

Arni-6x6-PCI-Plus Technical Description

Doc. No. 1111-1-HAA-1064-1

Rev. 1.4



Copyright

© Copyright 2005, Odin TeleSystems, Inc. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written consent of Odin TeleSystems Inc., 800 East Campbell Road, Suite 334, Richardson, Texas 75081, U. S. A.

Trademarks

Odin TeleSystems, the Odin Logo, OTX, and Arni are trademarks of Odin TeleSystems Inc., which may be registered in some jurisdictions. Other trademarks are the property of their respective companies.

Changes

The material in this document is for information only and is subject to change without notice. While reasonable efforts have been made in the preparation of this document to assure its accuracy, Odin TeleSystems Inc., assumes no liability resulting from errors or omissions in this document, or from the use of the information contained herein.

Odin TeleSystems Inc. reserves the right to make changes in the product design without reservation and notification to its users.

Warranties

THE PRODUCT AND ITS DOCUMENTATION ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND. ODIN TELESYSTEMS EXPRESSLY DISCLAIMS ALL THE WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE. ODIN TELESYSTEMS DOES NOT WARRANT THAT THE FUNCTIONALITY OF THE PRODUCT WILL MEET ANY REQUIREMENTS, OR THAT THE OPERATIONS OF THE PRODUCT WILL BE UNINTERRUPTED OR ERROR-FREE, OR THAT DEFECTS WILL BE CORRECTED. FURTHERMORE, ODIN TELESYSTEMS DOES NOT WARRANT OR MAKE ANY REPRESENTATIONS REGARDING THE USE OF THE PRODUCT OR ITS DOCUMENTATION IN TERMS OF THEIR CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. NO ORAL OR WRITTEN INFORMATION OR ADVISE GIVEN BY ODIN TELESYSTEMS OR ODIN TELESYSTEMS' AUTHORIZED REPRESENTATIVE SHALL CREATE A WARRANTY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY.

UNDER NO CIRCUMSTANCE SHALL ODIN TELESYSTEMS INC., ITS OFFICERS, EMPLOYEES, OR AGENTS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES (INCLUDING DAMAGES FOR LOSS OF BUSINESS, PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT AND ITS DOCUMENTATION, EVEN IF ODIN TELESYSTEMS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT WILL ODIN TELESYSTEMS' LIABILITY FOR ANY REASON EXCEED THE ACTUAL PRICE PAID FOR THE PRODUCT AND ITS DOCUMENTATION. SOME JURISDICTIONS DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY.



Table of Contents

1	Abstract	5
2	Arni-6x6-PCI-Plus Overview.....	5
3	Physical specifications	5
4	Data Architecture	6
5	PCM Highways	7
6	API Supported Physical Devices	9
6.1	Board Devices.....	9
6.2	POTS FXS Line Interface Device.....	9
6.3	DSP and FXO Line Interface	9
7	Line Interface Functionality	9
7.1	FXO Line functions	9
7.2	FXS Line functions	10
7.3	Fall Back.....	10
8	Compliance features	11
9	PCI Bus.....	11
10	POTS Interface Connections	11
11	Clocks.....	13
12	JTAG	13
13	Indicators.....	13
14	Power	14



15	Certifications.....	14
16	Reference documents.....	14
17	Glossary	14



1 Abstract

This document provides a technical description of Odin TeleSystems' Arni-6x6-PCI-Plus adapter card. This presentation is targeted to systems integrators and application developers who are developing telecommunications systems and/or software applications using the Arni-6x6-PCI-Plus platform. The purpose of this document is to provide the needed information about the hardware to allow software developers to efficiently integrate Arni-6x6-PCI-Plus into their overall system under design.

For information on how to develop host applications utilizing the OTX Hardware Device Driver Application Programming Interface (API), please refer to the "Programmer's Guide for OTX Hardware API" document (Odin TeleSystems Inc. document number 1411-1-SAA-1006-1). For information on how to develop custom DSP applications, please refer to "Programmer's Guide for OTX C54x DSP Software Development Kit" (Odin document number 1412-1-SAA-1007-1). And finally, for help on how to install the Arni-6x6-PCI-Plus card and the OTX Device Driver Software, please refer to the Installation Guide for OTX PCMCIA Adapters (Odin TeleSystems Inc. document number 1512-1-HCA-1003-1).

2 Arni-6x6-PCI-Plus Overview

Arni-6x6-PCI-Plus is a 6 FSX by 6 FXO POTS (Plain Old Telephone Service) adapter for the PCI Local bus.

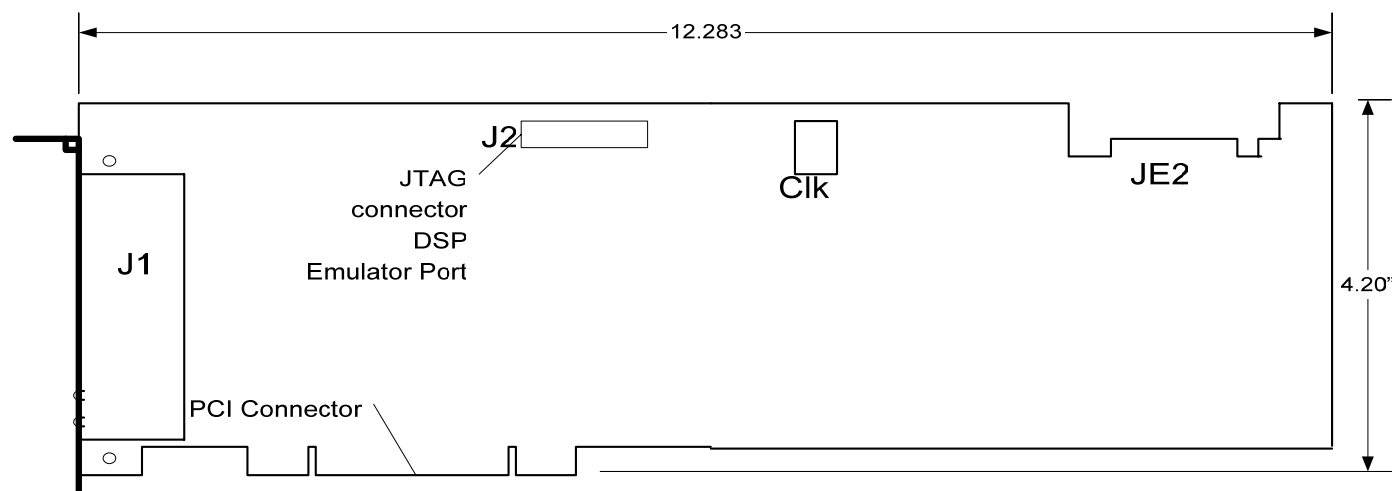
The Arni-6x6-PCI-Plus is a member of the Odin Telecom frameworX (OTX) product family. It is supported by the OTX device driver and by the OTX Hardware Application Programming Interface (API). It is populated with 6 Texas Instruments TMS320C54CST 120 Mips DSPs. Each DSP comes with 14 different telephony algorithms in rom. Equipped with the appropriate OTX software modules, Arni-6x6-PCI-Plus can be utilized in a variety of POTS applications.

The Arni-6x6-PCI-Plus supports 6 FXO (Central Office Connections) interfaces and 6 FXS (Standard analog telephone) interfaces.

3 Physical specifications

Arni-6x6-PCI-Plus is a full-length PCI board available with a Centronix (telco) connector. An optional Harmonica converts from the Centronix connector to 12 RJ-11 modular jacks.

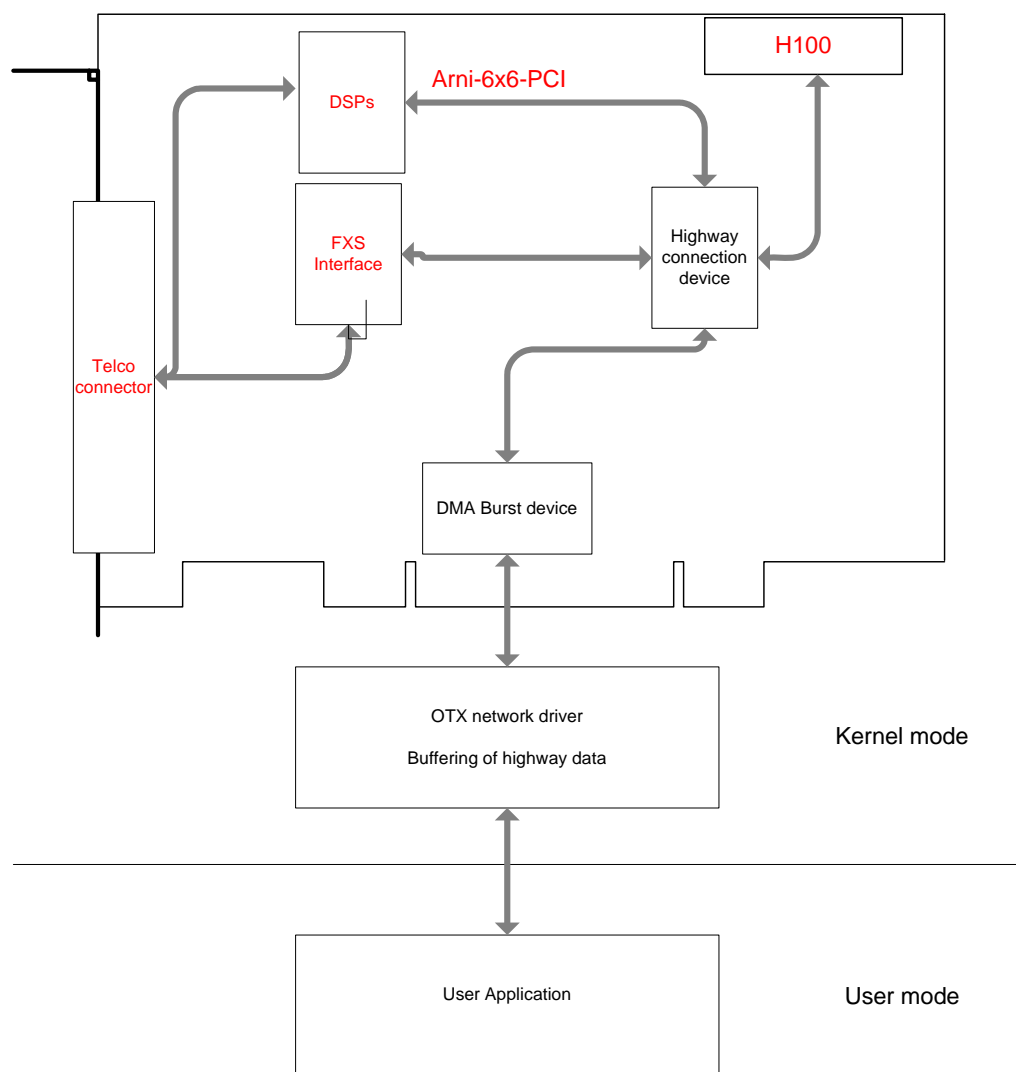
The Arni-6x6-PCI-Plus is shown in the figure below.



4 Data Architecture

Internally, Arni-6x6-PCI-Plus utilizes a serial TDM (Time-Division Multiplexed) data stream for transfer of data or voice. The internal serial TDM data stream is called a “Highway.” The external interface is referred to as “line”.

The serial highway provide data paths between physical devices as shown in the figure below.



5 PCM Highways

The Arni-6x6-PCI-Plus utilizes a 2 Mbit/sec (32 timeslot) PCM highway for data routing. The highway functions as an add/drop multiplexer, with the different devices inserting their data into an assigned time slot and accepting data from an assigned time slot.

The PCM highways are connected to the Time-space switch device (OTX_DEVICE_TSS) on the board. The TSS device supports up to 16 local highways (not all of them are connected) and 32 H.100 highways.



The local highway connections for the Arni-6x6 board are listed in the table below:

Local Highway	Connected To
0	DSP0
1	DSP1
2	DSP2
3	DSP3
4	DSP4
5	DSP5
6	All 6 FXS devices
7	N/C
8	Burst
9	N/C
10	N/C
11	N/C
12	N/C
13	N/C
14	N/C
15	N/C

The six FXS (SLIC) devices use highway six. The OTX driver configures the six FXS devices to use the following time slots:

TS0: FXS0 (u-law/a-law/16-bit-linear)
TS1: FXS0 (16-bit-linear)
TS2: Not used
TS3: FXS1 (u-law/a-law/16-bit-linear)
TS4: FXS1 (16-bit-linear)
TS5: Not used
TS6: FXS2 (u-law/a-law/16-bit-linear)
TS7: FXS2 (16-bit-linear)
TS8: Not used
TS9: FXS3 (u-law/a-law/16-bit-linear)
TS10: FXS3 (16-bit-linear)
TS11: Not used
TS12: FXS4 (u-law/a-law/16-bit-linear)
TS13: FXS4 (16-bit-linear)
TS14: Not used
TS15: FXS5 (u-law/a-law/16-bit-linear)
TS16: FXS5 (16-bit-linear)
TS17-31: Not used



6 API Supported Physical Devices

6.1 Board Devices

The Arni-6x6 configuration and status registers are accessible by API calls. The board devices include the serial to parallel converters and the DMA controller. The application can read or write the data directly from the Arni-6x6 buffers, or have the DMA controller place the data in the host memory and notify the application when data is available.

6.2 POTS FXS Line Interface Device

The Arni-6x6 POTS FXS Line Interface device fully supported by API calls to configure the interface for the required functionality. There is full access to all device registers for monitoring or diagnostics.

6.3 DSP and FXO Line Interface

The DSPs on the Arni-6x6 contain the interface to the FXO lines. The DSPs on the Arni-6x6 can be used to run included algorithms in ROM, Odin provided standard DSP applications, or they can be used to run user developed custom applications. The Arni-6x6 telecom configuration is delivered with a number of Odin's Signal Processing Module (SPM). These SPMs, or DSP application packages, provides supports for many common telecom applications; such as tone detection and generation, FSK detection, and HDLC sending and receiving.

For more information on custom DSP application development, please refer to "*Programmer's Guide for OTX C54x DSP Software Development Kit*" (Odin document number 1412-1-SAA-1007-1)

7 Line Interface Functionality

7.1 FXO Line functions

The Arni-6x6-PCI-Plus FXO Line interfaces support several useful features:

- Line voltage monitor
- Loop current monitor
- Parallel handset detection
- Polarity reversal detection
- Caller ID support



- Ring detection
- Pulse dialing
- Overload protection
- Billing tone detection
- 84 dB dynamic range
- FCC compliant

7.2 FXS Line functions

The Arni-6x6-PCI-Plus FXS Line interfaces include a full range of features:

- Programmable loop current
- On hook transmission for caller ID
- FSK caller ID generator
- Separate DTMF generator
- Separate DTMF decoder
- 1 REN (Ringer Equivalency Number) Ring generator
- Programmable ring cadence and frequency
- Onboard battery voltage generator
- Onboard ring voltage generator
- Battery voltage reversal
- Line voltage monitoring
- Loop current monitoring

7.3 Fall Back

The line interface subsystem implements a fall back connection where the FXO connections are directly connected to the FXS connections during a power failure or other fault conditions. These direct connections are user controllable through API calls.



8 Compliance features

The Arni-6x6 offers a variety of features to facilitate compliance with different countries requirements:

- Programmable ringer impedance
- Programmable ring detect threshold
- Programmable DC termination
- Programmable AC termination
- Programmable Loop current
- Programmable ring frequency

9 PCI Bus

The Arni-6x6-PCI-Plus board is compliant with the PCI 2.1 local bus specification. It is a universal interface, supporting both 3.3 volt and 5 volt signaling. The Arni-6x6-PCI-Plus supports 32 bits at 33 MHz and can be both Slave and Master.

10 POTS Interface Connections

The back panel of Arni-6x6-PCI-Plus contains a 50 pin Centronics connector. An optional harmonica and cable adapts to 12 RJ-11 jacks. The pin out for the TELCO connector is shown in Table 1: Connector Pin Assignment. The pin assignments for the connector were dictated by the certification requirements. The FXO and FXS are required to maintain the 2.5 millimeter clearance. Table 2: 66 Block Wiring Definition shows the assignment of the FXO and FXS when using a pre-wired telecom 66 block.

Wire Pair	Connector Pin	Position	Connector Pin	Position
1	1	Not Used	26	Not Used
2	2	Not Used	27	Not Used
3	3	Not Used	28	Not Used
4	4	Not Used	29	Not Used
5	5	Not Used	30	Not Used
6	6	Not Used	31	Not Used
7	7	Not Used	32	Not Used
8	8	RING_FXS_5	33	TIP_FXS_5
9	9	RING_FXS_4	34	TIP_FXS_4
10	10	RING_FXS_3	35	TIP_FXS_3
11	11	RING_FXS_2	36	TIP_FXS_2
12	12	RING_FXS_1	37	TIP_FXS_1
13	13	RING_FXS_0	38	TIP_FXS_0
14	14	Not Used	39	Not Used



Wire Pair	Connector Pin	Position	Connector Pin	Position
15	15	Not Used	40	Not Used
16	16	Not Used	41	Not Used
17	17	Not Used	42	Not Used
18	18	Not Used	43	Not Used
19	19	Not Used	44	Not Used
20	20	RING_FXO_5	45	TIP_FXO_5
21	21	RING_FXO_4	46	TIP_FXO_4
22	22	RING_FXO_3	47	TIP_FXO_3
23	23	RING_FXO_2	48	TIP_FXO_2
24	24	RING_FXO_1	49	TIP_FXO_1
25	25	RING_FXO_0	50	TIP_FXO_0

Table 1: Connector Pin Assignment

Wire Pair	Figure	TIP Pin 26-50	RING Pin 1-25	ARNI Assignment
1		white	blue	Not Used
2		white	orange	Not Used
3		white	green	Not Used
4		white	brown	Not Used
5		white	slate	Not Used
6		red	blue	Not Used
7		red	orange	Not Used
8		red	green	FXS 5
9		red	brown	FXS 4
10		red	slate	FXS 3
11		black	blue	FXS 2
12		black	orange	FXS 1
13		black	green	FXS 0
14		black	brown	Not Used
15		black	slate	Not Used
16		yellow	blue	Not Used
17		yellow	orange	Not Used
18		yellow	green	Not Used
19		yellow	brown	Not Used
20		yellow	slate	FXO 5
21		violet	blue	FXO 4
22		violet	orange	FXO 3
23		violet	green	FXO 2
24		violet	brown	FXO 1
25		violet	slate	FXO 0

Table 2: 66 Block Wiring Definition



11 Clocks

On the Arni-6x6-PCI-Plus board, the internal TDM data highway and the all the devices processing TDM data are synchronized to one clock reference. The clock reference can be derived from multiple sources and then routed to all the devices. The following clocking sources are supported by Arni-6x6-PCI-Plus:

- OTX_CLOCK_SOURCE_H100_0 - Clock extracted from the H100 connector (JE2 connector)
- OTX_CLOCK_SOURCE_LOCAL_1 - External 2.048 MHz clock (J3 connector)
- OTX_CLOCK_SOURCE_INTERNAL - On-board free running oscillator

12 JTAG

The JTAG port (reference designator J2) are used for Board Testing, programming of The FPGA PROMS, and Connecting the DSP emulator board for DSP Software Development.

Table x. JTAG Chains

Chain	Parts
TMS0	PROM
TMS1	PCI, TSS
TMS4	FPGA
TMS5	DSPs

13 Indicators

The Arni-6x6-PCI-Plus has 6 LED indicators one per DSP which can be programmed for:

- FXSn off hook
- FXOn off hook
- FXSn ringing
- FXOn ring detect
- FXSn Fault



14 Power

The Arni-6x6-PCI-Plus operates from 3.3 Volt, 5 volt and 12 volt power supplied from the host PC. Power consumption is TBD.

15 Certifications

Final certifications are TBD. The following is a list of planned certifications:

- FCC Part 15 (CFR47, Part 15, Subpart B)
- FCC Part 68
- CE EMC (EN61326-1 Class B Equipment, AS/NZS 2064 Class B Limits)

16 Reference documents

The following documents provide further detailed information related to the Arni-6x6-PCI-Plus board:

- Programmer's Guide for OTX Hardware Driver (Odin document # 1412-1-SAA-1006-1)
- Installation Guide for OTX PCI Adapters (Odin document number 1512-1-HCA-1001-1)
- Programmer's Guide for OTX C54x DSP Software Development Kit (Odin document number 1412-1-SAA-1007-1)
- "Si3210 Data Sheet", Silicon Labs
- "TMS320C54CST Data Sheet"

17 Glossary

API – Application Programmer Interface

CPU – Central Processing Unit. Refers to the host PC in this document.

DAA – Data Access Arrangement. (FXO connection)

DSP – Digital Signal Processor

EEPROM – Electrically Erasable Programmable Read Only Memory.

FPGA – Field Programmable Gate Array.

FXS –Foreign eXchange Subscriber. This interface connects to a telephone.



FXO –Foreign eXchange Office. This interface connects to the central office.

LED – Light Emitting Diode

LS – Least Significant

MS – Most Significant

OTX – Odin Telecom FrameworX

POTS – Plain Old Telephone Service. Normal analog telephone service.

SDK – Software Development Kit

SLIC – Subscriber Line Interface Circuit. (FXS connection)

Smoke – Visual indication of a board fault condition.