

T/SU-X

SIOX rev.B Extender Kit
for *TORNADO* DSP Systems, Controllers and Coprocessors

User's Guide

covers:
T/SU-X rev.1A

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About this Document

This user's guide contains description for *T/SU-X* SIOX rev.B extender kit 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. ***TMS320C3x User's Guide.*** Texas Instruments Inc, SPRU031C, USA, 1992.
2. ***TMS320C54x. CPU and Peripherals. Reference Guide.*** Texas Instruments Inc, SPRU131D, USA, 1997.
3. ***TMS320C6x. CPU and Instruction Set. Reference Guide.*** Texas Instruments Inc, SPRU189C, USA, 1998.
4. ***TORNADO-3x. User's Guide.*** MicroLAB Systems, 1998.
5. ***TORNADO-P33. User's Guide.*** MicroLAB Systems, 2000.
6. ***TORNADO-54x. User's Guide.*** MicroLAB Systems, 1998.
7. ***TORNADO-6x. User's Guide.*** MicroLAB Systems, 1998.
8. ***TORNADO-P6x. User's Guide.*** MicroLAB Systems, 1999.
9. ***TORNADO-PX31DP. User's Guide.*** MicroLAB Systems, 1996.
10. ***TORNADO-SX30. User's Guide.*** MicroLAB Systems, 1996.
11. ***TORNADO-E31. User's Guide.*** MicroLAB Systems, 1996.
12. ***TORNADO-E33. User's Guide.*** MicroLAB Systems, 2000.
13. ***TORNADO-EL31. User's Guide.*** MicroLAB Systems, 1996.
14. ***TORNADO-E6x. User's Guide.*** MicroLAB Systems, 1998.

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Chapter 1. Introduction

This chapter contains general description for *T/SU-X* SIOX rev.B (serial I/O expansion) extender kit for *TORNADO* DSP systems/controllers/coprocessors.

1.1 General Information

T/SU-X (fig.1-1) is SIOX rev.B interface extender kit for *TORNADO* DSP systems (*TORNADO-3x/54x/6x/P6x/P33/etc*), *TORNADO-E/EL* stand-alone DSP controllers (*TORNADO-E3x/E54x/E6x/etc*) and *TORNADO-PX/SX* DSP coprocessors (*TORNADO-PX31DP/SX30/etc*) from MicroLAB Systems Ltd.

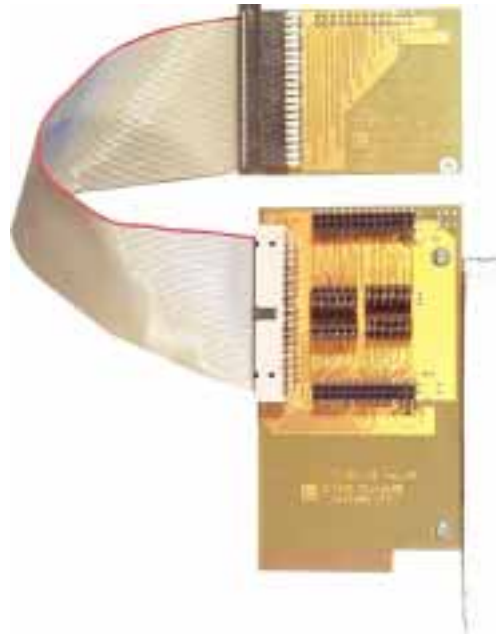


Fig. 1-1. *T/SU-X* SIOX rev.B extender kit.

Overview

T/SU-X SIOX rev.B extender kit comprises of the following components:

- *T/SU-X/BC* host SIOX rev.B interface board, which plugs into host SIOX interface site of *TORNADO* DSP system/controller as standard SIOX rev.B daughter-card module (DCM)
- *T/SU-X/BX* SIOX rev.B extender carrier board
- *T/SU-X/XC* connection cable.

T/SU-X/BX SIOX extender carrier board provides two remote sites for SIOX/SIOX-Bus rev.B DCMs. On-board configuration jumpers are provided for each SIO port of SIOX-A/B sites of *T/SU-X/BX* SIOX extender carrier board in order to connect to any SIO port of host SIOX interface site. Up to four *T/SU-X/BX* SIOX

extender carrier boards can be connected to one *T/SU-X/BC* SIOX rev.B interface DCM via one *T/SU-X/XC* connection cable.

T/SU-X/BX SIOX extender carrier board can also directly connect to *TORNADO-PX3x/PX6x/etc* PIOX coprocessors via *T/SU-X/XC* connection cable.

Installation

T/SU-X/BC option of *T/SU-X* SIOX extender kit plugs directly to the SIOX rev.B site onto *TORNADO* mainboard and connects to remote *T/SU-X/BX* SIOX extender carrier board by means of *T/SU-X/XC* connection cable (fig.1-2). *T/SU-X/BX* SIOX extender carrier board can carry up to two SIOX/SIOX-Bus rev.B DCMs (fig.1-3).

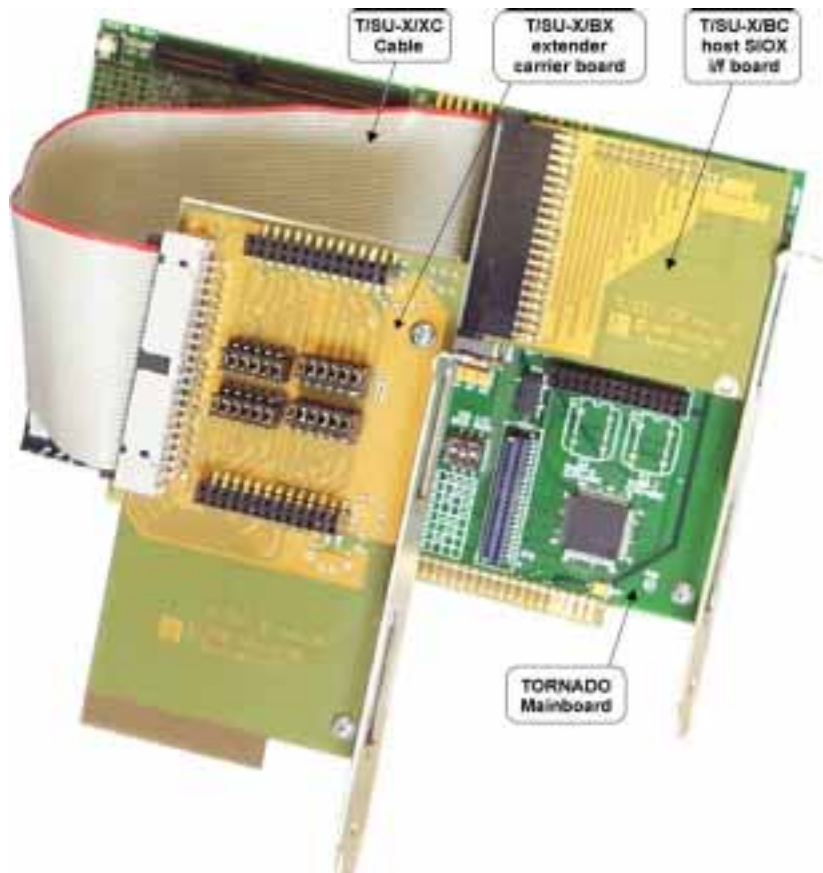


Fig. 1-2. *T/SU-X* SIOX extender kit connected to *TORNADO-6x* mainboard.

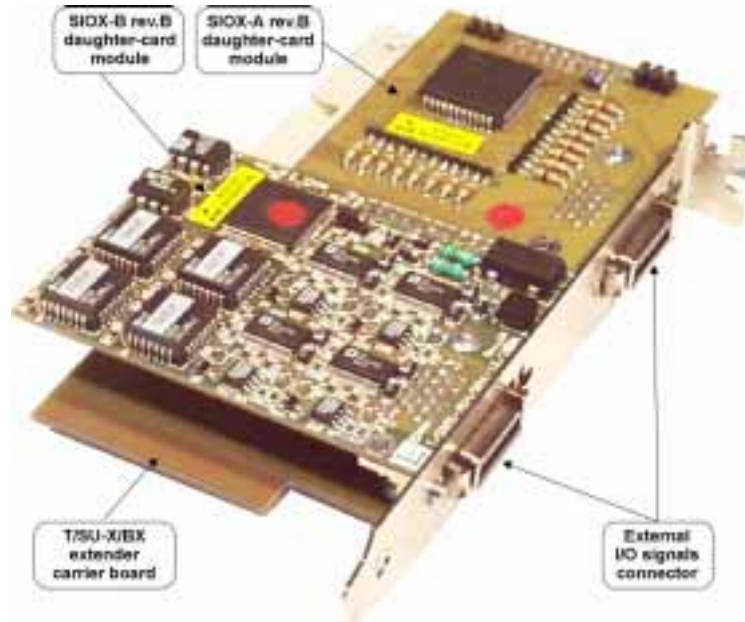


Fig. 1-3. *T/SU-X/BX* SIOX extender carrier board with two SIOX rev.B DCM installed.

Applications

T/SU-X SIOX extender kit has been designed for remote installation of SIOX/SIOX-Bus rev.B DCM for *TORNADO* DSP systems, controllers and coprocessors, and must be used in the following cases:

- in order to connect SIOX rev.B DCMs to SIO-1 port of host SIOX interface site in case only one SIOX rev.B site is available on host *TORNADO* DSP system, controller and coprocessor (i.e. *TORNADO-P6x/E6x/E54x/PX6x/etc*)
- in order to connect two SIOX rev.B DCMs to SIO-0 and SIO-1 ports of host SIOX interface site simultaneously
- in order to connect SIOX rev.B DCMs to SIO ports of host SIOX interface of host *TORNADO* DSP coprocessors (i.e. *TORNADO-PX3x/PX6x/etc*)
- in order to connect several SIOX-Bus rev.B DCMs to one SIO port of host SIOX interface of host *TORNADO* DSP system, controller or coprocessor.

1.2 Technical Specifications

The following are technical specifications for *T/SU-X* SIOX extender kit for temperature of external environment +25°C.

<u>parameter description</u>	<u>parameter value</u>
<i>host SIOX interface</i>	
host SIOX interface	SIOX rev.B SIOX-Bus rev.B
maximum clock frequency of host SIOX interface	50 MHz
 <i>general:</i>	
number of SIOX/SIOX-Bus rev.B DCMs, which can be installed onto T/SU-X/BX carrier board	2
maximum number of T/SU-X/BX extender carrier boards connected to one T/SU-X/BC SIOX interface DCM	4

Chapter 2. Technical Description

This chapter contains detail technical description for architecture and construction of *T/SU-X* SIOX extender kit.

2.1 Operation Details

Basic configuration and connectivity of *T/SU-X* SIOX rev.B extender kit is presented at fig.2-1.

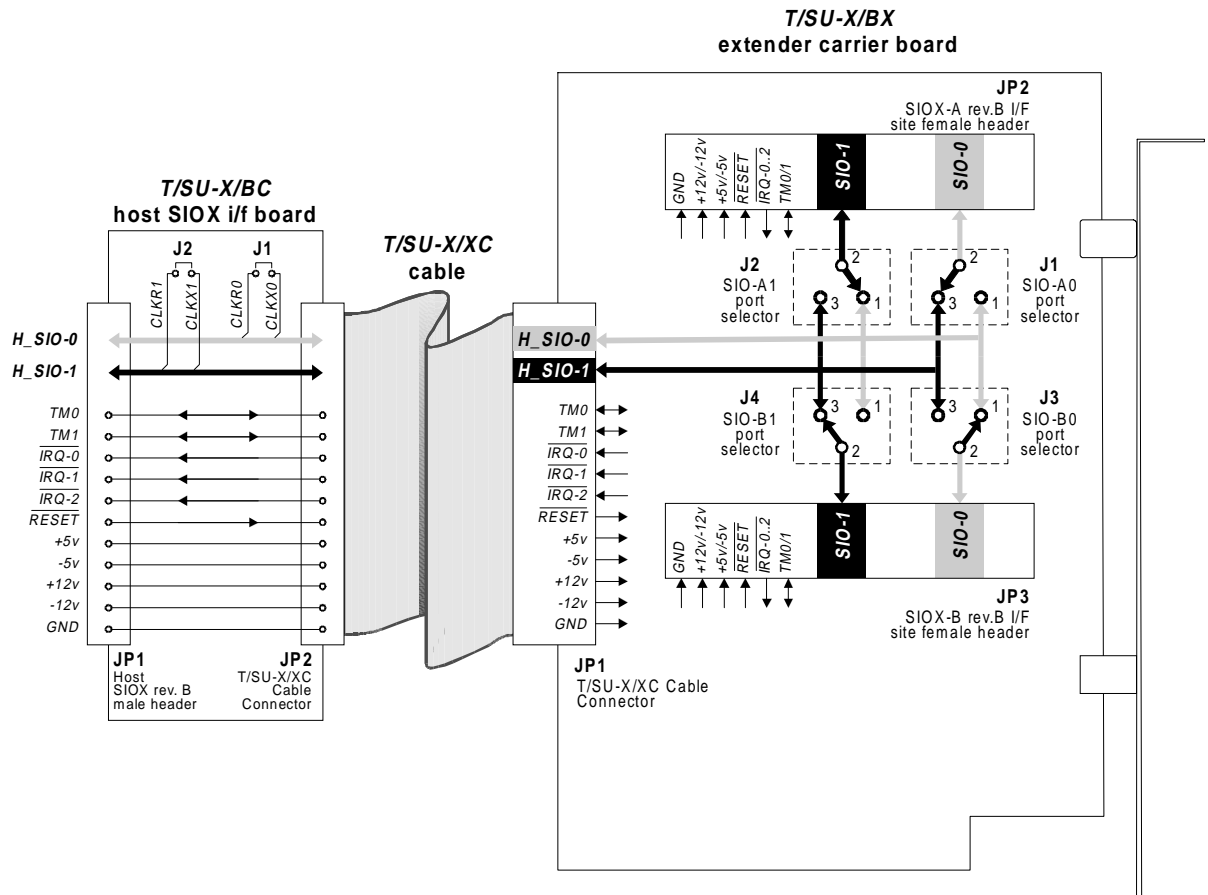


Fig. 2-1. Block diagram of *T/SU-X* SIOX extender kit.

T/SU-X/BC host SIOX interface board

T/SU-X/BC host SIOX interface board of T/SU-X SIOX extender kit plugs directly to host SIOX rev.B site onto *TORNADO* mainboard via on-board JP1 connector and connects to remote T/SU-X/BX SIOX extender carrier board via on-board JP2 connector by means of T/SU-X/XC connection cable.

T/SU-X/BX extender carrier board

T/SU-X/BX SIOX extender carrier board provides two standard remote SIOX rev.B sites SIOX-1 (JP2) and SIOX-B (JP3) for SIOX/SIOX-Bus rev.B DCMs.

T/SU-X/BX SIOX extender carrier board connects to host SIOX rev.B interface site of host *TORNADO* mainboard via JP1 connector by means of T/SU-X/XC connection cable and T/SU-X/BC host SIOX interface board (not required for connection to host *TORNADO-PX3x/PX6x/etc* PIOX coprocessors).

On-board configuration jumpers J1/J2/J3/J4 are provided for SIO-0/1 ports of SIOX-A/B sites of T/SU-X/BX SIOX extender carrier board in order to connect to any SIO port of host SIOX interface site in accordance with tables 2-1, 2-2, 2-3 and 2-4.

Table 2-1. Configuration of SIO-0 port of SIOX-A site for T/SU-X/BX extender carrier board.

J1 jumper setting	description
1-2	SIO-0 port of SIOX-A site is connected to SIO-0 port of host SIOX interface.
2-3	SIO-0 port of SIOX-A site is connected to SIO-1 port of host SIOX interface.

Notes: 1. Highlighted configuration corresponds to factory setting.

Table 2-2. Configuration of SIO-1 port of SIOX-A site for T/SU-X/BX extender carrier board.

J2 jumper setting	description
1-2	SIO-1 port of SIOX-A site is connected to SIO-0 port of host SIOX interface.
2-3	SIO-1 port of SIOX-A site is connected to SIO-1 port of host SIOX interface.

Notes: 1. Highlighted configuration corresponds to factory setting.

Table 2-3. Configuration of SIO-0 port of SIOX-B site for T/SU-X/BX extender carrier board.

J3 jumper setting	description
1-2	SIO-0 port of SIOX-B site is connected to SIO-0 port of host SIOX interface.
2-3	SIO-0 port of SIOX-B site is connected to SIO-1 port of host SIOX interface.

Notes: 1. Highlighted configuration corresponds to factory setting.

Table 2-4. Configuration of SIO-1 port of SIOX-B site for T/SU-X/BX extender carrier board.

J4 jumper setting	description
1-2	SIO-1 port of SIOX-B site is connected to SIO-0 port of host SIOX interface.
2-3	SIO-1 port of SIOX-B site is connected to SIO-1 port of host SIOX interface.

Notes: 1. Highlighted configuration corresponds to factory setting.

Host timer I/O pins (*TM/XIO-0/1*), host interrupt request inputs (*IRQ-0/1/2*), host SIOX reset output (*RESET*) and power supply pins ($\pm 5V$, $\pm 12V$ and ground) of host SIOX interface are connected in-parallel to the corresponding pins of SIOX-A and SIOX-B sites of *T/SU-X/BX* SIOX extender/carrier board.

2.2 Construction

T/SU-X SIOX rev.B extender kit comprises of three different components:

- *T/SU-X/BC* host SIOX rev.B interface board, which plugs into host SIOX interface site of *TORNADO* DSP system/controller as standard SIOX rev.B daughter-card module (DCM)
- *T/SU-X/BX* SIOX rev.B extender carrier board, which is used for installation of two SIOX rev.B DCMs
- *T/SU-X/XC* connection cable, which connects *T/SU-X/BC* host SIOX rev.B interface board and up to four *T/SU-X/BX* SIOX rev.B extender carrier boards.

T/SU-X/BC host SIOX rev.B interface board (fig.1-1 and A-1) is standard full-size SIOX DCM with two connectors on it (fig.2-1). Construction of *T/SU-X/BC* DCM assumes that host *TORNADO* DSP system with *T/SU-X/BC* DCM installed fits into one ISA/PCI-bus slot of PC chassis.

T/SU-X/BX SIOX extender carrier board has two standard SIOX rev.B sites and PC rear panel bracket, which is useful in case this extender board is used inside PC chassis. Remote SIOX DCMs plug onto SIOX-A/SIOX-

B sites of extender board and connects to external analog/digital I/O world via rear panel of PC as if they are installed onto *TORNADO* PC plug-in DSP systems.

Chapter 3. Installation

This chapter contains information for installation and configuration of *T/SU-X* SIOX rev.B extender kit.

3.1 Installation

T/SU-X/BC host SIOX interface board installs as SIOX DCM onto *TORNADO* DSP system/controller mainboard.

For installation of *T/SU-X/BC* host SIOX interface board into SIOX 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/SU-X/BC* host SIOX interface board and plug-in its on-board JP1 SIOX male header into host SIOX interface site header of *TORNADO* DSP system.

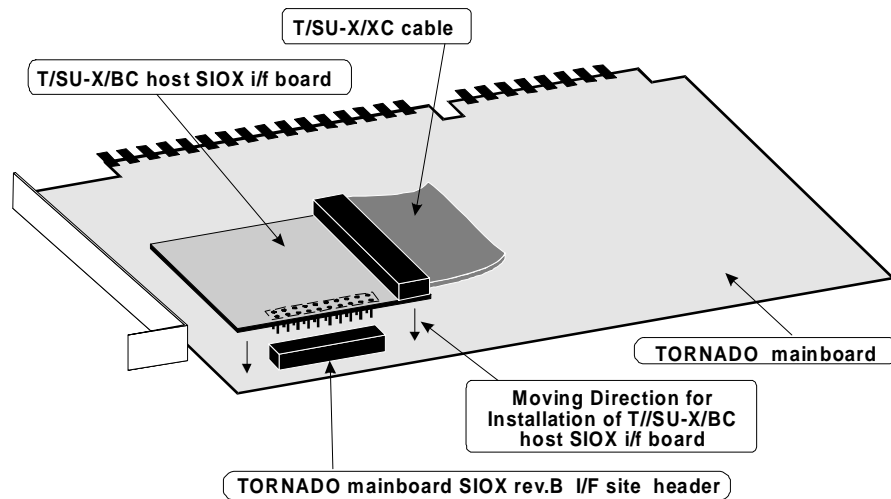


Fig. 3-1. Installation of *T/SU-X/BC* host SIOX interface board into SIOX site of *TORNADO* DSP system.

6. Screw mounting clip of *T/SU-X/BC* host SIOX interface board to the mounting bracket of *TORNADO* DSP system.
7. Connect one side of *T/SU-X/XC* cable to on-board JP2 connector of *T/SU-X/BC* host SIOX interface board and another side to the JP1 on-board connector *T/SU-X/BX* extender carrier board.
8. Configure on-board jumpers J1..J4 of *T/SU-X/BX* extender carrier board (refer to table 2-1..2-4) in order to meet requirements of your application.
9. Install SIOX DCMs into SIOX-A and SIOX-B sites of *T/SU-X/BX* extender carrier board.
10. Safely install *TORNADO* board with installed *T/SU-X/BC* host SIOX interface board, and *T/SU-X/BX* extender carrier board into PC slots and screw them to the rear panel of PC.
11. Switch on power of host PC.

Appendix A. On-board Connectors and Jumpers

This appendix contains a summary for the on-board connectors and configuration jumpers for *T/SU-X* SIOX rev.B extender kit.

The on-board connectors and configuration jumpers are presented at fig.A-1.

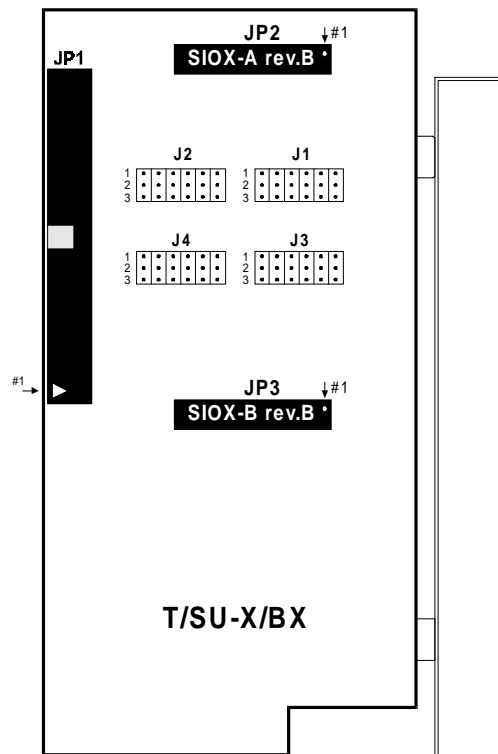


Fig. A-1a. On-board connectors and configuration jumpers for *T/SU-X/BX* SIOX extender carrier board.

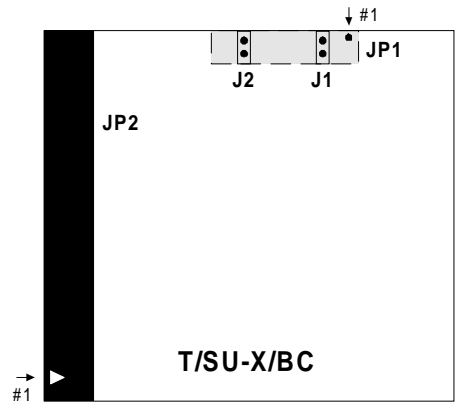


Fig. A-1b. On-board connectors for *T/SU-X/BC* host SIOX interface board.

A.1 Configuration Jumpers

Table A-1 lists on-board configuration jumpers for *T/SU-X/BX* SIOX extender carrier board and table A-2 lists configuration jumpers for *T/SU-X/BC* host SIOX interface board.

Table A-1. Configuration jumpers for *T/SU-X/BX* SIOX extender carrier board.

Jumper	Description
J1 (J1-1...J1-6)	Selects host SIOX serial port for SIO-0 port of SIOX-A site of <i>T/SU-X/BX</i> SIOX extender carrier board. Refer to table 2-1 for more details.
J2 (J2-1...J2-6)	Selects host SIOX serial port for SIO-1 port of SIOX-A site of <i>T/SU-X/BX</i> SIOX extender carrier board. Refer to table 2-2 for more details.
J3 (J3-1...J3-6)	Selects host SIOX serial port for SIO-0 port of SIOX-B site of <i>T/SU-X/BX</i> SIOX extender carrier board. Refer to table 2-3 for more details.
J4 (J4-1...J4-6)	Selects host SIOX serial port for SIO-1 port of SIOX-B site of <i>T/SU-X/BX</i> SIOX extender carrier board. Refer to table 2-4 for more details.

Table A-2. Configuration jumpers for *T/SU-X/BC* host SIOX interface board.

Jumper	Description
<i>J1</i>	Compensator of cable effects for SIO-0 port of host SIOX interface. This jumper must be installed in case SIOX rev.B DCM, which is installed onto <i>T/SU-X/BX</i> SIOX extender carrier board and is configured to host SIO-0 port of host SIOX interface, features common serial clock for both receiver and transmitter of SIO-0 port, i.e. <i>CLKX0</i> and <i>CLKR0</i> are connected on this DCM (refer to the user's guide for particular SIOX DCM, which is connected to SIO-0 port of host SIOX interface). Leave this jumper uninstalled for DCM with separate <i>CLKX0</i> and <i>CLKR0</i> signals.
<i>J2</i>	Compensator of cable effects for SIO-1 port of host SIOX interface. This jumper must be installed in case SIOX rev.B DCM, which is installed onto <i>T/SU-X/BX</i> SIOX extender carrier board and is configured to host SIO-1 port of host SIOX interface, features common serial clock for both receiver and transmitter of SIO-1 port, i.e. <i>CLKX1</i> and <i>CLKR1</i> are connected on this DCM (refer to the user's guide for particular SIOX DCM, which is connected to SIO-1 port of host SIOX interface). Leave this jumper uninstalled for DCM with separate <i>CLKX1</i> and <i>CLKR1</i> signals.

A.2 On-board Connectors

Table A-3 lists the on-board connectors for *T/SU-X/BX* SIOX extender carrier board, and table A-4 lists on-board connectors for *T/SU-X/BC* host SIOX interface board..

Table A-3. On-board connectors *T/SU-X/BX* SIOX extender carrier board.

Connector	Description
<i>JP1</i>	Connector for connection to <i>T/SU-X/BC</i> host SIOX interface board via <i>T/SU-X/XC</i> cable. Refer to fig.1-1, 1-2 and 2-1 for more details.
<i>JP2</i>	SIOX-A interface site female header.
<i>JP3</i>	SIOX-B interface site female header.

Pinout of *JP2* and *JP3* remote SIOX site headers on *T/SU-X/BX* SIOX extender carrier board is presented in Appendix B.

Table A-4. On-board connectors *T/SU-X/BC* host SIOX interface board.

Connector	Description
<i>JP1</i>	Host SIOX rev.B male header.
<i>JP2</i>	Connector for connection to <i>T/SU-X/BX</i> SIOX extender carrier board via <i>T/SU-X/XC</i> cable. Refer to fig.1-1, 1-2 and 2-1 for more details.

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 DCMs (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 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.

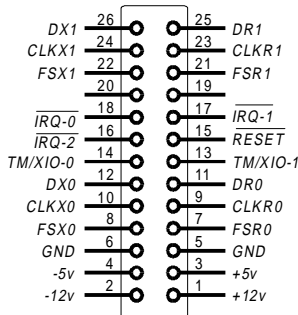


Fig.B-2. *TORNADO* on-board SIOX connector pinout with two serial ports (top view).

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.

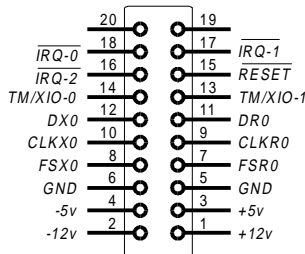


Fig.B-3. TORNADO on-board SIOX connector pinout with one serial port (top view).

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		
DX0 FSX0 CLKX0	O/Z I/O/Z I/O/Z	Data, frame synchronization and serial clock signals for transmitter of SIO-0 port of SIOX site..
DR0 FSR0 CLKR0	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 (available in SIOX site connector with two serial ports only)		
DX1 FSX1 CLKX1	O/Z I/O/Z I/O/Z	Data, frame synchronization and serial clock signals for transmitter of SIO-1 port of SIOX site..
DR1 FSR1 CLKR1	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		
TM/XIO-0	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.
TM/XIO-1	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		
GND		Ground.
+5v		+5v
+12v		+12v
-5v		-5v
-12v		-12v

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

SIOX site signal levels

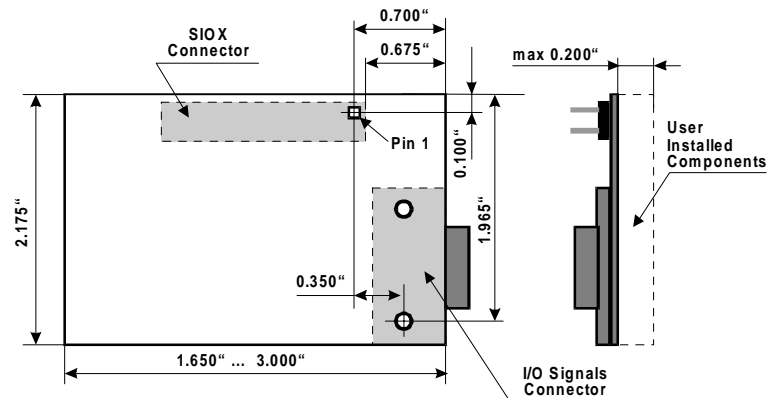
Signal levels for SIOX interface signals correspond to that for the CMOS/TTL signals with $I_{OL}=2\text{ma}$ and $I_{OH}=-0.3\text{ma}$ load currents.

CAUTION

Some *TORNADO* boards (*TORNADO-3x/542L/E31*) provide SIOX interface signal levels for CMOS/TTL only, whereas other *TORNADO* boards (*TORNADO-54xx/6x/E6x/P6x*) 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 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 DCMs.



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.