C297-E097C

SHIMADZU
Excellence in Science

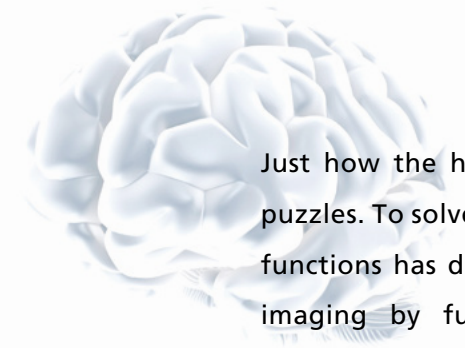
functional Near-Infrared Spectroscopy System for Research

LABNIRS

Toward Next-Generation Optical Brain-Function Imaging

LABNIRS™

functional Near-Infrared Spectroscopy System for Research



Just how the human brain functions remains one of the greatest unsolved puzzles. To solve this mystery, brain-function imaging for visualization of brain functions has developed rapidly in recent years. In particular, in vivo optical imaging by functional near-infrared spectroscopy (fNIRS) has attracted attention as a technique that supports next-generation brain science. Utilizing its leading-edge science and technology, Shimadzu has developed the LABNIRS, thereby contributing to the still growing field of brain science.

LABNIRS is a functional Near-Infrared Spectroscopy System for research.

High Performance

- Next-generation optical brain-function measurements start with multi-channel and high density
- High-speed sampling
- Reliability of 3 wavelengths and photomultiplier tube achieve superb sensitivity

Easy Operation

- Intuitive user interface
- Measurement and analysis by simple button clicks

Outstanding Scalability

- Comprehensive options provide powerful measurement support
- Increase the number of channels according to the aim of the experiments

Contents

Shimadzu's functional Near-Infrared Research Supports Various Research

Rehabilitation Research

Movement, Work, Language, Hearing

LABNIRS permits brain-function measurements in task environments involving body movements. High-density measurements at double the conventional spatial resolution improve the accuracy with which active regions can be identified.

Drug Development and Medical Research

Neuroscience and Psychiatry

Brain Function of Newborn Babies

LABNIRS can be applied to brain function research and drug development for research into mental illnesses, such as depression and schizophrenia. It is expected to be used for such application as the prediction of drug efficacy and as a monitoring tool for therapeutic efficacy based on brain function. (LABNIRS is not a medical device. Use it for research purposes only.)

Basic Research

Brain Functional Network Research

Multi-Modality Research

Multiple channels permit measurement of the entire head. Rapid data sampling that is five times faster than conventional instruments captures reactions resulting from fast neural activities.

Informatics Research

Robotics

Ergonomics

"Kansei" (emotion) engineering

LABNIRS permits real-time NIRS + EEG (electroencephalogram) measurements and data transfer that are effective for robot control and other research.

Spectroscopy System for Applications

Education and Psychology Research

Cognitive Psychology

Social Psychology

Development and Education

Up to 80 optical fibers in 40 sets allows simultaneous measurements on multiple subjects. The number of measurement channels can be increased in stages to match the aim of the research and the budget.

Expanding Range of Research Applications

Rehabilitation Research

Measurements While Walking

Recent years have seen progress in applied research into the use of fNIRS for nerve rehabilitation, such as functional recovery after a stroke. Unlike fMRI, which requires the subject to remain still, fNIRS permits brain-function measurements in a task environment while moving. Consequently, it is possible to obtain measurements while the subject is moving on a treadmill or ergometer, enabling the acquisition of information about cerebral activity related to the motion or cognitive functions involved in the motion.

Example of measurement system during motion

1 Main unit: 40 sets, L-shaped fibers
2 Whole-head fiber holder/holder kit (short-distance)
3 3D position measurement system, MRI fusion software, Video synchronization system

Neurorehabilitation Research

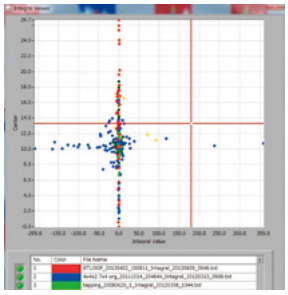
In the rehabilitation field, feedback on the patient's recovery process, used to promote more efficient recovery, is known as neurorehabilitation. fNIRS permits measurements during various tasks for speech therapy or occupational therapy.

Bibliography
・Stroke, 34 (12), 2866-2870 (2003)
・PLoS ONE, 7 (3), e32234 (2012)

Drug Development and Medical Research

Group Comparisons for Mental Disorder Research

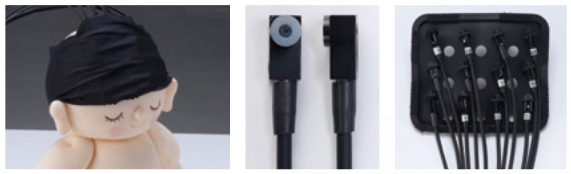
Centroid and integration functions are used to calculate the integrated value and centroid value for each channel within a specified time range. These values are plotted on a scatter diagram with integrated values on the horizontal axis and centroid values on the vertical axis. Previously acquired disease-specific data can be displayed color-coded by group.



Bibliography
・Schizophrenia Research, 136 (1), 63-69 (2012)

Measurements on Newborn Babies and Infants

The brain functions of newborn babies and infants and how they develop is a research area not yet fully explained. Because it uses near infra-red light, fNIRS is a safe brain-function measurement technique effective for measurements on newborn babies and infants. It can be used for diverse research applications including the senses of touch, hearing, and vision.



Holder set for newborn babies (Pad Type)

Holder for infants measurement (Cap Type), Fiber set for infants measurement

Bibliography
・Brain Research, 1383, 242-251 (2011)
・NeuroReport, 23 (6), 373-377 (2012)

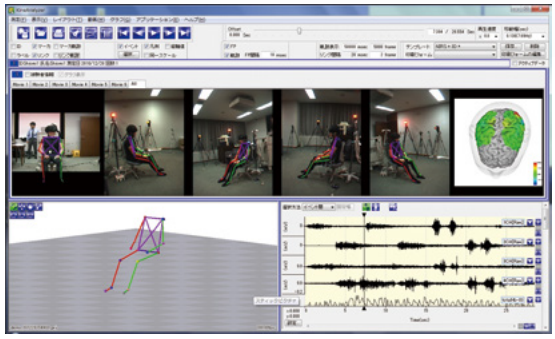
Example of measurements on infants

1 Main unit: 12 sets, L-shaped fibers 2 Holder for infants measurement, Type A
3 Fiber set for infants measurement (12 sets) ・ Phantom for infants measurement
Converter box rack for infants measurement

Informatics Research

Motion Analysis

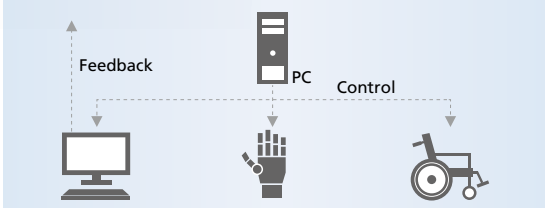
Simultaneous measurements with a motion analysis system can link the subject's body movements and brain functions.



Bibliography
・NeuroImage, 34 (4), 1416-1427 (2007)

BMI Research

Real-time transfer of measured data to another PC permits biofeedback on the subject and application to brain-machine interfaces (BMI) for control of external devices.



Example of Real-Time Data Transfer System

1 Main unit: 4 sets or more, L-shaped fibers
2 Whole-head fiber holder/holder kit (short-distance)
3 3D position measurement system, MRI fusion software
Video synchronization system, Real-Time Data Transfer System

Education and Psychology Research

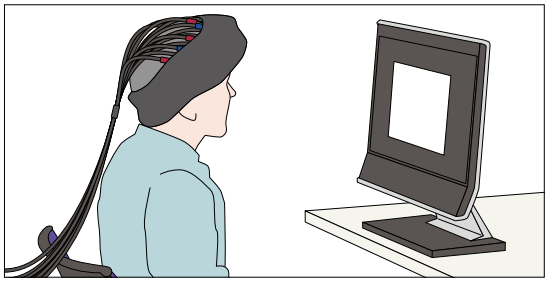
Cognitive Neuroscience

To acquire strictly task-dependent signals, the brain-function measurements are performed in a laboratory where various conditions can be controlled. fNIRS places few restrictions on the measurement environment or the subject's posture, which makes it effective for psychological experiments.
Acquiring brain-function data with respect to diverse topics to understand human cognitive functions under various conditions may lead to the kansei evaluation of products.

Bibliography
・J. Biomed Opt., 15 (3), 037006 (2010)
・NeuroReport, 21 (2), 127-131 (2010)
・Res. Develo. Disabil., 33 (2), 518-524 (2012)
・Schizophrenia Research, 136 (1), 63-69 (2012)

Eye Movements

Simultaneous measurements with an eye movement tracker can link the subject's eye movements and brain functions.



Examples of Visual Function Measurement Systems

1 Main unit: 32 sets, L-shaped fibers 2 Temporal Fiber Holder
3 3D position measurement system, MRI fusion software
Video synchronization system, Stimulus Presentation System

Basic Research

Simultaneous NIRS and EEG Measurements

Simultaneous measurements of neural activity and changes in blood flow enhance the spatiotemporal resolution and permit application to many research fields.

Bibliography
・Brain Topogr, 22 (3), 197-214 (2009)
・NeuroImage, 59 (4), 4006-4021 (2012)

Example of Simultaneous EEG measurement system

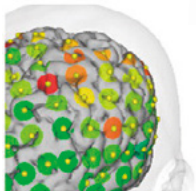
1 Main unit: 36 sets, L-shaped fibers
2 EEG simultaneous measurement fiber holder
3 3D position measurement system, MRI fusion software
Video synchronization system, EEG data integration software

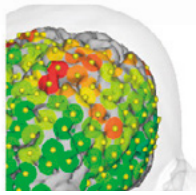
High Performance

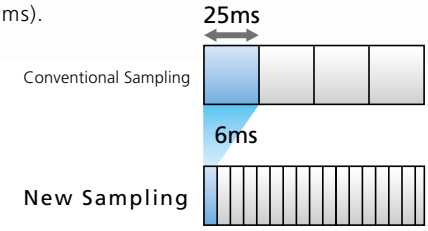
Higher Temporal and Spatial Resolution

1 Accepts up to 40 sets––2.5 times more than before (142 channels max.).
2 Spatial resolution doubled for high-density measurements.
3 Captures rapid cerebral blood flow signals in just 6 ms (previously 25 ms).


Multi-Channel Measurements

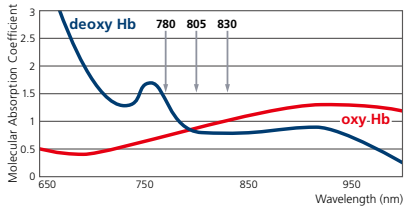

Normal Placement


High-Density Placement



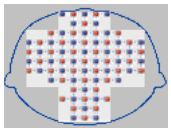
High Sensitivity is the Basis for Reliable Measurements

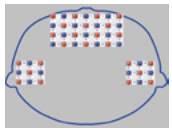
1 Three semiconductor laser wavelengths capture more accurate data.
2 A photomultiplier tube captures the weakest cerebral signals.

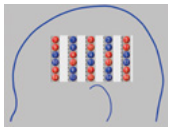


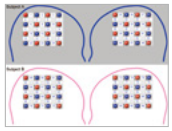
Flexible Fiber Placements

Time-division illumination permits unrestricted fiber placements. Enables the effective coverage of the area of interest with a limited number of fibers.


One-Plane Placement (for whole-head measurements)


Three-Plane Placement


High-Density Placement


Four-Plane Placement (for two-person measurements)

Fiber Shape Selection

Select the fiber shape according to the aim of the research and the environment.


L-Shaped Fiber


Straight-Type Fiber

Holder: FLASH*1 (Flexible Adjustable Surface Holder)

Flexible Adjustable Surface Holder (FLASH) supports more stable measurements. Select from the wide range of holders, which are easily customizable.

*1 Patented in Japan 04254420
*2 Supports high-density, short-distance measurements
*3 Exclusive use of fiber set for infants measurement


Forehead Fiber Holder


Parietal Fiber Holder *2


Temporal Fiber Holder *2


Whole-head Fiber Holder


EEG simultaneous measurement fiber holder

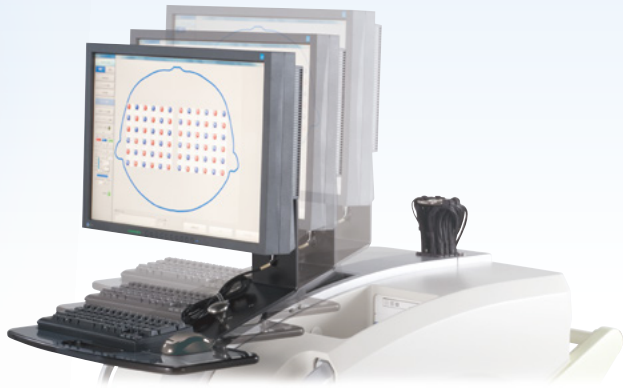

Fiber Holder for infants Measurement, Type A *3


Fiber Holder for infants Measurement, Type B *3


Whole-head Fiber Holder for infants Measurement *3


Holder Kit

Easy Operation



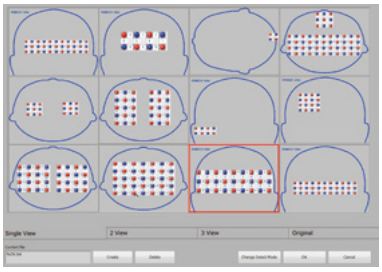
Graphical User Interface

The intuitive user interface permits complex measurements and analysis conditions settings with simple button clicks.

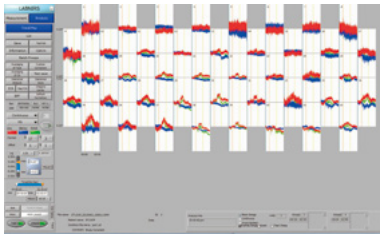
Measurement Mode

1 Simple design of fiber placements

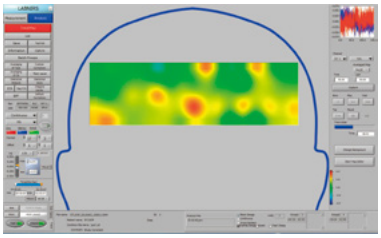
2 The set fiber placements are reflected on the trend graph and map during measurements.



Optional optical fiber placement



Trend graph



Map

Analysis Mode

1 Comprehensive data processing functions

*4 Patented in Japan 04379155

Features a variety of analysis and processing tools, including independent component analysis (ICA*4), frequency filters, task addition, channel addition, centroid and integral analysis.

2 Statistical analysis functions

General linear model (GLM) statistical processing offers simple statistical analysis and evaluations at the point of measurement.

3 Multi-distance functions

Combining short-distance measurements reduces the effects of scalp blood flow and other extra signals.

4 Batch processing functions

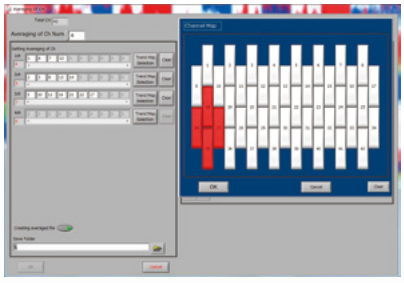
Permits batch processing with predetermined analysis procedures.

5 Data output functions

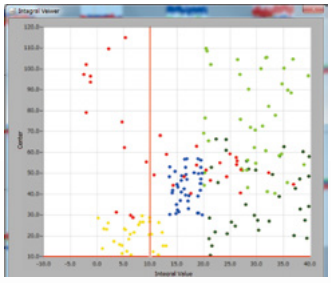
Permits output as text files (compatible with NIRS-SPM).

6 Data continuity

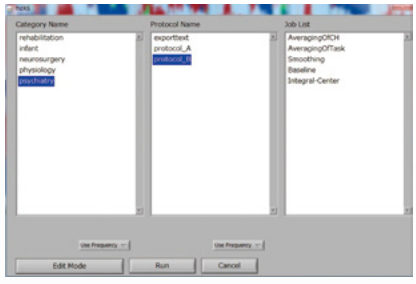
FOIRE Series data can be loaded to make use of past data.



Channel addition



Centroid and integral analysis functions



Batch processing functions

For Research Use only. Not for use in diagnostic procedures.

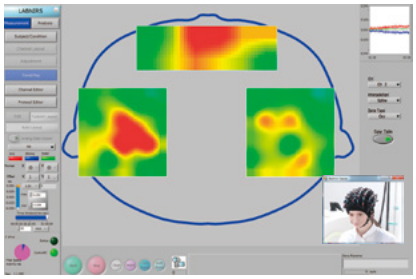
Outstanding Scalability

Options

Comprehensive options support diverse research requirements.

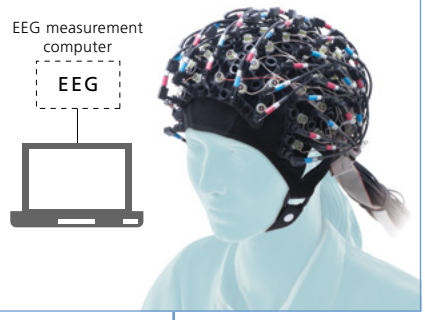
Video recording system

Records synchronized video images of the environment and a subject's body movements during measurements.



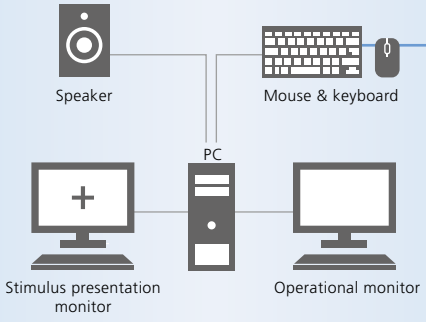
Simultaneous EEG Measurement

This permits simultaneous NIRS and EEG measurements. LABNIRS high-speed sampling is effective for simultaneous EEG measurements. Please consult your Shimadzu representative.



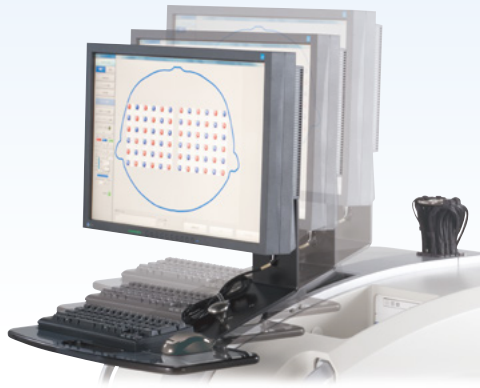
Stimulus presentation system

This allows testing with precise control of the presentation timing of visual and voice stimuli.



Fiber Extensions

Fiber can extended to suit the application. Effective for measurement synchronization with MRI and for measurements inside a chamber or driving simulator.

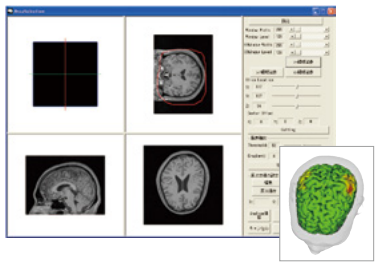


Flexible System Configuration

Three Steps to Customize the Best System for You

MRI Fusion Software

Map images based on 3D information can be displayed over individual MRI images. Using a whole-head FLASH holder permits seamless mapping of the entire brain.

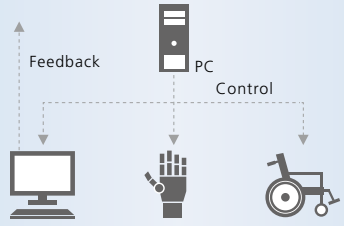


3D Position Measurement System

Attach the fibers to measure three-dimensional information. This is an indispensable item to achieve highly reproducible measurements.

Real-Time Data Transfer System

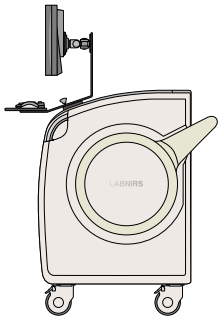
This supports biofeedback with the subject and brain-machine interface (BMI) to control external devices by transferring measured data to another PC in real time. Please consult your Shimadzu representative.



STEP 1

Select the main unit.

Select between 4 and 40 sets in increments of 4 sets to suit your research application. More sets can be subsequently added.

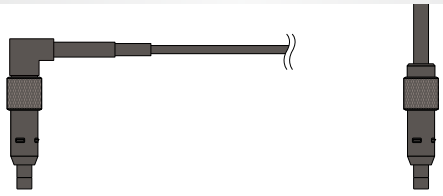


4 sets 10ch	8 sets 24ch	12 sets 38ch	16 sets 52ch
20 sets 67ch	24 sets 82ch	28 sets 97ch	32 sets 112ch
36 sets 127ch	40 sets 142ch		

* Number of channels (ch) indicates the maximum number of logical channels.

Select the fiber shape.

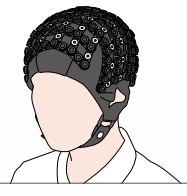
Select L-shaped or straight-type optical fibers to suit the research application and measurement environment.



STEP 2

Select the holder.

Select the holder you need from the various types available. (See page 8.)



- Forehead
- Parietal (high-density)
- Temporal (high-density)
- Whole-head
- EEG simultaneous measurements
- Holder set for newborn babies
- Holder kits

STEP 3

Select the options.

Select the required options for your research application. (See page 10.)

■ Options

Fibers	Straight-type fiber, L-shaped fiber
Holders	Forehead fiber holder, Parietal fiber holder, Temporal fiber holder, Whole-head fiber holder, Holder set for newborn babies (17 channels), Holder kits, EEG simultaneous measurement fiber holder
Options	3D position measurement system, MRI fusion software, Video recording system, Real-time data transfer software, EEG data integration software

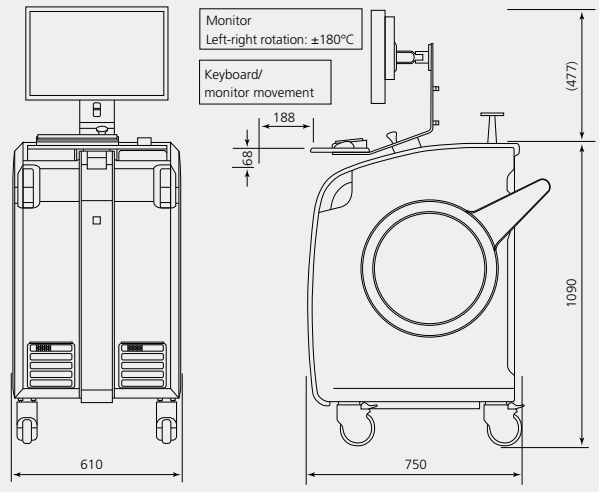
Note: No fibers and holders included as standard. Select the straight-type or L-shaped fiber according to the number of sets of the main unit.

■ Specifications

Measurement method	3-wavelength absorbance calculation
Measured item	Changes in Oxy-Hb, Deoxy-Hb, Total-Hb
Light source	3-wavelength near-infrared semiconductor lasers, Class 1 [IEC-60825-1 (2007)]
Detector	Photomultiplier tube
Power supply	100-240 V AC, 50/60 Hz, 1100 VA
External dimensions	W610 × D750 × H1090 mm (excluding protrusions and LCD)
Weight	230 kg (40 sets)

For Research Use Only

■ External Dimensions



Dimension units: mm
Tolerance: ±10 %

Laser Safety

This product uses semiconductor lasers categorized as Class 1 under IEC-60825-1 (2007). Read the Instruction Manual carefully before using the product.

- All values in this brochure are standard values. Actual values may differ slightly.
- Photographs in this brochure may include items and options not included with the system.

This product is to be used only for research purposes in IRB-approved studies.
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SHIMADZU

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