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1. Feature of CPJexc

Hardware feature

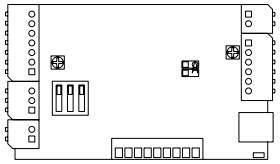
- Converts CAN, IBUS, resistive and digital steering wheel controls into USB HID keyboard
  and HID remote controller
- Supports both standard CAN and extended CAN
- Resistance range adjustable
- Supported digital steering wheel controls :
  BMW IBUS, AUDI '99-'04 (LIN), VW '99-'04 (LIN), Renault Clio, Renault Scenic MK2 8200107974, Hyundai(digital, Sonata2/3, Marcia, Santamo), Renault SM (digital), Volvo XC70 '03
- Works same as standard USB HID keyboard and HID remote controller by hardware
- 24V tolerant 4 channel resistive(voltage) input
- Supports 28 physical buttons, 52 programmable logical buttons
- Long and Short button for one physical button, up to 5 simultaneous key strokes by one button.
- Supports Cyclic Button
- 6 programmable LED port
- Remote wake-up(resume PC from sleep with steering wheel controls)
- Channel Master/Slave selectable
- Supports J2P BUS peripherals(BSGc, BSGr, CPJ MIX)
- Phone/Mute signal output
- Supports BSGd(Button Signal Generator digital),
  BSGd emulates BMW IBUS, AUDI '99-'04(LIN), VW '99-'04(LIN)
- Remote signal output for CPJ MIX
- SMPS power supplier circuit(Ultra low heat emission)
- Temperature range : -40 ~ +85°C

Manager feature(for Windows PC)

- Preset switching by buttons.
- Application Launcher(An application launches or pops up with preset switching).
- Voice and OSD by button and preset switching.
- User definable button voice and OSD.
- Rearview by reversing light
- Online firmware update.
- No driver installation needs
- Powered by 12~14V DC(vehicle ACC)
- Available OS : Windows 10, Windows 8, Windows 7, Vista, XP, 2003

Manager does not support Windows XP, Linux, Mac. But CPJexc works at Linux and Mac after it is configured at Windows.
Manager does not support Android devices. But CPJexc works at Android devices (Android version 3.1 onwards) after it is configured at Windows.

2. Contents



CPJexc

9pin connector x1
Heat Shrinkable Tube x2
Short Manual

CAN cable x1

3pin J2P cable x1

7pin cable x1

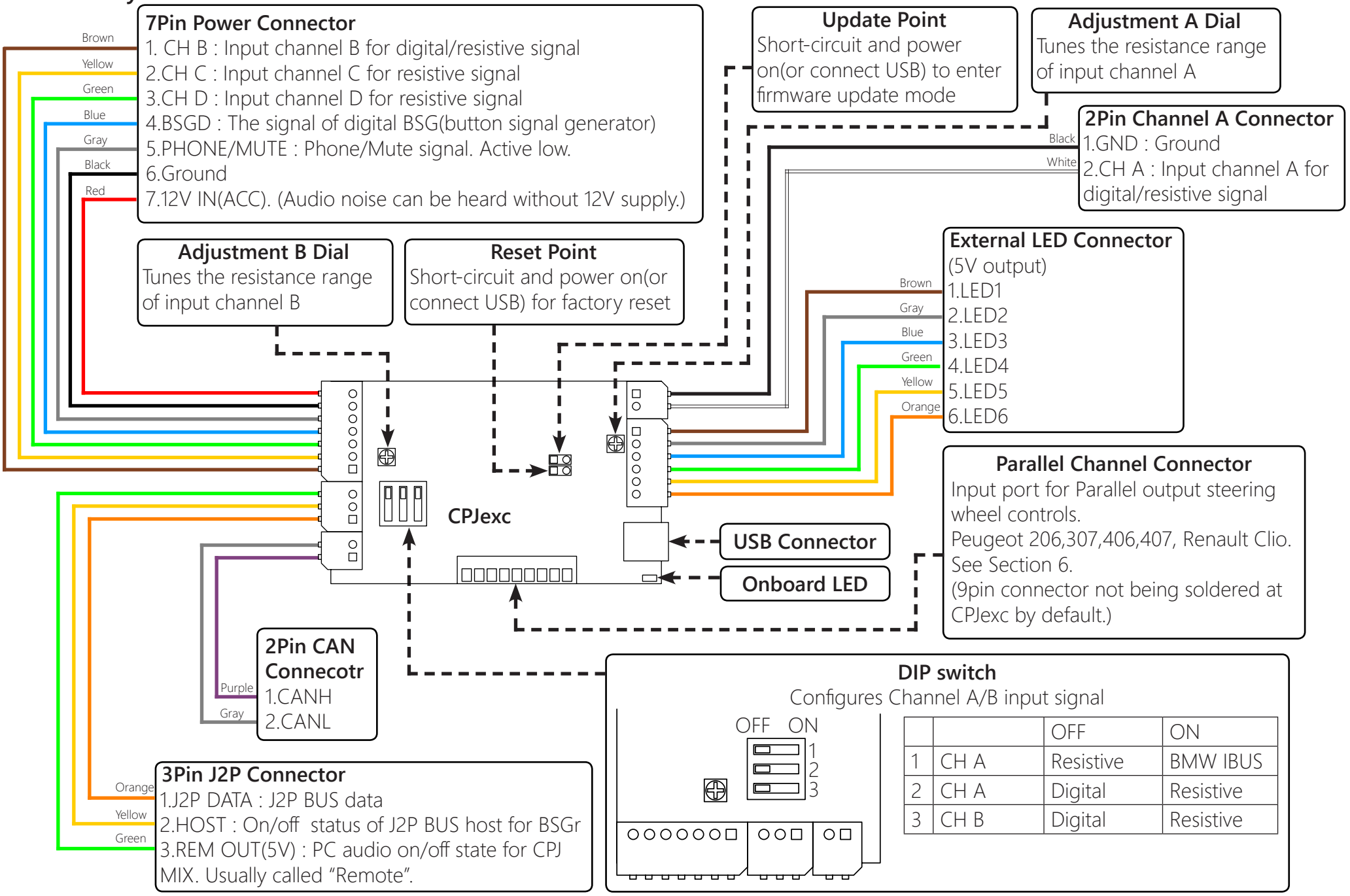
1CH cable x1

6pin LED cable x1

9pin cable x1

*USB A-mini B 5P cable and Manager CD is optional.
You can download Manager(the Configuration Program) at www.exInterface.com

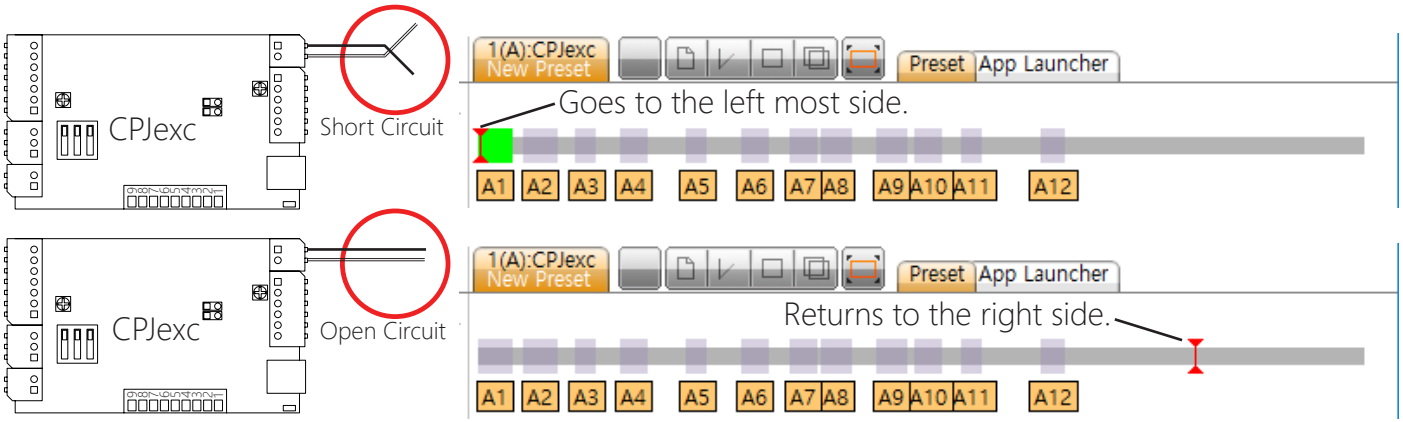
3. Board Layout



		OFF	ON
1	CH A	Resistive	BMW IBUS
2	CH A	Digital	Resistive
3	CH B	Digital	Resistive

4. Operational Test and Exchange

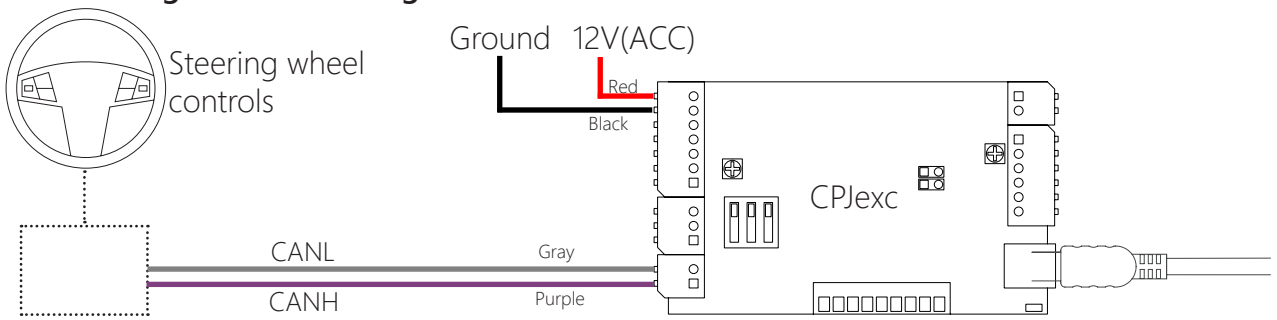
Configure Channel A(or B) as resistive.(See Section 5-3. Wiring of resistive steering wheel controller)
To check if CPJexc works properly, short-circuit the two wires of a input channel without connecting steering wheel controls. If CPJexc works properly, the red indicator must goes to the left most side by short-circuit, and returns to the right by open-circuit.
If the red indicator does not move, CPJexc is out of order.



If CPJexc is out of order, please contact your local distributor or exInterface.com
exInterface.com(RcJoyCon.com) provides 1:1 exchange with a new one.

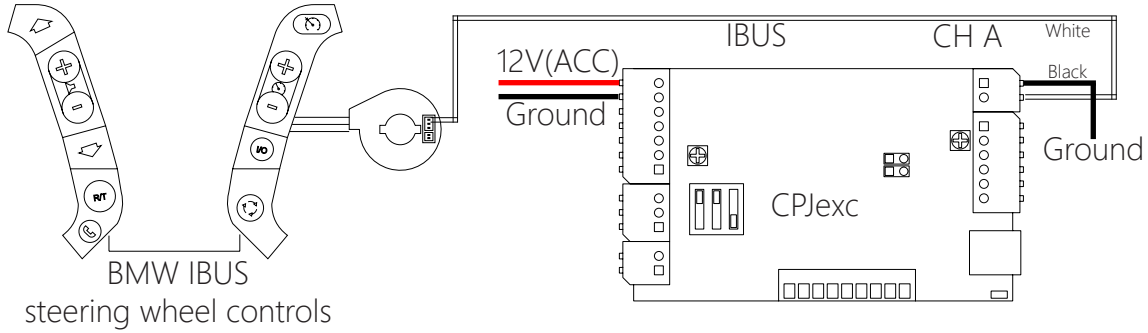
5. Wiring

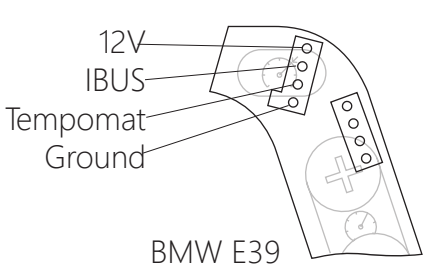
5-1. Wiring of CAN steering wheel controls

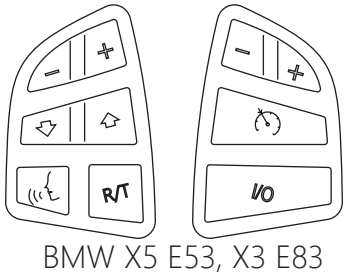


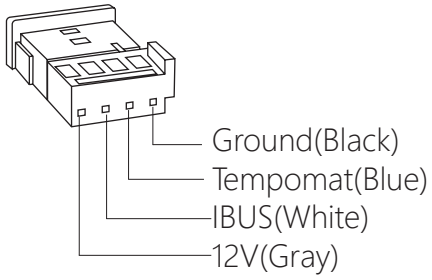
5-2. Wiring of BMW IBUS steering wheel controls

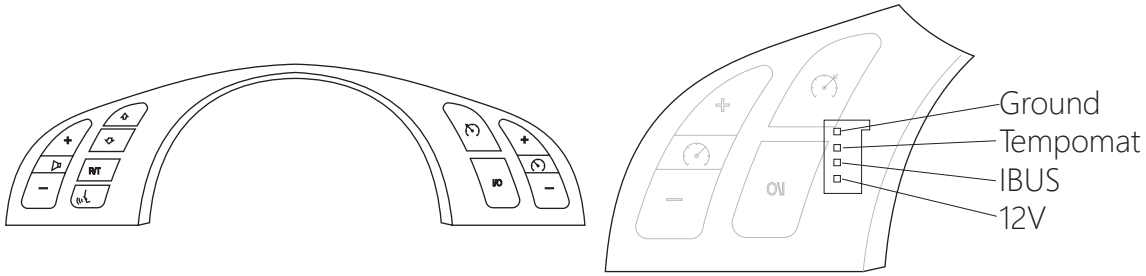
Connect IBUS wire to CH A.
Do not configure IBUS and Tempomat at the same time.
If the channel B is configured as BMW tempomat, IBUS message can be missed because reading temponmat signal takes too long time.
*12V power(ACC) must be supplied to CPJexc for BMW Tempomat.



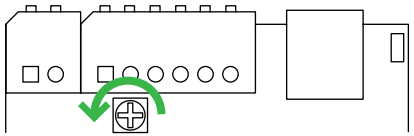




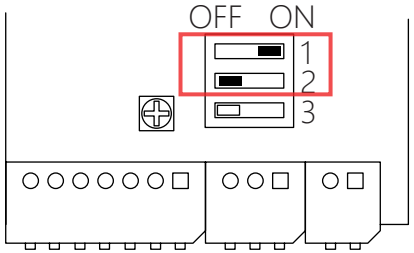




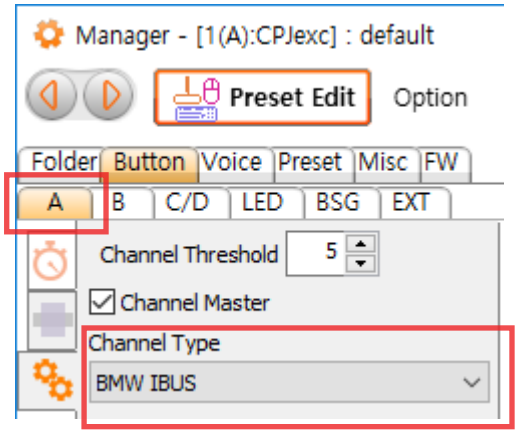
Turn the Adjustment A dial to the end of counterclockwise.



Turn on DIP switch 1 and turn off switch 2 for IBUS on Channel A.

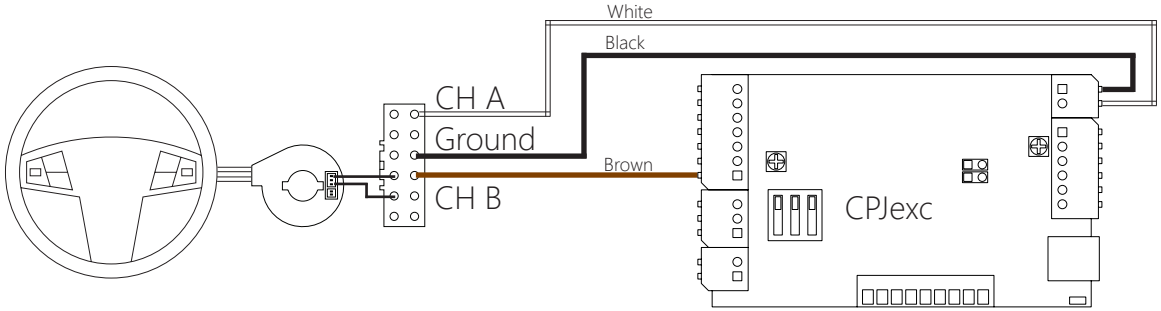


Choose [Button] -> [A]-> [Configure], select Channel Type as BMW IBUS.

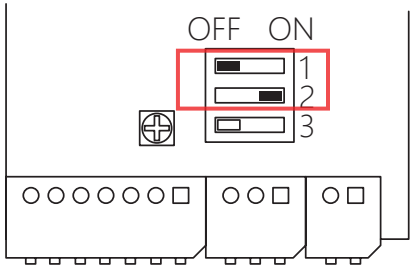


5-3. Wiring of resistive steering wheel controller

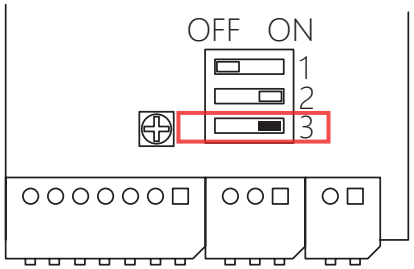
Connect CPJexc's input channel(CH A, CH B, CH C, CH D)wire to the steering wheel control's resistive signal wire.



Warning!! Do not connect signal and Ground wire reversely.

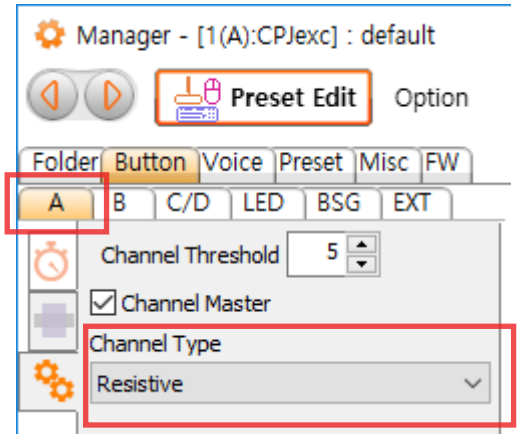


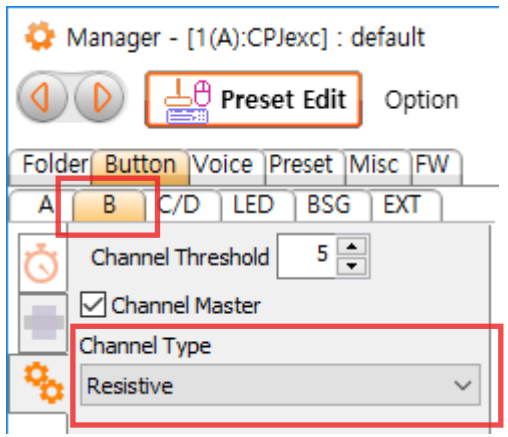
To configure Channel A as resistive,
turn off DIP switch 1, turn on DIP switch 2



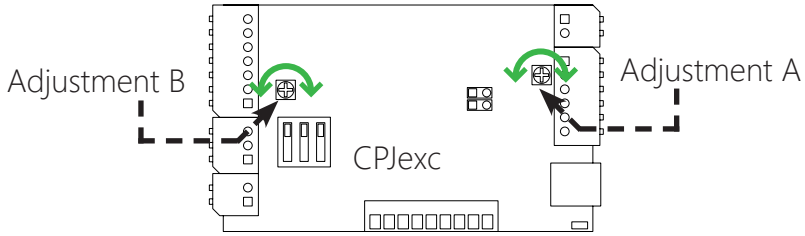
To configure Channel B as resistive,
turn on DIP switch 3.

Choose [Button] -> [A or B]-> [Configure], select Channel Type as Resistive.





If the buttons in Manager are too close each other, tune the Adjustment A/B on the Board.
Default position of Adjustment A/B is center.

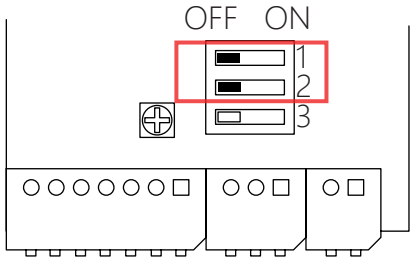


5-4. Wiring of digital steering wheel controller

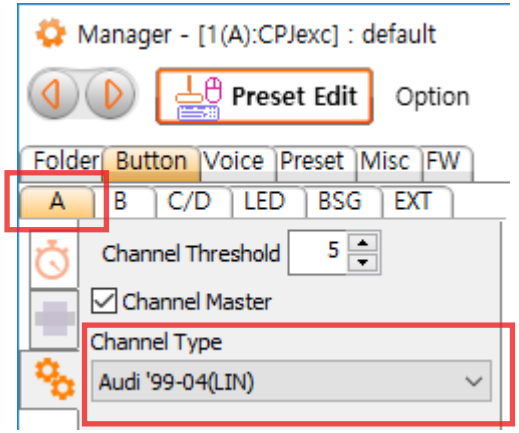
5-4-1. AUDI '99-'04(LIN)

Connect Radio control Data to CH A.

Turn off both DIP switch 1 and 2.

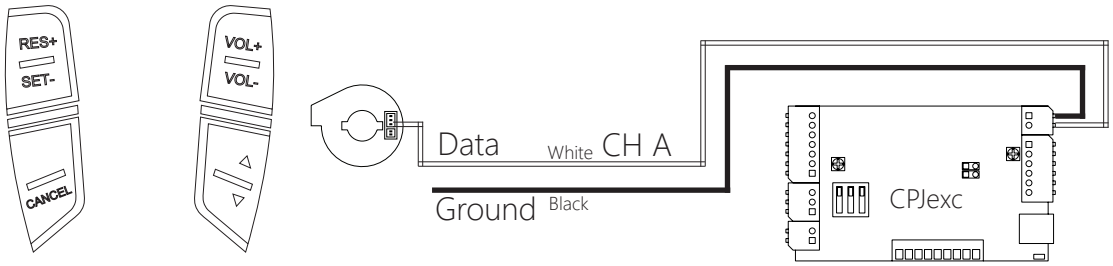


Choose [Button] -> [A]-> [Configure],
select Channel Type as Audi '99-'04(LIN).

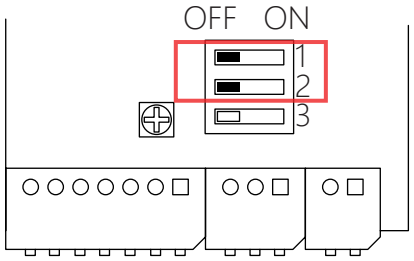


5-4-2. VW(Volkswagen) '99-'04 (LIN)

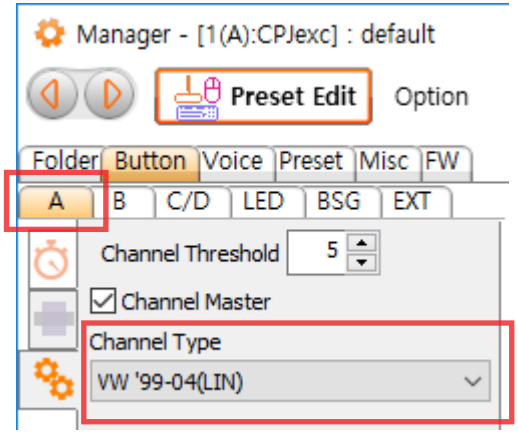
Connect Radio control Data to CH A.



Turn off both DIP switch 1 and 2.



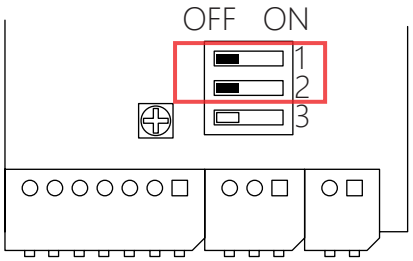
Choose [Button] -> [A]-> [Configure], select Channel Type as VW '99-'04.



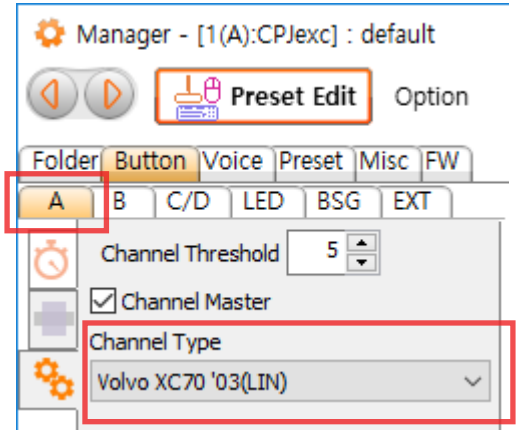
5-4-3. Volvo XC70 '03 (LIN)

Connect Radio data signal to Channel A.

Turn off both DIP switch 1 and 2.

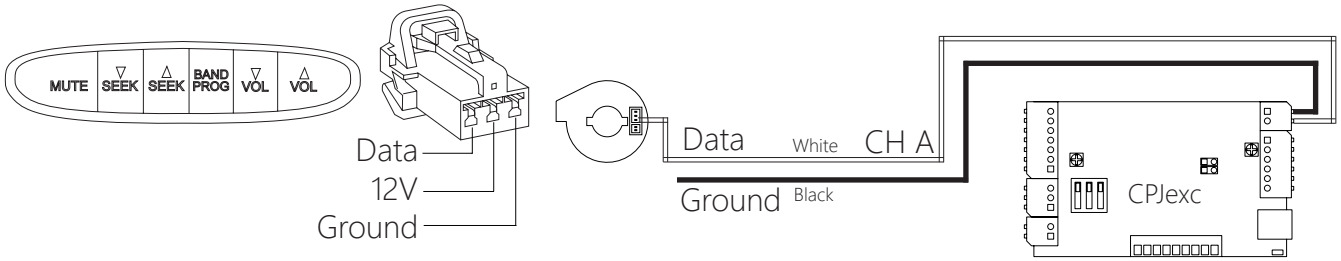


Choose [Button] -> [A]-> [Configure], select Channel Type as Volvo XC70 '03.

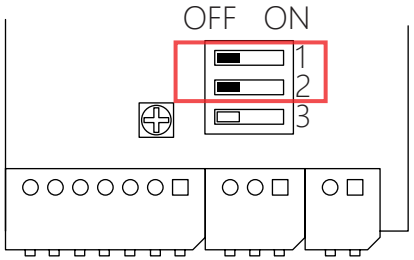


5-4-4. Hyundai Marcia Sonata2/3

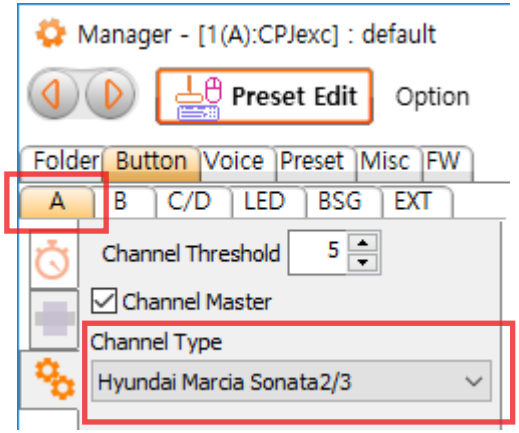
Connect Radio control data to Channel A.



Turn off both DIP switch 1 and 2.

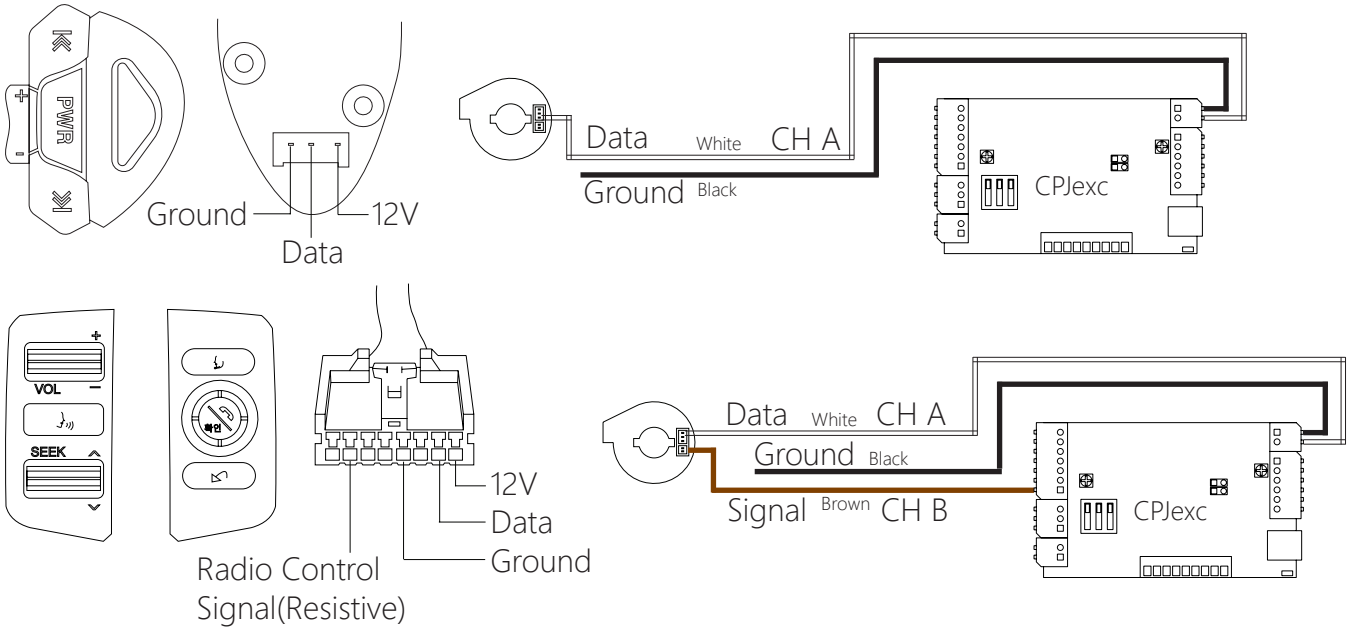


Choose [Button] -> [A]-> [Configure],
select Channel Type as Hyundai Marcia Sonata2/3.

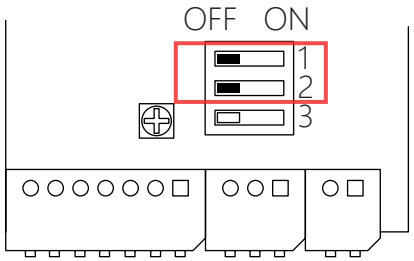


5-4-5. Renault SM

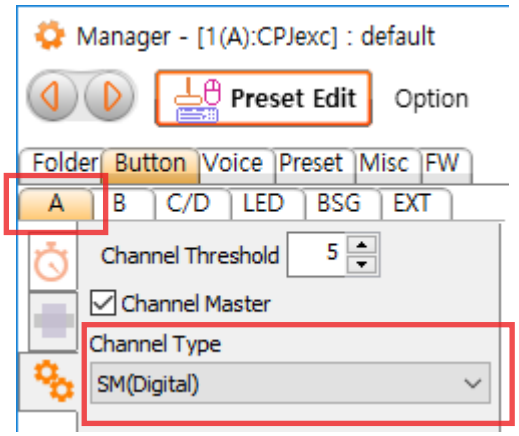
Connect Radio control signal to Channel A.



Turn off both DIP switch 1 and 2.

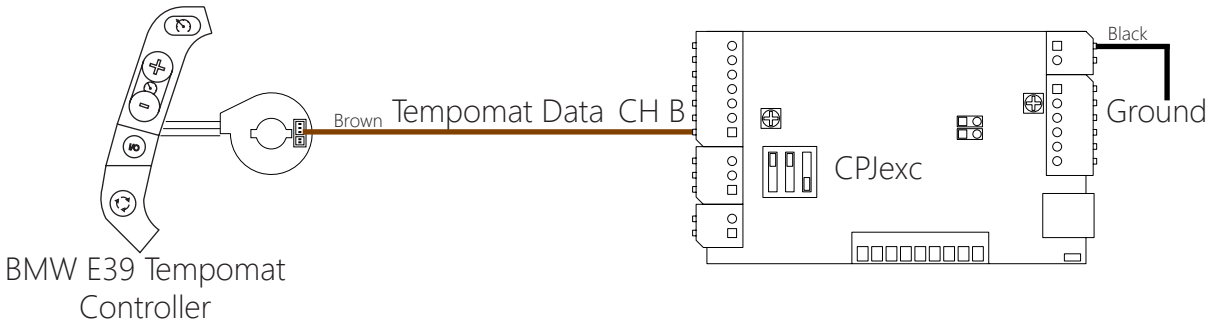


Choose [Button] -> [A]-> [Configure], select Channel Type as SM(Digital).

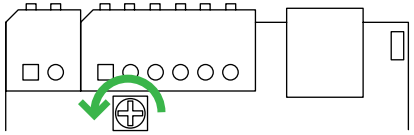


5-4-6. BMW Tempomat Controller

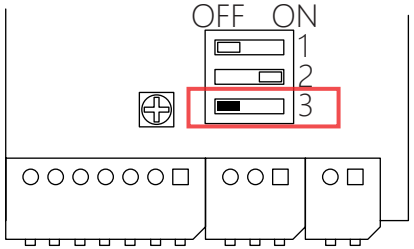
Connect Tempomat Data wire to Channel B.
Do not configure IBUS and Tempomat at the same time.
If the channel B is configured as BMW tempomat, IBUS message can be missed because reading temponmat signal takes too long time.



Turn the Adjustment B dial to the end of counterclockwise.

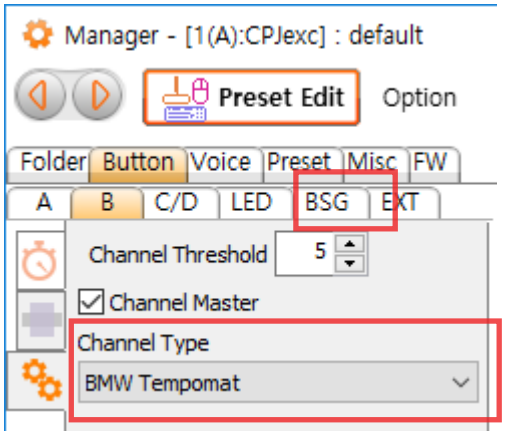


Turn off DIP switch 3 for temponat signal on Channel B.



*12V power(ACC) must be supplied to CPJexc for BMW Tempomat.

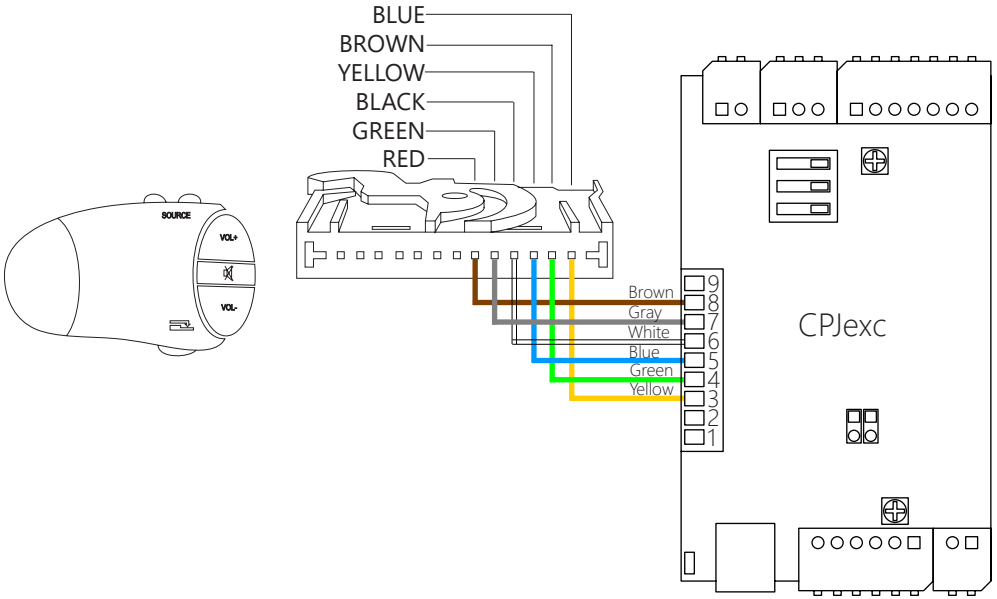
Choose [Button] -> [B]-> [Configure], select Channel Type as BMW Tempomat.

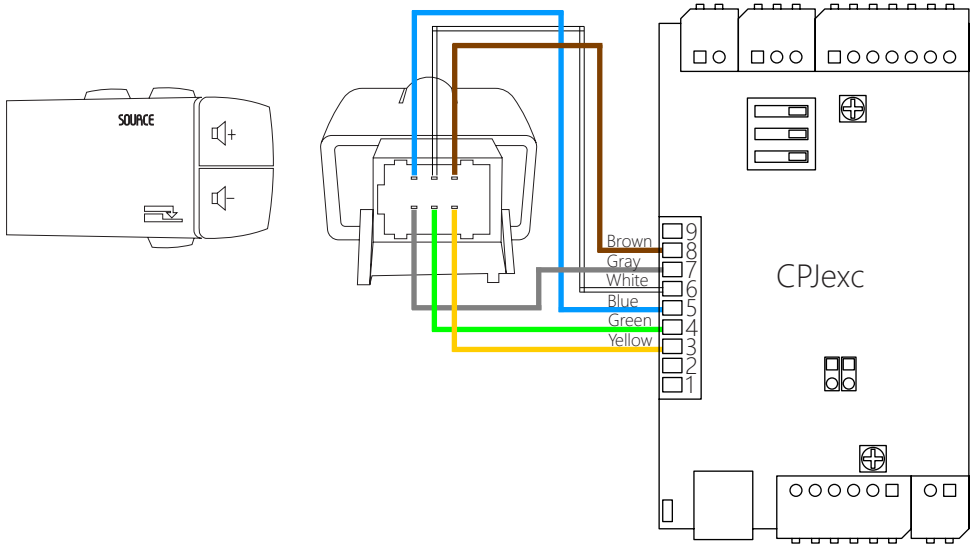


5-5. Wiring of parallel channel

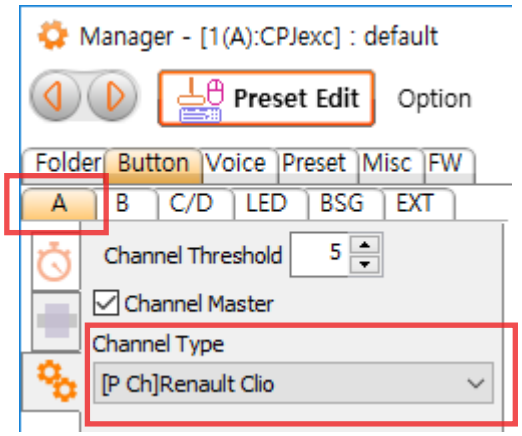
Connect the wires of the steering wheel controller to the Parallel Channel, as the diagrams nd select Vehicle type at the MISC tab. And peform "Auto Detect" at setting page in the Button tab.
Parallel Channel is recognized as CH A or B at Manager.

5-5-1. Renault Clio



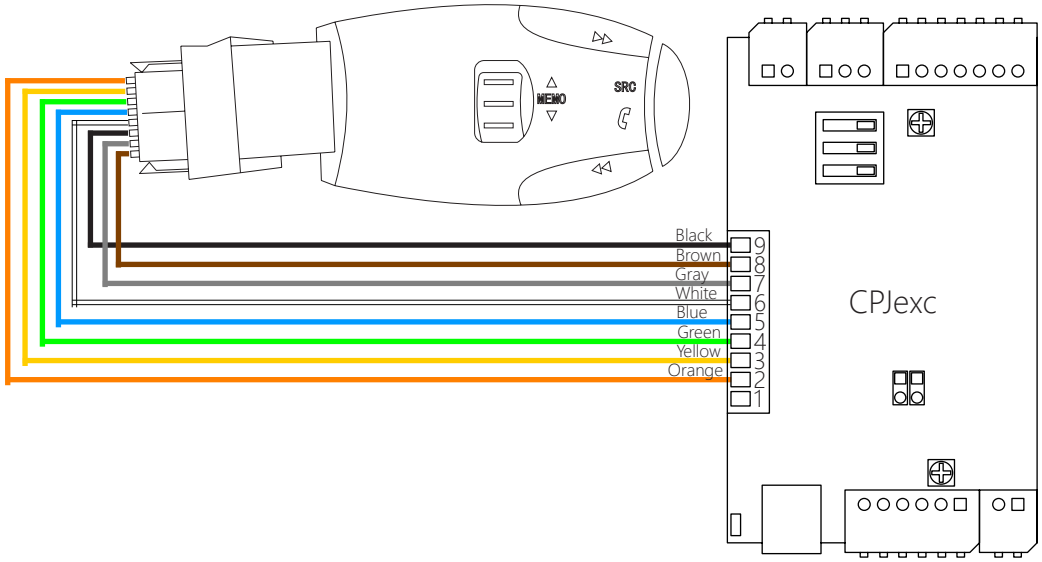


Choose [Button] -> [A]-> [Configure], select Channel Type as [P Ch]Renault Clio.

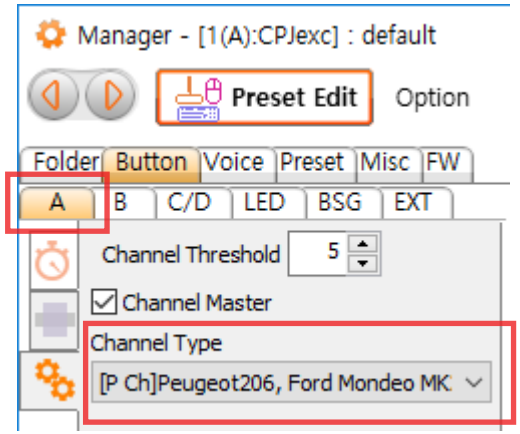


5-5-2. Peugeot 206 307 406

Connect Radio control signal to Parallel Channel.

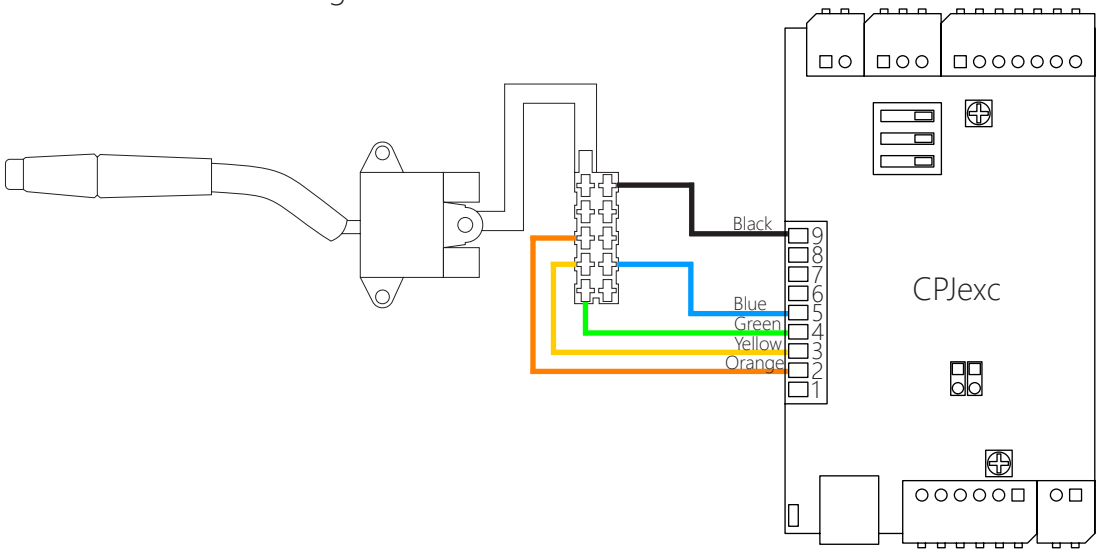


Choose [Button] -> [A]-> [Configure],
select Channel Type as [P Ch]Peugeot206, Ford Mondeo MK2.

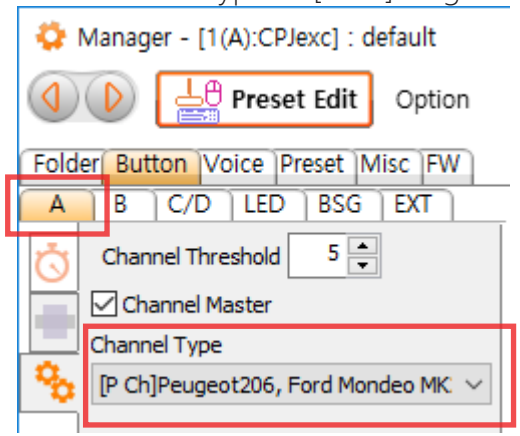


5-5-3. Peugeot 306

Connect Radio control signal to Parallel Channel.

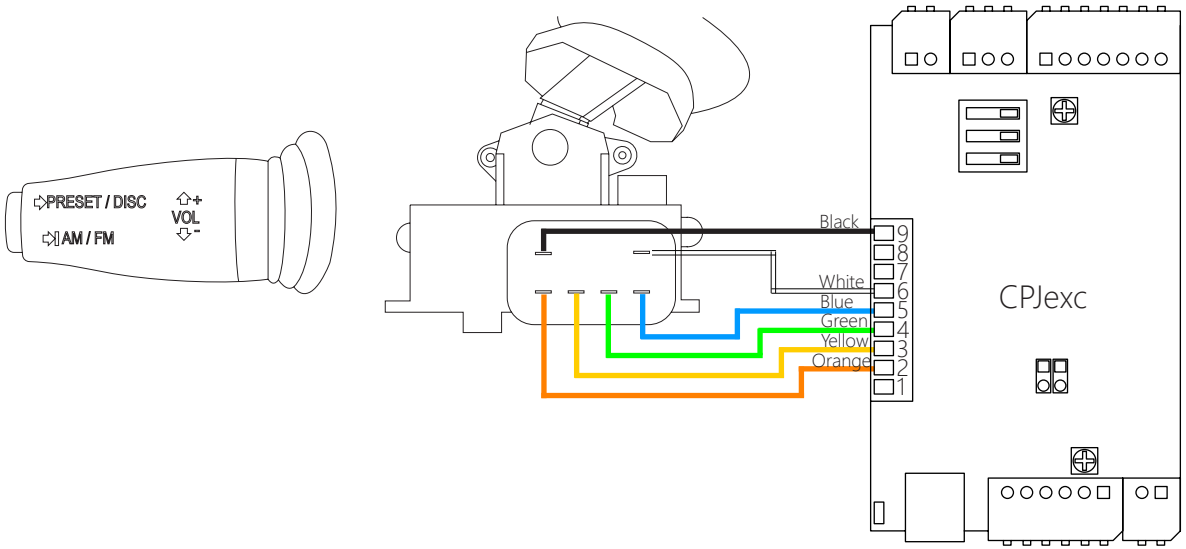


Choose [Button] -> [A]-> [Configure],
select Channel Type as [P Ch]Peugeot206, Ford Mondeo MK2.

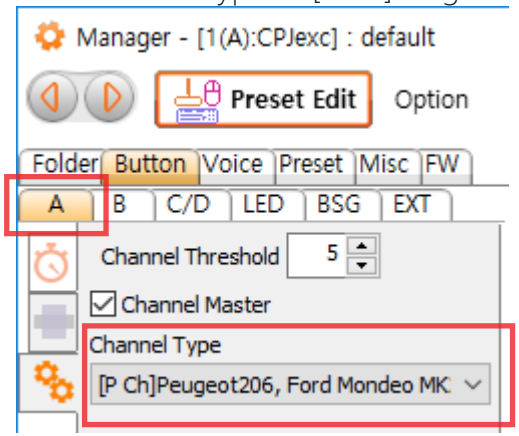


5-5-4. Ford Mondeo MK2 '96-'00

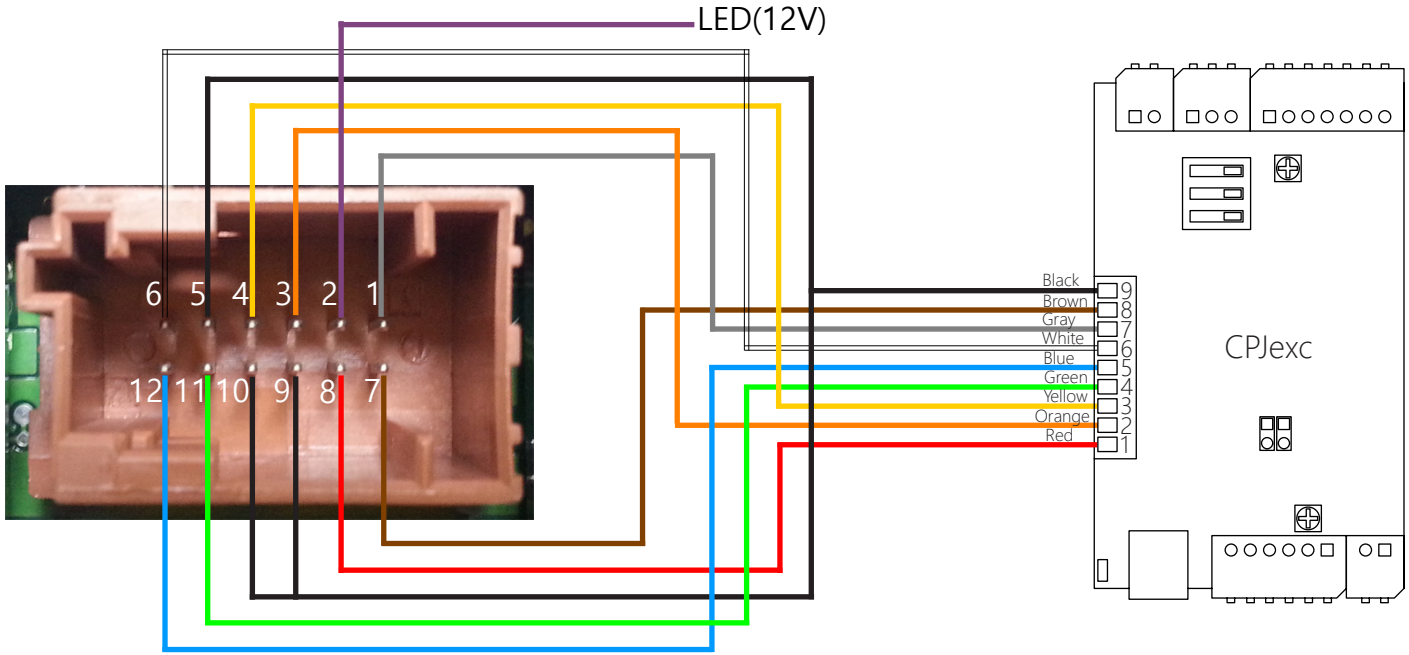
Connect Radio control signal to Parallel Channel.



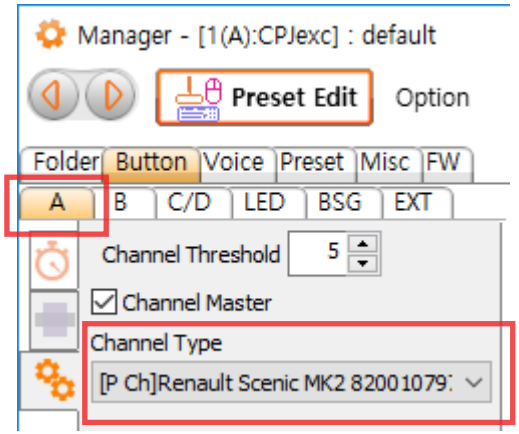
Choose [Button] -> [A]-> [Configure],
select Channel Type as [P Ch]Peugeot206, Ford Mondeo MK2.



5-5-5. Renault Scenic MK2 8200107974

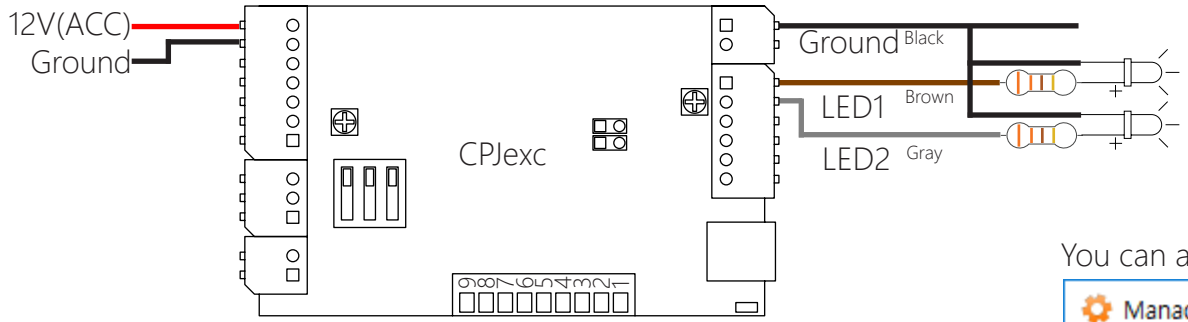


Choose [Button] -> [A]-> [Configure],
select Channel Type as Renault Scenic MK2 8200107974.



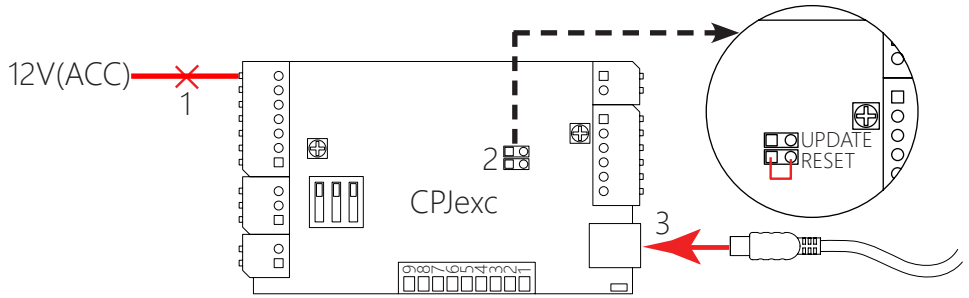
6. POWER and LED

External Power is required for CPJexc to work when the PC power is off.
Connect ACC(12V) to 7 pin, connect chassis ground to 6 pin.
For external LED, a current limit resistor(usually 330ohm) must be connected in series.
Without the current limit resistor, LED burns out. Black wire is Ground. LED output is 5V.

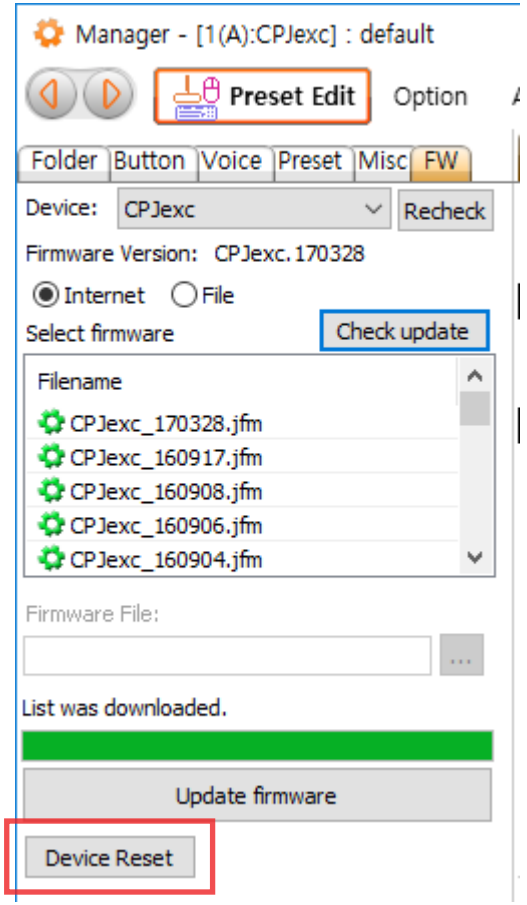


7. Factory Reset

1. Remove the external power.
2. Short-circuit two reset points.
3. Connect USB.



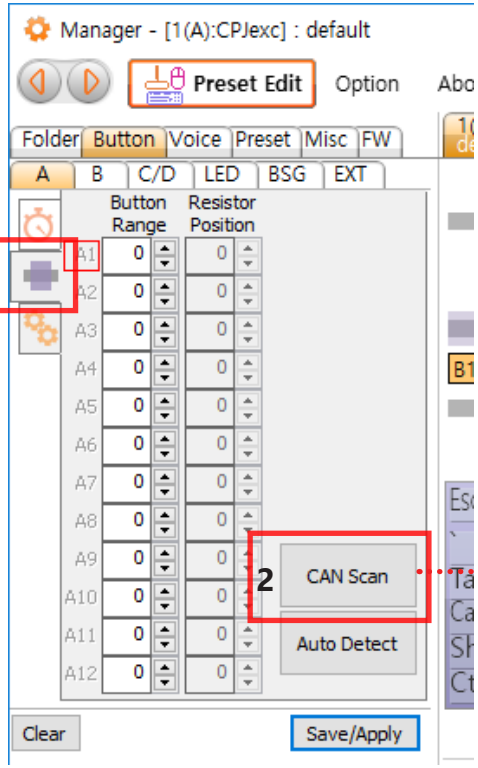
You can also reset the device at the FW tab in Manager.

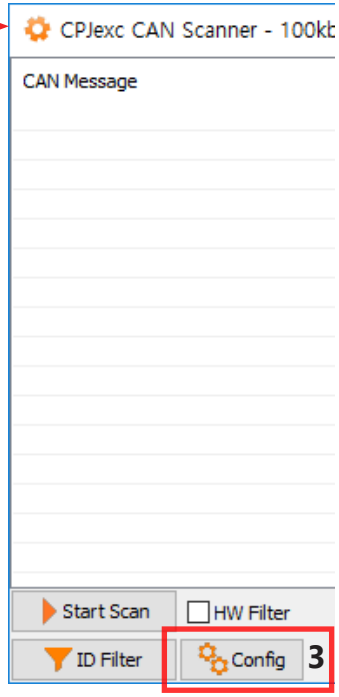


8. CAN Button Setup

8-1. CAN BUS Configuration

Choose [Button] -> [A]-> [Range and Position], click **CAN Scan,** then **CPJexc CAN Scanner** pops up.



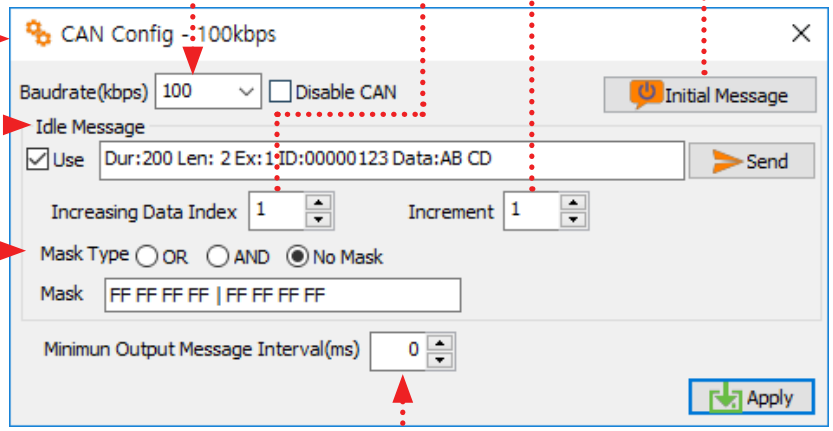


Idle message is sent on CAN BUS periodically by Duration("Dur:"). Idle message is requied to receive data from some device(eg. I-Drive Controller).

Increasing Data Index:
The data of the Idle Message is increased by **Increment** every time it is sent.
Increment can be -128 ~ 127.

Baudrate of CAN BUS in kbps

See section 8-6.



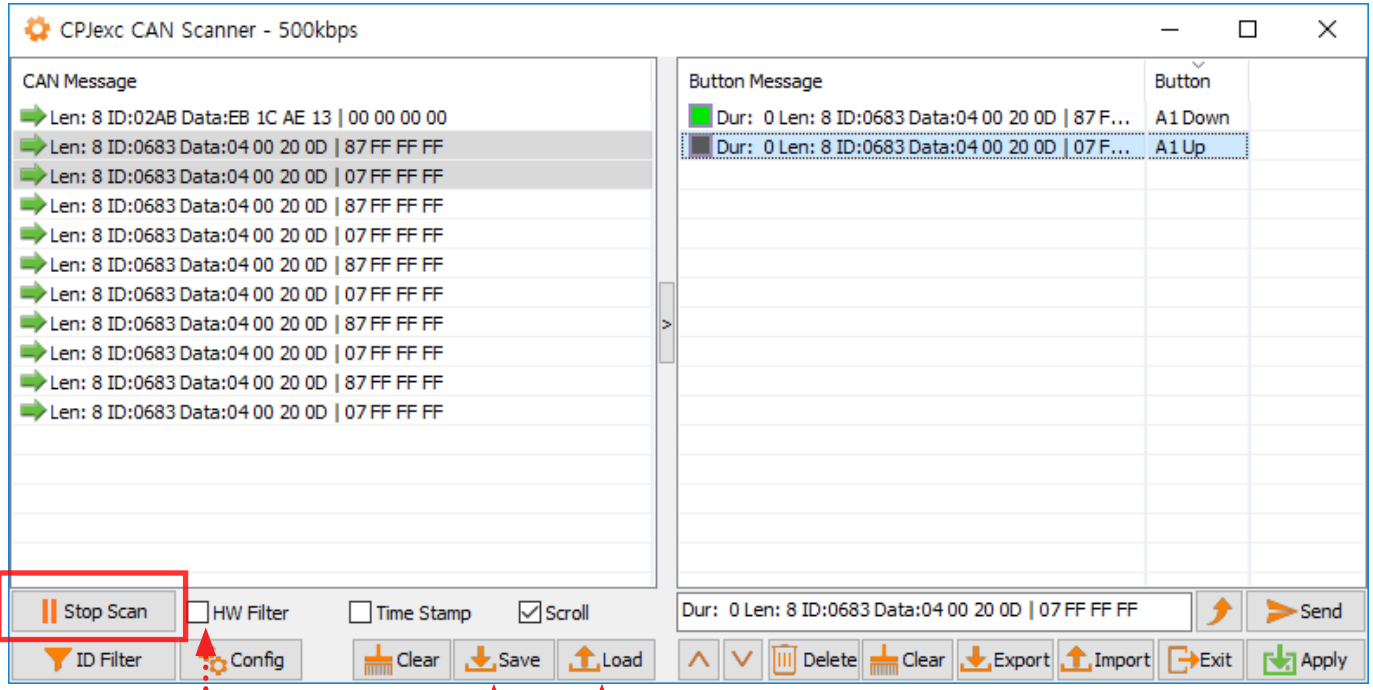
Minimum Output Message Interval(ms):
Once a CAN message is sent, the next CAN message is sent after this period. This is applied for every CAN message that is sent from CPJexc. This prevents the sent CAN messages to be too close each other.

Mask:
To send the increasing data 0~0Fh, the data need to be ANDed with 0x0F.
To send the increasing data F0h~FFh, the data need to be ORed with 0xF0.

8-2. CAN message Scanning

If you don't know the CAN message of the steering wheel control button, you need to find it.
When the Scan started, numerous CAN message will be listed in the CAN mesage list.

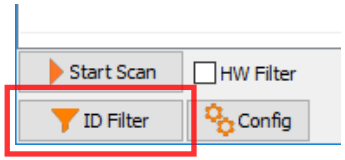
To Scan the CAN messages, click **Start Scan**.

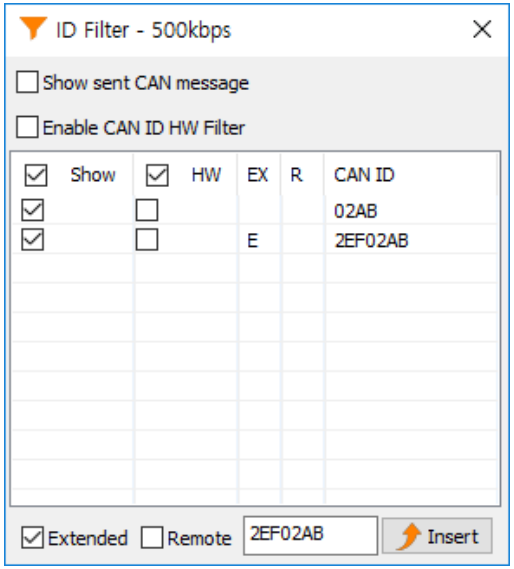


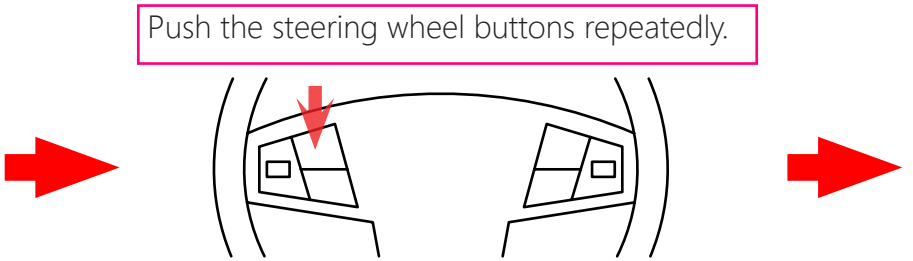
At first scanning, turn off HW Filter to Scan all the messages.

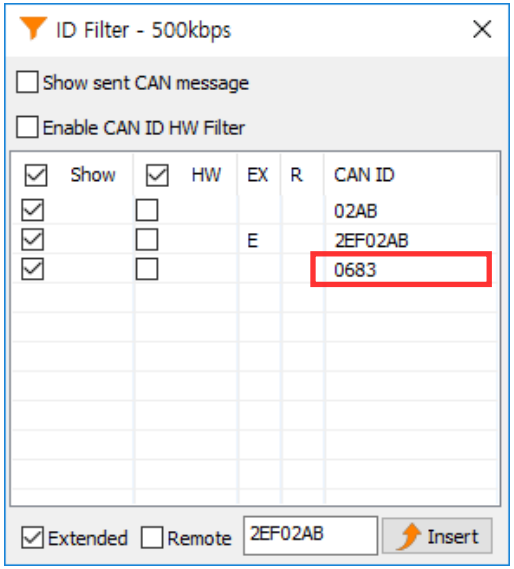
Save or load the CAN messages as a file(.can).

The steering wheel control message has its own CAN ID or IDs. We need to see only the steering wheel control CAN ID.
Click ID Filter to seel the ID Filter dialog. All the scanned CAN IDs are listed in the ID Filter list.





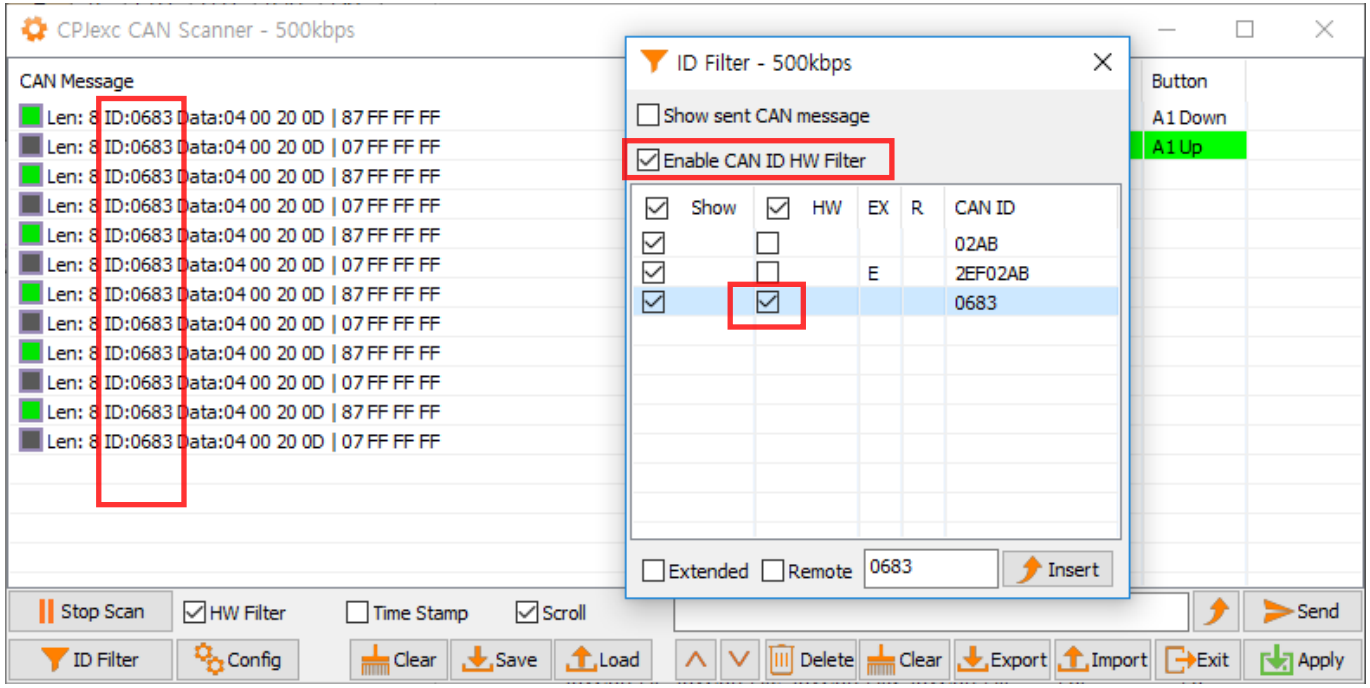




When you push the steering wheel button repeatedly, a new ID will appear at the end of the ID filter list.
This is the steering wheel control's CAN ID.

To filter out the the CAN message with the steering wheel control's CAN ID, enable the HW Filter.
Check the box Enable CAN ID HW Filter and HW of the steering wheel control's CAN ID.
Then CPJexc received only the CAN message of the steering wheel control.

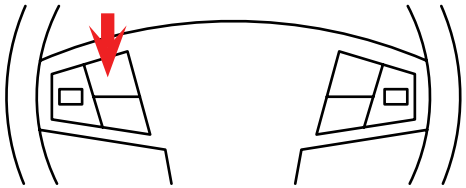
Because there is too many CAN messages to receive all the CAN messages on the CAN BUS,
leave the HW Filter enabled after the scanning is finished.



8-3. CAN Button Message Registering

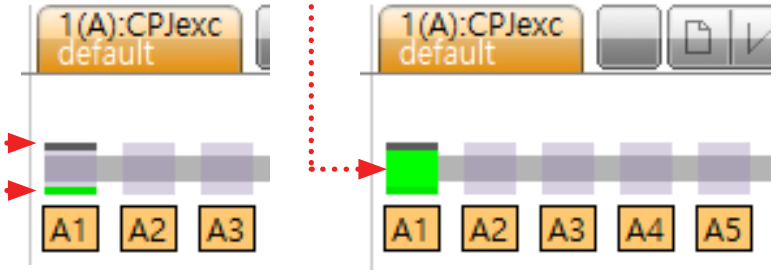
To use a CAN message as a button, the CAN message need to be registered as a Button Message.

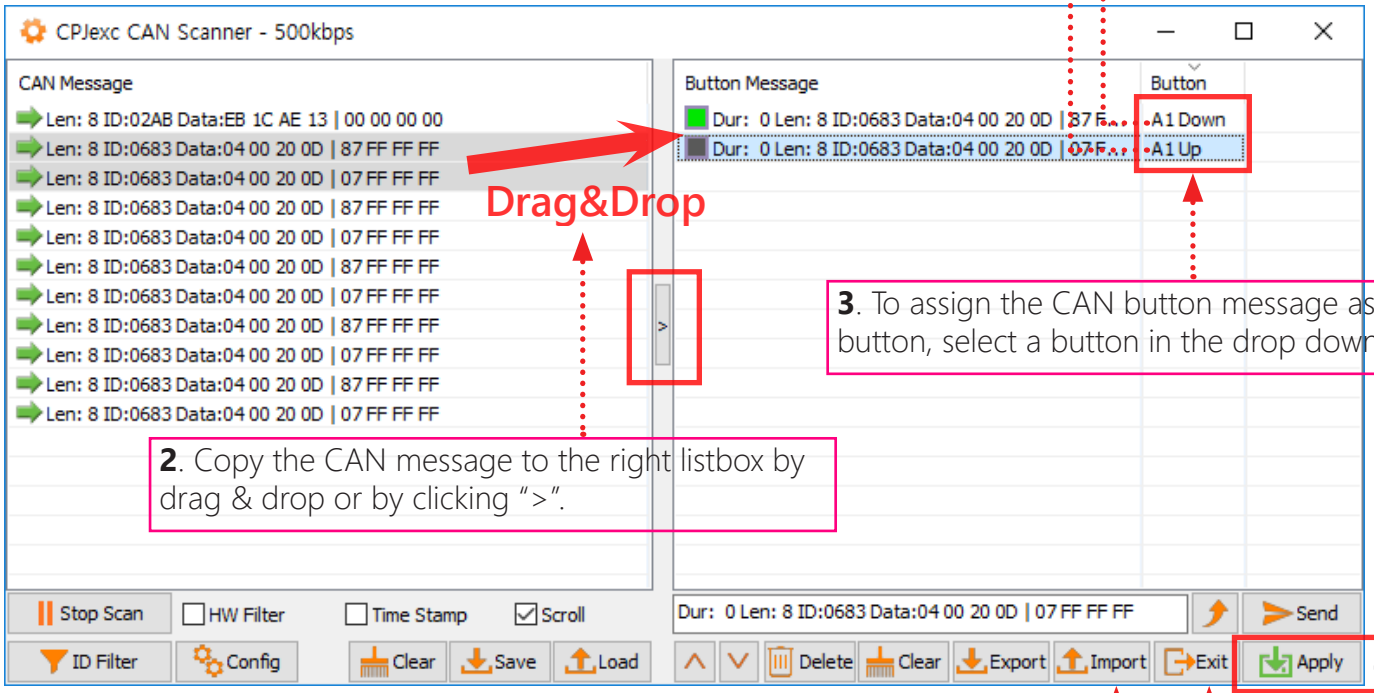
1. Press the steering wheel buttons, CAN messages are listed at left listbox.



4. Up Button appears as a gray bar, Down Button appears as a green bar.

The button bar turns to green when the steering wheel button is pushed.





2. Copy the CAN message to the right listbox by drag & drop or by clicking ">".

3. To assign the CAN button message as a button, select a button in the drop down list.

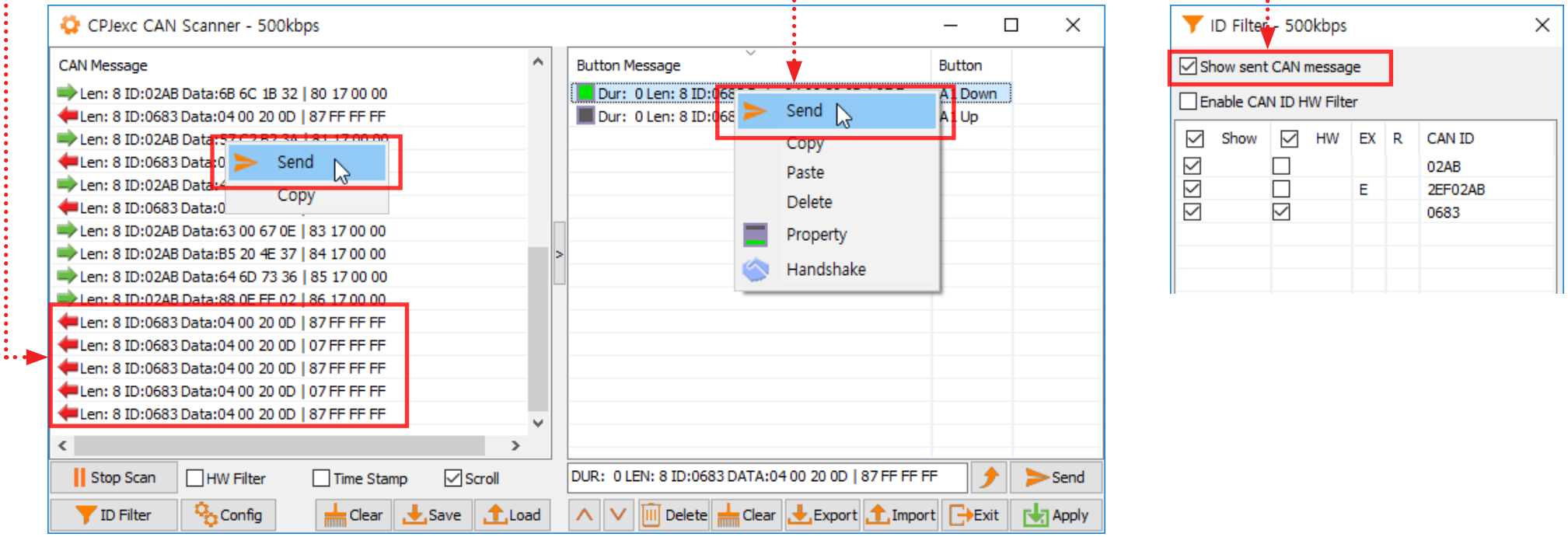
A Button is composed of Down and Up message.
If a down button message is repeated periodically with being pressed and there is no up button message(eg. volume button), set the duration above 0.
The unit of "Dur" is 10ms.

CAN button can be assigned to any channel button.

Export or import the CAN button messages as a file(.cbn).

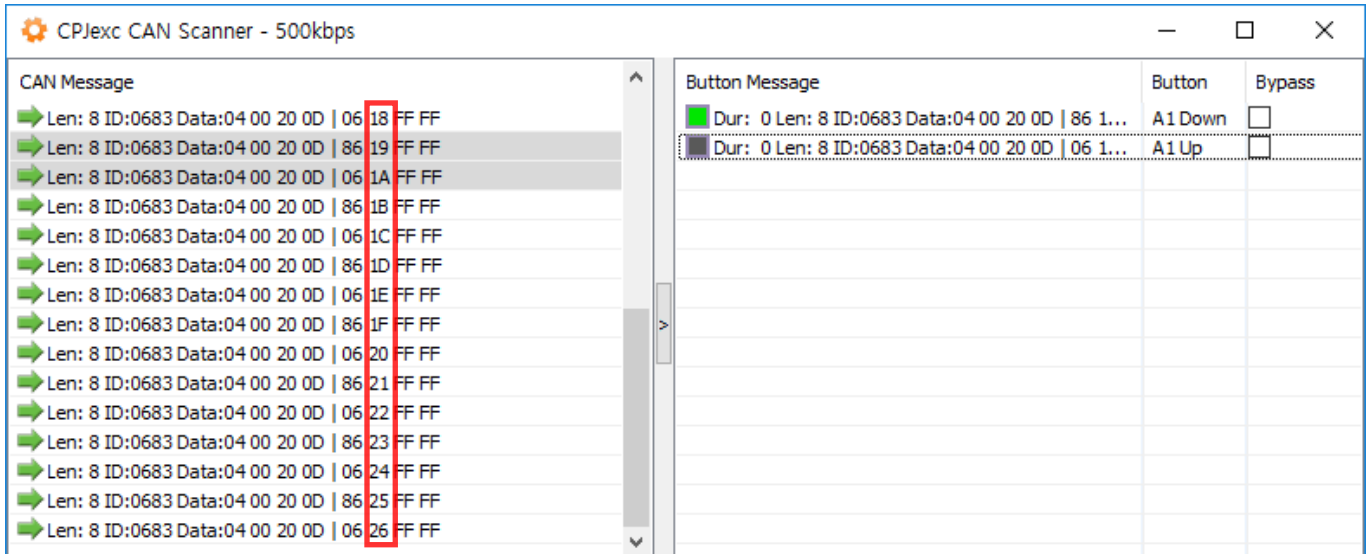
8-4. Send CAN message

You can send the CAN message on the CAN BUS with **Send** context menu or by double-clicking the CAN message in the listbox.
If the **Show sent CAN message** is checked, the CAN message sent on the CAN BUS is listed in the CAN message listbox.

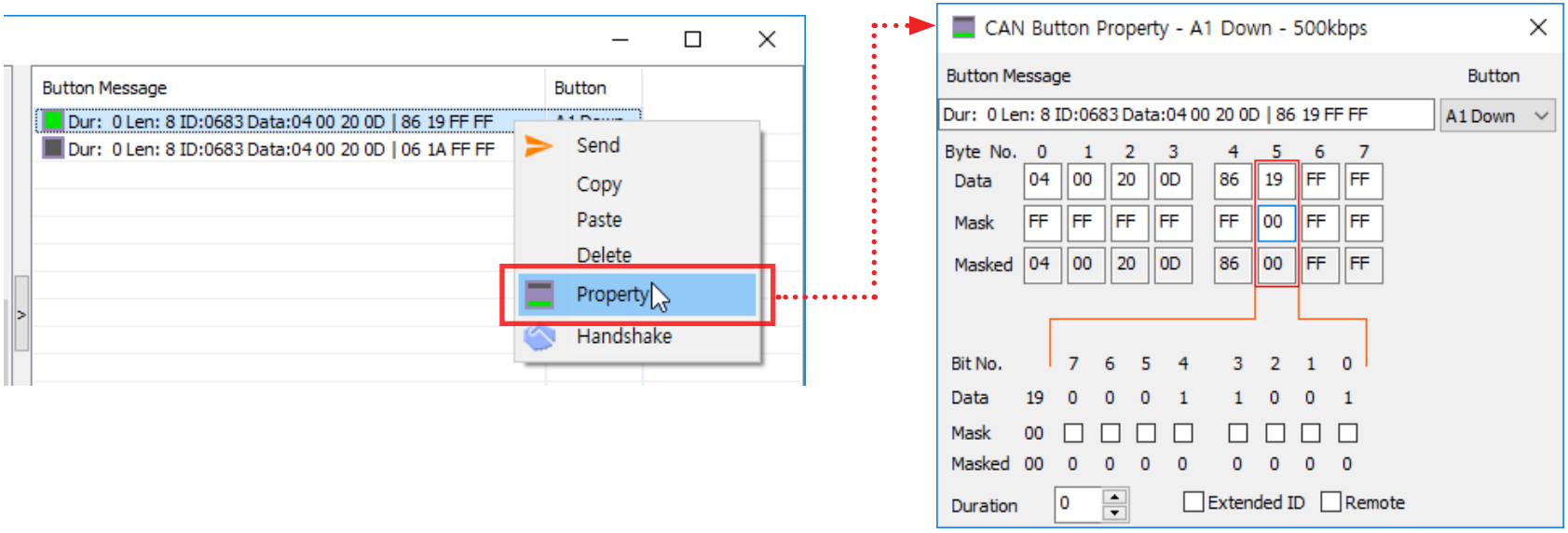


8-5. CAN DATA Bit Mask

In some CAN system, the CAN button message includes an increasing data, to prevent the data to be processed more than once.
We need to ignore this variable data to idendify the CAN button message exactly.
CPJexc provide CAN DATA bit mask to ignore the varialble data.

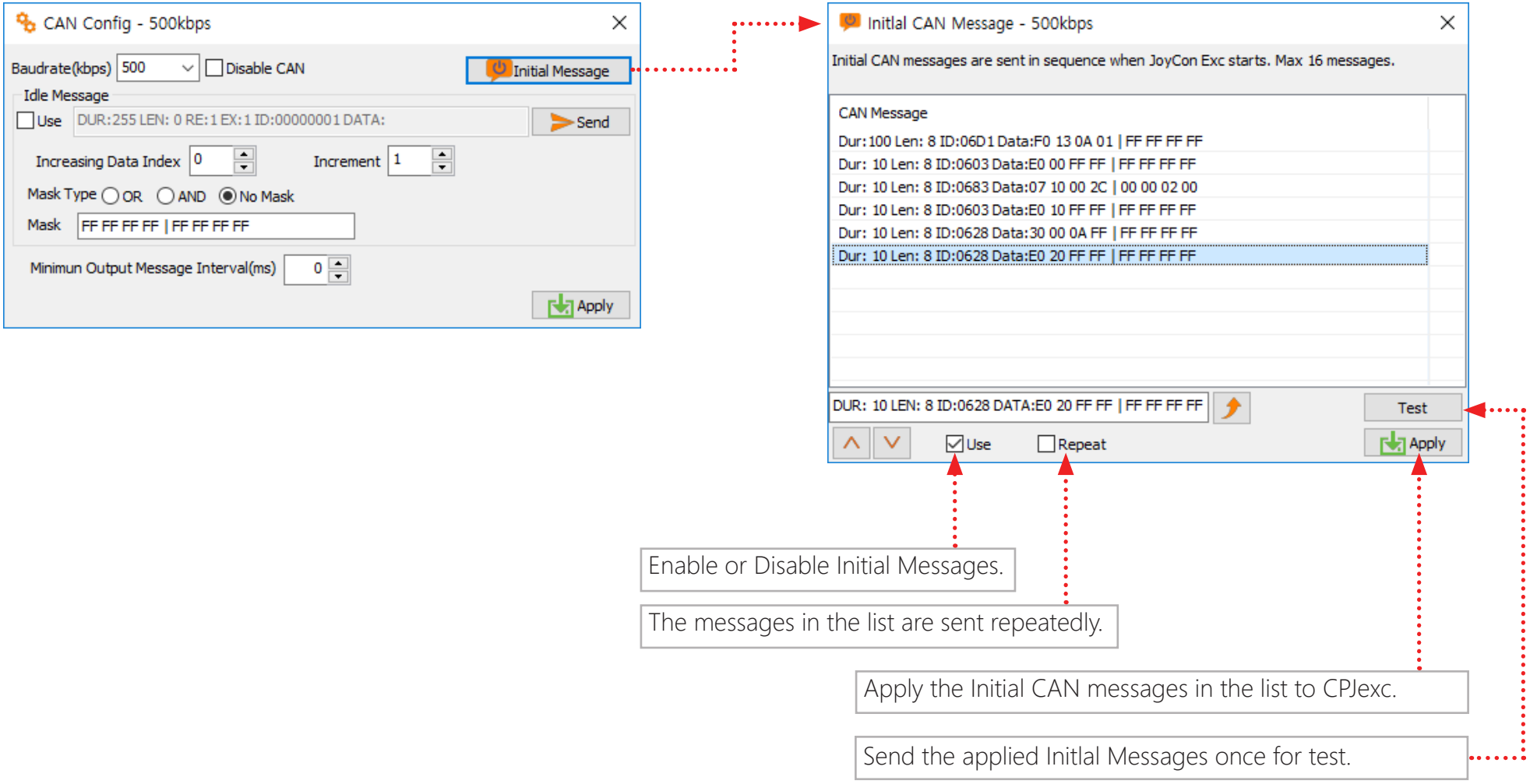


Unexpected data bits can be ignored by setting the mask bits as 0.



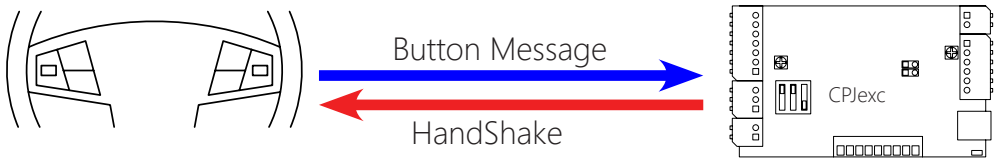
8-6. Initial Messages

When CPJexc starts, Initial Messages are sent to initialize the steering wheel controls or to inform other equipments that the car radio exist.
The CAN messages are sent as the list sequence.
The interval of the messages are determined by the duration(Dur:).
The Initial CAN messages can be max 16.

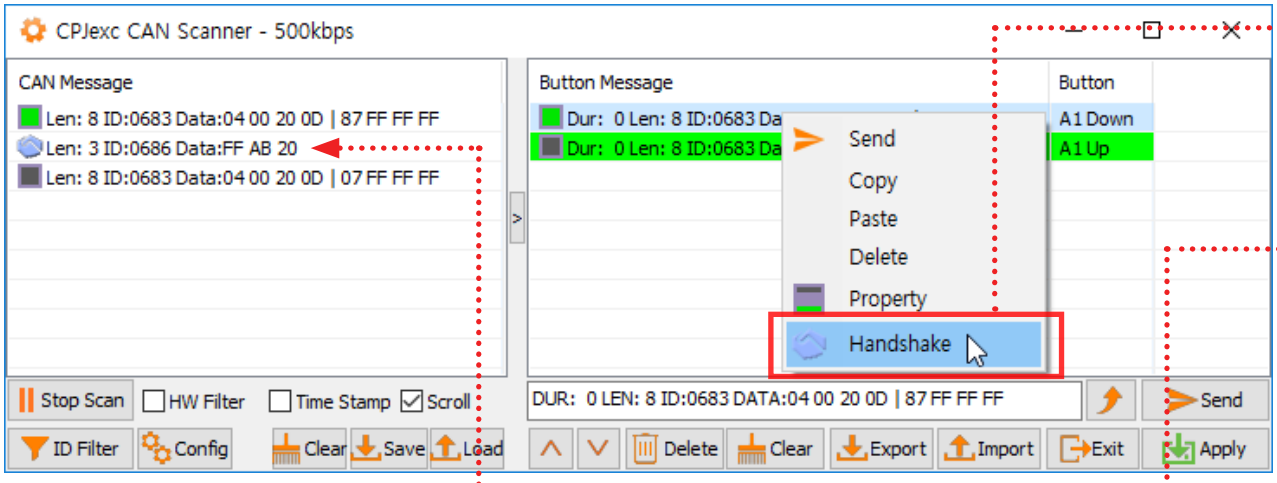


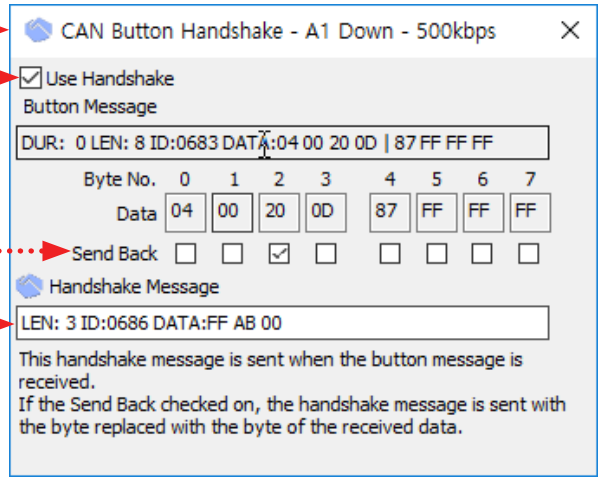
8-7. Handshake

In some CAN system, the steering wheel button waits for the Handshake message after it sends a button message.(eg. 2014 Nissan Altima S)
If the steering wheel button does not receive the handshake message, it wait for the handshake pernamently, sending the same button message repeatedly.
CPJexc can send a handshake message for each button message.

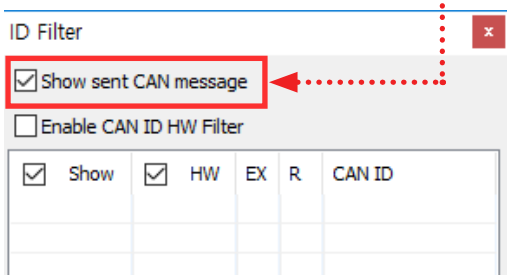


Check the box to enable Handshake for this Button Message.





If you want to see the the handshake message in the CAN message List, check the box **Show sent CAN message** in the ID Filter.

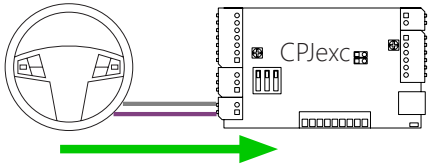
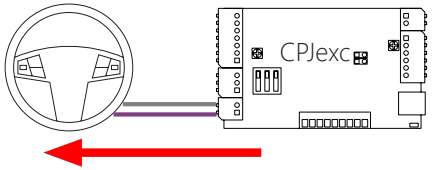
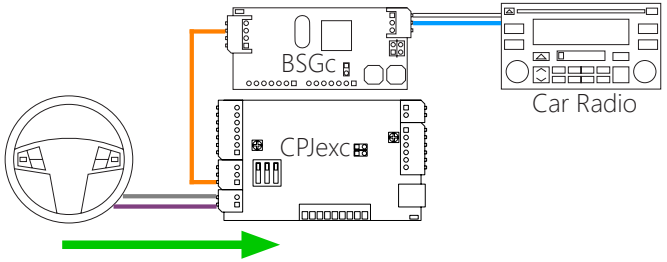
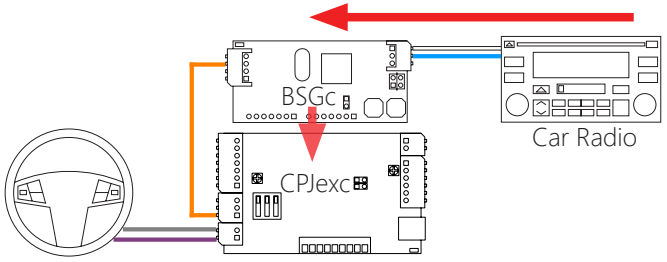
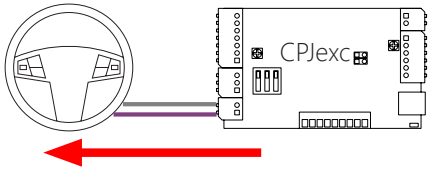


The CAN message which is sent back as a respond.

Check the box if data of the received button message is sent back(as it is) in the handshake message.
The data of Handshake message is replaced with the byte checked.
(The received data can be variable, the variable data is inserted in the handshake message as it is.)

8-8. The icons of CAN scanner

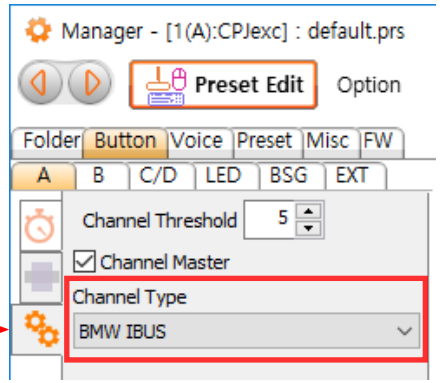
The icons of CAN scanner list means the origin of the CAN message.

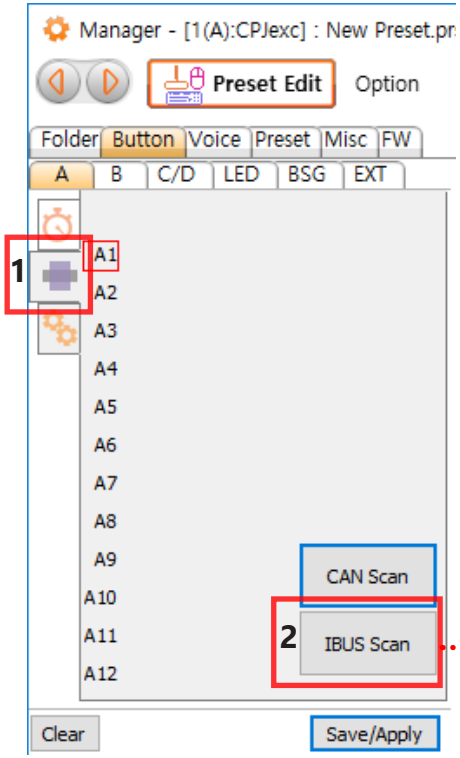
	Origin	Destination	Port	Desciption	
	Steering wheel controls	CPJexc	2Pin CAN Connector	The CAN message which is received from 2Pin CAN Connector	
	Steering wheel controls	CPJexc	2Pin CAN Connector	If the CAN message which is registered as a Down Button, is replaced with .	
	Steering wheel controls	CPJexc	2Pin CAN Connector	If the CAN message which is registered as a Up Button, is replaced with .	
	CPJexc	Steering wheel controls	2Pin CAN Connector	When "Show send CAN message" option is enabled.	
	Steering wheel controls	CPJexc	2Pin CAN Connector	When BSGc is enabled and "Bypass Steering wheel Control to Head unit" option is enabled, is replaced with .	
	Car Radio	CPJexc	BSGc	When BSGc is enabled and "Bypass Head unit to Steering wheel Control" option is enabled.	
	CPJexc	Steering wheel controls	2Pin CAN Connector	Handshake	

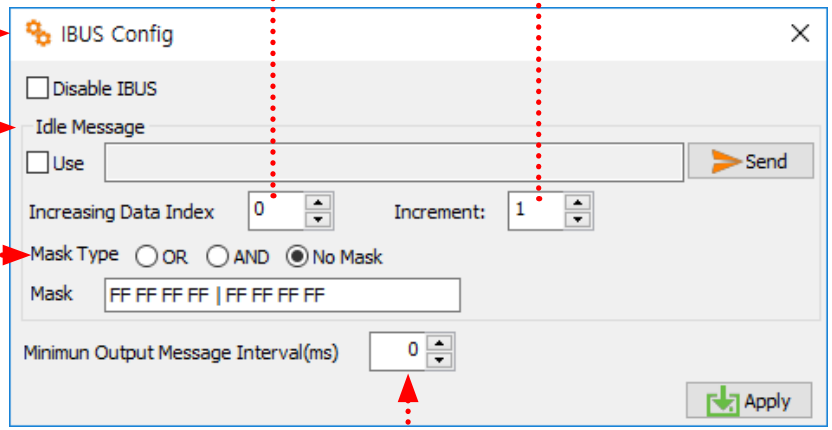
9. IBUS Button Setup

9-1. IBUS Configuration

Choose [Button] -> [A]-> [Configure], select Channel Type as BMW IBUS.
Choose [Button] -> [A]-> [Range and Position], click **IBUS Scan,**
then **CPJexc IBUS Scanner** pops up.







Increasing Data Index:
The data of the Idle Message is increased by **Increment** every time it is sent.
Increment can be -128 ~ 127.

Idle message is sent on IBUS periodically by Duration("Dur:").

Minimum Output Message Interval(ms):
Once a IBUS message is sent, the next IBUS message is sent after this period. This is applied for every IBUS message that is sent from CPJexc. This prevents the sent IBUS messages to be too close each other.

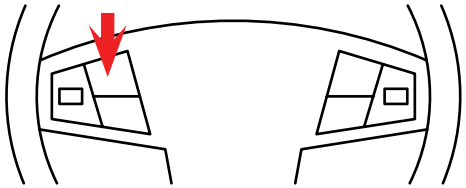
Mask:
To send the increasing data 0~0Fh, the data need to be ANDed with 0x0F.
To send the increasing data F0h~FFh, the data need to be ORed with 0xF0.

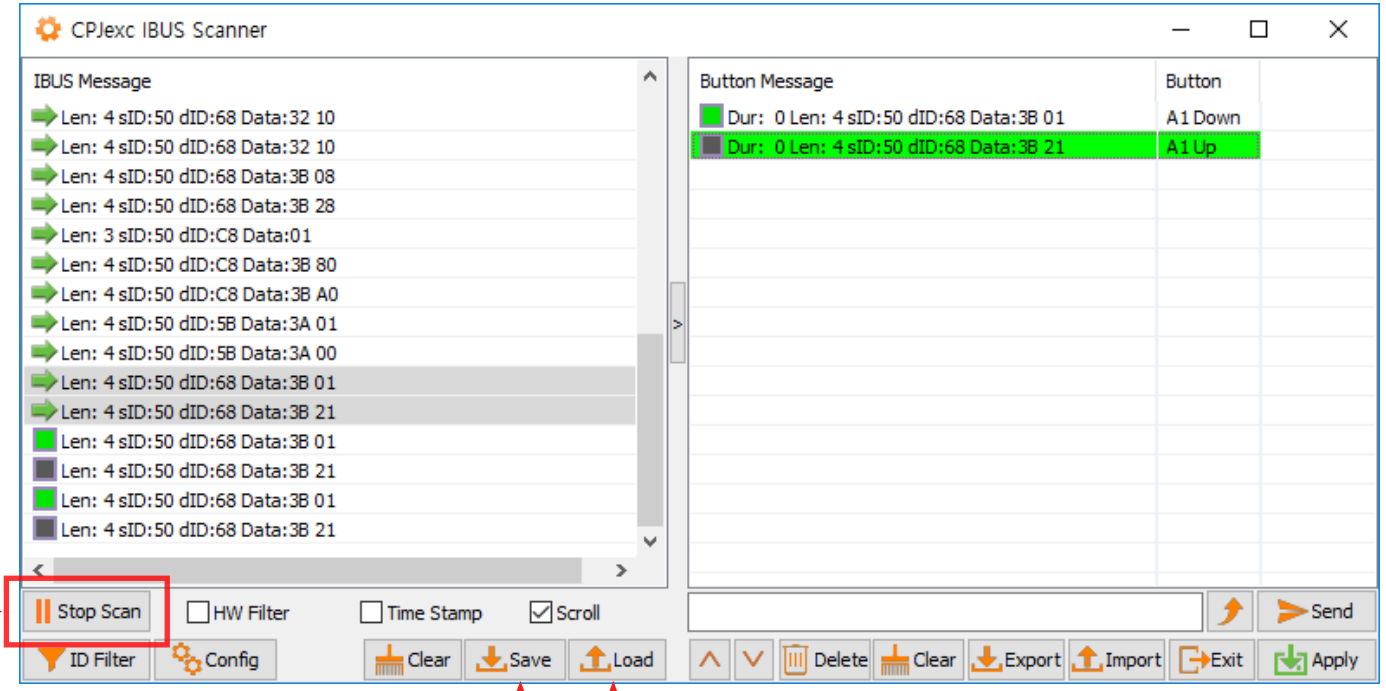
9-2. IBUS Message Scanning

If you don't know the IBUS message of the steering wheel control button, you need to find the IBUS message of the steering wheel button.

1. To Scan the IBUS messages, click **Start Scan**.

2. Push the steering wheel buttons, IBUS messages are listed at left listbox.



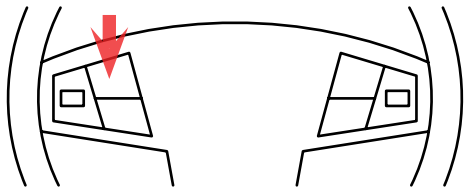


Save or load the CAN messages as a file(.ibs).

9-3. IBUS Button Message Registering

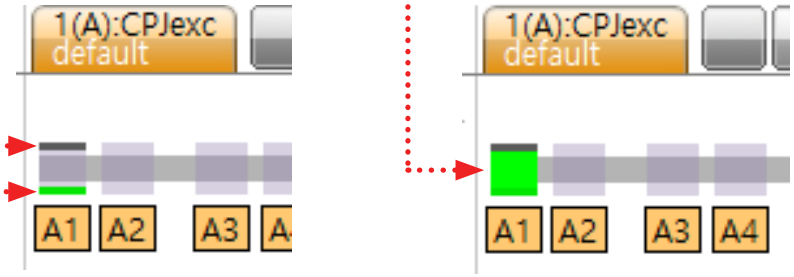
To use an IBUS message as a button, the IBUS message need to be registered as a Button Message.

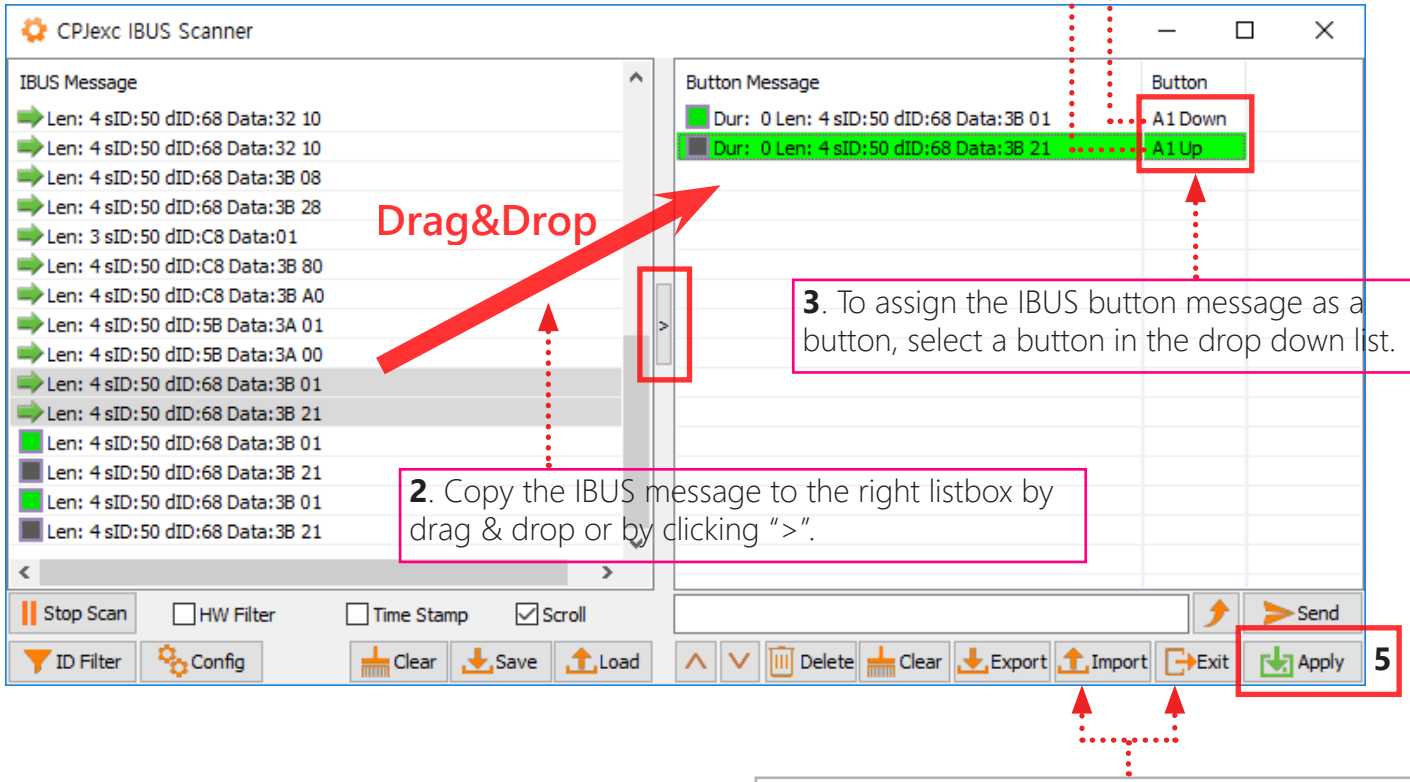
1. Press the steering wheel buttons, IBUS messages are listed at left listbox.



4. Up Button appears as a gray bar, Down Button appears as a green bar.

The Button bar turns to green when the steering wheel button is pushed.





2. Copy the IBUS message to the right listbox by drag & drop or by clicking ">".

3. To assign the IBUS button message as a button, select a button in the drop down list.

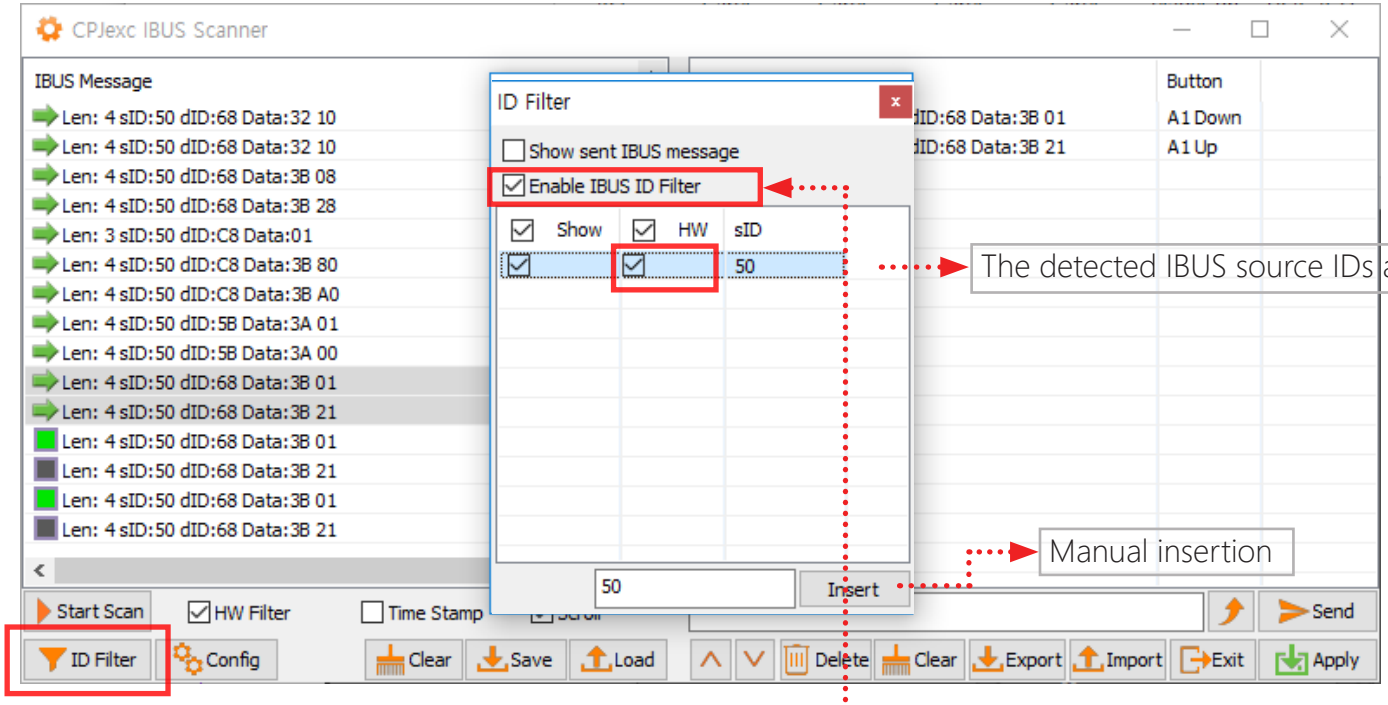
A Button is composed of Down and Up message.
If a down button message is repeated periodically with being pressed and there is no up button message(eg. volume button), set the duration above 0.
The unit of "Dur" is 10ms.

IBUS button can be assigned to any channel button.

Export or import the IBUS button messages as a file(.ibn).

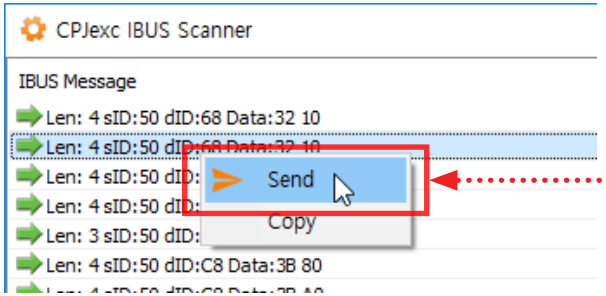
9-4. IBUS ID Filter

If there are too many IBUS messages on the IBUS, some messages can be missed.
You can filter out the IBUS messages you want using Hardware ID filter.



The detected IBUS source IDs are listed.

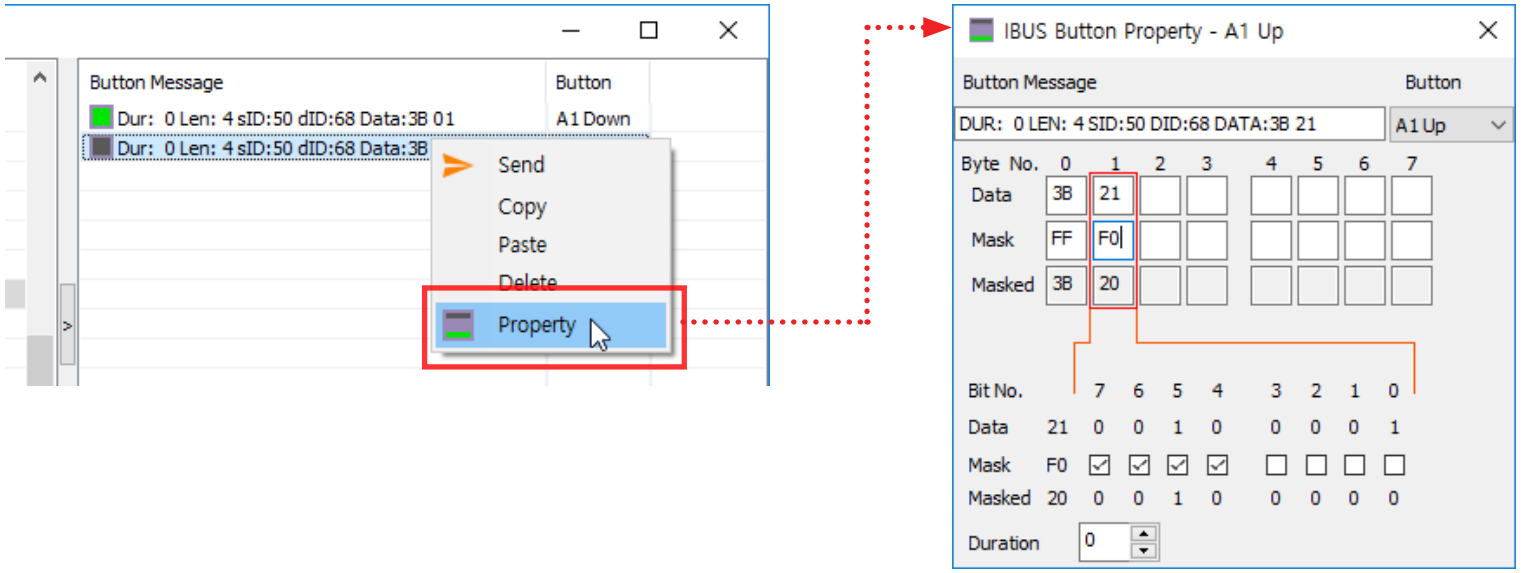
Manual insertion



You can send the IBUS message on the IBUS with **Send** context menu or by double-clicking the IBUS message in the listbox.
If **Show sent IBUS message** is checked, the IBUS message sent on the IBUS is listed at IBUS Message listbox.

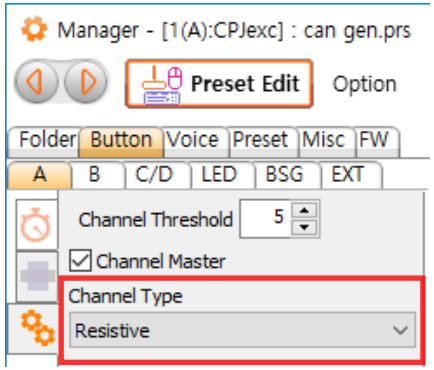
9-5. IBUS DATA Bit Mask

Unexpected data bits can be ignored by setting the mask bits as 0.

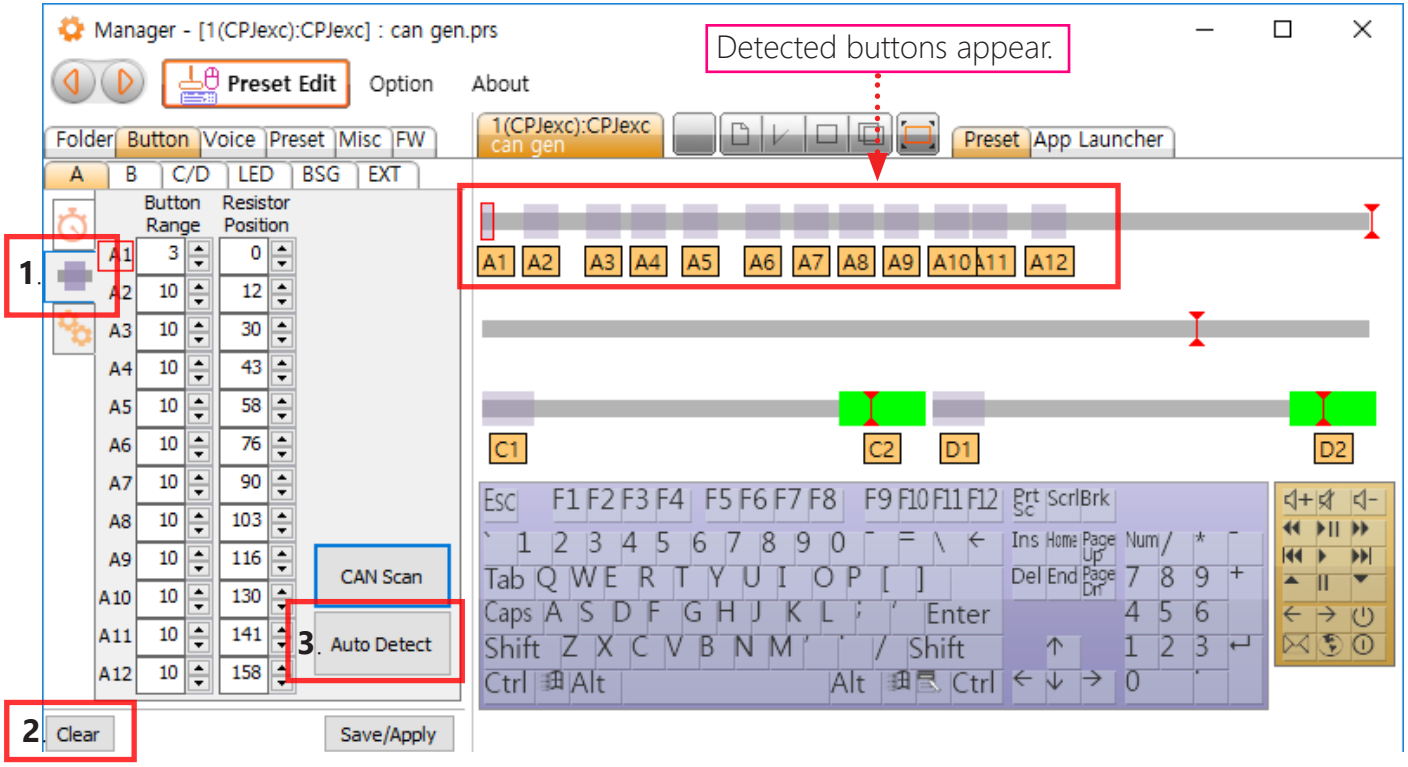


10. Resistive Button Setup

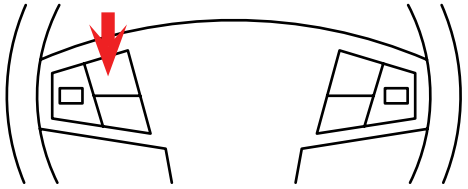
Choose [Button] -> [A or B]-> [Configure], select Channel Type as Resistive.



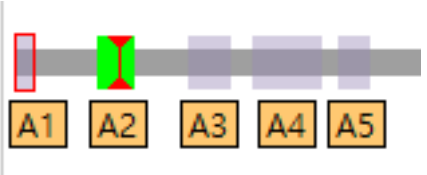
1. Choose [Button] -> [A or B]-> [Range and Position],
2. clear previous buttons,
3. click **Auto Detect.**



4. Press the steering wheel buttons one by one.



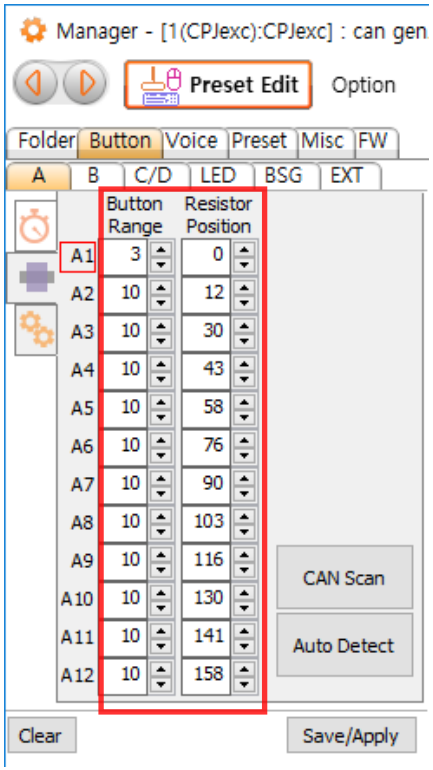
5. After all the buttons are detected, click **Auto Detect** again to finish auto-detection.



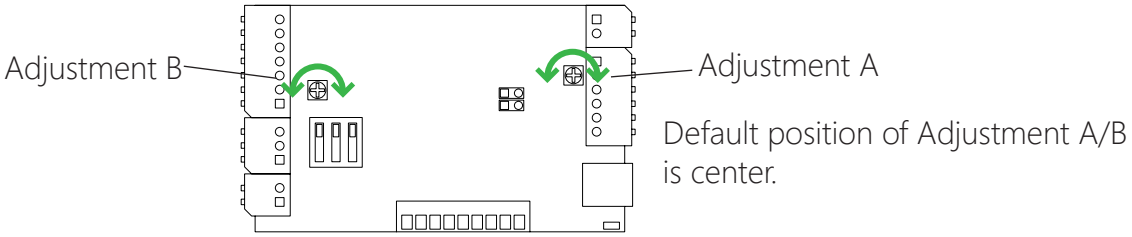
Button Range and Resistor Position of the buttons are stored in the onboard memory of CPJexc.

Button bar turns to green when the steering wheel button is pressed.

The resistance values can be fine tuned manually. After you change the values, click Save/Apply. Resistor range and position of the buttons are stored in the onboard memory of CPJexc.

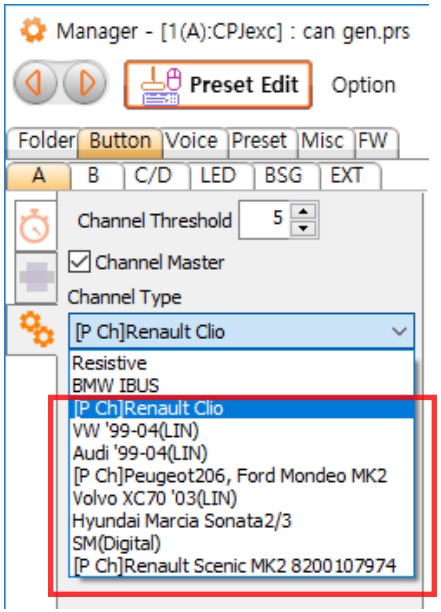


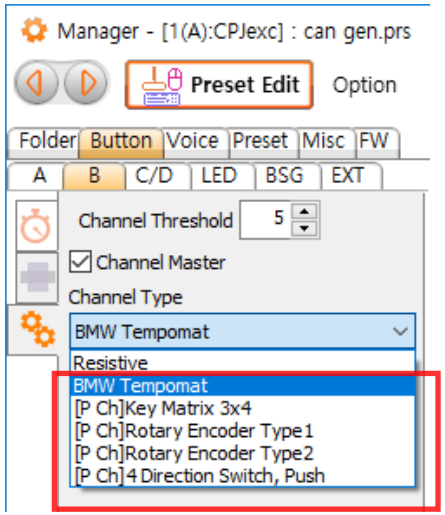
If the buttons in Manager are too close each other, tune the Adjustment A/B on the board.



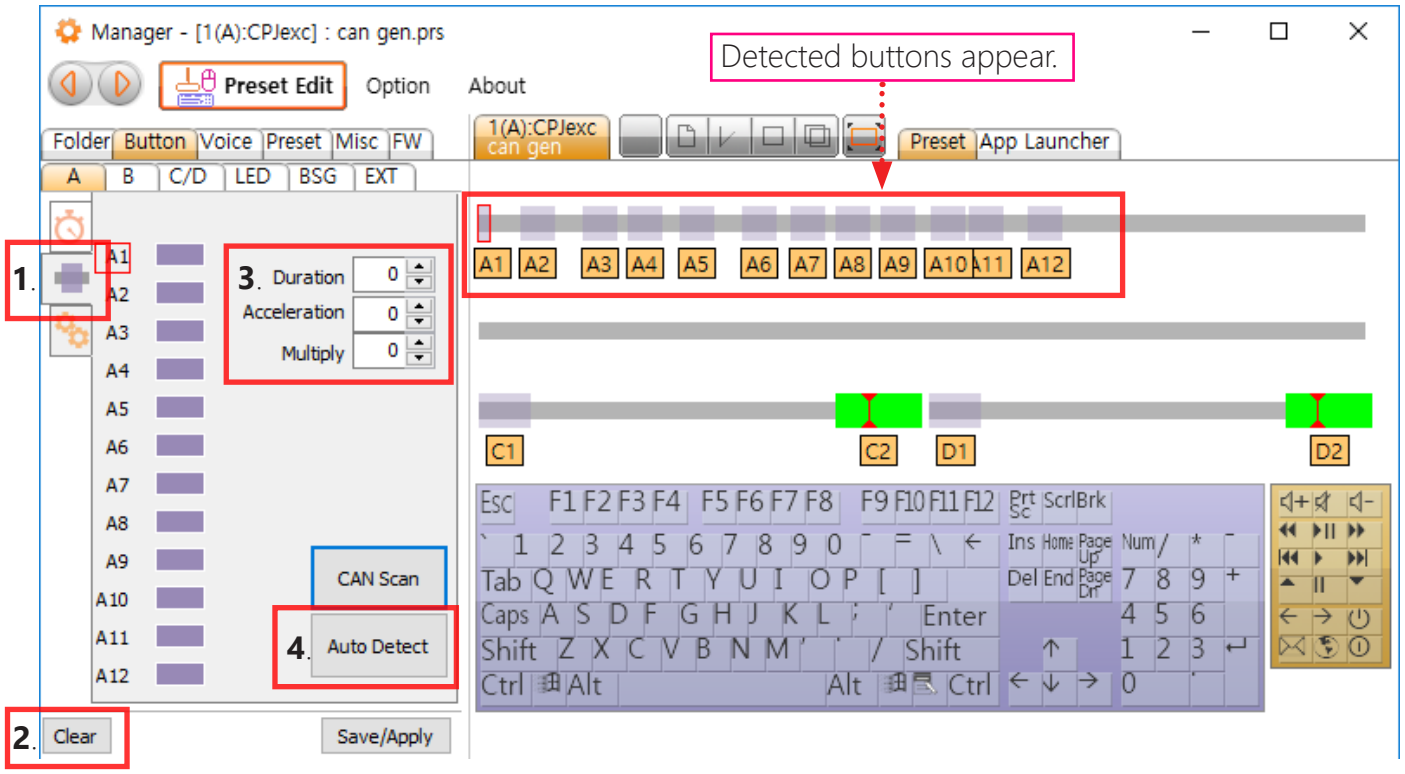
11. Digital Button Setup

Choose [Button] -> [A or B]-> [Configure], select Channel Type as Digital.



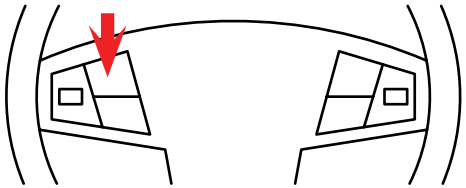


1. Choose [Button] -> [A or B]-> [Range and Position],
2. clear previous buttons,
3. Set Signal Reading Parameters:
   Put above 0(about 4) at Duration for the rotational wheel.
   Put 0 at the rest of the parameters by default.
4. click **Auto Detect.**



Button bar turns to green when the steering wheel button is pressed.

5. Press the steering wheel buttons one by one.



6. After all the buttons are detected,
click **Auto Detect** again to finish auto-detection.

Digital code of the buttons are stored in the onboard memory of CPJexc.

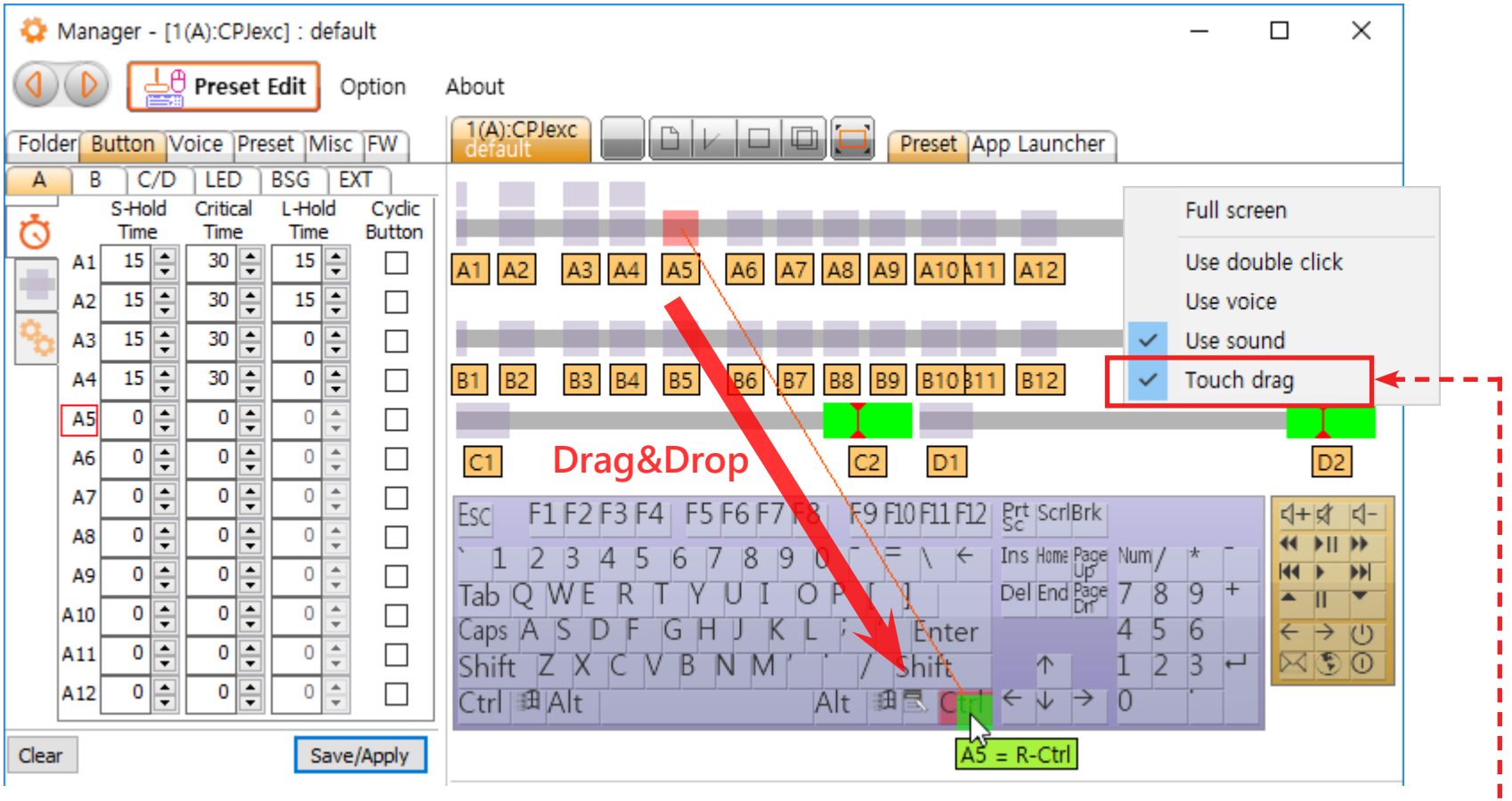
12. Preset Editing

12-1. Connecting a button to the hotkey

Drag&drop a Button Bar to the keyboard keys(or HID remote controller buttons). Up to 5 keys can be connected to one button.

Drag&drop sequence is same with the keyboard key stroke sequence.

For example, if you want a button to generate hotkey CTRL+ALT+DEL, drag-drop the Button Bar on the CTRL first, ALT next and DEL last.

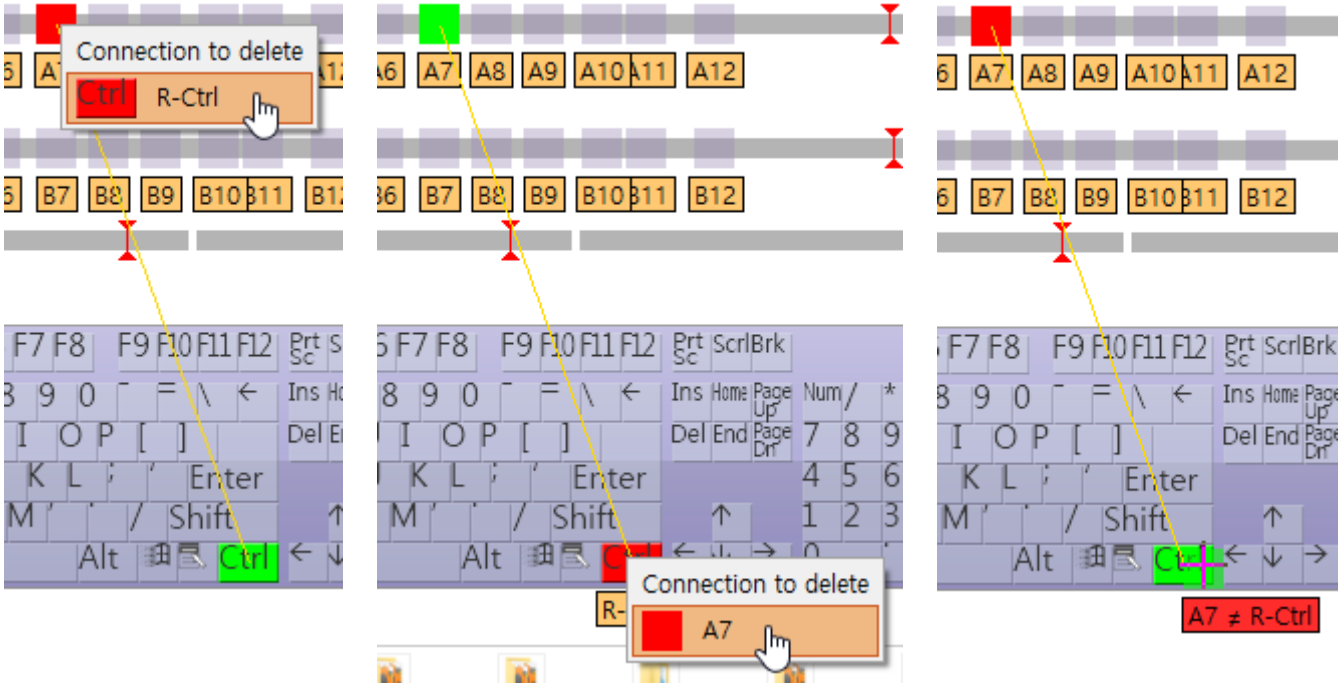


If **Touch drag** option is activated at the Context Menu, the Button Bar icon is attached to the mouse cursor by clicking it, and is dropped by another clicking on the keyboard key(or HID remote controller buttons).

12-2. Disconnecting a buttons from the Hotkey

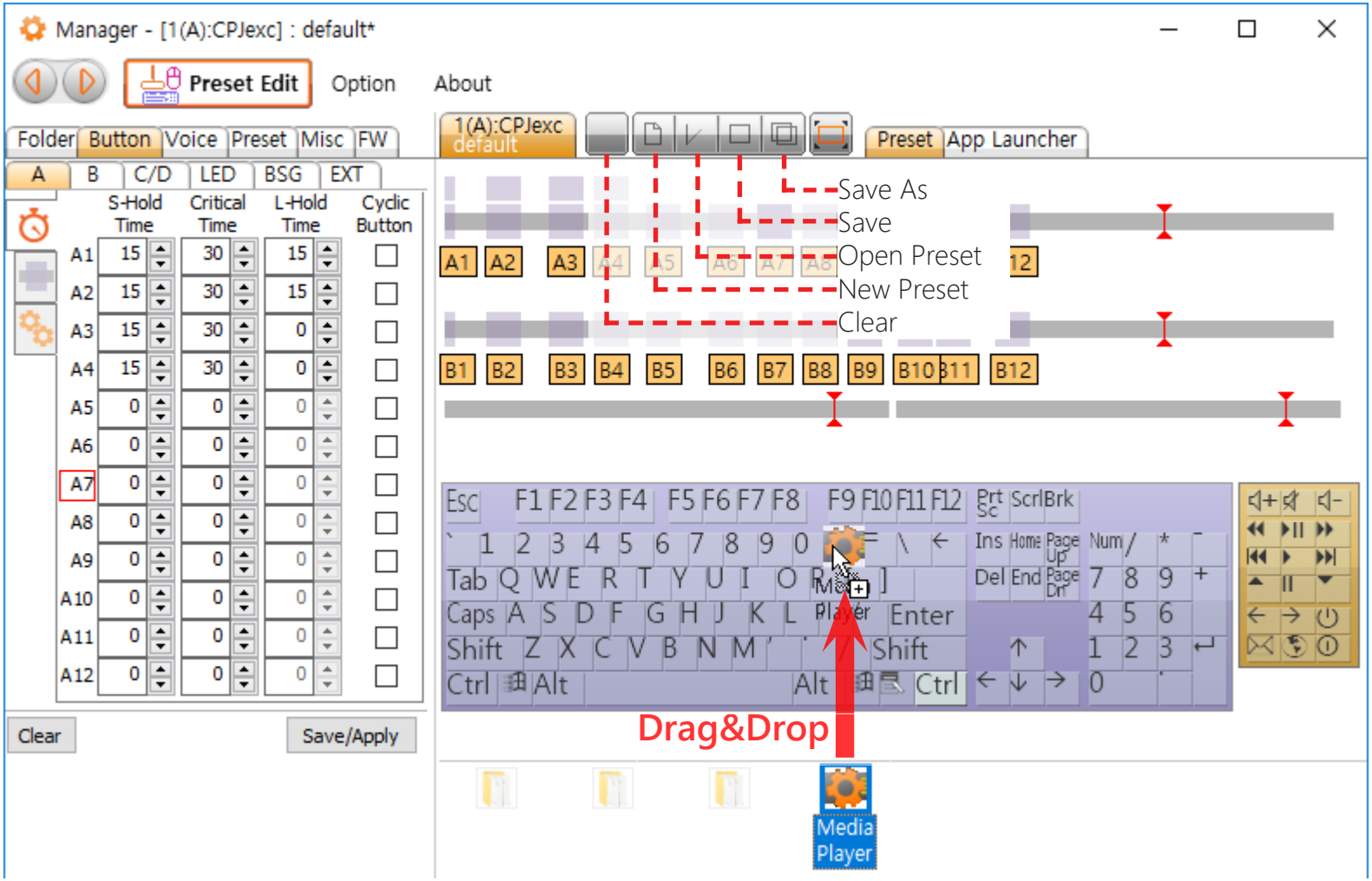
Right-click the Button Bar or keyboard key(or HID remote controller button) and click an item in the drop down menu.

Or drag and drop the Button Bar to the connected keyboard key(or HID remote controller button) again.



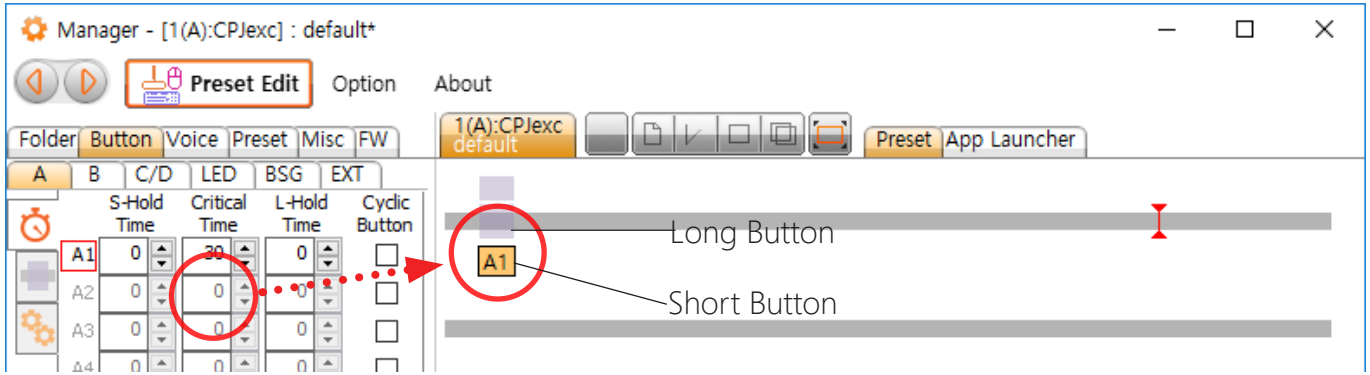
12-3. Save / Restore Preset File

The hotkeys and configuration can be saved as a preset file(.prs) by Save(Save As) button.
The hotkeys and configuration can be restored by Open Preset button or by double-clicking a preset file(.prs) or by drag-drop of a preset file(.prs) to the preset edit view.
Resistor range and position of the buttons and the CAN IBUS settings are stored in the onboard memory of CPJexc.



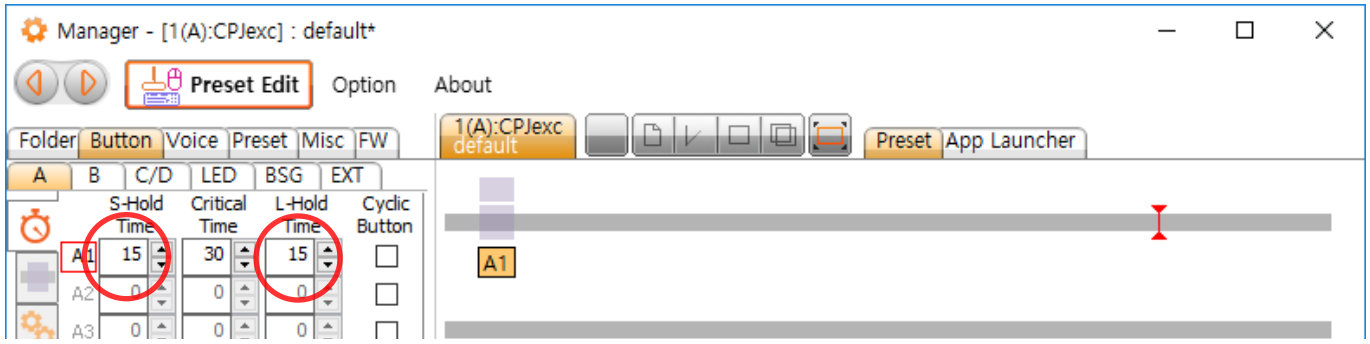
12-4. What is Short Button and Long Button

CPJexc supports two separated functions for one steering wheel remote control button.
The two functions are Short Button and Long Button.
Short Button is generated when the remote control button is pressed or released before **Critical Time**. Long Button is generated when the remote control button is released after **Critical Time**.
To use Long Button, set the **Critical Time** over than 0, then Long Button Bar will appear above the Short Button bar.



12-5. Separating Short from Long button

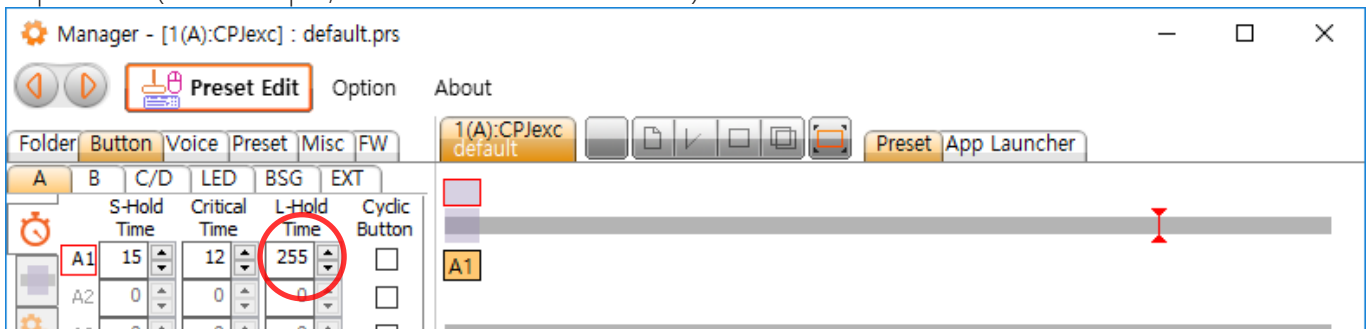
When you want to generate only the long button, the short button is required not to be generated immediately by pressing the remote control button.
Put 1~254 in **S-Hold Time**.
The short button is generated when the button is released before **Critical Time** while **S-Hold Time**.
The long button is generated when the button is released after **Critical Time** while **L-Hold Time**.
Hold Time value 1 is about 10ms, so Hold Time value 254 is about 2540ms(2.54s).



Hold Time 0 means that the button keeps being pressed while you keep pressing the remote control button. This is useful when you need to keep a key pressed in volume control.
(C, D channel support only Short Button and S-Hold Time.)

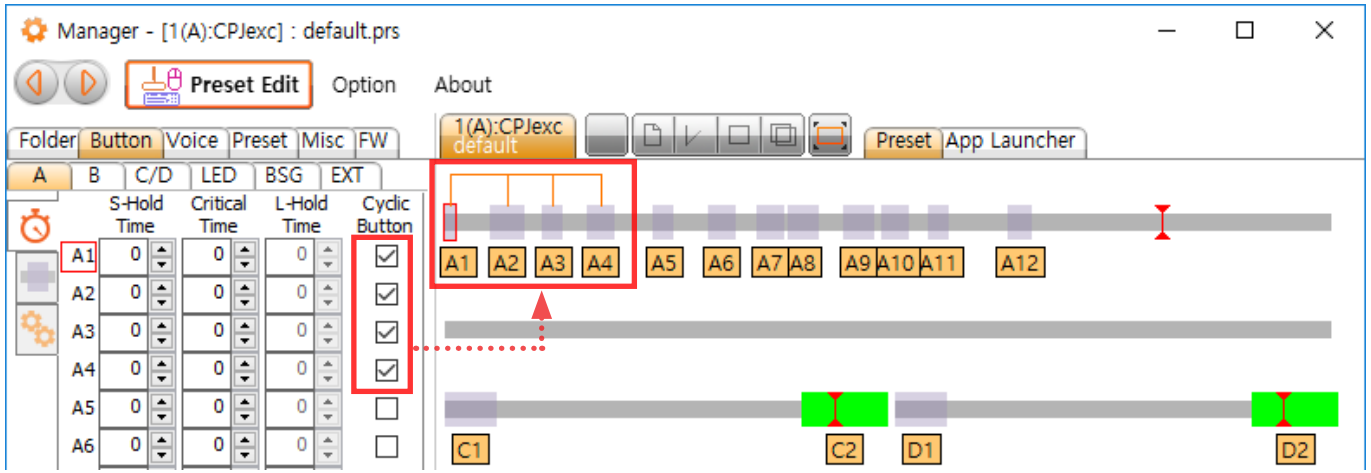
12-6. Toggle Button

If the **Hold Time** of a button is 255, the button is toggled.
This is useful when a keyboard key need to be stroked while SHIFT, CTRL, or ALT keys are kept pressed. (For example, ALT+TAB or Window+TAB)



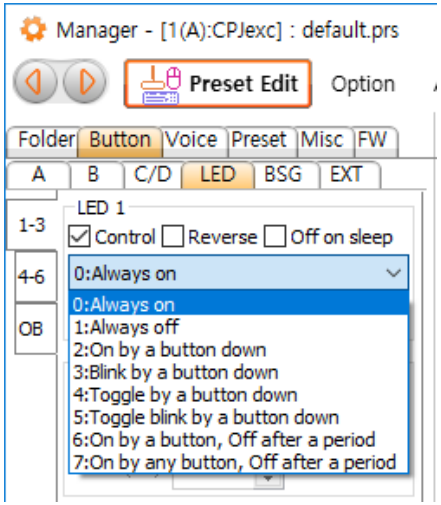
12-7. Cyclic Button

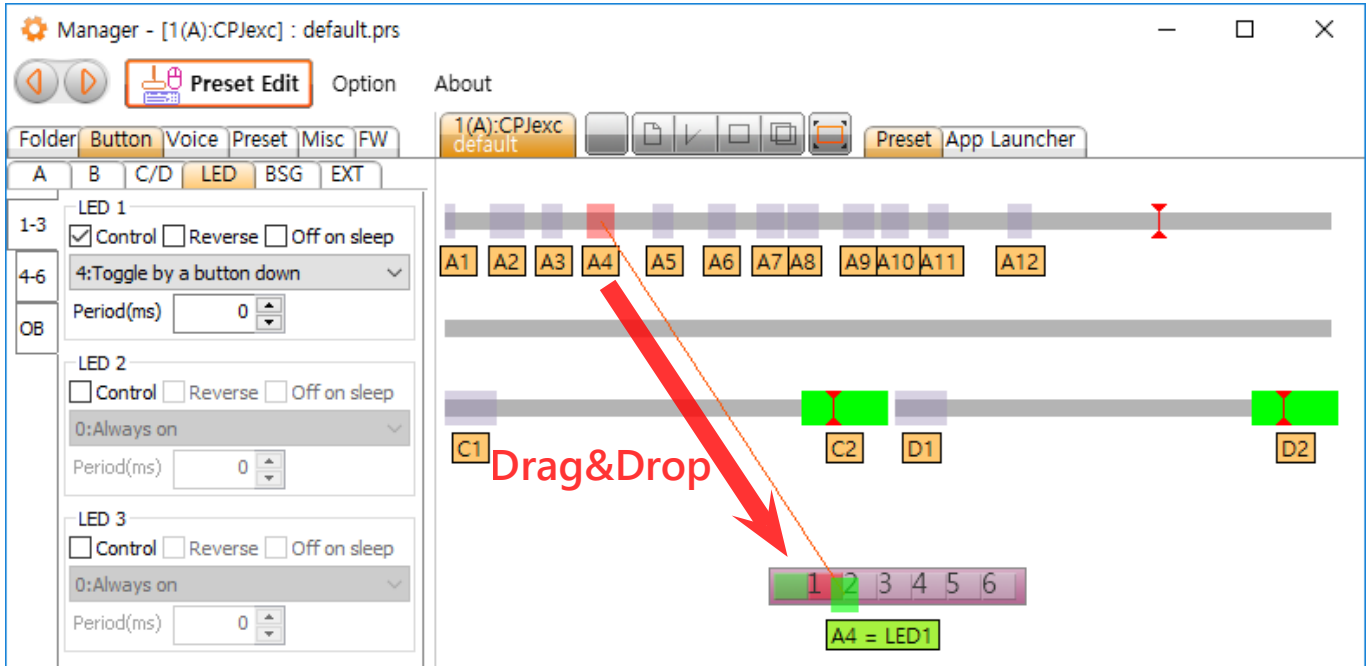
You can rotate the buttons by checking Cyclic Button. The cyclic buttons rotate by pressing any checked button.
For example in the next picture, when you press A1(or A2 or A3 or A4),
button works A1->A2->A3->A4->A1->A2....



12-8. Programmable LED control

CPJexc can control one onboard LED and 6 external LEDs.
If you want to control LED with the current preset, check on box **Control** in the LED tab. If **Control** is not checked, this preset doesn't control LED and LED keeps previous configuration.
If **Reverse** is checked, On Off is reversed.
If **Turn Off on Sleep** is checked, LED is turned off when the PC goes into sleep mode.





LED control has 8 modes.
0. Always On : LED is turned on always
1. Always Off : LED is turned off always
2. On by a button : LED is turned on while a button is pressed.
3. Blink by a button : LED blinks periodically while a button is pressed.
4. Toggle by a button : LED is turned on by pressing a button, and is turned off by another pressing the button.
5. Toggle blink by a button : LED blinks periodically by pressing a button, and is turned off by another pressing a button.
6. On by a button, off after a period : LED is turned on by pressing a button, and is turned off after a period automatically.
7. On by any button, off after a period : LED is turned on by pressing any button, and is turned off after a period automatically.
Unit of **Period** is millisecond. In the blink mode(3, 5), turning on is one period and turning off is another period. For example, if the **Period** is 500(ms), LED is turned on every 1 second(1000ms).

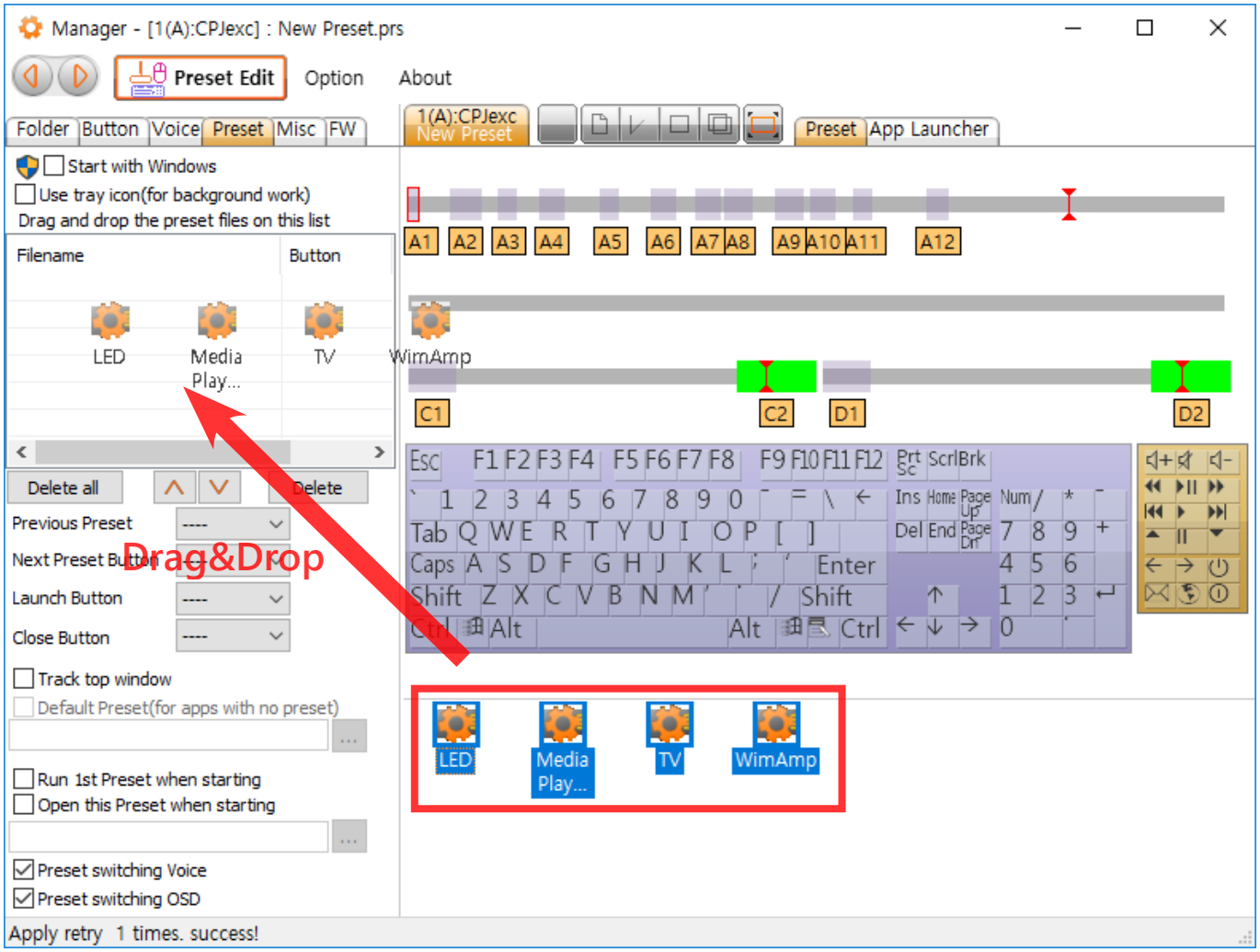
To assign a button to LED, drag-drop a button to a LED.

13. Preset Switching

A preset can be downloaded to CPJexc by Preset Button automatically, it is useful when you need to change steering wheel remote control's configuration while driving.

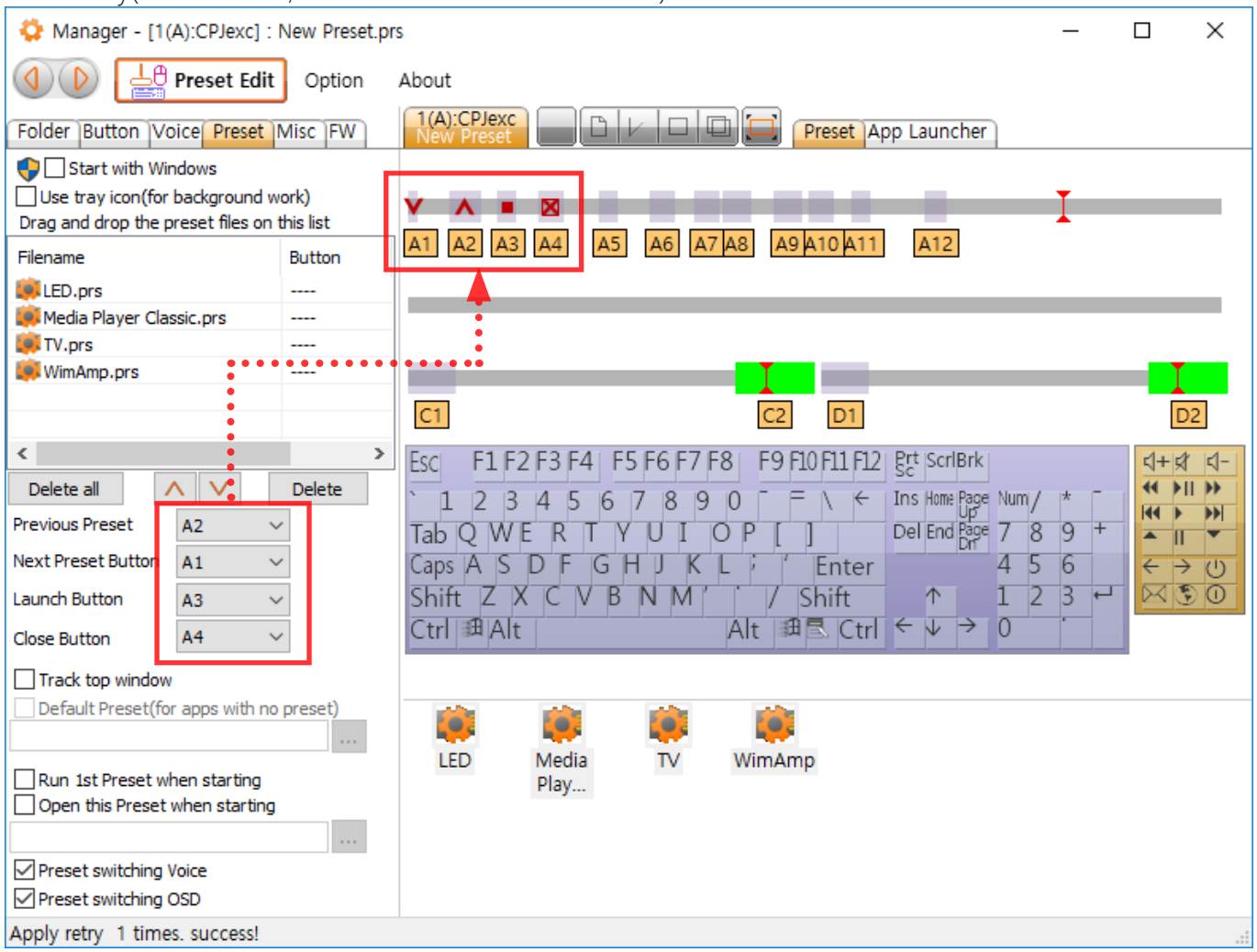
13-1. Preset List

Drag Drop preset files on the list of Preset tab. Preset is switched with the sequence of this list.

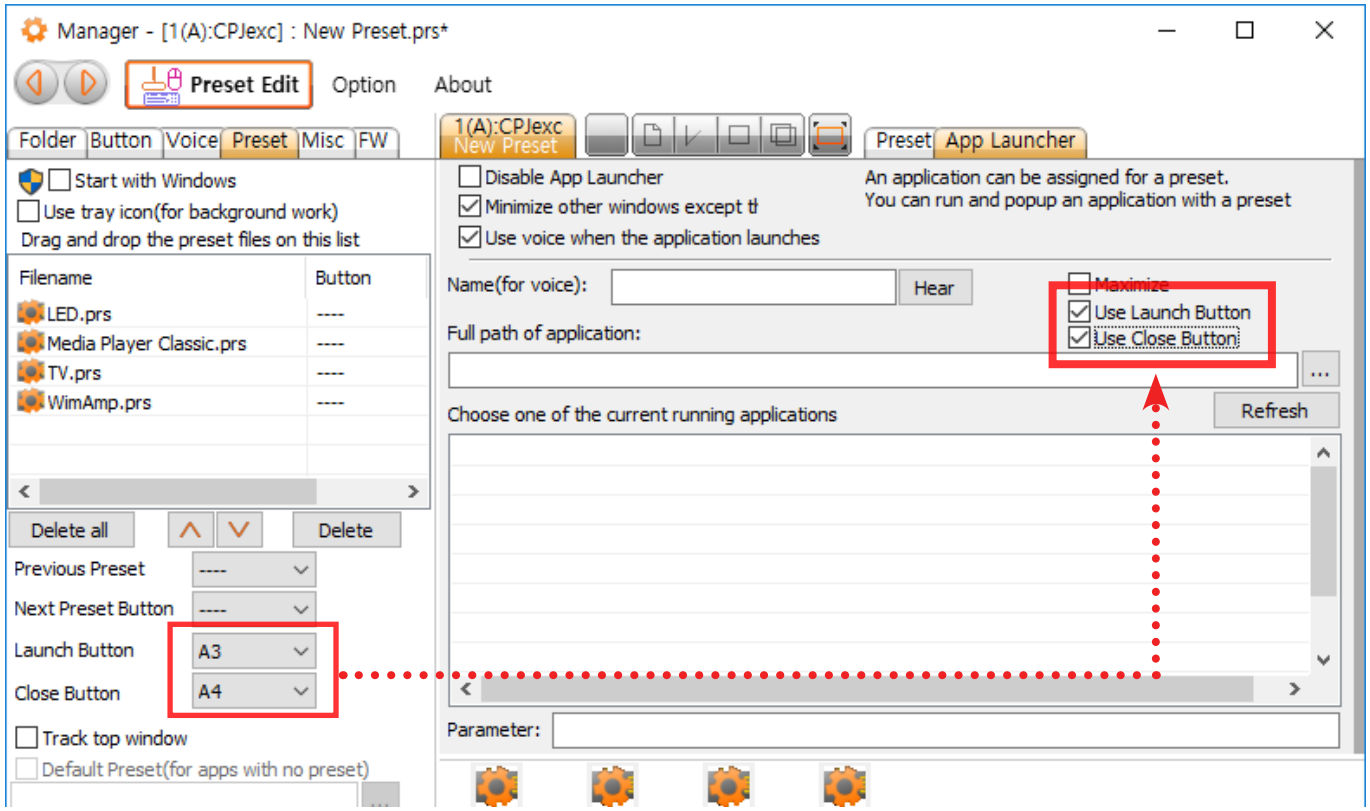


13-2. Preset Button

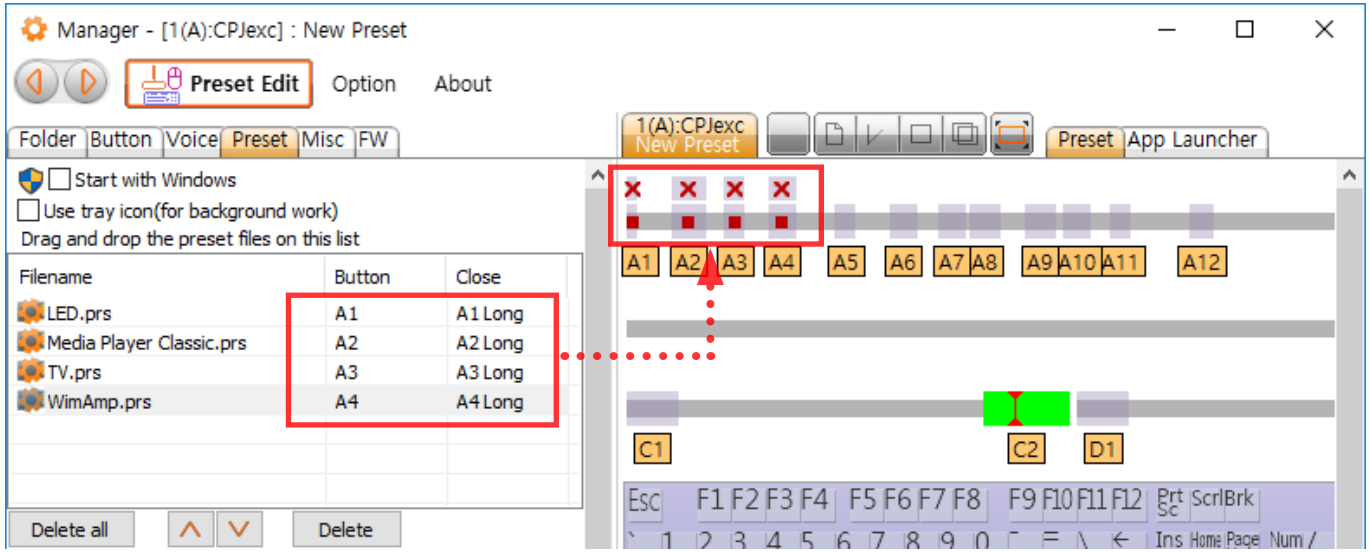
The presets are switched in sequence by **Previous Preset Button/Next Preset Button**. An application which is associated with the current preset in Application Launcher is closed by **Close Button**, Launched by **Launch Button**. Configure the Preset Button of every preset file in the preset list in the same way(S-Hold Time, L-Hold Time and Critical Time).



To use **Close Button** or **Launch Button**, check **Use Launch Button** or **Use Close Button** at Application Launcher for each preset file.

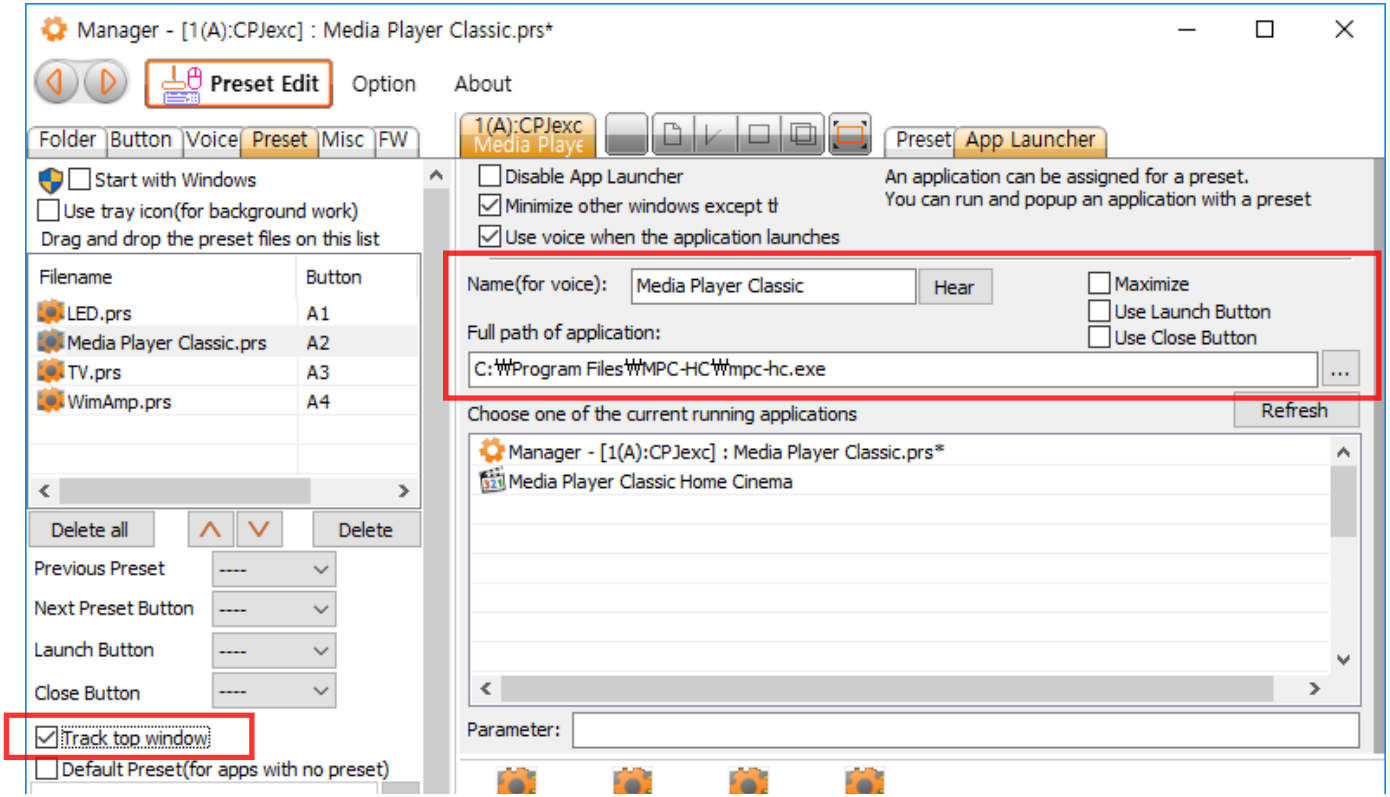


There is another way to switch the presets. You can switch a preset and launch an application directly not in sequence with **Preset Button** in the preset list. The application which is associated with the preset is closed by **Close Button** in the Preset List. Configure the Preset Button of every preset file in the preset list in the same way(S-Hold Time, L-Hold Time and Critical Time).



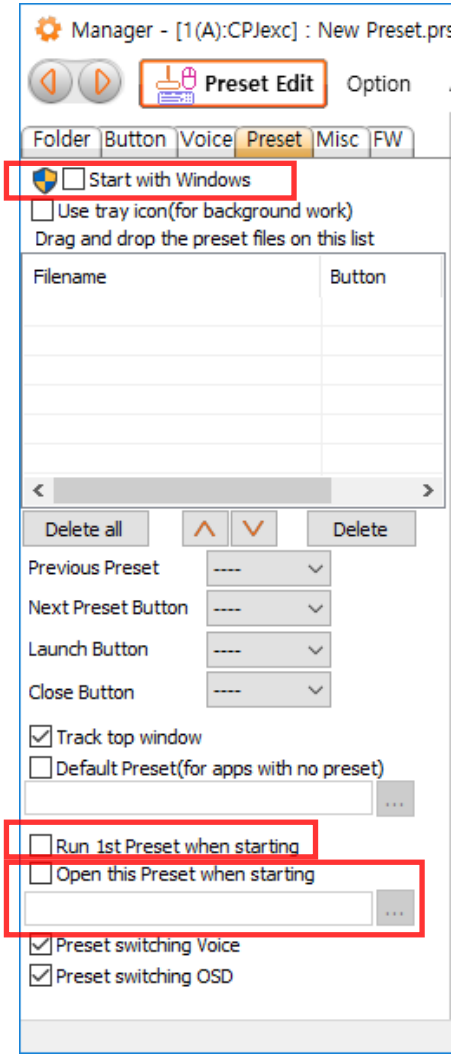
13-3. Application Launcher

An application can be launched and popped up when Preset is switched. Drag-drop (.exe) file(or shortcut file) or double-click current running application in the list box. **Name** is spoken when the application is launching. If the application is not running, the application is launched. If the application is already running, the application pops up. If the **Track top window** is checked, Preset is automatically switched by the top window.



13-4. Start option

Check **Start with Windows** to run Manager when Windows starts.
Check **1st Preset when Starting** to run the first preset in the preset list when Manager starts. "Run Preset" means to launch or pop up an application with opening an preset).
Check **Open this Preset when Starting** and drag-drop a preset on the edit box, this preset is opened and applied to CPJexc when Manager starts.

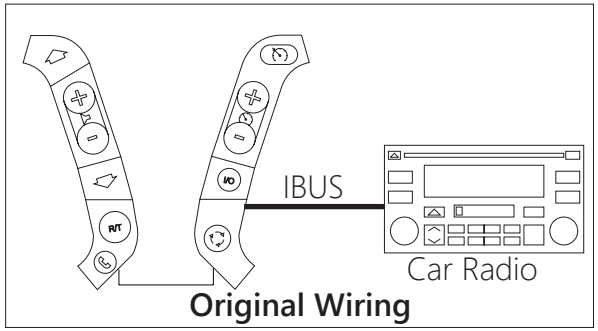


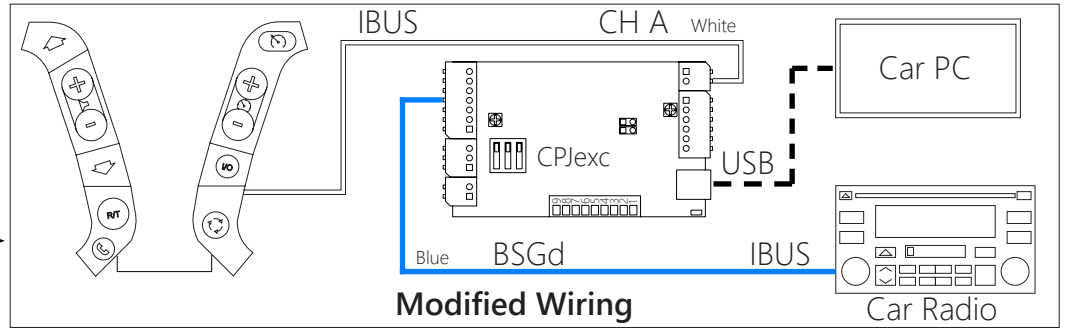
14. BSG(Button Signal Generator) for BMW IBUS

BSG(Button Signal Generator) emulates the button signal that controls the car radio.
CPJexc itself supports BMW IBUS, AUDI '99-'04(LIN) and VW(Volkswagen) '99-'04(LIN) through BSGd(4th pin at 7Pin Power Connector).
You can control both car PC and BMW stereo with the steering wheel controls using BSGd.

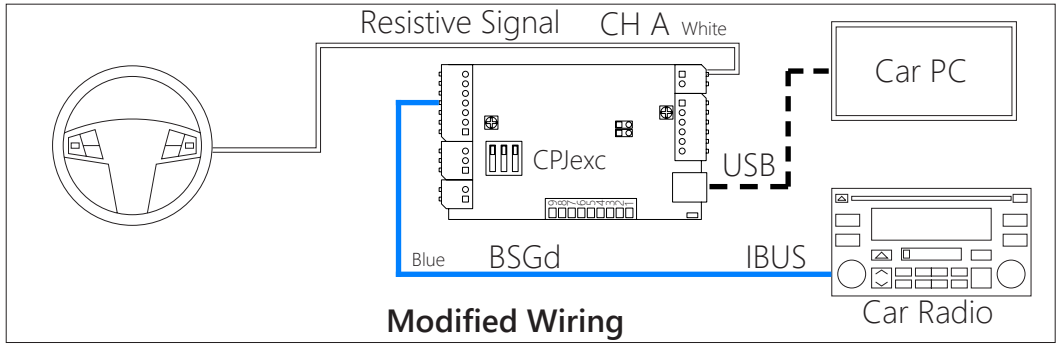
14-1. Wiring of BSGd for BMW IBUS

Steering wheel controller's IBUS wire -> Channel A data wire of CPJexc
BSGd wire -> IBUS wire of car radio(or original equipement)



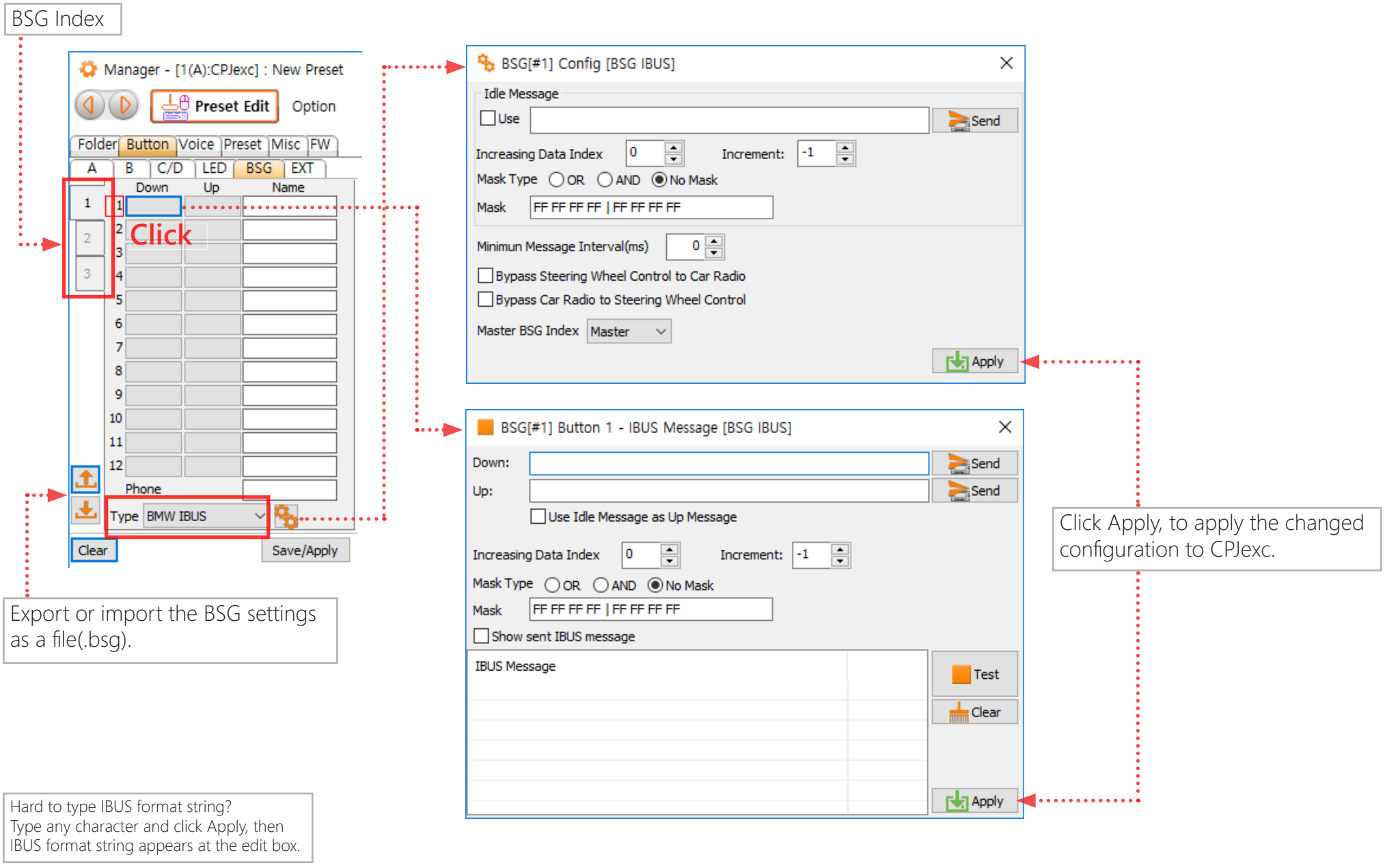


Even though the steering wheel control button is not IBUS, CPJexc can generate IBUS signal to control the IBUS car radio.



14-2. Manager Setting of BSGd for BMW IBUS

Choose the **BSG index**.
Choose BMW IBUS at **Type.**



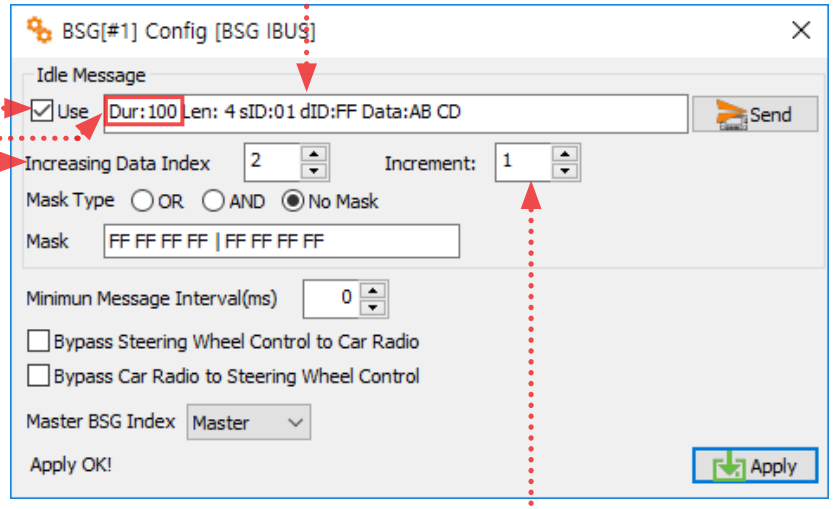
14-3. Idle Message

Idle Message is needed for some car equipement(car radio) to be activated. Idle message is sent on IBUS through BSGd periodically by Duration("Dur:").

14-3-1. Using Idle Message

Check on "**Use**", and put an IBUS message in the edit box(Drag&Drop or Copy&Paste)
"**Dur:**" is the interval of Idle Message.
"Dur:1" is 10ms. "Dur:100" is 1000ms, 1sec.

For example,
if the idle message is
Dur:100 Len: 4 sID:01 dID:50 Data:AB CD
the message is sent every 1 second to the Radio though BSGd.



14-3-2. Increasing Data of Idle Message

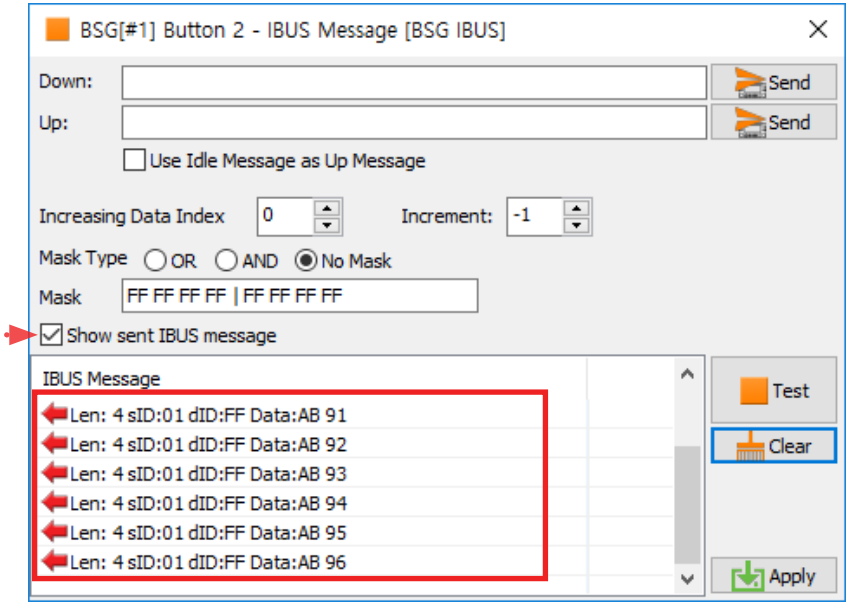
Increasing Data is needed for some car equipment.
The Idle Message data indicated by **Increasing Data Index** is increased by **Increment** every time the Idle Message is sent.

Increment can be -128 ~ 127.
If Increasing Data is not used, set 0 at **Increasing Data Index**.

Example:
Idle message is
Dur:100 Len: 4 sID:01 dID:50 Data:AB CD
Increasing Data Index is 2
Increment is 1.
The data is sent like below every 1 second to the Radio though BSGd.

Len: 4 sID:1 dID:50 Data:AB 16
Len: 4 sID:1 dID:50 Data:AB 17
Len: 4 sID:1 dID:50 Data:AB 18
Len: 4 sID:1 dID:50 Data:AB 19
Len: 4 sID:1 dID:50 Data:AB 1A
....

You can see the sent Idle Message at Button Property with checking **Show sent IBUS message**.



14-3-3. Mask of Idle Message

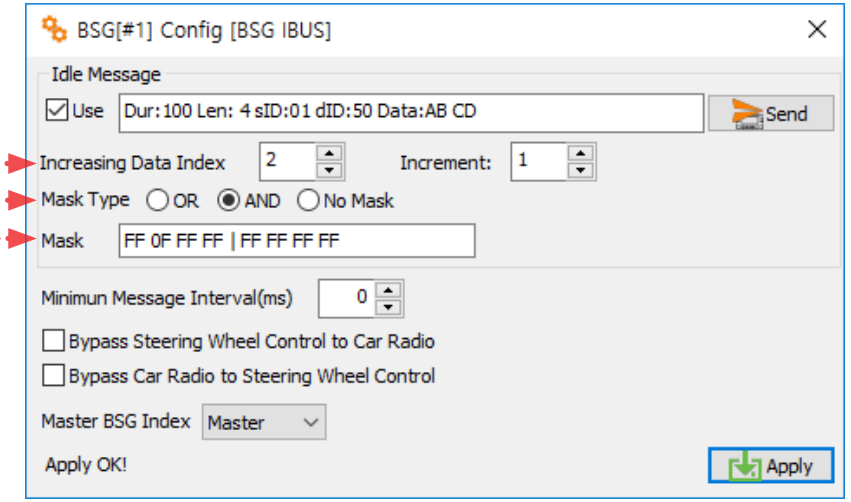
Increasing Data need to be limited for some car car radio(or equipment).

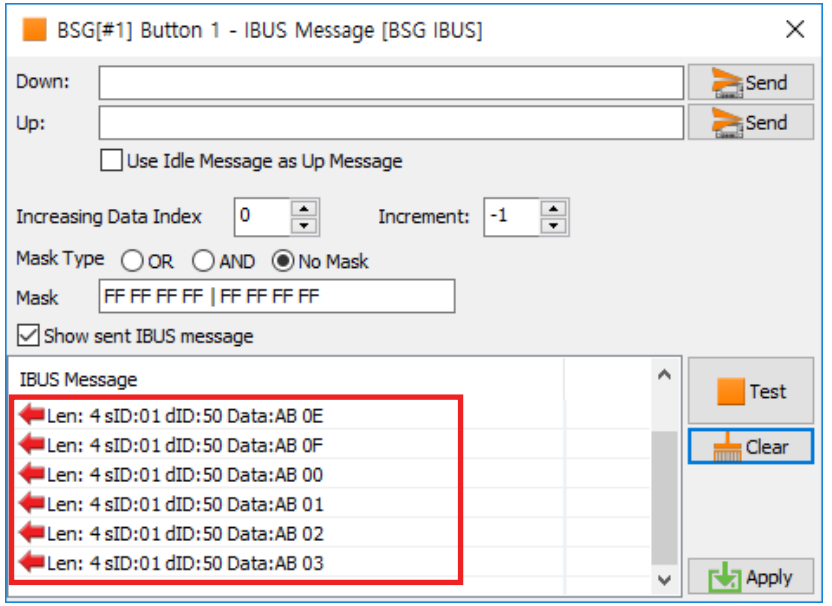
To send the Increasing Data 0~0Fh, the higher bit need to be ANDed with 0x0F.
To send the Increasing Data F0h~FFh, the higher bit need to be ORed with 0xF0.

Example:
Idle Message is
Dur:100 Len: 4 sID:01 dID:50 Data:AB CD
Increasing Data Index is 2
Increment is 1
Mask Type is "AND"
Mask is "FF 0F FF FF | FF FF FF FF"

The messages are sent every 1 second to the Radio though BSGd like below.

S Len: 4 sID:01 dID:50 Data:AB 0B
S Len: 4 sID:01 dID:50 Data:AB 0C
S Len: 4 sID:01 dID:50 Data:AB 0D
S Len: 4 sID:01 dID:50 Data:AB 0E
S Len: 4 sID:01 dID:50 Data:AB 0F
S Len: 4 sID:01 dID:50 Data:AB 00
S Len: 4 sID:01 dID:50 Data:AB 01
S Len: 4 sID:01 dID:50 Data:AB 02
....





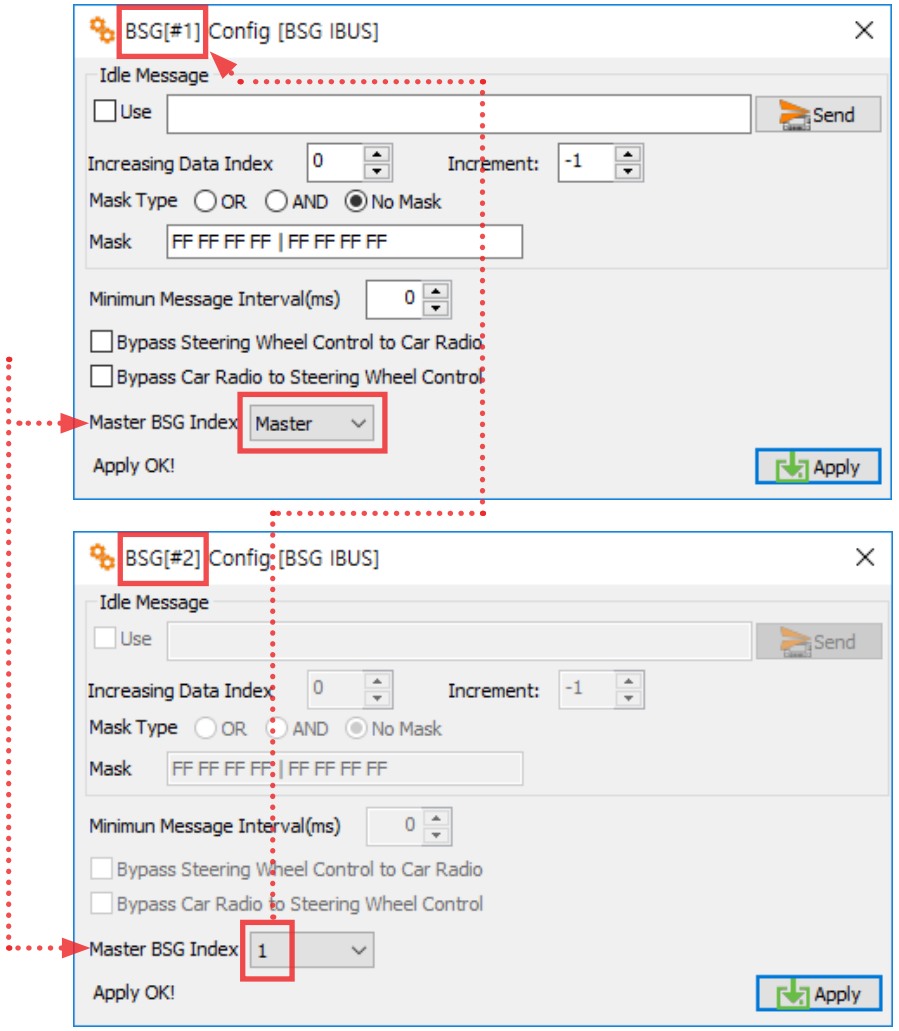
14-4. Extension of BSG Index

One BSG IBUS has 12 buttons.
If you need more than 12 buttons' IBUS output for car radio(or original equipment) though BSGd, you can use another BSG index as slave BSG IBUS.
The IBUS messages of the slave BSG IBUS are outputed through BSGd on the CPJexc.

If this BSG module is the master BSG module, choose "Master".
If this BSG module is the extension of the other BSG, choose the master BSG index of this BSG module at **Master BSG Index**.

For example,
If **Mater BSG Index** is 1, this BSG index works as a part of the BSG index 1.

Even though both BSG index 1 and 2 are all Master, IBUS message is sent normally.
The reason of putting **Mater BSG Index** is to share the Idle Message of Master BSG index.

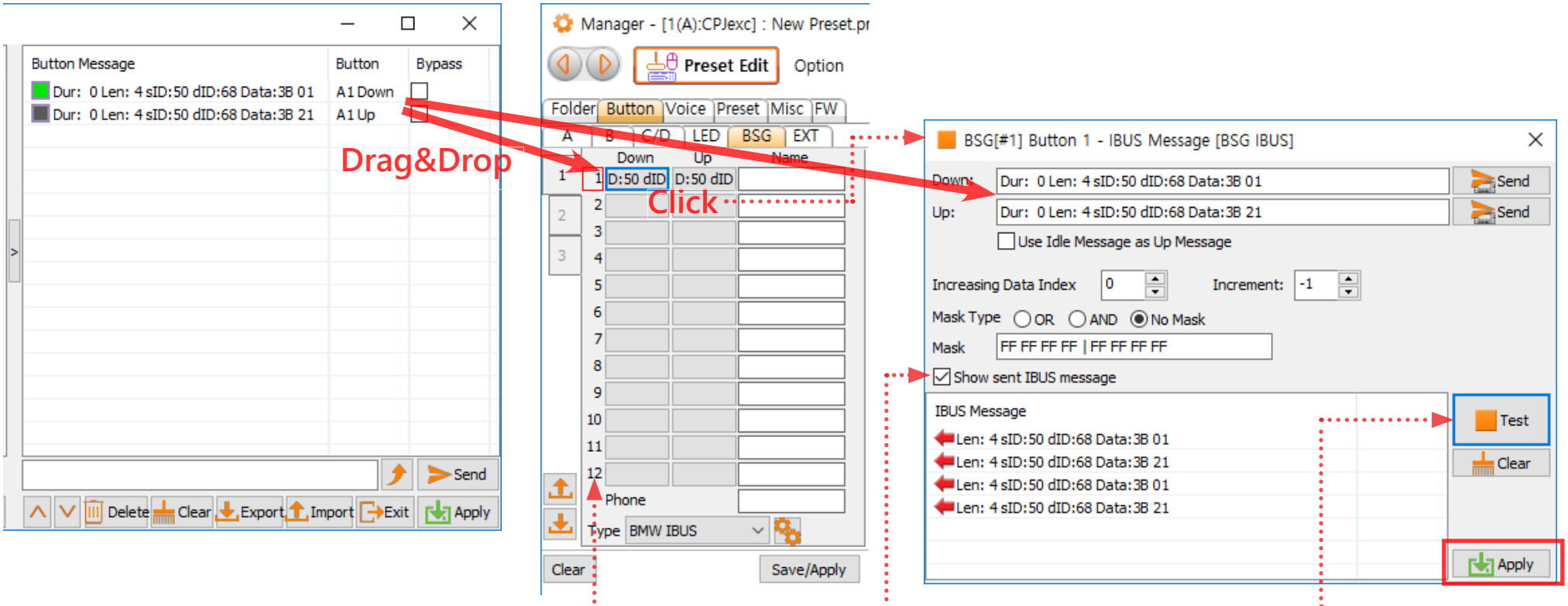


14-5. BSG Button Configuration

14-5-1. BSG Button Message Configuration

BSG button is composed Up Button message and Down Button Message.
Up Button Message is sent through the BSGd when the steering wheel button is pressed.
Down Button Message is sent through the BSGd when the steering wheel button is released.
Name of BSG button is spoken when the Button is pressed.

Click the BSG Button, then Button Property pops up.
Type IBUS message format string in Button Property or Drag&Drop or Copy&Paste IBUS message from **CPJexc IBUS Scanner** to Button Property.

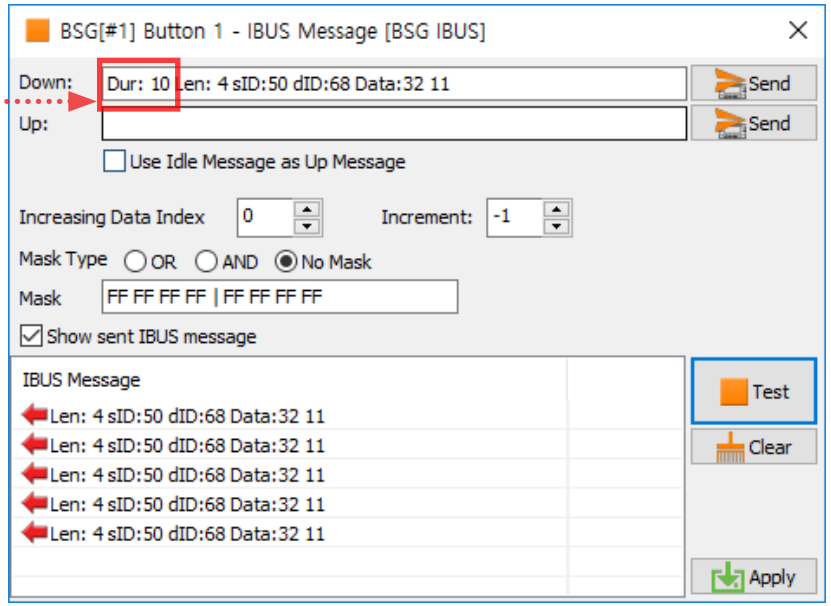


Test the configured BSG button with "Test" Button, or clicking the button number.

If **Show sent IBUS message** is checked, the IBUS message sent on the IBUS are listed at the listbox.

14-5-2. Repeated Button

Some button repeats IBUS message while the button is being pressed.
"Dur:" is the interval of the repeated IBUS message. (Unit is 10ms.)
The Down Button Message is sent repeatedly while the button is being pressed.



Example:
BMW Volume+/- buttons repeat IBUS message every 100ms(**"Dur:10")** while the volume button is being pressed.

Down Button Message is
Dur: 10 Len: 4 sID:50 dID:68 Data:32 11

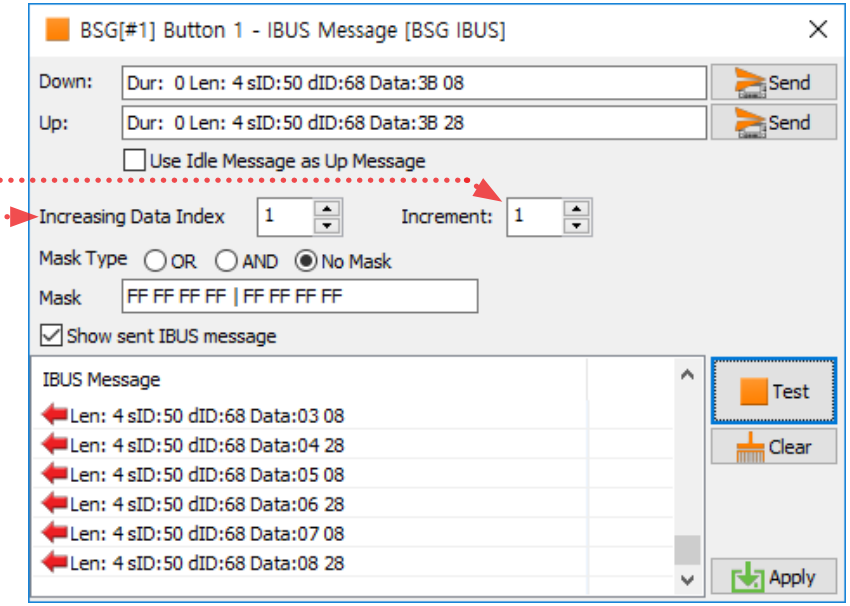
While the button is being pressed, the messages are sent to the radio though BSGd every 100ms like below.

Len: 4 sID:50 dID:68 Data:32 11
Len: 4 sID:50 dID:68 Data:32 11
Len: 4 sID:50 dID:68 Data:32 11
Len: 4 sID:50 dID:68 Data:32 11
Len: 4 sID:50 dID:68 Data:32 11
....

14-5-3. Increasing Data of Button Message

In some vehicle, a data of the Button Message needs to be increased every time it is sent.
The Button Message data indicated by **Increasing Data Index** is increased by **Increment** every time the Button Message is sent.

Increment can be -128 ~ 127.
If Increasing Data is not used, set 0 at **Increasing Data Index** .



Example:
Down Message is
Dur: 0 Len: 4 sID:50 dID:68 Data:3B 08
Up Message is
Dur: 0 Len: 4 sID:50 dID:68 Data:3B 28
Increasing Data Index is 1
Increment is 1

When the button is pressed and released, the messages are sent to the radio though BSGd like below.

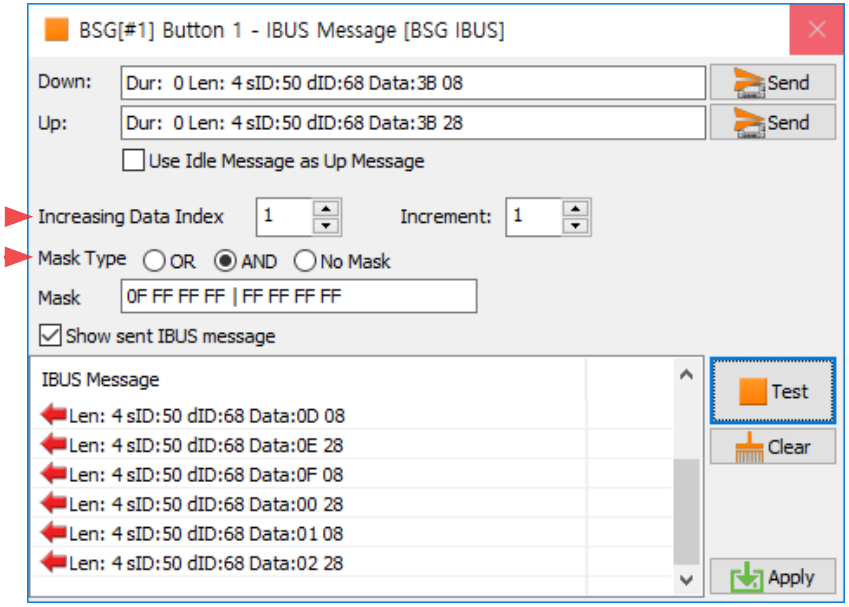
Len: 4 sID:50 dID:68 Data:03 08
Len: 4 sID:50 dID:68 Data:04 28
Len: 4 sID:50 dID:68 Data:05 08
Len: 4 sID:50 dID:68 Data:06 28
Len: 4 sID:50 dID:68 Data:07 08
Len: 4 sID:50 dID:68 Data:08 28
....

14-5-4. Mask of Button Message

In some vehicle, Increasing Data need to be limited for some car equitment.

To send the Increasing Data 0~0Fh, the higher bit need to be ANDed with 0x0F.
To send the Increasing Data F0h~FFh, the higher bit need to be ORed with 0xF0.

Example:
Down Button Message is
Dur: 0 Len: 4 sID:50 dID:68 Data:3B 08
Up Button Message is
Dur: 0 Len: 4 sID:50 dID:68 Data:3B 28
Increasing Data Index is 1
Increment is 1
Mask Type is "AND"
Mask is "0F FF FF FF | FF FF FF FF "



When the button is pressed and released, the messages are sent to the radio though BSGd like below.

Len: 4 sID:50 dID:68 Data:09 28
Len: 4 sID:50 dID:68 Data:0A 08
Len: 4 sID:50 dID:68 Data:0B 28
Len: 4 sID:50 dID:68 Data:0C 08
Len: 4 sID:50 dID:68 Data:0D 28
Len: 4 sID:50 dID:68 Data:0E 08
Len: 4 sID:50 dID:68 Data:0F 28
Len: 4 sID:50 dID:68 Data:00 08
Len: 4 sID:50 dID:68 Data:01 28
Len: 4 sID:50 dID:68 Data:02 08
Len: 4 sID:50 dID:68 Data:03 28
Len: 4 sID:50 dID:68 Data:04 08
....

14-5-5. Using Idle Message as Up Message

14-5-5-1. Common Up Button Message

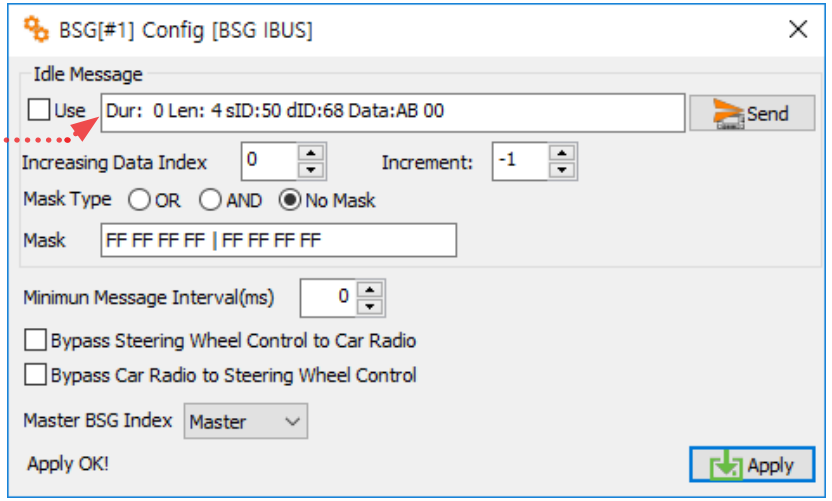
Some steering wheel control button use common Up Button Message.
You can use this option for the buttons to have common Up Button Message.

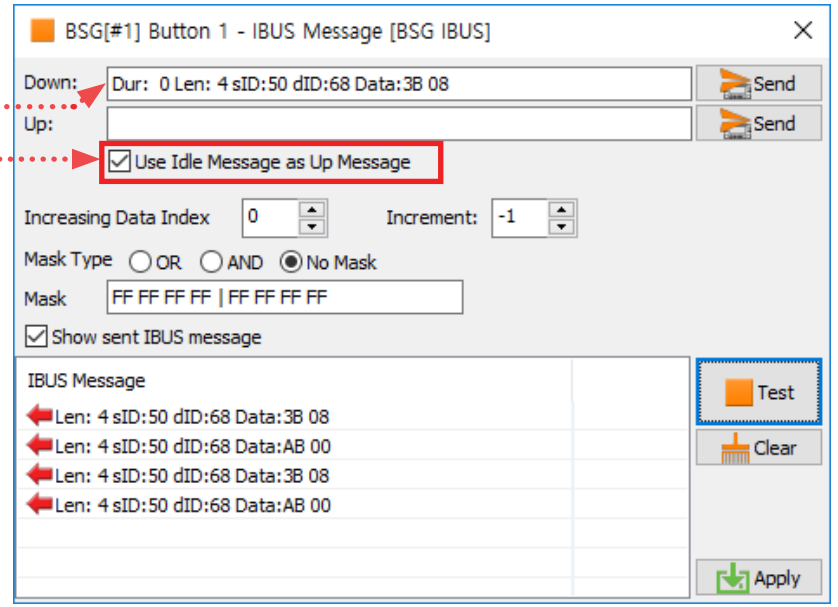
Example:
Idle Message is
Dur:0 Len: 4 sID:01 dID:50 Data:AB 00
Down Button Message is
Dur: 0 Len: 4 sID:50 dID:68 Data:3B 08

Check on **Use Idle Message as Up Message**

When the button is pressed and released, the messages are sent to the radio though BSGd like below.

Len: 4 sID:50 dID:68 Data:0B 08
Len: 4 sID:50 dID:68 Data:AB 00
Len: 4 sID:50 dID:68 Data:0B 08
Len: 4 sID:50 dID:68 Data:AB 00
....





14-5-5-2. Common Increasing Data

Some steering wheel control button needs common increasing data both at Down Button Message and Up Button Message.

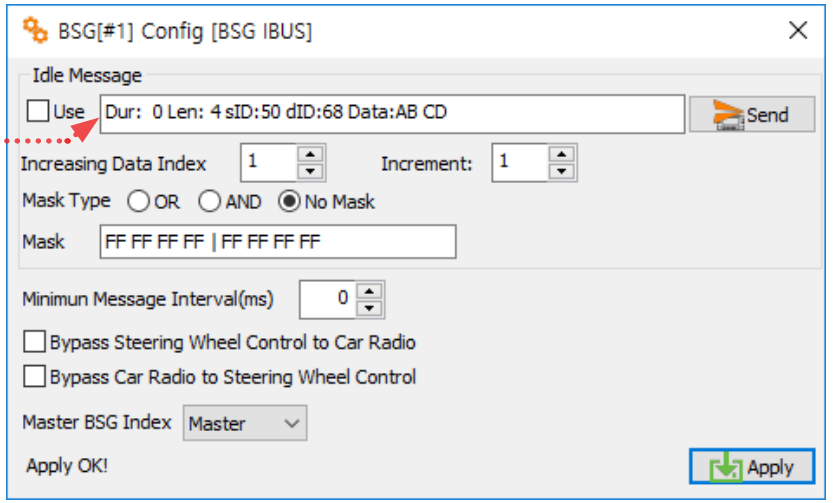
This option is used to give common increasing data both for Down and Up Button Messages.

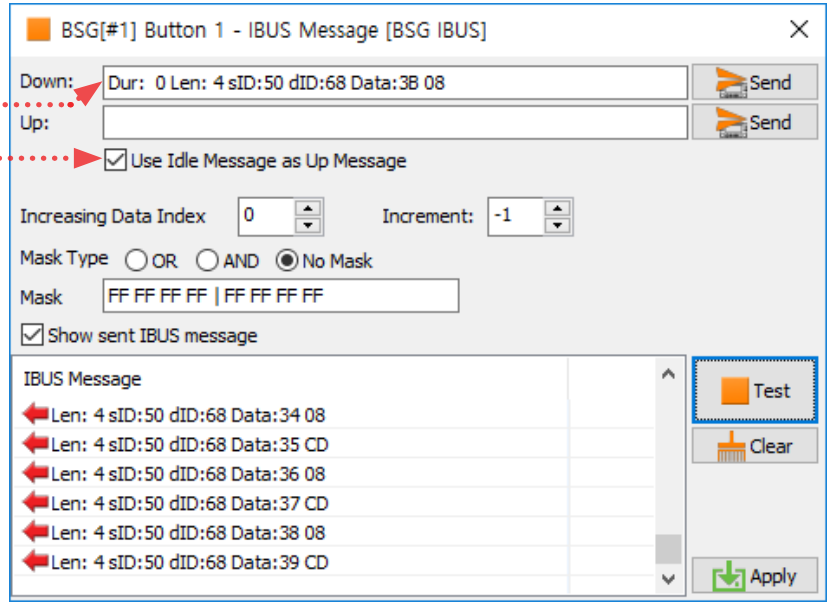
Example:
Idle Message is
Dur: 0 Len: 4 sID:50 dID:68 Data:AB CD
Down Button Message is
Dur: 0 Len: 4 sID:50 dID:68 Data:3B 08

Check on **Use Idle Message as Up Message**

When the button is pressed and released, the messages are sent to the radio though BSGd like below.

Len: 4 sID:50 dID:68 Data:33 08
Len: 4 sID:50 dID:68 Data:34 CD
Len: 4 sID:50 dID:68 Data:35 08
Len: 4 sID:50 dID:68 Data:36 CD
Len: 4 sID:50 dID:68 Data:37 08
Len: 4 sID:50 dID:68 Data:38 CD
....

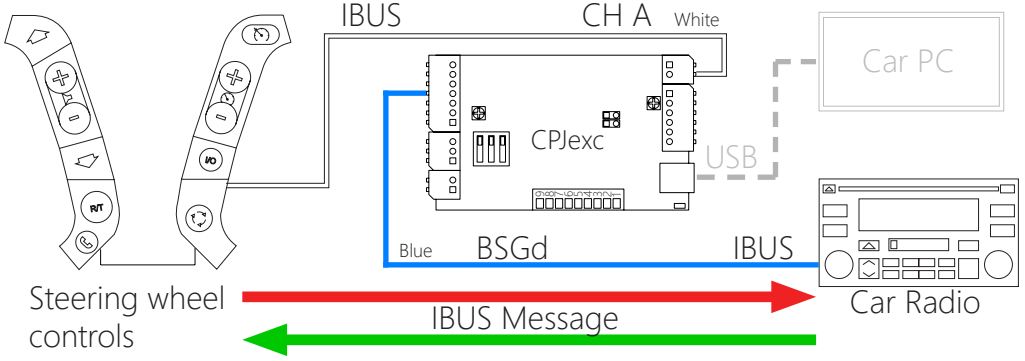


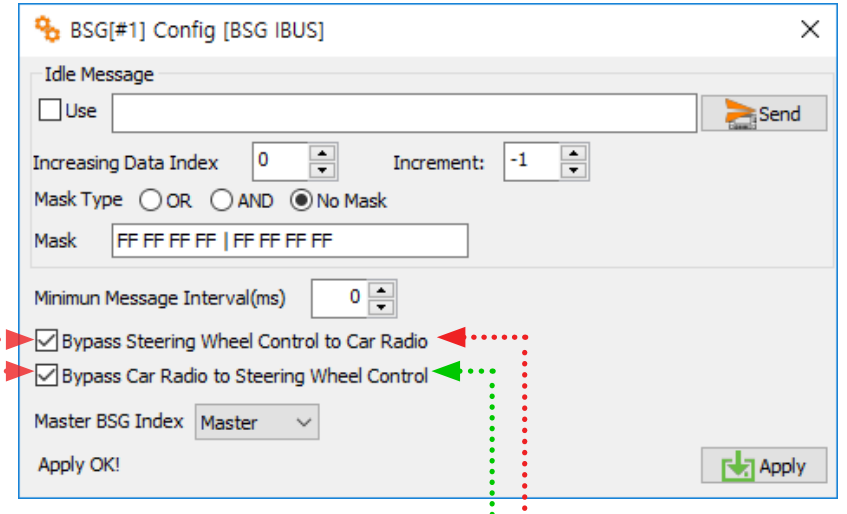


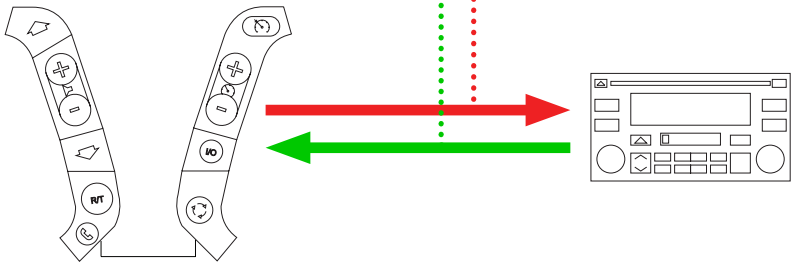
14-6. Bypass of IBUS Message

If not all of the steering wheel control buttons are used for the car PC, you may want some button still work for the car radio.

Because CPJexc is wired between the steering wheel control and the car radio, CPJexc need to bypass the messages which are used for original equipment(car radio).

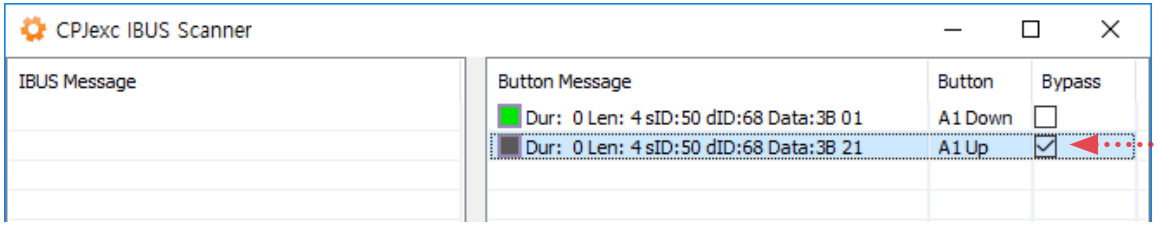






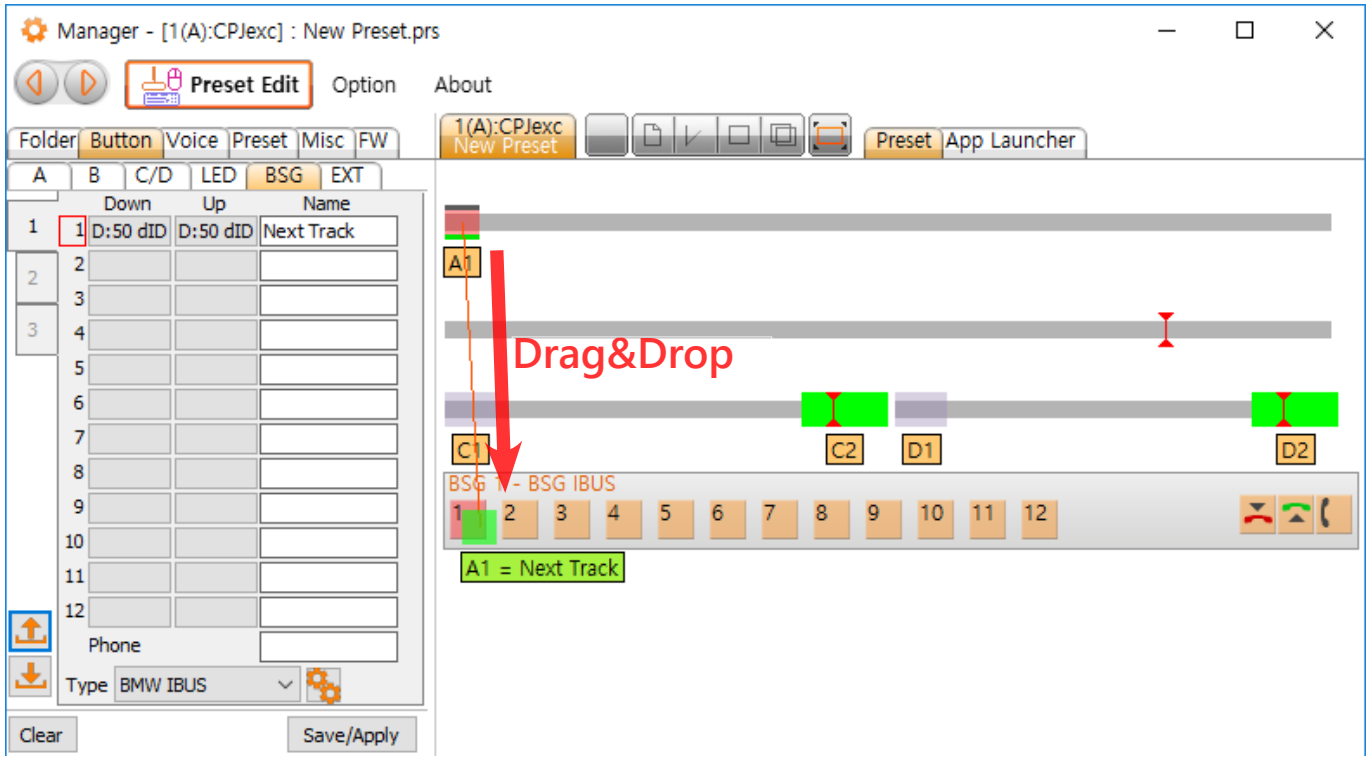
If **Bypass Steering Wheel Controls to Head Unit** is checked, CPJexc by-passes all the messages originate from the steering wheel controls except the messages used as a button message.
If you want to bypass the button message from steering wheel control to the car radio, check **Bypass** at the button message list in IBUS Scanner.
Usually the Up Button Message need to bypass to the car radio.

If **Bypass Head Unit to Steering Wheel Controls** is checked, CPJexc by-passes all the messages originate from the head unit.



14-7. Connecting Steering wheel button to BSG button

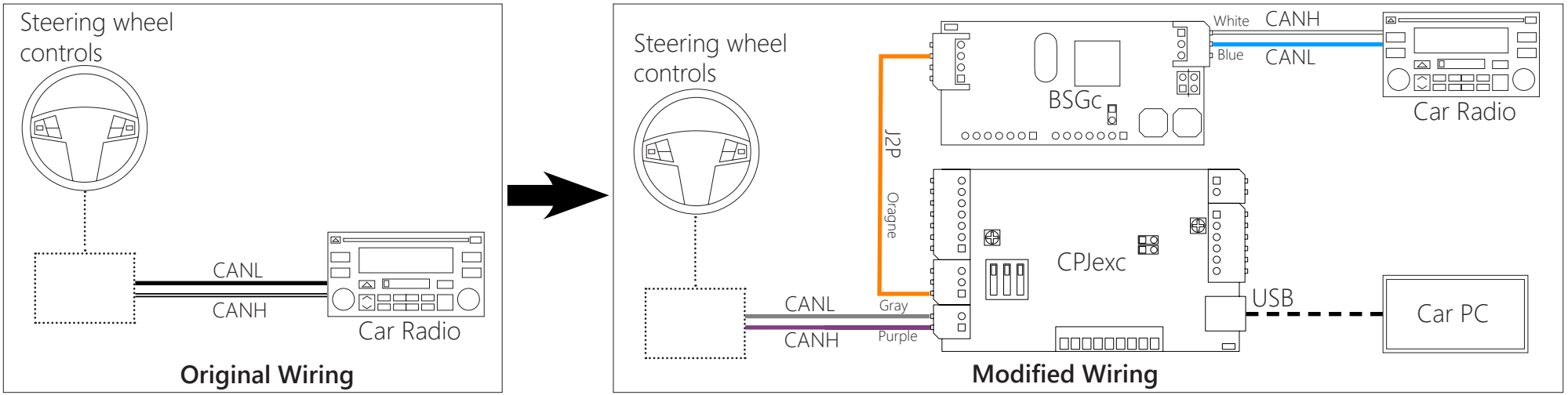
Drag&Drop a button to the BSG buttons to use steering wheel buttons for BSG Buttons. Then the BSG button works by the steering wheel control button.
This is same with connecting the steering wheel buttons to USB keyboard or HID remote controller.



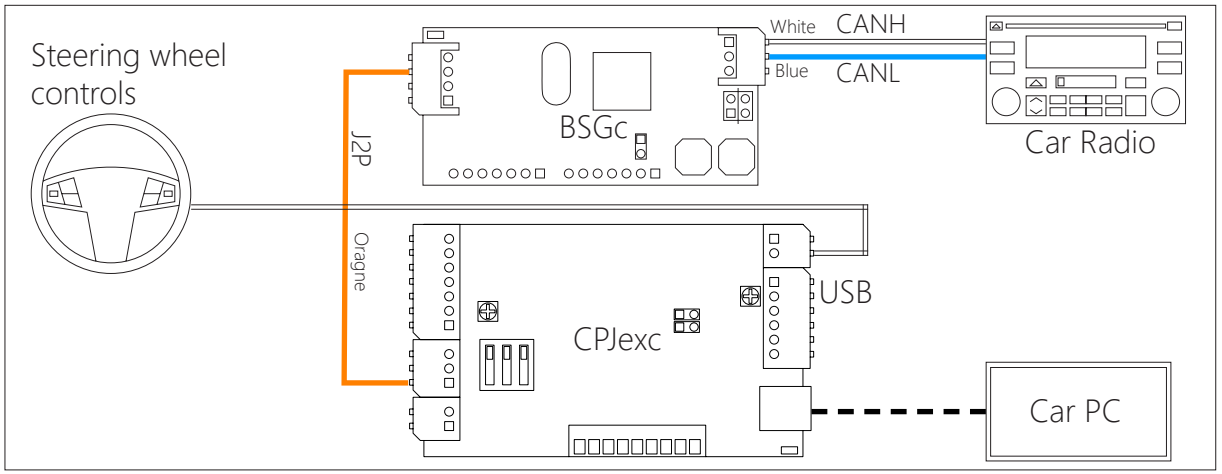
15. BSG (Button Signal Generator) for CAN BUS

BSGc(Button Signal Generator CAN) is an external devices connected through J2P BUS wire (J2P BUS is a signal wire that connects CPJexc and its peripherals.)
You can control both car PC and car radio with steering wheel controls using BSGc.

15-1. Wiring of BSGc



Even though the steering wheel control button is not CAN BUS, CPJexc can generate CAN signal to control the CAN BUS radio with BSGc.

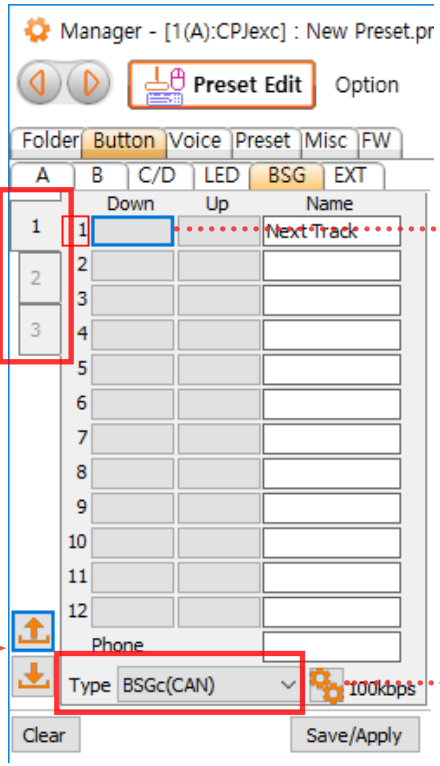


CPJexc firmware newer than 160228 does not supports old BSGc.
New BSGc supports online firmware update.
This user guide is described based on new BSGc.
If you have old BSGc, contact www.exInterface.com to exchange it with a new one.

15-2. Manager Setting

Choose the **BSG index**.
Choose BSGc at **Type.**
Set baudrate.

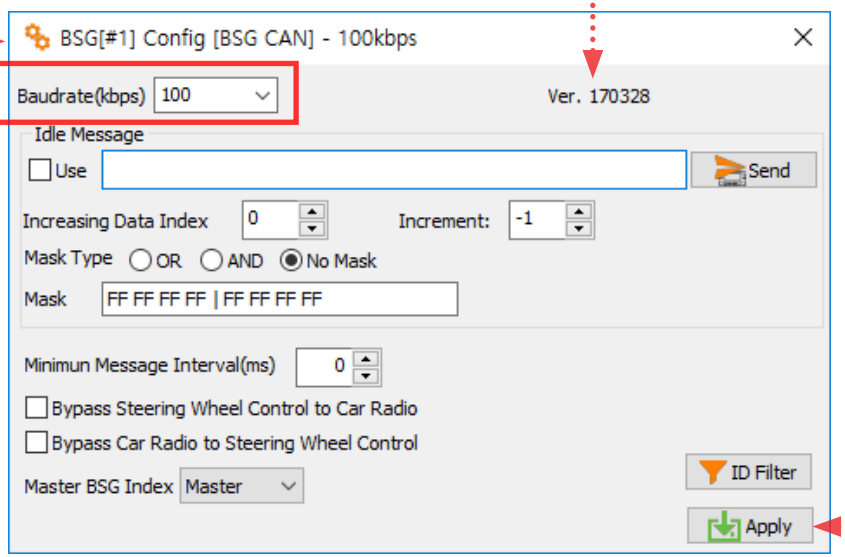
BSG Index

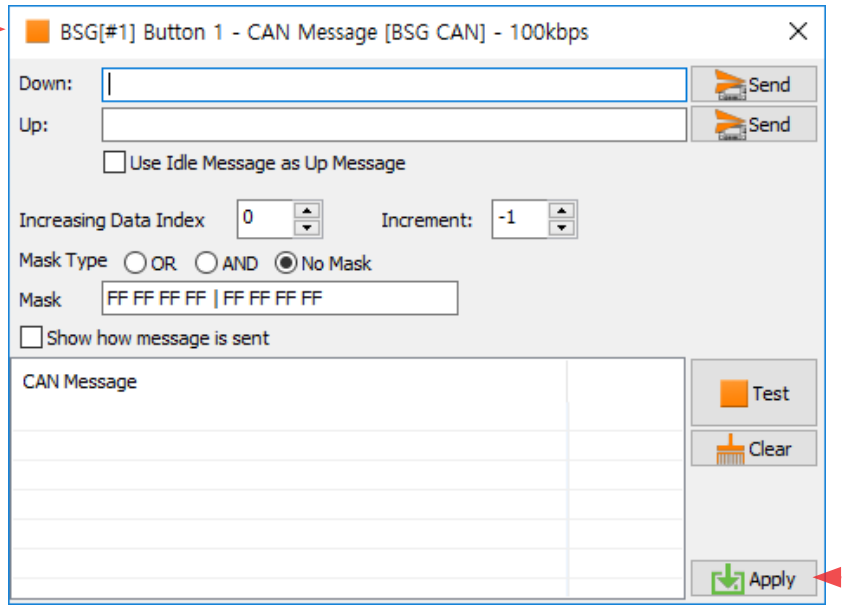


Export or import the BSG settings as a file(.bsg).

Hard to type CAN format string?
Type any character and click Apply, then CAN format string appears at the edit box.

If BSGc is connected properly, the version appears.
If "No J2P Device at #n" appears, check J2P wiring or BSGc is powered.
This is supported from the new BSGc that supports firmware update.





Click Apply, to apply the changed configuration to CPJexc.

15-3. Idle Message

Idle Message is needed for some car equipement(car radio) to be activated.
Idle message is sent on CAN BUS periodically by Duration("Dur:").

15-3-1. Using Idle Message

Check on box "**Use"**, and put an CAN message in the edit box(Drag&Drop or Copy&Paste).
"**Dur:**" is the interval of Idle Message.
"Dur:1" is 10ms. "Dur:100" is 1000ms, 1sec.

For example,
if the idle message is
Dur:100 Len: 2 ID:0500 Data:12 34
the message is sent every 1 second to the Radio though BSGc.

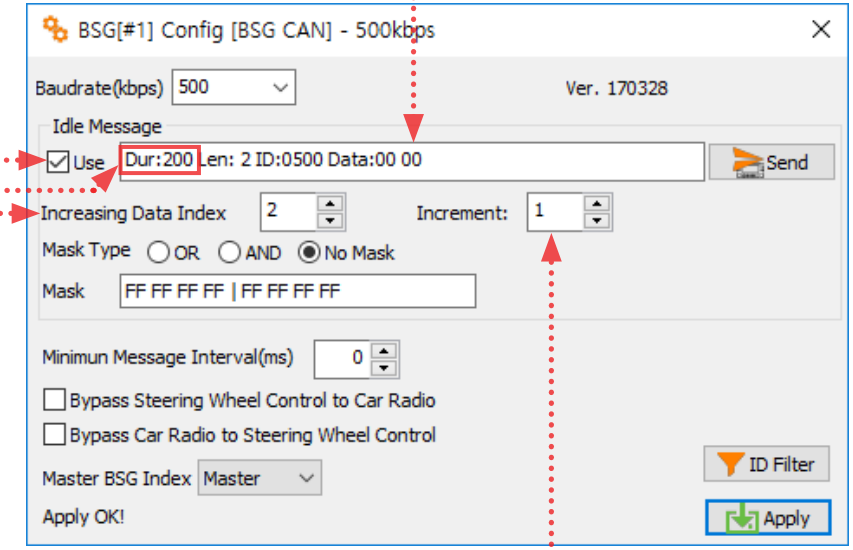
15-3-2. Increasing Data of Idle Message

Increasing Data is needed for some car equipment.
The Idle Message data indicated by **Increasing Data Index** is increased by **Increment** every time the Idle Message is sent.

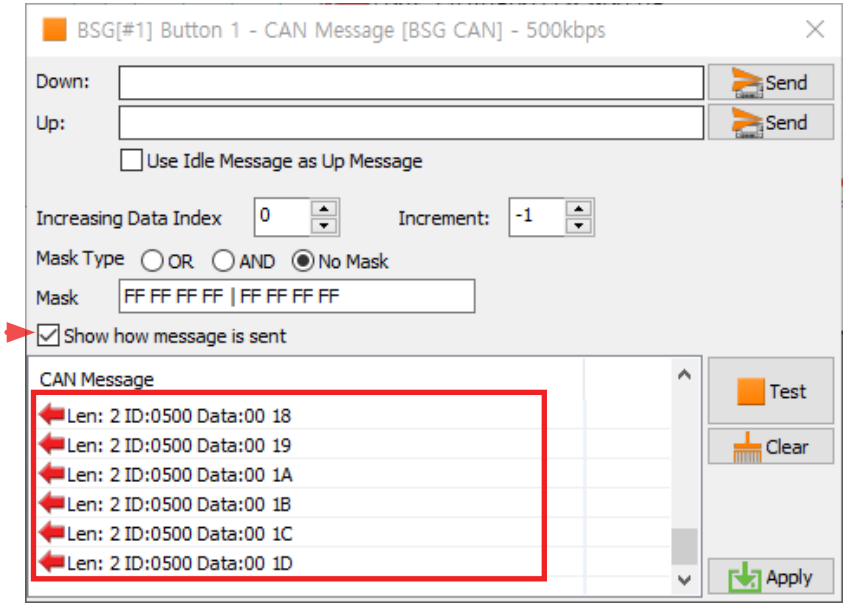
Increment can be -128 ~ 127.
If Increasing Data is not used, set 0 at **Increasing Data Index**.

Example:
Idle message is
Dur:200 Len: 2 ID:0500 Data:00 00
Increasing Data Index is 2
Increment is 1.
The data is sent like below every 1 second to car radio though BSGc.

S Len: 2 ID:0500 Data:00 18
S Len: 2 ID:0500 Data:00 19
S Len: 2 ID:0500 Data:00 1A
S Len: 2 ID:0500 Data:00 1B
S Len: 2 ID:0500 Data:00 1C
....



You can see the sent Idle Message at Button Property with checking **Show how message is sent**.



15-3-3. Mask of Idle Message

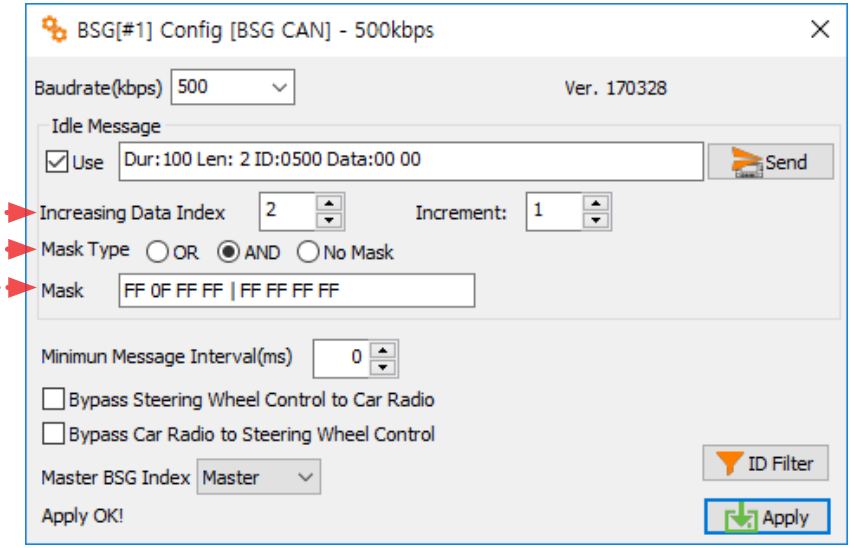
Increasing Data need to be limited for some car radio(or equipment).

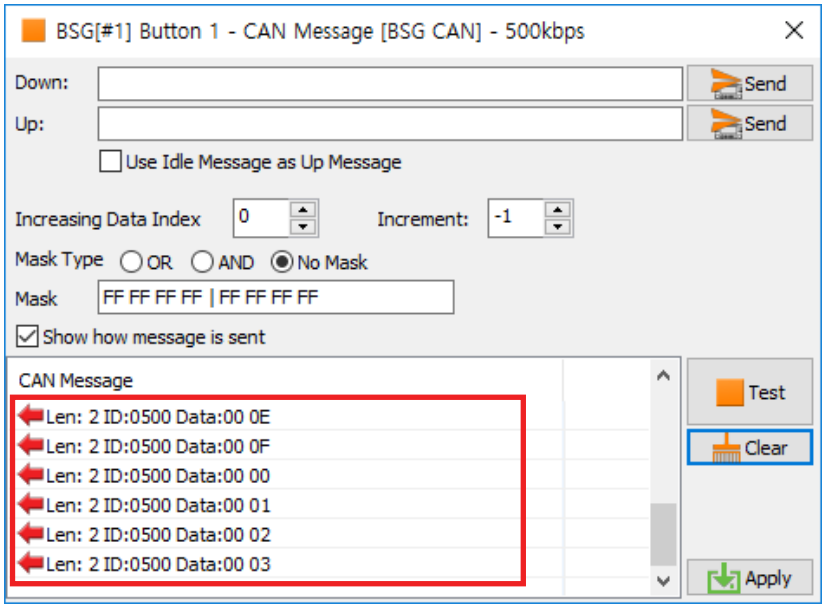
To send the Increasing Data 0~0Fh, the higher bit need to be ANDed with 0x0F.
To send the Increasing Data F0h~FFh, the higher bit need to be ORed with 0xF0.

Example:
Idle Message is
Dur:100 Len: 4 sID:01 dID:50 Data:AB CD
Increasing Data Index is 2
Increment is 1
Mask Type is "AND"
Mask is "FF 0F FF FF | FF FF FF FF"

The messages are sent every 1 second to the Radio though BSGc like below.

Len: 2 ID:0500 Data:00 07
Len: 2 ID:0500 Data:00 08
Len: 2 ID:0500 Data:00 09
Len: 2 ID:0500 Data:00 0A
Len: 2 ID:0500 Data:00 0B
Len: 2 ID:0500 Data:00 0C
Len: 2 ID:0500 Data:00 0D
Len: 2 ID:0500 Data:00 0E
Len: 2 ID:0500 Data:00 0F
Len: 2 ID:0500 Data:00 00
Len: 2 ID:0500 Data:00 01
Len: 2 ID:0500 Data:00 02
Len: 2 ID:0500 Data:00 03
Len: 2 ID:0500 Data:00 04
....





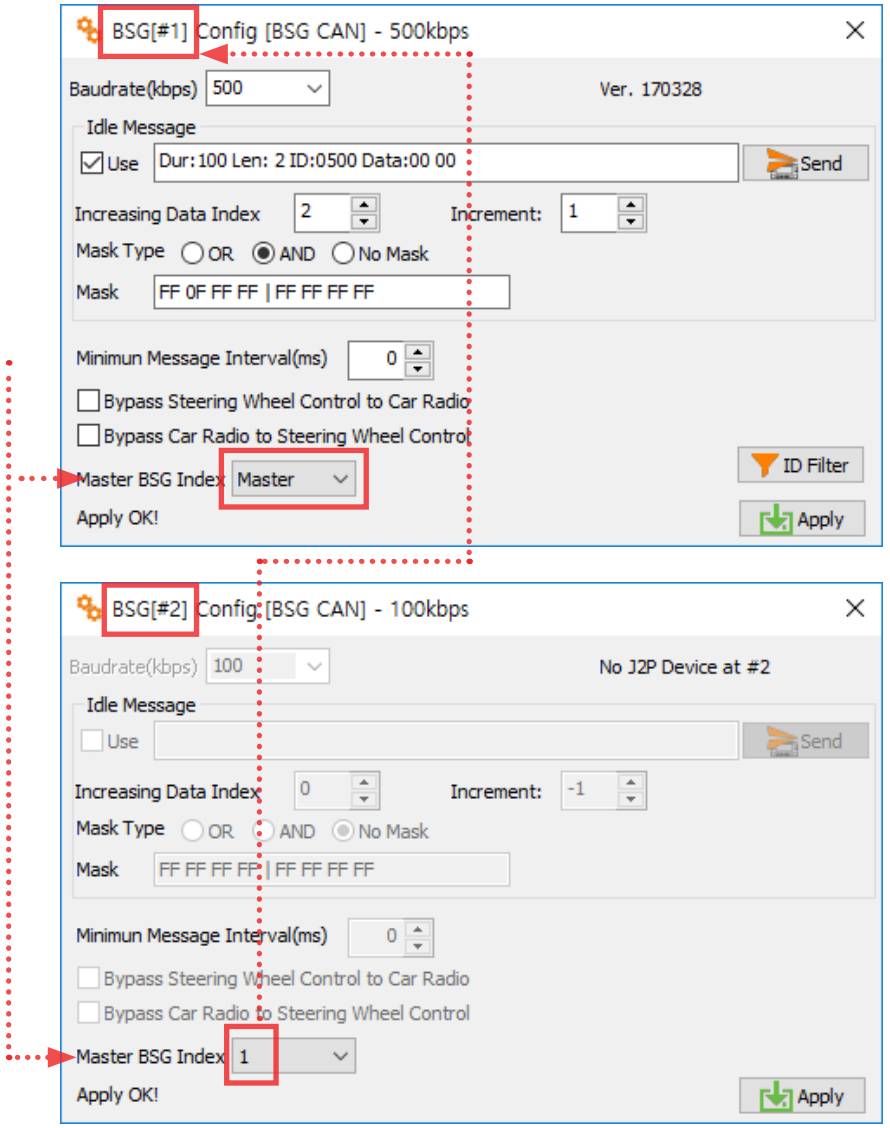
15-4. Extension of BSG Index

One BSGc has 12 buttons.
If you need more than 12 buttons' CAN output for the radio or original equipment though BSGc device, you can use another BSG index as slave BSGc.
The CAN messages of the slave BSGc are outputed through one Master BSGc device.

If this BSG module is the master BSG module, choose "Master".
If this BSG module is the extension of the other BSG. choose the master BSG index of this BSG module at **Master BSG Index**.

For example,
If **Mater BSG Index** is 1, this BSG index works as a part of the BSG index 1.

The Slave BSG shares the Idle Message of Master BSG.



15-5. ID Filter of BSGc

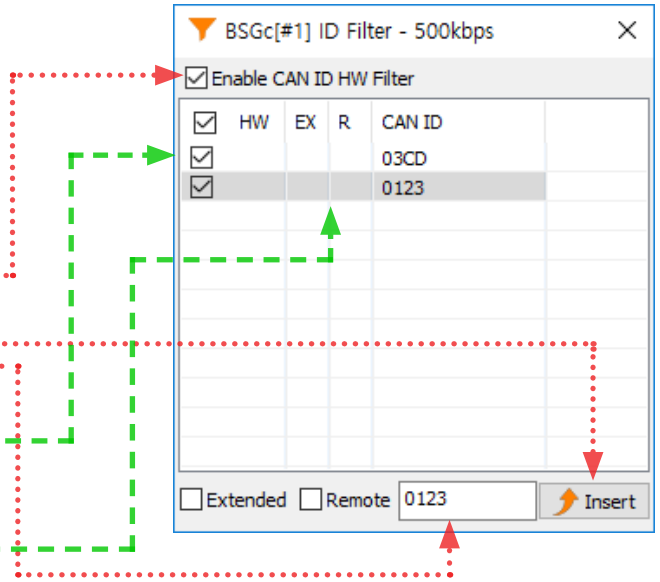
One BSG receives CAN messages from the original equipment(car radio). If two many CAN messages are received, the message you want may be omitted to be processed.

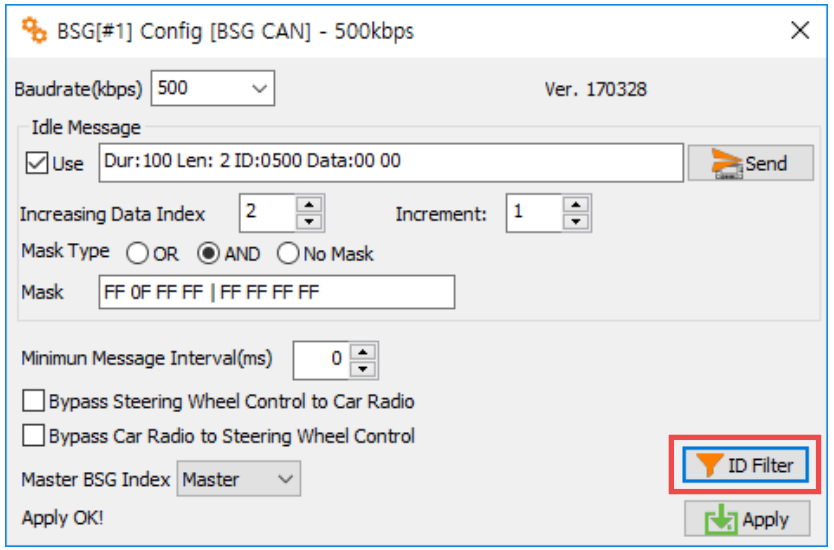
BSGc can filter out the CAN messages with Hardware CAN ID Filter, so that BSGc can process the CAN message you want or bypass them to the steering wheel controls .

To use BSGc HW ID Filter, check on **Enable CAN ID HW Filter**.
Put the CAN ID in the edit box and click Insert.

Check on box **HW** of the CAN ID to activate HW Filter.

If a CAN ID is Extended ID or remote frame check on EX or R.



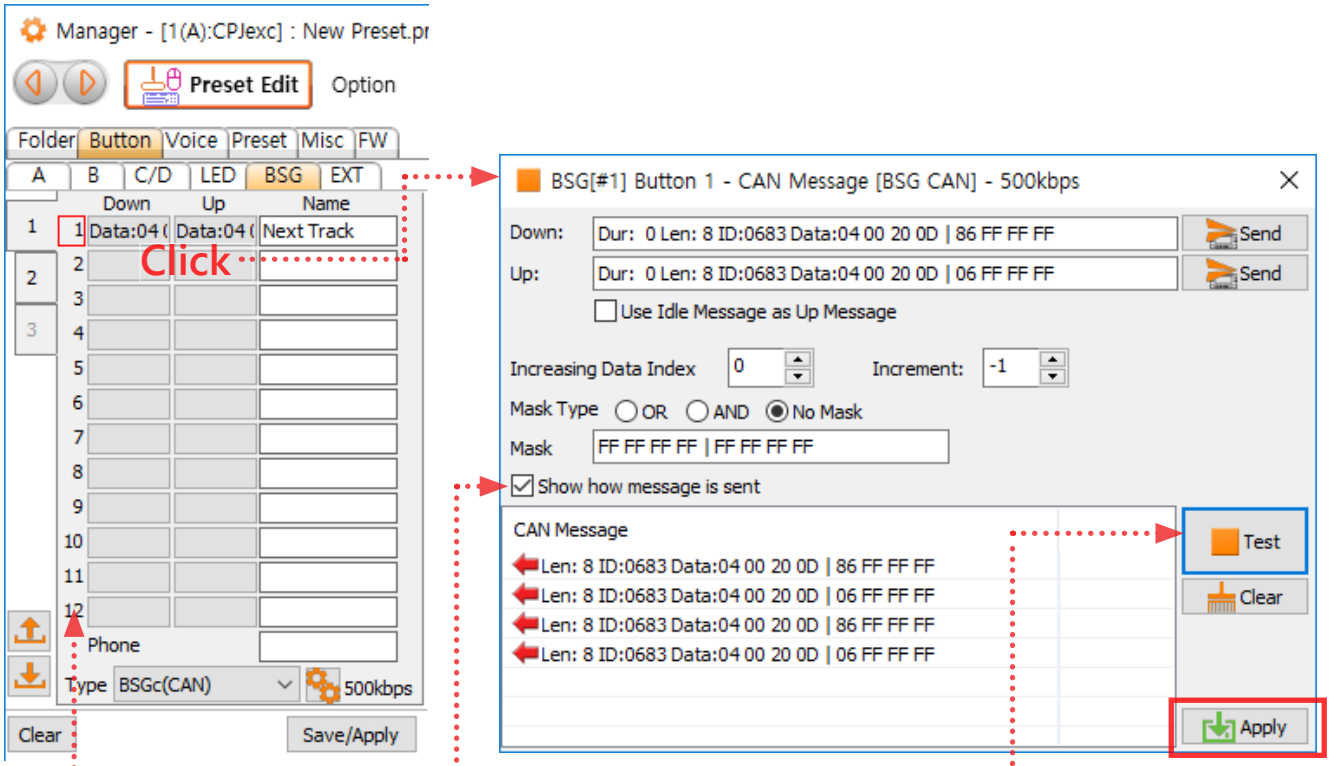


15-6. BSG Button Configuration

15-6-1. BSG Button Message Configuration

BSG button is composed of Up Button message and Down Button Message.
Up Button Message is sent through the BSGc when the steering wheel button is pressed.
Down Button Message is sent through the BSGc when the steering wheel button is released.
Name of BSG button is spoken when the Button is pressed.

Click the BSG Button, then Button Property pops up.
Type CAN message format string in Button Property or Drag&Drop or Copy&Paste CAN message from **CPJexc CAN Scanner** to Button Property.



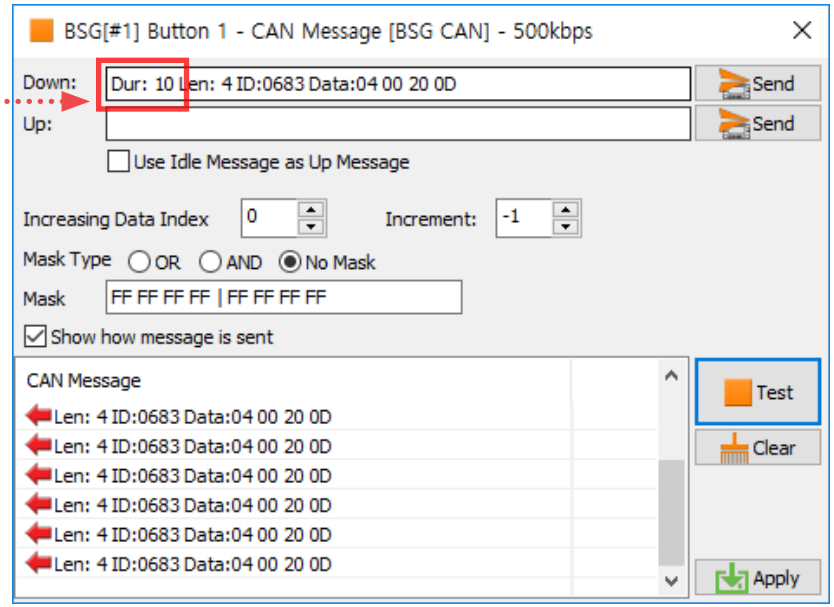
Test the configured BSG button with "Test" Button, or clicking the button number.

If **Show how message sent** is checked on, the CAN message sent through the BSGc are listed at the listbox.

Hard to type CAN format string?
Type any character and click Apply, then CAN format string appears at the edit box.

15-6-2. Repeated Button

Some button repeats CAN message while the button is being pressed.
"Dur:" is the interval of the repeated CAN message. (Unit is 10ms.)
The Down Button Message is sent repeatedly while the button is being pressed.



Example:
Down Button Message is
Dur: 10 Len: 4 ID:0683 Data:04 00 20 0D

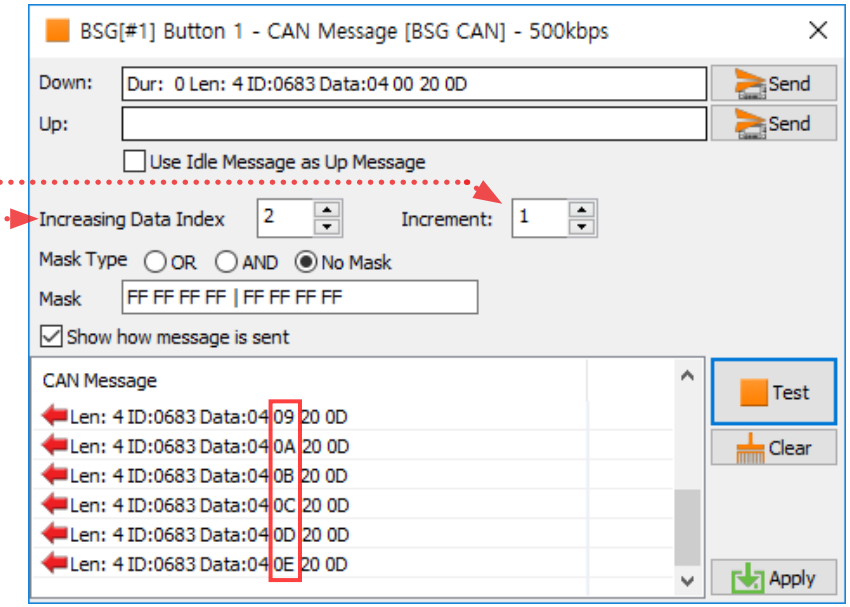
While the button is being pressed, the messages are sent to the radio though BSGc every 100ms like below.

Len: 4 ID:0683 Data:04 00 20 0D
Len: 4 ID:0683 Data:04 00 20 0D
Len: 4 ID:0683 Data:04 00 20 0D
Len: 4 ID:0683 Data:04 00 20 0D
Len: 4 ID:0683 Data:04 00 20 0D
....

15-6-3. Increasing Data of Button Message

In some vehicle, a data of the Button Message needs to be increased every time it is sent.
The Button Message data indicated by **Increasing Data Index** is increased by **Increment** every time the Button Message is sent.

Increment can be -128 ~ 127.
If Increasing Data is not used, set 0 at **Increasing Data Index** .



Example:
Down Message is
Dur: 0 Len: 4 ID:0683 Data:04 00 20 0D
Up Message is
Dur: 0 Len: 4 ID:0683 Data:04 00 20 FF
Increasing Data Index is 2
Increment is 1

When the button is pressed and released, the messages are sent to the radio though BSGc like below.

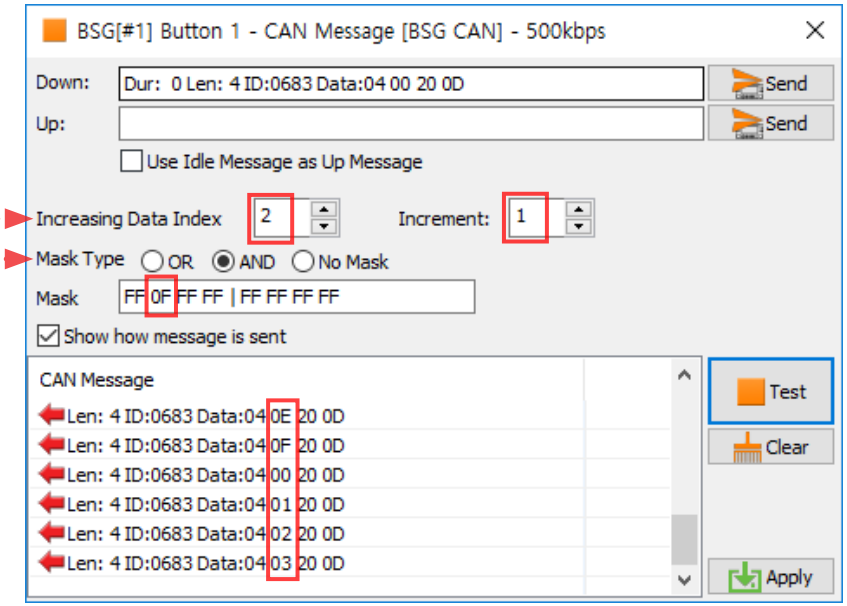
S Len: 4 ID:0683 Data:04 09 20 FF
S Len: 4 ID:0683 Data:04 0A 20 0D
S Len: 4 ID:0683 Data:04 0B 20 FF
S Len: 4 ID:0683 Data:04 0C 20 0D
S Len: 4 ID:0683 Data:04 0D 20 FF
....

15-6-4. Mask of Button Message

In some vehicle, Increasing Data need to be limited for some car equitment.

To send the Increasing Data 0~0Fh, the higher bit need to be ANDed with 0x0F.
To send the Increasing Data F0h~FFh, the higher bit need to be ORed with 0xF0.

Example:
Down Button Message is
Dur: 0 Len: 4 ID:0683 Data:04 00 20 0D
Up Button Message is
Dur: 0 Len: 4 ID:0683 Data:04 00 20 FF
Increasing Data Index is 2
Increment is 1
Mask Type is "AND"
Mask is "FF 0F FF FF | FF FF FF FF "



When the button is pressed and released, the messages are sent to the radio though BSGc like below.

Len: 4 ID:0683 Data:04 0C 20 0D
Len: 4 ID:0683 Data:04 0D 20 FF
Len: 4 ID:0683 Data:04 0E 20 0D
Len: 4 ID:0683 Data:04 0F 20 FF
Len: 4 ID:0683 Data:04 00 20 0D
Len: 4 ID:0683 Data:04 01 20 FF
Len: 4 ID:0683 Data:04 02 20 0D
Len: 4 ID:0683 Data:04 03 20 FF
Len: 4 ID:0683 Data:04 04 20 0D
Len: 4 ID:0683 Data:04 05 20 FF
Len: 4 ID:0683 Data:04 06 20 0D
Len: 4 ID:0683 Data:04 07 20 FF
....

15-6-5. Use Idle Message as Up Message

15-6-5-1. Common Up Button Message

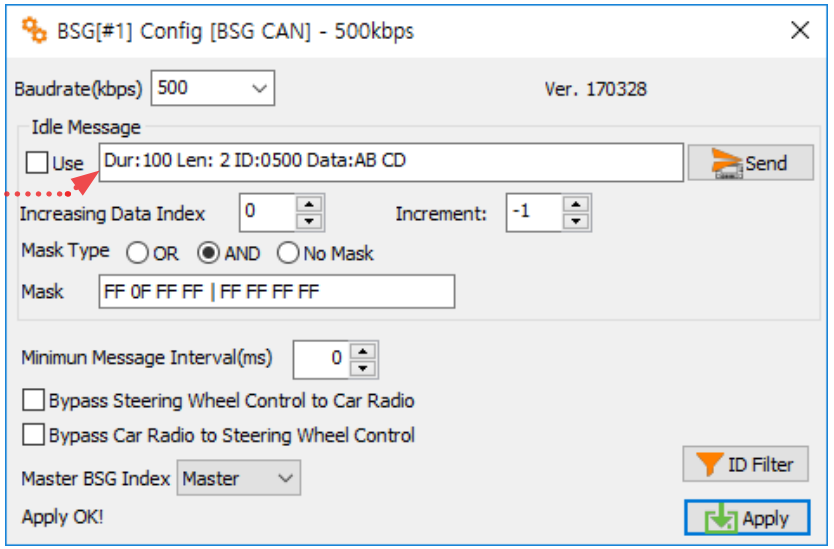
Some steering wheel control button use common Up Button Message.
You can use this option for the buttons to have common Up Button Message.

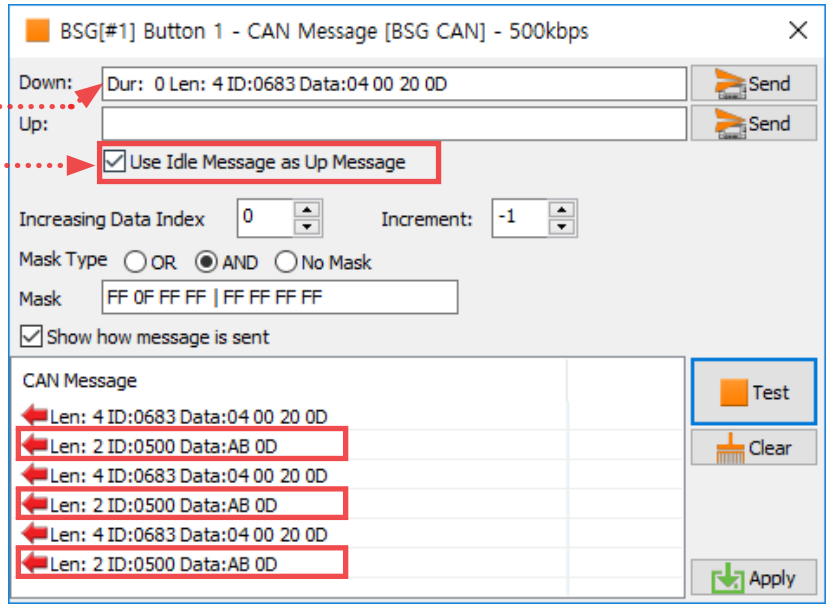
Example:
Idle Message is
Dur: 0 Len: 2 ID:0500 Data:AB CD
Down Button Message is
Dur: 0 Len: 4 ID:0683 Data:04 00 20 0D

Check on **Use Idle Message as Up Message**

When the button is pressed and released, the messages are sent to the radio though BSGc like below.

Len: 4 ID:0683 Data:04 00 20 0D
Len: 2 ID:0500 Data:AB CD
Len: 4 ID:0683 Data:04 00 20 0D
Len: 2 ID:0500 Data:AB CD
....





15-6-5-2. Common Increasing Data

Some steering wheel control button needs common increasing data both at Down Button Message and Up Button Message.

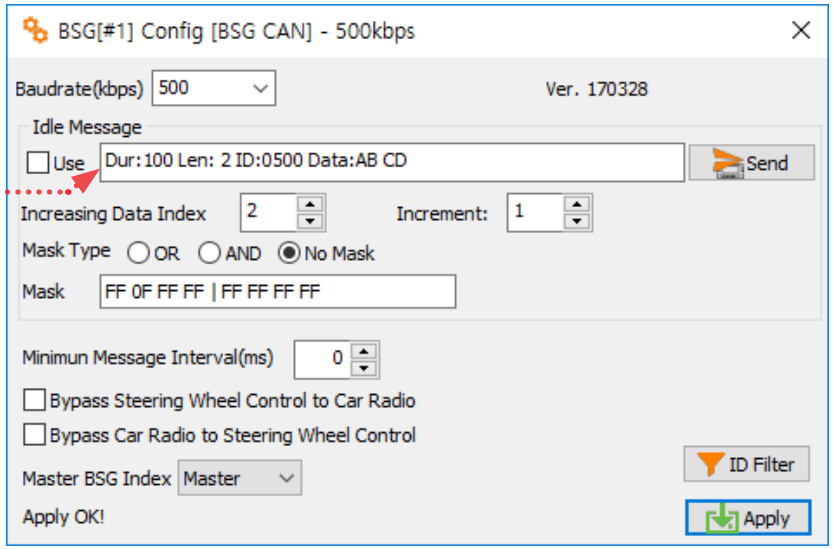
This option is used to give common increasing data both for Down and Up Button Messages.

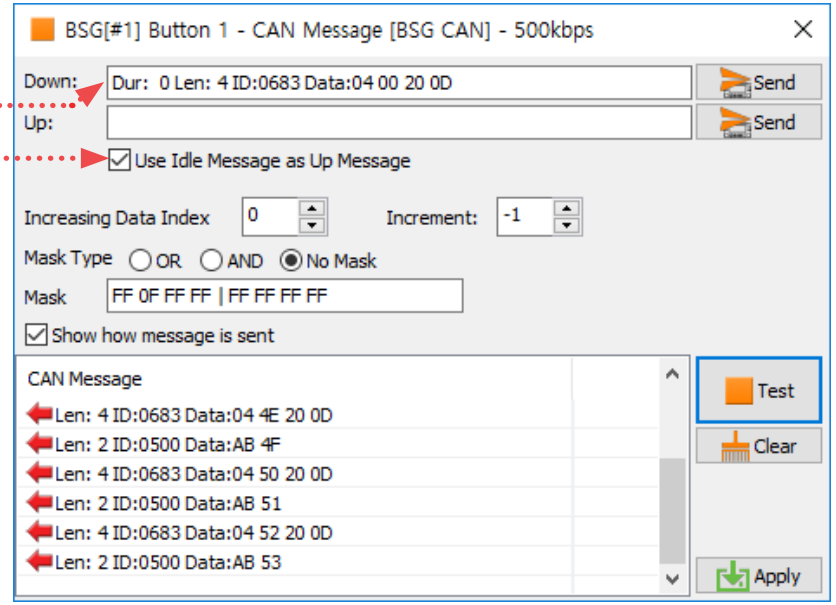
Example:
Idle Message is
Dur: 0 Len: 2 ID:0500 Data:AB CD
Down Button Message is
Dur: 0 Len: 4 ID:0683 Data:04 00 20 0D

Check on **Use Idle Message as Up Message**

When the button is pressed and released, the messages are sent to the radio though BSGc like below.

Len: 4 ID:0683 Data:04 4E 20 0D
Len: 2 ID:0500 Data:AB 4F
Len: 4 ID:0683 Data:04 50 20 0D
Len: 2 ID:0500 Data:AB 51
Len: 4 ID:0683 Data:04 52 20 0D
Len: 2 ID:0500 Data:AB 53
....

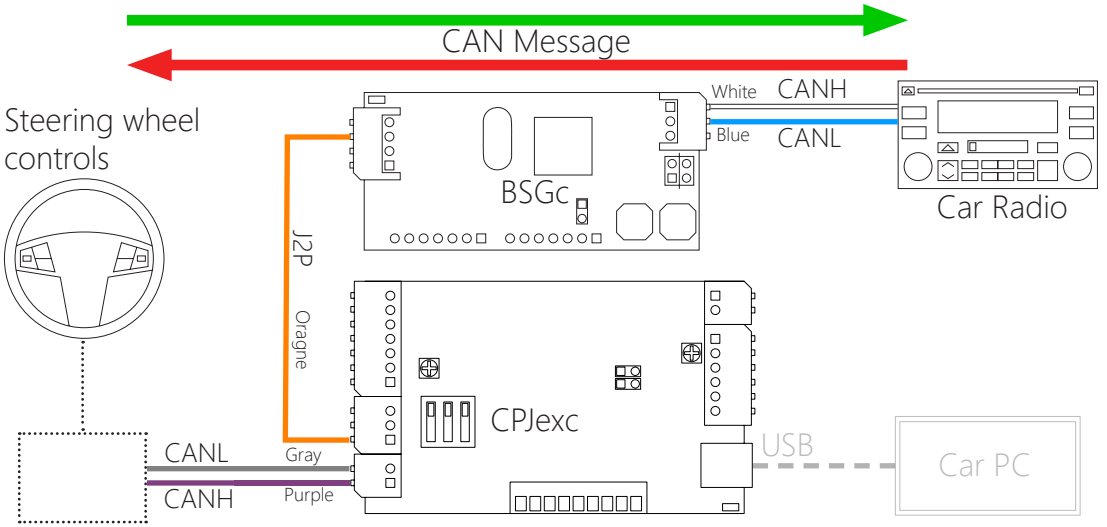


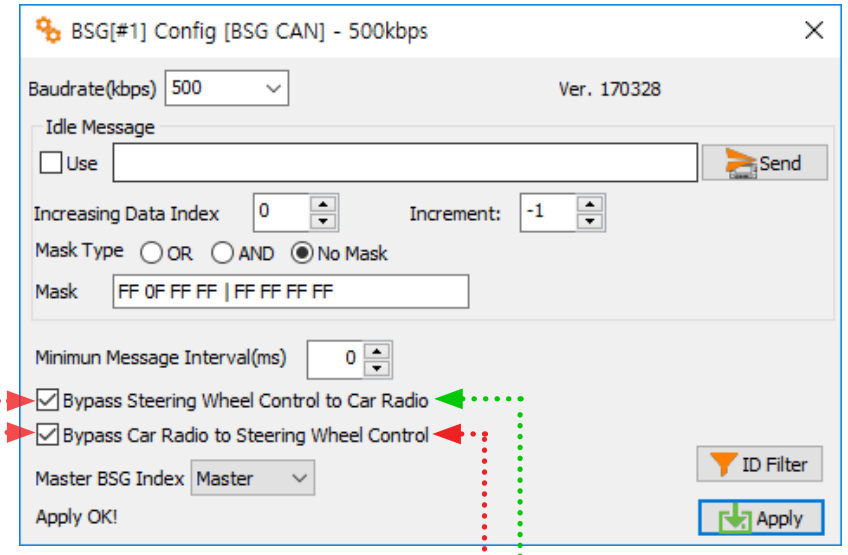


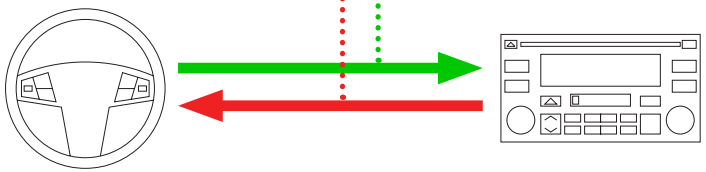
15-7. Bypass of CAN Message

If not all of the steering wheel control buttons are used for the car PC, you may want some button still work for the car radio.

Because CPJexc is wired between the steering wheel control and the car radio, CPJexc need to bypass the messages which are used for original equipment(car radio).

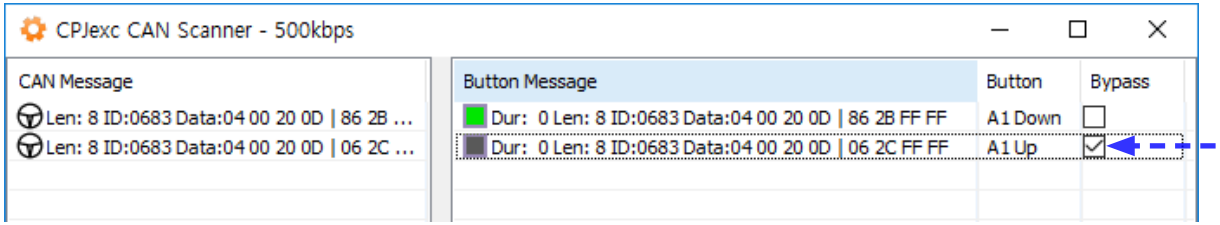


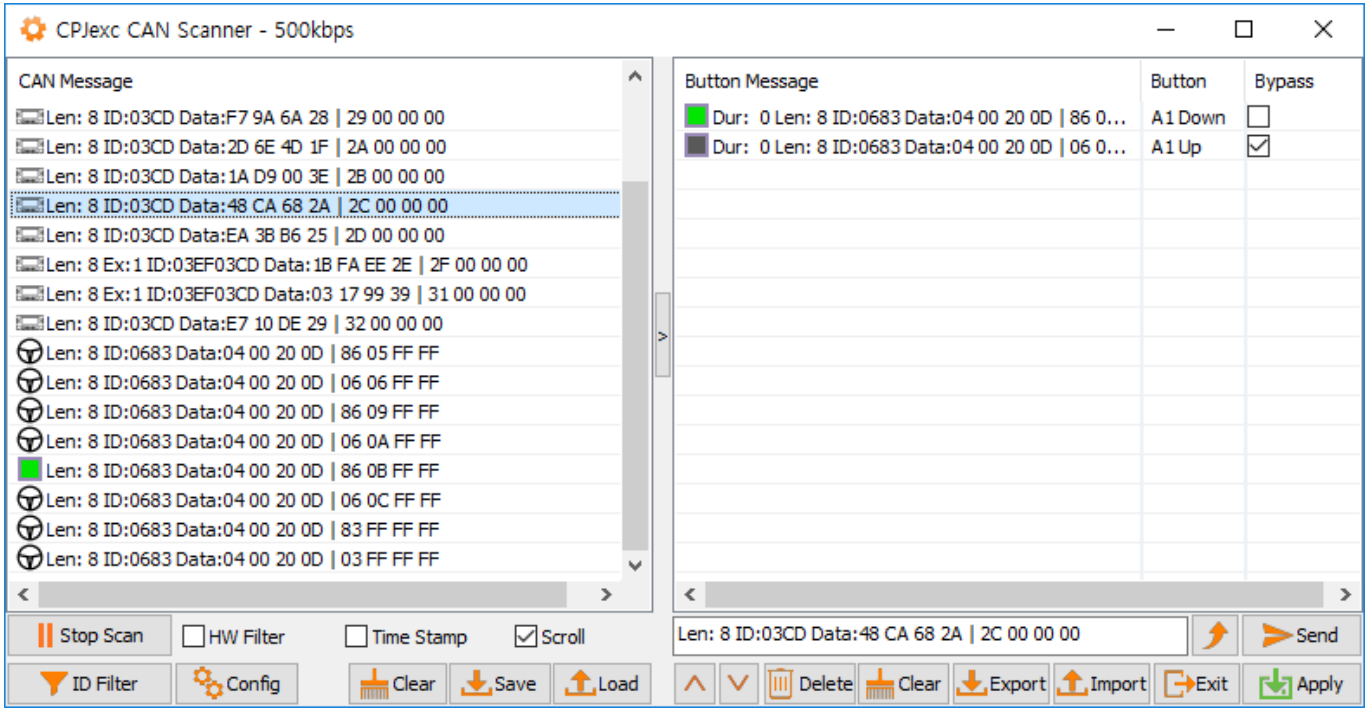




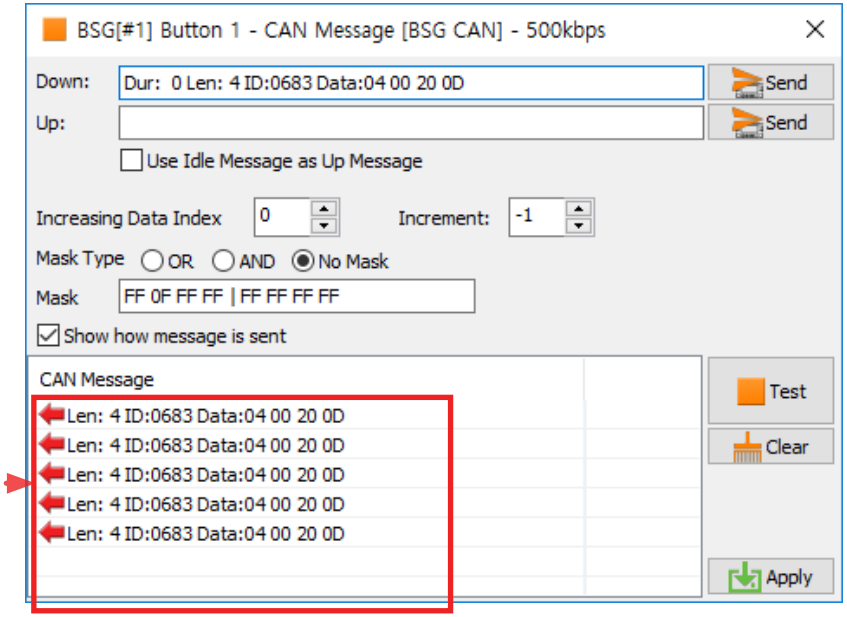
If **Bypass Steering Wheel Controls to Head Unit** is checked on, CPJexc bypasses all the messages originate from the steering wheel controls except the messages used as a button message.
If you want to bypass the button message from steering wheel control to the car radio, check **Bypass** at the button message list in CAN Scanner.
Usually the Up Button Message need to bypass to the car radio.

If **Bypass Head Unit to Steering Wheel Controls** is checked on, CPJexc bypasses all the messages originate from the car radio.



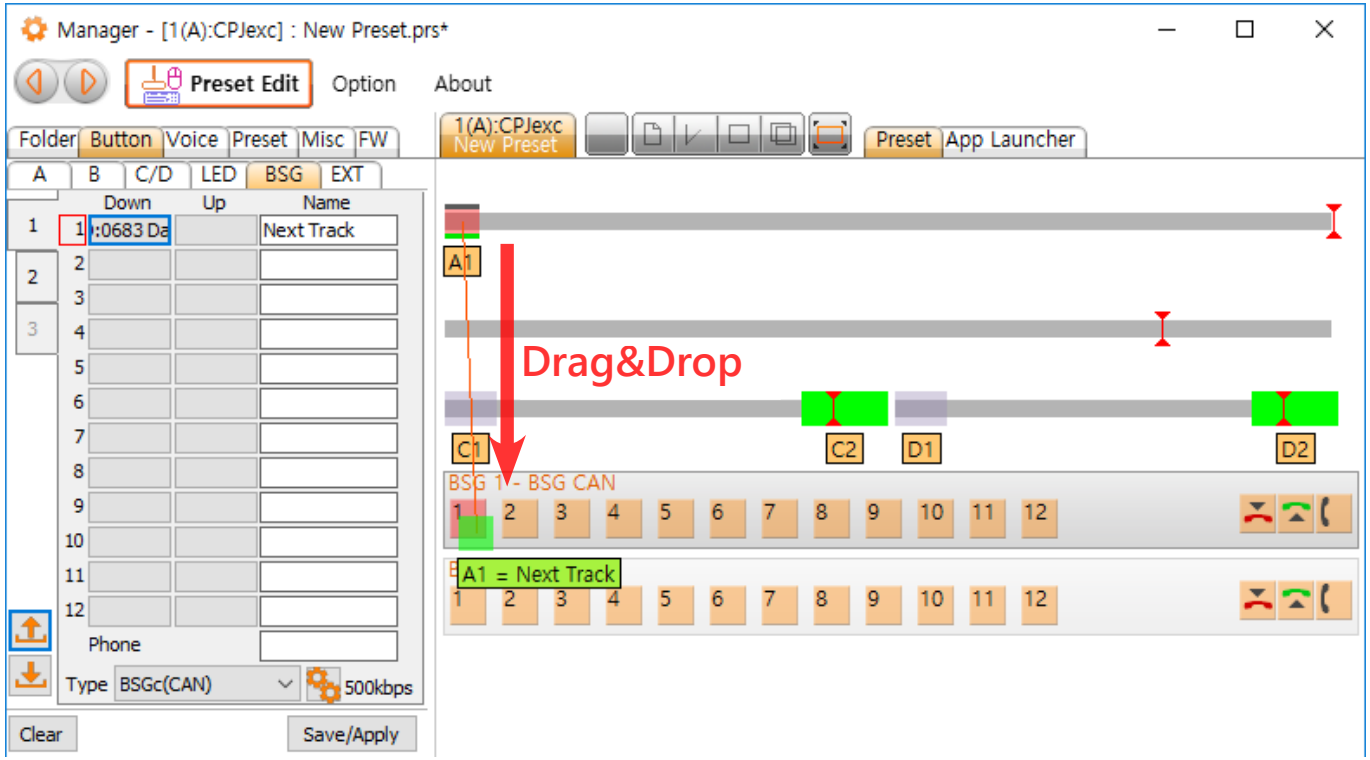


The CAN message from the BSGc to the car radio is shown at BSG button property dialog when "**Show how message is sent**" is enabled.



15-8. Connecting Steering wheel button to BSG button

Drag&Drop a button to the BSG buttons to use steering wheel buttons for BSG Buttons. Then the BSG button works by the steering wheel control button.
This is same with connecting the steering wheel buttons to USB keyboard or HID remote controller.



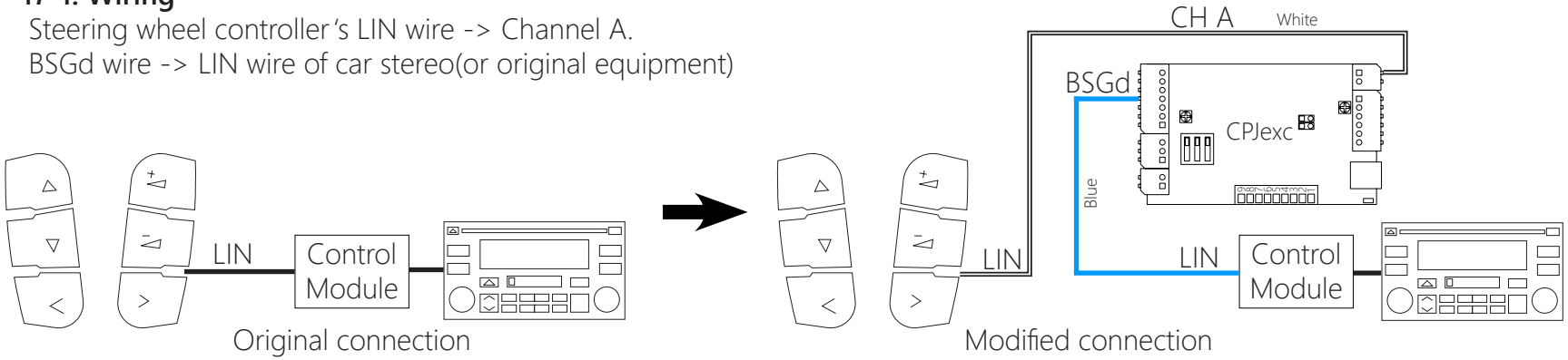
16. BSG for Internal CAN BUS

BSG for Internal CAN BUS is almost same with BSGc(BSG for CAN BUS).
But the output of BSG for Internal CAN BUS goes through onboard CAN BUS.
This can be used to send CAN messages to control car equipment(ex. windows, headlight ect.).

17. BSG for AUDI '99-'04(LIN) and VW(Volkswagen) '99-'04(LIN)

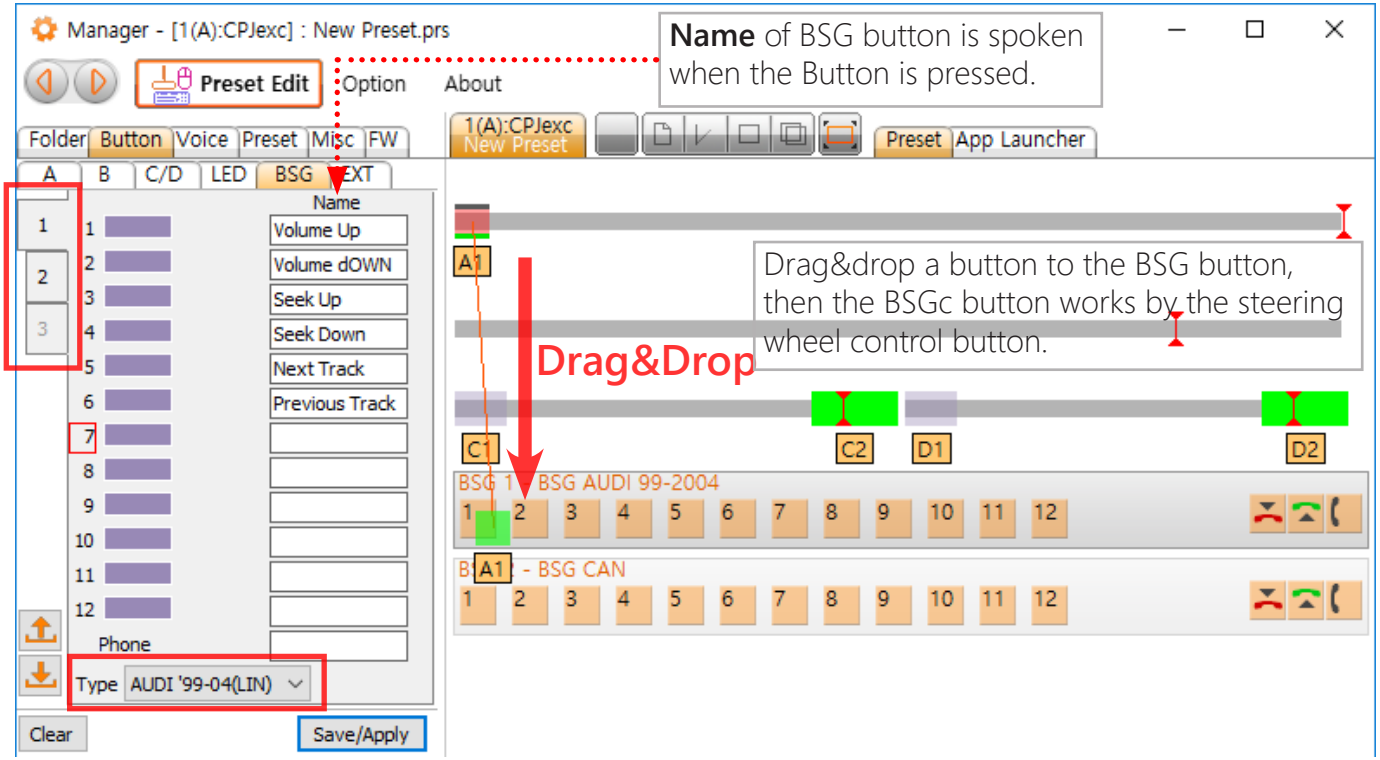
17-1. Wiring

Steering wheel controller's LIN wire -> Channel A.
BSGd wire -> LIN wire of car stereo(or original equipment)



17-2. Manager Setting

Choose the **BSG index**.
Choose AUDI'99-'04(LIN) or VW '99-'04(LIN) at **Type.**



The latest manual is at
http://www.exInterface.com/mn/cpjexc