

T/SDAS-SCOM1

Single-channel Speech/Fax/Modem AD/DA SIOX Daughter-card Module
for *TORNADO* DSP Systems, Controllers and Coprocessors

User's Guide

covers:
T/SDAS-SCOM1 rev.3B

MicroLAB Systems Ltd

59a Beskudnikovskiy blvd, 127486, Moscow, RUSSIA

phone/fax: +7-(095)-485-6332 Email: info@mlabsys.com WWW: www.mlabsys.com

CAUTION

Фирма *МикроЛАБ Системс Лтд (МЛС)* оставляет за собой право вносить любые изменения и прекращать выпуск и поддержку любых изделий и программного обеспечения, упоминаемых в настоящем документе, без какого-либо предварительного уведомления, если иное специально не оговаривается. *МЛС* рекомендует своим покупателям пользоваться подлинными и самыми последними версиями фирменных информационных документов и осуществлять предварительное консультирование с фирмой перед размещением заказа, чтобы быть уверенным, что настоящая информация достоверна и применима на текущий момент.

МЛС гарантирует качество и соответствие технических параметров поставляемой продукции приведенной технической спецификации. Всякое тестирование и проверка продукции производятся фирмой в степени и объемах, необходимых для поддержки настоящей гарантии. Какое-либо дополнительное тестирование и проверка продукции на соответствие другим требованиям проводятся лишь и только в случаях, выполняемых по специальным заказам, или тогда, когда это специально оговаривается.

МЛС не несет никакой ответственности за правильность функционирования и работоспособность оборудования и программного обеспечения, разработанного и изготовленного с применением продукции (или отдельных ее компонентов) фирмы, если это не подтверждено специальным фирменным сертификатом *МЛС*.

Продукция *МЛС* не предназначена для применения в аппаратуре, системах или изделиях для поддержки жизнедеятельности. Применение продукции *МЛС* в таком оборудовании категорически запрещено без специального письменного подтверждения от *МЛС* или оригинального фирменного сертификата *МЛС*.

IMPORTANT NOTICE

Настоящая продукция предназначена для использования в составе лабораторного тестового и научно-исследовательского оборудования. *МЛС* не несет ответственности за работоспособность настоящей продукции в составе другого типа оборудования и/или в отличных от специфицированных условиях эксплуатации. При повреждениях настоящей продукции, вызванных ее применением в составе другого типа оборудования и/или условий эксплуатации, гарантийные обязательства аннулируются без какого-либо возмещения ущерба и ремонт производится за счет покупателя.

Настоящая продукция генерирует, использует и может излучать радиочастотную энергию, которая может создавать радиочастотные помехи для другой аппаратуры, несмотря на все конструктивные и другие меры, предпринятые для минимизации создаваемых помех. Однако, в случае возникновения помех для работы другой аппаратуры покупатель должен сам и за свой счет принять меры для их устранения или уменьшения.

ITEMS OF LICENSE AGREEMENT

Никакие части настоящего документа, аппаратные и программные части настоящей продукции не могут быть реассемблированы, ретрассированы и/или изменены с целью восстановления и/или изменения электрической схемы, конструкции, алгоритма работы или принципа функционирования любыми методами, воспроизведены, скопированы, запомнены в архивах с возможностью воспроизведения, а также переданы по средствам связи в любом виде и любыми методами, будь то электронные, механические, копировальные, фотографические, записывающие или другие, без предварительно выданного фирменного письменного разрешения от *МЛС*. Нарушение настоящего положения вне зависимости от приобретения настоящей продукции и/или документа трактуется как нарушение авторских прав и преследуется по закону.

Приобретение настоящей продукции автоматически означает согласие покупателя с положениями лицензионного соглашения, равно как и другими положениями закона об авторских правах. Нарушение настоящих положений, равно как и других положений закона об авторских правах, трактуется как нарушение авторских прав, преследуется по закону и автоматически ведет к аннулированию всех обязательств *МЛС* по поддержке настоящей продукции.

Copyright © 1993-2000, MicroLAB Systems Ltd. All rights reserved.

About this Document

This user's guide contains description for *T/SDAS-SCOM1* AD/DA SIOX daughter-card module (DCM) for *TORNADO* DSP systems/controllers/coprocessors from MicroLAB Systems Ltd.

This document does not include detail description neither for *TORNADO* systems, nor for TI DSP and corresponding software and hardware applications. To get the corresponding information please refer to the following documentation:

1. ***TLC32046 Wide-band AIC User's Guide.*** Texas Instruments Inc, SLAS028B, 1995.
2. ***TLC32047 Wide-band AIC User's Guide.*** Texas Instruments Inc, SLAS049B, 1995.
3. ***TMS320C3x User's Guide.*** Texas Instruments Inc, SPRU031C, USA, 1992.
4. ***TMS320C54x. CPU and Peripherals. Reference Guide.*** Texas Instruments Inc, SPRU131D, USA, 1997.
5. ***TMS320C6x. CPU and Instruction Set. Reference Guide.*** Texas Instruments Inc, SPRU189C, USA, 1998.
1. ***TORNADO-3x. User's Guide.*** MicroLAB Systems, 1999.
2. ***TORNADO-54x. User's Guide.*** MicroLAB Systems, 1998.
3. ***TORNADO-6x. User's Guide.*** MicroLAB Systems, 1998.
4. ***TORNADO-P6x. User's Guide.*** MicroLAB Systems, 2000.
5. ***TORNADO-P3x. User's Guide.*** MicroLAB Systems, 2000.
6. ***TORNADO-PX31DP. User's Guide.*** MicroLAB Systems, 1996.
7. ***TORNADO-SX30. User's Guide.*** MicroLAB Systems, 1996.
8. ***TORNADO-E3x. User's Guide.*** MicroLAB Systems, 2000.
9. ***TORNADO-E6x. User's Guide.*** MicroLAB Systems, 1998.

Warranty

All hardware and software products purchased from MicroLAB Systems Ltd are guaranteed against damages during *one year* after shipment. MicroLAB Systems Ltd guarantees free of charge repair or replacement for the manufacturer caused damaged products during warranty period. Software updates will be also sent free of charge to the customer during warranty period.

Product registration

MicroLAB Systems strongly recommends that you register each of your purchased hardware/software product in order to get free product updates and free technical support within the warranty period.

The registration procedure is as easy as the following:

- Open the PRODUCT REGISTRATION FORM, which is contained in the REGISTER.TXT text file available either on the MicroLAB Systems 'Technical & Programming Guide' CD-ROM or from the MicroLAB Systems FTP-site. If you are unable to locate the REGISTER.TXT file, then call/email to MicroLAB Systems.
- Fill in the applicable fields of the PRODUCT REGISTRATION FORM. It is important that you will to specify your name, post address, phone/fax, email address, purchased product name and serial number, and the product reception date.
- Return the PRODUCT REGISTRATION FORM to MicroLAB Systems either via email, fax or regular mail.

Note, that all product purchased from MicroLAB Systems shall be registered within 90 days after the date of the shipment.

If you need assistance, documentation or information...

Should you need technical assistance for purchased MicroLAB Systems Ltd products or if you want to order additional documentation or get latest information about MicroLAB Systems Ltd products, please call, fax or mail to MicroLAB Systems Ltd customer support service:

address: 59a Beskudnikovsky blvd, 127486, Moscow, RUSSIA.
MicroLAB Systems Ltd

phone/fax: +7-(095)-485-6332

information request: info@mlabsys.com

technical support: techsupport@mlabsys.com

product registration: register@mlabsys.com

WWW: <http://www.mlabsys.com>

FTP: <ftp://ftp.mlabsys.com>

Trademarks

TORNADO-3x, TORNADO-4x, TORNADO-54x, TORNADO-6x, TORNADO-P6x, TORNADO-P3x, TORNADO-PX, TORNADO-SX, TORNADO-E, MIRAGE-510DX, UECMX, MX-Link are trademarks of *MicroLAB Systems Ltd*

TMS320, XDS510 are trademarks of *Texas Instruments Inc*

Other trademarks and company names used are trademarks of their respective holders.

Contents

Chapter 1. Introduction	1
1.1 General Information	1
1.2 Technical Specifications	5
Chapter 2. Construction	9
2.1 Block Diagram	9
2.2 Construction	14
Chapter 3. Installation	15
3.1 Installation	15
3.2 Connection to external signal I/O equipment	16
3.3 Software Configuration for SIO Port of Host <i>TORNADO</i> DSP	18
Appendix A. On-board Connectors and Switches	19
A.1 Configuration Switches	19
A.2 On-board Connectors	20
Appendix B. SIOX Rev.B Interface Site	23
B.1 General Description	23
B.2 SIOX rev.B Site Connector and Signals	24
B.3 Physical Dimensions for SIOX rev.B DCM	27

Figures

<i>Fig. 1-1.</i>	<i>T/SDAS-SCOM1 DCM.</i>	1
<i>Fig. 1-2.</i>	<i>T/SDAS-SCOM1 DCM installed onto TORNADO-62 mainboard.</i>	2
<i>Fig. 1-3.</i>	<i>T/SDAS-SCOM1 DCM with T/X-XCMP cable set.</i>	3
<i>Fig. 1-4.</i>	<i>T/SDAS-SCOM1 DCM with external T/X-XTLI external telephone line interface option.</i>	4
<i>Fig. 1-5.</i>	<i>T/SDAS-SCOM1 DCM with external T/X-XTSI external telephone station interface option.</i>	5
<i>Fig. 2-1.</i>	<i>Block diagram of T/SDAS-SCOM1 DCM.</i>	9
<i>Fig. 3-1.</i>	<i>Installation of T/SDAS-SCOM1 DCM into SIOX site of TORNADO DSP system.</i>	15
<i>Fig. A-1.</i>	<i>On-board connectors and configuration switches for T/SDAS-SCOM1 DCM.</i>	19
<i>Fig. A-2.</i>	<i>Pinout for JP2 external I/O connector of T/SDAS-SCOM1 DCM.</i>	21
<i>Fig.B-1.</i>	<i>TORNADO-54x board with two SIOX sites.</i>	23
<i>Fig.B-2.</i>	<i>TORNADO on-board SIOX connector pinout with two serial ports (top view).</i>	24
<i>Fig.B-3.</i>	<i>TORNADO on-board SIOX connector pinout with one serial port (top view).</i>	25
<i>Fig.B-4.</i>	<i>Physical dimensions for SIOX DCM.</i>	27

Tables

<i>Table A-1.</i>	Configuration switches for <i>T/SDAS-SCOM1</i> DCM.	20
<i>Table A-2.</i>	On-board connectors of <i>T/SDAS-SCOM1</i> DCM.	21
<i>Table A-4.</i>	Signal description for JP2 external I/O connector of <i>T/SDAS-SCOM1</i> DCM.	21
<i>Table B-1.</i>	SIOX interface signal description.	25

Chapter 1. Introduction

This chapter contains general description for *T/SDAS-SCOM1* SIOX DCM.

1.1 General Information

T/SDAS-SCOM1 is a single-channel AD/DA front-end SIOX (serial I/O expansion) DCM (fig.1-1) for *TORNADO* DSP systems (*TORNADO-3x/54x/6x/etc*), *TORNADO-E* stand-alone DSP controllers (*TORNADO-E3x/E54x/E6x/etc*) and *TORNADO-PX/SX* DSP coprocessors (*TORNADO-PX/SX/etc*) from MicroLAB Systems Ltd.

T/SDAS-SCOM1 DCM provides speech/fax/modem AD/DA quality and can connect to external microphone, phones, audio equipment, PSTN phone line, telephone, fax machine, computer modem and other speech/audio and telephone equipment.



Fig. 1-1. *T/SDAS-SCOM1* DCM.

Installation

T/SDAS-SCOM1 DCM installs as SIOX DCM (fig.1-2) into the SIOX site onto *TORNADO* DSP mainboard. If required, the *T/SU-X* SIOX extender can be used for remote connection to SIOX interface of *TORNADO* mainboard.



Fig. 1-2. T/SDAS-SCOM1 DCM installed onto TORNADO-62 mainboard.

Overview

T/SDAS-SCOM1 DCM comprises of one AD/DA channel of speech/fax/modem quality using one TLC32046 (or TLC32047) AIC chip from Texas Instruments Inc, and features:

- one A/D-channel with line-in and microphone inputs, programmable input multiplexer, programmable gain amplifier, programmable antialiasing filter and 14-bit ADC
- one D/A-channel with 14-bit DAC, programmable low-pass filter, reconstruction filter, output amplifiers for line-out and headphones/speakers
- two (2) digital inputs and two (2) digital outputs.

Sampling frequency for T/SDAS-SCOM1 DCM can be set by DSP software for any value below 25 kHz, and, moreover, the phase shift for sampling frequency can be programmed in every sampling cycle. The latter feature is very important for fax/modem communication, which require run-time adjustment of sampling frequency.

Communication between T/SDAS-SCOM1 DCM and TORNADO on-board DSP is performed via DSP on-chip serial port (SIO), which is part of TORNADO on-board SIOX DCM interface site.

T/SDAS-SCOM1 DCM allows expansion of analog I/O channels via on-DCM channel expansion connector.

External signal I/O

Connection of T/SDAS-SCOM1 DCM to external analog I/O world is performed via the on-board I/O JP2 connector, which is available via rear panel of host PC (if T/SDAS-SCOM1 is installed onto TORNADO DSP system for PC).

The ultimate feature of T/SDAS-SCOM1 DCM is modular design of external I/O facilities in order to meet multiple application configurations. Below is a list of available external I/O options:

- T/X-XCMP single-channel analog signal I/O cable set (fig.1-3), which allows connection to external MIC/Line-in/Line-out/Phone set
- T/X-XTLI external telephone line interface option (refer to the subsection below and fig.1-4), which allows direct connection to PSTN (public switch telephone network) subscriber line

- *T/X-XTSI* external telephone station interface option (refer to the subsection below and fig.1-5), which provides emulation of PSTN (public switch telephone network) subscriber line and allows direct connection to external telephone, fax machine, computer modem and other standard PSTN compatible equipment.

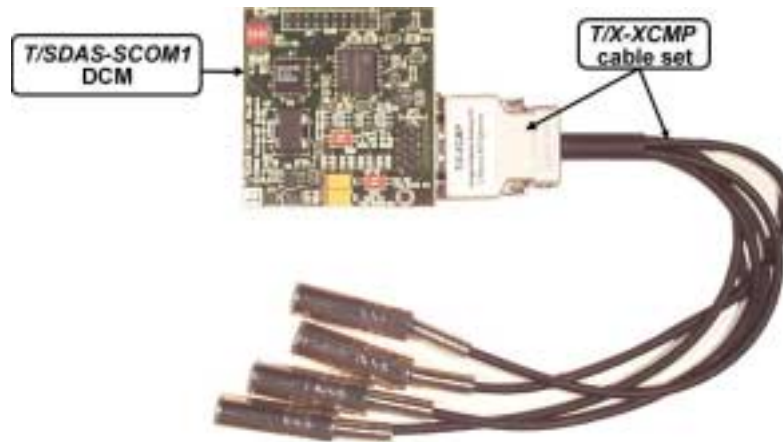


Fig. 1-3. *T/SDAS-SCOM1* DCM with *T/X-XCMP* cable set.

External telephone line interface option

T/X-XTLI external telephone line interface option (fig.1-4) (also known as DAA (digital access arrangement) based passive telephone line interface) is designed as the end-user PSTN (public switched telephone network) equipment and offers direct access to available PSTN subscriber lines. In case appropriate DSP software is supplied, this converts *TORNADO* DSP system or controller with installed *T/SDAS-SCOM1* DCM and external *T/X-XTLI* telephone line interface into automatic answering machine, fax machine or modem with data transmission over PSTN telephone lines.

External *T/X-XTLI* telephone line interface connects directly to *T/SDAS-SCOM1* DCM and is similar to phone line interface of automatic answering machine, fax machines and computer modems. Line outlet of *T/X-XTLI* telephone line interface plugs directly to the phone line wall-outlet.

T/X-XTLI option operates under the DSP software control and detects incoming line calls/rings, picks up the phone and provides dialing either using DTMF or pulse dialing.



Fig. 1-4. T/SDAS-SCOM1 DCM with external T/X-XTLI external telephone line interface option.

External telephone station interface option

T/X-XTSI external telephone station interface option (also known as SLIC (subscriber line interface circuit) based active telephone line interface) for *T/SDAS-SCOM1* DCM (and fig.1-5) is functionally opposite to *T/X-XTLI* external telephone line interface option, and is designed for emulation of subscriber line equipment of typical PSTN telephone station.

External *T/X-XTSI* telephone station interface option connects directly to *T/SDAS-SCOM1* DCM and is similar to subscriber line equipment of typical PSTN telephone station.

Line outlet of *T/X-XTSI* option directly connects to telephone, automatic answering machine, fax machine or computer modem, but it cannot plug to the PSTN phone line wall-outlet.

T/X-XTSI option operates under the DSP software control and provides required voltage shift for output phone line, generates line calls/rings, detects phone pick-up and receives dialing signals either for DTMF or pulse dialing.



Fig. 1-5. T/SDAS-SCOM1 DCM with external T/X-XTSI external telephone station interface option.

applications

T/SDAS-SCOM1 AD/DA DCM is designed for single-channel speech/fax/modem signal processing applications as well as for other general signal processing applications (biomedical, instrumentation, etc), which apply for AD/DA requirement similar to that of T/SDAS-SCOM1 AD/DA DCM.

1.2 Technical Specifications

The following are technical specifications for T/SDAS-SCOM1 AD/DA DCM for temperature of external environment +25°C.

<u>parameter description</u>	<u>parameter value</u>
<i>A/D channel:</i>	
ADC type	ADC section of TLC32046 (TLC32047) AIC from TI
number of A/D channels	1
resolution	14 bits
input differential signal range for A-IN inputs	±6V, ±3V, ±1.5V
input differential signal range for AUX-IN input	±6V, ±3V, ±1.5V, ±0.6V, ±0.3V, ±0.15V
input impedance for A-IN and AUX-IN inputs	≥1 MOhm

optional on-board voltage bias for electret microphones at the AUX-IN '+' differential input	+5V@16kOhm
cut-off frequency of on-board optional AC coupling high-pass filter at the '+' input of AUX-IN differential input amplifier	approx. 1.5 Hz
maximum external DC offset in case AUX-IN '+' differential input is AC coupled	±45 V max
maximum cut-off frequency of AIC low-pass antialiasing filter	8 kHz (TLC32046) 12 kHz (TLC32047) (refer to the AIC chip documentation)
cut-off frequency of optional AIC on-chip high-pass filter	approx. 75 Hz (refer to the AIC chip documentation)
SNR	-68 dB (type)
sampling frequency	up to 25 kHz

D/A channel

DAC type	DAC section of TLC32046 (TLC32047) AIC from TI
number of channels	1
Resolution	14 bits
SNR	-68 dB (typ)
cut-off frequency of low-pass filter	8 kHz (TLC32046) 12 kHz (TLC32047) (refer to the AIC chip documentation)
output differential signal range for A-OUT output	±6V
output signal range for PH-OUT output	± 4 V
external load impedance for A-OUT output	≥600 Ohm
external load impedance for PH-OUT output	>8 Ohm
maximum output power for PH-OUT output	0.8 W
sampling frequency	up to 25 kHz

common parameters:

On-board MCLK master clock frequency for AIC chip	4.068 MHz
maximum external master clock frequency for AIC chip from either TM-0/1 SIOX pins or external XMCLK pin of JP2 connector	10.368 MHz x2
number of bits in data packet via SIO-port	16 bits
logical low level for external clock frequency input and digital I/O signals at external JP2 connector	≤ 0.6 V
logical high level for external clock frequency input and digital I/O signal at external JP2 connector	≥ 2.4 V
host SIOX interface power supplies (no external loads at A-OUT and PH-OUT outputs)	+5 V @ 90 mA +12 V @ 50 mA -12 V @ 50 mA
physical dimensions	2.075"x2.175"x0.21"

CAUTION

This manual does not contain detail description for TLC32046 and TLC32047 AIC chip from Texas Instruments Inc. For details about AIC chips refer to the corresponding technical information from Texas Instruments Inc, which is enclosed with this manual either in electronic or paper form.

analog input section

Analog input section of *T/SDAS-SCOM1* DCM is designed for analog-to-digital conversion of input analog signal from either A-IN or AUX-IN analog inputs and further transmission of digital code to the receiver of SIO-0 port of SIOX interface of *TORNADO* DSP system.

Analog input section comprises of the following components:

- differential A-IN input amplifier (A-IN-Amp) with gain factor 0dB
- differential AUX-IN input amplifier (AUX-IN-Amp) with gain factor either 0dB or +20dB, which is selected via SW2-1 on-board configuration switch. AUX-IN '+' input of AUX-IN-Amp differential amplifier can be also configured via on-board SW3-1 switch to appear either DC or AC coupled, whereas the '-' input of differential AUX-IN-Amp input amplifier is always DC coupled. The '+' input of AUX-IN-Amp differential amplifier also provide optional voltage bias circuit, which must be used when connecting to external electret microphone, and which is enabled by on-board SW3-2 switch.
- programmable input multiplexer (IMUX-ADC)
- programmable gain amplifier (PGA-ADC) with gain factors 0dB, +6dB and +12dB
- programmable low-pass antialiasing filter (LPF-ADC)
- programmable high-pass filter (HPF-ADC)
- 14-bit analog-to-digital converter (ADC).

Differential A-IN and AUX-IN input amplifiers are designed for interfacing and amplification of external analog signals. Both A-IN and AUX-IN input amplifiers feature high input impedance and over-voltage protection.

A-IN input has been designed for interfacing to external DC line-level signals, whereas the AUX-IN input can be used to interface either to external DC/AC line-level signals or to microphone. The gain factor for AUX-IN input amplifier can be set either 0dB or +20dB and is selected via on-board SW2-1 switch (refer to Appendix A).

A-IN input is DC coupled and can process external DC/AC analog signals within the frequency range below the cutoff frequency of the AIC antialiasing filter.

AUX-IN input features optional DC/AC coupling and voltage shift circuit, which allows connection to external either DC or 'DC shifted' AC signals and to external electret microphones. AUX-IN input can process external DC/AC analog signals within the frequency range below the cutoff frequency of the AIC antialiasing filter.

DC/AC coupling feature allows to connect to external either DC signals or external 'DC shifted' AC signal. DC/AC coupling feature is applicable to the '+' input only of differential AUX-IN-Amp input amplifier, whereas the '-' input is always DC coupled. DC/AC coupling feature for the '+' input of differential AUX-IN-Amp input amplifier is selected via the on-board SW3-1 switch (refer to Appendix A).

The '+' input of AUX-IN-Amp differential amplifier can also provide on-board +5V@15kOhm DC voltage bias for connection to electret microphones, which is enabled via on-board SW3-2 switch (refer to Appendix A).

CAUTION

In case the on-board DC voltage bias is enabled via SW3-2 switch for the '+' input of AUX-IN-Amp differential amplifier, then the '+' input of AUX-IN-Amp differential amplifier must be AC coupled.

Input multiplexer IMUX-ADC, programmable gain amplifier PGA-ADC, programmable high-order low-pass antialiasing filter (LPF-ADC), optional high-order low-frequency high-pass filter (HPF-ADC), and 14-bit analog-to-digital converter (ADC) are internal components of A/D section of TLC32046 (or TLC32047) AIC chip from Texas Instruments Inc.

analog output section

Analog output section of *T/SDAS-SCOM1* DCM has been designed for conversion of digital code from transmitter of SIO-0 port of SIOX interface of *TORNADO* DSP system into output analog signals at line output (A-OUT) and speaker/headphone output (PH-OUT).

Analog output section comprises of the following components:

- 14-bit digital-to-analog converter (DAC)
- programmable low-pass filter (LPF-DAC)
- $SIN(X)/X$ reconstruction filter (RF-DAC)
- differential A-OUT output buffer
- PH-OUT amplifier for external headphones or speaker.

14-bit DAC, programmable low-pass filter LPF-DAC, $SIN(x)/X$ reconstruction filter RF-DAC and differential A-OUT output buffer are internal components of D/A section of TLC32046 (or TLC32047) AIC chip from Texas Instruments Inc.

A-OUT and PH-OUT buffers are used for interfacing to external low-impedance loads and provide minimum signal distortions.

A/D and D/A control logic

The A/D and D/A control logic are internal components of TLC32046 (or TLC32047) AIC chip from Texas Instruments Inc.

Control Unit (CU)

T/SDAS-SCOM1 on-board Control Unit (CU) is implemented using FPGA chip and offers selector of master clock source frequency for on-board TLC32046 (or TLC32047) AIC chip and optional external digital input facility, which is used for interfacing to external telephone line/station interface options.

External digital I/O

T/SDAS-SCOM1 DCM offers two external digital inputs (*DIN-0* and *.DIN-1*) and two external digital outputs (*DOUT-0* and *DOUT-1*) in order to control external telephone line/station interface options. Both external digital inputs and outputs are TTL compatible and are available via real-time serial I/O data streams during

secondary communication with TLC32046 (or TLC32047) AIC via SIO-0 port of host *TORNADO* SIOX interface.

External digital inputs (*DIN-0* and *DIN-1*) appear as bits D15 and D14 correspondingly of secondary receiver data word, which is transmitted to the receiver of SIO-0 port of host *TORNADO* SIOX interface during secondary communication (refer to the corresponding subsection below) of TLC32046 (or TLC32047) AIC.

External digital outputs (*DOUT-0* and *DOUT-1*) can be set by host *TORNADO* DSP software via bits D10 and D11 correspondingly of command data word (D0=1, D1=1), which is transmitted from the transmitter of SIO-0 port of host *TORNADO* SIOX interface during secondary communication (refer to the corresponding subsection below) of TLC32046 (or TLC32047) AIC.

communication with host SIOX interface

Communication between *T/SDAS-SCOM1* DCM and *TORNADO* on-board DSP is performed via SIO-0 port of host *TORNADO* SIOX rev.B interface site using 16-bit serial data words. Refer to TLC32046 (TLC32047) AIC documentation for details.

All *TORNADO* DSP systems and controllers with SIOX rev.B interface support communication with *T/SDAS-SCOM1* DCM.

TLC32046 (TLC32047) AIC data word formats for primary communication

TLC32046 (TLC32047) AIC data words format for primary communication contain DAC data from DSP to AIC and ADC data from AIC to DSP, and correspond to that described in original TLC32046 (TLC32047) AIC documentation:

Primary Communication Transmitter Word for TLC32046 (TLC32047) AIC (DAC data)

DAC-13	DAC-12	DAC-11	DAC-10	DAC-9	DAC-8	DAC-7	DAC-6	DAC-5	DAC-4	DAC-3	DAC-2	DAC-1	DAC-0	CB-1	CB-0
bit-15	bit-14	bit-13	bit-12	bit-11	bit-10	bit-9	bit-8	bit-7	bit-6	bit-5	bit-4	bit-3	bit-2	bit-1	bit-0

- Notes: 1. DAC-0..DAC-13 are data bits transmitted from DSP to AIC and contains DAC data.
2. Two least significant bits are Control Bits ({CB-1,CB-0}), which are used either to request secondary communication ({1,1}) or to define phase adjustment ({0,0}, {0,1}, {1,0}). Refer to TLC32046 (TLC32047) AIC documentation for details.

Primary Communication Receiver Data Word from TLC32046 (TLC32047) AIC (ADC data)

ADC-13	ADC-12	ADC-11	ADC-10	ADC-9	ADC-8	ADC-7	ADC-6	ADC-5	ADC-4	ADC-3	ADC-2	ADC-1	ADC-0	0	0
bit-15	bit-14	Bit-13	bit-12	bit-11	bit-10	bit-9	bit-8	bit-7	bit-6	bit-5	bit-4	bit-3	bit-2	bit-1	bit-0

- Notes: 1. ADC-0..ADC-13 are data bits transmitted from AIC to DSP and contains ADC data.

TLC32046 (TLC32047) AIC data word formats for secondary communication

TLC32046 (TLC32047) AIC transmitter data words format for secondary communication contain the configuration data for AIC, which correspond to that described in original TLC32046 (TLC32047) AIC documentation, whereas the AIC receiver data word for secondary communication contains read-back external digital input status.

Secondary Communication Transmitter TA/RA Word for TLC32046 (TLC32047) AIC

x	x	TA-4	TA-3	TA-2	TA-1	TA-0	x	x	RA-4	RA-3	RA-2	RA-1	RA-0	0	0
bit-15	bit-14	bit-13	bit-12	bit-11	bit-10	bit-9	bit-8	bit-7	bit-6	bit-5	bit-4	bit-3	bit-2	bit-1	bit-0

Secondary Communication Transmitter TA'/RA' Data Word for TLC32046 (TLC32047) AIC

x	TA'-5	TA'-4	TA'-3	TA'-2	TA'-1	TA'-0	x	RA'-5	RA'-4	RA'-3	RA'-2	RA'-1	RA'-0	0	1
bit-15	bit-14	bit-13	bit-12	bit-11	bit-10	bit-9	bit-8	bit-7	bit-6	bit-5	bit-4	bit-3	bit-2	bit-1	bit-0

Secondary Communication Transmitter TB/RB Data Word for TLC32046 (TLC32047) AIC

x	x	TB-4	TB-3	TB-2	TB-1	TB-0	x	x	RB-4	RB-3	RB-2	RB-1	RB-0	1	0
bit-15	bit-14	bit-13	bit-12	bit-11	bit-10	bit-9	bit-8	bit-7	bit-6	bit-5	bit-4	bit-3	bit-2	bit-1	bit-0

Secondary Communication Transmitter Command Data Word for TLC32046 (TLC32047) AIC

X		DOUT-1	DOUT-0	RF	x	GC-1	GC-0	SYNC	ISEL	LB	HPF	1	1
bit-15..12		bit-11	bit-10	bit-9	bit-8	bit-7	bit-6	bit-5	bit-4	bit-3	bit-2	bit-1	bit-0

Secondary Communication Receiver Data Word from TLC32046 (TLC32047) AIC

DIN-0	DIN-1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
bit-15	bit-14	bit-13	bit-12	bit-11	bit-10	bit-9	bit-8	bit-7	bit-6	bit-5	bit-4	bit-3	bit-2	bit-1	bit-0

Master clock (MCLK) for TLC32046 (TLC32047) AIC

On-board synchronization, sampling frequency and serial clock are generated by TLC32046 (TLC32047) AIC chip, which is derived from the AIC master clock (*MCLK*) source clock. Refer to TLC32046 (TLC32047) AIC chip documentation for details.

T/SDAS-SCOM1 DCM on-board AIC master clock controller comprises of AIC master clock selector (on-board SW1 switch) and succeeding ½ frequency divider.

CAUTION

TLC32046 (TLC32047) AIC master clock input appears as the $\frac{1}{2}$ frequency from on-board master clock selector (SW1 switch).

It is important to have AIC master clock to be synchronous with clocking of particular signal processing application (fax/modem baud rate, vocoder clocking, etc) in order to provide correct signal processing functionality.

T/SDAS-SCOM1 DCM offers a variety of AIC master clock (*MCLK*) source configurations, which are selected via on-board SW1 switch (refer to Appendix A for more details) and allow to meet different signal processing applications:

- on-board 9.216 MHz crystal oscillator, which provide 4.608 MHz AIC master clock and is suitable for most telecommunication and speech processing applications
- $\frac{1}{2}$ of host SIOX *TM-0* or *TM-1* output timer frequency from host *TORNADO* on-board DSP, which can be used for perfect synchronization of AIC sampling frequency with DSP clock
- $\frac{1}{2}$ of external master clock input frequency (*XMCLK* input at JP2 external I/O connector), which can be used for generation of non-standard AIC master clock and for external synchronization.

In case AIC master clock (*MCLK*) is sourced from either on-board 4.608 MHz crystal oscillator, or external master clock (*XMCLK*) source, then SW1 can be configured for “translation” (forwarding) of x2 AIC master clock to either *TM-0* or *TM-1* timer/IO signals of host SIOX interface site of host *TORNADO* DSP system or controller. In some signal processing applications this will allow perfect synchronization between DSP timer interrupts and AIC sampling frequency.

AIC master clock source selection and “translation” feature are set by *T/SDAS-SCOM1* on-board switch SW1 (refer to Appendix A).

sampling frequency

ADC and DAC sampling frequencies are generated by TLC32046 (TLC32047) AIC and can be set either identical or different for ADC and DAC via host *TORNADO* DSP software. Refer to TLC32046 (TLC32047) AIC chip documentation for details.

Maximum sampling frequency value for both ADC and DAC is 25 kHz, which covers virtually all speech and fax/modem signal processing applications.

2.2 Construction

T/SDAS-SCOM1 DCM meets standard SIOX rev.B DCM form-factor. Construction of *T/SDAS-SCOM1* DCM assumes that host *TORNADO* DSP system with *T/SDAS-SCOM1* DCM installed fits into one either ISA-bus or PCI-bus slot of PC chassis.

Connection of *T/SDAS-SCOM1* DCM to external analog I/O world is performed via the on-board JP2 connector, which is available via rear panel of host PC (if *T/SDAS-SCOM1* is installed onto *TORNADO* DSP system for PC). Either *T/X-XCMP* signal cable set, or external *T/X-XTLI* telephone line interface, or *T/X-XTSI* external telephone station interface options are available for *T/SDAS-SCOM1* DCM in order to connect to different external signal I/O equipment and to meet different signal processing applications.

Chapter 3. Installation

This chapter contains information for installation and configuration of *T/SDAS-SCOM1* DCM.

3.1 Installation

T/SDAS-SCOM1 DCM installs as SIOX rev.B DCM onto *TORNADO* DSP system mainboard.

For installation of *T/SDAS-SCOM1* DCM into SIOX rev.B site of *TORNADO* DSP system follow the recommendations below (fig.3-1):

1. Switch off the power of host PC.
2. Remove *TORNADO* mainboard from PC slot.
3. Take *T/SDAS-SCOM1* DCM and slant it for about 30°.40° degrees refer to *TORNADO* mainboard. Insert JP2 external I/O connector of *T/SDAS-SCOM1* DCM into the corresponding hole of mounting bracket of *TORNADO* DSP system.

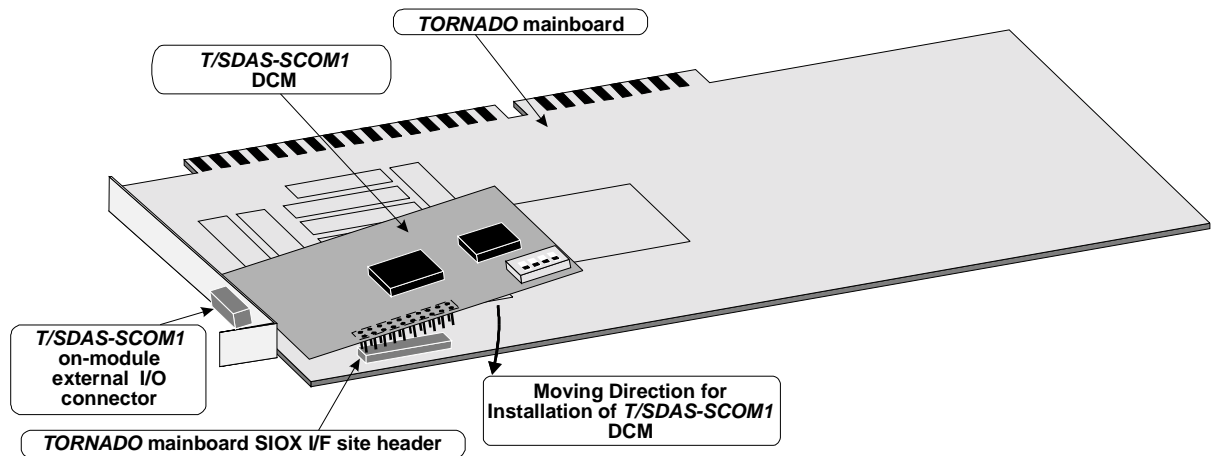


Fig. 3-1. Installation of *T/SDAS-SCOM1* DCM into SIOX site of *TORNADO* DSP system.

4. Rotate *T/SDAS-SCOM1* DCM around mounting bracket and allocate pin #1 of JP1 connector of *T/SDAS-SCOM1* DCM against pin #1 of SIOX interface header on *TORNADO* mainboard.

CAUTION

Female connector of host SIOX interface has 20 pins for *TORNADO-3x/P3x/E3x* DSP systems and controllers and 26 pins for *TORNADO-54x/6x/P6x/E6x/E54x* DSP systems and controllers. Pin #1 of host SIOX site connectors always fit into the same physical position on *TORNADO* DSP systems and controllers.

Pin #1 of SIOX connector of *T/SDAS-SCOM1* DCM must always plug into pin #1 of host SIOX site connector not regarding type of host *TORNADO* DSP systems or controller.

Missing doing this will result in damage of *T/SDAS-SCOM1* DCM and/or host *TORNADO* hardware.

5. Safely plug-in SIOX male header of *T/SDAS-SCOM1* DCM into SIOX female header of *TORNADO* DSP system.
6. Screw external analog I/O connector shell of *T/SDAS-SCOM1* DCM to the mounting bracket of *TORNADO* DSP system.
7. Configure on-board SW2-1 switch to selection the gain factor of AUX-IN input amplifier (refer to Appendix A).
8. Configure on-board SW3-1 and SW3-2 switches to select the DC/AC coupling and voltage bias for AUX-IN input (refer to Appendix A).
9. Configure on-board switch SW1 for selection of master clock source for on-board AIC (refer Appendix A).
10. Install *TORNADO* board into PC slot and screw it to rear panel of PC.
11. Connect the plug to external analog I/O connector of *T/SDAS-SCOM1* DCM.
12. Switch on power of host PC.

3.2 Connection to external signal I/O equipment

Connection of *T/SDAS-SCOM1* DCM to external audio and telephone equipment is performed by means of on-board JP2 connector (fig.A-1), *T/X-XCMP* external signal I/O cable set and external telephone line/station interface options.

CAUTION

It is highly recommended to plug-in and unplug *T/X-XCMP* external signal I/O cable set and external telephone line/station interface options into/from on-board JP2 connector of *T/SDAS-SCOM1* DCM when host *TORNADO* power is switched off.

The ground signal of *T/SDAS-SCOM1* DCM has no galvanic isolation from host *TORNADO* and/or PC ground signal and chassis.

CAUTION

When connecting external audio/telephone equipment to *T/SDAS-SCOM1* DCM you should be aware that A-IN/AUX-IN analog inputs and A-OUT analog outputs of *T/SDAS-SCOM1* DCM are DC coupled (except for specific AC coupling configuration for the '+' input of differential AUX-IN input). If required, external DC isolation capacitors should be used.

connection to external stereo-audio equipment

T/SDAS-SCOM1 DCM allows direct connection to external single-channel speech/audio equipment via *T/X-XCMP* single-channel audio cable set, which plugs directly into on-board JP2 connector (fig.1-3).

T/X-XCMP single-channel audio cable set for *T/SDAS-SCOM1* DCM uses ¼" standard miniature phone jacks for connection to external consumer audio equipment with single-ended I/O signals. This set comprises of 4 jacks:

- A-IN (audio line-in) input (mono-jack with ground signal), which connects to the '+' A-IN differential input ('-' differential A-IN input is connected to the ground)
- AUX-IN (microphone) input (mono-jack with ground signal), which connects to the '+' AUX-IN differential input ('-' differential AUX-IN input is connected to the ground)
- OUT (audio line-out) output (mono-jack with ground signal), which connects to the '+' A-OUT differential output ('-' differential A-OUT output is connected to the ground)
- HPH (speaker/headphones) output (mono-jack with ground signal)

connection to microphones

T/SDAS-SCOM1 DCM provides optional on-board +5v DC offset voltage at the '+' input of differential AUX-IN input for direct connection to electret microphones. Please refer to your microphone operation guide in order to learn whether your microphone requires external DC offset voltage.

The on-board +5v DC offset voltage for '+' input of differential AUX-IN input is enabled via on-board SW3-2 switch (refer to Appendix A).

connection to headphones

T/SDAS-SCOM1 DCM allows direct connection to 32 Ohm and 600 Ohm headphones and 8 Ohm speakers with max power output below 0.8W. The value of signal distortions for headphones is not specified and may be higher than that for standard A-OUT outputs.

external telephone line/station interface options

T/SDAS-SCOM1 DCM allows direct connection to external *T/X-XTLI* telephone line interface (fig.1-4) or external *T/X-XTSI* telephone station interface (fig.1-5).

T/X-XTLI external telephone line interface option offers direct access to available PSTN (public switched telephone network) subscriber lines for conversion *TORNADO* DSP system or controller with installed *T/SDAS-SCOM1* DCM into automatic answering machine, fax device or modem with data transmission over telephone lines.

T/X-XTSI external telephone station interface option offers direct connection of telephone, fax machine or computer modem to *TORNADO* DSP system or controller with installed *T/SDAS-SCOM1* DCM in order to emulate standard PSTN subscriber lines.

3.3 Software Configuration for SIO Port of Host *TORNADO* DSP

When programming the *TORNADO* DSP systems for communication with *T/SDAS-SCOM1* DCM it is recommended to follow the recommendations below:

- *SIO port transmitter* of *TORNADO* on-board DSP must be configured as the following:
 - *CLKX* signal must be configured as input, active high
 - *FSX* signal must be configured as input, active low, no advance setting feature
 - *DX* signal must be configured as active high
 - *data format* must be 16 bits per frame
 - transmitter must be configured for STANDARD MODE and VARIABLE DATA RATE (TMS320C3x only)
- *SIO port receiver* of *TORNADO* on-board DSP must be configured as the following:
 - *CLKR* signal must be configured as input, active high
 - *FSR* signal must be configured as input, active low, no advance setting feature
 - *DR* signal must be configured as active high
 - *data format* must be 16 bits per frame
 - receiver must be configured for STANDARD MODE and VARIABLE DATA RATE (TMS320C3x only).

Appendix A. On-board Connectors and Switches

This appendix contains a summary for the on-board connectors and configuration switches for *T/SDAS-SCOM1* DCM.

On-board connectors and configuration switches are presented at fig.A-1.

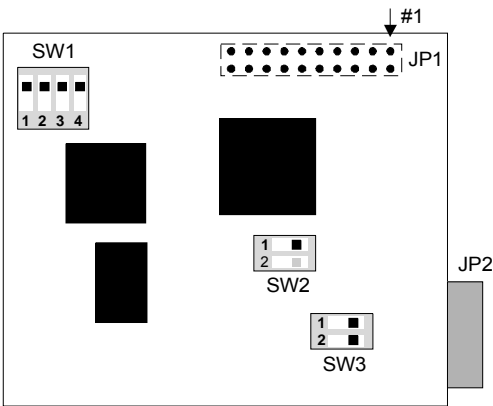


Fig. A-1. On-board connectors and configuration switches for *T/SDAS-SCOM1* DCM.

A.1 Configuration Switches

Table A-1 specifies how to set on-board configuration switches.

Table A-1. Configuration switches for T/SDAS-SCOM1 DCM.

Switch	Description
SW1-1..4	Master clock (MCLK) source selector for on-board AIC:
	ON/OFF/OFF/OFF - on-board 4.608 MHz crystal oscillator is used as AIC master clock. SW1-3 and SW1-4 switches define translation of on-board 9.216 MHz clock to host SIOX <i>TM-1</i> and <i>TM-0</i> timer/IO pins correspondingly ('OFF' corresponds to 'no translation feature', 'ON' corresponds to enable translation).
	OFF/ON/OFF/OFF - ½ of the frequency of external <i>XMCLK</i> input from external I/O connector JP2 is used as AIC master clock. SW1-3 and SW1-4 switches define translation of external <i>XMCLK</i> clock to host SIOX <i>TM-1</i> and <i>TM-0</i> timer/IO pins correspondingly ('OFF' corresponds to 'no translation feature', 'ON' corresponds to enable translation).
	OFF/OFF/ON/OFF - host SIOX <i>TM-1</i> timer/IO is used as AIC master clock
	OFF/OFF/OFF/ON - host SIOX <i>TM-0</i> timer/IO is used as AIC master clock
SW2-1	Gain factor for AUX-IN input amplifier of analog input section of channel:
	ON - gain +20 dB
	OFF - gain 0 dB
SW3-1	DC/AC coupling control for the '+' differential AUX-IN input of analog input section:
	ON - DC coupled input
	OFF - AC coupled input
SW3-2	DC voltage bias control for the '+' differential AUX-IN input of analog input section:
	OFF - no on-board DC bias is provided
	ON - on-board +5 V DC bias @ 15 kOhm is provided

Notes: 1. Highlighted configurations correspond to the factory setting.

A.2 On-board Connectors

Table A-2 contain the list of on-board connectors.

Table A-2. On-board connectors of *T/SDAS-SCOM1* DCM.

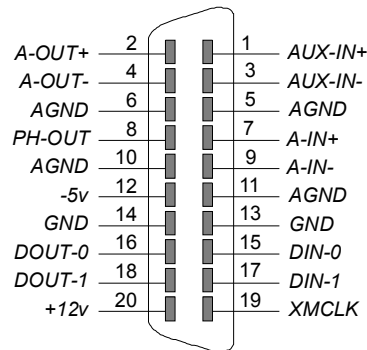
Connector	description
<i>JP1</i>	SIOX interface site male header.
<i>JP2</i>	External analog I/O connector.

Pinout of *JP1* host SIOX connector is presented in the user's guide of host *TORNADO* DSP system or controller, which is used for installation of *T/SDAS-SCOM1* DCM.

Pinout for *JP2* external I/O connector

Pinout of *JP2* external I/O connector for *T/SDAS-SCOM1* DCM is presented at fig.A-2, and description of signals is presented in table A-3.

The connector p/n for *JP2* is DHA-RA26 female half-pitch connector from DDK Ltd manufacturer. P/n for compatible plug-in connector is DHA-PC26. In case customer needs to design his own application specific cable for connection to *T/SDAS-SCOM1* DCM, then compatible plug-in connectors for *JP2* are available from MicroLAB Systems upon request.

Fig. A-2. Pinout for *JP2* external I/O connector of *T/SDAS-SCOM1* DCM.Table A-4. Signal description for *JP2* external I/O connector of *T/SDAS-SCOM1* DCM.

Signal name	Type	description
<i>A-IN+</i> <i>A-IN-</i>	AI	Differential A-IN inputs.
<i>AUX-IN+</i> <i>AUX-IN-</i>	AI	Differential AUX-IN inputs.

<i>A-OUT+</i> <i>A-OUT-</i>	AO	Differential A-OUT outputs.
<i>PH</i>	AO	Phone and speaker output.
<i>XMCLK</i>	TTL/IN	External master clock input for TLC32046 (TLC32047) AIC chips.
<i>DIN-0, DIN-1</i>	TTL/IN	External digital inputs. Used for control of external telephone line/station interface options or as general purpose digital inputs.
<i>DOUT-0, DOUT-1</i>	TTL/OUT	External digital outputs. Used for control of external telephone line/station interface options or as general purpose digital outputs.
<i>GND</i>	-	Ground.
<i>+12v</i> <i>-5v</i>	-	Power supply outputs from <i>TORNADO</i> mainboard for external telephone line/station interface options or other connected general purpose analog/digital front-end devices.

Notes: 1. Signal types: *AI* - analog input; *AO* - analog output; *TTL/IN* - TTL compatible digital input; *TTL/OUT* - TTL compatible digital output.

Appendix B. SIOX Rev.B Interface Site

This appendix contains information about *TORNADO* SIOX rev.B interface site specifications. This description is general to all *TORNADO* DSP systems/controllers/coprocessors, whereas different *TORNADO* boards with different DSP platforms may differ in the number and in the on-board routing of SIOX serial ports, timer/IO pin specifications. Refer to your particular *TORNADO* user's guide for more details.

B.1 General Description

TORNADO architecture provides expansion of the on-board DSP I/O resources via on-board serial I/O expansion interface sites (SIOX-A and SIOX-B) (fig.B-1), which are designed to carry compatible DCM (DCM).



Fig.B-1. *TORNADO*-54x board with two SIOX sites.

Some *TORNADO* boards (typically *TORNADO* DSP systems for PC) provide two SIOX interface sites, whereas other *TORNADO* boards (typically *TORNADO* stand-alone DSP controllers and DSP coprocessors) provide only one SIOX site.

TORNADO SIOX rev.B interface site comprises of signals for one or two SIO-0/SIO-1 logical serial ports, timers/IO pins, DSP interrupts, and host power supplies.

CAUTION

In case *TORNADO* on-board DSP features two or more on-chip serial ports (TMS320C30, TMS320C54x, TMS320C6x), then *TORNADO* on-board SIOX sites provides two SIO-0 and SIO-1 serial ports and the SIOX site headers are 26-pin headers.

In case *TORNADO* on-board DSP features only one on-chip serial ports (TMS320C31, TMS320C32), then *TORNADO* on-board SIOX sites provides only one SIO-0 serial port and the SIOX site headers are 20-pin headers.

Both *TORNADO* on-board SIOX-A and SIOX-B interface sites feature identical pinout control and may only differ in the routing of DSP physical serial ports to SIO-0 and SIO-1 logical serial ports. If *TORNADO* on-board DSP features two or more on-chip serial ports (TMS320C30, TMS320C54x, TMS320C6x), then DSP serial ports routing is performed on *TORNADO* mainboard, and allows simultaneous operation of two or more SIOX DCM, which are routed to different DSP serial ports.

B.2 SIOX rev.B Site Connector and Signals

TORNADO SIOX rev.B interface site comprises of signals for SIO-0 and SIO-1 logical serial ports, DSP on-chip TM/XIO-0/1 timers/IO pins, three DSP interrupts, SIOX reset control, and power $\pm 5V/\pm 12V$ host power supplies.

TORNADO on-board SIOX site connector with two serial ports

TORNADO on-board SIOX site connector with two serial ports is an industry standard dual-row 26-pin female header with 0.1"x0.1" pin pattern. Compatible SIOX plug-in part on SIOX DCM should be the industry standard either 26-pin 0.1"x0.1"male header (in case both SIO-0 and SIO-1 serial ports are utilized on SIOX plugged-in DCM) or 20-pin 0.1"x0.1"male header (in case only SIO-0 serial port is utilized on SIOX plugged-in DCM).

SIOX site connector pinout with two serial ports is shown at fig.B-2 and signal specifications are listed in table B-1.

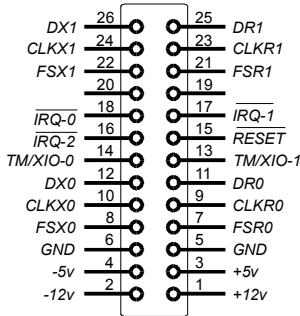


Fig.B-2. TORNADO on-board SIOX connector pinout with two serial ports (top view).

TORNADO on-board SIOX site connector with one serial port

TORNADO on-board SIOX site connector with one serial port is an industry standard dual-row 20-pin female header with 0.1"x0.1" pin pattern. Compatible SIOX plug-in part on SIOX DCM should be the industry standard 20-pin 0.1"x0.1" male header.

SIOX site connector pinout with one serial ports is shown at fig.B-3 and signal specifications are listed in table B-1.

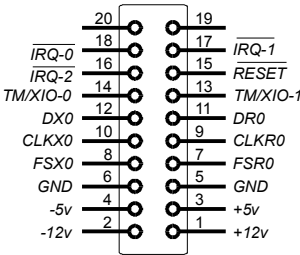


Fig.B-3. *TORNADO* on-board SIOX connector pinout with one serial port (top view).

SIOX site signal description

Description for SIOX interface site signals is presented in table B-1.

Table B-1. SIOX interface signal description.

SIOX signal name	signal type	description
SIO-0 port control		
<i>DX0</i> <i>FSX0</i> <i>CLKX0</i>	O/Z I/O/Z I/O/Z	Data, frame synchronization and serial clock signals for transmitter of SIO-0 port of SIOX site..
<i>DR0</i> <i>FSR0</i> <i>CLKR0</i>	I I/O/Z I/O/Z	Data, frame synchronization and serial clock signals for receiver of SIO-0 port of SIOX site..
SIO-1 port control <i>(available in SIOX site connector with two serial ports only)</i>		
<i>DX1</i> <i>FSX1</i> <i>CLKX1</i>	O/Z I/O/Z I/O/Z	Data, frame synchronization and serial clock signals for transmitter of SIO-1 port of SIOX site..
<i>DR1</i> <i>FSR1</i> <i>CLKR1</i>	I I/O/Z I/O/Z	Data, frame synchronization and serial clock signals for receiver of SIO-1 port of SIOX site..

DSP Timers/IO, DSP Interrupt Requests and SIOX Reset		
<i>TM/XIO-0</i>	I/O/Z	This signal is typically connected to the DSP on-chip timer-0 I/O pin and can be software configured by DSP as either timer or I/O pin.
<i>TM/XIO-1</i>	I/O/Z	This signal is typically connected to the DSP on-chip timer-1 I/O pin and can be software configured by DSP as either timer or I/O pin.
\overline{RESET}	O	Active low SIOX reset signal. Some <i>TORNADO</i> boards (for example <i>TORNADO-3x</i> boards) wires this signal directly from the DSP reset signal and SIOX plugged-in DCM reset is performed simultaneously with <i>TORNADO</i> on-board DSP reset, however other <i>TORNADO</i> boards (for example <i>TORNADO-54x/6x</i> etc. boards) features dedicated SIOX site reset signal, which is controlled by <i>TORNADO</i> on-board DSP for better synchronization between the DSP software and SIOX DCM operation.
$\overline{IRQ-0}$, $\overline{IRQ-1}$, $\overline{IRQ-2}$	I	Active low external interrupt request lines for <i>TORNADO</i> on-board DSP. These line are pulled up.
Power Supplies		
<i>GND</i>		Ground.
<i>+5v</i>		+5v
<i>+12v</i>		+12v
<i>-5v</i>		-5v
<i>-12v</i>		-12v

Note:

1. Signal type is denoted as the following: I - input, O - output, Z - high impedance.
1. All logical signal levels and load currents correspond to that for CMOS/TTL signals.

SIOX site signal levels

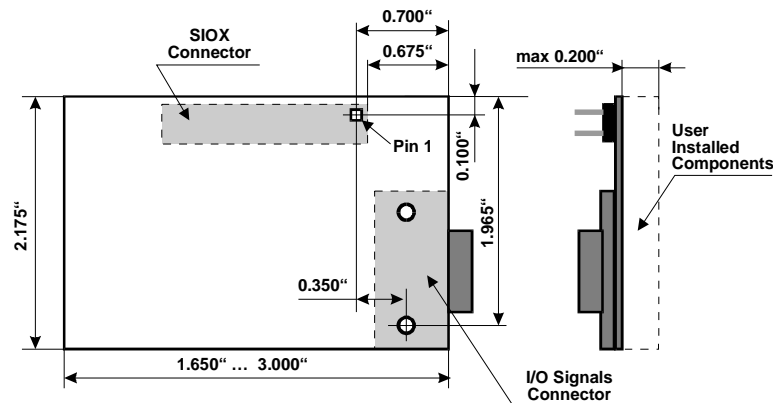
Signal levels for SIOX interface signals correspond to that for the CMOS/TTL signals with $I_{OL}=2\text{ma}$ and $I_{OH}=-0.3\text{ma}$ load currents.

CAUTION

Some *TORNADO* boards (*TORNADO-3x/542L/E31*) provide SIOX interface signal levels for CMOS/TTL only, whereas another *TORNADO* boards (*TORNADO-33/54x/E54x/6x/E6x/P6x/etc*) provide SIOX interface signal levels universal for both 3V TLL and standard TTL. Refer to documentation for your particular *TORNADO* board for information about SIOX interface signal levels.

B.3 Physical Dimensions for SIOX rev.B DCM

Physical dimensions for SIOX DCM are presented at fig.B-4. This information is intended for those customers, who need to design customized SIOX DCM.



SIOX connector: 20-pin or 26-pin straight dual-row mail header
(0.025" Sq., 0.1"x0.1" pattern)

Recommended connector for Analog I/O: DDK DHA-RC14-R122N
DDK DHA-RC20-R122N
DDK DHA-RC26-R122N

Fig.B-4. Physical dimensions for SIOX DCM.