Beijing SENDIG Technology Co. Ltd.

USER'S MANUAL

For the

909B

16 Channel Online Vibration Data Collector and Interface Software

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1 General

909B 16-channel Vibration Data Collector can be used for continuous on-line machinery condition monitoring and fault diagnosis. It measures the vibration overall value (True RMS, equivalent peak value or peak-peak value) and waveform (both time- and frequency domain) of acceleration, velocity, displacement and envelopment. It can be used either in lab or in remote on-line condition monitoring and fault diagnosis combined with software.

<u>Features:</u>

Overall value measurement: acceleration, velocity, displacement, envelopment, EU;

8x2-channels simultaneous-sampling;

Mixed-sensor input: Charge accelerometer, ICP accelerator, Eddy current displacement probe, Electromagnetic velocity sensor and voltage;

80dB dynamic range;

Frequency range set by computer software or manually;

CAN network transmission, max speed 500Kbps(130m), max distance 10Km(5Kbps), communication baud rate selectable by users;

4-channel rotation speed measurement, can also be used as input of trigger source;

Anti-aliasing filter: 8th order elliptic lowpass, cut-off frequency programmable remotely .

Operating Environment

◆ Working temperature: $5^{o}C – 50^{o}C$

◆ relative humidity $\leq 85\%$(on-saturation);

◆ no caustic gas, no strong electromagnetic interference, no strong vibration or impact

<u>Warning:</u>   909B and the sensors can not contact with running parts directly.
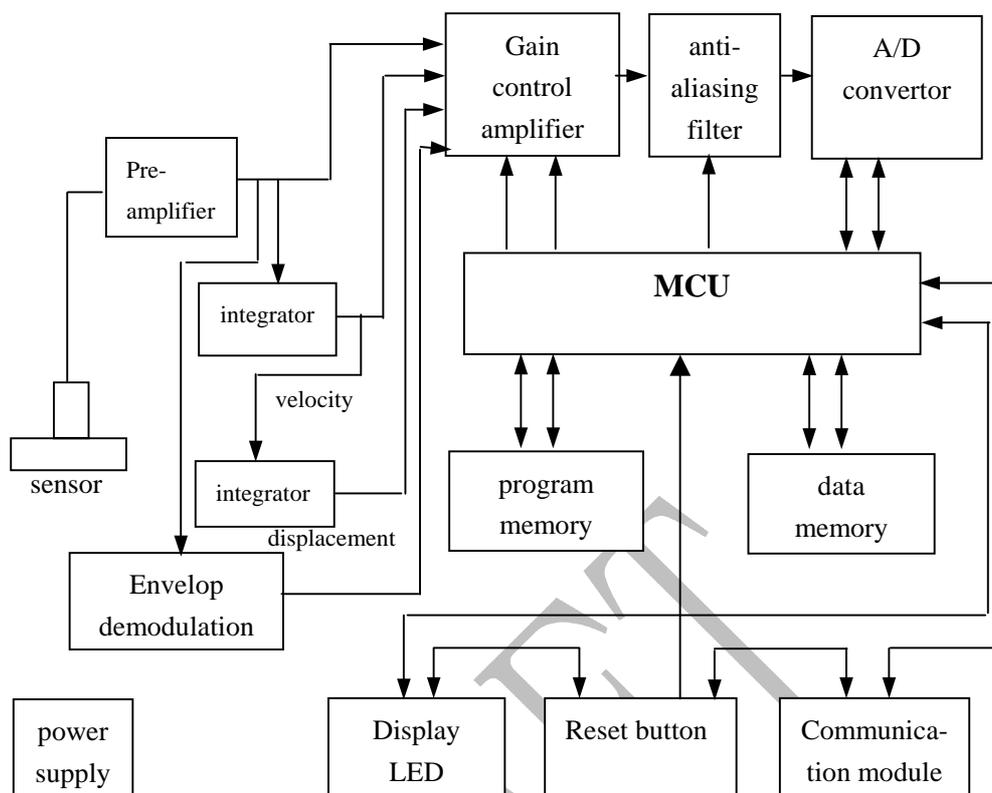
2 Block Diagram of 909B

fig-1 Netcollector principle diagram

3 Specification

Measurement Rang/Frequency Range (When sensor sensitivity is 5PC/ms^{-2}):

Signal Type	Maximum Measurement Range	Resolution	Frequency Range
Displacement(peak-peak)	2000 micron	~0.2 micron	10 - 500 Hz
Velocity(True RMS)	71mm/s	~0.01 mm/s	10 - 1000 Hz
Accelerator(equivalent peak)	100m/s^2	~0.01 m/s^2	20 - 10000 Hz
Envelopment(True RMS)	20 unit	~0.01 unit	Demodulation:5-2000Hz from 15-40 kHz
Voltage (peak-peak)	$\pm$ 10V	0.001V	20-10000Hz
Rotating speed	120-60000rpm	1 rpm	2-1000Hz

Vibration measurement precision:$\pm$ 5%；

Rotating speed measurement precision(Maximum): 1.0% ；

Sensor: piezoelectricity accelerator meter, ICP accelerator, Eddy current displacement probe, electromagnetic velocity sensor

Frequency range of spectrum analysis: 50,100,200,500,1000,2000,5000,10000(Hz)

Sampling frequency is 2.56 times of analysis frequency range

Anti-aliasing filter: 8-step elliptical

CAN baud rate:5Kbps,10Kbps,20Kbps,50Kbps,100Kbps,125Kbps,250Kbps,500Kbps selectable

Notes: the factory default CAN baud rate is 125Kbps, under this baud rate the maximum transmission distance is about 500 meters. If there were special request, the right baud rate can be chose according the following table. Please make a choice cautiously.
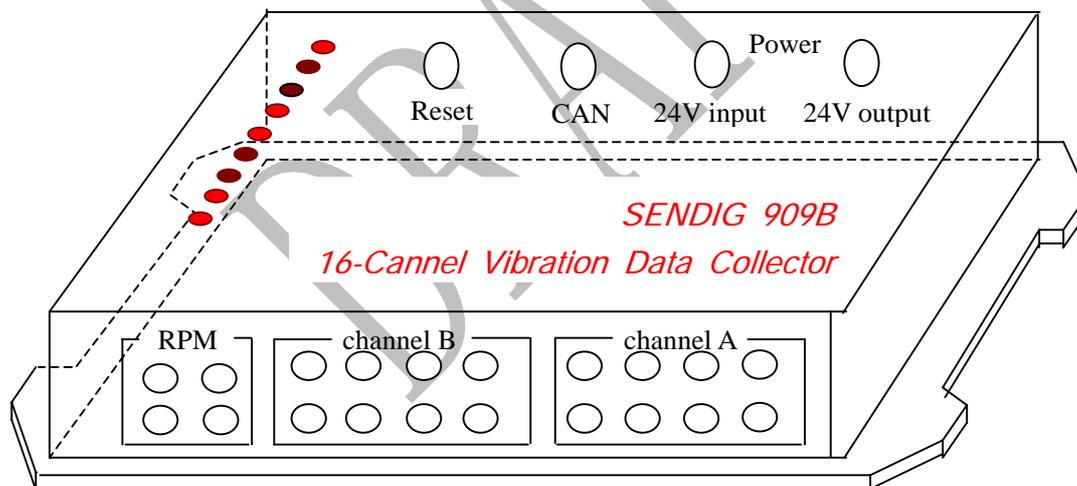
Baud Rate(bps)	5K	10K	20K	50K	100K	125K	250K	500K
Distance(m)	10K	6.7K	3.3K	1.3K	620	530	270	130

Size: 200 x 150 x 45 (mm)

Weight: 2 kg

4 Configuration

The appearance and indicating lights:

🔴	CAN Transmit	Data Transmitting indicator
🔴	CAN Receive	Data receiving indicator
🔴	Channel SW1	Channels indicator lowest bit
🔴	Channel SW2	Channels indicator middle bit
🔴	Channel SW3	Channels indicator highest bit
🔴	Parameter SW1	Parameter indicator lower bit
🔴	Parameter SW2	Parameter indicator higher bit
🔴	Power	Power supply indicator

Indicator lights combination:

Channel Sw3	Channel Sw2	Channel Sw1	Group Input
0	0	0	Group1
0	0	1	Group2
0	1	0	Group3
0	1	1	Group4
1	0	0	Group5
1	0	1	Group6
1	1	0	Group7
1	1	1	Group8

Parameter SW2	Parameter SW1	Overall Type
0	0	Acceleration
0	1	Velocity
1	0	Displacement
1	1	Envelopment

5 Setup of DIP switch

There are two switches inside the collector, the 8 bit switch K1 and 4 bit switch K2. The two switches can only be changed when the back cover is opened.

The switches can realize the setup of the following 4 functions:

identification code (ID) of the collector to be used in the network;

communication baud rate;

terminal matching resistance;

work mode;

The detailed setup methods are as follows:

5.1 Set up the Identification Code(ID) of Collector

Each collector should have its own ID as CAN bus node address because of the need of communication. The SW.1, SW.2, SW.3, SW.4, SW.5 of the 8 bit switch K1 are used to set up the ID, which can be defined to 32 different addresses (0 to31). The definition is as follows:

Collector ID	SW.1	SW.2	SW.3	SW.4	SW.5
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
9	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1

14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0
21	1	0	1	0	1
22	1	0	1	1	0
23	1	0	1	1	1
24	1	1	0	0	0
25	1	1	0	0	1
26	1	1	0	1	
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0
31	1	1	1	1	1

Where 0 and 1 are corresponding to switch's OFF and ON

5.2 Set up the Communication Baud Rate

The SW.6, SW.7, SW.8 of the 8 bit switch K1 are used to select CAN bus communication baud rate. The definition is as follows:

	SW.6	SW.7	SW.8
5K	0	0	0
10K	0	0	1
20K	0	1	0
50K	0	1	1
100K	1	0	0
125K	1	0	1
250K	1	1	0
500K	1	1	1

Where 0 and 1 are corresponding to switch's OFF and ON

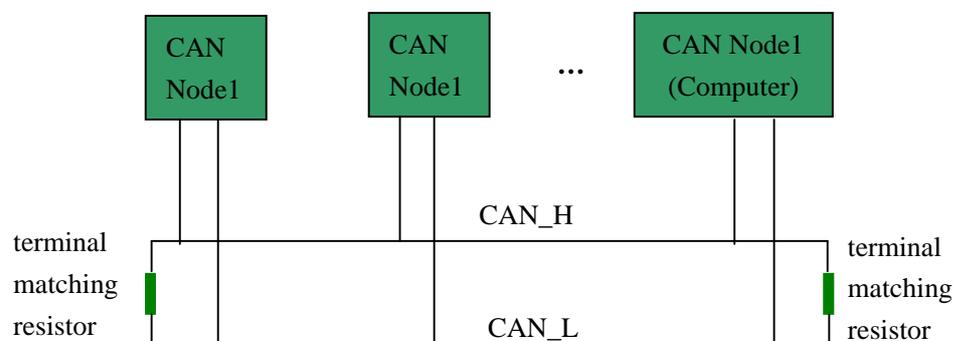## 5.3 Set up the Terminal Matching Resistance

Fig-3 the connection of terminal resistor in CAN bus

In order to reduce reflection and increase the reliability of the system, the terminal matching resistor

are set at the two ends of CAN bus, which is shown in fig-3. The value of terminal matching resistor should be equal to the characteristic impedance of the transmission cable. The terminal matching resistor of twisted-pair cable is 120 ohm.

If SW.1 and SW.2 of the 4 bit switch K2 are set to ON, that means terminal matching resistor 120 ohm is connected, otherwise if SW.1 and SW.2 of the 4 bit switch K2 are set to OFF, that means terminal matching resistor 120 ohm is disconnected.

5.4 Select the work mode of collector

The collector has two work modes: high speed mode, mute mode, which are controlled by SW.3 of 4 bit switch K2.

5.4.1 High speed mode

The high speed mode is the default mode, which can be set by setting SW.3 of 4 bit switch K2 at OFF. In this mode, the output signal of CAN bus has fixed slope and can switch as quickly as possible.

5.4.2 Mute mode

In this mode its transceiver is disabled, so the CAN bus transceiver of collector is in the state of non-working. At this time its wasting supply power the same as what in the working state. This mode can be set by setting SW.3 of 4 bit switch K2 to ON.

Generally the collector need to work at the high speed mode, so the switch should be at OFF sate.

Notice: All the above have been set when leaving factory and do not need to be reset in most cases. Because the wrong settings would lead communicate abnormally, so the mode should be reset cautiously, on the other side, if you change the ID or baud rate of collector, all the parameters should be changed in the software accordingly.

6 Setting Input

When measuring vibration, the sensors should be installed correctly. Clean up the measured points' surface on the equipment, and then mount the sensor to the point via screw or magnet mount.

> **Notice:** Because the suction force of the magnet mount is very strong, please hold the sensor gently to put (or take off from) the measured point when installing (or taking off) the sensor. Pay attention not to pull the connection cable.

Selection of Sensor:

Every channel can be set up to ICP sensor or Eddy Current sensor. This can only be done at factory according to customer's requests.

Setting Sensor's Sensitivity

For charge-output piezoelectric accelerator, the factory default sensitivity of each channel is 5 pC/ms^2. The actual sensitivity should be correctly input in the interface software.

For voltage-output type ICP, eddy proximity, or electromagnetic velocity sensors, the factory default sensitivities are set to 2.0 mV/EU in the software, where EU=Engineering Unit. The actual sensor's sensitivity should also be correctly input in the interface software.

7 Interface Software

7.1 Interface

Almost all the operation of the software is made by menu, while the tool bar provides some shortcuts of the most commonly used operation.

The "Group Input" section is at the left of the screen. Here the users can select 2 channels each time to make some configuration or operation. Collector can be selected by clicking "previous collector" "next collector" button, or by clicking "collector ID" list box. Channel couple can be selected by clicking corresponding "Group Input" icon.

The status bar is on the bottom of the screen, which mainly display information like the current operation status, date, time and so on.

The working window is in the middle of the screen and is very important, which includes setting window and measuring window respectively:

The setting window is used to setup each channel: Group Input type, which channel to use, measurement parameter, sensor property and the RPM channel, etc…;
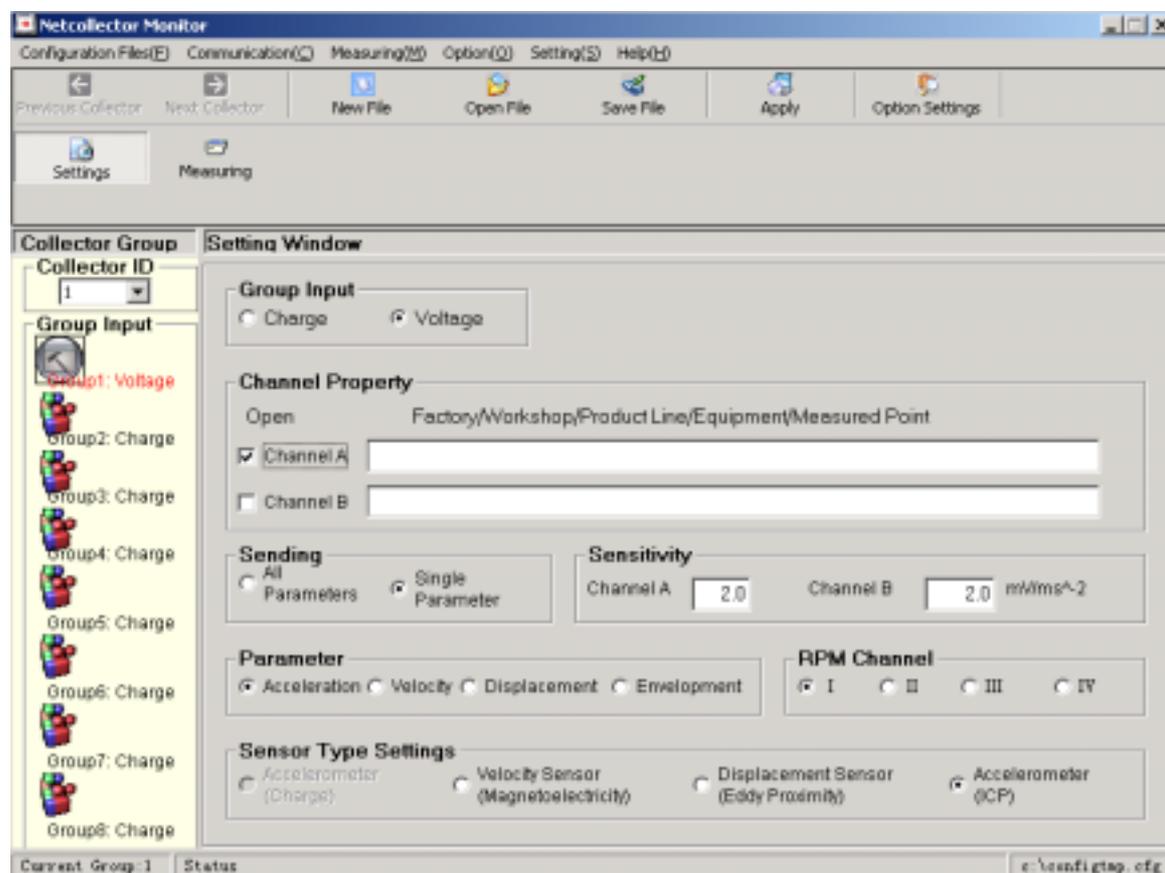
Fig-4 window of setting collector

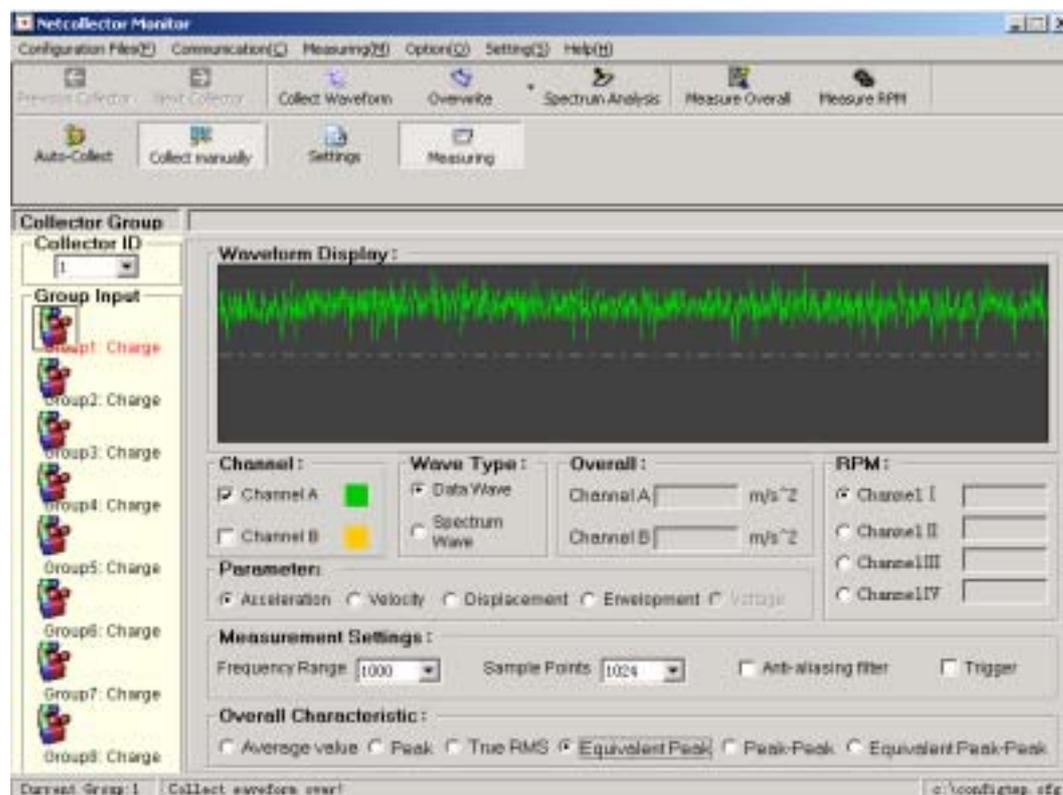The measuring window for collecting the overall, RPM, and waveform:

Fig-5 window of collecting waveform

To see overall of a channel, then under the "Measuring window", click "collect manually", and then click "Measure Overall" on the tool bar. The real-time overall of this channel will be displayed, and the "Measure Overall" button becomes "Stop Measuring Overall". You have to click "Stop Measuring Overall" before you can do other operation.

Notice: the default characteristic overall value of acceleration is equivalent peak, while velocity is true RMS, displacement is equivalent peak-peak, and acceleration envelopment is true RMS.

If the overall of all measured points need to be displayed real-timely in the HMI(Human-Machine-Interface) software, then click "auto-Collect" on the toolbar.

To collect the waveform of 1 or 2 channels for analysis, then click "Collect manually", and then click "Collect Waveform". Thus the collected waveform will be displayed in the waveform display box.

The two windows can be switched by clicking at menu("Setting"-"Setting", "Measuring") or toolbar button("Setting", "Measuring").

7.2 Communication

The communication functions include the following:

1) Collector selection: you can click "Previous Collector", "Next Collector" to select a different collector.

2) Communication Card Reset: if there appears abnormity in CAN communication card (for example, receiving and sending indicator lights are all on), then reset the card to restore its original state.

3) Baud Rate Selection: collector provides 8 baud rates for users to select: 5KHz, 10KHz, 20KHz, 50KHz, 100KHz, 125KHz, 250KHz, 500K. The corresponding transmission distance (reference value) are: 10Km, 6.7Km, 3.3Km, 1.3Km, 620m, 530m, 270m, 130m respectively. Users can select the proper baud rate according to the actual requirement. Improper baud settings will lead to abnormal or uncertain communication. The baud rate selection should be set according to the interior hardware setting of collector. The default setting is 125KHz when leaving the factory.
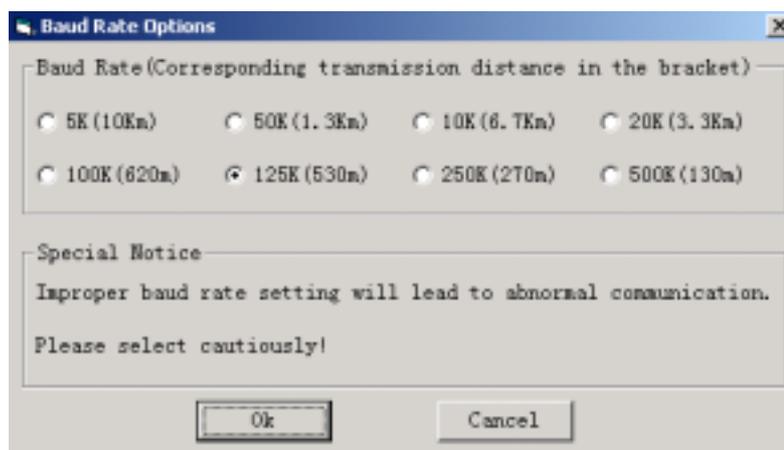
Fig-6 window of baud rate setting

5) Search collector: If it is the first time to run this software then please detect online collectors firstly. The window to search collector is as follows:
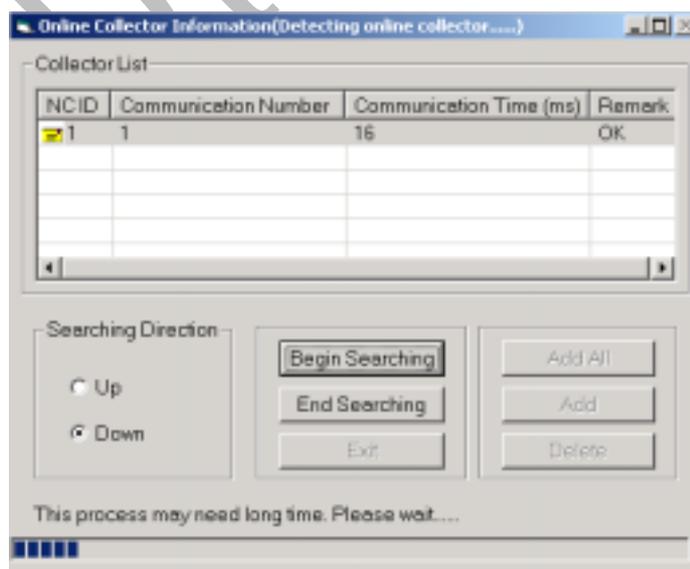

Fig-7 window of searching collector

By clicking "Begin Searching" button, the software will detect all online collectors automatically and add them to the collector list. Users can select partial collector or all collectors according to their requirement. The method is: press "Ctrl" or "Shift" key and click the collectors to make them high lighted, then click "Add" button to add them to the configuration file, or click "Add All" button directly to add all detected collectors.

If the communication is successful after baud rate is set and collectors are found, the programme will memorize these information in a configuration file. When run this programme next time, you need only open the configuration file.

7.3 Configuration File

Configuration file is used to register some settings of collector such as channel name, type, sensitivity and type of the sensor etc. "Configuration File" menu including the followings:

1) New: create a new configuration file;

2) Open: open a saved configuration file;

3) Save: save the file opened currently;

4) Save as: rename the current file and save it;

5) Apply: if one collector's all channels or several collector's corresponding channels are almost the same, then select this menu or click the "Apply" in toolbar, thus apply the information of current group to other channels or collectors quickly;

6) Exit   exit this software.

7.4 Measuring

Measuring function of collector includes: collect waveform, save waveform, measure overall and RPM and etc. This menu include:

1) Collect Waveform: after selecting the ID, group input, channel of collector, sampling frequency, sampling points, and etc., you may "collect waveform" and see the collected waveform in the "waveform display" window.

2) Save waveform: users can save the collected waveform data for the further analysis in the future. There are three ways to do it:

Save manually: users should input the file name. If the two channels collect data simultaneously, users should input the file names respectively.

Save automatically: the system will save waveform files according to the following rules: collector name + collector ID + group name + group ID + channel name (A or B) + file ID + .dat, where the collector name, group name and the directory of the data file can set by users in "Options" window. For example, users set the collector name as NC,

sensor group name as Grp   after collect the waveform of channel A 12 times, the name of waveform file is: "NC1Grp2A12.dat".

Overwrite: overwrite the last data file used by users automatically

3) Spectrum analysis: Startup the "Waveform Browser" software to analyze the collected waveforms;

4) Measure overall: get the overall value of one measurement channel, and display the value in the vibration display box;

5) Measure RPM: measure the RPM channel appointed by user and display it;

6) Collect manually and auto-Collect: The function of "Auto-Collect" is designed for "DataCenter" software, thus the data such as overall, RPM, waveform etc. can collected automatically according to the settings in the "DataCenter" software without users' interference, and can also be sent to HMI and MCMe3 software for display, storage and analysis.

7.5 Options Setting:

There are following options for users to choose:

1) Waveform file: these settings are used when the waveform is saved automatically. Users may set the directory to save the waveform file or set the name of collector and group input;
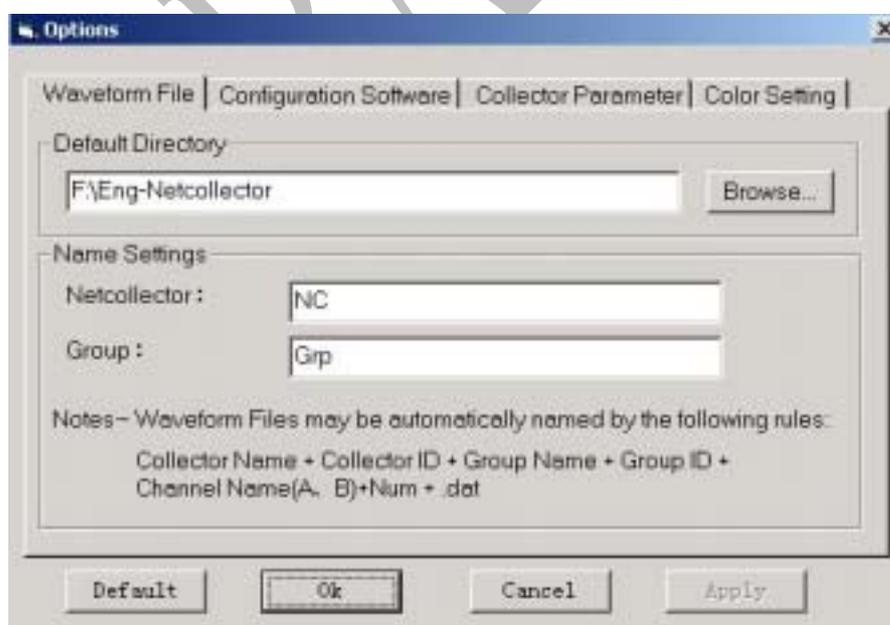

Fig-8 Waveform file settings

2) Configuration Software: set the directory location of configuration / HMI (Human Machine Interface) software;

3) Collector Parameter: users can unify all the collectors' configurations or each channel' s parameters of a collector;
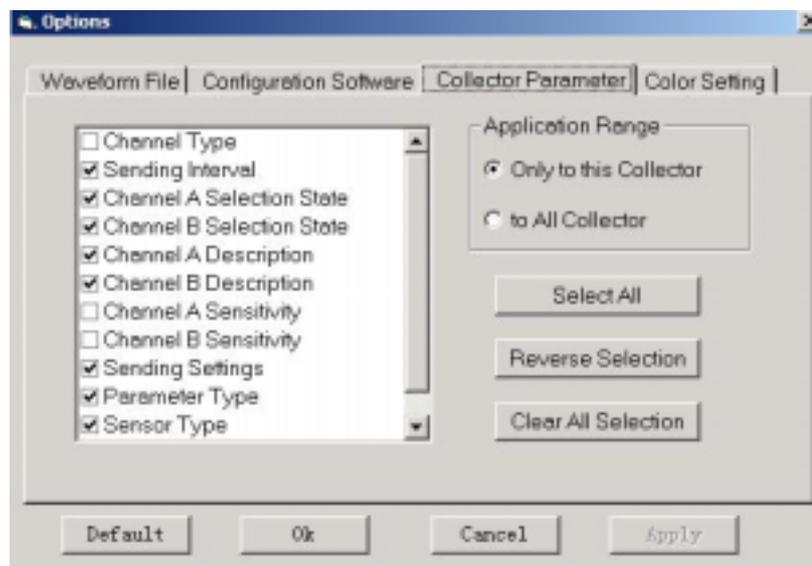

Fig-9 setting uniform parameters

4) Color setting: users can select the waveform's color and the waveform display section's background color of each channels when drawing waveform.
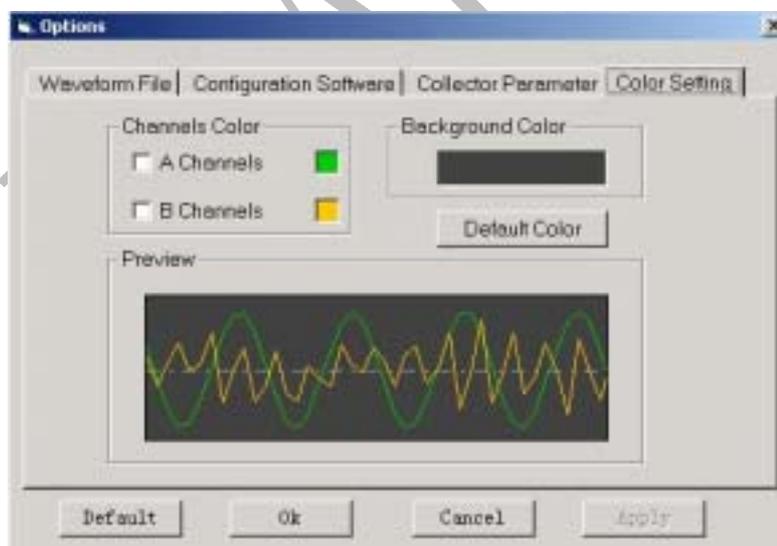

Fig-10 setting the color of waveform

All the above settings can be restored to the default settings by clicking "Default".

5) Apply the option: some information of the measured point such as "Sending interval" needs to be set when automatic collection. Click "Apply" to read the corresponding settings and to send to data management software. If the measured point's information is changed in Datacenter software, then this menu must be clicked so as to make the new setting information in effect.

7.6 Setting Menu

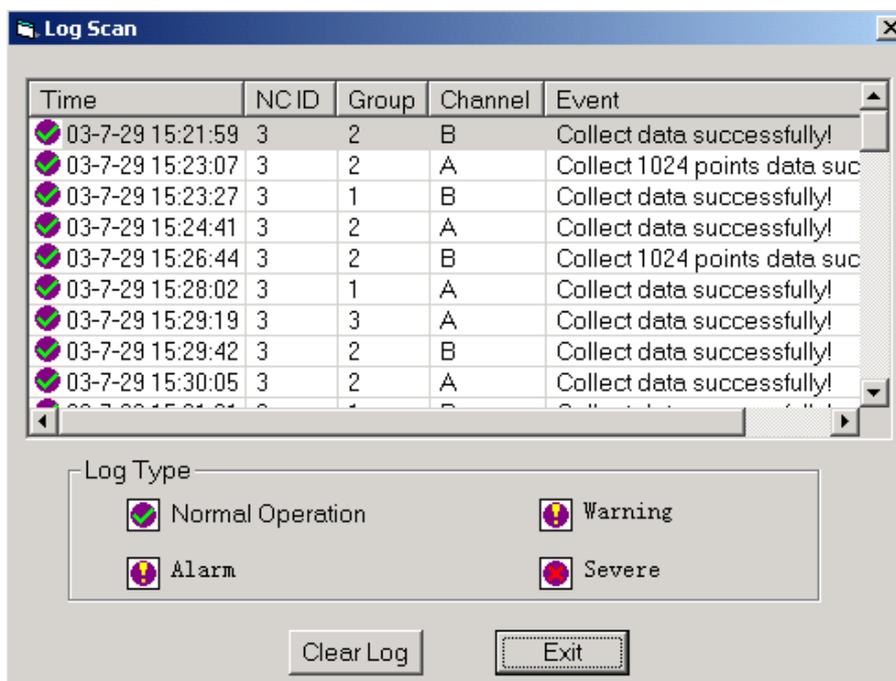1) Log scan: display working log of the collectors;

Fig-11 log scan window

2) Tool bar: To display the toolbar or not;

4) Status bar: whether or not to display status bar.