GPS Speedometer

LC-8000 series

LC-8120 GPS Speedometer

LC-8220 GPS Vector Speedometer

LC-8300 Compact & High-sensitive GPS Speedometer

ONOSOKKI

LC-8000 Series GPS Speedometer

LC-8000 series GPS speedometer measures vehicle speed and travel distance by using GPS, GLONASS and IMU with high accuracy and high response. Wide variety of optional software supports various vehicle tests and vehicle measurement fulfilling the needs of users.

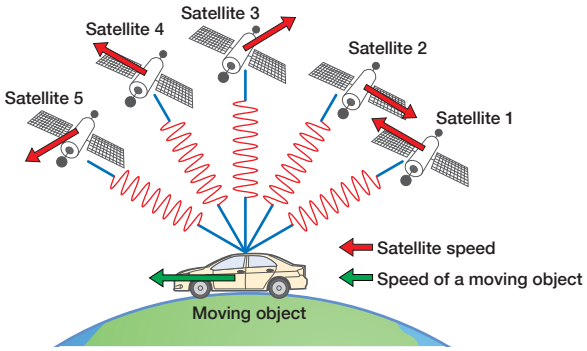
LC-8000 series Line up

LC-8120: Standard model	LC-8220: High-end model	LC-8300: Compact & High-sensitive model
Can be upgraded by adding optional software to have the performance equivalent to the LC-8220.	Over 30 measurement items including forward speed, lateral speed and sideslip angle are allowed in a single unit. Meets the needs of every driving test.	Compact size (70 % reduction in volume compared to the LC-8120), PC-less measurement type, touch panel display.

1 High accuracy

By the use of Doppler effect*1 of moving object and carrier wave transmitted from the satellites, the LC-8000 series enable highly accurate calculation of the moving object speed. Receiving plural satellite signals from GPS and GLONASS allows high sensitive, high response measurement.

*1: The Doppler effect is the change in frequency of acoustic/electromagnetic radiation emitted by a source when there is speed difference between an observer and its source.
The shift is perceived to higher frequencies when the source approaches and to lower frequencies when it recedes.



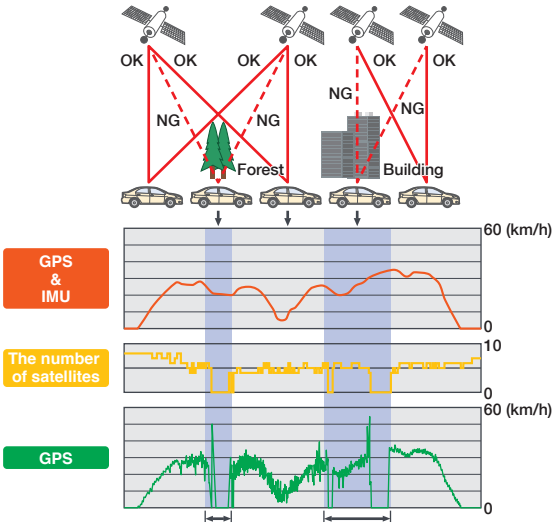
2 Stable and high sensitivity

Using IMU (Inertial Measurement Unit)*2 and plural satellite signals (GPS and GLONASS), the LC-8000 series enable stable measurement which is not affected by its satellite acquisition state.
High precision IMU (linearity ±0.03%/F.S. or less) is provided as an option. Capable of high-response vehicle behavior measurement for the ESC evaluation test.

*2: IMU is the sensor unit which detects the angle speed and acceleration in each direction by the gyro sensor and accelerometer placed in orthogonal three axes.

LC-0087
Compact IMU

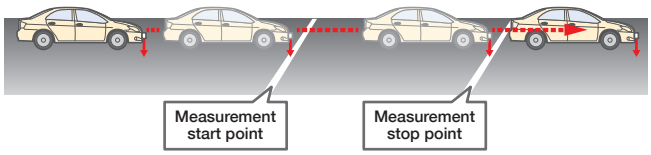
LC-0855
High precision IMU



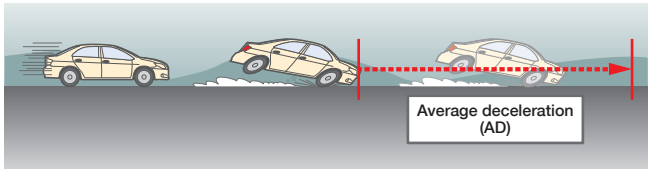
3 Supports various kinds of vehicle tests Option

Optional software allows to increase the number of vehicle tests to be supported.

- **White line detecting function (LC-0856):**
  Detection of white lines at measurement start point and stop point. Can be used for tire test based on UN-ECE R117 regulation.



- **Jerk measurement function (LC-0871):**
  Calculation, display and recording X,Y, and Z axes deviation value. Helpful for evaluating riding comfortableness.
- **Average deceleration calculation (Supports wet grip performance test) (Added to LC-0831):**
  "Average deceleration (AD) " which is useful for tire wet grip performance test based on UN-ECE R117 regulation is added to the LC-0831.



LC-8120 GPS Speedometer

Basic model of GPS Speedometer.
Enables highly accurate measurement of various driving tests.

Options : DC OUT, DC IN, CAN IN, CAN OUT, Z Dist Slope *1, XYZ Acc XYZ Deg *2, HI precision IMU, HI response IMU

*1: Slope measurement
*2: Tri-axial measurement (Acceleration angle)

Features common to LC-8000 series

- Using GPS enables stable measurement which is not affected by weather or road surface conditions.
- Highly accurate and fast response measurement by original algorithm using GPS, GLONASS and IMU.
- Various vehicle measurements can be conducted by adding optional software.
- Data import of CAN·OBD II is optionally available.

Specific features

- With excellent performance of a delay time within 5 ms, useful for acceleration tests or brake tests.
- The LC-8120 can be upgraded by adding optional software to have the performance equivalent to the LC-8220.

Product configuration

Standard system configuration

LC-0721 GPS/GLONASS antenna
Easily attached via magnet.

LC-0087 Compact IMU
(Inertial Measurement Unit)
Measurement of tri-axial acceleration data. Interpolating velocity using IMU when satellites cannot be captured.

LC-0083 Remote box
Remote control of start/stop command, selecting measurement mode.

Front

Rear

LC-8120 GPS Speedometer main unit

Standard software
(The CD is attached to the main unit.)

Software option (sold separately)
- LC-0831: Acceleration/deceleration Test
- LC-0832: Fuel Consumption Test
- LC-0833: Track Display

CAN
- Communication data such as engine rotation, torque and air pressure
- Supports CANdb file format

LC-0850A General purpose I/O unit (option)
A single unit can be mounted on the main unit.
8ch analog input, 5ch pulse input, and 16ch analog output.

LC-0823 Vector measurement function (option)
Forward speed, lateral speed, and side slip angle measurement available. LC-0721 antenna is provided as standard.

LC-0855 High precision IMU (option)
Highly accurate acceleration measurement of X,Y, and Z axis directions.

DPU-414 Printer (option)
Direct printing of measurement data.

LC-0084 Display unit: Large size (option)
Satellite acquisition state can be checked on the LED screen.
Easy visible with large display.
Equivalent function to the LC-0080.

LC-0080 Display unit: Small size (option)
Display of vehicle speed, distance and the number of satellites.
Enables operations of the display when testing.

PC (sold separately)
Setting of measurement condition, logging for measurement data of speed/distance etc.

LC-8220 GPS Vector Speedometer

High-end model featuring the measurement of sideslip angle and 16ch analog output

Provided as standard: DC IN, DC OUT, Z Dist Slope, XYZ Acc XYZ Deg

Options: CAN IN, CAN OUT, HI precision IMU, HI response IMU

Features common to LC-8000 series

- Using GPS enables stable measurement which is not affected by weather or road surface conditions.
- Highly accurate and fast response measurement by original algorithm using GPS, GLONASS and IMU.
- Various vehicle measurements can be conducted by adding optional software.
- Data import of CAN·OBD II is optionally available.

Specific features

- Measurement of over 30 items including forward speed, lateral speed and sideslip angle are allowed in a single unit.
- Analog output up to 16ch selected from acquired data, such as forward/backward acceleration, gradient angle.
- 8ch of analog input, 5ch of pulse input.

Product configuration

Standard system configuration

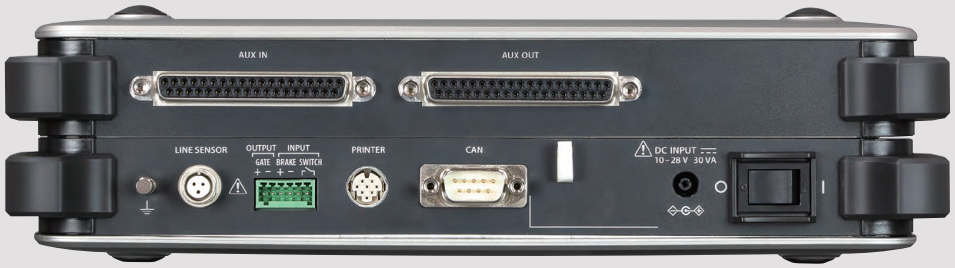
LC-0721 GPS/GLONASS antenna
Vector measurement with two antennas.

LC-0087 Compact IMU (Inertial Measurement Unit)
Measurement of tri-axial acceleration data. Interpolating velocity using IMU when satellites cannot be captured.

LC-0084 Display unit: Large size (option)
Satellite acquisition state can be checked on LED. Sideslip angle can be displayed.

LC-0083 Remote box
Remote control of start/stop command, selecting measurement mode.

Front



Rear

LC-8220 GPS Vector Speedometer

Standard software
(The CD is attached to the main unit.)

Software option (sold separately)
- LC-0831: Acceleration/deceleration Test
- LC-0832: Fuel Consumption Test
- LC-0833: Track Display

CAN
- Communication data such as engine rotation, torque and air pressure
- Supports CANdb file format

PC (sold separately)
Setting of measurement condition, logging for measurement data of speed/distance etc.

DPU-414 Printer (option)
Direct printing of measurement data.

LC-0855 High precision IMU (option)
Highly accurate acceleration measurement of X,Y, and Z axis directions.

LC-0815 INPUT CONNECTOR BOX (option)
Cable connection to the rear of the LC-0850A or the LC-8220. Conversion unit of the D-sub connector to BNC connector.

LC-0819 OUTPUT CONNECTOR BOX (option)
Cable connection to the rear of the LC-0850A or the LC-8220. Conversion unit of the D-sub connector to BNC connector.

LC-8300 Compact & High-sensitive GPS Speedometer

Compact & high-sensitive, PC-less measurement type

Provided as standard:	DC IN, CAN IN	Options:	CAN OUT, XYZ Acc XYZ Deg, Z Dist Slope

Features common to LC-8000 series

- Using GPS enables stable measurement which is not affected by weather or road surface conditions.
- Highly accurate and fast response measurement by original algorithm using GPS, GLONASS and IMU.
- Various vehicle measurements can be conducted by adding optional software.
- Data import of CAN･OBD II is available.

Specific features

- Compact size (70 % reduction in volume compared to the LC-8120) Easily installed even in a limited space such as two-wheel vehicles.
- Data logging without a PC: Data can be stored in an attached USB memory or internal storage memory.
- Easy to operate with a touch panel: The touch panel display improves visibility and ease of operation.
- Analog 4ch, pulse 1ch, CAN 64ch input as standard.

Product configuration

Standard system configuration

LC-0088 GPS/GLONASS antenna
Compact, easy installation on a dashboard.

LC-0089 Touch panel type display unit
Test mode selection or test condition setup as well as test start/stop can easily be operated on a touch panel.

LC-0853 USB memory
USB memory for measurement data logging.

LC-0083 Remote box
Remote control of start/stop command, selecting measurement mode.

Front

Rear

Right side view

LC-8300 Compact & High-sensitive GPS Speedometer

Standard software
(The CD is attached to the main unit.)

Software option (sold separately)
- LC-0831: Acceleration/deceleration Test
- LC-0832: Fuel Consumption Test
- LC-0833: Track Display

CAN
- Communication data such as engine rotation, torque and air pressure
- Supports CANdb file format

Compact IMU
(option, provided as standard with LC-0825)

External compact IMU is a standard accessory of LC-0825 IMU data output function. Speed, acceleration, and angle speed are measured based on the external compact IMU as a measurement origin. Internal IMU of LC-8300 is not activated when an external compact IMU is used. The data output from the internal IMU is not available.

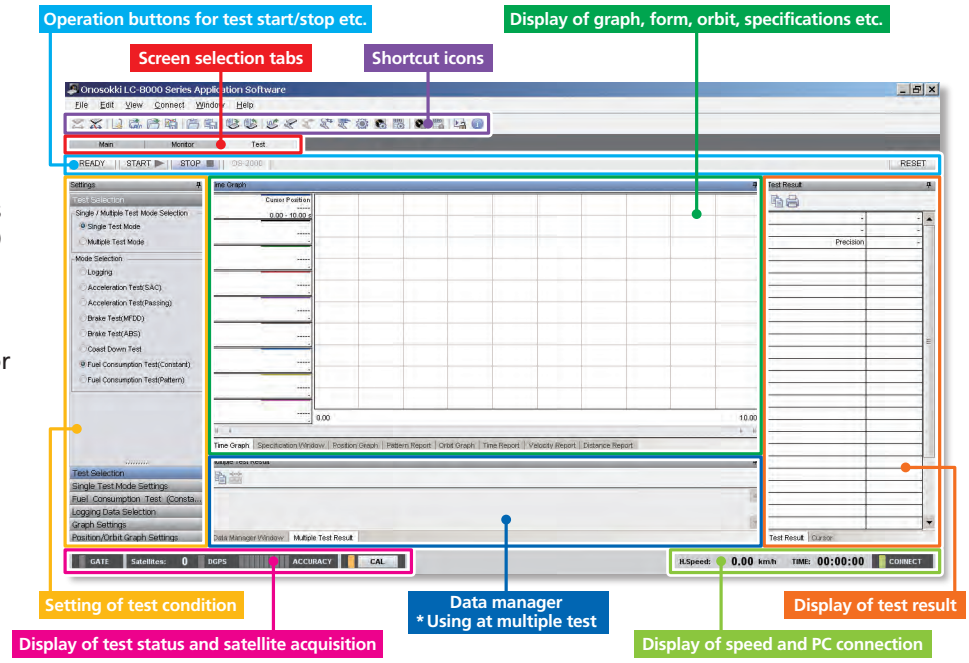
PC (sold separately)
Setting of measurement condition, logging for measurement data of speed/distance etc.

DPU-414 Printer (option)
Direct printing of measurement data.

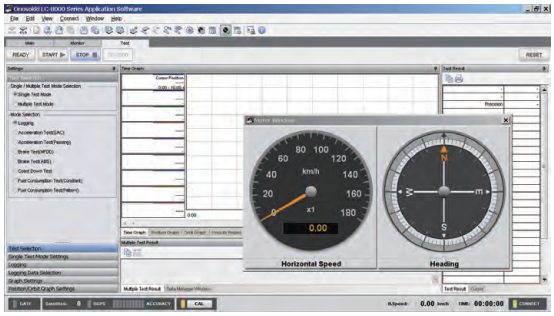
Application Software ver.3

Feature

- Displays of measurement data and CAN/OBD II data, and settings of measurement items.
- Screen display with good visibility such as a floating meter function.
- Data transfer to the OS-2000 series (Time series data analysis software) by [OS-2000] button.
- Docking Window enables various layout building.
- Language selection of Japanese or English is available.

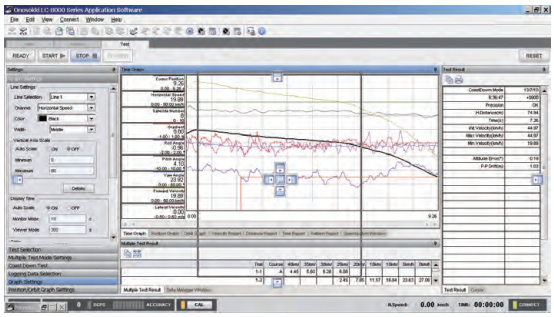


"Meter" display as a window

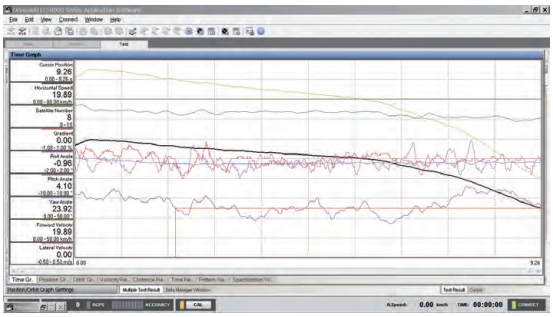


Meter display can be set as a separate-frame window.
Displaying meter items are selectable to make various layout.

"Docking Window" enables vairous layout building

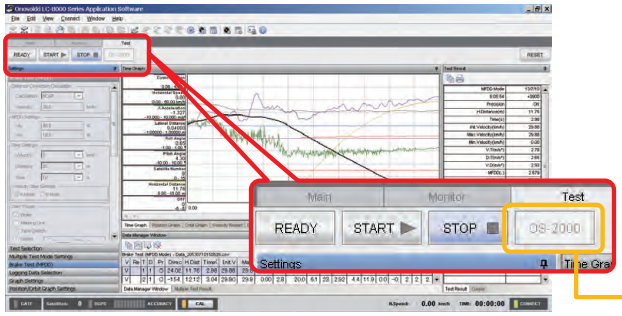


<Test screen>
The dockable locations are displayed by dragging the central window. Screen layout can be changed according to the measurement scene.



<Test screen/ example of layout>
Example of a graph display in large image by setting to hide items other than the central graph window. It can also display only a single window without using docking.

Easy data transfer to OS-2000 series by just one click operation



<Test screen>

OS-2000 series

One click operation of data transfer to OS-2000 (time-series data analysis software).

Time-series data analysis software OS-2000 series can perform flexible data-edit from huge amount of data which Microsoft® Excel® cannot handle. OS-2000 can handle various data format including CSV or WAV files, as well as the recorded data of LC-8000 series.
It can freely perform overwriting of different waveforms, waveform division, movement, enlargement, and the reduction. Various filters, video replay function, FFT Analysis function, and sound quality evaluation are also provided.

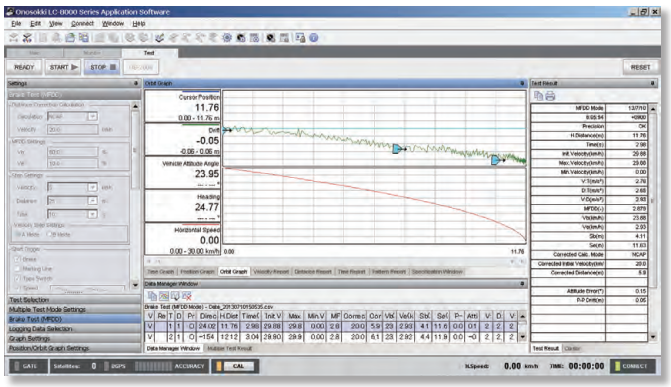
OS-2000 series is automatically activated for data transfer by clicking this button.

Optional Software

Various optional functions are able to be added; Multiple test function, orientation detection function, divided coasting test function, vehicle path/ driving direction display function, CAN input/ output function etc.

- **LC-0831: Acceleration/deceleration Test**
  - Display of elapsed time in acceleration test. (0 to 400 m / 0 to 1000 m)
  - AD (average deceleration) calculation in braking test.
  - MFDD (Mean Fully Developed Deceleration) calculation in braking test.
  - Display of deceleration speed and elapsed time in ABS test.
  - Data display in V-STEP/ D-STEP/ T-STEP modes.
- **LC-0832: Fuel Consumption Test**
  - Input of the pulse signal from the DF-210B Flow Meter.
  - Calculation and display of fuel consumption, fuel consumption rate, and accumulated fuel consumption, etc.
  - Data output in D-STEP/ T-STEP modes.
- **LC-0833: Track Display**
  - Display of vehicle path.
  - Measurement of drift amount.
  - Measurement of minimum turning radius.

<Example: When LC-0831, LC-0833 options are installed>



Vehicle path of the test is also measured and displayed

Track display software is able to be used with the other test function (optional software) at the same time. For example, drift amount can be measured at the same time when MFDD at the brake test is measured.

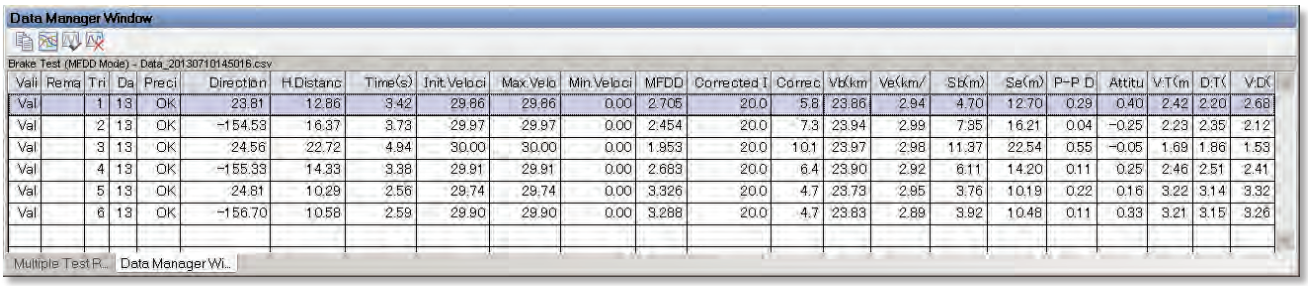
Major Functions

Multiple test function

LC-0831 Acceleration/Deceleration test | LC-0832 Fuel consumption test

- The multiple test results are collectively managed in data manager.
- This function allows easily to verify the difference of each test result.

* One item of data is created with the Ready → Start → Stop measurement sequence.



Data Manager Window

Brake Test (MFDD Mode) - Data_20130710145016.csv

Vali	Rema	Tri	Da	Preci	Direction	H.Distanc	Time(s)	Init.Veloci	Max.Velo	Min.Veloci	MFDD	Corrected I	Correc	Vb(km	Ve(km/	Sb(m)	Se(m)	P-P D	Attitu	V-T(m	D-T(	V-D(
Val		1	13	OK	23.81	12.86	3.42	29.86	29.86	0.00	2.705	20.0	5.8	23.86	2.94	4.70	12.70	0.29	0.40	2.42	2.20	2.68
Val		2	13	OK	−154.53	16.37	3.73	29.97	29.97	0.00	2.454	20.0	7.3	23.94	2.99	7.35	16.21	0.04	−0.25	2.23	2.35	2.12
Val		3	13	OK	24.56	22.72	4.94	30.00	30.00	0.00	1.953	20.0	10.1	23.97	2.98	11.37	22.54	0.55	−0.05	1.69	1.86	1.53
Val		4	13	OK	−155.33	14.33	3.38	29.91	29.91	0.00	2.683	20.0	6.4	23.90	2.92	6.11	14.20	0.11	0.25	2.46	2.51	2.41
Val		5	13	OK	24.81	10.29	2.56	29.74	29.74	0.00	3.326	20.0	4.7	23.73	2.95	3.76	10.19	0.22	0.16	3.22	3.14	3.32
Val		6	13	OK	−156.70	10.58	2.59	29.90	29.90	0.00	3.288	20.0	4.7	23.83	2.89	3.92	10.48	0.11	0.33	3.21	3.15	3.26

Multiple Test R... | Data Manager Wi...

Orientation detection function

LC-0831 Acceleration/Deceleration test | LC-0832 Fuel consumption test

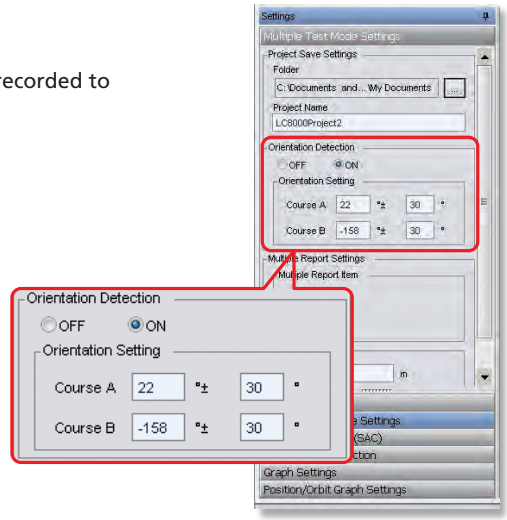
- Function available for multiple test.
- Used when reciprocal running tests are required.
- By setting the driving direction of the vehicle, measurement data is respectively recorded to course A and course B.
- Useful for rearranging result, and displaying average value for each course.

Multiple Test Result

Trial	Course	40km/h	35km/h	30km/h	25km/h	20km/h	15km/h	10km/h	5km/h	0km/h
1	A				0.45	0.91	1.39	1.88	2.41	2.98
3	A				0.48	0.89	1.28	1.68	2.10	2.49
5	A				0.46	0.92	1.33	1.78	2.26	2.78
Average(A)	A	0.00	0.00	0.00	0.46	0.91	1.33	1.77	2.26	2.75
2	B				0.50	0.94	1.43	1.92	2.45	3.04
4	B				0.64	1.13	1.57	2.02	2.50	2.96
6	B				0.58	1.10	1.59	2.05	2.56	3.06
Average(B)	B	0.00	0.00	0.00	0.57	1.06	1.53	2.00	2.50	3.02
Average		0.00	0.00	0.00	0.52	0.98	1.43	1.89	2.38	2.89

Data Manager Wi... | Multiple Test R...

Results of multiple test

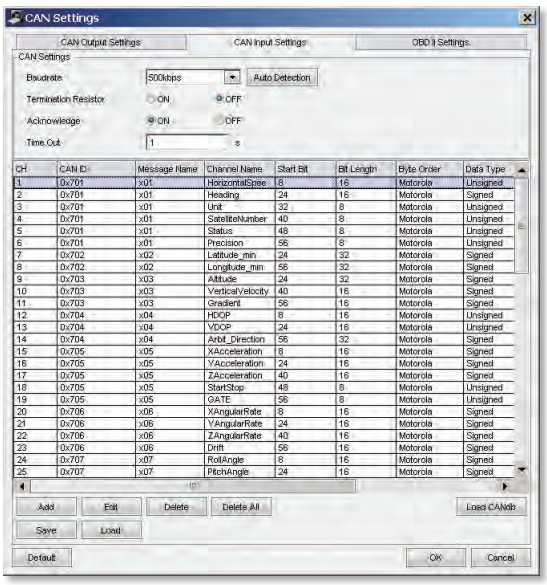


Major Functions

CAN input function

LC-0851 CAN input

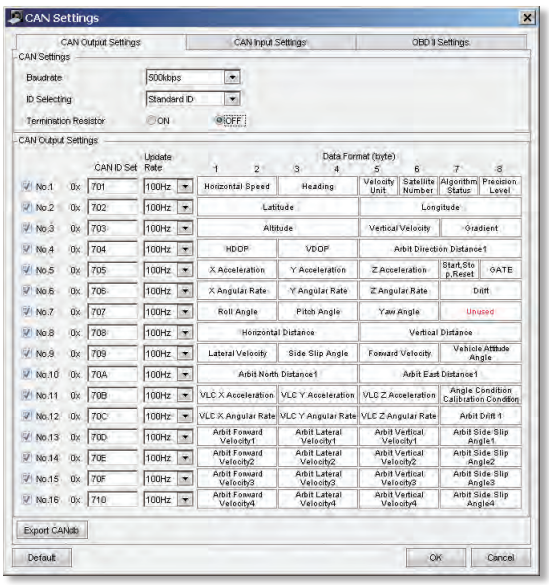
- Enables input of CAN data.
- Up to 100 Hz of input sampling.
- Easy setup of measurement and recording channel, CANdb format file can be read.



CAN output function

LC-0811A CAN output **LC-0854** CAN output

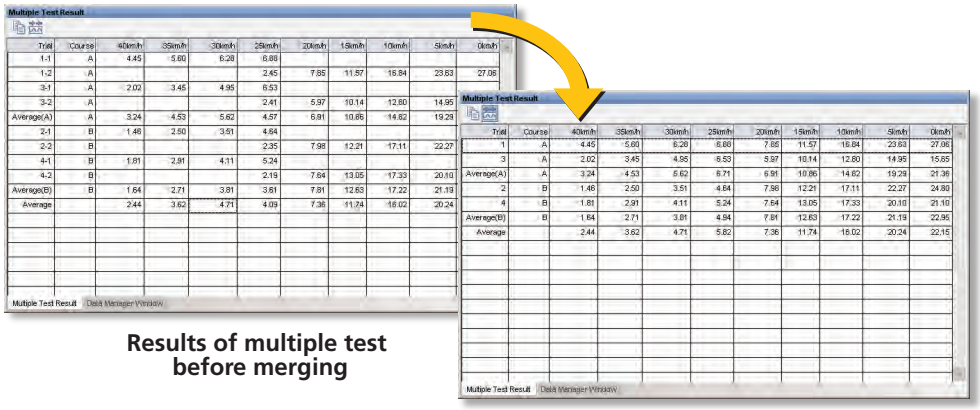
- Data output measuring in the main unit as CAN data.
- Up to 100 Hz of output sampling.
- CANdb format file generation function makes it easy to use with CAN recording device.



Divided coasting test function

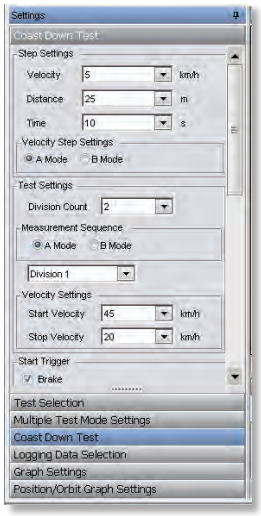
LC-0831 Acceleration/Deceleration test

- A function available when the orientation detection function is set in coasting test and multiple test.
- Test is started and finished automatically by setting the number of divisions and the test start speed.
- Multiple recorded data are merged to see in one table.



Results of multiple test before merging

Results of multiple test after merging



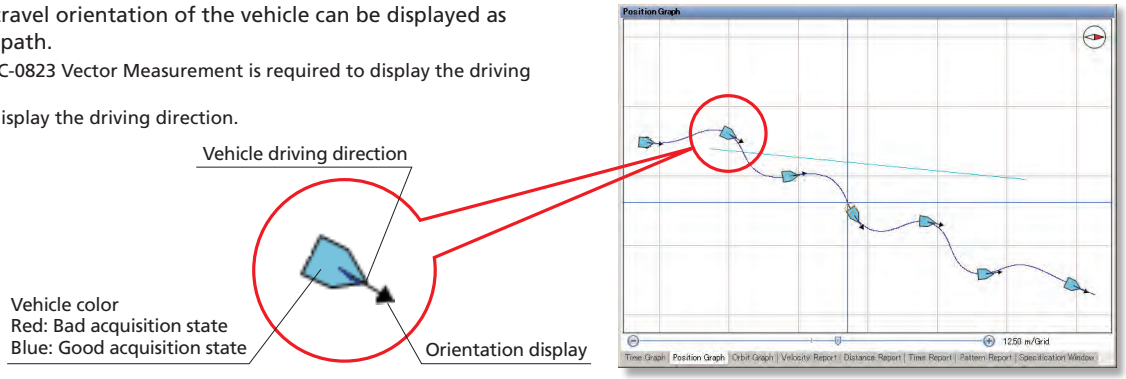
Divided coasting test setting

Vehicle path/ driving direction display

LC-8220 GPS Vector speedometer & **LC-0833** Track display
LC-0823 Vector measurement & **LC-0833** Track display

- Driving direction, travel orientation of the vehicle can be displayed as well as the vehicle path.

*The LC-8220, or the LC-0823 Vector Measurement is required to display the driving direction.
*The LC-8300 cannot display the driving direction.



Specification of Options

LC-8120/8220

	High precision IMU (LC-0855)
X,Y,Z acceleration	
Measurement range	-49.0 to 49.0 m/s²
Linearity	±0.1 %/ F.S. (Reference accuracy)
X,Y,Z angular speed	
Measurement range	-150.0 to 150.0°/s
Linearity	±0.03 % / F.S. (Reference accuracy)
Update cycle	100 Hz/ 500 Hz *500 Hz is only for analog output
Cable	Approx. 5 m
Operating temperature range	0 to 50°C (Humidity: 20 to 95 % RH, with no condensation)
Storage temperature range	-10 to 60°C (Humidity: 20 to 95 % RH, with no condensation)
Protection class	IP43
Outer dimensions (Weight)	Approx. 72 (W) × 72 (D) × 43 (H) mm (not including protruded section) (Approx. 200 g/ when magnet base mounted: Approx. 400 g)

	External input/output unit (LC-0850A)
Arbitrary analog output	
Item	Selectable 16ch from Horizontal speed, Forward speed, Lateral speed, Vertical speed, Number of satellites, Travel orientation, North speed, East speed, Sideslip angle, Yaw angle, Pitch angle, Roll angle, IMU coordinate axis XYZ acceleration, IMU coordinate axis XYZ angular speed, Slope angle, Satellite lost flag, Vehicle coordinate axis XYZ acceleration, Vehicle coordinate axis XYZ angular speed, Vehicle attitude angle, IMU coordinate axis XYZ jerk.
Output voltage	-10.0 to 10.0 V (Can be changed by PC software.)
Offset	±5 mV or less
Output accuracy	±0.1 % / F.S.
Temperature stability	±0.02 % / F.S./°C
Update frequency	100 Hz
Load resistance	100 kΩ or more
Output delay	5 ms or less
External synchronous output	
Function	Synchronous pulse output / Asynchronous clock output
Output level	Square wave pulse output: Hi 5±0.5 V, Lo 0.5 V or less
DUTY	At synchronous pulse output: Hi approx. 100 µs At asynchronous clock output: 50±10 %
Output frequency	100 Hz
Load resistance	10 kΩ or more
Analog input	
Number of channels	8ch
Voltage range	±10 V / 20 V
Sampling frequency	100 Hz
Offset	±20 mV or less
Measurement accuracy	±0.5 % / F.S.
Pulse input	
Number of channels	4ch: TTL pulse 1ch: SIN input
Conversion	4ch TTL: Selectable from pulse count, frequency or duty 1ch SIN input: Frequency
Frequency range (4ch TTL)	Pulse count: DC to 50 kHz Frequency: 1 Hz to 50 kHz Duty; 1 Hz to 10 kHz
Frequency range (1ch SIN)	Frequency: 1 Hz to 50 kHz
Accuracy (4ch TTL)	Pulse count: ±1 count or less Frequency: Input frequency × 0.02 % ±1 Hz or less Duty conversion: 1 kHz or less; ±2 % or less, 1 kHz or more; ±6 % or less
Accuracy (1ch SIN)	Frequency: Input frequency × 0.02 %±1 Hz or less
Power source output	12 ±2 VDC (approx. 4 VA or less) × 1ch
Outer dimensions	Approx. 269 (W) × 180 (D) × 43 (H) mm (not including protruded section)

	CAN input function (LC-0851)
Standard	Conforms to Ver. 2.0B
Update frequency	100 Hz
Baud rate	Selectable from 125, 250, 500 or 1000 kbps
Format	Supports standard ID/ extended ID
Data	CAN input: Up to 32ch can be acquired. Can be acquired up to 10 items of specified measured values by OBD II protocol.
Accessory	D-Sub 9 pin connector

	INPUT CONNECTOR BOX (LC-0815)	OUTPUT CONNECTOR BOX (LC-0819)
Function	Converts D-Sub input connector of an external input function unit to BNC.	Converts D-Sub output connector of an external output function unit to BNC.
Connector	BNC × 16, D-Sub 37pin × 1	
Accessory	D-Sub cable	
Outer dimensions (weight)	Approx. 230 (W) × 100 (D) × 28 (H) mm (Approx. 750 g)	

	Display unit: Small size (LC-0080)	Display unit: Large size (LC-0084)
Display method	Fluorescent display tube (green)	
Function	Display settings, test start/stop commands, memory commands, display of speed, distance and number of acquired satellites, simple test results, data display format settings (1-line or 2-line), output commands to optional DPU-414 Digital Printer	
Accessory	Cable	
Option	Windshield attachment (LC-0740)	–
Outer dimensions (weight)	Approx. 144 (W) × 41 (D) × 66 (H) mm (not including protruded section) (Approx. 300 g)	Approx. 196 (W) × 50 (D) × 60 (H) mm (not including protruded section) (Approx. 450 g)

	White line detecting sensor (LC-0856)
Power voltage (consumption current)	12 to 24 VDC (30 mA or less)
Light source	Red semiconductor laser (wave length: 655 nm)
Light emission output	0.5 mW or less
Detection distance	0.2 to 1.5 m
Laser spot diameter	Approx. 6 × 4 mm (distance 1 m or less)
Cable length	Approx. 5 m
Reflection sheet	Attached reflection sheet (1 m × 2)
Operating temperature range	0 to +50°C
Protection class	IPX3
Outer dimensions (weight)	Approx. 300 (W) × 40 (D) × 45 (H) mm (Approx. 350 g, not including a cable)

LC-8300

Model name	Product name	Function
LC-0082	Power cable (for battery)	Cable for power supply from the battery
LC-0864	Tape switch	Non-voltage contact, use as an external trigger

Common

	IMU unit (LC-0087)
X, Y, Z acceleration	
Measurement range	-98.0 to 98.0 m/s²
Linearity	±0.2 %/ F.S. (Reference accuracy)
X, Y, Z angular speed	
Measurement range	-150.0 to 150.0 °/s
Linearity	±0.1 %/ F.S. (Reference accuracy)
Cable	Approx. 5 m
Protection class	IP43
Outer dimensions (weight)	Approx. 56 (W) × 56 (D) × 35 (H) mm (not including protruded section) (Approx. 110 g/ when magnet base mounted: approx. 250 g)

	CAN output function (LC-0811A, LC-0854)
Standard	Conforms to ver. 2.0B
Update frequency	Selectable from OFF, 1 Hz, 5 Hz, 10 Hz, 20 Hz or 100 Hz
Baud rate	Selectable from 125, 250, 500 or 1000 kbps
Format	Supports standard ID/ extended ID
Data	Speed, distance, satellite and other information are gathered one ID (ID can be specified)
Accessory	D-Sub 9 pin connector, CAN branch cable (LC-0862)

	Remote box (LC-0083)
Function	Remote control of start/stop command, clear of display
SW	START, STOP, RESET, SELECT / READY
Outer dimension (weight)	Approx. 115 (W) × 45 (D) × 20 (H) mm (not including protruded section) (Approx. 80 g)

Model name	Product name	Function
DPU-414	Digital printer	For simple test output (AC adapter is option)
LC-0860	CAN cable	CAN communication cable, 2 m
LC-0861	CAN termination resistance adapter	
LC-0863	CAN-OBD II cable	Cable for supplying OBD II signal by using the CAN port
PS-P20023A	AC adapter for main unit	Adapter for supplying power from AC (cable option)

GPS Speedometer PC software ver. 3.1 operating environment	
CPU	Intel® Core™ 2 Duo / 2 GHz or more
OS	Windows® 7 [32 bit / 64 bit] / 10 [32 bit/ 64 bit]
Memory	512 MB or more
HDD	80 GB or more
Display	Can be displayed XGA (1024 × 768) or more
USB	USB 2.0 (High Speed) 1 port or more

Specification of LC-8000 Series

		LC-8120 GPS Speedometer	LC-8220 GPS Vector Speedometer	LC-8300 Compact & High-Sensitive GPS Speedometer
Horizontal speed	Measurement range	0.1 to 500.0 km/h		
	Accuracy	±0.1 km/h*1		±0.2 km/h*2
Horizontal distance	Accuracy	±0.05 %*3		±0.20 %*4
Forward speed	Measurement range	– (Available by LC-0823)	-500.0 to 500.0 km/h	–
	Accuracy		±0.2 km/h*5	
Forward distance	Accuracy		±0.10 %*6	
Lateral speed	Measurement range		-20.0 to 20.0 m/s	
	Accuracy		±0.08 m/s*7	
Lateral distance	Accuracy		±0.15 %*8	
Sideslip angle	Measurement range		-25.0 to +25.0°	
	Accuracy		0.15°RMS (Reference accuracy)*9	
Vehicle attitude angle	Measurement range		-180.0 to +180.0°	
	Accuracy		0.1°RMS (Reference accuracy)*10	
Yaw angle	Measurement range	– (Available by LC-0821)	-180.0 to +180.0°	
	Accuracy		0.1°RMS (Reference accuracy)*10	
X,Y,Z acceleration	Measurement range		-98.0 to 98.0 m/s² [-49.0 to 49.0 m/s² *12]	-98.0 to 98.0 m/s²
	Linearity		±0.2 % / F.S. [±0.1 % / F.S.*12] (Reference accuracy)	±0.2 % / F.S. (Reference accuracy)
X,Y,Z angular speed	Measurement range		-150.0 to 150.0°/s	
	Accuracy		±0.1 % / F.S. [±0.03 % / F.S.*12] (Reference accuracy)	±0.1 % / F.S. (Reference accuracy)
Analog (speed) output	Voltage range	0 to 10 V/ 0 to 500 km/h		
	Output accuracy	±0.2 %/ F.S.		
	Load resistance	100 kΩ or more		10 kΩ or more
	Temperature stability	±0.05 % / F.S./°C		
	Output delay	5 ms or less		10 ms or less
	Remarks	–		Switch with the pulse output section
Pulse (distance) output	Resolution	1, 5, 10 mm/P Selectable		
	Output delay	5 ms or less		10 ms or less
	DUTY	50 % ±10 %		
	Load resistance	10 kΩ or more		1 kΩ or more
	Output signal	Square wave pulse output: Hi; 5 V±0.5 V, Lo; 0.5 V or less		
	Remarks	–		Switch with the analog output section
Arbitrary analog output	Item	– (Available by LC-0850A)	Selectable 16ch from Horizontal speed, Forward speed, Lateral speed, Vertical speed, Number of satellites, Travel orientation, North speed, East speed, Sideslip angle, Yaw angle, Pitch angle, Roll angle, IMU coordinate axis XYZ acceleration, IMU coordinate axis XYZ angular speed, Slope angle, Satellite lost flag, Vehicle coordinate axis XYZ acceleration, Vehicle coordinate axis XYZ angular speed, Vehicle attitude angle, IMU coordinate axis XYZ jerk.	–
	Output voltage		-10.0 to 10.0 V (Can be changed by PC software)	
	Offset error		±5 mV or less	
	Output accuracy		±0.1 % / F.S.	
	Temperature stability		±0.02 % / F.S./°C	
	Update frequency		100 Hz/ 500 Hz*11	
	Load resistance		100 kΩ or more	
	Delay time		5 ms or less	
External synchronous output	Function		Synchronous pulse output/ Asynchronous clock output	
	Output level		Square wave pulse output: Hi; 5±0.5 V, Lo; 0.5 V or less	
	DUTY		At synchronous pulse output: Hi; approx. 100 µs At asynchronous clock output: 50±10 %	
	Output frequency		100 Hz	
	Load resistance		10 kΩ or more	
Analog input	Number of channels		8ch	4ch
	Voltage range		±10 V/ 20 V	±20 V
	Sampling frequency		100 Hz	
	Offset error		±20 mV or less	
	Measurement accuracy		±0.5 % / F.S.	–
	Linearity		–	±0.5 % / F.S.
Pulse input	Number of channels		4ch: TTL pulse 1ch: SIN input	1ch
	Conversion		4ch TTL: Selectable from pulse count, frequency or duty 1ch SIN input: Frequency	–
	Frequency range (4ch TTL)		Pulse count: DC to 50 kHz Frequency: 1 Hz to 50 kHz Duty: 1 Hz to 10 kHz	–
	Frequency range (1ch SIN)		Frequency: 1 Hz to 50 kHz	
	Accuracy (4ch TTL)		Pulse count: ±1 count or less Frequency: Input frequency × 0.02 % ±1 Hz or less Duty conversion: 1 kHz or less; ±2 % or less, 1 kHz or more; ±6 % or less	
	Accuracy (1ch SIN)		Frequency: Input frequency × 0.02 %±1 Hz or less	
	Input coupling	–		AC or DC
	Input voltage range (AC)			0.2 to 24 Vrms
	Input voltage range (DC)			Hi: +3.0 to 28.0 V, Lo: -1.0 to 1.0 V
	Input waveform			AC selected: Sine wave, DC selected: Square wave
	Frequency range (DC selected)			DC to 50 kHz (Pulse count) 1 to 50 kHz (Frequency) 1 to 10 kHz (Duty)
	Frequency range (AC selected)			1 Hz to 50 kHz
	Accuracy (DC selected)			Pulse count: ±1 count Frequency: Input frequency × 0.02 %±1 Hz DUTY: ±2% (less than 1 kHz) : ±6% (1 kHz or more)
	Measurement range (DUTY)			10 to 90 %
	Min. pulse width (DUTY)			10 µs or more
	Accuracy (AC selected)			Frequency: Input frequency × 0.02 % ±1 Hz
Power supply output		– (Available by LC-0850A)	12 ± 2 VDC (Approx. 4 VA or less) × 1ch	12 ± 2 VDC (Approx. 200 mA or less) × 1ch

		LC-8120 GPS Speedometer	LC-8220 GPS Vector Speedometer	LC-8300 Compact & High-Sensitive GPS Speedometer
External trigger input/output	Input	Non-voltage contact input: 1ch contact (Switching logic is available) Voltage input: 5 to 24 V input (Switching logic is available) White line detection sensor input		Start, stop signals (non-voltage/voltage contacts)
	Output	Gate output: 1ch Gate ON/OFF, Square wave pulse output, Load resistance 39 kΩ or more		Gate signal or speed judgment output signal
PC interface		USB 2.0		
General specification	Power supply	10 to 28 VDC/ 100 to 240 VAC (AC adapter: option)		9 to 28 VDC/ 100 to 240 VAC (AC adapter: option)
	Power consumption	Max. 30 VA		Max. 12 VA
	Operating temperature range	0 to 50 °C		
	Storage temperature range	-10 to 60 °C		
Accessory		Antenna (LC-0721), Remote box (LC-0083), IMU (LC-0087) and connection cables, DC power supply cable, USB cable, PC standard software, IMU mounting jig	Antenna (LC-0721) × 2, Large display unit (LC-0084), Remote box (LC-0083), IMU (LC-0087) and connection cables, DC power cable, USB cable, PC standard software, Antenna & IMU mounting jig	Antenna, Remote box, Touch panel display unit and connection cables, Power cable for cigarette lighter socket, USB memory, PC standard software, Mount adapter for display unit, Carrying case
Outer dimensions (weight)		Approx. 269 (W) × 180 (D) × 43(H) mm (not including protruded section) (Approx. 1.4 kg)	Approx. 269 (W) × 180 (D) × 71 (H) mm (not including protruded section) (Approx. 2.2 kg)	Approx. 170 (W) × 120 (D) × 40 (H) mm (not including protruded section) (Approx. 0.75 kg)

*1: Accuracy at 30 km/h or higher horizontal speed and with 7 or more acquired satellites.
*2: Accuracy at 30 km/h or higher horizontal speed with 7 or more acquired satellites and no multipath effect.
±0.3 km/h at less than 30 km/h horizontal speed and with 7 or more acquired satellites.
±0.6 km/h with less than 7 acquired satellites.
*3: Accuracy at 300 m measurement distance with 30 km/h or higher horizontal speed and with 7 or more acquired satellites. ±0.5 % with less than 7 acquired satellites and no multipath effect.
*4: Accuracy at 300 m measurement distance with 30 km/h or higher horizontal speed with 7 or more acquired satellites and no multipath effect. ±0.5 % at less than 30 km/h horizontal speed and with less than 7 acquired satellites.
*5: Accuracy with 2 m distance between antennas at 100 km/h horizontal speed and with 7 or more acquired satellites.
±0.8 km/h with 2 m distance between antennas at 100 km/h horizontal speed and with 4 or more acquired satellites.
*6: Accuracy with 2 m distance between antennas at 100 km/h horizontal speed and with 7 or more acquired satellites.
±0.70 % with 2 m distance between antennas at 100 km/h horizontal speed and with 4 or more acquired satellites.
*7: Accuracy with 2 m distance between antennas at 100 km/h horizontal speed and with 7 or more acquired satellites.
±0.20 m/s with 2 m distance between antennas at 100 km/h horizontal speed and with 4 or more acquired satellites.
*8: Accuracy with 2 m distance between antennas at 100 km/h horizontal speed and with 7 or more acquired satellites.
±0.65 % with 2 m distance between antennas at 100 km/h horizontal speed and with 4 or more acquired satellites.
*9: Accuracy with 2 m distance between antennas at 30 km/h or higher horizontal speed and with 7 or more acquired satellites.
0.30°RMS with 2 m distance between antennas at 30 km/h or higher horizontal speed and with 4 or more acquired satellites.
*10: Accuracy with 2 m distance between antennas and with 7 or more acquired satellites.
±0.2°RMS with 2 m distance between antennas and with 4 or more acquired satellites.
*11: Analog output is available when the LC-0870 High response IMU output (option) is attached.
*12: Available when the LC-0855 High precision IMU (option) is attached.

Comparison Table of Measurement Items

Main item	LC-8120	LC-8220	LC-8300
Horizontal speed	○	○	○
Horizontal distance	○	○	○
Forward speed	△*1	○*6	×
Forward distance	△*1	○*6	×
Lateral speed	△*1	○*6	×
Lateral distance	△*1	○*6	△*10
Vertical speed	△*2	○	△*7
Vertical distance	△*2	○	△*7
Slope	△*2	○	△*7
Number of satellites	○	○	○
Travel orientation	○	○	○
Latitude/longitude/altitude	○	○	○
Sideslip angle	△*1	○*6	×
Yaw, pitch, roll angles	△*3	○	△*8
XYZ acceleration/angular speed (IMU coordinate axes)	△*3	○	△*8
XYZ acceleration/angular speed (Vehicle coordinate axes)	△*4	○	×
Vehicle attitude angle	△*1	○*6	×
[High precision IMU] XYZ acceleration/angular speed (IMU coordinate axes)	△*5	△*5	×
XYZ jerk	△*9	△*9	×

Additional notes

- Time-series data cannot be recorded on the main unit of the LC-8120/8220. However, one of the data displayed on the display unit or a simple test result at the moment can be recorded. In total 32 items of data can be recorded.
- The reference position of all measurement items is the place where IMU is. Even if the vehicle gravity center position is different from the position where IMU is fixed, forward speed, lateral speed, vertical speed and sideslip angle of an arbitrary position are calculated and output by setting the distance from the arbitrary position to IMU. Four arbitrary positions can be set.

The following options are required.
*1: LC-0823 Vector measurement function
*2: LC-0822 Vertical direction measurement function
*3: LC-0821 IMU data output function
*4: LC-0821 IMU data output function and LC-0823 Vector measurement function
*5: LC-0855 High precision IMU
*6: Two or more antennas are required.
*7: LC-0826 Vertical direction measurement function
*8: LC-0825 IMU data output function
*9: LC-0871 Jerk measurement function
*10: Distance calculation is available with double integral of the IMU lateral acceleration. Adding the LC-0825 IMU data output function is required

○: Standard △: Option ×: Not available

List of optional functions

	Model name	Product name	LC-8120	LC-8220	LC-8300
Software	LC-0831	Acceleration/deceleration test	op	op	op
	LC-0832	Fuel consumption test	op	op	op
	LC-0833	Track display	op	op	op
Hardware	LC-0080	Display unit: small size	op	op	—
	LC-0082	Power cable	○	○	op
	LC-0083	Remote box	○	○	○
	LC-0084	Display unit: large size	op	○	—
	LC-0087	Compact IMU	○	○	op*2
	LC-0088	GPS/GLONASS antenna	—	—	○
	LC-0089	Touch panel display unit	—	—	○
	LC-0721	GPS/GLONASS antenna	○	○	—
	LC-0811A	CAN output	op	op	—
	LC-0815	INPUT connector box	op	op	—
	LC-0819	OUTPUT connector box	op	op	—
	LC-0821	IMU data output	op	○	—
	LC-0822	Vertical direction measurement function	op	○	—
	LC-0823	Vector measurement function	op	○	—
	LC-0825	IMU data output	—	—	op
	LC-0826	Vertical direction measurement function	—	—	op
	LC-0850A	External input/output unit	op	○	—
	LC-0851	CAN input	op	op	○*1
	LC-0853	USB memory	—	—	○
	LC-0854	CAN output	—	—	op
	LC-0855	High precision IMU	op	op	—
	LC-0856	White line detection sensor	op	op	op
	LC-0864	Tape switch	—	—	op
	LC-0870	High response IMU	op	op	—
	LC-0871	Jerk measurement function	op	op	—

*1: CAN input is provided as standard to LC-8300.
The number of channels is different.
- LC-8120/8220: Option (32ch max.)
- LC-8300: Standard (64ch max.)

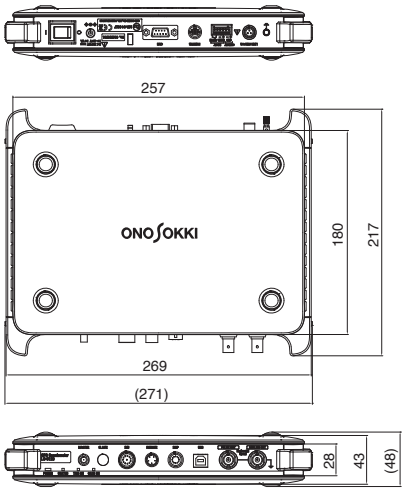
*2: LC-0087 is a standard accessory of LC-0825 IMU data output (option).

○ : Provided as standard
op: Available as an option
— : Not supproted

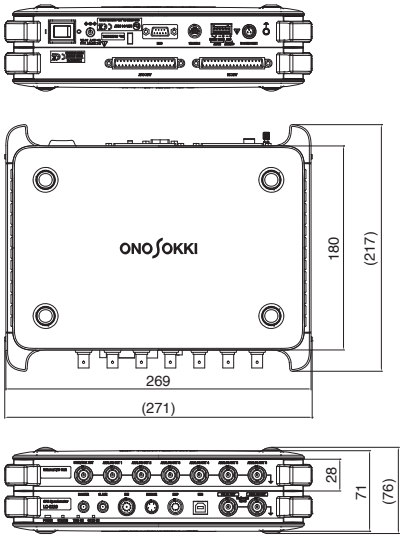
Outer Dimensions

Unit (mm)

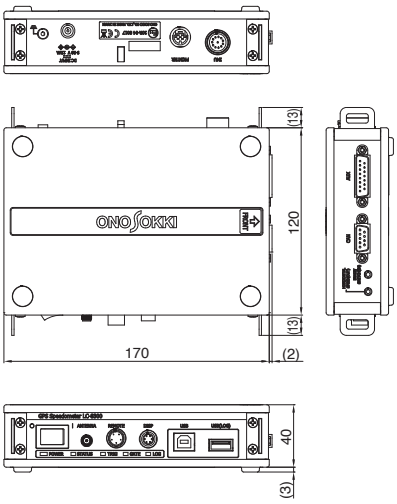
LC-8120 GPS Speedometer



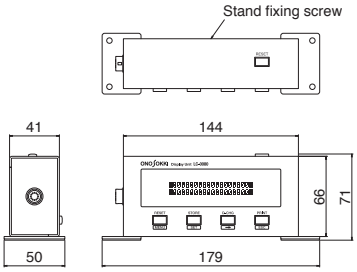
LC-8220 GPS Vector Speedometer



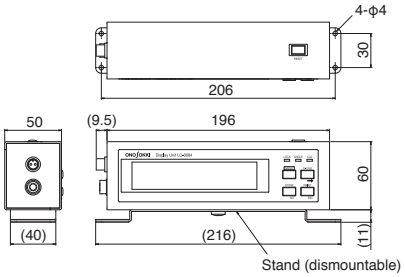
LC-8300 Compact & High-sensitive GPS Speedometer



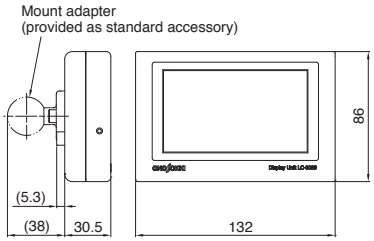
LC-0080 Display Unit: Small size



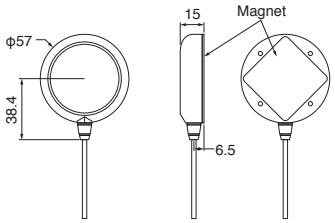
LC-0084 Display unit: Large size



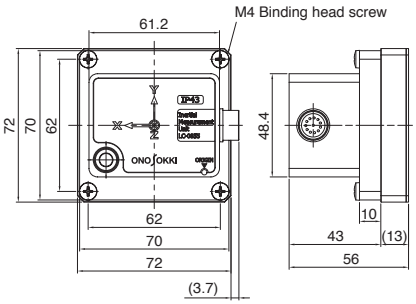
LC-0089 Touch panel type display unit



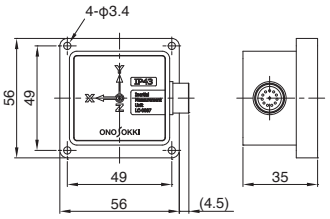
LC-0721 GPS/GLONASS antenna



LC-0855 High precision IMU



LC-0087 Compact IMU



ONOSOKKI

WORLDWIDE ONO SOKKI CO., LTD.
1-16-1 Hakusan, Midori-ku, Yokohama, 226-8507, Japan
Phone : +81-45-935-3918 Fax : +81-45-930-1808
E-mail : overseas@onosokki.co.jp

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URL: http://www.onosokki.co.jp/English/english.htm

U.S.A.
Ono Sokki Technology Inc.
2171 Executive Drive, Suite 400,
Addison, IL. 60101, U.S.A.
Phone : +1-630-627-9700
Fax : +1-630-627-0004
E-mail : info@onosokki.net
http://www.onosokki.net

THAILAND
Ono Sokki (Thailand) Co., Ltd.
1/293-4 Moo.9 T.Bangphud A.Pakkred,
Nonthaburi 11120, Thailand
Phone : +66-2-584-6735
Fax : +66-2-584-6740
E-mail : sales@onosokki.co.th

INDIA
Ono Sokki India Private Ltd.
Plot No.20, Ground Floor, Sector-3,
IMT Manesar Gurgaon-122050,
Haryana, INDIA
Phone : +91-124-421-1807
Fax : +91-124-421-1809
E-mail : osid@onosokki.co.in

P.R.CHINA
Ono Sokki Shanghai Technology Co., Ltd.
Room 506, No.47 Zhengyi Road, Yangpu
District, Shanghai, 200433, P.R.C.
Phone : +86-21-6503-2656
Fax : +86-21-6506-0327
E-mail : admin@shonosokki.com

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