CTW Automation
100 Lexington Parkway / Lexington NC 27295 USA

July-2023

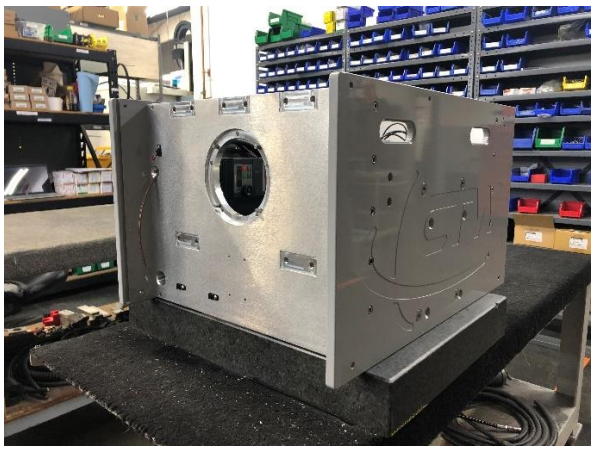
CTW Automation presents: What goes into your shock dyno from beginning to end?

CTW Automation build and calibration procedure

Every shock dyno we sell begins with a deposit. Our CTW shock dynos are essentially custom built for each customer based on their needs. This starts the way CTW Automation controls the quality and build process.

From the deposit, a production sheet is created and sent to the manufacturing floor. Any custom additions or options are discussed and noted so that the final product and all the components come together at the end. The goal is to have the machine fully operation before crating so that when you get it at your facility it is ready to begin its Testing life.

The crank type dynos are hand built in a specific clean area using a polished-ground surface plate. Parts are installed and fitted to specifications worked out over the last 30 years. Items requiring clearance fit are heated (or chilled) prior to assembly and then built along the way. When the dyno assembly is completed, it then moves into the Calibration Room to continue the process of building the world's finest shock dyno.



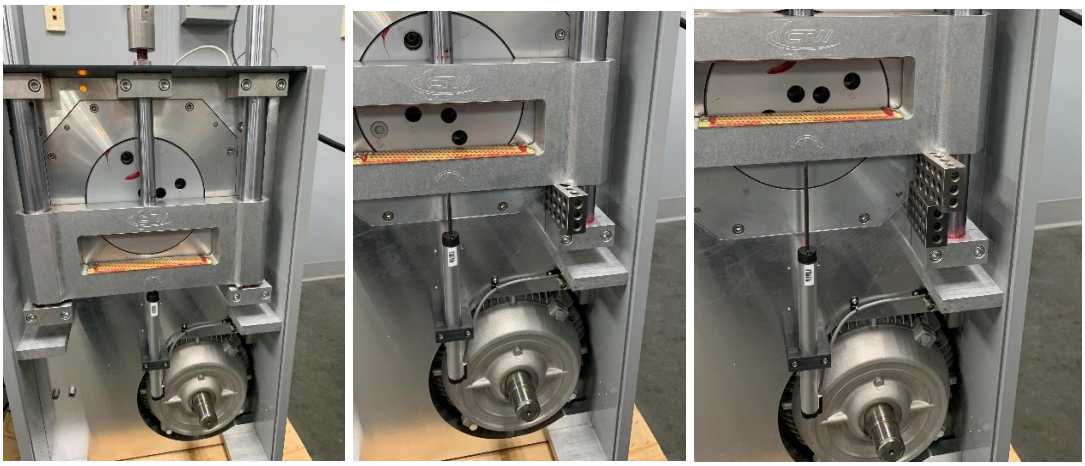
Custom / hand crafted on precision flat plate

When placed in the "Cal" room, the dyno is connected to power and the motor control is programed. Each dyno starts with an 8-hour run in. This means that it is manually set to run at a continuous speed to allow for the machine to take a set, allow the bearings to run in and go through heat cycling as well as let the belts get stretched into place. This also begins to work the wear plates and cam follower interface which is the KEY to the dyno. These 8 hours ensure the machine is ready to move to calibration. Any mechanical problems or issues will be sorted out at this time.

8-hour run in / break in for each shock dyno

Calibration is another process that has been fully developed over the last 30 years, going back to the first machines at Roehrig Engineering. The goal is to run the machine in every stroke, across the full range of speed and to apply a large amount of force to make certain the dyno is ready. By the time the machine reaches your business, it will have been run for 48 hours.

Static calibrations.
The sensors are calibrated. Displacement is straight forward, and it uses a linear lookup table that we create with gauge blocks. The temperature sensor is a set calibration. The force channel depends on several variables and a spread sheet allows for the various inputs to be summed and an initial calibration table to be created. Using this, we can specify the range of the loadcell for each dyno. Different load cells require different signal conditioning to achieve the best lb. / voltage output. The electronic boards are proprietary and have been finetuned over the many years. At this stage, they are printed boards with components added. Each dyno has a unique calibration because every sensor is unique, even if only in a small way. That is also why it is important to maintain your settings.zip folder as it contains the calibrations for your particular dyno and sensors.



Calibration begins with displacement

There is the option for an additional type of calibration, the NIST calibration. Some customers require a traceable calibration. This means we have a set of sensors that we have had verified by a third party with documentation and traceability reports. We then use these specific sensors to compare to what the standard dyno sensors are reading. By putting a displacement sensor inline and a load cell in line, we can match the readings to certified results and provide a report when done. Many manufactures have this done once a year. This also means that every dyno we sell actually gets matched back to certified sensors and measuring tools thus giving the proper results when testing.

NIST Type Calibration: Displacement and Force signals

Dynamic calibrations.
Now we start the dynamic process of testing and calibrating. Up to this point, things have been "static", now we start to run and calibrate dynamically which is how you will be using the dyno. Our first Test covers two items but the important one is the "electrical noise" level of the dyno. By running the dyno at a speed without a damper, we can establish the precision of the load cell signal. Typically, when running, it is +/- 0.2 lbs. Since the standard RD3 has a 3K load cell, the total range is +/- 3000 lbs. and we can measure as little as 0.2 lbs. differences. Recently, we had a customer purchase the option for a smaller load cell and this lower level was reduced to 0.05 lbs. At this point, we are measuring millivolts of change.
Next, we run a few different dampers at each stroke. One is a lightly valved damper to allow us to run a long PVP test that will go from slow to peak velocity. Then we use a damper capable of generating a large amount of force. These tests allow us to make certain the dyno will reach the speeds and forces that are claimed. It also will show any mechanical issues at the same time.

Once all of these runs are completed and saved, we move to the final stage. A brief history, at Roehrig Engineering and now at CTW, we developed a dynamic test using a damper to test each and every dyno to ensure they all match. It can be said that all CTW dynos match back to THE known standard and using these techniques and dampers, we make certain to maintain this high level of precision and matching. This last test also allows use to fine tune the most famous part, the wear plate / yoke stiffness.

History note: Roehrig Engineering, used a damper that would cause an audible "click" sound if the machine had any mechanical play in the wear plates – cam follower area. This then became known as the "clicker" shock. Every shock dyno, EMA, LA has had this same shock (or a close cousin) run across it during the testing and calibration phase. This has continued until this very day. By testing, with load, we can determine and quantify the amount of mechanical play in the system and reduce it to a bare minimum. This critical step ensures the data you get is from the damper and not from the machine. This is massively important at turn around, BDC and TDC. And we have seen a great many machines from our competitors that are just not aware of this. I can tell you, many of them love the PVP graph because it hides the mechanical problems of their machines!

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Performance runs with various shocks / dampers

At this point, we do have some customers that want additional verification. This can be repeatability which we demonstrate by running a damper through the same test multiple times. Then a table for forces at selected speeds establishes a repeatability across (X) number of Tests. We have also done Gauge R&R testing for manufactures which is complicated but necessary for them.

When we are done, your machine has been:

- Custom built from scratch.
- Tested on every stroke for ability, speed and force.
- Your bearings and grease have been cycled and heated as well as stressed.
- Your belts have been tensioned and set while being loaded and stretched.
- Your yoke, wear plates and cam follower have been loaded, tested and adjusted for optimum clearance.
- Your sensors have been calibrated to the machine and have been verified back to THE known standard both statically and dynamically.
- Your power, electronics and frame have been run and used for 2 days, minimum.
- Your settings, data and calibrations are all saved on our server for future reference and use.
- If you purchase the machine with a computer, we use your computer for this process so that it is ready when it arrives at your facility.

And that is why you buy a CTW Automation shock dyno.

www.ctwautomation.com
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