

# **XPAND Trinity 3D Superlight Polarizer**

User Manual



**XPAND™**  
V I S I O N



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## General Warnings

- » Before use, make sure the XPAND Trinity 3D Superlight Polarizer is installed safely and securely (refer to the **Setup and Configuration** section of this user manual). You should begin using the product only after proper installation.
- » Do not get the product wet by any means as this may cause fire, electric shock or malfunctioning.
- » When cleaning, do not use flammable sprays or flammable solutions directly or indirectly on the product.
- » Do not disassemble, repair, or modify the product yourself.
- » To reduce the risk of electric shock or fire do not open the product or remove any part.
- » Prior to cleaning XPAND Trinity 3D Superlight Polarizer always disconnect the power supply.
- » If using a motorized mount together with the product, only install it on mounts which can handle the weight of the product. Use of XPAND's Motorized Mount MK3 is strongly recommended.

## Information

This manual can be revised without any prior notice. In addition, the design and specifications are subject to change without notice. Keep track of XPAND's website for possible changes.

This manual is to provide information and instructions for proper use of the product. Do not copy, bind or distribute.

Please check to see if this product is working properly upon receipt.

## System Overview

The XPAND Trinity 3D Superlight Polarizer allows 3D Ready DCI projectors to project stereoscopic video on silver screens in combination with circular polarized passive 3D glasses. This product delivers one of the best light efficiency levels in the comparable products class.

If you want to use your projector as a regular 2D projector, you can move the XPAND Trinity 3D Superlight Polarizer out of the way of the projector lens allowing for a 2D projection at the projector's original brightness.

Main features of the XPAND Trinity 3D Superlight Polarizer are:

- » High brightness and contrast ratio.
- » Control via string macros sent by a digital cinema server or projector.
- » Configurable operation using a dedicated PC-based configuration utility.
- » Service upgradable firmware.

## What's Included

- » (1) XPAND Trinity 3D Superlight Polarizer
- » (2) GPIO cables for connecting the unit to the projector
- » (1) Ethernet Crossover Cable
- » (1) Power Supply Adapter.
- » (1) User Manual

**WARNING:** The supplied Ethernet Crossover Cable should not be used as a regular network cable. It is intended primarily for direct connection of the Trinity Polarizer to a PC when performing network settings configuration if needed.

## System Parts

Important parts of the XPAND Trinity 3D Superlight Polarizer are shown in below image. This image is often referred to by this user manual so it is suggested you study it carefully before proceeding to installation of the unit.

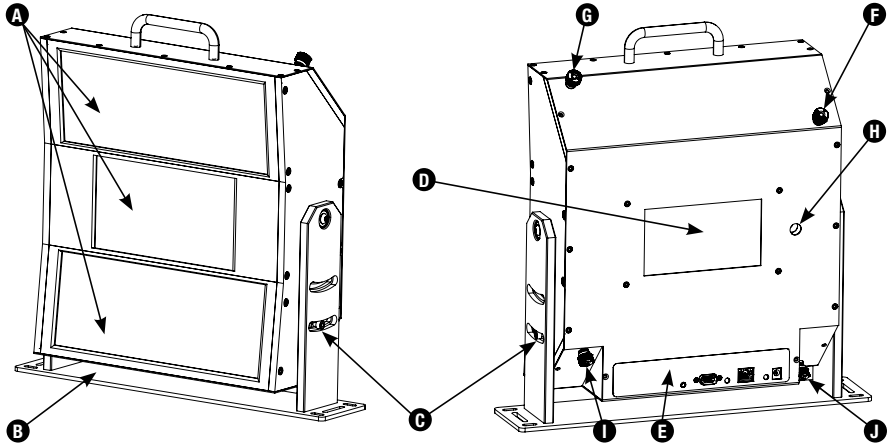


Figure 1: System Parts

- (A) - Output windows / Active area
- (B) - Mounting plate
- (C) - Tilt adjustment screws
- (D) - Input window
- (E) - Connector panel

- (F) - Top half image vertical frame adjustment screw
- (G) - Top half image horizontal frame adjustment screw
- (H) - Central image scale adjustment
- (I) - Bottom half image vertical frame adjustment screw
- (J) - Bottom half image horizontal frame adjustment screw

## Connector Panel

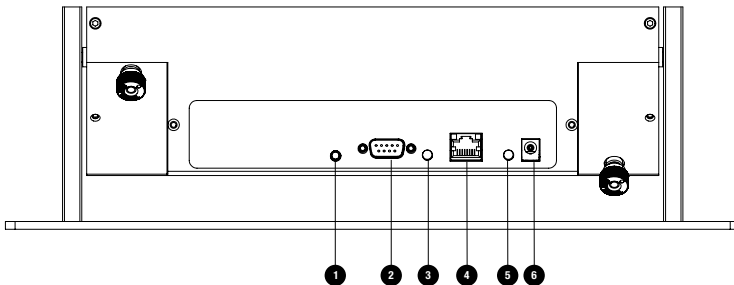


Figure 2: Connector Panel

- (1) Motion Control - Typically used for controlling a motorized mount, if the Trinity Polarizer is attached to one. See section **Motion Control Output** for more information.
- (2) GPIO - Connector for connecting the unit to the projector. With use of special cables this connector can also be used for connecting the projector's or the digital cinema server's GPIO ports to the unit.
- (3) SYNC / 3D MODE LED - Amber LED for indicating which mode the unit is currently operating in.

(4) ETHERNET - RJ45 / Ethernet port used for connecting the unit to the local network. Two square LEDs are integrated in the connector, showing network activity of the unit.

(5) STATUS LED - Green LED for indicating current status of the unit.

(6) DC12V 1A - Power in.

## Inputs

- » GPIO Port: DSUB-9PIN-Male. See pinout diagram shown in **Figure 3** for more information.
- » Ethernet Port: RJ45 / 8P8C Ethernet connector.
- » DC Power Jack: 6.2 mm  $\Phi$  (Hole size), 1.6 mm  $\Phi$  (Lead size). Mating connector: 5.5 mm  $\Phi$  (OD), 2.1 mm  $\Phi$  (Bore).

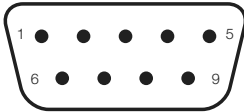


Figure 3: GPIO Male 9-pin Connector Pinout

Pin 1: SYNC IN (From projector)

Pin 3: Trigger 1 (GPIO mode source control)

Pin 4: Trigger 2 (Reserved)

Pins 6, 8, 9: GND

Pins 2, 5, 7: Not used

## Outputs

- » Motion Control Port: Mating connector is either a stereo or mono 3.5 mm  $\Phi$  plug. See section **Motion Control Output** for more information.

## LED Indications

There are two LEDs on the unit which are used to indicate its status and mode:

- » **Green LED:** STATUS LED. Indicates the status of the unit and used to identify errors.
- » **Amber LED:** SYNC / 3D MODE LED. Indicates the mode in which the unit is currently operating. Note that if this LED is ON, the unit is always in 3D mode and is modulating the incoming light, thus making 3D viewing possible. If the LED is OFF, 3D viewing is not possible, however the unit may still be operating in 3D mode. See section **Modes of Operation** for more details.

LED indications given in below table can be encountered. For more information about different states corresponding to below LED indications see the rest of this manual.

GREEN LED	AMBER LED	UNIT MODE AND STATUS
OFF	OFF	The unit is not operating. Either its power is unplugged or an unexpected error occurred and a hard reset must be performed by removing and reapplying power.
ON	OFF	The unit's mode control source is set to "Network" or "GPIO". The unit can be in 2D or 3D mode. If the unit is in 3D mode, then no valid 3D sync signal is present.
ON	BLINKING (1 s ON, 1 s OFF)	The unit's mode control source is set to "frame sync", it is in 2D mode and scanning for a condition to transition into 3D mode. No 3D synchronization signal is present and the unit is waiting for one.
ON	ON	Normal 3D operation. The unit is in 3D mode and a valid 3D synchronization signal is detected.
BLINKING	BLINKING	<b>Simultaneous</b> blinking once every second of both LEDs indicates the device has encountered an error. A reset is required. The power supply should be unplugged for 5 s and then plugged back in.
BLINKING	BLINKING	<b>Alternating</b> blinking of both LEDs indicates a start-up routine. When the unit is powered up it goes through an initialization sequence during which both LEDs blink out of phase for approximately 5 s.
BLINKING	BLINKING	<b>Simultaneous</b> fast blinking of both LEDs indicates the unit has entered the "factory reset routine". See section <b>Factory Reset</b> for more information.

Table 1: LED indications

# Operation

## Overview

The main goal of the XPAND Trinity 3D Superlight Polarizer is to modulate the light coming from the projector in a way which enables 3D viewing in combination with circular polarized passive 3D glasses. The modulation must be done in synchronization with the projector and in a way that results in as little light as possible being lost. To achieve synchronization with the projector a 3D synchronization signal is fed from the projector to the unit using one of the cables supplied with the product.

Much of the unit's operation can be configured over the network by using a dedicated PC-based configuration utility. See the **Unit Configuration Using the PC Based Configuration Utility** section of this manual for more information.

## Factory Reset

At any time the XPAND Trinity 3D Superlight Polarizer can be reset to its factory default settings by following these steps:

- (1) Unplug all cables from the unit.
- (2) Short pins 3 and 4 of the unit's GPIO port.
- (3) Plug the power back into the unit.
- (4) Both LEDs on the unit should now be flashing quickly, indicating that a factory reset is about to be done.
  - » To confirm the factory reset, remove the short circuit between pins 3 and 4. The unit will make two more slow flashes with both LEDs to indicate, that a reset has been made.
  - » To abort a factory default reset, unplug the power cord from the unit and **only then** remove the short circuit.

A reset is especially useful when performing network settings configuration if a mistake is made. A Factory Reset will return the unit to its factory default settings, making it again accessible at its default IP of 192.168.0.250.

Note that all network settings of the unit will be reset so if they have been previously modified, the unit will now no longer be reachable and the network settings should be reconfigured. See section **Unit's Initial Network Settings Configuration** for more information.

## Modes of Operation

The Trinity Polarizer operates in one of two modes: 2D mode or 3D mode. As their names suggest, the 3D mode is intended for watching 3D content and 2D mode for viewing 2D content at which point the polarizer should be removed from in front of the projector.

Which mode the unit should be operating in is determined by different conditions which depend on which mode control source is selected. See section **Mode Control Sources** for more information.

The unit signals if it is in 2D or 3D mode through its SYNC / 3D MODE LED and through its Motion Control Output. If the LED is ON, the unit is always in 3D mode and is modulating the incoming light, thus making 3D viewing possible. If the LED is OFF, 3D viewing is not possible. However the unit may still be operating in 3D mode but no valid 3D synchronization signal is fed to the unit from the projector.

The best way to determine whether the unit is operating in 2D or 3D mode is to connect to it by using the PC-based Configuration Utility and have a look at the **Current Mode** parameter.

### 2D Mode

In 2D mode the unit stops modulating the incoming light and sets its Motion Control Output to 2D state (see section **Motion Control Output** for more details). A 2D state on the Motion Control Output triggers the movement of the unit away from the projector, if mounted onto a motorized mount connected to this output.

In 2D mode the SYNC/3D MODE LED state depends on which mode control source is currently selected. If the "frame sync" mode control source is selected, the LED is flashing slowly thus indicating, that the unit is not detecting a valid 3D synchronization signal. For other mode control sources the LED is OFF when in 2D mode. See **LED Indications** and **Mode Control Sources** sections of this manual for more information.

While in 2D mode, the unit continuously scans for conditions to transition to 3D mode. These conditions depend on which mode control source is selected - refer to section **Mode Control Sources**.

### 3D Mode

In 3D mode the unit sets its Motion Control Output to 3D state (see section **Motion Control Output** for more details). A 3D state on the Motion Control Output triggers the movement of the unit in front of the projector, if mounted onto a motorized mount connected to this output.



If a valid 3D synchronization signal is fed from the projector to the unit, it starts modulating the incoming light and normal 3D viewing is possible. Validity of the signal is determined by  $f_{\text{min}}$  (3D Sync Low Threshold Frequency) and  $f_{\text{max}}$  (3D Sync High Threshold Frequency). See macros descriptions in section **Network Mode Control Source** and section **Using the Configuration Utility**.

In 3D mode the SYNC/3D MODE LED state depends on the presence of a valid 3D synchronization signal coming from the projector. If a valid 3D sync is detected, the LED is ON. If the signal is not present or is invalid, the LED is OFF.

Note: When "frame sync" mode control source is selected, absence of a valid 3D synchronization signal automatically sets the mode to 2D. See the **Mode Control Sources** section of this manual for more information.

While in 3D mode, the unit continuously scans for conditions to transition to 2D mode. The conditions depend on which mode control source is selected - refer to section **Mode Control Sources**.

## Mode Control Sources

The XPAND Trinity 3D Superlight Polarizer has three ways of determining whether it should operate in 2D or 3D mode:

**(A) Detecting a valid 3D synchronization signal coming from the projector -> "Frame Sync mode control source"**

**(B) Listening for a 3D or 2D command macro on the LAN -> "Network mode control source"**

**(C) Triggering on a dedicated GPIO line of the GPIO connector -> "GPIO mode control source"**

Which one of the three mode control sources is active can be set using the PC-based configuration utility (see the **Using the Configuration Utility -> Device Mode Control Settings** section, parameter **Mode Control Source**) or by sending a dedicated string macro command over the network from a projector or digital cinema server (see the "modctrls" command in section **Network Mode Control Source**). By default the "Frame Sync" mode control source is selected.

### Frame Sync Mode Control Source

The default way of determining whether the unit must begin operating in 3D mode is to monitor the 3D synchronization signal line coming from the projector for the presence of a valid synchronization signal. This signal comes into the Trinity Polarizer through its GPIO connector. If a valid signal is detected, the unit transitions to 3D mode and stays there for as long as the signal is present.

The 3D synchronization signal is a square wave. The unit determines whether a signal is valid or not by measuring its frequency. By default all signals with a frequency between 35 Hz and 150 Hz are considered valid. However, these limits can be modified through the unit's PC-based configuration utility. For more information see section **Using the Configuration Utility -> Device Mode Control Settings**, parameters **3D Sync Low Threshold Frequency** and **3D Sync High Threshold Frequency**.

### GPIO Mode Control Source

If the unit is set for GPIO Mode control source, it then supports control over one GPIO line which is typically connected to one of the projector's or digital cinema server's GPIO lines.

By default an externally applied open loop / open circuit between pins 3 and 8 sets 2D mode. Close circuit on those same pins sets 3D mode. Polarity can be inverted by using the PC-based configuration utility (see section **Using the Configuration Utility -> Device Mode Control Settings**, parameter **GPIO Signal Polarity**) or by sending a dedicated command macro from the projector or the digital cinema server (see the "gpiopol" command in section **Network Mode Control Source**).

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An optically isolated open-collector or open drain GPIO control line needs to be connected between pins 8 and 3 to avoid damage to the unit and/or projector - see below schematics. Projectors and servers are typically equipped with such outputs so only a suitable passive cable is required.

Alternatively CMOS levels with a 3.3 V supply can be used with pin 8 connected to GND. However optically isolated lines are preferred.

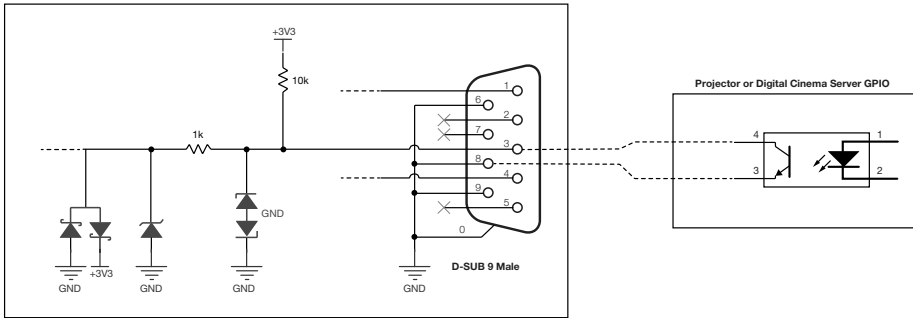


Figure 4: GPIO Mode Control Wiring Diagram

## Network Mode Control Source

If the unit is set for this mode control source, it then accepts command macros from over the network, signalling it to move to 3D or 2D mode. This method is intended for controlling the unit and the optional motorized mount connected to it over the network, by a projector or digital cinema server.

The unit's *network settings* must first be configured so that it becomes accessible over the network. For information on how this is done see section *Unit's Initial Network Settings Configuration*. Once the unit's network settings have been properly configured, its mode can be controlled by sending string macros to its IP address on port 1000.

Macros are simple strings sent to the unit's IP address and take the following form:

**<command>parameter</>**

Examples:

2D mode command macro string: **<mode>2D</>**

3D mode command macro string: **<mode>3D</>**

The 2D and 3D macros are not the only ones which are accepted by the XPAND Trinity 3D Superlight Polarizer however they are the two most typically used ones. **Table 2** below summarizes all string macros which are recognized. Most are accepted no matter which mode control source is selected whereas some only have effect if Network Mode Control Source is set.

The Trinity Polarizer accepts up to 8 commands in one string:

**<command1>parameter1<command2>parameter2 ... <command8>parameter8</>**

Below example shows a string macro made up of two commands - the command to set the mode control source to Network and then set the unit to 3D mode:

**<modctrls>n<mode>3D</>**

Command	Parameter Value	Description
mode	2D / 3D	Sets the currently active mode based on the input parameter value. <b>Note:</b> This command only takes effect if the "Network Mode Control Source" is selected. If "Frame Sync" or "GPIO" mode control sources are selected, the command is ignored.
syncpol	norm / inv	Sets polarity of 3D sync signal and thereby determines whether high level of the 3D frame synchronization square signal corresponds to the left eye 3D image or the right one.
modctrls	f / n / g	Sets the active mode control source. f – Frame sync mode control source n – Network mode control source g – GPIO mode control source

$f_{smin}$	24 – 160*	Sets the minimal frequency of 3D sync signal at which the system operates in 3D mode. This value is only used if "Frame sync" is set as mode control source. For "Network" and "GPIO" mode control source this frequency is hardcoded to 20 Hz.
$f_{smax}$	24 – 160*	Sets the maximum frequency of 3D sync signal at which the system operates in 3D mode. This value is only used if "Frame sync" is set as mode control source. For "Network" and "GPIO" mode control source this frequency is hardcoded to 160 Hz.
gpiopol	norm / inv	Sets the polarity of the GPIO input signal.

\* Parameter  $f_{smin}$  must be lower than  $f_{smax}$

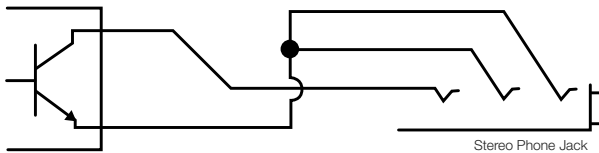
**Table 2: Recognized Network Command String Macros**

Note that there is a known issue when connecting the Trinity Polarizer to Doremi and NEC digital cinema servers which must surround the string macro with "\w" (without quotes) to ensure proper operation. This introduces a short delay when sending the macro over the network which gives the unit enough time to receive the command before the server disconnects. An example of a macro which puts the unit in 3D mode if the "Network Mode Control Source" is already selected is "\w<mode>3D</>\w" (without quotes).

## Motion Control Output

In a typical setup the Trinity Polarizer is mounted onto a motorized mount unit which can automatically move the unit in front of and away from the projector. The "Motion Control Output" on the unit is intended for connecting it to such a mount. It is through this port that the unit signals the mount to move it away from the projector when operating in 2D mode and to move it in front of the projector when in 3D mode.

The "Motion Control Output" is an open collector, optically isolated output - see diagram *in Figure 5*. By default the output is open when in 3D mode and closed/shorted when in 2D mode. This polarity can however be reversed by using the PC-based configuration utility. See section *Using the Configuration Utility -> Device General Settings*, parameter **Motion Control Polarity**.



**Figure 5: Unit's Motion Control Output Port Diagram**

# Setup and Configuration

## Installation

1. Before starting the installation process make sure the unit is turned OFF and power is unplugged.
2. Turn off the projector which will have the XPAND Trinity 3D Superlight Polarizer installed in front.
3. Position the Trinity Polarizer unit in front of the projector lens. A distance of 2 to 5 mm from the projector should be taken as a reference. The side of the unit which contains the connectors must be facing towards the projector so the light coming from the projector enters the unit through the input window, marked with (D) in **Figure 1**. The light should enter the unit **perpendicular to the input window. This is important to obtain a clear image. Failure to follow this instruction may result in an inverted and offset "ghost image" to be shown on the screen.** It is strongly recommended that the Trinity Polarizer is mounted onto XPAND's Motorized Mount MK3 unit in order to automate the movement in front of and away from the projector. This manual assumes the use of such a mount. For proper mounting of the system refer to the mount's user manual. The final setup is shown in **Figure 6**. Before proceeding, make sure the construction is stable enough for operation.

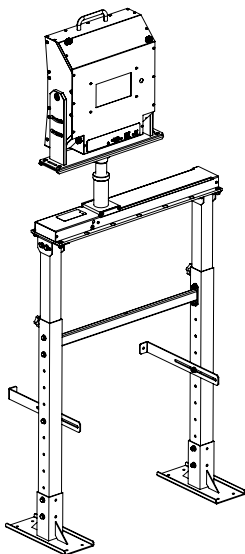


Figure 6: Final Setup

4. Connect one of the supplied GPIO cables to the GPIO connector on the projector and to the 9 pin GPIO connector on the back of the Trinity Polarizer. Two cables are supplied with the unit. Choose the correct one based on the available connectors on the projector.
5. If the unit will be controlled or configured over the network, first configure its network settings. For information on how to do this see section **Unit's Initial Network Settings Configuration**. Then connect the unit to the network using a standard RJ45 Ethernet cable. Alternatively, it can be connected directly to the projector or digital cinema server by using an Ethernet crossover cable if both are configured properly. Note that some projectors or digital cinema servers may have more than one RJ45 port and some may be used for other applications. Make sure to use the one intended for network connection.
6. If the unit is mounted on a motorized mount, go through the **Motion Control Setup Wizard** described below to properly configure the way the Trinity Polarizer moves away and in front of the projector. This step enables seamless viewing of 2D content by automatically moving the Trinity Polarizer out of the way of projector's light path when no 3D content is being shown.
7. Connect a 12 V/1A power adapter to the DC input connector on the back of the unit.
8. Using a 3D calibration Image, fine tune the position of all optical elements within the unit to get a clear and aligned 3D image on the screen. See section **Adjusting the Image Position** for more information. In order to obtain a clear 3D image it is important that this step is not left out.

## Motion Control Setup Wizard

The process below should be carried out when installing the XPAND Trinity 3D Superlight Polarizer, if it is mounted on a motorized mount unit. Such setup is crucial to ensure that the Trinity Polarizer is moved away from the projector automatically by the mount when the projector is used for 2D viewing. Likewise the mount automatically moves the unit in front of the projector when in 3D mode. Keeping the Trinity Polarizer in front of the projector when viewing in 2D degrades image quality.

**It is strongly recommended that XPAND's Motorized Mount MK3 is used in combination with XPAND Trinity 3D Superlight Polarizer. Its use is assumed in below setup steps.**

To ensure the mount always moves the unit out of the way of the projector's light path when in 2D mode, first complete steps 1 through 5 described in section *Installation* and then continue with steps listed below before proceeding to step 7.

**Warning: This process is valid only when installing a new unit which has not yet been re-configured and is still set to factory default settings. If the unit has already been re-configured and is moved to another projector, it should first be set to its factory default state before proceeding with below steps. Factory default settings can be set by using the PC configuration utility or by performing a factory reset - see the *Factory Reset* section for more information. Note however, that when performing a full factory reset as described in section *Factory Reset*, network settings are reset as well and will have to be reconfigured again to make the Trinity Polarizer accessible on the network.**

- 6a. Disconnect power from both the Trinity Polarizer and the motorized mount unit.
- 6b. Connect the polarizer's Motion Control Output to the mount by using a mono or stereo cable supplied with the motorized mount.
- 6c. Apply power to both units and wait for both to stop moving.
- 6d. Turn on the projector and start showing 3D content.
- 6e. Both the green and yellow LED on the Trinity Polarizer need to be turned ON. If the mount starts moving, wait for it to stop.
- 6f. **At this point the unit must be located in front of the projector and the light from the projector should be entering the unit's input window!** The unit is in 3D mode and a 3D image can be seen if using passive 3D glasses. Note that the image may not yet be aligned properly. See section *Adjusting the Image Position* for information on how that is done.

**If the unit is not located in front of the projector, its 3D position needs to be inverted either on the polarizer unit OR on the motorized mount unit. Not on both!**

- a. To invert the positions on the Trinity Polarizer first connect to it using the PC based configuration utility. For this the unit must be connected to a local network (LAN). See section *Unit's Initial Network Settings Configuration* for more information on how to connect to the Trinity Polarizer. Once connected, invert the 2D and 3D positions by selecting "Inverted" next to the *Motion Control Polarity* parameter. At that point the unit should start moving in front of the projector.
  - b. To invert 3D and 2D positions on the motorized mount consult its user manual.
- 6g. Stop the 3D content on the projector and start showing 2D content.
  - 6h. **At this point the unit should start moving away from the projector.** The unit is in 2D mode. If required, adjust the position of the stand, mount and/or unit to ensure that the Trinity Polarizer is completely out of the way of projector light path when in 2D mode.
  - 6i. Firmly screw and fix everything in place to avoid the whole setup being moved with time.

## Unit's Initial Network Settings Configuration

This section describes how to configure the network settings on a new XPAND Trinity 3D Superlight Polarizer unit so that it is accessible on a local area network. If more units are to be connected to the same network only one should be connected at a time while performing network configuration.

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It is suggested you consult your IT department and verify if configuring the Trinity Polarizer according to the below described procedure is compatible with your local network structure and organization.

A unit configured to its factory default settings has a default static IP address of 192.168.0.250 and a network mask of 255.255.255.0. Such configuration will make the device accessible on any local network which uses an IP address range of 192.168.0.\* and on which the 192.168.0.250 address is not yet used. Many routers use this address space by default so chances are that the unit will be accessible out of the box if connected to such a network.

However there is also a high chance that the network on which the unit is connected does not use the proper range of IP addresses and so the unit's default static IP is not supported. In such a case the Trinity Polarizer can be accessed by directly connecting it to a PC using an Ethernet crossover cable supplied with the unit and properly configuring the network settings on the PC.

The following steps need to be taken to make an initial connection to the unit and configure its network settings:

1. First, try connecting the unit directly to the local network to which it will be connected during normal operation.
2. Download the Configuration Utility from XPAND's website, install it on your PC and run it.
3. Select "Factory default device" from the "Select Device" drop-down list. This list contains all devices known to the utility and should only contain the "Factory default device" after a fresh install.
4. After confirming the selection an automatic attempt to connect to the unit will be made. This is indicated in the status bar at the bottom of the utility which should read "Please stand by. Retrieving device data...". If an automatic connection attempt is not made by the utility, initiate it manually by clicking the "Get Device State" button.
5. Two situations are possible after initiating a connection:
  - a. If the application successfully connected to the unit, then information about it will be displayed by the application and the status bar will read "Device found. Application idle.". In this case the unit's default IP is within the network's IP range and it is accessible on that network. If you plan on using only one unit on this network then the IP can be left unchanged but must be reserved on the network to avoid it being assigned to another device when the unit is powered off or disconnected from the network. Consult your IT department on how to reserve an IP address on your local network. Chances are that this can be configured on the router however configuration elsewhere on the network may be required.

Once the IP is reserved, network configuration is finished.

If however more devices will be connected to the same network, this unit's IP must be changed since each device requires a unique IP. Proceed to step number 6.

- b. The application failed to connect to the unit (status bar reads "Device not found on LAN."). First try to connect a few more times manually by pressing the "Get Device State" button. Also try restarting the device by unplugging it from power, waiting for 5 s and then plugging it back in. If this does not help, then the default IP address of the unit probably does not match the available IPs allowed by the local network to which it is connected. To establish a connection with such a unit a direct connection with your PC is needed:
      - » Unplug the network cables from the unit and from the PC.
      - » On your PC, change your network settings and assign your PC a static IP address of 192.168.0.50 and a network mask of 255.255.255.0. It is important that the IP address has the first three numbers equal to the first three numbers of the unit's IP address. These numbers are 192.168.0 when it is configured to factory default settings. For Windows 7 PC reconfiguration can be done by following below steps:
        - » Go to **Control Panel -> Network and Sharing Center -> Change adapter settings**
        - » Right-click on "**Local Area Connection**" and select "**Properties**"
        - » Select **Internet Protocol Version 4 (TCP/IPv4)** and click on "**Properties**"
        - » Remember the settings shown in the **General** tab. You will need to restore them once you finish configuring the unit.
        - » In the **General** tab select "**Use the following IP address**" and enter an IP of **192.168.0.50**, and a network mask of **255.255.255.0**. The Default gateway field can be left empty.
        - » Also select the "**Use the following DNS server addresses**" but leave the fields empty.
        - » Click "**OK**" and then "**Close**"
      - » Connect the Trinity Polarizer to the PC using an Ethernet crossover cable which is supplied with the unit.
      - » From the configuration utility retry connecting to the unit. Only proceed to step 6 once a successful connection has been made.
6. At this step a successful connection has been made to the Trinity Polarizer unit by using the PC-based configuration utility. Its IP address now needs to be changed to a valid IP for the network on which the unit will be located during normal operation. First, one such IP address must be found.
  - » If possible, you should consult your IT department and have them assign and reserve a free IP address which can be permanently used by the Trinity Polarizer unit.
  - » Alternatively you can try and reserve an IP for the unit yourself by properly configuring the network. In some cases all that is needed is reserving the IP address on the router, if the unit is connected to one and the network is configured accordingly (see

the router's user manual for more information). However, depending on your network's configuration, IP address reservation may need to be done elsewhere on the network.

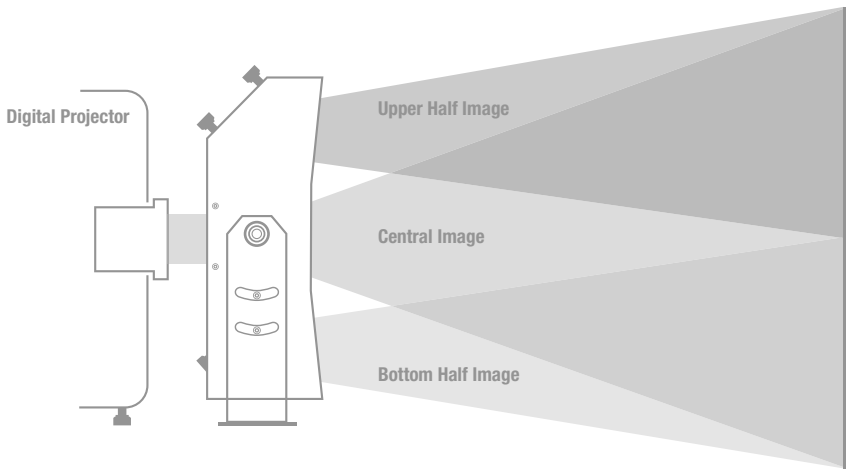
- After step 5, the PC-based Configuration Utility should still be connected to the Trinity Polarizer unit and its IP address can now be updated with that acquired in step 6. To do so press the "Change Network Settings on Device" button. This enables changing of network settings on the connected device, including its IP address. Enter the new IP address from step 6 in the "Device IP" field. If the unit and the device which will be controlling it are on the same subnetwork then the network mask should be set to 255.255.255.0 and the default gateway setting is not critical. However if they are on different subnetworks, the mask and default gateway should be configured properly based on your network's structure. Consult your IT department for help.
- Remember the new IP which you entered!** To send it and other network settings to the device press the "Confirm New Network Settings" button. **Warning! If you assign an invalid address to the unit you will no longer be able to access it over the network! You will be able to access it again by connecting it directly to your PC as described in step 5b) if setting the PC's static address so that the first three numbers are the same as those of the unit's IP which you have just set. So if you set the IP address to 1.2.3.4 you will only be able to access it directly from your PC as described in 5b), if setting the PC's static IP address to 1.2.3.\* (excluding 1.2.3.4).**
- Since the unit's IP has now been changed a new device must be added to the list of known devices inside the configuration utility. Click the "Add new device" link and enter a device name, its new IP and make sure the port is set to 1000. An attempt to connect to this device will then be made. If you were configuring the unit by direct connection with a crossover cable this attempt will fail and you have to connect the Trinity unit and the PC to their respective networks (make sure to first reset you PC network settings you may have changed in step 5b). If an automatic connection attempt is not made by the utility, initiate it manually by clicking the "Get Device State" button.

Once a successful connection is made, device information read from the unit will be updated in appropriate fields of the configuration utility.

**Note:** The network may require some time to refresh its list of known devices and accept the new IP address for the unit. If reconnection fails, try waiting a minute or two before trying again. You can also disconnect the device from the network during that time.

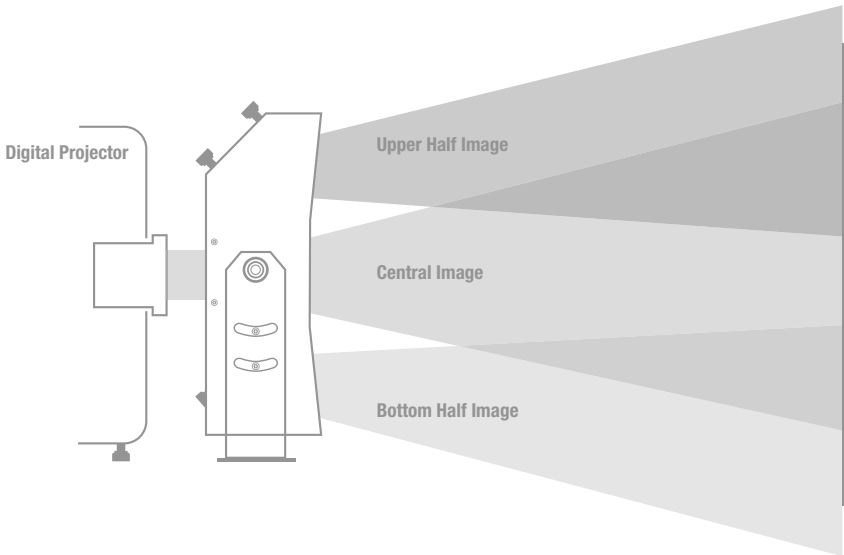
## Adjusting the Image Position

Internal workings of the Trinity Polarizer are such, that the incoming image from the projector is split into three separate images which are then reunited on the screen. One of the three images is a 3D image for one eye - central image. The 3D image for the other eye is split horizontally into an upper and bottom half image. On the screen the two halves need to be aligned to each other as well as to the central image. **Figure 7** shows the concept just described. Note that the split image is not split sharply in the middle but tends to fade out towards the top and bottom edge.



**Figure 7: Trinity Polarizer Image Splitting**

**Figure 8** shows an example of unaligned images. The height of the central image is not equal to the sum of heights of the two split images. Additionally the two split images are not aligned to each other nor to the central image. This must be corrected to obtain aligned images as shown in **Figure 7**. Note that the images may also be misaligned horizontally, which is not shown in the two 2D figures (**Figure 7** and **8**).



**Figure 8: Misaligned Trinity Polarizer Image Splitting**

To align the three images and obtain a clear 3D image on the screen a combination of adjusting the zoom on the projector, main image scale adjustment on the unit and vertical and horizontal adjusting of the two split images on the unit is needed. To make adjusting of the images easier it is suggested that a suitable 3D calibration image is used.

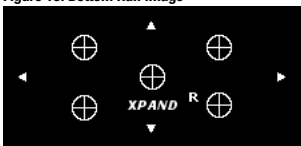
Many 3D calibration images exist and any one of them can be used for calibration of the Trinity Polarizer. However some images are more appropriate than others. It is suggested that XPAND's dedicated 3D calibration image shown in **Figure 12** is used for calibrating the Trinity Polarizer. When using this calibration image, three images shown in **Figure 9, 10, and 11** are projected onto the screen. In order to calibrate the system all images must be aligned in a way that when superimposed on the screen, image shown in **Figure 12** is obtained. Note that the "R" and "L" signs can be reversed, depending on the 3D Sync Polarity setting on the projector or the Trinity Polarizer.



**Figure 9: Upper Half Image**



**Figure 10: Bottom Half Image**



**Figure 11: Central Image**



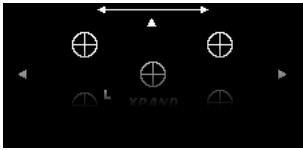
**Figure 12: Final Calibrated Image**



In order to properly position all three images screws F, G, H, I and J shown in **Figure 1** should be used. See figures 13 through 17 to see how all images are positioned using the screws.

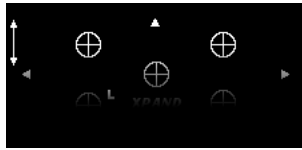
**To allow fine positioning of the optical elements inside the polarizer, all screws are fine pitched with a fine thread. This makes the screws sensitive to over tightening. Extra care should be taken when rotating them!**

Top half image horizontal frame adjustment screw G moves the upper half image left and right as shown below.



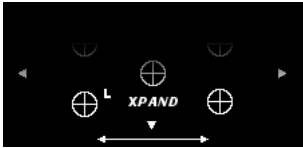
**Figure 13: Top Image Horizontal Adjustment using Screw G**

Top half image vertical frame adjustment screw F moves the upper half image up and down as shown below.



**Figure 14: Top Image Vertical Adjustment using Screw F**

Bottom half image horizontal frame adjustment screw J moves the bottom half image left and right as shown below.



**Figure 15: Bottom Image Horizontal Adjustment using Screw J**

Bottom half image vertical frame adjustment screw I moves the bottom half image up and down as shown below.



**Figure 16: Bottom Image Vertical Adjustment using Screw I**

Central image scale adjustment screw H expands and shrinks the central image as shown below. Note that this adjustment is mostly seen with short-throw projectors and that the adjustment is usually only noticeable in the corners of the image.



**Figure 17: Central Image Scale/Zoom Adjustment using Screw H**

Once all images are aligned as much as possible, the proper polarity of the 3D calibration image should also be verified. When looking at the aligned image through the right lens of a pair of circularly polarized passive 3D glasses, the "R" text should be visible on the screen and text "L" should not be seen. Similarly only the "L" text should be seen when observing the screen through the glasses' left lens. If the texts are seen through the wrong lens, invert the 3D sync signal polarity either on the projector or by using the PC configuration utility - see section **Using the Configuration Utility**, part **Device General Settings** parameter **3D Sync Signal Polarity**.

## Recommended Projector Settings for XPAND Passive 3D Cinemas

- » Dark time: 450  $\mu$ s
- » Output reference delay: -100  $\mu$ s

Parameters listed below are more a function of the DCI server and/or the projector than a function of the Trinity Polarizer so given values should be taken as reference only and modified if the expected results are not obtained:

- » L/R Output Reference Polarity: Inverted (change, if 3D image appears inverted).
- » L/R Display Reference: Not Used
- » L/R Input Reference: Use input reference - frame seq mode (polarity = true)
- » Input frame dominance: Left (L1R1 L2R2)

Note that on some projectors above setting for the “L/R Input Reference” parameter may not work. In such a case the following values should be tried before modifying any other settings:

- » Use line interleave where first line = Left, second line = Right
- » Use active data port, Port A = Left, Port B = Right
- » Use selected input port/polarity = true

## Unit Configuration Using the PC Based Configuration Utility

### Overview

The XPAND Trinity 3D Superlight Polarizer features a PC-based setup and configuration utility which can be used for changing advanced settings on the unit. Its default settings enable it to work out of the box so no configuration is required. However, based on the system with which the unit is used, some settings may need to be changed to ensure desired operation.

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The PC configuration utility is subject to updates so make sure to check the help file bundled with each release for up to date information about its features and functionality!

The configuration utility is made up of six parts:

- (1) Device Selection - Selecting and connecting to a unit.
- (2) Device Network Settings - Unit's network settings information and control.
- (3) Device Information - General information about the connected unit.
- (4) Device General Settings - Information and control of connected unit's general settings.
- (5) Device Mode Control Settings - Information and control of connected unit's settings pertaining to its mode control source.
- (6) The Menu Bar - Additional features related to the configuration utility and connected unit.

### Using the Configuration Utility

The list below only gives a general description of configuration utility's features. For a more detailed and up to date explanation see the configuration utility's help file.

#### Device Selection and Connection

In a common setup a cinema theatre will have more than one cinema hall equipped with XPAND's 3D systems which support Ethernet control and the operator will be able to access all of them from the same PC. To distinguish between all connected devices a “known devices list” needs to be maintained. This section is used to manage such a list of known devices, connect to them and display and change the information about each one. The section features the following controls:

- » **Select Device drop-down list:** Used to select a device to connect to from a list of devices known to the utility. Devices must be added manually. See “Add new device” control description below.
- » **Get Device State button:** By pressing this button the utility attempts to connect to the currently selected device and retrieve its configuration which it then displays.
- » **Device info:** Clicking on this control displays information about network parameters of the device currently selected in the “Select Device” drop-down list as known to the configuration utility. A pop-up window which displays this information also allows modifying these parameters in the list. Note that if the actual settings of the unit are modified from PC A, the ones stored by the configuration utility on PC B will have to be updated manually through the Device Info pop-up window.
- » **Add new device:** Opens a pop-up window which can be used to enter network parameters of a new device and add it to the list of known devices.
- » **Delete selected device:** Deletes the currently selected device from the list of known devices.

#### Device Network Settings

This section displays the connected unit's network settings as set on the device and also allows changing them. The fields and controls listed below make this possible.

**WARNING:** Modifying device network settings can make the device unreachable over the network if the wrong values are used. It is advised you consult with your IT department before making any changes. New devices on the network may be blocked by the local network if strong security is implemented. Your IT department must add the new device to their known devices list in order for them to be reachable over the network.

- » **Change Network Settings on Device button:** If a device is connected, pressing this button enables the user to modify its network settings. Its IP address, network mask and default gateway can be changed. Once the button is pressed, the "Device IP", "Device Network Mask" and "Device Default Gateway" information becomes editable, the button is transformed into a "Confirm New Network Settings" button and an additional "Abort" button is shown. When new values are entered they are sent to the device by pressing the "Confirm New Network Settings" button. The process is aborted by pressing the "Abort" button.
- » **Device IP:** Displays the IP address of the currently connected device.
- » **Device MAC:** Displays the MAC address of the currently connected device.
- » **Device Network Mask:** Displays the network mask of the currently connected device.
- » **Device Default Gateway:** Displays the default gateway of the currently connected device.

## Device Information

This section displays general information about the connected device.

- » **Device ID:** Displays the ID of detected device (e.g. XPS2A).
- » **Firmware Version:** Used to identify the FW version loaded on the unit.
- » **Current 3D Sync Frequency:** Reports whether a synchronization signal is detected on the unit's 3D sync GPIO input. Validity of the signal and its frequency are reported. Whether a signal is valid or not is determined based on the currently set low and high frame sync frequency settings. See parameters for **3D Sync Low Threshold Frequency** and **3D Sync High Threshold Frequency** described below.
- » **Current Mode:** Reports whether the connected unit is currently operating in 2D or 3D mode.
- » **GPIO Logic Level:** Displays the logic level detected on unit's GPIO input and the resulting mode of operation (e.g: Open Loop, 2D). Note that the mode reported here may not be the same as the "Current Mode" described above if a control source other than GPIO is selected.

## Device General Settings

This section displays and enables modification of general settings of the connected device.

- » **3D Sync Signal Polarity:** Can be used to determine and change the interpretation of the incoming 3D sync synchronization signal's levels. "Normal" setting interprets a high level of the synchronization signal as corresponding to the left eye 3D image. If set to "Inverted", the high level is interpreted as corresponding to the right eye 3D image. So this parameter can be used to invert the left and right eye 3D images if needed. This is usually done when 3D content seems "unnatural" and uncomfortable.
- » **Motion Control Polarity:** Polarity of the motion control output signal. See section **Motion Control Output** for more information.  
**WARNING:** This parameter should not be used as a way of changing the unit's position when attached to a motorized mount!!! This is a global setting which should be configured if needed when first installing the device on a motorized mount in front of the projector. See the **Installation -> Motion Control Setup Wizard** section of this manual for more information on how to properly set up and configure the unit and motorized mount.
- » **Global Delay:** Delay between the 3D sync edge and the start of the left/right-eye open intervals. Valid values are between 0 - 65535  $\mu$ s. Default value is 120  $\mu$ s. If the value exceeds the current value of the frame synchronization signal period, the delay parameter is ignored.  
To set global delay on the unit, enter a new value and press the "Enter" key to confirm the change.

## Device Mode Control Settings

This section displays and enables modification of settings relating to control of conditions which have to be met in order for the device to transition between 2D and 3D modes.

- » **Mode Control Source:** Defines the mode detection method or in other words the source which determines whether the unit should operate in 2D or 3D mode. See the **Mode Control Sources** section of this manual for more information on each mode control source.
- » **GPIO Signal Polarity:** Determines how the GPIO mode control source's input state is interpreted. Normal polarity means that an externally applied short circuit between pins 3 and 8 on the unit's GPIO connector sets 3D mode. "Inverted" setting interprets that same short circuit as 2D mode.
- » **3D Sync Low Threshold Frequency:** For "Framesync" mode control source this value sets the minimal frequency at which the incoming 3D synchronization signal is still considered as valid. If the unit is in 3D mode and the frequency is above this limit

(and below the high threshold - see next parameter), the unit starts modulating the incoming light and 3D viewing is possible. Valid values are between 24 and 160 Hz with a requirement that the low threshold frequency is lower than the high threshold frequency - see next parameter.

For "Network" and "GPIO" mode control source this frequency is hardcoded at 20 Hz.

To set the low threshold frequency on the device, enter a new value and press the "Enter" key to confirm the change.

- » **3D Sync High Threshold Frequency:** Maximal frequency at which the incoming 3D synchronization signal is still considered as valid. If the unit is in 3D mode and the frequency is below this limit (and above the low threshold - see previous parameter), the unit starts modulating the incoming light and 3D viewing is possible. Valid values are between 24 and 160 Hz with a requirement that the high threshold frequency is higher than the low threshold frequency - see previous parameter.

For "Network" and "GPIO" mode control source this frequency is hardcoded at 160 Hz.

To set the high threshold frequency on the device, enter a new value and press the "Enter" key to confirm the change.

## The Menu Bar

Most of the menu's items are self-explanatory and intuitive. However the following submenu items deserve some additional explanation:

- » **Restore Default Settings:** Selecting this item enables resetting the currently connected device to its default settings. Note that the network settings remain unchanged and only the "functional" ones are reset. Resetting also the network settings would very likely make the unit not accessible on the network without repeating the initial network settings configuration again. If a reset of network settings is required, a full factory reset of the unit should be performed. See section **Factory Reset** for instructions on how that is done.
- » **Check for Updates:** By selecting this submenu item, the application connects to XPAND's server and checks if any updates are available for the configuration utility. If a newer version of the utility exists, the user can choose to download and install it. During the installation, the previous current version will be uninstalled. It is advised that you regularly check XPAND's website for new releases, especially if you experience any issues with the existing version.

## Maintenance

### Input and Output Window Cleaning

Both the input and output window of XPAND Trinity 3D Superlight Polarizer should be examined regularly for dirt, dust or stains. Clean windows are important for obtaining a clear and sharp 3D image.

The preferred method for cleaning the windows is to use compressed air of low pressure. This removes any dirt and dust.

For removing stains such as fingerprints and smudges clean the windows by wiping them lightly with a smooth, dry cloth to prevent any scratches. If needed, the used cloth can be slightly damp.

Take special care not to scratch the windows.

After cleaning make sure the unit is still positioned correctly and the light from the projector is still perpendicular to the input window.

## Product Specifications

Product Name	XPAND Trinity 3D Superlight Polarizer
Model Name	HB105C2
Compatibility	DCI projectors
HFR Ready	Yes

Required Silver Type	Silver Screen
Minimum Throw Ratio	1.25 : 1
3D Technology	Triple beam polarization modulator
Polarization	Circular Polarization (Circular Polarization Glasses)
Transmittance	70%
Efficiency	28%
Stereoscopic Contrast	130 : 1
Dark Time	450 $\mu$ s
Maximum Lamp Power	7 kW
Input Stereo Sync Signal Frequency	24 Hz to 160 Hz, HFR support. All commonly encountered frequencies are supported: 48 Hz, 50 Hz, 60 Hz, 72 Hz (triple flash 24 Hz cinema), 96 Hz (double flash 48 Hz HFR cinema), 120 Hz (double flash 60 Hz HFR cinema)
Input Terminal 3D	GPIO 9 pin DB9 male connector. <b>Converter cables to DB15 and DB37 connectors commonly found on projectors are included. Contact XPAND for other converter cables.</b>
Input LAN	8P8C (RJ-45/Ethernet) Connector
“MOTION CONTROL” Output Terminal	Stereo (a cable with stereo or mono 3.5 mm plug can be used)
STATUS LED	LED Indication - Green
SYNC / 3D MODE LED	LED Indication - Amber
Weight	12,2 kg +/- 0,1 kg (26.9 lbs) - accessories not included
Size	380 mm x 390 mm x 125 mm (15.0" x 15.4" x 4.9") - W x H x D
Input Window	126 mm x 70 mm (5.0" x 2.8")

Storage Temperature	-20 ~ 85 °C (-4 ~ 185°F) – noncondensing!
Operating Temperature	0 ~ 60 °C (32 ~ 140°F) – noncondensing!
Relative Humidity	20% – 90%
Material	Case Material (Main material): Aluminium
Colour	Black
Power Input	DC 12 V/1A
Power Consumption	3D operation: 4.2 W; 2D mode: 1.2 W
Mount	XPAND Motorized Mount MK3 is suggested
Mount Control	server (TCP / IP); projector (GPIO); projector (3D sync signal); manual (button)

## General Health and Safety Warnings

### 1. May Trigger Seizures

Some people have a condition that can cause them to experience seizures or lose consciousness momentarily while viewing certain kinds of flashing lights or patterns. These persons may have seizures while watching certain kinds of television pictures or playing certain video or computer games. Persons who have not had any previous seizures may still have an undetected seizure condition. People who have experienced symptoms linked to a seizure condition, including experiencing seizures or loss of awareness, or people with family members who have experienced such symptoms, should consult their physician before viewing 3D media. We recommend that Parents or Guardians observe their children while the children view 3D content. 3D content viewing should immediately be discontinued in case adults or children experience any of the following symptoms: dizziness, altered vision, eye or muscle twitching, involuntary movements, loss of awareness, unconsciousness, disorientation, or seizures. Do not view 3D content for extended periods of time.

### 2. May Cause Eye Fatigue

Some users have reported dizziness, headaches, or eye fatigue as a result of viewing media in 3D. 3D content viewing should immediately be discontinued in case adults or children experience any of these conditions. Do not view 3D content for extended periods of time. Parents or Guardians should limit use by children to no more than a few hours per day.

### 3. Young Children

The vision of young children (especially children under the age of six) is still under development. Consult your doctor (such as a paediatrician or eye doctor) before allowing young children to watch 3D video images or play 3D videos games. Parents or Guardians should supervise young children to ensure they follow these recommendations.

### 4. Choking hazard: Keep out of reach of small children.

Babies and young children could choke on small pieces associated with 3D glasses and related equipment. Keep the 3D polarization unit and 3D glasses out of reach of small children.

### 5. Stereoscopic viewing may cause a slight after-effect in vision.

Your eyes change to accommodate viewing through 3D glasses. Wait a few moments after you remove the 3D glasses for your eyesight to return to normal before resuming your regular activities.

6. Do not use 3D glasses for purposes other than viewing 3D visual content.

Do not wear 3D Glasses as sunglasses or safety glasses. Never wear 3D glasses while driving, swimming, or operating machinery. Do not use near staircases, ledges or balconies. You may risk falling during or after use.

## Regulatory Compliance Statements

Caution: Any changes or modifications to this equipment not explicitly approved by X6D Limited shall void the user's authority to operate it.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Hereby X6D Limited declares that the HB105C2 is in compliance with the essential requirements and other relevant provisions of the EU Directive 2004/108/EC. The declaration of conformity may be consulted at <http://www.xpandvision.com/products/xpand-trinity/doc/>

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