
A Comprehensible Guide to J1939

By Wilfried Voss

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About this book

After writing "A Comprehensible Guide to Controller Area Network", documenting the SAE J1939 standard seemed to be a logical choice when it came to investigating CAN based higher layer protocols. As I have learned from a number of professionals in the CAN industry, J1939 is still gaining enormous popularity, even though it is already in business for some years. However, the quality and availability of documentation on J1939 is in utter contrast to its popularity.

According to Wikipedia, the biggest multilingual free-content encyclopedia on the Internet, "SAE J1939 is the vehicle bus standard used for communication and diagnostics among vehicle components, originally by the car and heavy duty truck industry in the United States." Beyond that statement there is only few information to find on J1939 and the same is true for the entire World Wide Web.

The SAE (Society of Automotive Engineers), like many standardization organizations, is keeping a close lock on their written works and profound information on their web site is sparse. Downloading the J1939 PDF documents comes with a hefty price tag, even for SAE members who receive a discount not worth mentioning.

At the time when this book was released the only available and complete technical reference on J1939 was provided by the SAE either as PDF downloads for a price tag of US\$595.00 (Single-User, one-year subscription) or one could buy the complete SAE J1939 standard in one colossal work of 1600+ pages for a mere US\$310.00. Regular books dedicated to J1939 and available for a reasonable price did not exist at the time when I started the research and, as mentioned previously, valid references on the World Wide Web were extremely sparse.

Beyond the commercial aspects there is also the issue of educational value and readability of these standards. Standards, like those developed for J1939, are not designed to educate or, God forbid, entertain.

Standardization organizations seem to be the worst when it comes to providing comprehensible and readable documentation of the products they are trying to promote, which ironically creates revenues for technical writers who actually know their job.

Despite the poor condition of the written standard, it was initially a pleasure to investigate the J1939 protocol functions. SAE J1939 is a very ingeniously designed protocol that takes a resourceful advantage of the CAN 29-Bit message identifier. Rather than relying on a myriad of protocol functions, SAE J1939 uses predefined parameter tables, which keeps the actual protocol on a comprehensible level. SAE J1939 is a prime example of good American engineering according to the KISS principle (KISS = Keep It Simple, Stupid!), but it is nevertheless at least as effective as, for instance, CANopen or DeviceNet.

I had originally contemplated to continue my "Comprehensible Guide" series with CANopen, but was overwhelmed by the amount of information that I would need to compile, which also indicates the effort it takes for the newcomer to get familiarized with the topic. SAE J1939 was so much more fun to investigate (again, initially), because it seemed simple and straightforward. However, this conclusion can only be made after relentless digging through the standards and, after repeated reading, finally understanding what the authors were trying to convey to the reader.

This book is an attempt to create an enjoyable and readable J1939 reference for everybody. The information provided in this book is, besides the SAE J1939 Standards Collection, based on publicly available information such as, but not limited to web sites and printed literature as well as contributions by engineers familiar with Controller Area Network and the J1939 protocol. The information in this book, while based on the J1939 standard, is not a reproduction of any copyrighted SAE document.

Also, this book does not intend to replace the entire SAE J1939 Standards Collection, especially since the standards SAE J1939 and SAE J1939/71 contain mainly data references which account to more than 1000 pages of 8.5 x 11" in size. These data references are not part of this book. The mere intention was to explain the standard in the sense of being a comprehensible guide.

I also need to apologize in advance that the information in this book may seem to be repetitive at times.

First of all, I always try to provide a generic overview of the topic covered in my books. This will help people with a lesser technical background to understand the technology without having to read all details.

Initially I have been trying to describe the collective SAE J1939 Standard by going through the sequence of documents as numbered by the SAE (J1939, J1939/01...J1939/81). As it turns out, a great amount of information in these documents is redundant. It really seems to be the case that individual groups with different interests created their individual documents, sometimes referring to information in other documents, and in other cases reproducing the same information in different form.

In all consequence, the only documents needed to understand the protocol features are:

J1939-21 Data Link Layer

J1939-81 Network Management

The information in this book is based on these documents.

Let me point to the legal disclaimer that states that the publisher and author have used their best efforts in preparing this book.

I would also like to take the opportunity and apologize to all engineers of the SAE who worked on the J1939 standards collection. My comments throughout this book, regarding the condition of the documentation, are not favorable. You have created a great protocol, but the standard is poorly written and lacks any visible structure. Working through the standard was at times tiresome and frustrating.

It was especially irritating to learn that the SAE engineers who created the standard were not fully familiar with the CAN specification. The SAE J1939 Standards Collection contains a number of references to the CAN standard that are misleading in the best case, while others are plain wrong.

One would also expect that engineers, regardless of their special expertise, are familiar with the unit of time, "ms" or "msec" (milli-seconds). Instead the J1939 standard uses mS, which is officially milli-Siemens (electric conductance, equal to inverse Ohm - Ω).

Last, but not least, in case you have questions related to J1939 and/or you would like to contact me, please do so (by any means) through one of my web sites, <http://www.J1939Forum.com>. Just post an inquiry and either I or the community or both will respond.

About the author

Wilfried Voss is the President of esd electronics, Inc., a company specializing in CAN technology. The company is located in Greenfield, Massachusetts. Mr. Voss has worked in the CAN industry since 1997 and before that was a specialist in the paper industry. He has a master's degree in electrical engineering from the University of Wuppertal in Germany.

Mr. Voss has conducted numerous seminars on CAN and CANopen during various *Real Time Embedded And Computing Conferences* (RTECC), ISA (Instrumentation, Systems, and Automation Society) conferences and various other events all over the United States and Canada. He is also the founder of Copperhill Technologies, a software engineering and consulting company, and the creator of VisualSizer, a comprehensive servo motor sizing software.

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