



momentum™

md16ae

16x16 AES3/EBU Digital Interface Manual



On
Stage
with
the Best

Pro Co Sound, Inc.
225 Parsons Street | Kalamazoo, MI 49007
1-888-253-7360 | www.procomomentum.com

Warranty

Pro Co Sound guarantees Momentum for five years, any excuse, even abuse. If you need to return the Momentum unit(s), ship them to Pro Co Sound in the original carton or a suitable shipping container via insured freight. Pro Co will return the Momentum unit(s) to you, free of charge including return postage. Once out of Warranty, Pro Co also offers service on all its products.

Customer Responsibility:

Please read the owner's manual thoroughly before operating the system. Complete the Warranty Card within ten days after receipt of your Momentum system. Mail the card to us or register your product on line at www.procomomentum.com.

The Warranty is subject to the following conditions:

1. Pro Co Sound or its authorized representative or dealer must perform all warranty servicing of the units, otherwise all aspects of this warranty are void.
2. All tamper-proof seals on the unit(s) must be intact in order for the unit(s) to be serviced as a warranty claim.

How obtain Warranty services:

If, after following all of the operating instructions in this manual, you find that service or support is still needed:

1. First contact the dealer or contractor from which you purchased your Momentum product for help.
2. If your problem is not resolved after contacting your dealer, call Pro Co Sound at 1-800-253-7360 and ask for Momentum Service. Our hours are 8:00 a.m. to 6:00 p.m. EST, Monday through Friday.

If the problem cannot be resolved remotely, Pro Co Sound may, at its discretion, advance the replacement of the defective unit(s) and at that time provide a Return Authorization number by which the defective unit(s) can be returned for credit or repair.

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Safety Precautions

Always follow the basic precautions listed below to avoid the possibility of physical injury to you or others, or damage to the device or other property. These precautions include, but are not limited to, the following:



To reduce the risk of fire or electrical shock, do not expose any part of your Momentum System to rain or moisture.



To reduce the risk of electrical shock, do not remove cover. There are no user serviceable parts inside. Refer servicing to service personnel.

Use Extreme Caution!

Before making adjustments to your Momentum system, be aware that certain actions could possibly damage your hearing and/or the audio system itself. Think through your actions and the possible ramifications of your adjustments. Proceed with caution and follow these important Safety Instructions:

1. Read these instructions carefully.
2. Retain these instructions for future reference.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use any part of this apparatus near water.
6. Do not block any ventilation openings.
7. Do not install near any heat source.
8. Do not defeat the safety purposes of the polarized or grounding type plugs.
9. Do not use the Momentum power supply for any purpose other than stated in this manual.
10. Only use Pro Co recommended accessories with any Momentum device.

Welcome

Thank You

Thank you for your recent purchase of the Pro Co Momentum **md16ae**. We hope you find our product to be versatile and flexible. The entire line of Momentum products was designed with the intention of offering optimal flexibility for multitude of applications.

Pro Co Sound, a Michigan based business, was founded in 1974. We build audio interface products, in-ear monitor controllers and facility distribution systems. We continue to live by our mission;

"To become our customers' very best partner, by building a world class organization, through continual, rapid improvement in all that we do, and to share in the successes and failures of our efforts."

Welcome to the Pro Co Family.

Receiving Your Momentum md16ae

When receiving your Momentum System, please check all cartons for damage. If there is damage, notify the shipper and dealer in that order. Before removing any components of your Momentum System from the shipping cartons, be sure that the order is complete as expected. Do this by checking each Momentum System component on your packing slip to be sure it matches the number of packing boxes and the specific type and number of components contained within. Fill out the warranty cards and send them in! You should find the following in the carton:

1 x **md16ae**
2 x Rack Ears

2 x Stage Boots (optional)
1 x One Spot Power Supply

NOTE: Stage boots may be requested, for no additional charge at time of order.

Momentum System

The Momentum digital snake system by Pro Co is designed to replace traditional analog audio wiring anywhere audio distribution is needed. By capturing audio at the source, converting it to digital audio and distributing it over a standard Ethernet network, many of the difficulties in executing the increasingly complicated audio systems of today can be simplified. By reducing the amount of field terminations, installation becomes less time consuming. Texas Instrument, Burr Brown mic preamps and Cirrus Logic digital converters provide a platform that is as close to analog as possible without the inherent problems that are associated with traditional wiring.

Flexibility and expandability are enhanced through the use of modules for inputs, outputs and DSPs. Signal routing becomes as easy as clicking a button. You can place inputs, outputs, DSPs and controls anywhere on the Momentum network. Also digital interfaces are available for seamless system integration into many of the popular formats.

Features

The Momentum network uses standard Gigabit Ethernet technology. With using standard Ethernet technology, the Momentum system can be setup and controlled using standard Ethernet products.

- Standard Gigabit Ethernet Protocol
- Power Over Ethernet (PoE) 802.3af Compatible
- Up to 256 total active system inputs
- 0.315 ms A/A latency 96k sampling (no DSP)
- 0.630 ms A/A latency 48k sampling (no DSP)
- 1.00 ms A/A latency 48k sampling (with DSP)
- Fiber optic option
- Firmware upgradable in field
- Selectable 48K or 96K sampling
- Clip LED indicators for each output
- Front mounted control panel
- Available with rack mount kit or optional stage boots
- Onboard memory and programming

The md16ae Enclosure

The **md16ae** enclosure can be used in a number of different configurations depending on the needs of the end user. Units are shipped with rack ears, which can be front or rear mounted or can rotate for vertical or horizontal surface mounting. Optional rubber stage boots allow the units to be used as stage boxes.

md16ae Front View with Rack Ears



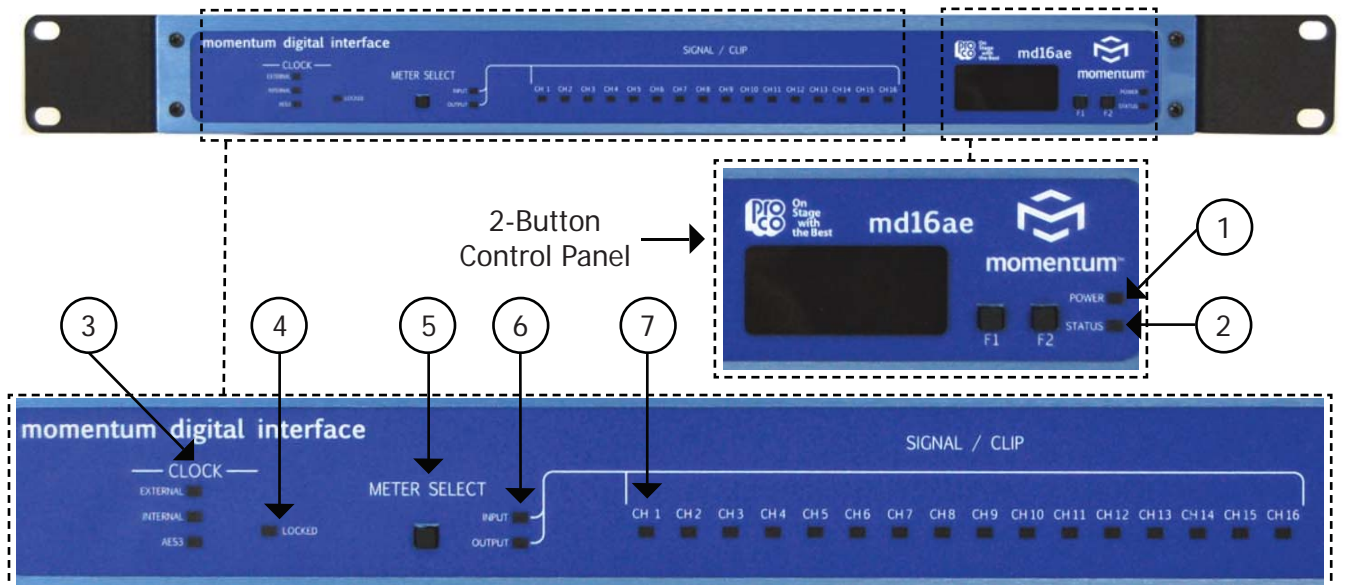
md16ae Front View with optional Stage Boots



Front Panel

The front of the **md16ae** has a 2-button control panel and 16 input/output channels each with a **signal / clip LED** indicator visible on the front panel.

The control panel includes a **power LED**, **status LED**, a **3-digit readout display** and **control buttons (F1 and F2)**.



LED	Description
1	Power LED Green = Digital power OK
2	Status LED Green = Network connected; Red = Network fault
3	Clock Source Indicates selected clock source
4	Locked Light Red = unlocked; Green = locked
5	Meter Select Toggles between input/output metering * Also toggles display between input/output start channel
6	Meter LED Indicates input/output selected
7	Signal/Clip LED Green = -40dB F.S. or above; Red = -3dB F.S. or above

* Changing meter will also change meter in the software.

Rear Panel

The rear panel offers network status LEDs for monitoring the unit's network connection.

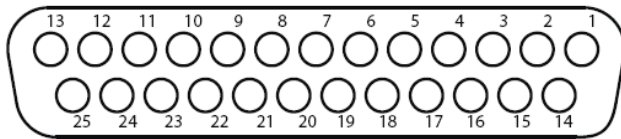
External Clock Connection

See below for pin out diagram

LED	Description
1	Active Link
2	TX
3	1000m
4	Quality

Pin Out Diagram

Tascam® Compatible Pin Out



DB25 Pin	Description
1	Digital Out 7/8 +
2	Ground
3	Digital Out 5/6 -
4	Digital Out 3/4 +
5	Ground
6	Digital Out 1/2 -
7	Digital In 7/8 +
8	Ground
9	Digital In 5/6 -
10	Digital In 3/4 +
11	Ground
12	Digital In 1/2 -
13	No Connect

DB25 Pin	Description
14	Digital Out 7/8 -
15	Digital Out 5/6 +
16	Ground
17	Digital Out 3/4 -
18	Digital Out 1/2 +
19	Ground
20	Digital In 7/8 -
21	Digital In 5/6 +
22	Ground
23	Digital In 3/4 -
24	Digital In 1/2 +
25	Ground

Power



Use only with the power supplies provided by Pro Co Sound.

OR

Use only 802.3af PoE power supplies.

The Momentum input unit requires **48VDC** power to operate. There are two recommended ways to power the unit:

Use the **Pro Co One Spot power supply**. It is shipped with the unit and allows the powering of only one device. An alternative to the One Spot is the **Multi Unit Power Supply (MUPS)**. This power supply comes with three jumper cables that will allow up to four units to be linked together and powered by one MUPS. The MUPS is an additional option and must be ordered separately.

Alternative Method of Powering Device:

Use a standard **Gigabit IEEE 802.3af PoE network switch** to power the device through the Ethernet cable. The POE switch must be capable of 15.4Watts per Ethernet port.



↑
Ethernet port

↑
One Spot or MUPS power supply ports

POE Precautions

POE is an IEEE regulated protocol. The use of this power method is only recommended as an alternative to the one spot or MUPS power supplies. POE is not recommended for use when multiple mi8s will be connected to a common device such as a mixing console or multi-track recorder. Also do not use POE where excessive static electricity is present. Doing so may result in inconsistent POE performance.

Use POE only in situations where individual sources are connected to individual mi8s, such as mics, keyboards, or mixing console outputs. Never connect more that one mi8 to a single device when powered off POE.

Failure to follow these guidelines may result in unpredictable power issues due to the nature of the IEEE (802.3af) standard. Pro Co Sound is not responsible for power up anomalies due to the use of POE.

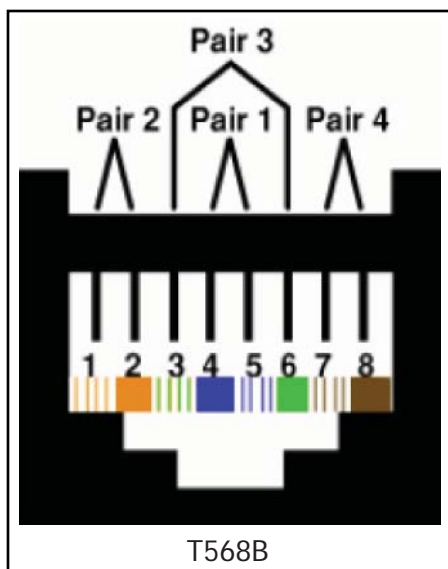
Network Wiring

Copper Wiring

- Use **CAT6** network cable
- Maximum cable length is 100 meters
- Maximum cable length with POE active is 50 meters

Copper Connection

- Use T568B or equivalent connectors when wiring your system. This view shows the color code as viewed from the front of the female socket or the rear of the male connector.
- Crossover wiring is not needed; the Momentum network interface compensates for unit-to-unit connections.



Pin	T568B (female)	Description
1	Orange/White	Bi-directional pair +A
2	Orange	Bi-directional pair - A
3	Green/White	Bi-directional pair +B
4	Blue/Power	Bi-directional pair +C
5	Blue/White	Bi-directional pair - C
6	Green Receive	Bi-directional pair - B
7	Brown/White	Bi-directional pair +D
8	Brown Power	Bi-directional pair - D

Fiber Connection (Optional)

The Momentum Fiber option uses ST style connectors and operates at 850nm. The system is fully IEEE 802.3z Gigabit Ethernet compliant. The following are performance based on the cable type:

- ▶▶ 220 meter distance use 62.5/125um MMF 160MHz Km Cable
- ▶▶ 275 meter distance use 62.5/125um MMF 200MHz Km Cable
- ▶▶ 500 meter distance use 50/125um MMF 400MHz Km Cable
- ▶▶ 550 meter distance use 50/125um MMF 500MHz Km Cable

Network Configurations

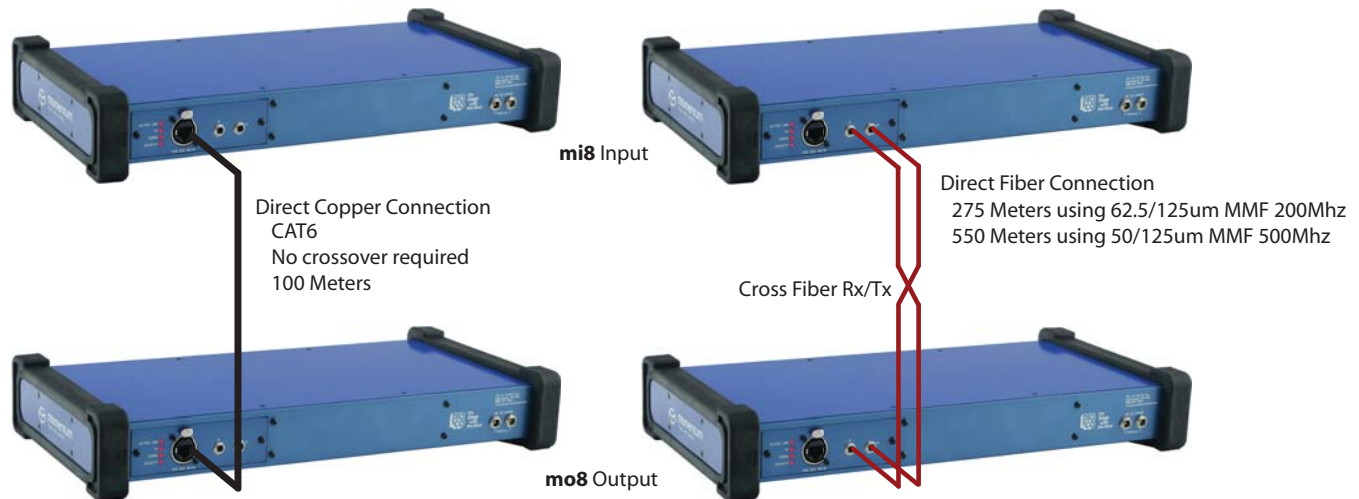
The following are examples of network configurations. These samples show configurations using analog inputs and outputs. Momentum digital input and outputs or DSP devices use the same methods for network configuration.

Using the Momentum system, the network configuration possibilities are endless. For more information on advanced configurations and support, visit www.procomomentum.com. For further support, contact your local dealer or Pro Co technical support.

One to One Connection

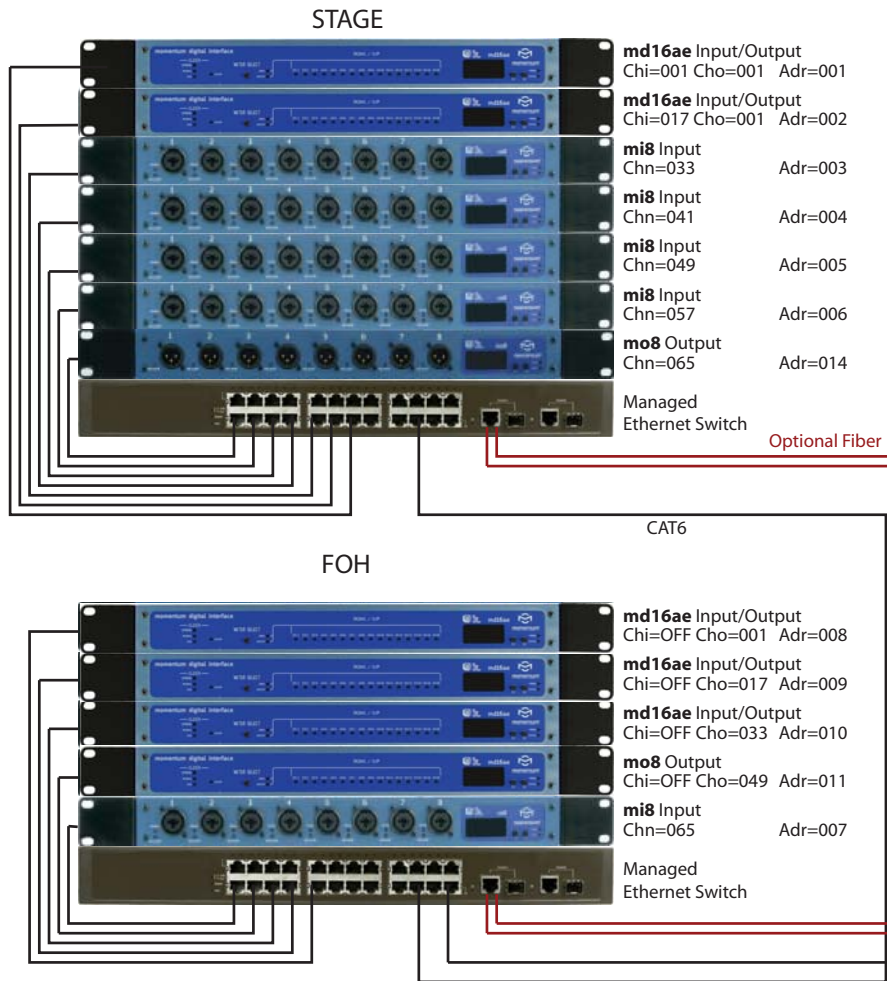


Chn 001 must be present on the network at all times. This unit will sync the network clock.



Optionally, Fiber and Copper may both be connected for redundancy.

48 x 8 Typical Snake System



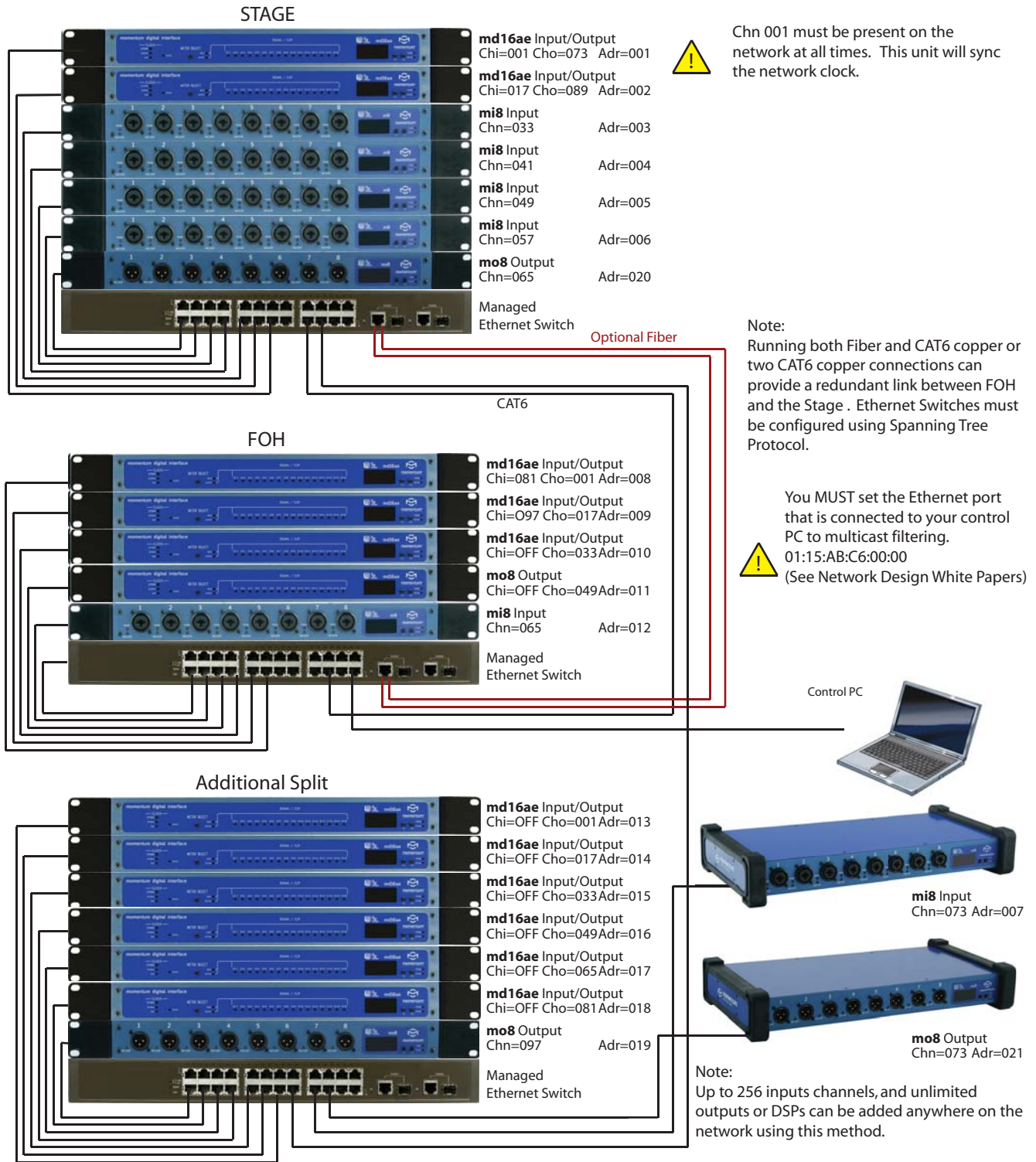
! Chn 001 must be present on the network at all times. This unit will sync the network clock.

Note:
Running both Fiber and CAT6 copper or two CAT6 copper connections can provide a redundant link between FOH and the Stage. Ethernet Switches must be configured using Spanning Tree Protocol

!
You MUST set the Ethernet port that is connected to your control PC to multicast filtering.
Multicast MAC 01:15:AB:C6:00:00
(See Network Design White Papers)



48 x8 With Split Network System

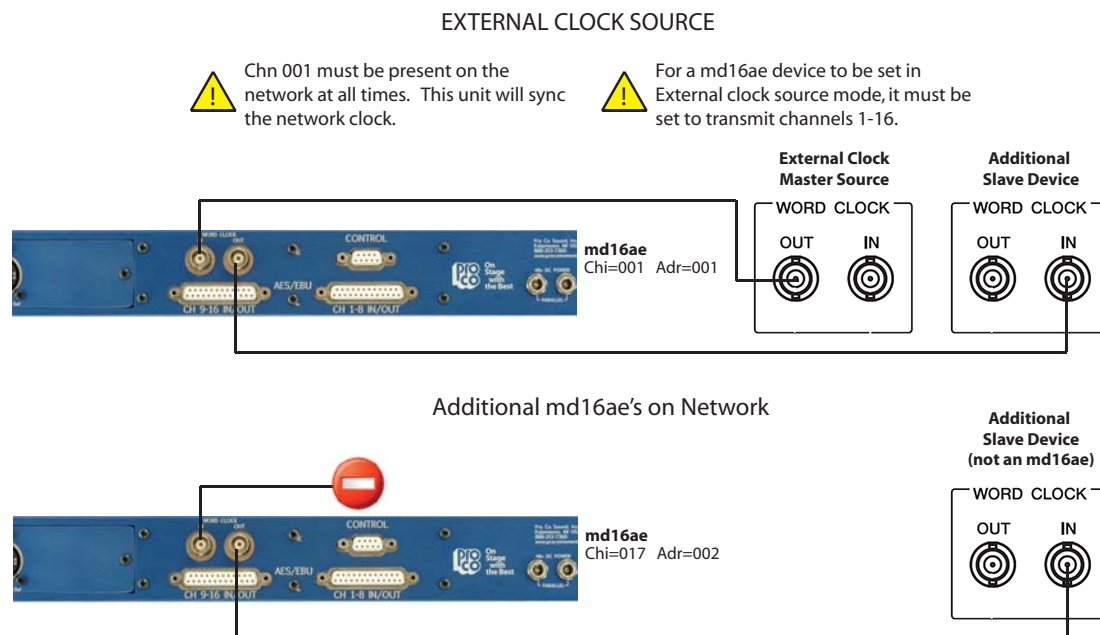


Clock Configurations

External Clock Source

There are three available clock sources for the **md16ae**. In order for the clock source to be changed, the device must be set to **input start channel 1**. *This will set the device as the Momentum Network Clock Master.* If the device is set to any other start channel, it will only sync from the device on the Momentum Network that is set to start channel 1. Clock (CL) adjustment will be UNAVAILABLE on the front panel.

With the **md16ae** set to start channel 1, the three clock sources are External, Momentum and AES3. External clock will sync the **md16ae** to the word clock BNC input (0.2 to 5Vp-p). With Momentum clock selected the **md16ae** will use its internal clock. With AES3 selected the **md16ae** will use channels 1 and 2 of the AES3 connection from which to sync. Any **md16ae** on the network displaying a green locked light will output a valid clock signal from the word clock BNC out connector.



Overview of External Clock Source:

*Please take note of the following instructions as the wiring of the **md16ae** differs from standard clock wiring.*

Only one **md16ae** can be connected to one external master clock and this device must transmit channel 1. Other Momentum devices will then sync to this **md16ae**. The external clock connections should not be daisy chained from one **md16ae** to another.

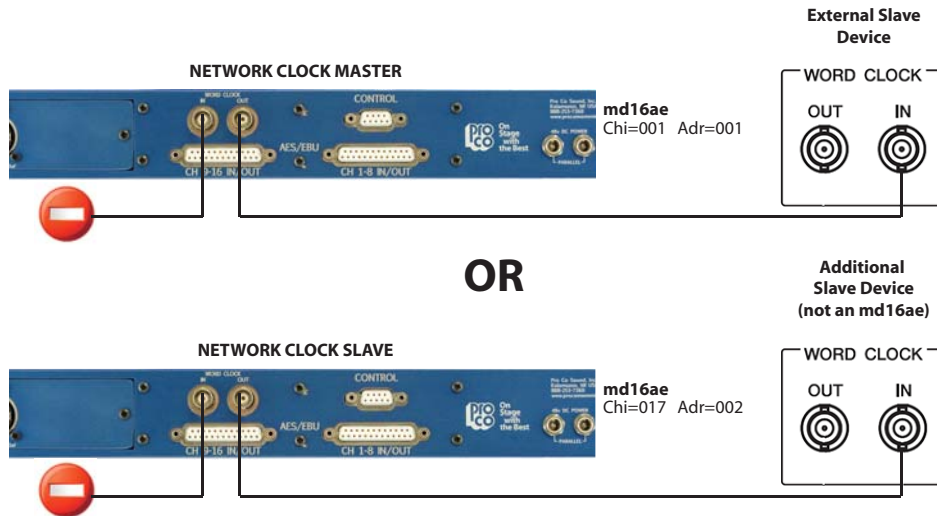
- Set the md16ae clock source to **External** using 2-button panel or PC software.
- Connect clock source output to the word clock input of the md16ae.
- Set clock to match the applicable Momentum sample rate. (48k or 96k)
- When selected, the locked clock LED should be green.
- An additional non-Momentum slave device can be connected to the word clock output.

Momentum Network Clock Source

MOMENTUM NETWORK CLOCK SOURCE



Chn 001 must be present on the network at all times. This unit will sync the network clock.



Overview of Momentum Network Clock Source:

- If the **Momentum Network clock** is selected and transmitting channel 1, this unit is the clock master.
- If it is set to transmit any other channel, the unit will sync to the Momentum device that has been set to transmit channel 1.
- Set clock to match the applicable Momentum sample rate. (48k or 96k)
- When selected, the locked clock LED should be green.
- An additional non-Momentum slave device can be connected to the word clock output.

AES3 Clock Source

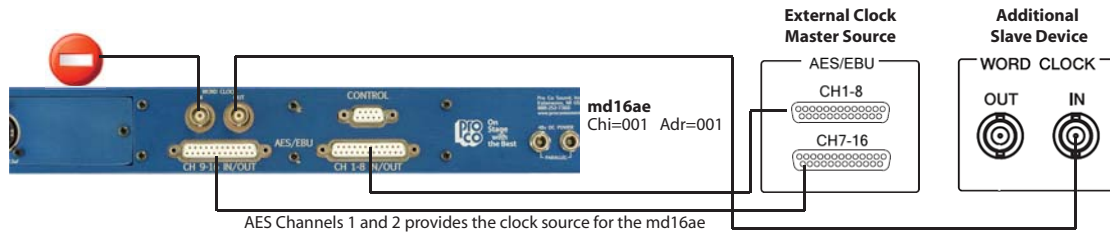
AES3 CLOCK SOURCE



Chn 001 must be present on the network at all times. This unit will sync the network clock.



For a md16ae device to be set in AES3 clock source mode, it must be set to transmit channels 1-16.



Additional md16ae's on Network



Overview of AES3 Clock Source:

Only one **md16ae** can be set to sync to the AES3 clock source and this device must transmit channel 1. All other Momentum devices will then sync to this device.

- With AES3 clock source selected, the md16ae will sync to AES3 channels 1 & 2.
- Set clock to match the applicable Momentum sample rate. (48k or 96k)
- When selected, the locked clock LED should be green.
- An additional slave device can be connected to the word clock output.

Setup

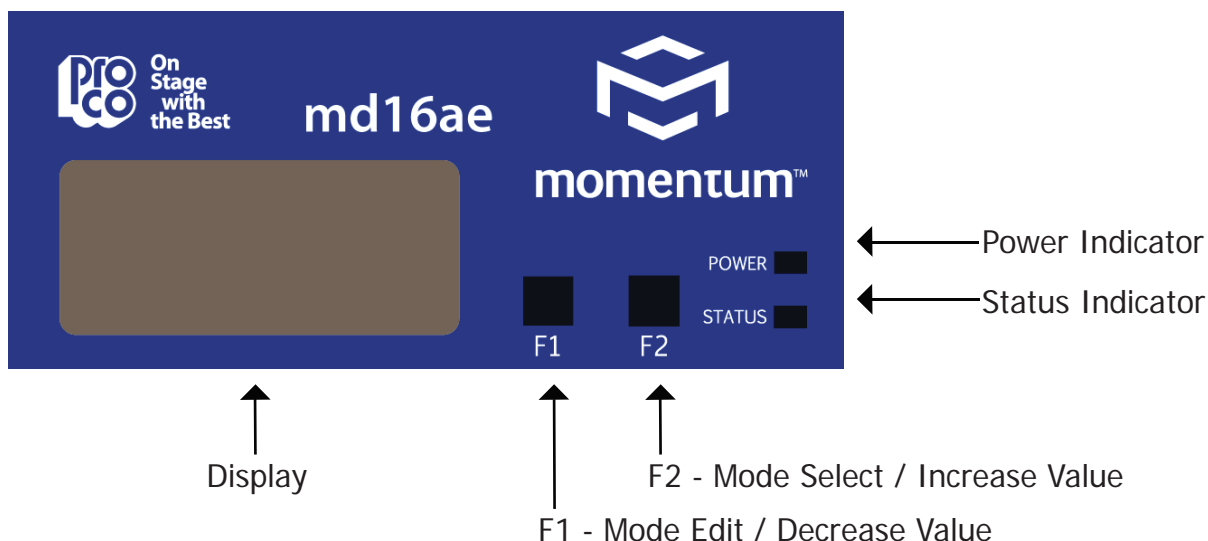
Network Clock Sync

PLEASE TAKE NOTE OF THE FOLLOWING:

The Momentum network **MUST** have **ONE mi8** or **md16ae** that is assigned **CHANNEL 1**. This assignment is used to synchronize all of the device clocks on the network. Without this assignment, the system clock will not sync and audio 'clicks' will be heard.

Using the Control Panel

The **md16ae** unit includes a **control panel** with an **LED display** and **two push buttons (F1 and F2)**. The device can be configured through a series of key strokes using F1 and F2. The **control panel** will only control the local device and cannot change other units via the network.



Button/LED	Description
F1 Mode Select:	F1 activates the edit mode within a particular function.
F2 Mode Select:	F2 generally selects which function to edit.
Power Indicator:	The power indicator shows that a power source is connected to the Momentum units. The LED is connected to the digital power source. All other power sources in the system can be monitored via the PC software.
Status Indicator:	The status indicator is a bi-color LED. GREEN indicates all Momentum Network connections have been found and the network is running. RED indicates there are one of two problems; <ol style="list-style-type: none"> 1) A Ethernet link is not established or is not connected. 2) the audio sync packet (channel 1) is not found.

Setting Device Before Use

THE FOLLOWING FRONT PANEL SETTINGS MUST BE CONFIGURED PRIOR TO USING MOMENTUM. The IP setting is required only if the unit will be controlled with a PC or external controller. A detailed description of control functions can be found in chapter 3, pages 16-18.

» Start Channel Route for Input and Outputs

Ch_i - Channel Input **Ch_o** - Channel Output

This function sequentially routes all sixteen input/output channels to match the corresponding devices. The start channel route is primarily used during the initial set up of the system. Channels are set in grouping of sixteen i.e. 1-16, 17-32, 33-48 etc. If "--" shows on the display, it indicates that one or any of the channels is out of sequence. To individually route channels use the "rou" function. See page 17 for details on the "rou" function.

» IP Address

Adr

An IP address will need to be set **only** if the Momentum network will be controlled with a PC or external controller. The IP address defaults to **192.168.1.1**. When in the idle menu state, pressing the F1 button will flash the current address. **The number shown is the LSB of the IP address (192.168.1.[LSB])**. If the network is to be controlled with a PC, each Momentum unit will need a unique IP address. All IPs need to be set manually on the individual unit.



It is best practice to keep the input unit's IP address sequential with its channel. In other words, Chn 001-008 would be Adr 001 and Chn 009-016 would be Adr 002 and so on.

» Sample Rate

Sr

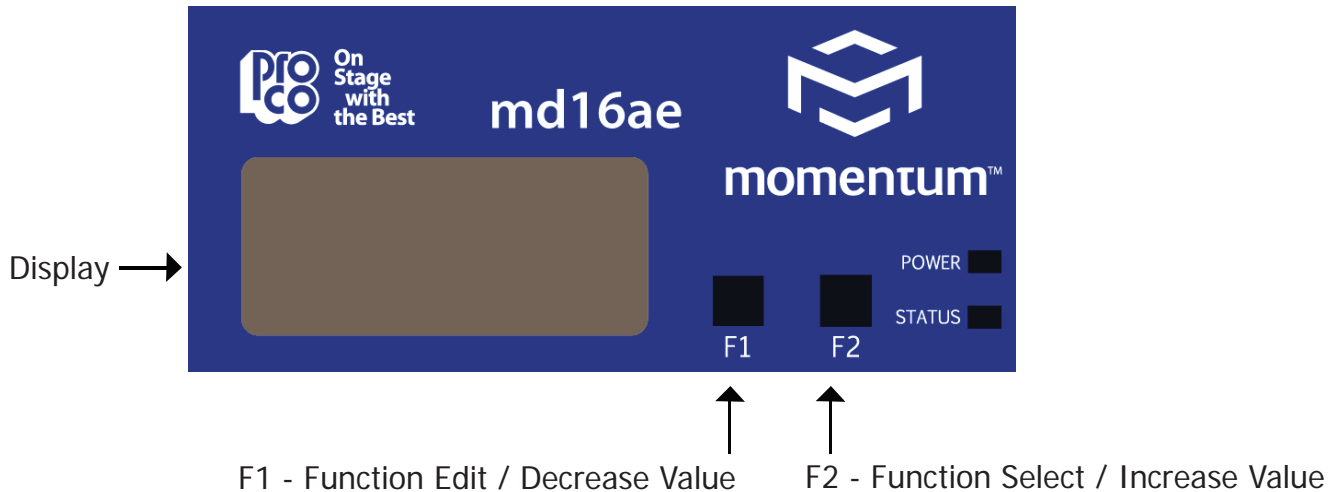
ALL DEVICES in the network must be set at the same sample rate of either **48k** or **96k**.

» Clocking

CL

The **md16ae** must be set to input start channel 1 in order to access the clocking function. Use the F1 soft button to scroll between the three clocking options; external (coax connection), Momentum (Internal Network clock) and AES3 (Input channel 1 of AES3). External clocks can only be at a sample rate of 48k or 96k to match the Momentum capability.

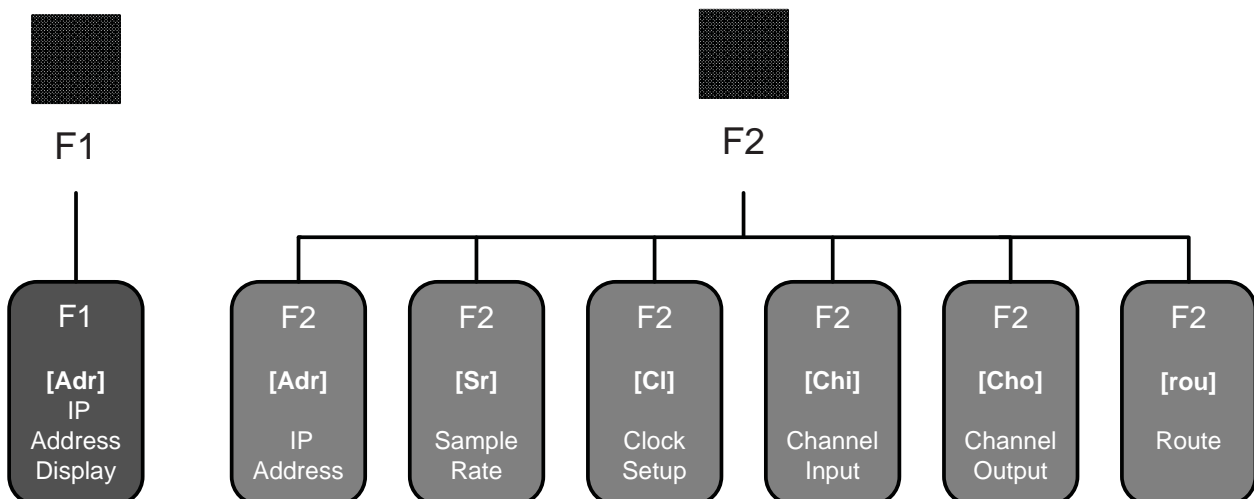
This chapter describes each of the control panel functions and how to access them to make changes to your network. Changes are made using the F1 and F2 keys.



F1 and F2 Functions

The settings of the Momentum units are accessible through a series of key strokes between F1 and F2. In general, F2 selects which function to edit, and F1 activates the edit mode within that function. Holding both F1 and F2 executes edit and exits edit mode.

The flow chart below displays each of the controlling F1 and F2 functions. Descriptions of each functions follow in a guide on pages 16 and 17.



* Clock not visible if not transmitting channel 1.

Description of Functions

To return to the beginning of the menu, allow the display to time out. When the display times out and when the unit is at idle, the start channel number of the unit's channel bank will be displayed.

Please note:

1. The functions in the step by step guide are presented in the same order as the functions on the unit's menu structure.
2. In order to edit a channel, the user must first scroll to the function in need of editing, select the appropriate channel and make the edit.

» IP Address View

Adr

1. Pressing F1 will flash the IP address of a unit.

» Individual Channel Route

rou

1. Toggle F2 to until "rou" is displayed.
2. Tap F1 to activate "rou" edit mode.
3. Toggle F1 to scroll channels. Toggle F2 to select a channel.
4. Tap F1 to decrease value. Tap F2 to increase value.
5. Press and hold F1 and F2 to execute and save the change.
6. Return to selecting channels or exit by allowing display to time out.

Note about Routing:

- The number shown on the display will be the first of eight consecutive numbers.
- When an individual channel is given new routing number that is out of sequence, the display will show "- - -". This display makes it easy to identify which **md16ae** unit has channel/channels that are out of sequence.
- To put channels back into sequential order, toggle F2 to "Cho" and assign that sequence a new start channel.

» Input Channel Start Route (Off or 1-241)

Chi

1. Toggle F2 until "Chi" is displayed.
2. Tap F1 to activate "Chi" edit mode.
3. Tap F1 to decrease value. Press F2 in increase value. Channels increase/decrease by eight. (Off disables all inputs)
4. Press and hold F1 and F2 to execute and save the change.

Description of Functions

» Input Channel Start Route (1-241)

Cho

1. Toggle F2 until "Cho" is displayed.
2. Tap F1 to activate "Cho" edit mode.
3. Tap F1 to decrease value. Press F2 to increase value. Channels increase/decrease by eight.
(Off mutes all outputs)
4. Press and hold F1 and F2 to execute and save the change.

» IP Address Edit

Adr

1. Within this function, selecting "Clr" will allow the user to reset the IP to the factory default of 192.168.1.1.
2. Toggle F2 until "Adr" is displayed.
3. Tap F1 to activate "Adr" edit mode.
4. Tap F1 to decrease value. Press F2 to increase value. (Toggle F2 to select Clr to set the IP to factory default of 192.168.1.1.)
5. Press and hold F1 and F2 to execute and save the change.

» Sample Rate

Sr

1. Toggle F2 until "Sr" is displayed.
2. Tap F1 to activate "Sr" edit mode.
3. Tap F2 to change the value: 48 = 48K Sample Rate ; 96 = 96K Sample Rate
4. Press and hold F1 and F2 to execute and save the change.

» Clocking

CL

1. This function will not be available unless the input start channel is 1.
2. Toggle F2 to select "CL".
3. Tap F1 to activate "CL" edit mode.
4. Tap F2 to scroll between the three clocking options; external, Momentum and AES3.
5. Press and hold F1 and F2 simultaneously to execute and save the change.

Resolution	24 bit, 48/96 kHz
Digital Audio I/O	16 inputs, 16 outputs
Digital Audio Interface	Digidesign®/Tascam® Compatible DB25 Connectors
Clock Sources	External Momentum Clock AES3
External Clock Interface	BNC Word Clock In and Out
Word Clock Input	Sensitivity: 0.2 to 5Vp-p
Word Clock Output	3.3Vp-p
Impedance	75 ohms/70K ohms
Jitter Attenuation	Below AES3 Jitter Transfer Function Mask

Network Specifications

Standard Gigabit Ethernet Protocol

Power Over Ethernet (PoE) 802.3af Compatible

Up to 256 total active system inputs at 48K or 96K sampling

Onboard memory and programming

0.315 ms A/A latency 96K sampling (no DSP)

0.630 ms A/A latency 48K sampling (no DSP)

1.00 ms A/A latency 48K sampling (with DSP)

Open UDP Ethernet communication for 3rd party control