I-2534

Industrial 4-port CAN bus switch

User Manual

Warranty

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Revision

Version	Firmware Version	Date	Author	Description
1.1	1.0	2012 09/14	Johney	Update errata.
1.0	1.0	2011 03/25	Johney	New release.

Tables of Content

1 Introduction

The I-2534 is a CAN switch used to establish a connection among four CAN bus sub-networks. In order to solve the problem of the star topology within the CAN network, the I-2534 is specially designed for integrating four CAN networks or solving the star topology. Not just like general CAN repeater, the I-2534 has three more important features.

(1) Extending CAN bus working distance.
(2) Connecting four CAN sub-networks with different baud rate.
(3) Enhancing the capacity of CAN network.

The transmission distance limitation of the CAN bus system on each port of the I-2534 is independent, which means the total CAN network distance can be extended by routing mechanism as the figure 1-1.
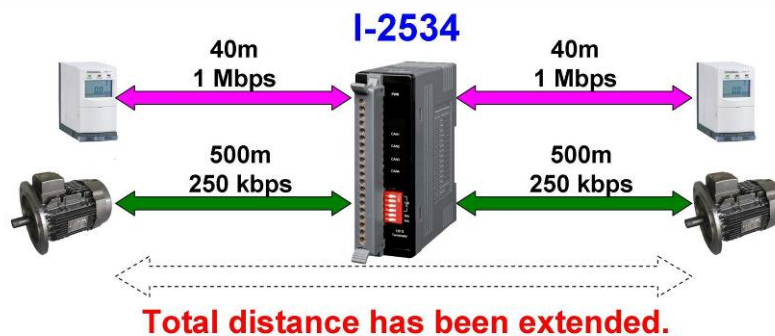

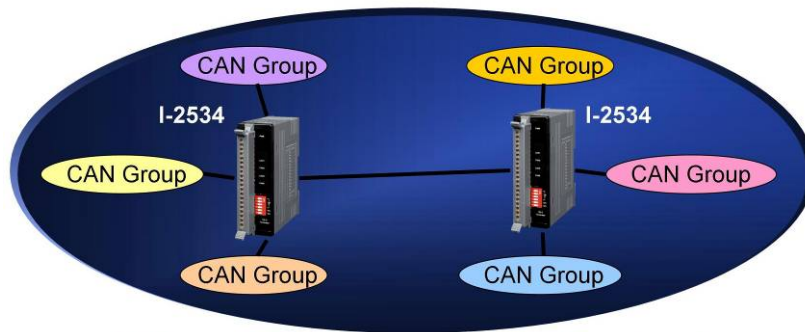Figure 1-1**:** Application of the I-2534 Extend Distance

The I-2534 could transfer CAN messages among four independent CAN networks. When the CAN bus system on one port of the I-2534 has some error (e.g. bus short), the system on the other three ports still work on correctly. Besides, the I-2534 provides message filter to avoid the influence of the network with low baud. The baud rate of four CAN ports can be different for highly flexibility as shown in the figure 1-2.
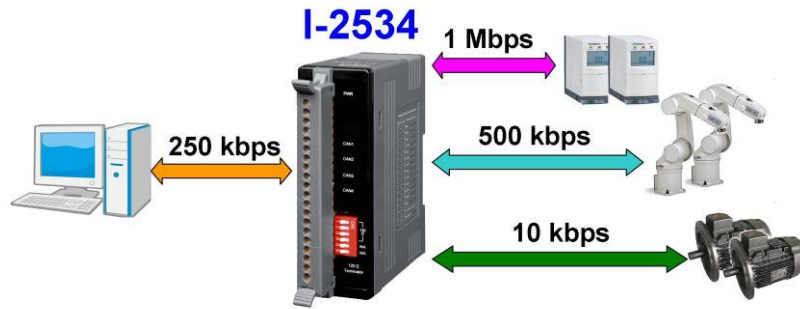
Integrate CAN devices with different baud rate.

Figure1-2: Application of theI-2534 integrating different baud rate.

The I-2534 could combine different CAN sub-networks, so it enhances the maximum capacity in the single CAN network. The application likes Figure 1-3.

Enhance CAN capacity in single network.

Figure1-3: Application of the I-2534 enhance the capacity of CAN network.

1.1 Specifications

System	
Controller	32-bit Microcontroller, 60MHz
RTC (Real Time Clock)	No
Watchdog	Watchdog IC
ESD Protection	4 kV Contact for each channel
CAN Interface	
Transceiver	NXP TJA1042
Channel number	4
CAN Specification	ISO-11898-2, CAN 2.0A and CAN 2.0B
Baud Rate (bps)	5k, 10 k, 20 k, 33.3 k, 50 k, 62.5 k, 83.3 k, 125 k, 250 k, 500 k, 800 k, 1 M bps and user-defined
Baud Rate Selection	Selectable by rotary switch
Isolation	3000 V_{DC} for DC-to-DC, 2500 Vrms for photo-couple
Terminator Resistor	Selectable 120Ω terminator resistor by DIP switch
Transmission Distance (m)	Depend on baud rate (for example, max. 1000 m at 50 kbps)
CAN Filter	Configurable by user
LED	
Round LED	CAN status LED x 4 , Power LED x 1
UART Interface	
RS-232	1 port
RS-232 Connector	3-pin screwed terminal block (TxD, RxD, GND)
Power	
Input range	Unregulated +10 ~ +30 VDC
Power Consumption	3W
Mechanism	
Installation	DIN-Rail
Dimensions	32.3 mm x 99 mm x 77.5 mm (W x L x H)
Environment	
Operating Temp.	-25 ~ 75 ℃
Storage Temp.	-30 ~ 80 ℃
Humidity	10 ~ 90% RH, non-condensing

1.2 Features

- 4 CAN communication ports.
- TJA1042 CAN transceiver.
- Compatible with CAN specification 2.0A and 2.0B.
- Fully compatible with the ISO 11898-2 standard.
- Baud rate : 5 k, 10 k, 20 k, 33.3 k, 50 k, 62.5 k, 83.3 k, 125 k, 250 k, 500 k, 800 k, 1 M bps and user-defined.
- CAN bus filter is configurable.
- CAN bus route path is configurable.
- 100 data frames buffer for each CAN channel.
- Max data flow up to 2500 fps for all CAN channels.
- Selectable baud rate by rotary switch.
- Selectable 120Ω terminator resistor by DIP switch.
- LED for CAN status.
- Utility tool for CAN filter, route path and user-defined baud rate configuration.
- 2500 Vrms isolation on the CAN side
- 3 kV galvanic isolation between the power supply and CAN channel
- 4 kV ESD protection for each CAN channel
- Hi-Pot、Surge、EMI and EFT testing are all pass.

1.3 Product Check List

The package of the I-2534 includes the following items:

- □ I-2534 module;
- □ Software CD ROM;
- □ Quick Start manual;
- □ Release Note

It is recommended that users should read the release note first. All of the important information needed will be provided in the release note as follows:

- □ Where you can find the software driver, utility and demo programs.
- □ How to install software & utility.
- □ Where is the diagnostic program?
- □ FAQs and answers.

Attention !

If any of these items are missing or damaged, please contact your local field agent. Keep aside the shipping materials and carton in case you want to ship or store the product in the future.

2 Technical data

2.1 Block Diagram

The figure 2-1 is the block diagram illustrating the functions of the I-2534 module.
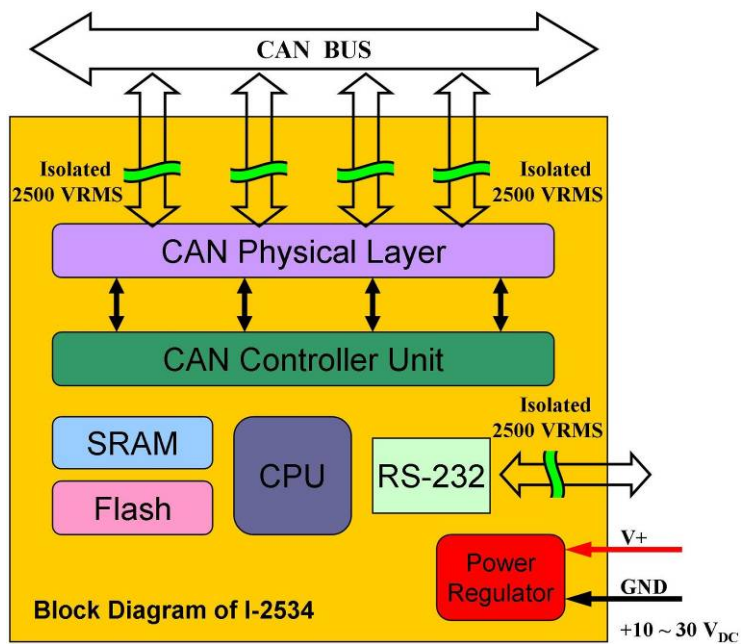

Figure 2-1   Block Diagram of the I-2534

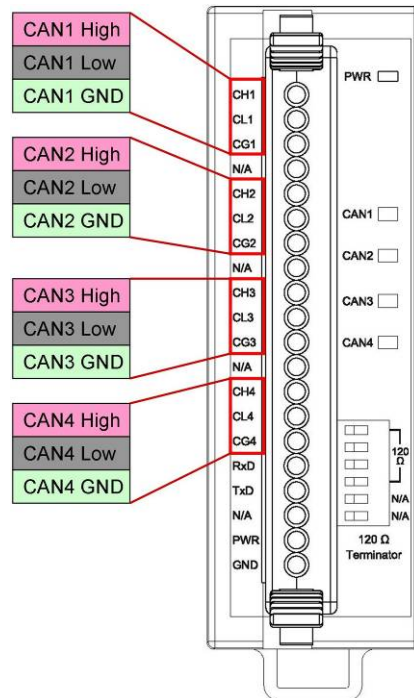## 2.2　CAN bus Pin

The figure 2-2 illustrates the CAN bus pins.

Figure 2-2　CAN bus pins of the I-2534

Name	Port	Description
CH1		CAN_High, signal line of CAN port.
CL1	1	CAN_Low, signal line of CAN port.
CG1		CAN_Ground, ground voltage level of CAN port.
CH2		CAN_High, signal line of CAN port.
CL2	2	CAN_Low, signal line of CAN port.
CG2		CAN_Ground, ground voltage level of CAN port.
CH3		CAN_High, signal line of CAN port.
CL3	3	CAN_Low, signal line of CAN port.
CG3		CAN_Ground, ground voltage level of CAN port.
CH4		CAN_High, signal line of CAN port.
CL4	4	CAN_Low, signal line of CAN port.
CG4		CAN_Ground, ground voltage level of CAN port.

2.3 Power & RS-232 Pin

The figure 2-3 shows the power pins and RS-232 pins. There is an import thing that RS-232 GND pin and CAN 4 GND pin use the same pin.
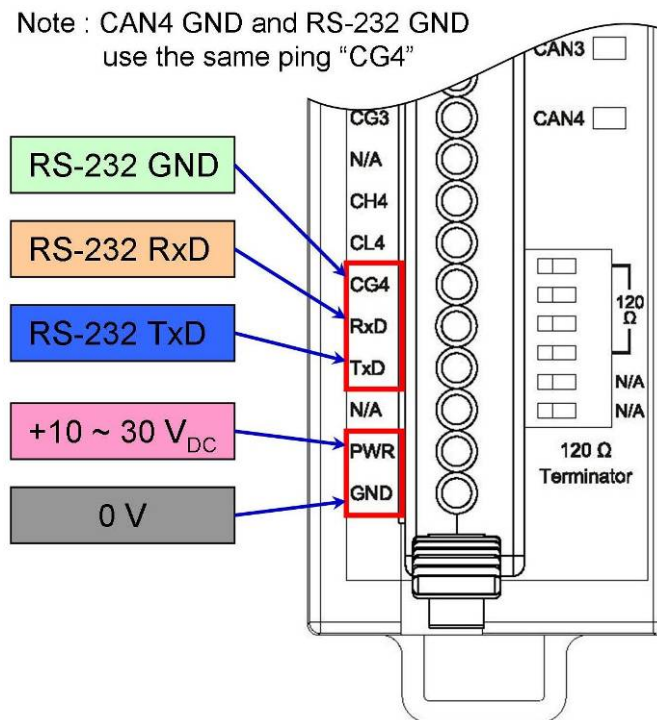

Figure 2-3   RS-232 and Power pins of the I-2534

Name	Description
TxD	TXD pin of RS-232 port.
RxD	RXD pin of RS-232 port.
CG4(GND)	SG (or GND) pin of RS-232 port. CAN4 GND and RS-232 GND use the same pin "CG4".

Name	Description
PWR	Voltage Source Input. +10V_{DC} ~ +30V V_{DC}.
GND	Power Ground.

2.4 Indicator LED

The figure 2-4 shows the LED name and its status.
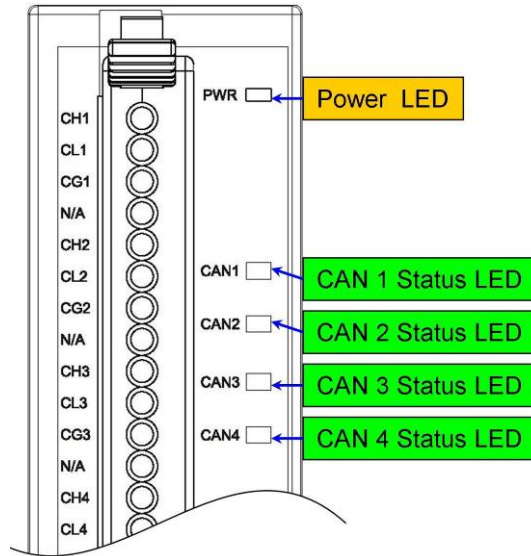
Figure 2-4   CAN LED and Power LED of the I-2534

LED Name	LED Color	Description
PWR LED	OFF	The I-2534 has no power source.
	RED	The I-2534 has power.

LED Name	LED Color	CAN Status Description
CAN1 CAN2 CAN3 CAN4	OFF	CAN port does not transmit or receive message now.
	GREEN	CAN port is transmitting or receiving message now.
	RED	CAN port have some errors when transmitting message.

Note: In initial mode, the CAN1 ~ CAN4 LEDs will be all twinkled once per second.

2.5 CAN bus Terminal Resistor & DIP-Switch

Each CAN port of the I-2534 includes one built-in 120Ω terminal resistor, users can decide whether it is enable or not. The DIP switch for terminal resistor is shown in the figure 2-5.
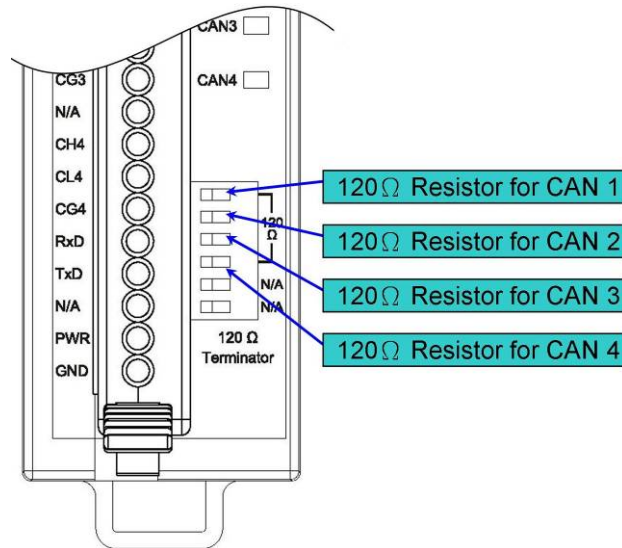

Figure 2-5   120Ω terminal resistors of the I-2534

DIP No.	Switch status	CAN bus resistor status
1	ON	CAN 1 with 120Ω terminal resistor.
	OFF	CAN 1 without terminal resister.
2	ON	CAN 2 with 120Ω terminal resister.
	OFF	CAN 2 without terminal resister.
3	ON	CAN 3 with 120Ω terminal resister.
	OFF	CAN 3 without terminal resister.
4	ON	CAN 4 with 120Ω terminal resister.
	OFF	CAN 4 without terminal resister.
5	N/A	Not Available
6	N/A	Not Available

In order to reduce the reflection effects on the CAN bus line, the CAN bus line has to be terminated at both ends by two terminator resistors. According to the ISO 11898-2 spec, each terminator resistor is 120Ω (or between 108Ω~132Ω). The bus topology and the positions of these terminator resistors
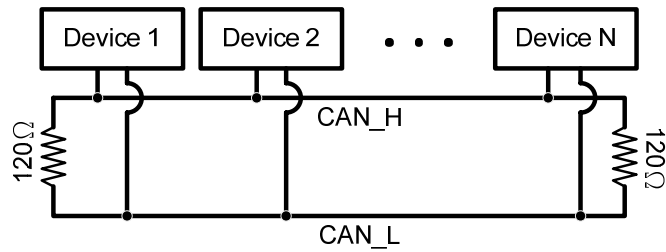
are shown as the figure 2-6.

Figure 2-6   120Ω terminal resistor position

Generally, if your application is as the figure 2-7, we recommend you to enable the terminator resistor.
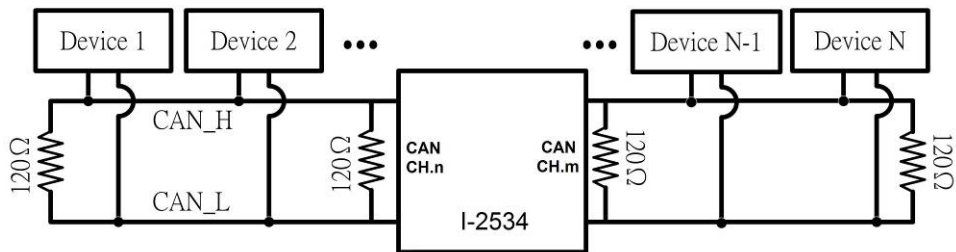

Figure 2-7   Enable the 120Ω terminal resistors of the I-2534

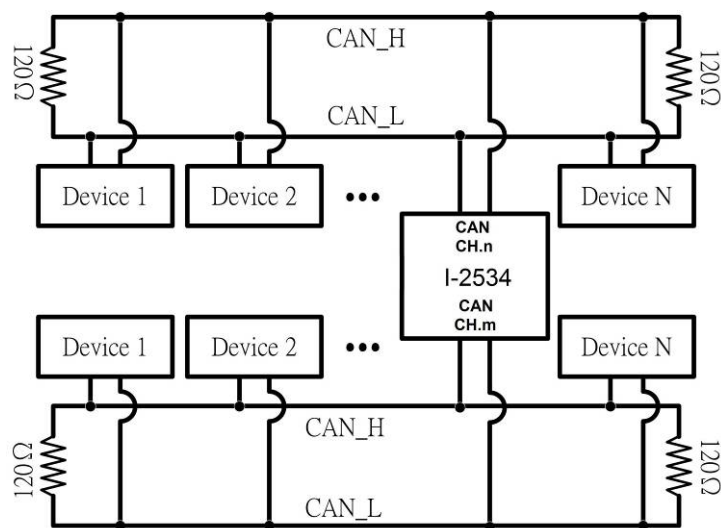If your application is like the structure as the figure 2-8, the terminator resistor is not needed.

Figure 2-8   Disable the 120Ω terminal resistors of the I-2534

2.6 Rotary Switch & CAN Baud Rate

The figure 2-9 illustrates where to set the CAN bus baud rate of four CAN ports in the I-2534 module.
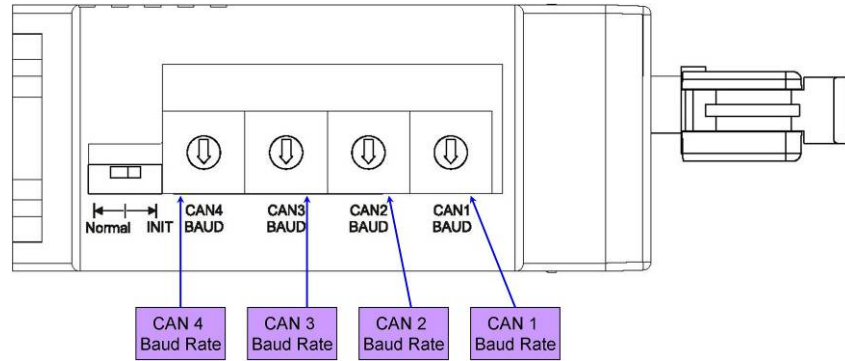
Figure 2-9　CAN baud rate configuration

Switch Value	CAN bus Baud Rate
0	5 kbps
1	10 kbps
2	20 kbps
3	33.3 kbps
4	50 kbps
5	62.5 kbps
6	83.3 kbps
7	100 kbps
8	125 kbps
9	250 kbps
A	500 kbps
B	800 kbps
C	1 Mbps
D	User-defined baud rate.
E~F	Not-available

2.7 Normal / Initial Mode Switch

The figure 2-10 illustrates the mode of the I-2534 module. In general usage, users should take care about the position of this switch.
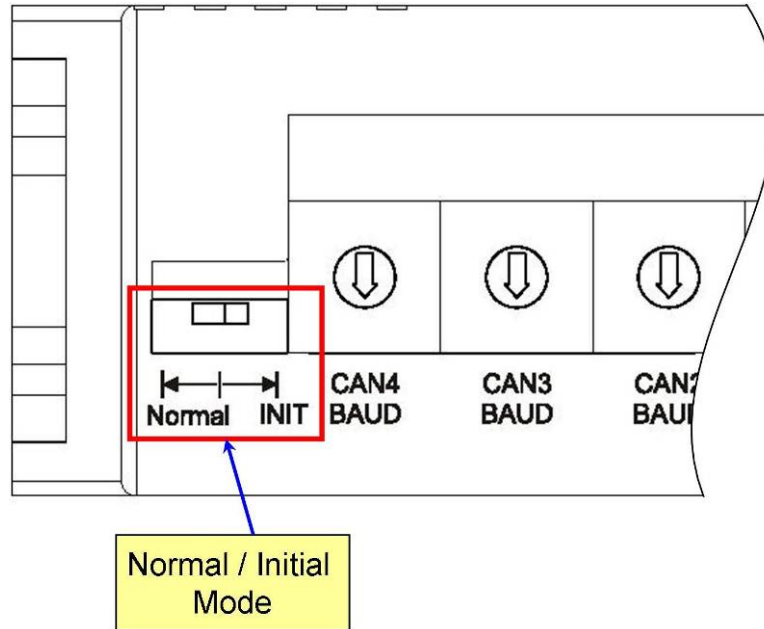
Figure 2-10   Operation Mode of the I-2534 module

Mode Name	The I-2534 Status Description
Normal	The I-2534 is in the normal mode.
Initial	The I-2534 is in the configurable mode. Users could use "I2534_Utility" to configure the route path, CAN filter or user-defined CAN baud rate. In initial mode, the CAN1 LED ~ CAN4 LED will be all twinkled once per second.

2.8 CAN bus Wire Connection

The CAN bus wire connection of the I-2534 is displayed in the figure 2-11.
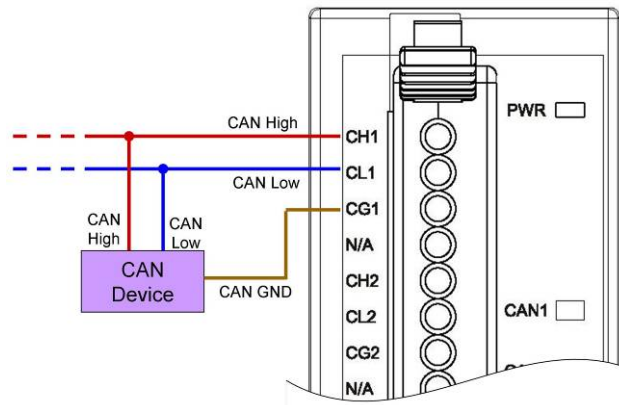
Figure 2-11   CAN bus wire connection with the I-2534 module

The I-2534 has a metallic board attached to the back of the plastic frame. When users mount the I-2534 onto a metal DIN-Rail, users can connect the DIN-Rail to Earth Ground. The figure 2-12 shows the detail.
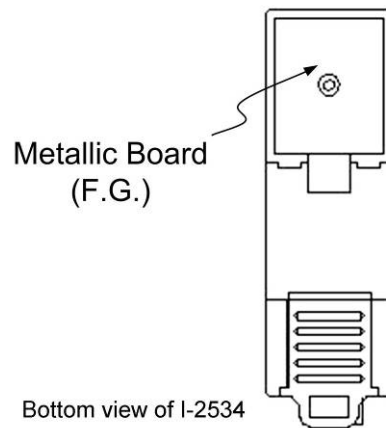

Figure 2-12   Metallic Board at Back of the I-2534

3 Network Deployment

3.1 Driving Capability

Before introducing the driving capability of the I-2534, some characteristics of copper cable must be assumed. The AC parameters are 120Ω impedance and 5 ns/m line delay, and the DC parameter follows the table shown below.

Table 3-1 Recommended DC parameters for CAN Bus Line

Wire Cross-Section [mm^2]	Resistance [Ω/km]
~0.25 (AWG23)	< 90
~0.5 (AWG20)	< 50
~0.8 (AWG18)	< 33
~1.3 (AWG16)	< 20

Under the conditions described above, users can refer to the following table to know the maximum node numbers in each segment and the maximum segment length when using different type of wire.

Table 3-2 Driving Capability

Wire Cross-Section [mm2]	The maximum segment length [m] under the case of specific node number in this segment			
	16 Nodes	32 Nodes	64 Nodes	100 Nodes
~0.25 (AWG23)	< 220	< 200	< 170	< 150
~0.5 (AWG20)	< 390	< 360	< 310	< 270
~0.8 (AWG18)	< 590	< 550	< 470	< 410
~1.3 (AWG16)	< 980	< 900	< 780	< 670

3.2 Star / Tree Topology

In general, users use the daisy-chain method to connect all CAN devices in their applications. In some cases, the "Star" or "Tree" topology may be needed. The I-2534 which has four independent CAN ports could solve the topology problem of the CAN network. The figure 3-1 shows the CAN network with "Star" topology and the figure 3-2 illustrates "Tree" topology.
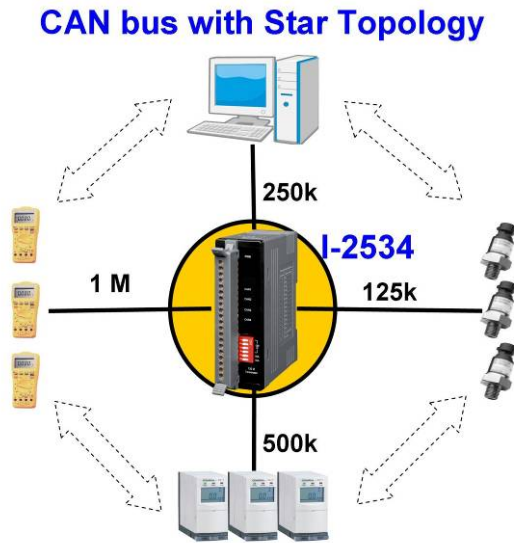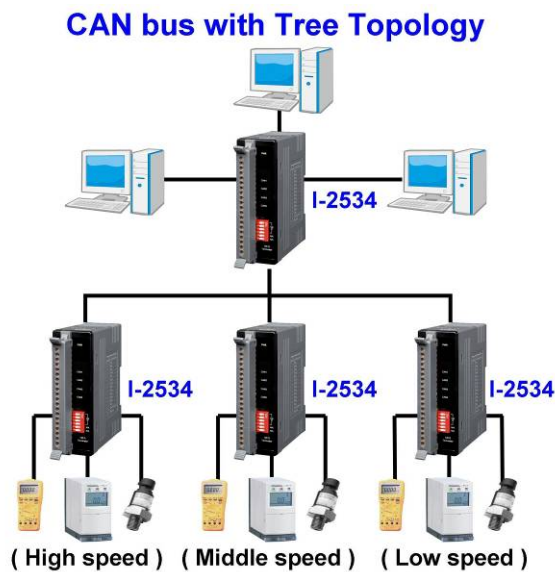

Figure 3-1   Star topology with the I-2534

Figure 3-2   Tree topology with the I-2534

3.3 I-2534 Utility Tool & RS-232 Cable

The I-2534 utility tool can be free downloaded from the following web site or get it in the product CD (path: CAN\Converter\I-2534\):
http://www.icpdas.com/products/Remote_IO/can_bus/i-2534.htm

After getting the utility tool, please follow the following steps to set up the communication between the Utility and the I-2534.

Step0: Power off the I-2534.

Step1: Set the Normal / Initial mode switch to "INIT" position. The figure 3-3 shows the detail.
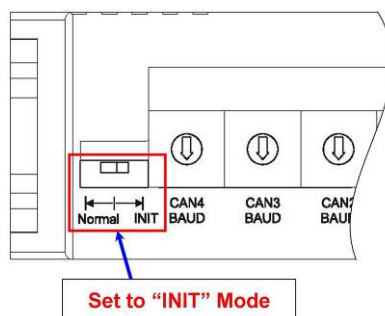
Figure 3-3   Set the I-2534 into the initial mode

Step2: Connect the PC available COM port with the COM port of the I-2534. When connecting to the COM port of the I-2534, the TxD pin of the cable is connected to the TxD pin of the I-2534, RxD pin of the cable is connected to the RxD pin of the I-2534, and GND pin of the cable is connected to the CG4 pin of the I-2534. The figure 3-4 illustrates detail.
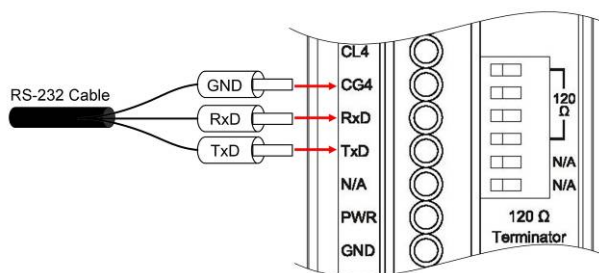
Figure 3-4   Wire connection of the RS-232

Step3: Power on the I-2534. Then, the CAN 1~ CAN 4 LEDs are all twinkled once per second.

Step4: Execute the I2534_Utility.exe.

3.4 Route Path Configuration

The I-2534 is an intelligent CAN bus switch module. Users could configure the route path of each CAN port. The route path could be imaged as pipe line. Users could configure where the pipe line connects to in different applications. The figure 3-5 illustrates the abstract idea.
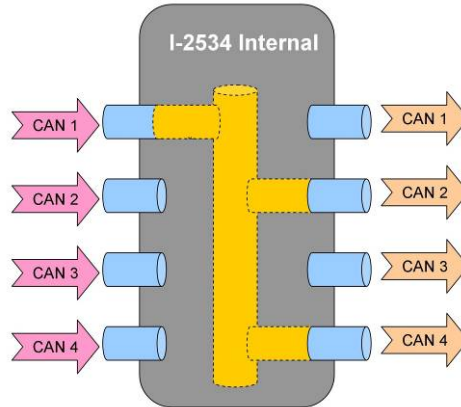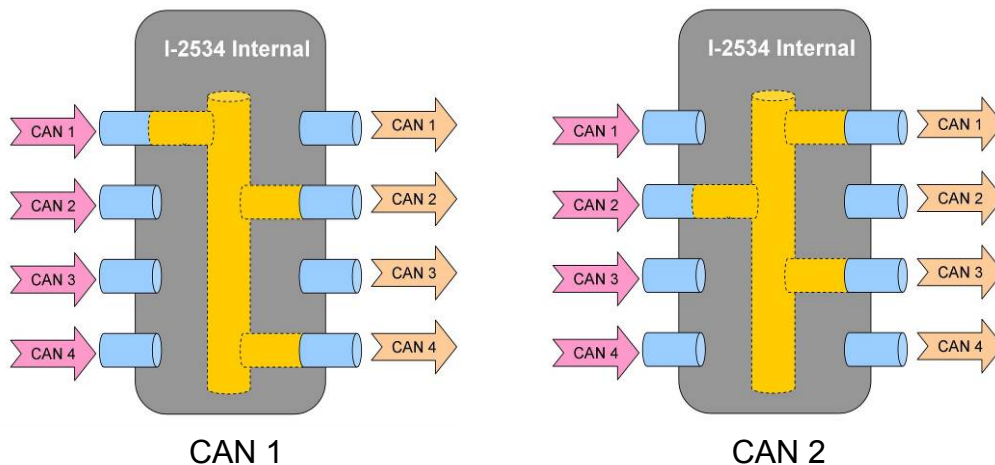

Figure 3-5   Abstract idea of the route path within the I-2534

The figure 3-5 illustrates that the CAN message from CAN port 1 transfers to CAN port 2 and CAN port 4. Users could configure each CAN port by the "I2534_Utility". Take a look at an example. We assume that users want the follow setting.

CAN 1

CAN 2

CAN 3   CAN 4
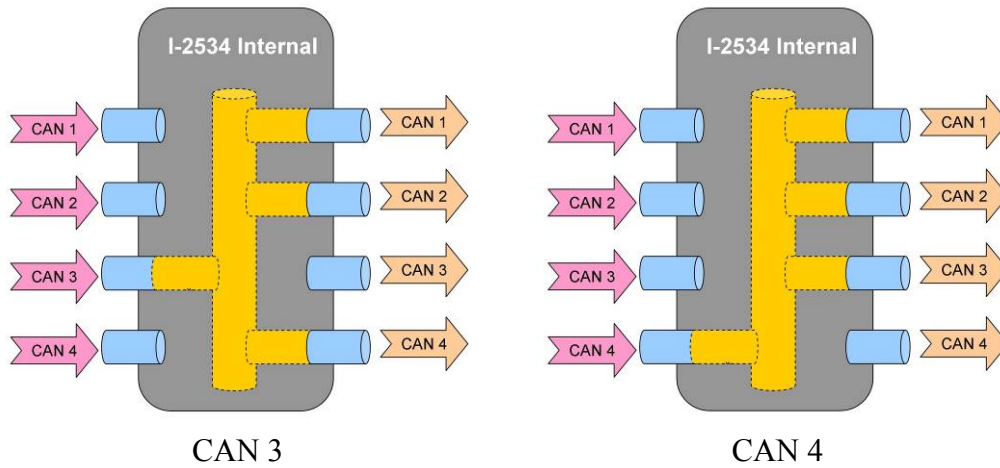
Figure 3-6   Example of the route path

After finishing the wire connection as the section 3.3, users could set the configuration in the "I2534_Utility". The figure3-7 below shows the corresponding setting.
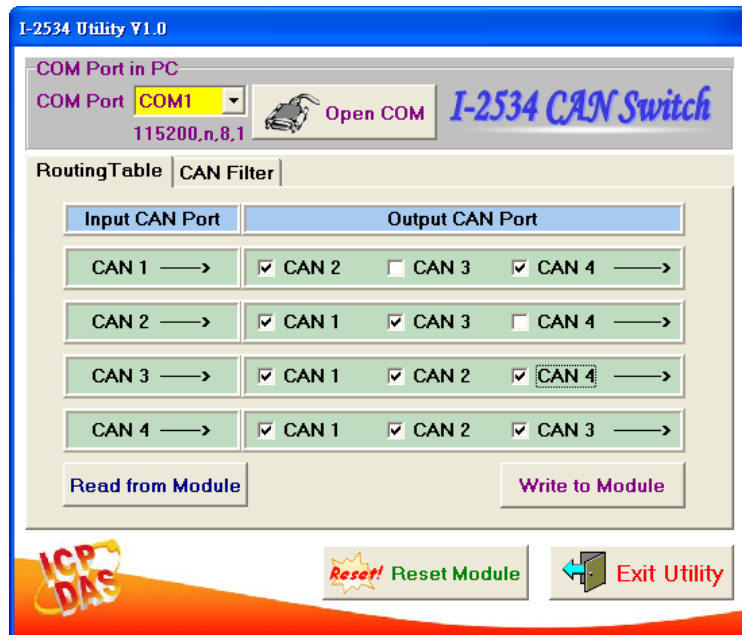

Figure 3-7   Example of the route path configuration

After setting the route table, users should click the "Write to Module" button to save the configuration to the I-2534. Users can reset the module to enable the configuration by clicking the "Reset Module" button or turning it off and then turning it on. If users want to review the configuration, click "Read from Module" button to read back the information.
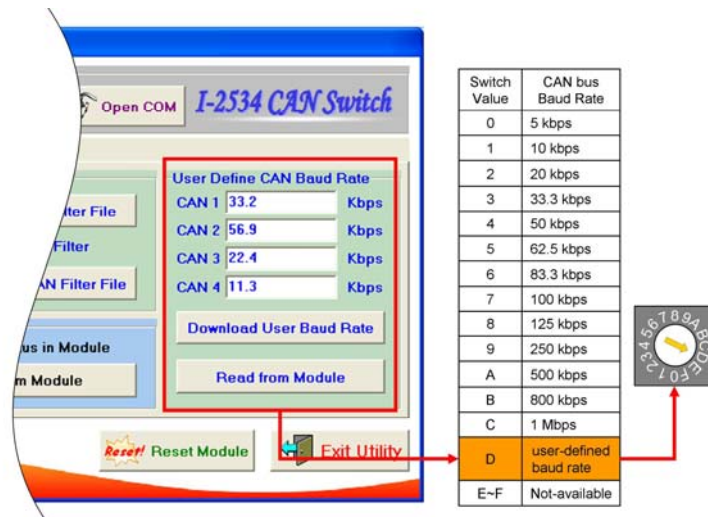
3.5 CAN User-defined Baud Rate Configuration

The I-2534 allows users to set the special CAN baud rate by using the "User-defined CAN Baud Rate" field of the Utility. Before configuring the user-defined baud, turn off the I-2534, adjust the rotary switch of baud to 'D' position, and then turn on it. After building the connection between the Utility and the I-2534, fill your expected baud in the field of User Define CAN Baud Rate. For example, fill the value "33.2" in the "CAN 1" field for setting the baud of "CAN 1" to 33.2 kbps, and click the "Download User Baud Rate" button to save into the I-2534. Then, Users can reset the module to enable the configuration by clicking the "Reset Module" button or turning it off and then turning it on. If users want to review the configuration, click "Read from Module" button to read back the information.

Figure 3-8   CAN user-defined baud rate configuration

3.6 CAN Filter Configuration

There are two parts of CAN filter configuration. One is "Download CAN Filter" which functions as setting the CAN filter and downloading the configuration to the I-2534. Another is "Read CAN Filter" which provides read back the CAN filter configuration form the I-2534 module.
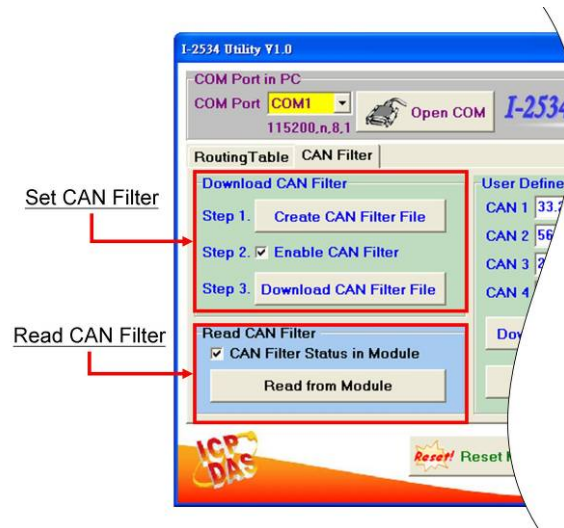

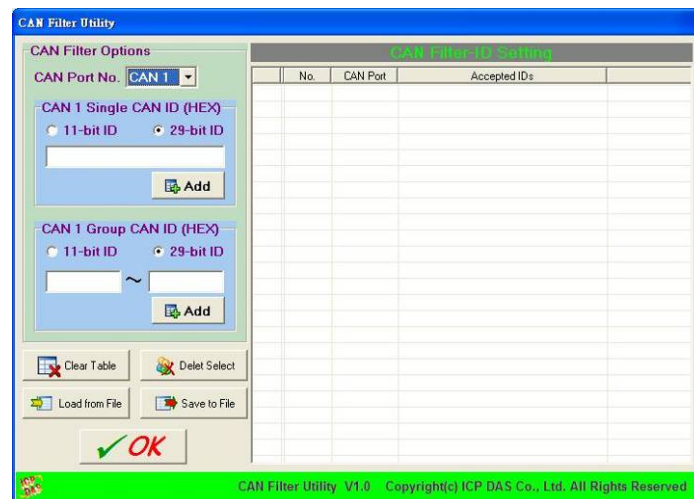Figure 3-9   Set and read the CAN filter configuration

Figure 3-10   CAN filter configuration dialog

3.6.1 Apply a New CAN Filter to I-2534

When users set the CAN filter first time, they need use "Download CAN Filter" field.

Step 1: Click the "Create CAN Filter File" button to start setting CAN filter.
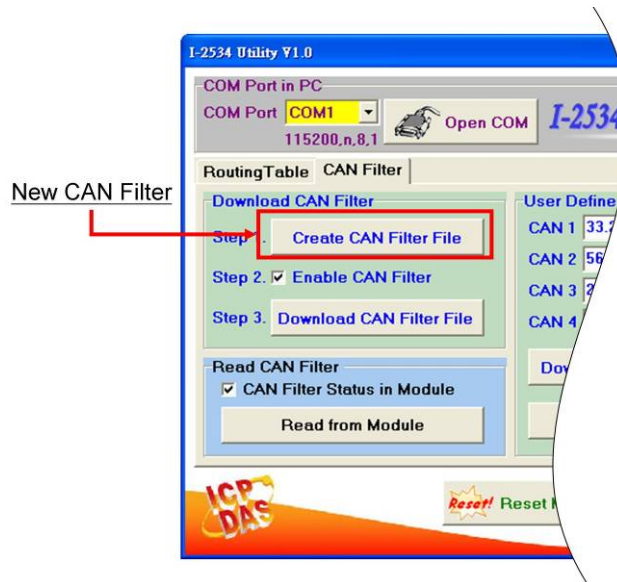
Figure 3-11　Create CAN filter file
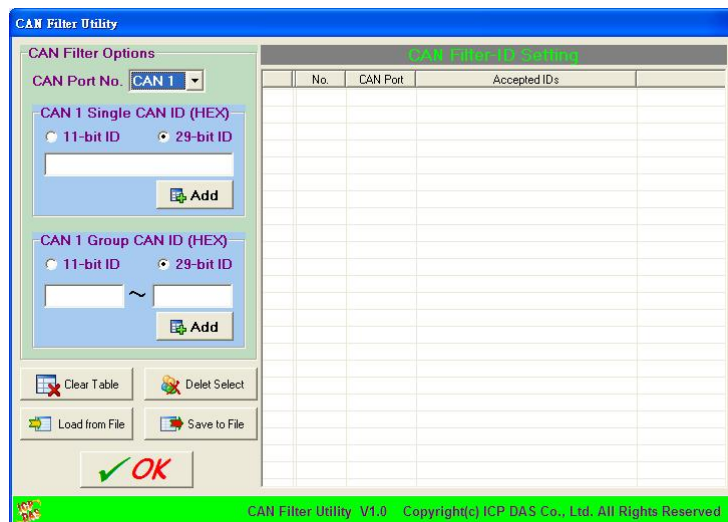
Users would see the following window.

Figure 3-12　An new CAN filter configuration dialog

Step 2: Select the CAN port which users want to configure the CAN filter on.
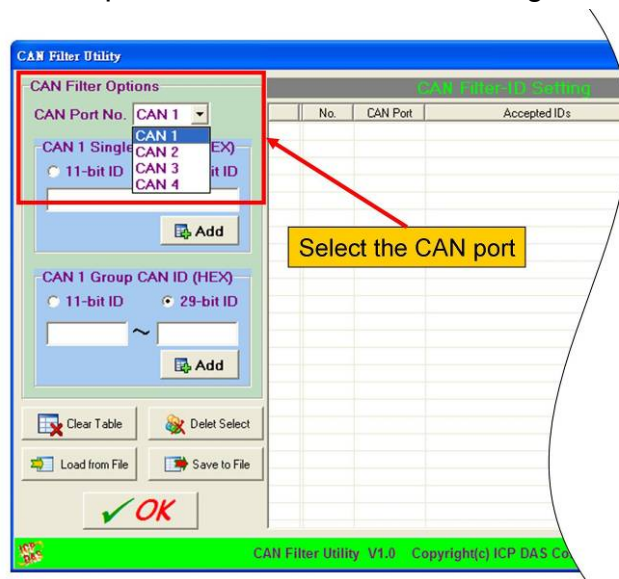

Figure 3-13   Select desired CAN port

Step 3: Add the CAN filter with single CAN ID or group of CAN ID. The CAN message with the ID in the list will be received, otherwise it will be dropped.
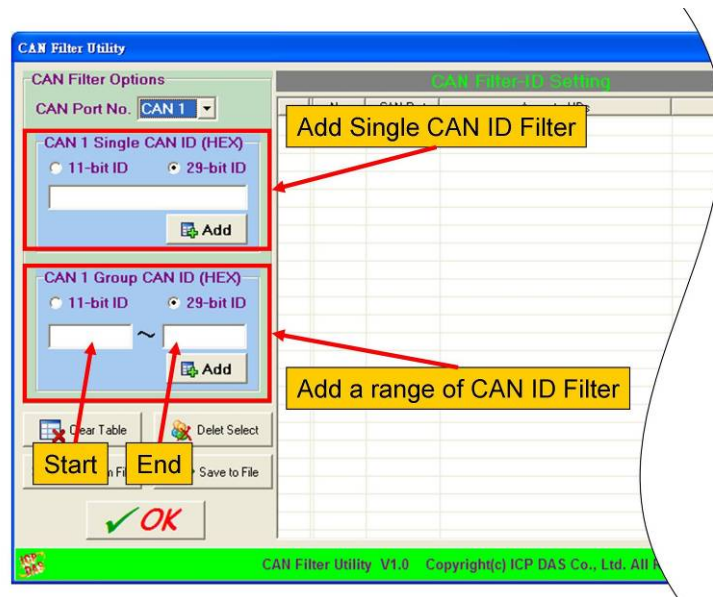

Figure 3-14   Add single or group of CAN filter

For example, if users want to pass the CAN port 1 with CAN ID 0x07F in the CAN 2.0B specification. Firstly, select "29-bit ID" item in the "CAN x Single CAN ID" field. Secondly, fill the value "7F" in the edit box. Finally, click "Add" button in the "CAN x Single CAN ID" field.

Moreover, if users want to pass the CAN 2.0A messages with CAN ID 0x04 ~ 0x15 while these messages are received by the CAN port 1 Firstly, select "11-bit ID" item in the "CAN x Group CAN ID" field. Secondly, fill the value "4" in the "Start" field and the value "15" in the "End" field. Finally, click "Add" button in the "CAN x Group CAN ID" field.

After completing those two examples, users could see the follow picture.

Figure 3-15   Two CAN filter data

The "No." field shows the sequential number for each record of the CAN filter configuration.
The "CAN Port" field indicates the record is belong to which CAN port.
The "Accepted IDs" field displays that which CAN ID would be received.
An icon in the head of the line may represent the following information.

 : This record is the CAN filter of 11-bit and single CAN ID.

 : This record is the CAN filter of 11-bit and group CAN ID.

 : This record is the CAN filter of 29-bit and single CAN ID.

 : This record is the CAN filter of 29-bit and group CAN ID.

Step 4: When completing the CAN filter configuration, click the "Save to File" button to save it by using a record file with "*.FLT" extension file name.
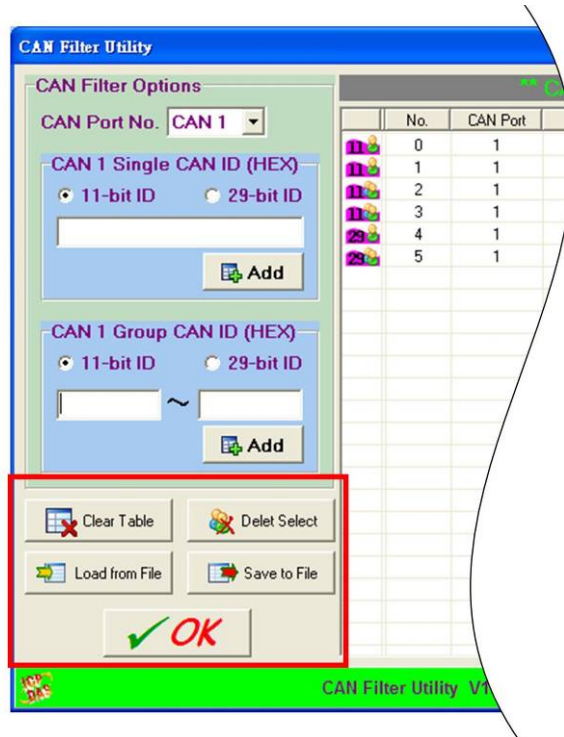

Figure 3-16   Five buttons in CAN filter configuration dialog

There are more five buttons to help users configuring the CAN filter.

1. "Clear Table" would delete all CAN filter records in the list.

2. "Delete Select" would delete the selected CAN filter record.

3. "Load from File" allow users to load the configuration from the existent CAN filter file (*.FLT).

4. "Save to File" provides the function to save the current CAN filter configuration into a file (*.FLT).

5. "OK" would exit the configuration dialog.

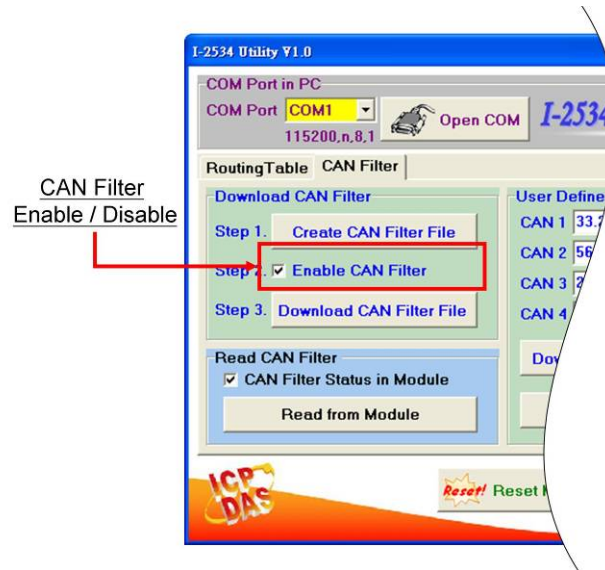Step 5: Check the "Enable CAN Filter" item to make the CAN filter enable.

Figure 3-17　CAN filter status

Step 6: Click "Download CAN Filter File" to download the selected CAN filter file into the I-2534 module.
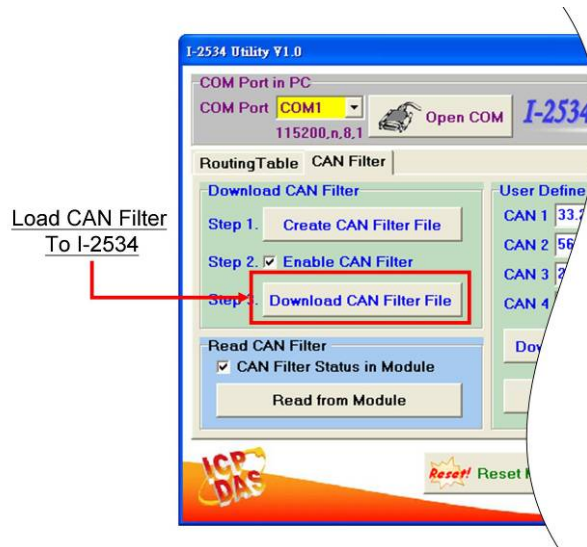

Figure 3-18　Download CAN filter data

After finishing all the steps above, users need to reset the module to enable the configuration by clicking the "Reset Module" button or turning it off and then turning it on. If users want to review the configuration, click "Read from Module" button to read back the information.

3.6.2 Download Existent CAN Filter File to I-2534

The steps are the same as step 5 and 6 of the section 3.6.1.

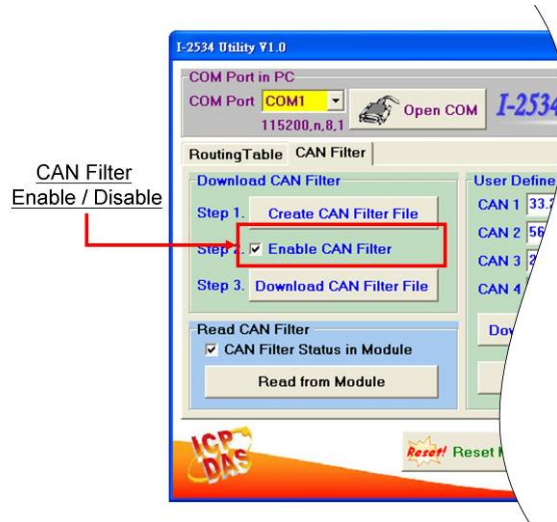Step 1: Check the "Enable CAN Filter" item to make the CAN filter enable.

Figure 3-19   CAN filter status

Step 2: Click "Download CAN Filter File" to download the selected CAN filter file into the I-2534.
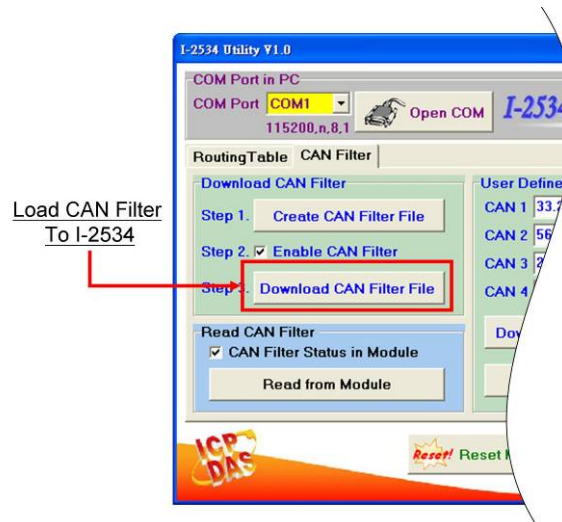

Figure 3-20   Download CAN filter data

Afterwards, users need to reset the module to enable the configuration by clicking the "Reset Module" button or turning it off and then turning it on. If users want to review the configuration, click "Read from Module" button to read back the information.

3.6.3 Read I-2534 CAN Filter Configuration

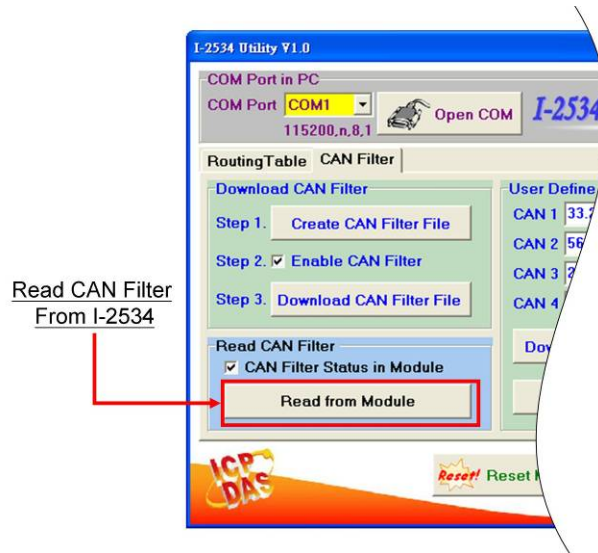Click the "Read from Module" to read the CAN filter setting from the I-2534.

Figure 3-21   Read CAN filter form the I-2534

If reading the CAN filter data successfully, users would see whether the CAN filter setting is enable or not from the following figure 3-22.
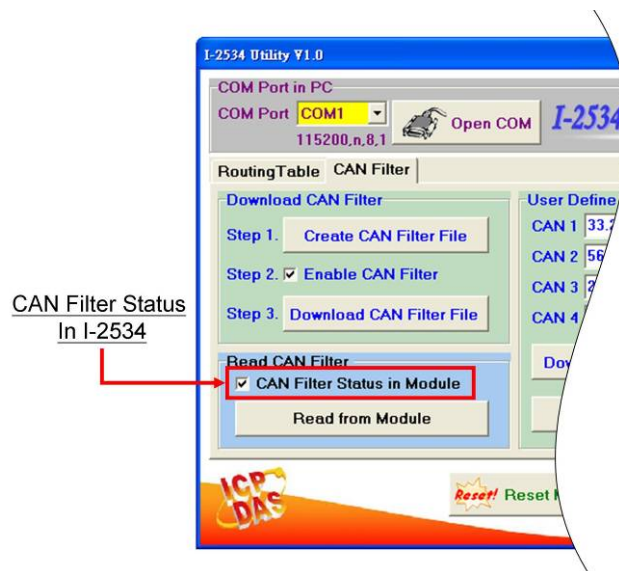

Figure 3-22   CAN filter status in the I-2534 module

If the CAN filter status is enabled, users would see the configuration dialog such as "Create CAN Filter File". Users can modify the CAN filter setting if necessary, or save it into a file.
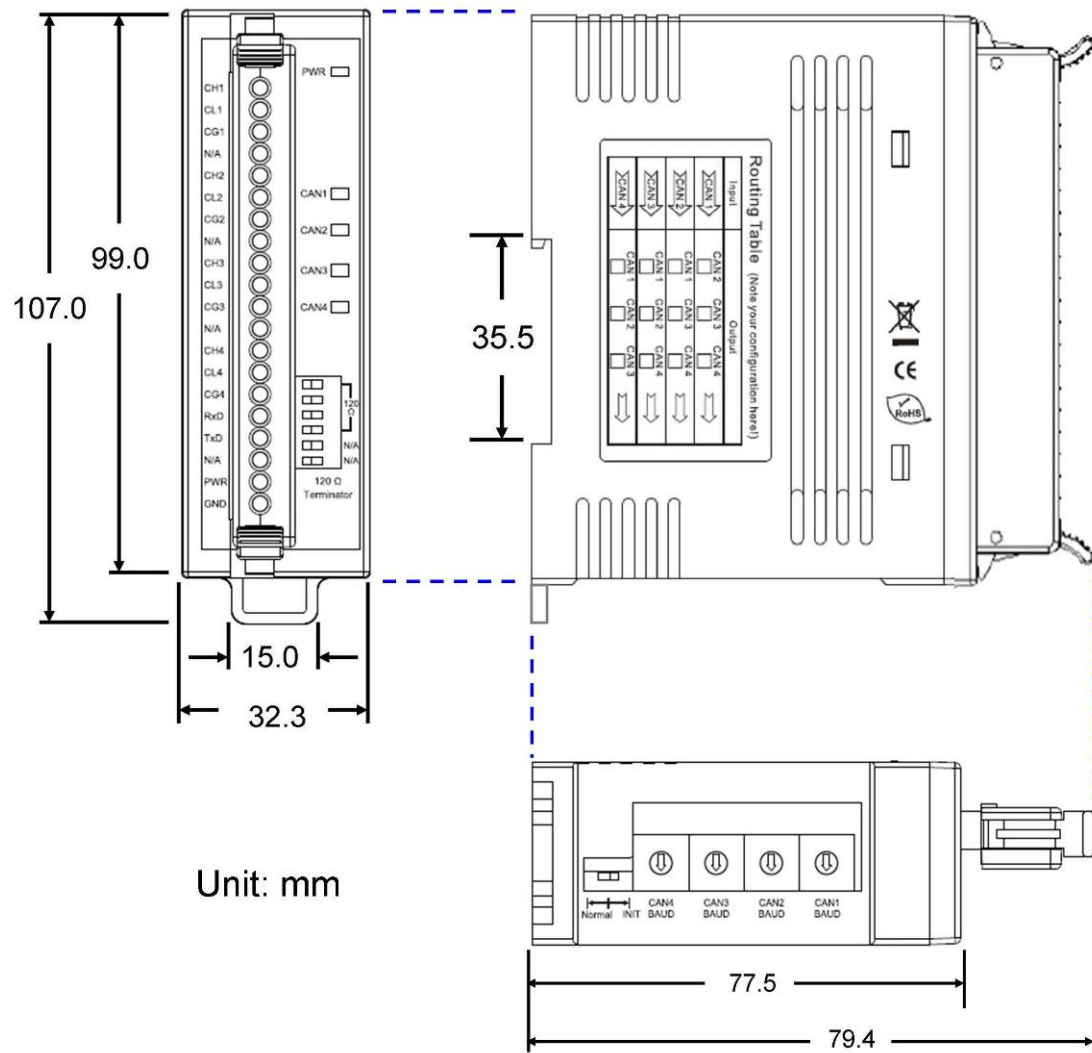
4 Dimension

Unit: mm

Figure 4-1   Dimension of the I-2534