The I-2533 CAN to Fiber Bridge

User Manual

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1 Introduction

I-2533 is a local CAN bridge used to establish a connection between two CAN bus system via fiber optic transmission medium. In order to solve the problem between CAN and fiber transmission medium, I-2533 is specially designed for converting the electrical CAN bus signal to fiber optic cables. Not just like I-2533, I-2533 has three more important features.

First, the transmission distance limitation of the CAN bus system will not reduced because of CAN baud rate. It means that the total network distance can be extended. Second, the bus error on one CAN network will not affect the operation of another CAN network. Finally, the two CAN network can communication with each other by using different CAN baud rate for highly flexibility. Besides, I-2533 provides the utility tool for user-defined baud rate and filter configuration. By using this tool, it is allowed to have user-defined baud rate and message filter. When users use the I-2533 on two CAN network with different CAN baud rate, it may be useful to reduce the bus loading on the network which has low baud rate.



1.1 Specifications

ConnectorScrewed terminal block (CAN_GND, CAN_L, CAN_H)Baud Rate (bps)10 k ~ 1 MTransmission Distance (m)Depend on baud rateIsolation2500 VrmsTerminator ResistorSwitch for 120 Ω terminator resistorSpecificationISO-11898-2, CAN 2.0A and CAN 2.0BFiber InterfaceTotal and the experiment of	CAN Interface			
Transmission Distance (m)Depend on baud rateIsolation2500 VrmsTerminator ResistorSwitch for 1200 terminator resistorSpecificationISO-11898-2, CAN 2.0A and CAN 2.0BFiber InterfaceConnectorConnectorST (Multi-mode)Wave Length850 nmFiber Cable $50 / 125 \mum$, $62.5 / 125 \mum$, $100 / 140 \mum$ ($62.5 / 125 \mum$ is recommended)Transmission Distance (m)2 km max (in $62.5 / 125 \mum$ fiber cable)UART InterfaceCOM 1COM 1RS-232 (configuration only)COM 1CSrewed terminal block (RxD, TxD, GND)Baud Rate (bps)115200Data bit8Stop bit1ParityNoneLEDPWR LED, CAN_Tx LED, CAN_Rx LED, CAN_Err LED, FB_Err LEDPowerPowerPower supplyUnregulated +10 ~ +30 VpcProtectionPower reverse polarity protection, Over-voltage brown-out protectionPower Consumption3 WMechanismInstallationDIN-RailDimensions32.3mm x 77.5mm x 99.0mm (W x L x H)Environment-25 ~ 75 °CStorage Temp25 ~ 75 °C	Connector	Screwed terminal block (CAN_GND, CAN_L, CAN_H)		
Distance (m)Depend on baud rateIsolation2500 VrmsTerminator ResistorSwitch for 120Ω terminator resistorSpecificationISO-11898-2, CAN 2.0A and CAN 2.0BFiber InterfaceConnectorConnectorST (Multi-mode)Wave Length850 nmFiber Cable50 / 125 µm , 62.5 / 125 µm, 100 / 140 µm (62.5 / 125 µm is recommended)Transmission Distance (m)2 km max (in 62.5 / 125 µm fiber cable)UART InterfaceCOM 1COM 1RS-232 (configuration only)COM 1ConnectorScrewed terminal block (RxD, TxD, GND)Baud Rate (bps)115200Data bit8Stop bit1ParityNoneLEDPowerPWR LED, CAN_Tx LED, CAN_Rx LED, CAN_Err LED, FB_Err LEDPowerPower reverse polarity protection, Over-voltage brown-out protectionPower Consumption3 WMechanismInstallationInstallationDIN-RailDimensions32.3mm x 77.5mm x 99.0mm (W x L x H)Environment-25 ~ 75 °CStorage Temp40 ~ 80 °C	Baud Rate (bps)	10 k ~ 1 M		
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EnvironmentOperating Temp25 ~ 75 °CStorage Temp40 ~ 80 °C	Installation	DIN-Rail		
EnvironmentOperating Temp25 ~ 75 °CStorage Temp40 ~ 80 °C	Dimensions	32.3mm x 77.5mm x 99.0mm (W x L x H)		
Storage Temp40 ~ 80 °C	Environment			
Storage Temp40 ~ 80 °C	Operating Temp.	-25 ~ 75 ℃		
		-40 ~ 80 °C		
	Humidity	5 ~ 95% RH, non-condensing		

1.2 Features

- Fiber Port: ST (Multi-mode)
- Maximum transmission distance up to 2 km at any CAN baud rate
- 82C250 CAN transceiver
- 2500 Vrms isolation on the CAN side
- Support both CAN 2.0A and CAN 2.0B
- Fully compatible with the ISO 11898-2 standard
- Rotary switch for CAN baud rate configuration
- Build-in switch for 120 Ω terminator resistor
- Up to 100 CAN nodes on each channel
- Removable terminal block, Mount easily on DIN-Rail
- Allow user-defined baud rate
- Fiber broken line detection
- Utility tool for message filter configuration

2 Technical data

2.1 Block Diagram

The following figure is the block diagram illustrating the functions of the I-2533 module.

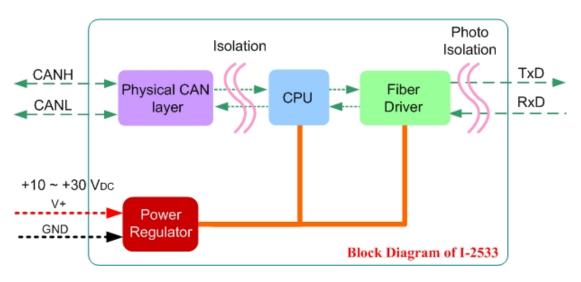


Figure 2-1 Block Diagram of I-2533

2.2 Appearance

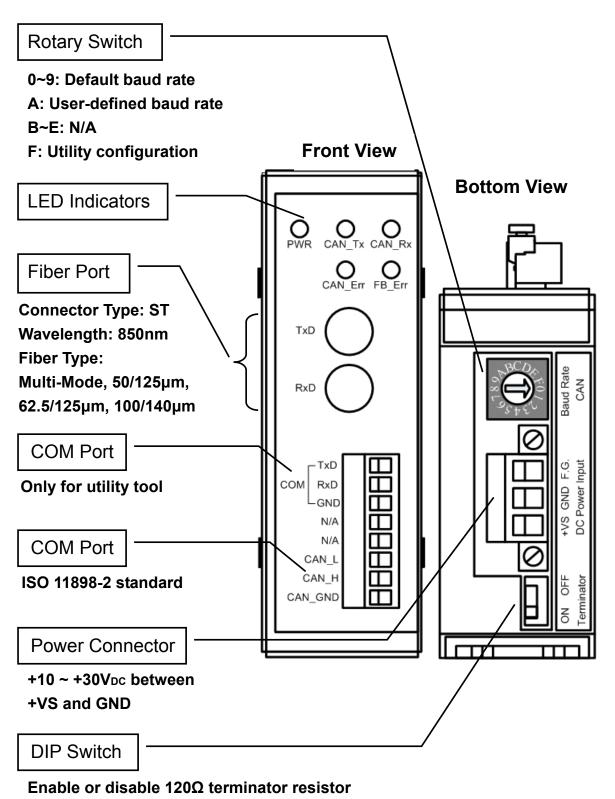


Figure 2-2 Appearance of I-2533

2.3 Pin Assignment

The pin assignments of COM port, CAN port, fiber port and power connector of I-2533 are shown in the following tables.

Port	Name	Description
	TXD	TXD pin of RS-232 port.
COM	RXD	RXD pin of RS-232 port.
	GND	SG (or GND) pin of RS-232 port.
	CAN_L	CAN_Low, signal line of CAN port.
CAN	CAN_H	CAN_High, signal line of CAN port.
	CAN_GND	CAN_Ground, ground voltage level of CAN port.
Fiber	TXD	Transmit optic data.
FIDEI	RXD	Receive optic data.
	+VS	Voltage Source Input. +10 V_{DC} ~ +30V V_{DC} .
Power	GND	Power Ground.
	F.G.	Frame Ground.

Table 2-1 Pin Assignment

Sometimes, the CAN_GND voltage level of different CAN devices on a CAN bus system are not equal. In this case, it could cause some problems and derogate the system stability. There is one way to relieve this situation; users can connect the CAN_GND of different CAN devices with each other to balance the voltage level of CAN_GND.

Electronic circuits are always influenced by different levels of Electro-Static Discharge (ESD), which become worse in a continental climate area. F.G. provides a path for conducting the ESD to the earth ground. Therefore, connecting the F.G correctly can enhance the capability of the ESD protection and improve the module's reliability.

Wiring of CAN_GND and F.G. is not necessary; users can modify the configuration of wiring according to real applications.

2.4 Rotary Switch

When users would like to set the CAN baud rate or message filter of I-2533, use the rotary swich on the upper of the power connector to archieve this purpose. Users can find it on the top of the power connector.

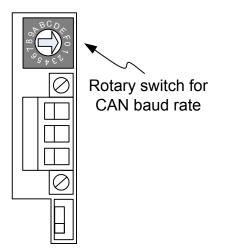


Figure 2-3 Location of Rotary Switch

There are 16 sections on the rotary switch. They are descripted on the following table.

Switch Value	Description
0	Set baud rate to 10 kbps
1	Set baud rate to 20 kbps
2	Set baud rate to 50 kbps
3	Set baud rate to 80 kbps
4	Set baud rate to 100 kbps
5	Set baud rate to 125 kbps
6	Set baud rate to 250 kbps
7	Set baud rate to 500 kbps
8	Set baud rate to 800 kbps
9	Set baud rate to 1 Mbps
A	Set baud rate to user-defined baud rate which is configured
	by I-2533 utility.
B~E	Not-available
F	Set I-2533 into configuration mode.

Table 2-2 Description of Rotary Switch

2.5 LED Indicator

There are 5 LEDs on the I-2533. One for power indication, three for CAN bus indication and one for fiber indication. The LED assignment and description are shown as follows.

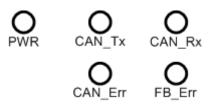


Figure 2-4 LED Assignment of I-2533

LED Name	Color	Description
PWR	Red	When power on the I-2533, this LED is turned on.
CAN_Tx	Green	When I-2533 sends one CAN message to CAN bus,
		this LED flashes once. Therefore, if bus loading is
		heavy, the LED will be always on.
CAN_Rx	Green	When I-2533 receives one CAN message from CAN
		bus, this LED flashes once. Therefore, if bus loading
		is heavy, the LED will be always on.
CAN Err	Red	1. If I-2533 detects the bus-off status on the CAN
		bus, this LED is always on.
		2. If I-2533 can't send CAN messages successfully
		because the bus connector is off or some errors
		happen, this LED flashes five times per second.
		3. If the CAN data buffer is full, this LED flashes once
		per second.
Fiber Err	Red	1. If the I-2533 detects the RXD line of the fiber is off,
		this LED is always on.
		2. If the fiber data buffer is full, this LED flashes once
		per second.

Table 2-3 LED Description

2.6 Terminator Resistor Setup

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

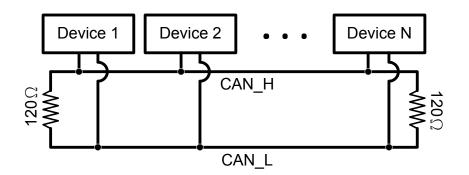


Figure 2.5 CAN bus network topology

Each I-2533 includes one build-in 120Ω termintor resistor, users can decide if it is enabled or not. The DIP switch for terminator resistor is under the power connector.

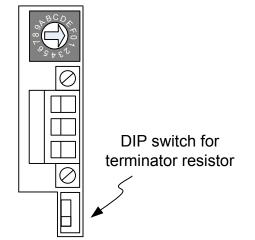


Figure 2-6 Location of Terminator Resistor DIP Switch

The following DIP switch statuses present the condition if the terminator resistor is active (default) or inactive.

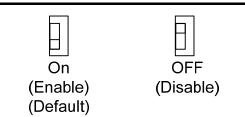


Figure 2-7 Adjustment of Terminal Resistance

Generally, if your application is as follows, we recommend you to enable the terminator resistor.

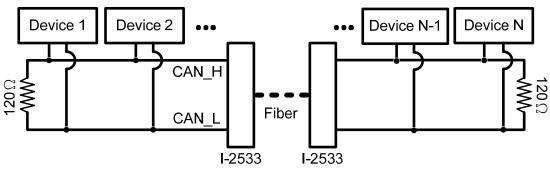
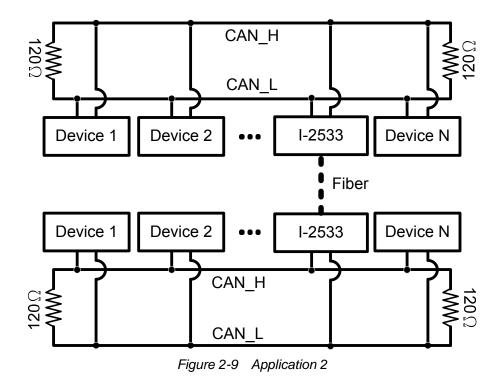
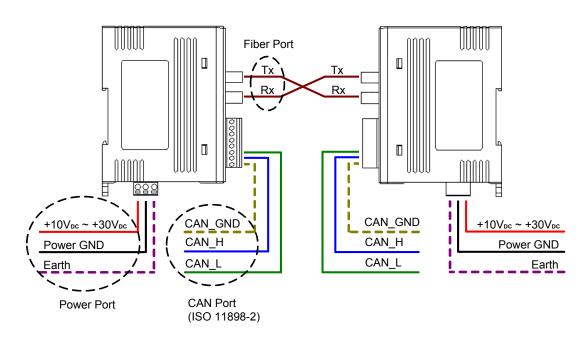


Figure 2-8 Application 1

If your application is like the structure as follows, the terminator resistor is not needed.



2.7 Wire Connection



The wire connection of I-2533 is displayed below.

Figure 2-10 Wire Connection of I-2533

The I-2533 has a metallic board attached to the back of the plastic basket. This metallic board and the F.G. pin of power connector are interconnected inside the I-2533. When users mount the I-2533 onto a metal DIN-Rail, users can connect the DIN-Rail to Earth Ground to replace connecting the F.G. pin of power connector.

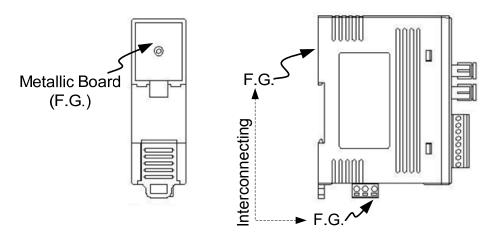


Figure 2-11 Metallic Board at Back of I-2533

3 Network Deployment

3.1 Driving Capability

Before introducing the driving capability of I-2533, 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.

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

Table 3-1 Recommended DC parameters for CAN Bus Line

Under the conditions described above, users can refer to the following table to know the maximum node numbers in each segment following ISO 11898-2 and the maximum segment length when using different type of wire.

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

Table 3-2 Driving Capability

3.2 Fiber Selection & Fiber Length

The specification of fiber used to connect I-2533 is shown as following table.

Туре	Diameter [µm] (Core/Cladding)	Operating Wavelength [nm]
	50/125	
Multi-Mode	62.5/125	850
	100/140	

Table 3-3	Specification of Fiber
-----------	------------------------

I-2533 allows maximum 2 km fiber length for each kind of CAN baud. Alought the maximum fiber length has no relationship with the CAN baud rate, but the some attributions of fiber still influence it. Higher attenuation of fiber will reduce the transmission distance. Users can use following table to know the relationship between those two.

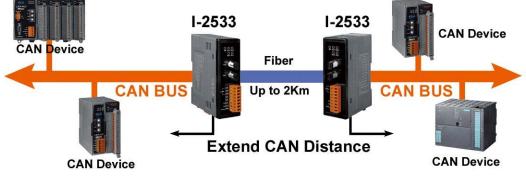
Table 3-4 The relationship between CAN baud rate and ideal fiber length

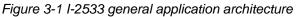
CAN Baud Rate [bit/sec]	Ideal Fiber Length [m]
1 M ~ 10 k	2000

Table 3-5 Attenuation & Fiber Length

Attenuation [dB/km]	Fiber Length [m]
2.8	< 2000
4	< 1500

By the way, when users use I-2533 in their application, they need to use one pair of I-2533 for communication. The general application architecture may look like as follows.





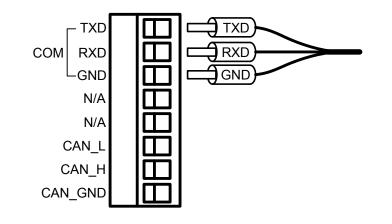
3.3 Filter & User-defined Baud Rate Configuration

When users want to use user-defined baud rate or set the message filter, I-2533 utility tool may be needed. It can be free downloaded from the following web site or get it in the product CD (path: CAN\Converter\I-2533\): <u>http://www.icpdas.com/products/Remote_IO/can_bus/i-2533.htm</u>

After getting the utility tool, please follow the following steps to set the baud rate and message filter.

Step0: Power off the I-2533. Set the rotary switch to "F", and connect the PC available COM port with the COM port of the I-2533. Users can find the communication cable in the product box. When connecting to the COM port of I-2533, the TxD pin of the cable is connected to the TXD pin of the COM port, RXD pin of the cable is connected to the RXD pin of the COM port, and GND pin of the cable is connected to the GND pin of the COM port. Then, power on the I-2533.





Step1: Execute the I2533_Utility.exe, the dialog of the I-2533 Utility will be poped up. Select the PC COM port which is connected with the COM port of the I-2533. Then, click "Connect" button.

🍜 I-2533 Utility Ver 1.00				
COM Port No.	COM 4	Connect	Close	

Step2: After connecting the I-2533 successfully, the parameters stored in the I-2533 will be shown on the dialog.

🧊 I-2533 Utility Ver 1.00	
COM Port No. COM 4 Connect Close	
Configuration	
User-defined Baud Rate 1000000 bps	Firmware Version : 1.00
Pass 11-bit ID (CAN 2.0A) of CAN messages from 7FF	to 7FF Add
Pass 29-bit ID (CAN 2.0B) of CAN messages from 1FFFFFF	to 1FFFFFFF Add
11-bit ID (CAN 2.0A) Pass List: (Empty for all pass) 29-bit ID (CAN 2	.0B) Pass List: (Empty for all pass)
Delete one Clear all	Delete one Clear all
Factory Default Load From File Save	To File Save All Configuration

Step3: Users can set the baud rate on the "User-defined Baud Rate" field. Here, fill "250000" for 250 kbps. Then, set the filter by using the "from" field, "to" field, and "Add" button. For example, If users want to pass the CAN message with ID 0x4 and 0x5 in the CAN 2.0A specification. Fill the value "4" in the "from" field of CAN 2.0A, and the value "5" in the "to" field of CAN 2.0A.

🏂 l-2533 Utility V	er 1.00				
COM Port No.	COM 4	Connect	Close		
Configuration					
User-defined Ba	ud Rate 250000	bps		Firmware Version	: 1.00
Pass 11-bit ID (C/	AN 2.0A) of CAN	messages from 4		to 5	Add
Pass 29-bit ID (C	AN 2.0B) of CAN	messages from 1FF	FFFFF	to 1FFFFFF	Add
11-bit ID (CAN 2.0)A) Pass List: (Er	npty for all pass)	29-bit ID (CA	N 2.0B) Pass List: (Empty	for all pass)

Step4: Click "Add" button to add this configuration. The configuration is shown on the "Pass List" field. If the "Pass List" is not empty, only the messages matched with the "Pass List" will be passed. If the "Pass List" filed is empty, it means all-pass. If users want to pass the message with ID 0x0 in the CAN 2.0A specification, fill the value "0" in both of "from" and "to" field and click "Add" button.

🖗 l-2533 Utility V	er 1.00		
COM Port No.	COM 4 Connect	Close	
Configuration			
User-defined Ba	ud Rate 250000 bps	Firmware Ve	ersion : 1.00
Pass 11-bit ID (C/	AN 2.0A) of CAN messages from 4	to 5	Add
Pass 29-bit ID (C	AN 2.0B) of CAN messages from 👖	FFFFFF to IFFFFFF	Add
11-bit/D (CAN 2.0	IA) Pass List: (Empty for all pass)	29-bit ID (CAN 2.0B) Pass List: (E	mpty for all pass)

Step5:.The method of configuring the message filter of the CAN 2.0B messages is similar with the configuration steps of the message filter of the CAN 2.0A messages. After finishing all of the configurations, click "Save all configuration" to store the configuration in the I-2533.

🎏 I-2533 Utility Ver 1.00				
COM Port No. COM 4	Connect	Close		
Configuration				
User-defined Baud Rate 250000	bps	Fin	mware Version :	1.00
Pass 11-bit ID (CAN 2.0A) of CAN mes	sages from 39	to 3E	}	Add
Pass 29-bit ID (CAN 2.0B) of CAN mes	sages from 1FFFF	FFF to 1F	FFFFF	Add
11-bit ID (CAN 2.0A) Pass List: (Empty 1 000 002 004~005 007 009~00A 00C~00D 00F~010 012 014 016 018 01A~01B 01D~01F 021~022 024~025 027~028 02B~02C		bit ID (CAN 2.0B) Pa 000000 000002 000004~00000005 000007 000000C~0000000A 00000C~000000D 00000F~000000D 000014 000014 000018 00001A~0000001B 00001A~0000001F 000021~0000001F 000021~00000022 000024~00000022 000028~00000028	ss List: (Empty fo	or all pass)
Delete one	Clearall		Delete one	Clearall
Factory Default	Load From Fi	e Save To File	e Save All C	onfiguration

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Step6: When the procedure is successful, the following message will be shown.



Step7: Then, Users can save the configurations in to an .ini file. Click "Save to File" to archieve this purpose.

00F~010 012 014 016 018 01A~01B 01D~01F 021~022 024~025 027~028 02B~02C			000000 000000 000000 000000 000000 00000	14 16		
	Delete on	e Clear all			Delete one	Clearall
Factory Default]	Load Fro	m File Ҝ	Save To File		onfiguration
($-\mathcal{N}$	
Save your text	or word file				\checkmark	? 🔀
Savejn:	Contraction I_2533_Utility			•	E 💣 📰 •	
My Recent Documents Desktop My Documents My Computer		M., 12522 ()				Caus
My Network Places	File <u>n</u> ame: Save as <u>t</u> ype:	My_12533_ini			[<u>S</u> ave Cancel
-	15.75					

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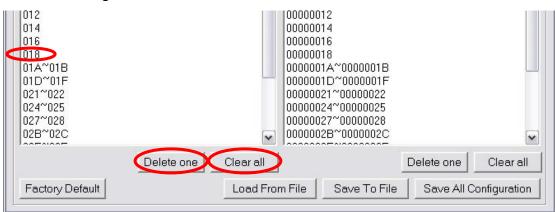
Step8: Of course, users can load the configurations from .ini file, and store them into the I-2533.

018 01A~01B 01D~01F 021~022 024~025 027~028 02B~02C		00000018 0000001A~000 0000001D~000 00000021~000 00000024~000 00000027~000 00000028~000	00001F 000022 000025 000028 00002C	
	Delete one	Clear all	Delete one	Clear all
Factory Default		Load From File	To File Save All C	Configuration
(M		
Open	-	\checkmark		? 🔀
Look jn:	C 1_2533_Utility	•	• 🖻 👉 🖬 •	
My Recent Documents Desktop My Documents My Computer	My_I2533_ini.ini			
My Network Places	File <u>n</u> ame: Files of <u>t</u> ype: I	My_12533_ini.ini .ini files Open as read-only	• •	<u>O</u> pen Cancel

Step9: If users want to recover the configurations to be default, click "Factory Default" and "Save All Configuration" button.

01D~01F 021~022 024~025 027~028 02B~02C		~	0000001D~0000001F 00000021~00000022 00000024~00000025 00000027~00000028 0000002B~0000002C		
	Delete one	Clear all		Delete one	Clearall
Factory Default		Load From	m File Save To File	Save All C	Configuration

Step10: Selecting one filter form the "Pass List" and clicking "Delete one" button can remove one setting. For example, if users want to remote the setting of ID 0x018 from the CAN 2.0A Pass List, click the ID 0x018 in the "Pass List", and click "Delete one" button. The ID 0x018 will be removed from the "Pass List". "Clear all" button will remove all settings from the "Pass List".



Step11. After finishing the configuration, set the rotary switch value to "0" ~ "A" and reboot the I-2533. The CAN message filter will be applied automatically in the value "0" ~ "A" of the rotary switch. The CAN baud rate set by utility is only appled when the rotary switch is set to "A".

4 Dimension

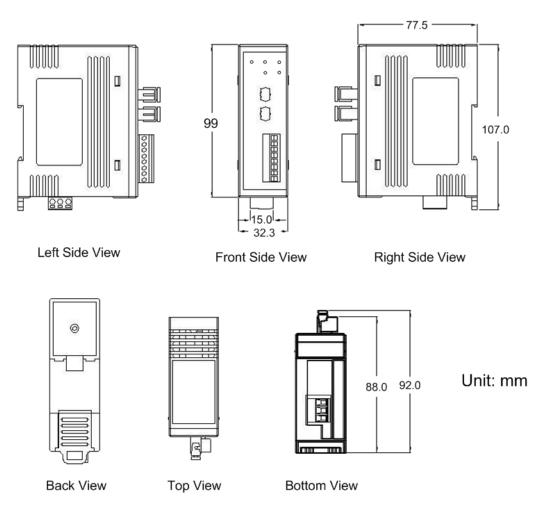


Figure 4-1 Dimension of I-2533