Operation Manual

T44/48 Series

Version 8 (Firm. 1.5 and above)

Advanced System Amplifier

Dante™ Available

Keep these important operating instructions.
Check www.tecnare.com for updates.

General Information

T 44/48 Series Operation Manual

Ver.: 8_UK 05/2020

The information contained in this manual has been carefully checked for accuracy, at the time of going to press, however no guarantee is given with respect to the correctness.

Exel Acoustics SL accepts no responsibility for any errors or inaccuracies that may appear in this manual or the products and software described in it. Technical specifications, dimensions, weights and properties do not represent guaranteed qualities. As manufacturers we reserve the right to make alterations and modifications within the framework of legal provisions, as well as changes aimed at improving quality.

EXEL ACOUSTICS SL
CL Encinar, 282 – Pol. Ind. Monte Boyal
45950 Casarrubios del Monte (Toledo) Spain
Phone: (+34) 918 170 110 Fax:

e-mail: support@tecnare.com www.tecnare.com

IMPORTANT SAFE INSTRUCTIONS

Before using our product, be sure to carefully read the manual and safe Instructions. Keep this document with the device all time.

1. Read these instructions
2. Keep these instructions.
3. Heed all warnings.
4. Follow all SAFETY INSTRUCTIONS as well DANGER and OBLIGATION warnings.
5. Only use attachments / accessories specified by Exel Acoustics SL.
6. Do not use this apparatus near water.
7. Clean only with dry cloth.
8. Do not block any ventilation openings. Install in accordance with Exel Acoustics' instructions.
9. Do not install near any heat sources such as radiators, heat registers, stoves or other apparatus (including amplifiers) that produce heat.
10. Do not defeat the safety purpose of the polarized or grounding type plug. A polarized plug has two blades with one more wide than the other. A grounding type plug has two blades and a third pin are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
11. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles and the point where they exit from the apparatus.
12. Unplug this apparatus during lightning storms or when unused for long periods of time.
13. Refer all servicing to qualified service personnel. Service is required when the apparatus has been damaged in any way, such as power-supply cord or plug damaged, liquid has been spilled or objects have fallen into the apparatus, this apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

CAUTION: To reduce the risk of fire of electric shock, do not expose this device to rain or moisture.

14. Use the mains plug to disconnect the device from mains.
15. Do not expose this equipment to dripping or splashing and ensure that no objects filled with liquids, such as vases, are placed on the equipment.
16. The mains plug of the power supply cord shall remain readily operable.
17. Do not connect the unit's output to any other voltage source, such as battery, mains source, or power supply, regardless of whether the unit is turned on or off.
18. Do not remove the top (or bottom) cover. Removal of the cover will expose hazardous voltages. There are no user serviceable parts inside and removal may void warranty.
19. If the equipment is used in a manner not specified by the Exel Acoustics, the protection by the equipment may be impaired.

CAUTION: Do not remove any covers, loosen any fixings or allow items to enter any aperture

CAUTION: The rear of the product may get hot. Avoid direct skin contact during operation and for at least 5 minutes after power has been isolated.

CAUTION: The product must only be positioned at floor level when operated in a horizontal position.

IMPORTANTES INSTRUCCIONES DE SEGURIDAD

Antes de usar este producto, asegúrese de leer cuidadosamente el manual y las instrucciones de seguridad.

1. Lea estas instrucciones.
2. Conserve estas instrucciones.
3. Respete y siga todas las advertencias.
4. Siga todas las INSTRUCCIONES DE SEGURIDAD, así como las advertencias de PELIGRO y OBLIGACIÓN.
5. Utilice solo accesorios autorizados por Exel Acoustics SL.
6. No use este aparato cerca del agua.
7. Limpiar solo con un paño seco.
8. No bloquee las aberturas de ventilación e intalar de acuerdo con las instrucciones de Exel Acoustics.
9. No instale el aparato cerca de fuentes de calor tales como radiadores, calefactores estufas u otros aparatos que produzcan calor.
10. Esta unidad debe ser conectada mediante un cable de alimentación de 3 hilos. Por razones de seguridad, LA CONEXIÓN A TIERRA NO DEBE DESCONECTARSE EN NINGUNA CIRCUNSTANCIA.
11. Proteja el cable de alimentación de ser pisado o aplastado, especialmente los enchufes, receptáculos y en el punto en el que salen del aparato.
12. Desconecte este aparato durante tormentas eléctricas, terremotos o cuando no vaya a emplearse durante largos periodos.
13. Confíe las reparaciones a personal cualificado. Se requiere servicio cuando el aparato ha sido dañado de alguna manera como por ejemplo si el cable de alimentación o el enchufe está dañado, se ha derramado líquido o han caido objetos dentro del aparato, el aparato ha sido expuesto a lluvia o a la humedad, no funciona con normalidad o se ha caído.

PRECAUCIÓN:Para reducir el riesgo de incendio por desgarga eléctrica, no exponga este aparato a la lluvia o a la humedad.

14. Desconecte completamente este aparato de la red eléctrica desconectando el cable de alimentación.
15. No exponga este equipo a salpicaduras ni coloque sobre él objetos que contengan líquidos, tales como vasos o botellas. Equipo IP20.
16. El enchufe o la conexión a red debe ser facilmente accesible.
17. No conecte la salida de la unidad a ninguna otra fuente de voltaje, como batería o fuente de alimentación independientemente de si la unidad está encendida o apagada.
18. No retire la cubierta superior (o inferior). La retirada de la cubierta lo expondrá a voltajes peligroso. No hay piezas reparables por el usuario en el interior y su extracción podría anular la garantía.
19. Si el equipo se utiliza de la forma no especificada por Exel Acoustics, la protección del equipo puede verse afectada.

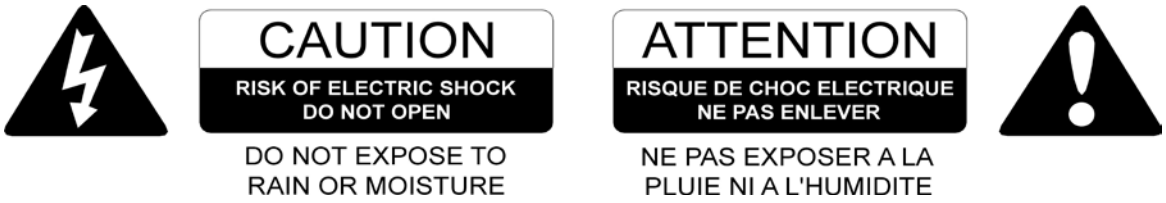
PRECAUCIÓN: No retire la cubiert, afloje tornillos o permita la entrada de elementos por ninguna abertura

PRECAUCIÓN: La parte trasera del equipo puede calentarse. Evite el contacto directo con la piel durante su funcionamiento y durante, al menos, 5 minutos después de que se haya apagado

PRECAUCIÓN: El equipo solo debe colocarse en el suelo cuando se opera en posición horizontal.

SYMBOL USED

			
Dangerous voltages; risk of electrical shock	Important operating instructions	Frame or chassis	Protective earth ground
Pour indiquer les risques resultant de tensions dange-reuses	Pour indequer important Instructions	Masse, chassis	Terre de protection
Warnung vor gefährlicher elektrischer Spannung	Wichtige Betriebsanweisung oder Gebrauchsanleitung sanleitung	Rahmen oder Gehäuse	Masse Schutzleiter
Presencia de voltajes peli-grosos	Importantes instrucciones operativas	Masa o chasis	Puesta a tierra



AVERTISSEMENT DE SECURITE

Pour déconnecter l'appareil de l'alimentation principale de façon permanente, débranchez le connecteur du câble fourni à l'arrière de l'appareil.

Ne retirez pas les couvercles, ne desserrez pas les fixations et ne laissez aucune pièce s'introduire dans les ouvertures.

Ne placez pas d'objets contenant du liquide à proximité de l'appareil.

Ne remplacez le fusible de réseau principal que par un fusible du même type.

Le radiateur arrière de cet appareil devient chaud. Evitez tout contact direct avec la peau pendant le fonctionnement et au moins 5 minutes après la mise hors tension de l'appareil

STANDARDS

FOR CUSTOMERS IN EUROPE

CE

This product complies with both the LVD (electrical safety) 73/23/EEC and EMC (electromagnetic compatibility) 89/336/EEC directives issues by the commission of the European community.

Compliance with these directives implies conformity with the following European standards:

EN60065	Product safety
EN55103-1	EMC emissions
EN55103-2	EMC immunity

This product is intended for the following electromagnetic environments: E1, E2; E3 & E4.

THIS PRODUCT MUST BE EARTHED. Use only a flexible cable or cord with a green and yellow core which must be connected to the protective earthing terminal of a suitable mains plug or the earthing terminal of the installation. The cord must be a maximum of 2m long, have a 2.5mm2 CSA, a 300/500V rating and comply with EN50525-2-11 / H05W-F.

THIS PRODUCT IS DESIGNED FOR PERMANENT INSTALLATION. It must be fitted in to a 19" rack enclosure and not operated unless so installed. The rack enclosure should be open at the front and back to allow free ventilation and movement of air through the product.

FOR CUSTOMERS IN THE USA

This product has been tested for electrical safety and complies with UL60065 7th edition

THIS PRODUCT MUST BE EARTHED. Use only a flexible cable or cord with a green or green / yellow core which must be connected to the protective earthing terminal of a suitable mains plug or the earthing terminal of the installation. The cord must be a maximum of 6' long, be 14AWG, have a rating SJ, SJT, SJE or 300/500V H05W-F and be marked VW-1.

THIS PRODUCT IS DESIGNED FOR PERMANENT INSTALLATION. It must be fitted in to a 19" rack enclosure and not operated unless so installed. The rack enclosure should be open at the front and back to allow free ventilation and movement of air through the product.

DECLARATION OF CONFORMITY WITH FCC RULES

We, EXE Acoustics SL, CL Encinar 282, Pol. Ind. Monte Boya, 45950 - Casarrubios del Monte (Toledo), España, declare under our sole responsibility that this family of devices, complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FEDERAL COMMUNICATIONS COMMISSION NOTICE

An example of 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 in a residential and commercial installation.

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. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

FOR CUSTOMERS IN THE CANADA

This product complies with CA /CSA C22.2 No.60065-03
Ce produit est conforme avec CA /CSA C22.2 No.60065-03

THIS PRODUCT MUST BE EARTHED. Use only a flexible cable or cord with a green or green / yellow core which must be connected to the protective earthing terminal of a suitable mains plug or the earthing terminal of the installation. The cord must be a maximum of 6' long, be 14AWG, have a rating SJ, SJT, SJE or 300/500V H05W-F and be marked VW-1.

CE PRODUIT DOIT ÊTRE MIS À LA TERRE. Utilisez uniquement un câble souple avec un noyau vert ou vert / jaune qui doit être relié à la borne de terre de connecteur d'alimentation ou la borne de terre de l'installation. Le cordon doit être un maximum de 6' (2m) de long, 14 AWG (2.5mm2 CSA), être classé SJ, SJT, SJE ou 300/500V H05W-F et être marquée VW-1.

THIS PRODUCT IS DESIGNED FOR PERMANENT INSTALLATION. It must be fitted in to a 19" rack enclosure and not operated unless so installed. The rack enclosure should be open at the front and back to allow free ventilation and movement of air through the product.

CE PRODUIT EST CONÇU POUR UNE INSTALLATION PERMANENTE. Il doit être installé dans un boîtier rack 19-in. Le rack devrait être ouvert à l'avant et l'arrière pour permettre la ventilation et le mouvement d'air libre à travers le produit .

DECLARATION OF CONFORMITY WITH CANADIAN ICES-003

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

DECLARACIÓN DE CONFORMIDAD
DECLARATION OF CONFORMITY

EXEL ACOUSTICS SL

CL Encinar, 282. Polígono Industrial Monte Boyal. 45950 – Casarrubios del Monte (Toledo), España (Spain).

Declara que los amplificadores de la serie ***T*** y sus respectivas opciones, cumple con los objetivos de las Directivas:

*Declare under our sole responsibility that the **T-Series** family of amplifier products comply with relating Directives:*

(1) Directiva de Baja Tensión - 2014/35/UE
(2) Directiva de Compatibilidad Electromagnética - 2014/30/UE
(3) Directiva RoHS - 2011/65/UE
(4) Directiva RAEE - 2012/19/UE

(1) Low Voltage Directive 2014/35/EU
(2) EMC 2014/130/EU
(3) RoHS Directive 2011/65/EU
(4) WEEE Directive 2012/19/EU

Y es conforme a las siguientes Normas Armonizadas Europeas:
In compliance with these Harmonized European Norms:

(1) EN60065 8th. Audio, video and similar electronic apparatus. Safety requirements.
(2) EN55032:2012. EMC emissions & immunity.
(3) EN55035-2017

Table of Contents

1. Welcome and unpacking

1.1. Welcome to Tecnare

Thank you for choosing a Tecnare® **T44/T48 Series** Advanced System Amplifier "**Made in UK**" for your aplication.

Please spare a little time to study the contents of this manual, so that you obtain the best possible performance from this unit.

All Tecnare® products are carefully engineered for world-class performance and reliability.

If you would like further information about this or any other Tecnare® product, please contact us. We look forward to helping you in the near future.

As part of a continuous evolution of techniques and standards, Exel Acoustics SL as manufacturer of Tecnare® products reserve the right to change the specifications of its products and the content of its documents without prior notice.

Updates and supplementary information are available on the Tecnare® website:

http://www.tecnare.com

Tecnare Technical Support is available at:

- (T): +34 918 170 110 - +34 918 171 001
- (e-mail): support@tecnare.com

Thank you again for placing your confidence in Tecnare® products.

1.2. Unpacking

After unpacking the unit please check carefully for damage. Every Tecnare product is tested and inspected before leaving the factory and should arrive in perfect condition. If damage is found, please notify the carrier concerned at once. You, the consignee, must instigate any claim. Please retain all packaging in case of future re-shipment.

1.3. The User Guide

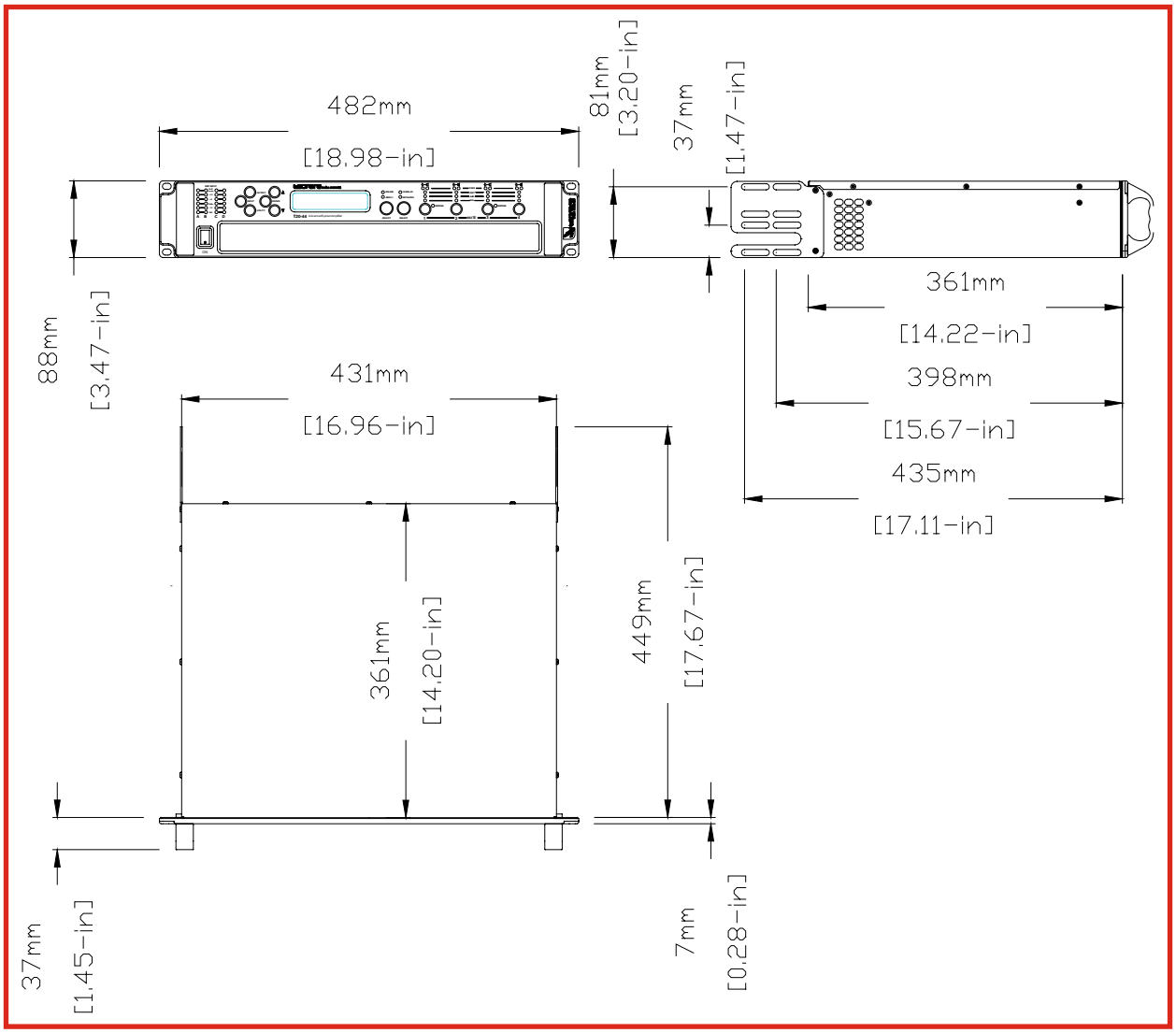
This user manual gives a progressively more detailed description of the functions of the Tecnare T44/48 Series Advanced System Amplifier. A pages quick reference guide is provided for those users who are experienced with this type of equipment and just need to know how to 'drive' the front panel. A detailed explanation of the front and rear panel controls and indicators is contained in the next section.

The final section describes each individual function or feature with annotated images explaining its use. Where appropriate, the graphical display is shown to further elaborate on the units operation.

To complete the manual a reference section is included, describing the technical performance and Mechanical drawing of the device complete with graphs of filter responses.

2. Installation Instructions

2.1. Mechanical Installations



The **T44/48** *Series Amplifier* system is designed to be mounted in a standard 19” rack enclosure.

Where the amplifier is used in a fixed installation, as long as the bottom unit is supported and there are no gaps between units, it is acceptable to use only the front panel 19” rack holes when fitting it in a standard rack enclosure. If the amplifier is mounted in a mobile rack it is important that the rear is supported with a rear rack mounting kit (*part number* ***TSK-TS***). Damage caused by insufficient support is not covered by the warranty.

To prevent damage to the front panel it is recommended that plastic cups or washers are fitted underneath the rack mounting bolt heads.

It is possible to mount multiple T44/48 Series amplifiers without ventilation gaps between them but it is essential that an unobstructed flow of clean air is available from the front of the unit to the rear. It is important that neither the air intakes on the front of the unit or the exhaust vents at the rear are covered. Steps must be taken to ensure that hot air does not continually circulate through the amplifier from the back of the rack to the front.

The amplifier should never be exposed to rain or moisture during operation or storage. If the unit does come into contact with moisture, remove the AC power cord immediately and leave it in a dry and warm location to dry out.

Note that when any equipment is taken from a cold location into a hot humid one, condensation may occur inside the device. Always allow time for the equipment to attain the same temperature as its surrounding environment before connecting the AC power cord.

IMPORTANT: *It is the responsibility of the user to ensure that dirt, liquids and vapour from theatrical smoke and fog machines is not ingested by the amplifier. Damage so caused is not covered by the manufacturer's warranty.*

2.2. AC Power Connection

The amplifier utilises a 32A Neutrik® PowerCON™ type locking AC power connector. Use only an AC power cord with a correctly terminated PowerCON™ type (NAC3FC-HC) connector to make the connection to the mains power supply.

The amplifiers are designed to operate on 50/60 Hz AC power. The power supply sections automatically configure themselves for either 115V or 230V nominal voltage at turn on. The amplifiers will operate over an extended range of supply voltages (please refer to the technical specifications). The threshold of these ranges are: **[115V range = 75-138Vrms]**; **[230V range = 138 - 275Vrms]**.

Note that whilst the amplifier will operate correctly at voltages indicated, the specified output power will only be achieved when operating with the stated nominal voltages.

Once amplifier has configured itself in a particular range it will not change range, even if the main voltage varies wildly, unless power is completely interrupted for several seconds or is cycled by the user.

During start-up the amplifier asses the main environment, displaying one of the following messages if a problem is detected with the quality of the incoming mains supply.

Problem and T Series LCD Screen Message	Description of the Problem
Mains too low	During startup the unit waits for the mains to settle within either the 115V or 230V range. If the mains are taking a long time to settle and the voltage measurement is ***below*** the 115V range this message is displayed.
Mains too high	During startup the unit waits for the mains to settle within either the 115V or 230V ranges. If the mains are taking a long time to settle and the voltage measured is ***above*** the 230V range this message is displayed.
Mains unstable	During startup the unit waits for the mains to settle within either the 115V or 230V ranges and remain there for a settling time. If the mains are taking a long time to settle but the voltage measured is currently in either the 115V or 230V ranges this message is displayed.

When an amplifier is running normally the mains are continuously monitored to ensure that it remains within the initially selected range. If the main voltage is outside the range the amplifier will enter a protection mode and briefly display the message below. When in this mode audio will be muted but communication will still be possible.

Fault: Mains out of range	The amplifier was running, but the measured mains voltage was outside the initial range.

While in a protection mode caused by an unstable mains supply the amplifier will continually monitor the mains and automatically resume normal operation if it is assessed to be stable and within the initial range the selected when the unit was first powered up. While the mains remains out of range one of the messages above will be displayed.

2.3. Audio Connections

2.3.1. Input Connections

For each input channel there is a female XLR-3 connector for analogue inputs. The T-Series can be fed with up to four balanced analogue audio signals. There is also one female XLR-3 for one stream (two channels) of AES3 digital audio. Note that only two channels of AES3 digital audio are available. The Dante option permits more channels of Digital Audio inputs.

The analogue input panel also features four XLR-3 male link connectors passively wired to the input connectors. They allow transmitting the input signal to daisy-chained amplifier.

The AES3 input panel also feature one XLR-3 male link ports. It allows transmitting the imput signal to daisy-chained amplifier.

The HOT, + or 'in phase' connection should be made to pin 2 of the XLR connector.
The COLD, - or 'out of phase' connection should be made to pin 3 of the XLR connector.
Pin 1 of the XLR connectors is internally connected to the chassis.

The shield of the input cable should always be connected Pin 1 of the XLR to ensure the EMC performance and regulations are met.

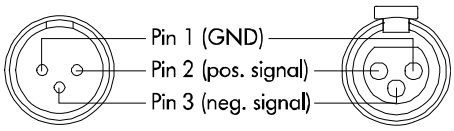


Fig. 02: PIN out assignment T-Series Analogue Input/Link - Balanced connection

2.3.2. Using unbalanced connection

Please note that the use of unbalanced connections is not recommended, however when connecting the amplifier to an unbalanced audio source, the signal conductor should be connected to XLR pin2. The 'Cold' conductor or cable screen should be connected to XLR pin 1 with a short connection made between pin 1 and pin3 as shown in Figure 03.

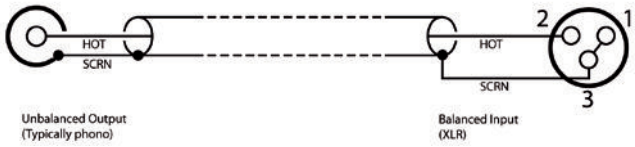


Fig. 03: Balanced to Unbalanced Analogue wiring and PIN out.

2.3.3. AES3 Input

A Latching XLR-3 connector accepts two channels of AES3 digital audio. Input Impedance is 110 ohms; ensure that 110 ohm digital audio cable is used.

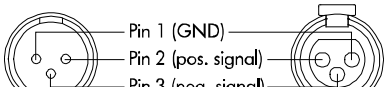


Fig. 04 PIN assignment T-Series Digital Input/Link

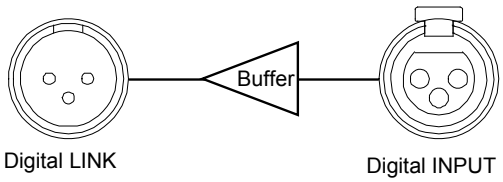


Fig. 05 Digital Input and Link

2.3.4. Amplifier Output Connections

The ***T44*** amplifier is fitter with one SpeakON™ NL4 connector per amplifier channel. the appropriate conductor terminations are shown below and on the rear panel of the unit.

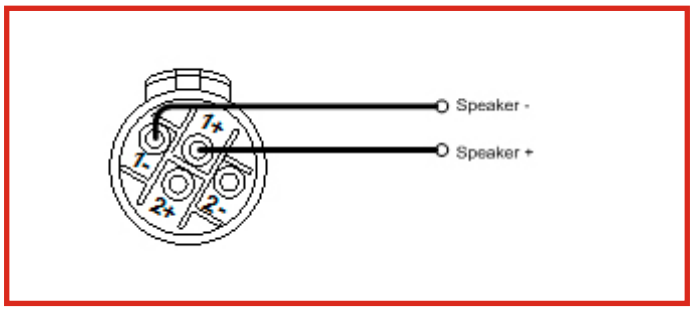


Fig. 06 Amplifier output connections - T-44

Additionally, the SpeakON™ NL4 connector for amplifier channel 1 carries the output for amplifier channels 1 and 2. Similarly, the SpeakON™ NL4 connector for amplifier channel 3 carries the output for amplifier channels 3 and 4. This can be useful for making a connection to two loudspeakers with one 4-core cable (i.e. Bi-amp).

On the ***T48*** model, all output are Bi-Amp; each SpeakON™ connector carries two amplifier outputs – Channels 1&2, Channels 3&4, Channels 5&6 and Channels 7&8.

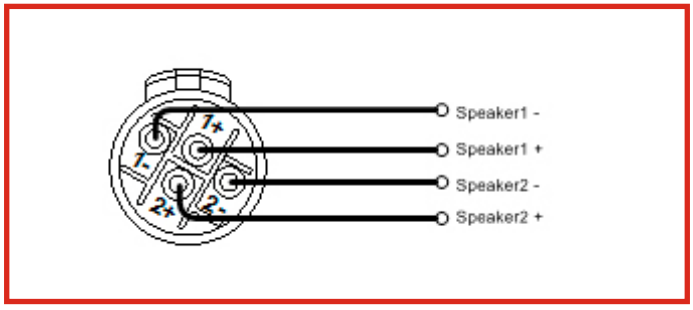


Fig. 07 Amplifier Output Bi-amp connexion (CH1 & CH3) and T-48 model

In addition, the channel 1 or channel 3 connector (all the SpeakON™ connectors on the T48 model) can also be used if the pair of amplifier channels is being operated in bridged mode.

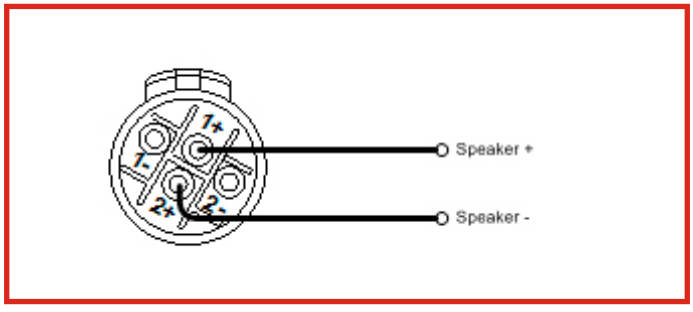


Fig. 08 Amplifier Output Bridge connexion (CH1 & CH3)

2.3.5. Load Matching

Each output of the device can be optimised to drive either a low impedance load (e.g. 2, 4 or 8 Ohms), or a Constant Voltage (C.V.) using the Load parameter in the Output menu. There are several C.V. settings (25V, 70V and 100V Line) which determine the maximum RMS voltage that the amplifier will produce. Select the one which is appropriate for the installation. A number of low impedance settings (depending on the model) are also available. Although it is not critical that this setting matches the impedance of the connected load, this will maximise the power that is available for the load.

3. Introduction and Key Features

3.3.1. Introduction

The Tecnare **T44/48** Series Advanced System Amplifier represents current state-of-the-art technology in several areas. This product is the result of several years of research, from which many advances in switched mode power technologies and ever finer detail in signal processing have stemmed. Taking advantage of the latest advances in analogue to digital conversion technologies, the unit achieves performance levels among the very best that engineering permits.

Bellow is a list of key features, followed by some information on the major advanced features of the product.

3.3.2. Key Features

- Four/Eight channels of sonically pure Class D amplification
- Very high power density - packs four channels and 20kW or eight channels and 10kW into just 2U of rack space
- Packed with robust protection and monitoring systems to keep the show going
- External Breaker Protection (EBP) limits the current draw to prevent breakers opening
- Tecnare minimal signal path design
- Class leading sonic performance achieved by the use of state of the art Amplifier technologies and highly advanced DSP algorithms using Linea Micro Detail (LMD)
- 96kHz sampling frequency provides for a nominally flat response beyond 40kHz.
- Rotary encoders, illuminated buttons and graphical display provide a rapid, intuitive and user-friendly control interface
- High speed Ethernet communications supporting DHCP, static-IP and auto-IP and direct connection to a computer without the need for a router or a switch
- Powerful Drive Module concept, abstraction from device centric to speaker based control
- Innovative Component Presets to allow individual outputs to be used for selected drivers of a loudspeaker system
- Twelve layers of Parameter Overlays for trouble-free Grouping
- Unique VX limiter providing dynamic control for passive 2-way enclosures
- Unique LIR linear phase crossover shapes giving FIR-like performance without the drawbacks
- Linear phase HF system EQ profiling which provides perfect integration between enclosures
- Accepts 48kHz and 96kHz FIR files via System Engineer (Models marked with “F”)
- Innovative excursion control limiter with sliding High Pass Filter; limits only the damaging low frequencies
- Transducer thermal modelling provides regulation limiters, addressing long term overload
- Overshoot limiter governs amplitude of transient signals retaining average power whilst constraining peak energy
- (Optional) Dante™ / AES67 digital audio networking with automatic fallover to Analogue or AES3
- AES3 inputs

3.3.3. Drive Module

The ***T44/T48*** Series processor has a new way of ordering and grouping channels in order to give a more speaker-based approach to controlling, designing and recalling speaker configurations; these are called Drive Modules. A Drive Module is the Processing provided by one Input DSP Block, and a number of Output DSP Blocks, which are associated with one-another by means of routing. For example, if Input DSP Block B is routed to Outputs 3 and 4, then this is a 2-way Drive Module with Input DSP Block B forming the ‘***Master***’ control, and Output DSP Blocks 3 and 4 providing the driver-related control. Overall, this forms the processing typically for one loudspeaker sub-system. The System Enginner Drive Module control panel for this sub-system may then used for control and monitoring of the associated speaker.

Drive Module Modules may be included in Module Groups, which use the Parameter Overlay feature in the Device to achieve trouble-free Grouping in the System Engineer application.

The Presets in the Device are Drive-Module centric, and are used to configure individual Drive Modules rather than the whole device.

Importantly, Drive Modules move the focus away from the processing device, and onto the loudspeaker systems.

A Drive Module Preset may be broken apart into Components, allowing any output to be used for any component within a Drive Module Preset (i.e. any driver in a loudspeaker subsystem).

See Overview of Modules.

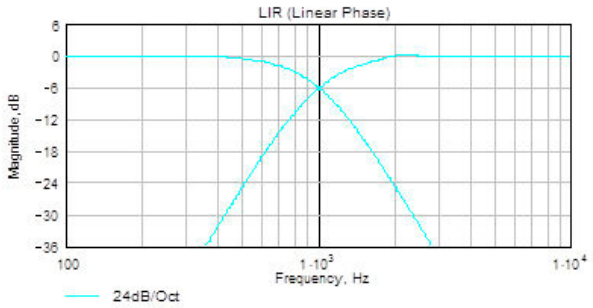
3.3.4. Overlays

When the Device is used in Modules view in System Engineer, this allows the modules to be grouped into Overlay Groups. These groups allow various Input (master) parameters to be adjusted in all modules in that group, whist maintaining independent parameter values across each group. This is achieved in the device by combining the parameters for all the layers for a given section (Gain Delay, EQ etc.). When an Overlay parameter is active, the Overlay indicator will become illuminated. The combined Gain or Delay, etc. associated with a given section is shown on the module panel in System Engineer, within square brackets "[ ]" under the Delay and Gain for each input channel. The combined EQ curve is shown in an olive colour. The Input Mute button in System Engineer will flash if an overlay mute is active. On the device, the presence of an active overlay is generally indicated by square brackets "[ ]" after the parameter value on the display. An input overlay mute is indicated on the mute/clip indicator for that channel flashing. Note that overlay parameters cannot be adjusted on the Device itself; these can only be controlled by the System Engineer application. However, overlay parameters may be removed on the device - *see "Overlay Flush"*. Note that overlays are not stored in presets or snapshots or carried in setting files.

3.3.5. LIR Linear Phase Crossover Filtering

The ***T44/T48*** Series also includes a new type of crossover filtering "*Linear Impulse Response*" (LIR) crossover filtering, which results in a Linear Phase crossover that has a constant delay regardless of frequency (unlike other types of crossover which delay different frequencies to a different extent, thus smearing the arrival time). The LIR crossover can thus be described as having a flat Group Delay response, and thus entirely free of Group Delay Distortion.

The shape of the LIR crossover filter is quite similar to a 4^{th} order or 24dB/Oct Linkwitz-Riley filter, and maintains zero phase difference between the adjacent bands across the crossover region to keep the polar response rock steady. See Figure 09.



09.- LIR Filter response

3.3.6. FIR Linear Phase Equalisation

The Input High-Shelf Equalisers use *Finite Impulse Response* (FIR) filtering to produce Linear Phase equalisation; that is all frequencies are delayed by the same amount, perfectly preserving the transient response. This can also be important in applications where different amounts of EQ are applied to different parts of a speaker cluster, such as to add 'Throw' EQ boost so that parts of cluster which are throwing further can have HF absorption correction added. If this EQ is not linear phase, then the zones where the speakers combine may suffer frequency response anomalies.

4. Panel Interface User Guide

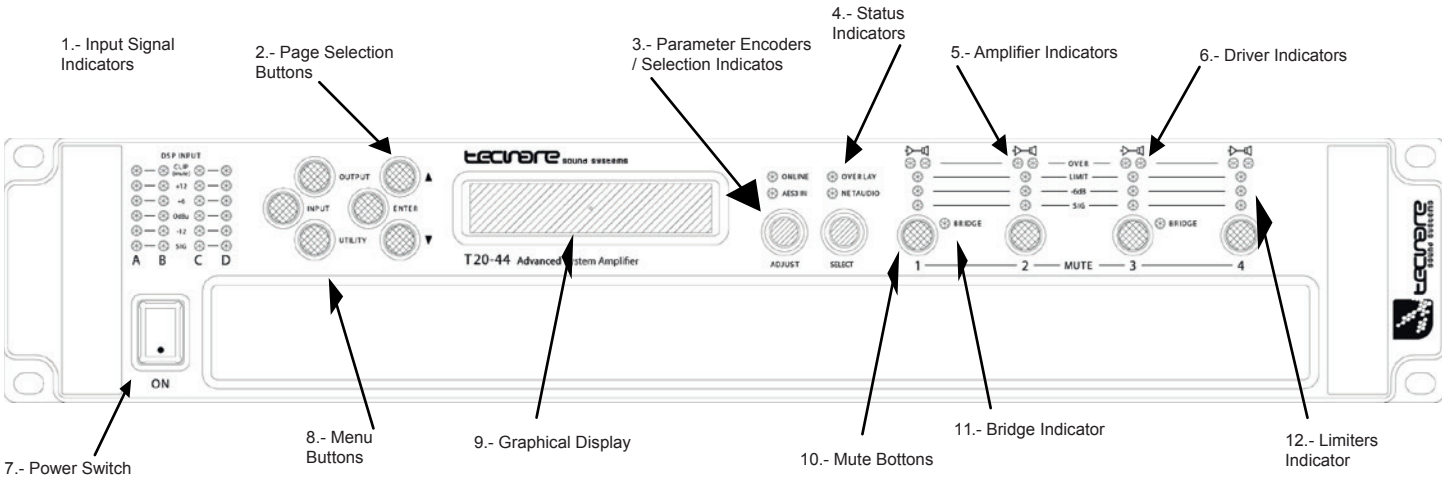


Fig. 10.- T44 Front panel schema. The T44 is illustrated but T48 is similar just that it with more output indicators and mute buttons

4.1. Panel Layouts

The front panel of the Device T-44 Series amplifiers is a combination of buttons together with the LCD display allows the user access to detailed information and complete control over the amplifier's status. This chapter illustrates all the functions and settings accessible via the amplifier front panel.

All the setup and setting functions described in this chapter can be also accessed via computer with System Engineer software.

4.1.1. Front Panel

1. Input Signal Indicators

A set of five indicators show "**Sig**", "**-12**", "**0dBu**", "**+6**" and "**+12**" and "**Clip** (mute)" for each of the DSP inputs "**A**" "**B**" "**C**" "**D**". The signal present Indicators operate at approximately **–40** dBu. The "**0dBu**" indicators are intended to show nominal operating level and can also be useful for setting system gain structure. The **Clip/mute** Indicators- warn the user of input overload and operate at 1dB before clip. This indicator also shows a muted input. Input mute is turned on/off in the <**INPUT/DSP**> gain page. This indicator will also flash regularly if a ***Module Group*** has muted this channel.

2. Page Selection Buttons

When one of the buttons <**INPUT/DSP**>, <**OUTPUT**> or <**UTILITY**> is illuminated, the up <▲> and down <▼> arrows will also illuminate, informing the user that these buttons may be used to scroll through the various pages of parameters that may be viewed and edited. The <**ENTER**> button is used to confirm an operation such as storing or recalling a preset or snapshot. It will illuminate when the user is being invited to press it. It will flash when warning the user that pressing this button will activate an important function.

3. Parameter Encoders

Two velocity sensitive parameter encoders are used to adjust parameters shown on the display. Up to three parameters at a time are displayed on the screen. The parameter name is shown above the parameter value in each of the three screen sections. Use SELECT to highlight the parameter, then ADJUST to change it.

4. Status Indicators

The "**OVERLAY**" indicator shows when there are parameters active on a group layer, which the user cannot access through the front panel of the device (*see "Overlay Flush"*). The "**NETAUDIO**" indicator shows that a networked digital audio card is installed and routed (Such as Dante™). The "**ONLINE**" indicator has three states:

- ***OFF:*** The unit is offline and not connected to a computer or network.
- ***Flashing:*** the unit is searching for an IP address; if the unit does not find an IP address the unit will assign itself an IP address automatically and the indicator will stop flashing.
- ***ON:*** the unit is online and connected with software. IP settings can be viewed or changed within the <**UTILITY**> pages.

The **AES3** IN indicator illuminates when one or more of the inputs is using an *AES3 Source.*

5. Amplifier Indicators

This indicates when the amplifier protection systems are reducing the gain to keep the parameters of the amplifier within specification, or when that the channel is clipping.

6. Driver Indicators

This indicates a signal **6dB** higher than the limiter threshold, or when the threshold of the excursion limiter has been exceeded, or when the thermal limiter is active. Please note that because of the long release time of the thermal limiter, this indicator may remain illuminated for several seconds after signal on that channel is reduced.

7. Power Switch

Applies mains power to the device. If the device has entered Sleep mode, it may be woken up again either from the *System Engineer* application, or by switching this switch off, then on again.

8. Menu Buttons

There are three buttons to determine which section of the device to view or edit. The <**OUTPUT**> button displays pages of parameters associated with a particular output channel. The <**INPUT/DSP**> button displays pages of parameters associated with a particular input socket or input DSP channel. Pressing <**INPUT/DSP**> or <**OUTPUT**> buttons repeatedly will scroll through the inputs/outputs of the processor. After the last channel, navigation returns to the Home screen. The <**UTILITY**> button displays pages of miscellaneous parameters not associated with any particular channel. Whilst in Edit mode, one of these three buttons will be illuminated. They are mutually exclusive – pressing one of the buttons will deselect any others that are active. Pressing Utility will escape back to the Home screen.

9. Graphical Display

When the device is switched on, it will show the default screen; a useful overview of channel allocation. On most pages the currently selected channel and parameter information is displayed on the upper part of the screen and the parameter value on the lower part of the screen. The screen contrast can be changed by pressing the <**UTILITY**> button to navigate to "Screen" and using the encoders to change the percentage; this can also optimise the viewing angle. In most pages the currently selected channel and parameter information is displayed on the upper part of the screen and the parameter value on the lower part of the screen.

10. Output Mute Buttons

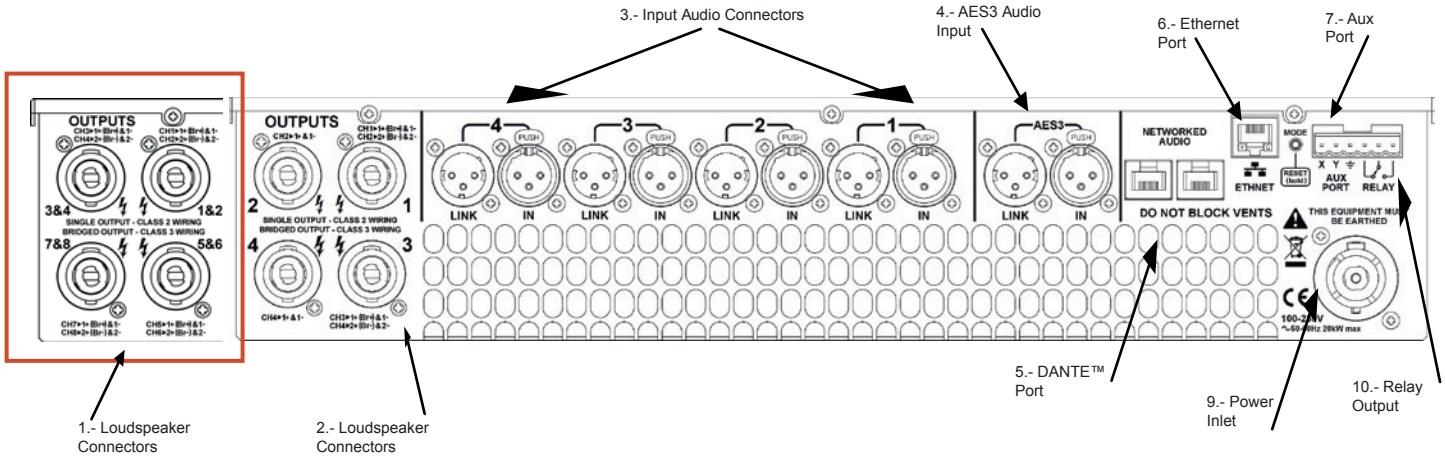
DSP output mute status is indicated and controlled by and illuminated button for each channel. These flash when the entire unit is muted from the AUX port or from System Engineer Mute-All, or if this channel has been muted by the protection systems.

11. Bridge Indictor

This will illuminate when the channel pair is in Bridge mode. The controls for the left channel of the pair will determine the settings. *See "Bridge".*

12. Limiter Indicator

The output indicators shows the status of the limiter and output level. The level indicated is that before the limiter, referenced to the limiter threshold. The <**SIG**> indicator shows when a signal is present on the output. The second indicator <**-6dB**> shows that the signal has reached 6dB below the limiter threshold. The third <**LIMIT**> indicator indicates that the threshold of that output channel has been reached.



4.1.2. Rear Panel

1. Loudspeaker Connectors (T48)

The amplifier SpeakON™ outputs. Connect the first loudspeaker to the 1+ and 1- terminals and the second loudspeaker to the 2+ and 2- terminals. For Bridged mode, use terminals 1+ and 2+.

2. Louspeaker Connectors (T44)

The amplifier SpeakON™ outputs. Connect the loudspeaker to the 1+ and 1- terminals. CH1 also carries the (duplicated) loudspeaker output for channel 2 on terminals 2+ and 2-. Similarly, CH3 carries the loudspeaker output for channel 4 on terminals 2+ and 2-. For Bridged mode, use terminals 1+ and 2+ of either CH1 or CH3.

3. Audio Input Connectors

Analogue Audio Input Connectors- All audio connections are fully balanced and wired: pin-1 to ground (as required by the AES48 standard), pin-2 hot & pin-3 cold. At the left of each input there is an Analogue Audio Link Connectors. It carries a duplicate (parallel) connection (to another amplifier for example).

4. AES3 Audio Input

For inputting Digital Audio signals. The Input is fully balanced and wired: pin-1 to ground, pin-2 data+ & pin-3 data. The Link connector allows a buffered AES3 signal to be passed on to another device.

5. DANTE™ Ports

Connection ports for DANTE™ with the Primary and Secondary port convention available.

6. Ethernet Communication Port

The amplifier may be controlled entirely from another controller, typically a Personal Computer, running Tecnare audio's System Engineer software as well as via TIPI 3rd party protocol. Connection will normally be made to the controller via this Ethernet port connector. This port is also used for updating the firmware in the unit. Connection will normally be made to the controller via this Ethernet port connector with shielded Cat-5e cables. This port is also used for updating the firmware in the unit.

7. Auxiliary Port

The auxiliary port may be configured to recall snapshots or apply muting. *See "AUX Port" secction*.

8. Power Inlet

The unit should be connected to a suitable mains electricity supply using an earthed PowerCON® 32A (NAC3FC-HC) connection power lead. The device has a switch mode power supply that is capable of operating with a nominal mains voltage of 100V to 230V, 50/60Hz without re-configuration.

IMPORTANT: *The device must be earthed to a suitable power earth; failure to do so may affect performance and/or operation and will invalidate warranty and could be potentially hazardous.*

9. Relay Output

This isolated relay output may be used to indicate abnormal conditions to external monitoring apparatus. *See "Fault Relay"*.

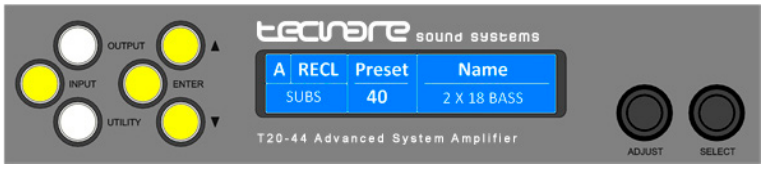
5. Quick Start

The **T44/48** Series amplifier are not only powerful amplifiers but have extremely comprehensive processing ability allowing complex systems to be designed to suit any application for many applications however, all you need to do is recall the appropriate Preset, connect your speakers and source and away you go. This section shows you how to achieve the quickest, most straightforward set up using an T20.

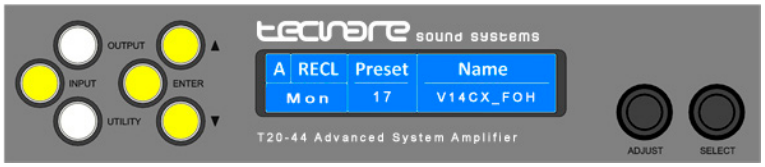
5.1. Loading a 2-way (Bi-amp) Presets

1. Connect the amplifier. The T44 requires mains connected to its 32Amp PowerCON® inlet, an input feed, either balanced analogue to the input XLRs, AES3 to the dedicated AES XLR, or the optional DANTE™ to the DANTE™ RJ45 port. A 2-way loudspeaker run in bi-amp mode can be connected directly to output SpeakON® 1 and 3 as these also have channels 2 and 4 respectively connected to pins 2± specifically for bi-amp operations. See the chapters on mains, input and output connections for more details.

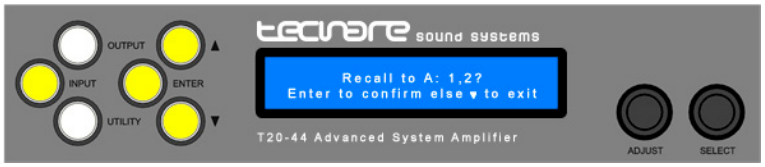
2. Power up the amplifier, once it has completed its power-up cycle press <**INPUT**> and press the down arrow once to show the Preset recall for Channel A-



3. Using <**ADJUST**> encoder control to scroll round to the required 2-way preset, e.g. V14CX_FOH



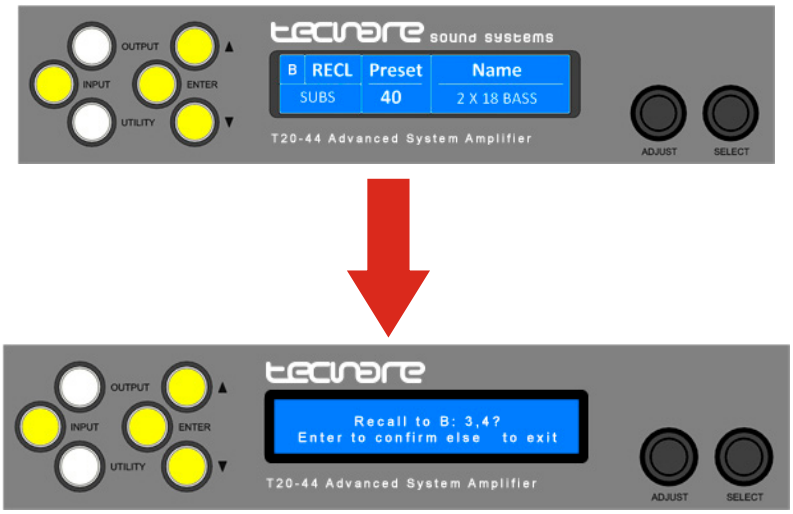
4. Pressing <**ENTER**> button and them the LCD will be displayed “Enter to confirm or ▼ to exit”



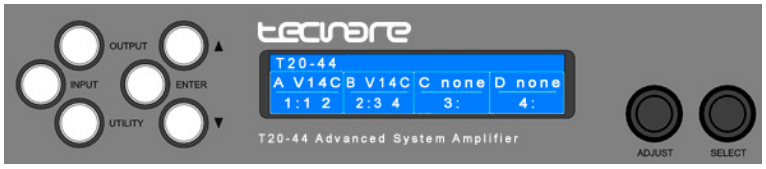
5. The <**ENTER**> button will be flashing, pressing it and you will see the following:

6. Input A will now feed output 1 with V14CX_FOH LF settings and output 2 with V14CX HF settings.

7. Pressing <**INPUT**> button you will get the Input B. Them the LCD screen will show the preset for Input B. Again using the <**ADJUST**> control select the V14CX preset and press <**ENTER**>.



8. Pressing <**ENTER**> the preset will be loading complete. Pressing <**UTILITY**> you come back to the default screen.



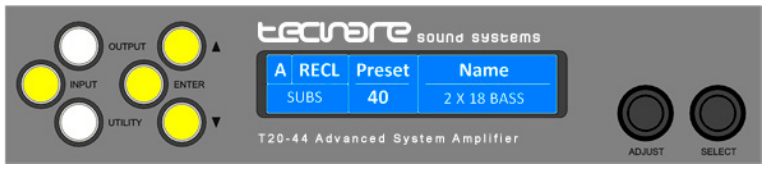
This screen shows tha DSP A and B are both loaled with the V14CX_FOH preset. Input 1 is routed to output 1&2, input 2 is routed to output 3&4. Input 3 and 4 are not used therefore no routed anywhere. The amplifier is ready for use.

5.2. Loading a 1-way (Passive) Presets

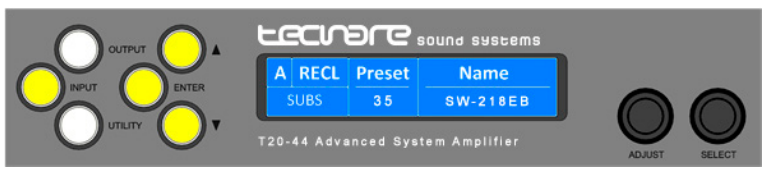
Loading Preset for 1-way or passive loudspeaker is exactly the same procedure other than it being necessary to define the preset for all four Inputs.

1. Connect the amplifier. The T44 requires mains connected to its 32A PowerCON® inlet, an input feed, either balanced analogue to the input XLRs, AES3 to the dedicated AES XLR input or Optional DANTE™ to the DANTE™ RJ45 port. A passive loudspeaker can be connected directly to output SpeakON® 1, 2, 3 and 4. See the chapters on mains, input and output connections for more details.

2. Power-up the amplifier, once it has completed its power-up cycle press <**INPUT**> and press the down arrow once to show the Preset recall for Channel A.



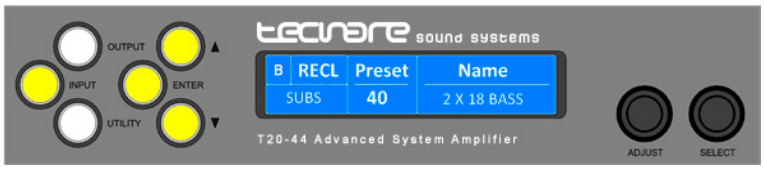
3. Use the <**ADJUST**> encoder control to scroll round to the required 1-way Preset, e.g. SW-218EB



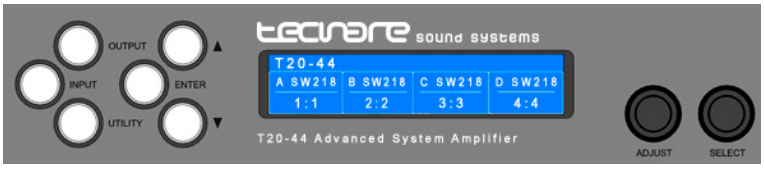
4. pressing <**ENTER**> button and them you the LCD will be displayed “Enter to confirm or ▼

5. The <**ENTER**> button will be flashing, pressing it and you will see the following:

6. Pressing <**INPUT**> button you will get the Input B. Them the LCD screen will show the preset for Input B.



7. Again using the <**ADJUST**> control to select the next 1-way preset (SW-218EB) and press <**ENTER>** twice to confirm. When the preset is loaded press <INPUT> again to load the same preset into **C** and repeat. Finally press <**INPUT**> once more to enter the preset into **D**. Press <**UTILITY**> to return to the home screen.



This screen shows tha DSP A, B, C & D are loaded with the SW-218EB passive preset. Input 1 is routed to output 1, Input 2 to output 2 and so on. The amplifier is ready for use.

6. Operation Modes

This chapter provides comprehensive information on ***T44/48*** Series operation. The detailed information included here is essential to realizing the full functionality of T44/48 Series amplifiers. The user can choose to control of T44/48 Series amplifiers from the front panel or remotely via **System Engineer®** control software, as they are interactive and communicate bi-directionally.

6.1. Operation Precautions

Make sure that the Power switch on T44/48 amplifier's front panel is either OFF before making any input or output connections.

Ensure no input signal is present when powering on the T44/48 amplifier to reduce the risk of any inadvertent bursts of high level audio.

6.2. Starting up the unit

When power switch is switched on the unit will go through its start-up cycle, checking all the sub-systems as it does so. Along the way, the screen will inform you of its progress. Once this is complete the display will then show the Home screen indicating drive module configurations.

6.3. Overviews of the Modules, Preset Component and Snapshots

A ***Drive Module*** represents a loudspeaker subsystem (*e.g. Sub and full range*), and comprises one input channel and a number of output channels, associated with one-another by routing. The size of the Drive module is determined by the number of outputs in it. The device may contain up to four Modules.

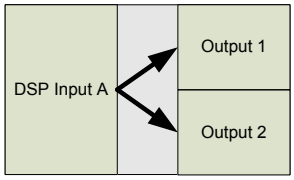


Fig. 12 Drive Module

A ***Module Preset*** is a collection of settings (parameters) for a Drive Module of a particular size. The Preset contains a set of parameters for one input and a set of parameters for each of the outputs in the module. When a Module Preset is recalled, it will automatically change the routing between Input DSPs and Outputs, consuming a number of outputs according to the size of the Drive Module. Recalling a Module Preset thus always creates a Drive Module with consecutive outputs.

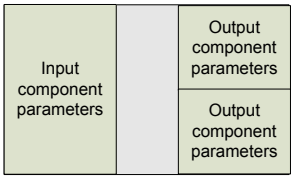


Fig. 13 Module Preset

A ***Component*** is a collection of settings (parameters) for one (input or output) channel. Any one of the output components in a Module Preset may be recalled to any individual output.

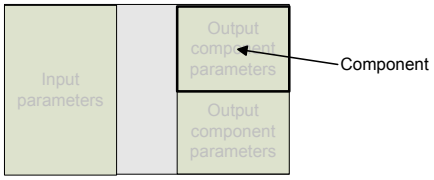


Fig. 14 Component

These concepts are depicted in the System Engineer application as in the following example of a 2-way Module:

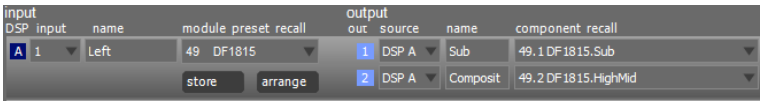


Fig. 15 System Engineer 2-way module

A ***Snapshot*** is a device-wide representation of most of the settings in the device. This is represented as four Input Component numbers, eight four Output Component numbers, plus a number of machine-centric settings such as routing and Input/Output Analogue/Digital selection etc.

Device Settings	Input A component number	Output 1 component number
	Input B component number	Output 2 component number
	Input C component number	Output 3 component number
	Input D component number	Output 4 component number

Fig. 16 Snapshot

6.4. Navigation

Parameter navigation and adjustment on the ***T44/48*** Series is very straightforward. There is no concept of drilling down deeper into hidden menus; every parameter is accessible by simply scrolling across a 'map' of parameter pages which can be thought of as placed on a 2-dimensional grid. Horizontally across the width of the grid are the various channels, and vertically up and down the grid are the parameter pages for each section of processing.

To view a parameter, repeatedly press the desired <**INPUT**> or <**OUTPUT**> channel button until the desired channel is reached. Then repeatedly press the up <▲> and down <▼> buttons to scroll through the processing parameters for the selected input/output.

Two encoders allow you to select and adjust a parameter. Often, several parameters will be shown in various zones on the display. To select a parameter for adjustment, turn the right-most encoder such that the parameter you wish to adjust is highlighted. Then turn the leftmost encoder to adjust the value of that parameter. Turning this encoder clockwise will increase the value of a parameter, or anticlockwise will decrease it. The encoders are velocity-sensitive so turning an encoder rapidly will cause the action to 'accelerate', so the value changes more rapidly.

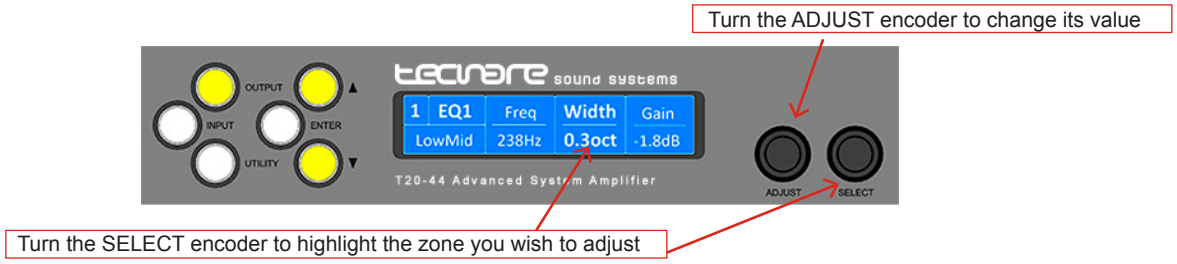


Fig. 17 Navigation menu

6.5. The Home Page

The ***Home Page*** presents an overview of the configuration of the device. It indicates the user-define Device Name at the top, and shows the four "*Drive Module*". In each Drive Module the top line shows the Input DSP channel ('A', 'B' etc), and the name the user has given to this channel. The bottom line shows the physical input number, and a list of the outputs which are routed from the Drive Module.

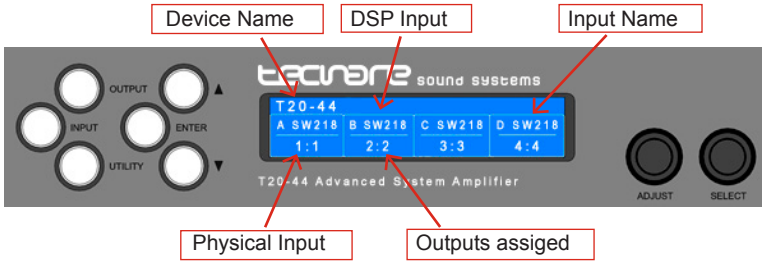


Fig 18. The Home page Screen

6.5.1. Drive Module

The **T44/48** Series uses Drive Modules to represent loudspeaker sub-systems. Drive modules result in a less processor-centric and more speaker-orientated system design. A drive module is defined as the processing provided by one Input DSP, and a number of outputs, which are associated with one-another by means of routing. For example, if Input DSP B is routed to outputs 3 and 4, then this is a 2-way Drive Module; input DSP B forming the 'master' control, and output DSP 3 and 4 providing the driver-related control. The Input DSP parameters then control the Drive Module (and thus the speaker sub-system). The Drive Module control panel in the *System Engineer* application is then used for control and monitoring of this sub-system.

6.5.2. Drive Module Presets

Presets ***do not change*** the settings device-wide. Rather, recalling a Module Preset creates a Drive Module by 'consuming' a number of consecutive outputs and setting up routing between the Input the preset was recalled on and those outputs. The parameters in that Drive Module are then set according to the parameters in the components in the Module Preset

> **Note**: Module presets only work with consecutive outputs. Modules with non-consecutive outputs can be created by manually manipulating the routing, and then recalling Component Presets to the individual outputs. The resulting system can then be stored in a *Snapshot*.
>
> **Note**: When a Module Preset Recall consumes outputs to construct a module, it treats a pair of Bridged outputs as a single channel, so recalling a 2-way Module Preset will consume 3 output channels if a Bridged pair is encountered. *See "Bridge".*
>
> **Note**: DSP inputs "A" to "D" are not the same as physical inputs "1" to "4". The ***T44/48*** Series has four audio inputs and four DSP inputs. This is a matrix mixing system where any physical inputs, be they analogue, AES3 or networked audio feeds, can drive any number of DSP inputs.

6.5.3. Component Preset

A Component Preset represents the processing for just one output. Any part of a Module Preset may be recalled to any one output. A Drive Module comprised of parameters which have been recalled to its outputs using Component Preset Recalls can then be saved into another Module Preset provided the outputs remain consecutive (i.e. you have not changed the routing manually). If the routing has been changed manually, then the whole arrangement may be saved into a Snapshot. *Also see Snapshots and Recalling Components*.

6.5.4. Factory Module Preset

The device may contain a library of *Factory Presets* designed to suit Tecnare loudspeakers.

Factory Presets may contain some parameters that are fixed and hidden from view; the remainder of the parameters are available for user manipulation. The number and type of hidden parameters is dependent on the Factory Preset, typically crossover frequencies, output delay and some EQs are hidden; those settings that are a function of the loudspeaker cabinet design and should not require adjustment for different applications. Factory Presets are locked (as indicated by a 'box' [□] symbol after the Preset name) so they cannot be over-written. The user can, however, store an edited version of a Factory Preset in any free preset location.

In addition to the Factory Presets the device may have further '*Skeleton Presets*' which will help to create new presets. They can be used to develop settings for any loudspeaker combination and are recalled in the same way as the Factory Presets described above. These Presets are also usually locked but the user can name and store their own edited versions in any free preset location.

6.5.5. Storing Module Preset

Once a drive module has been created it can be stored by pressing the <**INPUT**> button until the edited channel is reached, then pressing the down <▼> button until store page is reached. Using <**ADJUST**> encoder will change the preset number. When the destination preset is reached, pressing the <**ENTER**> button will enable the name associated with that preset to be changed. Once the name changing is active, the character to be changed will be highlighted and the <**ADJUST**> encoder will edit the character. Using the <**SELECT**> encoder will move through the character positions. Once the new preset name has been assembled, the operation can be confirmed by pressing the <**ENTER**> button, then a message will be displayed, "*Enter to confirm or ▼ to exit*"; pressing <**ENTER**> will store the preset.

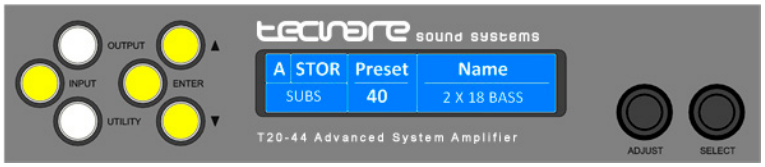


Fig. 19. Store module Screen

Note: Storing a Drive Module preset for a module which is not configured with consecutive outputs is not permitted.

Note: When storing a Drive Module preset on the device, Component Names cannot be edited. To change Component names, the Module Preset must be saved in the System Engineer application.

6.5.6. Recalling Module Preset

To recall a Drive Module preset, press the <**INPUT**> button, then use the down <▼> button navigate to the RECL Preset page. Using the <**ADJUST**> encoder will scroll through the presets available. When the desired preset is reached, pressing <**ENTER**> will display the message "*Enter to confirm or ▼ to exit*", pressing <**ENTER**> will recall the preset. ***Note that presets do not contain and do not disturb parameter Overlays.*** *See Overlays on page 18.*

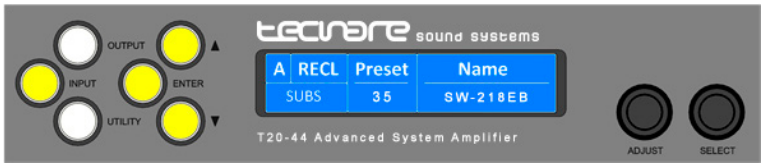


Fig. 20. Recall module Screen

6.5.7. Recalling Components

To recall a Component Preset (to a single output), press the <**OUTPUT**> button, then use the down <▼> button navigate to the RECL Preset page. Using the encoder, <**ADJUST**> will scroll through the component presets available (as indicated by the ModulePreset.Component number and ModulePreset.Component name). When the desired component is reached, pressing <**ENTER**> will flash the Enter button. Pressing <**ENTER**> again will then recall the component preset. ***Note that component presets do not contain and do not disturb parameter Overlays***. *See* *Overlays on page 18.*

Fig. 21. Component recall Screen

See also *Snapshots*

6.6. Input

6.6.1. AES3 Inputs

In addition to the usual analogue inputs, the Device can also accept AES3 digital inputs. When a DSP input channel is assigned to an AES3 channel, the "**AES3**" indicator will illuminate.

There is no 'standard' for the relative gains between Analogue and AES3 so depending on the levels delivered by the audio source, it may be necessary to adjust the digital input gain trims to normalise them. It is possible to adjust the gain of the AES3 input using the Input Trim AES3 Gain parameter. For example, to achieve 0dBFS = +18dBu, set the AES3 trim to -2dB. To achieve 0dBFS = +24dBu, set the trim to +4dB.

This device will automatically lock onto any sample rate within the range 28kHz and 108kHz.

6.6.2. DANTE™ Inputs

When the DANTE™ card is fitted, it is possible to select any channel(s) as being sourced from this network. To do this, connect the audio network connection to the connection on the rear of the T-44/48, and set the relevant Input Type menu and Type Source parameter to "Dante".

When the Digital Audio Network input is installed and routed, the "**Net Audio**" indicator above the encoders will illuminate. This indicator will come on even if there are no cables plugged into the networked audio port on the T44/48. As for the AES3 inputs, it is possible to set the relative gain between an Analogue input and the signals sourced from the Digital Audio Network (Dante®) using the Input Route Dante gain parameter.

The amplifier will automatically select the correct sample rate from the incoming stream.

For other details on the operation of the Digital Audio Network, please refer to the relevant manufacturer's documentation.

6.6.3. Automatic Input Selection (Fallover)

It is possible to configure the input selection to be automated. The Input TYPE screen has a Fallover parameter, which defaults to Manual, allowing you to select what Type of input you wish to use. When Fallover AES3>Analogue is selected (on an input channel which supports AES3), then the AES3 source will be automatically selected if it has a valid audio stream on it. If the AES3 stream should fail, then Analogue is automatically selected instead.

When Fallover Dante>Analogue is selected (when the Dante option is fitted), then the Dante source will be automatically selected if it has a valid audio stream on it. If the Dante stream should fail, then Analogue is automatically selected instead.

Similarly, it is possible to select Fallover Dante>AES3 on a channel that supports AES3 and the Dante option is fitted.

The 'Auto' setting allows the highest priority input source that is active to be automatically selected, so the user could just plug a source into any input and it will be automatically selected. ***The priorities are: Dante first, AES3 second, Analogue third.***

Note that any automatic selection will take precedence over manual selection, so if you try to manually select Dante when there is no valid Dante stream, then it will revert to the fallover input source.

6.6.4. Gain and polarity

The gain page of the input channel selected allows users to increase or decrease the amount of signal going into the selected input. Using <**SELECT**> encoder to highlight the Gain value allows the value to be changed by the <**ADJUST**> encoder in 0.2dB steps from -40dB to +20dB. The presence of an active Group Overlay parameter is indicated by the '[ ]' symbol (*See Overlays*). This page will also allow users to change the polarity of the selected input from normal to reverse and to mute the selected channel.

Fig. 22 Gain and polarity Screen

6.6.5. Delay

The delay page which controls the amount of delay associated with the input channel selected and is adjustable from 0 to 998ms. The delay parameter is adjustable in fine steps at low values; the adjustment becomes progressively coarser as the value increases. The presence of an active Group Overlay parameter is indicated by the '[ ]' symbol. *See Overlays*.

6.6.6. High Pass Filter

System high pass filtering is provided for the input signal. Filter type is selectable from *1st order, Butterworth, Bessel, Linkwitz-Riley* and *Hardman*. Filter slopes of up to 4th order or 24dB / octave are provided. Not all filter types are available in all slopes. For example 18dB / octave Linkwitz-Riley filters do not exist.

The Hardman type filter is always described by its' order as the filter becomes progressively steeper rather than following a linear slope so a dB/octave description is not accurate.

6.6.7. Parametric Equalisation

There are nine stages of equalisation available for each input channel, three shelving filters and six parametric filters.

6.6.8. FIR Shelving EQ

The Input High Shelf EQ is implemented using a *Finite Impulse Response* (**FIR**) filter, and exhibits a linear phase response; that is all frequencies are delayed by the same amount. This can be important in applications where different amounts of EQ are applied to different parts of a speaker cluster, such as to add 'Throw' EQ boost so that parts of cluster which are throwing further can have HF absorption correction added. If this EQ is not linear

phase, then the zones where the speakers combine may suffer frequency response anomalies.

Being a linear phase FIR equaliser, this necessarily introduces some latency delay, which is constant regardless of the settings. However, when the 'Enable' parameter is set to "Off", it is removed from the signal path entirely, so it does not add any latency. In this page you can change the frequency parameter from 2kHz to 20kHz, enable/disable the filter, and change the cut or boost in 0.2dB increments.

The presence of an active Group Overlay parameter is indicated by the '[ ]' symbol being appended to the Gain value (*See Overlays*). The filter (and its associated latency) can be completely removed by setting the enable parameter to the "Off" position. Note that this EQ can only be used in Module Groups if set to 'On'.

Also see "Latency Delay" on page 43.

FIG. 23 Input FIR setting screen

6.6.9. Parametric Filter

Parametric filters are defined by frequency, bandwidth and gain. The frequency is adjustable over the range from 10Hz to 25.6kHz. The bandwidth shown as Width on the screen, ranges from 0.10 octaves to 5.2 octaves. Bandwidth can be shown and adjusted as Q or Octaves (Oct). Gain is adjusted in 0.2dB increments. The presence of an active Group Overlay parameter is indicated by the '[]' symbol being appended to the Gain value. *See Overlays*.

Also see "Bandwidth Units" Units in Utilities on page 38.

6.6.10. Routing

Fig. 24 Routing Screen

Routing allows users to route any physical analogue or digital signal channel to any DSP input. This is effectively a matrix mixing system where all DSPs can be driven from any one input, or from pairs of inputs "**1+2**", "**3+4**", "**1+3**", "**1+4**", "**2+3**" ", "**2+4**", "**1+2+3**", "**1+2+3+4**", "**1+2+4**", "**1+3+4**" or "**2+3+4**". Summed inputs have 6dB of attenuation so that a sum of largely similar programme material remains at the correct calibrated level.

6.7. Output

6.7.1. Gain and Polarity

The gain page of the output channel allows users to increase or decrease the relative signal gain for the selected output. The Gain value may be adjusted in 0.2dB steps from -40dB to +20dB. This page will also allow users to change the polarity of the selected output from normal to reverse-

6.7.2. Delay

The delay page controls the amount of delay associated with the output channel selected and is adjustable from 0 to 998ms. The delay parameter is adjustable in fine steps at low values; the adjustment becomes progressively coarser as the value increases.

6.7.3. High and Low Pass Filters

High pass and low pass crossover filtering is provided for the output signal. Filter type is selectable from 1st order, Butterworth, Bessel, Linkwitz-Riley, Hardman and LIR Linear Phase. Filter slopes of up to 8th order or 48dB / octave are provided. Not all filter types are available in all slopes. For example 18dB / octave Linkwitz-Riley filters cannot be selected because they do not exist.

The Hardman type filter is always described by its order as the filter becomes progressively steeper rather than following a linear slope so a dB/octave description is not accurate.

6.7.4. LIR Crossover Filtering

The "*Linear Impulse Response*" (**LIR**) crossover filtering gives a Linear Phase crossover which has a constant delay regardless of frequency (unlike other types of crossover which delay different frequencies to a different extent, thus smearing the arrival time). The LIR crossover can thus be described as having a flat Group Delay response, and thus entirely free of Group Delay Distortion, this is exactly the same as can be provided by common FIR filtering but without the complications and disadvantages inherent with the FIR technique.

The shape of the LIR crossover filter is similar to a 4th order Linkwitz-Riley filter, and maintains zero phase difference between the adjacent bands across the crossover region to keep the polar response rock steady.

Note that very narrow bandwidths are not possible with this crossover type. If the Low Pass frequency is too close to the High Pass frequency, then the filter will 'mute'.

Linear Phase filtering necessarily introduces delay; the laws of physics demand it. To keep this delay to a minimum, it is recommended that more conventional crossover shapes (such as Linkwitz-Riley) are used for the very lowest frequency high-pass edge, particularly if this is less than perhaps 100Hz, which is well below the frequency thought to cause audible '*Group Delay Distortion*'.

This constant delay will depend on the lowest high-pass frequency used in the crossover filters in a given Drive Module.

Also see the section on "Latency Delay" on page 43.

6.7.5. Parametric Equalizarion and All-Pass Filters

There are ten different EQ filters; two shelving filters and eight parametric filters. Parametric filters are defined by frequency, bandwidth and gain. The frequency is controlled over the ranges from 10Hz to 25.6kHz. The bandwidth, shown as Width on the screen, is controlled over ranges from 0.10 octaves to 5.2 octaves. Bandwidth can be shown and adjusted as ***Q*** or ***Octaves*** (Oct). Gain is adjustable in 0.2dB increments.

Any of the six Parametric filters can be used as All-Pass filters. When a filter is set to All-Pass mode, the Gain parameter value will show as "***All-Pass***" on the display. This setting may only be engaged by right-clicking the EQ 'icon' in the EQ window of the System Engineer panel.

Also see "Bandwidth Units" Units in Utilities on page 38.

6.7.6. FIR Filter (available on some models)

Each output supports a 768 tap Finite Impulse Response (FIR) filter which may be programmed using a third party application, such as the ***Eclipse Audio® FIR Designer software***, and loaded via the System Engineer application.

FIR filters may be used for equalisation, phase manipulation or for crossover filtering with linear or arbitrary phase response.

The filter itself cannot be programmed from the front panel, but the Name of the FIR design is shown on the display, and the action of the filter may be enabled/disabled.

6.7.7. Limiters

The T44/48 Series includes three limiters in the output signal path.

IMPORTANT: Please note that whilst the Limiters in this product offer some degree of protection for amplifiers and drivers, *Exel Acoustics SL* and its Tecnare brand cannot be held responsible for any damage which might occur in these components.

- ***VX Limiter***

This is a peak-detecting signal limiter. The VX Mode parameter determines the style of limiter. When Virtual Crossover (VX) mode is off, the limiter is controlled in a conventional manner; the only controls being Threshold and Overshoot.

The Overshoot limiter prevents the signal from exceeding threshold during the attack phase of the main limiter by more than a predetermined amount. The optimal Overshoot setting is usually about 8dB. Lower Overshoot settings will sound progressively ‘harder’.

When VX mode is engaged, the user can choose the crossover point of a ‘virtual crossover’, which gives two limiters per output so the user can individually limit the drivers in a passive 2-way enclosure using individual thresholds, and optimised attack and release characteristics for each. The Threshold of the second ‘Hi’ limiter is set relative to the threshold of the first ‘Lo’ limiter.

The effect of the VX threshold and split frequency on the Limiter curve can be seen in System Engineer.

This Limiter introduces some delay. In non-VX mode, this delay will depend on the lowest high-pass frequency used in the crossover filters in a given Drive Module. In VX mode, the delay is related to the Split frequency. This delay will be applied to all of the outputs in a given Drive Module to keep them in phase.

Also see “Latency Delay” on page 43.

Fig. 25 Limiter setting screen

6.7.8. Tmax Thermal Limiter

The Thermal Limiter is intended to protect the driver against damage due to over-heating. It models the temperature of the driver, and constrains the output signal level in order to keep the average output power below a predetermined limit, applying attack and release characteristics to go some way towards modelling the complex thermal circuit of a driver’s voice coil and magnet assembly.

Threshold – the continuous RMS voltage which the driver should be able to withstand. This is calibrated at the output of the amplifier. The Thermal Limiter can be defeated by setting the Threshold to the maximum “Off” value.

Attack – The time-constant of the speed at which the driver heats up (in seconds).

Release – The time-constant of the speed at which the driver cools down (expressed as a multiple of the Attack time).

On ***Tecnare*** *Loudspeaker Preset* this protection is calibrated by Tecnare and cannot be modified. Please in case of used power amplifier different to advice of Tecnare refer to our support department for limiter setting.

6.7.9. Xmax Excursion Limiter

The *Excursion Limiter* protects the driver against excessive linear movement of the cone and voice-coil which could otherwise cause mechanical damage. Since this movement (excursion) is related to the inverse of the signal frequency, drivers are prone to being damaged by very low frequencies. This limiter is progressively more sensitive at lower frequencies and, rather than varying the gain to provide the limiting action, it uses a sliding high-pass filter to progressively curtail the low-frequency response, effectively limiting the linear excursion to below the X-max specification of the driver.

To set the limiter up, it is necessary to know the shape of the family of Excursion vs. Frequency curves of the driver for various drive voltage levels. A curve should then be chosen where the slope is high where it passes though the specified X-Max value for the driver. The peak voltage and frequency of this point should then be noted.

The **Xmax** limiter is then set up using just two parameters:

Threshold – the peak voltage of the point arrived at above. This is calibrated at the output of the amplifier. The Excursion Limiter can be defeated by setting Threshold to the maximum “Off” value.
Frequency – The frequency at which the above threshold voltage is appropriate for.

A further parameter “Min” may also be available for more advanced applications. This allows the increasing limiting action at lower frequencies to level-off below a certain frequency. In most application, this would be left set to its default value of 5Hz.

On ***Tecnare*** *Loudspeaker Preset* this protection is calibrated by Tecnare and cannot be modified. Please in case of used power amplifier different to advice of Tecnare refer to our support department for Xmax Excursion Limiter setting.

6.7.10. Bridge

When an amplifier pair is set to Bridge Mode, it uses two amplifier channels to drive one loudspeaker with greater power. In this mode, only one set of Output controls is active per pair of amplifier channels since both of the amplifiers in the pair are driven with the same signals, as determined by the left-hand (lower numbered) channel of the pair controls. Bridge settings should be set up before recalling Drive Module Presets. Module Preset Recall will see a bridged pair of outputs as a single channel.

Bridge Mode is enabled or disabled in the AMP page for a given odd numbered Output. When enabled, the Bridge indicator will be illuminated between the bridged channels.

When Bridged, the partner (even numbered) channel will not show any signal on the limiter meter, and the Mute button will not operate, neither will you be able access any of its parameters for adjustment. The Amplifier protection indicator however will still operate. The amplifier protection indicator however will still operate. Note that the gain of bridge pair channels will be 6dB higher than a single channel so 38dB. This may impact on limiter setting and balance of level in a system where some amplifier channels are bridged and other are in standard mode.

6.7.11. Routing

Outputs can be driven from any DSP input. This routing is the fundamental means by which Drive Modules are created.

When a Module Preset is recalled, automatic routing will always consume outputs consecutively alphabetically and numerically. However, non-consecutive Drive Modules may be created using manual routing and Recalling Components. *See the "Drive module" section in page 27 for more information.*

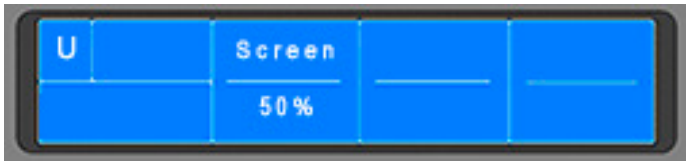
Note that the T48 model can route Dante inputs *5..8* directly to output processing for outputs *5..8*, thus bypassing input processing.

6.7.12. Driver

The optimal drive level may be adjusted for a given driver impedance using the Load parameter. *See Load Matching on page 16.*

The live measured impedance value is also shown on the Driver page. Since the device can only measure this when there is a signal, the impedance is indicated as "?" when there is insufficient signal level to perform a measurement.

6.8. Utility Page



6.8.1. Screen Contrast

The Screen page in the <**UTILITY**> section adjusts the contrast (and optimal viewing angle) of the screen from 0-100% in 1% increments.

6.8.2. Stereo Linking

Stereo linking is available between DSP Drive Modules A & B and between C & D. Changing a parameter in either of the stereo linked Drive Modules will change the other linked Drive Module. Stereo linking is controlled by the **STEREO** page in the <**UTILITY**> menu.

Note: *Stereo linking will only work when the linked Drive Modules are of equal size.*
Note: *Stereo Linking state is not stored in Presets (but is stored in Snapshots)*

6.8.3. Version

The Model Name of the device may be viewed in the "VER" page of the <**UTILITY**> menu, along with the version number of the product firmware, and the version number of the Dante option (if fitted).

6.8.4. DANTE™ Name

When the DANTE™ option is fitted, the name given to the Dante node of this device in Audinate's *Dante Controller* application is visible in this screen. This allows you to associate the Dante Name with the Device Name. We would recommend you make these alike. You can check which Device a given Dante node is in by clicking the 'ID' icon in the Dante Controller application, which will cause the device to flash its screen.

6.8.5. Current Ethernet IP Address

This may be viewed in The “IP Curr” page of the <**UTILITY**> menu. This value cannot be edited.

6.8.6. IP Mode

The Ethernet IP address may be automatic “**Auto**” or may be a fixed static value “**Static**” as determined by the “IP Mode” page of the <**UTILITY**> menu.

> ***WARNING*** *– Do NOT use Static mode unless your IT system specifically requires it. Auto mode should always be used where possible since in this mode, the T44/48 amplifier can always be ‘discovered’ by the System Engineer application. When in Static mode, a warning will flash on the Default screen.*

Also see “Ethernet configurations” on page 39.

6.8.7. IP Static

This allows the Static Ethernet IP address to be adjusted by the rotary encoders on the *IP Static* page of the <**UTILITY**> menu. This page will only be visible when in Static mode.

6.8.8. Store Snapshot

This page of the <**UTILITY**> menu allows a Snapshot to be defined.

Also see Snapshots on the page 42.

6.8.9. Recall Snapshot

This page of the <**UTILITY**> menu allows a Snapshot to be recalled.

Also see Snapshots and “AUX Port”.

6.8.10. Bandwidth Units

This page of the <**UTILITY**> menu allows the Bandwidth of Parametric Equalisers to be viewed and adjusted in either Octaves or ‘Q’.

6.8.11. Aux Style

This page of the <**UTILITY**> menu allows the action of the Aux port to be viewed and adjusted.

Also see “AUX Port” on the page 42.

6.8.12. ECO Mode

This page of the <**UTILITY**> menu allows the device to save power by going into a low power mode when it is not being used.

Standby is a fast mode which saves some energy, but will wake-up very quickly if an audio input is detected. The associated Standby Time parameter allows the amplifier to automatically go into power-save if no audio signal has been detected for a period of time. This function can be defeated by setting the latter control to Manual. Tecnare would strongly advise leaving it set to automatic however as there is no negative consequence to doing this since ‘wake-up’ on detecting the presence of an audio input signal is instantaneous. The Standby Now ‘parameter’ allows the amplifier to be put into standby mode manually when it is not being used

Sleep is a deep power save mode which saves the most energy, however it will take a small number of seconds for the amplifier to wake-up, and it may only be woken up manually (either from the System Engineer application or by switching the device off then on again). The associated Sleep Time parameter allows the amplifier to automatically go into Sleep mode if no audio signal has been detected for a period of time. This function can be defeated by setting the latter control to Manual.

6.8.13. External Breaker Protection (EBP)

The Power ("PWR") utility page provides access to the ***External Breaker Protection*** (**EBP**) feature, which allows the output power to be limited in order to prevent the nuisance tripping of mains circuit breakers or fuses when the amplifier needs to be operated on a mains supply with restricted capacity. Set the EBP value to that of the circuit breaker or fuse to which the amplifier is connected.

6.9. Ethernet

Ethernet connection permits full control of all functions along with real-time metering from a remote position.

6.9.1. Ethernet configurations

IP addressing in the Device can be completely automatic; No setup is required. When first installing and launching System Engineer, the computer Firewall may ask to allow System Engineer to access the network.

NOTE: This must be allowed for both private and public networks

6.9.2. DHCP

There are two primary IP address ranges – one used when there is a DHCP server present (e.g. a Router in the system), and another where there is no DHCP server (so the Device and the Computer will instead use 'Auto IP'). Both the device and the computer must be in the same IP address range. In an office IT environment where there is a DHCP server, both the computer and the Device will be in the DHCP IP address range, so will connect immediately.

6.9.3. AUTO-IP

The device will initially search for a DHCP server when first switched on (during which time its ***Online*** Indicator will be flashing). As it can take up to one minute to establish that there is no DHCP server available, this is the time it may take before Auto IP is entered.

Please be aware that it can also take some time from a computer being switched on in an isolated network (without a DHCP server), or unplugged from a network with DHCP to time out of DHCP searching, so it will not connect immediately to amplifiers that are already using Auto IP. The time it takes before it decides to revert to Auto IP depends on the operating system but it can take several minutes to acquire an Auto IP address.

6.9.4. Static-IP

If the device or the computer has a static IP address set, System Engineer may not be able to 'see' the device if it is in a different IP Address range - unless there are good reasons it is best to avoid the use of static IP addressing if at all possible. In static IP mode, the main menu will display the static IP address of the device on the main screen, with blinking. ***Unless there are good reasons it is best to avoid the use of static IP addressing if at all possible except you have a comprehensive understanding of network systems.***

6.10. Troubleshooting

6.10.1. System Engineer Installation or running problems

1. Verify that Microsoft .NET Framework version 3.5 or 4.0 is correctly installed. **Warning:** the complete .NET Framework is necessary (don't install only "profile client" or "SDK" versions)

2. Verify if Microsoft .NET Framework version 1.1 or 2.0 are not installed on your computer. If it is the case, it is advised to uninstall with Microsoft .NET Framework removal tool, and then to reinstall .NET Framework 3.5 or 4.0. Warning: uninstalling these former versions can prevent some of your software to work correctly, if they use it

3. Before installing a new System Engineer version, it is strongly advised to uninstall all previous versions

4. Try to uninstall and reinstall System Engineer

6.10.2. Connection Problems

If the System Enginner Software cannot connect to the device:

- Verify that the RJ45 cable is plugged, that all the devices are powered on, and that the RJ45 ports LEDs (yellow and green) are blinking

  Solution: Verify all cables, RJ45 can be rather fragile

- A Router acting as a DHCP server is highly recommended as this provides the most trouble-free way of administering IP addresses. Always switch on any DHCP server before connecting either the computer or Amplifier to the network

- If not using a DHCP server, check that the Current IP address in the device is compatible with the IP address of the computer. Generally, the leftmost two sets of 3 digits should be the same

- If there is no Router in the system acting as a DHCP server, wait 10 minutes (for the computer to acquire the correct IP address) and try again

- Check that the Firewall in the computer will allow System Engineer access to the network for both private and public networks. Please refer to the Help feature in the System Engineer application for further guidance on this

- Verify that your System Engineer version is recent enough to use the T44/48 (V7.1.25 or more)

  Solution: Install the latest System Engineer version

- Verify that "Ethernet" network appears in the System Engineer left panel, in Network view

  Solution: "*Network*"→"*Add Networks*"→select "*Ethernet*"→ "*Add*"
  Do not forget to click on the connection button or on "Network"→"Connexion"

- If the **T44/48** is directly plugged to the computer RJ45 port, and everything is in automatic mode, wait 2 minutes before trying to connect again. (Windows has to stop looking for a DHCP server, and then the **T44/48** has to choose an address. The Online LED has to stop blinking)

- Verify that the network card is activated, and succeed in connecting

  Solution In order to activate the network card: "*Local Area connection*" icon in task-bar →right click→"*Activate*" Control Panel→Right click on "*Local Area connection*"→ "*Activate*"
  If it was already activated, you can try the "*Repair*" option, which will reset the IP settings: "*Local Area*

connection" icon in task-bar → right click → "*Repair*" Control Panel → Right click on "*Local Area connection*" → "*Repair*"

- Verify that System Engineer is allowed in Windows firewall:
  "*Control Panel*" → "*Security Center*" → "*Security parameters for: Windows Firewall*" → "*Exceptions*" tab → Verify that "***System Engineer.exe***" is in the exception list and that the corresponding box is checked. If you have an anti-virus software, it may have an additional firewall which can block System Engineer. Verify your anti-virus firewall.

6.11. Advanced troubleshooting

In order to determine if the problem comes from communication between computer and device, or from the software, it can be useful to "ping" the ***T44/48***, that is to say to carry a little test in order to see if the ***T44/48*** answers to a request via the network, without using System Engineer (a very well-known test for networking amateurs).

- Find the ***T44/48*** current IP in <**UTILITY**> → "*Current IP*"ç

- Open Windows command pront: Start Menu → type "cmd" in Start Menu search bar → click on the

"cmd" icon

- In the command prompt, after ">", type "*ping*", followed by a blank space, and by the ***T44/48*** IP address (4 integers separated by dots). For instance, for a T44/48 with IP address 192.168.1.100:

Ping 192.168.1.100

A messenger "Pinging 192.168.1.100 with 32 bytes of data" appears, followed by several line:

i. If all lines consist in the following message: "Request timed out", the connection does not work. In this case, verify the connection between the computer and the T44/48: cables, plugs, RJ45 ports LEDs blinking, as well as IP settings. Verify that your network card works, with a working and up-to-date pilot. Try automatic and manual mode, with or without DHCP server, with or without router if you have one.

ii. If messages such as "Reply from (T44/48 IP address)", followed by pieces of information (time, statistics, etc.), then the computer and the T-44/48 are correctly configured and able to see each other. In this case, verify System Engineer settings: does Ethernet network appears in the left panel, is " System Engineer.exe" authorized in all firewalls, is .Net Framework 3.5 or 4 installed and up-to-date?

7. Hardware Function

7.1. Snapshots

A Snapshot may be recalled either via the device User Interface, from the System Engineer application or via the AUX port on the rear of the Device.

The snapshot menu is accessed via the utility pages. Recalling a Snapshot triggers the recalling of a Component to each input and output, and may change other device-wide settings, effectively recalling a processor-wide preset. In addition to being able to recall snapshots from System Engineer and from the Device's front panel, some of the snapshots are also recallable from the auxiliary port.

Also see "AUX Port"

The parameters inside the Drive Modules are not individually stored in Snapshots. Recalling a Snapshot will merely trigger the recall of the appropriate Input and Output Components, rather than restoring the parameters that were active when the Snapshot was stored. This has the distinct advantage that the library of OEM presets may be updated without having to be concerned about what parameters might have been saved in users Snapshots. It does however require that any existing edits to the parameters in Drive Modules are stored into Drive Module presets before a Snapshot is stored.

Also see "Overviews of the Modules, Preset Component and Snapshots"

7.2. AUX Port

The AUX has two inputs, X & Y. These allow simple contact closure devices (relays or switches) or external logic signals to change the state of the amplifier as described below.

Connecting an AUX input to ground (the earth symbol) will trigger it; there is no requirement for an external voltage. However, the ports can also be triggered directly by a logic signal as long as the logic 'low' goes below +0.5V.

NOTE: Do not connect systems if their logic 'high' voltage exceeds +24V

The AUX port may be configured to work in a number of ways by adjusting the Style parameter in the Aux page of the *Utility menu*:

- ***None -*** *No operation*
- ***2+Mute (Event or State) –*** *Either Snapshot 1 or Snapshot 2 may be recalled by applying a momentary or static connection to an Aux port terminal, or the device may be muted by Grounding both Aux port terminals*
- ***3 Snaps (Event or State) –*** Either Snapshot 1 or 2 or 3 may be recalled by applying a momentary or static connection pattern to an Aux port terminals
- ***4 Snaps (State) –*** One of the four Snapshots 1,2,3,4 may be selected by applying a static connection pattern to the Aux port terminals
- ***3+Mute (State) -*** One of the three Snapshots 1,2,3 may be selected by applying a static connection pattern to the Aux port terminals, or the device may be muted by Grounding both Aux port terminals
- ***3+Sleep (State) -*** One of three Snapshots 1,2,3 may be selected by applying a static connection pattern to the Aux port terminals, or the device placed in Sleep by Grounding both Aux port terminals
- ***Mute+Sleep (State) -*** The device may be muted by grounding Aux X or placed in Sleep by grounding Aux Y

AUX X	AUX Y	2+MUTE ACTION (STATE OR EVENT)	3+Snaps ACTION (STATE OR EVENT)	4+Snaps ACTION (STATE)	3+MUTE ACTION (STATE)
Open	Open	No Change	No Change	Recall Snapshot 1	Recall Snapshot 1
Gnd	Open	Recall Snapshot 1	Recall Snapshot 1	Recall Snapshot 2	Recall Snapshot 2
Open	Gnd	Recall Snapshot 2	Recall Snapshot 2	Recall Snapshot 3	Recall Snapshot 3
Gnd	Gnd	Mute	Recall Snapshot 3	Recall Snapshot 4	Mute

Fig. 27 This table shows the action taken for various Aux connection patterns in the various Aux port modes

Some of the above modes allow the AUX port to be used:

- Either in *Event* mode (whereby a momentary push-button or momentary relay contact closure on one of the AUX lines will cause a Snapshot to be recalled)
- Or in *State* mode (where a rotary switch etc. connected to both of the AUX lines selects which Snapshot to use).

Some of the other modes only allow State mode, requiring the connection pattern to persist in order for the Snapshot to be held as the current one.

NOTE: That if the contact closure port is being driven, or if the Aux Style is set to one of the State modes, this will override the snapshot recall setting in the menu (or in System Engineer). Also under these conditions, the snapshot menu items are not accessible, and the Home screen will show the Snapshot number as a reminder.

Also see Snapshots on the page 42.

7.3. Latency Delay

All Digital Signal Processing, and conversion between different formats of signal – analogue/digital/network etc., necessarily introduce some delay (latency) to the signal path. Of course, we strive to minimise these latencies. Small as they are, it is sometimes useful to know their precise values. The following describes the principal latencies introduced by various parts of the Device:

Analogue Input OR Digital input at 96KHz sample rate OR Digital input at 48KHz sample rate	0.385 ms 0.5 ms 0.66 ms
Analogue Output OR AES3 Output	0.402 ms 01 ms
Processing Latencies (limited to a minimum of 1.57ms	
Input HiShelf FIR	0.4ms (0ms if set to 'Off')
LIR Linear Phase crossover	1.19ms/Fhp(kHz), limited to 30ms maximum**
VxLim Limiter (VX mode off)	0.12ms/Fhp(kHz), limited to 1.57ms maximum**
VxLim Limiter (VX mode on)	0.358ms/Fsplit(kHz), limited to 1.57ms max

** This latency figure is calculated using the crossover HPF in (kHz)

Important tip: The processing latency is constant at 1.57ms unless LIR crossover filters or FIR HiShelf EQs are used, so normally you would just need to add the Input and Output delays to this constant value.

If LIR or FIR are in use, the Processing latency of a Drive Module may increase beyond this figure. The Drive Module Latency may be viewed on the Latency page of the relevant Input DSP channel. This can be accessed by pressing <**INPUT**> then <▼> down until the latency page is reached.

When LIR, is used the Vx Limiter can take the overall latency above the 1.57ms. When high pass frequency is set below 40Hz the filter will automatically revert to Linkwitz riley, this is set so that the latency will not exceed 30ms as stated.

Note that the latency reported on the Latency screen in the utilities menu does not include the Input/Output latencies. The computed latency value is displayed in UTILITY page.

When using input FIR filters, LIR or VX Limiters always check the view latency screen to see the latency attributed to that Drive Module.

Example:

Input/Output	
Analogue Input	0.385ms
Analogue Output	0.402ms
Processing	
Input HiShelf FIR (Off)	0ms
LIR Linear Phase crossover (500Hz)	2.38ms
VxLim Lim (VX mode on, 1KHz Fsplit)	0.358ms
Total	***3.525ms***

Please note that the latencies within a Drive Module are equalised among outputs of that Drive Module. That is, padding delay will be automatically added to some outputs such that the total latency is the same in each output of a Drive Module. On models which have Output FIR filters, these may declare latency which will also be compensated for.

This latency equalisation does not extend outside a Drive Module, so Drive Modules are not guaranteed to have the same latency as one-another.

7.4. Secure Mode

When activated, this will disable all the front panel controls so they cannot affect the signal path, making the unit secure against tampering. The only option that is left for user control is snapshot recall. If this is not required then storing the same device state in every snapshot will effectively disable this feature. When in secure mode, the indicators still operate normally. To activate secure mode, press and hold the <UTILITY> button for 5 seconds. To deactivate, press and hold the <**UTILITY**> button for 5 seconds.

When in secure mode, this will be shown on the display.

Note that the communications port is still active in secure mode.

7.5. Overlay Flush

If the device has been used in Module Groups, and still has an active Overlay (as indicated by the Overlay indicator), these can be removed by simultaneously pressing and holding for 5 seconds the <**UTILITY**> and <**ENTER**> buttons. *See Overlays.*

7.6. Revert to Factory Setting

If you wish to erase all of your settings in the device and revert everything to factory settings, then simultaneously press and hold for 5 seconds the **Up** button ***and*** the **Mute 1 button**, then follow the prompts on the display. Only continue by pressing the Enter button if you are sure this is what you want to do. Otherwise, press the Down button to escape. Alternatively, you can access this feature from System Engineer application using the 'Hamburger' button on the bottom-right of the device control panel, selecting 'revert to factory settings'.

7.7. Protection system

Comprehensive protection features preserve the longevity of the loudspeaker and amplifier by continuously monitoring several critical parameters, and reducing the gain, or muting the amplifier either temporarily or permanently depending on the nature and seriousness of the fault or misuse. The amplifier will recover and restart if at all possible, but may remain in shut down if a serious fault persists.

Limiters deal with routine over-driving of the amplifier, making sure that the driver(s) are not pushed too hard. The limiter indicators will warn you when the driver is being driven into limit.

Minor faults are dealt with by 'dimming' the amplifier, reducing the level to a sufficient degree and for a sufficient time that the amplifier is able to recover gracefully without any user interaction. When the fault condition has passed, the amplifier will recover automatically.

When the protection systems are reducing the level, this is indicated by illuminating the left-hand Amplifier channel protection indicator. This will also illuminate when the output voltage is 'clipping'. This indicator will remain permanently illuminated if the channel has been muted by the protection systems. The Mute button will also flash. This will usually also be indicated by a warning message on the display.

Some types of protection affect all output channels, so you may see the Amplifier indicator illuminated, and the Mute button flash, on every channel.

Amplifier Indicator	Driver Indicator	Notes
	Limiter 6dB over	
	Thermal limiting	
	Excursion limiting	
Amplifier clipping		
Amplifier clip limiting		
Amplifier Current limiting		
Amplifier VHF limiting		
PSU Current limiting		Will show on all output channels
PSU Power limiting		Will show on all output channels
Thermal limiting		Will show on all output channels

Fig. 29 Protection System

7.7.1. Incident Reporting

In the System Engineer application, a coloured indicator appears on a Device Bar in the System View which displays the Incident state of the device. The Incident state may be one of three states:

- **Red:** Fault (The device is faulty in some way and requires attention)
- **Yellow:** Check (The device may not be performing to its full and should be checked)
- **Green:** OK (The device is performing well and requires no attention)

Holding your mouse over the Incident indicator for a few seconds will show the current incident level and name.

If an incident is reported you can disable it, and all less serious incidents, by right clicking the bar in System View and selecting 'Enable/Disable Alarms'. Doing this will show a cross over the Incident indicator and the device will no longer report any Incidents at this level or below.

If any Incidents have previously been disabled they can be enabled by using the right click context menu and selecting 'Enable/Disable Alarms' again.

Any active incident will be shown on the display of the device.

A Fault state will also cause the Fault Relay to open. *See "Fault Relay".*

7.7.2. Fault Relay

Three connections are available via the Phoenix connector for this relay. The schematic representation printed on the rear panel shows the 'idle' state of the relay (when the amplifier is not switched on). When the amplifier is switched on, the relay will normally energise. When a Fault incident occurs, the relay will be de-energised. This will allow either a Fault Incident or a loss of power to be seen as a 'Fault'.

7.7.3. Performance Logging

The System Engineer application allows you to inspect various performance measurements, including various graphs of performance against time, recording events over a period of up to three days. Since the amplifier cannot record any events whilst powered-off, breaks in a log due to power-downs are indicated by a break symbol || in the log. The events recorded are:

Supply Current - How much current is being supplied to the device via the mains inlet

DC Link Voltage – A voltage which is derived from the mains supply voltage

Thermal Capacity – How much of the available thermal capacity has been used

Driver Current (for each output) – The average current being delivered to the driver

Driver Impedance (for each output) – The average impedance of the driver

Protection Limiting (for each output) - How much the amplifier is 'dimming' itself in order to protect itself from potential damage

The data in the log can be exported by right-clicking on the log to launch a context menu, and selecting "copy log data to clipboard". The data could then be pasted into a spreadsheet for further analysis. Your dealer may ask you to do this is you have experienced a problem.

Alternatively, all of the operational and performance data, including the logs may be collected together into a single file by selecting File > Save Device Diagnostics. Your dealer will be able to read and interpret this data.

7.7.4. Tipi Third Party Interface

Whilst the device can be set up and controlled entirely from the front panel, or by using a dedicated control panel in the System Engineer PC application, Tipi provides a powerful yet very simple means of controlling the device using ASCII strings from a very wide range of controller devices. The Tipi protocol uses TCP/IP on the Ethernet interface. For a full list of Tipi command strings and settings, please refer to the Tipi Protocol document.

8. Remote Control and System Engineer® Processing

As outlined in section 1.1 (Thanks and unpacking), this device feature an Ethernet connection to be integrates seamlessly into the System Engineer environment, providing all features, functionality and connectivity associated with all ***DP Series Processors*** and ***T Series amplifiers***.

The internal Processing includes programmable crossovers, EQ, limiter protection and other functions, and can be fully controlled via System Engineer software.

Visit ***http://www.tecnare.com*** to download the latest software, firmware and documentation for your devices.

8.1. Quick Start Guide of System Engineer

8.1.1. Software setup

The ***System Engineer***® is a multibrand software allows to remotely controlling **T44/48** amplifiers, **DP4896, DP2696** processors, **XiT4** amplifiers and **PCC-3 Self-Powered Series Loudspeaker**. This software requires the full Microsoft .NET Framework™ version 3.5 or 4.0. If it is not already installed on your system, you can find this software on Microsoft™ official website. Before installing the software, it is necessary to remove all previous versions of System Engineer. Then, execute the "*SetupSecure.msi*" software which you can find in the *Software_DPS_System Engineer_v…* folder. If a window prompts you for network access authorisations, authorise everything. Make sure that the file called "*Authorisation"* is inside of the installation folder. If not, when the software is launched for the first time, it asks for an authorisation code. The Tecnare authorisation code is:

STBXKAHTCE

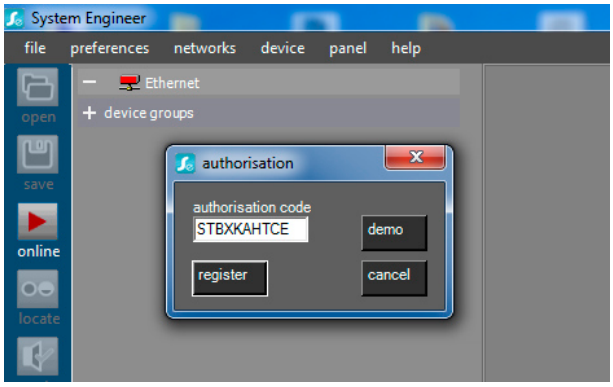


Fig. 30 Tecnare Authorisation code on System Engineer

This athorisation code can be changed by accesing the tab "*change authorisation code"* in the menu *"preferences":*

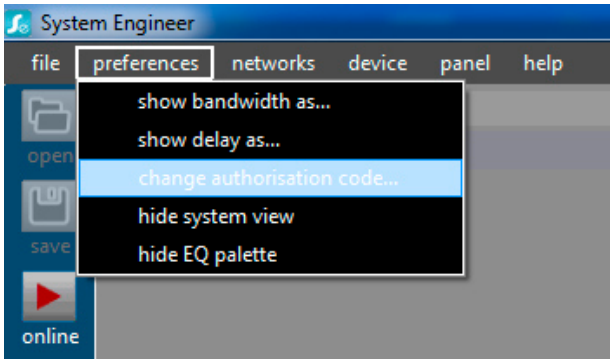


Fig. 31 Change Authorisation code

The T-44/48 amplifier can be remotely controlled via an Ethernet port, located at the rear of the device. Thanks to an RJ45 cable, connect the device to the computer or to the same network as the computer. Wait for the orange **Online** LED to stop blinking and click on the connection icon.

8.1.2. Firmware update

The System Engineer sometimes prompt you to use a more recent firmware for your devices. To update the firmware, right-click on the device you want to update in the Device View, and select “update firmware. . . “. TThen browse to the folder where the Firmware is stored, and choose the firmware corresponding to your device (“TECNARE_T44/48Series. . .dfw”). ***Firmware updates take some time, please do not disconnect or power cycle the device in the meantime.***

8.1.3. Useful recommendation

1. Power failure and data loss

Warning If “Please Wait” is displayed on the T44/48, do not unplug the mains: otherwise, Data loss could occur.

If a power failure happens while you are using the software remote control, it is possible that some data get lost. Please reload all presets before further use.

2. Overlay flush

Although group functions are not available via front panel, it is possible to erase all overlay parameters. Just push <**UTILITY**> and <**ENTER**> simultaneously and hold it for 5 seconds.

Sometimes, while handling overlays overlay parameters can remain after the module removal from a group. In this case, it is necessary to disconnect the device from network, to flush overlay with the <**ENTER**> and <**UTILITY**> key combination, and to rewrite group parameters.

3. Preset and software versions

A preset file created with a given version of System Engineer will be compatible with all following versions.

Compatibility problems can happen if a preset file is opened with an older software version that the one it was created with.

In order to avoid these problems, using the manufacturer presets given with your System Engineer version, and use only one System Engineer version at the same time. In case you have several versions, please check your presets regularly.

You should also use the same firmware version on all your devices.

Please make sure your software, firmware and presets are up-to-date. You can find the latest versions on the TECNARE website, www.tecnare.com.

8.2. Remote Control Setup

8.2.1. Plug & Play connection

The T-44/48 amplifier can be remotely controlled via a PC. The PC to T44/48 connection is plug-and-play and uses TCP-IP protocol, so that any standard router can be used to control several T44/48.

Here is the required hardware for devices remote control:

- Windows™ PC with System Engineer software
- RJ45 cables
- TCP-IP router (in order to connect several devices)

For one T44/48 only Plug the device directly to the PC using the RJ45 cable or through switch or route. Wait for the **Online** LED on the device to stop blinking, then click on “Online” in System Engineer.

For several devices Plug the **T44/48** to the switch or router using RJ45 cables. For a non-Wi-Fi router, plug the router or switch to the PC. For a Wi-Fi router, connect the PC to the router Wi-Fi network. Wait for the **Online** LED on the device to stop blinking, and then click on “Online” in System Engineer.

Any router can be used with T44/48. Tecnare advices you to use a standard 10/100/1000 router with embedded DHCP functionality.

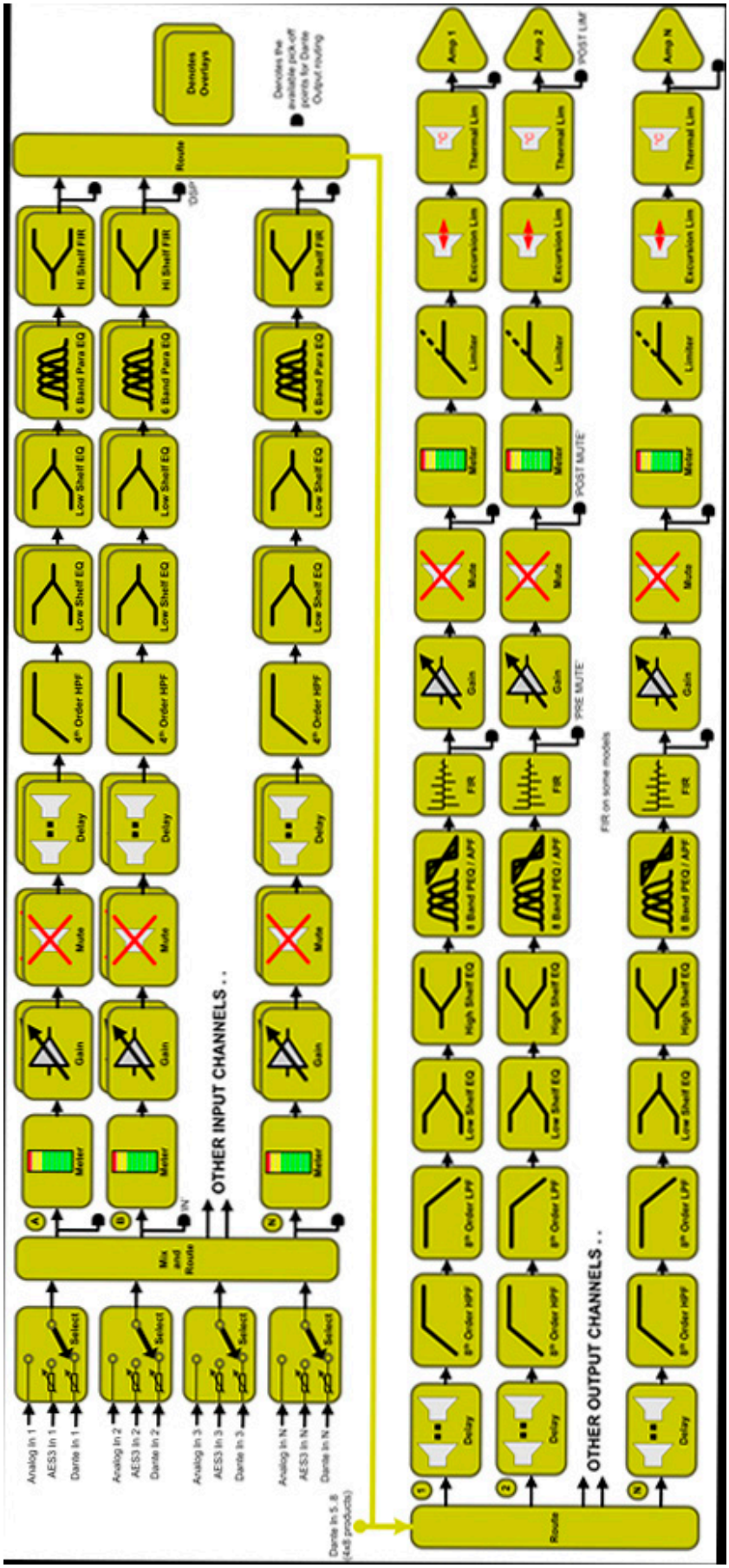
8.2.2. Recomendations

- Using a Wi-Fi connection in live events is hazardous because the audience’s mobile device emits Wi-Fi. It is advised to use RJ45 cables in order to use System Engineer remotely (as well as any remote control software).
- Connexion between a T44/48 and a PC can be tricky because of firewalls, which are included by default in Windows as well as in antivirus or antimalware. In order to make the connection work, it is necessary to allow System Engineer to communicate via UDP ports, which is done automatically most of the time but can also fail. The simpler workaround is to use a router between the PC and the T44/48, because the PC can keep the router firewall settings in memory and thus communicate with any T44/48.
- Tecnare T-Series using TIPI Control Protocol to reliably control T-44/48 from any number of third party control panels or software applications over Ethernet (TCP/IP).

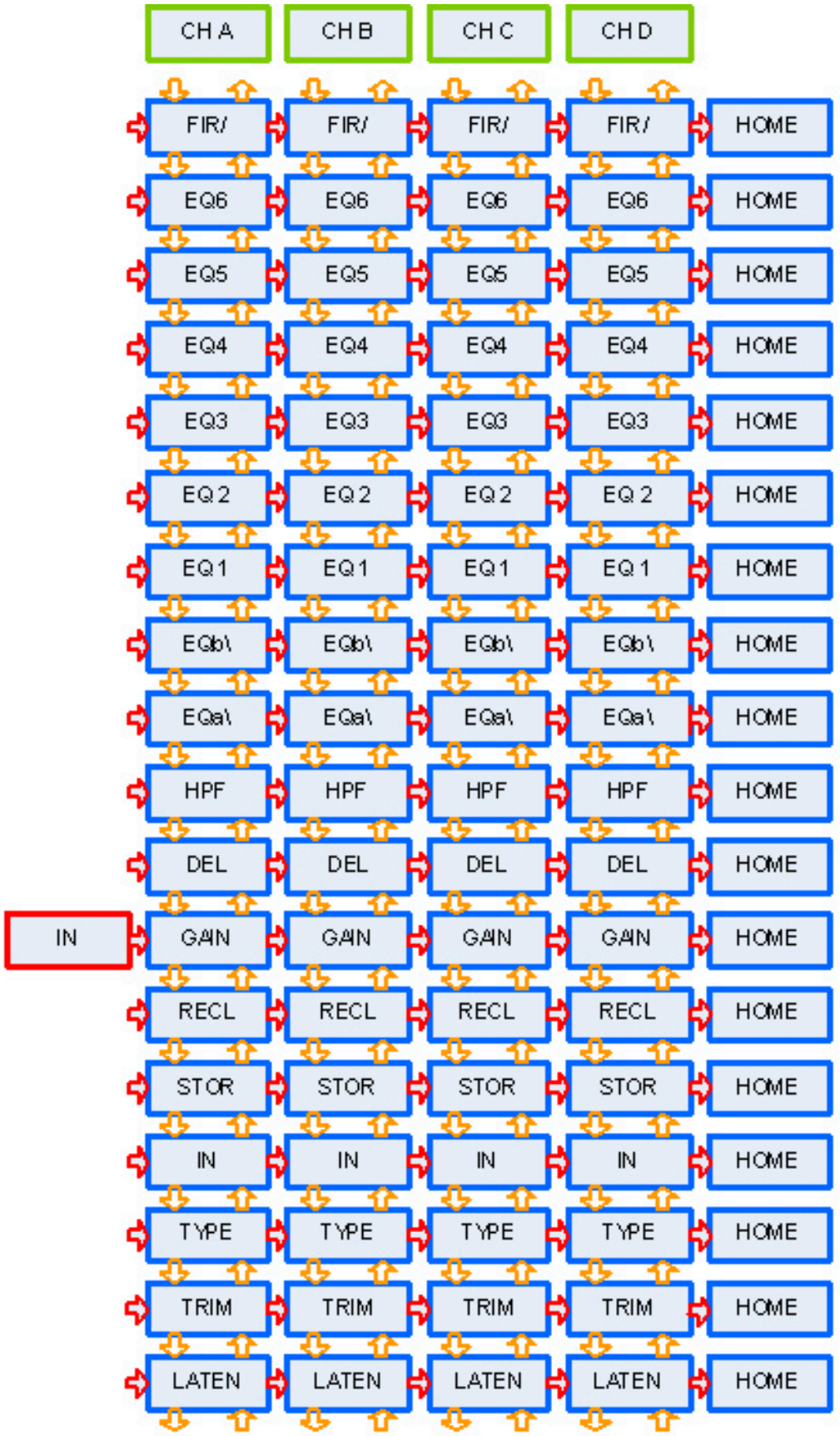
In summary:

- T44/48 in automatic mode
- Cable connexion strongly advised, never rely on Wi-Fi
- DHCP router, preferably one router/computer
- If there is no other option that uses UDP, configure the “System Engineer.exe” software to communicate with UDP (FYI, the UDP port used by System Engineer are 6000, 6001, 55166, 55167)

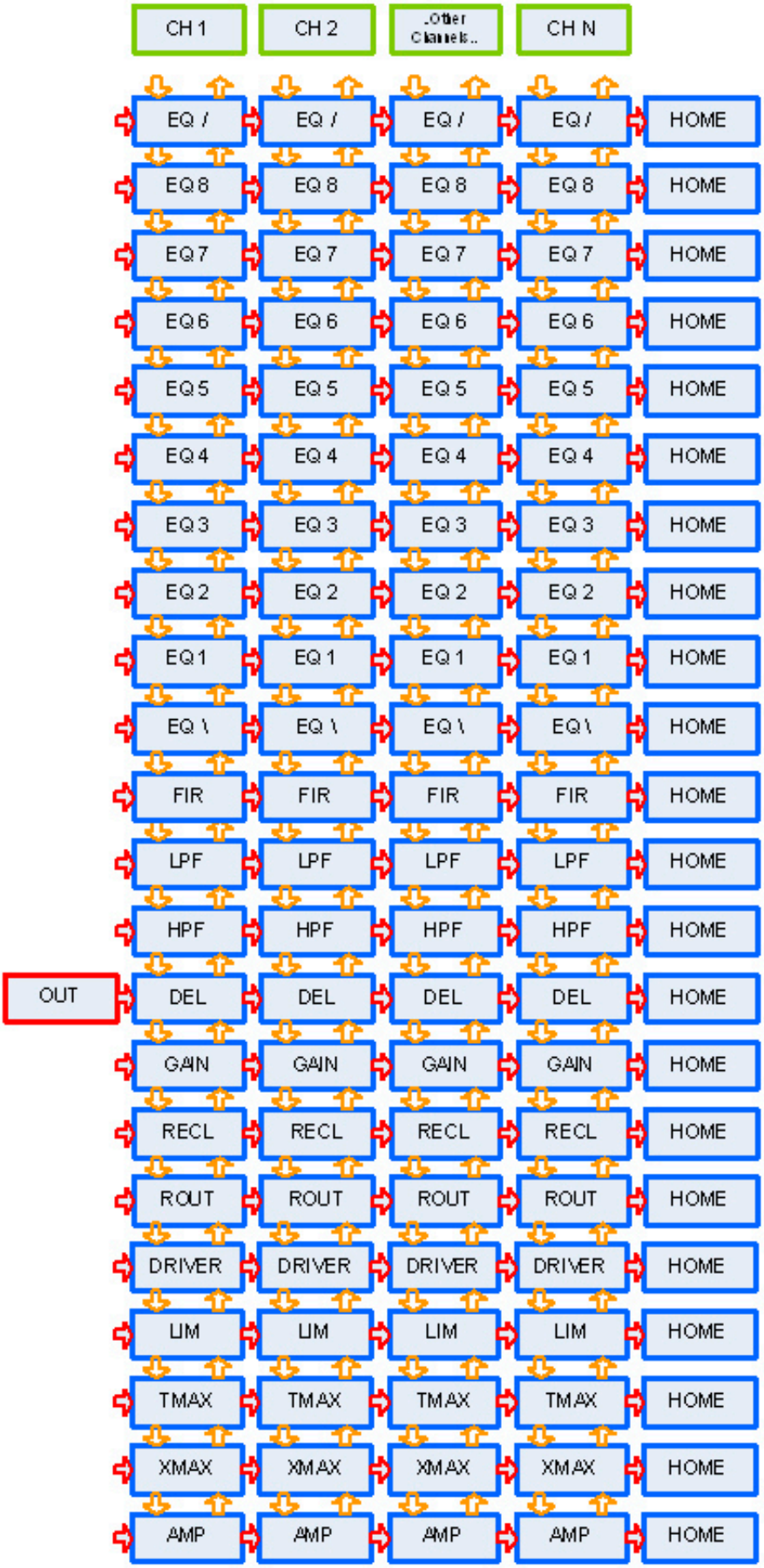
9. Processing Block Diagram



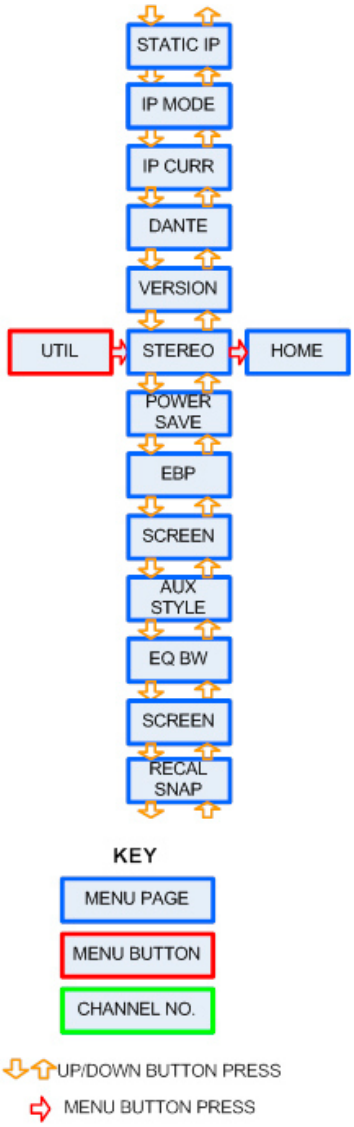
10. Input Menu Map



11. Output Menu Map



12. Utility Menu Map



13. Technical Specifications

General	
Number of Channels	Four (T44) or Eight (T48)
Total power output (T44)	20.000/10.000/6.000 Watts RMS (T20-44, T10-44,T06- 44)
Total power output (T48)	20.000/10.000/6.000/3.000 Watts RMS (T20-48, T10-48, T06-48, T03-48)
Input types	Analog, AES3, (Dante option, AES67 compatible)
Control, monitoring & alarm	Ethernet, configurable function Volt-free relay and contact closure port
System sleep and wakeup	Front panel switch, network command, contact closure and audio detection
Max ambient temperature (full power, no limiting)	2078,8mm x 355mm x 427,9mm (*81.32" x 13.98" x 16.85"*)

Audio	
Amplifier topology	Proprietary 5th generation Tecnare Class D
Amplifier modulation scheme	Low feedback, multiple loop, with feedforward error correction
Dynamic range (analog input to speaker output	>113dBA typ.
Dynamic range (AES3 or Dante input to output)	>114dBA typ.
Frequency response	<7Hz to >30kHz, 4 Ohms, -2.5dB. (Note 1)
Total harmonic distortion, THD	<0.05% typ, 1kHz, AES17, 4 Ohms.
Inter-channel crosstalk (worst combination of channels)	better than -85dBr at 1kHz. better than -75dBr at 10kHz.
Slew Rate	>60V per microsecond typical
Damping factor (Ref 8 Ohms)	>800 at amplifier output
Maximum analog input level	+20dBu.
Analog input sensitivity range for full output	0dBu to +20dBu, continuously adjustable.
Analog input	20k Ohm, electronically balanced.
Analog link	Directly connected to the analog input.
Analog ground scheme	AES48 standard compliant.
AES3 input	Transformer isolated
AES3 link	Actively regenerated with automatic direct bypass to the AES3 input if the unit is unpowered. Do not 'daisy-chain' more than 8 amplifiers from a single AES3 source
AES3 supported sampling rates	24kHz to 192kHz (auto locking).

Note 1: On 8-output models, the frequency response reduces to 23kHz on outputs which have FIR enabled

Digital processing	
Resolution	40 bit, using proprietary LMD (Linea-Micro-Detail) algorithms.
Sample rate	Class leading limiter suite. See the 'speaker protection systems' section.
	Hardman crossover filters. Better out of band rejection than Linkwitz-Riley.
	LIR crossover filters. Linear Phase without the compromises of FIR filters.
	FIR Shelving EQ filters. For linear phase filtering.
	FIR Output filters. For equalisation or crossovers with linear / arbitrary phase (on some models
	Overlays. Twelve additional independent overlays of EQ, Delay and Gain.

Power Output			
Model	**T20-44**	**T10-44**	**T06-44**
Power specification	RMS output power per channel, all channels driven with continuous program material and a nominal ambient temperature of 40degC / *105degF*		
Crest Factor of 4 (12dB), 2-Ohm nominal load	5.000W	2.500W	1.500W
Crest Factor of 2.8 (9dB), 4-Ohm nominal load	3.000W	2.500W	1.500W
Crest Factor of 2 (6dB), 8-Ohm nominal load	1.500W	1.500W	1.500W (when set correctly)
Bridged, per channel pair, 4 Ohm load	10.000W	5.000W	3.000W
25V line (CV) operation, Crest Factor 4 (12dB)	1250W	885W	685W
70V line (CV) operation, Crest Factor 4 (12dB)	3.500W	2.500W	1.500W
100V line (CV) operation, Crest Factor 4 (12dB)	5.000W	2.500W	1.500W

Power Output				
Model	**T20-48**	**T10-48**	**T06-48**	**T06-48**
Power specification	RMS output power per channel, all channels driven with continuous program material and a nominal ambient temperature of 40degC / *105degF*			
Crest Factor of 4 (12dB), 2-Ohm nominal load	1.500W	1.250W	750W	400W
Crest Factor of 2.8 (9dB), 4-Ohm nominal load	2.500W	1.250W	750W	400W
Crest Factor of 2 (6dB), 8-Ohm nominal load	1.500W	1.250W	750W	400W
Bridged, per channel pair, 4 Ohm load	3.000W	2.500W	1.500W	800W
25V line (CV) operation, Crest Factor 4 (12dB)	685W	625W	485W	355W
70V line (CV) operation, Crest Factor 4 (12dB)	1.935W	1.250W	750W	400W
100V line (CV) operation, Crest Factor 4 (12dB)	2.500W	1.250W	750W	400W

Power supply	
Topology (main power supply)	3rd generation Series Resonant
Topology (auxiliary and standby supplies)	Low quiescent Eco-Flyback.
Internally stored energy	>600 Joules.
Mains input voltage range (automatically configured)	85V to 240V.
Mains input frequency range	47Hz to 63Hz.
Mains inrush current (max for <10ms)	6A at 115V, 12A at 230V

Protection System

NOTE: Under all circumstances the control and protection systems will endeavor to deliver the maximum power possible for a given set of conditions, applying limiters only in extreme circumstances. Muting will only occur when a dangerous situation is detected, normal operation automatically resuming when the condition clears

System protection	*Speaker protection*
Excessive output current	Audio soft-clip limiter
Excessive power supply current	VxLim, Multiband peak limiter .
Excessive amplifier section temperature	VxMax, Multiband overshoot limiter
Excessive power supply section temperature	Vx-Xmax, Driver excursion limiter
Excessive DSP section temperature	Vx-Tmax, Driver thermal limiter. (long term power limiter)
Mains voltage out of range	DC offset protection
Fan speeds out of range	Excessive HF energy (VHF) limiter
Internal power rails out of range	

Power distribution protection systems
Mains inrush current limiting (soft start and anti-surge).
Mains average current limiting (mains breaker / fuse trip protection).
Randomised initialisation when powered up to reduce the peak power demand in large systems.

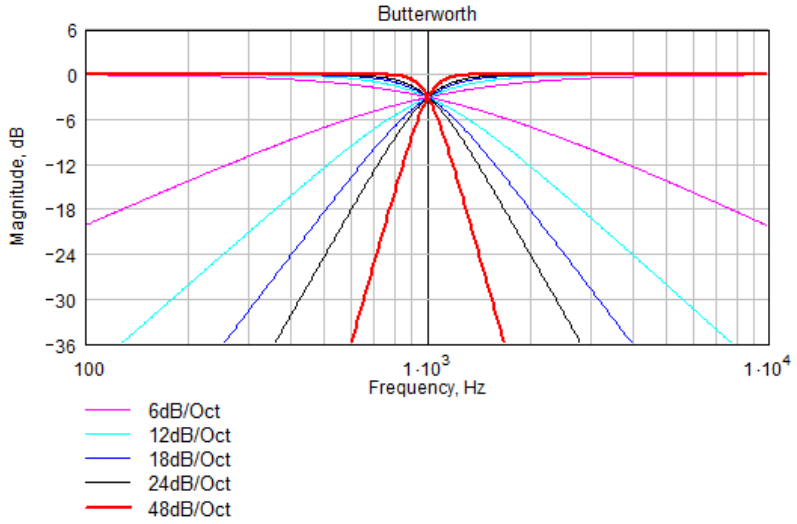
Monitoring and logging	
Supply current logged vs time	Number of power cycles counted
Supply voltage logged vs time	Number of mains brownout events counted.
Thermal Capacity logged vs time	Fan speeds continuously monitored
Each driver current logged vs time	Fan underspeed events counted
Each driver impedance logged vs time	Various protection mute events counted
Protection limiting for each output logged vs time	Driver Impedance continuously monitored

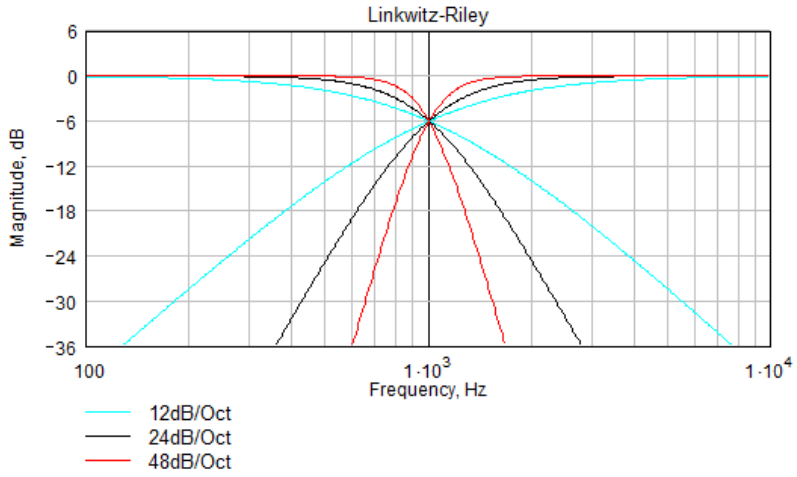
An inbuilt alarm and notification system can be configured to indicate problems to remote devices either via the network or the Volt-free changeover relay contacts accessibly on the rear panel.

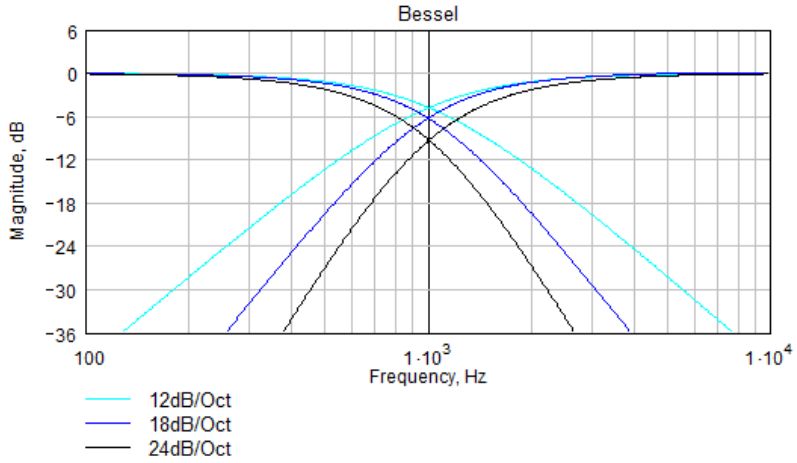
Physical	
Cooling	Variable speed fans
Airflow	Front to back
Air filtration	Washable media, changeable without the use of tools.
Analog IN and LINK connectors	Genuine Neutrik™ XLR
AES3 IN and LINK connectors	Genuine Neutrik™ XLR
Audio output connector	Genuine Neutrik™ SpeakON®
Mains input connector	Genuine Neutrik™ 32A PowercON®
Dante Primary and Secondary	Shielded RJ45
Relay output & contact closure inputs	Phoenix pluggable terminal block
Front panel display (backlit)	Graphical, high contrast, daylight visible
Front panel encoders	Two, indented, velocity sensitive
Front panel push buttons	Large, tactile, illuminated
LED indicators	Bright, easily differentiated
Enclosure	Standard 19" 2U (88mm) with handles and optional rear support system
Depth (behind rack ears)	357mm(*14"*)
Relay contacts	Can switch between 10uA and 1A at up to 30V
Net Weight	12.5kg (*27.5 pounds*)

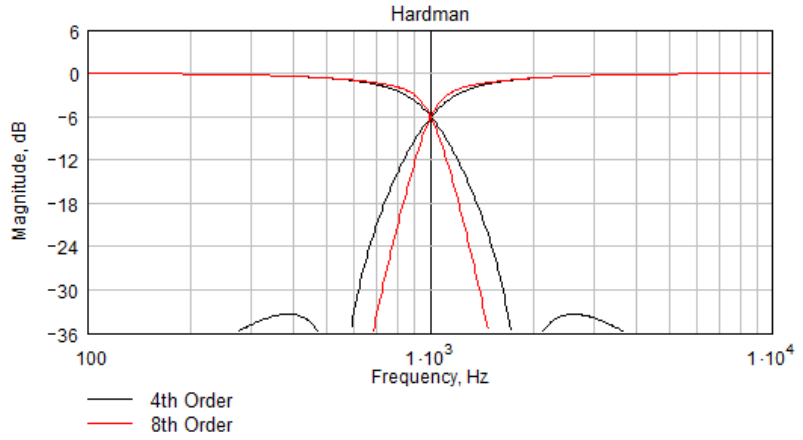
Options	
Rear rack support kit	TSK-TS
DANTE® Lindex CARD / AES67	Optional DANTE CARD. Only fixed in factory
T-Rack3U	Modular 19"/3HU Slim & Slam Rack, 600P, four collapsible handles
T-Rack6U	Modular 19"/6HU, Pro-Rack Side Sliding door (Front & Rear. Made of black PVC
TS-Rack10U	Modular 19"/10HU, Pro-Rack Side Sliding door (Front & Rear. Made of black PVC
TRBP1U	Blank panel 19"/1HU
TPB1U	19"/1HU connection panel for the connection of one T-Series Amplifier with 2 Analogue IN /Link, 2 single Analogue IN port, 1 AES3 IN/Link port, 1 Ethernet port, 4 SpeakON® NL4 and 1 SpeakON® NL8 and 1 PowercON® 32A
TPB1U-IN	19"/1HU input connection panel for the connection of T-Series Amplifiers with 4 Analogue IN/Link port and 1 AES3 IN/Link port, 1 Ethernet port IN/Link and DANTE Primary and Secondary port
TPB2U	19"/2HU connection panel for the connection of T-Series Amplifiers with 2 Analogue IN /Link, 2 single Analogue IN port, 1 AES3 IN/Link port, 1 Ethernet port IN/Link, DANTE Primary and Secondary port, 6 SpeakON® NL4 and 3 SpeakON® NL8
TPB2U-OUT	19"/2HU Output connection panel for the connection of 3 T-Series Amplifiers with 18 SpeakON® NL4 and 3 SpeakON® NL8
PD32	Power distribution panel, 19"/2HU with 3 16A schuko socket, 3 discrete 32A circuit breaker, 1 P17 Plug In and CEE32A out socket, 3 Neon light on the front and 3 3 16A schuko socket and 3 PowercON® 32A on the back.

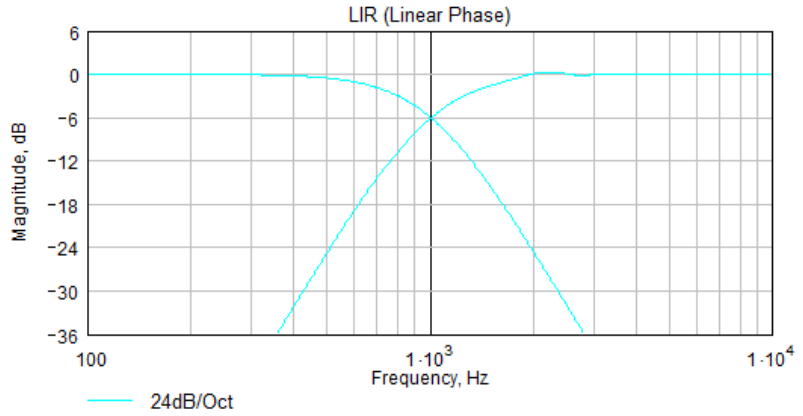
14. EQ and Filter Response Graphs

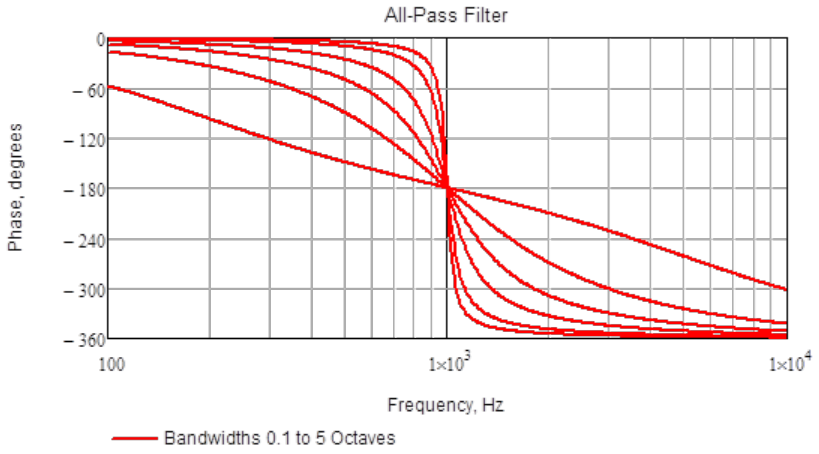


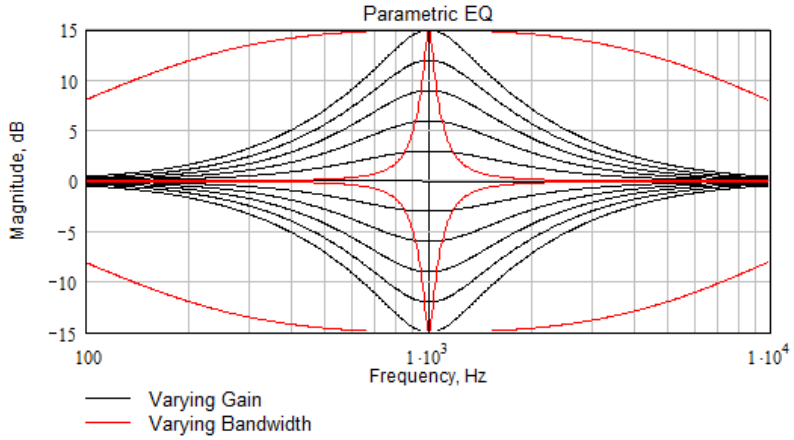





Hardman
6
0
−6
−12
−18
−24
−30
−36
Magnitude, dB
100
1·10^3
1·10^4
Frequency, Hz
4th Order
8th Order


LIR (Linear Phase)
6
0
−6
−12
−18
−24
−30
−36
Magnitude, dB
100
1·10^3
1·10^4
Frequency, Hz
24dB/Oct


All-Pass Filter
0
– 60
– 120
– 180
– 240
– 300
– 360
Phase, degrees
100
1×10^3
1×10^4
Frequency, Hz
Bandwidths 0.1 to 5 Octaves


Parametric EQ
15
10
5
0
−5
−10
−15
Magnitude, dB
100
1·10^3
1·10^4
Frequency, Hz
Varying Gain
Varying Bandwidth

Reinventing The Rules

***T44/48 Series** Operation manual*

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EXEL ACOUSTICS SL
CL Encinar, 282 - Pol. Ind. Monte Boyal
45950 Casarrubios del Monte (To)
Spain
(e): *support@tecnare.com*

www.tecnare.com - www.facebok.com/tecnare
(T): *+34 918 170 110 - +34 918 171 001*
(F): *+34 918 183 053*

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