3-Axis MRI Gradient Amplifier
400A 750V

International Electric Co.
Output performance

Output current max: ±400 A
Pulse duration max: 25ms @ 400A, duty cycle 25% max ¹)
100ms@ 300A, duty cycle 45% max ¹)
Output current rms: 200 A bipolar ¹)
Output current dc: 150 A ¹)
Output voltage max: ±750 V
Rise time to 120uH coil:
< 60 us, 0-200 A (10-90 %)
< 80 us, 0-300 A (10-90 %)
< 100 us, 0-400 A (10-90 %)
Switching frequency:
> 180 kHz effective
Switching frequency ripple:
< 3 Vrms differential
Bandwidth:
> 10 kHz (-3dB)
Propagation delay:
20-25 us, independent on amplitude ²)
Output noise current:
0,1...10Hz: < 500...200 μArms linearly descending
10...10kHz: < 200 μArms
DC-offset current:
< 10 mA, including self heating and ambient temperature effects, adjustable to zero
Gain accuracy and linearity:
< 0.05 %, total gain error including self heating and ambient temperature effects
Total Harmonic Distortion:
< 0.25 % @ 1kHz, 200 Arms

¹) Load dependent. Test load 580 uH + 120mΩ. Bipolar pulse.
²) Additional constant 20us delay when using signal low-pass filtering

Control and monitoring

Input sensitivity: 1/40 V/A Factory set, user definable
Signal input impedance: 30 kΩ
Current monitor: 1/40 V/A BNC-connector at cover of amplifier unit
Voltage monitor: 1/100 V/V BNC-connector at cover of amplifier unit

Fault protection:
(Shutdown due to): Overcurrent
Overvoltage
Overheat
Overload
Low DC voltage
Internal voltages out of tolerance
IGBT failure
Software failure

Tuning to load (supported 15 different coils for each axis) and diagnostics are done with GPA Tuner program. Communication port mini-USB.
System specifications

Input voltage 3-phase 400/480 Vph-ph, 50/60 Hz
Input current
32 Arms @ 400 V
27 Arms @ 480 V

Power supply:
Output voltage 410 Vdc, effective 820 Vdc
Output power continuous 20 kW
Output power pulsed > 100 kW
Capacitor bank > 100 mF
Power factor >0.9, active PFC input stage

Environmental requirements:
Ambient temperature 10 °C to 30 °C
Ambient humidity 30 to 70 % non-condensing
Storage temperature -20 °C to +85 °C
Cooling Air cooling (front in, rear out)

Cabinet dimensions:
Height 1800 mm
Width 600 mm
Depth 900 mm
Weight 650 kg

Regulatory

Safety and Compliance CB certificate EN 61010, EN 60601-1

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Amplifier output current and voltage waveforms to 580 μH gradient coil
Company in brief

International Electric Company (IECO) designs and manufactures state-of-the-art electronics for medical, industrial and military applications tailored to meet customer needs.

With over 30 years of experience in power electronics we are able to provide solutions for even the most challenging requirements. IECO’s quality system is ISO 9001 and ISO 13485 certified.

Power amplifier technology

IECO introduced its first gradient amplifier in 1994. This revolutionary PWM amplifier enabled excellent image quality in open MRI systems. Simultaneously IECO also launched the first D-class magnet power supply delivering new efficiency levels with 0,1ppm accuracy. IECO’s expertise has recently been utilized in the development of the industry’s first High Temperature Superconductive MRI magnets.

IECO’s power amplifiers are easily scalable for any type of load and any power level needed. Compact amplifier units can be connected in series or in parallel in Master/Slave operation to gain output voltages up to 1100V and output currents up to 1200A. Thanks to low-noise, wide bandwidth and excellent step response, IECO has gained the reputation of a technology leader in gradient amplifiers.

Over 700 MRI amplifier systems delivered worldwide.