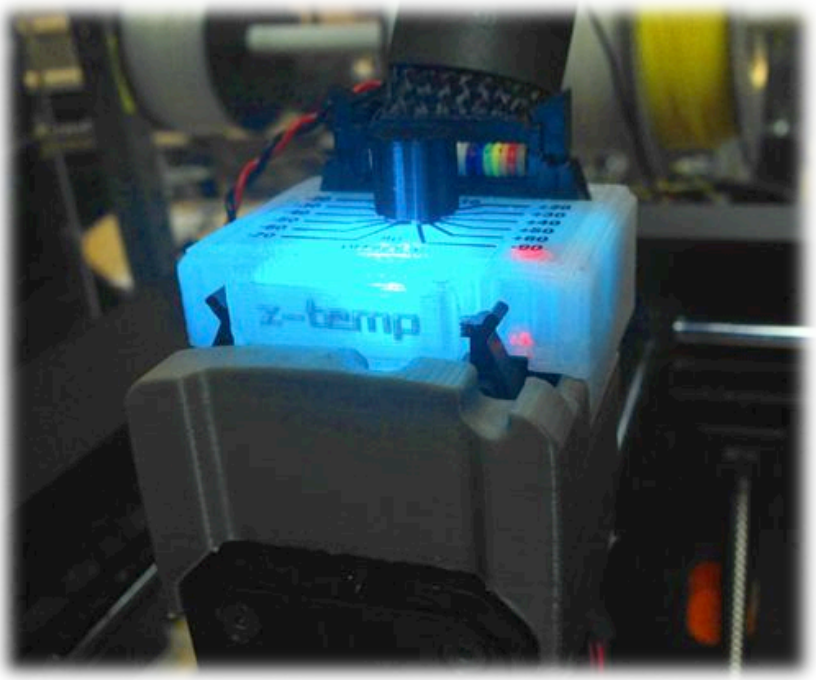
Z-TEMP™

Installation and Use

V 13.0



Contents

Compliance Information

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numerique de la classe B est conforme a la norme NMB-003 du Canada.

Information on Disposal for Users of Waste Electrical & Electronic Equipment

This symbol on the product and / or accompanying documents means that used electrical and electronic products should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product to a designated collection point where it will be accepted free of charge.

Alternatively, in some countries you may be able to return your products to your local retailer upon purchase of an equivalent new product.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point.

Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

Introduction

Thank you and congratulations on your purchase of the Z-Temp™ temperature control system for the Zortrax™ M200® 3D printer. You are now free to use *your* choice of filament!

Why use the Z-Temp™?

Independence

The M200 is a fine machine, but users are limited to the temperatures specified at slicing time by a selected profile provided by Zortrax for their proprietary materials. With the Z-Temp™, users are free to select from a wide range of extrusion temperature for any material they choose to use in their printers.

Accuracy

Due to component variations, the M200's temperature sensing and control system is accurate only to within approximately ±5-10ºC. Even when using a Zortrax profile, the final temperature may not be optimal; Z-Temp can compensate for these errors.

On-the-Fly Adjustment

Used per Zortrax's procedure, extrusion temperatures are fixed at slicing time – there is no ability to change temperature mid-print for fine adjustments or special part characteristics. With Z-Temp, extrusion temperature can be changed at any time during the printing process. Furthermore, there is no need to re-slice your model when you want to print it using a different material – just set the Z-Temp and use the same Z-code you previously generated.

Real-Time Temperature and Heater Activity Display

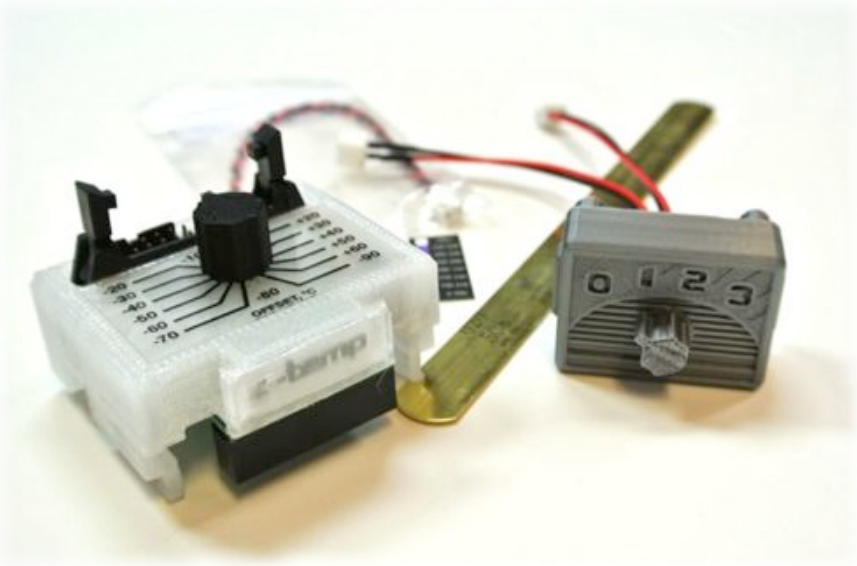
The M200 provides no operator feedback of actual temperature during printing. The Z-Temp's patent-pending multi-color display confirms at a glance the approximate extruder temperature at any time, its Heater Monitor provides an informative display of power delivered to the hot end, and its Temperature Monitor Output can be used with an external meter to read exact actual hot-end temperature.

Please visit our website at www.z-temp.co to view samples of parts printed using the Z-Temp, for many tips and settings for various materials, and for support from the user community. As we learn more about printing new materials with the M200® we will publish them on the News, Tips for Use, Materials Guide, and Gallery pages of the site – those pages will be updated more frequently than this User Manual.

Kit Contents

Your Z-Temp kit should contain the following components:

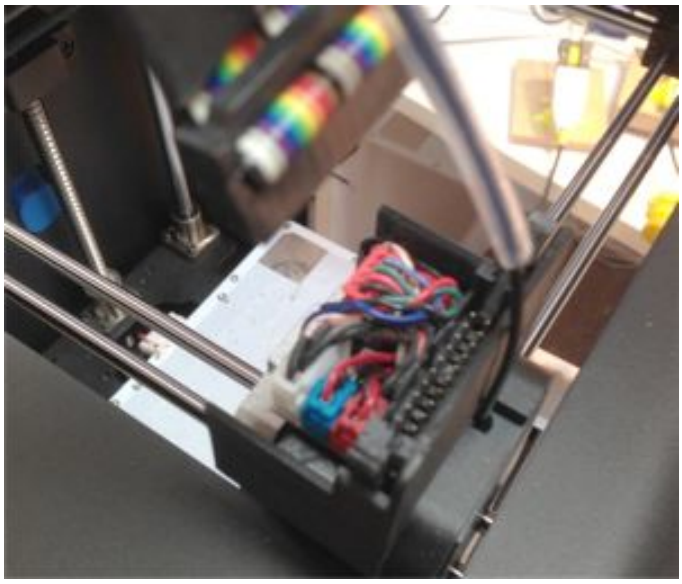
- Z-Temp™ extruder temperature control module
- Bed heater control assembly
- Temperature voltage output cable
- ColorTemp™ visual thermometer color-key sticker
- 0.5mm shim for increasing initial layer nozzle distance (see http://www.z-temp.co/tips-and-tricks.html to learn about use of the shim).



Extruder Control Installation

Switch the printer off. Move the print head to a corner to minimize stress on the guide rods. It's not necessary to unload the filament before installation, but it does make things a bit easier.

Use the ejector levers to remove the ribbon cable. Remove the snap-on cover.

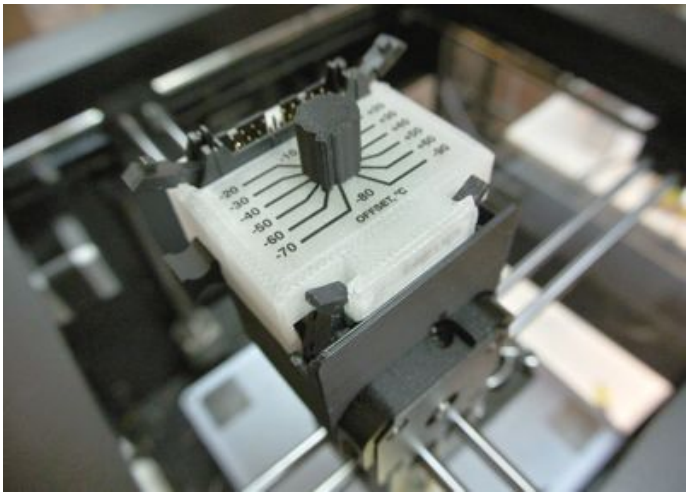


Plug the Z-Temp into the M200's ribbon cable connector, **making sure to line it up correctly**.

Damage to the printer or the Z-Temp may occur if the connector is not aligned!

Z-Temps manufactured in 2016 feature a keyed connector to prevent misalignment.

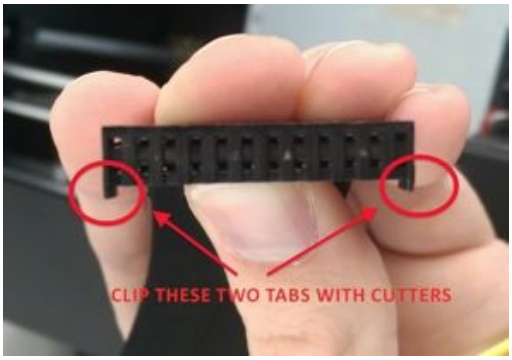
Snap the ejector latches into the Z-Temp's housing to secure it in place.



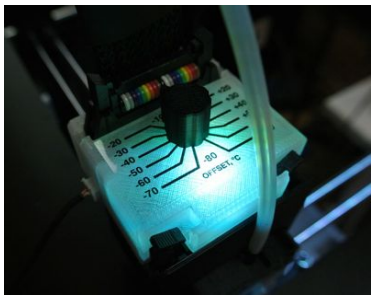
Open the ejector levers on the Z-Temp’s ribbon cable connector and insert the ribbon cable. Support the back of the Z-Temp during this operation to minimize stress.

Some M200s ship with ribbon connectors having tabs at the edges of the female connector housing. If these tabs are found to prevent mating with your Z-Temp's male header, simply snip off the tabs with a pair of cutters.

Some ribbon connectors have 24 pins, whereas the male header of the extruder (and that of the Z-Temp) has only 20 pins. The female connector should be centered on the male header, with one pair of unused sockets extending past each end of the header.



Extruder Control Test

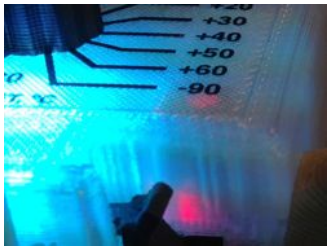


Switch the printer on. The Z-Temp will light up blue (assuming the extruder is cold).

Set the Z-Temp's control knob for 0 degrees temperature offset.

Use the M200's front panel interface to manually heat the extruder (Maintenance->Heat the Extruder). Under firmware 1.0 and 1.0.1, the nominal temperature for this operation is around 240ºC. Under prior versions of the firmware it's 260º.

A small red dot appears on the M200's panel, monitoring extruder heater power.



As the temperature of the extruder rises, the Z-Temp's color will change to indicate the current temperature as shown in the chart below. As the temperature approaches the M200's setpoint, the heater power monitor will begin to flicker as the printer's pulse-width modulation and PID control loop kick in.

Change the Z-Temp's temperature offset setting and observe the effect on the heater power monitor and the temperature indicated by the Z-Temp's color. The Z-Temp updates its display many times per second, but due to thermal inertia of the hot end and the M200's PID control loop, it will take some time for changes in extruder temperature to occur.

Extruder Control Use

Please visit our website at www.z-temp.co to view samples of parts printed using the Z-Temp, for many tips and settings for various materials, and for support from the user community. As we learn more about printing new materials with the M200® we will publish them on the Materials Guide page of the site, which will be updated more frequently than this User Manual.

Measured temperatures for Zortrax material profiles appear in the table below. The Z-Temp "offset" is relative to whichever of these is chosen at slicing time. We recommend using the Z-ABS profile for all materials – it offers the most choices of layer height and its nominal temperature has remained constant through all versions of Z-Suite.

Standardizing on use of the Z-ABS profile also offers the possibility of printing an "absolute temperature" label for your Z-Temp so you don't have to do mental arithmetic using the offset temperature to find the actual temperature. Please see the "Temperature Range Selection" section of this manual for more information and printable template file.

	Raft Building	Part Building
Z-ABS	280C	275C
UltraT	265	260
Z-Glass	270	255
Z-HIPS	260	260

Notes:

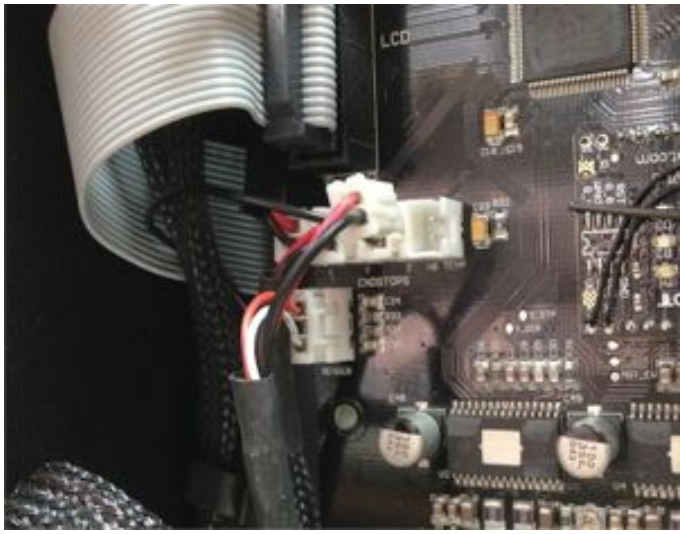
1. Values measured using Z-Suite 1.4 profiles. Nominal temperature may vary depending on the version of Z-Suite used for slicing, but they can be verified using Z-Temps temperature monitor voltage output.
2. All materials perform "Load" and "Unload" at 240C under firmware 1.0 (260º under previous firmware versions). Loading and unloading offset may need to be set differently from printing offset.
3. Temperature can vary as much as ±3-5 degrees during printing due to PID error, fan speed changes, etc. When the fans first turn on after raft building, the temperature can drop as much as 10 degrees, and require several minutes to recover. We recommend using 80-100% manual fan with PLA. Auto fan should generally not be used with PLA since it produces more airflow and a greater temperature drop than manual fan.

Bed Heater Switch Installation

The bed heater switch is not necessary for printing with ABS or other materials requiring a heated bed, however when printing with PLA or lignin-based materials we find that reducing the bed heat can make raft and support reemoval considerably easier.

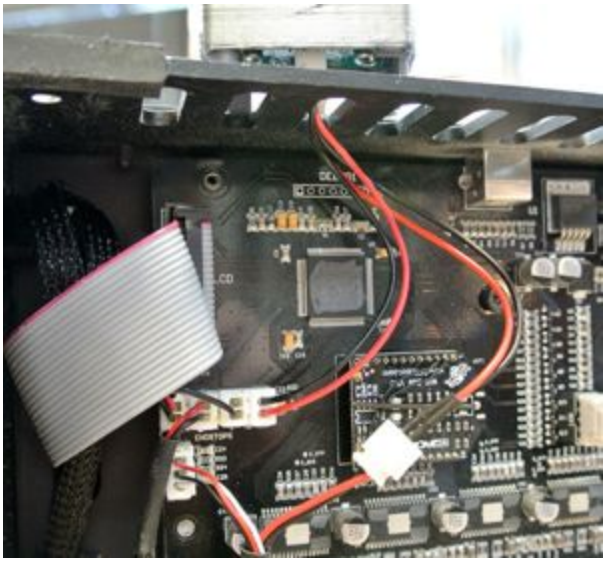
Switch the printer off, disconnect the power cable, and remove its bottom cover. This entails removing of four flat-head screws around the perimeter; instructions are available on the Zortrax website here (the support article is about changing the ribbon cable, but you do NOT have to change the ribbon cable to install the Z-Temp modifications, just take off the bottom cover). Take care when removing the bottom cover not to pull the cooling fan cable. Use pliers to disconect the cooling fan cable from the motherboard.

Identify and disconnect the bed temperature sensor cable. It is recommended to use pliers to grip the connector housing rather than pulling on the wires.



Insert the bed heater switch wiring harness through the third slot from the front on the printer chassis' right-hand side.

Connect the temperature sensor cable to the wiring harness's male connector and the wiring harness's female connector to the motherboard, where the sensor was formerly connected.



Snap the switch housing into the chassis, ensuring that the lettering is right-side up.

Re-install the bottom cover of the printer, reconnecting the cooling fan power cable in the process.

Bed Heater Switch Use

The bed heater switch has four positions:

0 – 30-35ºC
1 – 40-45º
2 – 50-55º
3 – Switch has no effect, full temperature (approximately 65º)

We like to use Position 0 with PLA for easiest raft removal. **Due to changes first implemented in M200 firmware 1.0, however, a specific procedure must be followed in order to use the minimal heat setting of Position 0.**

To use Position 0:

1. Set the switch to Position 0 before launching the print.
2. On launching the print, platform heating will be passed immediately, saving time, and the M200 display will show “Heating Extruder”.
3. While the extruder is heating, change the bed switch to Position 1.
4. After bed height sensing is finished (you will probably have used the shim to increase initial bed height for PLA) set the bed heat switch back to Position 0. Bed heating will stop soon thereafter and stay off during the print.

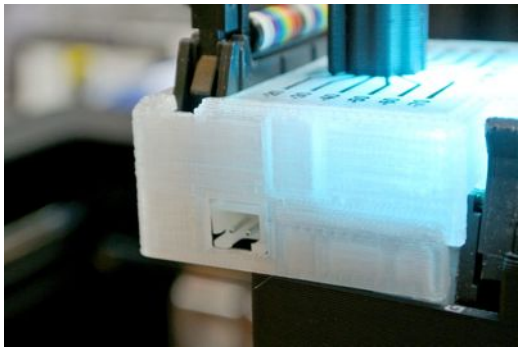
It is not necessary to follow this procedure if using beta firmware (anything prior to v1.0) in your M200.

Bed heater operation can be monitored via the blue LED under the M200’s print bed.

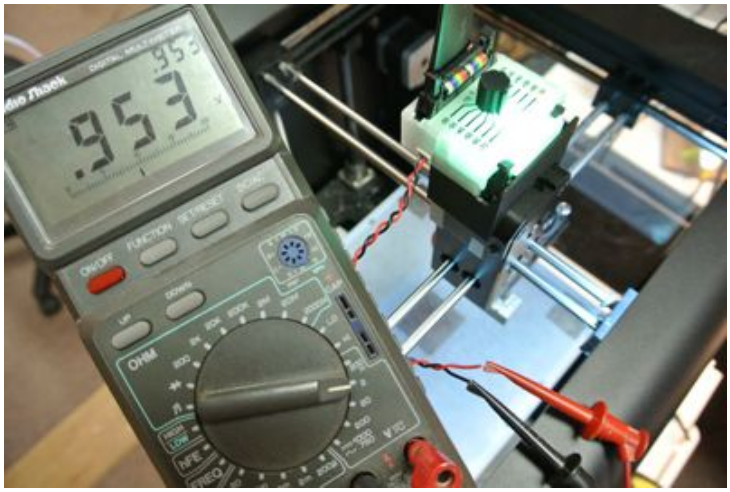
One more note: If for some reason you’re using M200 firmware v0.0.5 or earlier, the firmware polls the temperature sensor once at the start of a print, and infrequently or not at all thereafter. If you’re using this older firmware, it is necessary to set the bed heater switch to the desired position before launching a print. Changes to the switch position once a print operation has been launched may have no effect or may even prevent a print from ever starting. It may also be necessary to switch the printer off and back on again in order to cancel bed heating once it’s begun.

Temperature Monitor Output

On the left side of the Z-Temp is a 2-pin JST-XH connector to which can be connected an external multimeter or voltmeter.



The signal on this connector comes directly from the M200's temperature-sensing electronics, and will provide a real-time indication of the actual nozzle temperature (within the accuracy of the M200's thermocouple its signal-conditioning circuitry on the printhead PCB, which is typically about ±5ºC). The scale factor is 200ºC per Volt, so to get the temperature you simply multiply the voltage reading by 200: for example in the photo below the voltage is .953 volts, so the indicated nozzle temperature is 190.6ºC.



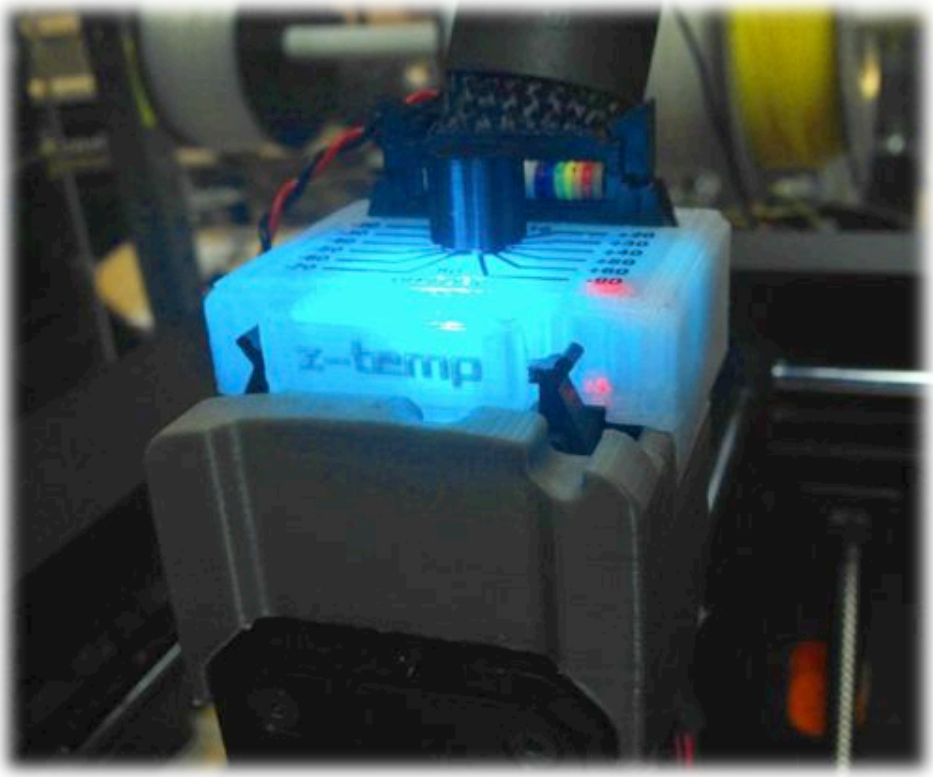
Because actual hotend temperature may be affected by motherboard converter errors, slicing parameters, fan speed, ambient temperature, etc., this feature is useful for verifying the actual temperature at any moment and for measuring nominal temperatures used by the Zortrax profiles.

Modified Extruder Head Cover

If desired, an extruder cover having a lower façade may be printed and installed in place of the original Zortrax part. This provides better access to the ejector levers, and better visibility of the illuminated front face of the Z-Temp and heater monitor LED.

Installation is simple, requiring removal of only the two screws holding the cover and extruder PCB to the stepper motor saddle. The STL for the low-façade part can be downloaded from:

http://www.z-temp.co/extruder_cover.stl



Temperature Range Selection

Z-Temp includes two "DIP switches" on the underside of its PCB, allowing you to select from among several different temperature ranges:

- The Default range of -90 to +60º of offset gives a wide range in easily-remembered 10-degree steps.
- Fine Resolution offers 5-degree steps between -80 and -10º of offset (195-265º when using Z-ABS profile) for increased control when printing with PLA and lignin-based materials, plus a 0 offset position. The Fine range does not include any settings for *increased* extruder temperature (positive offset).
- The Mixed range offers 5-degree steps from -85 to -35º of offset (190-240º actual with Z-ABS profile), and coarser steps from 250-325º.
- Finally, there's a "low-temperature" range for use with special materials such as wax, going down to -140º of offset while still offering higher temps for more common materials.

Your Z-Temp is shipped set to the Default range. To change the setting, remove any yellow protective tape from the switch and move the slider with a pen tip or other small pointed object.

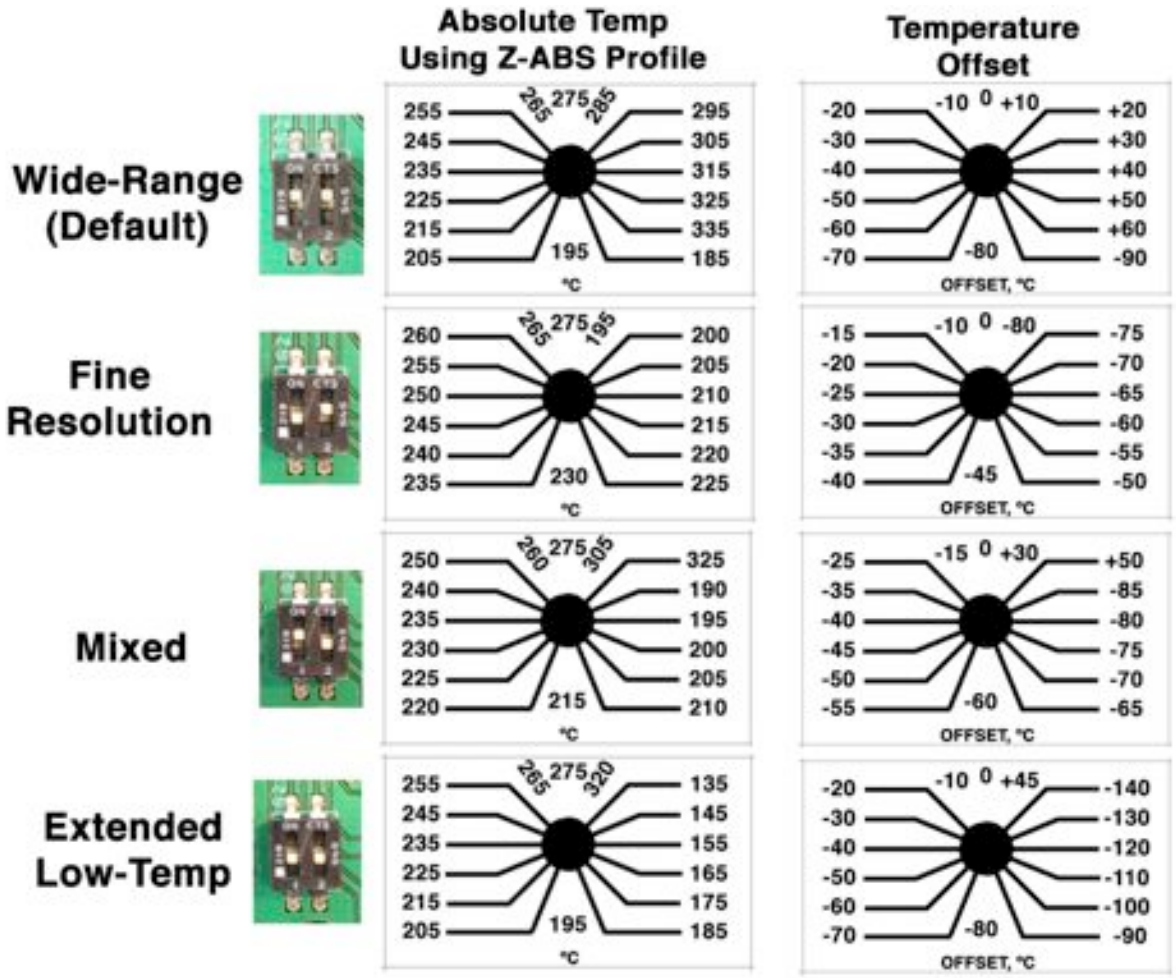
If you, like us, always slice with Z-Suite's Z-ABS profile (nominal temerature 275ºC), you may want to replace your Z-Temp's standard nameplate showing temperature offset with one showing actual temperature, so you don't have to do mental arithmetic to arrive at actual temperature. Printable PDF templates for relative and absolute nameplates for each of the available ranges are available for download from the Z-Temp website. Simply print and cut out the appropriate label from the templates linked to here, pull off the control knob, peel off the standard label, glue the new label to your Z-Temp, and replace the control knob. They look great printed on inkjet or laser transparency sheets available at most stationery stores (flip the artwork first so that the printed side ends up facing the Z-Temp) but it's fine to just print on paper, too.

Remember that the absolute scales only apply if you slice using the Z-ABS profile, and assume that the nominal profile temperature is 275ºC (which it has been in every version of Z-Suite from early days through 1.4.1).

Temperature Range Selection (continued)

NOTE: The absolute scales shown here are correct only if the nominal temperature of the Z-Suite profile used is 275ºC, which is the case for the Z-ABS profile in all recent versions.

Printable versions of these dial nameplate templates are available for download from the Z-Temp website.



Specifications

Temperature Error: Typically < 1ºC, maximum 2ºC (This is the accuracy of the Z-Temp's temperature offset settings – it does not include any errors in the M200's sensor or electronics)

Temperature Offset Range: -90 to +60ºC offset from M200 nominal, in sixteen 10-degree steps in normal range; -140 to +10ºC when the low-range option is selected.

ColorTemp™ Indicator Transition Temperatures (±2ºC, excluding any errors in the M200's sensor or electronics**):**

- < 120ºC – Blue-Green (cold)
- 120 – 190ºC – Blue (heating)
- 190 - 230ºC - Green (PLA)
- 230 - 240ºC - Yellow (Generic ABS)
- 240 - 260ºC - Orange (Generic ABS, Nylon)
- 260 - 280ºC - Red (High-temperature ABS)
- 280 - 290ºC - Pink
- 290 - 300ºC - Purple
- 300+ºC - White

Weight: 31g

Warranty and Disclaimers

The Z-Temp™ is warranted to perform as described when used as specified herein with the M200 printer together with Z-Suite 1.4.1 or earlier and M200 firmware 1.0.1 or earlier (compatibility information is updated with each new release on the Z-Temp website). No warranty is made as to its operation with future versions of Zortrax software or firmware.

The manufacturer and/or seller of the Z-Temp assumes no responsibility for damage to any 3D printer it is used with or any consequential damages of any kind resulting from its use. All risks are assumed by the user.

Use of third-party (non-Zortrax) filament will void the warranty of your Zortrax printer. Use of the Z-Temp may do so as well.

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