User's Guide
SPRUHR4B–November 2013–Revised June 2015

SOMPLC-F28PLC83 System on Module for Power Line Communication

The SOMPLC-PLC83 is a self-contained hardware system on module (SOM) for power line communication, including the analog front end and the digital modem on one single PCB. It is the ideal plug-in tool for developers willing to easily and quickly evaluate the most popular narrowband power line communication standards like PRIME/G3/P1901.2 in their application environment. After the developer brings up the high voltage coupling, the SOM easily plugs into the application with standard communication ports (UART, SPI, I^2C, CAN) through a connector header interface. The SOM also plugs into the TI data concentrator reference design and future PLC development tools. Hardware schematics and Gerber files are also available to simplify integration into the application PCB.

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1 SOMPLC Features

- Small size: 1.5 in x 1.9 in
- PRIME and G3 Compatible
- F28PLC83 PLC engine with VCU
- CENELEC A functionality
- AFE031 integrated analog front end
- 34-pin mini header for interfacing with other boards
- Multiple serial communications interfaces available including UART, SPI, I^2C, and CAN
- Additional ADC interface
- Additional GPIO interfaces

2 SOMPLC Description

Figure 1 shows an overview of the SOMPLC PCB and its components.

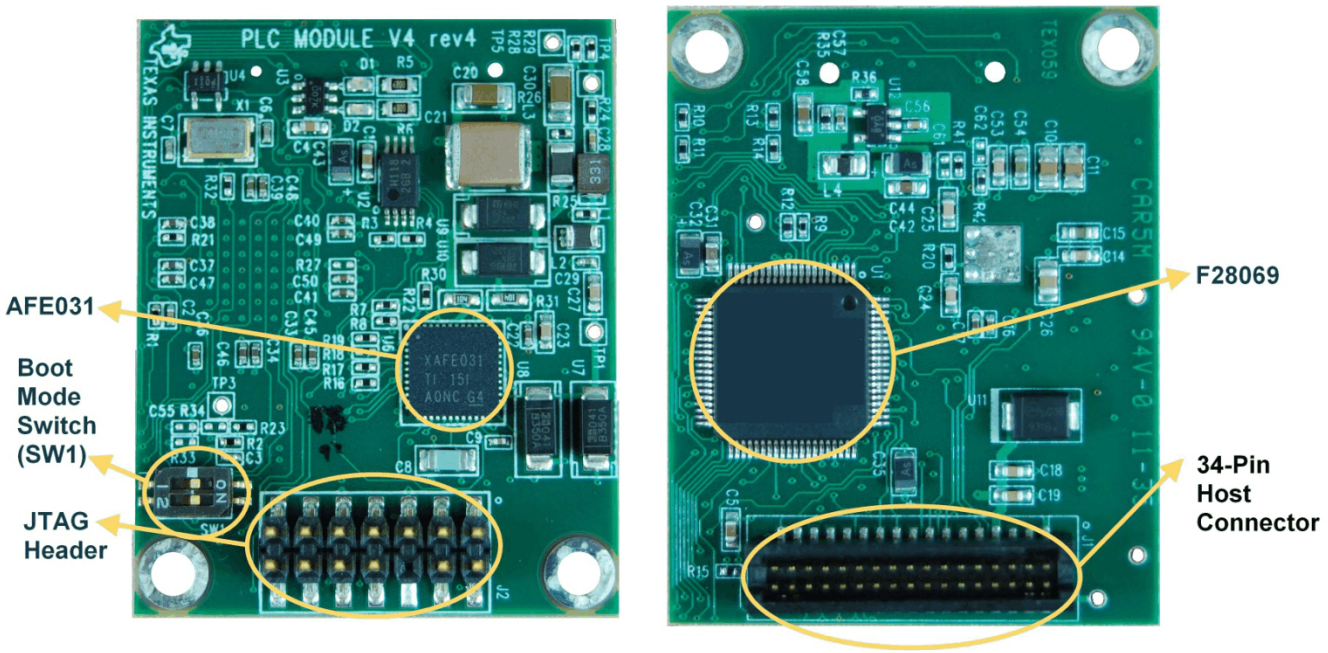
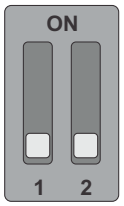


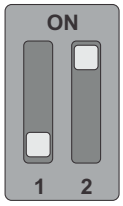
Figure 1. PCB Overview

3 Boot Modes (SW1 Positions)

Figure 2 shows how to set the boot mode using switch SW1.



FLASH Boot Mode (Default Setting)
Position 1: OFF
Position 2: OFF



SCI-A Boot Mode
Position 1: OFF
Position 2: ON

Figure 2. SW1 Boot Modes

4 UART SCI Communication

To communicate with the SCI, the following requirements must be met.

Baud Rate = 57600
Message Data Bits = 8
Stop Bits = One
Parity = None
Handshake = None
RTS Enable = True

NOTE: There is no RS232 driver on the SOMPLC. Therefore, external communications with RS232 devices must be considered external to this design.

5 SOMPLC 34-Pin Definition

Table 1 shows the interfaces and connections that are supported on this module. Table 2 describes each pin in the 34-pin connector.

Table 1. Supported Interfaces

Required Connections	Optional Connections
• SCI (UART) • Line • 15 V • 3V3 • GND	• ADC • GPIOs • SCI (UART) • CAN • SPI • I2C • Zero Cross • Analog Gnd

Table 2. 34-Pin Connector

Pin	Name	I/O	Electrical	Description
1	L1	I/O	0 V (GND)	Neutral (analog ground), connected to the PL coupler
2	L2	I/O	0 V (±6 V Peak)	Analog PLC signal, connected to the PL coupler
3	NC	NC	-	Unused
4	NC	NC	-	Unused
5	GND	-	-	Ground
6	GND	-	-	Ground
7	V15	-	+15 V to +18 V	Power supply pin (+15V). Peak current 400 mA in transmit mode. (average 100mA)
8	3V3	-	+3.14 V to 3.47 V	CPU and Logic Digital Power pin (+3.3V). Max current 1000mA.
9	EN	I-I/O	-0.3 V to VCC + 0.3 V	System enable (logical level, active high). Controls power up and power down of the module. When low, the module goes to power down mode. **This feature is NOT yet implemented in software** or GPIO13.
10	ZC	I	-0.5 V to 6.5 V	Buffered ZC input. The input signal **MUST be isolated from the power line** before entering this pin.
11	RX-A	I	-0.3 V to VCC + 0.3 V	Asynchronous serial host transmit, SCI-A
12	TX-A	O	-0.3 V to VCC + 0.3 V	Asynchronous serial host receive, SCI-A
13	Phase B/GPIO	I-I/O	-0.3 V to VCC + 0.3 V	Phase B enable signal (for 3-phase selection) or GPIO5
14	**Phase C/GPIO**	I/O	-0.3 V to VCC + 0.3 V	Phase C enable signal (for 3-phase selection) or GPIO10
15	SDAA	I/O	-0.3 V to VCC + 0.3 V	I2C data pin
16	SCLA	I	-0.3 V to VCC + 0.3 V	I2C clock pin
17	ADC-B0	I	-0.3 V to VCC + 0.3 V	Unused ADC input. (ADC-B0).
18	AGND	-	-	Analog Ground.
19	GPIO26	I/O	-0.3 V to VCC + 0.3 V	Unused multi-purpose IO, GPIO26
20	GND	-	-	Ground
21	GPIO27	I/O	-0.3 V to VCC + 0.3 V	Unused multi-purpose IO, GPIO27
22	GND	-	-	Ground
23	CAN RX/GPIO	I-I/O	-0.3 V to VCC + 0.3 V	CAN RX interface or GPIO30
24	**CAN TX/GPIO**	O-I/O	-0.3 V to VCC + 0.3 V	CAN TX interface or GPIO31
25	CLKA/GPIO	I	-0.3 V to VCC + 0.3 V	SPI clock or general purpose I/O (GPIO18).
26	**STEA/GPIO**	I	-0.3 V to VCC + 0.3 V	SPI slave transmit enable or general purpose I/O (GPIO19)
27	SIMOA/GPIO	I	-0.3 V to VCC + 0.3 V	SPI slave in, master out or general purpose I/O (GPIO16)
28	**SOMIA/GPIO**	O	-0.3 V to VCC + 0.3 V	SPI master in, slave out or general purpose I/O (GPIO17)
29	System RESET	I	-0.3 V to VCC + 0.3 V	Reset of SOMPLC (active Low)
30	GPIO04	I/O	-0.3 V to VCC + 0.3 V	Unused multi-purpose IO pin, GPIO04.
31	NC	NC	-	Unused
32	NC	NC	-	Unused
33	RX-B	I	-0.3 V to VCC + 0.3 V	Asynchronous serial host receive, SCI-B
34	TX-B	O	-0.3 V to VCC + 0.3 V	Asynchronous serial host transmit, SCI-B

6 Mechanical Specification

The connectors used on the SOMPLC are as follows:

- A male 0.05-mil header (2 x 17) is on the SOMPLC module.
  - This connector is keyed so that the module cannot be placed backwards.
  - An example part that fits this design is Sullins Connector Solutions part number SBH31-NBPB-D17-SP-BK, Digi-Key part number: S9108-ND
- A female 0.05 mil receptacle (2x17) should be used on the host board to mate with the SOMPLC module.
  - This connector is keyed and should follow the appropriate orientation as the male connector.
  - An Example Part that will fit this design is Sullins Connector Solutions part number SFH31-NPPB-D17-SP-BK, Digi-Key part number: S9117-ND

The top view of the connector is shown in Figure 3.

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34

Figure 3. 34-Pin Connector Top View

7 PLC SOM Programming

Depending on the end use of the SOM, different versions of the PLC software may be programmed to the module.

7.1 Using the XDS100 and CodeSkin to Program the F28069 MCU

Programming with this method eliminates the need for CCS to load the release(.out) file. A .hex release file is used instead and, therefore, CCS is not required.

1. Install the desired Texas Instruments PLC Development Package from www.ti.com/plc.
2. Download, install, and start the latest C2Prog from http://www.codeskin.com.

3. Set switch SW1 to "FLASH Boot Mode" as described in Section 3.
4. Connect a Texas Instruments XDS100 class emulator to the SOMPLC module using the 14-pin JTAG header.
5. Power up the SOMPLC module by applying both 15 V and 3.3 V through the 34-pin host connector.
6. Program the *.hex file (located in C:\Texas Instruments\<PackageName>\SW\bin) as shown in Figure 4. Select "28069,67,66" in the Target pulldown list and "JTAG" in the Options pulldown list.

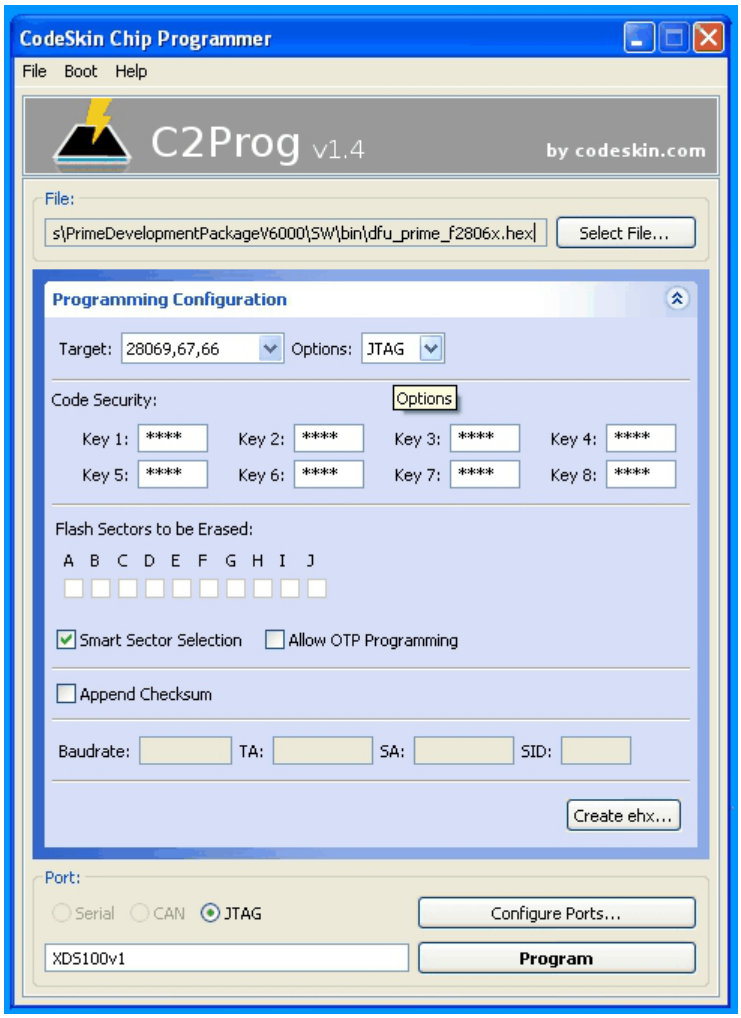


Figure 4. Programming Configuration Using XDS100

7. Click on the Configure Ports button and set the JTAG port to "XDS100v1".

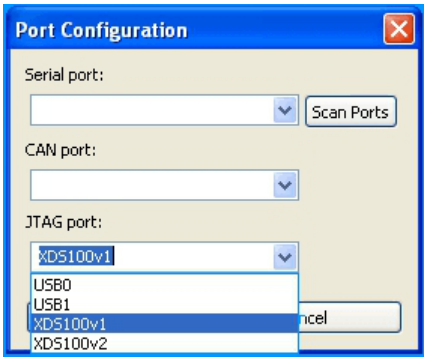


Figure 5. Port Configuration

8. Start flashing the F28069.

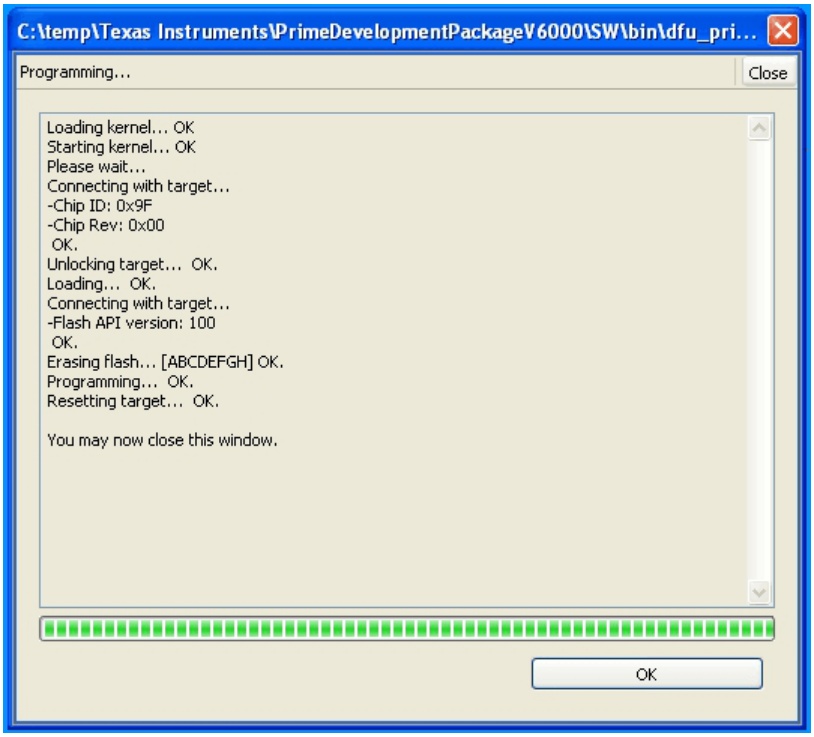


Figure 6. Programming Progress Using XDS100

9. After programming is complete, close the program and restart the SOMPLC module.

7.2 Using Code Composer Studio and JTAG Emulator to Program the F28069 MCU

If an XDS100 emulator is not available, Code Composer Studio (CCS) and an XDS510 or XDS560 emulator can be used to program the device. Install CCS v4.2.4 or higher before you start the following procedure.

1. Install the desired Texas Instruments PLC Development Package from www.ti.com/plc.
2. Set switch SW1 to "FLASH Boot Mode" as described in Section 3. When a JTAG emulator is used, it is capable of interrupting the set boot mode to gain control of the MCU. When the programming procedure is complete it will be necessary for the mode to be set to "FLASH Boot Mode" for the SOMPLC module to continue to work properly.
3. Power up SOMPLC module by applying both 15V and 3.3 V through the 34-pin host connector.
4. Connect the emulator to the SOMPLC module with the 14-pin JTAG cable.
5. Open CCS
6. Create a F28069 target configuration
7. Connect to F28069 device.
8. Load the PLC-specific *.out firmware located in c:\Texas Instruments\<PackageName>\SW\bin) CCS flashes the firmware onto the F28069 device.

7.3 Using a Serial Port (RS232 or SCI) to Program the F28069 MCU

In some situations, you can connect the SOMPLC module directly to a computer's serial port using RS232 communications. In this scenario, you must have a host board that can converting the RS232 communications protocol to work with the F28069 SCI-A port. In most cases, this can be done using an external RS232 driver device such as the MAX3221ECPWR by Texas Instruments. If this is in place, the following procedure can be used to program the MCU.

1. Install the desired Texas Instruments PLC Development Package from www.ti.com/plc.
2. Download, install, and start the latest C2Prog from http://www.codeskin.com.
3. Make sure the SOMPLC module is not powered on. Set switch SW1 to "SCI-A Boot Mode" as described in Section 3.
4. Connect SOMPLC module to the RS232 host using the appropriate cable.
5. Power up the SOMPLC module by applying both 15 V and 3.3 V through the 34-pin host connector.
6. Program the *.hex file (located in c:\Texas Instruments\<PackageName>\SW\bin) as shown in Figure 7. If a UART cable is used, serial port should be selected. Otherwise, if a USB-serial cable is used, JTAG port should be selected.

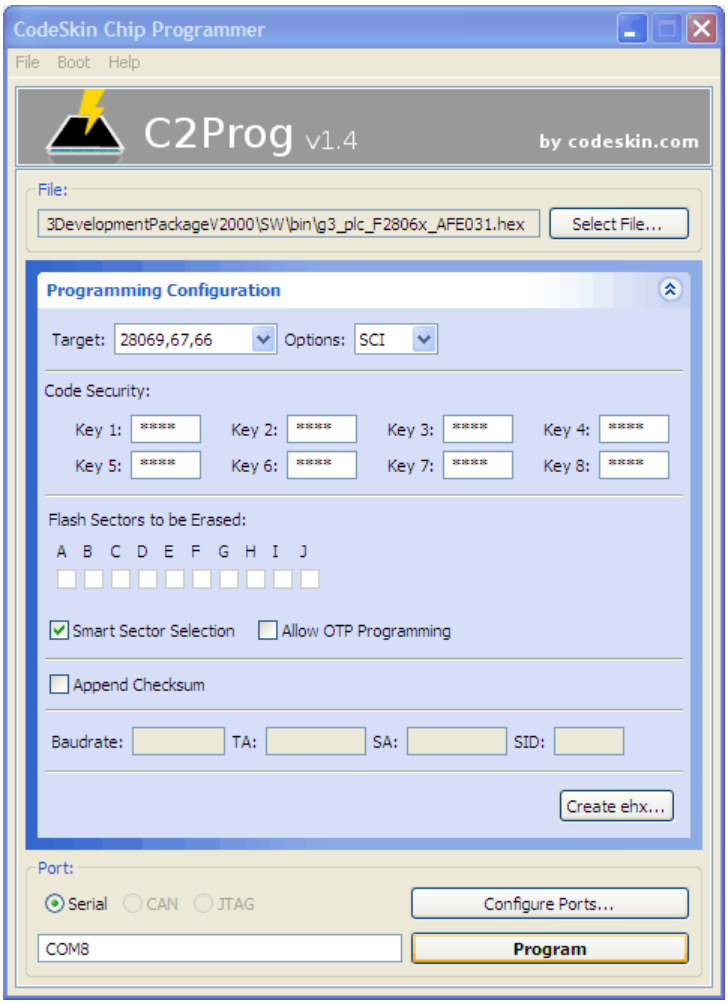


Figure 7. Programming Configuration Using Serial Port

7. Start flashing the F28069.

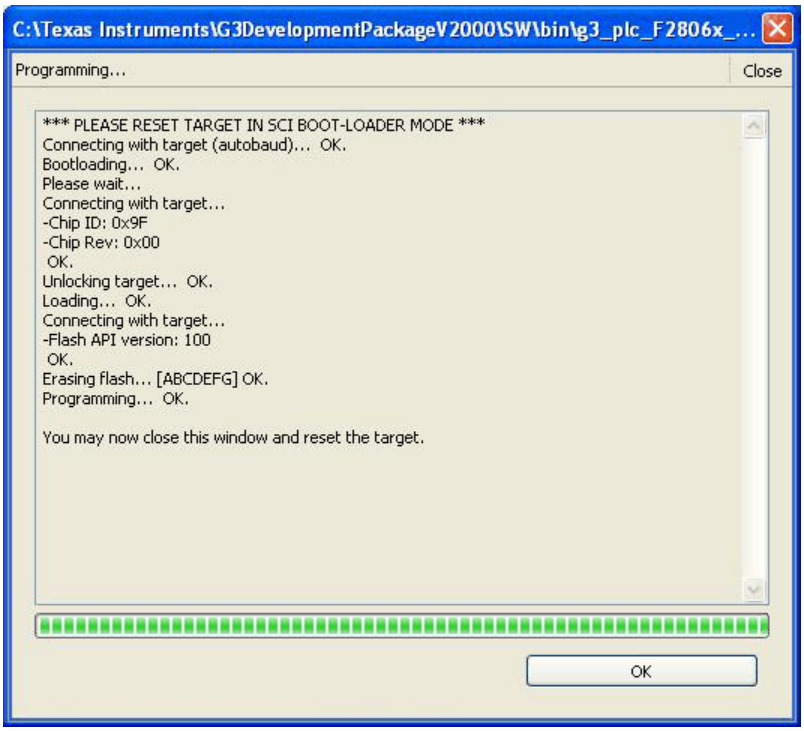


Figure 8. Programming Progress Using Serial Port

8. After programming is complete, close the program and remove the power supply from the SOMPLC module.
9. Make sure the SOMPLC module is powered off. Set switch SW1 to "FLASH Boot Mode" as described in Section 3.
10. The programming procedure is now complete. You may now apply power to the SOMPLC module.

Revision History

Changes from March 30, 2015 to June 30, 2015	Page
• Figure 3: Removed references to 'female' connector; maintained the use of '34-pin connector.'	5

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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