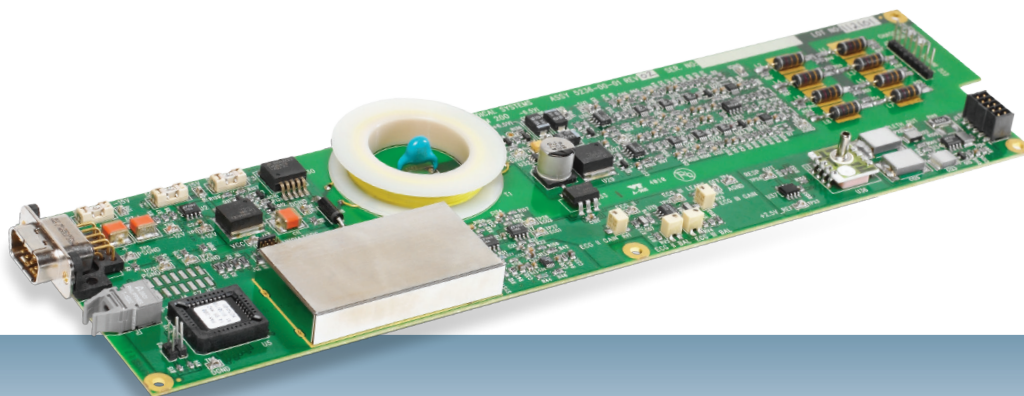


# PAM-200

Accurate Gating Trigger for the MRI Environment



## Patient Acquisition Module

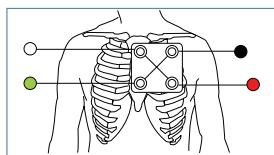


### Precision Engineering

The PAM Module is an embedded instrumentation pack which provides an accurate gating trigger for use in an MRI environment. The PAM-200 is a complete solution consisting of ECG Acquisition, an Optical Plethysmograph for pulse acquisition, and a pneumatic respiration pad for respiration acquisition.

#### ECG Patient Acquisition

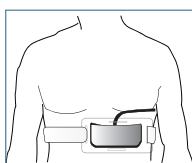
The PAM utilizes a 4 lead configuration in a Right Arm, Left Arm, Right Leg and Left leg setup. The Right Leg is the reference lead with Right Arm, Left Arm and Left Leg as the active leads. The PAM provides for two simultaneous vectors. The first vector is Right Arm and Left Leg. The second vector is Right Leg and Left Leg. The two vectors are orthogonal to each other and will result in one vector less effected by magnetic gradients.



#### Respiratory Acquisition

The PAM utilizes a pneumatic technique which responds to the expansion of the chest during respiration. A foam filled bellows is attached to the patient with a strap, and the air pressure in the bellows changes as the chest moves and compresses the bellows. The internal foam provides the spring action to return the bellows to the pre-compressed state. The bellows is attached to the

PAM System Module by a flexible plastic tube, there is no electrical connection. The bellows has a stiff backing which aids in the compression action of the chest movement. Positive pressure (exhalation) will result in a positive going signal. The respiratory signal is transmitted in the digital stream to the console computer, but the PAM has provision for an analog signal to drive a LED bar indicator which could be located on the gantry or magnet housing.



#### Peripheral Pulse Acquisition (Pleth)

The PAM has provision to perform cardiac gating by way of an optical based peripheral pulse, which is acquired on the patient finger. The optical emitter and detector are located within the PAM housing and the light energy is coupled to the patient through fiber optic cable. The patient connection is through a finger clip similar to a pulse oximetry sensor. The peripheral pulse signal is transmitted in the digital stream to the console computer, but the PAM has provision for an analog signal to drive a LED bar indicator which could be located on the gantry or magnet housing.



### Accessories

ECG	
Name	Part No.
Integrated MRI ECG Cable/Lead Set, 6'	5189-00-01
ECG Extension Cable, 1 Meter (External Magnet Use only)	590384
MRI Electrodes	590391
NeuPrep Gel	590291

RESPIRATION	
Name	Part No.
Bellows	2802-00-01
Strap, 42"	2842-00-10
Hose to Bellows	3215-00-01

PLETH	
Name	Part No.
Optical Pleth Cable, 2.8 Meters	3168-00-01

**Please contact an IVY sales representative at 1-800-247-4614, to learn more about the PAM-200 Patient Acquisition Module.**

## Technical Specifications

### MRI Gating Module Operating Conditions

The Ivy Biomedical Systems PAM-200 MRI Gating Module, ECG Cable, Peripheral Pulse Cable and Pneumatic Respiration Pillow have been tested and verified to be MRI Conditional under the following operating conditions:

Maximum Static Field:	1.5T
Maximum Spatial Gradient:	1580 g/cm
Maximum Peak Gradient Strength:	33 mT/m
Maximum flux change / time (db/dt):	113.4 T/sec
Maximum Wholebody SAR (15min):	3.88 W/kg

### Communications

Unidirectional fiber optic communication with console

Optical Transmitter:	Avago HFBR-1522
Optical Receiver:	Avago HFBR-2522
Maximum Distance:	45M
Transmission Rate:	115.2KBaud
Optical Frequency:	660nm
Serial Configuration:	8bit, 1 start bit, 1 stop bit, no parity

### Communication Protocol

9 bytes once every 1mS, customized up to 1MB  
 ECG1: 14 bit signed, 1mS sample, 136.7nV / count  
 ECG2: 14 bit signed, 1mS sample, 136.7nV / count  
 Respiration: 12 bit signed, 5mS sample, amplitude auto-scaled  
 Peripheral Pulse: 12 bit signed, 5mS sample, amplitude auto-scaled

### ECG Performance

Detection Amplitude Range:	0.3mV to 4.5mV
ECG Bandwidth:	5Hz to 20Hz
Digitization Rate:	10KHz
Digitization Resolution:	16 bits
Delay:	10mS
ECG Scaling at electrode:	7313 counts / mV or 136.7nV / count

### ECG Electrical

Patient Leakage:	< 50uA @264Vac 60Hz
Patient Isolation:	4000V @60Hz for 1 minute

(Specifications subject to change without notice)

### Respiratory Performance

Pressure Range:	0 to 1psi ( 760 mm Hg)
Digitization Rate:	1KHz
Waveform transmission rate:	200Hz
Digitization Resolution:	16 bit
Bandwidth:	3Hz
Baseline restoration :	20 seconds
AGC Range:	40dB
ACG lock:	60 seconds
AGC lock amplitude:	70% of full scale amplitude

### Respiratory Patient Connection

Pneumatic connection:	Colder Products #PMC1602
Hose to bellows connection:	Lure Lock
Pillow strap:	2" wide Velcro Strap

### Peripheral Pulse Performance

Peripheral Pulse Bandwidth:	10Hz
Peripheral Pulse Digitization Rate:	1KHz
Waveform transmission rate:	200Hz

### Mechanical

The PAM is housed in a RF tight Cast Aluminum housing with a removable Aluminum top cover.  
 Length: 13.625 inches 346 mm  
 Width: 3.5 inches 88.9 mm  
 Height: 1.375 inches 34.9 mm

### Power Requirements

+8V to +15V  $\pm 5\%$  of negative supply @1A; Ripple < 50mV  
 -8V to -15V  $\pm 5\%$  @500mA; Ripple < 50mV

### Shipping Conditions

Temperature:	+5 to +55 °C +41 to +131 °F
Relative Humidity	90% max (non-condensing)

### Environmental (Operating Conditions)

Ambient Temperature	5 to 40 °C	41 to 104 °F
Ambient Temperature Change	< 3 °C/hr	< 37 °F/hr
Humidity( non-condensing)	30 to 75 %RH	
Humidity Change (non-condensing)	< 5 %/hr	
Altitude (feet above sea level)	-1300 to 10000 Ft (-396 to 3048 meters)	
Atmospheric Pressure	1060 to 700 Hpa	
Shock	Maximum 20G @ less than 3 rms half sine-	
Maximum Continuous Magnetic Field	0.6 Tesla (6000 Gauss)	
Vibration	Maximum random 0.21G RMS	

### Regulatory

Unit meets or exceeds the specifications and regulations for:

- UL60601-1 (2003) First Edition
- CAN/CSA C22.2 No 601.1-M90
- CDN MDR (CMDCAS)
- CE
- WEEE 2012/19/EU

### Warranty

One Year (parts and labor)



PAM-200 with custom designed case

Manufactured by:



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