User's Manual LBA-AD-Converter

LBA-ADC500-1

Version 1.0

AD-Converter LBA-ADC500 1

Unpacking

The scope of supply consists

☐ 1 Program CD
☐ 1 LBA-AD-Converter, Type : LBA-ADC500-1
☐ 1 USB 1.1 interconnecting cable
☐ 1 User's Manual
☐ 1 Benutzerhandbuch
☐ 1 Power Adapter (10 W) : Input : AC 100 .. 230 V, 50/60 Hz, Output : 9V DC

Technical Data

Power Supply : 9V (600mA) DC Power Adapter
Reverse polarity protection
Plug jack - 5.5mm outer / 2.5mm inner diameter
Current Consumption : approx. 500 mA
Power Consumption : < 5 W
PC Port : USB 1.1
X-/ Y-Sampling Rate : 500,000 Samples / s
X-/ Y-FIFO Size : 4 k bytes per channel
LED Indicator : The red LED indicator will flash each time data is being received
Test Duration : 2 µs x 4096 = 8.192 ms
X-/ Y Gain Settings : Programmable gain range : 2 .. 512
X-/ Y-Input Voltage Range : 0 .. +2,5 V (= linear area)
X-/ Y-Input Resistance : 2 kΩ, +/-5%
O-SYNC Input : Isolated optocoupler
In row: 150 Ω with optocoupler diode
IFH: 7 .. 20 mA, IFL: 0 .. 250 µA
Test Period : ~ 0.1 s / Scan
Dimensions : 106 mm (W) x 35 mm (H) x 230 mm (L)
Weight : 0.51 kg (without cables and power supply)
Operating Temperature : 0° to 40°C
Storage Temperature : -20° to 70°C
All specifications subject to change without notice

System Requirements

The LDS system is only with PC /Notebook computers with USB interface usable. The software supplied with this product can be used with every version of the Windows operating system that supports USB (Windows 98, Windows ME, Windows 2000, Windows XP).Windows 95 and Windows NT4.0 do not support USB, so the USB 1.1 device can not be used with such systems. The LBA-ADC500-1 device can be connected to USB 1.1 or USB 2.0 hosts and supports the full bitrate of 12 MBit/s. It is not powered by the bus, so an external power supply is needed. The free hard disk capacity should be greater then 10 MByte.

Abbreviations
LBA = **L**aser **B**eam **A**nalyzer
LDS = **L**aser **D**iagnosis **S**ystem
SM = Stepper **M**otor
USB = Universal **S**erial **B**us
2D = **2**-**d**imensional
3D = **3**-**d**imensional

Task
☐ Starting the measurement by LDS software and O-SYNC signal
☐ Buffering and adjusting the analogue x and y signals from LBA
☐ Digitizing the LBA's x and y signals
☐ Storing the digitized x and y data in a FIFO memory
☐ Reading the data saved in the FIFO to the LDS program via the USB interface
☐ Controlling of the sledge stepper motor via the USB interface (2/3 D measurements only).

Hardware Description
Figure. 1
Schematic diagram of the LBA-ADC500 1
The two analogous input signals X and Y will be buffered and inverted. The following stage amplify the signals with factor 2 .. 512. The amplification is controlled by a programmable resistance network in the feedback circuit. The trigger signal O-SYNC starts the conversion of the two ADCs. The ADC result will then be placed in the following FIFOs. If the FIFO's are full, the measuring process is finished. The FIFO memory can then be read. The control of the ADCs is carried out via 8 bit registers which can be read or set via the USB interface.
For test and adjusting purposes the analogous inputs can be connected by plug links with ground (offset adjustment) or with an internal analogous pulse signal. The triggering signal can also derived internally by plug connection.

Introduction
CO2- and YAG-High-power-Lasers are increasingly making their way in all fields of material processing. This development is due not only to the laser's reliability, (in particular the resonator), but also because of cheaper handling systems. Only a few years ago the laser was a tool for certain specialists, today it is to be found as a stand alone tool in mass production.
Although technical progress has made the laser into a reliable tool you must not treat it as a Black Box. The quality of the raw beam influences the focusing potential of the laser beam, in combination with the optical line components e.g. mirror and lens units. Also, the intensity distribution at the focus is a very important parameter for laser material processing.
Due to the great number of parameters which could influence beam quality a control system is important. The beam quality and beam position can be automatically controlled by a beam diagnosis system. System designers can also get important information about the laser beam's quality. As a result this yields important data for further system development.
The development of our diagnosis system depends upon the control of beam parameters. The method of measurement will be described in the following paragraphs.

Test Principle

A thin, very reflective needle rotates vertically to the laser beam driven by a synchronous motor. If the needle passes through the beam, then a fraction of the radiation power is scattered into two detectors. These are positioned so that a measuring of the intensity distribution is carried out in x and y direction at the same time. These signals (X and Y) are passed to the ***LBA-ADC500 1*** to the further work. Since the needle moves with constant speed across the beam, the intensity profile is taken undistorted.
The triggering signal (0-SYNC) is attached to the AD Converter by a LBA photo detector at the swing plate.

Test Environment

Figure 2

Principle Test Environment

Note:

During *X-/Y-Display* or *Beam Surveillance* the SM controller and the measuring sledge are not necessarily installed.

Connecting the ADC500-1

Install the LBA in the laser beam path (refer to the LBA user's manual). If you want a 2D or 3D presentation the LBA must be mounted on a stepper motor sledge on the top of the acrylic plate. If you have got a LBA 3/A it will be necessary to temporarily remove its side plates. After screws have been mounted don't forget to place the side plates back and close the LBA carefully to avoid any insurance of the user or any damages in the LBA.
Connect the X and Y output of the LBA to the suitable BNC socket of the LBA-ADC500-

1. Note :

X- and y-channels must not be changed – otherwise you get a distorted picture !
Connect the O-SYNC of LBA to the O-SYNC of the LBA-ADC500-1
Only for 2D and 3D representations :
The hardware installation is now finished.

Installing LDS Software

Program Installation

To install LDS on Windows ME/98/2000/XP systems, simply insert the CD. This should automatically start the setup program. If the setup program doesn't start automatically, execute the *setup.exe* program located in the root directory of the CD. After some further questions the actual installation starts.

USB Driver Installation

As USB devices are hot pluggable is not necessary to turn off the PC when plugging in or removing a LBA-ADC500-1 device. Just plug in the device when the PC is switched on and Windows is running. When you plug in the LBA-ADC500-1 device for the first time you will be prompted for suitable device driver after a few seconds. You have to be logged in as administrator to be able to install device drivers on Windows 2000 or Windows XP. Select 'ezusb2k.inf' in the '<LDS path>\Driver\WIN_98_ME' or '<LDS path>\Driver\WIN_2000_XP' directory. The device driver will then be installed. Now the LBA-ADC500-1 device can be used.

Program Path Structure
The setup program produces the subdirectories at the installation under the LDS program path.
☐ Handbuch : Path for the German manual
☐ Manual : Path for the English manual
☐ Bitmaps : Filing for bitmap files
☐ REFERENCES : Reference-/ 1 D file path
☐ Data : 2/3 D data file path
☐ Driver\WIN_98_ME : USB driver path for Windows 98/ME
☐ Driver\WIN_2000_XP : USB driver path for Windows 2000 and XP.

Program Description

General Functions

Language Selection

Figure 3
Language Selection Dialog
After the first program call the desired language can be chosen (see Dialog Figure. 3).
After removing the language dialog you can redisplay the language selection by activating the main menu item ***Option*** ☐ ***Language Selection***.

General Symbol Buttons
Help Button: Help is called context related
Function key: ***F1***
Ok Button: adjusted parameters are stored
Function key: ***Ctrl O***
Demo Button: Dialog is left without storage
Function key: ***Esc***
Save Button: Test result is stored
Function key: ***Ctrl S***
Printer Button: Graphic of the test result is printed
Function key: ***Ctrl-P***

User Interface

Figure.4
The User Interface of LDS

The Title Bar
The title bar which lists the name of the software and whose version is positioned in the upper area of the LDS main window.

The Menu Bar

The Menu File
File
☐ *Open / Print File*
☐ *Reference File*
☐ *Bitmap File*
☐ *2/3D-File*
☐ *Exit*
The menu file includes entries to show, print or edit LDS files. In addition, you can exit the LDS program.

The Menu Measurement
Measurement
☐ *X-/ Y-Display*
☐ *Beam Surveillance*
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☐ *2 D-Representation*
☐ *3D-Representation*

The Menu Settings
Settings
☐ *Beam Parameter*
☐ *LBA Type*
The Menu Options
Options
☐ *Language Selection*
☐ *Horizontal Toolbar*
☐ *Vertical Toolbar -> right*
☐ *Vertical Toolbar -> left*
☐ *Demo Mode*
The Menu Help
Help
☐ *LDS Help*
☐ *About*
The description of the individual program functions is carried out in the next sections.
Tool Bar
The meaning of the symbols from left to right
☐ Toggling Demo-Mode <-> Real-Mode
☐ X-/Y-Display
☐ Beam Surveillance
☐ 2D-Representation
☐ 3D-Representation
☐ Help System
The position of the tool bar can be moved to the right or left side of the main window.
See main menu items
Options
☐ ..
☐ *Horizontal Tool Bar*
☐ *Vertical Toolbar -> right*
☐ *Vertical Toolbar -> left*
☐ ..
Status Bar
Serve for the representation of used program settings, LBA and beam parameters.
Demo Mode
The simulation of all test functions makes it possible for the ***Demo Mode*** without attached LBA, inclusive of measuring sledge. The simulated X/Y signals in the dialog ***Beam Parameter*** (see below) can be pre-set in their form and variation. The stepper motor functions also are simulated.
Demo-/ Real Mode Toggle
Two variants are possible
1. With this button symbol you can change between *Real Mode* and *Demo Mode*.
2. Toggle about main menu bar item ***Options -> Demo Mode***
The operating state ***Demo Mode/ Real Mode*** is shown on the status bar.
Help System
The context-dependent help system can be called with the function key ***F1*** or by the help symbol button.
LDS Information
Figure. 5
LDS Information report
The hardware details listed above are read out from an EEPROM of the AD Converter.
These parameters aren't available in *Demo-Mode*.

Call Path:
Main menu bar items **: *Help*☐ *Info***
Adjustment Functions
LBA Settings
Figure. 6
The LBA Settings Dialog
Call Path:
Main menu bar items : *Settings* ☐*LBA Type*
The used LBA Type and the mains frequency can be selected here.
In addition, the sledge feed per stepper motor step is fixed necessarily for 2/3 D measurements. This is dependent on the spindle feed, gear ratio and the stepper motor resolution (steps / revolution). The adjusted values of LBA type and line frequency are shown on the status bar of the main screen. These details are necessary to adjust the different LBA types and different needle speeds in the LDS program.
Caution!
A wrong LBA type can lead to the destruction of the LBA.
Beam Parameter Settings
Figure. 7
Dialog Beam Parameter
Call Path :
Main menu bar items : ***Settings*** ☐ ***Beam Parameter***
These inputs are used for the representation of the beam parameters. The following parameter groups can be adapted to the desired requirements.
Demo-Mode
The group contains the form and variance of the X-/ Y signals in the ***Demo Mode.***
Dependent Parameters
Dependent parameters are parameters which are valid only for a certain LBA types. At a change of the LBA gain adjustment these values must be defined newly. The parameters *Noise Limit* and *Power Factor* are part of this group. The power factor specification is necessary since an absolute power measurement isn't possible with LDS.
2 D- / 3D-Color Table
The color table serves the color representation of the laser beam profile. The color values result from the respective amplitude value. The distribution of the color map areas can chosen ***Linear*** (equally areas of colors) or ***Quadratic*** (bigger areas at higher amplitude values). The color table only refers to signal amplitudes which are greater then the noise limit.

Filter
The neighbour values are added to every sample and generated from that the average value. The predefined number indicates the bandwidth of the average values. This way this becomes the measuring signal, filtered more or less depending on filter setting. A high value means a greater filter efficiency.
Diameter at
The multiple alternative makes possible the information of the height at which one the diameter calculation is supposed to occur.
2 D- / 3D-Resolution
The number of measurements per beam profile can be provided here. You pay attention, that the more highly the resolution is chosen, extended also the measurement duration.
Test Functions
1 D Display
Figure 8
Overlaid X/Y signal representation

Figure 9
X and Y signal representation during ***Duplex*** display mode
Call Paths :
1. Main menu bar items **: *Measurement* ☐ *X- / Y Representation***
2. 1D Symbol button
Task :
The test function makes the representation of the two Y LBA signals possible in different windows (***Single / Duplex***). As a signal source LBA and a file can be chosen between with signal courses recorded before.
Pre Settings:
Average : (only in Real Mode adjustable)
The advertisement and assessment is carried out only to Average of the predefined number of measuring.
X-Axis:
With this choice you fix the scale of the x-axis. The area extends from 1 mm / Div to 10 mm / Div. It can be reduced at certain LBA types.
Gain (only in ***Real Mode*** possible)***:***
You can choose between an automatic and manual setting. The input area at a manual selection is between 512/255 and 512/1.
Repositioning
At activation the display is orientated to every measuring centrically. Unlike this (at deactivation) the orientation is determined only once at the start. So a temporal drift can be made visible during a longer time period.

Source
Before you run the test you choose here from where you want to get the dates.
Channel (only at ***Single*** display mode selectable)
Switchover of the signal representation
1. X Representation
2. Y Representation
3. X+Y Representation
In addition during the X+Y representation the Y signal can be positioned vertically with a slide control. (***Y-Shift***)
Starting / Stopping Test
Operate the ***Start / Stop*** button. During the test the ***Start / Stop*** button frame is coloured and the test results represented by diameter, drift, peaks and power will be displayed cyclically. It is possible within the test duration to store the test result as a Ref file. This file can be used as a reference at the ***Beam Surveillance*** later or permits further representation of the signal forms (see *Source*).
Printing Graphics
Click on the printer symbol button. Depending on a way of the representation further choice of the menus is also necessary.
Beam Surveillance
Figure 12
Laser Beam Surveillance
Call Paths:
1. Main menu bar items : ***Measurement*** ☐ ***Beam Surveillance***
2. *Beam Surveillance* symbol button
Task
Control of the laser beam profile over a longer time period.

Monitored Beam Parameters
The following parameters are monitored:
☐ X Drift
☐ Y-Drift
☐ X-Maximum
☐ Y-Maximum
☐ X Diameter
☐ Y Diameter
☐ Beam Power
Every single parameter can be activated or deactivated.
Beam Parameter Tolerances
After generation of the reference file the tolerance values are proved with default values. Adjust these to tolerances to your needs. You can save the tolerance specifications automatically by clicking the Ok button.
Reference File List
Select the desired reference file. Without choice no monitoring is possible.
Alarm
If the Alarm button is marked and a transgression of the tolerance limits is performed an acoustic peep tone is generated at the PC / Notebook. The operating system should not prevent the acoustic output.

Starting / Stopping Monitoring
The monitoring is started (button border is colored) or interrupted with the button ***Start/Stop***. At tolerance transgression the difference values are deposited red.
2 D and 3D Representation
The data of 2D measurement can be displayed either in flat view or in a quasi 3-dimensional view representing the beam intensity like a mountain where the highest intensity is represented by the highest point of the display. With 3D view modus you get a picture like a modeburn in a polyacryl plate.
Precondition
2D-/3D Measurements can be carried out only with measuring sledges and corresponding stepper motor control unit.
Caution !
Before the test beginning the laser beam must absolutely centrically be adjusted in the LBA opening. There otherwise is the danger of a destruction of the LBA.
2 D Representation
Figure 10
2D Representation
Call Paths:
1. Main menu bar items : ***Measurement ☐ 2D Representation***
2. 2D-symbol button
Distance Measurement
By pushing the left mouse button and simultaneous dragging over the 2D graphic it is possible to measure the distance between start and end-point. The length value appears on left bottom corner in the graphic window in the format L= x.xx .
3D Representation
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3D Representation
Call Paths:
1. Main menu bar items : ***Measurement☐ 3D-Representation***
2. 3D symbol button

Pre Settings

Rotation :

Possibility to rotate the laser beam profile graphic in 90° steps.

Average *:* (only in ***Real Mode*** adjustable)

Every result scan is formed from the mean average values of the predefined number of scans. The signal to noise ratio can be improved with that.

Y/Y-Axis:

With this choice you fix the scale of the x and y-axis. The area extends from 1 mm/Div to 5 mm/Div. It can be reduced at certain LBA types.

Gain : (only in ***Real Mode*** possible)

The gain input area covers the range between 512/255 and 512/1.

Source :

Before you run the test you choose here from where you want to get your data.

Displays

Color Partition

Fig. 12

Show the color partition in the signal amplitude range from 0 (min) to 255 (Max). The partition of the color sectors results from the ***2/3 D Color Table*** settings in the ***Beam Parameter*** dialog. The lowest color section is the area which one below the noise limit is placed The example shows the color map distribution with the ***Beam Parameter*** settings ***Linear*** and ***Varicolored***.

Sledge Position

Figure 13

The pointer indicates the position of the sledge related to the beam middle. A manual slide movement is achieved by clicking on one of the two arrow symbol buttons on the right edge.

X- / Y Channel

The X-/ Y waveforms are displayed after every scanning.

LBA- and Beam Parameter

Push the left mouse button over the graphic window. The following information window appears.

Figure 14

Used LBA- and Beam Parameters

Starting / Stopping 2D-/ 3D Representation

Caution!

Before you start the test the measuring sledge must be placed so that the laser beam is led by the LBA opening **centrically**.

With the help of the button ***Start / Stop*** trigger the measuring process or stop it if it was already activated. After the start the laser beam profiles are scanned and shown cyclically. At stop having been carried out the last laser beam profile scanning still is brought to an end.

Printing 2D-/ 3D Graphic

After a completed measuring process you click on the printer symbol button.

Saving 2D-/ 3D Graphic

Click on the save button symbol and then enter the desired file name without extension. This file (extension : .dat) can be displayed again after selecting ***Source*** ☐ ***File***.

Safety Precautions
AD Converter has to be protected from external voltages. Voltages > 10 V, can lead to the destruction of the device and prevent the rights to claim under guarantee. The LBA AD Converter works itself with small voltages of +5 V and + 12 V. Endangering the operator is excluded.

Maintenance
A maintenance of the LBA AD-Converter isn't necessary.

Hardware Guarantee Conditions
The Europe-wide Lausberg Products guarantee covers the costs for spare parts and labour costs for Manufacturer in Munich products.
The guarantee doesn't extend on failures of products which weren't sold by Lausberg Products. In addition, damages due to a wrong or improper handling, transit damages, damages by falling down or errors caused by repair staff which is inexperienced or not authorized, are also excluded.
The prevailing regulations of the Lausberg Products guarantee leave the legal guarantee of the individual European countries untouched.
The services mentioned above are only applied in the countries of the European Union.

Guarantee Period
The guarantee period is 12 months as of purchase date.

Procedure at Failure of the AD Converter
Making a error description, Enclosing invoice absolutely, Making contact to Lausberg Products Sending the faulty AD-Converter together with the corresponding accompanying documents to Lausberg Products freely.