



***Black Box
LWU200-E-US
Users' Manual 2.0***

Safety of the Black Box LWU product

The **Black Box LWU** is classified as Class 3B laser product. The **Black Box LWU** System has been tested and found to comply with the EN 60825-1:1994+A11:96+A2:2001 (laser safety), EN 60950-1:2001 (electrical safety), EN 55022:1998+A1:200+A2:2003 Class 3B (emission) and EN 55024:1998+A1:2001+A2:2003 and EN 61000-6-2:2001 (immunity) European standards.

The laser radiation is emitted from the transmitter optics through the glass window in the front side of the laser head under less than 10 mrad divergences. No other aperture through which laser radiation can occur present in the laser head.

Warning!

Invisible laser radiation! Looking directly into the laser beam can cause permanent damage to the eye! Safe looking distance varies with beam power and divergence. See attached data sheet for exact figures.

The **Black Box LWU** product should be installed in such a way that nobody can access the optical window or can get in the way of the laser beam accidentally. For detailed instructions please read chapter 5.3.5 Eye Safety on page 20.

The **Black Box LWU** product provided with all the necessary labels specified by the standards. Moreover informative labels should be put on clearly visible places where the laser beam can be accessed. The locations of the warning labels are shown on page 20 of the manual (Chapter 5.3.5/Eye Safety).

The Outdoor Interconnection Unit is assembled with a certified power cord, which must be connected to the mains through a power outlet to make the disconnection possible at any time. Any modification to the above installation is prohibited. If modifications are required by the local standard, please contact the manufacturer. To ensure the compliance with the EN 60950 safety requirements, the system should be installed only by the manufacturer or its certified partners.

Warning!

Operating the Black Box LWU product other than described in this manual can cause undesired laser radiation and can be dangerous to the eye or electrical shock!

Black Box

Elektrische Sicherheit des Black Box LWU Produkts**D**

Das **Black Box LWU** ist eine Klasse 3B Lasereinrichtung.

Das **Black Box LWU** Produkt wurde geprüft und entspricht den Anforderungen der Europäischen Standards EN 60825-1:1994+A11:96+A2:2001 (Lasereinrichtungen), EN 60950-1:2001 (Elektrische Sicherheit), EN 55022:1998+A1:200+A2:2003 Klasse 3B (EMV, Störaussendung) und EN 55024:1998+A1:2001+A2:2003 sowie EN 61000-6-2:2001 (EMV, Störfestigkeit)

Der Laserstrahl wird von der Sendeoptik durch die Glasscheibe an der Frontseite des Laserkopf mit einer Divergenz von weniger als 10mrad abgestrahlt. Es sind keine weiteren Blenden vorhanden durch die Laserstrahlen auftreten können.

Warnung!

Unsichtbare Laserstrahlen! Nicht direkt in den Laserstrahl schauen, da dies die Augen permanent schädigen kann. Der Sicherheitsabstand variiert mit der Laserleistung und Divergenz des Laserstrahl. Details hierzu sind im Datenblatt nachzulesen.

Das **Black Box LWU** Produkt muß so installiert werden, daß niemand Zutritt zu der Optik des Laserkopf hat oder zufällig in den Bereich des Laserstrahl kommen kann. Kapitel 5.3.5 auf Seite 20 des Handbuchs enthält ausführliche Anweisungen zum Schutz der Augen.

Das **Black Box LWU** Produkt ist mit allen notwendigen Warnhinweisen versehen die durch die Standards vorgegeben werden. Weitergehende Hinweise sollten an gut sichtbaren Stellen angebracht werden wo man sich dem Laserkopf gefahrlos nähern kann. Die Positionen der Warnhinweise sind auf Seite 20 des Handbuchs dargestellt (Kapitel 5.3.5, Schutz der Augen)

Die „Outdoor Interconnection Unit“, die mit einem zertifizierten Netzkabel ausgeliefert wird, muß mit der Stromversorgung verbunden werden, indem der Netzstecker in eine geeignete Netzsteckdose gesteckt wird, womit die Lasereinrichtung auch jederzeit wieder vom Netz getrennt werden kann. Jegliche Modifikationen an der Installation sind verboten.

Falls aufgrund nationaler Vorschriften dennoch Änderungen an der Installation vorgenommen werden müssen, ist vorher der Hersteller zu befragen.

Um die Konformität bezüglich der Elektrischen Sicherheit nach EN60950 sicherzustellen, sollte das System nur vom Hersteller oder seinen zertifizierten Partnern installiert werden.

Warnung !

Die Inbetriebnahme oder der Betrieb des Black Box LWU Produkts, abweichend von den Vorgaben dieses Handbuchs, kann unerwünschte Laserstrahlung verursachen und gefährlich für die Augen werden oder einen elektrischen Schock verursachen.

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Sécurité de produit Black Box LWU

Le produit **Black Box LWU** est classifié dans la catégorie laser 3B.

Le système de Laserbit a été testé et correspond aux normes européennes:
EN 60825-1:1994+A11:96+A2:2001 (sécurité du laser),
EN 60950-1:2001 (sécurité électrique),
EN 55022:1998+A1:200+A2:2003 Classe 3B (émission),
EN 55024:1998+A1:2001+A2:2003 et EN 61000-6-2:2001 (immunité).

La radiation laser est émise à partir de l'émetteur optique à travers une fenêtre en verre placée à la tête du laser et a une divergence de moins de 10 mrad. Aucune autre ouverture dans la tête ne peut laisser passer de radiation laser.

Attention!

La radiation laser est invisible! Interdiction de regarder le rayon laser! Risques graves de lésions pour les yeux! La distance de sécurité pour la vue est variable et dépend de la puissance du rayon et de sa divergence! Consulter la feuille de données ci-jointe pour calculs exacts.

L'installation de produit **Black Box LWU** doit être faite de sorte que personne ne puisse accéder à la fenêtre optique ou traverser le rayon laser par accident. Pour instructions détaillées, lire la partie Sécurité de l'œil dans le chapitre 5.3.5 du manuel à la page 20.

Le produit **Black Box LWU** possède la totalité des étiquettes stipulées par les normes. De plus, des avis informatifs sont placés à des endroits clairement visibles où le rayon laser pourrait être accessible. Une liste des endroits où sont placés les avis informatifs est donnée dans le chapitre 5.3.5 du manuel (Eye Safety) à la page 20.

Le boîtier de connections extérieure (Outdoor Interconnection Unit) est fourni avec un fil électrique certifié par lequel l'appareil est connecté à la prise de courant. Grâce à cela, il est possible de débrancher à n'importe quel moment. Il est formellement interdit d'apporter de quelconques modifications à cette installation. Si une modification est cependant nécessaire à cause des normes locales, contacter le fabricant.

Attention!

Tout opération consistant à utiliser le produit *Black Box LWU* de façon différente que celle indiquée dans le manuel pourrait engendrer des effets indésirables du rayon laser, être dangereuse pour la vue et provoquer un choc électrique!

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Sicurezza dei prodotti Black Box LWU

Black Box LWU è classificato di essere un Classe 3B prodotto di lazer.

Il sistema Laserbit è stato collaudato e trovato conforme con EN 60825-1:1994+A11:96+A2:2001 (sicurezza sul prodotti lazer), EN 60950-1:2001 (sicurezza elettrica), EN55022:1998+A1:200+A2:2003 Class B (emissione) ed EN 55024:1998+A1:2001+A2:2003 ed EN 61000-6-2:2001 (immunità), Norme Europee.

La radiazione lazer viene emessa dalla ottica del trasmettitore via la finestra di vetro posizionata sulla fronte della testa di lazer con una divergenza minore di 10 mrad. Non esiste nessun'altra apertura attraverso quale radiazione di lazer può presentarsi.

Avvertimento!

Radiazione lazer invisibile! Guardando direttamente nel raggio di lazer può causare danni permanenti degli occhi! La distanza di sicurezza dello sguardo varia secondo la potenza e la divergenza dello raggio di lazer. Distanza di sicurezza viene comunicato sulla pagina tecnica allegata.

Prodotti **Black Box LWU** devono essere installati in tale maniera, che nessuno possa accedere la finestra ottica o esporsi al raggio di lazer per caso. Per informazioni più dettagliate vedi la parte Sicurezza Occhi del capitolo 5.3.5 nel manuale sulla pagina 20.

I prodotti **Black Box LWU** verranno forniti con tutte segnalazioni previste nelle norme. In addizione segnalazioni informative devono essere posizionate nei posti ben visibili dove il raggio di lazer può essere acceso. Le locazioni delle segnalazioni di sicurezza sono dimostrati sulla pagina 20 del manuale (Capitolo 5.3.5/ Sicurezza Occhi)

La Unità Interconnessione Esterna (Outdoor interconnection Unit) viene fornita con un cavo di alimentazione certificato quale deve essere collegato con la rete di potenza tramite una presa per assicurare la separabilità in qualsiasi momento. Qualunque modifica sul questo impianto è proibito. Se modifiche si devono eseguire per rispettare la norma locale, si prega di contattare il produttore.

Per garantire la conformità con la norma EN 60950, il sistema deve essere installato dal produttore o dai partner certificati.

Attenzione!

Qualsiasi operazione di Black Box LWU diversa di quello descritto in questo manuale può causare non desiderata radiazione lazer e può essere pericoloso per gli occhi o causare scossa elettrica!

Black Box

1 Table of contents

1	<i>Table of contents</i>	6
2	<i>Introduction</i>	7
2.1	What is FSO?	7
2.2	Optical Free-space Transmission	9
2.3	Typical applications	10
2.4	About the place where <i>Black Box LWU</i> is produced	Error! Bookmark not defined.
3	<i>The product Black Box LWU</i>	11
4	<i>Content of the package</i>	13
5	<i>Sites of installation</i>	13
5.1	Key factors of operation	13
5.2	Preferred installation sites	14
5.3	Direct sunshine	15
6	<i>Eye safety</i>	15
7	<i>The mounting bracket</i>	16
8	<i>System installation</i>	17
8.1	On the table test	17
8.2	How can you install the ODIU?	18
8.3	Fixing the heads	20
8.4	Alignment of the heads	21
8.5	Connecting to your Network	23
9	<i>Warranty conditions</i>	24
10	<i>Appendix A</i>	25
a.	Product registration form	25
b.	Failure report form	26
c.	<i>Black Box LWU</i> Data Sheet	27

Black Box

2 Introduction

2.1 What is FSO?

FSO is free space optics provides point-point broadband communications using Laser Light as the transmission medium.

FSO is a state of art data communication method which is based on a very old communication solution. Ancient Chinese developed a protection system against the Mongol tribes, building watchtowers within the line of site to other towers. And as soon as the towers saw some hostile sign on the horizon they use they shield to reflect the sun to the remote towers. In this way the area could be prepared against the attack in a very short period of time.



In the ancient times for this communication use the mirror as a transmitter and the sunlight was the light source, and the receiver was the remote guard's eye. This basic signalling method was developed later into up communication device which used „line coding“. This allowed the guards to tell the number of enemy, or the direction they are coming from.

Current **FSO** systems use a laser-diode as a light source, and a receptor diode (photo diode) to receive the signals coming from the laser diode from the transmitter side. But the basic elements are still the same: line of site between

the communication nodes, and individual line coding. It is all about performance. **Black Box** offers **FSO** systems with the highest power budget available on the market.

Why is it important?

Because of in the ancient Chinese times, the rain, the fog, or even the cloudy weather, could impact the operation of the whole system.

In the **FSO** units, comprising light source and receiver the cloud problem was solved, but development conditions still can impair performance. To go through the rain, the fog, or snow you need more and more power to be seen from the remote side. Achievable power levels are limited by a number of factors including eye safety.



In this way there is no other choice to see more than „training the eye“. Making the receiver more and more sensitive to sense light emitted from the remote side.

Black Box offers high transmit power and also very hard receiver sensitivity. These two factors combined to provide one of the best performing **FSO** systems on the market today.

Black Box

This manual describes the **Black Box LWU** product of free space laser transmission system.

The **Black Box LWU** product offers cost effective reliable free space laser transmission for 100 Mbps data to the air, where a clean line of site is available. It delivers the most effective point-to-point connection between computer networks or telephone exchanges.

No need for installing cables, no rental costs, no licensing requirements.

Ideal for urban areas or city centres, where the use of these lines are expensive. Suitable for factories or industrial environments where high noise level can interfere with the transmitted data. The best choice to make a connection across rivers and other natural or artificial obstacles, where cable is not available.

The transmission technique used in the **Black Box FSO** devices provides transparent and wire-speed data transfer with virtually zero latency. Because they use infrared light as the transmission medium, **Black Box LWU** system do not require frequency licenses and the transmission is not effected by electro-magnetic or radio-frequency interference. Basically the **Black Box LWU** link can be considered as a virtual fibre in the air, which ends in real fibre optic cable at both ends. Our product is built using high quality components for operation in even the most adverse conditions.

Metal housing gives robust, waterproof environment for the electronics. The shield protects the device from direct sunlight and provides extra air isolation. The **Black Box LWU** systems comprise two laser-heads and the two indoor interconnection units (OIU) - one at each end. The interface connections are housed in the outdoor unit together with the PSU of the system.

Best practises were employed in cost engineering throughout the development of **Black Box LWU**.

Black Box

2.2 Optical Free-space Transmission

The principle used in free space laser transmission is very similar to the one is used for fibre optic transmission. The difference is while fibre optic devices use electronics and optics optimized for transmission to the air. Also one can observe to the similarity in the transmission properties. No galvanic contact, no ground-loops, no need for surge protection, noise immunity, long distances, high bandwidth.

What makes it unique – and difficult to design – is that it does not require any transmission medium like fibre or copper, but it has to cope with the dynamically changing parameters. For instance while the attenuation of an optical fibre is constant, the attenuation of the atmosphere between the laser units can change dramatically (depending on the weather conditions).

The laser-heads are usually placed on top of building, where the clean line of site is guaranteed and the beam cannot be interrupted.

In the head the incoming signal is amplified, encoded, and then drives the laser-diode. The transmitter optics assures the proper beam shape and controls the beam divergence. The receive optics perceives and directs the transmitter signal to the photo diode. The diode converts it back into electrical, than it is decoded, amplified and converted.

There are several things that can influence the quality of transmission. We can classify those factors into three main groups.

System conditions - transmitting power, transmitter's wavelength, beam divergence, receiver optics diameter, receiver sensitivity, parameters of optical system and casing. These parameters determine the system's characteristic at a certain distance and are controlled by system design and factory set up.

Weather conditions - molecular absorption, particle scattering and turbulence. These elements have great effect on the operational conditions of the system. We do not have very much influence on them; proper product selection can eliminate the undesirable effects.

Environmental conditions - building movements, direct sunlight, refractive surfaces. These are also key factors related to the installation sites and can be controlled by appropriate site survey and system installation

2.3 Typical applications

Most typically the **Black Box LWU** is used to interconnect LAN-s. The system is protocol transparent, thus other applications also can be taken into consideration. Appropriate interface converters are needed and system bandwidth must be matched for that.

Here we collected some circumstances, where the employment of the **Black Box LWU** is the most adequate and cost effective solution.

Those are:

Areas with natural or artificial obstacles



Where cable is actually not an alternative, like across rivers or railways or in rugged terrain.

Urban areas

Where only leased lines are available with limited speed, and high rental cost. With Laserbit links you can establish on line LAN-to-LAN connections.



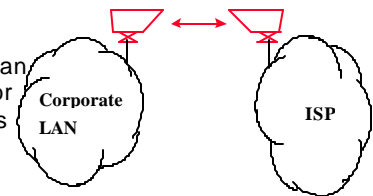
Industrial areas



Where you have noisy environment with high EMI or RFI. Factory buildings, airport objects can be connected through laser link.

ISP connections

Where high bandwidth is required. ISP's can offer high-speed links to their customers or trunks can be established between ISP's instead of expensive leased lines.



Black Box

3 The product **Black Box LWU**

The **Black Box LWU** series products from **Black Box** set a new standard for Free Space Optical transmission systems. They provide simple and easy to installation solution that is unique in laser based networking. This new range of products incorporates a lightweight, compact mechanical design with a factory-set optical system, which allows end-users to benefit from simple and quick installation. The **Black Box LWU** is more competitively priced than 2.4 GHz radio solutions and the bandwidth provided can be about ten times higher.

Black Box LWU range offers cost effective, reliable and secure laser based free space optical transmission for local area networks (LAN) at full duplex Fast Ethernet wire speed. The transmission carries data using a concentrated laser beam and a unique modulation technique is employed to ensure error free data transfer over distances of up to 200 meter. Transparent and wire speed data transfer together with virtually zero latency ensures that the **Black Box LWU** system can be easily integrated into any environment. The **Black Box LWU** series use laser light as a transmission medium. As with all **Black Box LWU** systems this means that frequency licenses are not required and transmission is not affected by electro-magnetic interference. The data transmission via a laser beam is secure as it is extremely hard to intercept, and cannot be detected by spectrum analysers. In the case of a **Black Box LWU** system the laser link is considered a "virtual" fibre in the air.

The **Black Box LWU** system comprises of two Laser Heads, two Outdoor Interconnection Units (OIU) and two sets of interconnection cables— one at each end. The Laser Heads are installed outdoors, usually on rooftops or sidewalls of buildings, where a clear optical path exists between the two sites. Next to the head the Outdoor Interconnection Unit provides fast and easy interconnection between the laser head and the cable coming from the network equipment. Moreover the OIU houses the Power Supply Unit (PSU) of the system and the network interface. The PSU provides the low voltage power required to operate the laser. Each **Black Box LWU** head contains built-in transmission monitoring service, which features a visual signal strength indicator and LINK status information accessible on the rear side of the head assembly through a window. In addition **Black Box LWU** units are equipped with optical aid to target the remote head easily. All that makes the installation real fast and easy even for people who have never dealt with FSO equipment before

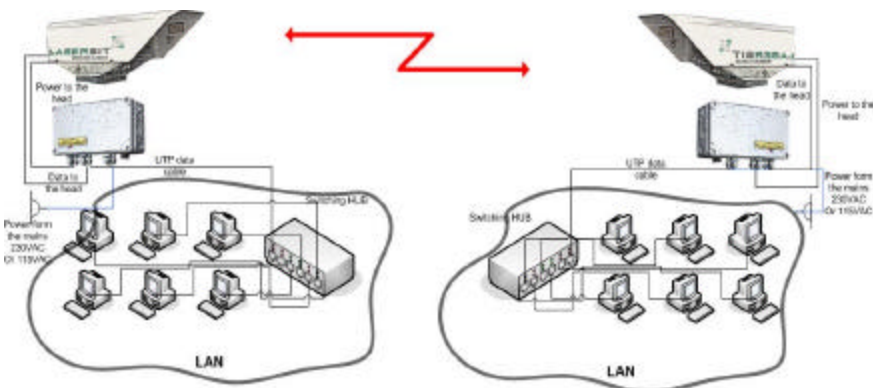
By utilizing IEEE, and ITU standard compliant interfaces **Black Box LWU** system protects the customers' investments in long-term projects. Provides fast and easy connection for Fast-Ethernet, or PDH computer or telephone networks.

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The TP system layout

The **TP** systems should be considered as repeaters in the network. So the installation distance between the head and the network device is 100m. The distance on a back to back site is maximum 5 meters, between the heads.

The head needs a power and data cable, which is connected to the ODIU (Outdoor Interconnection Unit). The required power for the outdoor unit is 230VAC or 115VAC, depending on the order. Please note that the transformer is not a switching mode power supply, so has to be configured for the proper voltage before connection, this has to be done before shipment. The heads are fixed 100Mbps and are auto-negotiating.



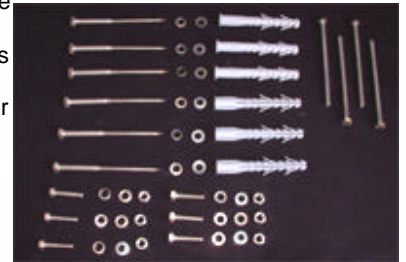
Black Box

4 Content of the package

For the **Black Box LWU** systems **Black Box** provides all the necessary accessories to fix the head to the bracket, fix the Power supply unit and the bracket to the wall, below you can see what is provided in the **Black Box LWU** package.



- 2ps of **Black Box LWU** heads
- 2ps of **Black Box LWU ODIUs** (Outdoor Interconnection Unit) /the two grey plastic boxes/
- ODIU accessories:
 - 2ps of 276x110x1,5 metal plates
 - 2x4ps of 6x40 spacers
 - 2x4ps of 6x15 spacers
 - 2x4ps of M6x70 flat sphere headed screws
 - 2x4ps of M5 nuts
 - 2x4ps of spring washers
 - 2x4ps of washers
 - 2x4ps of ø8x48 wall plugs
 - 2x4ps of M4,5x70 cross headed self-tapping-screws
- 2ps of mounting brackets for **Black Box LWU** heads /a camera consol like grey, metal appliances/
- a manual CD
- bracket accessories bag contents see below:
 - 2x3ps of M6x90 self-tapping-bolts
 - 2x3ps of ø10x80 wall plugs
 - 2x2ps of M6x90 tangent bolts (for vertical fine alignment)
 - 2x3ps of M6x25 bolts
 - 2x3ps of M6 nuts
 - 2x6ps of 6mm spring washers
 - 2x6ps of 6mm washers



5 Sites of installation

5.1 Key factors of operation

There are four key issues that the site survey has to shed light on. Proper system operation cannot be guaranteed without satisfying all of the four requirements.

Clear line of sight - The entire optical path between the two ends must be free of any obstacles. It not only means that one has to see the other side, but other possible sources of disturbance should also be taken into consideration. For example there might be turbulence above the roofs and other constructions, and this can

Black Box

cause fraction or scattering of the beam or snow accumulation on roofs too close to the beam can influence or even interrupt communication.

Solid mount surface - is the key for long-term operation. Since the diameter of the beam is limited, it is extremely important to mount the unit on a stable structure with the possible smallest movement. This way the receiver of the remote unit cannot get out of the beam due to the movement of the opposite head.

East-West orientation - although the receiver optics are equipped with optical filters to protect the receiver diode from the effect of undesired light sources, direct sunshine can cause saturation of the diode. This prevents the system from working properly for several minutes a day at certain times of the year. In most cases this effect can be avoided by careful selection of the mounting spot.

In order to comply with the requirements of the successful installation- including the discussed four key factors and other criteria -the following matters should be taken into consideration.

5.2 Preferred installation sites

All buildings and constructions have a certain movement of their own. It's determined by the structure and material of the building. Metal structures can shift or twist due to temperature changes. Wooden construction can expand or shrink with any changes in humidity. Give preference to concrete or brick buildings. On the other hand high structures like towers, skyscrapers or poles are always subject to movement. Mount the support frame to walls of the building or near corners, as they are the most stable spots. Use appropriate consoles for wall mounting. If a stand is used on the top of building, secure it directly to the ceiling or to the concrete cornice wherever is possible. Do not fix stands to insulating materials as they can slowly sink under the weight of the unit and with temperature changes. Big chimneys and smokestacks may look stable, but as their inner temperature varies they can also move. Vibration caused by heavy traffic, trains and elevators etc. may slowly move the system out of its specified direction. Another important consideration is to provide enough space for alignment and to have the potential for future maintenance.

Preferred installation sites		Avoid (*)
Concrete wall	Behind window	Soft materials
Brick wall	Old constructs	Chimneys
	Microwave towers	Wooden constructs
		Metal masts or Frames
		Hidden heat isolations, like Styrofoam

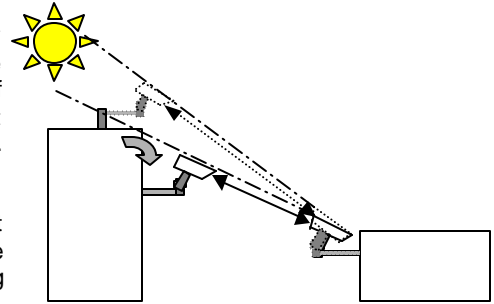
(*)
 In cases where installations are listed under "AVOID" cannot be avoided than special mounting accessories to be designed and special installations must be used.

It is not only the building that has to be solid, but the support structure too. Antenna poles and security camera holders are not suitable for the **Black Box LWU** units.

Black Box

5.3 Direct sunshine

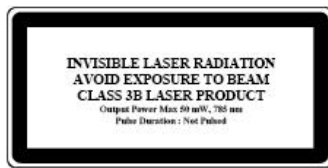
To prevent the sun shining directly into the receiver optics, first one has to determine the orientation of the link. Try to avoid East-West orientation wherever it is possible. Examine both sides of the link at sunset and sunrise and find a position where the sun cannot get behind any of the heads. Be aware that the path of the sun is changing throughout the year.



6 Eye safety

There are no two installation spots of the same kind, the buildings or structures, the available space and the accessibility of the place will be different in each case. Nevertheless, as a general rule it is very important to select the installation site so that nobody can look directly into the transmitter. For this reason place the head either so high (on the side wall of the building) or so close to the edge of the building (on a parapet on the rooftop) that no person can approach it accidentally and can get into the beam path. Set up barriers if necessary and put warning signs at prominent places.

The laser heads are provided with all labels and hazard warnings required by the laser standard. There are warning labels on both the left and right side of the protective cover next to the optical window and there is a warning and an informative label on the rear side of the laser head.

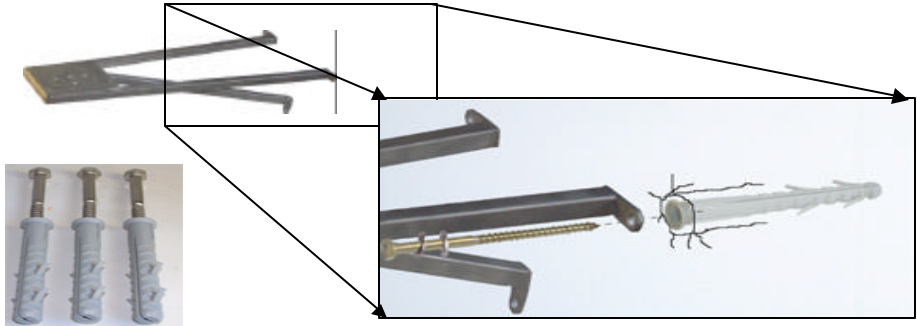


Black Box

7 The mounting bracket

Black Box provides the mounting bracket and all the necessary components for **Black Box LWU** units. A simple fixing technique of this bracket can be seen on the following figure, required tools are as follows:

- drilling machine
- 10 mm wrench



Bracket sizes:

Length: 329mm
Leg Width: 209mm
Head Width: 100mm
Drill size: 10mm wall drilling

Installation steps:

- Place the bracket on the wall
- Mark the wall with a permanent marker
- Use your 10mm wall drill to drill all of the holes into the wall
- Clean the holes
- Place the wall-plugs into the holes (please note that some times you need to use hammer to put the wall-plugs into the hole, if you have to please be careful not to break the wall-plug)
- Place the bracket to the wall an line it up to the holes
- Put the screws into the wall-plug through the hole on the leg of the bracket (please see the figure above)
- Tighten up the screws

Packet list for the bracket:

Black Box

8 System installation

8.1 On the table test

Warning! Do not look either into the transmitter or the receiver optics because at this distance even the reflected laser beam *can* be dangerous to your eyes. Operating the system on much shorter distance than presumed originally can cause saturation or even permanent damage to the receiver. Always use optical attenuators for this kind of test.

The on-the-table test needs careful planning and careful use during the test period. The units should be placed at about 2 m distance from each other with optical windows facing one another. Put an appropriate optical attenuator (Attenuating foil or cardboard with several small holes) between the heads. Make all the necessary connection as described below to connect your network equipment (computer or protocol analyzer) to the heads and power up the units. Turn ON the Outdoor Interconnection Units and check if the power LED is ON on the head.

You should be able to align the units without any tool and get full received level on the signal strength LED's. Make sure that the "Saturation" indicator is OFF. Adjust your attenuators if necessary to avoid saturation of the receivers.

Please note that at this short distance, specially the longer distance links can reflect to the remote site or even to the same head. If you experience full receiving level, with no traffic throughput, in that case try to move the heads slightly units out of the reflection zone.



Please also take in consideration that the laser beam is concentrated and in such a short distance can harm your eyes, every time you test the units on short distance, do it with extra care. Never look into the sighting device if the remote laser is turned on. We strongly suggest to double check the power connection before you turn on the device. Handle the power connection with extra care. Safety first.

After obtaining the desired received level, check the data connection between devices. Using computers or appropriate testing devices.

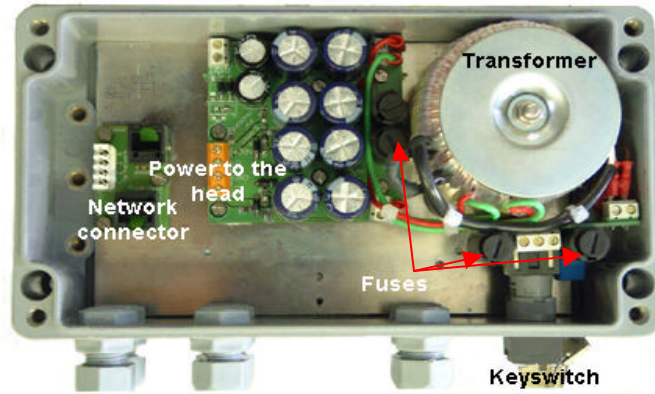
On the table tests are perfect for troubleshooting (If there is a transmission problem, check the status of the connecting devices (e.g. Link signal or cable polarity) and cables.) in a controlled area. If you experience some problems during the test, please try to test the connected equipments with a direct connection.

Black Box

8.2 How can you install the ODIU?

Functionalities of the ODIU

The outdoor interconnection unit (ODIU) provides the power supply and data connection for the head. The power connection (+8VDC, GND, -8VDC and +30VDC).



The ODIU made from poly-propylene enforced with fibre. This construction provides robust shock and waterproof environment (IP65) for the electrical devices.

The transformer is a not switch able transformer, so the main voltage must match to the one marked on the front cover. If the main power is different then this can damage the transformer.

In the ODIU there can be found four fuses, two for the transformer and the other two for the head.

Fuses

On the primary side, the fuse ratings are: T0.8A (250V)

On the secondary side, the fuse ratings are: T4A (250V)

Installing the ODIU box

The physical fixing of the ODIU box can be seen below.

Necessary toolkit:

- Philips screwdriver
- 5mm wrench
- Drilling machine with an Ø8mm bit (the minimum effective length is 50mm)

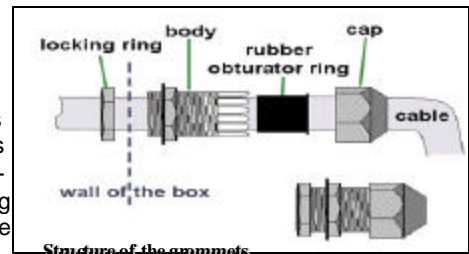
First you have to fix the ODIU box to the metal plate:

- Pick the four M6x70 flat sphere headed screws, and take them to the holes on the corners of the box
- On the back of the box, where the screws came out, you have to put up the four 6x40 spacers (these are the longer ones) to the legs of the screws
- Pull on the metal plate to the legs of the screws
- Fix the metal plate with four M5 nuts using the four washers, and four spring washers like in the figure



Then you can fix the whole construction to a wall:

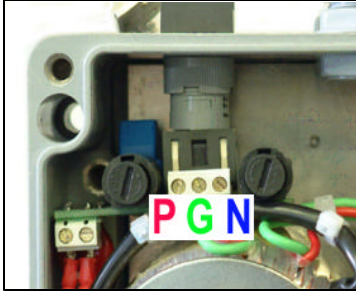
- Drill four holes, using the metal plate for measuring the places of the bores, with a Ø8mm bit. The depth of the bores have to be a minimum of 50mm
- Put the four wall-plugs into the four holes
- Put the four M4,5x70 cross headed self-tapping-screws through the four free holes of the metal plate
- Pull up the four 6x15 spacers (the shorter ones) to the screws
- Tight the screws into the wall-plugs, and tight it up as strong as possible for the appropriate fastening



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Connecting the head to the ODIU, and the ODIU to the power supply

Ensure that the cables are connected as it seen below.

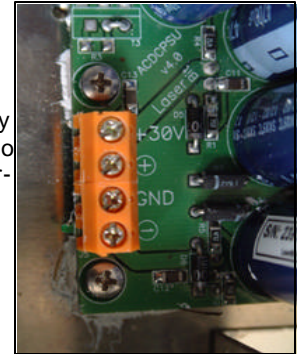


For the power connection recommended to use three-wired Ø0,75mm cables. The order of the connection can be seen on the figure.

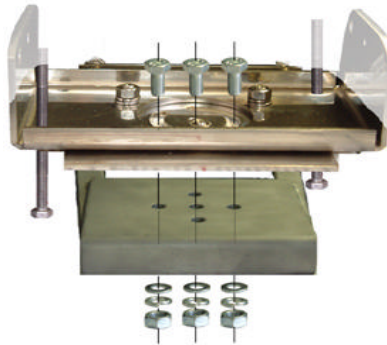
- P – Phase
- G – Ground
- N - Neutral

The necessary power can be supported to the head by the connector which can be seen in the figure next to this text. Order of the cables from the head: (the four-twisted-pair-wired cable)

- Brown-White - +30V
- Orange-White - +8V
- Green-White - GND
- Blue-White - -8V



8.3 Fixing the heads



Your **Black Box LWU** head can be fixed to its stand with the three M6x25 bolts. On the figure you can see a plinth of a **Black Box LWU** unit, a head of a **Black Box LWU** mounting bracket, and the necessary fixing parts. The steps of the fixing are:

- First place the head to the stand
- Place the bolts into the holes which is easily accessible for the installation and the two cuts
- Place up the washers and spring washers
- Fix the bolts with the nuts

After you put up the washers and the nuts, do not screw the nuts up tight because of the comfortable positioning (see the chapter of Alignment).

After the fixing, place the two M6x90 tangent bolts into the two of the four holes on the corners of the plinth. The important is that the bolts have to be in opposite corners. You can do the vertical fine alignment with these bolts.

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8.4 Alignment of the heads

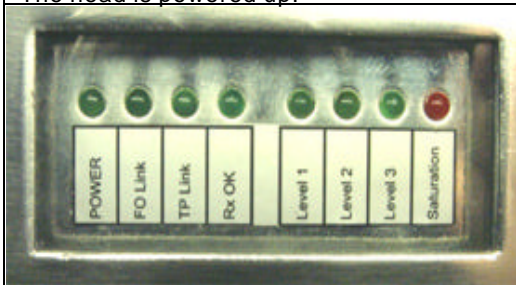


- Target Side B with the crosshair built in to the head on Side A
- Repeat the first step with Side B!
- Power up the heads!
- Screw the three nuts up tight on both heads, which were used for the head fastening, but be careful that the heads do not move out from its position!
- Screw the two nuts up tight on both heads, which are used for the fixing the vertical direction, but be careful that the heads do not move out from its position!

Meanings of the LEDs

Power:

The head is powered up.



FO Link:

Fibre optical link between the two heads.

TP Link:

Copper link between the head and the Network equipment.

RX OK:

There is enough light to start communicate through the link.

Level 1:

25% of the total (acceptable by the receiver) incoming power
It indicates after 25 μ W incoming light efficiency.

Level 2:

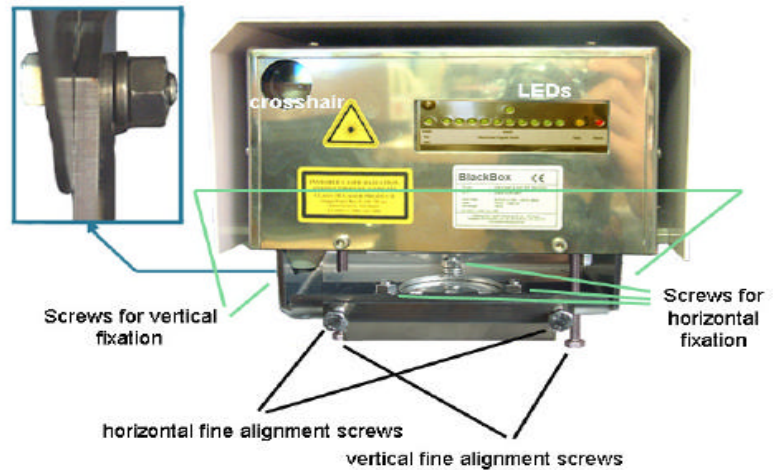
50% of the total (acceptable by the receiver) incoming power
It indicates after 50 μ W incoming light efficiency.

Level 3:

75% of the total (acceptable by the receiver) incoming power
It indicates after 100 μ W incoming light efficiency.

Saturation:

Overload (Overloading can cause stop in the communication, and permanently it can damage the receiver)
After 15mW (or higher) incoming light efficiency



- After the heads are lined up with the sighting device, you have lined the units into a negligent position
- Following the LED's you might require some fine alignment! Depending on the distance this can be small or large movements.
/Please note the larger the distance the less movements are required for the fine alignment, The importance of the finealignment counts, so please take your time to do it accurate as possible/
- The Fine adjustments should be done as follows
 - 1 First using the horizontal fine adjustment bolts make the two bolts hand-tight
 - 2 Tight the left bolt with a 10mm spanner and look at the readings on the receiver, if the receiving level start decreasing again, start using the bolt on the right hand side and tighten it with the spanner, and reach the maximum again. We strongly suggest you to repeat the steps 2-3 times to make sure that the bolts are tight.
 - 3 In the meantime the remote end should look at the receiving level. And if the receiving level decreases dramatically the tightening procedure should start again.
 - 4 If the horizontal alignment was done then using the vertical fine alignment bolt /can be seen on the figure above/ this alignment should be done.
/Please note that the vertical fine adjustment bolts should be placed in cross/
 - 5 Hand tighten the two bolts.
 - 6 Tight the front bolt with a 10mm spanner and look at the readings on the receiver, if the receiving level start decreasing again, start using the bolt on the rear and tighten it with the spanner, and reach the maximum again.

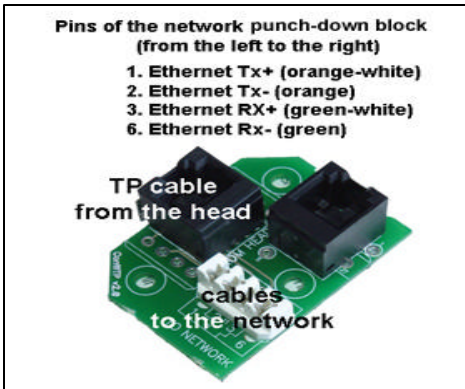
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We strongly suggest you to repeat the steps 2-3 times to make sure that the bolts are tight

- Repeat the steps 1-6 on the remote end as well.
- Now the system is secured with the fine adjustment bolts. The long term alignment bolts should be tightened on side and on the bottom of the unit.
/Please note: During the tightening process should you experience some movements. This should be compensated with further tightening of the fine adjustment bolts/

8.5 Connecting to your Network

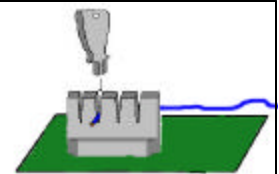
You have a TP head



You can find a TP connector unit in your ODIU, with there connectors. You have to plug in the TP cable of your head into the RJ45 connector. Your network is connectable to the LB system using the white one rowed connector, where you have to connect the four cable of your network with the help of the punch down tool. The order of the cable can be seen on the figure.

The punch-down tool

Place your first cable on the top of the chosen connector, without removing of the insulator from the cable. Then using the punch down tool push down the cable into the connector.



9 Warranty conditions

Black Box warrants that the **Black Box** product purchased will be free from defects in material and workmanship for a period of one (1) year from the date of purchase. This warranty period will not be extended by virtue of a repair of the product or a replacement of any component of the product during the warranty period.

This warranty covers only normal commercial use. **Black Box** is not responsible for warranty service should the **Black Box** identification marks, serial numbers or original seals be removed, altered, or broken, or should the product fail to be properly maintained or fail to function properly as a result of any modification, misuse, abuse, improper installation, neglect, improper shipping, damage caused by disasters such as fire, flood, earthquake or lightning, improper electrical current, or service other than by **Black Box** or its authorised partners.

If the **Black Box** product fails to operate as warranted at any time during the warranty period, **Black Box** will repair, or at its option, replace the defective product at no additional charge.

In no event will **Black Box** be liable for any damages including loss of data, lost profits, lost savings, lost business, or other incidental or consequential or indirect damages arising out of the installation, use, maintenance, performance, failure or interruption of the **Black Box LWU** product, even if **Black Box** has been advised of the possibility of such damage.

The purchaser or user shall have the responsibility to give **Black Box** prompt written notice of any warranty claims. If the product was purchased through an authorised partner of **Black Box**, notice may be given in writing to that authorised partner in the area in which the product was being used.

The product may be returned to **Black Box** only if it has a Return Material Authorisation (RMA) number. The product must be shipped prepaid, insured and in the original shipping package or similar package for safe shipment. The RMA number must be marked on the outside of the shipping package. Any product returned without an RMA number shall be rejected.

Transportation charges for the return of the product will be paid by **Black Box** if it is determined by **Black Box** that the product was defective within the terms of the warranty; otherwise the purchaser or user shall be responsible for costs of return handling and transportation.

If the **Black Box** product does not operate as warranted above, the customer's sole remedy shall be repair or replacement. The foregoing warranties and remedies are exclusive and are in lieu of all other warranties, expressed or implied, either in fact or by operation of law, statutory or otherwise, including warranties of merchantability and fitness for a particular purpose. **Black Box** neither assumes nor authorises any other person to assume for it any other liability in connection with the sale, installation, use or maintenance of the product.

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10 Appendix A

a. Product registration form


Please take your time to fill out **Black Box** product registration form to ensure your warranty period begins, otherwise **Black Box** consider warranty beginning from the date of shipment from **Black Box**.

Customer Name		Contact Name	
Address		Tel.:	
		FAX:	
		E-mail:	
BLACK BOX <small>AN IRVING-CLOUD COMPANY</small>			
Product Registration Form			
Link Information			
Link type	LB-		-
S/N 1		S/N 2	
Old Information If the 1 and Serial # Match			
S/N 1		S/N 2	
Description of Installation			
Connecting devices		Side A	Side B
Detector voltages			
Serial Number - N/CMS			
Installation District	Installation date	Duration of Installation	
Contact details of the register		Company name	
Installation done by		Phone No.:	
		E-mail:	
		FAX No.:	

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b. Failure report form

In case of failures please report it to the **Black Box**, with filling out the failure report form and forward it to the **Black Box**!

 BLACK BOX <small>NETWORK SERVICES</small>		Failure Report Form	
Customer Name		Contact Name:	
Address		Tel.:	
		Fax:	
		E-mail:	
Link Information			
Link type			
S/N 1		S/N 2	
ONU Information			
S/N 1		S/N 2	
Description of the Failure			
Date of failure		Date of Failure report	
Warning: Officers and players do not write into this section below			
Failure report Nr	Issue Date	Issued by	

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c. Black Box LWU Data Sheet

Electrical Characteristics	
Light source	Laser Diode
Laser diode power (mW)	70
Detector	Si PIN
Dynamic range	>25 dB
Bandwidth	100 Mbps
BER	< 10 ⁻⁹
System latency	< 50 ns
Data In/Out	
Fast Ethernet	100BaseTX UTP available at an IDC panel in the Outdoor Box
Power	
Power required	230 VAC, 50 W max. (110 VAC optional)
Power to head	2 x 8 VDC +30 VDC, 2 x 1 A max.
Power consumption	20 VA
Optical Characteristics	
Wavelength	785 nm
Beam divergence	20 - 70 mrad
Receiver acceptance angle	8.5 mrad
Physical Characteristics	
Head Housing	Stainless steel
Weight	2.5 kg
Dimensions (with cover and Alignment Unit, mm)	160 x 110 x 350
Environment	
Operating temperature	- 25 to + 60 Centigrade
Storage temperature	- 40 to + 80 Centigrade
Humidity	95% non condensed
Protection rating	IP65 for Head Assembly and Outdoor Unit, IP20 for Indoor Unit

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