S.P.E. ELETTRONICA INDUSTRIALE

TORO 720

On Board charger

TECHNICAL MANUAL

Version： 00

Release date: 23/08/2023

“Before installing and using the product, please read the manual”

Contents

1. Charger instructions

This manual will introduce the composition. installation, wiring, operation and setting, error display and other contents of AP-P720 series smart on board charger in detail,,

When AP-P720 series smart on board chargers are applied to lead-acid / Lithium batteries, the corresponding charge profile can be selected through Bluetooth to achieve a good charging effect, When applied to lithium batteries, the charging characteristics can be controled through CAN BUS and BMS communication of the battery

1.1 Operation safety instructions

Before starting the operation, please read the operation instructions and precautions carefully to reduce the occurrence of accidents, The "CAUTION, CAUTION, WARNING, DANGER" items in the product and product manual do not

represent all the safety precautions to be followed, but only serve as a supplement to various operational safety precautions, Therefore, the personnel responsible for the installation and operation of this product must be trained and master the correct operation methods and various safety precautions before operating the equipment,

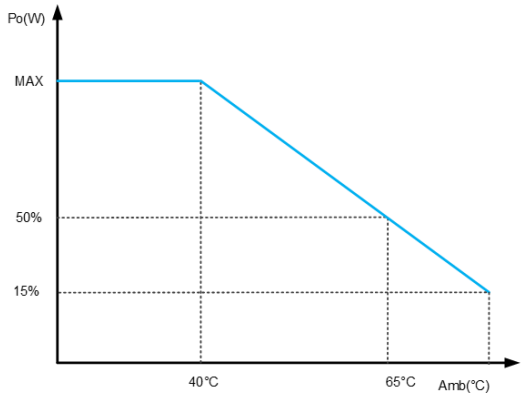
When carrying out various operations of this product, the user must abide by the safety regulations of the relevant industry, and strictly abide by the relevant equipment precautions and special safety instructions provided by the company, The company will not be responsible for any safety problems beyond the original design and manufacture due to violation, If there are other local safety regulations, please follow them together, See Table 1-1 for common usage precautions,

Table 1-1 Safety precautions for operation

⚠ Warning	Ensure that the charger is well grounded before operating the charger to avoid electric shock and endanger personal safety
⚠ Warning	Before connecting the cables, please confirm the polarity and wiring is correct
⚠ Warning	Do not touch uninsulated connectors or terminals
⚠ Warning	Be sure to use special tools when working with dangerous voltages and AC voltage
⚠ Warning	Do not move the charger while it is operating
⚠ Warning	The operator cannot disassemble the faulty internal components of the unit by himself, and must be maintained by professionals
Danger	When the charger is running, there are parts with voltage, Improper direct contact or indirect contact through wet objects will bring the danger of electric shock
⚠ Warning	Do not operate the charger if it has been violently bumped, dropped or damaged in any way

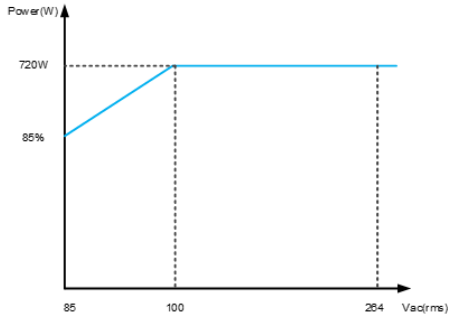
1.2 Operating environment condition

- The altitude does not exceed 3000 meters
- Ambient temperature not higher than +65℃ and not lower than -20℃(if AMB>40℃, the charger start reduce output power)
- Ambient humidity: 0% ~ 95% RH without condensation
- Non-explosive hazard environment
- No oil stains, water stains and places that are prone to condensation
- Do not charge frozen or non-rechargeable batteries
- Keep the environment ventilated (when charging lead-acid batteries)

Item	Specifications	Remark
Operating temperature		1. Test at Vin=100Vac / 24V or 48V output (depending on the model)

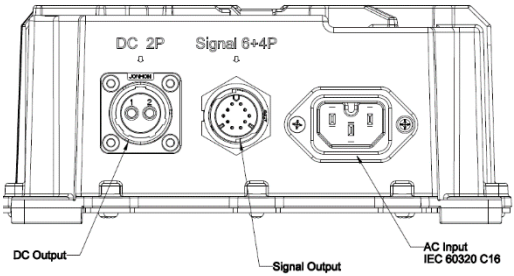
1.3 Charger feature

- Allows wide range of input voltage variation (100Vac~240Vac, if Vin<100Vac, charger reduce output power)
- Resonant soft switching technology to improve charge efficiency；
- Adopt active power factor correction；
- Support online program update
- Bluetooth APP can be used to set charging profile and charging current
- Lithium battery BMS can control charger voltage and current through CAN BUS

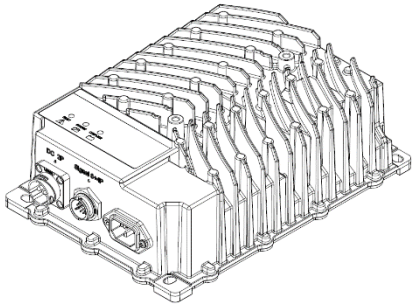
Item	Specifications	Remark
AC power de-rating		Test at Full Power output (24V or 48V) / AMB=25°C

2. Product introduction

2.1 General overview

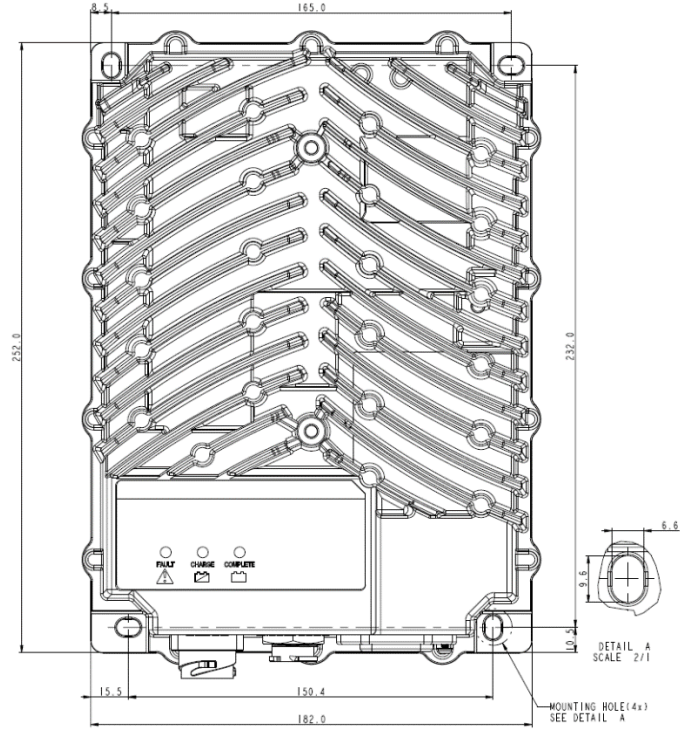


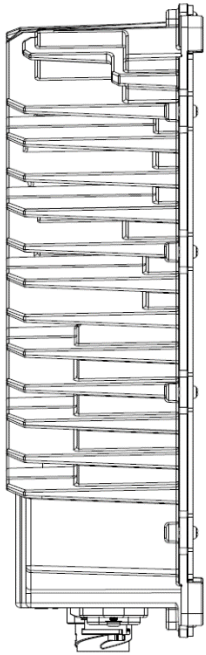
Front View



ISO View

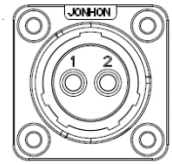
2.2 Installation dimension and mounting hole locations



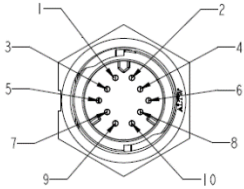


2.3 Interface definition

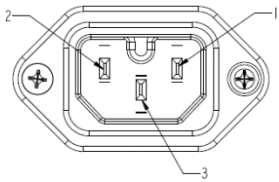
Part name	Male connector	Mating connector
AC input	IEC 60320 C16 inlet	IEC 60320 C15 certified AC power Cord Wire size: 18 AWG min
DC output	JONHON ICA-BY20F series 2pins	JONHON ICA-BY20T Wire size: 10 AWG min
Signal output	Amphenol X-Lok C Size series CD-10PMMS 10pins	Amphenol X-Lok C Size series CD10AFFM Wire size: 20 AWG



DC Output	
1	Battery+
2	Battery-



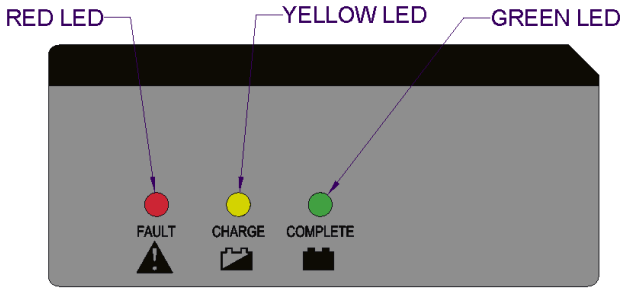
Signal Output	
1	LED 1A
3	LED 3A
5	LED 5A
7	Ground
2	Temp+
4	Temp-
6	CANH
8	CANL
9	Interlock+
10	Interlock-



AC Input IEC60320 C16	
1	Line
2	Natural
3	FG

3. Operating Instructions

3.1 LED marking and identification



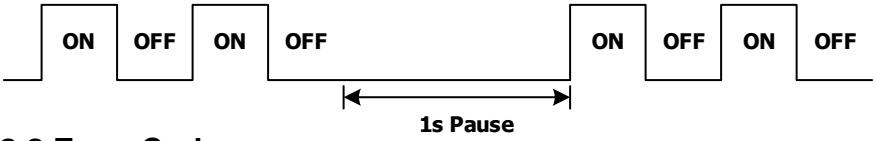
Normal state

No,	LED	status
1,	R/G/Y LEDs on	Standby
2,	Yellow LED Blinking	Battery charging
3	Green LED on	charge finished or Balance/Equilizing charge

Error state

No,	LED	Status
1	Red LED blinking 1 time and Pause 1 second	No Battery
2	Red LED blinking 2 time and Pause 1 second	Battery reverse
3	Red LED blinking 3 time and Pause 1 second	Output voltage error
4	Red LED blinking 4 time and Pause 1 second	Over current
5	Red LED blinking 5 time and Pause 1 second	Timeout error
6	Red LED blinking 6 time and Pause 1 second	LLC
7	Red LED blinking 7 time and Pause 1 second	OTP
8	Red LED blinking 8 time and Pause 1 second	Low input voltage
9	Red LED blinking 9 time and Pause 1 second	PFC voltage error

Example: Battery reverse



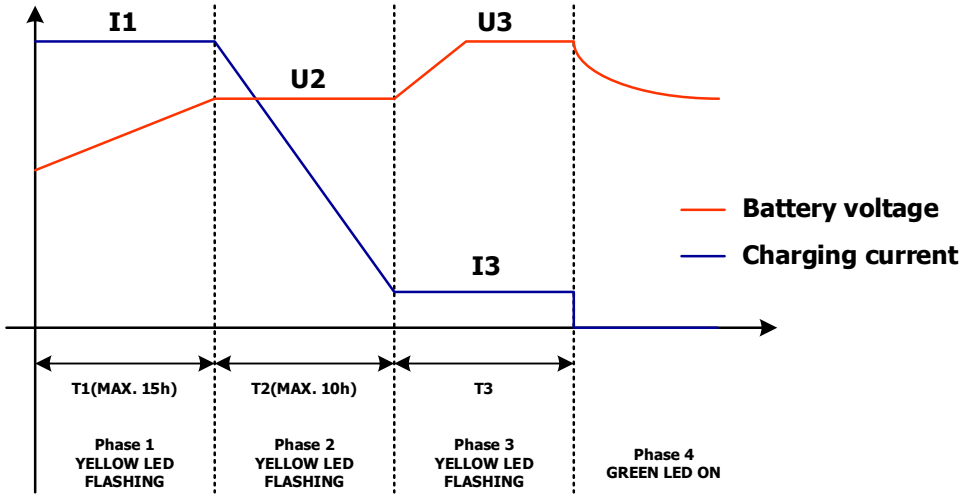
3.2 Error Code

Index:0x32C1
Subindex:0x07

CAN Open code	Error Description
1	extra voltage
2	thermostate
3	timer overflow
4	timer overflow phase I
5	timer overflow phase U
6	dV/dt error
7	dI/dt error
8	*reserved*
9	Security timer overflow
10	mosfet open
11	open circuit
12	power module fault
13	thermal sensor fault(battery)
14	thermal sensor fault(control board)
15	*reserved*
16	RPDOs error

3.3 Charging profile

3.3.1 Battery type: IUIa WET 12h



The charging current can switch between different current commands after selecting the battery type via Bluetooth

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I3[A]	2,3	3,0	3,8	4,5

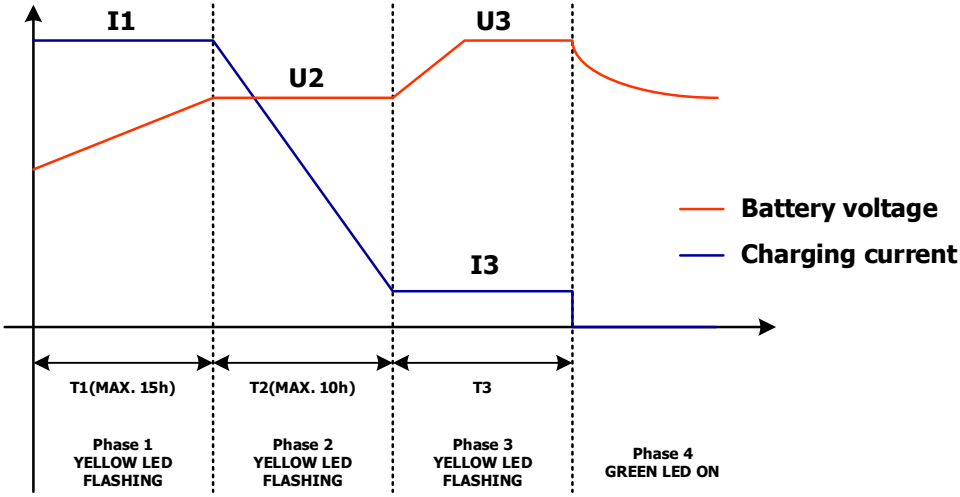
Charging voltage

model>	24V	48V
U2[V]	28,8	57,6
U3[V]	31,8	63,6

The charging time limit T3 changes with the T1+T2

T1+T2[h]	<1	2	3	>3
T3[h]	1	2	3	3

3.3.2 Battery type: IUIa WET 8h



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I3[A]	1,9	2,5	3,1	3,8

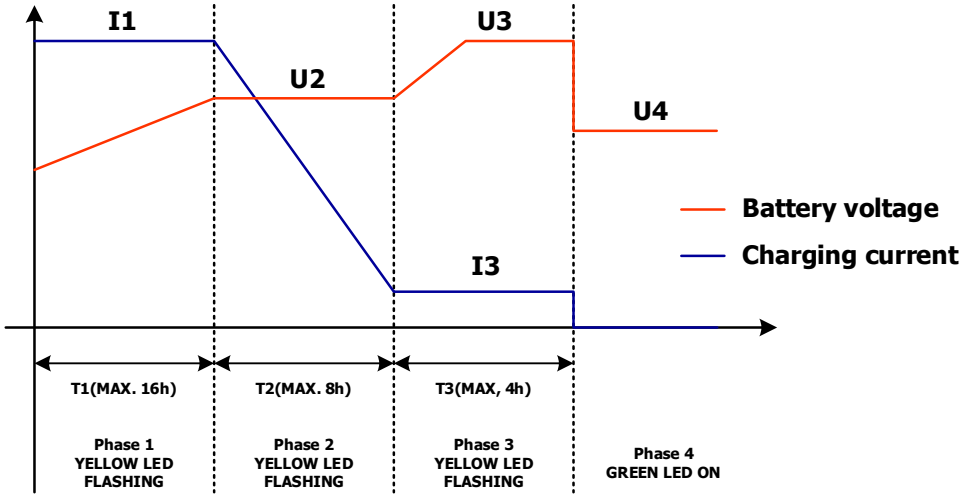
Charging voltage

	24V	48V
U2[V]	28,8	57,6
U3[V]	31,8	63,6

The charging time limit T3 changes with the T1+T2 ,

T1+T2[h]	<1	2	3	>3
T3[h]	1	2	3	3

3.3.3 Battery type: IUIU0 AGM Discover



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I3[A]	1,2	1,6	2,0	2,4

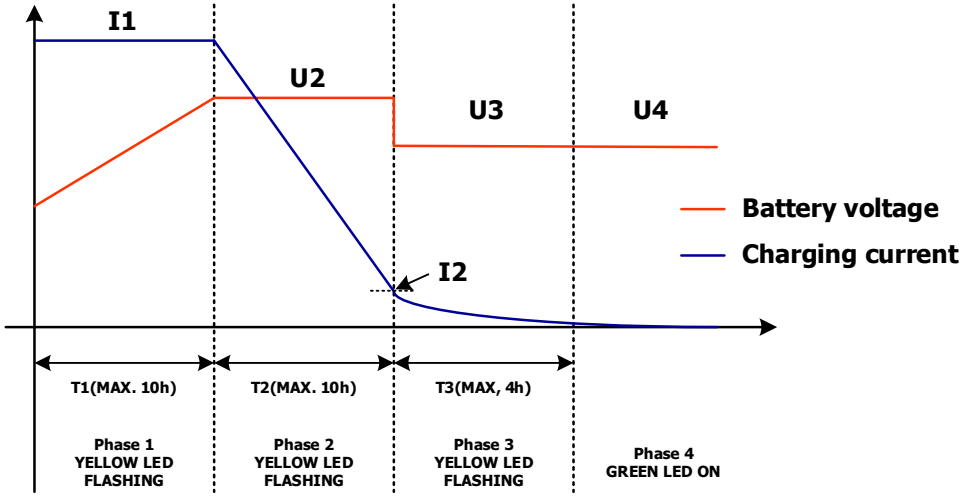
Charging voltage

	24V	48V
U2[V]	28,8	57,6
U3[V]	31,2	62,4
U4[V]	27,2	54,4

The charging time limit T3 changes with the T1+T2 ,

T1+T2[h]	<1	2	3	>4
T3[h]	1	2	3	4

3.3.4 Battery type: IU0U AGM Generic



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I3[A]	1,2	1,6	2,0	2,4

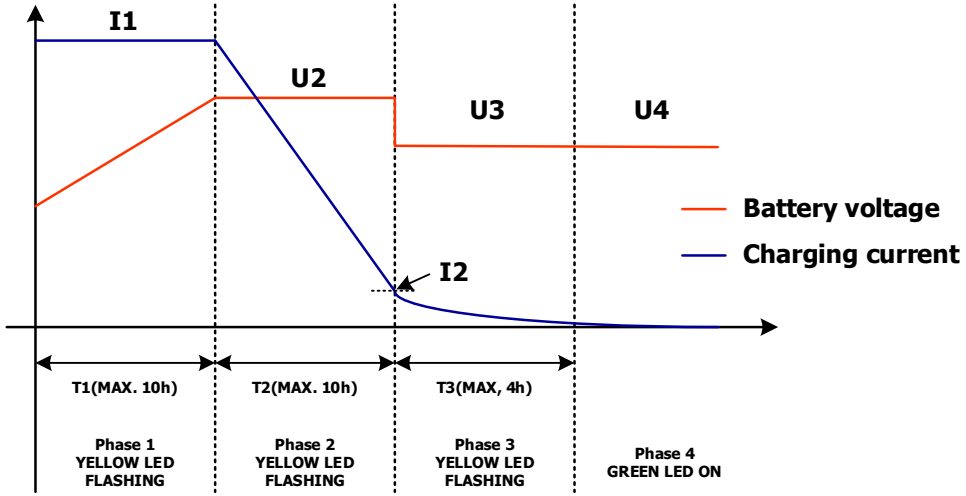
Charging voltage

Model>	24V	48V
U2[V]	29,4	58,8
U3[V]	27,6	55,2
U4[V]	27,6	55,2

Charging time limit,

T{1]	+T2[h]	T3[h]
10h	10h	4h

3.3.5 Battery type: IUU0 AGM FULLRIVER



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I3[A]	1,2	1,6	2,0	2,4

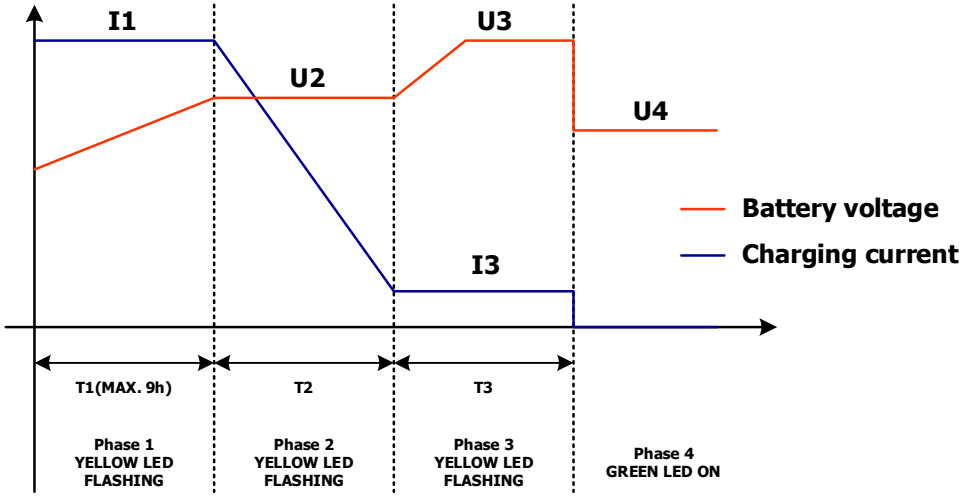
Charging voltage

Model>	24V	48V
U2[V]	29,8	59,6
U3[V]	27,6	55,2
U4[V]	27,6	55,2

Charging time limit

T[1]	+T2[h]	T3[h]
10h	10h	4h

3.3.6 Battery type: IUIa GEL



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I3[A]	0,6	0,8	1,0	1,2

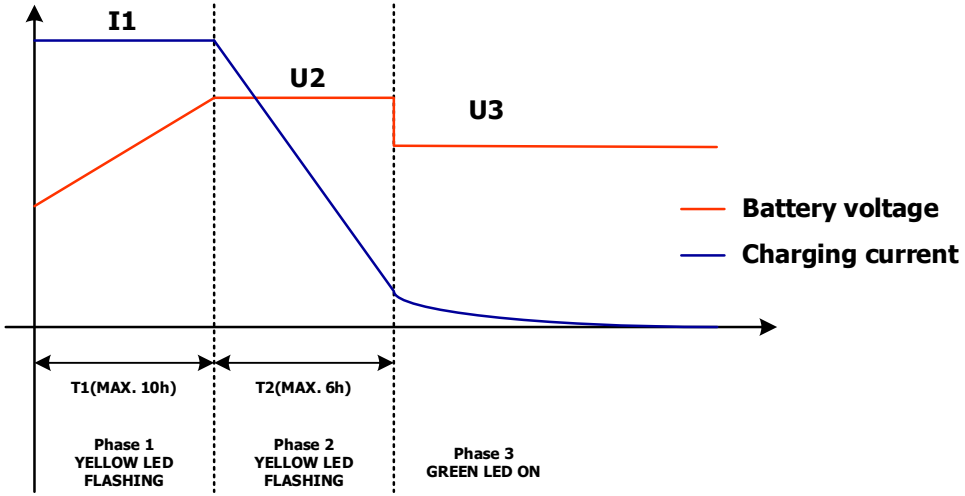
Charging voltage

Model>	24V	48V
U2[V]	28,2	56,4
U3[V]	32,4	64,8
U4[V]	27,6	55,2

The charging time limit T3 changes with the T1+T2 ,

T1+T2[h]	<1	2	3	4	>4
T3[h]	1	2	3	4	4

3.3.7 Battery type: IU0U Zenith



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15

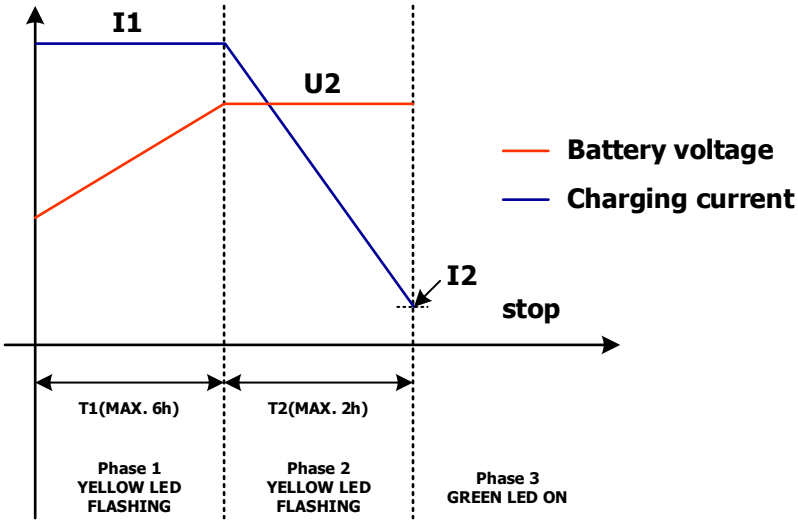
Charging voltage

Model>	24V	48V
U2[V]	29,2	58,4
U3[V]	27	54

The charging time limit T2 changes with the T1,

T1[h]	<=2	3	4	5	>=6
T2[h]	2	3	4	5	6

3.3.8 Battery type: Lithium Relion



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I2[A]	0,5	0,75	0,75	1

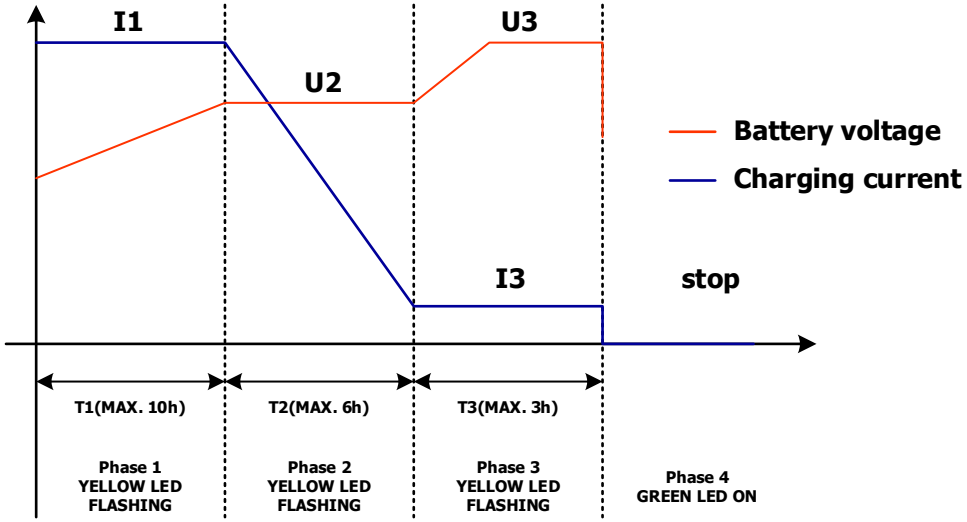
Charging voltage

Model>	24V	48V
U2[V]	28	56

Charging time limit

T1[h]	T2[h]
6	2

3.3.9 Battery type: IUIa AGM Trojan



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I3[A]	1,4	1,8	2,25	2,7

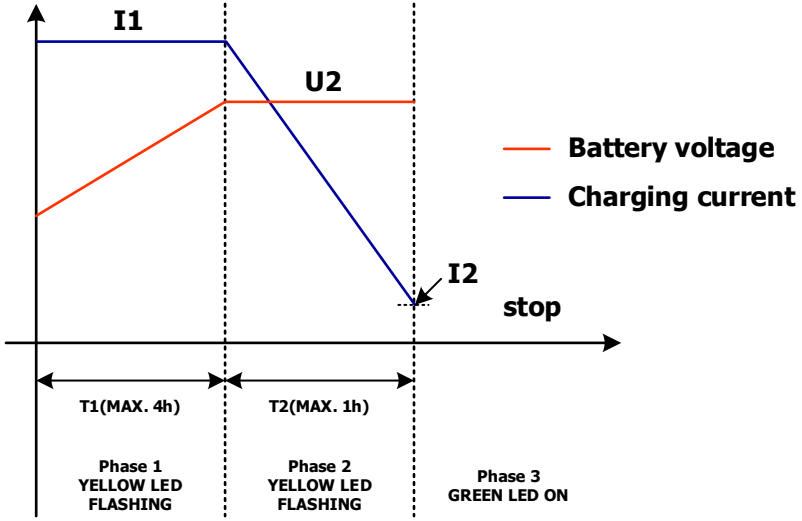
Charging voltage

Model>	24V	48V
U2[V]	28,7	57,4
U3[V]	32,4	64,8

Charging time limit

T[1]	T2[h]	T3[h]	T1+T2+T3[h]
10h	6h	3h	16h

3.3.10 Battery type: Trojan Trillium



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
I1[A]	7,5	10	12,5	15
I2[A]	0,4	0,5	0,6	0,8

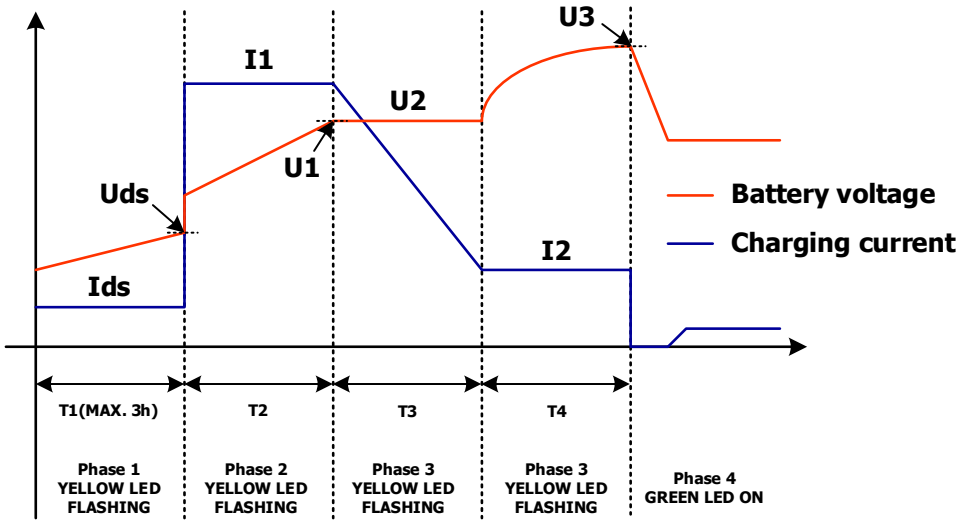
Charging voltage

Model>	24V	48V
U2[V]	29,2	58,4

Charging time limit

T1[h]	T2[h]
4	1

3.3.11 Battery type: AGM Hoppecke



The charging current can switch between different current commands after selecting the battery type via Bluetooth,

No	1	2	3	4
Ids[A]	0,5	0,66	0,825	1,0
I1[A]	7,5	10	12,5	15
I2[A]	0,8	1,07	1,34	1,6

Charging voltage

Model>	24V	48V
Uds[V]	22,8	45,6
U1[V]	28,8	57,6
U2[V]	28,8	57,6
U3[V]	27	54

Charging time limit

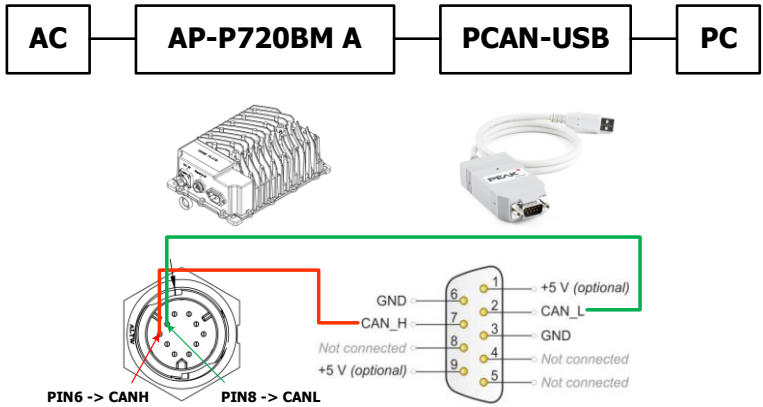
T1[h]	T2+T3[h]	T1+T2+T3[h]
3h	8h	12h

The charging time limit T4 changes with the T2+T3 ,

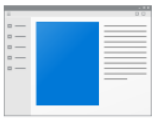
T2+T3[h]	<=4	5	6	7	8
T4[h]	2	2,5	3	3,5	4

3.4 Online program update

Step 1, Hardware connection

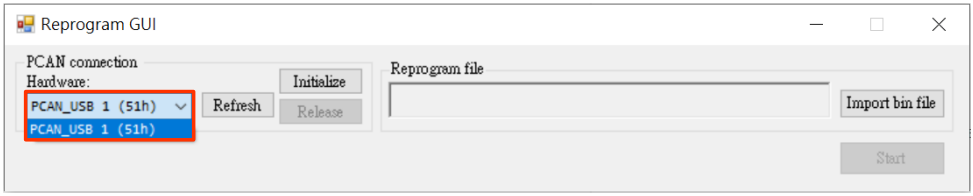


Step 2, Turn on the AC power,
Step 3, Open PCAN_reprogram tool,exe

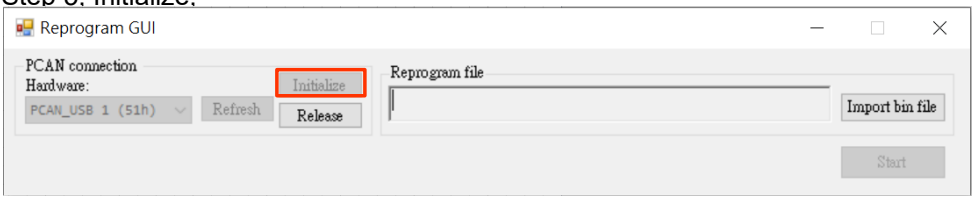


PCAN_reprogra
m tool.exe

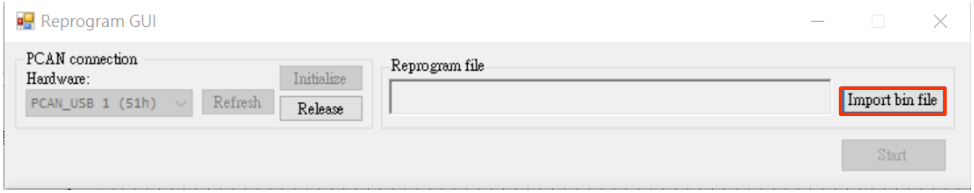
Step 4, Select PCAN_USB for hardware connection



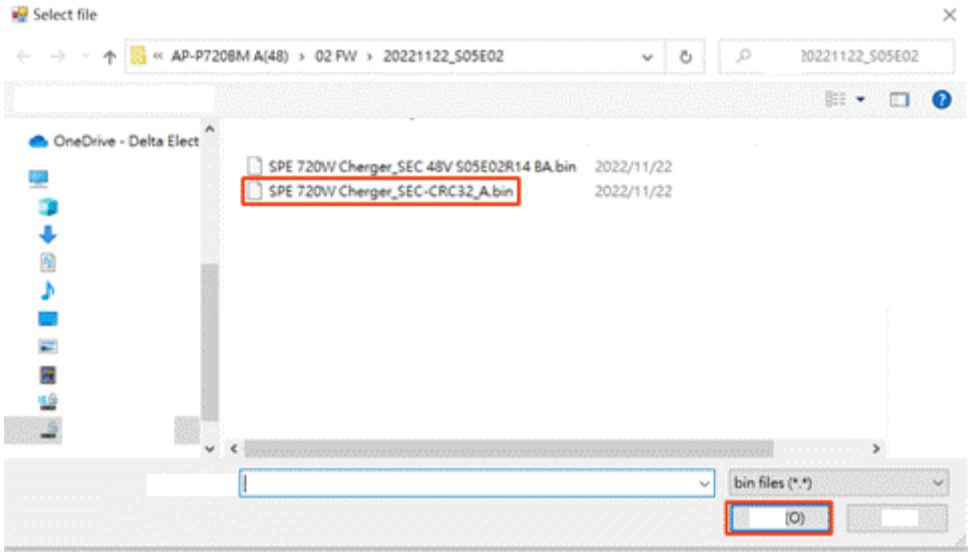
Step 5, Initialize,



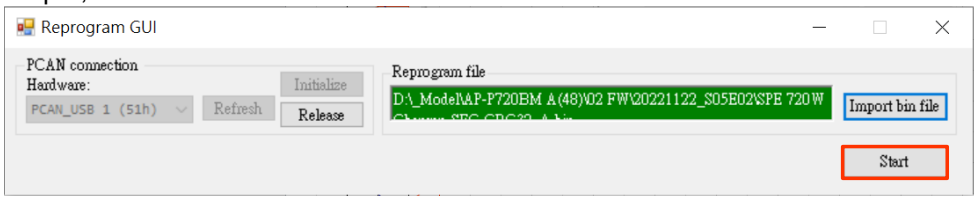
Step 6, Import bin file,



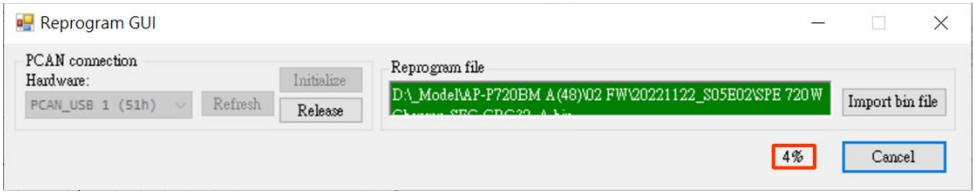
Step 7, Select the bin file to be updated,



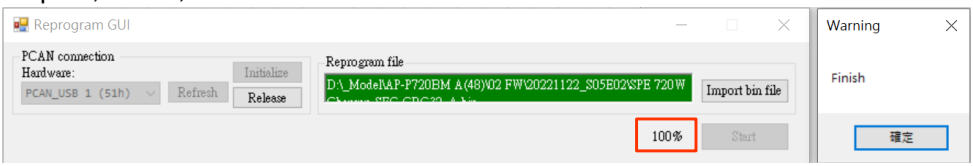
Step 8, Start



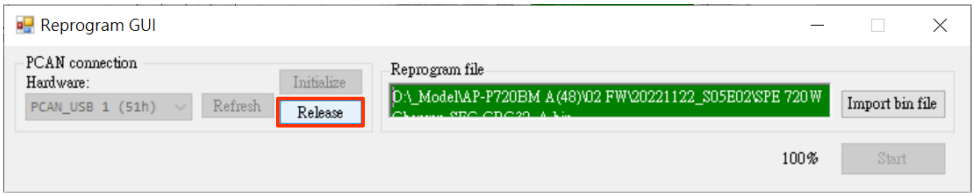
Step 9, Wait 3 to 5 minutes,



Step 10, Finish,

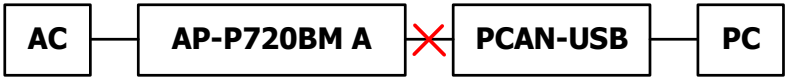


Step 11, Release,



Step 12, Turn off the AC power

Step 13, Disconnect PCAN-USB



Step 14, Turn on the AC power again to charge,