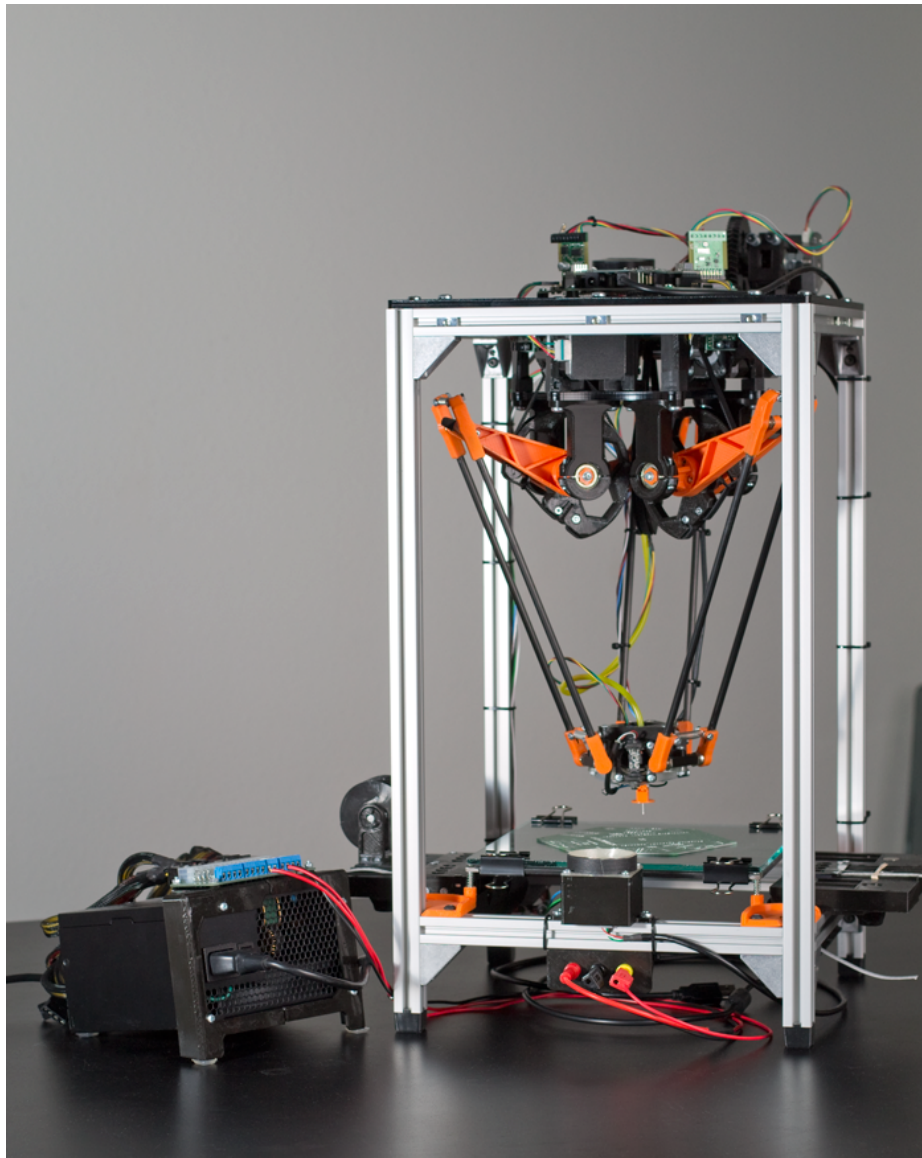


Preliminary BOM for FirePick Delta

Beta Test Kits - Round 1



Published May 6, 2015

Heated Bed Assembly

Part Number	Quantity	Description	Purpose	Barebones?
Hardware Bag 1				
FBHCS-M5-10L	8	Fastener, M5 button-head cap screw, 10mm L	Bed leveling corners	NO
FFLT-M3-10L	4	Fastener, M3 flat-head machine screw, 10mm L	Heated bed PCB attachment	NO
FNUT-M3	4	Fastener, M3 nut	Heated bed PCB attachment	NO
FNUT-M4	4	Fastener, M4 nut	Bed leveling corners	NO
FNUT-M5-HNKK5	8	Extrusion nut, M5	Attachment to frame extrusion	NO
FSHCS-M4-30L	4	Fastener, M4 socket head cap screw, 30mm L	Bed leveling corners	NO
FWSH-M3	4	Fastener, M3 flat washer	Heated bed PCB attachment	NO
FWSH-M4	12	Fastener, M4 flat washer	Bed leveling corners	NO
MSPRING01	4	Spring, bed leveling	Leveling springs for heated bed	YES
MCLIP01	4	MCLIP01 - Metal clip for heated bed to glass	Attaches glass to heated bed surface	YES
MMAG01	6	Magnet, 1/2" dia. x 3/8" L	Install in 3D0028 to act as "pucks" for PCB holding to steel bed	YES
Zip ties	TBD	0.1" wide x 6"	Wire management	NO
N/A	30"	Wire, twisted pair, heated bed thermistor	Thermistor to EAT0002 wiring	NO
N/A	30"	Wire, 18 AWG, yellow, heated bed (ATX power supply '+12V2' to bed)	Heated bed power wiring (~10A)	NO
N/A	30"	Wire, 18 AWG, Black, heated bed (EAT0002 to bed)	Heated bed power wiring (~10A)	NO
N/A	50"	Wire, 18 AWG, Black, heated bed (EAT0002 to ATX power supply 'GND')	Heated bed power ground wiring (~10A)	NO
N/A	2	Ferrule, thermistor to twisted pair	Ferrule crimps are more reliable than soldering these connections	NO
Electronics				
EAT0002	1	Modular tool PCB	Connects modular tool to EMC02	YES
EL-THERMISTOR	1	Thermistor, for heated bed	Temperature sensing element for 3D printing heated bed	NO
EHB01	1	PCB heated bed	Heated bed for 3d printing	NO
3D Printed Pieces				
3D0052	4	Heated Bed Bracket	Attachment points for the heated bed assembly to the frame	NO
3D0028	6	PCB magnet holder	Magnetic "pucks" for holding PCBs	NO
Plates / Panels				
PG01	1	Glass plate, 1/8" (3mm) x 200mm x 200mm	Glass plate for flat, even surface to print on	YES
PS01	1	Bed plate, low-carbon steel, waterjet cut	Modular bed that provides magnetic attachment points for SMT PCBs via AD0017 "pucks". Also provides a heat spreading functionality for the heated bed	YES

Frame Assembly

Part Number	Quantity	Description	Purpose	Barebones?
Hardware Bag 1				
FBHCS-M5-10L	48	Fastener, M5 button-head cap screw, 10mm L	Fasteners for frame extrusion pieces	NO
FNUT-M5-HNKK	37	Extrusion nut, M5	Holds aluminum extrusion frame peices togeth	NO
FWSH-M5-SPLIT	32	Fastener, M5 flat washer	Fasteners for frame extrusion pieces	NO
3D0025	4	Extrusion foot, cast rubber	Custom rubber feet for bottom of machine fra	YES
Hardware Bag 2 (Brackets)				
XEB505	16	Extrusion 45 degree angle bracket	Corner brackets for frame	NO
Plates / Panels				
PC01	1	Top plate, acrylic laser cut	Mounting plate for delta mechanism	YES
Extrusions				
XE2020-260	8	Extrusion, 20x20mm, 260mm long	Horizontal extrusions for frame	NO
XE2020-500	4	Extrusion, 20x20mm, 500mm long	Vertical extrusions for frame	NO

Delta Mechanism

Part Number	Quantity	Description		Barebones?
Hardware Bag 1				
DB608	6	Bearing, 608	Ball bearings for delta arms	NO
DGB383	3	GT2 belt, 383mm L	NOTE: This may be in one continuous length rather than three separate pieces	NO
DGP16T	3	GT2 pulley, 16 teeth, 5mm bore	Aluminum pulley goes on end of NEMA 17 stepper motor	NO
FSET-M3-6L	6	Fastener, M3 set screw	NOTE: These may already be in the 16T GT2 pulley	NO
FBHCS-M5-14L	12	Fastener, M5 button-head cap screw, 14mm L	These connect the 3D00456 stepper mounts to the frame PC01 plate.	NO
FBHCS-M5-20L	12	Fastener, M5 button-head cap screw, 20mm L	These connect the 3D0001a bearing blocks to the 3D00456 stepper mounts	NO
FFLT-M3-12L	3	Fastener, M3 flat-head machine screw, 12mm L	This fastener holds the GT2 belt to the 150T pulley.	NO
FNUT-M3	54	Fastener, M3 nut		NO
FNUT-M5	24	Fastener, M5 nut	Go inside 3D00456 nut traps	NO
FPAN-M3-10L	12	Fastener, M3 pan-head machine screw, 10mm L		NO
FPAN-M3-12L	3	Fastener, M3 pan-head machine screw, 12mm L	This fastener holds the GT2 belt to the 150T pulley.	NO
FPAN-M3-20L	21	Fastener, M3 pan-head machine screw, 20mm L	12 are used to attach the 608 bearing block caps 6 are used to attach the EOPT001 to the 3D00456. 3 are used to attach the 3D0007 optical interruptors to the 3D0003a delta arms	NO
FPAN-M3-30L	12	Fastener, M3 pan-head machine screw, 30mm L	These hold the 3D0003a arms to the 3D0002b pulleys	NO
FPAN-M3-50L	6	Fastener, M3 pan-head machine screw, 50mm L	These hold the 3D0003b nuts to the 608 bearings and the 3D0003a delta arms	NO
FWSH-M3	6	Fastener, M3 flat washer	These go between the 3D0003b nuts and the 608 bearings on the delta arm assemblies	NO
Hardware Bag #2				
DBS-0.375-10L-HEX	6	Ball stud, 3/8" dia, M3x10	Delta mechanism bearings	YES
Plates / Panels				
PC03a	1	Delta motor plate (Acrylic laser-cut)	Center plate between motors and delta pulleys/arms/bearings	YES
Electronics				
EOPT001	3	Optical endstop board	Homing switches (these are optical interruptor type)	YES
3D Printed Pieces				
3D0001a	6	Delta motor Assembly - 608 bearing block	Black. Bearing blocks for delta arms.	NO
3D0002b	3	Delta motor assembly - Pulley, 150 teeth	Black. Large pulley connected to 3D0003a/b arms	NO
3D0003a	6	Delta motor assembly - Delta arm 90mm	Orange. Delta mechanism upper arm	NO
3D0003b	6	Delta motor assembly - Delta arm 90mm nut	Orange. Nut to allow 608 bearings to be attached to 3D0003a via M3 hardware.	NO
3D0004	6	Delta motor Assembly - 608 bearing block caps	Black. Caps for bearing blocks.	NO
3D0007	3	Delta motor assembly - Limit switch interruptor	Black. This is attached between the 3D0003a arms and acts as an interruptor to the optical limit switch	NO
3D0456	3	Delta stepper mount	Black. Mounts steppers to PC01 and PC03a middle plate	NO
Big heavy stuff				
EM-ST17	3	Stepper motor, NEMA 17	Stepper motors for delta mechanism	NO

Motion Controller Assembly

Part Number	Quantity	Description	Purpose	Barebones?
Hardware Bag 1				
FNUT-M3	14	FNUT-M3	6 go in the 3D0021, 8 go in the 3D0015a	NO
FPAN-M3-25L	6	FPAN-M3-25L	For attaching PC04a to EMC02 and the PC01 panel via standoffs	NO
FPAN-M3-20L	8	FPAN-M3-20L	Fasteners for 3D0021 and PC04a	NO
Electronics				
EMC02	1	EMC02 motion controller board	Motion controller breakout board	YES
N/A	17	Shunt / Shorting jumper, 0.1"	Configuration jumpers for EMC02 module	YES
EL-ARDUINO-MEGA256	1	Arduino Mega 2560	Microprocessor loaded with Arduino / Marlin firmware	NO
N/A	1	USB cable, "A" to "B"	For Arduino	NO
EL-STEPSTICK	3	Stepstick (stepper motor driver module)	Stepper motor driver module	YES
Wiring				
N/A	3	Stepper motor cable, 4-pin, ~145mm		NO
N/A	3	Endstop cable, ~95mm L		NO
3D Printed Pieces				
3D0021	4	EMC01 Modular tool card-cage	Card cage for the modular tools. Prevents them from being plugged in backwards, and provides mechanical integrity	NO
3D0015a	3	EMC02 mounting plate	Provides a	NO
FSTN-M3-16L-UNTHRE	6	Standoffs (spacers)	For mounting the PC04a plate onto the EMC02 assembly	NO
Plates / Panels				
PC04a	1	EMC02 cover plate, laser cut acrylic	Cover plate	YES

Up-Looking Camera

Part Number	Quantity	Description	Purpose	Barebones?
Hardware Bag 1				
FPAN-M5-8L	2	Fastener, M5 pan-head machine screw, 8mm L	These attach the up-looking camera module to the frame	NO
FPAN-M3-8L	4	Fastener, M3 pan-head machine screw, 8mm L	These attach the LED diffuser ring to the camera module housing	NO
FPAN-M2-8L	4	Fastener, M2 pan-head machine screw, 8mm L	These attach the camera module to the housing	NO
FNUT-M3	4	Fastener, M3 nut	These attach the LED diffuser ring to the camera module housing	NO
FNUT-M2	4	Fastener, M2 nut	These attach the camera module to the housing	NO
FNUT-M5-HNKK5	2	Extrusion nut, M5	These attach the up-looking camera module to the frame	NO
N/A	42"	Wire, 24 AWG, red	Up-looking camera LED ring +5V power	NO
N/A	42"	Wire, 24 AWG, black	Up-looking camera LED ring GND	NO
N/A	42"	Wire, 24 AWG, white	Up-looking camera LED ring ON signal	NO
N/A	6	Crimp pin, 0.1" for rectangular header	Crimp pin for cable	NO
N/A	2	Rectangular header, 3-pin non-polarized	Rectangular housing for cable	NO
N/A	7	Zip ties, 0.1" wide (long enough to zip tie to frame)	Cable management	NO
3D printed parts				
3D0026b	1	Up-looking camera housing base (black PLA)	Provides an enclosure for the camera, with an attach point for an LED ring light	NO
3D0030b	1	Up-looking camera housing diffuser (clear / natural PLA)	Acts as a diffuser for the ring light. Attaches to the 3D0026b base.	NO
Electronics				
EL-CAM-ELP-USB100W03M	1	EL-CAM-ELP-USB100W03M	Up-looking camera module.	YES
N/A	1	USB cable for the ELP camera	This USB cable should be included with the ELP camera.	YES
ELED02 Ring Light Kit				
ELED02	1	Up-looking camera ring light PCB	LED Ring light for improving down-looking camera effectiveness. Note: This is a kit intended to be used during the testing phases of the SMT pick and place functionality of the machine.	YES
N/A	16	LED, 1206, red		
N/A	8	Resistor, 0805, 120 ohm		
N/A	1	MOSFET, SOT-23, BSS138		
N/A	1	Resistor, 10K		
N/A	1	Capacitor, 100 uF		
N/A	1	Rectangular header, male, right-angle, 3-pin, 0.1" offset		

SMT Modular Tool

Part Number	Quantity	Description	Purpose	Barebones?
Hardware Bag 1				
FNUT-M5-HNKK5	2	Extrusion nut, M5	Vacuum pump frame mount and clamp	NO
FPAN-M5-14L	1	FPAN-M5-14L	Vacuum pump mount clamp	NO
FBHCS-M5-14L	1	FBHCS-M5-14L	Vacuum pump mount to frame	NO
DTB-0.0625-0.1875	1	Tubing coupler, barbed, 1/16" to 3/16"	Adapt vacuum pump tubing size down to smaller size	YES
FFLT-M5-10L	3	Fastener, M5 flat-head machine screw, 10mm L	Modular tool changer points	NO
FNUT-M5	3	Fastener, M5 nut	Modular tool changer points	NO
FPAN-M2-5L	4	Fastener, M2 pan-head machine screw, 5mm L	NEMA 8 motor to 3DAT0021a	NO

Nozzle Bag

TBD-Large nozzle	1	Large nozzle tip, machined 12L40 steel	Vacuum tip for large SMT parts (electrolytic caps, etc)	YES
TBD-Small nozzle	1	Small nozzle tip, machined 12L40 steel	Vacuum tip for small SMT parts (resistors, etc)	YES
TBD-Coupler	1	Coupler, machined aluminum	This is permanently attached to the hollow-shaft NEMA 8 motor, and allows various tips to be installed	YES
TBD	1	Set screw, M3 x 5mm	Used to attach the coupler of the NEMA 8 hollow shaft motor	YES
TBD	1	O-ring	Goes on the aluminum shaft, provides a lock-fit and air-tight connection between the coupler and the tips	YES

Electromechanical

EM-ST08-HOLLOW	1	Stepper motor, NEMA 8 hollow-shaft	SMT nozzle part rotation	YES
VP01	1	Diaphragm vacuum pump, 12V	Vacuum source	YES

3D printed parts

	1	Vacuum pump mount	Mount vacuum pump to frame	NO
3DAT0021a	1	Modular tool mount for SMT, NEMA 8 motor	Holds NEMA 8 motor	NO

Electronics

EAT0004	1	Modular tool PCB	Connects modular tool to EMC02	YES
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Misc.

MFOAM01	1	Foam strip	Vibration damper for diaphragm pump	YES
DTS-0.1875ID-0.3125OD-150L	1	Tubing, silicone, 3/16" ID, 5/16" OD, 150mm L	Attaches to diaphragm pump	NO
DTS-0.0625ID-0.1875OD-500L	1	Tubing, silicone, 1/16" ID, 3/16" OD, 500mm L	Attaches to NEMA 8 hollow-shaft motor	NO
N/A	18"	Wire, 24 AWG, red	SMT modular tool, NEMA 8 motor extension	NO
N/A	18"	Wire, 24 AWG, green	SMT modular tool, NEMA 8 motor extension	NO
N/A	18"	Wire, 24 AWG, yellow	SMT modular tool, NEMA 8 motor extension	NO
N/A	18"	Wire, 24 AWG, black	SMT modular tool, NEMA 8 motor extension	NO
N/A	14"	Wire, 24 AWG, red	SMT modular tool, diaphragm pump	NO
N/A	14"	Wire, 24 AWG, black	SMT modular tool, diaphragm pump	NO
N/A	1	Cable, NEMA 8 stepper motor	NOTE: This comes with the NEMA 8 motor	NO
N/A	4	Zip ties	1x for holding silicone tubing to NEMA 8 motor. 3 for wire management	NO
N/A	5mm	Heat shrink tubing - 1" unshrunk	Wrap around stepper motor	NO
N/A	3x 10mm	Heat shrink tubing - 1/8" dia unshrunk	Extension wiring on stepper motor cabling	NO
N/A	2x 15mm	Heat shrink tubing - 3/16" dia unshrunk	Diaphragm pump wiring	NO

3D Printing Modular Tool

Part Number	Quantity	Description	Purpose	Barebones
Hardware Bag 1				
FHEX-M8-60L-HOBBED	1	Hobbed bolt	Hobbed bolt for the 3d printer extruder (hobbed portion pushes the plastic into the hotend)	NO
FNUT-M3	1	Fastener, nut, M3	This goes in the guidler hinge nut trap	NO
FNUT-M8	1	Fastener, nut, M8	This goes on the end of the hobbed bolt (NOTE: This is optional, as you can just use the nylock nut, but this will make unscrewing the nylock a lot easier)	NO
FPAN-M3-25L	3	Fastener, M3 pan-head machine screw, 25mm L	2 for the J-Head groove mount clamp. 1 for the Guidler hinge.	NO
FPAN-M3-8L	3	Fastener, M3 pan-head machine screw, 8mm L	Attaches the NEMA 17 stepper motor to the Wade extruder	NO
FSET-M8-20L	1	Set screw, M8, 20mm L	608 bearing rotates around this in the guidler	NO
FWSH-M3-SPLIT	3	Fastener, washer, M3, split-lock	Optional; These can be used on the NEMA 17 stepper motor attachment screws to ensure the motor does not vibrate loose	NO
FWSH-M8	1	Fastener, washer, M8	This goes on the outside of the 608 bearing, before the M8 nut	NO
MSPRING01	2	Extruder spring	For the guidler. They go over the FSHCS-M4-60L screws	YES
FSHCS-M4-60L	2	Fastener, socket-head cap screw, M4, 60mm L	Guidler tensioning	NO
FWSH-M4	4	Fastener, washer, M4	These go over the FSHCS-M4-60L screws, on both sides of the springs	NO
FNUT-M4	2	Fastener, nut, M4	These go into the nut traps in the 3DAT0001a, for the guidler tensioning screws	NO
FNUT-M8-LOCK	1	Fastener, M8, nut, nylock	The M8 lock nut keeps the large herringbone gear and hobbed bolt from coming loose	NO
FNUT-M5-HNKK5	1	Extrusion nut	This attaches the Wade extruder to the extruded frame	NO
FBHCS-M5-10L	1	Fastener, button-head cap screw, M5, 10mm L	This attaches the Wade extruder to the extruded frame	NO
VF01	2	Embedded Bowden Couplings - For Plastic (1.75mm Filament)	Bowden tubing push-to-fit connector (1 for Wade extruder, 1 for the modular tool). NOTE: There are two pieces to each fitting: The outside coupling with the spiky barbs, and the fitting that goes inside it	YES
FFLT-M5-10L	3	FFLT-M5-10L	Modular tool changer points	NO
FNUT-M3	2	FNUT-M3	Clamp for J-Head groove mount	NO
FNUT-M5	3	FNUT-M5	Modular tool changer points	NO
Misc.				
DTPTFE-4OD-2ID-500L	500mm	Bowden tube, PTFE (Teflon), 4mm OD, 2mm ID	For Bowden tube	NO
N/A	30"	Wire, 24 AWG, red	Hotend heating element	NO
N/A	30"	Wire, 24 AWG, black	Hotend heating element	NO
N/A	30"	Wire, twisted pair, 26-28 AWG	hotend thermistor	NO
N/A	2	Ferrule, thermistor to twisted pair	Because ferrules are more reliable than soldering for this connection	NO
N/A	2	Ferrule, resistor to 24 AWG wire	Because ferrules are more reliable than soldering for this connection	NO
N/A	2x	Heat shrink, PTFE (Teflon)	To cover the hotend's crimped ferrules	NO
N/A	2x	Heat shrink, for thermistor leads	To cover the thermistor's crimped ferrules	NO
N/A	200mm	Kapton tape, ~12mm wide	NOTE: Doesn't ship with the kit	NO
N/A	9	Zip ties (small / 6")	Wire management	NO
N/A	2x 35mm	Heat shrink tubing, 3/8" dia	For wiring and bowden tubing securing (both ends)	NO
N/A	500mm	Techflex sleeving (optional)	Optional. Covers Bowden tube and wiring	NO
N/A	2x 35mm	Fiberglass sleeving	Thermistor wiring / insulation (between glass bead and crimped ferrule)	NO
Electromechanical				
EM-ST17	1	EM-ST17	Stepper motor, NEMA 17	NO
DB608	3	Bearing, 608	Bearing, 608	NO
3D printed parts				
3DAT0001a	1	Wade extruder body	Extruder housing. Based on Greg's Wade reloaded extruder assembly (http://www.thingiverse.com/thing:18379)	NO
3DAT0002	1	Wade large gear (herringbone)	Large herringbone gears for extruder	NO
3DAT0003	1	Wade small gear (herringbone)	Small herringbone gear for extruder	NO
3DAT0004	1	Guidler	For extruder	NO
3DAT0027	1	Extruder latch	Inspired by the Luilzbot extruder latch. Makes it easier to secure the guidler	NO
3DAT0012	1	3DAT0012 - 3D printer mount	Black - Modular tool housing (Conical taper part)	NO
3DAT0017	1	3DAT0017 - 3D printer mount - J-Head (top)	Orange - Modular tool housing (top part, to secure the J-Head groove mount)	NO
3DAT0018	1	3DAT0018 - 3D printer mount - J-Head (clamp)	Black - Modular tool housing (Clamp for 3DAT0017 for J-Head groove mount)	NO
3DAT0028	1	Wade extruder hobbed bolt spacer - 8.5mm	This is a spacer for getting the hobbed portion of the bolt to line up with the Wade extruder's filament hole. It is intended for hobbed bolts that have a hobbed position 30mm away from the bolt head's mating side	NO
Electronics / Hotend Components				
EAT0004	1	Modular tool PCB	Connects modular tool to EMC02	YES
EL-STEPSTICK	1	StepStick A4988 stepper driver PCB module with heatsink	Plugs into EAT0004 and drives the NEMA 8 hollow-shaft stepper motor	NO
N/A	3	Shunt / Shorting jumper, 0.1"	These set the microstepping on the stepstick	NO
3DJH0001	1	Genuine J-Head Mk V-BV, 0.40mm nozzle, for 1.75 filament	Genuine hotend from hotends.com (Reifsnnyder Precision Works)	NO
3DJH0002	1	Resistor, 5.6 ohm, 5W, 1%	UB5C-5.6-ND	NO
3DJH0003	1	Thermistor, 100k, 3% (Semitec 104GT-2)	Temperature sensing element for 3D printing heated bed	NO

ATX Power Supply

Part Number	Quantity	Description	Purpose	Barebones?
Hardware Bag 1				
FPAN-M3-25L	4	Fastener, pan-head machine screw, M3, 25mm L	Holds the EPWR01 to the 3D0053 frame.	NO
FPAN-6_32-0.3125L	4	Fastener, pan-head machine screw, 6-32 x 5/16" L	These attach the power supply to the 3D0053 frame. The power supply that ships with the kit does not use metric M3 screws; they use the older imperial 6-32 thread size.	NO
FNUT-M3	4	Fastener, nut, M3	Holds the EPWR01 to the 3D0053 frame.	NO
MFEET01	4	Square 12.5mm adhesive rubber feet	These go under the power supply and the 3D0053 frame to keep it from sliding around the workbench	NO
N/A	50"	Wire, 18 AWG, red	+5V power to EMC02 board	NO
N/A	50"	Wire, 18 AWG, black	GND to EMC02 board	NO
N/A	50"	Wire, 18 AWG, yellow	+12V power to EMC02 board	NO
N/A	50"	Wire, 24 AWG, green	PS_ON signal	NO
Plates / Panels				
PC04	1	ATX cover plate	Plate to cover the EPWR01 PCB	YES
Electronics				
EPWR01	1	Power supply breakout board	Breakout board that brings the DC power voltages and signals to screw terminals	YES
N/A	1	Rectangular header, male, right-angle, 0.1" offset	Optional. May be used with either the shunt / shorting block or external cabling to turn the power supply on or off.	NO
N/A	1	Shunt / shorting block, 0.1" offset	Optional. May be used with the rectangular 2-pin header to turn the power supply on or off.	NO
3D Printed Pieces				
3D0053	1	External ATX supply frame	Optional; This frame makes using the ATX power supply a lot more convenient	NO
FSTN-M3-14L-UNTHREADED	4	Standoff, 3D printed, for M3 screw, 14mm long, unthreaded	For attaching the PC04 ATX cover plate to the 3D0053 frame	NO
Big Stuff				
EL-PWR-ATX	1	ATX power supply, 480W	Provides DC +12V and +5V power to the machine	NO

End Effector and Arms

Part Number	Quantity	Description	Purpose	Barebones?
Hardware Bag 1				
DBS-0.375-10L-HEX	6	Ball stud, 3/8" dia, M3x10	Delta mechanism bearings	YES
FNUT-M3	21	Fastener, M3 nut	End effector (4*3 for end effector side mounts. 3 for holding the two end effector 3d printed halves together.	NO
FPAN-M3-12L	4	Fastener, pan-head machine screw, M3, 12mm L	These hold the 30mm fan into the end effector	NO
MMAG04	3	Magnet, 0.25" dia x 0.25"L	Modular tool changing system attachment point	YES
FPAN-M3-8L	4	Fastener, pan-head machine screw, M3, 8mm L	These hold the camera mount onto the end effector	NO
FPAN-M3-10L	12	Fastener, pan-head machine screw, M3, 10mm L	These hold the tension springs into the delta arms	NO
FPAN-M3-20L	3	Fastener, pan-head machine screw, M3, 20mm L	These hold the two halves of the end effector together	NO
Electronics / Electromechanical				
EL-CAM-ENDO	1	Endoscopic USB camera module	Vision for SMT pick and place	YES
EL-USB-CABLE	1	USB cable	Attaches to endoscopic USB camera module	YES
EL-FAN-30MM	1	EL-FAN-30MM	Cooling for modular tools (3D print hotend, etc)	NO
3D printed parts				
3DAT0011a	1	End effector - ATC hub (top)	Top half of end effector	NO
3DAT0010a	1	End effector - ATC hub (bottom)	Bottom half of end effector. Printed in clear / natural PLA. Acts as a diffuser for the ring light assembly.	NO
3DAT0015c	1	Camera-to-end-effector mount - downward endocam	Attachment point for the camera	NO
ELED01 Ring Light Kit				
ELED01	1	End effector camera ring light PCB	LED Ring light for improving down-looking camera effectiveness. Note: This is a kit intended to be used during the testing phases of the SMT pick and place functionality of the machine.	YES
N/A	16	LED, 1206, white		
N/A	8	Resistor, 0805, 120 ohm		
N/A	1	MOSFET, SOT-23, BSS138		
N/A	1	Resistor, 10K		
N/A	1	Capacitor, 100 uF		
N/A	1	Rectangular header, male, right-angle, 3-pin, 0.1" offset		
Cabling for Ring Light				
N/A	30"	Wire, 24 AWG, red	End effector LED ring +5V power	NO
N/A	30"	Wire, 24 AWG, black	End effector LED ring GND	NO
N/A	30"	Wire, 24 AWG, white	End effector LED ring ON signal	NO
N/A	6	Crimp pin, 0.1" for rectangular header	Crimp pin for cable	NO
N/A	2	Rectangular header, 3-pin non-polarized	Rectangular housing for cable	NO
Delta Arms				
AD0003b	6	Delta rods, carbon fiber tubing with 3D printed end cups	NOTE: These have been glued together in a special jig to ensure exactly 270mm center-to-center.	YES
MSPRING02	6	Tension springs	These hold the delta arms into the ball-studs	YES
Cabling for Fan				
N/A	1	Cable assembly for 30mm fan. Red/black wires with rectangular 2-pin 0.1" offset housing on one end, and stripped/tinned ends on other side. ~1 meter long	For extending the 30mm fan from the end effector to the EMC02 PCB	NO
N/A	2x 15mm	Heat shrink tubing, 1/8" dia unshrunk	For fan cable assembly	NO