GPS Speedometer

LC-8310

High-sensitive GPS Speedometer

ONOSOKKI

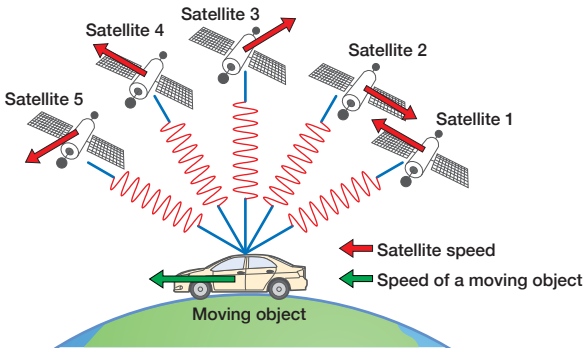
LC-8310 High-Sensitive GPS Speedometer

LC-8310 High-Sensitive 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.

1 High accuracy

By the use of Doppler effect*1 of moving object and carrier wave transmitted from the satellites, the LC-8310 enables highly accurate calculation of the moving object speed. Receiving plural satellite signals from GPS and GLONASS allows high sensitive, high response measurement.

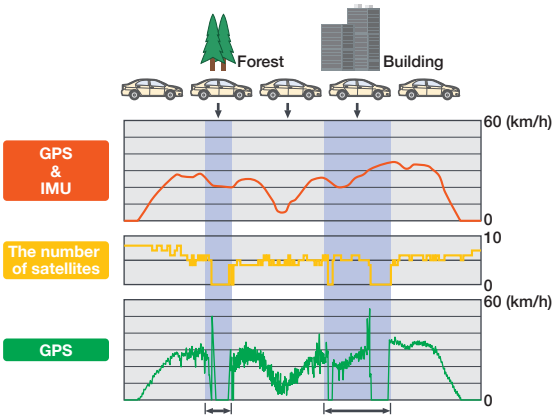
*1: The Doppler effect is the change in frequency of acoustic/electromagnetic radiation emitted by a source when there is speed difference between an observer and its source.
The shift is perceived to higher frequencies when the source approaches and to lower frequencies when it recedes.



2 Stable and high sensitivity

Using IMU (Inertial Measurement Unit)*2 and satellite signals (GPS and GLONASS), the LC-8310 enables highly accurate calculation of the moving object speed. Receiving plural satellite signals from GPS and GLONASS allows high sensitive, high response measurement.

*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.

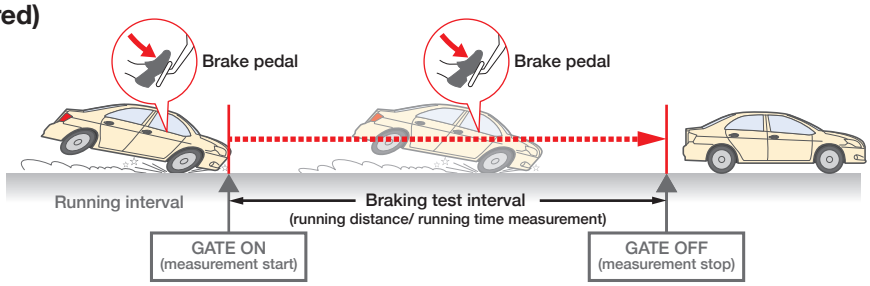


3 Supports various kinds of vehicle tests Option

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

● Braking test (MFDD) : (LC-0831 required)

MFDD (Mean fully developed deceleration) : one of the requirements for brake test. Measures the braking distance, braking time, MFDD etc. from the start of braking to the vehicle stop. Also measures the speed, braking distance, braking time, and interval deceleration for each specified step.

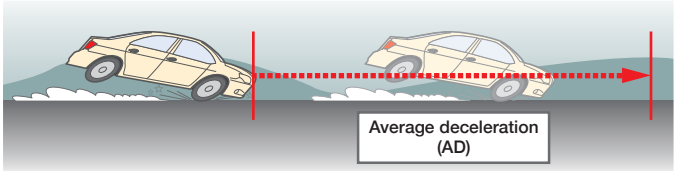


● Average deceleration calculation : Wet grip performance test supported (LC-0831 required)

With LC-0831, you can calculate the tire's wet grip performance based on UN-ECE R117.

Average deceleration (AD) m/s² $AD = \frac{V1^2 - V2^2}{2d}$

V1: Initial velocity km/h (setup value: 80 km/h)
V2: Final velocity km/h (setup value: 20 km/h)
d: Distance between V1≧V2 (m)



● Coast down test: WLTP* supported (LC-0831 required)

To calculate the driving resistance, let the vehicle coast and measure the time in each speed range. LC-0831 can output time and distance data for each specified velocity, the elapsed time every 10 km/h can also output.

*WLTP: Worldwide harmonized Light-duty Test Procedure

High-Sensitive GPS Speedometer, PC-less measurement type

Features

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

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

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

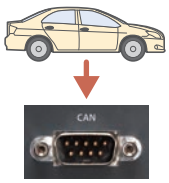
Front

Rear

Right side

LC-8310 High-sensitive GPS Speedometer

CAN input function



Right side of the LC-8310 main unit (conforms to CAN Ver2.0 B)

Analog · pulse input function

Analog: 4 channels
Pulse: 1 channel
Voltage range: 0 to ±20 V

Standard software
(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

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-8310 is not activated when an external compact IMU is used. (The data output from the internal IMU is not available.)

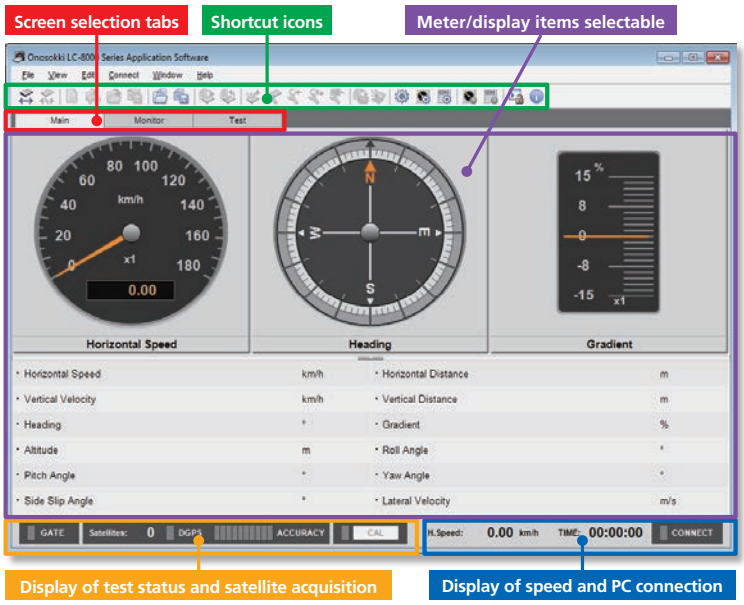
PC (sold separately)
Setting of measurement condition, logging for measurement data of speed/distance etc.

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.

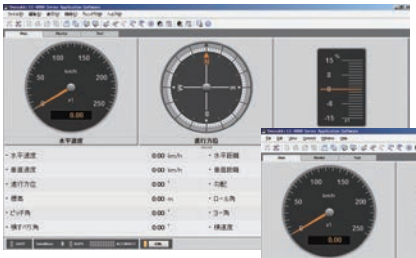


"Meter" display as a window

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

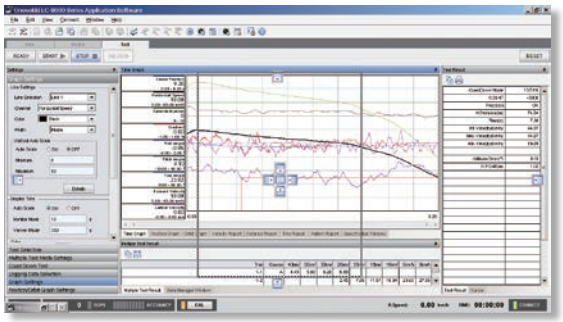
Language Selection

Japanese or English is selectable as standard

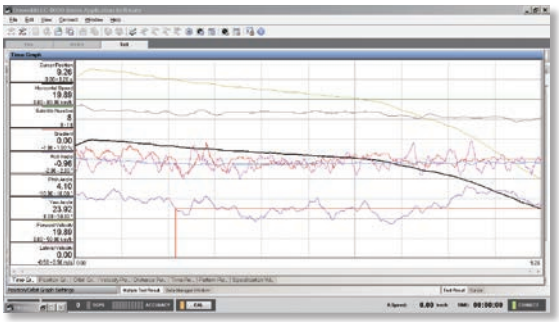


Application setting screen (part)

"Docking Window" enables vairous layout building

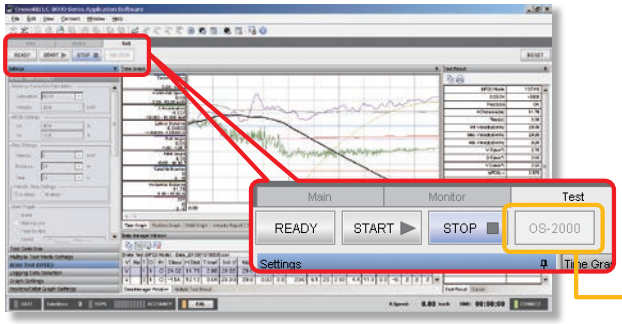


<Test screen>
The dockable locations are displayed by dragging the central window. Screen layout can be changed according to the measurement scene.



<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

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.

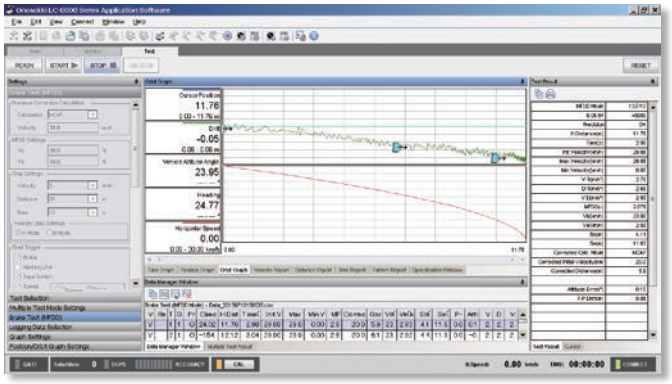
LC-0832: Fuel Consumption Test

- Input of the pulse signal from the DF-2200 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.

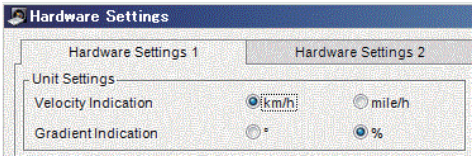
LC-0854: CAN output function

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

Right side of the LC-8310 main unit

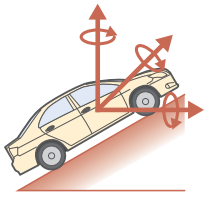
LC-0824: Unit selection function

- Measurement unit can be selected from km or mile.



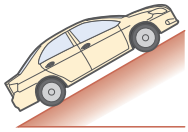
LC-0825: IMU data output

- XYZ directions of acceleration, angular speed, and angle information can be measured.



LC-0826: Vertical direction measurement function

- Vertical measurement can be performed with GPS height data and IMU Z-axis data. Slope can also be calculated from vertical data.



Hardware test function

- **LC-0827: Hardware acceleration test function**
- **LC-0828: Hardware brake test function**
- **LC-0829: Hardware coasting test function**

The following tests can be performed without using a PC. Results can be viewed on the form display.

- Startup acceleration test
- Passing acceleration test
- MFDD brake test
- ABS brake test
- Fade recovery test
- Coasting test

You can also check the deceleration in braking tests etc.

Distance (m)	Velocity (km/h)	Time (s)	d-Time (s)	Acc (m/s²)
0.00	0.0	0.00	----	----
10.00	57.4	1.73	1.73	9.22
20.00	87.5	2.23	0.50	16.69
30.00	110.0	2.59	0.36	17.41

MENU DISP PRINT READY START RESET

LC-0827: Display example of distance-based report

MFDD TEST	13	State N8	Memory Usage USB 31%
V0	: 46.4 km/h	Sb	: 2.28 m
Time	: 1.49 s	Se	: 6.97 m
HD	: 7.16 m	CV0	: --- km/h
MFDD	: 10.961	CD	: m
Vb	: 36.8 km/h	Ve	: km/h

MENU DISP PRINT READY START RESET

LC-0828: Display example of result display

Velocity (km/h)	Distance (m)	Time (s)	d-Time (s)	Acc (m/s²)
120.0	21.78	0.57	0.16	-16.90
110.0	27.18	0.74	0.17	-17.25
100.0	31.81	0.90	0.16	-17.43
90.0	35.74	1.05	0.15	-17.42

MENU DISP PRINT READY START RESET

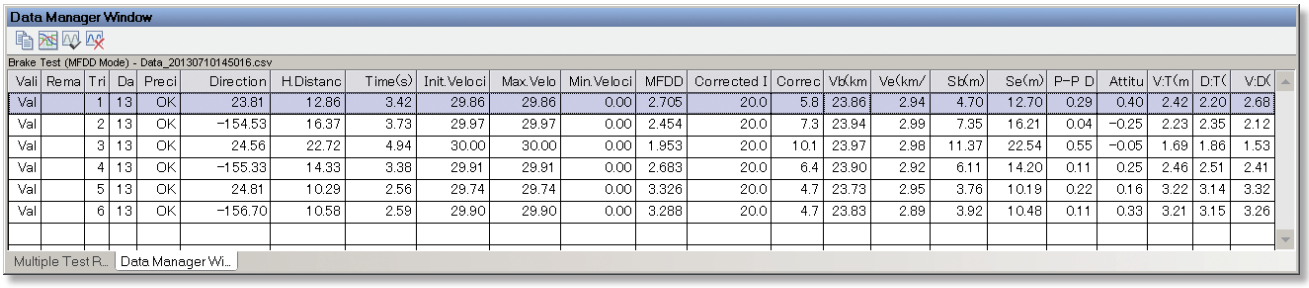
LC-0829: Dispay example of speed-based report

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.



Vali	Rema	Tri	Da	Preci	Direction	H.Distanc	Time(s)	Init.Velocl	Max.Velo	Min.Velocl	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

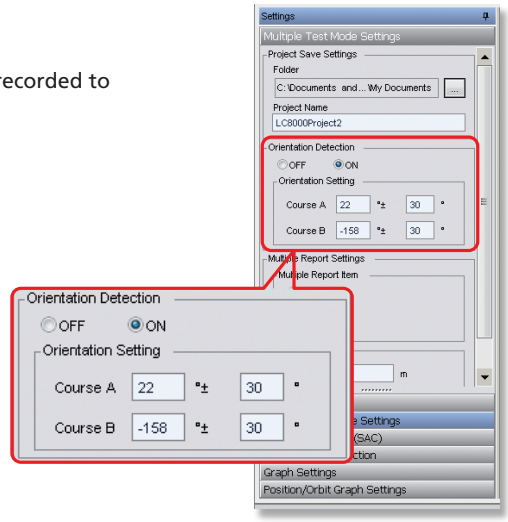
Orientation detection function

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.

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	1.76	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

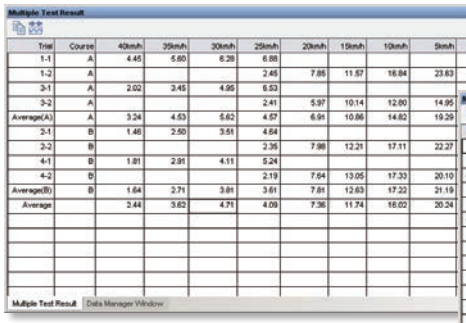
Results of multiple test



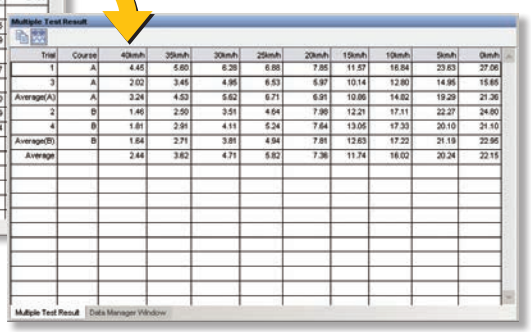
Divided coasting test function

LC-0831 Acceleration/Deceleration test

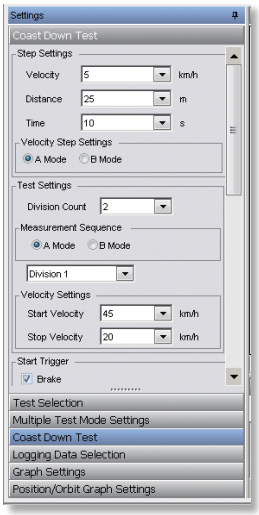
- A function available when the orientation detection function is set in coasting test and multiple test.
- Test is started and finished automatically by setting the number of divisions and the test start speed.
- Multiple recorded data are merged to see in one table.



Results of multiple test before merging



Results of multiple test after merging



Divided coasting test setting

Specification

Horizontal speed	Measurement range	0.1 to 500.0 km
	Accuracy	±0.2 km/h*1
Horizontal distance	Accuracy	±0.20 %*2
XYZ acceleration	Measurement range	-98.0 to 98.0 m/s^2
	Linearity	±0.20 %/F.S. (reference accuary)
XYZ angular speed	Measurement range	-150.0 to 150.0 °/s
	Accuracy	±0.1 %/F.S. (reference accuary)
Analog (speed) output	Voltage range	0 to 10 V/ 0 to 500 km/h
	Output accuracy	±0.2 %/F.S.
	Load resistance	10 kΩ or more
	Temperature stability	±0.05 %/F.S./°C
	Output delay	10 ms or less
	Remarks	Switch with the pulse output section
Pulse (distance) output	Resolution	1, 5 or 10 mm/P Selectable
	Output delay	10 ms or less
	DUTY	50 % ± 10 %
	Load resisntance	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
Analog input	Number of channels	4
	Voltage range	± 20 V
	Sampling frequency	100 Hz
	Offset error	± 20 mV or less
	Linearity	±0.5 %/F.S.
Pulse input	Number of channels	1ch
	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 x 0.02 % ±1 Hz DUTY : ±2 % (less than 1 kHz) : ±6 % (1kHz or more)
	Measurement range (DUTY)	10 to 90 %
	Min. pulse width (DUTY)	10 µs or more
	Accuracy (AC selected)	Frequency: Input frequency x 0.02 % ±1 Hz
Power supply output	12 ± 2 VDC (approx. 200 mA or less) x 1 ch	
External trigger input/output	Input	Start, stop signals (non-voltage/voltage contacts)
	Output	Gate signal or speed judgment output signal
PC interface	USB 2.0	
General specification	Power supply	9 to 28 VDC/100 to 240 VAC (AC adapter use: option)
	Power consumption	up to 12 VA
	Operating temperature range	0 to 50 °C
	Storage temperature range	-10 to 60 °C
Accessory	Antenna (LC-0088), Remote box (LC-0083), Touch panel display unit (LC-0089), Cable for cigarette lighter socket (LC-0865), USB memory (LC-0853), PC software, Mount adapter for diaplay unit, Carrying case (LC-0817A), CAN branch cable (LC-0862), Instruction manual, Pin-jack BNC cable, USB cable for PC connection, Base plate for mount adapter	
Outer dimensions (weight)	approx. 170 (W) x 120 (D) x 40 (H) mm (not including protruded section) (approx. 0.75 kg)	

*1. 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 accquired satellites.
±0.6 km/h with less than 7 acquired satellites.

*2. Accuracy at 300 m measurement distance with 30 km/h or higher horizontal speed with 7 or more satellites and no multipath effect.
±0.5 % at less than 30 km/h horizontal speed and with less than 7 accquired satellites.

Operating environment for GPS Speedometer PC software (ver.3.0)	
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	XGA (1024 × 768) or more
USB	USB 2.0 (High Speed) 1 port or more

Measurement Items

○: Measurement items guaranteed traceability accuracy
△: Reference value

Main item	LC-8310
Horizontal speed	○
Horizontal distance	○
Lateral distance	△*1
Vertical speed	△*2
Vertical distance	△*2
Slope	△*2
Number of satellites	△
Travel orientation	△
North speed	△
East speed	△
North distance	△
East distance	△
Latitude/longitude/altitude	△
Yaw, pitch, roll angles	△*1
XYZ acceleration/angular speed (IMU coordinate axes)	△*1

The following options are required
*1: LC-0825 IMU data output function
*2: LC-0826 Vertical direction measurement function

List of optional functions

Model number	Product name
LC-0831	Acceleration / deceleration test
LC-0832	Fuel consumption test
LC-0833	Track display
LC-0082	Power cable
★LC-0083	Remote box
★LC-0088	GPS/GLONASS antenna
★LC-0089	Touch panel display unit
LC-0824	Unit selection function
LC-0825	IMU data output
LC-0826	Vertical direction measurement function
LC-0827	Hardware acceleration test function
LC-0828	Hardware brake test function
LC-0829	Hardware coasting test function
★LC-0853	USB memory
LC-0854	CAN output
LC-0860	CAN cable (2m)
LC-0861	CAN terminal register adapter
★LC-0862	CAN branch cable (2m)
LC-0863	CAN-OBD2 cable
LC-0864	Tape switch
★LC-0865	Cable for cigarette lighter socket
LC-0866	General-purpose input output cable
★LC-0817A	Carrying case
DPU-414	Compact thermal printer
PW-C0725-W2-U	AC adapter for printer *for Japan use
TP-0411	Thermal paper for printer (28 m for 1 roll, 10 rolls in a pack)
PS-P20023B	AC adapter for main unit

★: Comes as standard accessory with LC-8310. Also order available separately as an option.

Specification of options

Item	Compact IMU unit (LC-0087)	
X,Y,Z acceleration	Measurement range	-98.0 to 98.0 m/s^2
	Linearity	±0.2 % /F.S. (reference)
X,Y,Z angular speed	Measurement range	-150.0 to 150.0 °/s
	Linearity	±0.1 % /F.S. (reference)
Cable	approx. 5 m	
Protection class	IP43	

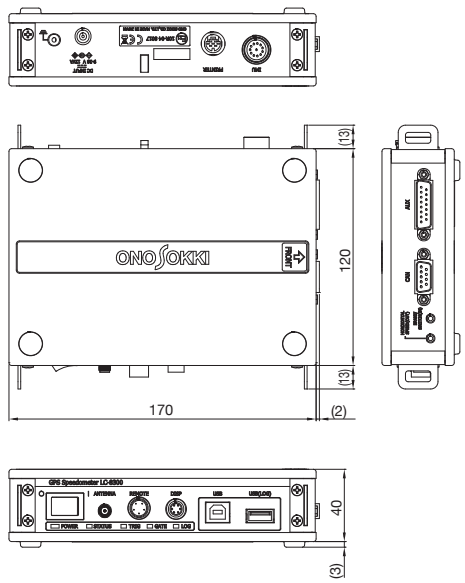
Item	Remote box (LC-0083)
Function	Command of measurement start/stop, clear of display
SW	START, STOP, RESET, SELECT, READY

Item	CAN output function (LC-0854)
Standard	Conforms to ver. 2.0B
Update frequency	OFF, 1 Hz, 5 Hz, 10 Hz, 20 Hz, or 100 Hz selectable
Baud rate	125, 250, 500, or 1000 kbps selectable
Format	Supports standard ID/ extended ID
Data	Speed, distance, satellite and other information are gathered one ID (ID can be specified.)
Accessory	D-Sub9 pin connector CAN branch cable (LC-0862)

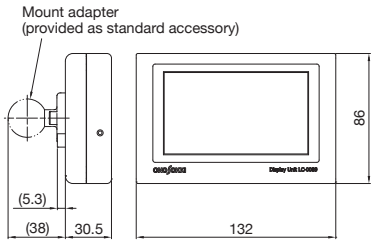
Outer Dimensions

Unit (mm)

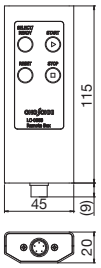
LC-8310 High-sensitive GPS Speedometer



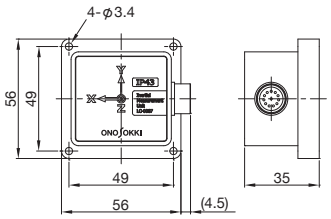
LC-0089 Touch panel type display unit



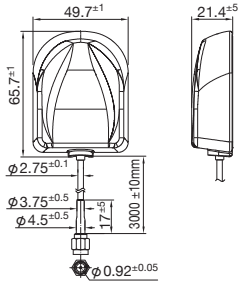
LC-0083 Remote box



LC-0087 Compact IMU



LC-0088 GPS/GLONASS antenna



Reliable and high level calibration JCSS*1 Accredited Calibration Laboratory

Ono Sokki provides reliable and high level calibration as "Accredited Calibration Laboratory", which is certificated by JCSS calibration laboratory accreditation system, based on the skills and know-how of quality assurance system which has been acquired through many years of practice.
Under the JCSS of calibration laboratory accrediation system, Ono Sokki is assessed and accredited as Accredited Calibration Laboratories to meet the requirements of Measurement law, relevant regulations and ISO/IEC.

Accreditation Scope
- Acousticss & Ultrasound
- Acceleration
- Torque
- Fluid flow
- Electricity (Direct Current & Low Frequency)
- Speed

ilac-MRA IAJapan JCSS 0170 JCSS

Ono Sokki can issue the calibration certificates with the JCSS*1 accreditation symbol, which assures the traceability to National Measurement Standards as well as a laboratory's technical and operational compentence, and is acceptable in the world throught the ilac*2/ MRA*3.

*1: JCSS: Japan Calibration Servicce System
*2: ilac: International Laboratory Accreditation Conference
*3: MRA: Mutual Recognition Arrangements

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