Setting NPB Intelligent Chargers to Automatic charging mode or PSU mode

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MEAN WELL intelligent charger NPB series allows 2 ways of charging control[1] – Automatic charging with pre-programmed charging profile or real time control via CANBus interface. Charging is a process of providing a controlled current within a controlled voltage range from charging devices to batteries. According to battery cells' configuration the charging current and voltage can be different. Further, depends on the chemical-electrical characteristics, the charging setting can be 2-stage or 3-stage. A 2-stage charging starts with a constant current charging phase followed by a constant voltage phase. A 3-stage charging profile extends the constant voltage charging phase by having a float charging voltage in order to fully charge batteries typically Lead Acid types. Table 1 and Figure 1 shows these commonly used charging control methods.

	Stage 1	Stage 2	Stage 3	Suitable battery
2-stage	Constant current	Constant voltage		Li-ion types
3-stage	Constant current	Boost voltage	Float voltage	Lead acid types

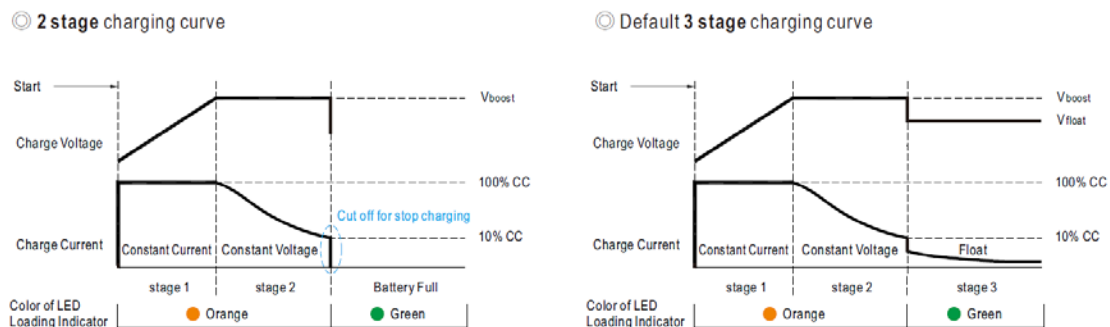Table 1. Typical Charging Stages

Figure 1. Charging Curves of 2 and 3 Stages

To perform the charging processes as above, control logic has to be implemented either inside the charger or in an external battery management system (BMS). This can be done by pre-installing the selected charging profile in an intelligent charger like NPB, so that when the charger detects a battery, it will start the charging process automatically according to the charging profile pre-programmed. Another way is to run the control logic by an external BMS with the help of digital control interface. In

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this scenario, the charger works as a programmable power supply, its output current as well as voltage are controlled by BMS in real time. MEAN WELL NPB intelligent chargers with advanced MCU and CANBus interface can be programmed in either charger mode with automatic charging control or power supply mode that enables external BMS control. Detailed setting procedure is explained below.

Charger Mode (with embedded charging curve)
By default, the NPB series is set to charger mode. The default charging profile is stated in specification and it is programmable by users with smart programmer SBP-001 and MEAN WELL Smart Battery Charging Program Software.

The PC software provides an user-friendly and intuitive graphical interface, simply connecting NPB, SBP and PC with USB and accessory cable of SBP. The NPB charging curve can be programmed according to the battery requirement.
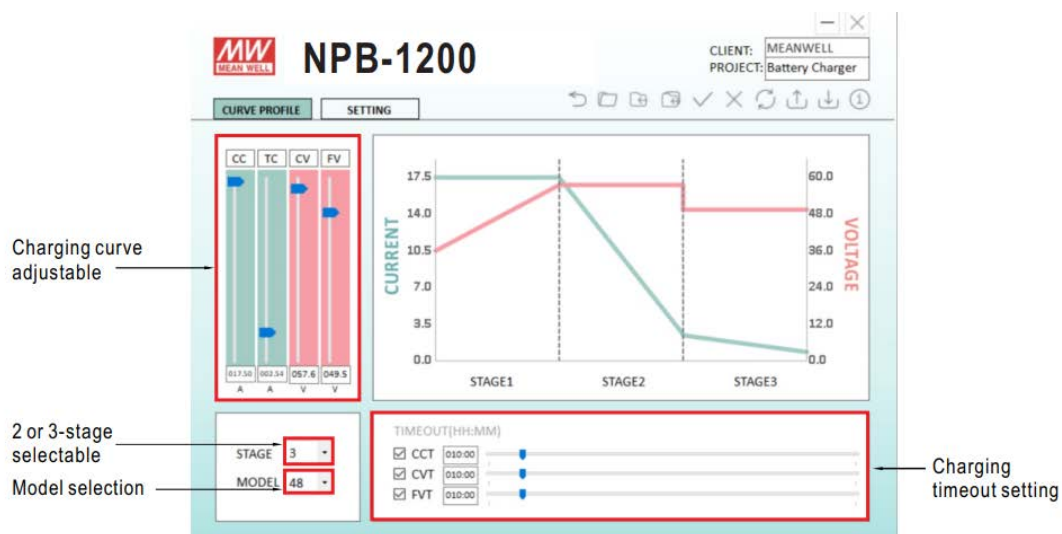

Figure 2. Smart Battery Charging Program Sotware Interface

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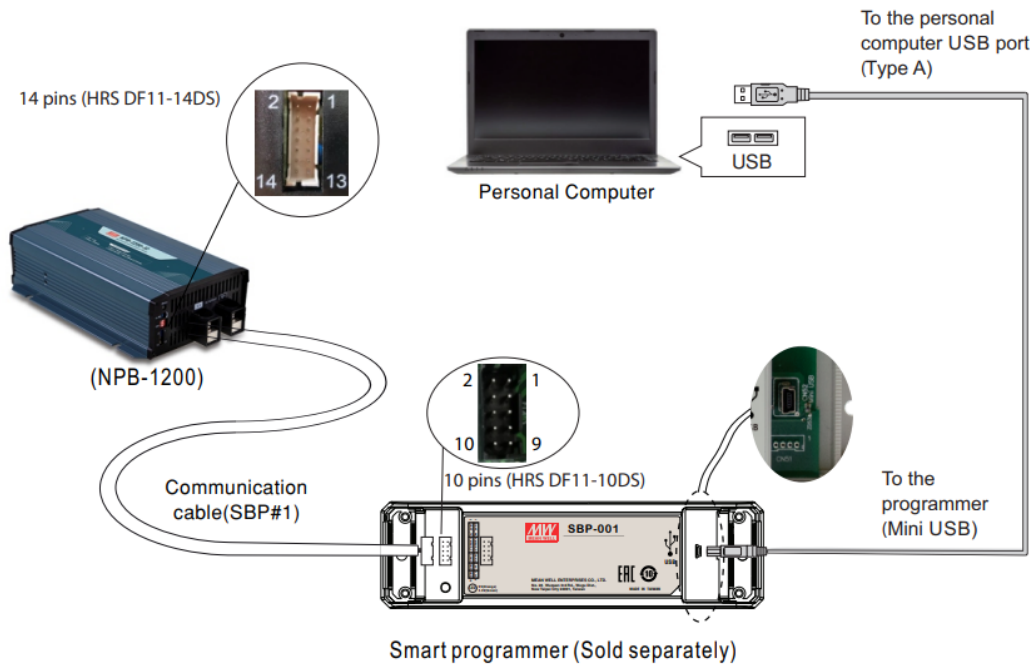
Figure 3. Smart Programmer Connection Diagram

After uploading a new charging curve to the charger, an AC off/on cycle is required to initialize the new charger curve setting. Note that under charger mode, the output current and voltage are defined by the preprogrammed charging profile. They are not controllable via CANBus during operation.

Programmable Power Supply Mode (controlled via CANBus)
When there is a need for flexible control, external BMS is required and the charger should be set into power supply mode. By doing this, the power supply will follow the command from the BMS to adjust the output current and voltage in real time. This makes conditional charging possible to optimize the lifetime of a battery. Furthermore, it can run different charging curves to batteries with alternative specifications without changing the charging device. Setting NPB-1200 to power supply mode can be easily done via CANBus or with SBP+PC software:

1) Setting to PSU mode by SBP and PC :
   On the software pop up window, select the "SETTING" panel on the top, and then click the "Disable" cell in the CHARGING CURVE SELECTION block. Restart the NPB to reinitialize the setting to power supply mode.

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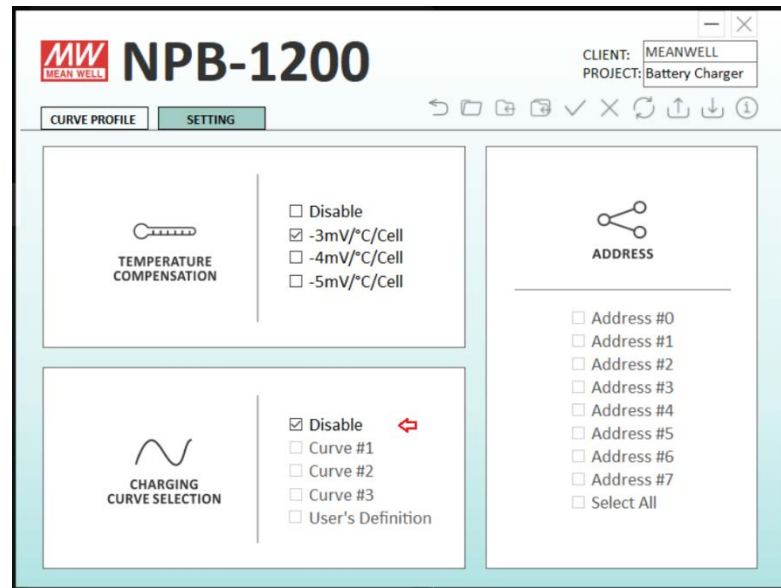
Figure 4. Smart Battery Sotware Setting Page

2) Setting to PSU mode via CANBus

First, set the CANBus address by CN71 according to the manual.

Between A0/A1 and GND(Single)	logic
Open	1
Short	0

Device No.	Device address	
	A1	A0
0	0	0
1	0	1
2	1	0
3	1	1
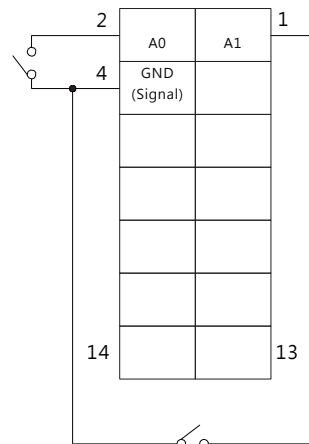
Figure 5. CANBus Address Numbers and Connection Diagram

Message ID definition：

Description	Message ID
Charger to controller message ID	0x000C00XX
Controller to charger message ID	0x000C01XX
Controller broadcasts to charger message ID	0x000C01FF

NOTE：XX means the address of NPB-450/750/1200/1700(which can be assigned by the A0~A1 of the CN71, from range 0x00~0x03)

Table 2. CANBus Message ID

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Second, set the "CURVE_CONFIG" command and disable Bit 7 "CUVE" to "0" to switch to power supply mode. After setting, run an AC repower to reinitialize the new setting and then the power supply can be control by a CANBus controller with the command set provided in user manual.

Command Code	Command Name	Transaction Type	# of data Bytes	Description
0x00B4	CURVE_CONFIG	R/W	2	Configuration setting of charge curve

Table 3. CURVE_CONFIG Command code

CURVE_CONFIG(Only available under charger mode):

High byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Definition	---	---	---	---	---	FVTOE	CVTOE	CCTOE
Low byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Definition	CUVE	STGS	---	---	TCS		CUVS	

Bit 7 CUVE: Charge curve function enable
0 = Disabled, power supply mode
1 = Enabled, charger mode(default)

Table 4. CURVE_CONFIG Command Parameters

Charging control with CANBus

After NPB is restarted and enters power supply mode, its output can be programmed with "VOUT_SET" and "IOUT_SET" within specified adjustable range. The data format is CAN 2.0B 29-bit and the value is scaled with a variable factor "F" which is a number between 0.1 to 0.01 depending on the command selected . The adjustable range, F factor, and an example of reading are explained below.

CANBus Command		Model	Adjustable Range	Tolerance	Default
0x0000	OPERATION	ALL	00h(OFF)/ 01h(ON)	N/A	01h (ON)
0x0020	VOUT_SET	12V	10.5 ~ 21V	±0.12V	0V
		24V	21 ~ 42V	±0.24V	0V
		48V	42 ~ 80V	±0.48V	0V
		72V	54 ~ 100V	±0.60V	0V

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CANBus Command		Model		Adjustable Range	Tolerance	Default
0x0030	IOUT_SET	NPB-1700	12V	17 ~ 85A	±0.85A	85A
			24V	10 ~ 50A	±0.50A	50A
			48V	5 ~ 25A	±0.25A	25A
		NPB-1200	12V	14 ~ 70A	±0.70A	70A
			24V	7.2 ~ 36A	±0.36A	36A
			48V	3.6 ~ 18A	±0.18A	18A
		NPB-750	12V	8.6 ~ 43A	±0.43A	43A
			24V	4.5 ~ 22.5A	±0.23A	22.5A
			48V	2.26 ~ 11.3A	±0.11A	11.3A
		NPB-450	12V	5 ~ 25A	±0.25A	25A
			24V	2.7 ~ 13.5A	±0.14A	13.5A
			48V	1.36 ~ 6.8A	±0.07A	6.8A
			72V	1.1 ~ 5.5A	±0.06A	5.5A

Table 5. CANBus Programmable Power Supply Mode Commands

Command Code	Command Name	Transaction Type	# of data Bytes	Description
0x0000	OPERATION	R/W	1	ON/OFF control
0x0020	VOUT_SET	R/W	2	Output voltage setting (format: value, F=0.01)
0x0030	IOUT_SET	R/W	2	Output current setting (format: value, F=0.01)
0x0040	FAULT_STATUS	R	2	Abnormal Status
0x0050	READ_VIN	R	2	Input voltage read value (format: value, F=0.1)
0x0060	READ_VOUT	R	2	Output voltage read value (format: value, F=0.01)
0x0061	READ_IOUT	R	2	Output current read value (format: value, F=0.01)
0x0062	READ_TEMPERATURE_1	R	2	Internal ambient temperature (format: value, F=0.1)

Table 6. CANBus Commands and F factors

EX: Vo_real(Actual output voltage)= READ_VOUT × Factor.

If factor of a model is 0.01 for READ_VOUT, and protocol reads 0x0960

(Hexadecimal)=>2400(Decimal), Then Vo_real = 2400 × 0.01 = 24.00V.

Full details of supported CANBus command set are listed in the installation manual .

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Comparison Table of Charger Mode and Power Supply Mode :

A quick overview of control modes and protection settings is provided in Table 7.

	Charger Mode (Factory Default)	Power Supply Mode
Charging Control	Charging process is controlled automatically by the charger with preinstalled charging profile	Constant voltage output by default. Charging voltage and current can be dynamically controlled via CANBus
Overload Protection	$I_o > I_{\_set}*95\%$ & $V_o < 55\% \ V_{boost\_default}$	$I_o > I_{\_set}*95\%$ & $V_o < V_{\_set}*77\%$
Applicable CANBus Commands	ON/OFF control, CURVE_CONFIG, monitoring command set	ON/OFF control, VOUT/IOUT_SET, monitoring command set
Mode Selection	Select charging curves in PC software or set CURVE_CONFIG Bit 7 to 1 via CANbus	Click "Disable" charging in PC software or set CURVE_CONFIG Bit 7 to 1 via CANbus

Table 7. Comparison Table Charger Mode vs. Power Supply Mode

MEAN WELL NPB series ranging from 450W to 1700W, provides a convenient user programmable interface as well as CANBus communication protocol for advanced control by external BMS. With the flexible setting possibilities, it can meet various application requirements. For more charging requirements and solutions, please contact our authorized distributors (link) and local representatives to get MEAN WELL professional support.

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Note 1 : Another special feature of NPB, Auto-Ranging charging, requires advanced BMS control and will be introduced in a separate article.