

User Manual for Kunkin KP184 Modbus Software

Interflexo – Sistemas de Automação e Controlo Unipessoal,
Lda.

Table of Contents

Introduction.....	3
System Requirements.....	5
Software Installation Instructions.....	6
Setup Installer Prompts.....	7
Application Main Screen.....	10
Configuration Dialog Window.....	11
LCD Panel.....	14
General Settings.....	16
Load Settings.....	16
Preset Memories.....	17
Data Acquisition.....	18
Timer to turn Load ON/OFF.....	20
Battery Capacity Discharge Test.....	21
Test Settings.....	21
End Voltage Reached Action.....	22
End Test Signal.....	23
Battery tab right click menu.....	24
Battery Capacity Discharge / Solar Panel Test Report.....	26
Battery Internal Resistance Test.....	31
Choosing current pulses for IR test.....	33
CV Current Limited Load Mode.....	34
Programmed Current Profile Load Mode.....	36
Event Log.....	39
Info Tab.....	40
Solar Panel Test Mode.....	41
Test Examples:.....	43
18650 NCM Lithium Cell Capacity Test.....	43
Unlocking the unlimited data acquisition time.....	46
Antivirus Programs.....	49
Change Log.....	50
Software Disclaimer.....	65

Introduction

Kunkin KP184 is a budget electronic load that back on 2020 packed a nice list of features:

- Works both at 110 and 230VAC
- DC load voltage up to 150V
- DC load current up to 40A
- DC load dissipated power up to 400W
- Measurement accuracy is 0.05% +5 counts offset for both current and voltage with 1mV / 1mA resolution
- RS232 or RS485 connectivity with Modbus protocol

Back in 2020 the manufacturer complimentary software however was hard to get, almost impossible to get it to run properly, badly translated and was not up to the task regarding the product potential.

There are many online reviews / teardowns / tweaks and suggestions about this product, those are not the point of this document.

Interflexo developed the KP184 Modbus software at first to fill an in house need for battery testing automation and then made it available to the rest of the community.

The KP184 Modbus software allows full device operating panel remote operation on the Modbus supported load test modes. This is a good thing. The device's operating panel is not very resilient, or practical and does not

tolerate heavy use or abuse. This way you can extend the useful life of your equipment for many years.

The special device test modes: 10Khz dynamic load (DYN), overcurrent protection test (OCP) modes and compare test (COP) modes are not Modbus friendly. The device's firmware has a minimum sample period of 250 ms.

The data acquisition works beautifully only limited by your disk size and file system limitations.

Burn-in tests for your new electronic device project or repair can be programmed, logged and plotted using any of the standard load modes Constant current (CC), constant voltage (CV), constant resistance (CR) and constant power (CW).

On the battery capacity CC/CW discharge and internal resistance test modes was possible to go beyond the product capabilities with extra features, improvements and automatically produce detailed test result PDF reports with curve plots.

A new test mode (SOL) was created for solar panels diagnostic with Isc/Voc characterization, I-V curve plot and MPP determination with a detailed PDF report.

A new CV load mode (CVL) was created with added software current limitation, it is operated in dynamic CC mode with a software configurable PID loop.

A new dynamic Cycle load mode (CYC) was created. It adds support for a user programmable custom variable load current profile of unlimited steps, ramps, and repetitions.

If you have any special needs in my mind about the remote use of this electronic load please drop me a line (interflexo@sapo.pt). After the work already done I have a good understanding after a quick assessment of what can be or can not be done.

System Requirements

- Kunkin KP184 or modded KP182 electronic load with its own supplied serial cable.
- x86 personal desktop computer, laptop, or notebook with 800×600 minimum resolution display, 1024×768 or more recommended.
- For processor type, system clock speed, amount of RAM, hard disk size and graphics card please observe the recommended system requirements for your particular operating system.
- A minimum of available 100Mb on disk (HDD or SSD) are required for software installation.
- USB port plus USB to serial adapter or RS232 serial port.
- Operating system Windows Vista/7/8/10 – 32 or 64 bit

Software Installation Instructions

- Use the link below to download the setup executable installer to any directory with permissions.
https://www.interflexo.com//kp184//setup_kp184_10540.exe
- Open File Explorer.
- Navigate to the folder with the downloaded setup executable file.
- Select the setup executable file.
- Use the right mouse button to show the file context menu.
- Click the Run as administrator option.
- Follow all the prompts that appear.
- It is suggested that you follow all the defaults, but you can select an alternate directory for the installation.
- An optional application shortcut may be created on your desktop.
- Maintain your Windows system with all updates and current patches.

Note 1: Windows 10 may interrupt your kp184 Modbus install with a warning about “Microsoft-verified apps”. Kp184 Modbus is safe to install and use, so choose “install anyway”. See the Windows 10 warns me to use a “Microsoft-verified” app article for more information.

Note 2: Windows 10 in S mode does not allow the installation of kp184 Modbus or other apps from outside the Microsoft Store. You may change your system settings to allow for this and other installations you trust. See the Windows 10 S won’t let me install Third-Party Apps article for more details.

Setup Installer Prompts

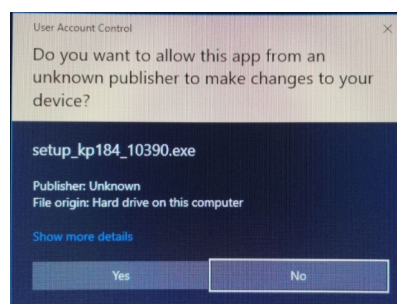
After starting the setup installer if your windows system has the Windows Defender Smartscreen enabled it will ask for confirmation, please click on the **More info** option.



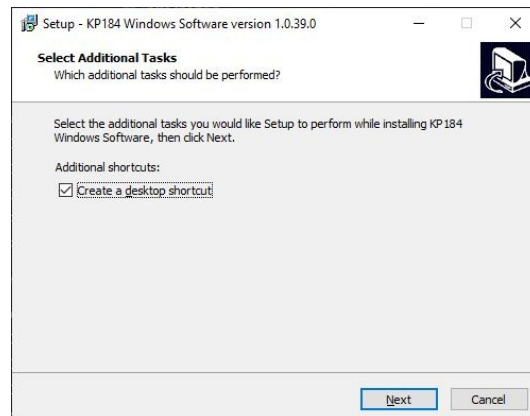
Click on the **Run anyway** button.



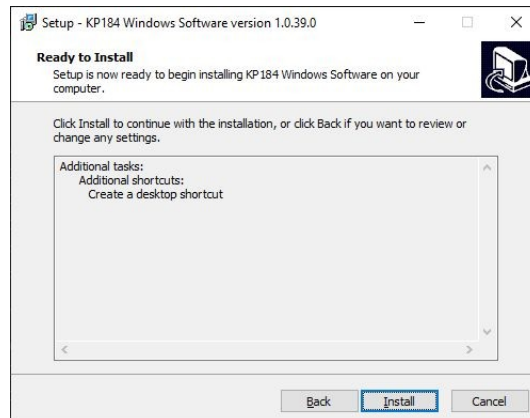
And confirm with the **Yes** button.



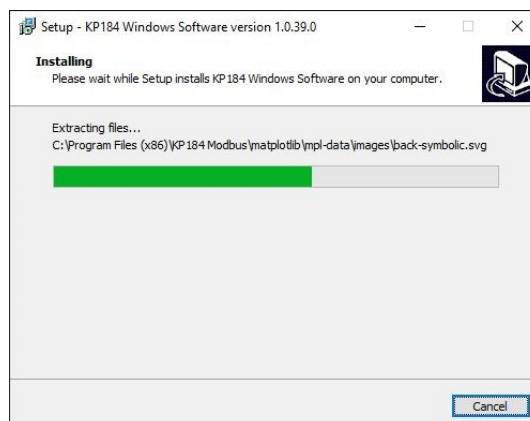
Confirm if you want to create a desktop shortcut and click on the **Next** button.



Click on the **Install** button.



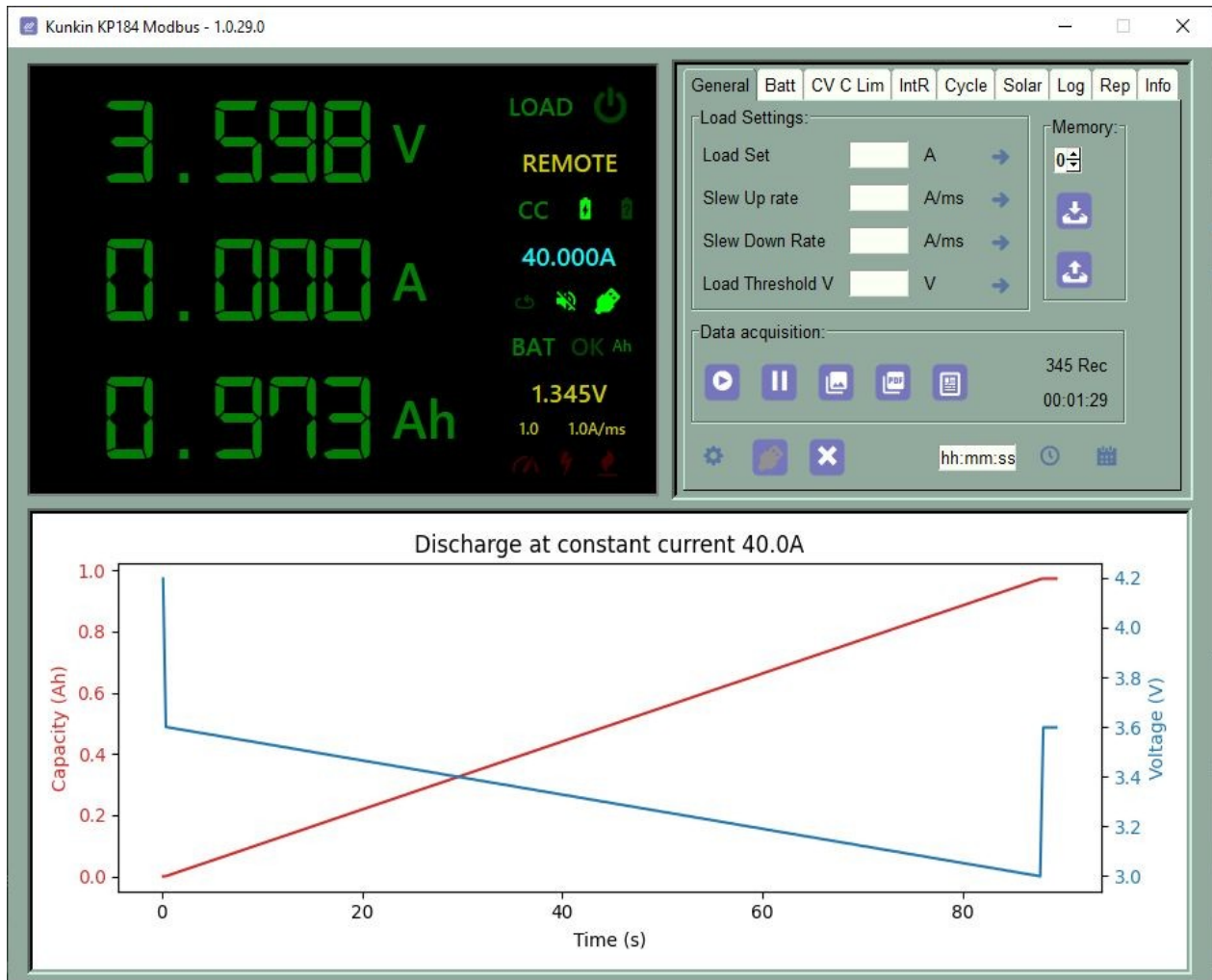
Wait for the installation process to finish.



Click on the **Finish** button to exit the setup installer.



Application Main Screen



Configuration dialog button. Disabled when connected to COM port.

Configuration Dialog Window

The

The screenshot shows the 'Configuration' dialog box with the following settings:

- General Settings:**
 - KP184 Address (1..250): 1
 - ☐ Threshold voltage for Load OFF by software
 - Data capture sampling period in ms (≥ 250): 250
 - ☐ CRC LSB First - 2020 FW and above
 - ☒ Beep on Load ON/OFF
- File Settings:**
 - May use "__DUT_BRAND__", "__DUT_MODEL__" or "__DUT_SN__" in file names
 - Captured data .CSV file name: C:\Users\Utilizador\Documents\KP184 Modbus\mycsv __DUT_SN__.csv
 - Graph .PNG file name: C:\Users\Utilizador\Documents\KP184 Modbus\kp184_graph __DUT_SN__.png
 - Graph .PDF file name: C:\Users\Utilizador\Documents\KP184 Modbus\kp184_graph __DUT_SN__.pdf
 - Battery capacity discharge / Solar panel test report .PDF file name: C:\Users\Utilizador\Documents\KP184 Modbus\kp184_report __DUT_SN__.pdf
- COM Settings:**
 - COM Port: COM39
 - Baud rate: 115200
- Registration Settings:**
 - Registration ID: 10608643299
 - Registration Key: (empty field)

Buttons: OK, Cancel

standard Kunkin KP184 operating parameters are omitted from this manual, please refer to the equipment manual for reference.

KP184 Address (1...250): Device communication address, must match the value configured on Kunkin operating panel.

Threshold voltage for Load OFF by software: The hardware threshold voltage for Load OFF on the Kunkin KP184 is implemented with some weird

ramp that throttles down the current in an unstable way. This software option lowers the KP184 hardware programmed value by 500mV to get it out of the way and just cuts the load automatically when the programmed threshold value is reached.

The screen values are always refreshed 3 times per second. The **Data capture sampling period** refers to the .csv and plot graph data creation.

The captured data includes elapsed time in seconds, voltage, current, capacity (Ah) and energy (Wh). I probably should add Power in Watts.

Check the **CRC LSB First** option if you experience difficulties establishing the serial communication with KP184 later models (Firmware 2020 and up – can be checked through the Kunkin screen brief flash at startup)

File settings group: Default file names and folders for captured data, graph images and battery capacity discharge test reports.

A verification is made to check if the folder and path are valid. In error case it will default to “My Documents\KP184 Modbus\”.

All the data file names (.csv; .png; .pdf) are used as base file names, numbers are automatically added in subsequent files to avoid overwriting files.

__DUT_BRAND__ , __DUT_MODEL__ and __DUT_SN__ strings can be used on configured file names for csv data, image, PDF and report files. These substrings will be replaced on runtime with the Rep tab DUT report identification details.

Please use a decent USB serial adapter in the absence of a legacy COM port. A FTDI or Silabs processor chips are far better than a low the cost Prolific or WCH. A Digitus DA-70156 USB 2.0 to Serial (FTDI/FT232RL) from ASSMANN Electronic GmbH costs 8,67 EUR + Shipping on Amazon. Don't need to break the bank.

The serial COM is a high latency communication. The protocol used is a Modbus RTU with CRC checks. COM Port configuration: 8,N,1 No hardware/software flow control. It will work reliably across the KP184 limits from 2400 to 115200. Please favor the higher speeds to keep the application responsive depending on your adapter, cable and distances.



Connects to the configured COM serial port



When connect the corresponding icon lights up on the black LCD panel area. When there is an adapter/cable/ baud rate problem the icon first flashes during five seconds trying to find the Kunin KP184 then stays dimmed.



Exits the application

All controls have tool tips (hints) when you carefully hover the cursor over the controls.

LCD Panel



Switches the electronic load ON/OFF. The dimmed image signals the OFF state.



Remote/Local Toggles the voltage sense mode. Local uses the power connectors and is affected by the voltage drop (proportional to the electronic load current) on the cables, connectors, etc. Remote uses the independent front BNC connector for voltage sense and is not affected by the voltage drop because it does not carry any meaningful current. You may connect the alligators directly to the battery (being tested) terminals, please respect the polarity. The assembly bellow costs about 7 Eur.



CV/CC/CW/CR Signals and Cycles through the four load modes. Constant Voltage, Constant Current, Constant Power and Constant Resistance.



Toggles battery capacity test mode ON/OFF. Mode ON unlocks Battery tab.



Toggles Internal resistance test mode ON/OFF. Mode ON unlocks In Resist tab.

0.000V/0.000A/0.000W/0.000Ω Shows the programmed load value



Toggles the Power up load state. OFF (dimmed) the electronic load is always OFF at power up. ON the electronic load remembers the last state when was power down and uses it at power up.



Toggles Kunkin KP184 key beep sound ON/OFF.

GEN/CVL/CYC/SOL Shows the Kunkin active test mode. Toggles between General (CV, CC, CW, CR), CVL (Constant Voltage Current Limited), CYC (Cycle – User Programmed Variable Current Load Profile) and SOL (Solar panel) test modes. Battery capacity test mode and Battery internal resistance test mode both have separate icons shown above.

0.000V Threshold voltage for load OFF programmed value. Please notice the tool tip (hint) to check for hardware or software handling type. When using the software type the indicator flashes red when stopping the load.

0.0 0.0 A/ms Current slew down rate and current slew up rate when switching ON/OFF.



Overpower indicator. Power > 410W.

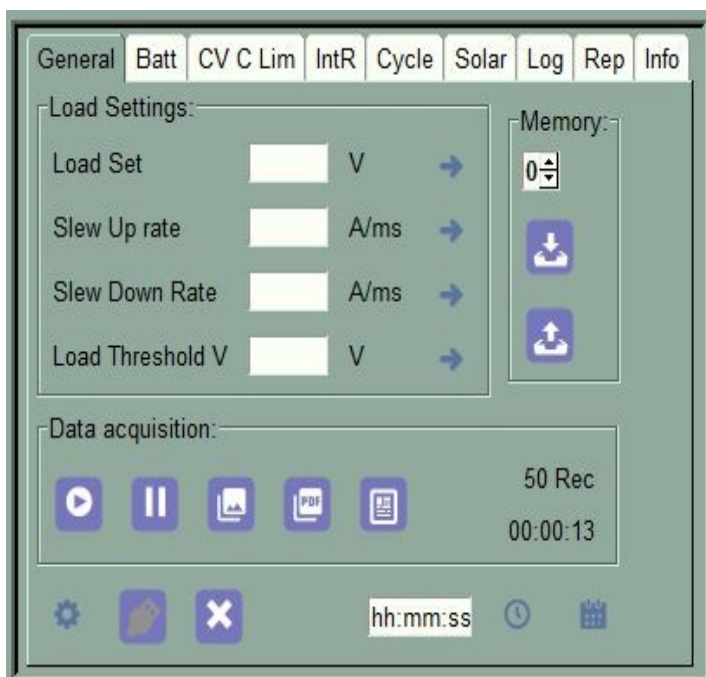


Over voltage indicator. Voltage > 152V.



Over temperature indicator.

General Settings



Load Settings

Set the:

Load Set Value: 0..150V;
0..40A; 0..400W; 0..8000Ω

Slew Up rate: 0..100A/ms

Slew Down rate: 0..100A/ms

Threshold Voltage: 0..150V

→ And use the corresponding send button. The new setting is sent to Kunkin KP184. This button can appear enabled or disabled according to the setting entered string syntax validation and COM port communication status.

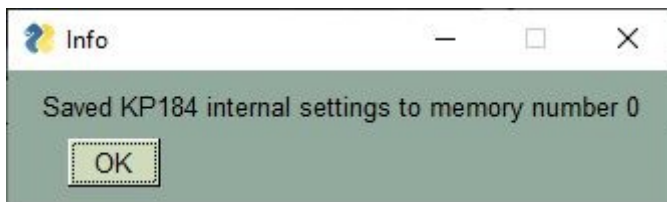
Preset Memories



Preset memory load button. Loads settings from preset memory number (0..9) defined on the spin box and sends them to Kunkin KP184.



Preset memory save button. Saves settings from Kunkin KP184 to preset memory number (0..9) defined on the spin box.



A non blocking pop up window confirms the selected operation.

Settings involved on preset memories:

key_sound

power_up_state

voltage_sense

load_mode

cv_setting

cc_setting

cr_setting

cw_setting

threshold_volt
slew_up_rate
slew_dn_rate
dynamic_mode_1
level_1_cur
level_1_tim
level_2_cur
level_2_tim
dynamic_mode_2
battery_mode
bat_end_volt
bat_go_half_cur
bat_cap_units
bat_test_over_signal

Data Acquisition



Erases previous memory data. Start collecting new data.



Pauses/Resumes collecting data.



Saves collected data on a previously configured .csv file name and folder. The file name is used as a base file name, numbers are automatically added in subsequent files to avoid overwriting files. It can be used during data acquisition to follow up during long processes. A progress window is shown during the file creation process. The system can save more than 14.000

records per hour. Adjust the data sampling period (> 250ms) on the configuration dialog window according to your needs.



Saves the plot graph on a previously configured PDF file name and folder. The file name is used as a base file name, numbers are automatically added in subsequent files to avoid overwriting files. It can be used during data acquisition. A matching “.png” image file is also added for easier document insertion. After file creation the PDF file is automatically opened on Adobe Acrobat Reader or configured web browser.



Creates a battery capacity discharge test or solar panel test PDF report according to the current selected test mode. When using battery capacity test mode this option creates a detailed report page including battery identification, test results and test settings. Please refer to page 18 for details about this report.

The number of saved records is constantly updated as well as the elapsed time in the format hh:mm:ss.

Timer to turn Load ON/OFF



Calendar date picker for timer to turn Load ON/OFF. Adjust this setting prior to COM port connection. The settings below can be adjusted during serial communications.



Timer disabled



Timer enabled to turn Load ON at a specific date and time



Timer enabled to turn Load OFF at a specific date and time

These last three buttons cycle through each other when the user clicks the button. The tool tips (hints) are always updated.

The input text box accepts a time in the format hh:mm:ss. Adjust this setting preferably with Timer disabled.

The input text box content is always checked for errors and in case of invalid value the current time is used and the timer is disabled.

Battery Capacity Discharge Test



Toggles battery capacity test mode ON/OFF. Mode ON unlocks Battery tab.

The load test modes available on battery test mode are limited to CC (Constant Current) and CW (Constant Power).

Use the load mode toggles on the LCD area to set the load mode.

Test Settings

Fill the Load Set Value and End Test Voltage (LVC) and

→ use the corresponding send button. This button is enabled based on the entered setting string syntax and COM port communication status.

The software supervises LVC value and finishes the test even if Kunkin KP184 feels like going further.

The Max Duration input text box allows the user to specify a maximum test duration in seconds. Zero disables this feature.

To start the test use the Load Switch button:



When the test starts:

- The test stops automatically according to the programmed End Voltage and Max Duration parameters.
- The data acquisition is started and terminated automatically.
- The selected capacity units for the plot graph are based on the current choice for the LCD display Ah/Wh at the beginning of the test.

End Voltage Reached Action

Kunkin KP184 reports the memory register corresponding to this parameter when changed through the Kunkin KP184 configuration menus but does not change the internal parameter when the software sends the write memory command.

This occurrence happens on several other features. Once again the Kunkin software behaves in the exact same manner. There are no errors reported through the Modbus protocol.

This feature was implemented by software.

“Stop test at once” option ends the test when the programmed end voltage condition is reached.

“Go half current until the next under voltage” option lowers the discharge current to half the initially configured value at least 10mV prior to the test end voltage reached mark. The next time the test programmed end voltage condition is reached the test is ended. A specific log is added for this event.

In case of high voltage instability due to bad connections or other reasons the 10mV step may not be enough to avoid tripping prematurely the test end voltage condition. Please check your electric connections.

End Test Signal

The radio buttons show the parameter value and allow the user to change it.

The options are:

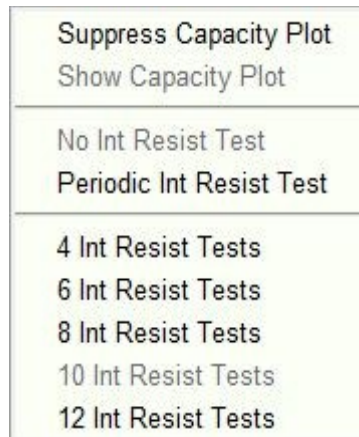
- Buzz once
- Buzz until a key is pressed on the Kunin KP184
- The PASS output electric signal is enabled after the test is finished

Under battery test mode:

- The plot graph displays a line for the voltage and another for the capacity.
- On the LCD area the large Power indicator shows the battery capacity (Ah). Clicking on it resets the capacity value to 0.0Ah.
- On the LCD area the **Ah/Wh** indicator allows the user to switch between Ah/Wh when clicked. The alternate units and Power are always displayed the battery tab.

Battery tab right click menu

Using the mouse right click button on the “Bat” tab opens the following context menu:



The capacity (Ah) plot curve may be suppressed on the battery capacity discharge test plot graph, voltage curve plot graph display only. You can use these options during setup or capacity test any number of times, the plot graph is recreated with the user latest choice. After test completion it is not possible to change the test plot graph any more.

The user can optionally ask for periodic battery internal resistance test calculation during the capacity discharge test. A user selectable number of data points will be evenly acquired from the start to the test end voltages. The data points include the battery internal resistance in Ohms and the capacity (Ah) at it was calculated. At the end of the test the %SOC is calculated for each data point.

The parameters to perform the battery internal resistance test are extracted from the “IntR” tab. Before defining the battery capacity discharge test

parameters, please enter Battery Internal Resistance test mode, and verify the “IntR” tab parameters.

The number of periodic internal resistance tests performed during the battery capacity discharge test can be selected from the list [4, 6, 8, 10, 12] on the same context menu.

The results appear on the PDF report and on the “Log” tab.

These settings are stored on the application configuration defaults .ini file.

Enabling or disabling the automatic internal resistance test can't be done after the battery capacity test is started, please do it during the setup operations.

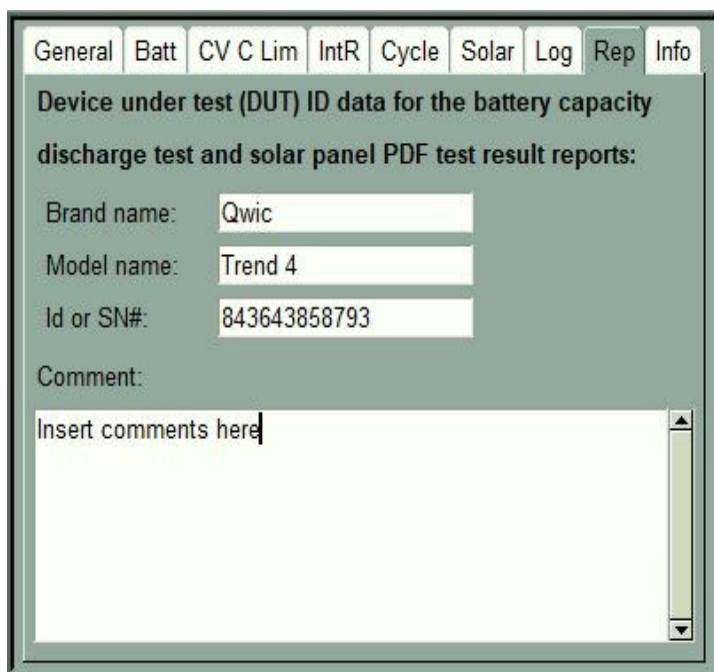
Enabling or disabling the automatic internal resistance test causes the current plot graph and paused acquired data to be deleted.

There are interlocks in place to avoid changing the “test end voltage” and the “set current” parameters during the battery capacity discharge test if the periodic internal resistance tests are enabled. If the periodic internal resistance tests are not selected these parameters can be adjusted during the battery capacity discharge test.

Battery Capacity Discharge / Solar Panel Test Report

The report creation is a silent operation. However a line is added to the application log when the report is created.

DUT Report Identification Details



The screenshot shows a software window with a tabbed interface. The 'Rep' tab is selected. The window title is 'Device under test (DUT) ID data for the battery capacity discharge test and solar panel PDF test result reports:'. Below the title, there are three text input fields: 'Brand name:' with the value 'Qwic', 'Model name:' with the value 'Trend 4', and 'Id or SN#:' with the value '843643858793'. Below these fields is a 'Comment:' label and a large text area with the placeholder text 'Insert comments here'.

The battery or solar panel identification details that will be used on the test report can be filled on the Rep tab.

These are simple text fields, you can type anything you want or leave them blank.

Please refer to page 16 regarding this report's generation button placement

(General settings tab / Data acquisition frame / Last button on the right).

The PDF battery capacity test report is created if:

- Test mode is Battery capacity test mode.
- Load is OFF.
- Data recording is OFF.
- Discharge test capacity value in Ah is not null.
- Discharge test elapsed time is not null.

- The test result graph PNG file was successfully created.

The battery capacity discharge test may have ended automatically when the end test voltage was reached, time limit was reached or test was user terminated or temporary suspended by a load OFF command.

The PDF solar panel test report is created if:

- Test mode is Solar panel test mode.
- Load is OFF.
- Data recording is OFF.
- Maximum power MPP value is not null.
- The test result graph PNG file was successfully created.

The report is saved on a previously configured PDF file name and folder. The file name is used as a base file name, numbers are automatically added in subsequent files to avoid overwriting files. After file creation the PDF file is automatically opened on Adobe Acrobat Reader or configured web browser.

Please read the chapter referring to the Info tab. There you will find information regarding the way to optimize the report vertical page space and size of the plot graph.

On the next pages you can find examples of both test report pages.

Battery Capacity Discharge Test Report

Test Equipment: Kunkin KP184

Date: 04/10/2022

DUT Brand: No Brand

DUT Model: Hybrid 25Ah 5C

DUT ID/#SN: 843643858793

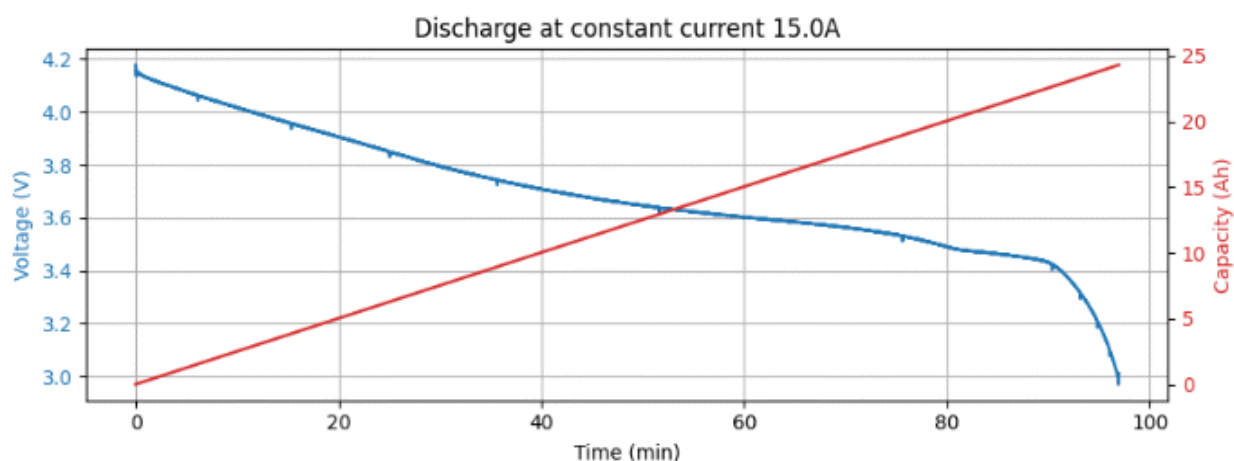
Periodic Internal Resistance Test

Load Set: 15.000 A

Pulse 1: 0.8 s 15.0 A

Test End Voltage: 3.000 V

Pulse 2: 0.8 s 30.0 A



Test Results:

Battery Energy: 89.62 Wh

Battery Capacity: 24.272 Ah

Discharge Time: 01:36:55

Discharge Current: 15.000 A

Start Voltage: 4.178 V

End Voltage: 2.990 V

SOC: Internal Resistance:

99.9 % 1.4 mOhm

93.7 % 1.3 mOhm

84.1 % 1.3 mOhm

74.2 % 1.3 mOhm

63.2 % 1.3 mOhm

46.7 % 1.3 mOhm

22.0 % 1.3 mOhm

6.8 % 1.4 mOhm

3.9 % 1.5 mOhm

2.1 % 1.5 mOhm

0.9 % 1.6 mOhm

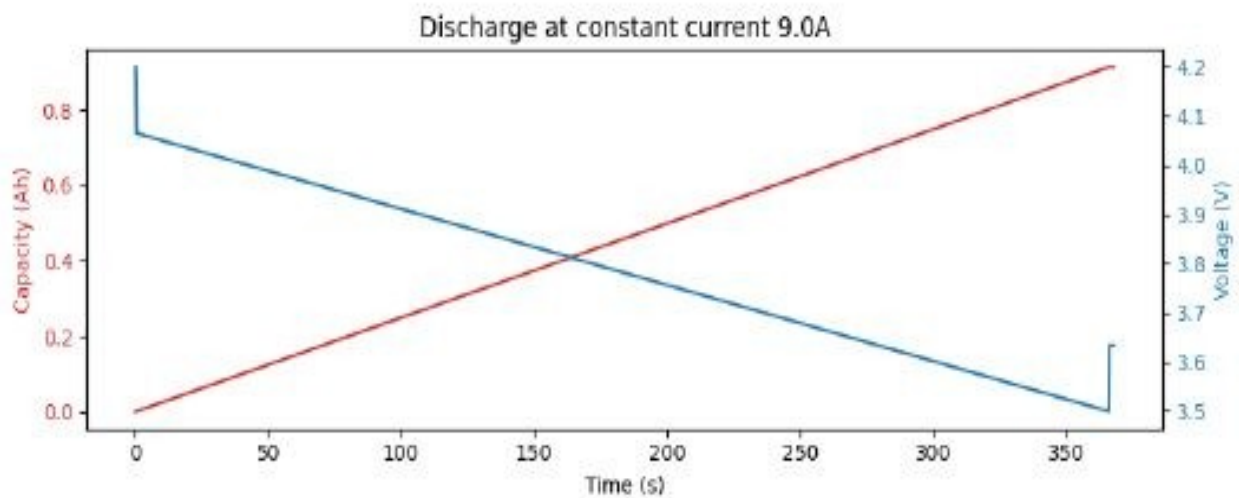
0.0 % 1.7 mOhm

KP184 Modbus Software - Interflexo
Copyright © 2021 All rights reserved

Battery Capacity Discharge Test Report - 18/11/2021 16:53:39

Battery Capacity Discharge Test Report

Test Equipment: Kunkin KP184
Date: 18/11/2021
DUT Brand: Qwic
DUT Model: Trend 4
DUT ID/#SN: #1234567890#
Load Set: 9.00 A
Test End Voltage: 3.5 V

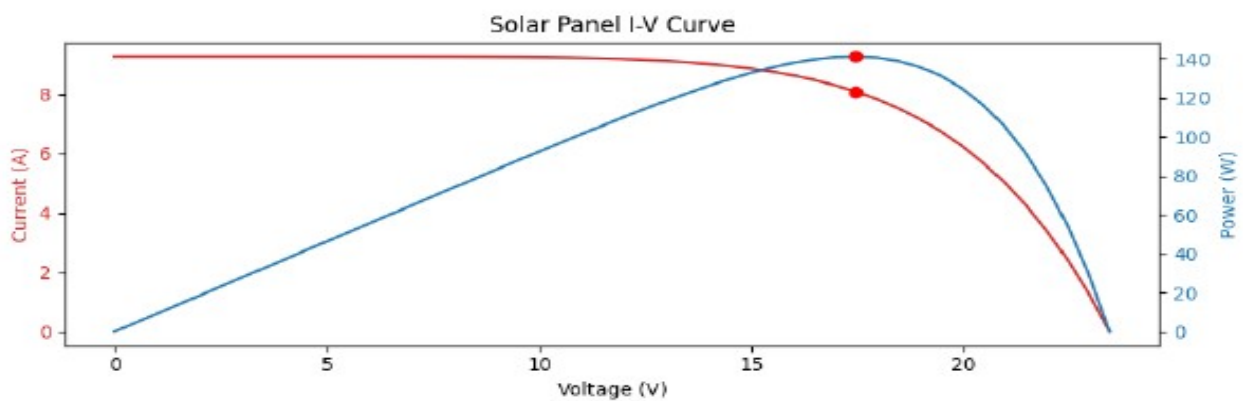


Test Results:

Battery Energy: 3.46 Wh
Battery Capacity: 0.91 Ah
Discharge Time: 00:06:07
Discharge Current: 9.00 A
Start Voltage: 4.2 V
End Voltage: 3.5 V

Solar Panel I-V Test Curve Report

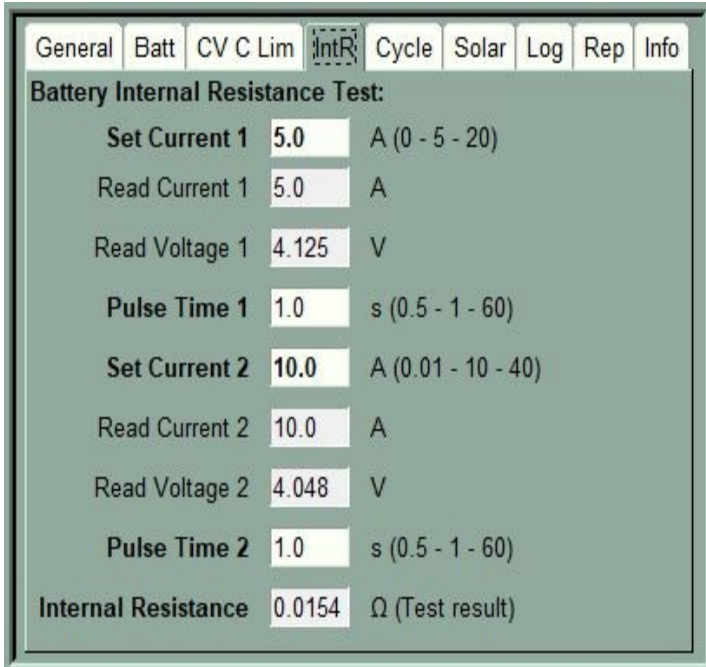
Test Equipment: Kunkin KP184
Date: 18/11/2021
DUT Brand: Qwic
DUT Model: Trend 4
DUT ID/#SN: #1234567890#



Test Results:

Open circuit voltage Voc:	23.441 V
Short circuit current Isc:	9.258 A
Maximum power MPP:	141.09 W
Maximum power point voltage Vmp:	17.455 V
Maximum power point current Imp:	8.083 A

Battery Internal Resistance Test



Parameter	Value	Unit / Range
Set Current 1	5.0	A (0 - 5 - 20)
Read Current 1	5.0	A
Read Voltage 1	4.125	V
Pulse Time 1	1.0	s (0.5 - 1 - 60)
Set Current 2	10.0	A (0.01 - 10 - 40)
Read Current 2	10.0	A
Read Voltage 2	4.048	V
Pulse Time 2	1.0	s (0.5 - 1 - 60)
Internal Resistance	0.0154	Ω (Test result)

In the LCD area:

Toggles Internal resistance test mode ON/OFF. Mode ON unlocks In Resist tab.

Fill the “Set Current 1” and “Set Current 2” step pulse values. Use large and differentiated paired values like 1A and 2A or 5A and 10A

depending on the specification of the equipment you are testing. Use remote voltage sense to rule out cable and connectors voltage drops and calculate meaningful results.

The current step pulse times are configurable. These tests can meet IEC 62620 standards for Li-ion batteries and IEC 61951-2 standards for Ni-MH batteries.

As a standard DCIR test please allow 1 second duration for Kunkin KP184 voltage settling.

DCIR is a function of the battery state of charge (SOC). Ideally SOC should not change during the test.

If you know what you are doing you can customize longer pulse times to meet your needs.

The first step may be configured to 0A to measure the battery internal resistance from an open circuit voltage (OCV) state.

The result in ohms (Ω) is displayed on the bottom under “Internal resistance”.

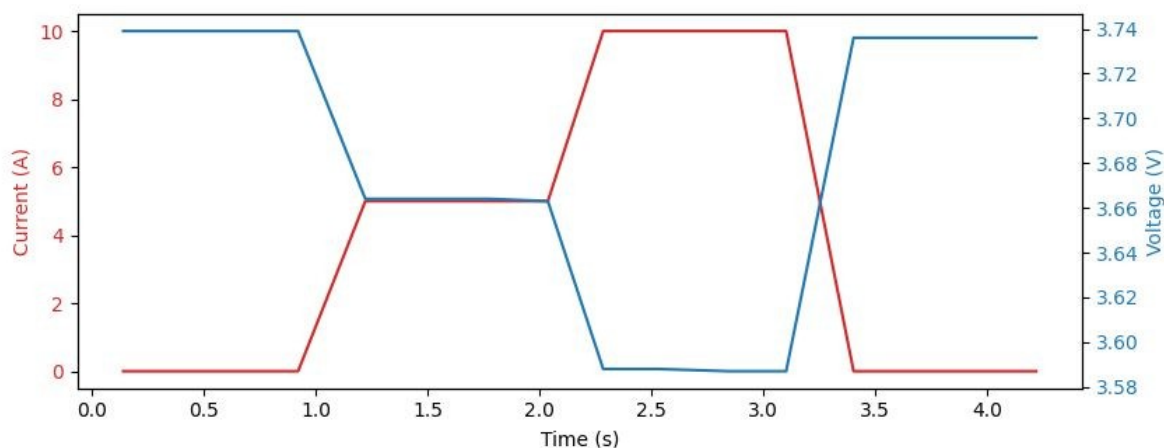
To start the test use the Load Switch button:



The test stops automatically.

Before pressing the Load Switch icon you may switch to the "General" tab and start data acquisition to log the process to gain access to plot graph and optional saving of .csv data. Do remember to manually pause collecting data on the same tab after the process is finished.

This mode is implemented in software. It is impossible to change the Kunkin KP184 parameters by serial port regarding this test. Once again the Kunkin software behaves in the exact same manner.



Chosing current pulses for IR test

KP184 has a voltage accuracy of $\pm 0.05\%$ +5mV. The table below shows the impact of this accuracy on the calculated IR error. The lower the cell IR (Internal Resistance) is the higher the current pulses should be.

Examples are provided for:

5 Cell IR reference values (1.5, 15, 30, 90 and 150 mOhm)

4 Test current pulse levels (0.05 - 0.1, 0.5 - 1, 5 - 10, 15 - 30 A)

IR Test Pulse Current Selection

Cell Voltage Table

3.7 0.007 KP184 Voltage accuracy

Cell IR (Ohm)	Pulse 1 (A)	Pulse 2 (A)	Read V1 (V)	Read V2 (V)	Calc IR (Ohm)	IR Max Error (Ohm)
0.0015	0.05	0.1	3.700	3.700	0	0.1370
0.0015	0.5	1	3.699	3.699	0	0.0137
0.0015	5	10	3.693	3.685	0.0016	0.0014
0.0015	15	30	3.678	3.655	0.0015	0.0005
0.015	0.05	0.1	3.699	3.699	0	0.1370
0.015	0.5	1	3.693	3.685	0.016	0.0137
0.015	5	10	3.625	3.550	0.015	0.0014
0.015	15	30	3.475	3.250	0.015	0.0005
0.03	0.05	0.1	3.699	3.697	0.04	0.1370
0.03	0.5	1	3.685	3.670	0.03	0.0137
0.03	5	10	3.550	3.400	0.03	0.0014
0.03	15	30	3.250	2.800	0.03	0.0005
0.09	0.05	0.1	3.696	3.691	0.1	0.1370
0.09	0.5	1	3.655	3.610	0.09	0.0137
0.09	5	10	3.250	2.800	0.09	0.0014
0.09	15	30	2.350	1.000	0.09	0.0005
0.15	0.05	0.1	3.693	3.685	0.16	0.1370
0.15	0.5	1	3.625	3.550	0.15	0.0137
0.15	5	10	2.950	2.200	0.15	0.0014
0.15	15	30	1.450	-0.800	0.15	0.0005

Please read the datasheet of the cell being tested and set the test higher current pulse near the cell pulse current limit for best results.

CV Current Limited Load Mode

General Batt **CV C Lim** IntR Cycle Solar Log Rep Info

Software Current Limited CV Load Mode:

CV Setting V → 3.850 V

Current Limit A → 18.000 A

P I D

PID Tunings: 2.544 17.761 -0.000

Kp → -48.000

Ki → -14.000

Kd → 20.000

Current Cmd: 18.000 A ☐ Proport on measur

This is a software current limited CV load mode.

Kunkin KP184 is hardware configured to CC and a software configurable PID loop holds the user configured CV setting by automatically adjusting the CC load.

Please understand that with an update period of 250ms this process is only viable for fairly stable circuits.

GEN/CVL/... Toggle the test mode indicator to access CVL test. It unlocks In CVL tab.

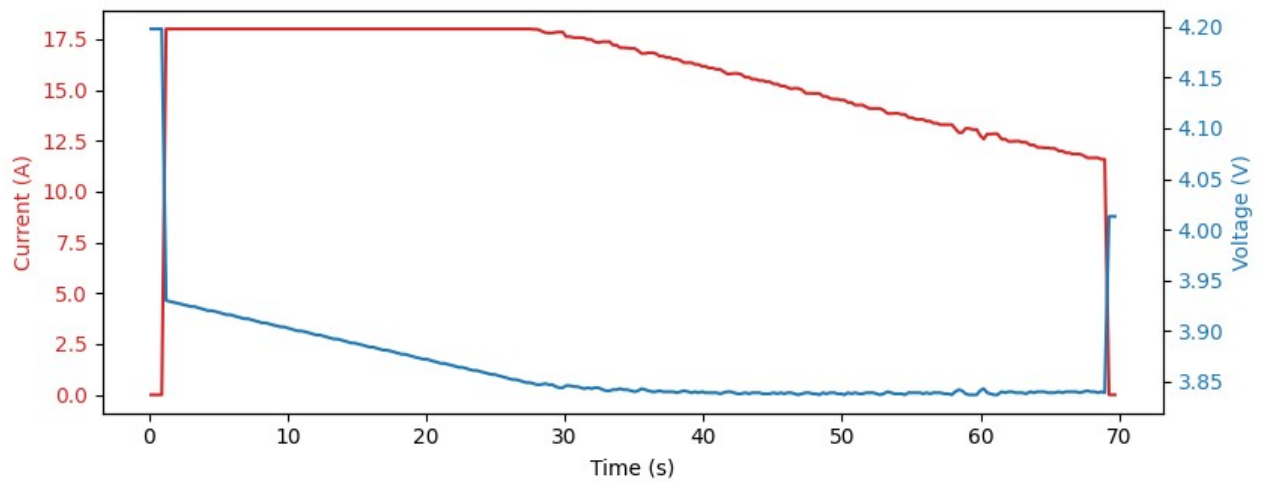
Fill the CV Setting voltage and the current limit.

Kp, Ki, Kd adjusts the PID gains on the fly.

Proportional on Measurement: To eliminate overshoot in certain types of systems, the application can calculate the proportional term directly on the measurement instead of the error.

To start/stop the test use the Load Switch button:





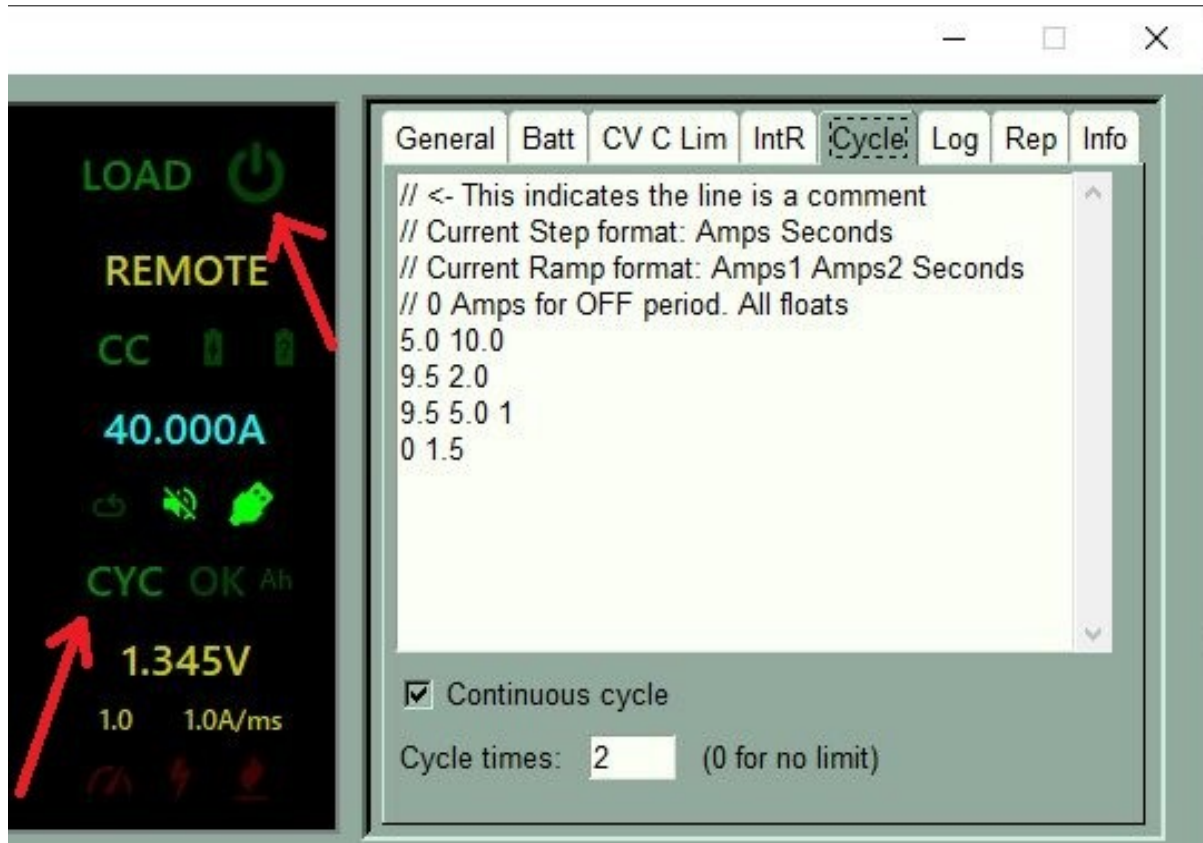
Load Settings:

CV Setting: 3.85V
Current Limit: 18A

Kp: -48
Ki: -14
Kd: 20

Proportional on Measurement: No

Programmed Current Profile Load Mode



The dynamic Cycle mode allows the user to program a custom variable load current profile of unlimited steps, ramps and repetitions.

Toggle the test mode indicator to access the special test modes **GEN / CVL / CYC/SOL**. CYC unlocks the Cycle Tab

The format is simple and can be edited on the multi-line text box.

Any empty lines are ignored. All lines beginning with '/' are treated as a comment.

A step current is programmed with a current value in Amperes and a pulse time in seconds. Both integer or floats can be used separated by spaces.

A null current of 0 Amperes indicates an OFF time.

A current ramp is programmed with two current values in Amperes and a duration time in seconds. Both integer or floats can be used separated by spaces.

The programmed profile can be repeated any number of times and stops automatically or indefinitely and must be stopped with Load Switch button. Use the checkbox to enable the cycle repetitions and the edit box to enter the number of repetitions, use 0 for no limit.

The load commands are sent in real time through the serial interface. Use 115200 baud to reduce the lag as much as possible. The minimum programmable time step is 0.1s

The log tab records all relevant load changes.

To start/stop the test use the Load Switch button:



Before pressing the Load Switch icon you may switch to the "General" tab and start data acquisition to log (plot graph and optional saving .csv data) the process. Do remember to manually pause collecting data on the same tab after the process is finished.

In the Cycle tab you can write lines as in a text programming language.

For example:

0 5 5

5 2

0 2

5 2

5 0 5

Will result in the following load programmed profile:

Ramp from 0A to 5A in 5 seconds

Hold 5A during 2 second

Turn Load OFF (0A) during 2 second

Turn Load ON (5A) during 2 second

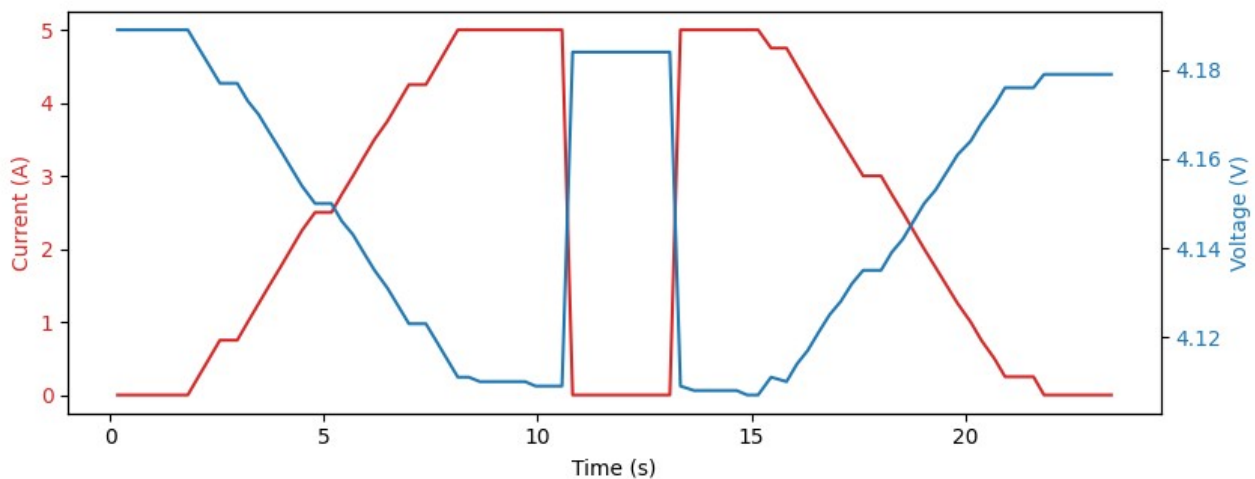
Ramp from 5A to 0A in 5

seconds.

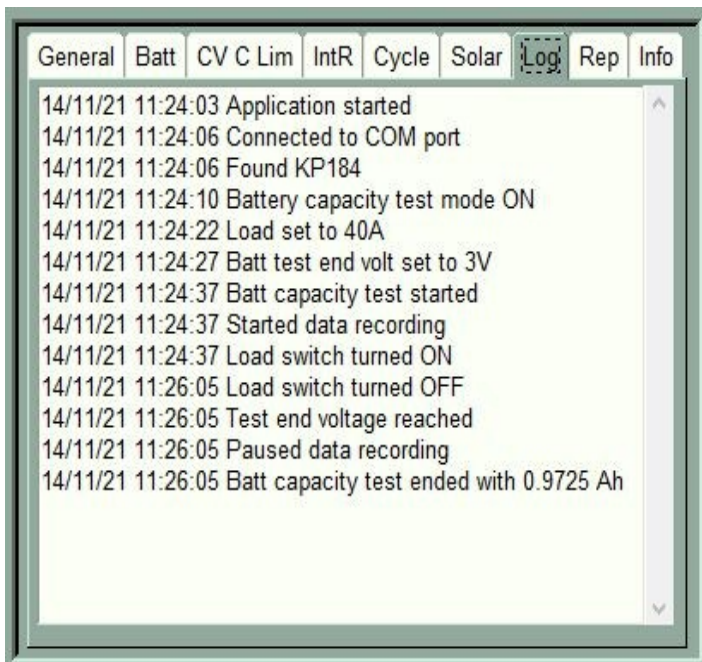
You can repeat the programmed profile any number of times or just indefinitely.

After writing the profile instructions just press the Load Switch icon.

Before pressing the Load Switch icon you switch to the "Log" tab to just watch the log lines in real time and inspect how Kunkin is being commanded.



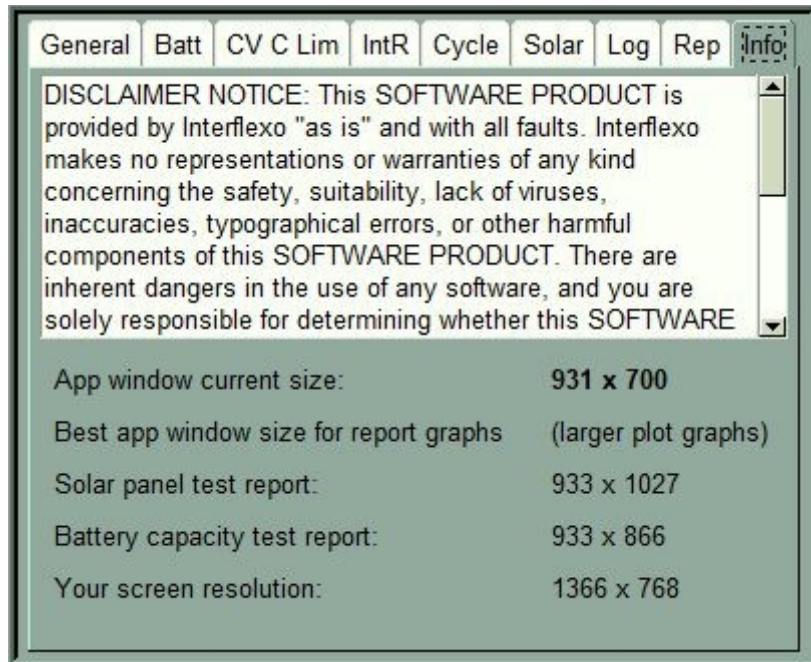
Event Log



The log tab allows the user to keep a track record of the current session activities, events and results. Events as over temperature, over power and over current are also logged as well as its recoveries.

Right click on the text widget and select **“Copy to clipboard”** to export the complete log in text format or **“Clear Log”** to erase all current session log data.

Info Tab



The info tab contains a software disclaimer notice.

The information regarding the screen resolution and the application window size in pixels can be used to fine tune the plot graph aspect ratio for PDF report vertical space optimization. The application window is dynamically resizable via cursor dragging. The user can follow the application window size during the window corner or edge drag operation. Set the window width to the minimum value and set the window height close to the report type recommended height. The application remembers the last used window size and location on the desktop screen.

Solar Panel Test Mode

The Solar Panel Test Mode allows the user to perform a configurable CV sweep load to test all the solar panel operating points (I-V curve plot) for diagnostic or manufacturer specifications confirmation.

Toggle the test mode indicator on the black LCD panel to access the special test modes **GEN / CVL / CYC/SOL**. SOL unlocks the Solar Tab

General	Batt	CV C Lim	IntR	Cycle	Solar	Log	Rep	Info
Start		<input type="text" value="1.1"/>	V (1.1)					
Stop		<input type="text" value="22.0"/>	V					
Smooth Step		<input type="text" value="1.0"/>	V (0.1 - 0.5 - 5)					
Step Time		<input type="text" value="1.0"/>	s (0.5 - 1 - 2)					
Repeat Test Cycle Time		<input type="text" value="0"/>	min (0 - 10 - 1440) 0 OFF					
Solar panel test results:		I-V characteristic curve						
Open circuit voltage Voc		<input type="text" value="23.441"/>	V					
Short circuit current Isc		<input type="text" value="9.258"/>	A					
Maximum power MPP		<input type="text" value="141.08"/>	W					
I mp		<input type="text" value="8.052"/>	A	V mp		<input type="text" value="17.521"/>	V	

Enter the **Start** test voltage. Usually 1.1V to allow for the panel short circuit current measurement. KP184 minimum load voltage is about 1V.

Enter the **Stop** test voltage. Usually some tenths on Volt above

the panel open circuit voltage.

Enter the incremental voltage **step** and the **step time** in seconds. The software will automatically interpolate smoothly through the desired steps. On the right inside curved braces the user can find the upper and lower limits values where applied and a reasonable value in the middle.

Repeat Test Cycle Time if greater than zero repeats the solar panel test within the configured minutes from 1 to a maximum of 1440 minutes (24 hours). The collected data .csv file and PDF report of each test are automatically saved.

To start/stop the test use the Load Switch button:



The data acquisition to log (plot graph and optional saving .csv data) the process will be started automatically for you. The system will stop collecting data when the process is finished.

The software will record the measured:

- Voc – Open circuit voltage
- Isc – Short circuit current
- MPP – Maximum power point
- Vmp – Voltage on the maximum power point MPP
- Imp – Current on the maximum power point MPP

Please use the Rep tab (page 18) to fill in the details about solar panel identification (brand, model and #SN) to use on the test report.

You may now access the General tab / Data acquisition frame to:



Save the collected data on a .csv file.



Save the current plot graph on a PDF/PNG file.



Create the detailed solar panel test PDF report.

Please refer to page 21 for an example on the solar panel test report.

Test Examples:

18650 NCM Lithium Cell Capacity Test

Assuming the software is already configured and communicating with Kunkin KP184 or else please refer to page 5 regarding the software and hardware configuration.



Use the “Toggle Connect/disconnect serial port” button on the General settings tab to open the configured serial connection.



The “Serial Connection Status” icon on the black LCD panel should light up meaning you have a serial connection with Kunkin KP184.



Use the black LCD panel “Toggle Battery Capacity Test Mode ON/FF” icon to enter the battery capacity test mode. The icon should light up and the battery capacity test settings tab should open automatically. If you are changing from one test mode to another you may have to click on the Battery tab to open it.

On the battery capacity test mode you may choose to set the test load mode as constant current **CC** or constant power **CW**. Please check the corresponding selected indicator on the black LCD panel. Click on the same “Toggle Load Mode” indicator to toggle the selected load mode.

The currently programmed load value can be found on the black LCD panel cyan value Ex. 5.000A.

→ If you want to change this value on the Test Settings frame please enter the new load value and press the right arrow set button.

The programmed test end voltage can be found at the right outside the Test Settings frame. Hover the cursor through the controls and use the tool tips to double check.

→ If you want to change this value on the Test Settings frame please enter the new test end voltage and press the right arrow set button. A value of 2.8V can be used for this battery chemistry.

You can leave the maximum test duration disabled at 0s.

In the “End Voltage Reached” frame select the “Stop Test at Once” option.



Please make sure the “Hardware threshold voltage for load limit” is below the programmed test end voltage so it does not interfere with this test. You can change this setting on the General tab / Load Settings frame / Load

Threshold setting.



Use the black LCD panel “Toggle Load ON” button to start the test. You can interrupt the test at any moment using the same button.

You will hear a tone and the battery capacity discharge test will begin. The data acquisition will be started automatically for you.

Clicking
the
Ah/Wh
small



indicator toggles the battery capacity value large indicator units between Ah and Wh.

Clicking
the
battery



capacity value large indicator resets its value. This can only be done with the load off to avoid inadvertently resetting it during the test.

The test will end automatically with a tone when the test end voltage value is reached or the maximum test duration is achieved. The data acquisition will also be automatically stopped.



You may press the General tab / Data acquisition frame / Pause/Resume button at this point to continue the data acquisition process and register the cell's voltage recovery for as long as you want. You may stop it again with the same button.



Saves the collected data on a .csv file.



Saves the current plot graph on a PDF/PNG file.



Creates the detailed battery capacity discharge test PDF report.

Unlocking the unlimited data acquisition time

This unregistered product exhibits watermarks and works in trial mode where the data capture is limited to 15 minutes, at a time, all other features remain functional. If you find out that this software product is useful to you, please register sending your registration ID from the configuration dialog to interflexo@sapo.pt along with \$30 USD by PayPal. Interflexo will then email you back the unlocking registration KEY.

This will help to support the software maintenance and the development of new features.

Please use one of the following secure PayPal links for payment:

[PayPal Link](#)

or

[PayPal.Me](#)

If you don't have a PayPal account or you don't want to use it, just select the provided link option "Pay with a Bank Account or Credit Card".

Detailed registration instructions:

1. Please start the KP184 Modbus application.
2. From the application main screen press the Configuration Settings button, this action will open the configuration dialog window.
3. From the bottom of the settings window copy/paste the Registration ID code from your system and send it by email to interflexo@sapo.pt
4. Interflexo will then email you back your personal Registration Key. Please copy/paste it to the input field below.
5. Please close the configuration dialog with the OK button.

Configuration

General Settings:

KP184 Address (1..250): ☐ Threshold voltage for Load OFF by software

Data capture sampling period in ms (>= 250):

☐ CRC LSB First - 2020 FW and above ☒ Beep on Load ON/OFF

File Settings:

Captured data .CSV file name:

Graph .PNG file name:

Graph .PDF file name:

Battery capacity discharge test report .PDF file name:

COM Settings:

COM Port: Baud rate:

Registration Settings:

Registration ID: Registration Key:

If you have any questions don't hesitate to drop a line to interflexo@sapo.pt

Antivirus Programs

This application is programmed in Python. Python code is often distributed as source code, but sometimes it is more convenient to use another format: such as a compiled (.exe) file. A module called pyinstaller is typically used to compile and package the source code.

Code compiled with pyinstaller is often incorrectly classified as malware, virus or Trojan by antivirus programs.

This is what is known in the virus industry as a “false positive”. The code does not do anything malicious, but because it was compiled in a way that looks like other code which might do malicious things antivirus judges it to be a virus. Things get worse when antivirus systems use somewhat blind machine learning algorithms.

Even with code signature developers go to great lengths to keep their code whitelisted having to individually contact antivirus providers submitting and backing up the false positive claims. Every KP184 Modbus software release is checked against a 60+ antivirus panel including the industry heavy weights Kaspersky, Norton, Panda, Bitdefender, McAfee, Avira, Avast, Symantec and Microsoft Defender before being made available to download.

Please rest assured that we take pride in the quality of our service and product, and rare instances like this occur due to the complexity of file structures.

If you have further concerns, please do send us a mail and we will immediately assist you.

Change Log

V1.0.1.0 – 28 May 2020

- First release.

V1.0.2.0 – 2 June 2020

- Capacity (Ah)/Energy (Wh) calculations error fix.
- Minor bug fixes.
- New software CVL mode with current limiting capability. Operates Kunkin in CC mode and a PID configurable control loop holds the configured CV setting by permanently adjusting the CC load.

V1.0.3.0 – 13 June 2020

- Plot graphs are now placed on the same directory as the configured .csv file.
- A matching “.png” plot graph image file is also added to the same output directory for easier document insertion.
- Dimmed icons bumped 78% in brightness.
- Several minor cosmetic issues fixed.
- Several support modules were updated in the Python ecosystem.

V1.0.4.0 – 20 June 2020

- Fixed an issue with the battery capacity test maximum duration.
- A new log tab allows the user to keep a track record of the current session activities and results. Events like over temperature, over power and over current are also logged as well as its recoveries. Right click on the text widget and select “Copy to clipboard” to export the complete log in text format.

V1.0.5.0 – 24 November 2020

- Fixed some data logging hiccups during application main window drag.
- Fixed graph y-label slightly clipped.
- Several support modules were updated in the Python ecosystem.

V1.0.6.0 – 15 January 2021

- Added some thread locks around logged data handling.
- Several support modules were updated in the Python ecosystem.

V1.0.7.0 – 21 January 2021

- Added automatic PDF report creation from the battery discharge capacity test results.
- Smoother data files (.csv; .png; .pdf) bulk writes during data acquisition.
- Several support modules were updated in the Python ecosystem.

V1.0.8.0 – 25 January 2021

- Added a software implemented end voltage condition test: go half current until next under-voltage during battery capacity discharge test.
- Added Windows Setup Installer.
- Documentation, fonts and Microsoft Visual C++ 2015 Redistributable (x86) are automatically installed if required.

V1.0.9.0 – 25 January 2021

- Added the new information to the automatic PDF report creation for the end voltage condition test: go half current until next under-voltage during battery capacity discharge test.

V1.0.10.0 – 25 January 2021

- .ini configuration file now is placed on folder "KP184 Modbus" inside "User\AppData\Roaming" folder. During setup installation upgrades this file is not overwritten to preserve your configuration.
- Data files (.csv, .png, .pdf, pdf reports, etc. are now created on a folder "KP184 Modbus" inside "My Documents" folder. You can select other folders, the configured folder for .csv files is used.

V1.0.12.0 – 27 January 2021

- .csv data files; .png plot graph files; .pdf plot graph files and .pdf test report files now all have independent configurable file names and folders and reset to folder "KP184 Modbus" inside "My Documents" in case of error.
- There is a new button specific for the battery capacity discharge test report creation.
- PDF User Manual now is installed on the folder named "KP184 Modbus" inside "My Documents".

V1.0.13.0 – 9 February 2021

- Replaced several functions from external lib modules that will be deprecated in the future.

V1.0.14.0 – 17 February 2021

- Fixed an issue related to configuration dialog file browse select controls startup folder.

V1.0.15.0 – 2 March 2021

- Also accepts Modded KP182 (U23 > ADUM1201 + 2 RX/TX resistors + USB/Serial Converter).

V1.0.16.0 – 3 March 2021

- Added a new configuration setting for CRC LSB First – New 2020 FW and above.

V1.0.17.0 – 12 March 2021

- Current and power manual entry values limits (20A 200W) are checked for the KP182 MOD model, they are half the KP184 model (40A 400W).
- A new dynamic CYC test mode allows the user to program a custom variable current load profile of unlimited steps, ramps and repetitions.

V1.0.18.0 – 13 March 2021

- Made some corrections to the new CYC test mode current ramp profiles.
- Added a new "Clear Log" to the Log context menu to help better inspect the new CYC test mode results.

V1.0.19.0 – 31 March 2021

- Battery capacity LCD display always shows 5 significant digits, 3 decimal places until 99,999Ah and 2 decimal places above that value.
- You can run as many instances of the application as you want and configure each one for a different serial port. Only the first application instance will save it's default configuration on disk.

V1.0.20.0 – 1 April 2021

- Fixed the Version 1.0.19.0 startup problem

V1.0.21.0 – 3 April 2021

- LCD Panel uses a new 7 segment display mono-spaced font
- Pros: String does not shift around when '1' char is used
- Cons: Decimal separator takes as much space as an '8'

V1.0.22.0 – 23 April 2021

- Enhanced battery DCIR test. The first step may be configured to 0A to measure the battery internal resistance from an open circuit voltage (OCV) state. The step pulse time is configurable to meet specific user needs.

V1.0.23.0 – 27 April 2021

- Enhanced battery DCIR test. Both pulse step times are now configurable. These tests can now meet IEC 62620 standards for Li-ion batteries and IEC 61951-2 standards for Ni-MH batteries.
- Application load time was cut to one third.

V1.0.24.0 – 29 April 2021

- Back to one exe file distribution. Unpacked folder distribution causes problems accessing the .ini file.
- When a new configuration key was added to an older .ini file, example "inres_pulse_time2" from version 22 to 23 the error message "Can't access the .ini" was not adequate, there is a new popup message stating that one or more configuration keys were added.

V1.0.25.0 – 6 June 2021

- An optional Beep on load ON/OFF was added to the configuration page. Beeps are annoying but on remote operation it is nice to receive a notification when battery discharge is over.

V1.0.26.0 – 5 July 2021

- Several Python modules were updated.

V1.0.27.0 – 28 October 2021

- Overcomes a KP184 internal firmware issue that periodically (each 7.53h) resets the Wh value during very long battery discharge tests. The screen shows the internal Kunkin Wh value but the saved .csv file shows the correct calculated value by the software.
- Several Python modules were updated.

V1.0.28.0 – 2 November 2021

- On the non static cycle (CYC) load mode the user load profile definition text for line comment char was changed from '#' to '//'. The .ini read file parsing code was deleting multiple line comments.
- Several GUI tool-tips were corrected.

V1.0.29.0 – 14 November 2021

- New solar panel test mode (SOL) added. A user defined CV sweep mode records de solar panel characteristic I-V curve and MPP data for device diagnostic or manufacturer specification confirmation.
- The data acquisition report button now handle both types of reports (battery capacity discharge test and solar panel test) according to the last test mode.
- Correction on the non static cycle (CYC) load mode startup.
- Some settings were not available on the configuration dialog window.

V1.0.30.0 – 19 November 2021

- Both types of reports (battery capacity discharge test and solar panel test) now share the same PDF generation engine and have a consistent layout.
- Correction on the non static cycle (CYC) load mode. Now when the load profile programming code is empty the load does not turn on and an appropriate message is displayed.

- On the solar panel test mode (SOL) plot graph curves the MPP point is now highlighted in red.
- On the data acquisition save .csv or .png plot graph files a file explorer window is opened with the selected file.

V1.0.31.0 – 5 December 2021

- Some python modules were updated.
- Resolved some issues with the tests PDF reports.

V1.0.32.0 – 10 December 2021

- When having trouble to connect both CRC LSB First flag states are tested for the new Kunkin 2020 Firmware and above.
- Resolved some issues with the modded KP182 identification on the PDF reports.

V1.0.33.0 – 28 December 2021

- Some python modules were updated.

V1.0.34.0 – 30 December 2021

- Application now checks for updates at startup.

V1.0.35.0 – 4 January 2022

- Application load time was cut in half.
- Software updates are automatically downloaded and installed upon user confirmation.

V1.0.36.0 – 20 June 2022

- Cyclic solar panel test option added.
- Some python modules were updated.

V1.0.37.0 – 27 June 2022

- Cycle mode continuous operation not restarting correction.
- Corrected PDF plot graph export missing module.

V1.0.38.0 – 2 August 2022

- `__DUT_BRAND__`, `__DUT_MODEL__` and `__DUT_SN__` strings can be used on configured file names for csv data, image, PDF and report files. These substrings will be replaced on runtime with the Rep tab DUT Report Identification Details.
- Record time is paused during paused data recording.

V1.0.39.0 – 6 September 2022

- Application is now a resizable grab anywhere window.
- The application last window size and screen position are saved.
- The screen plot graph aspect ratio is also used on the PDF reports. Info on the Report tab helps the user to get optimized and larger plot graphs on the PDF reports.

V1.0.40.0 – 22 September 2022

- Plot graph x axis now shows hours, minutes or seconds units depending on test duration.
- PDF Report button was not enabled after very long battery capacity discharge test completion.

V1.0.41.0 – 23 September 2022

- Plot graph grid lines added for x and left y axis.
- Capacity plot graph may be suppressed with right click context menu options on "Bat" tab on setup or during test itself, voltage curve plot graph display only. This setting is stored on the configuration defaults .ini file.
- Ah / Wh data now has 6 decimal places. Now small current battery capacity discharge plot graphs look better.
- Application exit confirmation dialog added.

V1.0.42.0 – 25 September 2022

- On low amperage battery capacity tests eliminated the race condition between Kunkin and software end voltage reached.
- On battery capacity test the cable disconnect condition is handled and logged.
- Long .csv data file creation can now be interrupted.

V1.0.43.0 – 28 September 2022

- During battery capacity test the data acquisition pause button will also stop the load current. Ex: for fixing some cable issue. Hitting the pause button again will make the test resume (plot graph + load current). The open circuit voltage spike will appear on the plot graph.

V1.0.44.0 – 29 September 2022

- 10 different measurements of the battery internal resistance at regular SOC intervals can optionally be acquired during the battery capacity discharge test. Two new enable/disable options were added to the right click context menu options on the "Bat" tab. The results appear on the PDF report and on the "Log" tab. This setting is stored on the configuration defaults .ini file.

V1.0.45.0 – 29 September 2022

- Corrected PDF report SOC table value calculations on battery internal resistance data regarding capacity discharge test.

V1.0.46.0 – 29 September 2022

- Corrected battery capacity test end voltage to eliminate the influence of the optional battery internal resistance measurement current pulses.

V1.0.47.0 – 30 September 2022

- Correction to the battery capacity discharge test PDF reports related to the internal resistance measurements.

V1.0.48.0 – 1 October 2022

- Added user comments to the battery capacity test and solar panel test PDF reports.
- Added a selection choice of [4, 6, 8, 10, 12] periodic internal resistance tests on the battery capacity discharge test to the “Bat” tab context menu. The selection was added to configuration .ini file.
- Added pulse setup data to the battery capacity report when periodic internal resistance tests are performed.
- Adjusted default and check values of solar panel test start voltage parameter. KP184 minimum load voltage is about 1V.

V1.0.49.0 – 3 October 2022

- Added KP184 internal bat_end_volt parameter automatic manipulation to allow periodic internal resistance test higher current pulses than the current discharge set value on the battery capacity test. Fast pulses won't trip a premature test end voltage condition.

V1.0.50.0 – 3 October 2022

- Added interlocks to avoid changing the “test end voltage” and the “set current” parameters during the battery capacity discharge test if the periodic internal resistance tests are enabled. If the periodic internal resistance tests are not selected these parameters can be adjusted during the battery capacity discharge test.
- Added an image to the “Bat” tab to remember the user about the mouse right click menu feature.

V1.0.51.0 – 6 March 2023

- Solved the update download failure issue on non standard “Downloads” system folder name.
- Improved serial error handling and logging on communication protocols.
- Added serial response timeout to the KP184 Modbus protocol
- Added capacity discharge test termination reason to the PDF report.
Reasons: LVC, user abort, eload abort, current interruption or max_time reached.
- Some python modules were updated.

V1.0.52.0 – 23 March 2023

- Corrected issue with solar panel test that was blocking data acquisition.

V1.0.53.0 – 31 March 2023

- Some python modules were updated.

V1.0.54.0 – 13 April 2023

- Downgraded python numpy module version to allow application startup on Windows 7 - 32 bits systems.

Software Disclaimer

This SOFTWARE PRODUCT is provided by Interflexo "as is" and "with all faults. Interflexo makes no representations or warranties of any kind concerning the safety, suitability, lack of viruses, inaccuracies, typographical errors, or other harmful components of this SOFTWARE PRODUCT. There are inherent dangers in the use of any software, and you are solely responsible for determining whether this SOFTWARE PRODUCT is compatible with your equipment and other software installed on your equipment. You are also solely responsible for the protection of your equipment and backup of your data, and Interflexo shall not be liable for any damages you may suffer in connection with using, modifying, or distributing this SOFTWARE PRODUCT.

Interflexo is not affiliated, associated, authorized, endorsed by, or in any way officially connected with Kunkin, or any of its subsidiaries or its affiliates.

Copyright © 2023 by Interflexo Lda. All rights reserved.