Elegoo Mars Pro/Saturn ChiTu G-Codes

A listing of g-code commands that I have tested on my Elegoo Mars Pro over UART/Serial connection via OctoPrint Terminal. Some of these g-codes also seem to work using "ChiTu HB" Debug console via the ethernet connection of the Elegoo Saturn as well.
Links to Marlin docs are for reference only. ***Remember ChiTu is not Marlin.***

Informational Codes:

M27

Description: Returns current print progress as a relative file position.
Marlin Doc: https://marlinfw.org/docs/gcode/M027.html
Response:
    If printing: `SD printing byte 0/29771388`
    Not printing: `Error:It's not printing now!`
Breakdown: Current file position / Total file size

M110

Description: Sets line number to ensure controller firmware does not ignore out of order commands. OctoPrint seems to set this to zero upon initial serial connection.
Marlin Doc: https://marlinfw.org/docs/gcode/M110.html
Input: `M110 N0`
   - N: line number
Response: `\x00`

M114

Description: Prints the current axis position in mm from home.
Marlin Doc: https://marlinfw.org/docs/gcode/M114.html
Response: `ok C: X:0.000000 Y:0.000000 Z:60.000000 E:0.000000`

M115

Description: Prints firmware build information.
Marlin Doc: https://marlinfw.org/docs/gcode/M115.html
Response: `ok CBD make it.Date:Dec  3 2019 Time:15:21:14`

M4000

Description: Prints current status of the hardware.
Response: `ok B:0/0 X:0.000 Y:0.000 Z:-45.796 F:256/0 D:0/0/1`
Breakdown:
- B: Heated Bed current temp / target temp
- E1: Hot End 1 current temp / target temp
- E2: Hot End 2 current temp / target temp
- X: X-Axis position (mm)
- Y: Y-Axis position (mm)
- Z: Z-Axis position (mm)
- F: Hot End 1 fan PWM / Hot End 2 fan PWM (max 256)
- D: Current file position / Total file size / File paused
  - File Paused
    - 0: False
    - 1: True

M4001

Description: Prints basic controller configuration parameters.
Response: `ok X:0.011430 Y:0.011430 Z:0.000625 E:0.001340 T:0/0/0/155/1 U:'GBK' B:1`
Breakdown:
- X: Steps per mm
- Y: Steps per mm
- Z: Steps per mm
- E: Steps per mm
- T: Machine Type / X Size / Y Size / Z Size / # Hot ends
  - Machine types:
    - 0: XYZ Mode
    - 1: Delta Model
- U: Character Encoding
- B: Heated Bed Enabled
  - 0: False
  - 1: True

M4002

Description: Prints the firmware version.
Response: `ok V4.3.3_LCDC`

M4006

Description: Prints the file name of current print job.
Response: `ok '_mars_psd_V9angled_sla.ctb'`

Motion Control Codes:

G0

Description: Linear Z axis movement.
Marlin Doc: https://marlinfw.org/docs/gcode/G000-G001.html
Input: `G0 Z<+|-_mm> F<speed_mm/min>`
Response: `ok N:<#>`

G28

Description: Home the build plate.
Marlin Doc: https://marlinfw.org/docs/gcode/G028.html
Response: None

G29

Description: Marlin docs say it's used for automatic bed leveling. In practice it just moves
the build plate up and down within the vat 50 times. Could be useful for "stirring" resin
that has sat idle in the vat for a while.
Marlin Doc: https://marlinfw.org/docs/gcode/G029-mbl.html
Response: `ok N:<#>`

G90

Description: Sets absolute positioning mode for all movements.
Marlin Doc: https://marlinfw.org/docs/gcode/G090.html
Response:

G91

Description: Sets absolute positioning mode for all movements.
Marlin Doc: https://marlinfw.org/docs/gcode/G091.html
Response:

Print Control Codes:

M24

Description: Resume a paused print.
Marlin Doc: https://marlinfw.org/docs/gcode/M024.html
Response: `ok N:<#>`

M25

Description: Pause the current print.
Marlin Doc: https://marlinfw.org/docs/gcode/M025.html
Response: `ok N:<#>`

M33

Description: Stop the current print.
Response:
   If printing: `ok N:<#>`
   If not printing: `Error:It's not printing now!`

M106

Description: Set LED cooling fan speed while printing.
Marlin Doc: https://marlinfw.org/docs/gcode/M106.html
Input: `M106 S0`
   - S: fan speed PWM (min-0, max=256)
Response: `ok N:<#>`

M112

Description: Emergency stop. Kills all motors and drops serial connection.
Marlin Doc: https://marlinfw.org/docs/gcode/M112.html
Response: `ok N:<#>`

M6030

Description: Starts a print job from a file on the USB device.
Input: `M6030 '<file_name>'`
Response: `ok N:<#>`

Filesystem Codes:

M20

Description: Print a listing of files/sizes currently on the storage device.
Marlin Doc: https://marlinfw.org/docs/gcode/M020.html
Response:

```
Begin file list
System Volume Information 0
_d300p_carriage_tensioner_sla.ctb 51793495
_Diamond_Tray_sla.ctb 13482731
_Flexi-Rex-improved_sla.ctb 29771388
_mars_psd_V9angled_sla.ctb 41483585
End file list
```

M28

Description: Start manual streaming write to the USB device. All commands except the M4000 and M29 are treated as write data and the effective data length of a package is recommended to be 256 * 5 or shorter.
The data written is formatted as follows：
　　　/ Valid data (data length) / data in the file offset (4byte)|
　　　Test (1byte, XOR operation of all preceding data) / 0x83(1byte) |
If an incorrect test or data loss occurs, you receive the following message: `resend`
Marlin Doc: https://marlinfw.org/docs/gcode/M028.html
Input: `M28 <file_name>`
Response:

```
Detected manual streaming. Disabling temperature polling.
Finish writing with M29. Do NOT attempt to print while
manually streaming!
Delete failed :TEST.TXT
```

M29

Description: Stop manual streaming writes and close the file on the storage device.
Marlin Doc: https://marlinfw.org/docs/gcode/M029.html
Response:

```
Manual streaming done. Re-enabling temperature polling.
All is well.
Done saving file!
```

```
                    // TEST.TXT
```

M30

Description: Delete a file from the USB device.
Marlin Doc: https://marlinfw.org/docs/gcode/M030.html
Input: `M30 <file_name>`
Response: `File deleted :TEST.TXT`

Configuration Codes:

M8004

Description: Z axis stepper motor direction
Input: `M8004 I-1`
- `1: reverse`
- `-1: forward`
Response: None

M8005

Description: Z axis build plate manual movement configuration.
Input: `M8005 Z0`
- `0: Z normal`
- `1: Z- inverted`
Response: None

M8006

Description: Z axis default movement speed.
Input: `M8006 I30`
- `I: mm/sec`
Reponse:

M8007

Description: Jerk setting.
Input: `M8007 I15`
- `I: mm/sec`
Response:

M8008

Description: Acceleration setting.

Input: `M8008 I1000`
- `I: mm/sec`
Response:

M8010

Description: Z axis steps per mm setting.
Input: `M8010 S0.000625`
- `S: steps/mm`
Response:

M8013

Description: Z axis max speed setting.
Input: `M8013 I5`
- `I: mm/sec`
Response:

M8015

Description: Primary build platform movement speeds.
Input: `M8015 I3 T2`
- `I: Initial homing speed`
- `T: Peel and lift speed`
Response:

M8016

Description: Secondary build platform movement speeds.
Input: `M8016 I3 T3 D1`
- `I: Second homing (bounce) speed`
- `T: Peel and lift speed between layers`
- `D: Z axis hold/dwell time (ms)`
Response:

M8026

Description: Maximum Z axis height in mm
Input: `M8026 I155`
- `I: mm`
Response:

M8029

Description: End stop configuration parameters.

Input: `M8029 I0 T0 S0 C0`
- I: Z axis end stop position type.
    - 0: Unilateral limit, only use Z-limit, do not use Z+
    - 2: Double limit, if Z+ and Z- limit are used at the same time, Z+ can limit the maximum stroke of the Z axis.
- T: Z axis end stop wiring type.
    - 0: normally open
    - 1: normally closed
- S: Z axis end stop position.
    - 0: nearest the base, Z-
    - 1: farthest from the base, Z+
- C: Response after homing.
    - 0: return to 0
    - 1: stay in the end stop trigger position

Response:

M8030

Description: Action after homing

Input: `M8030 I-1 T-1 S4 C0`
- I: LED_Fan control
    - 0: disabled
    - -1: always on
    - -2: active when printing
- T: MB_Fan control (Mars carbon filter, Saturn Exhaust)
    - 0: disabled
    - 1: only on while LED is on
    - -1: always on
    - -2: active when printing
- S: LED light control
    - 4: on when image being displayed
- C: Action after homing
    - 0: Return to zero point (0,0,0)
    - 1: Stop at limit position

Response:

M8034

Description: USB device support

Input: `M8034 I1`
- I: USB device support
    - 0: disabled
    - 1: enabled

Response:

M8070

Description:
Input: `M8070 Z6 S3`
```
   - Z: peel and lift distance FAST MOVE (mm)
   - S: peel and first move SLOW MOVE (mm)
```
Response:

M8083

Description: Z axis zero point and limit position setting.
Input: `M8083 I1`
```
   - I: zero and end stop switch position
        - 0: same
        - 1: offset
```
Response:

M8084

Description: Z-axis end stop offset
Input: `M8084 Z0`
```
   - Z: mm
```
Response:

M8085

Description: Touch screen settings.
Input: `M8085 I5000 T0`
```
   - I: boot logo duration. (min=100ms, max=6000ms)
   - T: screensaver time to activate
        - 0: disabled
```
Response:

M8087

Description: External Drive Settings
Input: `M8087 I0 T0`
```
   - I: Settling time of the direction signal to the high level
     of the pulse signal, in nanoseconds
   - T: The minimum hold time of the pulse signal, in ns. If
     there is no external drive control board, set it to zero.
```
Response:

M8093

Description: Dump [debug info](#) to file on USB device.

Input: `M8093 I1`

Response:

```
Delete failed :Machine_Errer_Code.status
Done saving file!
// Machine_Errer_Code.status
```

M8489

Description: Action after printing is completed.

Input: `M8489 P3`

```
- P: action after printing is completed
    - 0: disable motors
    - 1: do nothing
    - 2: home Z, disable motors
    - 3: move to Z axis max (up), disable motors
```

Response:

M8500

Description: Save configuration changes to EEPROM

Response: `ok N:<#>`

M8512

Description: Write [configuration](#) to file on USB device.

Input: `M8512 config_backup.gcode`

Response:

```
Delete failed :CONFIG_BACKUP.GCODE
Done saving file!
// CONFIG_BACKUP.GCODE
```

M8513

Description: Delete all configuration parameters

Response: None

M9003

Description: Configure WiFi in client mode

Input: `M9003 '"wifi_ssid","wifi_password"'`
Response: `ok N:<#>`

M9005

Description: Configure WiFi in hotspot mode
Input: `M9005 '"my_ssid","my_password"'`
Response: `ok N:<#>`

M99999

Description: Local Area Network broadcast, through this instruction to scan the device
Response: `ok MAC:<mac_address> IP:<ip_address> VER:<fw_ver> ID:<device_id> Name:<device_name>`

Unknown Codes:

M23

Description: Unknown
Marlin Doc: https://marlinfw.org/docs/gcode/M023.html
Response: `Error:no file was selected!`

M4004

Description: Unknown
Input: `M4004`
Response: `ok C:0`

M5000

Description: Unknown
Response: `Error:auth length should be 16,yours:-1`

M5002
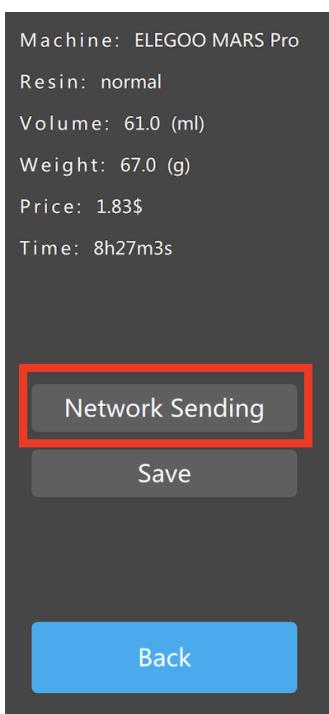
Description: Seems to correspond to the "ID:" field in the M8093 dump output. Still not sure if it's a build ID, controller ID or other.
Response: `0x350041 0x4d485001 0x20393150`

Chitubox Network File Transfer:

Enabling Chitubox network file transfer

Edit the default profile **ELEGOO_MARS_Pro.cfg** located in the install directory.
`<install_path>\CHITUBOX\resource\machine\ELEGOO_MARS_Pro.cfg`
Change the **bNetSending** key from **0** to **1** and save the file.

After slicing, Chitubox should now show the **Network Sending** button:

File Transfer protocol Explained

When the Network Sending button is pressed Chitubox broadcasts the **M99999** gcode command on port **3000** (UDP).
Response: `ok. NAME:<printername> IP:<ip>`
Breakdown:
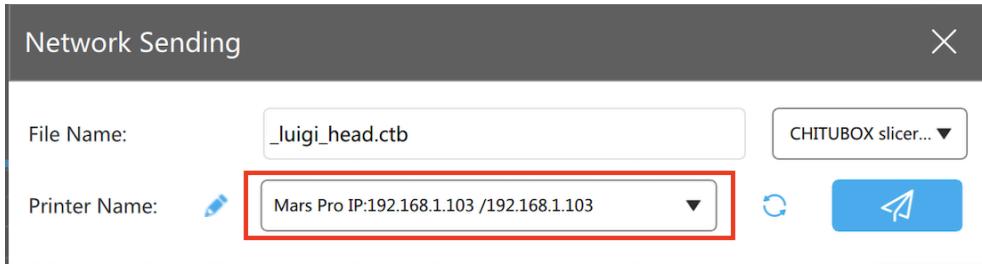
<printername> is the name to assign to your printer, for example **Mars Pro**
<ip> is the ip address assigned to the device that will receive the file

Now that Chitubox is able to recognize your device that will receive the file:

When the send button is pressed, Chitubox will send the **M4001** gcode command to the device.
Response: `ok. X:0.0 Y:0.0 Z:0.0 U:'UTF-8'`

Next Chitubox will send the **M28** **<filename>** gcode command.
Response: `ok`
Breakdown:
      <filename> is the name of the file being transferred

Then the file will be transferred with this protocol:
| Valid Data (k-bytes) | address file position (4 bytes) | test valid data (1byte) | 0x83 |

In total k + 6 bytes are transferred for each data chunk.

Data Verification Test

1. Data ends with 0x83
2. Address file position is equal to the current index of the file being written
3. Test valid data is equals the calculation:
   XOR operation between for each k-bytes XOR operation between 4 bytes address file position

The transfer ends with the **M29** gcode command.
If the test fails, send the resend request with:
      `resend <address file position>`

Console Observations:

Power on the printer

Description: Printed to the console after the printer is powered on.
Response:
```
UART1 init OK
start
```

```
        start
        start_task
        USB disk_OK
        //############Error!cann't open file
        chitu_initial_file_autorun!
```

Insert USB Device

Description: Printed to the console after a USB device is inserted.
Response:
```
        USB disk_ok
        ok
```

Configuration Backup from [M8512](#) (translated):

```
; Version: V4.3.3_LCDC / 1440x2560 /F2.14 ';' is followed by a
comment
M8513; Clear previous configuration parameters, restore parameters to
factory settings, reconfigure parameters
M8004 I-1; Z motor direction
M8005 Z0; Z axis 0: extrusion head movement 1: platform movement
M8006 I30; starting speed
M8007 I15; rail turning speed
M8008 I1000; acceleration
M8010 S0.000625; z mm
M8013 I5; Z max speed
M8015 I3; Z first zero speed
M8016 I3; Z second reset speed
M8015 P2.000000; Z slowly rising speed
M8016 P3.000000; Z fast rising and falling speed
M8016 D1; milliseconds to wait after Z rises
M8020 S3.000000; Makerware withdrawal length
M8021 S1.750000; consumable diameter
M8028 S0.000000; wire back compensation
M8030 T-2; MB_F control of motherboard cooling fan, 1: follow
exposure 0: normally closed -1: normally open -2: follow printing
M8030 S4; LED control, 0: normally closed 1: normally open 2:
following model printing 4: following exposure
M8070 S3.000000; each Z moves slowly up the distance
M8071 X1440 Y2560; projection resolution
M8070 T0; projector warm-up time
M8070 Z6.000000; the distance moved by each Z rise
M8070 I9600; projector baud rate
```

```
M8026 I155.000000; Z maximum travel
M8029 I0; XY limit 0: minimum limit 1: maximum limit 2: bilateral
limit
M8029 T0; limit wiring 0: limit normally open 1: limit normally
closed
M8029 S0; Z limit type 0: minimum limit 1: maximum limit
M8029 C0; Action after XYZ homing 0: Return to zero point (0,0,0) 1:
Stop at the limit position
M8034 I1; folder support or not
M8083 I1; whether to enable auto leveling
M8030 C0; Action after Z return 0: Return to zero point (0,0,0) 1:
Stop at limit position
M8030 I-2; LED fan LED_F control, 1: Follow exposure 0: Normally
closed -1: Normally open -2: Followed printing
M8084 Z-0.100000; Delta Z offset, 0: Disable offset, the stroke is
determined by setting Z to zero, non-zero, the stroke is triggered by
the leveling trigger position + offset value
M8085 I5000; Boot logo duration, minimum 100ms, maximum 6000ms
M8085 T0; standby time of screen saver, unit is second
M8087 I0 T0; I: Time from direction valid to pulse valid (ns), T:
Minimum pulse holding time (ns). If there is no external driver,
please set all to 0
M9003 "CBD"
M8500; save configuration
```

Diagnostics Dump from [M8093](#) (translated):

```
; Version: V4.3.3_LCDC / 1440x2560 /F2.14
"CBD"
; ID: 00350041-4d485001-20393150-ff
;; update: update.SH4
;; update: update.SH4
; status.e_temp              10c; Temporary code
; status.e_other              1; Other
; status.e_mem                0; SD card USB disk EEPROM FLASH
; status.e_communication      0; communication
; status.e_indicator         20; interrupt
; status.e_driver             0; driver
; status.e_printer            0; print
; status.e_LCD                0; LCD
```

```
; status_back.e_temp              0; temporary code
; status_back.e_other         a0008; Print model records
; status_back.e_mem             400; SD card USB disk EEPROM FLASH
; status_back.e_communication     0; communication
; status_back.e_indicator        30; interrupt
; status_back.e_driver            0; driver
; status_back.e_printer           0; print
; status_back.e_LCD        12fd0000; LCD

; last_save_status_back:
; status_back.e_temp              0; temporary code
; status_back.e_other         a0008; Print model records
; status_back.e_mem             400; SD card USB disk EEPROM FLASH
; status_back.e_communication     0; communication
; status_back.e_indicator        30; interrupt
; status_back.e_driver            0; driver
; status.stop_mask                1; interrupt
; status_back.e_printer           0; print
; status_back.e_LCD        12fd0000; LCD
; LCD pulse1 times                0; LCD pulse 1
; LCD pulse2 times                0; LCD pulse 2
; current time            210718967; time


M8004 I-1           ; Z motor direction
M8005 Z0            ; Z axis 0: extrusion head movement 1: platform
movement
M8006 I30           ; starting speed
M8007 I15           ; rail turning speed
M8008 I1000         ; acceleration
M8010 S0.000625     ; z mm
M8013 I5            ; Z max speed
M8015 I3            ; Z first zero speed
M8016 I3            ; Z second reset speed
M8015 P2.000000     ; Z slowly rising speed
M8016 P3.000000     ; Z fast rising and falling speed
M8026 I155.000000   ; Z maximum travel
M8030 C0            ; Action after XYZ return 0: Return to zero point
(0,0,0) 1: Stop at the limit position
M8034 I1            ; folder support or not
M8083 I1            ; whether to enable auto leveling
M8084 Z-0.100000    ; Z offset, 0: Disable offset, the stroke is
determined by setting Z to zero, non-zero, the stroke is triggered by
the leveling trigger position + offset value
```

```
M8085 I5000            ; Boot logo duration, minimum 100ms, maximum
6000ms
M8085 T0               ; standby time of screen saver, unit is second
M8087 I0 T0            ; I: Time from direction valid to pulse valid
(ns), T: Minimum pulse holding time (ns). If there is no external
driver, please set all to 0
M8500                  ; save configuration
```