Quest Coffee Roaster Handbook

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Introduction

This booklet pertains to the North American, 120-Volt, version of the Quest roasters. A version is also available for 220-Volt mains; we've made mention of the differences where practicable. There are only two models, the M6, the M3, and a sub-model, the M3s. Moreover, they are all based on the same platform. So, this handbook was conceived as "seen one Quest, seen them all." But that isn't true. The Quest roasters are all hand-built, with many changes made and innovations added over the years. Therefore, this handbook is of necessity not necessarily definitive for any particular roaster.

We've tried to include all the information found in the information sheets that come with Quest roasters.

The temperatures herein are in degrees Celsius (see Annex for a Celsius to Fahrenheit conversion table).

The Quest roasters are small versions of a commercial drum roaster. They can continuously roast back-to-back batches with no cooling cycles required between roasts using a standard 120-Volt, 15-Ampere electrical outlet. The original version (M3) and its successor (M3-Mk-2) were predominantly conduction roasters. The current versions (M3s) and (M6) are hybrid conduction/convection roasters.

The operation of Quest roasters is manual. They have only three controls, an on/off/timer switch, a heater power control, and a blower speed control. There is no proprietary hardware and no software. They are easy to take apart using standard metric hand tools for cleaning, repair or modification.

There are no monitoring provisions beyond an ammeter that displays the heater current, a sight-glass through which to view the roast, a trier, and ports for probes, if installed, to monitor bean temperature (BT) and environmental temperature (ET). The roasters come with one analogue thermometer, which will fit into either port. Optional K-type thermocouples are available.

There is no inbuilt smoke suppression on any of the Quest roasters nor provision for venting to the outside. However, due to the simple design, many owners have been able to add ventilation.

What one receives may vary depending upon the supplier. The M3 roaster comes in a standard package from the factory or the Quest dealer in the United States, Coffee Shrub. At the time of writing, the M6 roaster sold by Coffee Shrub comes complete with a rectangular bean collection tray that will fit into the cooling chamber (but which is too small to handle a full load) and an external fan-driven cooler (which is more than adequate for a full load). An M6 purchased from the factory does not include the rectangular bean collection tray nor the external fan set. These are options that the buyer must specify upon ordering.

Cautions

The information in this handbook comes from diverse sources. While we have tried to make it accurate, the authors take no responsibility for the contents herein. We make no claims, promises, or guarantees about the accuracy, completeness, or adequacy of this document's contents and expressly disclaim liability for errors and omissions. We are not providing

professional advice and encourage the reader to seek professional assistance. You use a Quest at your own risk with no liability to the authors for considering the advice herein.

Quest roasters are not household appliances; they are most suitable for small commercial applications and serious hobbyists. Operating these roasters requires a great deal of care and good practices such as:

- Operate only in a well-perforated location.
- Do not operate unattended.
- Do not use a Variac (voltage booster).
- Avoid using extension cords. If necessary, select the thickest gauge possible.
- Use an electrical receptacle with a safety ground (IE 3-pin socket).
- The roaster becomes very hot during operation; do not touch the metal parts. It can still be hot even an hour after use. Keep the roaster away from flammable objects and children.
- Never put your fingers into the drum door opening while the drum is turning, as there are blades inside.
- The air transfer pipe can serve as a carrying handle when the roaster is cool. Hold it firmly as it is not fastened in place and can rotate. On the M3 roasters, the balance point is near the back; on the M6 roaster, it is farther forward.
- The roaster should not be run empty for extended periods at temperatures beyond 250º Celsius.

First Set-up

Locate the supplied accessories and handles and set them aside.

Attach the wooden handles to the charging port cover, the cooling chamber/chaff collector cover, the ash collector drawer (if fitted), and the sides of the bean collector bin.

Tightly screw the balance weight onto the drum door handle.

Check that the filter plate and filter are correctly installed. To install, first insert the plate obliquely with the filter hole on the deeper side. Note that the concave depression that holds the filter's rim should be upward. Then lower the plate onto the four fixing points, and insert the filter basket into the hole.

Screw a thermometer or thermocouple into the M6 tapped port on the front panel below the trier port. If using the supplied analogue thermometer, secure it so that the dial is oriented correctly using the locknut provided. In this position, the thermometer provides an approximation of bean temperature (BT) measurement. To measure the environment temperature (ET), install another thermometer (optional) on the other front panel port. Close off unused ports with bolts, such as the one supplied with the roaster.

Insert the trier into the port on the front cover, ensuring that the locating pin is in the slot. This position ensures that no beans will get caught in the trier during roasting.

If necessary, carefully zero the needle on the ammeter using a small straight slot screwdriver.

Once assembled, check to see that the roaster sits level on its stand. The stand is heavy-gauge wire; bend it carefully as necessary.

Controls and Basic Settings

Power Switch: The power switch is the upper-right knob on the control panel. It turns stiffly, as it is a mechanical timer. The on position is fully clockwise, and the off position is fully anticlockwise. Its primary function is a safety switch; it will automatically switch off the roaster if not manually reset periodically. The switch can also function as a timer, in which case it operates as follows:

- 9 o'clock: 10 minutes
- 12 o'clock: 20-minutes
- 3 o'clock: 30-minutes

Before charging the roaster with green beans, turn the switch fully on. Alternatively, set it to run for a little longer than the predicted time for the roast. If the roaster stops during the process, immediately turn the switch back on.

Heater Control: The knob at the bottom-left of the control panel steplessly adjusts the heater current from fully-off to fully-on. As the heaters warm and cool, their resistance changes slightly, which causes the current to drift away somewhat from the intended setting. Thus, it is necessary to readjust the electrical current back to the desired setting a few minutes after changing the setting to obtain a precise heat level.

Ammeter: The ammeter is on the upper-left of the control panel. It measures the electrical current flowing through the heaters. Each mark on the meter corresponds to 0.5-Ampere. One can convert the displayed electrical current to the consumed power with the formula **P=I*E**, where **P** is the power (watts), **I** is the current intensity (amperes), and **E** is the electromotive force (volts). Alternatively, use an energy monitor such as a KIll-a-Watt®.

Blower Control: The blower is multi-purpose; it moves air through the roaster, removes chaff from the roasting chamber, and can cool the roasted beans. The knob at the bottom-right of the control panel steplessly adjusts the blower level. There are two versions of this control. On some models, the blower is always on. On other models, the blower stays off from the lowest setting to about 3.8, at which point it begins to turn. Although the dial has higher graduations, it does not turn past 8.

Thermometer: The bean temperature displayed on the thermometer is a relative value, not the actual bean temperature. The BT indicated by thermometers on all roasters varies, mainly depending on the probe's placement and the batch size. It is advisable to correlate the displayed temperature to the actual bean temperature at known points. The appendix contains a table to record corrected values for future reference. The temperature displayed via the ET port, on the other hand, is accurate.

Circuit Breaker: The circuit breaker is at the roaster's back, next to the power cord. It shuts down the roaster if there is a failure causing an excessive current draw. If the roaster does not operate, reset the breaker by depressing the button. If the breaker opens again, the roaster needs repair.

Basic Operation

Preheat: Preheat the roaster to the desired temperature before use. To do this, close all the doors, set the blower to the lowest setting, set the heater control to maximum, and set the timer switch to the 10 o'clock position. Setting the timer switch to the 10 o'clock position during preheating minimizes the risk of overheating should one forget that the roaster is operating.

> *When starting the roaster, verify that the drum is turning and the electrical compartment cooling fan turns. The cooling fan is under the roaster at the back.*

Once the roaster reaches the desired temperature, turn the heater control to a lesser value to avoid heating the empty roaster beyond 250° Celsius ET/BT for more than brief periods.

> *Particular care not to overheat the roaster is necessary, especially for models having an OFF position on the blower control.*

For roasters equipped with an MET thermocouple (see the section on modifications), the manufacturer does not specify a maximum temperature. However, users frequently accept the highest acceptable MET to be ~300° Celsius.

Charging: The term charging means to pour the beans into the roaster. Weigh the desired charge and pour the beans into the bean collector bin or a tray to inspect them for foreign objects and damaged beans. Turn the timer switch to its fully clockwise position. Using the measuring cup, pour the beans into the roaster from either side, not from the front; this will ensure that the beans descend into the roasting chamber without getting caught in the air transfer pipe. Alternatively, use a funnel. If some beans accidentally enter the air pipe, carefully use a bent piece of wire or a small brush to get them out.

> *Do not forget to close the drum door before charging the roaster.*

Using the Trier: During the roast, one can see the beans via the sight-glass on the roaster's front. To obtain a small sample for closer inspection and to smell the beans, use the trier. When sampling, withdraw the trier until the locating pin is just clear of its slot. Turn the trier clockwise until the locating pin faces upwards. Hold the trier in this position for a few seconds to allow the beans to fill the trier, then withdraw it. Do not leave the trier out of the roaster for a prolonged period, as air will be drawn into the roasting chamber cooling it. Reinsert the trier with the locating pin vertical, then turn it anticlockwise until the locating pin reseats into its slot. Any beans in the trier will drop back into the roasting chamber. It may be difficult to obtain a sample from very small roasts.

Roasting: Control the roast by choosing:

- The batch size
- The charging temperature
- The heater current
- The blower speed
- The dropping temperature

See the *Roasting* section of this handbook for more detail.

Dropping: The term dropping means to release the beans from the roaster. The drum door's balance weight keeps the door closed. It also keeps the door open when fully raised. To drop the beans, place the collector bin tightly under the roaster's front and lift the handle. The beans will exit quickly, with a few of them lingering until the drum's vanes drive them out.

> *Do not raise the balance weight while the roaster is operating; beans will begin to exit, and it will be difficult to completely re-close the door with the beans in the way.*

Cooling the Beans: Once all the roasted beans have dropped, cool them immediately to stop the roast from coasting beyond the desired roast level. Quest roasters have an inbuilt cooling facility that uses the chaff collector at the roaster's upper back. To cool this way, drop the beans into the rectangular collector bin (where supplied) and insert the bin fully into the chamber. Run the blower on its highest setting. Alternatively, cool the beans with the optional bean cooler. The Quest's rectangular collection bin and cooling chamber can only handle loads of about 300 grams or less. The round bin supplied with the M6 and its optional fan/cooler unit will easily cool more than 500 grams (about a pound) of beans.

> *Be careful with the heater control when the collector bin is in the cooling chamber. Inserting the bin into the chamber stops all air from passing through the roasting chamber, even when the blower runs at high speed. Unless the heater control is turned off or set to a low current, the roaster will quickly exceed the recommended ET/BT for an empty roaster of 250° Celsius.*

Continuous Roasting: After dropping the first batch, set the heater power such that the roaster attains and maintains the desired charge temperature for the next batch.

Cooling the Roaster: When finished roasting, turn off the power and open all the doors to cool down the roaster. Bear in mind that the roaster will be dangerously hot for a while. Although running the blower is not strictly required during cooling, it is prudent to run the roaster for a short time with the heaters turned off.

Cleaning and Maintenance

Cleaning the roaster often avoids the accumulation of tough stains. More importantly, it keeps the roaster operating at peak efficiency and safety.

Cleaning Between Roasts

After the roast has dropped, briefly run the blower on high to move any retained chaff into the cooling chamber. Clean the cooling chamber and its filter at the roaster's top back and the drawer at the roaster's bottom front (where fitted). Although hot, cleaning both of these when doing back-to-back roasts is easy using a small shop vacuum. Failure to remove the ash and chaff will reduce airflow, which will prevent the roaster from producing repeatable roasts. It could also result in a fire.

> *Caution: To avoid damage to the vacuum when removing the chaff from a hot roaster, do so very quickly.*

Cleaning After Roasting

After roasting, turn the blower to the highest blower level, with the heat off, for about one minute to suck any remaining chaff from the drum. While running the blower, open the bean entrance cover and sweep any powder into the air pipe; it will move into the cooling chamber. Sweep all the chaff and dust in the cooling chamber into the filter cup, dump the cup and reinsert it. Then turn off the roaster.

Clean the lower chaff collector if fitted; clean roasters without a lower chaff collector by vacuuming via the air intake hole. Opening one of the doors will increase the airflow and help remove the chaff.

Periodic Deep Cleaning

Periodic deep cleaning is necessary to ensure that the air flows smoothly and efficiently and that chaff, ash and powder accumulations do not ignite.

> *Over time, it is typical for the roaster's stainless steel case to change colour to a bluish hue, particularly near the heater elements. One cannot remove this colour.*

Here are some cleaning tips:

- Most of the roaster, including the bean chute and door, the air transfer tube, the filter plate, and most of the panels comprising the chaff collection/cooling chamber and its door, can be easily removed and soaked to loosen any hardened deposits.
- Clean coffee oil stains using an alcohol swab. Hand sanitizing wipes work very well; choose a brand with high alcohol content.
- Clean the filter cup often. Stains and baked on deposits can be removed by soaking in warm water for a while then brushing. Stubborn deposits can be dissolved chemically, such as with Cafiza®.
- Clean the blower fan blades often to avoid an accumulation of coffee powder. Access them by removing the filter plate.

Maintenance

There is nearly nothing to maintain on a Quest roaster, as it is constructed entirely of stainless steel and simple components. The only preventive maintenance required is to lubricate the front bearing occasionally. The grease eventually dries out due to the heat. If it is not lubricated, the bearing will become noisy. Take note that the bearing has a rotating part and a stationary part. Between the two parts, there is a small space. Put one drop of oil in the space to soften the grease; do not over-lubricate, or the grease may drip out of the bearing. The type of oil is not particularly important since its purpose is to thin the thickened grease in the bearing. Since the bearing is outside the roasting chamber, food-grade oil is not required.

To inspect the interior of the roasting chamber and to replace the heaters, remove the drum as follows:

- Remove any thermometers or thermocouples first.
- Unscrew the four hexagon-head screws on the front plate, two on the upper bean chute and one on each side.

- Unscrew the single screw in the middle of the bearing (some are hex-head, some are Philips-head).
- Support the air pipe to prevent it from falling, as it is not firmly affixed.
- Remove the front plate, then the drum.

To reinstall:

- Take note of the drive slot on the drum and the drive pin on the drum motor axle. Slightly rotate the drum while inserting it until the slot slides over the drive pin. When properly installed, the entire drum, except for the axle, will be entirely within the roasting chamber, and the drum will *not* turn freely.
- Insert one end of the air pipe over the flange on the rear control cabinet. Be careful that it does not drop, as it is only a friction-fit.
- Slide the front plate bearing over the drum axle. As the front plate moves into place, insert the air tube's forward end over the bean entrance chute's flange.
- Lightly reinstall the screws.
- Ensure that everything is in place before tightening the screws; do not over-tighten.

Heater Replacement: The factory has supplied slightly different heaters over the years. When replacing defective heaters, while not essential on the 120-volt version, it is good practice to replace them both. Replacing both heaters on the 220-volt version is more important. Two different heaters in series will result in the voltage across them being different, possibly leading to early failure.
First, remove the front plate and the drum. Also, remove the cover from the electrical bay; it has a small fan on it. The fan wires plug into a little white connector with a spring-release tab. Using a 5.5 mm socket, take the wires off of the four heater connections. Using a 7 mm socket, remove the bolts from the defective heater(s). The heater(s) will come out easily. They connect to the roasting chamber backplate only with those four bolts, passing through holes in the backplate and the rear compartment.

Roasting Guidelines

Since this publication is a handbook for Quest roasters, not instruction on the finer points of roasting coffee, the following guidelines are not a complete description of the roasting process, which is as much an art as science.

It is essential first to understand the process using only the senses. As the roast progresses, you will see the beans change from green to yellow; this usually happens at a bean temperature of about 160° Celsius. The smell will be like grass or drying hay and gradually smell like baking bread. You will also see exhaust exiting the roaster at two intervals. The first one will be mostly steam, which will subside, then you will see smoke. You will also hear two distinct sounds as the roast progresses. First-crack start (1Cs) will occur at about 205º Celsius; it sounds like breaking pencils. At this point, the typical coffee smell will begin to emerge. Second-crack start (2Cs) will occur about 225º Celsius; it sounds like breaking toothpicks. The first crack and second crack periods last for about 10-15º Celsius, mainly depending on the bean. It is good practice to know these points of roasting and to anticipate their occurrence. The sections Roasting Guidelines and Profiles below contain suggestions for appropriate timing, temperatures and settings.

One can roast coffee beans to many different levels, each with its characteristics. Generally, as coffee roasts:

- Weight decreases (12-20% for drinkable roasts), and volume increases (the degree of expansion varies by type of bean).
- The bean's inherent flavours diminish and the flavours imparted by roasting increase.
- The acidity level drops.
- Some believe the caffeine level drops. However, as the vaporization temperature is well above all roasting temperatures, it is unlikely that any loss is significant.
- Body is more complicated; first, it increases, then it decreases, but is noticeable only on very light or dark roasts.

Based on the cracking points, there are three primary roast groups, light, medium, and dark.

Light Roasts

Light roasts are light brown with no oil on the bean surface, with a toasted grain taste and noticeable acidity. Light roasts are dropped during 1C.

Medium Roasts

Medium roasts are medium brown to brown with no oil on the surface, although darker roasts in this group may appear slightly shiny. They are balanced, exhibiting significant flavour and aroma. They are dropped during the quiet period between the end of 1C and the start of 2C.

Dark Roasts

Dark roasts are dark brown to almost black, with an oil sheen showing on the surface. The roasting process's flavour overwhelms the beans' flavour, and the coffee from some beans may taste spicy, bitter or smoky.

Roast Names and Drop Temperatures

There are dozens of names for various roasts, and the terms and drop temperatures are not standardized. The bean temperatures at the dropping point for some common roasts follow.

> *These are internal bean temperatures, not necessarily the temperature displayed on the Quest's BT thermometer.*

Cinnamon–200º C (~start of 1C)	Full City–229º C (~first pop of 2C)
New England–205º C	Full City+–234º C
American–210º C	Vienna–239º C
City–219º C (1C end)	Italian–243º C
City+–224º C	French–245º C (2C ends)

Click here to see Sweet Maria's pictorial guide to judging the degree of roast.

First Operation (Seasoning)

Before using the roaster for the first time, season the drum to remove any manufacturing debris and oil and avoid imparting metallic flavours into the initial roasts. To do this, preheat the roaster to about 180º Celsius. Using inexpensive beans, charge the roaster to near its maximum capacity. Turn the heater to the highest setting and the blower to the lowest setting. The goal is to heat the beans through to the end of 2C. This process will create a lot of smoke. About 10-15 seconds into 2C, turn off the heaters and let the beans continue to tumble and cool in the drum for at least 15-minutes. Discard the roasted beans.

> *Do not continue the roast to the point where the beans turn black and dry out, as this could cause a fire.*

Seasoning is an opportunity to get used to the roaster and correlate the thermometer readings to actual bean temperature by recording the time and displayed temperature of the roast's critical points: Yellow, 1C start/end, and 2C start/end. Use the table provided in the annex to record the observed temperatures corresponding to these data points.

Profiles

Roasting coffee is more than merely achieving a given roast level. There is a considerable nuance of flavour created by varying other aspects of the roast. For example, one might shorten or lengthen the time to get to the desired drop temperature. Or one might shorten or extend only a portion of the process. Additionally, one might use different blower settings.

Controlling the roaster to obtain the desired result consistently is called profiling. Profile on the Quest by adjusting the heater and the blower to make changes as the roast progresses. When using the roaster, it is good to keep a log of the bean type, charge size, control settings, and times to reach the roasting stages to duplicate subsequent batches. A typical roasting and cupping form is annexed.

By switching the Quest over to thermocouples connected to a computer, one can graph this process using software applications (see the section on Modifications). Successful profiles can be stored and used as a template. Here are two suggested profiles from the manufacturer from which to start.

Profile 1

This profile is suitable for first-time roasters. Because the roaster is loaded to capacity and starts at a relatively low charge temperature, it is unlikely to overheat and scorch the beans.

Prepare 500-550 grams of beans (M6), 250-300 grams (M3).

1. Preheat the roaster until it idles at 150º Celsius.
2. Immediately before charging, raise the heater current to the maximum and the blower to the minimum (but not stopped).
3. Charge the roaster. The temperature displayed on the thermometer will drop at first, then rise.
4. When the temperature rises to 125º Celsius, turn the blower control to the maximum to clear released chaff and help dry the beans.

5 When the temperature reaches 150º Celsius, return the blower control to the minimum setting (but not stopped).
6 About 10-20 seconds before the desired drop temperature, turn off the heat and turn the blower control to high to suck out any remaining chaff.
7 At the desired drop temperature, open the drum door to let the beans out into the collector bin.
8 Immediately place the collector bin in the cooling chamber for two or more minutes with the blower on high to stop the roast, or use an external cooler.

Profile 2

This profile demonstrates how to vary the controls to create a new profile.

1 Begin the same as for Profile 1, up to and including step 5.
2 Upon hearing the start of 1C, turn the heater control so that the current drops one mark on the ammeter.
3 Mid-way through 1C, turn the blower control up by one digit.

By limiting the heater current, one can roast smaller batches using these two profiles. Roasting smaller batches makes the roaster more responsive. For example, in the M6, a 350-gram roast can be done by setting the heater current to about 9-Amperes (120-volt model).

These are merely examples of how to profile. Achieving mastery and consistency requires considerable practice and experimentation to understand how each adjustment influences the roast. The best way to proceed is to reduce the number of variables. Roasting a consistent sample size and sticking with a single type of bean are two examples. Other variables include the temperature at the time of charge, varying the temperature during various phases of the roast, varying the blower speed, and lengthening/shortening the overall roast time.

Adjustments: When cupping the coffee, make a note of any defects. If it is sour, aim to shorten the roasting time on the next roast using a bit more heat or charging at a higher temperature. If it is bitter, lengthen the roasting time using a bit less heat or charge at a lower temperature. If the roast is underdeveloped, increase the time between 1C and 2C by lowering the heat a little immediately before 1C. Make all such changes in small increments to better learn from your changes; for example, when reducing or increasing heat, do so one graduation at a time on the ammeter.

Do not confuse roasting deficiencies with brewing deficiencies when tasting*; both processes can produce sour, acidic or bland coffee. To properly analyze a roast, one must "cup" the coffee. Cupping is a specific process of brewing and analyzing, which is beyond the scope of this handbook.*

Here are some rough guidelines to correct roasting defects, based on an overall roast time between 11 and 22 minutes, in three phases.

Phase	Too Short	Good	Too Long

Drying: from Charge to Yellow	<3 minutes **Grassy**	3 to 6 minutes	>6 minutes **Leathery**
Ramping: from Yellow to 1C-start	<5 minutes **Toasty**	5 to 10 minutes	>10 minutes **Bready**
Finishing: from 1C-start to Drop	< 3 minutes **Acidic**	3 to 6 minutes	>6 minutes **Flat**

Engineering

There are currently two main models, the M3s and the M6. The M6 is the larger of the two, with a longer roasting chamber and more powerful heaters. Otherwise, they are nearly identical. The current roasters differ from the original mainly because they have drums with perforated backplates.

The box at the back of the Quest roasters and the controls is substantively identical on all the models. There are some minor circuitry differences depending on the way the fan control operates.

There are either one or two chaff collectors. The one below the roasting chamber is for ash and fine particle collection. The primary chaff collector is the one at the top, which doubles as a bean cooler. An external bean cooler is available as an option.

Roasting Chamber: The diameter and build of the roasting chambers on Quest roasters are nearly the same. The M6 roaster's chamber is ~7 cm longer. Early M3 roasters had the trier on the left side; all subsequent roasters have the trier on the right. Some roasters, possibly only some M3s models, have insulated shells.

Heaters: All Quest roasters use two U-shaped electrical elements located in the space between the drum and the outer case. On some roasters, the heaters are underneath, on either side of the centre line. On others, one heater is higher, diagonally opposite from the lower one. The heaters on 110-Volt and 220-Volt roasters are the same; in the 110-Volt roasters, they are connected in parallel, while on the 220-Volt roasters, they are in series.

Drums: The original Quest M3 roaster (up to May 2013 production) had a clockwise-turning drum thicker than that of the M6, MK-2 and M3s versions, which turn anticlockwise. Note that the drums are not interchangeable, as the vanes must be oriented to move the beans toward the front of the roaster. Some posters on coffee blogs have opined that some Quest models route the beans to the back; this is incorrect. All the drums are open at both ends, except the M3s and the M6 drums, which have perforated backplates. The M6 drum is the same as the M3s drum but ~7 CM longer. The drums in all Quest roasters turn at a constant rate using a 30-Watt motor attached to a speed-reducing gearbox. The shape, number and size of the drum's vanes have changed over the years and models.

Air Flow: All Quests have a 15-Watt variable-speed blower.

The airflow is identical in the original Quest and the MK-2. The blower exhausts air from the upper chaff collection chamber through the slots at the roaster's back. Thus, the chamber is a low-pressure

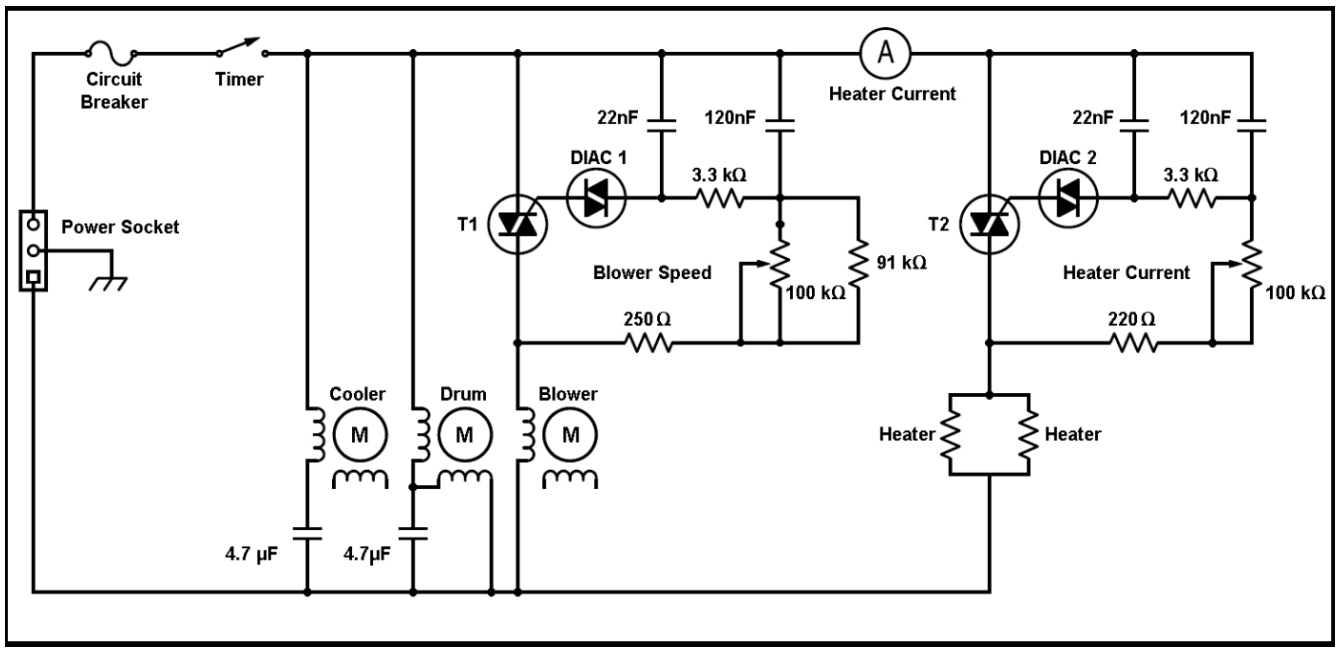
zone, providing the chamber door is closed. The chamber's low pressure sucks the air out of the roasting chamber via the air transfer tube and the bean chute, providing its door is closed. There are gaps between the drum and both endplates of the roaster. The drum's low pressure creates suction at both ends, which draws air into the drum through these gaps from the heated space between the drum and the outer shell. Make-up air enters via a hole at the lower back of the roasting chamber, near the electronics cooling fan.

In the M3s and the M6, the same fan, air tube, and bean chute create suction in the drum. From this point on, the flow is different. There is no air hole at the back of the roaster. There are two ~3mm longitudinal slots underneath the roaster below the heaters, running the drum's entire length. Air enters via these shots where it is heated. The majority of the heated air moves back and enters the drum via a perforated backplate. Some air still enters the drum via the space between the front of the drum and the front plate.

There are also Quests, probably all M3s models, with three or four air inlet tubes. The tubes enter the chamber from the roaster's backplate, one between each of the heater's legs and one at the top. If there's a fourth one, it's at the top left, as viewed from the front. We believe all these versions have insulated roasting chambers.

Electronics: The heater control and the blower control are kluge-wired using discrete components. The two are virtually identical, using circuitry similar to that of light dimmers. The controls are variable resistors, which control Triacs. The circuitry chops the AC sine wave, delivering pulses of varying width to the blower motor and the heaters. The Triac for the heaters is on the chassis for conductive cooling. In newer roasters, with somewhat bigger heaters, a small heat sink is also fitted on the heater Triac. The Triac for the blower motor is identical, but it is merely air-cooled since the current through it is relatively small. A 5-Watt muffin fan located on the bottom of the cabinet helps to keep the Triacs cool.

The following schematic is from an Mk-2. There are likely component value differences between roasters based on production date. The controls on all the Quest roasters are about the same. The two control circuits are similar to those in light dimmers. The resistor across the blower speed control stops the blower from being switched off in some models. The heaters are in parallel, so if one fails, the roaster will run at half power. The heaters on the 220-volt version are identical to the 110-volt version but are in series. If one heater fails, then the roaster will not heat at all.



Specifications

The most important item to note for owners in the USA is that everything on the Quest is metric. The screws that hold the bean chute on are 3 mm, those that secure the drum ends and all the body screws are 2.5 mm. The heater connection nuts are 5.5 mm, and the bolts holding the heaters in place are 7 mm. The grub screw holding the fan to the blower shaft is 1.5 mm.

The specifications provided here are merely examples of two specific Quest roasters that I own. It is important to note that the manufacturer incorporated many changes over the years.

	M6	**M3 Mk2**
Overall Dimensions (cm)*	24W x 38H x 43D	24W x 33H x 36D
Net Weight (kg)**	12	10
Capacity (g)	300-550	150-300
Circuit Requirement	120-Volts, 15-Amperes or higher	
Heaters (Watts)***	1615	1340

**The M6 is 7 cm longer than the M3, all in the roasting chamber; the other two dimensions are identical. The M6 is taller only because the base is taller. Depth measurement does not include the handle for the roasting chamber door.*

***Measured without accessories.*

****The manufacturer rates Quest roasters at 110 and 220 Volts. However, the nominal voltage in North America is 120-Volts. Thus, the power shown on the roaster's nomenclature plate will be less than the power consumed. The electrical power shown above is as measured, normalized to 120-Volts.*

Manufacturer's Information

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Parts are available in North America from coffeeshrub@gmail.com or the manufacturer at questm3roaster@gmail.com.

Modifications

> ***Additional Caution:*** *You modify a Quest at your own risk with no liability to the authors for considering the advice herein. Please re-read the Caution note earlier in this document.*

This section of the handbook does not cover all of the Quest's possible modifications, nor is it intended to. The Home-Barista website Click Here is an excellent source for Quest modification information.

Digitizing the Quest

The Quest's most common modification is to enable digital temperature readings and to store/display them. Digitizing the Quest ranges from simple to complicated. For example:

- Replace the analogue thermometer with a thermocouple connected to a digital thermometer.
- Add additional thermocouples to measure more parameters.
- Connect thermocouples to a computer logging application.

This section of the Quest handbook provides only ideas and basic information.

Thermocouples

Thermocouples are not all the same; there are numerous standards. Thermocouples generate a small voltage proportional to temperature, which thermometers convert to a temperature reading. A newer kind of thermocouple, the RTD, creates a resistance proportional to temperature, which thermometers convert to a temperature reading. The most commonly used thermocouple for this application is the T-type. The type of thermocouple must match the type of meter/interface used.

At one time, it was possible to purchase a kit to make the following modifications. This kit is no longer on offer.

Usual BT Location: The thermometer threads on the roaster's faceplate are M8 x 1.25 mm. Probes with this screw size are available from several sources, including the factory and Coffee Shrub. These thermocouples screw into either the BT or the ET hole without modification. Non-threaded thermocouples need adapters, which most manufacturers sell.

Alternate BT Location: The stock BT thermometer location is optimum for most batch sizes, but it may be a bit too high for tiny batches. An alternate location is possible using one of the screw holes on the drum door's sight glass. To do this, remove the uphill* M4 sight-glass screw, and drill a tiny hole in the centre of it. Install a 1/16" x 6" thermocouple, such as the *Omega TJ36-CASS-116G-2.00-SB-SMPW-M* through the hole, bent so that the probe protrudes only one inch inside the faceplate. Although this probe will be subject to being impacted by the beans, its short length makes it strong enough to function without being damaged by the beans.

> **Uphill Definition: Use the left hole for clockwise rotation drums (before May 2013); use the right hole for counter-clockwise rotation (MK-2) drums.*
>
> *Tighten the screws securing the sight-glass carefully to leave the glass a bit loose.*

ET measurement: Quest roasters come equipped with an M8 tapped hole at the proper location to measure the environmental temperature. This hole is closed off with a bolt. The same thermocouple used for measuring BT will work here, although some users prefer a thinner probe, as it is more responsive. When the roaster is empty, the BT and the ET measurements are nearly the same, being the drum's air temperature. Once charged, the ET thermocouple continues to measure the drum's air temperature, while the BT indicates an approximation of the bean temperature.

MET Measurement: A modification to measure maximum environmental temperature (MET) is possible. MET is a measurement of the temperature between the drum and the case. The easiest solution is to remove one of the upper M4 hex screws securing the bean chute and insert a 1/8" x 6" thermocouple between the drum and the shell.

For a better solution, drill a suitable hole in the centre of the M4 hex screw, and install a 1/16" x 6" thermocouple, such as the *Omega TJ36-CASS-116G-6.00-SB-SMPW-M*. The beans cannot impact a probe at this location. Therefore, one can install a long, thin probe; the lighter the probe, the more responsive the readings will be. *This screw will be weaker than the other three holding the chute. Do not torque it down beyond a little more than finger tight.*

A 1/8" probe can protrude straight out and be pushed in or pulled out to achieve optimum readings; a 1/16" probe is too flexible. On an M3 roaster, to secure the thinner probe, bend the probe 90º 2.5" from the cable end. Route the wire across the bean chute's face to the side of the roaster, and secure it with a cable tie. Be sure to bend the probe according to the manufacturer's recommendations for a minimum radius. On an M6 roaster, push the probe completely in, which will position it correctly.

The heaters on some roasters are mounted low in the roasting chamber; therefore, you can use either of the two upper screw holes. The heaters on other roasters are different. As viewed from the front, the left-hand one is mounted high; the other is mounted low. Therefore, to avoid having the probe close to the upper element, we recommend mounting the probe in the right-hand hole.

The displayed value of the MET is highly dependent on the location of the probe. Even minor variations in placement make significant differences in the indicated temperature. Thus, it is of little use as an absolute value, especially for making comparisons between roasters. However, this is the

most responsive of the three temperature readings (BT, ET, MET). Thus, it is an excellent choice to monitor the effects of heater and blower control changes.

Measuring Devices

Energy Monitors: Some owners like to see the power displayed in Watts, rather than amperes, as indicated by the current meter, as this is more precise. A Watt is a Watt. These owners often add an energy monitor, such as the KIll-a-Watt®, or one of its clones. This type of meter provides a more accurate indication of the consumed power, as it does not matter what the voltage is. Also, it allows users to compare settings between roasters, even if one operates on 120-Volts and the other on 220-Volts.

Digital Thermometers: Consumer-grade digital thermometers are available everywhere. The only important thing is that the type and the plug match with the thermocouple. If only a BT measurement is needed, many inexpensive single-channel meters are readily available. Some multimeters include a single K-type socket and a selector-switch position to convert the voltage into the equivalent temperature. If using multiple probes, multichannel thermometers are available, the most common having either two or four ports. A quick search of popular online sites, such as Amazon, will turn up dozens.

Data Meters: However, digital thermometers and multimeters usually lack a computer interface. If a computer connection is wanted, lab-quality meters with a data port are available in one to four-channel versions. Arguably the most popular is the Mastech MS-6514. It is a 2-port meter that can run on its internal battery or a standard 5-volt USB power supply. A meter's advantage over a thermometer is that a thermometer cannot interface to a computer; it only provides a temperature reading. On the other hand, a meter provides both a computer interface and a digital readout. So, one can use it with or without a computer.

Custom Interfaces: Small single-board computers, such as the Arduino, can be used to interface between the Quest and a computer. Similar input/output devices such as those from Phidget are even more popular. How to use these is beyond the scope of this handbook. Find information on Arduino here: Click here. Find information on Phidgets here: Click here. Search the Home-Barista website. Click here for additional information.

Roasting Software: With the Quest linked to a computer, one can easily display the temperatures provided by the thermocouples as curves against time, using a software application. Such apps usually include the ability to develop and display a desired profile in the background. The user can then manipulate the heater and blower controls to duplicate the profile while roasting.

Airflow

Blower Control: A common modification to the Quest is to remove the resistor on models that have a continuously running blower. After the change, the blower motor will no longer run from 0 to about 3.8. Opening either the bean chute door or the chaff filter door has a similar effect, as it stops the

blower from being able to draw air through the drum. In either case, one needs to be careful not to overheat the roaster.

Air Intake: On some older models, air enters the roaster by suction through a small hole in the lower back of the drum enclosure. From there, it enters the drum via the gaps between the drum and the endplates. Thus, the air entering at the back will be cooler than the air entering at the front. To overcome this imbalance, some owners install a 6" piece of copper pipe in the hole. This modification directs the air to the middle of the drum, heating it more evenly. The only downside of this modification is that it reduces the aperture's size, thus reducing airflow.

Newer models do not have the aforementioned intake hole. Instead, several air intake tubes allow the air to enter the drum at critical points within the roasting chamber, ensuring incoming air flows over heaters before entering the roasting drum. Typically, two of these tubes enter the U-shaped space between each of the heaters. There are one or two more, usually high in the chamber. It should be possible to change older Quests to this form of intake by removing the backplate, blocking the original intake hole at the bottom, and drilling holes for added tubes.

The latest Quests have neither intake hole nor tubes. Instead, there are two slits of about 3 mm width, one on each side, low down on the roaster. These slits run the entire length of the outer case. At least some of the roasters with a lower chaff drawer have this feature, the slits being on either side of the drawer assembly. To convert older Quests to something similar, block the air intake hole, cut narrow slits in the lower case and open the slits to about 3 mm by bending. Make adjustments by changing the bend.

Air Exhaust: The air from the blower exits the roaster at the back via slots in the case. The aperture size provided by these slots is significantly larger than the aperture of the air entrance hole, the tubes or the slits. Nevertheless, some owners cut away the metal between the slots to increase airflow. This modification also makes it easier to clean the blower fan. Note that there are two sets of slots, side by side. The outboard set serves the blower, while the inboard set ventilates the electrical cabinet. The latest Quests have the metal between the slots opposite the blower exhaust twisted to direct the exhaust somewhat upward.

Increasing Capacity

Painting the drum

Some Quest owners–to increase the maximum batch capacity or alter the roast environment's thermal dynamics–paint the roasting drum's exterior with high-heat matte black spray paint. Doing so causes the drum to efficiently absorb and conduct more infrared heat to the roast chamber independent of airflow speed (convection). Increasing the drum's ability to absorb infrared heat increases the batch capacity, and heat changes are faster, even for large batch sizes (EG. <10 minutes, 300g roasts on an M3).

This modification is a bit difficult to reverse. Also, it may become challenging to roast small batch sizes (EG. <150g) without introducing tipping or scorching. This modification may make flavour profiling more difficult because the roaster will operate slightly more conductively and less convectively.

Making this modification is relatively easy. First, remove the drum and prepare the exterior surface by scuffing it with 120-grit sandpaper. Wipe off any grit and debris. Then, mask it so that spray paint cannot coat the drum shaft or the drum's interior. Next, spray high-heat (600 C / 1200 F) matte black paint in several light coats according to the container's instructions. You can use BBQ grill paint for this. Run the roaster for a prolonged period (EG. 30-45 min) at about 200º C to burn off any volatile components before roasting coffee.

Insulating the Roasting Chamber

Some owners add a layer of heat-proof insulation around the exterior of the roasting chamber. This insulation allows the Quest to retain more heat, increasing capacity and the speed of heating. However, the downside is that if the user wishes to dump heat when a roast is getting too hot, it will be slower.

Shorten the Cord

The Quest works best when used without an extension cord. However, many users like to see the power displayed in Watts, so they use the roaster via an energy monitor, such as a KIll-a-Watt®. However, because it is difficult to read a monitor plugged into a wall socket, they put the monitor on an extension cord then plug the roaster into that. A increase in voltage occurs simply by keeping the extension cord as short as possible and by shortening the supplied power cord, especially on the M6 because of its bigger heaters.

Knobs/Handles

The supplied knobs and handles are relatively small. Some users make longer ones.

Bean Cooling

The supplied rectangular bean collector placed in the chaff collector cools the beans. This works but has several drawbacks. First, it is slow. Second, there is no air circulation through the roasting chamber with the bean collector inserted into the chaff collector. Use an external cooler instead, such as the optional one from the manufacturer or make one. Make a small box with a muffin fan in it and set the bean collector on top. The flow of ambient air through the beans is much more efficient than the Quests' inbuilt cooling function.

Venting

The Quest can be used indoors. The factory suggests putting it on a counter next to a window and opening the window wide enough to take the stream of exhaust. Some owners have roasted under a kitchen fan, which works reasonably well, but some smell still lingers in the room. Here are some ideas to vent the Quest.

For improving exhaust removal in the kitchen under a range hood, cut a piece of thin metal the size of one of the range hood's air intake filters and cut a hole in it. Attach a piece of dryer vent hose to the metal plate. Put the metal plate in place of the range hood filter, and place the other end of the hose

near the Quest's vent. Because the hose does not touch the Quest, heat would not be an issue due to the range hood also sucking in air from the room.

A straightforward modification is to direct the exhaust upwards. This modification would work best if the range hood has better suction than average. Attach a small hook to an aluminum dryer vent elbow. Hang the elbow over the back of the Quest so that it covers the ventilation slots.

To roast in any room or garage with a window, cut some plywood 6" by window height. Cut a hole in the plywood and install a muffin fan on that, blowing outside. On the inside of the fan, connect a piece of clothes dryer vent hose. Open the window enough to put the plywood in and close the window on it. Place the other end of the hose near the Quest's vent.

Automating the Quest

Because the Quest roasters are entirely manually operated, with no special hardware and no firmware, they lend themselves easily to automation. While most Quest buyers select them because they are simple, manual roasters, several owners have already automated theirs. It is not our intention to do a deep dive into automating the Quest. Here are some basic ideas.

MET/ET/BT Control: Arguably, the Quest should have some form of control over the temperature, especially MET. In its stock form, providing one continues to reset the power switch, the roaster will get increasingly hotter until the heaters fail. By connecting a thermostat to a thermocouple installed in the MET position, the user can select a maximum MET. The temperature will move up and down in a sawtooth pattern when the roaster gets to the thermostat's set point. The on/off cycles' frequency and depth depend on the thermocouple's mass and the thermometer's deadband. In practice, the operator would likely run the roaster so that it never gets this hot. This modification would thus be considered something to add for safety.

A better implementation for temperature control would be to use a PID driven by the BT, not the MET. However, users report that it is challenging to adjust the PID parameters for optimum operation. Note, however, that the BT thermocouple temperature is not an actual measurement of BT. Also, electric drum roasters such as the Quest are not very responsive; it takes some time for heater current change to be seen as a change in ET and even longer to change the BT.

Just as one can use roasting application software to display and record roasting parameters, some of them have inbuilt capabilities to control a roaster. This video, while not Quest-specific, provides some good information. Click here

Written by Maurice Nunas, with contributions from other Home-Barista members, including CarefreeBuzzBuzz and 'spromance'. To contribute additional material, suggest edits and to comment, please email to <nunas_at_nunas_dot_com> .

Annex

BT Thermometer Correction Table

Stage ►	Yellow (Dry)	1C Start	1C End	2C Start	2C End
Actual (° C)	160	205	219	229	245
Load (grams)▼	////////////////////	////////////////////	////////////////////	////////////////////	////////////////////
550					
500					
450					
400					
350					
300					
250					
200					
150					

Bean Temperature Displayed on Quest Thermometer at Stages of Roast, by Roast Size

Coffee Roasting Record

Roast #	Date	Coffee Used					Start Wt	Fin. Wt	Temp
Segment	1	2	3	4	5	6	7	8	9
Time									
Power									
Fan									
Yellow		1st Crack Begin		1st Crack End		2nd Crack Begin		Drop/Cool	

Roasting Notes:	Cupping Notes:

Actual Bean Temperature* °C to °F at Important Roast Points

C	F	Roast Level		C	F	Roast Level	
160	320	Yellow		234	453		Full City+
200	392	1C start	Cinnamon	239	462		Vienna
205	401		New England	243	469		Italian
210	410		American	245	473	2C end	French
219	426	1C end	City	260	500	ET Max (empty)	
224	435		City+	300	572	MET Max	
229	444	2C start	Full City	300	572	MET Max	

** Not necessarily as displayed on the BT thermometer or thermocouple*

- End -