

---

## PROFIBUS Slave Firmware for PRU-ICSS Data Sheet

---

### FEATURES

- Network Topology: Linear bus with and without termination
- supports the cyclic PROFIBUS-DP (DPV0) and the enhancements to DP for acyclic services (DPV1)
- Transmission speed:
  - 9.6Kbaud to 12Mbaud
- Transmission characteristics:
  - Half duplex, asynchronous
- Data transfer services:
  - Acyclic
  - Send data with or without Acknowledge
  - Send and request Data with Reply
  - Cyclic (polling)
  - Send and request data with reply
- Telegram size up to 244 bytes
- Diagnostics :
  - Standard (6 bytes) and Extended (max 22 bytes) supported
- Synchronization:
  - SYNC and UNSYNC commands as well as FREEZE and UNFREEZE command Supported
- Automatic baud rate detection
- Conformance certified PRU-ICSS firmware binary
- Available for following processors
  - OMAP-L138
  - AM1810
  - AM335x
  - AM437x
  - AM571x
  - AM572x
  - K2G



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**Description**

Programmable real-time unit and industrial communication subsystem (PRU-ICSS) Profibus slave firmware from TI can be used by customers to add Profibus slave function on top of Processor SDK into Sitara processors. PRU-ICSS Profibus slave firmware implements Profibus slave layer 2 functionality with one UART in accordance with specification. This provides Profibus slave application specific integrated circuit (ASIC) like functionality integrated into Sitara processors with PRU-ICSS peripheral.

Profibus slave firmware binary for PRU-ICSS maintained by TI. Profibus slave's application allows loading and run the Profibus Slave firmware and interface with firmware. This also includes Hardware abstraction layer (HAL) for Profibus Slave stacks.

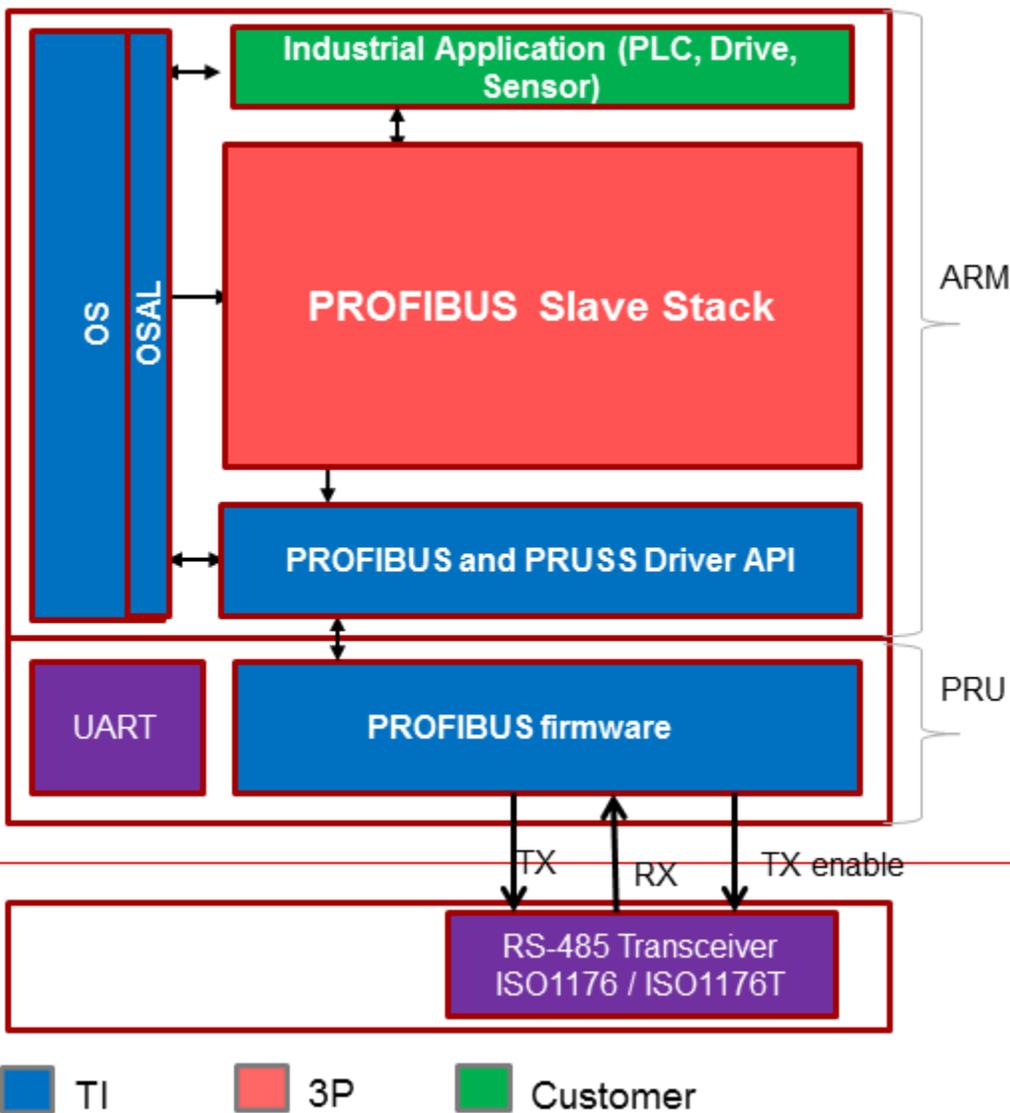


Figure 1 Software layer architecture

## Performance Summary

A 300 MHz ARM™ CPU speed is sufficient to support a simple IO or sensor application. More complex applications can use higher speed grades of up to 1.5 GHz depending on SoC. The PRU cores speed remains 200 MHz for all speed grades. All real-time critical PROFIBUS interface operations are handled inside the PRU cores and do not impact the ARM CPU.

## Memory Summary

This section describes memory usage of the Profibus slave firmware and Profibus slave application running on Cortex-A

**Table 1 Profibus Slave PRU-ICSS Firmware Memory Statistics**

Memory	Program memory	Data memory
PRU0	2076b	TBD
PRU1	3656b	390b
PRU-ICSS Shared RAM	NA	7580b

**NOTE:** AM572x PRU-ICSS firmware is used for this analysis

**Table 2 Profibus Slave Application Memory Statistics**

Section	Memory
.text (executable code)	12096b
.rodata (constant data)	6328 b
.data (initialized non-constant data –writable static)	407 b
.bss (uninitialized data)	78 b

**NOTE:** Profibus slave application files are used for this analysis with gcc-arm-none-eabi-4\_8-2014q3 toolchain options : -mcpu=cortex-a15 -mtune=cortex-a15 -marm –mfloat-abi=hard -mfpu=neon -O2

## Hardware Requirements

- Sitara processor with PRU-ICSS peripheral supports the Profibus slave
- Profibus slave firmware uses following interrupts mapped to Host Interrupt Controller say GIC

Stack/application interrupts		
Interrupt name	Host Interrupt	Remarks
ARM to PRU	PRU_ICSS_EVTOUT0	Notifies the PRU to process the ARM request
PRU to ARM	PRU_ICSS_EVTOUT1	Notifies the Acknowledge/response from PRU to ARM

- Profibus Slave requires one EDMA channel for atomic memory copy operation.
- The PROFIBUS firmware uses the following PRU-ICSS interrupts for the PROFIBUS fieldbus data link (FDL) functionalities

Interrupt name	Interrupt number
----------------	------------------

UART	6
ECAP	15
PRU0 to PRU1	16
PRU1 to PRU0	17

- HW signals required to implement Profibus Slave functionality is shown below, this info needs to be used in conjunction with <http://www.ti.com/tool/PINMUXTOOL>

**Table 3 PRU-ICSS signals required for Profibus Slave functionality**

Signal name		Description
prX_uart0_txd	Mandatory	UART Transmit Data
prX_uart0_rxd	Mandatory	UART Receive Data
prX_pru1_gpoY	Mandatory	TX enable pin [Y=0..20] for RS485 transceiver

**NOTE:** With respect to prX, X is 1 or 2 (respectively PRU-ICSS1 or PRU-ICSS2 – refer to SOC TRM for availability)

## Software

Profibus slave firmware, examples and associated documentation for Sitara Processors is Available from <http://www.ti.com/tool/PRU-ICSS-PROFIBUS>. Profibus slave software runs on top of TI Processor SDK

More details can be found here

[http://processors.wiki.ti.com/index.php/Industrial\\_Protocol\\_Package\\_Software\\_Developer\\_Guide](http://processors.wiki.ti.com/index.php/Industrial_Protocol_Package_Software_Developer_Guide)  
[http://processors.wiki.ti.com/index.php/Processor\\_SDK\\_RTOS\\_Software\\_Developer\\_Guide](http://processors.wiki.ti.com/index.php/Processor_SDK_RTOS_Software_Developer_Guide)  
[http://processors.wiki.ti.com/index.php/Processor\\_SDK\\_Linux\\_Software\\_Developer's\\_Guide](http://processors.wiki.ti.com/index.php/Processor_SDK_Linux_Software_Developer's_Guide)

## Certification Information

PROFIBUS DPV0/1 slave certification at Profibus International (PNO/PI) was received with AM1810 EVM\_ board in October 2010.



## Certificate

PROFIBUS Nutzerorganisation e.V. grants to

**Texas Instruments Deutschland GmbH**  
**Haggertystraße 1, 85356 Freising**

the Certificate No: **Z01544** for the PROFIBUS Slave:

Model Name: **Sitara Evaluation Module (EVM)**  
Revision: **V1.0; SW/FW: 1.0; HW: 1.0**  
GSD: **PRU\_0CDA.GSD; File Version 17.10.2009**

This certificate confirms that the product has successfully passed the certification tests with the following scope:

DP-V0	MS0, Sync, Freeze, Fail_Safe
DP-V1	MS1, MS2, I&M
<input checked="" type="checkbox"/> Physical Layer	RS485

Test Report Number: **543-1**  
Authorized Test Laboratory: **Siemens AG, Fürth, Germany**

The tests were executed in accordance with the following documents:  
"Test Specifications for PROFIBUS DP Slaves, Version 3.0 from November 2005".

This certificate is granted according to the document:  
"Framework for testing and certification of PROFIBUS products".

For all products that are placed in circulation by August 05, 2013 the certificate is valid for life.

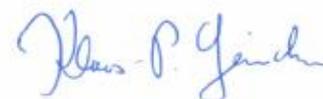


(Official in Charge)

Board of PROFIBUS Nutzerorganisation e. V.



(Jörg Freitag)



(K.-P. Lindner)



## References

1. PROFIBUS slave on Sitara Processors - spry155b  
<http://www.ti.com/lit/wp/spry155b/spry155b.pdf>
2. Industrial Communications Solution Guide - slyy050b  
<http://www.ti.com/general/docs/litabsmultiplefilelist.tsp?literatureNumber=slyy050b>
3. TI Design PROFIBUS Communication Development Platform:  
<http://www.ti.com/tool/TIDEP0002>
4. IEC 61158 Field bus for use in Industrial control system
5. IEC 61784 part 1 Communication profiles for Industrial control system

## Acronyms

Acronym	Description
PRUSS	Programmable Real-Time Unit Sub System
PRU-ICSS	Programmable Real-Time Unit and Industrial Communication Sub System
FDL	Field Databus Link
DP	Decentralized Peripherals
SAP	Service Access Point
DL	Datalink Layer
IPC	Inter Processor Communication
ISR	Interrupt Service Routine
AL	Application Layer
LED	Light Emitting Diode
HAL	Hardware Abstraction Layer
PLC	Programmable Logic Controller
HAL	Hardware Abstraction Layer
ASIC	Application Specific Integrated Circuit
OS	Operating Systems
SoC	System On Chip
EVM	Evaluation Module
IDK	Industrial Development Kit (EVM)
GIC	Generic Interrupt Controller

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer’s risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
<b>TI E2E Community</b>	<a href="http://e2e.ti.com">e2e.ti.com</a>