

Tonewinder V1.3

The Ultimate CNC Winder

Operating Manual

Revision 1.0 BETA

• October 2024



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Original Operating Manual

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1 Using this Manual

This chapter provides information about this manual, the conventions used throughout the manual, and the reference documentation that is available in addition to this manual.

1.1 About this Manual:

This manual describes the functional features and operating principle of your **Tonewinder V 1.3** “*The ultimate CNC winder*” and provides instructions for installation, setup, start-up, shutdown, operation, maintenance, and troubleshooting.

This manual applies to the two models of this version, which are:

- ◆ **Tonewinder V1.3:** The wire tension is manually adjusted.
- ◆ **Tonewinder V1.3 ATC:** The wire tension is automatically adjusted.

The layout of this manual is designed to provide quick reference to the sections of interest to the user. To obtain a full understanding of your device, read this manual thoroughly.

This manual also contains safety messages, precautionary statements, and special notices that can prevent personal injury, damage to the device, or loss of data when followed properly.

Note the following:

- The **Tonewinder** configuration may vary; therefore, not all descriptions necessarily apply to your particular device.
- If some detail applies to only one model or variant, the model or variant is identified by name.
- Illustrations in this manual are provided for basic understanding. They can vary from the actual model of the device or component. However, this does not influence the descriptions. No claims can be derived from the illustrations in this manual.

1.2 Conventions:

This section describes the conventions that are used throughout this manual.

1.2.1 Safety Messages:

The safety messages and precautionary statements in this manual appear as follows:

- Safety messages or precautionary statements that apply to the entire manual and all procedures in this manual are grouped in the [Safety chapter](#).
- Safety messages or precautionary statements that apply to an entire section or multiple procedures in a section appear at the beginning of the section to which they apply.
- Safety messages that apply to only a particular section or procedure appear in the section or procedure to which they apply. They appear different from the main flow of text.

Safety messages are often preceded by an alert symbol and/or alert word. The alert word appears in uppercase letters and bold type.

Make sure that you understand and follow all safety messages presented in this manual.

1.2.2 Special Notices and Informational Notes:

Special notices and informational notes in this manual appear different from the main text flow. They appear in boxes and a note label identifies them. The label text appears in uppercase letters and bold type.

NOTICE Highlights information necessary to prevent damage to the device or invalid test results.

TIP Highlights information of general interest or helpful information that can make a task easier or optimize the device's performance.

1.2.3 Typographical Conventions:

These typographical conventions apply to the descriptions in this manual:

Data Input and Output

- The following appears in **bold** type:
 - ◆ Input that you enter by the keyboard or that you select with the mouse
 - ◆ Buttons that you click on the screen
 - ◆ Commands that you enter by the keyboard
 - ◆ Names of, for example, dialog boxes, properties, and parameters
- For brevity, long expressions and paths appear in the condensed form, for example: Click **START > MAIN MENU > NEW BOBBIN**

References and Messages

- References to additional documentation appear *italicized*.
- Messages that appear on the screen are identified by quotation marks.

Viewpoint

If not otherwise stated, the expressions *left* and *right* in this manual always refer to the viewpoint of a person who is facing the device from the front.

Particularly Important Words

Particularly important words in the main flow of text appear in **bold** or *italicized*.

Electronic Manual Version (PDF)

The electronic version (PDF) of the manual contains numerous links that you can click to go to other locations within the manual. These include:

- Table of contents entries
- Index entries
- Cross-references (*in orange text*), for example, to sections and figures

2 Safety

This chapter provides general and specific safety information and informs about the intended use of the device.

2.1 Safety Symbols and Signal Words:

2.1.1 Safety Symbols and Signal Words in This Manual:

This manual contains safety messages to prevent injury to the persons using the device. The safety symbols and signal words in this manual include the following:



Always be aware of the safety information. Do not proceed until you have fully understood the information and consider the consequences of what you are doing.



CAUTION Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.



WARNING Indicates a hazardous situation that, if not avoided, could result in serious injury.

2.1.2 Observing this Manual:

Observe the following:






- Before installing or operating the device, read this manual carefully to become familiar with the winder and this manual. The manual contains important information about user safety as well as the use and care of the device.
- Always keep the manual near the device for quick reference.
- Save this manual and pass it on to any subsequent user.



Read, understand, and comply with all safety messages and precautionary statements presented in this manual.

2.1.3 Safety Symbols on the Device:

The table lists the safety symbols that can appear on the device or labels affixed to the device. Follow the safety notices in this manual to prevent the risk of operator injury or damage to the device.

Symbol	Description
	Indicates a potential hazard. Refer to this manual to avoid the risk of personal injury and/or to prevent damage to the device.
	The power supply is off. The Power supply is on
	Indicates alternating current.
	Indicates a terminal for protective grounding.
	Indicates a terminal for functional grounding

2.2 Intended Use:

The device is designed for use in the manufacture of musical instrument pickup coils.

The device is for use by qualified personnel only.

2.3 Safety Precautions:

2.3.1 General Safety Information:

All users must observe the general safety information presented in this section and all specific safety messages and precautionary statements elsewhere in this manual during all phases of installation, operation, troubleshooting, maintenance, shutdown, and transport of the device.



If the device is used in a manner not specified by **Tonewinder OE**, the protection provided by the device could be impaired. Observe the following:

- Operate the device only within its technical specifications.
- Use only the replacement parts and additional components, options, and peripherals specifically authorized and qualified for the device by **Tonewinder OE**.
- Perform only the procedures that are described in this operating manual and supporting documents for the device. Follow all instructions step by step and use the tools recommended for the procedure.
- Open the enclosure of the device and other components only if specifically instructed to do so in this manual.
- **Tonewinder OE** cannot be held liable for any damage, material or otherwise, resulting from inappropriate or improper device use. If there is any question regarding appropriate usage, contact **Tonewinder OE** before proceeding.

Safety Standard

This device is a Safety Class I instrument (provided with a terminal for protective grounding). The device has been manufactured and tested according to international safety standards.

2.3.2 Qualification of the Personnel:

Observe the information below on the proper qualification of the personnel repairing the device.



Repairs

Only skilled personnel are permitted to repair the device and to establish the electrical connections according to the appropriate regulations. **Tonewinder OE** recommends always having service personnel certified by **Tonewinder OE** perform the repairs.

2.3.4 Electrical Safety Precautions:



WARNING— Electric Shock or Damage to the Device

High voltages are present inside the device that could cause a electric shock or damage to the device.

- Do not make any changes to the electrical or grounding connections.
- If you suspect any kind of electrical damage, disconnect the power cord and contact **Tonewinder OE** Technical Support for assistance.
- Do not open the housing or remove protective panels unless specifically instructed to do so in this manual.
- Do not place liquid reservoirs directly upon the device. Liquid might leak into the device and come into contact with electronic components causing a short circuit.

2.4 Compliance Information:

Tonewinder OE performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the device is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described in this manual.

Changes that you make to the device may void compliance with one or more of these EMC and safety standards. Changes to the device include replacing a part or adding components, options, or peripherals not specifically authorized and qualified for the product by **Tonewinder OE**. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from **Tonewinder OE** or one of its authorized representatives.

The device has been shipped from the manufacturing site in a safe condition.

3 Device Overview

This chapter introduces you to the device and its main components.

3.1 Device Features:

The device comprises the following main features:

- **User-friendly Pickup winder** for musical instruments, **totally autonomous**, works without the need for a computer connection.
- Winding speed may reach **1500 r.p.m.**. Nevertheless, we recommend not exceeding 1,200 r.p.m.
- Compatible with **any wire gauge**. Tonewinder has been specially tested with wires from AWG38 to AWG45.
- Automatic winding is available in **four different winding strategies**: Constant, Table, Scatter, and Emulate Mode.
- There is also a **manual winding mode** with additional manual speed control.
- **The wire tension sensor monitors** the tension wire across the whole winding and automatically holds the process in case of wire breaks or any other issue.
- Wire tension may be manually adjusted during winding in the standard version, and will be automatically adjusted in the ATC version.
- There is a **tachymetric sensor** that holds the winding in case of motor blocking.
- All settings and controls are made with the 2,8-inch touchscreen so **there is no need for a PC connection**.
- Tonewinder has up to **59 memories** for storing your bobbin projects.
- **Software upgrades can be made via Wi-Fi** (Only Microcontroller). The touch Screen must be upgraded with a microSD card.
- Tonewinder incorporates an **accurate magnetic field meter** (Gaussmeter), to evaluate the charge level of the magnets.
- Tonewinder also includes a **Pickup Calculator**, to help you design your windings.
- There is a **library of iconic pickups**, where you can see the essential parameters, including the winding diagram, and you can apply this data to your projects. Available in two modes, constant and scatter.

- The software includes an **Interactive Help**. By clicking on any parameter, you will get a more detailed explanation.
- Tonewinder incorporates **troubleshooting and maintenance sections**.

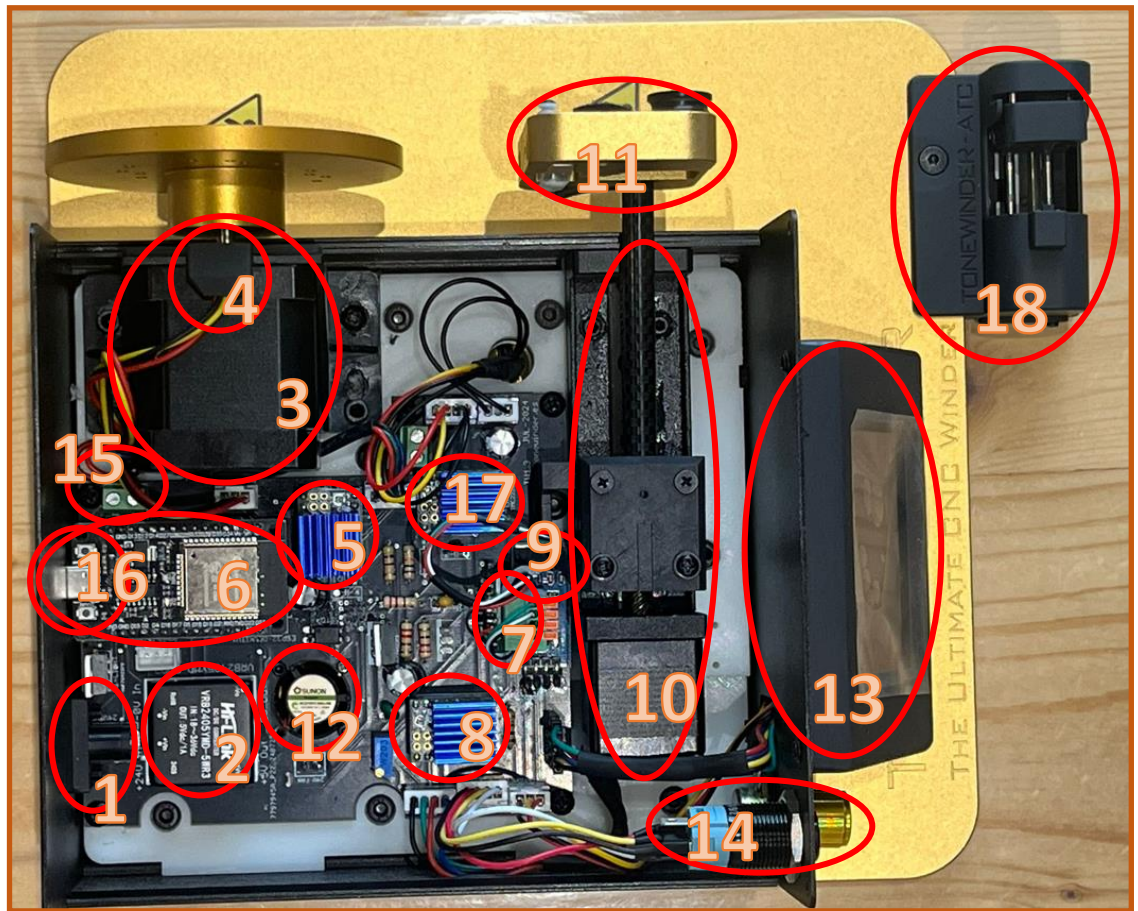
3.2 Operating Principle:

Tonewinder is designed for winding up instrument pickups, generally guitars and basses but it can be used for other purposes (electric coils, etc.). Its main function is to be able to wind up musical instrument pickups, doing it with the accuracy that a CNC offers you, the advantage of which is to control at all times:

- Position of the wire that you are winding
- Speed of rotation of the bobbin
- Real tension of the wire
- Wire tension adjustment (**Automatic in the ATC version**)

In this way, you can program the automatic winding in the way you like the most in order to achieve certain nuances in the sound of the pickup. It can also work semi-automatically (using the knob) and manually guiding the wire with your hands.

The following picture shows the interior components of **Tonewinder**, and illustrates how the device operates:



No.	Description	No.	Description
1	Main power 24V entrance	10	Step motor X – Nema 11
2	Power supply 5v	11	Tension sensor
3	Step Motor Y – Nema 17	12	Cooling fan
4	Tachometer sensor	13	Touch screen 2.8"
5	Driver TMC2226 motor Y	14	Main power switch and knob
6	Microcontroller ESP32	15	Cosmetic Ligth power control
7	Tension sensor electronics	16	USB connector
8	Driver TMC2226 motor X	17	Driver TMC2226 motor Z (ATC)
9	Home sensor-motor X	18	ATC (Automatic Tension Control)

Figure 1: Inside view of **Tonewinder V1.3**

3.3 External Components:

On the front-right, the device provides easy access to the user-accessible components:



Figure 2A: Front-right side view of the device (here: **Tonewinder V1.3**)



Figure 2B: Front-right side view of the device (here: **Tonewinder V1.3 ATC**)

No.	Description
1	Power button
2	Control knob (factor)
3	Touch screen 2.8"
4	Gaussmeter sensor
5	Touchscreen pen stick
6	Wire Stabilizer
7	Wire guider pulleys
8	Wire tension screw
9	Plate to install the coils
10	Automatic Tension Control (ATC), is only available in the ATC version or installation kit. The wire stabilizer must be placed in the arm.

3.4 Touch Screen Display (HMI):

ToneWinder has a 2,8-inch Nextion Enhanced touchscreen with high sensitivity and precision. A touchscreen pen stick is attached in a convenient holder.

3.5 Coils Plate:

The cylindrical plate to fix the coils is machined in aluminum, with a gold anodized finish. It has 2.5 metric threads to house any available coil in the market. It also has a central thread to be able to fix the simple coils, using a fixing piece.



Figure 3: Plate to install the coils

Grooves are made in the holding plate to house the pickup eyelets, so they can be perfectly seated on the plate.

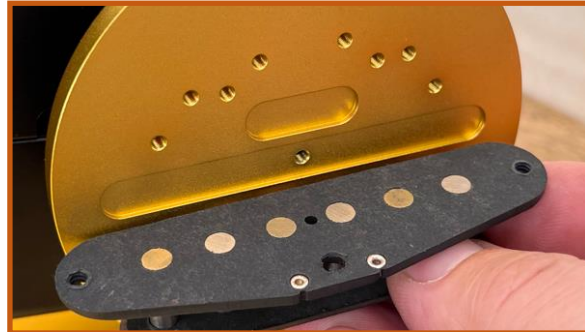


Figure 4: Coil plate insertions

3.6 Wire guide arm + Tension sensor:

The wire guide arm consists of two pieces of anodized aluminum, joined together by a 300gr load cell, this mount is capable of measuring variations of 1 gr in the tension of the wire. In the lower part, it has housed two polyethylene pulleys for the correct guidance of the thread. The upper part houses the wire tension screw, with which you can regulate the tension applied to the screw. **In the ATC model, the stabilizer must be placed in the wire tension screw position, in order to apply as little tension as possible to the wire.**



Figure 5: Wire-Guide Assembly (Left: TW 1.3, Right: TW 1.3 ATC)

The wire guidance block is fixed to the transmission of the X-axis motor (Nema 11 stepper motor), using an 8 mm carbon tube.

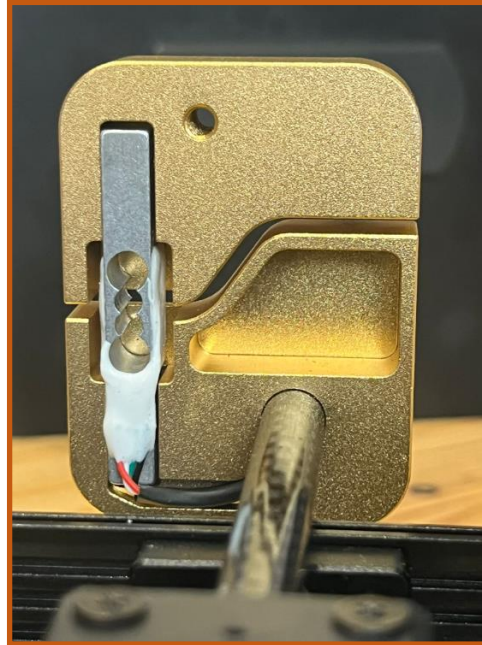


Figure 6: Wire Guide Arm view

3.7 Software Operation:

Tonewinder is designed to be operated from the integrated touchscreen display, without using a computer. The software provides complete instrument control.

There are two sets of software running inside Tonewinder. The software running in the ESP32 microcontroller, which can be upgraded via Wi-Fi or USB cable. The touch screen software can only be upgraded via a micro SD card.



Figure 7: ESP32 Software update screen

The very last version of both software packages is available for download on the **Tonewinder** website: <http://www.Tonewinder.es>.

NOTE: only version 10.8 (10.8_ATC) or later must be used in the TW 1.3 (TW1.3 atc)

4 Unpacking

This chapter provides information for unpacking the device and informs you about the scope of delivery.

4.1 Unpacking:

Damaged Packaging, Defective on Arrival

Inspect the shipping container for signs of external damage and, after unpacking, inspect the device for any signs of mechanical damage that might have occurred during shipment.

If you suspect that the device may have been damaged during shipment, immediately notify the incoming carrier and **Tonewinder OE** about the damage. Shipping insurance will compensate for the damage only if reported immediately.

4.2 Scope of Delivery:

Tonewinder is delivered inside a protective case:



Figure 8: Hardcase view (TW1.3 and TW1.3 ATC)



Figure 9A: Distribution inside the hard case (TW 1.3)



Figure 9B: Distribution inside the hard case (TW 1.3 ATC)

The following items are included in the package in addition to the winder in the TW 1.3:



Figure 10A: Accessories in Tonewinder 1.3

No.	Name	Function
1	External Adaptor/Power Supply 24 Vdc/2.5 A	Supply energy from the power wall socket to the winder. Works with 110vac and 230 vac.
2	Adapter for single coils	Fix the single coils (magnets protruding) to the plate. Two sizes.
3	Lifter for humbucker bobbins	The part that lifts the humbucker coil when a cable is soldered to the wire at the start of the coil.
4	Calibration Magnet	Magnet to calibrate the Gaussmeter. Usually 1200 Gs.
5	Allen Key Set	Set of different Allen keys.
6	HB Bobbin screws	For fixing the humbucker coil to the plate.
7	Single Coil Screw	For fixing the single coil to the plate.
8	Lint-free cleaning cloth	Lint-free cleaning cloth.
9	Touchscreen pen	Handle the touchscreen.
10	Stabilizer screw	Stabilize the wire movement before it enters in the arm.

The following items are included in the package in addition to the winder in the TW 1.3 ATC:



Figure 10B: Accessories in Tonewinder 1.3 ATC

No.	Name	Function
1	External Adaptor/Power Supply 24 Vdc/2.5 A	Supply energy from the power wall socket to the winder. Works with 110vac and 230 vac.
2	Adapter for single coils	Fix the single coils (magnets protruding) to the plate. Two sizes.
3	Lifter for humbucker bobbins	The part that lifts the humbucker coil when a cable is soldered to the wire at the start of the coil.
4	Calibration Magnet	Magnet to calibrate the Gaussmeter. Usually 1200 Gs.
5	Allen Key Set	Set of different Allen keys.
6	HB Bobbin screws	For fixing the humbucker coil to the plate.
7	Single Coil Screw	For fixing the single coil to the plate.
8	Lint-free cleaning cloth	Lint-free cleaning cloth.
9	Touchscreen pen	Handle the touchscreen.
10	Accessories Toolbox	Clip-on tray to keep all the accessories close to the winder
11	Wire Tension Screw	Adjust the wire tension in case there is no ATC. It must be placed in the guider arm (see Figure 5, page 24).
12	Stabilizer screw	Located in the arm, stabilize the wire keeping the basal tension as low as possible.

5 Installation

This chapter specifies the requirements for the installation site and describes how to set up, install, and configure the device.

5.1 Installing the device:

The device is installed and set up by the buyer and must follow the steps below.

1. Pay attention to the safety guidelines and observe all site requirements. For the safety guidelines when installing the device.
2. Set up the device hardware.
3. Turn on the device.

5.2 Site Requirements:

The operating environment is important to ensure the optimal performance of the device. This section provides important requirements for the installation site. Note the following:

5.3.1 Workbench:

For dimensions and weight of the device, see [chapter 9 Specifications](#).

Provide a sturdy workbench of a height that ensures convenient access to the interior of each device in the system. The workbench must stand in a secure and level position that is free of vibrations. The bench top must be dry and clean.

Allow sufficient free space on the sides and on the rear of the system for electrical connections and proper air circulation. Allow at least 15 cm of clearance on the rear, at least 20 cm of clearance on each side, and at least 30 cm of clearance above the top.

Make sure that the power switch and power cord can be easily reached at any time.

5.3.2 Power Considerations:

The power supply of the device has wide-ranging capability, accepting any line voltage in the range specified for the device.

CAUTION—Electric Shock or Damage to the Device

- Connecting the device to a line voltage higher or lower than specified could result in personal injury or damage to the device. Therefore, connect the device to the specified line voltage only.
- Do not use defective multiple sockets or extension cords, as they could result in personal injury or damage to the device.
- After the power to the device is turned off, the device is still energized as long as the power cord is connected. Repair work on the device while the device is connected to power could lead to personal injury. Therefore, always unplug the power cord before starting repair work inside the device. If you were instructed to remove any covers or panels, do not connect the power cord to the device while the cover or panels are removed.

5.3.3 Power Cord:

The power cords are designed to match the wall socket requirements of the country in which they are used. The end of the power cords that plug into the power socket on the device is identical for all power cords. The end of the power cords that plug into the wall socket is different.



WARNING—Electric Shock or Damage to the Device

- Never use a power cord other than the power cords provided by **Tonewinder OE** for the device.
- Only use a power cord that is designed for the country in which you use the device.
- Do not use defective multiple sockets or extension cords, as they could result in personal injury or damage to the device.
- In case of emergency, it must be possible to reach the power cord easily at any time to disconnect the device from the power line.

5.3.4 Condensation:

NOTICE Condensation in the device can damage the electronics. Therefore, when using, shipping, or storing the device, avoid or minimize conditions that can lead to a build-up of condensation in the device. For example, avoid significant or fast changes in environmental conditions. If you suspect that condensation is present, allow the device to warm up to room temperature. This may take several hours. Wait until the condensation is gone completely before connecting the device to the power line.

5.3.5 Operating Conditions:

When operating the device, make sure that the installation site meets these general environmental and operating conditions:

Temperature

Temperature fluctuations can affect the performance of the device. Avoid locations with significant changes in temperature and strong air drafts. For example, do not place the device in direct sunlight, near heating or cooling sources, or under an air duct.

Humidity

The relative humidity of the operating environment is important for the performance of the device. Operate the device in the specified humidity range, with no condensation.

When the humidity is too high, condensation may occur, causing damage to the electronic components in the device. When the humidity is too low, static electricity may accumulate and discharge, shortening the life of the electronic components.

Vibration

Vibrations may affect the performance of the device. Therefore, the installation site should be free of vibrations. Avoid placing the device in locations where vibrations are caused by other instruments.

5.4 Setting Up the Hardware:

Tonewinder comes fully tested, calibrated, and ready to use. You just need to connect the mains cable and switch it ON. Eventually, you will need to make a [fine adjustment of the wire guider position](#) in the first windings.

5.5 Turning On Tonewinder:

1. Turn on the device with its main power switch.
2. Wait until the device completes the following sequence of events after power-up:

◆ *Self-test diagnostics*

The device runs a series of internal tests. During these self-diagnostics, all of the main components are checked. When testing is complete and has been successful, **Tonewinder** continues moving the axis X, to find the home position, and the ATC motor (only in TW 1.3 ATC).



Figure 11: Start-up screen

If an error is detected during the self-test, the device is not ready for work. For further information, see [chapter 8 Troubleshooting](#).

If Tonewinder initializes correctly, it will automatically jump to the startup screen, where you can see which software versions are installed on your unit, and the light will flash twice.



Figure 12: Start-up screen after initialization process

◆ *Homing motor X*

In the **homing** state, the device moves the axis X to find the home position.

◆ *Homing motor Z (only in versions with ATC)*

In the **homing** state, the device moves the axis Z to find the home position.

6 Operation

This chapter describes the elements of device control, and provides information for routine operation and for shutdown.

6.1 Introduction to this Chapter:

The information in this chapter assumes that the initial setup of the device has been completed. If this is not the case, refer to the instructions in [Chapter 5](#) before proceeding.

6.2 Touch Screen Display:

The role of the keys depends on the screen presented. These keys are called *general keys*.

General Soft Key Functions

Depending on the screen, general soft key functions are available:

Soft key	Description
Back	To come back to the previous screen
Main	To go directly to the Main Menu
Reset	To reset the device, and come back to the initial screen

6.3 Terminology:

Please find below a concise description of the parameters utilized in the **Tonewinder** software, along with their recommended values. A warning message will be displayed if any parameter exceeds these predefined limits. For further assistance, you can access the contextual help screen by simply tapping on the corresponding parameter icon.

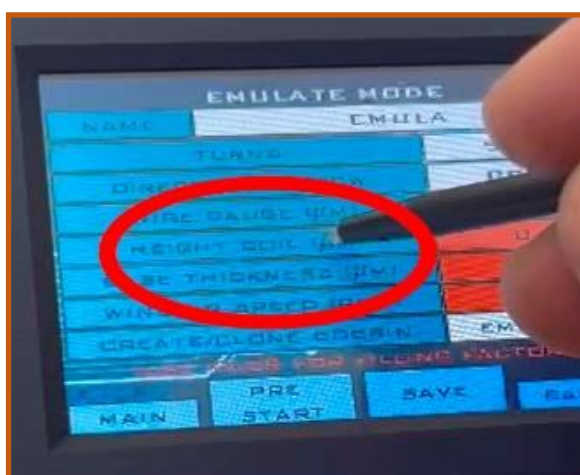


Figure 12+1: Contextual help access

Parameter	Description	Range
Max Speed	Max speed that Tonewinder can operate	Up to 1500 RPM
Offset	Distance between “Home position” and “Zero position”	<10,000 μm
Home position	Home reference to axis X	n.a.
Zero position	Position that aligns the Wire Guide Arm with the plate	n.a.
Delta	Distance, measured from the limits of the height of the bobbin, where the wire won't be wound, to avoid overload of wire.	<1,000 μm Typically 50/70 μm
Initial turns	Number of turns that the device runs at extra low speed.	<20 turns
Filling factor	This is the ratio of the total conductor cross-section to the area of the core window (see Appendix 1)	[10, 100] %
Constant mode	Mode where the filling factor is constant during all the coil	n.a.
Table mode	Mode where you can fix up to 6 segments with different filling factor	n.a.
Scatter mode	Mode where the winding of the bobbin is done under “semi-random” conditions.	n.a.
Emulate mode	Mode where you can modify the filling factor during the bobbin, using the external potentiometer.	n.a.
Manual mode	Mode where you need to distribute the wire manually, during the winding.	n.a.
CW	The direction of rotation of the plate clockwise	n.a.
CCW	The direction of rotation of the plate counterclockwise	n.a.
Wire Gauge	Gauge of the wire that you are using	[20,200] μm
Height Coil	Free height of the bobbin	[1,000, 30,000] μm
Base Thickness	Thickness of the base of the bobbin, which leans on the plate	[700, 5,000] μm
Turns per layer	(TPL) is the number of turns that Tonewinder will wind in each direction. It is proportional to Filling Factor, Height and wire gauge	n.a.
Winding speed	Speed used to wind the bobbin	[50, 1500] rpm

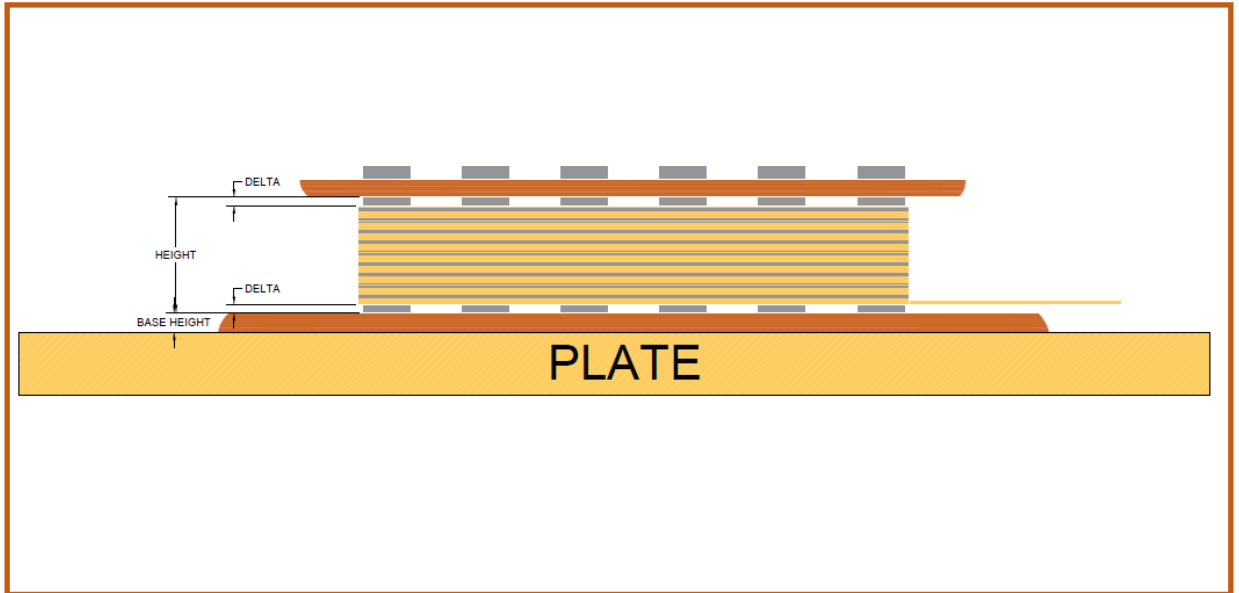


Figure 14: Basic Parameters screen

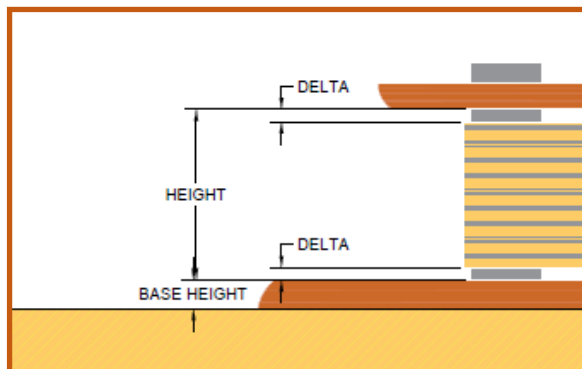


Figure 15: Basic Parameters screen

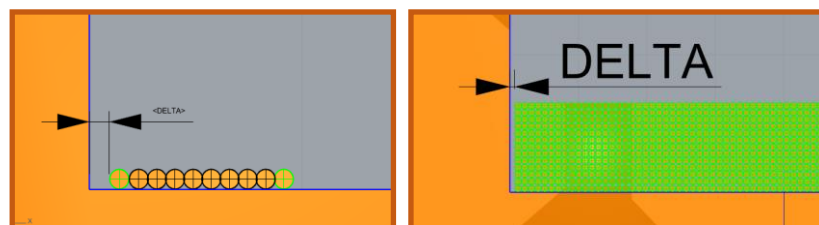


Figure 16: Basic Parameters screen

6.3.1 Interactive help:

Clicking with the stick pen on the parameter name you will see a comprehensive description of the selected parameter/variable.

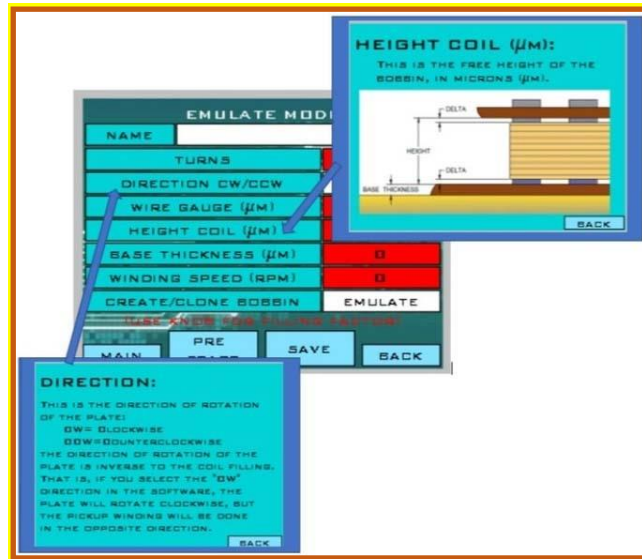


Figure 17: Interactive Help Screens

6.4 Preparing Tonewinder for Operation:

This section gives information on any additional steps that are required to prepare the device for operation and wind up a bobbin.

6.4.1 Verify “Offset Position”:

Before Operating the Device for the First Time, you should verify the “**Offset Position**”. The “**Offset Position**” is the distance the arm has to move from the point it detects the home position (reference point) until the small white pulley is aligned with the plate.

This parameter is very important as it is essential that the windings are centered on the coil. The "offset position" is calibrated at the factory, but it is recommended to check it when starting to work with the winder.

Prepare the device for the first-time operation, follow the next steps to verify that the “**Offset position**” is set properly:

1. Switch ON **Tonewinder** and navigate to the “**BASIC PARAMETERS**” screen (**Main Menu>Settings>Basic Parameters**). Click on the “**Verify**” button.



Figure 18: Basic Parameters screen

2. The screen for checking and calibrating this parameter opens:

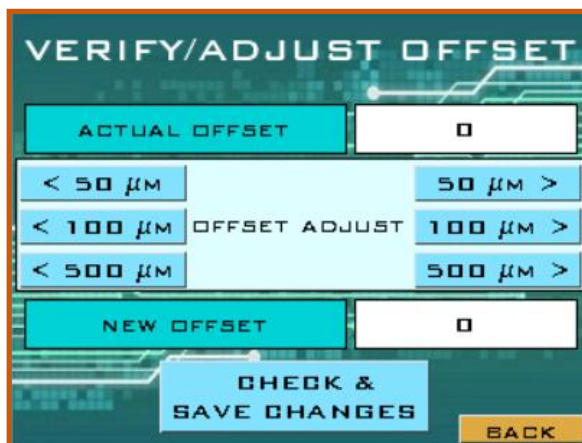


Figure 19: Verify/Adjust Offset Position screen

3. By pressing the “**Check & Save Changes**” button, the arm will move to the left until it reaches the home position, then it will move back to the right, traveling the distance indicated in the “**Actual Offset**” field.
4. At this point you should check, using a ruler resting fully on the plate, that the small white pulley on the guide arm is aligned with the plate.

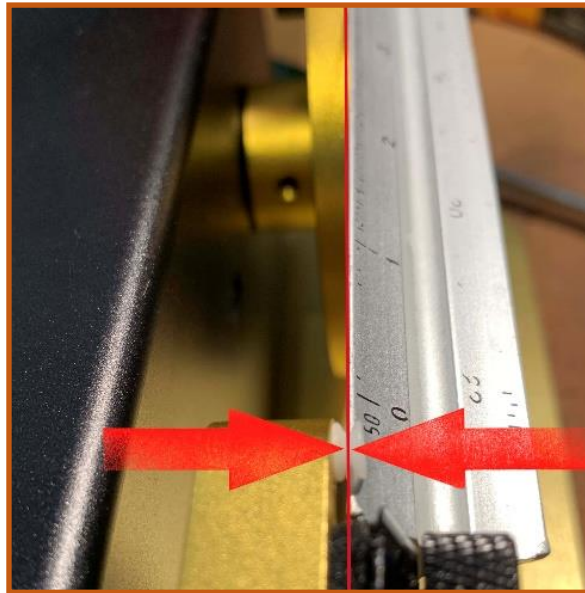


Figure 20: Adjusting offset to align turning plate with wire guide

5. If the center of the pulley coincides perfectly with the ruler, you can go back to the start (just by pressing the "back" button) to start working with your winder. If not, continue to the next step.

NOTE: This is a suitable enough setting to start working with **Tonewinder**, but during the first windings you will be able to adjust this parameter to its final value (See [Constant Mode](#)).

6. If the center of the pulley is misaligned with the ruler, use the partial movement buttons to increase or decrease this value, and press "Check & Save Changes" again. You can repeat this process as many times as you like until you are sure that the value obtained is good. Then press the "BACK" key to return.

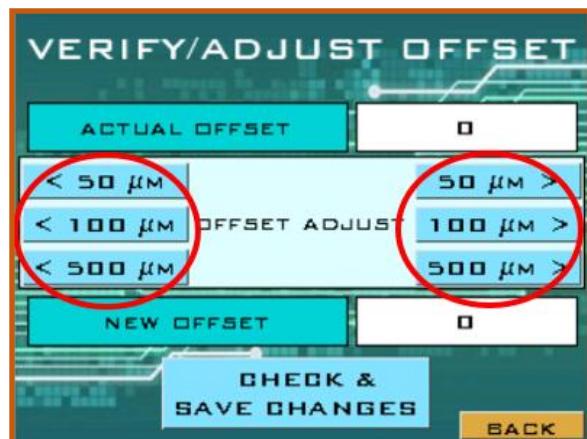


Figure 21: Partial movements buttons

NOTE: This is a suitable enough setting to start working with **Tonewinder**, but during the first windings you will be able to adjust this parameter to its final value (See [Constant Mode](#)).

6.4.2 Setting up the wire:

*Before Operating **Tonewinder** for each bobbin, setting up the wire.*

Prepare **Tonewinder** for winding a bobbin, follow the next steps to set up the wire properly (You may find your own way to do this):

1. Fix the pickup to the plate firmly and make sure it rests completely flat against the aluminum plate (using the fixing screws), then fix the wire with adhesive tape to the winding plate having in mind to let distance enough to later make the soldering or necessary connections (If it is not already soldered to the pickup), but avoiding to intercept the wire trajectory from the white pulley to the pickup.
2. Open the Wire Tension Screw (Stabilizer Screw in the ATC version) and pass the Cooper wire through the white polyethylene pulley, and then between the felt pads, placing the wire up to the black upper pulley:

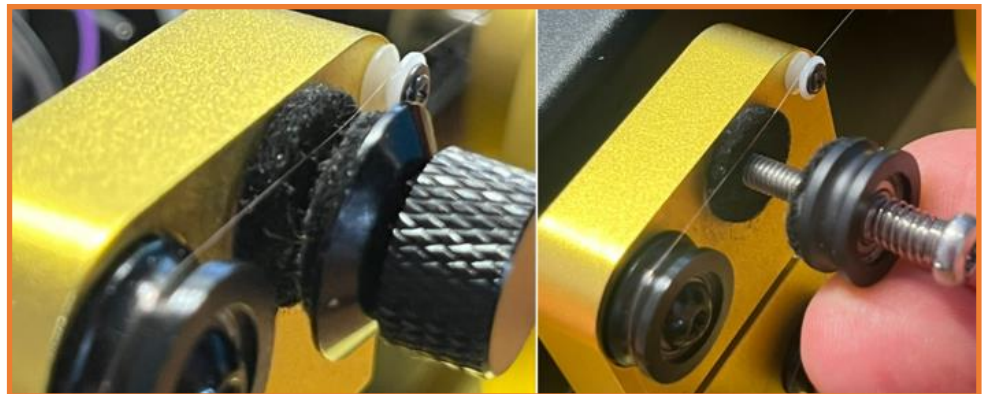


Figure 22: Wire layout in the upper Guider Arm (Left: TW 1.3, Right: TW 1.3ATC)

3. Turn clockwise the wire tension adjustment screw lightly (or release the pulley of the stabilizer screw in the ATC model) so that the wire is trapped between the two felt pads. The tighter this screw is tightened, the more tension the wire will have during winding.

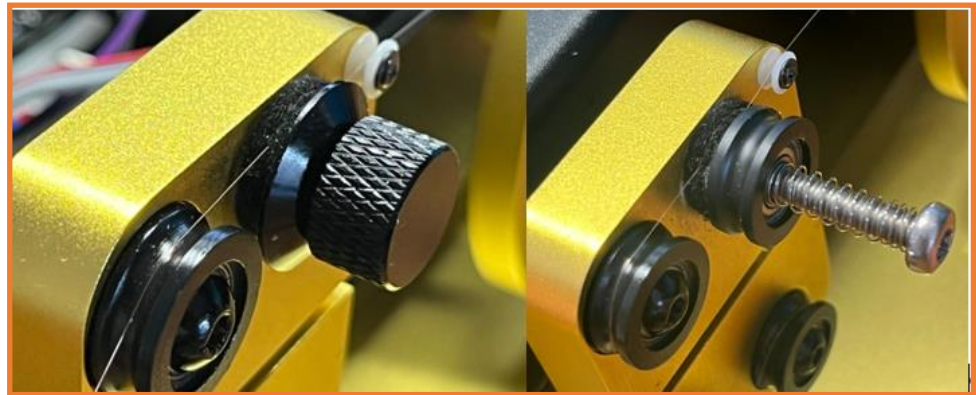


Figure 23: Wire trapped between felt pads (Left: TW 1.3, Right: TW 1.3ATC)

4. Finish placing the wire between the two black pulleys at the bottom, as shown in figure 24:



Figure 24: Wire Guider Arm

NOTE: it is recommended not to tighten the wire tension screw too much, and to adjust it to the desired tension at the start of winding.

- In case you have a model **without ATC** (with ATC, skip to the point 6), guide the copper wire through the stabilizer on the **Tonewinder** base lifting it with your fingers to be able to introduce the wire between lower and upper plates. Do not tight too much the screw, the tension should be enough to avoid the wire to go off the black pulleys while winding, but as light as possible, unless you wish to have additional wire tension.



Figure 25: Wire stabilizer used in the base in TW1.3.

- If you have a model **with ATC**, place the wire into the ATC according to these pictures. Both of them are valid:



Figure 26: Wire routing on the ATC (First way).



Figure 27: Wire routing on the ATC (Second way).

7. Below you will find the correct wire layout for both models.

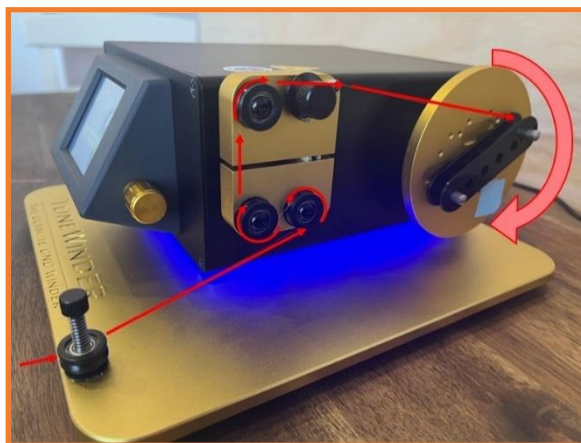


Figure 28: Wire layout in TW 1.3 (no ATC). Right side view.

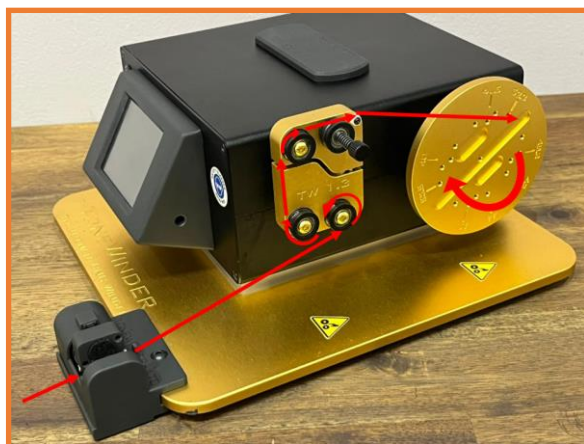


Figure 29: Wire layout in TW 1.3 ATC. Right side view.

NOTE: Please keep in mind that the direction of rotation of the plate is inverse to the coil filling. That is, if you select the “**CW**” direction in the software, the plate will rotate clockwise, but the pickup winding will be done in the opposite direction.

6.5 Operating with Tonewinder:

Operating **Tonewinder** is very simple. Everything is managed through the program loaded on the ESP32 microcontroller and the Nextion touch screen (or HMI, Human Machine Interface), without the need to be connected to a PC.



Figure 30: Initial screen

After switching ON the winder, pushing “**START**”, the “**MAIN MENU**” is shown.

NOTE: The only software version compatible with TW 1.3 is version 10.8 or higher.

The options you may select are:

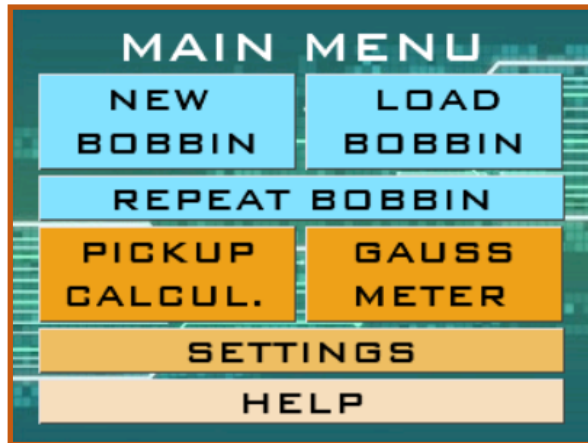


Figure 31: "MAIN MENU" screen

Next, we will review "MAIN MENU" options.

6.5.1 Create a "NEW BOBBIN":

You can create a new bobbin from scratch. There are four automatic winding modes, and also one manual mode (for manual wire guides):



Figure 32: "NEW BOBBIN" screen

In addition, you can also use one of the presets listed in the "Iconic Pickup Wizard" section.

6.5.1.1 Constant mode:

This is the simplest winding mode. The entire winding is done using a single filling factor (the filling factor is the percentage of wire filling at the coil height. A 100% means that, at each turn, the wire is placed next to the

previous one in such a way that the entire height of the coil is covered by wire, and 50% means that only wire is placed in 50% of the height of the coil).

CONSTANT MODE				CONSTANT MODE			
NAME				NAME			
URNS	0			URNS	0		
DIRECTION CW/CCW	CW			DIRECTION CW/CCW	CW		
WIRE GAUGE (μm)	0			WIRE GAUGE (μm)	0		
HEIGHT COIL (μm)	0			WIRE TENSION (GR)	ATC		
BASE THICKNESS (μm)	0			HEIGHT COIL (μm)	0		
WINDING SPEED (RPM)	0			BASE THICKNESS (μm)	0		
FILLING FACTOR (%)	0			WINDING SPEED (RPM)	0		
URNS PER LAYER	0			FILLING FACTOR (%)	0		
TEST	PRE	SAVE		TEST	PRE	SAVE	CLOSE ATC
MAIN	START		BACK	MAIN	START		BACK

Figure 33: "CONSTANT MODE" screen (Left: TW 1.3, Right: TW 1.3ATC)

Select, eventually a name (only needed if you want to save it), the total number of turns, the winding direction (plate turning Clockwise or counterclockwise), wire diameter (values are in microns, μm), the wire tension (only in ATC version, in grams), the coil height (μm) and base thickness (μm), winding speed (Tonewinder may reach 1500 rpm but normal winding speed is about 800/1000 rpm), and Filling Factor.

If a parameter is set out of the "normal" range, the winder could still be started but the parameter field will be turned red. (In this case, not all required specifications may be met).

CONSTANT MODE	
NAME	PAF NECK
URNS	5100
DIRECTION CW/CCW	CW
WIRE GAUGE (μm)	70
WIRE TENSION (GR)	ATC
HEIGHT COIL (μm)	650
BASE THICKNESS (μm)	1650
WINDING SPEED (RPM)	800
FILLING FACTOR (%)	65
URNS PER LAYER	60
TEST	PRE
MAIN	START
	SAVE
	CLOSE ATC
	BACK

Figure 34: Field warning

NOTE: Remember that you can open an interactive help screen in each parameter, by just clicking in the name parameter field.

The “Turns per Layer” field is only calculated if you click on the field. This parameter depends on the Filling Factor, wire diameter, and coil height.

CONSTANT MODE	
NAME	PAF NECK
URNS	5100
DIRECTION CW/CCW	CW
WIRE GAUGE (μM)	70
WIRE TENSION (GR)	ATC
HEIGHT COIL (μM)	6500
BASE THICKNESS (μM)	1650
WINDING SPEED (RPM)	800
FILLING FACTOR (%)	65
URNS PER LAYER	60
TEST	PRE
MAIN	START
SAVE	CLOSE ATC
	BACK

Figure 35: “Turns per Layer” update

Any time you may store the coil parameters by clicking “SAVE”, “SAVE BOBBIN” screen will then be shown, there you may choose in which one of the available memory positions you wish to save the parameters by clicking on it. In case there were already saved parameters there, they would be erased and overwritten.

SAVE BOBBIN (PAGE 1)	
SELECT FIELD WHERE YOU WANT SAVE IT	
1	FREE SPACE
2	FREE SPACE
3	FREE SPACE
4	FREE SPACE
5	FREE SPACE
6	FREE SPACE
7	FREE SPACE
8	FREE SPACE
9	FREE SPACE
10	FREE SPACE
11	FREE SPACE
>>	BACK

Figure 36: “SAVE BOBBIN (page 1)” screen

NOTE: There are up to 59 memory slots, spread over five different pages. In the first 23 memory slots you can save (and load) standard files and Clonearray files (we will see in further chapter), but in the remaining memory slots you can only save standard files.

Once the coil parameters are saved, pressing "**BACK**" will return you to the previous "**CONSTANT MODE**" screen.

Before proceeding, you can visually check that the size parameters are correct by clicking the "**TEST**" button:

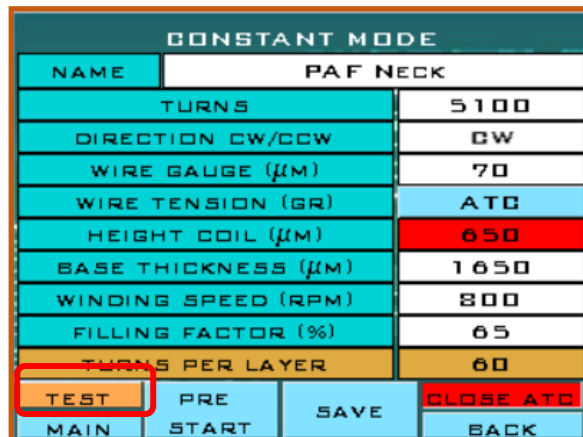


Figure 37: press the "**TEST**" button.

and the following screen will appear on your display:

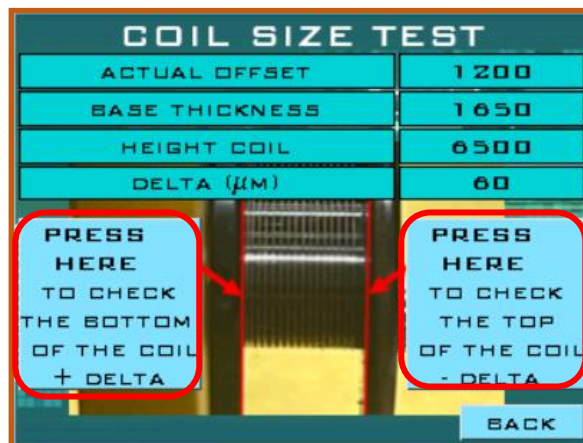


Figure 38: "**COIL SIZE TEST**" screen

By pressing either button, the arm will move to that position, and you can visually verify that it is correct or not (it is only a visual check). When you have finished verifying the initial and final winding positions, you can go back by pressing "**BACK**".

If you have a version **with ATC**, you will need to select the target tension at which you want to wind the bobbin (Tonewinder sets default values). To access the tension settings, press the "ATC" button.

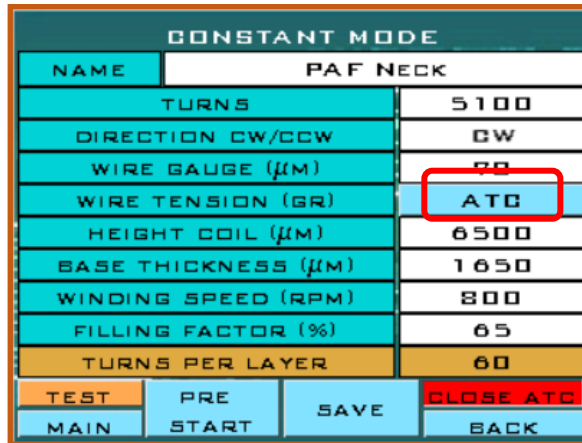


Figure 39: Press the "ATC" button to set the wire tension (only in ATC models)

Setting both fields with the same value means that tension will remain constant during the whole run. You can make a ramp up or ramp down just by increasing or decreasing the final tension value:

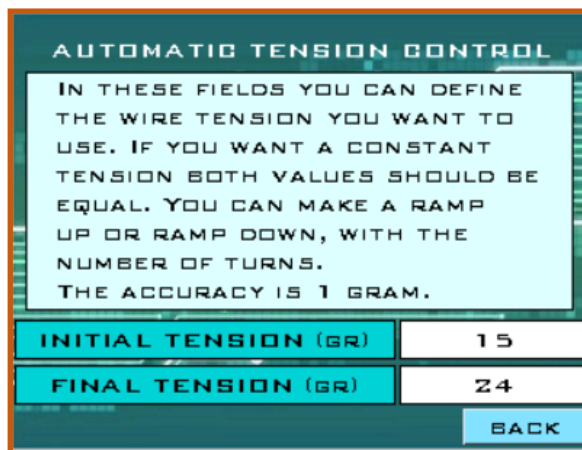


Figure 40: Initial and final tension value (only in ATC models)

Once you have set the voltage values you can go back.

For models with ATC, the "Close ATC"/"Open ATC" key allows you to close/open the ATC system to secure the wire in the ATC. If you do not operate it, it will close automatically when you start the winding process.

CONSTANT MODE	
NAME	PAF NECK
TURNS	5100
DIRECTION CW/CCW	GW
WIRE GAUGE (μM)	70
WIRE TENSION (GR)	ATG
HEIGHT COIL (μM)	6500
BASE THICKNESS (μM)	1650
WINDING SPEED (RPM)	800
FILLING FACTOR (%)	65
URNS PER LAYER	60
TEST	PRE
MAIN	START
SAVE	CLOSE ATG
	BACK

Figure 41: "Close/Open ATC" key (only in ATC models)

When you select the "PRE-START" button, the process of winding the pickup starts with the execution of the initial turns at a very low speed (the number of initial turns is an adjustable parameter in the "BASIC PARAMETERS" page), allowing to accommodate the wire in the coil and prepare the system for winding.

"Pre-Start" should be pushed smoothly and keep pushed until screen changes. Clicking over Pre-Start too fast does not give enough time to the communication procedures to interchange information correctly and may produce unexpected motor movements.

CONSTANT MODE	
NAME	PAF NECK
TURNS	5100
DIRECTION CW/CCW	GW
WIRE GAUGE (μM)	70
WIRE TENSION (GR)	ATG
HEIGHT COIL (μM)	6500
BASE THICKNESS (μM)	1650
WINDING SPEED (RPM)	800
FILLING FACTOR (%)	65
URNS PER LAYER	60
TEST	PRE
MAIN	START
SAVE	CLOSE ATG
	BACK



Figure 42: Press "**Pre-start**" to start winding

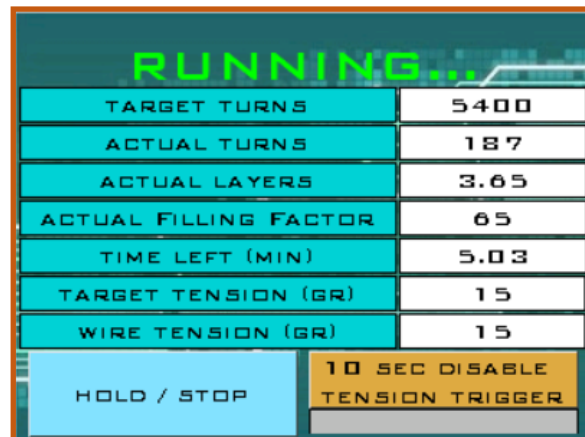
During the initial turns, in case you have a unit **without ATC**, you can adjust the wire tension by acting on the wire tension screw. In case you have a unit **with ATC**, this process will be carried out by the ATC automatically.

Once the initial turns have been finished, the **Tonewinder** will be ready to start winding and the "**START**" button will be shown.



Figure 43: "**PRE-START**" screen

Pushing the "**START**" button, the instrument will start winding under controlled acceleration until the selected winding speed is reached, if the light is activated it will ramp up and down during winding. During winding, the following real-time winding information is displayed on the screen:



RUNNING...	
TARGET TURNS	5400
ACTUAL TURNS	187
ACTUAL LAYERS	3.65
ACTUAL FILLING FACTOR	65
TIME LEFT (MIN)	5.03
TARGET TENSION (GR)	15
WIRE TENSION (GR)	15
HOLD / STOP	10 SEC DISABLE TENSION TRIGGER

Figure 44: "RUNNING" screen

NOTE: the "TARGET TENSION" field is only available in the ATC models.

All those parameters are being updated in real time while winding. The tension at which the wire is working is all time monitored and shown (and adjusted in case of having the ATC). If the "WIRE TENSION SENSOR" is activated (can be deactivated in "BASIC PARAMETERS" screen), and the wire tension falls below the setting lower limit (default 5gr) or max. limit (default 35 gr), the winder "understands" there is an issue with the wire (i.e wire broken) and automatically holds the winding process, showing the following screen (and blue light will blink if enabled):



AUTO HOLD	
WINDED TURNS	0
WINDED LAYERS	
PLEASE CHECK WIRE. WIRE TENSION WAS TOO LOW OR TOO HIGH	
DISABLE WIRE SENSOR	<input checked="" type="checkbox"/>
CONTINUE	STOP

Figure 45: Screen "AUTO HOLD" (tension sensor)

Under this holding state, you may check if there is any issue. If you wish, you may disable the wire sensor (this will deactivate the automatic hold when one of the limits is reached, but the tension value will continue to be shown). If you disable here the "WIRE SENSOR", this selection will be stored also in

“**BASIC PARAMETERS**”, so you will have to activate it again in case you want it active for successive windings.

If you try to change the wire tension during the winding process by adjusting the tension screw (**only in models without ATC**), this may cause a tension peak that exceeds the trigger limits and cause Tonewinder to stop winding. To avoid this, you can press the "10 sec Disable wire Trigger" button and for ten seconds you can change the tension without stopping the winding, even if the tension peaks above the limits. After these 10 seconds (you can see them in the progress bar below the button) the trigger will be active again.



Figure 46: 10 seconds Disable tension trigger

The winder will auto hold as well in case the Y motor stops or gets blocked for any reason, or the tachometric sensor stops measuring the plate turning pulses (**and blue light will blink if enabled**), then showing the following screen:

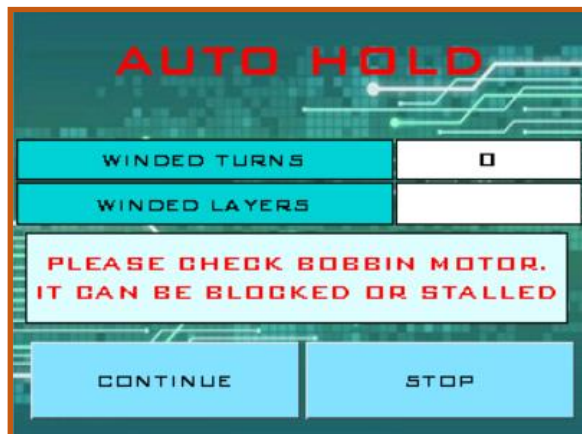


Figure 47: "AUTO HOLD" screen (tachometer sensor)

If the reason for the hold can be solved, you may continue winding by clicking “CONTINUE”, otherwise you may abort the winding by clicking “STOP”. In this case this screen will be shown:



Figure 48: “RUN ABORTED” screen

At any time during the winding process, you may hold the winding by clicking “HOLD/STOP”, the winder will quickly decelerate and hold, and wound turns and layers are shown on the screen.



Figure 49: “MANUAL HOLD” screen

Also, if you think the coil that is winding have an unwanted left or right bias, you can correct it by increasing or decreasing the "OFFSET" value in 100 um increments. When "CONTINUE" is pressed, the new "OFFSET" value will be permanently stored in the "BASIC PARAMETERS". This is the fine "OFFSET" adjustment.

NOTE: the “OPEN ATC” key is only available in ATC models, and allows you to open/close the ATC during the hold/stop.

Clicking **“STOP”** at this stage will abort the winding process. By clicking **“CONTINUE”** the winding will continue at the same stage it was held.

Tonewinder always ends the bobbins with the wire next to the bottom base of the pickup.

Once the winding is completed, the **“RUN COMPLETED SUCCESSFULLY”** screen is shown, then you can return to **“MAIN MENU”** screen.



Figure 50: **“RUN COMPLETED”** screen

6.5.1.2 Table mode:

In table mode, you can similarly make a coil to the constant mode, but being able to select up to 6 different sections, where you can vary the filling factor:

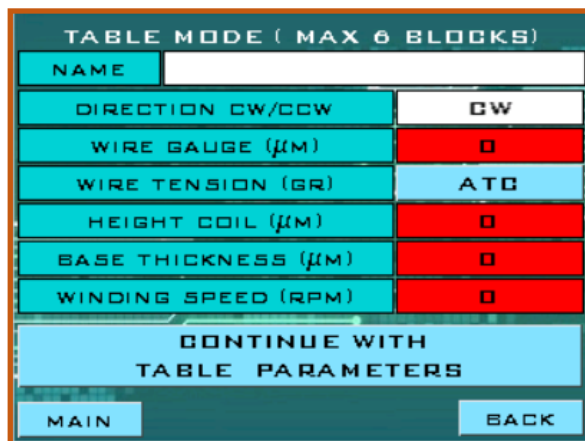


Figure 51: **“TABLE MODE”** screen

In each one of the blocks you must select the number of turns you want to make and the desired filling factor, selecting it from the slider. To update the TPL of the block click on the value field:

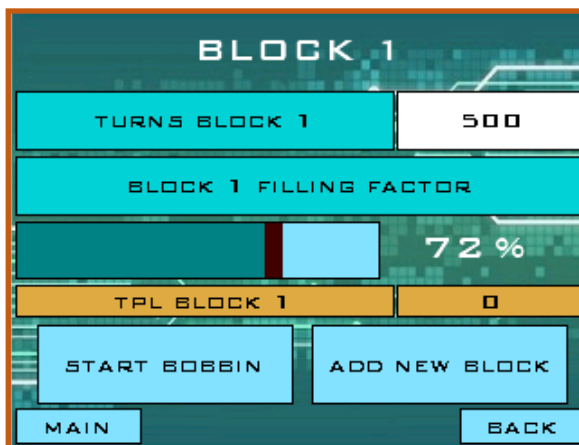


Figure 52: "BLOCK PARAMETERS" screen

At this point, we can add a new block (up to a maximum of six) or start with the winding. Once we have completed the desired sections, and before starting the winding process, the system shows a screen with the total number of selected blocks and the total number of blocks to be made:

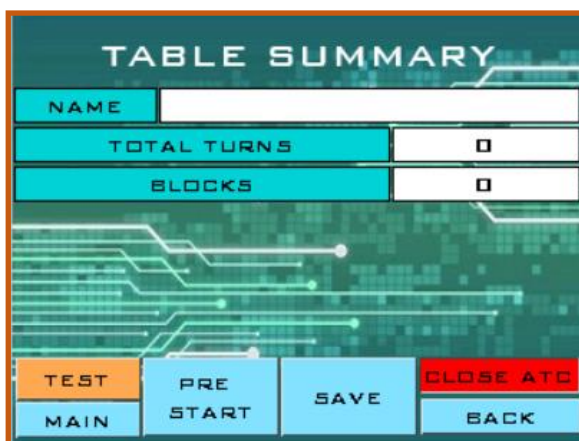


Figure 53: "TABLE SUMMARY" screen

NOTE: the "CLOSE ATC" key is only available in ATC models, and allows you to open/close the ATC before starting the coil.

Winding is identical to "CONSTANT MODE" from this point on.

NOTE: In this mode, **Tonewinder** will finish the coil by making the last laps next the base of the coil.

6.5.1.3 Scatter mode:

In this mode you may wind the pickup randomly or disorderly, randomly modifying the filling factor every certain number of turns. This mode is configured on two screens. In the first of them, the general parameters of the coil and winding are fixed:

SCATTER MODE	
NAME	SCATTER
TURNS	5000
DIRECTION CW/CCW	CW
WIRE GAUGE (μM)	70
WIRE TENSION (GR)	ATC
HEIGHT COIL (μM)	6500
BASE THICKNESS (μM)	1650
WINDING SPEED (RPM)	900
CREATE/CLONE BOBBIN	CREATE
MORE SCATTER PARAMETERS	
MAIN	BACK

Figure 54: "SCATTER MODE" screen

NOTE: the "ATC" key is only available in ATC models, and allows you to set the target tension (initial and final) during the run.

Also, in this mode, it is possible to save in normal mode (only the basic parameters of the pickup are saved), but it is also possible to make a Clone-array type save (in addition to the basic parameters, the position of the arm is saved so that it can be reproduced exactly later). Saving clone-array files is explained in [a little further on](#).

To create a new bobbin from scratch you must select "CREATE" in the "CREATE/CLONE BOBBIN". "CLONE" is selected when you want to clone your bobbin after winding it.

In the second screen ("SCATTER PARAMETERS") you will set the particular Scatter parameters. You have to choose the max and min Filling Factor and also the turns interval between changes (i.e each 50 turns the FF will be set randomly inside the limits previously selected). You may also set a pre and post scatter number of turns at which the **Filling Factor** will be kept constant.

You may see the **TPL** of every stage by clicking the **TPL** field.

SCATTER PARAMETERS	
URNS PRE-SCATTER	100
URNS POST-SCATTER	100
FILLING FACTOR PRE-POST	90
TPL (PRE-POST)	0
MIN FILLING FACTOR	45
TPL (MIN FF)	0
MAX FILLING FACTOR	80
TPL (MAX FF)	0
URNS SCATTER CHANGE	50
TEST	PRE
START	SAVE
MAIN	BACK
	CLOSE ATC

Figure 55: "SCATTER PARAMETERS" screen

NOTE: the "CLOSE ATC" key is only available in ATC models, and allows you to open/close the ATC before starting the coil.

Saving and winding processes are the same as for "CONSTANT MODE" from this point.

Clicking "SAVE" here will store only the coil parameters, but if your intention is to later **clone** the bobbin once made, then you need to go step by step the following process:

1. Make a reset to initialize the winder to make sure there is no spurious data in the ram memory, then select "NEW BOBBIN" in "MAIN MENU", and "SCATTER MODE" in "NEW BOBBIN".
2. Wind the pickup, using the basic parameters as appropriate.
3. Once the coil is finished, press "REPEAT BOBBIN" in the "MAIN MENU".
4. Modify the "CREATE/CLONE BOBBIN" field to display "CLONE".
5. Set a name for the bobbin.
6. Press "SAVE" to save the coil made. At this time the system will save both the general parameters and the data for the reproduction of the coil. (**NOTE:** Remember that this kind of file only can be saved in the 23rd first memory slots)
7. Once the saving is done, we can Load and replicate this coil as many times as desired.

NOTE: In this mode, **Tonewinder** will finish the coil by making the last laps next to the base of the coil.

6.5.1.4 Emulate mode:

In this mode, you can manually vary the filling factor at any time, by activating a potentiometer (Factor knob). It also allows you to save these parameters during winding so that you can clone the winding pickup later as many times as you want:

EMULATE MODE			
NAME	EMULA		
URNS	8000		
DIRECTION CW/CCW	CW		
WIRE GAUGE (μM)	70		
WIRE TENSION (GR)	ATC		
HEIGHT COIL (μM)	6500		
BASE THICKNESS (μM)	1500		
WINDING SPEED (RPM)	1200		
CREATE/CLONE BOBBIN	CREATE		
TEST	PRE	SAVE	CLOSE ATC
MAIN	START		BACK

Figure 56: "EMULATE MODE" screen

NOTE: the "CLOSE ATC" key is only available in ATC models, and allows you to open/close the ATC before starting the coil.

In this mode, we have to turn the potentiometer to vary the **Filling Factor** while winding.

Clicking "SAVE" here will store only the coil parameters, but if you intend to later **clone** the bobbin once made, then you need to go step by step the following process:

8. Make a reset to initialize the winder to make sure there is no spurious data in the ram memory, then select "NEW BOBBIN" in "MAIN MENU", and "EMULATE MODE" in "NEW BOBBIN".
9. Wind the pickup, acting on the potentiometer to modify the filling factor as appropriate.
10. Once the coil is finished, press "REPEAT BOBBIN" in the "MAIN MENU".
11. Modify the "CREATE/CLONE BOBBIN" field to display "CLONE".
12. Set a name for the bobbin.
13. Press "SAVE" to save the coil made. At this time the system will save both the general parameters and the data for the reproduction of the coil. (**NOTE:** Remember that this kind of file only can be saved in the 23rd first memory slots).

14. Once the saving is done, we can Load and replicate this coil as many times as desired.

6.5.1.5 Manual mode:

Within this menu you can also make a manual winding of a pickup, selecting the total number of turns, the maximum winding speed and the direction of rotation:

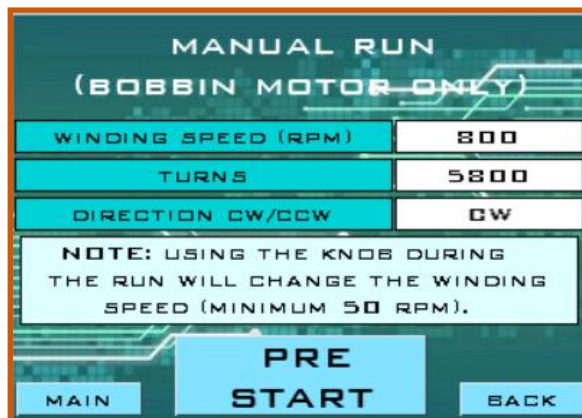


Figure 57: "MANUAL RUN" screen

In Manual winding mode, the X motor moves to a fully out position (Fully at the right end) to facilitate the manual guidance of the wire in the pickup. The wire guide arm can be used to stand the wire during winding. Winding speed can be continuously varied, by activating the potentiometer, between 50 r.p.m. and the selected speed chosen in previous screen.

6.5.1.6 Iconic Pickup Wizard Section:

In this section, you have access to a library of some of the most famous pickups of all time. To access this library, inside the "MAIN MENU", click on the button at the bottom left:

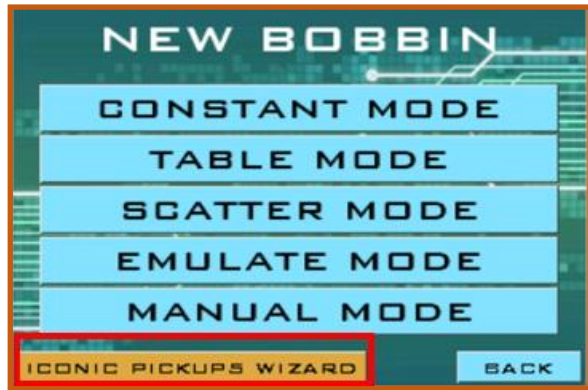


Figure 58: "ICONIC PICKUPS WIZARD" access

NOTE: All the information in this section is a compilation of the most popular pickups and is intended to be helpful. It is possible that some specifications or dimensions may not exactly match the original. If you are going to use the presets in this section, you should check the coil and wire diameter before using them.



Figure 59: "ICONIC PICKUPS WIZARD" screen

This library has different categories, depending on the pickup you want to make. For example, if you go to the "STRAT PICKUPS" section:

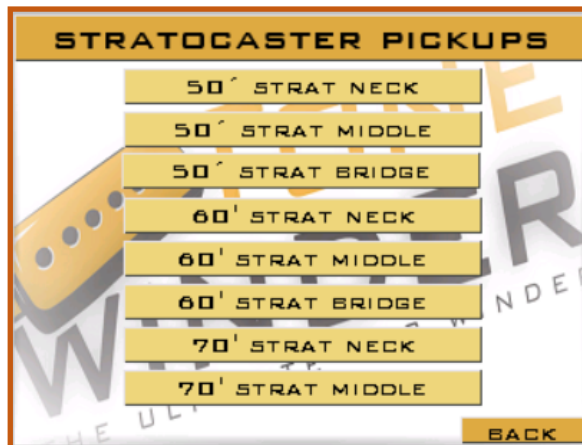


Figure 60: "STRATOCASTER PICKUPS" menu

If you select one of the pickups, for example, "60' STRAT NECK", a new screen will appear with a picture of this pickup and its basic construction parameters:



Figure 61: "50' STRAT MIDDLE" screen

You can use this preset in two winding modes, Constant and Scatter. Select the mode by pressing the blue "Constant" key.

In addition, we will have access to a useful construction diagram (by clicking "VIEW SCHEME"), which will indicate the direction of rotation of the wire and the plate, as well as the distribution of the pick-up output cables.

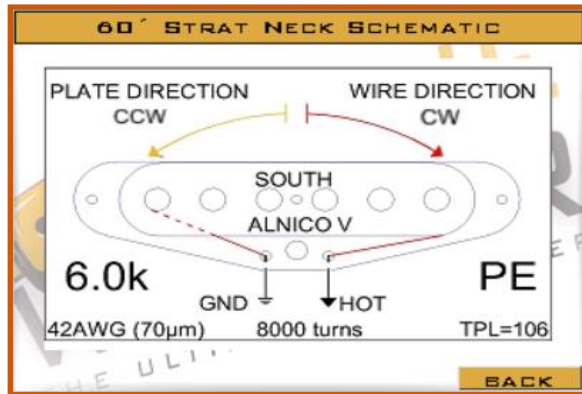


Figure 62: "60° STRAT NECK SCHEMATIC" screen

This information is also available for humbucker pickups, such as the famous PAF:

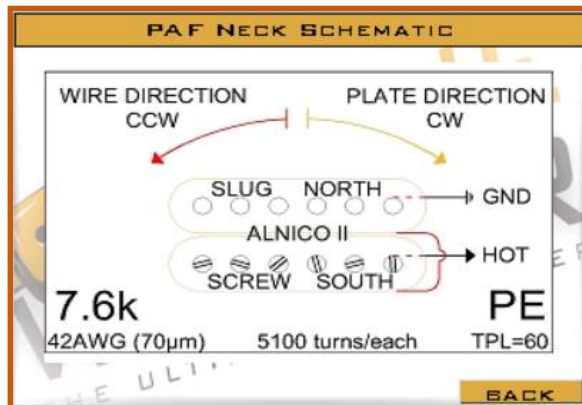


Figure 63: "PAF NECK SCHEMATIC" screen

You also can apply the basic parameters of these pickups on a real winding project (only in **Constant mode** or **Scatter mode**), just by clicking on the "APPLY" button.

CONSTANT MODE	
NAME	50° STRAT MIDDLE
TURNS	7800
DIRECTION CW/CCW	CW
WIRE GAUGE (µm)	70
WIRE TENSION (GR)	ATC
HEIGHT COIL (µm)	10800
BASE THICKNESS (µm)	2000
WINDING SPEED (RPM)	750
FILLING FACTOR (%)	70
TURNS PER LAYER	106
TEST	CLOSE ATC
PRE	
MAIN	BACK
START	SAVE

Figure 64: Applying pickup parameters

If you desire to apply all these parameters in another winding mode, you must copy them manually.

Once all the basic parameters have been copied, you will be able to wind the pickup in the normal way, and even save this pickup in one of the available memories.

6.5.2 Load Bobbin:

In this menu you can load the parameters of both a coil stored in memory by “**DEFAULT**”, and a previously saved coil:



Figure 65: “**LOAD BOBBIN**” screen

There is 1 coil saved by default and space to store up to 59 new coils, spread out over 5 pages. Once the data is saved, it remains stored in the SPIFFS memory of the ESP32. Via Wi-Fi, you can download these memories to a PC, to later reload them in **Tonewinder**. This applies to both simple files and also clone mode files previously stored using the **Scatter** mode and **Emulate** mode. (**NOTE:** Remember that this kind of file only can be saved in the 23rd first memory slots).

6.5.3 Repeat Bobbin:

By choosing this option you may repeat the last winded coil (This option can not be used if the last winding was made in **Manual Mode** or **Clone Mode**)

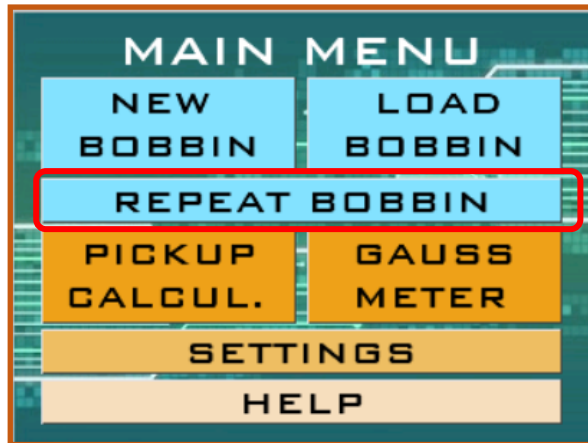


Figure 66: "REPEAT BOBBIN" button

You may also use **SAVE** from this screen.

6.5.4 Pickup Calculator:

In this new software version (from 10.4), a pickup calculator has been implemented which allows you to calculate very accurately the number of turns needed to achieve a given pickup resistance, taking into account the geometry of the bobbin, the type of wire used and the winding conditions. It also calculates the outer dimensions of the coil to avoid exceeding the physical limits of the coil.

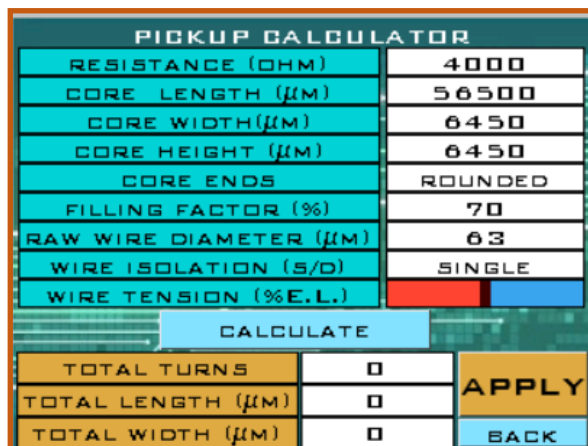


Figure 67: "PICKUP CALCULATOR" screen

By entering the internal measurements of the bobbin, the geometry at the ends, the type of wire used, the filling factor, and the percentage of tension of the wire with respect to its elastic limit, the program returns the estimated number of turns to achieve this resistance, as well as the external measurements of the winding once it is finished.

NOTE: note that this value depends on other factors such as the internal dimensions of the bobbin core, the type of wire used, the winding strategy and the filling factor of the bobbin. For this reason, this calculation should be understood as a guideline value.

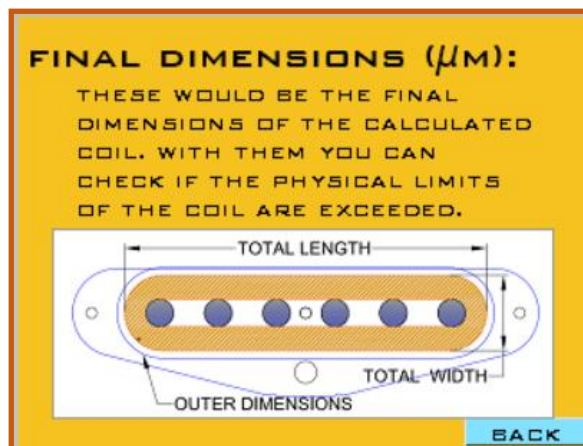


Figure 68: Final dimension diagram

Once this value is calculated you can apply it to a real winding program (only constant mode) by just clicking on the **“APPLY”** button.

Also, remember that you can access the interactive help for each parameter just by clicking on the parameter name field.

AWG	DIAM	SINGLE INCH	DOUBLE INCH	RESIST	ELASTIC LIMIT	BREAKING LIMIT	RECOMMENDED TENSION
	µm	µm	µm	Ohm/m	gr	gr	gr
38	102	102	107	2.11	98.1	102.0	48-52
41	71	79	83	4.36	43.5	54.8	23-24
42	63	71	76	5.42	37.4	43	18-20
43	56	61	69	7.01	29.6	34	14-16
44	51	57	59	8.47	23.6	27.1	12-14

Figure 69: Some interactive help screens

6.5.5 Gaussmeter:

This version of **Tonewinder** incorporates a powerful and useful magnetic field meter (Gaussmeter), to be able to evaluate the charge of the magnets of your bar or rod magnets.



Figure 70: Gaussmeter operation

The linear range of this device is about $\pm 2300/2500$ Gs, which covers by far the usual values for pickup magnets, usually below $\pm 1300/1500$ Gs.

It can also be calibrated using the calibration and verification magnet supplied with the winder.

6.5.5.1 Gaussmeter Operation:

The operation of the Gaussmeter is very simple, just place the magnet just above the hall sensor, and Tonewinder will show you the polarity of that side of the magnet, and the value of the magnetic field, measured in units of Gauss (Gs).

NOTE: Please note that the magnet should not be on top of the sensor when you enter this screen, as Tonewinder will be auto-zeroing the sensor at this point, so there should be no magnetic field on the sensor. If you have entered the page with the magnet on top of the sensor, exit the screen, remove the magnet, and re-enter the screen.

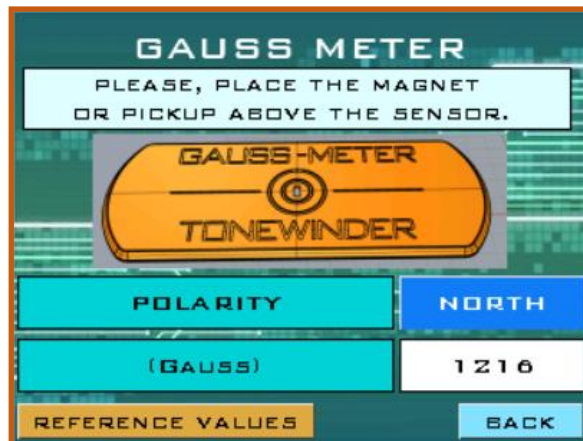


Figure 71: “Gaussmeter” screen

A verification and calibration magnet is supplied with your Tonewinder unit, with the value of the magnetic field in both polarities.



Figure 72: Verification/calibration magnet

You can use it from time to time to check that the sensor is measuring correctly. If the measurements are not correct, the sensor must be recalibrated. Up to 5/10% variation is considered acceptable due to the magnet not being exactly in the same position.

This new tool also incorporates a table with the most common reference values for the different types of magnets used for pickups. This section can be accessed by clicking on the reference values button.

COMMON REFERENCE VALUES FOR MAGNETS		
MAGNET	ROD	BAR
ALNICO 2	850-1000	530-580
ALNICO 3	630-670	450-490
ALNICO 4	750-790	600-690
ALNICO 5	900-1100	720-760
ALNICO 5 UN	N.A.	450-490
ALNICO 6	660-700	500-580
ALNICO 8	1400-1500	1200-1280
CERAMIC	1250-1400	1270-1350

NOTE: THESE VALUES SHOULD BE TAKEN AS APPROXIMATIONS TO 100% LOAD, AS THEY MAY VARY BY MANUFACTURER.

[BACK](#)

Figure 73: Common reference values for magnets

6.5.5.2 Gaussmeter Calibration:

All units come calibrated with the appropriate magnet, but if you are not getting good magnetic field readings or have doubts that it is working correctly, you can calibrate the sensor with a simple procedure explained below.

To calibrate this device, you have to access from "MAIN MENU>SETTINGS>GAUSSMETER CALIBRATION", and you will access to this screen:

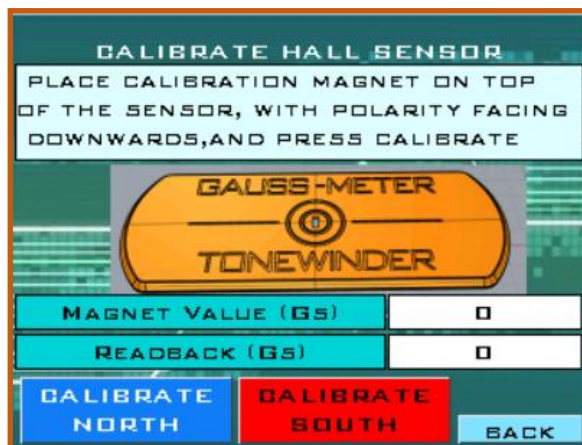


Figure 74: "Calibrate Gaussmeter" screen

And follow next steps:

- **STEP 1:** Switch on the winder and wait until the initializing process is finished, then press “START“. In the MAIN MENU screen press “Settings“, and then press “Calibrate Hall Sensor“, to calibrate the sensor of the Gaussmeter.

Place the magnet that is provided with the kit on the top of the Gaussmeter with the South polarity facing downwards,



Figure 75: Calibration magnet (south calibration).

then input the value of Gauss that is provided with the magnet on the “Magnet value (Gs)” field,

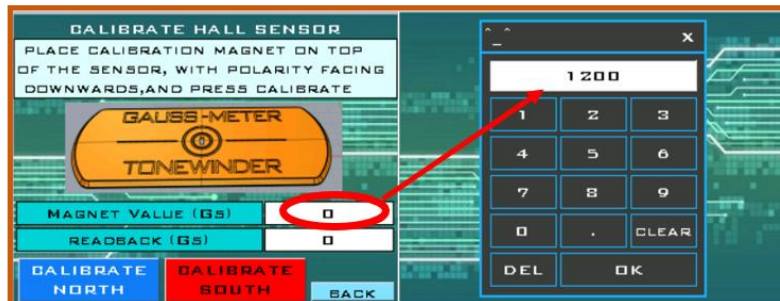


Figure 76: Input the magnet value.

and press “Calibrate South“. Once the readback field shows you the value (it must be almost the same as the input value),

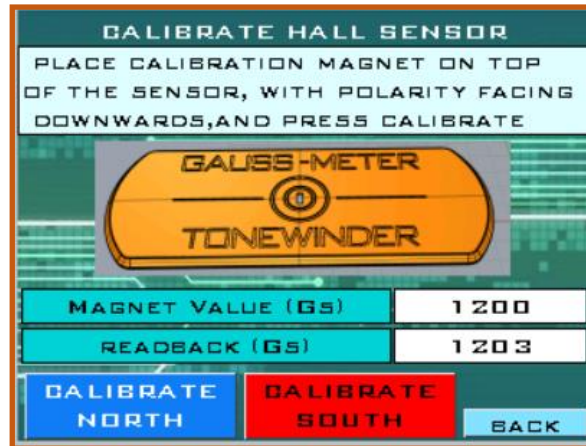


Figure 77: Readback after calibration.

let the instrument finish the calibration (the guide arms will move to the home position and then to the offset position).

- **STEP 2:** Change the magnet with the North polarity facing downwards in the center of the Gaussmeter, and repeat the same process described in the previous step. Then remove the magnet from the Gaussmeter.



Figure 78: Calibration magnet (north calibration).

NOTE: if after the calibration, the readback is not the same as the input value, reset the winder and repeat the from STEP 1.

- **STEP 3:** Reset the unit, from the “SETTINGS” menu, and when the initialization is finished, go to the MAIN MENU and press “GAUSSMETER” (take care that there is any magnet located on the sensor because when you press this button, Tonewinder makes an Autozero of the signal).

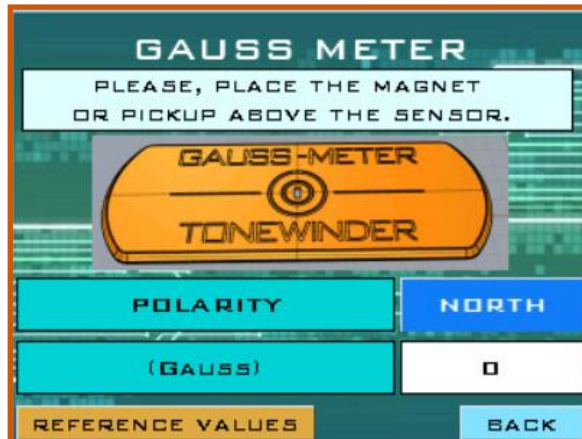


Figure 79: Gaussmeter screen.

- **STEP 4:** Verify, using the magnet provided in the kit, that the measured value is correct in both polarities. Up to 5/10% variation is considered acceptable due to the magnet not being exactly in the same position.

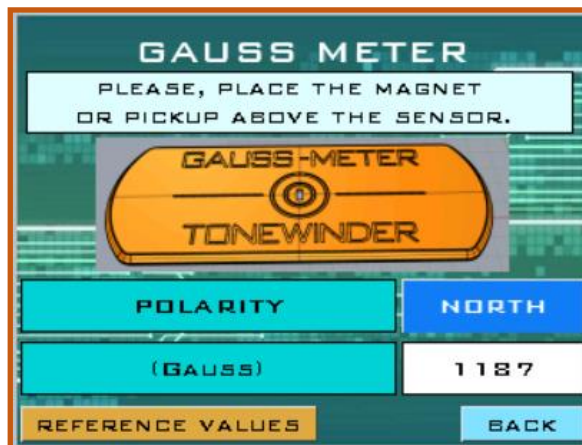


Figure 80: Magnet value verification.

NOTE: If the value is not correct, reset the unit and repeat from STEP 1.

Once the Gaussmeter is calibrated and verified, you can use it to measure your magnets. This hall sensor can work under a linear range of up to 2300/2500 Gs, in both polarities North and South, which is almost double the strongest magnets used for guitar pickups (excluding Neodymium magnets).

We recommend verifying the calibration magnet from time to time (once per month, for example), to check if the calibration is still fine. In case you have doubts about the readbacks of the magnets, you can recalibrate the sensor by repeating the procedure from **STEP 1**.

6.5.6 Settings:

In this section you can adjust the main parameters of the winder, it also allows you to calibrate Gaussmeter (see section [6.5.5.2 Calibrate Gaussmeter](#)), update the ESP32 microcontroller software, through a Wi-Fi network, and reset the device.

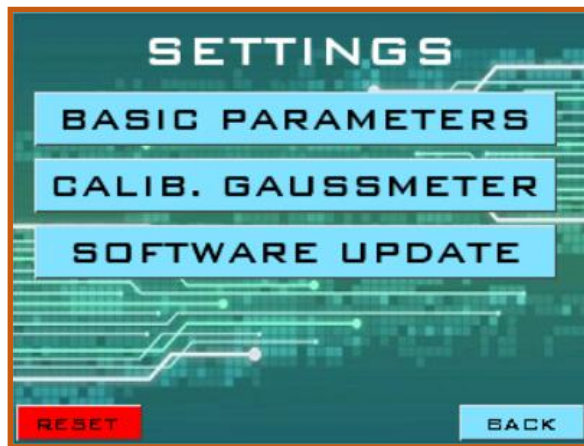


Figure 81: "SETTINGS" screen

6.5.6.1 Basic Parameters:

In the Basic parameters screen you have these parameters:

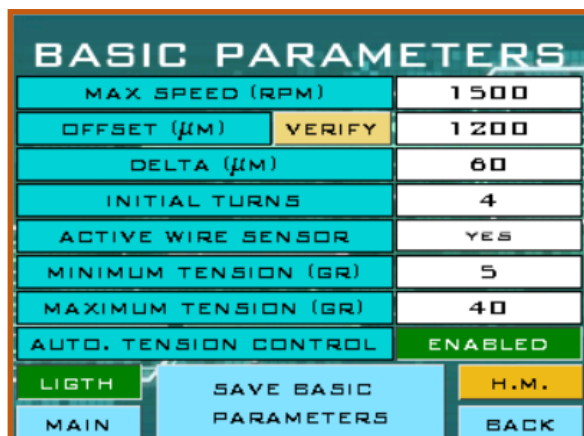


Figure 82: "BASIC PARAMETERS" screen

- **Max Speed:** allows you to limit the maximum winding speed, to avoid that we can mistakenly select a very high coil speed, the system limits the speed to this value. Don't exceed 1500 RPM.
- **Offset:** the distance, in microns, from the home position (initial set point of the X motor position) to the plane of support of the coil on the plate is aligned with the small white pulley of the guide arm. To verify or recalibrate this value see section [6.4.1 Verify "Offset Position"](#).
- **Delta:** it is the distance, in microns, where you do not want to have wire, stuck to the limits of the height of the coil, to avoid piling up the wire in the changes of direction of the winding and the overload in the wings of the coil, avoiding pickup deformations. The default value is 60 um
- **Initial Turns:** Number of initial turns that the system will perform, to accommodate the thread in the coil, before starting the winding. The default value is 5 turns.
- **Active Wire Sensor:** From here you can activate/deactivate the wire tension sensor.(Only auto hold system. Wire tension monitoring will be still performed)
- **Minimum tension:** Threshold for the auto stop low level. The default value is 5 grams.
- **Maximum tension:** Threshold for the auto stop high level. The default value is 35 grams.
- **Auto. Tension Control:** Switch On/Off the ATC system, so you can operate as the standard version.
- **Ligth:** Switch On/Off for the cosmetic light.
- **H.M. (hidden menu):** Allows you to calibrate the displacement of the arm after a software update (see FC_14).

Once you have set or modified any parameter you must click on "**SAVE BASIC PARAMETERS**" to permanently store it.

6.5.6.2 Calibrate Gaussmeter:

See section [6.5.5.2 Calibrate Gaussmeter](#).

6.5.6.3 Software Update (and Upload/Download files):

From the “**SETTINGS**” screen you can also update the microcontroller software via Wi-Fi 2.5G network (No 5G compatibility). To do this, press on the button “**Soft. Update**”and the following screen will shown up :

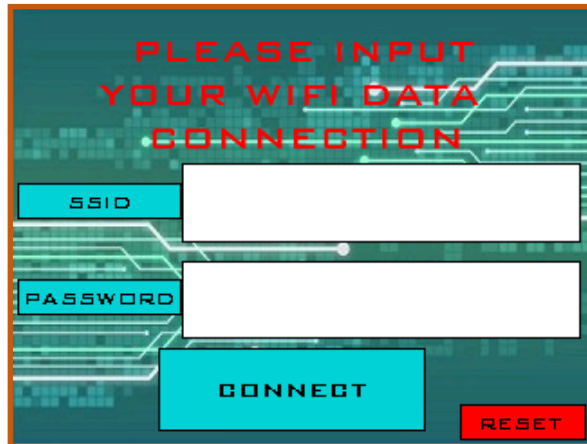


Figure 83: “**WI-FI CONNECTION**” screen

Pressing on each of the fields will open the keyboard to be able to enter both, the name of the **Wi-Fi** to which you want to connect and the access password. Be aware of case discrimination.

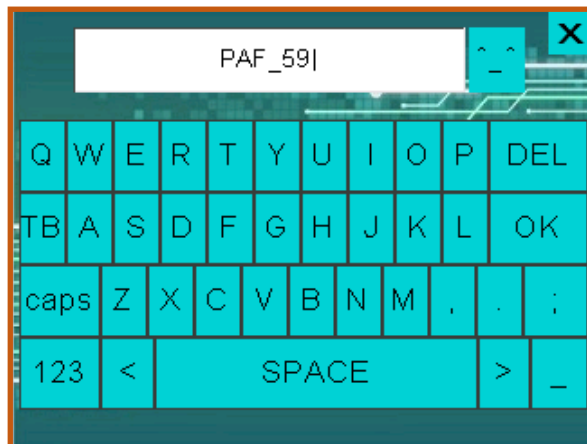


Figure 84: **QWERTY** keyboard screen

Once the fields have been properly filled in, by pressing the “**CONNECT**” button the device will show the next screen where you can open the communication to connect with the **Wi-Fi** network, showing you the IP address that you have to write in your browser to connect with **Tonewinder**.

If the winder cannot connect with the router in 25 seconds, it will return to “**SETTINGS**” screen. If this happens, please check the **SSID** name, **password**, and also distance to the router.

When the next screen shows up, **Tonewinder** has managed to establish a connection with the router and show up on the screen the **IP** address that we have to use in the browser of our PC to establish a connection with the **Tonewinder** web server.



Figure 85: “**SOFTWARE UPDATE**” screen

Note: It is possible that under certain circumstances (especially distance from **Tonewinder** to the transmitter of the **Wi-fi** network) **Tonewinder** does not connect to the network. If the problem persists, it is recommended to move the device closer to the **Wi-Fi** transmitter, and if this is not possible,



WARNING— Electric Shock or Damage to the Device

High voltages are present inside the device that could cause an electric shock or damage to the device.

you can temporarily remove the top cover of the equipment, removing the four screws from the corners, during the update process.

Once we have typed in the IP address in our browser, and “**enter**” is pressed,

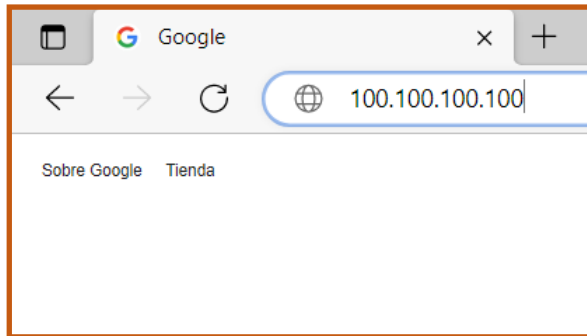


Figure 86: IP address in your navigator

Then, we have to push the connection blue button in the **Tonewinder** screen.



Figure 87: Press Connection button

Next screen will be shown.

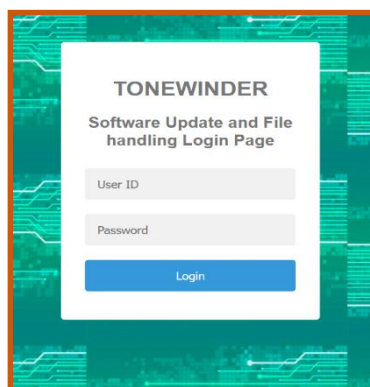


Figure 88: **Tonewinder** Access screen

This is the access screen to the **Tonewinder** web server menu. In the "**User ID**" field we must type: **admin** (all lowercase), in the "**password**" field we should type: **tonewinder** (all lowercase). This "*password*" does not provide

security on the internet, so it must be used exclusively in a private environment. Once you enter "User ID" and "Password" we will access the screen **Tonewinder Server**

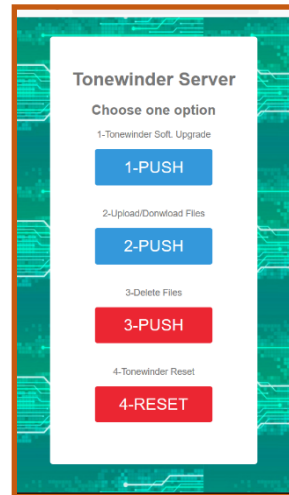


Figure 89: Tonewinderserver

Tonewinder Server Options Menu:

1. Update **Tonewinder software**.
2. Upload/Download files from/to a PC.
3. Erase files from **Tonewinder memory**.
4. Reset **Tonewinder**.

By selecting "1. **Tonewinder Soft. Upgrade**", we must make sure to choose one of the files with **.bin extension**. This step is crucial because in case of uploading a wrong file **Tonewinder** would be inoperative. You can download the latest version compatible with your **Tonewinder** on <http://www.Tonewinder.es> the correct files are:

Tonewinder_Inicializer.ino.bin, this program prepares the winder to allocate the working program. This file is only necessary if you are configuring **Tonewinder** from Scratch. If you just want to upgrade a working **Tonewinder**, the only needed file is the **Tonewinder_xx.bin**, this is the working program. You can download the latest version compatible with your **Tonewinder** on <http://www.Tonewinder.es>

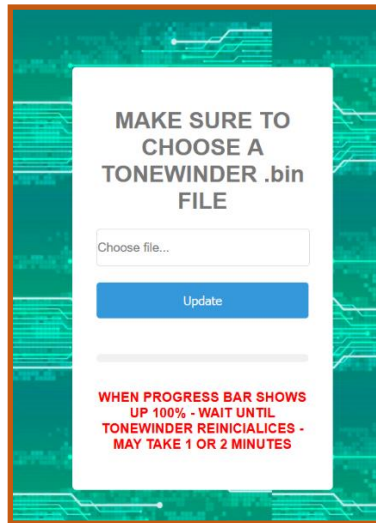


Figure 90: Select a software update

Once the file is selected, press the “**UPDATE**” button. The blue Progress bar will advance. Once 100% is complete, we wait for **Tonewinder** to reboot (it may take less than a few minutes).

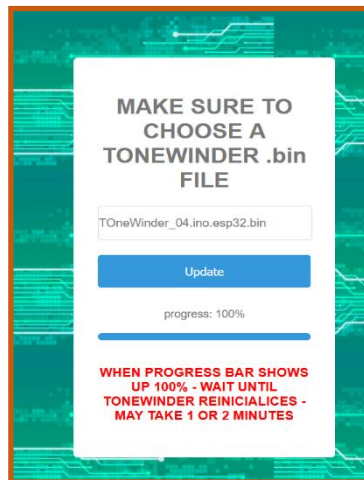


Figure 91: New software updated

When **Tonewinder** restarts, it will be disconnected from the router until we follow the connecting steps.

NOTE: If the updated file is **ToneWinder_Inicializer.ino.esp32.bin** we have to wait for the screen “**FORMATING**” is gone to...

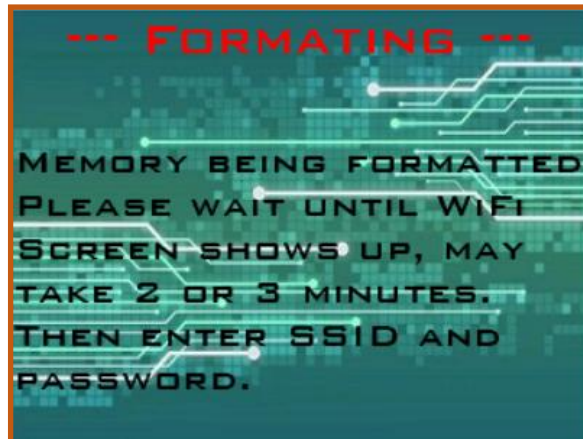


Figure 92: Formating Screen

...write again **SSID** and **Password** in the “**WI-FI CONNECTION**” screen to connect to our **Wi-Fi** router.

If we select “**2- Upload / Download Files**” the screen will appear that will allow us to download the files from **Tonewinder** to the download folder on our PC by selecting the file and pressing “**enter**”, the download will start.



Figure 93: File list overview

After files **1-59.txt** and **CloneArrayxx.txt** are downloaded, it is recommended to move them from the downloads folder to a folder identified with the file name, such as “**PAF 2022-11-21**”.

Through “**Upload file**” we can upload files previously downloaded to the PC back to **Tonewinder**. When selecting the files we will see the progress

monitor advance and through the "Refresh" button we will see the list of files updated.

It is important to decide in advance where we want to locate the files uploaded to **Tonewinder**. If we want to store the file in a free memory position or in one already occupied, in this case, the old file will be deleted.

If our file "1.txt" that we have named "Tele 2022-22-17" we rename it as "3.txt", once uploaded to **Tonewinder** will be shown as : "Tele 2022-22-17", in the memory position 3.



Figure 94: "LOAD BOBBIN" screen

If the file we are uploading is a **CLONE file (i.e. 1.txt)**, then we need to upload also the corresponding **CloneArra1.txt** to same memory position (as we have renamed "1.txt" to "3.txt" we have to rename "CloneArray1.txt" to "CloneArray3.txt" and then upload it to **Tonewinder**.

The option "3- Delete Files" give us the possibility to delete files from the **Tonewinder** memory.

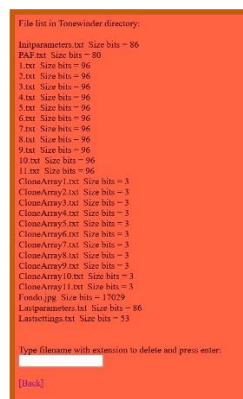


Figure 95: Delete File Overview

To delete a file we have to write the full name including the extension and then press “**enter**”. If the file has been properly erased, a confirmation screen will be shown.

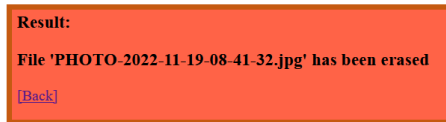


Figure 96: Message after deleting a file

We can only delete user files, or files that we have previously uploaded to memory. System files cannot be erased with this tool.

Option **4- RESET**. Reinitialices **Tonewinder** and disconnect it from the router.

NOTE: IT IS IMPORTANT TO CLOSE ALL BROWSER SCREENS UPON COMPLETION.

6.5.6.4 Backup/Restore the software:

This procedure describes the process followed to make a Mirror_Copy of your Tonewinder processor, store it on a Windows OS-based PC, and upload it back to a Tonewinder.

This Mirror_Copy of your Tonewinder processor contains a copy of the memory including the current software version, plus all the custom programs, basic settings, and calibration data as OFFSET VALUE or GAUSSMETER CALIBRATION DATA.

Note: HMI touchscreen software is not copied.

You can make a copy of all your files and software to be able to upload it again in case of file corruption, accidental deletion of important files, or transfer of your preferred files to another Tonewinder.

- **Installing the files in your HD:**

1. Download the “**ESP Flash Tools**” from our website, www.tonewinder.es.

2. Extract all the files to a temporary folder on your hard disk.




📌	 esptool.exe	09/03/2023 12:47	6.483 KB
📌	 DownloadTonewinderFLASH.bat	19/02/2024 13:55	2 KB
📌	 UploadTonewinderFLASH.bat	19/02/2024 13:59	3 KB

Figure 97: ESP32 Memory flashing files

- **Create/Backup a Mirror Copy of your Tonewinder Memory (DownloadTonewinderFLASH. Bat file):**

1. Switch OFF the Tonerwinder and disconnect it from the mains.
2. Connect a USB cable between the Tonewinder rear USB slot and one of your Windows PC USB connectors. Take note of the COM number of this connection.
 - *If you do not know it, please go to Windows Configuration Bluetooth and Devices, Devices, then connect your USB cable between Tonewinder and your PC USB sockets, you should see a message showing "USB-Serial CH340 (COMx)". Take note of the COM number to write it in the next step.*
3. Make sure the files **esptool.exe** and **DownloadTonewinderFLASH.bat** , are present in the directory.
4. Execute the file DowloadTonewinderFLASH.bat (by double-clicking on the file) and follow the steps suggested on the screen. You will be asked to press "ENTER" several times and to enter the COM number of your USB connection. For example: COM5
5. If no errors are shown on the screen, the process will end and a new file will be created in the current directory : **tonewinderMemory_FLASH.bin**





📌	 esptool.exe	09/03/2023 12:47	6.483 KB
📌	 <input checked="" type="checkbox"/> tonewinderMemory_FLASH.bin	15/01/2024 9:42	4.096 KB
📌	 DownloadTonewinderFLASH.bat	19/02/2024 13:55	2 KB
📌	 UploadTonewinderFLASH.bat	19/02/2024 13:59	3 KB

Figure 98: ESP32 Memory flashing files

6. This file is a binary copy of your Tonewinder memory, that you can store to be used later for backup or to clone your Tonewinder memory to other Tonewinder units.
7. Remember to disconnect the USB cable before switching On the Tonewinder again.

- **Upload/Recover a Mirror Copy to your Tonewinder Memory (UploadTonewinderFLASH):**

1. **WARNING. By following this procedure all existing files in Tonewinder will be overwritten**
2. Switch OFF the Tonerwinder and disconnect it from mains.
3. Connect a USB cable between the Tonewinder rear USB slot and one of your Windows PC USB connectors. Take note of the COM number of this connection.
 - *If you do not know it, please go to Windows Configuration Bluetooth and Devices, Devices, then connect your USB cable between Tonewinder and your PC USB sockets, you should see a message showing "USB-Serial CH340 (COMx)". Take note of the COM number to write it in the next step.*
4. Make sure the files **esptool.exe**, **tonewinderMemory_FLASH.bin**, and **UploadTonewinderFLASH.bat**, are present in the same directory.
5. Execute the file UploadTonewinderFLASH.bat (by double-clicking on the file) and follow the steps suggested on the screen.
You will be asked to press "ENTER" several times and to enter the COM number of your USB connection. For example: COM5
6. If no errors are shown on the screen, the process will end and your Tonewinder will be updated with the content of the file: **tonewinderMemory_FLASH.bin**
7. Remember to disconnect the USB cable before switching On the Tonewinder again.

- **Contents of BAT files:**

BAT files are one of those "bad reputation files" as they may contain malicious instructions that may create troubles in your system or even worse,

stolen valuable information about you, your accounts, or the information contained in your system.

The 2 BAT files used in the process of Flashing ESP32 Memory :

UploadTonewinderFLASH.bat

DownloadTonewinderFLASH.bat

Are editable text files, that you may open with a simple right-mouse click, and choose "edit with".

We have created these two files to simplify the process of memory copy, but they just use the internal commands of the file created by EXPRESSIVE SYSTEMS sptool.exe

You can inspect the files, or even edit them (we do not take any responsibility for that) to your convenience.

- **Text file "DownloadTonewinderFLASH.bat":**

```
@echo off
echo A copy of your tonewinder memory will be stored in the current directory
echo under the name tonewinderMemory_FLASH.bin This file will have all the
echo System files plus your customer files. It is a "mirror copy" of your device.
echo -----
echo Make sure program esptool.exe is present in this directory
echo and that you have full rights to copy and save files.
echo If errors are shown on the screen, try to create a temporary directory from
\Documents or
echo one of your HD. Move this DownloadTonewinderFLASH.bat file and
esptool.exe there and run the bat file
echo -----
echo -----
echo WARNING-WARNING-WARNING Tonewinder must be switched OFF before
connecting it to the PC
echo AND MUST BE OFF DURING ALL THE PROCESS. ONCE FINISHED DISCONNECT
THE RS232/USB CABLE
echo -----
echo Please be prepared to introduce the COMx (COM3, COM5...) where you are
connecting the USB cable
echo from Tonewinder. If you do not know it, please go to Windows Configuration
echo Bluetooth and Devices, Devices, then connect your USB cable between
Tonewinder and
echo your PC USB sockets, you should see a message showing "USB-Serial CH340
(COMx)".
```

```

echo Take note of the COM number to write it in the next step.
pause
set /p dl=Enter drive letter (example COM5) and push "intro":
echo once the download starts and 100%% is reached wait until the program asks
you to press a key to exit
pause
.\esptool.exe --port %dl% --baud 921600 read_flash 0 0x400000
%~d0%~p0\tonewinderMemory_FLASH.bin
echo If no errors are shown, a mirror copy of your Tonewinder memory has been
successfully saved in %~d0%~p0
pause
exit

```

- **Text file UploadTonewinderFLASH.bat:**

```

@echo off
echo This program will upload the file tonewinderMemory_FLASH.bin to
your tonewinder.
echo Make sure program esptool.exe and file
tonewinderMemory_FLASH.bin are present in this directory
echo This file has all the system files plus your customer files as they were
when the file was
echo downloaded from Tonewinder. It is a "mirror copy" of your device at
the time it was downloaded.
echo WARNING-WARNING-WARNING All current files in Tonewinder will
be ERASED.
echo If errors are shown on screen, try to create a temporary directory
from \Documents or
echo one of your HD. Move this UploadTonewinderFLASH.bat file,
tonewinderMemory_FLASH.bin,
echo and esptool.exe there and run the bat file.
echo -----
-----
echo -----
-----
echo WARNING-WARNING-WARNING Tonewinder must be switched OFF
before to connect it to the PC
echo AND MUST BE OFF DURING ALL THE PROCESS. ONCE FINISHED
DISCONET THE RS232/USB CABLE
echo -----
-----

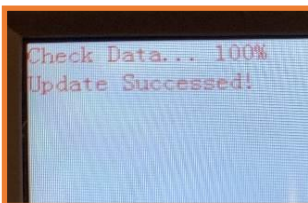
```

```
echo Please be prepared to introduce the COMx (COM3, COM5...) where
you are connecting the USB cable
echo from Tonewinder. If you do not know it, please go to Windows
Configuration
echo Bluetooth and Devices, Devices, then connect your USB cable
between Tonewinder and
echo your PC USB sockets, you should see a message showing "USB-Serial
CH340 (COMx)".
echo Take note of the COM number to write it in the next step.
pause
set /p dl=Enter drive letter (example COM5) and push "intro":
echo once the upload starts and 100%% is reached wait until program ask
you to press a key to exit.
echo press "intro"
pause

.\esptool.exe --chip esp32 --port %dl% --baud 921600 --before
default_reset --after hard_reset write_flash -z --flash_mode dio --
flash_freq 80m --flash_size 4MB 0x0
%~d0%~p0\tonewinderMemory_FLASH.bin

echo If no errors shown, Tonewinder has been updated with backup file
tonewinderMemory_FLASH.bin.
pause
exit
```

6.5.6.5 Touch Screen Software Update:



The touchscreen software update is performed using a **microSD, max 32Gb**, card through the slit located under the screen. **Only a Windows OS can be used to save and update this software.**

Download the updated version of the **Nextion software** program in the download section of <http://tonewinder.es>.

NOTE: the downloaded file is compressed (zip), and you must decompress it before use it. **The extension of this file is .tft.**

Copy the program to an empty **microSD** card. With **Tonewinder** turned off, insert the **microSD** card into the ready-made socket under the display (**Contacts facing to you**). Make sure the card has been adjusted correctly (you will feel a soft resistance when the card is seated, making a final click). Then operate the **Tonewinder** power switch.

The guide arm will be moved first to the starting position and then to the zero position. This movement is normal.

The update screen should show the progress of the program load and, after a few seconds, the screen will show the successfully updated status.

Remove the **microSD** card by pushing it lightly and then remove it completely.

NOTE: if you receive this message (see below), your microSD card must be formatted as **FAT32 (fast)**, only under **Windows OS**. If this error persists, please read **FC_12**.

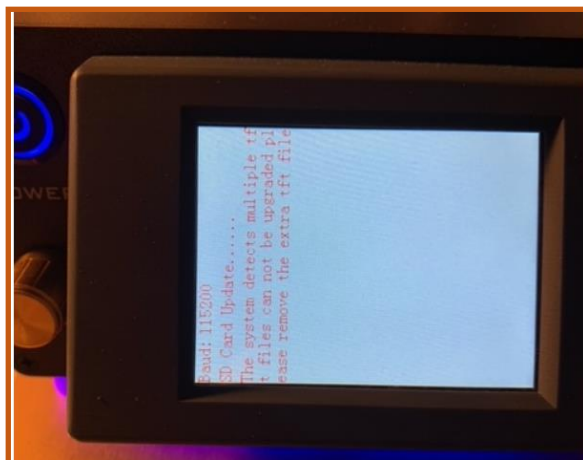


Figure 99: error during the upload.

6.5.7 Help:

Within this section, you have access to different submenus related to different operating problems during winding, such as:

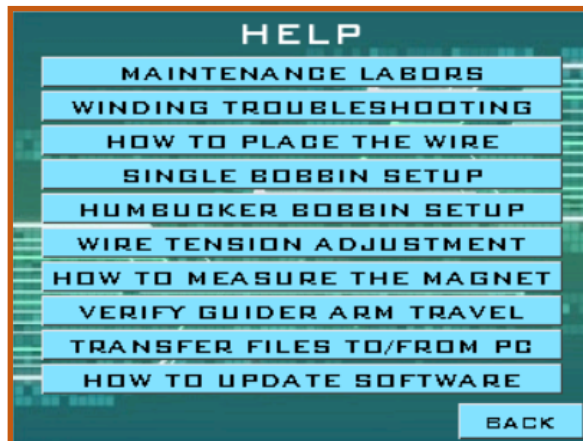


Figure 100: "HELP" screen

- **MAINTENANCE:** This section describes all the maintenance work that you need to carry out on your unit to ensure its correct operation. All these works are also covered in section ["7.1 Routine and Preventive Maintenance"](#) of this operating manual.

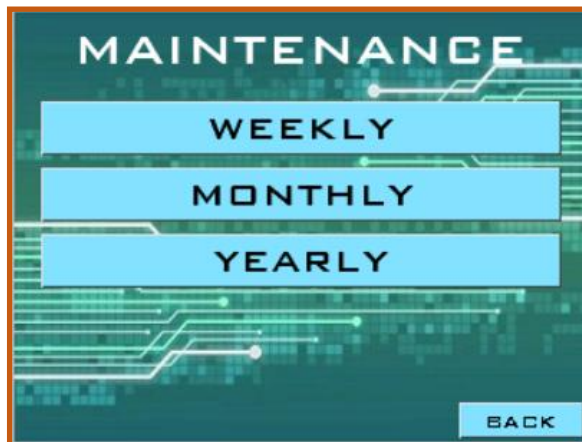


Figure 101: "Maintenance" screen

By clicking on each button you have access to the maintenance works of each period, including descriptive pictures.



Figure 102: "Weekly Maintenance" screen

- **CORRECT WIRE POSITION:** The path of the wire on the winder is shown.



Figure 103: Correct wire position scheme

- **WIRE TENSION ISSUES:** you should visit this section when you are having problems with wire tension during winding. These problems can be no tension on the screen, too little tension, or too much tension.



Figure 104: Wire Tension Issues

In each of these fields, you will find a list of possible causes of why you are facing this problem. For example, here you have a list of possible reasons for a wire tension too high



Figure 105: Wire Tension Issues

- **WIRE BREAKAGE ISSUES:** you should visit this section when you are facing problems of wire breakages during winding.

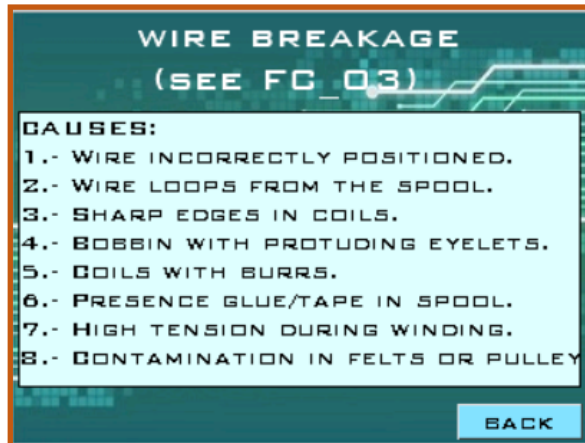


Figure 106: Wire Tension Issues

A factory communication on possible causes of wire breakage during winding is also available on our website <http://www.Tonewinder.es>.

- **ODD SHAPED COIL:** You should visit this section if your coil shape is not uniform or has any of the following finishes:

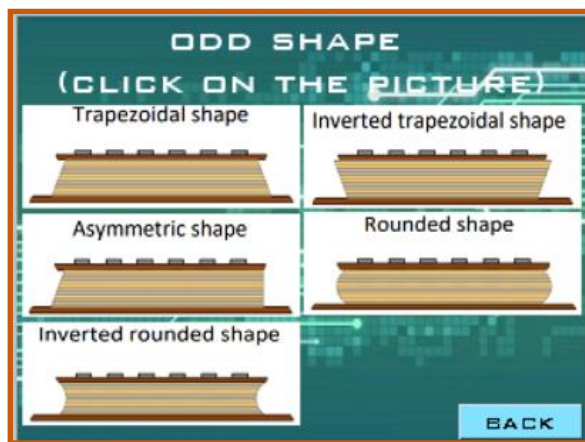


Figure 107: Odd shape coil

By clicking on any of the drawings will take you to another screen which will explain the reasons why you may have got this shape and what you need to do to correct it and get a normal shape.

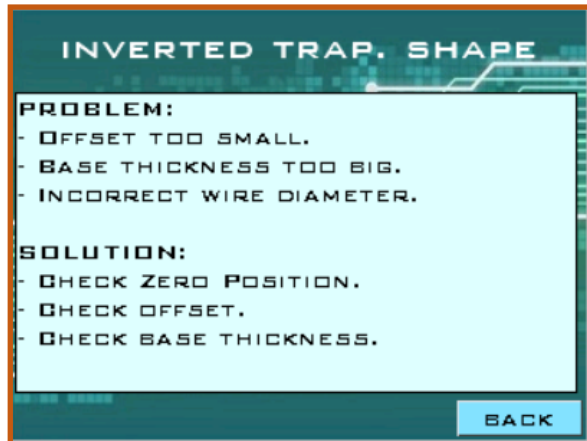


Figure 108: Inverted Trapezoidal shape

- **RELATED TO CLONE:** you should visit this section when you are having problems to clone a pickup.
- **OTHER ISSUES:** If you are facing another kind of issues you can contact us at info@tonewinder.es.

6.6 File System Operation:

Tonewinder uses different files for its operation, some of these files are for the exclusive use of the winder itself such as system files, and others are configurable by the user to define the winding parameters or the name of the files, among others.

All of these files are used in the volatile memory of the **Tonewinder** and in the permanent memory **SPIFFS**. **(S)erial (P)eripheral (I)nterface (F)lash (F)ile (S)ystem**.



Figure 109: Tonewinder File list

We can work with **Tonewinder** without worrying about the structure of the file system, but it is important to understand it if we want to export files to an external PC, and / or manipulate them thus making the file storage capacity practically unlimited and also increase the possibilities of customization of the windings.

6.6.1 System files:

Those are files for the exclusive use of **Tonewinder** that should not be modified or deleted, since any of these actions could cause the unforeseen operation of **Tonewinder** or even a breakdown. Winding files, system parameters, winding data, and image parameter files.

Winding parameter files:

The structure of the winding parameter files is as follows. These are data files separated by commas and ending with a "/0". These files meet the parameters of csv files, but **Tonewinder** uses the txt extension for these files. They have 30 positions + "/0" and their content corresponds to the following parameters:

1. Coil rotation direction
2. Number of coil turns
3. Winding coil width
4. Filling factor %

5. Wire gauge
6. Support thickness
7. Winding speed RPM
8. Winding mode (Continuous, Random, Table, Manual, Emulation, or Cloning)
9. Random mode fill factor change interval
10. Minimum fill factor in random mode
11. Maximum fill factor in random mode
12. First stage laps in Table mode and pre and post-random turns in random mode.
13. First stage filling factor
14. First stage winding mode
- 15 - 17 idem (12. to 14.) second stage
- 18 - 20 idem (12. to 14.) third stage
- 21 - 23 idem (12. to 14.) fourth stage
- 24 - 26 idem (12. to 14.) fifth stage
- 27 - 29. idem (12. to 14.) sixth stage
- 30 - 31 Wire tension ATC min. and max. value
32. File Name

Winding parameter file types:

1. Winding files with preset parameters (**DEFAULT**):
 - PAF.txt

Shown in **Tonewinder** screen with its name followed by the (**DEFAULT**) tag.

2. The **Initparameters.txt** and **Lastparameters.txt** files, with the same structure as the previous ones, but where initialization parameters for the winding and last wound coil parameters are stored respectively. (The **Lastparameters.txt** file cannot be used for manual winding mode. The parameters of the manual winding mode speed and number of turns are stored in **Lastparameters.txt** but the rest of the parameters are not stored) (**NOTE:** Repeat coil cannot be used when the manual winding mode has been used in the last coil).

System parameters files:

Tonewinder use the file Lastsettings.txt to store parameters as:

- Maximum winding speed

- Number of initial turns
- DELTA
- OFFSET
- Wire tension sensor auto-hold enable/disable
- SSID WIFI
- PASSWORD WIFI
- Min. Wire Tension set value
- Max. WirebTension set value
- Ligth enable/disable switch
- GasussmeterCalibration factors
- ATC (Auto Tension Control) enabled/disabled

NOTE: SSID and PASSWORD are relative to the **Tonewinder** connection to **Wi-Fi** router.

System parameter files structure is the same as the winding parameter files, but it has only the 10 fields, already mentioned +"/0":

Winding data files:

The **EmulateArraySPIFFS.txt** file contains the winding data of the last winded coil using **EMULATE** winding mode, it is only stored in SPIFFS memory when such data has not been yet stored in a **CLONE** file type. It is a temporary system file and the data it contains could be corrupted, so if you intend to use such data, you should do it with caution. This file does not contain information except in the case of winding in **CLONE** mode.

Image files:

This is just a picture, Fondo.jpg, contains information for the web server background and is an optional file that can be removed to save SPIFFS memory space.

6.6.2 User Files:

There are two types of user files, the first one is exactly the same as the System winding parameters files, but all parameters are user configurable, those are the files **1.txt** to **59.txt**.

```
0,1000,10200,100,75,1500,800.00,2,0,10,100,500,90,2,6000,50,2,500,90,2,0,50,0,0,50,0,0,50,0,2022-11-10
```

*In this example we have a Table Winding file and its 30 parameters fields with the given name **2022-11-10**.*

The second file type is an attached file to the winding parameters file (Separate file but must be copied next to), which contains winding data generated during EMULATE winding mode and used exclusively in **CLONE COIL** winding mode. These are the files **CloneArray1.txt** to **CloneArray23.txt**. They only contain winding information in two fields, time from winding start in milliseconds, and wire positioning motor speed. The file stores a maximum of 4000 information points with a frequency of approximately 3.8 times per second. So the maximum storage time could be set between 16 and 17 minutes. If we exceed the winding time beyond 17 minutes, and the 4000 memory positions are filled, the subsequent data will not be stored. These files are empty for any winding mode other than **CLONE MODE**.

```
0,0
```

*This is the data contained in a **CloneArrayXXX.txt** for any file other than **CLONE MODE**. Empty file with only 0, 0.*

Below an example of the partial content of a **CloneArrayXXX.txt** file with winding data. Time and X motor speed comma separated data. The number of data depends of the winding time (Max 4000 points).

```
380,91
632,96
888,99
1147,101
1401,102
1666,101
1923,100
2183,105
2439,97
2706,103
2962,101
3222,95
3478,97
3746,207
3996,365
4264,425
4520,435
4788,514
5042,611
5303,722
5558,880
5826,1103
6083,1284
6342,1555
6599,1992
6866,2000
7122,2000
7382,1973
```

6.6.3 Storage memory:

Tonewinder has 59 memory positions available to store user files. The memory position gives the name of the corresponding file. But it is only possible to save Clonearray files in the first 23 positions, due to a memory limitation. When we create a new file, or modify an existing one, when saving it, the file acquires the name of the memory position where we save it and then this deletes the file that was previously in that memory position, if there was any.

That is, if we create a new file with the name "**Tele 2022-11-17**" (Maximum 20 characters for the name) and we save it in memory position number 3, the file will be stored with the name "**3.txt**" and will contain in its data, as a parameter no. 30, the name "**Tele 2022-11-17**" (which we will see on the **Tonewinder**[®] screen in memory position no. 3)



Figure 110: "LOAD BOBBIN" screen

The amount of SPIFFS available memory for user files is about 1.3 Mb. Enough to store 59 user files (**1.txt** to **59.txt**), and 23 Clonearray data files (**CloneArray1.txt** to **CloneArray23.txt**).

7 Maintenance and Service

This chapter describes the routine maintenance and the service procedures that the user may perform.

7.1 Routine and Preventive Maintenance:

Tonewinder is designed to be trouble-free if properly maintained.

7.1.1 Weekly maintenance:

Lubricate felt discs in wire guide arm and wire stabilizer with oil.



Figure 111: Lubricating wire tension felts

7.1.2 Monthly maintenance:

Clean and lubricate pulleys with oil.



Figure 112: Lubricating pulleys

7.1.3 Yearly maintenance:

Clean and grease the guide arm screw, then move it back and forth several times. Lubricate motor bearings with oil.

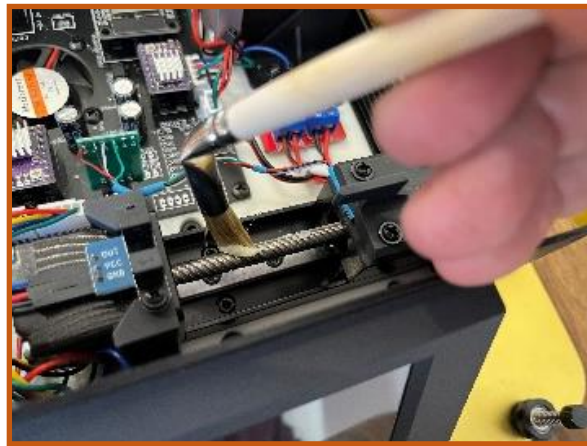


Figure 113: Lubricating wire arm guider screw with grease

7.2 Reload Software procedure (from scratch):

If connection between **Tonewinder** and Wifi router is possible, reload software according to section [6.5.4.3 Software Update and Upload/Download files.](#)

Only if connection between **Tonewinder** and Wifi router **is not possible**, you can still upload the software by means of a USB/USB cable.

Plug the USB cable in the ESP32 board connector in the back cover (2).



Figure 114: Back panel with USB-C and 24V power inlet connectors

1. On a PC with Windows download and install the program **flash_download_tool_xxx.exe** ([download](#)). There will also be the drivers you eventually need if your PC does not find a new Serial Port Connection when connecting the USB. (Retain the COM number for posterior use)
2. Start the program **flash_download_tool_xxx.exe** and select:
 - a. ChipType : **ESP32**
 - b. Workmode : **Developer Mode**
3. Find the bin file to upload and select it, then write the memory address as indicated below. Type in or select the COM port (previously noted) and the port speed (speed **921.600** baud).
(ToneWinder_Inicializer.ino.esp32.bin): **0x10000**
Select the check box on the left of the file name.
4. If not already selected, click on the SPI SPEED and SPI MODE as shown in the image below.
5. Push **START**

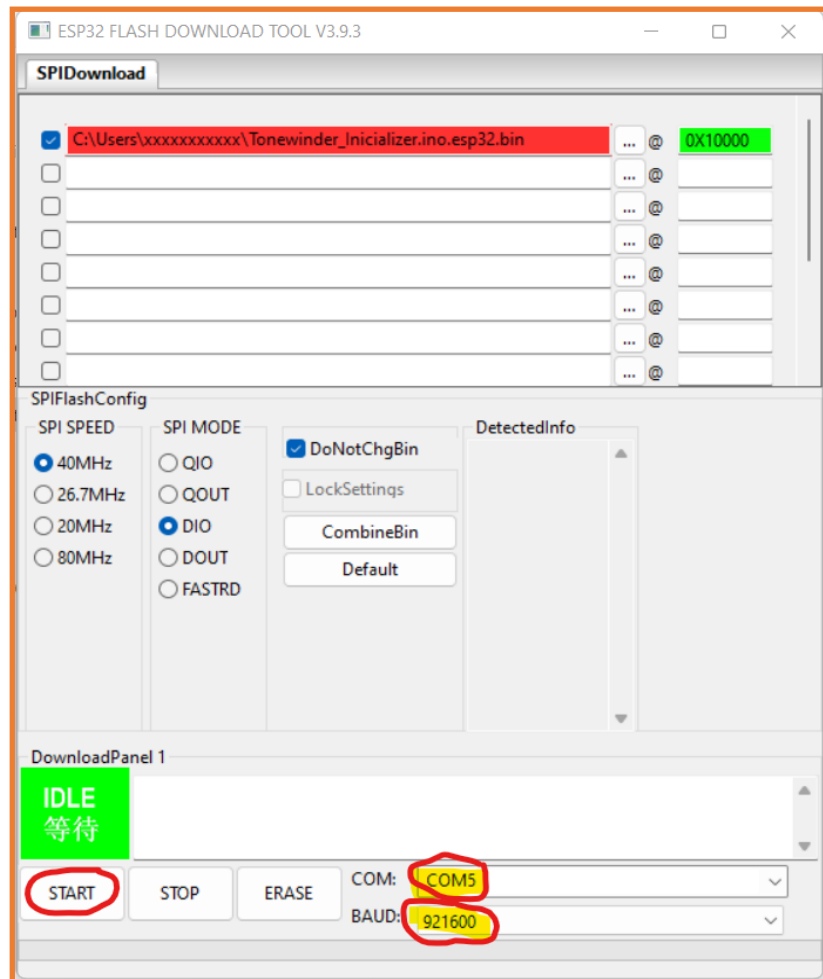


Figure 115: ESP32 Flash program

In case the last uploaded program was Initializer, once successfully uploaded, Tonewinder will reinitiate, will format the system and will automatically show the Wi-Fi connection screen (may take a couple of minutes).

From this point, we can continue uploading .bin files by means of the USB or we can introduce the Wi-Fi router SSID and Password, and then we can continue the upload via the web server (recommended procedure).

8 Troubleshooting

This chapter is a guide to troubleshooting issues that may arise during the operation of the device.

8.1 General Information about Troubleshooting:

Tonewinder has been designed with robustness in mind, to provide fully satisfactory and reliable operation. Both its mechanical components and the control program have been exhaustively tested for reliability, however, it is possible that some component deteriorates or suffers wear and it needs to be replaced, or that the control program is corrupted due to unexpected electric phenomena. In both cases we have solutions. We have spare parts for any of the components, we have a repair service in our facilities and the control programs can be reloaded by yourself.

In the event of unexpected or anomalous operation, we must always first ensure that **Tonewinder** is connected to an appropriate electrical source (between 100V and 240V 50/60Hz)

The following features help you to identify and eliminate the source of problems that may arise during the operation of the device.






If you are unable to resolve a problem following the instructions given here or if you experience problems that are not covered in this section, contact **Tonewinder OE** Technical Support for assistance. See the contact information at the beginning of this manual.

To facilitate device identification, have the serial number and technical name available when communicating with **Tonewinder OE**.

8.2 Troubleshooting Check:

If a problem occurs with the device, the following troubleshooting check helps identifying and isolating the cause of the problem. Subsequent troubleshooting sections cover the problems in greater detail.

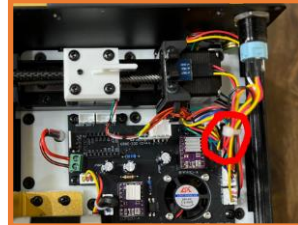
8.2.1 Problems related to power supply:

Symptom	Description and Remedial Action
<p>Dark screen. Your unit doesn't ignite and no light is visible.</p>	<ul style="list-style-type: none"> <p>Check the Power supply cable, socket, and switch.</p> <ol style="list-style-type: none"> <p>Check if there is power in the wall socket with a Multimeter.</p>  <p>Check if there is power in the power supply (a green LED must be on). You can check the 24 VDC in the plug.</p>   <p>Check that the plug of the power adapter is firmly connected to the winder.</p>  <p>Check that the power button is pressed down.</p> 

If the power supply is ok, the internal connections of the winder must be checked.

- Open the upper cover of the winder, by removing four M3 screws (two in the front cover, and two in the rear cover), and verify:

1. Check if the internal power switch connector is properly connected. Disconnect and reconnect just in case.



2. Verify if there are 24 vdc between pins 1 and 2 of the connector PCB. If this voltage is present, the problem may be a circuit breaker fault and must be replaced.

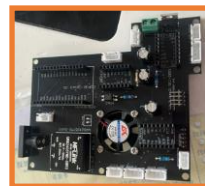


3. If there are 24 VDC, check if this voltage is present in the terminal of the PCB connector. If is present, probably there is a failure in the PCB board, and must be replaced.


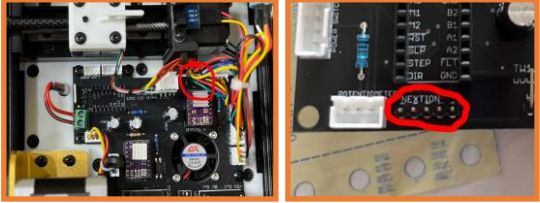


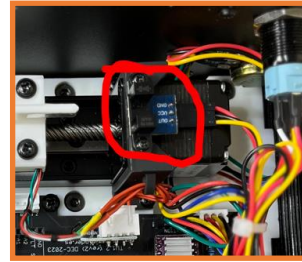
4. If there is any voltage in this connector, but there were 24 vdc in the plug connector of the power adapter, there can be two possibilities:

- a. There may be an internal short circuit on the PCB that makes this voltage disappear. In this case, disconnect all wire connectors from the PCB, and remove the motor controllers and the microcontroller. If the voltage is restored at the PCB connector, it means that one of these components is producing the short circuit, and you should reconnect them one by one to see which one is faulty.
- b. The shortcut is present on the PCB by itself; therefore it must be replaced or repaired.



8.2.2 Problems related to the initialization of the unit:

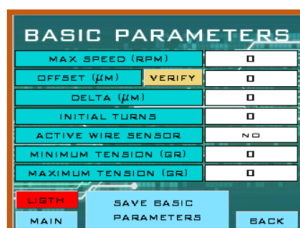
Symptom	Description and Remedial Action
<p>The screen is On but the winder does not initialize. Your unit stays on this screen:</p> 	<ul style="list-style-type: none"> • If the guide arm moves when the winder is switched on, finishing the initialization process <ol style="list-style-type: none"> 1. Could be a failure in the software of the ESP, and must be reloaded, <ol style="list-style-type: none"> a. If you have a backup of your ESP, you can use the procedure described in the section “6.5.6.6 Backup/Restore the software”. b. If you don't have any backup file, you can use the procedure described in the section “7.2 Reload Software procedure (from scratch)”, to reload the software to your ESP. 2. Could be a connection failure in the touch screen connector. To check this, open the top cover of the winder and check if the wires of the connector are well fixed. Disconnect and reconnect just in case: <div style="text-align: center;">  </div> 3. It may be that the ESP microcontroller is defective or is not working properly. In this case, it should be replaced. 4. It may be that the HMI Touch Screen is defective or is not working properly. In this case, it should be replaced. • If the guide arm doesn't move when the winder is switched on, finishing the initialization process. <ol style="list-style-type: none"> 1. Could be a failure in the software of the ESP, and must be reloaded. 2. If you have recently exchanged the microcontroller, check that it is fitted correctly. 3. Check that the home sensor is working properly. To do this, remove the top cover of your unit: <ol style="list-style-type: none"> a. Place an opaque object in the center of the sensor and if a red LED on the bottom of the sensor does not light up, the sensor connections, both on the PCB and on the sensor itself, need to be checked.



- b. if when activating the home sensor, the red led under the sensor lights up, and the winding initializes correctly, jumping to the start page, there may be a problem in the stepper motor that moves the arm, or in the driver.
- c. Check the connection of X-motor on the PCB.
- d. Swap the motor drivers (with the power off), and if the winder initializes correctly on start-up, the problem is the X-motor driver itself, and needs to be replaced.


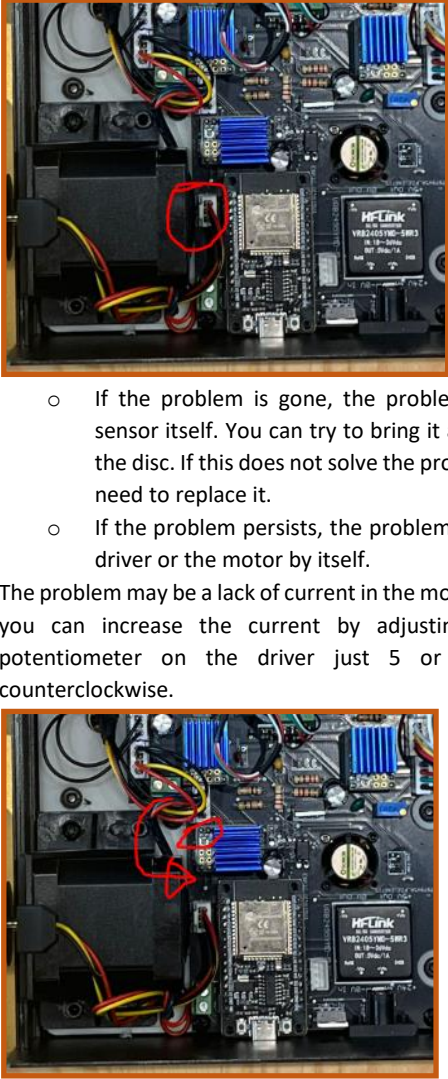
NOTE: Only swap them to test them. Once this has been tested, return each driver to its place, as each one is set to a certain current depending on the motor it works with.

The screen is On and the winder initializes correctly, but basic parameters are set in zero.



- Could be a failure in the software of the ESP, and must be reloaded,
 1. If you have a backup of your ESP, you can use the procedure described in the section "[6.5.6.6 Backup/Restore the software](#)".
 2. If you don't have any backup file, you can use the procedure described in the section "[7.2 Reload Software procedure \(from scratch\)](#)", to reload the software to your ESP.
 3. The shortcut is present on the PCB by itself; therefore it must be replaced or repaired.
- If reloading the software does not solve the problem, try reloading the Initializer first.

8.2.3 Problems related to stops during operation:

Symptom	Description and Remedial Action
<p>The winder suddenly stops, the light blinks and the screen shows the message:</p> 	<ul style="list-style-type: none"> • Winding motor stalled or blocked by a foreign object (Traces of hair or winding wire coils obstructing the winding shaft or wire tension too high). • Open the top cover, and disconnect the Hall sensor of the Y-motor: <ul style="list-style-type: none"> ○ If the problem is gone, the problem is the hall sensor itself. You can try to bring it a bit closer to the disc. If this does not solve the problem you will need to replace it. ○ If the problem persists, the problem could be the driver or the motor by itself. • The problem may be a lack of current in the motor, for which you can increase the current by adjusting the potentiometer on the driver just 5 or 10 degrees counterclockwise.  <ul style="list-style-type: none"> • Check that the max speed is set below 1500 RPM.

The winder suddenly stops, the light blinks and the screen shows up the message



And the wire is not broken.

- Check the trigger limits for the wire tension.

BASIC PARAMETERS		
MAX SPEED (RPM)		1200
OFFSET (μM)	VERIFY	750
DELTA (μM)		60
INITIAL TURNS		2
ACTIVE WIRE SENSOR		YES
MINIMUM TENSION (GR)		5
MAXIMUM TENSION (GR)		45
AUTO. TENSION CONTROL		DISABLED
LIGHT	SAVE BASIC PARAMETERS	BACK
MAIN		

- Lubricate felt disc with oil (Tension Screw and Stabilizer).

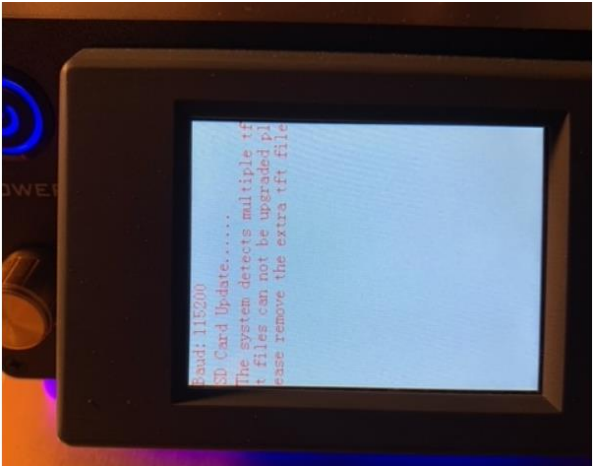


- Check that the pulleys are turning without resistance. Lubricate just in case.



- Disable the auto-hold Wire Sensor by clicking on the black button (This change will be stored in Basic Parameters):

8.2.4 Software-related problems:

Symptom	Description and Remedial Action
The Winder makes strange noise, motors vibrating or moving too fast	<p>Corrupted files</p> <ul style="list-style-type: none"> • Switch OFF the winder for 10 seconds and test again • Reload the software
Reloading the ESP software	<ul style="list-style-type: none"> • If you have a backup of your ESP, you can use the procedure described in the section “6.5.6.6 Backup/Restore the software”. • If you don't have any backup file, you can use the procedure described in the section “7.2 Reload Software procedure (from scratch)”, to reload the software to your ESP. • If reloading the software does not solve the problem, try reloading the Initializer first.
Reloading the HMI software	<ul style="list-style-type: none"> • if you receive this message (see below), your microSD card must be formatted as FAT32 (fast), only under Windows OS  <ul style="list-style-type: none"> • Make sure that your micro SD Card is less than 32 Gb.

8.2.5 Other problems:

If you face any kind of problem, please contact us by email:

info@tonewinder.es

9 Specifications

This chapter provides the physical and performance specifications, including information about the materials used in **Tonewinder**.

9.1 Physical Specifications:

The physical specifications of the device are specified as follows:

Type	Specification
Device type	Tonewinder V 1.2 R2
Microcontroller	ESP 32 Wroom Wi-Fi 240Ghz 512 Kb de SRAM
Motor X Driver	TMC2226
StepMotor X	Nema 11 with transmission (Resolution 0,0075mm)
Motor Y Driver	TMC2226
StepMotor Y	Nema 17 (Resolution 0,045 degrees)
Motor Z driver (ATC)	TMC2226
StepMotor Z	Stepmotor 230 mA
Work Voltages	5vdc and 24vdc
Tension Sensor	Max 300 gr
Tension gauge accuracy	1 gr
Touch Screen	<i>Nextion 2.8" Enhanced</i>
Max Speed	<i>1,500 r.p.m.</i>
Max power	<i>100w</i>
Range of use	Indoor use only
Ambient temperature	15 – 35 °C
Ambient humidity	12 - 80% relative humidity (non-condensing)
Power requirements	100 – 240 V AC; 50/60 Hz, 100 VA
Overvoltage category	II
Emission sound pressure level	<70 dB(A), typically 54 dB(A)
Dimensions (Height x width x depth)	110x225x238 mm
Weight	Approx. 2.8 kg

9.2 Appendix 1:

About **Filling Factor**

In addition to other factors such as wire quality, wire insulation coating, magnets, and many others, also the filling factor (**Filling Factor**) is a parameter of great importance when characterizing the sound of our pickups. One of the determining factors of the sound that an inductive-type transducer can generate is its distributed capacitance. This intrinsic characteristic of any coil is due, to some extent, to the way in which the wire loops of the coil are distributed along the width of the coil, which can be, among others, a winding of loops located contiguously with each other, without leaving any space between them (FF of 100%) or, a winding spacing the turns to each other (an FF of 20% means putting only two turns of wire in the place where ten of them would fit contiguously, without space in between)

We must keep in mind that lowering the filling factor increases the space between turns in the same layer, and therefore reduces the distributed capacitance in this precise layer, but a standard guitar pickup has several tens or hundreds of layers that overlap and also produce distributed capacity. By increasing the space between loops, we leave space available for subsequent layers of loops to settle in that place. This means that an increase in the spacing between loops does not necessarily have the effect of a directly proportional reduction of distributed capacitance.

The increase in distributed capacity decreases the ability of our transducer to generate high frequencies, and therefore also reduces the number of harmonics (their intensity) of our transducer and causes the dominant tone of the transducer to be lower. That is why playing with the value of the filling factor allows us to vary the tone of our sound, allowing us to print that unique personal stamp we are looking for.



Figure 116: Filling Factor 20%

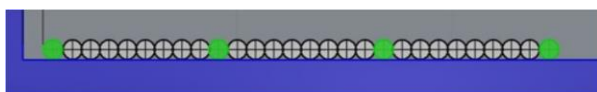


Figure 117: Filling Factor 100%

www.tonewinder.es

Tonewinder OE

Rocafort, Valencia

