

## ELECTRIC VEHICLE xEV MEASUREMENT

DEVELOPMENT AND PRODUCTION

GENERAL



# Introduction to Precision Measuring Instrument Solutions

## Power Control Unit (PCU)

### IGBT (Insulated Gate Bipolar Transistor)

This is a power transistor which is a major component in an inverter. An inverter is an assembly of semiconductor components. A **vision measuring system** is effective for high-speed inspection of minute parts such as chip and bonding wires, and a **measuring microscope** is effective at checking chip bonding solder for cracks.



### PCU Cover

A **CNC coordinate measuring machine** that allows automatic contact measurement of complicated 3D form is used for the PCU cover, which is an aluminum die casting.

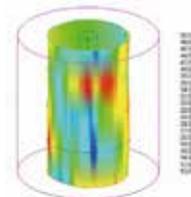


## Motor



### Motor Core

The use of a **vision measuring system equipped with a touch signal probe** allows effective measurement both of discrete pressed components before lamination, and laminated parts. The vision measurement mode is available for thin, flat, discrete components before lamination and the touch probe mode is available for 3D evaluation of twist and displacement of laminated parts. A **roundness/cylindricity measuring instrument** is also effective for measurement of rotor outside diameter and stator inside diameter.



### Coil

A **laser scan micrometer** that allows high speed, high-resolution measurement is effective at measuring the outside diameter of coils used for rotors.



## Battery

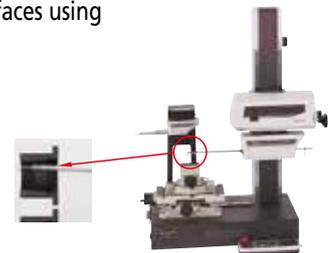
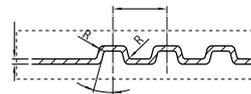
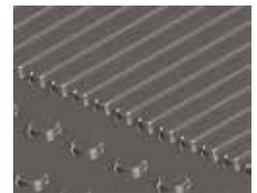
### Lithium-ion Battery

Control over the thickness of the separators that insulate the positive electrode from the negative electrode is absolutely essential for the manufacturing process of lithium-ion batteries (which are subject to explosion or fire risk). The high-accuracy length measuring machine VL-50 is best suited to this thickness measurement thanks to a low measuring force that minimizes distortion of the material. Also, a measuring microscope is used to check for any contamination inside a laminate-type lithium-ion battery.



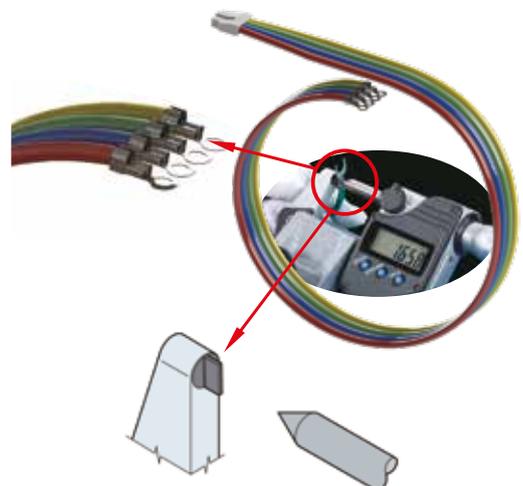
### Fuel-cell Separator

The fuel-cell separator is molded to incorporate flow channels for gas diffusion. The minute-form measuring system UMAP that has a minimum probe-ball diameter of 15 $\mu$ m and an ultra-low measuring force of 1 $\mu$ N (minimum) has achieved high-reliability measurement of features such as corner radius, pitch, and angle. For wall-thickness measurement, a Formtracer is ideal since it allows continuous measurement of top and bottom faces using with a dual-side conical stylus.



### Wiring Harness

A specialized micrometers is used for measuring the height of crimped contacts on wiring harnesses.



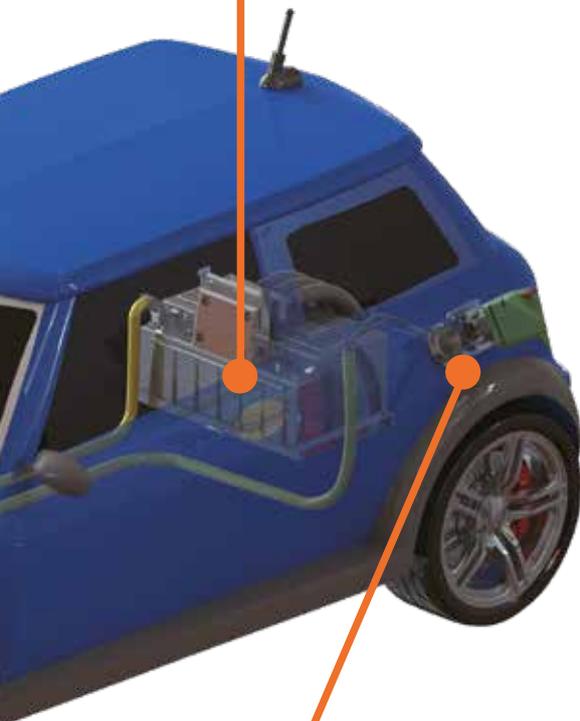
## Battery Charger/ Charger Plug

### In-vehicle Battery Charger

An in-vehicle battery charger includes various parts such as a cover, connector, housing, and relay. Mitutoyo's product lineup - including coordinate measuring machines, vision measuring machines, form measuring instruments, and others - fully cover the many types of measurement required on these components..

### Quick Charger

In order to improve efficiency of the metal terminals in a socket, measurement by a surface roughness tester is effective.

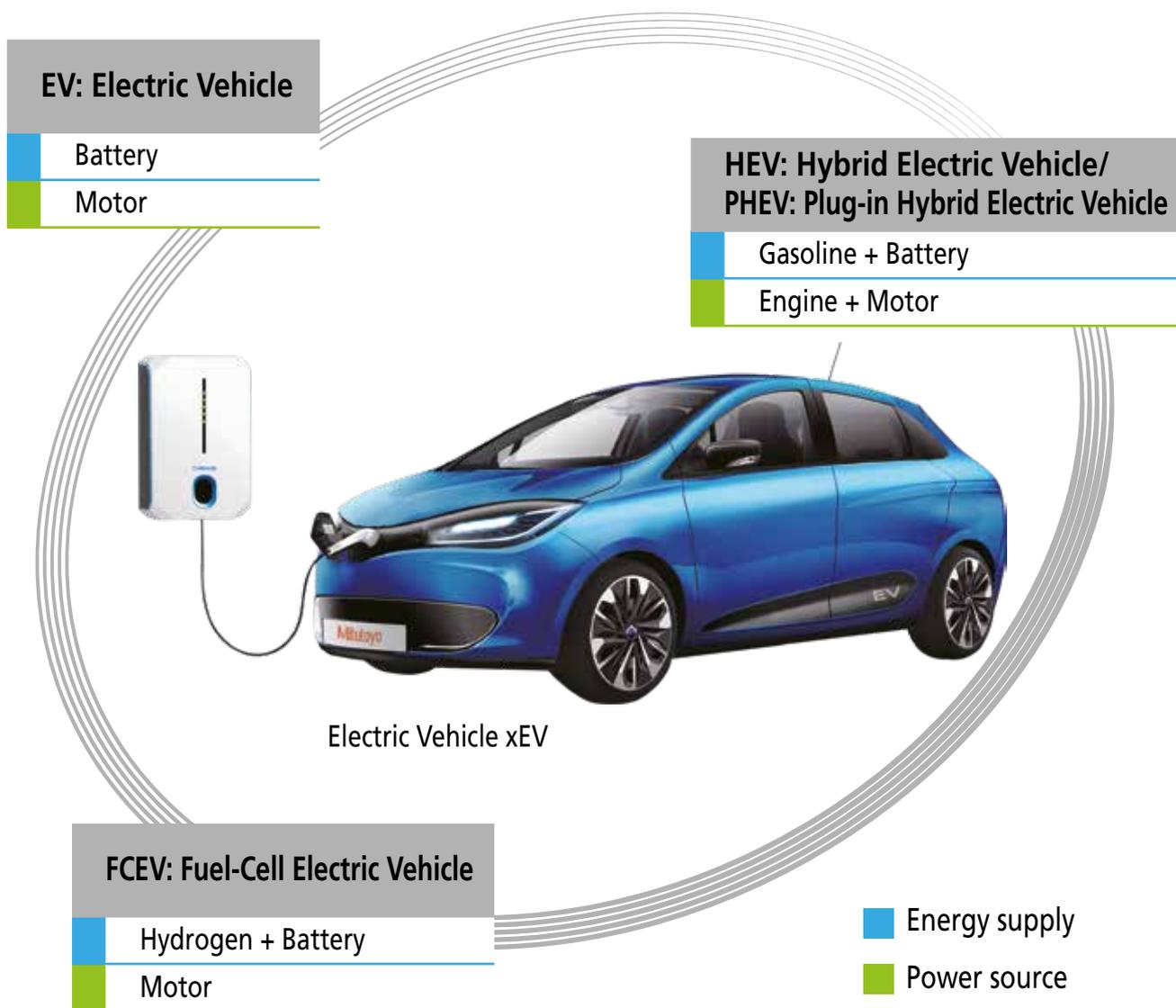


Electric vehicle xEV is the generic name for electromotive vehicles such as a hybrid electric vehicles, plug-in hybrid electric vehicles and fuel-cell electric vehicles as defined by the Agency for Natural Resources and Energy within the Ministry of Economy, Trade and Industry, Japan.

## Solutions to Measurement for Electric Vehicle xEV

Mitutoyo offers solutions to measurement of a wide variety of electric vehicles from research and development to preproduction and mass production.

### Classification of Electric Vehicle xEV



## Precision Measuring Instruments That Support Development and Production of Electric Vehicle xEV

The table below matches Mitutoyo's precision measuring instruments to various applications.

Components		Applications	Coordinate measuring machine	CNC vision measuring system	Minute form measuring system	Form measuring system	Measuring microscope	Precision sensor	Hardness testing machine	Measuring tool
Battery	Lithium-ion Battery	Cover part dimension measurement, surface texture	✓			✓	✓		✓	✓
		Battery case dimension measurement, surface texture	✓	✓			✓		✓	✓
		Separator thickness/width						✓		
	Hydrogen/oxygen fuel-cell separator	Section dimension measurement/observation (presence or absence of contamination)		✓				✓		
		Molded part dimension/form measurement			✓					
		Molded part thickness measurement				✓				
Motor	Motor Core	Mold contour measurement			✓					
		Unlaminated pressed-part dimension measurement		✓		✓	✓		✓	✓
		Laminated-part dimension, various geometric tolerance measurement	✓	✓		✓				✓
	Commutator	Rotational axis runout	✓					✓		
		Peripheral adjacent gap	✓	✓		✓	✓			
		Bearing coaxiality	✓			✓				
Coil	Outside diameter						✓		✓	
	Post-wound form check	✓								
Power Control Unit (PCU)	IGBT*	Various dimensions of power modules	✓	✓		✓	✓		✓	✓
		Various dimensions of semiconductor circuitry		✓			✓			
		Soldered part crack inspection					✓			
	Inverter housing	Bonding wire height		✓						
Battery charger	In-vehicle Battery Charger	Various dimensions of aluminum cabinet, surface texture	✓	✓		✓	✓		✓	✓
		Various dimensions of aluminum cabinet	✓	✓		✓	✓		✓	✓
		Various dimensions of pressed parts	✓	✓		✓	✓		✓	✓
	Quick Charger	Connector pin squareness/roughness	✓	✓		✓				
		Various dimensions of sockets	✓	✓		✓	✓		✓	✓
		Terminal surface texture				✓				
Wiring Harness	Quick Charger	Various dimensions of panels	✓	✓		✓	✓		✓	✓
		Height of crimp contact								✓
		Core wire length/diameter		✓			✓	✓	✓	

\* Insulated Gate Bipolar Transistor

## Industries of Focus: Automotive



Process improvement is very important in automotive manufacturing. Mass production allows manufacturers to refine their process to be more cost effective while reducing the risk of non-conformities. Going paperless is also a large initiative taken by many facilities. MeasurLink® is a great tool for both of these activities. Electronic Data collection and database retention allows for reduced record keeping and instant access to data.

### Continuous Improvement

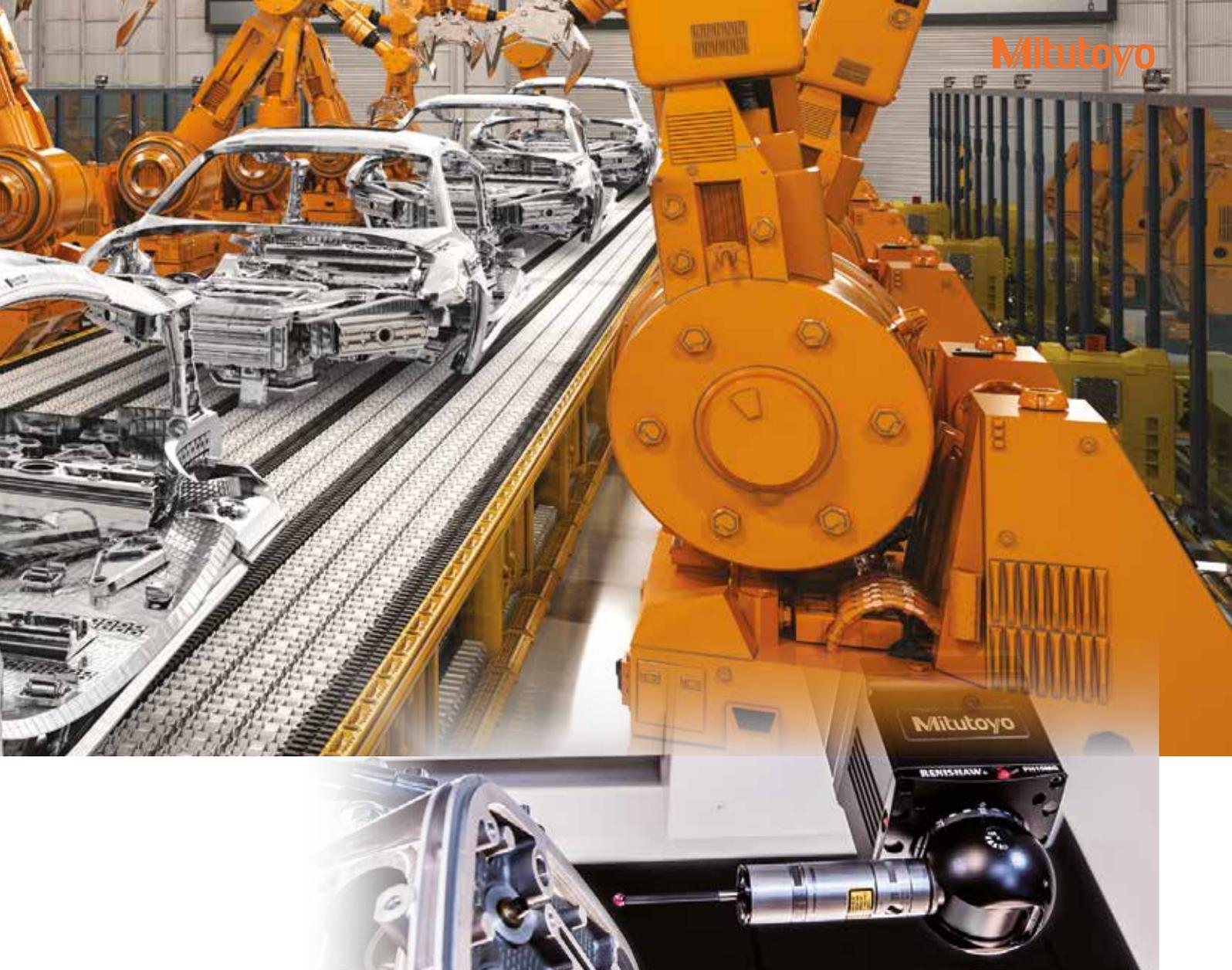


Continuous Improvement activity is nonstop in automotive facilities locally and globally. Constantly improving your process will not only improve the quality of your products, it will also save you money. By having more efficient processes, customer satisfaction will also improve.

Use MeasurLink® to:

- Reduce scrap
- Prevent non-conformities
- Reduce cycle time
- Improve tool life accuracy

**MeasurLink® ENABLED**  
Data Management Software by Mitutoyo

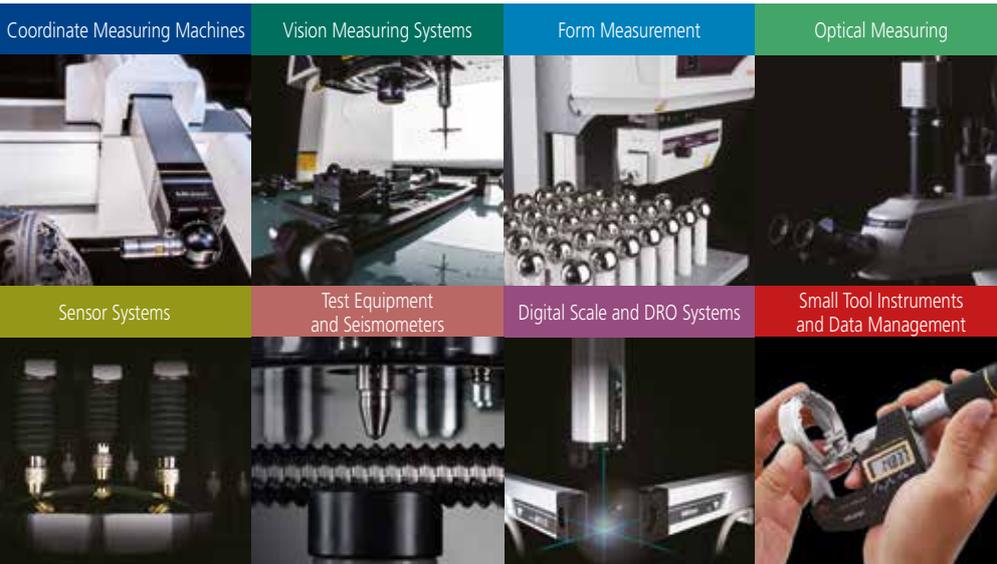


## Reduce the Workload



Reduce the workload associated with managing inspection data. MeasurLink® Real-Time eliminates the need for paper based data collection. Electronic data collection not only enables faster, more accurate data collection, but it also makes reporting, data mining and audit preparation a simpler task.

- Faster inspection times
- More accurate data collection
- Reduced dependency on spreadsheets
- Gather data from electronic gages, RS232 devices, PC based metrology equipment, PLC's and more



**Whatever your challenges are,  
Mitutoyo supports you from start to finish.**

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver bespoke measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.



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