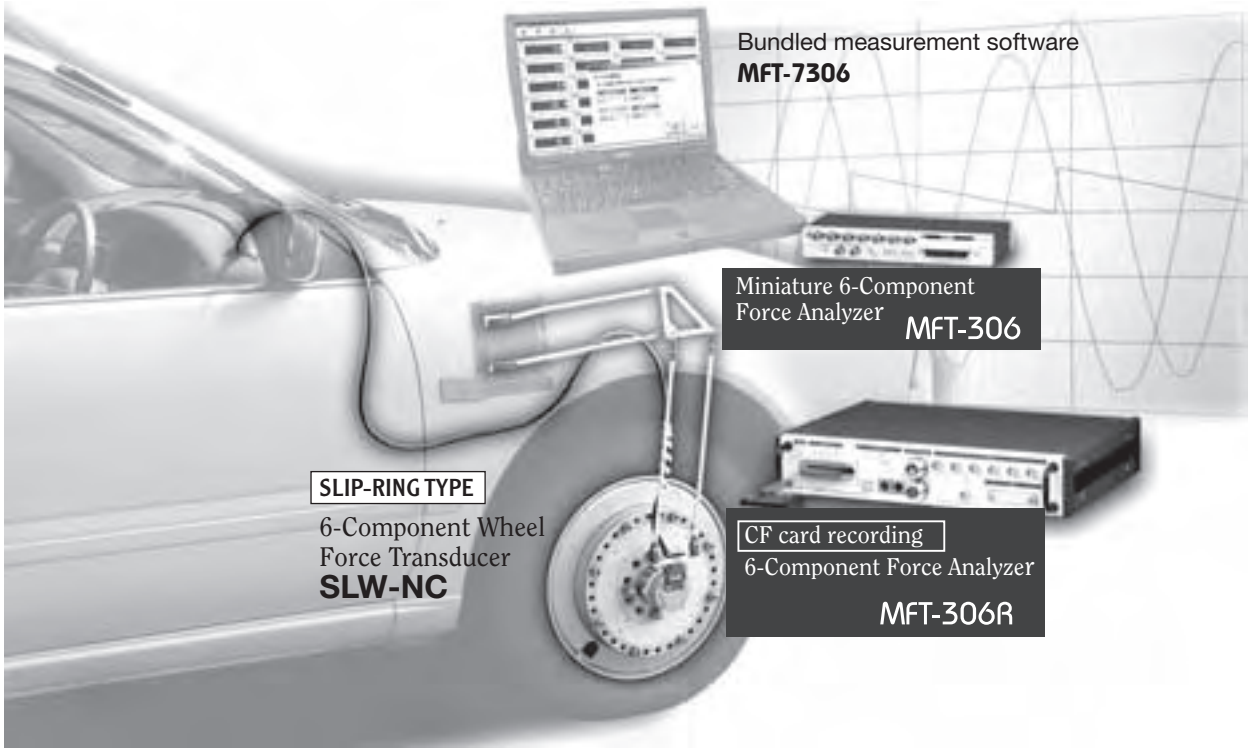
Slip-ring type

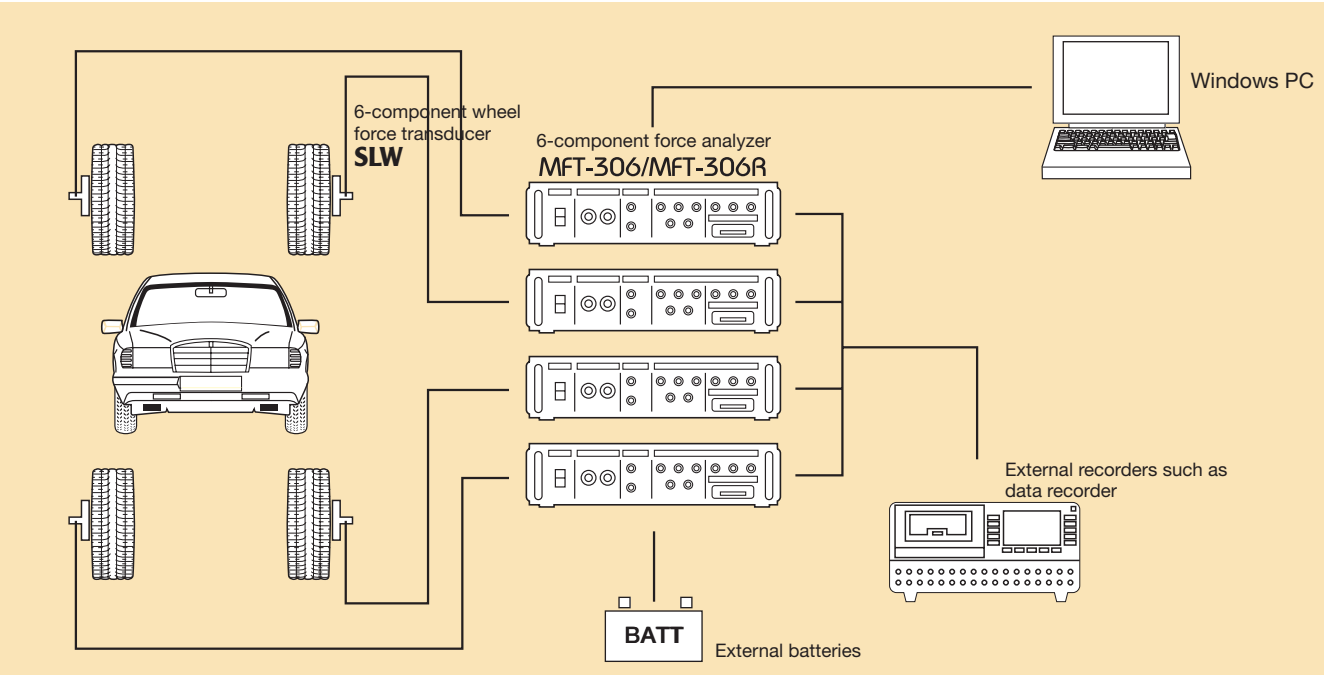
6-Component Wheel Force Measurement



The 6-Component Wheel Force Measuring System is comprised of the 6-Component Wheel Force Transducer and the exclusive 6-component force analyzer. Depending on how the 6-component force is detected, there are two types available, the slip-ring type and the digital telemeter type. The slip-ring 6-Component Wheel Force Measuring System is the combination of the 6-Component Wheel Force Transducer SLW-NC and the 6-Component Force Analyzer MFT-306 or MFT-306R. The MFT-306 is a miniature model (160(W)x25(H)x75(D) mm.)

Setting and monitor viewing are done on a PC, controlling up to 4 analyzers. The other model, MFT-306R, can record measurements using the CF card. After measuring and computing the 6-component force, measurement data and the tire rotation count can be output in voltage form and digitally recorded to the CF card. The CF card can perform recording with up to 4 analyzers synchronously and can also synchronize with the Smart Dynamic Strain Recorder DC-204R.

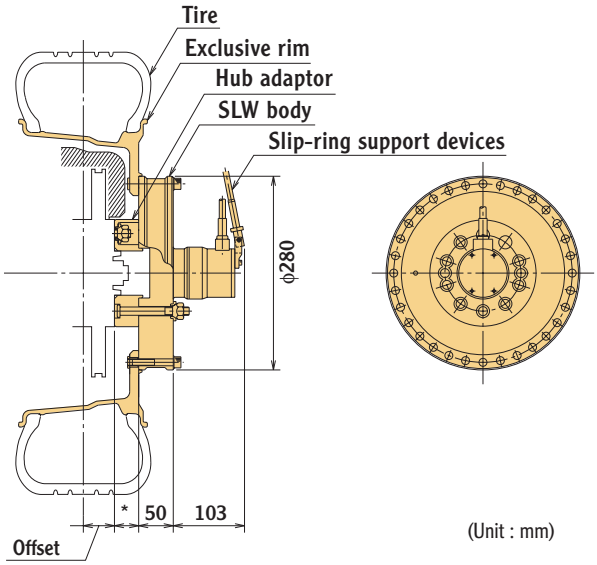
System block diagram



For the details of the Force Analyzer, see page 5.

Slip-ring type

SLW-NC 6-Component Wheel Force Transducer Fx, Fy, Fz 20/30 kN Mx, My, Mz 3/6kN-m



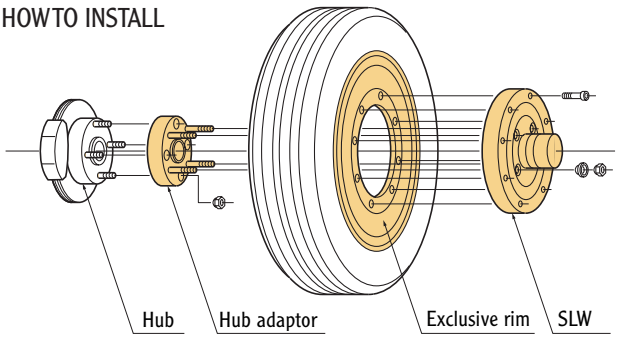
* Somewhat different depending on types of passenger car

The 6-Component Wheel Force Transducer is a thin lightweight load cell, which measures an external force passed to the tires while in motion from the road surface by breaking it down into orthogonal three-component forces and also into three moments around it, can take high-precision measurements in every driving condition using the load detection area in which a strain gauge is strategically applied, the slip-ring and the rotary encoder's fitting area, which are designed with full consideration to vibration resistance, and a waterproof structure. This transducer is used with the exclusive 6-component force analyzer MFT-306/-306R to show the 6-component force with the car body as the reference for the coordinates. The encoder required for the computation of these angles is built in and also the slip-ring hold mechanism for maintaining the encoder at a constant reference position with respect to the car body is provided as an accessory.

Protection ratings : IP 54 equivalent

- **High stability**
- **Light weight**
- **Possible installation to various vehicles using exclusive rim and hub adaptor**
- **Easy fixture to a real car**
- **Waterproof construction making driving in the rain possible**

HOWTO INSTALL



Specifications

Type	SLW-20KNC	SLW-30KNC
Capacity	Fx, Fy, Fz 20kN Mx, My, Mz 3kN-m	Fx, Fy, Fz 30kN Mx, My, Mz 6kN-m
Non-linearity	1%RO	
Hysteresis	1%RO	
Temperature effect on zero	0.02%RO/ °C	
Temperature effect on span	0.01%/ °C	
Overload	Fx, Fy, Fz 150% Mx, My, Mz 130%	Fx, Fy, Fz 130% Mx, My, Mz 130%
Compensated temperature range	-10 ~ +60 °C	
Temperature range	-20 ~ +80 °C	
Maximum rotation	2500 rpm	
Fixing to hub	Using hub adaptor Applicable hub : 100.0-4/100.0-5/114.3-4/114.3-5 holes	
Fixing to tire	Using exclusive rim Applicable rim : 12-in. or larger	
Input/Output cable	ϕ9mm multi-core shielded polyurethane cable 5m	
Weight	5.2 kg.	5.6 kg.

Slip-ring type

6-Component Wheel Force Measurement

Miniature

MFT-306 6-Component Force Analyzer

The Miniature 6-Component Force Analyzer MFT-306 uses the 6-Component Wheel Force Transducers attached to the axle shafts to input an external force passed to the tires from a road surface on the basis of an orthogonal three-component force and also of the three moments around it. After being converted into digital form, the input signals are used to digitally compute the crosstalk correction between each component force and the rotation correction with the encoder's rotation signal. The 6-component force and tire rotation count signals are output in voltage form through the front panel's output connector. Setting and monitor viewing are done on a PC, controlling 6-Component Force Analyzers up to 4 units. After they are set, the analyzer can perform measurements by itself with the PC disconnected.

- *Small and lightweight - Reduction of installation area*
- *High-speed operation of crosstalk, rotation correction, etc.*
- *6-component force data, tire rotation count signal output in voltage form*
- *Forward and backward measurement possible with this encoder*
- *6-Component Wheel Force Transducer characteristics data set by PC*
- *Up to 4 controllable units*

Specifications MFT-306

Interface	RS-232C
Baud rate	19200bps
Data length	8-bit
Parity	none
Stop bit	1-bit
Control	none
Operating environments	0~+50°C, 85% RH or less (No condensation allowed)
Power supply	DC 10~16V 1A MAX.
Anti-vibration Vibration	29.4m/s²
Dimension	160(W) x 25(H) x 75(D) mm (excluding projections)
Weight	500g

CF card recording

MFT-306R 6-Component Force Analyzer

The CF card recording 6-Component Force Analyzer MFT-306R also uses the 6-Component Wheel Force Transducer to measure a 6-component force passed to the tires from the road surface, just like the MFT-306. After computation, the 6-component force measurement data and tire rotation count are output in voltage form and digitally recorded to the CF card. The USB port is used to connect to a PC for various settings, monitoring, and the importing/processing of recorded data. The CF card can perform recording with up to 4 analyzers synchronously and can also synchronize with our DC-204R and DC-204Ra.

- *High-speed operation of crosstalk, rotation correction, etc.*
- *6-component force data, tire rotation count signal output in voltage form*
- *Forward and backward measurement possible with this encoder*
- *6-Component Wheel Force Transducer characteristics data set by PC*
- *Up to 4 controllable units*
- *Start-to-stop data recorded in a CF card*
- *Synchronous recording of up to 4 units and synchronous measuring of up to 8 units when combined with the DC-204R*

Specifications MFT-306R

Interface	USB1.1
Status LD	Power status, Wheel position, Recording status
Operation	Recording START/STOP key
Recording area	
Media	Compact Flash memory card (specified by us) Supplied as standard 128MB Upto 512MB
Format	DADiSP ™/2000 compliant
Speed	500µS, 1mS, 2mS, 5mS, 10mS, 20mS, 50mS, 100mS
Data	START-to-STOP or up to card-full measurements recorded
Power supply	DC 10~16V 1.2A MAX.
Operating environments	0 ~ +50°C, 85% RH or less (No condensation allowed)
Dimension	320(W)x60(H)x220(D)mm (excluding projections)
Weight	2kg

Common specifications

Applicable transducer	6-Component Wheel Force Transducer SLW-NC
Rotary encoder	360 pulses/rev. (A-phase, B-phase) 1 pulse/rev. (Z-phase)
Bridge excitation	DC 4.8V
Balancing range	±2000x10^{-6} strain
Measuring range	±8000x10^{-6} strain
Measuring full scale	±200x10^{-6} strain or equivalent to capacity
Frequency response	DC~400MHz (-3dB±1dB)
Crosstalk correction	
Correction range	±12.7% RO or less
Correction accuracy	±0.05%RO
Offset possion correction	
Offset setting range	-100 ~ 200mm
Correction accuracy	±0.05%RO

6-component force voltage output	
Output	0~5V or -5~+5V (settable)
Output accuracy	±0.2%FS
Tire rotation speed output	
Output	0~5V
Output accuracy	±0.5%FS
Calibration output	
Output	-5V, 0V, +5V (when set to ±5V)
Output accuracy	±0.2%FS
Low-pass filter	
Cutoff frequency	20, 50, 100Hz and PASS
Cutoff characteristics	Bessel type

MFT-7306 Control Software

Setting of the 6-Component Wheel Force Transducer characteristics data	
Type of transducer	Enter the name of the Force Transducer
Serial No.	Enter the serial number of the transducer
Capacity	Enter the capacity of the transducer
Rated Output	Enther the rate output of the transducer
Crosstalk	Enter the crosstalk correction value
MFT-306 measurement condition setting	
Output voltage full scale	Set to 200x10^{-6} strain equivalent to capacity
Output voltage shift	Settable between + to - full scale
Low-pass filter	Select either 20, 50, 100Hz or PASS
Tire dynamic load radius	Enter the dynamic load radius of the tire
Wheel offset	Enter the offset value of the wheel
Monitor	
Switching the number of monitors	Can display to any number of monitors from 1~24
Monitoring channel	Can monitor a desired wheel and channel
Monitoring contents	Fx, Fy, Fz, Mx, My, Mz, Speed monitor value ±peak value shown
List	
List	Shows the 6-Component Wheel Force Transducer's type, serial No., Rated output, Crosstalk correction value, Full scale, Shift, Low-pass filter tire dynamic load radius, Wheel offset
Print	Print the list

System	
Box number	Set the box number of the MFT-306 connected Check the box number of the MFT-306
Balance select	Select either rotation balance or no-rotation balance
Unit select	Select the unit of monitor display (SI unit/ Gravimetric unit)
Serial port select	Select the serial port of the PC
Other	
Version information	Version information of MFT-306 and MFT-7306
Balance	
One-wheel balance	Balance operation of a desired wheel
All-wheel balance	Balance operation of all of the selected wheels
Calibration output	
Output voltage	Select either + full scale output, - full scale output, or 0V output
One-wheel calibration	Calibration output of a desired wheel
All-wheel calibration	Calibration output of all of the selected wheels
Peak reset	
One-wheel peak reset	Reset the ± peak value of all channels of a desired wheel
All-wheel peak reset	Reset the ±peak value of all channels of selected wheels

Monitor examples