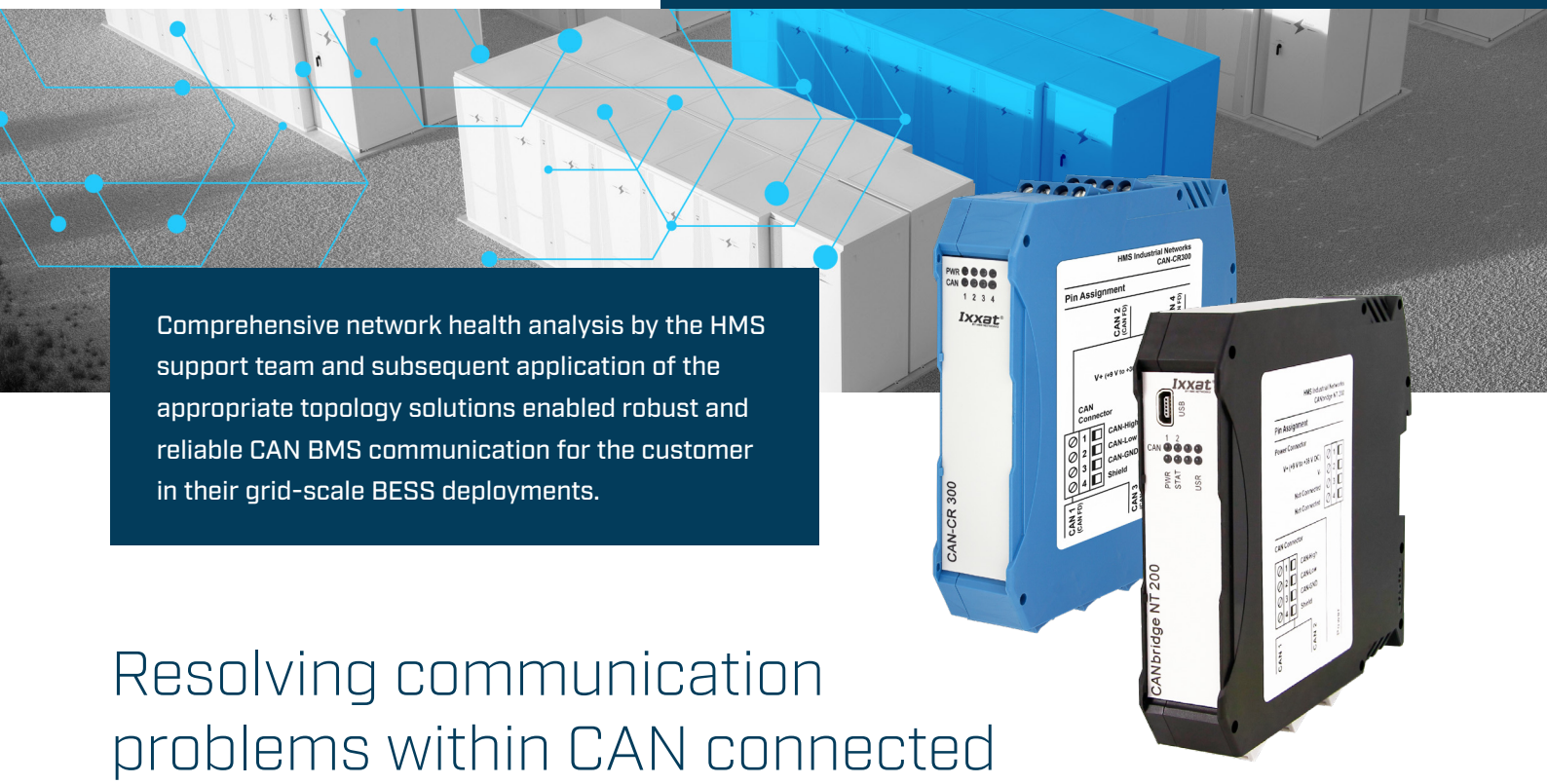
Ixxat® BY HMS NETWORKS

Case study

Deploying and commissioning reliable, large-scale CAN-based BMS networks



Comprehensive network health analysis by the HMS support team and subsequent application of the appropriate topology solutions enabled robust and reliable CAN BMS communication for the customer in their grid-scale BESS deployments.

Resolving communication problems within CAN connected Battery Energy Storage Systems

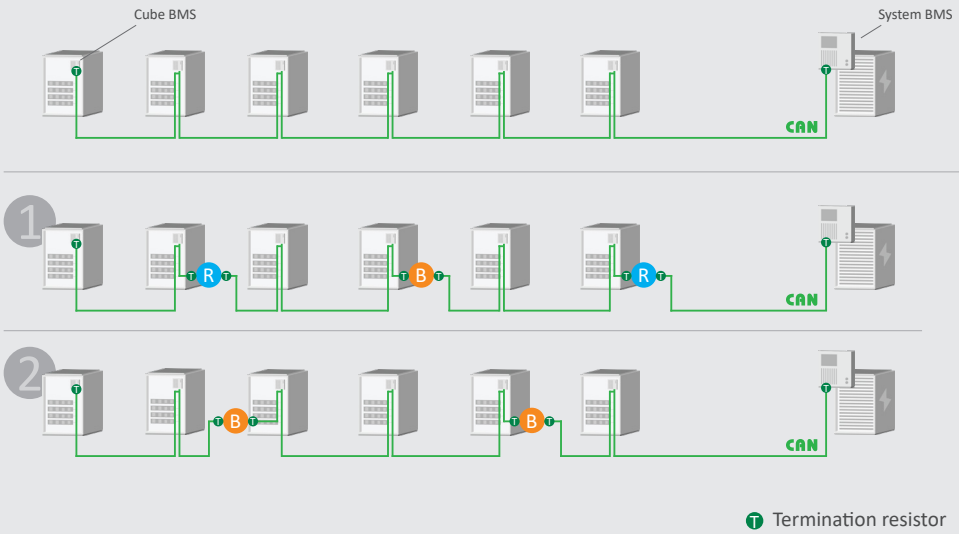
Customer background

The customer is designing and deploying modular, scalable BESS which utilize high bitrate CAN bus in the BMS network architecture. Controller Area Network (CAN), originally used in the automotive sector, is known for its robustness. However, specific requirements must be met to maintain reliability and overall communication stability. These include specific demands for the network length and topology as well as the cabling and terminations.

During early-stage commissioning of a multi-MW project, site technicians identified battery rack communications issues. Initial attempts to identify the root cause were unsuccessful, whereupon the customer contacted HMS to request assistance troubleshooting and resolving the issue and achieving communications stability in their battery/BMS network.

Customer benefit summary

- Fast and professional remote support with extensive network analysis from resident CAN experts
- Identification of system weaknesses on physical layer with direct suggestions for improving communication reliability
- Cost-optimization of system design for future deployments
- Clear understanding of when and how to apply various CAN bus topology solutions (repeaters, bridges, gateways)
- One partner for global support: Services as well as extensive product portfolio



Initial situation, one long CAN bus without segmentation

Proposed solutions to the customer to resolve the communication problems:

1. Use of a CAN bridge for segmentation and signal refreshing, plus two repeaters for signal refreshing
2. Use of two CAN bridges for more precise segmentation of the network

T Termination resistor R CAN repeater B CAN bridge

Remote diagnosis in collaboration with technicians, utilizing digital tools

HMS leveraged digital tools to overcome time zones and provide thorough, remote troubleshooting support to a job-site halfway around the globe. Specific CAN bus analysis tools were utilized including Ixxat CANcheck and USB-to-CAN V2 combined with canAnalyser software interface.

For the error analysis, the customer carried out signal measurements on the bus and checked the wiring. Working jointly with the customer, systemic physical-layer problems were identified early. By analyzing the CAN waveforms, it was shown that the network instability was due to excessive capacitive load combined with signal reflections. Common contributors to such symptoms are (a) use of non-conformant cabling, (b) cabling length being exceeded, (c) lack of sufficient shielding/grounding.

Unfortunately, system re-wiring and cable replacement was not possible due to project requirements and physical limitations. A different approach was needed!

Solution through intelligent CAN bus segmentation

The total physical cabling length of this system was roughly 115 meters. Whereas a 500 kbit CAN network typically can achieve lengths of 100-110 m, the underlying issues on this system limited the length even more, before active error frames appeared. The HMS team suggested segmenting (sub-dividing) the network accordingly using the appropriate CAN topology components to improve the signal quality.

The intuitive choice – implementing CAN repeaters to "extend" the network – was not applicable for this system! Although CAN repeaters do provide bit-wise refreshing of signal levels, their signal propagation delay time effectively only adds length to a line topology network.

Instead, the larger CAN network was intelligently divided into multiple, shorter segments utilizing 2-channel CAN bridges, which offer message-wise "repeating" across all channels. This allows each sub-segment to maintain the intended baud rate along with the rest of the overall larger network. In addition, electrical disturbances are also not transmitted across the CAN bridge, which further improves the overall signal quality on all segments.

Conclusion

Through close collaboration with the customer, HMS was able to effectively analyze and troubleshoot the existing system remotely and recommend multiple paths towards a resolution. HMS' experience in these situations combined with an extensive toolbox of diagnostic tools and topology components lead to a successful resolution for the customer and a successful deployment of another large-scale Battery Energy Storage System.

Learn more on
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Under the Ixxat brand, HMS Industrial Networks offers communication solutions for machines, safety as well as energy and automotive applications. This includes standardized software and hardware as well as customized OEM solutions. Ixxat solutions enable CAN, CAN FD and Industrial Ethernet based communication inside industrial automation devices, battery storage systems, cars, medical equipment, etc. The Ixxat brand also includes safety solutions for industrial communication as well as gateways for smart grid energy systems.