# ADS 1200

Audio, data and contact closure multiplexers for fibre-optic links

**USER MANUAL**

## 1. General description

ADS 1200 systems offer combined full duplex transmission of data, audio and contact closure signals, all independent, over one or two multimode or single-mode optical fibres (TRA/TRB or TRX respectively, see figures 1a,b). For technical specifications please consult section 5.

Two 4-wire audio channels and two contact closure channels are available on the topmost pair of modular connectors (port 1 and port 2). The data section comprises two RS-485/RS-422 (Manchester and biphase compatible) and two RS-232 channels, on the two lower modular connectors.

Internal dip switches control the configuration (2/4 wiring and type; default is 4-wire RS-485) of the RS-4xx interfaces. If necessary, the RS-485 interfaces can be adapted to use biasing; by default, the data interfaces are transparent. By removing a jumper and output rewiring, port D1 can be used for digital current loop. Audio input impedance is jumper selectable. The contact closure outputs are potential-free and open on synchronization failure.

LEDs indicate power and local as well as remote sync status (see section 2), and also monitor data I/O.

The 7TE modules will slot into the backplanes of NKF's MC 10 or MC 11 power supply cabinets. Stand-alone models (/SA option, see supplementary manual) needs an external 12 $V_{DC}$ power supply.

## 2. Connectors and indicators

| Indication | | Meaning |
|---|---|---|
| (ST or FC connector) | | Optical input (two-fibre units) |
| (ST or FC connector) | | Optical output (two-fibre units) |
| (ST or FC connector) | | Optical input/output (single-fibre units) |
| Modular sockets: | | |
| A1/CC1 | | audio1, contact closure 1 |
| A2/CC2 | | audio2, contact closure 2 |
| D1/D2 (D1: see text) | | RS-485 (422), RS-232 |
| D3/D4 | | RS-485 (422), RS-232 |
| System status LEDs: | | |
| ***SYNC** | (red) | No sync from optical in, or no internal sync |
| | (orange) | No sync @ remote optical in |
| | (green) | All sync OK |
| ***DC** | (green) | DC power good |
| Data status LEDs: | | |
| ***D1, *D3** | red/green | RS-485 input to D1,3 = 1/0 |
| | off | high-Z |
| ***D2**, ***D4** | green/off | RS-232 input to D2,4 =1/0 |

*Table 1. Connectors and indications on the ADS 1200 front panel (the modular sockets will take RJ45 plugs)*

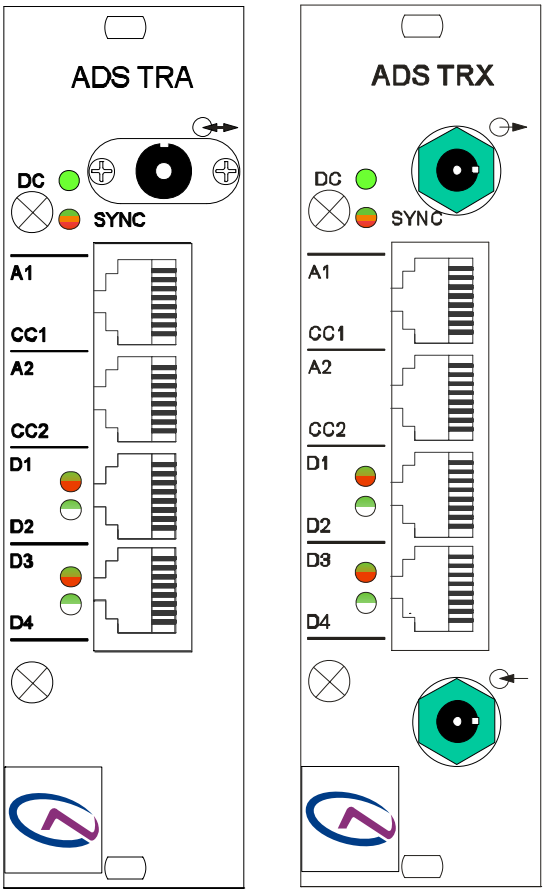



*Figure 1. ADS front panels: TRA (left, similar to TRB, one-fibre), and TRX (right, two-fibres)*

## 3. Configuration and installation

### 3a) *Configuration*

Interface selection and configuration are performed using switches and jumpers on the circuit boards of the ADS 1200 units. To access these elements, each unit must be opened by taking out the two front panel Phillips head screws indicated in figure 1 and partially sliding out the circuit board (shown in figure 2).

An ADS 1200 data board has two 8-fold (S1, S2) and one 4-fold (S3) dip switch blocks. The first switch of each block and the ON positions are also indicated in figure 2.

The jumper-pin groups A and B control audio input impedance of A1 and A2, respectively; jumper C regulates the current loop impedance of one of the RS-485 data outputs (see below).

***Data interface selection***: the 4 dip switches in bank S3 determine the RS-4xx interface type available on ports D1 and D3 as per table 2.

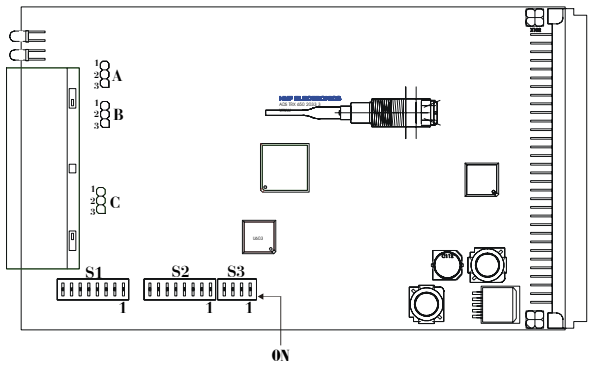


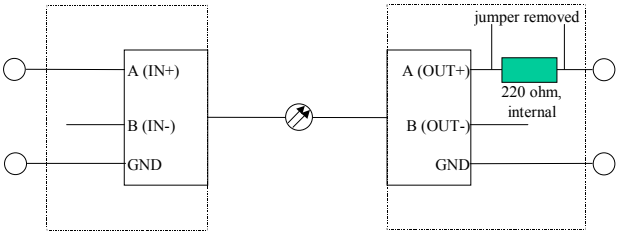

*Figure 2. ADS TRA/B printed circuit board; details left out for clarity.* ***Please take care not to damage the optical fibre floating above the board.***

| Interface type ↓ | port D1 | | port D3 | |
|---|---|---|---|---|
| | S3-1 | S3-2 | S3-3 | S3-4 |
| RS-485 2-w. | 0 | 0 | 0 | 0 |
| RS-485 4-w. | 0 | 1 | 0 | 1 |
| RS-422 | 1 | 0 | 1 | 0 |

*Table 2. Choosing RS-485 interface types using dip switch bank S3*

Two-wire RS-485 mode uses the input terminals for I/O. In older ADS/VAD units, for two-wire mode the + in and + out needed to be combined, as well as - in and - out; old and new units can be used together with the old-style cable layout.

***Current loop output:*** The RS-485 output impedance of port D1 can be made suitable for digital 20 mA current loop ('TTY') applications by pulling a 2-pin jumper (C2-3) from the board, thus inserting a resistor into the non-inverting data line. The jumper may be put on pins C1-2 to save it. *Current loop I/O should*




*use only non-inverting lines and signal ground (see figure 3); the interface type should be set to RS-485 (4-w). Input signal voltage on A-GND (IN+-GND) should be at least 4V.*

*Figure 3. Current loop connections*

***RS-485 line biasing:*** In most cases, the RS-485 data interface will work with the default settings. If however data line biasing is called for by other equipment connected to the ADS 1200, biasing impedances may need to be applied and dwell times set. With the other dip switches configured for RS-485 mode, the eightfold switch banks S1 (for interface D1) and S2 (for interface D3) on the ADS 1200 circuit boards (see figure 2) control attachment of two bias impedance resistors to both input and inverting input (see table 3 below).

| **Switch** bank S1 for D1 bank S2 for D3 | **Function (RS-485 mode set)** |
|---|---|
| 1-3 | dwell time select, see table 4 |
| 4 ON | inverting input tied to +5V over 390 Ω |
| 5 ON | inverting input tied to +5V over 10 kΩ |
| 6 ON | line termination 120 Ω (default = off) |
| 7 ON | input tied to GND over 10 kΩ |
| 8 ON | input tied to GND over 390 Ω |

*Table 3. Choosing bias resistances, dwell times and line termination for interfaces D1 and D3*

Please note that the 'soft zero' biasing adaptation method used ties the *inverting* ('negative') input to the higher voltage, while the biasing resistor of the normal input is tied to signal ground. This will provide a well-defined bus state when no driver is active.

The first three dip switches of the banks S1 and S2 on the circuit boards (see figure 3) are used to configure the tristate-sensing/dwell timing of interface D1 and D3, respectively, if biasing of RS-485 lines is used, to help indicate the conclusion of transmission (table 3). Dwell time is approximately 10*bit length or slightly longer.

| **Setting no.** | **Switch** bank S1 for D1 bank S2 for D3 | | | **Dwell time** (±7%) | **Data rate** (bit/s) |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | | |
| 0 | OFF | OFF | OFF | * | 0-max |
| 1 | OFF | OFF | ON | ** | 0-max |
| 2 | OFF | ON | OFF | 0.17 ms | ≥64000 |
| 3 | OFF | ON | ON | 0.34 ms | 38400 |
| 4 | ON | OFF | OFF | 0.67 ms | 19200 |
| 5 | ON | OFF | ON | 1.35 ms | 9600 |
| 6 | ON | ON | OFF | 2.68 ms | 4800 |
| 7 | ON | ON | ON | 5.38 ms | ≤2400 |

*) default, hardware tri-state detect (1V differential sense, **not to be used together with line-biasing**)

**) logic high in the data directly drives the output enable (I.E. no delay). This setting is especially suitable for very low data rates.

*Table 4. Dip switch settings for unbiased and biased RS-485 interfacing. Settings 1-7 all need bias resistors to define zero.*

Depending on the actual data rate, switches 1-3 of block S1 and S2 should then be set as per table 4 (*please read the notes below*). Default is all three switches off, i.e. hardware tristate sensing.

***Notes on dwell times:***

- *When in doubt about which of two dwell times to select, please use the longer of the two.*
- Settings 1-7 will only work if the lines are biased to a 'soft zero'.
- The serial receiver dwell timing circuitry (re)starts a timer on the rising edges of input data from the copper side, at the same time sending an output enable signal to the serial data transmitter on the

other side of the optical link. When the timer is allowed to run out (no more rising edges, meaning no more data), this output will get no enable signals anymore and will go into tristate, freeing up its line.
- Different dwell times may be used within the system. Mixing hardware-tristate-detect on one side and dwell-time on the other side is also feasible.
- The setting of tristate/dwell time in a unit does affect the data fed into that unit, i.e. the way data is output at the remote unit.

***RS-485 line termination:*** Line termination impedance of interfaces D1 and D3 may be set to low (120 Ω) using dip switch 6 of bank S1 and S2, respectively (see table 3). Default is high impedance.

***Audio port impedance:*** Audio input impedance in the ADS 1200 can be set by moving jumpers A (for audio interface A1) and/or B (for interface A2) on the upper circuit board (fig. 2). A jumper on pins 1-2 will select high impedance for that port (default); shorting pins 2 and 3 will lower the audio input impedance to 600 Ohms.

**3b) *Installation***

Provide the units with power and connect appropriate cabling (twisted pair for long electrical links). Through-connecting the signal ground lines is recommended. If SYNC problems occur after powering up, please check the optical link first.

## 4. Connector pin assignments

The electrical port pin assignments (see table 5) are such that similar ports of different units may be connected back to back with reversed cable (RS-232 interfaces excepted). See figure 5 for the pin numbering convention used.

| Pin | Port 1 (2) | Pin | Port 3 (4) |
|---|---|---|---|
| 1 | Audio in + | 1 | RS-485/422 in + ** |
| 2 | Audio in - | 2 | RS-485/422 in - ** |
| 3 | GND | 3 | RS-232 in |
| 4 | CC1out b | 4 | RS-232 out |
| 5 | CC1in (ref. to GND) | 5 | GND |
| 6 | CC1out a | 6 | GND |
| 7 | Audio out - | 7 | RS-485/422 out - |
| 8 | Audio out + | 8 | RS-485/422 out + |

*Table 5. Electrical port pin assignments*
*** see note Figure 5*

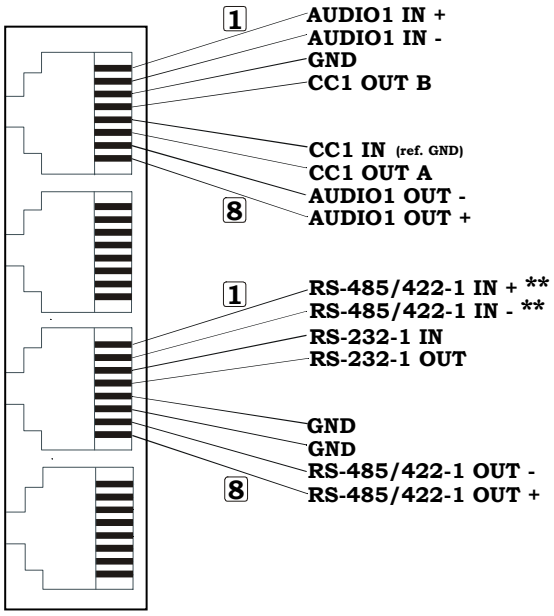



*Figure 5.*
*Socket pin assignments. The second port (A2/CC2) is similar in layout to port A1/CC1/ while the downmost port (D3/D4) is similar to the third (D1/D2).*
*Input connector pins marked ** also work as outputs in 2-wire mode (see text).*

## 5. Technical specifications

| ADS type > | 1200 TRX/ 1210 TRA-TRB | 1240 TRX/ 1250 TRA-TRB | |
|---|---|---|---|
| **Property ↓** | | | |
| **Optical** | | | |
| Wavelength(s) | 850/850-1300 | 1310/1310-1550 | nm |
| Fibre | MM (2x/1x) | SM (2x/1x) | |
| Budget, distance | 15 (19)[1)], 5 (6)[1)] | 22, 44 | dB, km |
| **Audio** | | | |
| Channels | 1 at port 1, 1 at port 2 (both full duplex) | | |
| Bandwidth | 40 to 15k | | Hz |
| I/O level | 0 (+6 max) | | dBV |
| SNR | >62dBA | | |
| THD | <1 (at nom. level) | | % |
| I/O impedance | in: 600 or >50k/out: <50 balanced | | Ω |
| **Contact closure** | | | |
| Channels | 1 at port 1, 1 at port 2 (both full duplex) | | |
| Activation at | 0.75 (<1.5 kΩ) | | V |
| Input | +5 V pull-up, 10 kΩ | | |
| Output | Normally open, fail-safe | | |
| Output switch | 2A @ 30 $V_{DC}$ | | |
| **Data (port 3; port 4)** | | | |
| Channels per port | RS-232; RS-485 [2)] (2-wire, 4-wire, RS-422 or 20 mA digital CL) | | |
| Data format | Asynchronous, serial | | |
| Data rate (per channel) | DC to 64 | | kbit/s |
| **Management** | | | |
| Front panel LEDS | see text | | |
| SNM management variables | Voltage, module temp., alarm status, configuration et al | | |
| **Environmental and Safety** | | | |
| Operating temp. | -40 to 74 | | °C |
| Humidity (max.) | <95 (no condensation) | | % |
| Electrical safety | AL / IEC / EN 60950-1 | | |
| UL recognition file | E242498 | | |
| Laser safety | IEC 60825-1, IEC 60825-2 | | |
| EMC immunity | EN 55024, EN 50130-4, EN 61000-6-2 | | |
| EMC emission | EN 55022 (Class B) FCC 47 CFR 15 (Class B) | | |
| **Powering** | | | |
| Power cons. | 4 | | W |
| Power voltages | +/-15 (rack), 12 external (SA) | | W |
| **Mechanical** | | | |
| Opt. connectors | ST (MM) [3)], FC (SM) [3)] | | |
| Data, audio, CC connectors | for RJ45 plug (4x) | | |
| Dimensions | 190x128x35 (7TE) | | mm |
| Weight (appr.) | 450 | | g |

[1)] With 62.5 µ optical fibre
[2)] Manchester/biphase compatible
[3)] On one-fibre models, other connectors may be fitted on request

*Table 6. ADS 1200 series, technical specifications*

## 6. Safety, EMC, ESD

**General**
The safety information contained in this section, and on other pages of this manual, must be observed whenever this unit is operated, serviced, or repaired. Failure to comply with any precaution, warning, or instruction noted in the manual is in violation of the standards of design, manufacture, and intended use of the unit.
Installation, adjustment, maintenance and repair of this equipment are to be performed by trained personnel aware of the hazards involved. For correct and safe use of the equipment and in order to keep the equipment in a safe condition, it is essential that both operating and servicing personnel follow standard safety procedures in addition to the safety precautions and warnings specified in this manual, and that this unit be installed in locations accessible to trained service personnel only.
Optelecom-NKF assumes no liability for the customer's failure to comply with any of these safety requirements.

**UL/IEC/EN 60950-1: General safety requirements**
**The equipment described in this manual has been designed and tested according to the UL/IEC/EN 60950-1 safety requirements.**
*If there is any doubt regarding the safety of the equipment, do not put it into operation.* This might be the case when the equipment shows physical damage or is stressed beyond tolerable limits (e.g. during storage and transportation).
*Before opening the equipment, disconnect it from all power sources.* The equipment must be powered by a SELV[*)] power supply.
When this unit is operated in extremely elevated temperature conditions, it is possible for internal and external metal surfaces to become extremely hot.

**Optical safety**
**This optical equipment contains Class 1M lasers or LEDs and has been designed and tested to meet IEC 60825-1:1993+A1+A2 and IEC 60825-2:2004 safety class 1M requirements.**
*Optical equipment presents potential hazards to testing and servicing personnel owing to high levels of optical radiation.*
When using magnifying optical instruments, avoid looking directly into the output of an operating transmitter or into the end of a fibre connected to an operating transmitter, or there will be a risk of permanent eye damage**.** Precautions should be taken to prevent exposure to optical radiation when the unit is removed from its enclosure or when the fiber is disconnected from the unit. The optical radiation is invisible to the eye.
*Use of controls or adjustments or procedures other than those specified herein may result in hazardous radiation exposure.*
The installer is responsible for ensuring that the label depicted below (background: yellow; border and text: black) is present in the restricted locations where this equipment is installed.


The locations of all optical connections are listed in the Indications and Connectors section of this manual.
Optical outputs and wavelengths are listed in the Technical Specifications section of this manual.

**EMC**

**The equipment has been tested and found to meet the CE-regulations relating to EMC, and complies with the limits for a Class B device, pursuant to Part 15 of the FCC rules.** These limits are designed to provide reasonable protection against interference to radio communications in any installation. The equipment generates, uses and can radiate radio frequency energy; improper use or special circumstances may cause interference to other equipment or a performance decrease due to interference radiated by other equipment. In such cases, the user will have to take appropriate measures to reduce such interactions between this and other equipment.

*Any interruption of the shielding inside or outside the equipment could cause the equipment to be more prone to fail EMC requirements.*

Non-video signal lines must use appropriate shielded CAT5 cabling (S-FTP), or at least an equivalent.

If system components, such as cabling (e.g. coaxial cable, data/audio/cc wiring) and/or the units, are used outdoors, ensure that ***all*** electrically connected components are carefully earthed and protected against surges (high voltage transients caused by switching or lightning).

**ESD**

**Electrostatic discharge (ESD) can damage or destroy electronic components. Proper precautions should be taken against ESD when opening the equipment.**

*) SELV: conforming to IEC 60950-1, <60$V_{DC}$ output, output voltage galvanically isolated from mains. All power supplies or power supply cabinets available from Optelecom-NKF comply with these SELV requirements.