Contents

List of Figures

List of Tables

Important User Information

Note on Hardware Manual:

This manual is intended for customers who have purchased a Scintec Boundary Layer Scintillometer BLS and/or the BLSDMI Option. A careful reading of this manual is substantial for a proper use and safe operation of the BLS.

Warranty and Liability:

Scintec guarantees that the product has been thoroughly tested. The warranty included in the conditions of delivery is valid only if the Boundary Layer Scintillometer, and where applicable the BLSDMI Option, has been installed and used according to the instructions supplied by Scintec.

Scintec shall in no event be liable for incidental or consequential damages resulting from the incorrect and faulty use of the product. Note that user made modifications might affect the validity of the CE declaration.

Scintec reserves the right to make modifications to the design and technical specifications of products without prior notice.

1 INTRODUCTION

1.1 FEATURES

The BLS series are sophisticated scintillometer systems for the evaluation of atmospheric scintillation caused by refractive index fluctuations . Large apertures of the transmitter and receiver eliminate saturation and inner scale effects. The instruments have the following features:

- Transmitter with large emission angle
- Homogeneous emission due to a large number of radiation sources
- Pulsed transmission with selectable repetition rate
- Modulated radiation for elimination of background
- Extremely sensitive, shot noise limited detector unit
- Insensitive to transmitter vibrations due to the large emission angle
- Interference filter for use in direct sunlight
- Path length user defined
- Virtually no transmitter alignment necessary
- Rapid installation and alignment of receiver with positioning device
- SUDF data format for graphical data display in real time and from file
- Comprehensive error identification and correction
- Calculation of structure function constant C_n^2 of refractive index fluctuations
- Calculation of structure function constant C_T^2 of temperature fluctuations
- Calculation of Fried diameter r_o
- Calculation of turbulent surface heat flux H_0 under conditions of free convection
- Calculation of crosswind speed u
- Rugged weather-resistant design
- Eye-safe emission

1.2 DESCRIPTION

The BLS450, BLS900 and BLS2000 consist of an optical transmitter, an optical receiver with positioning device, a signal processing unit (SPU) and a data evaluation software (BLSRUN) for a Microsoft Windows® based operating system. The SPU/DL-version of the signal processing unit comes with an integrated data logger.

The BLS900 transmitter emits radiation through 924 light emitting diodes (LED) on two disks. The BLS450 transmitter uses one radiating disk only. The BLS2000 transmitter uses two disks, each equipped with 912 LEDs. The LEDs can be operated in 4 different pulse repetition rates from 1Hz to 125 Hz. A pulse rate of 125 Hz provides maximum accuracy and transverse wind speed measurement capability, whereas a pulse rate of 1 Hz results in a very low power consumption. The two-disk configuration of the BLS900 and BLS2000 allows for a correction of absorption fluctuations which is performed in the BLSRun software and increases the accuracy of the measurement. The two-disk configuration also provides crosswind measurement capability.

In the receivers of the BLS450, BLS900 and BLS2000, radiation is collimated by a lense onto 2 photodiodes. The lense is of convex glass type for the BLS450 and BLS900. In order to minimize spherical aberration, the BLS2000 holds a Fresnel lens. One photodiode is used for sensing the

[1] Patent DE 19751144

turbulence-induced fluctuations, the auxiliary detector is used as an alignment aid. For alignment purposes the receiver is mounted on a 3 axis-positioning device and comes with a mounted telescope. The receiver electronics pre-amplifies and filters the signals. Transmitter and receiver can easily be mounted on standard tripods with 5/8-inch threads.

The SPU houses two plugged-in cards: A signal processing card that filters, demodulates and digitises the received signals, and a microprocessor card for evaluating and storing the converted data. Additionally, the microprocessor handles the communication to a PC via a serial interface. The SPU/DL version is additionally equipped with non-volatile flash memory for storing up to approx. 700 days of measurement data.

The BLSRUN software reads the measured data either in real-time, from volatile SPU memory or from the non-volatile SPU/DL storage. All data are displayed in tabular form and can be stored in the SUDF format for graphical display with ScintecView.

2 QUICK REFERENCE GUIDE

The following steps are required to perform a measurement with the BLS900 / BLS2000:

1. Select path and site (Section)
2. Install the instruments (Section)
3. Install the software BLSRUN (Section)
4. Select the device type and set all parameters in the Settings menu (Section).
5. Align the instruments (Sections and)
6. Determine the background signal (Section)
7. Start the measurement (Section)

The signalling of the Position Indicator LED at the SPU is as follows:

A) Continuous illumination with short interrupts (~80% duty cycle): Receiver is correctly aligned.

B) Short blinks with long interrupts (~20% duty cycle): Receiver is not correctly aligned.

C) Blinks with interrupts of the same duration (~50% duty cycle): Battery voltage is low.

Notes:

1. The Position Indicator is active in the Measurement Mode only. The Position Indicator will begin signalling approx. 2 minutes after the measurement is started.

2. In order to allow the Position Indicator to operate, the system has to be aligned correctly in the Alignment Mode before switching to the Measurement Mode.

3 HARDWARE PREPARATIONS

3.1 SELECTION OF PATH AND SITE

The propagation path length is defined as the distance between the glass window of the transmitter and the lens of the receiver ( )

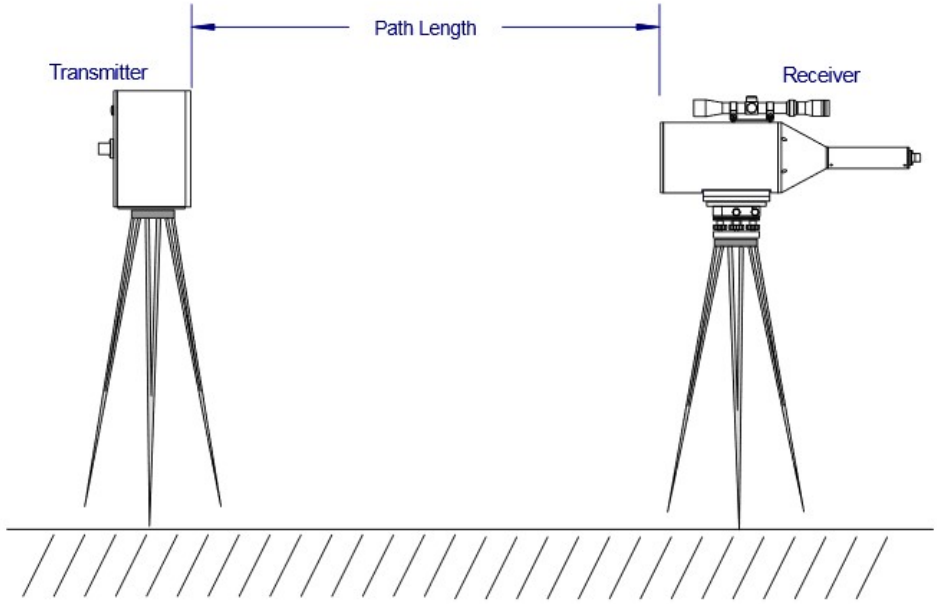

Figure 1: Illustration of path length definition

Operation of the BLS450 and BLS900 is possible over paths in the range 500 to 5000 m. The BLS2000 can be used from 1000m to 12000m.

After having chosen path and site

- the path length and height must be entered in the *Settings* menu of the BLSRUN software
- the amplifier dip switch in the receiver unit must be set.

3.1.1 PROPAGATION PATH

The ground along the propagation path should be as even as possible. A well defined measurement height is required for application of the free convection scaling for calculation of the turbulent sensible heat flux. Note that also the primarily measured quantities C_n^2, i.e. the structure function constant of refractive index fluctuations strongly depend on height.

A correction for slant paths is included in the BLSRUN software.

3.1.2 PATH HEIGHT

The path height is defined as the height of the straight line connecting the transmitter and the receiver above ground. In case of a slant path the height of the transmitter and the receiver must be specified. If the surface is not totally flat, use the average height with an increased weight at the