

## UTRANS Universal Serial Bus Transceiver Card

### General Description:

The Universal serial bus TRANSciever (UTRANS) interfaces instrument systems, to any computer with a USB port. UTRANS automatically detects the port type and configures itself for USB-1.1 or USB 2.0. UTRANS is an integral part of all tethered instruments and acts as the link connecting the ship-board data acquisition computer to the instrument cable (Figure 2). In this configuration the user achieves intelligent and flexible real-time data acquisition. In internally recording instruments, UTRANS links an internal single-board PC/104 data acquisition computer to the local instrumentation (See figure 2. Overview of ODAS-IR). This dual-purpose flexibility of UTRANS means that tethered and autonomous (internally recording) instruments have all other internal electronics in common, allowing the user to easily convert from tethered to autonomous operation without significant additional costs.

When it is paired with our analog-to-digital converter board, UTRANS also serves as a turn-key, stand-alone, data acquisition system for those users that want to record or telemeter signals from their own instrument systems. For example, our analog-to-digital converter board and UTRANS can be connected to any USB equipped computer to form a 16-channel, 16-bit data acquisition system with aggregate sampling rates of up to 500k samples per second. It does not matter whether the computer is a lap-top sitting on a bench or a PC/104 computer deep in the ocean. With the addition of our frequency converter boards (SCOUNT) the user can even sample the frequency output from Sea-Bird thermometers and conductivity probes.

As well as linking to the USB port on a host computer, UTRANS also links to remote instruments on a tether using a single pair of conductors for bi-directional high-speed serial communication. There can be up to 32 remote instruments connected to UTRANS, but typically there is only one remote instrument. The list of channel numbers (or addresses) and the sampling rate chosen by the user (in a setup file) are loaded into UTRANS via the USB link (Figure 2). UTRANS transmits this list at the chosen rate continuously from its internal address FIFO and gathers the data from the remote instruments in its data FIFO. When a "record" length of data has been accumulated, they are transmitted to the host via the USB. This process is started and stopped by the host. The serial data and addresses are transmitted as 16-bit words and encoded with Manchester II to form a secure return-to-zero stream in the tether. The maximum data rates are cable length dependent but rates of 500 kilo-bits per second are possible with a 2500 m 22 gauge cable.

### Software:

The software package ODAS4 supports the data acquisition and recording with UTRANS. The real-time version (ODAS4-RT) operates from Windows platforms and has been tested with XP and 2000. All user interaction is via a GUI and a single ASCII setup file. The setup file is used to configure (among other things) the sampling rate, sampling order, channel selection, communication rates, the base names of data files (which are automatically incremented after every restart) and the conversion of raw data into physical units for selected sensors. The GUI is used to select the setup file, edit the setup file, start and stop data acquisition, and request statistics on selected channels to check performance or to calibrate

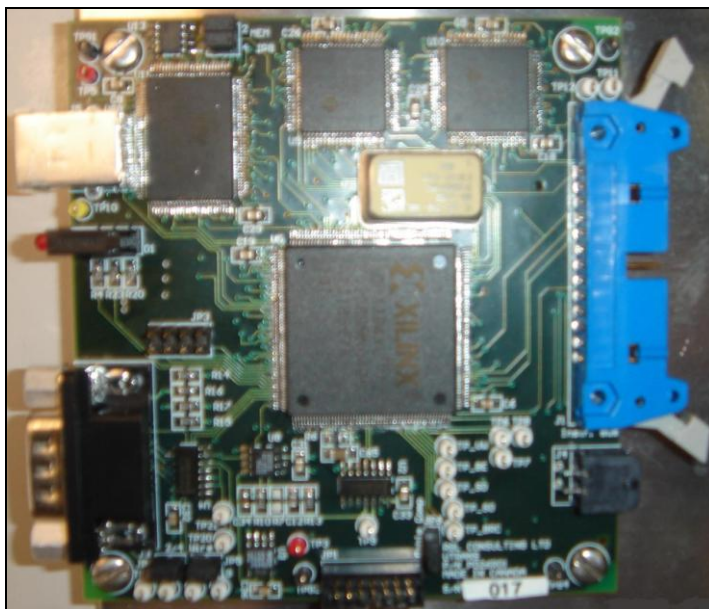


Figure 1. UTRANS Board

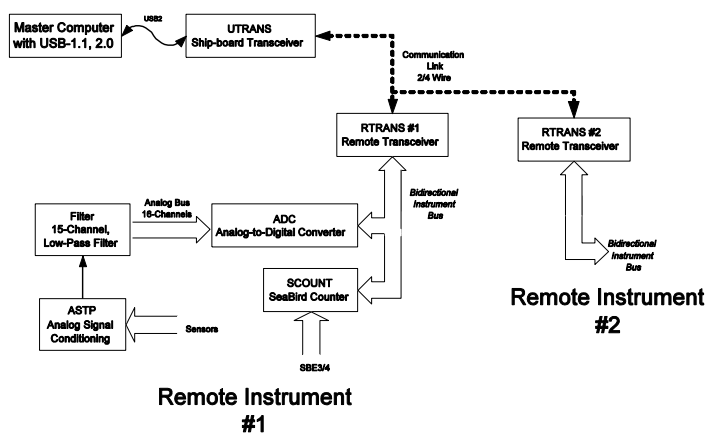


Figure 2. ODAS-RT Overview (Rolf to elaborate on caption here)

sensors. Record-average values are displayed in real-time for selected channels so that the user can monitor instrument depth, attitude, temperature, salinity, speed, heading and many other parameters, in physical units. This information is displayed even when the data are not being recorded. This is useful, for example, when pulling a tethered instrument to the surface - the user is fully informed about the disposition of the instrument. A graphical display of time series is available from other software.

The software for an internally recording instrument (ODAS4-IR) is a simplified version of the real-time software, and it functions on a MZ104+ single-board PC/104 computer. Other PC/104 boards have not been tested but the software should work with any board that has a USB port. Because the software is designed for autonomous and automatic power-up recording, it requires no GUI. ODAS4-IR operates on a reduced-kernel Linux operating system. The O/S occupies only 30 Mbytes of disk space. Linux was chosen for its simplicity, configurability and robustness. ODAS4-IR uses the same setup file as the real-time version and provides the user with complete flexibility to configure the data acquisition and recording. The O/S and the data recording space resides on a 384 Mbyte Disk-on-Chip (available up to 1024 Mbytes) and data can also be recorded on an optional IDE drive for very long data records. An Ethernet link provides communication with the user (secure shell) and secure ftp is used to download data.

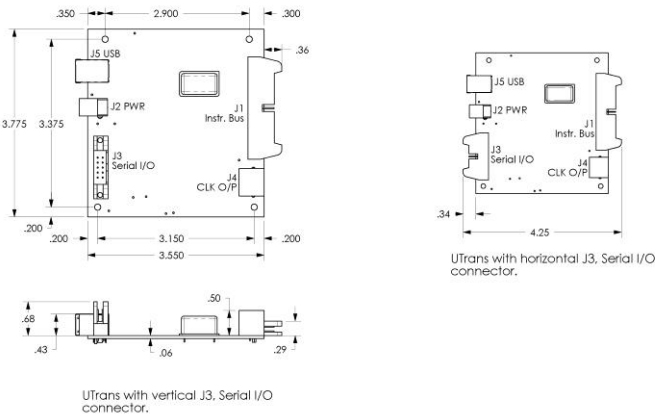
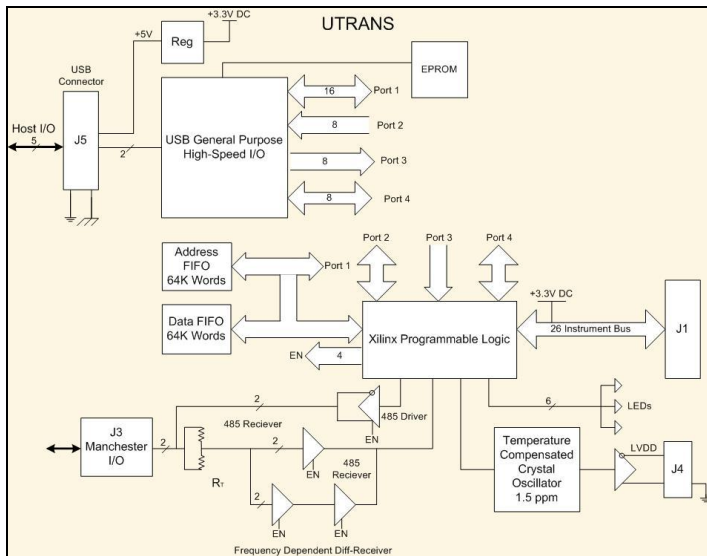


Figure 3. UTRANS board dimensions

Block Diagram



Specifications:

Host I/O	USB1.1 and USB2.0, automatically detected
Data FIFO	64K samples
Address FIFO	64K samples
Serial communication rates.	2 Mbits/s, and all rates that are integer divisions of 1 Mbits/s.
Serial Communication Modes	Simplex (2-wire) and duplex (4-wire)
Serial Line Drivers	RS-485 centered on 2.5V
Serial Line Receivers	RS-485 centered on 2.5V and cable compensation differential receiver. User selectable.
Maximum Bit Rate times cable length	Less than $1.5 \times 10^9$ meter-bits/s
Encoding	Manchester II, 2-phase, return-to-zero
Conductors	2 for simplex bi-direction communication, 4 for full duplex communication, user selectable.
Clock	24 MHz, $\pm 1.5$ ppm, 0-50°C, also available as low-voltage differential signal to other instruments.
Power	5 VDC from USB cable or external source
Current	200 mA
Power for other devices on the Instrument bus	3.3VDC, 100 mA max
Dimensions	PC/104 form factor 3.775 X 3.550 X 0.68 inches 96 X 90 X 17 mm

**Connector List:**

J1 Instrument Bus, IDC 0.1"	
1	D0
2	D1
3	D2
4	D3
5	D4
6	D5
7	D6
8	D7
9	D8
10	D9
11	D10
12	D11
13	D12
14	D13
15	D14
16	D15
17	I_Data_Valid
18	Data_Transferred
19	I_Address_Valid
20	Digital Ground
21	Sequence_Clk
22	/Sequence_Clk
23	Digital Ground
24	Digital Ground
25	3.3V DC
26	3.3V DC

J2 Power Select	
1-2	External 5V DC Power
2-3	USB 5V DC Power

J3 Serial I/O, IDC 0.1"	
1	GND
2	GND
3	TX+
4	TX-
5	RX+
6	RX-
7	GND
8	GND
9	GND
10	GND

J4 Clock O/P, 3-pin DIN	
1	CLK -
2	CLK +
3	GND

J5 USB	
1	+5V DC
2	USB D-
3	USB D+
4	GND
5	Shield

External 9-D	
1	GND
2	TX+
3	RX+
4	GND
5	GND
6	GND
7	TX-
8	RX-
9	GND