

dsPIC MetalScan Signal Enhancer : Users' Guide

The dsPIC MetalScan Signal Enhancer acquires sets of 1024 samples, applies the de-noising algorithm and sends out packets of 512 de-noised samples through the RS232 port at 115200 baud rate, 8N1 format. Fig. 1 shows the Explorer 16 board. Four buttons on this board are used for configurations and reset as shown in this figure.

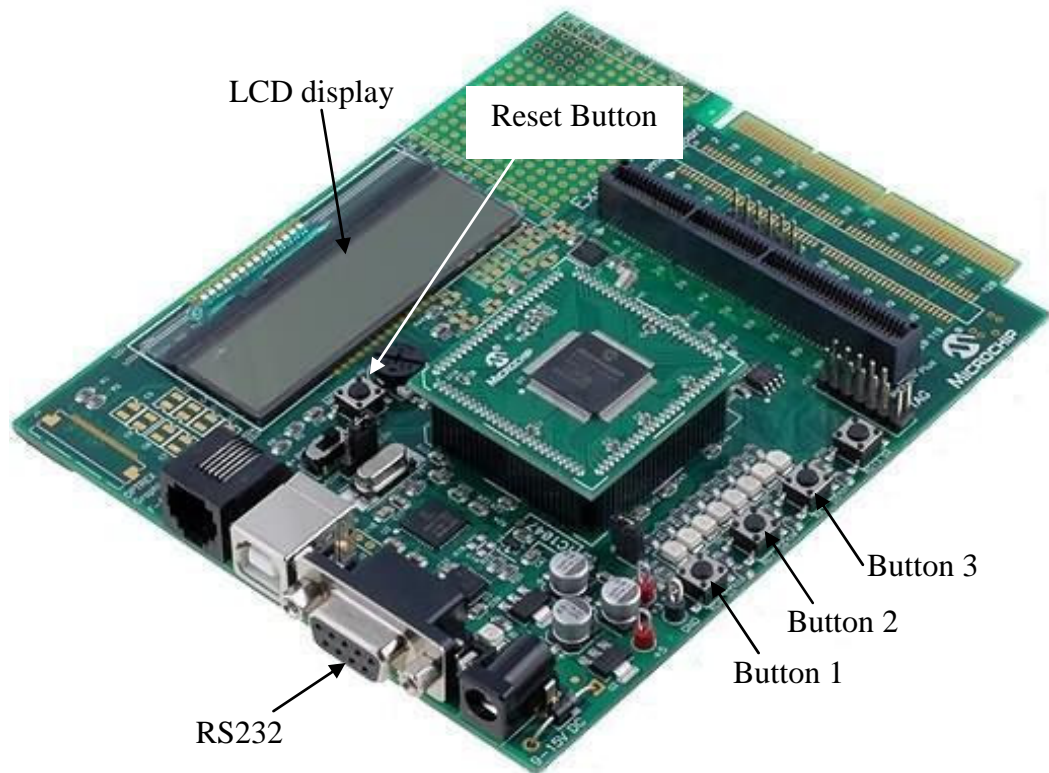


Fig.1 Explorer 16 board and some useful descriptions.

Figure 2 shows a flowchart of the menus. When the power is supplied to the dsPIC or when the **reset button** (shown in Fig.1) is pressed, the LCD display shows the following two options:

- 1) Vib+Bkgrnd
- 2) Bkgrnd Only

By pressing **button 1**, the signal enhancement algorithm tackles **both** the vibration interferences and background noise. Pressing **button 2** disables the vibration interference removal algorithm and only performs background noise removal. After this step, the following two options are available to the user:

- 1) Configuration
- 2) Continue (Starts de-noising with new settings or otherwise original parameters if no configuration is done)

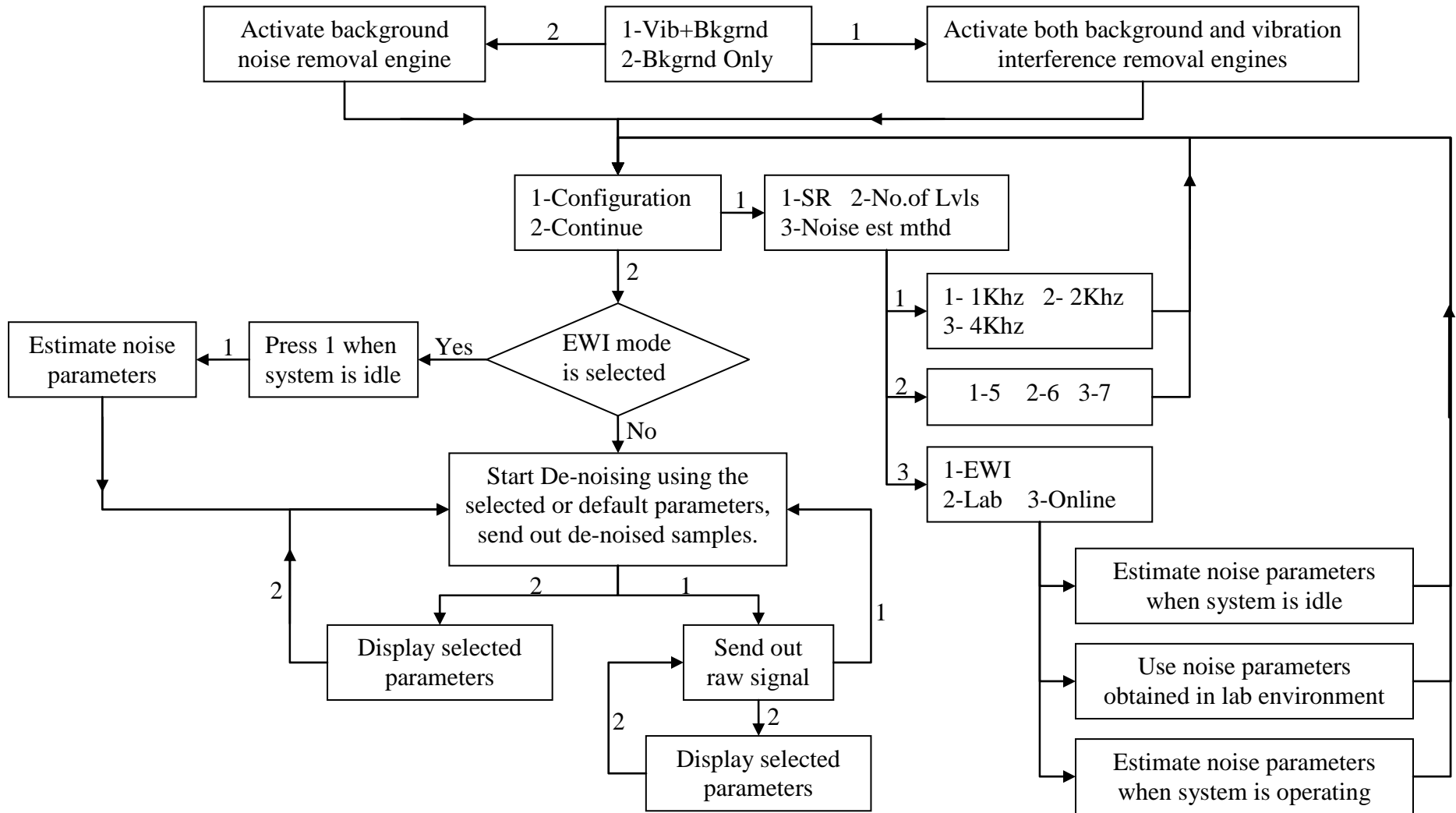


Fig.2 Flowchart of the Menus.

By pressing **button 1**, system enters the **configuration** mode. The following parameters can be adjusted under this mode:

- 1) Sampling Frequency (SR).
- 2) No. of Lvls. (Number of Levels)
- 3) Noise est mthd (Noise Estimation Method)

1) Sampling Frequency (SR)

By pressing **button 1** the following sampling frequency options will be available:

- 1) 1 KHz
- 2) 2 KHz (*default setting*)
- 3) 4 KHz

Pressing **button 1, 2 or 3** will set the sampling frequency to 1, 2, or 4 KHz, respectively.

2) No. of Lvls (Number of Levels)

Pressing **button 2** leads the user to another menu to adjust the applied number of levels for de-noising. Number of levels corresponds to the degree of de-noising accuracy. Higher accuracy results in a better performance but leads to slower operational speed. The following options are available for number of levels:

- 1) 5 Levels (*default setting*)
- 2) 6 Levels
- 3) 7 Levels

Note: At 4 KHz sampling frequency only 5 levels of de-noising is possible. Selection of 6 or 7 levels at 4 KHz may lead to unexpected results.

3) Noise est mthd (Noise Estimation Method)

This option is concerned with the background noise present in the measurement device in the absence of any vibrations or passage of metallic particles. The de-noising algorithm requires some characteristics of the background noise in order to tackle this kind of noise. Three options are available for the estimation of these parameters:

- 1) EWI (Estimate When Idle) (*default setting, recommended*)

In this mode the required noise parameters are calculated when the sensor is idle. Idle in this context means that no vibrations is introduced to the system and no metallic particle passes through the sensor so that the output of the sensor only contains **MAINLY** the background noise due to electrical interferences or other sources of disturbance.

2) Lab

In this mode the above mentioned noise parameters which are previously calculated in the lab are used for the de-noising purpose. If the environment where the sensor is

mounted changes considerably from the lab environment, de-noising results may be affected. EWI is the recommended option.

3) Online

In this mode, the processor estimates the noise parameters while the sensor is at its normal operation (monitoring) state. This approach should be taken only when the background noise characteristics drastically change over time. It should be noted that background noise means **ONLY** the noise from the electrical circuit, not those due to the vibration interferences or temperature variations.

Note: This mode cannot be used at 4 KHz sampling frequency due to the limited capacity of the Explorer 16.

The **default values** set for sampling frequency, number of levels and noise estimation method are as follows:

SR = 2 KHz, Number of Levels = 5, and Noise Estimation Method = EWI

If the user chooses not to change a parameter, the above default settings will be used.

When the user finishes configuration step, he or she will be guided back to the main menu automatically:

- 1) Configuration
- 2) Continue

By pressing **button 2**, the processor enters the normal operation (monitoring) state with settings specified by “Configuration” or default settings if no configuration is done. If the EWI (Estimate When Idle) mode is selected as the noise estimation method, by pressing **button 2**, the following message is displayed:

Press **button 1** when idle

When the sensor is not subjected to any vibrations or passage of particles, the user may press **button 1** to re-estimate the background noise. Then the processor resumes the normal de-noising operation.

At the de-noising state, the LCD display shows:

Output:
De-Noised Signal

In this mode by pressing **button 1**, the user can switch the output to raw signal and the LCD display shows:

Output:
Raw Signal

Raw signal is the output of the sensor as measured by the 12 bit A/D convertor at the selected sampling frequency without de-noising.

By pressing **button 2**, the LCD displays the selected parameters. By pressing the **button 2** again the user can see the current output of the system as “De-noised signal” or “Raw Signal”.