EMBC1000-PCI429EI-42

USER MANUAL

(Simplified V1.5.2)

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User's Manual Information

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Application of EMBC1000-PCI429EI-42

EMBC1000-PCI429EI-42 is a PCI based card that provides new levels of performance and flexibility for systems interfacing to ARINC429 data bus, including data transmission, data reception, real-time data display, data recording and replay, data post analysis, etc..

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CHAPTER 1 OVERVIEW

1.1 About EMBC1000-PCI429EI-42

Figure 1-1 EMBC1000-PCI429EI-42 Card

EMBC1000-PCI429EI-42 is a PCI card designed specifically to interface with ARINC429 data bus target hardware or systems, including data transmission, data receiving, event monitoring, remote control, real-time data display, data recording and replay, data post analysis of ARINC429 target hardware or systems.

Designed with 4 independently programmable receive (Rx) channels and 2 independently programmable transmit (Tx) channels, and automatic error detection in receive channels and error injection in transmit channels. EMBC1000-PCI429EI-42 card operates in 100k/50k/48k/12.5kbps rates with software configurable. This including other advanced designs make it an ideal tool to perform data acquisition, data analysis, remote control or event monitoring over the ARINC429 bus.

EMBC1000-PCI429EI-42 card comes with drivers software, API (Application Programming Interface) library and user oriented application software, running under Windows 2000/XP. The user oriented application software has been designed with the capabilities of simulating the outputs of various airborne systems, receiving inputs from these systems, and providing bus analyzer functions. API library is also provided together with example source code (Visual C++), which allow users to easily develop

their own application software or project.

EMBC1000-PCI429EI-42 card is of PCI Plug-and-Play (PnP) compatible for easy installation (any PCI 2.1, or higher, compatible slot), and multiple such cards can work together inside one PC or workstation.

1.2 Applications

EMBC1000-PCI429EI-42 card is well suited for all types of ground support work (development, manufacturing test, on-site maintenance, etc.), as well as on-board data acquisition. LRU developers find that this card provides easy access for simulating and/or testing new systems prior to use with actual flight systems. Avionics maintenance and validation teams enjoy on-site testing and analysis with this card.

Figure 1-2 Wide Applications

1.3 Characteristics

EMBC1000-PCI429EI-42 card features with the following characteristics:

- Comply with 32-bit 33Mhz PCI bus speed;
- PCI Plug-and-Play (PnP) compatible for easy installation;
- Up to 4 programmable ARINC429 Rx channels;
- Up to 2 programmable ARINC429 Tx channels;
- Support 32/25 bit Word length;
- 1024 bytes FIFO for each Rx channel;
- 1024 bytes FIFO for each Tx channel;
- Programmable baud rate (12.5Kbps、48Kbps、50Kbps、100Kbps);
- Transmitting capability:
  Queued (FIFO) transmission to any external channel;
  Scheduled label and SDI transmission to any channel;

Recurrent support(Time gap: 1 ~ 99,999,999 us);

- Receiving capability:
  Queued (FIFO) reception from any external channel;
  “Mailbox” type reception from any channel;
  Filtering of receive labels
- Automatic error detection in receive channels:
  Parity error;
  Gap error (less than 4 bit times);
  Short word error (time out error);
  Long word error (more than 32/25 bits);
- Transmit error injection:
  Parity error (make the parity bit to be opposite);
  Gap error (make gap to be 2 bit times);
  Short word error (30/23 bits);
  Long word error (34/27 bits);
- Up to 256 multiple cards in one system supported;
- Complete set of drivers for Windows XP/2000;
- Complete API and ANSI C DLL library for user’s design and integration;
- Well configured application software and source codes provided；
- PCI Modular design: 130mm x85mm；
- Working temperature [-40℃, +85℃]；

1.4 System Requirements

An IBM compatible PC equipped with PCI bus, Pentium processor, math co-processor, hard disk drive, CD-ROM drive, monitor, Windows XP or Windows 2000, etc.. shall be required for installing the PCI card and the associated software.

A cable assembly is required to interface to the ARINC 429 bus target hardwar or other discrete channels.

1.5 Special Handling and Care

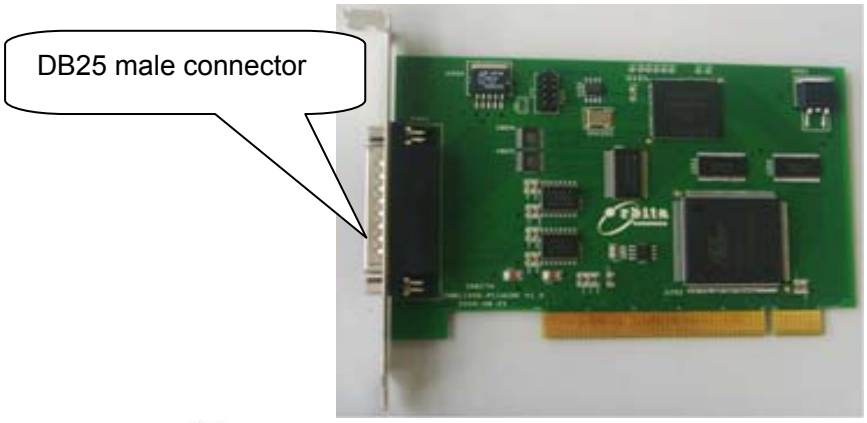
Since EMBC1000-PCI429EI-42 card uses state-of-the-art components and connectors, properly handlings and cares must be taken to ensure that the device will not be damaged by Electrical Static Discharge (ESD), physical shock, or improper power surges.

- Turn off power to the PC completely;
- NEVER insert or remove card with power turned on;
- Ensure that standard ESD precautions are taken. At least, one hand should be grounded to the power supply in order to eliminate static potentials;
- Do not store the card in environment exposed to excessive heat, magnetic fields or radiation.

CHAPTER 2 GETTING STARTED

2.1 ARINC429 bus Interface

One front-panel DB25 male connector (it has been referred to “P801” inside the card) is used for implementation of ARINC429 bus signal interface between ARINC429 target hardware and the PCI bus.



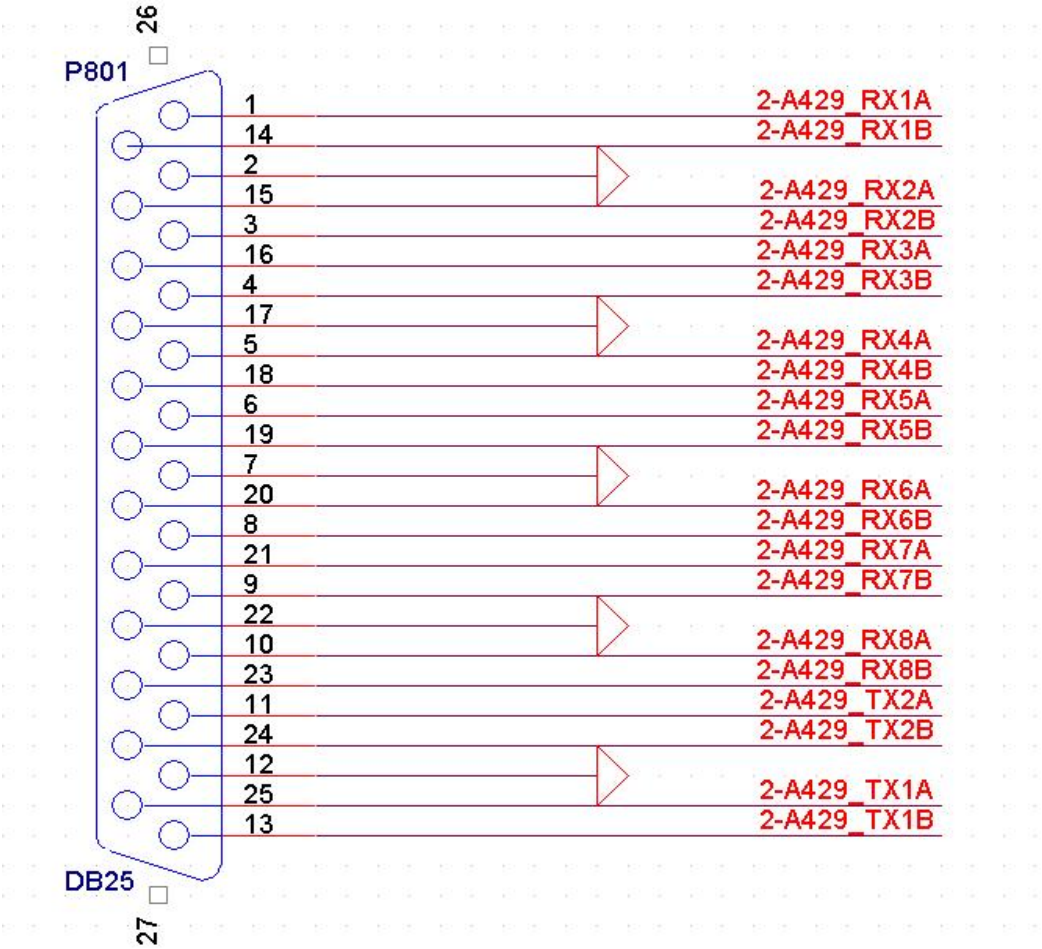


Figure 2-1 DB25 male connetor for ARINC429

Table 2-1 DB25 male Connector Pinouts

Pin No	Descriptions	Pin Number	Descriptions
1	Receive channel 1 A	14	Receive channel 1 B
2	GND	15	Receive channel 2 A
3	Receive channel 2 B	16	Receive channel 3 A
4	Receive channel 3 B	17	GND
5	Receive channel 4 A	18	Receive channel 4 B
6	NC	19	NC
7	GND	20	NC
8	NC	21	NC
9	NC	22	GND
10	NC	23	NC
11	Transmit channel 2 A	24	Transmit channel 2 B
12	GND	25	Transmit channel 1 A
13	Transmit channel 1 B		

Note: Per ARINC-429 specification, “A-Side” signal is “+” (positive) with respect to ground, while “B-Side” signal is “-“ (negative) with respect to ground.

2.2 Electric properties of ARINC429 bus connections

For the ARINC429 receive (Rx) channels, when you connect with any target hardware, the max input voltage of any signals shall be: ±30VDC.

As for the ARINC429 tranmit (Tx) channels, their bus data signals are standrard outputs:＋5V±5% for High Voltage and－5V±5% for Low Voltage. If the ARINC429 tranmit (Tx) channel works under full load, the max resistance and capacitance impedance of the load is: 400Ω/30,000pF; while the max resistance and capacitance impedance of the load is: 4000Ω/10,000pF when the ARINC429 tranmit (Tx) channel works only under half load.

2.3 Resources on CD-ROM

The CD-ROM includes:
Directory: G:\ (assume G:)

\ApplicationSoftware

EMBC1000-PCI429EI.exe	data anaysis executable file
wdapi901.dll	DLL file for executable file

wdapi901.lib LIB file for executable file

Note: EMBC1000-PCI429EI.exe、wdapi901.dll、wdapi901.lib must be kept in the same directory.

\doc

EMBC1000-PCI429EI-42USERMANUAL(SV1.5.2).pdf User manual

\ driver

\boarddriver Board oriented drivers

EMBC1000-PCI429EI.sys

EMBC1000-PCI429EI-42_device.inf

\LIBdriver LIB oriented drivers

EMBC1000-PCI429.inf

EMBC1000-PCI429.sys

wd901.cat

\UserDesign For user's development use

\APILibrary

PCI_LINK3.dll

PCI_LINK3.lib

wdapi901.dll

wdapi901.lib

\sample

VC++ sample

\DataAnalysis

DataConvert.exe

Source File.txt

Target File.txt

\training Video files to show the operations

LookBack.avi

TX1_SEND.avi

TX2_SEND.avi

DataAnalysis.avi

LIBdriver_install.avi

LB_ERROR_INJECTION.avi

boarddriver_install.avi

CHAPTER 3 ERROR INJECTION AND DETECTION

EMBC1000-USB429EI-42 is a device which has the ability to inject errors into the transmit channel and detect the errors from receive channels.

3.1 Parity Error

If you enable the parity error injection,the parity bit in the nomal word will be chang to negative artificially. The **Figure 3-1** show you the definition of the Parity Error in the 32bits word. The Parity Error in the 25bits word is defined in the same way.

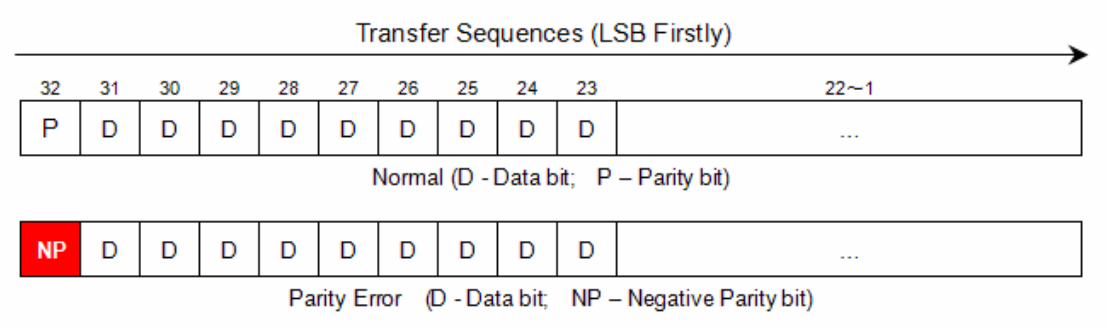


Figure 3-1 Parity Error(32bit)

3.2 Gap Error

According to the ARINC429 protocol, the gaps between two words is 4 Null bits at least, in EMBC1000-USB429EI-42, the way to inject Gap error into transmit data is to make the Gap time between two words is 2 Null bits, Shown in **Figure 3-2**:

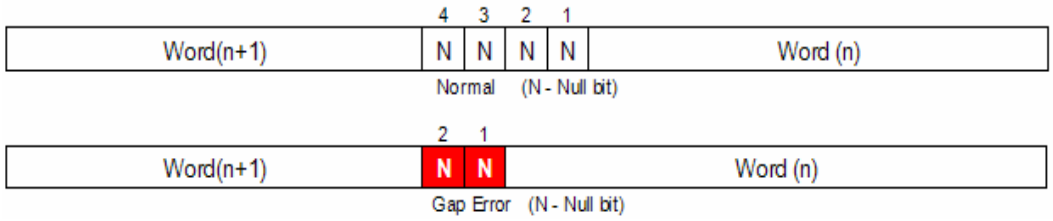


Figure 3-2 Gap Error(32bit)

3.3 Short Word Error

ShortWord Error is also called “Break Error”, means the data was send not enough 32/25 bits, just like the data frame is broken, In EMBC1000-USB429EI-42, the way to inject the shortword error into the transmit data is cut down two bits which replace by two NULL bit, Shown in **Figure 3-3**:

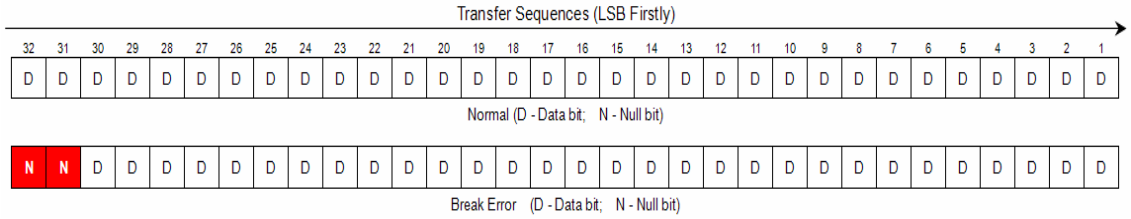


Figure 3-3 Short Word Error(32bit)

3.4 Long Word Error

ILong Word Error is also called “Long Frame Error”.It means the word sending contain 34/27 bits.If you enable the Long Wordd error injection, the 2 bits ”00” will be add to nomal word(32 bits or 25 bits).The **Figure 3-4** show you the definition of the Long Word Error in the 32bits word. The Long Word Error in the 25bits word is defined in the same way.

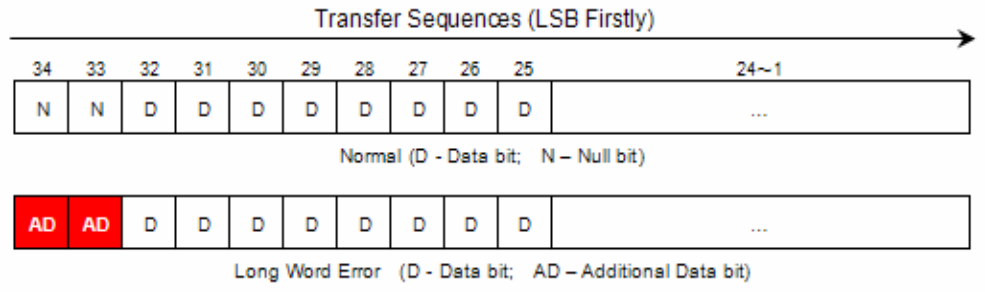


Figure 3-4 Long Word error(32bit)

CHAPTER 4 OPERATIONS AND SETUP

4.1 HARDWARE and its drivers INSTALLATION

4.1.1 Hardware installation

EMBC1000-PCI429 card is designed to be inserted directly into any PCI 2.1, or higher, compatible slot of PC.

Note: When installing the card, the following cautions must be taken:

1) *NEVER insert or remove the card with the power turned on.*
2) *ALWAYS take proper precautions to guard against static damage. Use a wrist strap if available, or ensure proper static grounding by touching the power supply cover with power OFF.*
3) *Insert the card gently into the motherboard slot. Secure with proper hardware.*
4) *Make sure that adjacent cabling and wiring do not hinder the airflow around the card.*

Once the PCI card gets installed into your PC and proper connections are made between ARINC429 target hardware and PCI card via the DB25 connector, then the hardware installation gets basically done. Congratulations!

> ***NOTE:*** *Please be advised that you should assign a number to each PCI card (we called* ***Board Number*** *in our setup software) you inserted into the system according to the sequential order of the PCI slots in your system. If only ONE PCI card be inserted in your system, then the* ***Board Number*** *is 0. If there are more than one PCI card installed into your system, you should assign a number (valid 0-255) to each board according to the location of each PCI slot in the system. When the application software is used, it must be configured with each board, though mutliple boards can work together.*

However, before you could use this card, you need to install drivers software from the provided CD-ROM onto your PC: **board oriented drivers and LIB oriented drivers**, which are designed to run under Windows XP or Windows 2000.

4.1.2 Board oriented drivers Installation

Once the card gets installed and the PC is turned ON, the PC shall perform automatic detection for the card inserted. If the drivers have not been installed yet, it will treat the card to be a new hardware and, it will report to you right away by bringing up “Add New Hardware Wizard” to guide you for the installation of the required drivers.

Figure 4-1 Add New Hardware Wizard window

Click on “Install from a list or specific location” and then click on the Next button, you will asked to choose:

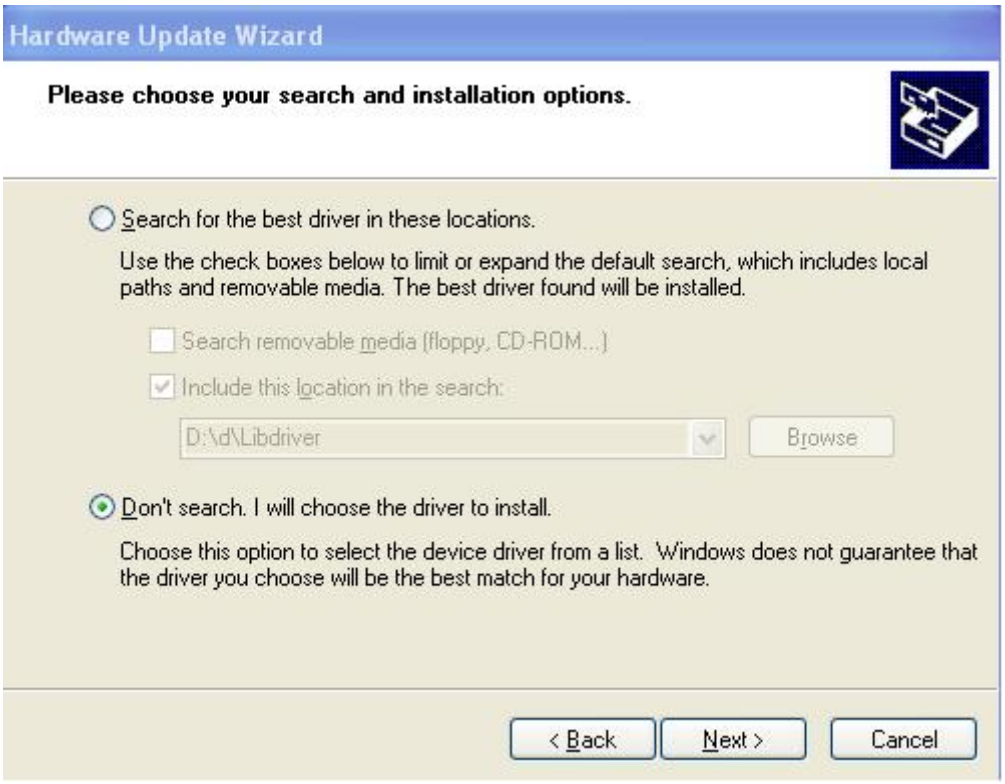


Figure 4-2 choose the driver to install

Choose “Don’t search.I will choose the driver to install”, then click on the **Next** button, you will get:

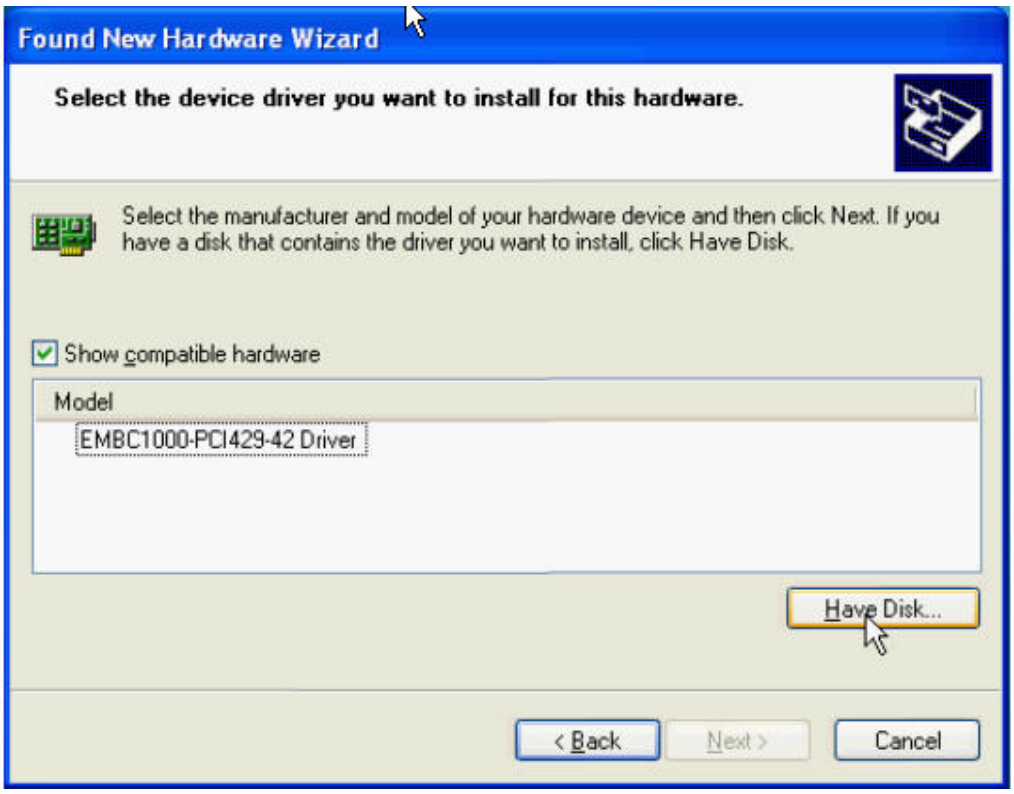


Figure 4-3 select the .inf file from disk

click on “**Have Disk…** “button, you will enter the next window:

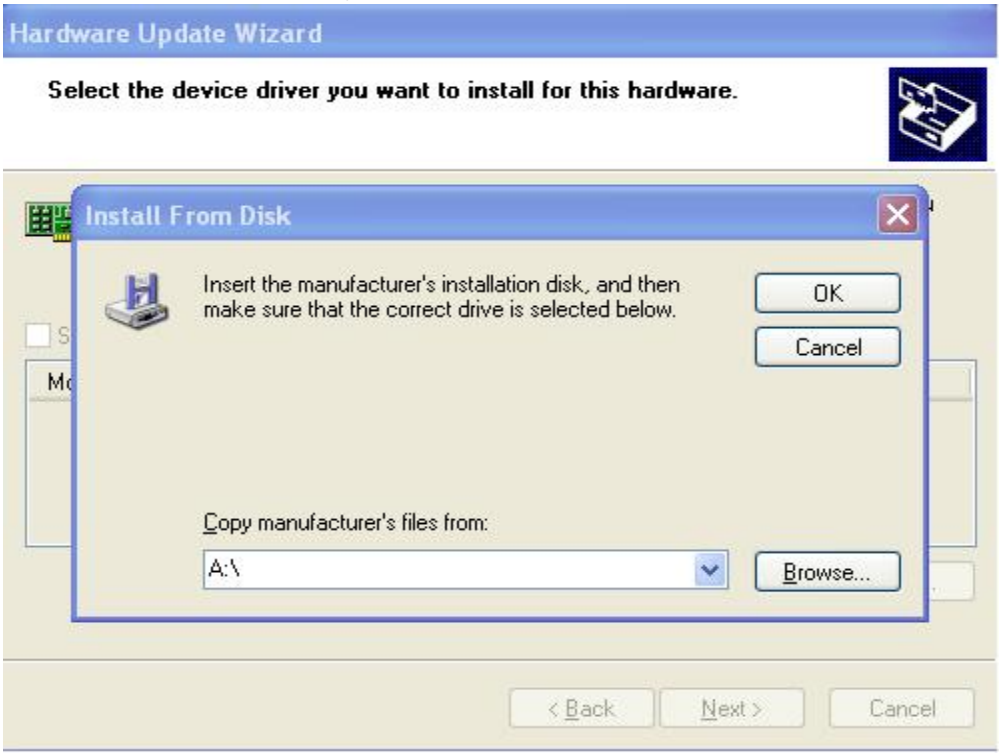


Figure 4-4 open the .inf file

Browse the CD-ROM, open the EMBC1000-PCI429EI_device.inf from CD_ROM (**G:\ driver\ boarddriver**) and click on **OK** button, you will get:

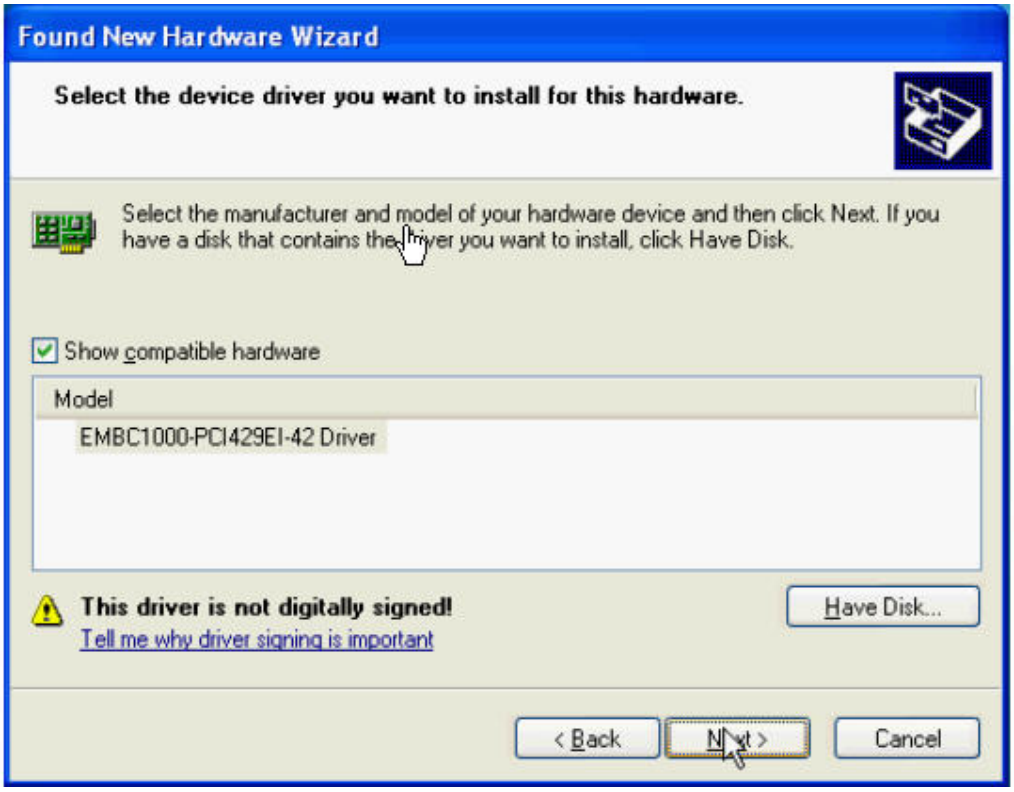


Figure 4-5 open the .inf file

Click on **Next** button to have the driver installed.

Figure 4-6 finish the board drivers installation

Click on **Finish** button to complete this installation procedure. Congratulations! Now you have installed the board drivers onto your PC successfully.

4.1.3 LIB oriented drivers Installation

From your desktop of Windows XP, enter into the **Control Panel** and then open **Add Hardware**, you will get:

Figure 4-7 open Add Hardware

Click on **Next** button, you enter:

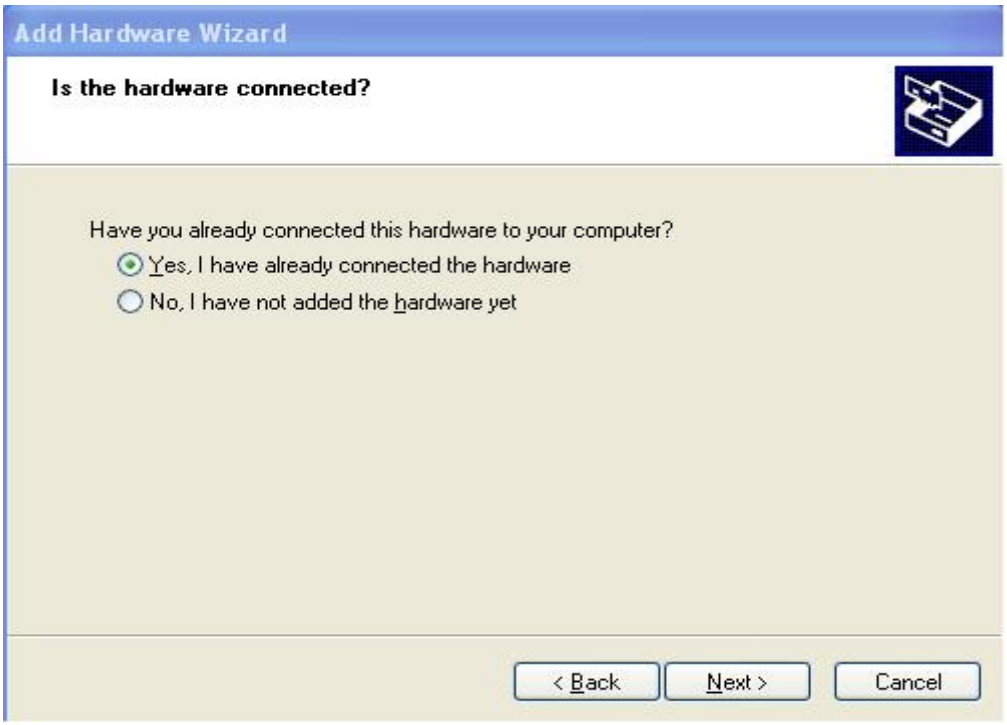


Figure 4-8 Add Hardware Wizard

Click on “Yes,I have already connected the hardware”,and then click on **Next** button, you will be asked:

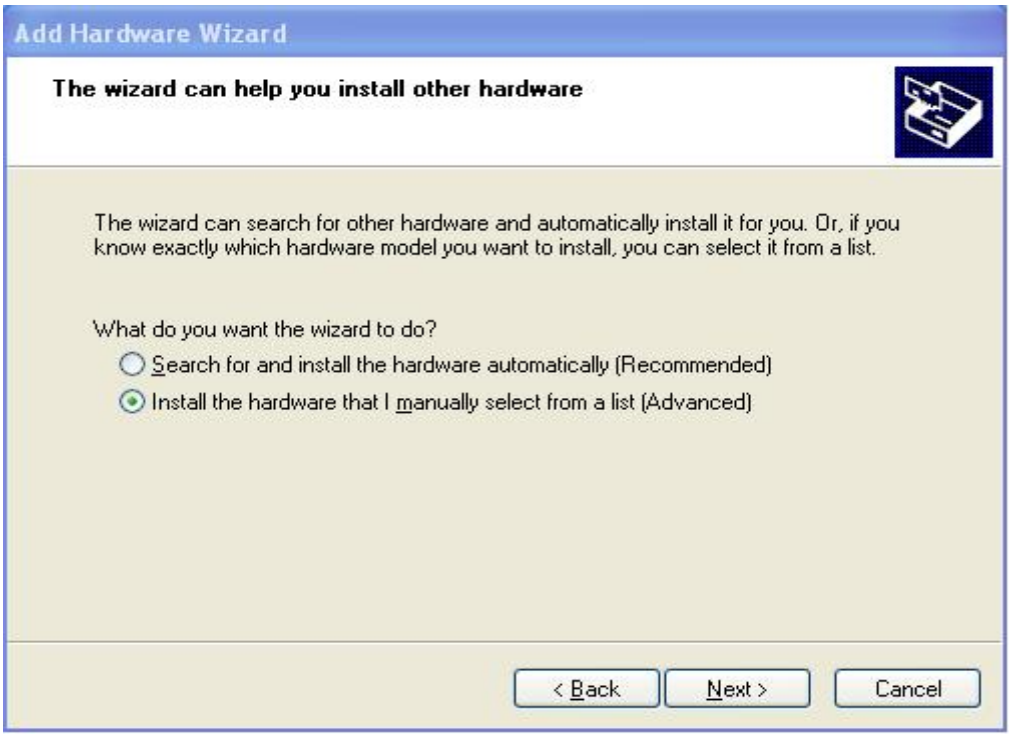


Figure 4-9 Add Hardware Wizard

Click on “install the hardware that I manually select from a list”,and then click on **Next** button, you will get:

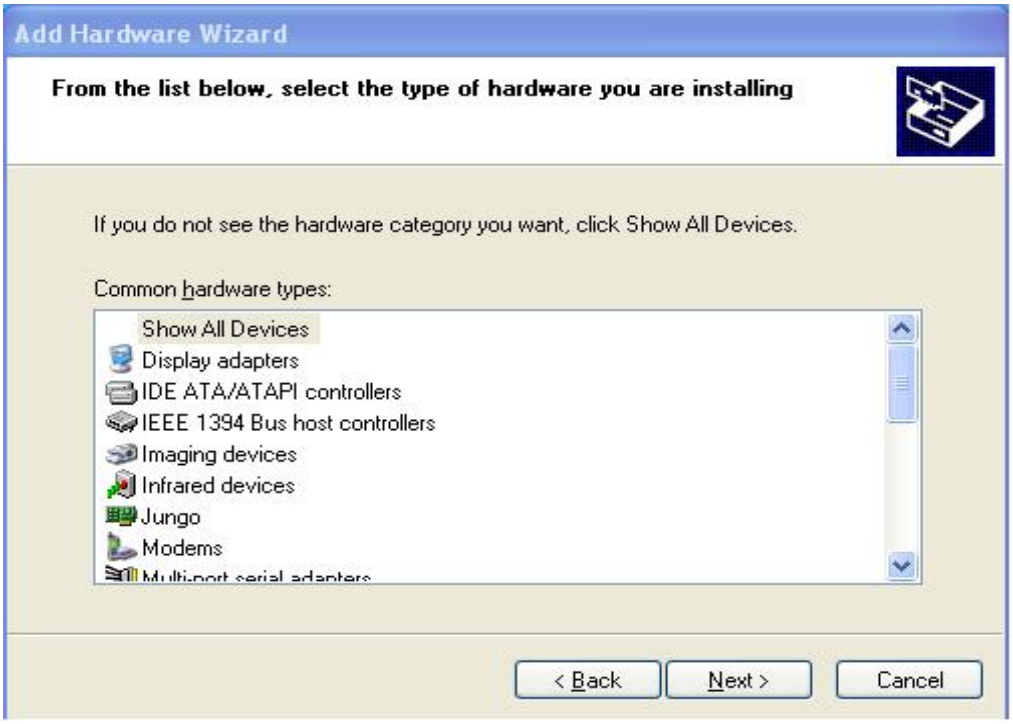


Figure 4-10 select the type of hardware

Click on **Next** button, you enter the window below.

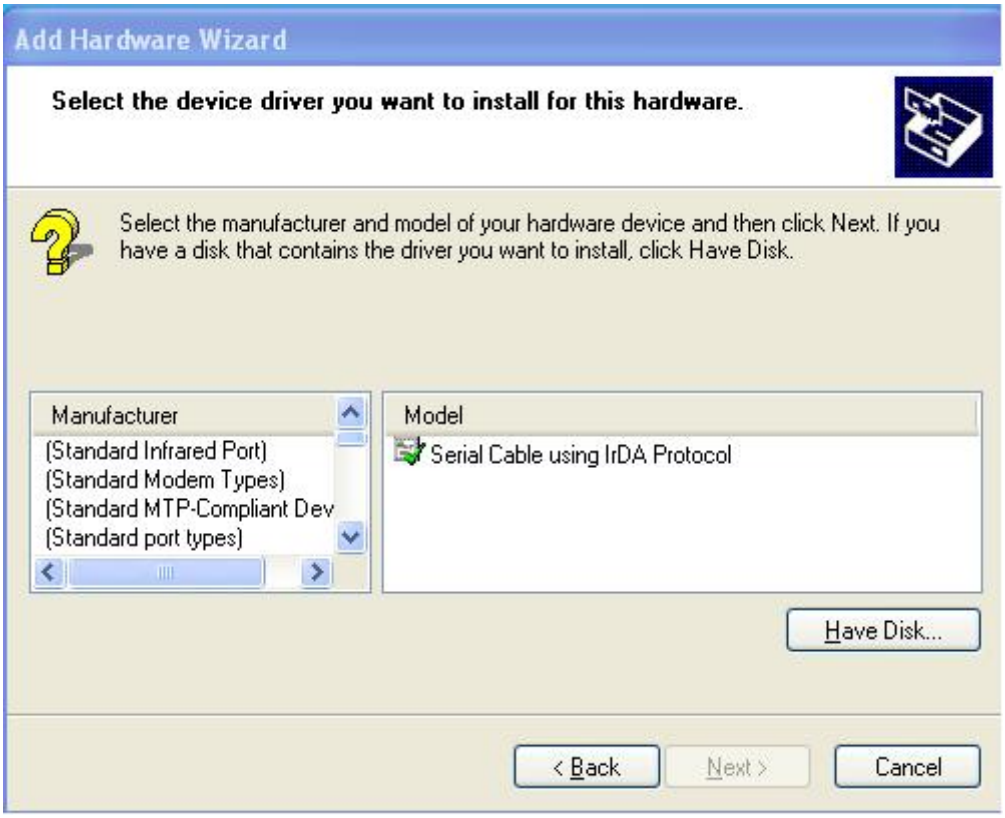


Figure 4-11 select the .inf file from disk

Click on **Have Disk…** button, you will see:

Figure 4-12 open the .inf file

Open the EMBC1000-PCI429.inf from CD-ROM (G:\ driver\ LIBdriver) and then click on **OK** button, you enter:

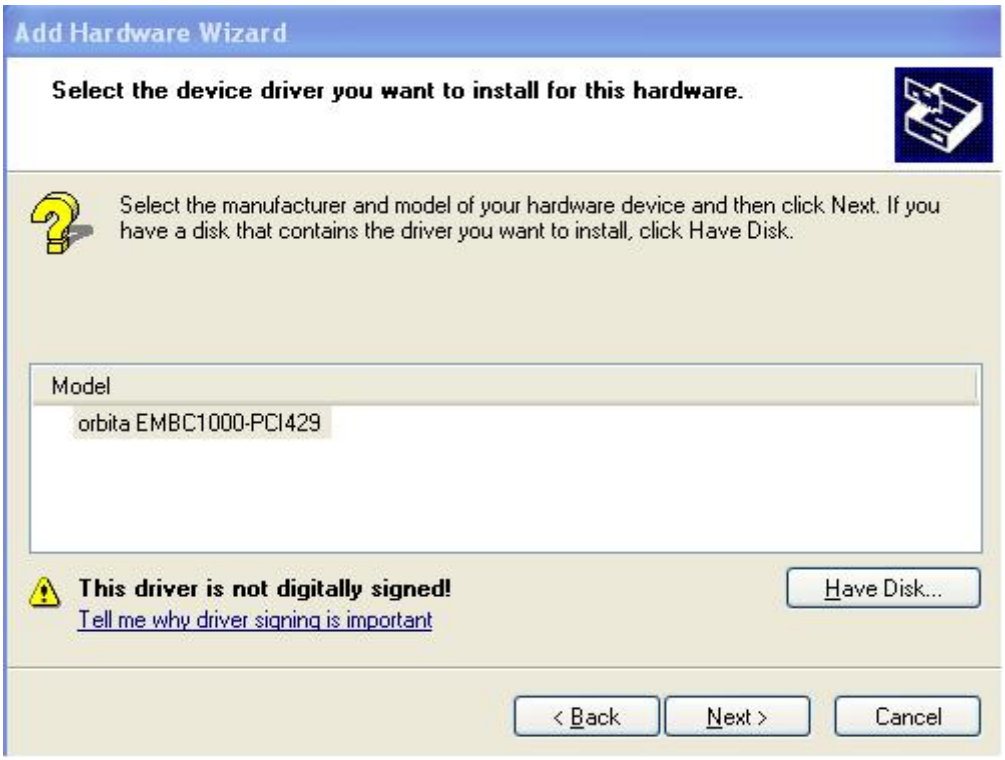


Figure 4-13 open the .inf file

Click on **Next** button, you get:

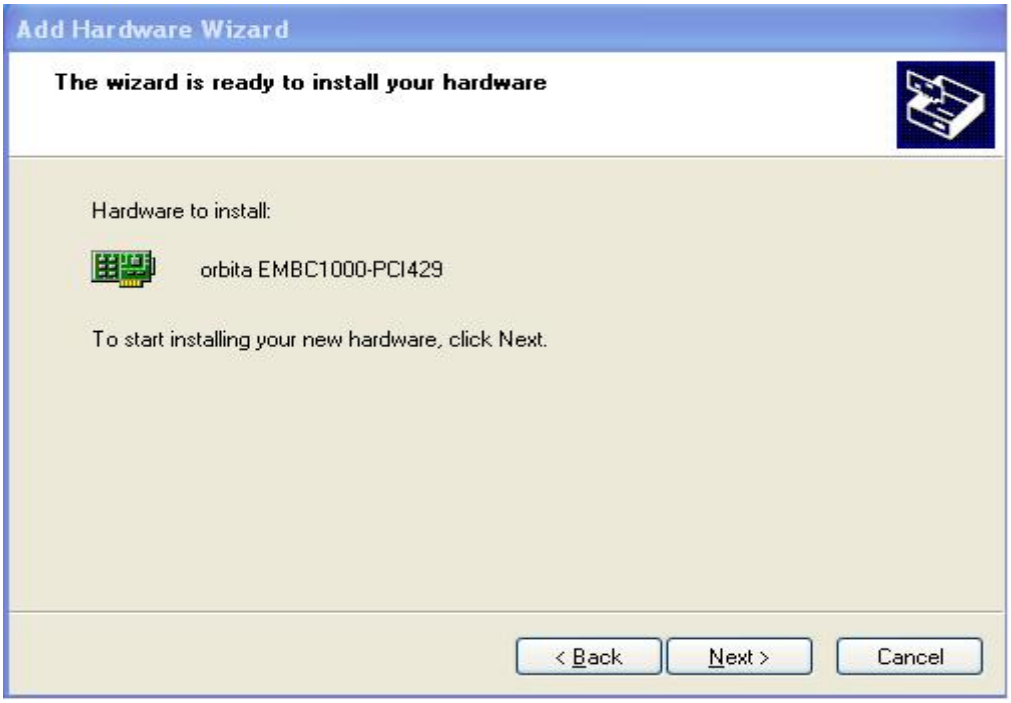


Figure 4-14 install hardware

Click on **Next** button to have the LIB drivers installed.

Figure 4-15 finish the LIBdriver installing

Click on **Finish** button to complete this installation procedure. Congratulations! Now you have installed the LIB drivers onto your PC successfully.

HINT: Check if the hardware drivers get installed properly

Yes, you can simply open the **Device Manager** to check. If both board drivers and LIB drivers gets installed properly, they shall be displayed under device group **Jungo** as below:

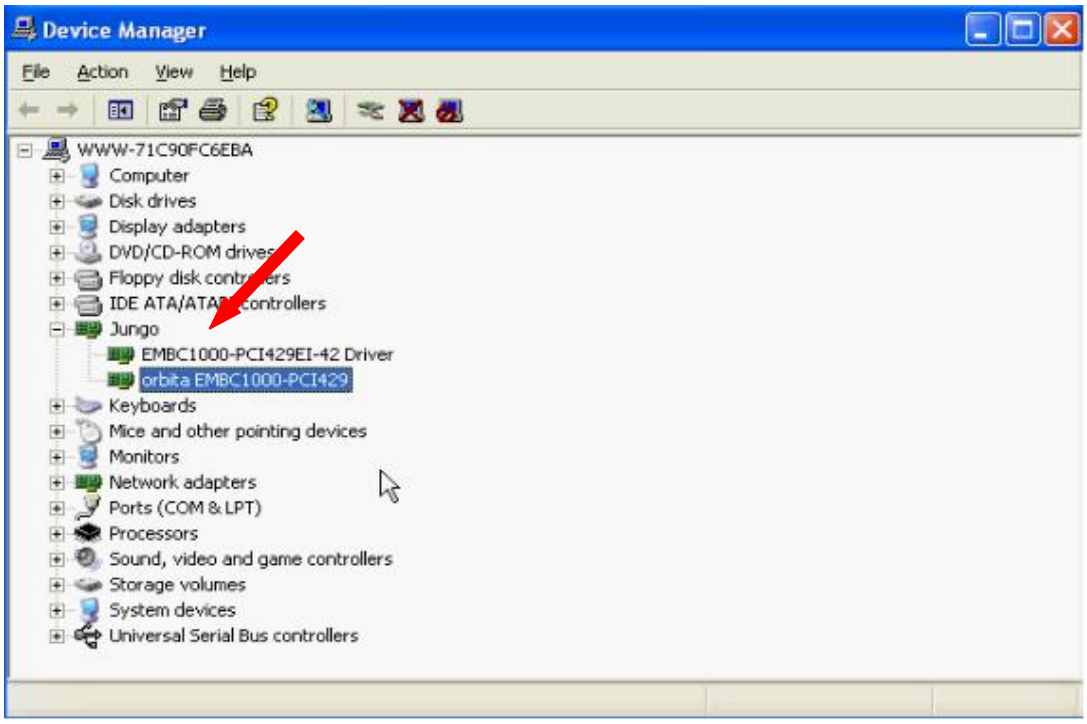


Figure 4-16 hardware install successfully

4.2 Get started with the Application Software

Once the HARDWARE INSTALLATION gets done successfully, EMBC1000-PCI429EI card is ready to use.

Each PCI card should be assigned a number (we called **Board Number** in our setup software) according to the sequential order of the PCI slots in your system. If only ONE PCI card be inserted in your system, then the **Board Number** is 0. If there are more than one PCI card installed into your system, you should assign a proper number (valid 0-255) to each board according to the location of each PCI slot in the system. When the application software is used, it must be configured with each board with the specified Board Number, though mutliple boards can work together.

Double click on the application software EMBC1000-PCI429EI.exe (G:\ ApplicationSoftware)，you will see the software startup Logo:

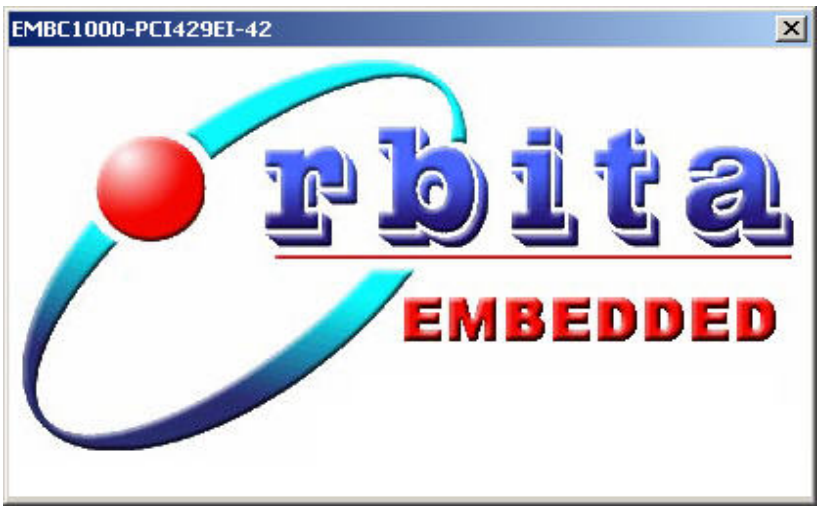


Figure 4-17 software startup Logo

After about 10 seconds, the “Select Board Number” window will popup. The ”Board Number” means the application software will only opration this card. When multiple cards in one system,the user should open multiple application software to operate the cards. The user should get the value of “Board Number” from the PCI slot which the card inserted.If only one card in the system, the “Board Number” is 0.

Now you should enter the ”Board Number" (possible assignment value range: 0 to 255) of the PCI card. Click on OK button after the number gets entered.

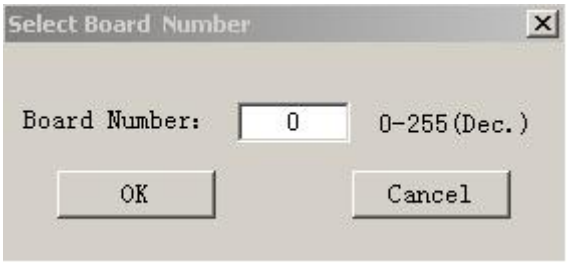


Figure 4-18 Select Board Number

If the “Board Number” you entered is incorrect or the hardware drivers have not been installed properly, you will observe the Error information window as below. In this case, you should double check if the PCI card is in proper working mode or if the card is numbered properly.

Figure 4-19 Error prompt

If Board Number is properly specified and the PCI card works well with the system, the application software will be launched and its main window will be opened as below.

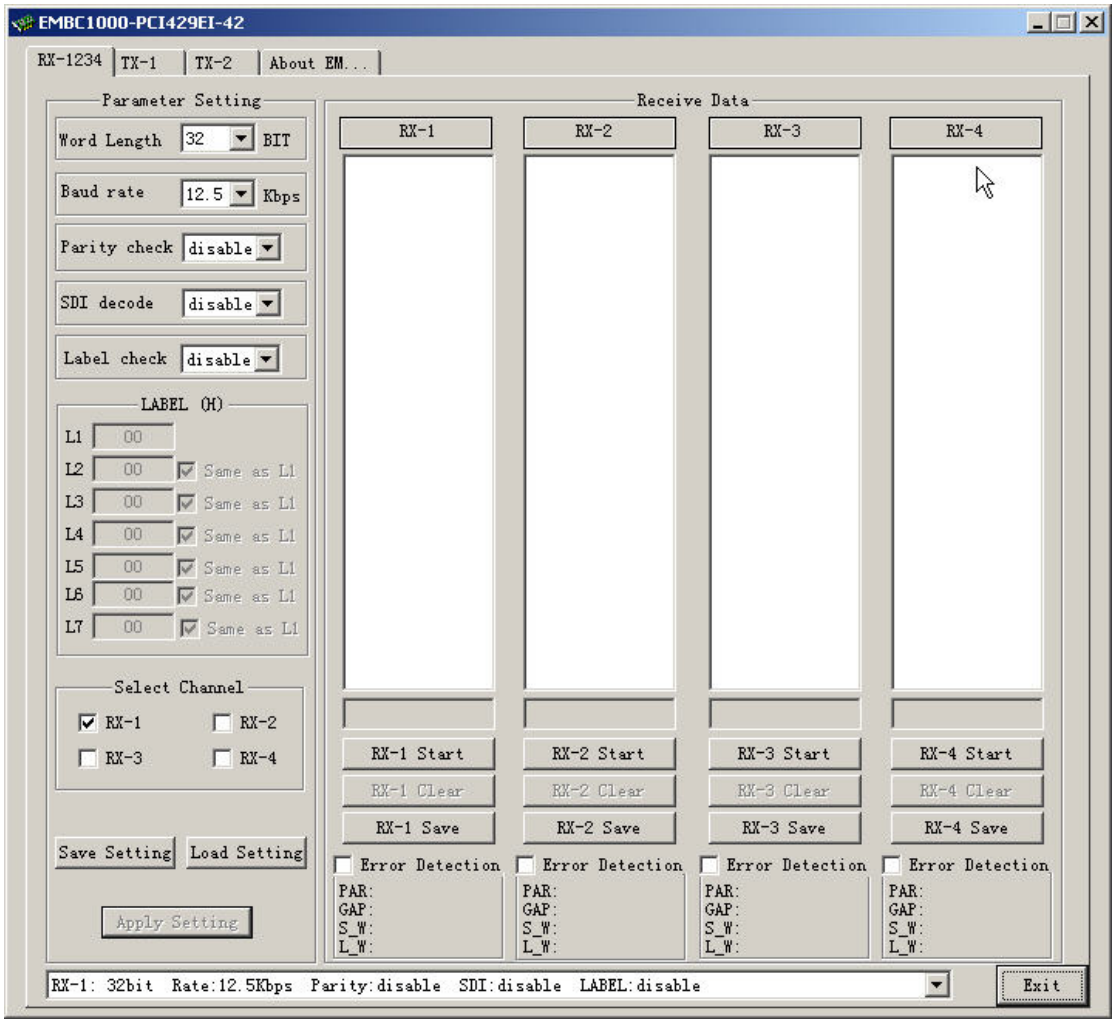


Figure 4-20 main window of the application software

4.3 Parameters Setup

4.3.1 Rx Channel Parameter Setup

Click the “RX-1234”, you will enter the parameters setup page of Rx channels, shown in **Figure 4-2**1.

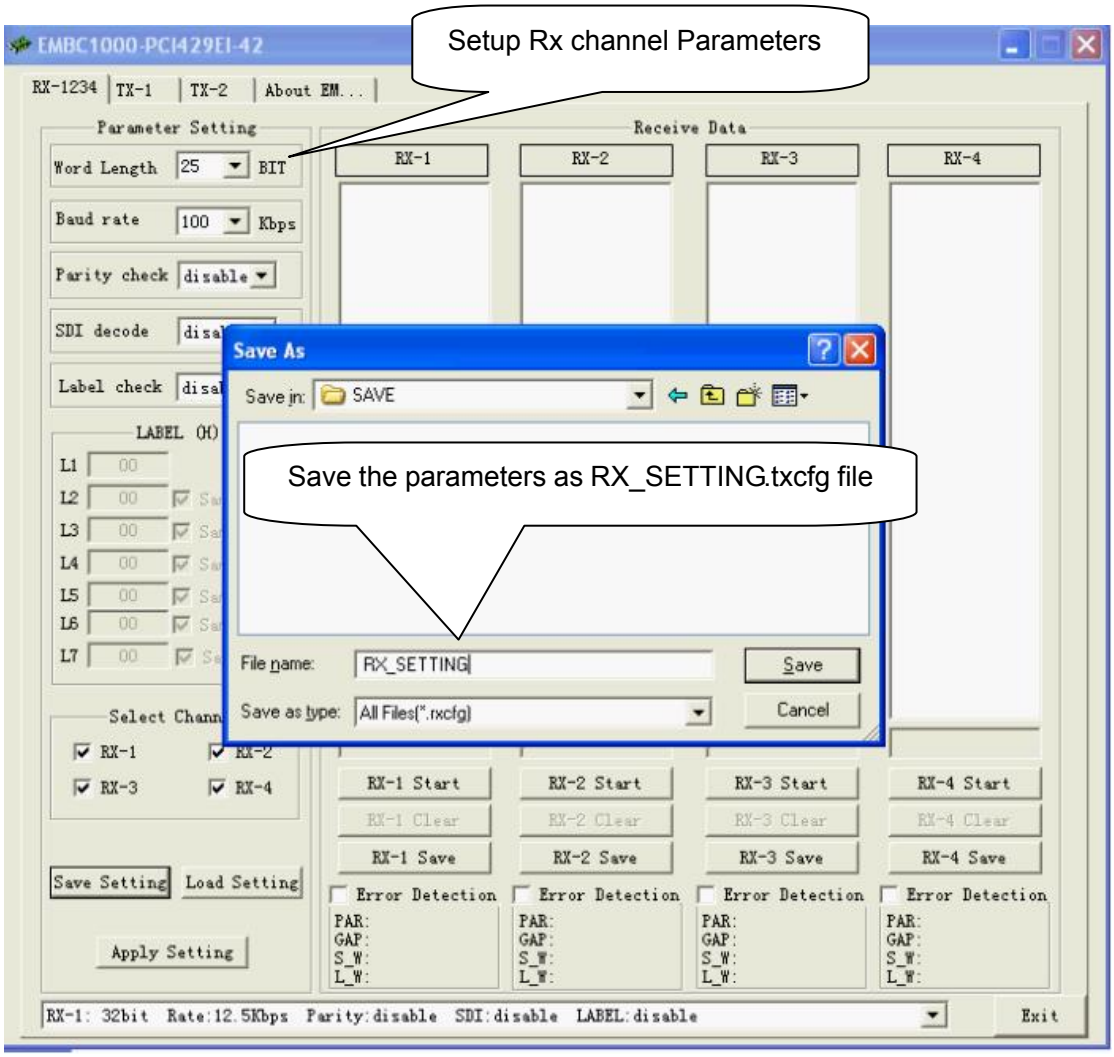


Figure 4-21 Rx channel parameters setup

Now you are free to set the Rx channel parameters, such as: Word length，Baudrate, Parity check, SDI check, Lable check, etc.. After changing the parameter, you must press the “Apply setting” button to make it valid, and the configuration can be saved into a data file by pressing the “Save Setting” button, and an existing configuration can be loaded from a file by pressing the “load setting” button.

Note: User must press the “Apply setting” button to enable the changes to parameters.

Possible assignment value for each parameter

Under the receive (Rx) channel parameter setup window, the content of each parameter

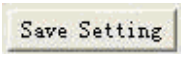
can be selected by pulling down the respective menu bar. The contents of each parameter are listed below.

Table 4-1 Possible Assignment Value For Each Rx Parameter

Menu Item	Possible assignment value	Default
Word Length	32, 25 bit	32
Baud Rate	12.5, 48, 50, 100 Kbps	12.5
Parity Check	Disable, odd, even	Disable
SDI Decode	Disable, 00,01,10,11 (binary)	Disable
Label Check	Disable, enable	Disable
L1	0~0xFF	00
L2	0~0xFF	00
L3	0~0xFF	00
L4	0~0xFF	00
L5	0~0xFF	00
L6	0~0xFF	00
L7	0~0xFF	00

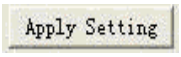
Buttons on Rx parameters setup page description:

"**Slect channel":** Select a singel Rx channel or multiple channles which you want to change the parameters.



"**Save Setting":** button: Save the Rx configuration into a txt file.

"**Load Setting":** button: Load Rx configuration from a exiting txt file.



"**Apply Setting**": button: Enabel the parameter changes.

If the Rx parameters setup done, you can observe it from the pulldown bar:

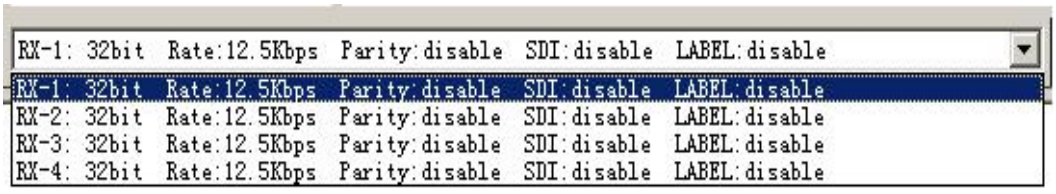


Figure 4-22 Parameter setting display

Once the Rx channel parameters get setup, each Rx channel will perform data receiving operations strictly according to the data format defined in the setup.

4.3.2 Tx Channel Parameter Setup

Click the “TX-1” button, you will enter the parameters setup page of the first Tx channel channel, shown in Figure 4-23.

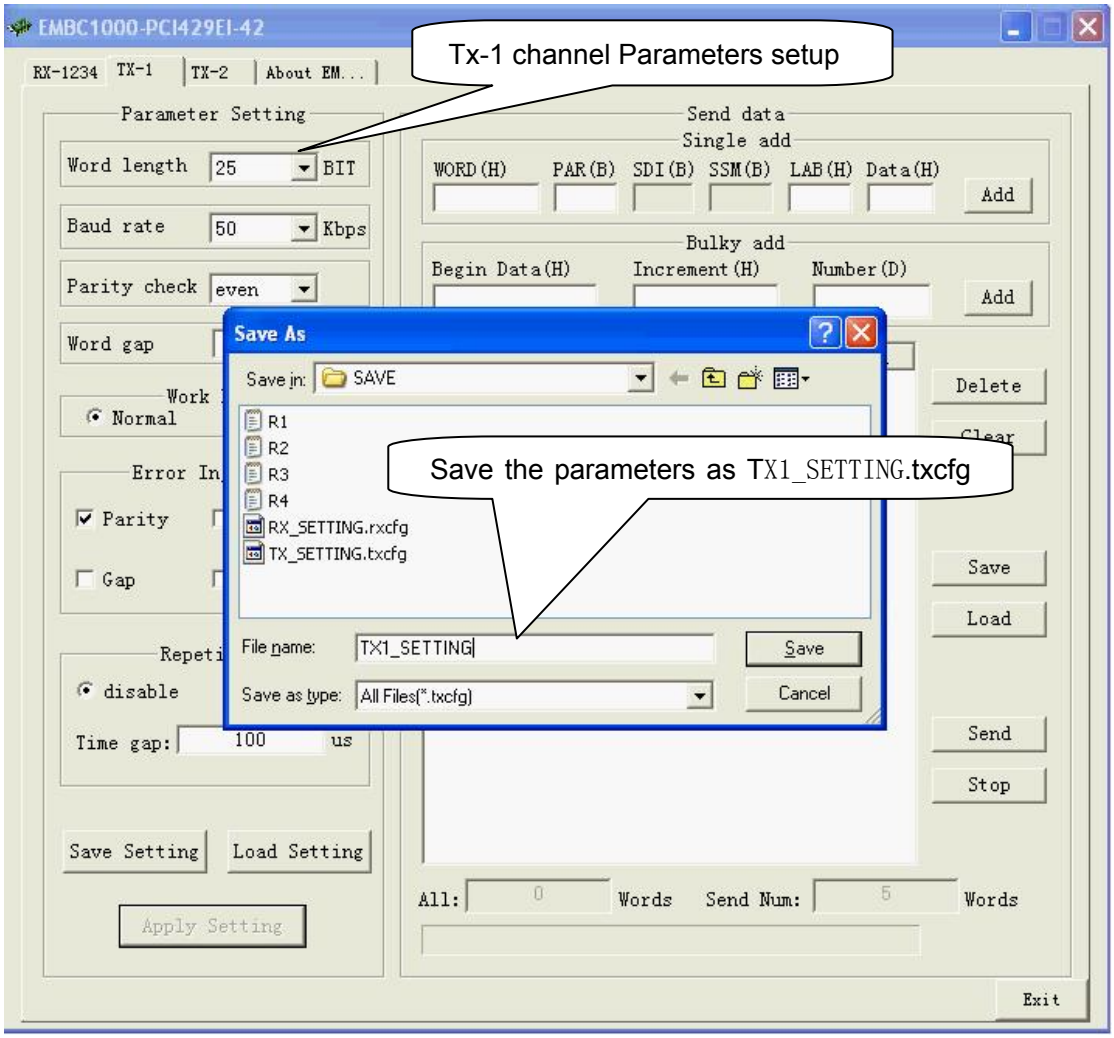


Figure 4-23 setup transmit channels’ parameter

In this window, you are free to change the Tx channel parameter such as: word length, baud rate, parity, word gap, repetition mode, error injiection and the work mode such as: “Normal mode” or “Loopback mode”. In the loopback mode, EMBC1000-PCI429EI can only receive the data from the internal Tx channels of the device, data from external target will be ignored. The configuration can be saved into a data file by pressing the “Save Setting” button, and an existing configuration can be loaded from a file by pressing the “load setting” button.

In the Repetition Mode, if “enable” is selected, the current data in “send data” area will be tramsitted repeatedly. The interval time between 2 sequential words is specified by ”Time gap” (ranged from 1 to 99,999,999 us), the repetition transmit will be terminated by press the “stop” button in “send data” area. In the Repetition Mode, if “disable” is selected, the current data will only be sent one time.

Note: User must click on the “Apply Setting” button to to make any parameter changes effecticve.

Click on the “TX-2”, you will enter the parameters setup window for transmit channel (Tx-2). The setting for this channel is identical to TX-1’s.

Possible assignment value for each parameter

Under the trasimit (Tx) channel parameter setup window, the content of each parameter can be selected by pulling down the respective menu bar. The contents of each parameter are listed below.

Table 4-2 Possible Assignment Value For Each Tx Parameter

Menu Item	Possible assignment value	Default
Word Length	32, 25	32
Baud Rate	12.5, 48, 50, 100	12.5
Parity Check	Disable, odd, even	Disable
Word Gap	5 ~ 255	10
Work Mode	Normal, Loopback	Normal
Repetition Mode *	Disable, Enable	Disable
Error injection **	Parity/Gap/Short Word/Long Word Error	No error injecting
Time gap ***	1 ~ 99,999,999 us	100 us

* The max number of data can be transmitted under Repetition Mode is 1024.

* The max number of data can be transmitted under Repetition Mode is 1024.

** You are free to inject the errors:

Parity error: the parity bit of the data will be opposite to the bit you defined.

Gap error: set the word gap to be 2 bit times;

Short word error: only send 30/23 bits in one word(32/25bit).

Long word error: send 34/27 bits in one word(32/25bit)..

Note: only of those error(gap error, short word error, long word error) can be injected at the same time.

*** Refers to the time gap between two Repetition transmits. Time gap can only be assigned a value when Repetition Mode is under “Enable”.

4.4 Data Transmission Operations

After the parameter setup is finished, the user can add the data into the “Send data” area for data transmission operations (by pressing “Send” button under the data transmit window).

The user can add the data into the “Send data” area, either in single or bulk mode.

In single mode, there is a dedicated data entry area under “Single add”, where one may simply put a digital number (in Hex) into the field of “WORD(H)”, or he may define the following detailes to compose a WORD to be sent: PAR(B), SDI(B), SSM(B), LAB(H), Data(H), which represents Parity, SDI check bits, SSM bits, Lable check and Data.

Table 4-3 The fields definition of Tx data

Field	Range
WORD(HEX)	0x00000000~0xFFFFFFFF
PAR(Binary)	0,1
SDI (Binary)	00,01,10,11
SSM (Binary)	00,01,10,11
LAB(HEX)	0x0~0xFF
DATA(HEX)	0x000000~0x7FFFF

In bulk mode, there is a dedicated data entry area under “Bulky add”, where one may simply create a base digital number (in Hex, here we defined it to ”Begin Data”), and define the increment and the toal number of data in the respective field, then it will automatically generate a set of data.

It is also possible for the user to use single mode entry method repeatedly to generate a set of data (bulk data) to tranmit.

For any data added into this field, it can be saved into a data file by pressing the “Save” button, and an existing data file can be loaded in pressing the “Load” button.

The user can press “Clear” button to clear all the data which have addedd in the “Send data” area. If you want to delete one word from the data added in the “Send data” area, you should select it and then press “Delete” button.

Each time, the total number of WORDs added shall counted and be displayed in the “All” field. And the total number of WORDs transmitted via this transmit channel shall be counted and displayed in the “Send Num” field.

Data transmission can be terminated any time by pressing “Stop” button.

1) Add single Tx data in WORD field

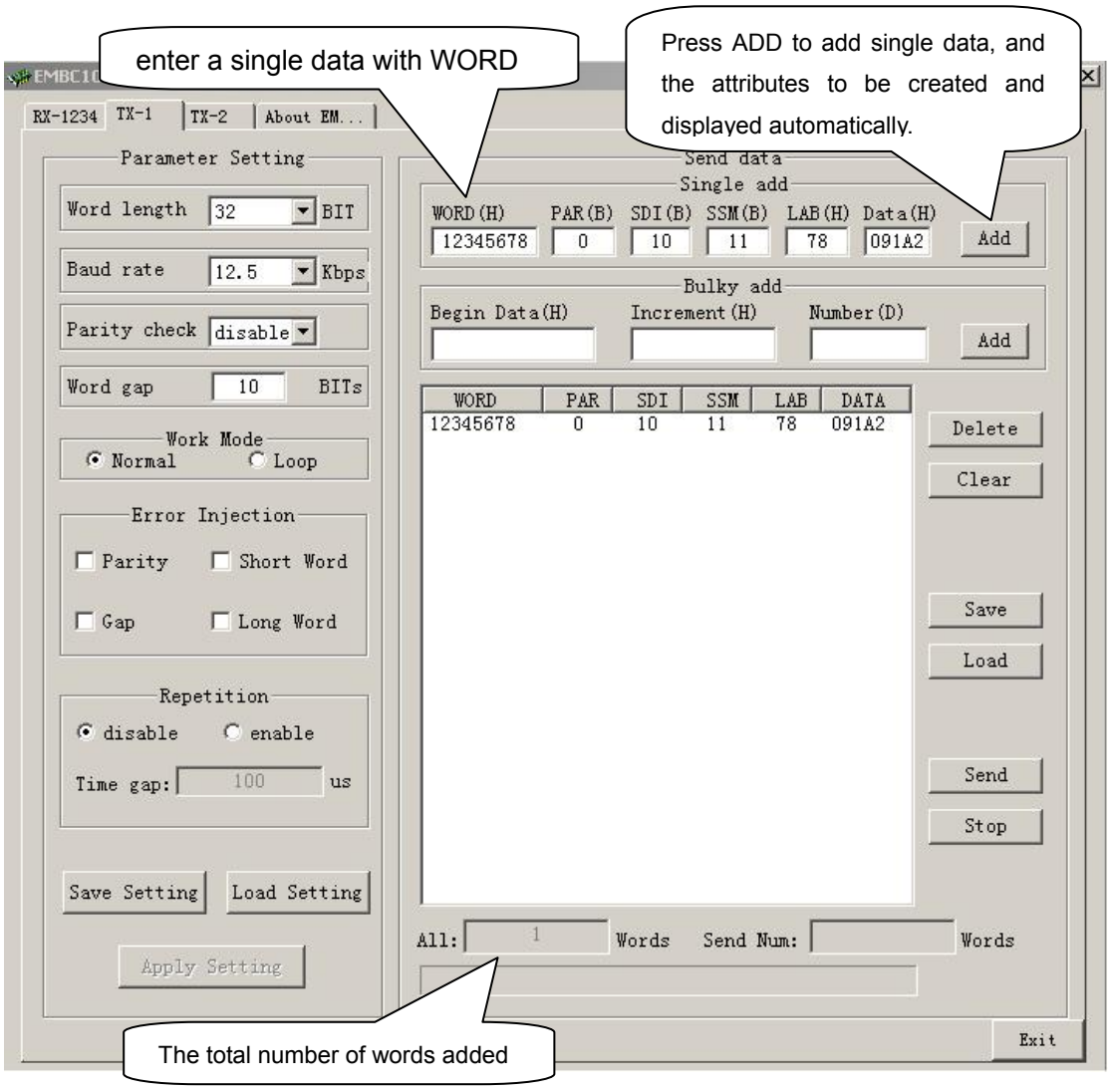


Figure 4-24 Add single data with WORD field

2) **Add single data in attribute fields**

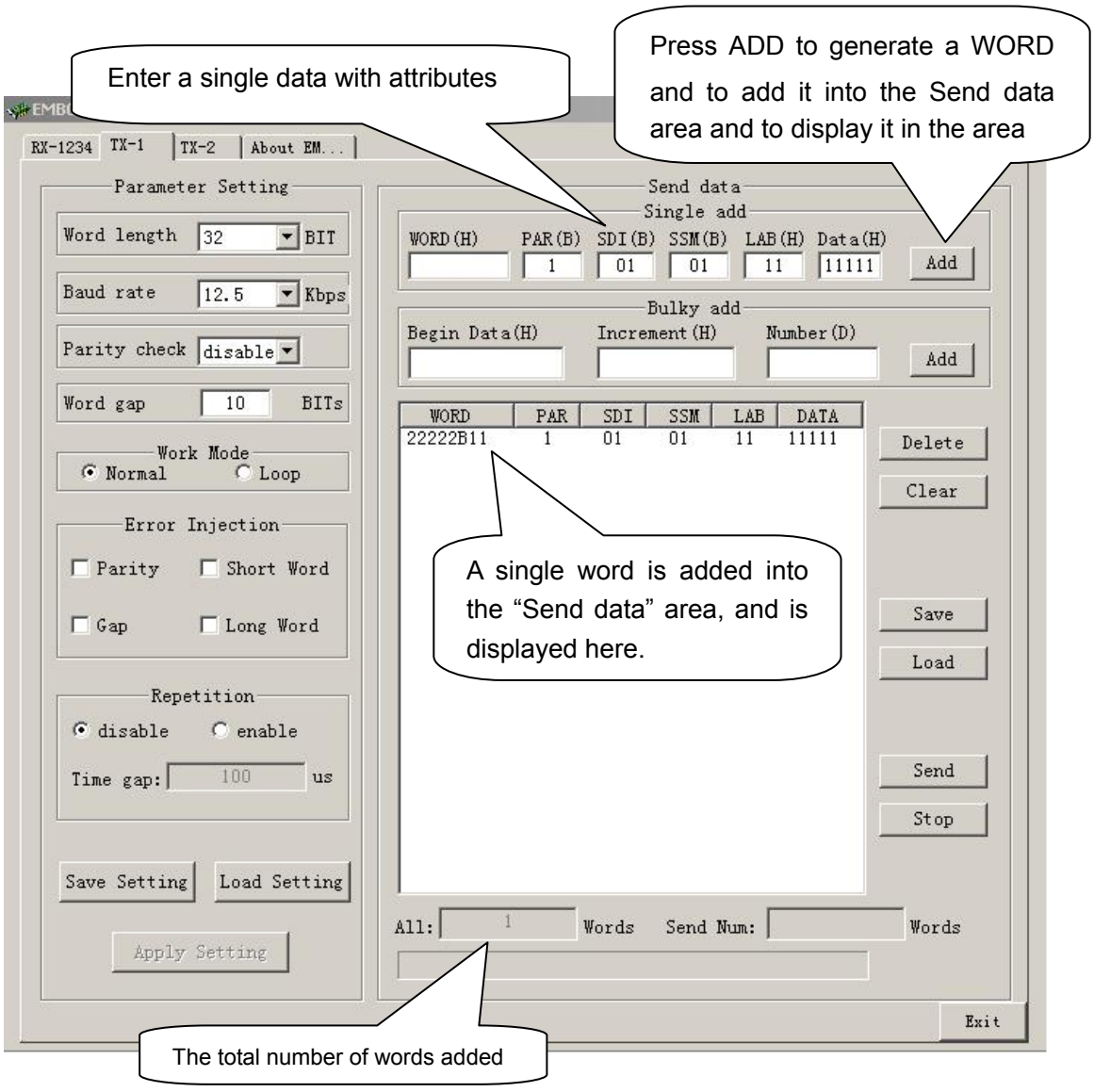


Figure 4-25 Add single data with attribute fields

3) Add Bulk data

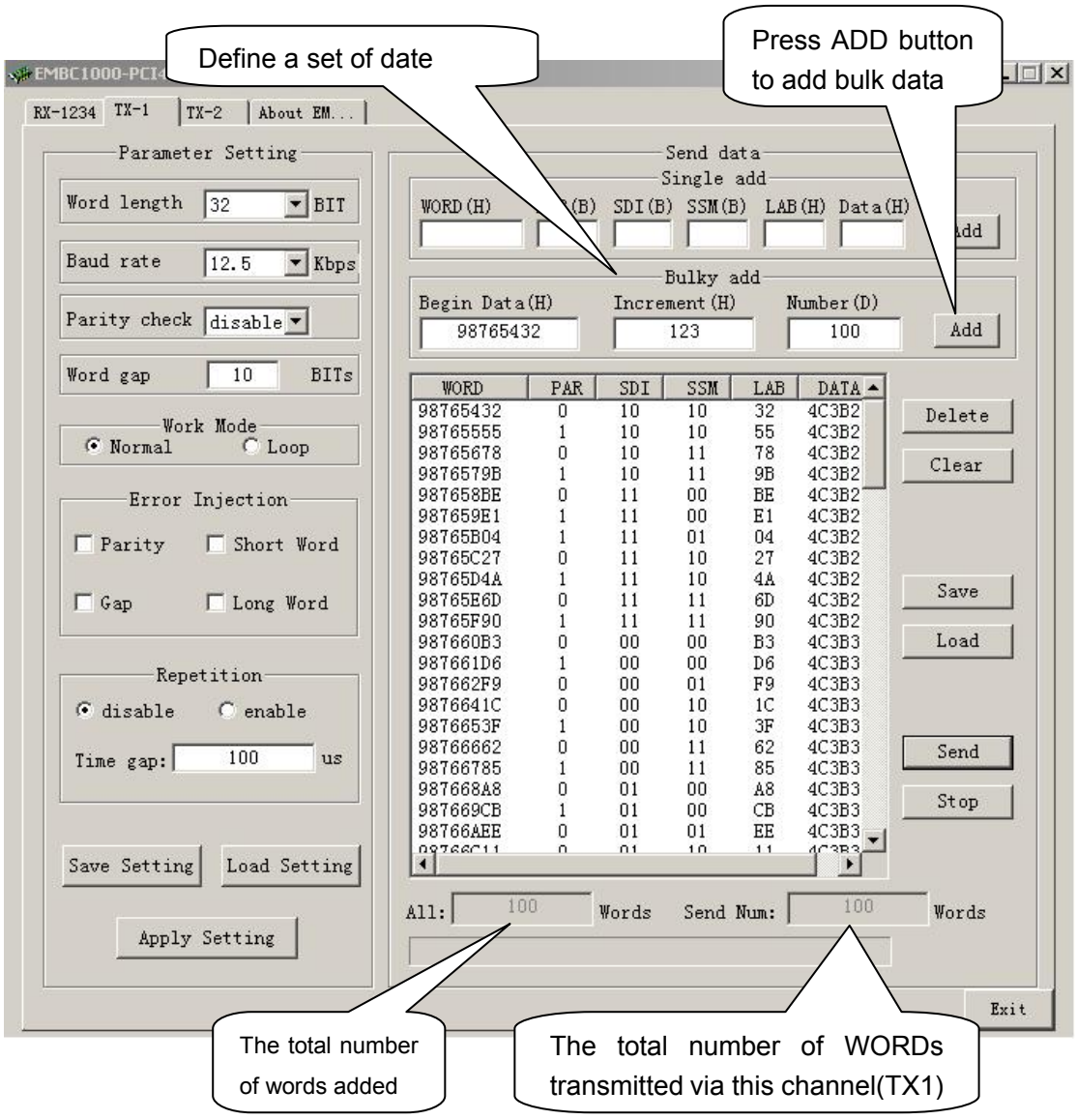


Figure 4-26 Add Bulky data

Attention: about the Data Format

The standard ARINC429 Data Word Format is different from the format of the data in the “Send data” or “Receive data” area, show in **Figure 4-27** and Figure 3-28 .

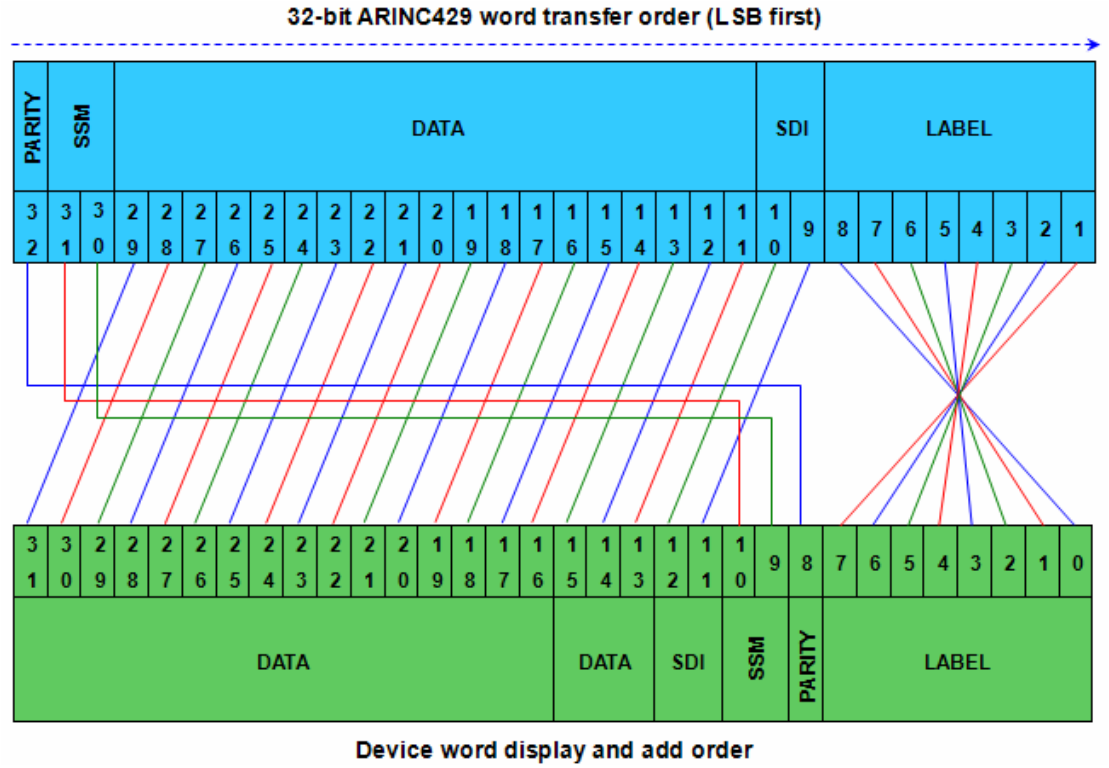


Figure 4-27 Mapping of ARINC429 Data in 32-bit Format

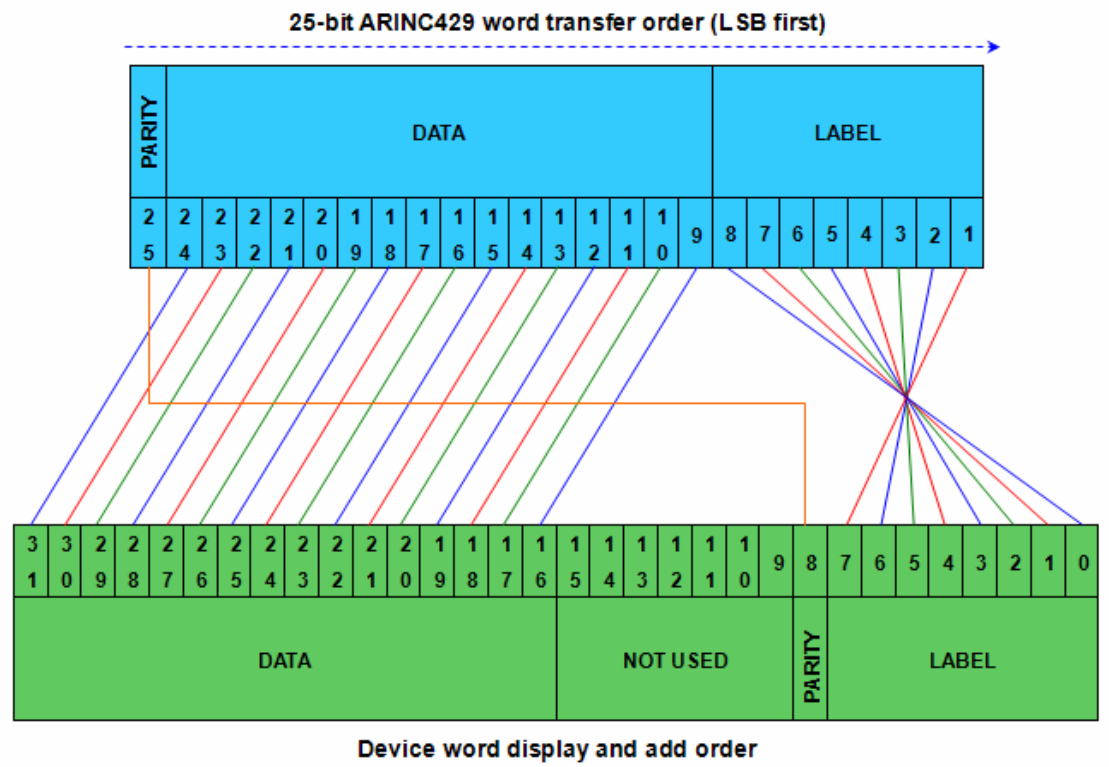


Figure 4-28 Mapping of ARINC429 Data in 25-bit Format

4.5 Data Receiving Operations

Data Receiving Operation is quite simple. Once the Rx channel parameter setup gets done, then the user can simply press “RX-1 Start”/“RX-2 Start”/“RX-3 Start”/“RX-4 Start” button to enable the RX1/RX2/RX3/RX4 channel to start to receive data from the connected ARINC429 target hardware. It is also very important that the communication protocols between target hardware and this card should be defined the same.

Please be advised that “RX-1 Start”/“RX-2 Start”/“RX-3 Start”/“RX-4 Start” buttons can be toggled. Once you press “RX-1 Start”/“RX-2 Start”/“RX-3 Start”/“RX-4 Start” once, it will be toggled into “RX-1 Stop”/“RX-2 Stop”/“RX-3 Stop”/“RX-4 Stop”.

To terminate Data Receiving operation, simply pressing “RX-1 Stop”/“RX-2 Stop”/“RX-3 Stop”/“RX-4 Stop” buttons again and, all buttons will then be toggled to “RX-1 Start”/“RX-2 Start”/“RX-3 Start”/“RX-4 Start” mode.

The data received and the total number of the data received will be displayed in the “Receive Data” area. It is advised that the “Receive Data” area only display 3000 words max. When more than 3000 words received, only the last 3000 words can be displayed.

The user can press “RX-1 Save”/“RX-2 Save”/“RX-3 Save”/“RX-4 Save” button to create a .txt data file to save all data received before pressing “RX-1 Start”/“RX-2 Start”/“RX-3 Start”/“RX-4 Start” button. Once the .txt data file created, then all data received will be saved into this .txt file for later analysis. The .txt data file can not be created if Data Receiving operation is still in progress.

The user can clear the data displayed on the “Receive Data” area by pressing “RX-1 Clear”/“RX-2 Clear”/“RX-3 Clear”/“RX-4 Clear” button.

The user can enable the automatic error detection function by selecting the button--“Error Detection”. And the error will be display on the “Receive Data” area, and the total number of the error detected will be display on the “Error Detection” area. The user can clear them by pressing “RX-1 Clear”/“RX-2 Clear”/“RX-3 Clear”/“RX-4 Clear” button.

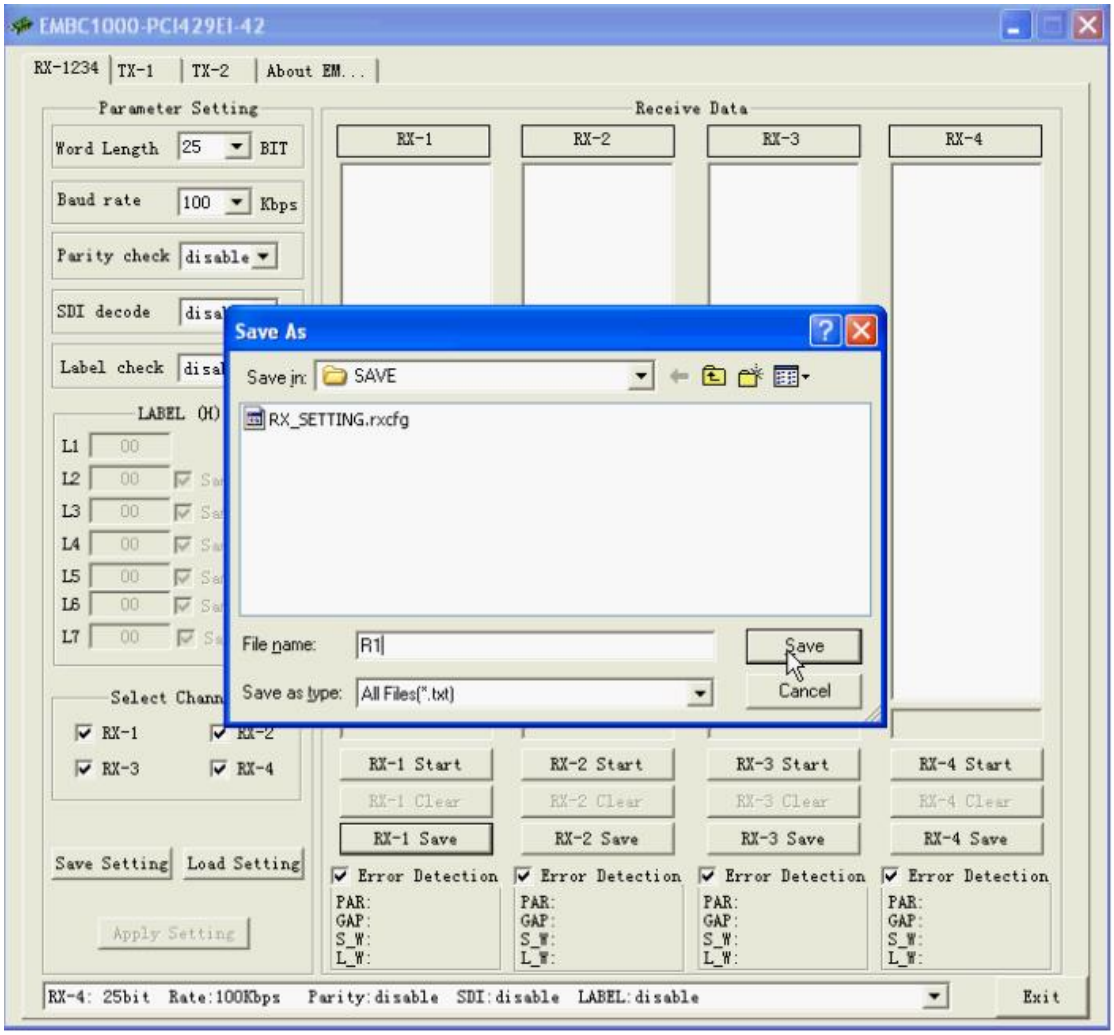


Figure 4-29 Create a .txt file to save Data Received

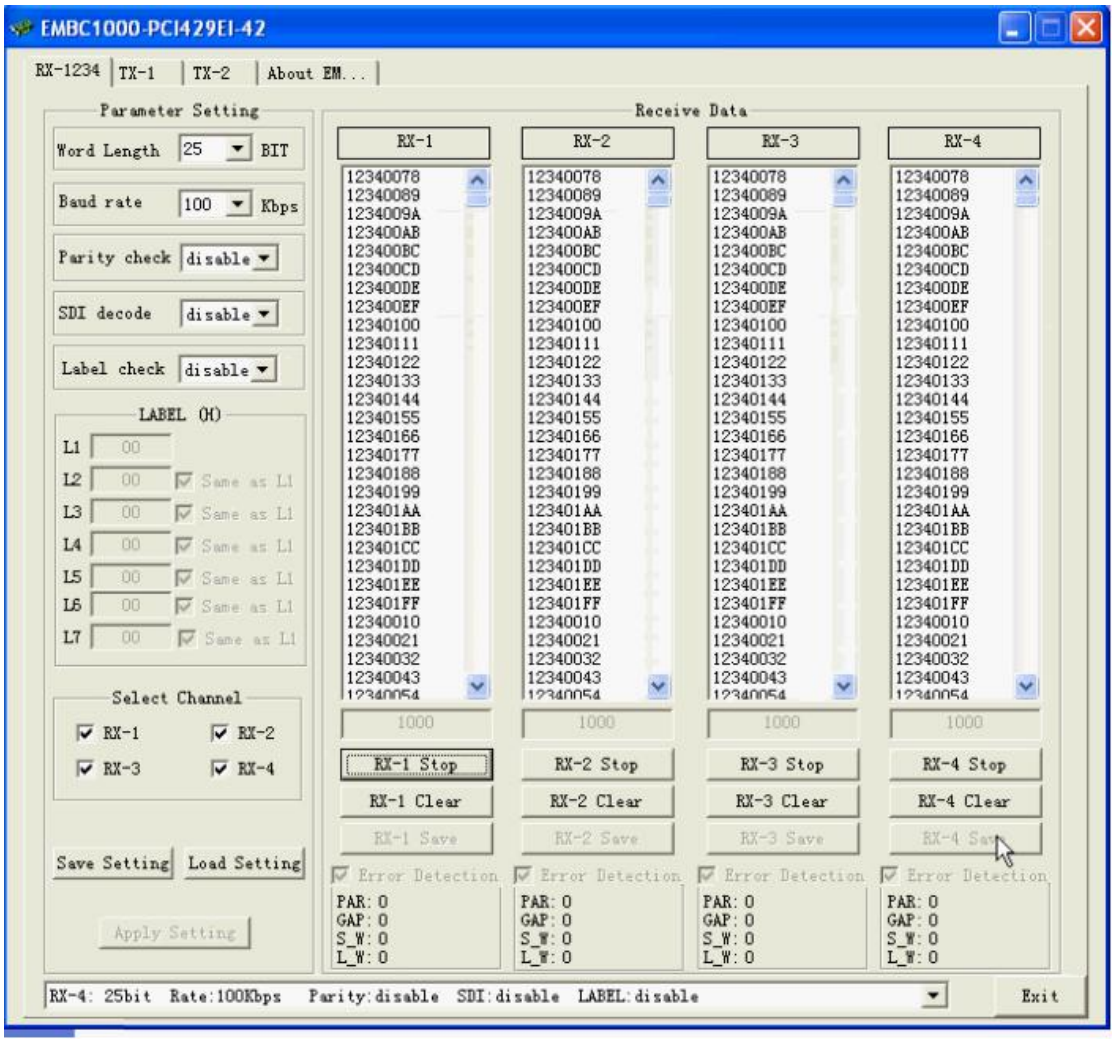


Figure 4-30 Data Receiving operations(Disable automatic error detection)

4.6 Error injection and error detection Operation

4.6.1 Transmit error injection

The user can enable the error injection when she doing the tx channel parameters setup.The user can selet parity error, gap error, short word error, long word error(**Figure 4-35**) to inject into the data transmit.

You are free to inject the errors:

1. Parity error: the parity bit of the data will be opposite to the bit you defined;
2. Gap error: set the word gap to be 2 bit times;
3. Short Word error: only send 30/23 bits in one word(32/25bit);
4. Long Word error: send 34/27 bits in one word(32/25bit).

Note: only of those error(gap error, short word error, long word error) can be injected at the same time.

Step about data receiving with automatic error detection:

1. Do parameter setup,just as the Word Length, Baud Rate, Parity Check, Work Mode, Error Injection, Repetition and so on;
2. Press the “Apply setting” button to enable the changes to parameters;
3. Add the data you want to send;
4. Press the “Send” buttons to send the data you added.

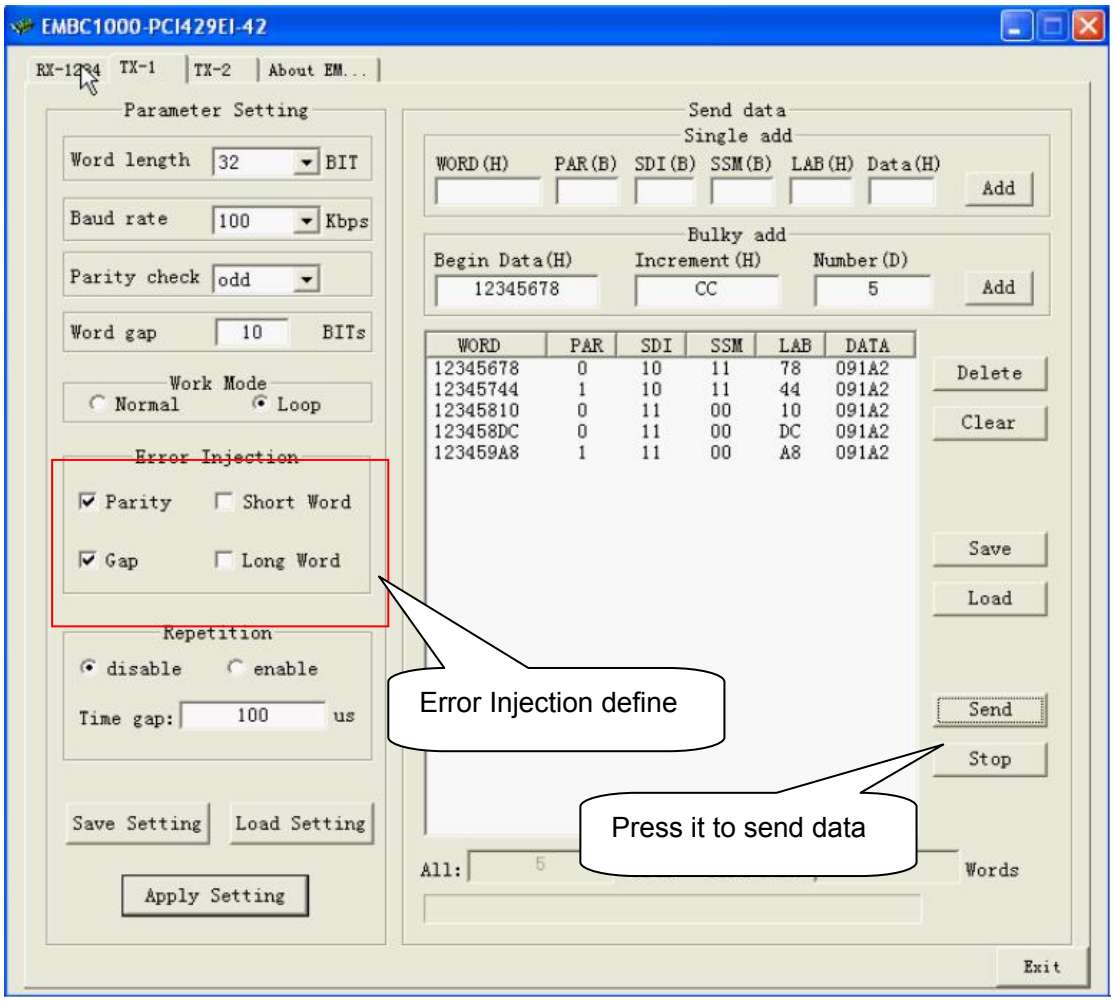


Figure 4-35 Error injection operation

Note: User must press the “Apply Setting” button to to make the error injection effecticve.

4.6.2 Automatic error detection in receive channels

Some error (such as: **Parity Error**, **Gap Error**, **Short Word Error**, **Long Word Error**) can be automatic detected when you enable the automatic error detection by select the button-- “Error Detection”.

Step about data receiving with automatic error detection:

1. Do parameter setup,just as the Word Length, Baud Rate, Parity Check, SDI Decode, Label Check and so on;
2. Select the channel which you want to it's parameters;
3. Press the "Apply setting" button to enable the changes to parameters;
4. Select the the "Error Detection" button to enable the error detection function, each channel has its own "Error Detection" button;
5. Press the "RX-1 Start"/"RX-2 Start"/"RX-3 Start"/"RX-4 Start" buttons to begin the Data Receiving operation.

Once some error detect from the receiving data, they will be display on the "Receive Data" area(just as: PE, GE, SE, LE, PG), and the total number of the error detected will be display on the "Error Detection" area. The user can clear them by pressing "RX-1 Clear"/"RX-2 Clear"/"RX-3 Clear"/"RX-4 Clear" button.

Table 4-4 Error detect form Receiving data

Error	Error description
PE	Parity Error
GE	Gap Error
SE	Short Word Error
LE	Long Word Error
PG	Parity and Gap Error

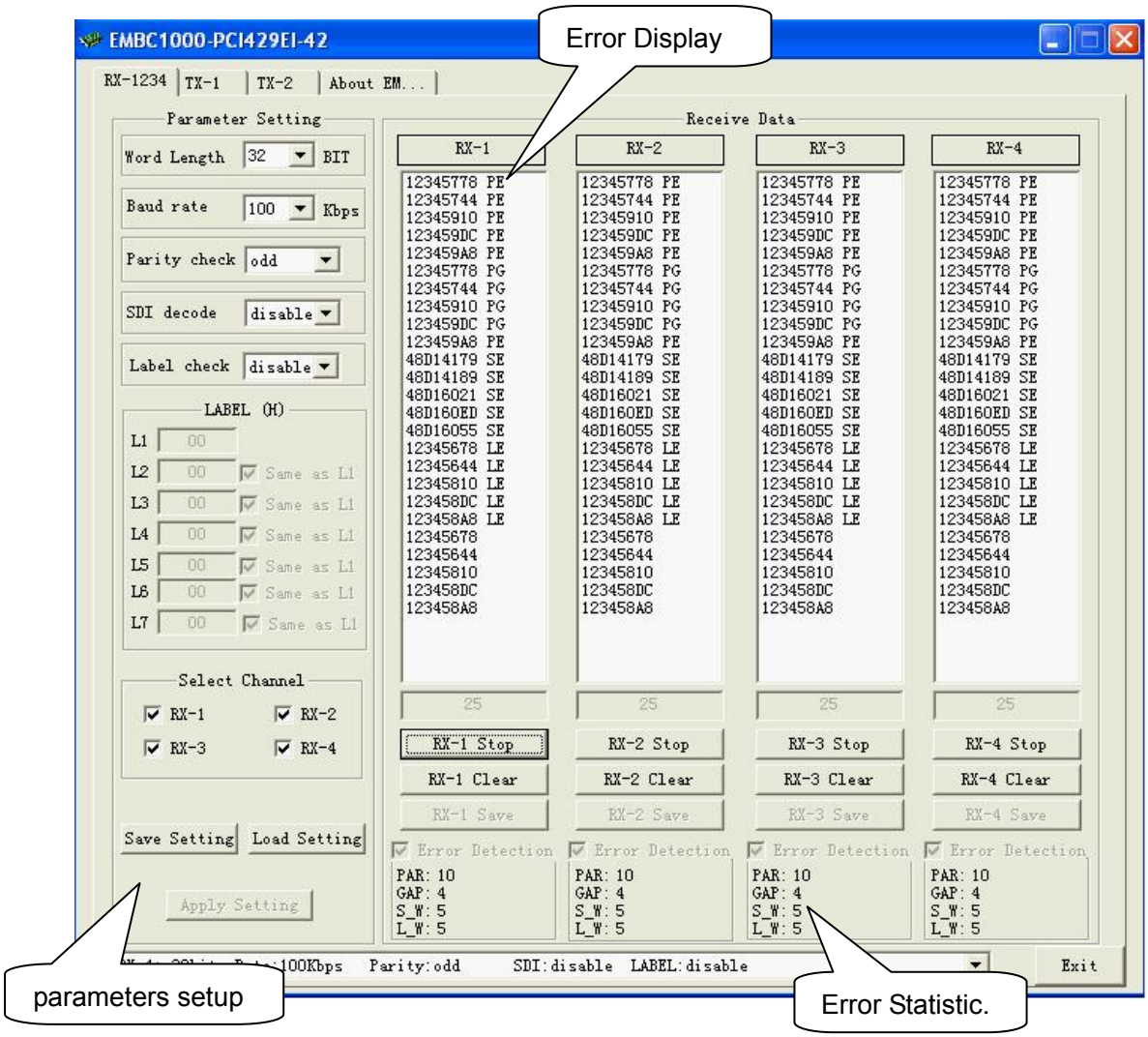


Figure 4-32 error detection operation

CHAPTER 5 Data Analysis Software

The ARINC429 data received can be analyzed with the provided **Data Analysis** software. The software will deal with the data either saved in the .txt data file or in the data field entered on-line.

Double click on the software Data Convert.exe(**G:\DataAnalysis**), you will see the main window showed in **Figure 5-1**.

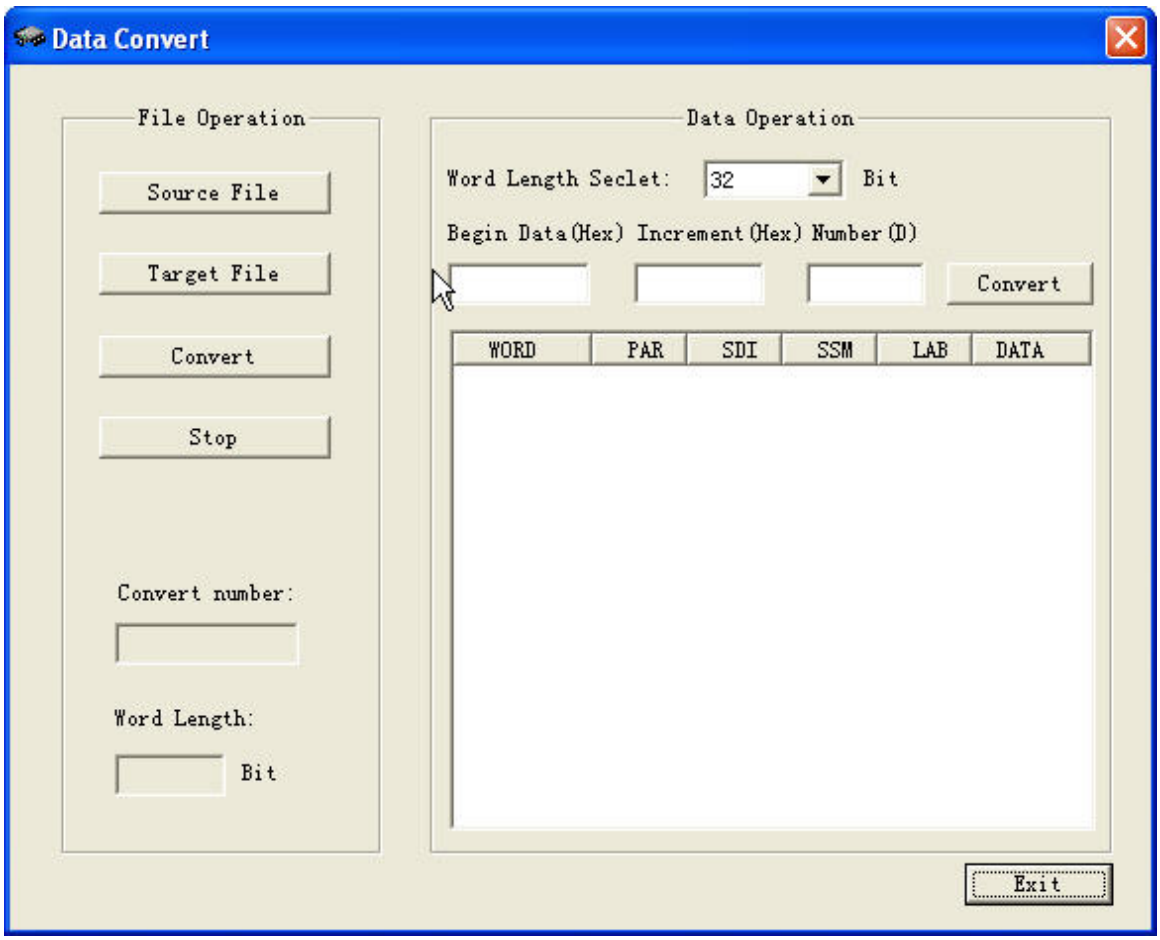


Figure 5-1 main window of Data Convert

The software will deal with the data either saved in the .txt data file or in the data operation field entered on-line.

1) Data **Conversion from a Data File**

In this way, user can analyze the ARINC429 data saved in the *.txt file (assume Source File.txt).

Click the "**Source File**" button to open the data file.

The ARINC429 data saved in the Source File are in Hex, the first line is always the

definition of the word length (25 or 32 bit), following are the data (each word per line) , shown in **Figure 5-3.**

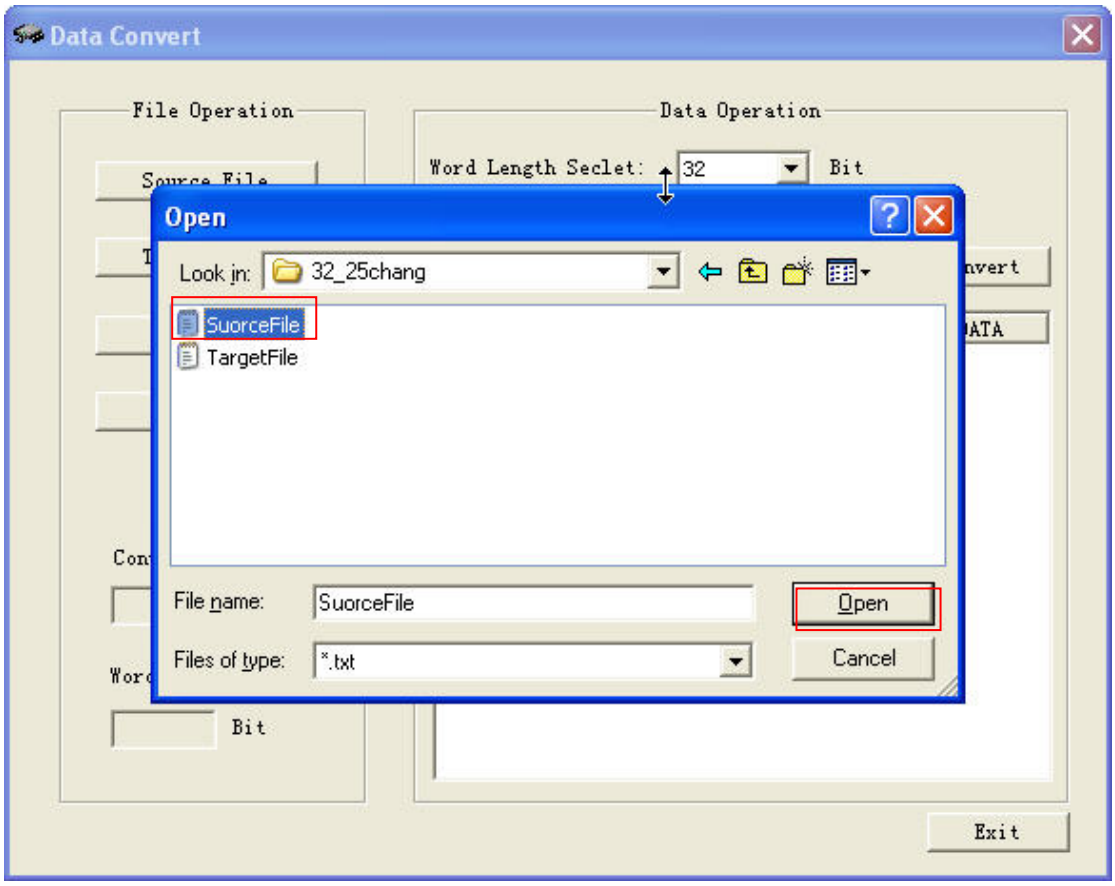


Figure 5-2 open a source file

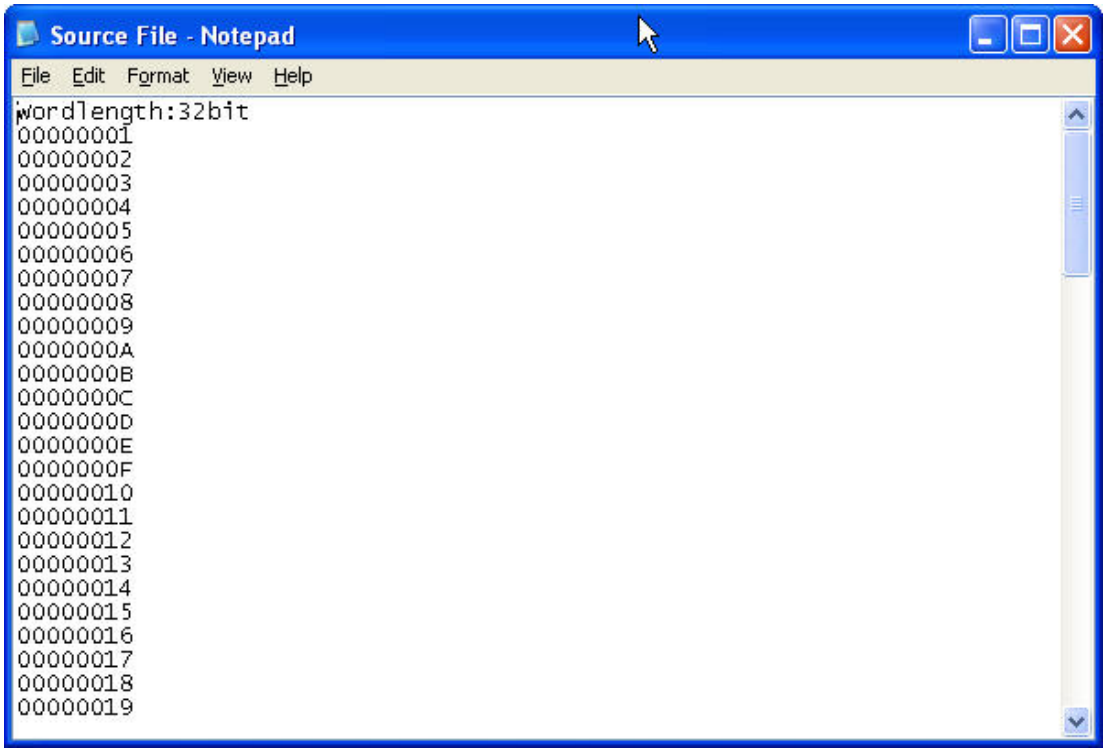


Figure 5-3 Source File

Then, you need to create a target file to save such conversion. Click the "**Target File**" button to open a *.txt file (assume Target File.txt) which saved the results of the analysis (actually, conversion results so far), shown in **Figure 5-4.**

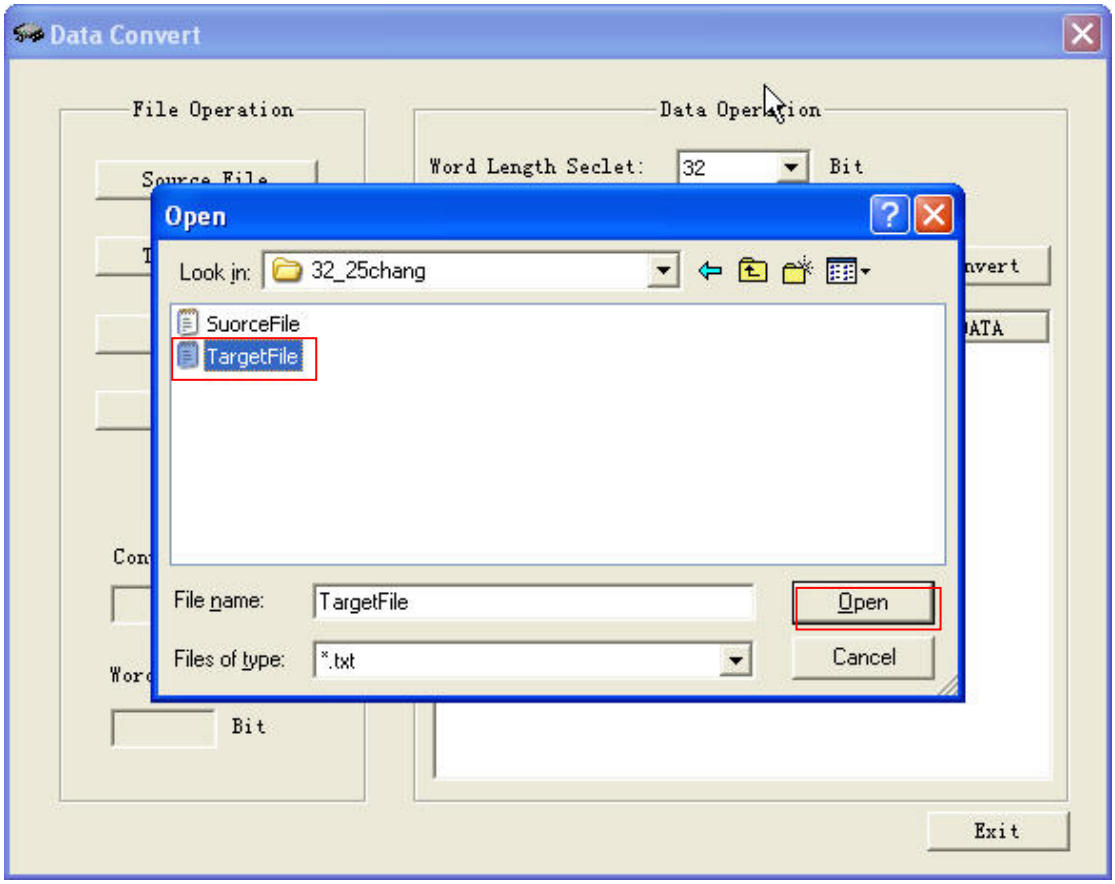


Figure 5-4 open Target File

Click the "**Convert**" button, when the analysis (conversion) is completed, the "Convert **number**" area will show the total number of the words analysed. And then you can open the Target File(Target File.txt) to study the results, shown in **Figure 5-5** and **Figure 5-6.**

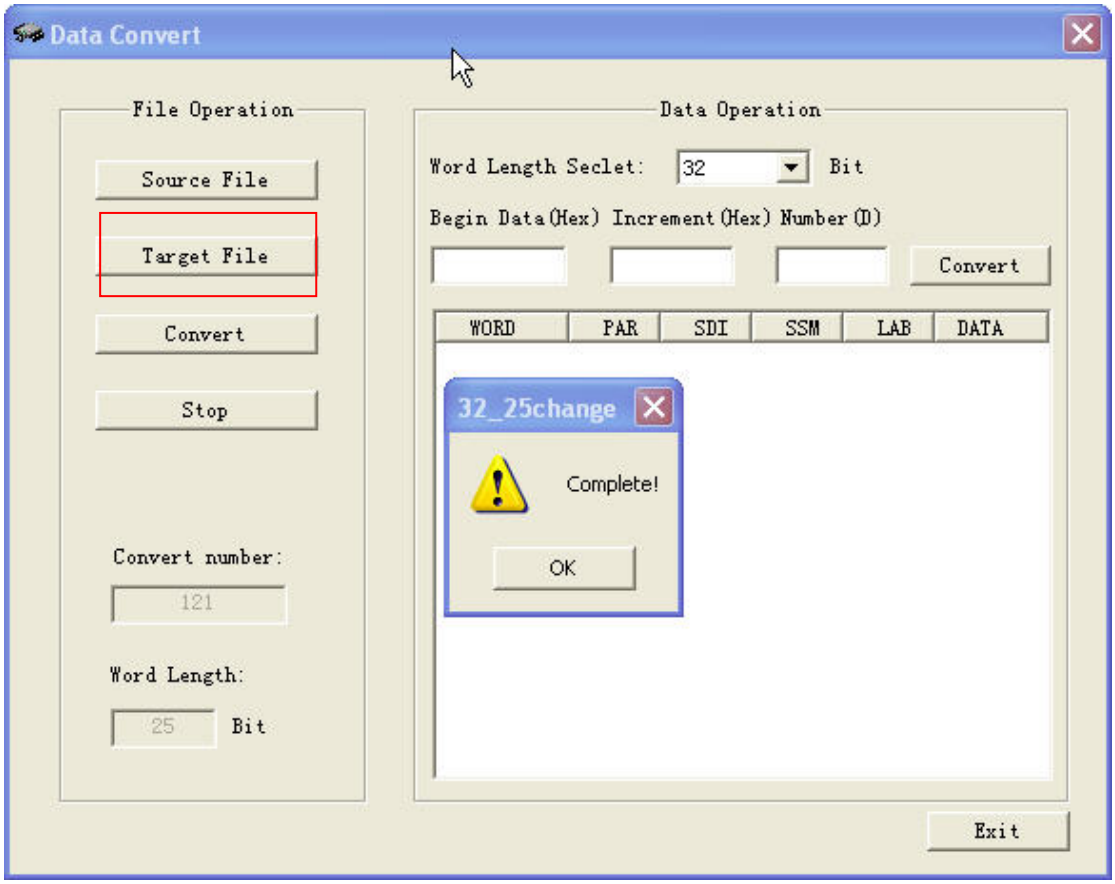


Figure 5-5 Conversion completed

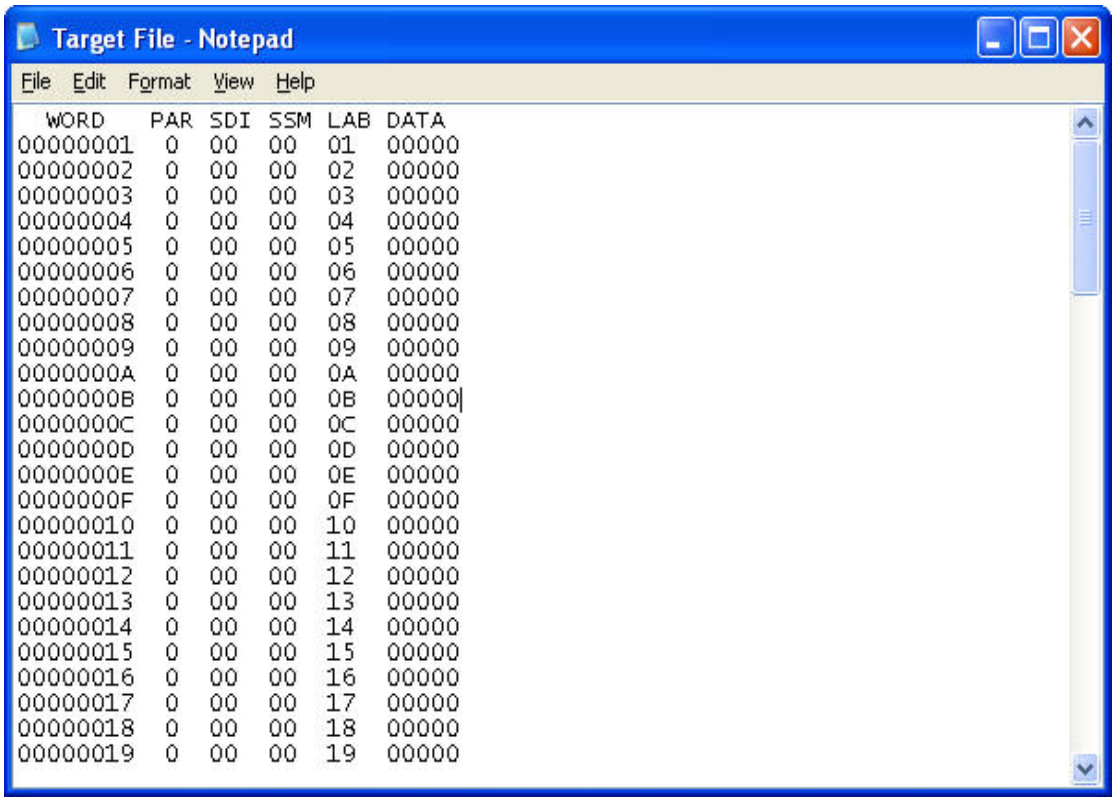


Figure 5-6 Target File

2) Data Conversion in Data Operation field

There is a dedicated data entry area under "**Data Operation**". One may simply create a set of data by using the base digital number (in Hex, here we termed it to be "**Begin Data**"), defining the increment(accept 0 to 0xFFFFF) and the toal number(accept 0 to 65535) of data in the respective field.

Once the data is configured, you may click on the "Convert" button, it will automatically generate a set of data and perform conversion over them automatically. The attributes such as PAR, SDI, SSM, LAB, DATA, etc. will be generated and displayed in the "**Data Display Area**", shown in **Figure 5-7.**

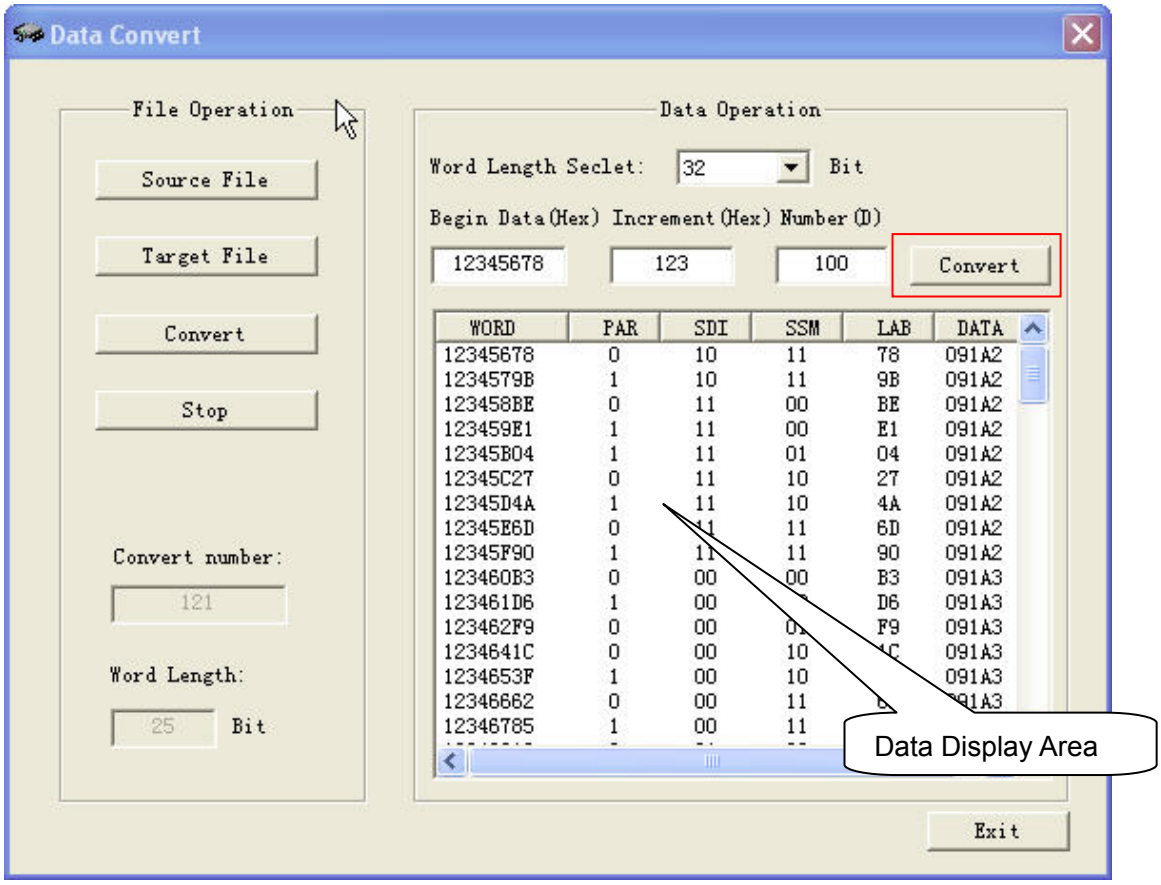


Figure 5-7 data conversion in Data Operation field

CHAPTER 6 Develop Your own Application Software

To allow the user to develop his own application software or project, EMBC1000-PCI429EI card comes with drivers software, API (Application Programming Interface) library and user oriented application software, running under Windows 2000 or Windows XP. The user oriented application software has been designed with the capabilities of simulating the outputs of various airborne systems, receiving inputs from these systems, and providing bus data analysis functions. API library is also provided together with example source code (Visual C++), which allow users to easily develop their own application software or project based on the real world applications.

6.1 Application Programming Interface

When you begin to develop your own application software for this PCI card, you should finish the settings below in you project(build in Visual C++ 6.0):

Copy PCI_LINK3.dll, PCI_LINK3.lib, wdapi901.dll, wdapi901.lib (you can find them in CD-ROM\UserDesign\APILibrary) to your project working directory.

Add the PCI_LINK3.lib and wdapi901.lib to the project: Project→Setting→Link, shown in **Figure 6-1:**

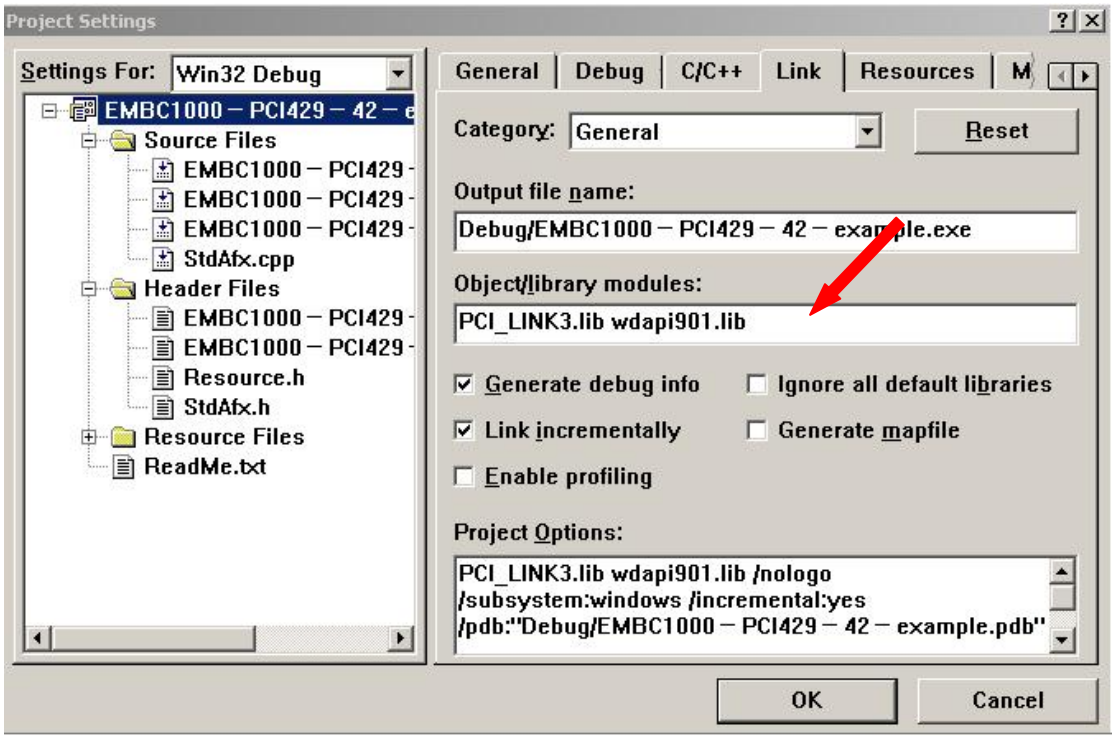


Figure 6-1 Add the PCI_LINK3.lib and wdapi901.lib to the project

Edit the head file, refer to the source code below:

```
// EMBC1000－PCI429－42－exampleDlg.h : header file
#if  !defined(AFX_EMBC1000PCI42942EXAMPLEDLG_H__5ACC0538_C64A_4316_8
DDD_9A1CA8B3A7CF__INCLUDED_)
#define
AFX_EMBC1000PCI42942EXAMPLEDLG_H__5ACC0538_C64A_4316_8DDD_9A1C
A8B3A7CF__INCLUDED_
#if _MSC_VER > 1000
#pragma once
#endif // _MSC_VER > 1000
typedef void * WDC_DEVICE_HANDLE;
/////////////////////////////////////////////////////////////////////////////
// CEMBC1000PCI42942exampleDlg dialog
class CEMBC1000PCI42942exampleDlg : public CDialog
{
// Construction
public:
	CEMBC1000PCI42942exampleDlg(CWnd* pParent = NULL);   //standard
constructor
// Dialog Data
	//{{AFX_DATA(CEMBC1000PCI42942exampleDlg)
	enum { IDD = IDD_EMBC1000PCI42942EXAMPLE_DIALOG };
	//}}AFX_DATA
	// ClassWizard generated virtual function overrides
	//{{AFX_VIRTUAL(CEMBC1000PCI42942exampleDlg)
	protected:
	virtual void DoDataExchange(CDataExchange* pDX); // DDX/DDV support
	//}}AFX_VIRTUAL
// Implementation
protected:
	HICON m_hIcon;
	// Generated message map functions
	//{{AFX_MSG(CEMBC1000PCI42942exampleDlg)
	virtual BOOL OnInitDialog();
	afx_msg void OnSysCommand(UINT nID, LPARAM lParam);
	afx_msg void OnPaint();
	afx_msg HCURSOR OnQueryDragIcon();
	afx_msg void OnInit();
	afx_msg void OnTX1Init();
	afx_msg void OnTX2Init();
	afx_msg void OnRX1Init();
	afx_msg void OnRX2Init();
	afx_msg void OnRX3Init();
	afx_msg void OnRX4Init();
```

```
    afx_msg void OnSendDataTX2();
    afx_msg void OnSendDataTX1();
    afx_msg void OnClose();
    afx_msg void OnRxread();
    afx_msg void OnRx1read();
    afx_msg void OnRx2read();
    afx_msg void OnRx3read();
    afx_msg void OnRx4read();
    //}}AFX_MSG
    DECLARE_MESSAGE_MAP()
};
#pragma comment(lib,"PCI_LINK3.lib")
extern "C" _declspec(dllexport) WDC_DEVICE_HANDLE DeviceFindAndOpen(int
Board_num);
extern "C" _declspec(dllexport) DWORD OBT429TOPCI_LibInit(void);
extern "C" _declspec(dllexport) int RX_DATA( WDC_DEVICE_HANDLE hDev,
unsigned int RX_N, unsigned int RX_DATA[256], unsigned int fifo_leve);
extern "C" _declspec(dllexport) int TX1_SEND(WDC_DEVICE_HANDLE hDev,
unsigned int txdata[64], int fifo_leve);
extern "C" _declspec(dllexport) int TX2_SEND(WDC_DEVICE_HANDLE hDev,
unsigned int txdata[64], int fifo_leve);
extern "C" _declspec(dllexport) void RX1_INIT(WDC_DEVICE_HANDLE hDev,
                    unsigned int enable,      // (0, 1)
                    unsigned int word_length,          // (25, 32)
                    unsigned int parity_select,    // (0,1,2)
                    unsigned int label_enable,    // (0,1)
                    unsigned int sdi,          // (0,1)
                    unsigned int scaler,               // (0~65535)
                    unsigned int label1,
                    unsigned int label2,
                    unsigned int label3,
                    unsigned int label4,
                    unsigned int label5,
                    unsigned int label6,
                    unsigned int label7
                  );
extern "C" _declspec(dllexport) void RX2_INIT(WDC_DEVICE_HANDLE hDev,
                    unsigned int enable,      // (0, 1)
                    unsigned int word_length,          // (25, 32)
                    unsigned int parity_select,    // (0,1,2)
                    unsigned int label_enable,    // (0,1)
                    unsigned int sdi,          // (0,1)
                    unsigned int scaler,               // (0~65535)
                    unsigned int label1,
```

```
                    unsigned int label2,
                    unsigned int label3,
                    unsigned int label4,
                    unsigned int label5,
                    unsigned int label6,
                    unsigned int label7
                   );
extern "C" _declspec(dllexport)   void RX3_INIT(WDC_DEVICE_HANDLE hDev,
                    unsigned int enable,       // (0, 1)
                    unsigned int word_length,          // (25, 32)
                    unsigned int parity_select,    // (0,1,2)
                    unsigned int label_enable,    // (0,1)
                    unsigned int sdi,          // (0,1)
                    unsigned int scaler,                //
                    unsigned int label1,
                    unsigned int label2,
                    unsigned int label3,
                    unsigned int label4,
                    unsigned int label5,
                    unsigned int label6,
                    unsigned int label7
                   );
extern "C" _declspec(dllexport)   void RX4_INIT(WDC_DEVICE_HANDLE hDev,
                    unsigned int enable,       // (0, 1)
                    unsigned int word_length,          // (25, 32)
                    unsigned int parity_select,    // (0,1,2)
                    unsigned int label_enable,    // (0,1)
                    unsigned int sdi,          // (0,1)
                    unsigned int scaler,                // (0~65535)
                    unsigned int label1,
                    unsigned int label2,
                    unsigned int label3,
                    unsigned int label4,
                    unsigned int label5,
                    unsigned int label6,
                    unsigned int label7
                   );
extern "C" _declspec(dllexport) void TX1_INIT(WDC_DEVICE_HANDLE hDev,
unsigned int enable, unsigned int word_length, unsigned int parity, unsigned int scaler,
unsigned int tgap, unsigned int mode);
extern "C" _declspec(dllexport) void TX2_INIT(WDC_DEVICE_HANDLE hDev,
unsigned int enable, unsigned int word_length, unsigned int parity, unsigned int scaler,
unsigned int tgap, unsigned int mode);
extern "C" _declspec(dllexport) void RX_ENABLE(WDC_DEVICE_HANDLE
```

```
hDev,unsigned int num,unsigned int enable);
extern "C" _declspec(dllexport) void TX_ENABLE(WDC_DEVICE_HANDLE hDev,unsigned int num,unsigned int enable);
extern "C" _declspec(dllexport) void DeviceClose(WDC_DEVICE_HANDLE hDev);
extern "C" _declspec(dllexport) void OBT429_RESET(WDC_DEVICE_HANDLE hDev);

//{{AFX_INSERT_LOCATION}}
// Microsoft Visual C++ will insert additional declarations immediately before the previous line.
#endif
// !defined(AFX_EMBC1000PCI42942EXAMPLEDLG_H__5ACC0538_C64A_4316_8DDD_9A1CA8B3A7CF__INCLUDED_)
```

Now the API setup is done. When you build your project, VC++ will link the APIs automatically and add them to your project.

6.2 Example Source Code

This example source code will show you how to use the API. Detailed info is given in CD-ROM (G:\ UserDesign\sample).

6.3 API Function Description

1. Card Initialization Function: OBT429TOPCI_LibInit()

Name	DWORD OBT429TOPCI_LibInit(void)
Function	Initialize the card
Parameter	Void
Return Value	DWORD

2. Getting the handle: DeviceFindAndOpen()

Name	WDC_DEVICE_HANDLE DeviceFindAndOpen(int Board_num)
Function	Get the handle of card
Parameter	Board_num: the number of the PCI slot which the card insertedpossible assignment value : 0 to 255
Return Value	WDC_DEVICE_HANDLE hDevX

3. Reset the card: OBT429_RESET()

Name	void OBT429_RESET(WDC_DEVICE_HANDLE hDev)
Function	Reset the card (Note：After resetting, all channels' parameters will be the default value.)
Parameter	hDev: handle of the card
Return Value	void

4. Set the parameters of RX-1: RX1_INIT()

Name	void RX1_INIT(WDC_DEVICE_HANDLE hDev, unsigned int enable, unsigned int word_length, unsigned int parity_select,unsigned int label_enable, unsigned int sdi,unsigned int scaler, unsigned int fifo_half_level, unsigned int label1, unsigned int label2, unsigned int label3, unsigned int label4, unsigned int label5, unsigned int label6, unsigned int label7)
Function	Set the first receive channel's parameters
Parameter	hDev: handle of the card enable: enable the receive channel(RX1) possible assignment value : 0:disable 1: enable word_length: word length possible assignment value : 0:32bits 1: 25bits parity_select: set parity check possible assignment value: 0:disable 1: odd 2: even label_enable: enable the label check possible assignment value : 0:disable 1: enabl sdi: set SDI check possible assignment value : 0:disable 1: SDI=00 2: SDI=01 3: SDI=10 4: SDI=11 Scaler: set Buad rate possible assignment value : 0:12.5Kbps 1: 48Kbps 2: 100Kbps 3: 50Kbps fifo_half_level: set fifo_half level possible assignment value: 0~1023 label1: possible assignment value: 0~0xFF label2: possible assignment value: 0~0xFF label3: possible assignment value: 0~0xFF label4: possible assignment value: 0~0xFF

	label5: possible assignment value: 0~0xFF label6: possible assignment value: 0~0xFF label7: possible assignment value: 0~0xFF
Return Value	void

5. Set the parameters of RX-2: RX2_INIT()

Name	void RX2_INIT(WDC_DEVICE_HANDLE hDev, unsigned int enable, unsigned int word_length, unsigned int parity_select,unsigned int label_enable, unsigned int sdi,unsigned int scaler, unsigned int fifo_half_level, unsigned int label1, unsigned int label2, unsigned int label3, unsigned int label4, unsigned int label5, unsigned int label6, unsigned int label7)
Function	Set the second receive channel's parameters
Parameter	hDev: handle of the card enable: enable the receive channel(RX2) possible assignment value: 0:disable 1: enable word_length: word length possible assignment value: 0:32bits 1: 25bits parity_select: set parity check possible assignment value: 0:disable 1: odd 2: even label_enable: enable the label check possible assignment value: 0:disable 1: enabl sdi: set SDI check possible assignment value: 0:disable 1: SDI=00 2: SDI=01 3: SDI=10 4: SDI=11 Scaler: set Buad rate possible assignment value: 0:12.5Kbps 1: 48Kbps 2: 100Kbps 3: 50Kbps fifo_half_level: set fifo_half level possible assignment value: 0~1023 label1: possible assignment value: 0~0xFF label2: possible assignment value: 0~0xFF label3: possible assignment value: 0~0xFF label4: possible assignment value: 0~0xFF label5: possible assignment value: 0~0xFF label6: possible assignment value: 0~0xFF label7: possible assignment value: 0~0xFF
Return Value	void

6. Set the parameters of RX-3: RX3_INIT()

Name	void RX3_INIT(WDC_DEVICE_HANDLE hDev, unsigned int enable, unsigned int word_length, unsigned int parity_select,unsigned int label_enable, unsigned int sdi,unsigned int scaler, unsigned int fifo_half_level, unsigned int label1, unsigned int label2, unsigned int label3, unsigned int label4, unsigned int label5, unsigned int label6, unsigned int label7)
Function	Set the third receive channel's parameters
Parameter	hDev: handle of the card enable: enable the receive channel(RX3) possible assignment value: 0:disable 1: enable word_length: word length possible assignment value: 0:32bits 1: 25bits parity_select: set parity check possible assignment value: 0:disable 1: odd 2: even label_enable: enable the label check possible assignment value: 0:disable 1: enabl sdi: set SDI check possible assignment value: 0:disable 1: SDI=00 2: SDI=01 3: SDI=10 4: SDI=11 Scaler: set Buad rate possible assignment value: 0:12.5Kbps 1: 48Kbps 2: 100Kbps 3: 50Kbps fifo_half_level: set fifo_half level possible assignment value: 0~1023 label1: possible assignment value: 0~0xFF label2: possible assignment value: 0~0xFF label3: possible assignment value: 0~0xFF label4: possible assignment value: 0~0xFF label5: possible assignment value: 0~0xFF label6: possible assignment value: 0~0xFF label7: possible assignment value: 0~0xFF
Return Value	void

7. Set the parameters of RX-4: RX4_INIT()

Name	void RX4_INIT(WDC_DEVICE_HANDLE hDev, unsigned int enable, unsigned int word_length, unsigned int parity_select,unsigned int label_enable, unsigned int sdi,unsigned int scaler, unsigned int fifo_half_level, unsigned int label1, unsigned int label2, unsigned int label3, unsigned int label4, unsigned int label5, unsigned int label6, unsigned int label7)
Function	Set the fourth receive channel's parameters
Parameter	hDev: handle of the card enable: enable the receive channel(RX4) possible assignment value: 0:disable 1: enable word_length: word length possible assignment value: 0:32bits 1: 25bits parity_select: set parity check possible assignment value: 0:disable 1: odd 2: even label_enable: enable the label check possible assignment value: 0:disable 1: enabl sdi: set SDI check possible assignment value: 0:disable 1: SDI=00 2: SDI=01 3: SDI=10 4: SDI=11 Scaler: set Buad rate possible assignment value: 0:12.5Kbps 1: 48Kbps 2: 100Kbps 3: 50Kbps fifo_half_level: set fifo_half level possible assignment value: 0~1023 label1: possible assignment value: 0~0xFF label2: possible assignment value: 0~0xFF label3: possible assignment value: 0~0xFF label4: possible assignment value: 0~0xFF label5: possible assignment value: 0~0xFF label6: possible assignment value: 0~0xFF label7: possible assignment value: 0~0xFF
Return Value	void

8. Set the parameters of TX-1: TX1_INIT()

Name	void TX1_INIT(WDC_DEVICE_HANDLE hDev, unsigned int enable, unsigned int word_length, unsigned int parity, unsigned int scaler, unsigned int fifo_half_level, unsigned int tgap, unsigned int mode)
Function	Set the first transmit (TX1) channel's parameters
Parameter	hDev: handle of the card enable: enable the transmit channel(TX1) possible assignment value: 0:disable 1: enable word_length: word length possible assignment value: 0:32bits 1: 25bits parity_select: set parity check possible assignment value: 0:disable 1: odd 2: even Scaler: set Buad rate possible assignment value: 0:12.5Kbps 1: 48Kbps 2: 100Kbps 3: 50Kbps fifo_half_level: set fifo_half level possible assignment value: 0~1023 tgap: set the word gap possible assignment value: 4 to 255 mode: select the work modle possible assignment value: 0: Loop 1: Normal
Return Value	Void

9. Set the parameters of TX-2: TX2_INIT()

Name	void TX2_INIT(WDC_DEVICE_HANDLE hDev, unsigned int enable, unsigned int word_length, unsigned int parity, unsigned int scaler, unsigned int fifo_half_level, unsigned int tgap, unsigned int mode)
Function	Set the second transmit (TX2) channel's parameters

Parameter	hDev: handle of the card enable: enable the transmit channel(TX2) possible assignment value: 0:disable 1: enable word_length: word length possible assignment value: 0:32bits 1: 25bits parity_select: set parity check possible assignment value: 0:disable 1: odd 2: even Scaler: set Buad rate possible assignment value: 0:12.5Kbps 1: 48Kbps 2: 100Kbps 3: 50Kbps fifo_half_level: set fifo_half level possible assignment value: 0~1023 tgap: set the word gap possible assignment value: 4 to 255 mode: select the work modle possible assignment value: 0: Loop 1: Normal
Return Value	void

10. Send data via the TX1: TX1_SEND()

Name	int TX1_SEND(WDC_DEVICE_HANDLE hDev, unsigned int txdata[1024], int fifo_leve)
Function	Send dat a from the first transmit (TX1) channel
Parameter	hDev: handle of the card txdata[1024]: the array for the words which are going to send fifo_leve: the number of the words which are going to send possible assignment value: 1 to 1024
Return Value	0: means sending data faild 1: means sending data successful Note: The return value should be used to judge if sending data successfulor not.

11. Send data via the TX2: TX2_SEND()

Name	int TX2_SEND(WDC_DEVICE_HANDLE hDev, unsigned int txdata[1024], int fifo_leve)
Function	Send dat a from the second transmit (TX2) channel

Parameter	hDev: handle of the card txdata[1024]: the array for the words which are going to send fifo_leve: the number of the wordswhich are going to send possible assignment value: 1 to 1024
Return Value	0: means sending data faild 1: means sending data successful Note: The return value should be used to judge if sending data successfulor not.

12. Receive data from RX-1, RX-2, RX-3, RX-4: RX_DATA()

Name	int RX_DATA(WDC_DEVICE_HANDLE hDev, unsigned int RX_N, unsigned int RX_DATA[1024], unsigned int RX_ER_STA[1024], unsigned int fifo_leve)
Function	Receive data throug 4 receive(RX1/RX2RX3/RX4) channels
Parameter	hDev: handle of the card RX_N: select the receive channel possible assignment value: 1: select RX1 2: select RX2 3: select RX3 4: select RX4 RX_DATA[1024]: the array for the words which receving from outside. RX_ER_STA[1024]: the array for the error detect from the receving channal shen enable the error detection. fifo_leve: the number of the wordswhich are going to send possible assignment value: 1 to 1024
Return Value	The number of the data receive

13、Releas card: DeviceClose ()

Name	void DeviceClose(WDC_DEVICE_HANDLE hDev)
Name	Close the card and release the handle of the card.
Parameter	hDev: handle of the card
Return Value	void

14. Check if the receive (RX1/RX2/RX3/RX4) channel's FIFO is empty or not:: RX_FIFO_STATUS ()

Name	int RX_FIFO_STATUS(WDC_DEVICE_HANDLE hDev, unsigned int RX_N)
Function	Check if the receive (RX1/RX2/RX3/RX4) channel's FIFO is empty or not
Parameter	hDev: handle of the card RX_N: select the receive channel possible assignment value: 1: select RX1 2: select RX2 3: select RX3 4: select RX4
Return Value	0: means the channel's FIFO is empty 1: means the channel's FIFO is full 2: means the channel's FIFO is half_full (the number of the data in fifo is bigger than the "fifo_half_level" you seted.) Others: means some mistake,such as the TX_N is invalid.

15. Check if the transmit(TX1/2) channel's FIFO is empty or not: TX_FIFO_STATUS ()

Name	int TX_FIFO_STATUS(WDC_DEVICE_HANDLE hDev, unsigned int TX_N)
Function	Check if the transmit(TX1/TX2) channel's FIFO is empty or not
Parameter	hDev: handle of the card TX_N: select the transmit channel possible assignment value: 1: select TX1 2: select TX2
Return Value	0: means the channel's FIFO is empty 1: means the channel's FIFO is empty 2: means the channel's FIFO is half_full (the number of the data in fifo is bigger than the "fifo_half_level" you seted.) Others: means some mistake,such as the TX_N is invalid.

16、Reset the any channel's FIFO: FIFO_RESET ()

Name	void FIFO_RESET(WDC_DEVICE_HANDLE hDev, unsigned int CHANNEL)
Function	Reset the any channel's(RX1/RX2/RX3/RX4/TX1/TX2) FIFO

Parameter	hDev: handle of the card CHANNEL: select channel possible assignment value: 1: select RX1 2: select RX2 3: select RX3 4: select RX4 5: select TX1 6: select TX2
Return Value	void

17、Enable the receive(RX!/RX2/RX3/RX4) channel: RX_ENABLE ()

Name	void RX_ENABLE(WDC_DEVICE_HANDLE hDev, unsigned int num,unsigned int enable)
Function	Enable the receive(RX!/RX2/RX3/RX4) channel
Parameter	hDev: handle of the card num: select the receive channel possible assignment value: 1: select RX1 2: select RX2 3: select RX3 4: select RX4 enable: enable the receive channel possible assignment value: 0:disable 1: enable
Return Value	void

18、Enable the transmit(TX1/TX2) channel: TX_ENABLE ()

Name	void TX_ENABLE(WDC_DEVICE_HANDLE hDev, unsigned int num,unsigned int enable)
Function	Enable the transmit(TX1/TX2) channel
Parameter	hDev: handle of the card num: select the transmit channel possible assignment value: 1: select TX1 2: select TX2 enable: enable the transmit channel possible assignment value: 0:disable 1: enable
Return Value	void

19、Enable Automatic send repetition in the transmit(TX1/TX2) channel: TX_RE_ENABLE ()

Name	void TX_RE_ENABLE(WDC_DEVICE_HANDLE hDev, unsigned int num,unsigned int enable)
Function	Enable Automatic send repetition in the transmit(TX1/TX2) channel
Parameter	hDev: handle of the card num: select the transmit channel possible assignment value: 1: select TX1 2: select TX2 enable: enable or disable possible assignment value: 0:disable 1: enable
Return Value	void

20、Fill fifo when enable the automatic send repetition in the transmit (TX1/TX2) channel:TX_RE_FILLFIFO ()

Name	Void TX_RE_FILLFIFO(WDC_DEVICE_HANDLE hDev, unsigned int num,unsigned int txdata[1024], int fifo_level)
Function	Fill fifo when enable the automatic send repetition in the transmit (TX1/TX2) channel
Parameter	hDev: handle of the card num: select the transmit channel possible assignment value: 1: select TX1 2: select TX2 txdata [1024]: the array for the words which are going to send automatically possible assignment value: 0:disable 1: enable fifo_leve: the number of the words which are going to send automatically possible assignment value: 1 to 1024
Return Value	void

21、Set the time gap when enable Automatic send repetition in the transmit(TX1/TX2) channel: TX_RE_SETTIME ()

Name	void TX_RE_SETTIME(WDC_DEVICE_HANDLE hDev, unsigned int num,unsigned int timegap)
Function	Set the time gap when enable Automatic send repetition in the transmit(TX1/TX2) channel
Parameter	hDev: handle of the card num: select the transmit channel possible assignment value: 1: select TX1 2: select TX2 timegap: Refers to the time gap between two Repetition transmits possible assignment value:1~99,999,999 us
Return Value	void

22、Read back the total number of the word have be send in the transmit(TX1/TX2) channel:TX_RE_ SEND ()

Name	unsigned int TX_RE_SEND(WDC_DEVICE_HANDLE hDev, unsigned int TX_N)
Function	Read back the total number of the word have be send in the transmit(TX1/TX2) channel
Parameter	hDev: handle of the card TX_N : select the transmit channel possible assignment value: 1: select TX1 2: select TX2
Return Value	unsigned int ,the total number of the word have be send

23、Inject error in the transmit(TX1/TX2) channel: TX_ER_INJ()

Name	void TX_ER_INJ(WDC_DEVICE_HANDLE hDev, unsigned int TX_N,unsigned int error)
Function	Inject error in the transmit(TX1/TX2) channel

Parameter	hDev: handle of the card TX_N : select the transmit channel possible assignment value: 1: select TX1 2: select TX2 error: error type possible assignment value: 1: enable gap error 2: enable parity error 3: enable short word error 4: enable long word error 11: disable gap error 12: disable parity error 13: disable short word error 14: disable long word error
Return Value	void

24、Enable/disable error detection in RX-1, RX-2, RX-3, RX-4: RX_ER_DETECT_EN ()

Name	void RX_ER_DETECT_EN(WDC_DEVICE_HANDLE hDev, unsigned int RX_N,unsigned int en)
Function	Enable/disable error detection in the Rx(RX-1/RX-2/RX-3/RX-4) channel
Parameter	hDev: handle of the card RX_N : select the receive channel possible assignment value: 1: select RX1 2: select RX2 3: select RX3 4: select RX4 en: enable/disable error detection possible assignment value: 1: enable 2: disable
Return Value	void

CHAPTER 7 PRODUCT ORDERING INFO

Product Number	Rx Channel	Tx Channel	Baud rate				Software support
			100K	50K	48K	12.5K	
EMBC1000-PCI429EI-42	4	2	√	√	√	√	Windows 2000 or Windows XP based drivers and application software

CHAPTER 8 RELATED PRODUCTS

Product Number	Interface	Error Injection And Detection	Rx Channel	Tx Channel	Baud rate				Software support
					100K	50K	48K	12.5K	
EMBC1000-PCI429-42	PCI		4	2	√	√	√	√	Windows 2000 or Windows XP based drivers and application software
EMBC1000-USB429-42	USB		4	2	√	√	√	√	Windows 2000 or Windows XP based drivers and application software
EMBC1000-USB429EI-42	USB	√	4	2	√	√	√	√	Windows 2000 or Windows XP based drivers and application software

Appendix A: ARINC429 Protocol Introduction

ARINC429 is an international standard for Digital Information Transfer System (DITS). It is application-specific for commercial and transport aircraft. It ignores the complexities of different manufacturers' avionics system interfaces and supplies uniform plat form for system communication.

Based on the requirements of ARINC Specification 429, digital information is transmitted by wires in unidirectional data bus, differential coupling or twisted pairs. So ARINC429 is serial communication. The ARINC429 standard supports High, Low, and Null states.

ARINC data words are always 32 or 25 bits in length. Transmission of sequential words is separated by at least four Null bits. Each ARINC word contains a parity bit, 8-bit label. The label words are quite important in ARINC429 and identify the data type and the parameters associated with it, such as latitude data, longitude data. The rest data bits of the word are divided into different fields based on the label. For making communication completely standardized and to avoid conflicts, all of the flight functions have been given labels and data formats.

When a 32-bit ARINC word is transmitted, each word contains:

- Parity : bit32
- SSM : bit31~30, Sign Status Matrix
- Data : bit29~11
- SDI : bit10~9, Source Destination Identifiers
- Label : bit8~1

The 32-bit ARINC Word typically use the format shown in Table A-1 which includes five primary fields, namely P (parity), SSM, Data, SDI, and Label. Attention, ARINC convention numbers the bits from 1 (LSB) to 32 (MSB), not from 0 to 31 as usually.

The order of 32-bit data word transmitted on ARINC bus is as follows (LSB first): Label(8)- Label(7)- Label(6)- Label(5)- Label(4)- Label(3)- Label(2)- Label(1)- SDI(1)- SDI(2)- Data(1)- Data(2)- Data(3)- Data(4)- Data(5)- Data(6)- Data(7)- Data(8)- Data(9)- Data(10)- Data(11)- Data(12)- Data(13)- Data(14)- Data(15)- Data(16)- Data(17)- Data(18)- Data(19)- SSM(1)- SSM(2)- Parity. The least significant bit of each byte, except the label, is transmitted first, and the label is transmitted ahead of the data in each case.

Table A-1. 32-bit ARINC Data Word Format

PARITY	SSM	DATA	SDI	LABEL
32	31~30	29 ~ 11	10~9	8~ 1

When a 25-bit ARINC word is transmitted, each word contains:

- Parity : bit25
- Data : bit24~9
- Label : bit8~1

The 25-bit ARINC Word typically use the format shown in Table A-2. Attention, ARINC convention numbers the bits from 1 (LSB) to 25 (MSB), not from 0 to 25 as usually.

Table A-2. 25-bit ARINC Data Word Format

PARITY	DATA	SDI	LABEL
25	24 ~ 9	10~9	8~ 1

The order of 25-bit data word transmitted on ARINC bus is as follows (LSB first): Label(8)- Label(7)- Label(6)- Label(5)- Label(4)- Label(3)- Label(2)- Label(1)-Data(1) -Data(2) -Data(3) -Data(4) -Data(5) -Data(6) -Data(7) -Data(8) -Data(9) -Data(10) -Data(11) -Data(12) -Data(13) -Data(14) -Data(15) -Data(16) –Parity. The least significant bit(LSB) of each word except the label is transmitted first, and the label is transmitted with MSB first.