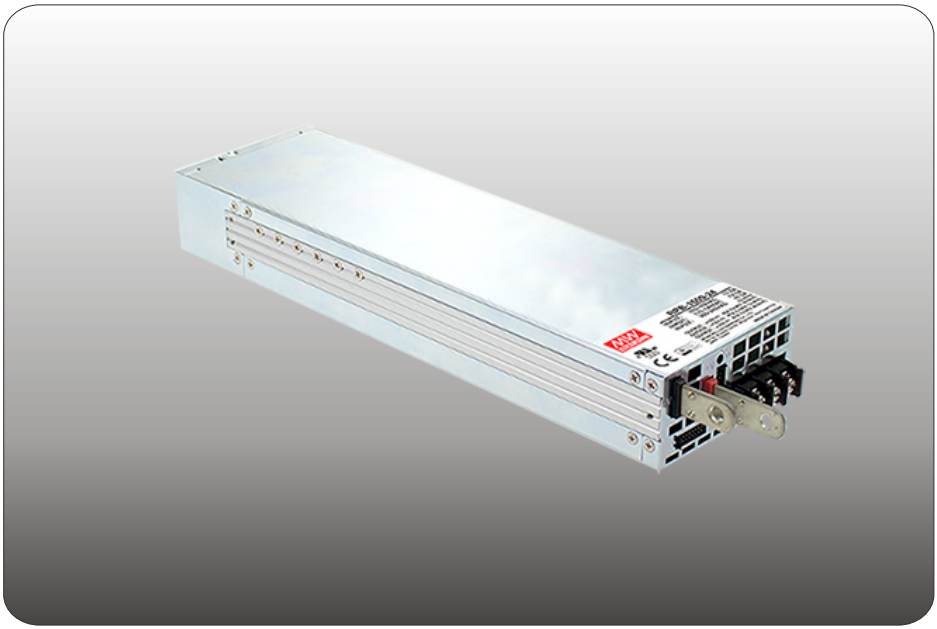


RSP-1600
Communication Note

RSP-1600 Communication Note

Index

Sep. 2023 Version 0

1.Communication Protocol

Users can use three different methods to control outputs of RSP-1600. The control priority between the methods is as follows: Communication (PMBus or CAN bus) > PV/PC > SVR. These three control methods can be used interchangeably. When using communication control, it is essential to communicate with the device within 4 seconds. Otherwise, the program will reset the control priority and set the communication parameters back to the factory default values.

NOTE: When communication function is used, some of the parameters will return to the factory default values if any of the conditions happens, AC recycling and communication timeout. Take RSP-1600-12 as an example, command OPERATION becomes ON, Vo and Io change to 12V and 100A.

1.1 PMBus Addressing and CAN ID setting

◎Each RSP-1600 unit should have their unique and own device address to communicate over the bus.

*PMbus 7-bit addressing definition:

MSB						LSB
1	0	0	0	A2	A1	A0

*CAN message ID definition :

Message ID	Description
0xC00XX	RSP-1600 to Controller Message ID
0xC01XX	Controller to RSP-1600 Message ID
0xC01FF	Controller broadcasts to RSP-1600

XX means the CAN ID of RSP-1600

A0-A2 allows users to designate an address or ID for the RSP-1600 unit; these three bits are defined through PIN7 (A0), PIN8 (A1) and PIN9 (A2) on CN1. There are up to 8 different addresses are available to be assigned. When connecting one of these pins, for example, PIN8 with PIN14 (-V(Signal)), the corresponding bit, A1, is set to logic “0”; when it is kept opened, for example, PIN7, the corresponding bit, A0, is set to logic “1”. Please refer to Table 1-1 for detailed setup.

Module No.	Device address or ID		
	A0	A1	A2
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
7	1	1	1

Table 1-1

1.2 PMBus Communication Interface

◎RSP-1600 is compliant with PMBus Rev.1.1, the maximum communication speed is 100KHz and the maximum number of assignable addresses is up to 8 units on a bus.

◎PMBus communication interface is able to provide the current operating status and information as follows:

1.Output voltage, current and internal temperature.

2.Alarm and status.

3.Manufacturer's and model data.

◎PMBus commands: The command list of the RSP-1600 is shown in Table 1-2. It is compliant with the standard protocol of PMBus Rev. 1.1. For more detailed information, please refer to PMBus official website (http://pmbus.org/specs.html)

Table 1-2

Command Code	Command Name	Transaction Type	# of data Bytes	Description
01h	OPERATION	R/W Byte	1	Remote ON/OFF control
02h	ON_OFF_CONFIG	Read Byte	1	ON/OFF function configuration
19h	CAPABILITY	Read Byte	1	Capabilities of a PMBus device
20h	VOUT_MODE	R Byte	1	Define data format for output voltage (format: Linear 16, N= -9)
21h	VOUT_COMMAND	R Word	2	Output voltage setting value (format: Linear 16, N= -9)
22h	VOUT_TRIM	R/W Word	2	Output voltage trimmed value (format: Linear 16, N= -9)
46h	IOUT_OC_FAULT_LIMIT	R/W Word	2	Output overcurrent setting value (format: Linear 11, N= -2)
47h	IOUT_OC_FAULT_RESPONSE	R Byte	1	Define protection and response when an output overcurrent fault occurred
79h	STATUS_WORD	R Word	2	Summary status reporting
7Ah	STATUS_VOUT	R Byte	1	Output voltage status reporting
7Bh	STATUS_IOUT	R Byte	1	Output current status reporting
7Ch	STATUS_INPUT	R Byte	1	AC inpit voltage statusreporting
7Dh	STATUS_TEMPERATURE	R Byte	1	Temperature status reporting
7Eh	STATUS_CML	R Byte	1	Communication, logic, Memory status reporting
80h	STATUS_MFR_SPECIFIC	R Byte	1	Manufacture specific status reporting
81h	STATUS_FANS_1_2	R Byte	1	Fan1 and 2 status reporting
88h	READ_VIN	R Word	2	AC input voltage reading value (format: Linear 11, N=-1)
8Bh	READ_VOUT	R Word	2	Output voltage reading value (format: Linear 16, N= -9)
8Ch	READ_IOUT	R Word	2	Output current reading value (format: Linear 11, N= -2)
90h	READ_FAN_SPEED_1	R Word	2	Fan speed 1 reading value (format: Linear 11, N= 5)
91h	READ_FAN_SPEED_2	R Word	2	Fan speed 2 reading value (format: Linear 11, N= 5)
98h	PMBUS_REVISION	R Byte	1	The compliant revision of the PMBus (default: 11h for Rev. 1.1)
99h	MFR_ID	Block Read	12	Manufacturer's name
9Ah	MFR_MODEL	Block Read	12	Manufacturer's model name
9Bh	MFR_REVISION	Block Read	6	Firmware revision
9Ch	MFR_LOCATION	Block R/W	3	Manufacturer's factory location
9Dh	MFR_DATE	Block R/W	6	Manufacture date. (format: YYMMDD)
9Eh	MFR_SERIAL	Block R/W	12	Product serial number

PMBus Data Range and Tolerance

◎Display parameters

PMBus command	Model	Range	Tolerance
READ_VIN	ALL	80 ~ 264V	±10V
READ_VOUT	12V	0 ~ 15V	±0.18V
	24V	0 ~ 30V	±0.36V
	48V	0 ~ 60V	±0.48V
READ_IOUT (Note. 1)	12V	0 ~ 150A	±2.5A
	24V	0 ~ 80A	±1.34A
	48V	0 ~ 40A	±0.67A
READ_FAN_SPEED_1	ALL	0 ~ 26500RPM	±2000RPM
READ_FAN_SPEED_2	ALL	0 ~ 26500RPM	±2000RPM

Table 1-3

◎ Control parameter

PMBus command	Model	Adjustable range	Tolerance	Default
OPERATION	ALL	00h(OFF) / 80h(ON)	N/A	80h(ON)
VOUT_COMMAND (Note. 2)	12V	12V	N/A	12V
	24V	24V	N/A	24V
	48V	48V	N/A	48V
VOUT_TRIM (Note. 2)	12V	-3 ~ 3V	±0.18V	0V
	24V	-6 ~ 6V	±0.36V	0V
	48V	-12 ~ 12V	±0.48V	0V

Table 1-4

Note:

1.READ_IOUT will display ZERO amp when output current is less than values in the table below:

Model	Minimum readable current
12V	5A±1A
24V	2.7A±1A
48V	1.3A±1A

Table 1-5

2.When using PMBus to adjust output voltage, VOUT_COMMAND only can be used to display the rated voltage of the unit and cannot be written. It is VOUT_TRIM that sets up the amount of trimmed voltage. Taking RSP-1600-12 as an example, to get a 9V output, please set value of VOUT_TRIM to -3V. Adjustable voltage range for each model is shown as below:

Model	Adjustable voltage range
12V	9 ~ 15V
24V	18 ~ 30V
48V	36 ~ 60V

Table 1-6

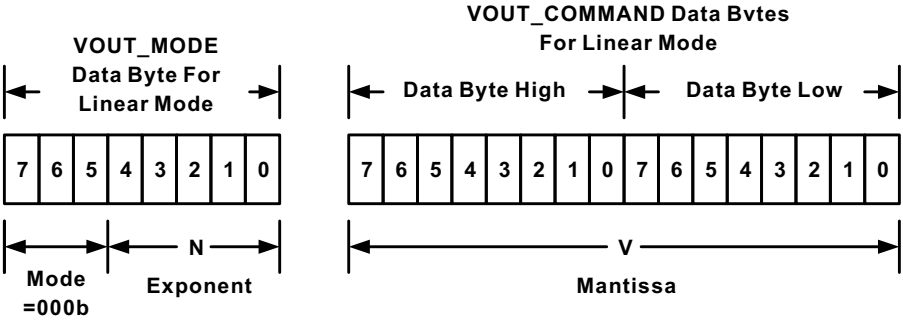
Notes on PMBus

1.Insert a at least 50msec delay between commands

2.Examples for Format Conversion :

(1)LINEAR16 format：VOUT_COMMAND、VOUT_TRIM、READ_VOUT.

Actual voltage = communication reading V × 2^N. There are two definitions in the VOUT_MODE command that refer to N requirements.



Linear Format Data Bytes

The Mode bits are set to 000b.

The Voltage, in volts, is calculated from the equation:

Voltage = V • 2^N

Where:

Voltage is the parameter of interest in volts;

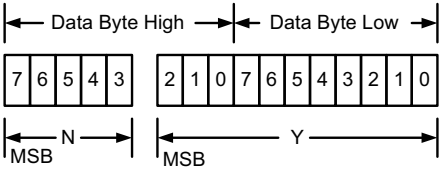
V is a 16 bit unsigned binary integer; and

N is a 5 bit two's complement binary integer.

EX: Vo_real (actual output voltage) = V x 2^N , V is from READ_VOUT. N If VOUT_MODE = 0x17, meaning N is -9. READ_VOUT is 0x3000 12288, then Vo_real =12288 × 2^{-9}=24.0V.

(2)LINEAR11 format：IOUT_OC_FAULT_LIMIT、READ_VIN、READ_IIN、READ_IOUT、READ_TEMPERATURE_1、READ_FAN_SPEED_1、READ_FAN_SPEED_2、CURVE_CC .

Actual value X = communication read value Y x 2^N. Among them, the definition of the description column for each aircraft type is referred to



Linear Data Format Data Bytes Y, N and the "real world" value is:

The relation between

$X = Y \cdot 2^N$

Where, as described above:

X is the "real world" value;

Y is an 11 bit, two's complement integer; and

N is a 5 bit, two's complement integer.

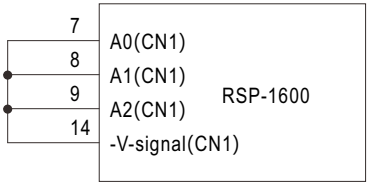
Devices that use the Linear format must accept and be able to process any value of N.

EX: Io_real (actual output current) = $Y \times 2^N$, Y is from READ_IOUT. N If READ_IOUT is 0xF188h, meaning N is -2 and Y is 0x0188. Y is 0x0188 → 392, then Io_real = $392 \times 2^{-2} = 98.0A$.

Communication Example

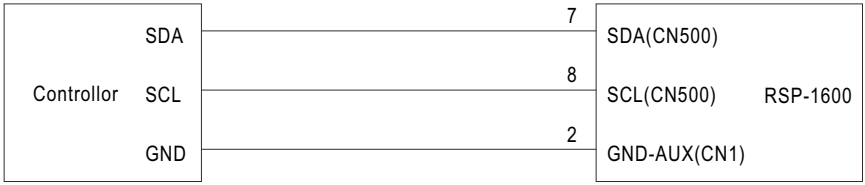
The following steps will describe how to set the RSP-1600-48 to 56V.

1.Set the address of the charger to “0” .



2.Connect the SDA, SCL and GND pins of the master to the corresponding SDA (PIN7) and SCL (PIN8) of CN500 and GND-AUX (PIN2) of CN1 on the supply.

◎Set speed: 100KHz



3.Communication function can be accessed immediately after RSP-1600 is connected to AC. Set output voltage at 56V.

Address(7 bit)	Operation	Command Code	Data
0x40	Write	0x22	0x00, 0x10

Command code: 0x22(VOUT_TRIM)

Data: 56V → 0x00(Lo) + 0x10(Hi)

NOTE: CHURVE_VBST is LINEAR16 forma

4.It is recommended to review all of the settings and parameters using the appropriate commands. In the event that they do not meet your requirements, you may rewrite them as needed. EX: Read VOUT_TRIM to check whether output voltage was set to a proper level.

Read VOUT_TRIM

Address(7 bit)	Operation	Command Code
0x40	Read	0x22

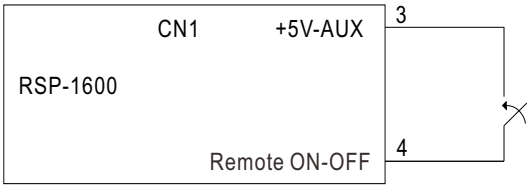
The unit returns data below

Address(7 bit)	Data
0x40	0x00, 0x10

Data: 0x00(Lo) + 0x10(Hi) → 0x1000 → 4096 × 2^{-9} = 8V。

48V +8V = 56V, the result is correct

5.Finally, check whether Remote ON-OFF (PIN4) and +5-AUX (PIN3) pins of the CN1 connector are short-circuited if there is no output voltage. Also please make sure command sending/reading is in an interval of below 4 sec in order not to trigger communcation timeout.



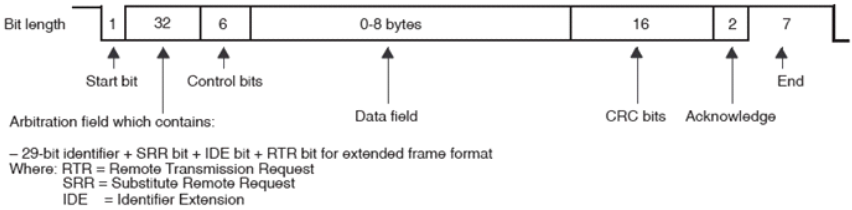
1.3 CANBus Communication Interface

◎Physical layer specification

This protocol follows CAN ISO-11898 with Baud rate of 250Kbps.

◎Data Frame

This protocol uses Extended CAN 29-bit identifier frame format or CAN 2.0B.

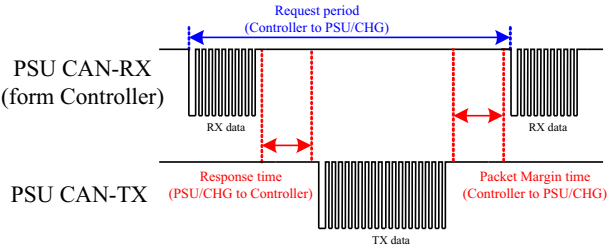


◎Communication Timing

Min. request period (Controller to RSP-1600): 50mSec。

Max. response time (RSP-1600 to Controller): 12.5mSec。

Min. packet margin time (Controller to RSP-1600): 12.5mSec。



◎Data Field Format

Controller to RSP-1600

Write:

Data filed bytes

0	1	2	3
COMD. low byte	COMD. high byte	Data low byte	Data high byte

Read:

Data filed bytes

0	1
COMD. low byte	COMD. high byte

RSP-1600 to Controller

Response:

Data filed bytes

0	1	2	.....	7
COMD. low byte	COMD. high byte	Data low 1	.....	Data high 6

NOTE: RSP-1600 will not send data back when writing parameters, such as VOUT_SET

1.3.1 CANBus Command list

Command Code	Command Name	Transaction Type	# of data Bytes	Description
0x0000	OPERATION	R/W	1	ON/OFF control ON: 01h OFF: 00h
0x0020	VOUT_SET	R/W	2	Output voltage set (format: value, F=0.1)
0x0030	IOUT_SET	R/W	2	Output current set (format: value, F=0.1)
0x0040	FAULT_STATUS	R	2	Abnormal status
0x0050	READ_VIN	R	2	Input voltage read value (format: value, F=1)
0x0060	READ_VOUT	R	2	Output voltage read value (format: value, F=0.1)
0x0061	READ_IOUT	R	2	Output current read value (format: value, F=0.1)
0x0062	READ_ TEMPERATURE_1	R	2	Internal ambient temperature (format: value, F=0.1)
0x0070	READ_FAN_SPEED_1	R	2	Fan speed 1 reading value (Format: value, F=1, unit: RPM)
0x0071	READ_FAN_SPEED_2	R	2	Fan speed 2 reading value (Format: value, F=1, unit: RPM)
0x0080	MFR_ID_B0B5	R	6	Manufacture's name
0x0081	MFR_ID_B6B11	R	6	Manufacture's name
0x0082	MFR_MODEL_B0B5	R	6	Manufacture model name
0x0083	MFR_MODEL_B6B11	R	6	Manufacture model name
0x0084	MFR_REVISION_B0B5	R	6	Firmware version
0x0085	MFR_LOCATION_B0B2	R	3	Manufacture place
0x0086	MFR_DATE_B0B5	R	6	Manufacture date

Command Code	Command Name	Transaction Type	# of data Bytes	Description
0x0087	MFR_SERIAL_B0B5	R	6	Manufacture serial number
0x0088	MFR_SERIAL_B6B11	R	6	Manufacture serial number

Table 1-8

1.3.2 Definition and contents of CANBus Command list

◎Definition of Command FAULT_STATUS(0x0040) :

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Low byte	HI_TEMP	OP_OFF	AC_FAIL	SHORT	OLP	OVP	OTP	FAN_FAIL

Bit 0 FAN_FAIL : Fan locked flag
0 = Working normally
1 = Fan locked

Bit 1 OTP : Over temperature protection
0 = Internal temperature normal
1 = Internal temperature abnormal

Bit 2 OVP : DC over voltage protection
0 = DC voltage normal
1 = DC over voltage protected

Bit 3 OLP : DC over current protection
0 = DC current normal
1 = DC over current protected

Bit 4 SHORT : Short circuit protection
0 = Shorted circuit do not exist
1 = Shorted circuit protected

Bit 5 AC_FAIL : AC abnormal flag
0 = AC input range normal
1 = AC input range abnormal

Bit 6 OP_OFF : DC status
0 = DC output turned on
1 = DC output turned off

Bit 7 HI_TEMP：Internal high temperature protection
0 = Internal temperature normal
1 = Internal temperature abnormal

Note: Unsupported settings displays with "0"

◎MFR_ID_B0B5 (0x0080) is the first 6 codes of the manufacturer's name (ASCII); MFR_ID_B6B11 (0x0081) is the last 6 codes of the manufacturer's name (ASCII)
EX: Manufacturer's name is MEANWELL MFR_ID_B0B5 is MEANWE；MFR_ID_B6B11 is LL

MFR_ID_B0B5					
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0x4D	0x45	0x41	0x4E	0x57	0x45

MFR_ID_B6B11					
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0x4C	0x4C	0x20	0x20	0x20	0x20

◎MFR_MODEL_B0B5 (0x0082) is the first 6 codes of the manufacturer's model name (ASCII); MFR_MODEL_B6B11 (0x0083) is the last 6 codes of the manufacturer's model name (ASCII)
EX: Model names is RSP-1600-48 → MFR_MODEL_B0B5 is RSP-16；MFR_MODEL_B6B11 is 00-48

MFR_MODEL_B0B5					
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0x52	0x50	0x42	0x2D	0x31	0x36

MFR_ID_B6B11					
Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
0x30	0x30	0x2D	0x34	0x38	0x20

◎MFR_REVISION_B0B5 (0x0084) is the firmware revision (hexadecimal).
A range of 0x00 (R00.0)~0xFE (R25.4) represents the firmware version of an MCU; 0xFF represents no MCU existed.

EX: The supply has two MCUs, the firmware version of the MCU number 1 is version R25.4 (0xFE), the MCU number 2 is version R10.5 (0x69)

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0xFE	0x69	0xFF	0xFF	0xFF	0xFF

◎MFR_DATE_B0B5 (0x0086) is manufacture date (ASCII)

EX: MFR_DATE_B0B5 is 180101, meaning 2018/01/01

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0x31	0x38	0x30	0x31	0x30	0x31

◎MFR_SERIAL_B0B5 (0x0087) and MFR_SERIAL_B6B11 (0x0088) are defined as manufacture date and manufacture serial number (ASCII)

EX: The first unit manufactured on 2018/01/01→MFR_SERIAL_B0B5: 180101 ; MFR_SERIAL_B6B11: 000001

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0x31	0x38	0x30	0x31	0x30	0x31

Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
0x30	0x30	0x30	0x30	0x30	0x31

1.3.3 CANBus Value Range and Tolerance

(1)Display parameters

CANBus command	Model	Display value range	Tolerance
READ_VIN	ALL	80~264V	±10V
READ_VOUT	12V	0~15V	±0.18V
	24V	0~30V	±0.36V
	48V	0~60V	±0.48V
READ_IOUT	12V	0~150A	±2.5A
	24V	0~80A	±1.34A
	48V	0~40A	±0.67A
READ_ TEMPERATURE_1	ALL	-40~100℃	±5℃
READ_FAN_SPEED_1	ALL	0~26500 RPM	±2000RPM
READ_FAN_SPEED_2	ALL	0~26500 RPM	±2000RPM

(2)Control parameters

CANBus command	Model	Display value range	Tolerance	Default
OPERATION	ALL	00h(OFF)/01h(ON)	N/A	ON
VOUT_SET	12V	9~15V	±0.18V	12V
	24V	18~30V	±0.36V	24V
	48V	36~60V	±0.48V	48V
IOUT_SET	12V	20~100A	±2.5A	100A
	24V	11~55A	±1.34A	55A
	48V	5.5~27.5A	±0.67A	27.5A

Note:

1.READ_IOUT will display ZERO amp when output current is less than values in the table below.

Model	Minimum readable current
12V	5A±1A
24V	2.7A±1A
48V	1.3A±1A

1.3.4 Communication example

1.3.4.1 Sending comman

The master adjusts output voltage of the unit with address "01" to 30V

CAN ID	DLC (data length)	Command code	Parameters
0xC0101	0x4	0x2000	0x2C01

Command code: 0x0020 (VOUT_SET) → 0x20(Lo) + 0x00(Hi)

Parameters: 30V → 300 → 0x012C → 0x2C(Lo) + 0x01(Hi)

NOTE: Conversion factor for VOUT_SET is 0.1, so $\frac{30V}{F=0.1}$ =300

1.3.4.2 Reading data or status

The master reads operation setting from the unit with address "00".

CAN ID	DLC (data length)	Command code
0xC0100	0x2	0x0000

The unit with address "00" returns data below

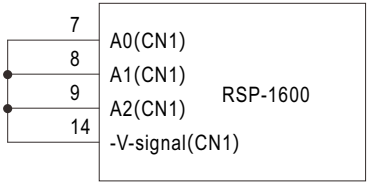
CAN ID	DLC (data length)	Command code	Parameters
0xC0000	0x3	0x0000	0x01

The unit with address "00" returns data below

Practical Operation

The following steps will describe how to set the RSP-1600-48 to 56V.

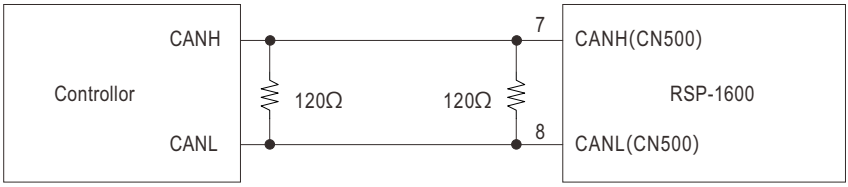
1.Set the address of the charger to “0”.



2.Connect the CANH/CANL pins of the master to the corresponding CANH(PIN7) and CANL(PIN8)pins of the CN500 connector on the supply. It is recommended to establish a common ground for the communication system to increases its communication reliability by using GND-AUX (PIN2) of CN1.

◎Set baud rate: 250kbps, type: extended

◎Adding a 120Ω terminal resistor to both the controller and rack shelf ends can increase communication stability



3.Communication function can be accessed immediately after RSP-1600 is connected to AC. Set output voltage at 56V.

CANID	DLC(data length)	Command Code	Parameters
0xC0100	0x04	0x2000	0x3002

Command code: 0x0020(VOUT_SET)

Data: 56V → 560 → 0x0230 → 0x30(Lo) + 0x02(Hi)

NOTE: Conversion factor for CURVE_CV is 0.1, so $\frac{56V}{F=0.1}$ =560

4.It is recommended to review all of the settings and parameters using the appropriate commands. In the event that they do not meet your requirements, you may rewrite them as needed.

EX: Read VOUT_SET to check whether output voltage was set to a proper level.

Read VOUT_SET

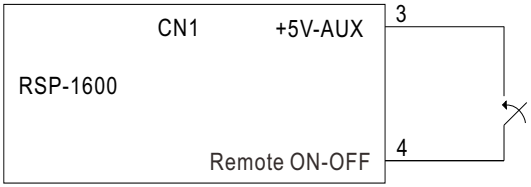
CANID	DLC(data length)	Command Code
0xC0100	0x04	0x2000

The unit returns data below

CANID	DLC(data length)	Command Code	Parameters
0xC0100	0x04	0x2000	0x3002

Data: 0x02(Lo) + 0x30(Hi) → 0x0230 → 560 = 56V.

7.Finally, check whether Remote ON-OFF (PIN4) and +5-AUX (PIN3) pins of the CN1 connector are short-circuited if there is no output voltage. Also please make sure command sending/reading is in an interval of below 4 sec in order not to trigger communcation timeout.



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