Komodo CAN Duo Interface / AVADirect Custom Computers

Company:
AVADirect/Major Forklift Manufacturer

CHALLENGE

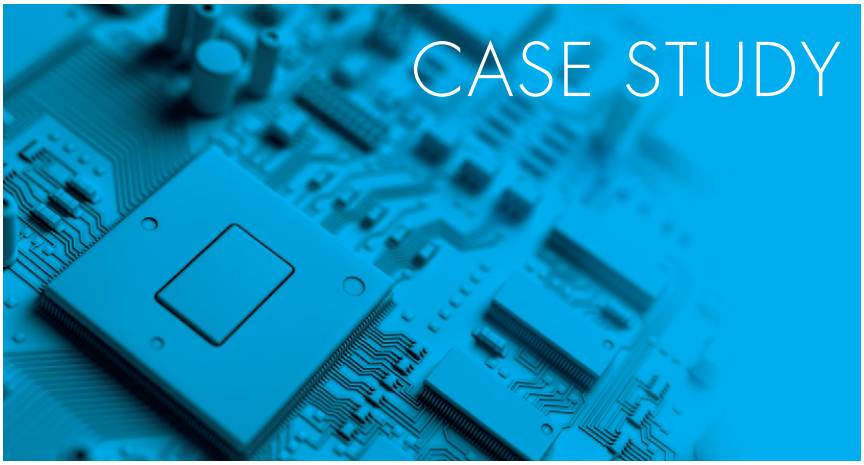
In order to build a custom computing solution that could translate forklift movements to the forklift simulation software, AVADirect and their client determined they would need to build a system integration that would incorporate a tool capable of capturing and translating CAN data between the forklift and the PC running the software.

SOLUTION

AVADirect helped their client build a comprehensive, custom computing solution from front to end integrating the Komodo CAN Duo Interface for their CAN analysis requirements.

BENEFITS

The Komodo CAN Duo Interface is a plug-and-play solution that could be easily integrated into the custom computing system to translate CAN data associated with movements of the forklift to the forklift simulation software. This software allows forklift operators to train with the use of controls without needing to use the actual forklift itself, making forklift training much more efficient, safe, and cost-effective.



AVADirect Custom Computers is a company whose mission is to create and provide cutting-edge, tailored-made computing solutions for their customers, whether it be government agencies, educational institutions, enterprises, businesses, everyday home users, or PC enthusiasts. AVADirect is a build-to-order custom systems integrator where they can provide true custom solutions that are not bound by in-house constraints.

One of their customers, a major forklift manufacturer, came to AVADirect for help with designing and building a custom computing solution for their virtual reality-specific forklift simulator. Within their setup, their customer required a plug -and-play, cost-effective tool with a serial port connection to translate all of the forklift movements and control data over to a PC that ran the training simulation software. AVADirect used the Komodo CAN Duo Interface to address this need.

Background/Problem:

Forklift training in real-world settings is often a cumbersome and costly process. This training can take numerous hours and includes high potential for mistakes, especially for new and beginner forklift operators who are not familiar with the controls and maneuvers. This can result in training liabilities or damages to equipment or the training environment.

To help make the forklift training process more streamlined, safe, and effective, AVADirect helped design and create a custom computing solution for their forklift manufacturing client to allow operators to train using a virtual reality forklift simulator. During the research and development process, their teams determined that that the custom computing

solution would require the integration of a CAN system to capture CAN traffic resulting from movements of the forklift.

Technical Approach:

AVADirect and their client sought a CAN interface tool to act as a serial port connection that could translate data associated with movements of the forklift over to a PC that hosted the training simulation software. This would allow a simulated use of controls of the forklift in various circumstances and environments.

CAN Protocol in Industrial Applications

The CAN bus is a communication protocol that is used heavily in automotive, machinery, and other industrial applications due to its robustness and reliability. For one, CAN functions over minimal wiring using a twisted pair system. This greatly reduces the overall weight of the vehicle/machine. Secondly, CAN uses arbitration methods as a form of CAN bus negotiation that allow devices, or nodes, to prioritize messages for safe and efficient communication. In cases where multiple devices are trying to access the bus at once, the message with the highest priority will be transmitted while the other devices go into "listening" mode. Additionally, CAN also uses error correction capabilities that make it fitting for high-risk machinery applications

CAN is an industry standard used in forklift vehicles that allows the steering, carrying, lifting, and stacking movements to be executed. Each component that contributes to the operation of the forklift system, including sensors, switches, or microcontrollers, are nodes on the CAN bus and are controlled via the CAN network.

The CAN protocol specifies four fundamental frame types which nodes use to interact:

1. **Data Frame** – carries 0-8 bytes of data, along with an identifier and CRC check
2. **Remote Frame** – requests a data frame transmission with a certain identifier node
3. **Error Frame** – transmitted when an error is detected
4. **Overload Frame** – provides extra delay between data and remote frames

Using a CAN Interface

Their teams selected the Komodo CAN Duo Interface, a plug-and-play solution that supports Windows, Mac, and Linux machines, to help them carry out their CAN translation requirements. This tool was able to easily integrate within their custom computing system to immediately start recording activity on the CAN bus, including the decoded CAN data, the record or frame type, and the bitrate.

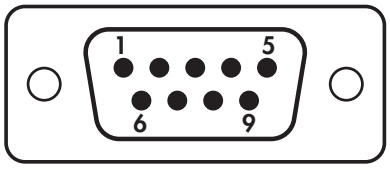
Komodo CAN Interface Connectors

The Komodo CAN Duo Interface offers two customizable, independent CAN channels that allow users to non-intrusively monitor CAN bus data in real time and actively send CAN messages across the bus at a maximum bitrate of 1 Mbps. Each CAN channel is equipped with a DB-9 and terminal block connector to connect to the CAN bus. Additionally, the Komodo CAN Duo Interface has two virtual USB ports (via a single physical USB port) and comes with eight configurable GPIOS to connect to external logic.

DB-9 Connector

The DB-9 connector follows the SAE J1939 CAN-CIA standard and has the following pinout:

1. No Connect
2. CAN–
3. GND
4. No Connect
5. SHLD
6. GND
7. CAN+
8. No Connect
9. V+

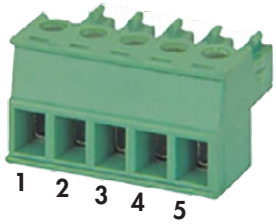


Terminal Block Connector

Each CAN channel features a green terminal block that consists of two parts: a right-angle closed-end header and a right-angle plug. The plug includes screw terminals so it can be used easily with wires.

The terminal block pinout is as follows:

1. GND
2. CAN–
3. SHLD
4. CAN+
5. V+



DIN-9 Connector

Additionally, the Komodo interface features a DIN-9 connector for GPIO use.

Pin Descriptions

GND

Ground – The grounds of the CAN channels are galvanically isolated from each other and the Komodo interface's circuitry. Each channel's CAN– and CAN+ signals are referenced to their respective ground pin.

CAN–

Dominant Low – When a dominant bit is transmitted, the voltage of this pin is lower than CAN+. When configured as an input, voltage may range from –12 V to 12 V.

SHLD

CAN Shield – This pin may optionally be connected to the CAN bus shield.

CAN+

Dominant High – When a dominant bit is transmitted, the voltage of this pin is higher than CAN–. When configured as an input, Voltage may range from –12 V to 12 V.

V+

Power – The Komodo interface can optionally source power to the CAN bus. If enabled, it will provide approximately 4.8 V out on this pin and can source up to 73mA (per CAN channel).

The input voltage on V+ should not exceed 30 V.

No Connect

Reserved for future use. Internally, these pins are floating.

Komodo CAN Interface Power

The Komodo interface is USB-powered device that features a single USB-B receptacle. This port connects to the analysis computer that runs the software or a custom application. This port must be plugged in to provide power to the Komodo CAN Duo Interface and to power the CAN bus over V+ (if enabled).

The Komodo interface consumes less than 150 mA from the host PC and reports itself as a high-powered device. Because of this, the Komodo interface provided the forklift manufacturer's setup with a power-efficient solution that also allowed them to easily and discreetly connect the forklift to the PC.

CAN Data Captured by the Komodo Interface

The Komodo CAN Duo Interface has allowed their teams to capture CAN data packets resulting from the forklift movements as they occurred on the bus, including

- **Bitrate:** the bitrate of the CAN bus in kHz.
- **ID:** The ID of the source CAN node of the CAN packet. When a packet is marked as RTR, the ID, instead, corresponds to the destination CAN node (the requestee).
- **DLC:** (Data Length Code) the specified number of bytes transmitted in a single CAN packet.
- **Data:** The data payload for CAN packets, and a textual description for CAN events, errors, and capture events.
- **Record:** Bus event, GPIO event, data frame, arbitration loss, remote frame.

Ch	Index	m:s.ms.us	Len	Err	Bitrate	ID	Record	DLC	Data
A	184996	2:06.696.472	3 B		125 KHz	01d	Data Frame	3	01 FE 38
A	184997	2:06.697.083	3 B		125 KHz	042	Data Frame	3	01 01 01
A	184998	2:06.782.806			125 KHz	029	Remote Frame (Km)	2	
A	184999	2:06.784.222	2 B		125 KHz	029	Data Frame	2	F5 02
A	185000	2:06.786.809			125 KHz	01d	Remote Frame (Km)	3	
A	185001	2:06.788.650	3 B		125 KHz	01d	Data Frame	3	01 FF 38
A	185002	2:06.790.805			125 KHz	04e	Remote Frame (Km)	2	
A	185003	2:06.792.599	2 B		125 KHz	04e	Data Frame	2	1C 80
A	185004	2:06.793.396	1 B		125 KHz	03a	Data Frame	1	00
A	185005	2:06.794.184	1 B		125 KHz	039	Data Frame	1	00
A	185006	2:06.795.070	2 B		125 KHz	029	Data Frame	2	F5 02
A	185007	2:06.796.213	2 B		125 KHz	04e	Data Frame	2	1C 80
A	185008	2:06.797.519	3 B		125 KHz	01d	Data Frame	3	01 FF 37
A	185009	2:06.798.123	3 B		125 KHz	042	Data Frame	3	01 01 01
A	185010	2:06.893.774	1 B		125 KHz	03a	Data Frame	1	00
A	185011	2:06.894.239			125 KHz	029	Remote Frame (Km)	2	
A	185012	2:06.894.624	1 B		125 KHz	039	Data Frame	1	00
A	185013	2:06.895.445	2 B		125 KHz	029	Data Frame	2	F5 02
A	185014	2:06.896.587	2 B		125 KHz	04e	Data Frame	2	1C 80

"The Komodo CAN Duo Interface has allowed us to implement industrial machinery into VR simulations seamlessly. As part of a complex solution, the Komodo interface makes integration simple – we would not have been able to sync two different realities together so easily."

— Joseph Mundy, *Sales and Support Manager*

Komodo CAN Interface Setup for Forklift Simulation

Within the setup, their teams utilized a custom cable to connect the Komodo CAN interface to the CAN bus within the forklift vehicle. Using the Komodo's terminal block connector, they were able to connect the necessary wires to establish the connection to capture the CAN data. The data could then be transferred from the Komodo interface to the analysis PC running the simulation software through a USB cable connection.

Their setup using the Komodo CAN Duo Interface is as follows:

Advantage:

The Komodo CAN Duo Interface has been an integral component for extracting and logging CAN data to help with the development of the forklift simulation software. Due to the Komodo interface's durability, their teams have efficiently incorporated this tool into their setup without requiring any replacements after implementation. Additionally, because the Komodo interface offers real-time data capture, this has allowed them to reduce latency to improve the VR environment.

Performing forklift simulation training allows users to immerse themselves in a realistic and challenging environment. As opposed to real-world training, the VR alternative reduces risk in liabilities or damages and improves safety awareness.

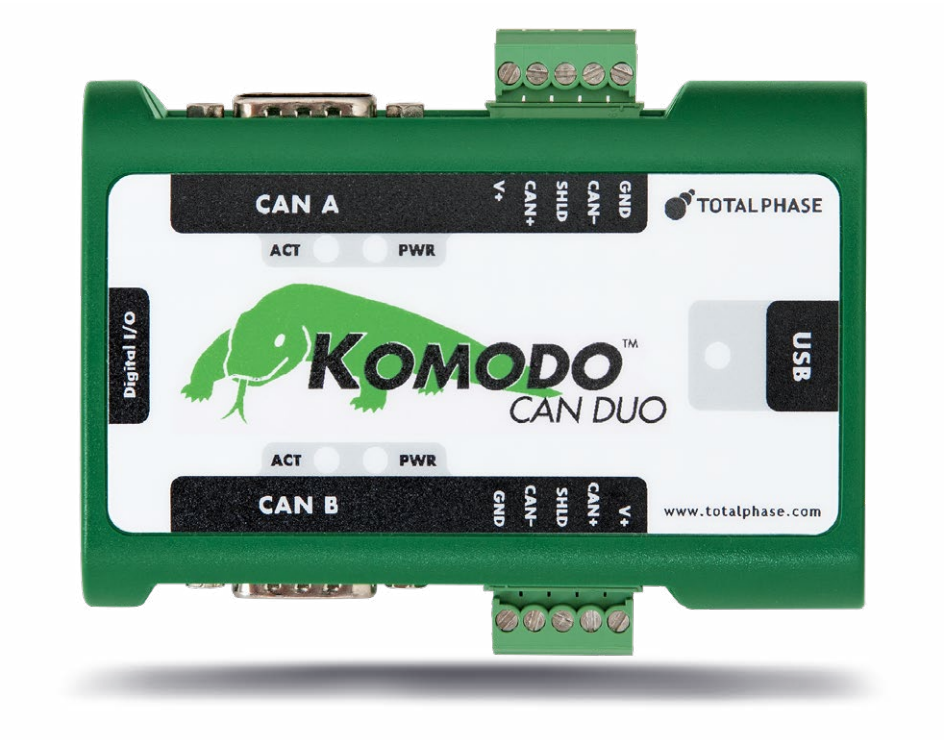
To help determine the effectiveness of the forklift simulation software compared to real-world settings, the Komodo CAN Duo Interface also allowed the forklift manufacturer to extract data from the training to then determine a certifiable score. By utilizing the forklift simulator, the forklift manufacturer was able to determine that the VR training hit a 90% translation rate compared to real-world training.

Conclusion:

The Komodo CAN Duo Interface has seamlessly integrated into AVADirect's custom computing solution to be used to capture and translate the CAN data resulting from real-world forklift movements. This captured data is used by the PC running the forklift simulation software and has allowed their teams to create a forklift simulator system that offers realistic training that mimics the look and feel of operating a real machine. The Komodo interface has offered AVADirect and their client a plug-and-play CAN analysis solution that requires no additional configurations, allowing them to streamline their CAN system developments.

Product Brief:

The Komodo CAN Duo Interface is a powerful USB-to-CAN adapter and analyzer that includes two independent, customizable CAN channels. This all-in-one tool is capable of simultaneous active CAN data transmission and non-intrusive CAN bus monitoring and supports high-speed and fault-tolerant CAN bus speeds up to 1 Mbps. The Komodo interface includes 8 GPIOS to connect external logic and provides real-time data capture and filtering capabilities.



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