Overview:

ARTME 3D's original Desktop Filament Extruder E1.6 has evolved in leaps and bounds. It is a plastic - extruder in unbeatable small but powerful design to produce filament for 3D printers from plastic granules.

Special feature:

The extruder works with an extruder screw with compression zone made of stainless steel and has a winding unit to wind the filament directly onto a spool. The new winding unit of the E1.6 can accommodate spools of different sizes up to 2500g spools. And all this with a footprint of just 35 x 35 cm. The thoughtful design also allows it to process homemade (shredded) granules from 3D printing waste.

Drive:

The drive consists of a powerful and infinitely variable Nema23 stepper motor with planetary gear, which is controlled via a digital stepper motor driver. The rewind unit and pull unit are each driven by Nema17 stepper motors.

Control:

An Arduino with ramps board and LCD display handles the control. The rewinding works automatically. The filament diameter can be calibrated from 1.75 to 2.85mm by selecting the nozzle size and the filament's own weight to the desired diameter. After the filament length has been set, the extruder switches off automatically.

Materials:

Standard 3D printing materials such as PLA, ABS, ASA, PETG, TPE and PP have been tested with success. However, this version does not yet reliably process high-temperature plastics such as nylon due to the extruder screw geometry.

Power supply:

The extruder is powered by 12V safety extra-low voltage and due to its high efficiency it requires little power, so you can run it e.g. with a cheap and safe table power supply. (Not included in the scope of delivery). Carbon neutral operation via solar cells is also possible.

Open Source:

The complete documentation and the necessary 3D printing files can be found for download at www.artme-3d.de/support. The Original Desktop Filament Extruder E1.5 by ARTME 3D is an open source project used under a CC BY-SA license (https://creativecommons.org/licenses/by-sa/4.0/):

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Under the following condition:
- Mention my name: David Thönnes of ARTME 3D
- Link my project: www.artme-3d.de
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Development aspects:

Miniature design to enable decentralized application where plastic can be recycled or filament is to be produced at low cost.
Short cycle times to minimize damage to the plastic to enable many recycling processes.
Open source to allow everyone access to successful recycling.
Process stability through high-quality and well-designed components.
Comfortable control and easy operation.
Easy and fast adjustment of filament diameter.
Inexpensive to buy as a kit.

Technical data:

Dimensions: 350mm wide, 594mm high, 350mm deep.
Power supply: 12V DC safety extra-low voltage
Power consumption: 60 to 90 watts (depending on material type), 120 watts when heating up. (Required power supply for mains operation: output voltage 12VDC, output current 10A. Attention: In countries with 110/120V mains voltage, a power supply with 12.5A output current is required)
Maximum extruder temperature: 250°C
Maximum speed: 20 RPM
Filament diameter accuracy: +/- 0.05mm when using granules/pellets. +/- 0.1mm when using shredded 3D printing waste.
Maximum extrusion rate without filament calibration: 350 grams per hour (0.35 kg/h).
Normal extrusion line with filament calibration: 150 to 300 grams per hour (0.15 to 0.35 kg/h), depending on the material. (Cooling, calibrating and rewinding will slightly reduce the maximum extrusion rate).
Maximum system speed (producing filament true to size and rewinding): 0.7m to 1.6m per minute. Experience shows that it takes on average about 4 to 7 hours to produce about 1kg of filament with 1.75mm diameter.
Extruder screw: 3 zone stainless steel extruder screw with 12mm diameter.
Compression ratio approx. 3:1. L/D ratio: 8:1.
Tested materials: PLA, ABS, PETG, TPE, PP.

Mode of operation:

The plastic granulate is melted by the extruder and leaves the nozzle with integrated melt filter as a soft filament. The diameter of the filament is set by the filament's own weight and the pressure and temperature options. A sensor detects the height of the soft filament sheet between the nozzle and the draw motor and controls the take-up speed. Due to the small design, diameter adjustment is relatively quick. If the appropriate values for the plastic grade are known, the extruder can be started in a few minutes. Experience values for the setting can be found at www.artme-3d.de/support.

Tools and required accessories:

The kit includes the following tools:

- Tubular socket wrench 6x7mm
- Tubular socket wrench 8x9mm
- Tubular socket wrench 13x17mm
- Allen wrench 1.5mm
- Allen wrench 2.0mm
- Allen wrench 3.0mm
- Allen wrench 4.0mm
- Allen wrench 5.0mm

If you purchase a kit from ARTME 3D, you will need the following material, which is not included, to build and operate the extruder:

- 3D printed parts (white parts on the photos, files for download at www.artme-3d.de/support)
- Table power supply 12VDC 10A (Attention: In countries with 110/120V mains voltage you have to choose a power supply with 12,5A output current).
- An empty filament spool (diameter inner hole 50 to 60mm).
- Required tools:
    - Phillips screwdriver PH1
    - Slotted screwdriver 3mm
    - Wrench size 8
    - Torx wrench TX 25
    - Hammer
    - Sandpaper/Files
    - Superglue
    - rubber gloves, dust mask
    - Access to a vice is an advantage.
    - If the 3D printer used for the 3D printed parts is not calibrated very accurately, it may be necessary to have a drill with 3.5mm, 5.5mm and 12mm drill bits.
    - Needle nose pliers and wire stripper is advantageous

Skills and Difficulty Level:

The assembly of this extruder is a little more complex than, for example, the assembly of a 3D printer. In addition to the wiring of the electronics and the assembly of the 3D printed parts into functional components, activities such as:

- The printing of very many parts (possibly several days printing time and. approx. 1 to 1.4 kg material consumption).
- Reworking of 3D printed parts.
- Aligning threaded rods and the extruder tube according to instructions.
- Filing of grooves in the feed zone of the extruder tube with the key file. (The file is included in the kit).

Labor requirements:

Depending on your experience in assembling such kits, you will need to allow between 6 and 15 hours of time for assembly.

Support me:

The development and documentation of this project so far required hundreds of hours of work in 3 years, as well as high investments in materials and machinery. If you would like to support me in the development and free publication of projects of this kind, I will be happy about a small donation via paypal to paypal@artme.de.

Scope of delivery:

See the table for the extruder parts list. All parts are included in the kit except for the stl files and the empty FIlament coil and power supply.

Quantity	Name english	Spects
50	wood screw	2,5x12 mm
11	wood screw	3x25 mm
7	cap head screw	M3x6
25	cap head screw	M4x10 mm
2	cap head screw	M5x14
4	countersunk screw	M5x15
1	cap head screw	M5x30
1	hexagon screw	M5x70 mm
1	wing nut	M5
10	hammer nut	M4, Slot 8
17	nut	M5
1	hexagon screw	M10 x 50 mm
4	washer	M4
2	washer	M5
1	grub screw	M4x10 mm
1	hexagon screw	M5x40 mm (20mm thread)
1	wood screw	4x60 mm
2	wood screw	5x60 mm
2	wing screw	M6x35
6	Slot nut	B Typ, 8mm, M4
2	cap	30x30 mm
1	cap	60X30 mm
1	parallel key	4x4x20 mm
4	threaded rod	M5x117 mm
1	timing belt	GT2, 6mm x 500mm

2	connector for profile	90°
4	felt pads	22 x 5 mm
1	ptfe tubing-part	4x2x10mm
1	wire	0,6 x 210mm, V2A
1	ball bearing	4x12x4 C3
12	cable tie	95mm
2	mounting bracket	for Nema 23 with M6 thread
1	thrust bearing	47x30x11mm
12	ball bearing	4x13x5 mm
1	nail	4,6x130mm
2	hose clamp	40mm diameter
1	Pully	GT2, 6mm, 20 teeth, 5mm bore
2	ball bearing	10x26x8mm
1	U ball bearing	FZ0463, 4x13x4 mm
1	Extruder feed wheel	12mm, 38 teeth
1	Compression spring puller	8x0,8x22 mm
1	Compression spring snap	6x0,5x35 mm
1	Tension spring Swing arm	3x0,2x20 mm
1	ptfe tubing	6x4x630 mm
1	stepper motor	Nema23, 15:1
4	ferrule	0,5mm²
2	stepper motor	Nema17, 39mm
1	stepperdriver extruder	Leadshine DMT332T
1	extruder barrel	16x2x160 (12,05 innen)
1	extruder screw grinded	12,0h9 x 215 mm
1	Aluminium heating element	6mm drilling
1	Aluminium heating element	3+6mm drilling
1	warding file	vierkant/square, 100mm long
1	plate	280x300x15 mm
1	aluminium profile	30x60x500 mm
1	aluminium profile	30x30x160 mm
1	aluminium profile	30x30x120 mm
1	adapter disk	55x20x3 mm
1	shaft holder	SHF16 with M4 thread
2	heating cartridge	6x20mm 50W/12V, 53cm Kabel
2	ferrule	0,5mm²
1	thermistor	3x15 mm, NTC 100K
1	nozzle with M6 thread	Verschlussschraube M14x1,5 DIN 910, M6

1	3D printer nozzle PLA/PETG	M6 thread, E3D-Style, with 1.7mm bore
1	melt filter	16x100mm, Mesh 50 (0,3mm)
1	teflon tape	130mm
1	bending aid filter	stl
1	sign template	stl
2	clamp vice	stl
1	coupling bearing surface	stl
1	coupling	stl
1	bending template threaded rods	stl
1	feed zone	slt (in ABS od ASA if possible)
1	hopper part1	stl
1	mounting tool	stl
1	hopper part2	stl
1	hopper part3	stl
1	Spool holder bracket	stl
1	Spacer	stl
1	Spool holder disc	stl
1	Spool holder disc lid 1	stl
1	Motor mount	stl
1	Motor mount lid	stl
1	Belt tensioner	stl
1	Spool adapter 50mm (option)	stl
1	Spool adapter 51mm (option)	stl
1	Spool adapter 52mm(option)	stl
1	Spool adapter 53mm (option)	stl
1	Spool adapter 54mm (option)	stl
1	Spool adapter 55mm (option)	stl
1	Spool adapter 56mm (option)	stl
1	Spool adapter 57mm (option)	stl
1	Spool adapter 58mm (option)	stl
1	Spool adapter 59mm (option)	stl

1	Spool adapter 60mm (option)	stl
1	Spool holder disc lid 2	stl
1	Filament spool (Not included)	750g or 1000g (not included in the kit)
1	hook left	stl
1	hook rechts	stl
1	swing for 0.7 bis 1.0kg spools	stl
1	swing for 2.5kg spools (option)	stl
1	crossbrace 1	stl
1	crossbrace 2	stl
1	lifter	stl
4	Rails	stl
1	sledge part1	stl
1	sledge part2	stl
1	Spiral axis for 1,75mm Part1	stl
1	Spiral axis for 1,75mm Part2	stl
1	Spiral axis for 2,85mm Part1	stl
1	Spiral axis for 2,85mm Part2	stl
1	axis holder right	stl
1	snap part 1	stl
1	snap part 2	stl
1	plow	stl
1	axis holder left	stl
2	stopper	stl
1	motor mount Part 1	stl
1	motor mount Part 2	stl
1	motor mount Part 3	stl
1	lever	stl
1	disc	stl
1	filament guide	stl
1	arduino	mega 2560 R3
1	ramps Board	ramps 1.5
3	jumper	2,54mm
1	stepperdriver winder	tmc 2208
1	optical endstop with cable	reprap, 3 Pin

1	arduino case	stl
1	LCD adapter	for LCD 2004
2	LCD cable	500-600mm
2	terminal block	Wago 221-415 5pol
1	terminal block holder	stl
1	driver mount	stl
3	Connector Ramps/DMT322T	Dupont Jumperwire male-male
2	wire ramps	1,0mm² black, 150mm
2	wire ramps	1,0mm² red, 150mm
1	wire DMT322T	1,0mm² black, 260mm
1	wire DMT322T	1,0mm² red, 260mm
6	ferrule	1,0mm²
1	Arduino top	stl
1	fan	24V= or 12V=, 50x50x15mm
1	power supply (not included)	12VDC 10A (12,5A when 110V net) closed design
1	Y stepper cable	4 pin for two Nema 17
1	strain relief	stl
1	LCD cover	stl
1	LCD 2004 Display	Smart Display Controller
2	holder ribbon cable	stl
1	fan holder	stl
1	fan	12V=, 50x50x15mm
2	ferrule	0,25mm²
1	usb cable	200mm
1	sensor holder	stl
1	sensor body	stl
1	sensor arm	stl
1	sensor shutter	stl
1	bending aid	stl
1	cover body	stl
1	rock wool	135x230x40 mm
1	cover top left	stl
1	cover top right	stl