

GPA-400-350



# 3-Axis MRI Gradient Amplifier

400A 350V



International Electric Co.

## Output performance

Output current max	±400 A
Pulse duration max	25ms @ 400A, duty cycle 25% max <sup>1)</sup> 100ms@ 300A, duty cycle 45% max <sup>1)</sup>
Output current rms	200 A bipolar <sup>1)</sup>
Output current dc	150 A <sup>1)</sup>
Output voltage max	±350 V
Rise time to 120uH coil	< 100 us, 0-200 A (10-90 %) < 140 us, 0-300 A (10-90 %) < 180 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 <sup>2)</sup>
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

<sup>1)</sup> Load dependent. Test load 580 uH + 120mΩ. Bipolar pulse.

<sup>2)</sup> 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	1/50 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
Output power continuous	20 kW
Output power pulsed	> 100 kW
Capacitor bank	> 50 mF
Power factor	>0.9 , active PFC input stage

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### 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)

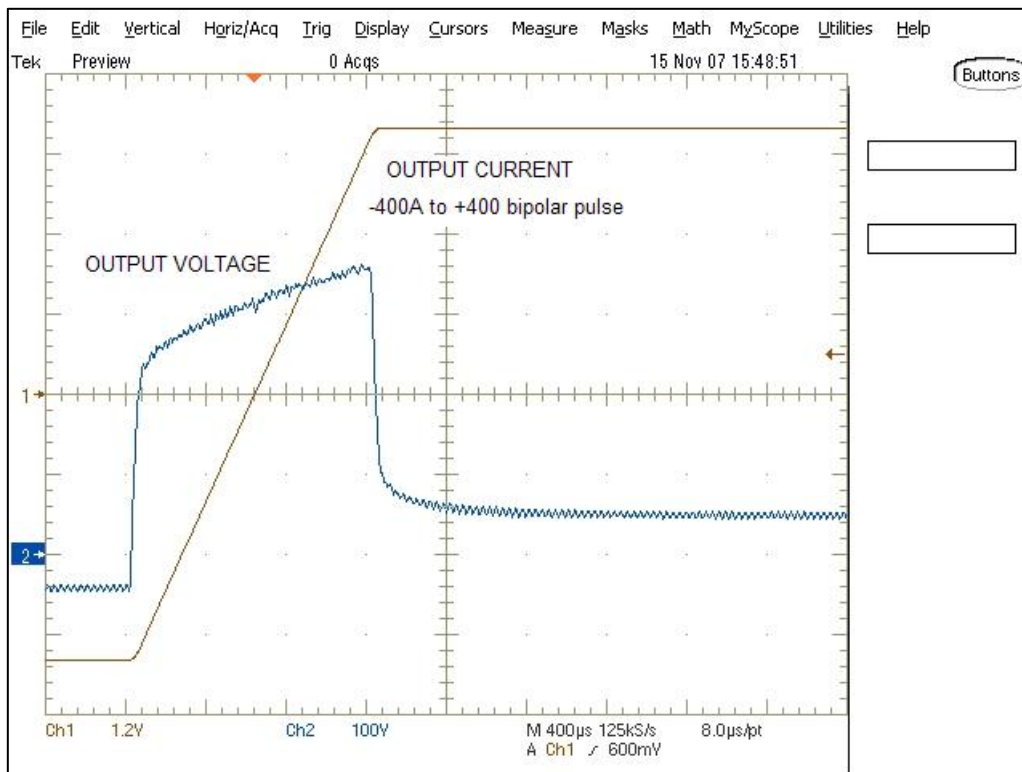
### Cabinet dimensions:

Height	1200 mm
Width	600 mm
Depth	900 mm
Weight	480 kg

## Regulatory

Safety and Compliance

CB certificate EN 61010, EN 60601-1



Amplifier output current and voltage waveforms to 420 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.



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