GradientOne

White Paper

Instrument Automation

"With GradientOne, what used to take 10-20 minutes of setup and programming now takes less than 10 seconds"

Introduction

Whether you're building consumer electronics or hardened networking gear, improving engineer productivity from R&D through production, is always a winning strategy.

The average new electronics product takes an average of 16 months from conception to mass production. Each iteration in hardware development is costly.

Design validation/test engineering is a crucial step in the development cycle. Engineers spend much of their time setting up experiments, acquiring test data, gleaning insights, summarizing results and sharing the data. Any time savings translates directly to faster quality assessments and reduced time to market.

Yet many tasks in the test engineering phase require manual effort where no tools are available or the limited tools that are available are outdated and underpowered. These legacy approaches put an extra burden on test engineers.

A new approach, using contemporary cloud-based technologies, can decrease the amount of time test engineers spend on manual, repetitive tasks, and accelerate the time to insight. This paper highlights the R&D productivity advantages you unlock when you use web technologies in conjunction with test instruments during the test engineering process.

Common Test Engineering Tasks and Challenges

In general, you can boil down most hardware test engineering to a set of steps such as the list below. Depending on your test suite — the product being tested and the equipment used — you may have some different or additional steps, but this is the basic idea.

Common Tasks Required For An Automated Oscilloscope Waveform Capture:

- Develop test program
- Execute test and download data from instrument
- Visualize waveform
- Analyze test data
- Generate report
- Collaborate with test results

The existing approach to test engineering is riddled with manual and inefficient processes.

Develop a test program. This typically involves writing a program to automate connecting the device, configuring settings, and initializing the instrument. Of course, tracking changes in the program is a challenge, as is updating the program (or writing a new one) for each new instrument. This also requires expertise, which can be lost as engineers move between projects/etc.

Run a test and store results. More inefficiencies surface when you try to store and share the test data. You may need to write another program to download the data (and deal with the challenge of change management and maintenance of that program), or physically connect cables/etc. Making those tests and results available to other engineers or programs is difficult. There is no permissions-based access model built in to most devices.

Visualize the waveform. The waveform is captured on the device. Getting it into a usable form is often a device-specific task. And sharing the data is another challenge.

Analyze test data. Scraping the data and loading it into a spreadsheet can be a manual process at best, and require more hand coding at worst. Parsing and analyzing data that has a different format on each device is time-consuming and error-prone.

Generate a report. Now that you've got all this data and information, you want to summarize the results. But this means pulling together disparate data and information and screenshots and cobbling together a report. Consistency is an issue here, and not everyone has the skillset to make an attractive presentation.

Collaborate with test results. Clogging up inboxes with more attachments is slow and inefficient. Tracking changes in shared documents can be a nightmare. It's also difficult to find and track feedback in email chains and discussion threads.

The right, cloud-based solution can dramatically improve test engineering throughput.

REPETITIVE TASKS AND PROGRAMMING

Running test programs and gathering data soaks up engineering cycles. And, whether it's taking screenshots or sharing reports and data, many of the tasks test engineers are asked to perform are perfect candidates for automation.

In addition to those manual tasks, most test engineering requires at least some device-specific programming/setup. Writing, maintaining, and tracking these programs takes time. Change the testing equipment and you need to update, if not fully replace, the programs you've written. What happens if the engineer who wrote the code is unavailable when it needs to be modified?

Cloud computing is the perfect solution to these challenges.

The Solution: GradientOne

GradientOne is the first and only cloud-based test engineering platform. Taking full advantage of all the cloud has to offer, GradientOne's solution is a leaps-and-bounds improvement over the existing, mostly manual, approach.

GradientOne reduces test engineering costs per iteration and frees up resources to work on the actual product development.

With GradientOne, you'll see faster and cheaper test iterations, and with no more test programs to write, or manual data importing to perform, test engineers can focus on the product itself.

Task	Existing Approach	GradientOne's Cloud-based Solution
Develop test program	Write a program to perform the following tasks: • Create network connection between computer and scope • Program instrument settings • Place scope in a 'ready' state	No development required. GradientOne automatically establishes the network session and maintains instrument health and readiness.
Execute test and store data	• Store test data on the scope • Write program to download data from the scope • Use a USB to download data from the scope	WIth one click of a mouse the test executes: waveform, measurements, and screenshot automatically downloaded from instrument and stored in the cloud, accessible by any authorized user.
Visualize waveform	• Use onboard scope display • Load data into a spreadsheet • Write program to plot data	Plot waveform data in a web browser accessible and navigable by using standard mouse/touch features.
Analyze test data	• Load test data into spreadsheet • Write program to parse data and develop custom analyses	Use cloud-powered indexing and search to provide advanced analytics: • Statistical summary • Linear regression • Yield analysis • Histograms • Batch comparisons • Principal Component Analysis
Generate report	Cut and paste the following into a MS Word document: • Screenshot • waveform plot • test metadata • Measurements • photos of setup	Simple yet powerful report builder, automatically integrating relevant test results and metadata into one document.
Collaborate with test results	• Circulate test report via email • View email chain for comments, feedback	Use web enabled sharing and comment threading

Example: Easy Automation of a Rigol DS1054Z Oscilloscope with GradientOne

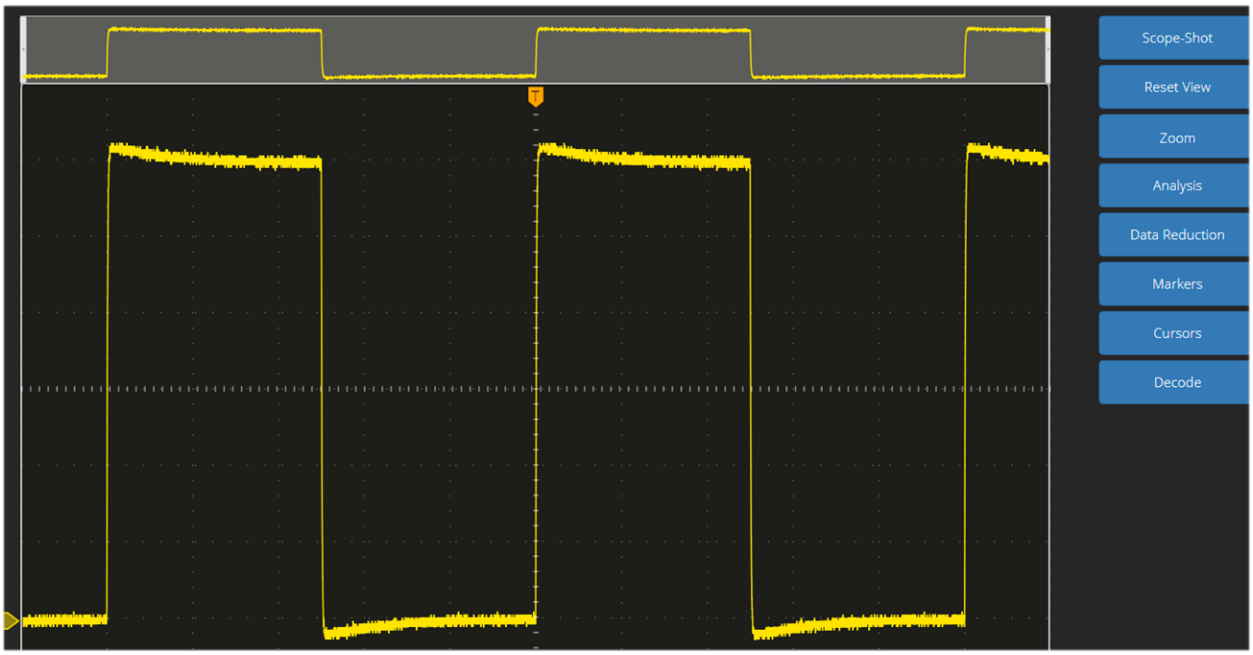
This example shows how to use GradientOne to capture a waveform, explore trace metadata, explore channel measurements, share test results, automate re-use of the original test, and search the Results Library to compare and analyze test results.

GETTING STARTED

First things first, you'll need to follow GradientOne's 5-minute installation/configuration steps to get your device connected.

CAPTURE A WAVEFORM

Capturing a Waveform — acquiring the signal, storing the data, collecting the measurements, and rendering the plot — is easy with GradientOne. Find your device in the list, click "Control Instrument" and then click "Get Trace". That's it!



In addition to all of the samples being rendered for zooming and navigating on the plot, the screenshot of the test is also stored for reference and confirmation purposes.

EXPLORE TRACE METADATA AND CHANNEL MEASUREMENTS

Along with a waveform, all the relevant metadata associated with the test is also captured and indexed for storage and look up. This makes it easy to review tests associated with a specific serial number of an instrument, or tests run within a certain time frame.

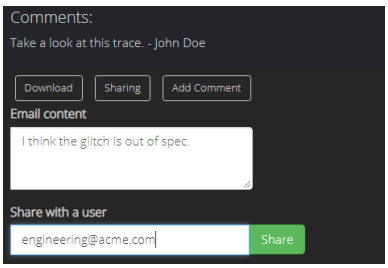
The channel measurements are also stored and presented to the user.

Measurements

Frequency	1.00e+3 Hz
Period	0.001 s
Voltage RMS	2.13e+0 V
Voltage Peak to Peak	3.26 V
Voltage Max	3.12 V
Voltage Min	-0.14 V
Voltage High	3.02e+0 V
Voltage Low	-3.09e-2 V
Voltage Average	1.50e+0 V
Width Positive	0.0005 s
Duty Cycle Positive	0.5 s
Amplitude	3.0509 V
Voltage Cycle RMS	2.13e+0 V

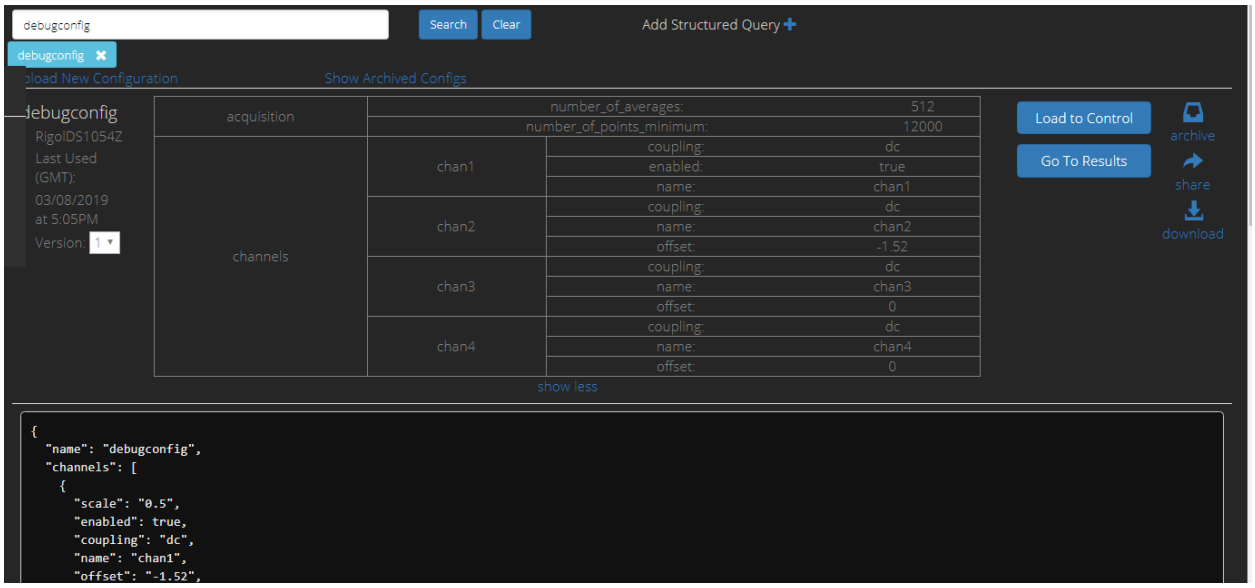
USE COLLABORATION FEATURES

To share a test's results with other members of your team, there's no need to download anything or attach a file to a message. Simply use the built-in collaboration features for sharing or commenting.



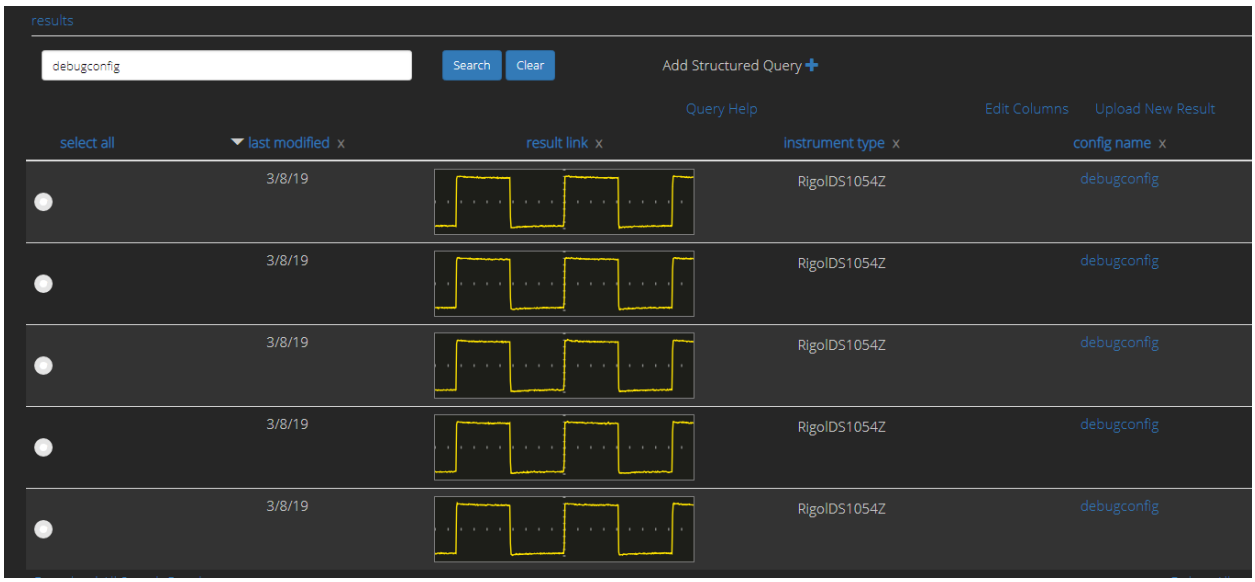
AUTOMATE RE-USE OF THE ORIGINAL TEST

All the tests that are run using GradientOne are stored in the Configurations library. To reuse a test, look up the desired configuration using the Search feature. The instrument settings are displayed in JSON format. Click "Load to Control", then "Get Trace" to start the test.

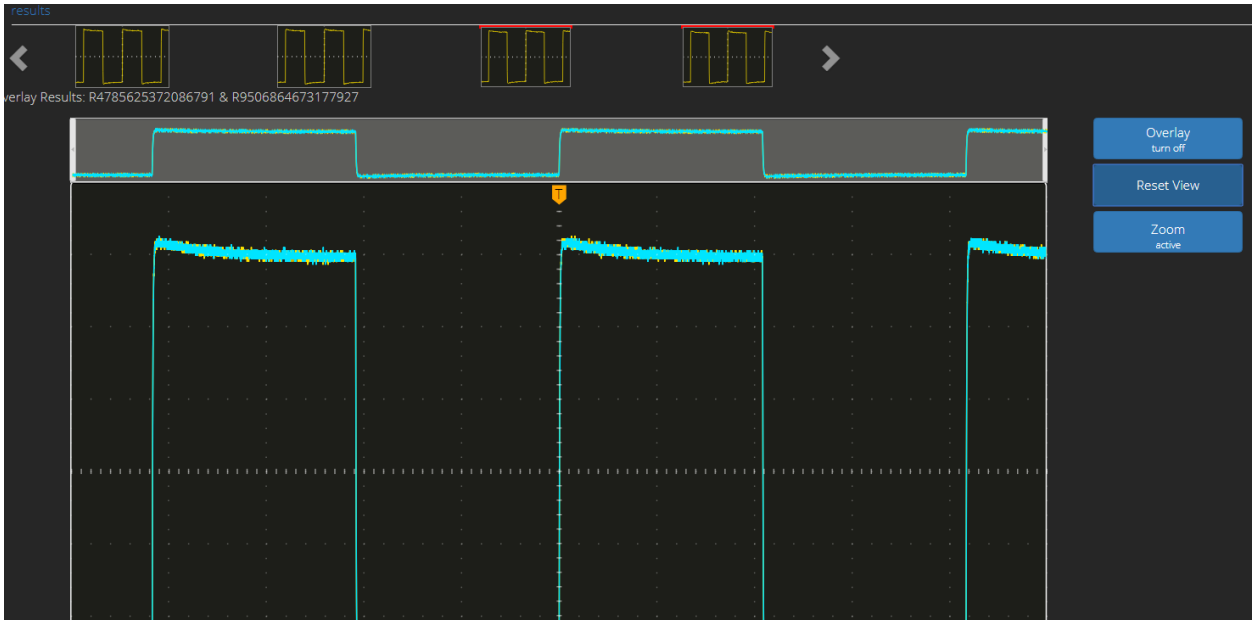


SEARCH THE RESULTS LIBRARY TO COMPARE AND ANALYZE TEST RESULTS

All the test metadata is indexed and stored. Test engineers can select the desired test results for comparison via the overlay feature and then pass those results on for statistical analyses.



Zoom in on test results for closer inspection.



Finally, pass the results to the analysis suite.

ch1 frequency x	ch1 duty cycle positive x	ch1 voltage average x	ch1 voltage high x	ch1 voltage low x	ch1 period x	ch1 voltage rms x	ch1 width positive x	ch1 voltage cycle rms x
999.9999	0.5	1.496438	3.019016	-0.0308197	0.001	2.134943	0.0005	2.133266
999.9999	0.5	1.496823	3.019508	-0.02950821	0.001	2.134988	0.0005	2.133252
999.9999	0.5	1.496104	3.018279	-0.03032783	0.001	2.133639	0.0005	2.131695
999.9999	0.5	1.496839	3.018524	-0.03090164	0.001	2.13422	0.0005	2.132102
999.9999	0.5	1.496538	3.018115	-0.03032783	0.001	2.134243	0.0005	2.131736

Delete All

Summary

	Mean	Median	Mode	Standard Deviation	Max	Min
ch1 frequency	999.9999	999.9999	no mode	0	999.9999	999.9999
ch1 duty_cycle_positive	0.5	0.5	no mode	0	0.5	0.5
ch1 voltage_average	1.4965	1.496538	no mode	0.0003	1.496839	1.496104
ch1 voltage_high	3.0187	3.018524	no mode	0.0006	3.019508	3.018115
ch1 voltage_low	-0.0304	-0.03032783	-0.03032783	0.0006	-0.02950821	-0.03090164
ch1 period	0.001	0.001	no mode	0	0.001	0.001
ch1 voltage_rms	2.1344	2.134243	no mode	0.0006	2.134988	2.133639
ch1 width_positive	0.0005	0.0005	no mode	0	0.0005	0.0005
ch1 voltage_cycle_rms	2.1324	2.132102	no mode	0.0008	2.133266	2.131695

The Future of Test Engineering

GradientOne is revolutionizing test engineering.

From setting up and running tests, to storing data and screenshots, to visualizing waveforms, GradientOne makes the job quick and easy. And once you have data, tasks like performing analysis, generating a report, and sharing those results are just a click away. If you'd like to see how we can help simplify test engineering, you can start using GradientOne for free.