HIOKI

CAN FD
CAN

Controller Area Network

Monitor CAN FD/CAN signals without a sub-harness

No modification of vehicle cables
Acquire CAN data immediately, simply by hooking probes to the cables

No impact on the CAN bus or ECUs
Eliminate testing concerns by using non-contact sensing technology

Accurate, reliable signal capture
Use in a diverse array of development and evaluation applications that demand reliability

C E

3 year Warranty

50-sec.
introductory video

0:00 / 0:52

https://www.youtube.com/embed/XdHYFXRkIQ4?rel=0

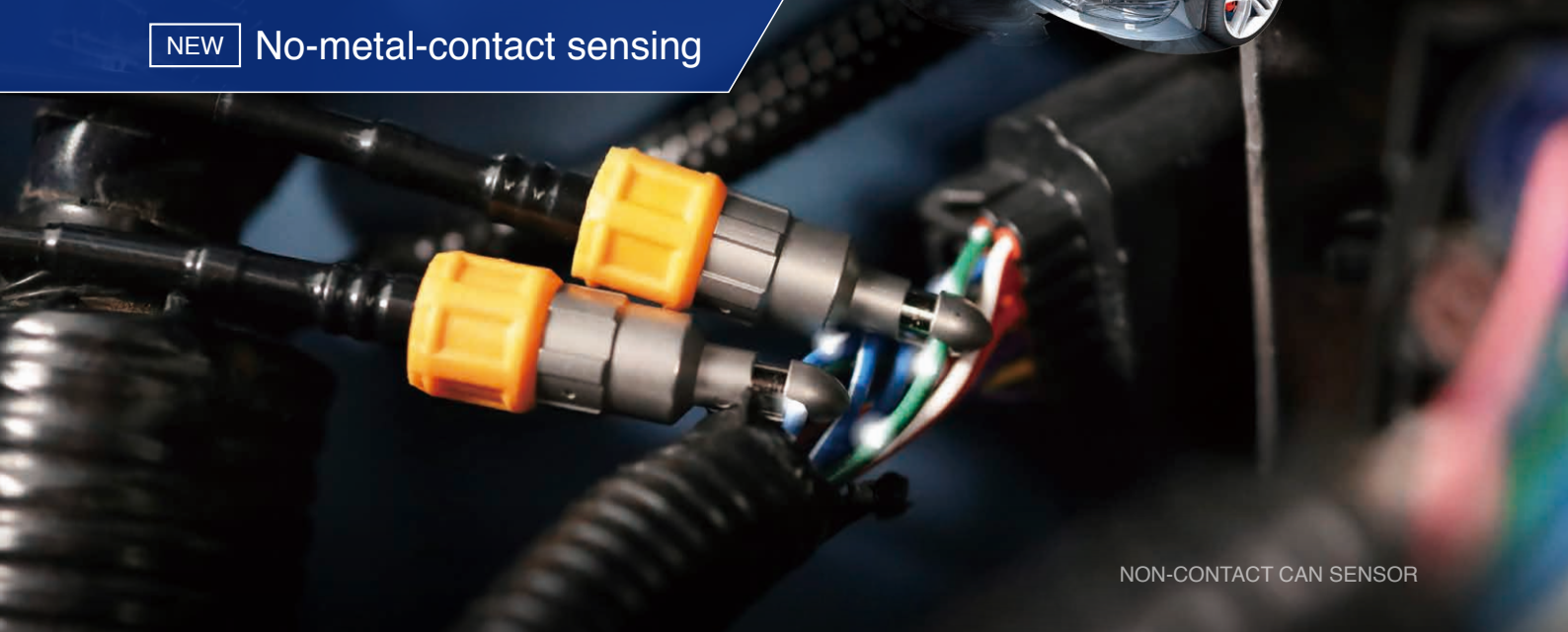# Capture CAN signals without modifying vehicle cables

No-metal-contact sensing

NON-CONTACT CAN SENSOR

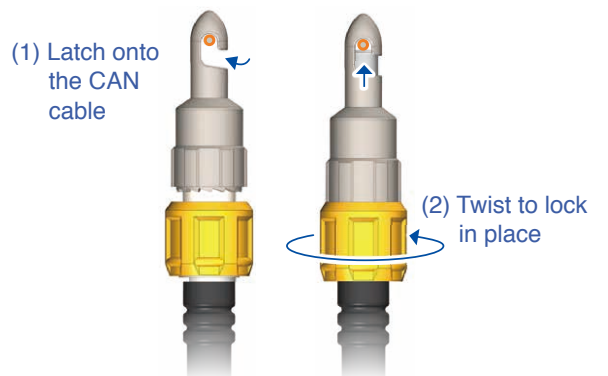## 1 No need for a sub-harness--simply hook probes over cable insulation

New approach means dramatically fewer man-hours

Capture CAN signals without the need to fabricate sub-harnesses or strip back cable insulation so as to significantly reduce the number of man-hours spent on test preparation.
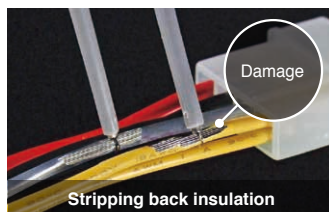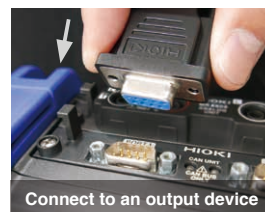
Insulation
CAN signal line

No metallic contact with CAN signal lines

Easy setup

Hook the probes to insulated CAN cables. Now you're ready to acquire signals.

(1) Latch onto the CAN cable

(2) Twist to lock in place

Conventional CAN signal acquisition method

Fabrication man-hours

Damage

Using a sub-harness

Stripping back insulation

**Simply connect and you're all set**

Connect to an output device
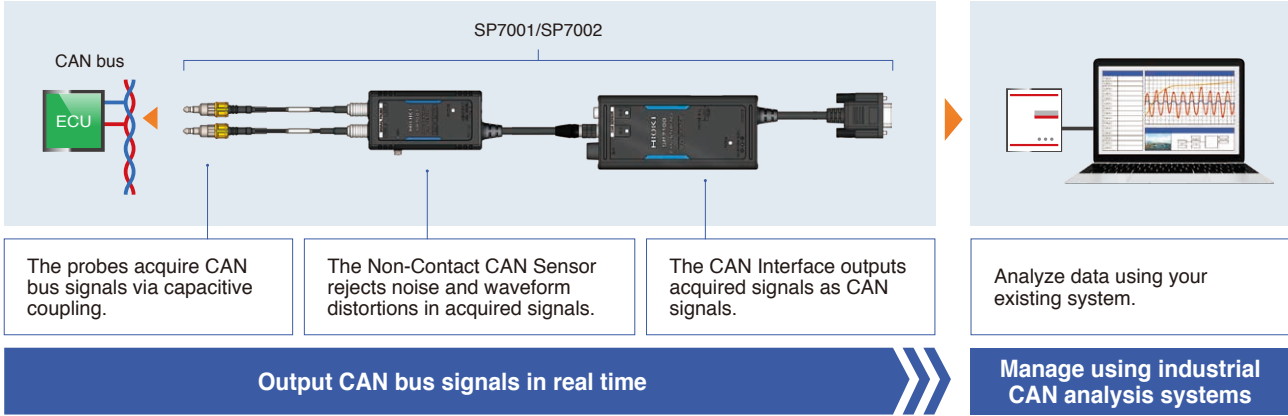
Connect the ground cable

2 Continue using your existing CAN analysis system

Industry-standard CAN output connector pin layout

Customers who already have a CAN analysis system such as those manufactured by Vector Informatik GmbH need only connect the sensor to that system's input terminal (via a D-sub 9-pin connector).
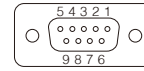
Pin	Assignment
1	CH2 CAN low
2	CH1 CAN low
3	CH1 GND
4	N.C.
5	Shield
6	CH2 GND
7	CH1 CAN High
8	CH2 CAN High
9	N.C.

SP7001/SP7002

CAN bus

ECU

The probes acquire CAN bus signals via capacitive coupling.

The Non-Contact CAN Sensor rejects noise and waveform distortions in acquired signals.

The CAN Interface outputs acquired signals as CAN signals.

Analyze data using your existing system.

Output CAN bus signals in real time

Manage using industrial CAN analysis systems

3 A Non-Contact CAN Sensor engineered to fully meet professional requirements

Wide -40°C to 85°C operating temperature

Acquire CAN signals in environments from -40°C to 85°C (-40°F to 185°F), the temperature range required in vehicle testing

-40°C to 85°C
(-40°F) (185°F)

Use in extreme temperature environments

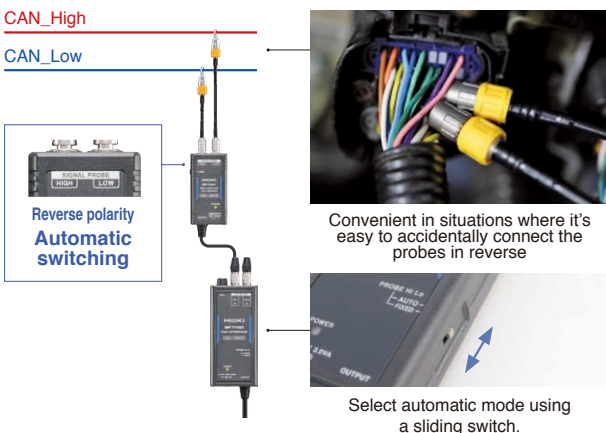### Power with 12 V and 24 V vehicle batteries and other sources

Use a DC power supply with the Power Cable L9500[1], a standard accessory. If using commercial AC power, use the AC Adapter Z1008[2]. [1] Included with the SP7100. [2] Sold separately as an option.

DC power supply			AC power supply
Vehicle battery	Power socket	Portable power supply	Outlet

Connect probes without worrying about CAN bus polarity

If you're using automatic input polarity mode, the SP7001/SP7002 will automatically switch the input polarity to ensure you can capture CAN signals properly, even if the probes are connected in reverse relative to the CAN bus's polarity (CAN_High/CAN_Low).
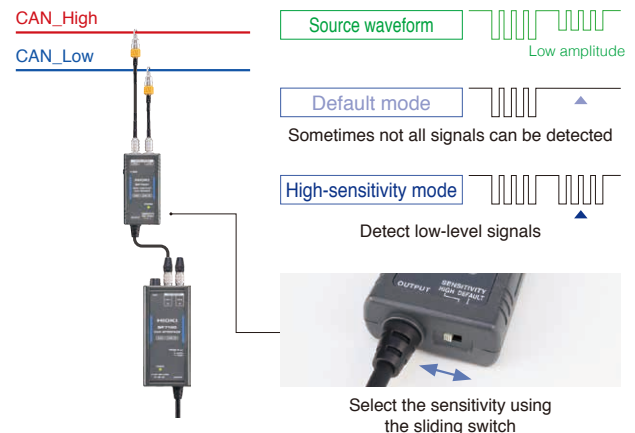
*This function will operate as long as the CAN bus load factor is at least 5%.

CAN_High
CAN_Low

Reverse polarity Automatic switching

Convenient in situations where it's easy to accidentally connect the probes in reverse

Select automatic mode using a sliding switch.

Adjustable sensitivity accommodates a variety of conditions

Use high-sensitivity mode to broaden the detection level when the CAN signal amplitude is low relative to the CAN standard or when you are unable to detect a signal due to cable conditions.
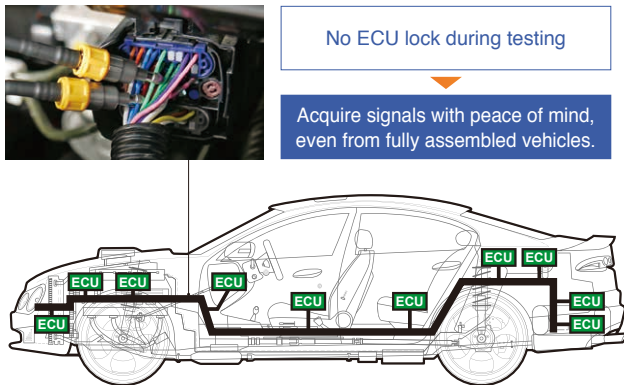
* It is recommended to use default mode under typical situations since it delivers the optimal level of vibration and noise immunity.

CAN_High
CAN_Low

Source waveform — Low amplitude

Default mode — Sometimes not all signals can be detected

High-sensitivity mode — Detect low-level signals

Select the sensitivity using the sliding switch

Eliminate testing concerns
by using non-contact sensing technology

Designed not to trigger ECU security lock-outs

The SP7001/SP7002 acquires signals without changing the electrical characteristics of the CAN bus. Even if the vehicle is equipped with an ECU that has a security lock-out function designed to detect changes in the CAN bus's electrical characteristics, you'll be able to carry out testing without worrying about getting locked out.

No ECU lock during testing

Acquire signals with peace of mind, even from fully assembled vehicles.

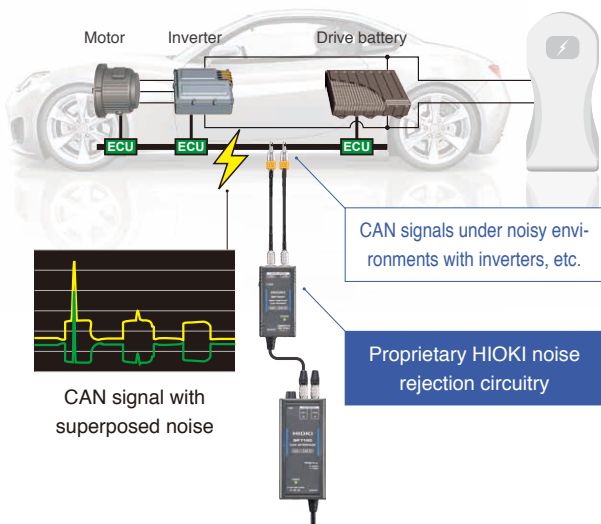ECU ECU ECU ECU ECU ECU ECU ECU ECU

Vibration resistance designed for on-road testing

The sensor delivers noise immunity designed for in-vehicle testing in a variety of road environments. Acquire CAN signals in a stable manner in evaluation testing not only on test courses, but also in vehicles undergoing test-drives on public roads.

Vibration resistance
vibration acceleration: 45 m/s² (4.6 G)

Noise immunity robust enough for use with EVs and HVs

The sensor delivers enough noise immunity to acquire CAN signals in a variety of noise environments. Acquire CAN signals in a stable manner, even with vehicles such as EVs and HVs that rely increasingly on electric equipment.

Motor   Inverter   Drive battery

ECU   ECU   ECU

CAN signals under noisy environments with inverters, etc.

CAN signal with superposed noise

Proprietary HIOKI noise rejection circuitry

Carry out testing on public roads with peace of mind since no vehicle modifications are needed

Because it acquires signals without making electrical contact, the SP7001/SP7002 is ideal for use in tests where CAN bus insulation cannot be modified. Also apply in the development of advanced driver assistance systems (ADAS) and self-driving technology.

Onboard the vehicle

Drive while the sensor is connected to the CAN bus
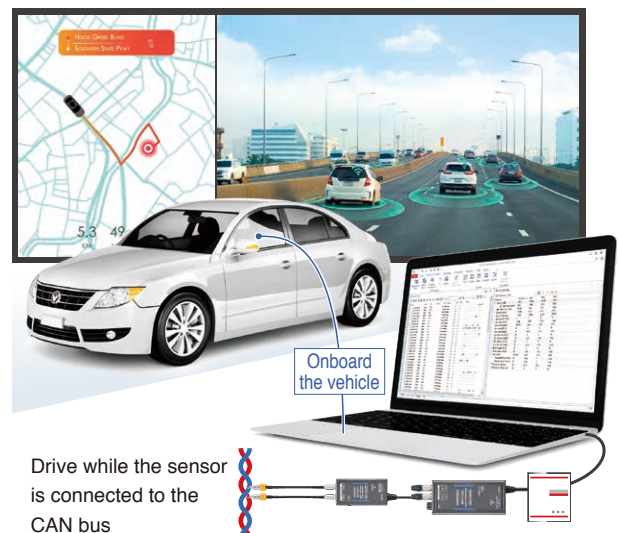
Accurate,
thorough signal capture

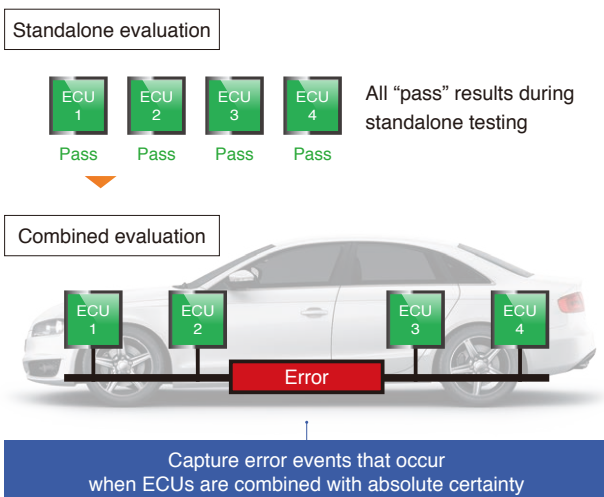## Acquire CAN signals with the same accuracy as the contact method

The non-contact method captures CAN signals reliably and accurately, just like the contact method. In addition, with a CAN signal detection delay of just 130 ns, the sensor delivers real-time performance.

Contact method

Non-contact method

Enlarged waveform
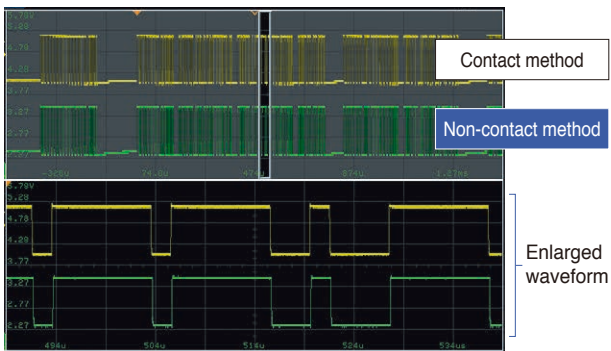
CAN waveform that's identical to one captured using the contact method

Non-contact method also excels with CAN FD high-speed signals

Unlike the contact method, the non-contact method does not distort the original signal when probing the CAN bus. This approach avoids communication errors caused by degraded communications quality.

*Model with CAN FD support: SP7001

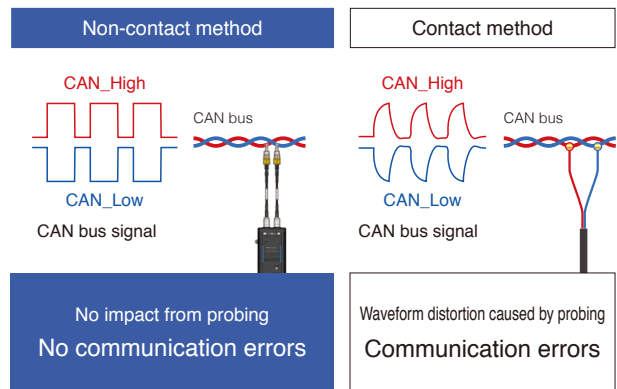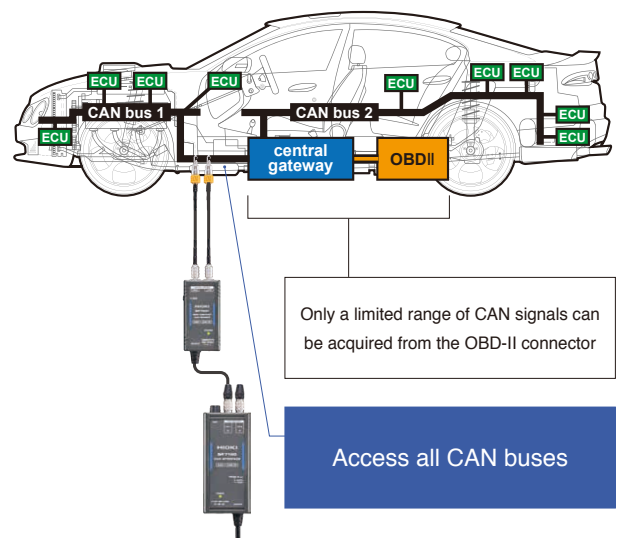| Non-contact method	Contact method
CAN_High	CAN_High
CAN bus	CAN bus
CAN_Low	CAN_Low
CAN bus signal	CAN bus signal
No impact from probing **No communication errors**	Waveform distortion caused by probing **Communication errors**

Reliably capture even infrequent events

The Non-Contact CAN Sensor does not affect the electrical characteristics of the CAN bus, allowing you to reliably catch the occasional CAN error events.

Standalone evaluation

ECU 1	ECU 2	ECU 3	ECU 4
Pass	Pass	Pass	Pass

All "pass" results during standalone testing

Combined evaluation

ECU 1 · ECU 2 · ECU 3 · ECU 4 · Error

Capture error events that occur when ECUs are combined with absolute certainty

Acquire signals without needing to go through a central gateway

Only a tiny percentage of all CAN signals can be acquired from the OBD-II connector that is used in vehicle diagnostics. By using the product with the vehicle's internal CAN bus, you can acquire all CAN signals.

ECU · ECU · ECU · ECU · ECU · ECU · ECU · ECU · ECU · CAN bus 1 · CAN bus 2 · central gateway · OBDⅡ

Only a limited range of CAN signals can be acquired from the OBD-II connector

Access all CAN buses

Example applications

Analysis of vehicles that have more electrical equipment and data

More extensive safety equipment such as ADAS and increasing adoption of self-driving technology are leading to dramatic growth in the number of ECUs in vehicles and in the complexity of CAN buses. Hioki's Non-contact CAN Sensor can be used to easily capture the information you need from complex buses.
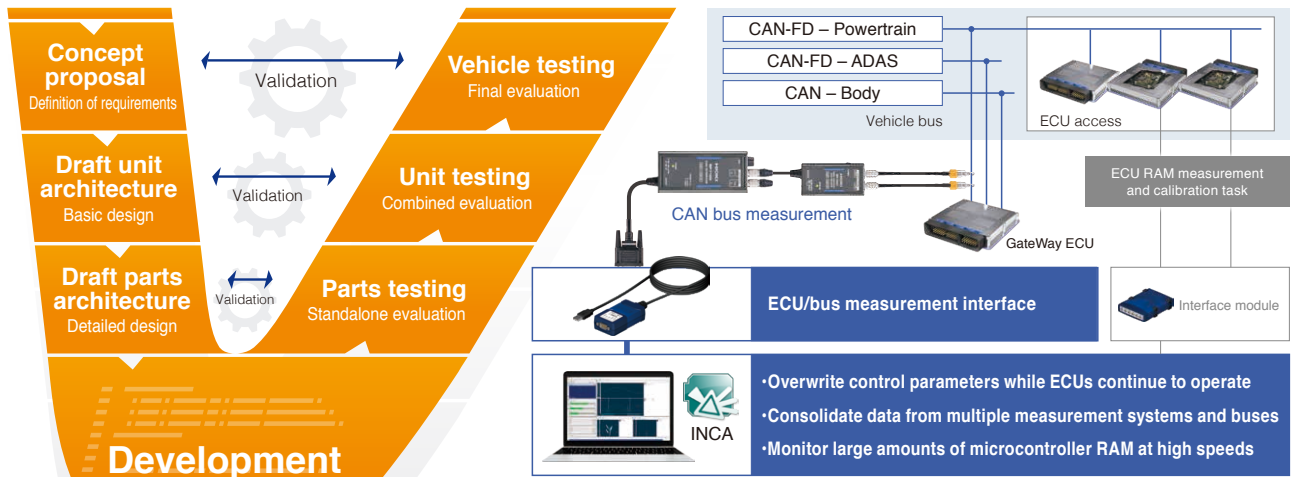

ECU
GPS
Radar
Onboard camera
ECU
Instrument panel
Brakes
ECU
Steering angle
Wheel speed
ESP
Engine
G sensor
ECU
Wheel speed
Water temperature gauge
Air-conditioning control
Throttle
ECU
Radar
TCS
Wheel speed
ECU

For illustrative purposes only

Sensor data decoded from CAN
Example display from Vector's CANalyzer

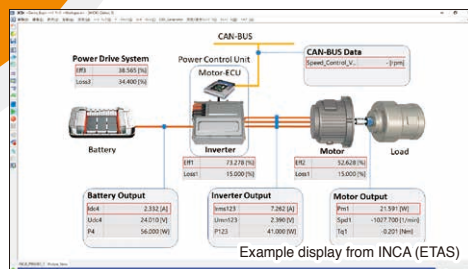**Acquire data such as engine RPM, vehicle speed, and temperature**

Industrial CAN analysis systems

Calibration task in unit and vehicle testing (example for a power control unit)
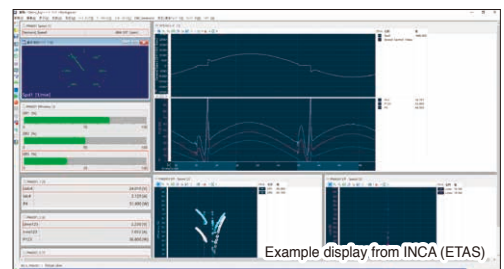
With complex systems such as power control units, in order for manufacturers to perform ECU calibration tasks, they have to monitor CAN bus data exchanged between ECUs, then assess the state of the vehicle. By using the SP7001/SP7002 with an ECU measurement and calibration tool like INCA* from ETAS in such applications, you can easily monitor CAN bus data. As a result, ECU calibration tasks can be performed more efficiently.

Concept proposal
Definition of requirements

Validation

Vehicle testing
Final evaluation

Draft unit architecture
Basic design

Validation

Unit testing
Combined evaluation

Draft parts architecture
Detailed design

Validation

Parts testing
Standalone evaluation

Development

V-model

CAN-FD – Powertrain
CAN-FD – ADAS
CAN – Body
Vehicle bus
ECU access

ECU RAM measurement and calibration task

CAN bus measurement

GateWay ECU

ECU/bus measurement interface

Interface module

INCA

•Overwrite control parameters while ECUs continue to operate
•Consolidate data from multiple measurement systems and buses
•Monitor large amounts of microcontroller RAM at high speeds

Example display from INCA (ETAS)

Power control unit measurement and calibration

Example display from INCA (ETAS)

Comparison of measured values from a connected Power Analyzer PW6001, against CAN data and ECU RAM values

ETAS

*INCA (from ETAS) is an ECU measurement and calibration tool that's capable of simultaneously reading and writing multiple ECU RAM values. Inquiries concerning ETAS tools should be directed to www.etas.com.

Acquire CAN signals used in a broad range of industries

Aircraft

Construction and farming machinery
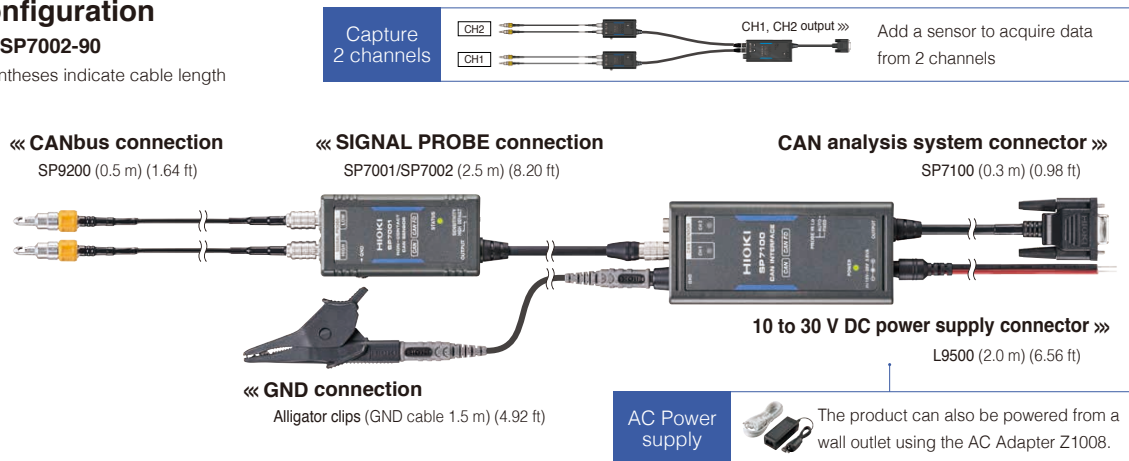

Motorcycles

Industrial robots

Medical devices

IoT systems

Basic configuration

SP7001-90 / SP7002-90

Figures in parentheses indicate cable length

Capture 2 channels
CH2
CH1
CH1, CH2 output »
Add a sensor to acquire data from 2 channels

« CANbus connection
SP9200 (0.5 m) (1.64 ft)

« SIGNAL PROBE connection
SP7001/SP7002 (2.5 m) (8.20 ft)

CAN analysis system connector »
SP7100 (0.3 m) (0.98 ft)

« GND connection
Alligator clips (GND cable 1.5 m) (4.92 ft)

10 to 30 V DC power supply connector »
L9500 (2.0 m) (6.56 ft)

AC Power supply
The product can also be powered from a wall outlet using the AC Adapter Z1008.

Specifications

Detection method	Capacitive-coupled signal detection *No bare-wire connections
Detectable cables	AVS/AVSS-compliant cables External diameter: 1.2 to 2.0 mm (0.05 to 0.08 in)
Number of channels	2 (SP7100)
Compatible communications speeds	SP7001, SP7002: CAN 125 kbit/s to 1 Mbit/s SP7001: CAN FD 125 kbit/s to 3 Mbit/s
Total delay time	130 ns (typical)
CAN terminal resistance	60 Ω (typical), built-in
Signal output connector	D-sub 9-pin female (CH1, CH2)
Operating temperature and humidity range	Temperature: -40°C to 85°C (-40°F to 185°F) Humidity: -40°C to 60°C (-40°F to 140°F), 80% RH or less (non-condensing) 60°C to 85°C (140°F to 185°F), 60% RH or less (non-condensing)
Storage temperature and humidity range	-40°C to 85°C (-40°F to 185°F), 80% RH or less (non-condensing)
Compliant standards	Safety: EN 61010 EMC: EN 61326
Vibration resistance	JIS D 1601:1995 5.3 (1) Class 1: passenger cars; conditions: Class A equivalent 4h along X-axis and 2h along Y- and Z-axes at a vibration acceleration of 45 m/s² (4.6G)

External dimensions	SP7001, SP7002: 44 mm (1.73 in) W × 85 mm (3.35 in) H × 20 mm (0.79 in) D SP7100: 55 mm (2.17 in) W × 120 mm (4.72 in) H × 25 mm (0.98 in) D SP9200: Probe: φ 11.6 mm (0.46 in) × 33.7 mm (1.33 in) H Guard hook: Approx. φ 5 mm (0.20 in) × 11.8 mm (0.46 in) H
Mass	SP7001, SP7002: 180 g SP7100: 130 g SP9200: 26 g *Including cables
Cable length	SP7001, SP7002: 2.5 m (8.20 ft) SP7100: 0.3 m (0.98 ft) SP9200: 0.5 m (1.64 ft)
GND terminal	Banana input terminal
Power supply	Z1008 AC Adapter Rated supply voltage: 100 to 240 V AC Assuming voltage fluctuations of ±10% of the rated supply voltage Anticipated transient overvoltage: 2500 V Maximum rated power: 8 VA (including AC adapter), 3 VA (product only) External power supply Rated supply voltage: 10 to 30 V DC Maximum rated power: 3 VA
Product warranty	SP7001, SP7002, SP7100: 3 years

Example bundles

Number of channels	Capture 1 channel		Capture 2 channels		
CAN standard	CAN FD/CAN	CAN	CAN FD/CAN	CAN FD/CAN	CAN
			CAN FD/CAN	CAN	CAN
Model number (order code)	*CAN FD / CAN* SP7001-90	*CAN* Value SP7002-90	*CAN FD / CAN* SP7001-90	*CAN* Value SP7002-90	*CAN* Value SP7002-90
	—	—	SP9200	SP9200	SP9200
	—	—	*CAN FD / CAN* SP7001	*CAN FD / CAN* SP7001	*CAN* SP7002

Set model

NON-CONTACT CAN SENSOR
SP7001-90
CNA FD / CAN

set content

SIGNAL PROBE SP9200

NON-CONTACT CAN SENSOR SP7001

CAN INTERFACE SP7100 (Includes L9500 and GND cable.)

NON-CONTACT CAN SENSOR
SP7002-90
CAN

set content

SIGNAL PROBE SP9200

NON-CONTACT CAN SENSOR SP7002

CAN INTERFACE SP7100 (Includes L9500 and GND cable.)

Value
Take advantage of bundled pricing rather than purchasing individual products separately.

System components and options

SIGNAL PROBE SP9200
Set of 2

NON-CONTACT CAN SENSOR SP7001
CAN FD CAN
CAN FD/CAN support

NON-CONTACT CAN SENSOR SP7002
CAN
CAN support

CAN INTERFACE SP7100
Includes L9500 and GND cable.

POWER CABLE L9500
For supplying 10 to 30 V DC

AC Adapter Z1008
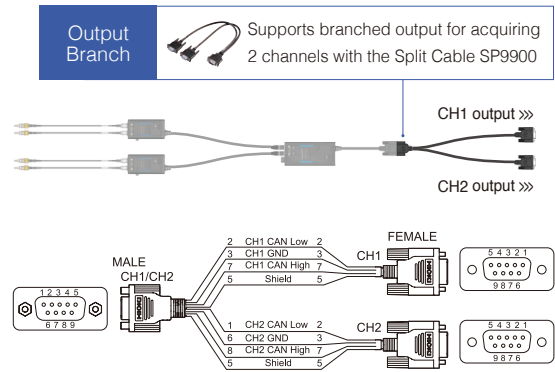For supplying 100 to 240 V AC

SPLIT CABLE SP9900
For branched CH1/CH2 output

CARRYING CASE C1013
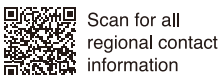Hard case with space for 2 channels

About the Split Cable SP9900

If the input interface provided by the device you plan to use does not support 2-channel input, use the SP9900 Branch Cable.

Output Branch — Supports branched output for acquiring 2 channels with the Split Cable SP9900

CH1 output ⟫⟫

CH2 output ⟫⟫

MALE CH1/CH2
1 2 3 4 5
6 7 8 9

2	CH1 CAN Low	2
3	CH1 GND	3
7	CH1 CAN High	7
5	Shield	5

FEMALE CH1
5 4 3 2 1
9 8 7 6

1	CH2 CAN Low	2
6	CH2 GND	3
8	CH2 CAN High	7
5	Shield	5

CH2
5 4 3 2 1
9 8 7 6

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