

# The General Radio Company

## A veteran in test-equipment

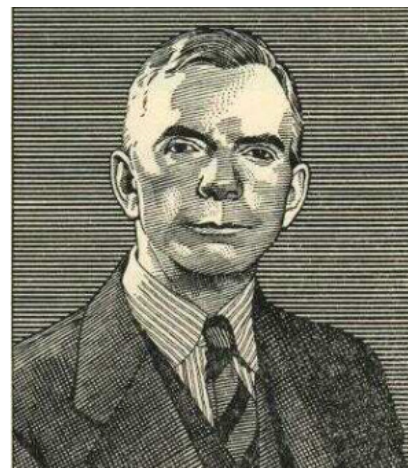
*Gerard Broodbakker*

The General Radio Company was founded in 1915 in Cambridge, Massachusetts, to provide a starting radio market, with good quality components such as variable capacitors, decade resistors, coils and rectifier-systems. As time passed and the radio industry grew in sophistication and volume, the design and manufacture of electronic testing instruments became more important. When the United States entered the First World War in 1917, the demand for General Radio products rose dramatically. This was not the last time that the company's path was tied to war; it was destined to play a key role in supplying testing equipment during the Second World War, and still later in the Korean conflict (1950-1953).

General Radio has had a rocky journey. It rose to fame as an 'engineer's company', principally due to their strong relationship with the Massachusetts Institute of Technology. It was perhaps one of the first businesses in

the USA to be employee-owned from the beginning. While this unique formula may now seem like an accomplishment by itself, at the end of the sixties the company's private shareholders were not prepared to finance the R&D for next generation technology. Their main competitors Hewlett&Packard and Tektronix had a better marketing strategy and were well-funded. In 2001, General Radio was split into three divisions that were bought by other companies.

Excellence had become too expensive, yet, quality is timeless. Even now you can find more than fifteen hundred of their items for sale on Ebay. Many of the original products are still available through IET-Labs. Our Study-collection has a beautiful set of very old and more recent General Radio instruments, of which some have been restored to their original condition; most recently, we had the great pleasure of giving



*Melville Eastham  
Founder, General  
Radio Company*

### Some of General Radio's accomplishments:

- One of the world's first portable oscilloscopes.
- Production of stroboscopes such as the Strobotac.
- Production of high-precision impedance standards and metrological equipment.
- Invention of the "five-way" binding-post connector for accurate measurements.
- Invention of High Frequency and microwave genderless connectors (GR874- and GR900-series)
- Automatic PCB logic-analysers.
- The Variac variable autotransformers (U.S. trademark of General Radio from 1934 to 2001)
- Production of sound level-meters.

new life to the historic GR805-C Standard Signal Generator.

### The GR805-C Standard Signal Generator

In 1941, the GR805-A design was commissioned by the USA army as a precision laboratory instrument primarily for the rapid and accurate testing of radio receivers. One of the designers was J.K. Clapp, patentholder of the classical 'Clapp oscillator'. The signal generator needed to be sturdy, with proven electron-

ics that would aid the war effort; furthermore, it needed to meet the army's main requirements of operational simplicity and speed. Consequently, the instrument was intentionally constructed using neither advanced technology, nor the advanced innovations that marked GR products. When the GR805-A finally appeared in the 1942 GR sales catalog (K2), it had a price tag of \$850, and limited availability. Material and production resources were scarce during the ongoing war, and orders were prioritized. General

Radio eventually put out newer versions of the Standard Signal Generator in 1945 (GR805-B) and 1948 (GR805-C), and despite only minor improvements on the original design, they cost \$1,350 i.e. over 60% more. Despite the considerably high prices, the GR805s were sold in huge numbers throughout the years. The instrument even had a fourth version in 1963 (GR805-D), priced at a whopping \$2,250, which was discontinued in the following year.

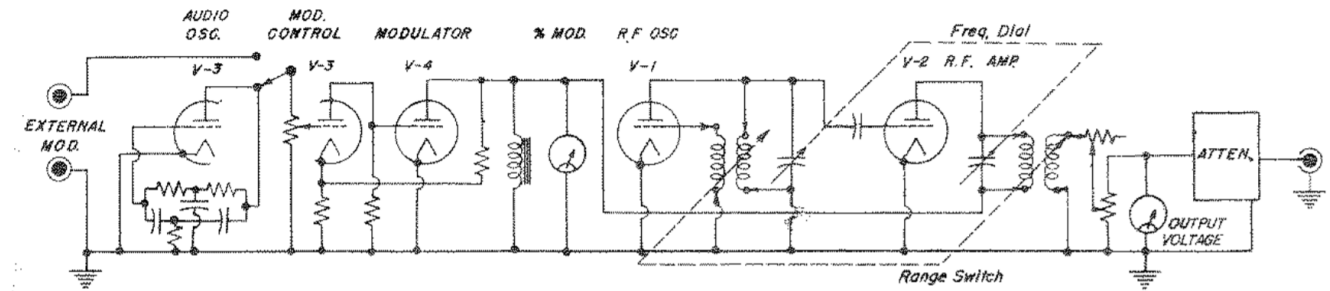


*One of our two GR805-C (serial no. 988)*

The layout of the signal generator system is straightforward. The entire unit consists of:

- A modulation oscillator (400 Hz and 1000 Hz) with a voltmeter to read the percentage modulation,
- A carrier-frequency oscillator (16 kHz – 50 MHz),
- A tuned radio-frequency amplifier,
- A resistive output attenuator, with an RF-voltmeter reading the output level, and
- A well-regulated power supply with mains-filter. (not shown here)





*Simplified schematic of the 805-C from its operation manual*

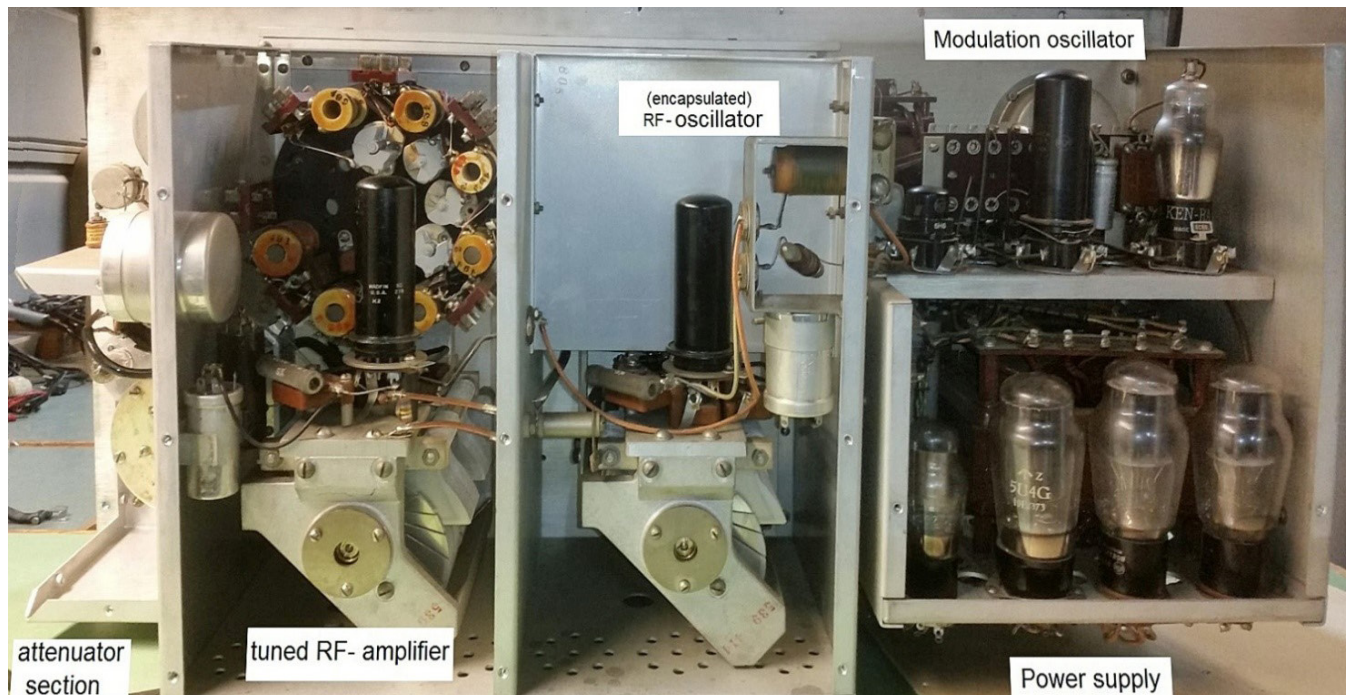
### Instrument Description

For a stable oscillation-frequency, the free running LC-oscillator was isolated from the changing output-conditions using an RF-amplifier. Excellent signal purity could be obtained by tuning this RF-amplifier. The bandwidth of the filter had to be adequate to allow LF-modulation up to 7 kHz. Independence from the mains-voltage was a necessity, and required the use of a stabilized power supply with a prop-

er control margin. An elaborate mains-filter was used to remove disturbance and electro-smog resulting from the AC-power source. The instrument's triple casing provided stability and prevented spurious signals from entering or escaping the instrument – this is critical when working with highly sensitive receivers and large power communication equipment.

The outer case of the GR805-C is a massive steel box with strong

handles, giving the instrument good survivability even in difficult environmental circumstances. However, it does contribute considerably to its total net weight of 53 kg, 117 lbs. The case features ventilation-holes to easily rid the instrument of its 150W dissipation. Given its inception in 1941, this impressive AM-CW signal generator had exceptional specifications with respect to stability and accuracy.



*Back view of the GR805-C*

## Restoration and calibration

The two GR805-C units in our possession appeared on our desk during an inventory check in early January 2020. These units were gifted to Delft University in 1948 by the Rockefeller Foundation, and were probably used for about 20 years, until the end of the sixties ushered in a new era of solid-state equipment. For over half a century, these historic units were kept safely tucked away in the echoing cellars of the Study Collection. Under the dust coating, was there something worth salvaging? With some hesitation, we dared to fire up the first box, carefully increasing the line voltage with a Variac. Although the main oscillator responded to 6 of the 7 frequency bands, there was no output.

Of course, if we gave up so easily, we would never have become electrical engineers. We quickly

exchanged the valves by reaching into our stock of thousands of thermo-ionic vacuum tubes. Only the lowest frequency band, from 16 kHz to 50 kHz, seemed to be faulty. The problem was found to be inside the oscillator turret, where Coil A had a loose connection. Soldering the multiple litz wire was a straightforward job. The restoration process involved cleaning and lubricating the box's mechanics – a gratifying task for a machine this old. To our astonishment, all the capacitors were in good shape, even after over 50 years of unuse. "As long as the oil stays inside, they are okay," said a fellow member of the Study Collection.

Several more replacements were made. The original power socket at the back was switched with a modern USA version. While the original output-connector was retained, the GR774 sock (designed for the USA Navy) was

replaced by a genderless GR874 socket – both sockets have the same thread, which is rather convenient. At this stage, we could finally connect the output. With the exchange of the high power 1614-tubes, the instrument had to be fully recalibrated – no easy feat when most of the components are over 70 years old! As it happens, I remember having done this before in December 1968, as a trainee at the start of my technical education. Still a tough job but completed with success. I am curious about restoring the other one. The support of my colleagues is very much appreciated.

The 72-year-old instrument now surpasses all factory-specifications and is part of the permanent exhibition of the Study Collection. Quality is timeless indeed! Conclusion: To win a war you need 'the right stuff'.



*GR874 Socket*