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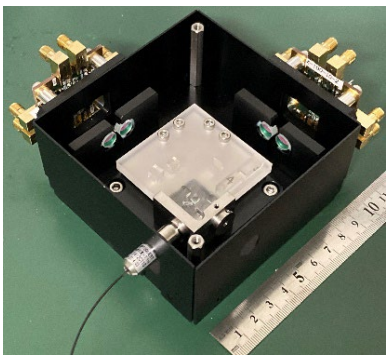
Mitsubishi Electric Develops World's First Laser Communication Terminal Integrating Space Optical Communication and Spatial Acquisition

Will enable high-speed, large-capacity satellite communications anywhere on Earth



Optical receiver prototype for laser communication terminal (LCT)

Concept of free-space optical communications network connecting everywhere

TOKYO, May 31, 2022 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has developed the prototype of what is believed to be the world's first* optical receiver for use in laser communication terminals (LCTs), that integrates space optical communication using laser beams and a function to detect the direction of received beams in the 1.5-μm band, a general-purposeband used for terrestrial optical fiber communications and other applications.

High-resolution satellite imagery is used to assess damage caused by disasters, but since such images are transmitted via radio waves it has been difficult to transmit high-resolution images in real time due to limitations in data capacity and the size of satellite antennas. Large-capacity, high-speed space optical communications that do not require optical fiber are thus required to support fast and accurate damage assessments following disasters. But space optical communications use very narrow laser beams, about 1/1000th of that of radio waves, so the challenge has been how to precisely align laser beams with satellites traveling at high speed.

Mitsubishi Electric has now developed an optical receiver that solves this problem by integrating functions to detect both four phase changes of laser light and beam direction. The result is a downsized optical receiver that enables space optical communication with 10 times the speed, capacity and distance of radio-wave communication. Since the wavelength is much shorter, smaller antennas can be used in compact

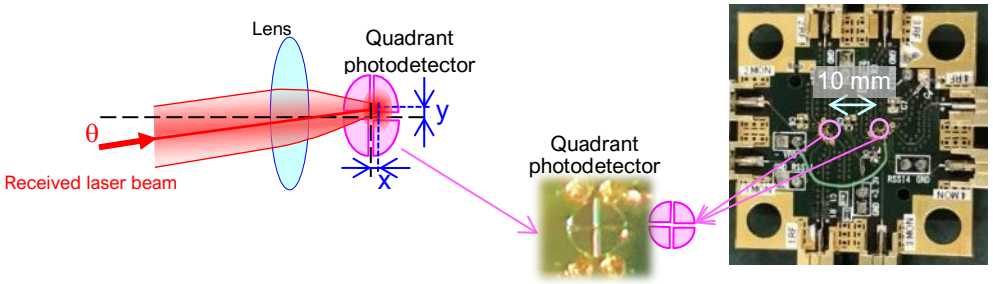
* According to Mitsubishi Electric's research as of May 31, 2022

communication units that can be installed in locations difficult for optical fiber, such as between buildings. Installations also are possible in areas where normal infrastructure is not available, such as disaster zones, developing countries or remote areas, thereby expanding the use of wireless communications in a variety of situations.

Features

1) World's first optical receiver that integrates spatial laser acquisition in the photodetector

- The photoelectric converter, which receives laser light and converts it into electrical signals, is divided into four segments and the direction of received laser beams is detected with high precision by comparing the output signal intensity of each segmented element. The dedicated sensor for detecting beam directions in conventional systems is no longer necessary.
- The small optical receiver integrates functions for space optical communication and laser angle-of-arrival detection in a photodetector, which is believed to be a world's first.

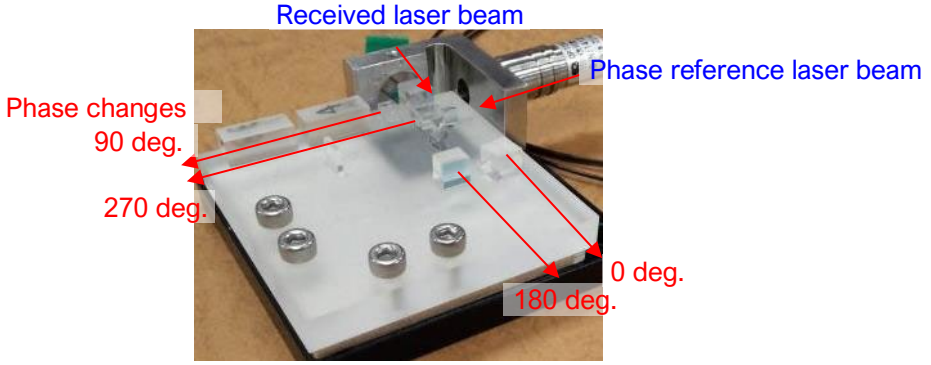


Direction of arriving laser beam direction (q) measured from the beam's focal point (x, y)

New quadrant photodetector

2) Optical circuit detects four phase changes for high-speed, large-capacity communications

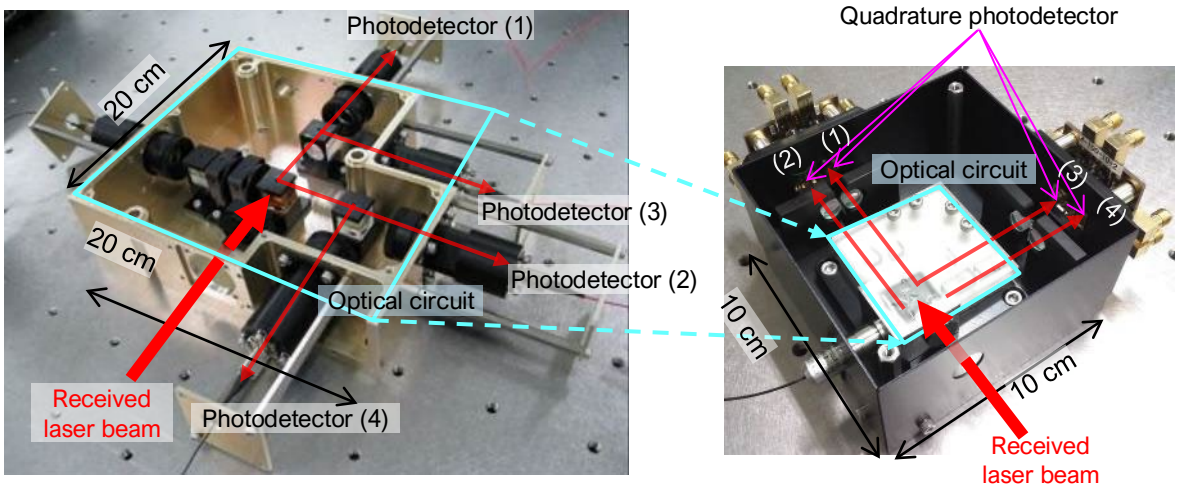
- A newly developed optical circuit for coherent space optical communication detects four phase changes (0, 90, 180, and 270 degrees) in contrast to conventional two-phase (0 and 180 degrees) detection. As a result, communication capacity and speed are double those of two-phase optical communication schemes in the same bandwidth and some 10 times those of radio-wave communication systems.
- The coherent detection method enables communication even with weaker laser beams compared to the conventional method of detecting intensity changes due to beams turning on and off, thus enabling communication over longer distances using the same laser-beam intensity. In addition, the coherent method is less influenced by sunlight and other background light for more stable communications.



New optical circuit

3) Optical receiver integrates photodetectors and optical circuit in one small (10 cm^3), lightweight module

- The photodetectors' beam-direction detection function eliminates the need for a dedicated sensor. Furthermore, the optical circuit is contained on a small 5cm-by-5cm glass substrate, mounting two photodetectors on a single printed circuit board. The single-module configuration realizes a lightweight optical receiver measuring just 10 cm^3, less than one-fourth the size of Mitsubishi Electric's previous model.



Previous optical receiver　　New optical receiver

Future Plans and Prospects

Development targeting on-board use in satellites will proceed, mainly for government-sponsored development programs.

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About Mitsubishi Electric Corporation

With more than 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Mitsubishi Electric enriches society with technology in the spirit of its "Changes for the Better." The company recorded a revenue of 4,476.7 billion yen (U.S.$ 36.7 billion*) in the fiscal year ended March 31, 2022. For more information, please visit www.MitsubishiElectric.com

*U.S. dollar amounts are translated from yen at the rate of ¥122=U.S.$1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2022