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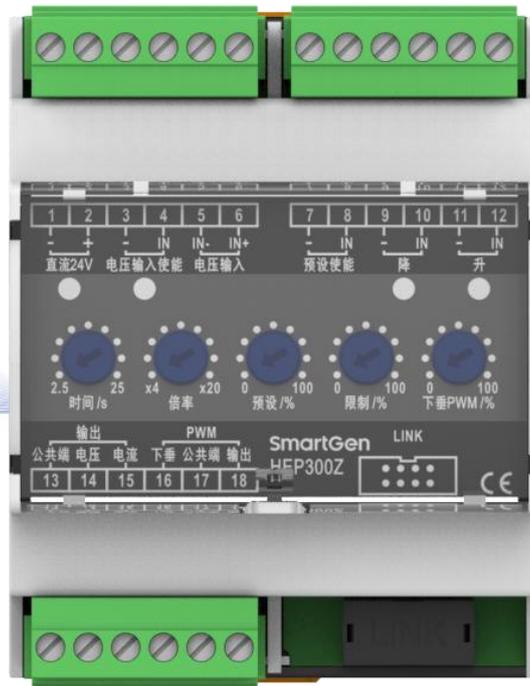
MAKING CONTROL SMARTER

HEP300Z
ELECTRONIC POTENTIOMETER
USER MANUAL

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SmartGen

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Table 1 Software Version

Date	Version	Content
2024-01-25	1.0	Original release.

CONTENT

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1 OVERVIEW

HEP300Z Electronic Potentiometer integrates digital, intelligent and network technology to convert the digital signal or analog signal to target voltage, current or PWM signal with the microprocessor. It is used not only for converting the digital output signal (speed raise/drop, voltage boost/buck) of sync controller or power sharing controller to analog signal (±10V DC voltage, ±20mA DC current or PWM pulse signal) which can be used by speed governor or AVR, but also converting the DC voltage signal to DC current signal or PWM signal when transmission distance is too far and serious voltage signal attenuation occurs. In addition, it can output droop PWM signal. The output range of parameters can be set simply by regulating the potentiometers on the panel. It is easy and reliable to use, and can be widely used in systems of electronic speed regulation, voltage regulation and parallel.

2 PERFORMANCE FEATURES

The main features are as follows:
——All the parameters can be set via potentiometers on the panel: TIME/s (Slope), PRESET/%, LIMIT/%, PWM DUTY/%;
——Two input modes: digital signal (UP, DOWN) and analog voltage signal;
——Various output signal: ±10V DC, ±20mA DC, and 500Hz (0-100)% PWM;
——With the LINK port, the data input/output can be monitored via PC software.
——With wide power supply range of 8~35V DC, it can be compatible with different voltages of starting batteries;
——Easy to be mounted on the 35mm din rail;
——With modular design, pluggable terminals, and compact structure, it is easy to install.

3   SPECIFICATIONS

Table 2 Technical Parameters

Item	Content
Operating Voltage	DC 24V, it also can be used for DC12V system, and has protection for DC reverse connection
Power Consumption	3W (Standby mode: ≤2W)
Integral Time (Slope)	10s-500s
Voltage Input	DC±10V
Voltage Output	DC±10V
Current Output	DC±20mA
PWM Output	6V@500Hz (0-100)%PWM
Droop PWM Output	6V@500Hz (0-100)%PWM
I/O Response Time	<100ms
Vibration Test	5Hz~8Hz: Amplitude=±7.5mm 8Hz~500Hz: Acceleration=±2g Refer to the IEC 60068-2-6
Shock Test	A_{peak}=50g, D=11ms, half-sine pulse shape, apply three shocks successively in each direction of three mutually perpendicular axes of the specimen, which means 18 shocks in total Refer to the IEC 60068-2-27
Bump Test	A=20g, D=16ms, half-sine pulse shape Refer to the IEC 60255-21-2
Case Dimensions	93.0mm x 71.6mm x 60.7mm
Working Temperature	(-40~+70) °C
Working Humidity	(20~93) %RH
Storage Temperature	(-40~+80) °C
Weight	0.24kg

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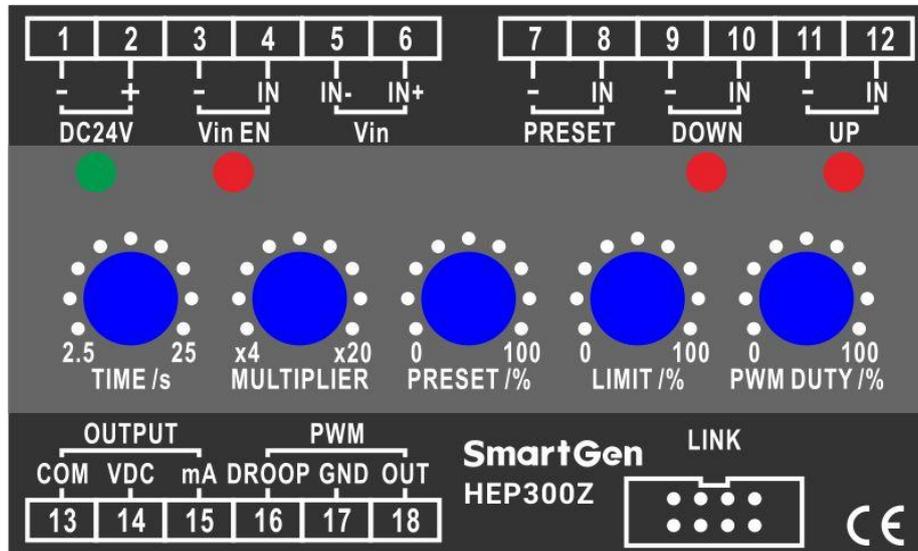## 4 OPERATION

4.1 POTENTIOMETERS AND INDICATORS

Figure 1 Front Panel

Table 3 Potentiometers and Indicators

Item	Description
TIME	Integral time potentiometer: it can adjust the slope, which means the integral time from -10V to 10V. The slope setting depends on the TIME potentiometer only, and isn't affected by the LIMIT potentiometer.
MULTIPLIER	Integral time multiplier potentiometer: the value multiplied by "TIME" value equals the final integral time value.
PRESET	Output preset/% potentiometer: it can adjust the median voltage (output preset value). If the PRESET input port is active, the preset/% value will be outputted after the module is powered on again. The preset value will be saved automatically if the PRESET input port is active. If the PRESET input port is inactive, the output preset value won't be changed by adjusting the potentiometer. Output preset value = -5V+ Preset/%*10V
LIMIT	Output limit/% potentiometer Output Min. value = output preset value - Limit/%*5V Output Max. value = output preset value + Limit/%*5V
PWM DUTY	The duty cycle of Droop PWM output
Power Indicator (Green)	It lights up when the power supply is normal.
Vin EN Indicator (Red)	It lights up when the Vin EN input port is closed.
DOWN Indicator (Red)	It lights up when the DOWN input port is closed and flashes if the output value reaches the lower limit value.
UP Indicator (Red)	It lights up when the UP input port is closed and flashes if the output value reaches the upper limit value.

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4.2 THE OUTPUT MODE OF UP/DOWN DIGITAL INPUT PORTS SETTING

The UP/DOWN digital input signal comes from the digital output signal (speed raise/drop, voltage boost/buck) of sync controller or power sharing controller, and the module can convert the digital signal to the analog signal (±10V DC voltage, ±20mA DC current or PWM pulse signal) which can be used by speed governor or AVR.

Setting sequence:

a) Set the Vin EN digital input port as inactive and enter into the output mode of UP/DOWN digital input port setting;

b) Set the slope, which is the integral time or the speed from the output value to target value after the UP/DOWN input port is active. By setting the TIME and MULTIPLIER potentiometer, then the "MULTIPLIER" value multiplied by "TIME" value equals integral time. Take the output voltage signal as example: Integral time means the time needed for the output value from -10V to 10V, and the slope means the voltage value adjusted per second. If set the "TIME" as 10s and the "MULTIPLIER" as 5, so the integral time equals 50s, and the slope equals 0.4V/s (10V-(-10V))/50s). As shown in the graph below:
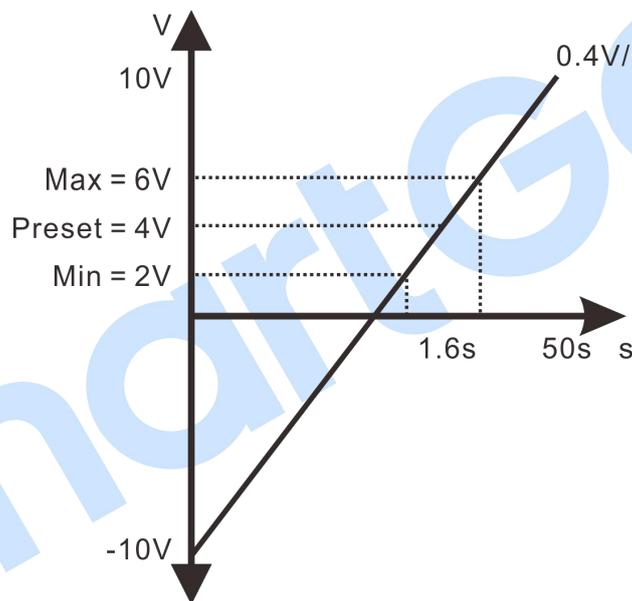

Figure 2 Slope Graph

⚠NOTE: The slope is not affected by the setting of the PRESET or LIMIT potentiometer.

c) Set the median voltage, which is the output preset value when the PRESET IN port is active. Set the PRESET potentiometer to get the median voltage value or output preset value (-5V+ Preset/% * 10V).

⚠NOTE: The preset value of potentiometer will be saved automatically if the PRESET input port is active, the preset value will be outputted after the module completes the power-on reset. If the PRESET input port is inactive, the median voltage value or output preset value doesn't change by adjusting the potentiometer.

d) Set the output limit value by adjusting the limit/% potentiometer. Take the output voltage signal as the example: Output Min. value = output preset value - Limit/%*5V, Output Max. value = output preset value + Limit/%*5V. If the preset/% is 90%, limit/% is 40%, so the median voltage is 4V, and the range is between 2V and 6V. The relation is shown in the table below:

Table 4 Relation between Median Voltage and Range

Median Voltage		Range	
Preset (%)	Voltage (V)	Limit (%)	Voltage (V)
0	-5.0	0	±0
10	-4.0	10	±0.5
20	-3.0	20	±1.0
30	-2.0	30	±1.5
40	-1.0	40	±2.0
50	0.0	50	±2.5
60	1.0	60	±3.0
70	2.0	70	±3.5
80	3.0	80	±4.0
90	4.0	90	±4.5
100	5.0	100	±5.0

e) Droop PWM value must be set if the speed governor or AVR controlled by the module has the Droop control function, and the control signal is 500Hz PWM. The duty cycle of Droop PWM can be set simply by adjusting the PWM DUTY potentiometer;

f) After parameters above are set, the voltage, current and PWM output can be controlled via UP/DOWN input port. The relation is shown in the table below:

Table 5 Relation between Voltage, Current, PWM and Droop

Voltage Output (V)	Current Output (mA)	PWM Output (%)	Droop Output (%)
-10	-20	0	
-8	-16	10	
-6	-12	20	
-4	-8	30	
-2	-4	40	
0	0	50	Depend on the Droop PWM only.
2	4	60	
4	8	70	
6	12	80	
8	16	90	
10	20	100	

4.3 THE OUTPUT MODE OF VOLTAGE ANALOG INPUT PORTS SETTING

The voltage analog input signal comes from the voltage output signal of speed governor or AVR, and the module can convert the digital signal to the analog signal (±10V DC voltage, ±20mA DC current or PWM pulse signal) which can be used by speed governor or AVR.

a) Set the Vin EN digital input port as active and enter into the output mode of voltage analog input port setting;

b) Droop PWM value must be set if the speed governor or AVR controlled by the module has the Droop control function, and the control signal is 500Hz PWM. The duty cycle of Droop PWM can be set simply by adjusting the PWM DUTY potentiometer;

c) The voltage, current and PWM output can be controlled by the voltage input value via voltage analog input port, and the valid range of voltage input is ±10V. The relation is shown in the table below:

Table 6 Relation between Input and Output

Voltage I/O (V)	Current Output (mA)	PWM Output (%)	Droop Output (%)
-10	-20	0	
-8	-16	10	
-6	-12	20	
-5	-10	25	
-4	-8	30	
-2	-4	40	
0	0	50	Depend on the Droop PWM only.
2	4	60	
4	8	70	
5	10	75	
6	12	80	
8	16	90	
10	20	100	

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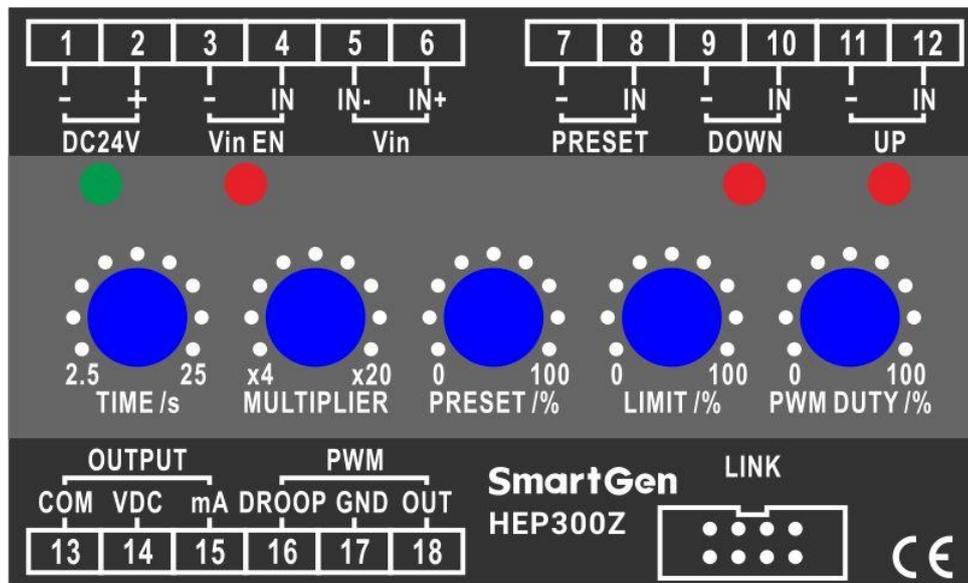
Figure 3 Front Panel

Table 7 Terminals Wiring Connection

No.	Function	Cable Size	Remarks
1	DC 24V −	1.5mm^2	Power supply of 8-35V
2	DC 24V +	1.5mm^2	
3	Vin EN −	1.0mm^2	DC voltage input enable terminal: if the input port is closed to be active, then the output signal of Terminal 14, 15 and 18 will be controlled by analog voltage.
4	Vin EN IN	1.0mm^2	
5	Vin IN −	1.0mm^2	Connect with the voltage output signal of speed governor or AVR.
6	Vin IN +	1.0mm^2	
7	PRESET −	1.0mm^2	Preset/% Potentiometer output enable terminal: if the input port is closed to be active, then the Terminal 14, 15 and 18 will output. Preset/% potentiometer stands for the preset value.
8	PRESET IN	1.0mm^2	
9	DOWN −	1.0mm^2	Connect to the relay output signal of sync controller or power sharing controller. If the input port is closed to be active, the output value will be reduced.
10	DOWN IN	1.0mm^2	
11	UP −	1.0mm^2	Connect to the relay output signal of sync controller or power sharing controller. If the input port is closed to be active, the output value will be increased.
12	UP IN	1.0mm^2	
13	OUTPUT COM	1.0mm^2	
14	OUTPUT VDC	1.0mm^2	Output ±10V
15	OUTPUT mA	1.0mm^2	Output ±20mA
16	PWM DROOP	1.0mm^2	Droop output: variable duty cycle of 500Hz PWM
17	PWM GND	1.0mm^2	
18	PWM OUT	1.0mm^2	Variable duty cycle of 500Hz PWM

⚠**NOTE: LINK interface is for parameters programming, and the module can be programmed by PC via a SG72 converter. If remote monitoring function is needed, please use the SG485 module from SmartGen.**
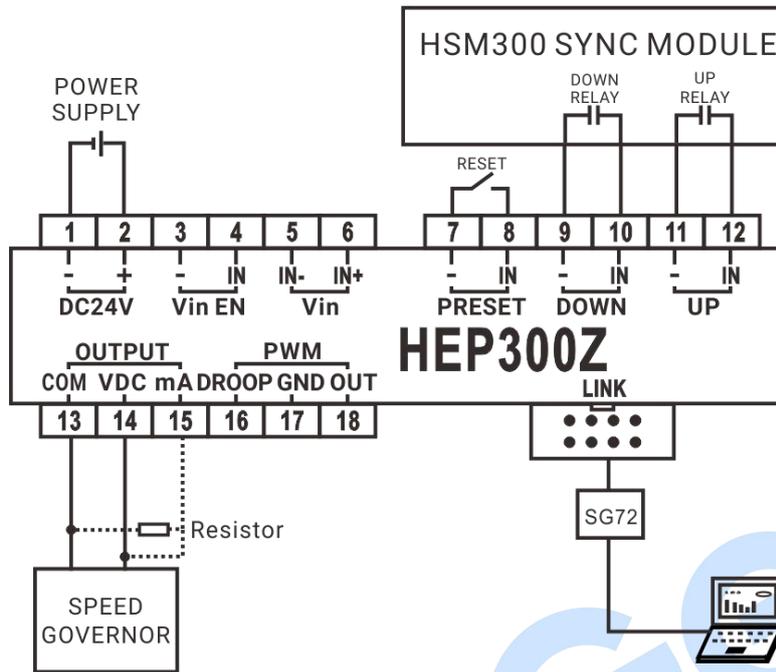
6 TYPICAL APPLICATION

Figure 4 Typical Application Diagram of Speed Up/Down

⚠**NOTE: The resistor in the diagram is used for converting the voltage signal to current signal and outputting it to the speed governor without signal attenuation. The dotted line stands for another way of wiring connection.**
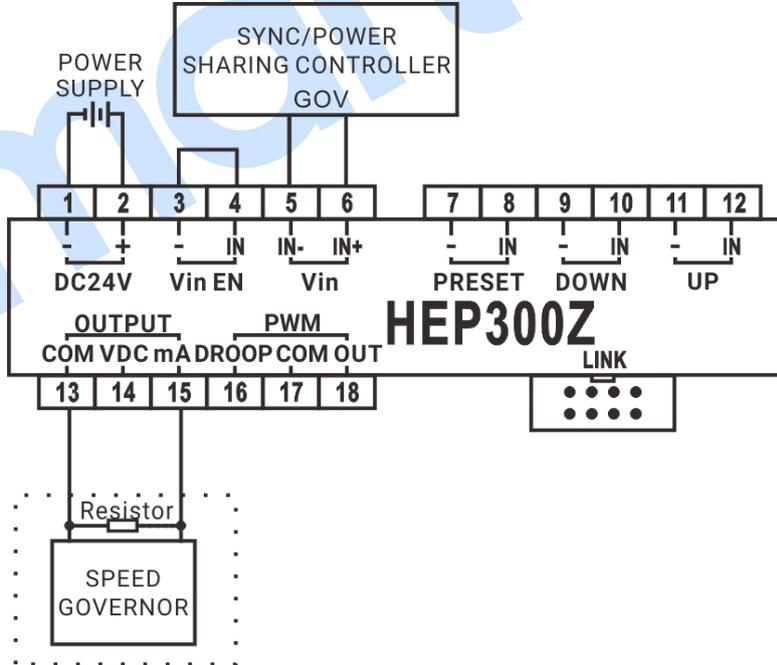

Figure 5 Typical Application Diagram of DC Voltage

⚠**NOTE: The resistor in the diagram is used for converting the voltage signal to current signal and resistance it to the speed governor without signal attenuation. The dotted line means the resistor is connected with the speed governor.**

7 INSTALLATION

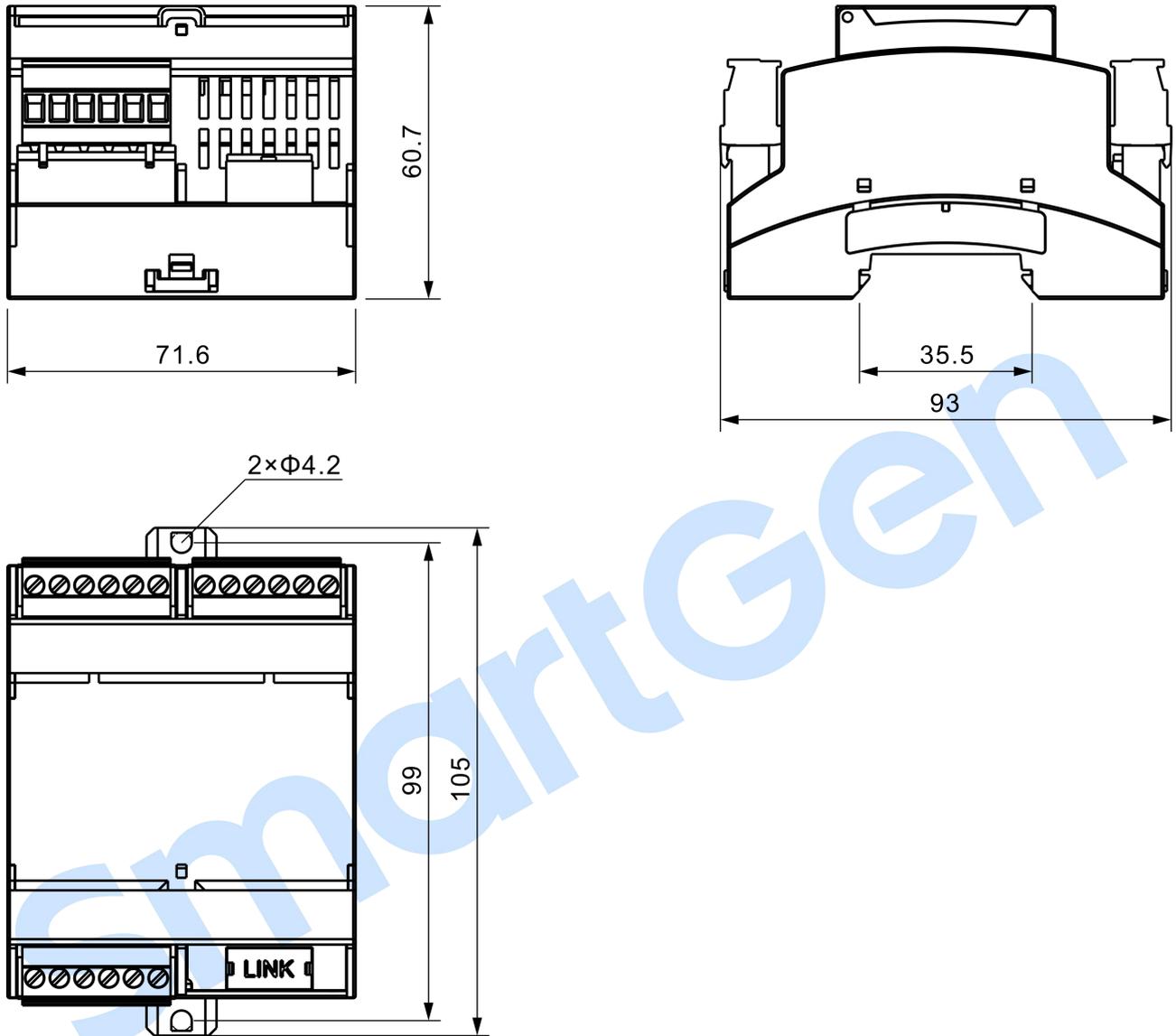### 7.1 OVERALL AND CUTOUT DIMENSIONS

Figure 6 Overall and Cutout Dimensions (Unit: mm)

7.2 BATTERY VOLTAGE INPUT

HEP300Z is suitable for wide battery voltage range of 8-35V DC. The negative of battery must be connected with the engine case. The wiring cable size must be over 1.5mm^2 (from the power supply to the battery). If there is a floating charger, please connect the output wires of charger to the battery's positive and negative directly, then connect separate wires from the battery's positive and negative to the controller's positive and negative input ports in order to prevent the charger interfering with the controller's normal working.

8   TROUBLESHOOTING

Table 8 Troubleshooting

Trouble	Possible Solutions
The module has no response after power on	Check the power supply;
	Check the wiring connections.
Communication failure between LINK interface and PC	Check the wiring connections;
	Check the COM terminal setting is correct or not;
	Power on the host PC to check the connection is normal or not;
	Check the communication port of the PC is normal or not.

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