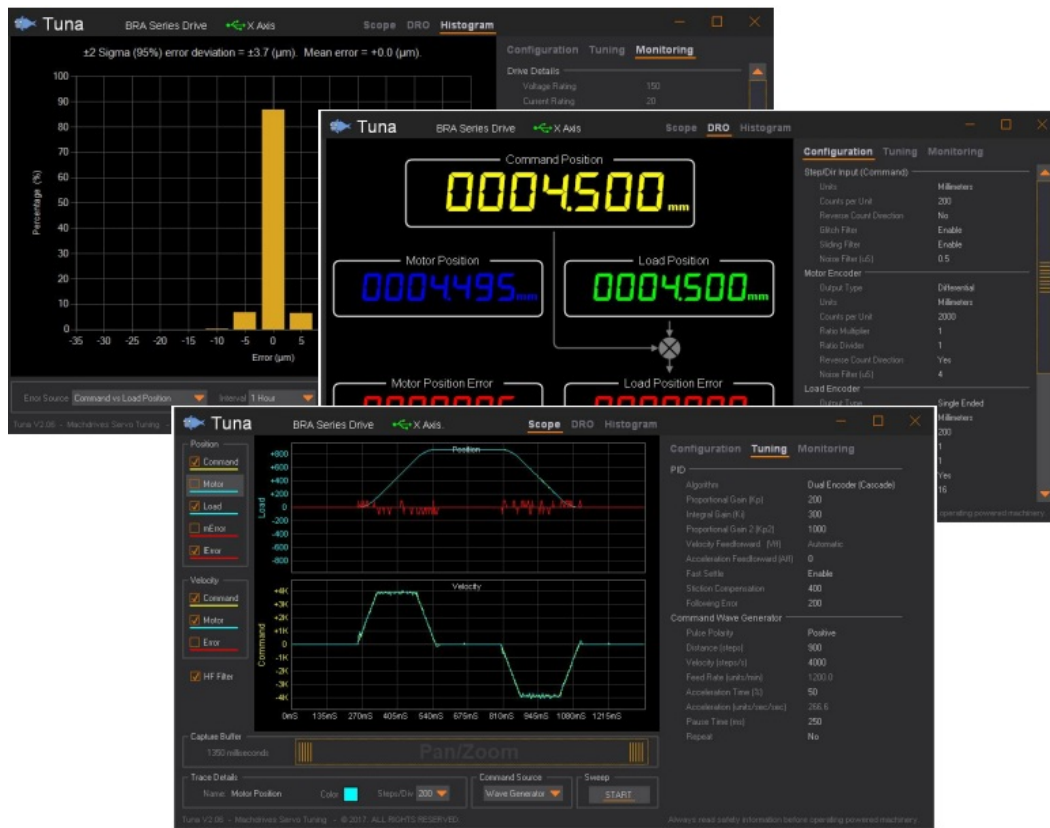


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Machdrives

Machdrives BRB Servo Tuning Software for Windows



Product Information

Specifications

- **Product Name:** TunaTM
- **Manufacturer:** Machdrives
- **Document Revision:** TUNAUM V1.3
- **Software Revision:** Version 2.08
- **Support:** www.machdrives.com

Product Usage Instructions

Safety

- Ensure to read and follow all safety instructions provided in the user manual before using the TunaTM product.

System Requirements

- Check the system requirements outlined in the manual to ensure compatibility before proceeding with installation.

Installation

Installing the Tuna Software

- Follow the detailed steps provided in section 3.1 of the manual to install the Tuna software correctly.

Installing the USB Drivers

- Refer to section 3.2 for step-by-step instructions on installing the necessary USB drivers for the TunaTM product.

Connecting the Drive

- Find instructions in the manual on how to properly connect the TunaTM drive to your system.

Application Layout

- Understand the application layout as described in section 5.0 of the manual to navigate through the features effectively.

Setting the Drive Identity

- Learn about setting the drive identity in section 7.1 for better customisation options.

Setting

- Follow the guidelines in section 7.2 to set the drive identity according to your requirements.

Using the Wave Generator

- Explore how to use the wave generator feature by referring to section 8.0 of the user manual.

INTRODUCTION

Notice

- This guide is provided subject to the following conditions and restrictions.
- No part of this publication may be reproduced mechanically or electronically in any form without obtaining written permission from www.machdrives.com
- The text and graphics included in this manual are for illustration and reference only. The specifications on which they are based are subject to change without notice.
- The Machdrives and Tuna brands are trademarks of Firestick Pty Ltd.
- Microsoft and Windows are registered trademarks of Microsoft Corporation.
- Mach3 is a trademark of ArtSoft USA. MachDrives has no affiliation or association with Mach3 or ArtSoft USA.
- Any other trademarks used in this manual are the property of the respective trademark holder.

Document Revision History

Document Name: TUNAUM

Version	Date	Details
1.0	04-Jan-2017	Initial release
1.1	20-Mar-2017	Updated software revision history.
1.2	23-Jun-2022	Updated software revision history, 1.0 Safety, 2.0 System Requirements, 3.1 Installing the Tuna Software, 3.2 Installing the USB Drivers, 6.0 Activating the Drive.
1.3	30-May-2025	Updated website links

Software Revision History

Software Name: Tuna™ for Windows®

Versio n	Date	Details
2.06	14-Jan-2017	Initial Release
2.07	20-Mar-2017	Added support for BRB and BRC series servo drives.
2.08	23-Jun-2022	Added support for BRD, BRE and BRF series servo drives. Added support for non-standard DPI screen resolution. Performance enhancements.

SAFETY

WARNING

- Using this software with powered machinery involves inherent electrical and mechanical risks. You or any associated third parties shall be suitably qualified or experienced to manage such risks and ensure this software and associated equipment are operated safely and in accordance with your local regulations and industry best practice.
- This software may contain defects that could cause sudden, uncontrolled machine motion. You shall never operate the machine in such a way that the machine's motion may cause property damage, personal injury or death.
- Keep all body parts well away from the machine while under power.
- You should be prepared to shut down the drive(s) during the tuning process if the system becomes unstable or experiences runaway.
- You can stop the drive(s) with the Enable or ENA input, but you should not rely solely on electronics and firmware for safety. It is recommended that you also completely remove power to the drive(s) in emergencies.
- While all efforts have been taken in the preparation of this manual to ensure its accuracy, it still may contain errors or omissions.
- Where the contents of this manual differ from, or conflict with, your local regulations or

industry best practice, then your local regulations or industry best practice shall prevail.

- If any doubt, please contact Machdrives support for clarification before proceeding.

SYSTEM REQUIREMENTS

- Microsoft Windows XP, Windows 7, Windows 8.x, Windows 10 or Windows 11
- NET Framework 2.0 or higher installed
- Pentium 4 processor or equivalent (minimum)
- 512MB RAM (minimum)
- ST Microelectronics Virtual COM Port driver (for BRA, BRB and BRC drives)
- WCH CH340 USB driver (for BRD, BRE and BRF drives)

INSTALLATION

Installing the Tuna Software

- The Windows Tuna application www.machdrives.com/downloads/software/tuna.zip can be downloaded with this link.
- Extract the executable file from the .zip and follow the prompts to install the software. You will need to read and accept the EULA before the software can install.

Installing the USB Drivers

- The following is for BRA, BRB, and BRC drives only
- Your servo drive appears as a Virtual COM Port in Windows and needs a VCP driver to communicate.
- Make sure the PC has an internet connection before connecting the USB cable for the first time. The drive does not need power or any other cables connected. The PC will automatically download and install the correct driver. This may take a few minutes.
- If there is no internet connection available the first time the drive is plugged in, Windows will not install the drivers on subsequent connections.
- You will then need to open Device Manager/Ports and find the USB Serial Device and uninstall it before trying again.
- **Note:** the device will only be listed if the USB cable is connected to the drive.
- If auto installation fails, or there is no internet connection available, the driver

www.machdrives.com/downloads/drivers/vcp_v1.4.0_setup.zip can be downloaded from downloaded with this link.

The following is for BRD, BRE, and BRF drives only

- The WCH CH340 USB driver should automatically install on most systems with internet access. If not, it can be downloaded from www.machdrives.com/downloads/drivers/ch341ser.zip and installed manually from this link.
- Follow the prompts to install the driver.

For all model drives

- Whether the Tuna application is “installed” or “open” does not affect the driver installation.
- When the driver is installed correctly, it will show in “Devices and Printers” and will also appear in the “Device Manager” under “Ports (COM & LPT)”.
- **Note:** The servo drive must be connected to the USB cable before it will appear, but the drive does not need to be powered on.

CONNECTING THE DRIVE

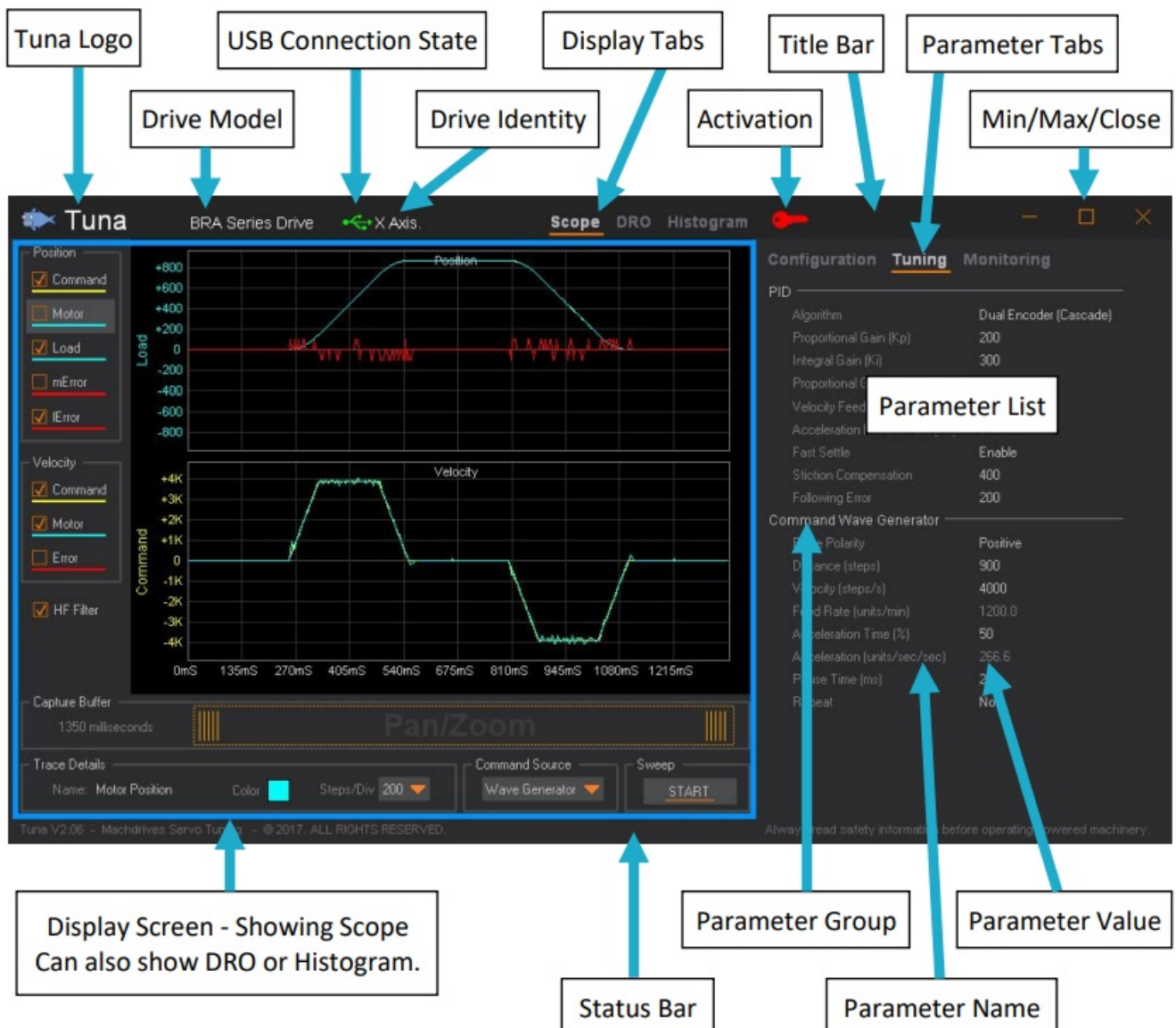
- A mini-B USB cable is required to use the Machdrives Tuna application. Make sure the PC has an internet connection before plugging in the drive for the first time. This will enable it to find and install the correct USB driver automatically.
- A good quality shielded USB cable must be used with the shield connected to the metal shells at both ends, as required by the USB standard.
- The cable should be as short as practical to reduce susceptibility to radio interference. Do not use USB extension cables. Running Tuna from a notebook often allows a shorter cable to be used if the CNC controller is some distance from the drives.
- During testing, different low-cost “shielded” USB cables were purchased online, and most were found to be faulty, with the shield not connected. A properly constructed cable should never drop the connection between the drive and the Tuna software.
- If in doubt, check both end shells for continuity with a meter, then strip the sleeve from a small section in the middle of the cable and check the braided shield to the end shell

for continuity as well.

APPLICATION LAYOUT

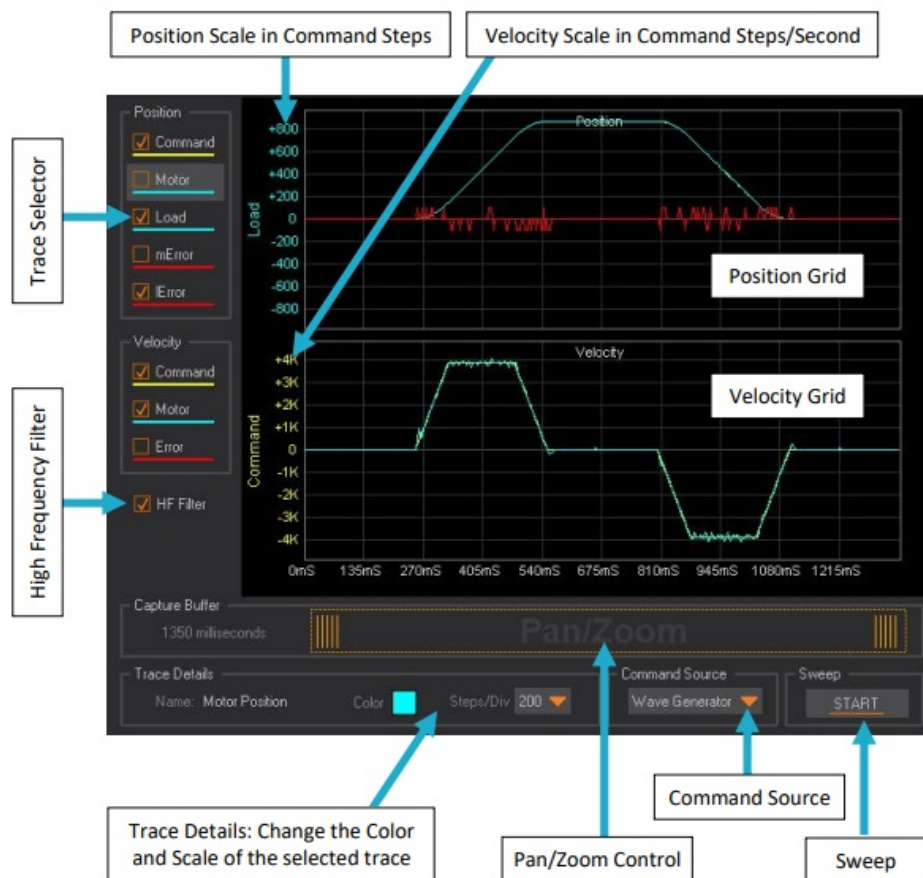
Main Form

- The Tuna application is laid out with the Parameter List on the right, the Display Screen on the left, the Title Bar on the top and the Status Bar on the bottom. The display tabs can select three different types of display screens.
- **Scope:** This is an oscilloscope-style display that shows real-time position and velocity information.
- **DRO:** This is a Digital Read Out display that shows real-time motor and load encoder positions.
- **Histogram:** This shows real-time statistical analysis of position error.



Scope Display

- This is an oscilloscope-style display that shows real-time position and velocity information. Traces can be turned on and off using the Trace Selector on the left. The “Trace Details” panel allows customisation of the selected trace colour and scale.
- The “Pan/Zoom” control allows a close-up view of a time slice of the display. The “HF Filter” removes data that is too dense to display for the selected zoom level.
- The “Command Source” can be switched between the “Step/Dir Inputs” and the “Wave Generator”.
- The “Capture Buffer” length is set automatically for the Wave Generator and can be manually configured for the “Step/Dir Inputs”.
- The Wave Generator profiles are configured on the “Tuning” Parameter tab. Note: The Wave Generator sweep can only be started if the drive is enabled.
- Load traces are only available on dual encoder servo drives.

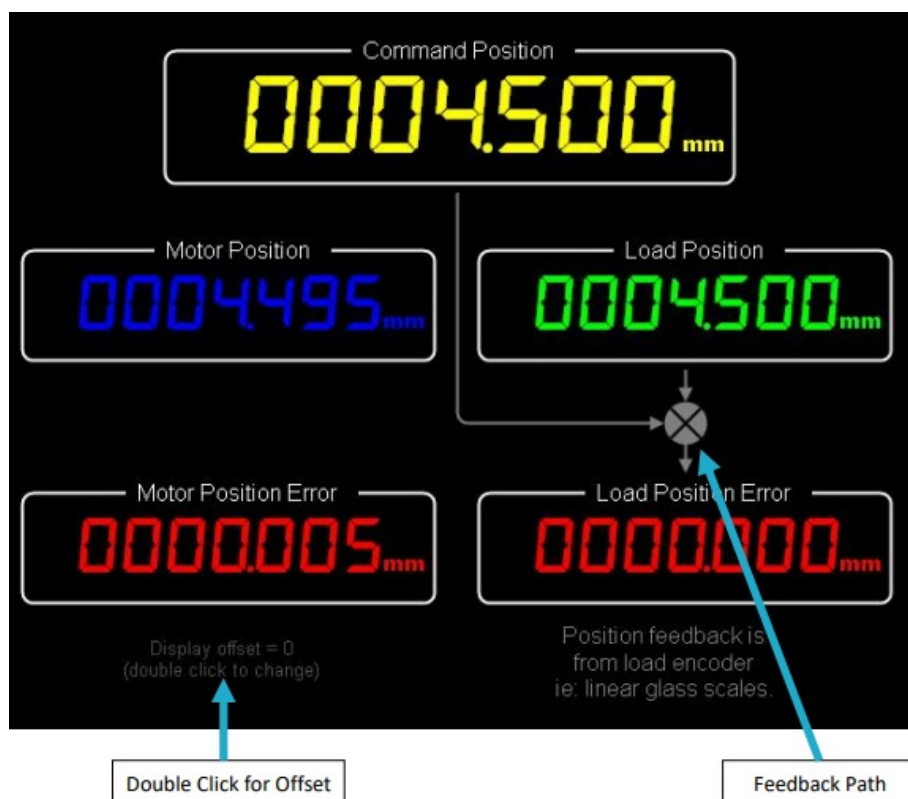


DRO Display

- The Digital Read Out (DRO) shows the command position from your CNC software or Waveform Generator, and compares it to the actual motor and load position in real-time. The load position will only function on dual encoder drives.
- The units (millimetres or inches) for all readouts are controlled by the Command “Units” parameter on the “Configuration” tab. This is the unit you prefer to work in, and

is the same as your native units in Mach3.

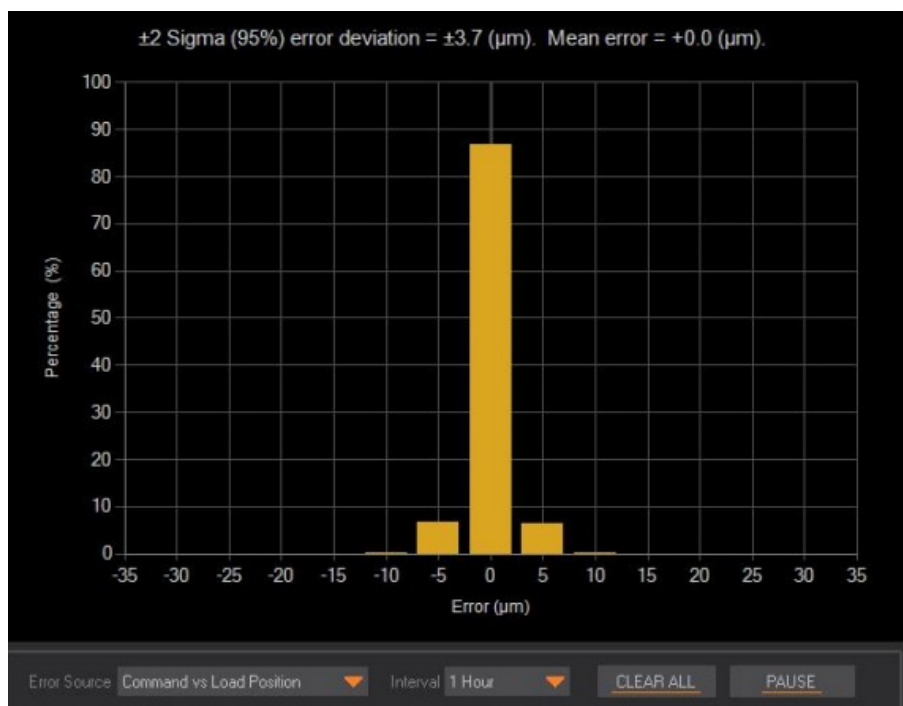
- This allows the mixing of hardware and displayed units. For example, using low-cost metric ballscrews or glass scales, yet displaying in inches. Conversion is performed automatically inside the drive without rounding or any loss of precision.
- The position feedback path shows which encoder is being used for position feedback. This reflects the PID “Algorithm” parameter setting on the “Tuning” tab.
- Individual readouts can be turned on or off by clicking on them. A display offset can also be entered by double-clicking outside the readouts. This allows the synchronisation of readout values with your CNC software.
- Offsets only affect displayed values and do not change drive position or operation in any way. The readout values are zeroed automatically when the drive is enabled.



Histogram Display

- The histogram display shows a real-time statistical analysis of position error. Error can be calculated from “Command vs. Motor Position” or “Command vs. Load Position” on dual encoder systems.
- Error resolution displayed on the X axis is in Command Steps as configured for the “Step/Dir Input”.
- The example below shows 200 counts/mm, giving a step resolution of 0.005mm or 5µm.

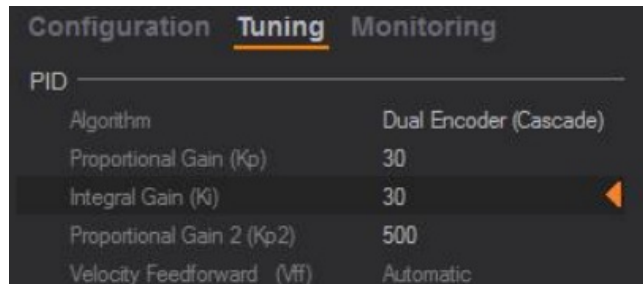
- Errors are sampled 1000 times a second and grouped by step deviation. The percentage of errors in each group is then displayed as a percentage of the total errors during the collection “Interval”.
- Data for all intervals is collected and calculated continuously while the “Sweep” is running. Changing the “Interval” selection only affects the displayed data and can be changed at any time.
- Data collection can be paused using the “PAUSE” / “CONTINUE” button, and data for all intervals can be cleared with the “CLEAR ALL” button.
- Statistical error calculations displayed at the top of the histogram are calculated for the selected “Interval”. The error deviation shows the error spread covering 95% of errors.
- The mean error shows the bias or average offset of those errors.



Parameter List

- The parameter list allows a user to view and change the drive’s parameter values when connected by USB. When disconnected, the current values will still be displayed, but will become read-only. The Parameters are grouped into three tabs as follows.
- **Configuration:** Used to configure the drive, normally only during installation.
- **Tuning:** Used to tune the servo control loops, normally only during installation.
- **Monitoring:** Used to monitor the drive health, which can be done at any time. All parameters on this tab are read-only.
- Parameters can be selected by clicking the desired row with the mouse. The selected

parameter is highlighted as shown, and an orange pointer appears on the right. The selected row can be moved up or down with the arrow keys.



The screenshot shows a software interface with three tabs: 'Configuration', 'Tuning' (which is selected and underlined), and 'Monitoring'. Below the tabs is a section titled 'PID'. It contains a table of parameters. The 'Integral Gain (Ki)' row is highlighted, and an orange arrow points to its right side. The parameters and their values are as follows:

PID	
Algorithm	Dual Encoder (Cascade)
Proportional Gain (Kp)	30
Integral Gain (Ki)	30
Proportional Gain 2 (Kp2)	500
Velocity Feedforward (Vff)	Automatic

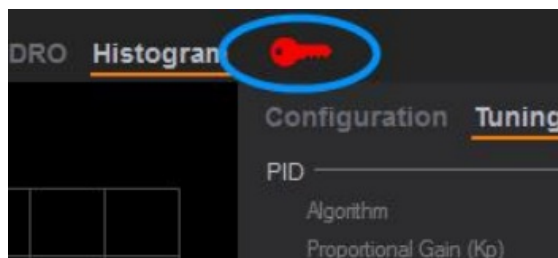
- Numeric parameters can be changed by typing the new value directly and then pressing ENTER. Alternatively, numbers can be adjusted up and down by the “+” and “-” keys, respectively. Editing can also be started by double-clicking or pressing ENTER.
- All values must be positive integers and are validated for minimum and maximum limits on entry.
- Descriptive text parameter values are not typed in, but are selected from a drop-down list. Double-clicking or pressing ENTER on the selected row will drop down the selection list.
- A new value can be selected with the mouse or by using the arrow keys and pressing ENTER.
- During entry of a parameter, changes can be abandoned by pressing the ESC key. Changes are effective in real-time and are saved automatically.
- Scrollbars will appear if the parameter list length exceeds the available space. The list can be scrolled with the mouse, or the mouse scroll wheel can be used.
- The arrow keys can also be used, and the list will scroll automatically to keep the selected parameter in view.
- Some parameters are calculated automatically and are read-only. These are displayed for information only. Parameters that are not applicable are hidden, and their values are ignored.
- For example, setting the PID “Algorithm” to “Single Encoder” hides the entire configuration section for the “Load Encoder” parameters.
- Parameters are model-dependent. Your parameters may be different to the examples shown in this manual.

ACTIVATING THE DRIVE

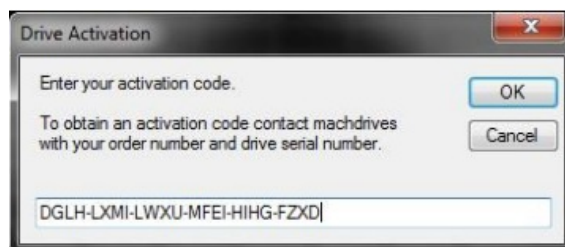
- BRD, BRE and BRF drives do not require activation, so this section does not apply to

them.

- BRA, BRB and BRC drives require a one-time activation before they are fully functional. Activation ensures that only the correct person receives and commissions the drive, and that you have received a genuine Machdrives product.
- To activate the drive, email the serial number and your order number to support@machdrives.com.
- You will receive a 24-character code in the format: DGLH-LXMI-LWXU-MFEI-HIHG-FZXD. Every code is unique and will only work in the drive with the supplied serial number.
- Open the Tuna application and plug the USB cable into the drive.
- An orange key will appear on the title bar if the drive has not been activated.



- Click the key and paste the code in the dialogue box exactly as supplied, then click OK.



- You will receive a confirmation message that the drive has been activated, and the key will disappear from the title bar.



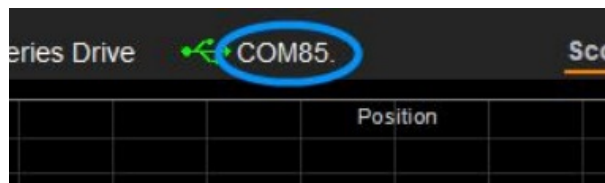
- If the code is entered incorrectly three times, the Tuna application will need to be restarted before it can be attempted again.
- You should receive the activation code within one business day of requesting it. While you are waiting, you can still install and configure the drive.
- You can also tune it by setting the command source to "Wave Generator". This uses the internal motion profile generator as the command source.

- The drive cannot, however, be commanded from the Step/Direction interface until it has been activated.

SETTING THE DRIVE IDENTITY

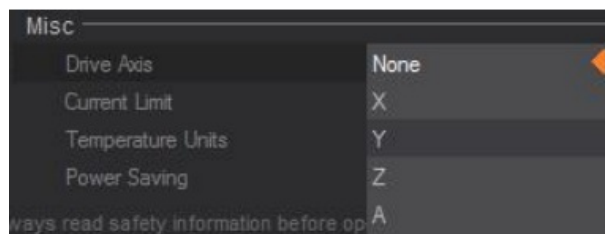
Overview

- The drive identity allows the COM port name to be replaced with an axis letter for each drive in your CNC machine. This is useful when configuring or monitoring multiple axes at the same time.
- The drive identity is shown in the Tuna title bar next to the USB icon, as shown.
- By default, this is set to the COM port name that the drive appears as under Windows. If no drive is currently connected, this will show as “Not Connected”.

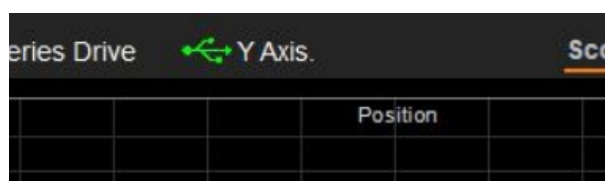


Setting

- To change the identity from the COM port number to the axis letter, connect your drive, then choose a “Drive Axis” letter from the “Misc” parameter group on the “Configuration” tab, as shown.



- The drive axis letter will now be displayed in the title bar in place of the COM port number. This is saved automatically and will appear in future every time the drive is connected.



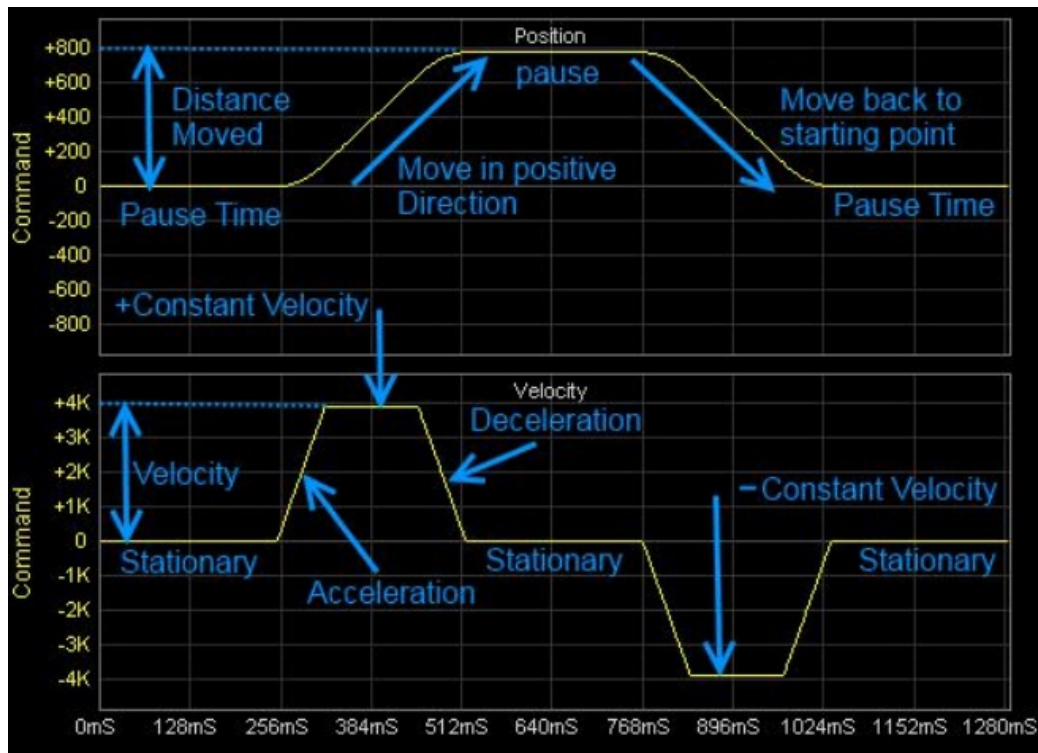
- Setting the drive identity does not affect your CNC controller software, such as Mach3. It is only used for convenience when connecting to the Tuna application.
- Normally, the drive axis letter would be set to reflect the same axis name as

configured in your CNC controller.

USING THE WAVE GENERATOR

Waveform Components

- The Wave Generator functionality is located inside each drive. It can generate precise motion profiles to control the drive during tuning. Waveforms contain position, velocity and acceleration components as illustrated below.



- The parameters used to generate the above waveforms are shown here. Note the “Distance” moved of 800 steps, the “Velocity” of 4000 steps/sec and the “Pause Time” of 250ms.
- The Wave Generator parameters are located on the “Tuning” tab.
- Parameter values shown in grey are read-only and are calculated from other parameter values.

Command Wave Generator	
Pulse Polarity	Positive
Distance (steps)	800
Velocity (steps/s)	4000
Feed Rate (units/min)	1200.0
Acceleration Time (%)	50
Acceleration (units/sec/sec)	300.0
Pause Time (ms)	250
Repeat	No

Waveform Parameters

- The following parameters are used to generate waveforms.

Parameter	Description
Pulse Polarity:	
<i>Positive</i>	The axis moves in the positive direction, then back to the starting point.
<i>Negative</i>	The axis moves in the negative direction, then back to the starting point.
Distance	The distance to move in command steps.
Velocity	The move velocity in command steps/sec.
Feed Rate	This is a calculated value controlled by the Velocity parameter above.
Acceleration Time %	This is the percentage of the move that is spent in both acceleration and deceleration. This controls the shape of the velocity waveform as follows. • 0% – Square waveform. • 100% – Triangular waveform. • 50% – Trapezoid waveform.
Acceleration	This is a calculated value controlled by the Acceleration Time % above.
Pause Time	This is the time the axis pauses between moves in milliseconds.
Repeat:	
<i>No</i>	A single waveform is generated.

Yes	The waveform repeats continuously.
-----	------------------------------------

Creating a Square Velocity Waveform

- Square velocity waveforms are useful for tuning velocity loops. The fast rising and falling edges expose any instabilities, making tuning simpler and more accurate. To generate a square profile, simply set the “Acceleration Time %” parameter to zero.
- The other parameters can be adjusted as appropriate. See your drive user manual for specific details on tuning the velocity loop.

Creating an S-Profile Position Waveform

S-profile position waveforms are useful for tuning position loops. The waveform should match the output from your CNC controller, such as Mach3, as closely as possible. To generate an S-profile, use the following steps.

1. Adjust the “Velocity” parameter so the “Feed Rate” matches the feed you most commonly use during machining.
2. Adjust the “Acceleration Time %” parameter so the “Acceleration” parameter is similar to the motor acceleration setting in your CNC controller, such as Mach3.
3. Adjust the other parameters as required to give a suitable waveform.
 - See your drive user manual for specific details on tuning the position loop.

USING THE SCOPE

Overview

- The scope display provides up to eight channels of position and velocity information. Load data is only available on models running dual encoder mode.

Selecting Traces

- Up to five position traces and three velocity traces can be displayed at the same time. Traces can be displayed or hidden by ticking the checkbox next to the trace name on the trace selector panel.

- Position and velocity traces are displayed on their respective grids. Grids with no traces visible are hidden, and any remaining grid expands to use the available display space.
- Trace colour and scale can be changed by clicking on the trace name in the “Trace Selector” panel next to the checkbox. The current settings are displayed in the “Trace Details” section under the grids.
- Clicking on the colour square allows selecting a new colour.
- The trace scale in command steps can be selected from the “Steps/Div” drop-down list.

Pan/Zoom Control

- The Pan/Zoom control allows display of a selected time slice of the scope waveform. By default, the control displays the entire capture buffer. Dragging either handle inwards zooms into a smaller time window.
- Dragging the centre of the control left or right pans the window along the timeline. Double-clicking the control expands it back to its default state. Stopping the sweep before zooming and panning is recommended.

Command Source Selection

- The command information that your servo drive follows normally comes from the Step/Dir outputs of your CNC controller, such as Mach3. During tuning, the “Command Source” can be switched to come from the internal Waveform Generator instead.
- This allows precise control of the waveforms without an external CNC controller.
- The “Command Source” is automatically set to “Step/Dir Inputs” every time the drive is powered on, and can only be changed when a sweep is not running.

Sweeping

- Trace sweeping can be controlled by the “START / “STOP button under the grids. If the “Command Source” is set to “Wave Generator” then starting the sweep will also start generating the configured waveform.
- The drive must be enabled to start the sweep in “Wave Generator” mode.

- When the “Command Source” is set to “Step/Dir Inputs”, the sweep can run even if the drive is disabled or motor power is removed. This is useful for manually checking the encoder response during setup.
- **Note:** Until a drive has been activated, sweeps can only be run in “Wave Generator” mode.

TUNING THE DRIVE

- The PID tuning process is specific to your drive model and the selected PID algorithm.
- See the tuning section of your drive user manual for details.

Checklist

- Before starting the tuning process, the drive must be configured correctly. Check the following before proceeding.
- The command parameters are set correctly on the “Configuration” tab.
- The encoder parameters are set correctly on the “Configuration” tab.
- The encoder functionality is checked by manually moving the axis and checking that the DRO value moves by the correct amount and in the correct direction.
- The “Power Saving” parameter is set to “Disabled” on the “Configuration” tab.
- The Machine axis is positioned in the centre of travel.
- The “Following Error” on the “Tuning” tab is set to a number approximately twice the expected move distance output from the Waveform Generator.
- The PID “Algorithm” on the “Tuning” tab is set correctly if multiple algorithms are available.

Tuning the Velocity Loop

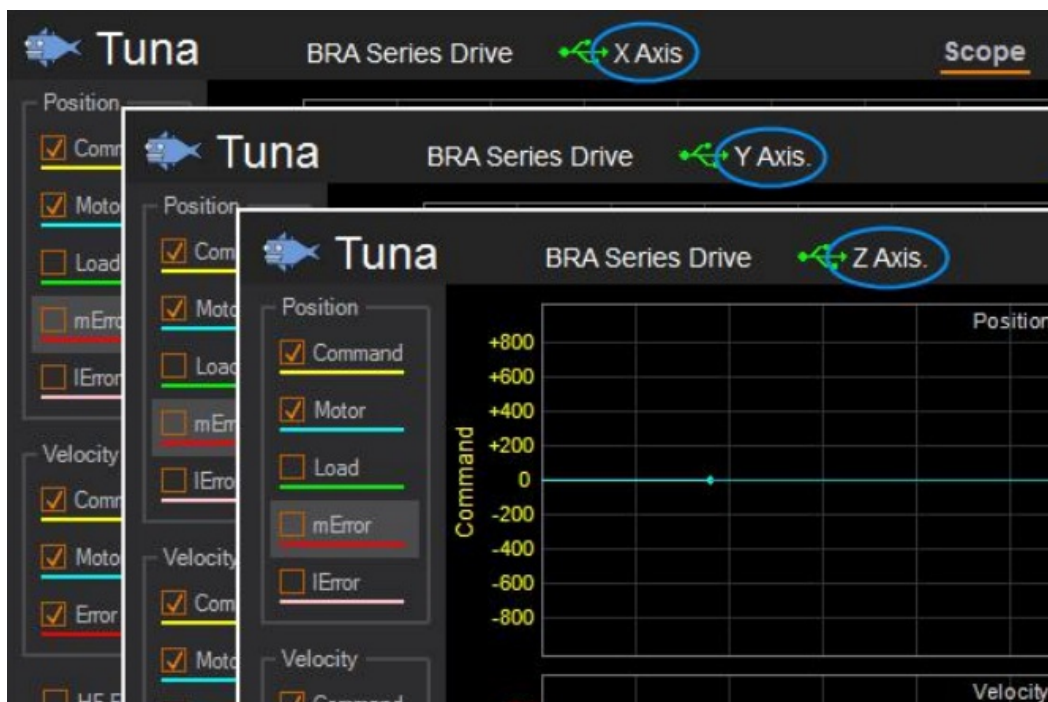
- The velocity loop must be tuned first. The objective is to get the motor velocity to follow the command velocity as closely as possible with good stability.
- This loop is tuned with a square velocity waveform to expose any instabilities and improve tuning. See section 8.3 for details on configuring the Wave Generator to output a square wave.
- Follow the procedure detailed in your drive user manual for tuning the velocity loop.

Tuning the Position Loop

- The position loop should be tuned with a waveform as close to your typical machining waveform as possible. Match the “Feed Rate” and “Acceleration” parameters to the output of your CNC controller.
- This step must follow after tuning the velocity loop.
- The Wave Generator should be configured to generate an S-profile position waveform. See section 8.4 for details.
- Follow the procedure detailed in your drive user manual for tuning the position loop.

CONNECTING MULTIPLE DRIVES

- As most CNC systems have more than one axis, it is sometimes useful to have Tuna connected to multiple drives at the same time.
- Connecting multiple drives requires running multiple instances of the Tuna application and a separate USB cable to each drive.



- Each instance of Tuna will only connect to one drive at a time. When a drive is connected, it is not available for other instances to connect to. Connection is handled automatically when a free Tuna instance and drive are available.
- It is recommended to set the drive identities as illustrated when connecting multiple drives. This helps avoid confusion in remembering which axis is assigned to each COM port. See chapter 7 for details on setting the drive identity.
- Running multiple Tuna instances requires that your PC has sufficient resources in the

form of RAM and CPU capacity. The Tuna application has been designed to place low demands on PC hardware, so older PCs with parallel ports can run it successfully.

- If using a low-powered PC, it may not be possible to run Tuna and Mach3 successfully at the same time. In such instances, it is recommended to run
- Tuna from a separate PC or notebook.

Contact

- Website: www.machdrives.com
- Support: www.machdrives.com/pages/contact.php
- email: support@machdrives.com
- Sales: www.machdrives.com
- www.ebay.com.au/str/machdrives
- email: sales@machdrives.com
- Social Media www.youtube.com/@machdrives
- www.facebook.com/machdrives
- twitter.com/machdrives
- www.machdrives.com

FAQ

Where can I find support for TunaTM?

You can visit www.machdrives.com for support or contact support@machdrives.com via email.

How can I purchase TunaTM?

For sales inquiries, visit www.ebay.com.au/str/machdrives or email sales@machdrives.com.

Documents / Resources



[Machdrives BRB Servo Tuning Software for Windows \[pdf\]](#) User Manual
BRB, BRC, BRD, BRE, BRF, BRB Servo Tuning Software for Windows, B
RB, Servo Tuning Software for Windows, Tuning Software for Windows,
Software for Windows, for Windows

References

- [User Manual](#)

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🔗 BRB, BRB Servo Tuning Software for Windows, brc, BRD, BRE, BRF, for Windows, Machdrives, Servo Tuning Software for Windows, Software for Windows, Tuning Software for Windows

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