ANYCUBIC PREDATOR
Duet 2 to Duet 3 Mini 5+ upgrade

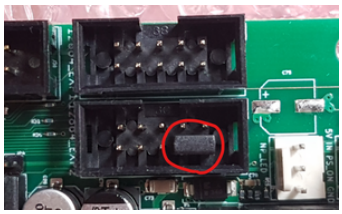
Description of Connections (https://duet3d.dozuki.com/Wiki/Duet_3_Mini_5plus_Wiring)

Header	PCB label	Function
1 x 4-way barrier strip	POWER IN, GND, VIN	Two pins for main VIN and GND. **Powered at 24V from PSU**
	OUT_0, V_OUT_0_OUT, OUT_0_NEG	Two pins for positive and negative OUT_0 terminals. OUT_0 is intended to drive a bed heater or other high current resistive load. If you connect an inductive load to this output, you must use a suitably rated external flyback diode. The ground side of OUT_0 is switched by the mosfet and the positive side is protected by a 15A fuse. **OUT_0 powers the Heated Bed**
2 x 2-pin JST VH connectors	OUT_1, OUT_2	Intended for extruder heaters or similar medium/high current resistive loads. Maximum recommended current 6A each. If you connect inductive loads to these outputs, you must use external flyback diodes. **OUT_1 powers the Hotend 0 Heater. 70W @ 24V means 2.9A.** **OUT_2 powers the Hotend 1 Heater. Not used.**
2 x 4-pin Molex KK connectors	OUT_3, OUT_4	Intended for PWM-controllable fans or other medium/low current loads, flyback diodes are built-in to these outputs. The connector fits a standard PC-type 4-pin PWM fan. Alternatively, a 2-pin fan may be connected between the V_OULC1+ pin (+ve) and the OUT_n_NEG pin (-ve). **OUT_3 powers the Print Cooling Fan (5V).** **OUT_4 is not used.**
		Note: OUT_3 and OUT_4 are protected by a flyback diode to V_FUSED. This does not provide protection if driving these outputs from a higher voltage than V_FUSED

1 x 3-pin Jumper	OUT_3&4 Select V	The positive supply to the above connectors is the centre pin of the 3-pin jumper block. A jumper in the "left" position will power them from the fused VIN supply (max 2A each). A jumper in the "right" position will power them from the onboard 12V regulator (subject to overall 12V supply current *see note 1 below*). **Need to feed the centre pin (V_OUTLC1) with +5V, so OUT_3 & OUT_4 can feed 5V devices.**
2 x 2-pin Molex KK connectors	OUT_5, OUT_6	These are intended for PWM-controllable fans or other medium/low current loads, flyback diodes are built-in to these outputs. Note out_6 PWM pin is shared with LASER/VFD. **OUT_5 powers the Hotend Fan (12V).** **OUT_6 powers the Board Cooling Fan (12V).**
		Note: OUT_5 and OUT_6 are protected by a flyback diode to V_FUSED. This does not provide protection if driving these outputs from a higher voltage than V_FUSED
1 x 3-pin Jumper	OUT_5&6 Select V	The positive supply to the above connectors is the centre pin of the 3-pin jumper block. A jumper in the "left" position will power them from the fused VIN supply (max 2A each). A jumper in the "right" position will power them from the onboard 12V regulator (subject to overall 12V supply current *see note 1 below*). **Need to feed the centre pin (V_OUTLC2) with +12V, so OUT_5 & OUT_6 can feed 12V devices. This can be done shortening V_OUTLC2 and 12V_EXT pins with a jumper.**
5 x 4-pin Molex KK connectors	DRIVER_0, DRIVER_1, DRIVER_2, DRIVER_3, DRIVER_4	Stepper motor connections, See "Connecting Stepper Motors" section below. **DRIVER_0 is assigned to X Motor.** **DRIVER_1 is assigned to Y Motor.** **DRIVER_2 is assigned to Z Motor.** **DRIVER_0 is assigned to E Motor.**

x 16-pin socket strip	EXTERNAL DRIVERS	Step, Direction, Enable, Diag and UART connections for DRIVER_5 and DRIVER_6, along with fused VIN, ground, 3.3V and 5V. Designed for a **Mini 2+ expansion board** to plug directly in. Step, direction and enable can also be used with other external drivers (3.3V signal level). **Not used.**
1 x 2x5 IDC connector	PanelDue_SD	Connects the [PanelDue UPDATE LINK]() UART and shared SPI bus for external SD card. Powered from 5V supply (*see note 2*). Note shared with io0.in and io0.out pins on the IO_0 header. **Connected to PanelDue via Ribbon Cable. IO_0 connector must not be used to avoid interference.**
1 x 3-pin Molex KK connectors	LASER/VFD	5V buffered output shared with out6, along with 5V and ground supply (*see note 2 below*). Provides a 5V PWM signal to drive hobby servos, and PWM->analog controls for VFDs or Lasers. Note out6 PWM pin is shared with OUT_6. **Not used. Be aware that OUT_6 powers the Board Cooling Fan (12V).**
1 x 2-pin Molex KK connectors	12V	Always on 12V supply. Total 12V load should not exceed 800mA.
Network	**Wifi**	U.FL/IPEX push on connector for external antenna. *Note this connector is delicate, take care when plugging and unplugging*. "LED ESP": green LED indicates Wifi connection status
Reset		Single push to reset the board. Double push to put the board into UF2 bootloader upload mode. See [Duet 3 Mini 5 + Firmware, Updating firmware via USB UPDATE LINK]()
1 x JST ZH 6-pin connectors	SWD	Connection for an SWD programming device such as an Atmel-ICE
1 x 2-pin Molex KK connectors	CAN	CAN-FD Bus connection for Duet 3 CAN-FD expansion boards.

5 x 5-pin Molex KK connectors	IO_0, IO_1, IO_2, IO_3, IO_4	These are for endstop switches, Z probes, filament monitors and other low-voltage I/O functions. Each connector provides both 3.3V and 5V power. The inputs will tolerate up to 30V with 10K series resistors (but see below for bypass option). The outputs are 3.3V signals levels with 470R series resistors. IO_1,2,3 are PWM capable. **IO_0 is not used because interferes with PanelDue Ribbon Connector.** **IO_1 is connected to Smart Effector Z-Probe.** **IO_2 is connected to X Endstop.** **IO_3 is connected to Y Endstop.** **IO_4 is connected to Z Endstop.**
2 x 2-pin Jumpers 10K->470R bypass	IO2.in, IO3.in	v1.01 and later only. Jumpers to allow the 10K resistors on IO2.in and IO3.in to be bypassed with 470R resistors. This is required to use IO2 or IO3 for I2C. **Not applicable in 0.x boards.**
2 x 3-pin KK connectors	IO_5, IO_6	Input only IO connections that will tolerate up to 30V with 10K series resistors. **IO_5 is not used.** **IO_6 is connected to Filament Sensor.**
3 x 2-pin KK connectors	TEMP_0, TEMP_1, TEMP_2	Connections for thermistor or PT1000 sensors. **TEMP_0 is connected to Bed Thermistor.** **TEMP_1 is connected to Hotend 0 Thermistor or PT1000.** **TEMP_2 is connected to Hotend 1 Thermistor or PT1000. Not used.**
1 x 2x13 IDC connector	SBC	Connections to a Single Board Computer (SBC) such as a Raspberry Pi. **Not used.**

1 x 2x5 IDC connector	TEMPDB	For connecting a PT100 or thermocouple interface board. Note boards cannot be stacked so only 1 board at a time is supported. **Not used.**
1 x 3-pin Jumper	5V_SELECT	Source of optional External 5V input, see note 2 below
1 x 2-pin Jumper	Int_5V_Disable	Connect a jumper across this to disable the internal 5V regulator, see note 2 below
2 x 2x5 IDCs	12864_EXP1, 12864_EXP2	Headers for connecting a 12864 display using a ST7567 controller, see "Connecting a 12864 display" below. **Not used. The PanelDue does not provide a card detect signal, so it is necessary to bridge pins 2 and 4 of the EXP2 connector.** 
1 x 3-pin KK connector	NP_LED	This is to connect and power NeoPixel LED strips (DotStar LED strips are not supported) . Connect the DO pin to Neopixel DI. External 5V must be supplied to the "EXT 5V" header to power the NeoPixel array, they cannot be powered from the onboard regulator.
1 x 3-pin KK connector	EXT 5V	Input for External 5V supply, see Note 2 below. There is a buffered 5V "pson" pin which can be used to switch an external supply, note it is shared with io4.out

Notes

1. Total 12V load should not exceed 800mA
2. 5V can be powered from multiple inputs (USB, External 5V input, SBC) as well as the internal 5V regulator. Total 5V load should not exceed 800mA when powered from the internal 5V regulator.
3. The PanelDue connector on the Duet 3 Mini 5+ shares the io0.out and io0.in pins, so IO_0 cannot be used at the same time.

LED indications

LEDs are provided to indicate the following:

Label	Colour	Function
ACT	Green	Indicates activity on the CAN-FD bus
STATUS	Red	See description below
V_FUSED	Blue	Indicates fused VIN supply present
12V+	Amber	Indicates indicates on-board 12V regulator operating
5V+	Red	Indicates indicates 5V supply present
3.3V+	Green	Indicates on-board 3.3V regulator operating
ESP	Green	WiFi version only. Indicates WiFi activity; flashing for searching/connecting, on for connected.
OUT_0	Red	Next to the OUT 0 connector, indicates when on
OUT_1	Red	Next to the OUT 1 connector, indicates when on
OUT_2	Red	Next to the OUT 2 connector, indicates when on

The red LED next to the Reset button is labelled "STATUS". *On version 0.2 boards it is labelled DIAG*. It indicates the state of the board, as follows.

LED	Meaning
Flashing steadily, about half a second off and half a second on	Normal operation, RepRapFirmware is running
Flashing three times, then off for a while	Firmware CRC check failed
Fading from bright to dim and then back again	USB bootloader activated

Pin names

Duet 3 EXP3HC pin names:

out0
out1
out2
out3
out4
out5
out6
out3.tach
out4.tach
io0.in
io1.in
io2.in
io3.in
io4.in
io5.in
io6.in
io0.out
io1.out
io2.out
io3.out
io4.out
spi.cs0
spi.cs1
spi.cs2
spi.cs3
temp0
temp1
temp2

Manual calibration

The following is for RepRapFirmware 3.x for all boards except the Duet Maestro, but should also work in RepRapFirmware 1.x and 2.x, by changing M308 command to the appropriate M305 commands (see also next section).

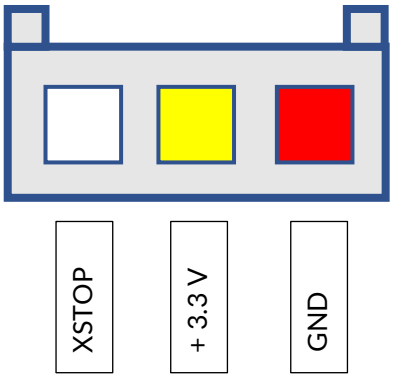
1. Configure the input to be calibrated as a thermistor
2. Connect a resistor to the input, with the resistance being the same as the thermistor resistance at 25C. For example, if you are using a standard 100K thermistor as supplied with E3D hot ends, use 100K. If you are using a Dyze Design or Slice Engineering high temperature thermistor, use 500K.
3. Send **M308 Snn Hhhh** (where nn is the sensor number) for various value of hhh until you find the value of hhh that gives the reading closest to 25C. Higher values of hhh increase the temperature reading. The allowed range of hhh is -127 to 127.
4. If you wish to calibrate the low-end error, then replace the resistor with a value corresponding to a high temperature, for example 100 or 220 ohms. Then send **M308 Snn Lvvv** for various values of vvv until you find the value that gives a reading close to the expected value for that resistance using the thermistor settings you have chosen. For example, if you are using the standard parameters for E3D thermistors (T100000 B4725 C7.06e-8) then the expected reading is 285C for 100 ohms, or 236.5C for 220 ohms.
5. Include the L and H parameters you found in your M308 commands in config.g.

26/10/2021 23:06:52	**M308 S1 L999** Measured L correction for port "temp1" is -1
26/10/2021 23:05:35	**M308 S1 H999** Measured H correction for port "temp1" is -4
26/10/2021 23:05:04	**Error:** Temperature reading fault on heater 1: sensor open circuit
26/10/2021 23:03:54	**M308 S0 L999** Measured L correction for port "temp0" is -1
26/10/2021 23:03:00	**Error:** Heater 0 fault: heater monitor 0 was triggered
26/10/2021 23:02:41	**M308 S0 H999** Measured H correction for port "temp0" is -5

It gives errors when you place the jumper, but they should be ignored. In fact, the Hotend Fan will start spinning for safety because it thinks it is at 2000°C even when it is actually cold!

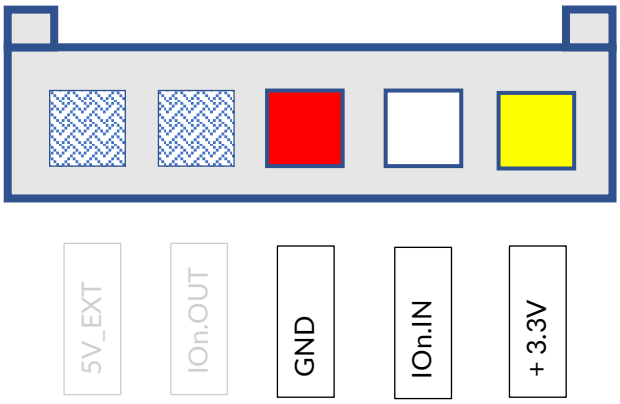
ENDSTOPS

Duet 2:



XSTOP
YSTOP
ZSTOP

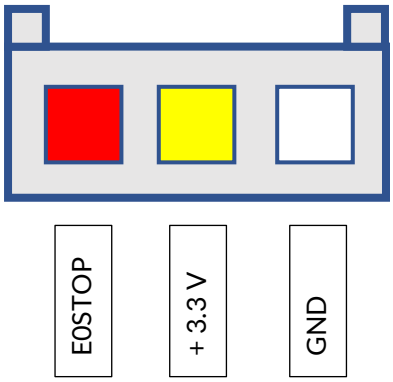
Duet 3 Mini 5+:



IO2
IO3
IO4

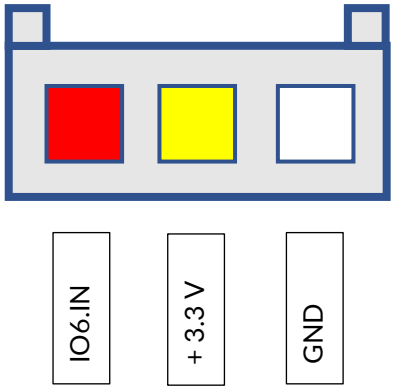
FILAMENT SENSOR (no wiring changes)

Duet 2:



E0STOP

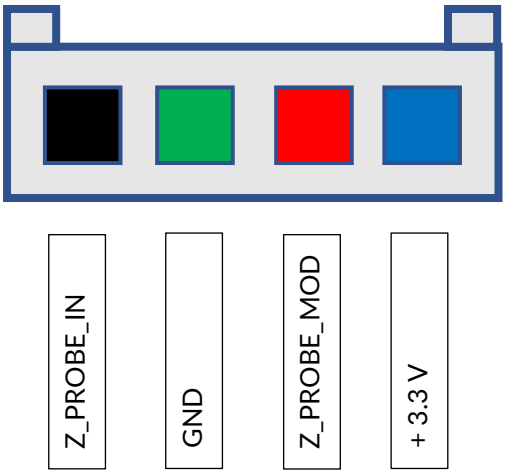
Duet 3 Mini 5+:



IO6

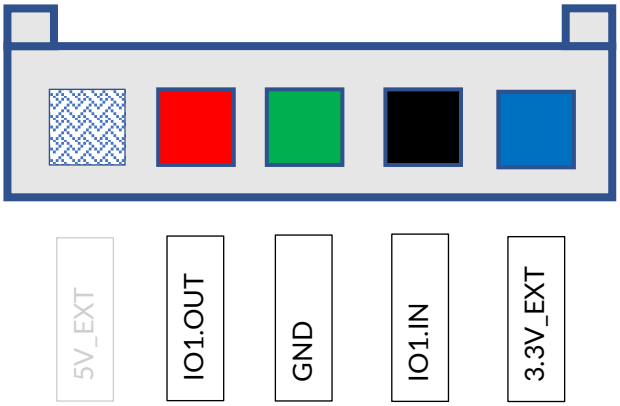
SMART EFFECTOR

Duet 2:



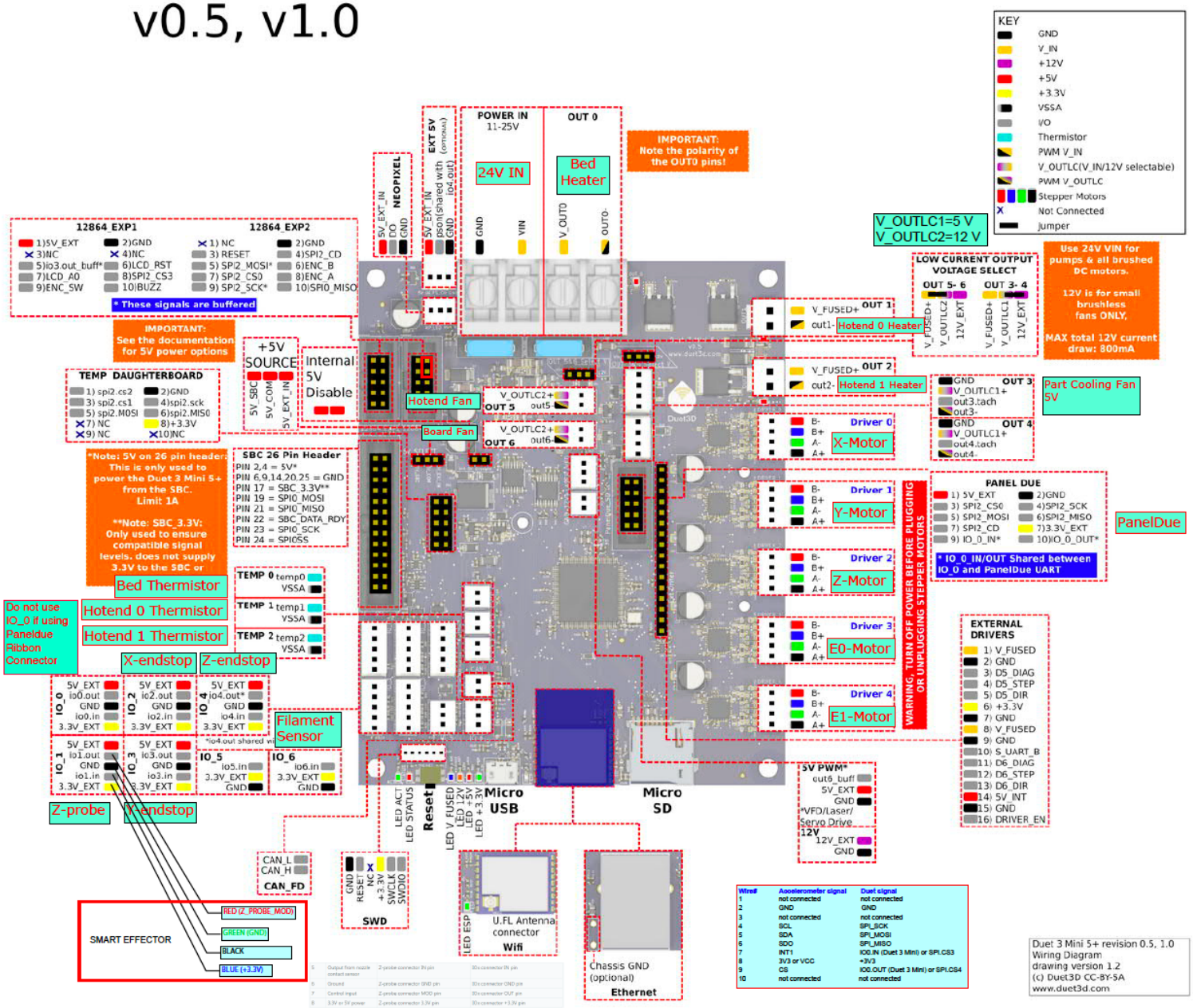
PROBE

Duet 3 Mini 5+:



IO1

Duet 3 Mini 5+ Wiring Diagram v0.5, v1.0



CONFIG.G (based on Kapa’s work):

```
; Configuration file for Duet 3 Mini 5+ (firmware version 3)
; executed by the firmware on start-up
;
; generated by RepRapFirmware Configuration Tool v3.2.3 on Thu Jun 03 2021 12:23:05
GMT+0200 (hora de verano de Europa central)

; General preferences
G90                                     ; Send absolute coordinates...
M83                                     ; ...But relative extruder moves

; Network

M550 P"Anycubic Predator"               ; Set printer name
M552 S1                                 ; Enable network
M586 P0 S1                              ; Enable HTTP
M586 P1 S0                              ; Disable FTP
M586 P2 S0                              ; Disable Telnet

; Delta Settings

M665 L440.718:440.718:440.718 R226.900 H431.890 B185.0 X0.091 Y-0.016 Z0.000
M666 X0.132 Y-0.661 Z0.529 A-0.24 B-0.07

; Drives (on TMC2209)

M569 P0.0 S1 D3                         ; Physical drive 0.0 goes forwards. D3= StealthChop
M569 P0.1 S1 D3                         ; Physical drive 0.1 goes forwards. D3= StealthChop
M569 P0.2 S1 D3                         ; Physical drive 0.2 goes forwards. D3= StealthChop
M569 P0.3 S0 D2                         ; Physical drive 0.3 goes backwards
                                        ; (Orbiter Extruder). D2= Spreadcycle
M584 X0.0 Y0.1 Z0.2 E0.3                ; Set drive mapping

; Steps

M350 X16 Y16 Z16 E16 I1                 ; Configure microstepping with interpolation
                                        ; for X, Y, Z, E.
M92 X160.00 Y160.00 Z160.00 E690.00     ; Set steps per mm
                                        ; (X, Y, Z: LDO-42STH48-1684MAC 0.9 deg Stepper.
                                        ; Orbiter Extruder: 690 steps/mm)

; Speed, Acceleration and Jerks

M203 X36000.00 Y36000.00 Z36000.00 E7200.00 ; Set MAXIMUM SPEEDS (mm/min)
                                            ; (Orbiter Extruder LDO-36STH20-1004AHG =
                                            ; 7200 mm/min)
M201 X4000.00 Y4000.00 Z4000.00 E800.00     ; Set ACCELERATIONS (mm/s^2)
                                            ; (Orbiter Extruder LDO-36STH20-1004AHG =
                                            ; 800 mm/s^2)
M204 P1000 T4000                            ; Set printing and travel ACCELERATIONS
M566 E300.00                                ; Set maximum instantaneous speed changes
                                            ; (JERKS) (mm/min) ONLY EXTRUDER (Orbiter
                                            ; Extruder: 300 mm/min)
M205 X8 Y8 Z8                               ; Set maximum instantaneous speed changes
                                            ; (JERKS) (mm/seg) XYZ. Use this for Marlin
                                            ; COMPATIBILITY

; Stepper Current

M906 X1250.00 Y1250.00 Z1250.00 E1200.00 I30        ; Set motor currents (mA) and motor
                                                    ; idle factor in per cent (Orbiter
                                                    ; Extruder LDO-36STH20-1004AHG =
                                                    ; 1200 mA PEAK)
M84 S30                                             ; Set idle timeout

; Axis Limits

M208 Z-2 S1                                         ; Set minimum Z
```

```
; Endstops (connected to IO_2, IO_3 & IO_4)

M574 X2 S1 P"io2.in"                ; Configure active-high endstop for high end on X
                                    ; via pin io2.in. io0 cannot be used as it
                                    ; interferes with PanelDue Ribbon Cable
M574 Y2 S1 P"io3.in"                ; Configure active-high endstop for high end on Y
                                    ; via pin io3.in
M574 Z2 S1 P"io4.in"                ; Configure active-high endstop for high end on Z
                                    ; via pin io4.in

; Filament runout sensor (connected to IO_6)

M591 D0 P2 C"io6.in" S1             ; Set filament runout sensor connected via pin
                                    ; io6.in

; Z-Probe (Smart Effector Piezo Sensor) (connected to IO_1)

M558 P8 R0.4 C"io1.in+io1.out" H5 F800:400 T9000    ; For using Smart Effector Piezo
                                                    ; Sensor. Set dive height 5mm +
                                                    ; speeds (800:400 mm/min probing
                                                    ; speed and 9000 mm/min travel
                                                    ; speed)
G31 K0 P500 X0.0 Y0.0 Z-0.112                       ; For using Smart Effector Piezo
                                                    ; Sensor. Set Z probe trigger value
                                                    ; offset and trigger height.
M557 R170 S25                                       ; Define mesh grid

; HEATERS

; Heated Bed (Heater0) (connected to OUT_0)

M308 S0 P"temp0" Y"thermistor" T100000 B3950 C0 R2200 A"Bed"      ; Configure sensor 0
                                                                  ; as thermistor on pin
                                                                  ; temp0. R2200 for
                                                                  ; Duet3
M950 H0 C"out0" T0                  ; Create bed heater output on out0 and map it to
                                    ; sensor 0
M140 H0                             ; Map heated bed to heater 0
M143 H0 P0 S140 A2                  ; Disable temporarily H0 (A2 parameter) if temp
                                    ; exceeds 140C
M143 H0 P0 S150 A0                  ; Heater fault H0 (A0 parameter) if temp
                                    ; exceeds 150C
M307 H0 B0 S1.00                    ; Disable bang-bang mode for the bed heater and set
                                    ; PWM limit
M570 H0 P60 T15 S0                  ; Heater fault for 60seg of 15°C excursion

; Extruder Heater (Heater1) (connected to OUT_1)

M308 S1 P"temp1" Y"pt1000" A"Hotend" ; Configure sensor 1 as PT1000 on pin temp1.
M950 H1 C"out1" T1                  ; Create nozzle heater output on out1 and map it to
                                    ; sensor 1
M143 H1 S290 A2                     ; Disable temporarily H1 (A2 parameter) if temp
                                    ; exceeds 290C
M143 H1 S300 A0                     ; Heater fault H1 (A0 parameter) if temp
                                    ; exceeds 300C
M307 H1 B0 S1.00                    ; Disable bang-bang mode for heater  and set
                                    ; PWM limit
M570 H1 P10 T30 S0                  ; Heater fault for 10 seg of 30°C excursion

; Heater model parameters (PID TUNING)

M307 H0 R0.405 C527.094:527.094 D1.64 S1.00 V24.1 B0 I0    ; Heater0 (BED) PID tune
                                                           ; (M303 H0 S60)
M307 H1 R2.643 C315.029:207.706 D8.14 S1.00 V24.0 B0 I0    ; Heater1 (HOTEND) PID tune ;
                                                           ; (M303 T0 S210)

; Fan0 = Part Cooling Fan (connected to OUT_3) V_OUTLC1: 5V

M950 F0 C"out3" Q500                ; Create Fan0 for Part Cooling on pin "out3" and
                                    ; set its frequency (LDO 5015H05S), 5V 5000rpm
                                    ; 500Hz PWM.
M106 P0 S0 H-1                      ; Set Fan0 to default off, manual control
```

```
; Fan1 = Hotend Fan (connected to OUT_5) V_OUTLC2: 12V

M950 F1 C"out5" Q500          ; Create fan 1 for Hotend Cooling on pin "out5" and
                              ; set its frequency
M106 P1 S1 H1 T45             ; Set fan 1 value. Thermostatic control is turned on

; Fan2 = MotherBoard Cooling (connected to OUT6) V_OUTLC2: 12V
; ---MCU & DRIVERS sensors---

M308 S3 Y"mcu-temp" A"MCU"           ; Create sensor for MCU temp
M308 S4 Y"drivers" A"DRIVERS"        ; Create sensor for DRIVERS temp
M912 P0 S-2.3                        ; Calibrate MCU temp (Duet 3 Mini 5+)
M950 F2 C"out6" Q500                 ; Create fan 2 on pin "out6"
M106 P2 H3:4 L.3 B.5 X1 T40:65       ; Set fan 2 PWR fan. Turns on when MCU temperature,
                                     ; hits 40C and full when the MCU temperature
                                     ; reaches 65C or any TMC2209 alarms

; Tools

M200 D1.75                    ; Set Filament Diameter to 1.75 mm.
M563 P0 D0 H1 F0              ; Define tool 0: Extruder Drive 0 + Heater 1 + Fan 0
G10 P0 X0 Y0 Z0               ; Set tool 0 axis offsets
G10 P0 R0 S0                  ; Set initial tool 0 active and standby temperatures
                              ; to 0C
M302 S180 R180                ; Allow extrusion starting from 180°C and retractions
                              ; already from 180°C

; Additional Settings

M404 N1.75                    ; Define filament diameter for print monitor
M207 S1.50 R0 F7200 Z0.2      ; FIRMWARE RETRACTION(Orbiter Extruder: Retraction = 1.5mm;
                              ; Retraction Speed = 120 mm/s = 7200 mm/min; Zhop = 0.3 mm)

; LCD

M575 P1 S0 B57600             ; Set Baudrate to 57600. PanelDue without checksums mode

; Miscellaneous

M911 S23 R24 P"M913 X0 Y0 G91 M83 G1 Z3 E-5 F1000"  ; Set voltage thresholds and actions
                                                    ; to run on power loss
T0                                                  ; Select first tool (Extruder 0)
M501                                                ; Loading config_override
```