The device measures the sway of railway cars and protects safety and security !

Analysis System of Riding Comfort for Railway Track and Railway Cars

DIGITAL SWAY METER／W0051A
GPS SPEED METER／W0077T

W0051A   W0077T

＜Features＞

● This device can measure the degree of sway by just put it on a floor of a railway car.

●Measurement starts immediately when a power source switch is turned on.

●Records are put in an USB memory without realizing recording time.

● It receives signals from GPS.

● A marker switch handles the operation for sections where signals cannot be received.

Impulse Determining System that Supports Education for Driving Operators

DRIVING SWAY METER／W0080C

＜Uses＞

●The best device for education and training for railway car drivers.

●The best device for skill test of driving operators' license examination.

＜Features＞

● Small and simple all-in-one type determining device.

● Determines impulse with the 8-impulse rank

● Can be used for 20 hours with 6 AA-sized nickel metal hydride batteries.

● Remote foot petal allows both hands become free.

■Outline

   The mission of railway business is to carry passengers safely, comfortably, fast and in large quantity. And riding comfort of railway cars is built on the exquisite balance of railway lines (railway tracks) and vehicle performance.   Therefore, it is essential to measure sway that can be done easily on a floor of a railway car. Measurement of sway helps to grasp any abnormality of railway tracks or railway cars thus is useful for maintenance.

   Also, driving skills that suppress driving impulse as low as possible is required in driving operator's education.   Driving sway meter has also been used in skill test of driving operator's license examination.

   Watts Ltd. is a company specialized in oscillation measuring devices and riding comfort analysis. We have been active in the fields, as well as monitoring riding comfort of railway cars.

Support System to Obtain Speed and Distance Information

■ System Connection Diagram

GPS SPEED METER／W0077T

DIGITAL SWAY　METER／W0051A

To W0051A　←　SPEED SIGNAL

← EXIT INPUT

■W0077T Compositions

●GPS RECEIVER／GPS18SG

It obtains speed information by receiving signals from the GPS satellites. Place the device on the signals.

GPS18SG

●MARKER SWITCH／W0034S2T

For sections where GPS cannot be received, for example, in a tunnel, station premises and underground, press the device by hand while watching kilometer post on the railroad line.
Select a distance among 1km, 500m, 200m and 100m

●GPS SPEED METER／W0077T

It is a body of GPS SPEED METER. Connect GPS18SG and W0034S2T for use. Output signal is connected to an external input terminal of W0051A.

W0077T

W0034S2T

■W0051A Compositions

●DIGITAL SWAY METER／W0051A

Put the device on a floor of a railway car and record vibration acceleration of three components of X, Y, Z to an USB memory. Operation is easy as it starts measurement when a power source switch is turned on. It can record the driving information (speed, distance) simultaneously by an external input terminal. Due to large memory capacity of the USB, you do not need to worry about recording time. The recorded data can be easily opened on general-purpose WindowsPCs.

W0051A

＜ACCESSORIES＞

USB Memory × 1

AC Adapter × 1

Battery Charger × 1

Nickel Metal Hydride Batteries × 6

■Software Applications（Windows 10 English version OS）

●W0051　Riding Comfort of Vehicles Analysis Software Tool

It analyzes riding comfort of a rolling stock. It has two analysis criteria: riding comfort diagram analysis and riding comfort level analysis. It also includes recording data's editing (cutting) tool and filter tool. It is the most suitable tool to check riding comfort of railway cars.

●W0048 Railroad Line's Max Value of Motion Point Analysis Software Tool

It includes an analysis tool that identify the place that a train was swayed largely. It picks up the max value of motion that exceeds the specified oscillation threshold and lists the location of the place, time and degree of oscillation. It is useful for railroad track maintenance.
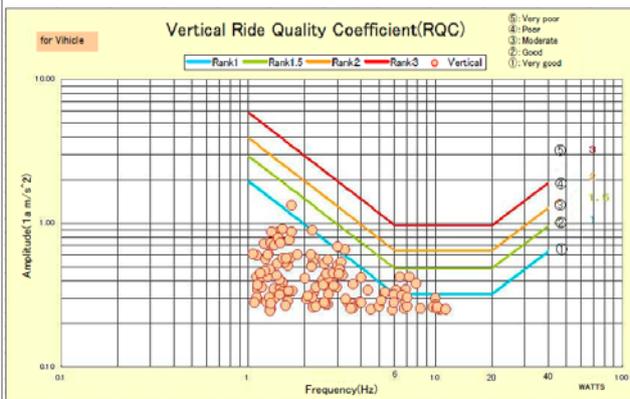
●W0062　Oscillation Chart File Conversion Software Tool

It includes a tool that converts external input signals recorded in W0051A to distance and speed. It filters the recorded data and convert them to an oscillation bandwidth then converts the chart that takes distance on the horizontal axis and oscillation on the vertical axis to a CSV file of which general purpose MS-EXCEL can read. You can open the CSV file on MS-EXCEL and draw a chart on a worksheet. It is useful for railroad track maintenance.
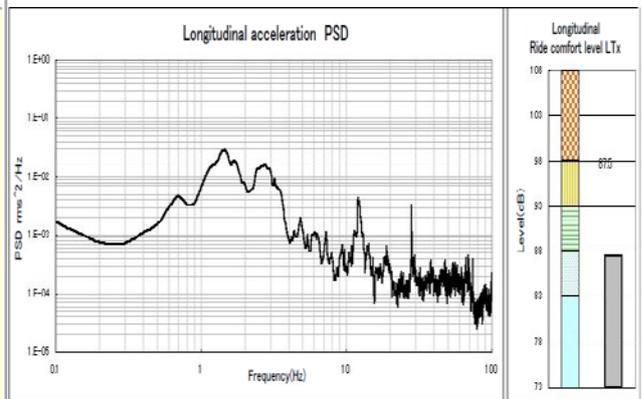
Riding Comfort is Shown in Graphs!

●W0051 Riding Comfort of Vehicles Analysis Software Tool
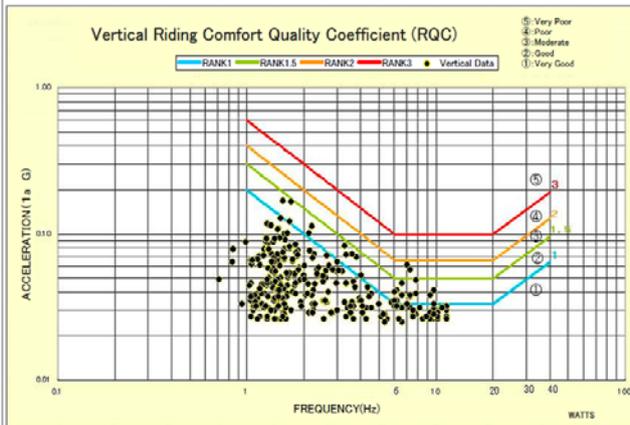
Riding comfort diagram analysis graph

Vertical Ride Quality Coefficient(RQC)

for Vehicle

Rank1 Rank1.5 Rank2 Rank3 ○ Vertical

⑤:Very poor
④:Poor
③:Moderate
②:Good
①:Very good

Amplitude(1a m/s^2) — Frequency(Hz) WATTS

Riding comfort level analysis graph

Longitudinal acceleration PSD

PSD rms^2 /Hz — Frequency(Hz)

Longitudinal Ride comfort level LTx

Level(dB)

●W0048   Railroad Line's Max Value of Movement Point Analysis Software Tool

Riding comfort diagram analysis graph

Vertical Riding Comfort Quality Coefficient (RQC)

RANK1 RANK1.5 RANK2 RANK3 ● Vertical Data

⑤:Very Poor
④:Poor
③:Moderate
②:Good
①:Very Good

ACCELERATION(1a G) — FREQUENCY(Hz) WATTS

List of the Max Value of Movement

List of Extraordinary Large Value(2a)　Theshold:LONGITUDIAL=0.050 LATERAL=0.050 VERTICAL=0.050
Data File Name:1cut_5csv　5/11/2018 9:41:06 AM

Number	Distance(km)	Longitudinal(G)	Frequency(Hz)	Speed(km/h)	RANK
0001.	0000.875	0.050	07.8	120.4	K1
0002.	0000.911	0.056	07.3	122.4	K1
0003.	0001.781	0.052	07.3	126.9	K1
0004.	0000.893	0.056	10.7	121.9	K1
0005.	0001.757	0.060	10.2	126.9	K1
0006.	0002.087	0.056	10.7	116.9	K1

Number	Distance(km)	Lateral(G)	Frequency(Hz)	Speed(km/h)	RANK
0001.	0001.509	0.060	03.4	128.3	K1
0002.	0001.518	0.052	03.5	128.3	K1
0003.	0001.570	0.058	03.3	127.8	K1
0004.	0002.844	0.056	03.5	087.7	K1
0005.	0002.855	0.056	02.7	087.7	K0
0006.	0002.915	0.052	02.8	085.2	K0
0007.	0002.926	0.056	03.9	086.2	K1
0008.	0002.967	0.052	03.2	086.2	K1
0009.	0002.984	0.050	03.9	086.2	K1
0010.	0001.467	0.052	06.0	128.3	K1
0011.	0001.537	0.064	04.8	127.8	K1.5
0012.	0001.560	0.050	05.3	128.3	K1
0013.	0002.770	0.058	06.0	088.2	K1
0014.	0002.813	0.052	04.9	087.2	K1
0015.	0002.837	0.052	04.9	087.7	K1
0016.	0002.843	0.054	07.3	087.2	K1
0017.	0002.938	0.050	05.5	086.7	K1

●W0062   Oscillation Chart File Conversion Software Tool

Oscillation Chart （MS-EXCEL）

Oscillation chart for track manegement   KChart-BT/W0062

| Date | 2007.09.19 | Section | 500km | ～ | 520km |
| Vehicle | 282 | Railroad | AB-C・Down Line | | |

WATTS

SPEED(km/h)

LATERAL Acceleration(G)

LATERAL RCL (dB)

VERTICAL Acceleration(G)

VERTICAL RCL (dB)

＜How to see the graphs＞
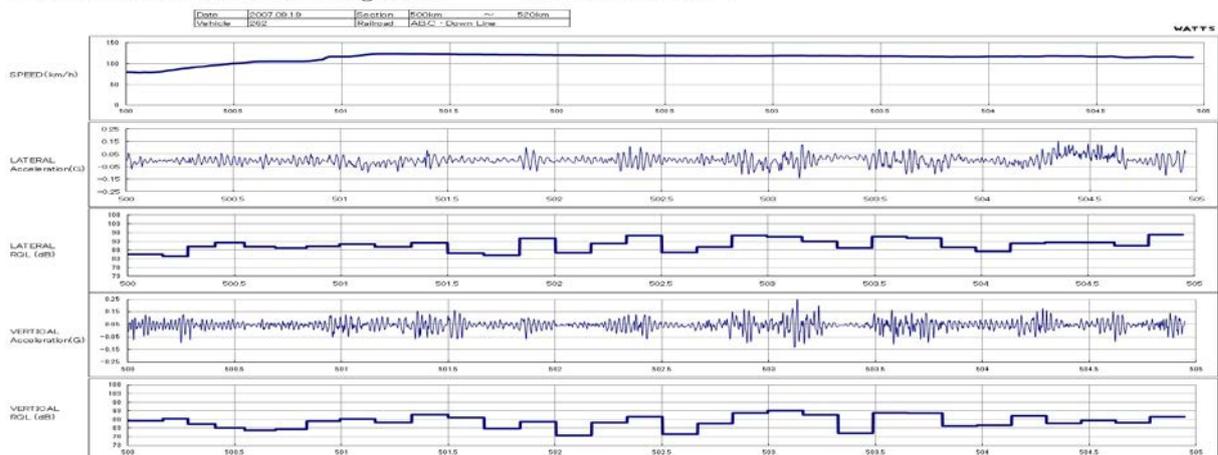
In the left graph of W0051, frequency (Hz) is placed on the horizontal axis and one side amplitude value of oscillation acceleration (m/s^2) is placed on the vertical axis. The right chart shows section's spectral density of oscillation and riding comfort level (dB).

In the left graph of W0048, frequency (Hz) is placed on the horizontal axis and one side amplitude value of oscillation acceleration (G) is placed on the vertical axis. The right is a list of the extraordinary large values the device picked up.   In the graph W0062 shows distance (Km) on the horizontal axis while speed(km/h), horizontal oscillation (G), horizontal riding comfort level(dB), vertical oscillation (G), vertical riding comfort level (dB) on the vertical axis respectively. The chart is drawn by MS-EXCEL. (1G=9.8m／s²)

Human Mind Education Cultivates Safety and Security!

WP00078A 4/4

■W0080C　Compositions

●DAIVING SWAY METER／W0080C

　It is a body of W0080C.　It, when it is put on a floor of railway car, determines impulse on braking and acceleration during driving operation. There are 8 ranks of criteria. Driving skills are determined through the set grade point by each rank. The determination method uses the same principle as the conventionally adopted overturning coefficient of falling pieces.

●REMOTE FOOT SWITCH／78COMFU

Switching operation of W0080C can be alternatively done by foot pedal.

78COMFU

＜ACCESSORIES＞

Nickel Metal Hydride Batteries × 6

Battery Charger × 1

AC Adapter × 1

Storing Case × 1

■Specifications（W0051A・W0077T・W0080C）

Product Name	Rating and Specifications	Product Name	Rating and Performance
W0051A	Acceleration sensor:　Tri-axial Piezoresistance Type,±4.9m/s^2full Sensible frequency bandwidth：DC～125Hz Linearity accuracy：Less than±1% Total processing accuracy：1% (9.8m/s^2full) Sampling frequency：409.6Hz／ch (Fixed) Power: 6 AA-type battery (About 10 hrs.) External input : 1ch, 0V ～ ＋4V（Not available to negative voltage） Outer size：100(W)×125(D)×75(H), about 900g	W0077T	Marker switch：Use in sections where GPS cannot be received.　Can be used for 24 hrs. with 2 AA-type battery. ON Time：About 3V output, OFF time 0V Outer size：66.5(W)×92(D)×28.4(H)mm, about 250g
W0077T	GPS Receiver：outer size φ61mm × thickness 19.4mm Cable length 5m Receiving sensitivity：－185dBW (min) Positioning time：About 5 minutes, at initial stage, about 1minute after Almanac Sampling rate：5Hz Speed accuracy：0.5km/h RMS（While moving at a fixed speed） Speed output rate：Select one among 20km/h／V, 50km/h／V, 100km/h／V and 200km/h/V Speed output range：Select one among 0-80km/h, 0-200km/h, 0-400km/h and 0-800km/h to 0-4V Output impedance：50Ω、S/N ratio: less than -60dB Power: 6 AA-type battery (About 6 hrs.) Outer size：100(W)×122(D)×40(H)mm：About 450g	W0080C	Acceleration sensor: Biaxial Piezoresistance Type：±2.94m/s^2full Total processing accuracy：Less than ±2% Power: 6 AA-type battery (About 20 hrs.) Outer size：100(W)×180(D)×45(H)mm 、About 1.4kg
		Common use Environmental condition	Temperature：0℃-40℃、Humidity：20%-80% Storage temperature：-20℃-70℃ Avoid condensation, corrosive gas, etc. Conforming to JIS E4031-2B、JIS E4032-1A

※W0051A and W0080C are used joint patent license with Railway Technical Research Institute

※ Specifications are subjects to change for further performance improvement.

■ Distributor

■ Manufacturer

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