

Open-Source Miniature Fluorimeter to Monitor Real-Time Isothermal Nucleic Acid Amplification Reactions in Resource-Limited Settings

Jackson Coole^{*1}, Alex Kortum^{*1}, Yubo Tang¹, Imran Vohra¹, Yajur Maker¹, Kathryn Kundrod¹, Mary Natoli¹, Rebecca Richards-Kortum¹

¹Department of Bioengineering, Rice University

* These authors contributed equally

Corresponding Author

Rebecca Richards-Kortum
rkortum@rice.edu

Citation

Coole, J., Kortum, A., Tang, Y., Vohra, I., Maker, Y., Kundrod, K., Natoli, M., Richards-Kortum, R. Open-Source Miniature Fluorimeter to Monitor Real-Time Isothermal Nucleic Acid Amplification Reactions in Resource-Limited Settings. *J. Vis. Exp.* (), e62148, doi:10.3791/62148 (2021).

Date Published

February 3, 2021

DOI

10.3791/62148

URL

jove.com/video/62148

Materials

Name	Company	Catalog Number	Comments
1/4-inch-long 4-40 threaded insert	McMaster-Carr	90742A116	Used to secure the two sides of the 3D printed optical enclosure together.
10v power supply	GlobTek, Inc.	WR9HU1800CCP-F(R6B)	AC/DC Wall Mount Adapter 10V 18W
15 mm focal length lens	Thorlabs	LA 1074	Two total are used for the fluorimeter. This lens is used to focus the LED illumination.
1-inch-long 4-40 screws	McMaster-Carr		
20 mm focal length lens	Thorlabs	LA 1540	Four total are used for the fluorimeter.
2x WarmStart LAMP Master Mix	New England Biolabs, Inc	E1700	Master mix was used to create the LAMP reactions shown in Figure 3C
3.5" Touch Screen	Uctronics	BO10601	
3/16-inch-long 4-40 screw	McMaster-Carr	90128A105	
3/16-inch-long 4-40 threaded insert	McMaster-Carr	90742A115	Used to secure the OPT3002 test board onto the 3D printed enclosure
3/8-inch-long 4-40 screws	McMaster-Carr	90128A108	Used to secure the two sides of the 3D printed optical enclosure together.
3D printer filament	3D Universe	UMNFC-PC285-BLACK	Black or another dark color preferred
3D printer used	Ultimaker	Ultimaker 2+	
8-tube PCR strips	BioRad	#TLS0801	
Advanced Mini Dry Block Heater	VWR International	10153-320	The following heat blocks are acceptable substitutes without the need for redesigning the optical assembly: 949VWMNLUS, 949VWMHLUS, and 949VWMHLEU
barrel jack to two-pin adapter	SparkFun Electronics	1568-1238-ND	

Blue Excitation Filter Foil	LEE	LE071S	Selected for use with FITC - other fluorescent dyes may require different filters.
Blue LED - 460 nm	Mouser	LZ1-30DB00-0100	Selected for use with FITC - other fluorescent dyes may require different parts
Dichroic Mirror	Thorlabs	DMLP505T	Selected for use with FITC - other fluorescent dyes may require different parts
Emission Filter	Edmunds Optics	OG-515	Selected for use with FITC - other fluorescent dyes may require different parts. The arrow on the part points away from the illumination source.
Excitation Filter	Omega Filters	490AESP	Selected for use with FITC - other fluorescent dyes may require different parts
LED Driver	LEDdynamics	3021-D-I-700	
M2.5 Hex Shaped insert	McMaster-Carr	91292A009	Used to secure the Raspberry Pi to the 3D printed LCD Screen Holder
Microcontroller	Arduino	Nano	
Mini Breadboard	Adafruit	65	
Molecular biology-grade mineral oil	Sigma Aldrich	69794	
OPT3002EVM - Light-to-Digital Sensor	Texas Instruments	OPT3002EVM:	Light-to-digital sensor used. Consists of two PCBs: a SM-USB_DIG board and the OPT3002 test board; only the OPT3002 test board is needed for this device.
Purchased oligonucleotides	Integrated DNA Technologies		
RPA kit positive control DNA	TwistDx Limited	CONTROL01DNAE	
SARS-CoV-2 RNA Control	Twist Biosciences	MN908947.3	
Single board computer	Raspberry Pi	Raspberry Pi 3	
TwistAmp RPA exo kit	TwistDx Limited	TAEXO02KIT	
Ultraclear flat caps	BioRad	#TCS0803	
Yellow Emission Filter Foil	LEE	LE767S	Selected for use with FITC - other fluorescent dyes may require different parts