ADAM-4541

Fiber Optic to RS-232/422/485 Converter

Introduction

Fiber optic transmission offers the benefits of wide bandwidth, immunity to EMI/RFI interference, and secure data transmission. The ADAM-4541 can be used as an RS-232/422/485 point-to-point or point-to-multipoint connection for transmitting and converting full/half-duplex signals and their equivalents within a fiber optic environment. Fiber optics are the perfect solution for applications where the transmission medium must be protected from electrical exposure, lightning, atmospheric conditions or chemical corrosion.

The ADAM-4541 is specifically designed to link various machinery equipped with RS-232/422/485 communication ports (such as computer systems or manufacturing machines) across distances in excess of 2.5 km. Using standard ST connectors, the module's fiber optic ports can accommodate a wide range of fiber optic cable sizes, including 62.5/125 ㎜.

Features

* Compact size economizes space

* Direct plug-and-play

* Easily mounted on a DIN-rail, panel or piggyback

* Transmission speeds of up to 115.2 kbps

* Multi-mode optical fibers enable transmission farther than 2.5 km

* Half/Full-duplex, bidirectional transmission mode

* Avoids lightning strikes and EMI/RFI interference

* Prevents damage from electrostatic discharge

* Stable and error-free data transmission

* Automatic internal RS-485 bus supervision

* No external flow control signals required for RS-485

* Transient suppression and over-current protection on RS-422/485 data lines

* Reserved space for termination resistors

* Power and data flow indicators for troubleshooting

* Power requirement: +10 ~ +30 V_{DC}

Specifications

* **Casing:** ABS with captive mounting hardware

* **Communication mode:** Asynchronous

* **Fiber optics:** Multimode

* **Connector:** Plug-in screw terminal

* **Fiber port:** ST

* **Transmission distance:** Over 2.5 km

* **Wavelength:** 820 nm

* **Optical power budget (attenuation):** 12.5 dB (measured with 62.5/125 ㎜ optical fiber)

* **Transmission mode:** Full/Half-duplex, bidirectional

* **Transmission rate:** Up to 115.2 kbps

* **Accessories (included):** Nylon DIN-rail mounting adapter, SECC panel mounting bracket

* **Operating temperature:** -10 ~ 70° C (14 ~ 158° F)

* **Operating humidity:** 5 ~ 95% (non-condensing)

* **Power consumption:** 1 W (typical); 1.5 W (max)

Note: Multi-mode fiber optics are designed for industrial applications. 50/125 ㎜, 62.5/125 ㎜, and 100/140 ㎜ are commonly used.

Installation

Initial Inspection

We carefully inspect the ADAM-4541 both mechanically and electrically before we ship it. It should be free of marks and scratches and in perfect condition on receipt.

As you unpack the module, check it for signs of shipping damage (damaged box, scratches, dents, and so on). If it is damaged or fails to meet our specifications, notify our service department or your local sales representative immediately. Also, call the carrier immediately and retain the shipping carton and packing material for inspection by the carrier. We will then make arrangements to repair or replace the unit.

Before you begin installation, please make sure you have the following items:

- 1 ADAM-4541 module
- 1 mounting bracket
- 1 user's manual
- 1 3P to DB 9 cable

Switch and jumper settings

Switch settings

DIP switches in the ADAM-4541 converter modules set the data format (number of bits) and baud rate for the ADAM network. You can configure the other modules in the network via software commands. Your program and the PC's serial port should match the settings of the converter and repeater modules.

SW1

Switch 1 controls the data format. Data can be 9, 10, 11 or 12 bits. The factory default is 10 bits: one start bit, eight data bits, no parity bit and one stop bit.

When using the converter in combination with other ADAM modules, do not change the default setting, because ADAM modules have a fixed data format of ten data bits. The option of changing to 9, 11 or 12 bits is for use with other modules (other than ADAM modules) that have different data formats. Should you change the ADAM module's data format, be aware that you will also have to change the data format settings on all the other modules in the network.

SW2

Switch 2 sets the baud rate. The options range from 1200 bps to 115.2 kbps. The factory default is 9600 bps. Be aware that when you change the baud rate, you also have to change the baud rate for all the connected modules accordingly. If the RS-232/422 mode is ON, the baud rate does not need to be set.

Default settings

Both modules are not addressable by the host computer. The baud rate and data format must be set using SW1 and SW2 located inside the module. The default settings are:

Default settings	
Function	**Setting**
Baud rate	9600 bps
Data format	10 bits

The following tables illustrate the switch settings for the ADAM-4541:

ADAM-4541 data format settings (SW1)		
Data Format	**1**	**2**
9 bits	O	O
*10 bits	●	O
11 bits	O	●
12 bits	●	●

O = Off   ● = On   * = Default

ADAM-4541 baud rate settings (SW2)									
Baud Rate	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1200 bps	●	O	O	O	O	O	O	O	O
2400 bps	O	●	O	O	O	O	O	O	O
4800 bps	O	O	●	O	O	O	O	O	O
*9600 bps	O	O	O	●	O	O	O	O	O
19.2 kbps	O	O	O	O	●	O	O	O	O
38.4 kbps	O	O	O	O	O	●	O	O	O
57.6 kbps	O	O	O	O	O	O	●	O	O
115.2 kbps	O	O	O	O	O	O	O	●	O
RS-232/422	O	O	O	O	O	O	O	O	●

O = Off   ● = On   * = Default

Block Diagram

ADAM-5000/485
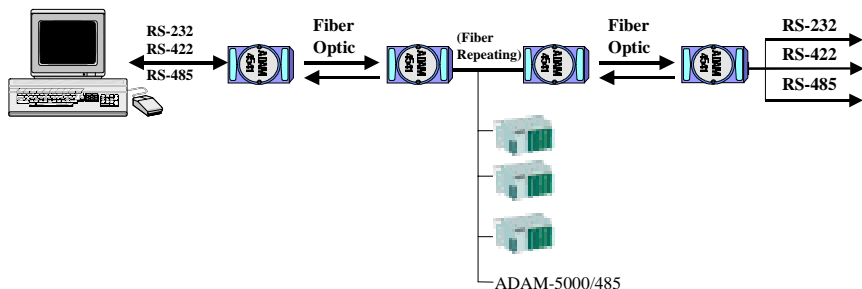
Example Program

This program can be used as a diagnostic test for the ADAM-4541. It will transmit a string to COM1 and then receive a string from COM1 (a loop-back test).

Program: LOOPBACK.C

```c
#include <dos.h>
#include <io.h>
#include <stdio.h>
#include <conio.h>
#define TIME_OUT        4000
static int base0=0x3f8;
static int base1=0x2f8;
static char rec[160];
static char cmd[160];
void main ()
{
    int i,timeout;
    char rflag,tflag;
    bioscom(0,0xE3,0);  /* Set COM1 as follows: Baud Rate = 9600, Data Bits = 8,*/
    printf("\nInput string : ");          /*  Parity = none,    Stop Bits = 1  */
    gets(cmd);
    while (cmd[0] != 'q' && cmd[0] != 'Q')
    {
        cmd[strlen(cmd)] = 0x0d;
        i=0;
        tflag=1;
        while (tflag)
        {                           /* Send data */
            outportb (base0,cmd[i];
            while ((inportb(base0+5) & 32) !=32);

            rflag=1;
            timeout=TIME_OUT;
            while (rflag)
            {                           /* Check received data */
                if ((inportb(base0+5) & 1) !=0)
                {   /*Receive data */
                    rec[i]=inportb(base0);
                    if (rec[i] == 0x0d)
                    {
                        rec[i+1]='\0';
                        printf("\nReceived data : %s\n,rec);
                        tflag==0;
                    }
                    rflag=0;
                }
                else
                {                           /* Check timeout */
                    timeout--;
                    if (timeout == 0)
                    {
                        printf("Timeout error");
                        rec[i+1]='\0';
                        rflag=0;
                        tflag=0;
                    }
                }
            }
            i++;
        }
        printf("\nInput command : ");
        gets(cmd);
    }
}
```

Signal Wiring

When you run the example program, you must connect the ADAM-4541's terminals as follows:
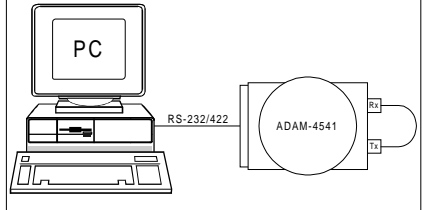
Troubleshooting

Possible reasons for malfunction

➢ The TX and RX connections are reversed.

  Solution: Make sure the fiber connection is made so that the TX of one end is connected to the RX of the other.

➢ Poor connection between the ADAM-4541 and the communication port.

  Solution: Make sure the ADAM-4541 is securely plugged into the communication port.

➢ Attenuation on the fiber causes the signal level to drop below the accepted level.

  Solution: Reduce the attenuation by reducing connector loss, transmission distances, etc.

➢ The connection between the communication ports is neither DTE to DTE nor DCE to DCE, but is a DTE to DCE connection.

  Solution: Add a converter to one of the optical modems, so that the pin assignments from the communication port to the modem are from pin 2 to pin 3 and from pin 3 to pin 2.

➢ The fiber has been damaged.

  Solution: Repair or replace the fiber.

➢ The ADAM-4541 has been damaged.

  Solution: Use the supplied software to perform a loop-back test of the optical modem to determine whether it has really been damaged.

Power Supply

For the ease of use in industrial environments, the ADAM modules are designed to accept industry standard +24 V_{DC} unregulated power. Operation is guaranteed when using any power supply between +10 and +30 V_{DC}. Power ripples must be limited to 5 V peak to peak, while the voltage in all cases must be maintained between +10 and +30 V_{DC}. All power supply specifications are referenced at the module connector.

The power cables should be selected according to the number of modules connected and the length of the power lines. When using a network with long cables, we advise the use of thicker wire, to limit line voltage drop. In addition to serious voltage drops, long voltage lines can also cause interference with communication wires.
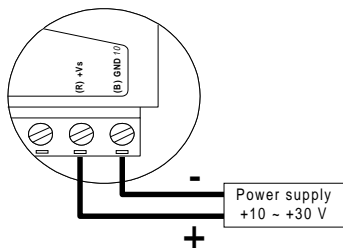
We advise that the following standard colors (as indicated on the modules) be used for power lines:

+Vs   ➔   (R) Red
GND   ➔   (B) Black

Front View

SW2	BAUD RATE
1	1200
2	2400
3	4800
4	9600
5	19200
6	38400
7	57600
8	115200
9	RS-232/422 mode