User Manual

Version 1.6.0 February 2018

I-7531(-UT)

(CAN Bus Isolated Repeater)

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Important Information

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

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If you encounter any problems while operating this device, feel free to contact us via mail at: service@icpdas.com . We guarantee to respond within 2 working days.

1. Introduction

I-7531 / I-7531-UT is a CAN repeater used to establish a physical coupling of two or more segments of a CAN bus system. User can implement tree or star topologies as well as for long drop lines with I-7531 / I-7531-UT. Connecting via I-7531 / I-7531-UT, the division of a CAN system into several subsystems increases the maximum number of bus nodes.

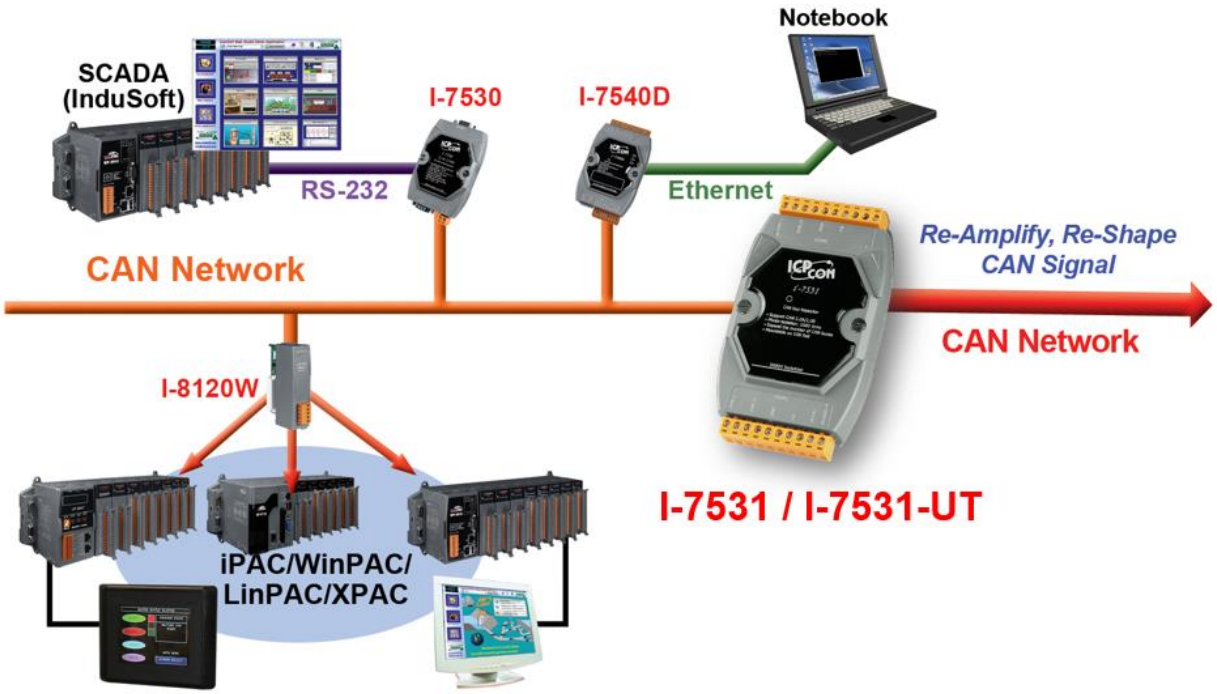


Figure1. Application of I-7531 / I-7531-UT

I-7531 / I-7531-UT is an optically isolated CAN repeater which provides 2500 V_{rms} optical isolation allowing you to separate and protect critical segments of the system from the rest of the CAN network. And its galvanic isolation isolates both CAN segments from each other as well as from the power supply. The CAN connection of I-7531 is by terminal blocks. A power supply of 10 ~ 30 V_{DC} is required. I-7531 / I-7531-UT is housed in a rugged DIN-Rail mountable box, making it easy to install in an industrial cabinet. Therefore, I-7531 / I-7531-UT can be used in CANopen, DeviceNet and generic ISO 11898-2 standard.

If user wants to know more detail information about the I-7531 / I-7531-UT, please visit our website as follow:
http://www.icpdas.com/products/Remote_IO/can_bus/i-7531.htm

1.1 Features

- High speed
- Removable terminal block & Mountable on DIN Rail
- Bus pins protected against transients in an industrial environment
- No disturbance of the bus lines with an un-powered node
- Transmit data (TxD) dominant time-out function prevents the output drivers from driving a permanent dominant state
- A thermal protection circuit is integrated to prevent the transceiver from damage if the junction temperature exceeds thermal shutdown level

1.2 Specification

- Support CAN 2.0A/CAN 2.0B
- Fully compatible with ISO 11898-2
- Maximum communication baud : 800Kbps
- Propagation Delay: ~200ns
- Driving capability: Up to 100 nodes on each CAN port
- Photo-coupler isolation between 2 CAN ports: 2500 Vrms
- Power consumption: 2W max
- CAN terminal resistors are integrated (can be disabled by jumper)
- 3KV galvanic isolated among of power supply and each CAN port
- Power Supply: +10V_{DC} ~ +30V_{DC}
- I-7531's Operating temperature: -25°C ~ +75°C
- I-7531-UT's Operating temperature: -40°C ~ +85°C
- Humidity: 5% ~ 95%
- Dimensions: 122 mm x 72 mm x 35 mm

1.3 Application

- Home Automation
- Vehicle Automation
- Monitor system
- Factory Automation
- Building Automation

2. Technical data

2.1 Block Diagram

Figure 2 is a block diagram illustrating the functions of the I-7531 module. Power supply are with 3000 V_{DC} galvanic isolated between each CAN port. Futhermore, there is photo-isolation 2500 Vrms between two CAN ports.

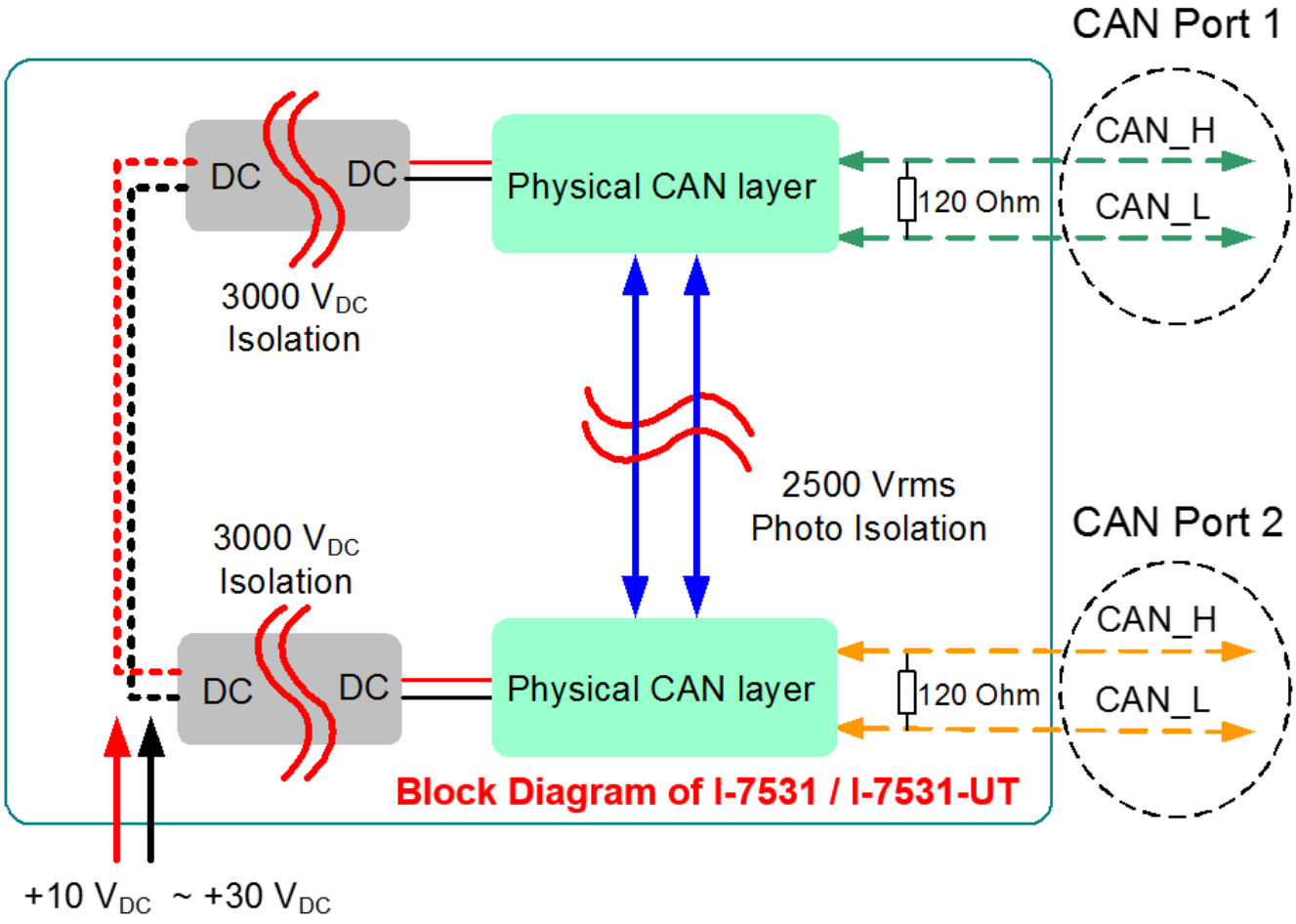


Figure2. Block Diagram of I-7531

2.2 Appearance

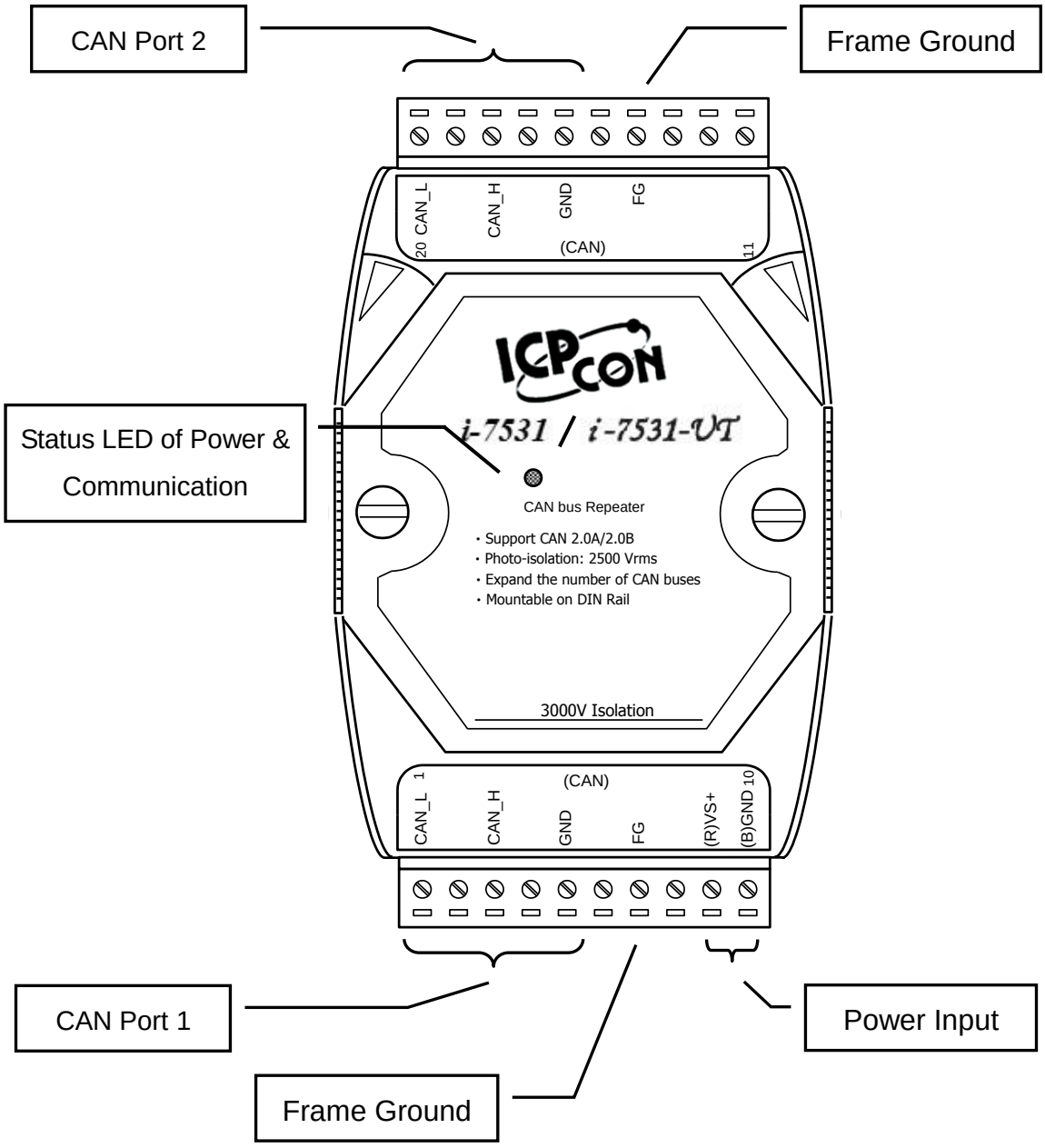


Figure3. Appearance of I-7531 / I-7531-UT

2.3 Pin Assignment

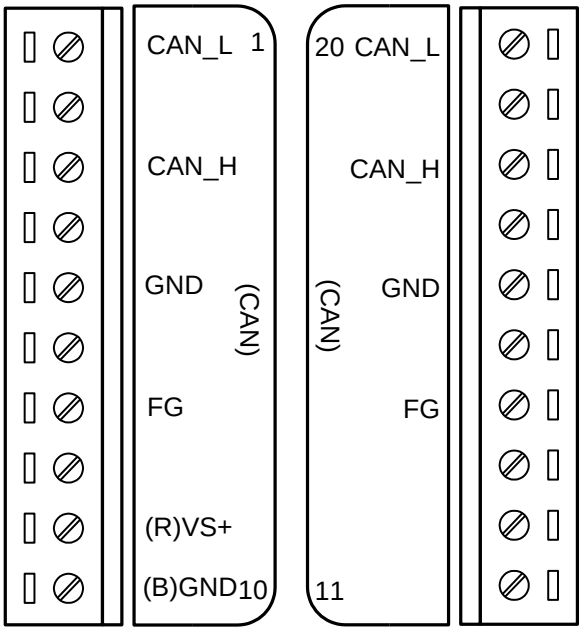


Figure4. Pin Assignment of I-7531 / I-7531-UT

Table1. Pin Description of I-7531 / I-7531-UT

No.	Part	Name	Description
1	CAN Port 1	CAN_L	CAN_Low. Signal Line of CAN port 1.
3		CAN_H	CAN_High. Signal Line of CAN port 1.
5		GND	CAN_Ground (or CAN_GND), Voltage level of ground of CAN_L and CAN_H of CAN port 1.
7	FG	FG	Frame Groud.
9	Power Input	(R)VS+	Voltage Source. It could be +10V_{DC} ~ +30V_{DC}.
10		(B)GND	Power Ground.
14	FG	FG	Frame Groud.
16	CAN Port 2	GND	CAN_Ground (or CAN_GND), Voltage level of ground of CAN_L and CAN_H of CAN port 2.
18		CAN_H	CAN_High. Signal Line of CAN port 2.
20		CAN_L	CAN_Low. Signal Line of CAN port 2.

Note 1: In some cases, the voltage level of CAN_GND of different CAN device in the same CAN bus system are not equal. At this time, it could cause some problems to derogate system staibility of this CAN bus system.

There is one way to relieve this situation; user can connect the CAN_GND between those CAN devices to achieve equal voltage level of CAN_GND.

Wiring of CAN_GND is not necessary; user can modify the configuration of wiring according to actual applications.

Note 2: Electronic circuits are constantly vulnerable to Electro-Static Discharge (ESD), which become worse in a continental climate area. FG(Frame Ground) provides a path for bypassing ESD to earth ground, allowing enhanced static protection (ESD) capability and ensures that the module is more reliable.

If user wants to use FG, both the Pin 7 and Pin 14 should be connected to earth ground. Within I-7531 / I-7531-UT, Pin 7 and Pin 14 (FG) are not interconneced.

2.4 Wire Connection

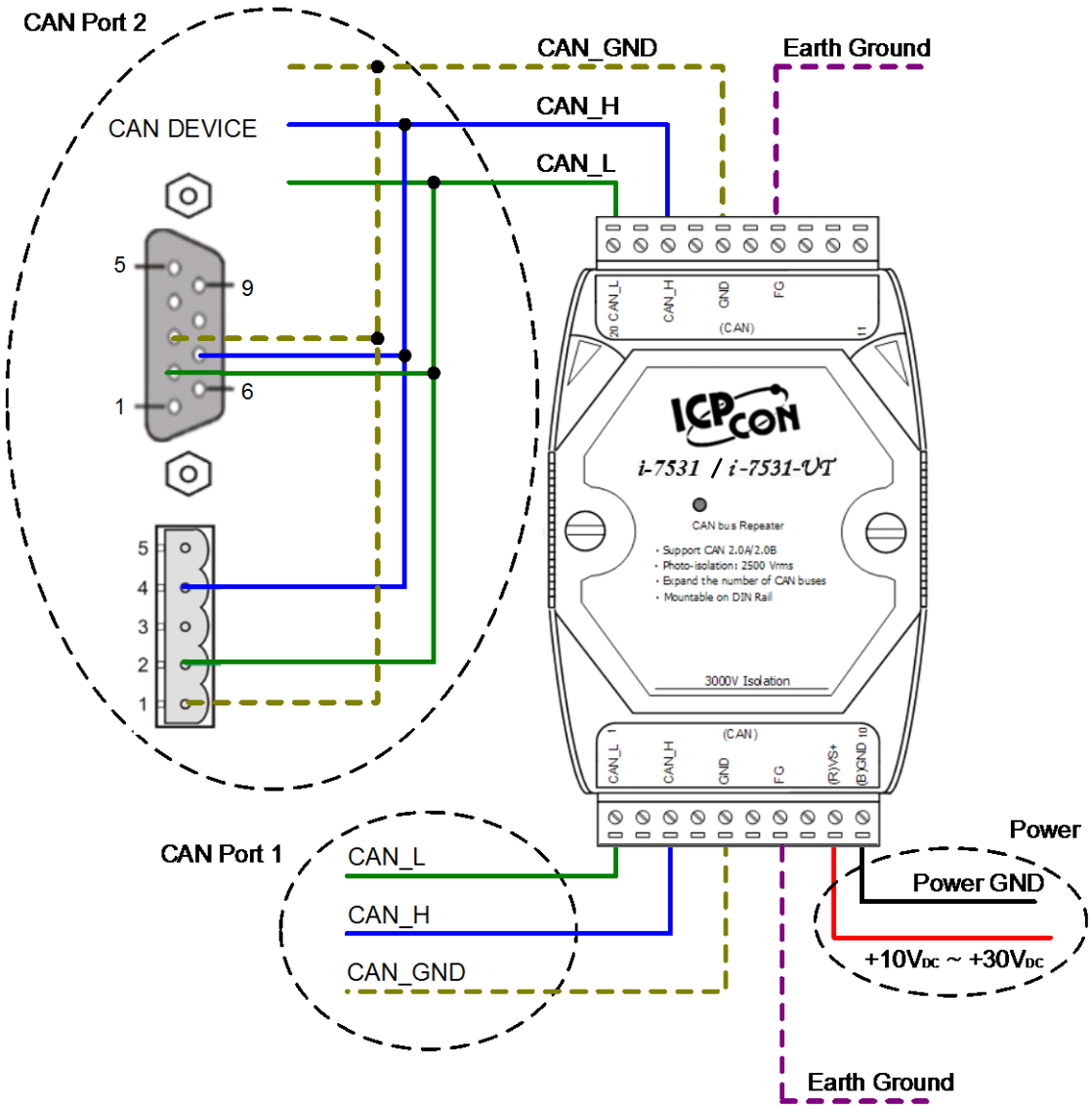


Figure5. Wire Connection of I-7531

2.5 Status LED

When user turning I-7531 / I-7531-UT on, the status LED of I-7531 / I-7531-UT will be display with red light. Moreover, when a message passes through I-7531 / I-7531-UT, the status LED will be twinkle once with yellow light while the red light is still on.

Note 3: Twinkling rate correlates with baud rate of CAN bus. User may see no twinkling when the twinkling period is too short because of the higher baud rate of CAN bus. Besides, the yellow LED could look like always on when bus loading is heavy.

2.6 Terminator Resistor Setting

According to the ISO 11898-2 specifications, the bus line of CAN_H and CAN_L must be terminated by resistor for proper operation. The equivalent resistance between CAN_H and CAN_L should be 60Ω. There are some examples below.

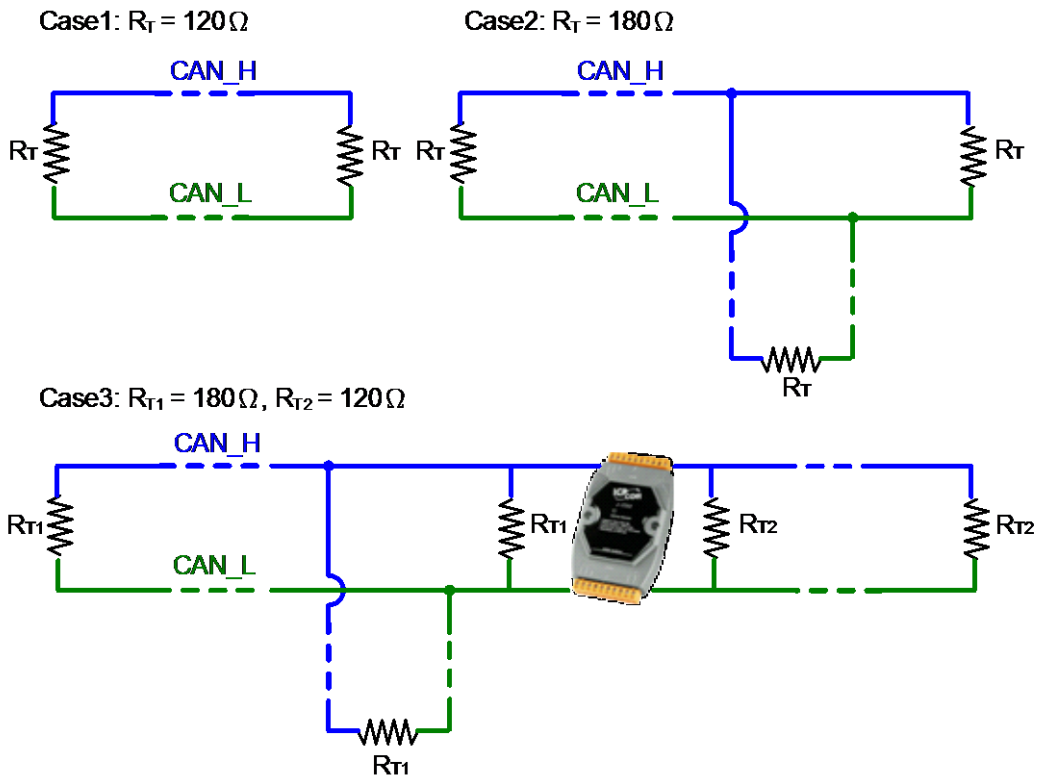


Figure6. Terminator Resistor

On the other hand, I-7531 / I-7531-UT module include two build-in 120Ω terminator resistors, user can decide to enable those two terminator resistors or not.

The JP2 of I-7531 / I-7531-UT is used for adjusting terminal resistor on CAN Port 1, and the JP3 of I-7531 is used for adjusting terminal resistor on CAN Port 2.

Before adjusting JP2 or JP3 of I-7531 / I-7531-UT, user needs to open the cover of I-7531 / I-7531-UT first. Those locations of JP2 and JP3 are shown as following:

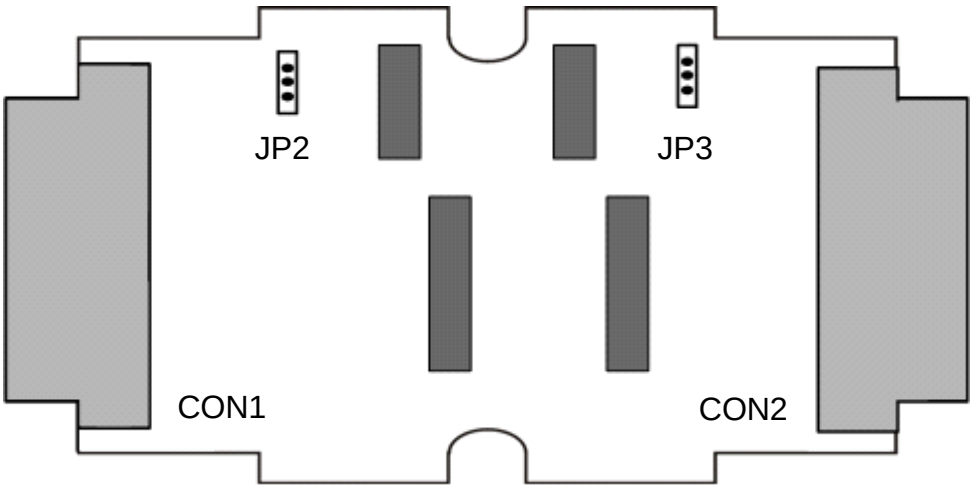


Figure7. JP2 and JP3 positions

The following connection statuses present the condition if the terminal resistor is enabled (default) or disabled.

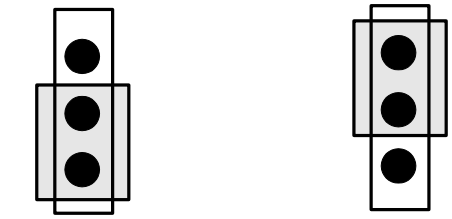


Figure8. Adjustment of Terminator Resistor

2.7 Cable Selection

The CAN bus is a balanced (differential) 2-wire interface running over either a Shielded Twisted Pair (STP), Un-shielded Twisted Pair (UTP), or Ribbon cable.

The table below show recommended DC parameters of CAN bus line.

Table2. 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

The recommended AC parameters of CAN bus line are 120Ω impedance and 5 ns/m specific line delay.

2.8 Driving Capability and Baud Rate

The relationship between ideal total bus length and baud are displayed below.

Table3. Baud, Total Bus Length, and Number of I-7531 / I-7531-UT

Baud [bit/sec]	Ideal Bus Length without I-7531 / I-7531-UT [m]	Max I-7531 / I-7531-UT Number
800K	50	1
500K	100	2
250K	250	6
125K	500	12
50K	1000	25
20K	2500	62
10K	5000	125

Note 4: When users add one I-7531 into a CAN network, the ideal total bus length will reduce 40 meters because of the propagation delay of I-7531. For example, if users use baud 500K and one I-7531, the ideal total bus length will be "**100 – 40 * 1 = 60 meters**".

After deciding the number of I-7531 and calculating the corresponding ideal bus length, users can use the following table to know the maximum node number in each segment and the maximum segment length when using different type of wire.

Table4. Driving Capability

Wire Cross-Section [mm^2]	**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 m	<200 m	<170 m	<150 m
~0.5 (AWG20)	<390 m	<360 m	<310 m	<270 m
~0.8 (AWG18)	<590 m	<550 m	<470 m	<410 m
~1.3 (AWG16)	<980 m	<900 m	<780 m	<670 m

Note 5: The definition of segment and the relationship between segment length (L_{seg1}, L_{seg2} …) and ideal total bus length (L_{total}) are shown in the following figure.

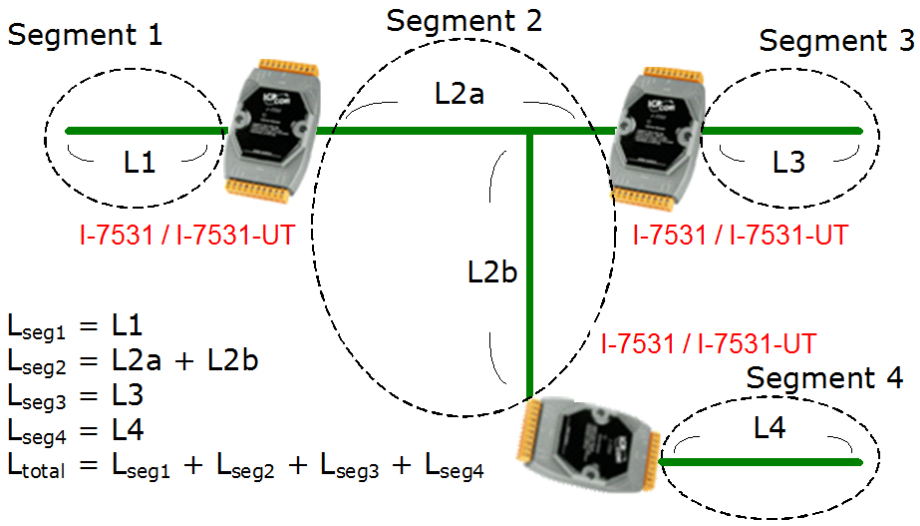


Figure9. Definition of L_{seg1} and L_{total}

3. Application Architecture

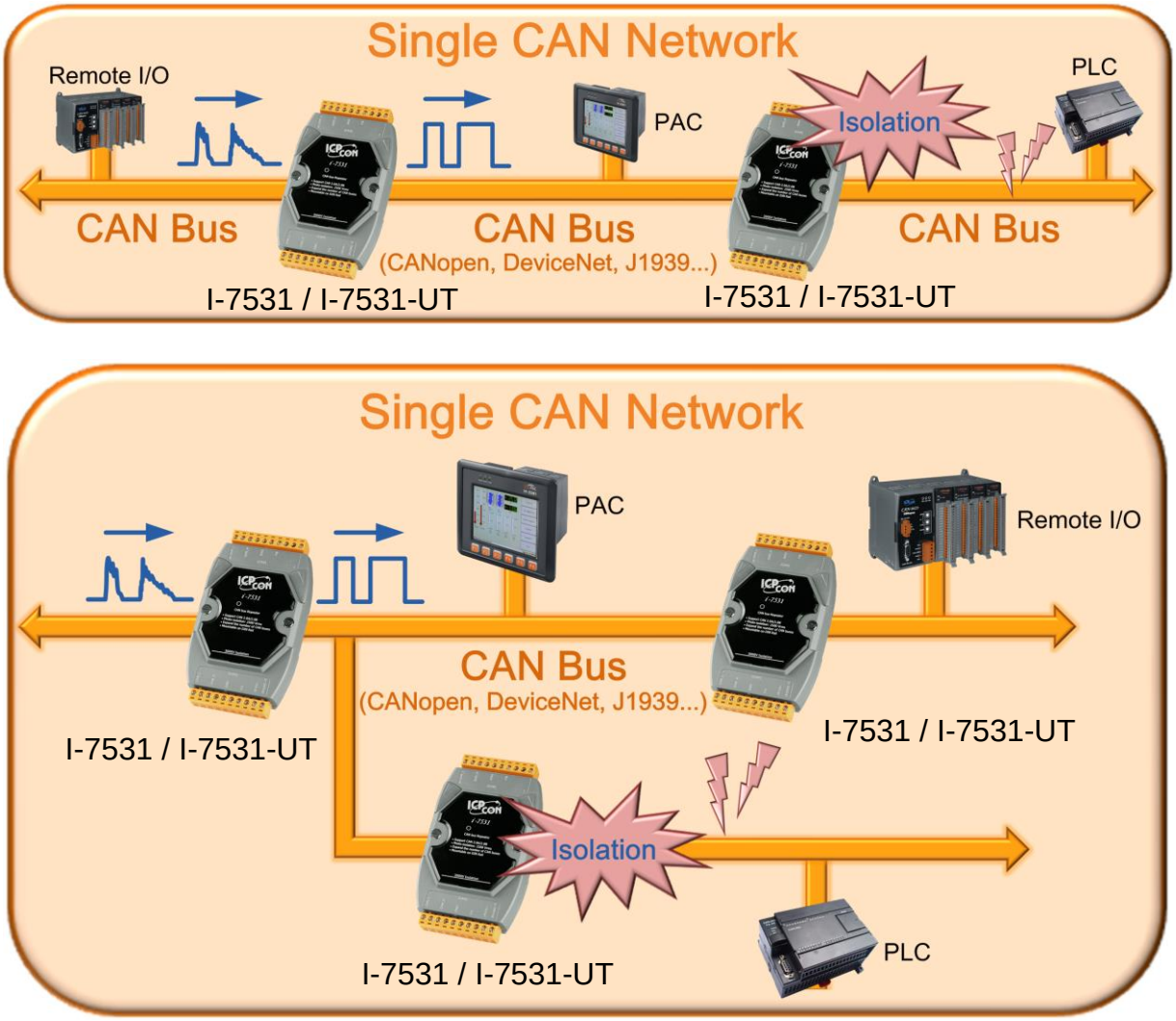
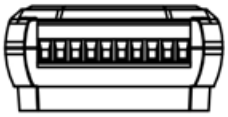
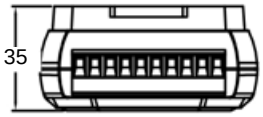


Figure10. Application Architecture

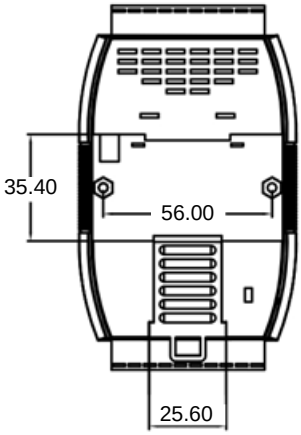
4. Dimension and Mounting



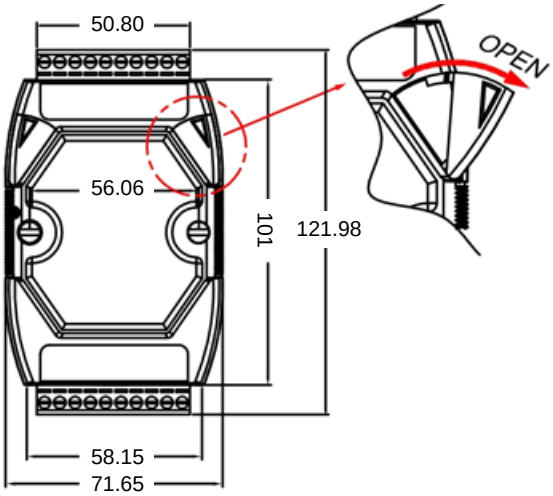
Top View



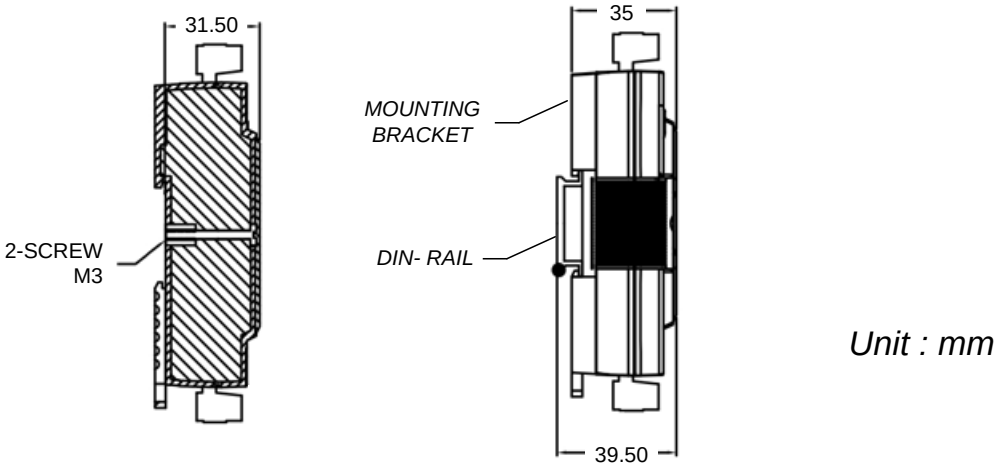
Bottom View



Back View



Front View



Side View

Unit : mm

Figure11. Dimension

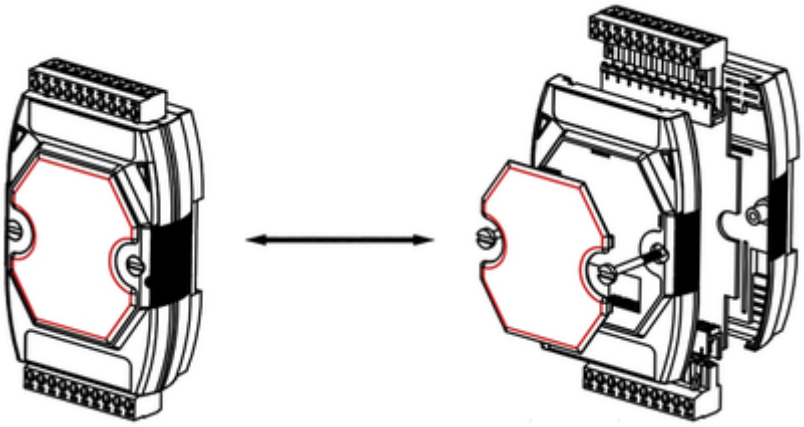


Figure12. Assembly Drawing

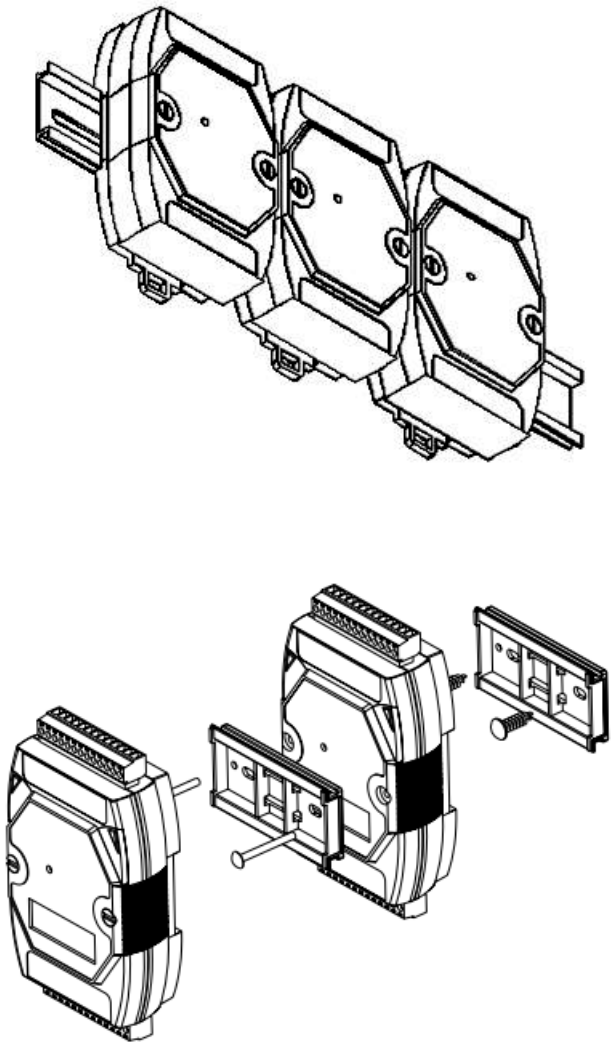


Figure13. Mounting