



**OPEN
SOURCE
SATELLITE**

Mercury GS Manual

VERSION 01
DRAFT



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1 Document History

Please see the following record of revisions:

Document Revision	Document Status	Change Description
01	DRAFT	Initial Revision

2 Applicable Documents

The following references are applicable to this document. The latest version of each document applies.

Document Reference	Document Title	Reference in this Document
KS-DOC-01104	OSSAT Mercury GS Specification	[Mercury GS Spec]

3 References

The following references are applicable to this document.

Document Reference	Document Title	Reference in this Document

4 Mercury GS

4.1 Introduction

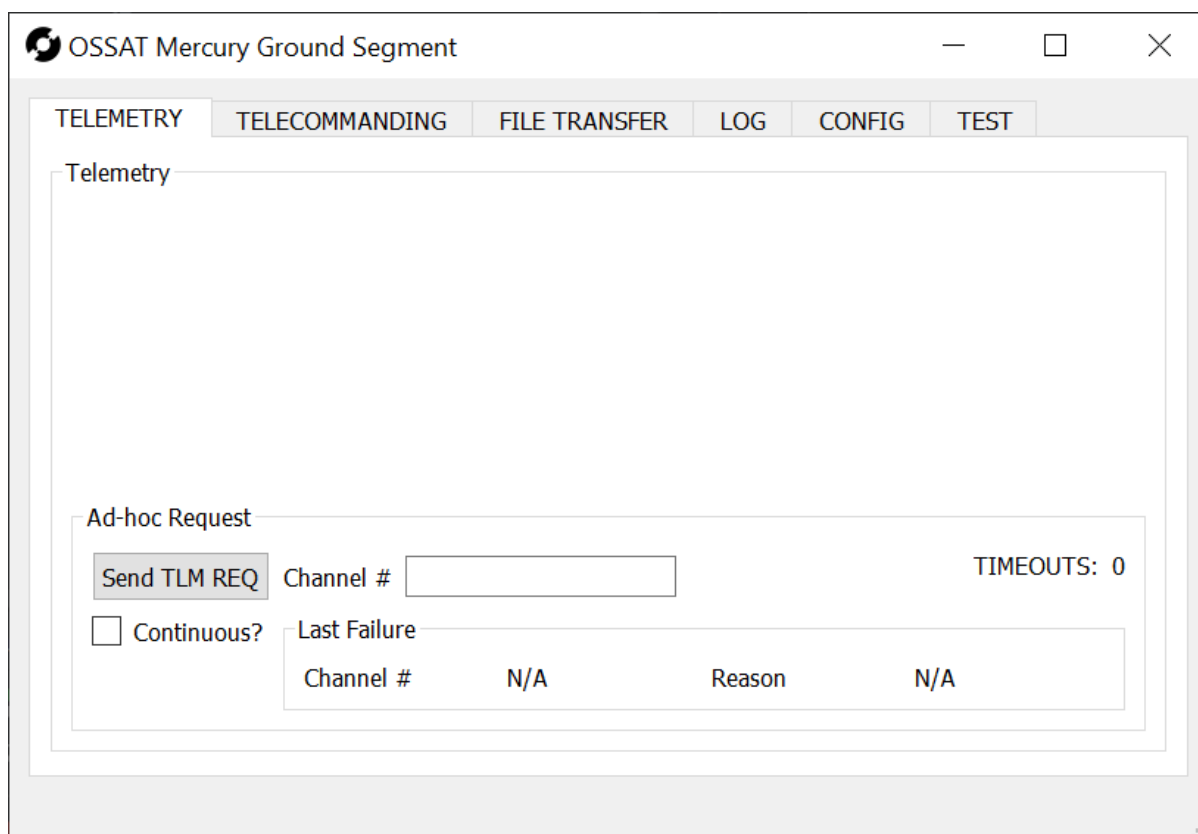
This document aims to inform the reader of how to use the Mercury GS Ground Station Software. Terminology related to the Space Industry shall be used in this document, for further information reference the Glossary and the Readme file of the repository. The software is broken up into tabs, and these shall be described in their own headings.

Mercury GS uses its own communications protocol, and formats frames automatically to be sent over the serial link. This protocol is described in the Mercury GS Spec.

NOTE: This protocol is not representative of one that would be used in Space. It is a simple protocol suitable for lab testing.

4.2 Telemetry

The below image shows the Telemetry tab of Mercury GS. This tab is used to send Telemetry Requests, receive, and display Telemetry Responses and Telemetry Rejection Responses.



The screenshot shows the 'OSSAT Mercury Ground Segment' application window with the 'TELEMETRY' tab selected. The interface includes a 'Telemetry' section with an 'Ad-hoc Request' form. This form contains a 'Send TLM REQ' button, a 'Channel #' input field, and a 'TIMEOUTS: 0' label. Below the input field is a 'Continuous?' checkbox. To the right, there is a 'Last Failure' section with a table showing 'Channel #' as 'N/A' and 'Reason' as 'N/A'.

4.2.1 Sending A Telemetry Request

To send a Telemetry Request follow these steps:

1. Type a channel number into the "Channel #" field.
2. Hit the "Send TLM REQ" button.

NOTE: You will notice the “TIMEOUTS” value go up after sending a Telemetry Request. This is due to not receiving a response within a set time.
If you send a Telemetry Response back to Mercury GS, with the same channel number and within the timeout period, then the timeout will not count up.
The timeout period can be adjusted in the CONFIG tab.

4.2.2 Sending A Telemetry Request Continuously

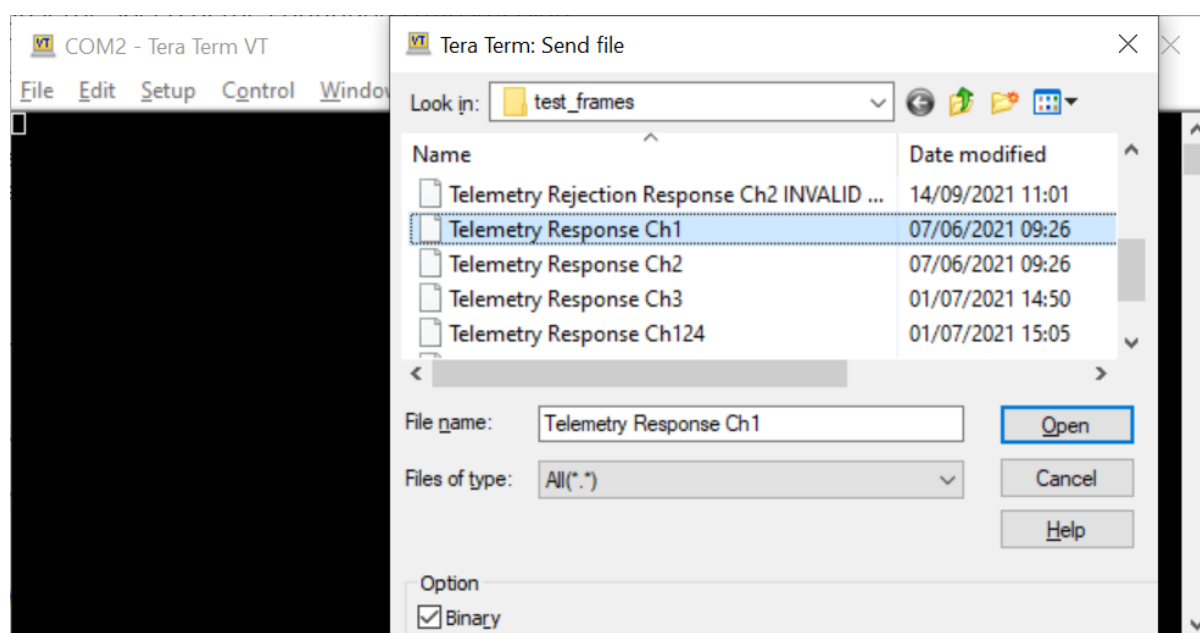
A Telemetry Request can be sent repeatedly to stress test the connection.
To send a Telemetry Request continuously, follow these steps:

1. Type a channel number into the “Channel #” field.
2. Click the “Continuous?” button.
3. Hit the “Send TLM REQ” button.


NOTE: The continuous transmission can be cancelled by unchecking the “Continuous?” button. You can also adjust the speed of the continuous transmission by adjusting the “TC/TLM Rate” field on the CONFIG tab, this can be done on the fly and the transmission speed adjusts accordingly.

4.2.3 Receiving a Telemetry Response

We will also want to receive Telemetry Responses from the spacecraft.
Unfortunately, we don’t all have satellites lying around. So in lieu of one we shall use a terminal program (the steps required to setup the COM ports and a terminal are described in the repository). Pull open your terminal program, we have used Tera Term, and navigate to the Test Frames folder. Send one of the Telemetry Response files in binary.



Once this has been successfully sent and received by Mercury GS, you will see the Telemetry Response show up under the “Telemetry” section.


OSSAT Mercury Ground Segment

TELEMETRY
TELECOMMANDING
FILE TRANSFER
LOG
CONFIG
TEST

Telemetry
TIM CH 1 1

Ad-hoc Request

Send TLM REQ
Channel #

TIMEOUTS: 0


☐ Continuous?

Last Failure

Channel #	Reason
N/A	N/A

4.2.4 Receiving a Telemetry Rejection Response

Similarly to a Telemetry Response, we can also receive a Telemetry Rejection Response. Use your terminal software to send a Rejection Response. It should display under the “Last Failure” section with the Channel Number and the Reason for the rejection.


OSSAT Mercury Ground Segment

TELEMETRY
TELECOMMANDING
FILE TRANSFER
LOG
CONFIG
TEST

Telemetry

Ad-hoc Request

Send TLM REQ
Channel #

TIMEOUTS: 0

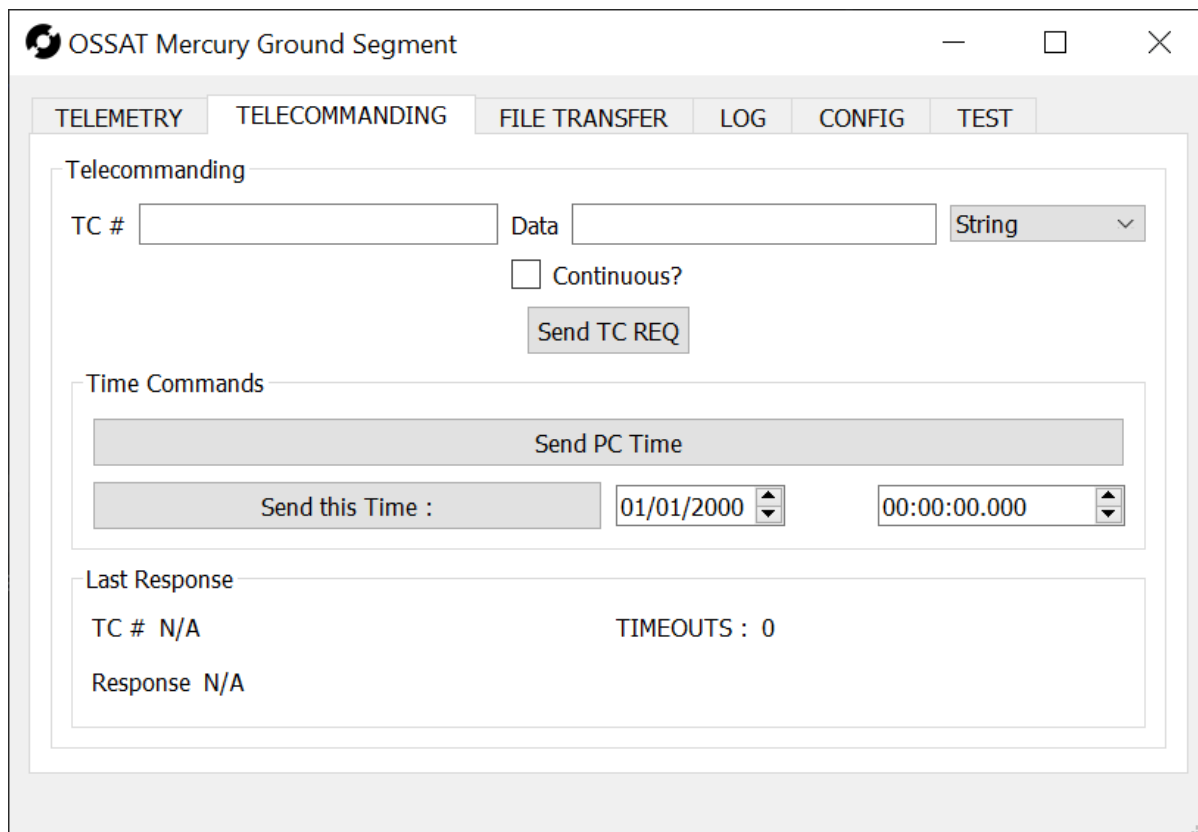
☐ Continuous?

Last Failure

Channel #	Reason
1	CHANNEL_NOT_SUPPORTED

4.3 Telecommands

As well as receiving and requesting Telemetry from the spacecraft, we will want to command it via Telecommands. See below the Telecommand tab of Mercury GS.



The screenshot shows the 'OSSAT Mercury Ground Segment' window with the 'TELECOMMANDING' tab selected. The interface includes a 'Telecommanding' section with fields for 'TC #' and 'Data', a 'String' dropdown menu, a 'Continuous?' checkbox, and a 'Send TC REQ' button. Below this is a 'Time Commands' section with a 'Send PC Time' button and a 'Send this Time :' section containing date and time pickers. At the bottom is a 'Last Response' section showing 'TC # N/A', 'Response N/A', and 'TIMEOUTS : 0'.

4.3.1 Sending A Telecommand Request

You can send a Telecommand Request by doing the following:

1. Input the Telecommand Number into the “TC #” field.
2. Select the type of the data in the drop down menu. These can be: String, Float, or Integer.
3. Type the you wish to send in the “Data” field. This is validated depending on the type selected in the previous step.
4. Click the “Send TC REQ” button.

NOTE: Telecommands can also transmit continuously and are also subject to timeouts, like with a Telemetry Request check the box to do so. Continuous Rate and Timeout period can be configured in the CONFIG tab.

4.3.2 Sending the Time

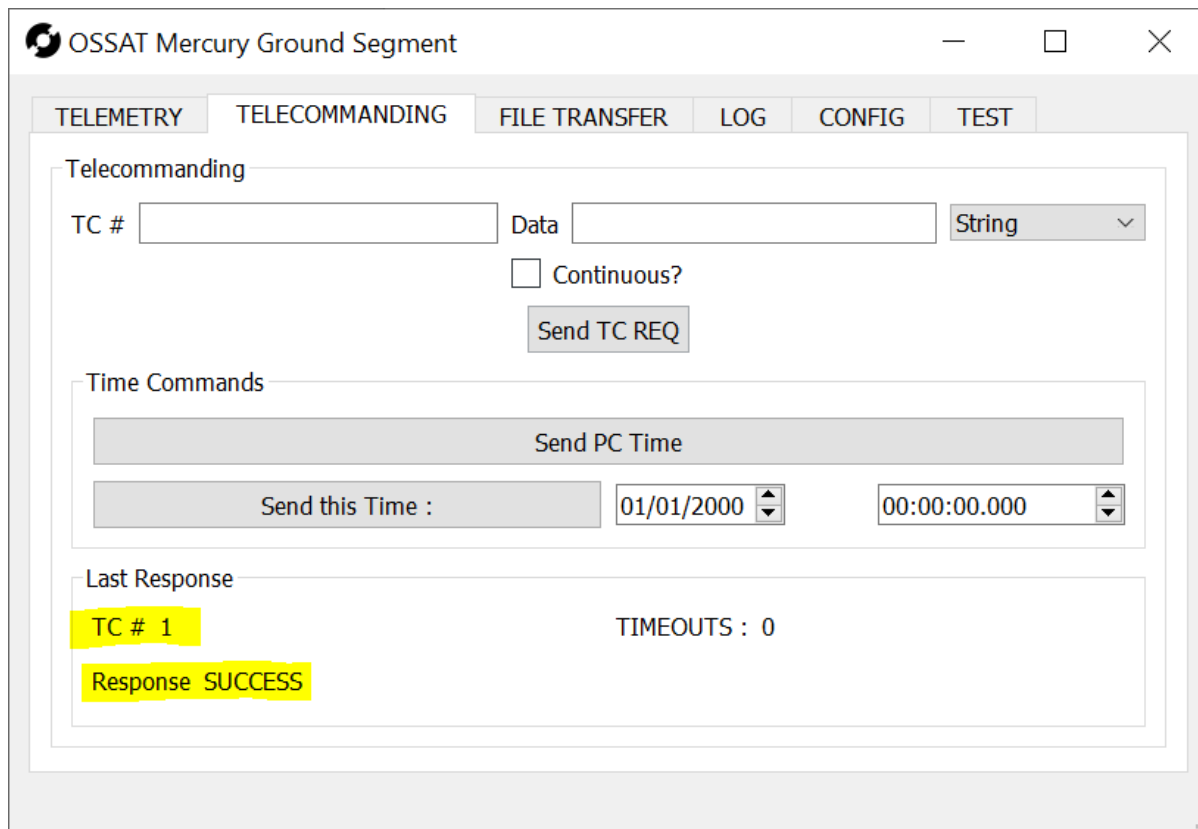
You can transmit a Telecommand Request that specifically sends the time to the Spacecraft. To do this either:

- Press the “Send PC Time” button.

- Enter a date and time into the fields next to the “Send this Time :” button and then hit the forementioned button.

4.3.3 Receiving a Telecommand Response

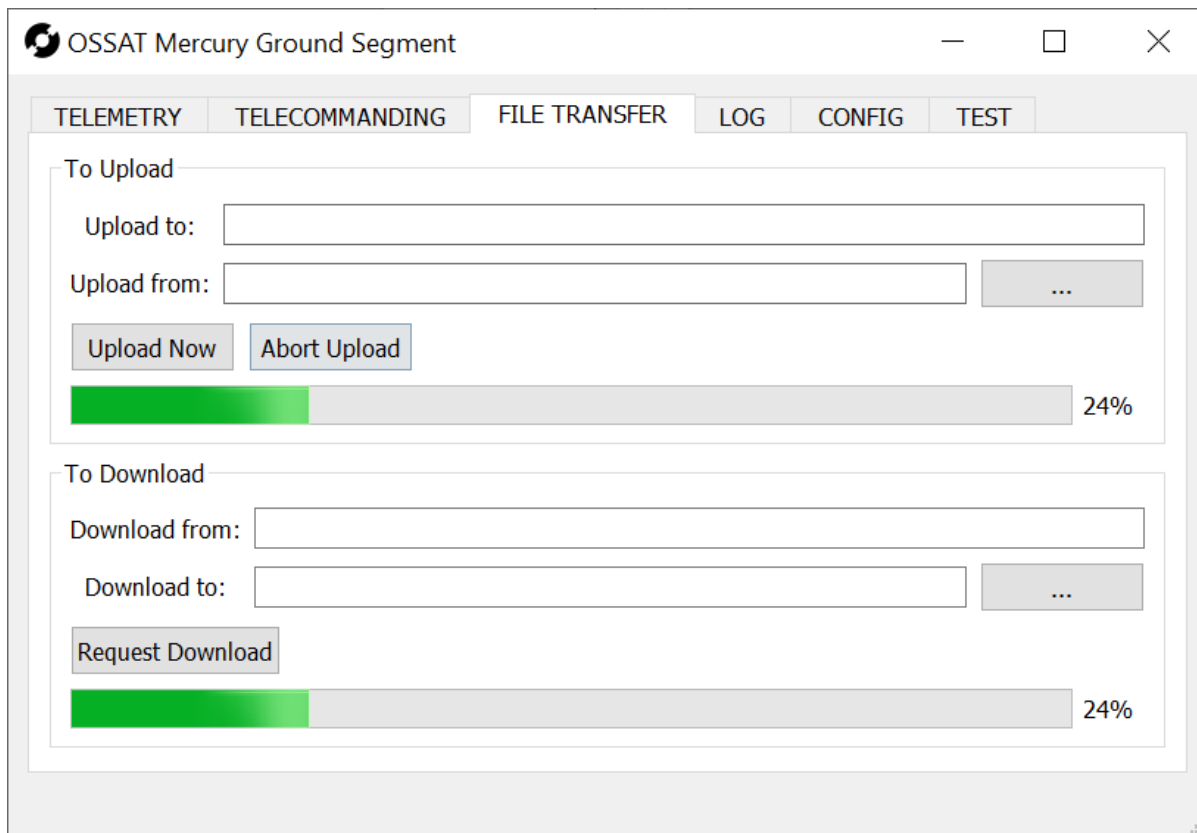
We can also receive a response to sending a Telecommand. To do so follow the same steps as 4.2.3 (Receiving A Telemetry Response), but instead of sending a Telemetry Response, send a Telecommand Response. This will show under the “Last Response” section.



The screenshot shows the 'OSSAT Mercury Ground Segment' application window. The 'TELECOMMANDING' tab is selected. The 'Telecommanding' section contains a 'TC #' input field, a 'Data' input field, and a 'String' dropdown menu. Below these is a 'Continuous?' checkbox and a 'Send TC REQ' button. The 'Time Commands' section has a 'Send PC Time' button and a 'Send this Time :' button. The 'Send this Time :' button is followed by a date input field showing '01/01/2000' and a time input field showing '00:00:00.000'. The 'Last Response' section displays 'TC # 1' and 'Response SUCCESS' in yellow boxes, with 'TIMEOUTS : 0' to the right.

4.4 File Transfer

The below image shows the File Transfer tab.



OSSAT Mercury Ground Segment

TELEMETRY TELECOMMANDING **FILE TRANSFER** LOG CONFIG TEST

To Upload

Upload to:

Upload from: ...

Upload Now Abort Upload

24%

To Download

Download from:

Download to: ...

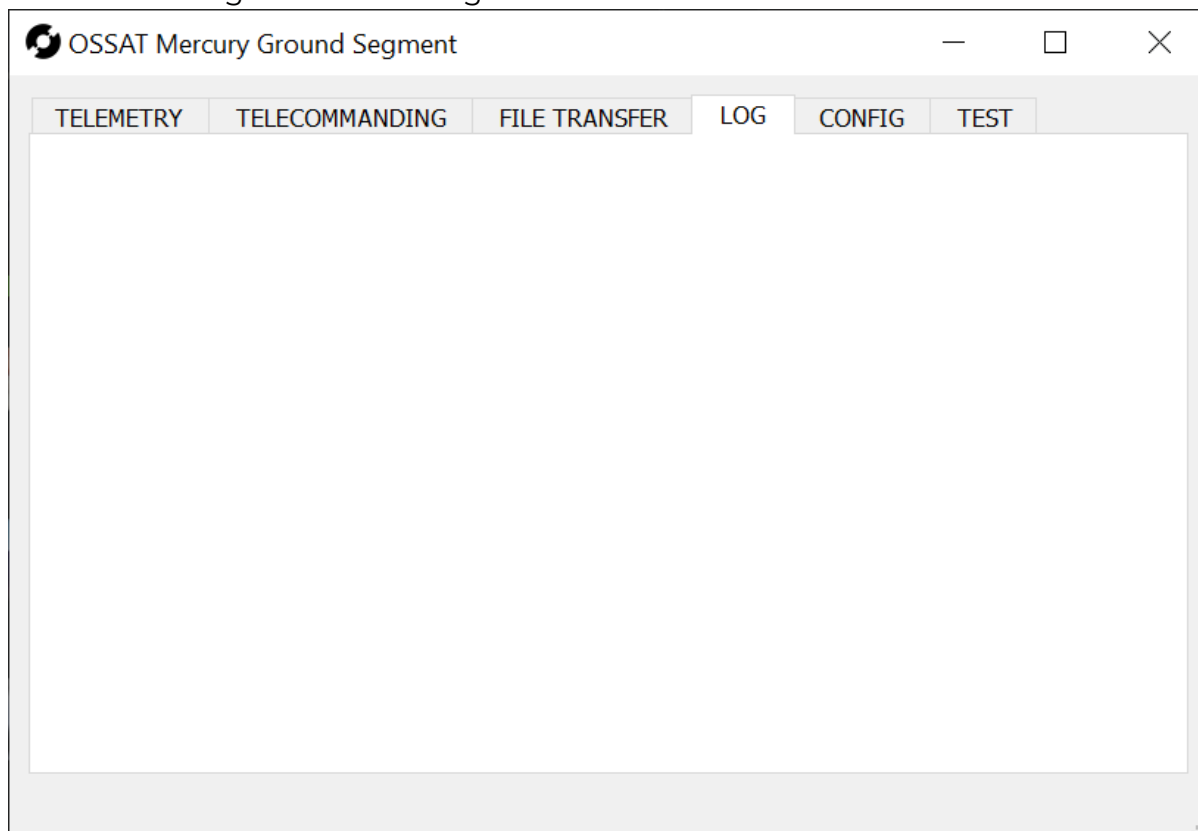
Request Download

24%

NOTE: This tab is not currently implemented and is placeholder/TBD.

4.5 Log

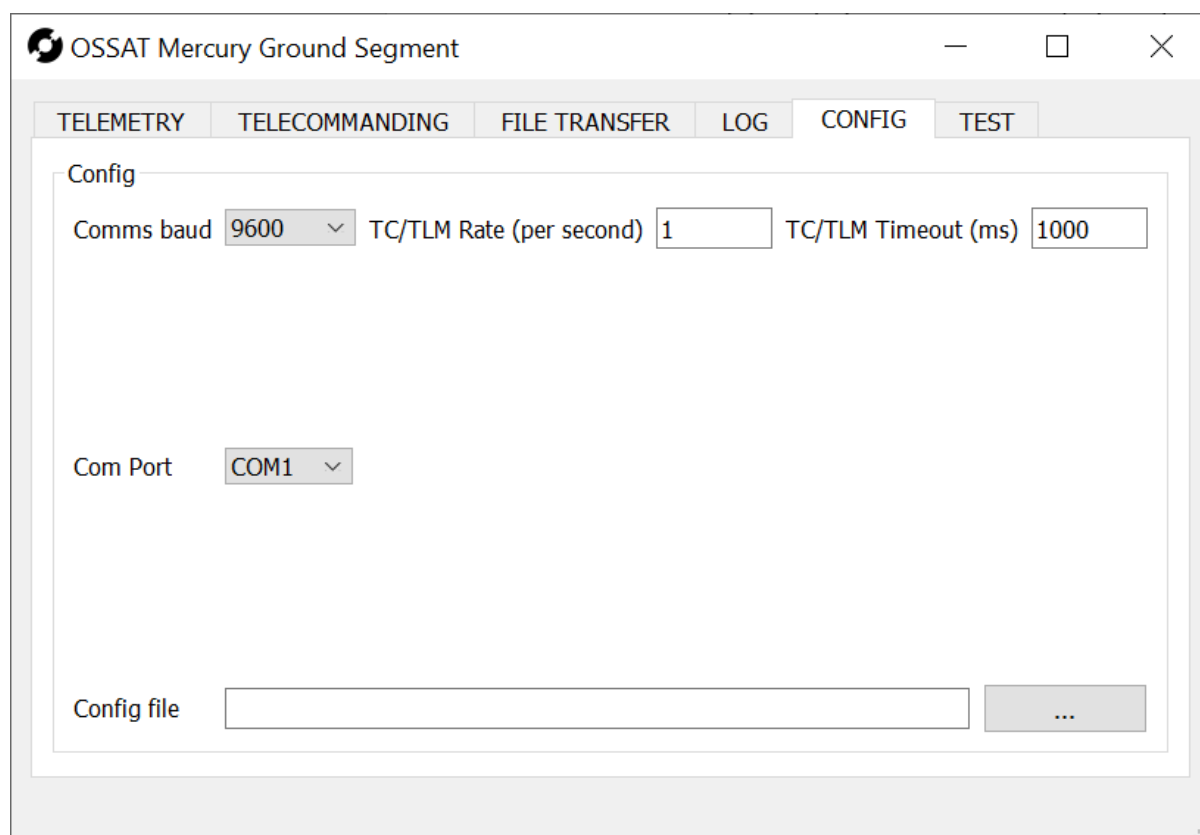
The below image shows the Log tab.



NOTE: This tab is not currently implemented and is placeholder/TBD.

4.6 Config

The below image shows the Config tab.



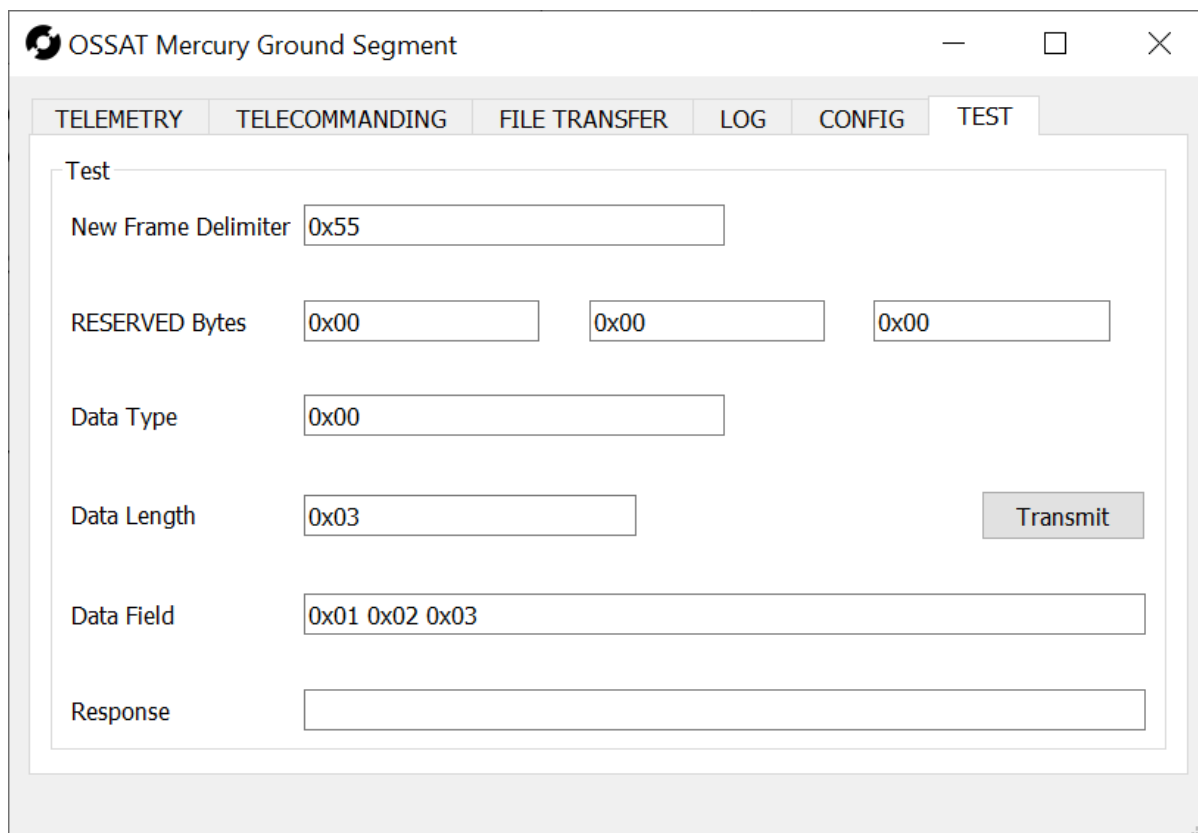
This tab can be used to adjust parameters of Mercury GS. You can change the Continuous Transmission rate in the “TC/TLM Rate” field. Or change the timeout period in the “TC/TLM Timeout” field.

You can also adjust the baud rate that Mercury GS talks over the serial port with the “Comms baud” drop down menu, as well as change the Com Port used with the “Com Port” drop down menu.

All of these configurations can be changed by uploading a config file. This is done using the “Config file” field. NOTE: This feature is not yet implemented.

4.7 Test

We may want to test the capability of the Spacecraft to handle invalid frames. The Test tab is used to do this by creating frames that ignore Mercury's communications protocol and are just sent directly. This tab is shown below.



The screenshot shows the 'OSSAT Mercury Ground Segment' application window with the 'TEST' tab selected. The interface includes the following fields and controls:

- TELEMETRY** | **TELECOMMANDING** | **FILE TRANSFER** | **LOG** | **CONFIG** | **TEST**
- Test** (Section Header)
- New Frame Delimiter**: Input field containing '0x55'.
- RESERVED Bytes**: Three input fields, each containing '0x00'.
- Data Type**: Input field containing '0x00'.
- Data Length**: Input field containing '0x03'.
- Transmit**: A button to send the frame.
- Data Field**: Input field containing '0x01 0x02 0x03'.
- Response**: An empty input field for the received data.

Create your message by filling in the fields with the hexadecimal values of the message you wish to send. And then press the “Transmit” button. All data received back from the Spacecraft within a one second window will be displayed in the “Response” field.



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