BlackTrax Wiki

A Complete BlackTrax User Wiki

About this Manual

Table of contents:

About Introduction

This wiki provides instructions for the installation, configuration and operation of the BlackTrax system.

An offline copy of the wiki can be downloaded below. This version is current as of June 2020 .

A BlackTrax License will authorize the use of the BlackTrax system for a restricted number of output connections based on the type of License that was purchased. For more information, go to Licensing.

Text Conventions

The following text conventions are used in this wiki:

- Instructions titles appear in **Bold and Orange**. For example, "**To view a BTCamera’s video feed in the visible spectrum**"
- Menus and menu commands appear in **Bold and Navy**. For example, “To open the window if closed, go to the **View** menu and click **Cameras**.”
- User interface elements such as buttons, tools, shortcuts, and dialog boxes appear in *Italics and Medium Blue*. For example, “To close the project, click *Yes*.”
- Keyboard keys are indicated in CAPITALS AND BLUE. For example, “To call up the save menu, enter in the command CTRL+SHIFT+B.”
- References to manuals appear in *Italics Underlined in Blue*. For example, “For an in depth understanding on BTWYSIWYG and its capabilities, please refer to the *WYSIWYG Reference Guide.*”
- Instructions to direct you to different features of the BTSystem or areas in the physical Space are indicated by being Green and Underlined. For Example “In the Physical Space, take the BTBeacon.”

BlackTrax System Overview

BTSensor Installation

Table of contents:

Environment Considerations for BTSensor Installation

The environment of the Space has a great impact on the capacity of BlackTrax to function as intended. When you install the BTSystem, always remember the following precautions to limit interference and make the ideal tracking environment.

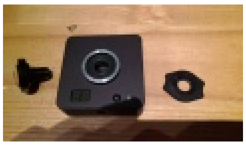
- **Infrared interference:** External infrared sources and reflections may cause interference with BTSensors. For best results, ensure the venue is free from sunlight, lights which emit infrared spectrum, infrared based devices, fire, and highly reflective materials. For infrared sources and reflections which cannot be removed from the venue, there are provisions within the software to mask out the affected areas of the BTSensor's field of view.
    - **Note:** Infrared interference is more critical during the BTSensor calibration than during tracking operation. Since the BTSystem looks for a unique signal during tracking, there is some tolerance for other infrared sources.
- **Reflective surfaces:** Reflective materials that are present in a venue might reflect and mimic a BTBeacon's unique LED pulse, creating errors with tracking. Complex objects inside the tracking area must be covered to block reflections. Reflective objects outside the tracking area can be blocked out.
- **Cabling:** Ethernet connected BTSensors are subject to the limitation of Ethernet communication standards. The total Ethernet connection between any component to the BTServer can not be longer than 91.44m for BlackTrax to function correctly. This range may be extended with a PoE switch to link cables together.
- **Sensor stability:** Ensure that the location where you choose to install BTSensors is stable, sturdy and always stationary. Any movement of a BlackTrax sensor will require recalibration of the entire sensor system.
    - **Example:** If a BTSensor is hung on a truss system which sways, the accuracy and performance of the BTSystem will be affected. If the sway is small, you can decrease accuracy in the system and may be able to track with lesser accuracy.
- **Sensor blocking:** Ensure that BTSensors have an unimpeded view of the intended tracking area. Multiple BTSensors need to see the same area at the same time for tracking to occur. Care should be taken to ensure temporary objects do not obscure tracking.

Installing a BTSensor Lens

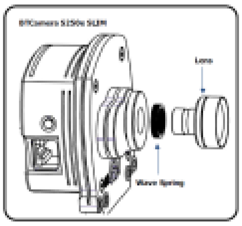
To install a BTSensor lens

Note: Only used on s250e and Slim 13E sensors.

1. Screw the lens onto the BTSensor with the included plastic lens tensioner between the M12 lens adapter and the lens itself. Tighten until proper focus is achieved.
2. Once you achieve the desired focus, hold the lens in place while you tighten down the lens tensioner.



Note: The s250e comes with a spring for the lens instead of a tensioner. No tightening is required for this lens.



BTSensor Placement and Orientation

In order for tracking to function correctly, multiple BTSensors must be arranged to have overlapping fields of view of the Space. A BTSensor's field of view is the part of the Space that is visible through the BTSensor while the BTSensor is in a fixed position and orientation.

Attention: Sensors must not be installed closer than 1m apart to help ensure optimal sensor calibration. Good sensor placement and orientation are absolutely critical to proper operation of the BTSystem!

BTSystem Hardware Configuration

Table of contents:

BTSystem Configuration

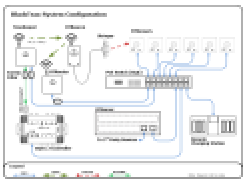
System Configuration Overview

Hardware modules that connect directly to the BTServer should be located in the same location outside of the tracking area. BTSensors must be positioned where they will not be disturbed and have the best unblocked view of the tracking area. TimeKeeper, BTRouter and eSync 2 Controller can be positioned closer to the tracking space.

The following diagram outlines a typical hardware configuration and demonstrates how all BlackTrax hardware modules are connected together.

Attention: The Timekeeper and BTRouter Ethernet port are designed only to connect to a commercially available Power over Ethernet (PoE) network switch. The TimeKeeper and BTRouter are not designed to be a peripheral device to a Class B personal computer. As such, the Ethernet port shall not be connected to a Class B personal computer in any operating configuration.

BlackTrax System Configuration Diagram

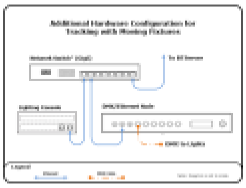


Optional Equipment Configuration

Optional Equipment Overview

Depending on your tracking needs, additional components must be connected with the BTSystem. The following outlines how to connect this optional equipment with the BTSystem.

Tracking with Moving Light Fixtures Diagram



BTSystem Components

Table of contents:

Standard System Components

List of Standard System Components

Note: The quantity of BTSensors, BTBeacons, BTSmart Chargers, and Stringers delivered with a BTSystem are dependent on each user’s needs and on the individual sale.

- (1) BTServer (pre-installed software below)
  - Hardware secured inside the server
    - BTX Dongle
    - Motive Dongle
  - Pre-installed software
    - BTWYSIWYG
    - Motive for BlackTrax
    - BlackTrax Software Suite
    - Device Manager
- (1) BTRouter
- (1) TimeKeeper
- Ferrite filters
- (1) eSync 2 Controller*
  - BNC/RCA Adapter
- BTSensors
- BTBeacons
- Mini Beacons
- Stringers
- BTSmart Charger
- Sync Dock
- (1) BTCalibration Kit
  - (1) BTCalibration Wand Head
  - (1) BTCalibration Triangular Wand Holder
  - (1) BTCalibration Telescopic Wand Handle
  - (1) BTCalibration Ground Plane
  - (1) BTCalibration Hybrid Power Supply Unit
  - (1) BTLighting Calibration Wand
  - (1) Carrying case

Attention: *The original eSync Controller is discontinued.

Not Included Mandatory Components

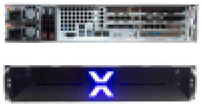
- Category 6 Ethernet cable
- Power over Ethernet (PoE) gigabit Switch

Optional Components

- DMX/Ethernet Node (for tracking with moving lights)
- Additional Power over Ethernet (PoE) gigabit Switches

BTServer

BTServer 2.0 (Rev 5)



Product ID

- **Model:** BTServer 2.0 (Rev 5)

Physical Characteristics

- **Width:** 48 cm (19")
- **Height:** 9 cm (3.5")
- **Depth:** 48.5 cm (19")
- **Weight:** 15.2 kg (33.5 lb.)

Operating Temperature

- 0°C - 40°C

Technical Specifications

BTServer 2.0 (Rev 5):

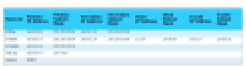
- (2x) Intel Xeon Silver 4110 @ 2.1GHz (3.00 GHz Turbo, 2400 MHz, 11M L3 Cache, 8 Core, 85W)
- (2x) 2.5" 480GB SSD SATA in RAID1 on LSI MegaRAID SAS 9341-4i
- 32GB (8x4GB) RAM (DDR4, ECC, 2666 MHz)
- Nvidia GeForce GTX1060 with 6GB GDDR5
- 100-240VAC, 800W redundant power supply with IEC
- (2x) Intel I350 Quad-Port Gigabit Ethernet Controller (1 dedicated, 1 definable)
- Windows 10 IoT Enterprise LTSB 2016

Default User Login

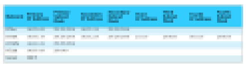
- **User name**: btuser

Note: There is no password associated with the default user account for the BTServer

Default Network Address (Main)



Default Network Address (Backup)



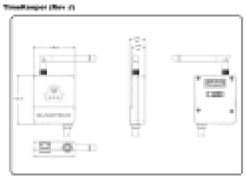
Note:

- The BTServer is built with 2 Network Interface Cards (NIC) with 4 ports on each card, and the functions are: (see BlackTrax detailed system diagram)
  - Port 1: BTNet (PoE Switch - Tracking, BTSensors, BT Smart Chargers)
  - Port 2: RTTrPL and Lighting Input (Network Switch - Lighting)
  - Port 3: RTTrPM (Network Switch - 3rd Party)
  - Port 4: BTLink (links to BTServers)
  - Port 5-8: (User Defined)
- Lighting Input and RTTrPL are combined into the RTTrPL port.
- BTLink is the network connection link to the other BTServers.

Attention: Windows Remote Desktop Connection should not be used with a BlackTrax system. Security measures on the BTX dongle installed in the BTServer will prevent it from working. Users should use TeamViewer or VNC if remote access to a BTServer is required.

TimeKeeper

TimeKeeper (Rev J) Diagram



Product ID

- **FCC ID**: RKT-BTTKV01
- **IC**: 10858A-BTTKV01
- **Model number:** BTTKV01

Physical Characteristics

- **Width**: 6.46 cm (2.545")
- **Height**: 7.50 cm (2.951")
- **Depth**: 2.50 cm (0.968")
- **Weight**: 86.64 g (3.056 oz)

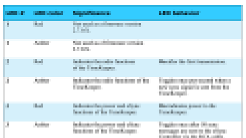
Operating Temperature

- 0°C to +40°C (32°F to 104°F)

Input/Output & Power

- **Data**: Ethernet, Radio 2.4(GHz) 10Hz
- **Power**: 48VDC/15.6W from PoeE Network Switch via Ethernet port (No input power via USB port)

Status LEDs



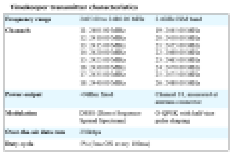
Note: The Ethernet status lights on the TimeKeeper are not enabled while the TimeKeeper is in use.

TimeKeeper Functions

The TimeKeeper is a single wireless access point that uses a proprietary radio system running on the 2.4 Ghz frequencey to send data to all BTBeacons. Data sent includes a signal used to synchronize the BTBeacons with the BTSensors and configuration commands sent to the eSync Controller via a BNC cable.

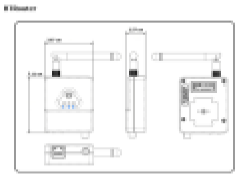
When USB based cameras are used in BlackTrax, TimeKeeper is connected to the Sync port of an OptiHub via RCA connection. USB camera systems require different synchronization settings for Motive. TimeKeeper must be configured in the Device Manager for the specific use of USB camera systems.

TimeKeeper Transmitter Characteristics



BTRouter

BTRouter Diagram



Product ID

- **FCC ID**: RKT-BTTKV01
- **IC**: 10858A-BTTKV01
- **Model number** BTTKV01

Physical Characteristics

- **Width**: 5.7 cm (2.245")
- **Height**: 7.11 cm (2.8")
- **Depth**: 2.57 cm (1.013")
- **Weight**: 125 g (4.41 oz)

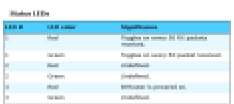
Operating Temperature

- 0°C to +40°C (32°F to 104°F)

Input/Output & Power

- **Data**: Ethernet, Radio 2.4(GHz) 10Hz
- **Power**: 48VDC/15.6W from PoE Network Switch via Ethernet port (No input power via USB port)

Status LEDs

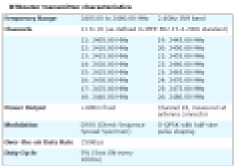


BTRouter Functions

The BTRouter is a single wireless access point that uses a proprietary radio system running on 2.4 Ghz frequency to receive data from all BTBeacons. Data received includes BTBeacon button presses, battery status, configuration details as well as inertial measurement unit (IMU) data. IMU data can be used to calculate the BTBeacon's orientation.

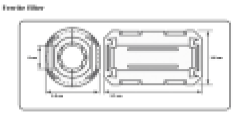
Note: Upon delivery of a new BTSystem shipment, the IMU on most of the Beacons included are disabled by default, and the IMU of the Beacon with ID 1 will be switched on by default to help with Fixture Calibration.

BTRouter Transmitter Characteristics



Ferrite Filter

Ferrite Filter Diagram



Product ID

- **Manufacturer**: API
- **Model number**: BF1835

Physical Characteristics

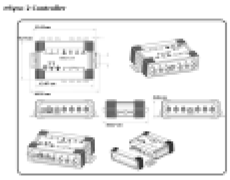
- **Width**: 1.8 cm (0.709”)
- **Height**: 1.96 cm (0.776”)
- **Depth**: 3.48 cm (1.378”)
- **Center diameter**: 0.89 cm (0.354”)
- **Weight**: 15 g (.53 oz)
- **Operating temperature**: 0°C to +40°C (32°F to 104°F)
- **Impedance**: 172 Ohm

Ferrite Function

The ferrite filter is a cylindrical clamp fastened over cables to conform with regulatory standards. A ferrite filter must be clamped over any cables connected to the TimeKeeper and BTRouter. Ferrite filters should be fastened on any connected cables as close to the respective device as possible.

eSync 2 Controller

eSync 2 Controller Diagram



Physical Characteristics

- **Width**: 13.89 cm (5.47”)
- **Height**: 4.09 cm (1.61”)
- **Depth**: 9.25 cm (3.64”)
- **Weight**: 368.54 g (13 oz)
- **Operating temperature**: 0°C to +40°C (32°F to 104°F)

Input/Output & Power

- **PoE**: IEEE 802.3af-2003
- **Adapter**: 12V @ 0.6A power supply
- **Data**: Ethernet

Status LEDs

- Per port activity status
- Master time
- External lock
- Ethernet link status
- Ethernet activity

eSync 2 Controller Functions

The eSync 2 Controller synchronizes BTSensors so that the shutters of BTSensors open and close simultaneously and in synchronization with the pulsing of LED Stringers attached to BTBeacons.

eSync 2 Controller Connection to the TimeKeeper

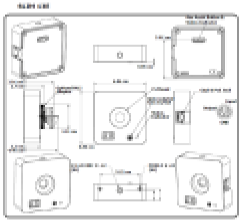
The eSync 2 Controller connects to the TimeKeeper over RCA cable. A BNC/RCA adapter is used to plug the RCA into input 3 of the eSync 2 Controller.

BTSensors

Table of contents:

SLIM 13E

SLIM 13E Diagram



Product ID

- **Model number**: CAM-CAM-S13

Physical Characteristics

- **Mounting**: 0.635 cm (1/4”)-20 tripod thread
- **Operating temperature**: 0°C to +51°C (32°F to 123.8°F)
  - **Note:** Warm-up time of 30 minutes is recommended for optimal tracking performance. Watch out for condensation when used in temperatures below 0°C.
- **Case**: Aluminum and Polycarbonate
- **Width**: 6.86 cm (2.7”)
- **Height**: 6.86 cm (2.7”)
- **Depth**: 2.3 cm (0.9”)
- **Weight**: 320 g (11.29 oz)

Lens & Filter

- **Stock lens**: 5.5 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 56°
  - **Vertical FOV**: 46°
- **Optional Lens**: 8.0 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 42°
  - **Vertical FOV**: 34°
- **Optional Lens**: 3.5 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 82°
  - **Vertical FOV**: 70°
- Adjustable focus with wave spring assist
- 850nm band-pass filter
- 850nm (Infrared) / 700nm (Visible) Filter Switcher

Image Sensor

- **Resolution**: 1280 × 1024
- **Frame Rate**: 30–240 FPS (100 FPS average usage)
- **Accuracy**: Sub-millimeter
- **Latency**: 4.2 ms
- **Shutter type**: global
- **Shutter speed**:
    - **Default**: 0.5 ms (500 µs)
    - **Minimum**: 0.01 ms (10 µs)
    - **Maximum**: 3.9 ms (3,900 µs) at 240 FPS

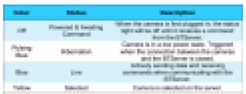
Input/Output & Power

Data: Ethernet
Synchronization: Ethernet
Power: (PoE) 8.0 watts

Sensor Status

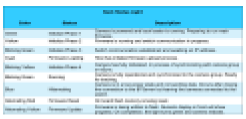
Front Light Status

The Slim Series sensors have a front LED status light to indicate their current state in relation to the BTServer. The following table lists the default status light colors.



Back Light Status

The Slim Series sensors also have a status indicator on the back panel and indicates the state of the sensor only. When updating the software on your BTServer, the sensor may need a firmware update in order to communicate to the new version. Firmware updates are automatic when starting the connection to the BTServer. If you revert back to an older version of the firmware as well. This process is automatic.



BTSensor Functions

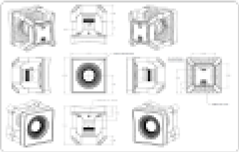
BTSensors are used to view BTBeacon positions in the Space. A BTBeacon's position in 3 dimensions (X, Y, and Z) can be determined when two or more BTSensors simultaneously have a direct line-of-sight to a connected Stringer’s LED. This information is then sent to the BTServer.

Attention:

- The switch must provide consistent power to every port simultaneously in order to power each sensor.
- Standard PoE switches must provide a full 15.4 watts to every port simultaneously.
- Note that PoE Midspan devices or power injectors are not suitable for Ethernet camera systems.

PRIME 41

PRIME 41 Diagram



Product ID

- **Model number:** CAM-CAM-P41

Physical Characteristics

- **Mounting:** 0.635 cm (1/4")-20 tripod thread (x2)
- **Operating temperature:** 0°C to +51°C (32°F to 123.8°F)
  - **Note:** Warm-up time of 30 minutes is recommended for optimal tracking performance. Watch out for condensation when used in temperatures below 0ºC.
- **Case**: Aluminum and Polycarbonate
- **Width**: 12.6 cm (4.96”)
- **Height**: 12.6 cm (4.96”)
- **Depth**: 13.6 cm (5.34”)
- **Weight:** 1.45 kg (3.2 lb)

Lens & Filter

- **Stock lens**: 12 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 51°
  - **Vertical FOV**: 51°
- Adjustable focus and f-stop
- 850nm band-pass filter

Image Sensor

- **Resolution**: 2048 x 2048
- **Pixel Size**: 5.5 µm x 5.5µm
- **Frame Rate**: 30–180 FPS (adjustable)
- **Latency**: 5.5ms
- **Shutter type**: global
- **Shutter speed**:
  - **Default**: 0.5 ms (500 µs)

    - **Minimum**: 0.01 ms (10 µs)
    - **Maximum**:
        - 8.1ms (8100 µs) at 120 FPS
        - 5.3 ms (5300 µs) at 180 FPS

Input/Output & Power

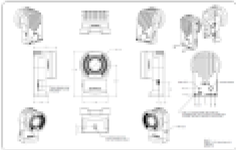
- **Data:** GigE (1000BASE-T)
- **Synchronization:** Ethernet
- **Power:** PoE or PoE+[1]

Attention:

- The switch must provide consistent power to every port simultaneously in order to power each sensor.
- Standard PoE switches must provide a full 15.4 watts to every port simultaneously.
- Note that PoE Midspan devices or power injectors are not suitable for Ethernet camera systems.

FLEX 13

FLEX 13 Diagram



Product ID

- **Model number**: CAM-CAM-F13

Physical Characteristics

- **Mounting**: 0.635 cm (1/4”)-20 tripod thread
- **Operating temperature**: 0°C to +51°C (32°F to 123.8°F)
  - **Note:** Warm-up time of 30 minutes is recommended for optimal tracking performance. Watch out for condensation when used in temperatures below 0°C.
- **Case**: Aluminum and Polycarbonate
- **Width**: 5.38 cm (2.12”)
- **Height**: 8.10 cm (3.19”)
- **Depth**: 4.24 cm (1.67”)
- **Weight**: 187 g (6.6 oz)

Lens & Filter

- **Stock lens**: 5.5 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 56°
  - **Vertical FOV**: 46°
- **Optional Lens**: 8.0 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 42°
  - **Vertical FOV**: 34°
- **Optional Lens**: 3.5 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 82°
  - **Vertical FOV**: 70°
- Adjustable focus with wave spring assist
- 850nm band-pass filter
- 850nm (Infrared) / 700nm (Visible) Filter Switcher

Image Sensor

- **Resolution**: 1280 × 1024
- **Frame Rate**: 30–240 FPS (100 FPS average usage)

- **Accuracy**: Sub-millimeter
- **Latency**: 4.2 ms
- **Shutter type**: global
- **Shutter speed**:
  - **Default**: 0.5 ms (500 µs)
  - **Minimum**: 0.01 ms (10 µs)
  - **Maximum**: 3.9 ms (3,900 µs) at 240 FPS

Input/Output & Power

Data: USB 2.0
Synchronization: USB 2.0 (via Optisync)
Power: USB 2.0 @ 1A

BTSensor Functions

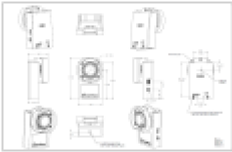
BTSensors are used to view BTBeacon positions in the Space. A BTBeacon's position in 3 dimensions (X, Y, and Z) can be determined when two or more BTSensors simultaneously have a direct line-of-sight to a connected Stringer’s LED. This information is then sent to the BTServer.

Attention:

Note that USB extensions of any kind are not suitable for connections between USB Sensors and the system's OptiHub.

FLEX 3

FLEX 3 Diagram



Product ID

- **Model number**: CAM-CAM-F03

Physical Characteristics

- **Mounting**: 0.635 cm (1/4")-20 tripod thread
- **Operating temperature**: 0°C to +51°C (32°F to 123.8°F)
  - **Note:** Warm-up time of 30 minutes is recommended for optimal tracking performance. Watch out for condensation when used in temperatures below 0°C.
- **Case**: Aluminum and Polycarbonate
- **Width**: 4.52 cm (1.78")
- **Height**: 7.47 cm (2.94")
- **Depth**: 3.66 cm (1.44")
- **Weight**: 100 g (4.2 oz)

Lens & Filter

- **Stock lens**: 5.5 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 56°
  - **Vertical FOV**: 46°
- **Optional Lens**: 8.0 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 42°
  - **Vertical FOV**: 34°
- **Optional Lens**: 3.5 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 82°
  - **Vertical FOV**: 70°
- Adjustable focus with wave spring assist
- 850nm band-pass filter
- 850nm (Infrared) / 700nm (Visible) Filter Switcher

Image Sensor

- **Resolution**: 1280 × 1024
- **Frame Rate**: 30–240 FPS (100 FPS average usage)

- **Accuracy**: Sub-millimeter
- **Latency**: 4.2 ms
- **Shutter type**: global
- **Shutter speed**:
  - **Default**: 0.5 ms (500 µs)
  - **Minimum**: 0.01 ms (10 µs)
  - **Maximum**: 3.9 ms (3,900 µs) at 240 FPS

Input/Output & Power

Data: USB 2.0
Synchronization: USB 2.0 (via Optisync)
Power: USB 2.0

- **Standard**: 5V @ 490mA
- **High Power**: 680mA

BTSensor Functions

BTSensors are used to view BTBeacon positions in the Space. A BTBeacon's position in 3 dimensions (X, Y, and Z) can be determined when two or more BTSensors simultaneously have a direct line-of-sight to a connected Stringer’s LED. This information is then sent to the BTServer.

Attention:

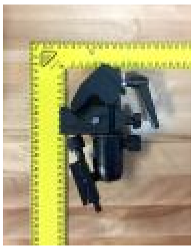
Note that USB extensions of any kind are not suitable for connections between USB Sensors and the system's OptiHub.

Included Mounting Hardware

The list and specifications of mounting hardware included with the BTSensors.

Super Clamp

- **Attachment**: 16 mm hexagonal + M5 and 1/4" thread attachment type.
- **Clamp range - maximum (round tube)**: 55 mm
- **Color**: Black
- **Safety payload**: 15 kg
- **Weight**: 0.5 kg



Super Clamp with Heavy Ball Head Adapter

Heavy Ball Head Adapter

- **Thread**: 3/8"
- **Removable insert**: 3/8" - 1/4" thread

Hex Spigot

- **Thread**: Male 1/4" - Male 3/8"

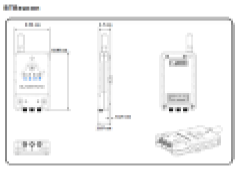
Hex Spigot

Safety Chain

Each BTSensor comes with a safety chain and a bolt for attachment.

BTBeacon

BTBeacon Diagram



Product ID

- **FCC ID**: RKT- BTBCV01
- **IC**: 10858A- BTBCV01
- **Model**: BTBCV01P

Physical Characteristics

- **Case**: Plastic with Velcro strap attachments
- **Width**: 4.94 cm (1.945”)
- **Height**: 8.08 cm (3.18”)
- **Depth**: 1.87 cm (.737”)
- **Weight**: 70 g (2.5 oz)

Input/Output & Power

- **Data**: USB, Radio 2.4 (GHz) 10Hz
- **Power**: Rechargeable Lithium-ion Battery, charged by 5V USB and 1,350 mAh capacity
- **Watt hour**: 4.44 Wh normal operation, 5.04 Wh while charging

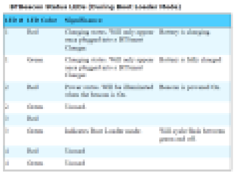
Operating Temperature

- 0°C to +40°C (32°F to 104°F)

BTBeacon Status LEDs (During Operation)

Warning: If a BTBeacon experiences a charge error, there could be a potential issue with the Lithium-ion battery. Discontinue use immediately. For more information about Lithium-ion battery safety see “Health and Safety Information”. Alternately, no battery may be in the BTBeacon.

BTBeacon Status LEDs (During Boot Loader Mode)



BTBeacon Functions

Each BTBeacon has three ports, each of which can power a single connected Stringer. When a Stringer is connected to a BTBeacon’s LED port, the Stringer’s LED will emit infrared light in a unique pattern. These infrared pulses create a unique ID used to identify BTBeacons. When the LED infrared pulse is seen by 2 or more BTSensors, the positional coordinates (XYZ) for the Stringer LED is calculated by the BTServer. Position is based on the location of visible Stringer LEDs connected to a BTBeacon. Orientation data (roll, pitch, yaw) is determined by an internal inertial measurement unit (IMU). The IMU also functions as a backup for determining the BTBeacon's position. The IMU measures acceleration and rotation.

Note: IMU is disabled by default. It is still possible to generate orientation data through the use of Rigid Frames. For more information please refer to the Frame Calibration View section of this wiki.

The BTBeacons have a red power and reset button, and two white auxiliary buttons. The auxiliary buttons are used during fixture calibration.

The BTBeacon transmits the following data over radio to the BTRouter, which is relayed to the BTServer: IMU data, button presses, battery status, configuration details, and Stringer IDs.

To enter the BTBeacon into Boot Loader Mode, turn the beacon off and hold A or B while inserting the BTBeacon into the BTSmart Charger. This mode is used to update firmware.

BTBeacon Transmitter Characteristics

BTBeacon Battery Life

- 1 LED: 10 hours
- 2 LEDs: 8 hours
- 3 LEDs: 5.5 hours
- 1 Stringer: 10 hours

- 2 Stringers: 8 hours
- 3 Stringers: 5.5 hours

BTBeacon Charging Information

A BTBeacon's rechargeable lithium-ion battery is not fully charged when shipped. Please read the following instructions carefully:

- Never charge BTBeacon near heat or flammable objects.
- The temperature range which the BTBeacon can be charged is 0°C to 40°C (32°F to 104°F). Charging outside the recommended temperature range may automatically be blocked by the protection circuitry of the device.
- Do not charge or use the BTBeacon if any damage has occurred to the device.
- The temperature range over which the BTBeacon's battery can operate is 0°C to 40°C (32°F to 104°F). Operation outside of this temperature range may damage the performance of the battery or may reduce its life expectancy.
- Battery performance will naturally decay over time. If a battery can not maintain charge for long periods, even when it is being charged correctly, this may indicate it is time to replace the battery.

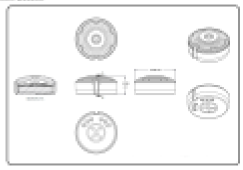
BTBeacon Battery Replacement

After a period of time the battery of the BTBeacon will naturally decay through normal use and require replacement. Contact your BTE for details on replacing the BTBeacon battery.

Attention: Any unauthorized modification to the BTBeacon or its battery will invalidate any warranty claim and may damage the device.

Mini Beacon

Mini Beacon Diagram



Physical Characteristics

- **Case**: Plastic on a wearable band
- **Diameter**: 3.487 cm (1.37")
- **Height**: 1.549 cm (0.61")

Operating Temperature

- 0°C to +40°C (32°F to 104°F)

Mini Beacon Functions

A Mini Beacon emits infrared light in a unique pattern. These infrared pulses create a unique ID used to identify Mini Beacons. When the LED infrared pulse is seen by 2 or more BTSensors, the positional coordinates (XYZ) for the Stringer LED is calculated by the BTServer.

The Mini Beacon's internal rechargeable battery can be recharged with the use of the Sync Dock. The Sync Dock sets the Mini Beacons to automatically sync with the TimeKeeper of the BlackTrax system, while charging.

Attention: The Mini Beacon must connect to the new TimeKeeper model. Contact BlackTrax Technical Support (CAST) for the firmware required to run the Mini Beacons with TimeKeeper, Router and Beacons.

Note:

- When a Mini Beacon is docked in the Sync Dock, it will take around 1 minute for the Mini Beacon to fully sync with the TimeKeeper.
- The Mini Beacon does not transmit a radio signal.
- The default brightness of a Mini Beacon is 2.5ms.
- The battery life of a Mini Beacon at default brightness is 8 hours.

Mini Beacon Charging Information

A Mini Beacon’s rechargeable lithium-ion battery is not fully charged when shipped. Please read the following instructions carefully:

- A Mini Beacon will take about 2 hours to fully charge.
- Never charge Mini Beacons in the Sync Dock near heat or flammable objects.
- The temperature range which the MIni Beacon can be charged is 0°C to 40°C (32°F to 104°F). Charging outside the recommended temperature range may automatically be blocked by the protection circuitry of the device.
- Do not charge or use the Mini Beacon if any damage has occurred to the device.
- The temperature range over which the Mini Beacon's battery can operate is 0°C to 40°C (32°F to 104°F). Operation outside of this temperature range may damage the performance of the battery or may reduce its life expectancy.
- Battery performance will naturally decay over time. If a battery can not maintain charge for long periods, even when it is being charged correctly, this may indicate it is time to replace the battery. Contact your BTE for details on replacement.

Attention: Any unauthorized modification to the Mini Beacon or its battery will invalidate any warranty claim and may damage the device.

BTSmart Charger

BTSmart Charger Diagram

Size and Weight

- **Case**: Steel
- **Width**: 36 cm (14.2”)
- **Height**: 9.6 cm (3.8”)
- **Depth**: 17.2 cm (6.8”)
- **Weight**: 2200 g (77.6 oz)

Input/Output & Power

- **Data**: Ethernet, USB
- **Power**: 20 Watt
- **Voltage range**: 100V - 240V

Note: BTSmart Charger Rev 6 is built with a momentary contact type power button with the blue LED that will light up only after the "boot up" is complete. To turn the device power off, press the power button, then wait until the blue LED light turns off before you disconnect from the power source.

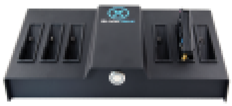
BTSmart Charger Functions

The BTSmart Charger is a device used to recharge the battery of a BTBeacon. BTBeacons are connected to the BTSmart Charger using the BTBeacon’s USB port. While connected, the BTSystem can read the status of the battery, regulate charging and maximize battery life. The BTSmart Charger can hold a maximum of 6 BTBeacons at one time.

BTSmart Charger Configurations

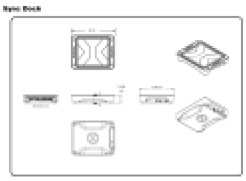
The BTSmart Charger can be configured to either be horizontal and sit flat on a desk, or be vertical and be mounted on a wall.

Horizontal Configuration Diagram



Sync Dock

Sync Dock Diagram



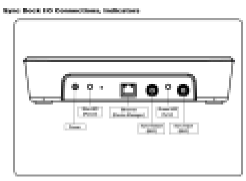
Size and Weight

- **Case**: Steel
- **Width**: 23.88 cm (9.40”)
- **Height**: 32 cm (12.60”)
- **Depth**: 5.28 cm (2.08”)
- **Weight**: 461 g (16.27 oz)

Input/Output & Power

- **Data**: BNC (Sync In/Out), Ethernet (Device Manager)
- **Power**: 30 Watt
- **Voltage range**: 100V - 240V

Input/Output Panel Diagram



Sync Dock Functions

The Sync Dock is a device used to recharge the battery of Mini Beacons. A maximum of 20 Mini Beacons can be docked onto 20 docking cases in the Sync Dock. While docked, the Mini Beacons automatically sync with the TimeKeeper of the BTSystem.

Sync Dock Panel Connections and Indicators

- **Power**: Plug power input into the Power Jack Connector from the AC power adapter.
- **Sync Input (BNC)**: Connect and receive sync calibration data from the TimeKeeper of the BlackTrax System through the BNC connector.

    - **Note:** From the TimeKeeper, use a BNC splitter to split the BNC connection. One end of the BNC split connects to the eSync (normal connection) and the other end of the BNC split connects to the Sync Dock.
- **Sync Output (BNC)**: Connect and send sync calibration data to another Sync Dock through the BNC connector.
    - **Note:** You can daisy chain multiple Sync Docks through the Sync Input and Sync Output connections to sync several Sync Docks and Mini Beacons at once. You can daisy chain a maximum of 16 Sync Docks with 320 Mini Beacons at once.
- **Ethernet**: Connect to the Device Manager through the ethernet connection.
- **Blue LED**: When the Sync Dock is plugged into a power source, the blue LED at the front panel lights up.
- **Green LED**: When the Sync Dock is receiving sync transmission from the BTSystem, the green LED at the front panel lights up.

Mini Beacon Docking

- **Mini Beacon Sync**: When a Mini Beacon is placed on the Sync Dock, it will take about 1 minute for the Mini Beacon to fully sync with the TimeKeeper. When the Mini Beacon is placed on the Sync Dock, its LED is turned off until it is removed.
- **Blue LED** (on each single dock casing): Indicates the sync status of the docked Mini Beacon. This LED flashes while the Mini Beacon is syncing and turns solid when sync is complete.
    - **Note:** If a Mini Beacon is removed from the Sync Dock before calibration is complete, the Mini Beacon will not turn its LED on.
- **Green LED** (on each single dock casing): Indicates power of the docked Mini Beacon. This LED flashes while the Mini Beacon is charging, and turns solid when charging is complete.
- **Mini Beacon Charging**: A Mini Beacon will take about 2 hours to complete charge.

Calibration Kit

Table of contents:

Calibration Kit functions

BlackTrax Calibration Kit Functions

The Calibration Kit is used for calibrating the BTSensors and Lighting Fixtures position in the Space. The function of each equipment in the Kit are:

1. The Wand Head is attached to the Wand Handle and connected to the Power Supply Unit.
2. When you move the Wand Head inside the Space, the BTSensors look for active LEDs located on the Wand Head.
3. When multiple BTSensors see the LEDs on the Wand Head, the BTSystem is able to generate a measurement point for BTSensor calibration.
4. BTSensors use the measurement point data to determine their position relative to each other.
5. The Ground Plane is connected to the Power Supply Unit and placed in the designated origin of the Space.
6. The Ground Plane LEDs are used in the BlackTrax system to calculate the BTSensor positions relative to the origin and the orientation of the Cartesian axes.
7. The Lighting Calibration Wand is used for fixture calibration.
8. The Lighting Calibration Wand can be attached to a BTBeacon instead of a Stringer to extend the range of a BTBeacon LEDs. This is used to calibrate fixtures in areas that are difficult to reach.

Wand Head

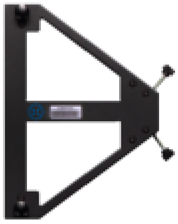
Wand Head

Size and Weight

- **Width**: 105.92 cm (41.7”)
- **Height**: 26.92 cm (10.6”)
- **Depth**: 2.03 cm (0.8”)
- **Weight**: 715 g (25.22 oz)

Triangular Wand Holder

Triangular Wand Holder



Size and Weight

- **Length**: 24 cm (9.45”)
- **Height**: 17.5 cm (6.89”)
- **Width**: 4.45 cm (1.75”)
- **Weight**: 420g (14.82 oz)

Telescopic Wand Handle

Telescopic Wand Handle

Size and Weight

- **Length**: 2.03 cm (0.8”)
- **Height**: 149.86 cm (59”)
- **Width**: 2.03 cm (0.8”)
- **Weight**: 365 g (12.86 oz)

Ground Plane

Ground Plane

Size and Weight

- **Width**: 76.96 cm (30.3”)
- **Length**: 98.04 cm (38.6”)
- **Depth**: 5.08 cm (2”)
- **Weight**: 1905 g (67.2 oz)

Hybrid Power Supply Unit (HPSU)

Hybrid Power Supply Unit (HPSU)

Size and Weight

- **Width**: 1.35 cm (0.5")
- **Height**: 0.45 cm (0.2")
- **Depth**: 1.1 cm (0.4")

Power Run Time

- **High**: 1:00
- **Med**: 2:45
- **Low**: 3:15

Notes

1. Most applications (comparable to the previous PSU) use Medium, depending on the size of the venue and how far the sensors are. You may try out low or high to conserve power or boost the IR.
2. A USB port is available where you can use to charge an external Beacon.
    - An External Beacon can be charged approximately 90% if the HPSU is fully charged, and the Beacon Battery is completely out of charge. This assumes no Stringers are attached to the Beacon.
    - The HPSU can also be used to extend the life of a Beacon Battery if it is required to run past its normal usage time. A Beacon with 1 Stringer has approximately 7.5 hours of additional usage time. Beacons with either 2 or 3 Stringers attached have approximately 1 hour of additional usage time.

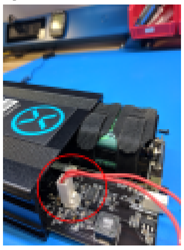
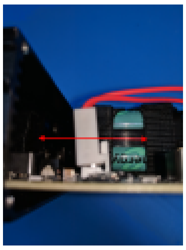
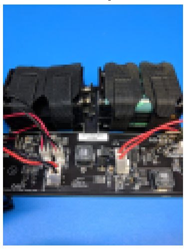
Changing Internal Batteries in the HPSU

Attention: Please use an anti-static mat while being grounded.

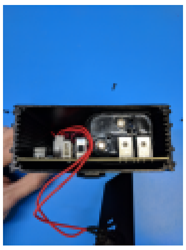
Tool Required: *1/16 hex bit key.

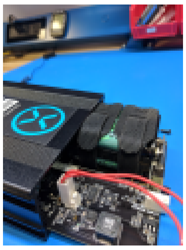
To add batteries to the second pack

 Side A  Side B

1. Remove the 4 screws from Side A using the 1/16 hex bit.
2. Once the screws are removed, pull the panel away to reveal the interior of the HPSU.
3. Remove the board half way to expose the attachment for the power switch.
4. Carefully remove the power switch pin. Pull the pin straight upwards.
   - 
     - **Attention**: AVOID MOVING THE PIN IN THE DIRECTION SHOWN IN THE PICTURE WITH ARROWS (below).
   - 
5. Once the pin is removed, push the board back into the HPSU.
6. Turn the HPSU to Side B and remove the screws.
7. Remove the HPSU all the way to expose the second battery pack.
8. Add the batteries.
9. Tighten the straps.
10. Reattach the power switch on Side A. Carefully pushing down the pin until it is locked in place.
    - 
11. Push the board back into the case, making sure not to pinch any wires on Side B.
12. Close Side A.

To change the pre installed HPSU batteries

1. Remove the 4 screws from Side A using the 1/16 hex bit.
2. Once the screws are removed, pull the panel away to reveal the interior of the HPSU.
   - 
   - **Note:** HPSU board slides into the bottom slot of the interior.

3. Carefully pull the board out from the HPSU. You only need to remove the board half way to replace the batteries.
    - 
4. Once you have replaced the batteries, tighten the Velco straps on the batteries.
5. Slowly and carefully push the board back into the HPSU.

Lighting Wand

Lighting Wand

Size and Weight

- **Size**: 2 m (6.56’)
- **Weight**: 235 g (8.29 oz)

BTCalibration Kit Case

BTCalibration Kit Case

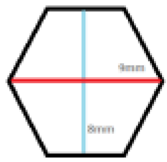
Outside dimensions: 134.6 x 40.6 x 15.5 cm (53” x 16” x 6.12”)
Weight: (with foam lining only): 11.6 kg (25.57 lbs.)

Stringer 2

Stringer 2 Diagram

Physical Characteristics

- **Cable length**: 1.37 m (4.5') Custom sizes are available
- **Cable thickness**: 2.8 mm (0.11")
- **LED Diffuser diameter**: 8 mm (5/16")
- **Strain relief**: 28 mm (1.1")
- **Male SMA Connector**: 9 mm x 8 mm (0.35" x 0.32")
    - **Male SMA Connector** diagram



Stringer 2 Functions

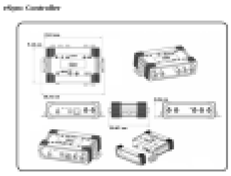
When the Stringer 2 is connected to a BTBeacon LED port, the LED portion of Stringer 2 will pulse that BTBeacon's unique ID signal. The pulse is viewed by BTSensors, sent to the BTServer and used to calculate the BTBeacon position in the Space.

Discontinued

Table of contents:

eSync Controller

eSync Controller Diagram



Physical Characteristics

- **Width**: 13.89 cm (5.47”)
- **Height**: 4.09 cm (1.61”)
- **Depth**: 9.25 cm (3.64”)
- **Weight**: 368.54 g (13 oz)
- **Operating temperature**: 0°C to +40°C (32°F to 104°F)

Input/Output & Power

- **PoE**: IEEE 802.3af-2003
- **Adapter**: 12V DC and 3 Amps
- **Data**: Ethernet

Status LEDs

- Per port activity status
- Master time
- External lock
- Ethernet link status
- Ethernet activity

eSync Controller Functions

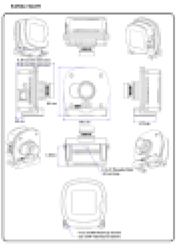
The eSync Controller synchronizes BTSensors so that the shutters of BTSensors open and close simultaneously and in synchronization with the pulsing of LED Stringers attached to BTBeacons.

eSync Controller Connection to the TimeKeeper

The eSync Controller connects to the TimeKeeper over RCA cable. The RCA cable is plugged into the RCA port of the eSync Controller.

S250e Slim

S250e SLIM diagram



Product ID

- Model Number: BT-S250-15

Physical Characteristics

- **Mounting**: 0.635 cm (1/4”)-20 tripod thread
- **Operating temperature**: 0°C to +51°C (32°F to 123.8°F)
- **Case**: Aluminum and Polycarbonate
- **Width**: 8.1 cm (3.19”)
- **Height**: 8. cm (3.16”)
- **Depth**: 6.76 cm (2.66”)
- **Weight**: 430.91 g (15.2 oz)

Lens & Filter

- **Stock lens**: 5.5 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 56°
  - **Vertical FOV**: 46°
- **Optional lens**: 8 mm F#1.8 (wide band AR coated)
  - **Horizontal FOV**: 42°
  - **Vertical FOV**: 34°
- M12 Lens Mount
- Adjustable focus with wave spring assist
- 800nm IR long pass filter with Filter Switcher

Image Sensor

- **Resolution**: 832 × 832
- **Frame Rate**: 30–250 FPS (100 FPS average usage)
- **Accuracy**: Sub-millimeter

- **Latency**: 4 ms
- **Shutter Type**: global
- **Shutter Speed**:
  - **Default**: 0.5 ms (500 µs)
  - **Minimum**: 0.01 ms (10 µs)
  - **Maximum**: 3.8 ms (3,800 µs) at 100 FPS

Input/Output & Power

- **Data**: Ethernet
- **Synchronization**: Ethernet
- **Power**: (PoE) 15.4 watts

Power Supply Unit (PSU)

Power Supply Unit (PSU)

Size and Weight

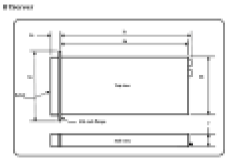
- **Width**: 10.5 cm (4.1”)
- **Height**: 9.8 cm (3.8”)
- **Depth**: 4.57 cm (1.8”)
- **Weight**: 335 g (11.82 oz)

Power

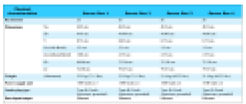
- **Power**: 10 Watt

BTServer (Legacy)

BTServer (Rev 1-4) Diagram



Physical Characteristics



Technical Specifications

BTServer Rev 4:

- (2x) Intel Xeon Processor E5-2620 v4 (8C, 2.1GHz, 3.0GHz Turbo, 2133MHz, 20MB, 85W)
- (2x) 2.5" 512GB SSD SATA in RAID 1
- 16GB (4x4GB) 2400MHz DDR4 RDIMM ECC
- NVidia GeForce GTX 1060
- Dual, Hot-plug, Redundant Power Supply (1+1), 1100W
- Integrated Intel I350 (4x1Gbit) Quad Port Network Card + Additional Intel I350 Quad-Port Gigabit Ethernet Controller
- Windows Embedded 8.1 Industry Pro

BTServer Rev 3:

- (2x) Intel Xeon Processor E5-2620 v3 (6C, 2.4GHz, 3.2GHz Turbo, 1866MHz, 15MB, 85W)
- (2x) 2.5" 512GB SSD SATA in RAID 1 -or- (2x) 2.5" 500GB HDD SATA in RAID 1
- 64GB (8x8GB) 2400MHz DDR4 RDIMM ECC
- NVidia GeForce GTX 1060 -or- NVidia GeForce GTX 960 -or- Earlier
- Dual, Hot-plug, Redundant Power Supply (1+1), 1100W
- Integrated Intel I350 (4x1Gbit) Quad Port Network Card + Additional Broadcom BCM5719 Quad-Port Gigabit Ethernet Controller
- DVD-ROM Optical Disk Drive
- Newer Systems: Windows 8.1 Pro; Legacy Systems: Windows 7 Professional

BTServer Rev 2:

- (2x) Intel Xeon Processor E5-2620 v2 (6C, 2.1GHz, 2.6GHz Turbo, 1600MHz, 15MB, 80W)
- (2x) 2.5" 500GB HDD SATA in RAID 1
- 16GB (4x4GB) 1866MHz DDR3 ECC RDIMM
- NVidia GeForce GTX 760 -or- Earlier
- Dual, Hot-plug, Redundant Power Supply (1+1), 1100W
- Intel X520-T2 Dual Port 10GbE Network Interface Card
- DVD-ROM Optical Disk Drive

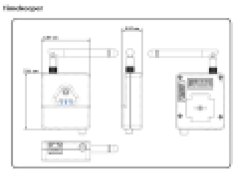
- Windows 7 Professional

BTServer Rev 1:

- (2x) Intel Xeon Processor E5-2620 v2 (6C, 2.1GHz, 2.6GHz Turbo, 1600MHz, 15MB, 80W)
- (2x) 3.5" 500GB HDD SATA in RAID 1
- 4GB RDIMM, 1600MT/s, Low Volt, Single Rank, x8 Data Width
- NVidia GeForce GTX 760 -or- Earlier
- Dual, Hot-plug, Redundant Power Supply (1+1), 1100W
- Broadcom 5720 Quad Port 1Gb Network Interface Card
- DVD-ROM Optical Disk Drive
- Windows 7 Professional

TimeKeeper (Legacy)

TimeKeeper (Rev G) Diagram



Product ID

- **FCC ID**: RKT-BTTKV01
- **IC**: 10858A-BTTKV01
- **Model number:** BTTKV01

Physical Characteristics

- **Width**: 5.7 cm (2.245")
- **Height**: 7.11 cm (2.8")
- **Depth**: 2.57 cm (1.013")
- **Weight**: 125 g (4.41 oz)

Operating Temperature

- 0°C to +40°C (32°F to 104°F)

Input/Output & Power

- **Data**: Ethernet, Radio 2.4(GHz) 10Hz
- **Power**: 48VDC/15.6W from PoeE Network Switch via Ethernet port (No input power via USB port)

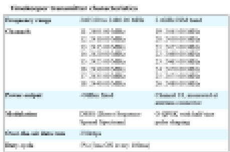
Status LEDs

Note: The Ethernet status lights on the TimeKeeper are not enabled while the TimeKeeper is in use.

TimeKeeper Functions

The TimeKeeper is a single wireless access point that uses a proprietary radio system running on the 2.4 Ghz frequencey to send data to all BTBeacons. Data sent includes a signal used to synchronize the BTBeacons with the BTSensors and configuration commands sent to the eSync Controller via an RCA cable.

TimeKeeper Transmitter Characteristics

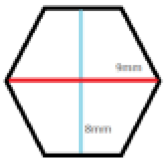


Stringer

Stringer Diagram

Physical Characteristics

- **Cable length**: 1.37 m (4.5') Custom sizes are available
- **Cable thickness**: 2.9 mm (0.11")
- **LED Diffuser diameter**: 7.93 mm (5/16")
- **Strain relief**: 30 mm (1.18")
- **Male SMA Connector**: 9 mm x 8 mm (0.35" x 0.32")
    - **Male SMA Connector** diagram



Stringer Functions

When a Stringer is connected to a BTBeacon LED port, the LED portion of a Stringer will pulse that BTBeacon's unique ID signal. The pulse is viewed by BTSensors, sent to the BTServer and used to calculate the BTBeacon position in the Space.

General System Information

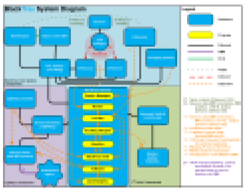
Table of contents:

BTSystem Information Flow and Connections

Introduction

The following diagram outlines how the components of the BTSystem are connected and how data flows between the different modules of the system.

BlackTrax Detailed System Diagram



BTX Dongle

Embedded inside each BTServer is a BTX dongle which serves two principal uses. The primary function of a dongle is to act as a key. The dongle is the only way that BlackTrax software will open and operate. The dongle has dynamic embedded information that controls the level of the software you can open/use, as well as the expiry date of the Membership Period. A BTX Dongle grants the server access to the BlackTrax software package as well as a custom version of WYSIWYG for BlackTrax. The expiry date for the BTX dongle is set for April, 2021.

Secondly, a dongle is a security device used by CAST to prevent unauthorized use of the software and protects an End User's work as well as their investment in the Product.

Attention: Windows Remote Desktop Connection should not be used with a BlackTrax system. Security measures on the BTX dongle will prevent it from working. Users should use TeamViewer or VNC if remote access to a BTServer is required.

Saved System Data

In BlackTrax, when system information is saved, the information is saved to a general folder on the BTServer. Information saved this way includes configuration files and system lists from sub-processes.

By default this folder can be found at the following location, depending on your server version and BlackTrax release version:

- All BlackTrax Servers running v2.0.0 or later - C:\bt_run_time

FCC Information

Important FCC Information

These devices comply with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. This device must not cause harmful, interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

Certificate Numbers

- Model BTTKV01: Radio Cert. No.: IC: 10858A-BTTKV01
- Model BTBCV01P: Radio Cert. No.: IC: 10858A-BTBCV01

Not Included Mandatory Components

Attention: BlackTrax requires additional components to function which are not included with purchase of the BTSystem.

- Category 6 Ethernet Cabling
- Power Over Ethernet Gigabit Switch for BTSensors

Category 6 Ethernet Cabling

All Ethernet cabling used to connect the system components together must be of Category 6 (Cat6) quality or greater. Cat6 is necessary for the transmission of data at gigabit speeds, which is required by BlackTrax. The amount of cable needed will vary depending on the Space dimensions and user needs.

Attention: The maximum allowed length of a Cat6 cable is 91.44 meters. Cat6 standards should be followed when connecting modules together to ensure the BTSystem operates as intended. This range can be extended by using Gigabit switches to connect Cat6 cable of 91.44 meter length or less.

Power Over Ethernet Gigabit Switch for BTSensors

BlackTrax requires a dedicated Power over Ethernet (PoE) gigabit switch or dedicated virtual local area network (VLAN) to connect all the BTSensors with the rest of the system. The switch should have the following:

- A PoE gigabit switch.
- A PoE port for each BTSensor, plus 4 extra to connect to the TimeKeeper, BTRouter, eSync Controller and BTServer.
- PoE switches must support 15.4 watts per Ethernet port.

Optional Components

Depending on the purpose of tracking, you may need additional hardware components that are not included with the BTSystem.

DMX/Ethernet Node for Tracking with Moving Lights

Table of contents:

Merging Channel:

- The merging channel is a single DMX channel that is patched into your lighting console to enable the control of moving fixtures from BlackTrax.
- The merging channel can be a dimmer channel that controls intensity fading between BlackTrax and the lighting console, or as a simple non-dim On/Off control.
- The merging channel must be patched in your console and set as the trigger channel in your merge node.
- When the merging channel is at full (100%) intensity, BlackTrax has complete control over the channels connected to the BlackTrax project. When the merging channel is at zero (0) intensity, the lighting console has full control over the channels in the BlackTrax project.
- In the *Project Properties* widget in BlackTrax, you can activate and set the monitoring of the Merge Channel that was set in your merge node.

Compatible DMX/Ethernet nodes

To connect BlackTrax downstream to a lighting console, a DMX to Ethernet/Ethernet to DMX node is required. The following nodes have been tested and are approved to work with BlackTrax:

Luminex

- Luminex Luminode 1
- Luminex Luminode 2
- Luminex Luminode 4
- Luminex Luminode 12
- Luminex Ethernet-DMX2/Truss MkII
- Luminex Ethernet-DMX4 MkII
- Luminex Ethernet-DMX4/ Truss MkII
- Luminex Ethernet-DMX8 MkII
- Luminex Ethernet-DMX8/ Truss MkII

Note: Luminex Ethernet-DMX models have been discontinued and replaced with the Luminode range.

Sundrax

- Sundrax ArtGate Pro
- Sundrax ArtGate DIN
- Sundrax ArtGate Board
- Sundrax ArtGate Compact
- Sundrax ArtGate Solid
- Sundrax ArtGate Arma
- Sundrax ArtJet Pro

ELC

- ELC DLN8GBX
- ELC DLN8GBXSL
    - **Note:** Both models must be running a minimum firmware version of 1.28.

Luminex Ethernet - DMX Node Settings

The Luminex Ethernet DMX nodes must be configured to work with your BlackTrax system.

Attention: The following guide outlines how each variable should be set for use with BlackTrax. Each BlackTrax event is unique. There are circumstances where these settings need to be modified based on factors such as the rig, cabling, and patching.

Setup the node through the web interface. Please ensure your IP settings match that of the node(s) you wish to configure. There are 2 ways to configure your node to work with BlackTrax:

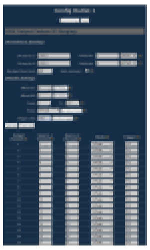
1. To merge RTTrPL with an Art-Net or sACN universe via the 5-pin DMX ports.
2. To have the merged data be rerouted to another universe over the network (for example, when other nodes are being used downstream of your Luminex nodes).

To configure a node to merge and send data via the DMX ports

1. To navigate to the web interface, enter the IP address of the node in your browser window.
2. Under **Setup**, click on the desired node you wish to configure.
    - **Note:** The 8 port nodes will appear as multiple 4 port nodes in the interface.
3. For the desired ports, choose *Output* as the **Direction**, and *Custom* for **IP Merging**.

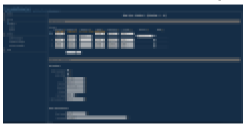
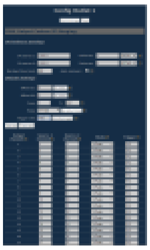
    

    - **Result:** A blue box appears beside the number for the output after **IP Merging** is set to *Custom*.
4. Click on this blue box beside the number for the output.
    - **Result:** The *Config Outlet* window for that output appears.

      
5. Set the universes you wish to merge. Source one chooses the DMX protocol, with a universe, and source two chooses the RTTrPL universe.
    - **Notes:**
        - RTTrPL universes start from universe 0 instead of 1.
        - RTTrPL must be source 2.
6. Change the Mode to be X-Fade, set the trigger channel to be the same as your merging channel, and then click *Set default mode.*
7. Click *Submit Changes.*
    - **Result:** That output will be configured as expected. If you select *Show table*, you should see the channels have all changed to X-Fade, with a trigger of the specified channel.
8. Repeat the above for all outputs you wish to configure on the node.
9. Click *Submit Changes*.
10. Navigate to the *Global* tab under **Setup**. Set *Enable Trigger* to DMX, and the universe to whichever universe your Merging Channel is patched to, with the desired DMX protocol.

To configure a node to reroute merged data to send to other DMX nodes

Note: It is recommended that the reroute is done to a universe which is different than the universes from the console and BlackTrax. For example, if you are merging sACN universe 1, with RTTrPL universe 1, you might re route the merged data to sACN universe 101.

1. To navigate to the web interface, enter the IP address of the node in your browser window.
2. Under **Setup**, click on the desired node you wish to configure.
    - **Note:** The 8 port nodes will appear as multiple 4 port nodes in the interface.
3. For the desired ports, choose *Output* as the **Reroute**, and *Custom* for **IP Merging**.
   
    - **Result:** A blue box appears beside the number for the output after **IP Merging** is set to *Custom*.
    - **Result:** The port will now have an arrow leading to a box to specify the new universe to reroute the merged data on.
4. Click on this blue box beside the number for the output.
    - **Result:** The *Config Outlet* window for that output appears.
      
5. Set the universes you wish to merge. Source one chooses the DMX protocol, with a universe, and source two chooses the RTTrPL universe.
    - **Notes:**
        - RTTrPL universes start from universe 0 instead of 1.
        - RTTrPL must be source 2.
6. Change the Mode to be X-Fade, set the trigger channel to be the same as your merging channel, and then click *Set default mode.*
7. Click *Submit Changes.*
    - **Result:** That output will be configured as expected. If you select *Show table*, you should see the channels have all changed to X-Fade, with a trigger of the specified channel.
8. Repeat the above for all outputs you wish to configure on the node.
9. Click *Submit Changes*.
10. Navigate to the *Global* tab under **Setup**. Set *Enable Trigger* to DMX, and the universe to whichever universe your Merging Channel is patched to, with the desired DMX protocol.

Luminex Luminode Settings

The Luminex Luminiode must be configured to work with your BlackTrax system.

Attention: The following guide outlines how each variable should be set for use with BlackTrax. Each BlackTrax event is unique. There are circumstances where these settings need to be modified based on factors such as the rig, cabling, and patching.

Setup the node through the web interface. Please ensure your IP settings match that of the node(s) you wish to configure. There are 2 ways to configure your node to work with BlackTrax:

1. To merge RTTrPL with an Art-Net or sACN universe via the 5-pin DMX ports.
2. To reroute the merged data to another universe over the network (for example, when other nodes are being used downstream of your Luminex nodes).

To configure a node to merge and send data via the DMX ports

1. Navigate to the web interface, enter the IP address of the node in your browser window.
2. Under *Node*, click on the desired node you wish to configure.
3. Set up both the inputs on the center column, select *X-FADE*.
    - **Result:** The second input is created.
4. Choose your universes and label accordingly.
5. Set up your merge channel in the middle section, choose the channel, and you can use the gear to change the source.
6. Select the DMX output to use the DMX port on the node. If you need to re-route, choose *Artnet*, or *sACN*,and specify the output universe.

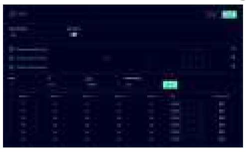
Standard merge settings:
Outputs universe 1 to the DMX port on the node, with a crossfade.

Custom Settings (Node menu)

Note: This is for multiple merge channels.

To apply custom settings for multiple merge channels

1. Select *Custom* in the center column.
    - **Result:** This setting creates 4 inputs and shows a *Patch* button in the center area.
2. Make input 1 *Artnet*, or *sACN* Universe 2 *RTTrPL*.
3. Set universes accordingly.
4. Click the *Patch* button in the middle section.
    - **Result:** This brings up the following:



5. In the middle, you can control which channels you want to affect, the mode (*X-FADE*), and the control channel. Press *Apply* to the right of these input boxes, and you should see it affect all the channels in the table below these settings. You can do this multiple times to control which channels are listening to which control channels. You can then press *Apply* on the top-right corner to save. It

will also close this screen.
6. Select the DMX output to use the DMX port on the node. If you need to re-route, choose *Artnet*, and specify the universe you want to output to.

To configure a node to reroute merged data to send to other DMX nodes

Standard re-route settings:
This is done by selecting an *Artnet* or *sACN* output, and designating the universe you wish to use. You can also designate which IP re routes the merged data to (default will be broadcast on 2.x.x.x).

Re-routes universe 101 to 1, with a crossfade.

Global Settings

Global settings is used to specify the merge channel universe:

Other

Remember to press the *Save* button whenever you make changes, and that you enable the outputs you want to use.

The standard view of Node page with one output enabled and the other disabled (checkboxes in the upper left):

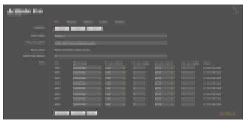
ArtGate Node Settings

DMX nodes of the ArtGate family of models must be configured to work with your BlackTrax system.

Attention: The following guide outlines how each variable should be set for use with BlackTrax. Each BlackTrax event is unique. There are circumstances where these settings need to be modified based on factors such as the rig, cabling and patching.

Setup the node through a web interface, or setup the node through a BlackTrax server. Please ensure your IP settings match that of the node(s) you wish to configure.

To configure a node

1. To navigate to the ArtGate model's web interface, enter the IP address of the node in your browser window.
    - **Result:** The Main Settings window of the ArtGate model appears.
      
2. On the *Main* tab, scroll down to the **Ports** section.
3. For each DMX port that you want to use:
    1. Set **Mode/merging** column to *Out/ComXFade*.
    2. Set **Pri.unv.protocol** column to the desired protocol (*Art-Net* or *sACN*).
    3. Set the **Pri.unv.number** column to the desired universe.
    4. Set the **Sec.unv.protocol** to *RTTrPL*.
    5. Set the **Sec.unv.number** to the corresponding RTTrPL universe.
4. Click *Save Settings* at the bottom of the page.
5. Click the *Advanced* tab on the main toolbar at the top of the page.
    - **Result:** The Advanced port settings window appears.
      
6. Scroll down to the **Advanced Port Settings** section.
7. For each DMX port that you set on the *Main* tab:
    1. Set the **Trigger/XFade unv.protocol** column to the desired protocol for the merge channel (*Art-Net* or *sACN*).
    2. Set the **Trigger/XFade unv.number** column to the universe which contains the merge channel.
    3. Set the **Common Trigger/XFade control channel** to the chosen DMX merge channel in the above universe.
8. Click *Save Settings* at the bottom of the page.

Notes:

- RTTrPL universes start from universe 0 instead of 1.
- Information updated as per ArtGate Pro firmware version 4.06.

ELC Node Settings

ELC DLN8GBX and DLN8GBXSL Nodes from ELC Lighting must be configured to work with your BlackTrax system.

DLN8GBX and DLN8GBXSL Nodes must be run a minimum firmware version of 1.28.

Attention: The following chart is a guide that outlines how each variable should be set. Each BlackTrax event is unique. There are circumstances where these settings would need to be modified based on factors such as rig, cabling, and patching.

MENU	VARIABLE	SET TO...	NOTE
DMX Port (#)	Port Mode	Output	The DMX Port settings need to be configured for each port in use, e.g. if Port 1 is in use, DMX Port 1 must be configured.
	Mode	Single	
	Primary	Art-Net or sACN (#)	The Art-Net number needs to correspond to the DMX universe as assigned by the console. ELC DLN8GBX and DLNGBXSL Nodes start numbering universes at "0.0", e.g. 0.0 = Universe 0, 0. = Universe 1. sACN does not follow the same logic as Art-Net. In sACN 1 = Universe 1.
	Resend	N/A	Leave this setting blank.
	Hold	Always	
	Rate	Sync	
BlackTrax	Mode	Controlled	
	Universe	(*)	The universe number must be the same as assigned by the lighting console.
	Channel	(*)	Free DMX channel not used by another DMX device. This channel will be used to control the merging value between BlackTrax and the lighitng console.
Network settings	Dynamic	OFF	
	IP Address	(*)	Free IP address not used by another device.

Known Issues in BlackTrax

Known issues with reference to BlackTrax 2.4.0 :

1. Special characters are not sorted correctly in Portfolio Manager so the wrong Portfolio may be loaded.
2. Sorting several Frame LEDs at once do not sort correctly.
3. If a pan-flip happens while BlackTrax is tracking and the Fixture is released to the console, the Fixture may perform a pan-flip when the release is complete.
4. Inverting Fixtures in Fixture Calibration view or BTWYG can result in inversion status not reflecting expected behavior, or changing.

Known issues with reference to Motive 2.0.1 :

1. Visible Bounds will disappear from the 3D view if Windows is Locked.
    - The feature will still work. If you need to see the bounds, restart Motive to fix the issue.

System Procedures

Table of contents:

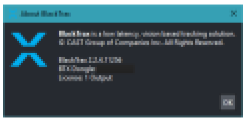
Licensing

Licensing Overview

BlackTrax includes a licensing security system to authorize hardware devices on the BlackTrax Network. Unrecognized devices on the BlackTrax Network are not compatible with the software. An unrecognized device is any device on the BlackTrax Network that was not sold directly to you by CAST Software.

A BlackTrax License will authorize the use of the BlackTrax system for a restricted number of output connections based on the type of License that was purchased. The number of output connections allowed for each type of License varies from a minimum of 1 output connection and up to a maximum of 12 output connections, or the non-restricted Unlimited License.

The number of output connections that is authorized with the BlackTrax License is indicated in the *About BlackTrax* dialog box.



Notes:

- The default License Folder location is: C:\bt_run_time\license. Licenses can be downloaded from the BlackTrax Members Only Downloader which can be found at this link.
- You need to update your license if you have added new hardware devices to the network and received an error message in BlackTrax.
- You need to upgrade your license if you want to add output connections for additional unicast outputs.

Attention: BlackTrax Licenses purchased before BlackTrax Release Version 2.2.3 will automatically convert to the Unlimited License.

Charging BTBeacons

Charging Overview

BTBeacons are charged using the BTSmart Charger. BTBeacons can be connected to the BTSmart Charger using the Mini USB port found on the side of the BTBeacon.

Attention:

- The Mini USB port of the BTBeacon is not designed to be a peripheral device to a Class B personal computer. As such, a user shall not connect the USB port to a Class B personal computer during normal operation.
- The sole power source of the BTBeacon is the internal 3.7V rechargeable Lithium-ion battery. The BTBeacon does not require a connection at the Mini USB port to operate.

To charge a BTBeacon using the BTSmart Charger

Connect the BTBeacon to the charge station via the Mini USB port found on the side of the BTBeacon.

Result: The BTBeacon is charging. To determine when the BTBeacon is fully charged, see BTBeacon status LEDs (During operation).

Replacing a BTBeacon's Lithium-Ion Battery

BTBeacon Lithium-ion Battery Overview

After extensive use the lithium-ion battery in a BTBeacon may no longer operate and be unable to power the BTBeacon. The lithium-ion battery’s life cycle is at its end if the lithium-ion battery will not hold a charge and the BTBeacon will not power on. When this occurs, it is recommended that the lithium-ion battery inside the BTBeacon be carefully replaced with a new lithium-ion battery.

Attention:

- Only use lithium-ion batteries supplied by CAST. It is recommended that batteries be changed every 6 months to ensure optimal performance.
- The following are required when replacing a BTBeacon’s battery:
    - Replacement battery
    - 3/8” Hex key
    - Adhesive tape

To replace a BTBeacon’s battery

1. On the BTBeacon, hold down the red *Power* button for 2 seconds.
    - **Result:** The BTBeacon will power off. No lights on the unit will be on.
2. Turn the BTBeacon over. Using a hex key, remove the 3/8” screws holding the case together.
3. Carefully separate the two halves of the BTBeacon case. There is a ribbon cable connecting the motherboard in one half of the case, to the lithium-ion battery in the other half of the case.
4. Disconnect the ribbon cable from the motherboard.
5. The lithium-ion battery is attached to the case with adhesive tape. Gently remove the battery free from the case.
    - **Attention:** When removing the battery, use soft tools and take care to not puncture or damage the battery casing.
6. Properly dispose of the old battery.
7. Take a new battery and adhere it to the inside of the case.
    - **Note:** The adhesive tape must be heat resistant to function properly.
8. Connect the ribbon of the new battery to the motherboard.
9. Join the halves of the BTBeacon case and close the unit.
10. Fasten screws to the back of the BTBeacon case, sealing it.
11. Press the *Power* button down.
    - **Result:** The lights of the BTBeacon will flash and the unit will turn on. The BTBeacon’s battery has successfully been replaced.


Opening the case to remove the battery

 Disconnecting the ribbon cable

 Adding new double sided tape, and insert new battery

Reconnecting the ribbon cable

 Closing the case

Installing Third Party Software

The BTServer is a closed system. Circumventing the security measures in place on the BTSystem for any reason, including the installation of third party software on the BTServer, is explicitly not permitted. Circumventing the security of the BTSystem will immediately void the warranty.

This policy is in effect to protect the performance and stability of the BTSystem. Having third party software installed might adversely affect the BTSystem.

Note: If third party software must absolutely be installed on the BTSystem, please contact CAST or your local BTE for a possible solution. If a BTE or CAST deems the software acceptable, they may arrange to install it for you.

Server Failover

In the event a user needs to switch from their main BT Server, to a backup BT Server, the following procedure should be followed.

Note: Users should keep a backup of their related show files in the event they need to switch servers during operation. Users can easily do this using BTBackup on their servers, or by manually copying the files to a USB stick.

1. Only 1 instance of Motive, as well as BTEngine should be present on the network at any given time. Therefore, the backup server should not have these modules open, or be disconnected from all networks until needed.
    - The BlackTrax GUI, and BTWYG can be opened, with their files loaded on both servers at the same time.
2. In the event of needing to switch servers, ensure the main BTServer has been disconnected from it's associated networks.
3. On the Backup server, Launch Motive, with the correct file.
4. In the BTGUI launch **BTEngine** and *Apply Changes.*

From this point the show should be running as expected from the Backup Machine. Optionally, users could have all modules and files running on the Backup Machine, with it completely disconnected from all networks until the time of failover.

BTWYSIWYG For BlackTrax

Table of contents:

Preparing the BTWYG file

Table of contents:

BTWYG Introduction

BTWYSIWYG is an award-winning program that offers lighting designers a customized 3D CAD, reporting and pre-visualization application which is included in the BlackTrax software suite. Using BTWYSIWYG will let you create a virtual representation of the Space.

BTWYSIWYG exports this information as a .btx file, which is then used by BlackTrax as a blueprint for tracking in the Space. If you are tracking with moving fixtures, fixture position and patching must also be included in the .btx file.

When connected to BlackTrax, BTWYSIWYG can act as a visualizer for what is happening in the Space. Trackable and fixture movement can be fully simulated, using information from BlackTrax or other data sources.

The following section on BTWYSIWYG covers only the features directly related to BlackTrax. For an in-depth understanding of BTWYSIWYG and its full capabilities, please refer to the current *WYSIWYG Reference Guide*.

Tip: A registered BlackTrax Expert can be consulted to assist with any portion of a BlackTrax project, including transferring information from BTWYSIWYG to BlackTrax.

Creating a BTWYSIWYG Project

Creating a BTWYSIWYG Project from BlackTrax

When a new BlackTrax project is launched from the *Portfolio Manager* for the first time, a new BTWYSIWYG project associated with the launched BlackTrax project is automatically created and opens by default.

When a new BTWYSIWYG project is created from BlackTrax, all necessary settings and configurations are automatically applied to that new BTWYSIWYG project. These template projects simplify the setup process for BTWYSIWYG on new installations.

Creating and launching the new BTWYSIWYG project from the BlackTrax *Portfolio Manager* will automatically start BTWYSIWYG in a state that is ready for BlackTrax use.

In the *Editing section* of the *System Configuration* widget in BlackTrax, you can set the BTWYSIWYG file to automatically open after the associated BlackTrax file launches from the *Portfolio Manager*. For more information about editing, see Editing section.

Notes:

- We recommend to create and launch the new BTWYSIWYG project from the BlackTrax *Portfolio Manager*, which is more convenient than to create the new project and settings manually in BTWYSIWYG.
- You can also launch the BTWYSIWYG file associated with a BlackTrax project via the **BTWYG** option under the **Modules** menu.

Creating a New BTWYSIWYG Project in BTWYSIWYG

The *New* command creates a new show document and will be saved as a ".wyg" file.

To create a new BTWYSIWYG project

1. In BTWYSIWYG, on the *Welcome Screen*, click **File** to choose **New**.
    - **Result:** The BTWYSIWYG opens a new show file in CAD.

BTWYG Welcome Screen

Saving the BTWYSIWYG Project

Once you have all the information on the Space that was created in BTWYSIWYG, the information must be saved as a BTWYSIWYG project file (.wyg). **Save** will save the open BTWYSIWYG project to the same file name and location under which it was previously saved. If you are saving the project for the first time, this command will perform **Save As...,** which will save the current project with a new file name and/or a new destination.

To save the BTWYSIWYG project using Save

1. In BTWYSIWYG, from the **File** menu, choose **Save**.
    - **Result:** The *Save as* window appears.
2. In the *Save as* window, navigate to where you want to save the project file.
3. In the *File name* field, type in the name of the project.
4. Click *Save*.

To save the BTWYSIWYG project using Save As...

1. In BTWYSIWYG, from the **File** menu, choose **Save As.**
    - **Result:** The *Save as* window appears.
2. In the *Save as* window, navigate to where you want to save the project file.
3. In the *File name* field type in the name of the project.
4. Click *Save*.

Requirements for Creating the Space in BTWYSIWYG

To use BlackTrax, you are required to create a virtual representation of the Space in BTWYSIWYG. This virtual Space will possess vital information that BlackTrax requires as follows: what the dimensions and tracking area of the Space are, what objects or people you want BlackTrax to follow (Trackables), and information on devices in use (e.g., fixtures). This section will guide you when creating the Space and aspects that must be included in BTWYSIWYG.

To create the BTWYSIWYG file for tracking with moving fixtures in BlackTrax, follow these mandatory steps

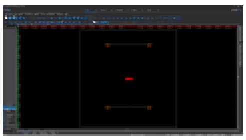
1. **Define a common origin position in the Space.** (Default set in template file.)
2. **Create and patch Trackables to a motion universe and assign avatars.** (Default set in template file.)
3. Hang moving fixtures approximately where they will be in the venue with the correct orientation.
4. Patch fixtures to DMX universe and assign Spot IDs.
5. **Patch DMX universes to console.** (Default set in template file.)
6. **Patch all created universes to BlackTrax.** (Default set in template file.)
7. Save the BTWYSIWYG project.
8. **Export the BTWYSIWYG project for use with BlackTrax.** (Default set in template file.)

- **Tip:** Some of the required steps are set by default when the *BlackTrax Template* file is used in creating a BlackTrax Portfolio, or from the *Templates* section in BTWYSIWYG.

To create the BTWYSIWYG file NOT for tracking with moving fixtures, follow these mandatory steps

1. **Define a common origin position in the Space.** (Default set in template file.)
2. **Create and patch Trackables to a motion universe and assign avatars.** (Default set in template file.)
3. **Patch all created universes to BlackTrax**. (Default set in template file.)
4. Save the BTWYSIWYG project.
5. **Export the BTWYSIWYG project for use with BlackTrax.** (Default set in template file.)

- **Tip:** Some of the required steps are set by default when the *BlackTrax Template* file is used in creating a BlackTrax Portfolio, or from the *Templates* section in BTWYSIWYG.

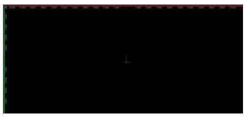

BTWYG file with patched fixtures and a trackable

Defining a Common Origin in BTWYSIWYG

Origin Introduction

Most objects in BTWYSIWYG are drawn as 3D objects, with width, depth, and height values using the Cartesian coordinate system of 3 working axes, X, Y, and Z. The point where the 3 axes meet is called the origin and the value of X, Y, and Z is 0 respectively (0,0,0).

By default, the origin will be in the center of the WYSIWYG project. This default origin is called the Document Origin. It is possible to move the origin from its default location to a new position. This origin is called the User Origin.


CAD mode with a frame representing the default origin

Origin Requirements

- The location of the origin is recommended to be inside the Space.
- The origin should be easy to see and determine in the Physical Space.
- The origin in the Physical Space needs to be visible to at least 2 BTSensors for BTSensor calibration to function.
- The location of the origin needs to be consistent. The origin needs to be the same in the BTWYSIWYG virtual Space, in Motive, in the Physical Space and any Third Party Programs connected to BlackTrax. Inconsistencies will cause errors in the BTSystem and any connected downstream technologies.
- The alignment of the ground plane in relation to the axes needs to be the same in the BTWYSIWYG virtual Space, in Motive, and in the Physical Space. **It is recommended that the following conventions are followed when aligning the origin**:
    - The +Y axis directed Upstage.
    - The +X axis is directed Stage Left.
    - The +Z axis is directed vertically towards the ceiling.

Ruler Tool

The Ruler Tool helps you design your show file in the Wireframe views of the CAD mode, providing a visual aid for coordinate reference and measurement. By default, the ruler is aligned with the document origin and displays coordinate information along the top and left side of the view. Its scale matches the default grid scale. The ruler has different colors to represent different axes (X=Red, Y=Green, Z=Blue).

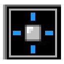
X Axis Ruler

Y Axis Ruler

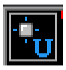
Z Axis Ruler

Ruler Icons

Document Origin: The document origin icon appears when the Ruler’s zero position (origin) is aligned with the Document Origin, which is set by default to be the center point of the BTWYSIWYG venue defined for the event.

 Document Origin Icon

User Origin: The user origin icon appears when you have set a new User Origin for the file.

 User Origin Icon

Creating the Venue in BTWYSIWYG

Using the tools in BTWYSIWYG's CAD mode, create an accurate scale representation the venue where Space is in. We suggest a minimum level of detail that includes floor, walls, and pipes, trusses, or structural frames in which BTSensors or moving fixtures will be attached. A more detailed venue will look better, and visualization will be more accurate.

Attention:

- Fixtures need to be attached to pipes or trusses to insert in BTWYSIWYG.
- You may insert fixtures on the floor, but the inserted fixtures will not spin using Fixture Properties.

Note: Due to the complexity of recreating an accurate representation of a venue, refer to the *WYSIWYG Reference Guide's* chapter on The CAD environment for a thorough understanding.

Creating Trackables in BTWYSIWYG

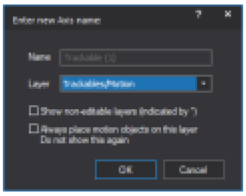
Trackables are objects or people to track. A Trackable can be represented by a library object from the *Library Browser*, or on a drawn object like a sphere or riser. Trackables are created on the *Trackables/Motion* layer by default.

Important Notes:

- Trackables are automatically named and patched when created.
- By default, when a New Portfolio is launched from BlackTrax, BTWYSIWYG opens with 12 Trackables.

To create a trackable in BTWYSIWYG

1. In BTWYSIWYG CAD mode, from the **BlackTrax** menu, choose **BT Trackable**.
    - **Result:** The *Enter new Axis name* window appears.



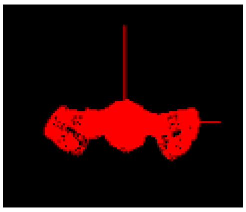
2. In the *Enter new Axis name* window, click the layer for the Trackable from the *Layer* drop-down list.
3. You can also select the checkboxes to enable the other options for the layer display.
4. Click *OK*.
5. On your drawing, click where you wish to place your Trackable.
    - **Result:** A Trackable object appears where the mouse was clicked. The Trackable object is represented as a Cartesian axis.

To add a library object to your trackable

1. In BTWYSIWYG CAD mode, at the bottom of the screen, click the *Wireframe* view tab.
2. From the **LIBRARY** menu, choose **Browse Library**.
    - **Result:** The *Library Browser* window appears.
3. At the bottom of the *Library Browser* window, click the *Library* items tab to display the contents.
4. Navigate to the desired object you wish to represent a Trackable.
    - **Note:** The actual look of the Trackable is purely cosmetic and will only represent the Trackable's position in the visualization.
5. At the top of the *Library Browser*, click the *Insert* tool.
    - **Tip:** You can also double-click the object name.
6. To insert the object, click on your drawing to place the object where you want in relation to the Trackable.
    - **Tip:** You should place the object relative to the drawn Trackable where the stringers will be on your physical tracked object. The object will then move and rotate around the centroid of the Trackable.
7. To stop inserting the object, right-click on the drawing and select **Finish Library Item** from the menu that appears.
8. Right-click on the Trackable object you inserted on the drawing.
9. From the menu that appears, select **Properties**.
10. On the *General* tab, from the *Attach to Axis* drop-down list, select the Trackable object you wish to assign the Library object to.
11. Click *OK*.

Result: The Trackable is represented as the inserted object and its motion is associated with the

BTTrackable.

 Trackable object with a person attached

Note: The BlackTrax Template file has one Trackable and avatar created and patched by default. It is possible to create multiple Trackables at once using the array tool in BTWYSIWYG, and this created Trackable. For more information about multiple objects, see the *Array* section in the *WYSIWYG Reference Guide*.

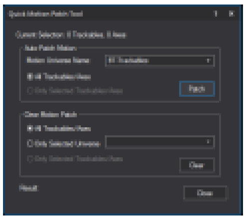
Patching Trackables in BTWYSIWYG

Patching Trackables Introduction

Important Note: As of BlackTrax v2.2, the Quick Motion Patch Tool is no longer required to patch Trackables because Trackables are automatically named and patched when inserted.

Trackables that are created need to be patched to a Motion Universe. The patch allows the visualization of Trackable movement in BlackTrax. This section shows how to easily patch Trackables using the *Quick Motion Patch Tool*, as well as the manual way to patch each Trackable.

Note: Read the *WYSIWYG Reference Guide's* chapter on *Data mode* for a complete understanding of patching manually assigned Trackables.


Quick Motion Patch Tool

Patching Trackables Using Quick Motion Patch Tool

To patch all trackables using the quick motion patch tool

1. From the **Tools** menu, choose **Quick Tools** and then choose **Quick Motion Patch Tool**.
2. Under the Auto-Patch Motion section, ensure that *All Trackable/Axes* is selected.
3. Click *Patch*.
    - **Note:** If the motion universe **BT-Trackables** does not yet exist in the file, BTWYSIWYG will ask in a dialog box if you wish to create it. In the dialog box, click *Yes* to create the motion universe.
    - **Result:** The Trackables are patched to the motion universe. The total number of Trackables patched will be reported at the bottom of the window.
4. Click *Close*.

To patch only selected trackables using the quick motion patch tool

1. Select all Trackables you wish to patch in one of the wireframe views.
    - **Tip:** Remember that the Trackable is the Cartesian axis associated with the Trackable, not the Trackable object itself.
2. From the **Tools** menu, choose **Quick Tools** and then choose **Quick Motion Patch Tool**.
3. Under the **Auto-Patch Motion** section, ensure that *Only Selected Trackable/Axes* is selected.
4. Click *Patch*.
    - **Note:** If the motion universe **BT-Trackables** does not yet exist in the file, BTWYSIWYG will ask in a dialog box if you wish to create it. In the dialog box, click *Yes* to create the motion universe.
    - **Result:** The Trackables are patched to the motion universe. The total number of Trackables patched will be reported at the bottom of the window.
5. Click *Close*.

To clear all trackables' patch using the quick motion patch tool

1. From the **Tools** menu, choose **Quick Tools** and then choose **Quick Motion Patch Tool**.
2. Under the **Clear Motion Patch** section, ensure that *All Trackable/Axes* is selected.
3. Click *Clear*.
    - **Result:** All Trackables are unpatched from the motion universe. The total number of patched Trackables removed will be reported at the bottom of the window.
4. Click *Close*.

To clear only selected trackables' patch using the quick motion patch tool

1. Select all trackables you wish to clear patch info for in one of the Wireframe views.
    - **Tip:** Remember that the Trackable is the Cartesian axis associated with the Trackable, not the Trackable object itself.
2. From the **Tools** menu, choose **Quick Tools** and then choose **Quick Motion Patch Tool**.
3. Under the **Clear Motion Patch** section, ensure that *Only Selected Trackable/Axes* is selected.
4. Click *Clear*.
    - **Result:** All selected Trackables are unpatched from the motion universe. The total number of patched Trackables cleared will be reported at the bottom of the window.
5. Click *Close*.

Hanging Moving Fixtures in BTWYSIWYG

If you want moving fixtures to follow a Trackable, you must place and hang the moving fixtures in BTWYSIWYG. When a moving fixture is placed in BTWYSIWYG, BlackTrax collects valuable fixture information such as the properties, range of capabilities, orientation and position in the venue.

Moving fixtures must be placed on the floor or hung onto pipes or trusses. The position and orientation of the fixtures in BTWYSIWYG must be close to their location in the actual Space for tracking to work correctly.

Attention:

- Calibration can resolve the fixtures' incorrect locations or backward orientation, but the calibration process is tedious. The fixtures in the actual Space should match their virtual fixture orientation and location to make calibration easier.
- Library objects that are classified as moving lights are capable of following Trackables.

Tip: To keep fixture orientation consistent, make a note on the orientation of the fixture’s tail. This provides an accurate indication of the fixture's orientation.

Note: Read the *WYSIWYG Reference Guide’s* chapter on *Hanging and focusing fixtures* for a complete understanding on how to hang fixtures.

To insert fixtures in BTWYSIWYG

1. In BTWYSIWYG CAD mode, at the bottom of the screen, click the *Wireframe* view tab.
2. From the **Library** menu, choose **Browse Library.**
   - **Result:** The *Library Browser* window appears.
3. At the bottom of the *Library Browser* click *Fixture Tool*.
4. On the menu that is now visible, double-click *Manufacturer* to select fixtures by manufacturer name, *Type* to select by fixture type, or *All* to see all the fixtures in alphabetical order.
   - **Note:** Alternately, you can use the *Library Browser's* search function to locate the fixture that you want to insert. Simply type the name of the fixture (or a partial name) in the search box at the top of the *Library Browser*, and then click the *Search* icon.
5. Double-click the fixture name.
   - **Result:** A fixture with default settings for this type attaches to the cursor.
6. To change the properties of the fixture before inserting, in the *Library Browser* right-click on the fixture name. On the menu that appears, click **Properties**.
   - **Result:** A dialog box opens with a shaded view of the fixture on the left and an image of its symbol on the right. Change the properties as needed.
7. To place the fixture, click over a hang structure.
   - **Result:** Copies of the fixture attaches to hang structures when clicked. Continue placing this type of fixture by clicking on the other hang structures as desired.
8. Right-click to finish placing this fixture type. On the menu that appears select **Finish placing fixtures**.
   - **Note:** Alternately, clicking ESC will finish placing fixtures.
9. To place other fixture types, repeat the above steps for each type.
   - **Attention: Fixtures intended for tracking must not hang directly over the Space.** When placing moving fixtures that are to follow Trackables, it is recommended that fixtures are not hung directly above the Space. Fixtures hung above the Space may run into pan and tilt range limitations when attempting to follow a Trackable.

 Fixtures placed on a pipe

Best Practices for Moving Fixture Placement

To obtain precise tracking in BlackTrax, the limitations of moving fixtures must be taken into account. The following section will guide you through known limitations of moving fixtures in BlackTrax and provide smart practices used to overcome these limits.

Attention: Do not place fixtures that will track directly above the Space.

A number of issues can occur if fixtures are directly above the Space. If fixtures are placed above the Space and are following a Trackable which moves in a circular path underneath, this can cause fixtures to spiral and reach a pan stop.

Note: BlackTrax has a feature where if a fixture pan-flips, the fixture will dim while performing the flip. This is in place to reduce the disruption caused by the pan-flip during operation.

Tips:

- Prediction algorithms can be selected when tracking to try and achieve specific tracking needs. For more information, see Fixture Sensitivity.
- To avoid these problems, it is recommended that moving fixtures are instead placed in front, behind, or on the sides of the Space. This will limit the range of both pan and tilt movement needed by fixtures to follow a Trackable and avoid these potential problems.
- If tracking must occur below a fixture, a possible solution is to hang the fixture sideways.

Patching and Assigning an ID to Fixtures in BTWYSIWYG

Patching Fixtures to BTWYSIWYG Introduction

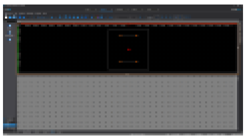
When a new BTWYSIWYG project is created from BlackTrax, DMX universes are automatically created and patched 1:1 by default.

When tracking occurs, BlackTrax uses the DMX values generated by the console, but overrides the pan and tilt channels with new values. These new values direct the fixture to aim and follow a Trackable. If a fixture was edited to have a constant beam size, the zoom and iris values will also change. The patching must be the same so that BlackTrax can override the correct DMX universe and channels.

In BTWYSIWYG, you can create and patch a DMX universe using the spreadsheet in DATA mode or Quick Tools.

To create a DMX universe

1. In BTWYSIWYG DATA mode, click the *Patch layout* tab at the bottom of the screen.
2. Right-click on the patch shortcut area on the right of the screen.
3. On the menu that appears click **New Patch**.
    - **Result:** The *Enter new Patch Universe name* dialog box appears, prompting for the type of universe that you want to create and the name of the new universe.
4. Type the name of the patch universe.
5. Under **Patch Universe Type**, select *DMX*.
6. Click *OK*.
    - **Result:** The patch shortcut appears in the *Patch* tab.


DATA Mode with one DMX universe created

Assigning Spot ID Numbers to Fixtures

An individual Spot ID number must be assigned to every single fixture in the project in BTWYSIWYG. This Spot ID number will map to a fixture ID on a connected lighting console. The Spot ID is used by the BTSystem to differentiate between fixtures in the project.

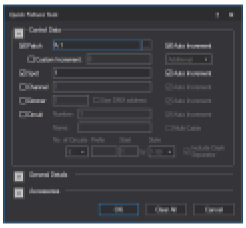
Fixture Patching Methods

There are multiple ways to patch fixtures in BTWYSIWYG. The following section will guide you through some of the simplest methods. For more information about patching, see the WYSIWYG Reference Guide’s chapter on *Data mode*.

To patch fixtures and assign spot IDs using quick tools

Use *Quick Tools* and click on the fixtures in Wireframe view to patch and assign spot IDs. The first fixture clicked will be assigned the patch and ID as configured in *Quick Tools*. The next fixture clicked will be assigned the next available channel in the patch and the next fixture ID in the sequence until you are finished using *Quick Tools*.

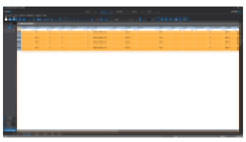
1. In BTWYSIWYG CAD mode Wireframe view, from the **Tools** menu, choose **Quick Tools** and then choose **Quick Tools**. Alternately click the *Quick Tools* icon in the *Tools* toolbar.
    - **Result:** The *Quick Fixture Tool* window appears.
2. In the *Quick Fixture Tool* window, in the **Fixture Attributes** section, select the *Spot* checkbox.
3. In the *Spot* field, enter a number which will be the first fixture ID used in the sequence.
4. In the **Fixture Data** section, select the *Patch* checkbox.
5. In the *Patch* field, enter the universe and channel the first fixture will patch to, separated by a period.
   Example: “A.1” would patch to universe A, address 1.
6. Click *Ok*.
    - **Result:** When a fixture is selected, it will be assigned a Universe and channel to operate on. The first fixture selected will be assigned the to the channel number entered in *Quick Tools*. Subsequent fixtures selected will be assigned the next sequential channel and Spot ID number.
7. Click on a fixture to patch it to a universe and channel. Click on each fixture that you want to be patched and assigned a spot ID.
8. To stop patching fixtures, right-click.
9. On the menu that appears, click **Finish Quick Tools**.


Quick Tools

To patch fixtures and assign spot IDs using the data spreadsheet

The Spreadsheet view In DATA mode displays information on all fixtures created in the BTWYSIWYG project. You can edit the patch information and Spot ID directly in the spreadsheet table.

1. In BTWYSIWYG DATA mode, click on the *Spreadsheet* tab.
2. In the Columns section on the left side of the window, click *All Data (Sortable)*.
    - **Result:** All fixture data are displayed in the spreadsheet.
3. In the *Patch* column, enter the appropriate patch information for each fixture.
4. In the *Spot* column, enter a unique Spot ID for each fixture.
    - **Tip:** It is possible to assign sequential values to fixtures quickly by selected all fields for the fixtures you wish to edit (for example all spot ID fields for all fixtures) and type the spot ID of the starting fixture and a '+' and hitting enter. For example, 101+ will set the first fixture to spot 101, and every fixture after that will increase by 1. If this method is used to assign values, it is recommended that fixtures are first sorted so fixtures are organized. Fixtures can be sorted in order of position, or Unit # along a pipe/truss. This can also be used for patching fixtures as well.


DATA>Spreadsheet with fixtures patched for BlackTrax

Patching DMX Universes to a Console

BlackTrax requires that the patching information of the connected console be recorded in BTWYSIWYG. This will inform BlackTrax which console is in use and which ports will transmit information.

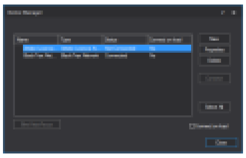
When a new BTWYSIWYG project is created from BlackTrax, DMX universes are automatically created and patched 1:1 by default.

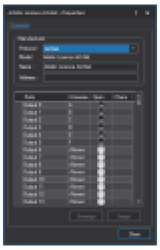
You can also patch the DMX universes to a DMX console in the *Device Manager* window in BTWYSIWYG.

Note: The DMX console used in BlackTrax and displayed in the *Device Manager* window in BTWYSIWYG is an sACN device. This device will also work with Art-Net without any changes.

To patch the DMX universe to a console

1. In BTWYSIWYG LIVE mode, from the **Managers** menu, choose **Device Manager.**
    - **Result:** The *Device Manager* window appears.
2. In the *Device Manager* window, click *New*.
    - **Result:** The *Library Selection* window appears.
3. Navigate through the console library until you find the console or device that you are connecting to. Click the console name to highlight it.
4. Click *Insert*.
    - **Result:** The console appears in the *Device Manager* window.
5. With the console name still selected, click *Properties*.
    - **Result:** The *Properties* window appears.
6. From the *Protocol* drop-down list, select the protocol used by the console.
    - **Result:** The console model is displayed in the *Model* field. The name of the console is displayed in the *Name* field.
7. In the *Address* field, type the designated address of the console, if applicable.
8. You must bind output ports from the console to BTWYSIWYG patch universes. Bind a Port output to the appropriate universe by clicking the *Universe* field next to the output.
    - **Result:** A drop-down list of available Universes is displayed.
9. Select the appropriate Universe from the list.
10. Repeat the above steps to bind all ports to their appropriate patch universes.
11. Click *Close* to close the *Properties* window.
12. Click *Close* to exit the *Device Manager* window.
    - **Result:** BlackTrax will know which console will be connected and which ports will transmit information


Device Manager with an Art-Net device and a BlackTrax console


Art-Net Device Properties with patched universes

Patching Universes to BlackTrax

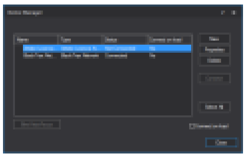
When a new BTWYSIWYG project is created from BlackTrax, DMX universes are automatically created and patched to BlackTrax 1:1 by default.

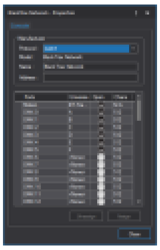
You can also patch the DMX universes to the BlackTrax Network in the *Device Manager* window in BTWYSIWYG.

After universes are created, be it motion or DMX, this information will need to be patched to BlackTrax. This will inform BlackTrax which of its ports are in use and which ports will transmit information.

To patch universes to BlackTrax

1. In BTWYSIWYG LIVE mode, from the **Managers** menu, choose **Device Manager.**
    - **Result:** The *Device Manager* window appears.
2. In the *Device Manager* window, click *New*.
    - **Result:** The *Library Selection* window appears.
3. In the *Library Selection* window, in the *Search* field, type **BlackTrax Network** and then click the *Search* icon.
    - **Result:** The device *BlackTrax Network* will be displayed in the search results.
4. Click on *BlackTrax Network* from the list to highlight it, then click *Insert*.
    - **Result:** The BlackTrax Network appears in the *Device Manager*.
5. With the BlackTrax Network name still selected, click *Properties*.
    - **Result:** The *Properties* window appears.
6. You must bind output ports from the BlackTrax Network to BTWYSIWYG patch universes. Bind a Port output to the appropriate universe by clicking the *Universe* field next to the output.
    - **Result:** A drop-down list of available Universes is displayed.
7. Select the appropriate Universe from the list.
8. Repeat the above steps to bind all ports to their appropriate patch universes.
9. Click *Close* to close the *Properties* window.
10. Click *Close* to exit the *Device Manager*.
    - **Result:** BlackTrax will know what ports are in use.


Device Manager with an Art-Net device and a BlackTrax console


The BlackTrax Console with Motion and DMX universes patches

Applying BTX information to BlackTrax from BTWYSIWYG

After a project is created, modified and saved in BTWYSIWYG, the new information must be sent and applied to the BlackTrax Project.

There are three methods for sending BTX information to BlackTrax from BTWYSIWYG:

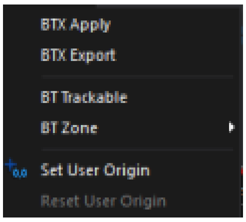
- **BTX Apply** in LIVE mode
- **BTX Export** in CAD mode
- **BTX Apply** in CAD mode

To send BTX information with BTX Apply in BTWYSIWYG LIVE mode

1. In BTWYSIWYG LIVE mode, from the **Live** menu, choose **BlackTrax Panel**.
    - **Result:** The *BlackTrax* window appears.
2. Ensure that the BlackTrax Portfolio is open, and BTWYSIWYG is connected to it.
3. In the *BlackTrax* window of BTWYSIWYG , click *BTX Apply*.
    - **Result:** BTWYSIWYG sends the BTX information to the BlackTrax Project.

To send BTX information with BTX Export in BTWYSIWYG CAD mode

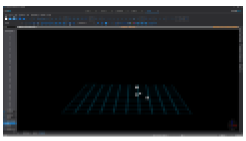
1. In BTWYSIWYG CAD mode, from the **BlackTrax** menu, choose **BTX Export**.
    - **Result:** A *Save as* window appears.
2. In the window, navigate to where you want to save the project file.
3. In the **File name** field type in the name of the project.
4. Click *Save*.
    - **Result:** The BTX information from BTWYSIWYG is exported and saved as a separate file which can be used to manually update your BlackTrax Project.
    - **Note:** If there are errors in the export, BTWYSIWYG will display the errors after the export is completed.



BlackTrax Menu found in CAD mode

To send BTX information with BTX Apply in BTWYSIWYG CAD mode

1. Ensure that the BlackTrax Portfolio is open, and BTWYSIWYG is connected to it.
2. In BTWYSIWYG CAD mode, from the **BlackTrax** menu, choose **BTX Apply**.
    - **Result:** BTWYSIWYG sends the BTX information to the BlackTrax Project.


LIVE mode showing the BlackTrax panel with BTX Apply

Optional .BTX Information

Table of contents:

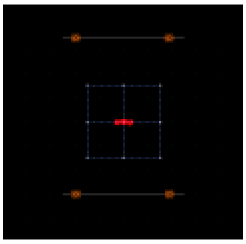
BlackTrax Zones

Three-dimensional areas called Zones, can be drawn inside the virtual representation of the Space in BTWYSIWYG. Zones are an incorporeal volume and can only be viewed in BTWYSIWYG, but if created, exists simultaneously in the virtual and physical Space. Zones are available in rectangular, cylindrical and spherical shapes of any size.

BlackTrax has a number of preset interaction between Zones and fixtures, which can be accessed in the Chapter section in BlackTrax. For information about BlackTrax Zones, see To enable a Zone for a Fixture.

To draw a rectangular zone

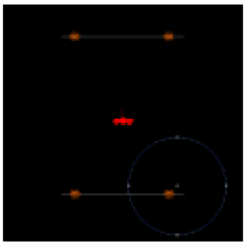
1. In BTWYSIWYG CAD mode, click the *Wireframe* view tab.
2. From the **BlackTrax** menu, choose **BT Zone** and then choose **Rectangular Zone**.
   - **Result:** The *New Rectangular Zone* window appears.
3. In the *New Rectangular Zone* window, in the *Width* field, enter in the width of the Zone.
4. In the *Depth* field, enter in the depth of the Zone.
5. In the *Height* field, enter in the depth of the Zone.
   - **Note:** Alternately, Zone dimensions can be created by selecting *Interactive*. The Zone is then drawn in Wireframe view, and dimensions are automatically recorded.
6. In the *Zone Name* field, enter a unique name for the Zone.
7. Click *OK*.
   - **Result**: The Zone will be inserted into the Space. It can be repositioned by dragging and dropping where needed. The dimensions of the Zone can be altered by manipulating the Zone directly, or by right-clicking the Zone and selecting **Properties**.


BTWYG drawing with a Rectangular Zone selected

To draw a cylindrical zone

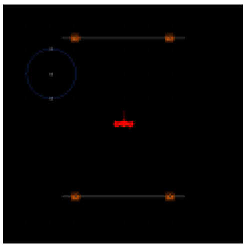
1. In BTWYSIWYG CAD mode, click the *Wireframe* view tab.
2. From the **BlackTrax** menu, choose **BT Zone** and then choose **Cylindrical Zone**.
   - **Result:** The *New Cylindrical Zone* window appears.
3. In the *New Cylindrical Zone* window, in the *Height* field, enter the height of the Zone.
4. In the *Horizontal Radius* field, enter in the horizontal radius of the Zone.
5. In the *Vertical Radius* field, enter in the vertical radius of the Zone.
   - **Note:** Alternately, Zone dimensions can be created by selecting *Interactive*. The Zone is then drawn in Wireframe view, and dimensions are automatically recorded.
6. *Lock Ratio* controls the aspect ratio of the radius. This feature is enabled by default. To disable, clear the *Lock Ratio* checkbox.
7. *Number of Segments* controls how many segments make up the radius of the cylindrical Zone. The default is set to 16. To change the number of segments, clear the *Use Document Defaults* checkbox. Enter the new segment number in the field.
   - **Note:** The maximum number of segments allowed is 40.
8. In the *Zone Name* field, enter a unique name for the Zone.
9. Click *OK*.
   - **Result:** The Zone will be inserted into the Space. It can be repositioned by dragging and

dropping where needed. The dimensions of the Zone can be altered by manipulating the Zone directly, or by right-clicking the Zone and selecting *Properties*.


BTWYG drawing with a Cylindrical Zone selected

To draw a spherical zone

1. In BTWYSIWYG CAD mode, click the *Wireframe* view tab.
2. From the **BlackTrax** menu, choose **BT Zone** and then choose **Spherical Zone**.
    - **Result:** The *New Spherical Zone* window appears.
3. In the *New Spherical Zone* window, in the *Horizontal Radius* field, enter in the horizontal radius of the Zone.
4. In the *Vertical Radius* field, enter in the vertical radius of the Zone.
    - **Note:** Alternately, Zone dimensions can be created by selecting *Interactive*. The Zone is then drawn in Wireframe view, and dimensions are automatically recorded.
5. *Lock Ratio* controls the aspect ratio of the radius. This feature is enabled by default. To disable, clear the *Lock Ratio* checkbox.
6. *Number of Segments* controls how many segments make up the radius of the spherical Zone. The default is set to 12. To change the number of segments, clear the *Use Document Defaults* checkbox. Enter the new segment number in the field.
    - **Note:** The maximum number of segments allowed is 40.
7. In the *Zone Name* field, enter a unique name for the Zone.
8. Click *OK*.
    - **Result:** The Zone will be inserted into the Space. It can be repositioned by dragging and dropping where needed. The dimensions of the Zone can be altered by manipulating the Zone directly, or by right-clicking the Zone and selecting *Properties*.


BTWYG drawing with a Spherical Zone selected

Planning BTSensor Placement

Table of contents:

BTSensor Introduction

Tracking only occurs in BlackTrax if two or more BTSensors can see a BTBeacon at the same time. Therefore, when placing BTSensors, there must be some overlap between what each BTSensor sees.

Place and aim BTSensors in BTWYSIWYG first before setup in the physical Space. This step is optional and will not affect your BlackTrax project. Planning BTSensor placement in BTWYSIWYG helps you test the BTSensor's coverage of the venue and determine how best to position them. BTSensors must not be placed any closer than 1m apart to help ensure optimal sensor calibration.

BTSensor Placement

To place a BTSensor in BTWYSIWYG

1. In BTWYSIWYG CAD mode, click the *Wireframe* view tab.
2. From the **Library** menu, choose **Browse Library**.
    - **Result:** The *Library Browser* window appears.
3. At the bottom of the *Library Browser* window, click the *Fixture* tool.
4. In the search box, type **BlackTrax.**
5. Double-click on the name of the BTSensor that you want to insert.
    - **Result:** A fixture with default settings for this type attaches to the cursor.
6. To change the properties of the fixture before inserting, such as the lens size, right-click on the fixture name, and then click **Properties**.
    - **Result:** A dialog box opens with a shaded view of the BTSensor on the left and an image of its symbol on the right. Use the *Appearance* tab to change the lens settings for the BTSensor. Options are 5.5 mm, 8.0 mm, 3.5 mm for Slim 13E. For s250e BTSensor options are 5.5 mm, 8.0 mm.
7. To place the BTSensor, move the mouse over a hang structure, and then click. Continue placing this type of fixture by clicking on the other hang structures as desired.
    - **Note:** BTSensors can be hung in Space without a hang structure.
8. Right-click and select **Finish placing fixtures** from the menu to finish placing the fixture.
    - **Result:** BTSensors will be hung in virtual space. BTSensors will emit a red beam to represent their field of vision.

To aim a BTSensor in BTWYSIWYG

1. In BTWYSIWYG CAD mode, click the *Wireframe* view tab.
2. In the *Wireframe* view, select a BTSensor.
    - **Tip:** You can also use the *Fixture Selection Tool* to select a single sensor or multiple sensors.
3. Use the *Fanning Tool* to aim the BTSensor(s) to the desired location.
    - **Tip:** You can also use the *Cuts and Adjustments* tool or the **Focus** menu to aim BTSensors in BTWYSIWYG.
    - **Result:** The BTSensor will orientate itself based on the new Pan and Tilt values. The BTSensor’s new field of view will be shown. For information about focussing, see the section on Quick focus in the WYSIWYG Reference Guide.

Example of BTSensor Placement

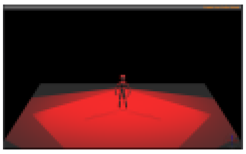
In CAD mode, BTSensors can be hung in the venue exactly the same as fixtures, from any pipe or truss. In this example BTSensors are hung around the perimeter on pipes represented in yellow, a mannequin in orange is at the origin of the room.

When BTSensors are hung, the BTSensor’s field of view will correctly project in the visualization. A BTSensor field of view of in BTWYSIWYG is depicted as a red beam Everything in the red beam is what the BTSensor can see.

Tracking can only occur when two or more BTSensors see the same area at the same time. By selecting multiple BTSensors, we can see their field of view and where their vision overlaps. Overlapping views are depicted in BTWYSIWYG as a deeper red then an individual view.

Two BTSensors whose field of view are overlapping. The deeper red in the center is the overlapping area where tracking can occur.

By placing BTSensors in BTWYSIWYG and viewing their projected field of view, it is easy to determine where BTSensors should go and how they should be aimed to maximize the tracking area in the venue. Any gaps in coverage where tracking cannot occur will also be shown. Once the position and orientation of BTSensor have been determined, you can record the data to reproduce the BTSensor placement in the actual venue.



BlackTrax Visualization

Table of contents:

Vis Introduction

BlackTrax projects can be visualized within BTWYSIWYG where fixture and Trackable interactions are simulated in the BTWYSIWYG virtual Space. Fixtures or Trackables that are selected in BlackTrax will be selected in BTWYSIWYG depending on the settings defined in the BlackTrax **System Configuration** widget. BTWYSIWYG, Motive, and BlackTrax must be open and running the project file for visualization to work correctly.

To visualize BlackTrax activity in BTWYSIWYG

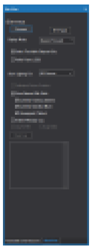
1. In BlackTrax, open the BlackTrax project file.
2. In BTWYSIWYG LIVE mode, go to the *BlackTrax* panel.
    - **Note:** To open the *BlackTrax* panel if closed, choose **BlackTrax** from the **Live** menu.
    - **Result:** The *BlackTrax* panel appears on the right side of the BTWYSIWYG window.
3. In the *BlackTrax* panel, select the *BTX Mode* checkbox.
4. In the *BlackTrax* panel and with BlackTrax running, click *Connect*.
    - **Result:** Activity in BlackTrax will now be visualized in BTWYSIWYG.

Using BTWYSIWYG as a Tracking Visualizer

Tracking data can be visualized in BTWYSIWYG. Viewing tracking data is useful for troubleshooting. Seeing fixtures and Trackables move in BTWYSIWYG based on the data helps determine if data is actually being transmitted. There could be problems in the BTSystem connections if there is no activity in BTWYSIWYG.

To visualize tracking data in BTWYSIWYG

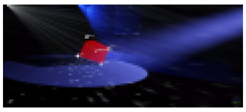
1. In BTWYSIWYG LIVE mode, from the **Live** menu, choose **BlackTrax Panel** to open the *BlackTrax* panel.
    - **Result:** The *BlackTrax* panel appears on the right side of the BTWYSIWYG window.



2. In the *BlackTrax* panel, select the *BTX Mode* checkbox to enable the option to connect with BlackTrax.
3. Click *Connect* to activate the connection with BlackTrax, or click *Disconnect* to deactivate the connection to BlackTrax.
    - **Note:** The BlackTrax template file connects automatically to BlackTrax when opened.
4. To customize how you interact with Trackables within Shaded view, select from the following options:
    - *Display Mode*: On this drop-down menu, select *Beacon Focused* or *Trackable Focused*.
        - *Beacon Focused*: Displays all LEDs and Centroids regardless of the Trackable patch in BlackTrax. This mode hides all objects attached to Trackables in BTWYSIWYG.
        - *Trackable Focused*: Displays only LEDs and Centroids that are actively patched to a Trackable in BlackTrax. This mode also displays objects attached to the Trackable in BTWYSIWYG.
    - *Select Trackable Objects Only*: Select this checkbox to choose only Trackable objects in the Shaded view of BTWYSIWYG.
    - *Prefer Frame LEDS*: Select this checkbox to display only Rigid or Soft Frame's LEDs and Centroids. When enabled, Classic and Mini Beacons will not be displayed in the Shaded view if they are currently assigned to a Rigid or Soft Frame.
5. To set how the fixtures and their beams are displayed and selected in Shaded view, select from the following options:
    - *Show Lighting For*: On this drop-down menu, select which beams of the fixtures will be displayed.
        - *All Fixtures*: Displays all the beams of the fixtures in the BlackTrax project.
        - *Tracking Only*: Displays only the beams of the fixtures that are currently following Trackables.
        - *No Fixtures*: No beams of the fixtures will be displayed.
    - *Calibrated Fixture Position*: Select this checkbox to show the position of the fixture as calibrated by BlackTrax instead of using the BTWYSIWYG drawn position.
    - *Show Beams With Stick*: Select this checkbox to display the beams of light produced by the fixtures as stick beams with the corresponding colors indicating their tracking status.

        - *Currently Tracking (Green)*: Select this checkbox to display only the stick beams of the fixtures connected and actively following a Trackable in a BlackTrax chapter. This stick beam appears in green color.
        - *Currently Standby (Blue)*: Select this checkbox to display only the stick beams of the fixtures that are connected to the system and are set to follow a Trackable in a BlackTrax chapter. This stick beam appears in blue color.
        - *Unassigned (Yellow)*: Select this checkbox to display only the stick beams of the fixtures that are connected to the system but not set to follow a Trackable in any BlackTrax chapter. This stick beam appears in yellow color.
6. Select the *Enable Message Log* checkbox to activate the message logging options.
    - *Log To File*: Select this checkbox to record the log information and automatically store into a file in the "bt_run_time" folder of your local drive.
    - *Log Data*: Select this checkbox to record the motion tracking information as it is displayed in the message box.
    - *Clear Log*: Click this button to clear the message box.

Viewing LEDs and Centroids in Shaded View of BTWYSIWYG



How LEDs of a Beacon are displayed in Shaded view:

- An LED appears as a solid circle when in front of everything in Shaded view.
- An LED appears as a circle outline when behind an object in Shaded view.
- An LED appears in the color that is identical to the Beacon color in BlackTrax.
- When an LED is selected, its color turns to white and the text label identification appears. For example, the screenshot (above) shows "L:101.4" which indicates LED of Beacon 101 and LED no. 4.

How Centroids are displayed in Shaded view:

- A Centroid appears as a solid square object when in front of everything in Shaded view.
- A Centroid appears as a square outline when behind an object in Shaded view.
- A Centroid appears in the color that is identical to the Beacon color in BlackTrax.
- When a Centroid is selected, its color turns to white and the text label identification appears. For example, the screenshot (above) shows "C:Whiteboard(101)" which indicates the Centroid associated with Beacon 101 is patched to the Whiteboard trackable.
- When a Centroid is selected, the LEDs associated with the Centroid are automatically selected.
- The Centroid appears with only a number if it is not patched to a Trackable.

Using the Trackables and Beacons Widget

The *Trackables and Beacons* widget is an easier, convenient and faster way to find and select LEDs and Centroids in the Shaded view of BTWYSIWYG.

To use the trackables and beacons widget

1. In BTWYSIWYG LIVE mode, from the **Live** menu, choose **Trackables and Beacons** to open the *Trackables and Beacons* panel.
    - **Result:** The *Trackables and Beacons* panel appears and displays the list of Trackables, Beacons, and Frames associated with the connected BlackTrax project.
2. In the *Trackables and Beacons* panel, click on the arrow at the far left of the list of Trackables, Beacons or Frame to expand or collapse the corresponding list below them.
3. On the *Trackables and Beacons* panel, click on a single or multiple Trackables, Beacons or Frame to select in the Shaded view.
    - **Result:** In the Shaded view, the selected Trackable(s) or Beacon(s) or Frames will turn to white with the corresponding text label identification.

Note: You can activate Shaded View Selection by pressing TAB while in CAD, Design or Live mode > Shaded View. Once you press TAB, a purple message at the top right-hand corner of the Shaded view window appears: "Shaded View Select ON", and you may click on the objects in Shaded view to select. Please refer to the "*Using Shaded View Selection*" section in the current *WYSIWYG Reference Guide*.

Using Calibration Data to Adjust Visualization in BTWYSIWYG

Once fixtures have their position calibrated in BlackTrax, this information can be used to improve visualization in BTWYSIWYG. The position of fixtures in BTWYSIWYG will change to the calibration locations, creating a more accurate visualization.

To use calibrated fixture positions in BTWYSIWYG

1. In BlackTrax, open the BlackTrax project file.
2. In BTWYSIWYG LIVE mode, go to the *BlackTrax* panel.
    - **Note**: To open the *BlackTrax* panel if closed, from the **Live** menu, choose **BlackTrax Panel**.
    - **Result:** The *BlackTrax* panel appears on the right side of the BTWYSIWYG window.
3. Select the *BTX Mode* checkbox.
4. Click *Connect*.
5. Select the *Calibrated Fixture Position* checkbox.
    - **Result:** The position of fixtures in BTWYSIWYG changes to reflect the calibration data created in BlackTrax.

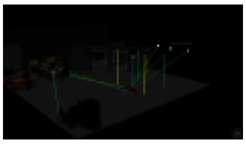
Note: For information about calibrating fixtures, see Fixture Calibration.

Using Stick Beams for Fixtures in BTWYSIWYG

When you visualize in BTWYSIWYG, stick beams can represent the beams of light produced by fixtures. This reduces clutter and confusion in the visualization and helps determine where fixtures are aiming and which fixtures are selected.

To use fixture stick beams in BTWYSIWYG

1. In BlackTrax, open the BlackTrax project file.
2. In BTWYSIWYG LIVE mode, go to the *BlackTrax* panel.
    - **Note:** To open the *BlackTrax* panel if closed, from the **Live** menu, choose **BlackTrax Panel**.
    - **Result:** The *BlackTrax* panel appears on the right side of the BTWYSIWYG window.
3. Select the *BTX Mode* checkbox.
4. Click *Connect*.
5. Select the *Show Beams With Stick* checkbox.
    - **Result:** Fixture beams will be represented as sticks in BTWYSIWYG.
6. To toggle specific stick beams on or off, clear the checkbox next to the desired stick beam status (*Currently Tracking (Green)*, *Currently Standby (Blue)*, or *Unassigned (Yellow)*).



Understanding Stick Beam Colors

The color of a stick beam communicates information about the parent fixture at a glance.

- A Green stick beam means a fixture is connected to the system, there is a chapter created in BlackTrax where it follows a Trackable and it is currently following a *Trackable - Currently Tracking (Green)*.
- A Blue stick beam means a fixture is connected to the system, there is a chapter created in BlackTrax where it follows a Trackable, but it currently is not set to follow a *Trackable - Currently Standby (Blue)*.
- A Yellow stick beam means that a fixture is connected to the system, but there is no chapter in BlackTrax where that fixture is told to follow *Trackables - Unassigned (Yellow)*.

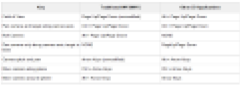
Shaded View Camera Control

The default camera control in the Shaded view of BTWYSIWYG is set to *Other 3D Applications* where commands and behavior are identical to other 3D applications instead of the traditional WYSIWYG standard.

Mouse Actions

*Affected by View Option, "Pan tool moves objects".

Keyboard Actions



Note: In the *Application Options* window, you can choose *Traditional WYSIWYG* on the *Shaded View Camera Control* list if you want to use the standard WYSIWYG camera control in Shaded view.

Motive for BlackTrax

Table of contents:

Initial Setup

Table of contents:

Motive Introduction

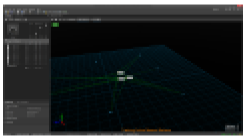
The Motive module is used to manage and control BTSensors. Motive is part of the BlackTrax software suite that is already installed on the BTServer and is ready for you to use. The following section will guide you through specific steps on how to use Motive to configure BTSensors to work in the Space and function with the BTSystem.

Attention: Users should only install versions of Motive included in BlackTrax System Update packages. Failure to do so could result in your BlackTrax system not functioning correctly.

The Motive splash screen appears upon launch and it will display a notification if the Motive license is about to expire or if the Motive license has expired or if the Motive license is not found. Motive will still run with an expired license if the version was released at any time before the license expired.

If your license is expired, please contact BlackTrax Support.

Motive opens and ready for use.



Layout Presets in Motive

Custom preset layouts in Motive were created for BlackTrax and set as preset layouts which can be restored quickly from the **Layout** menu or from the Main Toolbar drop-down menu. The custom preset layouts for BlackTrax are:

Layout Preset	Description	Keyboard Shortcut
Running	Opens the windows that will be used when a BlackTrax project is running.	CTRL+1
Aiming	Opens the windows that will be used for the aiming of BTSensors.	CTRL+2
Calibration	Opens the windows that will be used for the configuration of BTSensors.	CTRL+3
Configuration	Opens the windows that will be used for the configuration of a BlackTrax project.	CTRL+4
Recording	Opens the windows that will be used for the recording of motion data in a BlackTrax project.	CTRL+5

The GUI layout in Motive can be customized. All windows can be docked and undocked from the GUI. Each window can be positioned and organized by drag-and-drop using the on-screen docking indicators. Windows may float, dock, or stack. Windows form a tabbed window when stacked together. The custom layouts in Motive can be saved and loaded, allowing for the quick switching between default and custom configurations suitable for different needs.

Note: Layout configurations from older versions will not load in Motive 2.

To restore a preset layout

1. In Motive, click the drop-down box at the right-hand side of the main toolbar and click the layout preset from the drop-down menu of layout presets.
    - **Result**: Motive opens the preset windows in the selected layout.
    - **Tip**: You can also restore a particular layout from the Layout menu.

BTSensor Differences in Motive

Depending on your tracking needs, the type of BTSensors used in your BTSystem will vary. Each model of BTSensor has slightly different settings in Motive. Due to these different settings, steps outlined in this manual may be slightly different depending on what BTSensor is in use.

Differences include specific properties of the BTSensor found in Motive in the *Devices* window, and the BTSensor's view found in the *Camera Preview* window.

Note: All BTSensors purchased from CAST are capable of tracking.

BTSensor Presets

BTSensor Introduction

BTSensors are required to be configured in certain ways to complete specific tasks: tracking objects, referencing the BTSensor's real-time location or aiming BTSensors. These settings can be entered in manually, or automatically configured in Motive by selecting a preset from the *Preset* drop-down menu on the *Devices* window. The following tables explain what BTSensor settings are changed when you select a preset.

SLIM 13E Presets

SLIM 13E presets

BTSensor Properties			
Preset Setting	**Filter Switch**	**Video Type**	**Gain**
Tracking	Infrared Spectrum	Object Mode	User defined (No Change)
Reference	Visible Spectrum	MJPEG / MJPEG Quality: 4	User defined (No Change)
Aiming	Infrared Spectrum	MJPEG / MJPEG Quality: 4	User defined (No Change)
Custom	User defined	User defined	User defined (No Change)

S250e SLIM Presets

S250e presets

BTSensor Properties		
Preset Setting	**Filter Switch**	**Video Type**
Tracking	Infrared Spectrum	Precision Mode
Reference	Visible Spectrum	MJPEG / MJPEG Quality: 4
Aiming	Infrared Spectrum	MJPEG / MJPEG Quality: 4
Custom	User defined	User defined

Prime 41 Presets

PRIME 41 presets

BTSensor Properties		
Preset Setting	**Video Type**	**Gain**
Tracking	Object Mode	User Defined (No Change)
Reference	MJPEG / MJPEG Quality: 4	User Defined (No Change)
Aiming	MJPEG / MJPEG Quality: 4	User Defined (No Change)
Custom	User Defined	User Defined (No Change)

Note: Prime 41 BTSensor does not have a Filter Switch.

To select a preset setting for a BTSensor

1. In Motive, go to the *Devices* window.
   - **Tip:** To open the window, from the **View** menu, choose **Devices Pane**.
2. In the *Devices* window, select a single BTSensor, or select all BTSensors in the group by clicking the group name.
3. At the top of the *Devices* window, click the *Preset* drop-down menu and select the desired preset.
   - **Result:** The selected BTSensors will have their settings changed to that of the selected preset.

Note: BTSensors have been custom designed for BlackTrax, which removes the illumination ring.

Checking the Connectivity of BTSensors

BTSensors must be connected to the BTSystem for tracking to occur. The connection status of BTSensors can be determined in the *Devices* window in Motive.

To determine if BTSensors are connected

1. In Motive, click the drop-down box at the right-hand side of the main toolbar and click *Running* from the drop-down menu of layout presets. 

    - **Result:**
        - Motive opens the preset windows in the *Running* layout.
        - In the *Devices* window, all connected BTSensors will be displayed under the *Cameras* group.
          
    - **Note:** If a BTSensor is not visible in the *Devices* window, check the physical connections to see if any BTSensors are disconnected.
    - **Tip:** To help identify BTSensors, you can click the *Aim Assist* button on a BTSensor in the *Devices* window, and the corresponding BTSensor will flash yellow in the *Camera Preview* window.

Using Motive to Aim BTSensors

For tracking to occur, BTSensors must be positioned around the perimeter of the tracking area and aimed towards the area. Tracking occurs in an area when 2 or more BTSensors view the same area at the same time. A video feed of what BTSensors see is shown in Motive. By viewing the BTSensor's video feed in the visible spectrum, BTSensor positioning can be evaluated.

Attention: The Space origin must be visible to at least 2 BTSensors for sensor calibration to function correctly.

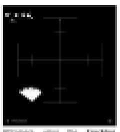
Note: To quickly see a BTSensor's video feed in the visible spectrum, change the preset setting of the BTSensor to Reference. See To select a preset setting for a BTSensor for more information.

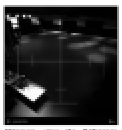
Motive 2

To view a BTSensor's video feed in the visible spectrum

1. In Motive, click the drop-down box at the right-hand side of the main toolbar and click *Aiming* from the drop-down menu of layout presets.
    - **Result:** Motive opens the preset windows for the aiming of BTSensors.
2. In the *Devices* window, click the group name to select a single BTSensor, or select all BTSensors in the group.
3. With the BTSensor(s) selected, look below to the **Properties** section of the *Devices* window.
4. On the *Camera Settings* section, set the *Filter Switch* field to *Visible Spectrum*.
5. On the *Camera Settings* section, set the *Video Type* field to *MJPEG Mode* and select the range of *MJPEG Quality* from the drop-down menu. The range of *MJPEG Quality* is between *1* (minimum) and up to *4* (maximum).

Result: The video displayed from the BTSensors will appear as a grayscale image in the visible spectrum.


BTSensors using the Tracking preset.

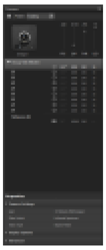

BTSensors using the Reference preset.

Motive 1.10 or lower

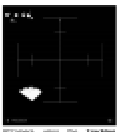
To view a BTSensor's video feed in the visible sprectrum

1. In Motive, click on the box at the right hand side of the main toolbar and click *Aiming* from the drop-down menu of layout presets.
    - **Result:** Motive opens the preset windows for the aiming of *BTSensors*.
2. In the *Cameras* window. click the group name to select a single BTSensor, or select all BTSensors in the group.
3. With the BTSensor(s) selected, go to the **Properties** section of the *Cameras* window.

4. Under the *Camera Settings* heading, set the *Filter Switch* field to *Visible Spectrum*.
5. Set the *Video Type* field to one of the MJPEG mode options.



Result: The video displayed from the BTSensors will appear as a grayscale image in the visible spectrum.



BTSensors using the **Tracking** preset.

BTSensors using the **Reference** preset.

BTSensor Aim Assist Feature

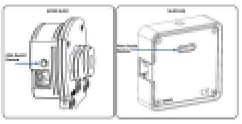
BTSensors have an *Aim Assist* button to help with aiming BTSensors. When you press the *Aim Assist* button, the BTSensor video feed is selected and prominently displayed in Motive. The BTSensor video feed changes to show the Space in the visible spectrum, and the exposure increases to brighten the image. This helps aiming the BTSensors correctly. Pressing the *Aim Assist* button a second time will return the BTSensor's video feed to its previous settings.

To toggle aim assist on BTSensor

With the BTSensor connected to the BTSystem, and with Motive operating, press the *Aim Assist* button on the BTSensor.

Result: In Motive, the BTSensor will be selected and its live video feed prominently displayed. The BTSensor's video feed will be toggled between its current settings and Aim Assist mode.

Aim Assist location



Motive Project File

A BlackTrax project requires specific information (BTSensor, calibration and configuration) from Motive, that is unique to every BlackTrax project. This information is required every time BlackTrax operates.

Motive 2

In Motive, recorded motion capture data is stored as a *Take* (.tak) file format, all application-related configurations are saved onto *Profile XML* (.xml) files, and calibration data for each BTSensor position, orientation and lens parameters are saved as standalone calibration *CAL* (.cal) file format.

In Motive, profile and calibration data are automatically saved into the ProgramData folder and automatically reloaded when Motive is opened again.

In Motive, profile data is automatically saved once every five minutes and calibration data is automatically saved whenever calibration is updated (such as in Continuous Calibration).

Multiple *Take* (.tak) files are automatically saved in a Session Folder which can be accessed from the *Data* window.

To save a Take to a new location and/or using a new file name

1. In Motive, from the **File** menu, choose **Save Current Take As**.
    - **Result:** The *Save Current Take As* dialog box appears.
2. In the *File Name* field, type the name of the *Take* file.
3. Click *Save*.
    - **Result:** The renamed *Take* file will be saved in the selected location.

To save an existing Take file using the same location and file name

1. In Motive, from the **File** menu, choose **Save Current Take**.
    - **Result**: Only the recording of the wanding is saved after calibration.
    - **Notes:**
        - Save current take is automatically applied after ground plane calibration.
        - Use **Export Camera Calibration** from the **File** menu to save the calibration data. See To export a calibration CAL file.

To save a Profile to a new location and/or using a new file name

1. In Motive, from the **File** menu, choose **Save Profile As**.
    - **Result:** The *Save Profile* dialog box appears.
2. In the *File Name* field, type the name of the *Profile XML* file.
3. Click *Save*.
    - **Result:** The renamed *Profile XML* file will be saved in the selected location.

To save an existing Profile using the same location and file name

In Motive, from the **File** menu, choose **Save Profile**.

To load a Profile

1. In Motive, from the **File** menu, choose **Load Profile**.
    - **Result:** The *Load Profile* dialog box appears.
2. In the *Load Profile* dialog box, navigate to where the desired .xml file was saved and click on the file to select it.

3. Click *Open*.
    - **Result:** The .xml file will load all application-related configuration settings into Motive.

Motive 1.10 or lower

New Project will create a new Motive project folder with the new project document (.ttp file) and all its associated files automatically stored within the specified folder. Specify the name and save the new Motive project.

Notes:

- When a new Motive project is created from BlackTrax, all necessary settings and configurations are automatically applied to that new project. These template projects can be used to simplify the setup process for Motive on new installations.
- We recommend to creating and launching the new Motive project from the BlackTrax File menu which is more convenient than having to manually create the new project and settings in Motive.

Save Project will save the open Motive project to the same file name and location under which it was previously saved. If you are saving the project for the first time, this command will perform as Save Project As... . Save Project As... is used to save the current project with a new file name and/or a new destination.

To save a Motive project to a new location and/or using a new file name

1. In Motive, from the **File** menu, choose **Save Project As...**.
    - **Result:** The *Save As* dialog box will appear.
2. In the *File Name* field, type the name of the project.
3. Click *Save*.

To save an existing Motive Project using the same location and file name

In Motive, from the **File** menu, choose **Save Project**.

To load a Motive Project

1. In Motive, from the **File** menu, choose **Open...**.
    - **Result:** The *Open* dialog box will appear.
2. In the *Open* dialog box, navigate to where the desired .ttp file is saved. Click on the file to select it.
3. Click *Open*.
    - **Result:** The .ttp file will load. Its information and settings will load into Motive.

BTSensor Calibration

Table of contents:

BTSensor Calibration Settings

After BTSensors are placed and orientated with overlapping views around the Space, BlackTrax requires that all BTSensors be calibrated. Calibration enables BlackTrax to know BTSensor positions relative to each other and the floor. This spatial awareness of the Space is required for tracking to be accurate. Before BTSensor calibration can occur, certain settings in Motive must be configured.

Motive 2

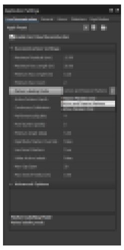
In Motive, calibration data for each BTSensor position, orientation and lens parameters are saved as standalone calibration CAL (.cal) file format which can be exported to a desired location for later use. See To export a calibration CAL file below.

Motive can be set for Continuous Calibration where the system continuously monitors BTSensor movements and readjusts the BTSensor calibration accordingly. See To configure Motive for continuous calibration below.

To configure BTSensors for calibration

1. In Motive, change the layout to *Calibration* preset. From the **Layout** menu, choose **Calibration**.
    - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click *Calibration* from the drop-down menu of layout presets.
2. Go to the *Devices* window.
    - **Note**: To quickly configure a BTSensor for calibration, change the preset setting of the BTSensor to *Tracking* then proceed to Step 7 in this section.
3. In the *Devices* window, select the camera group by clicking on the group name.

4. While the sensor group is still selected, click the *Properties* section for the sensor group.
5. Click the *Camera Settings* section and set the *Video Type* field to *Object Mode* for tracking and calibration.
6. Set the *Filter Switch* field to *Infrared Spectrum*.
7. Go to the *Application Settings* window and click the *Live Reconstruction* tab.
8. On the *Live Reconstruction* tab, click the *Marker Labelling Mode* drop-down box and select *Active and Passive Markers* or *Passive Markers Only* to set for calibration.



- **Note:** Select *Active Markers Only* or *Active and Passive Markers* to set for tracking.

To configure Motive for continuous calibration

BTSensors must have already been calibrated if Continuous Calibration will be used.

1. In the *Calibration* preset layout, go to the *Application Settings* window.

2. On the *Application Settings* window, click the *Live Reconstruction* tab.
3. On the *Live Reconstruction* tab, click *Continuous Calibration*.
4. On the *Continuous Calibration* drop-down menu, select *Continuous*.
    - **Result:** Motive monitors and updates the BTSensor calibration continuously. The system uses the motion of Beacons on stage to update any slight changes needed for the BTSensor calibration without the need for manual refine.

Notes:

- If you use this feature, select the *Continuous* option. The *Continuous+Bumped* option can be used in controlled situations. As this option is more agressive, it should not be used during show conditions, and only when the user would have time to perform a manual calibration if needed.

You can use the Status *Log* window to see if the system has updated the BTSensor calibration. Click **View** > **Status Log Pane** to open.

- If the calibration has been updated, you can use *Export Camera Calibration* to export the current BTSensor calibration. (see the following section below)

To export a calibration CAL file

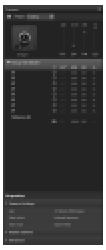
1. In the *Calibration* preset layout, click the **File** menu.
2. From the **File** menu, choose **Export Camera Calibration**.
    - **Result:** The *Export Camera Calibration* window appears.
3. Navigate to the location where the calibration file will be saved.
4. In the *File name* field, type the name of the calibration *.cal* file.
5. Click the *Export* button.
    - **Result:** The calibration results are preserved as a *.cal* file which can be loaded into Motive.

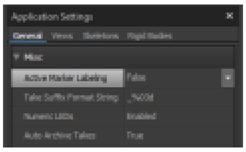
To open and restore a calibration CAL file

1. In Motive, from the **File** menu, choose **Open**.
    - **Result:** The *Open* window appears.
2. Navigate and select the *.cal* file you wish to open and restore.
3. Click *Open*.
    - **Result:** The saved calibration data will be restored in Motive.

Motive 1.10 or lower

To configure BTSensors for calibration

1. Change the Motive layout to **Calibration** (found under **Layout** > **Calibration**).
2. Go to the *Cameras* window.
    - **Note**: To quickly configure a BTSensor for calibration, change the preset setting of the BTSensor to *Tracking*, then proceed to **Step 6** in this section.
3. In the *Cameras* window, select the sensor group by clicking on the group name. 
4. While the sensor group is still selected, look below to the *Property* section for the sensor group. Under the *Camera Settings* heading, set the *Video Type* field to *Precision Mode/Object Mode*.

5. Set the *Filter Type Switch* field to *Infrared Spectrum*.
6. Go to the *Application Settings* window.
7. In the *Application Settings* window, in the *Options* tab, under the *Application Options* heading, set the *Active Marker Labeling* field to *False*.

8. Close the *Application Settings* window.

Masking Infrared Interference for Calibration

Masking is a function in Motive where an area of the BTSensor’s vision is masked (blocked from view). This tells the system to ignore the masked section when looking for infrared sources. This is used primarily to mask outside infrared interference that can confuse the system during BTSensor calibration.

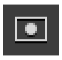
Excessive masking may limit a BTSensor field of view, as a masked area makes a BTSensor blind to tracking in that area. You can reposition BTSensors to improve fields of view, rather than masking in extreme cases of infrared interference.

Attention: Calibration will be successful if you mask infrared interference before calibration. Masking differs if Motive is configured for active or passive markers.

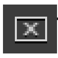
Motive 2

To automatically mask all visible infrared sources from all BTSensors

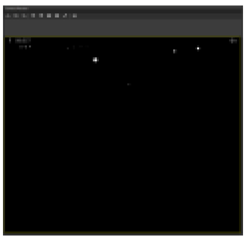
Attention: Automatic masking will remove all previous masks from the BTSensor.

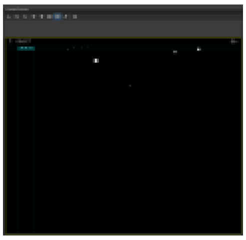
1. In Motive, go to the *Camera Preview* window.
2. On the *Camera Preview* toolbar, click the *Mask Visible Markers* button.
    -  The *Mask Visible Markers* button.
    - **Result:** All currently visible infrared sources are masked. Any previously created masks are removed. If additional sections need to be masked, use manual masking techniques.

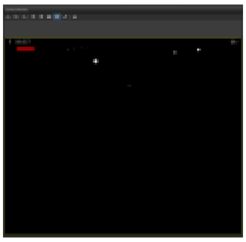
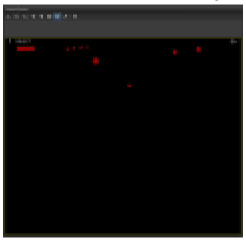
To clear all masks from all BTSensors

1. In Motive, go to the *Camera Preview* window.
2. On the *Camera Preview* toolbar, click the *Clear Masking* button.
    - The *Clear Masking* button.
    - **Result:** All masking are cleared from all BTSensors.

To manually mask a BTSensor view

1. In Motive, go to the *Camera Preview* window.
    - **Result:** What each connected BTSensor sees is displayed as a 2D image in the *Camera View* window. If BTSensors are configured to see infrared sources, they appear as white objects.
    -  *Camera View* window with infrared interference.
2. On the *Camera Preview* toolbar, select the shape of the mask, either *Draw Rectangular Mask* or *Draw Circular Mask* from the toolbar.
    -  The *Draw Rectangular Mask* button.
    - **Result:** You will create masks in the selected shape.

-  *Camera View* window with rectangular mask.

3. To mask the infrared interference areas inside the *Camera View* window of a BTSensor, click on one corner of the interference while holding the left mouse button down and drag the mask to cover the infrared interference.
    - **Result:** The infrared object (white object) is covered by a mask (red object). The infrared source will not interfere with tracking when masked.
    -  *Camera View* window with partial IR masking.
4. Repeat the above steps for each instance of infrared interference.
    -  *Camera View* window with full IR masking.

To toggle additive or subtractive masking

The *Toggle Additive/Subtractive Masking* button makes all the draw masking buttons remove the masking instead. For example, if you click the *Toggle Additive/Subtractive Masking* button to subtractive and then draw a rectangle, the individual masking where the rectangle was drawn will be removed.

1. In Motive, go to the *Camera Preview* window.
2. On the *Camera Preview* toolbar, click the *Toggle Additive/Subtractive Masking* button.
    -  The *Toggle Additive/Subtractive Masking* button.
    - **Result:** Toggle subtractive makes all draw masking buttons remove the masking when applied. Toggle additive makes all draw masking buttons add the masking when applied.
3. Draw the mask.
    - **Result:** The mask is removed if toggle subtractive is selected. The mask is added if toggle additive is selected.

Motive 1.10 or lower

To automatically mask all visible infrared sources from all BTSensors

Attention: Automatic masking will remove all previous masks from the BTSensor.

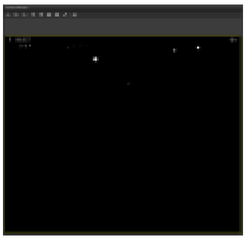
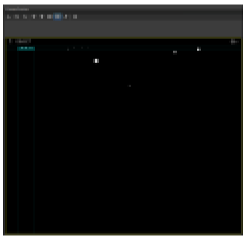
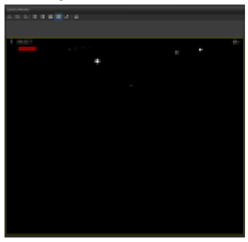
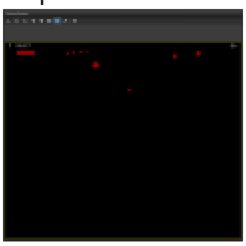
1. In Motive, go to the *Camera Preview* window.
2. On the *Camera Preview* toolbar, click the *Block Visible Markers* button.
    - **Result:** All currently visible infrared sources are masked. Any previously created masks are removed. If additional sections need to be masked, use manual masking techniques.

To clear all masks from all BTSensors

1. In Motive, go to the *Camera Preview* window.

2. On the *Camera Preview* toolbar, click the *Clear Blocking* button.
    - **Result:** All masking are cleared from all BTSensors.

To manually mask a BTSensor view

1. In Motive, go to the *Camera Preview* window.
    - **Result:** What each connected BTSensor sees is displayed as a 2D image in the *Camera View* window. If BTSensors are configured to see infrared sources, they appear as white objects.

2. On the *Camera View* toolbar, select the shape of the mask, either *Rectangular Blocking* or *Circular Blocking* from the toolbar.
    - **Result:** You will create masks in the selected shape.

3. To mask the infrared interference areas inside the *Camera View* window of a BTSensor, click on one corner of the interference while holding the left mouse button down and drag the mask to cover the infrared interference.
    - **Result:** The infrared interference (white object) is covered in by a mask (red object). While  masked, the infrared source will not interfere with tracking.
4. Repeat for each instance of infrared interference.


Calibrating a BTSensor

BTSensor Calibration Introduction

If BTSensors that were initially placed in the Space were moved after setup or bumped accidentally, the BTSensors must be calibrated. BTSensor calibration enables the system to determine where the BTSensors are in relation to each other using the calibration wand, and where they are in relation to the origin using the ground plane.

Proper calibration is very important because incorrect calibrations will send incorrect position data and erroneously affect the BTSystem's accuracy.

Attention: Anytime a BTSensor is moved or bumped, BTSensor calibration must be performed and saved to the Motive project file. See *Working with Recordings* for details saving and playing back Motive recordings.

Differences Between Full Calibration and Refine Calibration

There are three ways to calibrate BTSensors: a Full calibration, a Refine calibration, and a Partial Refine calibration.

- **Full:** This method calibrate BTSensors using no previous information. This calibration is always used when using BlackTrax in a new Space.
- **Refine:** This calibration method uses existing information from a previously saved calibration as a starting point of the calibration. This calibration method is primarily used when BTSensors are moved slightly after an initial calibration and needs calibration again.
- **Partial:** This calibration method uses existing information from a previously saved calibration as a foundation. The user selects either a **Full** or a **Refine** calibration type as above, and is able to select a number of BTSensors to perform the partial calibration upon. BTSensor calibration builds upon the previous calibration and corrects any errors. This calibration method is primarily used when some BTSensors are moved slightly after an initial calibration and need correction, but not the entire BTSensor rig.

Wand Calibration

Wand calibration enables BlackTrax to determine the relative position of BTSensors to each other in the Space. This is followed by ground plane calibration, which enables BlackTrax to determine the BTSensor's relative position to the ground. See *Ground Plane calibration* below for more information.

Note: When wanding starts, Motive records the wanding and autosaves it to the session folder.

To calibrate BTSensors with the calibration wand

1. In Motive, change the layout to Calibration preset. From the **Layout** menu, choose **Calibration**.
    1. Go to the *Camera Calibration* window.
    2. Choose either a *Full* or *Refine* calibration based on the guidelines above.
    3. In the *Calibration* tab, under the *Wand Option* heading, set the *OptiWand* sub-heading to *Custom*.
    4. Set the *Wand Length (mm)* field to *1000*.

    5. Set the *Center Distance (mm)* field to *350*.
2. Click *Start Wanding*.
    - **Result:** BTSensors record calibration wand data within the Space. The *Calibration Engine* section records the samples of each BTSensor and the spread of the samples.
        1. In the Physical Space, plug the power source into the calibration wand, and connect the HPSU.
            - **Result:** The calibration wand's LEDs should be visible in Motive as an infrared source.
        2. Wand the Physical Space by moving the powered calibration wand across the Space. Move the wand up and down, back and forth, and rotate the head while you move, to create different data points (think of a figure eight motion). Ensure the calibration wand LEDs are not covered or being blocked from BTSensor view.
            - **Tip:**
                - When in use, the front facing LED on the Slim 13E BTSensor turns blue to indicate that the wand is visible.
                - You must fill as much of a BTSensor's view with as much wanding data as possible to improve calibration accuracy.
3. In Motive, look at the *Camera Preview* and *Perspective View* window. *Perspective View* shows all BTSensors on the ground when they do the very first wanding. Examine each BTSensor's recording of the calibration wand. Wand samples are represented as colored lines. Each BTSensor is represented by a unique color. Each BTSensor should have the same number of samples recorded.
    - **Attention:**
        - If a BTSensor will not record samples while wanding, consult the *Camera Preview* window. See if other BTSensors are detecting the wand. If the wand does not appear on any other BTSensors, the area will not calibrate due to lack of coverage. If the wand shows up on at least two other BTSensors, continue wanding, but adjust the path and angle of the wand to give the BTSensors different views. If a section of the intended Space will not record samples after all of the steps above, cancel the calibration. Reposition the BTSensors to obtain better overlapping field of views of the tracking area.
        - If a BTSensor will not record samples while wanding, you may deselect the problem BTSensor in the *Devices* window and recalibrate with the remaining BTSensors. The area of the Space the problem BTSensor was covering may have less accurate tracking or even no tracking available, but the rest of the Space should be accurate.
    - **Note:** The *Calibration Engine* section gives feedback about the BTSensor calibration, including the number of times the calibration wand is viewed by each BTSensor. An estimate on the quality of the calibration is displayed based on the number of samples which were recorded. Calibration quality can be: **Low**, **Medium**, **High**, or **Very High**.
4. Click *Calculate*.
    - **Result:** Motive starts to calibrate BTSensors based on the collected data. The current state of calibration is displayed at the top of the *Calibration Engine* followed by the calibration result rating and the overall quality.
    - **Note:**
        - The calibration data captured in *Perspective View* is colored to indicate data accuracy.
            - **Blue**: Less than 6mm accurate in that area.
            - **Red**: Greater than 88mm accurate in that area.
        - The calibration engine displays a quality rating for all BTSensors as well as the global average and the wand average based on the Desired Quality. The quality ratings are (in order from worst to best): **Poor** < **Fair** < **Good** < **Great** < **Excellent** < **Exceptional**.

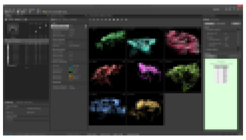
A full bar in the quality column is the best ranking.

- A relatively high Error for a BTSensor indicates that the given BTSensor received poor samples during calibration. Restart the wand calibration process. At least two BTSensors must have vision of the calibration wand for data to be captured for calibration. There is a progress bar in the Results column to highlight the quality of each BTSensor.
- While calibrating, BTSensors initially attempt to calibrate for the lowest level of quality. Once BTSensors have met the criteria of that quality level, the system will advance to the next level quality and attempt to calibrate. This process repeats until the highest quality calibration based off the data has been achieved. Once exceptional quality had been achieved, the system will apply the calibration automatically.
- In the *Perspective View* window you can see a visualization of the wand sample collected for calibration. The position of BTSensors will move to match their position in the physical Space as the system determines their location.

5. Once the rating for each BTSensor reaches “Excellent” or greater, and the Overall Results quality rating reaches “Excellent” or greater, the calibration results will automatically be applied to the system.

   To apply the calibration manually

   1. In the *Calibration Engine* section click *Apply Results*.
      - **Result:** The *Calibration Results Reports* window will open. Calibration results are available
   2. In the *Calibration Results Reports* window click *Apply*.
      - **Result:** The calibration data will be applied to the BTSensors and they will know their position in the Space in relation to each other. BTSensors positions can be viewed in the *Perspective View* window in Motive. Ground plane calibration is required next to determine the BTSensor’s position relative to the origin (if using a **Refine** calibration, you may skip ground plane calibration).
6. In Motive 2, click the **File** menu and select **Save Current Take** or click **File** menu and select **Save Profile.** In Motive 1.10 or lower , to save the changes to the project file, click the **File** menu and select **Save Project**.



Partial BTSensor Calibrations

As mentioned above, it is possible for the user to calibrate sections of their BTSensor setup after the initial calibration, as opposed to having to recalibrate the entire BTSensor setup (as of Motive 1.10).

The partial BTSensor calibrations are based off either a **Full** or **Refine** calibration as you would do above. To be able to complete a partial calibration, Motive needs the calibrated BTSensors as reference. These are known as **Anchor Cameras**. You need at least 2 of these anchor BTSensors, in addition to the BTSensors you wish to calibrate in order to complete the calibration successfully.

To complete a partial BTSensor calibration

1. In Motive, change the layout to Calibration preset. From the **Layout** menu, choose **Calibration**.
   1. Go to the *Camera Calibration* window.
   2. Choose either a *Full* or *Refine* calibration based on the guidelines above.
   3. In the *Calibration* tab, under the *Wand Option* heading, set the *OptiWand* sub-heading

to *Custom*.
4. Set the *Wand Length (mm)* field to *1000*.
5. Set the *Center Distance (mm)* field to *350*.
2. Select the BTSensors you would like to calibrate from the list in the *Devices* window.
3. Calibrate the system as you would above, confirming you would like to only calibrate the selected BTSensors.
4. Once complete, you **do not** need to set the ground plane.

Note: You will see all BTSensors collecting data. Only the selected BTSensors will use this data to calibrate, and all other BTSensors will ignore this data. When calculating, Motive may return a poor result overall, but this is not indicative of the actual result of just the updated BTSensors, it is reporting as if you wanded the entire Space. It is important to verify the tracking data with a Beacon after a partial calibration has been completed to verify the calibration results.

Known Wand Calibration Issues

- **Issue**: When *Calibration Engine* is calculating, calibration might return a very high error (100+), a very poor rating for the BTSensors, and you may see the distortion map in the *Camera View* warp outside the camera square.
  Solution: Either the wand data you provided Motive does not match the real world wand (check the wand length and center distance from above) or Motive displays unsuccessful results. Reboot Motive and run the calibration recording again through the solver and if the wanding data itself is good, this normally fixes the issue.
- **Issue**: After calibrating multiple times the *Calibration Engine* will not give a Global “Excellent” rating.
  Solution: The data samples taken from wanding may be of poor quality and could be an issue. Ensure the Space is properly masked from infrared interference, and BTSensors are aimed correctly. Start calibration again and rewand the Space.

Note: Not all the BTSensors will always receive an 'Excellent' or greater rating. Acceptable tracking can still be achieved with what appears to be poor results. The calibration report will let you know how accurate each BTSensor is relative to each other. If one BTSensor is poor, it might be okay if there are several other BTSensors seeing that same area.

Tip: The best way to verify calibration is to lay out the ground plane and ensure that each point is only shown as 1 marker (not two or more points or the points are moving when the ground plane is sitting on the ground and not moving).

Ground Plane Calibration

After the BTSensors are calibrated with the calibration wand, you must set the ground plane. This step will inform the BTSystem where they are in relation to the origin. It will also inform the BTSystem the direction of the axis.

Attention: The origin of the Space must be visible to a minimum of 2 correctly calibrated BTSensors for ground plane calibration to be accurate.

Note: As of Motive 1.10, when performing **Refine**, **Full Refine,** or **Partial Refine** calibration types, the user does not have to reset the ground plane.

To calibrate BTSensors with the ground plane

1. In the Physical Space, unfold and lock the ground plane into an L shape, ensuring the arms are at a

90° angle.

2. Plug in the power source to an outlet and connect the ground plane to a power source or battery pack.
3. Move the center marker or the ground plane over the Origin of the Space. Adjust the feet of the ground plane to align it with the origin as defined in BTWYSIWYG. You can see if the ground plane is level with the built-in level on the ground plane arms.
    - **Attention:** The origin of the coordinate plane of the tracking area must be the same as the origin of the virtual representation of the tracking Space as made in BTWYSIWYG. If the virtual representation and actual tracking area do not share the same origin and axes orientation, positional data and fixture tracking will be incorrect. The origin also needs to match any Third Parties origin connected to BlackTrax.
    - **Tip:** Mark the origin of the Space and the orientation of the axes be marked for future reference.
4. Aim the long arm of the ground plane to the venue +Y axis.
5. Aim the short arm of the ground plane to the venue +X axis.
6. In Motive, in the *Camera Calibration* window, in the *Ground Plane* tab, set the *Vertical Offset (mm)* field to *90mm*.
    - **Attention:**
        - If the ground plane is not placed at the height of the Origin, such as on a tripod or stage, measure the distance between the X-Y plane and the center of the ground plane markers. Enter in this value in the *Vertical Offset (mm)* plus 90mm.
        - You can offset the ground plane position if the ground plane cannot be placed on the origin due to space restrictions, such as obstructions blocking the Origin from BTSensor view.
        - **To offset the ground plane**
            1. Measure the distance (mm) on each axis from the Origin to the ground plane's position.
            2. Record the difference in the *Capture Volume Translation* table.
            3. Click *Apply Translation*.
                - **Note:** Each time you *Apply Translation*, the origin will offset by 1 by each unit you specified. You should clear the offsets back to 0 after making them in case the button is hit accidentally after you finish setting it.
                - **Attention:** It is possible to rotate the ground plane's position in Motive without physically moving the ground plane
        - **To rotate the ground plane**
            - Click *Apply Rotation*.
            - Enter in the desired rotation values in the *Capture Volume Rotation* table.
7. To apply the ground plane calibration, click *Set Ground Plane*.
    - **Result:** The BTSensors will know their position in relation to the ground and adjust accordingly in *Camera View* window in Motive.
    - **Attention:** If Motive is having a hard time determining the ground plane, or the markers are not stable, you may try to increase the *Maximum Residual* in *Application Settings* > *Live Reconstruction*. This will help average out BTSensors that may not have a great calibration and provide stable tracking points for the Ground Plane.
8. In Motive 2, from the **File** menu, choose **Save Current Take** or from the **File** menu, choose **Save Profile**. In Motive 1.10 or lower, to save the changes to the project file, from the **File** menu, choose **Save Project**.
    - **Note:** The axis in Motive is different than the axis in BlackTrax. Please keep that in mind when offsetting the ground plane in Motive. For reference:

- BlackTrax +X = Motive -X
- BlackTrax +Y = Motive +Z
- BlackTrax +Z = Motive +Y

Tracking Mode

Table of contents:

Tracking Mode Settings

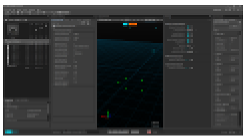
After BTSensors are calibrated, minor adjustments need to be entered in Motive for the system to switch from BTSensor calibration to tracking mode. These settings enable fixture tracking to occur. Once tracking mode is configured, no changes to the Motive project are needed unless BTSensors were moved or bumped since BTSensor calibration.

Motive 2

To configure BTSensors for normal tracking

1. In Motive, change the layout to **Configuration** preset. From the **Layout** menu, choose **Configuration**.
    - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click **Configuration** from the drop-down menu of layout presets.
2. In *Devices* window, click *Filters* under the **Properties** section.
3. On the *Filters* section, click the *Filters Type* drop-down menu and click *None*.
4. In the *Application Settings* window, click the *Live Reconstruction* tab.
5. On the *Live Reconstruction* tab, select the *Enable Point Cloud Reconstruction* checkbox.
6. On the *Reconstruction Settings* section, click *Marker Labeling Mode* and then click *Active and Passive Markers* or *Active Markers Only* to set Motive for tracking.
    - **Result:** Active and passive markers or only active markers are displayed on the *Perspective View* window.
    - **Note:** After Calibration, Motive will set the *Maximum Residual* as low as possible but in most situations this is not forgiving enough. We recommend you increase the *Maximum Residual* to at least 15 mm after calibration. You may also increase it higher if calibration is poor or the BTSensors have moved since calibration. Keep in mind the *Active Residual* in the *Status Bar*, and ensure that value is as low as possible. If the value is too high for acceptable use (greater than 5 mm in most cases and 10 mm in extreme cases), you should consider re-calibrating your space.
7. In the *Streaming* window, under the *OptiTrack Streaming Engine* heading, select the *Broadcast Frame Data* checkbox.
    - Under the *Network Interface Selection* heading, set the *Local Interface* field to *Local loopback*.
    - Close the *Data Streaming* window.
8. In the *Synchronization* window, click the *Synchronization* drop-down box and then click *Custom Synchronization*.
9. Under the *Sync Input* heading in the **Details** section, click the *Source* drop-down menu and then click *Reserved*.
10. Under the *Sync Input* heading in the **Details** section, type *5000* on the *Sync Offset (us)* field.
11. On the *Synchronization* section, click *Apply*.

Note: The *Input Monitor* section can be used to immediately check if the TimeKeeper is connected correctly to the eSync and Motive. In the *Reserved* field of the *Input Monitor* section, there should be a value of around 100 Hz (or close to this number). This means Motive is receiving the TimeKeeper sync signal. If this number is not in the range of 99.998 - 100.004 Hz (or close) there may be a configuration issue with the TimeKeeper, and you should report the issue to a BTE to be resolved.

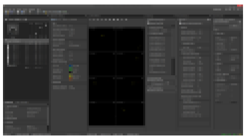


Note: If you experience Tracking issues after configuring these settings, reset Motive Settings from the BlackTrax GUI. If your issue is not resolved, please contact BlackTrax support for further assistance.

Motive 1.10 or lower

To configure BTSensors for normal tracking

1. In Motive, change the layout to **Configuration** preset. From the **Layout** menu, choose **Configuration**.
2. In the *Synchronization* window, under *Synchronization*, click C*ustom Synchronization* from the drop-down menu.
    1. Under the *Sync Input* heading, set the *Source* field to *Reserved*.
    2. Set the *Synchronization offset* to *5000*.
    3. Click *Apply*
        - **Note:** The *Input Monitor* section can be used to immediately check if the TimeKeeper is connected correctly to the eSync and Motive. In the *Reserved* field of the *Input Monitor* section, there should be a value of around 100 Hz (or close to this number). This mean Motive is receiving the TimeKeeper sync signal. If this number is not in the range of 99.998 - 100.004 Hz (or close) there may be a configuration issue with the TimeKeeper, and you should report the issue to a BTE to be resolved.



Note: If you experience Tracking issues after configuring these settings, reset Motive Settings from the BlackTrax GUI. If your issue is not resolved, please contact BlackTrax support for further assistance.

Customizing Tracking Bounds

Motive can have restrictions placed to customize tracking. Infrared sources, such as a LED Stringer of a BTBeacon, that are outside these restrictions will not be acknowledged by the system.

Motive 2

Limiting Tracking Within Boundaries

In Motive, as an optional step, you can create a boundary around the Space. The boundary commands the system to ignore infrared sources outside this boundary. BTBeacon positional data found outside the boundary will not be sent downstream to other applications.

To define boundaries, you need to measure how far the origin of the Space is from the intended boundary in the Space. This is required for each axes (XYZ). The origin of the Space should be the same origin as the duplicate Space made in WYSIWYG.

Attention: In Motive, the Z axis represents length and the Y axis represents height. For the rest of BlackTrax the Z axis represents height and the Y axis represents length. +X also becomes -X in Motive.

Note: Be aware of the -Y setting for your Space. If the origin of the Space is elevated and tracking occurs below the origin, ensure the value can cover the intended tracking area.

To set the tracking boundary of the space

1. In Motive, change the layout to **Running** preset. From the **Layout** menu, choose **Running**.
   - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click **Running** from the drop-down menu of layout presets.
2. In the *Application Settings* window, click the *Live Reconstruction* tab.
3. On the *Live Reconstruction* tab, click the *Advanced Options* heading to open the *Advanced Options* section.
4. On the *Advanced Options* section, click the *Reconstruction Bounds* heading to open the *Reconstruction Bounds* section.
5. On the *Reconstruction Bounds* section, click the *Visible Bounds* drop-down menu and select *True*.
   - **Result:** The set tracking boundary of Space is displayed in the *Perspective View* window. The set tracking boundary of the Space will not be displayed in the *Perspective View* window if *False* is selected.
6. Set the *Minimum X (meters)* field to the distance from the origin of the Space to the intended boundary on the negative (-) X axis (width).
7. Set the *Maximum X (meters)* field to the distance from the origin of the Space to the intended boundary on the positive (+) X axis (width).
8. Set the *Minimum Y (meters)* field to the distance from the origin of the Space to the intended boundary on the negative (-) Y axis (height).
9. Set the *Maximum Y (meters)* field to the distance from the origin of the Space to the intended boundary on the positive (+) Y axis (height).
10. Set the *Minimum Z (meters)* field to the distance from the origin of the Space to the intended boundary on the negative (-) Z axis (length).
11. Set the *Maximum Z (meters)* field to the distance from the origin of the Space to the intended boundary on the positive (+) Z axis (length).
12. Close the *Reconstruction Properties* window.
    - **Result:** The boundary in your Space is defined. Tracking is only possible inside this

boundary.
13. To save as a profile, select **Save Profile** or **Save Profile As** from the **File** menu.
    - **Tip:** You can also export the BTSensor calibration data. See To export a calibration CAL file.

To set BlackTrax BTSensor beam length

Attention: The Maximum distance should be the largest distance between a BTSensor and the furthest tracking boundary. The minimum distance should be the shortest distance between a BTSensor and the closest tracking boundary.

Note: After BTSensor calibration, Motive automatically determines these values with estimates of acceptable tracking distances. You may override these values at any time, but if you re-calibrate these fields will be re-populated.

1. In Motive, change the layout to **Running** preset. From the **Layout** menu, choose **Running.**
    - **Tip:** You may click the drop-down box at the right hand side of the main toolbar and click **Running** from the drop-down menu of layout presets.
2. In the *Application Settings* window, click the *Live Reconstruction* tab.
3. On the *Reconstruction Settings* section of the *Live Reconstruction* tab, set the *Maximum Ray Length* field to the desired maximum length.
4. On the *Reconstruction Settings* section of the *Live Reconstruction* tab, set the *Minimum Ray Length* field to the desired minimum length.
5. To save as a profile, choose **Save Profile** or **Save Profile As** from the **File** menu.
    - **Result:** The beam length of BTSensors will be set. BTSensors will only acknowledge BTBeacons within this range.
    - **Tip:** You can also export the BTSensor calibration data. See To export a calibration CAL file.

Motive 1.10 or lower

To set BlackTrax BTSensor beam length

Attention: The Maximum distance should be the largest distance between a BTSensor and the furthest tracking boundary. The minimum distance should be the shortest distance between a BTSensor and the closest tracking boundary.

1. Open the *Reconstruction Properties* window. To open the window, from the **View** menu, choose **Reconstruction Properties**.
2. In the *Reconstruction Properties* window, in the *Point Cloud* section, under the *Options* heading set the *Minimum Ray Length* field to the desired minimum length.
3. Set the *Maximum Ray Length* field to the desired maximum length.
4. Save the changes to the project file. To save, from the **File** menu, choose **Save Project**.
    - **Result:** The beam length of BTSensors will be set. BTSensors will only acknowledge BTBeacons within this range.
    - **Note:** After BTSensor calibration, Motive will automatically determine these values with estimates of acceptable tracking distances. You may override these values at any time, but if you re-calibrate these fields will be re-populated.

Limiting Tracking Within Boundaries

In Motive, as an optional step, you can create a boundary around the Space. The boundary will tell the system to ignore infrared sources outside this boundary. BTBeacon positional data found outside the boundary will not be sent downstream to other applications.

To define boundaries you will have to measure how far the origin of the Space is from the intended boundary in the Space. This will need to be done for each axes (XYZ). The origin of the Space should be the same origin as the duplicate Space made in WYSIWYG.

Attention: In Motive, the Z axis represents length and the Y axis represents height. In the rest of BlackTrax the Z axis represents height and the Y axis represents length. +X also becomes -X in Motive.

Note: Be aware of the -Y setting for your Space. If the origin of the Space is elevated and tracking occurs below the origin, ensure the value can cover the intended tracking area.

To set the tracking boundary of the space

1. Open the *Reconstruction Properties* window. To open the window, from the **View** menu, choose **Reconstruction Properties**.
2. In the *Reconstruction Properties* window, in the *Point Cloud* section, under the *Reconstruction Bounds* heading set the *Bound Reconstruction* field to *True*.
3. Set the *Minimum X (meters)* field to the distance from the origin of the Space to the intended boundary on the negative (-) X axis (width).
4. Set the *Maximum X (meters)* field to the distance from the origin of the Space to the intended boundary on the positive (+) X axis (width).
5. Set the *Minimum Y (meters)* field to the distance from the origin of the Space to the intended boundary on the negative (-) Y axis (height).
6. Set the *Maximum Y (meters)* field to the distance from the origin of the Space to the intended boundary on the positive (+) Y axis (height).
7. Set the *Minimum Z (meters)* field to the distance from the origin of the Space to the intended boundary on the negative (-) Z axis (length).
8. Set the *Maximum Z (meters)* field to the distance from the origin of the Space to the intended boundary on the positive (+) Z axis (length).
9. Close the *Reconstruction Properties* window.
    - **Result:** The boundary in your Space will be defined. Tracking is only possible inside this boundary.
10. Save the changes to the project file. To save, from the **File** menu, choose **Save Project**.

Optional View Settings

Because every Space is different, there are certain BTSensor settings that will be unique. This section provides guidelines on certain Motive settings which will create an accurate tracking environment.

Motive 2

To enable visualization of the tracking boundary

If the tracking boundaries of the Physical Space were enabled and defined, the limits can be visualized after BTSensors have been calibrated.

1. In Motive, change the layout to **Configuration** preset. From the **Layout** menu, choose **Configuration**.
   - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click **Configuration** from the drop-down menu of layout presets.
2. In the *Application Settings* window, click the *Live Reconstruction* tab.
3. On the *Live Reconstruction* tab, click the *Advanced Options* heading to open the *Reconstruction Bounds* section.
4. On the *Reconstruction Bounds* section, click the *Visible Bounds* drop-down menu and click *True*.
   - **Result:** The set tracking boundary of the Space will be displayed in the *Perspective View* window.
5. To save the take, choose **Save Current Take** or **Save Current Take As** from the **File** menu.
6. To save as a profile, choose **Save Profile** or **Save Profile As** from the **File** menu.

To disable visualization of the tracking boundary

1. In Motive, change the layout to **Configuration** preset. From the **Layout** menu, choose **Configuration**.
   - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click **Configuration** from the drop-down menu of layout presets.
2. In the *Application Settings* window, click the *Live Reconstruction* tab.
3. On the *Live Reconstruction* tab, click the *Advanced Options* heading to open the *Reconstruction Bounds* section.
4. On the *Reconstruction Bounds* section, click the *Visible Bounds* drop-down menu and click *False*.
   - **Result:** The set tracking boundary of the Space will not be displayed in the *Perspective View* window.
5. To save the take, choose **Save Current Take** or **Save Current Take As** from the **File** menu.
6. To save as a profile, choose **Save Profile** or **Save Profile As** from the **File** menu.

Motive 1.10 or lower

To enable visualization of the tracking boundary

If the tracking boundaries of the Space have been defined, and enabled the limits can be visualized after BTSensors have been calibrated.

1. Open the *Reconstruction Properties* window. To open the window, from the **View** menu, choose **Reconstruction Properties**.
2. In the *Reconstruction Properties* window, in the *Advanced Options* section, under the *Reconstruction Bounds* heading set the *Visible Bounds* field to *True*.

    - **Result:** In the *Perspective View* window, the boundary of the Space appears as a transparent volume.
3. Save the changes to the project file. To save, from the **File** menu, choose **Save Project**.

To disable visualization of the tracking boundary

1. Open the *Reconstruction Properties* window. To open the window, from the **View** menu, choose **Reconstruction Properties**.
2. In the *Reconstruction Properties* window, in the *Point Cloud* section, under the *Reconstruction Bounds* heading set the *Visible Bounds* field to *False*.
    - **Result:** The visualization of the tracking boundary is disabled.
3. Save the changes to the project file. To save, from the **File** menu, choose **Save Project**.

Adding a Reticle to BTSensor Views

A reticle (cross-hair) can be added to all BTSensor views to aid in aiming and position.

Note: When the aim-assist feature is used on a BTSensor, a reticle is automatically toggled on for that BTSensor.

Motive 2

To add a reticle to all BTSensor views

1. In Motive, change the layout to **Aiming** preset. From the **Layout** menu, choose **Aiming**.
    - **Tip:** You may click the drop-down box on the right-hand side of the toolbar and click **Aiming** from the drop-down menu of layout presets.
2. On the *Application Settings* window, click the *Views* tab.
3. On the *Views* tab, click the *2D Display Options* heading to open the *2D Display Options* section.
4. On the *2D Display Options* section, click the *Reticles* drop-down menu and click *True.*
    - **Result:** Reticles are displayed on all connected BTSensor views in Motive.
    - **Tip:** When you are on the *Multi-Camera 2D View*, you may click the *Visual Aids* icon and select the **Reticles** menu to enable.

Motive 1.10 or lower

To add a reticle to all BTSensor views

1. Open the *Application Settings* window. To open the window, from the **Edit** menu, choose **Application Settings...**.
2. In the *Application Settings* window, in the *Display* tab, under the *2D Display Options* heading, set the *Camera Reticle* field to *True*.
    - **Result:** Reticles appear on all connected BTSensor views in Motive.

Recording in Motive

Table of contents:

Recording Introduction

In Motive, you can save recordings of tracked objects and you can play back these recordings at another time. You can record the wanding of the Space while calibrating BTSensors. The recorded wanding can be played back anytime instead of physically repeating the wanding of the Space.

Modes in Motive

In Motive, there are three modes of operation: **LIVE**, **REC** (Record) and **EDIT**. Modes act as a reminder of where information shown in the Perspective View and Camera View window is originating from.

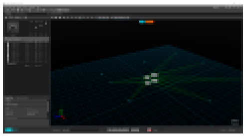
Motive 2

The *Status Bar* is always docked at the bottom of Motive, and it provides both recording and navigation controls over Motive's primary operating modes.

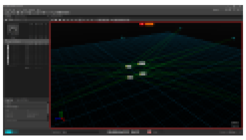
 LIVE/REC mode

 EDIT mode

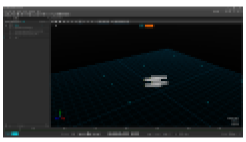
- **LIVE:** Information shown in LIVE mode is happening in real-time. Everything shown is what BTSensors see at the present time. When in LIVE mode, a green image is displayed in *Perspective View*.
    - **Note:** LIVE mode is the default mode of Motive.



- **REC:** Information shown in REC mode is happening in real-time and being recorded to file for later use. Everything shown is what BTSensors see at the present time. When in REC mode, a red image is displayed in *Perspective View* and a red border appears around the *Perspective View* and *Camera View* windows.



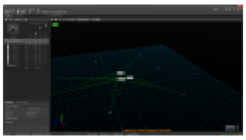
- **EDIT:** Information previously recorded is being played back. Everything shown is what BTSensors saw during a recording in REC mode. When in EDIT mode, a blue image is displayed in *Perspective View*.



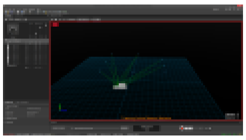
Attention: When Motive is in EDIT mode, no live data is sent through the BTSystem. Be sure that no application downstream of BlackTrax is relying on tracking information while switching between LIVE and EDIT modes.

Motive 1.10 or lower

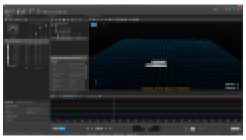
- **LIVE:** Information shown in LIVE mode is happening in real-time. Everything shown is what BTSensors see at the present time. When in LIVE mode, a green image is displayed in *Perspective View*.
  Note: LIVE mode is the default mode of Motive.



- **REC:** Information shown in REC mode is happening in real-time and being recorded to file for later use. Everything shown is what BTSensors see at the present time. When in REC mode, a red image is displayed in *Perspective View* and a red border appears around the *Perspective View* and *Camera View* windows.



- **EDIT:** Information previously recorded is being played back. Everything shown is what BTSensors saw during a recording in REC mode. When in EDIT mode, a blue image is displayed in *Perspective View*.



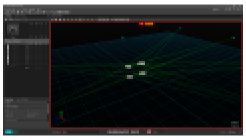
Attention: When Motive is in EDIT mode, no live data is sent through the BTSystem. Be sure that no application downstream of BlackTrax is relying on tracking information while switching between LIVE and EDIT modes.

Working with Recordings

Motive 2

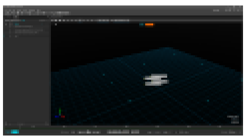
To record in Motive

1. In Motive, change the layout to **Recording** preset. From the **Layout** menu, choose **Recording**.
   - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click **Recording** from the drop-down menu of layout presets.
2. On the *Status Bar*, type a name for the recording in the *Take* field.
3. To start recording, click the *Red Circle* on the right-hand side of the window.
   - **Result:** Motive enters REC mode. A red outline appears around the *Perspective View* and *Camera View* windows. Any trackable object in the Space will be recorded to file.
4. To stop recording, click the *Red Circle* again.
   - **Result:** Motive exits REC mode. The recording will be saved as a ".*tak*" file.



To play back a recording in Motive

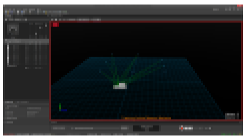
1. In Motive, change the layout to **Recording** preset. From the **Layout** menu, choose **Recording**.
   - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click **Recording** from the drop-down menu of layout presets.
2. To open the previous recording that you want to use, double-click the ".*tak*" file from the list in the *Project* pane.
   - **Result:** Motive enters EDIT mode and the *Status Bar* changes to the EDIT mode functions. A timeline of the recording is displayed.
   - **Note:** Click any point in the timeline and the recording jumps to the selected point.
3. On the *Status Bar,* Click the *Play* button (arrow icon) to play the recording in the *Timeline* window.
   - **Result:** The recording of what BTSensors saw is replayed on the system. The BTSystem acts as if the recording is actually happening in real-time.



Motive 1.10 or lower

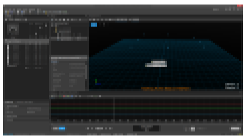
To record in Motive

1. In Motive, from the **View** menu, choose **Timeline** (or go to **Layouts** > **Recording**).
   - **Result:** The *Timeline* window will open.
2. In the *Timeline* window, enter a name for the recording in the *Take* field.
3. To start recording, click the *Red Circle* on the right-hand side of the window.
   - **Result:** Motive will enter REC mode. A red outline will appear around the *Perspective View* and *Camera View* windows. Any trackable object in the Space will be recorded to file.
4. When you want to stop recording, click the *Red Circle* again.
   - **Result:** Motive will exit REC mode. The recording will be saved as a .tak file.



To play back a recording in Motive

1. In Motive, from the **View** menu, choose **Timeline** and **Project** (or click **Layout** > **Recording**).
    - **Result:** The *Timeline* and *Project* windows will open.
2. Open the previous recording you want to use by double-clicking the .tak file from the list in the *Project* pane.
    - **Result:** Motive will enter EDIT mode and the *Timeline* window will change to EDIT mode functions. A timeline of the recording will be displayed.
    - **Note:** By clicking at any point in the timeline, the recording will jump to that point.
3. Click the *Play* button (arrow icon) to play the recording in the *Timeline* pane.
    - **Result:** The recording of what BTSensors saw will be replayed for the system. The BTSystem will act as if the recording were actually happening in real-time.



Calibrating BTSensors from a Recording

Each time you calibrate the BTSensors in Motive, the software automatically starts the recording of the wanding. You can use this recording at a later date to re-calibrate your system, without the need of physically wanding again.

Motive 2

To calibrate from a recording

1. In Motive, change the layout to **Recording** preset. From the **Layout** menu, choose **Recording**.
   - **Tip:** You may click the drop-down box at the right-hand side of the main toolbar and click **Recording** from the drop-down menu of layout presets.
2. To open the previous recording that you want to use, double-click the "*.tak*" file from the list in the *Data* window.
   - **Result:** Motive enters EDIT mode, and the *Status Bar* changes to EDIT mode functions and the timeline of the recording is displayed.
3. From the **View** menu, choose **Camera Calibration Pane**.
4. In the *Camera Calibration* window, ensure your wand settings match the previous wanding that was applied. Choose to do a *Full* or *Refine* calibration type.
   - **Note:** If the source recording was a *Full* calibration type, you must select *Full* calibration type again.
5. In the *Camera Calibration* window, click *Start Wanding* to begin the calibration process.
   - **Result:** Motive scans the recording for the selected samples. After a few seconds, Motive returns the same samples, and you can calculate the result as with a normal calibration.
6. On the *Status Bar*, click *LIVE* to return the system to LIVE mode.
7. Set your ground plane as per normal.
   - **Note:** This step is only required if *Full* calibration type was selected.

Motive 1.10 or lower

To calibrate from a recording

1. In Motive, from the **View** menu, choose **Timeline** and **Project** (or select **Layout**>**Recording**)
2. To open the desired recording, double-click the .tak file from the list in the **Project** pane.
   - **Result:** Motive will enter Edit mode, and the timeline window will change to Edit mode functions. A timeline of the recording will be displayed.
3. From the **View** menu, choose **Camera Calibration**.
4. In the *Camera Calibration* window, ensure your wand settings match what they were when the wanding took place. Choose if you wish to do a *Full* or *Refine* calibration type.
5. Press *Start Wanding* to begin the calibration process.
   - **Result:** Motive will now scan the recording for the samples which were selected. After a few seconds, it will return the same samples, and you can calculate the result as with a normal calibration.
6. On the *Timeline,* click the *Live* button, to return the system to Live mode.
7. Set your ground plane as per normal.

Using USB Sensors with BlackTrax

When you use USB Sensors in BlackTrax, the Motive settings differ from the PoE BTSensors, which include settings in the *Devices*, *Camera Calibration*, and *Synchronization* windows.

TimeKeeper is connected to the Sync port of an OptiHub via RCA connection. The BT Router and BTTimekeeper must be connected to a gigabit PoE switch when using USB Sensors.

Supported USB Sensors include Flex 3 and Flex 13 USB Sensors.

Setting up USB sensors in the BlackTrax System

USB Sensors connect to the BlackTrax System using the *USB A > USB B* cable that is included.

To connect USB sensors to BlackTrax

1. Connect the USB Sensors to the OptiHub to connect to the BTServer.
   - **Attention**:
     - Do not exceed 5 m (16.4 ft) maximum distance between the USB Sensor and the OptiHub.
     - Do not use USB extensions, couplers, or adapters between the OptiHub and the USB Sensors.
2. Connect the TimeKeeper to the OptiHub to provide sync information to the USB Sensors. Connect the TimeKeeper to the OptiHub through the Sync In port via RCA connection.
3. Connect the OptiHub to a BTServer.
   - You may use up to 2 x 5 m (16 ft) active USB extenders in addition to the original 5 m (16 ft) USB cable.
   - The maximum distance from BTServer to OptiHub can increase to 15 m (49.21 ft) when you use USB extenders.
   - **Important Notes**:
     - Multiple OptiHubs can be linked via their RCA Synchornization ports to increase the sensor count because each OptiHub supports only six (6) BTSensors.
     - The same USB cable limitations mentioned above apply when using multiple OptiHubs with the BTSystem.
     - Every single OptiHub to BTServer connection requires its own dedicated USB cable connection.

Preparing IR Sensors in Motive

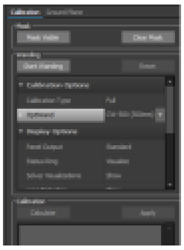
To prepare the IR sensors

1. Open Motive.
   - **Result**: Motive recognizes the USB Sensors. Your BTSensors will populate the Devices list as outlined in the Checking the Connectivity of BTSensors page.
2. To focus the BTSensors, refer to the Using Motive to Aim BTSensors page for focusing instructions.
   - **Tip**: During aiming, set the LED setting for the Group of Sensors to 15.

Calibrating USB Sensors in Motive

To calibrate USB sensors

1. Follow the calibration steps outlined in the Calibrating a BTSensor page in the Motive for BlackTrax section then apply changes to the following steps for USB settings.
2. In the *Camera Calibration* window, click *Calibration Options*.
3. Click the *OptiWand* drop-down menu under *Calibration Options* then click *OptiWand-CW-500*.
4. In the *Devices* window, set the LED slider value to where the wand can be clearly visible to the BTSensors.
5. Follow Steps 2 to 5 under the Wand Calibration section of the Calibrating a BTSensor page.
6. After completing the steps above, follow the steps in the Ground Plane Calibration page.


Camera Calibration window

- **Result**: The system is calibrated. Motive saves the current state and returns to the last calibration and camera settings when reopened.

Tracking Mode Settings

To send information from Motive

1. In Motive, change the layout to *Configuration* preset. From the **Layout** menu, choose **Configuration**.
   - **Tip**: You may click the drop-down box at the right-hand side of the main toolbar and click *Configuration* from the drop-down menu of layout presets.
   - **Results**: Motive displays the Configuration layout preset showing the *Devices*, *Application Settings*, *Perspective View*, *Streaming*, and *Synchronization* windows.
2. In the *Devices* window, click *Filters* under the **Properties** section.
3. In the *Devices* window, select the group and set *FPS* to *100*.
4. Click the *Filters Type* drop-down menu under the *Filters* section then click *None*.
5. In the *Application Settings* window, click the *Live Reconstruction* tab.
6. On the *Live Reconstruction* tab, select the *Enable Point Cloud Reconstruction* checkbox.
7. Click *Marker Labeling Mode* under the *Reconstruction Settings* section then click *Active and Passive Markers* or *Active Markers Only* to set Motive for tracking.
   - **Resul**t: Active and passive markers or only active markers are displayed on the *Perspective View* window.
   - **Note**: After calibration, Motive sets the *Maximum Residual* to the lowest value possible, which is not forgiving enough in most situations. We recommend you increase the *Maximum Residual* to at least 15 mm after calibration. You may also increase it higher if calibration is poor or the BTSensors have moved since calibration. Keep in mind the *Active Residual* in the *Status Bar* and ensure that value is the lowest possible. If the value is too high for acceptable use (greater than 5 mm in most cases and 10 mm in extreme cases), you should consider re-calibrating your space.
8. In the *Streaming* window, under the **OptiTrack Streaming Engine** section, switch *Broadcast Frame Data* to *On*.
9. Click the *Local Interface* drop-down menu then click *loopback*.
10. Close the *Streaming* window.
11. In the *Synchronization* window, click the *Synchronization* drop-down menu then click *Custom Synchronization*.

12. On the **Details** section, click *Sync Input*.
13. Click the *Source* drop-down menu under *Sync Input* then click *OptiSync*.
14. Click *Synchronization Control* then type *5000* on the *Sync Offset (us)* field.
15. On the *Synchronization* section, click *Apply*.

BlackTrax

The system is now ready to work with the main BlackTrax software. For more information on outputs from BlackTrax, please see the Output Configuration page.

Ensure that BTBeacons (and possibly Rigid Frames) have been added to the *Beacons* widget and all changes were applied for the system to output data.

BlackTrax GUI

Table of contents:

Before Using BlackTrax

Attention: Before running the BlackTrax GUI, you must complete the following mandatory steps to ensure a successful BlackTrax experience:

- **Set up the BTSystem in the Space**: The BTSystem needs to be physically installed in the Space. See BTSystem Hardware Configuration for more information.
- **Create a file in BTWYSIWYG**: A .wyg file provides BlackTrax with information on Trackables, Fixtures and Space dimensions. From a .wyg file, you can either generate a .btx file or send the necessary information directly between programs. See Creating a .btx file in BTWYSIWYG for more information.
- **Configure and Calibrate BTSensors using Motive**: Use Motive to configure BTSensors to inform the BTSystem on how to track and share positional information with other components. See Calibrating a BTSensor for more information.

BlackTrax User Interface

Table of contents:

UI Introduction

When BlackTrax launches for the first time, the BlackTrax Splash Screen appears while BlackTrax is preparing to load, and then the *Portfolio Manager* window opens. In the *Portfolio Manager* window, you can add a new portfolio which stores the BlackTrax, BTWYSIWYG and Project History backup files.

A project is launched from the *Portfolio Manager* and opens into Edit view. How the *Portfolio Manager* is subsequently displayed at startup depends on the *Open most recent Portfolio when BlackTrax starts* setting in the *System* section of *System Configuration* (enabled by default).

Before the Edit view and the other views of BlackTrax are explained, we will first define the options in *Portfolio Manager* and describe the various parts of the user interface.

The Splash Screen upon launch of BlackTrax

The Portfolio Manager upon opening

The Default state of the BTGUI upon opening

Attention: If a License issue is detected, the *License Folder* button appears on the *Portfolio Manager*. Click the *License Folder* button to open the *license* Folder in the *File Explorer* window.

Portfolio Manager

Portfolio Manager at first launch

- All project files are saved via the *Portfolio Manager*.
- Upon installation of BlackTrax, the *BlackTrax Portfolios* folder is created to your default drive where saved project files for BlackTrax and BTWYSIWYG are automatically saved.
- The *Portfolio Manager* displays the list of saved Portfolios.
- The *Portfolio Manager* displays the name of the currently opened Portfolio.
- Project History (.btbak) backup files are automatically generated when a project is saved manually or in *Auto Save*. The backup files are saved in the *Project History* folder that is automatically created in the *BlackTrax Portfolios* folder.
- In the *Portfolio Manager*, you can:
    - Add a new Portfolio.
    - Duplicate a Portfolio.
    - Delete a Portfolio.
    - Sort the displayed list of Portfolios.
    - Import a file(s) into new Portfolios.
    - Update a file(s) in Portfolios.
    - Open a Portfolio folder.
    - Launch a Portfolio.
    - Close a Portfolio.

To add a portfolio

1. In *Portfolio Manager*, click the *Add* (+) button.
    - **Result:** The *New Portfolio* dialog box appears.
2. Type the name of the new Portfolio in the *Portfolio Name* box.
    - **Result:**
        - The new Portfolio folder is added to the *BlackTrax Portfolios* folder and the name is added to the list of Portfolios in *Portfolio Manager*.
        - The new BlackTrax and BTWYSIWYG files are generated and saved in the new Portfolio.

To duplicate a portfolio

1. In *Portfolio Manager*, select the Portfolio that you want to duplicate.
2. Click the *Duplicate* button.
    - **Result:** The *Duplicate Portfolio* dialog box appears.
3. Type the name of the duplicate Portfolio in the *Portfolio Name* box.
    - **Result:**
        - The duplicate Portfolio folder is added to the *BlackTrax Portfolios* folder and the name is added to the list of Portfolios in *Portfolio Manager*.
        - The BlackTrax and BTWYSIWYG files are renamed and saved into the new Portfolio.
    - **Note:** Project History is not duplicated.

To delete a portfolio

Note: A Portfolio that is currently in use cannot be deleted.

1. Close BTWYSIWYG. *Portfolio Manager* will not delete the files if BTWYSIWYG is open.

2. From the list of Portfolios displayed in *Portfolio Manager*, click on the Portfolio that you want to delete.
    - **Result:** The selected Portfolio is highlighted.
3. Click the *Delete* button.
    - **Result:** The selected Portfolio folder and all the BlackTrax and BTWYSIWYG files in the folder are deleted from the *BlackTrax Portfolios* folder.

To sort the displayed portfolios by name

1. In *Portfolio Manager*, click on the drop-down arrow and choose the *Sort: Name* drop-down menu.
    - **Result:** The list of Portfolios will be displayed in alphabetical order.

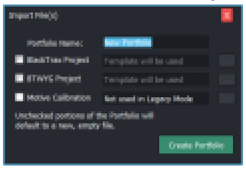
To sort the displayed portfolios by date

1. In *Portfolio Manager*, click on the drop-down arrow and choose the *Sort: Date* drop-down menu.
    - **Result:** The list of Portfolios will be displayed with the most recent Portfolio on top and the oldest Portfolio at the bottom.

To import a file(s) from a portfolio

BlackTrax and BTWYSIWYG files can be imported into new Portfolios. When importing files, the user does not need to import all file types. If no file is imported for a given section, the template file will be used for that portion of the Portfolio.

1. In *Portfolio Manager*, click the *Import File(s)* button.
    - **Result:** The *Import File(s)* dialog box appears.



2. Type the new name of the Portfolio in the *Portfolio Name* box.
3. Select the *BlackTrax Project* checkbox to include BlackTrax files that will be imported and added to the new Portfolio.
4. Click on the ellipsis button to browse and select the BlackTrax file.
    - **Result:** The link appears in the *BlackTrax Project* box.
5. Select the *BTWYG Project* checkbox to include BTWYSIWYG files that will be imported and added to the new Portfolio.
6. Click on the ellipsis button to browse and select the BTWYSIWYG file.
    - **Result:** The link appears in the *BTWYG Project* box.
    - **Note:** The unchecked portions of the Portfolio will default to a new, empty file.
7. Click *Create Portfolio*.
    - **Result:**
        - BlackTrax and BTWYSIWYG projects that were imported into the new Portfolio open.
        - BlackTrax and BTWYSIWYG files are renamed and copied to the *BlackTrax Portfolios* folder.

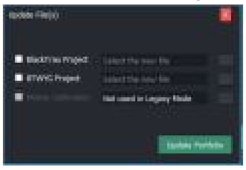
To update a file(s) in a portfolio

BlackTrax and BTWYG files of a Portfolio can be updated or replaced with the *Update File(s)* button. Updated files will be placed in the appropriate folders under the correct name for the selected Porfolio. You can browse for a new BlackTrax or BTWYG file which will replace the current file in the Portfolio.

Note: BTWYG must be closed to replace a BTWYG file.

1. In *Portfolio Manager*, select the Portfolio that you want to update.

2. In *Portfolio Manager*, click the *Update File(s)* button.
    - **Result:** The *Update File(s)* dialog box appears.

      
3. On the *Update File(s)* dialog box, select the *BlackTrax Project* checkbox to enable access and browse the BlackTrax files in Portfolios.
4. Click on the ellipsis button to browse and select the new BlackTrax file that will replace the current file in the current Portfolio.
    - **Result:** The link appears in the *BlackTrax Project* box.
5. Select the *BTWYG Project* checkbox to enable access and browse the BTWYG files in Portfolios.
6. Click on the ellipsis button to browse and select the new BTWYG file that will replace the current file in the current Portfolio.
    - **Result:** The link appears in the *BTWYG Project* box.
7. Click *Update Portfolio*.
    - **Result:** BlackTrax and BTWYG projects in the current Portfolio are updated with the selected new file.

To open a portfolio folder

1. In *Portfolio Manager*, select a Portfolio.
2. Click the *Open Folder* button.
    - **Result:**
        - The folder of the selected Portfolio opens in the browse dialog.
        - The name of the open Portfolio is highlighted in blue in the *Portfolio Manager* window.
    - **Note:** By default, all BlackTrax Portfolios folders are saved in C: > BlackTrax Portfolios > Portfolio Name > BlackTrax folder and BTWYG folder.

To launch a portfolio

1. In *Portfolio Manager*, select a Portfolio.
2. Click the *Launch Portfolio* button.
    - **Tip:** You may double-click the selected Portfolio.
    - **Note:** If you have Outputs that are assigned to NICs that do not exist on the current machine, a dialog box will appear asking you to select a new NIC.
        1. On the NIC dialog box, click on the drop-down menu of the displayed outputs to change the NIC for each output.
        2. On the NIC dialog box, click *OK*.
    - **Result:**
        - The new NIC is assigned to the desired output.
        - All the BlackTrax and BTWYSIWYG files in the selected Portfolio open.
        - The *Messages* window of BlackTrax appears showing the most recent change in the state of the system.
        - New Portfolios open with 12 Trackables by default for BlackTrax and BTWYG.

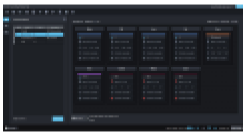
- **Notes:**
    - How the *Portfolio Manager* is displayed at startup depends on the *Open most recent Portfolio when BlackTrax starts* setting in the *System* section of *System Configuration* (on by default).
    - The *Open most recent Portfolio when BlackTrax starts* feature is disabled if a license check fails when opening the Main GUI.
    - BlackTrax always opens to the Edit View.

    - How BTWYSIWYG files open from the *Portfolio Manager* depends on the *Launch BTWYG file with Portfolio* setting in the *System* section of *System Configuration* (enabled by default).

Layout of the BlackTrax GUI

The functions of BlackTrax are divided into three simple core views. You may customize how the GUI lays out the various toolbars and widgets to your liking, and as such, this documentation refers to the default layout of the GUI. Along the left of the window are the View toolbar and Sub-View toolbar where you may click and navigate to the different views. The views of BlackTrax are:

Live view: The Live view is where you monitor a BlackTrax project. From this view, you have the ability to manually switch between Chapters and Books or enable Chapter Control from a console. You can connect or disconnect BlackTrax modules to the system as well as view the current BTBeacon patch, data and their Trackables. You may choose which Trackables are displayed based on group, active chapter, or all available. Only the information that was saved and applied to the project is displayed in Live view.


Live View

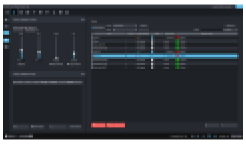
Edit view: The Edit view is where you assign fixtures to follow Trackables and program your Chapters. An instance of fixtures and Trackable relationships is called a chapter. Chapters can be edited, saved and managed on this page. You can also create and manage Books. Books are collections of Chapters. You may control how a fixture follows a Trackable using Fixture Settings. Various fixture settings and how they connect to BlackTrax are managed from this view.


Edit View

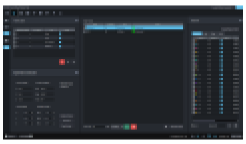
Calibration view: The Calibration view is the parent of Calibration sub-views. Each sub-view offers settings and operations specific to the type of calibration. The sub-views available are Fixture Calibration view and Frame Calibration view.

Note: Calibration view in itself is not a view, but automatically defaults to the last active sub-view once clicked.

Fixture Calibration sub-view: Fixture Calibration sub-view allows you to correct and adjust approved movable fixtures connected to BlackTrax, ensuring precision when following Trackables. Features of fixtures that can be calibrated are the pan and tilt settings and pan and tilt motor mapping (DMX to angle). The calibration profiles can be created, exported and imported for use as needed.


Fixture Calibration sub-view

Frame Calibration sub-view: Frame Calibration allows you to create and edit Rigid Body and Soft Body Frames. A Frame is a collection of beacons and LEDs that form an object. From this view, you can construct, offset, and move the centroid and orientation of a Frame as well as rename them.


Frame Calibration sub-view

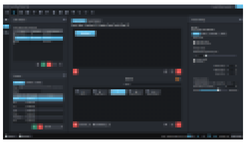
Full Screen Mode

BlackTrax can display the GUI in a full screen mode. You can hide the Windows interface and focus directly on your programming/tracking work.

To switch between full screen or windowed mode

1. From the **View** menu, choose **Full Screen Mode** or **Windowed Mode**.

- **Tip:** You may click the *Enter(Exit) Full Screen Mode* icon on the Main Toolbar or click *F11*.
- **Result:** BlackTrax GUI switches to full screen from the default windowed mode, or BlackTrax GUI switches back to the default windowed mode from full screen.



Note: If you are in full screen mode, and launch one of the BT Modules via the **Modules** menu, BlackTrax will switch to windowed mode upon launching the module.

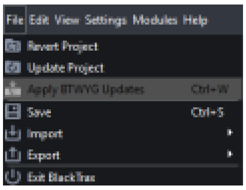
Menu Bar

BTGUI Menu Bar

The Menu Bar across the top of the GUI is where you will find access to all functions of the software. The different menu bars are:

- **File:** Saving of projects, as well as updating BTWYG information. You can also export various functions such as fixture calibration data and a programming report.
- **Edit:** *Undo*, *Redo* and *Discard Changes* can be found here.
  - *Discard Changes* will rollback changes made in the BlackTrax project to the last savepoint created. If no savepoint was created, the project will revert to as it was when originally opened.
- **View:** All docking widgets for the current view can be found here as well as options to manipulate saved views.
- **Settings:** Modify system and project settings.
- **Modules:** Access to the various modules of the BlackTrax System, including BTEngine and BTWYG
- **Help:** About information for your current release of BlackTrax and quick access to the License Folder.

File Menu



BlackTrax File Menu

Introduction

The **File** menu is where you can save, update, revert BlackTrax Projects and create Motive Projects. You can update a .btprj file with a .btx file from BTWYG, or via the **Apply BTWYG Updates** when new BTWYG information is sent to BlackTrax.

Other features that are available are being able to import and export calibration data, as well as exporting chapter programming data for reference as an .html file.

You can also exit BlackTrax from this menu.

Reverting to a Project History File

From the **File** menu, you can choose **Revert Project** to select and open a Project History file of the BlackTrax Portfolio that is currently in use.

To revert to a BlackTrax history file

1. From the **File** menu, choose **Revert Project**.
   - **Result:** The *Revert Project* dialog box appears showing the menu list of the dates and times of the saved Project History files.
   - **Tip:**
     - You may click on the *Revert Project* icon on the main toolbar.
     - You may click on the *Backup Date and Time* arrow in the *Revert Project* dialog box to sort the list in ascending or descending order.
2. In the *Revert Project* dialog box, click on a *Backup Date and Time*.
3. Click *Revert*.
   - **Result:** The Project History backup file associated with the date and time displayed opens and the currently opened project is saved and archived in Project History.

Updating BTX Projects

If a BTWYSIWYG file (.btx) has been edited since it was used to make a BlackTrax project file (.btprj), Update BTX Projects can be used to update the BlackTrax project file. Any new .btx information will be carried over to the existing .btprj while maintaining any work you have already done to the project.

To update a BlackTrax project with new information from BTWYSIWYG via a .btx file

1. From the **File** menu, choose **Update Project**.
   - **Result:** The *Browse* window appears.
2. In the *Browse* window, navigate to the edited .btx file location, and select the file.
3. Click *Open*.

- **Result:** Information from the .btx file (e.g. fixtures, trackables, Space dimensions) will be loaded into BlackTrax project file (.btprj).

To update a BlackTrax project with new information from BTWYSIWYG directly

1. In BTWYG, go to Live Mode
2. From the **Live** menu, choose **BlackTrax Panel** (If *BlackTrax* panel is closed).
   - **Result:** The *BlackTrax* panel appears.
3. Ensure BTWYG is connected to BlackTrax (if it is not, click connect).
4. In the *BlackTrax* window, click *BTX Apply.*
5. In BlackTrax, from **File** menu, choose **Apply BTWYG Updates**.

Saving BlackTrax Projects

BlackTrax projects are saved as a .btprj file. **Save** Project will save the open BlackTrax project to the same file name and location under which it was previously saved.

To save a BlackTrax project using Save Project

1. To save the current project, from the **File** menu, click **Save**.
   - **Result:** The currently open project is saved in the portfolio and a Project History backup (.btbak) file is created.

Importing and Exporting Fixture Calibration Data

You can import and export fixture calibration data to be used at a later date. This is useful to backup just calibration data, as well as exporting calibration data to be used in lighting consoles. In both cases for import and export, if no fixtures are selected in **Calibration Views** > **Fixture View** window, then all fixtures with calibration data will be exported/imported. If fixtures are selected, then only the selected fixtures will export/import.

To import fixture calibration data

1. From the **File** menu, choose **Import** and then choose **Fixture Calibration.**
   - **Result:** The *Browse* window appears.
2. Browse to the .btcal file and open it.
   - **Result:** The calibration data stored in the .btcal is applied.

To export fixture calibration data

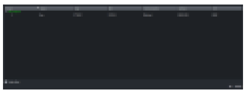
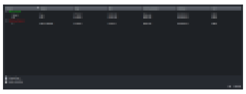
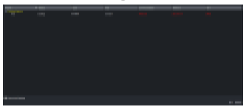
1. From the **File** menu, choose **Export** then choose **Fixture Calibration.**
   - **Result:** The *Export Calibration* browse window appears.
2. Under file type, select if you want to export .btcal (for importing back into a .btprj file) or .xml (for importing into lighting consoles or other devices).
3. Browse to the folder you wish to save the file.
4. Click *Save.*
   - **Result:** All calibrated fixture data is exported.

Importing and Exporting Output

Configuration Data

You can import and export output configuration data to configure the current tracking output or store tracking output data for later use.

To import output configuration data

1. From the **File** menu, choose **Import** and then choose **Outputs**.
   - **Result:** The *Browse* window appears.
2. Browse to the .btoc file and open it.
   - **Result:** The *Output Import Details* window appears. The table in the *Output Import Details* window displays the output configuration settings that will be imported into your project.
       
3. In the *Output Import Details* window, select the checkbox of the following options:
   - *Create New*: This option will create the new outputs as defined in the New Outputs section.
   - *Delete Existing*: This option will delete any outputs in the Deleting Outputs section. These existing outputs are already present in the BlacTrax project.
   - *Overwrite Existing*: The current output configuration defined in the Existing Outputs section will be replaced with the settings of the output configuration being imported.
   - **Note:** The checkbox will only appear if an output being imported has that option (i.e. *Check New* will only appear if there are new outputs).
4. If an output data with the same name is already present in your file, the changes will be highlighted, and you are given the option to overwrite the current output with these new settings.
5. The Output Configuration data stored in the .btoc is applied to the current project in BlackTrax.

To export output configuration data

1. From the **File** menu, choose **Export** and then choose **Outputs**.
   - **Result:** The *Export Calibration* window appears.
2. Under file type, select if you want to export .btoc.
3. Browse to the folder you wish to save the file.
4. Click *Save*.
   - **Result:** All Output Configuration data is exported to the selected folder.

Note: The project file must first be saved before you can export output configurations.

Exporting a Show Report

You can export a show report from the Export menu, which contains all the information regarding the programming of the show, including chapters, trackables, and Frames.

To export a show report

1. From the **File** menu, choose **Export** and then choose **Show Report.**
   - The *Export Show Report* window appears.
2. Browse to where you would like to save the file and click on *Save.*
   - **Result:** The file is saved and contains all project information as of the export in an .html format.

Closing BlackTrax

You can close BlackTrax from the file menu, at which point it will ask you to save the project, if changes were detected.

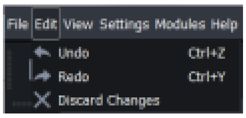
To close BlackTrax

1. From the **File** menu, choose **Exit BlackTrax.**
2. If prompted, save or discard project changes.
    - **Result:** The GUI is now closed.

Edit Menu

Introduction

The **Edit** menu is where you can undo or redo your changes, or discard your changes and revert back to the last time you hit the *Apply Changes* button.



Undo

If you want to reverse the last action you applied, you can easily reverse the action by using the **Undo** tool available on the **Edit** menu.

Redo

If you did not want to reverse the previous undo action you applied, you can easily reverse the previous undo action by using the **Redo** tool available on the **Edit** menu.

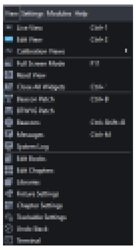
Discard Changes

Each time you click *Apply Changes*, a snapshot is created of the current editing and live space. As you make changes, **Changes: Blind** will highlight in the status bar, alerting you that new changes have not been made live. Normally, you would click on *Apply Changes* to apply your new edits live to the stage, but in the event you wish to discard your changes and revert back to the last time you click *Apply Changes*:

To discard your changes

1. From the **Edit** menu, choose **Discard Changes**.
2. Click *Yes* to confirm you wish to discard all changes.
    - **Result:** All changes are discarded back to the last time you clicked *Apply Changes*.

View Menu



View Menu

Introduction

The **View** menu contains all docking widgets, both global and per view, view shortcuts, and common widget operations. If you are ever curious about what can be done/opened, the **View** menu should prove helpful.

Top Section

The top section of the **View** menu contains you're three core views (**Live View**, **Edit View**, **Calibration Views**), and **Calibration Views**' two sub-views (**Fixture View** and **Frame Calibration View**). Click on each one will take you to the selected view and hovering over **Calibration Views** will give you access to the two sub-views.

Upper Middle Section

This section contains commonly used widget functions.

Switching to Full Screen Mode

The BlackTrax GUI can be displayed in full screen mode. You can hide the Windows interface and work directly on programming and tracking.

1. From the **View** menu, choose **Full Screen Mode** or **Windowed**.

- **Tip:** You may click the *Enter(Exit) Full Screen Mode* icon on the main toolbar or click F11.
- **Result:** BlackTrax GUI switches to full screen mode from the default windowed mode, or BlackTrax GUI switches back to the default windowed mode from full screen.

Resetting All Views to Factory Defaults

If at any point you are not happy with the layout you have created, you may click **Reset View** to restore the GUI's views back to factory default.

1. From the **View** menu, choose **Reset View.**

- **Result:** Any custom views you have created (moved docking widgets, floated widgets to other screens, or changes the sizing of widgets) will be reverted to factory defaults.
- **Note:** This will affect all views and cannot be undone.

Closing All Widgets

If you want to close all open widgets and just focus on the center pane in the GUI, you may use the **Close**

All Widgets option.

1. From the **View** menu, choose **Close All Widgets**.

- **Result:** Any widgets currently open, including docked and floating on other monitors, will be closed.
- **Note:** This will only affect the current view and cannot be undone.

Lower Middle Section

This section contains all global widgets, meaning anything you can open and access across all views. In this section you will find:

- **Beacon Patch**
- **BTWYG Patch**
- **Beacons**
- **Messages**
- **System Log**

Note: Each widget remembers its location per view only. Meaning if you take *Beacon Patch* and move it to a second monitor in Edit view, then switch to Live view, *Beacon Patch* will reset to its last saved position in Live view (if no last saved position is available, it will revert to the factory default position).

Bottom Section

This section contains all per-view widgets, meaning each widget is only found in one view and can not be shared between other views. In this section, per view, you will find:

Live View

- **Running Books (In Multi Book Projects)**
- **Running Chapters**
- **Modules**
- **Trackable Details**

Edit View

- **Edit Books (In Multi Book Projects)**
- **Edit Chapters**
- **Libraries**
- **Fixture Settings**
- **Chapter Settings**
- **Trackable Settings**
- **Undo Stack**
- **Terminal**

Fixture Calibration Sub-View

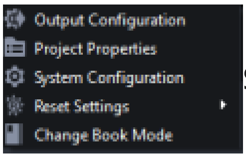
- **Fixture Calibration Control**
- **Fixture Calibration Properties**
- **Fixture Calibration Points**

Frame Calibration Sub-View

- **Frame LEDs**

- **Rigid Frame Construction**

Settings Menu



Settings Menu

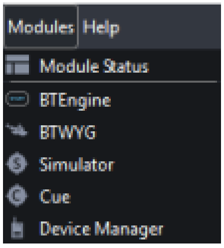
Introduction

The **Settings** menu contains links to all the widgets that contain settings for the software, the current project or the option to change between Chapter or Book mode.

Menu

- **Output Configuration:** The *Output Configuration* widget displays the active tracking output data from the Output Modules and Trackable Settings as a result of the tracking operation in BlackTrax.
- **Project Properties:** In *Project Properties*, you will find settings and information of the current project such as the show name, author, and description (all editable), and the settings that will change the DMX input for Chapter Control Channel, Book Control Channel, and the Merging Channel.
    - **Chapter**
        - *Universe*: Specifies the universe used for Book and Chapter Control Channels
        - *Book Control Channel*: The Book Control Channel specifies the DMX channel which will be used to trigger Book changes from a lighting console in a Multi Book Project.
        - *Chapter Control Channel*: The Chapter Control Channel specifies the DMX channel which will be used to trigger Chapter changes from a lighting console.
    - **Merging Channel**
        - *Enable Monitoring*: When this checkbox is enabled the current DMX value of the Merging Channel will be displayed in the Status Bar.
        - *Universe*: Specifies the universe used for the Merging Channel.
        - Merging *Channel*: The Merging Channel is just a monitoring channel and does not control the merging channel. The Merging Channel must be set in the merge node and monitored from the GUI.
- **System Configuration:** In *System Configuration*, you will find settings that will change the software behaviors (such as Fixture Calibration behavior, warning prompts, and autofocus behavior going to BTWYG).
- **Reset Settings:** The ability to reset Blacktrax, Motive or BT Engine settings to their original manufacturer settings. During the reset, all tracking operations will pause momentarily.
- **Change Book Mode:** Click on the *Change Book Mode* to switch BlackTrax between *Standard Chapters (no Books)* mode or *Extended Chapters (with Books)* mode.

Modules Menu



BlackTrax Modules Menu

Introduction

The **Modules** menu launches these modules that are used with BlackTrax. If you are in full screen mode, selecting a module will exit full screen mode.

Modules

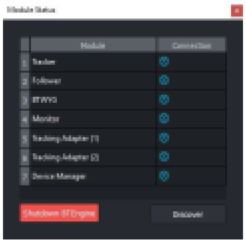
- **Module Status**: Displays the list of currently active modules. See Module Status page.
- **BTEngine**: Launches the *Tracker*, *Follower*, and *Monitor* modules as background tracking modules with settings that are integrated within the *Output Configuration* window of the **Settings** menu. *Tracking Adapter* module is launched when an output is present in the project.
  - *Tracker* module is a background process that takes the positional data of a BTBeacon from the Motive module, the corresponding BTBeacon idetification data from the BTRouter, and combines this data together.
  - *Follower* module is a background process that takes positional data from the *Tracker*, generates angle and DMX values for moving light fixtures, and forwards the data to other modules for their own use. BTWYSIWYG uses the data from *Follower* to virtualize real-time lighting tracking. *Follower* also listens to ArtNet/sACN from a console or from other sources.
  - *Monitor* module is a background process that maintains communication and command settings of multiple Tracking Adapters that were set in the *Output Configuration* window.
  - *Tracking Adapter* module is a background process that is an extension of *Tracker's* RTTrPM output. It is used by the BTSystem to customize RTTrPM data for Third Party use. The *Tracking Adapter* receives data provided by the *Tracker* module and customizes this data based on preferences configured in the *Tracking Adapter*. This customized data is then sent off to designated Third Party programs for their use.
- **BTWYG**: Launches the BTWYG file associated with the currently open Portfolio.
- **Simulator**: Identification and positional data of BTBeacons can be created, configured and managed in simulation. See Simulator Module page.
- **Cue**: Realtime or simulated tracking data in BlackTrax can be recorded and saved as Chapters for playback. See Cue Module page.
- **Device Manager**: Launches the *Device Manager* as an integrated software application module where external hardware used in the BlackTrax system can be accessed and managed directly through a PC. See BlackTrax Device Manager page.

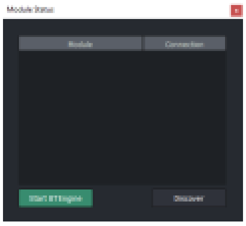
Module Status

The *Module Status* widget displays the list of modules that are currently active with the corresponding link connections. In the widget, you may click the *Discover* button to display the currently active module connections.

In the *Module Status* widget, you may right-click on a module to restart or exit the module (excluding BTWYG). In the *Module Status* widget, you may click *Shutdown BTEngine* to close all BTEngine modules at once.

In the *Module Status* widget, the *Shutdown BTEngine* button will change to *Start BTEngine* button if no modules are running.


Modules Status widget with modules running

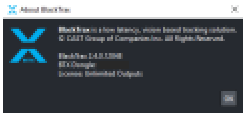

Modules Status widget without modules running

Help Menu

The **Help** menu is where you will find the shortcut to the License Folder location, and the *About BlackTrax* dialog box with information about BlackTrax, product version, build number, BTX Dongle code and License information.

The default License Folder location is C:\bt_run_time\license. For information on how to download the license, please refer to the Licensing.

The About BlackTrax dialog box:

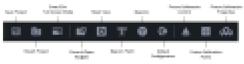


Toolbars

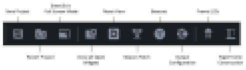
Main Toolbar in Live View

MainToolbar in Edit View

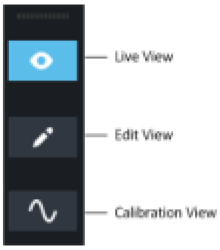
Main Toolbar in Calibration View > Fixture View



Main Toolbar in Calibration View > Frame View



View Toolbar

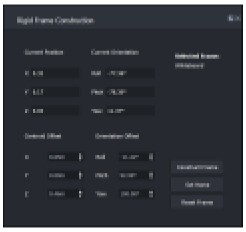


View and Sub-View Toolbar

There are three toolbars in the BlackTrax GUI: Main, Views, and Sub-Views.

- **Main:** On top of the left side, contains basic operations such as saving , as well as common functions found throughout the software such as Reset View, Beacon Patch, and a fullscreen option. On the right side, you have access to the most used docking widgets found in your current view. The right side of the toolbar will change depending on which view you are currently in.
- **Views:** The ability to change between the three core views: Live, Edit, and Calibration.
- **Sub-Views:** Sub-views are available for the Calibration View. Each sub-view offers functions related to a specific type of calibration.

Docking Widgets

 Frame Construction Docking Widget

The GUI is comprised of several docking widgets, each covering features and functionally to control, calibrate, and operate the system. You can find all available docking widgets under the **View** menu, and the most common widgets available in the toolbar.

All docking widgets comprise of a 'float' and 'close' function. Floating a widget will detach it from the GUI, and allow you to drag it around the screen, or to another monitor. The close function will close the widget, at which point you must re-open it from the **View** menu or toolbar.

Different widgets function in different ways, and their specific function will be covered in other sections of this documentation.

Status Bar

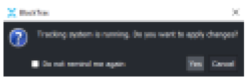
Status Bar with a running show

Along the bottom of the screen, the status bar displays important system information at a glance. The following information is available for view:

Attention: The following status icons act as buttons and can be clicked on to toggle following.

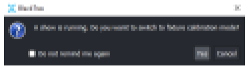
- **Mode Status**: Displays if calibration mode is active or normal mode is active.
  - **Normal Mode:** Fixtures follow according to chapter programming and current chapter. BlackTrax controls pan and tilt, and optionally zoom, iris, and dimming of intensity.
  - **Fixture Calibration Mode:** Fixtures follow according to the Fixture Calibration View, and BlackTrax controls intensity, pan, tilt, zoom, iris, colour, and gobo. Chapters are ignored.

Attention: The calibration status icons act as buttons and can be clicked on to toggle calibration.

- **Current Chapter:** Displays the chapter currently active.
- **MCV:** Stands for Merging Channel Value and displays the current DMX value from the console of the merging channel.
  - **Note:** The numbers beside "MCV" will flash colors when a new DMX packet is received by BlackTrax.
- **DMX Input:** Indicates if the system is receiving DMX information either from ArtNet or sACN. An animated icon indicates the system is receiving information.
- **Motion Control:** Indicates if the system is receiving motion information. An animated icon indicates the system is receiving information.
- **BTWYG Updates:** Indicates if the system is receiving an update from BTWYG via the BTX Apply function.
- **Messages:** A button to access the messages widget.
- **Changes:** Indicates if changes are **Live** (everything is actively sending to the lighting fixtures and all constructed Frames are reporting position) or **Blind** (changes that have been made, but are not actively sending to the real world system or live space). The *Apply Changes* button will apply the changes to the live space.
  - Any change made to the BlackTrax project will be saved to a temporary savepoint. The savepoint that was created will last until the BlackTrax project is closed.
  - The blue LED next to the **Changes: Live** indicator will turn to a flashing red LED next to the **Changes: Blind** indicator whenever changes are made to the project but are not yet applied to the live space.
- **Apply Changes:** Click *Apply Changes* to apply any blind changes to the live space.
  - **Result:**
    - The *Apply Changes* confirmation and reminder dialog box appears and offers the option to select the *Do not remind me again* checkbox to disable this confirmation/reminder dialog box. The *Do not remind me again* checkbox is linked with and has identical functionality as *Enable confirmation prompts for system changes* checkbox in *System Configuration*. 
    - The changes made from the selected option/s will be applied to the live space and blue LED next to **Changes: Live** will be displayed.

Mode Status

To enable fixture calibration

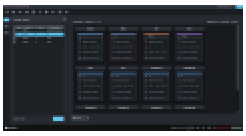
1. When in Normal Mode, in the status bar, click the *Normal Mode* button to switch to Fixture Calibration Mode.
    - **Result:**
        - The mode switch confirmation and reminder dialog box appears and offers the option to select the *Do not remind me again* checkbox to disable this confirmation/reminder dialog box. The *Do not remind me again* checkbox is linked with and has identical functionality as *Enable confirmation prompts for system changes* checkbox in *System Configuration*. 
        - BlackTrax is set to Fixture Calibration Mode and the features of the Fixture Calibration view is unlocked.

To disable fixture calibration

1. When in Fixture Calibration Mode, in the status bar, click the *Fixture Calibration* button to switch to Normal Mode.
    - **Result:** BlackTrax is set to Normal Mode and the Fixture Calibration view features is locked.

Live View

Table of Contents:


Live View showing all Trackables in the BlackTrax Project

Live Trackables

In the main window at the center area of the Live View, you see live trackable information, the current BTBeacon patch data, and their Trackables. There are different options for viewing this data.

Icon View

This view displays Trackable Data in the same way it is represented in the *Beacon Patch* Docking Widget. Displayed are:

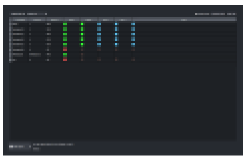
- Trackable containers with Trackable Names.
- Any assigned beacons with their relevant information appear in the Trackable containers.
- Trackable containers appear with colored borders indicating if the Beacon is currently visible (Blue), or not visible (Red), or inactive (Grey).
- An indicator beside the beacon number to indicate if the beacon is currently visible (Blue), or not visible (Red), or inactive (Grey).


Live Trackables with Icon View

Table View

This view displays live trackable information with live LED status monitoring in the following columns:

- Trackable with name.
- Assigned Beacon.
- Battery Status.
- Radio Status: Fresh data (Blue), Stale data (Red).
- Visibility of the trackable: Visible (Blue), Not-visible (Grey).
- Status of the individual LED associated with the trackable: Active (Blue), Inactive (Dark Grey).


Live Trackables with Table View

Small View

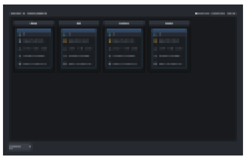
This view displays Trackable Data that is represented as small icons with the Trackable Name, beacon number with the relevant information and the indicator. Click on the box beside *Small View* to select this display option. Displayed are:

- Small Trackable container icons with Trackable Names.
- Any assigned beacons with their relevant information appear in Small Trackable containers.
- Small Trackable containers appear with colored borders indicating if the Beacon is currently visible (Blue), or not visible (Red), or inactive (Grey).
- An indicator beside the beacon number to indicate if the beacon is currently visible (Blue), or not visible (Red), or inactive (Grey).

In addition to the views mentioned above, there are further sorting options available to show the relevant data as the user prefers. They are:

Show per Chapter

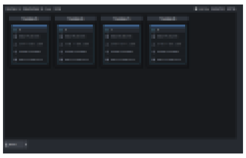
This option will show only trackables currently assigned to the currently running chapter.



Per Chapter Live Trackables using the Icon View

Show by Group

This option displays any trackables that have been assigned to a group through the Trackables docking widget. When showing by group, an additional drop-down menu appears to allow the selection of groups. For information on Trackable group creation, refer to Grouping Trackables in the *Libraries* widget section of this manual.



Displaying Trackables in a selected group

Tab Views

There are also two options for displaying trackable information while using the Icon View.

- *Centroid Tab* displays battery information, as well as the XYZ Calculated centroid of a trackable, as well as Roll, Pitch, Yaw and BTBeacon information.
- *LED Tab* displays battery information, as well as the XYZ information of individual LED Stringers connected to the beacon.

Running Chapters Widget

Overview

The *Running Chapters* widget contains the list of recalled Chapters, which can be selected to become active. The *Running Chapters* widget displays:

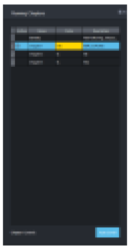
- Names and descriptions assigned to the recalled Chapters.
- Tracking status of the recalled Chapters.
- Programmed fade time of the recalled Chapter.

Active: When Tracking is active, assigned fixtures will follow the Trackables assigned to the selected active Chapter. Selecting which Chapter to activate can be controlled by using manual control in BlackTrax, or using DMX via Art-Net or sACN from a connected lighting console.

Fade: **Fade** column displays the programmed fade time of the fixture's zoom, iris, pan and tilt values between two different Chapters or to and from the lighting console.

- Fade time is set in the *Edit Chapters* or *Chapter Settings* widget in Edit View and applies to change transitions from Chapter to Chapter, Trackable to Trackable, Console to Chapter, and Chapter to Console.
- The default fade time value is 0 seconds and the maximum value is 60 seconds.
- The running Chapter's Fade time is displayed as it counts down in the *Fade* column and on the Status Bar.
- The running Chapter's cell highlights in yellow as a fade is in progress.

See Edit Chapters Widget for information on Chapter Settings.


Running Chapters Widget

Manual Chapter Control

Manual control enables control of chapters from within the BlackTrax GUI.

To enable manual control of chapters

1. In the center widget of *Live View* where the Icons are displayed, click on the drop-down menu at the bottom left-hand corner.
2. On the drop-down menu, click *Manual*.

To select a chapter to be active using manual control

1. In the *Running Chapters* widget, from the list of saved *Chapters*, click on the *Chapter*.
    - **Result:** The selected Chapter shows an Active icon in the Active field to indicate it is currently active. Fixtures assigned to the selected Chapter will follow the assigned Trackables in the Space.

DMX Chapter Control

With DMX control enabled, the selection of which chapter is active can be controlled from a lighting console.

To enable DMX control of chapters

1. In the center widget of *Live View* where the Icons are displayed, click on the drop-down menu at the bottom left-hand corner.
2. On the drop-down menu, click *DMX Input*.
    - **Result:** The connected lighting console has control over the selected Chapter. The Universe and Address used to control the Chapters from the lighting console are displayed in the bottom left-hand corner of the center widget and on the Status Bar. The Chapter Control DMX value is also displayed at the bottom left-hand corner of the *Running Chapters* widget.

To toggle auto scrolling to an active chapter

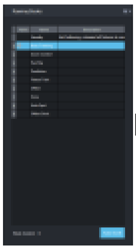
With DMX Input enabled, *Auto Scroll* is available for use. *Auto Scroll* will make the chapter list always display the active chapter when enabled.

1. In the *Running Chapters* widget, click *Auto Scroll*.

Running Books Widget

Overview

The *Running Books* widget contains the list of created Books that can be recalled to become active. When a Book is recalled, the list of Chapters in the Book is displayed in the *Running Chapters* widget. Selecting which Book to recall can be controlled by using manual control in BlackTrax, or using DMX via Art-Net or sACN from a connected lighting console.


Running Books Widget

Manual Book Control

Manual control enables the control of Books from within the BlackTrax GUI.

To enable manual control of books

1. In the center widget of *Live View* where the Icons are displayed, click on the drop-down menu at the bottom left-hand corner.
2. On the drop-down menu, click *Manual*.

To select a book to be active using manual control

1. In the *Running Books* widget, from the list of created *Books*, click the *Book*.
    - **Result:** The selected Book will have an Active icon in the Active field to show it is currently active. The list of Chapters in the selected Book will be displayed in the *Running Chapters* widget.

DMX Chapter Control

With DMX control enabled, selecting which Book to recall can be controlled from a lighting console.

To enable DMX control of books

1. In the center widget of *Live View* where the Icons are displayed, click on the drop-down menu at the bottom left-hand corner.
2. On the drop-down menu, click *DMX Input*.
    - **Result:** The connected lighting console has control over the selected Book and all the Chapters in the Book. The Universe and Address used to control the recalled Book and Chapters from the lighting console are displayed in the bottom left-hand corner of the center widget and in the Status Bar. The Book Control DMX value is also displayed at the bottom left-hand corner of the Running Books widget.

To toggle auto scrolling in the active chapter

With DMX Input enabled, the *Auto Scroll* feature becomes available for use. *Auto Scroll* will make the Books list always display the active Book when enabled.

1. To toggle auto scrolling, in the *Running Books* widget, click *Auto Scroll*.

Trackable Details Widget

Trackable Details Widget

Overview

This widget is used to monitor the details of beacons assigned to any Trackables in the currently selected Chapter that have a Rigid or Soft frame assigned to them. Selecting a Trackable with a Rigid or Soft frame assigned to it in the central widget of the Live View will display all the beacons which the Rigid or Soft frame is assigned. The widget lists the name of all the beacons assigned to the frame, as well as the battery status, stale radio data, and a visibility icon (Blue for visible, red for not visible, grey for inactive).

Edit View

Table of Contents:

Overview

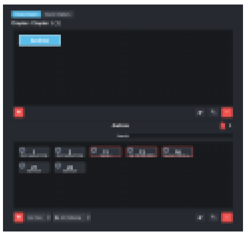
The Edit View is where moving fixtures are assigned to follow the position of Trackables in chapters. A chapter is saved information on which Trackables are to be tracked, and which fixtures are to follow them at a specific instance. Specific customization can also be enabled in a chapter such as configuring how a BTBeacon's LEDs should be used for Tracking; if a zone is to be used in the chapter; and if a terminal command is used to alter tracking behavior.


Edit View Overview

Chapter Configuration

Single Chapter Configuration

The central widget in Edit View is where you modify Chapters and assign Trackables and Fixtures to the chapters. If you select a single Chapter in the *Edit Chapters* widget, *Single Chapter* tab will automatically be selected in Edit View. The *Single Chapter* tab is where you modify settings for the currently selected chapter in the *Edit Chapters* widget.



If you select a single Chapter in the *Edit Chapters* widget:

- You can drag Trackables from the *Trackables* in the *Libraries* widget to the top pane of the central widget to assign the Trackable to the selected Chapter.
- You can copy/paste Trackables using the "*Copy/Paste*" buttons on the top pane of the central widget.
- You can delete selected Trackables from the selected chapter using the "*Delete*" button on the top pane of the central widget.

If you select a Trackable on the top pane of the *Single Chapter* tab:

- You can drag the desired fixtures from the *Fixtures* tab in the *Libraries* widget to the bottom pane of the central widget to assign the Fixture to the selected Trackable.
- You can copy/paste Fixtures using the "*Copy/Paste*" buttons at the bottom pane of the central widget.
- You can delete selected fixtures from the selected Trackable/Chapter using the "*Delete*" button on the bottom pane of the central widget.

Tip: You may right-click on the Trackable icons on the top pane or Fixture icons on the bottom pane and choose the **Copy** menu or **Replace Trackables** menu.

Select a fixture in the bottom pane of the central widget and open the *Fixture Settings* widget to apply fixture settings.

In the *Single Chapter* tab, fixtures are displayed in *List View* or *Table View*. You can add filters in each view to display fixtures with specific settings.

In *Icon View*, moving fixtures are displayed with a grey border and conventional fixtures are displayed with a red border. The icons will display a symbol to indicate the specific settings when a filter is selected:

- **Uses Iris:** Will show if a fixture uses iris to change the beam size.
- **Uses Prediction:** Will show if a fixture has prediction settings.
- **Has Offset:** Will show if a fixture has any offset settings applied.
- **Has Following Setting:** Will display if a fixture is assigned to follow specific LEDs of assigned BTBeacons.

- ◦ **Uses LED 1:** Will display if a fixture is assigned to follow the LED in BTBeacon port 1.
  - ◦ **Uses LED 2:** Will display if a fixture is assigned to follow the LED in BTBeacon port 2.
  - ◦ **Uses LED 3:** Will display if a fixture is assigned to follow the LED in BTBeacon port 3.
- **Uses Zones:** Will show if a fixture uses zoom to change the beam size.
- **Uses Auto-Spot Mode:** Will show if a fixture has Auto-Spot mode settings.
- **Uses Zoom:** Will show if a fixture has any zone settings applied.

Table View displays all fixtures assigned to the currently selected trackable in a table format. You may configure the columns to display an icon according to the applied fixture settings. The columns are **Spot ID**, **Name**, and **Type**, followed by any of the settings enabled in the following list:

- **LED Following**
- **Zoom**
- **Iris**
- **Smooth Pickups**
- **Auto Douse**
- **Sensitivity**
- **Offset**
- **Auto Spot Mode**
- **Zone**

Note: The **Name** column displays the Name of the fixture that matches the **Name** column in the *Libraries* widget. The **Type** column displays if the fixture is a *Moving Head*, *Moving Mirror*, or *Conventional* fixture.

Click the *Clear Trackable Selection* button at the bottom of the top pane of the central widget to clear the selected individual trackable or all the selected trackables.

Click the *Clear Fixture Selection* button at the bottom of the bottom pane of the central widget to clear the selected individual fixture or all the selected fixtures.

Several Chapter Configuration

In the *Several Chapters* tab in the central widget, settings can be applied to several fixtures at once and across multiple chapters.

If you select several Chapters in the *Edit Chapters* widget:

- The *Edit Chapters* tab will automatically be selected.
- All Chapters will automatically be scanned for all Fixtures and Trackables.
- All Trackables that are used across the selected Chapters will appear at the top pane of the central widget in *Several Chapters* tab.
- If no Trackable is selected, all Fixtures that are assigned to all the Trackables used in all the selected Chapters will appear at the bottom pane of the central widget in *Several Chapters* tab.
- If no Trackable is selected, changes to the *Fixture Settings* will apply to all selected Fixtures across the selected Chapters.

If you select a Trackable on the top pane of the central widget in *Several Chapters* tab:

- Only the Fixtures assigned to the selected Trackable across all the selected Chapters will appear at

the bottom pane of the central widget in *Several Chapters* tab.
- If you select a Fixture assigned to the selected Trackable, changes to the *Fixture Settings* will modify the Fixture Settings for Chapters where the Fixture is assigned to the selected Trackable.

Use the *Search* box to search for fixtures by spot number or fixture type across the selected chapters.

Click the *Clear Selection* button at the bottom to clear the selected individual fixture or all the selected fixtures.

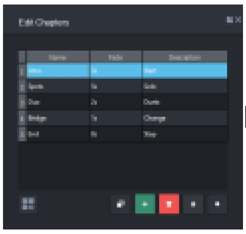
Edit Chapters Widget

Overview

The *Edit Chapters* widget is where Chapters are created, removed, and re-ordered. The selected chapter or chapters in this widget define what is displayed in the central pane of the Edit View, in Single Chapter, or Several Chapters mode.

The *Edit Chapter*s widget displays the name, description and the programmed fade time that were set for each Chapter in the *Chapter Settings* widget. You can double-click the fields on the *Name*, *Fade* and *Description* columns to edit the values or you can open the *Chapter Settings* widget.

The *Chapter Settings* widget is accessed from the *Edit Chapters* widget. The *Chapter Settings* widget is where you set or change the name, description, fade time, and calibration preset for each Chapter that is selected. See the section **To edit chapter settings** below.


Edit Chapters Widget

Functionality

The following actions can be performed in the *Edit Chapters* widget:

To create a new chapter

1. In the *Edit Chapters* widget, click the *Plus* button.
    - **Result:** A blank chapter is created in the chapter list below the currently selected chapter.
2. For the changes to take effect, click *Apply Changes*.

To create a copy of an existing chapter

Copying a chapter will copy all aspects of the selected chapter, including fixture and Trackable relationships.

1. In the *Edit Chapters* widget, select the chapter you want to copy.
2. Click the *Copy selected chapter* button.
    - **Result:** A copy of the chapter is created in the chapter list below the currently selected chapter.
3. For the changes to take effect, click *Apply Changes*.

To delete a chapter

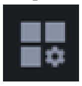
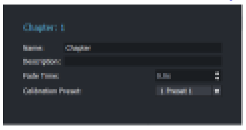
1. In the *Edit Chapters* widget, select the chapter you want to delete.
2. Click the *Delete* button.
    - **Result:** A dialog box appears asking if you really want to delete the chapter.
3. To confirm deletion, click *Yes*.
4. For the changes to take effect, click *Apply Changes*.

To move chapters in the chapter list

1. In the *Edit Chapters* widget, select the chapter you want to move.

2. Click the *Up Arrow* or *Down Arrow* button to move the selected chapters up or down.
3. For the changes to take effect, click *Apply Changes*.

To edit chapter settings

1. In the *Edit Chapters* widget, select the chapter or chapters you want to edit.
    - **Tip:** You may use the unified selection methods for multiple selection.
        - Use Ctrl+A to select all chapters.
        - Use Left-click to isolate the selection and deselect all the other chapters.
        - Use Right-click to change the active selection while keeping the current selection group.
    - **Result:** The active chapter is highlighted light blue where the active settings are displayed. Dark blue highlight indicates selection.
    - **Note:** When you select multiple chapters, conflicting chapter settings in text boxes will be highlighted in blue to indicate a difference in settings.
2. In the *Edit Chapters* widget, click the *Chapter Settings* button.
    - **Tip:** You may click the *Chapter Settings* icon on the Main Toolbar in Edit View.
       *Chapter Settings* icon.
    - **Result:** The *Chapter Settings* widget appears.
      
    - **Note:** When you select multiple chapters, the settings of the active chapter will appear in blue.
3. On the *Name* box, type the new name of the selected Chapter.
    - **Result:** The new name appears on the *Edit Chapters* widget.
4. On the *Description* box, type a description of the selected Chapter.
    - **Result:** The description appears on the *Edit Chapters* widget.
5. On the *Fade Time* scroll box, click the *Up* or *Down* arrow or type a value to set the fade time for the selected Chapter.
    - **Result:** The *Fade Time* value appears on the *Edit Chapters* widget.
    - **Notes:**
        - *Fade Time* sets the Chapter timings when fixtures' zoom, iris, pan and tilt functions fade during transition between two different Chapters or to and from the lighting console.
        - *Fade Time* applies to transition timings from Chapter to Chapter, Trackable to Trackable, Console to Chapter, and Chapter to Console. Trackables change, console release, offset values, LED following and beam sizing features are supported.
        - *Fade Time* value will be displayed in the Show Report.
        - *Fade Time* default value is 0; maximum value is 60 seconds.
        - Standby Chapters has no fade time; Standby default value is 0.
        - *Fade Time* does not apply to Intensity effects which are controlled via their individual feature's timing.
        - Chapters operate in LTP when several Chapters are triggered back to back. The latest Chapter will take priority and fixtures will snap to the beginning of that Chapter's starting position.
6. On the *Calibration Preset* drop-down box, click and select a calibration preset from the drop-down list.
    - **Result:** The fixture calibration data collected under the selected preset is applied to the selected Chapter.
7. For changes to take effect, click *Apply Changes*.

To name a chapter

1. In the *Edit Chapters* widget, in the *Name* field of the chapter, double-click to enable editing.
2. Type the name of the chapter in the *Name* field.
3. For the changes to take effect, click *Apply Changes*.

To write a description of a chapter

1. In the *Edit Chapters* widget, in the *Description* field of the chapter, double-click to enable editing.
2. Type the chapter description in the *Description* field.
3. For the changes to take effect, click *Apply Changes*.

To set a fade time for a chapter

1. In the *Edit Chapters* widget, in the *Fade* field of the chapter, double-click to enable editing.
2. Type a value or click the *Up* or *Down* arrows in the *Fade* field.
3. For the changes to take effect, click *Apply Changes*.

Edit Chapters Widget in Multi Book Mode

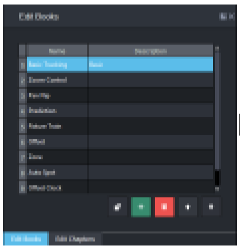
Edit Chapters Widget

In Extended Chapters (with Books) mode, the *Edit Chapters* Widget displays the name of the selected Book where the current selected Chapter is accessed. See Edit Books Widget.

Edit Books Widget

Overview

When BlackTrax is in **Multi Book** mode, Chapters can be created, edited, saved and managed as part of a Book or Books. In the *Edit Books* widget, a Book with Chapters can be created, removed, re-ordered or selected for editing. The Chapters in the selected Book will be displayed in the *Edit Chapters* widget for editing.


Edit Books Widget

Functionality

The following actions can be performed from the *Edit Books* widget:

To select a chapter from a book

1. In the *Edit Books* widget, from the table list of Books, click on the *Book* that contains the Chapter you want to select.
   - **Result:** The list of Chapters available in the selected Book are displayed in the *Edit Chapters* widget. You can proceed to select the Chapter from the *Edit Chapters* widget.

To create a new book

1. In the *Edit Books* widget, click the *Plus* button.
   - **Result:** A blank Book is created in the Book list below the currently selected Book.
2. For the changes to take effect, click *Apply Changes*.

To create a copy of an existing book

Copying a Book will copy all the Chapters in the selected Book, including fixture and Trackable relationships in all the Chapters in the selected Book.

1. In the *Edit Books* widget, select the Book you want to copy.
2. Click the *Copy selected book* button.
   - **Result:** A copy of the Book is created in the Books list below the currently selected Book.
3. For the changes to take effect, click *Apply Changes*.

To delete a book

1. In the *Edit Books* widget, select the Book you want to delete.
2. Click the *Delete* button.
   - **Result:** A dialog box appears asking if you really want to delete the Book.
3. Click *Yes* to confirm deletion.
4. For the changes to take effect, click *Apply Changes*.

To move books in the books List

1. In the *Edit Books* widget, select the *Book* you want to move.

2. Click the *Up Arrow* or *Down Arrow* button.
3. For the changes to take effect, click *Apply Changes*.

To name a book

1. In the *Edit Books* widget, double-click the *Name* field of the selected *Book*.
2. Write the name of the Book in the *Name* field.
3. For the changes to take effect, click *Apply Changes*.

To write a description of a book

1. In the *Edit Books* widget, double-click the *Description* field of the selected *Book*.
2. Write the description in the *Description* field.
3. For the changes to take effect, click *Apply Changes*.

Libraries Widget

Overview

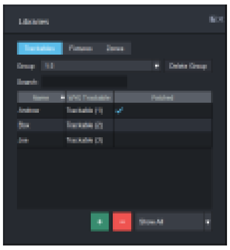
The *Libraries* widget contains all Trackables, Fixtures, and Zones that can be applied to Chapters in Edit View. The widget is separated into three tabs, one each for Trackables, Fixtures, and Zones. Each type of assignable item can be dragged from the Libraries widget into its respective pane in the Edit view. The top pane for trackables, bottom pane for fixtures being assigned to trackables, and into the *Fixture Settings* widget for Zones.

Trackables Tab

The *Trackables* tab is organized in a table format with three columns: **Name**, **WYG Trackable**, and **Patch** status.

- **Name**: The name of the trackable in BlackTrax, which can be changed by double-clicking the name field on the widget.
- **WYG Trackable**: The name of the trackable when it was exported from BTWYSIWYG.
- **Patched**: The patch status indicates whether or not the trackable has been assigned to a chapter or chapters. A blue checkmark is displayed to indicate that the Trackable has been assigned to a chapter or chapters.

Depending on your BlackTrax project, you may have a large amount of Trackables to keep track of. The *Search* Trackables function helps you to sort and locate the exact Trackables you need. Based on the selected chapter, the drop-down filter at the bottom of the widget also helps you choose which Trackables to display in the table.


Libraries Widget viewing the Trackables Tab

To search for a trackable

The only way to search for a Trackable is by searching for the Trackable Name assigned in BlackTrax.

1. In the *Search* field of the *Trackables* tab , enter the name of the Trackable(s) you are looking for.
    - **Result:** The Trackables List in the *Trackables* tab will display only Trackables that meet your search criteria.

To filter the list of trackables

Based on the selected Chapter, you can choose which Trackables to display in the table of the Trackables tab.

1. On the *Trackables* tab of the *Libraries* widget, click on the filter arrow at the bottom and choose from the drop-down menu options that appear.
    - **Show Unpatched**: Only unpatched Trackables appear in the table.
    - **Show Patched**: Only patched Trackables appear in the table.
    - **Show All**: Trackables that are patched and unpatched appear in the table.

Grouping Trackables

The *Group* feature in this widget can be used to group selected trackables and display together in Live mode.

To group trackables

1. From the list in the table, select the Trackables you would like to group together.
2. Click the *Group* drop-down menu and select *New Group From Selected*.
    - **Result:** The *New Trackable Group* dialog box appears.
3. Enter the group name in the *Group Name* field on the *New Trackable Group* dialog box.
    - **Result:** The group of Trackables is created and appears in the *Group* drop-down menu.
    - **Note:** The *Delete Group* button deletes the currently selected group (but not the Trackables themselves).

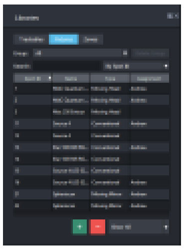
Note: The current group selection does change the filtering of the *Trackable* tab.

Fixtures Tab

The *Fixtures* tab is organized in a table structure with columns for **Spot ID**, Fixture **Name**, Fixture **Type**, and **Assignment**; whether or not it is assigned, and which Trackables it is assigned to in the currently selected chapter.

- **Spot ID**: An individual Spot ID number that was assigned to every single fixture in a BTWYSIWYG project. See Patching and Assigning an ID to Fixtures in BTWYSIWYG.
- **Name**: The name of a fixture as listed in the *Library Browser* in BTWYSIWYG.
- **Type**: The various types of fixtures such as Moving Head, Moving Mirror, or Conventional.
- **Assignment**: Shows whether or not the fixture is assigned, and which Trackables it is assigned to in the currently selected Chapter.

Like Trackables, there is built-in search functionality to search by *By Spot ID*, *By Fixture Name*, or by *Trackable* name. There is also a drop-down filter functionality to choose which Fixtures to display in the table.


Libraries Widget viewing the Fixtures Tab

To search for a fixture

1. In the *Fixtures* section, select from the Search By... drop-down menu how you want to search for Fixtures.
    - **Note:**
        - **By Spot ID** searches for Fixtures based on the ID assigned in BTWYSIWYG.
        - **By Fixture Name** searches for Fixtures based on how a Fixture is named in BlackTrax.
        - **By Trackable** searches for Fixtures currently assigned to a Trackable (in the selected chapter) based on the BT Trackable name. (For example, if you search for Trackable name *Name X*, all fixtures assigned to *Name X* will be displayed.)
2. In the *Search* Fixtures field, enter the name of the Fixture(s) you are looking for.
    - **Result:**

- The Fixture List displays only Fixtures that meet your search criteria.
- If the search finds only a single Fixture, that Fixture is selected automatically.

To filter the list of fixtures

Choose which Fixtures to display in the table of the Fixtures tab.

1. On the *Fixtures* tab of the *Libraries* widget, click on the filter arrow at the bottom and choose from the drop-down menu options that appear.
   - **Show Unassigned**: Only fixtures that are not assigned to Trackables appear in the table.
   - **Show Assigned**: Only fixtures that are assigned to Trackables appear in the table.
   - **Show Calibrated**: Only calibrated fixtures appear in the table. **Note:** This menu is based on the selected chapter's preset.
   - **Show All**: All fixtures appear in the table.

Grouping Fixtures

The *Group* feature in this widget can be used to group selected fixtures together for programming. Creating a fixture group will automatically select all fixtures in that group at the time of creation. Selecting a fixture group will automatically select all fixtures in that group.

To group fixtures

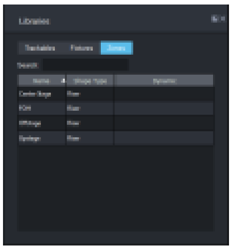
1. From the list in the table, select the fixtures you would like to group together.
2. Click the *Group* drop-down menu and select *New Group From Selected*.
   - **Result:** The *New Fixture Group* dialog box appears.
3. Enter the group name in the *Group Name* field on the *New Fixture Group* dialog box.
   - **Result:** The group of Fixtures is created and appears in the *Group* drop-down menu.
   - **Note:** The *Delete* button deletes the currently selected group (but not the Fixtures themselves).

Zones Tab

The *Zones* tab has three columns: Zone **Name**, **Shape Type**, and **Dynamic**.

- **Name**: The name of the BlackTrax Zone that was set in BTWYSIWYG.
- **Shape Type**: The type of BlackTrax Zone that was selected in BTWYSIWYG.
- **Dynamic**: Indicates if the BlackTrax Zone is dynamic/assigned to a Trackable.

On the *Search* box, you can search by the Zone Names.

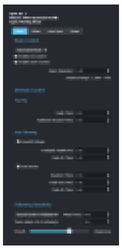

Libraries Widget viewing the Zones Tab

Fixture Settings Widget

Table of contents:

Overview

The *Fixture Settings* widget is where you configure how fixtures interact with Trackables in a specific chapter. *Fixture Settings* is separated into four tab sections: *Basic*, *Offset*, *Auto Spot* and *Zones*. The tabs will be explained in detail in the following pages.

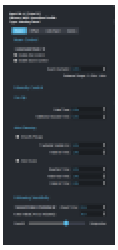


Fixture Settings - Basic tab

You can select a single fixture, or multiple fixtures in the center pane of Edit View to have *Fixture Settings* display the collective settings. In multi-fixture selection, there is always an 'active' fixture, which displays its current settings in the *Fixture Settings* widget. The active fixture is indicated by the name and spot ID of the fixture at the top of the *Fixture Settings* widget.

When you select multiple fixtures, any differences between fixtures will be highlighted in blue. For example: Spot 1 has a zoom setting of 1m and Spot 2 has a zoom setting of 2m. When you select both fixtures, the text box will highlight blue to indicate a difference between the two selected fixtures.

If you select a *conventional fixture* and a *moving fixture* at the same time, the settings of the active fixture will be displayed. Changes to moving fixture settings that do not apply to conventional fixtures will be ignored during multi-select for incompatible fixtures.



Fixture settings - Basic tab (With multiple fixtures selected, differences highlighted and Intensity Control features marked.)

Moving Fixtures

Moving Head and Moving Mirror are Moving Fixtures. All settings available in the *Basic*, *Offset*, *Auto Spot* and *Zones* tabs of the *Fixture Settings* widget are applicable to Moving Fixtures.

Conventional Fixtures

Conventional fixtures and non-moving LED fixtures are Conventional Fixtures. BTWYSIWYG sends conventional fixtures to BlackTrax, which can be assigned to Trackables and Chapters with reduced functionality settings.

Settings in the *Fixture Settings* widget that are disabled in conventional fixtures:

- Pan-Flip
- Following Sensitivity
- Offset
- Auto Spot

Settings in the *Fixture Settings* widget that are available in conventional fixtures:

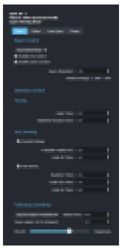
- Smooth Pickups
- Auto Douse
- LED Following Settings (Centroid, LED 1, LED 2, LED 3)
- Zones

Basic Tab

Basic tab is where you configure general settings of a fixture. Set **Beam Control**, **Intensity Control**, and **Following Sensitivity** for moving fixtures and conventional fixtures.

Configure the beam size of moving fixtures using zoom or iris, control the pan-flips function then set the sensitivity of the fixture that follows the trackable.

Configure the beam size of conventional fixtures using BTWYSIWYG Profile or custom, then enable smooth pickups and auto douse.


Fixture Settings - Basic tab

Beam Control

In BlackTrax you can set beam size of moving fixtures in *Automated Mode* or set the beam size of conventional and moving fixtures in *Static Mode*.

Automated Mode

BlackTrax will use the iris and zoom features of a moving fixture to control its beam size while following a Trackable. The beam setting of a moving fixture is linked to the chapter it was created in. Fixtures can be in multiple chapters and have different beam sizes in each chapter.

If both zoom and iris control are enabled, the BTSystem will tell the fixture to first use zoom control to shape the beam size. Using both the iris and zoom can increase the range.

Static Mode

BlackTrax will use the fixture's BTWYSIWYG Profile Size or you can set a Custom Beam Degree.

You can assign a conventional fixture to a Zone and a Trackable, to the same Zone, which will make the Zone Dynamic. When you assign the conventional fixture to the Trackable in *Static Mode*, you can trigger the conventional fixture to switch On or Off when the Trackable enters the Zone.

To control the beam size of a fixture in automated mode

1. In the *Chapter* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
    - **Result:** The settings of the selected fixture are displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. On the **Beam Control** section of the *Basic* tab, click on the drop-down menu and select *Automated Mode*.
    - **Result:** *Enable Iris Control* and *Enable Zoom Control* checkboxes are displayed.
6. Select *Enable Iris Control* and/or *Enable Zoom Control* checkboxes.
    - **Result:** The *Beam Diameter* and *Distance Range* settings are displayed.
7. On the *Beam Diameter* scroll box, click on the *Up* or *Down* arrows or type the value for the desired

beam diameter (in meters).
    - **Result:** The *Distance Range* displays at what distance from the fixture the beam diameter can be maintained.
8. For the changes to take effect, click *Apply Changes*.

To control the beam size of a fixture in static mode

1. In the *Chapter* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the moving or conventional fixture.
    - **Result:** The settings of the selected fixture are displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. On the **Beam Control** section of the *Basic* tab, click on the drop-down menu and select *Static Mode*.
    - **Result:** *Use Profile Size* and *Use Custom Size* checkboxes are displayed.
6. Select *Use Profile Size* checkbox or *Use Custom Size* checkbox.
    - **Result:** The non-editable *Beam Degrees* value is displayed if *Use Profile Size* is selected. The editable *Beam Degrees* value is displayed if *Use Custom Size* is selected.
7. If you selected the *Use Custom Size* checkbox, on the *Beam Degrees* scroll box, click on the *Up* or *Down* arrows or type the value for the desired beam angle.
    - **Note:**
        - When you select *Use Custom Size* in *Static Mode*, BlackTrax attempts to control the Zoom/Iris feature if available in the fixture.
        - When you select *Use Profile Size* in *Static Mode*, beam control returns to the lighting console (default).
8. For the changes to take effect, click *Apply Changes*.

Intensity Control

Pan-Flip

The *Fade Time* and *Additional Doused Time* features in the **Pan-Flip** section manages how a fixture performs a pan-flip during tracking in the chapter. The time it takes for a fixture to complete a pan-flip is determined by the speed of the fixture's pan/tilt motors as defined in WYSIWYG.

Fade Time sets the length of time it takes for a fixture to douse and then restore after pan stops. *Fade Time* applies to the operation of the fade itself when the fixture freezes in place, douses out, performs the pan-flip, then fades back up using the specified time. The default *Fade Time* value is 0 which snaps the fixture off as in previous versions.

Additional Doused Time adds delay time before the fixture fades back up. (For example, in cases where the fixture is slower than the WYSIWYG settings on file)

To set fade time and additional doused time

1. In the *Edit Chapters* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
    - **Result:** The settings of the selected fixture are displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Basic* tab in the *Fixture Settings* widget.
5. On the *Fade Time* scroll box under the **Pan-Flip** section, click the *Up* or *Down* arrows or type a value to add extra pan-flip douse time.

6. On the *Additional Doused Time* scroll box under the **Pan-Flip** section, click the *Up* or *Down* arrows or type a value to add extra pan-flip douse time.
    - **Note:** The range of time is limited to 0-3 seconds.
7. For the changes to take effect, click *Apply Changes*.

Notes:

- If another Pan-Flip occurs before the current fade is complete, the fixture will finish the fade, perform the new pan-flip, then fade back up.
- If the fixture performs two Pan-Flips in the same direction while the light is still fading out, it will cancel both Pan-Flips and move to the new position while fading back up as it will be back within the original pan range.

Auto Dimming

Note: For conventional LED fixtures without a built-in intensity or dimmer channel, BlackTrax substitutes a virtual dimmer for RGB or RGBW to control Intensity. The Virtual Dimmer that was used will be reported in the *BTWYG Patch* widget.

Smooth Pickups

This feature turns the fixture On once as a single event per chapter, only when the Beacon is visible.

- BlackTrax checks for motion at the beginning of the chapter.
- BlackTrax automatically douses the fixture to 0 if motion is not detected. When motion is seen, the fixture fades in to console control over the fade time specified once the *Trackable Visible For:* time has elapsed (motion must be seen continuously during this time for the fade to start).
- When completed, the *Smooth Pickups* feature is disabled for the remainder of the chapter.
- *Smooth Pickups* is disabled by default.

To enable and set smooth pickups

1. In the *Chapter* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
    - **Result:** The settings of the selected fixture are displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. Under the **Auto Dimming** section of the *Basic* tab, select the checkbox *Smooth Pickups* checkbox.
    - **Result:** *Trackable Visible For* and *Fade-in Time* scroll boxes are displayed.
6. Click on the *Trackable Visible For* scroll box to set the length of time required for a Trackable to be visible and the light to fade-in.
7. Click on the *Fade-in Time* scroll box to set how long the light fades-in.
8. For the changes to take effect, click *Apply Changes*.

Auto Douse

This feature turns the fixture On only when the Beacon is visible and as an ongoing event all throughout the course of the chapter.

- If all LEDs of the patched Beacon becomes hidden, BlackTrax automatically douses the fixture to 0 (from console control) after the reaction time is complete.
- BlackTrax automatically fades in the fixture when at least one LED is visible and after the reaction time is complete.
- Reaction time is the length of time required for motion to be visible, or to be hidden before the fade time starts.

To enable and set auto douse

1. In the *Chapter* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
   - **Result:** The settings of the selected fixture are displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. Under the **Auto Dimming** section of the *Basic* tab, select the *Auto Douse* checkbox.
   - **Result:** The *Reaction Time*, *Fade-In Time*, and *Fade-Out Time*, scroll boxes are displayed.
6. Click on the *Reaction Time* scroll box to set the length of hidden or visible time for fade time to start.
7. Click on the *Fade-In Time* scroll box to set how long the light fades-in.
8. Click on the *Fade-Out Time* scroll box to set how long the light fades-out.
9. For the changes to take effect, click *Apply Changes*.

Following Sensitivity

Sensitivity determines exactly how a fixture is supposed to follow a Trackable. The prediction algorithms takes the current BTBeacon and fixture information and makes an informed prediction on where the Trackable will be next. The BTSystem will then be able to anticipate where the fixture needs to aim to keep tracking tight on the Trackable.

The prediction algorithm available are:

- *None*: No prediction is used.
  - **Note:** When the *Following Sensitivity* is set to *None* or *Multiple*, the *Ahead Time* and *Delay Time* settings and options are not displayed.
- *Standard Prediction*: Taking the pan and tilt settings of fixtures following the Trackable, a Kalman filter is used to estimate the velocity and poisition of the fixture. A prediction of the fixture's future pan/tilt values is then created.
- *Delay*: Fixtures will follow a Trackable’s position after a set amount of time. This causes fixtures to follow behind moving Trackables. Useful for effects.
- *Linear Prediction*: Taking the current BTBeacon position as input, a Kalman filter is used to estimate the velocity, and position of the Trackable. A prediction of the Trackable’s future movement is then created.
- *Second Order Prediction*: Taking the current BTBeacon position as input, a Kalman filter is used to estimate the acceleration, velocity, and position of the Trackable. A prediction of the Trackable’s future movement is then created.
- *Second Order+Prediction*: Taking the pan and tilt settings of fixtures following the Trackable, a Kalman filter is used to estimate the acceleration, velocity, and position of the fixture. A prediction of the fixture’s future pan/tilt values is then created.

Fixture responsiveness can also be configured with prediction. Fixture responsiveness is measured on a scale of -4 (Smooth) to 2 (Responsive).

- *Smooth*: A fixture set to smooth will follow Trackables in a fluid manner. This may appear as a delay in extreme cases.
- *Responsive*: A fixture set to responsive will jump to and track every slight movement of a Trackable. This may appear very jumpy in extreme cases.

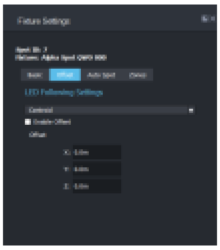
Note: It is recommended that you test a fixture’s prediction prior to use, to determine if the chosen prediction movement is right for your tracking needs.

To assign an algorithm to a fixture

1. In the *Chapter* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
   - **Result:** The settings of the selected fixture are displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. Under the **Following Sensitivity** section in the *Basic* tab, select the desired sensitivity from the *Sensitivity* drop-down menu.
   - If you want the fixture to be tracking ahead of where the Trackable will be, enter how far ahead in time (milliseconds) in the *Ahead Time* field.
6. Assign how reactive you want the fixture to follow by adjusting the *Turner value* slider to between *Smooth* or *Responsive*.
7. For the changes to take effect, click *Apply Changes*.

Offset Tab

Offset tab is where you configure LED Following Settings for selecting which individual LEDs of a BTBeacon assigned to follow a Trackable should follow.


Fixture Settings - Offset tab

LED Following Settings

Each Trackable can have the LEDs of assigned BTBeacons tracked individually by the BTSystem. This can be used instead of the default setting which is the average position of all visible LEDs. Tracking can also be altered, to follow a Trackable but on an offset.

LED Following Settings drop-down menu is enabled for both moving and conventional fixtures. *Enable Offset* checkbox is enabled for moving fixtures and disabled for conventional fixtures.

To assign a fixture to an individual LED of a trackable

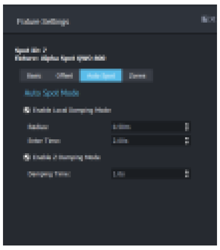
1. In the *Edit Chapters* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
    - **Result:** The settings of the selected fixture will be displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. On the **LED Following Settings** section, click on the drop-down menu and choose the LED you want to follow.
6. For the changes to take effect, click *Apply Changes*.

To offset the tracking of a trackable by a fixture

1. In the *Edit Chapters* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
    - **Result:** The settings of the selected fixture will be displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. Under the **LED Following Settings** section, select the *Enable Offset* checkbox to set the tracking offset from the X, Y, or Z axis.
6. Under the **Offset** subsection, enter how far off from the centroid you want to offset tracking in the X, Y or Z axis by entering the values in the *X*, *Y* or *Z* fields.
7. For the changes to take effect, click *Apply Changes*.

Auto Spot Tab

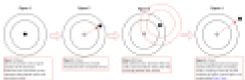
Auto Spot tab is where you configure the following properties of a fixture to better mimic a human follow spot operator.

 Fixture Settings - Auto Spot tab

Auto Spot Mode Settings

Auto Spot Mode is where a fixture simulates the behavior of a manual follow spot. In normal operation, moving fixtures will lock on to a Trackable and follow all movement, even if the movement is very slight. This has the possibility of making the fixture’s light look shaky or jittery. In Auto Spot Mode, when a Trackable is relatively still, the following fixture will freeze in place. When the Trackable starts to make larger movements, and/or attempt to exit the frozen light beam, the fixture will unfreeze and continue following tightly.

There are two different follow spot modes to choose from. They can be used independently or together. The different auto spot modes are:

- **Local Damping**: The system will ignore small movements on all axis. Select the *Enable Local Damping Mode* checkbox to display *Radius* and *Enter Time*.
  - *Radius*: Click on the *Radius* scroll box to adjust the size of the movement. Refer to the diagram below.
    - When a given Trackable is only moving within this value, in relation to the *Enter Time*, the fixture will freeze in place. A secondary radius will be built around this radius, which extends past the bounds of the first radius by half the size of the specified radius setting.
    - If the Trackable moves outside of the original first radius but still within the secondary radius, the fixture slowly readjusts to the new position, and the first radius moves to the new position.
    - If the Trackable moves outside of the secondary radius, the fixture resumes tracking as normal, responding to small movements again.
    - Diagram: 
  - *Enter Time*: Click on the *Enter Time* scroll box to adjust the length of time that a Trackable must be within the Radius for the setting to become engaged. The longer the time that the Trackable is within the radius, the slower the fixture responds to movements until eventually all movement is ignored.
- **Z-Damping**: The system will ignore small vertical movements on the Z axis. Select the *Enable Z-Damping Mode* checkbox to display *Damping Time*.
  - If the Trackable stays within a constant range, over the specified time, Z movements slow down until eventually Z movements are ignored within the distance traveled.
  - If the Trackable moves outside of the distance measured over the course of the specified Dampening Time, a new distance range is set.

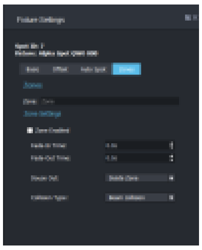
Note: Auto Spot Mode is determined per fixture, per Chapter.

To enable auto spot mode for a fixture

1. In the *Chapter* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
   - **Result:** The settings of the selected fixture will be displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget.
5. Under the **Auto Spot Mode** section, select the checkbox next to the desired *Auto Spot Mode*(s).
6. For the changes to take effect, click *Apply Changes*.

Zones Tab

Zones tab is where you configure the interaction of fixtures with any zones in the chapter.


Fixture Settings - Zones tab

Zone Settings

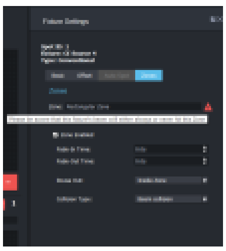
Zones in the project can be enabled to interact with fixtures following Trackables. When a Trackable or the beam of a fixture following the Trackable enters a zone, the fixture can be turned on or doused. How fixtures interact with zones is user definable.

Zones can have their interaction with Trackables and fixtures customized in the following ways:

- *Douse Out*: A fixture will douse when the Trackable it is following interacts with a zone.
    - *Inside Zone*: The fixture will be doused while the Trackable is inside the zone.
    - *Outside Zone*: The fixture will be doused while the Trackable is outside the zone.
- *Collision Type*: How the Trackable and fixture relationship interacts with the zone.
    - *Beam collision*: When the beam of the fixture following the Trackable is in the zone, the relationship is considered in the zone.
        - **Note:** A reflection of the beam will not count. The size of the beam must be set for Beam collision to work.
    - *Point collision*: When the Trackable is physically in the zone, the relationship is considered in the zone.

To enable a zone for a fixture

1. In the *Chapter* widget, select the chapter the fixture is in.
2. On the center pane, click on the *Trackable* the fixture is assigned to.
3. On the bottom pane, click on the *Fixture Icon* to select the fixture.
    - **Result:** The settings of selected fixture are displayed in the *Fixture Settings* widget.
4. With the *Fixture Icon* selected, go to the *Fixture Settings* widget and click the *Zones* tab.
    - **Result:** The Zone Name of the zone where the selected fixture has been assigned is displayed in *Zone* field.
    - **Note:** A warning symbol and text tooltip are displayed if errors are detected in Zone settings. Beam collision warning will not appear for conventional fixtures assigned to a Trackable with the same Dynamic Zone (but will appear for Point collision and for moving fixtures). See Zones Issues section below.

    
5. Under the **Zone Settings** section, select the *Zone Enabled* checkbox.
    - **Result:** The interaction between Zone and Fixture is active.
6. Select which zone you want the fixture to interact with, on the *Zones* tab in the *Libraries* widget,

select the zone then drag and drop on the *Zone* field in the *Fixture Settings* tab.

7. Choose how the fixture douses when entering a zone, select *Inside Zone* or *Outside Zone* from the *Douse Out* drop-down menu.
8. On the *Fade-In Time* field, click the *Up* or *Down* arrows or type the amount of time the fixture intensity fades-in rather than instantly switch on.
9. On the *Fade-Out Time* field, click the *Up* or *Down* arrows or type the amount of time the fixture intensity fades-out rather than instantly switch off.
10. Choose how the fixture interacts with the zone, select *Beam collision* or *Point collision* from the *Collision Type* drop-down menu.
11. For the changes to take effect, click *Apply Changes*.

- **Note:** See "*BlackTrax Zones*" for more information on creating zones for a BlackTrax project.

Zone Collisions

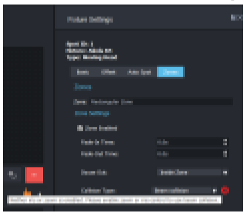
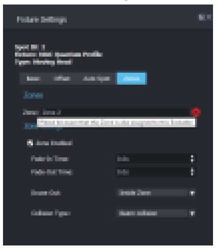
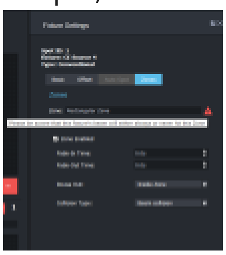
FIXTURE TYPE	ZONE TYPE	DYNAMIC ZONE TRACKABLE ASSIGNMENT	COLLISION TYPE	RESULTS	NOTES
Moving	Static	-	Point	Fixture will react when the Trackable touches the Static Zone.	
Moving	Static	-	Beam	Fixture will react when its beam touches the Static Zone.	
Moving	Dynamic	Self	Point	Fixture will react when the Trackable touches the Zone, which is always true because the Zone moves around with the Trackable.	Not recommended
Moving	Dynamic	Self	Beam	Fixture will react when its beam touches the Zone, which is always true because the Zone moves around with the Trackable.	Not recommended
Moving	Dynamic	Other	Point	Fixture will react when the Trackable touches the Zone. The Zone moves around with other Trackables.	
Moving	Dynamic	Other	Beam	Fixture will react when its beam touches the Zone. The Zone moves around with other Trackables.	
Conventional	Static	-	Point	Fixture will react when the Trackable touches the Static Zone.	
Conventional	Static	-	Beam	Fixture will react when its beam touches the Static Zone, which is always true or never happens.	Not recommended
Conventional	Dynamic	Self	Point	Fixture will react when the Trackable touches the Zone, which is always true because the Zone moves around with the Trackable.	Not recommended

Conventional	Dynamic	Self	Beam	Fixture will react when its beam touches the Zone. This is always true because conventional fixtures do not move.	Most efficient way to use Zones with conventional fixtures
Conventional	Dynamic	Other	Point	Fixture will react when the Trackable touches the Zone. The Zone moves around with other Trackables.	
Conventional	Dynamic	Other	Beam	Fixture will react when its beam touches the Zone. The Zone moves around with other Trackables.	

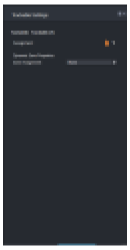
Zone Issues

When setting up your zones, you may encounter errors or warning messages.

The following setting combinations will cause errors and/or warnings:

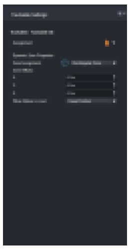
- **Enabling Beam collision on any fixture without Beam Control**: The fixture is in Automated Mode with neither zoom or iris control enabled. This only applies to moving fixtures as conventional fixtures are always in Static Mode (which supports Beam collision).

- **A dynamic zone is patched to the same fixture as Trackable**: The fixture and/or Trackable will always hit the Zone, because the Zone is attached to the Trackable the fixture is following. The one exception is for conventional fixtures using Beam collision, as conventional fixtures cannot move to point at the Trackable.

- **A static zone is patched to a conventional fixture using Beam collision**: Neither a conventional fixture nor a static zone can move, so this combination will either always hit (for example, if the conventional fixture is pointing at the zone), or never hit.


Trackable Settings Widget


Trackable Settings Widget

Overview

The *Trackable Settings* widget displays information on the selected Trackable, and where you can assign a Dynamic Zone to the given Trackable. Any BTBeacon or rigid frame assigned to the Trackable will inherit the Trackable’s settings, and function as directed.


Trackable Settings Widget with a Dynamic Zone assigned

Dynamic Zone Properties

From the *Zone Assignment* drop-down menu, you can choose any of the zones present in their file to become a Dynamic Zone for the selected Trackable. An icon will also be displayed beside the selected Zone name, displaying the shape of the currently selected zone (*Rectangular Zone*, *Cylindrical Zone*, or *Spherical Zone*).

Once a Zone is assigned as Dynamic, the Zone will no longer use the drawn (or Static) position for any Chapter. This can be confirmed in the *Libraries* Widget, under the *Zones* tab; the *Dynamic* checkbox will appear. A Dynamic Zone will follow the attached Trackable, and any interactions that are programmed for that Zone (fixtures dousing in or out for example) will be triggered depending on the Trackable's motion instead of the drawn WYSIWYG position.

By default, the Zone is centered around the centroid of the Trackable, but you can also offset the position of the Dynamic Zone on the X, Y and Z Axis relative to the centroid.

When Motion is Lost: The user can choose from 3 options for what the Dynamic Zone should do if the Trackable loses motion:

- *Keep Position*: When the Trackable loses motion, the Dynamic Zone will remain in the last known position, and fixtures will interact with it in that position until motion is regained.
- *Assume Inside*: When the Trackable loses motion, the fixtures assigned to the Trackable will assume they are inside the Dynamic Zone, and react based off the current Chapter programming.
- *Assume Outside*: When the Trackable loses motion, the fixtures assigned to the Trackable will assume they are outside of the Dynamic Zone, and react based off the current Chapter programming.

Programming Chapters

The Relationship section displays which Fixtures are assigned to which Trackables in the chapter. The *Libraries* widget displays Trackable and fixtures that are available.

Tip: You may use the unified selection methods for multiple selection.

- Use Ctrl+A to select all.
- Use Left-click to isolate the selection and deselect all the others.

To add a trackable to a chapter

1. In the *Chapter* widget, select a chapter you want to add a Trackable to.
2. In the *Libraries* widget, click the *Trackables* tab to view available Trackables.
3. On the *Trackables* tab, select the *Trackable* you want to add.
4. Click *Add*.
    - **Result:** A Trackable Container of the Trackable appears in the Relationship section for the chapter.
    - **Note:** Trackables can also be added to a chapter by dragging and dropping a Trackable from the *Trackables* tab into the top section of the center pane.
5. For the changes to take effect, click *Apply Changes*.

To delete a trackable from a chapter

1. In the *Chapter* widget, select a chapter you want to delete a Trackable from.
2. In the *Libraries* widget, click the *Trackables* tab to view available Trackables.
3. On the *Trackables* tab, select the *Trackable* you want to delete.
4. Click *Delete*.
    - **Result:** The Trackable is removed from the Chapter.
    - **Note:** You can also drag and drop the Trackable back into the Library or click the delete button in the Trackable section.
5. For the changes to take effect, click *Apply Changes*.

To remove all trackables from a chapter

1. In the *Chapter* widget, select a chapter where all Trackables will be removed from.
2. In the center pane, select all *Trackables* in the *Chapter*.
3. In the center pane, click *Delete*.
4. For the changes to take effect, click *Apply Changes*.

To assign a fixture to a trackable

When a Fixture is assigned to a Trackable, the BTSystem will instruct the fixture to follow the Trackable. Fixtures will only follow an assigned Trackable in the chapter they are assigned, and only when that chapter is active.

1. In the *Chapter* widget, select a chapter that has a *Trackable* you want to assign a fixture to.
2. In the center pane, select the Trackable bubble of the *Trackable*.
3. View available fixtures by going to the *Libraries* widget and clicking the *Fixtures* tab.
4. On the *Fixtures* tab, select a fixture you want to assign to the *Trackable*.
5. Click *Assign*.
    - **Result:** A Fixture Box of the fixture appears in the bottom section of the center pane indicating it is assigned to that Trackable.
    - **Note:** Fixtures can also be assigned a Trackable by dragging fixtures from the *Fixtures* tab

and dropping them onto a Trackable Container.

6. For the changes to take effect, click *Apply Changes*.

To unassign a fixture from a trackable

1. In the *Chapter* widget, select a chapter that has a *Trackable* you want to unassign a fixture from.
2. In the *Libraries* widget, click the *Fixtures* tab.
3. On the *Fixtures* tab, select the fixture you want to unassign from the *Trackable*.
4. Click *Unassign*.
    - **Result:** The Fixture is removed from the Trackable.
    - **Note:** Fixtures can also be removed from Trackables by dragging fixtures from the Trackable Box to the *Libraries* widget.
5. For the changes to take effect, click *Apply Changes*.

To copy and paste a trackable from a chapter to another chapter

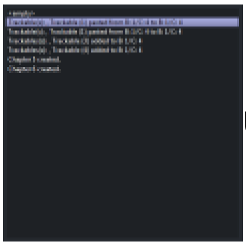
1. In the *Edit Chapters* widget, select a *Chapter* with the *Trackable* you want to copy.
2. In the *Chapter* widget, click on the *Trackable* you want to copy.
3. Click the *Copy* button.
4. In the *Edit Chapters* widget, select another *Chapter* you want to paste the copied *Trackable*.
5. In the *Chapter* widget, click the *Paste* button.
    - **Result**: The *Overwrite* dialog box appears.
6. Click *Overwrite* to cut and paste the selected Trackable or click *Keep* to cancel the operation and keep the previous Trackable.
    - **Result**: The icon of the copied Trackable appears in the Chapter widget when Overwrite is selected.
7. For the changes to take effect, click *Apply Changes*.

To copy and paste the fixtures from a trackable to another trackable

1. In the *Chapter* widget, click on the *Trackable* with the Fixture/s you want to copy.
2. In the bottom section of the *Chapter* widget, click on the *Fixture/s* you want to copy.
3. Click the *Copy* button.
4. In the same *Chapter* widget, click on another *Trackable* you want to paste the copied *Fixture/s*.
5. Click the *Paste* button.
    - **Result**: The *Overwrite* dialog box appears.
6. Click *Overwrite* to cut and paste the selected *Fixture/s* or click *Keep* to cancel the operation and keep the previous *Fixture/s*.
7. For the changes to take effect, click *Apply Changes*.

Undo Stack

The *Undo Stack* widget is where you can undo and redo changes applied in Edit View of the BlackTrax, such as chapter, editing, fixture settings and Trackable renaming. The *Undo Stack* widget displays all the editing operations that have been completed in Edit View. Each of the editing operation listed can be selected to set the Edit View according to the previous state of the selected editing operation history, however you may only undo a maximum of 10 steps during one undo operation.


Undo Stack widget

To go to a point in the editing operations that have been applied

1. From the **View** menu, choose **Undo Stack.**
2. In the *Undo Stack* widget, from the list on display, click on an editing history that you wish to go to.
    - **Result:** The Edit View goes to the applied state of BlackTrax in Edit View that is associated with the selected history in the *Undo Stack* widget.
    - **Tip:** You can also use the keyboard shortcuts Ctrl+Z to undo, or Ctrl+Y to redo.

Terminal Widget

 Terminal Widget with Syntax for a "Fixture Train"

Overview

The *Terminal* widget is where you alter fixture following behavior to achieve unique effects.

Attention: Terminal commands affect specified fixtures across all Trackables in the chapter.

To enter a terminal command

1. In the **Edit View**, select the chapter you want to affect.
2. Open the *Terminal* docking widget.
3. Click in the *Terminal* and enter the command.
4. All commands must end with a semicolon.

Fixture Train Command

Multiple fixtures can follow a Trackable one after the other creating a train or snaking effect. The parts of the command are as follows:

- **fixtures=** - The fixtures following the Trackable.
  - **Note:**
    - The fixture is identified by the fixture ID used in BlackTrax.
    - Fixtures will follow in the order stated. Fixtures can be expressed as a range (e.g. fixtures=1-10), or listed individually (e.g. fixtures=1,7,20).
    - Fixtures must start and end with a square bracket [and] - see the example below
- **start=** - The delay in seconds before the first fixture will start following the Trackable.
- **step=** - The delay in seconds before a fixture will start following the fixture before it.
  - **Example:** If step=1s, Fixture 1 will follow the Trackable after 1s, Fixture 2 will follow Fixture 1 1s after that.
- **span=** - The total time in s you want to delay all fixtures by. The delay between each fixture is determined by the number of fixtures divided by span time.
  - **Example:** If you have ten fixtures and the span is 10s, the delay between each fixture will be 1s.

Attention: You can only have a span= for the effect, or start= and step=. You cannot use both at once.

The following is an example of a complete fixture train command to demonstrate how it all comes together.

Example: delay fixtures=[1-10] start=1 step=1;

In this example fixtures 1 through 10 will follow the Trackable. Fixture 1 will start following 1s after the Trackable has started moving. Each subsequent fixture will follow the one ahead of it 1s after it moves.

Error Codes for Unsupported Fixtures

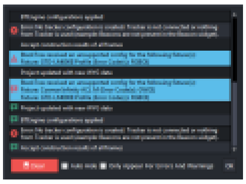
When you add new fixtures in BTWYSIWYG, fixture configuration updates are applied to BlackTrax when you *Apply BTWYG Updates* and *Apply Changes*.

The *Messages* dialog box will confirm the project update with the new BTWYG data that has been added to BlackTrax.

The *Messages* dialog box will confirm that it has received unsupported fixture configuration displaying the fixture model profile and the error codes. The descriptions of the error codes are listed below. If you receive an unsupported fixture error code, please report it to BlackTrax support, with the model, and any error codes received.

To apply fixture configuration updates from BTWYSIWYG to BlackTrax

1. In BTWYSIWYG CAD mode, from the **BLACKTRAX** menu, choose **BTX Apply**.
    - **Results:**
        1. The configuration of the fixture(s) that was added in BTWYSIWYG is applied to BlackTrax.
        2. In BlackTrax, the *Incoming BTX Update* icon in the Status Bar turns to blue.
2. In the Status Bar of BlackTrax, click on the *Incoming BTX Update* icon and *Apply Changes*.
    - **Note:** You can also apply this via the keyboard shortcut CTRL+W or from the **File** menu.
    - **Result:** The configuration of the new fixture(s) is applied to BlackTrax and the *Messages* dialog box appears confirming the update. If applicable, the *Messages* dialog box will display the fixture model and error codes for unsupported fixtures.



Error Codes for Unsupported Fixtures:

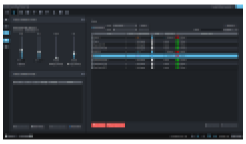
NPS	No Pan Stepping
NTS	No Tilt Stepping
PTOI	Pan Tilt Offset Incorrect
ZOI	Zoom Offset Incorrect
NZS	No Zoom Stepping
IROI	Iris Offset Incorrect
NIRS	No Iris Stepping
INOI	Intensity Offset Incorrect
NINS	No Intensity Stepping
NRCS	No Red Channel Stepping
NGCS	No Green Channel Stepping
NBCS	No Blue Channel Stepping

RGBOI	RGB Offset Incorrect
CWOI	Color Wheel Offset Incorrect
NCWOI	Non Color Wheel Offset Incorrect
GWOI	Gobo Wheel Offset Incorrect
AWOI	Animation Wheel Offset Incorrect
PWOI	Prism Wheel Offset Incorrect
PTCVI	Pan and Tilt Channel Values Incorrect
ZCVI	Zoom Channel Value Incorrect
IRCVI	Iris Channel Value Incorrect
INCVI	Intensity Channel Value Incorrect
RGBCVI	RGB Channel Values Incorrect
CWCVI	Color Wheel Channel Value Incorrect
NCWCVI	Non Color Wheel Channel Value Incorrect

Calibration View

Table of Contents:

Fixture Calibration View


Fixture Calibration View

The Fixture Calibration View is where you calibrate the position of fixtures to ensure fixture tracking is precise and accurate. In the *Fixtures* section:

- BTBeacons are assigned to fixtures.
- Fixtures can be set into groups for convenient selection.
- Calibration data collected are saved as presets which can be recalled in the *Edit Chapters* widget and displayed in the *Running Chapters* widget.
- A maximum of 24 presets are available for the calibration of fixtures in multiple positions.

To have a fixture follow an assigned Trackable, BlackTrax first determines the position of the Trackable. This is done using the BTSensors and the BTBeacon assigned to the Trackable. BlackTrax references where a fixture is based on information collected from the BTWYSIWYG .btx file. Based on the Trackable and fixture positions, the BTSystem calculates the pan and tilt angles a fixture need to be at for it to be aiming at a Trackable. This information is then sent to the fixture where it changes its pan and tilt settings accordingly to aim at the Trackable.

Note: If there are inconsistencies between the location of fixtures in the Space, and the virtual Space in BTWYSIWYG, tracking information BlackTrax creates for the fixture will be inaccurate.

Fixture calibration allows you to correct these inconsistencies and ensures the location of fixtures is accurate. It is recommended that all fixtures be calibrated when they are first installed in the Space, and individually anytime a fixture is moved or bumped.

Attention:

1. *Discard Changes* and *Apply Changes* are disabled during Calibration Mode.
2. Settings made in the Fixture Calibration page will not be applied until BlackTrax is set to Following and Calibration Mode.

Assigning beacons to fixtures for calibration

1. From the **View** menu, choose **Calibration Views** and then choose **Fixture View**.
    - **Result:** BlackTrax GUI opens the calibration mode widgets.
2. From the *Preset:* drop-down list, select the preset number.
    - **Note:** The preset numbers displayed will not change.
    - **Tip**: You may click *Rename* to type a new name for the selected preset.
3. Highlight a *fixture* (or *fixtures*) in the center pane of the BTGUI.
4. Right-click *Not Assigned* under the *Assigned Beacon* heading. Alternately, select the *Assign Beacon* Button beside *Group.*
5. Select a *beacon.*
6. Repeat steps 1-4 for all beacons you want to use for fixture calibration.
7. Fixtures will cycle through following the assigned beacon(s) as points are collected.

Fixture Calibration Control Widget


Fixture Calibration Controls Widget

To calibrate a fixture, measurement points must be collected. Measurement points are samples of fixture and BTBeacon data collected by the BTSystem. Typically this involves a fixture attempting to lock onto a BTBeacon in the Space. Then with the fixture’s beam frozen in place, moving the Stringer LED so that it is in the center of the beam.

There are two ways to control how fixtures move for fixture calibration: Follow Beacon, and Pan/Tilt Sliders.

Follow Beacon: Using this control method, a fixture that has been assigned a beacon, and is currently active, will attempt to follow a BTBeacon. If there are differences between the original project file and the actual physical space, fixture following will be inaccurate and be off center from the BTBeacon. This is normal behavior for uncalibrated fixtures, and will be corrected after successful fixture calibration.

Pan/Tilt Sliders: Using this control method, the pan and tilt sliders in the Measurement section are used to move selected fixtures.

Selecting a Control Mode for Fixture Calibration

To select a control mode for fixture calibration

1. In the *Fixture Calibration Control* widget, select the control method from the *Control Mode* drop-down menu.
    - **Result:** Fixtures will move according to the selected control method.

To move a fixture using the pan/tilt sliders

1. In the Fixture Calibration view, in the central widget, select the *fixture* you want to move.
2. Select the control method to *Pan*/*Tilt* Sliders.
3. The tilt of the fixture can be moved by adjusting the *Tilt* slider, or entering the exact angle in the *Tilt* field.
4. The pan of the fixture can be moved by adjusting the *Pan* slider, or entering the exact angle in the *Pan* field.

Tip:

- You may click the *Flip Pan* button to reverse the pan/tilt movement without the collection of measurement points.
- You must click *Apply Changes* after changing a Fixture's inverted status.
- Click on the *Time* scroll box to set a longer time to complete the Flip Pan movement during any of these operations:
    - During Fixture Calibration when measurement points are being collected.
    - When *Flip Pan* button is clicked but measurement points are not being collected.
    - When the fixture's pan/tilt reaches the end of its range and performs a Pan Flip movement.

Attention: During Fixture Calibration, when any of the 3 scenarios mentioned above occur, the fixture will perform a full 180 degree pan/tilt movement which could cause the hang structure to shake. Setting a longer time to complete the Flip Pan will make the movement smoother and avoid any change in position or alignment.

Controlling Zoom and Iris

Zoom and Iris can be controlled from the *Fixture Calibration Control* widget using the *Zoom* and *Iris* sliders similar to pan and tilt of the selected fixture(s). If the checkboxes for *Apply Globally* are set, then the control will apply to all currently active or queued fixtures, otherwise, it will only apply to the currently selected fixture.

In Fixture Calibration mode, Zoom and Iris control applies only to Fixure(s) assigned to a Beacon or in "*Pan*/*Tilt* Sliders" Control Mode; all other fixtures are released to the lighting console.

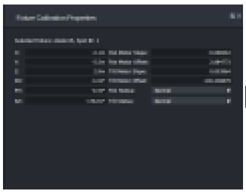
- **Note:** A momentary loss of control of your fixtures will happen occasionally while changing the Zoom and Iris in Fixture Calibration mode. This normal behavior happens only when you use the sliders to actively control the Zoom and Iris in Fixture Calibration mode.

Clearing Colour and Gobos, and Controlling Intensity

BlackTrax will also attempt to auto clear any colour and gobos that the console is instructing the fixture to use. While in Fixture Calibration Mode, BlackTrax will also control the intensity of the fixtures, turning them on or off based on if they are queued or not.

Fixture Calibration Properties Widget

The *Fixture Calibration Properties* widget displays the fixture positions and attributes that affect tracking.


Fixture Calibration Properties widget

The *Fixture Calibration Properties* widget displays:

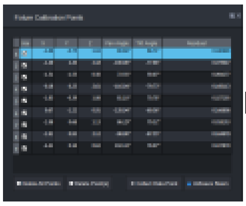
- **Selected Fixture:** Model Name and Spot ID number of the selected fixture.
- **X:** Horizontal measurement of the selected fixture's position.
- **Y:** Depth measurement of the selected fixture's position.
- **Z:** Vertical measurement of the selected fixture's position.
- **RX:** Rotation angle with reference to the X axis.
- **RY:** Rotation angle with reference to the Y axis.
- **RZ:** Rotation angle with reference to the Z axis.

Note: Slope and Offset values are used in determining the intrinsic perimeters of the fixture, to accurately map and calculate the DMX->Angle conversion of a fixture.

- **Pan Motor Slope:** Deviation value of the fixture's pan movement with reference to the offset.
- **Pan Motor Offset:** Offset value with reference to the fixture's pan movement origin.
- **Tilt Motor Slope**: Deviation value of the fixture's tilt movement with reference to the offset.
- **Tilt Motor Offset:** Offset value with reference to the fixture's tilt movement origin.
- **Pan Status:** Sets the orientation of the pan movement. Click on the drop-down and select *Normal* or *Inverted*. When a fixture is calibrated, this setting will always revert back to what the fixture is set to in WYSIWYG.
- **Tilt Status:** Sets the orientation of the tilt movement. Click on this drop-down and select *Normal* or *Inverted*. When a fixture is calibrated, this setting will always revert back to what the fixture is set to in WYSIWYG.

Fixture Calibration Points Widget

The *Fixture Calibration Points* widget displays the measurement points collected that specify the location and beam position of a selected fixture when aimed at a Trackable.


Fixture Calibration Points widget

The *Fixture Calibration Points* widget displays:

Table (Columns):

- **Number column:** Calibration point number.
- **Use:** Checkbox to select or deselect the row of data points of the selected fixture. By deselecting a checkbox, that point will no longer be used as part of the calibration next time the solver is run (manually or automatically).
- **X:** Horizontal measurement of the LED's position at the time of point collection (Reference: Stage Left)
- **Y:** Depth measurement of the LED's position at the time of point collection. (Reference: Upstage)
- **Z:** Vertical measurement of the LED's position at the time of point collection. (Reference: Towards the ceiling).
- **Pan Angle:** Collected pan angle of the selected fixture's moving head or mirror.
- **Tilt Angle:** Collected tilt angle of the selected fixture's moving head or mirror.
- **Residual:** Error tolerance value of the measurement points collected.

Buttons:

- *Delete All Points*: Click this button to erase all points collected from all the fixtures in this chapter.
- *Delete Point(s)*: Click this button to erase all selected points collected from the selected fixture.
- *+Collect Data Point*: Click this button to collect new measurement points from the selected fixture(s) using the current LED position as the position. Also the same as pressing B on the Beacon. The beam must be frozen for a point to be collected (in Control Mode: Manual, a point may be collected at any time).
- *Freeze Beam*/*Unfreeze Beam*: Freezes the fixture in place so that you may move the LED into the center of the beam to collect a data point. The fixture will no longer respond to the updated motion until the beam is unfrozen or a point is collected. Also the same as pressing A on the Beacon. Not available in Control Mode: Manual.

Fixture Calibration

Table of Contents:

To turn on fixture calibration

1. On the status bar, click *Normal Mode*.
    - **Result:** The BTSystem toggles to Calibration Mode. The features of the Fixture Calibration view are enabled.

To turn off fixture calibration

1. On the status bar, click *Fixture Calibration*.
    - **Result:** The BTSystem exits Calibration Mode and enter Normal Mode. The features of the Fixture Calibration page are disabled.

Single and Multi-Fixture Calibration

To calibrate a fixture, measurements points must be collected. Measurement points are samples of fixture and BTBeacon data collected by the BTSystem.

You can collect measurements points for a single fixture or multiple fixtures. Each fixture requires its own measurement points to calibrate correctly.

Attention: For accurate fixture calibration to occur, ensure that BTSensors are correctly calibrated and accurate first.

Collecting Calibration Data for a Single Fixture

To collect measurement points for a single fixture

1. In BlackTrax, in the Fixture Calibration View, in the *Fixtures* section, select the Preset number from the *Preset:* drop-down list. You may click *Rename* to type a new name for the selected preset.
    - **Note:** The preset numbers displayed will not change.
    - **Result:** The measurement points for the single fixture will be collected under this preset number, which can be recalled in the *Edit Chapters* widget and displayed in the *Running Chapters* widget.
2. In BlackTrax, in the Fixture Calibration view, in the *Fixtures* section, select the *fixture* that needs to be calibrated.
3. A BTBeacon will be used to calibrate the fixture. Click *Assign Beacon* to view a drop-down list of all available BTBeacons.
4. Select the desired **BTBeacon** from the drop-down list.
    - **Result:** The selected fixture will follow the selected BTBeacon in the Space.
5. In the Physical Space, take the chosen BTBeacon. Make sure that a single Stringer is connected to port 1 of the BTBeacon.
6. Move the BTBeacon to a point within the Space.
    - **Result:** The selected fixture should be following the BTBeacon in the Space.
    - **Attention:** The LED of the Stringer must be visible to 2 or more BTSensors simultaneously for tracking to occur.
7. At a point in the Space with the fixture following the BTBeacon, in BlackTrax click *Freeze Beam*.
    - **Tip:** Pressing the *A* button on the BTBeacon being tracked activates Freeze Beam remotely.
    - **Result:** The fixture will stop in place.
8. In the Physical Space, put the Stringer LED as close to the center of the fixture beam as possible.
9. With the LED still in the center of the beam, in BlackTrax click *Collect Data Point*.
    - **Tip:** Pressing the *B* button on the BTBeacon being tracked activates Collect Data Point remotely.
    - **Result:** BlackTrax will collect the data of the BTBeacon and fixture as a measurement point when *Collect Data Point* is selected. It will add the data to the *Fixture Calibration Points* section. The fixture will unfreeze and continue following the BTBeacon. The fixture will also pan-flip after collecting a point to ensure you are collecting points on both sides of the tilt range.
10. At a different location in the Space, repeat steps 5 to 8 until you create a total of 5 measurement points.
    - **Attention:** The minimum number of measurement points needed for calibration is 5.
    - **Note:**
        - For best results the measurement points samples should be at different points in the

Space, creating different pan and tilt angles. It is recommended to take measurement points in different areas of the Space and at different heights, creating the most variation.

- Points should be collected until the fixture is calibrated (typically 5-8 but sometimes more). The fixture will auto-calibrate after each point once 5 points have been achieved. Auto-calibration feature can be turned off in settings.

Collecting Calibration Data for Multiple Fixtures

Multiple fixtures can be calibrated at the same time to speed up the fixture calibration process. It may be easier to first assign the desired fixtures into a single fixture group. The fixtures are calibrated as normal by capturing measurement points for each fixture, but with the additional ability to cycle through the fixtures in the fixture group.

To create a fixture group

1. In the *Fixture* section, select the *fixtures* that need to be calibrated.
2. In the *Group* drop-down list, select *New Group* From Selected....
   - **Result:** The *New Fixture Group* window appears.
3. In the *New Fixture Group* window, enter a name for the fixture group in the *Group Name* field.
4. Click *OK*.
   - **Result:** The selected fixtures are joined in a fixture group.

To collect measurement points for multiple fixtures

1. In BlackTrax, in the Fixture Calibration View, in the *Fixtures* section, select the Preset number from the *Preset:* drop-down list. You may click *Rename* to type a new name for the selected preset.
   - **Note:** The preset numbers displayed will not change.
   - **Result:** The measurement points for the multiple fixtures will be collected under this preset number, which can be recalled in the *Edit Chapters* widget and displayed in the *Running Chapters* widget.
2. In BlackTrax, in the Fixture Calibration view, in the *Fixtures* section, use CTRL to select all fixtures you want to calibrate.
3. A BTBeacon will need to be used to calibrate the fixtures. Click *Assign Beacon* to view a drop-down list of all available BTBeacons.
4. Select the desired **BTBeacon** from the drop-down list.
   - **Result:** The selected fixture will follow the selected BTBeacon in the Space.
5. In the Physical Space, take the chosen BTBeacon. Make sure that a single Stringer is connected to port 1 of the BTBeacon.
6. Move the BTBeacon to a point within the Space.
   - **Result:** The first fixture of the selected fixture group should be following the BTBeacon in the Space. All fixtures will follow the BTBeacon in the Space. Only the active fixture will turn on, the rest are doused.
   - **Attention:** The LED of the Stringer must be visible to 2 or more BTSensors simultaneously for tracking to occur.
7. At a point in the Space with the fixture following the BTBeacon, in BlackTrax click *Freeze Beam*.
   - **Tip:** Pressing the *A* button on the BTBeacon being tracked will activate Freeze Beam remotely.
   - **Result:** The fixture will stop in place.
   - **Attention:** You will not be able to use Freeze Beam if the BTBeacon is not tracked within the Space.

8. In the Physical Space put the Stringer LED as close to the center of the fixture beam as possible.
9. With the LED still in the center of the beam, in BlackTrax click *Collect Data Point*.
    - **Tip:** Pressing the *B* button on the BTBeacon being tracked activates *Collect Data Point* remotely.
    - **Result:** BlackTrax will collect the data of the BTBeacon and fixture as a measurement point when *Collect Data Point* is clicked. It will add the data to the *Fixture Calibration Points* section. The fixture will douse, flip, then the next fixture in sequence will turn on.
10. Collect a measurement point for the currently selected fixture.
11. Continue cycling through fixtures and collecting measurement points at the current location until every fixture has one measurement point at that location.
12. At a different location in the Space, repeat steps 5 to 10 until you create a total of 5 measurement points for each fixture.
    - **Attention:** The minimum number of measurement points needed for calibration is 5.
    - **Note:** For best results the measurement points samples should be at different points in the Space, creating different pan and tilt angles. It is recommended to take measurement points in different areas of the Space and at different heights, creating the most variation.

To calibrate a fixture using collected measurement points

Once measurement points are created for a fixture, they can be used to create calibration data for the fixture and determine the fixtures calibrated position.

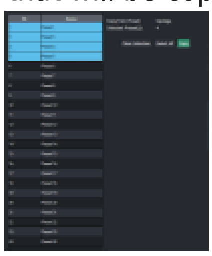
1. In the *Fixtures* section, select the *fixture* that needs to be calibrated.
    - **Note:** In the *Fixture Calibration Points* section, have a minimum of 5 measurement points created.
2. Click *Calibrate Selection*.
    - **Result:** Calibration data is created from the measurement points and displayed in the Calibration Results section under the Calibration Status column. The Calibration Status is automatically applied to fixtures. In the *Fixtures* section, the Calibrated field for the fixture will change to (green) to indicate that calibration data was created and that it is applied to the fixture. In the *Fixture Calibration Points* section, in the Calibration Error (Residual) column, residual values are created for each measurement point.

Copying Calibration Data Presets

Fixture calibration data can be copied between Presets in the *Copy to Preset* window.

To copy a calibration preset

1. In the **Fixtures** section of the Fixture Calibration View, right-click on a Fixture (or Fixtures) with calibration data that you want to copy.
    - **Tip:** Use the keyboard Ctrl or Shift to select and right-click multiple fixtures.
2. Select **Copy to Preset** from the menu options that appear.
    - **Result:** The *Copy to Preset* window appears and displays: the list of Presets (ID and Name) where you can paste the copied calibration data, the name of the Preset that will be copied, and the number of selected Presets.

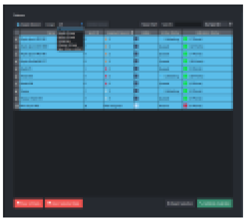


Copy to Preset window

3. On the *Copy to Preset* window, click on a Preset (or Presets) where the calibration data will be copied to.
    - **Result:** The selected Preset (or Presets) is highlighted.
    - **Notes:**
        - Use the keyboard *Ctrl* or *Shift* to select and highlight multiple Presets.
        - *Clear Selection*: You may click the *Clear Selection* button to clear your selected Presets and remove the highlight.
        - *Select All*: You may click the *Select All* button to select and highlight all the Presets displayed in the *Copy to Preset* window.
4. Click the *Copy* button.
    - **Result:** The fixture calibration data is copied to the selected Preset and the *Copy to Preset* window will close.

Multi-Person Calibration

Multi-Person Fixture Calibration is a feature of BlackTrax, which allows any number of people to simultaneously calibrate a group of fixtures.


Fixtures table

Assigning Beacons

When calibrating fixtures, you can assign individual beacons either by group, or on an individual basis. In the Fixture Table, you can right-click a fixture's **Assign Beacon** column and select *Assign Beacon*, or select multiple fixtures and select the *Assign Beacon* button at the top of the table. In this window, you can assign a beacon to your selection of fixtures. Repeat this process as many times as you have individual beacons you wish to use to calibrate all of your fixtures.

Active Status

In the Fixture Table, each Fixture has one of the following options as an associated calibration status, represented in the **Active Status** column.

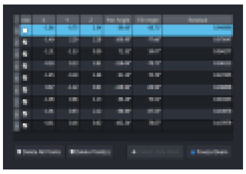
- **Inactive**: Fixtures display this status if not assigned a beacon, and not calibrating, or waiting to calibrate.
- **Queued**: Fixtures display this status if assigned a beacon for calibration, but currently not being calibrated. These Fixtures follow the beacon without intensity.
- **Calibrating**: Fixtures display this status if assigned a beacon for calibration, with intensity at full, and currently being calibrated.

Refining Calibration Data

After calibrating a fixture, Residuals for each measurement point will be calculated and displayed in the *Fixture Calibration Points* widget.

Calibration errors are differences between the calculated pan/tilt values of a fixture and the estimated pan/tilt values of the fixture, based on all measurement points used in the calibration. A calibration residual range between 0-0.08 indicates that a given measurement point is accurate relative to the overall fixture calibration. A collection of high quality samples is necessary for accurate fixture calibration. In this case, the smaller the number, the better.

A measurement point with a large residual value indicates that it was collected poorly relative to the other points. Poor quality measurement points should not be used in calibration; they should be removed and the fixture re-calibrated.


Fixture Calibration Points widget

To disregard measurement points for a fixture

1. In the *Fixtures* widget, select the *fixture* that has measurement points you want to stop using for calibration.
2. In the *Fixture Calibration Points* widget, clear the *Use* checkbox for any measurement points you will not use.
   - **Result:** The selected measurement points will not be used for the fixture's calibrated position next time you hit calibrate selection.

Note: If after removing measurement points from a fixture you have less than 5 remaining, you need to collect more sample measurement points before you recalculate fixture calibration.

To delete measurement points from a fixture

1. In the *Fixtures* widget, select the *fixture* you want to delete measurement points from.
2. In the *Fixture Calibration Points* widget, select any measurement points you want to delete.
3. Click *Delete Point(s)*.
   - **Result:** The selected measurement points are deleted from the fixture.

Managing Calibration Data

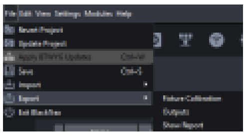
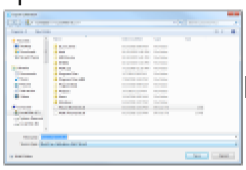
Fixture calibration data can be saved as a calibration file separate from the BlackTrax project. Calibration can be saved as a BlackTrax Calibration file (.btcal) which can be read by BlackTrax, or as an XML file for third-party use. Calibration profiles saved as .btcal files can be loaded and edited as needed in a project.

- Fixture calibration data from any preset can be exported or imported into any preset you are currently in.
- The calibration data that was imported becomes part of the preset you are currently in.
- The calibration data that was imported remains part of any other presets where data has been exported from or into already.

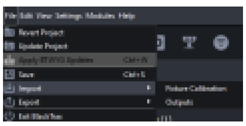
Attention: BlackTrax cannot use XML calibration files to further calibrate fixtures. Fixture calibration saved to this format is only for third party use.

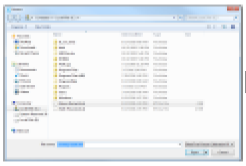
To export calibration data

Created calibration data can be saved separately from the BlackTrax project as a BlackTrax calibration file (.btcal).

1. In Fixture Calibration View, ensure that you are currently in the preset that you want to export from.
2. From the **File** menu, choose **Export** and then choose **Fixture Calibration**.
    -  Export Calibration Menu
    - **Result:** The *Export Calibration* browse window appears.
3. In the *Export Calibration* window, select which calibration file type will be used from the drop-down menu.
    - **Note:** To export specific fixtures from a preset, select the desired fixtures before exporting your calibration data.
4. Navigate to the location where you want to save the calibration file.
5. In the *File Name* field, type the name of the calibration session.
6. Click *Save*.
    - **Result:** Information on all fixtures (calibrated or not) are saved to the calibration file. The information will be accurate so long as the calibrated fixtures are not moved or bumped. This is provided the Motive calibration is the same (relative to the origin).
    - Export Calibration Data

To import calibration data

1. In Fixture Calibration View, ensure that you are currently in the preset that you want to import to.
2. In the *Fixtures* widget, select the *fixtures* which have calibration data you want to import.
3. From the **File** menu, choose **Import** and then choose **Fixture Calibration**.
    -  Import Calibration Menu
    - **Result:** The *Browse* window appears.
4. In the *Browse* window, browse to the location where the calibration file (.btcal) is located.
5. Select the *.btcal* file.

6. Click *Open*.
    - **Result:** The calibration file loads and a report is displayed showing which fixtures have data imported.
    - **Note:** If no fixtures are selected, all fixture data is imported.
    - Import Calibration Data

To uncalibrate a fixture

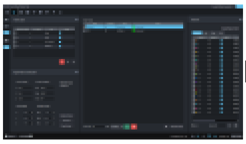
1. In the *Fixtures* widget, select the *fixtures* you want to remove all calibration data from.
2. Click the *Clear Selected Data* button.
    - **Result:** All calibration data and measurement points are deleted from the selected fixtures.

To uncalibrate all fixtures in the project

1. In the *Fixtures* widget, click *Clear All Data.*
    - **Result:** A dialog box appears asking if you really want to clear all calibration data from the project.
2. Click *Yes*.
    - **Result:** All calibration data are removed from all fixtures in the project.

Frame Calibration View

Table of Contents:


Frame Calibration View

Overview

The Frame Calibration View allows the user to construct Frames from existing beacons and their LEDs. Frames can be either Rigid of Soft. Rigid Frames are objects that are solid, or objects that will not change shape such as a table or box. Soft Frames are objects that can change shape, or flexible objects that move such as a person or inflatable object. Both Rigid and Soft Frames can be created from the Frame Calibration view, however, each has different requirements.

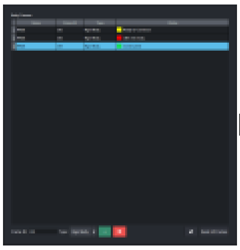
Rigid Frames

Rigid Frames require a minimum of 3 visible LEDs to be created and tracked. If less than 3 LEDs are visible at any point, the Rigid Frame will stop being tracked. A Rigid Frame can be composed of several beacons/LEDs. If a Rigid Frame is composed of more than 3 LEDs and one LED is hidden or removed, the centroid will remain static relative to the visible LEDs. The centroid can be rotated and moved around using offsets. That information is saved in the project file.

Soft Frames

Soft Frames are similar to Rigid Frames and only require a single LED to be created and tracked. You can also create Soft Frames with multiple LEDs. If a Soft Frame is composed of a single LED and the LED is hidden or removed, then the Frame will no longer be tracked. If a Soft Frame has multiple LEDs and a single LED becomes hidden or is removed, tracking will continue but shift to follow the centroid of the remaining LEDs. You can not offset the centroid of a Soft Frame, and no orientation data is calculated.

Body Frames



Body Frames Widget

Overview

The *Body Frames* widget (or central widget) in the Frame Calibration View lists the Frames that have been created. The widget presents a table view listing the Name, Frame ID, the type of Frame (Soft or Rigid) and the Status of the Frame (LEDs not ready, Ready to Construct and Constructed). In the *Body Frames* widget, you can create, clone and remove Rigid and Soft Frames as well as assign a numerical name to a Frame, similar to a Beacon ID.

Usage

The *Body Frames* widget is a table of all Frames in the project. The Table is composed of four columns: Name, Frame ID, Type, and Status; and at the bottom: the Frame ID box, Frame type drop-down, +/- buttons, clone frame and reset buttons.

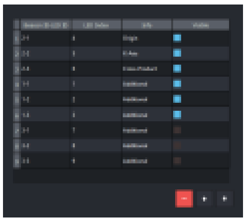
- **Name**
  - The assigned name of the Frame, RF or SF (depending on the type of Frame), followed by the ID assigned to the Frame when it was created
- **Frame ID**
  - The ID assigned to the Frame when it was created
- **Type**
  - The type of Frame (Rigid or Soft)
- **Status**
  - *Red: LEDs not ready.*
  - *Yellow: Ready to Construct.*
  - *Green: Constructed.*

Note: *Once the Frame has been constructed but the LEDs assigned to the Frame are not yet seen by the system, the Frame's status will list out the LEDs that must be seen before it changes to the "Constructed" status.*

- *Frame ID:*
  - At the bottom of the widget, a text entry field exists to enter the *Frame ID*, which can be any number so long as it is not already taken by an existing beacon or Frame in the system.
- *Type:*
  - The *Type* drop-down list specifies what type of Frame is being created (Rigid or Soft).
- + button:
  - The + button adds (create) a Frame to the list after the Frame ID and Type have been specified.
- *Delete* button:
  - The *Delete* button removes a Frame from the list.
  - **Note:** Click *Yes* or *Cancel* in the delete confirmation dialog that appears.

- *Clone the selected frame:*
    - Click this button to copy and paste a selected frame, then type the new frame ID in the *Clone Frame* dialog that will appear.
- *Reset All Frames*:
    - Click this button to reset the frames listed in the table.

Frame LEDs Widget



Frame LEDs widget

Overview

The *Frame LEDs* widget displays all the LEDs assigned to the currently selected Rigid or Soft Frame in the Frame Calibration View . The widget lists the LEDs assigned in a table format. The columns listed are: Beacon ID-LED ID, LED Index, Information on the LED placement order, and the Visibility status.

Usage

The *Frame LEDs* widget is used to assign Beacon LEDs to the currently selected frame in the *Body Frames* widget. The widget lists all the LEDs currently assigned to the selected frame in a column format, with the following columns:

- **Beacon ID-LED ID**
  - Lists the Beacon ID and the LED ID (example 3-1 is Beacon 3, LED 1).
- **LED Index**
  - The ID of the LED sorted in order of insertion (before re-ordering).
- **Info**
  - Lists the information on the LED placement order: Origin, X-Axis, Cross-Product, Additional. Please refer to *Assigning LEDs to a Rigid Frame* in Rigid Frames.
- **Visible**
  - Shows the visibility status icon (Blue for visible, red for not visible, grey for inactive).

You can drag beacons from the global Beacons widget to add to the currently selected frame into this widget to assign them to the frame.

There are also three buttons at the bottom of the widget:

- **Remove Selected LEDs**
  - Removes the select LED from the frame.
- **Re-Order LED: Switch with Previous**
  - Moves the currently selected LED and swaps it with the previous LED, if it is the first in the list, it will not move.
- **Re-Order LED: Switch with Next**
  - Moves the currently selected LED and swaps it with the next LED in the list, if it is the last in the list, it will not move.

You can replace each of the beacons in the Frame LEDs widget.

To replace a beacon

1. In the *Frame LEDs* widget, right-click on a selected beacon in the table.
   - **Result:** The *Replace Beacon* tooltip is displayed.
2. Click on the *Replace Beacon* tooltip.
   - **Result:** The *Replace Beacon* dialog box appears.

3. From the drop-down list, select the Beacon ID which will replace the selected Beacon.
4. Click *OK*.
    - **Result:** The new Beacon ID number is displayed in the table with the corresponding LED ID.

Note: Re-construct the Rigid Frame in the *Rigid Frame Construction* widget, then click *Apply Changes*.

Rigid Frame Construction Widget


Frame Construction Widget

Overview

The *Rigid Frame Construction* widget is where you configure and monitor the currently selected frame in the *Body Frames* widget. In the *Rigid Frame Construction* widget, Centroid Offset and the Orientation Offset can be set and applied separately. All the changes can be applied to the existing frames in the project. Frames must first be constructed in the *Rigid Frame Construction* widget before they are ready for use.

Usage

The *Rigid Frame Construction* widget displays the currently selected frame, and has several buttons used to perform various actions on the selected frame, or all frames in the project:

- *Construct Frame*
    - Creates the solution for the currently selected Rigid Frame.
- *Set Home*
    - Matches the orientation of the Rigid Frame to align with the world coordinate's orientation.
- *Reset Frame*
    - Clears the solution for the selected Rigid Frame.

The **Current Position** and **Current Orientation** of the selected Rigid Frame list the current position of the centroid of all LEDs and the current orientation of the selected Rigid Frame. Use the **Centroid Offset** and **Orientation Offset** scroll boxes to change the calculated centroid and offset of the constructed Rigid Frame.

Soft Frames do not have the capability of offsetting the centroid because the centroid of the frame is calculated based on the current position of the LEDs in the frame at any given time, and the centroid may change depending on how many LEDs are visible.

Centroid Offset applies any offsets to the Centroid of the currently selected Rigid Frame after the Rigid Frame is constructed.

To set the centroid offset values

1. On the *X*, *Y*, and *Z,* scroll boxes on the **Centroid Offset** section, click on the *Up* or *Down* arrows to adjust the measurement values.

- **Tips**:
    - Click on the cell then use the mouse wheel to scroll in increments of +/- 0.01m.
    - Click on the cell, press and hold CTRL and use the wheel to scroll in increments of +/- 0.10m.

Orientation Offset applies any offsets to the Orientation of the currently selected Rigid Frame after the Rigid Frame is constructed.

To set the orientation offset values

1. On the *Roll, Pitch* and *Yaw* scroll boxes on the **Orientation Offset** section, click on the *Up* or *Down* arrows to adjust the values in the cells.

- **Tips**:
  - Click on the cell then use the mouse wheel to scroll in increments of +/- 1 degree.
  - Click on the cell, press and hold CTRL and use the wheel to scroll in increments of +/- 10 degrees.

Creating Frames

Table of Contents:

Overview

Create Frames by creating and assigning a Frame ID in the *Body Frames* widget, and then assign LEDs to a selected Frame. Once the LEDs are assigned, you may configure settings for Rigid Frames in the *Rigid Frame Construction* widget. In the *Rigid Frame Construction* widget, you can also monitor the Centroid for both Rigid and Soft frames, as well as the orientation for Rigid Frames. This section describes the process of creating both Rigid and Soft frames.

Rigid Frames

Overview

Rigid Frames are designed to be objects whose shape does not change, and as the name suggests "rigid", such as a set piece like a table or box. Rigid Frames must have at least 3 LEDs assigned in order for a solution to be created for the frame. There is no limit to the number of LEDs that can be assigned to a rigid frame. If at any point less than 3 LEDs are visible for the specific rigid frame, tracking will stop. This section outlines the creation of a rigid frame.

Creating a Rigid Frame

Create a rigid frame in the *Body Frames* widget. First, assign an ID to the frame.

To assign an ID to a frame.

1. Enter a numerical ID for the frame in the *Frame ID* box (*Beacon ID*) at the bottom of the *Body Frames* widget.
2. On the drop-down list, click *Rigid Body.*
3. Click the green + button.

- **Result:** The Rigid Frame is created and added to the list in the widget.

Once the frame is created, you may double-click and type a new name on the default name cell, and press ENTER. By default, a Rigid Frame is given a name of 'RF(ID)'.

Assigning LEDs to a Rigid Frame

Assign LEDs to a rigid frame by dragging individual beacons from the global *Beacons* widget to the *Frame LEDs* widget with a rigid frame selected in the *Body Frames* widget.

You must place the LEDs in the correct order on the object as well as in the *Frame LEDs* widget because the first three LEDs assigned to a rigid frame defines the orientation of the frame.

- The first LED corresponds to the origin of the local coordinate system of the object.
- The second LED corresponds to the positive x-axis.
- The third LED is special because it can be placed anywhere, but it defines the location of the positive y-axis in the following way:
    - Placing the third LED somewhere in the same plane as LED 1 and LED 2, and taking the cross product of the vectors from the origin to LED 2, and the origin to LED 3 will define the positive z-direction of the local coordinate system of the rigid body. Use the right-hand rule to determine the cross-product.
    - **To perform the right-hand rule**:
        1. Place the side of the right hand, and place it along the line from the origin (LED 1) to the positive x-axis (LED 2).
        2. Curl the fingers of the right hand towards the line from the origin (LED 1) to LED 3.
        3. The direction where the thumb points is the positive z-axis.

Once the first three LEDs are placed, any further LEDs added to the rigid body can be placed anywhere and will be used as additional tracking points for the object, but are not required.

Constructing the Frame

Once the LEDs have been assigned, the frame can be initialized and the solution can be calculated. Click *Construct Frame* in the *Rigid Frame Construction* widget to initialize and calculate the solution. If the original solution of the rigid frame changes, BlackTrax will attempt to adjust the existing solution accordingly. This will change the status of all current frames with LEDs assigned to them from "Done" to a list of the LEDs that have not yet appeared (visible to the tracking system). Click the *Apply Changes* button to send all ready frames to the global *Beacons* widget(s), and allow them to be assigned to a trackable. Click the *Reset All Frames* button to remove the solution from all Frames, but not delete them. You must click *Apply Changes.*

Set Home

In most situations, it is necessary to align the Rigid Frame's orientation to an acceptable 'home' position. A home position is where the object will be 0,0,0 for the *Roll*, *Pitch*, and *Yaw* respectively. You can manually perform this action, but it is much easier to let BlackTrax determine this for you.

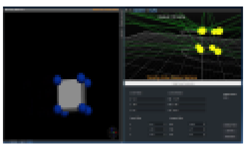
To use the set home function

1. Align the real world object along the same plain as the world coordinate system (ensure your X, Y, and Z directions match where you set the ground plane. An example is to set the front face of the object facing -Y).
2. Select your desired *Frame*.
3. Click *Set Home.*

Result: Your object will now be orientated with *Roll* at 0, *Pitch* at 0, and *Yaw* at 0. The object will rotate in the same way that the real world coordinate system would rotate.

Once the object is 'homed', it is easier to offset the centroid and orientation of the Rigid Frame (although you may do this before you home the object, if desired). Enter the required values into the *X*, *Y*, and *Z* fields for the centroid (in meters), and *Roll*, *Pitch*, and *Yaw* fields for Orientation (in degrees). These settings will be applied automatically, based off the time set under **System Configuration**>*Frame Calibration*>*Updating offsets interval (seconds)*. By default, this is set to update 0.5 seconds after the values are updated.

Note: You do not need to click *Apply Changes* when doing centroid and orientation offsets or setting the home orientation.



Soft Frames

Overview

Soft frames are designed to be objects whose shape can be flexible, such as a person or inflatable object. Soft frames need a single LED assigned in order for a solution to be created for the frame. There is no limit to the number of LEDs that can be assigned to a soft frame. If at any point less than 1 LED is visible for the specific frame, then tracking will stop. This section outlines the creation of a soft frame.

Creating a Soft Frame

Create a soft frame in the *Body Frames* widget. First, assign an ID to the frame.

To assign an ID to a frame

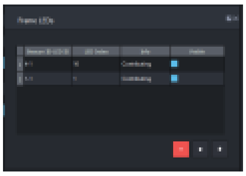
1. Enter a numerical ID for the frame in the *Frame ID* box (*Beacon ID*) at the bottom of the *Body Frames* widget.
2. On the drop-down list, click *Soft Body.*
3. Click the green + button.

- **Result:** The Soft Frame is created and added to the list in the *Body Frames* widget.

Once the frame is created, you may double-click and type a new name on the default name cell, and click *Enter*. By default, a Soft Frame is given a name of 'SF(ID)'. You must click *Apply Changes* after a name change.

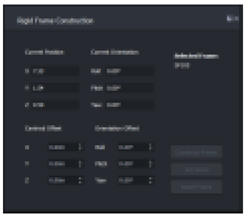
Assigning LEDs to a Soft Frame

Assign LEDs to a soft frame by dragging individual beacons from the global *Beacons* widget to the *Frame LEDs* widget with a soft frame selected in the *Body Frames* widget. The order of the LEDs for a soft frame does not matter because all soft frames are tracked at the centroid of the frame.



Constructing the Frame

Once the LEDs have been assigned, the frame can be initialized and the solution can be calculated. Click the *Apply Changes* button in the *Rigid Frame Construction* widget to initialize and calculate the solution. This will change the status of all current frames with LEDs assigned to them from "Done" to a list of the LEDs that have not yet appeared (visible to the tracking system). This will send all ready frames to the global *Beacons* widget(s), and allow them to be assigned to a trackable. The *Reset All Frames* button will not affect soft frames. The centroid of a soft frame cannot be set as the centroid is constantly being re-calculated based on the position of the LEDs that the frame is made up of.



Global Widgets

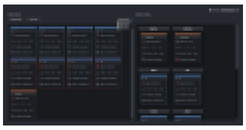
Table of contents:

Beacon Patch

The *Beacon Patch* widget is where information on the BTBeacon, Mini Beacon, Rigid and Soft Frames are displayed and the assignment of BTBeacons, Mini Beacons, Rigid and Soft Frames to Trackables is controlled. To know the position of a Trackable in the BTSystem, a BTBeacon or Mini Beacon or Rigid Frame or Soft Frame must first be assigned to the Trackable. The assignment will link the location of the BTBeacon/Mini Beacon/Rigid Frame/Soft Frame with the position of the Trackable.

The X, Y, Z position of a Trackable is based on the position of the assigned BTBeacon or Frame's centroid in the Space. The orientation of a Trackable is based on the IMU within the BTBeacon or the calculated orientation of a rigid frame. BlackTrax interprets the data based on the configuration of the Trackable as it was set in the *Trackable Settings* widget. BTBeacons broadcast data at all times when the BTBeacon is on, even if it is not assigned.

The Mini Beacon has a single built-in LED, no radio and no internal inertial measurement unit (IMU). The Mini beacon icon will display only the Mini Beacon number and the centroid positional coordinate.


Beacon Patch

Assigning Beacons To A Trackable

For the BTSystem to detect the location and orientation information of a Trackable, a BTBeacon or Mini Beacon or Rigid Frame or Soft Frame must first be assigned to a Trackable. The assignment will associate the data of the BTBeacon with the Trackable.

To assign a BTBeacon or Mini Beacon or Rigid Frame or Soft Frame to a Trackable

1. Drag and drop the *Beacon Icon* of the BTBeacon/Mini Beacon/Rigid Frame/Soft Frame from the **Available Beacons** section to the Trackable Container of the Trackable in the **Available Trackables** section.
2. Click *Apply Changes*.

- **Result:** The BTBeacon or Mini Beacon or Rigid Frame or Soft Frame will be assigned to the Trackable.
- **Note:** Assigning a BTBeacon or Mini Beacon or Rigid Frame or Soft Frame to a Trackable that already has a BTBeacon or Mini Beacon or Rigid Frame or Soft Frame assigned will cause the BTBeacon or Mini Beacon or Rigid Frame or Soft Frame that was previously assigned to be unassigned.

To un-assign a BTBeacon or Mini Beacon or Rigid Frame or Soft Frame from a Trackable

1. Drag and drop the *Beacon Icon* of the assigned BTBeacon/Mini Beacon/Rigid Frame/Soft Frame from the **Available Trackables** section to the **Available Beacons** section.
2. For the changes to take effect, click *Apply Changes*.

Different types of Beacons

There are three different types of beacons, which can be categorized by their heading colour:

- **Blue:** Regular or 'Classic' Beacon - this is a physical BTBeacon connected to stringers
- **Burgundy:** Mini Beacon - this is a physical Mini Beacon connected to stringers

- **Orange:** A rigid frame - a 'virtual' BTBeacon that is constructed using at least three LEDs from any number of BTBeacons
- **Pink:** A soft frame - a 'virtual' BTBeacon that is constructed using at least one LED from any number of BTBeacons

Beacon Patch Filtering

The **Available Beacons** section can be set to show only the selected types of beacons. By default, the section opens with all types of Beacons selected.

To select the Beacon type that will appear in this section

1. On the top right corner of the **Available Beacons** section, click on the *Beacons* drop-down menu.
2. Select the checkboxes of either the *Classic Beacon*, or the *Rigid Frame*, or the *Soft Frame* or *Mini Beacons* that you want to show in the section.
   - **Result**: Only the selected Beacon types will appear in the **Available Beacons** section.

Beacon Data

When BTBeacons are in the Space, their location and orientation are known by the BTSystem. This information is displayed in the Beacon Icon for easy reference. BTBeacon data can be separated into three categories: General, Centroid and LED.

Note: If any BTBeacon information is unavailable, it will appear as “?”. This could be because the BTBeacon LEDs are not visible by the BTSystem, or the LEDs are unplugged.

- **Beacon Number**: This is the identifying number of BTBeacon. It is used to tell BTBeacons apart and is assigned to the BTBeacon automatically.
- **Battery Icon**: This icon represents the percentage of power remaining in the BTBeacon. The timer next to the icon gives an estimate of how long the BTBeacon can operate using the current LED configuration.

Centroid Beacon Data

Centroid BTBeacon data is primarily information based on the average Cartesian coordinates position all visible LEDs connecting to the BTBeacon. Additional information about the BTBeacon is also displayed.

- **X** : This is the current X coordinate of the BTBeacon. This position is based on the average X coordinate position of all visible LEDs connected to the BTBeacon.
- **Y** : This is the current Y coordinate of the BTBeacon. This position is based on the average Y coordinate position of all visible LEDs connected to the BTBeacon.
- **Z** : This is the current Z coordinate of the BTBeacon. This position is based on the average Z coordinate position of all visible LEDs connected to the BTBeacon.
- **R** : This is the current roll (rotation of X axis) value of the BTBeacon. This is based on the IMU inside the BTBeacon or the solution based on the rigid frame.
- **P** : This is the current pitch (rotation of Y axis) value of the BTBeacon. This is based on the IMU inside the BTBeacon or the solution based on the rigid frame.
- **Y** : This is the current yaw (rotation of Z axis) value of the BTBeacon. This is based on the IMU inside the BTBeacon or the solution based on the rigid frame.
- **Button A** : This indicates the current status of the A button on the BTBeacon. The button can be set to either ON or OFF. This button is used in fixture calibration.

- **Button B** : This indicates the current status of the B button on the BTBeacon. The button can be set to either ON or OFF. This button is used in fixture calibration.

LED Beacon Data

LED BTBeacon data is information on the individual Cartesian coordinate position of every LED connected to the BTBeacon.

- **LED 1** : The number next to the icon is the identifying numbered pulse of the LED in the BTBeacon’s port 1.
- **LED 1 Data** : This is the current Cartesian coordinates of the LED in the BTBeacon’s port 1.
- **LED 2** : The number next to the icon is the identifying numbered pulse of the LED in the BTBeacon’s port 2.
- **LED 2 Data** : This is the current Cartesian coordinates of the LED in the BTBeacon’s port 2.
- **LED 3** : The number next to the icon is the identifying numbered pulse of the LED in the BTBeacon’s port 3.
- **LED 3 Data** : This is the current Cartesian coordinates of the LED in the BTBeacon’s port 3.

BTWYG Patch

The *BTWYG Patch* widget is where patching information from BTWYSIWYG is displayed. In BTWYSIWYG, BlackTrax Trackable Frames are created and patched to a DMX and Motion Universe for motion control. The BlackTrax System tracks the position and location of the Trackable Frames in real-time. See Patching Trackables in BTWYSIWYG for more information.


BTWYG Patch

Motion Patching:

- **WYG Trackable**: Name of the Trackable object created in BTWYSIWYG.
- **WYG Patch ID**: The patch name/number assigned to the motion universe corresponding to the Cartesian axis of the Trackable object.

Consoles:

Console Name: Name of the patched control console.

Console Mode: Console mode setting.

Console Ports: Output ports assigned to the patch universe.

- **BT Port**: Number of assigned BlackTrax System port sending and receiving data.
- **Port**: Number of the output port from the console sending data.
- **Patched To**: Number of the Patch Universe assigned to the console.

Lighting Patching:

Universe: Number of the DMX Universe where the lighting fixtures are patched to.

- **Spot ID**: Assigned identifier number used for automated fixtures.
- **Offset**: Assigned starting DMX value.
- **Size**: Total number of DMX values used in the patched fixture's attributes.
- **Fixture**: Name of the fixture.
- **Pan Inverted**: Yes or No confirms if the fixture pan control attribute is inverted or not.
- **Tilt Inverted**: Yes or No confirms if the fixture tilt control attribute is inverted or not.
- **Profile**: Features of the fixture type.

Fixture Profiles:

- **Name**: Identifies the names of the fixture and its features.
- **Type**: Identifies the type of fixture, Moving Head, Moving Mirror, or Conventional.
- **Pan/Tilt**:
    - **8-bit**: Confirms Yes or No if the fixture has 8-bit pan and tilt control.
    - **16-bit**: Confirms Yes or No if the fixture has 16-bit pan and tilt control.

- **Intensity**:
    - **8-bit**: Confirms Yes or No if the fixture has 8-bit dimming control.
    - **16-bit**: Confirms Yes or No if the fixture has 16-bit dimming control.
    - **Virtual**: Appears when the fixture only has RGB or RGBW or RGB with dimmer or HSI.
- **Zoom**:
    - **8-bit**: Confirms Yes or No if the fixture has 8-bit zoom control.
    - **16-bit**: Confirms Yes or No if the fixture has 16-bit zoom control.
- **Iris**:
    - **8-bit**: Confirms Yes or No if the fixture has 8-bit Iris control.
    - **16-bit**: Confirms Yes or No if the fixture has 16-bit iris control.
- **Errors**: Displays the profile errors when fixture modes or control profiles are not fully compatible with BlackTrax, which is determined when BlackTrax receives the fixture from BTWYSIWYG. For the list of error codes, see Error Codes for Unsupported Fixtures.
    - For example, the **Errors** column in the **Fixture Profile** section (below) displays the profile error referring to the virtual dimming channel values of the Source 4 LED Lustr fixture that are not supported in BlackTrax.

      
    - If an error is reported, the *Messages* log will appear to alert you of the error. Please contact BlackTrax Support with the error code reported and the fixture mode to help resolve it.

Zones:

- **Uri**: Source identifier value from BTWYSIWYG.
- **Name**: Name assigned to the zone created in BTWYSIWYG.

User Origin:

- The User Origin will always appear at 0, 0, 0 unless you specify a User Origin in BTWYSIWYG. The User Origin will display the X, Y, Z relative to the document origin if you specify a User Origin in BTWYSIWYG.
    - **X**: Coordinate value of the origin on the X axis.
    - **Y**: Coordinate value of the origin on the Y axis.
    - **Z**: Coordinate value of the origin on the Z axis.

To open BTWYG Patch

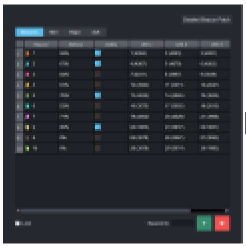
From the **View** menu in Live, Edit or Calibration view, choose the **BTWYG Patch** menu.

Result: The *BTWYG Patch Information* widget appears.

Beacons

The *Beacons* widget is where an overview of the Beacons in the BTSystem is displayed and where Beacons in the BTSystem are controlled.

- Beacons, Mini Beacons, Rigid Frames and Soft Frames seen by the BTSystem.
- Battery percentage per Beacon (Mini Beacon does not show Battery Percentage).
- Status if the Beacon, Mini Beacon, Rigid Frame or Soft Frame is visible or not.
- LED indexes with the corresponding bit codes (binary values) for every Beacon.
- You can lock or unlock the Beacon list from the *Lock* checkbox.
- You can add and remove classic Beacons from the new add and remove buttons.


Beacons widget

Beacons Widget Filtering

In the *Beacons* widget, you can click on either the *Beacons* tab or the *Mini* tab or the *Rigid* tab or the *Soft* tab to select the Beacon type that you want to show in this widget.

- *Detailed Beacon Patch*: Click this button to open the *Beacon Patch* widget.
- *Beacons* tab: Click on the *Beacons* tab to show Regular or Classic Beacons, which are the physical BTBeacons connected to the stringer.
- *Mini* tab: Click on the *Mini* tab to show Mini Beacons, which are the physical Mini Beacons with an LED embedded on top of the device.
- *Rigid* tab: Click on the *Rigid* tab to show only the Rigid Frame 'virtual' BTBeacons.
- *Soft* tab: Click on the *Soft* tab to show only the Soft Frame 'virtual' BTBeacons.
- *Lock*: Select this checkbox to lock the Beacons list and disable the *Beacon ID* box, adding and deleting Beacons in the table.(Available only in the *Beacons* tab.)
    - **Notes:**
        1. When the list is locked, Beacons will not update automatically from radio data.
        2. By default, the list is locked when a new project is loaded and when *Apply Changes* is pressed.
- *Beacon ID*: Assign a unique name for the Beacon. (Available only in the *Beacons* and *Mini* tabs.)
- *Add* button: Adds a Beacon to the list in the table. (Available only in the *Beacons* and *Mini* tabs.)
    - **Notes:**
        1. All Beacons follow a preset rule. (Beacon 1 = LED 1, 2, 3; Beacon 2 = LED 4, 5, 6, etc.)
        2. When adding Beacons, you can enter either a single Beacon ID or range. (e.g. 10-45)
- *Delete* button: Deletes a Beacon to the list in the table. (Available only in the *Beacons* and *Mini* tabs.)

Specific BTBeacons, Mini Beacons, Rigid Frames or Soft Frames can be assigned to Trackables for specific chapters. These settings will override any assignment made on the Beacon Patch page.

To assign a BTBeacon, Mini Beacon, Rigid Frame or Soft Frame to a Trackable for a specific chapter

1. In the *Chapters* tab, select the chapter the Trackable is in.

2. Select a *Trackable.*
3. Go to the *Beacons* widget.
4. Drag and drop icons the desired *BTBeacon, Mini Beacon, Rigid Frame or Soft Frame* from the list onto the currently assigned Beacon of the desired Trackable.
    - **Result:** The chosen BTBeacon, Mini Beacon, Rigid Frame or Soft Frame will be assigned to the Trackable for the specific chapter. A book icon will appear next to the Assignment setting in the Trackables section.
    - **Note:** To revert back to the globally assigned BTBeacon, click the Book icon.
5. For the changes to take effect, click *Apply Changes*.

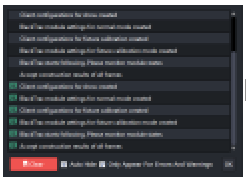
Messages

The *Messages* widget is where the history of error warnings and status updates of the state of the system are displayed.

By default, the *Messages* widget will auto hide from view after 5 seconds of display. You can toggle on or off the auto hide in the *Messages* widget.

The *Messages* widget will appear whenever there is a change to the state of the system, or an error has occurred. As an alternative, you can manually open the widget by selecting the speech bubble on the Status Bar.

The *Messages* widget can be set to appear only when a warning or error message has been generated. In this mode, the color of the Messages Icon on the Status Bar turns blue when information is added to the *Messages* widget.


Messages widget

To disable auto hide

1. In the *Messages* widget, clear the *Auto Hide* checkbox.
2. Click *OK*.

- **Note:** Clicking the *OK* button will hide the *Messages* widget manually.

To enable only appears for errors and warnings

1. In the *Messages* widget, select the *Only Appears For Errors and Warnings* checkbox.
2. Click *OK*.

To clear all information

1. In the *Messages* widget, click *Clear*.

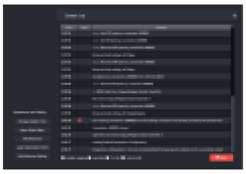
- **Result:** The *Messages* widget will be cleared of all the information listed.

System Log

The *System Log* widget displays system information about the BlackTrax project. The various features of the system log are:

- *Enable Logging*: Select this checkbox to log all events in *System Log* widget.
- *Log Data*: Select this checkbox to record all data transmitted. Used primarily for debugging purposes.
- *To File*: Select this checkbox to save the *System Log* to C:\bt_run_time.
- *Auto Scroll*: Select this checkbox to automatically scroll to the latest event when it is created in the *System Log*.

Note: If logging data *To File* is enabled, you may accumulate Gigabytes of data in a single day of use. We recommend that the log file is removed periodically to conserve BTSystem memory.



To set the system log as a separate window

Double-click the *System Log* heading.

Result: The *System Log* window appears as a separate window.

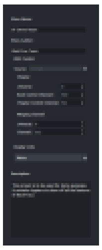
To reattached the system log window to BlackTrax

In the *System Log* window, on the top right of the window, click *Attach*.

Result: The *System Log* window reattaches to the main widget.

Project Properties

The *Project Properties* widget is where descriptive data and properties of the BlackTrax project are created, displayed and managed. You can change the properties that were set in the *Project Properties* widget.


Project Properties widget

The *Project Properties* widget displays the following:

- *Show Name*: Type the name of the current project in this box.
- *Show Author:* Type the name of the author of the current project in this box.
- **DMX Control:** On the *Source* drop-down menu, select the source of the DMX input for the *Universe* and the *Chapter Control Channel*. On the *Source* drop-down menu, select from either *Art-Net* or *sACN*.
  - **Note:** As *Art-Net* starts at 0 instead of 1, universe selection reflects that when changing between *sACN* and *Art-Net*.
- **Chapter:** Set the *Chapter Control Channel* number and the *Universe* for the assigned control channel of the active Chapter.
  - *Universe*: Click on this scroll box to set the Universe for the assigned control channel of the active Chapter.
  - *Chapter Control Channel:* Click on this scroll box to set the channel number for the control of the active Chapter.
  - **Note:** *Book Control Channel* scroll box is displayed in this section when the project is in Multi Book Mode.
- **Merging Channel:** Set the channel number that will only monitor the Merging Channel that was set in the merge node.
  - *Universe:* Click on this scroll box to set the Universe for the assigned control channel of the Merging Channel monitor.
  - *Channel:* Click on this scroll box to set the control channel for the Merging channel monitor.
  - **Note:** The Merging Channel is a single DMX channel that is patched into your lighting console to enable the control of moving fixtures from BlackTrax. This can be a dimmer channel that controls intensity fading between BlackTrax and the lighting console, or a simple On/Off control. This channel must be patched in your console and set as the trigger channel in your merge node. See DMX/Ethernet Node for Tracking with Moving Lights.
- *Display Units*: BlackTrax allows for either metric or imperial measurement to be used. This setting can be changed in the *Display Units* section. The default unit settings of BlackTrax is metric. Loading a project will revert BlackTrax to the default unit of measurement. Click on the *Display Units* drop-down menu to select the measurement unit.

To open the project properties widget

From the **Settings** menu, choose **Project Properties**.

Result: The *Project Properties* widget appears.

To set the DMX control source

In the *Project Properties* widget, in DMX Input section, select from the *Source* drop-down menu.

Result: The selected source will set the DMX input for the Chapter Control Channel of the BlackTrax project.

To set the universe and chapter control channel

1. Open the *Project Properties* widget.
2. In the **Chapter** section, click on the *Universe* scroll box.
3. Click on *Chapter Control Channel* scroll box.

To enable the merging channel monitoring

1. Open the *Project Properties* widget.
2. In the **Merging Channel** section, click on the *Universe* scroll box.
3. Click on the *Channel* scroll box.

To set the units of measurement

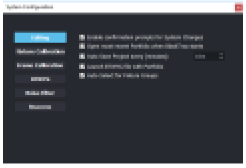
1. Open the *Project Properties* widget.
2. In the **Display Units** section, click on the drop-down menu to select *Metric* or *Imperial*.
3. Select the desired measurement type.

Result: The selected unit of measurement will apply to the BlackTrax project.

Attention: Inputs will always be in metric.

System Configuration

The *System Configuration* widget is where BlackTrax software behavior can be configured.

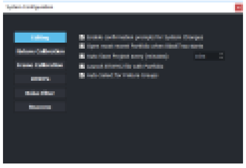

System Configuration Widget

The *System Configuration* widget displays the following buttons to access the sections:

- *System*: System prompts can be toggled On or Off. See Editing section page.
- *Fixture Calibration*: Settings that affect the collection of measurement points of the fixtures can be toggled On or Off. See Fixture Calibration Section page.
- *Frame Calibration*: Click on the *Updating offsets interval (seconds)* scroll box to set the time interval for the Centroid and Orientation Offset values to be applied to the selected Rigid Frame. See Frame Calibration Section page.
- *BTWYG*: Settings that enable incoming and outgoing links to BTWYSIWYG can be toggled On or Off. See BTWYG Section page.
- *Noise Filter*: Determines if the point is valid or not by using a probability algorithm to determine how likely a point would be. For example, if Beacon 1, LED 2 is seen in the same spot for 100 frames, but it then appears for one frame 10m away (typically caused by IR noise), then the filter tosses that single frame away and continues to track the real LED. See Noise Filter section page.
- *Beacons*: Settings that affect the function and reporting of Beacons. See Beacons Section page.

System Section

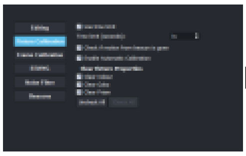
The System section in the *System Configuration* widget is where system prompts can be toggled On or Off.


System section

- *System*: Toggle system prompts.
  - *Enable confirmation prompts for System Changes*: Select this checkbox to display a dialog box asking for confirmation to apply the changes you have made in BlackTrax after clicking *Apply Change*s in *Normal Mode* and *Fixture Calibration Mode*.
  - *Open most recent Portfolio when BlackTrax starts*: Select this checkbox to open BlackTrax with the last Portfolio that was opened, or clear this checkbox to open the *Portfolio Manager* when opening BlackTrax.
    - **Note:** The *Open most recent Portfolio when BlackTrax starts* feature is disabled when a license check fails while opening the Main GUI of BlackTrax.
  - *Auto Save Project every (minutes)*: Select this checkbox to enable, and set the duration of Auto Saving of the .btprj associated with a Portfolio. Auto Save can happen anywhere from 5 minute to 30 minute intervals, and the timer is activated by editing changes in the BlackTrax GUI.
  - *Launch BTWYG file with Portfolio*: Select this checkbox to open the BTWYG file associated with the launched Portfolio at time of launch.
  - *Auto Select for Fixture Groups*: Select this checkbox to have fixtures in a Fixture Group be selected automatically in the *Libraries* Widget when selecting a group from the *Group* drop-down list.

Fixture Calibration Section

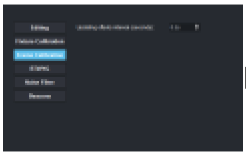
The Fixture Calibration section of the *System Configuration* widget is where the settings that affect the collection of measurement points of the fixtures can be toggled On or Off.


Fixture Calibration section

- *Fixture Calibration*:
    - *Use calibrated fixture position for beam Zone collisions*: Select this checkbox to use the calibrated beam zone settings of the fixture that was calibrated in BlackTrax. Clear this checkbox to use the beam zone settings applied to the fixture as drawn in BTWYSIWYG.
    - *Use calibrated fixture position for zoom/iris control*: Select this checkbox to use the calibrated zoom and iris settings of the fixture that was calibrated in BlackTrax. Clear this checkbox to use the zoom and iris settings applied to the fixture as drawn in BTWYSIWYG.
    - *Check if motion from beacon is gone*: Select this checkbox to disable the collection of measurement points when the signal from a beacon is not seen and a warning is displayed. Clear this checkbox to enable the collection of measurement points and the warning will not be displayed.
    - *Enable Automatic Calibration*: Select this checkbox to enable the automatic collection of the measurement points after the 5th measurement point and every point thereafter.
    - **Clear Fixture Properties**: Select the checkboxes for *Clear Colour*, *Clear Gobo*, and *Clear Prism* to remove the colour, gobo, and prism attributes from the fixtures selected in BlackTrax.
    - The fixture goes to white when *Clear Colour* is selected.
    - The gobo is removed from the fixture when *Clear Gobo* is selected.
    - The prism is removed from the fixture when *Clear Prism* is selected.
    - *Uncheck All/Check All*: Click on *Uncheck All* or *Check All* buttons to include or exclude the colour, gobo, and prism from the selected fixture in BlackTrax.

Frame Calibration Section

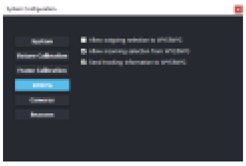
The Frame Calibration section in the *System Configuration* widget is where you can set the time interval for the Centroid and Orientation Offset values of the selected Rigid Frame.


Frame Calibration section

- *Frame Calibration*: Click on the *Updating offsets interval (seconds):* scroll box to set the time interval for the Centroid and Orientation Offset values to be applied to the selected Rigid Frame.

BTWYG Section

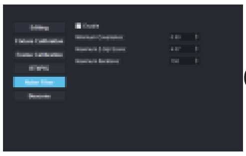
The BTWYG section in the *System Configuration* widget is where the settings that enable the incoming and outgoing links to BTWYSIWYG can be toggled On or Off.


BTWYG section

- *BTWYG*: Toggle incoming and outgoing links to BTWYSIWYG.
  - *Allow outgoing selection to WYSIWYG*: Select this checkbox to enable the selection of fixtures in WYSIWYG from BlackTrax.
  - *Allow incoming selection from WYSIWYG*: Select this checkbox to enable the selection of fixtures and trackables in BlackTrax from WYSIWYG.
  - *Send tracking information to WYSIWYG*: Select this checkbox to send information from BlackTrax to WYSIWYG.

Cameras Section

The Cameras section in the *System Configuration* widget is where noise filter settings are activated and configured.


Cameras section

- *Noise Filter*: Determines if the point is valid or not by using a probability algorithm to determine how likely a point would be. For example, if Beacon 1, LED 2 is seen in the same spot for 100 frames, but it then appears for one frame 10m away (typically caused by IR noise), then the filter tosses that single frame away and continues to track the real LED. As the system does not have a concept of 'real' and 'fake', the system uses a history to determine the 'real' LED. This means that in rare cases, noise may pass through the outlier filter if the noise is consistent, such as a reflection. There are other tricks to mask out reflections and to trim out extra parts of the tracking area. Please see Motive reconstruction bound settings for more information.
    - *Enable:* Select this checkbox to activate the noise filter.
    - *Minimum Covariance:* Click this scroll box to set how 'wide' or 'narrow' the range of noise suppression. Minimum Covariance affects a higher tolerance of points in a given spectrum.
    - *Maximum Z-Sqr Score:* Click this scroll box to set how 'wide' or 'narrow' the range of noise suppression. Maximum Z-Sqr Score affects a wider tolerance of points in a given spectrum.
    - *Maximum Iterations:* Click this scroll box to set the maximum number of repetitions per frame the same data point is analyzed to determine the noise level. There is no range to this field, but the default is 150.
- **Tip:** The easiest way to adjust the outlier filter is to increase or decrease the Min Covariance and then click *Apply Changes*. There is a large range that you may use, so it is best to step the field by either +0.1 or -0.1 each time to see if the noise becomes better or worse.

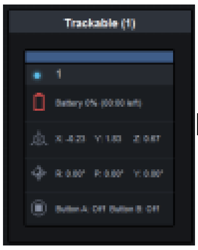
Beacons Section

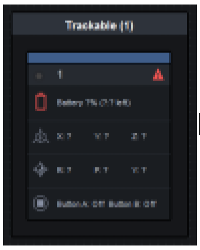
The Beacons section in the *System Configuration* widget is where settings that affect Beacon reporting and behavior within the system can be configured.

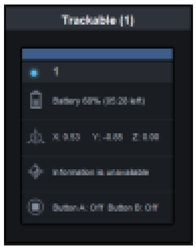
 Beacons section

- *Beacons*: Settings that affect the display of Beacon battery life.
    - *Radio becomes stale after (seconds):* Click on this scroll box to set how long after a packet of battery life data of the beacon is received (without receiving new packets) for the radio indicator in Live View to turn red. The radio indicator is also visible in Table View via the Radio column.

Live View:

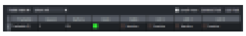


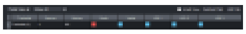
Icon with Fresh data (Gray)


Icon with Stale data (Red)


Icon with no orientation data

Table View:

 Radio column with Fresh data (Green)

 Radio column with Stale data (Red)

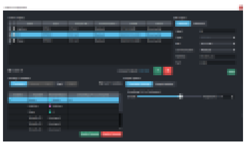
- *Number of battery packets to average:* Click on this scroll box to set the number of times the battery life information is collected to be averaged.
- *Display raw battery values in the Beacon Widget:* Select this checkbox to display the raw battery life percentage (non-averaged) as a separate column in the *Beacons* Widget.
- *Frame batteries updated every (minutes):* Click on this scroll box to set (in minutes), how the battery status of the beacons in rigid and soft body frames will update by displaying the lowest beacon's battery when that timer runs out (and repeats).
- *Detect battery time based on:* Select either 1 Stringer or 2 Stringers or 3 Stringers as the reference for monitoring the battery life capacity.
- *Process Classic Beacon Orientation:* By default, this checkbox is clear. This will prevent orientation of Classic Beacons being reported once the Beacon has been patched to a Trackable. Therefore Classic Beacon orientation will not affect:
    - Dynamic Zones
    - Avatar Rotation in BTWYG Live View
    - RTTrPM Outputs
- *Smoothed Centroid Jumps*: Select this checkbox to enable the option of setting the timing of the centroid updating when shifting from one calculated centroid to a newly calculated centroid. For example, when a Stringer contributing to a centroid becomes hidden from BTSensor view.
- *Smoothing time (milliseconds)*: Click on this scroll box to set the time (in milliseconds) it takes for the calculated centroid updating to complete when a Stringer contributing to a centroid becomes hidden, or is visible again in the BTSensor view. The shift will be smoother (*but takes more time to complete*) when the timing is longer.

Output Configuration

The *Output Configuration* widget displays the active tracking output data from the Output Modules and Trackable Settings as a result of the tracking operation in BlackTrax.

- The *Output Configuration* widget is used by the BTSystem to create, customize and remove Real-Time Tracking Protocol data for Third Party use (RTTrPL, RTTrPM, and Art-Net).
- The *Output Configuration* widget receives data based on preferences configured in Output Configuration. The customized data is then sent to designated Third Party programs.

Note: Output Configuration data can be imported and exported for use of current tracking output and saved for later use. You can activate **Import** or **Export Outputs** from the **File** menu.


Output Configuration widget

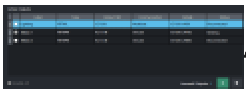
The *Output Configuration* widget displays the following sections:

- **Active Outputs:** The list data and settings of created outputs for the current BlackTrax project. See Active Outputs page.
- **Edit Output:** The section for managing the network connections of the selected output. See Edit Output page.
- **Sending Trackables:** The list of every active Trackable detected by the BTSystem and their third-party output status (only applicable to RTTrPM outputs). See Sending Trackables page.
- **Output Options:** The section enables you to select which RTTrPM modules to the output of the selected active module (only applicable to RTTrPM and outputs). See Output Options page.

Note: As a general rule, click *Apply Changes* to apply all changes that you set in *Output Configuration*.

Active Outputs

The **Active Outputs** section displays the list of output connections that are detected by the BlackTrax System. The connection settings and output statuses for every active module can be monitored via the Active Output table.

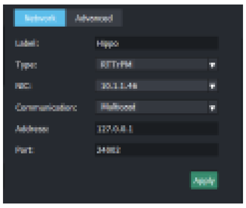

Active Outputs section

- *Enable* checkbox: Select the checkbox to enable the active output connection and determine if the connection is sending data externally.
  - **Note:** When the number of active outputs exceed your system's license, the warning dialog box appears prompting for you to click *OK* to disable a selected output or click *Disable All* and turn off all other outputs. A selected output that is within the number of Licensed Outputs will be enabled.
- **Label**: The unique name of the active module that you specified for the BTSystem.
- **Type**: The type of data protocol being sent to the selected module.
- **Output NIC**: The IP address where the output is being sent through from the selected active module.
- **Communication**: The type of connection, such as multicast, unicast or broadcast.
- **Details**: The target IP address where the output data will be sent to.
- **Status**: Connection status of the detected module.
- *Enable All*: Select this checkbox to enable all active output connections and display if all the licensed outputs are sending output data externally from the server.
  - **Note:** The *Enable All* checkbox is not available if the number of output connections displayed in the table exceed the number of Licensed Outputs authorized for the BlackTrax system.
- *Add*: Click this button to add a new active output connection.
- *Delete*: Click this button to delete an active output connection.
  - **Note:** Deleting an output marks it for deletion and it will be deleted when the user clicks *Apply Change*s next. As a general rule, click *Apply Changes* to apply all changes that you set in *Output Configuration*.

Edit Output

The **Edit Output** section is where you can set or change the network data of the output connection module that is added to the **Active Outputs** section. You can configure RTTrPM outputs' parameters.

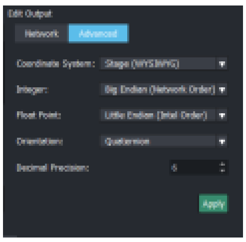
Network Tab


Network tab

- *Label:* Type the unique name of the active connection module that is added to the **Active Outputs** section.
- *Type:* Click on this drop-down menu to select the type of data protocol being sent to the selected active module.
- *NIC:* Click on this drop-down menu to select the local IP address where the output data is being sent through for the selected active module.
  - **Notes:**
    - When a project is opened in a server that is missing the saved NIC, BlackTrax will ask what NIC you would like to use for each output.
    - When BlackTrax detects an IP change in Windows, the *Messages* dialog box will alert you once to reboot BlackTrax to reload the settings.
- *Communication:* Click on this drop-down menu to select the type of IP address in the connection, such as multicast, unicast or broadcast. The default output address corresponding to multicast and broadcast will be entered automatically according to the selected type.
  - **Notes:**
    - The default multicast output address for the selected output is entered automatically if *Multicast* is selected.
    - The broadcast output address will be based off the selected NIC for the output and entered automatically if *Broadcast* is selected.
    - The user must enter the unicast address if *Unicast* is selected.
    - *Address* and *Port* fields are editable per output, where applicable if user settings are specified instead of the defaults.
- *Address:* The target IP address where the output data will be sent to.
- *Port*: The port number where the IP address for the output data is connected to.
- *Apply*: Click to apply the settings.

Note: As a general rule, click *Apply Changes* to apply all changes that you set in *Output Configuration*.

Advanced Tab


Advanced tab

- *Coordinate System:* Choose which type of coordinate system to use with positional data. Click on

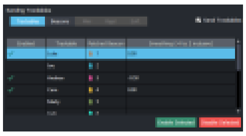
this drop-down menu to choose between the *Stage (WYSIWYG)* or *Screen* coordinate systems.
    - *Stage (WYSIWYG)*: In the *Stage* coordinate system, the Z axis refers to the upward direction, and Y is on the same plane as the X axis. (Used in WYSIWYG)
    - *Screen*: In the *Screen* coordinate system, the Z (and -Z) axis is on the same plane as the X axis, and the Y axis refers to the upward direction.
- *Integer:* Choose how integer data is sent. Click on this drop-down menu to change the network order of integer fields output in RTTrPM packets from *Big Endian (Network Order)* to *Little Endian (Intel Order)*.
- *Float Point*: Choose how the float variable value is defined. Click this drop-down menu and select *Big Endian (Network Order)* or *Little Endian (Intel Order)*.
- *Orientation:* Click on this drop-down menu to change the Beacon orientation to *Euler* or *Quaternion* coordinates.
- *Decimal Precision*: Click this scroll box and set the decimal point precision for the X, Y, Z values coming out of the RTTrPM.
- *Apply*: Click to apply the settings.

Note: As a general rule, click *Apply Changes* to apply all changes that you set in *Output Configuration*.

Sending Trackables

The **Sending Trackables** section is where Trackables are displayed and selected. The *Trackable Settings* in the **Output Options** section are then applied to the selected Trackable.

- Beacon IDs and Trackables are sent over RTTrPM.
- When you patch a Beacon or Mini Beacon or Rigid Body Frame or Soft Body Frame to a Trackable, a BlackTrax output sends the name of the Trackable (for example *Luke* instead of *1*).
  - The position and orientation of the Trackable is generated from the Beacon or Frame that is patched to it.
  - When you repatch a Trackable to a different Beacon or Frame, the position of the new Beacon or Frame is sent to the Trackable and out to the third party.
- Beacons and Frames that are not patched to a Trackable will send as Beacon IDs. You can repatch Trackables to different Beacons and Frames in the BlackTrax software and all connected third parties will receive the update automatically. You do not need to manually repatch Beacons in every third party.


Sending Trackables section

In the **Sending Trackables** section:

- *Send Trackables* checkbox: Select the checkbox to enable the *Trackables* tab.
  - **Result:** The *Trackables* tab is displayed.
  - **Note:** By default, the *Trackables* tab is *off*. Not all third parties are compatible with this feature; consult with BlackTrax Technical Support or the third party support to confirm compatibility.
- *Trackables* tab: Click the tab to display the list of Trackables and their output status: **Enabled**, **Trackable**, **Patched Beacon** and **Smoothing**.
  - **Enabled**: Displays a check mark when enabled.
  - **Trackable**: Displays the name of the Trackable.
  - **Patched Beacon**: Displays the ID or name of the Beacon or Frame assigned.
  - **Smoothing**: Displays the Smoothing value that was set in the *Trackable Settings* tab.
- *Beacons*/*Mini*/*Rigid*/*Soft* tab: Click the tab to display the table with the list of Trackables.
  - **Enabled**: Displays a check mark when enabled.
  - **Beacon**: Displays the Beacon ID or name.
  - **Smoothin**g: Displays the Smoothing value that was set in the *Trackable Settings* tab.

To enable sending trackable data to third parties

1. On the **Sending Trackables** section, select the *Send Trackables* checkbox.
   - **Result:** The *Trackables* tab appears.
2. Click the *Trackables* tab or *Beacons* tab or *Mini* tab or *Rigid* tab or *Soft* tab.
   - **Result:** The list of detected Trackables/Beacons/Mini Beacons/Rigid Frames/Soft Frames are displayed in their tabs.
3. On each of the tab list, select or highlight the Trackable or Beacon or Mini Beacon or Rigid Frame or Soft Frame.
4. Click *Enable Selected*.
   - **Result:** The **Enabled** column displays a check mark.
   - **Tip:** You can select/highlight several Trackables or Beacons or Rigid/Soft Frames at once and then click *Enable Selected* to send to third parties, or click *Disable Selected* to stop sending.

(By default, no Beacons are sending to third parties.)

Notes:

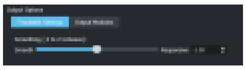
- If a Beacon or Frame is patched to a Trackable, the Beacon or Frame will not be available for selection to enable in their respective tab.
- *Rigid* and *Soft* bodies display their name instead of Beacon ID.
- Click *Apply Changes* to apply all changes that you set in *Output Configuration*.

Output Options

The **Output Options** section is where Trackable data that is being sent can be altered.

Attention: The settings affect Output Modules that are sending data from BlackTrax, and applies to RTTrPM outputs.

Trackable Settings tab: Set tracking smoothing response for a single or multiple trackables. The Smoothing option is enabled when *Acceleration and Velocity* in the *Output Modules* is selected.

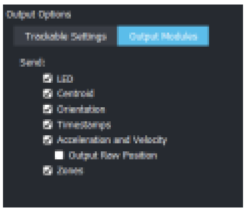
 Trackable Settings tab

- *Smoothing*: Set how fluid the XYZ values of the Trackable become.
  - Use the slider and the scroll box to adjust the range of fluidity from *Smooth* to *Responsive,* to set the range between -4 to +2. Both slider and the scroll box correspond to the same perimeter.
  - A more smoothed Trackable will result in less jitter going to the third party, and can help smooth out less than ideal calibrated volumes, but it will introduce a slight delay as well.

To set the smoothing response of a selected trackable

1. On the *Output Modules* tab, select the *Acceleration and Velocity* checkbox and clear the *Output Raw Position* checkbox.
   - **Result:** Smoothing is enabled on the *Trackable Settings* tab.
2. On the *Sending Trackables* section, select a single or multiple Trackable(s).
3. On the *Trackable Settings* tab, use the *Smooth* to *Responsive* slider or click the scroll box to set the range of fluidity between -4 to +2.
   - **Result:** The smoothing range that was set is displayed in the Smoothing column of the *Sending Trackables* section.

Output Modules tab: Select which data to send through the selected output module.



Output Modules tab

- **Send**: Select the checkboxes to choose the output connection data that will be sent through.
  - *LED*: Select this checkbox to send BTBeacon LED data.
  - *Centroid*: Select this checkbox to send BTBeacon Centroid data.
  - *Orientation*: Select this checkbox to send BTBeacon orientation data.
  - *Timestamps*: When enabled, the Frame ID generated by the TimeKeeper is used as a time stamp.
  - *Acceleration and Velocity*: Select this checkbox to send centroid and/or LED position acceleration and velocity data.
    - **Note:** The Smoothing option on the *Trackable Settings* tab is enabled when *Acceleration and Velocity* checkbox is selected.
  - *Output Raw Position*: Select this checkbox to turn off the filter that is used for the acceleration and velocity data that was sent.
    - **Notes:**
      - Acceleration and velocity data is not 100% accurate due to inaccuracies that can occur, such as BTSensor jitter, poor BTSensor calibration, reflections and IR

interference. This creates imperfect data or noise. Filtering the data is a way to correct any noise that enters the data.

- Enabling *Output Raw Position*, or disabling *Acceleration and Velocity* will de-activate the smoothing slider from the *Trackable Settings* tab.

- *Zones*: Select this checkbox to send Static and Dynamic Zones collision detection data for the selected Trackable over RTTrPM. *Zones* checkbox is selected by default.
  - **Notes:**
    - When a Trackable or Beacon collides a Zone, that Zone is sent as part of the Zone Collision module.
    - If a Zone is not listed, the Trackable is not colliding with that Zone.

RTTrPM (Real-Time Tracking Protocol - Motion)

RTTrPM is the protocol that is used to stream to third party listeners that are interested in the position and orientation of a tracking point, relative to the origin of the coordinate system (as defined by the user). Go to https://rttrp.github.io/RTTrP-Wiki/RTTrPM.html to see **RTTrPM Modules** and **Packet Structure** information for Trackable, Centroid and Tracked Point Position, Orientation, Centroid and Tracked Point Acceleration and Velocity, and Zone Collision Detection.

Note: As new modules can be added to the RTTrPM protocol for different features, ensure the third party has written support for the apropriate module. Contact CAST or the Third Party for information.

Output Configuration Settings for Third Parties

Known Output Configuration settings for third parties:

Media Servers:

Avolites Ai

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Little Endian (Intel Order)*
- Float Point: *Big Endian (Network Order)*
- Orientation: *Quanternion*

Output Options > *Output Modules* tab

- LED: *Unchecked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Checked*
- Acceleration and Velocity: *Checked*

disguise

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Quanternion*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Unchecked*
- Orientation: *Unchecked*
- Timestamps: *Checked*
- Acceleration and Velocity: *Checked*

Green Hippo

Edit Output > *Advanced* tab

- Coordinate System: *Screen*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Checked*
- Acceleration and Velocity: *Checked*

Modulo Kinetic

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Big Endian (Network Order)*
- Orientation: *Quanternion*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Checked*
- Acceleration and Velocity: *Checked*

Touch Designer

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Checked*
- Acceleration and Velocity: *Checked*

Watchout

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Unchecked*

- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Checked*
- Acceleration and Velocity: *Unchecked*

Widget Designer

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Checked*
- Acceleration and Velocity: *Unchecked*

Isadora

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Checked*
- Accelaration and Velocity: *Checked*

Camera Control:

CamBot Designer

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Little Endian (Intel Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Quanternion*

Output Options > *Output Modules* tab

- LED: *Unchecked*
- Centroid: *Checked*
- Orientation: *Unchecked*
- Timestamps: *Unchecked*
- Acceleration and Velocity: *Unchecked*

MRMC Flair

Edit Output > *Advanced* tab

- Coordinate System: *Screen*
- Integer: *Little Endian (Intel Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Quanternion*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Unchecked*
- Orientation: *Unchecked*
- Timestamps: *Unchecked*
- Acceleration and Velocity: *Unchecked*

Rushworks CTRL+R

Edit Output > *Advanced* tab

- Coordinate System: *Screen*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Quanternion*

Output Options > *Output Modules* tab

- LED: *Unchecked*
- Centroid: *Checked*
- Orientation: *Unchecked*
- Timestamp: *Unchecked*
- Acceleration and Velocity: *Unchecked*

Please Note: Rushworks CTRL+R will only work with the default RTTrPM Multicast network settings.

Lighting Visualization:

Capture

Edit Output > *Advanced* tab

- Coordinate System: *Screen*

- Integer: *Little Endian (Intel Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Unchecked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Unchecked*
- Acceleration and Velocity: *Checked*

WYSIWYG

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Quanternion*

Output Options > *Output Modules* tab

- LED: *Unchecked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamp: *Checked*
- Acceleration and Velocity: *Unchecked*

Motion Control:

Raynok Motion Control Software & System

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Little Endian (Intel Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Checked*
- Centroid: *Checked*
- Orientation: *Checked*
- Timestamps: *Unchecked*
- Acceleration and Velocity: *Unchecked*

Spatial Audio:

L-Acoustics L-ISA

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

Output Options > *Output Modules* tab

- LED: *Unchecked*
- Centroid: *Checked*
- Orientation: *Unchecked*
- Timestamps: *Unchecked*
- Acceleration and Velocity: *Unchecked*

SPAT

Edit Output > *Advanced* tab

- Coordinate System: *Stage (WYSIWYG)*
- Integer: *Big Endian (Network Order)*
- Float Point: *Little Endian (Intel Order)*
- Orientation: *Euler*

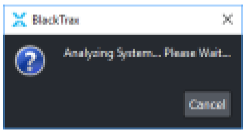
Output Options > *Output Modules* tab

- LED: *Unchecked*
- Centroid: *Checked*
- Orientation: *Unchecked*
- Timestamps: *Unchecked*
- Acceleration and Velocity: *Checked*

System Status Widget


System Status Widget

System Status displays the connection status, and data information for Tracker, Follower and Tracking Adapter outputs. You can click Alt+S on the keyboard to launch the *System Status* widget. *System Status* checks for any RTTrPM outputs when the widget opens, and if so, a pop-up dialog appears before opening and displays the text *Analyzing System...Please Wait...*. You may click on the *Cancel* button to abort the operation, otherwise the pop-up dialog appears for one minute. If you decide to skip the system being analysed, the widget will still be displayed, however any output latency will display as "No Information" in Red.



System Status pop-up dialog box

Each connection has the following information.

Connection:

- Tracker
  - Motive
    - Internal input from Motive for motion data
  - Router
    - Input from physical Router for battery and button pushes from Beacons
  - Tracking Adapter Output
    - Internal output to Tracking Adapter(s)

- Follower
  - Motion
    - Internal input from Tracker for motion data
  - DMX in
    - Input from a lighting console for sACN/Art-Net
  - BTWYG
    - Internal output to BTWYG for lighting visualization
  - RTTrPL
    - Output to a DMX Merge node for sending to a physical lighting system

- Tracking Adapter
  - Traker Input
    - Internal input from Tracker for motion data
  - RTTrPM
    - Output to a third party using the RTTrPM protocol

Status: Connected/Disconnected at time of *System Status* being launched.

Packets: Number of Packets sent at time of the *System Status* being launched.

Data Sending: Yes/No depending on if packets are increasing.

Note: (Follower only. Displays DMX in Source.)

The *System Status* widget will also analyze and display the output latency in milliseconds of any Tracking Adapter outputs running at the time of launching the widget. To accurately determine system latency, the system needs to be measured over a full minute. Latency does not account for any latency within Motive, from Stringer to BTSensor, or the network to the Third Party.

Latency will increase slightly with more active Beacons, so when using this tool, ensure all Beacons you wish to measure are actively tracking before starting the test.

Keyboard shortcuts

Standardized BlackTrax keyboard shortcuts are defined below:

Description	Keyboard shortcuts
New Project	Ctrl+N
Open Project	Ctrl+O
Save	Ctrl+S
Apply Changes	Ctrl+Enter
Apply BTWYG Updates	Ctrl+W
Copy	Ctrl+C
Paste	Ctrl+V
Select All	Ctrl+A
Undo	Ctrl+Z
Undo Stack	Ctrl+Shift+Z
Redo	Ctrl+Y
Live View	Ctrl+1
Edit View	Ctrl+2
Fixture Calibration View	Ctrl+3
Frame Calibration View	Ctrl+4
Close All Widgets	Ctrl+'
Beacon Patch	Ctrl+B
Beacons	Ctrl+Shift+B
Output Configuration	Ctrl+T
Messages	Ctrl+M
Fullscreen Toggle	F11
About BlackTrax	F1
Close	Alt+F4
Record Tracking and Lighting Data	Ctrl+R
Launch System Status Widget	Alt+S

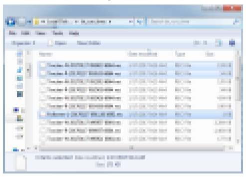
Record Tracking and Lighting Data

This feature enables BlackTrax to automatically record tracking and lighting data in the form of packets while receiving incoming tracking data from Motive. This data will save in the C:\bt_run_time folder as a .rec file. The recording can be played back in the **Cue** application.

To start/stop record tracking and lighting data

1. On your keyboard, click the shortcut Ctrl+R once to start recording.
    - **Result:** Tracking and Lighting Data starts recording automatically and the status bar displays the record icon. 

      Record icon
2. Click the shortcut Ctrl+R again to stop the recording.
    - **Note:** Three files are saved in C:\bt_run_time.
        1. Motion data: Tracker-N
        2. Radio data: Tracker-R
        3. RTTrPL packets: Follower-L

           
           Sample files saved in C:\bt_run_time

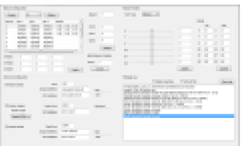
Simulator & Cue Modules

Table of contents:

Simulator Module

The *Simulator* Module is where the identification and positional data of BTBeacons can be created, configured and managed in simulation. The *Simulator* can send and receive simulated data to and from the other modules. The sections in the *Simulator* layout are:

- Beacon Configuration
- Beacon Position
- Network Configuration
- Message Log


Simulator Module

Layout of the Simulator Module

Beacon Configuration:

In the **Beacon Configuration** section, Beacons are created, identified, configured, and removed.

- *Create*: Click this button to create a single Beacon using the Beacon and LED 0, LED 1, and LED 2 fields and add to the list in the table.
- *LED Bit Code*: Select the LED Bit Type from the drop-down list.
  - **Attention**: Beacon LEDs are identified by flashing a specific bit code unique to that LED. Higher Beacon indexes can be created with the higher bit codes (thus more Beacons) which will add more latency to the system. A real system is based on 12-bits.
- *Delete*: Click this button to remove the selected Beacon(s) from the list in the table.
- *Beacon*: In the box, type the number assigned for the Beacon that you will create and assign the corresponding index numbers.
- *LED 0*, *LED 1*, *LED 2*: In the boxes, type the LED indexes for each LED ID corresponding to the Beacon number that you have set in the Beacon box.
- *Update*: Click this button to apply the LED Indexes to the Beacon, which will be displayed in the table.
- **Table**: Displays the list of Beacon(s) created and LED Indexes, Bit Codes and position for each corresponding LED.
- *LED 1*, *LED 2*, *LED 3*: Select the checkbox to enable position data for that LED, and then type the measurement (in meters) for the offseted X, Y and Z positions.
- *Apply*: Click this button to apply the LED positions for the selected LEDs.
  - **Note:** LED positions are relative to the centroid position.
- **Batch Beacon Creation**: Creates Beacons in a batch.
  - *Count*: In the box, type the number of Beacons you want to create in a batch.
  - *Create*: Click this button to create the batch of Beacons and add to the list in the table. When created this way, Beacons follow the standard Preset Beacon numbering for ID and LED indexes.

Beacon Position

In this section, the virtual positional offset coordinates of the centroid are displayed, and can be re-configured.

- *Path Type*: Click this drop-down list to select *Manual* or *Circle*.
  - *Manual*: Use the slider to set the measurements (meters) for X, Y, Z positions and RX, RY and RZ (rotation). You can also type the measurement values in the boxes beside the sliders.
    - *Update*: Click this button to apply the entered centroid position to the selected Beacon(s).
    - *Range*: In the boxes, type the measurement values (meters) in this section to set the maximum and minimum ranges of the movements.
    - *Update*: Click this button to apply the range values to all Beacons.
  - *Circle*: Automatically rotates the Beacon with reference to the set position and rotation of the centroid. You can also type the measurement values in the boxes beside to specify the rotation location and angle. R=Radius of the circle's movement, and A=Angle of the circle around the world coordinate system.
    - *Update*: Click this button to apply the position and rotation values to the selected

Beacon(s).

- *Start*/*Stop*: Toggle this button to start or stop the movement.
- *Pulse*: Click this button to trigger a single pulse of movement.

Network Configuration

In this section, the network address and port information linked to the internal IP addresses of the BTServer are displayed.

- *Motive Sender*: Displays the network address and port information used for sending position data to the other modules. Unmark the checkbox to disable the connection and stop sending position data.
- *Router Listener*: Displays the network address and port information used for receiving data packets (such as commands) from the Beacons. Unmark the checkbox to disable the connection and stop receiving data.
    - **Note:** This feature is not currently used.
- *Router Sender*: Displays the network address and port information used for simulating sent data packets from the Beacons (such as battery status). Clear the checkbox to disable the connection and stop sending data.

Message Log

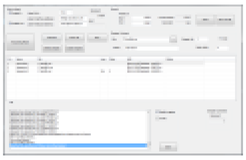
In this section, information on data that passes through the Simulator and system events are displayed. This information can also be saved to a separate file for review later. Message Log files can be found at C:\bt_run_time.

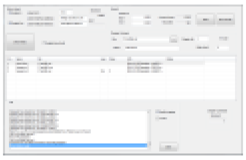
- *Display Log Data*: Select this checkbox to display detailed packet information in the Message Log.
- *Write to File*: Select this checkbox to save the log as a text file in the C:\bt_run_time folder.
- *Clear Log*: Click this button to clear all messages in the log.

Cue Module

Cue Module is where real-time or simulated tracking data in BlackTrax can be recorded as Time Stamp Frames that will be saved as Chapters and played back in sequence. The sections in the *Cue* layout are:

- Motive Input
- Record
- Recording Mode/Show Mode
- Chapter Content
- Chapter List Table
- Log
- Chapter Command


Cue in Recording Mode


Cue in Show Mode

Layout of the Cue Module

Motive Input

In the **Motive Input** section, network settings are displayed showing the port and the input/output connections to Motive.

Record

In the **Record** section, you can specify the Time Stamp Frame ID sequence to record by setting the start and end Frames.

- *Frame ID*: Specify the Frame time stamp data you want to record.
  - *Start*: In this box, type the Frame number where you will start the recording.
  - *End*: In this box, type the Frame number where you will end the recording.
  - *Current Frame*: Displays the actual Frames that are currently running.
  - *Recorded*: Displays the actual number of Frames that were recorded.
- *Start*/*Stop*: Click this button, to start or stop the recording.
  - **Note:** You will not be able to Start before your Start Frame. The recording will also automatically stop when you reach the end Frame.
- *Save To File*: Click this button to save the recorded Frames as a .rec file to any location that you choose.
  - **Note:** The *Save To File* button appears when a recording is completed. Once pressed a browse window appears.

Chapter Content

In the **Chapter Content** section, you can select the recorded file that will be used in the Chapter that you want to create.

- *File*: Type the file name and path or click the browse button to locate and select the recorded Frame.
- *Name*: Type a name for the Chapter that you want to create.
- *Chapter ID*: Type the number for the Chapter that you want to create (this corresponds to the Chapter ID in the Main GUI).
  - **Note:** When the Main GUI enters Chapter 1, it sends a command to Cue to start playing Chapter 1 as well (if in Show Mode). If the Main GUI enters a Chapter that does not exist in Cue, then Cue will stop playing the current recording.
- *Loop*: Select this checkbox to set the recorded file to play in a loop.
- *Delay (ms)*: Type the playback delay (in milliseconds) for the Chapter to wait after being triggered to start playing data.

Recording Mode/Show Mode

In this section, you can toggle between Recording Mode or Show Mode.

- *Recording Mode*: Saved files are created as Chapters and added to the table for editing and playback.
  - **Note:** Click the *Recording Mode* button to toggle into *Show Mode*, which will display the list

of Chapters in the table, and editing and playback from the Cue Module are disabled. Click *Enable Auto-Scroll* to enable automatic scrolling through the Chapter list.

- *Load List*: Click this button to load the list of saved Chapter(s) that were created and stored as a BlackTrax Cue File (.bcf) file.
- *Save List*: Click this button to save the list of Chapter(s) that were created in this module and added to the list in the table. This saves a .bcf file.
  - **Note:** A .bcf file only contains references to the Chapter's .rec files. It does not contain the .rec themselves. Ensure .rec files are still at the same path when loading .bcf files back into Cue.
- *Play*: Click this button to playback a selected Chapter from the table. Click the *Stop* button that appears to stop the playback.
- *Delete Chapter*: Click this button to remove the selected Chapter(s) from the table.
- *Create Chapter*: Click this button to create a Chapter that consists of the file that has been accessed and displayed in the Chapter Content section.

Table of Chapters

The table section displays the list of Chapters that have been created, showing in columns the Chapter number, Name, File, Loop, Delay, Information, and Status.

Log

In the **Log** section, information on data that passes through the Cue module and system events are displayed. This information can also be saved to a separate file for review later. Log files can be found at C:\bt_run_time.

- *Enable Logging*: Select this checkbox to display playback information.
- *To File*: Select this checkbox to enable saving the log of data information into a file in the bt_run_time folder.
- *Clear*: Click this button to clear all the displayed log data.

Chapter Command

- *Received*: Displays the number of Chapter changes received from the Main GUI.

Record and Playback Tracking Data in the Cue Module

The *Cue* Module is where you can record simulated tracking data and real-time tracking data in live mode from Motive.

In the *Cue* Module, the tracking data are recorded as Chapters that are stacked as a series of cues which can be recalled from the Main GUI in BlackTrax. The *Cue* Module follows the Chapter in the Main GUI in BlackTrax.

To record cues from tracking data recorded in Motive

Note: By default,the *Enable In* and *Enable Out* checkboxes in the **Motive Input** section of *Cue* Module are enabled and the network settings are displayed showing the port and the input/output connections to Motive.

1. In Motive, go to the Recording view mode which will display the Timeline of the recorded file in the **Timeline** section.
2. Open a recorded tracking data file (.tak) from Motive.
3. In Motive, identify the frame ID number where you want to start the cue that you will record.
4. In the **Record** section of the *Cue* Module, type the start frame ID number in the *Start* box of the **Frame ID** section.
5. In Motive, identify the frame ID number where you want to end the cue that you will record.
6. In the **Record** section of the *Cue* Module, type the end frame ID number in the *End* box of the **Frame ID** section.
7. In the **Record** section of the *Cue* Module, click *Start*.
8. In Motive, click the *Play* button in the **Timeline** section.
    - **Note:** You can type the start and end frame ID numbers in the preset boxes at the bottom of the **Timeline** section in Motive.
9. In the **Record** section of the *Cue* Module, click *Stop*.
    - **Result:** The *Save to File* dialog box appears.
10. Click *Save* to store the file in your specified location.
    - **Result:** The recorded frame is saved as a chapter content file (.rec) which will be used to create the stack of cues.

To create the chapters cue stack in recording mode

1. In the **Chapter Content** section of the *Cue* Module, type the file name and path of the recorded Frame in the *File* box or click the browse button to locate and select the recorded Frame that you want to create as a chapter in the cue stack list.
2. In the *Chapter Id* box, enter the number for the chapter you want to create. The Chapter ID number will correspond and sync with the Chapter that you wish to recall and playback in the BlackTrax GUI.
3. In the *Name* box, type the name that you want to add to the chapter that you will create.
4. Select the *Loop* checkbox to set the created chapter to play in a loop.
5. In the *Delay (ms)* box, you can type the length of time (in milliseconds) for the chapter to delay the playback after it was triggered to start playing.
    - **Result:** The recorded Frames that were created as Chapters will be displayed in the table as a stack of Chapter cues in series and sorted according to the Chapter ID number.
6. On the cue stack list of created Chapters, you can apply the following options:
    - Click *Save List* to save the current cue stack series of created Chapters as a BlackTrax Cue

File (.bcf).
    - Click *Load List* to load the list of saved Chapters that was created and stored as a BlackTrax Cue File (.bcf).
    - Click *Create Chapter* to add a Chapter that consists of the file that has been accessed in the **Chapter Content** section.
    - Click *Delete Chapter* to remove the selected Chapter from the cue stack list.
    - Click *Play* to playback a selected Chapter from the cue stack list.
7. Click *Recording Mode* to toggle into *Show Mode*.
    - **Result:** The table will display the cue stack of Chapters in the table which will be played back from the BlackTrax GUI. For example, when the Main GUI enters Chapter 1, *Cue* will also start playing back the recorded file in Chapter 1 as well. When the Main GUI enters the Standby Chapter or a Chapter that is not present in *Cue*, *Cue* will stop all playback. Editing and playback from the *Cue* Module are disabled.

BlackTrax Device Manager

Table of contents:

Device Manager User Interface

Table of contents:

Introduction

The **BlackTrax Device Manager** is a software application where external hardware used in the BlackTrax system can be accessed and managed directly through a PC.

- In the *Device Manager*, firmware can be uploaded to the Charging Stations, Sync Docks, Beacons, Mini Beacons, TimeKeepers and Routers.
- The *Device Manager* works with Charging Stations and Sync Docks that are connected to the BlackTrax network.
- *Device Manager* is connected and integrated to the BlackTrax Main GUI if running on the same PC.
- Beacon and Trackable information will be shared between BlackTrax and *Device Manager* when connected and integrated.
- Mini Beacons connected to a Sync Dock will send battery status information to BlackTrax Main GUI.
- *Device Manager* can be launched from the **Modules** menu in BlackTrax.
- *Device Manager* will appear in the *Modules Status* widget when connected to BlackTrax and will log connection status in *Messages*.

When *Device Manager* launches, it opens to the last used layout by default. When *Device Manager* opens for the first time, the *Main Panel*, *Device Settings*, *Charging Stations* and *System Log* widgets are displayed. The following section describes the various parts of the user interface.

Important Note: When uploading firmware, Device Manager will check if your TimeKeeper or Router can run the desired Firmware based on the version number of the current device.

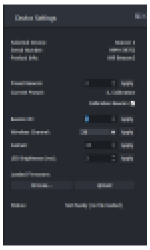
- If the TimeKeeper or Router is running a 2.x version, then Device Manager will not upload 3.x firmware.
- The TimeKeeper or Router must run on an existing 3.x version for Device Manager to allow the device to be updated to 3.x firmware.

Layout of the BlackTrax Device Manager GUI

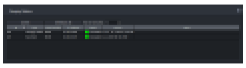
The *Device Manager* displays the table of connected devices for TimeKeepers, Routers, Beacons and Mini Beacons on the Main panel, the docking widgets for *Device Settings*, *Charging Stations*, *System Log* and the *Charging Station Settings* tab.

Main Panel: The Main panel (center area) of the *Device Manager* displays the table of connected devices for TimeKeepers, Routers, Beacons and Mini Beacons that are connected to the *Device Manager*.

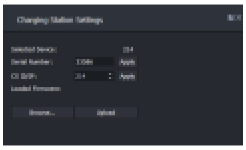
Device Settings: The *Device Settings* widget displays the properties and settings for the control of the devices connected to the Charging Station and/or Sync Dock. Each device type (Beacon, Mini Beacon, TimeKeeper, Router) has unique settings and properties. The *Device Settings* widget for each device type displays the different settings.



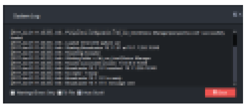
Charging Stations: The *Charging Stations* widget displays identification, firmware information, and status of all connected remote Charging Stations for BTBeacons and remote Sync Docks for Mini Beacons. In the *Charging Stations* widget, you can select and display a Charging Station, and the settings of the selected Charging Station will be displayed in the *Charging Station Settings* widget.



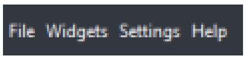
Charging Stations Settings: The *Charging Stations Settings* widget is where you can configure the settings of a selected remote Charging Station or Sync Dock. When you select a Charging Station or Sync Dock in the *Charging Stations* widget, the settings of the selected Charging Station or Sync Dock will be displayed in the *Charging Stations Settings* widget.



System Log: The *System Log* widget displays the messages and data information from events that occur in the *Device Manager*.



Device Manager Menu Bar

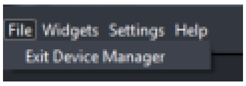


Device Manager Menu Bar

The Menu Bar across the top of the interface is where you will find menu commands to all functions of the software. The different menus are:

- **File**: Closing the Device Manager.
- **Widgets**: Access to all the docking widgets, advanced mode and reset view toggle.
- **Settings**: Access to the Device Manager Configuration module and the System Log widget.
- **Help**: About information for the current release of Device Manager.

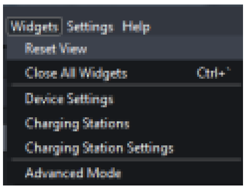
Device Manager File Menu



Device Manager File Menu

The **File** menu is where you can close the Device Manager when you click **File** > **Exit Device Manager**.

Device Manager Widgets Menu



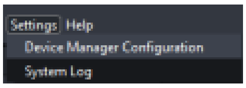
Device Manager Widgets Menu

The **Widgets** menu provides:

- Access to the dockable widgets: *Device Settings*, *Charging Stations* and *Charging Stations Settings*.
- Close and reset functions.
- Access to advance mode controls.

The docking widgets comprise of a 'float' and 'close' function. Floating a widget will detach it from the GUI, and allow you to drag it around the screen, or to another monitor. The close function will close the widget, at which point you must re-open it from the **Widgets** menu.

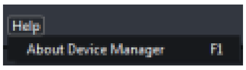
Device Manager Settings Menu



Device Manager Settings Menu

The **Settings** menu provides access to the *Device Manager Configuration* module and the *System Log* widget.

Device Manager Help Menu



Device Manager Help Menu

The **Help** menu provides access to the *About Device Manager* dialog box with information about the Device Manager, product version, and build number.

Device Manager Widgets

Table of contents:

Main Panel of Device Manager

When *Device Manager* launches, it displays the table of connected devices for TimeKeepers, Routers, Beacons and Mini Beacons on the Main panel, and the docking widgets for *Device Settings*, *Charging Stations*, *System Log*, and the *Charging Station Settings* tab.

The Main panel (center area) of the *Device Manager* displays the table of connected devices for the TimeKeepers, Routers, Beacons and Mini Beacons that are connected to the BlackTrax. Click on the *Device Type Filter* drop-down to choose which type of device to display: *All* or *TimeKeeper* or *Router* or *Beacon* or *Mini Beacon.*

Note: TimeKeepers and Routers may be connected to a Charging Station via the USB port on the back of the unit.

The Beacon, Mini Beacon, TimeKeeper, Router devices listed in the Main panel can each be selected and the settings of the selected device will be displayed in the *Device Settings* widget and available for modification. You can also select multiple devices to apply several settings at once.


Main panel of Device Manager

The configuration settings displayed in the Main panel are:

- *Refresh Selection***:** Click this button to update the selection in the list.
- *Device Type Filter*: Click this button to choose which type of device to display, *All* or *TimeKeeper* or *Router* or *Beacon* or *Mini Beacon*.
- **ID**: Identification number of the Beacon or Mini Beacon device.
  - The Beacon ID is different from its 3 LED IDs (aside from Beacon 1).
  - The Mini Beacon ID is the same as its LED ID.
- **Trackable**: Name of the Trackable to which this device is assigned within BlackTrax.
- **Type**: The type of devices such as TimeKeeper, Router or Beacon or Mini Beacon. Click the column heading *Type* to change the order of the list.
- **Status**: If the device is Connected or Disconnected.
- **Station**: Identification of the Charging Station where the device is currently plugged, or USB if plugged via USB. Mini Beacons display the port where it is plugged in on the Sync Dock (for example: *101:1* is Port 1 on Sync Dock 101).
- **Battery**: Percentage level of the battery life.
- **Radio**: Shows if the radio signal from the connected device is On or Off. The Mini Beacons do not have radio and will not be reflected in this column.
- **Version**: The firmware version of the connected device.
- **Preset**: Displays the assigned Preset number if the settings of the connected device match a Preset configuration or Custom if the settings have been modified.
- **Calibration**: Indicates if the device is a calibration Beacon.
- **Notes**: Displays packets of feedback information that is sent to the device for firmware upload.

Note: When a device is added to the list, it stays in the table, even if disconnected (will display status as Closed). When a device is added again, it will compare the unique hardware IDs to determine if the same device or not, and will update its previous location in the table.

Device Manager Device Settings

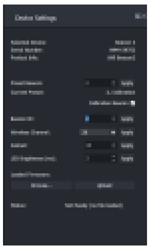
The *Device Settings* widget displays the properties and settings for the control of the devices connected to the Charging Stations and Sync Docks. Each device type (Beacon, Mini Beacon, TimeKeeper, Router) has unique settings and properties. The *Device Settings* widget for each device type displays different settings.

When a device is selected in the Main Panel, the *Device Settings* widget will display the preset settings by default.

Device Settings for a Beacon

To open device settings widget for a Beacon

1. In the Main Panel, click on the Beacon that you want to select.
   - **Result:** The *Device Settings* widget displays the settings of the selected Beacon.



- **Selected Device**: The type and ID number of the selected Beacon.
- **Serial Number**: The serial number of the selected Beacon.
- **Product Info**: The additional information or name that was set to identify the selected Beacon.

To change the settings in device setting for a Beacon

1. On the *Preset Beacon* scroll box, click the arrows and select the Preset Beacon number (or type a new number, from 1-85).
2. Click *Apply*.
   - **Result:**
     - The default Beacon settings based on the selected Preset Beacon are applied to the selected Beacon. Preset Beacon settings contain *Beacon ID*, *Wireless Channel*, *Subnet*, *LED Brightness*, and other system level settings.
     - **Current Preset** displays the current preset settings under a preset Beacon ID (i.e. 3, Calibration), or **Custom** when the settings of the Beacon were changed and currently do not match a Preset Beacon.
3. Select the *Calibration Beacon* checkbox if the selected Beacon should be programmed as a calibration unit. A Calibration Beacon automatically transmits signal packets faster.
   - **Note:** To unassign a Beacon as a Calibration Beacon, clear the checkbox and re-apply the Preset Beacon.
4. On the *Beacon ID* scroll box, click the arrows and select a Beacon ID number (or type a new number, from 1-85) if you want to customize the ID of the Beacon.
5. Click *Apply*.
   - **Result:** The Beacon ID number is changed and the Current Preset displays Custom.
6. On the *Wireless Channel* scroll box, click the drop-down list and select the Wireless Channel number if you want to change the previously assigned Wireless Channel.
7. Click *Apply*.
   - **Result:** The Wireless Channel is changed and the Current Preset displays Custom.

8. On the *Subnet* scroll box, click the arrows and select the wireless Subnet number (or type a new number) that devices on the same Wireless Channel will use to communicate.
9. Click *Apply*.
    - **Result:** The Subnet is changed and the Current Preset displays Custom.
10. On the *LED Brightness (ms)* scroll box, click the arrows and select the length of exposure (in milliseconds) (or type in a number, from 1-8) to increase or decrease the brightness of the LED.
11. Click *Apply*.
    - **Result:** The LED Brightness is changed and the Current Preset displays Custom.
    - **Note:** The increase in the level of LED Brightness will decrease the battery life of the Beacon but may result in the LED being seen at farther distances. (Default = 3ms)
12. In the **Loaded Firmware** section, a device firmware can be located, selected and uploaded into the selected Beacon(s).

To upload a firmware

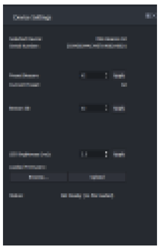
1. Click *Browse* and select the firmware file and load into memory.
2. Click *Upload*.
    - **Result:** The upload proceeds and the firmware upload process is displayed in the **Status** section.
3. *Device Manager* checks if the selected device matches the firmware.
4. The firmware update begins.
5. When firmware update is complete, a checksum is performed to verify the upload.
6. When checksum is complete, the device reboots.

- **Status**: Displays the current state of the firmware in the selected device.
    - Not Ready (no file loaded)
    - Ready (file loaded/previous flash complete)
    - Preparing...(jumping to boot loader)
    - Flashing...(Actually flashing the device)
    - Verifying...(checksum)
    - Finishing up...(jumping to main)

Device Settings for a Mini Beacon

To open device settings widget for a Mini Beacon

1. In the Main Panel, click on the Mini Beacon that you want to select.
    - **Result:** The *Device Settings* widget displays the settings of the selected Mini Beacon.



- **Selected Device**: The type and ID number of the selected Mini Beacon. The Mini Beacon ID is the same as its LED ID.
- **Serial Number**: The serial number of the selected Mini Beacon.

To change the settings in device settings widget for a Mini Beacon

1. On the *Preset Beacon* scroll box, click the arrows and select the Preset Beacon number (or type a new number, from 1-255).

2. Click *Apply*.
    - **Result:**
        - The default Mini Beacon settings based on the selected Preset Beacon are applied to the selected Mini Beacon. Preset Beacon settings contain *Beacon ID, LED Brightness*, and other system level settings.
        - **Current Preset** displays the current preset settings under a preset Beacon ID (i.e. 3), or **Custom** when the settings of the Mini Beacon were changed and currently do not match a Preset Beacon.
3. On the *Beacon ID* scroll box, click the arrows and select a Beacon ID number (or type a new number, from 1-255) if you want to customize the ID for the Mini Beacon.
4. Click *Apply*.
    - **Result:** The Beacon ID number is changed and the Preset Beacon ID is updated (provided the brightness remains at 2.5ms).
5. On the *LED Brightness (ms)* scroll box, click the arrows and select the length of exposure (in milliseconds, or type in a number, from 1-8) to increase or decrease the brightness of the LED.
6. Click *Apply*.
    - **Result:** The LED Brightness is changed and the Current Preset displays Custom.
    - **Note:** The increase in the level of LED Brightness will decrease the battery life of the Mini Beacon but may result in the LED being seen at farther distances. (Default = 2.5ms)
7. In the **Loaded Firmware** section, a device fimware can be located, selected and uploaded into the selected Mini Beacon(s).

To upload a firmware

1. Click *Browse* and select the firmware file and load into memory.
2. Click *Upload*.
    - **Result:** The upload proceeds and the firmware upload process is displayed in the Status section.
3. *Device Manager* checks if the selected device matches the firmware.
4. The firmware update begins.
5. When the update is complete, the device reboots.

- **Status**: Displays the current state of the firmware in the selected device.
    - Not Ready (no file loaded)
    - Preparing firmware file upload
    - Transferring firmware file
    - File loaded, ready to upload

Device Settings for a TimeKeeper

To open device settings widget for a TimeKeeper

1. In the Main Panel, click on the TimeKeeper that you want to select.
    - **Result:** The *Device Settings* widget displays the settings of the selected TimeKeeper.

- **Selected Device**: Displays TimeKeeper.
- **Serial Number**: The serial number of the selected TimeKeeper.
- **Product Info**: The additional information or name that was set to identify the selected TimeKeeper.

To change the settings in device settings for a TimeKeeper

1. Click on the *Wireless Channel* drop-down arrow and select the Wireless Channel number from the

drop-down list if you want to change the previously assigned Wireless Channel.
2. Click *Apply*.
3. On the *Subnet* scroll box, click the arrows and select the Subnet number (or type a new number) that devices on the same Wireless Channel will use to communicate.
4. Click *Apply*.
5. In the **Loaded Firmware** section, a device firmware can be located, selected and uploaded into the selected TimeKeeper(s).

Note: The Mini Beacon must connect to the latest TimeKeeper (Rev J) model. Contact BlackTrax Technical Support (CAST) for the firmware version required to run Mini Beacons with the TimeKeeper, Router and Beacons.

To upload a firmware

1. Click *Browse* and select the firmware file and load into the memory.
2. Click *Upload*.
    - **Result:** The upload proceeds and the firmware upload process is displayed in the **Status** section.
3. *Device Manager* checks if the selected device matches the firmware.
4. The firmware update begins.
5. When firmware update is complete, a checksum is performed to verify the upload.
6. When checksum is complete, the device reboots.

- **Status**: Displays the current state of the firmware in the selected device.
    - Not Ready (no file loaded)
    - Ready (file loaded/previous flash complete)
    - Preparing...(jumping to boot loader)
    - Flashing...(Actually flashing the device)
    - Verifying...(checksum)
    - Finishing up...(jumping to main)

Device Settings for a Router

To open device settings widget for a Router

1. In the Main Panel, click on the Router that you want to select.
    - **Result:** The *Device Settings* widget displays the settings of the selected Router.

- **Selected Device**: Displays Router.
- **Serial Number**: The serial number of the selected Router.
- **Product Info**: The additional information or name that was set to identify the selected Router.

To change the settings in device settings for a Router

1. Click on the *Wireless Channel* drop-down arrow and select the Wireless Channel number from the drop-down list if you want to change the previously assigned Wireless Channel.
2. Click *Apply*.
3. On the *Subnet* scroll box, click the arrows and select the Subnet (or type a new number) that devices on the same Wireless Channel will use to communicate.
4. Click *Apply*.
5. In the **Loaded Firmware** section, a device firmware can be located, selected and uploaded into the selected Router(s).

To upload a firmware

1. Click *Browse* and select the firmware file and load into the memory.
2. Click *Upload*.
    - **Result:** The upload proceeds and the firmware upload process is displayed in the **Status** section.
3. *Device Manager* checks if the selected device matches the firmware.
4. The firmware update is complete, a checksum is performed to verify the upload.
5. When checksum is complete, the device reboots.

- **Status**: Displays the current state of the firmware in the selected device.
    - Not Ready (no file loaded)
    - Ready (file loaded/previous flash complete)
    - Preparing...(jumping to boot loader)
    - Flashing...(Actually flashing the device)
    - Verifying...(checksum)
    - Finishing up...(jumping to main)

Device Manager Charging Stations

The *Charging Stations* widget displays identification, firmware information, and status of all connected remote Charging Stations for BTBeacons and remote Sync Docks for Mini Beacons .

In the *Charging Stations* widget, you can select and display a Charging Station or Sync Dock, and the settings of the selected Charging Station or Sync Dock will be displayed in the *Charging Station Settings* widget.

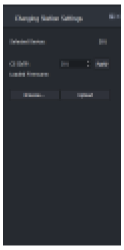
The *Auto Get (minutes)* scroll box on the *Charging Stations* widget sets the length of time interval when *Device Manager* will auto poll devices for connected Charging Stations, Sync Docks, and their connected devices.

The *Charging Stations* widget displays the following settings:

- *Connect*:
  - Click this button to connect the newly added Charging Station or Sync Dock.
  - For Sync Docks, click this button to apply the ID change after a firmware upload is complete.
- *Get Beacon List*: Click this button to poll the connected Charging Stations and Sync Docks for all connected Beacons and Mini Beacons and then add them to the main list.
  - **Note:** Sync Docks update its status once every 5 minutes. When connecting or disconnecting Mini Beacons, click *Get Beacon List* for the up to date reporting.
- *Auto Get (minutes)*: Click the *Up* or *Down* arrows or type a value to set the length of time interval when *Device Manager* auto polls all devices for connected Charging Stations, Sync Docks, and their connected devices.
- **ID**: Identification number of the Charging Station or Sync Dock in the range between 101 to 254. The default ID number is 201. The ID will always match the last octet of the IP Address (ID 201 = 10.133.5.201).
  - **Note:** For Sync Docks, 30 seconds after a firmware upload is complete, the ID changes will take effect only after you click *Connect*.
- **Type:** Charging Station or Sync Dock.
- **Serial Number**: The serial number of the hardware.
- **IP Address**: The network IP address where the Charging Station or Sync Dock is connected.
- **Status**:
  - Connected or Disconnected.
  - For Sync Docks, when firmware is uploading, the **Status** column will display *Disconnected* and the **Notes** column will display the warning text *Please wait up to 30 seconds, then click Connect for ID change to take effect*.
- **Version**: Firmware version.
- **Notes**: Other information.

Device Manager Charging Station Settings

The *Charging Stations Settings* widget is where you configure the settings of a selected remote Charging Station or Sync Dock. When you select a Charging Station or Sync Dock in the *Charging Stations* widget, the settings of the selected Charging Station or Sync Dock will be displayed in the *Charging Station Settings* widget.



- **Selected Device**: Identification number of the selected Charging Station or Sync Dock.
- **CS ID/IP**: Type the ID of the selected Charging Station or Sync Dock, then click *Apply*.
- **Loaded Firmware**: In this section, a device firmware can be located, selected and uploaded into the selected Charging Station or Sync Dock.

To upload a firmware

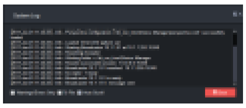
1. Click *Browse* and select the firmware file and load into the memory.
2. Click *Upload*.
    - **Result:** The upload proceeds and the firmware upload process is displayed in the Status section.
3. *Device Manager* checks if the selected device matches the firmware.
4. The firmware update is complete, a checksum is performed to verify the upload.
5. When checksum is complete, the device reboots.

- **Status:** Displays the current state of the firmware in the selected device.
    - Not Ready (no file loaded)
    - Ready (file loaded/previous flash complete)
    - Preparing...(jumping to boot loader)
    - Flashing...(Actually flashing the device)
    - Verifying...(checksum)
    - Finishing up...(jumping to main)

Device Manager System Log

Data collected from events which occur in the *Device Manager*, such as system messages, configuration changes, and other events can be displayed in the *System Log* widget. This information can be saved into a separate file for review later.

The *System Log* widget displays the date and time of the event, type of data, and the information.

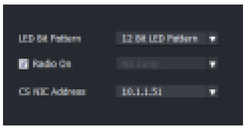


In the *System Log* widget, the checkboxes available to choose what and how messages are displayed or logged.

- *Warnings/Errors Only*: Select this checkbox to log and display only the notifications that indicate errors that occurred or predictive warnings.
- *To File*: Select this checkbox to record all Device Manager data and events into a remote file, marked with the current date and time. This file is saved at "C:\bt_run_time\Device Manager".
- *Auto Scroll*: Select this checkbox to automatically scroll to the most recent data or event that has occurred.
- *Clear*: Click this button to clear all messages.

Device Manager Configuration

The *Device Manager Configuration* widget is where you can configure the settings for the *Device Manager* application, such as Beacon LED Bit Pattern, Radio Status, and the Charging Station Network Address.



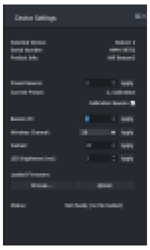
To configure the settings of the device manager

1. From the **Settings** menu of the *Device Manager*, choose **Device Manager Configuration**.
    - **Result:** The *Device Manager Configuration* window appears.
2. On the *LED Bit Pattern* scroll box in the *Device Manager Configuration* window, select the LED Bit Type that will apply to the Beacons connected to the Device Manager.
    - **Attention:** Beacon LEDs are identified by flashing a specific bit code unique to that LED. Higher Beacon indexes can be created with the higher bit codes (thus more Beacons) which will add more latency to the system. A real system is based on 12-bits.
3. Select the *Radio On* checkbox to indicate when a device is connected that its radio should stay on. *Radio On* checkbox is clear by default.
4. The jump settings scroll box displays how the Device Manager behaves when a new device is connected to the Charging Station. These jump settings are accessible in Advanced Mode.
    - *No Jump*: By default, the device will apply whatever it's firmware is set to.
    - *Jump to Bootloader*: Device Manager sets the device to jump to its bootloader.
    - *Jump to Main Firmware*: Device Manager sets the device to jump to the main firmware.
5. On the **CS NIC Address** scroll box, select the address for the Network Interface Card for the Charging Station that is connected to the BlackTrax System. Charging Stations are locked to the 10.133.5.x network.

Common Functions of the Device Manager

To set preset Beacons

The use of *Preset Beacon* numbers acts as an easy and convenient way to configure all perimeters of Beacons without manually entering all settings.

1. Connect the Charging Station to the BlackTrax System.
2. Open the *Device Manager*.
    - **Note:** All devices that are connected to the Charging Station are displayed in the *Device Manager* automatically showing the connection status and preset settings.
      
3. From the table in the Main panel of the *Device Manager*, select a Beacon.
    - **Result:** The *Device Settings* widget displays the settings (default preset or previously set custom settings) of the selected Beacon.
      
4. On the *Preset Beacon* scroll box of the *Device Settings* widget, scroll and select the Preset Beacon number.
5. Click *Apply*.
    - **Result:** All the pre-programmed settings associated with Preset Beacon number is applied to the selected Beacon.
    - **Note:**
        - **Current Preset** displays the current preset settings under a preset Beacon ID (i.e. 3, Calibration).
        - You may select several Beacons which assigns all Beacons with a different preset number, incrementing by 1.
6. Select the *Calibration Beacon* checkbox if you want to set the Beacon as a calibration unit.
    - **Result:** The Calibration Beacon is set at Time Slot 1 and IMU is enabled. A Calibration Beacon automatically transmits signal packets faster.
    - **Note:** To unassign a Beacon as a Calibration Beacon, you must uncheck the checkbox and re-apply the Preset Beacon.

Example of the Preset Beacon settings:

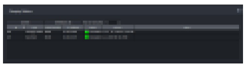
- Current Preset: 2
- Wireless Channel: 26
- Subnet: 35
- LED Brightness: 3ms

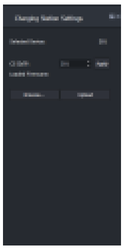
To upload firmware from device settings

1. In the *Device Settings* widget of a selected device, click *Browse* and select the firmware file and load into memory.
2. Click *Upload*.
    - **Result:** The upload proceeds and the firmware upload process is displayed in the Status section.
3. *Device Manager* checks if the selected device matches the firmware.
4. The firmware update begins.
5. When firmware update is complete, a checksum is performed to verify the upload.
6. When checksum is complete, the device reboots.
7. Status resets to display "Ready" if a file is loaded, or "Not Ready" if no file is loaded.

To program charging stations

When *Device Manager* opens, all devices that are connected to the Charging Station are automatically displayed in the *Device Manager* widget showing the connection status and the latest applied settings.



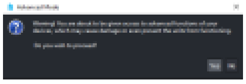
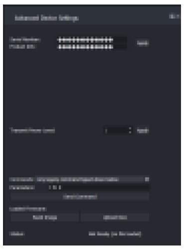
1. Select a Charging Station from the list in the Charging Stations widget.
    - **Result:** The *Charging Station Settings* widget displays the identification number of the selected Charging Station. The ID number includes the network address information.
      
2. If you added or replugged a Charging Station to the system, click *Connect* to check the network for any Charging Station on the system.
    - **Note:** When you add a new Charging Station into the system or if the Charging Station was unplugged from the system, you may need to enable the connection again.
3. If you added or replugged a Charging Station with Beacons, click *Get Beacon List* to poll the Charging Stations and update the main list with any connected Beacons.
    - **Note:** When you add a new Charging Station into the system or if the Charging Station was unplugged from the system, you may need to refresh the list of devices connected to the Charging Station.

To upload firmware from charging station settings

1. Select a Charging Station from the *Charging Stations* widget.
    - **Result:** The *Charging Station Settings* widget displays the settings of the selected Charging Station.
2. In the *Charging Station Settings* widget of the selected Charging Station, click *Browse* and select the firmware file and load into memory.
3. Click *Upload*.
4. *Device Manager* checks if the firmware matches the selected device and proceeds to update.

To configure TimeKeeper for USB camera system

Note: Connect the TimeKeeper to the BlackTrax server via a USB cable.

1. Open *Device Manager.*
2. From the **Widgets** menu of the *Device Manager*, choose **Advanced Mode**.
   - **Result:** The *Advanced Mode* warning dialog box appears with cautionary information resulting from access to the advanced function of devices.
     
3. Click *Yes*.
   - **Result:** The *Advanced Device Settings* window appears.
     
4. On the Main panel, select the TimeKeeper.
5. On the *Advanced Device Settings* window, select *Any legacy command typed down below* from the **Commands** drop-down menu.
6. Ensure *Trace* is enabled. The status log reports show **- >** as an indicator at the beginning of the line.
7. If *Trace* is disabled, type "*t 0*".
   - **Result:** **- >** appears in the status log reports.
8. On the *Parameters* field, type "*t 51 9*".
9. Click *Send Command*.
10. Type "*t 0*" again to disable *Trace*.
    - **Result:** **- >** disappears from the status log reports.

Attention: After completing these steps, you must select **Basic Mode** from the **Widgets** menu to close the *Advanced Mode* window.

Health and Safety Information

Table of contents:

BTBeacon Lithium-Ion Battery Information

The BTBeacon contains a rechargeable lithium-ion battery that is used to power the device. Improper use of a lithium-ion battery can result in fire or serious injury. Please read and understand the following general warnings on lithium-ion batteries.

General Warnings

- Do not place the battery near fire, heaters, other high temperature locations, or apply heat to the device.
- Do not pierce the battery with any sharp objects, strike with heavy objects, or otherwise damage the casing.
- Do not expose the battery to water or any other type of liquid, or allow the device to get wet.
- Never short-circuit, damage or heat the battery to approximately 60°C (140°F) ±.
- If the lithium-ion battery does catch fire, it may burn even more violently if it comes into contact with water or moisture in the air. DO NOT THROW WATER ON A BURNING BATTERY OR ITS LITHIUM-ION BATTERY! A fire extinguisher must be used.

Shipping Information

When transporting lithium-ion batteries, the following regulatory guidelines are followed:

- Section II of Packing Instructions 965 for Lithium Ion Battery Pack.
- UN manual of Tests and Criteria, Part III, sub-section 38.3 (withstanding a 1.2M Drop Test).
- The content of Lithium is less than 100Wh per battery.
- The quantity per package is less then 10kg (gross) for UN3480. Thus the consignment is not classified as dangerous goods.

Mini Beacon Lithium-Ion Battery Information

The Mini Beacon contains a rechargeable lithium-ion battery that is used to power the device. Improper use of a lithium-ion battery can result in fire or serious injury. Please read and understand the following general warnings on lithium-ion batteries.

- Name: Rechargeable Li-ion Polymer Battery
- Model: ABI-H493027
- Description: Single Cell Lithium ion Battery
- Watt-hour: 1.11 Wh
- Weight: 6.3 g
- Size: 30.5 x 30.1 x 4.95 mm

General Warnings

- Do not place the battery near fire, heaters, other high temperature locations, or apply heat to the device.
- Do not pierce the battery with any sharp objects, strike with heavy objects, or damage the casing.
- Do not expose the battery to water or any other type of liquid, or allow the device to get wet.
- Never short-circuit, damage, or heat the battery to approximately 60°C (140°F).
- If the lithium-ion battery catches fire, it may burn even more violently if it comes into contact with water or moisture in the air.
- DO NOT THROW WATER ON A BURNING BATTERY OR ITS LITHIUM-ION BATTERY! A fire extinguisher must be used.

Shipping Information

When transporting lithium-ion batteries, the following regulatory guidelines are followed:

- UN 3481 (PI967) - Lithium Ion Batteries contained in equipment (Section 2). Equipment must be packed in strong outer packaging that conform to the below.
- Net quantity of Lithium Ion cells or batteries per package:
  - Passenger: 5 kg
  - Cargo: 5 kg
- The content of Lithium-ion is less than 100 Wh per battery.
- Section II of Packing Instruction 965 for Lithium Ion Battery Pack.

Additional Requirements:

- The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
- Cells and batteries must be protected to prevent short circuits.
- The equipment must be packed in strong outer packaging constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained.
- Each package containing more than four cells, or more than two batteries installed in equipment (including circuit boards).
- Each consignment with packages bearing the lithium battery handling label must be accompanied

with a document with an indication that:
    - the package must be handled with care and that a flammability hazard exists if the package is damaged;
    - special procedures must be followed in the event the package is damaged, to include inspection and repacking if necessary; and
    - a telephone number for additional information.
- Where a consignment includes packages bearing the lithium battery handling label, the words "Lithium Ion Batteries in compliance with Section II of PI967" must be placed on the air waybill, when an air waybill is used.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.