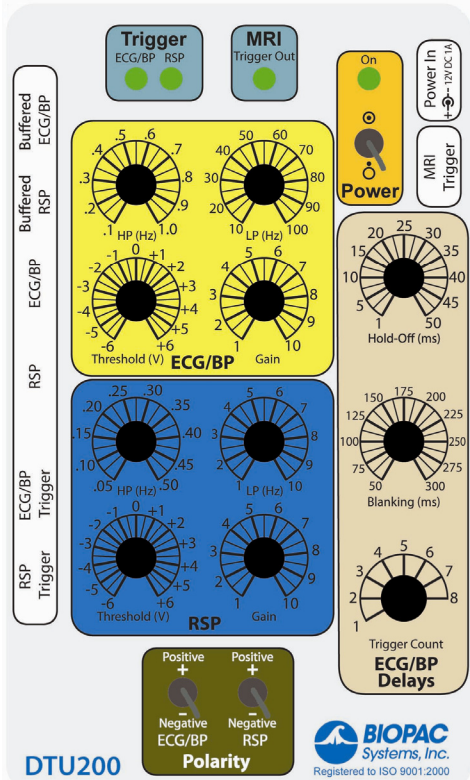


## DTU200 TRIGGER

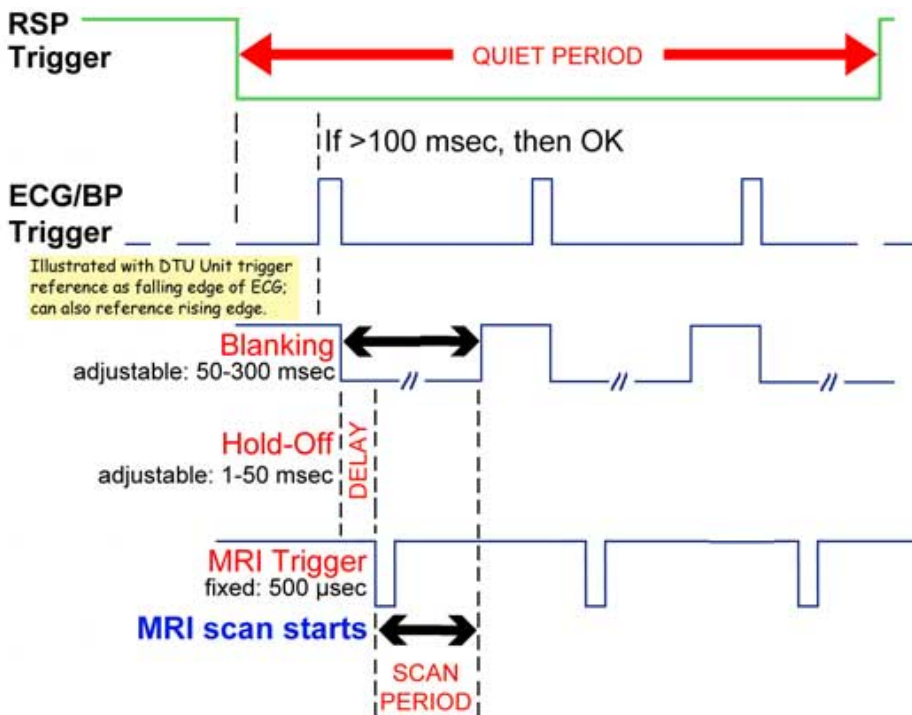


The **DTU200** is a dual channel gating system for small animal MRI applications (human system available—DTU300). It sends cardiac trigger pulses to the MRI when a respiration signal is in the quiet phase. Pre-processing filters and gain controls further refine the quality of the signal and ensure reliable triggering. The system requires two analog input signals:

1. **Cardiac signal** from either an Electrocardiogram Amplifier (ECG100C) or a Micro Pressure Measurement System (MPMS100A).
2. **Respiration signal** from a small animal respiration pad (TSD110-MRI) with a General Purpose Transducer Amplifier (DA100C).

### Cardiac phase

- **Threshold:** The ECG or Blood pressure signal passes through a user selectable threshold that creates a square wave (0-5 volt) cardiac trigger signal.
  - **The R-wave or BP signal crosses the threshold in both directions to initiate the MRI trigger signal pulse.**
- **Hold-Off:** A delay control allows precise timing of the trigger signal pulse relative to the rising or falling edge of the ECG R-wave (DTU200: 1-50 msec; DTU300 5-250 msec).
- **Blanking:** A blanking control, initiated on the falling edge of the first accepted ECG in the quiet period, provides a time discriminator (DTU200: 50-300 msec; DTU300: 250-1,500 msec) that prevents the DTU system from falsely triggering on an MRI-corrupted ECG signal.
- **Monitoring:** The cardiac trigger channel is available for monitoring purposes using a BNC to 3.5mm cable (CBL102, included). BIOPAC recommends monitoring this signal with the MP150 data acquisition and analysis system.



### Respiration

- **Threshold:** The respiratory system also passes through a similar threshold to create a square wave when the signal crosses the threshold in both directions. The quiet period is user-selectable to be the interval between rising and falling edges or falling and rising edges of the RSP signal.
- **Monitoring:** This signal is available for monitoring purposes using a BNC to 3.5mm cable (included) CBL102. BIOPAC recommends monitoring this signal with the MP150 data acquisition and analysis system.

### Signal Conditioning

- **Cardiac**  
 Gain: 1-10  
 Low Pass Filter: 10-100 Hz  
 High Pass Filter: 0.1-1 Hz
- **Respiration**  
 Gain: 1-10  
 Low Pass Filter: 1-10 Hz  
 High Pass Filter: 0.05-0.5 Hz

### Output controls

The MRI trigger channel only outputs a cardiac trigger when the respiration trigger channel goes into the quiet period, which occurs when the animal is between breaths and still. The system will output a precise number of cardiac triggers between each respiratory period by adjusting the trigger count control (1-8). Cardiac cycles are only considered if they occur >100 msec after the respiration trigger goes into the quiet period. If there isn't enough time to complete the required number of triggers, the unit will stop and wait for the next quiet period before starting a new count. For example, if the counter is set to output 5 triggers, but there is only enough time to send 4, the unit will ignore the fifth trigger and wait for the next quiet period before starting the count again.

### Signal Monitoring

There are outputs for the cardiac and respiration conditioned signals (available at BNC ports: Buffered ECG/BP and Buffered RSP) and the respective triggers. The conditioned signals are in the  $\pm 10$  volt level range and trigger outputs are 0-5 volts. Seven BNC to 3.5 mm monitoring cables (CBL102) are included.

### Compatibility

The unit will interface with either a BIOPAC MP100 or MP150 system. It will also work with third-party amplifiers and data acquisition systems that operate in the  $\pm 10$  volt range.

### DTU200/300 Specifications

<b>Inputs</b>	<b>ECG/BP</b>	ECG /BP Trigger	Buffered ECG/BP
	<b>RSP</b>	RSP Trigger	Buffered RSP
	<b>MRI Trigger</b>	Pulse width 500 $\mu$ sec, active low	
<b>Signal Controls</b>	<b>ECG/BP</b>	HP high-pass filter	LP low-pass filter
	<i>Threshold</i>	.10 - 1.0 Hz	-6 - +6 V (infinitely variable)
	<i>Gain Range</i>	10 - 100 Hz	1 - 10 (infinitely variable)
	<b>RSP</b>	HP high-pass filter	LP low-pass filter
	<i>Threshold</i>	05 - 0.5 Hz	1 - 10 Hz
	<i>Gain Range</i>	-6 - +6 V (infinitely variable)	1 - 10 V (infinitely variable)
<b>Polarity</b>	<b>ECG/BP</b>	+ (pos, up) or - (neg, down)	
	<b>RSP</b>	+ (pos, up) or - (neg, down)	
<b>ECG/BP Delays</b>	<b>Hold-Off</b>	DTU200: 1 - 50 ms	DTU300: 5-250 ms (infinitely variable)
	<b>Blanking</b>	DTU200: 50 -300 ms	DTU300: 250-1,500 ms (infinitely variable)
	<b>Trigger Count</b>	1 – 8	
<b>Status LED</b>	<b>Trigger</b>	ECG/BP red	RSP red
	<b>MRI Trigger Out</b>	green	
	<b>Power</b>	yellow	
<b>Power</b>	<b>Switch</b>	ON (up), OFF (down)	
	<b>Supply</b>	12 V DC 1 A	

## GATING SYSTEMS

## *Complete Dual-Channel Gating System for Small Animals*

**ECG GATING SYSTEM** uses an electrocardiogram amplifier to provide the cardiac trigger and includes:

### Part # GATE-CARDRESP-E

- MP150 Data Acquisition & Analysis System with *AcqKnowledge* software (for Windows or Mac)
- DTU200 Dual Channel Cardiac Respiratory Gating System
- ECG100C Electrocardiogram Amplifier Module
  - MECMRI-BIOP MRI Cable/Filter Set to Biopotential Amplifiers
  - LEAD108 (x 3) Radiotranslucent Clip Lead—unshielded, 1.8 m
  - EL508 (100/pk) Disposable Radiotranslucent Electrodes
- TSD110-MRI Respiration Transducer (transducer, sensor, and tubing)
  - DA100C General-purpose Transducer Amplifier

**BP GATING SYSTEM** uses a Micro Pressure Measurement System to provide the cardiac trigger and includes:

### Part # GATE-CARDRESP-B

- MP150 Data Acquisition & Analysis System with *AcqKnowledge* software (for Windows or Mac)
- DTU200 Dual Channel Cardio Respiratory Gating System
- MPMS100A-1 Micro Pressure Measurement System
  - TSD173A or TSD173B MRI-compatible Samba Preclin Micro Pressure Transducer
- TSD110-MRI Respiration Transducer (transducer, sensor, and tubing)
  - DA100C General-purpose transducer amplifier