



**OPEN  
SOURCE  
SATELLITE**

# Mercury GS Manual

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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]
KS-DOC-01056	OSSAT Glossary	[OSSAT Glossary]

## 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 on the use of the Mercury GS Ground Station Software. Terminology related to the Space Industry shall be used in this document. For further information regarding these terms, see the OSSAT 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 a 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.**

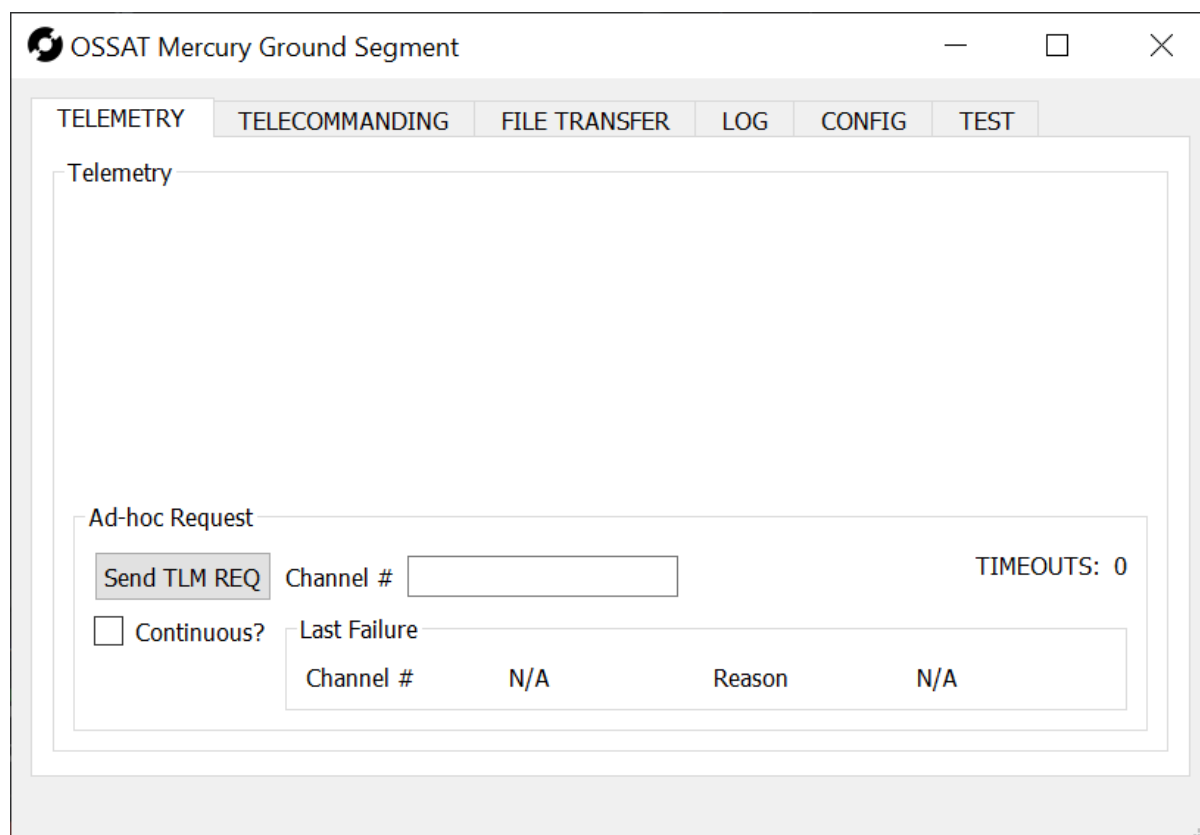
### 4.2 Testing Setup

To test this software without a satellite, you will need a terminal program and to set up two COM ports that are connected together. We suggest the use of Tera Term and HHD Virtual Serial Port Tools (<https://freevirtualserialports.com/>).

Detailed steps to achieve this setup are described in the Readme of the repository.

## 4.3 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.



### 4.3.1 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 a lack of response within a timeout period.

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.

### 4.3.2 Sending A Telemetry Request Continuously

A Telemetry Request can be sent repeatedly to stress test the connection.

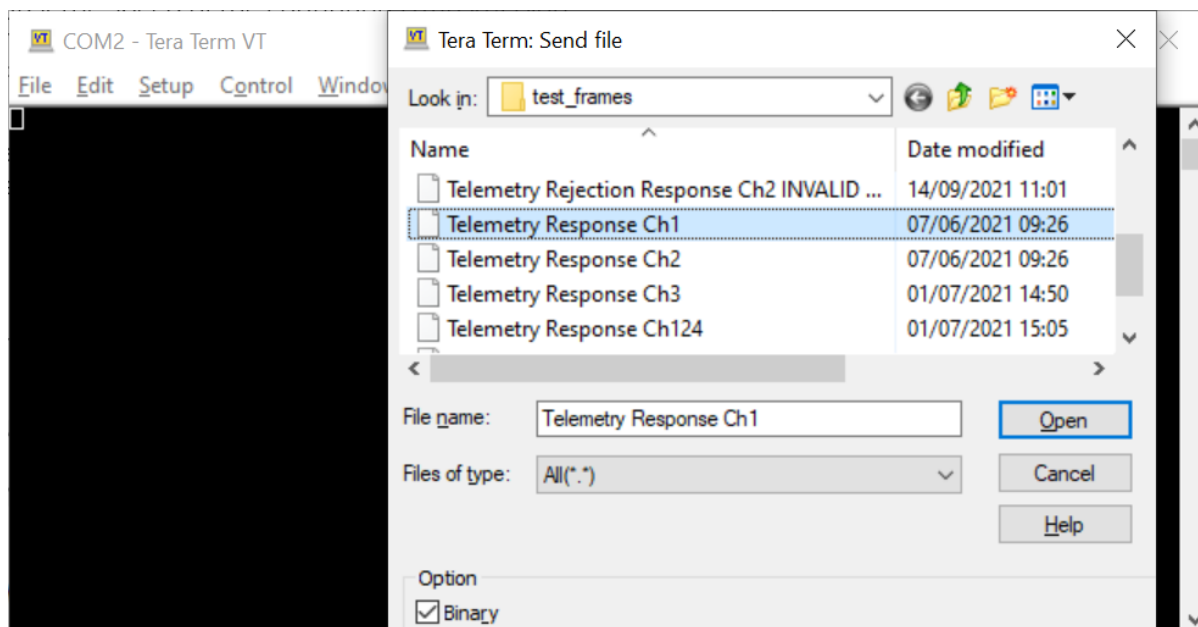
To send a Telemetry Request continuously, follow these steps:

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.

### 4.3.3 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, instead, we can use a terminal program (the steps required to setup the COM ports and a terminal are described in the repository README). Pull open your favourite 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

#### 4.3.4 Receiving a Telemetry Rejection Response

Similar 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?

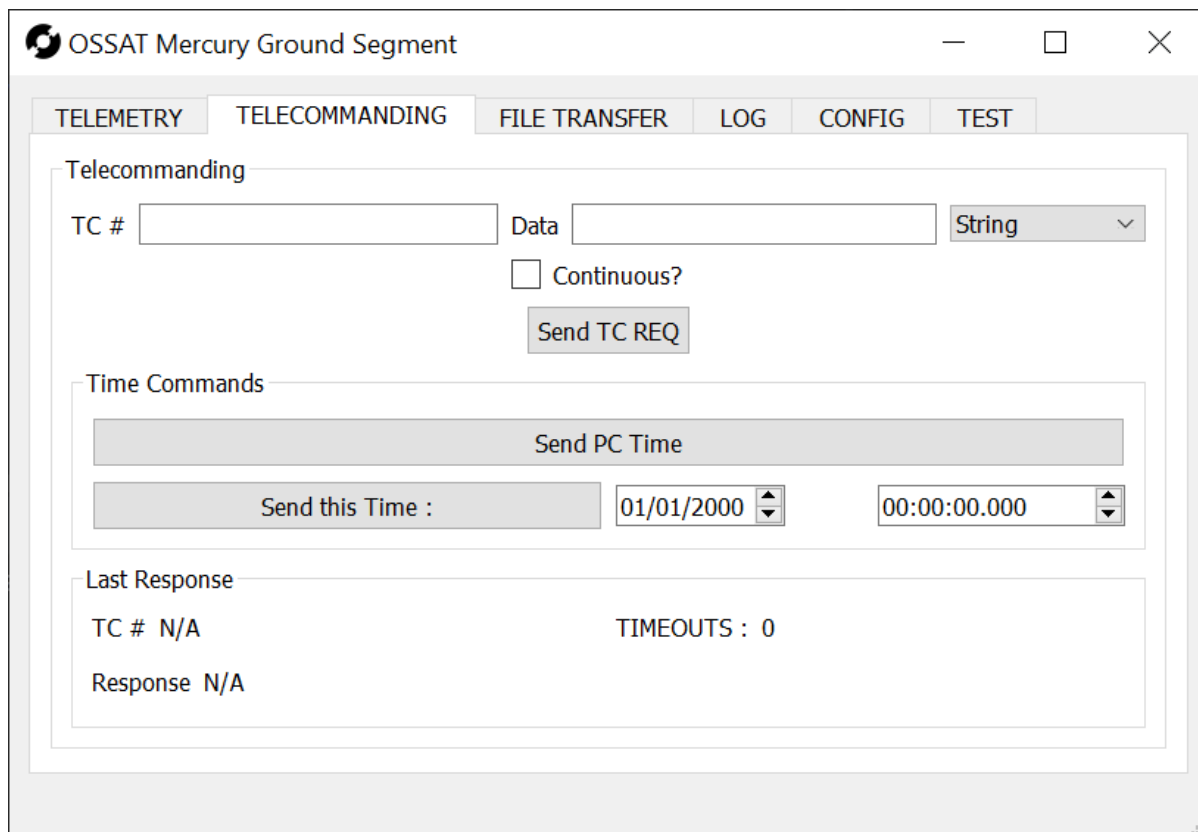
Last Failure

Channel #
Reason

1
CHANNEL\_NOT\_SUPPORTED

## 4.4 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' application window. The 'TELECOMMANDING' tab is selected. The interface includes a 'Telecommanding' section with a 'TC #' input field, a 'Data' input field, and a dropdown menu set to 'String'. There is 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 (01/01/2000 and 00:00:00.000). At the bottom is a 'Last Response' section showing 'TC # N/A', 'Response N/A', and 'TIMEOUTS : 0'.

### 4.4.1 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 data 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. Continuous Rate and Timeout period can be configured in the CONFIG tab.

### 4.4.2 Sending the Time

From Release 2.2, you will be able to transmit a Telecommand Request that specifically sends the time to the Spacecraft. To do this either:

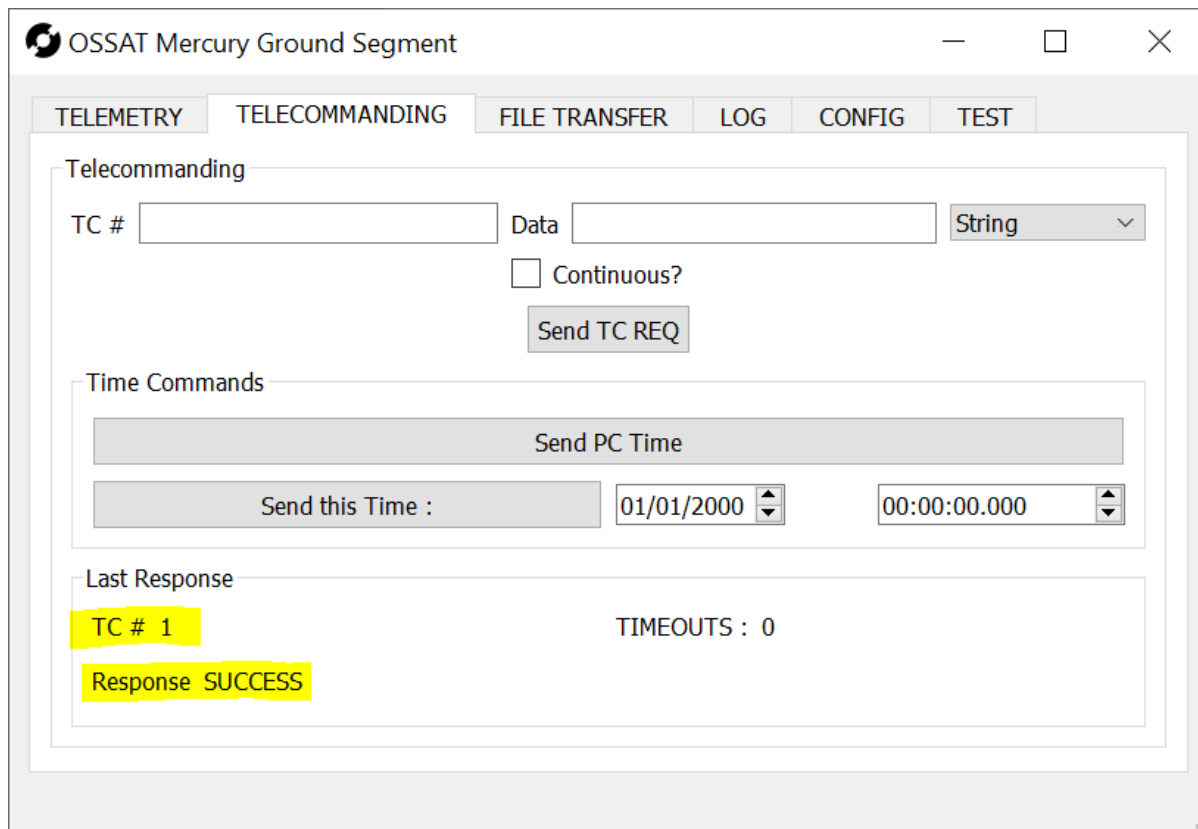
- Press the "Send PC Time" button.



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

#### 4.4.3 Receiving a Telecommand Response

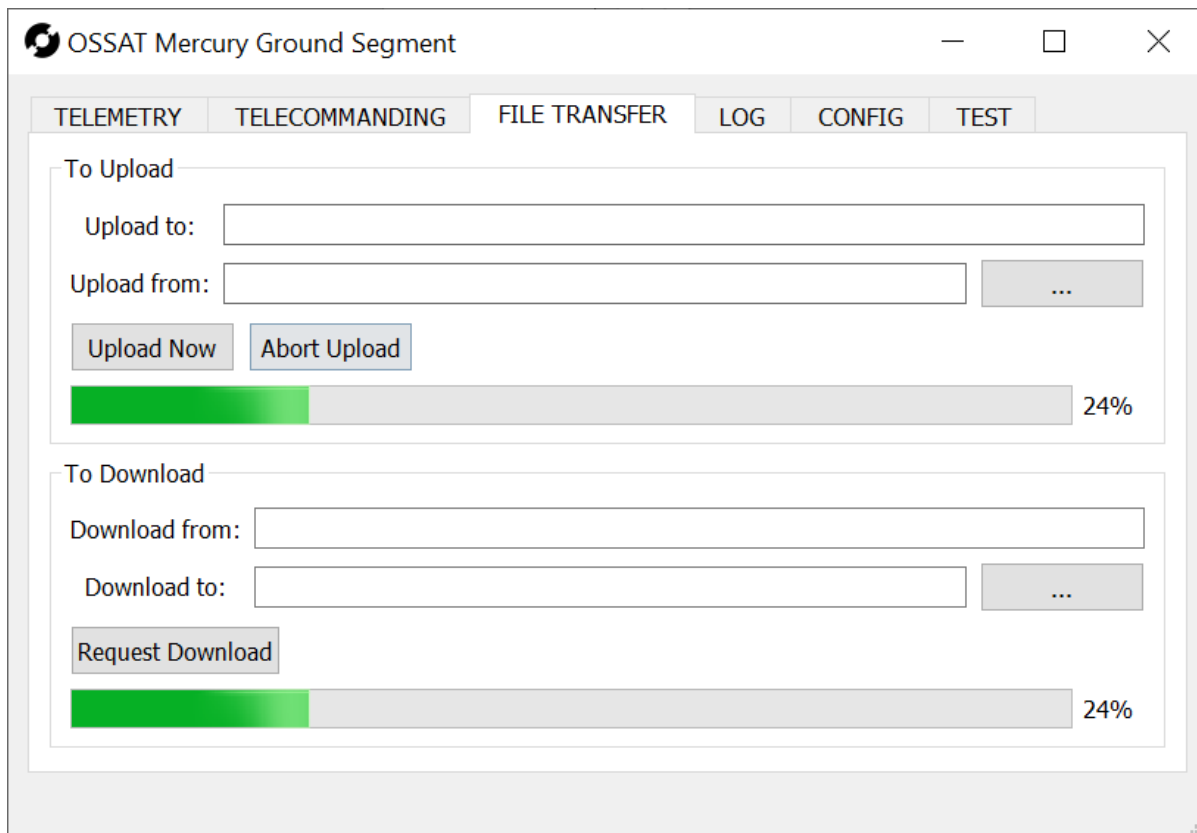
We can also receive a response to a sent Telecommand. To do so follow the same steps as 4.3.3 (Receiving A Telemetry Response), but instead of sending a Telemetry Response, send a Telecommand Response. This will show under the “Last Response” section.



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 includes a 'Send PC Time' button and a 'Send this Time :' button. To the right of the 'Send this Time :' button are two date/time input fields: '01/01/2000' and '00:00:00.000'. The 'Last Response' section displays 'TC # 1' and 'TIMEOUTS : 0'. Below this, the 'Response' is shown as 'SUCCESS'.

## 4.5 File Transfer

From Release 3.0, the tab shown below will be functional.



The screenshot shows the 'FILE TRANSFER' tab in the 'OSSAT Mercury Ground Segment' application. The interface is divided into two main sections: 'To Upload' and 'To Download'.

**To Upload Section:**

- 'Upload to:' text input field.
- 'Upload from:' text input field with a file selection button (three dots).
- 'Upload Now' button (green) and 'Abort Upload' button (grey).
- A progress bar showing 24% completion.

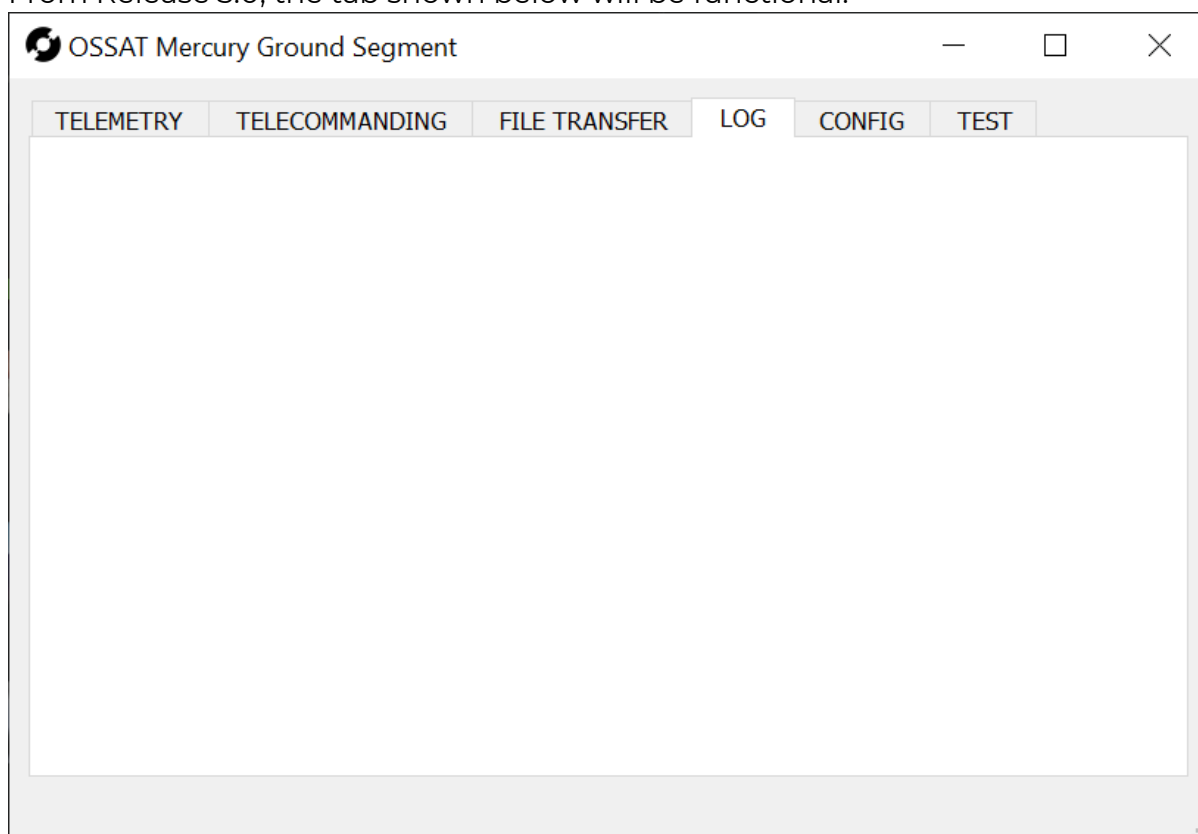
**To Download Section:**

- 'Download from:' text input field.
- 'Download to:' text input field with a file selection button (three dots).
- 'Request Download' button (green).
- A progress bar showing 24% completion.

The application window has a title bar with the OSSAT logo and the text 'OSSAT Mercury Ground Segment'. The tabs at the top are 'TELEMETRY', 'TELECOMMANDING', 'FILE TRANSFER' (active), 'LOG', 'CONFIG', and 'TEST'.

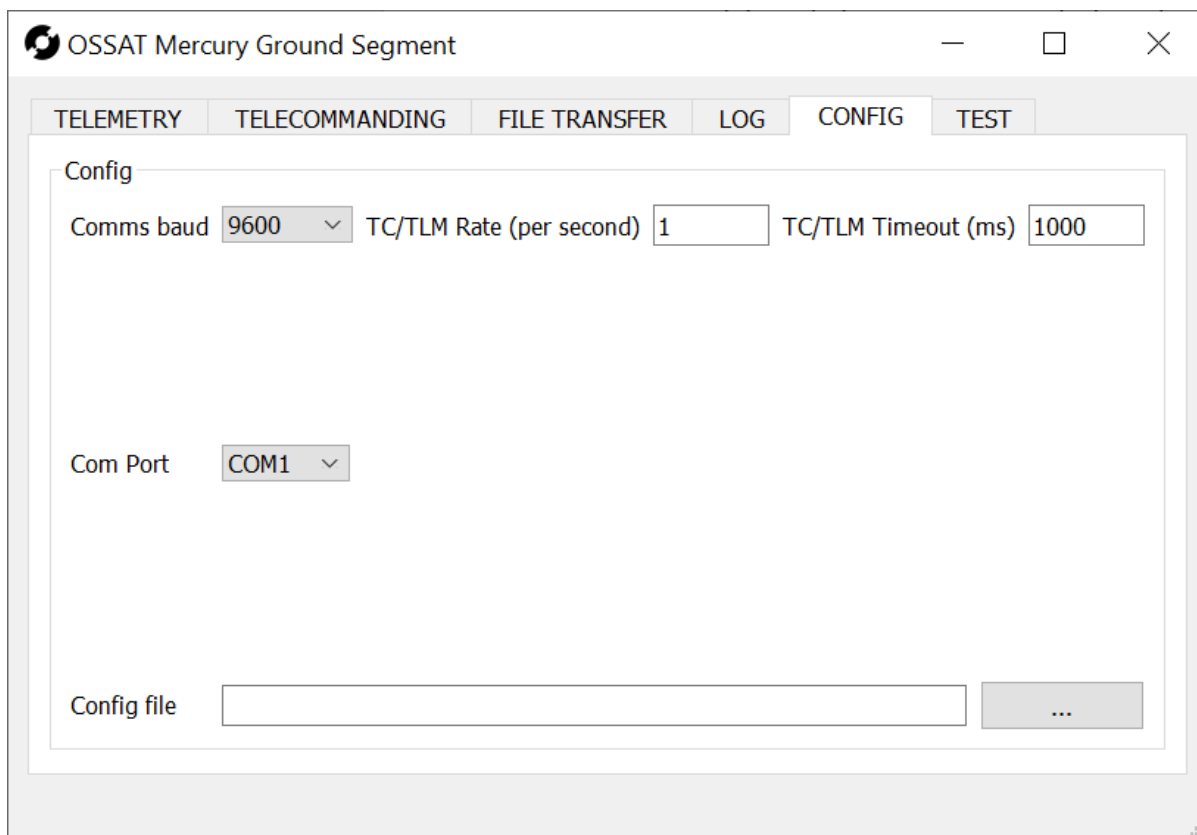
## 4.6 Log

From Release 3.0, the tab shown below will be functional.



## 4.7 Config

The below image shows the Config tab.



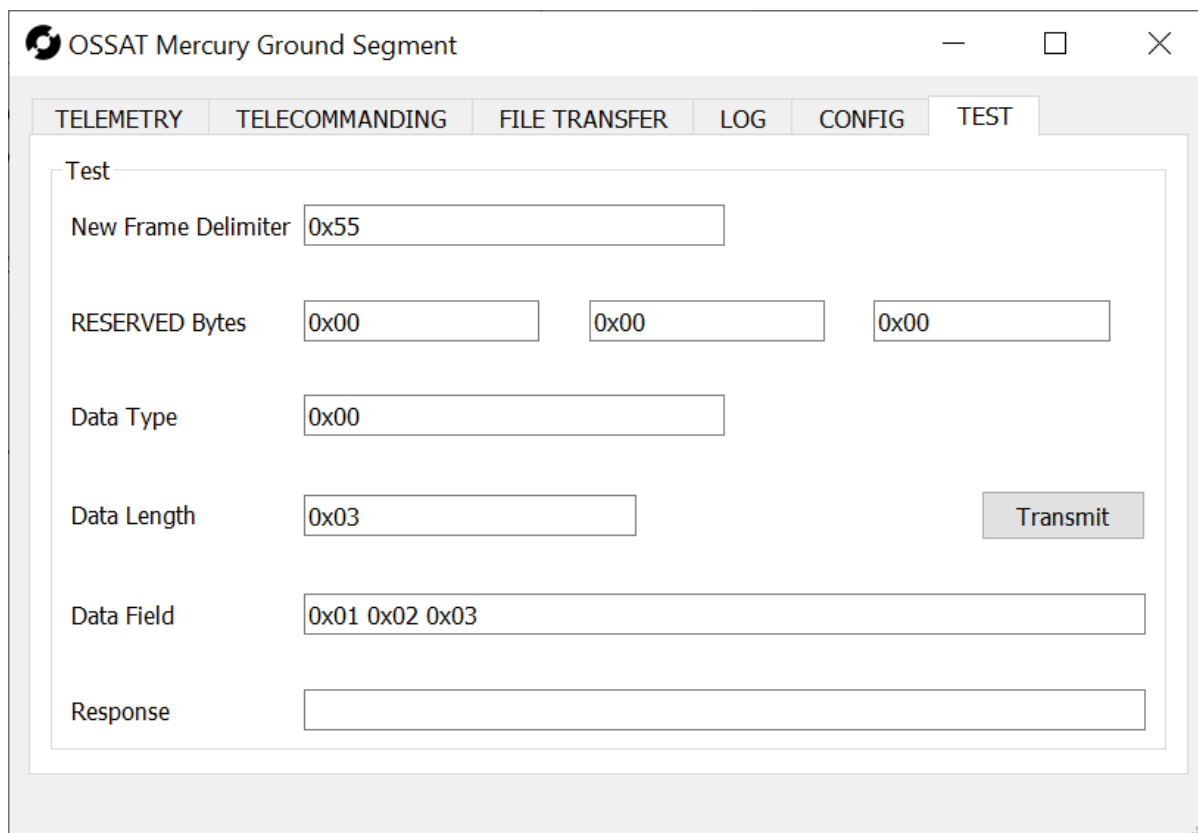
This tab can be used to adjust parameters of Mercury GS. You can change the Continuous Transmission rate in the “TC/TLM Rate” field. Or change the timeout period in the “TC/TLM Timeout” field.

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 using 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.

## 4.8 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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