TCM-1 tips and tricks

Biamp's TCM Series Beamtracking™ Microphones can be used in a wide variety of applications, and we've developed some tips and tricks to ensure that the TCM-1 is always performing at its best, and that TCM-1 installations always go smoothly. This article is intended to provide some extended information pertaining to the installation and programming of these microphones.

Discovery and communications

The TCM-1 is an Audio Expander Class Device and therefore requires a Server class device (Server, Server-IO, TesiraFORTÉ) to be discovered and managed from Tesira software. Unlike other Audio Expander Class Devices, the TCM-1 is not assigned an IP address for control communications. AVB's AVDECC (Audio Video Discovery, Enumeration, Connection management, and Control) protocol is utilized for this.

The TCM-1 still adheres to Tesira's discovery and communications rules that other audio expander devices require. This means that AVB devices must still be correctly configured to operate in either converged or separated mode.

A common system design utilizing the TCM-1 includes a single Server-class device, such as the TesiraFORTÉ VT4, with the TCM-1 directly connected to the TesiraFORTÉ's AVB port through a PoE+ injector. Since the AVB and Control networks are physically separated, this setup will require separated networks to be enabled on the Server class device to discover and communicate with the TCM-1.

Please reference the essential rules for implementing separated networks to ensure success in configuring device discovery and communications. In separated network mode the AVB and Control IP addresses must be in different subnets. If the TCM-1 does not appear in Remote Devices double check to verify your port IP addresses are not in conflict.

Device Count

The following TCM-1 device count limits apply to all Tesira systems running firmware release 3.5 or newer:
• Each Server or Server I/O can act as the proxy for up to 24 Expander devices in systems that include the TCM-1, TCM-1A, AMP-450P or EX-UBT.
• Each TesiraFORTÉ can act as the proxy for up to 12 Expander devices in systems that include the TCM-1, TCM-1A, AMP-450P or EX-UBT.
• Additional details on system device limits can be found in the System Limits section of Tesira Help.

NOTE: TCM-1EX microphones do not count against the total Expander device amount. For example, a TCM-1A with two TCM-1EX microphones connected should be considered one Expander device (TCM-1A) when making device count considerations.

Custom Blocks

To simplify programming of a system containing TCM-1 microphones, custom DSP blocks are automatically included in the Processing Library when installing Tesira software. The Library includes custom blocks for common TCM-1 pendant counts from one to six:

Choose the appropriate custom block for the project needs. When the custom block is opened, we see all the blocks necessary to set up a system using the TCM-1 or TCM-1A. These blocks are pre-configured with the optimal settings to get started. In larger or more customized systems, it may be necessary to modify the Custom Block or its components.
Adding an Auto Mixer Combiner

In a divide/combine space, it may be desired to utilize the Auto Mixer Combiner. The Auto Mixer Combiner requires a direct connection to the Mix Out of the associated Auto Mixers. This connection allows NOM coordination between Auto Mixers. The following images show a modification of the custom block which passes the Mix Out to the Combiner output node.

Duplicate the custom block as needed and then tie them to the Auto Mixer Combiner and configure the Groups settings as needed.
Adjusting Gate Hold Time

We have seen that some room layouts will benefit from a faster transition between mic pendants than others. To fine tune this transition time, do the steps that follow:

- open the Custom Block then open the Beamtracking Auto Mixer.
- Right-click on one of the blue "On" buttons and select "Edit Channel Settings"
- Make sure the "Set All" button is active (blue)
- Leave the "Off Attenuation" setting at -40, but edit the "Gate Hold Time (ms)" to a lower value. The default value is 1000 ms but we've observed good results when this value is set between 400 and 600 ms. Please consider the number of TCM-1 pendants and the intended use of the room/system when configuring this setting. If in doubt, contact Biamp Support while commissioning this setting.

TCM-1 LEDs

The TCM-1 and TCM-1A plenum boxes, as well as the microphone pendant, have LEDs that provide current status of the device(s).
### TCM-1 Status (plenum box)

<table>
<thead>
<tr>
<th>Status</th>
<th>LED Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Power</td>
<td>Off</td>
</tr>
<tr>
<td>Booting/Self-Test</td>
<td>Red Solid</td>
</tr>
<tr>
<td>Ready to receive configuration or updating firmware</td>
<td>Yellow Solid</td>
</tr>
<tr>
<td>Configured and ready to participate in the system</td>
<td>Green Solid</td>
</tr>
<tr>
<td>Unit is <a href="#">Locate</a> mode</td>
<td>Green Flashing</td>
</tr>
<tr>
<td>Unit has a Major Alarm</td>
<td>Red Flashing</td>
</tr>
<tr>
<td>Unit has a Minor Alarm</td>
<td>Yellow Flashing</td>
</tr>
<tr>
<td>Unit has both a Major &amp; Minor Alarm</td>
<td>Red &amp; Yellow Flashing</td>
</tr>
</tbody>
</table>

### Amplifier (TCM-1A only) Status

<table>
<thead>
<tr>
<th>Status</th>
<th>LED Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Power</td>
<td>Off</td>
</tr>
<tr>
<td>Powered</td>
<td>Green Solid</td>
</tr>
<tr>
<td>Amplifier Limiter Engaged</td>
<td>Yellow Solid</td>
</tr>
<tr>
<td>Amplifier is in <a href="#">Locate</a> mode</td>
<td>Green Flashing</td>
</tr>
<tr>
<td>Unit has a Major Alarm</td>
<td>Red Flashing</td>
</tr>
<tr>
<td>PoE+ power is not available or insufficient to power the amplifier - it has been turned off</td>
<td>Red &amp; Yellow Flashing</td>
</tr>
</tbody>
</table>

### Microphone Pendant Status

<table>
<thead>
<tr>
<th>Status</th>
<th>LED Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Power or Unit is not configured as part of a system</td>
<td>Off*</td>
</tr>
<tr>
<td>Unit is configured and operating normally</td>
<td>Green Solid*</td>
</tr>
<tr>
<td>Unit is in <a href="#">Locate</a> mode</td>
<td>Green Flashing</td>
</tr>
<tr>
<td>Microphone is Muted</td>
<td>Red Solid*</td>
</tr>
<tr>
<td>Unit has a Major Alarm condition</td>
<td>Red Flashing</td>
</tr>
</tbody>
</table>
* The pendant microphone LED behavior can be customized using logic in an active Tesira configuration file. In this case, certain LED indications may differ from the expected default. Additional information on customizing LED control can be found in the next section - TCM-1 pendant logic

TCM-1 pendant logic

The TCM-1 input block provides a series of logic nodes in order to customize the muting and LED behavior of the microphone pendant. Logic is enabled from the TCM-1 Mic Initialization Dialog. The following configuration within the Initialization Dialog on the left would produce the input block configuration on the right.

All logic nodes are provided per pendant with a maximum of three pendants per TCM-1 input block. The exception to this being the M1 -Mute control and status feedback logic nodes. If selecting "Mute Mics as a group" only a single logic input/output will be added for mute control and this will affect all channels simultaneously.

The "LED" Logic input will drive the LEDs for that particular pendant. When seeing a logic low (0) the LED will be off; when receiving a logic high (1) the LED will turn on.

The "RG" Logic input will select the LED color. A Logic low (0) will set the LED color to Red and a logic high (1) will set the LED color to Green. Please note that the LED will not illuminate until the "LED" Logic input is driven high (1).

The granularity provided by these controls allows for customized behavior to suit the LED operation to a variety of situations. One example of this is to enable the Green LED only when a pendant is active (gated on), while also allowing for a privacy mute that sets all pendants' LEDs to red for the duration of a privacy mute. The diagram below shows how logic could be wired to accommodate this scenario in a dual pendant system. This is accomplished by using the Mic
Active Logic Output of the TCM-1 Custom Block (included when installing the most recent version of Tesira software), in conjunction with a Logic State serving as the trigger for the privacy mute.

- **Logic State - Privacy Mute**
  - When Logic State output is high, the following conditions are met:
    - TCM-1 M1 Logic input is set high, muting both pendants
    - OR Gate outputs are set high, activating the LEDs on each pendant
    - NOT Gate output is driven low, setting the LED color to Red
  - When Logic State output is low, the following conditions are met:
    - TCM-1 M1 input is set low, unmuting both pendants
    - OR Gate outputs are set low, deactivating the LEDs on each pendant
    - NOT Gate output is driven high, which will set the LED color to Green

- **Mic Active Logic from Custom Block**
  - When a Mic Active Logic output is high and the Logic State is low, the following conditions are met:
    - OR Gate output is set high, enabling the LED for the active pendant
    - Since the Logic State is low, NOT Gate output is driven high, which sets the activated LED color to green

An example TCM-1 file including this logic can be downloaded [here](http://support.biamp.com/).

---

**Camera tracking**

Integrated AV systems can utilize positional information provided by the Tesira audio DSP to coordinate positional functions such as camera tracking. The camera presets are typically driven by auto-mixer gate logic. When we apply this concept to the TCM-1 pendants, the auto-mixer gate logic provides information on which pendant is gated on/active. This bit of information allows camera presets to frame the coverage area of a specific pendant. If additional information is desired for a tighter camera shot, TTP offers two TCM-1 subscriptions that supplement the auto-mixer gate logic:

- **TCM1Mic1 subscribe segmentsActive 1**
- **TCM1Mic1 subscribe audioSources 1**

The following examples were captured via PuTTY:
In Tesira v3.4 a Locate feature was added to assist with identifying physical Tesira devices on the network. This is particularly useful when attempting to identify expander devices in large distributed systems. Locate can be initiated from software:

- From Device Maintenance,
- Right-clicking the context menu of a DSP object
- Network toolbar, or via the
- System > Network > Locate Devices menu.

The locate feature can only be initiated/canceled from Tesira software.

TCM microphone pendant LEDs will repeatedly flash green to identify the microphone. If TCM-1EX pendants are connected then a sequence of flashes followed by a pause is used to identify the connected pendants.

The TCM-1 and TCM-1A devices will flash the "Power" LED on the plenum box alternately green and off when Locate is triggered from the Tesira software.

TCM-1A devices will also flash the "Amp" LED on the plenum box alternately green and off when Locate is triggered from the Tesira software.

With the TCM-1A and AMP-450P, the audible locate function was introduced. Audible Locate runs concurrently with visual Locate, and will state the device model and channel being located. Locate messages will be played from the amplifier at the level selected in the Locate dialog, regardless of the level or mute status selected elsewhere in the software. A speaker must properly be connected to the respective amplifier output for this audio message to be heard.
Ceiling flush mount

The TCM Series Beamtracking™ Microphones allow about 4'-8" (1.42 m) in total adjustable drop distance below the ceiling surface. As with any microphone, minimizing the distance from microphone to talker maximizes the signal-to-noise ratio (SNR) for a better conferencing experiencing. Additionally, the closer the TCM pendant is to the ceiling, the closer it will be to HVAC noise sources in or above that ceiling.

Form often follows function, however, there are situations when architecture or aesthetics influence microphone placement in the direction of “flush” or “tight” ceiling mounting. This compromise trades audio performance for visual appearance. Biamp does not offer a ceiling flush mount kit for the TCM-1 but the TCM microphone has performed adequately in a near-flush mounted situation. Performance will vary based on room specific details.

If a custom ceiling mounting solution is being considered it is critical that the Biamp logo and microphone LED’s are still visible below the ceiling surface. Ignoring this recommendation will negatively impact the tracking and pick up patterns of the TCM pendant.

Cue output

When tuning any room for conferencing it is important to know what is being sent to the far end. It can be helpful to set up a local output to assess changes made to mic settings. The output can simply be one of the analog outputs of a Tesira with an adapter wired to headphones, or the USB output of a Forte or EX-UBT connected to a PC for headphone monitoring and recording samples of the audio.

A Source Selector block with 4 or more inputs can be added to your layout. Connect the first input to the output of the TCM-1 mic block (this is the raw output of the TCM pendant). Connect input 2 to the output of the AEC processing block (this reveals changes due to the AEC echo reduction, noise reduction, and high pass filter). Input 3 should be connected to the output of the TCM-1 custom library processing block (this contains a level boost, EQ curve, gating automixer and AGC). If additional processing objects are added then additional inputs can be defined for the Source Selector. The last input should be taken just prior to your transmit block (whether it is VoIP, POTS, USB, or analog out).

Wire the Source Selector to the appropriate output and update your hardware. Put on headphones and you should be able to choose the pick points in the mic signal chain where you’d like to compare performance. This allows the local technician an opportunity to tune the mic performance without hearing any effects of codecs on the signal. Once the local performance is verified then you can place a call and assess the transmit quality on the far end.

Voice Lift / Mix-Minus

Attempting to do local reinforcement with the TCM-1 mics (or with any ceiling microphone) is not recommended. This is simply due to the physics of sound involved with respect to achieving acceptable reinforcement levels without feedback.
If local mix-minus reinforcement of talkers is desired Biamp recommends the use of lavaliere, handheld, or gooseneck mics placed in close proximity to the talker's mouth. This will allow maximum gain before feedback.

Achieving acceptable acoustic gain before feedback requires that the talker's mouth be located close to a microphone with respect to the reinforcement speakers so that the talker's reinforced voice coming from the loudspeakers will be substantially less powerful at the mic capsule than the actual talker's voice.

Ceiling mics require relatively high input gain to pick up the talker's voice at a distance. In most local reinforcement applications the reinforced audio from the loudspeaker may be equal to or even louder than the actual talker's voice at the ceiling mic capsule. This will result in feedback if the ceiling mic is routed to the speaker. Lowering the reinforcement level for the talker's voice to achieve acoustic stability typically results in the reinforced level being too quiet to be considered meaningful for reinforcement.

Please see our article Calculating PAG and NAG for more information on reinforcement. Each TCM-1 pendant can create 3 active lobes at a time but maintains NOM internally via gain sharing, so a NOM value of 1 per pendant should be used in calculations.

The TCM-1 is an active beam tracking microphone, capable of tracking multiple talkers (or vocal sources) simultaneously in a 360 degree torus of coverage. The lobes are constantly being repositioned for best coverage based on the talker's estimated position. There is no method for manually locking the lobe's coverage pattern.

In a mix-minus application the changing azimuth and elevation angles of the 3 beam tracking lobes may result in unpredictable gain before feedback behavior. Multiple TCM-1 and TCM-1EX pendants in a space will further increase the complexity of calculating PAG-NAG and feedback stability as coverage lobe patterns intersect and overlap.

TCM-1 mics are not able to distinguish between a voice emanating from a loudspeaker rather than a local talker. To prevent lobes tracking to loudspeakers in normal conferencing applications the TCM-1 lobes are temporarily "frozen" when the far end speaks and the TCM channel's AEC reference receives input. In a mix-minus application one lobe may track to the talker and other lobes may track to the reinforcement loudspeakers, further complicating the gain before feedback behavior.

If mix-minus sources are also sent to TCM-1 AEC references the mic's beam tracking will be inadvertently "frozen" during local speech and beamtracking will not function as expected. There is no method for pre-defining where the lobe be aimed when it freezes - it simply locks at the last active talker position. Tracking resumes ("un-freezes") when the signal to the AEC reference stops.

Further reading

- TCM-1 Calculator
- TCM-1 Tesira Microphone Help Documentation
- TCM-1 Software DSP Blocks
- Tesira TCM-1 Data Sheet
• Tesira TCM-1A Data Sheet
• Tesira TCM-1EX Data Sheet
• Tesira TCM-1 Manual
• Calculating PAG and NAG