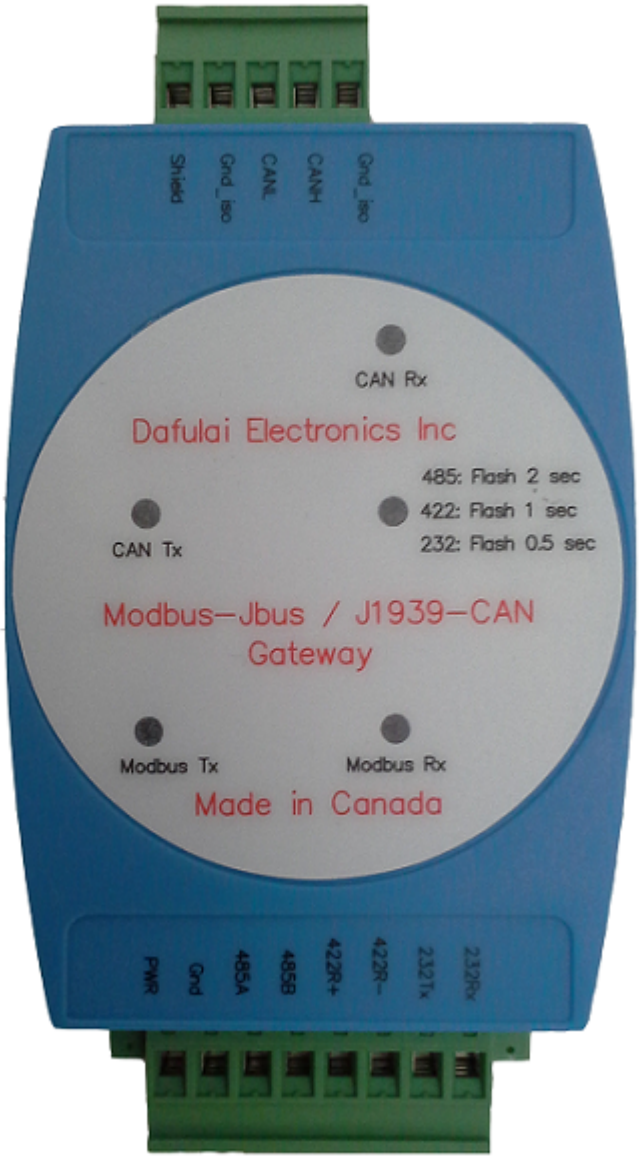
DFAJ1939Mod1 Rev 1.00 Datasheet

Modbus-Jbus RTU Slave / J1939 -CAN Gateway



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1 Overview

DFLJ1939Mod1 provides a good solution which converts J1939 protocol (or raw Can bus) to Modbus RTU protocol (or JBus Protocol) . From the perspective of modbus or JBUS network, our DFLJ1939Mod1 is a slave Modbus RTU or Jbus node. You don't need write any code to access CAN Bus and J1939 network by Modbus or JBUS Master. You just use our free configuration software to configure the map between PGN or CAN message ID and Modbus registers address before you use our DFLJ1939Mod1. Of cause, it includes Modbus device address and baud rate. You only need configuration once, DFLJ1939Mod1 can remember your all settings even though power off.

The application architecture for the DFLJ1939Mod1 is shown below :

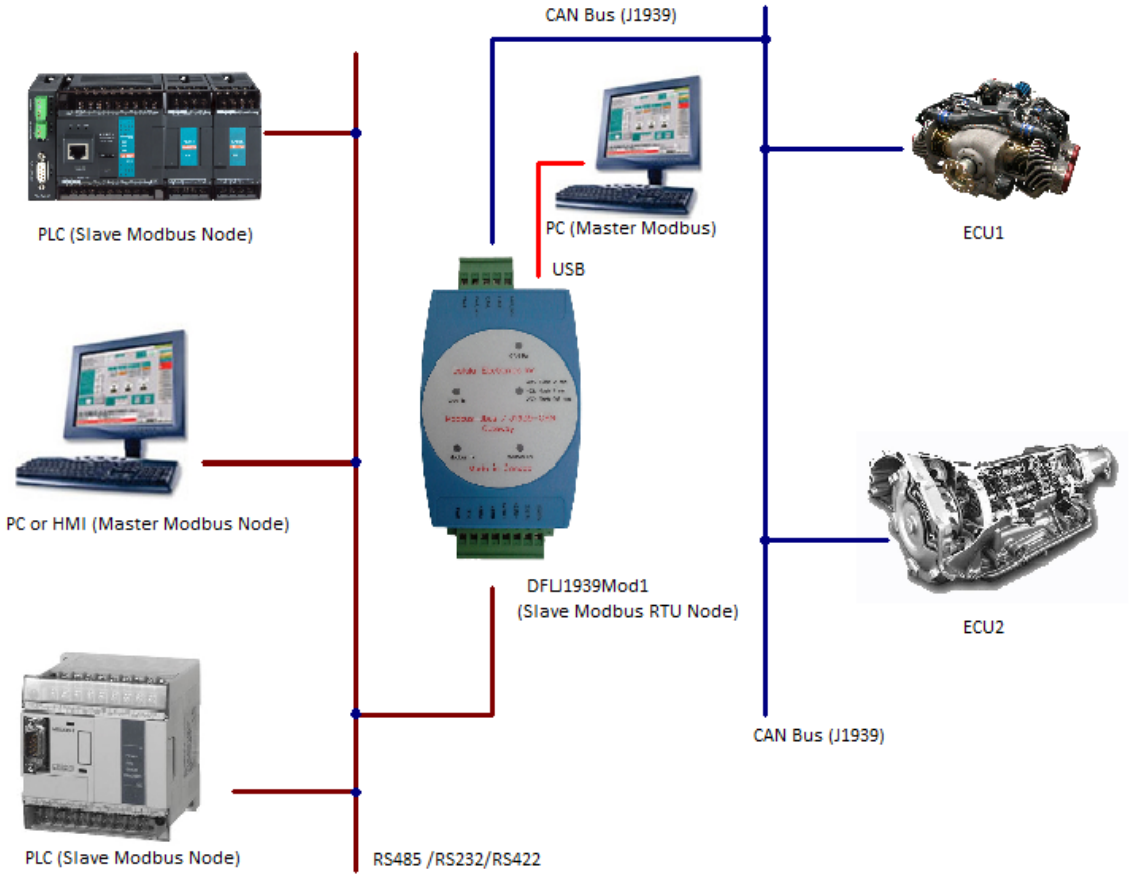


Fig. 1 Application Architecture

Block Diagram of DFLJ1939Mod1 is shown below:

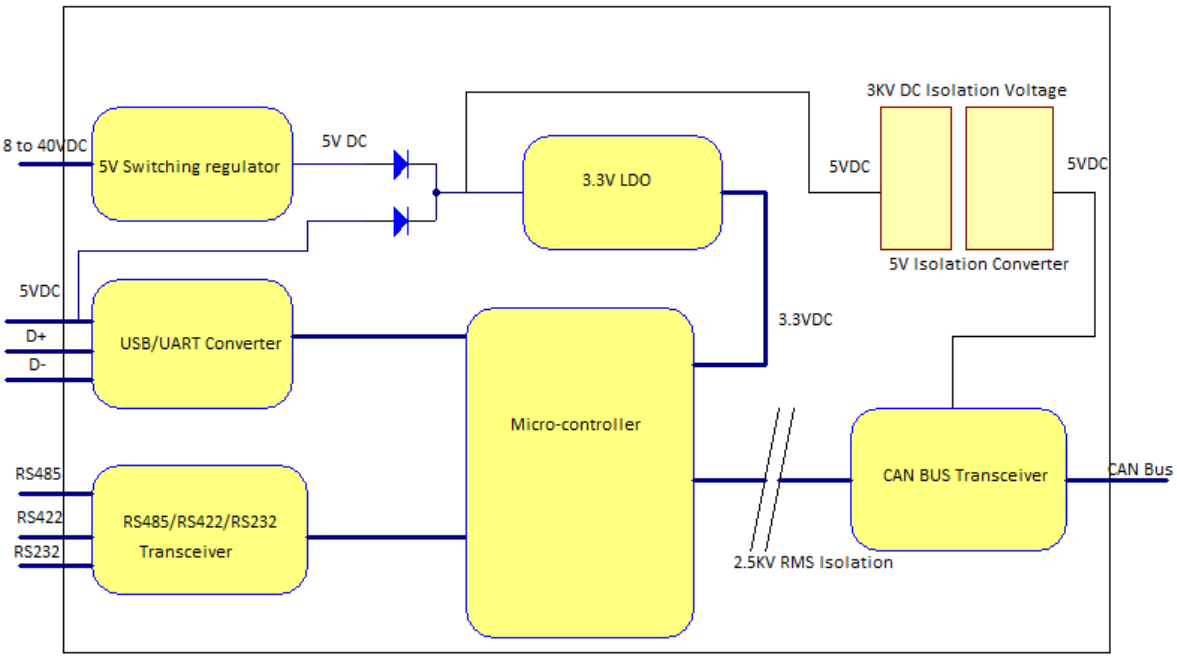


Fig. 2 Block Diagram of DFLJ1939Mod1

2 Features Highlights

- Support RS-232, RS-485, RS-422 and USB 2.0 interface
- Support Modbus/JBus RTU slave protocol with 2 independent slave nodes, so you can use 2 master Modbus/Jbus nodes to connect our DFLJ1939Mod1
- Support J1939 long messages (9 to 1785 bytes)
- Configurable Modbus/Jbus baud rates of 4800,9600, 19200, 28800,38400,43000,57600,115200
- Configurable Modbus/Jbus Network ID (1 to 250) and data format for none, odd or even parity and 1 or 2 stop bits.
- Support Function code 03 /04 /06 /16 of Modbus/Jbus function for reading/writing J1939/ Raw CAN Bus Message
- Configurable J1939 address and Names.
- J1939 Network addresses management
- Configurable J1939/Can Bus baud rates of 20K, 50K 125K, 250K, 500K,1000K
- Configurable CAN Bus raw data to little endian or big endian
- 35 mm Din Rail Enclosure
- Power supply range is 8V to 40VDC, it means both 12VDC and 24VDC are OK
- RoHS Design

- Software configure interface RS-232, RS-485, RS-422 without any hardware jumper.

3 Typical Application

- Battery Management System and PLC Control
- Automotive diagnostic scan tools and code readers
- PLC and Diesel Power-train application
- Digital dashboards

4 Hardware

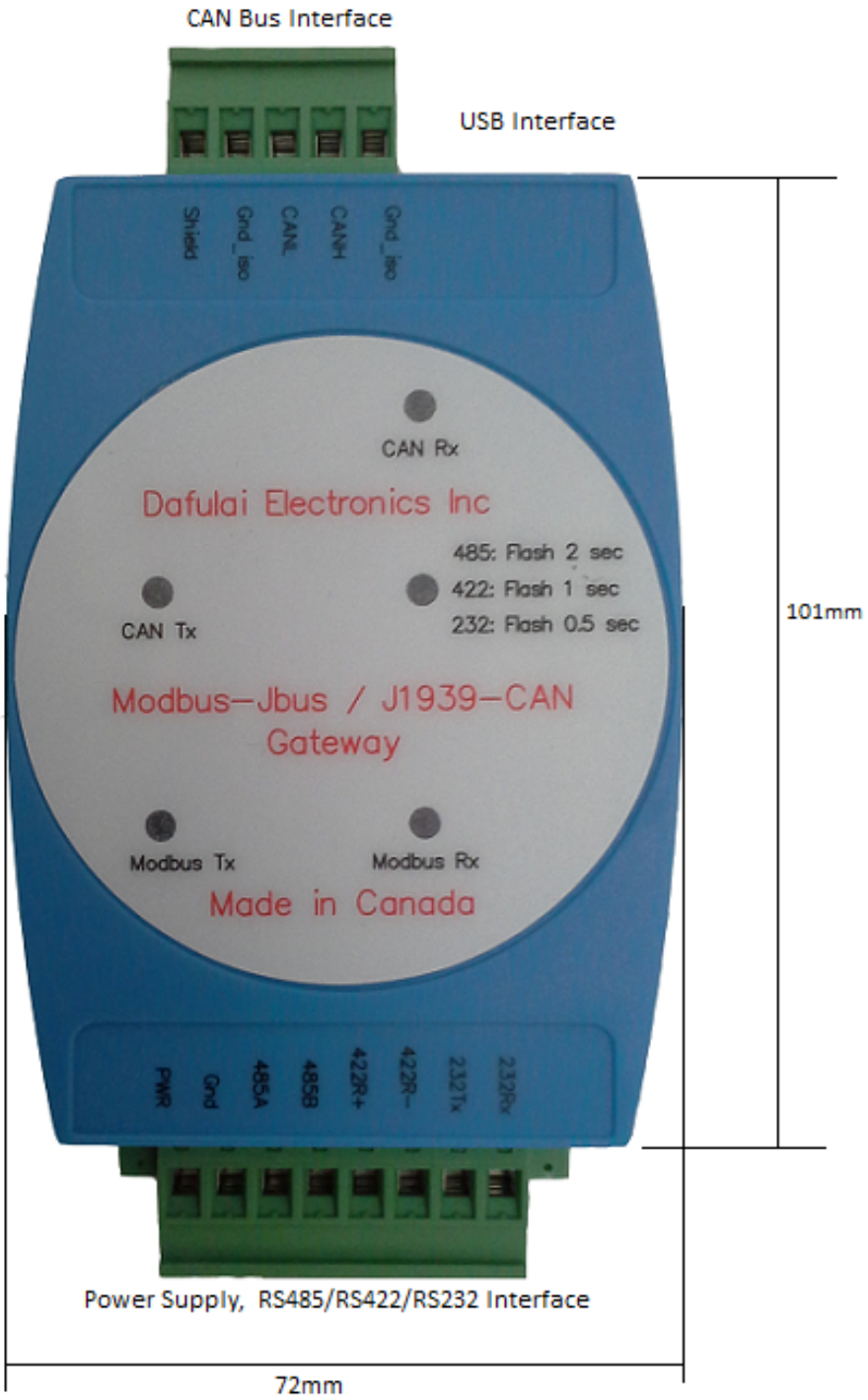
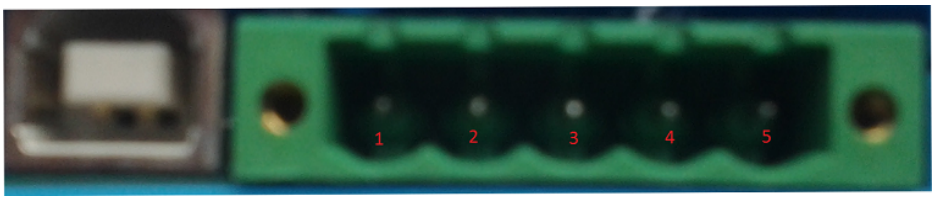


Fig 3 Hardware of DFLJ1939MOD1

4.1 Pin Assignment

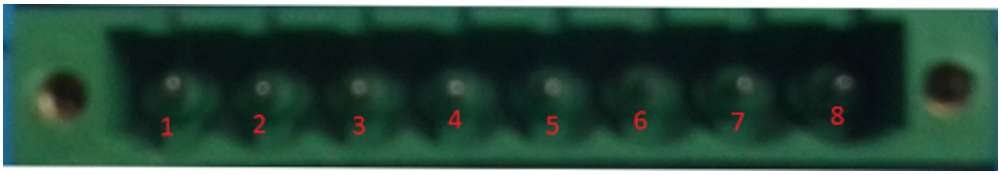
CAN BUS Side:



Table

Pin	Name	Description
1	Gnd_iso	CAN bus signal Ground
2	CANH	HIGH-level CAN bus line which is a differential signal
3	CANL	LOW-level CAN bus line which is a differential signal
4	Gnd_iso	CAN bus signal Ground
5	Shield	Shield line of double shielded CAN cable. Just keep unconnected if it is not double shielded CAN cable

RS485/RS422/RS432 Side:



Table

Pin	Name	Description
1	PWR	Positive side of Power supply (8V to 40VDC)
2	Gnd	Negative side of Power supply, it is Ground of Modbus/USB
3	485A	Positive side of RS485 Signal and RS422 transmit signal
4	485B	Negative side of RS485 Signal and RS422 transmit signal
5	422R+	Positive side of RS422 receive signal
6	422R-	Negative side of RS422 receive signal
7	232Tx	Transmit signal of RS232
8	232Rx	Receive signal of RS232

4.2 LED Indication

There are 5 LEDs to indicate the DFLJ1939MOD1's state. 4 LEDs' color is Green. One LED's color is Red

1 Red LED

If this LED is on for 2 seconds and off for 2 seconds repeatedly, it means DFLJ1939MOD1 is using RS485 interface.

If this LED is on for 1 second and off for 1 second repeatedly, it means DFLJ1939MOD1 is using RS422 interface.
If this LED is on for 0.5 second and off for 0.5 second repeatedly, it means DFLJ1939MOD1 is using RS232 interface.

If this LED is always on forever or always off forever, it means DFLJ1939MOD1 has malfunction. Please repair this unit.

2 Modbus Tx LED (Green color)
When RS232/RS485/RS422/USB transmits Modbus data packet, this LED will be on. Of cause, when we run configuration software, if RS232/RS485/RS422/USB transmits ACK byte, this LED will be on too.

3 Modbus Rx LED (Green color)
When RS232/RS485/RS422/USB received Modbus data packet, this LED will be on. Of cause, when we run configuration software, if RS232/RS485/RS422/USB receives data, this LED will be on too.

4 CAN Tx LED (Green color)
When CAN BUS transmits any data, this LED will be on.

5 CAN Rx LED (Green color)
When CAN BUS receives any data, this LED will be on.

5 Configuration Software

ModbusJ1939Configuration is a tool for configuration of DFLJ1939Mod1.
It can configure all parameters about Modbus/Jbus/Canbus/J1939, And it can configure the map table between Input/holding register address and PGN number or CAN BUS ID .

Configuration software can be downloaded from our website http://www.dafulaielectronics.com/Documents/ModbusJ1939Config.zip.
It is free of charge software. This software must be run under Windows Vista/Windows 7 /Windows 8/ Windows 10. After download, you should unzip the files, and run setup.exe to install this software.
If you install successfully, you will see shortcut "ModbusJ1939Configuration" in your desktop

You can use USB port or RS485/RS422/RS232 to run Configuration software. It is very flexible.
If you use USB port, you don't need external power supply, DFLJ1939Mod1 will use USB BUS power.
If you use RS485/RS422/RS232, you should provide 8-40VDC power supply to Pin 1 and Pin 2 of 8-pins terminal block. Of cause, you can still use USB Bus Power to replace it if you didn't connect 8-40VDC power supply.

Notes: For RS485/RS422/RS232, the default is RS485. The default Serial Port (Including USB) is 9600 N 1 (Baud rate :9600, No Parity, 1 stop bit, no flow control). Modbus / Jbus Device address is 1.

5.1 Communication Parameters Setting

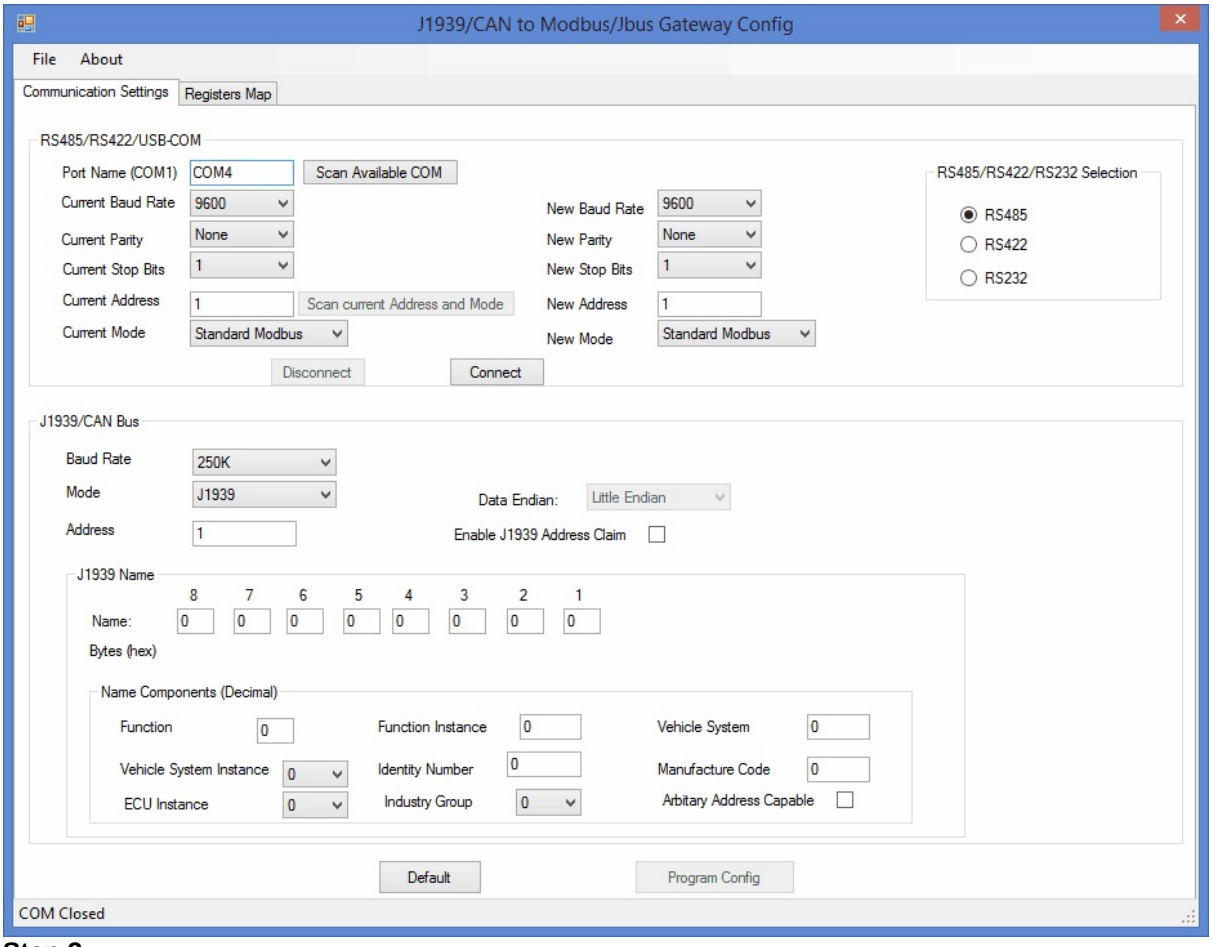
Step 1:

Plug in USB cable to DFLJ1939Mod1 and PC. If you don't have USB cable, you can use RS485/ RS422/RS232 and provide 8 to 40VDC power supply instead of it.

The Red LED will flash in different way to tell you which one is used for RS485/RS422/RS232. Please read Hardware LED indication.

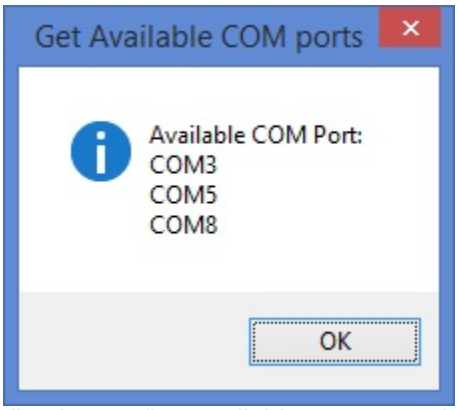
Step 2:

Run ModbusJ1939Configuration by double click its icon in desktop. You will see the windows below:



Step 3:

This is for group of "RS485/RS422/RS232/USB-COM". If you don't know port name of RS485/ RS422/USB-COM, you can click button "Scan Available COM". Bottom status bar will display scan progress. After finishing scan, the dialog below will be displayed.



Click OK, it will automatically choose first available COM Port in the dialog. Of cause, you can modify it to the other port.

Now, you should fill in current baud rate, current parity, current stop bits. These value must match the actual value of DFLJ1939Mod1. If not match, you cannot use the software to configure.

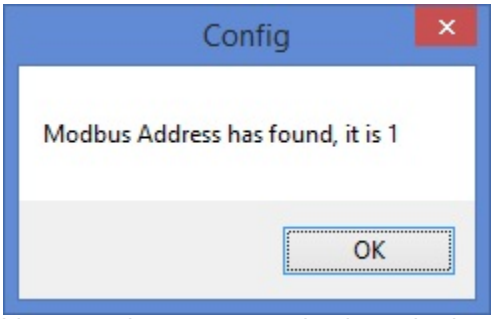
Note: When multiple COM ports are available, if you choose wrong COM Port, the configuration software will be frozen when you execute "Program Config" or "Scan current Address and Mode" command.

The good way to identity Com port in In multiple COM ports available is that power off DFLJ1939Mod1 and execute "Scan Available COM" command again. If one Com port is not in the available COM Ports, this COM Port will be our DFLJ1939Mod1

Step 4:

Click button "Connect", The status bar in the bottom will display "COM Open" to replace "COM Closed " if your com port name is correct. Otherwise, Return to Step 3 to choose COM Port name again.

If you don't know the current address of Modbus /JBus device or current mode (Standard Modbus or JBus) , please click button "Scan current Address and Mode" , it will display dialog below:



And Modbus/Jbus device address and Current mode (Standard Modbus or JBus) will be set automatically by this scan command. The current address and Current mode (Standard Modbus or JBus) must match the actual value of DFLJ1939Mod1. If not match, you cannot use the software to configure.

Step 5:

Fill in new Baud rate, new parity, new stop bits, new address and new mode. choose one of RS485, RS422 and RS232. These settings are for new parameters of DFLJ1939Mod1.

Step 6:

This is for J1939/CAN-BUS group.

Choose CAN bus/J1939 baud rate from drop-down menu. It will be one of 20K, 50K, 125K, 250K,500K and 1000K. Choose Mode from drop-down menu. It will be one of J1939,CAN 11bits ID and CAN 29 bits ID. Choose Data Endian from drop-down menu. It will be one of little endian and big endian. Data Endian Setting is not available for J1939 because J1939 is little endian. We know that for string it is always big endian. If data length is bigger than 4, we take it as big endian no matter what endian you choose. When you choose J1939 mode, you can enable/disable J1939 Address claim. If you set J1939 Address claim, you must input 8 bytes' J1939 name.

Next step, you will set up Register map table.

5.2 Register Address Map

DFLJ1939Mod1 has special input Registers and special holding registers. You can not map these registers.

The special input Registers are below:

39101 address of Modbus registers, or 39100 of JBus Register: **CAN BUS Status**,

Lsb is bit 0, Msb is bit15

Bit0:

1 = Transmitter or receiver is in Error State Warning state

0 = Transmitter or receiver is not in Error State Warning state

Bit1:

1 = Receiver is in Error Warning state

0 = Receiver is not in Error Warning state

Bit2:

1 = Transmitter is in Error Warning state

0 = Transmitter is not in Error Warning state

Bit3:

1 = Receiver is in Bus Passive state

0 = Receiver is not in Bus Passive state

Bit4:

1 = Transmitter is in Bus Passive state

0 = Transmitter is not in Bus Passive state

Bit5:

1 = Transmitter is in Bus OFF state

0 = Transmitter is not in Bus OFF state

Other bits are "don't care ", it should be 0.

39102 address of Modbus registers, or 39101 of JBus Register: **J1939 address for DFLJ1939Mod1 itself.**

39103 to 39199 of Modbus registers, or 39102 to 39198 of JBus Register: **Other nodes' J1939 address, these nodes are connected to CAN BUS**

Value 254 means empty J1939 address, it denotes no node connected

We can use Modbus master to read these address content, so we will know j1939 address of devices which connects CAN BUS. It is useful for us to config Register address map when using J1939 Protocol because we need to know source address and destination address of J1939.

Note: DFLJ1939Mod1 only gets J1939 address of devices which are connected to CAN BUS when DFLJ1939Mod1 power on, so DFLJ1939Mod1 doesn't know device's J1939 address when it is connected CAN BUS later.

The special holding Registers are below:

49101 address of Modbus registers, or 49100 of JBus Register: **Configuration command**.

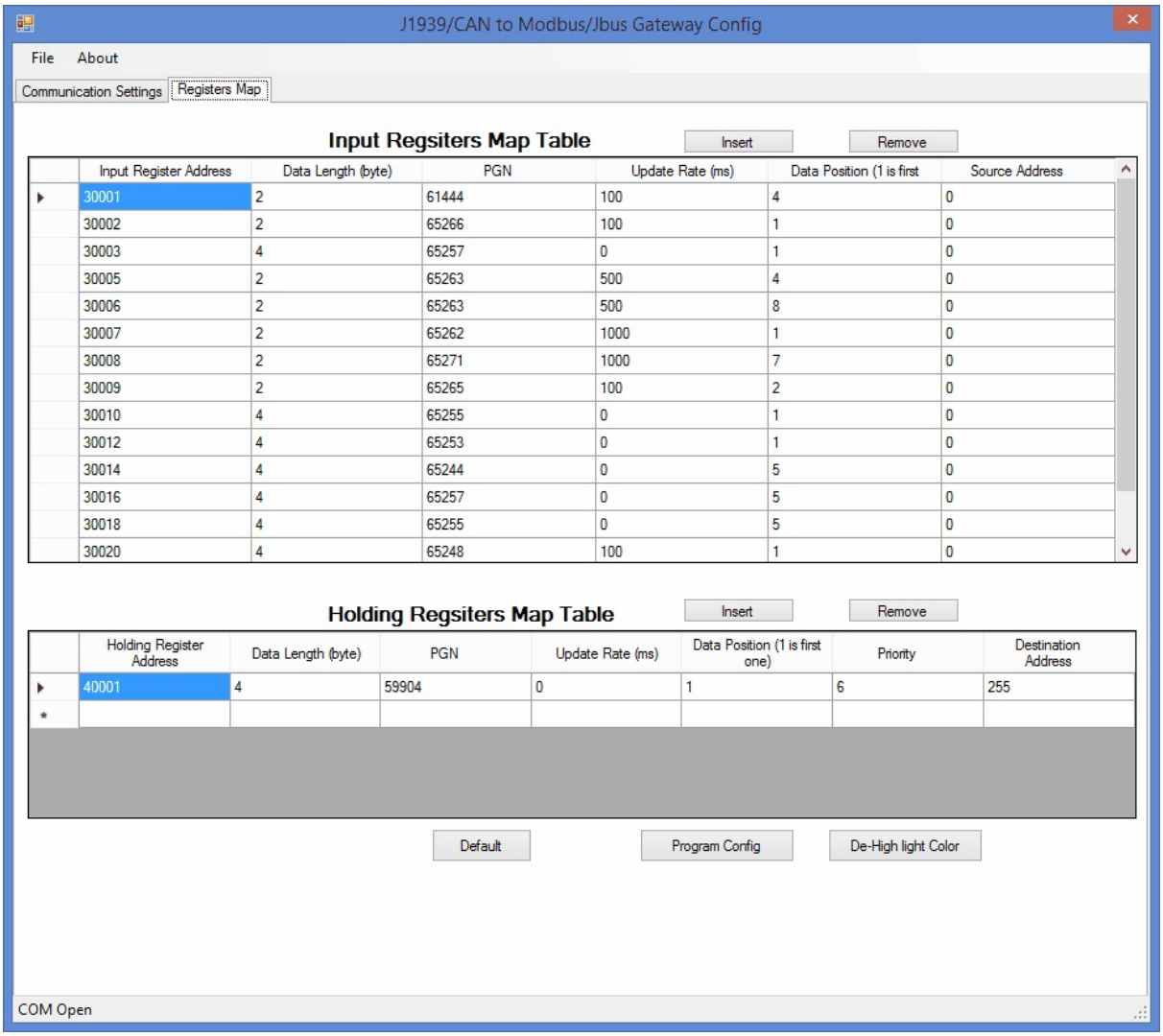
When you write any data to this holding register, DFLJ1939Mod1 will exit Modbus/Jbus and enter configuration communication mode. If DFLJ1939Mod1 has no received configuration data for 3 seconds, it will resume Modbus/Jbus.

Reading this register makes no sense. ,

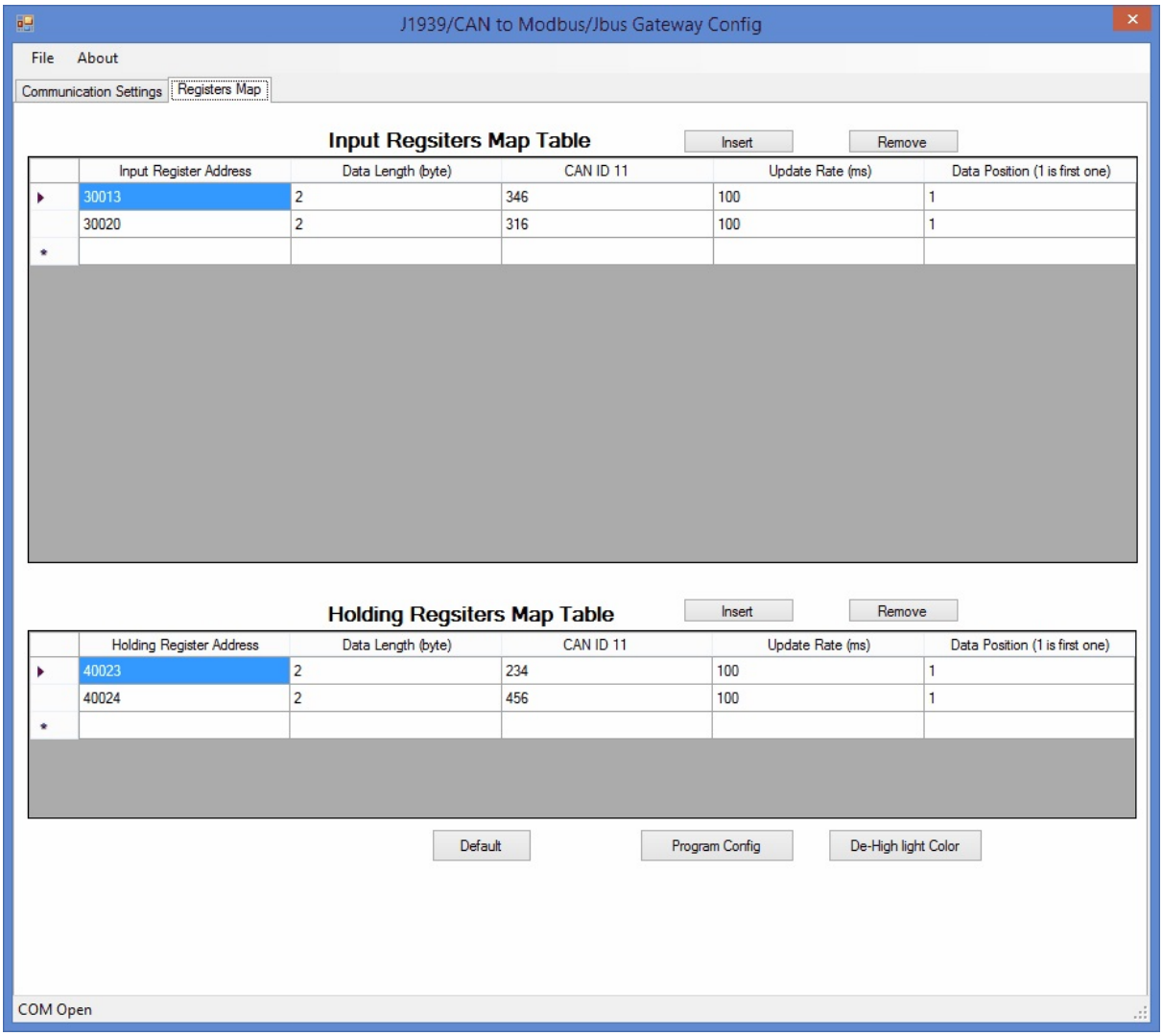
Now, Lets go back configuration. (continue to Step 6)

Step 7:

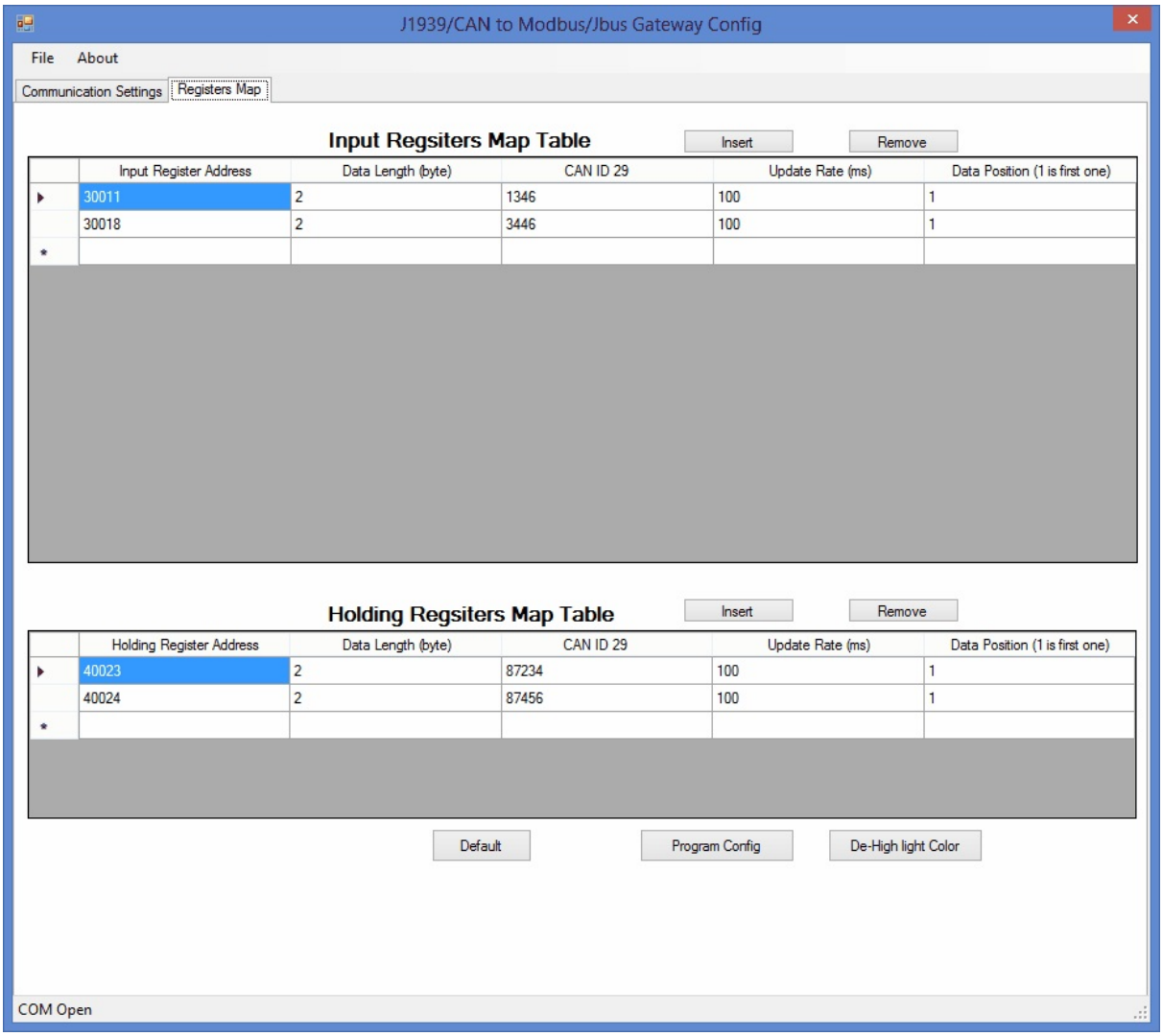
Click tab "Registers Map" , you will see screen below if you use J1939 Mode:



However, you will see screen below if you use CAN 11 bits ID mode



You will see screen below if you use CAN 29 bits ID mode:



There are 2 Registers Map tables. One is called "Input registers Map table" (top half screen). The other is called "Holding Registers Map Table" (Bottom half screen)

Lets explain "Input registers Map table" firstly.

This table sets up a relation between "Modbus/Jbus Input Registers" with Data of J1939 or Raw Can bus Data. Every row represents that the data values for an address range of Modbus/Jbus are composed of which J1939 PGN data or CAN bus data. The entire table is sorted on "Input Register Address" (ascending) automatically, The Column "Input Register Address" is the first address of consecutive Modbus/JBUS addresses. The column "Data Length" is the byte length of data. The data belongs to Modbus/Jbus registers, and at the same time, the data are from J1939/CAN BUS Data field. We know that Modbus/Jbus is word address, it means that one address of Modbus/JBus contains 2 bytes of data. So The column "Data Length (byte)" must be even number. If we choose J1939 Protocol, "Data Length (byte)" cannot be over 1786 because maximum J1939 message length is 1785. If we choose CAN 11bits/29bits Protocol, "Data Length (byte)" cannot be over 8 because

maximum CAN Bus data length is 8. The column "Update Rate (ms)" means how many mini-seconds the data will be updated. "Update Rate" can be 0 to 60,000ms. "Update Rate" =0 has special meaning. It means that J1939 will use PGN 59904 to request a PGN data automatically, or CAN Bus will send remote frame to request data automatically when Modbus master request these data.

In general, J1939 or Can bus will broadcast PGN or CAN data frame periodically. If broadcast period is T ms, you must set up "Update Rate" to T ms. In this case, J1939 or CAN bus will not send any request or remote frame when Modbus master request data. However, If J1939 or CAN bus does not broadcast PGN or CAN data frame periodically and you set up "Update Rate" to T ms, J1939 will use PGN 59904 to request a PGN data automatically, or CAN Bus will send remote frame to request data automatically when Modbus master request these data and J1939 or CAN BUS cannot get these data within "T+20" ms.

The Column "Data Position " denotes which data byte of J1939/CAN bus is begun to use as the Modbus input register. "Data Position" is 1-based location, it means that 1 denotes the first data byte . For example, if Data Position=3, and "Data Length=4", it will tell us that the 3rd to 6th byte of J1939/ CAN bus Data will put into Modbus input registers.

If you choose J1939 Protocol, you will see the column "PGN" and "Source address". The column "PGN" tells us which PGN will be used as modbus/Jbus input registers, The column "Source address" tells us only PGN from this "Source address" will be used as modbus/Jbus input registers. Source address value should be 0 to 253. How do you know address which is connected to J1939 Network? please read modus registers 39103 to 39199 contents.

If you choose CAN 11 bits ID or CAN 29 bits ID, you will see the column "CAN ID 11" or "CAN ID 29 ". The column "CAN ID 11" or "CAN ID 29" tells us which CAN BUS ID 's data will be used as modbus/ Jbus input registers

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Lets explain "Holding registers Map table" Secondly.

This table sets up a relation between "Modbus/Jbus holding Registers" with Data of J1939 or Raw Can bus Data. Every row represents that the data values for an address range of Modbus/Jbus are composed of which J1939 PGN data or CAN bus data. The entire table is sorted on "Holding Register Address" (ascending) automatically, The Column "Holding Register Address" is the first address of consecutive Modbus/JBUS addresses. The column "Data Length" is the byte length of data. The data belongs to Modbus/Jbus registers, and at the same time, the data are delivered to J1939/CAN BUS Data field. We know that Modbus/Jbus is word address, it means that one address of Modbus/JBus contains 2 bytes of data. So the column "Data Length (byte)" must be even number. If we choose J1939 Protocol, "Data Length (byte)" cannot be over 1786 because maximum J1939 message length is 1785. If we choose CAN 11bits/29bits Protocol, "Data Length (byte)" cannot be over 8 because maximum CAN Bus data length is 8. The column "Update Rate (ms)" means how many mini-seconds the data will be updated to J1939 or CAN Bus periodically when modbus/Jbus multiple words writing command (Function Code =16) receives. "Update Rate" can be 0 to 60,000ms. "Update Rate" =0 has special meaning. It means that J1939/CAN BUS will execute transmitting J1939/CAN bus Message

once when Modbus/Jbus master sends multiple words writing command to DFL1939MOD1. For non-zero "Update Rate", for example, "Update Rate"=T, J1939/CAN BUS will execute transmitting J1939/CAN bus Message every T ms periodically automatically when DFL1939MOD1.receives modbus/Jbus multiple words writing command once.

Notes: single word writing command of Modbus/Jbus (Function Code =06) cannot cause J1939/CAN Bus message transmitting in order to keep the entire data integrity.

The column "Data position" meaning is the same as the counterpart in "Input registers map table".

If you choose J1939 Protocol, you will see the column "PGN" , "Priority", and "Destination address". They tell us the PGN and Priority and destination address for J1939 message transmitting. The "Destination address" can be 0 to 253 and 255. The "Destination address" =255 has special meaning which means broadcast to all address.

If you choose CAN 11 bits ID or CAN 29 bits ID, you will see the column "CAN ID 11" or "CAN ID 29 ". The column "CAN ID 11" or "CAN ID 29" tells us which CAN BUS ID data frame will be broadcast.

Now, you can edit "Input registers Map table" and "Holding registers Map table". Please input any data after last row. Of cause, you can modify content of any row and column, just click it and change the content.

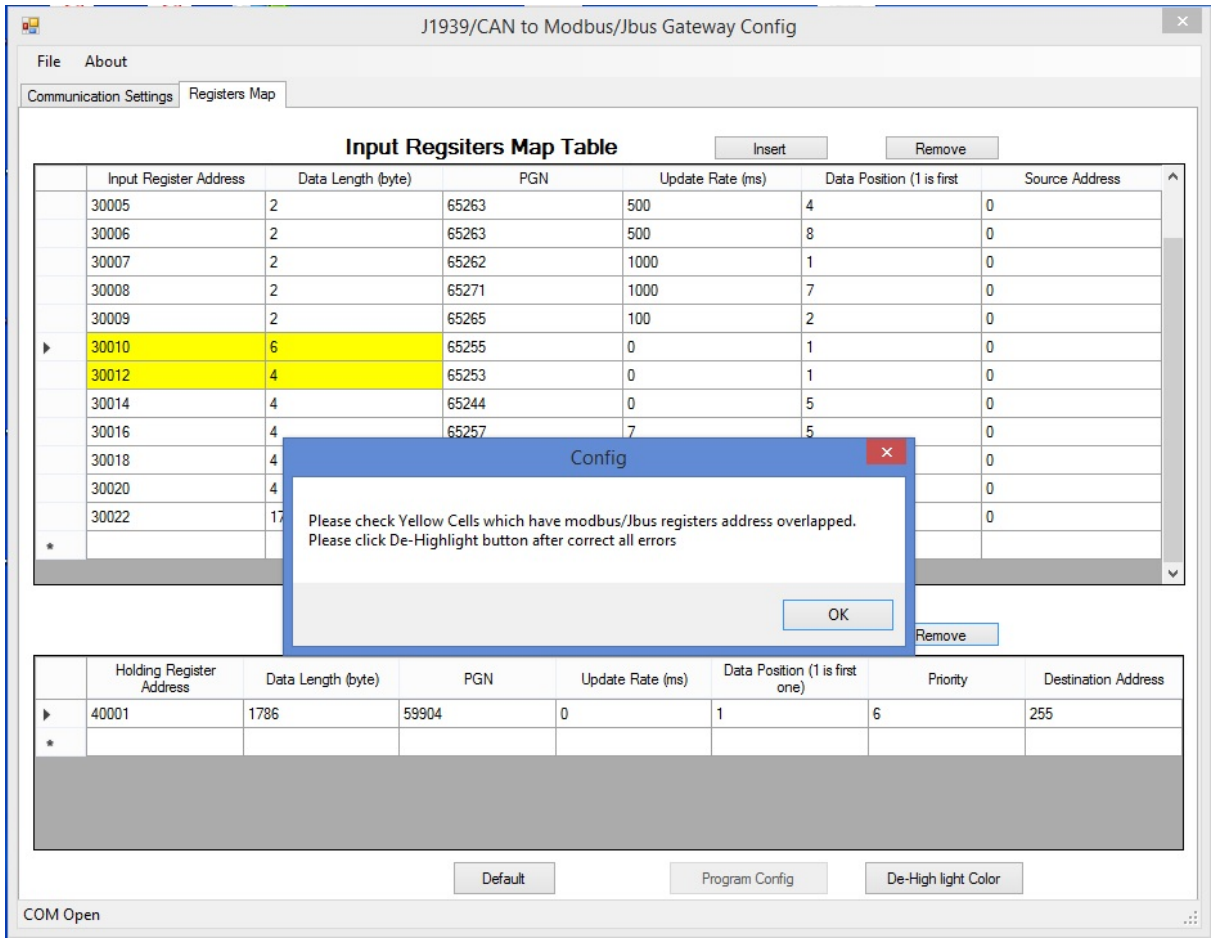
You can remove entire row by click the left side of row (entire row become blue color back ground) and click button "remove" beside the right side of the table title.

You can insert new row by click the left side of row (entire row become blue color back ground) and click button "Insert" beside the right side of the table title.

Step 8:

After you've done 2 map tables, you can click the button "Program Config" (the bottom position of windows) to start writing the configuration data to DFLJ1939Mod1.

If it has any error, it will pop out an dialog to tell us what error it is, and The color cell will tell us error location in the original Map table. Please see screenshot below:



You can modify map table to fix the error. Please click the button "De-High light Color" if you want to clear the color. At last, please click the button "Program Config" to start writing the configuration data to DFLJ1939Mod1. If success, you will see success dialog.

All configuration data can be stored in file. Please click "File/Save or File/Save as..." to save configuration for next time use or other person use.
In the next time, you can open configuration by click "File/Open ..." to special configuration file.
Actually, you don't need to save, all configuration will be saved automatically when you close the software. Next time, it will display previous contents when you open the software.
However, if you save to different file, you can let your coworker to use it.

The last question is how many PGNs can be used, how many register address can be used?

For input registers map table, the maximum input registers range is 2048. It does not means 2048 rows, it means address range is max 2048. for example, if start address is 31003, the max end address will be 31003+2048-1=33050. If we choose J1939 Protocol, PGN Maximum Qty is calculated by the following formula:

"Page Qty" x "PF QTY" x "PS QTY" <= 2048

Qty of All PGNs data bytes which are used for map<=4096

If we choose CAN Bus protocol, CAN ID maximum Qty is calculated by the following formula:

"Qty of the left-most 13 bits CAN ID " x "Qty of the right-most 8 bits CAN ID" x "Qty of the middle 8 bits CAN ID"< 2048

Qty of All CAN ID data bytes which are used for map<=4096

For holding registers map table, the maximum holding registers range is 1024. It does not means 1024 rows, it means address range is max 1024. for example, if start address is 41003, the max end address will be 41003+1024-1=42026. If we choose J1939 Protocol, PGN Maximum Qty is calculated by the following formula:

"Page Qty" x "PF QTY" x "PS QTY" <= 1024

Qty of All PGNs data bytes which are used for map<=2048

If we choose CAN Bus protocol, CAN ID maximum Qty is calculated by the following formula:

"Qty of the left-most 13 bits CAN ID " x "Qty of the right-most 8 bits CAN ID" x "Qty of the middle 8 bits CAN ID"< 1024

Qty of All CAN ID data bytes which are used for map<=2048

When Modbus master to access DFLJ1939MOD1, if modbus register address is not mapped, it will respond error code 0x02 , However, if modbus register address is mapped, but no data are available, it will respond error code 0x04.

6 Electrical And Mechenical Characteristics

Storage temperature ..... -40°C to +85°C
Operating temperature ..... -40°C to +85°C
Dimensions .....101mm x 72mm x 28mm (H x W x D)
DC Power Supply .....8 to 40VDC
Power Supply Current.....90mA at 12VDC Power supply
Isolation Voltage..... 3KVDC, 2.5KV RMS

IMPORTANT NOTICE

The information in this manual is subject to change without notice.

Dafulai's products are not authorized for use as critical components in life support devices or systems. Life support devices or systems are those which are intended to support or sustain life and whose failure to perform can be reasonably expected to result in a significant injury or death to the user. Critical components are those whose failure to perform can be reasonably expected to cause failure of a life support device or system or affect its safety or effectiveness.

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