

EMCGUI – User Guide

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Getting Started

Overview:

The purpose of EMCGUI is to provide a simpler way to interact with the EMC Server which sends commands to and receives data from the Motion Control flight simulator. The EMCGUI (client application) was built around the preexisting server code which is designed to communicate with the Motion Control. This has been done to improve data collection without tempering with the Motion Control's code. Because of this setup, running the entire system only requires direct interaction with the client application. However, basic knowledge of how all three components communicate is important to understand the function of the client. Necessary information on all three systems is given in this guide.

About Motion Control:

The Motion Control is a flight simulation system capable of movement with six degrees of freedom. Using the server, the pitch, roll, yaw, heave, horizontal, and planetary movement of the system can be controlled. The Motion Control system is used by researchers to conduct research relating to environmental risk factors faced by military pilots.

About the EMC Server:

The EMC server is a program that connects the client application to the motion control. The server is responsible for sending user commands to and collecting data from Motion Control. User commands are passed to the server from the client via UDP. The server is also responsible for passing runtime data to the client for the user to view.

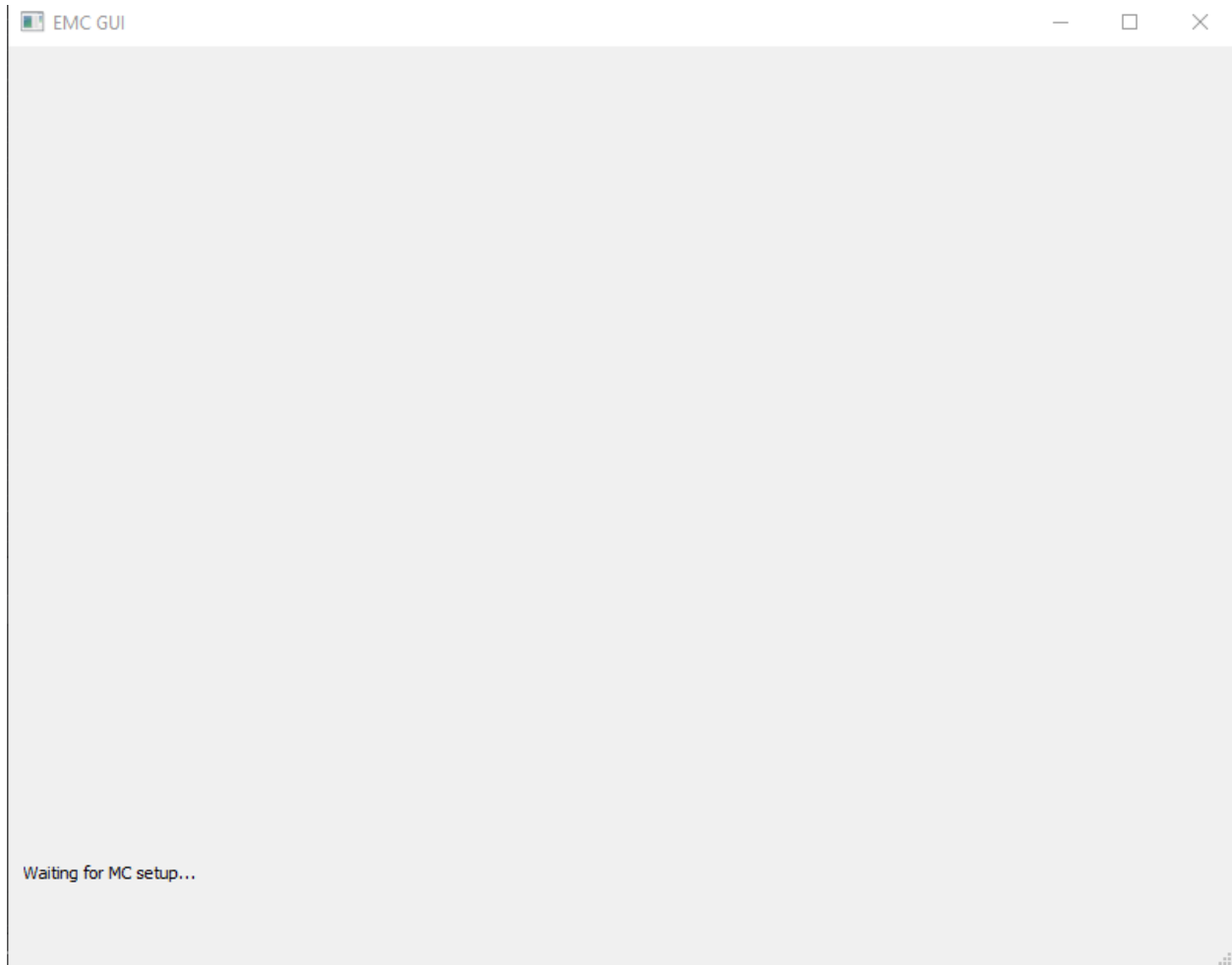
About the Client:

The client application (EMCGUI) is the software that allows the user to interact with the EMC Server. All user input is collected through the client and sent by the client to the server. User input collected by the client is used to control the Motion Control system, but the client does not directly communicate with Motion Control. All communication is done through the server.

Client Functions

The Main Window:

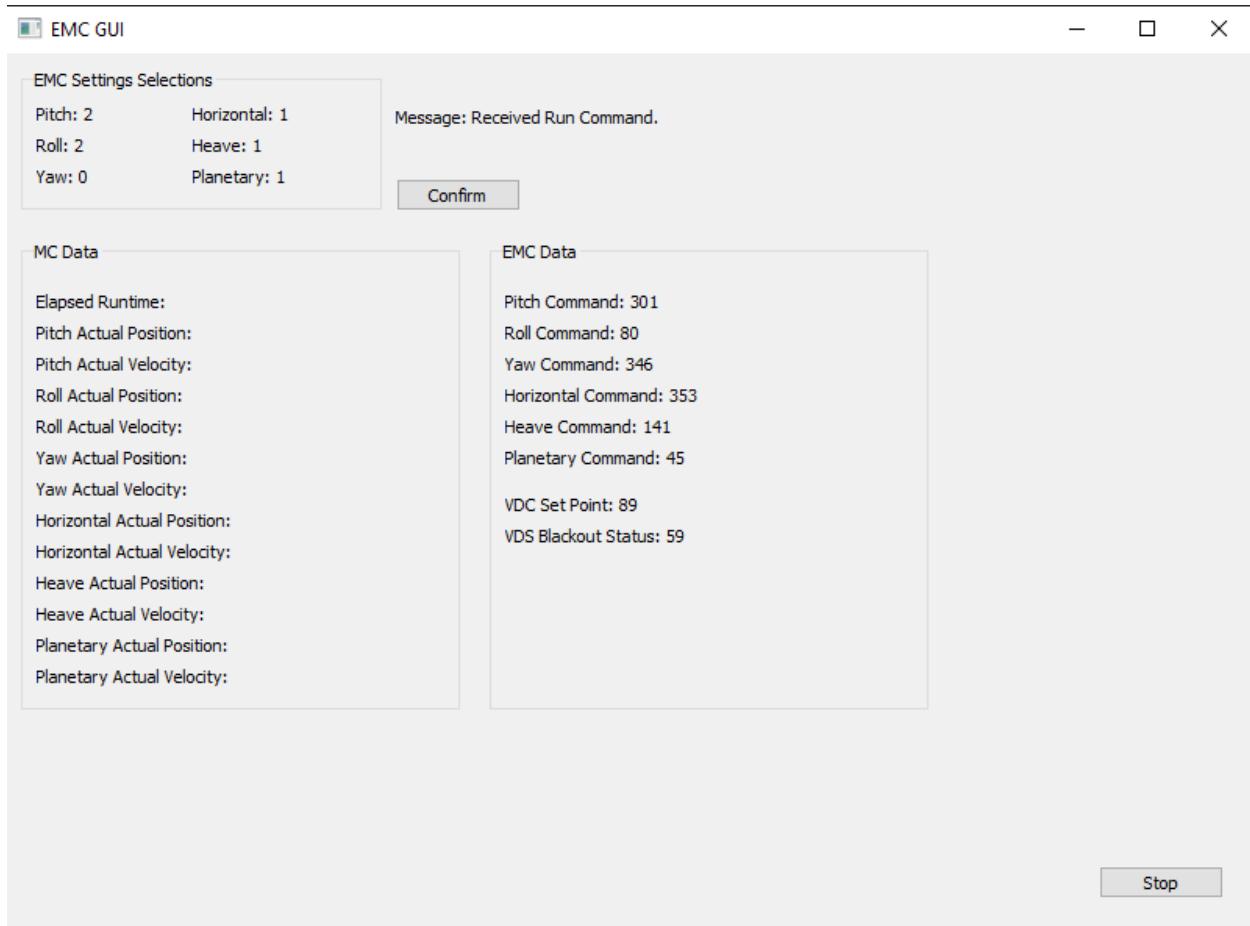
The Main Window has two modes: wait mode and data collection mode. On startup, the client will be in wait mode. At this point, the client is waiting for a run setup message from the server and the user cannot interact with the application until the command is received. Upon receiving the command, the client will exit wait mode.



The EMCGUI Main Window in wait mode.

In data collection mode, the main window has several components.

1. Settings display: Shows the user what settings values have been selected. These are the EMC settings values that will be sent to the server.
2. Settings Confirmation: Pressing this button sends the current settings selections to the server.
3. Message Window: Shows the most recent message received from the server. This message may be a command notification, or a string of runtime data.
4. MC Data: Shows current Motion Control data values. Updates every 8ms during data collection.
5. EMC Data: Shows current EMC data values. Updates every 8ms during data collection.
6. Stop Button: Sends a command to the server to stop data collection. Ends UDP connection to the server.



The EMCGUI Main Window during data collection.

The Settings Window:

The settings window is automatically displayed to the user after a run setup command has been received from the server. It is necessary for data collection that the user select motion type settings, so the user must select an option from each of the six categories before closing the window. The user can select a motion type for each of the categories by clicking one of the radio buttons in each of the six boxes or press the "Use Default" button to select "Position" for every category. Pressing confirm will save the selections and return the user to the main window.

The screenshot shows the 'EMC Settings' window with six radio button groups for different motion types. Each group has three options: 'No Motion', 'Position', and 'Velocity'. The 'Pitch Motion Type' group has 'Velocity' selected. The 'Horizontal Motion Type' group has 'Position' selected. The 'Roll Motion Type' group has 'Velocity' selected. The 'Heave Motion Type' group has 'Position' selected. The 'Yaw Motion Type' group has 'No Motion' selected. The 'Planetary Motion Type' group has 'Position' selected. At the bottom, there are two buttons: 'Use Default' and 'Confirm'.

Motion Type	No Motion	Position	Velocity
Pitch Motion Type	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Horizontal Motion Type	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Roll Motion Type	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Heave Motion Type	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Yaw Motion Type	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planetary Motion Type	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

The EMCGUI Settings Window

Server Functions:

The purpose of the EMC Server is to send user commands to Motion Control. All commands sent by the client to the server are immediately passed to Motion Control. All data collected from Motion Control is sent directly to the client.

Client Connection:

The server communicates with the client using a UDP connection. Data is both sent and received using this connection.

Sent Data:

Run Setup Command – Notifies the client that a run setup command has been received from Motion Control. Tells the user to select motion type settings.

MC Run Command – Notifies the client that the Motion Control is running. Tells the client to listen for data.

MC Runtime Data – Data indicating the current position and velocity of Motion Control. Updated every 8ms during a run.

EMC Runtime Data – Data indicating the current motion command values that the server sends to the Motion Control system.

MC Stop Command – Indicates that Motion Control has sent a stop command. Tells the client to stop listening for data and close the connection.

Received Data:

EMC Runtime Settings – Motion type settings selected by the user. To be used by the server and Motion Control as runtime motion type parameters.

Stop Command – Command from the user to stop the Motion Control.

Motion Control Connection:

The server must also communicate with the Motion Control System. One-time commands are sent and received using a TCP connection. Runtime data is sent and received using a UDP connection.

Sent Data:

EMC Runtime Settings – Data received from the client that is passed on to Motion Control to use as motion type settings during runtime.

EMC Runtime Data – Data indicating the current motion command values that the server sends to the Motion Control system.

Stop Command – Command received from client indicating that the user has stopped the run. Tells the Motion Control to stop sending data.

Received Data:

Run Setup Command – Message from Motion Control requesting motion type parameters. Indicates that Motion Control is waiting for parameters before starting a run.

Run Command – Indicates that Motion Control is running. Tells the server to listen for MC data and start sending EMC data.

MC Runtime Data – Data indicating the current position and velocity of Motion Control. Updated every 8ms during a run.

MC Stop Command – Indicates that Motion Control has stopped. Tells the server to stop listening for and sending data.

Running a Flight Simulation:

All three programs described in this guide are used in running a flight simulation. A strict order of operations is followed to ensure the system works. The user does not need to worry too much about proper order, as this is taken care of in the client and server code. The user can follow a step-by-step process to operate the system from the client.

Setting Up the Connection:

1. Turn on the server

In a Linux terminal on the server machine, run the command `“./emcserv”`. This will start the server, which will listen for a run setup command from Motion Control. Once the server is running, all further interaction with it can be done using the client application.

2. Turn on the client

On the client machine, run `EMCGUI.exe`. This will start the client program, which will listen for a run setup command from the server.

3. Run Motion Control

At this point, both the client and the server should be listening for a run setup command from the Motion Control. Start up the Motion Control, and send a run setup command to the server. This will establish a TCP connection between the server and Motion Control. The server will pass this message to the client, establishing a connection between all three programs.

Setting Up a Run:

4. Select Motion Type Settings

Once the client has received the run setup command, the motion type settings window will be displayed to the user. Here, a motion type parameter can be selected for each of the six types of movement possible for Motion Control. The user can save their selection by pressing the “confirm” button in the settings window, and then the “Send Settings” button in the main window.

Collecting Data:

5. Once the Motion Control begins running, it will send a run command to the server. The user will be notified with a message that data collection has begun. At this point, the server will continuously send its own data along with any data it receives from Motion Control. All data will be displayed in the main window.

Ending A Run:

6. Data collection can be stopped by the user or by Motion Control. If Motion Control stops a run, it will send a message to the server, which will be passed to the client. This notifies the client and server that the run has ended and that the connection should be closed. The user may also end the run by pressing the Stop button. This will send a message to the server and close the connection.

FAQ:

What is EMCGUI?

EMCGUI is the client application that communicates with the EMC server to operate the Motion Control system. EMCGUI allows the user to send commands to Motion Control and collect runtime data via the server.

Why use EMCGUI?

Connecting directly to the EMC server is done using remote SSH on the command line. EMCGUI is a cross-platform application with a user-friendly UI designed to make data collection and MC operation more convenient.

How does EMCGUI connect to Motion Control?

Communication is done by passing messages through the EMC server. EMCGUI automatically connects to the server on startup using a UDP connection. While connected, the client listens for messages from the server using a designated port. The connection can be ended at any time by pressing the stop button.