Suggested Additions to the CEA-2045 Standard

EPRI ANSI/CEA-2045 California Solar Initiative Project

Itron CSI RD&D Program Manager

GO solar CALIFORNIA

Suggested Additions to the CEA-2045 Standard

EPRI ANSI/CEA-2045 California Solar Initiative Project

Technical Update, November 2014

ACKNOWLEDGMENTS

The following organization(s), under contract to the Electric Power Research Institute (EPRI), prepared this report:

The Electric Power Research Institute (EPRI) prepared this report.

Principal Investigator
G. Aumaugher

This report describes research sponsored by EPRI.[1]

[1] This report has been published as EPRI Report 3002004864.

ABSTRACT

This report provides a summary of recommendations made to the Consumer Electronics Association (CEA) R7.8 working group regarding support for solar inverters via the CEA-2045 interface. The context for these recommendations is a California Solar Initiative project in which EPRI and partner organizations are performing development, lab testing and field demonstration of smart inverters. These inverters support the revisions being developed for the California Rule 21 interconnect guideline including advanced functionality and a standard communication interface.

The project, entitled "Standard Communication Interface and Certification Test Program" involves the development and test of inverters with communication interfaces based on the IEC standard information model, the SunSpec protocol mapping, and the CEA-2045 modular port. With a modular communication approach, these inverters are intended to be compatible with any communication system, and thereby mass producible.

These recommendations identify a specific method by which the SunSpec protocol is to be passed through the CEA-2045 interface. The method is consistent with other protocol pass-through handling in the CEA-2045 standard and is contributed so that it might become part of the standard in the future.

Keywords
CEA-2045
SunSpec Modbus
Solar Inverter
Communication Module

CONTENTS

1
INTRODUCTION

Context of this Document

EPRI is facilitating a California Solar Initiative project that aims to use the SunSpec protocol and ANSI/CEA-2045 modular interface for communication connectivity to solar inverters. The project involves the field deployment and testing of smart inverters. To demonstrate the flexibility provided by a modular approach, the project will integrate the inverters using a diversity of communication networks.

A method for handling the SunSpec protocol over the CEA-2045 interface has not previously been defined. This document sets forth a recommended approach, following the pass-through methods that have been used for other protocols within the CEA-2045 standard.

2 ADDITIONS TO THE STANDARD

Recommended Changes to CEA-2045 Section 4 "Serial Protocol"

Text in table 4-2 will be modified to add Message Type MS Byte 0x09, Message Type LS Byte 0x08 with a description SunSpec/Modbus Inverter Pass-Through.

Recommended Changes to CEA-2045 Section 10 "Pass-Through of Standard Protocols"

It is recommended to add a new section 10.1.5 as follows:

This section shows how the SunSpec protocol is supported by the interface. The messages shall be structured as follows, with the message type being a 0x09, 0x0B and the payload being defined entirely by the SunSpec Alliance.

Message Type = 0x09,0x0B	Reserved Must be '0x0'	Payload Length	SunSpec Message	Checksum
2 Bytes	3 Bits	13 Bits	Variable	2 Bytes

Figure 10-6 – SunSpec over Serial

The following is an example a Modbus RTU request for the content of analog output holding registers # 40108 to 40110 from the slave device with address 17. The Modbus RTU message would be:

0x11 0x03 0x006B 0x0003 0x7687

When transferred via the CEA-2045 link layer, the message would become:

0x09 0x0B 0x00 0x08 [0x11 0x03 0x006B 0x0003 0x7687] 0x15 0xA3

SunSpec Modbus RTU Pass-Through							
			Example Modbus RTU Frame				
Message Type	Reserved	Payload Length	Address	Function	Data	CRC	Checksum
2 Bytes	3 Bits	13 Bits	1 Byte	1 Byte	n Bytes	2 Bytes	2 Bytes
0x09, 0x0B	0x0	0x0008	0x11	0x03	0x006B 0x0003	0x7687	0x15 0xA3

3 EXISTING CEA-2045 FEATURES USED FOR SUNSPEC SUPPORT

The CEA-2045 standard includes link-layer messages that are relevant to the handling of any pass-through application layer protocol, including SunSpec Modbus messages. These Link-Layer messages are identified in the following sections.

Message Type Supported Query

This message can be initiated by either a communication module, referred to in the CEA standard as a UCM, or an end device, referred to as an SGD. Its support is mandatory per the CEA-2045 standard, and is used to make sure that the other device can support a given message type prior to attempting to utilize it. The intention of this message is to prevent one device from sending unrecognizable/uninterpretable messages to the other.

Prior to transferring a SunSpec message, the sender (UCM or SGD) shall send this query and verify that an acknowledgement is received.

Maximum Payload Length Query

In order to accommodate very simple central processing units (CPUs), the CEA-2045 standard assumes by default that message payload lengths are 2 bytes or less. For SunSpec Modbus pass-through, this default must be negotiated higher to accommodate the maximum SunSpec payload to be passed. Modbus messages cannot exceed 256 bytes. This message can be initiated by either a UCM or an SGD.

Neither a UCM nor SGD may send a message longer that the default without first negotiating successfully using this query. The purpose for this is to prevent overrun of serial data buffers.

Link Layer ACK and NAK

Each successful transfer of a message across the CEA-2045 interface results in a Link-Layer Acknowledge (ACK) response. This response implies only that the bytes were transferred without error, not that the message is supported.

All unsuccessful attempts to transfer a message (e.g. the cyclic redundancy check, or “CRC” is bad) results in a Link-Layer Not-Acknowledged (NAK) response which includes a “reason” code explaining the nature of the failure.

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com