TCC M

TC BAR M

USB-C

USB-C

HDMI

Network

Weekly Meeting
Report

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TeamConnect Bar

Network Guide
for System Integrators

SENNHEISER

Contents

1. Introduction

This document is intended for system integrators and room planners and serves as a planning guide for the network integration of the TeamConnect Bar (TC Bar) in a room.

The network guide contains recommendations for the optimal operation of the TC Bar, which is operated in particular with extended or routed Sennheiser devices in a networked environment (e.g. TeamConnect Ceiling Medium (TCC M)).

Furthermore, recommendations for setting up a Dante network are described in order to enable smooth use of the TC Bar via Dante.

2. Requirements

2.1. Operating System

The TC Bar was designed for indoor use and is operated with network-capable PC or Mac devices. The following system requirements apply for operation:

- Windows: 10 or later
- mac OS: 13 or later
- Android: 11 or later
- Installed DisplayLink® driver on used operating system

2.2. DisplayLink®

With DisplayLink®, you can quickly and easily connect multiple monitors to your PC via a simple USB-C® connection. DisplayLink® technology is integrated into the TC Bar and does not require an additional HDMI® cable from your PC or Mac to the TV screen.

▷ Check that the minimum version of the DisplayLink® driver is present on all user PCs / Macs involved to be able to use the Plug & Play functionality for screen sharing.

▷ Mac devices may not have a DisplayLink® driver installed by default as Apple is a closed system. In this case, it is necessary to install the minimum DisplayLink® driver version as indicated below.

Download

Information on the latest driver for your operating system can be found at:
https://www.synaptics.com/products/DisplayLink-graphics/downloads

2.3. Network

When it comes to bandwidth requirements for high-quality audio and video conferencing, there are a number of factors that can affect the input and output of both audio and video. An inadequate or interrupted Internet connection is reflected, for example, in a disrupted image or sound or in an in-

correctly synchronized rendering of both formats.

Bandwidth and Speed

The Internet speed required for video conferencing should be as high as possible to ensure a smooth conferencing experience. As a rule, the minimum bandwidth for transmitting and receiving video is approximately the following:

- HD (1280 × 720):   2 Mbit/s
- Full-HD (1920 × 1080):   4 Mbit/s
- QHD (2560 × 1440):   6 Mbit/s
- 4K UHD (3840 × 2160):   10 Mbit/s

Cabling

As long as a good Internet speed is guaranteed, the network cable used determines the actual transmission speed of data sent and received in the network.

▷ To ensure a reliable transmission speed of audio and video data with the TC Bar, please use an **RJ45** network cable with the **CAT5e S/FTP** standard or higher.

Power over Ethernet (PoE)

Power over Ethernet (PoE) is a network function that can supply network-compatible devices with power via an existing data connection.

Power and data transmission takes place via a network cable (RJ45) and, depending on the device type, can be sufficient for operation even without an additional power supply via the socket.

• Powered Device (PD)

Powered Device (PD)

• **TC Bar S** is a **Powered Device** (IEEE 802.3at Type 2,PoE+) and can be operated using the network cable alone.
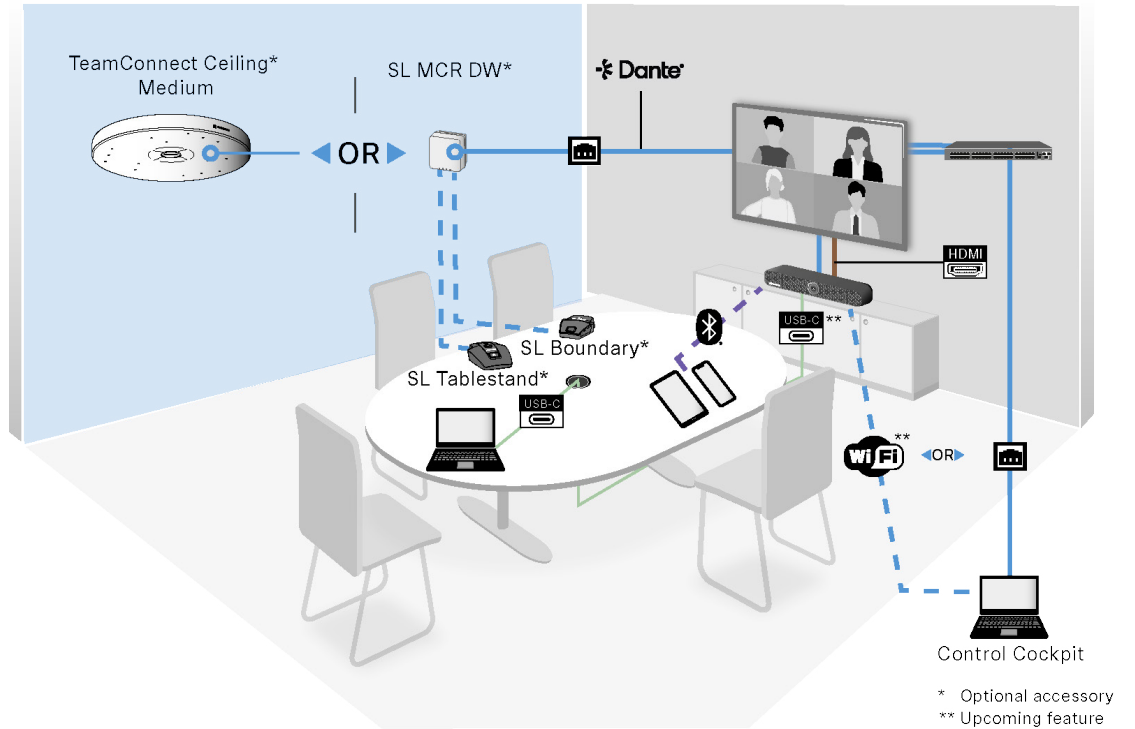
> **Note:**
> For a continuous power supply, we always recommend connecting and using the included power supply unit.

3. Network Modes

To integrate the TC Bar into an existing network structure and to control it, you need to use the Sennheiser Control Cockpit.

The TC Bar can be integrated into any existing or new network. Different network modes are available, which can be configured for the TC Bar in the Sennheiser Control Cockpit software.
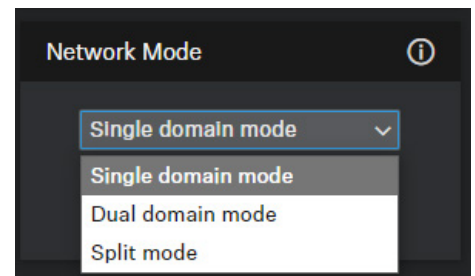
The following network settings are available for the TC Bar:

- Single Domain Mode (for TC Bar S and TC Bar M)
- Dual Domain Mode (for TC Bar S and TC Bar M)
- Split mode (only for TC Bar M)

Default modes

The following modes are configured by default:

TC Bar S: Single Domain Mode

TC Bar M: Split Mode

3.1. Device-Dependent Network Set-Up

Depending on the model, the TC Bar offers various options for integrating the device into a network. The following is an overview for quick orientation of outgoing use cases and for setting up preferred network configurations.

			Single Domain Mode	Dual Domain Mode	Split Mode	Comments
The following network modes are available: • Single Domain Mode (SDM) • Dual Domain Mode (DDM) • Split Mode (SM) **Use Cases**						
	Network Structure	**Description**				
1	• One network • One IP address • One network switch	▷ Configure both Dante and control networks over one switch ▷ Use only one IP address for both networks ▷ Control both networks over one single network port of the TC Bar	**X**			For details see „Single Domain Mode"
2	• Two separated networks (Control and Dante) over one cable • Two different IP addresses • One network switch	▷ Configure both Dante and control networks over one switch ▷ Use two different IPs to address the Control network and the Dante network separately ▷ Control both networks over one single network port of the TC Bar		**X**		For details see „Dual Domain Mode"
3	• Two separated networks (Control and Dante) over two different network cables • Two different IP addresses • One managed network switch or two independent network switches	▷ Configure both Dante and Control networks over two different switches ▷ Use two different IPs to address the Control network and the Dante network separately ▷ Control the Dante network and the Control network over different ports of the TC Bar			**X**	For details see „Split Mode"

3.2. Single Domain Mode

This mode is usually used if you want to use both the controller (Sennheiser or third-party provider) and Dante on the same physical port with only one available IP in the same network.

To set up both configurations, you need the Sennheiser Control Cockpit for the control network and the Dante Controller for other routed Sennheiser devices.

TC Bar S

- The TC Bar S has only one network port and can only provide a merged flow for Dante® and control over a switch.
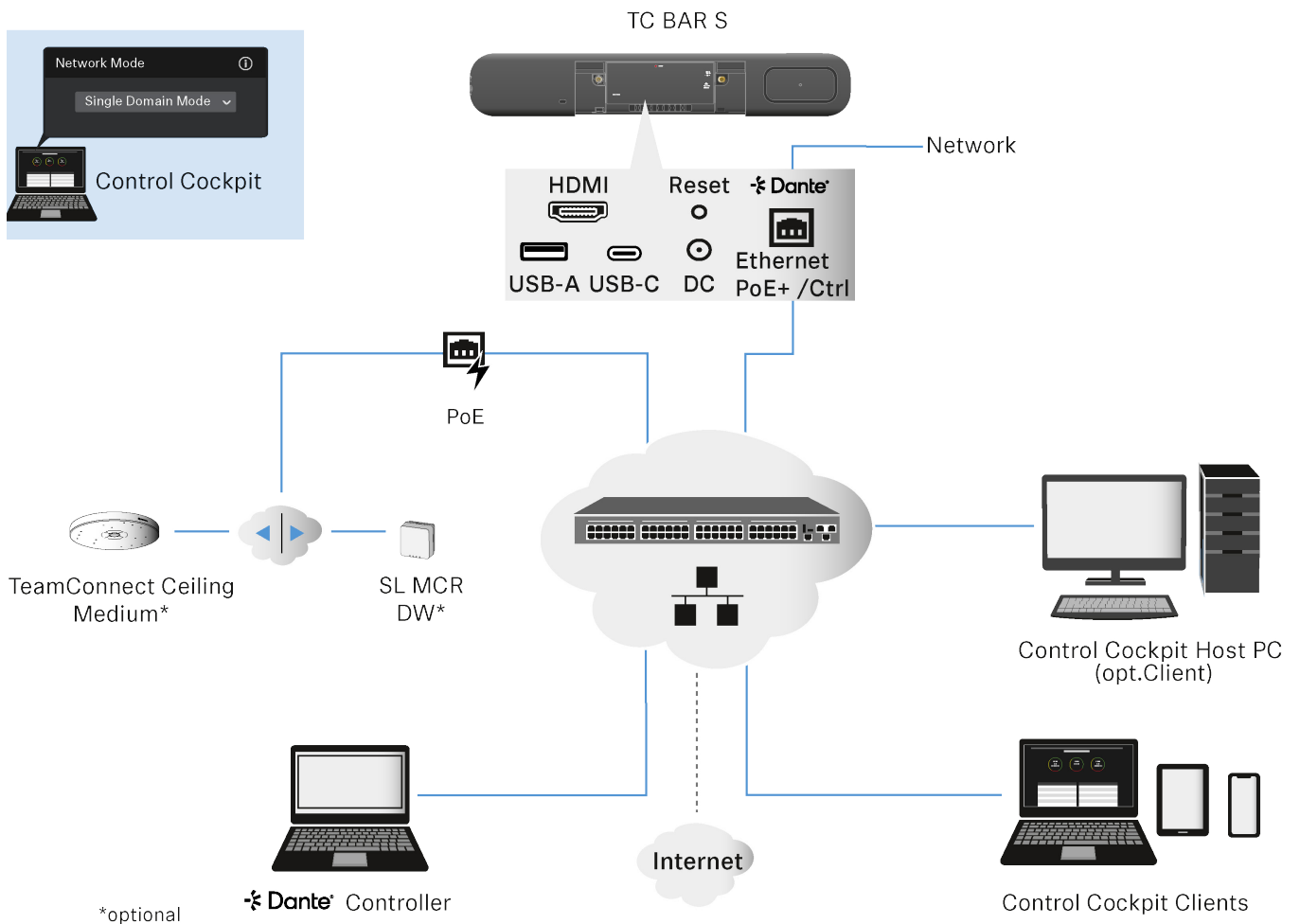
TC Bar M

- The TC Bar M provides two network ports but using only one IP address in this mode.
- One port can be used to control the bar over the network via Dante Controller and via Control Cockpit directly via a switch.

> **Attention!**
>
> There is a potential risk of creating loops (see „Danger of Network Loop").
>
> ▷ Make sure you always connect the TC Bar M to two different networks that do not run via a common switch.

- The other port is used to connect routed Sennheiser devices (e.g. TCC M)
- Any extensions connected can be managed both via the Dante Controller and via the Control Cockpit, as the Bar M forwards the flows using the integrated switch.
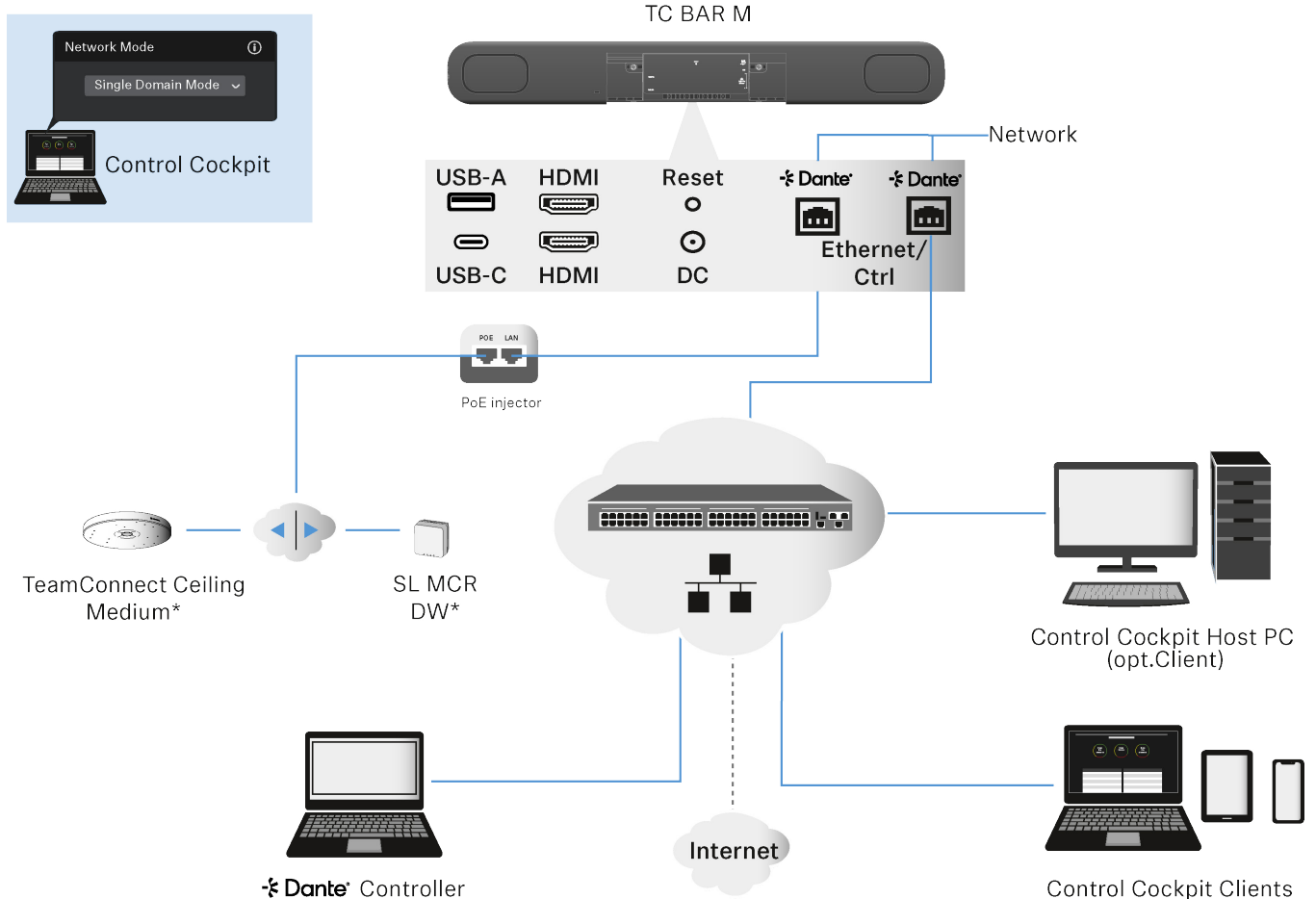
3.3. Dual Domain Mode

This mode is generally used if you receive a merged flow from two separate networks via a single network line and you want to resolve this merged flow back into two different IP and MAC addresses.

In this way you can operate the Dante network and the control network independently of each other via the same switch. Outgoing Dante® data packets are tagged as a VLAN in accordance with the 802.1q (Virtual Local Area Network) standard.

The incoming data packets must also be tagged by the externally connected network in order to be able to assign them correctly for internal use. Depending on the device, the data packets may need to be translated from the outgoing 802.1q standard to 802.3 via a managed switch.

For more information see „Network Availability and Extensions".

TC Bar S

- One IP is used to address the TC Bar via the Control Cockpit.
- The other IP is used to address the TC Bar via the Dante Controller.
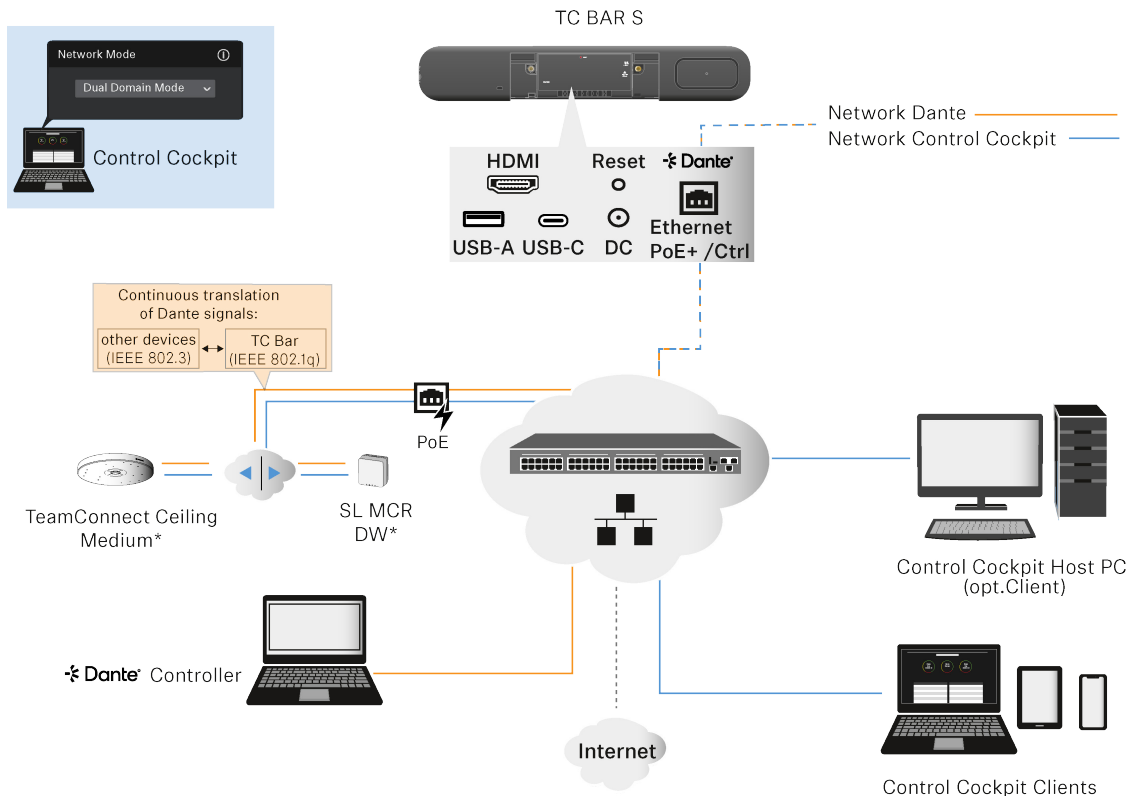
TC Bar M

- Both Ethernet ports can be used to address the TC Bar both via the Control Cockpit and via the Dante Controller. In this case, one IP is available for Dante and one IP for Cockpit.
- Any extensions connected can be managed both via the Dante controller and via the Control Cockpit, as the Bar M forwards the flows using the integrated switch.

> **Attention!**
>
> There is a potential risk of creating loops (see „Danger of Network Loop").
>
> ▷ Make sure you always connect the TC Bar M to two different networks that do not run via a common switch.
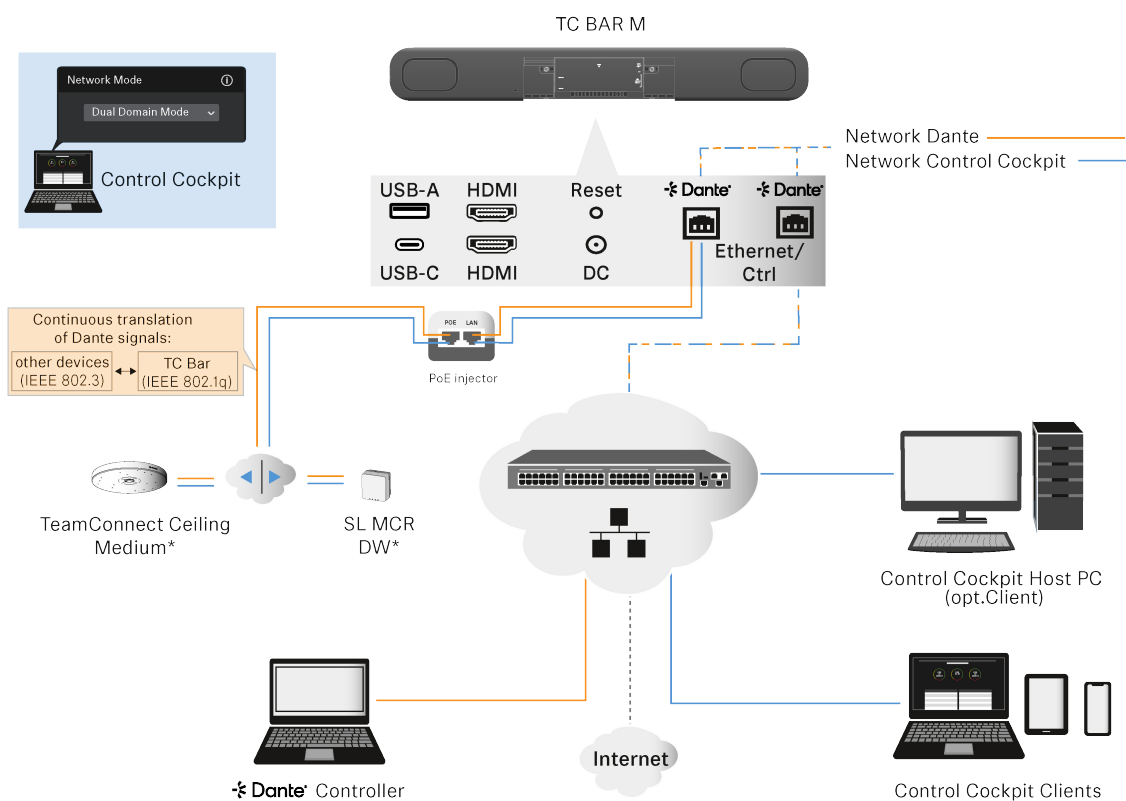
3.4. Split Mode

> **Note:**
> The Split Mode is available for the TC Bar M only.

In this mode, the Sennheiser Control Cockpit and the Dante Controller are located in different networks and both have different IP and MAC addresses. All data packages are untagged.

This mode is generally used if you receive two different IP and MAC addresses (one for Dante and one for Control). In this way, you want to operate the Dante network and the control network independently of each other and use a separate switch for each network.

The Ethernet connections can be used to address the TC Bar both via the Control Cockpit and via the Dante Controller as follows:

Ethernet port I: Control only

Ethernet port II: Dante only

TC Bar M
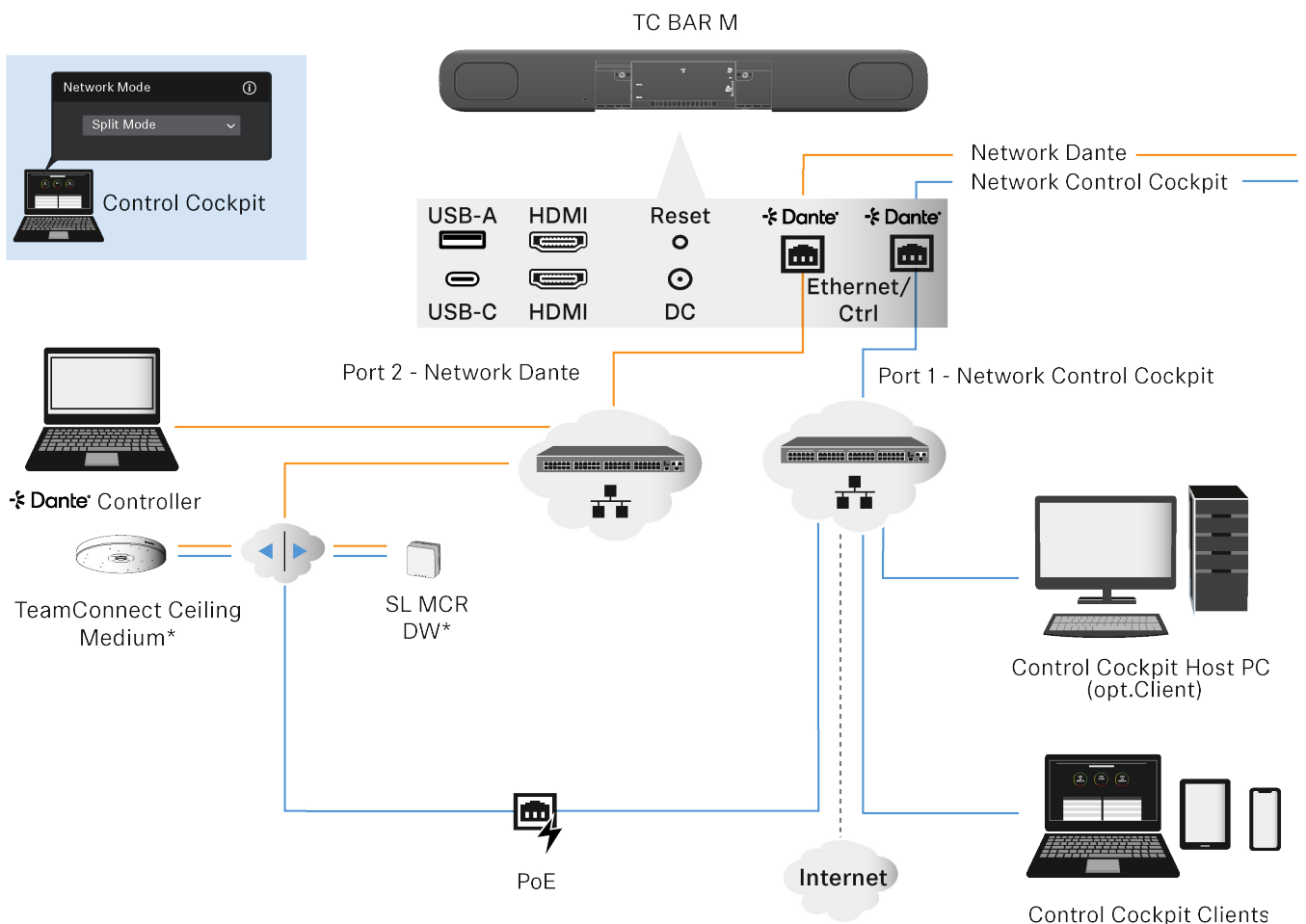
• The first Ethernet connection provides an IP address for the Control Cockpit network only.

• The second Ethernet connection provides an IP address for the Dante® network only.

> **Attention!**
>
> There is a potential risk of creating loops (see „Danger of Network Loop").
>
>   ▷ Make sure you always connect the TC Bar M to two different networks that do not run via a common switch.

4. Network Availability and Extensions

Virtual Local Area Network (VLAN 802.1Q)

The TC Bar S and M supports the tagged VLAN prioritization technology in accordance with IEEE 802.1Q.

A VLAN separates a physical network into logical sub-networks. This enables several virtual networks to be created from one physical switch port.

When using Dual Domain Mode, Dante® and Control Cockpit can be used separately. In case of Dante® network, this can be virtually separated and operated independently using a VLAN with just one network connection. The frames are given a tag containing a VLAN ID. This provides the switch port with information on which Dante® VLAN the frame belongs to.

For more information on activating VLAN in the Control Cockpit, see „Activating VLAN Tagging"

> **Note:**
> When using the **TC Bar M**, the Dante® and the Control Cockpit network can be operated independently of each other via the two available network ports. To do this, select the **Split Mode** in the field **Network Mode**.

Danger of Network Loop

A network loop occurs when a network has more than one active path carrying information from the same source to the same destination.

The information loops and amplifies itself using the additional path instead of stopping when it reaches its destination. Network loops might cause a slow, irregular Internet connection or network failure.

Examples

1. Both cables coming from the two ports of the TC Bar M are plugged into the same network switch.
   ▷ Make sure you always connect the TC Bar M to two different networks that do not run via a common switch.
   Example:
   • Ethernet I: Sennheiser Control Cockpit network
   • Ethernet II: Dante® network
2. Both ends of an Ethernet cable are plugged into the same router.
   ▷ Unplug the Ethernet cable.

TC BAR M

Network Dante
Network Control Cockpit

USB-A   HDMI   Reset   Dante   Dante

USB-C   HDMI   DC   Ethernet/ Ctrl

Attention!
Potential risk of creating network loops!
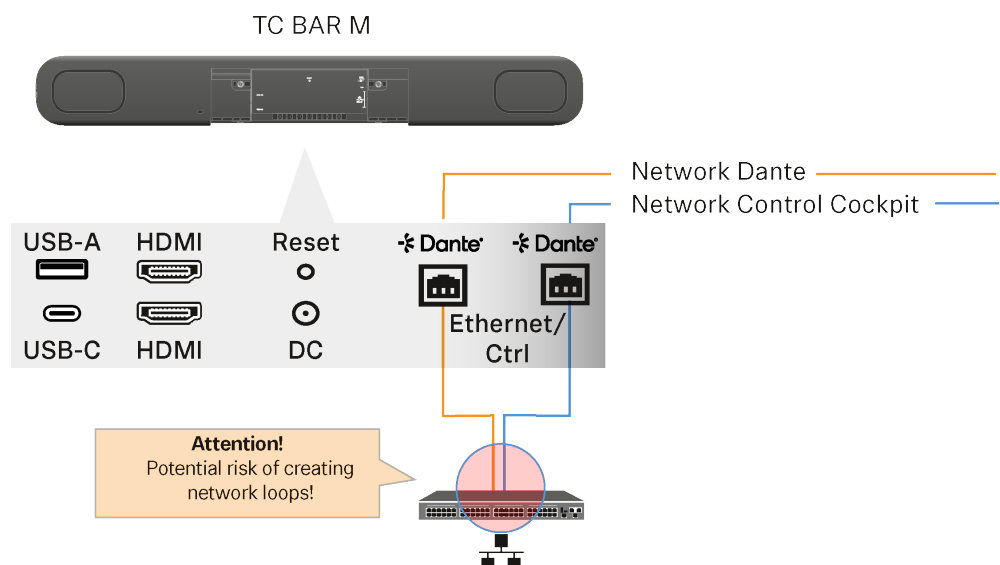
5. Dante Features for TC Bar S and M

With the built-in Dante Embedded Platform (DEP), the TC Bar integrates media and control of your entire AV system over a single IP network. The Dante functionality is deactivated by default and must be activated in the Control Cockpit ("Activating Dante Protocols").

The TC Bar offers various inputs and outputs for Dante and makes it possible to connect several extensions:

Dante Input

- 2x Dante input with AEC on each input

Dante Output

General:

- 4x Dante Output:
  - Audio content is only played back when the TC Bars are used as a USB device.
  - Otherwise, the Dante channels are muted

ConferenceOut:

- Audio data for e.g. Mobile Connect (Mono)
- Mix of internal microphones + 2x Dante channels, which is output as a sum together with the loudspeaker signal (mix options in CC)

LocalMicrophoneMixOut:

- Audio data for e.g. sound recordings of the room
- Mix of internal microphones + 2x Dante input channels

FarEndOutR & FarEndOutL:

- Audio data for AEC reference channel for TCC 2 + TCC M solutions (stereo or downmix) – currently not intended for external speakers
- Loudspeaker signal

Possible Dante Connections

Ceiling mics

- 2x TCC M (medium-sized conference rooms, recommended solution) or
  2x TCC 2 (not recommended, as TC Bars are not designed for large meeting rooms)
- 1x TCC 2 and 1 channel of an SL-DW MCR
- 1x TCC M and 1 channel of an SL-DW MCR

SL-DW or EW-DX:

- Up to 2 channels SL-DW MCR or EW-DX
- The use of the mixed sum signal of the MCR is not recommended

Note:

The **TC Bar S** has only one network connection. Therefore an additional switch is required in most cases. TC Bar S can in turn be supplied with power via this one port using PoE+.
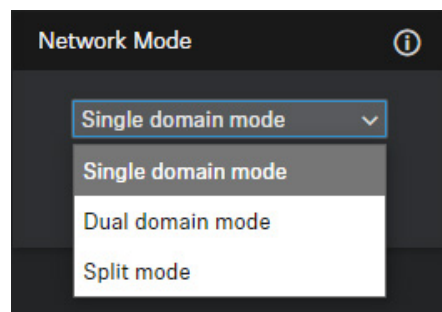
6. Best Practice

6.5. Configuring Network Settings (Control Cockpit)

Selecting Network Mode

First, the network mode must be selected in the Control Cockpit.

To select your desired Network Mode:

▷ In the Control Cockpit, navigate to **Devices** > **TC Bar** > **Network**.

▷ In the Network Mode window, select your mode.

▷ The device will be rebooted.

Activating Dante Protocols

You can enable a digital audio network protocol over Ethernet for routing and synchronization of Dante-compatible devices using the Dante Controller software.

> **Note:**
> Please note that the audio signal via Dante is not encrypted!

To enable the Dante protocols:

▷ In the Control Cockpit, navigate to **TC Bar** > **Network > Dante Protocols**.

▷ Click on the slider to move the slider on **Activated**.
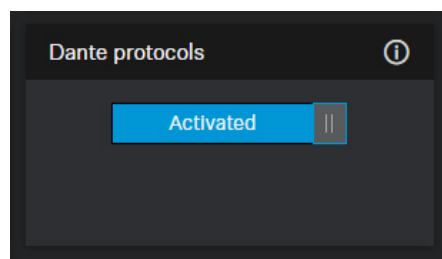
Activating VLAN Tagging

To tag the Dante® networks using VLAN, the network mode must be selected in the Control Cockpit and a VLAN id must be assigned.

To activate the Tagged VLAN for a Dante® network:

▷ In the Control Cockpit, navigate to **Devices** > **TC Bar** > **Network**.

▷ In the Network Mode window, select **Dual Domain Mode**.

▷ The device will be rebooted.

▷ After the reboot click on **Edit** in the Dante® settings.

▷ Enter the correct ID in the **VLAN ID** field to be routed to the correct network (default = **100**).

▷ Click **OK** to save the changes.
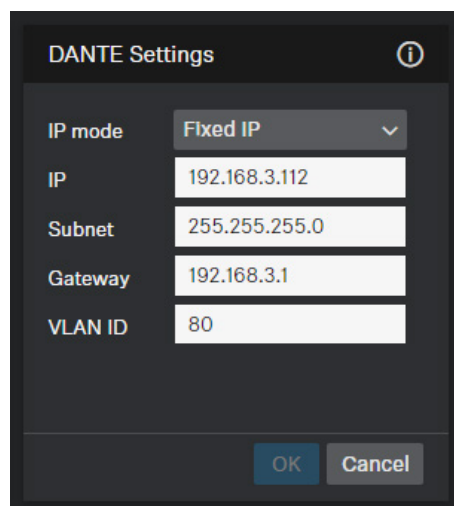
Activating 3rd Party Access

The TC Bar can be accessed by third-party applications via a media control protocol. To do this, third-party access must be activated in the Sennheiser Control Cockpit and protected using a password.

> **Note:**
> Please refer to the media control protocol for the TC Bar to obtain the complete range of functions and list of methods that can be called up.
>
> The general description for using third-party applications and product-specific API documentation can be found on the API documentation for Sennheiser products website (https://www.sennheiser-sites.com/responsive-manuals/en/api-docs/index.html).

To activate the 3rd Party Access:

▷ In the Control Cockpit, navigate to **Devices** > **TC Bar** > **Access**.

▷ In the **3rd Party Access** window, click on **Edit**.

▷ Click on the slider in the field **Access** to move the slider on **Activated**.

▷ Enter a new password for your 3rd Party Access and click **OK** to save the changes.
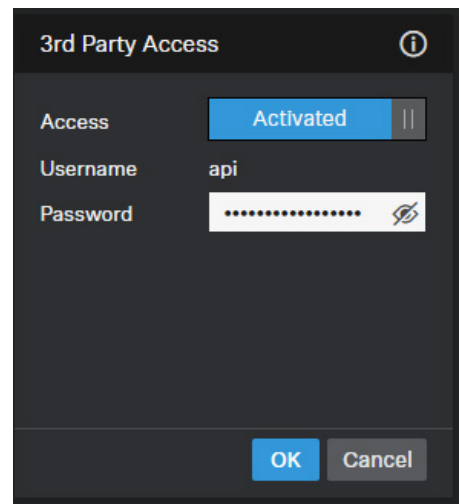
6.6. Designing and Configuring Dante Network

Dante AV-over-IP is based on common IT standards, enabling Dante to run alongside data traffic on networks comprised of readily available conventional switches and cabling.

For detailed information please refer to the Dante Information for Network Administrators:
Dante Information for Network Administrators

Selecting the Network Switch

If you are not using Dante devices connected in series, you will need a network switch that meets some requirements to create a stable Dante network.

Below you will find our recommendations for setting up a functioning network with Dante.

Our recommendations

▷ Use **non-blocking layer 2 gigabit** switches.

▷ Use **managed (intelligent) switches** that support DiffServ (DSCP) Quality of Service (QoS) with strict priority and 4 queues. Quality of Service (QoS) is a technology for prioritizing the transmission of audio data over background data traffic.

▷ Check whether all connections can perform **gigabit transmissions** simultaneously (whether the switch is non-blocking).

▷ Determine whether the **switching capacity is at least 1 Gbit/s × the number of ports × 2** (for input and output).

▷ Make sure that the switch has **sufficient packet forwarding functions** and **features** such as **VLAN** and **IGMP snooping**.

  ▷ The packet forwarding rate (throughput) is measured in packets per second (pps). A sufficient forwarding rate is 1.4 Mpps per connection (gigabit). This corresponds to a forwarding rate for the entire switch of 1.4 Mpps × the number of ports.

  ▷ VLAN is needed to separate a physical network into logical sub-networks (see „Virtual Local Area Network (VLAN 802.1Q)".

  ▷ IGMP is an important feature of network multicast and is used to set up and manage memberships of hosts and routing devices in a multicast group.

Managing Energy Efficiency Ethernet (EEE)

The EEE function reduces the power consumption of devices and is automatically managed by the switches. This issue can result in poor synchronization performance and occasional audio dropouts.

▷ Disable Energy Efficient Ethernet (EEE) or 'Green Ethernet' (IEEE 802.3az) on all ports used for Dante traffic.

Configuring Dante Network

Dante devices use DHCP for addressing when available or will auto-assign an IP address in the 169.254.0.0/16 range on the network. Dante devices continue to look for a DHCP server even after auto-assigning an IP address. Most Dante devices support static IP addressing.

▷ Switch off the WiFi function on the PC via which you are carrying out the Dante configuration.

▷ Assign the connected LAN as a private network.

▷ Make sure that all Dante devices, including the PC running Dante Controller, are assigned to the same IP subnet by assigning IP addresses in the same subnet.

7. Ports and Protocols

7.1. Sennheiser Control Cockpit Ports

In order to use the Control Cockpit software, certain ports must be enabled (especially for the organization firewall) for communication between software and devices. If necessary, please contact the local administrator to configure the required ports.

Port Requirements

Application layer

Port	Protocol	Service	Product
443	HTTPS	Web UI / Update service	Control Cockpit
444	HTTPS	Internal Communication Port	Control Cockpit
25	SMTP	Email Notification Device	API
465	SMTP (SSL)	Email Notification Device	API
8181	HTTP	REST API Device	API

> **Note:**
> The WEB UI and internal communication ports are set to 443 and 444 respectively by default but can be changed by the user during installation.

Transport Layer

Port	Protocol	Service
443	TCP	SSC Sound Control Protocol v2 / Firmware Update
5353	UDP	mDNS (Multicast 224.0.0.251)

7.2.   Dante Ports

To set up a Dante network, defined port information is required. The table below shows which ports, URLs and servers are used. For detailed information, please refer directly to the website: https://www.getdante.com/support/faq/which-network-ports-does-dante-use/

External Dante Ports

Address	Port	Usage	Type
239.255.0.0/16	4321	ATP Multicast Audio	Multicast
239.69.0.0/16	5004	AES67 Multicast Audio	Multicast
224.0.1.129-132 &	319, 320	PTP	Multicast
			Unicast
(DDM)			
224.0.0.251	5353	mDNS	Multicast
224.0.0.230 – 233	8700 – 8708	Multicast Ctrl & Monit.	Multicast
239.254.1.1	9998	Logging	Multicast
239.254.3.3	9998	TP Logging (if enabled)	Multicast
239.254.44.44	9998	Logging	Multicast
239.255.255.255	9875	SAP (AES67 discov.)	Multicast
UDP	28800, 28700-28708	Ctrl. & Monitoring.(ext)	Unicast
UDP	38800, 38700-38708	DVS control & monitoring (ext)	Unicast

Internal Dante Ports

Protocol	Port	Usage	Type
UDP	14336 -14591	Unicast Audio [Excluding Via]	Unicast
UDP	34336-34600	Unicast Audio [Via Only]	Unicast
UDP	4440, 4444, 4455	Audio Control [Excluding Via]	Unicast
UDP	24440, 24441, 24444,24455	Audio Control [Via Only]	Unicast
UDP	4777	Via Control [Via Only]	Unicast
TCP	4777	Via Websocket	Unicast
UDP	8850,28900, 24445	Via control & Monitoring (int.)	Unicast
UDP	8850, 38900, 8899	DVS control & monitoring (int.)	Unicast
UDP	8000	Dante Domain Manager Device Port	Unicast
UDP	8001	Dante Millau Device Proxy (int.)	Unicast
UDP	8002	Dante Lock Server	Unicast
UDP	8751	Dante Controller metering port	Unicast
UDP	8800	Control & Monitoring	Unicast
TCP	8753	mDNS clients (Internal only)	Unicast
TCP	16100-16131	HDCP Authent. for Video Endpoints	Unicast
UDP	61440-61951	FPGA level audio flow keepalive	Unicast
TCP	4778	DVS websocket (Apple Silicon only)	Unicast

8. Trouble Shooting

Unexpected errors may occur when updating device firmware via the Control Cockpit control software. You can identify the problem using error codes and solve it quickly with the recommended remedial steps.

Device Error Codes

0 None: The device is ready to be updated

1 DeviceNotReady : The device is not ready to be updated

▷ The device is not in the ‚Processing' update state and therefore cannot be updated.

▷ Please wait until the device is fully loaded (not grayed out in the Control Cockpit).

2 CannotSetDeviceProperty : The device is not ready to be updated

▷ The device could not enable the update property.

▷ Please check the connection to the device.

3 DeviceReportsError : Update error

▷ The device reports an update error.

▷ Please read the error message and react accordingly / contact the Sennheiser support.

4 NoDeviceReaction: Error after image upload

▷ The device does not react after firmware image upload.

▷ Please check the connections / contact the Sennheiser support.

5 GeneralError: General error

▷ A general error has occurred.

▷ Please check the connection and restart the device