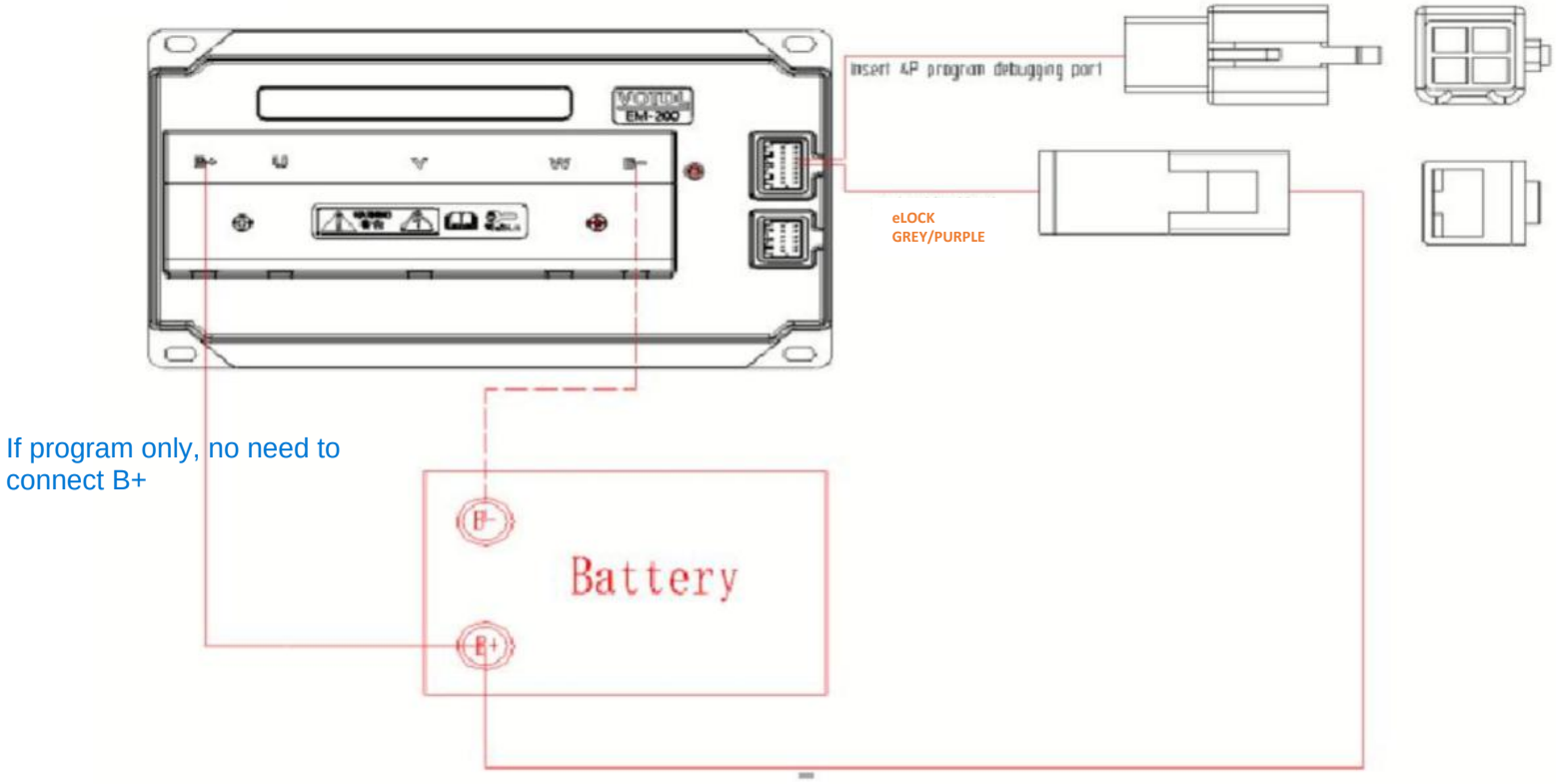
# PROGRAMMING MANUAL OF THE VOTOL CONTROLLER

# 1 INITIAL CONNECTIONS

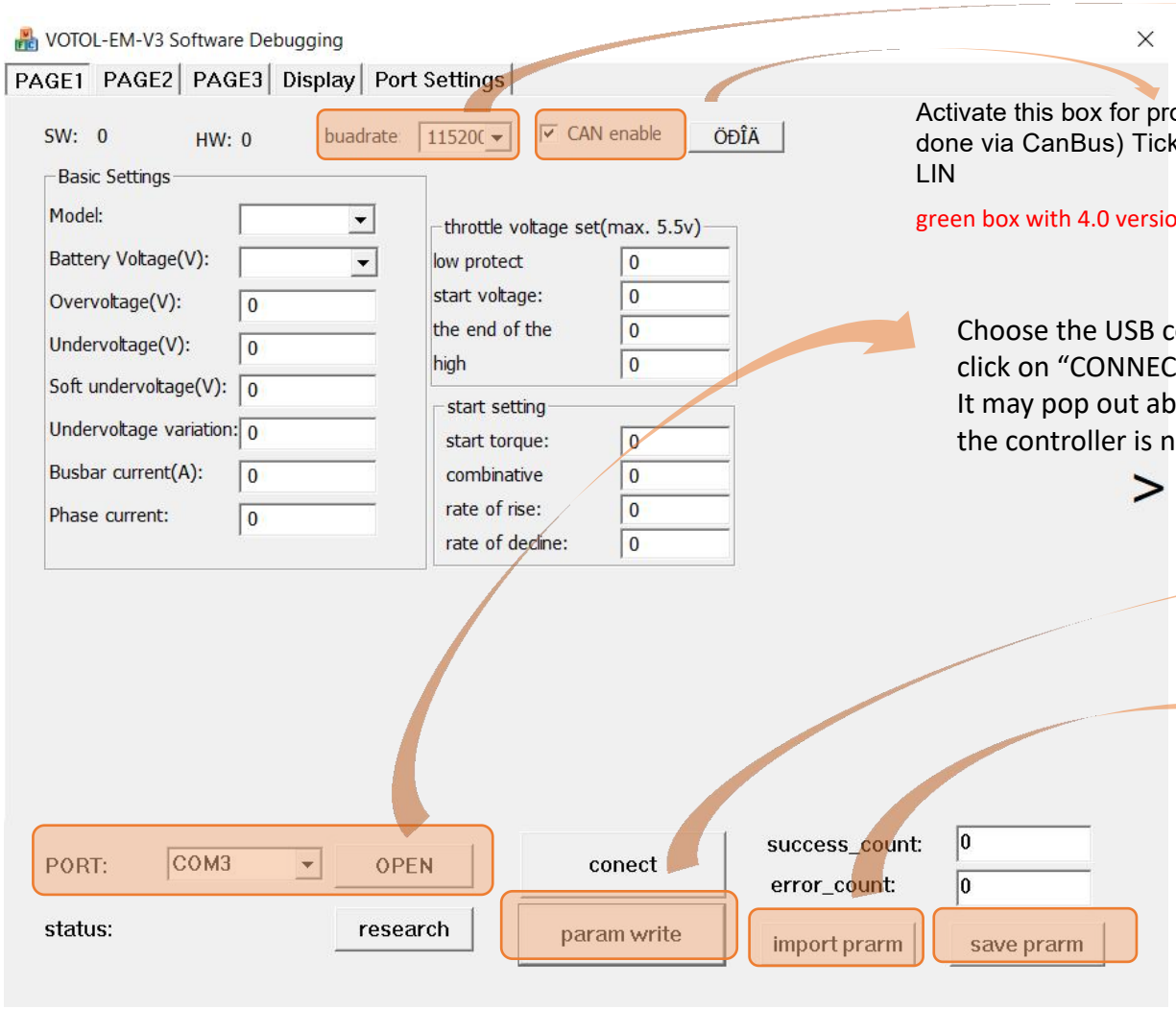
To program the controller, you must have the following power supplies active

The controller must be powered up by the power supplier line(Gray/Purple) with Elock+ (above 35V) for debuging .

above 20v minimum. Controller use SD4938 buck converter



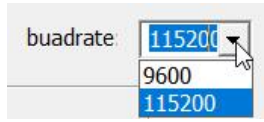
# 2 INITIAL PROGRAMMING




Activate this box for programming (which is done via CanBus) Tick for CAN, Untick for LIN

green box with 4.0 version do not need √

Commucation speed setting
通讯速度设置
CAN base choose 11520




Choose the USB connection port and click on the “OPEN” button. It will go to “CLOSE” state and then click on “CONNECT”. The parameters will pop out once it is connect successfully.
It may pop out abnormal connection or unable to connect if the USB cable is not connected well or the controller is not powered on.

>

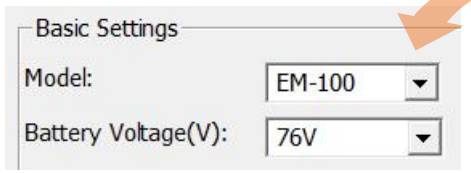
Press this button after implementing changes to the parameters.

Import a saved parameter configuration(ini file).

Save the created parameter configuration(bin file).

NO, OUTPUT INI FILEE

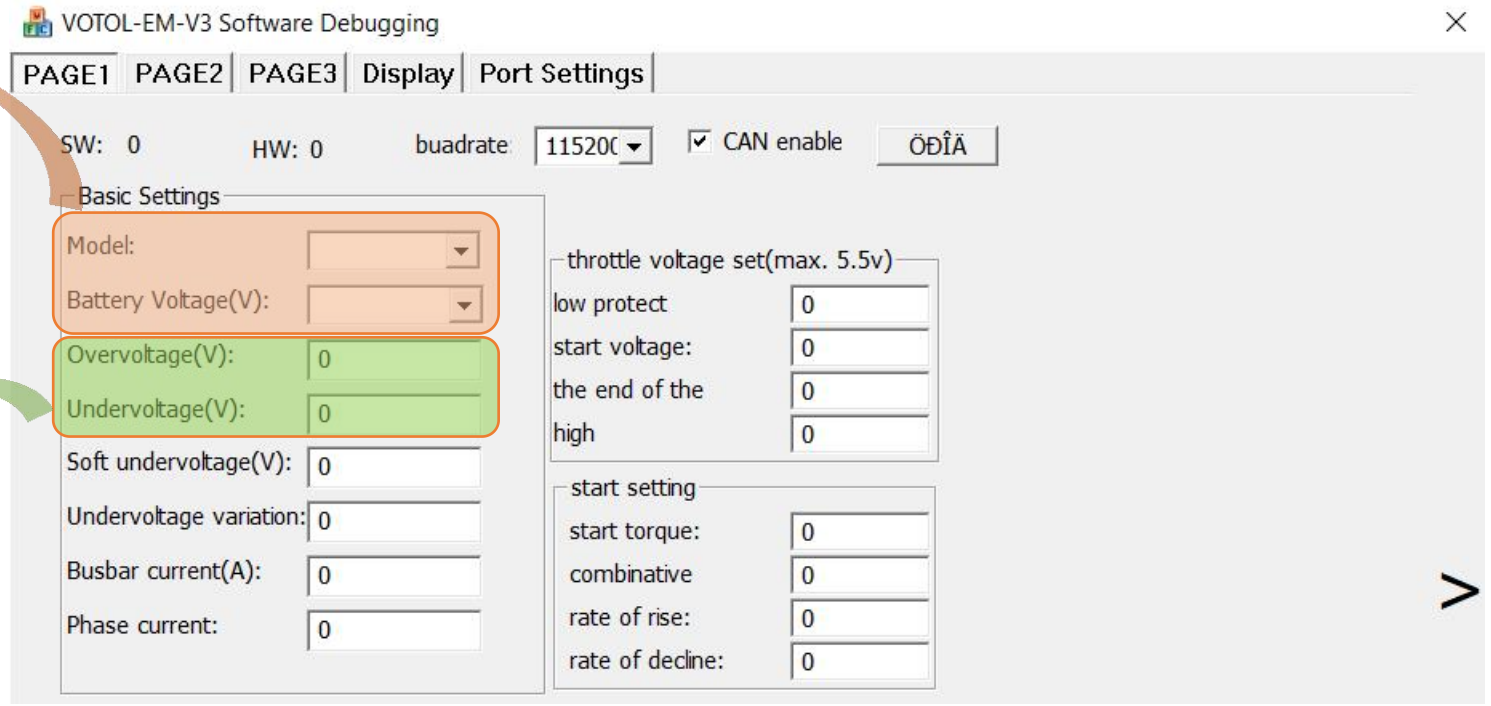
# 3 SETTING PAGE 1




Indicate the controller to be programmed and define the nominal voltage of the battery pack.
model from EM30 to EM200, all can be choosen

Fake, the controller from 30s to 550s read-only 100s

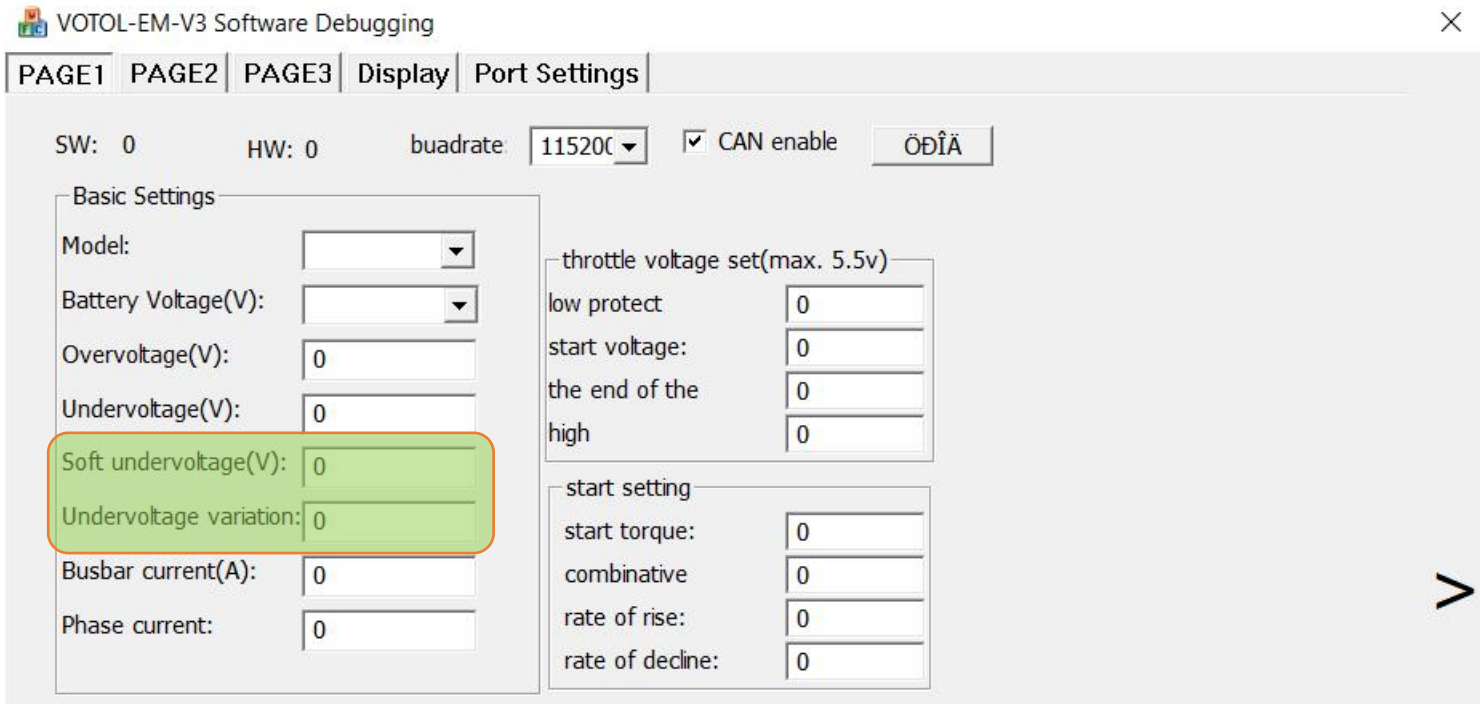

Indicate the maximum and minimum values allowed (according to the battery parameters)
Default +2V for over voltage select, while default +1V for under voltage select




Attention:
1, The controller will not output if it detect the voltage is higher than the overvoltage value or lower than the undervoltage value. It will report the fault code accordingly.
2, The value of undervoltage and overvoltage must be set according to the battery spec to avoid the hazard the battery cell and BMS components.

# 3 SETTING PAGE 1

**Soft undervoltage:**
The controller determines the current voltage value, which is 3V higher than the battery undervoltage value. If the current voltage value is lower than the soft undervoltage value, the controller output is immediately switched off to protect the battery.

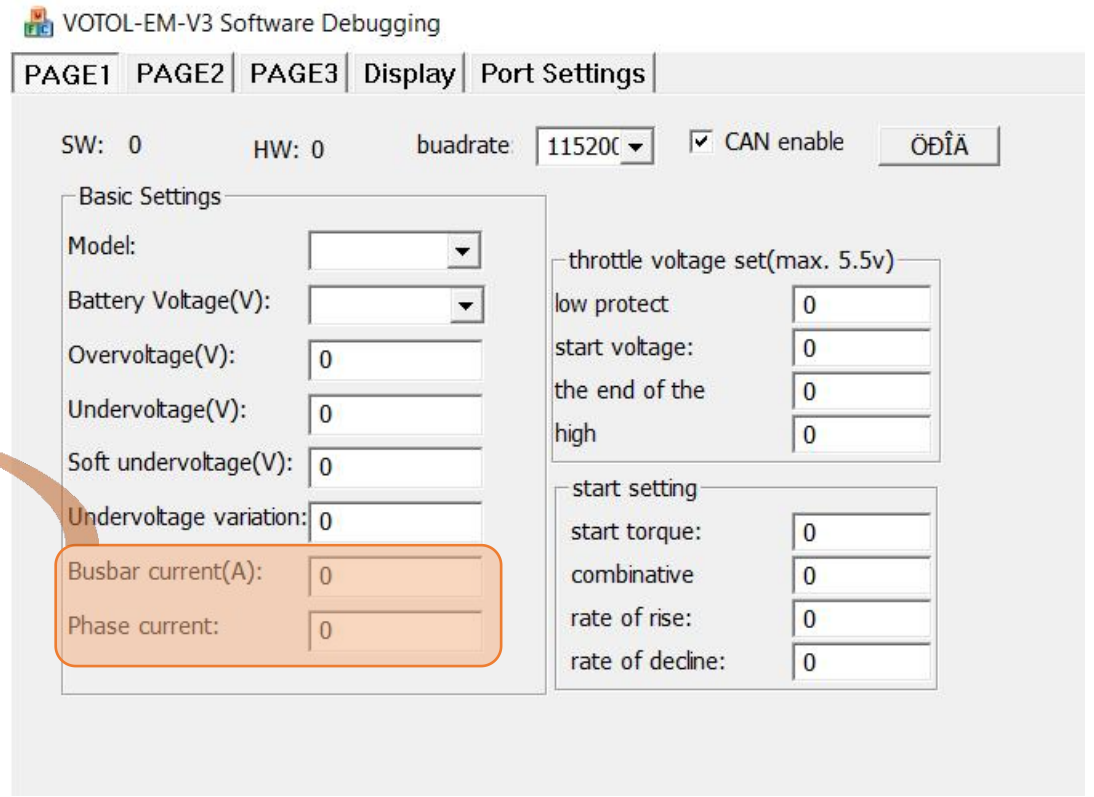



## Undervoltage variation:

Para evitar medidas incorrectas por parte del controlador, se incrementa el valor de la tensión “undervoltage” para no provocar un daño en el pack de baterías. Normalmente se suele marcar 1V, pero es posible aumentar dicho valor si queremos tener más seguridad.
To avoid incorrect measurements by the controller, the value of the "undervoltage" voltage is increased so as not to cause damage to the battery pack. Normally set with 3V, but it is possible to increase this value if we want to have more security.

# 3 SETTING PAGE 1


**Busbar Current**



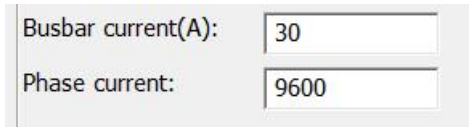

## Phase Current Limited Value

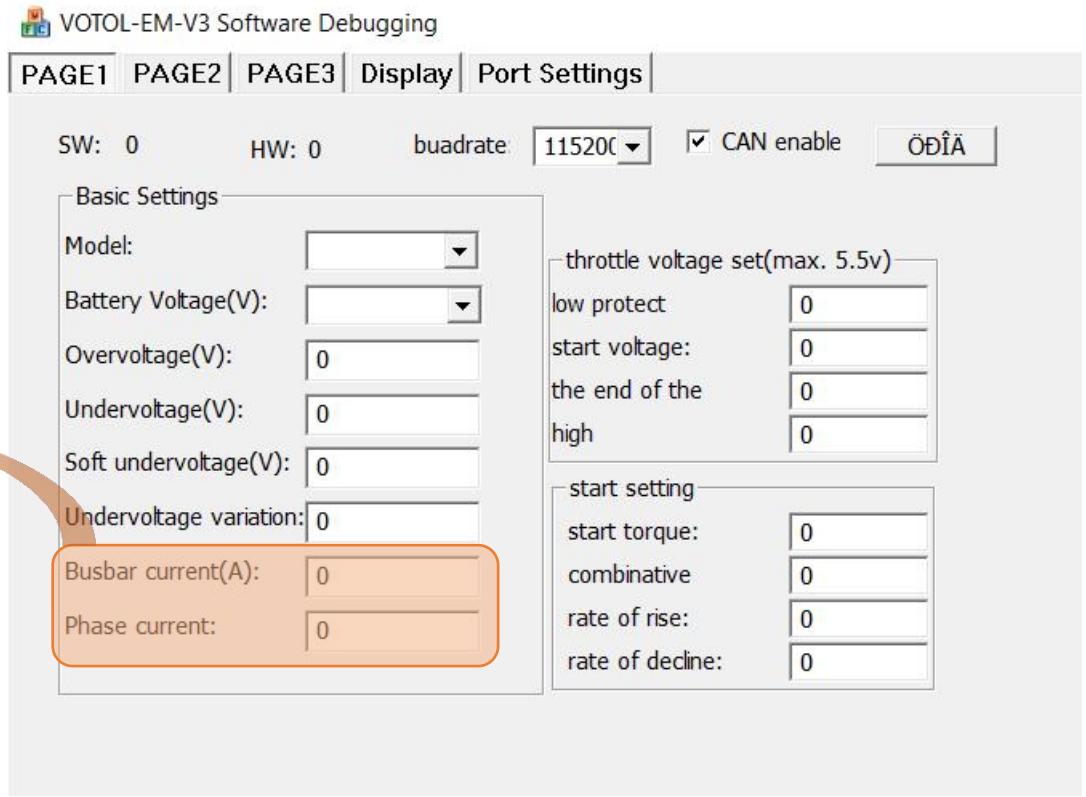
Larger controller, Bigger phase current. Refer to PhaseA img

Phase current = 9600
Especificar este valor y no modificar.
Specify this value and do not modify.

# 3 SETTING PAGE 1.1

| VOLTAGE / MODEL | EM-30S | EM-50 | EM-50S | EM-100 | EM-100S | EM-150 | EM-150S | EM-200 | EM-300 |
|---|---|---|---|---|---|---|---|---|---|
| 48-60V | 33A | 45A | 50A | 85A | | 120A | 150A | 200A | 400A |
| 72V | 33A | 45A | 50A | 85A | 100A | 120A | 180A | 200A | 400A |
| 84V | 30A | 45A | | 80A | | 120A | | | |
| 96V | | 40A | | 70A | | 100A | | 180A | 350A |




## Busbar Current

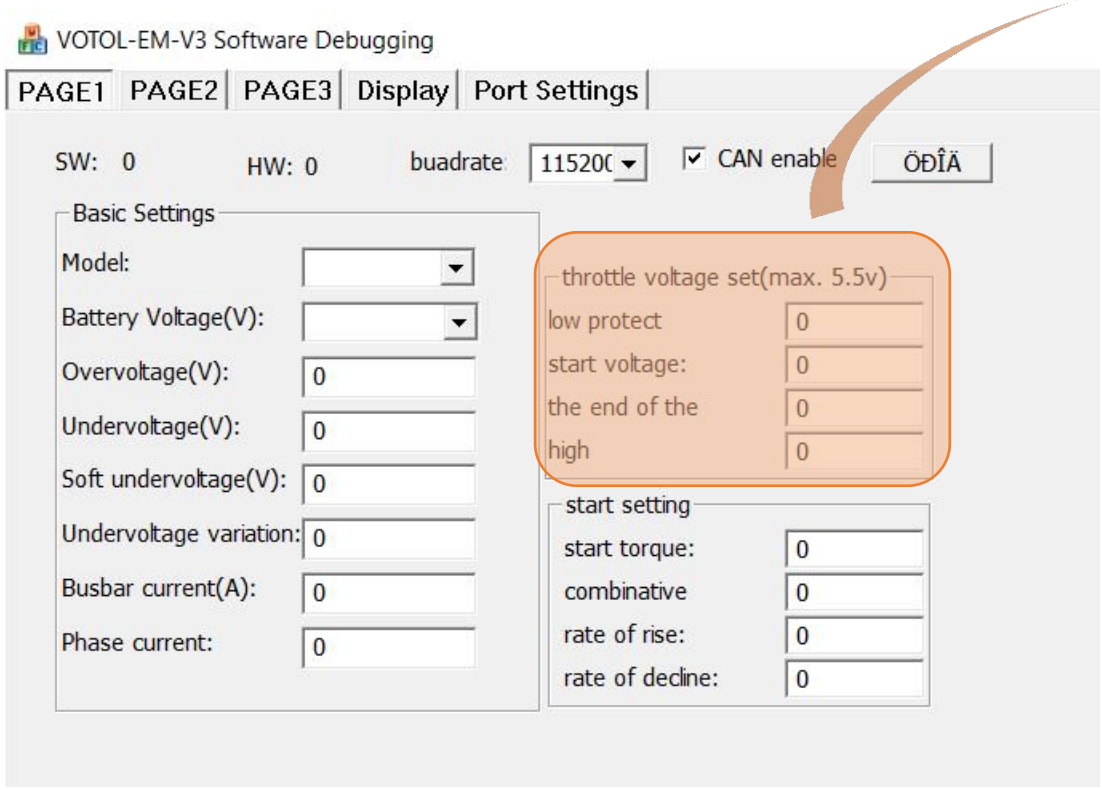
Corriente máxima permitida de alimentación al controlador.
El límite del controlador es 100A (72V)
Potencia máxima = 72V x 100A = 7200W = 7,20kW

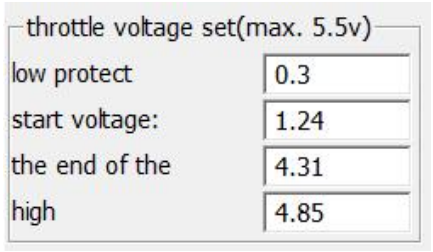
Maximum allowable power supply current to the controller. Controller limit is 100A (72V)Maximum power = 72V x 100A = 7200W = 7.20kW

## Phase Current Limited Value

Phase current = 9600
Especificar este valor y no modificar.
Specify this value and do not modify.

# 3 SETTING PAGE 1




## Parámetros del acelerador / Throttle Parameters

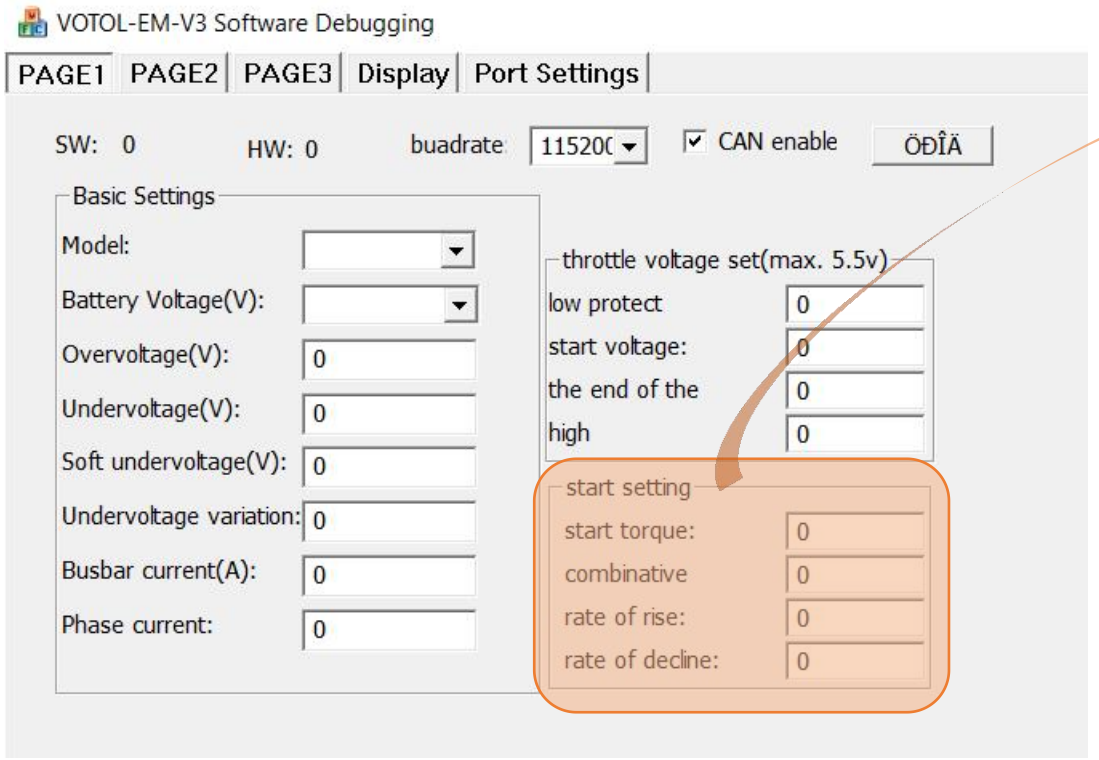
1. Low protection value: Si el valor de tension medido es inferior a ese valor, aparece un error en la señal del acelerador (valor muy bajo). If the measured voltage value is lower than this value, an error 95 appears in the throttle signal (value too low)

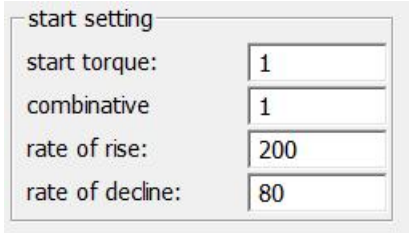
2. Starting voltage: Valor del voltaje a partir del cual el motor comienza a funcionar (sería el punto del 0% del acelerador). Voltage value from which the motor starts to work (it would be the 0% throttle point).

3. End voltage: Este valor marca el valor de tensión que establece el 100% del acelerador. Todo valor de tension superior, se seguirá considerando 100%. This value marks the voltage value that establishes 100% throttle. Any higher voltage value will continue to be considered 100% (The upper limit of the speed effective value, the max. speed value voltage.)

4. High protection value: Cuando el valor de tension sobrepasa este valor, aparece un error en la señal del acelerador (valor muy alto). When the voltage value exceeds this value, an error appears in the throttle signal (value too high).

# 3 SETTING PAGE 1



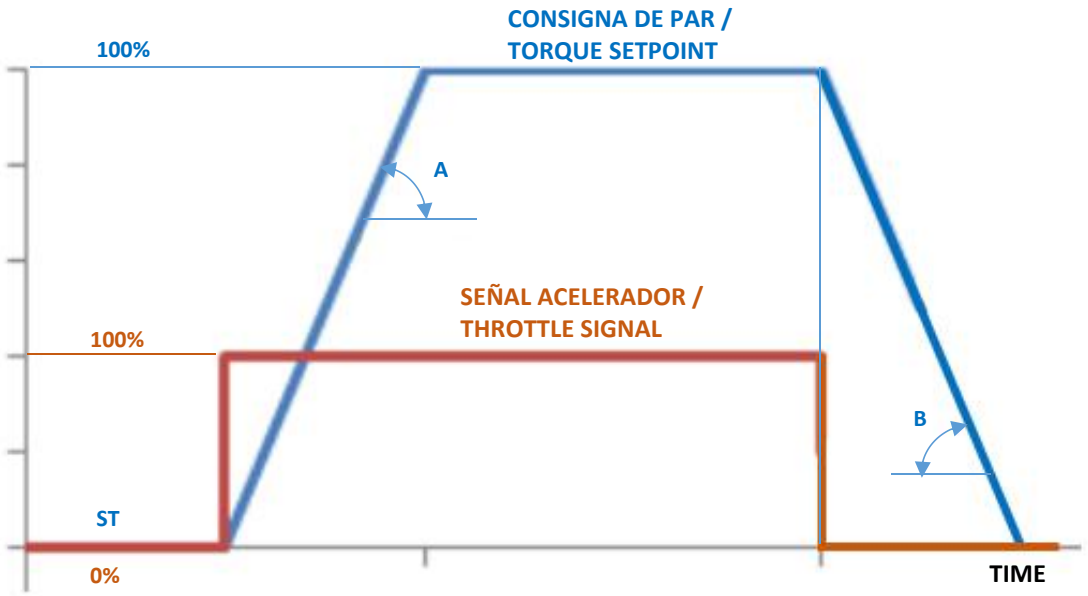




## Start setting adjustment

- Start torque: Torque parameter at startup, usually set to 0 and not changed.
- Combinative torque: Starting delay parameter, the range is 0-350. The larger the value, the more obvious the effect of the starting delay.
- These two parameter above is effective for middle motor with gear

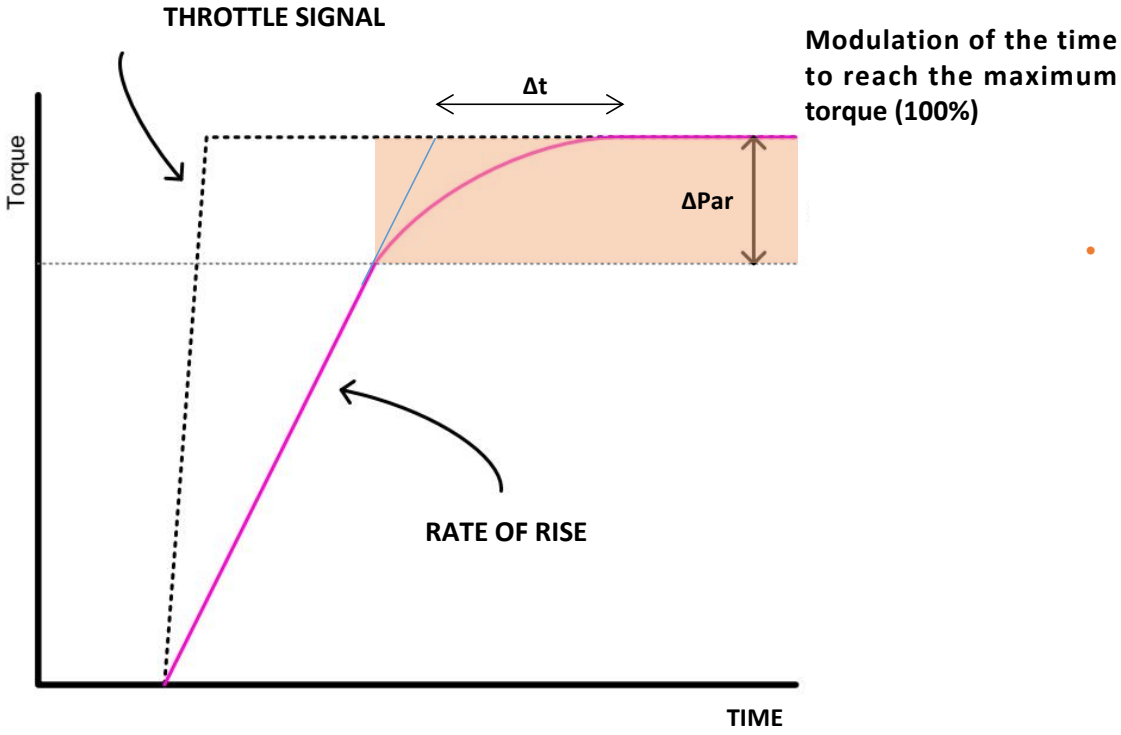
- rate of rise : Acceleration slope, the range is 10-255, the larger the value, the faster acceleration.
- rate of decline: Deceleration slope, 10-200 range value, the larger value, the more obvious the speed drop, and the inertia of the loosening handle is reduced.

# 3 SETTING PAGE 1




- ST = Start Torque  Rate of rise = tg(A)
- Rango de regulación / Regulation range = 10-250
- A mayor pendiente, más rápida es la respuesta (más rápido se alcanzará la consigna de par). The greater the slope, the faster the response (the faster the torque setpoint will be reached)
- Rate of decline = tg(B)
- Rango de regulación / Regulation range = 10-200
- A mayor pendiente, más rápida es la respuesta (más rápido se alcanzará la consigna de par). The greater the slope, the faster the response, the release speed of the handlebar drops faster (the faster the torque setpoint will be reached)

# 3 SETTING PAGE 1

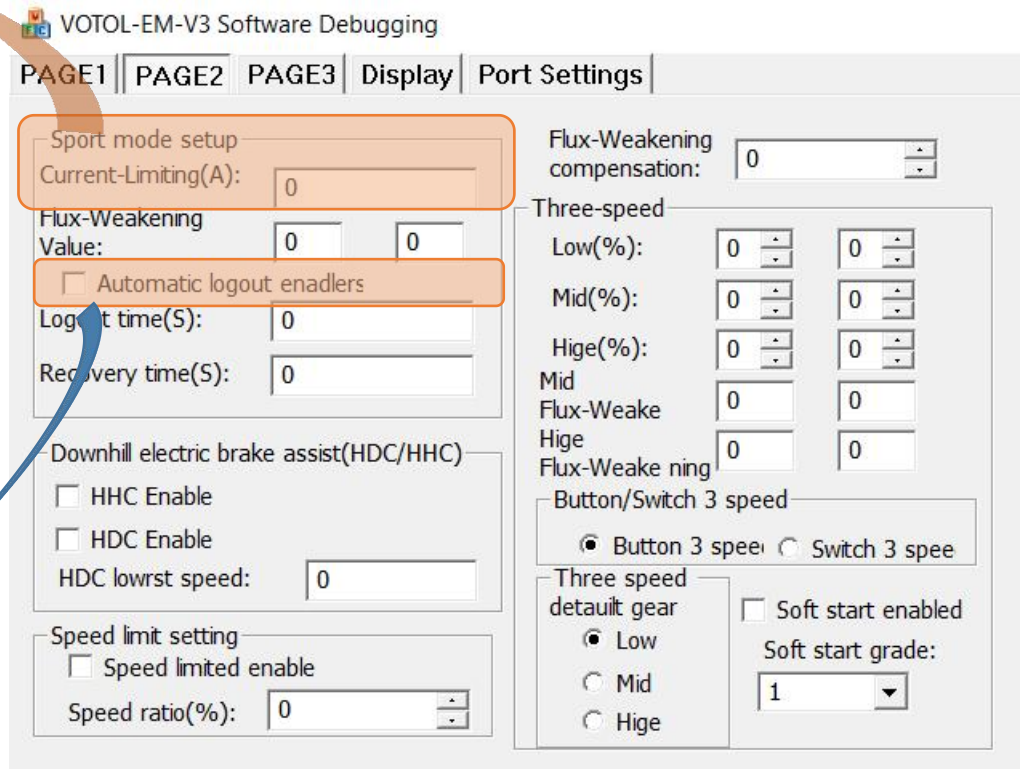



- Combinative torque
  - Rango de regulación / Regulation range = 0-350
  - As the value increases, more time is needed to reach the maximum torque setpoint. In this way, the behavior of the motor, in terms of acceleration, is smoothed out.
  - If the value 0 is specified, it means that there is no modulation, so the slope defined as Rate of Rise is followed until the torque setpoint is reached.

# 4 SETTING PAGE 2

**Current Limiting (A)** = Valor de la corriente máxima permitida de alimentación al motor. Value of the maximum current allowed to supply the motor

- Se debe especificar la corriente máxima admisible del motor eléctrico, que será la que aplique durante el modo S. The maximum allowable current of the electric motor during this driving mode S.
- El límite del controlador es de 150A (72V) (Pico de intensidad). Controller limit is 150A (72V)

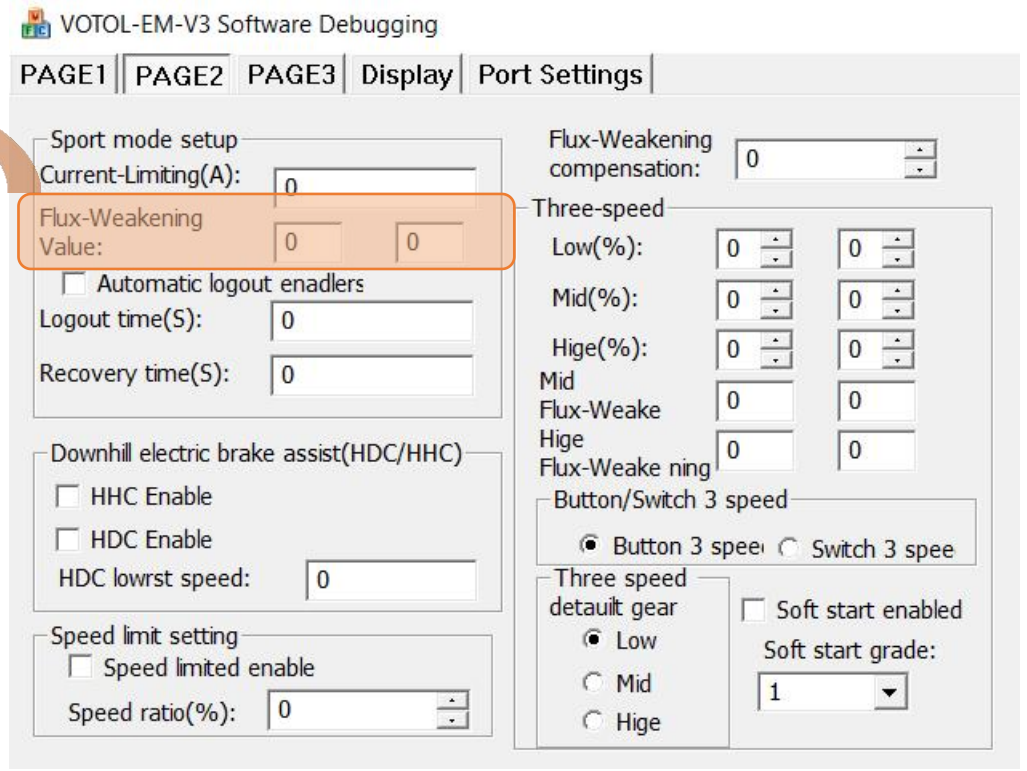

**Sport Mode = S Gear  Tick this to activate Sport mode**

Parameterization of driving mode Sport (S)

The motor is running in the flux weakening region

# 4 SETTING PAGE 2


- Flux weakening value at left side, range is 0-4000

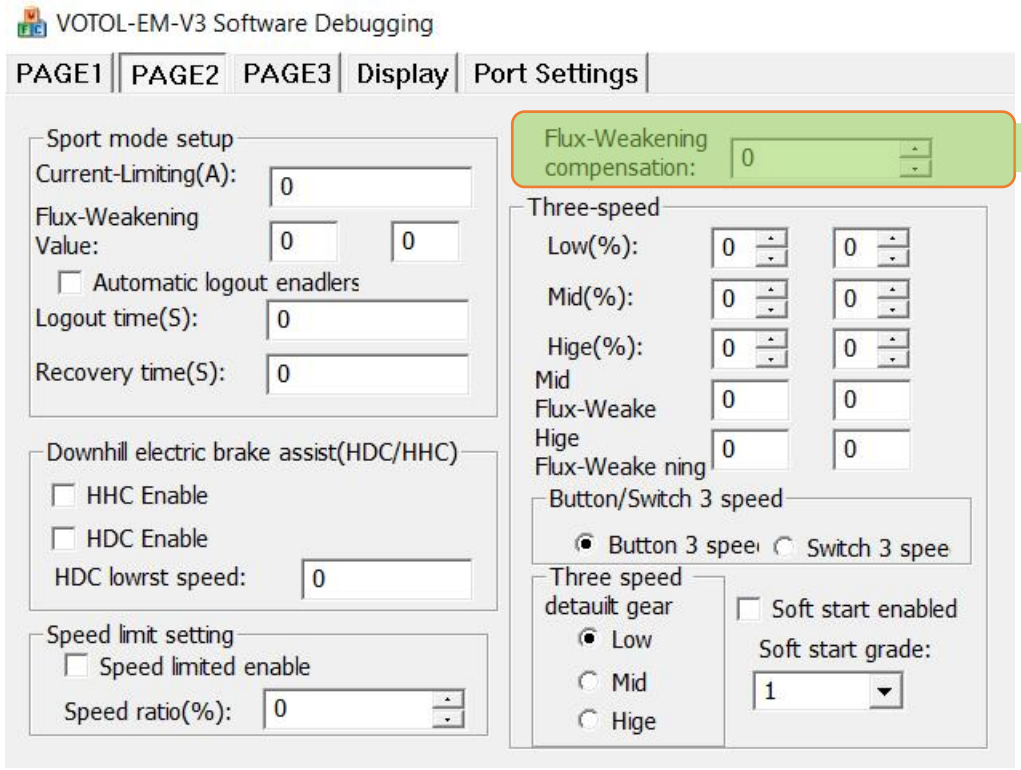



When controller turn into S gears, the motor will be in flux weaken condition, speed increased.
Setting value range is determined by motor condition:

| | |
|---|---|
| **Wheel hub motor, magnet high lower than 35mm** | **≤1500** |
| **Wheel hub motor, magnet high lower than 50mm** | **≤2300** |
| **Mid drive motor, surface attached magnetic steel** | **≤2300** |
| **Mid drive motor, V magnet steel** | **≤3000** |

Flux weakening adjustment at right side, range is 100-1200.
larger value, the motor more shake, smaller value, the motor less shake
Adjust the value in multiples of 50.

# 4 SETTING PAGE 2



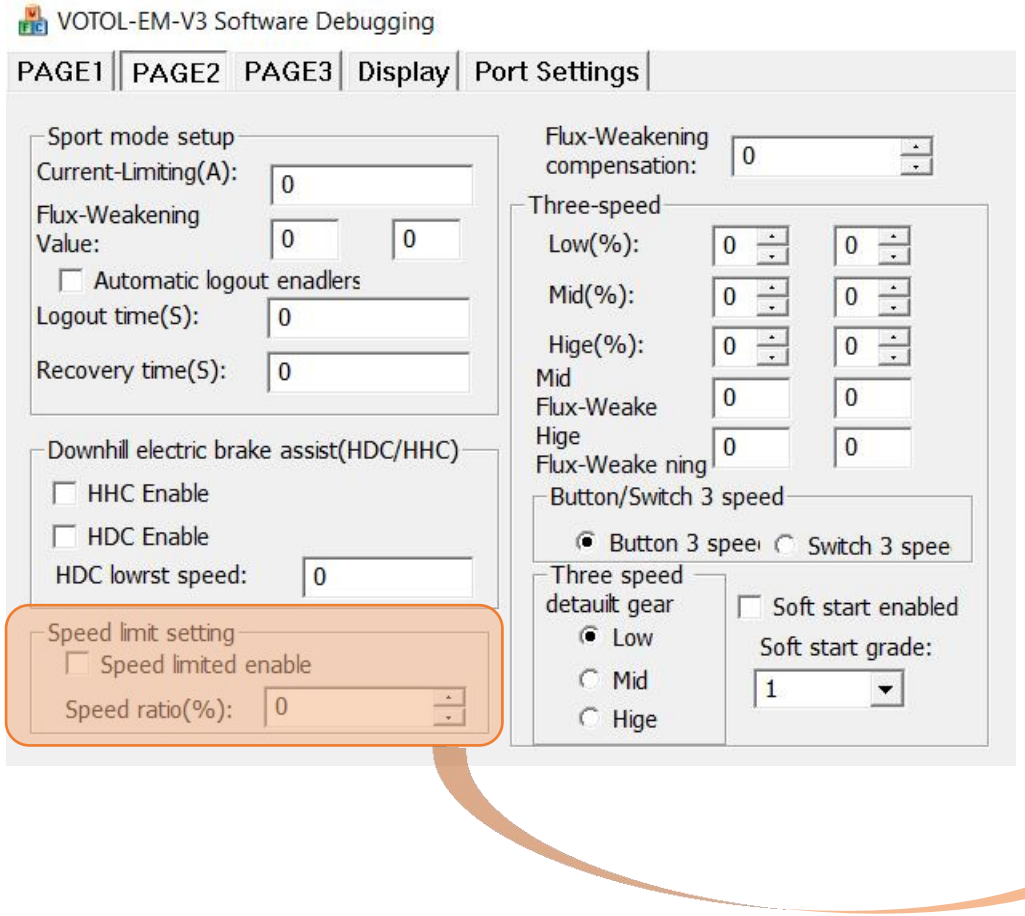

Flux weakening compensation factor

MTPA value

The hub motor is 10~20, this parameter can adjust the size of the reverse torque.

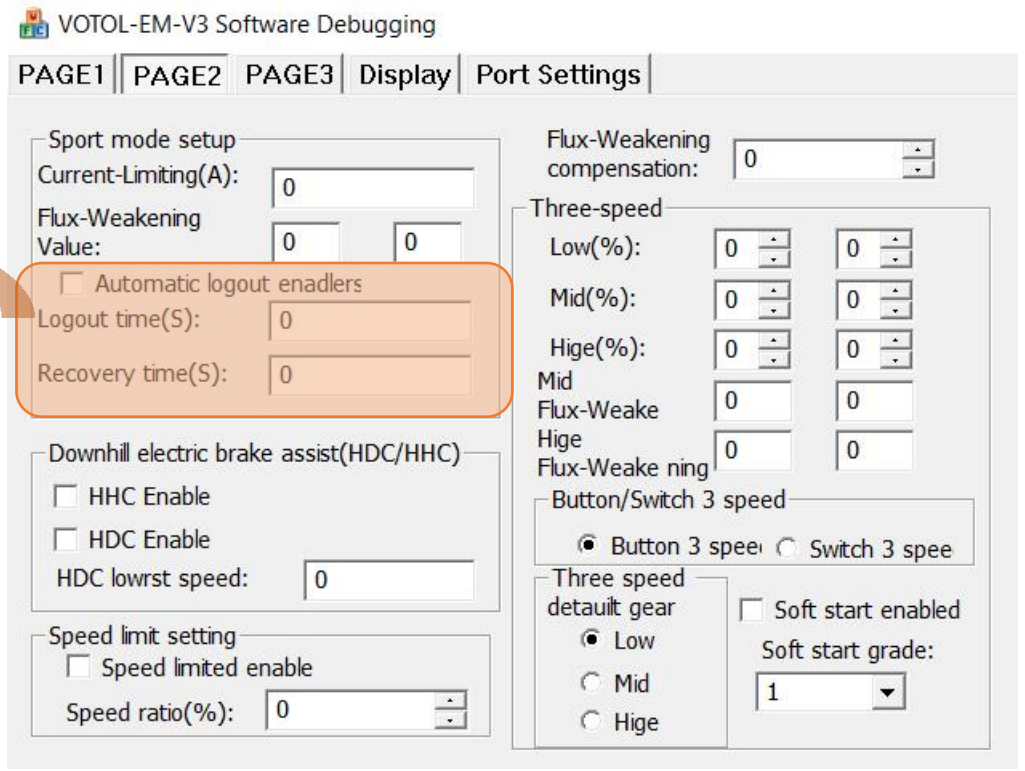
The mid-mounted motor is recommended to be 65~100, which can adjust the smoothness of reversing.

# 4 SETTING PAGE 2



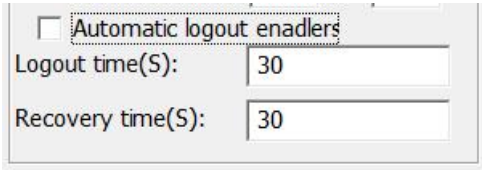

Speed limit setting：
Choose if the speed limit or unlimit. The default is unlimited speed.

# 4 SETTING PAGE 2




**Automatic Logout Enablers**

- Logout time: e.g. 30s after enter S gear sport mode (time is optional), auto-exit S gear sport mode.
- Recovery time: auto-exit S gear, recover from to S gear time. During recovery time (Invalid by press S gear).



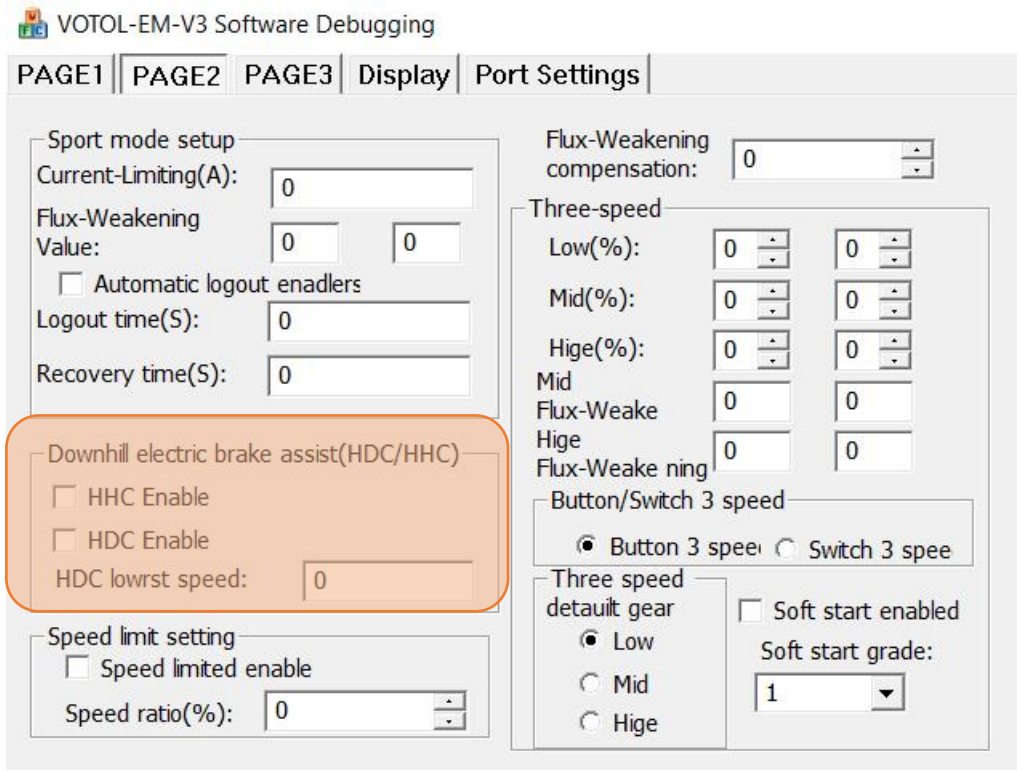
# 4 SETTING PAGE 2

**HHC = Hill Hold Control**

Specifies whether hill assist is enabled

Need Park func to properly work. If Park Func not function, you cant move vehicle backward

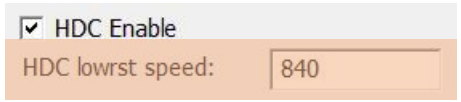
Operating mode not available




**HDC lowest speed**

It's a erratum in the program. It actually specifies the maximum speed of the motor.

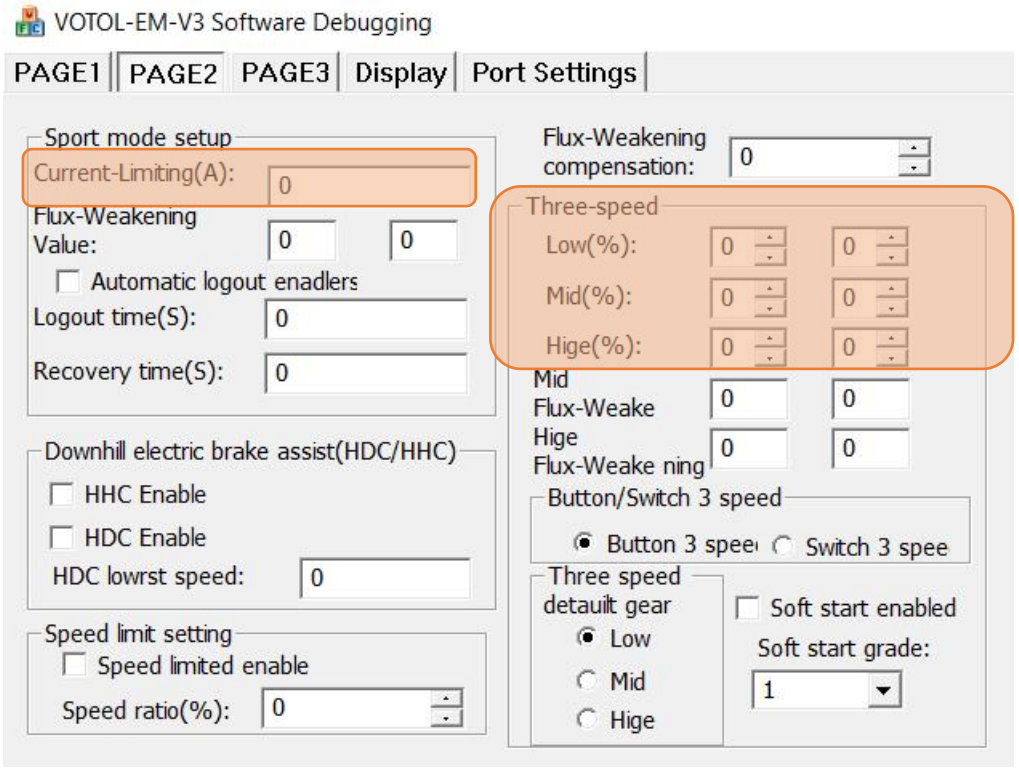
Yes, that is max RPM. and HDC enable is constant speed on/off (speed control/torque control)




Top Speed in rpm

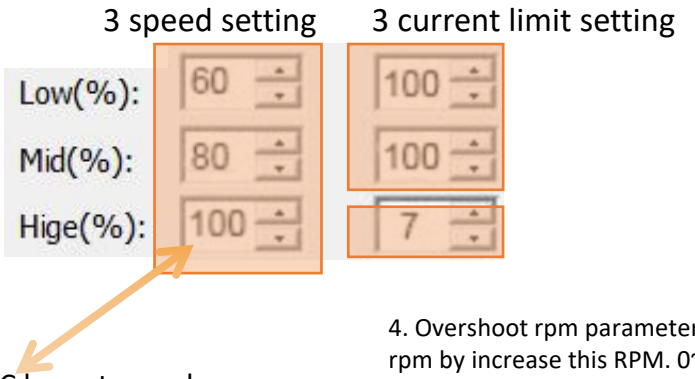
HHC just suit for three wheeler, not works for two wheelers.
when HHC enabled, the vehicle will hold still when switching from the brake to throttle pedal.

# 4 SETTING PAGE 2





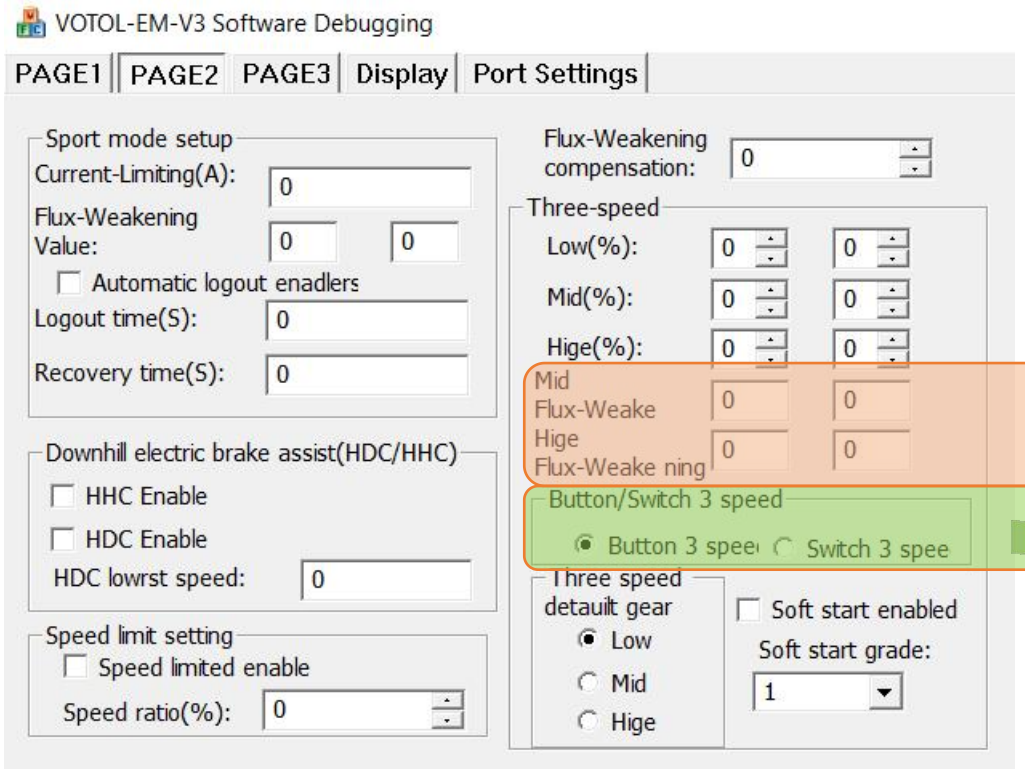
Configuración de los modos normales de funcionamiento.
Configuration of the normal modes of operation




Low speed =60%*HDC lowest speed
Mid speed =80%*HDC lowest speed
High speed =100%*HDC lowest speed

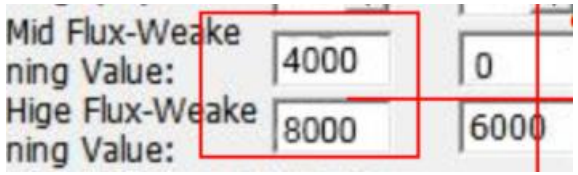
4. Overshoot rpm parameter. It will increase the rated rpm by increase this RPM. 0~14 from hub motor and 14 for IPM motor. It may affect the efficiency and performance of the power train by changing this value. Not suggest to be adjusted

# 4 SETTING PAGE 2




If docs properly, the value can be changed

此处值不可更改 The value can not be changed.






Escoger el tipo de mando que establece los 3 modos de funcionamiento:

- Button = Botón mediante el cual se establece el modo en función del número de veces que se presione

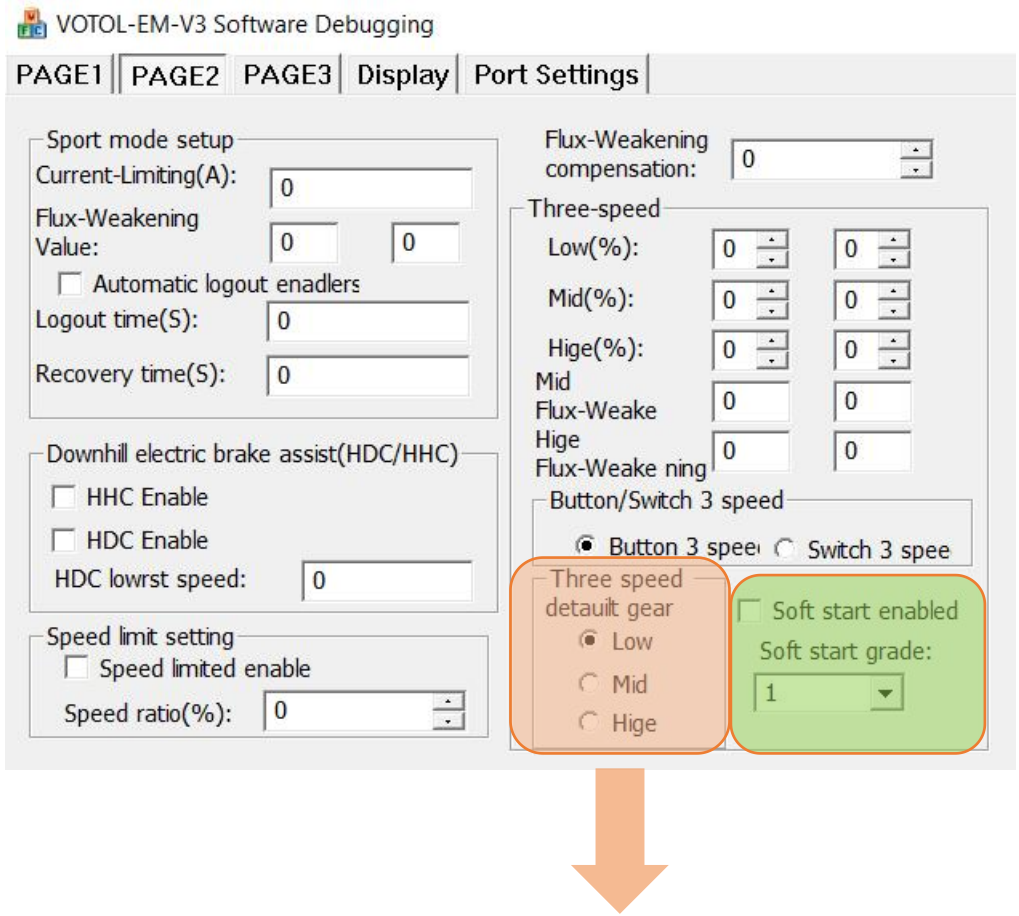
Switch = Interruptor de 3 posiciones

Choose the type of control that establishes the 3 operating modes:

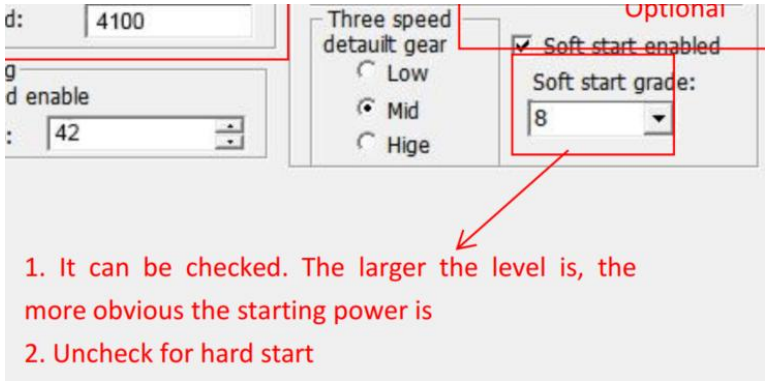
Button = Button through which the mode is set based on the number of times it is pressed

Switch = 3 position switch

# 4 SETTING PAGE 2




Soft start selection, not hard start, the higher the level, the more obvious the starting power.




En el caso de escoger “Button 3 speed”, establece la marcha que se activa por defecto.
In the case of choosing “Button 3 speed”, it establishes the gear that is activated by default.
Choose the default gear

# 5 SETTING PAGE 3

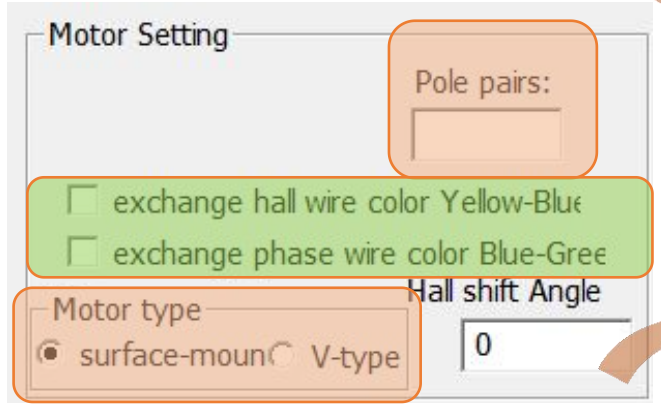
**Nº de pares polos del motor / Number of motor pole pairs**

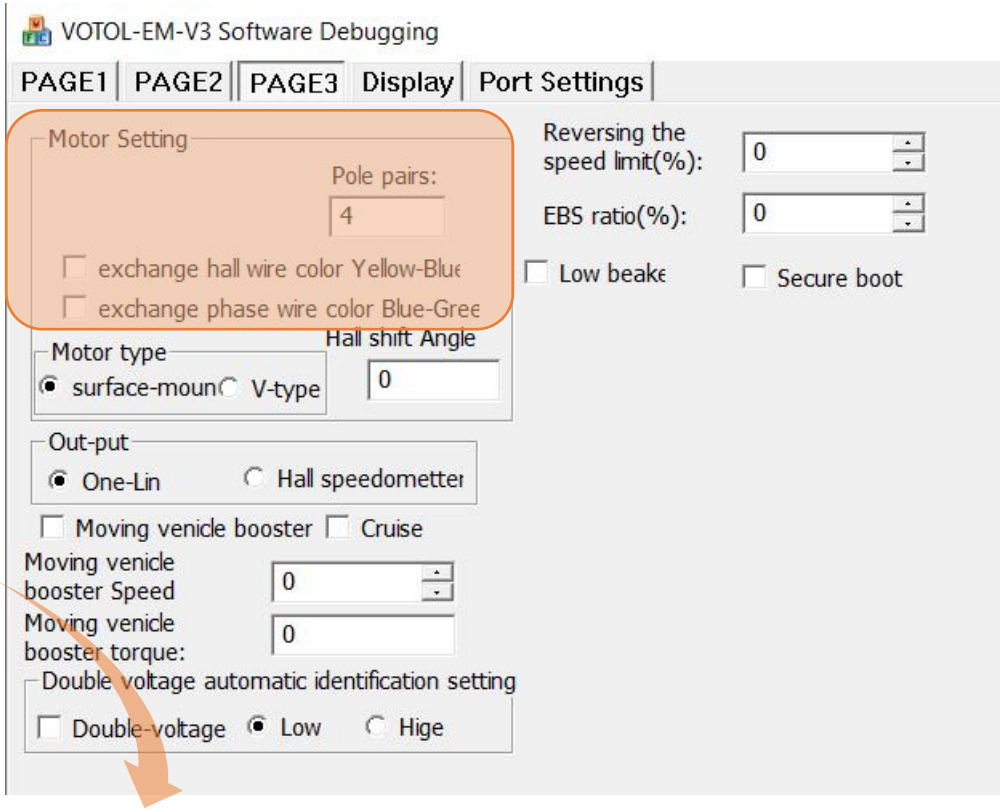
El motor Varchea posee 30 pares de polos

The Varchea motor has 30 pairs of poles.

Different motor may have different pole pairs.

Break the motor to count poles, or buy a rpm measurement



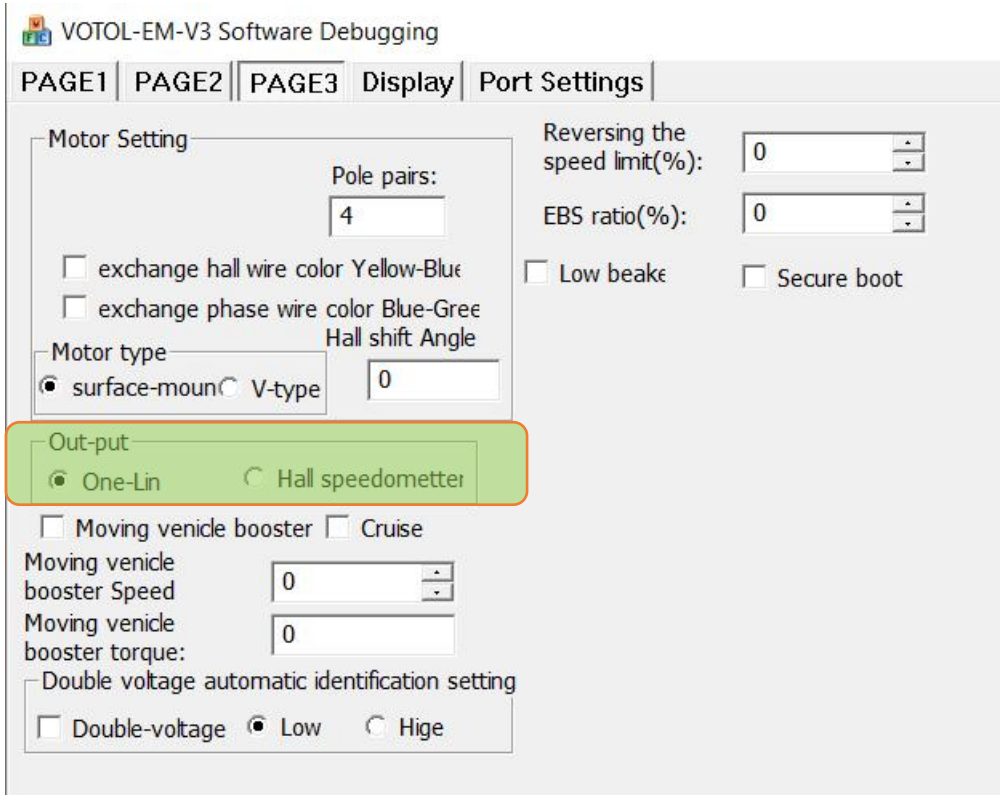

Motor wire sequence adjustment,
Hall wire sequence adjustment.

Motor rotor magnet fixing type,
the hall position in-hub motor


Phase shift angle adjustment angle, in hub motor usually with -60.

# 5 SETTING PAGE 3

Speedometer communication selection: ISDN or Hall signal



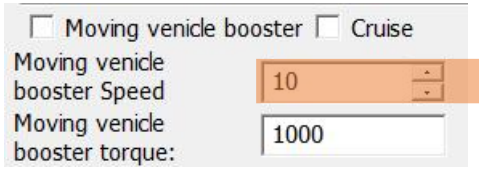

The controller to speedometer date output has 2 types: LIN protocol speedometer and hall speedometer, it needs to be decided by the vehicle's speedometer. We provide standard LIN protocol speedometer.
If we use CAN protocol, then we need to integrate with CAN speedometer.

# 5 SETTING PAGE 3

(1) Move assist function, valid after check

The speed of the transfer assist is selected as the percentage of the motor base speed. The default is 10%.

Moving assist torque value 320, corresponds to the torque value is 9~10N.m (varies depending on the motor characteristics)

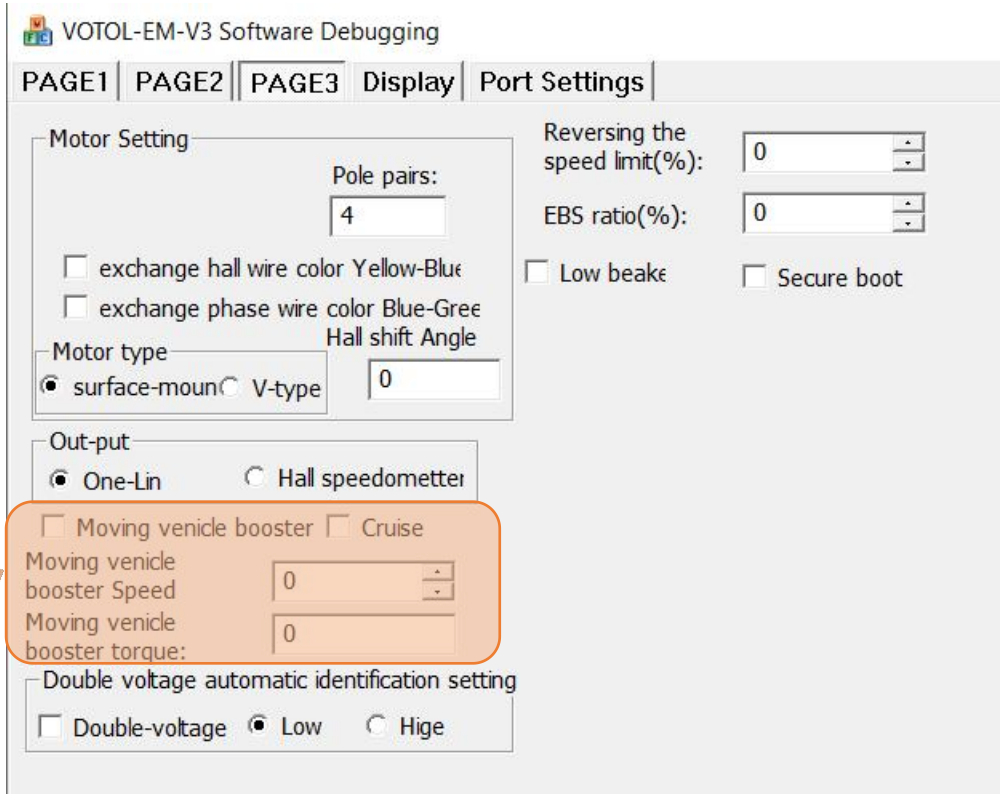



Es un valor en porcentaje con respecto a la motor base speed.
It is a value in percentage with respect to the motor base speed.

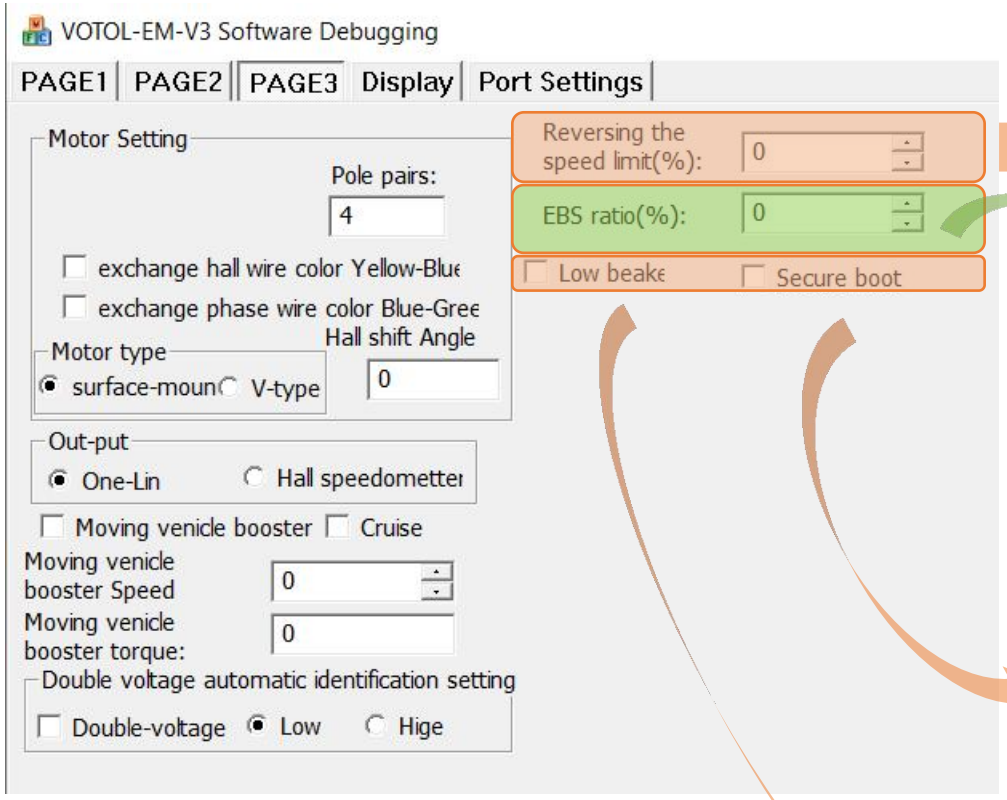
The vehicle moving assist function is used for two-wheeled vehicles, the speed is less than 3KM/H, and the torque is 9-19N.M.

(2) Cruise Function, valid after check

Turn to a certain angle and maintain more than 8 seconds, enter into the cruise control mode, any operation to exit the cruise mode (make a brake, turn the handle)



# 5 SETTING PAGE 3




Límite máximo velocidad marcha atrás. Maximum reverse speed limit.
Representa un porcentaje de las rpm máximas del motor. Represents a percentage of the maximum engine rpm.
Recomendación QS: No exceder el 30% (accidentes). QS recommendation: Do not exceed 30% (accidents)

**EBS = Electronic Brake System**

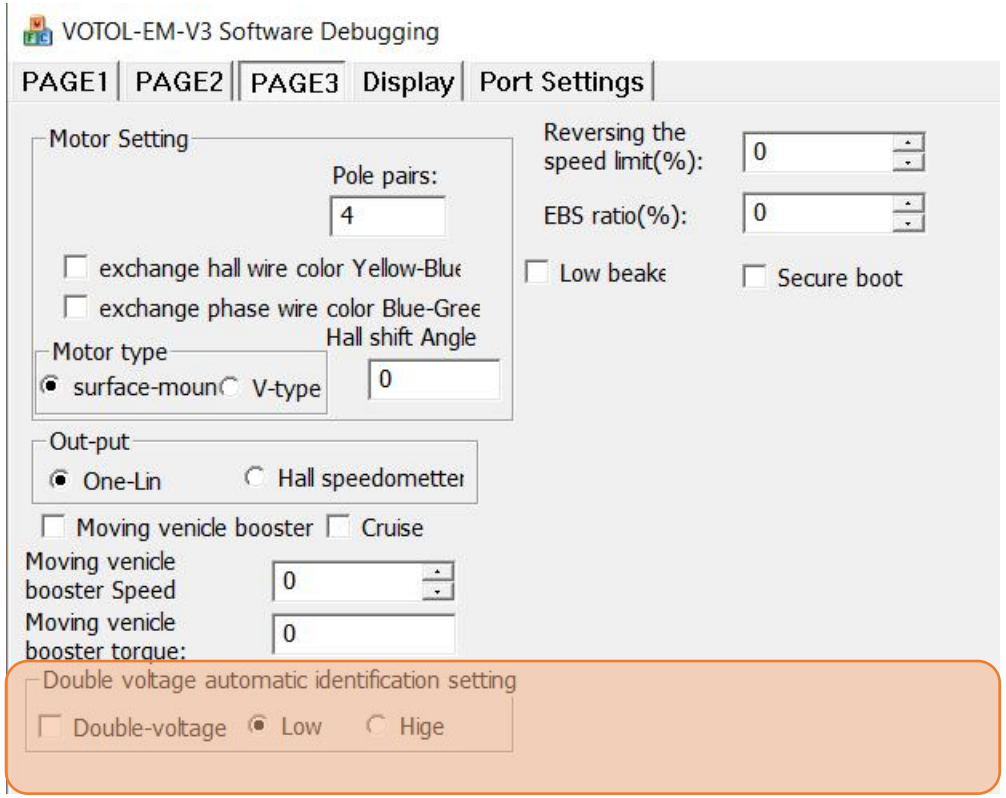
Establece el porcentaje de recuperación de energía en una frenada regenerativa
Sets the percentage of energy recovery in regenerative braking, two wheeler with 15-20, while three or four wheeler with 20-30.

**Safety Switch Function valid checked**

When using the safety switch function, need to select the safety switch (Kindly note the vehicle is running)

**Low brake enable valid check**

# 5 SETTING PAGE 3




Automatically switch dual voltage mode

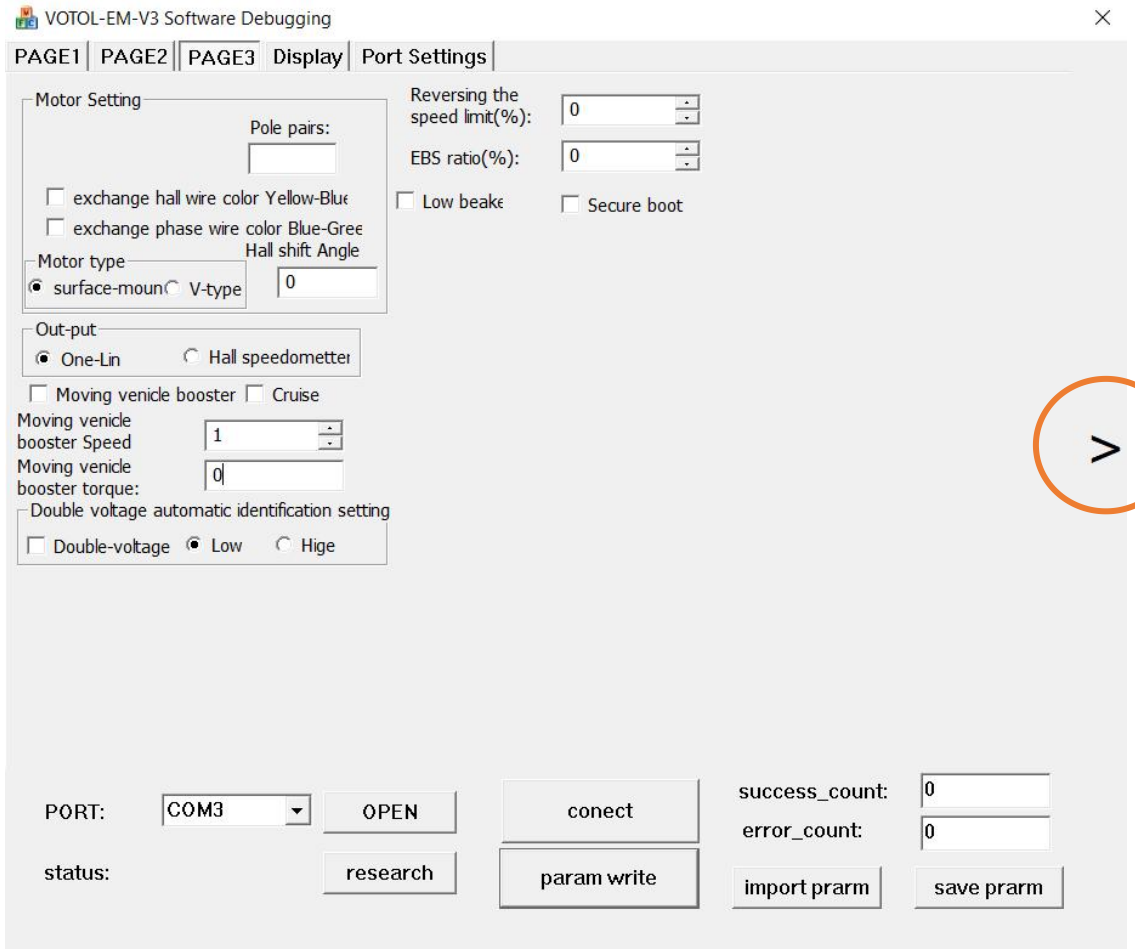
| mode | Volt for switching to low volt mode | Volt for switching to high volt mode |
|---|---|---|
| 48~60V | <49V | >63.5V |
| 60~72V | <61V | >77V |
| 72~84V | <72V | >93.5V |

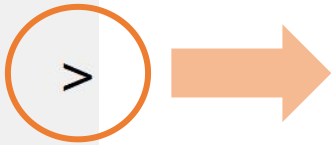
ECU available on 60V platform and 72V platform

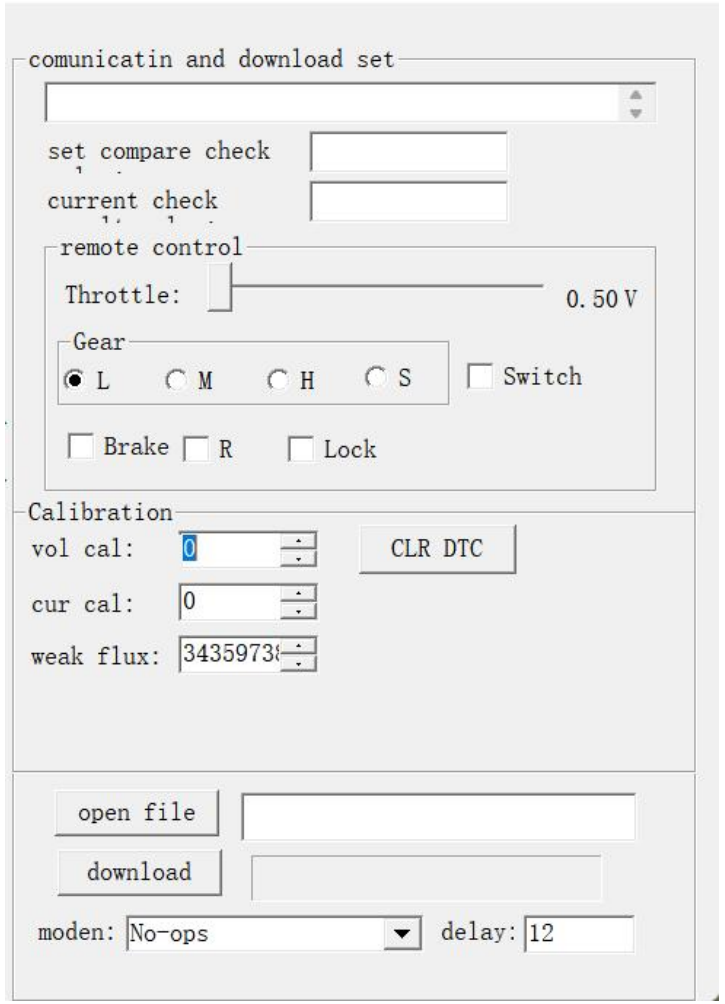
3.5 Dual voltage setting: default single voltage。
Note: The dual voltage function speed parameter value is followed by the motor speed setting. Adjust the parameters on the setup page 2.

Dual voltage setting, default single volage, low voltage

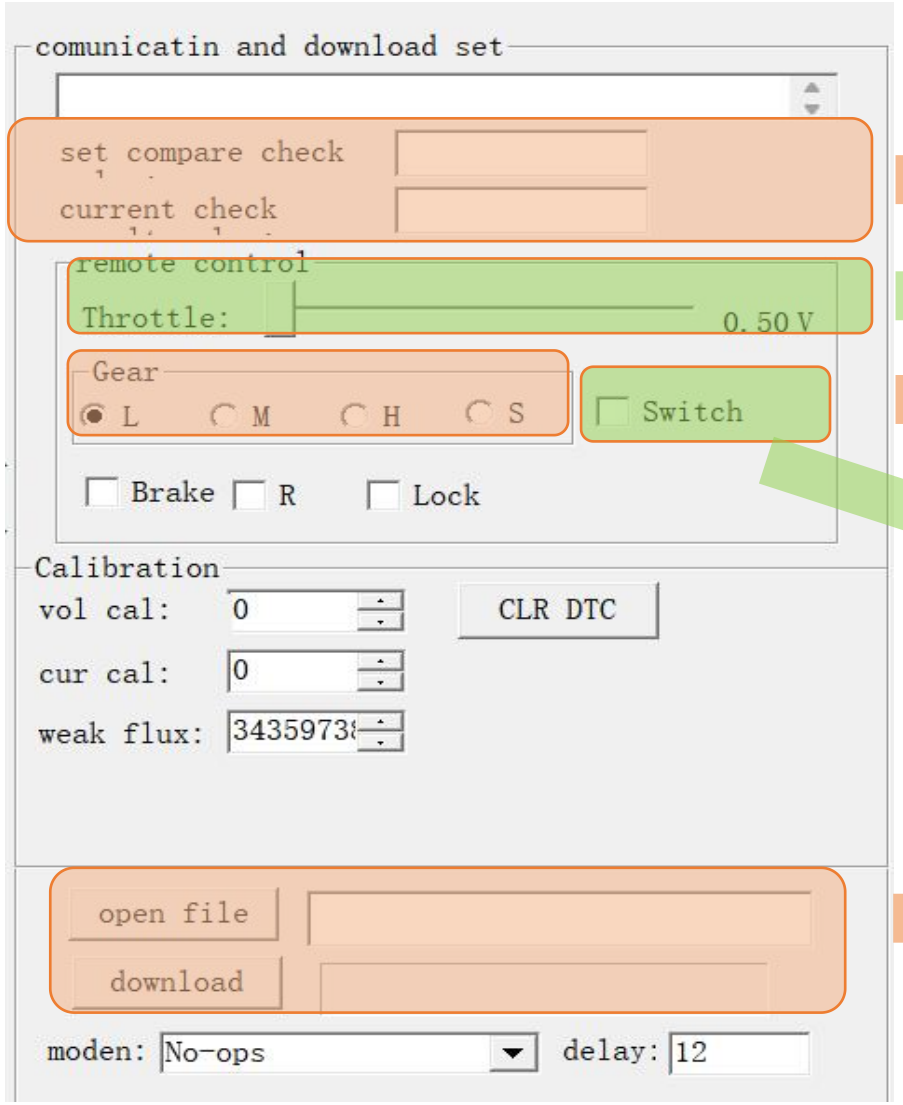
# 6 EXPLANDED PAGE





# 6 EXPLANDED PAGE




Checking pupose, no need to fill in.

Analog handle voltage.

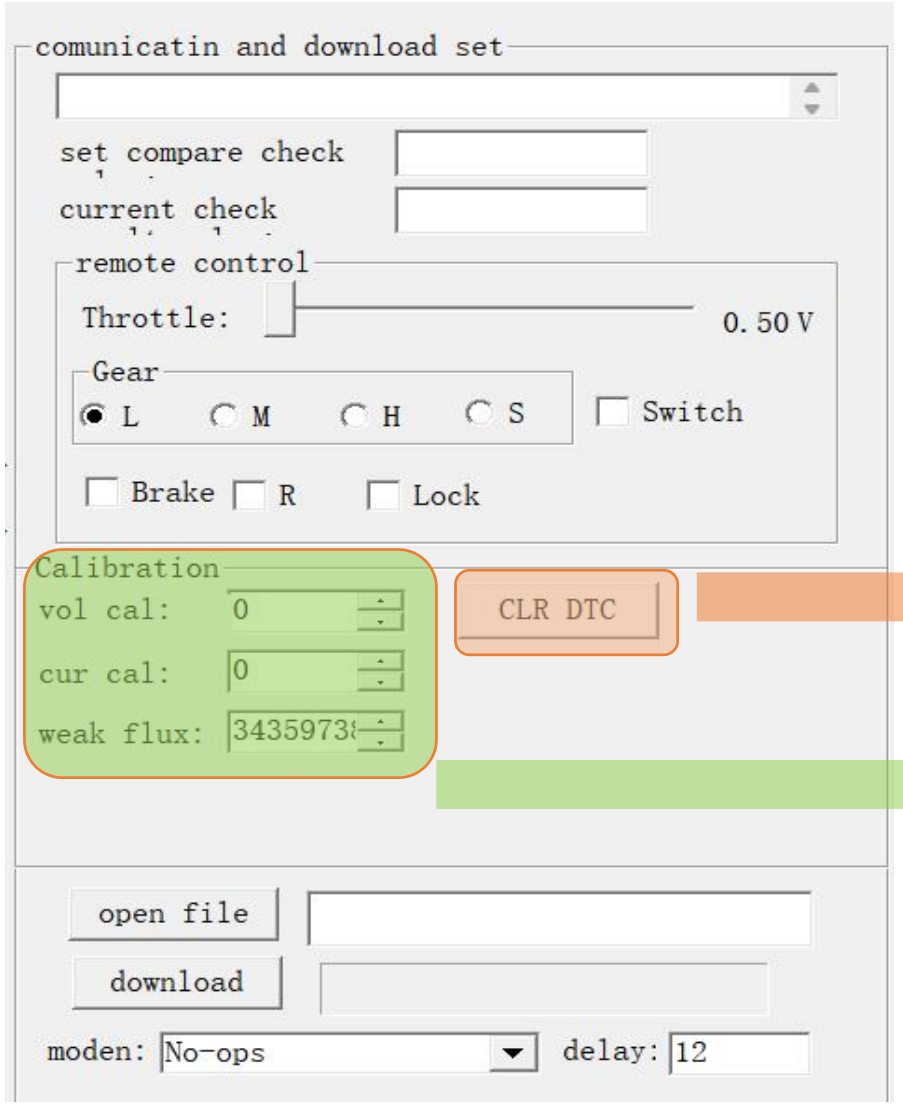
Low speed, Analog handle voltage, high speed, sport speed


Switch: if no select, display speed/voltage/current; If select, display speed/Q-axis voltage/D-axis voltage.


Brake/Reverse/Lock

Open the ECU program file (bin file) or configuration file (ini file)
Download: Import the ECU program file or configuration file into the controller.

# 6 EXPLANDED PAGE



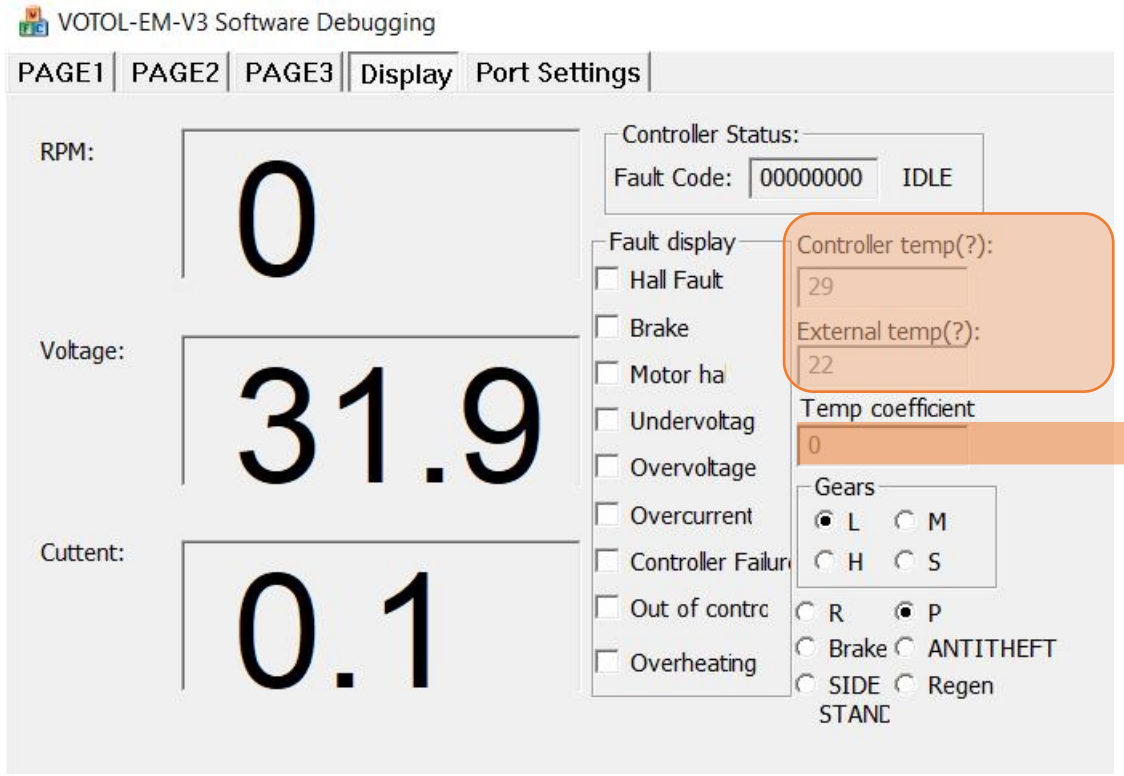

Remove failure

**Calibration values:**

Voltage calibration: adjust whether the displayed voltage is consistent with the actual voltage, no need to change

Current calibration: adjust whether the displayed current is consistent with the actual current, no need to change Weake flux value: adjust D-axis voltage and Q-axis current ,without changing

# 7 SETTING PAGE DISPLAY




For V1 motor:

- When temperature is over 120°C, the controller shut down.
- When temperature less than 100°C, the controller work again.

Display the controller temperature

Display the motor temperature

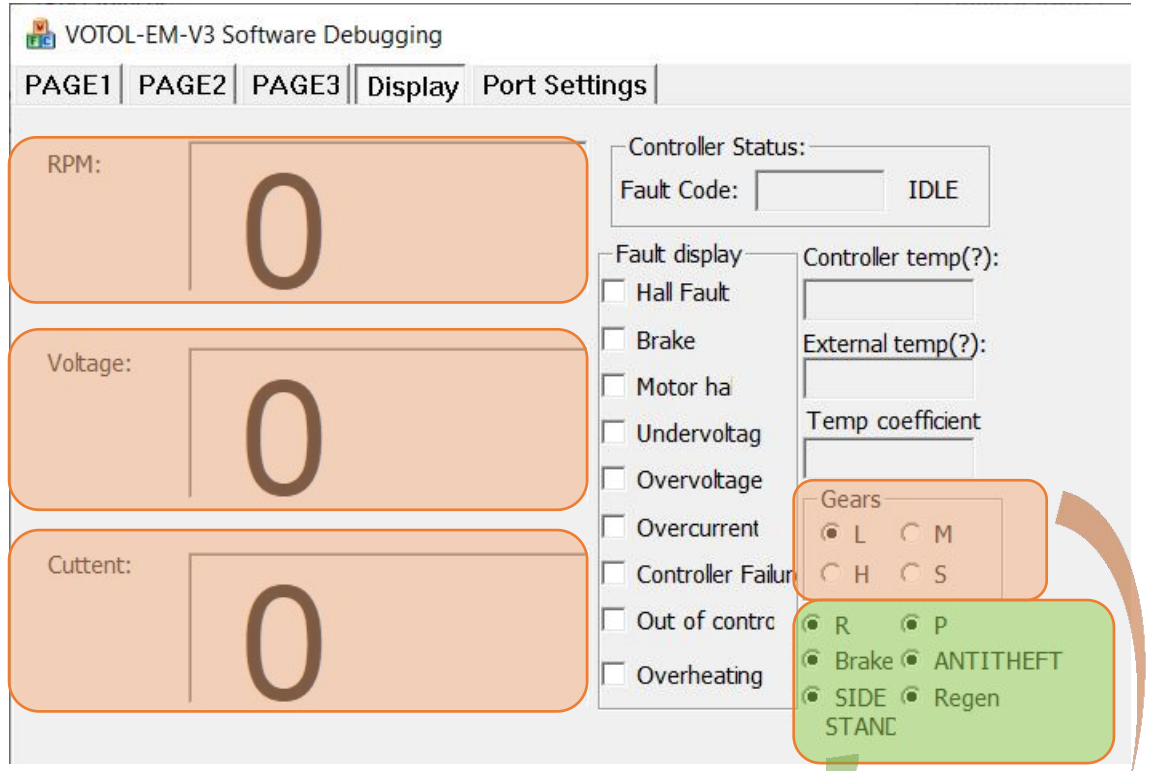
Temperature Coefficient: Displays the controller hardware coefficient

# 7 SETTING PAGE DISPLAY

Shows the value of the rotation rpm of the motor rotor in real time

Shows te value of the supply voltage to the controller in the rear time

Show the current value of the supply to the controller in real time (bus current value)

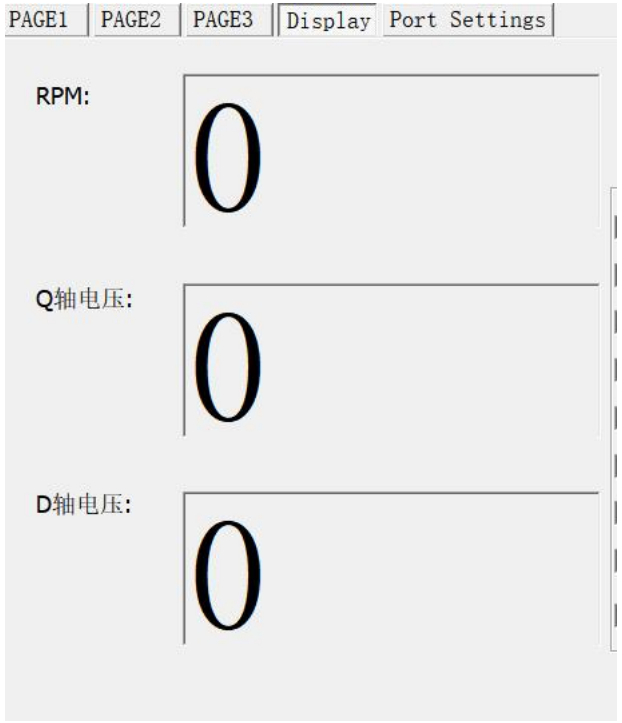



Show the active functions on the motor:

- R = Reversa / Reverse
- B = Frenando / Brake
- Side Stanc = Modo Sport / Sport Mode
- P = Posición Parking / Parking Position
- ANTI THEFT
- R = Regeneración / Regeneration

Shows the current gear mode

# 7 SETTING PAGE DISPLAY

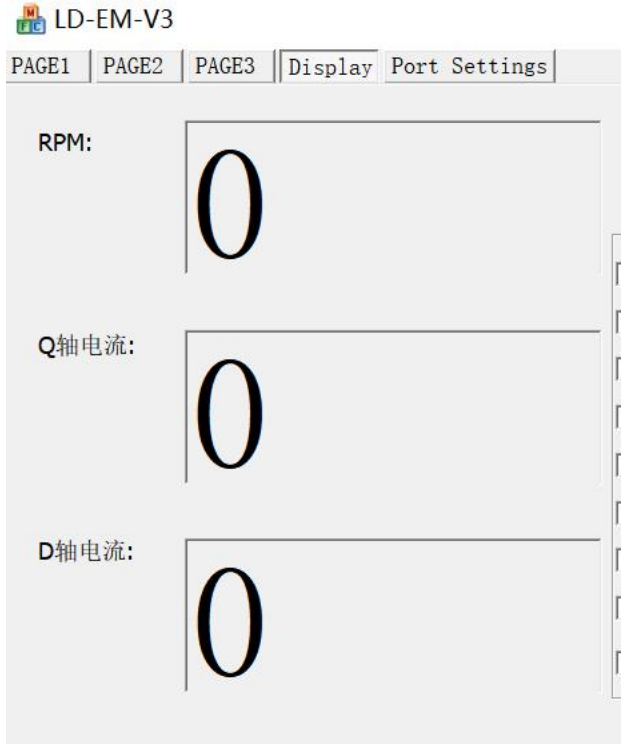



Q-axis voltage: the range is 2000-3000 when the motor angle is correct

D-axis voltage: the range is -600 to -1000 when the motor angle is correct (may fluctuate slightly)

After the weakening flux is adjusted to the final speed, adjust the D-axis voltage by adjusting the value of the weakening flux coefficient, the normal range is 0 to -300.

# 7 SETTING PAGE DISPLAY




Q-axis current: Phase current limit corresponds to page 1.

After the weakening flux is adjusted to the final speed, adjust the Q-axis current i current by adjusting the value of the weakening flux coefficient, the normal range is 100 to 200.

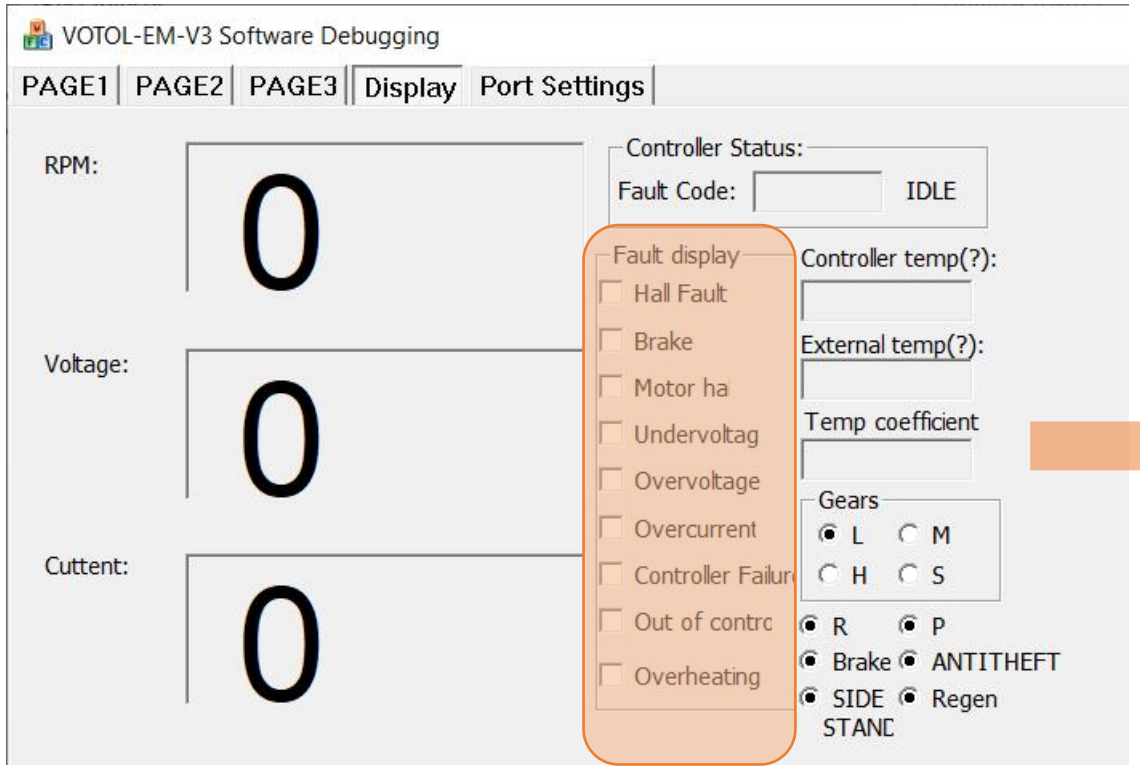
D-axis current: corresponds to the desired weakening flux value at the current speed.

If it is close to 0, weakening flux is not required for the current speed.

If with 500, the current speed needs 500 weakening flux to reach.

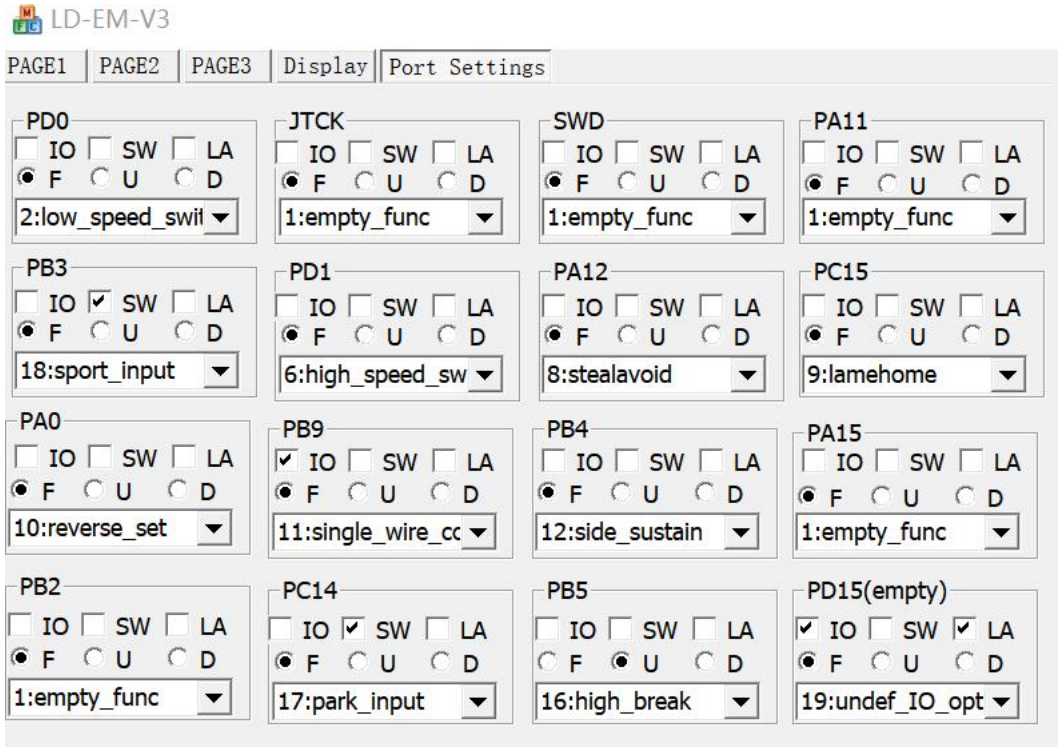
NOTE: The weakening flux value corresponds to the weakening flux value for the corresponding gear on page 2 of settings.

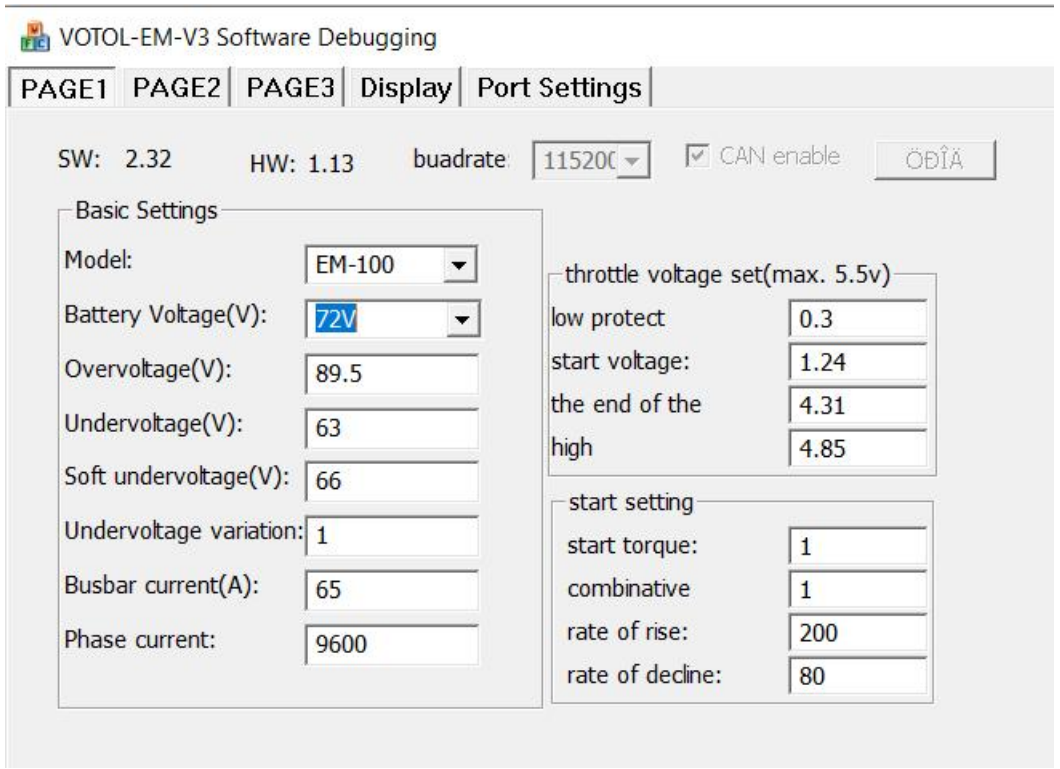
# 7 SETTING PAGE DISPLAY




Display the current failure

# 8 PORT SETTING INTERFACE



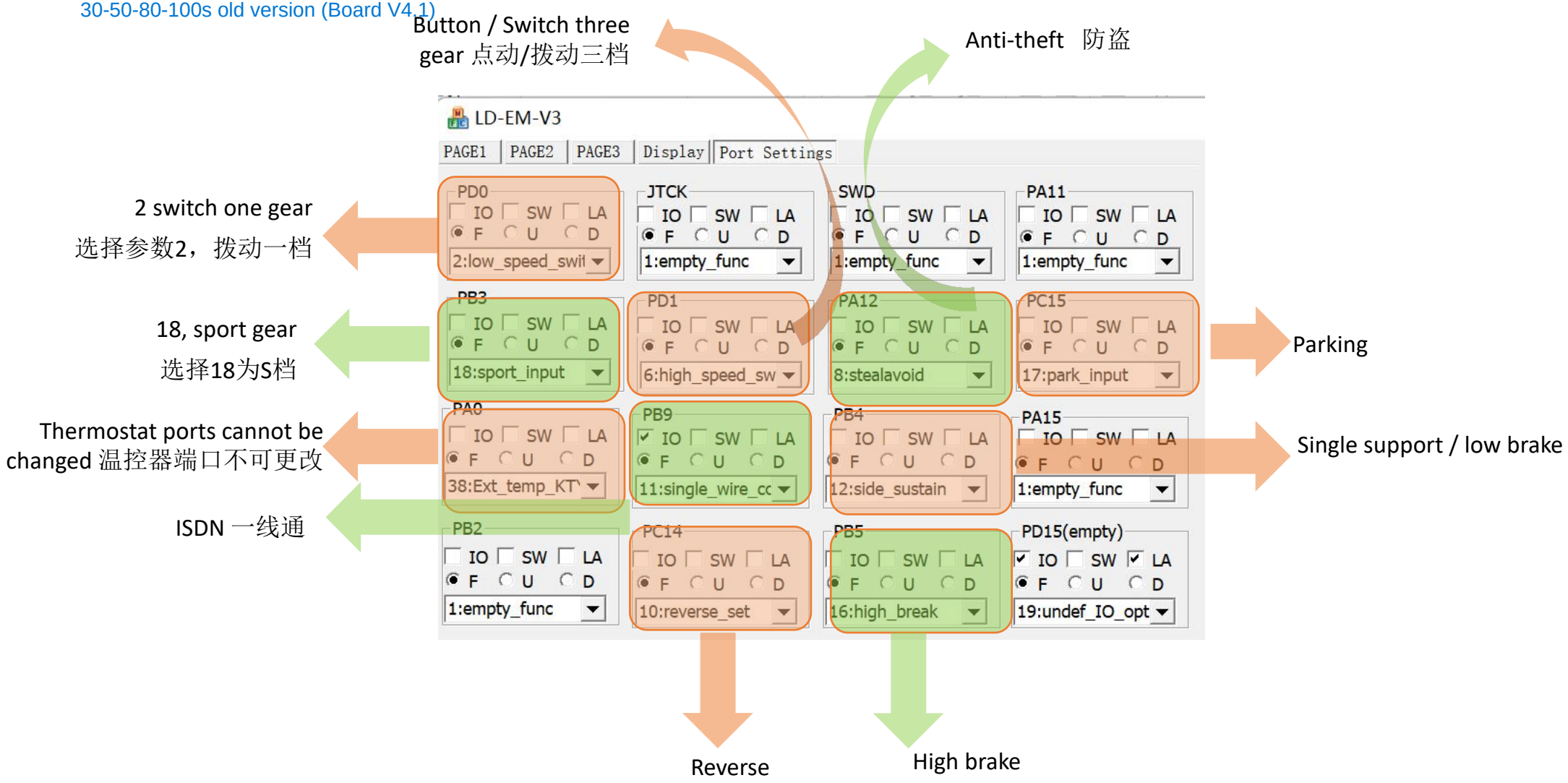



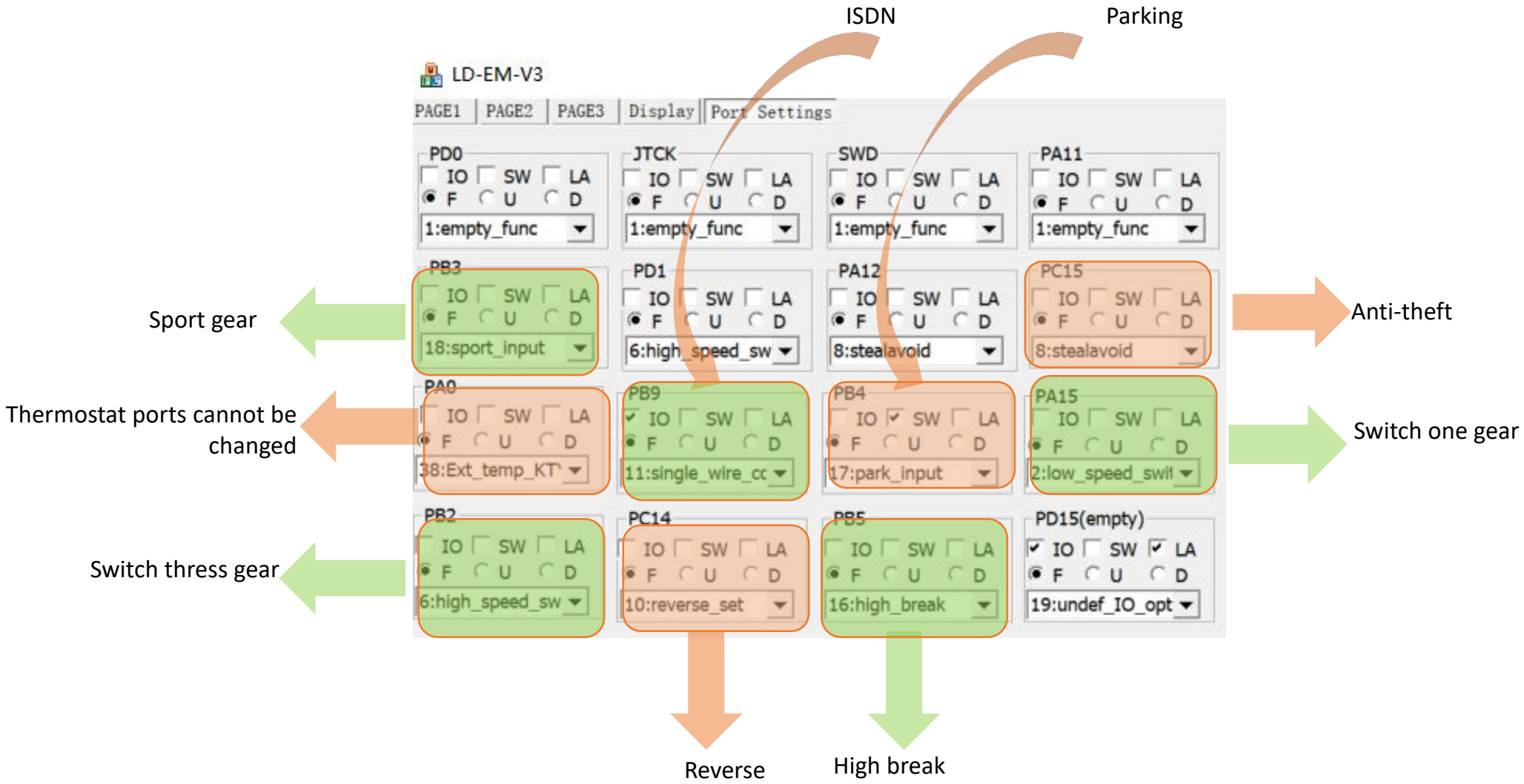

The above port functions are factory default configurations

# 9 PORT SETTING INTERFACE

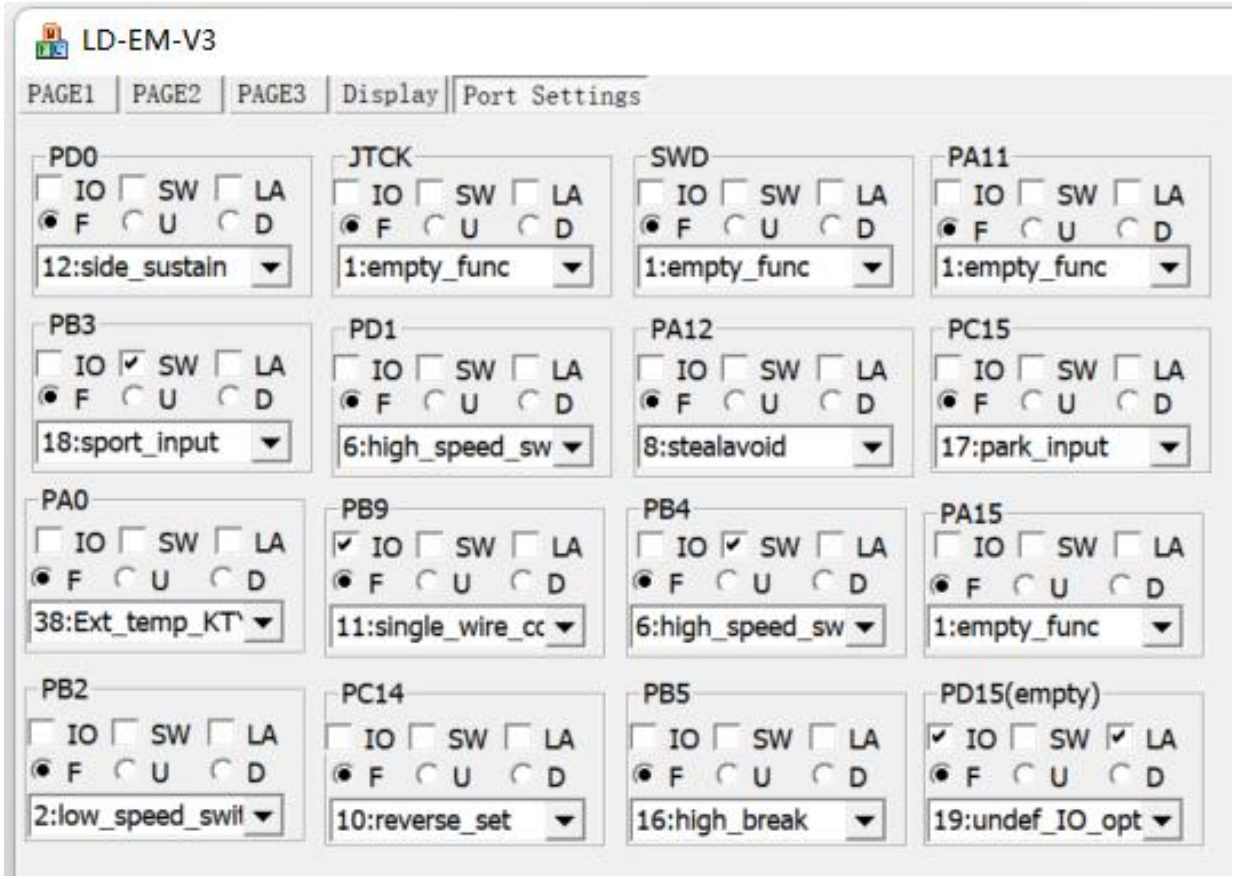
## EM30S EM50 (EM100 no anti-theft) -EM150S（before date 20200320) in common use

30-50-80-100s old version (Board V4.1)

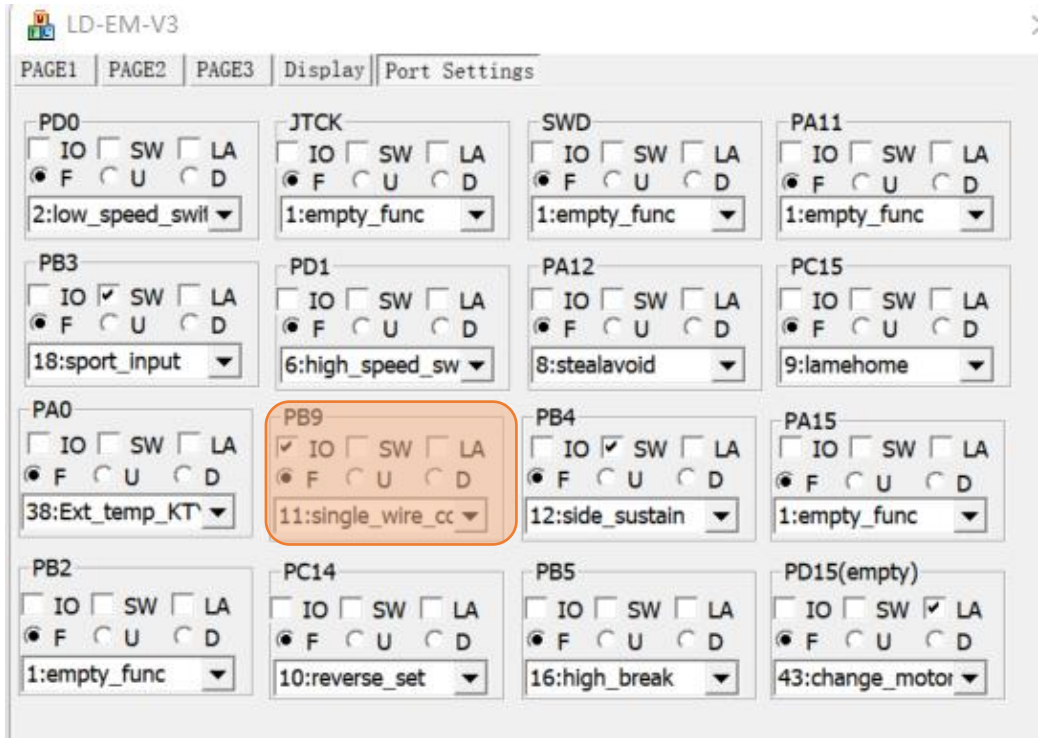


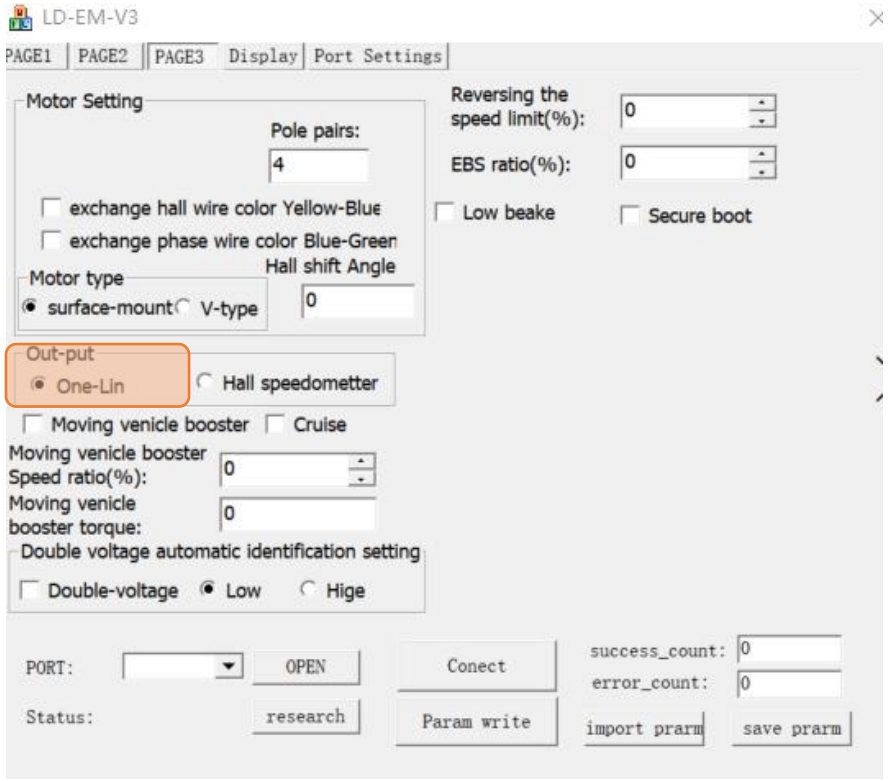

ISDN
Parking
LD-EM-V3
PAGE1
PAGE2
PAGE3
Display
Port Settings
PD0
1:empty_func
JTCK
1:empty_func
SWD
1:empty_func
PA11
1:empty_func
PB3
18:sport_input
PD1
6:high_speed_sw
PA12
8:stealavoid
PC15
8:stealavoid
PA0
38:Ext_temp_KT
PB9
11:single_wire_cc
PB4
17:park_input
PA15
2:low_speed_swit
PB2
6:high_speed_sw
PC14
10:reverse_set
PB5
16:high_break
PD15(empty)
19:undef_IO_opt
Sport gear
Thermostat ports cannot be changed
Switch thress gear
Anti-theft
Switch one gear
Reverse
High break

# PORT SETTING INTERFACE EM150SP (after date 20200321)

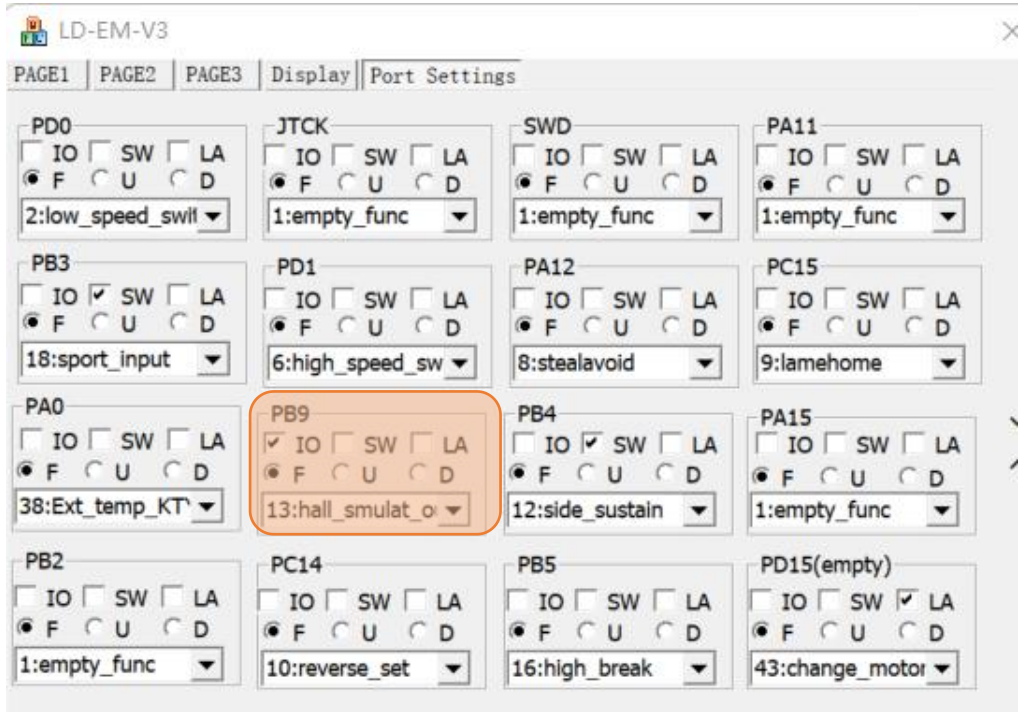


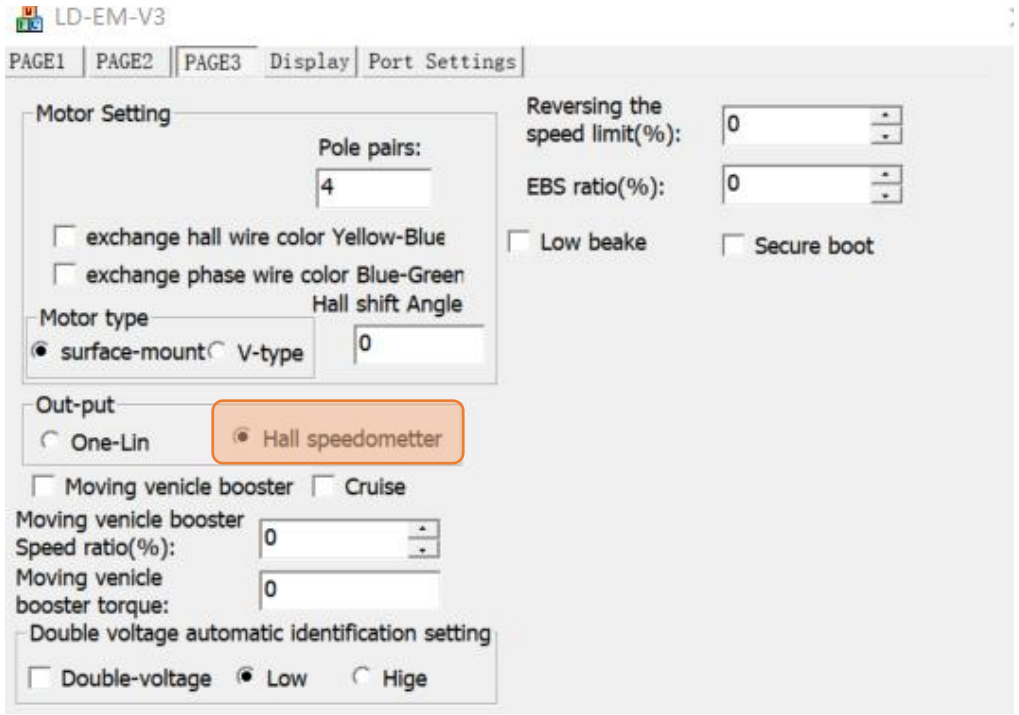
# ISDN (ONE-LINE) SETTING 一线通设置



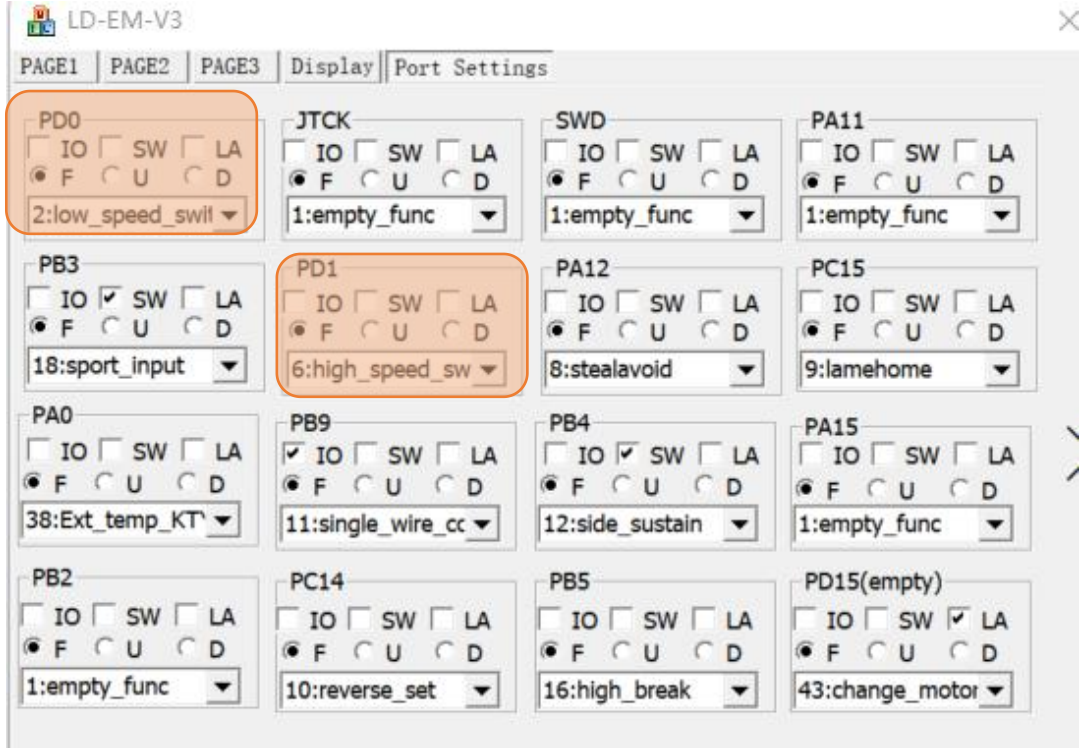
# 13 HALL SETTING 霍尔设置

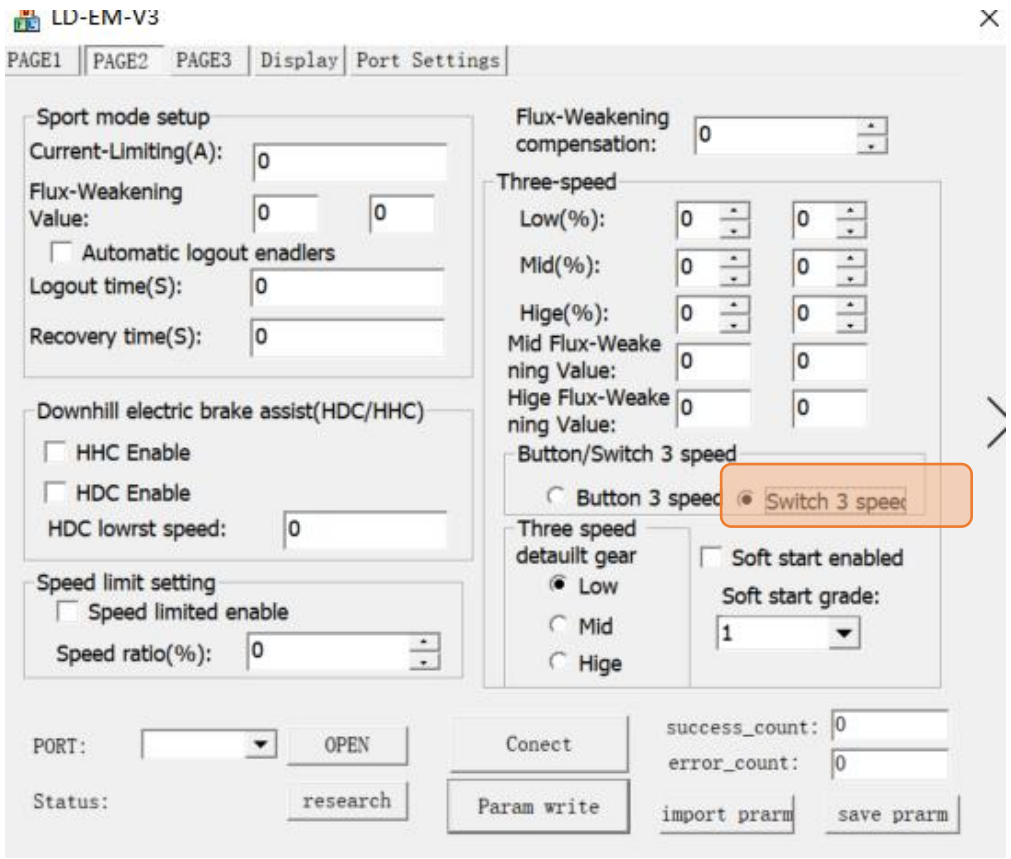


# 14 SWITCH THREE SPEED SETTING 拨动三速设置

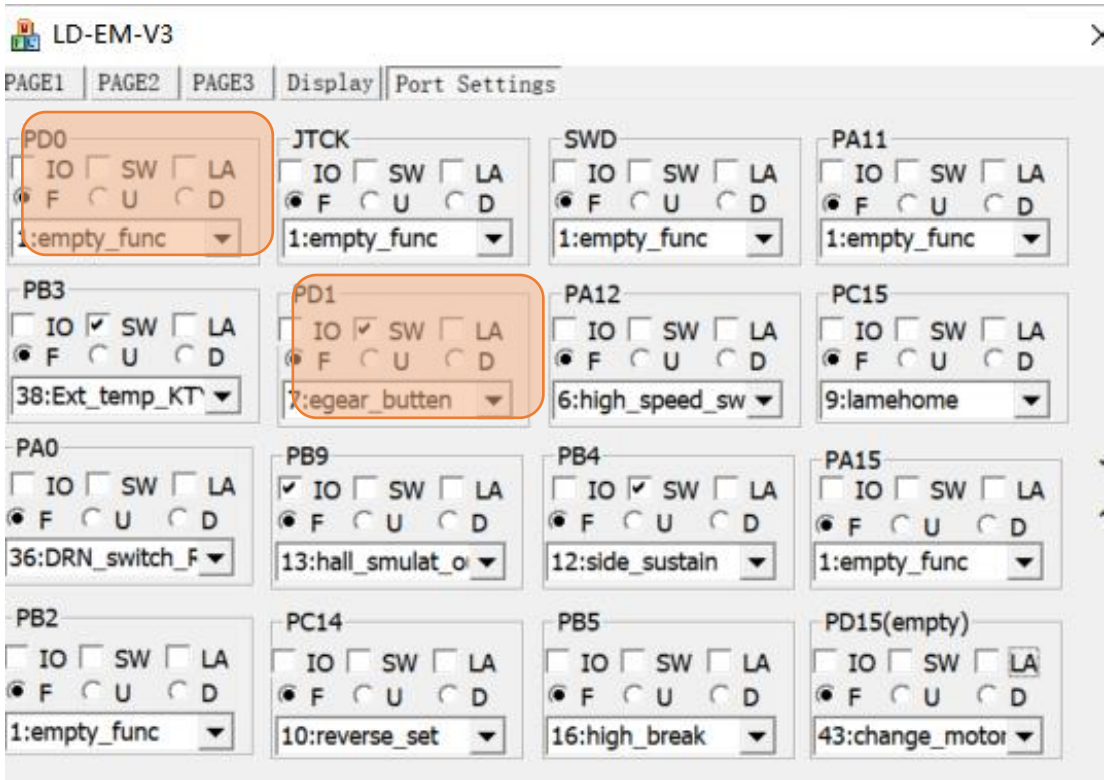
**EM30S EM50 (EM100 no anti-theft) -EM150S (before date 20200320) in common use**

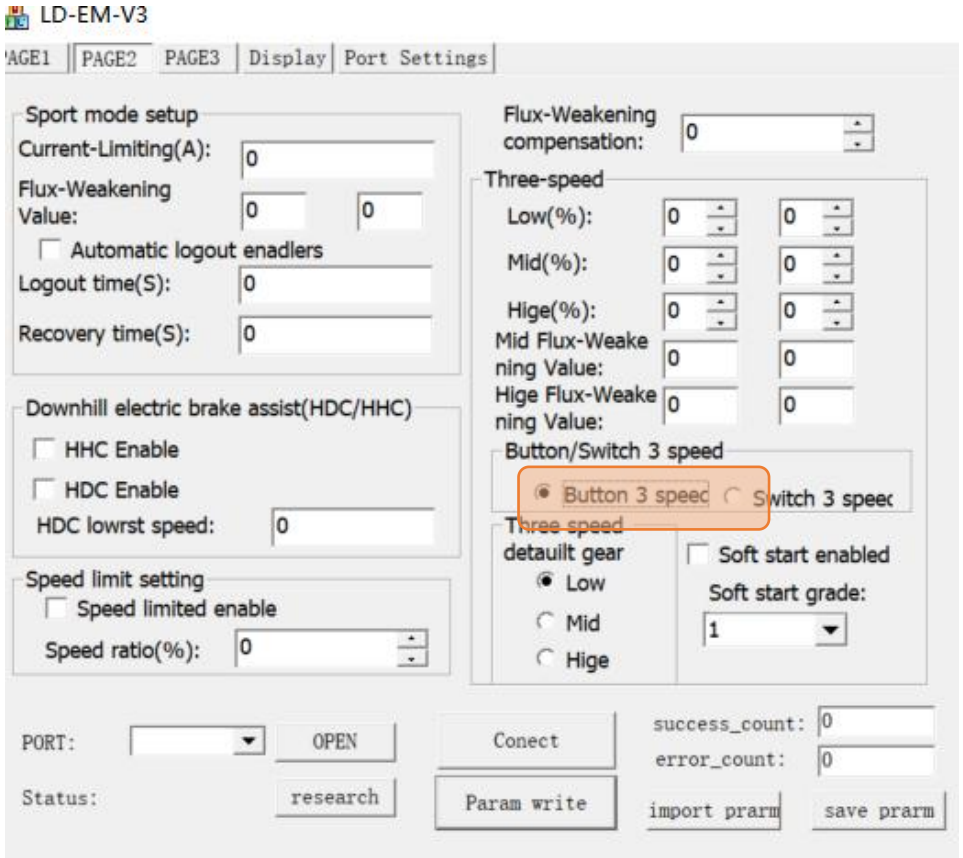


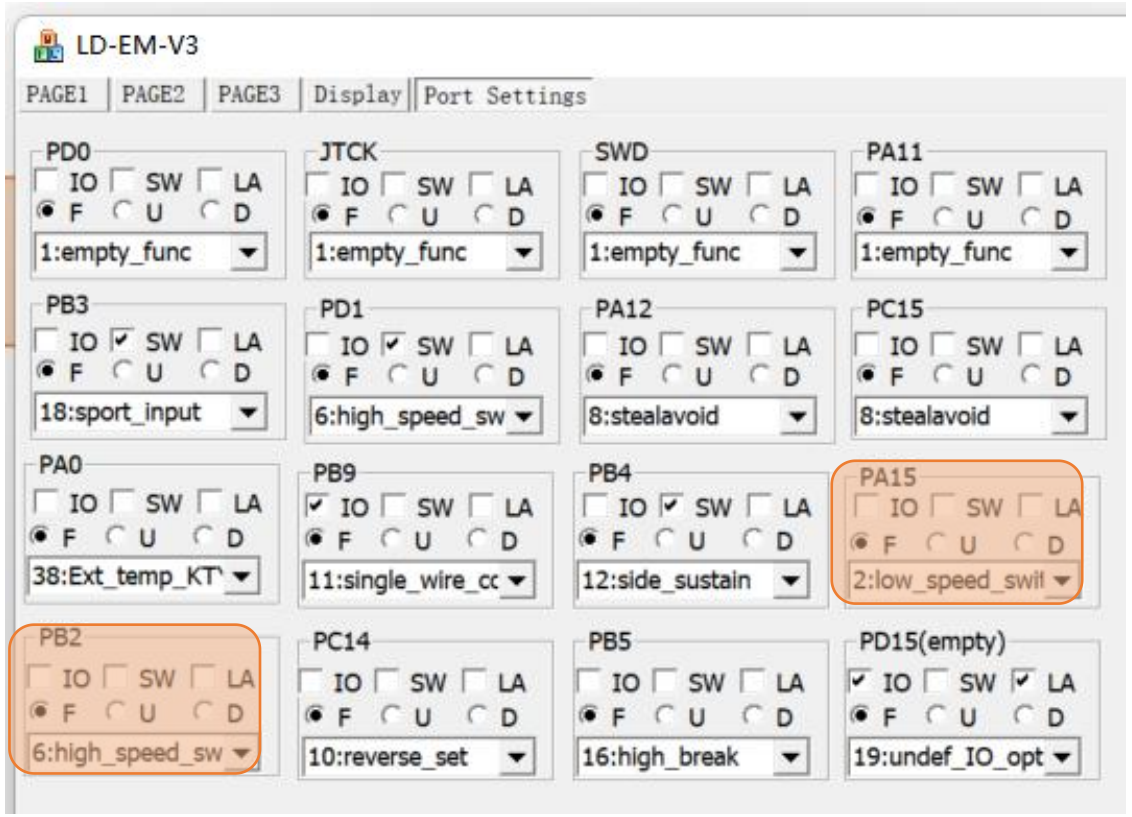
# 15 BUTTON THREE SPEED SETTING 点动三速设置

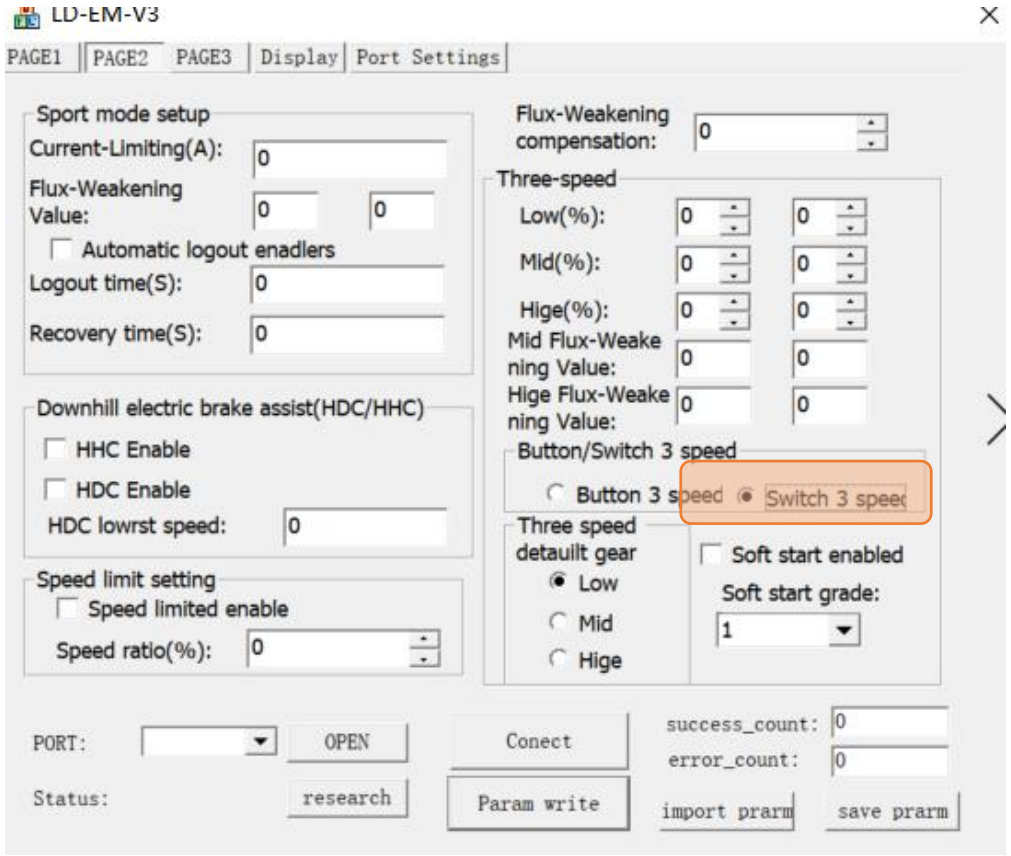
## EM30S EM50 (EM100 no anti-theft) -EM150S (before date 20200320) in common use



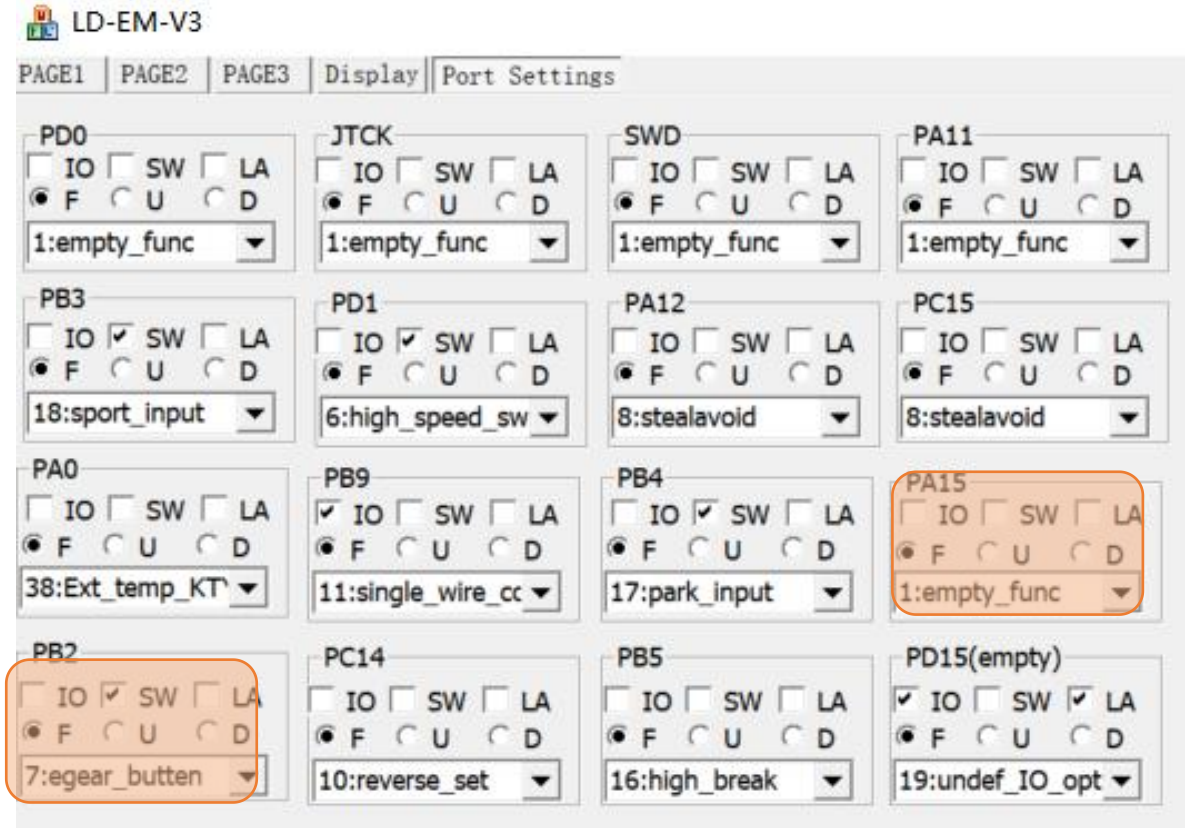



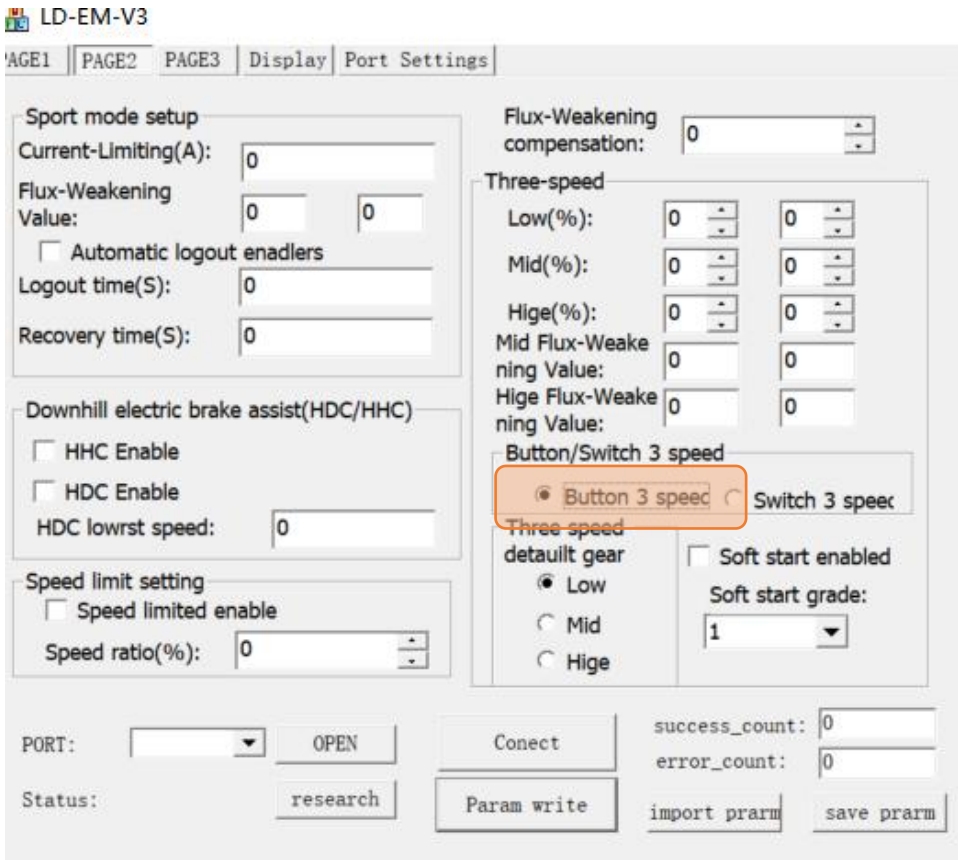
# SWITCH THREE SPEED SETTING 拨动三速设置 EM100 anti-theft 防盗



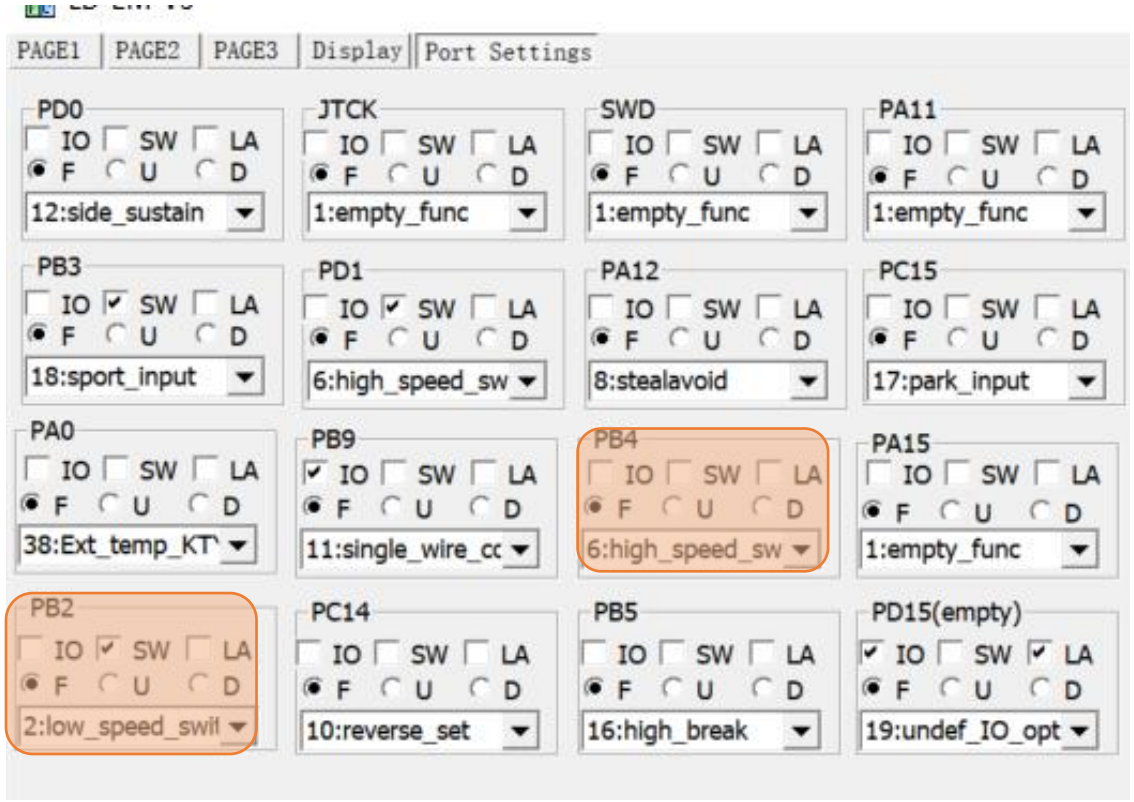
# BUTTON THREE SPEED SETTING 点动三速设置 EM100 anti-theft 防盗

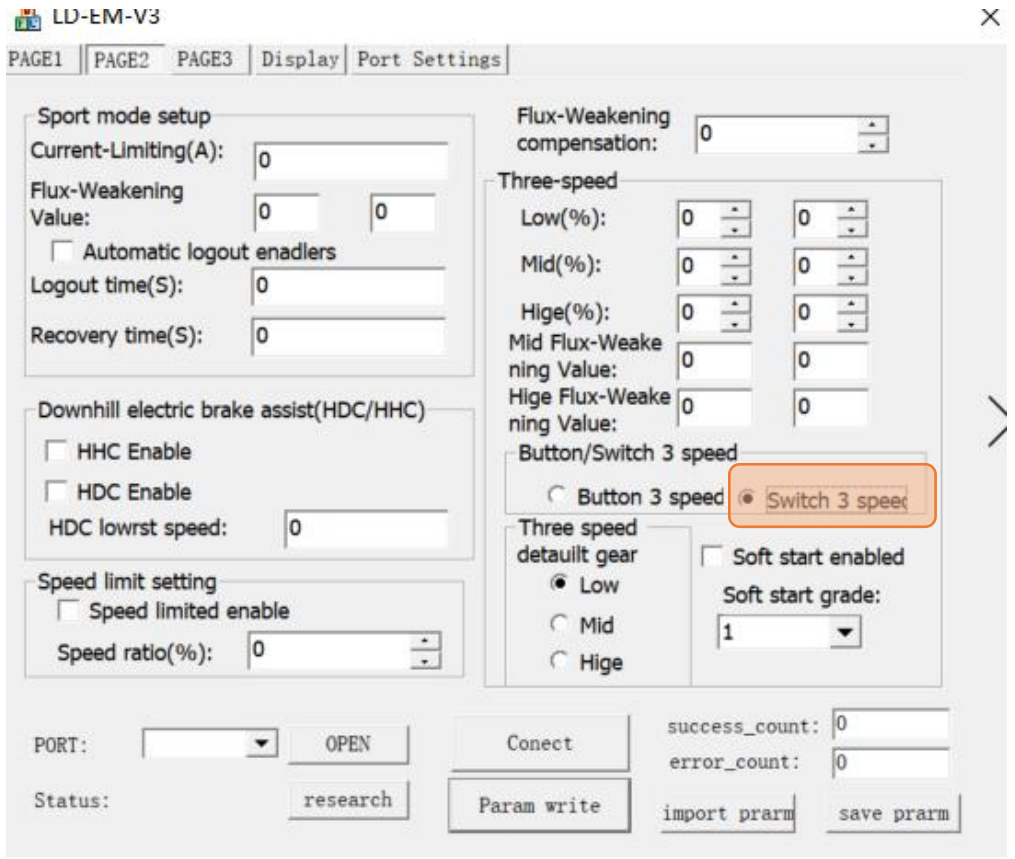


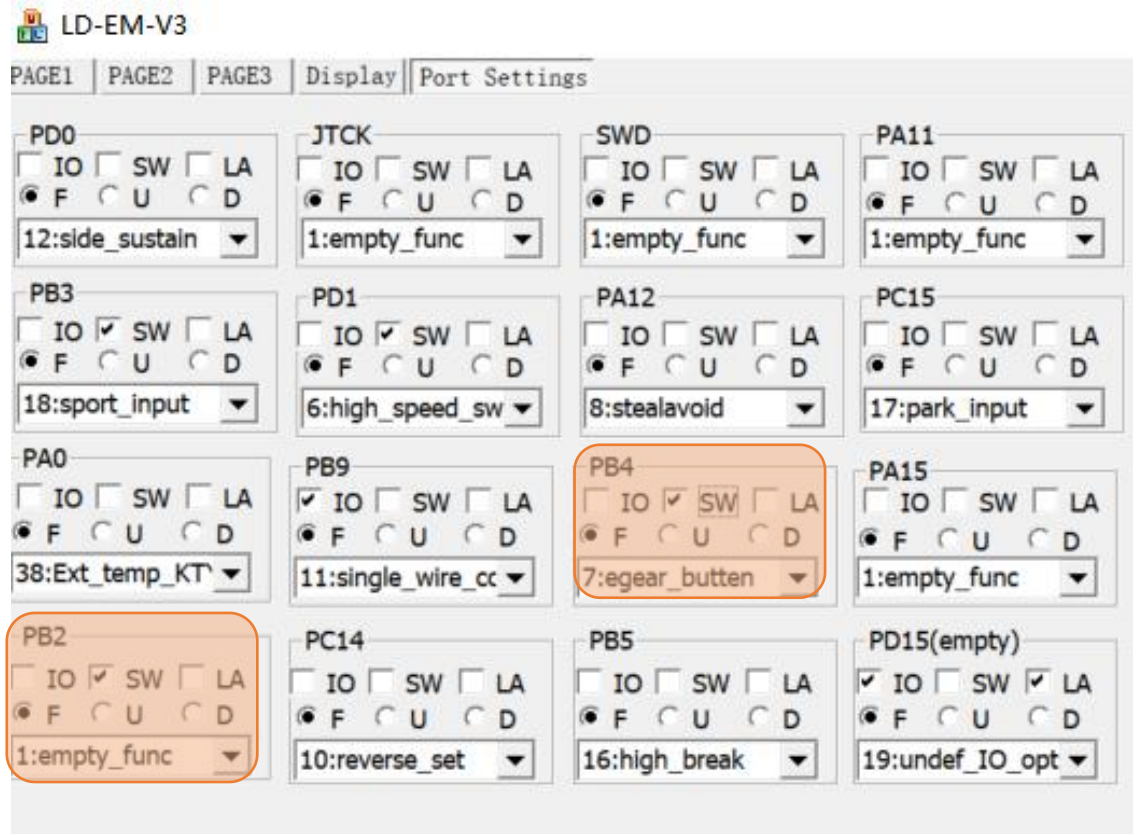
# SWITCH THREE SPEED SETTING 拨动三速设置

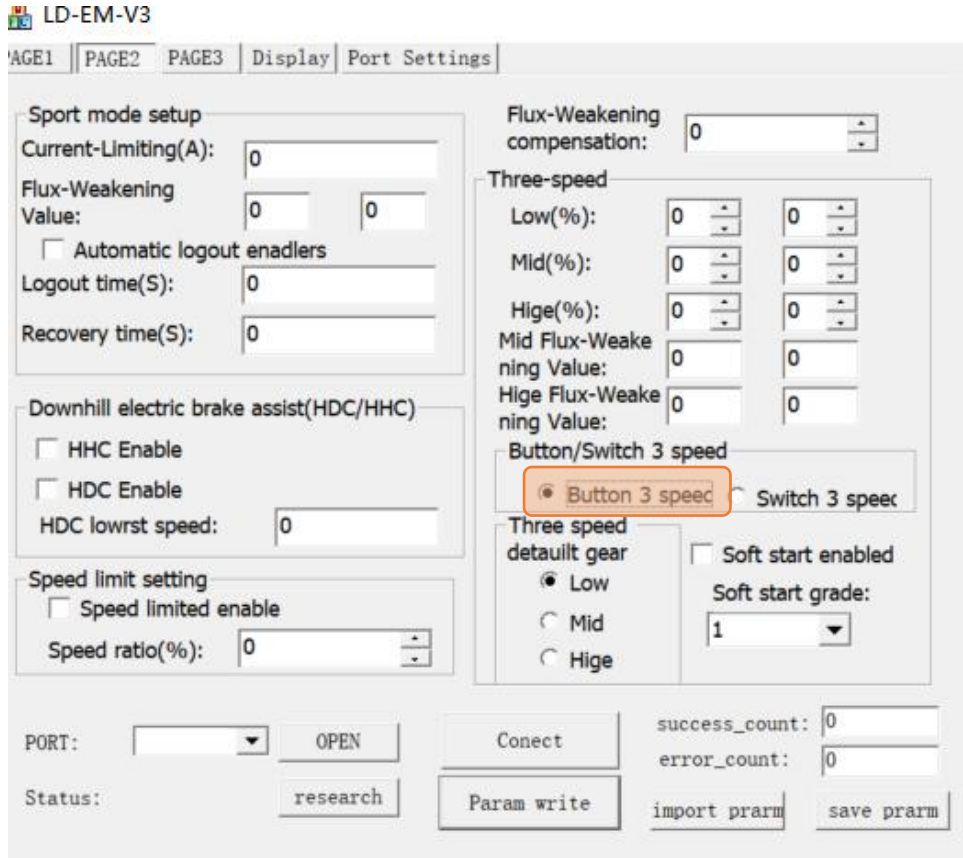
**(EM150SP after date 20200321) in common use**



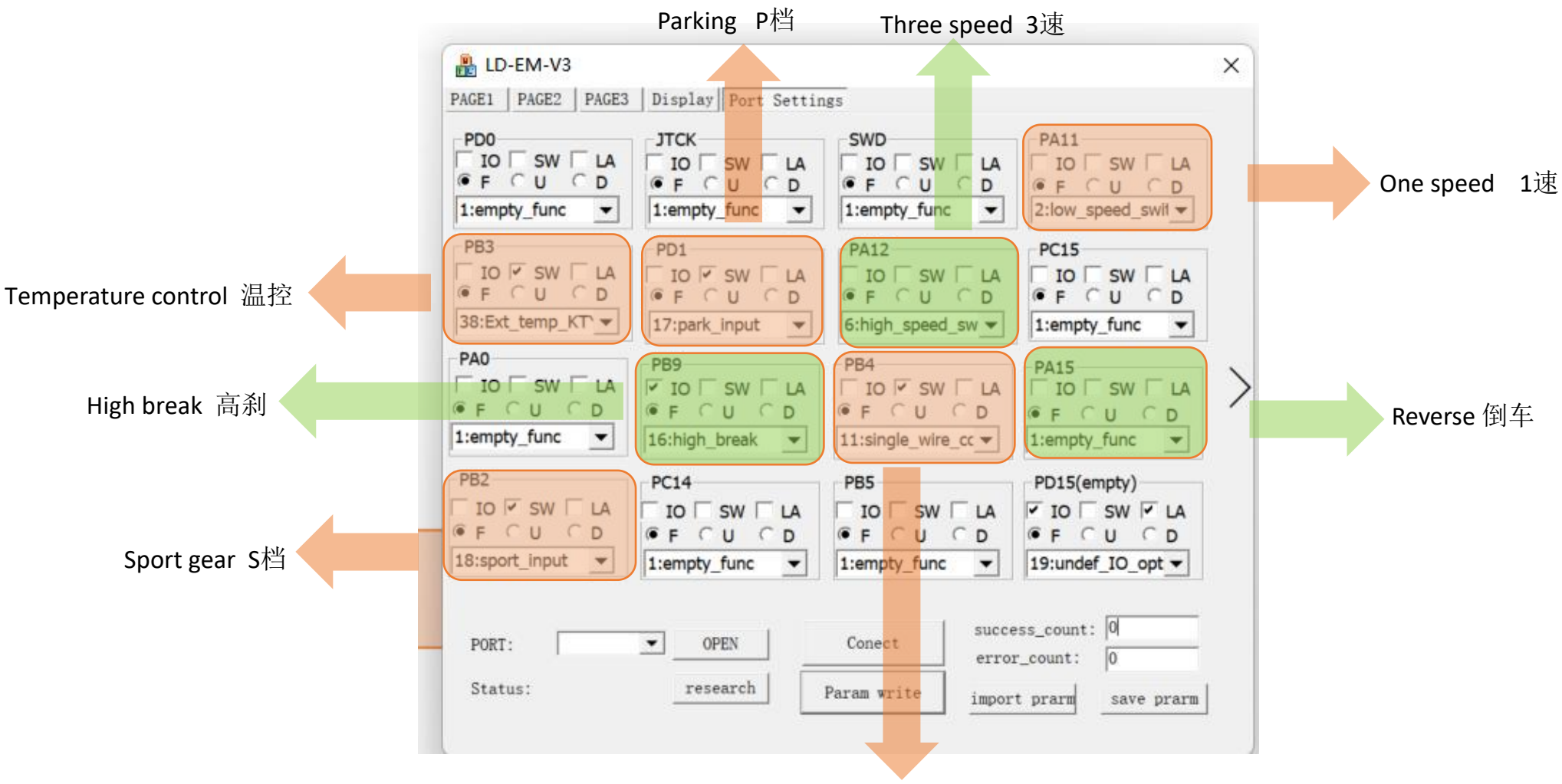
# 19 BUTTON THRESS SPEED SETTING 点动三速设置 (EM150SP after 20200321) in common use



# 20 150-2 200-2 260-2 PORT SETTING 系列控制器端口配置

Car version?, where my side sustain, anti-therf



# Thank you for using

Not

Our document!!