Model: MXDplus-8/16

±5A@ 24VDC; 72V AC

w/ EXTENDED OUTPUT and DIGITAL PID TUNING

Fully Integrated Shim Amplifier System

- The +/-5A dual stage amplifier allows for a wide range of inductive loads with the power required for intense shimming practices

- 8 or 16 channels per chassis of highly stable, low noise current sources used to drive shim coils in MRI and NMR applications.
- Expandable up to 4 chassis, allowing for up to 64 Channels of operation
- Fully integrated with bulk DC power source and complete digital control allowing for out of the box functionality
- System is packaged in an industry standard 4U: 19'' rack-mountable chassis
- Digital display allows for quick status viewing or troubleshooting
- Fully programmable PID for digital tuning of each amplifier with ability to Store parameters for multiple coils.

THE CHALLENGE

TO provide a stable current source with high output compliance for control of multiple shim channels in a modern MRI system

Shimming Technology

The MXD shim system is designed to adjust the magnetic field homogeneity (shim) under static and dynamic conditions. It is capable of real-time shimming on multiple slices, voxels or regions of interest with simultaneous compensation of shim induced eddy currents. (DSU unit required for real-time applications)

A true Turn-Key shim solution.

The system uses a Digital Protocol with optional analog interfaces for static and dynamic operation. Try the ShimApp for quick start-up digital control.

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SYSTEM OVERVIEW:

The MXDplus-8/16 is a complete shim power supply package. It contains the bulk DC power sources required to drive up to 16 channels of shim amplifiers. These amps are typically used to drive shim coils in an MRI or NMR application but can also be utilized in numerous industrial applications that require stable, low noise, programmable current. The unit can be used as a benchtop power supply or installed into a standard 19" cabinet. Its 4U footprint frees up valuable space in an otherwise crowded equipment cabinet.

Theory of Operation:

The master controller module runs embedded software that interprets high-level non-proprietary communication protocols. This computer controls the entire system and communicates with the amplifier modules in or der to monitor the system status and control the current output cannels. Each 8CH amplifier bank is controlled by an integrated microcontroller that communicates with the master controller through an internal data bus. The amplifier bank controller accepts, executes, and responds to commands issued by the master controller.

The MXD system has a linear amplifier output stage with high and low voltage power rails. Under steady-state operation, the system draws all output current from the low voltage output rails. During a step or transient response, the amplifier utilizes the high voltage rail until it reaches steady-state.

RESONANCE RESEARCH

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Specifications

INPUT CHARACTERISTICS	
Input Voltage	1-Phase, 200-240VAC, 50/60Hz
Input Current	12A
Input Voltage Cabinet configuration	3-Phase, 208VAC or 400/230VAC, 20AMAX
Analog Control Input	+/- 5V or +/- 10 V differential
OUTPUT CHARACTERISTICS	
Maximum current output	5ADC per channel, 8 or 16 Channel configuration
Maximum voltage output	DC compliance +/-24V AC compliance. +/-72V
Rated Output Power	500W from each +/- DC source per bank, 2000W total
Current Stability	50 ppm/day
Output Non-linearity	<0.1%
LOAD SPECIFICATION	
Resistance Range	2 ohm-4 ohm (including output cabling) for 5A
Inductance Range	100uH to 10mH
COMMUNICATION	
Setup control	RS-232 D-SUB 9M (Optional Ethernet, USB, CAN, Fiber Optic)
Digital resolution	16-bit, +/-32767 DAC Counts
Software Protocol	Hex based format (non-proprietary)
User Interface	Software application (ShimApp) included for basic control
AMPLIFIER TOPOLOGY	
System Bulk DC sources	Switch-mode
Amp Operation	Linear output stages, dual rail.
THERMAL MANAGEMENT	
Cooling	Internal PWM controlled fans
Thermal stability	Max 50 ppm/degree C (15 min. after start-up)
TRIM and TUNING	
DC offset trim	+/- 1%
Digital PID	3x Digital potentiometers for P, I and D per channel
Output Scale (Gain)	+/- 2.5%
MECHANICAL	
Width (inches / millimeters):	19.00” / 483 mm
Depth:	25.00” / 635 mm (including front handles)
Height 4U:	5.25” / 133 mm
Multiple chassis system would utilize a full size cabinet	
APPROVALS	
Regulatory compliance	Compliant to UL/EN/IEC/CSA C22.2 60601
OPTIONS	
Expandable interface	To Dynamic Shimming (DSU)
Optional filter unit	25A capacity and 6-32 channels (dual 25A filters per channel with common-mode choke)

Company Spirit

We, at Resonance Research, strive to conduct our business with complete commitment to our customer’s ultimate success in reaching their goals. We understand that in order to achieve this goal we need the cooperation and effort of the entire company. We function as a team in our efforts to provide our customers what they require and expect every time. We define quality as total conformance to our Quality Management System and customer success.

Company Goals

Resonance Research, Inc. enables challenging and demanding MR applications for neuro-imaging and spectroscopy at high magnetic fields. Examples of our expertise include static and dynamic control of magnetic field quality for ultra-high resolution applications.

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Company Significance

Resonance Research has a track record of success in introducing break-through technologies that impact the industry standards.

Company Products

Our product line consists of complete and fully integrated solutions, compatible with all major commercial MR scanners, and suitable for advanced research and pre-clinical platforms.

Products include scanners for advanced imaging and spectroscopy including real-time controls, magnets, gradient, shim and RF coils, multichannel current sources, components for research and manufacturing of pre-clinical animal and experimental human systems.

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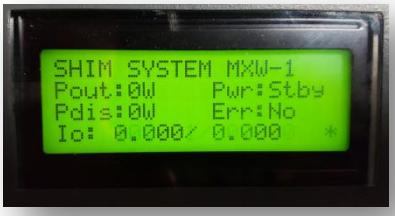
Indicators / Display

Display/Buttons	
Digital Display	4 x 20 Characters, LCD
Backlight	Yellow/Green
Buttons:	
← / → Left/Right	Navigates display screen pages left and right
⏻ Power	Controls main AC relay, Short press ON – Long Press OFF



System Screen

Channel Screen

Bank Power and Error LEDS
Tuning Interface

Interlock System Protection

Error reporting	
All errors are displayed on screen and can be polled via software	
Channel Error:	Overcurrent, Overpower, Over-dissipation, Overdrive
Bank Error:	High/Low Voltage Rail thresholds, Heatsink Overtemp
System Error;	Bank/Channel Error, Comm error, Interlock error, Fatal error
Interlocks	
External	Contact Closure required

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Company History

RRI was started in 1987 with the goal of developing, manufacturing, and marketing proprietary nuclear magnetic resonance (NMR) instruments for pharmaceutical, clinical, and analytical laboratory systems. Since that time RRI has become a well-known innovative leader in the development of advanced imaging products and accessories for use in Magnetic Resonance Imaging (MRI) Systems worldwide.

Connections

Current Output	
37P	AMP PN: 206306-1
Analog Input	
Vin Control	D-Sub 50 Male
Z0 input	Floating BNC or TWINAX
Power	
MAIN AC	IEC 320 C14 Inlet with integrated EMI filter and fuses
Comm	
RS-232	D-Sub 9 Male (standard)
Interlocks	
External	AMP 172168-1 6P Mini Mate-N-Lok

Resonance Research, Inc. strives to conduct its business with a total commitment to our customers and their requirements. We define quality as conformance to our customer's needs, both internal and external; and full compliance to all Quality Management System requirements.

We at Resonance Research understand that in order to achieve this goal, we need the cooperation and effort of the entire company. We must function as a team in our efforts to give our customers what they need every time.

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