

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ILLINOIS**

NORTHWESTERN UNIVERSITY,

Plaintiff,

v.

MITSUBISHI ELECTRIC CORP. and
MITSUBISHI ELECTRIC AUTOMATION,
INC.,

Defendants.

Case No. 1:21-cv-00607

JURY TRIAL DEMANDED

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

1. Plaintiff Northwestern University (“Northwestern”) brings this action for infringement of U.S. Patent Numbers 6,928,336, 6,907,317, 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 Mitsubishi Electric Corporation and Mitsubishi Electric Automation, Inc. (collectively the “Mitsubishi 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. Defendant Mitsubishi Electric Corporation is a Japanese corporation with a principal place of business at Tokyo Building, 2-7-3, Marunouchi, Chiyoda-ku, Tokyo 100-8310, Japan.

4. Defendant Mitsubishi Electric Automation, Inc. is a Delaware corporation with a principal place of business at 500 Corporate Woods Parkway, Vernon Hills, Illinois, 60061.

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. Mitsubishi Electric Corporation is subject to jurisdiction in the United States, and specifically in Illinois, under Fed. R. Civ. P. 4(k)(2). Mitsubishi Electric Corporation 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 Illinois and in this District.

8. This Court has personal jurisdiction over Mitsubishi Electric Automation, Inc. because, among other things, Mitsubishi Electric Automation, Inc. maintains its principal place of business in Illinois and is thus subject to personal jurisdiction in the state.

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

10. In particular, on information and belief, the Mitsubishi 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 Illinois.

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

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

13. In addition, on information and belief, the Mitsubishi Defendants have knowingly induced, and continue to knowingly induce, infringement within this District by advertising, marketing, offering for sale, and/or selling devices containing infringing functionality within this District to at least resellers, distributors, customers, and/or other end users, and by providing instructions, user manuals, advertising, and/or marketing materials that facilitate, direct, or encourage the use of infringing functionality with knowledge thereof.

14. The Mitsubishi Defendants have committed patent infringement in Illinois that has led to foreseeable harm and injury to Northwestern.

15. Venue is proper in the Northern District of Illinois under 28 U.S.C. §§ 1391 and 1400(b) because the Mitsubishi Defendants either maintain a place of business in the District or are foreign corporations that may 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.

16. In particular, venue over Mitsubishi Electric Corporation is proper in the Northern District of Illinois under 28 U.S.C. §§ 1391 and 1400(b) because Mitsubishi Electric Corporation is not resident in the United States and may thus be sued in any judicial district.

17. Venue over Mitsubishi Electric Automation is proper in the Northern District of Illinois under 28 U.S.C. §§ 1391 and 1400(b) because 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 and the maintenance of its corporate headquarters in this District.

BACKGROUND

I. Northwestern University

18. 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.

19. 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.

20. 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.

21. 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.

22. Over the past 15 years, the United States Patent and Trademark Office has awarded hundreds of patents to Northwestern, thereby 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.

23. 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.

24. 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.

25. 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.

26. 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 cobots 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

27. 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.

28. 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.

29. 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.

30. 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.

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

32. 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.

33. 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.

34. 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.

35. 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.

36. 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.

37. 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.

38. 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.

39. 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.

40. 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.

41. 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.

42. 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 cobot 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 Mitsubishi Defendants, whose products incorporate Northwestern's innovations.

43. 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 Mitsubishi Defendants' Infringing Products

44. Mitsubishi Electric Corporation is a multi-national manufacturer of industrial robots and solutions for factory automation. Mitsubishi Electric Corporation conducts business throughout the world through a number of subsidiaries.

45. On information and belief, Mitsubishi Electric Corporation conducts business in the United States through its wholly-owned subsidiary Mitsubishi Electric Automation, Inc.

46. Collectively, the Mitsubishi Defendants design, develop, manufacture, market, and sell industrial robots, controllers, and multi-function hubs intended to be used in collaboration with humans, including but not limited to the Assista Series, RV-F Series, RV-FR Series, and RV-CR Series of robots; MELSEC Series; CR Series, D-Type, F series, FR series and Safety Extension Unit controllers; GOT2000 Series, GOT1000 Series, and GOT SIMPLE Series human-machine interfaces; and R28TB, R32TB, R32TB-15, R33TB, R46TB, R56TB, R56TB-15, and R57TB pendants (the "Accused Products"). The Accused Products include these robotic arms, accompanying control box, and/or teach pendant, alone or in combination.

47. On information and belief, the human-machine interfaces and pendants, either alone or in conjunction with the controllers, operate as multi-function hubs used by human operators to interact with, program, and control the robot, among other functions.

48. On information and belief, the Mitsubishi Defendants began commercial marketing of the Assista robot systems in 2019.

49. On information and belief, the Mitsubishi Defendants began commercial marketing of its RV Series robots in 2016.

50. The Mitsubishi Defendants are involved in the sale and/or importation of cobot systems into the United States, including but not limited to the systems and architecture for providing modular intelligent assist systems and hubs for modular intelligent assist systems. The Mitsubishi Defendants' cobot systems embody and/or use the patented systems, configuration systems, and multi-function hub at issue in this case.

51. On information and belief, the Mitsubishi Defendants designed, developed, made, and sold infringing cobot systems despite having knowledge of the Northwestern patents at issue by virtue of its receipt of a letter from Northwestern's counsel notifying the Mitsubishi Defendants of their infringing conduct.

FIRST CAUSE OF ACTION

(Infringement of the '336 Patent)

52. Northwestern incorporates by reference its allegations in Paragraphs 1-41 as if fully restated herein.

53. 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.

54. 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.

55. The Mitsubishi 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.

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

57. 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.

58. As depicted below and described on the Mitsubishi Defendants' website, the Mitsubishi Defendants describe the Accused Products as intelligent assist systems. For example, they describe the Assista cobots as designed to “enable humans to share a workspace with our robots” in a safe way and highlight the flexibility and ease of use of the robots.



<p>Collaborative with No Safety Fence</p>  <p>Advanced in safety technology enable humans to share a workspace with our robots.</p>	<p>No robot programming expertise</p>  <p>We provide Easy Programming - Just touching on the tablet screen, which makes easy and quick set up.</p>	<p>A Wide Variety of Components</p>  <p>Various Components -Grippers, Fingers, Vision and other peripherals make automation easier and faster.</p>
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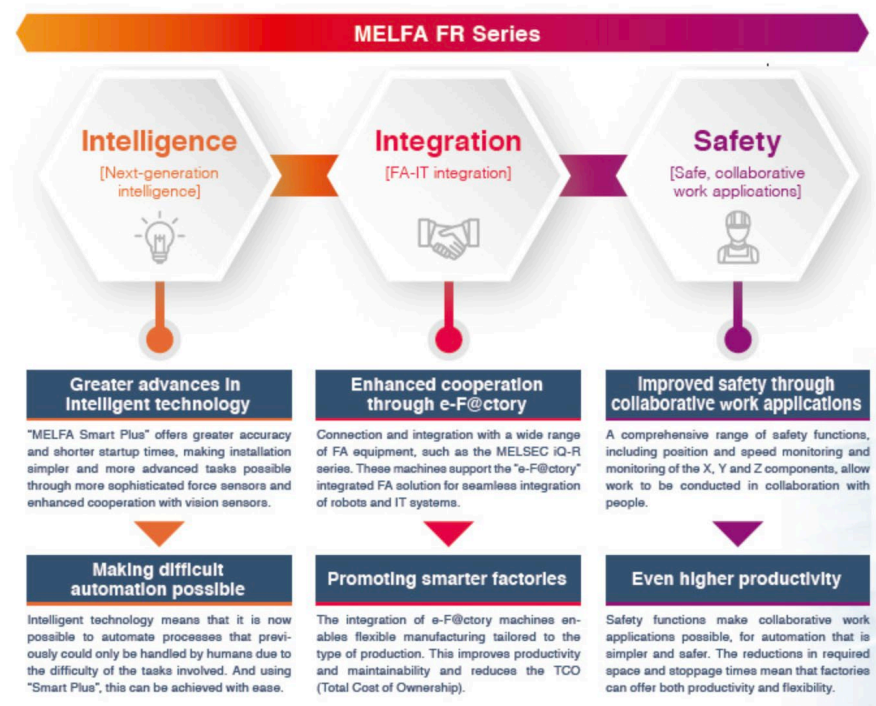
See, e.g., MELFA Assista, available online at <https://www.mitsubishielectric.com/fa/products/rbt/robot/pr/index.html> (last visited February 1, 2021) (Exhibit 4).

59. Similarly, as depicted below, the Mitsubishi Defendants describe the MELFA FR series of robots as having “next-generation intelligent functions” and advertise that “‘safe, collaborative work applications’ allow robots and people to work together with high levels of safety.”

MELFA FR series

"Next-generation intelligent functions" make it simple to carry out work that has always defied automation.
 "Safe, collaborative work applications" allow robots and people to work together with high levels of safety.
 "FA-IT integration functions" support nextgeneration manufacturing.
 With these 3 key features, the FR Series is capable of handling virtually all your automation needs.

- ▶ Product Details (Vertical type RV-FR series)
- ▶ Product Details (Horizontal type RH-FR series)
- ▶ Product Details (MELFA Smart Plus)
- ▶ MITSUBISHI INDUSTRIAL ROBOT MELFA FR Series Catalog

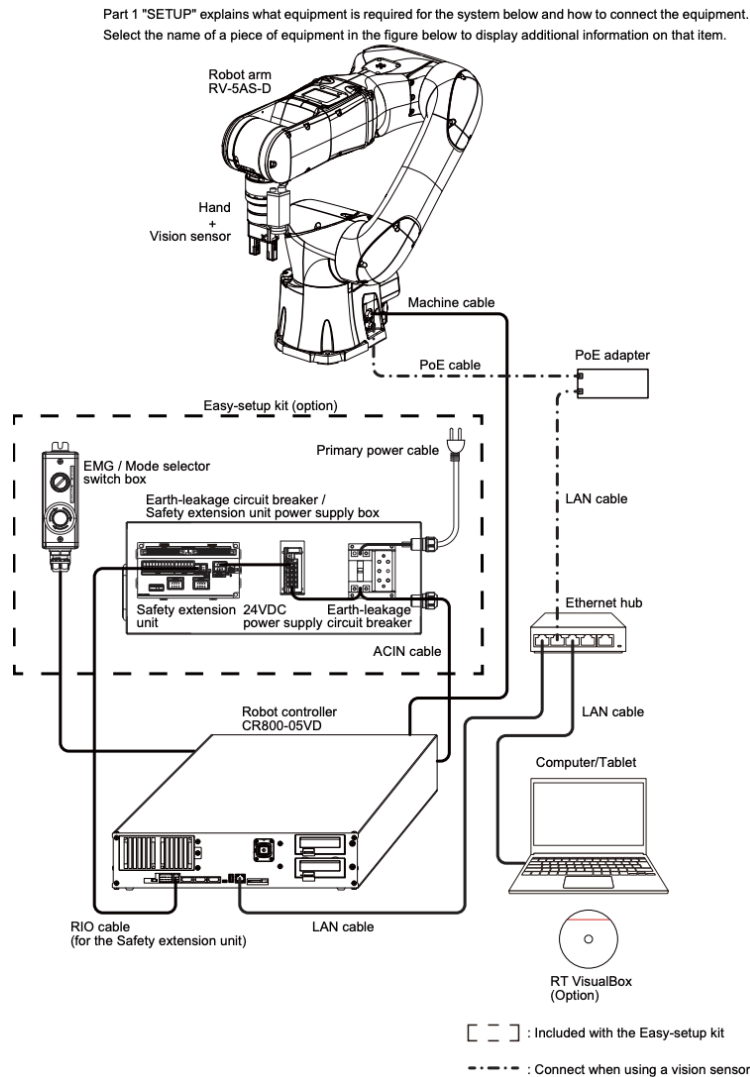


See, e.g., MELFA FR Series, available online at <https://www.mitsubishielectric.com/fa/products/rbt/robot/pmerit/frseries.html> (last visited January 29, 2021) (Exhibit 5)

60. The Mitsubishi Defendants' Accused Products have a modular architecture comprising at least one articulated robot arm, a controller, and a pendant user interface or human-machine interface. Further on information and belief, multiple articulated robot arms can be combined with one or more controller and teach pendant or human-machine interface in order to create multi-robot systems. This modular architecture allows for customization and rapid update of software to allow greater flexibility and additional automation of the intelligent assist device.

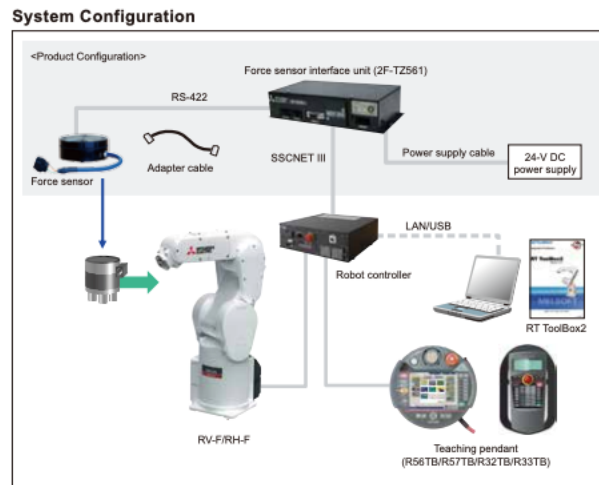
For example, the technical details of exemplary Accused Products, in their respective brochures, attached as Exhibits 6-7 include information on the robot arm, controller, and teaching pendant or human-machine interface, of the cobot systems:

Assista Series:



See, e.g., Hello ASSISTA Quick Set-up Guide, available online at <https://www.mitsubishielectric.com/fa/products/rbt/robot/pmerit/assista/doc/bfp-a3715Z.pdf#view=FitV&pagemode=none> (last visited February 1, 2021) (Exhibit 6).

RV Series:




See, e.g., Mitsubishi Industrial Robot F Series Catalog, available online at [https://dl.mitsubishielectric.com/dl/fa/document/catalog/robot/l\(na\)-09067eng/109067eng_f.pdf](https://dl.mitsubishielectric.com/dl/fa/document/catalog/robot/l(na)-09067eng/109067eng_f.pdf) (last visited January 29, 2021) (Exhibit 7).

61. In the Mitsubishi 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, as described below.

BROAD SIZE LINEUP

RV-FR robots are available in load capacities from 2kg to 20kg, with reach radii ranging from 504mm to 1,094mm.



Type	RV-2FR	RV-2FRL	RV-4FR	RV-4FRL	RV-7FR	RV-7FRL	RV-7FRL	RV-13FR	RV-13FRL	RV-20FR
Maximum Load Capacity	3kg		4kg		7kg			13kg		20kg
Maximum Load Radius	504 mm	649 mm	515 mm	649 mm	713 mm	908 mm	1503 mm	1094 mm	1388 mm	1094 mm
Environmental Specifications	Standard(IP30)		Standard (IP30), Oil mist (IP67), Clean (ISO class 3)							
Controller	CR800-R,CR800-D									

See, e.g., RV-FR Vertical Axis Robot, available online at <https://us.mitsubishielectric.com/fa/en/products/industrial-robots-melfa/vertical-type-robot/rv-fr-series/fr-series-overview> (last visited January 29, 2021) (Exhibit 8).

62. On information and belief, the articulated robot arm, the controller, and the teaching pendant or human-machine interface of the Mitsubishi 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 execute motion control algorithms, including automatic motion control algorithms.

63. On information and belief, there are communication links between the computational node(s) of the controller, teaching pendant and/or human-machine interface and the robot arm, including at least one node that actuates the motion module.

64. On information and belief, the Mitsubishi Defendants' Accused Products also include various sensors, such as the force sensor described below, 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.



From simple pick-and place-applications, to complex assembly tasks, Mitsubishi Electric industrial robots are equipped with class-leading speed and precision. Coupled with intelligent options like 3D vision, force sensing, seamless PLC integration, and the ability to operate in "collaborative applications", Mitsubishi Electric has the robots required for today's demanding manufacturing applications.

See, e.g., Industrial/Collaborative Robots-MELFA, available online at <https://us.mitsubishielectric.com/fa/en/products/industrial-robots-melfa> (last visited January 29, 2021) (Exhibit 9).

65. On information and belief, the computational nodes on the Mitsubishi 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.

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

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

68. The Mitsubishi 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.

69. The Mitsubishi Defendants specifically intend that its customers infringe the '336 patent. The Mitsubishi 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.

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

71. The Mitsubishi Defendants offered to sell and have sold in the United States, and imported into the United States, the Accused Products, which are a material part of the invention of the '336 patent. The Mitsubishi Defendants know that the Accused Products (i.e., a robotic arm, control box, and/or teach pendant, alone or in combination) 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.

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

73. The Mitsubishi 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)

74. Northwestern incorporates by reference its allegations in Paragraphs 1-63 as if fully restated herein.

75. 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.

76. 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.

77. The Mitsubishi 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.

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

79. 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;

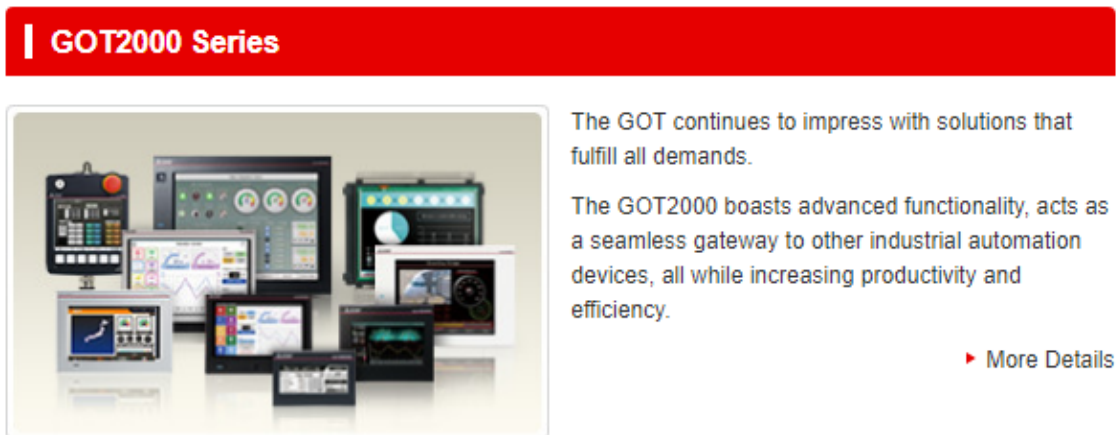
a computational node disposed on the physical interface, the computational node

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.

80. On information and belief and as depicted below, the Mitsubishi Defendants make, use, and sell several multi-function hubs with physical interface for use with the Accused Products, including but not limited to the following robot controllers and pendants compatible with the Mitsubishi Defendants infringing robots: GOT2000 Series, GOT1000 Series, and GOT SIMPLE Series human-machine interfaces; the R28TB, R32TB, R32TB-15, R33TB, R46TB, R56TB, R56TB-15, and R57TB pendants; and/or the MELSEC Series; CR Series, D-Type, F series, FR series and Safety Extension Unit controllers:

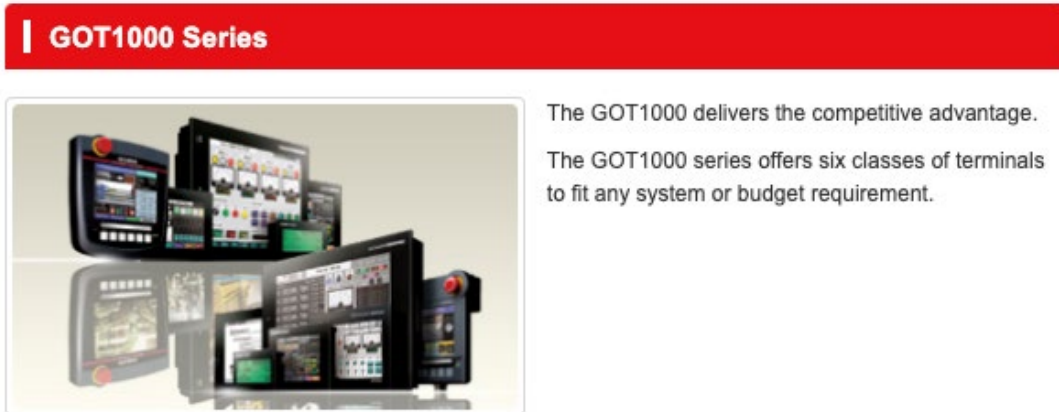
GOT2000 Series:



See, GOT2000 Series, available online at

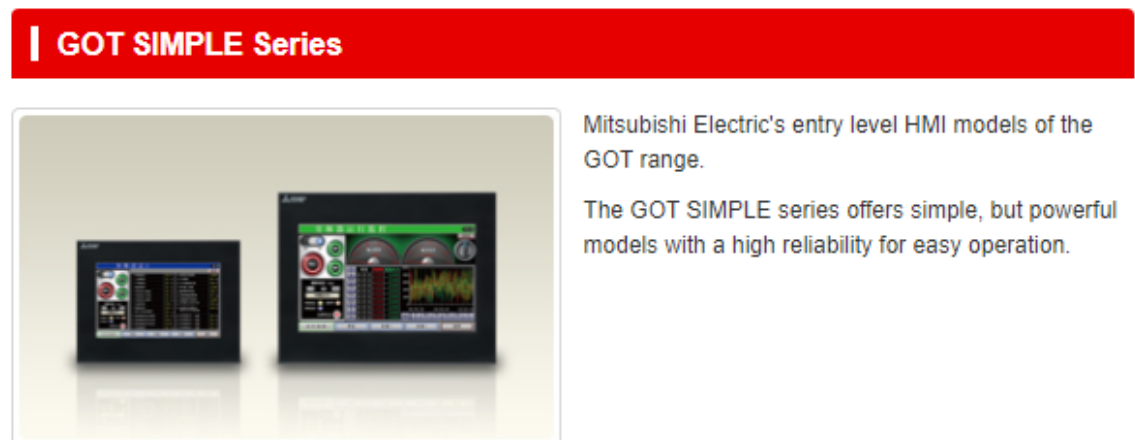
<https://www.mitsubishielectric.com/fa/products/hmi/got/items/got2000/index.html> (last visited January 29, 2021) (Exhibit 10).

GOT1000 Series:



See, GOT1000 Series, available online at <https://www.mitsubishielectric.com/fa/products/hmi/got/items/got1000/index.html> (last visited January 29, 2021) (Exhibit 11).

GOT SIMPLE Series:



See, GOT Simple Series, available online at https://www.mitsubishielectric.com/fa/products/hmi/got/items/got_simple/index.html (last visited January 29, 2021) (Exhibit 12).

R Series Teach Pendants:

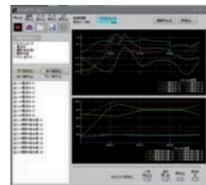
Teaching work assistance

Force GUI included^{*1}

- Computer software (RT ToolBox3) and a teaching box (R56TB or R32TB) are standard features of the force GUI screen, making it easy to use force sensors.
- Teaching can be carried out while monitoring the reactive force on the force GUI screen.

^{*1} GUI: Graphical User Interface

- Force data synchronized to the positional data can be saved as log data.
- Log data can be viewed as graphs using RT ToolBox.
- Log data files can be downloaded to a computer via FTP.



■ Force log (RT ToolBox3 log viewer)



R32TB



R56TB

Teaching while monitoring force states using the dedicated force control screen in the teaching box. Enables optimized location teaching

See, e.g., Mitsubishi Electric Industrial Robot FR Series Catalog, available online at http://sg.mitsubishielectric.com/fa/en/download_files/rbt/robot/109091c.pdf (last visited January 29, 2021) (Exhibit 13).

MELSEC Series Controllers:

Programmable Controllers MELSEC



The MELSEC Series takes control to the next level.

MELSEC Series PLCs always meet your system demands and more, with something to offer for any prospective control system.

Enhanced solutions are realized by a wide lineup of PLCs and network systems.

▶ More Details

See, e.g., Programmable Controllers MELSEC, available online at <https://www.mitsubishielectric.com/fa/products/cnt/plc/index.html> (last visited February 1, 2021) (Exhibit 14).

81. The Mitsubishi 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.

82. On information and belief, the physical interface of the Mitsubishi Defendants' multi-function hubs contain at least one computational node.

83. The Mitsubishi Defendants' multi-function hubs were designed to master even complex operating tasks easily with an intuitive user interface. To do so, these multi-function hubs are suitable for use in a wide variety of languages for operation and programming. And on information and belief, each hub offers suitable programable logic that can be used to create complex and customized programs for various functions, including motion and tasks to be completed by the robot arm.

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

85. 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 controller through a common data link.

86. 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 or control box via the common data link.

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

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

89. The Mitsubishi 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.

90. The Mitsubishi Defendants specifically intend that its customers infringe the '317 patent. The Mitsubishi 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.

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

92. The Mitsubishi Defendants offered to sell and have sold in the United States, and imported into the United States, the Accused Products, which are a material part of the invention of the '317 patent. The Mitsubishi Defendants know that the Accused Products (i.e., a robotic arm, control box, and/or teach pendant, alone or in combination) 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.

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

94. The Mitsubishi 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)

95. Northwestern incorporates by reference its allegations in Paragraphs 1-84 as if fully restated herein.

96. 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.

97. 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.

98. The Mitsubishi 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.

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

100. 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.

101. On information and belief, the Mitsubishi Defendants make, use, and sell several configuration systems known as controllers for use with the Accused Products, including but not limited to include the MELSEC Series controllers, CR Series, D-Type controllers, F series controllers, FR series controllers, and Safety Extension Unit controllers, as well as their accompanying human-machine interfaces and pendants such as GOT2000 Series, GOT1000 Series, and GOT SIMPLE Series, R28TB, R32TB, R32TB-15, R33TB, R46TB, R56TB, R56TB-15, and R57TB. *See, e.g.*, Exhibits 10-14.

102. On information and belief, the Mitsubishi Defendants' controllers, human-machine interfaces and/or pendants, are computer systems that are designed to communicate with, operate, and monitor the Mitsubishi Defendants' cobot systems, including the robot arm.

103. The Mitsubishi Defendants' controllers, human-machine interfaces and/or pendants, contain modular hardware and an open, PC-based software architecture that is capable of executing a stored program.

104. On information and belief, the Mitsubishi Defendants' controllers, human-machine interfaces and/or pendants, contain communication links between the controller, the robot arm, human-machine interfaces and/or pendants that enables communication between the modules and their associated computational nodes.

105. On information and belief, the Mitsubishi Defendants' controllers, human-machine interfaces and/or pendants 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.

106. On information and belief, the Mitsubishi Defendants' controllers, human-machine interfaces and/or pendants 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 controller, pendant, and/or robot arm.

107. On information and belief, the Mitsubishi Defendants' controllers, human-machine interfaces and/or pendants, facilitate the computational nodes' execution of motion control algorithms by the robot arm, including automatic motion control algorithms.

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

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

110. The Mitsubishi 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.

111. The Mitsubishi Defendants specifically intend that its customers infringe the '508 patent. The Mitsubishi 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.

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

113. The Mitsubishi Defendants offered to sell and have sold in the United States, and imported into the United States, the Accused Products, which are a material part of the invention of the '508 patent. The Mitsubishi Defendants know that the Accused Products (i.e., a robotic

arm, control box, and/or teach pendant, alone or in combination) 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.

114. The Mitsubishi Defendants have had actual notice of the '508 patent no later than May 5, 2020, when counsel for Northwestern sent the Mitsubishi Defendants a letter identifying the '508 patent and Accused Products that infringe the '508 patent. As of the filing of this complaint, Northwestern has not received a response.

115. The Mitsubishi 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 Mitsubishi Defendants infringe each of the asserted patents;
- B. order an award of damages to Northwestern in an amount adequate to compensate Northwestern for the Mitsubishi 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 Mitsubishi 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 Mitsubishi 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.

Dated: June 21, 2021

Respectfully submitted,

NORTHWESTERN UNIVERSITY

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Counsel for Plaintiff

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of the above and foregoing document has been served on June 21, 2021 to all counsel of record in the case who are deemed to have consented to electronic service via the Court's CM/ECF system.

/s/ Nevin M. Gewertz