TiMax TrackerD4
User Manual

V1.8 - April 2023

Precision Stagetracking for Sound, Light and Video

OSC	TiMax
PosiStageNet	DS100
sACN	GrandMA
Art-Net	Disguise

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How it works

Combining technologies to achieve high accuracy location

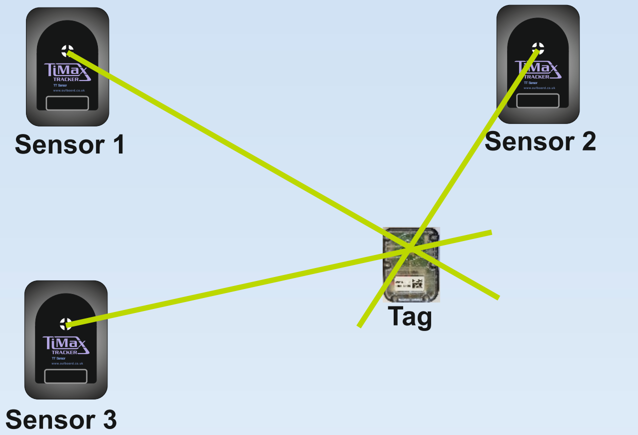
Each TTd4 Tag transmits a continuous stream of very short low energy radio frequency data packets containing its ID.

The packets are detected by the TTd4 Sensors which measure the Angle of Arrival at each sensor and the Time Difference of Arrival between each pair of sensors.

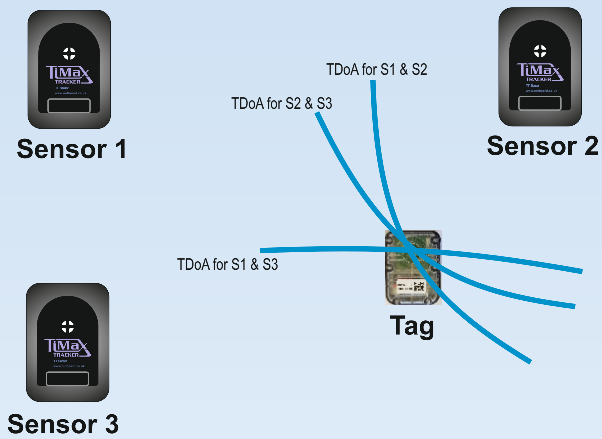
The Location Engine software is able to calculate the location of the tag by applying the measured angles and times to a virtual geometric model of the space using the known sensor positions and calibrated interconnection cable lengths.

The unique combinations of tracking technologies allow a tag to be located accurately in 3D when seen by only two sensors, this compares favourably with TDoA only tracking systems where typically 5 sensors must see a tag for a 3D location and yields much more robust tracking than AoA only based technologies which are highly susceptible to errors due to multi-path reflections.

AoA



TDoA



Location using Angle of Arrival (AoA)

Sensors are equipped with an internal multiple antenna array that allows each sensor to measure the angle on incidence of the radio frequency pulse transmitted by the tag.

The software contains a geometric model of the space and so from the reported angles of arrival at the sensors, the software can determine the position of the tag.

Location using Time Difference of Arrival (TDoA)

All the sensors are synchronised to a highly accurate clock signal allowing the software to measure the Time Diference of Arrival between each pair of sensors of the radio frequency pulse transmitted by the tag.

The software contains a geometric model of the space and from the reported time differences can determine the position of the tag by working out where the TDoA curves intersect.

Considerations for best performance

At least 2 sensors must see the tag to make a location and if more sensors see the tag from different points of view the accuracy will be enhanced further.

Ensure that the area to be tracked is covered by sensors from the front, behind and at the sides, it is very important that the tag is seen from as many points of view as possible for accurate location.

The RF pulse transmitted by the tag is very high frequency and low energy and will not pass through a human body.

Ensure the tag is worn by the performer in a position to ensure best all round visibility to the sensors from all points of view. Best tag positions are in hats and wigs. Tags mounted at the nape of the neck or in-between shoulder blades are also a good positions. The usual position is in a pouch on the radio belt. Try to find places where the tag is most visible from the widest possible angle and minimally shadowed by the wearers anatomy, i.e. arms and spare tyres.

Costume material can also have an effect on tracking performance - metallic thread and sequins can have a detrimental effect.

Study set construction and materials and choose sensor locations to minimise possible multipath reflections caused by metallic or foil surfaces that may reflect radio frequency signals.

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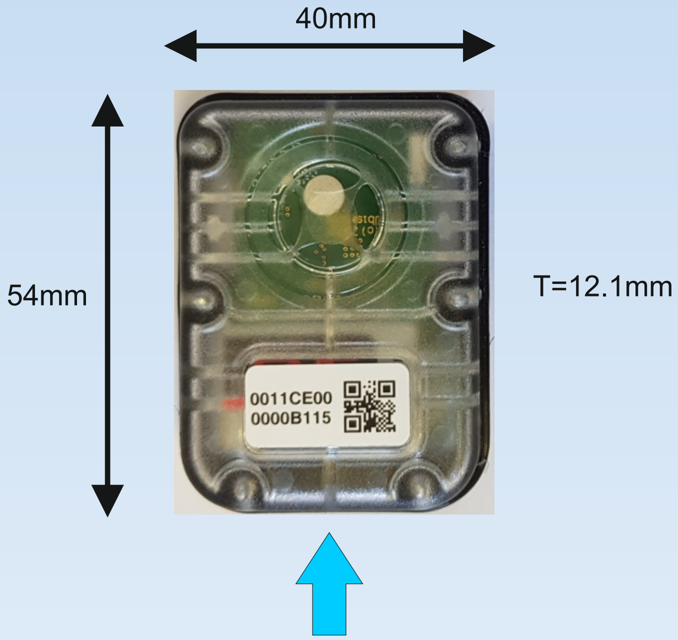
Tag Information

TTd4 Tags are supplied factory programmed with their update rate and while active will continue to transmit location pulses. Tags are activated and de-activated using a magnet. Tags will run for several months (depends on update rate) and indicate low battery status when the battery is discharged by around 90%.

Tag Activation



Magnetically activated on/off switch next to LED
Dull red component 6mm x 1mm
visible through the case.

To activate the tag hold a magnet here for 5 seconds, the LED will start blinking to indicate tag active.

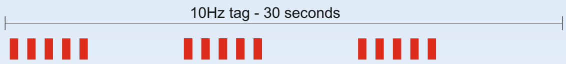
To turn off, hold a magnet here for 5 seconds, when the LED goes solid red remove the magnet and the LED will extinguish.

Tag Activity and Battery Indication

End view of tag
showing magnetic reed switch and LED

Blinking LED indicates tag on and running
At the standard 10Hz update rate the battary life expectancy for 24/7 operation is around 3 months

Continuous blinking LED indicates battery OK



Interrupted blinking LED indicates battery change due.
The tag will continue operating for 2-3 days.

From tag turn on it takes 2-3 min to go into interrupted blink mode if the battery voltage is less than 3v.

TTd4 Tag Specifications

Dimensions: 54mm x 40mm x 14mm (2.1" x 1.6" x 0.6")
Weight: 28g (1.0 oz.)
Temperature: -40°C to 85°C (-40°F to 185°F)
Humidity: 0 to 95%, non-condensing
Enclosure: UV-stabilised polycarbonate enclosure, silicone gasket V-0 flammability-rated Ingress protection to IP67 and IP69K
Update rate: Standard 10/20/50Hz, other custom frequencies are available
Peripherals: Activity feedback LED Magnetic reed switch (operable through enclosure) Motion detector
Radio frequencies: Ultra-wideband channel: 6 - 7GHz Telemetry channel (optional): Narrow-band 2.4GHz
Certifications: US: FCC Part 15 FCC ID SEAMOD31
EU: CE
Canada: RSS-Gen, RSS-102, RSS-210, RSS-220 Industry Canada ID 8673A-MOD31
Power supply: Replaceable lithium thionyl chloride battery (LTC-7PN)
Reliability: Estimated Mean-Time-Before-Failure (MTBF): 25 years

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Sensor Information

TTd4 ultra-wideband (UWB) sensors are precision measurement devices, containing an array of antennas and ultra-wideband radio receivers. The sensors detect UWB pulses from the tags, allowing the location system to find the tag positions with high accuracy.
Sensors are directional which means they have a high level of rejection of noise and other signals outside of their field of vision. Orientation of the sensor with respect to the tracked area is important.

Sensor Connection

Sensors are provided with an Ethercon Rj45 connector which carries PoE power, network data and a timing signals. Sensors are synchronised with each other to within a fraction of a nanosecond using signals sent between them on spare lines of the Ethernet cables, network data and timing signals are combined in the passive Timing Hub.

Sensors can run without any synchronisation in an AoA-only positioning mode.

Sensor LEDs

The top tri-colour LED indicates boot status and will repeatedly flash a four colour sequence as an error code if it fails to boot. Refer to the Boot Process document for details.

The 3 LEDs at the bottom are Network Status LEDs

Top LED (Red). If this LED is on, the Ethernet link has been established.

Middle LED (Green) - on indicates activity on the Ethernet link.

Bottom LED (Yellow) - shows the speed of the Ethernet link.

If the LED is off, the speed is 10 Mbps

If the LED is on, the speed is 100 Mbps

Sensor Specifications

Power Supply - Power-over-ethernet IEEE 802.3af compatible

Temperature Range - -40 to 149 (-40 to 65 ”)

Humidity - 0 to 95% non-condensing

Protection levels IP30

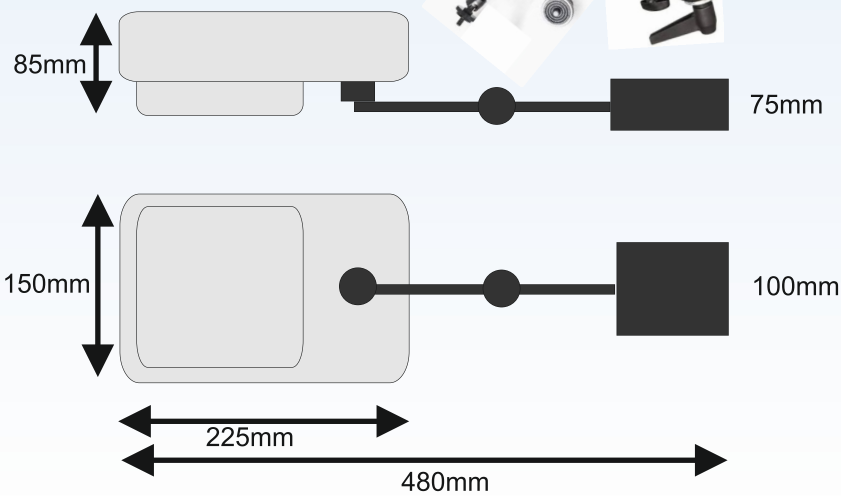
Case - Black UV Stabilized Ip30

Radio Frequency - Ultra-wideband channel 6 - 7GHz

Connections - 1 x Ethercon

Certifications - US: FCC Part 15 FCC ID SEASENSOR30, Canada: RSS-GEN, RSS-210, RSS-220; IC: 8673A-SENSOR30, EU: CE

TTd4 Sensor with magic arm and Superclamp



Sensor 4 pack case

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POE Timing Hub Information

Passive Timing Hub

In order to provide a single cat5 cable run to each sensor from a single point, the passive timing hub provides the system wtih a means of combining the network and timing signals needed by the sensor and passing the timing signals from the master sensor along the timing chain to downstream sensors.

The timing signal is necessary for Time Difference of Arrival operation.

If multiple hubs are required, the timing signal can be bridged between them, if this is not possible, each hub can run it's own timing master sensor.

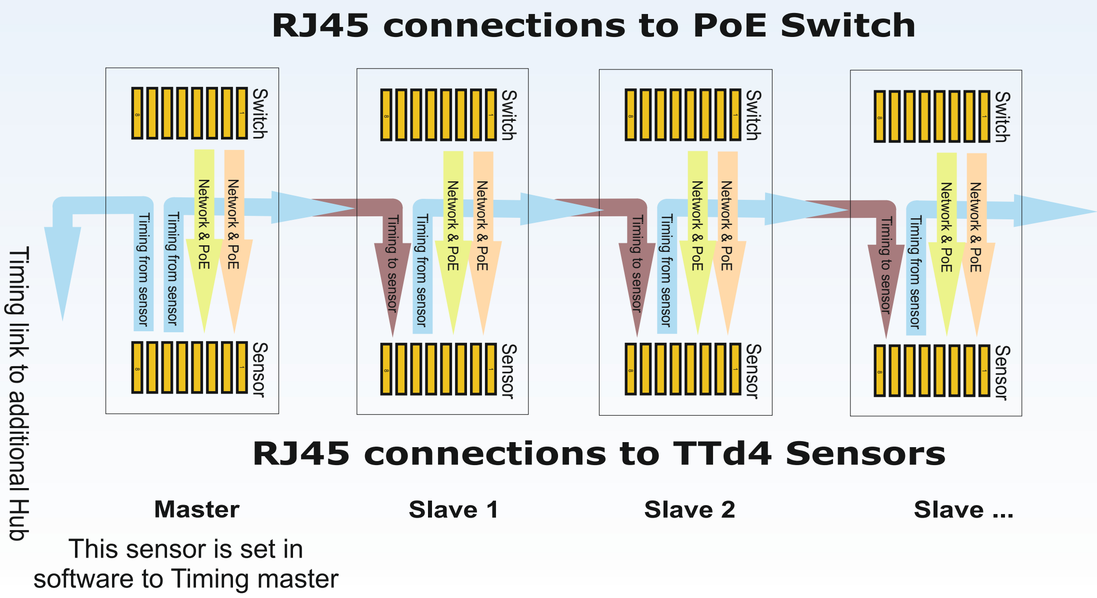
Connections

It IS important that the connections in the Hub are sequential, if there are less than 8 sensors connected to the Hub, there must be no empty Etercon connections between the Master and the highest number slave so if there are 3 sensors they must be connected to Master, Slave 1, Slave 2. If the connectors are not sequential then the timing signal chain will not be complete.

There are 2 ways to run a dual hub configuration:

All sensors running in a single timing tree - the timing signal link between the two hubs makes this happen.... the sensors on the 'A' hub have one sensor configured as the master (this MUST be connected to the Master position either hub) and the other 7 sensors are configured as slaves. The master sends the timing signal to the 'B' hub on the timing link cable. The 'B' hub sensors are ALL configured as slaves including the sensor connected to the Master connector... the two groups of sensors will then be synchronised.

It is also possible to configure a dual hub system with 2 separate timing trees, in this case the 2 groups of sensors will not be able determine TDoA data between any sensor on the 'A' timing tree and any sensor on the 'B' timing tree, they will share AoA information.. the result may be slightly reduced tracking performance in overlapped coverage areas where both 'A' and 'B' sensors can see the tag.



TiMax TRACKER d4

PC & Software

The TiMax TrackerD4 Location Engine Server PC can be supplied in laptop or rackmount format - the general specification includes an i7 processor, 8GB ram and at least one Network Interface for connection to the sensors.
The PC is supplied complete with software installed and fully configured.

The TTd4 software installation includes a number of apps for various tasks - the most frequently used apps are listed below with a brief explanation of purpose.

Please refer to the software manual for detailed instructions.

Platform Control

Platform Control is where Platform Services required for tracking to operate are started and stopped.
Set directory path for active dataset.
Platform Services can be set to autostart on bootup.
Platform Services MUST be running for the tracking system to work.

Location System Configuration

Location System Configuration (LSC) is used to set up the tracking system, configure sensors, calibrate the system, log and review tracking performance.
LSC does not need to be running for the tracking system to work.

Service Manager

Service Manager is used primarily to install a dataset built on another computer as well as providing a visualisation of the status of services required for tracking to run.
Service Manager does not need to be running for the tracking system to work.

Tracker Translate

Tracker Translate converts the raw incoming tracking data to OSC, PosiStageNet and other protocols, also provides the operator with a performance overview. The app also provides tag naming, backup and override as well as filtering and anti jitter functions.
Tracker Translate MUST be running for the tracking system to work.

The TiMax TrackerD4 Location Engine is a comprehensive package including sensor firmware and server-based software components required to configure, coordinate and manage the TiMax TrackerD4 Precision StageTracking system. This includes:

- Code running on the sensors
- A set of services that run on a networked Linux or Windows server or servers
- A set of Windows-based GUI configuration tools

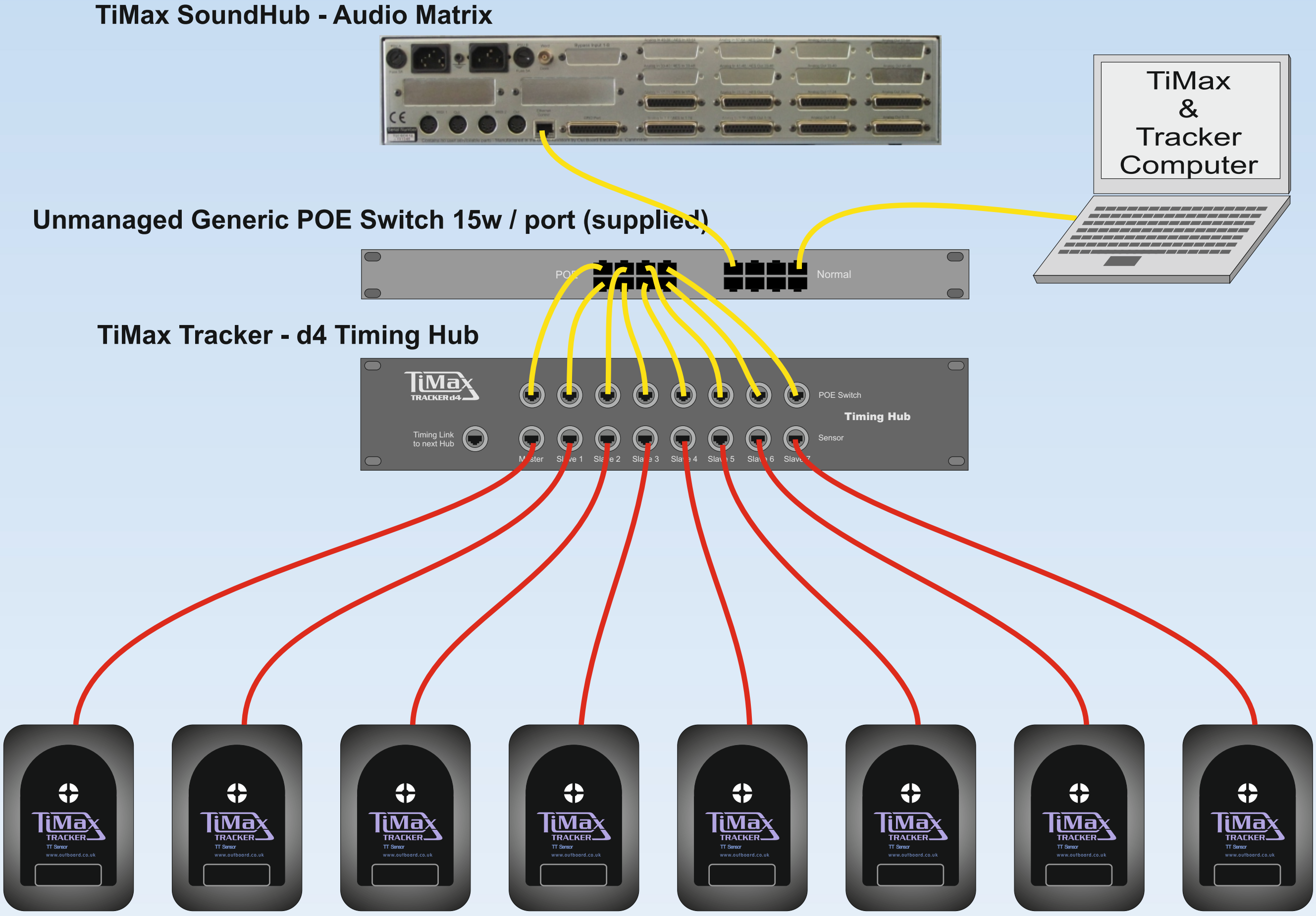
Scaleability and real-time performance lie at the core of the TiMax TrackerD4 architecture, allowing users to deploy sensor systems that scale from small installations running on a single machine through to large sites with several servers and thousands of sensors and tags.

- Management of initial sensor installation and configuration workflow
- Secure centralized management of configuration data for the sensor network
- Real-time coordination of the sensor network to share tag measurements between sensors
- Bayesian filtering of tag measurements to generate accurate tag location data
- Bulk storage and retrieval of measurement and location data for audit and review
- Health monitoring of the sensor network to support proactive maintenance

Interconnection
Single POE Timing Hub

Best Practice

Sensors, Hub and TiMax Tracker PC are connected on an isolated network of minimum complexity.
The TiMax PC should be connected to external networks via a second Network Interface Card (NIC)



Notes

Tracker Sensors are connected to the Timing Hub with shielded Cat5e (or better) cables - for outdoor use it is recommended to use Ethercon connectors. Maximum length 100m.

The Timing Hub is a passive hub for interconnection of timing signals between sensors carried on spare cores of the Cat5 cable.

The Timing Link connector on the Hub is used to interconnect the timing signal to a second hub for a 16 sensor system.

Sensors are POE powered and require around 10w per sensor.

Short patch cables from each POE port to the Hub provide IP data communications and power for the sensors, these lines are directly connected through the Hub from the POE port to the sensor port

One sensor is designated Timing Master in software, this sensor MUST be connected to the Master sensor port.

Slave sensors may be connected in any order but once the system is calibrated this order should not be changed

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Interconnection
Dual POE Timing Hubs

Larger Systems with 2 (or more) Hubs

The diagram below shows a typical 16 sensor system interconnection.
If it is not possible to link the Timing signal between 2 hubs, each group of sensors can run on its own local Timing synchronisation, this is achieved by defining a Timing Master for each Hub. In this case, each group of sensors will be able to resolve location using both TDoA and AoA and in coverage areas where sensors from both groups see the tag, the sensors will be able resolve location using AoA data shared between the sensor groups.

Dual hub setup with linked timing

The master sensor must be configured to output the timing signal on the Ethernet connector. Change the timing configuration as follows:
Start Location System Configuration

Navigate to the Sensor > Physical > Timing > Allow Ethernet Output parameter.

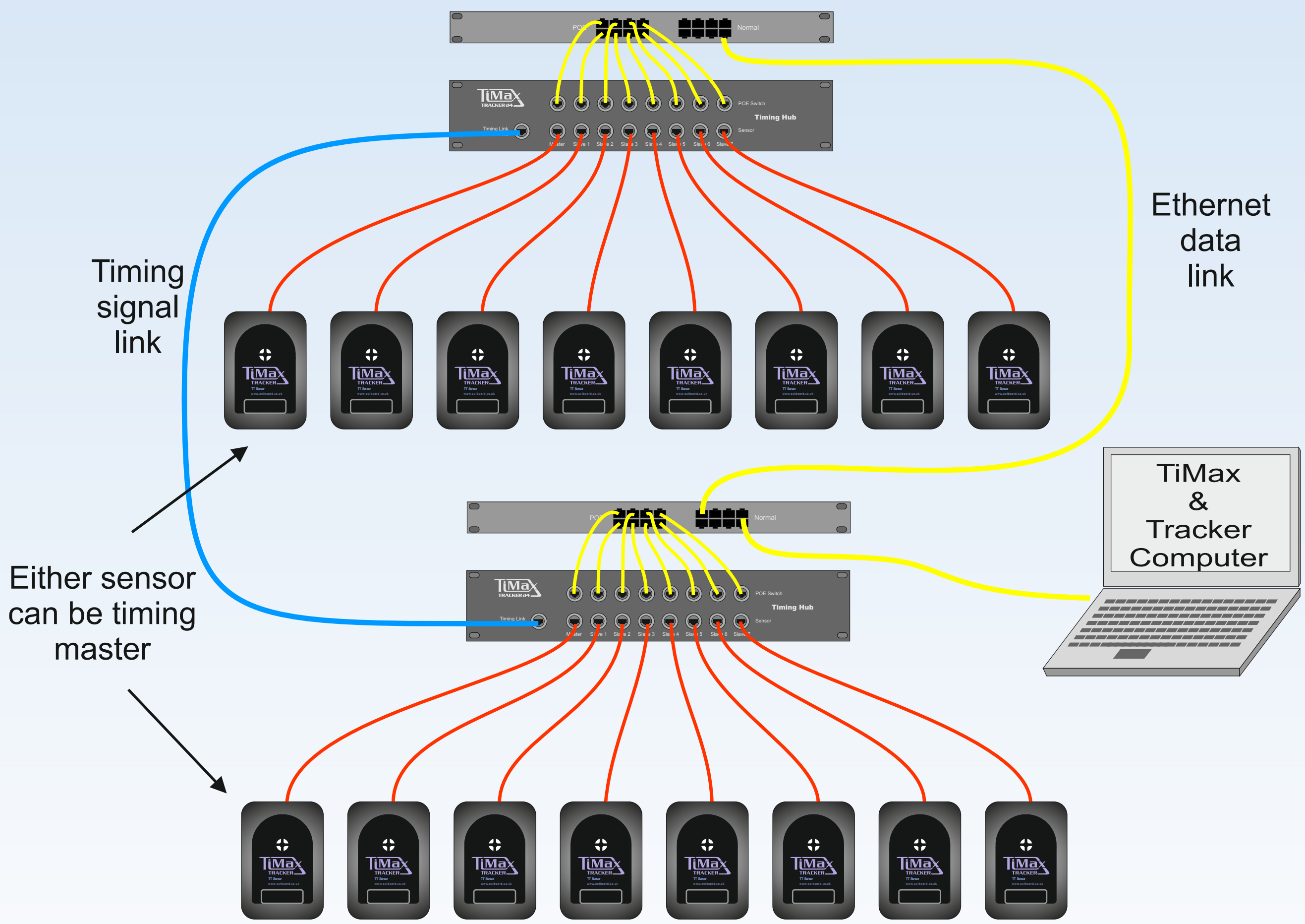
The parameter has the following values:
- False: the sensor is configured for timing input only on the Ethernet port.
- True: the sensor is configured to send timing output on the Ethernet port, if it does not receive timing from this port.

Double-click Allow Ethernet Output and set the parameter as required:
- To configure the sensor for both timing input and output, select the check box.
- To configure the sensor for timing input only, clear the check box.

Click Save.

Interconnection using Fibre Optical Networks

Installations on large sites can use Fibre networks for transport of the IP data signals
These connections are indicated in yellow on the drawing below.
Connections in red and blue MUST be direct connections on copper.



Yellow - IP data, can go over copper or fibre network

Red - Mixed IP and data non-IP Timing Clock, MUST go over copper

Blue - non-IP Timing Clock MUST go over copper

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Sensor Mounting

Sensors must be mounted with the spirit level at the bottom of the case level and the label text the right way up. The centre line of the field of vision projects forward perpendicular to the sensor case from the white spot just below the centre-line on the front.

Best Practice

The sensor cable should be pulled leaving a reasonable service loop of around 2 to 3 metres to allow repositioning of the sensor if required... for example if a lighting fixture is moved or added to a position that impairs the sensor performance. This is quite common.

Sensors should be mounted in a position where they are unlikely to be moved or inadvertently knocked out of position.

Make sure that sensors are mounted onto a solid support that will not move or change position.

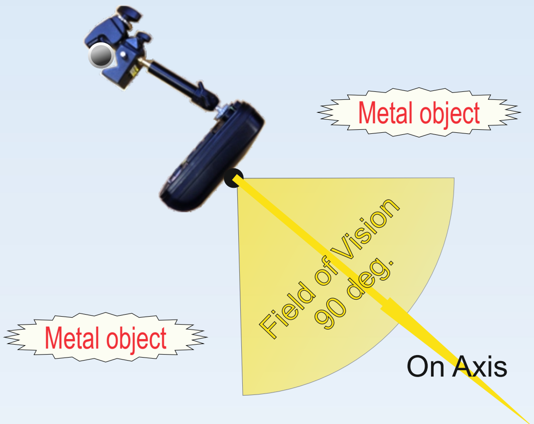
Choose sensor positions that will not have line of sight to the stage temporarily blocked by stage props or scenery.

Mount sensors in places where as much of the tracked (stage) area as possible within its field of vision

Evaluate potential sensor mounting positions in terms of offering access for repositioning the sensor if required.

Angle sensors such that their near-field vision is clear of any RF reflective surfaces, metal objects, walls, scenery. No metal or RF reflective objects or material in the sensor field of vision within minimium 3 metres from the sensor

Position sensors at least 3 metres away from any RF / WiFi transmitter or other potential source of RF interference.



Vertical position and angle

Sensor mounting height is not critical to system operation.

Experience has shown that mounting sensors at a height of 3-5 metres works well and achieves a good balance between proximity and body blocking issues, that is to say the sensors can see over the heads of performers between the sensor and the tracked character, while not being too far away.

Sensors mounted high should be positioned and angled down to avoid multipath reflections from overhead stage lights and fly bars and so as to see directly below.

Make sure the sensor is mounted forward of and metal or RF reflective objects below.

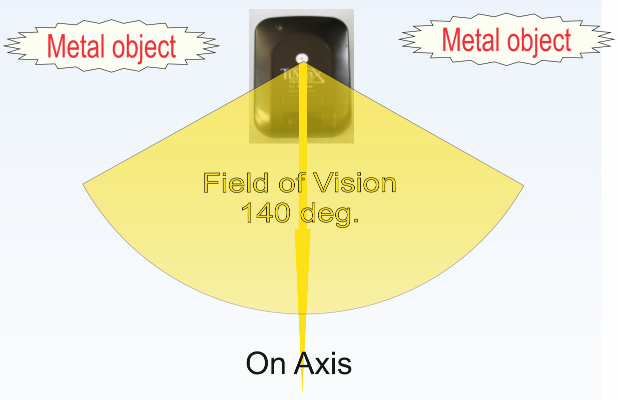
Horizontal position and angle

Position each sensor to see as much of the tracked (stage) area as possible.

Find locations for sensors that offer a full unobstructed view of the stage from as many different points of view or angles as possible.

Mount and angle sensors to be forward of any RF reflective objects or materials.

Angle sensors such that their field of vision excludes any RF transmitters in the near and mid field. Look out for 5GzWifi and comms system transmitters.



TiMax TRACKER d4

Sensor Positions

Avoid

Metallic objects in the sensors field of vision, particularly in the near field could result in multipath reflections and severe impact on tracking performance.

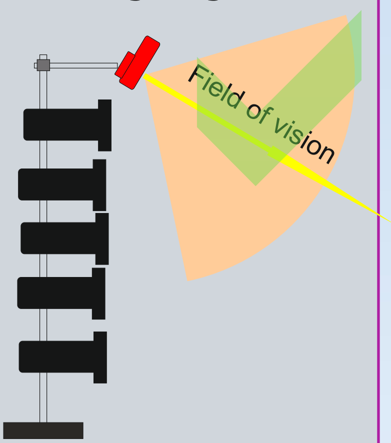
Tags below and near the sensor may not be seen due to severe loss of signal integrity at the antenna because of multiple arrivals.

Best practice

Mount the sensor forward of any stage lighting fixtures so the sensor has a clear unobstructed view of the stage or performance area.

Performers and other tracked objects near to and below the sensor will be clearly seen with no interference for best possible results.

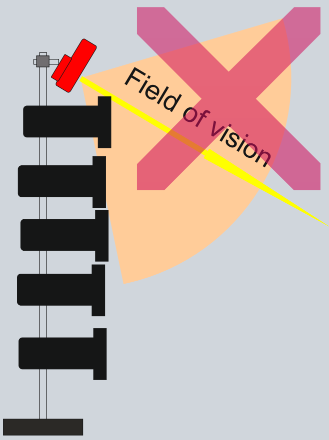
Floor lighting boom



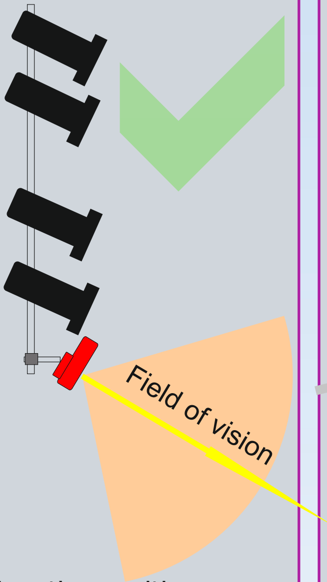
Usually a good choice for side stage sensor positions.

Important to make sure that the structure is firmly fixed does not move.

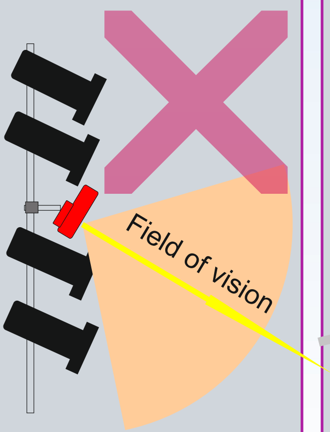
Use a boom to mount the sensor forward of adjacent lighting fixtures.



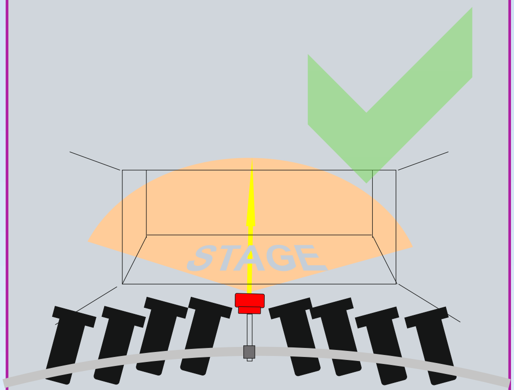
Flown lighting ladder



Mounting positions below lighting fixtures usually offer a good choice for a clear view of the stage while minimising nearfield reflections from adjacent lighting fixtures.



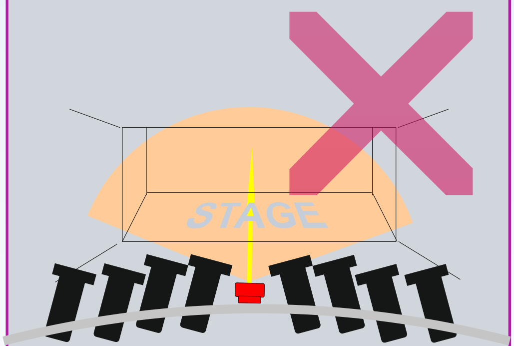
Balcony front lighting bar



Great position for uninterrupted full stage view either from either a single sensor near the centre, or a pair of sensors left and right.

Find uncluttered sections of the bar or mount the sensor forward of other fixtures.

Be sure to survey for wireless transmitters near or in the field of vision.



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Sensor Position Measurement

Sensor coordinates must be know in order to calibrate the system

There are 3 principle means to determine sensor positions, this is a necessary part of the setup prior to calibration.

Direct measurement - from a single point using a Totalstation or Leica Disto D910 - these all in one measurement devices combine laser distance measurements with inclinometer and rotational measurements and trigonometry calculator. They are quick and accurate but expensive.

Indirect measurement - using a simple laser measurement instrument and calculation in a spreadsheet, we have done the work for you and detailed the principle and methodology below.
TrigSolver-V2 spreadsheet download here: https://spaces.hightail.com/space/3k560K1n8K

Off plan - if you have detailed and know-to-be-accurate site plans, this is also an option however BEWARE, plans are often less accurate than they claim to be.

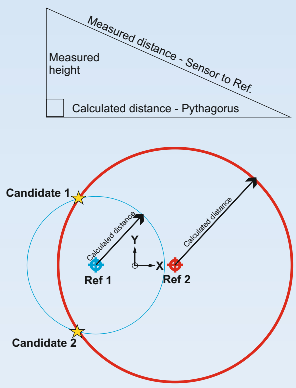
The sensor coordinates (x,y,z) must be entered into the Location System Configuration software to calibrate the system.

Measuring and calculating Ttd4 Sensor positions using Trig Solver spreadsheet

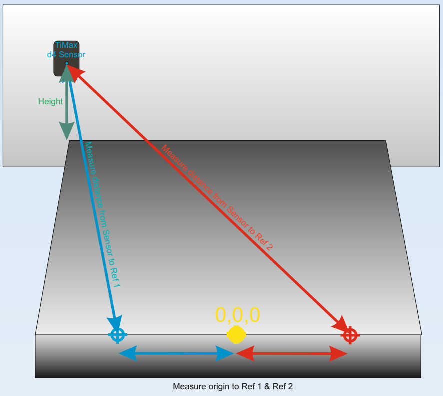
Calculate the position of a sensor within an x,y,z coordinate system by measuring the sensor height and distance from 2 known positions.

Measurements can be made using inexpensive and readily available laser measurement devices.

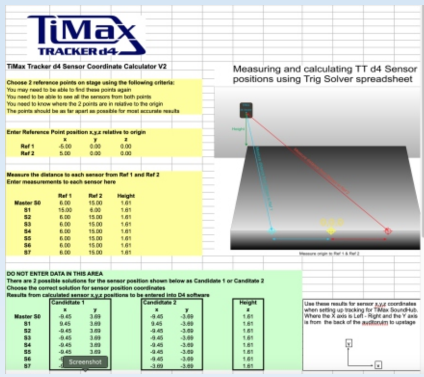
Theory



Measurement



Calculation



Measure and calculate the horizontal distance of a sensor from two known points. Project circles of those radii onto the horizontal plane and calculate the intersection points of the circles. Choose the candidate answer that corresponds to sensor position.

Recommended process:

1. Choose two reference points on the stage on a known axis with a known relationship to the origin (0,0,0) point.
2. All the sensors to be surveyed should be visible from **both** the reference points.
3. In the example illustrated above, the two points are chosen on the front edge of the stage and the origin of the coordinate system is chosen as the centre of this line.
4. Reference points should be as far apart as possible for best accuracy but still visible to all the sensors to be surveyed.
5. Enter the positions of Ref 1 and Ref 2 into the spreadsheet.
6. Measure from Ref 1 and Ref 2 to each sensor in turn and enter these distances into the spreadsheet.
7. Measure the height of each sensor and enter these into the spreadsheet.
8. The spreadsheet will calculate the x and y positions of the sensors from the measured distances by solving a simultaneous trigonometrical equation and display 2 sets of results one set in each of the Candidate 1 and 2 sections of the spreadsheet.
9. The 2 sets of results are mirrored about the plane on which the 2 reference points are located.
10. Use your skill and judgement to determine which is the real result and use that one when

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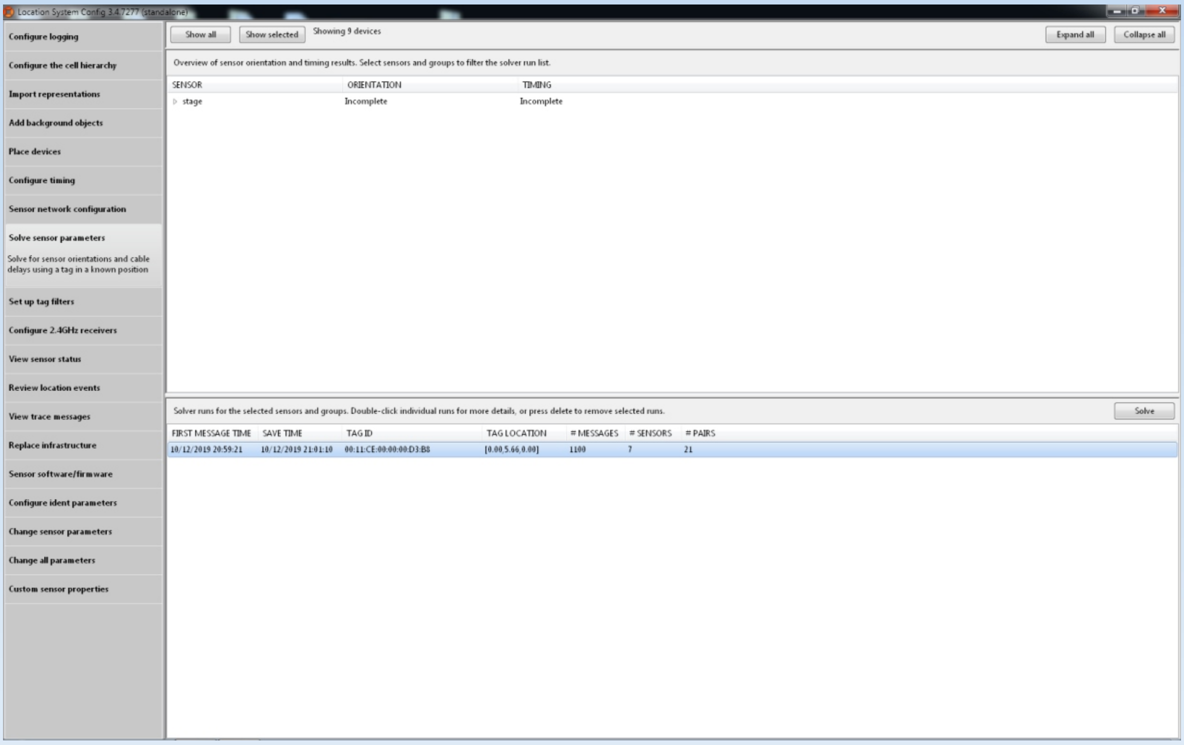
Calibration

TiMax TrackerD4 self-calibrates using Solve Sensor Parameters in the Location Engine software. In about 1-2 minutes it maps the entire tracked area, automatically measuring and recording pitch and yaw values for the Sensors, and timing offsets for the TDoA reference in the Sensor cabling.



If there is a previous calibration select it in the lower window and kbd Delete

Hit the Solve button, it opens a small window offering you to enter some tag ID and location information.

Place a TTd4 Tag at a reference point on stage
Select any tag and make a note of its ID, place it at a known measured position on stage (eg, 0,0,0) Click Solve, enter tag ID in the Solve and position and click Start

Choose all or some of Sensors to be calibrated
After a few seconds a list of Sensors will appear in the lower left window, tick (if tick box is present) to select the Sensors to be calibrated. First pass you should click all od them, but you can go back and check and recalibrate individual sensors if they get moved or you need to pick a different reference point on-stage for the reference Tag (see below).

Check for acceptable STANDARD ERRORS
After a few seconds a list of azimuth and timing parameters will appear in the lower middle and right hand windows tick to select any or all Sensors to be calibrated.Wait for around 1000 readings, until **STANDARD ERROR**s are below about 0.020. If all good click Save and Close

Choose different calibration reference points if necessary
Make a note of any higher STANDARD ERRORs and look for reasons; could be poor line of site to the calibration point or strong multi-path reflections. To remedy, try a different or multiple calibration points at different points on stage where eg upstage sensors might get a better view of the tag.

TIP - Avoid reflective surfaces near the Tag, or people walking round stage during calibration.

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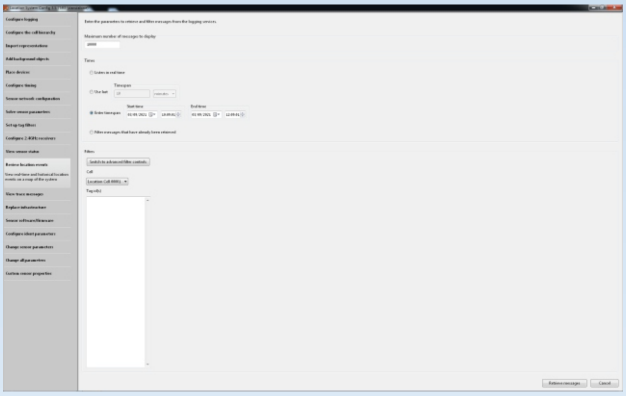
Review Location Events

To aid system setup and optimisation as well as to help us help you to spot and diagnose tracking issues, this guide explains how to monitor live events and how to extract past events that have been logged by the system.

To review past events:

1. On the Review location events tab, if necessary click Clear.
2. Click Get events.
3. Enter the maximum number of events to retrieve.
4. Select the Use last or Enter timespan options.
5. Click Retrieve Messages.
   - after all the location events within the time span are retrieved, the button changes back to Get events.
6. Review the events that have been retrieved.



To view the location of tags in real time:

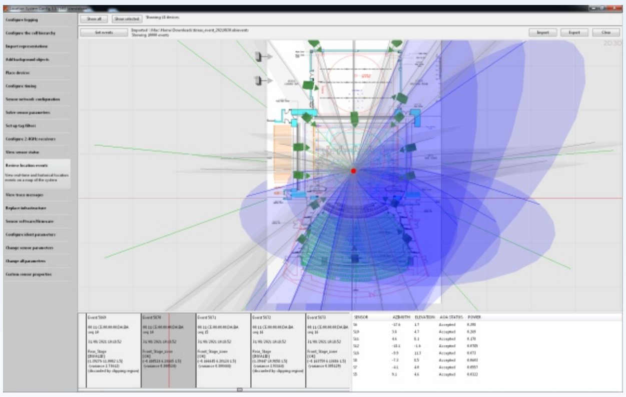
1. Go to the Review location events tab.
2. Click Get events.
3. Select the Listen in real time option.
4. Select the Location Cell.
5. Click Start listening.
6. Monitor events as they occur.
7. When you have finished, click Stop listening.

To filter location events that you have retrieved whether real-time or historical:

1. Click Get events.
2. In the Times section, select Filter messages that have already been retrieved.
3. In the Filters section, enter a Tag ID.Y
4. Click Filter Messages.You can now review the filtered messages.

To review location events:

1. Click in the time line area at the bottom of the screen.
2. Scroll through events using the horizontal scroll bar or the Left or Right Arrow keys.
3. Look for issues on an event by event basis and note the event number .. this is very useful when reporting problems.



Interpreting results:

AoA lines if accepted are shown in green and if rejected are shown in red.

TDoA curvesif accepted are shown in blue and if rejected are shown in an amber.

Sensors that have seen the tag are listed o the right of the Time Line with reported power and if the sighting has been accepted or rejected.

To export location events:

1. On the Review location events tab, click Get events.
2. Retrieve the required location events, as described above.
3. Click Export, and then save the location events as a .ubievents file.

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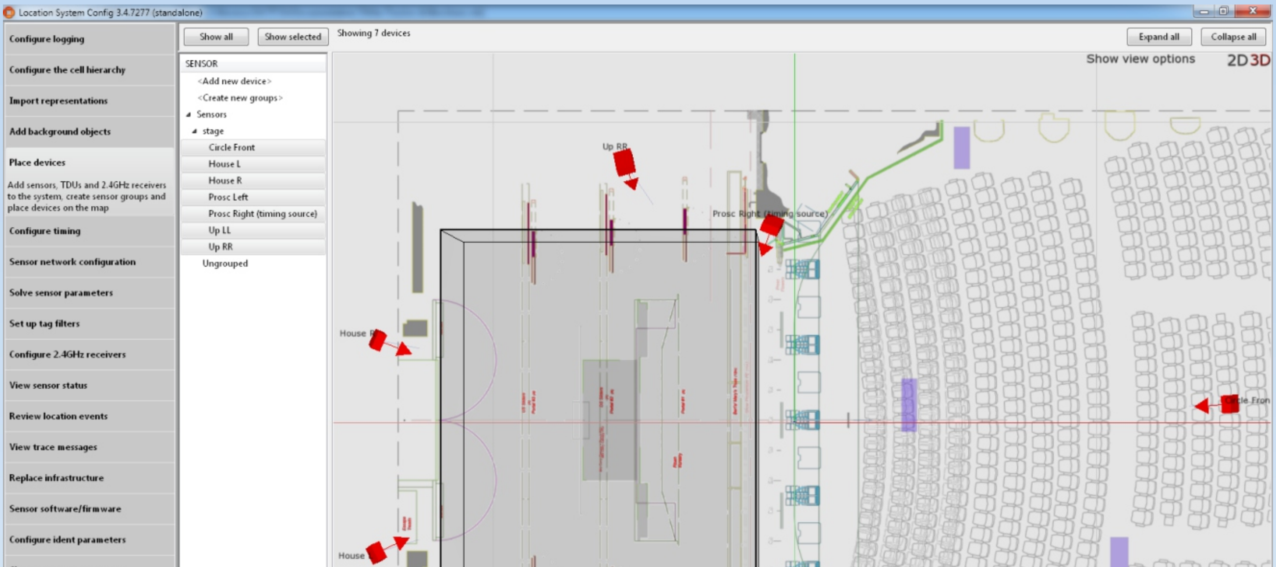
Example: Proscenium Stage



Tracking objectives

To track the entire performance area (stage) for sound location control. At least 2 sensors should be able to see the performers tag irrespective of body orientation and position on the stage.

Sensor location and infrastructure

In this example of a London West End stage, the grid above the stage is fully occupied with scenery and lighting fixtures on fly bars offering no opportunity to mount sensors overhead in places where they will not move or be in the way of something else that movers. Side and rear stage areas are extremely small and crowded as is typical of many older theatres.

Up-stage positions on the back wall either side of a retractable scenery house were identified. The scenic house was examined and found to be constructed of a timber frame with plywood or cloth covering so would not seriously impede or reflect tag RF pulses and degrade tracking.

Mid-stage positions on static lighting booms were chosen for this POV. These sensors were rigged on a forward facing boom such that the front face of the sensor was forward of the lighting fixtures, thus preventing near-field multipath reflections of the lighting fixtures.

Down-stage positions just inside the iron curtain and pros are usually good positrons, there is normally a lighting boom there and the POV provides an unobstructed full view of the stage. Sensors are rigged forward of lighting fixtures to prevent near-field multipath reflections.

A single sensor was also poisoned on the circle front lighting bar at a point chosen to be as far as possible from lighting fixtures, projection and wireless dmx and comms antenna.

The hub and switch are mounted above the stage in a small alcove off the fly tower with cat5 cable runs to the sensors running along the flytower catwalks and dropping down to the stage sensors, the circle front sensor cable needed to be run through the fire break from stage to auditorium and then around the circle front.

Tag location

In this production tags are mounted in a pocket on performers radio mic belt and positioned in the lower back.

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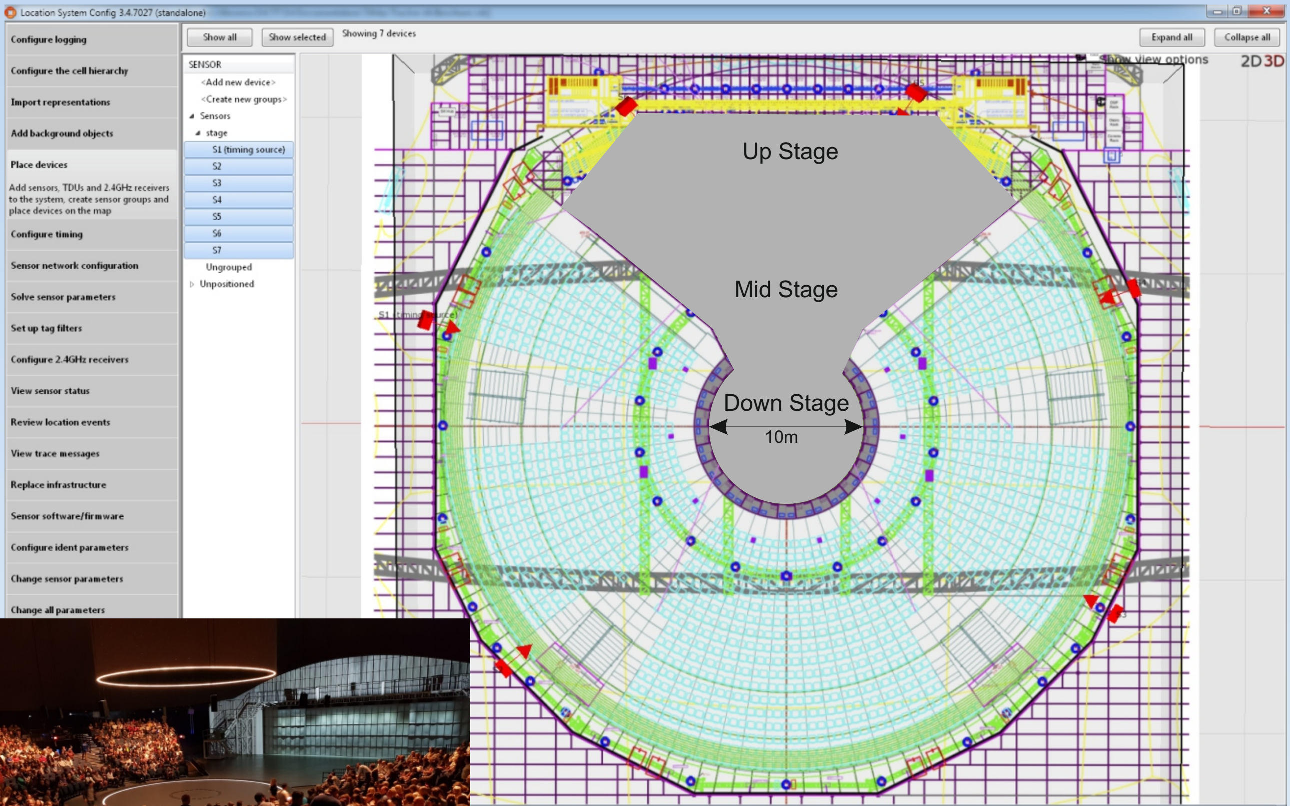
Example: In the Round



Tracking objectives

The entire performance area (stage) should be tracked for sound localisation control, is was decided not to track the upstage gantry for a number of reasons; the back wall construction is skinned in metal so multipath reflections would be severe and compromise tracking, additional sensors would be needed to properly cover this area, there is limited action on the gantry and most of it static so tracking could be faked with preprogrammed sound localisation cues. Sensor locations are chosen so that at least 2 sensors should be able to see the performers tag irrespective of body orientation and stage position.

Sensor location and infrastructure

In this example of a touring tented stage, access to the grid above the stage is extremely difficult for installation, access and cable infrastructure.

Positions are chosen at approximately equal distances around the periphery of the auditorium where sensors can be mounted to have full performance area viability from multiple points of view and are fully out of the audience site lines. Access for installation and maintenance is excellent.

Hub and switch are located under the downstage area with cat5 cable runs under the seating and up to the sensors. The tracking system computer is located at FOH with KVM links to temporary production desks and permanent backstage positions.

Tag location

In this production tags are mounted in a pocket on performers radio mic belt and positioned in the lower back.

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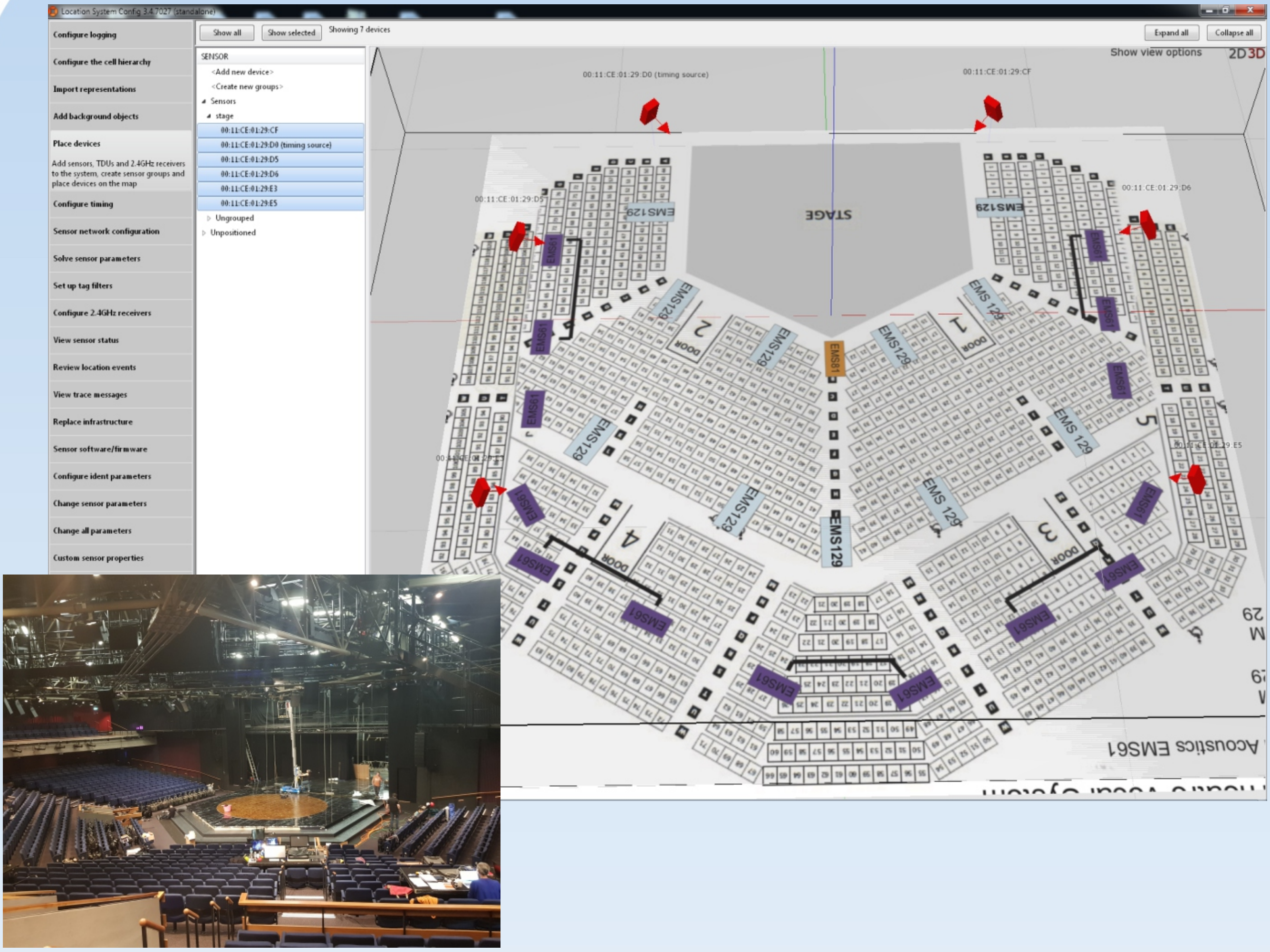
Example: Thrust Stage



Tracking objectives

The performance area (stage) should be tracked for sound localisation control, is was decided not to track the upstage area behind the proscenium arch for a number of reasons; the set in this area consists of several large metal trees so multipath reflections would be severe and compromise tracking, additional sensors would be needed to properly cover this area, there is no dialogue when actors are in this area. Sensor locations are chosen so that at least 2 sensors should be able to see the performers tag irrespective of body orientation and stage position.

Sensor location and infrastructure

Idea positions are on balcony front lighting bars house left and right and tucked in behind the main PA hangs pros left and right.

The hub and switch were located mounted above and behind the pros on a catwalk. Access for installation and maintenance, network cable runs to sensors and FOH are excellent.

The tracking control PC is located at FOH.

Tag location

In this production tags are mounted in a pocket on performers radio mic belt and positioned in the lower back.

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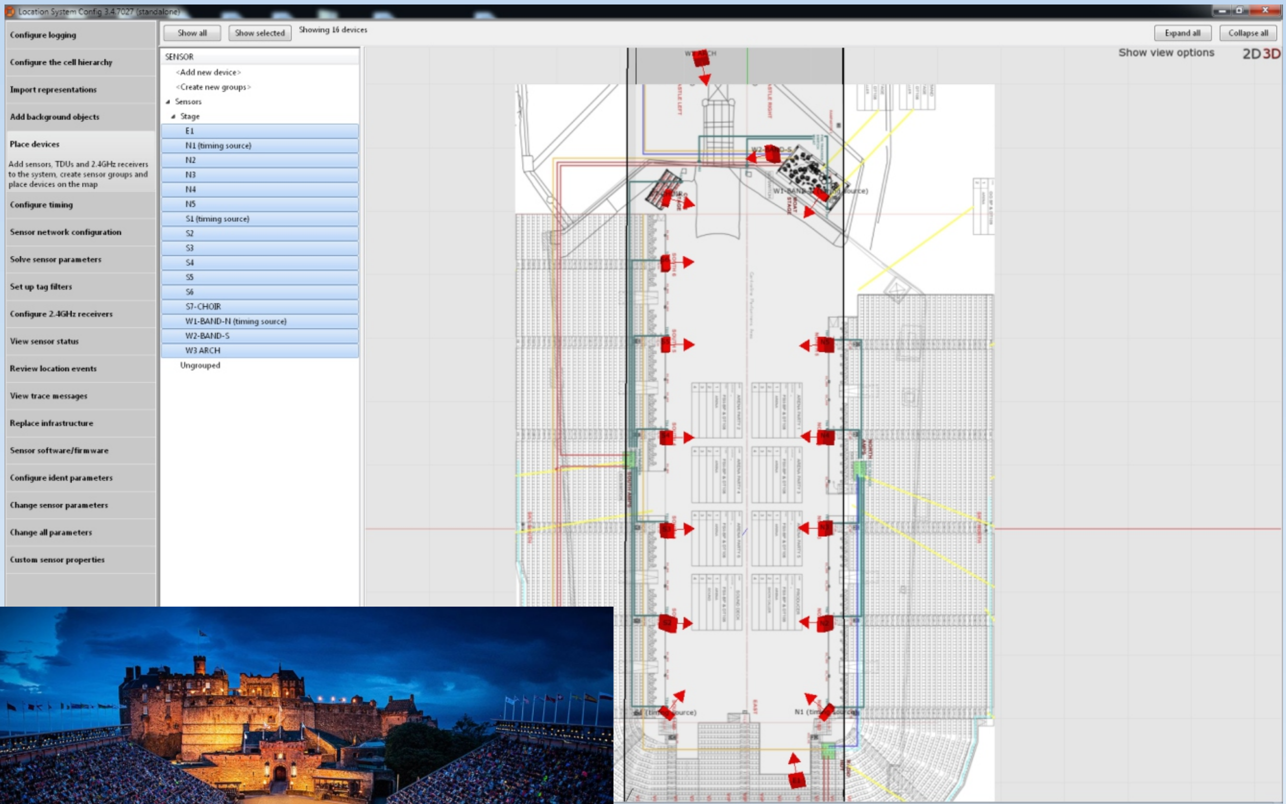
Example: Arena Stage



Tracking requirements

The esplanade should be tracked for sound localisation control with special attention being given to the castle entrance area from where most of the performing acts enter. A maximum of 16 active tags would be distributed amongst each performing group so while one act would be on stage, another would be coming off stage and having radios and tags removed while another would be being fitted with radios and tags in preparation for their turn

Sensor location and network infrastructure

Loudspeaker positions on top of metal arches at the bottom of each stairway up the bleachers were chosen for sensor locations to minimise sight line issues from the audience perspective. Concerns about the proximity of powerful magnets close to the sensors proved not to be an issue. These sensor positions provide an unobstructed view of some of the performance area so it is important to make sure that there is good multiple sensor coverage of all areas.

Given the scale of this example and the cable lengths needed to interconnect the system, it was decided to utilise the site wide fibre network to interconnect 3 tracking system hubs located around the arena in equipment containers. Copper network cables were run from the hubs to the sensors. As it was not possible to interconnect the timing signal between hubs, the system was configured with 3 sensors as timing masters, one on each hub.

Tag location

In this production tags are mounted in upper body positions, collars and hats, to minimise body blocking due to the fairly low aspect to the sensor locations. In addition several of the performing acts are military marching bands playing a variety of brass instruments which potentially could degrade tracking quality.

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In-Service Operation

System Startup and daily check

Power sensor hub and start the PC.

Platform Services will auto start if the checkbox in Platform Control is checked.

Tracker Translate will auto start if the check box Startup on Boot is checked.

Services are set to delayed auto start with a delay of around 1min to ensure the PC and network is fully booted before they start.

Once Platform Services are running, start Location System Configuration and go to the View Sensor Status tab, check all sensors are running, Sensors will take around 2-3 min to boot.

Tracker Translate software will auto start if checkbox in software is set.

Start Tags and take them all on stage.

Check ACTIVE status in Tracker Translate software for each tag.

Check the tag LED for constant flashing at the tag blink rate after the tags have been of for several minutes, if flashing is intermittent the battery is due for a change.

Weekly calibration check

Take a single tag and place on stage at the designated calibration point.

Start Location System Configuration and make sure all sensors are running

Go to Review Location Events, click Get Events and click Start Listening

Check all AOA lines and TDOA curves for all the sensors intersect at the tag location.

If there are calibration problems... continue through the process below.

Visually check each sensor to make sure that none have been moved and no new fixtures have been mounted which may interfere with or impair sensor performance.

Go to Solve Sensor Parameters, select and delete the existing calibration data.

Click Solve.

Enter the tag ID and calibration point coordinates and click Start.

Check all sensors as they appear in the list on the left.

Check all check-boxes for Pitch and Yaw and Timing.

Wait for around 1000 readings and click Save.

In service tag failure:

Run the designated or global spare tag out to the actor and switch to the Sec(ondary) or Ter(tiary) tag for that character in Tracker Translate software. All tag attributes will now be transferred to the new tag.

Replace a failed sensor

Start the Location System Configuration software and go to the Place Devices tab, expand sensors and stage lists.

Double click on the failed sensor and make a note of the x,y,z coordinates

Remove the sensor from the map by selecting it and delete key

Mount the replacement sensor in the same position, add it into the map and enter the x,y,z coordinates.

Run a system calibration as detailed above.

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