


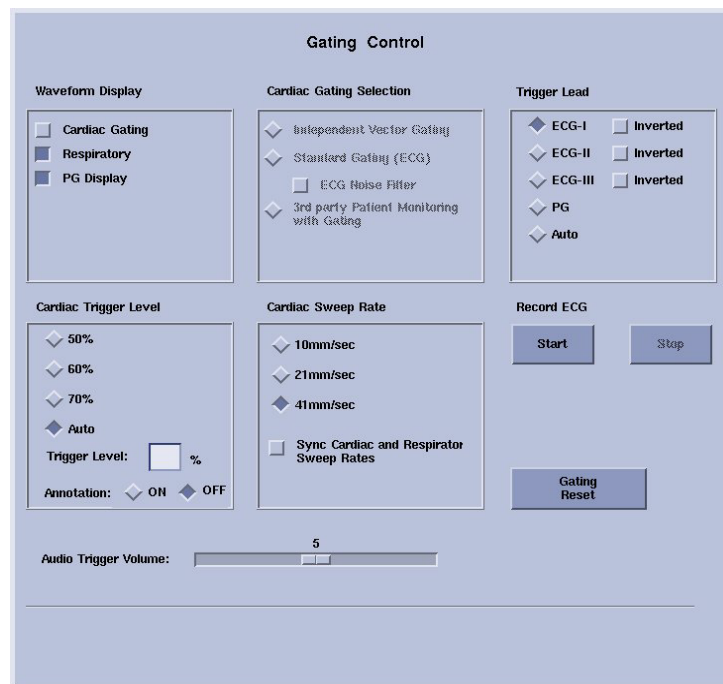
Record Physiological Data on MR750 at CFMRI

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This document describes the procedure for recording physiological data on the GE MR750 3T scanner at CFMRI. MR750 is capable of monitoring and recording peripheral pulse, respiratory effort and ECG.

1. Turn on the gating control to display waveforms

Click the gating control icon  in the footer area of the screen to open the Gating Control Window. In the Gating Control window, check the signal to be monitored. In the example below, Respiratory and PG (peripheral gating /Pulse) are selected.



The screenshot shows the "Gating Control" window with the following settings:

- Waveform Display:** Cardiac Gating, Respiratory, PG Display
- Cardiac Gating Selection:** Independent Vector Gating, Standard Gating (ECG), ECG Noise Filter, 3rd party Patient Monitoring with Gating
- Trigger Lead:** ECG-I Inverted, ECG-II Inverted, ECG-III Inverted, PG, Auto
- Cardiac Trigger Level:** 50%, 60%, 70%, Auto. Trigger Level: %
- Cardiac Sweep Rate:** 10mm/sec, 21mm/sec, 41mm/sec, Sync Cardiac and Respiration Sweep Rates
- Record ECG:** Start, Stop, Gating Reset
- Annotation:** ON OFF
- Audio Trigger Volume:** 5

The waveforms of the checked signal will be showing in the bottom right area of the screen under the tab "Waveforms", and also on the in-room operating console screen (iRoc) mounted on the scanner.

2. Attach the sensors

Pulse (Peripheral Gating): Pulse monitoring uses a photopulse sensor to detect blood flow in the vascular bed of the patient's finger.

- Make sure the hand where the sensor is placed remains cool and dry.
- Attach the sensor to the figure tip with minimal callous. Finger polish should be removed for best sensor reading.
- Check the waveform. If it is not a satisfactory, adjust the sensor or try a different digit.

Respiratory bellows: The Respiratory bellows detects the motion of the abdominal wall.

- a. Place the respiratory bellows over the diaphragm or abdomen where there is the greatest breathing motion when the subject is lying down.
- b. Fasten the bellows with the velcro straps. Placement of the bellows should be snug, but stretched as little as possible. The bellows should expand and contract approximately ½ to 1 inch with the patient's breathing. Do not place padding over the bellows.
- c. Once the bellows is in place, give the system about 60 seconds to stabilize, then check the respiratory signal. Adjust the bellows if necessary.

ECG: ECG signals are rarely monitored for studies done at CFMRI. If you need the ECG signal, please contact us beforehand so that we can prepare the leads and show you how to attach them.

3. Record the physiological signals

There are two methods for physiological recording: host control method and CV control method.

Host control method: The recording is controlled by the **Start** and **Stop** buttons in the **Gating Control** screen.

The maximum recording length of recording is 25 minutes. Host control method is not synchronized with the start and finish of the scan, for which reason, we recommend using the CV control method for fMRI studies. Host control method is designed to have higher priority than the CV control method. If the **Start** button is activated during a CV controlled recording, the CV controlled recording will be cancelled and the host controlled recording will be effective. The host control method records all available physiological signals (PG, respiratory, ECG).

CV control method: The recording is controlled via a pulse sequence control variable (CV) **phys_record_flag**, and is synchronized with scan start and stop.

To turn on CV controlled recording, download the scan series, then bring up the Display Research CV window. In the window, set the CV **phys_record_flag** to 1. With default setting of CV control method, only the respiratory and PG signals will be recorded. If you desire to record the EEG signals as well, another CV **phys_record_channelset** needs to be set as well. Below is the bitmask definition of the CV:

```
phys_record_channelset    /* Channel selection for recording physiological signals */
#define ECG2DREC 0x80     /* Bit Mask for ECG 2 Waveform Data Recording */
#define ECG2TREC 0x40     /* Bit Mask for ECG 2 Trigger Recording */
#define ECG3DREC 0x20     /* Bit Mask for ECG 3 Waveform Data Recording */
#define ECG3TREC 0x10     /* Bit Mask for ECG 3 Trigger Recording */
#define PPGDREC 0x08      /* Bit Mask for PG Waveform data Recording */
```

```
#define PPGTREC 0x04 /* Bit Mask for PG Trigger Recording */
#define RESPDREC 0x02 /* Bit Mask for Respiratory Waveform data Recording */
#define RESPTREC 0x01 /* Bit Mask for Respiratory Trigger Recording */
```

Note:

With default setting of CV control method, a recording of maximum length (25 minute) will require approximately 3 seconds to save to files to the hard disk after the end of the scan. User needs to make sure that the next phys-recording scan starts after the previous recording finishes saving data to files. If the next phys-recording scan starts before the previous recording finishes, the new recording request will be ignored.

4. Identify the recorded physiological files

The sampling rates are fixed to ECG:1ms, PG:10ms, Resp:40ms. The recording length is 30 sec + during of the scan, with the extra 30 sec data from before the start of the scan. The end of the file coincides with the end of the scan. The maximum duration of each files is 25minutes.

The file names follow the rule `datatype_psd_MMDDYYYYhh_mm_ss_ms`. The first field indicates the type of data the file contains. The second field is the name of the pulse sequence used in the scan. The last part of the file name is a time stamp which is taken at the end of the scan with system latency around 10ms. Below are some examples of the recorded files:

ECG2Data_epi_0401201012_34_22_834: ECG data from an EPI scan;
ECG2Trig_epi_0401201012_34_22_834: Trigger generated from the EEG data;

PPGData_fspgr_0405201014_02_26_42: Pulse data from a FSPGR scan;
PPGTrig_fspgr_0405201014_02_26_42: Trigger generated from the Pulse data;

RESPData_epi2_0414201002_15_54_226: Resp data from a DTI scan ;
RESPTrig_epi2_0414201002_15_54_226: Trigger generated from the Resp data;

The files are located under `/usr/g/service/log/gating`. We provide a tool **physiocracy** to help transfer the files to one of CFMRI servers. Type `physiocracy` without any input arguments in a terminal on the scanner console to see instructions on its usage.

For questions about this manual, please contact Kun Lu (kunlu@ucsd.edu).