# **GPS Speedometer**

## LC-8000 series



LC-8120 GPS Speedometer



LC-8220 GPS Vector Speedometer



LC-8300 Compact & High-sensitive GPS Speedometer

# 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<sup>\*1</sup> 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)\*<sup>2</sup> 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  $\pm 0.03\%$ /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.**

Easy visible with large display.

Equivalent function to the LC-0080.

Enables operations of the display

when testing.

### Enables highly accurate measurement of various driving tests.



# LC-8220 GPS Vector Speedometer

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



**GPS Speedometer** LC-8000 series

# LC-8300 Compact & High-sensitive GPS Speedometer

### **Compact & high-sensitive, PC-less measurement type**



#### 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.



# Application Software ver.3

#### Operation buttons for test start/stop etc. Display of graph, form, orbit, specifications etc. **Feature** Displays of measurement data and Screen selection tabs Shortcut icons CAN/OBD II data, and settings of - 8 × measurement items. 13 🗊 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 Japanease or English is available. 0.00 ME 00:00:00 Data manager \* Using at multiple test Display of test resul Display of test status and satellite acquisition





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.

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<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.



**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.

# **Major Functions**

## <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-0831 LC-0832 Acceleration/Deceleration test Fuel consumption test

## Multiple test function

- 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  $\rightarrow$  Start  $\rightarrow$  Stop measurement sequence.

rake Test (MF	DD M	ode) -	Data_2013	071014501B.csv				_	-	_			-			-	-		_		_
Vall Rema	Tri	Da	Preci	Direction	HDistanc	Time(s)	Init.Velaci	Max.Velo	Min.Velaci	MFDD	Corrected I	Correc	Vbkkm	VE(km/	SEKm)	Se(m)	P-P D	Attitu	W.T.(m	D:T(	V:D
Val	1	18	OK	23.81	12.86	3.42	29,86	29,86	0.00	2.705	20.D	5,8	23.86	2.94	4.70	12.70	0.29	0.40	2.42	2.20	268
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	7.95	16.21	0.04	-0.25	2.23	2.35	212
Val	53	15	OK	24.56	22.72	4.94	30.00	30.00	0.00	1.958	20.0	10.1	23.97	2.98	11.37	22.54	055	-0.05	1.69	1.86	1.55
Val	4	18	QK	+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	011	0.25	2.46	2.51	241
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	022	0.16	3.22	3.14	3.32
Val	6	18	OK.	-15670	10.58	2.59	29.90	29.90	0.00	3.268	20.0	4.7	23.83	.2.89	3.92	10.48	0.11	0.33	3.21	3.15	3.26
Val	6	13	OK OK	24.81 -156.70	10.29	2.56 2.59	29,74 29.90	29.74 29.90	0.00	3:326 3.268	20.0	4.7	23.73 23.83	2,95	8.76 9.92	10,19	0.22		0.16	0.16 3.22 0.33 8.21	0.16 3.22 3.14 0.33 3.21 3.15

### Orientation detection function

- 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	Diam/
1	A				0.45	0.91	1.39	1.86	2.41	2,98
3	A	-			D.48	D.89	1.28	1.68	2.10	2.49
5	Ą				0,46	0.92	1.33	1.76	2.26	2.78
Average(A)	A	0.00	0.00	0.00	D,46	0.91	1.33	1.77	2.26	2.75
2	В				0.50	0.94	1,43	1.92	2.45	3.04
4	В	2			D.64	1.13	1.57	2.02	2.50	2.96
6	в				0,58	1.10	1,59	2.05	2.56	3.06
Average(B)	В	0.00	0.00	0.00	0.57	1.06	1.53	2,00	2.50	3.02
Average	0	0.00	00.0	QD. Q	0.52	0.98	1.43	1.89	2.38	2.89



30

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Graph Settings Position/Orbit Graph Settings

IC-0832

LC-0831

Course A 22

Course B -158

"±

°±

**Results of multiple test** 

# **Major Functions**

### CAN input function



- 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.

1	CAN Output Set	Nuge	CAN Input	Settings		OBD / Set	ings
CAMS	ettings			-	-		
Bas	frate	500kbps	🚊 Auto	Detection			
Terr	inetion Resistor	ON	ROFF				
Ackr	towiedge	e on	OFF				
Tène	0.t	1	5				
эř.	CAND	Message Name	Channel Name	Shart Bit	Elt Length	Byte Order	Data Type
1	0x701	×01	HorizontaiSpee	8	16	Meterola	Unsigned
2	0×701	301	Heading	24	16	Motorola	Signed
3	0x701	×01	Unit	32	8	Metorola	Unsigned
4	0x701	201	SateliteNumber	46	8	Motorgis	Unsigned
5	0×701	×01	Status	48	8	Materala	Unsigned
6	0×701	x01	Precision	56	8	Motorola	Unsigned
2	0x702	×02	Latitude_mm	24	32	Métorola	Signed
8	Bx702	\$02	Longitude_min	56	32	Motorola	Signed
9	0x703	×03	Altuse	24	32	Matorola	Signed
10	Dx703	×03	Vertical velocity	40	16	Motorola	Signed
11	0x703	203	Gradient	56	16	Metorela	Signed
12	Dx704	×04	HDOP	-8	16	Motorota	Unsigneri
13	0x704	×04	VDOP	24	16	Motorola	Unsigned
14	UX704	X04	Stot Direction	26	32	Motorola	signed
15	0x/05	XUS	XAcceleration	No.	16	Metorola	spred
16	0x705	-x05	YAcceleration	24	16	Motorola	Signed
17	0x705	xU5	ZAcceleration	40	16	Motorola	Signed
10	0x705	X05	Statistop	140	10	Motorola	Unsigned
18	0.705	205	GAIE	30	0	Matordia	Linsighed
20	Dx796	200	XAnguarfote	104	10	MOLOPOLO	Signed
21	0.700	200	7.0 mm Cate	40	10	Mutorola	Cagned
10	0x700	200	Dill	140	36	Motorola	Standa
24	0.707	200	Paillante	00	10	Matarala	Cigniad
25	0,707	×07	Richande	24	18	Motorola	Signed
*	Lines on	1200	In association.	1=1	1149	Turney Old	1.000.000
Å	dd Ealt	Delate	Deleta All				Load CANda
ş	we Load		1.				
Data	uL.					OK	Canad

### Divided coasting test function

- 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.



Vehicle driving direction

**Results of multiple test** after merging



LC-0811A

OBD | Setting

CAN output

CAN output function

Up to 100 Hz of output sampling.

500ktops

ON

Standard D

with CAN recording device.

CAN Output Settings

CAN Settings

CAN Setu

Baustrate 10 Selecting

Terminatio CAN Output Settinits

- No.5

. No.6

V NO.7

Default

• Data output measuring in the main unit as CAN data.

CANdb format file generation function makes it easy to use

CAN Input Settings

1.

1.

OFF

LC-0854

**CAN** output



**Divided coasting** test setting

LC-0823 & LC-0833

### Vehicle path/ driving direction 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.



-8220 <sub>&</sub> LC-0833

Vehicle color Red: Bad acquisition state Blue: Good acquisition state

### Specification of Options \_

### • LC-8120/8220

	High precision IMU (LC-0855)
X,Y,Z acceleration	
Measurement range	-49.0 to 49.0 m/s <sup>2</sup>
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) $\times$ 72 (D) $\times$ 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 disp	play tube (green)		
Function	Display settings, test start/stop commands, memory com display of speed, distance and number of acquired satelli simple test results, data display format settings (1-line or output commands to optional DPU-414 Digital Printer			
Accessory	Cable			
Option	Windshield attachment (LC-0740)	_		
Outer dimensions (weight)	$\begin{array}{l} \mbox{Approx. 144 (W) \times 41 (D)} \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	$\begin{array}{l} \mbox{Approx. 196 (W) $\times$ 50 (D)$} \\ \mbox{$\times$ 60 (H) mm$} \\ \mbox{(not including protruded section)$} \\ \mbox{(Approx. 450 g)} \end{array}$		
	Addition the state of the			
	white line detectin	g sensor (LC-0656)		
Power voltage (consumption current)	12 to 24 VDC (30 mA or less)			
Light source	Red semiconductor laser (wave le	ength: 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	2)		
	A L 5000			

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/s <sup>2</sup>
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)

Madalwawa	Due du et nome	Function
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 <sup>®</sup> Core <sup>™</sup> 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	Measurement range				
speed	Accuracy	±0.1	km/h*1	±0.2 km/h*2	
Horizontal distance	Accuracy	±0.05 %*3		±0.20 %*4	
Forward speed	Measurement range		-500.0 to 500.0 km/h		
Forward distance	Accuracy		±0.2 km/i ±0.10 %*6		
Lateral speed	Measurement range		-20.0 to 20.0 m/s		
	Accuracy	- (Available by LC-0823)	±0.08 m/s*7	-	
Lateral distance	Accuracy	(	±0.15 %*8		
Sideslip angle			-25.0 t0 +25.0°		
Vehicle attitude	Measurement range		-180.0 to +180.0°		
angle	Accuracy		0.1°RMS (Reference accuracy)*10		
Yaw angle	Measurement range		-180.0 to +180.0°		
<u></u>	Accuracy		0.1°RMS (Reference accuracy)*10	$00.0 \text{ to } 00.0 \text{ m/s}^2$	
∧, r,∠ acceleration	Linearity	- (Available by LC-0821)	+0.2 % / ES [+0.1 % / ES * <sup>12</sup> ] (Beference accuracy)	+0.2 % / ES (Beference accuracy)	
X,Y,Z angular	Measurement range		-150.0 to	150.0°/s	
speed	Accuracy		±0.1 % / F.S. [±0.03 % / F.S.*12] (Reference accuracy)	±0.1 % / F.S. (Reference accuracy)	
Analog (speed)	Voltage range		0 to 10 V/ 0 to 500 km/h		
output	Output accuracy	100 kO	±0.2 %/ F.S.	10 kO or moro	
	Temperature stability	100 K22	+0.05 % / E.S./°C	10 K2 01 11016	
	Output delay	5 ms	or less	10 ms or less	
	Remarks		-	Switch with the pulse output section	
Pulse (distance)	Resolution		1, 5, 10 mm/P Selectable		
output	Output delay	5 ms	or less 50 % ±10 %	10 ms or less	
	Load resistance	10 kQ	or more	1 kQ or more	
	Output signal	5	Square wave pulse output: Hi; 5 V±0.5 V, Lo; 0.5 V or les	s	
	Remarks		-	Switch with the analog output section	
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 coordinate axis XYZ angular speed,		
	Output voltage		-10.0 to 10.0 V (Can be changed by PC software)		
	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		
Extornal	Delay time		5 MS OF IESS		
synchronous	Output level	- (Available by LC-0850A)	Square wave pulse output: Hi: 5±0.5 V. Lo: 0.5 V or less		
output	DUTY	(******************************	At synchronous pulse output: Hi; approx. 100 μs		
	O to the termination		At asynchronous clock output: 50±10 %		
	Output frequency		100 Hz		
Analog input	Number of channels		8ch	4ch	
0 1	Voltage range		±10 V/ 20 V	±20 V	
	Sampling frequency		100	Hz	
	Offset error		±20 mV	or less	
	Linearity		±0.5 % / F.S.	+0.5 % / ES	
Pulse input	Number of channels		4ch: TTL pulse 1ch: SIN input	1ch	
	Conversion		4ch TTL: Selectable from pulse count, frequency or duty	-	
	Frequency range		Pulse count: DC to 50 kHz		
	(ten rrc)		Duty: 1 Hz to 10 kHz		
	Frequency range (1ch SIN)		Frequency: 1 Hz to 50 kHz		
	Accuracy (4ch TTL)		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	10.50	
	Input coupling			AC or DC	
	Input voltage range (AC)			Hi: +3.0 to 28.0 V. Lo: -1.0 to 1.0 V	
	Input waveform			AC selected: Sine 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)	
	Min. pulse width (DUTY)			10 µs or more	
	Accuracy (AC selected)			Frequency: Input frequency × 0.02 % ±1 Hz	
Power supply out	tput	- (Available by LC-0850A)	12 ± 2 VDC (Approx. 4 VA or less) × 1ch	$12 \pm 2$ VDC (Approx. 200 mA or less) × 1ch	

### **GPS Speedometer** LC-8000 series

		LC-8120 GPS Speedometer	LC-8220 GPS Vector Speedometer	LC-8300 Compact & High-Sensitive GPS Speedometer
External trigger input/output Input Input Non-voltage contact input: 1 ch contact (Switching logic is available) Voltage input: 5 to 24 V input (Switching logic is available) White line detection sensor input		ntact (Switching logic is available) t (Switching logic is available) tion sensor input	Start, stop signals (non-voltage/voltage contacts)	
	Output	Gate output: 1ch Gate ON/OFF, Square wave pulse output, Load resistance 39 k $\Omega$ or more		Gate signal or speed judgment output signal
PC interface				
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			
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 *2: Accuracy at 30 +0.3 km/b at let	km/h or higher horizontal speed km/h or higher horizontal speed	I and with 7 or more acquired satellites. with 7 or more acquired satellites and no multipath effe	*7: Accuracy with 2 m distance between anter acquired satellites. ±0.20 m/s with 2 m distance between anter	nas at 100 km/h horizontal speed and with 7 or more nnas at 100 km/h horizontal speed and with 4 or

 $\pm 0.3$  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.

### Comparison Table of Measurement Items

Main item	LC-8120	LC-8220	LC-8300
Horizontal speed	0	0	0
Horizontal distance	0	0	0
Forward speed	∆*1	○*6	×
Forward distance	*1	○*6	×
Lateral speed	∆*1	○*6	×
Lateral distance	∆*1	○*6	△*10
Vertical speed	*2	0	∆*7
Vertical distance	*2	0	△*7
Slope	∆*2	0	∆*7
Number of satellites	0	0	0
Travel orientation	0	0	0
Latitude/longitude/altitude	0	0	0
Sideslip angle	∆*1	○*6	×
Yaw, pitch, roll angles	∆*3	0	∆*8
XYZ acceleration/angular speed (IMU coordinate axes)	∆*3	0	∆*8
XYZ acceleration/angular speed (Vehicle coordinate axes)	*4	0	×
Vehicle attitude angle	∆*1	○*6	×
[High precision IMU] XYZ acceleration/angular speed (IMU coordinate axes)	*5	*5	×
XYZ jerk			×

#### **Additional notes**

\*8: Accuracy with 2 m distance between antennas at 100 km/h horizontal speed and with 7 or more

\*9: Accuracy with 2 m distance between antennas at 30 km/h or higher horizontal speed and with 7

\*10: Accuracy with 2 m distance between antennas and with 7 or more acquired satellites.

\*12: Available when the LC-0855 High precision IMU (option) is attached.

±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.

±0.65 % with 2 m distance between antennas at 100 km/h horizontal speed and with 4 or more

0.30°RMS with 2 m distance between antennas at 30 km/h or higher horizontal speed and with 4 or more acquired satellites.

- 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.

more acquired satellites.

acquired satellites

acquired satellites

\*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
are	LC-0831	Acceleration/deceleration test	ор	ор	ор
ĮĮ,	LC-0832	Fuel consumption test	ор	ор	ор
S	LC-0833	Track display	ор	ор	ор
	LC-0080	Display unit: small size	ор	ор	-
	LC-0082	Power cable	0	0	ор
	LC-0083	Remote box	0	0	0
	LC-0084	Display unit: large size	ор	0	-
	LC-0087	Compact IMU	0	0	op*2
	LC-0088	GPS/GLONASS antenna	-	-	0
	LC-0089	Touch panel display unit	-	-	0
	LC-0721	GPS/GLONASS antenna	0	0	-
	LC-0811A	CAN output	ор	ор	-
	LC-0815	INPUT connector box	ор	ор	-
	LC-0819	OUTPUT connector box	ор	ор	-
are	LC-0821	IMU data output	ор	0	-
Mp.	LC-0822	Vertical direction measurement function	ор	0	-
har	LC-0823	Vector measurement function	ор	0	-
_	LC-0825	IMU data output	-	-	ор
	LC-0826	Vertical direction measurement function	-	-	ор
	LC-0850A	External input/output unit	ор	0	-
	LC-0851	CAN input	ор	ор	O *1
	LC-0853	USB memory	-	-	0
	LC-0854	CAN output	-	-	ор
	LC-0855	High precision IMU	ор	ор	-
	LC-0856	White line detection sensor	ор	ор	ор
	LC-0864	Tape switch	-	_	ор
	LC-0870	High response IMU	ор	ор	-
	LC-0871	Jerk measurement function	ор	ор	-

\*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**



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#### \*Outer appearance and specifications are subject to change without prior notice. URL: http://www.onosokki.co.jp/English/english.htm

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