

## The 9923 load current waveform generator provides a simulation of the actual discharge current waveform of the battery



9923 Card



Actual load current waveform  
on DSO



3311F Electronic load  
on 3302 mainframe

The Model 9923 load current waveform generator is designed to simulate the actual discharge current waveform that provides battery discharge testing solution.

Now on the market, the battery for the power application has been quite diverse, in the information products application such as mobile phones, tablet, laptop ... and so on, in the electric application such as electric bicycles, electric scooter, electric vehicles and so on.

As the above products in the actual operation, the battery output current is changed dynamically with the operation of the product, in order to assess the battery life, capacity, the use of time and related characteristics, with the actual battery load current waveform in general condition or worst condition to test the battery is practical and reasonable.

For the implementation of the real irregular load current waveform into the electronic load to simulate the actual current waveform, there are two methods as follow can be achieved;

First, use the oscilloscope with a current measuring device such as a Current Probe, Current Shunt to record the actual battery discharge current waveform, and the next step is based on the recorded current waveform to perform battery discharged current waveform regeneration:

1. Use the arbitrary waveform generator to edit the load current waveforms manually.
2. The oscilloscope current waveform recorded by the oscilloscope is properly processed and then downloaded directly to an arbitrary waveform generator.

The 9923 load current generator can be installed on a wide range of Prodigit's DC electronic loads which are with Analog Input to perform. Use manual editing or oscilloscope waveform download method to generate simulated load current waveform.

9923 Load current waveform generator can be installed on the DC load, including 3300F, 3302F, 3305F chassis or high power electronic load series such as on the 3350F, 3360F, 34000A, 36000A series.

9923 shall be with the accompanying PC application software to perform the waveform editing, oscilloscope waveform loading and download to 9923 and so on.

The Model 9923 Load Current Waveform Generator has up to 2048 steps timing sequence output voltage and up to 9999 times cycles functions. With the 9923 application software can generate the load current waveform voltage, Connecting the voltage to the ANALOG INPUT terminal of electronic load to make the electronic load be edited by the 9923 load current waveform to sink current. The sink current example as shown in Figure 1. 9923 specification is as below. 9923 output 10V is equal to the maximum current value of the electronic load, the output 5V is equal to 1/2 current specifications of electronic load, and so on.

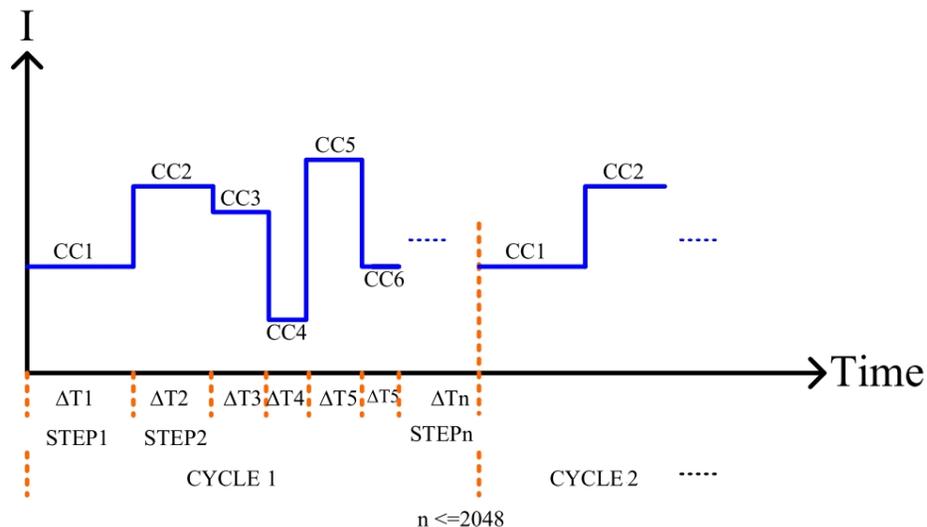


Figure 1 Load current waveform

## 9923 Load Current Waveform Generator Application Software

9923 Load Current Waveform Generator Application Software can edit Load Current Waveforms that provides users with a variety of real load conditions on electronic loads, up to 2048 steps of timing sequence can be edited.

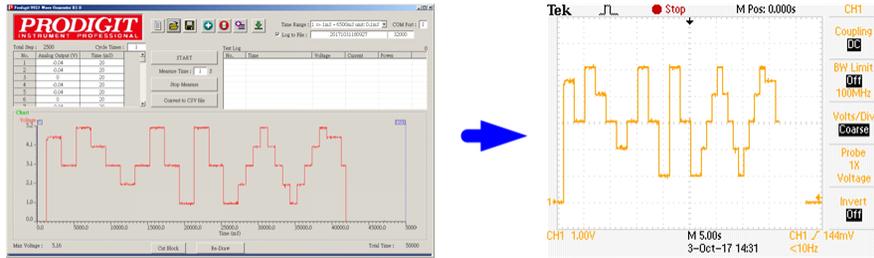
The timing sequence can be repeated cycle up to 9999 times, and the minimum time for each timing step is 50us and the maximum length is about 130000 seconds (about 36 hours). With the electronic load optional measurement function, it also can monitor the voltage, current and power status when sinking current.

In addition to self-editing the required sink current waveform, the user can also use the oscilloscope to store the actual current waveform (\*.CSV), by means of the 9923 application software to read the actual current waveform file (\*.CSV) and then download to 9923 Load Current Waveform Generator to proceed Electronic load simulation.

### Typical application

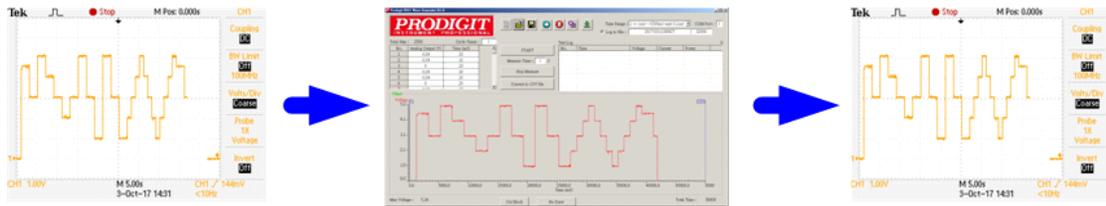
1. Battery discharge and its application (notebook computers, electric vehicles, electric scooter), simulation of a variety of dynamic load sink current waveform, to provide a number of current level of dynamic current simulation.
2. Load control test of power supply load modulation
3. Load simulation of fuel cell life cycle testing.

a. Use the self-editing load current waveform to simulate the method of reproduction :



Edit by 9923 application software    Regeneration the load current waveform

b. Using the oscilloscope's load current waveform (\*.CSV), after the 9923 application software is processed, download to 9923 to simulate the reproduction :

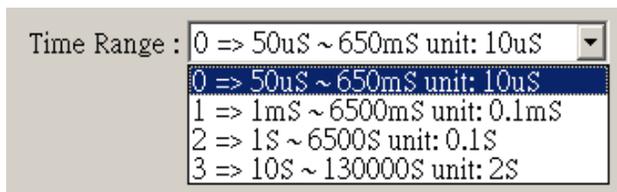


Actual load current waveform

edit by 9923 application software

Regeneration the load current waveform

c. Time Range : Select to use the time specification  
User can set Time Range 0~3 or use the oscilloscope to store the actual current waveform (\*.CSV), by means of the 9923 application software to read the actual current waveform file (\*.CSV) and then download to 9923 Current Waveform Generator to proceed Electronic load simulation.



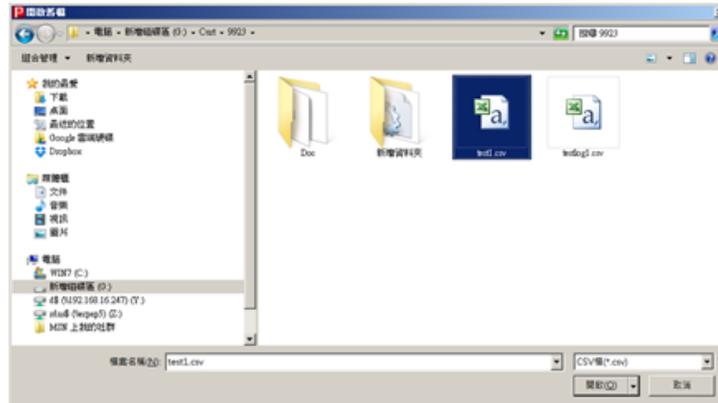
d. COM Port : Set RS-232 connection COM Port

e.  New File : Open a new file

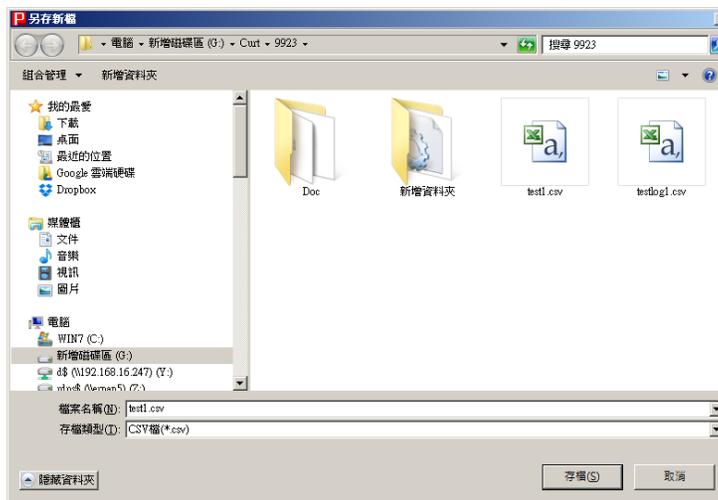


f. Open old File :

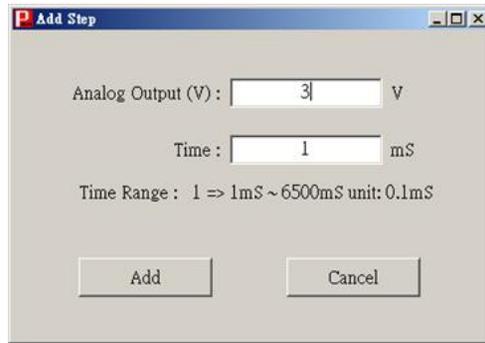
Loading the existing test step file, or loading the oscilloscope CSV format file, by means of the 9923 application software to read the actual current waveform file (\*.CSV) and then download to 9923 Current Waveform Generator to proceed Electronic load simulation.



g. Save to File : Save the test step setting values to the specified file.

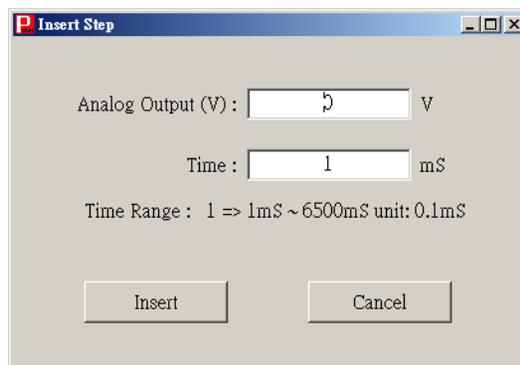


h. Addition : Add a test step after the last test step, maximum up to 2048 test steps, system will prompt the message if more than 2048.



1. Analog Output(V) : Set the Analog Output Voltage.
2. Time : Set the output voltage time, the unit changes according to Time Range.
3. Add : Make sure to add a new one.
4. Cancel : Cancel setting.

- i.  Delete : Delete a test step.
- j.  Insert : Insert a test step after the currently selected test step, maximum up to 2048 test steps, if more than 2048, system will prompt the message.



1. Analog Output (V) : Set the analog output voltage.
2. Time : Set the load time, the unit changes according to Time Range.
3. Insert : Make sure to insert a new one.
4. Cancel : Cancel setting.

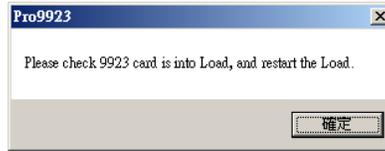
- k.  Download to Load : Download test step to 9923

- l. Test Step List : Show all test step setting data.

- Double-click to edit the column, press [Enter] to set, if not press [Enter] will not make changes.
  - When the modification is complete, the timing diagram will change and will automatically take the next step to provide the changes.
  - When press [Enter] in the last step, it will automatically go to the next channel to provide changes.
- m. Cycle Times : Set the number of cycles, maximum up to 9999 times.
- n. Log to File : Select whether to save file only and not appear in the list

<input checked="" type="checkbox"/> Log to File :	20170703172440	32000
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- Tick the Log to File, system will automatically generate the serial number YYYYMMDDhhmmss, the user can also change themselves, this field will be used to create a log to file name will be followed by 0001 count number, test log will be stored in the TestLog folder, and will be the number of the last field to do the number of pen shift action.
- o. Test Step List : Show all test step setting data.
- Double-click to edit the column, press [Enter] to set, if not press [Enter] will not make changes.
  - When the modification is complete, the timing diagram will change and will automatically take the next step to provide the changes.
  - When press [Enter] in the last step, it will automatically go to the next channel to provide changes.
- p. Start : Start the test.
1. First, the system should be connected to the 9923 to do connection detection. If the system does not use the 9923 card or has already started and has not restarted LOAD, the system will prompt alert [Please check 9923 card is into Load, and restart the Load.], Press OK to exist the start function, as shown below.

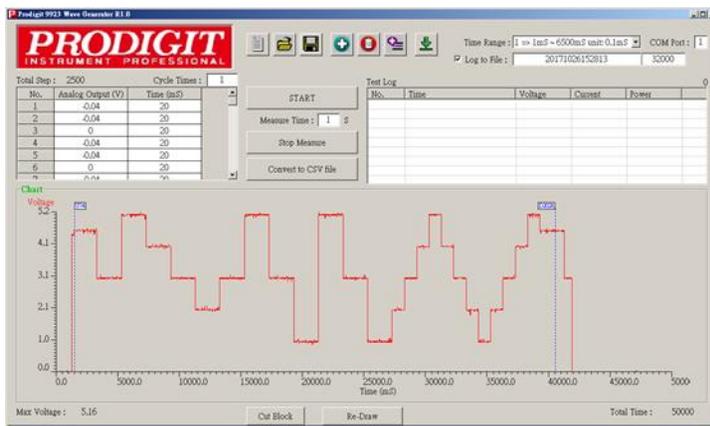


2. The next step will be followed to compare the test steps, the 9923 software will not download the EEROM of 9923 card if the test steps are the same, the 9923 software will prompt the user whether to download to 9923 if the test steps are not the same, the system will prompt [Have modify. Do you want to download LOAD?], As shown below.



3. After starting the test, if you set the Measure Time and greater than 0, the system will be according to the time to measure the voltage, current, power and other information, and recorded in the Test Log.
- q. Stop : Stop measuring
  - r. Chart : Display timing diagram.
  - s. ReDraw : Redraw timing diagram.
  - t. Cut Block : Delete the data outside the block.

Users can adjust the position of Ux and Dx to reduce the amount of data.



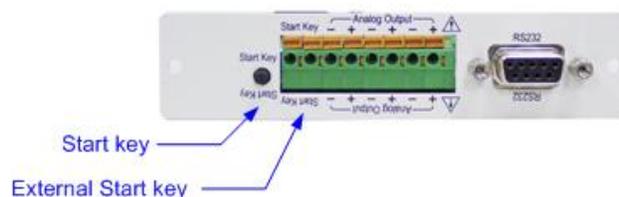
**Specification:**

ITEM	9923			
Voltage Output Level				
Range	0~10V (=full scale current spec.)			
Resolution	16bit			
Accuracy	±0.05%(reading + range)			
Time Range				
Range	0	1	2	3
	50 ~ 6500us	1 ~ 6500ms	1 ~ 6500sec	10 ~ 130000sec
Resolution	10us	1ms	1sec	2sec
Accuracy	±15us	±0.15ms	±0.15sec	±0.5sec
STEP	1 ~ 2048			
CYCLE	1 ~ 9999			
Interface	RS-232			

9923 Specification table

Stand-alone application (no need computer connection)

9923 supports stand-alone operation, the user only need to download the editing waveform data to 9923 then storage in the 9923 EEPROM, when the application it does not need to record the voltage, current and other information, you can remove the computer connection, the user only Press the Start button on the 9923 rear panel, Analog output will begin to load according to the edited voltage level and the analog input of the timing output voltage signal to the electronic load. Users can also use the Start key terminal (External Start key) to connect the appropriate length of the external button, more convenient to use.



9923 panel diagram

## Parallel application

9923 can be applied to parallel multiple load, because the 9923 current waveform generator is controlled by Analog Input to control the load current, when the load power or load current is insufficient, you can achieve the load power and current expansion through Analog input parallel control, 9923 Also supports parallel operation, the user can directly connected to up to three electronic loads Analog input through the 9923 rear panel 3 sets of Analog output (internal parallel), in the case of more than three in parallel, the user can also be through the T-type BNC connector or its connector directly in parallel. 9923 Current Waveform Generator Application Software the corresponding waveform voltage level is the sum of the current of the parallel load. For example, when 3 sets of 3311F 60V / 60A / 300W are required to test 120A, each 3311F must allocate 40A current Analog input. It shall provide  $6A / V$ ,  $40/6 = 6.66V$ , 9923 application software editing voltage must be edited 6.66V and then through the following diagram connected in parallel with three 3311F, each 3311F will be edited by the voltage level load 40A load current, the total of 3 units are 120A load current.



9923 is connected to three electronic loads

## 9923 Installation method



9923

3302F mainframe rear panel

9923 is installed in 3302F mainframe