G-code

From RepRapWiki

English • العربية • български • català • česky • Deutsch • Ελληνικά • español • فارسی • français • hrvatski • magyar • italiano • română • 日本語 • 한국어 • lietuvių • Nederlands • norsk bokmål • polski • português • русский • Türkçe • українська • 中文（中国大陆） • 中文（台灣） • עברית •

This page tries to describe the flavour of **G-codes** that the RepRap firmwares use and how they work. The main target is additive fabrication using FFF processes. Codes for print head movements follow the NIST RS274NGC G-code standard (http://www.nist.gov/manuscript-publication-search.cfm?pub_id=823374) , so RepRap firmwares are quite usable for CNC milling and similar applications, too. See also on Wikipedia's G-code article (https://en.wikipedia.org/wiki/G-code) .

There are a few different ways to prepare GCode for a printer. One is to use a slicer like Slic3r, Skeinforge or Cura. These programs take a CAD model, slice it into layers, and output the GCode required for each layer. Slicers are the easiest way to go from a 3D model to a printed part, but the user sacrifices some flexibility when using them. Another option for GCode generation is to use a lower level library like mecode. Libraries like mecode give you precise control over the tool path, and thus are useful if you have a complex print that is not suitable for naive slicing. The final option is to just write the GCode yourself. This may be the best choice if you just need to run a few test lines while calibrating your printer.

As many different firmwares exist and their developers tend to implement new features without discussing strategies or looking what others did before them, a lot of different sub-flavours for the 3D-Printer specific codes developed over the years. But this is the master page for RepRap. Nowhere in here should the same code be used for two different things; there are always more numbers to use... The rule is: add your new code here, then implement it.

But human nature being what it is, things aren't always done that way, so some multiple uses of the same code exist. The rule is that later appearances by them on this page than the original use of a code are deprecated and should be changed, unless there is a good technical reason (like the general G-Code standard) why a later instance should be prefered. Note that the key date is appearance here, not date of implementation.

Contents

- 8.169 M373: End bed level calibration mode
- 8.170 M374: Save calibration grid
- 8.171 M375: Display matrix / Load Matrix
- 8.172 M380: Activate solenoid
- 8.173 M381: Disable all solenoids
- 8.174 M400: Wait for current moves to finish
- 8.175 M401: Lower z-probe
- 8.176 M402: Raise z-probe
- 8.177 M404: Filament width and nozzle diameter
- 8.178 M405: Filament Sensor on
- 8.179 M406: Filament Sensor off
- 8.180 M407: Display filament diameter
- 8.181 M408: Report JSON-style response
- 8.182 M420: Set RGB Colors as PWM and is also Enable/Disable Mesh Bed Leveling
- 8.183 M421: Set a Mesh Bed Leveling Z coordinate
- 8.184 M500: Store parameters in EEPROM
- 8.185 M501: Read parameters from EEPROM
- 8.186 M502: Revert to the default "factory settings."
- 8.187 M503: Print settings
- 8.188 M540: Enable/Disable "Stop SD Print on Endstop Hit"
- 8.189 M540: Set MAC address
- 8.190 M550: Set Name
- 8.191 M551: Set Password
- 8.192 M552: Set IP address
- 8.193 M553: Set Netmask
- 8.194 M554: Set Gateway
- 8.195 M555: Set compatibility
- 8.196 M556: Axis compensation
- 8.197 M557: Set Z probe point
- 8.198 M558: Set Z probe type
- 8.199 M559: Upload configuration file
- 8.200 M560: Upload web page file
- 8.201 M561: Set Identity Transform
- 8.202 M562: Reset temperature fault
- 8.203 M563: Define or remove a tool
- 8.204 M564: Limit axes
- 8.205 M565: Set Z probe offset
- 8.206 M566: Set allowable instantaneous speed change
- 8.207 M567: Set tool mix ratios
- 8.208 M568: Turn off/on tool mix ratios
- 8.209 M569: Set axis direction and enable values
- 8.210 M570: Set heater timeout
- 8.211 M571: Set output on extrude
- 8.212 M572: Set or report extruder elasticity compensation
- 8.213 M573: Report heater PWM
- 8.214 M574: Set endstop configuration
- 8.215 M575: Set serial comms parameters
- 8.216 M577: Wait until endstop is triggered
- 8.217 M578: Fire inkjet bits
- 8.218 M579: Scale Cartesian axes
- 8.219 M580: Select Roland
- 8.220 M600: Set line cross section
- 8.221 M600: Filament change pause
- 8.222 M605: Set dual x-carriage movement mode
- 8.223 M665: Set delta configuration
- 8.224 M666: Set delta endstop adjustment
- 8.225 M667: Select CoreXY mode
- 8.226 M668: Set Z-offset compensations polynomial
- 8.227 M700: Level plate
- 8.228 M701: Load filament
- 8.229 M702: Unload filament
- 8.230 M851: Set Z-Probe Offset
- 8.231 M906: Set motor currents
- 8.232 M907: Set digital trimpot motor
- 8.233 M908: Control digital trimpot directly
- 8.234 M909: Set microstepping
- 8.235 M910: Set decay mode
- 8.236 M928: Start SD logging
- 8.237 M997: Perform in-application firmware upgrade
- 8.238 M998: Request resend of line

Introduction

A typical piece of Gcode as sent to a RepRap machine might look like this:

```
N3 T0*57
N4 G92 E0*67
N5 G28*22
N6 G1 F1500.0*82
N7 G1 X2.0 Y2.0 F3000.0*85
N8 G1 X3.0 Y3.0*33
```

Gcode can also be stored in files on SD cards. A file containing RepRap Gcode usually has the extension **.g**, **.gco** or **.gcode**. Files for BFB/RapMan have the extension **.bfb**. Gcode stored in file or produced by a slicer might look like this:

```
G92 E0
G28
G1 F1500
G1 X2.0 Y2.0 F3000
G1 X3.0 Y3.0
```

The meaning of all those symbols and numbers (and more) is explained below.

Slicers will (optionally?) add GCode scripts to the beginning and end of their output file to perform specified actions before and/or after a print such as z-probing the build-area, heating/cooling the bed and hotend, performing ooze free "nozzle wipe" startup routine, switching system power on/off, and even "ejecting" parts. More info on the Start GCode routines and End GCode routines pages.

To find out which specific Gcode(s) are implemented in any given firmware, there are little tables attached to the command descriptions, like this one:

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	Yes	automatic	No	Partial	Experimental	depreciated	???	???	???	???	No	???

Here means:

{{yes}}
: The Gcode is fully supported by the firmware.

{{partial}} or {{experimental}}
: There is some support for the Gcode. Often it is required to check out the source code branch for the firmware (usually stored in a different branch) or to flip configuration switches on the mainboard.

automatic
: The firmware handles this Gcode automatically, so there's no need to send the command. An example is power supply on/off Gcode (M80/M81) in the Teacup firmware.

???
: It is unknown if the firmware supports this Gcode. You may want to test this yourself before using it in production.

{{no}}
: The firmware does not support this Gcode.

depreciated
: The firmware depreciated this Gcode. The firmware author(s) should amend the depreciated Gcode on this page with workarounds (if needed) and the last supported firmware version that will accept this Gcode.

For the technically minded, Gcode line endings are Unix Line Endings (**\n**), but will accept Windows Line Endings (**\r\n**), so you should not need to worry about converting between the two, but it is best practice to use Unix Line Endings where possible.

Fields

A RepRap Gcode is a list of fields that are separated by white spaces or line breaks. A field can be interpreted as a command, parameter, or for any other special purpose. It consists of one letter directly followed by a number, or can be only a stand-alone letter (Flag). The letter gives information about the meaning of the field (see the list below in this section). Numbers can be *integers* (128) or *fractional* numbers (12.42), depending on context. For example, an X coordinate can take integers (**X175**) or fractionals (**X17.62**), but selecting extruder number 2.76 would make no sense. In this description, the numbers in the fields are represented by **nnn** as a placeholder.

Letter	Meaning
Gnnn	Standard GCode command, such as move to a point
Mnnn	RepRap-defined command, such as turn on a cooling fan
Tnnn	Select tool nnn. In RepRap, tools are extruders
Snnn	Command parameter, such as time in seconds; temperatures; voltage to send to a motor
Pnnn	Command parameter, such as time in milliseconds; proportional (Kp) in PID Tuning
Xnnn	A X coordinate, usually to move to. This can be an Integer or Fractional number.
Ynnn	A Y coordinate, usually to move to. This can be an Integer or Fractional number.
Znnn	A Z coordinate, usually to move to. This can be an Integer or Fractional number.
Innn	Parameter - X-offset in arc move; integral (Ki) in PID Tuning
Jnnn	Parameter - Y-offset in arc move
Dnnn	Parameter - used for diameter; derivative (Kd) in PID Tuning
Hnnn	Parameter - used for heater number in PID Tuning
Fnnn	Feedrate in mm per minute. (Speed of print head movement)
Rnnn	Parameter - used for temperatures
Qnnn	Parameter - not currently used
Ennn	Length of extrudate. This is exactly like X, Y and Z, but for the length of filament to extrude. ~~It is common for newer stepper based systems to interpret ...~~ Better: Skeinforge 40 and up interprets this as the absolute length of input filament to consume, rather than the length of the extruded output.
Nnnn	Line number. Used to request repeat transmission in the case of communications errors.
*nnn	Checksum. Used to check for communications errors.

Comments

Gcode comments begin at a semicolon, and end at the end of the line:

```
N3 T0*57 ; This is a comment
N4 G92 E0*67
; So is this
N5 G28*22
```

Comments and white space will be ignored by your RepRap Printer. It's better to strip these out on the host computer before sending the Gcode to your printer, as this saves bandwidth.

Special fields

N: Line number

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	???	Yes	???	Yes	???	?	???		

Example: N123

If present, the line number should be the first field in a line. For G-code stored in files on SD cards the line number is usually omitted.

If checking is supported, the RepRap firmware expects line numbers to increase by 1 each line, and if that doesn't happen it is flagged as an error. But you can reset the count using M110 (see below).

Although supported, usage of N in Machinekit is discouraged as it serves no purpose.

*: Checksum

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	???	Yes	???	???	???	?	???		

Example: *71

If present, the checksum should be the last field in a line, but before a comment. For G-code stored in files on SD cards the checksum is usually omitted.

If checking is supported, the RepRap firmware checks the checksum against a locally-computed value and, if they differ, requests a repeat transmission of the line of the given number.

Checking

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	???	Yes	???	???	???	?	???		

Example: N123 [...G Code in here...] *71

The RepRap firmware checks the line number and the checksum. You can leave both of these out - RepRap will still work, but it won't do checking. You have to have both or neither though. If only one appears, it produces an error.

The checksum "cs" for a GCode string "cmd" (including its line number) is computed by exor-ing the bytes in the string up to and not including the * character as follows:

```
int cs = 0;
for(i = 0; cmd[i] != '*' && cmd[i] != NULL; i++)
   cs = cs ^ cmd[i];
cs &= 0xff;  // Defensive programming...
```

and the value is appended as a decimal integer to the command after the * character.

Buffering

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	???	???	???	???	Yes	???	???	???	Yes	???		

If buffering is supported, the RepRap firmware stores some commands in a ring buffer internally for execution. This means that there is no (appreciable) delay while a command is acknowledged and the next transmitted. In turn, this means that sequences of line segments can be plotted without a dwell between one and the next. As soon as one of these buffered commands is received it is acknowledged and stored locally. If the local buffer is full, then the acknowledgment is delayed until space for storage in the buffer is available. This is how flow control is achieved.

Typically, the following moving commands are buffered: G0-G3 and G28-G32. The Teacup Firmware buffers also some setting commands: G20, G21, G90 and G91. All other G, M or T commands are not buffered.

RepRapFirmware also implements an internal queue to ensure that certain codes (like M106) are executed in the right order and not when the last move has been added to the look-ahead queue. This feature is not available in RepRapFirmware-dc42.

When an unbuffered command is received it is stored, but it is not acknowledged to the host until the buffer is exhausted and then the command has been executed. Thus the host will pause at one of these commands until it has been done. Short pauses between these commands and any that might follow them do not affect the performance of the machine.

G-commands

G0 & G1: Move

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		

- G0 : Rapid linear Move
- G1 : Linear Move

Usage
    G0 Xnnn Ynnn Znnn Ennn Fnnn Snnn
    G1 Xnnn Ynnn Znnn Ennn Fnnn Snnn
Parameters

*Not all parameters need to be used, but at least **one** has to be used*
Xnnn The position to move to on the X axis
Ynnn The position to move to on the Y axis
Znnn The position to move to on the Z axis
Ennn The amount to extrude between the starting point and ending point
Fnnn The feedrate per minute of the move between the starting point and ending point (if supplied)
Snnn Flag to check if an endstop was hit *(**S1** to check, **S0** to ignore, **S2** see note, default is **S0**)*[1]

Examples
G0 X12 *(move to 12mm on the X axis)*
G0 F1500 *(Set the feedrate to 1500mm/minute)*
G1 X90.6 Y13.8 E22.4 *(Move to 90.6mm on the X axis and 13.8mm on the Y axis while extruding 22.4mm of material)*

The RepRap firmware spec treats G0 and G1 as the same command, since it's just as efficient as not doing so.[2]

Most RepRap firmwares do subtle things with feedrates.

```
1. G1 F1500
2. G1 X50 Y25.3 E22.4
```

In the above example, we set the feedrate to 1500mm/minute on line 1, then move to 50mm on the X axis and 25.3mm on the Y axis while extruding 22.4mm of filament between the two points.

```
1. G1 F1500
2. G1 X50 Y25.3 E22.4 F3000
```

However, in the above example, we set a feedrate of 1500 mm/minute on line 1, then do the move described above accelerating to a feedrate of 3000 mm/minute as it does so. The extrusion will accelerate along with the X and Y movement, so everything stays synchronized.

The RepRap spec treats the feedrate as simply another variable (like X, Y, Z, and E) to be linearly interpolated. This gives complete control over the acceleration and deceleration of the printer head in such a way that ensures that everything moves smoothly together, and the right volume of material is extruded at all points.[3]

To reverse the extruder by a given amount (for example to reduce its internal pressure while it does an in-air movement so that it doesn't dribble) simply use G0 or G1 to send an E value that is less than the currently extruded length.

Notes

[1]Some firmwares allow for the RepRap to enable or disable the "sensing" of endstops during a move. Please check with whatever firmware you are using to see if they support the S parameter in this way, as damage may occur if you assume incorrectly. In RepRapFirmware, using the S1 or S2 parameter on a delta printer causes the XYZ parameters to refer to the individual tower motor positions instead of the head position, and to enable endstop detection as well if the parameter is S1.

[2]In the RS274NGC Spec, G0 is *Rapid Move*, which was used to move between the current point in space and the new point as quickly and efficiently as possible, and G1 is *Controlled Move*, which was used to move between the current point in space and the new point as precise as possible.

[3]Some firmwares may not support setting the feedrate inline with a move.

[4]RepRapFirmware provides an additional 'R1' parameter to tell the machine to go back to the coordinates a print was previously paused at. If this parameter is used and the code contains axis letters, an offset will be added to the pause coordinates (e.g. G1 R1 Z5).

Some older machines, CNC or otherwise, used to move faster if they did not move in a straight line. This is also true for some non-Cartesian printers, like delta or polar printers, which move easier and faster in a curve.

G2 & G3: Controlled Arc Move

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes[1]	Yes	Yes	No	No	Yes	???	Yes	Experimental

Usage
G2 Xnnn Ynnn Innn Jnnn Ennn Fnnn *(Clockwise Arc)*
G3 Xnnn Ynnn Innn Jnnn Ennn Fnnn *(Counter-Clockwise Arc)*
Parameters
Xnnn The position to move to on the X axis
Ynnn The position to move to on the Y axis
Innn The point in X space from the current X position to maintain a constant distance from

Jnnn The point in Y space from the current Y position to maintain a constant distance from
Ennn The amount to extrude between the starting point and ending point
Fnnn The feedrate per minute of the move between the starting point and ending point (if supplied)

Examples

G2 X90.6 Y13.8 I5 J10 E22.4 *(Move in a Clockwise arc from the current point to point (X=90.6,Y=13.8), with a center point at (X=current_X+5, Y=current_Y+10), extruding 22.4mm of material between starting and stopping)*
G3 X90.6 Y13.8 I5 J10 E22.4 *(Move in a Counter-Clockwise arc from the current point to point (X=90.6,Y=13.8), with a center point at (X=current_X+5, Y=current_Y+10), extruding 22.4mm of material between starting and stopping)*

Notes

[1]In Marlin Firmware not implemented for **DELTA** and **SCARA** printers.

G4: Dwell

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Parameters

Pnnn Time to wait, in milliseconds
Snnn Time to wait, in seconds (Only on Marlin and Smoothie)

Example

G4 P200

In this case sit still doing nothing for 200 milliseconds. During delays the state of the machine (for example the temperatures of its extruders) will still be preserved and controlled.

On Marlin and Smoothie, the "S" parameter will wait for seconds, while the "P" parameter will wait for milliseconds. "G4 S2" and "G4 P2000" are equivalent.

G10: Tool Offset

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	Yes	???	No	???

Usage

G10 Pnnn Xnnn Ynnn Znnn Rnnn Snnn[1]

Parameters

Pnnn Tool number
Xnnn X offset
Ynnn Y offset
Znnn Z offset[2]
Rnnn Standby temperature(s)
Snnn Active temperature(s)

Examples

G10 P2 X17.8 Y-19.3 Z0.0 *(sets the offset for tool (or in older implementations extrude head) 2 to the X, Y, and Z values specified)*
G10 P1 R140 S205 *(set standby and active temperatures[3] for tool 1)*

Remember that any parameter that you don't specify will automatically be set to the last value for that parameter. That usually means that you want explicitly to set Z0.0. RepRapFirmware will report the tool parameters if only the tool number is specified.

The R value is the standby temperature in ^{o}C that will be used for the tool, and the S value is its operating temperature. If you don't want the tool to be at a different temperature when not in use, set both values the same. See the T code (select tool) below. In tools with multiple heaters the temperatures for them all are specified thus: R100.0:90.0:20.0 S185.0:200.0:150.0 .

Notes

[1]Marlin and Smoothie use G10/G11 for executing a retraction/unretraction move. The RepRapPro version of Marlin supports G10 for tool offset.

[2]It's usually a bad idea to put a non-zero Z value in as well unless the tools are loaded and unloaded by some sort of tool changer. When all the tools are in the machine at once they should all be set to the same Z height.

[3]If the absolute zero temperature (-273.15) is passed as active and standby temperatures, RepRapFirmware will only switch off the tool heater(s) without changing their preset active or standby temperatures. RepRapFirmware-dc42 does not support this setting.

[4]The NIST G-code standard (http://www.nist.gov/customcf/get_pdf.cfm?pub_id=823374) mentions an additional L parameter, which is ignored. This command is subject to discussion.

G10: Retract

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes: 0.92	Yes	No	No	No	???	No	???		

Parameters
 Snnn retract length (S1 = long retract, S0 = short retract = default) (Repetier only)
Example
 G10

Retracts filament according to settings of M207 (Marlin) or according to the S value (Repetier).

G11: Unretract

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes: 0.92	Yes	No	No	No	???	No	???		

Parameters
 Snnn retract length (S1 = long retract, S0 = short retract = default) (Repetier only)
Example
 G11

Unretracts/recovers filament according to settings of M208 (Marlin) or according to the S value (Repetier).

G17..19: Plane Selection (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	Yes	???	Yes	???		

These codes set the current plane as follows:

- G17 : XY (default)
- G18 : ZX
- G19 : YZ

G20: Set Units to Inches

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	???	Yes	???		

Example
 G20

Units from now on are in inches.

G21: Set Units to Millimeters

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	???	Yes	Yes		

Example
 G21

Units from now on are in millimeters. (This is the RepRap default.)

G22 & G23: Firmware controlled Retract/Precharge

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	Yes	???	No	???		

Usage

G22 ; Retract
G23 ; Unretract/Precharge

Relying on machine's firmware to execute extrusion retract/precharge move, instead of having slicer generating to E axis G1 movement. The retract/precharge length, velocity is handled by the machine firmware.

G28: Move to Origin (Home)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Parameters

This command can be used without any additional parameters.
X Flag to go back to the X axis origin
Y Flag to go back to the Y axis origin
Z Flag to go back to the Z axis origin

Examples

G28 *(Go to origin on all axes)*
G28 X Z *(Go to origin only on the X and Z axis)*

When the RepRap firmware receives this command, it moves all (or the supplied) axis's back to the zero endstops as quickly as it can, then backs off by a millimeter and slowly moves back to the zero endstop activation points to increase position accuracy. This process is also known as "*Homing*".

If you add coordinates, these coordinates are ignored. For example, `G28 Z0.00` results in the same behaviour as `G28 Z`.

RepRapFirmware runs macro files to home either all axes or an individual one. If all axes are homed, the file **homeall.g** will be processed, and **homex.g**, **homey.g**, or **homez.g** if individual axes are homed. On a Delta printer, any G28 command will home all three towers by processing the **homedelta.g** file, regardless of any XYZ letters.

G29: Detailed Z-Probe

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	Yes	No, see G32	No, see G32	No	Yes	???	No	Yes

Example: G29

Probes the bed at 3 or more points. The printer must be homed with G28 before G29.

G29.1: Set Z probe head offset

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	Yes	???	No	???

Example: G29.1 X30 Y20 Z0.5

Set the offset of the Z probe head. The offset will be subtracted from all probe moves.

G29.2: Set Z probe head offset calculated from toolhead position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	Yes	???	No	???

Example: G29.2 Z0.0

Set the offset of the Z probe head. The offset will be subtracted from all probe moves. The calculated value is derived from the distance of the toolhead from the current axis zero point.

The user would typically place the toolhead at the zero point of the axis and issue the G29.2 command.

G30: Single Z-Probe

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	Yes	Yes	Yes	No	Yes	???	No	Yes

Usage

G30 Pnnn Xnnn Ynnn Znnn Hnnn Snnn

Parameters

Pnnn Probe point number
Xnnn X coordinate
Ynnn Y coordinate
Znnn Z coordinate
Hnnn Height correction[1]
Snnn Set parameter

Examples

G30
G30 P1 X20 Y50 Z0.3
G30 P3 X180 Y180 Z-99999 S1

In its simplest form probes bed at current XY location. If G30 without parameters is called in RepRapFirmware, the bed is not probed, but the current Z value will be used as trigger height and the 'H' value (if specified) will be omitted.

Some implementations allow more general behaviour: if a Pn field is specified the probed X, Y, and Z values are saved as point n on the bed for calculating the offset plane. Generally n is 0, 1, or 2. If X, or Y, or Z values are specified (e.g. G30 P1 X20 Y50 Z0.3) then those values are used instead of the machine's current coordinates. A silly Z value (less than -9999.0) causes the machine to probe at the current point to get Z, rather than using the given value. If an S field is specified (e.g. G30 P1 Z0.3 S) the bed plane is computed for compensation and stored. The combination of these options allows for the machine to be moved to points using G1 commands, and then probe the bed, or for the user to position the nozzle interactively and use those coordinates. The user can also record those values and place them in a setup GCode file for automatic execution.

RepRapFirmware uses the value of the S parameter to specify what computation to perform. If the value is -1 then the Z offsets of all the points probed are printed, but no calibration is done. If the value is zero or not present, then this specified that the number of factors to be calibrated is the same as the number of points probed. Otherwise, the value indicates the number of factors to be calibrated, which must be no greater than the number of points probed. Currently (as of version 1.09), the number of factors may be 3, 4 or 5 when doing auto bed compensation on a Cartesian or CoreXY printer, and 3, 4, 6 or 7 when doing auto calibration of a Delta printer.

Notes

[1]Recent RepRapFirmware versions support an optional H parameter, which is a height correction to be added to the trigger height set by the G31 Z parameter. It allows for the Z probe having a trigger height that varies with XY position.

G31: Set or Report Current Probe status

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	???	Yes	Yes	No	No	???	No	???		

Usage

G31 Pnnn Xnnn Ynnn Znnn Cnnn Snnn

Parameters

Pnnn Trigger value
Xnnn Probe X offset[1]
Ynnn Probe Y offset[1]
Znnn Trigger Z height
Cnnn Temperature coefficient[2]
Snnn Calibration temperature[2]

Examples

G31 P500 Z2.6
G31 X16.0 Y1.5

When used on its own this reports whether the Z probe is triggered, or gives the Z probe value in some units if the probe generates height values. If combined with a Z and P field (example: G31 P312 Z0.7) this will set the Z height to 0.7mm when the Z-probe value reaches 312 when a G28 Z0 (zero Z axis) command is sent. The machine will then move a further -0.7mm in Z to place itself at Z = 0. This allows non-contact measuring probes to approach but not touch the bed, and for the gap left to be allowed for. If the probe is a touch probe and generates a simple 0/1 off/on signal, then G31 Z0.7 will tell the RepRap machine that it is at a height of 0.7mm when the probe is triggered.

In RepRapFirmware, separate G31 parameters may be defined for different probe types (i.e. 0+4 for switches, 1+2 for IR probes and 3 for alternative sensors). To specify which probe you are setting parameters for, send a M558 command to select the probe type before sending the G31 command.

Notes

[1]X and Y offsets of the Z probe relative to the print head (i.e. the position when the empty tool is selected) can be specified in RepRapFirmware. This allows you to calculate your M557 probe coordinates based on the geometry of the bed, without having to correct them for Z probe X and Y offset. It also provides more accurate bed compensation.

[2]In RepRapFirmware, additional parameters 'S' (bed temperature in °C at which the specified Z parameter is correct, default is current bed temperature) and 'C' (temperature coefficient of Z parameter in mm/°C, default zero) can be set for the alternative (ultrasonic) sensor. This is useful for probes that are affected by temperature.

G32: Probe Z and calculate Z plane

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No: See G29	???	Yes	Yes	No	No	???	No	???		

Usage

G32

Probes the bed at 3 or more pre-defined points (see M557) and updates transformation matrix for bed leveling compensation.

RepRapFirmware executes macro file **bed.g** if present instead of using the M557 coordinates.

G31: Dock Z Probe sled

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	No	???	No	???		

G32: Undock Z Probe sled

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	No	???	No	???		

G38.x Straight Probe (CNC specific)

G38.2 probe toward workpiece, stop on contact, signal error if failure

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	Yes	???		

G38.3 probe toward workpiece, stop on contact

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	Yes	???		

G38.4 probe away from workpiece, stop on loss of contact, signal error if failure

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	Yes	???		

G38.5 probe away from workpiece, stop on loss of contact

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	Yes	???		

G40: Compensation Off (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	Yes	???	Yes	???		

G40 turn cutter compensation off. If tool compensation was on the next move must be a linear move and longer than the tool diameter. It is OK to turn compensation off when it is already off.

G54..59: Coordinate System Select (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	Yes	???	Yes	???		

See linuxcnc.org (http://linuxcnc.org/docs/html/gcode/gcode.html#sec:G54-G59_3) for more help

G80: Cancel Canned Cycle (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	Yes	???		

It cancel canned cycle modal motion. G80 is part of modal group 1, so programming any other G code from modal group 1 will also cancel the canned cycle.

G90: Set to Absolute Positioning

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	???	Yes	Yes		

Example: G90

All coordinates from now on are absolute relative to the origin of the machine. (This is the RepRap default.)

G91: Set to Relative Positioning

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	???	Yes	Yes		

Example: G91

All coordinates from now on are relative to the last position.

G91.x: Reset Coordinate System Offsets (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	Yes	???		

- G91.1 - reset axis offsets to zero and set parameters 5211 - 5219 to zero. (X Y Z A B C U V W)
- G91.2 - reset axis offsets to zero.

G92: Set Position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		

Parameters

This command can be used without any additional parameters.
Xnnn new X axis position
Ynnn new Y axis position
Znnn new Z axis position
Ennn new extruder position

Example

G92 X10 E90

Allows programming of absolute zero point, by reseting the current position to the values specified. This would set the machine's X coordinate to 10, and the extrude coordinate to 90. No physical motion will occur.

A G92 without coordinates will reset all axes to zero.

G93: Feed Rate Mode (Inverse Time Mode) (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	???	???	???	???	???	???	No	???	???	???	Yes	???

G93 is Inverse Time Mode. In inverse time feed rate mode, an F word means the move should be completed in (one divided by the F number) minutes. For example, if the F number is 2.0, the move should be completed in half a minute.

When the inverse time feed rate mode is active, an F word must appear on every line which has a G1, G2, or G3 motion, and an F word on a line that does not have G1, G2, or G3 is ignored. Being in inverse time feed rate mode does not affect G0 (rapid move) motions.

G94: Feed Rate Mode (Units per Minute) (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	???	???	???	???	???	???	No	???	???	???	Yes	???

G94 is Units per Minute Mode. In units per minute feed mode, an F word is interpreted to mean the controlled point should move at a certain number of inches per minute, millimeters per minute, or degrees per minute, depending upon what length units are being used and which axis or axes are moving.

G100: Calibrate floor or rod radius

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	Yes: 0.92	No	No	No	No	???	No	???

Parameters

X Flag to set floor for X axis
Y Flag to set floor for Y axis
Z Flag to set floor for Z axis
Rnnn Radius to add

Examles

G100 X Y Z *(set floor for argument passed in. Number ignored and may be absent.)*
G100 R5 *(Add 5 to radius. Adjust to be above floor if necessary)*
G100 R0 *(Set radius based on current z measurement. Moves all axes to zero)*

G130: Set digital potentiometer value

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	Yes	No	???

Example: G130 X10 Y18 Z15 A20 B12

Set the digital potentiometer value for the given axes. This is used to configure the current applied to each stepper axis. The value is specified as a value from 0-127; the mapping from current to potentimeter value is machine specific.

G131: Remove offset

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	Yes: 0.91	No	No	No	No	???	No	???

G132: Calibrate endstop offsets

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	Yes: 0.91	No	No	No	No	???	No	???

G133: Measure steps to top

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	Yes: 0.91	No	No	No	No	???	No	???

G161: Home axes to minimum

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	No	No	No	No	No	No	No	Yes	No	???

Parameters

X Flag to home the X axis to its minimum position
Y Flag to home the Y axis to its minimum position
Z Flag to home the Z axis to its minimum position
Fnnn Desired feedrate for this command

Example

G161 X Y Z F1800

Instruct the machine to home the specified axes to their minimum position. Similar to G28, which decides on its own in which direction to search endstops.

G162: Home axes to maximum

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	No	No	No	No	No	No	No	Yes	No	???		

Parameters

X Flag to home the X axis to its maximum position
Y Flag to home the Y axis to its maximum position
Z Flag to home the Z axis to its maximum position
Fnnn Desired feedrate for this command

Example

G162 X Y Z F1800

Instruct the machine to home the specified axes to their maximum position.

M-commands

M0: Stop or Unconditional stop

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	No	Yes	No	No	Yes	No	Yes	???	Yes	???		

Parameters

This command can be used without any additional parameters.
Pnnn Time to wait, in milliseconds[1]
Snnn Time to wait, in seconds[2]

Example

M0

The RepRap machine finishes any moves left in its buffer, then shuts down. All motors and heaters are turned off. It can be started again by pressing the reset button on the master microcontroller, although this step is not mandatory on RepRapFirmware. See also M1, M112.

The Marlin Firmware does wait for user to press a button on the LCD, or a specific time. "M0 P2000" waits 2000 milliseconds, "M0 S2" waits 2 seconds.

RepRapFirmware executes macro file **stop.g** before everything is turned off. Apart from that, RepRapFirmware (v1.09n-ch) accepts an extra 'H' parameter, whose value must be non-zero, to keep all heaters active. This is what Duet Web Control v1.07 sends to cancel a paused print.

Notes

[1]Not available in RepRapFirmware, but as a work-around G4 can be run before M0.

[2]Only available on Marlin.

M1: Sleep or Conditional stop

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	???	No	Yes	No	No	Yes	No	No	???	Yes	???		

Example

M1

The RepRap machine finishes any moves left in its buffer, then shuts down. All motors and heaters are turned off. It can still be sent G and M codes, the first of which will wake it up again. See also M0, M112.

The Marlin Firmware does the same as M0.

If Marlin is emulated in RepRapFirmware, this does the same as M25 if the code was read from a serial or Telnet connection, else the macro file **sleep.g** is run before all heaters and drives are turned off.

M2: Program End

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	No	No	No	???	No	No	No	???	Yes	???		

Example: M2

Teacup firmware does the same as M84.

M3: Spindle On, Clockwise (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	No	No	No	Yes	Yes	No	No	???	Yes	???		

Parameters
    Snnn Spindle RPM
Example
    M3 S4000

The spindle is turned on with a speed of 4000 RPM.

Teacup firmware turn extruder on (same as M101).

RepRapFirmware interprets this code only if a Roland mill has been configured.

M4: Spindle On, Counter-Clockwise (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	Yes	???		

Example: M4 S4000

The spindle is turned on with a speed of 4000 RPM.

M5: Spindle Off (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	No	No	No	Yes	No	No	No	???	Yes	???		

Example: M5

The spindle is turned off.

Teacup firmware turn extruder off (same as M103).

M6: Tool change

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	No	No	No	???	No	No	No	???	No	???		

Example: M6

M7: Mist Coolant On (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	use M106	No	No	No	No	No	No	No	???	Yes	???		

Example: M7

Mist coolant is turned on (if available)

Teacup firmware turn on the fan, and set fan speed (same as M106).

M8: Flood Coolant On (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	use M106	No	No	No	No	No	No	No	???	Yes	???		

Example: M8

Flood coolant is turned on (if available)

M9: Coolant Off (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	use M106	No	No	No	No	No	No	No	???	Yes	???		

Example: M9

All coolant systems are turned off.

M10: Vacuum On (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	use M106	No	No	No	No	No	No	No	???	No	???		

Example: M10

Dust collection vacuum system turned on.

M11: Vacuum Off (CNC specific)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	use M106	No	No	No	No	No	No	No	???	No	???		

Example: M11

Dust collection vacuum system turned off.

M17: Enable/Power all stepper motors

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	(automatic)	No	Yes	No	Yes	No	No	No	???	No	Yes		

Example: M17

M18: Disable all stepper motors

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	use M2	No	call M84	No	Yes	Yes	No	No	Yes	No	Yes		

Parameters

This command can be used without any additional parameters.[1]
X X axis
Y Y axis
Z Z axis
E Extruder drive(s)[2]

Examples

M18
M18 X E0

Disables stepper motors and allows axes to move 'freely.'

Notes

[1]Some firmware implementations do not support parameters to be passed, but at least Marlin and RepRapFirmware do.

[2]RepRapFirmware allows stepper motors to be disabled selectively. For example, M18 X E0:2 will disable the X, extruder 0 and extruder 2 motors.

M20: List SD card

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Parameters

This command can be used without any additional parameters.

Snnn Output style[1]

Pnnn Directory to list[2]

Examples

M20

M20 P/gcodes/subdir S2

This code lists all files in the root folder or G-code directory of the SD card to the serial port. One name per line, like:

```
ok
SQUARE.G
SQCOM.G
ZCARRI~2.GCO
CARRIA~1.GCO
```

On Marlin, a file list response is usually encapsulated. Standard configurations of RepRapFirmware mimic this style in emulation mode:

```
Begin file list:
SQUARE.G
ZCARRI~2.GCO
End file list
ok
```

If RepRapFirmware emulates no firmware compatibility, a typical response looks like:

```
GCode files:
"Traffic cone.g","frog.gcode","calibration piece.g"
```

Note that some firmwares list file names in upper case, but - when sent to the M23 command (below) they must be in lower case. Teacup and RepRapFirmware have no such trouble and accept both. Besides, RepRapFirmware always returns long filenames in the case in which they are stored.

Notes

[1]This parameter is only supported by RepRapFirmware and defaults to the /gcodes directory, which would be whatever directory printable gcode files are normally stored in on other firmware.

[2]If the S2 parameter is used on RepRapFirmware, then the file list is returned in JSON format as a single array called "files" with each name that corresponds to a subdirectory preceded by an asterisk, and the directory is returned in variable "dir".

M21: Initialize SD card

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	Yes	No	No	No	???	No	No		

Example: M21

The SD card is initialized. If an SD card is loaded when the machine is switched on, this will happen by default. SD card must be initialized for the other SD functions to work.

M22: Release SD card

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	No	No	No	No	???	No	???		

Example: M22

SD card is released, so further (accidental) attempts to read from it are guaranteed to fail. Helpful, but not mandatory before removing the card physically.

M23: Select SD file

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M23 filename.gco

The file specified as filename.gco (8.3 naming convention is supported) is selected ready for printing. RepRapFirmware supports long filenames as well as 8.3 format.

M24: Start/resume SD print

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M24

The machine prints from the file selected with the M23 command. If the print was previously paused with M25, printing is resumed from that point. To restart a file from the beginning, use M23 to reset it, then M24.

When this command is used to resume a print that was paused, RepRapFirmware runs macro file **resume.g** prior to resuming the print.

M25: Pause SD print

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M25

The machine pauses printing at the current position within the file. To resume printing, use M24. Do not use this code to pause the print in a G-code file, use M226 instead.

Prior to pausing, RepRapFirmware runs macro file **pause.g**. This allows the head to be moved away from the print, filament to be retracted, etc.

M26: Set SD position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	aborts	Yes	No	No	???	No	???		

Parameters
Snnn File position in bytes
Example
M26

Set SD position in bytes (M26 S12345).

M27: Report SD print status

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M27

Report SD print status.

Marlin and recent forks of RepRapFirmware report the number of bytes processed in this format, which can be processed by Pronterface:

```
SD printing byte 2134/235422
```

If no file is being printed, only this message is reported:

```
Not SD printing.
```

M28: Begin write to SD card

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M28 filename.gco

File specified by filename.gco is created (or overwritten if it exists) on the SD card and all subsequent commands sent to the machine are written to that file.

M29: Stop writing to SD card

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	No	Yes	No	No	???	No	???		

Example
M29 filename.gco

File opened by M28 command is closed, and all subsequent commands sent to the machine are executed as normal.

M30: Delete a file on the SD card

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	Yes	No	No	???	Yes	???		

Example: M30 filename.gco
filename.gco is deleted.

M30 in grbl

M30 exchange pallet shuttles and end the program. Pressing cycle start will start the program at the beginning of the file.

M31: Output time since last M109 or SD card start to serial

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

Example
M31

The response looks like:

```
echo:54 min, 38 sec
```

M32: Select file and start SD print

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	Yes	Yes	No	No	???	No	???		

Example
M32 filename.gco

It can be used when printing from SD card and does the same as M23 and M24.

tba available in marlin(14/6/2014)

M33: Get the long name for an SD card file or folder

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	No	No	No	???	No	???

Get the long name for a file or folder on the SD card from a dos path. Introduced in Marlin firmware 1.1.0 September 2015.

M34: Set SD file sorting options

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	No	No	No	???	No	???

Enable and disable SD card file-sorting, and/or set the folder sorting order. Proposed by Marlin firmware, May 2015.

M36: Return file information

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	No	No	No

Example
    M36 filename.gco

Returns information for the specified SD card file in JSON format. A sample response is:

{"err":0,"size":457574,"height":4.00,"layerHeight":0.25,"filament":[6556.3],"generatedBy":"Slic3r 1.1.7 on 2014-11-09 at 17:11:32"}

The "err" field is zero if successful, nonzero if the file was not found or an error occurred while processing it. The "size" field should always be present if the operation was successful. The presence or absence of other fields depends on whether the corresponding values could be found by reading the file. The "filament" field is an array of the filament lengths required from each spool. The size is in bytes, all other values are in mm. The fields may appear in any order, and additional fields may be present.

If the file name parameter is not supplied and a file on the SD card is currently being printed, then information for that file is returned including additional field "fileName". This feature is used by the web interface and by PanelDue, so that if a connection is made when a file is already being printed, the name and other information about that file can be shown.

M37: Simulation mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	dc42	No	No	???	No	???

Used to switch between printing mode and simulation mode. Simulation mode allows the electronics to compute an accurate printing time, taking into account the maximum speeds, accelerations etc. that are configured.

M37 S1 enters simulation mode. All G and M codes will not be acted on, but the time they take to execute will be calculated.

M37 S0 leaves simulation mode.

M37 with no S parameter prints the time taken by the simulation, from the time it was first entered using M37 S1, up to the current point (if simulation mode is still active) or the point that the simulation was ended (if simulation mode is no longer active).

M40: Eject

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

If your RepRap machine can eject the parts it has built off the bed, this command executes the eject cycle. This usually involves cooling the bed and then performing a sequence of movements that remove the printed parts from it. The X, Y and Z position of the machine at the end of this cycle are undefined (though they can be found out using the M114 command, q.v.).

See also M240 and M241 below.

M41: Loop

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

Example: M41

If the RepRap machine was building a file from its own memory such as a local SD card (as opposed to a file being transmitted to it from a host computer) this goes back to the beginning of the file and runs it again. So, for example, if your RepRap is capable of ejecting parts from its build bed then you can set it printing in a loop and it will run and run. Use with caution - the only things that will stop it are:

1. When you press the reset button,
2. When the build material runs out (if your RepRap is set up to detect this), and
3. When there's an error (such as a heater failure).

M42: Switch I/O pin

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes	Yes	No	Yes	No	No	No	No	No

Parameters
Pnnn Pin number
Snnn Pin value
Example
M42 P7 S255

M42 switches a general purpose I/O pin. Use M42 Px Sy to set pin x to value y, when omitting Px the LEDPIN will be used.

In Teacup, general purpose devices are handled like a heater, see M104.

In RepRapFirmware, only 1 and 0 are supported for the S field. On Duet hardware, the supported pin numbers and their names on the expansion connector are:

16 TXD1, 17 RXD1, 18 TXD0, 19 RXD0, 20 TWD1, 21 TWCK1, 23 RTS1, 36 PC4_PWML1, 52 AD14, 66 AD13, 67 PB16.

On RADDS hardware running RepRapFirmware-dc42, the supported Arduino Due pin numbers and their names are:

5 TIOA6, 6 PWML7, 39 PWMH2, 58 AD3, 59 AD2, 66 DAC0, 67 DAC1, 68 CANRX0, 69 CANTX0, 70 SDA1, 71 SCL1, 72 RX LED, 73 TX LED.

M43: Stand by on material exhausted

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

Example: M43

If your RepRap can detect when its material runs out, this decides the behaviour when that happens. The X and Y axes are zeroed (but not Z), and then the machine shuts all motors and heaters off except the heated bed, the temperature of which is maintained. The machine will still respond to G and M code commands in this state.

M48: Measure Z-Probe repeatability

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	No	No	No	???	No	???

Parameters
Pnnn number of points
Xnnn position on the X axis
Ynnn position on the Y axis
Vnnn verbosity
E engage
Lnnn legs of travel

As with G29, the E flag causes the probe to stow after each probe.

M70: Display message

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	see M117	No	???	see M117	No	No	Yes	No	???		

Example: M70 P200 Message

Instruct the machine to display a message on it's interface LCD. P is the time to display message for.

M72: Play a tone or song

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	see M300	No	No	see M300	No	No	Yes	No	???		

Example: M72 P2

Instruct the machine to play a preset song. Acceptable song IDs are machine specific. P is the ID of the song to play.

M73: Set build percentage

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	Yes	No	???		

Example: M73 P50

Instruct the machine that the build has progressed to the specified percentage. The machine is expected to display this on it's interface board. If the percentage is exactly 0, then a Build Start Notification is sent. If the percentage is exactly 100, then a Build End notification is sent.

M80: ATX Power On

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	automatic	Yes	Yes	Yes	No	Yes	No	No	???	No	???		

Example
M80

Turns on the ATX power supply from standby mode to fully operational mode. No-op on electronics without standby mode.

Note: some firmwares, like Teacup, handle power on/off automatically, so this is redundant there. Also, see RAMPS wiring for ATX on/off (http://forums.reprap.org/read.php?219,132664)

M81: ATX Power Off

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	automatic	Yes	Yes	Yes	No	Yes	No	No	???	No	Yes		

Example
M81

Turns off the ATX power supply. Counterpart to M80.

For redeem, adding 'P' will quit the daemon (redeem). Adding parameter 'R' will restart the daemon.

M82: Set extruder to absolute mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M82

Makes the extruder interpret extrusion as absolute positions.

This is the default in repetier.

M83: Set extruder to relative mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???

Example
M83

Makes the extruder interpret extrusion values as relative positions.

M84: Stop idle hold

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???

Parameters
This command can be used without any additional parameters.
Innn Reset flags[1]
Example
M84

Stop the idle hold on all axis and extruder. In some cases the idle hold causes annoying noises, which can be stopped by disabling the hold. Be aware that by disabling idle hold during printing, you will get quality issues. This is recommended only in between or after printjobs.

On Marlin, Repetier and RepRapFirmware, M84 can also be used to configure or disable the idle timeout. For example, "M84 S10" will idle the stepper motors after 10 seconds of inactivity. "M84 S0" will disable idle timeout; steppers will remain powered up regardless of activity.

Notes

[1]RepRapFirmware-dc42 and other firmware may not support this parameter.

M85: Set inactivity shutdown timer

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes	Yes	No	No	No	No	???	No	???

Example: M85 S30

Set inactivity shutdown timer with parameter S<seconds>. "M85 S0" will disable the inactivity shutdown time (default)

M92: Set axis_steps_per_unit

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???

Parameters
Xnnn Steps per unit for the X drive
Ynnn Steps per unit for the Y drive
Znnn Steps per unit for the Z drive
Ennn Steps per unit for the extruder drive(s)
Examples
M92 X87.489 Y87.489 Z87.489
M92 E420:420

Allows programming of steps per unit (usually mm) for motor drives. These values are reset to firmware defaults on power on, unless saved to EEPROM if available (M500 in Marlin) or in the configuration file (config.g in RepRapFirmware). Very useful for calibration.

M93: Send axis_steps_per_unit

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	No	???	No	No	No	No	???	No	???

M98: Call Macro/Subprogram

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	No	No	No

Parameters
Pnnn Macro filename
Example
M98 Pmymacro.g

Runs the macro in the file mymacro.g. In conventional G Codes for CNC machines the P parameter normally refers to a line number in the program itself (P2000 would run the Macro starting at line O2000, say). For RepRap, which almost always has some sort of mass storage device inbuilt, it simply refers to the name of a GCode file that is executed by the G98 call. That GCode file does not need to end with an M99 (return) as the end-of-file automatically causes a return. Macro calls cannot usually be nested or be recursive; i.e. you can't call a macro from a macro, although RepRapFirmware explicitly supports this.

RepRapFirmware also allows the filename to include a path to a subdirectory. For relative paths, the default folder is /sys, but some implementations may check the /macros directory too. Absolute file paths are supported on RepRapFirmware as well.

M99: Return from Macro/Subprogram

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	No	No	No

Example
M99

Returns from an M98 call.

RepRapFirmware closes the currently active macro file. If a nested macro is being run, RepRapFirmware goes up one stack level.

M98: Get axis_hysteresis_mm

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

Deprecated - clashes with the G Code standard M98 above

Example: M98

Report the current hysteresis values in mm for all of the axis.

Proposed for Marlin

M99: Set axis_hysteresis_mm

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

Deprecated - clashes with the G Code standard M99 above

Example: M99 X<mm> Y<mm> Z<mm> E<mm>

Allows programming of axis hysteresis. Mechanical pulleys, gears and threads can have hysteresis when they change direction. That is, a certain number of steps occur before movement occurs. You can measure how many mm are lost to hysteresis and set their values with this command. Every time an axis changes direction, these extra mm will be added to compensate for the hysteresis.

Proposed for Marlin

M101: Turn extruder 1 on (Forward), Undo Retraction

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	No	No	No	No	No	Yes	No	???	No	???

in Teacup firmware: If a DC extruder is present, turn that on. Else, undo filament retraction, which means, make the extruder ready for extrusion. Complement to M103.

in BFB/RapMan firmware: Turn extruder on (forward/filament in).

in other firmwares: Deprecated. Regarding filament retraction, see M227, M228, M229.

M102: Turn extruder 1 on (Reverse)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	Yes	No	???	No	???		

In BFB/RapMan firmware: Turn extruder on Reverse (Still to add)

In other firmwares: Deprecated.

M103: Turn all extruders off, Extruder Retraction

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	No	No	No	No	No	Yes	No	???	No	???		

In Teacup firmware: If a DC extruder is present, turn that off. Else, retract the filament in the hope to prevent nozzle drooling. Complement to M101.

In BFB/RapMan firmware: Turn extruder off.

In other firmwares: Deprecated. Regarding extruder retraction, see M227, M228, M229.

M104: Set Extruder Temperature

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes		

Parameters
  Snnn Target temperature
Example
  M104 S190

Set the temperature of the current extruder to 190°C and return control to the host immediately (*i.e.* before that temperature has been reached by the extruder). Duet-dc42 and other firmware also supports the optional T parameter (as generated by slic3r) to specify which tool the command applies to. See also M109.

This is deprecated because temperatures should be set using the G10 and T commands (q.v.).

Deprecation is subject to discussion. --Traumflug 11:33, 19 July 2012 (UTC)

M104 in Teacup Firmware

In Teacup Firmware, M104 can be additionally used to handle all devices using a temperature sensor. It supports the additional P parameter, which is a zero-based index into the list of sensors in config.h. For devices without a temp sensor, see M106.

Example: M104 P1 S100

Set the temperature of the device attached to the second temperature sensor to 100 °C.

M105: Get Extruder Temperature

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	Yes		

Parameters
  This command can be used without any additional parameters.
  Rnnn Response sequence number[1]
  Snnn Response type[1]
Examples
  M105
  M105 S2

Request the temperature of the current extruder and the build base in degrees Celsius. The temperatures are returned to the host computer. For example, the line sent to the host in response to this command looks like:

```
ok T:201 B:117
```

Expansion/generalization of M105 to be considered using S1 parameter as noted in Pronterface I/O Monitor

In Repetier you can add X0 to get raw values as well:

```
M105 X0
==> 11:05:48.910 : T:23.61 /0 @:0 T0:23.61 /0 @0:0 RAW0:3922 T1:23.89 /0 @1:0 RAW1:3920
```

Recent versions of RepRapFirmware also report the current and target temperatures of all active heaters.

Notes

[1]These parameters are only supported by RepRapFirmware to return a JSON-formatted response[2] if parameter S2 or S3 is specified. Additionally, parameter Rnn may be provided, where nn is the sequence number of the most recent G-code response that the client has already received.

The response comprises a single JSON object, with no nesting of objects or arrays, followed by newline. This is used by older firmware versions of the Panel touch-screen control panel. It is similar to the object returned by the web interface status request, but some fields are omitted. Here is a sample response when S2 is used:

```
{"status":"I","heaters":[25.0,29.0,28.3],"active":[-273.1,0.0,0.0],"standby":[-273.1,0.0,0.0],"hstat":[0,2,1],"pos":[-11.00,0.00,0.00],"extr":[0.0,0.0
 "efactor":[100.00,100.00],"tool":1,"probe":"535","fanRPM":0,"homed":[0,0,0],"fraction_printed":0.572}
```

The meaning of these fields is:

```
status:  I=idle, P=printing from SD card, S=stopped (i.e. needs a reset), C=running config file, A=paused, D=pausing, R=resuming, B=busy (running a ma
heaters: current heater temperatures, numbered as per the machine (typically, heater 0 is the bed)
active:  active temperatures of the heaters
standby: standby temperatures of the heaters
hstat:   status of the heaters, 0=off, 1=standby, 2=active, 3=fault
pos:     the X, Y and Z positions of the print head
extr:    the positions of the extruders
sfactor: the current speed factor (see M220 command)
efactor: the current extrusion factors (see M221 command)
tool:    the selected tool number. Zero typically means no tool selected.
probe:   the Z-probe reading
fanRPM:  the cooling fan RPM
homed:   the homed status of the X, Y and Z axes (or towers on a delta). 0=axis has not been homed so position is not reliable, 1=axis has been homed
fraction_printed: the fraction of the file currently being printed that has been read and at least partially processed.
message: the message to be displayed on the screen (only present if there is a message to display)
timesLeft: an array of the estimated remaining print times (in seconds) calculated by different methods. These are currently based on the proportion o
seq:     the sequence number of the most recent G-code response or error message. Only present if the R parameter was provided and the current sequenc
resp:    the most recent G-code response or error message. Only present if the R parameter was provided and the current sequence number is greater.
```

The response when S3 is used comprises these fields plus some additional ones that do not generally change and therefore do not need to be fetched as often. The extra fields include:

```
myName:  the name of the printer
geometry: one of "cartesian", "delta", "corexy, "corexz" etc.
```

The fields may be in any order in the response. Other implementations may omit fields and/or add additional fields.

[2]Newer versions of the PanelDue firmware use the M408 command to pull status responses instead.

M106: Fan On

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	???	No	???

Parameters

Pnnn Fan number (optional, defaults to 0)
Snnn Fan speed
Innn Invert signal[1]
Rnnn Restore previous fan value[1]

Examples

M106 S127

M106 P1 I1 S87

The first example turns on the default cooling fan at half speed, the second one inverts the cooling fan signal of the second fan and sets its value to 1/3 of its maximum.

Mandatory parameter 'S' declares the PWM value (0-255). M106 S0 turns the fan off. In some implementations like RepRapFirmware the PWM value may be specified as a real fraction: M106 S0.7.

Notes

[1]These parameters are only available in RepRapFirmware.

M106 in RepRapFirmware

RepRapFirmware supports an optional 'I' parameter, whose value must be greater than zero to invert the cooling fan output signal. This makes the cooling fan output suitable for feeding the PWM input of a 4-wire fan via a diode. If the parameter is present and zero or negative, the output is not inverted. If the parameter is not present, the inverted/non-inverted state remains unchanged. The default at power up is not inverted.

If the optional 'R' parameter is specified, the last-known fan value will be set. If the 'S' parameter is passed along with 'R', the firmware will not reset the last-known fan value. This may be useful for tool change macro files.

M106 in Teacup Firmware

Additionally to the above, Teacup Firmware uses M106 to control general devices. It supports the additional P parameter, which is an zero-based index into the list of heaters/devices in config.h.

Example: M106 P2 S255

Turn on device #3 at full speed/wattage.

Note: When turning on a temperature sensor equipped heater with M106 and M104 at the same time, temperature control will override the value given in M106 quickly.

M107: Fan Off

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	???	No	???		

Deprecated in Teacup firmware and in RepRapFirmware. Use M106 S0 instead.

M108: Set Extruder Speed

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	Yes	No	???	No	???		

Sets speed of extruder motor. (Deprecated in FiveD firmware, see M113)

M109: Set Extruder Temperature and Wait

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	not needed	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes		

Parameters
- **Snnn** minimum target temperature, waits until heating
- **Rnnn** maximum target temperature, waits until cooling (Sprinter)
- **Rnnn** accurate target temperature, waits until heating and cooling (Marlin)

Example
- M109 S215

M109 in Teacup

Not needed. To mimic Marlin behaviour, use M104 followed by M116.

M109 in Marlin, Sprinter (ATmega port), RepRapFirmware

Set extruder heater temperature in degrees celsius and wait for this temperature to be achieved.

Example: M109 S185

RepRapFirmware also supports the optional T parameter (as generated by slic3r) to specify which tool the command refers to (see below).

M109 in Sprinter (4pi port)

Parameters: **S** (optional), set target temperature value. If not specified, waits for the temperature set by M104. **R** (optional), sets target temperature range maximum value.

Example: M109 S185 R240 //sets extruder temperature to 185 and waits for the temperature to be between 185 - 240.

If you have multiple extruders, use **T** or **P** parameter to specify which extruder you want to set/wait.

Another way to do this is to use G10.

M109 in MakerBot

Example: M109 S70 T0

Sets the target temperature for the current build platform. S is the temperature to set the platform to, in degrees Celsius. T is the platform to heat.

M110: Set Current Line Number

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	not needed	No	No	Yes	Yes	Yes	No	No	???	No	???		

Parameters
  Nnnn Line number
Example
  M110 N123

This example sets the current line number to 123. Thus the expected next line after this command will be 124.

M111: Set Debug Level

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Debug	No	No	Yes	No	Yes	No	No	???	No	???		

Parameters
  Pnnn Debug module[1]
  Snnn Debug on/off
Examples
  M111 S6
  M111 P1 S1

Enable or disable debugging features in the firmware. The implementation may look different per firmware.

Notes

[1]This parameter is only available in RepRapFirmware.

M111 in RepRapFirmware

RepRapFirmware allows debugging to be set for each module. If the optional 'P' parameter is not specified, debugging will be enabled for all modules. For a complete list of all modules, refer to the Module enumeration in RepRapFirmware.h of the fork you are using.

M111 in Repetier

Set the level of debugging information transmitted back to the host to level 6. The level is the OR of three bits:

```
#define DEBUG_ECHO (1<<0)
#define DEBUG_INFO (1<<1)
#define DEBUG_ERRORS (1<<2)
#define DEBUG_DRYRUN (1<<3) // repetier-firmware
#define DEBUG_COMMUNICATION (1<<4) // repetier-firmware
```

Thus 6 means send information and errors, but don't echo commands. (This is the RepRap default.)

For firmware that supports ethernet and web interfaces M111 S9 will turn web debug information on without changing any other debug settings, and M111 S8 will turn it off. Web debugging usually means that HTTP requests will be echoed to the USB interface, as will the responses.

M112: Emergency Stop

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M112

Any moves in progress are immediately terminated, then RepRap shuts down. All motors and heaters are turned off. It can be started again by pressing the reset button on the master microcontroller. See also M0 and M1.

M113: Set Extruder PWM

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	No	No	No	No	No	No	No	No	???	No	???		

Example: M113

Set the PWM for the currently-selected extruder. On its own this command sets RepRap to use the on-board potentiometer on the extruder controller board to set the PWM for the currently-selected extruder's stepper power. With an S field:

M113 S0.7

it causes the PWM to be set to the S value (70% in this instance). M113 S0 turns the extruder off, until an M113 command other than M113 S0 is sent.

M114: Get Current Position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M114

This causes the RepRap machine to report its current X, Y, Z and E coordinates to the host.

For example, the machine returns a string such as:

```
ok C: X:0.00 Y:0.00 Z:0.00 E:0.00
```

In Marlin first 3 numbers is the position for the planner. The other positions are the positions from the stepper function. This helps for debugging a previous stepper function bug.

```
X:0.00 Y:0.00 RZ:0.00 LZ:0.00 Count X:0.00 Y:0.00 RZ:41.02 LZ:41.02
```

M115: Get Firmware Version and Capabilities

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	???	No	???		

Parameters
This command can be used without any additional parameters.
Pnnn Electronics type[1]
Examples
M115
M115 P2

Request the Firmware Version and Capabilities of the current microcontroller The details are returned to the host computer as key:value pairs separated by spaces and terminated with a linefeed.

sample data from firmware:

```
ok PROTOCOL_VERSION:0.1 FIRMWARE_NAME:FiveD FIRMWARE_URL:http%3A//reprap.org MACHINE_TYPE:Mendel EXTRUDER_COUNT:1
```

This M115 code is inconsistently implemented, and should not be relied upon to exist, or output correctly in all cases. An initial implementation was committed to svn for the FiveD Reprap firmware on 11 Oct 2010. Work to more formally define protocol versions is currently (October 2010) being discussed. See M115_Keywords for one draft set of keywords and their meanings. See the M408 command for a more comprehensive report on machine capabilities supported by RepRapFirmware.

Notes

[1]This parameter is supported only in RepRapFirmware and can be used tell the firmware about the hardware on which it is running. If the P parameter is present then the integer argument specifies the hardware being used. The following are currently supported:

```
M115 P0   Automatic board type selection if supported, or default if not
M115 P1   Duet 0.6
M115 P2   Duet 0.7
M115 P3   Duet 0.85
```

M116: Wait

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	No	No	Yes	No	Yes	No	No	???	No	???		

Parameters

This command can be used without any additional parameters.[1]
Pnnn Tool number
Hnnn Heater number
Cnnn Chamber number

Examples

M116
M116 P1

Wait for *all* temperatures and other slowly-changing variables to arrive at their set values if no parameters are specified. See also M109.

Notes

[1]Most implementations don't support any parameters, but RepRapFirmware version 1.04 and later supports an optional 'P' parameter that is used to specify a tool number. If this parameter is present, then the system only waits for temperatures associated with that tool to arrive at their set values. This is useful during tool changes, to wait for the new tool to heat up without necessarily waiting for the old one to cool down fully.

Recent versions of RepRapFirmware also allow a list of the heaters to be specified using the 'H' parameter, and if the 'C' parameter is present, this will indicate that the chamber heater should be waited for.

M117: Get Zero Position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	No	No	No	No	No	No	No	No	???	No	???		

Example: M117

This causes the RepRap machine to report the X, Y, Z and E coordinates *in steps not mm* to the host that it found when it last hit the zero stops for those axes. That is to say, when you zero X, the *x* coordinate of the machine when it hits the X endstop is recorded. This value should be 0, of course. But if the machine has drifted (for example by dropping steps) then it won't be. This command allows you to measure and to diagnose such problems. (E is included for completeness. It doesn't normally have an endstop.)

M117: Display Message

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example

M117 Hello World

This causes the given message to be shown in the status line on an attached LCD. The above command will display Hello World. If RepRapFirmware is used and no LCD is attached, this message will be reported on the web interface.

M118: Negotiate Features

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M118 P42

This M-code is for future proofing. NO firmware or hostware supports this at the moment. It is used in conjunction with M115's FEATURES keyword.

See Protocol_Feature_Negotiation for more info.

M119: Get Endstop Status

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Example
M119

Returns the current state of the configured X, Y, Z endstops. Takes into account any 'inverted endstop' settings, so one can confirm that the machine is interpreting the endstops correctly.

M120: Push

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	Yes	No	No	???	No	???		

Example
M120

Push the state of the RepRap machine onto a stack. Exactly what variables get pushed depends on the implementation (as does the depth of the stack - a typical depth might be 5). A sensible minimum, however, might be

1. Current feedrate, and
2. Whether moves (and separately extrusion) are relative or absolute

RepRapFirmware calls this automatically when a macro file is run. In addition to the variables above, it pushes the following values on the stack:

1. Current feedrate
2. Extruder positions

M121: Pop

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	Yes	No	No	???	No	???		

Example
M121

Recover the last state pushed onto the stack.

M120: Enable endstop detection

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

M121: Disable endstop detection

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

M122: Diagnose

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Example
M122

Sending an M122 causes the RepRap to transmit diagnostic information, for eaxmple via a USB serial link.

If RepRapFirmware is used and debugging is enabled for the Network module, this will also print LWIP stats to the host via USB.

M123: Tachometer value

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Sending an M123 causes the RepRap to transmit filament tachometer values from all extruders.

M124: Immediate motor stop

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Immediately stops all motors.

M126: Open Valve

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	No	No	Yes	No	No	No	No	No	Yes	No	???		

Example: M126 P500

Open the extruder's valve (if it has one) and wait 500 milliseconds for it to do so.

M126 in MakerBot

Example: M126 T0

Enables an extra output attached to a specific toolhead (e.g. fan)

M127: Close Valve

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	No	No	Yes	No	No	No	No	No	Yes	No	???		

Example: M127 P400

Close the extruder's valve (if it has one) and wait 400 milliseconds for it to do so.

M127 in MakerBot

Example: M127 T0

Disables an extra output attached to a specific toolhead (e.g. fan)

M128: Extruder Pressure PWM

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	???	No	No	No	No	No	???	No	???		

Example: M128 S255

PWM value to control internal extruder pressure. S255 is full pressure.

M129: Extruder pressure off

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	???	No	No	No	No	No	???	No	???

Example: M129 P100

In addition to setting Extruder pressure to 0, you can turn the pressure off entirely. P400 will wait 100ms to do so.

M130: Set PID P value

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	No	see M301	No	No: See M301	No	No	No	???	No	???

Parameters
- **Pnnn** heater number
- **Snnn** proportional (Kp)

Example
- M130 P0 S8.0 ; Sets heater 0 P factor to 8.0

Teacup can control multiple heaters with independent PID controls. For the default shown at https://github.com/Traumflug/Teacup_Firmware/blob/master/config.default.h, heater 0 is the extruder (P0), and heater 1 is the bed (P1).

Teacup's PID proportional units are in pwm/255 counts per quarter C, so to convert from counts/C, you would divide by 4. Conversely, to convert from count/qC to count/C, multiply by 4. In the above example, S=8 represents a Kp=8*4=32 counts/C.

M131: Set PID I value

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	No	see M301	No	No: See M301	No	No	No	???	No	???

Parameters
- **Pnnn** heater number
- **Snnn** integral (Ki)

Example
- M131 P1 S0.5 ; Sets heater 1 I factor to 0.5

Teacup's PID integral units are in pwm/255 counts per (quarter C*quarter second), so to convert from counts/qCqs, you would divide by 16. Conversely, to convert from count/qCqs to count/Cs, multiply by 16. In the above example, S=0.5 represents a Ki=0.5*16=8 counts/Cs.

M132: Set PID D value

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	No	see M301	No	No: See M301	see M301	No	No	Yes	No	???

Parameters
- **Pnnn** heater number
- **Snnn** derivative (Kd)

Example
- M132 P0 S24 ; Sets heater 0 D factor to 24.0

Teacup's PID derivative units are in pwm/255 counts per (quarter degree per 2 seconds), so to convert from counts/C, you would divide by 4. Conversely, to convert from count/qC to count/C, multiply by 8. In the above example, S=24 represents a Kd=24*8=194 counts/(C/s).

M132 in MakerBot

Example: M132 X Y Z A B

Loads the axis offset of the current home position from the EEPROM and waits for the buffer to empty.

M133: Set PID I limit value

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	No	see M301	No	No	No	No	No	Yes	No	???

Parameters
Pnnn heater number
Snnn integral limit (Ki)
Example
M133 P1 S264 ; Sets heater 1 I limit value to 264

Teacup's PID integral limit units are in quarter-C*quarter-seconds, so to convert from C-s, you would multiply by 16. Conversely, to convert from qC*qs to C*s, divide by 16. In the above example, S=264 represents an integral limit of 16.5 C*s.

M133 in MakerBot

Example: M133 T0 P500

Instruct the machine to wait for the toolhead to reach its target temperature. T is the extruder to wait for. P if present, sets the time limit.

M134: Write PID values to EEPROM

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Yes	No	No	No	No: See M504	see M500	No	No	Yes	No	???

Example: M134

M134 in MakerBot

Example: M134 T0 P500

Instruct the machine to wait for the platform to reach its target temperature. T is the platform to wait for. P if present, sets the time limit.

M135: Set PID sample interval

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	Yes	No	???

Parameters
Snnn Heat sample time in seconds
Example
M135 S300

Set the PID to measure temperatures and calculate the power to send to the heaters every 300ms.

M135 in MakerBot

Example: M135 T0

Instructs the machine to change its toolhead. Also updates the State Machine's current tool_index. T is the toolhead for the machine to switch to and the new tool_index for the state machine to use.

M136: Print PID settings to host

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	Debug	No	No	No	No	see M301	No	No	???	No	???

Example: M136 P1 # print heater 0 PID parameters to host

M140: Set Bed Temperature (Fast)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	???	No	???

Parameters
Snnn Target temperature

Hnnn Heater number[1]

Example

M140 S55

Set the temperature of the build bed to 55°C and return control to the host immediately (*i.e.* before that temperature has been reached by the bed). There is an optional R field that sets the bed standby temperature: M140 S65 R40.

RepRapFirmware allows the bed heater to be switched off if the absolute negative temperature (-273.15) is passed as target temperature. In this case the current bed temperature is not affected[1]:

```
M140 S-273.15
```

Recent versions of RepRapFirmware also provide an optional 'H' parameter to set the hot bed heater number. If no heated bed is present, a negative value may be specified to disable it.

Notes

[1]This parameter is not supported by RepRapFirmware-dc42 and other firmware.

M141: Set Chamber Temperature (Fast)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	uses M104	No	No	No	No	Yes	No	Yes	???	No	???		

Parameters

Snnn Target temperature

Hnnn Heater number[1]

Examples

M141 S30

M141 H0

Set the temperature of the chamber to 30°C and return control to the host immediately (*i.e.* before that temperature has been reached by the chamber).

Notes

[1]This parameter is only available in RepRapFirmware.

M142: Holding Pressure

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M142 S1

Set the holding pressure of the bed to 1 bar.

The holding pressure is in bar. For hardware which only has on/off holding, when the holding pressure is zero, turn off holding, when the holding pressure is greater than zero, turn on holding.

M143: Maximum hot-end temperature

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M143 S275

Set the maximum temperature of the hot-end to 275C

When temperature of the hot-end exceeds this value, take countermeasures, for instance an emergency stop. This is to prevent hot-end damage.

M144: Stand By Your Bed

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Example
M144

Switch the bed to its standby temperature. M140 turns it back to its active temperature; no need for any arguments for that use of M140.

M146: Set Chamber Humidity

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

Parameters
Rnnn Relative humidity in percent
Example
M146 R60

Set the relative humidity of the chamber to 60% and return control to the host immediately (*i.e.* before that humidity has been reached by the chamber).

M149: Set temperature units

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

Parameters
C Flag to treat temperature as degrees Celsius
K Flag to treat temperature as Kelvin
Example
M149 K

It affects the S or R values in the codes M104, M109, M140, M141, M143, M190 and G10. The default is M149 C.

M150: Set display color

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	No	No	No	???	No	???

Parameters
Rnnn red
Unnn green
Bnnn blue
Example
M150 R255 U128 B192

Set BlinkM Color via I2C. Range for values: 0-255

M160: Number of mixed materials

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	???

Example: M160 S4

This command has been superseded by the tool definition command M563 (see below).

Set the number of materials, N, that the current extruder can handle to the number specified. The default is 1.

When N >= 2, then the E field that controls extrusion requires N values separated by colons ":" after it like this:

```
M160 S4
G1 X90.6 Y13.8 E2.24:2.24:2.24:15.89
G1 X70.6 E0:0:0:42.4
G1 E42.4:0:0:0
```

The second line moves straight to the point (90.6, 13.8) extruding a total of 22.4mm of filament. The mix ratio for the move is 0.1:0.1:0.1:0.7.

The third line moves back 20mm in X extruding 42.4mm of filament.

The fourth line has no physical effect.

M163: Set weight of mixed material

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes: 0.92	No	No	No	No	???	No	???		

Parameters
Snnn extruder number
Pnnn weight

Set weight for this mixing extruder drive.

M164: Store weights

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes: 0.92	No	No	No	No	???	No	???		

Parameters
Snnn virtual extruder number
Pnnn store to eeprom (P0 = no, P1 = yes)

Store weights as virtual extruder S.

M190: Wait for bed temperature to reach target temp

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No: See M116	Yes	Yes	Yes	Yes	Yes	No	Yes	???	No	???		

Parameters
Snnn minimum target temperature, waits until heating
Rnnn accurate target temperature, waits until heating and cooling (Marlin)
Example
M190 S60

This will wait until the bed temperature reaches 60 degrees, printing out the temperature of the hot end and the bed every second.

M191: Wait for chamber temperature to reach target temp

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	see M301 C1	No	Yes	???	No	???		

Example: M191 P60

Set the temperature of the build chamber to 60 °C and wait for the temperature to be reached.

M200: Set filament diameter

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes	Yes	see M404	No	Yes	???	No	???		

Without parameters loads default grid, and with specified extension attempts to load the specified grid. If not available will not modify the current grid. If Z was saved with the grid file, it will load the saved Z with the grid.

M200 Dm.mmm sets the filament diameter to m.mmm millimeters. It is used with 'volumetric calibration' and G-code generated for an ideal 1.128mm diameter filament, which has a volume of 1mm^3 per millimeter. The intention is to be able to generate filament-independent g-code. (See Triffid_Hunter's_Calibration_Guide#Optional:_Switch_to_volumetric_E_units and http://wooden-mendel.blogspot.com/2011/09/volumetric-stage-two.html for more information.)

M200 D0 or M200 D1.128 ; reset E multiplier to 1, since sqrt(1/pi)*2=1.128

See also Gcode#M119:_Get_Endstop_Status

Question: what does a firmware do with filament diameter? Has this an effect on how much an E command moves the extruder motor? --Traumflug 11:34, 14 October 2012 (UTC) Yes, Marlin uses this to set a 'volumetric_multiplier' by which the E-steps of a move are scaled in the planner. DaveX (talk) 16:44, 12 April 2014 (PDT) Smoothie implements the same thing as Marlin --Arthurwolf (talk) 05:23, 10 November 2014 (PST)

M201: Set max printing acceleration

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	No	Yes	No	No	???	No	???		

Parameters
- **Xnnn** Acceleration for X axis
- **Ynnn** Acceleration for Y axis
- **Znnn** Acceleration for Z axis
- **Ennn** Acceleration for extruder drives

Example
- M201 X1000 Y1000 Z100 E2000

Sets the acceleration that axes can do in units/second^2 for print moves. For consistency with the rest of G Code movement this should be in units/(minute^2), but that gives really silly numbers and one can get lost in all the zeros. So for this we use seconds.

RepRapFirmware expects these values to be in mm/s^2.

M202: Set max travel acceleration

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	???	Yes	Yes	No	No	No	No	???	No	???		

in units/s^2 for travel moves (M202 X1000 Y1000) Unused in Marlin!!

M203: Set maximum feedrate

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	???	Yes	Yes	Yes	Yes	No	No	???	No	???		

Parameters
- **Xnnn** Maximum feedrate for X axis
- **Ynnn** Maximum feedrate for Y axis
- **Znnn** Maximum feedrate for Z axis
- **Ennn** Maximum feedrate for extruder drives

Example
- M203 X6000 Y6000 Z300 E10000

Sets the maximum feedrates that your machine can do in mm/min (Marlin uses mm/sec).

M203 Repetier

Set temperture monitor to Sx.

M204: Set default acceleration

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	No	No	No	???	No	???		

S normal moves T filament only moves (M204 S3000 T7000) im mm/sec^2 also sets minimum segment time in ms (B20000) to prevent buffer underruns and M20 minimum feedrate

Marlin notes: After Mar11-2015, the M204 options have changed in Marlin:

P = Printing moves

R = Retract only (no X, Y, Z) moves

T = Travel (non printing) moves

The command "M204 P800 T3000 R9000" set the acceleration for printing movements to 800mm/s^2, for travels to 3000mm/s^2 and for retracts to 9000mm/s^2.

M204 Repetier

M204 X[Kp] Y[Ki] Z[Kd] -

Set PID parameter. Values are 100*real value.

M205: Advanced settings

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	see M566	No	No	???	No	???		

minimum travel speed S=while printing T=travel only, B=minimum segment time X= maximum xy jerk, Z=maximum Z jerk, E=maximum E jerk

M205 Repetier

Output EEPROM settings.

M206:

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

M206 Marlin, Sprinter, Smoothie, RepRapFirmware - Set home offset

Parameters
- **Xnnn** X axis offset
- **Ynnn** Y axis offset
- **Znnn** Z axis offset

Example
- M206 X10.0 Y10.0 Z-0.4

The values specified are added to the endstop position when the axes are referenced. The same can be achieved with a G92 right after homing (G28, G161).

With Marlin firmware, this value can be saved to EEPROM using the M500 command.

A similar command is G10, aligning these two is subject to discussion.

With Marlin 1.0.0 RC2 a negative value for z lifts(!) your printhead.

M206 Repetier - Set eeprom value

M206 T[type] P[pos] [Sint(long] [Xfloat] Set eeprom value

Example: M206 T3 P39 X19.9

Set Jerk to 19.9

M207: Calibrate z axis by detecting z max length

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	???	No	No	No	No	???	No	???		

Example: M207

After placing the tip of the nozzle in the position you expect to be considered Z=0, issue this command to calibrate the Z axis. It will perform a z axis homing routine and calculate the distance traveled in this process. The result is stored in EEPROM as z_max_length. For using this calibration method the machine must be using a Z MAX endstop.

This procedure is usually more reliable than mechanical adjustments of a Z MIN endstop.

M207: Set retract length

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	Yes	No	No	No	???	No	???		

Parameters
- **Snnn** positive length to retract, in mm
- **Fnnn** feedrate, in mm/min
- **Znnn** additional zlift/hop

Example
M207 S4.0 F2400 Z0.075

Sets retract length, stays in mm regardless of M200 setting

M208: Set axis max travel

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
- **Snnn** Whether to set the axis minimum[1]
- **Xnnn** X axis limit
- **Ynnn** Y axis limit
- **Znnn** Z axis limit

Example
M208 X250 Y210 Z180

The values specified set the software limits for axis travel in the positive direction.

RepRapPro's version of Marlin uses M208 this way. Send M503 to see the current values. On Marlin, the value can be saved to EEPROM using the M500 command.

Notes

[1]With RepRapFirmware on a Cartesian printer, you can also use this command to specify software limits for axis travel in the negative direction, by adding parameter S1. The axis limits you set are also the positions assumed when an endstop is triggered.

```
M208 X200 Y200 Z90; set axis maxima
M208 X-5 Y0 Z0 S1 ; set axis minimum
```

M208: Set unretract length

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	Yes	No	No	No	???	No	???		

Parameters
- **Snnn** positive length surplus to the M207 Snnn, in mm
- **Fnnn** feedrate, in mm/sec

Sets recover=unretract length.

M209: Enable automatic retract

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes	No	No	No	No	???	No	???		

Example: M209 S1

This boolean value S 1=true or 0=false enables automatic retract detect if the slicer did not support G10/11: every normal extrude-only move will be classified as retract depending on the direction.

M210: Set homing feedrates

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M210 X1000 Y1500

Set the feedrates used for homing to the values specified in mm per minute.

M211: Disable/Enable software endstops

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

The boolean value S 1=enable or 0=disable controls state of software endstop.

The boolean value X, Y or Z 1=max endstop or 0=min endstop selects which endstop is controlled.

Example: M211 X1 Y1 Z1 S0

Disables X,Y,Z max endstops

Example: M211 X0 S1

Enables X min endstop

Example: M211

Prints current state of software endstops.

M212: Set Bed Level Sensor Offset

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes*	No	No	No	No	No	???	No	???		

This G-Code command is known to be available in the newer versions of PrintrBot's branch of Marlin. It may not be available in other firmware.

Example: M212 Z-0.2

Set the Z home to 0.2 mm lower than where the sensor says Z home is. This is extremely useful when working with printers with hard-to-move sensors, like the PrintrBot Metal Plus.

PrintrBot suggests that the user make minor (0.1-0.2) adjustments between attempts and immediately executes M500 & M501 after setting this.

M218: Set Hotend Offset

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

Sets hotend offset (in mm): T<extruder_number> X<offset_on_X> Y<offset_on_Y>.

Example: M218 T1 X50 Y0.5

M220: Set speed factor override percentage

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Parameters
: **Snnn** Speed factor override percentage (0..100 or higher)

Example
: M220 S80

Sets the speed factor override percentage.

M221: Set extrude factor override percentage

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???

Parameters
Snnn Extrude factor override percentage (0..100 or higher)
Example
M221 S70

Sets extrude factor override percentage.

M220: Turn off AUX V1.0.5

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	Yes	No	???	No	???

M221: Turn on AUX V1.0.5

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	Yes	No	???	No	???

M222: Set speed of fast XY moves

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	Yes	No	???	No	???

M223: Set speed of fast Z moves

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	Yes	No	???	No	???

M224: Enable extruder during fast moves

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	Yes	No	???	No	???

M225: Disable on extruder during fast moves

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	Yes	No	???	No	???

M226: Gcode Initiated Pause

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	Yes	Yes	???	No	???

Example
M226

Initiates a pause in the same way as if the pause button is pressed. That is, program execution is stopped and the printer waits for user interaction. This matches the behaviour of M1 in the NIST RS274NGC G-code standard (http://www.nist.gov/manuscript-publication-search.cfm?pub_id=823374) and M0 in Marlin firmware.

M226: Wait for pin state

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	see M577	No	No	???	No	???

Parameters
Pnnn pin number
Snnn pin state

Example
M226 P2 S1

Wait for a pin to be in some state.

M227: Enable Automatic Reverse and Prime

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M227 P1600 S1600

P and S are steps.

"Reverse and Prime" means, the extruder filament is retracted some distance when not in use and pushed forward the same amount before going into use again. This shall help to prevent drooling of the extruder nozzle. Teacup firmware implements this with M101/M103.

M228: Disable Automatic Reverse and Prime

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M228

See also M227.

M229: Enable Automatic Reverse and Prime

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M229 P1.0 S1.0

P and S are extruder screw rotations. See also M227.

M230: Disable / Enable Wait for Temperature Change

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M230 S1

S1 Disable wait for temperature change S0 Enable wait for temperature change

M231: Set OPS parameter

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes	No	No	No	No	???	No	???		

M231 S[OPS_MODE] X[Min_Distance] Y[Retract] Z[Backslash] F[ReatrctMove]

M232: Read and reset max. advance values

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes	No	No	No	No	???	No	???		

M240: Trigger camera

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

Example: M240

Triggers a camera to take a photograph. (Add to your per-layer GCode.)

M240: Start conveyor belt motor / Echo off

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Debug: Echo off	No	No	No	No	No	No	No	???	No	???		

Example: M240

The conveyor belt allows to start mass production of a part with a reprap.

Echoing may be controlled in some firmwares with M111

M241: Stop conveyor belt motor / echo on

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	Debug: Echo on	No	No	No	No	No	No	No	???	No	???		

Example: M241

Echoing may be controlled in some firmwares with M111

M245: Start cooler

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M245

used to cool parts/heated-bed down after printing for easy remove of the parts after print

M246: Stop cooler

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	No	???	No	???		

Example: M246

M250: Set LCD contrast

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

Example: M250 C20

Sets LCD contrast C<contrast value> (value 0..63), if available.

M251: Measure Z steps from homing stop (Delta printers)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes	No	No	No	No	???	No	???		

M251 S0 - Reset, S1 - Print, S2 - Store to Z length (also EEPROM if enabled)

(This is a Repetier-Firmware only feature)

M280: Set servo position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	Yes	???	No	???		

(Marlin, Repetier M340)

Set servo position absolute. P: servo index, S: angle or microseconds (Marlin)

M300: Play beep sound

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes	No	Yes	No	Yes	???	No	???		

Parameters
- **Snnn** frequency in Hz
- **Pnnn** duration in milliseconds

Example
```
M300 S300 P1000
```

Play beep sound, use to notify important events like the end of printing. See working example on (http://www.3dprinting-r2c2.com/?q=content/seasons-greetings) R2C2 electronics.

If an LCD device is attached to RepRapFirmware, a sound is played via the add-on touch screen control panel. Else the web interface will play a beep sound.

M301: Set PID parameters

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No: See M13[0-3])	Yes	Yes	Yes	Yes	Yes	No	No	???	No	???		

Parameters
- **Hnnn** heater number (Smoothie uses 'S')
- **Pnnn** proportional (Kp)
- **Innn** integral (Ki)
- **Dnnn** derivative (Kd)

Examples
```
M301 H1 P1 I2 D3 ; Marlin
M301 H1 P1 I2 D3 T0.2 B20 W127 S0.8 ; RepRapFirmware (v1.09 onwards), Duet-dc42
M301 S0 P30 I10 D10 ; Smoothie
```

Sets Proportional (P), Integral (I) and Derivative (D) values for hot end. See also PID Tuning.

Marlin

Hot end only; see M304 for bed PID. H is the heater number, default 1 (i.e. first extruder heater).

RepRapFirmware (v1.09 onwards)

H: Is the heater number, and is compulsory. H0 is the bed, H1 is the first hot end, H2 the second etc.
P: Interprets a negative P term as indicating that bang-bang control should be used instead of PID (not recommended for the hot end, but OK for the bed heater).
I: Integral value
D: Derivative value
T: Is the approximate additional PWM (on a scale of 0 to 255) needed to maintain temperature, per degree C above room temperature. Used to preset the I-accumulator when switching from heater fully on/off to PID.
S: PWM scaling factor, to allow for variation in heater power and supply voltage. Is designed to allow a correction to be made for a change in heater power and/or power supply voltage without having to change all the other parameters. For example, an S factor of 0.8 means that the final output of the PID controller should be scaled to 0.8 times the standard value, which would compensate for a heater that is 25% more powerful than the standard one or a supply voltage that is 12.5% higher than standard.
W: Wind-up. Sets the maximum value of I-term, must be high enough to reach 245C for ABS printing.
B: PID Band. Errors larger than this cause heater to be on or off.

An example using all of these would be:

```
M301 H1 P20 I0.5 D100 T0.4 S1 W180 B30
```

Smoothie

S0 is 0 for the hotend, and 1 for the bed, other numbers may apply to your configuration, depending on the order in which you declare temperature control modules.

Other implementations

W: Wind-up. Sets the maximum value of I-term, so it does not overwhelm other PID values, and the heater stays on. (Check firmware support - Sprinter, Marlin?) Example:

M301 W125

Teacup

See M130, M131, M132, M133 for Teacup's codes for setting the PID parameters.

M302: Allow cold extrudes

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes: 0.92	No	Yes	No	No	???	No	???		

Parameters

This command can be used without any additional parameters.

Pnnn Cold extrude state[1]

Examples

M302
M302 P1

This tells the printer to allow movement of the extruder motor, when the hotend is not at printing temperature

Notes

[1]When using RepRapFirmware, running M302 will only report the current cold extrusion state. To allow or deny cold extrudes/retracts, run either "M302 P1" or "M302 P0".

M303: Run PID tuning

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	No	No	No	???	No	???		

PID Tuning refers to a control algorithm used in some repraps to tune heating behavior for hot ends and heated beds. This command generates Proportional (Kp), Integral (Ki), and Derivative (Kd) values for the hotend or bed (E-1). Send the appropriate code and wait for the output to update the firmware.

Hot end usage:

```
M303 S<temperature> C<cycles>
```

Bed usage (repetier, not sure whether cycles work here):

```
M303 P1 S<temperature>
```

Bed usage (others):

```
M303 E-1 C<cycles> S<temperature>
```

Example:

```
M303 C8 S175
```

Smoothie's syntax, where E0 is the first temperature control module (usually the hot end) and E1 is the second temperature control module (usually the bed):

```
M303 E0 S190
```

M304: Set PID parameters - Bed

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	see M301	Yes	No	No	???	No	???		

Parameters
- **Pnnn** proportional (Kp)
- **Innn** integral (Ki)
- **Dnnn** derivative (Kd)

Examples
- M304 P1 I2 D3 ; set kP=3, kI=2, kD=3
- M301 P1 I2 D3 T0.7 H0 B20 W127 ; RepRapFirmware
- M304 ; Report parameters

Sets Proportional, Integral and Derivative values for bed. RepRapFirmware interprets a negative P term as indicating that bang-bag control should be used instead of PID. In RepRapFirmware, this command is identical to M301 except that the H parameter (heater number) defaults to zero.

See also PID Tuning.

M304 in RepRapPro version of Marlin: Set thermistor values

In the RepRapPro version of Marlin (https://github.com/reprappro/Marlin) M304 is used to set thermistor values (as M305 is in later firmwares). RRP Marlin calculates temperatures on the fly, rather than using a temperature table. M304 Sets the parameters for temperature measurement.

Example: M304 H1 B4200 R4800 T100000

This tells the firmware that for heater 1 (H parameter: 0 = heated bed, H = first extruder), the thermistor beta (B parameter) is 4200, the thermistor series resistance (R parameter) is 4.8Kohms, the thermistor 25C resistance (T parameter) is 100Kohms. All parameters other than H are optional. If only the H parameter is given, the currently-used values are displayed. They are also displayed within the response to M503.

M305: Set thermistor and ADC parameters

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	???	Yes	Yes	No	No	???	No	???		

Parameters
- **Pnnn** Heater number
- **Tnnn** Thermistor resistance at 25°C
- **Bnnn** Beta value
- **Rnnn** Series resistor value
- **Lnnn** ADC low offset
- **Hnnn** ADC high offset

Example
- M305 P1 T100000 R1000 B4200

Sets the parameters for temperature measurement. Supported by RepRapFirmware from 0.78c, and Duet-dc42 firmware.

The example above tells the firmware that for heater 1 (P parameter: 0 = heated bed, 1 = first extruder) the thermistor 25C resistance (T parameter) is 100Kohms, the thermistor series resistance (R parameter) is 1Kohms, the thermistor beta (B parameter) is 4200. All parameters other than P are optional. If only the P parameter is given, the existing values are displayed.

RepRapFirmware also supports an ADC correction functionality and a thermistor selection facility. Example:

```
M305 P1 T100000 R1000 B4200 H14 L-11 X2
```

Here the ADC high end correction (H parameter) is 14, the ADC low end correction (L parameter) is -11, and thermistor input #2 is used to measure the temperature of heater #1.

M306: set home offset calculated from toolhead position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	???	Yes	No	No	No	???	No	???		

Example: M306 Z0

The values specified are added to the calculated end stop position when the axes are referenced. The calculated value is derived from the distance of the toolhead from the current axis zero point.

The user would typically place the toolhead at the zero point of the axis and issue the M306 command.

This value can be saved to EEPROM using the M500 command (as M206 value).

Implemented in Smoothieware

M320: Activate autolevel(Repetier)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes	No	No	No	No	???	No	???		

(Repetier only)

M321: Deactivate autolevel(Repetier)

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes	No	No	No	No	???	No	???		

(Repetier only)

M322: Reset autolevel matrix

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes	No	No	No	No	???	No	???		

Example: M322 S1

Parameter S1 is mandatory

(Repetier only)

M340: Control the servos

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	Yes	No	No	No	No	???	No	???		

(Repetier only ,Marlin see M280)

M340 P<servoId> S<pulseInUS> / ServoID = 0..3 pulseInUs = 500..2500

Servos are controlled by a pulse width normally between 500 and 2500 with 1500ms in center position. 0 turns servo off.

M350: Set microstepping mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	Yes	No	No	No	No	???	No	???		

Sets microstepping mode.

Warning: Steps per unit remains unchanged.

Usage
    M350 Snn Xnn Ynn Znn Enn Bnn
Parameters
    *Not all parameters need to be used, but at least **one** should be used*
    Snn Set stepping mode for all drivers
    Xnn Set stepping mode for the X axis
    Ynn Set stepping mode for the Y axis
    Znn Set stepping mode for the Z axis
    Enn Set stepping mode for Extruder 0
    Bnn Set stepping mode for Extruder 1

Modes (nn)

1 = full step
2 = half step
4 = quarter step
8 = 1/8 step
16 = 1/16 step

Examples

M350 S16 *(reset all drivers to the default 1/16 micro-stepping)*
M350 Z1 *(set the Z-axis' driver to use full steps)*
M350 E4 B4 *(set both extruders to use quarter steps)*

M351: Toggle MS1 MS2 pins directly

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	No	No	No	???	No	???

Example: M351

M355: Turn case lights on/off

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	use M106	No	No	Yes: 0.92.2	No	No	No	No	???	No	???

Examples

M355 S1 *; Enable lights*
M355 S0 *; Disable lights*
M355 *; Report status*

Every call or change over LCD menu sends a state change for connected hosting software like

```
Case lights on
Case lights off
No case lights
```

M360: Report firmware configuration

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	Yes: 0.92.2	No	No	No	No	???	No	???

Target

This command helps hosting software to detect configuration details, which the user would need to enter otherwise. It should reduce configuration time considerably if supported.

Example

M360

Response

```
Config:Baudrate:250000
Config:InputBuffer:127
Config:NumExtruder:2
Config:MixingExtruder:0
Config:HeatedBed:0
Config:SDCard:1
Config:Fan:1
Config:LCD:1
Config:SoftwarePowerSwitch:1
Config:XHomeDir:-1
Config:YHomeDir:-1
Config:ZHomeDir:-1
Config:SupportG10G11:1
Config:SupportLocalFilamentchange:1
Config:CaseLights:0
Config:ZProbe:1
Config:Autolevel:0
Config:EEPROM:1
Config:PrintlineCache:24
Config:JerkXY:30.00
Config:JerkZ:0.30
Config:RetractionLength:3.00
Config:RetractionLongLength:13.00
```

```
Config:RetractionSpeed:40.00
Config:RetractionZLift:0.00
Config:RetractionUndoExtraLength:0.00
Config:RetractionUndoExtraLongLength:0.00
Config:RetractionUndoSpeed:0.00
Config:XMin:0.00
Config:YMin:0.00
Config:ZMin:0.00
Config:XMax:250.00
Config:YMax:150.00
Config:ZMax:90.00
Config:XSize:250.00
Config:YSize:150.00
Config:ZSize:90.00
Config:XPrintAccel:250.00
Config:YPrintAccel:250.00
Config:ZPrintAccel:100.00
Config:XTravelAccel:250.00
Config:YTravelAccel:250.00
Config:ZTravelAccel:100.00
Config:PrinterType:Cartesian
Config:MaxBedTemp:120
Config:Extr.1:Jerk:50.00
Config:Extr.1:MaxSpeed:100.00
Config:Extr.1:Acceleration:10000.00
Config:Extr.1:Diameter:0.00
Config:Extr.1:MaxTemp:220
Config:Extr.2:Jerk:50.00
Config:Extr.2:MaxSpeed:100.00
Config:Extr.2:Acceleration:10000.00
Config:Extr.2:Diameter:0.00
Config:Extr.2:MaxTemp:220
```

SCARA calibration codes (Morgan)

In order to ease calibration of Reprap Morgan, the following M-codes are used to set the machine up

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Partial	No	Yes	No	No	No	???	No	???		

M360: Move to Theta 0 degree position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Experimental	No	Yes	No	No	No	???	No	???		

The arms move into a position where the Theta steering arm is parallel to the top platform edge. The user then calibrates the position by moving the arms with the jog buttons in software like pronterface until it is perfectly parallel. Using M114 will then display the calibration offset that can then be programmed into the unit using M206 (Home offset) X represents Theta.

Smoothieware: M360 P0 will take the current position as parallel to the platform edge, and store the offset in the homing trim offset (M666) No further user interaction is needed.

M361: Move to Theta 90 degree position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Experimental	No	Yes	No	No	No	???	No	???		

Theta move to 90 degrees with platform edge. User calibrates by using jog arms to place exactly 90 degrees. Steps per degree can then be read out by using M114, and programmed using M92. X represents Theta. Program Y (Psi) to the same value initially. Remember to repeat M360 after adjusting steps per degree.

Smoothieware: M360 P0 will accept the current position as 90deg to platform edge. New steps per angle is calculated and entered into memory (M92) No further user interaction is required, except to redo M360.

M362: Move to Psi 0 degree position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Experimental	No	Yes	No	No	No	???	No	???		

Arms move to Psi 0 degree. Check only after other Theta calibrations

M363: Move to Psi 90 degree position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Experimental	No	Yes	No	No	No	???	No	???		

Arms move to Psi 90 degree. Check only after other Theta calibrations

M364: Move to Psi + Theta 90 degree position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Experimental	No	Yes	No	No	No	???	No	???		

Move arms to form a 90 degree angle between the inner and outer Psi arms. Calibrate by moving until angle is exactly 90 degree. Read out with M114, and calibrate value into Home offset M206. Psi is represented by Y.

Smoothieware: M364 P0 will accept the current position as 90deg between arms. The offset is stored as a trim offset (M666) and no further user interaction is required except to save all changes via M500

M365: SCARA scaling factor

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Experimental	No	Yes	No	No	No	???	No	???		

Adjust X Y and Z scaling by entering the factor. 100% scaling (default) is represented by 1

M366: SCARA convert trim

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	No	No	No	???	No	???		

Executing this command translates the calculated trim values of the SCARA calibration to real home offsets. This prevents the home and trim movement after calibration.

M370: Morgan manual bed level - clear map

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	No	No	No	???	No	???		

Clear the map and prepare for calibration

Usage

```
M370
M370 X<divisions> Y<divisions>
```

Without parameters is defaults to X5 Y5 (25 calibration points) When specifying parameters, uneven numbers are recommended.

M371: Move to next calibration position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	No	No	No	???	No	???		

Move to the next position for calibration. User moves the bed towards the hotend until it just touches

M372: Record calibration value, and move to next position

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	No	No	No	???	No	???		

The position of the bed is recorded and the machine moves to the next position. Repeat until all positions programmed

M373: End bed level calibration mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	No	No	No	???	No	???		

End calibration mode and enable z correction matrix. Does not save current matrix

M374: Save calibration grid

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	No	No	No	???	No	???		

Saves the calibration grid. (Smoothieware)

Usage
M374
M374 <file extension> Z

Without parameters safes the grid into the default grid file that gets loaded at boot Parameter specifies the extension of the grid file - useful for special grid files such as for a special print surface like a removable print plate. Addition of Z will additionally save the M206 Z homing offset into the grid file

M375: Display matrix / Load Matrix

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	No	No	No	???	No	???		

Display the bed level calibration matrix (Marlin) Load Grid matrix file (Smoothieware)

Usage
M375
M375 <file extension>

Without parameters loads default grid, and with specified extension attempts to load the specified grid. If not available will not modify the current grid. If Z was saved with the grid file, it will load the saved Z with the grid.

M380: Activate solenoid

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	No	???	No	???		

Example: M380

Activates solenoid on active extruder.

M381: Disable all solenoids

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	No	???	No	???		

Example: M381

M400: Wait for current moves to finish

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	???	No	???		

Example
M400

Finishes all current moves and and thus clears the buffer. That's identical to `G4 P0`.

M401: Lower z-probe

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	No	???	No	???		

Example: M401

Lower z-probe if present.

M402: Raise z-probe

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	No	???	No	???		

Example: M402

Raise z-probe if present.

M404: Filament width and nozzle diameter

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	Yes	No	No	???	No	???		

Parameters
- **Nnnn** Filament width (in mm)
- **Dnnn** Nozzle diameter (in mm)[1]

Examples
- M404 N1.75
- M404 N3.0 D1.0

Enter the nominal filament width (3mm, 1.75mm) or will display nominal filament width without parameters.

Notes

[1]While Marlin only accepts the 'N' parameter, RepRapFirmware further allows to specify the nozzle diameter (in mm) via the 'D 'parameter. This value is used to properly detect the first layer height when files are parsed or a new print is being started.

M405: Filament Sensor on

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

Example: M405

Turn on Filament Sensor extrusion control. Optional D<delay in cm> to set delay in centimeters between sensor and extruder.

M406: Filament Sensor off

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	No	No	No	???	No	???		

Example: M406

Turn off Filament Sensor extrusion control.

M407: Display filament diameter

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	No	Yes	No	No	???	No	???		

Example
- M407

Displays measured filament diameter. In RepRapFirmware, M407 does the same as M404.

M408: Report JSON-style response

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
  Snnn Response type
  Rnnn Response sequence number
Example
  M408 S0

Report a JSON-style response by specifying the desired type using the 'S' parameter. For some purposes it is necessary to pass the sequence number, which is why RepRapFirmware accepts an additional 'R' parameter to specify it.

The following response types are supported:

- Type 0 is the M105 S2 response, which is like the new-style status response (for the old web interface) but some fields are omitted.
- Type 1 is the M105 S3 response, which is like the M105 S2 response except that static values are also included.

- Type 2 is the new-style standard JSON response, which is also reported to the new web interface (see Duet Web Control)
- Type 3 is an extended version of type 2 which includes some additional parameters that aren't expected to change very frequently
- Type 4 is an extended version of type 2 which may be used to poll for current printer stats

- Type 5 reports the current machine configuration

For a more detailed comparison of type 2 - 5, see Proposed_RepRap_Duet_Status_Responses

PanelDue currently only uses M408 S0 and M408 S1.

M420: Set RGB Colors as PWM and is also Enable/Disable Mesh Bed Leveling

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	No	No	Yes	???	No	???		

Usage: M420 R<Red PWM (0-255)> E<Green PWM (0-255)> B<Blue PWM (0-255)>

Example: M420 R255 E255 B255

Set the color of your RGB LEDs that are connected to PWM-enabled pins. Note, the Green color is controlled by the E value instead of the G value due to the G code being a primary code that cannot be overridden.

In marlin, is also: M420 - Enable/Disable Mesh Leveling (with current values) S1=enable S0=disable

M421: Set a Mesh Bed Leveling Z coordinate

M421 - Set a single Z coordinate in the Mesh Leveling grid. X<index> Y<index> Z<offset in mm>

M500: Store parameters in EEPROM

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	Yes	Yes	Yes	???	Yes	No	No	???	No	???		

Parameters
  Snnn Enable auto-save (only RepRapFirmware)
Example
  M500

Save current parameters to EEPROM. RepRapFirmware allows "S1" to be passed, which forces parameters to be automatically saved to EEPROM when they are changed.

In Redeem any parameters set through G/M-codes which is different than what is read from the config files, are stored back to the local config. For instance setting stepper current and microstepping through M906 and M907 followed by M500 will update /etc/redeem/local.cfg.

M501: Read parameters from EEPROM

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes	Yes	???	Yes	No	No	???	No	???

Example
M501

Set the active parameters to those stored in the EEPROM. This is useful to revert parameters after experimenting with them.

M502: Revert to the default "factory settings."

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes	Yes	???	Yes	No	No	???	No	???

Example
M502

This command resets all tunable parameters to their default values, as set in the firmware. This doesn't reset any parameters stored in the EEPROM, so it must be followed with M501 if you want to do that.

M503: Print settings

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	Yes	Yes	???	???	Yes	No	No	???	No	???

Example
M503

This command asks the firmware to reply with the current print settings stored in EEPROM. The reply output includes the G-Code commands to produce each setting. For example, the Steps Per Unit values are displayed as an M92 command.

RepRapFirmware outputs the content of the configuration file, but note that it may be truncated if it is too long.

M540: Enable/Disable "Stop SD Print on Endstop Hit"

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	No	No	No	???	No	???

Parameters
Snnn state, S1=enable, S0=disable
Example
M540 S1

M540: Set MAC address

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Pnnn The MAC address
Examples
M540 P0xBE:0xEF:0xDE:0xAD:0xFE:0xED
M540 PDE:AD:BE:EF:CA:FE

Sets the MAC address (http://en.wikipedia.org/wiki/MAC_address) of the RepRap. This should be done before any other network commands. The MAC address is six one-byte hexadecimal numbers separated by colons. The 0x prefix is optional in later firmware revisions.

M550: Set Name

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Pnnn Machine name
Example

M550 PGodzilla

Sets the name of the RepRap to (in this case) Godzilla. The name can be any string of printable characters except ';', which still means start comment.

M551: Set Password

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn Password
Example
M551 Pmy-very-secret-word

On machines that need a password to activate them, set that password. The code 'P' is not part of the password. Note that as this is sent in clear it does not (nor is it intended to) offer a very high level of security. But on machines that are (say) on a network, it prevents idle messing about by the unauthorised. The password can contain any printable characters except ';', which still means start comment.

Note for RepRapFirmware: If the specified password differs from the default one (i.e. reprap), the user will be asked to enter it when a connection is established via HTTP or Telnet. For FTP, the password must always be passed explicitly.

M552: Set IP address

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn IP address
Snnn Enable networking (optional)
Example
M552 P192.168.1.14

Sets the IP address of the RepRap machine to (in this case) 192.168.1.14. A restart may be required before the new IP address is used. If no 'P' field is specified, this echoes the existing IP address configured. If S0 is added thus: M552 S0 P192.168.1.14 networking is disabled.

Recent RepRapFirmware versions allow the IP configuration to be changed without a restart.

M553: Set Netmask

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn Net mask
Example
M553 P255.255.255.0

Sets the network mask of the RepRap machine to (in this case) 255.255.255.0. A restart may be required before the new network mask is used. If no 'P' field is specified, this echoes the existing network mask configured.

Recent RepRapFirmware versions allow the IP configuration to be changed without a restart.

M554: Set Gateway

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn Gateway
Example
M554 P192.168.1.1

Sets the Gateway IP address of the RepRap machine to (in this case) 192.168.1.1. A restart may be required before the new gateway IP address is used. If no 'P' field is specified, this echoes the existing Gateway IP address configured.

Recent RepRapFirmware versions allow the IP configuration to be changed without a restart.

M555: Set compatibility

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn Emulation type
Example
M555 P1

For firmware that can do it, the firmware is set to a mode where its input and (especially) output behaves exactly like other established firmware. The value of the 'P' argument is:

P value	Firmware
0	Native (i.e. whatever the firmware actually is)
1	RepRap_Firmware
2	Marlin
3	Teacup
4	Sprinter
5	Repetier

M556: Axis compensation

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Snnn Height of the measured distances
Xnnn Deviation in X direction
Ynnn Deviation in Y direction
Znnn Deviation in Z direction
Example
M556 S100 X0.7 Y-0.2 Z0.6

Though with care and adjustment a RepRap can be set up with its axes at right-angles to each other within the accuracy of the machine, who wants to bother with care and adjustment when the problem can be solved by software? This tells software the tangents of the angles between the axes of the machine obtained by printing then measuring a test part. The S parameter (100 here) is the length of a triangle along each axis in mm. The X, Y and Z figures are the number of millimeters of the short side of the triangle that represents how out of true a pair of axes is. The X figure is the error between X and Y, the Y figure is the error between Y and Z, and the Z figure is the error between X and Z. Positive values indicate that the angle between the axis pair is obtuse, negative acute.

Imaging denoting how to determine the S parameter for Gcode M556

M557: Set Z probe point

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	Yes	No	No	???	No	???		

Parameters
Pnnn Probe point number
Xnnn X coordinate
Ynnn Y coordinate
Example
M557 P1 X30 Y40.5

Set the points at which the bed will be probed to compensate for its plane being slightly out of horizontal. The P value is the index of the point (indices start at 0) and the X and Y values are the position to move extruder 0 to to probe the bed. An implementation should allow a minimum of three points (P0, P1 and P2). This just records the point coordinates; it does not actually do the probing. See G32.

M558: Set Z probe type

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters

Pnnn Z probe type
Xnnn Use probe for X axis
Ynnn Use probe for Y axis
Znnn Use probe for Z axis
Hnnn Dive height[1]
Fnnn Feed rate (i.e. probing speed)[1]
Tnnn Travel speed to probe points[1]
Snnn Extra parameter for experimentation (1)
Rnnn Extra parameter for experimentation (2)[2]

Example

M558 P0 X1 Y0 Z1

A Z probe may be a switch, an IR proximity sensor, or some other device. This selects which to use. P0 indicates that no Z probe is present. P1 gives an unmodulated IR probe, or any other probe type that emulates an unmodulated IR probe (probe output is an analog signal that rises with decreasing nozzle height above the bed). If there is a control signal to the probe, it is driven high when the probe type is P1. P2 specifies a modulated IR probe, where the modulation is commanded directly by the main board firmware using the control signal to the probe. P3 selects an alternative Z probe by driving the control signal to the probe low. P4 selects a switch for bed probing (on the Duet, this must be connected to the E0 endstop pins).

The X, Y and Z parameters specify whether each axis uses the Z probe for homing or not. If the parameter is nonzero, the Z probe is used for homing that axis. if the parameter is zero, the endstop switch for that axis is used for homing instead. See also G31 and G32.

Recent versions of RepRapFirmware support an additional parameter H. This specifies the dive height (default 3mm) from which probing is done in response to a G30 command when the P parameter is present, or a G32 command.

Notes

[1]These parameters are only supported by recent RepRapFirmware versions.

[2]This parameter used to specify the Z probe channel in RepRapFirmware, but it has been superceded by the functionality of "M115 Px". With older firmware versions and a Duet 0.7/0.85, this parameter should be 1.

M559: Upload configuration file

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Example

M559

If the RepRap supports it, this uploads a file that is run on re-boot to configure the machine. This file usually is a special G Code file. After sending M559, the file should be sent, ending with an M29 (q.v.).

M560: Upload web page file

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Example

M560

For RepRaps that have web support and that can be driven by a web browser, this uploads the file that is the control page for the RepRap. After sending M560 the file (usually an HTML file) should be sent, terminated by the string

```
<!-- **EoF** -->
```

. Clearly that string cannot exist in the body of the file, but can be put on the end to facilitate this process. This should not be too serious a restriction...

M561: Set Identity Transform

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	Yes	Yes	No	No	???	No	???		

Example
M561

This cancels any bed-plane fitting as the result of probing (or anything else) and returns the machine to moving in the user's coordinate system.

M562: Reset temperature fault

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn Heater number
Example
M562 P2

Reset a temperature fault on heater/sensor 2. If the RepRap has switched off and locked a heater because it has detected a fault, this will reset the fault condition and allow you to use the heater again. Obviously to be used with caution. If the fault persists it will lock out again after you have issued this command. P0 is the bed; P1 the first extruder, and so on.

M563: Define or remove a tool

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn Tool number
Dnnn Extruder drive(s)
Hnnn Heater(s)
Example
M563 P0 D0:5:6 H1:3

Tools are usually (though not necessarily) extruders. The 'P' field specifies the tool number. Tool numbers can have any positive integer value and 0. The 'D' field specifies the drive(s) used by the tool - in this case drives 0, 5 and 6. Drive 0 is the first drive in the machine after the movement drives (usually X, Y and Z). If there is no 'D' field the tool has no drives. The 'H' field specifies the tool's heaters - in this case heaters 1 and 3. Heater 0 is usually the hot bed (if any) so the first extruder heater is usually 1. If there is no H field the tool has no heaters.

Tools are driven using multiple values in the 'E' field of G1 commands, each controlling the corresponding drive in the 'D' field above, as follows:

```
G1 X90.6 Y13.8 E2.24:2.24:15.89
G1 X70.6 E0:0:42.4
```

The first line moves straight to the point (90.6, 13.8) extruding a total of 2.24mm of filament from both drives 0 and 5 and 15.98mm of filament from drive 6.

The second line moves back 20mm in X extruding 42.4mm of filament from drive 6.

Normally an M563 command is immediately followed by a G10 command to set the tool's offsets and temperatures.

It is permissible for different tools to share some (or all) of their drives and heaters. So, for example, you can define two tools with identical hardware, but that just operate at different temperatures.

If you use the M563 command with a P value for a tool that has already been defined, that tool is redefined using the new values you provide.

RepRapFirmware supports an additional form of the M563 command. The command:

```
M563 S1
```

means add 1 (the value of the S parameter) to all tool numbers found in the remainder of the current input stream (e.g. the current file if the command is read from a file on the SD card), or until a new M563 command of this form is executed. The purpose of this is to provide compatibility between the Duet firmware, in which tool numbers typically start at 1, and programs such as slic3r that assume tools are numbered from zero.

Recent versions of RepRapFirmware allow the deletion of existing tools if M563 is called in this way:

```
M563 P1 D-1 H-1
```

M564: Limit axes

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Snnn Limit movement within axis boundaries
Example
M564 S0

Allow moves outside the print volume, or not. If the S parameter is 0, then you can send G codes to drive the RepRap outside its normal working volume, and it will attempt to do so. User beware... If you set the S parameter to 1 then the RepRap will not think outside the box. The default behaviour is S = 1.

M565: Set Z probe offset

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	Yes	see G31	No	No	???	No	???

Example: M565 X3 Y4.5 Z-2.37

Set the offset from the extruder tip to the probe position. The X, Y and Z values are the delta between the extruder and the actual trigger position of the probe. If the probe trigger point is below the extruder (typical) the Z offset will be negative. This just records the point offset; it does not actually do the probing. See G32.

M566: Set allowable instantaneous speed change

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Xnnn Maximum instantaneous speed change of the X axis
Ynnn Maximum instantaneous speed change of the Y axis
Znnn Maximum instantaneous speed change of the Z axis
Ennn Maximum instantaneous speed change of the extruder drives
Example
M566 X20 Y20 Z2 E10

Work around an algorithm limitation of some firmwares, which can't calculate step timings for a standing start. Teacup Firmware and Smoothieware don't have this limitation, so M566 is obsolete there.

M566 sets the speeds in mm/minute that axes can do from a standing start. If an accelerating algorithm starts a move with a zero velocity on other firmwares and then accelerates from that, it can give problems when the zero initial velocity is used to calculate a timestep between stepper pulses at the beginning: the timestep ends up being infinite... So these systems have initial small velocities to start at. This sets them.

Recent versions of RepRapFirmware don't have the limitation, but instead they use this parameter to determine the maximum allowable speed change of each motor when cornering.

M567: Set tool mix ratios

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Pnnn Tool number
Ennn Mix ratios
Example
M567 P2 E0.1:0.2:0.1:0.6

This example sets the mix ratio for tool 2 (the P value). When mixing is then turned on (see M568), only single E values need to be sent on a G1 command (any extra E values will be ignored, but are not illegal):

G1 X20 E1.3

This will move to X=20 extruding a total length of filament of 1.3mm. The first drive of tool 2 will extrude 0.1*1.3mm, the second 0.2*1.3mm and so on. The ratios don't have to add up to 1.0 - the calculation done is as just described. But it is best if they do.

See also M568.

M568: Turn off/on tool mix ratios

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
- **Pnnn** Tool number
- **Snnn** Whether mix ratios should be activated

Example
- M568 P2 S0

Turn on/off automatic mix ratios for tool 2. If the S parameter is 0 mixing is turned off; if it is non-zero it is turned on.

After turning off command G1 instructions must send as many E values as the tool has drives:

```
G1 X20 E0.2:0.4:0.166:0.3
```

The off state is the default.

M569: Set axis direction and enable values

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
- **Pnnn** Drive number
- **Snnn** Whether the drive should move forwards
- **Rnnn** Enable drive[1]
- **Xnnn** Map drive to X axis[2]
- **Ynnn** Map drive to Y axis[2]
- **Znnn** Map drive to Z axis[2]
- **Ennn** Map drive to extruder drive[2]

Example
- M569 P0 S1

Set the control value for the drive specified by P that sends it forwards to the given value in the S field. After sending the example, sending a 1 to X (drive 0) will make it go forwards, sending a 0 will make it go backwards. Obviously to be used with extreme caution...

Notes

[1]The 'R' parameter is not supported by all firmware, but in the dcnewman fork of RepRapFirmware and versions 1.09i and later of the dc42 fork, this sets the enable value -- logic level -- for the drive specified by P to the given value in the R field. Allowed 'R' values are 0 or 1. With the following example, drive 2 is enabled by sending an enable value of 0. Sending an enable value of 1 will disable the drive.

```
M569 P2 R0
```

You can use any combination of S XYZE and R parameters in a single M569 command. Values not provided are left unchanged.

[2]Recent firmware versions allow drives to be remapped. For example:

```
M569 P0 X0
```

Assigns driver 0 to control the X0 motor. In place of X0 you can use Y0 Z0 E0 E1 E2 etc. to assign the driver to the corresponding motor. Currently, only one driver can be allocated to each axis or extruder.

M570: Set heater timeout

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Snnn Heater timeout (in seconds)
Example
M570 S120

After a heater has been switched on, wait 120 seconds for it to get close to the set temperature. If it takes longer than this, flag a heater fault.

M571: Set output on extrude

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Snnn Output value
Example
M571 S0.5

This turns an output on whenever extrusion is being done, and turns it off when the extrusion is finished. The output could control a fan or a stirrer or anything else that needs to work just when extrusion is happening. The S parameter sets the value of the PWM to the output. 0.0 is off; 1.0 is fully on.

M572: Set or report extruder elasticity compensation

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	dc42	No	No	???	No	???

Parameters
Pnnn Drive number
Snnn Elasticity pre-compensation time (in seconds)
Example
M572 P3 S0.06

This sets the pre-compensation time in seconds (S parameter) for Bowden extruder elasticity for the specified drive (P parameter). Supported by RepRapFirmware-dc42. Normally, compensation should be applied to extruder drives only (drives 3 and higher).

Pre-compensation causes the extruder drive position to be increased by an additional amount proportional to the rate of extrusion. At the end of a move when the extrusion rate is decreasing, this may result in the extruder drive moving backwards (i.e. retracting). Therefore, if you enable this feature, you may need to reduce the amount of retraction you use in your slicing program to avoid over-retraction.

M573: Report heater PWM

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Pnnn Heater number
Example
M573 P1

This gives a running average (usually taken over about five seconds) of the PWM to the heater specified by the P field. If you know the voltage of the supply and the resistance of the heater this allows you to work out the power going to the heater.

M574: Set endstop configuration

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Xnnn Switch type for X axis
Ynnn Switch type for Y axis
Znnn Switch type for Z axis
Snnn Logic level
Example

M574 X1 Y2 Z0 S1

This defines the type of endstop switch or opto sensor that the printer has for each axis: 0 = none, 1 = low end, 2 = high end. The optional S parameter defines whether the endstop input is active high (S1, the default) or low (S0). Intended for use with boards that provide a single endstop input for each axis that may be used for either a high or a low end endstop, such as the Duet. Supported by RepRapFirmware. On delta printers, the XYZ parameters refer to the towers and the endstops should normally all be high end.

M575: Set serial comms parameters

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters
Pnnn Serial channel number
Bnnn Baud rate
Snnn Whether checksums should be used
Example
M575 P1 B57600 S1

This sets the communications parameters of the serial comms channel specified by the P parameter. P0 specifies the main serial interface (typically a USB port, or serial-over-USB), while P1 specifies an auxiliary serial port (for example, the port used to connect a PanelDue). The B parameter is the required baud rate (this parameter is typically ignored if the port is a true USB port). The S parameter is a bitmap of features. The lowest bit, if set, specifies that only commands that include a valid checksum should be accepted from this comms channel.

M577: Wait until endstop is triggered

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	No	No	???		

Parameters
Snnn Desired endstop level
Xnnn Select X axis endstop
Ynnn Select Y axis endstop
Znnn Select Z axis endstop
Ennn Select extruder drive endstop
Example
M577 E0 S1

Wait for an endstop switch to be pressed. The example above will wait until the first extruder endstop is triggered.

The following trigger types may be used using the 'S' parameter:

0: Endstop not hit 1: Low endstop hit 2: High endstop hit 3: Near endstop (only Z probe)

Note that this code is not available in RepRapFirmware-dc42.

M578: Fire inkjet bits

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	No	No	???		

Parameters
Pnnn Inkjet head number
Snnn Bit pattern
Example
M578 P3 S5

This fires inkjet head 3 (the P field) using the bit pattern specified by the S field. The example shown would fire bits 101. If the P parameter is ommitted inkjet 0 is assumed.

This is a version of the M700 command used by the Inkshield, but unfortunately M700 is already taken so cannot be used for that in the standard.

M579: Scale Cartesian axes

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	No	No	???		

Parameters

Xnnn Scale factor for X axis
Ynnn Scale factor for Y axis
Znnn Scale factor for Z axis

Example

M579 X1.0127 Y0.998

On a Cartesian RepRap you can get prints exactly the right size by tweaking the axis steps/mm using the M92 G Code above. But this does not work so easily for Delta and other RepRaps for which there is cross-talk between the axes. This command allows you to adjust the X, Y, and Z axis scales directly. So, if you print a part for which the Y length should be 100mm and measure it and find that it is 100.3mm long then you set Y0.997 (= 100/100.3).

M580: Select Roland

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	No	No	???		

Parameters

Rnnn Whether Roland mode should be activated
Pnnn Initial text to send to the Roland controller

Example

M580 R1 PVS4;!VZ2;!MC1;

This is not really anything to do with RepRap, but it is convenient. The little Roland mills (http://www.rolanddg.com/product/3d/3d/mdx-20_15/mdx-20_15.html) are very widely available in hackerspaces and maker groups, but annoyingly they don't speak G Codes. As all RepRap firmware includes a G-Code interpreter, it is often easy to add functions to convert G Codes to Roland RML language (http://altlab.org/d/content/m/pangelo/ideas/rml_command_guide_en_v100.pdf) . M580 selects a Roland device for output if the R field is 1, and returns to native mode if the R field is 0. The optional P string is sent to the Roland if R is 1. It is permissible to call this repeatedly with R set to 1 and different strings in the P field to communicate directly with a Roland.

M600: Set line cross section

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	???	???	No	No	Yes	???	No	???		

Example: M600 P0.061

Sets the cross section for a line to extrude in velocity extrusion mode. When the extruder is enabled and movement is executed the amount of extruded filament will be calculated to match the specified line cross section.

M600: Filament change pause

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	???	No	No	No	???	No	???		

Example: M600

Pause for filament change X[pos] Y[pos] Z[relative lift] E[initial retract] L[later retract distance for removal].

M605: Set dual x-carriage movement mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	???	No	No	No	No	???	No	???		

Example: M605 S1

Sets the dual x-carriage movement mode: S<mode> [X<duplication x-offset> R<duplication temp offset>].

M605 S0: Full control mode. The slicer has full control over x-carriage movement M605 S1: Auto-park mode. The inactive head will auto park/unpark without slicer involvement M605 S2 [Xnnn] [Rmmm]: Duplication mode. The second extruder will duplicate the first with nnn millimeters x-offset and an optional differential hotend temperature of mmm degrees. E.g., with "M605 S2 X100 R2" the second extruder will duplicate the first with a spacing of 100mm in the x direction and 2 degrees hotter.

M665: Set delta configuration

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	Yes	Yes	No	No	???	No	???		

Parameters

Lnnn Diagonal rod length
Rnnn Delta radius
Snnn Segments per second[1]
Bnnn Safe printing radius[2]
Hnnn Nozzle height above the bed when hmed after allowing for endstop corrections[2]
Xnnn X tower position correction[3]
Ynnn Y tower position correction[3]
Znnn Z tower position correction[3]

Examples

M665 L250 R160 S200 (Marlin)
M665 L250 R160 B80 H240 X0 Y0 Z0 (RepRapFirmware)

Set the delta calibration variables.

I don't think it's a good idea to have two different implementations for the same G-code, and I also question the practical value of specifying the print bed radius when defining a delta configuration, since many delta printers use a square or rectangular print bed. So perhaps we should stick to the Marlin-defined command as the definition for this command, and use a different command or set of commands to define print bed shape and size. --AndrewBCN (talk) 23:10, 31 January 2015 (PST)

The implementations are not different, they have the same L and R parameters, but each has additional parameters that are not relevant to the other implementation. I'm not against defining a new Gcode to define bed size and shape; however, you can already define the limits of a rectangular print area using M208. Even when a delta printer has a square bed, the printable area is not square. It is usually taken to be circular, although it is in reality more complicated. My purpose in adding the B parameter was to make it easy to define a radius outside which movement will not normally be attempted. I have changed "bed radius" to "safe printing radius" in the text to help clarify this. --dc42

Notes

[1]Only supported on Marlin.

[2]Only supported in RepRapFirmware.

[3]X, Y and Z tower angular offsets from the ideal (i.e. equilateral triangle) positions, in degrees, measured anti-clockwise looking down on the printer.

M666: Set delta endstop adjustment

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	Yes	No	Yes	Yes	No	No	???	No	???		

Parameters

Xnnn X axis endstop adjustment
Ynnn Y axis endstop adjustment
Znnn Z axis endstop adjustment

Example

M666 X-0.1 Y+0.2 Z0

Sets delta endstops adjustments.

M667: Select CoreXY mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	Yes	No	No	???	No	???		

Parameters

Snnn CoreXY mode
Xnnn X axis scale factor
Ynnn Y axis scale factor
Znnn Z axis scale factor

Example

M667 S1

M667 S0 selects Cartesian mode (unless the printer is configured as a delta using the M665 command). Forward motion of the X motor moves the head in the +X direction. Similarly for the Y motor and Y axis, and the Z motor and Z axis. This is the default state of the firmware on power up.

M667 S1 selects CoreXY mode. Forward movement of the X motor moves the head in the +X and +Y directions. Forward movement of the Y motor moves the head in the -X and +Y directions.

M667 S2 selects CoreXZ mode. Forward movement of the X motor moves the head in the +X and +Z directions. Forward movement of the Z motor moves the head in the -X and +Z directions.

M667 S3 selects CoreYZ mode. Forward movement of the Y motor moves the head in the +Y and +Z directions. Forward movement of the Z motor moves the head in the -Y and +Z directions.

Additional parameters X, Y and Z may be given to specify factors to scale the motor movements by for the corresponding axes. For example, to specify a CoreXZ machine in which the Z axis moves 1/3 of the distance of the X axis for the same motor movement, use M667 S2 Z3. The default scaling factor after power up is 1.0 for all axes.

To change the motor directions, see the M569 command.

M668: Set Z-offset compensations polynomial

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	No	No	No	dc42-cmm	No	No	???	No	???		

Polynomial compensation is an experimental method to compensate for geometric distortion of a delta machine Z-plane. After the bed is compensated with the set of G30 points, there remains error. This method fits a 6th degree polynomial with independent origins for each order to the residual error data (using a simulated annealing technique on the host). The polynomial is communicated and controlled through M668. Because the polynomial takes many floating point operations to compute each point, the firmware builds a grid of values, and used bi-linear interpolation to adjust the actual Z-axis offset error estimate.

For the polynomial used, 40 parameters are specified. The I parameter allows the coefficients to be loaded a few at a time, which limits the size of the G-code string. The index starts with 1, not with 0.

M668 Ix S[list of values] sets the polynomial parameters starting at index x, if index present and != 0.

M668 R recomputes the grid based on the current parameters.

M668 P[0|1] turns off or on the polynomial compensation.

Typical use would be:

M668 I1 S4.882E-17:0.0 M668 I3 ... ... M668 R P1

Which sets the list, computes the interpolation grid, and then enables compensation.

M700: Level plate

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	bq	No	No	No	No	No	???	No	???		

Example: M700

Script to adjust the plate level.

M701: Load filament

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	No	No	No	bq	No	No	No	No	No	???	No	???		

[1] only in bq-Marlin Firmware

Example: M701

M702: Unload filament

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	bq	No	No	No	No	No	???	No	???

[1] only in bq-Marlin Firmware

Example: M702

M851: Set Z-Probe Offset

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	???	???	???	Yes	???	???	No	???	???	???	No	???

Sets the Z-Probe Offset saved in the EEPROM and this setting also works like M206 as well and this has priority over the z probe offset you set in marlin configuration.h setting

Example: M851 Z-4

The example above will set the z-probe offset EEPROM setting to -4mm below the nozzle and enables the nozzle travel 4mm lower than the probe triggered position. It is however, a good idea to keep the setting inside your configuration.h as well for your own future reference.

This command appears on pronterface after marlin dev 1.1.0, it is unknown that this command can be used on marlin 1.0.0

M906: Set motor currents

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	M907?	Yes	No	No	???	No	Yes

Parameters

Xnnn X drive motor current
Ynnn Y drive motor current
Znnn Z drive motor current
Ennn E drive(s) motor current(s)
Innn Motor current idle factor (0..100)[1]

Example

M906 X300 Y500 Z200 E350

Sets the currents to send to the stepper motors for each axis. The values are in milliamps.

Notes

[1]RepRapFirmware supports an additional I parameter. This is the percentage of normal that the motor currents should be reduced to when the printer becomes idle but the motors have not been switched off. The default value is 30%.

M907: Set digital trimpot motor

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	Yes	No	No	No	???	No	Yes

Set digital trimpot motor current using axis codes (X, Y, Z, E, B, S). In Redeem (https://bitbucket.org/intelligentagent/redeem/src/6153607ded91c100fb4e41e936e6d045e19eda29/redeem/gcodes/M907.py?at=slave_stepper) , it sets the current in A (where M906 does in mA).

M908: Control digital trimpot directly

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	Yes: 0.92	No	No	No	No	???	No	???

M908 P<pin> S<current>

M909: Set microstepping

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	Yes

Example: M909 X3 Y5 Z2 E3

Set the microstepping value for each of the steppers. In Redeem this is implemented as 2^value, so
M909 X2 sets microstepping on X-axis to 2^2 = 4,
M909 Y3 sets microstepping on Y-axis to 2^3 = 8 etc.

M910: Set decay mode

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	No	No	No	???	No	Yes

Example: M910 X3 Y5 Z2 E3

Set the decay mode for each stepper controller The decay mode controls how the current is reduced and recycled by the H-bridge in the stepper motor controller. It varies how the implementations are done in silicone between controllers. Typically you have an on phase where the current flows in the target current, then an off phase where the current is reversed and then a slow decay phase where the current is recycled.

M928: Start SD logging

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	No	No	No	No	???	No	???

Example: M928 filename.g

Ended by M29.

M997: Perform in-application firmware upgrade

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	in development	No	No	No	No	No

Example: M997

If the files "iap/DuetIAP.bin" and "iap/RepRapFirmware.bin" are present on the SD card, this will trigger an automatic software upgrade. The actual firmware binary (i.e. RepRapFirmware.bin) will be deleted as soon as this operation has finished.

M998: Request resend of line

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	No	No	No	Yes	No	No	???	No	???

Parameters
Pnnn Line number
Example
M998 P34

Request a resend of line 34. In some implementations the input-handling code overwrites the incoming G Code with this when it detects, for example, a checksum error. Then it leaves it up to the GCode interpreter to request the resend.

M999: Restart after being stopped by error

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem
	No	No	No	Yes	No	Yes	Yes	No	No	???	No	???

Parameters
This command can be used without any additional parameters.
Pnnn Reset flags[1]
Example
M999

Restarts the firmware using a software reset.

Notes

[1]The dc42 fork of RepRapFirmware not only resets the board but also puts the board into firmware upload mode if parameter PERASE is present.

Other commands

G: List all G-codes

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	No	???		

Example: G

This lists all implemeted G-codes in the firmware with description and sends it back to the host.
(Note: this has been implemented in Redeem, and so is only a proposition)

M: List all M-codes

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	???	???	???	???	???	???	No	???	???	???	No	???		

Example: M

This lists all implemeted M-codes in the firmware with description and sends it back to the host.
(Note: this has been implemented in Redeem, and so is only a proposition)

T: Select Tool

Support	FiveD	Teacup	Sprinter	Marlin	Repetier	Smoothie	RepRapFirmware	BFB/RapMan	Machinekit	MakerBot	grbl	Redeem		
	Yes	Yes	No	Yes	Yes	Yes	Yes	???	???	???	No	???		

Parameters
: *This command can be used without any additional parameters.*
: Tool number

Example
: T1

Select tool (or in older implementations extruder) number 1 to build with.

The sequence followed is:

1. Set the current tool to its standby temperatures specified by G10 (see above),
2. Set the new tool to its operating temperatures specified by G10 and wait for **all** temperatures to stabilise,
3. Apply any X, Y, Z offset for the new tool specified by G10,
4. Use the new tool.

Selecting a non-existent tool (100, say) just does Step 1 above[1]. That is to say it leaves all tools in their standby state. You can, of course, use the G10 command beforehand to set that standby temperature to anything you like.

Note that you may wish to move to a parking position *before* executing a T command in order to allow the new extruder to reach temperature while not in contact with the print. It is acceptable for the firmware to apply a small offset [by convention (-1mm x tool-number) in Y] to the current position when the above sequence is entered to allow temperature changes to take effect just away from the parking position. Any such offset must, of course, be undone when the procedure finishes.

If the Z value changes in the offsets and the tool moves up, then the Z move is made before the X and Y moves. If Z moves down, X and Y are done first.

Some implementations (e.g. RepRapFirmware) allow you to specify tool-change G Code macros[2]. There are normally three specified (any of which can contain no commands if desired) that execute in this order:

1. Actions to do with the old tool before it is released - macro name: **tfreeN.g** where N is the tool number;
2. (Old tool is released);
3. Actions to do with the new tool before it is selected - macro name: **tpreN.g** where N is the tool number;
4. (New tool is selected); and
5. Actions to do with the new tool after it is selected - macro name: **tpostN.g** where N is the tool number.

With such implementations there is no wait for temperature stabilisation. That can be achieved by an M116 in any of the macros, of course.

After a reset tools will not start heating until they are selected. You can either put them all at their standby temperature by selecting them in turn, or leave them off so they only come on if/when you first use them. The M0, M1 and M112 commands turn them all off. You can, of course, turn them all off with the M1 command, then turn some back on again. Don't forget also to turn on the heated bed (if any) if you use that trick.

Tool numbering may start at 0 or 1, depending on the implementation. Some implementations (those that use the M563 command to define tools) allow the user to specify tool numbers, so with them you can have tools 17, 99 and 203 if you want. Negative numbers are not allowed.

Notes

[1] For RepRapFirmware, selecting a non-existent tool also removes any X/Y/Z offset applied for the old tool.

[2] Under special circumstances, the execution of those macro files may not be desired. RepRapFirmware 109p-ch allows the 'S0' parameter to be passed to prevent the execution of tool change macro files.

Proposed EEPROM configuration codes

BRIEFLY: each RepRap has a number of physical parameters that should be persistent, but easily configurable, such as extrusion steps/mm, various max values, etc. Those parameters are currently hardcoded in the firmware, so that a user has to modify, recompile and re-flash the firmware for any adjustments. These configs can be stored in MCU's EEPROM and modified via some M-codes. Please see the detailed proposal at M-codes for EEPROM config. (*This is proposed by --AlexRa on 11-March-2011. There is currently no working implementation of the proposed commands*).

Marlin uses codes M500-M503 to manipulate EEPROM values.

Sprinter has implemented the following commands to manipulate EEPROM Commit message (https://github.com/kliment/Sprinter/commit/4b1b0f1d96d2be2ed3941095f40a5c2d2bbb943d) .

Teacup uses codes M130-M136 to set, read, and save some parameters.

Replies from the RepRap machine to the host computer

All communication is in printable ASCII characters. Messages sent back to the host computer are terminated by a newline and look like this:

xx [line number to resend] [T:93.2 B:22.9] [C: X:9.2 Y:125.4 Z:3.7 E:1902.5] [Some debugging or other information may be here]

xx can be one of:

ok

rs

!!

ok means that no error has been detected.

rs means resend, and is followed by the line number to resend.

!! means that a hardware fault has been detected. The RepRap machine will shut down immediately after it has sent this message.

The **T:** and **B:** values are the temperature of the currently-selected extruder and the bed respectively, and are only sent in response to M105. If such temperatures don't exist (for example for an extruder that works at room temperature and doesn't have a sensor) then a value below absolute zero (-273°C) is returned.

C: means that coordinates follow. Those are the **X: Y:** etc values. These are only sent in response to M114 and M117.

The RepRap machine may also send lines that look like this:

// This is some debugging or other information on a line on its own. It may be sent at any time.

Such lines will always be preceded by //.

On the latest version of Pronterface and soon Octoprint a special comment of the form:

// action:command

is allowed to be sent from the firmware, the command can currently be pause, resume or disconnect which will execute those commands on the host. As this is also a comment other hosts will just ignore these commands.

The most common response is simply:

ok

When the machine boots up it sends the string

start

once to the host before sending anything else. This should not be replaced or augmented by version numbers and the like. M115 (see above) requests those.

All this means that every line sent by RepRap to the host computer except the start line has a two-character prefix (one of **ok**, **rs**, **!!** or //). The machine should never send a line without such a prefix.

Exceptions:

1. Marlin 1.0.0 Gen6 Firmware does not follow the two character rule. 'rs' is actually 'Resend' and '!!' is 'Error'. Example Lines:

- Error: Line Number is not current line + 1. Last Line: 7
- Resend: 8
- Writing to File: print.gco
- Done saving file.
- File opened:print.gco Size:22992
- File selected

When in the code base did this change take place and what other firmwares are affected?

2. The dc42 fork of RepRapFirmware responds to some commands with a reply string in JSON format, terminated by a newline. This allows later firmware revisions to include additional information without confusing clients (e.g. PanelDue) that do not expect it, and to make responses self-describing so that the client will not be confused if responses are delayed or lost. The commands affected are:

- M105 S2
- M105 S3
- M20 S2
- M36
- M408

Proposal for sending multiple lines of G-code

So far, this is a proposal, open for discussion.

Problem to solve

When using Marlin firmware or emulating Marlin, each line of G-code sent from the host to the controller is answered with an **ok** before the next line can be sent without locking communications up. This slows down communication and limits the number of commands that can be sent per second to the printer controller, as the USB stack on the host and the serial interface driver on the Arduino add their own latencies (up to 10 milliseconds). This is not a problem for other controller electronics using native USB such as the Duet, because the standard serial-over-USB drivers provide flow control, so the host software can be configured so as not to wait for the **ok**.

For more details on this proposal, some suggested solutions and comments, please see GCODE_buffer_multiline_proposal

Alternatives to G-code

Main article: Firmware/Alternative#alternatives to G-code

Several people have suggested using STEP-NC or some other control language; or perhaps designing a completely new control language.