



CTL503 User Manual

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Check for latest version of this manual here:

<http://electron.plus/pages/manuals>

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1 Notices

..1.1 Copyright

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..1.2 Part number

CTL503_User_Manual.PDF

..1.3 Issue

24.001, May 2024

..1.4 Location

The latest version of this document can be found on our website:

www.electron.plus/pages/manuals

..1.5 Published by

BFRAD Limited (t/a Electron Plus)
Unit 8 Manor Farm Business Centre
Manor Lane
Stutton
Suffolk
IP9 2TD
UK

Hereafter referred to as **Electron Plus**.

..1.6 Notes

- We frequently update our manuals and add new features and improvements as they available, please ensure that you check our website for an updated version of this document, especially if updating your **Electron Plus** software.

- We make every effort to ensure the accuracy of this manual's contents. If you find any errors, have suggestions for expanding on a feature, or feel that we can improve it's contents then please contact us at support@electron.plus
 - Copying or reproducing this document or any part of this document without written permission of **Electron Plus** is strictly prohibited.
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..1.7 Trademark acknowledgement

Electron Plus fully recognises and acknowledges any trademark(s) of the respective trademark holder.

Windows™ is a trademark of Microsoft Corporation.

Transzorb™ is a trademark of Vishay General Semiconductor, LLC.

..1.8 Purpose of manual

The purpose of this manual is to enable you to safely setup, configure and operate your **Electron Plus** instrument, associated software and/or accessories.

Please pay particular attention to any section with a warning symbol.

..1.9 Safety warnings

Warnings, cautions and notes are colour coded through-out this manual. These are divided into several categories and are described below:

WARNING - Pay special attention to anything written here - this is for your safety and continued protection and is critical information!

CAUTION - Damage may occur to your equipment or any DUT (device under test).

NOTE - General text, with useful information or tips.

2 Getting Started

..2.1 System requirements

We recommend at least Windows 7 operating system. **CTL** is available in both 32 bit and 64 bit from the **Electron Plus** website.

1x USB 2.0 type A (common) for connection to the instrument, at 0.0A

Screen resolution of at least 1440(W) x 900(H), it will work with others, but you risk some of the CONTROL RIBBON items not being visible.

CTL software uses the PC sound card for various alerts, although it will operate correctly without sound.

Technical Note

We test EPIC builds mainly on Windows 10/64 bit machines with 1920x1080 monitors.

We also test regularly on Windows 8 and Windows 11

..2.2 Getting help

Help is available by email: support@electron.plus

If you are experiencing an issue with **CTL**, please email a copy of the following files (see below) found in the **CTL** installation folder along with a description of the problem.

log.txt

bugreport.txt

This will help us understand your problem and provide a quicker fix.

3 Introduction

..3.1 Welcome

Congratulations and thank you for purchasing an **Electron Plus** product.

Please take a few minutes to read the ['Before you start'](#) section of this manual, especially as misusing this product can result in damage to it, your device-under-test or potentially place you in-danger.

..3.2 Before you start

Please ensure you use the power supply adaptor supplied. It is important that this device is powered with 11.75 to 12.5V, damage may occur if you exceed 12.5V.

Do not over-tighten the RED/BLEU/BLACK terminal post connections. You won't end up with better curves and you will risk damaging the instrument.

If you wish to make a permanent safety connection to EARTH read [Earthing for function and safety](#) section.

Like most 'old-style' curve tracers, the CTL503 is capable of generating voltages in excess of 100V, users are expected to be fully aware of the risks posed by these higher voltages and the precautions and procedures required to maintain the safety of personal operating the instrument and those nearby.

! If the red light is lit on the CTL503, assume there could be high voltages present and act accordingly !

..3.3 New in Software

CTL software is specifically for the **Electron Plus** range of curve tracers, this takes over from the earlier EPIC software suite.

Please contact us if you would like copies of previous software versions.

V24.001

Bug fixes

V23.003

View previous sweeps. Major re-write of graphics handling module. Control ribbon changes. Bug fixes. Flicker amelioration.

V23.002

Bug fixes and some control ribbon changes.

V23.001

Re-write of graphics handling module. Changes to control ribbon. Addition of CSV/PNG automatic exporting features. Bug fixes.

V22.001

ASA functions have been split out from EPIC (see ASA22 software)
Bug fixes

V21.012

Bug fixes
ASA - addition of manual mode

V21.011

Bug fixes
CTL503 - Vgs vs Id (at fixed Vds) mode added
CTL503 - updates to status display
CTL503 - removal of DEVTEST button/function.

V21.010

Bug fixes
Addition of version compiled for 32 bit systems
CTL503 added to EPIC
ASA200/240 - addition of SIGNAL/COMMON to EDIT page

V21.009

Bug fixes
SPA100 added to EPIC
REF50X added to EPIC

V21.008

Bug fixes

..3.4 Installation sequence

Please install the **CTL** software and the associated USB driver software BEFORE connecting your device to a computer.

You do not need to remove a previous copy of **CTL**, the new copy will overwrite the necessary existing file(s). The "settings.txt" file will only be created if it is not present.

When **CTL** is first started, it will build a number of files (unless they are already there from a previous installation) in the installation directory.

If upgrading from EPIC please be aware that the new program EXE is called after the version number (e.g. CTL24001_32.EXE or CTL24001_64.EXE) and that previous shortcuts will not work or may link to the previous version.

..3.5 Installing the Software

Electron Plus products require a USB connection to a PC running EPIC (our proprietary software) in order to function.

CTL now comes in two compiled versions:

CTL24001_64 - for 64 bit Windows installations & PC's (we recommend this).

CTL24001_32 - for 32 bit legacy Windows machines.

You can download the latest copy of CTL for free from www.electron.plus/pages/software, CTL is being constantly revised with new features, updates and bug fixes.

1. Select which variant you wish to use go ahead and download it (typically by double-clicking on the ZIP file named something like: Install_CTL24001_64.ZIP)
2. Open the downloaded file (typically Windows will recognise the ZIP format and open the file and display the contents like a folder), double click the EXE file - typically called Install_CTL24001_64.exe)
3. Follow the on screen instructions to complete the installation.

Before starting **CTL**, we recommend installing any USB drivers, see next section for details.

This manual MAY NOT represent the most up-to-date features and screen-shots, if something is unclear, please contact support@electron.plus and we will promptly try to assist you.

..3.6 Installing the USB driver

The product covered in this document communicates with the host PC via USB using an WCH CH340 bridge IC.

A copy of the official WCH device driver is available from the SOFTWARE section of our website www.electron.plus/pages/software, device drivers can also be downloaded directly from WCH's website (www.wch-ic.com/downloads/category/30.html). The driver we use with Windows machines is: CH341SER and is available as .EXE or a .ZIP

..3.7 Earthing for function and safety

For functional and/or safety reasons you may wish to EARTH the casing of your **Electron Plus** instrument. This is not necessary under most normal operating conditions.

In this case, we recommend loosening (and re-tightening) the M3 stainless steel chassis screw (2mm HEX drive) and fitting an earthing wire using either ring terminal or spade terminal.

If in doubt please contact **Electron Plus** for further details.

Caution

USB 0V, rear panel, front panel, casing and any external power supply 0V are all the same potential and connected via low impedances (PCB, metalwork, etc.) - Avoid creating 'ground loops' with your setup!

Note

Some earlier production CTL503 units may have a TORX T10 headed stainless steel earthing screw fitted instead of the 2mm HEX drive type. If you would like a 2mm HEX drive screw (our part# SCREW014), please contact the factory and we will supply one free-of-charge.

4 Theory of Operation

5 Operation

..5.1 Selecting Instrument

When **CTL** is first installed it will start in CTL503 mode.

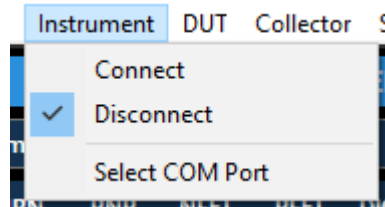
Technical Note

Variable used in settings.txt: **ActiveInstrument=CTL503**

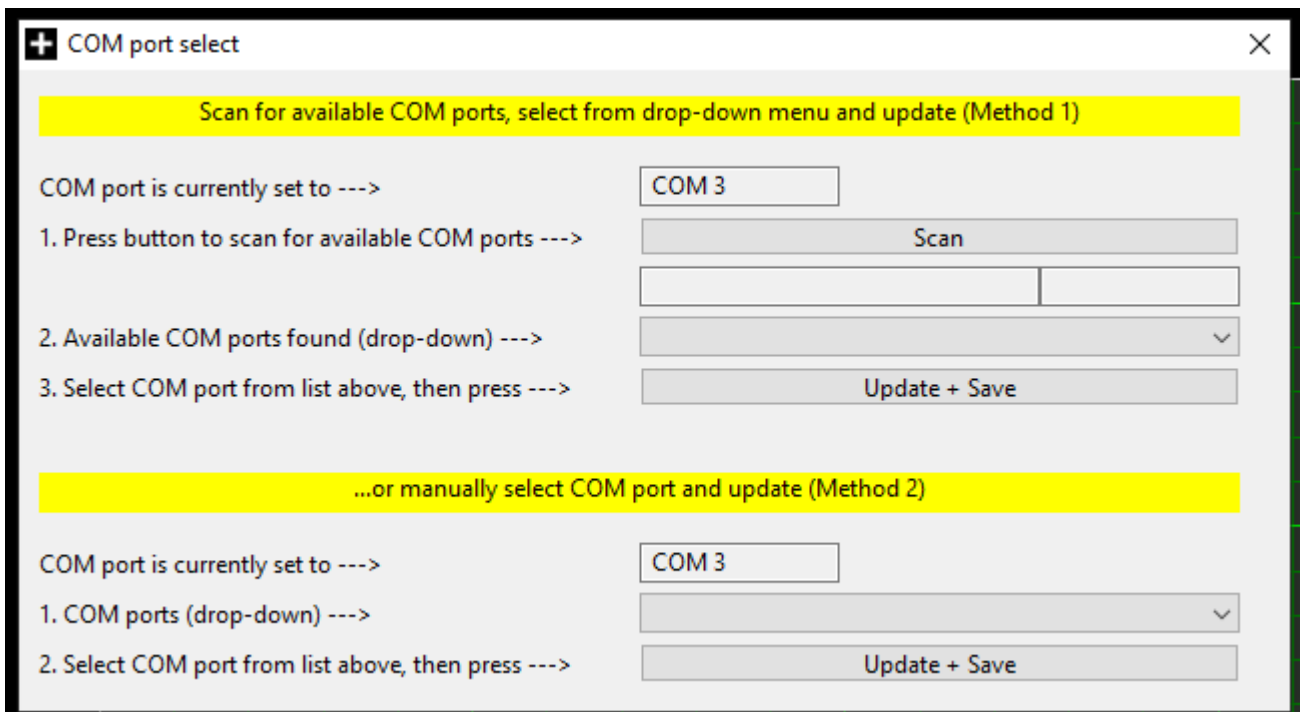
..5.2 Selecting Serial COM Port

To connect to the instrument you will need to select a COM port:

INSTRUMENT > SELECT COM PORT



then this pop-up window will appear:



Follow the on-screen prompts in sequence (for either 'Method 1' or 'Method 2') to find and select the appropriate COM port and save your selection. When you have finished, either close the pop-up window or click the main window (the pop-up will close automatically).

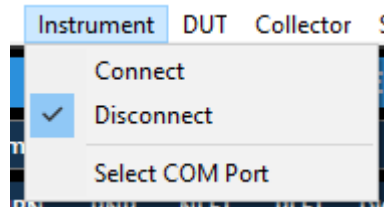
Technical Note

Each Electron Plus instrument type that uses a COM serial port has it's own entry in "settings.txt", e.g. CTL_ComPort=3

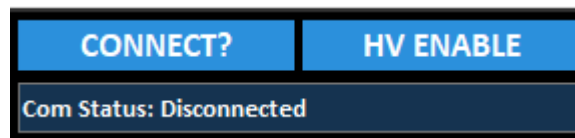
..5.3 Connecting instrument

To connect to the instrument you can use the options in the MENU or the button on the CONTROL RIBBON.

INSTRUMENT > CONNECT to connect, or **DISCONNECT** to disconnect.



or



An error message will be displayed if **CTL** cannot open a serial port to the instrument - this can be caused by the following:

1. Not having the serial port driver installed or
2. Wrong (or no) serial port COM number being selected or
3. No instrument attached or powered on.

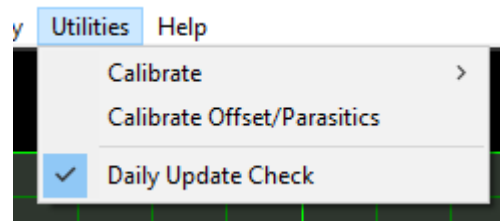
Ensure the correct driver is installed, the correct COM port is selected ([Selecting Serial COM Port](#) section).

..5.4 Check for updates

Once per day **CTL** will check if there is a newer version available. This feature maybe disabled or re-enabled here:

UTILITIES > DAILY UPDATE CHECK

Tick will enable **CTL** to perform the daily update check, unticking will prevent **CTL** from performing the daily update check.



Technical Note

In "settings.txt": **CheckWebsiteForUpdate=1** or **0** determines if this function is enabled/disabled. **DateOfLastUpdateCheck=04/11/2021** is self-explanatory.

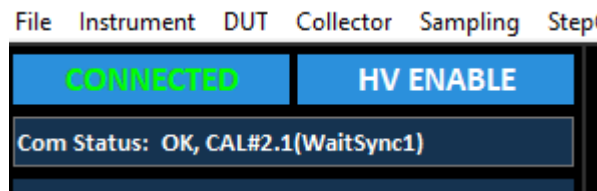
..5.5 Calibration loading

Each time **CTL** connects with a CTL503 it will automatically download a file containing all the necessary calibration coefficients. This happens in the background and the user does not need to do anything.

This downloaded calibration file is automatically compared with a locally (on the host computer) stored copy. If there are any differences then the locally stored copy is updated.

It may take several minutes for the correct calibration coefficients to load the first time a CTL503 is connected to **CTL** (i.e. moving your CTL503 to a 'fresh' computer). After this initial synchronisation of calibration coefficients the CTL503 will be ready immediately when connected.

The status of the background download from the CTL503 is displayed in the Status window (seen below).



Technical Note

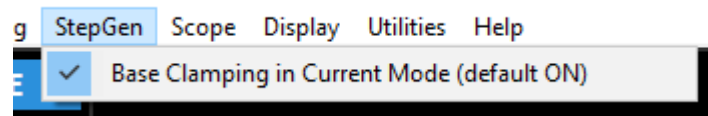
CTL will wait for two copies of the calibration file to download before comparing them with each other and the existing copy of "CTL_cal.txt" in the CTL folder, if both downloaded copies are identical and there is a discrepancy with "CTL_cal.txt" CTL will overwrite "CTL_cal.txt" with the new data and then check it again.

..5.6 Base Clamping

When generating 'zero' base current it is possible that the base generator will reach a maximum compliance voltage (due to the essentially infinite impedance of a reverse biased transistor base).

This will affect switching speed and under certain circumstances may cause damage to the DUT.

To prevent this happening a special clamping circuit can be applied to provide a low resistance path between Base and Emitter terminals when 'zero' is generated.



By default this circuit is enabled.

..5.7 Control Ribbon

The following sections are descriptions of [Instrument Status](#), [Signature Generator](#), [Test Controls](#) and [Edit Controls](#) and their functions.

..5.8 Menu Bar

.5.8.1 File

.5.8.2 New topic

6 Technical

..6.1 CSV File Format

At the end of each run there is a CSV file created with the results of the run.

This is used primarily as a store of information for graph creation in the software but may also be used by the operator for their own purposes.

Fields are separated by commas and at the end of each line is a carriage return/new line.
The first line contains the headings for each of the columns.

These are:

Step - the step number of the sweep (0 to 12)

Entry - the entry in that particular step (0 to 1000 typically)

Entries - total number of entries for that step

VR - voltage , in volts

VB - base voltage, in volts

VC - collector voltage, in volts

IR - current, in amps

IB - base current, in amps

IC - collector current, in amps

TIB - theoretical base current (what current the base generator is commanding), in amps

TVB - theoretical base voltage (what voltage the base generator is commanding), in volts

BGmode - I or V (current or voltage mode)

VCmax - maximum allowable voltage, in volts

VCres - collector resistor setting

ICmax - maximum allowable current, in amps

IBstep - step size [current mode], in amps

IBoffset - offset [current mode], in amps

VBstep - step size [voltage mode], in volts

VBoffset - offset [voltage mode], in volts

StepQty - number of steps in the run

Cpulse - collector pulse length approximate, in us (microseconds), normally 0, 80 or 300

BGpulse - base/gate pulse length approximate, in us (microseconds), normally 0, 80 or 300

SampleRate - sampling rate of the system, in Hz

BaseClamp - ClampOnIdle or NoClamp, see [Base Clamping](#) section

GraphType - self explanatory

Notes1 - unused at present

Notes2 - unused at present

In future we may add more fields to the CSV output, so please check this section in future manuals if you are doing something with the data stored in the CSV.