made to both servers simultaneously. Simultaneous retransmission requests for the same sequence numbers via both redundant servers are not supported however, one server will process the retransmission request and the redundant server will report the retransmission request as a duplicate request received (reference the Retransmission Threshold section).

   c) Duplicate requests of the same retransmissions being requested at the same time will not be processed.

   d) The option is available to keep a connection established for the entire day

   e) Retransmission requests will be accepted only during defined hours (CTS/CQS: 3:30 AM - 8:30 PM, ET and OPRA Extended Session commencing at 2:30 AM and OPRA Regular Session commencing at 6:10 AM - 6:30 PM, ET)

2. Prevention of invalid Data Subscribers and Multiple Connections on the same server

   a) When making a connection, each Data Subscriber is identified by a unique User ID/User Password within a defined timeframe. If the User ID/User Password are not received within the specific timeframe (30 seconds), the connection will close.

   b) The retransmission request contains the Data Subscriber's unique User ID/User Password.

   c) Requests from invalid Data Subscribers will not be processed.

   d) Only one connection at a time can be established by a Data Subscriber (user ID) on each server.

3. Provide Timely Retransmissions

   a) The retransmission request with the highest sequence number (most current) will be transmitted at a higher priority.

   b) A duplicate retransmission request will not be processed (reference the Retransmission Threshold section).

   c) A maximum of 1 million CTS, CQS or OPRA messages per request is allowed. Large requests will be broken down into smaller segments by the Autolink Facility (Smaller requests will be processed in between segments of larger requests).

   d) If more than 1 million messages are required, multiple requests should be generated.

   e) Multiple retransmission requests can be placed in a packet (size of packet between Block Length and ETX is 1,002 bytes).

Functionality, continued

4. Retransmission Request Acknowledgements

Upon receiving CTS, CQS or OPRA retransmission request from a Data Subscriber, the system will send one of the following acknowledgements back to the Data Subscriber:

a) The TCP/IP connection was refused.
b) The request was processed normally.
c) The request contained an invalid message size.
d) A duplicate request was received.
e) The request was rejected due to invalid system name, line, user ID, or password.
f) The format of the request was incorrect.
g) The request exceeded the number of messages per request.
h) The request exceeded the number of requests per day.
i) Invalid sequence number request.

5. Message Sequence Number Rollover

Although unlikely, in the event of CTS, CQS or OPRA message sequence number rollover, the Autolink Facility will internally maintain the actual message sequence number (12 bytes). As such, the Data Subscriber would be required to request the actual message sequence number.

For example:

If a Data Subscriber experienced an OPRA gap before and after a message sequence number rollover from 1,999,999,996 to 0,000,000,003. The Data Subscriber would request a retransmission message using the actual message sequence numbers of 001,999,999,996 to 002,000,000,003.

Autolink Facility Actual Message Sequence Number 12 Bytes	OPRA Output Sequence Number 10 Bytes
001,999,999,996	1,999,999,996
001,999,999,997	1,999,999,997
001,999,999,998	1,999,999,998
001,999,999,999	1,999,999,999
002,000,000,001 Reset Msg Seq Number	0,000,000,001 Reset Msg Seq Number
002,000,000,002	0,000,000,002
002,000,000,003	0,000,000,003

2.6 Retransmission Request Procedure

NOTE: REFERENCE <u>SECTION 3</u> FOR THE BELOW FIELD DESCRIPTIONS

1) Establish a TCP/IP connection:

A. A Data Subscriber can establish a TCP/IP connection to enter a retransmission request message and upon receipt of the message the Autolink Facility will generate a response back to the Data Subscriber, after which the Data Subscriber can close the TCP/IP connection or leave the TCP/IP connection up for the remainder of the day.

B. A Data Subscriber also has the option to establish and maintain their TCP/IP connection for the remainder of the day. If a Data Subscriber chooses this option, they will be required to send the following login request information upon establishing a TCP/IP connection. If the Data Subscriber does **not** send this information within the specific timeframe (30 seconds) the TCP/IP connection will close.

Block Length	S O H	System	User ID	User Password	U S	~ ~ ~	E T X
3	1	4	5	5	1		1

<u>Example:</u> 016<0x01>CTSA1234554321<0x03>

Connection Response: Upon receipt of a Data Subscriber's login (User ID/User Password), the Autolink Facility will send the following response which includes the original login request message information back to the Data Subscriber.

Block Length	S O H	Responding SIAC System	Response Code	System	User ID	User Password	U S	~ ~ ~	E T X
3	1	4	2	4	5	5	1		1

<u>Example: Successful connection (Response Code '01'):</u>

022<0x01>CTSA01CTSA1234554321<0x03>

Retransmission Request Procedure, continued

2) **Enter a Retransmission Request Message:** A Data Subscriber is required to send the following retransmission request information regardless of whether or not they have already established a TCP/IP connection.

Block Length	S O H	System	Multicast Line Number	Low Message Sequence Number	High Message Sequence Number	User ID	User Password	U S	~ ~ ~	E T X
3	1	4	3	12	12	5	5	1		1

Example: If a Data Subscriber requests an OPRA retransmission for the range of messages with starting sequence number 1 and ending sequence number 5 whose user ID is '12345' and password is '54321', the request would look as follows:

043<0x01>OPRA0010000000000010000000000051234554321<0x03>

Retransmission Request Message Response: Upon receipt of a retransmission request message, the Autolink Facility will send the following response which includes the original retransmission request message information back to the Data Subscriber.

Block Length	S O H	Responding SIAC System	Response Code	System	Multicast Line Number	Low Message Sequence Number	High Message Sequence Number	User ID	User Password	U S	~ ~ ~	E T X
3	1	4	2	4	3	12	12	5	5	1		1

Example: Successful Request (Response Code '01'):

049<0x01>OPRA01OPRA0010000000000010000000000051234554321<0x03>

Note: All retransmitted CTS, CQS or OPRA messages (sent as a result of a request received by the Autolink Facility) will <u>only</u> contain the alphabetic upper case character 'V ' in the Retransmission Requestor field of the Message Header. As such, no other Retransmission Requestor ID will be populated in this field.

2.7 Retransmission Thresholds

Capability	Description	Threshold
User Authorization	Requests with valid User ID/User Password will be processed. Incoming requests from Data Subscribers that are not in the enabled user ID list will not be processed.	N/A
Priority	The higher sequence number retransmission request will take precedence.	N/A
Maximum number of messages per request	A limit on the number of messages per request will be imposed. Note: If >1,000,000 the Data Subscriber must generate multiple TCP requests.	1,000,000
Smaller requests not penalized at the expense of larger requests	Large requests will be broken down into smaller segments (smaller requests will be processed in between segments of larger requests).	100,000
Maximum number of requests per day	A limit on the number of retransmission requests per system multicast line per day will be imposed per Data Subscriber.	500
Duplicate requests	Requests of the same range or within the same range received within a defined time frame, will be considered a duplicate, and will not be processed.	2 Minutes

SECTION 3: FIELD DESCRIPTIONS

3.1 Block Length

3 bytes, Numeric, Right Justified, Zero Filled. Indicates the total length of the message from the Start of Header (SOH) to the End of Text (ETX).

3.2 High Message Sequence Number

12 bytes, Numeric, Right Justified, Zero Filled. Identifies the end of the retransmission request message range.

3.3 Low Message Sequence Number

12 bytes, Numeric, Right Justified, Zero Filled. Identifies the start of the retransmission request message range.

3.4 Multicast Line Number

3 bytes, Numeric, Right Justified, Zero Filled. Indicates the multicast line number over which the retransmission should be generated.

System	Description	Multicast Line Number
CTSA	Network A	001-012
CTSB	Network B	001-012
CTSI	Index Network A&B	001-002
CQSE	Network E	001-012
CQSF	Network F	001-012
OPRA	OPRA	001-024

Note: Reference the latest National Market System (NMS) Common IP Multicast Distribution Network Recipient Interface Specification for the CTS/CQS/OPRA Network and Multicast Line breakdown using the following links.

CTS/CQS Link: https://ctaplan.com and select the Tech Specs option.
OPRA Link: https://www.opradata.com/specs/opra_common_ip_multicast_distribution_network.pdf

3.5 SOH AND ETX (CTS and CQS Only)

1 byte, The Start of Header (SOH) control character (0x01) indicates the beginning of the block, whereas an End of Text (ETX) control character (0x03) signifies the end of the block.

3.6 US (CTS and CQS Only)

1 byte, The Unit Separator (US) control character (0x1F) is needed in multiple message blocks to signify the end of the preceding message but not the end of the block. An ETX control character delimits the last message.

SECTION 3: FIELD DESCRIPTIONS, continued

3.7 Response Code

2 bytes, Numeric. Indicates one of the following response codes:

> 00 – Connection refused
> 01 – Successful connection/request
> 02 – Invalid size
> 03 – Invalid system, line, User ID or User Password
> 04 – Duplicate request
> 05 – Incorrect format
> 06 – Exceeded maximum retransmission request size
> 07 – Exceeded maximum number of retransmission requests
> 08 – Invalid message sequence number
> 99 – Temporary Internal Error

3.8 System / Responding SIAC System

4 bytes, Alphabetic, Right Justified. Indicates one of the following system names for both the System the request is being sent to by the Data Subscriber and the Responding SIAC System.

System	Description
1) CTSA	Network A
2) CTSB	Network B
3) CTSI	Index - Network A & B
4) CQSE	Network E
5) CQSF	Network F
6) OPRA	OPRA

3.9 User ID

5 bytes, Alpha Numeric, Right Justified. A unique identifier for each direct connect Data Subscriber (provided by SIAC).

3.10 User Password

5 bytes, Alpha Numeric, Right Justified. A unique password for each direct connect Data Subscriber (provided by SIAC).

Appendix A – TCP/IP Addresses/Ports

Current TCP/IP Addresses

Primary Data Center	
TCP/IP	**Mask**
159.125.39.193	255.255.255.192
159.125.38.193	255.255.255.192
Backup Data Center	
TCP/IP	**Mask**
198.140.39.193	255.255.255.192
198.140.38.193	255.255.255.192

Note: Backup Data Center TCP/IP addresses activated only upon site failover.

Port Numbers:

System	Port Number
OPRA	30901
CTS	30903
CQS	30905

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CTS/CQS Binary Parallel TCP/IP Addresses / Ports

Backup Data Center	
TCP/IP	**Mask**
198.140.39.204	255.255.255.248
198.140.38.204	255.255.255.248

*Port Numbers:

System	Port Number
CTS	30903
CQS	30905

Note: The above CTS/CQS Binary Parallel TCP/IP Addresses/Ports will be available for testing purposes from Thursday, September 7, 2017 thru Friday, September 15, 2017. On Monday, September 18, 2017, all binary retransmission requests will be supported via the Current TCP/IP Addresses.