# Keysight AP1200A Multi-Protocol Vehicle Network Interface



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TECHNOLOGIES

User Guide

# Notices

## Safety Information

**CAUTION**

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

**WARNING**

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

# Regulatory Markings

| | | | |
|---|---|---|---|
|  | The RCM mark is a registered trademark of the Australian Communications and Media Authority. |  CAN ICES/NMB-001(A) ISM GRP 1-A | The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.<br><br>CAN ICES/NMB-001(A) indicates that this ISM device complies with the Canadian ICES-001.<br>Cet appareil ISM est conforme a la norme NMB-001 du Canada.<br><br>ISM GRP 1-A indicates that this is an Industrial Scientific and Medical Group 1 Class A product. |
|  | This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product. |  **R-R-Kst SP21778** | This symbol is a South Korean Class A EMC Declaration.<br><br>This is a Class A instrument suitable for professional use and in electromagnetic environment outside of the home.<br>이 기기는 업무용(A급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며, 가정 외의 지역에서 사용하는 것을 목적으로 합니다 |
|  | DECLARATION OF CONFORMITY According to EN ISO/IEC 17050-1:2010 | | |

# Waste Electrical and Electronic Equipment (WEEE)



The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation.

Please refer to keysight.com/go/takeback to understand your trade in options with Keysight in addition to product takeback instructions.

# South Korean Class A EMC Declaration

Information to the user:

This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference.

| A 급 기기 ( 업무용 방송통신기자재 ) |
| --- |
| 사 용 자 안 내 문 |
| 이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다. |

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# 1    Product Inspection

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# Check the Product

Upon receiving the AP1200A Multi-Protocol Vehicle Network Interface from Keysight Technologies, perform the following product inspection:

– Inspect the outer shipping container, foam-lined instrument case, and product for damage.

– Retain the outer cardboard shipping container until you have inspected the contents of the shipment for completeness, and you have checked the product mechanically and electrically.

– Locate the shipping list and verify that all items ordered were received.

## Package Contents

**Standard Items:**



AP1200A

32 GB Micro SD Card

USB 2.0 (A/B) Cable

μDB-9F to DB-9M
Cable Adapter

AP1200A-J45

AP1200A-DB9

**Optional Items:**

AP1200A-MUL

AP1200A-DIP

AP1200A-GMP

**Figure 1-1**     AP1200A Package Contents

Your Multi-Protocol Vehicle Network Interface package contains the following:

### Standard Items:

– One AP1200A Multi-Protocol Vehicle Network Interface device
– One 32 GB Micro SD card
– One USB 2.0 (A/B) cable (2 meter)
– One µDB-9F to DB-9M Cable Adapter (1 meter)
– AP1200A-J45 Ethernet adapter cable, DB-26F- DB-25M, DB9(M)- RJ-45 (0.3 meter)
– AP1200A-DB9 DB-26HD cable F to 12x DB-9M + 1x RJ-45 + 2x Banana Plugs (for benchtop use) (1 meter)

You will also receive a "Startup Guide" card to help you get going quickly with your device.

| **NOTE** | While the USB cable in the AP1200A package uses industry-standard connectors and pinouts, not all USB cables are the same. To ensure reliable operation, use the cable included with the AP1200A. If you need to replace the original, be sure not to use one longer than 6" (2 m), or you may experience problems with your hardware. If necessary, contact Keysight for a replacement. |
|---|---|

### Optional Items:

– AP1200A-MUL DB-25F to OBD-II
– AP1200A-DIP OBD Cable with DoIP support, HD26F to DB25M, DB9M to OBD-II
– AP1200A-GMB DB-26HD to OBD x2
– AP00000A-SPY Vehicle Spy 3 Enterprise (Full Version)

If anything is missing, contact Keysight Technologies "Service and Support" on page 96 for prompt assistance.

The Vehicle Spy 3 Enterprise (Full Version) comes with the following:

– A copy of Vehicle Spy vehicle network software

– Drivers for the AP1200A

– An API install kit containing the neoVI Explorer utility for configuring the device

– Documentation materials

Vehicle Spy (often abbreviated as VSpy), termed as the "Swiss army knife" of automotive networking tools allows you to monitor and transmit on vehicle networks easily. VSpy includes capabilities for ECU simulation, data acquisition, scripting, diagnostics, data analysis, and much more.

The AP1200A and VSpy work together hand in hand. Keysight recommends purchasing a VSpy license to go along with your new hardware. Install AP00000A-SPY Vehicle Spy or use a limited Vehicle Spy Trial, available from Keysight's partner, Intrepid Control Systems here.

It is also possible to control the AP1200A from within other software using one of the APIs that the device supports

## Visual Inspection

Be sure to inspect all instrument cables, Ethernet cables, and devices carefully before making a connection. Inspect all cables and connectors for metal particles, scratches, deformed threads, dents, or bent, broken, or misaligned center conductors. Do not use damaged cables.

1      Product Inspection

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# 2 Introduction and Overview

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# Introduction

The AP1200A is a general-purpose interface tool, providing access to multiple channels of CAN, LIN, and other vehicle networks. The AP1200A can be used for standalone logging based on precise specifications, to monitor and transmit on networks, and create custom simulations for network analysis and troubleshooting.

The AP1200A provides more CAN channels, superior performance, more robust case and connectors, far larger script space, the ability to download data from the included SD card over USB, and support for a wider input voltage range. It also adds new revolutionary features to the world of vehicle networking tools, such as support for CAN FD, Automotive Ethernet and DoIP, individual multi-color network activity LEDs, USB device hosting, and much more.

# Product Specifications

The following are the product specifications for the AP1200A Multi-Protocol Vehicle Network Interface and its key internal components.

## Dimensions and Weight

Table 2-1 shows the AP1200A Multi-Protocol Vehicle Network Interface's dimensions and weight.

**Table 2-1**     Dimensions and Weight for AP1200A

| Physical Quantity | Measurement |
|---|---|
| Length | 5.433" (138.0 mm) |
| Width | 3.492" (88.7 mm) |
| Depth | 1.535" (39.0 mm) |
| Product weight | 10.6 oz (300 g) |
| Product shipping weight | 31.7 oz (900 g) |

## Other Specifications

Table 2-2 shows the AP1200A Multi-Protocol Vehicle Network Interface's other specifications.

**Table 2-2**     Other Specifications for AP1200A

| Specification | Description |
|---|---|
| Housing materials | Anodized aluminum and rubber |
| Product rating | 3 W |
| Operating temperature range | 23 °F (-5 °C) to 140 °F (60 °C) |
| Operating humidity | 50% to 80% RH |

# Operational Overview

The AP1200A is a compact but powerful hardware tool for working with vehicle networks. Its operation broadly consists of three categories:

– network interfacing

– data acquisition and logging

– simulation and scripting

## Vehicle Network Interfacing

One primary function of the AP1200A is to act as an interface between vehicle networks and a standard PC. Using the provided cables, you can connect the AP1200A to either a bench test setup or an actual vehicle, and monitor live network activity. All channels are captured simultaneously and are hardware time-stamped with great accuracy. The AP1200A transfers data from the attached networks over a USB connection. View the data via software such as the VSpy.

## Data Acquisition and Standalone Logging

The AP1200A enables the acquisition of data from networks with precise control over collection parameters. It is designed to operate not just when connected to a PC, but also in standalone mode, running independently within a vehicle. You can write custom scripts that run in real-time, logging data to the included microSD card. You can later download this data to the PC for analysis, and this can be done conveniently over USB without the need to remove the card.

## Simulation and Scripting

The AP1200A not only allows you to receive data from vehicle networks but also to transmit on them. Using VSpy or other software, you can define transmit messages with custom data and send them manually or on a schedule of your choosing. You can also write intelligent scripts that implement arbitrary logic, and compile them into CoreMinis that run within the AP1200A. This functionality allows you to create specialized test scenarios, and to simulate ECUs and gateways. It is also possible to reflash ECUs using data from the AP1200A's microSD card.

# Summary of Key Features

With the AP1200A, Keysight fits a lot of power and functionality into a tough little package. To give you an idea of how much you can do with the AP1200A, the following details a summary of the device's most important design, construction, operational, and performance features.

## Construction, Controls, and Cabling

The following details the construction, controls, and cabling of the AP1200A:

- Compact design
- Light weight
- Solid anodized aluminum case
- Thick rubber end boots for shock protection
- Ruggedized metal connectors
- Cable interfaces on sides for easier connections
- Multiple cable options for vehicle networks, including Ethernet, DoIP, and OBD-II
- Top membrane interface with network and logger status LEDs and two pushbuttons
- Ability to control LEDs and pushbuttons in custom scripts

## Power and Performance

The following details the power and performance of the AP1200A:

- Fourth-generation architecture, offering superior performance
- Memory updated to 32 MB and on-board flash to 64 MB, allowing much more space for scripting and buffering
- Field-upgradeable firmware
- Support for 4.5 V to 40 V input power
- Built-in five-second uninterruptible power supply to ensure graceful shutdown on power loss

- Ability to configure the device and download SD card data on the desktop only using USB power
- Low power consumption

## Network Interfaces and Features

The following details the network interfaces and features of the AP1200A:

- 6 dedicated DW CAN channels (ISO 11898-2): 5 Dual Wire HS CAN, 1 Dual Wire MS CAN
- 2 selectable CAN channels: 2 additional Dual Wire HS CAN, or 2 Single Wire SW CAN, or 2 Low-Speed Fault-Tolerant LSFT CAN (ISO 11898-3)
- All Dual Wire CAN channels have CAN FD support
- Initial support for non-ISO CAN FD, with ISO CAN FD upgrade included when it is available
- Software-programmable CAN termination
- 4 LIN channels
- 2 MISC I/O channels, for analog / PWM configuration
- Software-configurable CAN and LIN channel enable/disable, baud rates and other parameters
- 10/100 Ethernet with low power mode and activation line
- Ethernet link usable for DoIP/XCP, or to connect to Automotive Ethernet BroadR-Reach (100BASE-T1) network through Keysight APM0100E 100BASE-T1/Ethernet Media Converter (sold separately)
- Real-time clock for 64-bit message timestamping

## Logging and Simulation

The following details the logging and simulation of the AP1200A:

- Fully-programmable scripting and standalone logging functionality
- SD card logging of all traffic
- Software-configurable sleep mode
- Low power modes

- Comatose support; all 12 CAN transceivers, all 4 LIN channels, USB, or the membrane keypad can trigger device wakeup

## PC Interface and SD Card Support

The following details the PC interface and SD card support of the AP1200A:

- High-speed isolated USB connection protects the PC from potential damage
- Support for microSD cards up to 128 GB in size
- Data can be unloaded from the microSD card via USB without the need to remove the card, or via the included card reader
- Download speeds of up to 3.2 MB/s
- Firmware-based SD card presence and card door detector

## Advanced Features

- Device control by external software using three open APIs: neoVI DLL, SAE J2534, and TMC RP1210 A/B
- USB host slot for hardware expandability, such as powering a Keysight APM0100E 100BASE-T1/Ethernet Media Converter or using a neoVI MIC 2 microphone/trigger pendant available from Intrepid Control Systems

# Hardware and Software Requirements

Using the AP1200A only requires a small amount of hardware:

– A vehicle network, either within an actual vehicle or in a test bench environment.

– A DC power supply capable of providing 4.5 V to 40 V of DC power, with a nominal current of 250 mA at 12 V. Your network setup must include wiring capable of providing this power on pin 25 of a female DB-25 connector that connects to the AP1200A cable; see Chapter 8, "Reference for Connector Pinouts and Cable Signal Mappings" for pinout details.

– A PC with an open standard USB 2.0 (or higher) port. You can use a USB hub, but Keysight recommends that this be a powered hub to ensure that it provides sufficient power.

Some uses of the AP1200A that may require additional hardware:

– Interfacing to a BroadR-Reach (100BASE-T1) Automotive Ethernet network requires a Keysight APM0100E 100BASE-T1/Ethernet Media Converter or similar media converter device.

– Additional cables may be needed to connect the AP1200A depending on the nature of the network.

Vehicle Spy Professional is recommended for use with the AP1200A and provides everything you need to set up your hardware and use all of its capabilities. The setup program for VSpy will also install the necessary drivers for your AP1200A. If you do not have a VSpy license, you can use the VSpy trial version for basic network interfacing and driver setup. Use the API kit installer to set up drivers. Download them the VSpy trial version here. Refer to the installation instructions in Chapter 4, "Hardware and Software Setup". Alternatively install the driver available from www.keysight.com/find/AP1200A on the technical support tab.

Refer to the VSpy documentation for its more specific PC hardware and operating system requirements and recommendations.

| NOTE | VSpy will run on most modern Windows-based PCs. |

# 3     Hardware Overview

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## Overview

The design of the AP1200A is with all of its connectors located on its sides, making the device easier to use in cramped quarters. There is the left side and right side of the unit, as oriented when facing the device with its top label text.

**WARNING**    The AP1200A is a complex device that does not contain any user-serviceable parts. Do not attempt to open the case of the AP1200A, or you risk possible injury or damage to the unit.

# Case and Overall Design

A sturdy black-anodized metal case encloses the AP1200A. The device has been designed and tested for in-vehicle use. Refer to Figure 3-1 for a top view of the AP1200A.

Connectors and ports are often a point of failure with hardware devices. To ensure that the AP1200A provides you with years of reliable service, Keysight has ruggedized the physical interfaces on the device by using reinforced metal connectors.

To further protect the device against bumps and drops, it has rubber bumpers on both ends. These bumpers are removable, but there is no need to do this under normal circumstances, and Keysight recommends that you leave them in place.



**Figure 3-1**     AP1200A Top View

The bottom of the AP1200A contains useful reference information, including the device serial number, pinouts of its HD-26, and μDB-9 connectors, as shown in Figure 3-2. Pinouts for all AP1200A connectors and cables are in Chapter 8, "Reference for Connector Pinouts and Cable Signal Mappings".



**Figure 3-2**    AP1200A Bottom View

| NOTE | The AP1200A's miscellaneous I/O channels are "EMISC 1" and "EMISC 2". |
| --- | --- |

# Left Side Interfaces and Connectors

The left side of the AP1200A contains two components: the HD-26 connector and a set of red and green LEDs as shown in Figure 3-3.



HD-26 Network Interface Connector

Red and Green Status LEDs
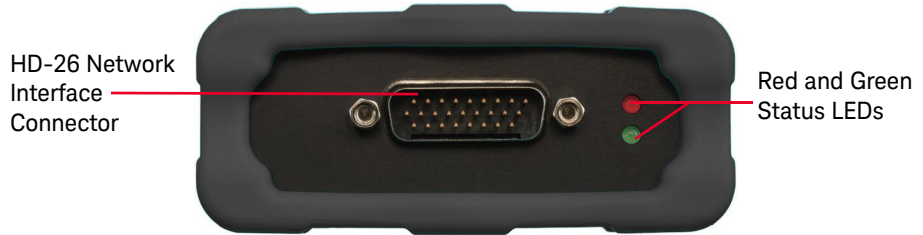
**Figure 3-3**     AP1200A Left Side View

## HD-26 Network Interface Connector

This male, high-density, 26-pin D-subminiature connector is the primary means by which the AP1200A interfaces with vehicle networks. One of two network interface cables is connected to this port, enabling CAN, LIN, and Ethernet messages to pass between the network and the AP1200A. This connector also provides primary power to the device.

## Red and Green Status LEDs

You can determine the status of the AP1200A by observing the blink pattern of these two LEDs. The patterns here will be identical to those seen in the keypad button LEDs on the top membrane panel detailed in "Membrane LED Display and Keypad" on page 34. The membrane LEDs are more convenient to use, but Keysight preserved the traditional side panel LEDs for those accustomed to them from working with the earlier device.

# Right Side Interfaces and Connectors

This side of the AP1200A contains most of its connectors, ports, and slots, as shown in .

Micro-SIM Slot and Cover                     USB "B" Connector



μDB-9 (Micro DB-9)      USB Host Port      microSD Slot and Cover
Connector
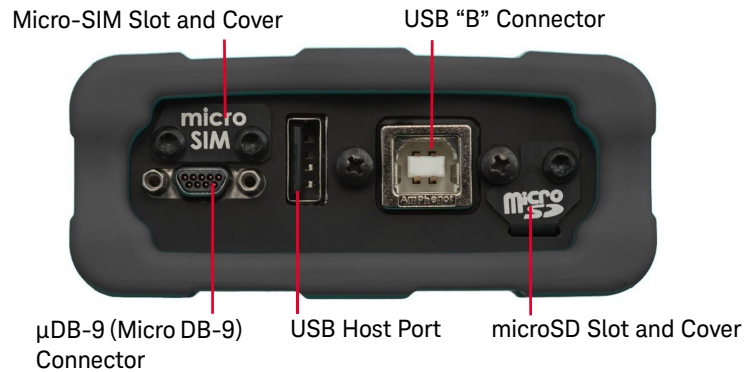
**Figure 3-4**        AP1200A Right Side View

### USB "B" Connector

The "square" connector for USB devices that use detachable cables. Standard "rectangular" connectors found on PCs are "A" connectors. As such the cable supplied with the AP1200A is a "USB A/B cable".

### μDB-9 (Micro DB-9) Connector

The connector carries LIN and miscellaneous I/O signals to and from the AP1200A. Using a micro DB-9 allows the device to be more compact; the cable provided converts this smaller connector to the standard DB-9 commonly used in the automotive industry.

### USB Host Port

The USB "A" connector allows the AP1200A to act as a USB host so that other devices can plug into it. Refer to "USB Host" on page 66 for more details.

## microSD Slot and Cover

This slot holds the microSD card that stores data logged or captured by the AP1200A. It is protected by a metal cover that prevents accidental ejection of the card and protects the slot from dirt and debris.

You can download the contents of the installed microSD card over USB, or for larger data sets, remove the card and use an external card reader.

## Micro-SIM Slot and Cover

The slot can hold a Micro-SIM card. Like the microSD card slot, it is covered with a metal plate to protect it and the device.

# Membrane LED Display and Keypad

A membrane LED display and keypad on top of the unit is as shown in Figure 3-5. The membrane contains 10 LEDs that provide immediate visual feedback about the status of the device, and two keypad buttons that can be used to toggle the indicator mode and for other functions.



**Figure 3-5**    AP1200A Membrane LED Display and Keypad

All of the LEDs and buttons are scriptable: you can use the buttons for user input, and the LEDs provide information from a CoreMini program running in the AP1200A.

## Keypad Buttons and LEDs

There are two keypad buttons on the AP1200A's top membrane as follows:

– One with a white computer icon located near the top left
– One with a white car icon located near the bottom right

Pressing either button toggles the meaning of the 8 RGB LEDs on the membrane as follows:

– **Computer Icon Button (Top Left)**: When pressed, it activates the "computer set" of LED meanings: each RGB LED shows the status of the network whose name appears in a white label *above* it. This set is active in the image in Figure 3-6.

– **Car Icon Button (Bottom Right)**: When pressed, it activates the "car set" of LED meanings: each RGB LED shows information about a network or AP1200A function based on the white icon or label *below* it.

The buttons themselves also contain red and green LEDs, which flash in the same pattern as the red and green LEDs on the left side of the device see "Left Side Interfaces and Connectors" on page 31. The illuminated LEDs show which set of indicator meanings is active, and may also be more convenient for monitoring general device status than the left-side LEDs.

The green and red status LEDs on the top membrane, and on the side of the AP1200A, show information about the AP1200A through several flash patterns, described in Table 3-1.

**Table 3-1**     AP1200A Green/Red LED Flash Patterns

| Flash Pattern | Description |
|---|---|
| Green LED flashing rapidly; red LED off | AP1200A is powered on but offline. |
| Green and red LEDs flashing rapidly in an alternating sequence | The device is powered and online with a PC running VSpy or other software. |
| Red LED flashing rapidly; green LED off | AP1200A is running a CoreMini script. |
| Red LED flashing at a constant rate; green LED flashing intermittently | VehicleScape Standalone Logging is active; the flash rate of the green LED reflects the rate of the logged data. |
| Green LED flashes three times slowly, red LED flashes once, then cycle repeats | AP1200A is in bootloader mode which normally occurs when flashing new firmware to the device. See Chapter 5, "Device Configuration" for more details. |

## Network/Logger Status RGB LEDs

The membrane contains 8 RGB (full color) LEDs in two rows of four. The meaning of each LED changes depending on the pressed button. The upper left computer button or the lower right car button consists of 8 LEDs indicating a total of 16 separate status conditions. To find the current meaning of each LED, check whether the car button or computer button has its LEDs flashing, and then refer to the label of the corresponding color described as follows.

### Interpretation of RGB LED Colors

These are "RGB" LEDs because they contain separate red, green, and blue elements. For networks, each indicates a different aspect of the device's overall status:

– **Green**: The device is transmitting messages on this channel.
– **Blue**: The device is receiving messages on this channel.
– **Red**: The device is detecting errors on this channel.

It is possible for more than one LED component to be lit, producing the following results:

– **Green+Blue (Cyan)**: The device is transmitting and receiving on this channel.
– **Green+Red (Yellow)**: The device is transmitting and detecting errors on this channel.
– **Blue+Red (Magenta)**: The device is receiving and detecting errors on this channel.
– **Green+Blue+Red (White)**: The device is transmitting, receiving, and detecting errors on this channel.

Figure 3-6 shows the top membrane of the AP1200A in active use, with the computer set of status indicators active, meaning that transmissions are occurring on five channels and errors on one.

As a further cue to network activity, the intensity of these LEDs is proportional to the amount of traffic on the corresponding network. Slower traffic on a network will cause the network's LED to flash more dimly, while heavy traffic will cause the LED to be brighter.

| NOTE | The blink rate remains the same regardless of the traffic level. |
|---|---|
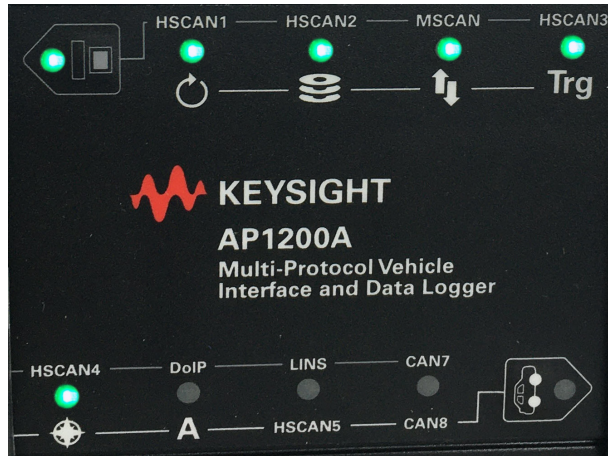


**Figure 3-6**     AP1200A Membrane LED Display and Keypad Showing Active LEDs

In Figure 3-6, the computer set of LED meanings is active, as indicated by the green LED lit within the computer icon in the top left corner (this LED alternates between green and red when the device is online). The other LEDs thus mean that the AP1200A is active and transmitting on the HSCAN1, HSCAN2, MSCAN, HSCAN3, and HSCAN4 channels (in use all these flash a few times per second.)

| NOTE | The LED for HSCAN4 is yellowish; it is flashing both a bright green and a dim red to indicate errors while transmitting on the HSCAN4 channel. |
|---|---|

## "Computer Set" LED Status Indicators

Table 3-2 lists the computer labels on the AP1200A membrane interface and describes the meaning of the LED associated with each when the computer set is selected (top left keypad button flashing). The LEDs are listed from top to bottom, left to right, as seen looking at the membrane in its usual orientation.

**Table 3-2**    AP1200A Top Membrane Computer Set LED Meanings

| Label | Description |
|---|---|
| HSCAN1 | Transmit / receive / error status of HS CAN channel 1 |
| HSCAN2 | Transmit / receive / error status of HS CAN channel 2 |
| MSCAN | Transmit / receive / error status of MS CAN channel |
| HSCAN3 | Transmit / receive / error status of HS CAN channel 3 |
| HSCAN4 | Transmit / receive / error status of HS CAN channel 4 |
| DoIP | Transmit / receive / error status of Ethernet channel |
| LINS | Status of all LIN channels |
| CAN7 | Transmit / receive / error status of HS CAN channel 6, SW CAN channel 2, or LSFT CAN channel 1, depending on CAN mode selected (see Chapter 5, "Device Configuration") |

## "Car Set" LED Status Indicators

Table 3-3 lists the car labels/icons on the AP1200A membrane interface and describes the meaning of the LEDs for each when the car set is selected (bottom right keypad button flashing). Again the LEDs are listed from top to bottom, left to right.

**Table 3-3**     Top Membrane Car Set LED Meanings

| Label | Description |
|---|---|
| ↻ | CoreMini script active |
| ⛁ | Disk (solid state drive) activity |
| ↑↓ | Uploading data |
| Trg | Logging a triggered collection after the trigger condition has activated |
| ⊕ | GPS lock |
| A | General purpose, user-programmable |
| HSCAN5 | Transmit / receive / error status of HS CAN channel 5 |
| CAN8 | Transmit / receive / error status of HS CAN channel 7, SW CAN channel 1, or LSFT CAN channel 2, depending on CAN mode selected see Chapter 5, "Device Configuration" |

# Standard Cables and Cable Options

The AP1200A ships with several standard cables, and optional OBD cables selected when ordering the device. The following illustrates these cables and describe the use of each one. For connector pinouts and cable signal tables of the AP1200A, refer to Chapter 8, "Reference for Connector Pinouts and Cable Signal Mappings" for details except for the USB cable, which is industry standard.

## USB "A/B" Cable

This standard cable shown in Figure 3-7 connects PCs or other hosts to USB devices that do not have integrated cables. The detachable cable makes the AP1200A easier to transport compared to a built-in cable. You can easily replace the cable if it is ever damaged.



**Figure 3-7**    USB "A/B" Cable

## µDB-9 (Micro DB-9) to DB-9 Cable

The µDB-9 connector allows the AP1200A to be more compact. This is a "straight-through" cable that converts the smaller connector to the regular DB-9 used in automotive applications. The cable is as shown in Figure 3-8, while a close-up of the special µDB-9 connector is as shown in Figure 3-9.



**Figure 3-8**      µDB-9 (Micro DB-9) to DB-9 Cable



**Figure 3-9**      Close-up of µDB-9 Connector

This µDB-9 connector attaches to the mating connector on the AP1200A, adapting it into an industry-standard DB-9 connector. For details on pinouts, see "AP1200A-J45 Connector Pinouts" on page 69.

## AP1200A-J45 Ethernet Cable Adapter

This special cable splits the HD-26 connector on the left side of the AP1200A to three connectors used to communicate with vehicle networks. This cable allows the AP1200A to connect to vehicle networks and receive its primary power input. Figure 3-10 shows the cable, while descriptions of the network interface connectors are as follows.



**Figure 3-10**    AP1200A Ethernet Cable Adapter

### DB-25 Connector

The main vehicle network interface connector in Figure 3-11, carries CAN, LIN, and Ethernet messages, as well as provide power to the AP1200A from the network. This connector carries main network traffic and primary DC power to the AP1200A. It also connects an additional cable for OBD applications.



**Figure 3-11**    DB-25 Connector

## DB-9 Connector

The connector in Figure 3-12 carries 4 LIN channels for LIN applications. This industry-standard connector carries LIN traffic.



**Figure 3-12**     DB-9 Connector

## RJ-45 Connector

This female RJ-45 socket in Figure 3-13 attaches a standard Ethernet cable for Automotive Ethernet and DoIP applications.



**Figure 3-13**     RJ-45 Socket

For details on pinouts, see "AP1200A-J45 Ethernet Cable Adapter Connector Pinouts and Signal Mapping" on page 72.

## AP1200A-DB9 DB-26HD cable F to 12x DB-9M + 1x RJ-45 + 2x Banana Plugs (for benchtop use)

This cable breaks out the DB-26HD Female connector on the AP1200A to individual DB-9M connectors for multiple 8 x CAN and 4 x LIN channels, plus an additional RJ-45 connector for DoIP and two banana plugs for power. This cable also has a switchable 2x SWCAN channel and 1x Individual MSCAN cable.



**Figure 3-14**    DB-26HD cable F to 12x DB-9M + 1x RJ-45 + 2x Banana Plugs

For details on pinouts, see "AP1200A-DB9 DB-26HD cable F to 12x DB-9M + 1x RJ-45 + 2x Banana Plugs (for benchtop use)" on page 77

## Optional OBD Cables

The AP1200A comes optionally with OBD cables, which interface the device to a vehicle or bench OBD port.

See "Hardware Connection Diagrams" on page 52 for connection diagrams that show how to connect the cables to the AP1200A and your network or bench.

### AP1200A-MUL DB-25F to OBD-II

This cable in Figure 3-15 has a standard black OBD-II connector and is suitable for use with the vehicles of most OEMs.

The DB-25F mates to the DB-25M connector on the AP1200A-J45 cable, converting DB-25 to a standard OBD-II connector, with a pinout to meet the needs of most newer vehicles using multiple DW CAN channels.



**Figure 3-15**     DB-25F to OBD-II

For details on pinouts, see "AP1200A-MUL DB-25F to OBD-II Cable Connector Pinouts and Signal Mapping" on page 80.

### AP1200A-DIP OBD Cable with DoIP support, HD26Fto DB25M, DB9M to OBDII

This special cable attaches to the AP1200A's HD-26 connector in place of the regular AP1200A Ethernet Cable Adapter. Figure 3-16 shows the DB-25, DB-9, and OBD-II connectors wired for use with DoIP. Suitable for gatewaying all traffic over pins 6 and 14 exclusively, or for use with DoIP.



**Figure 3-16**      AP1200A OBD Cable with DoIP Support

For details on pinouts, see "AP1200A-DIP OBD Cable with DoIP support, HD26F to DB25M, DB9M to OBDII cable Connector Pinouts and Signal Mapping" on page 84.

### AP1200A-GMB DB-26HD to OBD x2

This cable adapts the AP1200A to two of the following SAE J1962 connectors:

– One for the DLC on Global B vehicles

– One for a proprietary harness



**Figure 3-17**      DB-26HD to OBD x2

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# 4 Hardware and Software Setup

**KEYSIGHT**
TECHNOLOGIES

## Overview

This chapter details the steps necessary to set up the AP1200A to work with a vehicle network. Steps provided include how to install the required software and drivers, connect cables between the AP1200A and the network, and link the unit to a PC.

| NOTE | Vehicle and test bench setups will vary; as such, Keysight will only show a typical case in this guide. You may need to alter these steps to suit your particular needs. |
|------|------|

# VSpy and Driver Installation and Setup

Keysight recommends installing the software first. It is possible to install your hardware and software in either order. However, the AP1200A requires special drivers to function properly. Download and install the driver from www.keysight.com/find/AP1200A the technical support page. If you connect the hardware before installing the drivers, the hardware will not work correctly.

Keysight recommends the full-licensed version of VSpy so that you get the most from your AP1200A. You can get the limited trial version of VSpy with the installer available here.

Refer to "Hardware and Software Setup > Vehicle Spy and Driver Installation and Setup" and "Hardware and Software Setup > Driver and API Support File Installation and Setup" here for installation and setup details.

# Hardware Connection Diagrams

Connection diagrams show you at a glance how to physically connect your AP1200A to vehicle networks and your PC.

## Basic Hardware Connection Diagram

Figure 4-1 shows the basic hardware configuration of the AP1200A, with the USB cable connecting the device to the PC, and the AP1200A Ethernet Cable Adapter and µDB-9 to DB-9 cables linking it to vehicle networks.
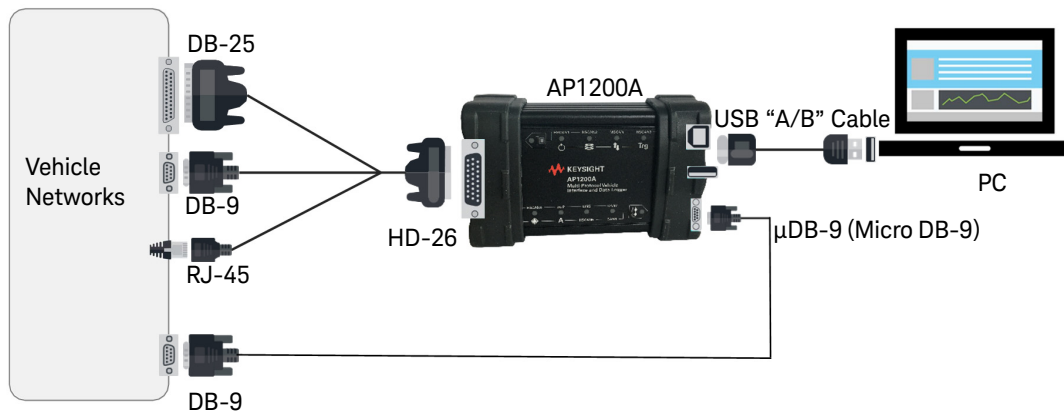


**Figure 4-1**    Basic AP1200A Hardware Connection Diagram

Figure 4-1 shows basic connections with no OBD cable.

## DB-25F to OBD-II (AP1200A-MUL)

Figure 4-2 shows the hardware setup using the DB-25F to OBD-II (AP1200A-MUL).
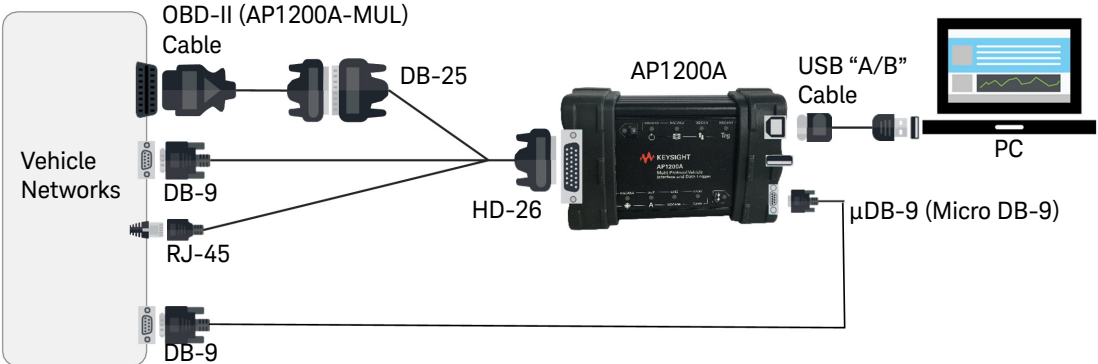


**Figure 4-2**     AP1200A Hardware Connection Diagram with OBD-II (AP1200A-MUL) Cable

## OBD Cable with DoIP support, HD26F to DB25M, DB9M to OBDII (AP1200A-DIP)

Figure 4-3 shows the special OBD Cable with DoIP support, HD26F to DB25M, DB9M to OBDII (AP1200A-DIP) that replaces the AP1200A Ethernet Cable Adapter.
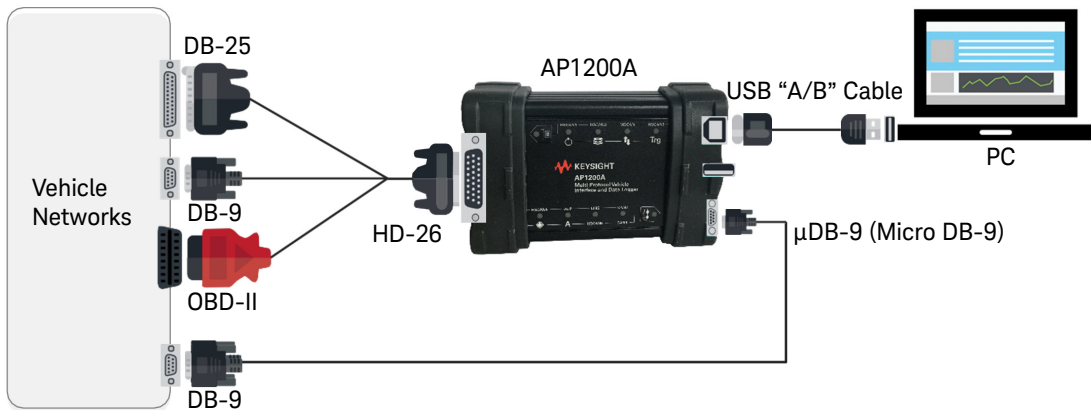


**Figure 4-3**    AP1200A Hardware Connection Diagram with AP1200A OBD Cable with DoIP Support

# Vehicle Network and Power Connections

The two connectors on the AP1200A attach the device to vehicle networks. The HD-26 connector on the left side of the device provides primary power input to the AP1200A and also carries most of the network channels. The OBD cable is attached to the HD-26 connector, either directly or indirectly. The µDB-9 connector on the right side of the device carries LIN and miscellaneous I/O channels, which you may or may not need depending on your application.

The listed connection steps are in a specific order chosen to make the process intuitive, and to prioritize the power connection so you can quickly verify that the AP1200A is operational. However, you can perform the steps in any order you find convenient.

## HD-26 and OBD Cable Connections to AP1200A

The connections made here will depend on the OBD cable, if any, you are using with the AP1200A.

Refer to the following steps if you are not using an OBD cable, or if you are using any OBD cable other than the AP1200A OBD Cable with DoIP Support:

1  **Attach the AP1200A Ethernet Cable Adapter to HD-26 Connector**: Attach the HD-26 female connector on the network interface cable to the HD-26 male connector on the AP1200A. Tighten the thumbscrews so that the cable remains securely attached, as shown in Figure 4-4.



**Figure 4-4**        Connecting the HD-26 Cable Connector to the AP1200A

**2  Attach OBD Cable to DB-25 Connector on AP1200A Ethernet Cable Adapter (OBD Use Only)**: Connect the female DB-25 connector to the male DB-25 of the AP1200A Ethernet Cable Adapter, as shown in Figure 4-5.



**Figure 4-5**    Attaching the DB-25 Connector of an OBD Cable to the DB-25 on the AP1200A Ethernet Cable Adapter

**3  Attach DB-25, DB-9, RJ-45, and optionally OBD-II Connectors to Vehicle Network**: Attach the connectors from the AP1200A Ethernet Cable Adapter and your OBD cable (if in use) to their mating halves on your network, then secure them in place.

As soon as you connect the device supplying power to the cable attached to the AP1200A, the device should boot up. You will recognize this by green LEDs beginning to flash in a quick and regular pattern on both the side of the device next to the HD-26 connection and in the upper left corner of the top membrane interface. If the LEDs do not start flashing, contact Keysight for assistance.

## µDB-9 to DB-9 Cable Connection to AP1200A

Continue with the µDB-9 connector on the right side of the AP1200A, using the special µDB-9 to DB-9 cable that comes with the device. This connection carries LIN and miscellaneous I/O channels for networks that require them; if they are not relevant to you, skip the following steps.

1 **Attach µDB-9 Connector to AP1200A**: Attach the µDB-9 end of the cable to the female µDB-9 connector on the AP1200A and secure it in place, as shown in Figure 4-6.

2 **Attach DB-9 Connector to Vehicle Network**: Attach the standard DB-9 at the end of the cable to the appropriate mating connector in your vehicle network.

Your AP1200A is now fully connected to your vehicle or bench network.



**Figure 4-6**      Connecting the µDB-9 Cable Connector to the AP1200A

# PC Connection

Now connect the AP1200A to the PC. The connection can be done either directly to a USB 2.0 (or higher) port on the computer, or indirectly through a USB hub.

The AP1200A can draw up to the USB standard maximum of 500 mA through its USB connection. All computers should be able to supply this amount of current. However, unpowered USB hubs may not be able to do so, especially if they have multiple devices connected to them. If you experience difficulties with the AP1200A when using an unpowered hub port, but the device works when connected directly to a PC USB slot, you will need to use the PC slot or a powered hub.

**1  Attach USB "B" Connector to AP1200A**: Insert the square "B" connector on the supplied USB cable into the matching receptacle on the right side of the AP1200A, as shown in Figure 4-7.



**Figure 4-7**       Connecting the USB Cable to the AP1200A

**2  Attach USB "A" Connector to PC or USB Hub**: Attach the standard rectangular USB connector to your PC or USB hub.

Upon connecting the USB, you may notice messages within Windows informing you that you are installing drivers. Running the VSpy or the API installation utility installs the drivers. However, configuring the device happens upon attaching the device for the first time. If you see error messages associated with drivers at this point, contact Keysight for assistance.

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# 5 Device Configuration

**KEYSIGHT**
TECHNOLOGIES

# Overview

The AP1200A ships from the factory ready to use with its default settings. However, you can also customize its operation to your exact needs by adjusting dozens of parameters that control its internal hardware and firmware. In this chapter, you will learn how to manage and fine-tune your AP1200A, including enabling and disabling networks, adjusting baud rates, turning on or off specific features, and much more.

Refer to "Device Configuration" here for device configuration details.

# 6 Core Feature Operation

**KEYSIGHT**
TECHNOLOGIES

# Overview

Now that we have completed installing and configuring our hardware and software, we are ready to use the AP1200A. This chapter details some of the many applications of the AP1200A.

Refer to "Core Feature Operation" here for application examples, and where possible, step-by-step instructions for those who wish to duplicate the results on the AP1200A. The goal is to assist new users, so provided are simplified examples. Advanced users may prefer to skim or even skip this.

The examples use Vehicle Spy 3 Professional, the optimal tool for working with your AP1200A. Due to the complexity of VSpy, Keysight only describes the basics necessary for the examples; for full details on this powerful software tool, press F1 on the keyboard in VSpy to bring up the help or see the separate VSpy documentation here.

# Interfacing to Automotive Ethernet (BroadR-Reach / 100BASE-T1)

The AP1200A can be used to monitor and transmit on a BroadR-Reach (100BASE-T1) Automotive Ethernet network, with the help of a device that changes the BroadR-Reach PHY into the standard 10/100 Ethernet PHY used by the AP1200A. Keysight provides an affordable tool for this exact purpose, called the APM0100E 100BASE-T1/Ethernet Media Converter.

Figure 6-1 shows the AP1200A connection diagram of Figure 4-1 modified to illustrate a typical Automotive Ethernet application. Connect the RJ-45 jack on the AP1200A network interface cable to the APM0100E's RJ-45 jack using a standard Ethernet cable. Then, connect the BroadR-Reach ECU or network to the APM0100E's Molex Mini50 connector on the other side of the converter. Power provided for the APM0100E is via the USB host slot on the AP1200A. This feature allows the AP1200A to power the APM0100E on or off as needed.
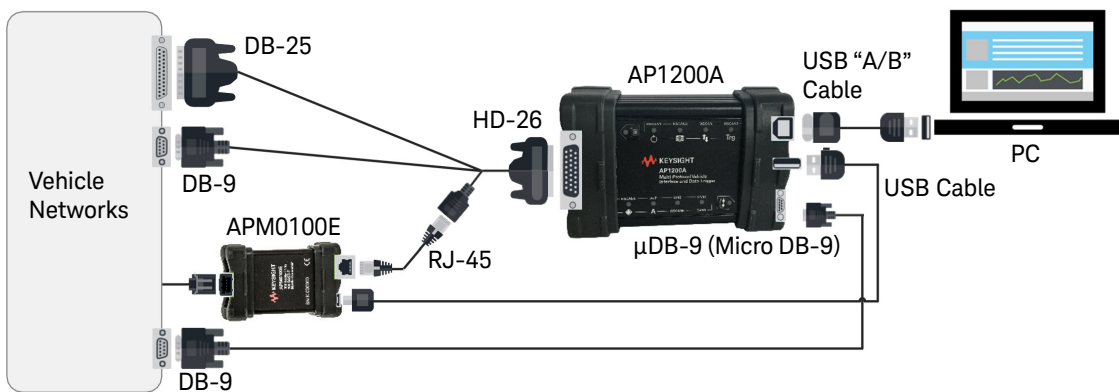


**Figure 6-1**    AP1200A Connection Diagram for Automotive Ethernet Using APM0100E Media Converter

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# 7    Advanced Features

**KEYSIGHT**
TECHNOLOGIES

# Overview

The chapter provides additional information on some of the AP1200A's new and advanced features.

# neoVI API

The AP1200A comes with support for a full API that allows you to control the device from other software packages or custom-written software. For instructions on using the API, consult the documentation here.

# USB Host

The AP1200A comes with a USB host port that allows other devices to be plugged into it, as shown in Figure 3-4. Due to the difficulties associated with driver development, the intention of this port is for specific devices rather than general-purpose use. The design of the port is so that it works with devices like the Intrepid neoVI MIC 2 microphone/trigger pendant, or the APM0100E (as seen in "Interfacing to Automotive Ethernet (BroadR-Reach / 100BASE-T1)" on page 63).

# 8 Reference for Connector Pinouts and Cable Signal Mappings

**KEYSIGHT**
TECHNOLOGIES

# Overview

This chapter contains the complete information on pinouts for the connectors and the network interface cables on the AP1200A. Provided are the following tables that show the mappings of signals between the pin numbers on the connectors of each network cable.

**NOTE**    The USB cable is industry standard and not covered here.

# AP1200A-J45 Connector Pinouts

The following details the pinouts for the connectors on the AP1200A.

## HD-26 Connector Pinout

Table 8-1 lists the pin assignments for the HD-26 connector, with pin numbering for the connector, as shown in Figure 8-1.

**Table 8-1**     AP1200A HD-26 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | ETH TX+ | Ethernet transmit channel, positive |
| 2 | HS CAN 4 L | High Speed CAN channel 4, low |
| 3 | HS CAN 5 L | High Speed CAN channel 5, low |
| 4 | HS CAN 1 L | High Speed CAN channel 1, low |
| 5 | MS CAN L | Medium Speed CAN channel, low |
| 6 | HS CAN 2 L | High Speed CAN channel 2, low |
| 7 | HS CAN 3 L | High Speed CAN channel 3, low |
| 8 | HS CAN 6 L / LSFT CAN L | High Speed CAN channel 6, low / Low Speed Fault Tolerant CAN channel 1, low |
| 9 | ETH TX- | Ethernet transmit channel, negative |
| 10 | GND | Ground |
| 11 | ETH RX+ | Ethernet receive channel, positive |
| 12 | HS CAN 4 H | High Speed CAN channel 4, high |
| 13 | HS CAN 5 H | High Speed CAN channel 5, high |
| 14 | HS CAN 1 H | High Speed CAN channel 1, high |
| 15 | MS CAN H | Medium Speed CAN channel, high |
| 16 | HS CAN 2 H | High Speed CAN channel 2, high |
| 17 | HS CAN 3 H | High Speed CAN channel 3, high |

**Table 8-1**        AP1200A HD-26 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 18 | HS CAN 6 H / LSFT CAN H / SW CAN 2 | High Speed CAN channel 6, high / Low Speed Fault Tolerant CAN channel 1, high / Single Wire CAN channel 2 |
| 19 | V BATT | DC Input Power |
| 20 | ETH RX- | Ethernet receive channel, negative |
| 21 | HS CAN 7 L / LSFT CAN 2 L | High Speed CAN channel 7, low / Low Speed Fault Tolerant CAN channel 2, low |
| 22 | ISO K/LIN 1 | LIN channel 1 |
| 23 | LIN 2 | LIN channel 2 |
| 24 | LIN 3 | LIN channel 3 |
| 25 | ETH ACTIVATE | Ethernet activation line |
| 26 | HS CAN 7 H / LSFT CAN 2 H / SW CAN | High Speed CAN channel 7, high / Low Speed Fault Tolerant CAN channel 2, high / Single Wire CAN channel 1 |



**Figure 8-1**        AP1200A HD-26 Connector Pin Numbering

## µDB-9 Connector Pinout

and show the pinout for the µDB-9 connector on the AP1200A.

| NOTE | The I/O channel numbering (which skips 3 and 4) is designed to ensure backward compatibility with the original device. |
|---|---|

**Table 8-2**        AP1200A µDB-9 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | LIN 1 | LIN channel 1 |
| 2 | LIN 2 | LIN channel 2 |
| 3 | LIN 3 | LIN channel 3 |
| 4 | LIN 4 | LIN channel 4 |
| 5 | GND | Ground |
| 6 | N/C | No connection |
| 7 | N/C | No connection |
| 8 | EMISC 1 | Enhanced miscellaneous I/O channel 1 (analog or digital with PWM and 0-40 V support) |
| 9 | EMISC 2 | Enhanced miscellaneous I/O channel 2 (analog or digital with PWM and 0-40 V support) |



**Figure 8-2**        AP1200A µDB-9 Connector Pin Numbering

# AP1200A-J45 Ethernet Cable Adapter Connector Pinouts and Signal Mapping

The primary cable for connecting the AP1200A to vehicle networks has four connectors: HD-26, DB-25, DB-9, and RJ-45. The HD-26 connector mates to the HD-26 on the AP1200A and uses the same pinout as shown in Table 8-1; the others are described as follows, followed by a signal mapping table.

## DB-25 Connector Pinout

Table 8-3 lists the pins of the DB-25 connector on the AP1200A Ethernet Cable Adapter.

**Table 8-3**        AP1200A Ethernet Cable Adapter DB-25 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | HS CAN 7 H / LSFT CAN 2 H / SW CAN | High Speed CAN channel 7, high / Low Speed Fault Tolerant CAN channel 2, high / Single Wire CAN channel 1 |
| 2 | N/C | No connection |
| 3 | HS CAN 6 H / LSFT CAN H / SW CAN 2 | High Speed CAN channel 6, high / Low Speed Fault Tolerant CAN channel 1, high / Single Wire CAN channel 2 |
| 4 | HS CAN 6 L / LSFT CAN L | High Speed CAN channel 6, low / Low Speed Fault Tolerant CAN channel 1, low |
| 5 | MS CAN H | Medium Speed CAN channel, high |
| 6 | MS CAN L | Medium Speed CAN channel, low |
| 7 | HS CAN 7 L / LSFT CAN 2 L | High Speed CAN channel 7, low / Low Speed Fault Tolerant CAN channel 2, low |
| 8 | ISO K/LIN 1 | K-Line channel 1 / LIN channel 1 |
| 9 | N/C | No connection |

**Table 8-3**          AP1200A Ethernet Cable Adapter DB-25 Connector Pinout

| Pin Number | Name | Description |
|------------|------|-------------|
| 10 | N/C | No connection |
| 11 | N/C | No connection |
| 12 | N/C | No connection |
| 13 | GND | Ground |
| 14 | HS CAN 1 H | High Speed CAN channel 1, high |
| 15 | HS CAN 1 L | High Speed CAN channel 1, low |
| 16 | HS CAN 2 H | High Speed CAN channel 2, high |
| 17 | HS CAN 2 L | High Speed CAN channel 2, low |
| 18 | HS CAN 4 H | High Speed CAN channel 4, high |
| 19 | HS CAN 3 H | High Speed CAN channel 3, high |
| 20 | HS CAN 3 L | High Speed CAN channel 3, low |
| 21 | HS CAN 5 H | High Speed CAN channel 5, high |
| 22 | HS CAN 5 L | High Speed CAN channel 5, low |
| 23 | HS CAN 4 L | High Speed CAN channel 4, low |
| 24 | N/C | No connection |
| 25 | V BATT | DC Input Power |

## DB-9 Connector Pinout

Table 8-4 shows the pinout for the DB-9 connector on this cable.

**Table 8-4**          AP1200A Ethernet Cable Adapter DB-9 Connector Pinout

| Pin Number | Name | Description |
|------------|------|-------------|
| 1 | LIN 1 | LIN channel 1 |
| 2 | LIN 2 | LIN channel 2 |

**Table 8-4**        AP1200A Ethernet Cable Adapter DB-9 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 3 | LIN 3 | LIN channel 3 |
| 4 | ETH ACTIVATE | Ethernet activation line |
| 5 | GND | Ground |
| 6 | N/C | No connection |
| 7 | N/C | No connection |
| 8 | N/C | No connection |
| 9 | N/C | No connection |

## RJ-45 Connector Pinout

Table 8-5 lists the pinout for the RJ-45 (Ethernet) connector on this cable.

**Table 8-5**        AP1200A Ethernet Cable Adapter RJ-45 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | ETH TX+ | Ethernet transmit channel, positive |
| 2 | ETH TX- | Ethernet transmit channel, negative |
| 3 | ETH RX+ | Ethernet receive channel, positive |
| 4 | N/C | No connection |
| 5 | N/C | No connection |
| 6 | ETH RX- | Ethernet receive channel, negative |
| 7 | N/C | No connection |
| 8 | N/C | No connection |

## Cable Signal Mapping

Table 8-6 shows the mapping of signals for the AP1200A Ethernet Cable Adapter, by pin order on the HD-26 that connects to the AP1200A.

**Table 8-6**    AP1200A Ethernet Cable Adapter Signal Mapping

| Signal Name | Signal Description | HD-26 Pin Number | DB-25 Pin Number | DB-9 Pin Number | RJ-45 Pin Number |
|---|---|---|---|---|---|
| ETH TX+ | Ethernet transmit channel, positive | 1 | | | 1 |
| HS CAN 4 L | High Speed CAN channel 4, low | 2 | 23 | | |
| HS CAN 5 L | High Speed CAN channel 5, low | 3 | 22 | | |
| HS CAN 1 L | High Speed CAN channel 1, low | 4 | 15 | | |
| MS CAN L | Medium Speed CAN channel, low | 5 | 6 | | |
| HS CAN 2 L | High Speed CAN channel 2, low | 6 | 17 | | |
| HS CAN 3 L | High Speed CAN channel 3, low | 7 | 20 | | |
| HS CAN 6 L / LSFT CAN L | High Speed CAN channel 6, low / Low Speed Fault Tolerant CAN channel 1, low | 8 | 4 | | |
| ETH TX- | Ethernet transmit channel, negative | 9 | | | 2 |
| GND | Ground | 10 | 13 | 5 | |
| ETH RX+ | Ethernet receive channel, positive | 11 | | | 3 |
| HS CAN 4 H | High Speed CAN channel 4, high | 12 | 18 | | |
| HS CAN 5 H | High Speed CAN channel 5, high | 13 | 21 | | |
| HS CAN 1 H | High Speed CAN channel 1, high | 14 | 14 | | |
| MS CAN H | Medium Speed CAN channel, high | 15 | 5 | | |
| HS CAN 2 H | High Speed CAN channel 2, high | 16 | 16 | | |
| HS CAN 3 H | High Speed CAN channel 3, high | 17 | 19 | | |
| HS CAN 6 H / LSFT CAN H / SW CAN 2 | High Speed CAN channel 6, high / Low Speed Fault Tolerant CAN channel 1, high / Single Wire CAN channel 2 | 18 | 3 | | |
| V BATT | DC Input Power | 19 | 25 | | |

**Table 8-6**        AP1200A Ethernet Cable Adapter Signal Mapping

| Signal Name | Signal Description | HD-26 Pin Number | DB-25 Pin Number | DB-9 Pin Number | RJ-45 Pin Number |
|---|---|---|---|---|---|
| ETH RX- | Ethernet receive channel, negative | 20 | | | 6 |
| HS CAN 7 L / LSFT CAN 2 L | High Speed CAN channel 7, low / Low Speed Fault Tolerant CAN channel 2, low | 21 | 7 | | |
| ISO K/LIN 1 | LIN channel 1 | 22 | | 1 | |
| LIN 2 | LIN channel 2 | 23 | | 2 | |
| LIN 3 | LIN channel 3 | 24 | | 3 | |
| ETH ACTIVATE | Ethernet activation line | 25 | | 4 | |
| HS CAN 7 H / LSFT CAN 2 H / SW CAN | High Speed CAN channel 7, high / Low Speed Fault Tolerant CAN channel 2, high / Single Wire CAN channel 1 | 26 | 1 | | |

# AP1200A-DB9 DB-26HD cable F to 12x DB-9M + 1x RJ-45 + 2x Banana Plugs (for benchtop use)

This cable breaks out the DB-26HD Female connector on the AP1200A VNET to individual DB-9M connectors for multiple CAN and LIN channels, plus an additional RJ-45 connector for DoIP and two banana plugs for power. This cable also has a switchable 2x SW CAN channel and 1x Individual MS CAN cable.

## HS CAN, MS CAN and Switchable SW CAN

Table 8-7 shows the connector pinouts and signal mapping for HS CAN, MS CAN, and Switchable SW CAN.

**Table 8-7**      HS CAN, MS CAN, and Switchable SW CAN

| HD-26F Pin Number | DB-9M Signal | DB-9M Signal Description | CAN Low | CAN High | GND/PWR |
|---|---|---|---|---|---|
| 4 | HS CAN 1 | High Speed CAN channel 1 | 2 | 7 | 3 |
| 14 | HS CAN 1 | High Speed CAN channel 1 | 2 | 7 | 3 |
| 5 | MS CAN | Medium Speed CAN channel | 2 | 7 | 3 |
| 15 | MS CAN | Medium Speed CAN channel | 2 | 7 | 3 |
| 6 | HS CAN 2 | High Speed CAN channel 2 | 2 | 7 | 3 |
| 16 | HS CAN 2 | High Speed CAN channel 2 | 2 | 7 | 3 |
| 7 | HS CAN 3 | High Speed CAN channel 3 | 2 | 7 | 3 |
| 17 | HS CAN 3 | High Speed CAN channel 3 | 2 | 7 | 3 |
| 2 | HS CAN 4 | High Speed CAN channel 4 | 2 | 7 | 3 |
| 12 | HS CAN 4 | High Speed CAN channel 4 | 2 | 7 | 3 |
| 3 | HS CAN 5 | High Speed CAN channel 5 | 2 | 7 | 3 |
| 13 | HS CAN 5 | High Speed CAN channel 5 | 2 | 7 | 3 |
| 8 | HS CAN 6 / SW CAN 2 | High Speed CAN channel 6 / Single Wire CAN channel 2 | 2 | 7 | 3 |

**Table 8-7**        HS CAN, MS CAN, and Switchable SW CAN

| HD-26F Pin Number | DB-9M Signal | DB-9M Signal Description | CAN Low | CAN High | GND/PWR |
|---|---|---|---|---|---|
| 18 | HS CAN 6 / SW CAN 2 | High Speed CAN channel 6 / Single Wire CAN channel 2 | 2 | 7 | 3 |
| 21 | HS CAN 7 / SW CAN 1 | High Speed CAN channel 7 / Single Wire CAN channel 1 | 2 | 7 | 3 |
| 26 | HS CAN 7 / SW CAN 1 | High Speed CAN channel 7 / Single Wire CAN channel 1 | 2 | 7 | 3 |

## LIN

Table 8-8 shows the connector pinouts and signal mapping for LIN.

**Table 8-8**        LIN

| HD-26F Pin Number | DB-9M Signal | DB-9M Signal Description | LIN Data | GND/PWR |
|---|---|---|---|---|
| 22 | LIN 1 | LIN channel 1 | 2 | 3 |
| 23 | LIN 2 | LIN channel 2 | 2 | 3 |
| 24 | LIN 3 | LIN channel 3 | 2 | 3 |
| 25 | LIN 4 | LIN channel 4 | 2 | 3 |

## RJ-45

Table 8-9 shows the connector pinouts and signal mapping for RJ-45.

**Table 8-9**       RJ-45

| HD-26F Pin Number | RJ-45 Pin Number | Signal | Signal Description |
|---|---|---|---|
| 1 | 1 | ETH TX+ | Ethernet transmit channel, positive |
| 9 | 2 | ETH TX - | Ethernet transmit channel, negative |
| 11 | 3 | ETH RX+ | Ethernet receive channel, positive |
| 20 | 6 | ETH RX - | Ethernet receive channel, negative |

## Banana Jacks

Table 8-10 shows the connector pinouts and plugs for banana jacks.

**Table 8-10**       Banana Jacks

| HD-26F Pin Number | Plugs |
|---|---|
| 19 | PWR+ |
| 10 | GND- |

# AP1200A-MUL DB-25F to OBD-II Cable Connector Pinouts and Signal Mapping

These two cables have the same pinouts and signal mappings, as they differ only in the physical construction of the OBD-II connector.

## DB-25 Connector Pinout

Table 8-11 shows the pinout of the DB-25 connector.

**Table 8-11**    DB-25 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | N/C | No connection |
| 2 | N/C | No connection |
| 3 | N/C | No connection |
| 4 | N/C | No connection |
| 5 | MS CAN H | Medium Speed CAN channel, high |
| 6 | MS CAN L | Medium Speed CAN channel, low |
| 7 | ISO L | ISO 9141-2 L-Line |
| 8 | ISO9141/K/LIN1 | ISO 9141-2 K-Line / LIN channel 1 |
| 9 | N/C | No connection |
| 10 | N/C | No connection |
| 11 | N/C | No connection |
| 12 | N/C | No connection |
| 13 | GND | Ground |
| 14 | HS CAN 1 H | High Speed CAN channel 1, high |
| 15 | HS CAN 1 L | High Speed CAN channel 1, low |
| 16 | HS CAN 2 H | High Speed CAN channel 2, high |
| 17 | HS CAN 2 L | High Speed CAN channel 2, low |
| 18 | N/C | No connection |

**Table 8-11**        DB-25 Connector Pinout

| Pin Number | Name | Description |
| --- | --- | --- |
| 19 | HS CAN 3 H | High Speed CAN channel 3, high |
| 20 | HS CAN 3 L | High Speed CAN channel 3, low |
| 21 | N/C | No connection |
| 22 | N/C | No connection |
| 23 | N/C | No connection |
| 24 | N/C | No connection |
| 25 | V BATT | DC Input Power |

## OBD-II / J1962 Connector Pinout

Table 8-12 lists the pinout for the OBD-II / J1962 connector on this cable.

**Table 8-12**        OBD-II / J1962 Connector Pinout

| Pin Number | Name | Description |
| --- | --- | --- |
| 1 | Discretionary | Discretionary |
| 2 | J1850 + | J1850 line, positive |
| 3 | Discretionary | Discretionary |
| 4 | Chassis GND | Chassis Ground |
| 5 | Signal GND | Signal Ground |
| 6 | CAN H | High Speed CAN channel, high |
| 7 | ISO9141/K | ISO 9141-2 K-Line |
| 8 | Discretionary | Discretionary |
| 9 | Discretionary | Discretionary |
| 10 | J1850 - | J1850 line, negative |
| 11 | Discretionary | Discretionary |
| 12 | Discretionary | Discretionary |
| 13 | Discretionary | Discretionary |

**Table 8-12**    OBD-II / J1962 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 14 | CAN L | High Speed CAN channel, low |
| 15 | ISO L | ISO 9141-2 L-Line |
| 16 | VBATT | Unswitched Vehicle Battery Positive |

**NOTE**    The table shows standard signals for the OBD-II connector; this includes J1850, which is not supported by the AP1200A.

## Cable Signal Mapping

Table 8-13 shows the mapping of signals for the AP1200A-MUL. The signal names for both connectors are shown and the table is based on the OBD-II connector's pin order.

**Table 8-13**    AP1200A-MUL Cable Signal Mapping

| OBD-II Pin Number | OBD-II Signal | DB-25 Signal | DB-25 Pin Number |
|---|---|---|---|
| 1 | Discretionary | HS CAN 3 H | 19 |
| 2 | J1850 + | N/C | N/C |
| 3 | Discretionary | MS CAN H | 5 |
| 4 | Chassis GND | N/C | N/C |
| 5 | Signal GND | GND | 13 |
| 6 | CAN H | HS CAN 1 H | 14 |
| 7 | ISO9141/K | ISO9141/K/LIN1 | 8 |
| 8 | Discretionary | N/C | N/C |
| 9 | Discretionary | HS CAN 3 L | 20 |
| 10 | J1850 - | N/C | N/C |
| 11 | Discretionary | MS CAN L | 6 |
| 12 | Discretionary | HS CAN 2 H | 16 |

**Table 8-13**     AP1200A-MUL Cable Signal Mapping

| OBD-II Pin Number | OBD-II Signal | DB-25 Signal | DB-25 Pin Number |
|---|---|---|---|
| 13 | Discretionary | HS CAN 2 L | 17 |
| 14 | CAN L | HS CAN 1 L | 15 |
| 15 | ISO L | ISO L | 7 |
| 16 | VBATT | VBATT | 25 |

# AP1200A-DIP OBD Cable with DoIP support, HD26F to DB25M, DB9M to OBDII cable Connector Pinouts and Signal Mapping

This special OBD cable replaces the AP1200A Ethernet Cable Adapter and contains HD-26, DB- 25, DB-9 and OBD-II connectors. The HD-26 connector mates to the HD-26 on the AP1200A and uses the same pinout shown in Table 8-1; the other connectors are described as follows, along with a signal mapping table.

## DB-25 Connector Pinout

Table 8-14 lists the pins of the DB-25 connector on this cable.

**Table 8-14**    AP1200A OBD Cable with DoIP Support DB-25 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | HS CAN 7 H / LSFT CAN 2 H / SW CAN | High Speed CAN channel 7, high / Low Speed Fault Tolerant CAN channel 2, high / Single Wire CAN channel 1 |
| 2 | N/C | No connection |
| 3 | HS CAN 6 H / LSFT CAN H / SW CAN 2 | High Speed CAN channel 6, high / Low Speed Fault Tolerant CAN channel 1, high / Single Wire CAN channel 2 |
| 4 | HS CAN 6 L / LSFT CAN L | High Speed CAN channel 6, low / Low Speed Fault Tolerant CAN channel 1, low |
| 5 | HS CAN 5 H | High Speed CAN channel 5, high |
| 6 | HS CAN 5 L | High Speed CAN channel 5, low |
| 7 | N/C | No connection |
| 8 | ISO K/LIN 1 | K-Line channel 1 / LIN channel 1 |
| 9 | N/C | No connection |
| 10 | N/C | No connection |
| 11 | N/C | No connection |

**Table 8-14**    AP1200A OBD Cable with DoIP Support DB-25 Connector
Pinout

| Pin Number | Name | Description |
|---|---|---|
| 12 | N/C | No connection |
| 13 | GND | Ground |
| 14 | HS CAN 4 H | High Speed CAN channel 4, high |
| 15 | HS CAN 4 L | High Speed CAN channel 4, low |
| 16 | HS CAN 2 H | High Speed CAN channel 2, high |
| 17 | HS CAN 2 L | High Speed CAN channel 2, low |
| 18 | N/C | No connection |
| 19 | HS CAN 3 H | High Speed CAN channel 3, high |
| 20 | HS CAN 3 L | High Speed CAN channel 3, low |
| 21 | N/C | No connection |
| 22 | N/C | No connection |
| 23 | N/C | No connection |
| 24 | N/C | No connection |
| 25 | V BATT | DC Input Power |

## DB-9 Connector Pinout

Table 8-15 contains the pinout for the DB-9 connector on this cable.

**Table 8-15**    AP1200A OBD Cable with DoIP Support DB-9 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | LIN 1 | LIN channel 1 |
| 2 | LIN 2 | LIN channel 2 |
| 3 | LIN 3 | LIN channel 3 |
| 4 | ETH ACTIVATE | Ethernet activation line |
| 5 | GND | Ground |

**Table 8-15**    AP1200A OBD Cable with DoIP Support DB-9 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 6 | N/C | No connection |
| 7 | N/C | No connection |
| 8 | N/C | No connection |
| 9 | N/C | No connection |

## OBD–II / J1962 Connector Pinout

Table 8-16 shows the pinout for the OBD–II / J1962 connector on the cable.

**Table 8-16**    AP1200A OBD Cable with DoIP Support OBD–II / J1962 Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 1 | MS CAN H | Medium Speed CAN channel, high |
| 2 | N/C | No connection |
| 3 | ETH TX+ | Ethernet transmit channel, positive |
| 4 | N/C | No connection |
| 5 | GND | Ground |
| 6 | HS CAN H | High Speed CAN channel, high |
| 7 | N/C | No connection |
| 8 | ETH ACTIVATE | Ethernet activation line |
| 9 | MS CAN L | Medium Speed CAN channel, low |
| 10 | N/C | No connection |
| 11 | ETH TX- | Ethernet transmit channel, negative |
| 12 | ETH RX+ | Ethernet receive channel, positive |
| 13 | ETH RX- | Ethernet receive channel, negative |
| 14 | HS CAN L | High Speed CAN channel, low |

**Table 8-16**     AP1200A OBD Cable with DoIP Support OBD-II / J1962
Connector Pinout

| Pin Number | Name | Description |
|---|---|---|
| 15 | N/C | No connection |
| 16 | VBATT | DC power input |

## Cable Signal Mapping

Table 8-17 shows the mapping of signals for the AP1200A OBD Cable with DoIP
Support, ordered by pin number on the HD-26 that connects to the AP1200A.

**Table 8-17**     AP1200A OBD Cable with DoIP Support Signal Mapping

| Signal Name | Signal Description | HD-26 Pin Number | DB-25 Pin Number | DB-9 Pin Number | OBD-II Pin Number |
|---|---|---|---|---|---|
| ETH TX+ | Ethernet transmit channel, positive | 1 | | | 3 |
| HS CAN 4 L | High Speed CAN channel 4, low | 2 | 15 | | |
| HS CAN 5 L | High Speed CAN channel 5, low | 3 | 6 | | |
| HS CAN 1 L | High Speed CAN channel 1, low | 4 | | | 14 |
| MS CAN L | Medium Speed CAN channel, low | 5 | | | 9 |
| HS CAN 2 L | High Speed CAN channel 2, low | 6 | 17 | | |
| HS CAN 3 L | High Speed CAN channel 3, low | 7 | 20 | | |
| HS CAN 6 L / LSFT CAN L | High Speed CAN channel 6, low / Low Speed Fault Tolerant CAN channel 1, low | 8 | 4 | | |
| ETH TX- | Ethernet transmit channel, negative | 9 | | | 11 |
| GND | Ground | 10 | 13 | 5 | 5 |
| ETH RX+ | Ethernet receive channel, positive | 11 | | | 12 |
| HS CAN 4 H | High Speed CAN channel 4, high | 12 | 14 | | |
| HS CAN 5 H | High Speed CAN channel 5, high | 13 | 5 | | |
| HS CAN 1 H | High Speed CAN channel 1, high | 14 | | | 6 |
| MS CAN H | Medium Speed CAN channel, high | 15 | | | 1 |

**Table 8-17**    AP1200A OBD Cable with DoIP Support Signal Mapping

| Signal Name | Signal Description | HD-26 Pin Number | DB-25 Pin Number | DB-9 Pin Number | OBD-II Pin Number |
|---|---|---|---|---|---|
| HS CAN 2 H | High Speed CAN channel 2, high | 16 | 16 | | |
| HS CAN 3 H | High Speed CAN channel 3, high | 17 | 19 | | |
| HS CAN 6 H / LSFT CAN H / SW CAN 2 | High Speed CAN channel 6, high / Low Speed Fault Tolerant CAN channel 1, high / Single Wire CAN channel 2 | 18 | 3 | | |
| V BATT | DC Input Power | 19 | 25 | | 16 |
| ETH RX- | Ethernet receive channel, negative | 20 | | | 13 |
| HS CAN 7 L / LSFT CAN 2 L | High Speed CAN channel 7, low / Low Speed Fault Tolerant CAN channel 2, low | 21 | | | |
| ISO K/LIN 1 | LIN channel 1 | 22 | 8 | 1 | |
| LIN 2 | LIN channel 2 | 23 | | 2 | |
| LIN 3 | LIN channel 3 | 24 | | 3 | |
| ETH ACTIVATE | Ethernet activation line | 25 | | 4 | 9 |
| HS CAN 7 H / LSFT CAN 2 H / SW CAN | High Speed CAN channel 7, high / Low Speed Fault Tolerant CAN channel 2, high / Single Wire CAN channel 1 | 26 | 1 | | |

# AP1200A-GMB DB-26HD to OBD x2

The following lists the pinout for DB-26HD to OBD x2 (AP1200A-GMB) cable.

## OBD Cable OBD x2 (AP1200A-GMB)

Table 8-18 lists the pinout for DB-26HD to OBD x2 (AP1200A-GMB) cable.

**Table 8-18**    AP1200A-GMB OBD Cable OBD x2

| Name | Description | 26 Pin Female with Thumb Screws | OBD-II Connector (4 Feet) | OBD-II Connector (4 Feet) |
|---|---|---|---|---|
| ETH TX+ | Ethernet transmit channel, positive | 1 | | 3 |
| HS CAN 4 L | High Speed CAN channel 4, low | 2 | 14 | |
| HS CAN 5 L | High Speed CAN channel 5, low | 3 | 11 | |
| HS CAN 1 L | High Speed CAN channel 1, low | 4 | | 14 |
| MS CAN 1 L | Medium Speed CAN channel 1, low | 5 | | 9 |
| HS CAN 2 L | High Speed CAN channel 2, low | 6 | 10 | |
| HS CAN 3 L | High Speed CAN channel 3, low | 7 | 12 | |
| HS CAN 6 L / LSFT CAN 1 L | High Speed CAN channel 6, low / Low Speed Fault Tolerant CAN channel 1, low | 8 | 15 | |
| ETH TX - | Ethernet transmit channel, negative | 9 | | 11 |
| GND | Ground | 10 | 5 | 5 |
| ETH RX+ | Ethernet receive channel, positive | 11 | | 12 |
| HS CAN 4 H | High Speed CAN channel 4, high | 12 | 6 | |
| HS CAN 5 H | High Speed CAN channel 5, high | 13 | 3 | |
| HS CAN 1 H | High Speed CAN channel 1, high | 14 | | 6 |
| MS CAN 1 H | Medium Speed CAN channel 1, high | 15 | | 1 |
| HS CAN 2 H | High Speed CAN channel 2, high | 16 | 2 | |
| HS CAN 3 H | High Speed CAN channel 3, high | 17 | 4 | |

**Table 8-18**        AP1200A-GMB OBD Cable OBD x2

| Name | Description | 26 Pin Female with Thumb Screws | OBD-II Connector (4 Feet) | OBD-II Connector (4 Feet) |
|---|---|---|---|---|
| HS CAN 6 H / LSFT CAN 1 H / SW CAN 2 | High Speed CAN channel 6, high / Low Speed Fault Tolerant CAN channel 1, high / Single Wire CAN channel 2 | 18 | 7 | |
| V BATT | DC Input Power | 19 | 16 | 16 |
| ETH RX- | Ethernet receive channel, negative | 20 | | 13 |
| HS CAN 7 L / LSFT CAN 2 L | High Speed CAN channel 7, low / Low Speed Fault Tolerant CAN channel 2, low | 21 | 9 | |
| ISO K/LIN 1 | LIN channel 1 | 22 | | |
| LIN 2 | LIN channel 2 | 23 | | |
| LIN 3 | LIN channel 3 | 24 | | |
| ETH ACTIVATE | Ethernet activation line | 25 | | 8 |
| HS CAN 7 H / LSFT CAN 2 H / SW CAN 1 | High Speed CAN channel 7, high / Low Speed Fault Tolerant CAN channel 2, high / Single Wire CAN channel 1 | 26 | 1 | |

# A       Appendix

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# List of Abbreviations

**Table A-1**        Abbreviation and Definition

| Abbreviation | Definition |
|---|---|
| **C** | |
| CAN FD | Controller Area Network Flexible Data-Rate |
| **D** | |
| DLC | Data Link Connector |
| DoIP | Diagnostics over IP |
| DW CAN | Dual Wire Controller Area Network |
| **E** | |
| ECU | Electronic Control Unit |
| **H** | |
| HS CAN | High Speed Controller Area Network |
| **L** | |
| LIN | Local Interconnect Network |
| LSFT CAN | Low-Speed Fault-Tolerant CAN |
| **M** | |
| MIC | Microphone |
| MISC | Miscellaneous |
| MS CAN | Medium Speed Controller Area Network |
| **O** | |
| OBD-II | On-board Diagnostics |
| OEM | Original Equipment Manufacturer |
| **P** | |
| PWM | Pulse with Modulation |
| **S** | |
| SMSC LAN9500 | Hi Speed USB 2.0 to 10/100 Ethernet Controller |

**Table A-1**    Abbreviation and Definition

| Abbreviation | Definition |
|---|---|
| SW CAN | Single Wire Controller Area Network |
| **V** | |
| VCP | Intrepid Control Systems Driver |
| VSpy | Vehicle Spy |
| **X** | |
| XCP | Measurement and Calibration Protocol |

A    Appendix

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Keysight AP1200A Multi-Protocol Vehicle Network Interface User Guide

# B    Appendix

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# Service and Support

Use the following web link to contact Keysight for service and support:

www.keysight.com/find/contactus

This information is subject to change without notice. Always refer to the English version at the Keysight website for the latest revision.

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