



WT-3115

Instruction Manual

DwyerOmega, Inc.

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1 INTRODUCTION

1.1 Introduction

CLWTC-1000™ is a programmable control system for automatic control of the Dwyeromega closed loop wind tunnel. The controller is connected to a PC through a USB cable for communication between the stageCONTROL-1000 software and the controller. The system is capable of controlling the air flow speed and temperature in the wind tunnel using a servo loop, measuring the instantaneous temperature and velocity of the air flow.

1.2 General Applications

Heat sink manufacturers, IC houses, board designers and other electronic manufacturers are increasingly becoming interested in evaluating the thermal performance of their product under different airflow conditions. The reduction of electronic component sizes and increase in their power dissipation has forced the electronic community to be more aware of the thermal performance of their products. The hotter the devices, the shorter their life span and the greater the likelihood of a malfunction. The general procedure for testing is to put these components in the wind tunnel and evaluate their temperature at different flow velocities and temperatures. The operator has to wait for an average of a half-hour for the component to reach the thermal equilibrium at each velocity. Typical characterization requires 5 data points with an average wait time of 3 hours. The CLWTC-1000 automates the air flow delivery process, thereby freeing the operator's time.

1.3 Identification

CLWTC-1000 is identified by a 6 digit number (i.e. A10001) located at the back of the unit.

2 HARDWARE DESCRIPTION

2.1 CLWTC-1000™ Controller

The controller is the electronic box which accepts commands from the software through the USB communication port and reports the data back to the system. It includes the circuitry for reading temperatures with a J thermocouple, velocity using a thermistor and powering the heaters and the blower. **Controller is powered by 220 VAC one phase.** Figure 1, shows the front view of the CLWTC-1000 controller.

Note: Please read the manual before operating the system.

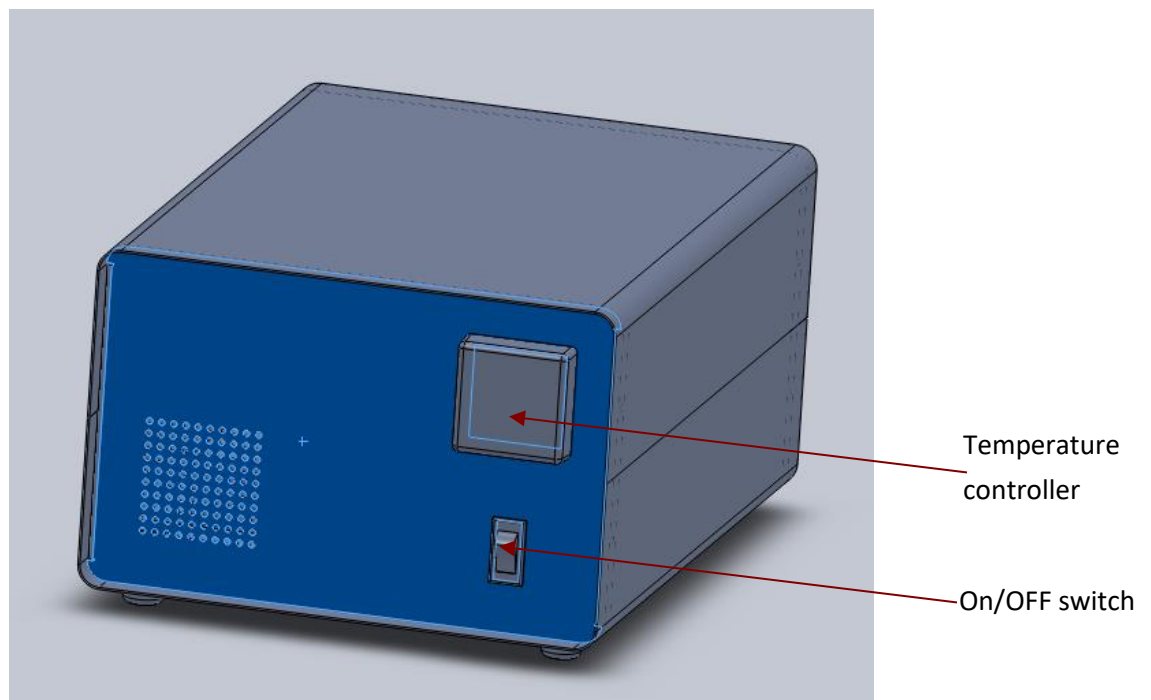


Figure 1 - Front View of the CLWTC-1000 Controller

The description of the controls on the front panel are as follows:

1. ON/OFF switch – Main switch to turn the system ON or OFF
2. Temperature Controller – The controller for controlling the temperature inside the tunnel. The control is done inside the software. This is only for visualizing the temperature on the panel.

Figure 2 shows the rear view of the controller.

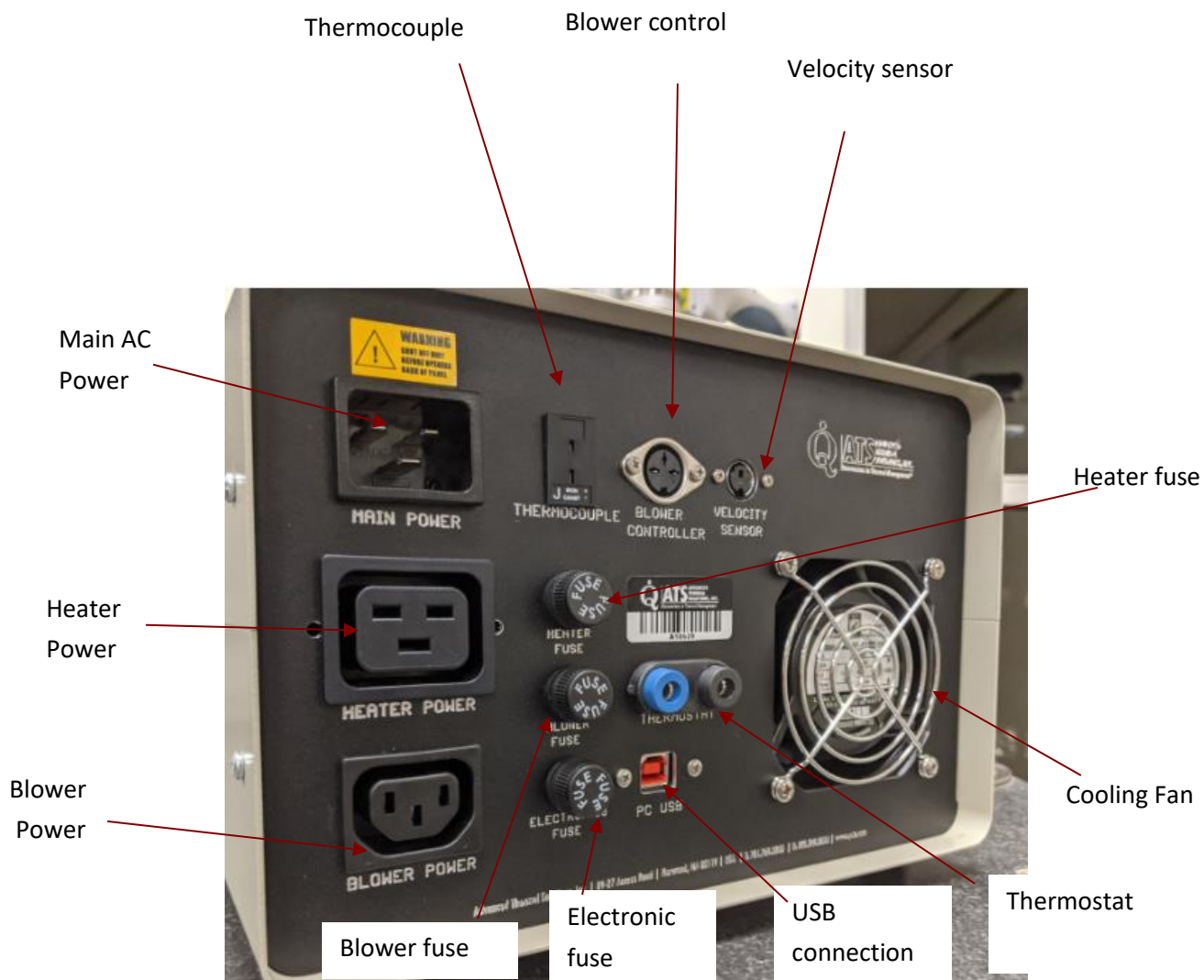


Figure 2 - Rear View of the CLWTC-1000 Controller

The function and description of ports and connectors on the front panel are as follows:

1. Main AC Power- Main power to the system for powering the system. **220 VAC one phase-20 A**
2. Heater Fuse - Fuse holder containing the fuse for the heater-20 Amps
3. Blower Fuse –Fuse holder containing the fuse for the blower- 5 Amps
4. Electronic Fuse – Fuse holder containing the fuse for the rest of the system including temperature controller, power supply and velocity measuring circuitry -5 Amps
5. Cooling Fan – Fan for cooling internal components of the system.
6. Blower Power- Connects the instrument to the blower for powering the blower
7. Heater Power- Connects the instrument to the heater for powering the heater
8. Blower control – Control signals sent to the blower via this port
9. Thermocouple – Thermocouple connection for maintaining and measuring the air flow inside the wind tunnel (**J type**)
10. Velocity Sensor - Velocity sensor connection for controlling and measuring the air flow inside the wind tunnel .
11. Thermostat—The two banana plug wires connect the controller to the wind tunnel. If the temperature inside the wind tunnel heater section gets to a high level (around 120 C), thermostat disconnects the power to the heaters for safety. Once the temperature gets to a safe level, it connects the circuit.

2.2 Velocity Monitoring

Each CLWTC-1000™ unit is supplied with a velocity sensor. These sensors are especially calibrated for measurement in flows ranging from 0 to 1000 ft/min (5 m/s). The sensors are used for monitoring the air velocity at any location in the wind tunnel for controlling the blower speed and flow using a feedback control servo loop. The calibration coefficients for each sensor are provided for every unit.

2.3 Temperature Monitoring

Each CLWTC-1000™ unit is supplied with a J thermocouple to measure the temperature inside the tunnel test section. The temperature feedback loop uses this temperature data to control the wind tunnel temperature to the set point. **Whenever software is run the cycle and stops, it automatically sets the wind tunnel temperature to 20 °C for safety. If the power goes off or user shuts the power to the controller and turns it on later, temperature automatically is set to -10 °C. User has to press the EZ button (RED) on the controller to let the instrument be able to communicate with software.**

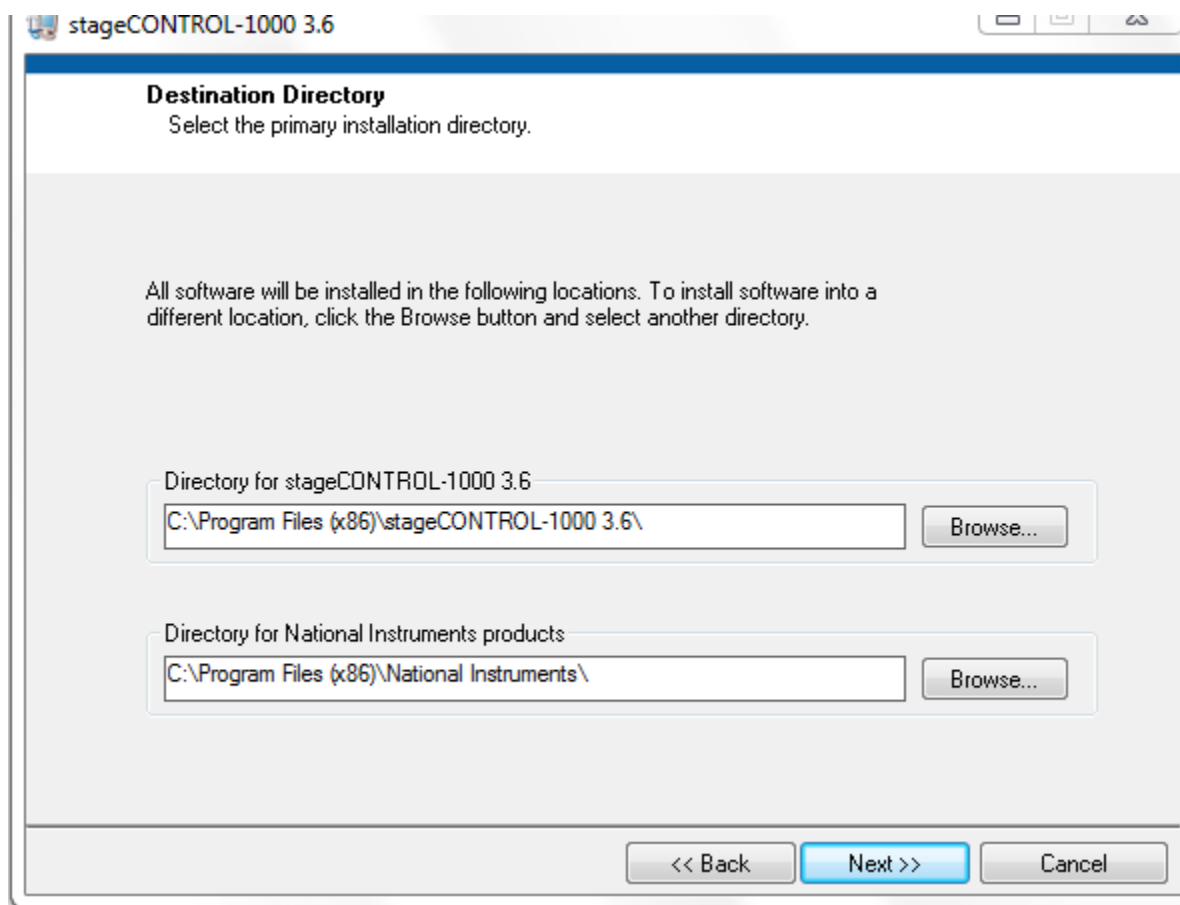
3 SOFTWARE DESCRIPTION –stageCONTROL-1000

3.1 stageCONTROL-1000 Operating Software

stageCONTROL-1000 software is a graphical user interface that communicates with the CLWTC-1000™ controller through PC USB. This software enables the user to perform an automatic flow control characterization on a test specimen. The user can automate this process by selecting a few parameters in the stageCONTROL-1000 software. The velocity sensor(candle stick) can be attached to any surface inside the wind tunnel to control the flow in the wind tunnel based on that point. The flow sensor uses the thermocouple temperature reading to calculate the velocity. It is important that the thermocouple bead placed near the flow sensor. In most applications the flow sensor and the thermocouple are installed close to the entrance of the test section.

3.2 Installation of stageCONTROL-1000 Operating Software

1. Download the manual, software and calibration file from Dwyeromega ftp site.
2. Install the software, by double clicking Installer\Volume\Setup.exe
3. Select directory for the software, see Figure 3.
4. After the installation, a shortcut of **stageCONTROL-1000 3.6** will be created in All Program \Dwyeromega and another shortcut will be created on desktop.



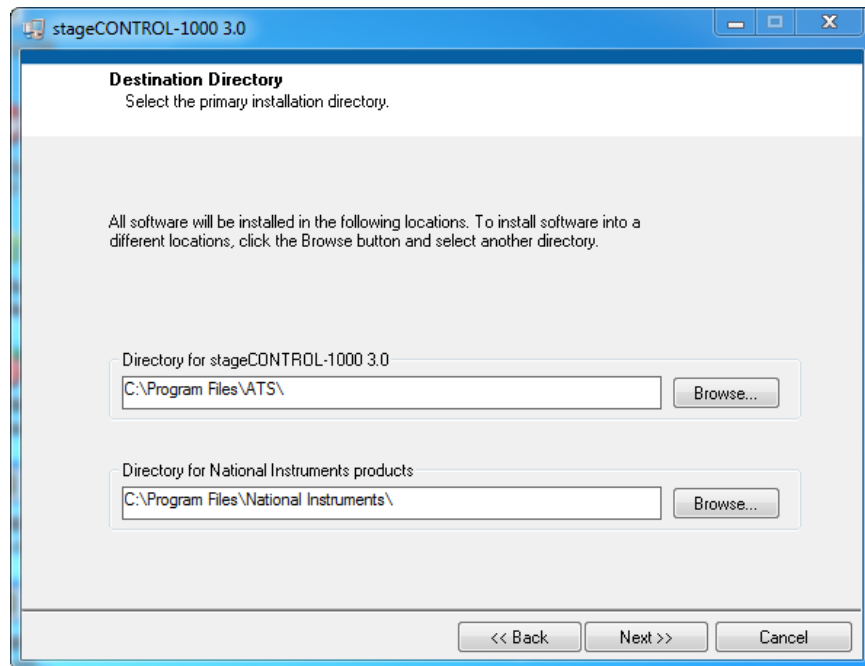


Figure 3 - Installation of stageCONTROL-1000

3.3 Installation of USB to RS485 Driver

1. Install the driver for the USB to RS485 Converter by double clicking CD\USB-to-Serial-2.08.02\Setup.exe
2. Connect the PC and CLWTC-1000 controller with a USB cable, Under PC's Device Manager\Ports (COM & LPT), a RS-485 Port will show up, see Figure 4.

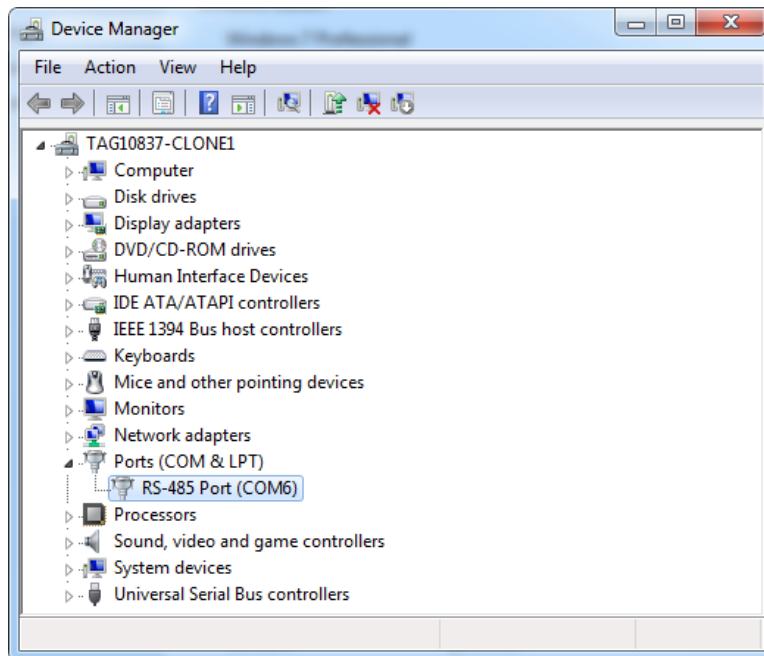


Figure 4- RS-485 Port

3.4 Operation of stageCONTROL-1000™

When you run stageCONTROL-1000 for the first time, a window (see Figure 5) will pop up asking for Calibration File. This file can be found from CD sent by Dwyeromega. You have to load this file before starting to use the stageCONTROL-1000.

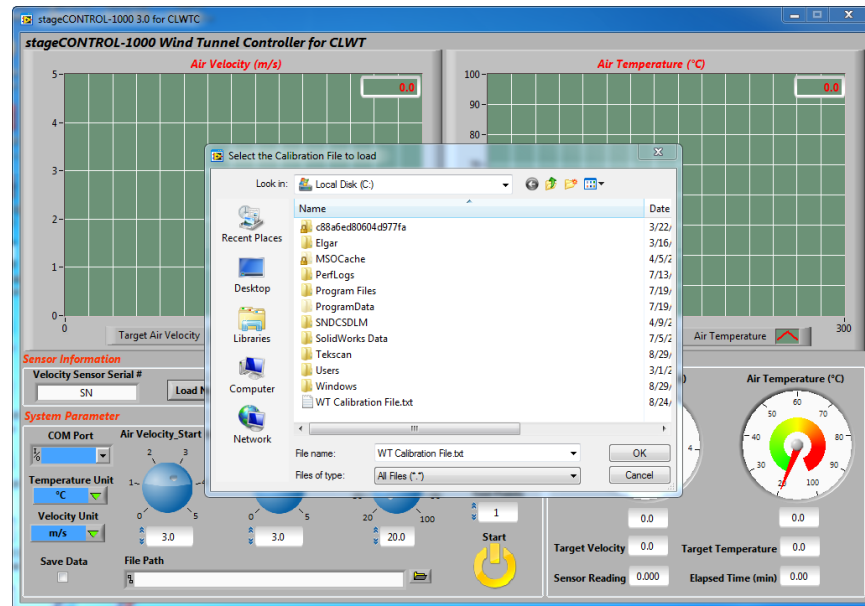


Figure 4 - Loading Calibration File for stageCONTROL-1000

When the stageCONTROL-1000 starts, it will automatically look for the CLWTC-1000™ Controller. If it doesn't find the device a window will pop up, see Figure 6 saying "The device is not found". You can also check under Device Manager\Ports (COM & LPT) to see if a RS-485 Port is present over there. You can either choose Retry or Continue to proceed.

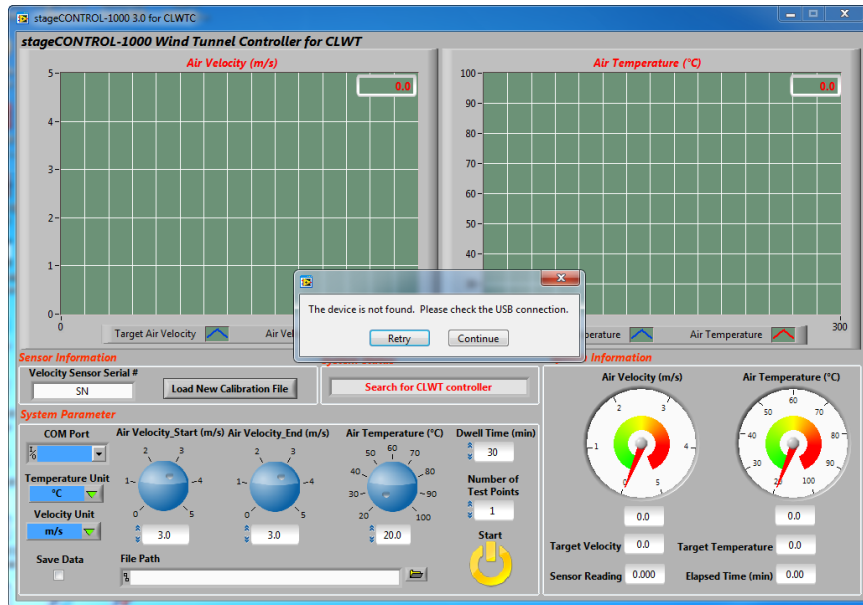


Figure 5 - The Device is not Found Warning

The following procedures should be taken by the operator prior to start the wind tunnel.

1. Specify the desired air velocity ranges for the experiment to be performed.
2. Specify the desired air temperature, the air temperature can't be larger than 85°C.
3. Select the desired number of data points. This value includes the two data points at the starting and ending velocities. When stageCONTROL-1000 is executed, it will start the wind tunnel at starting velocity and desired temperature and will stay there until the dwell time is reached. The software then increases the air velocity by the amount of velocity interval calculated from the following equation

$$\text{Velocity interval} = (V_{\text{Start}} - V_{\text{End}}) / (\text{Desired number of data points} - 1)$$
4. This process is repeated for subsequent velocities until the data for end velocity has been obtained.
5. Set the dwell time. This is the amount of time controller will keep the air flow velocity at the set point.

Note: When the user stops the software, if the temperature inside the tunnel is greater than 50°C, a message will pop asking the user to decrease manually the set point temperature below 50 °C from the controller front side by using the down arrow key. This is basically a safety feature to make sure the tunnel's temperature is not high if it is left unattended. Or you can click on skip to stop the software.

3.5 Description of stageCONTROL-1000 User Interface

The interface of stageCONTROL-1000 is illustrated in Figure 7.

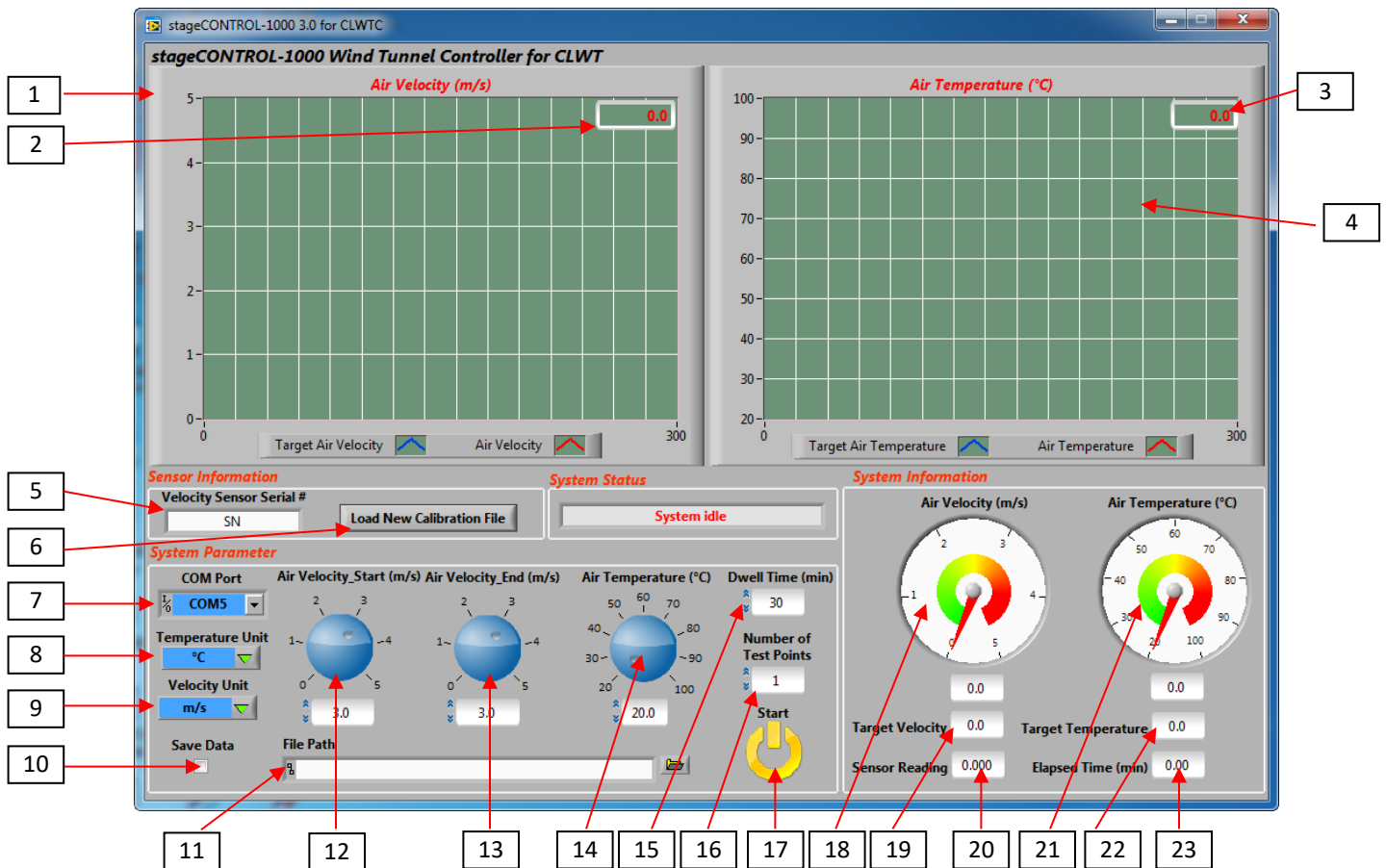


Figure 6 - The Device is not Found Warning

The user interface elements (number in the boxes) are explained as follows:

1. Air Velocity Chart: This chart shows the transient value and history of air velocity.
2. Air Velocity Digital Display: This shows current air velocity value.
3. Air Temperature Digital Display: This shows current air temperature value.
4. Air Temperature Chart: This chart shows the transient value and history of air temperature.
5. Velocity Sensor Serial #: Input the velocity sensor serial #, you can find the number on sensor connector.
6. Load New Calibration File: Click to load new calibration file for velocity sensor.
7. COM Port: Choose the port for data communication. The value chosen will determine which COM port will be active for serial data communication. These are virtual COM ports that will show after installing the driver for USB to RS485 conversion

8. Temperature Unit: Select temperature unit used in test.
9. Velocity Unit: Select velocity unit used in test.
10. Save Data: Check mark the box to save temperature and velocity data.
11. File Path: Enter a file path for test data.
12. Air velocity _Start: Set the starting velocity.
13. Air velocity _End: Set the ending velocity.
14. Air Temperature: Set the desired air temperature, the setting value must be in the range $T_{\text{ambient}} \leq T_{\text{air}} \leq 85^{\circ}\text{C}$.
15. Dwell time. This is the amount of time, in minutes, spent between each velocity interval.
16. Number of Test Points: Enter the desired number of data points. For example, if you enter 6, the software will perform the experiment for six different velocities, i.e. at the minimum and maximum velocities and four velocities in between at equal velocity intervals.
17. Start/Stop: When Start is pressed, stageCONTROL-1000 turns on the blower and the heater, and the test starts. When Stop is pressed, stageCONTROL-1000 turns off the blower and the heater and terminates test.
18. Air Velocity: Air velocity indicator.
19. Target Velocity: This shows the target velocity.
20. Sensor Reading: This shows the output of velocity sensor. This value is for debug purpose only.
21. Air Temperature: Air temperature indicator.
22. Target Temperature: This shows the target temperature.
23. Elapsed Time: This shows the elapsed time in minutes at current test point.

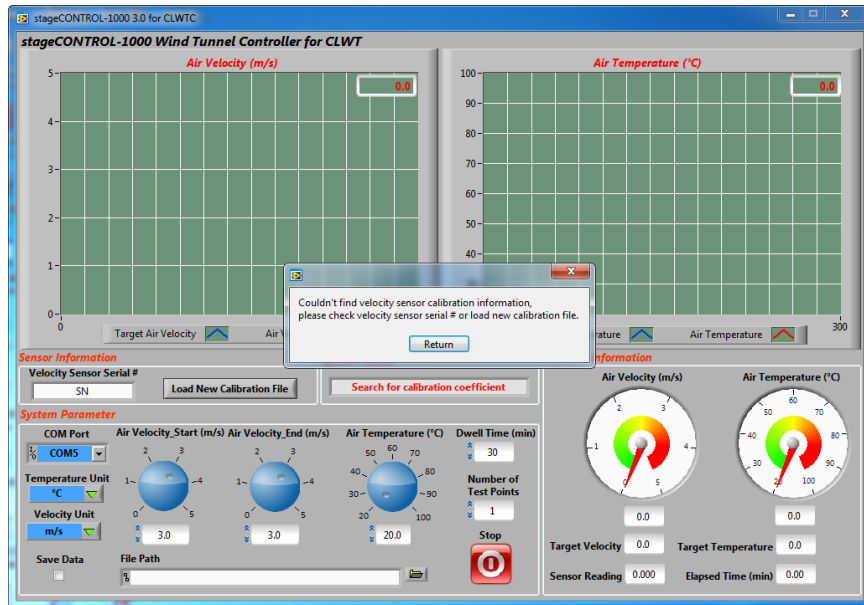


Figure 7 - Velocity Sensor Serial # Warning

Note: If the Velocity Sensor Serial # is incorrect, a warning window will pop out, see Figure 8. Please select “Return” and input correct serial number.