

Installation Guide and Checkout Procedure for GC Racer with Agilent Gas Chromatographs

Part Number M004, Rev 7

This manual applies to the installation and
checkout of the GC Racer with Agilent GC
Models 5890, 6890 and 7890.

B. Installation Guide

1. GC Racer: What is it?
2. GC Racer: What does it do?
3. GC Racer: How does it do that?
4. GC Racer: Optimizing your separation.
5. GC Racer: Installation Procedure.
6. GC Racer: Check Out Procedure.

A. Before you start.

1. Packing Slip - Confirm Delivery of All Parts.

Check the contents of your GC Racer Box to make sure you have all the necessary parts.

Check	Packing List
	GC Racer Control Box
	GC Racer Auxiliary Heater
	Door Interrupt Switch
	Column Hanger (2 each)
	Spare Insulation
	Current Sense Ring
	Aluminum Tape Strips (2 each)

2. Site Requirements.

Functional GC with fully insulated oven.

Ambient Temperature Range: 10 - 30 °C

Humidity Range: 0 - 90%, non condensing

Power Requirements: 120VAC/20 amp or 240VAC/13 amp dedicated electrical service.

Safety Measures: The GC Racer comes equipped with a door interrupt switch that must be installed correctly to insure proper operation.

The host GC must be equipped with a separate dedicated safety rated switch that disconnects power to the GC oven heater when the door is open.

3. Warranty

At Zip Scientific we are proud of the design and workmanship that goes into every product we sell. We'll keep working until our customers are fully satisfied. We believe in 100% customer satisfaction.

GC Racer Warranty

Zip Scientific provides limited warranty for GC Racer products.

If any defects in hardware or workmanship are encountered during the warranty period Zip Scientific will provide the option to repair, replace, or authorize return of products.

Warranty is limited to products used in the prescribed manner consistent with intended use.

An **Extended Warranty** is available directly from Zip Scientific. Please contact Zip Scientific for further information on Extended Warranty.

Zip Scientific
19 Benjamin Dr
Goffstown, NH 03045
USA

Tel: 603 490-4583
email: info@zipsci.com
www.gcracer.com

4. Product Registration

You must register your GC Racer in order to validate warranty and receive technical support. You may do this online at:

http://www.gcracer.com/warranty_registration.htm

or fill out the information below and mail to:

Zip Scientific
Product Registration

19 Benjamin Dr
Goffstown NH USA 03045

GC Racer Product Registration Form

Name	
Title	
Company	
Address	
Telephone	
Fax	
email	
GC Model	
GC Racer Serial Number	
Purchase Date	
Install Date	

B. Installation Guide

1. GC Racer: What is it?

The GC Racer is an auxiliary heating system designed to boost your “host GC” oven’s temperature programming power. You start with your GC (the host GC) and your application. Add the GC Racer and then operate your GC faster, perform more analysis, achieve higher sample throughput with reliable, rugged, field proven GC technology that’s been used for more than 25 years.

As seen in Figure 1, the GC Racer consists of a heater and a control box. The heater mimics the design used in commercial GCs for decades. It is rugged and reliable. The control box contains a temperature control circuit that is controlled by the host GC. There are three electrical connections. The first connection goes to the GC Racer heater; the second connects to the host GC; the third plugs in to a standard electrical outlet.

Caution!

The GC Racer features a door interrupt switch that interrupts electrical power to the heater located in the oven whenever the oven door is opened. This switch must be properly installed to insure proper operation of the system. It’s easy to do. No tools are required. Installation instructions are included in this manual.

The host GC must have its own dedicated safety rated switch that disconnects power to the oven heater when the door is open.

The GC Racer senses the electrical current sent to the GC heater and controls the auxiliary heater accordingly. There are absolutely no buttons, controls, or software associated with the GC Racer. It is completely transparent to the operator. No training is required. Set the temperature programming rate on the host GC and the GC Racer will take care of everything else. Don’t forget to enter the new, faster, retention times in your calibration routines.

The GC Racer easily installs in minutes!



Figure 1 GC Racer: control box and auxiliary heater

2. GC Racer: What does it do?

The GC Racer boosts the power of your GC oven and allows you to perform faster temperature programming. Figure 2 shows the temperature programming rates for a commercial GC and the performance provided when the GC Racer is installed. As you can see, the maximum useful programming rate decreases as the oven temperature increases. After installing the GC Racer, however, the maximum programming rates can be used throughout the entire operating range of the oven. Separation times can be effectively reduced with the added temperature programming capability afforded by the GC Racer. All of this can be done with standard GC columns.

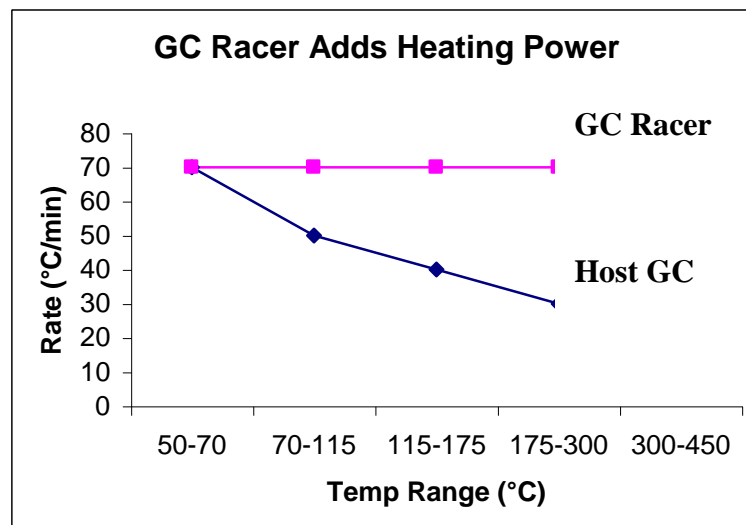


Figure 2. Heating performance with and without the GC Racer

3. GC Racer: How does it do that?

SAFETY FIRST! Before operating the GC Racer you must install the door interrupt switch as described in this manual. When the GC door is open, the GC Racer heater is off. The GC Racer's control box works with the existing GC temperature control circuit to apply electrical power to the auxiliary heater. The power to the GC Racer heater is turned off and on when the host GC oven is turned off and on. So if you turn the oven off to change a column or check a connection the GC Racer is automatically switched off. When you finish, close the oven door, and turn your GC oven back on, the GC Racer automatically switches on.

During normal operation, the host GC senses the oven temperature and adjusts the amount of current to the oven heater to achieve the desired temperature. The GC Racer senses the GC heater current and adjusts the power to the auxiliary heater with its own electronic circuit. Both the original host GC heater and the GC Racer work together to heat the oven. Since there is only one temperature sensor (the original host GC) the heaters cooperate to carry out a smooth fast temperature program without temperature lag and overshoot.

4. GC Racer: Optimizing your separation.

Optimizing your separation with the GC Racer is easy. Start by setting your programming rate to 70°C/min and hold the upper temperature to maintain the same overall run time. See Figure 3 for a typical GC optimization.

1. Run a sample and check the results.
2. If all of your peaks have eluted during the temperature program you can eliminate the hold at upper temperature.
3. If the last peak is coming off during the upper temperature hold you can either run the oven higher (check the temperature limits of your column!) or decrease the column length.
4. Try 100°C/min for an even faster separation.

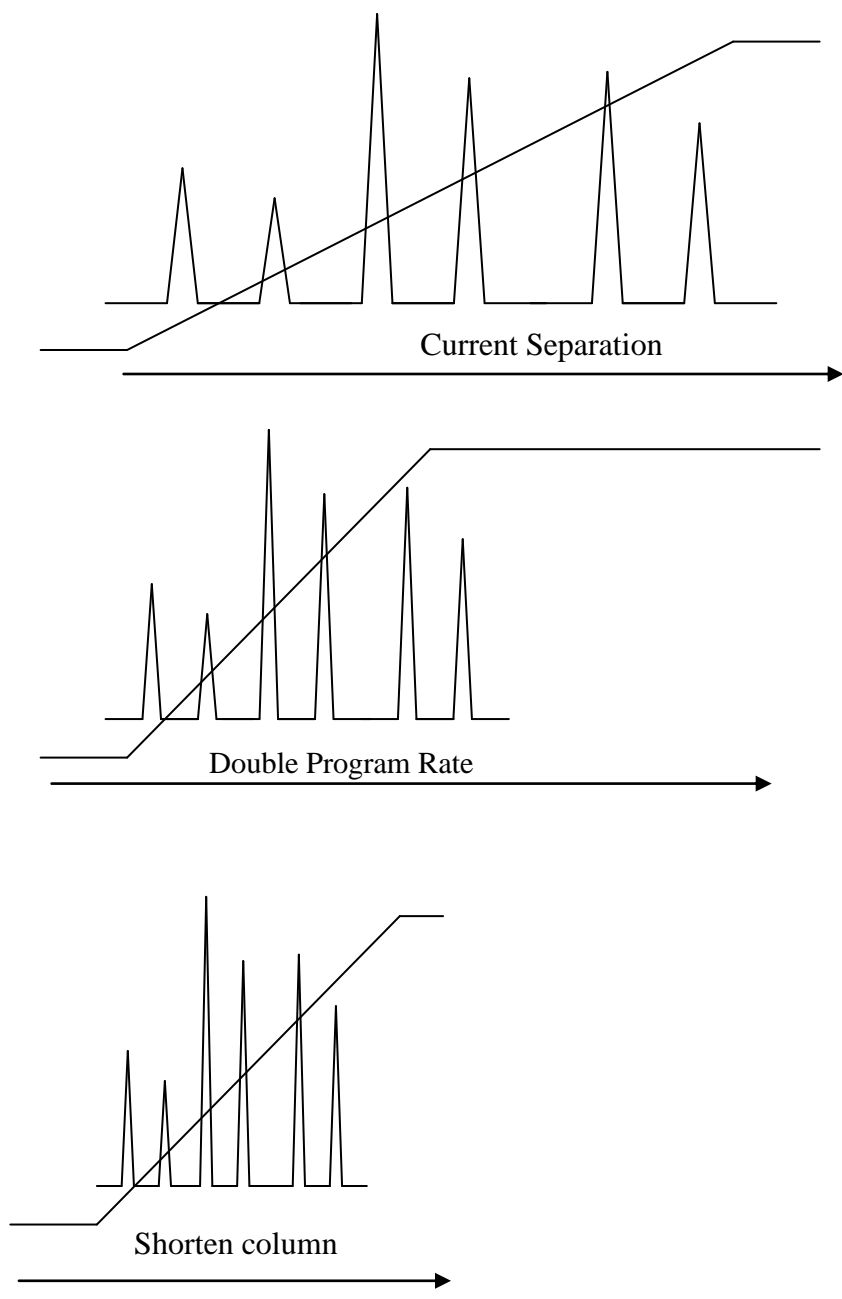


Figure 3. Optimizing your separation with the GC Racer

See if you can shorten your column. You can easily do this by removing the column end from the injector and removing a piece with a simple column cutter.

For most applications, fast temperature programming works best with 5 - 20 m columns. 5 m columns are the fastest but 15 m columns offer a good compromise between speed and resolution. Check your results: Are all peaks sufficiently separated? Remember that reducing column length by a factor of 2 (cutting the column in half) will reduce your resolution by 1.4 (square root of 2) as shown in Figure 4.

$$R = (t_2 - t_1) / W_b$$

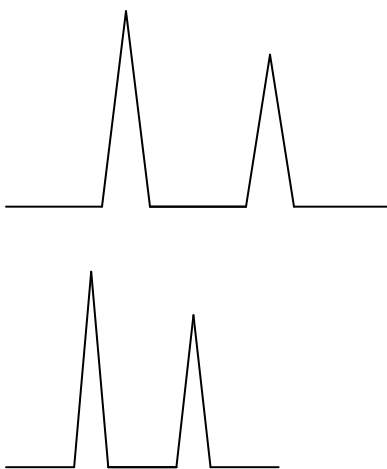


Figure 4. Effect of reducing column length.

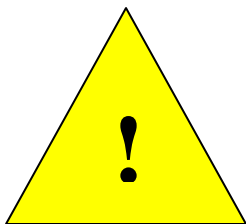
Table 1. Optimizing your separation with GC Racer						
Step	Column Length (m)	Initial Hold (min)	Ramp Rate (°C/min)	Ramp Time (min)	Final Hold (min)	Run Time (min)
1. Current Separation	30	1	20	15	5	21
2. Double Program Rate	30	1	100	3	5	9
3. Shorten Column Length and Final Hold Time	15	1	100	3	3	7

5. GC Racer: Installation.

Tip! Start by giving yourself plenty of workspace. The GC should be unplugged and positioned for plenty of access room to the electronics bay on the right hand side behind the keypad.

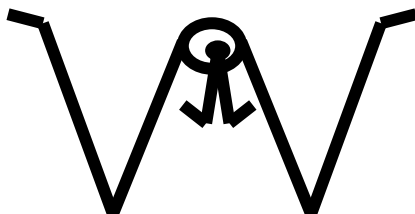
Turn GC Off! Disconnect GC system from electrical service.

You must unplug the GC to guard against electrical shock.



- Unpack the GC Racer and place the components on the bench top.
- Turn off your GC, **unplug it from the electrical service**, and allow oven, injector, and detector to cool down.

1. Remove the Agilent column hanger and install the GC Racer column hanger. Install the GC Racer column hanger by inserting the ends into the same holes used by the Agilent column hanger.



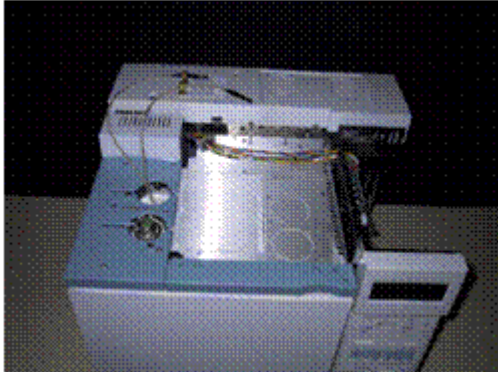
GC Racer Column Hanger

2. Place the GC Racer heater on the floor of the GC.

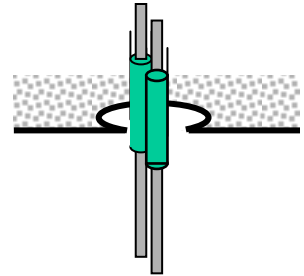


Place the GC Racer Heater Assembly in the GC oven.

Run the heater wires through the top oven wall through access holes located in the GC oven. The easiest path (shown) is up through an unused injection port, however, additional ports are located on the oven ceiling through cut-out panels on top of the GC oven. Slide the protective wire collars into position where the heater wires pass through the top of the oven. Now wrap a small piece of insulation around the two wires from inside the oven and wedge the "blanket" into the access port.



Run the heater wires through the top of the oven and position the protective sleeves as shown.

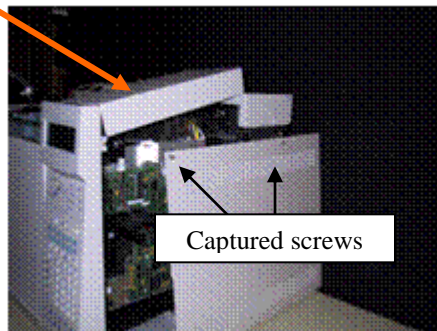
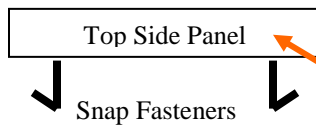


Turn GC Off! Disconnect GC system from electrical service.

You must unplug the GC to guard against electrical shock.

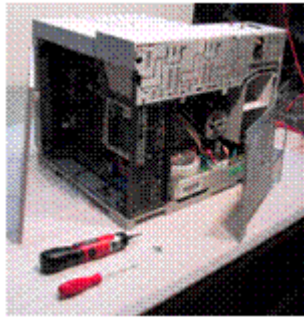
3. Remove the panels from the GC electronics bay.

Tip! This can be tricky. The secret is to remove the side panel first. Loosen the captured screws on the side panel and slide it towards the rear. Then reach up under the top panel and release the snap fasteners from the front and backside.

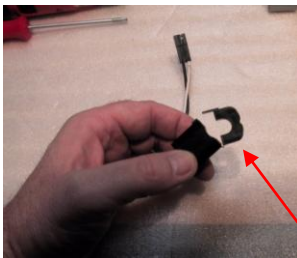


Remove the Side and Top Side Panels from the GC

4. Remove the rear panel of the GC according to manufacturer's manual.



5. Familiarize yourself with the cable connectors. The current sense cable has a two pin connector and the safety switch cable has a three pin connector with two wires. The connectors can only fit together one way and they feature a locking snap that must be pressed down to release the connector.
6. Locate the two white heater wires inside the rear of the GC. Install the oven sensor by clipping it around either one (**but not both**) of the heater wires. Route the leads through to the electronics bay.



Oven Sensor Clip.



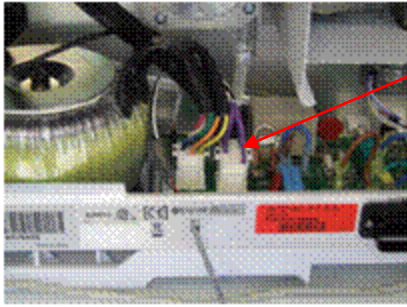
6890
Install the sensor clip around one of the white heater wires and route the leads through to the electronics bay.



7890 - 1
Remove the back panel & unplug the 2 transformer connectors.



7890 - 2
Clip the oven sensor on one heater wire.

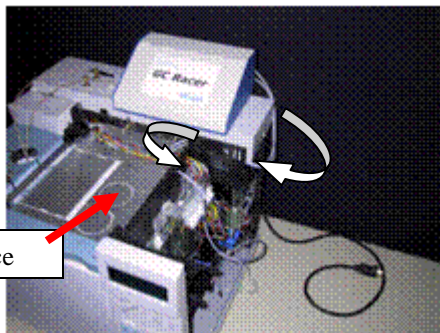


7890 - 3
Replace the transformer connection.

7. Route the current sense cable from the GC Racer Control Box into the electronics bay by pressing the connector through one of the vertical slots in the plastic panel.
8. Connect the current sense leads to the current sense cable.
9. Route the door interrupt switch cable. Slide them into the space between the top rear panel and the bracket that holds the top side panel. Run the cables 180 degrees back through a cutout and into the electronics bay.



Do NOT allow the cables to rest against the oven chassis. These oven surfaces can get very hot during operation. Make sure that the cables are routed as shown (back into the electronics bay).



Hot surface



Sneak peek at completed installation to illustrate cable routing.

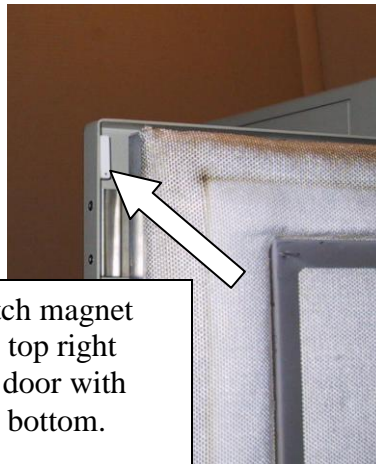
10. Install the door interrupt switch.

The door interrupt switch disconnects electrical power to the GC Racer heater whenever the GC oven door is opened. It is an industry standard proximity (magnetic) switch. When the GC oven door is closed, the switch components are close together (in proximity), contact is made and power

is connected. When the door is opened and the switch components are separated, contact is broken and power is interrupted.

The switch has two components. The first (magnet) is mounted on the oven door; the second (the switch with wire leads) is mounted on the GC oven such that both are next to each other when the oven door is closed. The switch components are designed for easy mounting with industrial adhesive backing. Simply peel the protective layer away and press the switch into place following the instructions below.

Open the GC oven door. Peel back the protective strip to expose the adhesive and mount **the magnet on the inside surface** of the upper door corner closest to the keypad display.



Door interrupt switch magnet installed **inside** the top right corner of GC oven door with the black dot at the bottom.

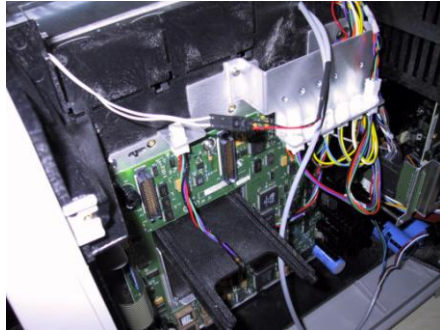
Next, close the oven door and mark the location for the switch. The switch should be positioned such that it faces the magnet within $\frac{1}{4}$ inch and the wires protrude out of the top.



Mount the door interrupt switch on the GC facing the (closed door) magnet position with the wires protruding from the top.

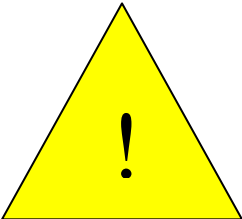
Peel off the protective strip and mount the switch.

Dress the wires into the electronics bay and connect the switch to the door interrupt switch cable. Again, make sure that the wires are not touching the (potentially) hot surfaces on top of the oven.



Dress the wires into the electronics bay and connect the switch to the switch cable. Again, make sure that the wires are not touching the oven.

11. Replace the GC panels. Be careful to position the GC Racer signal cable and connections where they do not bind or rub against GC components.
12. Place the GC Racer control box on top of the GC toward the rear of the GC and away from the FID (heat source).
13. Connect the heater wires to the control box by plugging in the banana style jacks. Either plug can connect to either jack.



DO NOT CONNECT A 120 VAC HEATER TO A CONTROL BOX CONNECTED TO HIGHER VOLTAGES.



Installation Complete

14. Make sure that the GC Racer is switched off, then plug it in to the appropriate electrical service (120V or 240V).
15. Make sure that the host GC is switched off then plug it in according to manufacturer's specifications.

GC Racer: Check out procedure.

Review entire procedure before performing system check.

1. Make sure that you have carrier gas flowing to installed columns and check the upper temperature limit of installed column(s) and oven max temp setting.
2. If any problems arise simply switch the host GC and GC Racer off immediately.
3. Switch the host GC on and wait for the system to complete the start up routine.
4. Set GC oven to 50 °C.
5. Turn on GC Racer, wait 1 minute and verify that GC oven remains under control at 50°C. The Heater Activity light should blink periodically indicating that the GC Racer is operating.
6. Open the oven door and verify that the safety switch is correctly installed by listening for the circuit relay to “click” on and off.
7. Set GC oven to 100 °C and verify that temperature climbs to setpoint and comes under control. The Heater Activity light should come on steady during high power demand and then blink as the temperature reaches 100 °C and comes under control.
8. CHECK UPPER TEMP LIMIT OF INSTALLED COLUMN(S) Cool oven to 60°C and set ramp rate to 60°C/min and final temperature as desired.
9. Run temperature program and observe the setpoint and actual temperature values. Monitor the Heater Activity light to gauge the heater demand.

Trouble Shooting

No serviceable parts inside.

Symptom	Possible Cause	Corrective Action
Circuit breaker tripped.	Heater short circuit.	Disconnect heater from control box and measure resistance to GC chassis.
Cannot maintain heat ramp.	No electrical power	Check circuit breaker. Check GC Racer fuse.
	Current sense ring not installed properly	Make sure that the current sense ring is clipped around one (NOT BOTH) of the oven heater wires.
	Heater resistance has changed.	Disconnect heater from control box and measure resistance. The resistance specifications are: 120V heater: 7 - 9 ohm 240V heater: 15 - 17 ohm