IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

NORTHWESTERN UNIVERSITY, Plaintiff, v. UNIVERSAL ROBOTS A/S and UNIVERSAL ROBOTS USA, INC., Defendants.	)	C.A. No. 21-149 (CFC) **JURY TRIAL DEMANDED**

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

1. Plaintiff Northwestern University ("Northwestern") brings this action for infringement of U.S. Patent Numbers 6,907,317, 6,928,336, and 7,120,508 (collectively the "patents at issue"), which claim groundbreaking intelligent assist systems in the field of collaborative robotics. Northwestern demands a trial by jury on all issues so triable and, for its complaint against defendants Universal Robots A/S and Universal Robots USA, Inc. (collectively the "Universal Robots Defendants"), alleges as follows:

THE PARTIES

2. Northwestern is a private, not-for-profit institution of higher education and research organized and existing under the laws of Illinois, with a principal place of business at 633 Clark Street, Evanston, Illinois 60208. Northwestern is the owner and assignee of the patents at issue.

3. On information and belief, Defendant Universal Robots A/S is a corporation organized and existing under the laws of Denmark, with its principal place of business at Energivej 25, l DK-5260 Odense S, Denmark.

4. On information and belief, Defendant Universal Robots USA, Inc. is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business at 27-43 Wormwood St., Boston, Massachusetts 02210.

JURISDICTION AND VENUE

5. This lawsuit is an action for patent infringement arising under the patent laws of the United States, Title 35, of the United States Code.

6. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

7. Universal Robots A/S is subject to jurisdiction in the United States, and specifically in Delaware, under Fed. R. Civ. P. 4(k)(2). Universal Robots A/S has contacts with the United States that include, *inter alia*, advertising, offering to sell, and/or selling their products and software throughout the United States, including in this District.

8. This Court has personal jurisdiction over Universal Robots USA because, among other things, Universal Robots USA is a Delaware corporation that, having availed itself of Delaware's corporate laws, is subject to personal jurisdiction in Delaware.

9. This Court has personal jurisdiction over both Universal Robots Defendants in that they have, directly or through their agents and/or intermediaries, committed acts within Delaware giving rise to this action and/or have established minimum contacts with Delaware such that the exercise of jurisdiction would not offend traditional notions of fair play and justice.

10. In particular, on information and belief, the Universal Robots Defendants, directly and/or through their agents and/or intermediaries, make, use, import, offer for sale, sell, and/or advertise their products and affiliated services in Delaware. For example, by maintaining a sales presence and physical location in this District.

11. Further on information and belief, the Universal Robots Defendants have placed, and continue to place, infringing products into the stream of commerce, via an established distribution channel, with the knowledge and/or understanding that such products are sold in the United States, including in Delaware and this District.

12. On information and belief, the Universal Robots Defendants have derived substantial revenue from their infringing activity occurring in this District and/or should reasonably expect their actions to have consequences in Delaware.

13. The Universal Robots Defendants have committed patent infringement in Delaware that has led to foreseeable harm and injury to Northwestern.

14. Venue over Universal Robots A/S is proper in the District of Delaware under 28 U.S.C. §§ 1391 and 1400(b) because Universal Robots A/S is not resident in the United States and may thus be sued in any judicial district. Moreover, a substantial part of the events and omissions giving rise to the claims at issue occurred in this District, including sale of the infringing products.

15. Venue over Universal Robots USA is proper in the District of Delaware under 28 U.S.C. §1400(b) because Universal Robots USA is deemed to reside in this District because it is incorporated under the laws of the State of Delaware.

BACKGROUND

I. Northwestern University

16. Northwestern is a world-renowned research university that fosters and creates important progress in engineering and applied science. Each year, Northwestern is ranked as one of the most innovative universities in the U.S. and in the world.

17. Northwestern is home to nearly 1,500 research laboratories across two campuses in the Chicago area. Northwestern's research laboratories are at the cutting edge of research in many fields, including medicine, biomedical research, engineering, materials and industrial processes, software, and therapeutics.

18. Much of the research at Northwestern, like the research that led to the patents at issue in this case, requires significant funding, and is financed by various public and private sources. The knowledge obtained through Northwestern's research benefits many people and

organizations around the world, including educators, researchers, employers, employees, and consumers.

19. To maximize those benefits, Northwestern sometimes patents and/or commercializes inventions made by its faculty and researchers, and then returns a portion of the proceeds of those activities to fund further education and research at the University.

20. Over the past 15 years, the United States Patent and Trademark Office has awarded hundreds of patents to Northwestern, recognizing the many discoveries made by its faculty and staff. These patents span numerous fields and disciplines. Many are based on groundbreaking research done at Northwestern's Robert R. McCormick School of Engineering and Applied Science.

21. Established in 1909, the McCormick School of Engineering is one of twelve constituent schools at Northwestern. The McCormick School of Engineering offers Doctor of Philosophy (Ph.D.) and Master of Science (M.S.) programs and houses some of the nation's top researchers and brightest students. There are more than 207 full-time faculty on staff at the McCormick School of Engineering, which budgets more than $1.5 billion a year for its research efforts and currently ranks fourth in the United States in industrial manufacturing and systems engineering, according to U.S. News & World Report.

22. One of the faculty members at the McCormick School of Engineering is Dr. Michael A. Peshkin, who is a Professor of Mechanical Engineering and Breed Senior Professor of Design. Dr. Peshkin is also a fellow of the National Academy of Inventors and a recipient of a number of teaching and educator awards.

23. Dr. Peshkin is a frequent collaborator with Dr. J. Edward Colgate. Dr. Colgate is also a Professor of Mechanical Engineering at the McCormick School of Engineering and the recipient of numerous awards and recognitions in the field of mechanical engineering.

24. Drs. Peshkin and Colgate are the inventors on a broad class of intelligent assist devices known as collaborative robots or "cobots." Cobots are programmable robotic manipulators and assist devices that can safely interact with human operators in a shared workspace. Prior to the invention of the cobot in the laboratory of Drs. Peshkin and Colgate, the word "cobot" did not exist. Now, according to the Wall Street Journal, the word is one "you'll need to know" for the "glossary of the future."

II. Cobots

25. Drs. Peshkin and Colgate presented the first academic paper on cobots at the Proceedings of the IEEE International Conference on Robotics and Automation in April of 1996. The paper, titled "Nonholonomic Haptic Display," won the Best Conference Paper award.

26. The first patent applications covering first-generation cobots were filed in 1996 and 1997 and resulted in the issuance of United States Patent Nos. 5,923,139 and 5,952,796, respectively.

27. First-generation cobots were passive devices that assured safe human-robot interactions by having no internal source of motive power and more limited range of motion, accomplished through the use of nonholonomic joints and transmission elements that created programmable constraints.

28. Drs. Peshkin and Colgate, along with others, developed a second generation of intelligent assist devices. Unlike first-generation cobots, these computer-controlled devices could be either active or passive, and used sophisticated sensors, controls, and motor technology to allow human operators to position loads with greater degrees of freedom, speed, precision, and ease. And

importantly, these new devices contained a modular architecture of programmable components coordinated through digital communication links that allowed for the creation of bespoke intelligent assist devices able to adapt to a variety of applications.

29. Work on these second-generation intelligent assist devices is protected by numerous United States patents, including the patents at issue in this case.

30. The patents at issue, U.S. Patent Nos. 6,928,336, 6,907,317, and 7,120,508, disclose an architecture, configuration system, and multi-functional hub for intelligent assist systems. These patents are attached as Exhibits 1-3.

31. Intelligent assist devices are a class of computer-controlled machines that interact with a human operator to assist in various tasks, including moving objects (or payloads). That assistance to a human operator may take various forms, such as supporting the weight of the object, helping the operator overcome frictional forces, helping the operator guide or direct the motion of the object, or moving the object itself.

32. At the time of the invention of the asserted patents, intelligent assist devices were considered to be a new development in technology. Although intelligent assist devices included some robotic characteristics, intelligent assist devices were not considered to be the same as industrial robots. In particular, intelligent assist devices were deemed considerably different from other equipment and machines, such as industrial robots, because they allow people to be in the proximity of the device while the device is operating.

33. The safety considerations for intelligent assist devices were distinct from industrial robots. For example, industrial robots, which are not in active operation while humans are in their immediate vicinity, would include safety cages to prevent humans from inadvertently coming near the robots. But such a safety solution is antithetical to intelligent assist devices, as such cages

would prevent the human interactions and collaborations that intelligent assist devices are specifically designed and intended to perform.

34. Intelligent assist devices also operate differently compared to how two or more humans working together would approach the problem of moving objects. For example, two human workers may discuss and formulate a plan for moving an object, and then execute that plan while verbally communicating. One worker may be able to tell that the other needs a break from visual or auditory cues and can then suggest that they both put the object down. Human workers perceive their environments through subjective sensory processing. In contrast, an intelligent assist device "communicates" with a human operator through, for example, computer componentry that does not function in the same way as the human brain. An intelligent assist device must be able to do more than simply "communicate" with the operator through a user interface (i.e., by receiving direct inputs from the operator). For example, it could also employ sensors that allow the intelligent assist device to understand the forces that the operator is supplying, or sensors allowing it to understand the position of the operator relative to the device. However, the range of sensing features was not well developed in prior art intelligent assist devices.

35. It was well appreciated at the time of the invention that the problem of creating intelligent assist devices that could operate effectively and safely in a collaborative way with humans was not trivial. It was not a matter, for example, of simply taking tasks that had previously been done by humans and automating those tasks. Rather, an intelligent assist device required sophisticated componentry, programming, and implementation to allow the machine to take over some portions of a task while also allowing the human operator to remain in the workspace of the intelligent assist device and collaborate with it.

36. Moreover, at the time the asserted patents were filed, the field of intelligent assist devices, while exciting, was in its infancy. The intelligent assist devices that did exist were somewhat primitive. For example, early intelligent assist devices suffered from limitations such as movement in only two dimensions, the capacity to undergo a single type of motion, or the ability to perform only one type of task.

37. The inventions of the asserted patents were improvements over the intelligent assist devices that existed at the time. While previous intelligent assist devices were "intelligent"—in that they could sense forces being supplied by the human operator and amplify that movement—the prior devices were limited in their application. For example, prior devices were passive devices that were not integrated into a factory system or working environment. Instead, they were largely prototypes that could perform a single task or motion. The claimed inventions overcame those limitations.

38. The inventions improved on those prior devices by, for example, incorporating a novel modular architecture. The claimed modular architecture includes a variety of modules, in which each individual moving component can be independently controlled but which is also integrated into a larger system that may be controlled centrally. At the time of the invention, such distributed control was unknown for intelligent assist devices. The asserted patents' novel modular architecture came with significant advantages, including efficiency gains from minimizing the need for central control of every joint and moving piece while still having a system in communication to globally handle the overall task assigned to the system.

39. In addition to (and, in part, because of) this novel modular architecture, the intelligent assist systems of the asserted patents have improved safety features over the prior art. The asserted patents incorporate novel intent sensors that can be used to predict and measure the

operator's expected actions. Prior devices were limited to the user affirmatively inputting data about their intentions (e.g., through a graphical or other user interface) or to detecting the forces that the operator was supplying. In contrast, the inventions of the asserted patents use readings from sensors, like intent sensors, to make predictions about the operator's actions in real time (including understanding where the operator is and will be and a number of other predictive measures) and adjust the system's movements accordingly. These specialty sensors are critical for the intelligent assist device to be able to operate safely around humans, as they allow the system both to predict human movement and to react quickly to the operator being in an unexpected position. For example, certain sensors enable the system to stop movement as soon as the device comes into unexpected contact with the operator or another human in the area.

40. The patents at issue are the result of the work of all named inventors on intelligent assist systems with a modular architecture. The importance of these contributions to the design and creation of intelligent assist systems, as disclosed and claimed in the '336, '317, and '508 patents, was widely recognized in the engineering community, including by industrial robotics manufacturers such as the Universal Robots Defendants, whose products incorporate Northwestern's innovations.

41. Northwestern has complied with the requirements of 35 U.S.C. § 287(a). Since issuance of the asserted patents, the patentees did not make, offer for sale, or sell in the United States any article covered by the asserted patents, or import into the United States any article covered by the asserted patents.

III. The Universal Robots Defendants' Infringing Products

42. Universal Robots A/S is a multi-national manufacturer of industrial robots and solutions for factory automation that conducts business throughout the world through a number of subsidiaries, including Universal Robots USA in the United States.

43. On information and belief, Universal Robots A/S is itself a wholly owned subsidiary of Teradyne, Inc. Teradyne, Inc. is a US-based developer and supplier of automatic test equipment.

44. On information and belief, Teradyne, Inc. bought Universal Robots and all of its subsidiaries in 2015.

45. Collectively, the Universal Robots Defendants design, develop, manufacture, market, and sell industrial robots intended to be used in collaboration with humans, including the UR3 and UR3e robots, the UR5 and UR5e robots, the UR10 and UR10e robots, and the UR16e robots and their accompanying control box and teach pendant (the "Accused Products"). The Accused Products include these robotic arms, accompanying control box, and/or teach pendant, alone or in combination.

46. On information and belief, each of the accused UR products contains a robotic arm, control box, and teach pendant, a multi-function hub used by the human operator to interact with, program, and control the robot, among other functions. An example of a teach pendant is the Universal Robots Defendants' 3PE Teach Pendant for use with the e-series robots, in addition to the Universal Robots software, ROBOTMASTER.

47. On information and belief, the Universal Robots Defendants began marketing the UR3 in 2015 and the UR3e in 2018.

48. On information and belief, the Universal Robots Defendants began marketing the UR5 in 2008 and the UR5e in 2018.

49. On information and belief, the Universal Robots Defendants began marketing the UR10 in 2012 and the UR10e in 2018.

50. On information and belief, the Universal Robots Defendants began marketing the UR16e in 2019.

51. On information and belief, the Universal Robots Defendants began marketing the 3PE Teach Pendant in 2020.

52. On information and belief, the Universal Robots Defendants have sold more than 50,000 UR robots.

53. The Universal Robots Defendants are involved in the sale and/or importation into the United States of cobot systems, including but not limited to the systems and architecture for providing modular intelligent assist systems and hubs for modular intelligent assist systems.

54. The Universal Robots Defendants' cobot systems embody and/or use the patented systems, configuration systems, and multi-function hub at issue in this case.

55. On information and belief, the Universal Robots Defendants designed, developed, made, and sold infringing cobot systems despite having knowledge of the Northwestern patents at issue based, at a minimum, on its own patent prosecution activities—or the patent prosecution activities of its related companies—wherein certain of the patents at issue and/or family members of those patents were cited as prior art, including, but not limited to, U.S. Patent No. 6,928,336, and/or, at a minimum, on their receipt of a letter from Northwestern's counsel notifying the Universal Robots Defendants of their infringing conduct.

FIRST CAUSE OF ACTION

(Infringement of the '336 Patent)

56. Northwestern incorporates by reference its allegations in Paragraphs 1-45 as if fully restated herein.

57. On August 9, 2005, the United States Patent and Trademark Office lawfully issued the '336 patent, entitled "System and Architecture for Providing a Modular Intelligent Assist

System." All rights, title, and interest in and to the '336 patent have been assigned to Northwestern, which is the sole owner of the '336 patent.

58. The '336 patent is valid and enforceable. The invention of the '336 patent addressed concerns specific to cobots—the need for natural and intuitive control of a payload by a human operator through easy and safe interactions with a powered robot. The '336 patent improved on the first generation of cobots by, among other things, claiming a novel modular architecture for a cobot that allows for wide flexibility and variability.

59. The Universal Robot Defendants have directly, literally under 35 U.S.C. § 271(a) and/or equivalently under the doctrine of equivalents, infringed the '336 patent, by making, using, selling, and/or offering to sell in the United States, and/or importing into the United States, without license or authority, the Accused Products.

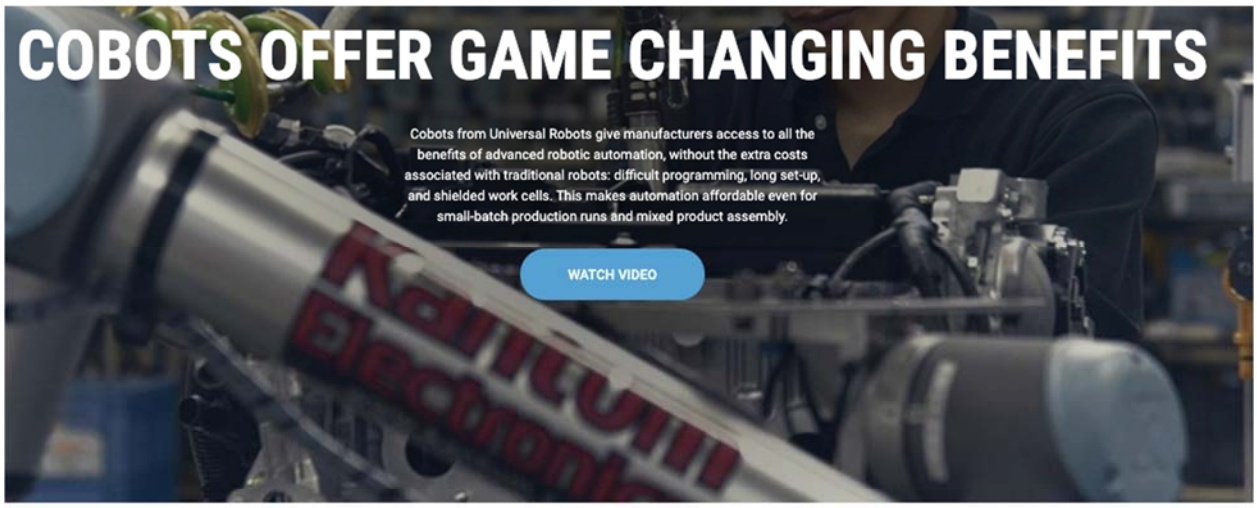
60. The Accused Products meet each and every element of one or more claims of the '336 patent. By way of illustration only, Universal Robots Defendants' Accused Products meet each and every element of claim 1 of the '336 patent.

61. Independent claim 1 of the '336 patent recites:

> An intelligent assist system having a modular architecture, comprising:
>
> a motion module for supporting and moving a payload;
>
> a plurality of computational nodes, at least one of the plurality of computational nodes being configured to control the motion module; and
>
> a plurality of communication links, at least one of the plurality of communication links being between two of the plurality of computational nodes to carry information between the nodes to actuate the motion module.

62. As depicted below and described on the Universal Robots Defendants' website, the Universal Robots Defendants describe the Accused Products as intelligent assist systems. For example, they describe their cobots as being "designed to share a workspace with humans, making

automation easier than ever before for business of all sizes." They even describe cobots as "game-chang[ing]."



WHY COBOTS?

Cobots are designed to share a workspace with humans, making automation easier than ever before for businesses of all sizes. All of these benefits have made our cobots a game-changer for a wide variety of applications

See, *e.g.*, Why Cobots, available online at https://www.universal-robots.com/products/collaborative-robots-cobots-benefits/ (last visited January 27, 2021) (Exhibit 4).

63. The Universal Robot Defendants' Accused Products have a modular architecture comprising at least one articulated robot arm, a control box, and a teach pendant, as depicted below, with regard to each of the Accused Products. This architecture allows for customization, user-friendliness, and rapid update of software to allow greater flexibility and additional automation of the intelligent assist device.

Robot arm:

The robot can be programmed to move a tool, and communicate with other machines using electrical signals. It is an arm composed of extruded aluminum tubes and joints. Using our patented programming interface, PolyScope, it is easy to program the robot to move the tool along a desired trajectory.

See User Manual UR5, CB3, available online at https://s3-eu-west-1.amazonaws.com/ur-support-site/22046/UR5_User_Manual_en_Global.pdf (last visited January 27, 2021) (Exhibit 5).

Control box:

Technical Details, available online at https://www.universal-robots.com/media/1808973/oem-control-box_tech-sheet_dec-2019.pdf (last visited January 27, 2021) (Exhibit 6).

Teach Pendant:

See E-Series Teach Pendant with 3-Position Enabling Device, available online at https://www.universal-robots.com/products/3pe/ (last visited January 27, 2021) (Exhibit 7).

64. On information and belief, all Universal Robot Defendants' Accused Products contain at least one articulated robot arm, one control box, and one teach pendant, or, on information and belief, multiple articulated robot arms can be combined with one or more control box and teach pendant in order to create multi-robot systems.

UR3:

UNIVERSAL ROBOTS

Technical details

UR3

Performance		
Repeatability	±0.1 mm / ±0.0039 in (4 mils)	
Ambient temperature range	0-50° *	
Power consumption	Min 90W, Typical 125W, Max 250W	
Collaboration operation	15 advanced adjustable safety functions. TÜV NORD Approved Safety Function Tested in accordance with: EN ISO 13849:2008 PL d	
Specification		
Payload	3 kg / 6.6 lbs	
Reach	500 mm / 19.7 in	
Degrees of freedom	6 rotating joints	
Programming	Polyscope graphical user interface on 12 inch touchscreen with mounting	
Movement		
Axis movement robot arm	Working range	Maximum speed
Base	± 360°	± 180°/Sec.
Shoulder	± 360°	± 180°/Sec.
Elbow	± 360°	± 180°/Sec.
Wrist 1	± 360°	± 360°/Sec.
Wrist 2	± 360°	± 360°/Sec.
Wrist 3	Infinite	± 360°/Sec.
Typical tool		1 m/Sec. / 39.4 in/Sec.
Features		
IP classification	IP64	
ISO Class Cleanroom	5	
Noise	70dB	
Robot mounting	Any	
I/O ports	Digital in	2
	Digital out	2
	Analog in	2
	Analog out	0
I/O power supply in tool	12 V/24 V 600 mA in tool	
Physical		
Footprint	Ø 128mm	
Materials	Aluminium, PP plastics	
Tool connector type	M8	
Cable length robot arm	6 m / 236 in	
Weight with cable	11 kg /24.3 lbs	

* The robot can work in a temperature range of 0-50°C. At high continuous joint speed, ambient temperature is reduced.

CONTROL BOX

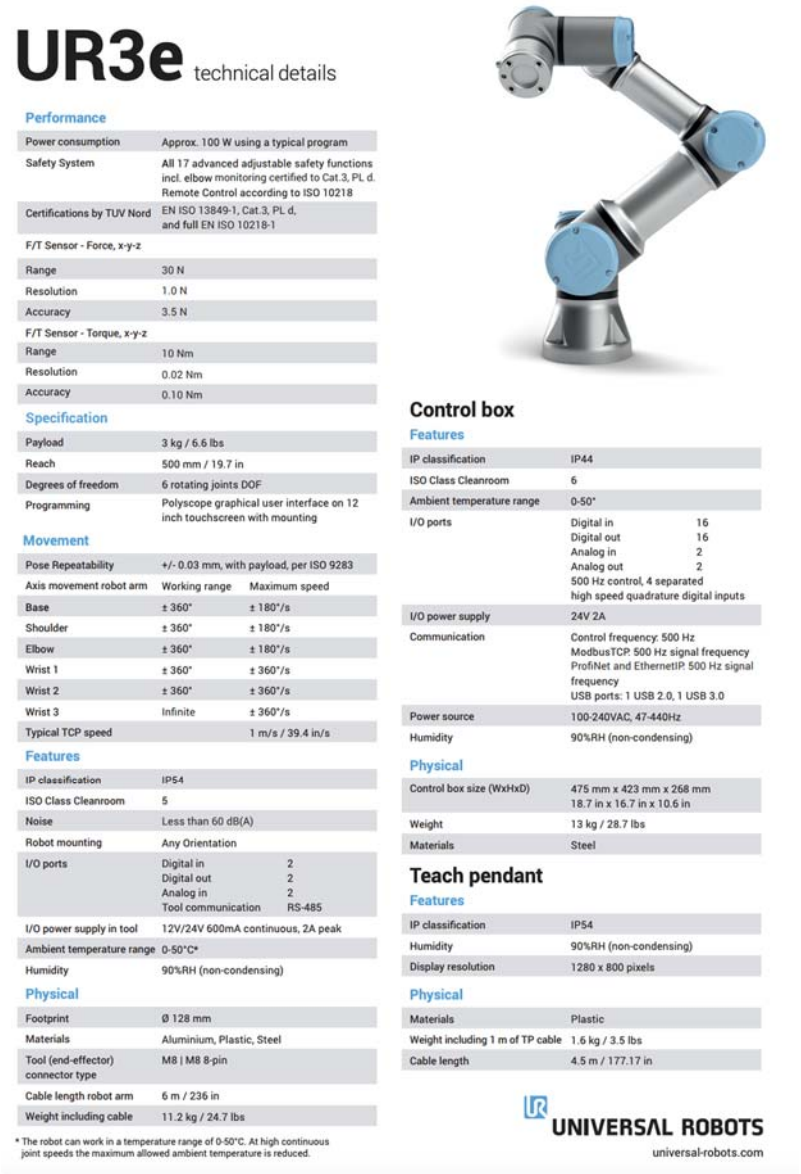
Features		
IP classification	IP20	
ISO Class Cleanroom	6	
Noise	<65dB(A)	
I/O ports	Digital in	16
	Digital out	16
	Analog in	2
	Analog out	2
I/O power supply	24V 2A	
Communication	TCP/IP 100Mbit, Modbus TCP, Profinet, EthernetIP	
Power source	100-240 VAC, 50-60 Hz	
Ambient temperature range	0-50°	
Physical		
Control box size (WxHxD)	475mm x 423mm x 268mm / 18.7 x 16.7 x 10.6 in	
Weight	15 kg / 33.1 lbs	
Materials	Steel	

TEACH PENDANT

Features	
IP classification	IP20
Physical	
Materials	Aluminium, PP
Weight	1,5 kg / 3.3 lbs
Cable length	4,5 m / 177 in

UR3 Technical Details, available online at https://www.universal-robots.com/media/1801288/eng_199901_ur3_tech_spec_web_a4.pdf (last visited January 27, 2021) (Exhibit 8).

UR3e:



UR3e technical details

Performance

Power consumption	Approx. 100 W using a typical program
Safety System	All 17 advanced adjustable safety functions incl. elbow monitoring certified to Cat.3, PL d. Remote Control according to ISO 10218
Certifications by TUV Nord	EN ISO 13849-1, Cat.3, PL d, and full EN ISO 10218-1
F/T Sensor - Force, x-y-z	
Range	30 N
Resolution	1.0 N
Accuracy	3.5 N
F/T Sensor - Torque, x-y-z	
Range	10 Nm
Resolution	0.02 Nm
Accuracy	0.10 Nm

Specification

Payload	3 kg / 6.6 lbs
Reach	500 mm / 19.7 in
Degrees of freedom	6 rotating joints DOF
Programming	Polyscope graphical user interface on 12 inch touchscreen with mounting

Movement

Pose Repeatability	+/- 0.03 mm, with payload, per ISO 9283	
Axis movement robot arm	Working range	Maximum speed
Base	± 360°	± 180°/s
Shoulder	± 360°	± 180°/s
Elbow	± 360°	± 180°/s
Wrist 1	± 360°	± 360°/s
Wrist 2	± 360°	± 360°/s
Wrist 3	Infinite	± 360°/s
Typical TCP speed		1 m/s / 39.4 in/s

Features

IP classification	IP54	
ISO Class Cleanroom	5	
Noise	Less than 60 dB(A)	
Robot mounting	Any Orientation	
I/O ports	Digital in Digital out Analog in Tool communication	2 2 2 RS-485
I/O power supply in tool	12V/24V 600mA continuous, 2A peak	
Ambient temperature range	0-50°C*	
Humidity	90%RH (non-condensing)	

Physical

Footprint	Ø 128 mm
Materials	Aluminium, Plastic, Steel
Tool (end-effector) connector type	M8 | M8 8-pin
Cable length robot arm	6 m / 236 in
Weight including cable	11.2 kg / 24.7 lbs

* The robot can work in a temperature range of 0-50°C. At high continuous joint speeds the maximum allowed ambient temperature is reduced.

Control box

Features

IP classification	IP44
ISO Class Cleanroom	6
Ambient temperature range	0-50°
I/O ports	Digital in 16 Digital out 16 Analog in 2 Analog out 2 500 Hz control, 4 separated high speed quadrature digital inputs
I/O power supply	24V 2A
Communication	Control frequency: 500 Hz ModbusTCP: 500 Hz signal frequency ProfiNet and EthernetIP: 500 Hz signal frequency USB ports: 1 USB 2.0, 1 USB 3.0
Power source	100-240VAC, 47-440Hz
Humidity	90%RH (non-condensing)

Physical

Control box size (WxHxD)	475 mm x 423 mm x 268 mm 18.7 in x 16.7 in x 10.6 in
Weight	13 kg / 28.7 lbs
Materials	Steel

Teach pendant

Features

IP classification	IP54
Humidity	90%RH (non-condensing)
Display resolution	1280 x 800 pixels

Physical

Materials	Plastic
Weight including 1 m of TP cable	1.6 kg / 3.5 lbs
Cable length	4.5 m / 177.17 in

UNIVERSAL ROBOTS

universal-robots.com

UR3e Technical Details, available online at https://www.universal-robots.com/media/1802780/ur3e-32528_ur_technical_details_.pdf (last visited January 27, 2021) (Exhibit 9).

UR5:

UNIVERSAL ROBOTS

Technical details

UR5

Performance

Repeatability	±0.1 mm / ±0.0039 in (4 mils)
Temperature range	0-50°
Power consumption	Min 90W, Typical 150W, Max 325W
Collaboration operation	15 advanced adjustable safety functions. TÜV NORD Approved Safety Function Tested in accordance with: EN ISO 13849:2008 PL d

Specification

Payload	5 kg / 11 lbs
Reach	850 mm / 33.5 in
Degrees of freedom	6 rotating joints
Programming	Polyscope graphical user interface on 12 inch touchscreen with mounting

Movement

Axis movement robot arm	Working range	Maximum speed
Base	± 360°	± 180°/Sec.
Shoulder	± 360°	± 180°/Sec.
Elbow	± 360°	± 180°/Sec.
Wrist 1	± 360°	± 180°/Sec.
Wrist 2	± 360°	± 180°/Sec.
Wrist 3	± 360°	± 180°/Sec.
Typical tool		1 m/Sec. / 39.4 in/Sec.

Features

IP classification	IP54
ISO Class Cleanroom	5
Noise	Comparatively noiseless
Robot mounting	Any
I/O ports	Digital in 2 Digital out 2 Analog in 2 Analog out 0
I/O power supply in tool	12 V/24 V 600 mA in tool

Physical

Footprint	Ø 149mm
Materials	Aluminium, PP plastics
Tool connector type	M8
Cable length robot arm	6 m / 236 in
Weight with cable	18,4 kg / 40.6 lbs

• The robot can work in a temperature range of 0-50°C. At high continuous joint speed, ambient temperature is reduced.

CONTROL BOX

Features

IP classification	IP20
ISO Class Cleanroom	6
Noise	<65dB(A)
I/O ports	Digital in 16 Digital out 16 Analog in 2 Analog out 2
I/O power supply	24V 2A
Communication	TCP/IP 100Mbit, Modbus TCP, Profinet, EthernetIP
Power source	100-240 VAC, 50-60 Hz

Physical

Control box size (WxHxD)	475mm x 423mm x 268mm / 18.7 x 16.7 x 10.6 in
Weight	15 kg / 33.1 lbs
Materials	Steel

TEACH PENDANT

Features

IP classification	IP20

Physical

Materials	Aluminium, PP
Weight	1,5 kg / 3.3 lbs
Cable length	4,5 m / 177 in

UR5 Technical Details, available online at https://www.universal-robots.com/media/1801303/eng_199901_ur5_tech_spec_web_a4.pdf (last visited January 27, 2021) (Exhibit 10).

UR5e:

UNIVERSAL ROBOTS

UR5e technical details

Performance

Power consumption	Approx. 200 W using a typical program
Collaboration operation	17 advanced adjustable safety functions incl. elbow monitoring. Remote Control according to ISO 10218
Certifications	EN ISO 13849-1, Cat.3, PL d, and EN ISO 10218-1

F/T Sensor - Force, x-y-z		F/T Sensor - Torque, x-y-z	
Range	50 N	Range	10 Nm
Resolution	2.5 N	Resolution	0.04 Nm
Accuracy	4.0 N	Accuracy	0.30 Nm

Ambient temperature range	0-50°C
Humidity	90% RH (non-condensing)

Specification

Payload	5 kg / 11 lbs
Reach	850 mm / 33.5 in
Degrees of freedom	6 rotating joints DOF
Programming	Polyscope graphical user interface on 12 inch touchscreen with mounting

Movement

Pose Repeatability	+/- 0.03 mm, with payload, per ISO 9283	
Axis movement robot arm	Working range	Maximum speed
Base	± 360°	±180°/Sec.
Shoulder	± 360°	±180°/Sec.
Elbow	± 360°	±180°/Sec.
Wrist 1	± 360°	±180°/Sec.
Wrist 2	± 360°	±180°/Sec.
Wrist 3	± 360°	±180°/Sec.
Typical TCP speed		1 m/Sec./ 39.4 in/Sec.

Features

IP classification	IP54
ISO Class Cleanroom	6
Noise	Less than 65 dB(A)
Robot mounting	Any Orientation
I/O Ports	Digital in 2 Digital out 2 Analog in 2 Analog out 0 UART interface (9.6k-5Mbps)
I/O power supply in tool	12V/24V 600mA continuous, 2A for shorter periods

Physical

Footprint	Ø 149 mm
Materials	Aluminium, Plastic, Steel
Tool (end-effector) connector type	M8 | M8 8-pin
Cable length robot arm	6 m / 236 in
Weight including cable	20.6 kg / 45.4 lbs

Control box

Features

IP classification	IP44
ISO Class Cleanroom	6
Ambient temperature range	0-50°C
I/O Ports	Digital in 16 Digital out 16 Analog in 2 Analog out 2 500 Hz control, 4 separated high speed quadrature digital inputs
I/O Power supply	24V 2A
Communication	Control frequency: 500 Hz ModbusTCP: 500 Hz signal frequency ProfiNet and EthernetIP: 500 Hz signal frequency USB ports: 1 USB 2.0, 1 USB 3.0
Power source	100-240 VAC, 47-440Hz
Humidity	90% RH (non-condensing)

Physical

Control box size (WxHxD)	475 mm x 423 mm x 268 mm 18.7 in x 16.7 in x 10.6 in
Weight	Max 13.6 kg / 30.0 lbs
Materials	Steel

Teach pendant

Features

IP classification	IP54
Humidity	90% RH (non-condensing)
Display resolution	1280 x 800 pixels

Physical

Materials	Plastic
Weight including 1m of TP cable	1.6 kg / 3.5 lbs
Cable length	4.5 m / 177.17 in

UR5e Technical Details, available online at https://www.universal-robots.com/media/1802778/ur5e-32528_ur_technical_details_.pdf (last visited January 27, 2021) (Exhibit 11).

UR10:

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Technical details

UR10

Performance

Repeatability	±0.1 mm / ±0.0039 in (4 mils)
Ambient temperature range	0-50°
Power consumption	Min 90W, Typical 250W, Max 500W
Collaboration operation	15 advanced adjustable safety functions. TÜV NORD Approved Safety Function Tested in accordance with: EN ISO 13849:2008 PL d

Specification

Payload	10 kg /22 lbs
Reach	1300 mm / 51.2 in
Degrees of freedom	6 rotating joints
Programming	Polyscope graphical user interface on 12 inch touchscreen with mounting

Movement

Axis movement robot arm	Working range	Maximum speed
Base	± 360°	± 120°/Sec.
Shoulder	± 360°	± 120°/Sec.
Elbow	± 360°	± 180°/Sec.
Wrist 1	± 360°	± 180°/Sec.
Wrist 2	± 360°	± 180°/Sec.
Wrist 3	± 360°	± 180°/Sec.
Typical tool		1 m/Sec. / 39.4 in/Sec.

Features

IP classification	IP54
ISO Class Cleanroom	5
Noise	72dB
Robot mounting	Any
I/O ports	Digital in 2 Digital out 2 Analog in 2 Analog out 0
I/O power supply in tool	12 V/24 V 600 mA in tool

Physical

Footprint	Ø 190mm
Materials	Aluminium, PP plastics
Tool connector type	M8
Cable length robot arm	6 m / 236 in
Weight with cable	28,9 kg / 63.7 lbs

CONTROL BOX

Features

IP classification	IP20
ISO Class Cleanroom	6
Noise	<65dB(A)
I/O ports	Digital in 16 Digital out 16 Analog in 2 Analog out 2
I/O power supply	24V 2A
Communication	TCP/IP 100Mbit, Modbus TCP, Profinet, EthernetIP
Power source	100-240 VAC, 50-60 Hz
Ambient temperature range	0-50°

Physical

Control box size (WxHxD)	475mm x 423mm x 268mm / 18.7 x 16.7 x 10.6 in
Weight	17 kg / 37.5 lbs
Materials	Steel

TEACH PENDANT

Features

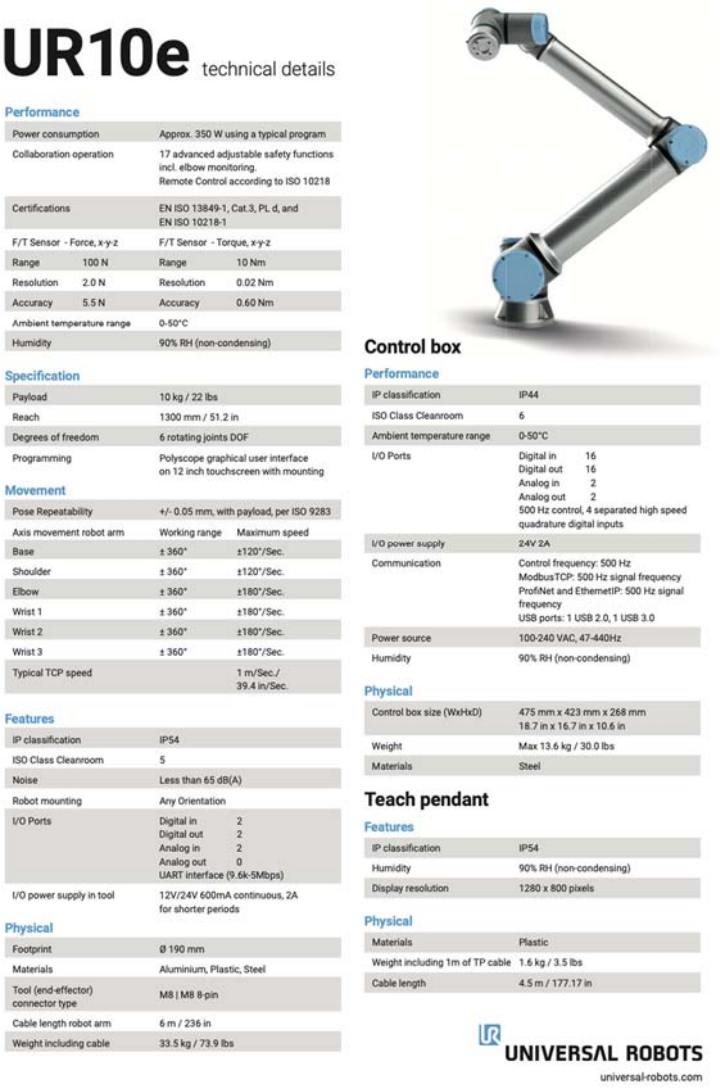
IP classification	IP20

Physical

Materials	Aluminium, PP
Weight	1,5 kg / 3.3 lbs
Cable length	4,5 m / 177 in

UR10 Technical Details, available online at https://www.universal-robots.com/media/1801323/eng_199901_ur10_tech_spec_web_a4.pdf (last visited January 27, 2021) (Exhibit 12).

UR10e:



UR10e technical details

Performance

Power consumption	Approx. 350 W using a typical program
Collaboration operation	17 advanced adjustable safety functions incl. elbow monitoring. Remote Control according to ISO 10218
Certifications	EN ISO 13849-1, Cat.3, PL d, and EN ISO 10218-1

F/T Sensor - Force, x-y-z		F/T Sensor - Torque, x-y-z	
Range	100 N	Range	10 Nm
Resolution	2.0 N	Resolution	0.02 Nm
Accuracy	5.5 N	Accuracy	0.60 Nm

Ambient temperature range	0-50°C
Humidity	90% RH (non-condensing)

Specification

Payload	10 kg / 22 lbs
Reach	1300 mm / 51.2 in
Degrees of freedom	6 rotating joints DOF
Programming	Polyscope graphical user interface on 12 inch touchscreen with mounting

Movement

Pose Repeatability	+/- 0.05 mm, with payload, per ISO 9283	
Axis movement robot arm	Working range	Maximum speed
Base	± 360°	±120°/Sec.
Shoulder	± 360°	±120°/Sec.
Elbow	± 360°	±180°/Sec.
Wrist 1	± 360°	±180°/Sec.
Wrist 2	± 360°	±180°/Sec.
Wrist 3	± 360°	±180°/Sec.
Typical TCP speed		1 m/Sec./ 39.4 in/Sec.

Features

IP classification	IP54
ISO Class Cleanroom	5
Noise	Less than 65 dB(A)
Robot mounting	Any Orientation
I/O Ports	Digital in 2 Digital out 2 Analog in 2 Analog out 0 UART interface (9.6k-5Mbps)
I/O power supply in tool	12V/24V 600mA continuous, 2A for shorter periods

Physical

Footprint	Ø 190 mm
Materials	Aluminium, Plastic, Steel
Tool (end-effector) connector type	M8 | M8 8-pin
Cable length robot arm	6 m / 236 in
Weight including cable	33.5 kg / 73.9 lbs

Control box

Performance

IP classification	IP44
ISO Class Cleanroom	6
Ambient temperature range	0-50°C
I/O Ports	Digital in 16 Digital out 16 Analog in 2 Analog out 2 500 Hz control, 4 separated high speed quadrature digital inputs
I/O power supply	24V 2A
Communication	Control frequency: 500 Hz ModbusTCP: 500 Hz signal frequency ProfiNet and EthernetIP: 500 Hz signal frequency USB ports: 1 USB 2.0, 1 USB 3.0
Power source	100-240 VAC, 47-440Hz
Humidity	90% RH (non-condensing)

Physical

Control box size (WxHxD)	475 mm x 423 mm x 268 mm 18.7 in x 16.7 in x 10.6 in
Weight	Max 13.6 kg / 30.0 lbs
Materials	Steel

Teach pendant

Features

IP classification	IP54
Humidity	90% RH (non-condensing)
Display resolution	1280 x 800 pixels

Physical

Materials	Plastic
Weight including 1m of TP cable	1.6 kg / 3.5 lbs
Cable length	4.5 m / 177.17 in

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UR10e Technical Details, available online at https://www.universal-robots.com/media/1802458/ur10e-tech-specs-eng.pdf (last visited January 28, 2021) (Exhibit 13).

UR16e:

UR16e technical details

Specifications

Payload	16 kg (35.3 lbs)
Reach	900 mm (35.4 in)
Degrees of freedom	6 rotating joints
Programming	12 inch touchscreen with polyscope graphical user interface

Performance

Power, Consumption, Maximum Average	585 W
Power, Consumption, Typical with moderate operating settings (approximate)	350 W
Safety	17 configurable safety functions
Certifications	EN ISO 13849-1, PLd Category 3, and EN ISO 10218-1

Force Sensing, Tool Flange	Force, x-y-z	Torque, x-y-z
Range	160.0 N	10.0 Nm
Precision	5.0 N	0.2 Nm
Accuracy	5.5 N	0.5 Nm

Movement

Pose Repeatability per ISO 9283	± 0.05 mm

Axis movement	Working range	Maximum speed
Base	± 360°	± 120°/s
Shoulder	± 360°	± 120°/s
Elbow	± 360°	± 180°/s
Wrist 1	± 360°	± 180°/s
Wrist 2	± 360°	± 180°/s
Wrist 3	± 360°	± 180°/s
Typical TCP speed	1 m/s (39.4 in/s)	

Features

IP classification	IP54
ISO 14644-1 Class Cleanroom	5
Noise	Less than 65 dB(A)
Robot mounting	Any Orientation
I/O ports	
Digital in	2
Digital out	2
Analog in	2
Tool I/O Power Supply Voltage	12/24 V
Tool I/O Power Supply	2 A (Dual pin) 1 A (Single pin)

Physical

Footprint	Ø 190 mm
Materials	Aluminium, Plastic, Steel
Tool (end-effector) connector type	M8 | M8 8-pin
Cable length robot arm	6 m (236 in)
Weight including cable	33.1 kg (73 lbs)
Operating Temperature Range	0-50°C
Humidity	90%RH (non-condensing)

Control box

Features

IP classification	IP44
ISO 14644-1 Class Cleanroom	6
Operating Temperature Range	0-50°C
I/O ports	
Digital in	16
Digital out	16
Analog in	2
Analog out	2
Quadrature Digital Inputs	4
I/O power supply	24V 2A
Communication	500 Hz Control frequency Modbus TCP PROFINET Ethernet/IP USB 2.0, USB 3.0
Power source	100-240VAC, 47-440Hz
Humidity	90%RH (non-condensing)

Physical

Control box size (WxHxD)	475 mm x 423 mm x 268 mm (18.7 in x 16.7 in x 10.6 in)
Weight	12 kg (26.5 lbs)
Materials	Powder Coated Steel

Teach pendant

Features

IP classification	IP54
Humidity	90%RH (non-condensing)
Display resolution	1280 x 800 pixels

Physical

Materials	Plastic, PP
Weight including 1m of TP cable	1.6 kg (3.5 lbs)
Cable length	4.5 m (177.17 in)

UR16e Technical Details, available online at https://www.universal-robots.com/media/1811483/ur_tech-specs_ur16e_en.pdf (last visited January 28, 2021) (Exhibit 14).

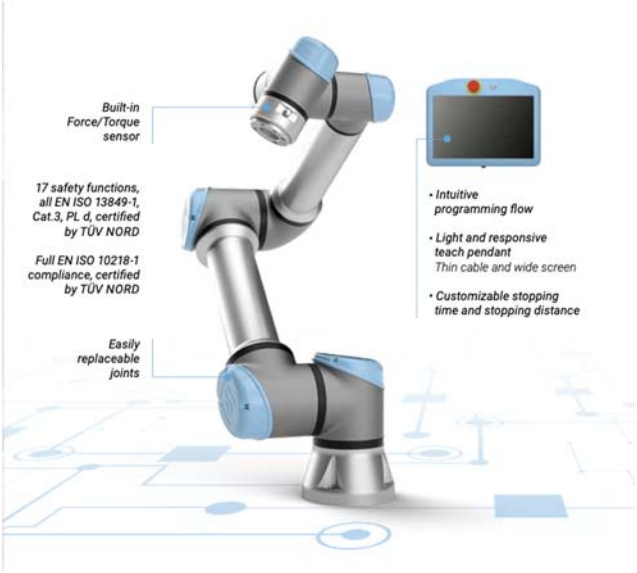
65. In the Universal Robots Defendants' Accused Products, the articulated robot arm comprises a motion module, or alternatively is comprised of multiple motion modules, each of which contain at least one actuator. The robot arm can support and move a payload.

66. On information and belief, the articulated robot arm, the control box, and the teach pendant of the Universal Robots Defendants' Accused Products each contain one or more computational nodes. At least one of the computational nodes is configured to control the

articulated robot arm. The computational nodes further comprise a programmable logic device and can execute motion control algorithms, including automatic motion control algorithms.

67. On information and belief, there are communication links between the node(s) of the control box and/or teach pendant and the robot arm.

68. The Universal Robot Defendants' Accused Products also include various sensors that are embedded in the articulated robot arm. Each sensor is itself a computational node. Examples of such sensors include torque, force, and motion sensors. The Universal Robots Defendants' marketing materials highlight the force and torque sensors present in their articulated robot arms.



See, e-Series from Universal Robots Brochure, available online at https://www.universal-robots.com/media/1802432/e-series-brochure.pdf (last visited January 28, 2021) (Exhibit 15).

69. On information and belief, the computational node(s) on the Universal Robots Defendants' Accused Products are connected by a plurality of communication links. At least one of the communication links carries information between the nodes to actuate the articulated robot arm.

70. In violation of 35 U.S.C. § 271(b), the Universal Robots Defendants have been and are indirectly infringing the '336 patent by inducing infringement of this patent by others who use the Universal Robots Defendants' Accused Products.

71. The Universal Robots Defendants' affirmative acts of making, selling, and offering to sell its services and/or products, or components thereof, cause the Universal Robots Defendants' Accused Products to be used in a manner that infringes the '336 patent.

72. The Universal Robots Defendants further provide guidance and instruction to third parties to use the Accused Products in their normal and customary way to infringe the '336 patent.

73. The Universal Robots Defendants specifically intend that its customers infringe the '336 patent. The Universal Robots Defendants perform the acts that constitute induced infringement with knowledge of the '336 patent and with knowledge or willful blindness that the induced acts would constitute infringement.

74. In violation of 35 U.S.C. § 271(c), the Universal Robots Defendants have been and are indirectly infringing the '336 patent by contributing to the infringement of this patent by others, such as the Universal Robots Defendants' customers, in the United States.

75. The Universal Robots Defendants offered to sell and have sold in the United States, and imported into the United States, the Accused Products (i.e., a robotic arm, control box, and/or teach pendant, alone or in combination), which are a material part of the invention of the '336 patent. The Universal Robots Defendants know that the Accused Products are especially made or especially adapted for an infringing use, and not a staple article or commodity of commerce suitable for substantial non-infringing use.

76. The Universal Robots Defendants have had actual notice of the '336 patent no later than May 5, 2020, when counsel for Northwestern sent the Universal Robots Defendants a letter identifying the '336 patent and Accused Products that infringe the '336 patent.

77. The Universal Robots Defendants willfully infringe the '336 patent by deliberately engaging in acts of infringement on an ongoing basis with knowledge of the '336 patent.

SECOND CAUSE OF ACTION

(Infringement of the '317 Patent)

78. Northwestern incorporates by reference its allegations in Paragraphs 1-67 as if fully restated herein.

79. On June 14, 2005, the United States Patent and Trademark Office issued the '317 patent, entitled "Hub for a Modular Intelligent Assist System." All rights, title, and interest in and to the '317 patent have been assigned to Northwestern, which is the sole owner of the '317 patent.

80. The '317 patent is valid and enforceable. The invention of the '336 patent addressed concerns specific to cobots—the need for natural and intuitive control of a payload by a human operator through easy and safe interactions with a powered robot. The '317 patent improves on the first generation of cobots by, among other things, claiming a hub for an intelligent assist system, which controls the systems and helps impart wider flexibility and variability.

81. The Universal Robots Defendants have directly, literally under 35 U.S.C. § 271(a), and/or equivalently under the doctrine of equivalents, infringed the '317 patent, by making, using, selling, and/or offering to sell in the United States, and/or importing into the United States, without license or authority, the Accused Products.

82. The Accused Products meet each and every element of one or more claims of the '317 patent. By way of illustration only, the Universal Robots Defendants' Accused Products meet each and every element of claim 1 of the '317 patent.

83. Independent claim 1 of the ’317 patent recites:

> A multi-function hub for use in an intelligent assist system, the multi-function hub comprising:
>
> a physical interface configured and arranged to be a central interface point for an operator;
>
> a computational node disposed on the physical interface, the computational node comprising programmable logic for implementing program controlled functions; and
>
> an input/output (“I/O”) interface for interfacing with an information network and disposed on the physical interface, the I/O interface being adapted to communicate with the computational node on the physical interface and at least one computational node disposed on the other module via a common data link, and the I/O interface uses a digital communication protocol to communicate with the computational node on the other module via the common data link.

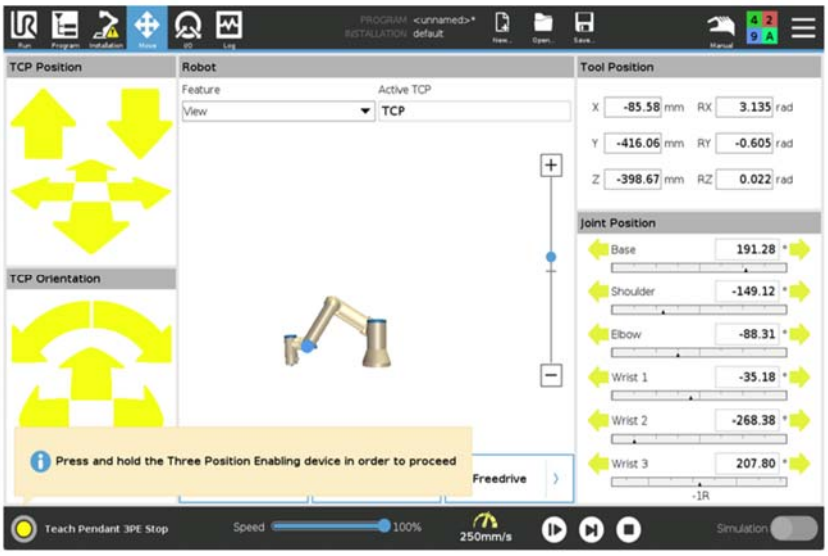
84. On information and belief, and as depicted below, the Universal Robots Defendants make, use, and sell several multi-function hubs for use with the Accused Products, including but not limited to the teach pendant, including the 3PE Teach Pendant compatible with all e-series robots, alone or in combination with accompanying control boxes, including the OEM control box:

See, e.g., New: e-Series Teach Pendant with 3-Position Enabling Device, available online at https://www.universal-robots.com/media/1814933/e-series_3pt_tp_fact-sheet_en.pdf (last visited January 28, 2021) (Exhibit 16).

Control box:

Technical Details, available online at https://www.universal-robots.com/media/1808973/oem-control-box_tech-sheet_dec-2019.pdf (last visited January 27, 2021) (Exhibit 6).

85. As depicted below, the Universal Robots Defendants' multi-function hubs contain a physical interface configured and arranged to be a central point for a user to interface with the computational nodes of the system, including the control box and the articulated robot arm.



Id.

86. On information and belief, the physical interface of the multi-function hub contains at least one computational node.

87. The Universal Robots Defendants' multi-function hubs are designed for simple "plug and play" use. These hubs are designed to be used with human operators with no programming experience by using a straightforward and visual programming logic. And, on information and belief, each hub offers suitable programming logic that can be used to create and implement complex and customized programs for controlling various functions, including motion and tasks to be completed by the robot arm.

88. The Universal Robots Defendants' multi-function hubs contain an input/output interface for interfacing with an information network and disposed on the physical interface of the hub.

89. On information and belief, the input/output interface on these multi-function hubs is adapted to communicate with the computational node on the physical interface of the hub and at least one computational node disposed on the robot arm or control box through a common data link.

90. On information and belief, the input/output interface on these multi-function hubs use a digital communication protocol to communicate with at least one computational node disposed on the robot arm, control box, teach pendant or other module via the common data link.

91. On information and belief, the Universal Robots Defendants' ROBOTMASTER is a software suite on the teach pendants and executed by the control box that allows for programming of the Universal Robots Defendants' cobots.

92. On information and belief, the Universal Robots Defendants' ROBOTMASTER software uses a graphical input/output user interface that enables a user to manipulate objects

related to the articulated robot arm or related to a computational node located on the arm in the Universal Robots Defendants' UR Series cobots.

93. In violation of 35 U.S.C. § 271(b), the Universal Robots Defendants have been and are indirectly infringing the '317 patent by inducing infringement of this patent by others who use the Universal Robots Defendants' Accused Products.

94. The Universal Robots Defendants' affirmative acts of making, selling, and offering to sell its services and/or products, or components thereof, cause the Universal Robots Defendants' Accused Products to be used in a manner that infringes the '317 patent.

95. The Universal Robots Defendants further provide guidance and instruction to third parties to use the Accused Products in their normal and customary way to infringe the '317 patent.

96. The Universal Robots Defendants specifically intend that its customers infringe the '317 patent. The Universal Robots Defendants perform the acts that constitute induced infringement with knowledge of the '317 patent and with knowledge or willful blindness that the induced acts would constitute infringement.

97. In violation of 35 U.S.C. § 271(c), the Universal Robots Defendants have been and are indirectly infringing the '317 patent by contributing to the infringement of this patent by others, such as the Universal Robots Defendants' customers, in the United States.

98. The Universal Robots Defendants offered to sell and have sold in the United States, and imported into the United States, the Accused Products (i.e., a robotic arm, control box, and/or teach pendant, alone or in combination), which are a material part of the invention of the '317 patent. The Universal Robots Defendants know that the Accused Products are especially made or especially adapted for an infringing use, and not a staple article or commodity of commerce suitable for substantial non-infringing use.

99. The Universal Robots Defendants have had actual notice of the '317 patent no later than May 5, 2020, when counsel for Northwestern sent the Universal Robots Defendants a letter identifying the '317 patent and Accused Products that infringe the '317 patent.

100. The Universal Robots Defendants willfully infringe the '317 patent by deliberately engaging in acts of infringement on an ongoing basis with knowledge of the '317 patent.

THIRD CAUSE OF ACTION

(Infringement of the '508 Patent)

101. Northwestern incorporates by reference its allegations in Paragraphs 1-90 as if fully restated herein.

102. On October 10, 2006, the United States Patent and Trademark Office issued the '508 patent, entitled "System and Architecture for Providing a Modular Intelligent Assist System." All rights, title, and interest in and to the '508 patent have been assigned to Northwestern, which is the sole owner of the '508 patent.

103. The '508 patent is valid and enforceable. The invention of the '336 patent addressed concerns specific to cobots—the need for natural and intuitive control of a payload by a human operator through easy and safe interactions with a powered robot. The '508 patent improves on the first generation of cobots by, among other things, claiming a configuration system for an intelligent assist system, which allows a human user to interact and use the cobot system.

104. The Universal Robots Defendants have directly, literally under 35 U.S.C. § 271(a), and/or equivalently under the doctrine of equivalents, infringed the '508 patent, by making, using, selling, and/or offering to sell in the United States, and/or importing into the United States, without license or authority, the Accused Products.

105. The Accused Products meet each and every element of one or more claims of the '508 patent. By way of illustration only, the Universal Robots Defendants' Accused Products meet each and every element of claim 1 of the '508 patent.

106. Independent claim 1 of the '508 patent recites:

> A configuration system for an intelligent assist system, the intelligent assist system comprising a module, and a computational node on the module, the configuration system comprising:
>
> a host computer system capable of executing a stored program, the host computer system being in communication with the computational node via a communication link;
>
> a graphical user interface enabling a user to manipulate objects related to the module or the computational node; and
>
> a plurality of visual indicators corresponding to a status of the module, the computational node, or the communication link.

107. On information and belief, the Universal Robots Defendants make, use, and sell several configuration systems known as control boxes for use with the Accused Products, including but not limited to the control boxes that accompany the UR3, UR5, and UR10 and the OEM control boxes that accompany the UR3e, UR5e, UR10e, and UR16e, alone or in combination with their accompanying teach pendants. *See*, *e.g.*, Exhibits 5-16. The OEM Control Box is depicted below.

UNIVERSAL ROBOTS

OEM Control Box

See, *e.g.*, OEM Control Box Installation Guide, available online at https://s3-eu-west-1.amazonaws.com/ur-support-site/55049/99500_OEM_Control_Box_Installation_Guide_en.pdf (last visited January 28, 2021) (Exhibit 17).

108. On information and belief, the Universal Robots Defendants' control boxes, alone or in combination with their accompanying teach pendants, are computer systems that are designed to communicate with, operate, and/or monitor the Universal Robots Defendants' systems, including the robot arm and/or teach pendant.

4.4. Robot Connection

The Robot Arm connector is next to the power supply connector. For details on connecting the Robot Arm cable, refer to the robot user manual.

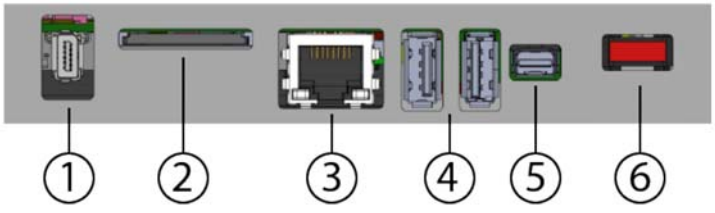
Id.

109. The Universal Robots Defendants' control boxes, alone or in combination with their accompanying teach pendants, contain modular hardware and an open, PC-based software architecture that is capable of executing a stored program.

110. On information and belief, and as depicted below, the Universal Robots Defendants' control boxes, alone or in combination with their accompanying teach pendants, contain communication links between the control box, the robot arm, and/or the teach pendant that enables communication between the control box and other modules and their associated computational nodes.

6.1. Control Ports

The bottom side of the OEM Control Box contains a bracket with ports for connecting external devices. The following illustration shows the bracket.



1	Teach Pendant port	2	SD card slot
3	Ethernet port	4	USB ports
5	Mini DisplayPort	6	10 A Mini Blade Fuse

Id.

111. On information and belief, the Universal Robots Defendants' control box and teach pendant systems contain a graphical user interface that enables a user to manipulate objects related to the articulated robot arm or related to a computational node located on the arm.

112. On information and belief, the Universal Robots Defendants' control box and teach pendant systems provide a plurality of indicators corresponding to the status of the articulated robot arm, a computational node on the arm, or the communication link between the control box, multi-function hub, and/or the arm.

113. On information and belief, the Universal Robots Defendants' control boxes facilitate the computational nodes' execution of motion control algorithms by the robot arm, including automatic motion control algorithms.

114. In violation of 35 U.S.C. § 271(b), the Universal Robots Defendants have been and are indirectly infringing the '508 patent by inducing infringement of this patent by others who use the Universal Robots Defendants' Accused Products.

115. The Universal Robots Defendants' affirmative acts of making, selling, and offering to sell its services and/or products, or components thereof, cause the Universal Robots Defendants' Accused Products to be used in a manner that infringes the '508 patent.

116. The Universal Robots Defendants further provide guidance and instruction to third parties to use the Accused Products in their normal and customary way to infringe the '508 patent.

117. The Universal Robots Defendants specifically intend that its customers infringe the '508 patent. The Universal Robots Defendants perform the acts that constitute induced infringement with knowledge of the '508 patent and with knowledge or willful blindness that the induced acts would constitute infringement.

118. In violation of 35 U.S.C. § 271(c), the Universal Robots Defendants have been and are indirectly infringing the '508 patent by contributing to the infringement of this patent by others, such as the Universal Robots Defendants' customers, in the United States.

119. The Universal Robots Defendants offered to sell and have sold in the United States, and imported into the United States, the Accused Products (i.e., a robotic arm, control box, and/or teach pendant, alone or in combination), which are a material part of the invention of the '508 patent. The Universal Robots Defendants know that the Accused Products are especially made or especially adapted for an infringing use, and not a staple article or commodity of commerce suitable for substantial non-infringing use.

120. The Universal Robots Defendants have had actual notice of the '508 patent no later than May 5, 2020, when counsel for Northwestern sent the Universal Robots Defendants a letter identifying the '508 patent and Accused Products that infringe the '508 patent.

121. The Universal Robots Defendants willfully infringe the '508 patent by deliberately engaging in acts of infringement on an ongoing basis with knowledge of the '508 patent.

PRAYER FOR RELIEF

WHEREFORE, Northwestern respectfully requests that this Court:

A. enter a judgment that the Universal Robots Defendants infringe each of the asserted patents;

B. order an award of damages to Northwestern in an amount adequate to compensate Northwestern for the Universal Robots Defendants' infringement, said damages to be no less than a reasonable royalty;

C. enter a judgment that the infringement was willful and treble damages under 35 U.S.C. § 284;

D. order an accounting to determine the damages to be awarded to Northwestern as a result of the Universal Robots Defendants' infringement, including an accounting for infringing sales not presented at trial, and award additional damages for any such infringing sales;

E. assess pre-judgment and post-judgment interest and costs against the Universal Robots Defendants, together with an award of such interest and costs, in accordance with 35 U.S.C. § 284;

F. render a finding that this case is "exceptional" and award to Northwestern its costs, expenses, and reasonable attorneys' fees, as provided by 35 U.S.C. § 285;

G. grant other and further relief as the Court may deem proper and just.

JURY DEMAND

Pursuant to Federal Rule of Civil Procedure 38, Northwestern respectfully demands a jury trial on all issues and claims so triable.

MORRIS, NICHOLS, ARSHT & TUNNELL LLP

/s/ Jeremy A. Tigan

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June 17, 2021

CERTIFICATE OF SERVICE

I hereby certify that on June 17, 2021, I caused the foregoing to be electronically filed with the Clerk of the Court using CM/ECF, which will send notification of such filing to all registered participants.

I further certify that I caused copies of the foregoing document to be served on June 17, 2021, upon the following in the manner indicated:

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