



SUB 16
User's Manual
Version 1.5
---English---

All safety and operating instructions should be read before the equipment is installed and operated. We recommend that installation be carried out by an authorised mobile electronics installation company. Please contact your local ALTO Mobile™ distributor for a list of authorised installers in your country.

- To reduce the risk of electric shock and potentially damaging the equipment, do not disassemble the product. No user serviceable parts inside; refer servicing to qualified personnel.
- The equipment should be protected from moisture and rain, especially if mounted in the vehicle's trunk area or any location that may be susceptible to water ingress.
- The equipment should be situated so that its location or position does not interfere with its proper ventilation. For example, the product should not be situated under carpeting or in a totally sealed enclosure.
Trunk-mounted equipment/amp racks should be well ventilated, using forced air cooling fans if necessary.
The equipment should be situated away from heat sources such as engine exhaust systems and radiators.
- This product is designed for vehicles with a 12 VOLT NEGATIVE GROUND electrical circuit. This product must not be used in vehicles that use a 24 Volt supply or a positive ground electrical circuit.
- Great care must be taken when wiring the product to the vehicle's electrical system. Unless you are fully familiar and trained in wiring automotive electrical systems, installation should only be undertaken by a qualified automotive electrician.

**CAUTION: HIGH ENERGY LF & ULTRA LOW BASS MAY DAMAGE YOUR SPEAKERS.
READ THE MANUAL THOROUGHLY BEFORE USE.
OPERATE WITH CARE. AND ENJOY!**

Dear Customer,

Thank you for choosing the ALTO Mobile™ SUB16 digital dynamic low frequency processor. We hope you'll love the results you get from it and enjoy using it as much as we enjoyed developing it.

The SUB16 is the result of considerable development work in our R&D centres in Europe and the Far East and is a close cousin of ALTO's professional audio products. We've been designing products for musicians and recording studios for many years - the product you now have in your hands has a fine pedigree.

The core of our digital audio products is a sophisticated DSP (Digital Signal Processor) coupled with state-of-the-art algorithms developed by our software team over the last 7 years.

The car audio environment is worlds away from the controlled listening area of the recording studio, and yet much of the sound processing so important to recording engineers can be applied with spectacular success to the automotive environment. ALTO Mobile™ is a specialist division of audio and computer software engineers, but above all we're car audio enthusiasts. We love the challenge of trying to reproduce studio quality sound inside a moving vehicle.

We're convinced you are an important member of our team and we listen to what you say and take on board your suggestions. It's this feedback that helps us create the products you want. Thank you.

ALTO MOBILE™ TEAM

In purchasing the SUB16, you purchased a very powerful dynamic sound processor that is easy to use. No programming or complex skills are required since it's just a case of choosing a preset.

The SUB16 is a low frequency device - unlike its sister model the ALTO Mobile™ DYNAMATE, which handles the full audio bandwidth, the SUB16's presets have been specifically created to both control and enhance bass and sub-bass frequencies.

Once it's all correctly installed, you'll be eager to play with your new buy. If the product has been installed for you there's nothing stopping you, so go ahead - just read the following warning first and remember to come back and read the rest of this manual.

Important Warning Take it easy to start with. Avoid operating your system at high volume initially. When you switch from Bypass mode to one of the active modes, the increase in energy can be very substantial and this could damage speakers if you're not expecting it.

Keep the volume level down until you are familiar with the unit.

If you've purchased the product but haven't had it installed in your vehicle, that's obviously the first thing you'll need to do. We strongly recommend that you have the unit professionally installed by a specialist company authorised by the ALTO Mobile™ distributor in your country. The installation instructions in this manual are for guidance only and are not intended to be a thorough explanation of all the steps involved in correctly fitting this unit. The instructions assume that the person installing the equipment has been trained to carry out such work.

Once you've had a quick play with it you'll have some idea of what the SUB16 can do, but it's worth taking time to understand each of the preset algorithms and the kind of results you can expect. Understanding how each group of presets manipulates the sound will help you to know when to apply a certain preset for best results.

The available presets are divided into named categories giving 8 groups of substantially different flavor. We've tried to cover all tastes by providing everything from a natural 'jazz bass' sound to nothing short of Bass Armageddon, all from one small package.

The SUB16 uses a combination of equalization, low and high-pass filtering, automatic gain control, dynamic companding, broadcast-type bass modeling and digital delay (speaker time alignment). Its aim is not only to offer a way of enhancing the different flavors of bass, but also to offer control and protection. The 8 groups of presets cover a wide variety of applications, and these are explained in detail later in this manual.

Five of the preset groups use multi-band digital equalization to create bass contours that bring out the best from a variety of music from Jazz and Classical to Dance and the ultra-lows of 'Street Bass'. Included in these groups are two designed to mimic closed and vented box characteristics. So, for example, if you have a closed or "infinite baffle" system but you crave the extra output of a vented system, the "Virtual Vented" preset group will help do just that - great for Dance music. On the other hand, if you have a vented system and find it booms too much when you're chilling out to some cool Jazz, select the "Purist" preset group to give the kind of control and detail you'd get from a closed system.

Two of the groups apply no tonal equalization but provide bandpass filtering with different center frequencies for the subsonic high-pass or low-pass. These help control the bass, safeguarding your speakers and providing a high quality digital crossover without altering the character of the bass.

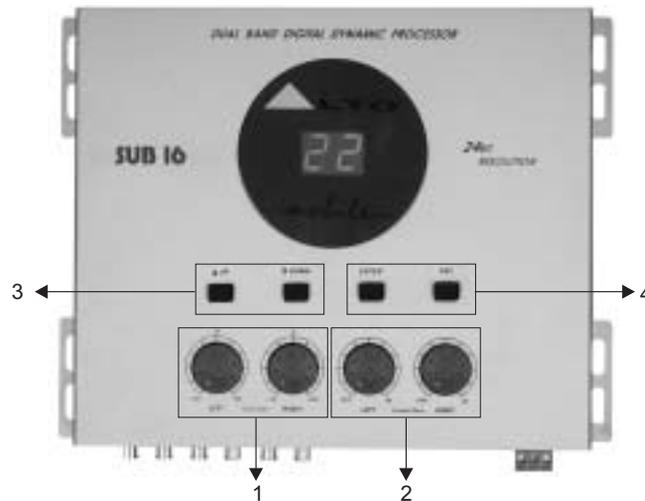
Finally we have a group dedicated to those of you with butt-kicking bass systems that just occasionally like to chill out by turning the bass down to match the output from the front speaker system. That's often inconvenient and difficult to get right with conventional gain controls. Now you can do it with a few button presses and without altering any of your carefully set analogue amp or crossover settings.

All the above preset groups each have 8 variations, and this is where you can choose to apply the AGC, dynamic companding and bass modeling.

AGC stands for automatic gain control. The circuit monitors the energy within the band and, if necessary, raises the level. The process is actually quite complex since it's fully dynamic - the circuit applies itself differently according to various set thresholds. The overall aim is to prevent musical passages from disappearing beneath the background road and engine noise.

Dynamic companding is a sophisticated signal processing technique used extensively in music recording studios. Its operation works to dynamically balance the music's energy levels, helping to retain the music's dynamics while providing a reproduction that is within the hi-fi system's abilities. Its operating characteristics depend on the input level, so it's constantly changing, which is what makes it a dynamic system.

The Bass Modeling function follows a technique used in broadcasting, designed to provide a form of soft clipping of the audio sine wave on heavy peaks. This allows speakers and amplifiers to handle significantly higher levels of bass without going into hard clipping, which is both hard on the ears and potentially a destroyer of speakers. Note that Bass Modeling only kicks in if the musical peaks exceed the upper threshold.



- 1. Input Gain Controls:** Use these controls to match the pre-amp output level from your car audio source unit. If a dot shows on the display next to one or both the digits, this indicates clipping (excess signal level/distortion) of one or both the channels of the input stage. Set the input level so that the LED dots light only very occasionally on musical peaks.
SUB16 MAX Input level: 15 V
- 2. Output Gain Controls:** Use these controls to match the optimum pre-amp input level of your amplifier or active crossover.
SUB16 MAX Output level: 9.5 V

Input/Output Gain Setting (SUB Outputs): Proper setting of the input and output levels is important in achieving the cleanest and highest level signal. Use of test tones and an oscilloscope will greatly assist in setting the optimum gain levels. For this reason, system setup is best left to a professional car audio installer. However, if you need to get up and running without professional help, follow these steps and you won't go far wrong.

Select Preset 04.

Set the ALTO's Output Gains to their 12 o'clock positions.

Turn the Input Gain controls fully counter-clockwise (minimum gain).

Turn the volume control on your CD player to about 75%.

Turn your amplifier input gains to a low setting (say 25%).

Now play some music and increase the ALTO's Input Gains until you see the red dots (next to each digit on the display) begin to flash occasionally on musical peaks. This will in most cases be the optimum setting for the input gains. Note that setting the volume control of your CD player at 75% rather than maximum is done to ensure that the signal output from the player is pure and undistorted.

Pause the music. Now set the ALTO's Output Gains to about their 3 o'clock position (i.e. 75% of maximum) and set your amplifier input gains to their Minimum Gain position (i.e. where the amp gives its lowest output level).

Note that the maximum output level from the ALTO processor exceeds 9 volts.

Play some music and gradually increase your amplifier's gain controls until you reach your preferred maximum listening level, or where you begin to hear any stress from the speakers. If the music sounds distorted with the amp gains at minimum, reduce the Output Gains on the ALTO unit.

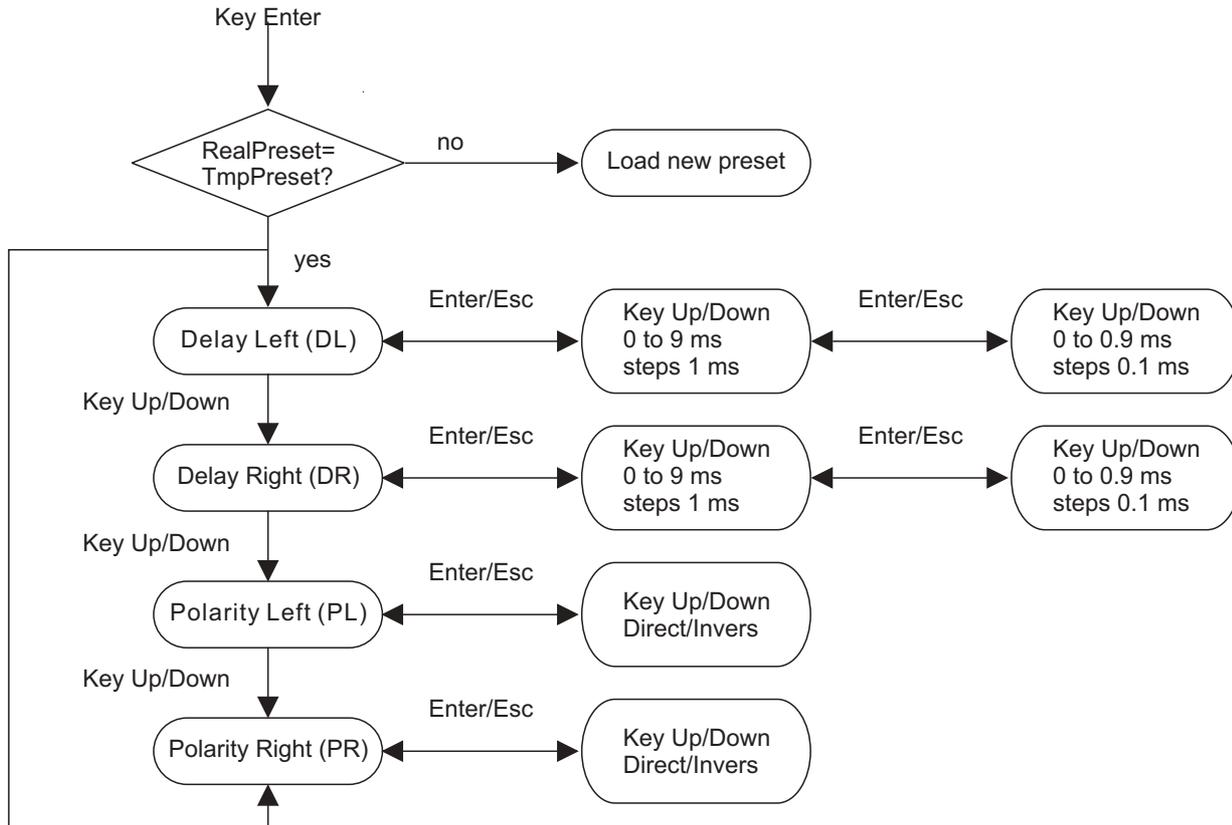
3. *Up/Down Keys*: Use these to select the required preset number as viewed on the display. There are 8 groups of different processing types, and each of these has 8 variations. Refer to the description of the preset groups for an explanation of how each group/preset differs.

4. *Enter/ESC Keys*: While searching using the *UP/DOWN* keys, the currently selected preset remains active. Once you have decided on a new preset (the preset number is showing on the display), press *ENTER* and the SUB16 will apply the new processing algorithm.

The Enter key is also used to access the editing sub-menus, used to modify 4 parameters: *Delay Left, Delay Right, Polarity Left, Polarity Right*.

The *ESC* Key is used to exit sub-menus.

The menu structure is shown in the following diagram:



The SUB16's presets are divided into 8 groups of sound processing algorithms and each of these has 8 variations. The effect of the processing is in many cases influenced by the level of the input signal at different frequencies, so in that sense it is very much a 'dynamic processor' and you should live with each preset setting for a while to reveal its full effect. In the listings we have used the following abbreviations: AGC - automatic gain control. CMP - dynamic compander. BM - bass modeling.

GROUP: Digital Cross

A bandpass filter to use as a high quality digital crossover with subsonic protection. No equalisation - the tonal character of the bass is unchanged. For all presets the subsonic high-pass filter is set at 25Hz (24dB/octave slope). There are two sets of four presets offering low-pass filter points of 63Hz, 80Hz, 95Hz and 125Hz (all with 24dB/octave slope).

PRESET 01: LP 63Hz. BM only

PRESET 02: LP 80Hz. BM only

PRESET 03: LP 95Hz. BM only

PRESET 04: LP 125Hz. BM only

PRESET 05: LP 63Hz. AGC + CMP + BM

PRESET 06: LP 80Hz. AGC + CMP + BM

PRESET 07: LP 95Hz. AGC + CMP + BM

PRESET 08: LP 125Hz. AGC + CMP + BM

GROUP: Extreme Control

A bandpass filter to use as a high quality digital crossover with a choice of subsonic protection level. No equalisation - the tonal character of the bass is unchanged. For all presets the low-pass filter is set at 100Hz (24dB/octave slope). There are two sets of four presets offering subsonic high-pass filter points of 50Hz, 40Hz, 30Hz and 20Hz (all with 24dB/octave slope).

PRESET 09: HP 50Hz. BM only

PRESET 10: HP 40Hz. BM only

PRESET 11: HP 30Hz. BM only

PRESET 12: HP 20Hz. BM only
PRESET 13: HP 50Hz. AGC + CMP + BM
PRESET 14: HP 40Hz. AGC + CMP + BM
PRESET 15: HP 30Hz. AGC + CMP + BM
PRESET 16: HP 20Hz. AGC + CMP + BM

GROUP: Purist

Designed to simulate the tonal characteristics of a closed box bass system when using a vented system.

Reduces the typical vented box 'hump' to give the impression of a flatter, more extended and controlled bass.

Good for jazz, classical and rock music. Subsonic high-pass at 26Hz (24dB/octave slope). Low-pass at 95Hz (18dB/octave slope).

PRESET 17: Bypass (bandpass filtering only)
PRESET 18: EQ only
PRESET 19: EQ + AGC
PRESET 20: EQ + AGC + CMP
PRESET 21: EQ + BM
PRESET 22: EQ + AGC + BM
PRESET 23: EQ + CMP + BM
PRESET 24: EQ + AGC + CMP + BM

GROUP: Virtual Vented

Applies a broad lift designed to simulate the tonal characteristics of a vented (bass reflex) system when using a closed box (infinite baffle) bass system. Good for dance and contemporary pop music. Subsonic high-pass at 26Hz (24dB/octave slope). Low-pass at 120Hz (18dB/octave slope).

PRESET 25: Bypass (bandpass filtering only)
PRESET 26: EQ only
PRESET 27: EQ + AGC
PRESET 28: EQ + AGC + CMP
PRESET 29: EQ + BM

PRESET 30: EQ + AGC + BM
PRESET 31: EQ + CMP + BM
PRESET 32: EQ + AGC + CMP + BM

GROUP: Depth Charge

Works on giving high energy levels in the ultra-low frequency zone. Good for classical music, pipe organ, some synthesizer tracks and anything rich in the sub-30Hz range. Use with care on 'street bass' and bass test tracks. Subsonic high-pass at 23Hz (24dB/octave slope). Low-pass at 100Hz (18dB/octave slope).

PRESET 33: Bypass (bandpass filtering only)
PRESET 34: EQ only
PRESET 35: EQ + AGC
PRESET 36: EQ + AGC + CMP
PRESET 37: EQ + BM
PRESET 38: EQ + AGC + BM
PRESET 39: EQ + CMP + BM
PRESET 40: EQ + AGC + CMP + BM

GROUP: You Want Dance?

No prizes for guessing this one. Applies a lift in the region 40-60Hz to emphasise the bass and drums in contemporary dance music. Subsonic high-pass at 26Hz (24dB/octave slope). Low-pass at 76Hz (18dB/octave slope).

PRESET 41: Bypass (bandpass filtering only)
PRESET 42: EQ only
PRESET 43: EQ + AGC
PRESET 44: EQ + AGC + CMP
PRESET 45: EQ + BM
PRESET 46: EQ + AGC + BM

PRESET 47: EQ + CMP + BM
PRESET 48: EQ + AGC + CMP + BM

GROUP: Street Armageddon

If you have a serious bass system and like to prove it at the local cruise, this one's for you. Designed to enhance 'street bass' and bass test tracks with a wicked lift focussed on the region between 30-40Hz. Handle with extreme care. Even with the subsonic protection, the high energy of the processed output could destroy subs quicker than the time it takes to say "oh shi...". Subsonic high-pass at 28Hz (24dB/octave slope).

Low-pass at 120Hz (18dB/octave slope).

PRESET 49: Bypass (bandpass filtering only)

PRESET 50: EQ only

PRESET 51: EQ + AGC

PRESET 52: EQ + AGC + CMP

PRESET 53: EQ + BM

PRESET 54: EQ + AGC + BM

PRESET 55: EQ + CMP + BM

PRESET 56: EQ + AGC + CMP + BM

GROUP: 100% Chillin'

PRESETS 57-64

This group is unlike all the others since it provides a way of *softening* rather than enhancing the level of bass.

Designed for big bass systems and those times when you want to *chill* and just listen to the music 'flat', without messing up your equipment settings. There are two different EQ contours (presets 57-59 and 60-62) and two pure gain reduction bandpass presets with no EQ (presets 63 & 64). All feature subsonic high-pass and low-pass filtering at different frequency centers.

Time alignment (Delay)

Each subwoofer output channel can be set with a delay from as little as 0.1 milliseconds to 9.9 milliseconds.

This allows the 2 subwoofers (and others if using more than one SUB16) to be accurately aligned in order to reduce phasing problems due to mounting positions, internal reflections and mechanical/electrical differences between the various subwoofers. To access the Delay menu functions, press the *ENTER* button when any active preset is selected (display must not be blinking). Then use the *UP/DOWN* keys to select Left or Right Channel Delay (dL/dr). Press *ENTER*. Then use the *UP/DOWN* keys again to set the milliseconds delay for that channel. Press *ENTER*. Now you can set values of tenths of a millisecond. When you have made your choice, use the *ESC* key to go back up the menu system.

Polarity 0/180°

The polarity or 'phase' of each channel can be switched Direct/Inverse. Follow the same instructions as above to access the Polarity menu and make changes. Options are Right Channel polarity (PR) and Left Channel polarity (PL), then d/i (direct/inverse) for each channel.

Full-band signal path

The SUB16 offers a full-band pass-through (unprocessed stereo in/out) to simplify adding the processor into your system circuit.

Mounting the Unit

The SUB16 has two fixing 'ears' at each side, allowing it to be firmly screwed to a suitable surface. It may be mounted vertically or horizontally. Take care not to mount the unit where it may become wet or subject to damage from items placed in the trunk area.

Signal Inputs/Outputs

The SUB16 provides two sets of outputs from just one stereo input pair. The inputs are split internally. One pair provides a full-band pass-through (unprocessed) signal output; the other pair is summed to mono and passes through to the DSP for bass processing. Two Low Frequency mono outputs are provided.

- Connect the phono type output cables from your car radio/cassette player, CD/receiver or other source unit to the *INPUT* terminals of the SUB16.
- Connect suitable cables (not supplied) from the various *OUTPUT* terminals of the SUB16 to the corresponding input terminals of your power amplifier(s).

Where to place SUB16 in the signal path

The SUB16 should be placed within your system's audio circuit between the source unit and the power amplifier (and in line before an active crossover, if you have one of these in your system). Connect the processed bass outputs and unprocessed full-band outputs according to your system setup.

It may be necessary or beneficial to alter the settings of your active crossover (if applicable) after fitting the SUB16.

Caution: SUB16 must always be placed in line BEFORE the power amplifier stage.

Power, Ground and Remote Switch-On (REM) Terminals

Caution: Before making any connections, you must stop power delivery from the battery to avoid accidental short-circuits. The conventional way is to disconnect the Negative terminal of the battery but beware - *this action will disconnect power from all electrical items in the vehicle, including:*

- the audio source unit (which may require a code number to reactivate it - do you know the code?)
- the security system (which may trigger and sound an alarm from its back-up battery - do you know how to override the alarm system?)

- memory modules (which may suffer memory loss if disconnected for too long).

If you have any doubts you should seek professional assistance first. Professional auto electricians will isolate individual circuits to maintain power to the remainder of the vehicle's electrical system.

At the far right of the side panel is a POWER INPUT terminal block with three screw terminals. The terminal marked +12V should be connected to a permanent 12 Volt supply from the vehicle battery.

The terminal marked GND (Ground) should be connected to a cable which is terminated to the vehicle chassis. Ensure that the point where this cable attaches to the vehicle chassis provides good electrical contact. If drilling a new ground point, ensure that it is safe (check that there is nothing behind the panel you are about to drill, such as the fuel tank). It may be necessary to rub away paintwork to expose the metal at this point - in this case, after making a firm screw connection of the ground cable to the chassis, paint over the terminal point to protect it from the possibility of corrosion. Where a ground point already exists (for an existing power amplifier, for example) it is generally best practice to ground the SUB16 to this same point on the vehicle chassis.

The terminal marked REM accepts a 12V switched input from the source unit (Cassette or CD player). When the source unit is switched on, a 12V pulse is sent down this line. The SUB16 senses this pulse and switches itself on or off. The source unit should be equipped with a suitable Remote Switch cable - check the instruction book supplied with your audio source unit.

If the Remote output from the source unit is already being used to switch on a power amplifier, it is usually possible to create a 'daisy-chain' by connecting a cable from the REM or Remote terminal on the amplifier to the REM terminal of the SUB16. This avoids the need to run a separate cable from the source unit.

Before reconnecting power to the circuit, double check all connections (be particularly careful to check there are no strands of wire which could touch the chassis of the SUB16 or one of the other terminals).

The power-on LED next to the power input terminal block will light to show the unit is receiving power.

An optional remote control unit is available. This uses a proprietary interface/control system and allows presets to be selected from the driver or passenger seat even if the unit itself is installed in the trunk.

Connections are made to the *A-LINK IN* and *A-LINK OUT* terminals. Follow the instructions supplied with the A-LINK Remote control unit.

Because of the nature of our digital sound processors and the variety of effects that can be achieved with them, there are operational details, tips and advice too numerous to include in an instruction manual such as this. For additional information, please visit our website at www.altomobile.com, which includes a technical discussion forum where users can exchange ideas.

Troubleshooting

Power LED not lit: Is the Remote switch cable from the source unit (Cassette or CD Player) attached to the REM terminal of the SUB16, and is the source unit switched on? Are the +12V and GND (Ground) terminals connected correctly? Is the Ground cable properly attached to the chassis of the vehicle or to an existing ground point that is known to be OK?

No Sound: Adjust the level of the Input Gain Controls. Adjust the level of the Output Gain Controls. Are the Input and Output signal cables correctly connected? If there is only sound from one channel, swap the Left and Right channel Input cables at the SUB16 - if the fault moves to the other channel then the fault is with the cable or source unit. If the fault remains in the same channel, swap the Left and Right channel Output cables at the SUB16 - if the fault still remains on the same *speaker* then the fault is with a cable or a unit after the SUB16 (power amplifier, active crossover or the speaker). Check gain controls on those units and any input switching options. If the fault moves to the other *speaker* then the SUB16 may be faulty - leave it installed in your system and return to your dealer so that they can check it.

Distorted Sound or Low Volume: Adjust the Input and Output Gain Controls of the SUB16, and the Input Level Controls of the power amplifier (and/or active crossover or additional processor where applicable). Check if the amplifier has a built-in crossover network - is it switched correctly?

To be protected by this warranty, the buyer must be able to produce a numbered, machine printed sales receipt (original only accepted, not a copy) from his supplying dealer that clearly shows the dealer's name and address, the buyer's name and address, purchase date, model name/number and serial number of the product. ALTO® reserves the right to verify the authenticity of the receipt directly with the supplying dealer.

- ALTO® warrants the mechanical and electronic components of this product to be free of defects in material and workmanship for a period of one (1) year from the original date of purchase. If any defects occur within the specified warranty period that are not caused by normal wear and tear or inappropriate use, ALTO® shall, at its sole discretion, either repair or replace the product.
- To obtain warranty service, the product must be returned in its original shipping carton. A description of the problem will be appreciated.
- Damages/defects caused by the following conditions are not covered by this warranty:
 - a. Misuse, neglect or failure to operate the unit in compliance with the instructions given in the user or service manuals.
 - b. Connection or operation of the unit in any way that does not comply with the technical or safety regulations applicable in the country where the product is used.
 - c. Damages/defects that are caused by force majeure or by any other condition beyond the control of ALTO®.
- Any repair carried out by unauthorised personnel will void the warranty.
- This warranty is extended exclusively to the original buyer (customer of retail dealer) and is not transferable to anyone who may subsequently purchase this product. No other person (retail dealer, etc.) shall be entitled to give any warranty promise on behalf of ALTO®.
- Failure of ALTO® to provide proper warranty service shall not entitle the buyer to claim (consequential) damages. In no event shall the liability of ALTO® exceed the invoiced value of the product.
- This warranty does not exclude or limit the buyer's statutory rights provided by national law, in particular, any such rights against the seller that arise from a legally effective purchase contract.

Channel Layout

2 inputs – > 2 mono outputs + L/R stereo Bypass

Analog Input section

Inputs: 2 RCA - F
Input Impedance: > 400 kOhms
Max. input Level: 15 V

Analog Output section

Outputs: 4 RCA - F
Output Impedance: < 600 Ohms
Max. output level: 9.5 V

Digital / Analog Interface

Frequency Response: Sub Outputs 20Hz - 1kHz (before software filters)
Bypass Mode 20Hz - 20kHz
Signal to Noise Ratio > 85 dB
THD+N 0.03 % @ 1KHz –3 dB
Conversion: 18 bit a-d and d-a converters

Power Supply

Type: Servo - controlled, Switching
Voltage supply: 11V - 16V DC (negative ground)

Remote Control:

Alto Mobile A-Link-

Time Alignment

Delay Range:	Variable from 0 to 9.9ms
Step Delay Adj:	1ms
Step Delay Fine:	0.1ms

Polarity (Phase)

Direct/Inverse:	L/R Channel, 0/180 degrees
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