CAInstruments

Kinexis (KX-101)

Programmable Vehicle Communication Adapter

User Manual

NOTICE: Pre-Release Document – Subject to Change

This document is a draft and is provided for preliminary reference only. It is not complete and may be missing sections or contain incomplete information. Content is subject to change without notice prior to the final release. Do not rely on this version for production use.

Change Log

Version	Date	
V0	2024-09-06	Original Document
V0.1	2025-05-01	Document Pre-Release

Table of Contents

1. Introduction

1.1. Product Overview

The **Kinexis** is a highly adaptable electronic module designed specifically for heavy-diesel applications. Featuring a wide range of programmable I/O and user-friendly software, it empowers owners, mechanics, and OEMs to innovate and achieve seamless interconnectivity tailored to their unique needs.

1.2. Front I/O

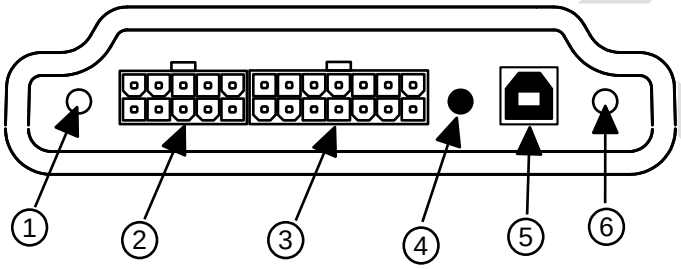


Figure 1: Kinexis front I/O

No.	Name	Function
1	Power LED	Indicates that the Kinexis is powered ON with a RED light.
2	Power and Data Connector	10-pin connector that includes the power, J1708/J1587, J1939 #1, and J1939 #2 connections.
3	Digital Outputs Connector	14-pin connector that includes the 12 digital outputs.
4	Recovery Button	Recessed button used to enter recovery/flash mode.
5	USB-B Connector	USB-B port used to connect the Kinexis to a PC for configuration and troubleshooting.
6	Status LED	Indicates the operation and status of the Kinexis with different colours and flash patterns.

1.3. Key Features

The Kinexis includes a variety of connection options for maximum application coverage. The table below summarizes the physical I/O available in the Kinexis device.

Interface	Quantity	Supported Format
SAE J1939	2	250K, 500K, 667K, AUTO
SAE J1708/J1587	1	N/A
Digital Outputs	12	On/Off, PWM, Frequency
USB	1	Type B

1.3.1. SAE J1939

The Kinexis includes two independent SAE J1939 ports, each capable of operating at 250K, 500K, and 667K baud rates. The SAE J1939 ports can be configured to a specific rate, or can be configured to automatically detect and match the speed of a connected SAE J1939 network.

1.3.2. SAE J1708/J1587

A legacy SAE J1708/J1587 port is included for interfacing with older vehicles and components.

1.3.3. Digital Outputs

The Kinexis features twelve open-drain (ground-switched) digital outputs, configurable for PWM, frequency, or on/off operation. These outputs can control indicators, analog gauges, and relays or emulate ground-switched signal circuits, such as cruise, jake, and other cab switch signals for an ECM or controller.

1.3.4. USB

The USB-B connector is used to connect a PC or laptop to the Kinexis module for configuration, firmware updates, and for troubleshooting and diagnostics.

1.3.5. Recovery Button

The recovery button can be used to force the Kinexis into recovery mode in order to restore the device to its factory defaults, or to perform firmware updates. Please note that the use of the button is only required if the Kinexis will enter recovery mode via the CAI ToolBox Software.

See 5.3. Recovery Mode for more information on how to use the recovery button.

1.4. Intended Use

The Kinexis device is designed to operate as part of monitoring or information reporting systems. Its primary function is to facilitate the communication and translation of data between different protocols and devices, enhancing interoperability and system efficiency.

Important Notice: The Kinexis is not intended for use as a systems-critical component. It should not be employed in applications where a malfunction, failure, or error could result in:

- Damage to property
- Personal injury
- Loss of life

Examples of prohibited applications include, but are not limited to, drive train control systems, emergency response systems, safety-critical machinery, and any other use where operational failure could pose significant risks.

By using the Kinexis, you acknowledge and accept these limitations. Always ensure that appropriate fail-safes and redundancies are in place within your system to mitigate potential risks.

2. Safety Information

2.1. General Safety Precautions

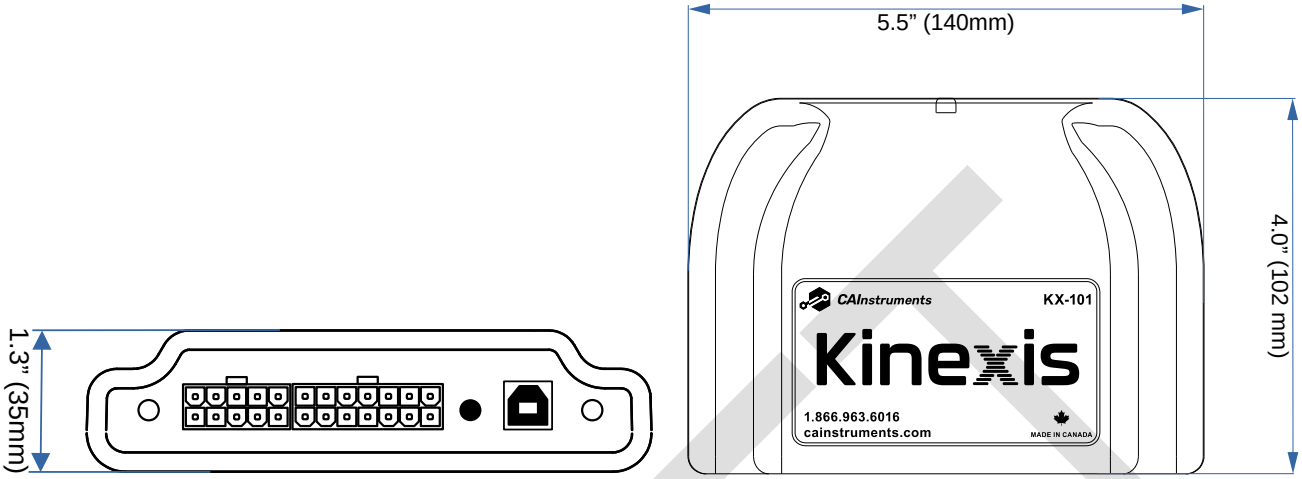
<Section not yet written>

2.2. Electrical Safety

<Section not yet written>

3. Product Specifications

3.1. Product Dimensions



3.2. Technical & Electrical Specifications

General Information

Parameter	Specification
Product Type	Electronic Communication Module
Installation	In-vehicle, hardwired
Enclosure Material	Flame-retardant ABS plastic
Dimensions (L x W x H)	4.0” x 5.5” x 1.3” (102mm x 140mm x 35mm)
Weight	<*TBD*>
Operating Temperature	-40°C to +85°C
Storage Temperature	-55°C to +100°C
Ingress Protection	IP53
Mounting Options	N/A
Regulatory Compliance	<*TBD*>

Electrical Characteristics

Parameter	Specification
Supply Voltage Range	10-32 VDC
Nominal Voltage	12 V / 24 V
Power Consumption	<*TBD*>
Reverse Polarity Protection	Yes

Overvoltage Protection	Yes (up to 80 V)
Short Circuit Protection (Digital Outputs)	Yes

Communication Interfaces

Parameter	Specification
CAN Bus	2x ISO 11898-2, up to 1 Mbps
J1708	1x SAE J1708
Supported Protocols	SAE J1939, J1587, Propreitary

Status and Diagnostics

Parameter	Specification
Status Indicators	Power, Multi-function RGB status LED
Configuration Interface	USB 2.0 (Type B)
Diagnostics	CAI ToolBox via USB

Software and Firmware

Parameter	Specification
Firmware Update	USB
Configuration Tool	CAI Control Center / CAI ToolBox
User Access	Per-device locking (optional)

3.2. Environmental Requirements

This device is **not waterproof or weather-resistant** and must be installed in a dry, protected location. Exposure to moisture, water spray, or direct environmental elements (such as rain, snow, or excessive dust) may cause damage or malfunction. It is recommended to install the module inside the vehicle cabin, such as behind the dashboard, or within a sealed and protected electrical enclosure. Ensure that the installation location shields the unit from water ingress, vibration beyond rated limits, and extreme temperature fluctuations.

4. Installation Instructions

4.1. Installation Steps

<Section not yet written>

4.1.1. Mounting the Kinexis

1. Select a secure, dry location on the equipment for mounting.
2. Ensure that the location provides adequate access to vehicle wiring and networks.
3. Secure the Kinexis using mounting hardware suitable for your application.

⚠ Attention: The Kinexis is not waterproof, and must not be mounted where it will be exposed to the elements.

4.1.2. Connect the 'A' Harness

The **'A' harness** contains 8 wires:

- Power wires: **Red**, **Black**
- J1708/J1587 interface: **Blue**, **White**
- J1939 interfaces: 2 pairs of **Green** and **Yellow**

a) Provide Power to the Adapter

- **Red** wire (Power +): Connect to switched or ignition power (12VDC or 24VDC).
- **Black** wire (Ground -): Connect to battery negative or chassis ground.
- ✅ Once connected, the red power LED on the Kinexis will light up.

b) Connect to J1708/J1587 (as required)

- **Blue** wire (J1708/J1587 +): Connect to the positive side of the J1708/J1587 network.
- **White** wire (J1708/J1587 -): Connect to the negative side.
- Note: These can be spliced into an existing J1708/J1587 network or directly connected to a single device if it's a point-to-point connection.

c) Connect to J1939 Networks (as required)

The Kinexis supports two J1939 networks, each using a green/yellow wire pair:

- **Green** wire: J1939 Low (-)
- **Yellow** wire: J1939 High (+)

Splice each green/yellow pair into the existing J1939 networks used by devices the Kinexis must communicate with.

4.1.3. Connect the 'B' Harness

The 'B' harness provides access to the Kinexis' digital outputs.

- Each output is a ground-switched circuit.

- Connect each output to the low side of the device it controls (e.g., lamps, gauges, relays).

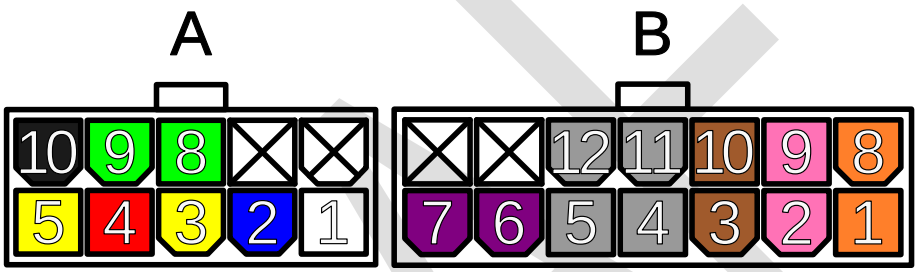
If your application requires an on/off voltage signal from the output, use a pull-up resistor between the output and your desired supply voltage.

4.1.4. Final Check

- Ensure all connections are secure.
- Confirm that the red power LED is illuminated.
- Power up and test your system to begin configuration and to verify communications and output functionality.

4.2. Wiring Diagrams

4.2.1. Kinexis Connector Pinouts



CONNECTOR A (10-PIN)

PIN	COLOUR	FUNCTION
1	WHITE	J1708/J1587 LOW
2	BLUE	J1708/J1587 HIGH
3	YELLOW	J1939 #1 HIGH
4	RED	12/24V SUPPLY
5	YELLOW	J1939 #2 HIGH
8	GREEN	J1939 #1 LOW
9	GREEN	J1939 #2 LOW
10	BLACK	SUPPLY GROUND

CONNECTOR B (14-PIN)

PIN	COLOUR	FUNCTION	GROUP
1	ORANGE	DIGITAL OUTPUT #1	1
2	PINK	DIGITAL OUTPUT #2	2
3	BROWN	DIGITAL OUTPUT #3	3
4	GREY	DIGITAL OUTPUT #4	4
5	GREY	DIGITAL OUTPUT #5	4
6	PURPLE	DIGITAL OUTPUT #6	5
7	PURPLE	DIGITAL OUTPUT #7	5
8	ORANGE	DIGITAL OUTPUT #8	1
9	PINK	DIGITAL OUTPUT #9	2
10	BROWN	DIGITAL OUTPUT #10	3
11	GREY	DIGITAL OUTPUT #11	4
12	GREY	DIGITAL OUTPUT #12	4

4.2.2. Vehicle Diagnostic Connectors

The vehicle's diagnostic connector is often one of the most accessible locations to tap into the databus. However, this is not always a reliable option—especially in newer vehicles (late 2010s and onward). On some of these newer models, the databus connections at the diagnostic port may be restricted to diagnostic functions only, making them unsuitable for general-purpose communication or integration.

There are several variants of the diagnostic port in use. The most common include the grey 6-pin (older vehicles, from the early 2000's and older), the black 9-pin (early 2000's to late 2010's), and the green 9-pin (late 2010's and later). The following table describes these connectors in more detail.

Connector	Protocols	Found On
Grey 6-Pin	J1708/J1587	Early 2000's and older
Black 9-Pin	J1708/J1587, J1939 (250k), OEM	Early 2000's to late 2010's
Green 9-Pin	J1939 (250K), J1939 (500k), OEM	Late 2010's and after

5. Operating Instructions

5.1. Configuration

5.1.1. J1708/J1587 Interface

The Kinexis includes one configurable J1708/J1587 interface. The J1708/J1587 section in the CAI Control Center software provides the following configuration options for the J1708/J1587 interface:

5.1.1.1. Enable/Disable

The *Enable* checkbox

5.1.1.2. Device Identity ('Communicate As')

When a device communicates over the J1708/J1587 interface, it must identify what type of device it is. This allows other components to discern the type of data that might be available and its relevance to different subsystems within the vehicle. The 'Communicate As' dropdown allows the user to choose an identity for the Kinexis based on a predefined list of common device types. The user should choose the identity that best suits the application and role of the Kinexis within it.

5.1.1.3. Output Parameters

The J1708/J1587 interface has a configurable list of transmitted parameters. By default this list is empty, however any parameters added to this list will enable support for the Kinexis to transmit these parameters using its configured identity (see section *5.1.1.2. Device Identity ('Communicate As')*).

5.1.2. J1939 Interfaces

This section has not yet been written.

5.1.3. Digital Outputs

5.1.3.1. Digital Output Operating Modes

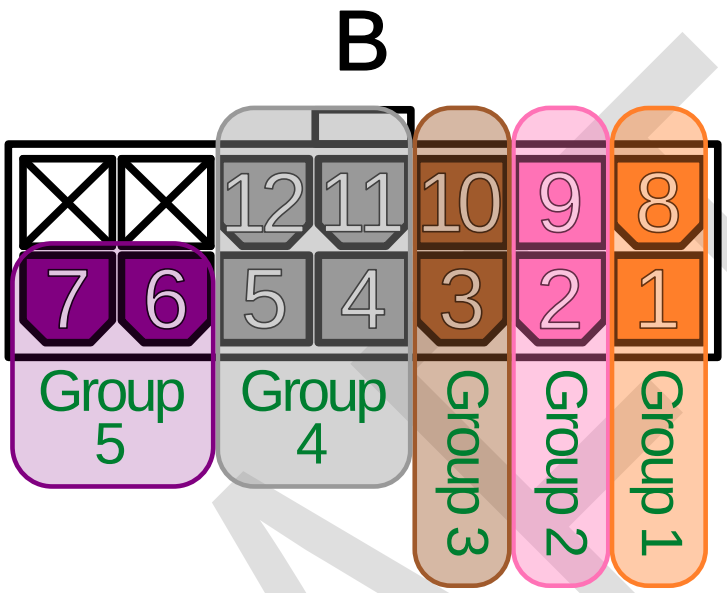
The Kinexis' digital outputs can be configured for one of four different operating modes, described in the following table:

Mode	Description
Disabled	Output is unused
On/Off Mode	Output toggles between *on* (shorted to ground) and *off* (open circuit) as a result of input data on the J1708/J1587, J1939 #1, or J1939 #2 interfaces. This can be used to control indicators, relays, or other loads (up to ??? mA) or digital inputs of other devices. **Note:** An external pull-up resistor may be required if the receiving device does not have an internal pull-up resistor. *When using an external pull-up resistor, it is critical to ensure that the pull-up voltage does not exceed the maximum voltage of the receiving device.*
Analog Mode	Output operates as a PWM (pulse-width modulation) output as a result of input data on the J1708/J1587, J1939 #1, or J1939 #2 interfaces. This can be used to control PWM-compatible loads, including most analog sender-driven gauges.
Frequency Mode	Output operates as a square-wave frequency output as a result of input data on the J1708/J1587, J1939 #1, or J1939 #2 interfaces. This can be used to supply frequency-controlled devices, including most analog speedometers and

tachometers.

Note: An external pull-up resistor may be required if the receiving device does not have an internal pull-up resistor. *When using an external pull-up resistor, it is critical to ensure that the pull-up voltage does not exceed the maximum voltage of the receiving device.*

5.1.3.2. Digital Output Groups



The 12 digital outputs are divided into five groups. Each group contains two outputs, except for Group 4, which has four. When configuring outputs, keep the following group-based limitations in mind:

1. If any output in a group is set to **Analog Mode**, the remaining outputs in that group can only be set to **Disabled, Analog Mode, or On/Off Mode**.
2. If any output in a group is set to **Frequency Mode**, the remaining outputs in that group can only be set to **Disabled or On/Off Mode**.

In summary:

- **Analog Mode and Frequency Mode cannot coexist within the same group.**
- **Multiple outputs in a group can be set to Analog Mode.**
- **Only one output per group can be set to Frequency Mode.**
- **Disabled and On/Off Mode are always allowed, regardless of other settings.**

For easy identification, outputs within the same group have matching-colored wires in the *Connector B* harness.

Example Configuration: 2 Frequency Outputs, 7 Analog Outputs, and 3 On/Off Outputs

Step 1: Assign Frequency Outputs

Since Frequency Mode limits other outputs in the same group to only Disabled or On/Off Mode, we should use groups with fewer total outputs. Groups 1, 2, 3, or 5 are ideal because they contain only two outputs each.

- Assign Output #1 (Group 1) to Frequency Mode.
- Assign Output #2 (Group 2) to Frequency Mode.

⚠ We cannot use Output #8 for the second frequency output, as it belongs to Group 1, which would place both frequency outputs into the same group.

Step 2: Assign Analog Outputs

Analog Mode can be used freely within a group, but cannot coexist with Frequency Mode in the same group.

- We can place 7 analog outputs in Groups 3, 4, and 5, avoiding groups that already contain frequency outputs.
- Assign:
  - Output #3 (Group 3)
  - Output #4 (Group 4)
  - Output #5 (Group 4)
  - Output #6 (Group 5)
  - Output #7 (Group 5)
  - Output #11 (Group 4)
  - Output #12 (Group 4)

⚠ Outputs #8 and #9 cannot be used for Analog Mode because that would mix Analog and Frequency Modes within their groups.

Step 3: Assign On/Off Outputs

On/Off Mode is always allowed, so the remaining three outputs can be assigned freely.

- Assign Output #7 (Group 1), Output #8 (Group 2), and Output #9 (Group 3) to On/Off Mode.

This configuration ensures compliance with output grouping rules while maximizing available functionality.

5.2. Normal Operation

<Section not yet written>

5.3. Recovery Mode

If the Kinexis should ever cease to function, such that it can no longer be configured via the CAI Control Center software, then the device can be forced into *recovery mode* by using the recovery button. When the Kinexis is in recovery mode, it can be restored back to its factory settings by updating or re-installing its firmware.

Steps to enter recovery mode:

1. Ensure the Kinexis is powered off.

2. Using a pen or other narrow object, press the recovery button located next to the USB port on the device (see 1.2. Front I/O for more information).
3. While continuing to press the recovery button, **power on the Kinexis**.
4. The Kinexis should power on in recovery mode, which is indicated by the *status LED* alternating between **red** and **yellow**.

Once in recovery mode, the Kinexis firmware can be updated using the CAI ToolBox Software and the appropriate firmware file downloaded from https://my.kinexis.net.

6. Troubleshooting

6.1. Troubleshooting Guide

6.1.1. LED Status Indicators

The Kinexis features two status LEDs on the front face of the device (see Figure 1: Kinexis Front I/O). The following tables describe the states indicated by the LEDs:

Table 1: Power LED States

LED	Meaning
Off	The Kinexis is unpowered or there is insufficient voltage at the Kinexis' power input.
On (solid red)	The Kinexis is powered.

Table 2: Status LED States

LED	State	Description
Off	Halted	The Kinexis is unpowered, has insufficient voltage at its power input, or has encountered a critical issue.
White (pulsing)	Idle Mode	The Kinexis is powered and idle; no data communication is ocurring.
Green (solid or flashing with other colours)	J1708/J1587 Communication Active	The Kinexis is receiving data on the J1708/J1587 interface.
Blue (solid or flashing with other colours)	J1939 #1 Communication Active	The Kinexis is receiving data on the J1939 #1 interface.
Cyan (solid or flashing with other colours)	J1939 #2 Communication Active	The Kinexis is receiving data on the J1939 #2 interface.
Yellow (flashing)	J1939 #1 Communication Error	The Kinexis is unable to communicate on the J1939 #1 interface.
Red (flashing)	J1939 #2 Communication Error	The Kinexis is unable to communicate on the J1939 #2 interface.
Yellow & Red (flashing back and forth)	Recovery Mode	The Kinexis is in recovery mode.
Magenta (pulsing)	Scan Mode	The Kinexis is currently performing a diagnostic databus scan (as commanded using the CAI ToolBox software).

6.1.2. J1708/J1587 Troubleshooting

If the Kinexis is not receiving communication on the J1708/J1587 databus (indicated by a solid or flashing **green** colour on the status LED), then the following troubleshooting steps can be taken:

<Section not yet written>

6.1.3. J1939 Troubleshooting

If the Kinexis isn't receiving communication on the J1939 #1 databus (no solid or flashing **blue** status LED), on the J1939 #2 databus (no solid or flashing **cyan** status LED), or if it's showing J1939 communication errors (flashing **yellow** for J1939 #1 or flashing **red** for J1939 #2), follow the troubleshooting steps below.

6.1.3.1. J1939 Terminating Resistors

SAE J1939 networks require **exactly two 120-ohm termination resistors** to ensure reliable communication. Many components, including Kinexis, will not communicate on a J1939 network unless the appropriate terminating resistors are present.

The two 120-ohm termination resistors are required to be installed, one at each end of the main J1939 bus (alternatively called the "backbone").

Verifying Terminating Resistors with a Multimeter

To verify proper termination:

1. **Power down** the J1939 network. This is usually done by turning off the ignition switch or disconnecting the battery.
2. Use a **digital multimeter** set to **resistance (ohms)**.
3. Touch one probe of the multimeter to **J1939 High** (usually a yellow wire) and the other probe to **J1939 Low** (usually a green wire).
4. A correct reading should be **approximately 60 ohms**, which is the result of reading two 120-ohm resistors in parallel.

If you measure:

- **~60 ohms**: Correct termination.
- **~120 ohms**: Only one termination resistor is present – one is missing.
- **Very high or infinite resistance (open circuit)**: No termination resistors are installed.
- **~40 ohms or less**: More than two termination resistors – remove the extras.

Installing Missing Termination Resistors

If testing indicates a missing termination resistor:

1. Locate one end of the **main J1939 backbone** (not a stub or drop cable).
2. Install a **120-ohm** resistor between the **J1939 High** and **J1939 Low** lines at this end.
3. Repeat the resistance check to confirm the reading is now approximately 60 ohms.

Note: Only use resistors rated for automotive or industrial use to ensure durability and compliance with the J1939 specification.

6.1.4.2. J1939 Voltage Tests

<Section not yet written>

7. Warranty and Support

7.1. Warranty Information

CAI provides a two-year limited warranty covering defects in materials and workmanship. Warranty claims require the product to be shipped to CAI for evaluation, with the customer responsible for shipping costs. If the issue qualifies for warranty coverage, CAI will repair or replace the product at no cost and cover return shipping. This warranty does not apply to failures resulting from improper installation, unauthorized modifications, or misuse.

7.2. Customer Support Contact

Phone (Local)	(780) 963-8930
Phone (Toll-Free)	1-866-963-6016
Email (Sales)	sales@c-a-i.net
Email (Support)	support@c-a-i.net
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