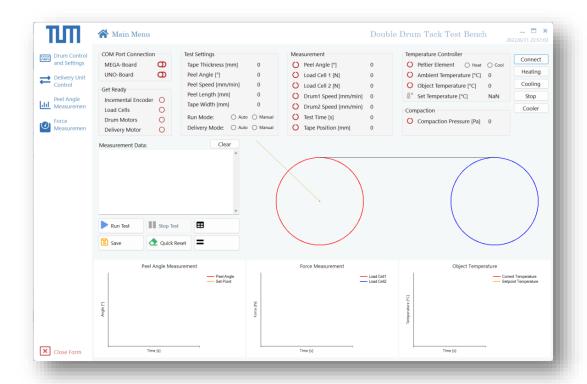
User Guide

For Double Drum Tack Test Bench Desktop Application "DDT Testbench"



Introduction

Welcome to DDT Testbench! This guide enables you to make the most of your installation. The DDT Testbench desktop application is developed by Tianheng Wu in the thesis "Automation of a Test Bench for Measuring the Tackiness of Pre-impregnated Carbon Fibers (Towpregs)" as a control interface for the double drum tack test bench.

In order to achieve the best possible results with DDT Testbench, it is recommended that your computer is configured accordingly:

- Use a computer with Windows system.
- Set the display scaling size as 125%, so that in all layouts can be fully displayed and avoid using scroll bars to operate.

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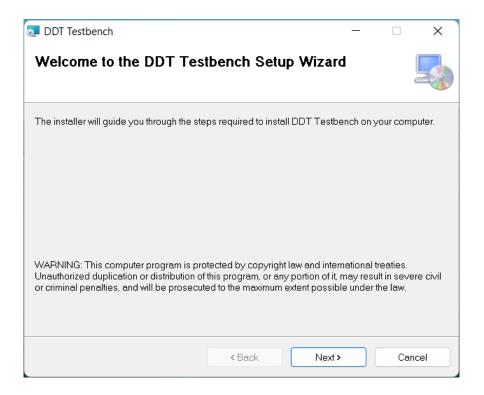
1 Installation and Overview

1.1 Installation

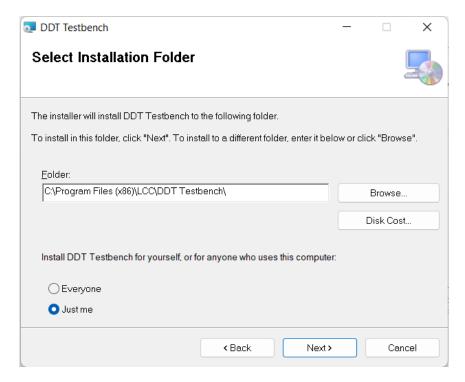
The installation package of DDT Testbench includes "DDT Testbench.msi" and "setup.exe" as shown below:



Please put these two files in the same directory so that you can start the installation successfully without error. After you open any of these files the installer will appear as follows:



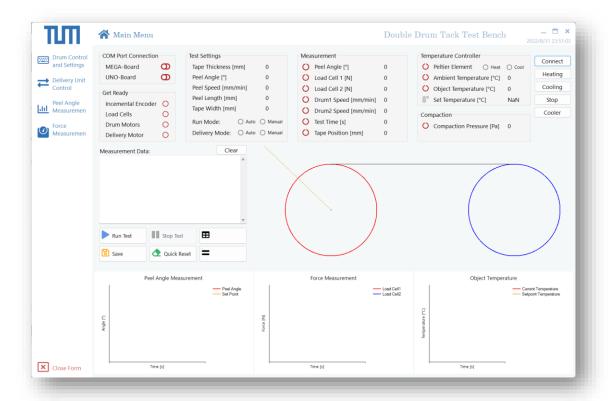
Then click Next to Select Installation Folder, the default installation folder path is: C:\Program Files (x86)\LCC\DDT Testbench, you can change the path or rename the folder name as you like.



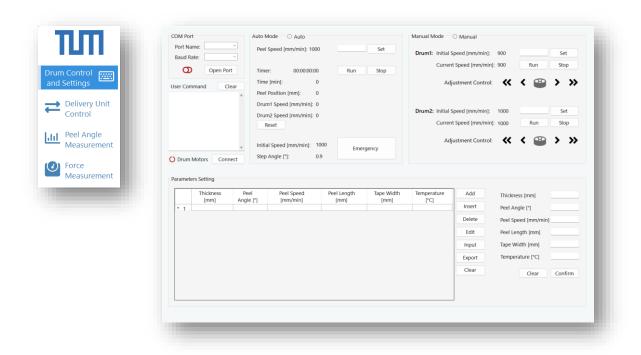
Then follow the installer step by step and select Next until the installation is complete. Close the installer and enjoy your test!

1.2 Overview

After opening DDT Testbench from your desktop and you can see the main menu directly as follows:



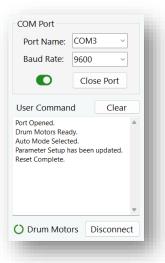
Click buttons on the left menu bar to select the section that you want to use, and the corresponding interface will be opened and displayed in the right part.

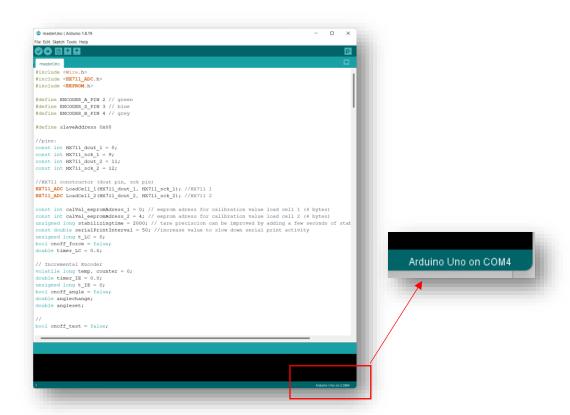


There are 5 main sections in DDT Testbench, Drum Control and Settings, Delivery Unit Control, Peel Angle Measurement, Force Measurement and Main Menu. The Main Menu is used for monitoring and control the entire testing process, and others can be used to test sensors or set test parameters.

2 Serial Port Communication

This application needs to be connected to two Arduinos to be able to use all functions. There are COM Port combo boxes in all control parts. You need to select the correct COM Name which can be checked in Arduino IDE software as shown in figure. The baud rate will be set automatically to 9600 (MEGA) or 57600 (UNO) depending on the Arduino board type. If the port is opened or closed, a corresponding feedback will be given in the text box.

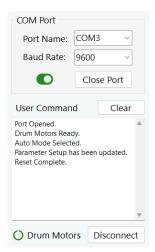




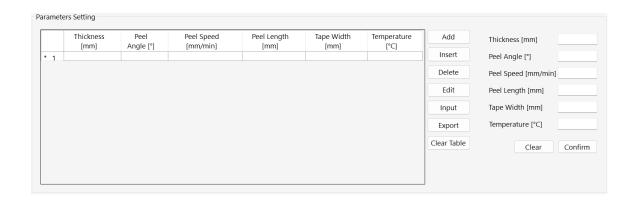
3 Parameter Settings and Drum Control

3.1 Parameter Settings

Before making any operation, it is recommended to connect to Arduino board first in COM Port box. Please check chapter 2 for more details.



When you are preparing for a test, you need to input all the parameters and click Confirm button to upgrade the value, or you can input the parameter setting files from the Excel file into the application and select one row that you need by double-clicking the row.



Add: Add a set of parameters in the last row of the table

Insert: Insert a set of parameters before the selected row

Delete: Delete the selected row

Edit: Change parameters in the selected row

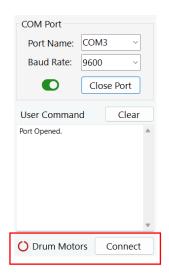
Input: Input Excel file with multiple sets of parameters

Export: Export all sets of parameters in the table

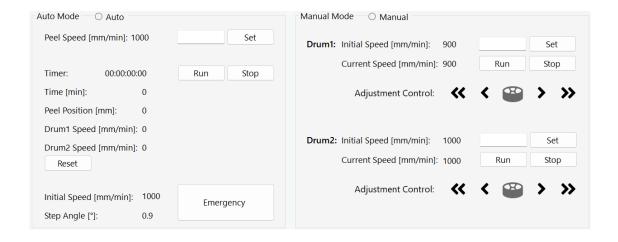
Clear Table: Clear all parameters in the table

3.2 Drum Control

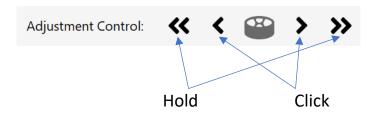
If you want to test the drums and motors, you can also set peel speed in auto mode or set drum speed in manual mode. Before the operation, please click Connect button to connect this app to motors first.



Notice: Click Disconnect to disable motor driver when motors are idle, so that the power is cut off to avoid overheating and damage.



Please click the radio button Auto or Manual to select the motor mode and then proceed to the next step. In the manual mode, you can control two drums separately. There are 4 arrow buttons in adjustment control part:

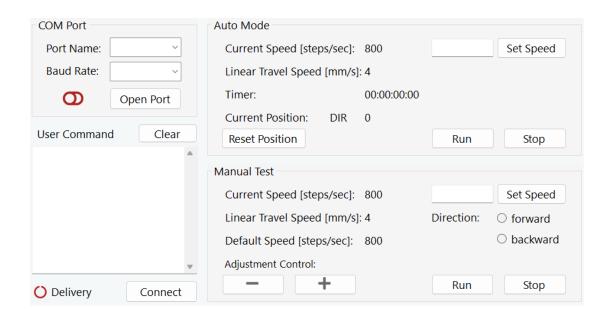


Left means counterclockwise and right means clockwise. Hold the double arrow button to keep the drum rotating in the corresponding direction and release to stop. Click the arrow button to run the motor in a small step for an adjustment.

4 Delivery Unit Control

The delivery unit control part is used to test the motor of the delivery unit. You need to open the port to connect to Arduino MEGA board.

Notice: If you have already opened the serial port in either of Drum Control and Settings or Delivery Unit Control, and connected to Arduino MEGA, serial ports in both combo boxes will show that they are open. You don't need to do this twice.



Auto Mode: The motor will continuously reverse the direction of motion in different intervals.

You can set the motor speed to change the linear travel speed of the lead screw. The conversion factor is 0.005, this means for example:

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1000 steps/sec (motor speed) = 1000 * 0.005 = 5 mm/s (linear travel speed)
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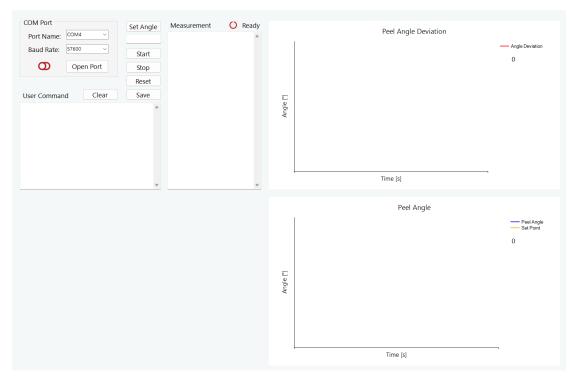
The current position and direction will be displayed (+ means forward, - means backward), so that you can adjust the speed of the motor to match the actual transmission, in order to achieve the requirement to keep the towpregs delivery route a straight line.

Manual Test: The motor will run continuously according to the direction and speed you set.

Hold to run the motor counterclockwise and hold to run it clockwise continuously at a relatively slow speed. (200 steps/sec)

5 Peel Angle Measurement

The peel angle measurement part is used to test the incremental encoder and measure the peel angle during the testing process.



Here you need to connect to Arduino UNO for the data acquisition. Once the port is opened, the text box will give you a prompt to wait a few seconds before continuing. This is for sensor startup, which is necessary for measurement stability and accuracy.

Notice: Even if you have set the peel angle in parameter settings, you still need to set it again here to make sure the angle measurement is ready for the testing process. If you have set it in parameters settings, the peel angle will be automatically shown in the text box, and just click Set Angle button.

The entire measurement data will be saved in the text box (Measurement) in real time. The current measured data will be displayed under chart series as below:

Start: Start a peel angle measurement after setting the target peel angle.

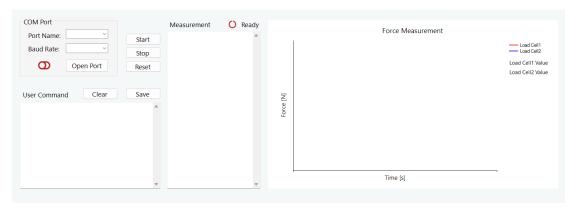
Stop: Stop the current measurement.

Reset: Clear data and charts, reset time. Peel angle will not be reset.

Save: Save the measured data.

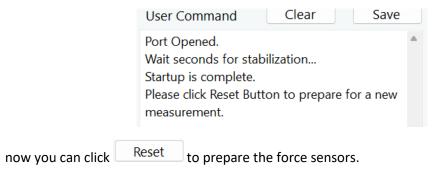
6 Force Measurement

The force measurement is used to test force sensors and measure the force during the tack testing process.

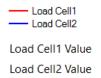


The serial port for data acquisition is the same. Analog to motor control, you only need to open the port in either measurement interface to connect to Arduino UNO, and wait seconds for the startup.

Notice: Please pay attention to the content of the text box (User Command), it will prompt you what to do. For example, you will see the text as shown below:



The entire measurement data will be saved in the text box (Measurement) in real time. The current measured data will be displayed under chart series as below:



Start: Start new force measurement after resetting.

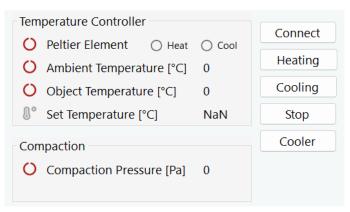
Stop: Stop the current measurement.

Reset: Clear data and charts, reset time.

Save: Save the measured data.

7 Temperature Control

The temperature control system is used to heat or cool the towpregs under different temperature conditions.

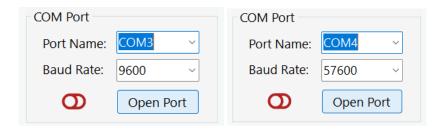


The IR temperature sensor is connected to Arduino MEGA, please open the corresponding serial port before operating. According to the measured object temperature, you can choose either Heating or Cooling to control the temperature of towpregs.

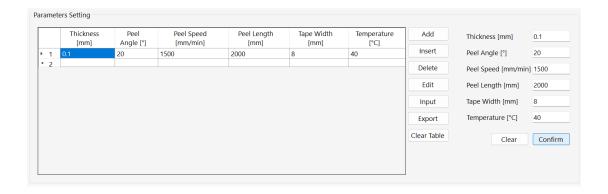
Notice: When cooling, the water cooler for the hot side of Peltier element will be turned on. If you click Stop to stop cooling, the cooler will not be turned off at the same time because we need some more time for heat dissipation. You can use Cooler button to turn it off.

How to do a complete test

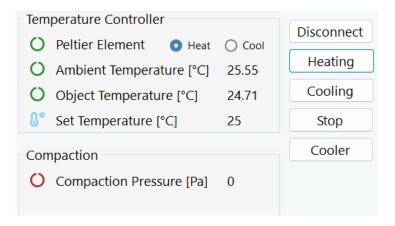
1. Connect to Arduino MEGA and UNO boards.



2. Input parameter settings.

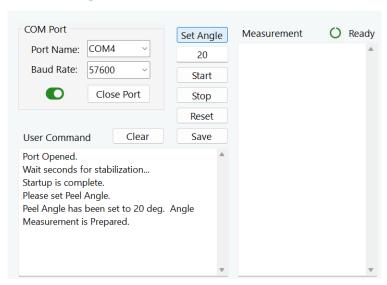


3. Enable temperature sensor using Connect button and choose Heating or Cooling depending on the setpoint temperature. Wait until the object temperature reaches the set temperature and is stable.

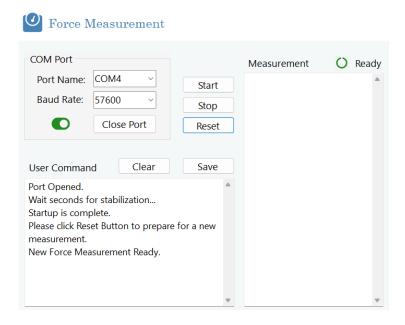


4. Set peel angle for a new measurement.

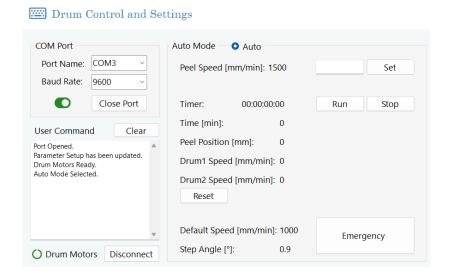
Peel Angle Measurement



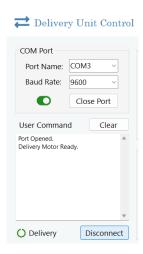
5. Reset force sensors for a new measurement.



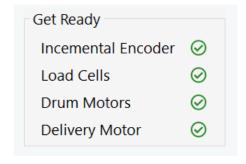
6. Enable the motor by Connect button and select Auto Mode.



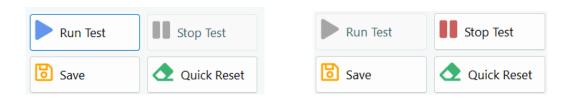
7. Enable delivery unit by Connect button to get ready.



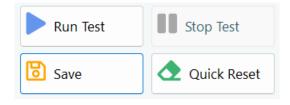
8. Go back to "Main Menu" to check if all devices are ready for the test.



9. Click Run Test to start the tack testing process, and Stop Test to stop it.



10. Click Save to save the test data for further analysis, and click Quick Reset if you want to proceed to the next test.



Common Problems

1. There is no correct COM name in combo box to select.

You should connect Arduino boards to your computer before opening the app. Close the current form by clicking Close Form button in the lower left corner and connect Arduinos to computer, then click to open the form again, the required COM will be shown now.

2. The peel angle measurement data always remains unchanged.

Please check the incremental encoder power supply wiring in the circuit.

3. The time interval of force measurement does not match the displayed time data.

You may not have the correct wiring. Please check the force sensor power supply wiring in the circuit.

4. The speed of the drum motor always remains unchanged.

You probably didn't receive the measured data from Arduino UNO. You can check the wires used for I2C communication between Arduino UNO and MEGA.