**SmartGen**

MAKING CONTROL SMARTER

# HED400
# ENGINE MONITORING MODULE
# USER MANUAL



郑州众智科技股份有限公司
SMARTGEN(ZHENGZHOU)TECHNOLOGY CO.,LTD.

**SmartGen**

**SmartGen** **Registered trademark**

**No. 28 Xuemei Street, Zhengzhou, Henan, China**

**Tel:** +86-371-67988888/67981888/67992951

　　 +86-371-67981000 (overseas)

**Fax:** +86-371-67992952

**Web:** www.smartgen.com.cn/

　　 www.smartgen.cn/

**Email:** sales@smartgen.cn

SmartGen reserves the right to change the contents of this document without prior notice.

**Table 1 Software Version**

| Date | Version | Note |
|---|---|---|
| 2025-03-26 | 1.0 | Original release. |
| | | |
| | | |
| | | |

**Table 2 Notation Clarification**

| Sign | Instruction |
|------|-------------|
| ⚠NOTE | Highlights an essential element of a procedure to ensure correctness. |
| ⚠CAUTION! | Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment. |
| ☠WARNING! | Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly. |

# CONTENT

**SmartGen**

# 1   OVERVIEW

**HED400 Engine Monitoring Module** can be used for single engine monitoring to realize the functions of speed control, data measurement and alarm display, etc. It fits with color LCD display, optional Chinese and English, which enables simple operation and reliable running.

**HED400 Engine Monitoring Module** applies 32-bit microprocessor technology, realizing precise measuring of multiple parameters, value adjusting and threshold setting etc. The parameters can be adjusted from the front panel or by PC software. With compact structure, simple wiring and high reliability, it can be used in various engine automation systems.

# 2   PERFORMANCE AND CHARACTERISTICS

— Applies 32-bit high-performance SCM, high integration of hardware;
— 4.3-inch color LCD display, resolution 480x272 with adjustable backlight, optional Chinese and English, etc.;
— The RS485 communication interface can set baud rate and adjust parameters via PC;
— The CANBUS interface can connect ECU with J1939 and monitor ECU common data (water temperature, oil pressure, speed, fuel consumption, etc.), and also can control speed;
— ECU fault code analysis function is fitted;
— With 6-way analog sensor input ports that all interfaces support resistance sensors, among which the sensor 3-6 input ports can support current and voltage types;
— Multiple kinds of curves of temperature, oil pressure, fuel level sensors are optional and users can define the sensor curves by themselves;
— With maintenance function, alarm will be issued for maintenance time due;

— Support non-road China  IVengine;

— Wide power supply range DC (8-35)V, which can suit different starting battery voltage environment;
— Silicone panel and pushbuttons, hard screen acrylic for screen protection;
— Sealed enclosure design, the whole unit protection can reach IP65;
— Modular design, high-quality anti-flaming shell, specified connector, embedded mounting, compact structure and easy installation.

## 3 SPECIFICATION

**Table 3 Technical Parameters**

| Items | Contents |
|---|---|
| Operating Voltage | DC8V~DC35V, DC reverse connection protection<br>Resolution: 0.1V<br>Accuracy: 1% |
| Overall Consumption | <7W (Standby mode: <2W) |
| Speed Sensor | Voltage Range: 1.0V~ 24V (RMS)<br>Frequency Range: 5Hz~10000Hz |
| Charger(D+) Voltage | Range: DC0V ~ DC60V<br>Resolution: 0.1V<br>Accuracy: 1% |
| Analog Sensor | Resistance Input<br>Range: 0Ω ~ 6000Ω<br>Resolution: 0.1Ω<br>Accuracy: 1Ω (below 300Ω) |
| | Voltage Input<br>Range: 0V ~ 5V<br>Resolution: 0.001V<br>Accuracy: 1% |
| | Current Input<br>Range: 0mA ~ 20mA<br>Resolution: 0.01mA<br>Accuracy: 1% |
| Digital Output 1-3 | 5A DC28V    DC power supply output (relay output) |
| Aux. Input 1-3 | Active when connect to negative of power supply<br>Low threshold voltage: 1.2V          High limit input voltage: 60V |
| RS485 Interface | Isolated, half-duplex, 9600 bps baud rate, the max communication length 1,000m |
| CAN Interface | Isolated, the max communication length 250m, using Belden 9841 cable or equivalent |
| CM-EMC Certificate | EN 55032, EN 55024 |
| Vibration Test | 5 Hz~ 8 Hz      ±17 mm<br>8 Hz ~100 Hz:   a= 4g<br>100 ~ 500Hz:     a=2g<br>IEC 60068-2-6 |
| Shock Test | 50g, 11ms, half-sine, three consecutive shocks are applied from each of the three perpendicular directions, a total of 18 times<br>IEC 60068-2-27 |
| Bump Test | 20g, 16ms, half-sine<br>IEC 60255-21-2 |
| Case Dimensions | 127mm x 115mm x 55.9mm |

| Items | Contents |
|---|---|
| Panel Cutout | 115mm x 103mm |
| Working Temperature | (-25~+70)°C |
| Working Humidity | (20~93)%RH |
| Storage Temperature | (-30~+80)°C |
| Protection Level | IP65 |
| Weight | 0.45kg |

## 4  OPERATION

### 4.1  CONTROLLER PANEL



**Fig.1 HED400 Front Panel Indication**

⚠NOTE: Partial icon' description.

**Table 4 Icons Description**

| Icon | Function | Description |
|---|---|---|
| | After-treatment Icon | Engine fault |
| | After-treatment Icon | High exhaust temperature indicator light |
| | After-treatment Icon | NCD status indicator light |
| | After-treatment Icon | DWS/ driver warning indicator light |
| | After-treatment Icon | DPF regeneration request |
| | After-treatment Icon | DPF Regeneration inhibit |

**SmartGen**

On homepage, if no key is pressed for 20s, the icons will automatically hide. Press any key to show the key icons again.

**Table 5 Keys Description**

| Icon | Keys | Description |
|------|------|-------------|
| ⚠ | Alarm View | When not on alarm page, press this key can skip to the alarm page. |
| ↩ | Return | Press this key to return to the previous page on menu page. |
| ⌂ | Homepage | Press this key to return to homepage. Long press this key on main screen to enter the menu page. |
| ⇦ | Left/Decrease | Press this key to turn the page left when switching the page;<br>Press this key to move the cursor up;<br>Press this key to decrease the number by one. |
| ⇨ | Right/Increase | Press this key to turn the page right when switching the page;<br>Press this key to move the cursor down;<br>Press this key to increase the number by one. |
| OK | Confirm | Press this key to confirm the current configuration during parameter setting. |
| 🕐 | Speed Control | Press this key, the controller will enter the speed control screen. |
| ⇧ | Speed Up | After pressing this key, the engine will increase the setting speed. |
| ⇩ | Speed Down | After pressing this key, the engine will decrease the setting speed. |
| ⇦+⇨ | Brightness | On main screen, press Left key + Right key simultaneously to enter the LCD backlight settings. |

⚠NOTE: Press any key to mute the sound on main screen.

## 5 MAIN SCREEN DISPLAY PARAMETER SETTING

The display theme of main screen can be set to instrument or four parameters display.



**Fig.2 Instrument Display**



**Fig.3 Four Parameters Display**
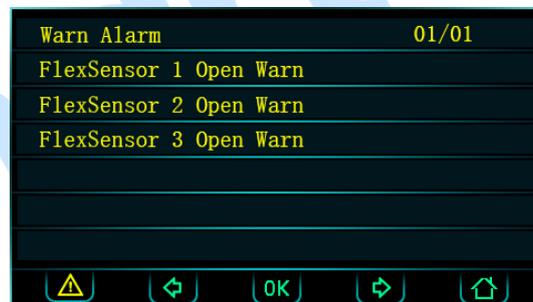


**Fig.4 Alarms Display**



**Fig.5 Input /Output Ports**

**Fig.6 Maintenance**



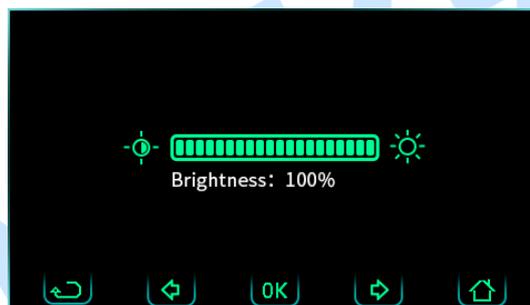**Fig.7 Details Information**



**Fig.8 Brightness Adjustment**

⚠**NOTE: On brightness adjustment screen, when the brightness level reaches 100%, press the brightness increase key again to enter the backlight on mode.**

## SmartGen

## 6 USER MENU AND PARAMETER SETTING

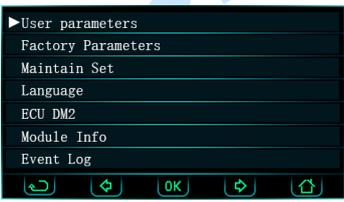Press ⌂ on the main screen, it will enter user menu, items are as follows:

——Parameter Setting: input the correct password (factory default is 00000) to enter the user parameter setting screen.

——Manufacturer Parameter Setting: input the correct password (factory default is 00318) to enter the manufacturer setting screen.

——Maintenance Setting: input the correct password (factory default is 01234) to enter the maintenance setting screen.

——Language Selection: to select simplified Chinese, English.

——ECU DM2: to display DM2 fault code of engine.

——Backlight Adjustment: to adjust the screen backlight.

——Controller Information: to view the development information of controller, such as software version, hardware version and release date.

——Event Log: to enter the details page of event log.

Parameter setting includes the following contents:

——Module Setting

——Engine Setting

——Speed Control Setting

——Flexible Sensor Setting

——Aux. Input Ports

——Aux. Output Ports

——Maintenance Setting

——Intelligent Display Setting

For example:

**Table 6 Menu Screen**

| Configuration Screen | Description | |
|---|---|---|
| ★Menu Setting | | |
| ▶User parameters<br>Factory Parameters<br>Maintain Set<br>Language<br>ECU DM2<br>Module Info<br>Event Log | ⟲ | Return to the previous menu. |
| | ◁ | Move the cursor to the previous line. |
| | OK | Confirm it to enter the menu corresponding to cursor. |
| | ▷ | Move the cursor to the next line. |
| | ⌂ | Move the cursor to the homepage. |
| ★Module Setting | | |
| ▶User Password<br>Factory Password<br>Maintain Password<br>Module Address<br>Local Remote Select<br>RS485 Baud Set<br>RS485 Stop bit | ⟲ | Return to the previous menu. |
| | ◁ | Move the cursor to the previous line; press it to decrease the number. |
| | OK | Press it to adjust the parameter; press it again to save after adjustment. |
| | ▷ | Move the cursor to the next line; press the confirm key to increase the number. |
| | ⌂ | One-touch back to homepage. |

# SmartGen

| Configuration Screen | Description | |
|---|---|---|
| ★Engine Type Setting | | |
| Engine Type:0:Non-ECU<br>▶0:Non-ECU<br>1:General ECU<br>2:GTSC1-PLUS<br>3:VOLVO<br>4:CAT<br>5:KUBOTA | ⮌ | Return to the previous menu. |
| | ◁ | Move the cursor to the previous line. |
| | OK | Press it to confirm the configuration. |
| | ▷ | Move the cursor to the next line. |
| | ⌂ | One-touch back to homepage. |
| ★Speed Control Setting | | |
| | ⮌ | Return to the previous menu. |
| Local Thro. Adj Set<br>0: Disable<br>Sensor Channel    Flexible Sensor 3<br>Sensor Type    0:Voltage<br>Start Value    00.75V<br>Max Value    03.84V | ◁ | Move the cursor to the previous line when no adjustment is made.<br>Change selection during adjustment.<br>Decrease the number during adjustment. |
| | OK | Press it to adjust parameters; press it again to save the parameter after adjustment. |
| | ▷ | Return to the previous menu when no adjustment is made;<br>Change the selections during adjustment.<br>Increase the number during adjustment. |
| | ⌂ | One-touch back to home page. |

⚠**NOTE:**

— **Please modify the parameters in standby mode (crank disconnect speed, flex. sensor and speed control setting, etc.) otherwise abnormal conditions may appear.**

— **High threshold must be greater than the low threshold; otherwise high and low condition may occur at the same time.**

— **Please set the return value correctly in setting warning alarm, otherwise abnormal alarm will occur. When setting high warning, return value should be less than setting value while return value should be greater than setting value in setting low warning.**

**SmartGen**

## 7 PARAMETER SETTING RANGE AND DEFINITION

**Table 7 Parameter Setting Content and Range**

| No. | Item | | Range | Default | Description |
|---|---|---|---|---|---|
| Language Setting | | | | | |
| 1 | Language | | (0-1) | 0 | 0: Simplified Chinese;　1: English |
| Module Setting | | | | | |
| 1 | User Password | | (0-65534) | 0 | The password for entering user parameter setting. |
| 2 | Manufacturer Password | | (0-65534) | 00318 | The password for entering advanced parameter setting.<br><br>⚠ **CAUTION:** Default password is "00318", operator can change the password to prevent others from changing the advanced configuration randomly. Please remember it after changing, if forget it, please contact the company service personnel. |
| 3 | Maintenance Password | | (0-65534) | 01234 | The password for entering maintenance parameter setting. |
| 4 | Comm. Address | | (1-254) | 1 | Controller address in remote monitoring. |
| 5 | Local/Remote Select | | (0-1) | 0 | 0: Local Mode;　1: Remote Mode |
| 6 | RS485 Comm. Baud Rate | | (0-2) | 0 | 0: 9600bps<br>1: 19200bps<br>2: 38400bps |
| 7 | Stop Bit | | (0-1) | 0 | 0: 1-bit;　1: 2-bit |
| 8 | Parity Bit | | (0-2) | 0 | 0: None;　1: Odd;　2: Even |
| 9 | RS485 Resistor | | (0-1) | 0 | 0: Disable;　1: Enable |
| 10 | CAN Baud Rate | | (0-1) | 0 | 0: 250kbps;　1: 500kbps |
| 11 | CAN Resistor | | (0-1) | 0 | 0: Disable;　1: Enable |
| 12 | Boot Screen Set | | (0-1) | 0 | 0: Disable;　1: Enable |
| 13 | Boot Screen Duration | | (0-3600)s | 2 | The duration for boot screen. |
| 14 | Theme Select | | (0-1) | 0 | 0: Tachometer;　1: Four Parameters |
| 15 | Top Left Display | | (0-17) | 1 | See Table of Main Screen Display Setting for the details. |
| 16 | Bottom Left Display | | (0-17) | 3 | |
| 17 | Top Right Display | | (0-17) | 2 | |
| 18 | Bottom Right Display | | (0-17) | 4 | |
| 19 | Manufacturer Device Information | | (0-1) | 0 | 0: Disable;　1: Enable |
| 20 | LCD Backlight | Brightness | (1-10) | 10 | The higher the brightness number, the brighter the backlight. When the button is not operated, the backlight delay begins. Once the time is up, the always on brightness is executed. |
| | | Delay | (0-5)min | 1 | |
| | | Always On | (0-10) | 0 | |

**SmartGen**

| No. | Item | | Range | Default | Description |
|---|---|---|---|---|---|
| | | Brightness | | | |
| Engine Setting | | | | | |
| 1 | Engine Type | | (0-29) | 1 | Default: general unit. Select corresponding engine model for connecting different J1939 units. |
| 2 | Flywheel Teeth | | (1.0-300.0) | 118.0 | Tooth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See the following installation description. |
| 3 | Idle Speed | | (0-6000)RPM | 750 | Standard for min.speed adjustment. |
| 4 | Rated Speed | | (0-6000)RPM | 2000 | Standard for overspeed judgment and max. speed regulation. |
| 5 | Crank Disconnect Speed | | (0-1000)RPM | 350 | When speed exceeds the set value, controller determines that the engine has started successfully. |
| 6 | ECU Address | | (0-255) | 3 | Engine speed control address. |
| 7 | DPF Regeneration Control Address | | (0-255) | 33 | The address of engine regeneration control. |
| 8 | Over Speed Warn Set | Enable | (0-1) | 0 | Set value is the percentage of rated speed, return value and delay value can be set. |
| | | Set | (0-200.0)% | 110.0 | |
| | | Return | (0-200.0)% | 108.0 | |
| | | Delay | (0-3600)s | 5 | |
| 9 | Battery Rated Voltage | | (0-60.0)V | 24.0 | Standard for battery over/under voltage. |
| 10 | Overvolt Warn | Enable | (0-1) | 0 | Set value is the percentage of battery rated voltage, return value and delay value can be set. |
| | | Set | (0-200)% | 120 | |
| | | Return | (0-200)% | 115 | |
| | | Delay | (0-3600)s | 60 | |
| 11 | Undervolt Warn | Enable | (0-1) | 0 | 0: Disable; 1: Enable |
| | | Set | (0-200)% | 85 | Set value is the percentage of battery rated voltage, return value and delay value can be set. |
| | | Return | (0-200)% | 90 | |
| | | Delay | (0-3600)s | 60 | |
| 12 | Aftertreatment Icon Display | | (0-1) | 1 | 0: Disable; 1: Enable |
| 13 | Charger Signal Source | | (0-1) | 0 | 0: ECU; 1: Analog |
| 14 | Charge Alt Fail | Enable | (0-1) | 0 | 0: Disable; 1: Enable |
| | | Set | (0-60.0)V | 8.0 | During engine normal running, when charger voltage is lower than this value, it will send a charging failure warning. |
| | | Return | (0-60.0)V | 10.0 | |
| | | Delay | (0-3600)s | 60 | |
| Speed Control Setting | | | | | |
| 1 | Enable Setting | | (0-1) | 0 | 0: Disable; 1: Enable |
| 2 | Port Select | | (0-1) | 0 | 0: Key/Input Port; 1: Throttle Control |
| 3 | Local | Enable | (0-1) | 0 | 0: Disable; 1: Enable |

| No. | Item | | Range | Default | Description |
|---|---|---|---|---|---|
| | Throttle Control | Setting | | | |
| | | Sensor Channel | (0-5) | 0 | 0: Flex. Sensor 1<br>1: Flex. Sensor 2<br>2: Flex. Sensor 3<br>3: Flex. Sensor 4<br>4: Flex. Sensor 5<br>5: Flex. Sensor 6 |
| | | Sensor Type | (0-2) | 0 | 0: Resistance Type<br>1: Current Type<br>2: Voltage Type |
| | | Start Value | (0-5000) | 50 | Different display units for different sensor types. |
| | | Max. Value | (0-5000) | 950 | |
| 4 | Remote Throttle Control | Enable Setting | (0-1) | 0 | 0: Disable;   1: Enable |
| | | Sensor Channel | (0-5) | 0 | 0: Flex. Sensor 1<br>1: Flex. Sensor 2<br>2: Flex. Sensor 3<br>3: Flex. Sensor 4<br>4: Flex. Sensor 5<br>5: Flex. Sensor 6 |
| | | Sensor Type | (0-2) | 0 | 0: Resistance Type<br>1: Current Type<br>2: Voltage Type |
| | | Start Value | (0-5000) | 50 | Different display units for different sensor types. |
| | | Max. Value | (0-5000) | 950 | |
| 5 | Speed Control Period | | (1-1000) | 1 | During the speed control, the engine speed increases or decreases for a single press of speed up/down key. |
| 6 | Acceleration Rate | | (0-2000)r/s | 500 | The change rate of engine speed up. |
| 7 | Deceleration Rate | | (0-2000)r/s | 100 | The change rate of engine speed down. |
| 8 | Gear RPM | 1st Gear | (0-6000)RPM | 750 | The engine runs at the preset gear-specific speed. |
| 9 | | 2nd Gear | (0-6000)RPM | 1200 | |
| 10 | | 3rd Gear | (0-6000)RPM | 1800 | |
| Sensor Setting | | | | | |
| Aux. Sensor 1~6 | | | | | |
| 1 | Sensor Select | | (0-3) | 3 | 0: Not Used; 1: Temp. Sensor; 2: Pressure Sensor; 3: Level Sensor; |
| 2 | Curve Type | | | | Change according to sensor type. |
| 3 | Open Action | | (0-1) | 1 | 0: Warning;   1: No Action |

| No. | Item | | Range | Default | Description |
|---|---|---|---|---|---|
| 4 | Display Unit | | (0-2) | 0 | 0: °C;  1:°F (Temperature Sensor)<br>0：kPa;  1：bar；2:psi (Pressure Sensor)<br>0：%;  1：L (Level Sensor)<br>**NOTE:** Display unit varies from sensor to sensor. |
| 5 | Alarm Detection Range | | (0-2) | 0 | 0: After normal running; 1: Always; 2: Inactive |
| 6 | Over Warn Set | Enable | (0-1) | 0 | 0: Disable;  1: Enable |
| | | Set | (0-9000) | 90 | When external sensor value exceeds it, warning alarm is issued. Alarm, delay value and return value can be set. |
| | | Return | (0-9000) | 80 | |
| | | Delay | (0-3600)s | 5 | |
| 7 | Under Warn Set | Enable | (0-1) | 0 | 0: Disable;  1: Enable |
| | | Set | (0-9000) | 20 | When external sensor value is less than it, warning alarm is issued. Alarm, delay value and return value can be set. |
| | | Return | (0-9000) | 30 | |
| | | Delay | (0-3600)s | 5 | |
| 8 | Custom Curve Set | | | | Corresponding curves needs to be set when selecting custom resistance /voltage/current type. |

Engine Temperature Setting (ECU)

| No. | Item | | Range | Default | Description |
|---|---|---|---|---|---|
| 1 | Data Source | | (0-6) | 0 | 0: ECU<br>1: Flex. Sensor 1<br>2: Flex. Sensor 2<br>3: Flex. Sensor 3<br>4: Flex. Sensor 4<br>5: Flex. Sensor 5<br>6: Flex. Sensor 6 |
| 2 | Display Unit | | (0-1) | 0 | 0: °C;  1: °F |
| 3 | Alarm Detection Range | | (0-2) | 0 | 0: After normal running; 1: Always; 2: Inactive |
| 4 | Over Warn Set | Enable | (0-1) | 1 | 0: Disable;  1: Enable |
| | | Set | (0-300)°C | 95 | When engine temperature exceeds it, warning alarm is issued. Alarm, delay value and return value can be set. |
| | | Return | (0-300)°C | 93 | |
| | | Delay | (0-3600)s | 5 | |
| 5 | Under Warn Set | Enable | (0-1) | 0 | 0: Disable;  1: Enable |
| | | Set | (0-300)°C | 20 | When engine temperature is less than it, warning alarm is issued. Alarm, delay value and return value can be set. |
| | | Return | (0-300)°C | 30 | |
| | | Delay | (0-3600)s | 5 | |

Engine Oil Pressure Setting (ECU)

| No. | Item | | Range | Default | Description |
|---|---|---|---|---|---|
| 1 | Data Source | | (0-6) | 0 | 0: ECU<br>1: Flex. Sensor 1<br>2: Flex. Sensor 2<br>3: Flex. Sensor 3<br>4: Flex. Sensor 4<br>5: Flex. Sensor 5 |

| No. | Item | | Range | Default | Description |
|---|---|---|---|---|---|
| | | | | | 6: Flex. Sensor 6 |
| 2 | Display Unit | | (0-2) | 0 | 0: kPa; 1: bar; 2: psi |
| 3 | Alarm Detection Range | | (0-2) | 0 | 0: After normal running; 1: Always; 2: Inactive |
| 4 | Over Warn Set | Enable | (0-1) | 0 | 0: Disable; 1: Enable |
| | | Set | (0-9000)kPa | 90 | When engine oil pressure exceeds it, warning alarm is issued. Alarm, delay value and return value can be set. |
| | | Return | (0-9000)kPa | 80 | |
| | | Delay | (0-3600)s | 5 | |
| 5 | Under Warn Set | Enable | (0-1) | 1 | 0: Disable; 1: Enable |
| | | Set | (0-9000)kPa | 124 | When engine oil pressure is less than it, warning alarm is issued. Alarm, delay value and return value can be set. |
| | | Return | (0-9000)kPa | 138 | |
| | | Delay | (0-3600)s | 10 | |
| Fuel Level Correlation | | | | | |
| 1 | Fuel Level Correlation | | (0-6) | 0 | 0: Not Used;<br>1: Flex. Sensor 1<br>2: Flex. Sensor 2<br>3: Flex. Sensor 3<br>4: Flex. Sensor 4<br>5: Flex. Sensor 5<br>6: Flex. Sensor 6 |
| Aux. Input Port Setting | | | | | |
| 1 | Aux. Input Port 1 | | (0-29) | 0 | 0: Not Used. Details refer to Table of Definable Contents of Digital Input Port 1~3. |
| 2 | Active Type | | (0-1) | 0 | 0: Close for active; 1: Open for active |
| 3 | Aux. Input Port 2 | | (0-29) | 0 | 0: Not Used. Details refer to Table of Definable Contents of Digital Input Port 1~3. |
| 4 | Active Type | | (0-1) | 0 | 0: Close for active; 1: Open for active |
| 5 | Aux. Input Port 3 | | (0-29) | 0 | 0: Not Used. Details refer to e Table of Definable Contents of Digital Input Port 1~3. |
| 6 | Active Type | | (0-1) | 0 | 0: Close for active; 1: Open for active |
| Aux. Output Port Setting | | | | | |
| 1 | Aux. Output Port 1 | | (0-39) | 0 | 0: Not Used, details refer to Table of Programmable Output Ports. |
| 2 | Active Type | | (0-1) | 0 | 0: Normally open; 1: Normally Close |
| 3 | Aux. Output Port 2 | | (0-39) | 0 | 0: Not Used, details refer to Table of Programmable Output Ports. |
| 4 | Active Type | | (0-1) | 0 | 0: Normally open; 1: Normally Close |
| 5 | Aux. Output Port 3 | | (0-39) | 0 | 0: Not Used, details refer to Table of Programmable Output Ports. |
| 6 | Active Type | | (0-1) | 0 | 0: Normally open; 1: Normally Close |
| Maintenance Setting | | | | | |

| No. | Item | Range | Default | Description |
|---|---|---|---|---|
| 1 | Maintenance 1 Set | (0-1) | 0 | |
| 2 | Maintenance 2 Set | (0-1) | 0 | |
| 3 | Maintenance 3 Set | (0-1) | 0 | |
| 4 | Maintenance 4 Set | (0-1) | 0 | After unit maintenance, it can reset time |
| 5 | Maintenance 5 Set | (0-1) | 0 | due alarm by resetting maintenance time, |
| 6 | Maintenance 6 Set | (0-1) | 0 | details refer to Table of Maintenance |
| 7 | Maintenance 7 Set | (0-1) | 0 | Setting. |
| 8 | Maintenance 8 Set | (0-1) | 0 | |
| 9 | Maintenance 9 Set | (0-1) | 0 | |
| 10 | Maintenance 10 Set | (0-1) | 0 | |

## 7.1 MAIN SCREEN DISPLAY SETTING

**Table 8 Main Screen Display Setting**

| No. | Items | Icon |
|---|---|---|
| 00 | Engine Speed | |
| 01 | Engine Water Temp. | |
| 02 | Engine Oil Pressure | |
| 03 | Fuel Level | |
| 04 | Bat. Volt. | |
| 05 | Charger Volt. | |
| 06 | Total Running Time | |
| 07 | Flex. Sensor 1 | |
| 08 | Flex. Sensor 2 | |
| 09 | Flex. Sensor 3 | |
| 10 | Flex. Sensor 4 | |
| 11 | Flex. Sensor 5 | |
| 12 | Flex. Sensor 6 | |
| 13 | Engine Load Rate | |
| 14 | Torque Percentage | |
| 15 | Urea Level | |
| 16 | DPF Carbon Accumulation | |
| 17 | DPF Soot Loading Rate | |

## 7.2 PROGRAMMABLE OUTPUT PORT ITEMS

**Table 9 Contents of Programmable Output Ports**

| No. | Items | Descriptions |
|---|---|---|
| 00 | Not Used | |
| 01 | Custom Combined Output 1 | |
| 02 | Custom Combined Output 2 | Function description see *7.3 Defined Combination Output*. |
| 03 | Custom Combined Output 3 | |
| 04 | Audible Alarm Output | Act when warning alarms and externally connected with alarm device. If the programmable input port "Alarm Mute" activates or any panel key is pressure, the output is disabled. |

| No. | Items | Descriptions |
|---|---|---|
| | | When alarm output resumes upon detection of new warning alarm. |
| 05 | Reserved | |
| 06 | Running Status Output | Output when engine is in normal running, disconnect when speed is less than the crank disconnect speed. |
| 07 | 1st Gear Speed Output | Output when input port of "1st Gear Active" is configured and receives an active signal. |
| 08 | 2nd Gear Speed Output | Output when input port of "2nd Gear Active" is configured and receives an active signal. |
| 09 | 3rd Gear Speed Output | Output when input port of "3rd Gear Active" is configured and receives an active signal. |
| 10 | Input Port 1 Active | Act when input port 1 is active. |
| 11 | Input Port 2 Active | Act when input port 2 is active. |
| 12 | Input Port 3 Active | Act when input port 3 is active. |
| 13 | Common Alarm | Act when common warning occurs. |
| 14 | Over Speed Warning | Act when engine over speed warning occurs. |
| 15 | Battery Over Volt. Warning | Act when battery over voltage warning occurs. |
| 16 | Battery Under Volt. Warning | Act when battery under voltage warning alarms. |
| 17 | High Water Temp. | Act when high water temperature warning occurs. |
| 18 | Low Oil Pressure | Act when low oil pressure warning occurs. |
| 19 | Charge Alt Fail | Act when charging failure warning alarms. |
| 20 | Flex. Sensor 1 High Warning | Act when Flex. Sensor 1 high warning occurs. |
| 21 | Flex. Sensor 1 Low Warning | Act when Flex. Sensor 1 low warning occurs. |
| 22 | Flex. Sensor 2 High Warning | Act when Flex. Sensor 2 high warning occurs. |
| 23 | Flex. Sensor 2 Low Warning | Act when Flex. Sensor 2 low warning occurs. |
| 24 | Flex. Sensor 3 High Warning | Act when Flex. Sensor 3 high warning occurs. |
| 25 | Flex. Sensor 3 Low Warning | Act when Flex. Sensor 3 low warning occurs. |
| 26 | Flex. Sensor 4 High Warning | Act when Flex. Sensor 4 high warning occurs. |
| 27 | Flex. Sensor 4 Low Warning | Act when Flex. Sensor 4 low warning occurs. |
| 28 | Flex. Sensor 5 High Warning | Act when Flex. Sensor 5 high warning occurs. |
| 29 | Flex. Sensor 5 Low Warning | Act when Flex. Sensor 5 low warning occurs. |
| 30 | Flex. Sensor 6 High Warning | Act when Flex. Sensor 6 high warning occurs. |
| 31 | Flex. Sensor 6 Low Warning | Act when Flex. Sensor 6 low warning occurs. |
| 32-39 | Reserved | |

## 7.3 DEFINED COMINATION OUTPUT

Defined combination output is composed by 3 parts: OR condition output S1, OR condition output S2, AND condition output S3.
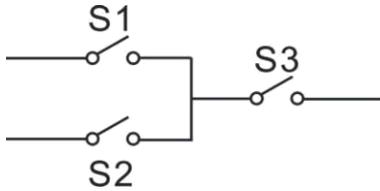


S1 or S2 is true, and S3 is true, then combination output works.

S1 and S2 both are false, or S3 is false, then combination output doesn't work.

⚠**NOTE:** S1, S2 and S3 can be any contents except itself defined combination output of the output settings.

⚠**NOTE:** S1, S2 and S3 cannot include or recursively include itself.

For example:

Contents of OR condition output S1: input port 1 is active;

Close when OR condition output S1 is active/inactive: close when active (disconnect when inactive);

Contents of OR condition output S2, input port 2 is active;

Close when OR condition output S2 is active/inactive: close when active (disconnect when inactive);

Contents of AND condition output S3: input port 3 is active;

Close when AND condition output S3 is active/inactive: close when active (disconnect when inactive);

When input port 1 is active or input port 2 is active, if input port 3 is active, defined combination output is working; if input port 3 is inactive, defined combination output is not working;

When input port 1 is inactive and port 2 is inactive, no matter port 3 is active or not, defined combination output is not working.

## 7.4 DEFINITION CONTENTS OF DIGITAL INPUT PORTS 1~3

### Table 10 Definition Contents of Digital Input Ports 1-3

| No. | Items | Description |
|---|---|---|
| 0 | Not Used | |
| 1 | User-defined | Users can customize the following functions:<br>Warning: warning only, no shutdown.<br>Inactive: input is deactivated.<br>Always active: input always detects.<br>Active when normal running: detect begins from normal running. |
| 2 | Speed Control Active | When the input is active, the controller is allowed to send speed control command to ECU. |
| 3 | Reserved | |
| 4 | Speed Raising Input | An external button (non self-locking) can be connected for manual speed control. |
| 5 | Speed Dropping Input | |
| 6 | Local/Remote Throttle Speed Control | During throttle speed control, when the input is active, speed control operates in remote throttle mode; when the input is inactive, speed control defaults to local throttle mode. |
| 7 | 1st Gear Active | When the input is active, speed adjustment is performed at the |

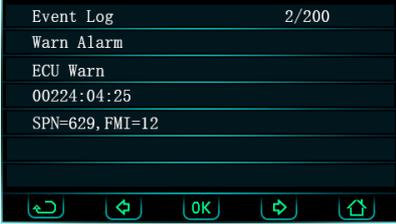| No. | Items | Description |
|---|---|---|
| | | first gear speed in the speed settings. |
| 8 | 2nd Gear Active | When the input is active, speed adjustment is performed at the second gear speed in the speed settings. |
| 9 | 3rd Gear Active | When the input is active, speed adjustment is performed at the third gear speed in the speed settings. |
| 10 | Alarm Mute | When active, it can disable the "Audio Alarm" output configured in the output settings. |
| 11 | Local CAN Speed Control Disabled | When input is active, the controller is disabled to send speed control command to ECU |
| 12 | DPF Manual Regeneration | When the input is active, the controller sends a manual regeneration request command to ECU. |
| 13 | DPF Manual Regeneration Disabled | When the input port is active, the controller sends a regeneration disabled command to ECU. |
| 14-29 | Reserved | |

**Table 11 Maintenance Setting**

| Item | Content | Description |
|---|---|---|
| Enable Set | 0: Disable;   1: Enable | It is used for enabling current maintenance function. |
| Maintenance Time | (0-30000)h | Hours from maintenance enabled until maintenance is required. |
| Time Due Action | 0: Warning<br>1: No Action | Alarm action upon reaching preset maintenance duration. |
| Pre-alarm Time | (0-30000)h | Hours from maintenance enabled to pre-alarm threshold is reached. |
| Pre-alarm Time Due Action | 0: Warning<br>1: No Action | Alarm action upon reaching pre-alarm maintenance duration. |
| First Maintenance Enable Select | 0: Disable;   1: Enable | Set activation status of the first maintenance service function. |
| First Maintenance Time | (0-30000)h | Hours from first maintenance enabled until maintenance is required. |
| First Maintenance Time Due Action | 0: Warning<br>1: No Action | Alarm action upon reaching preset first maintenance duration. |
| Reset Maintenance Time | 0: Disable;   1: Enable | After maintenance, reset the maintenance time via it. |

**SmartGen**

## 7.5 EVENT LOG

Enter "Event Log" via menu, up to 200 items can be recorded. Press 🔲, 🔲 can scroll page to view the log, press 🔲 can return to previous menu, press 🔲 to return to home page.

**Table 12 Event Log Screen**

| | |
|---|---|
| Event Log 1/200<br>Warn Alarm<br>Maint.1 Warn<br>00004:04:25 | First line: display current event log No. and total logs;<br>Second line: this log type is "Warning Alarm";<br>Third line: specific name of the event;<br>Fourth line: time stamp, it records engine's total running time. |
| Event Log 2/200<br>Warn Alarm<br>ECU Warn<br>00224:04:25<br>SPN=629,FMI=12 | First line: display current event log no. and total logs;<br>Second line: this log type is "ECU Warning Alarm";<br>Third line: specific name of the event;<br>Fourth line: time stamp, it records engine's total running time.<br>Fifth line: SPN value and FMI value in the alarm occurrence. |

## 8 SPEED CONTROL

### 8.1 KEY/INPUT PORT SPEED CONTROL

When speed control is enabled, select speed control type 0： Key/Input Port.

Press 🔲 on main screen to enter the speed control screen. Press 🔲 or activate "Speed Raising Input", the engine speed will rise by the configured value (default: 1RPM). Press 🔲 or activate "Speed Dropping Input", the engine speed will drop by the configured value (default:1RPM). Press 🔲 to exit the speed control mode and return to home page.

### 8.2 THROTTLE SPEED CONTROL

When speed control is enabled, select speed control type 1： Throttle Control. The controller supports both local and remote throttle speed control. The active throttle type can be switched via the "Local/Remote Throttle" input port.

Local throttle setting:
Speed control enable: 1: Enable
Sensor Channel: Flex. Sensor 3
Sensor Type: 0: Resistance
Start Value: 50Ω
Max. Value: 950Ω
Engine Idle Speed: 800RPM
Rated Speed: 2000 RPM

During operation, connect the potentiometer to the input port of Flex. Sensor 3, and connect the other terminal to the sensor common. The min. resistance value corresponds to engine idle speed (800RPM); the max. resistance corresponds to the rated speed (2000 RPM). Adjust the potentiometer's resistance will proportionally change the engine RPM. See the following figure for specific scaling

relationship. The same principle applies to voltage-type and current-type sensors.
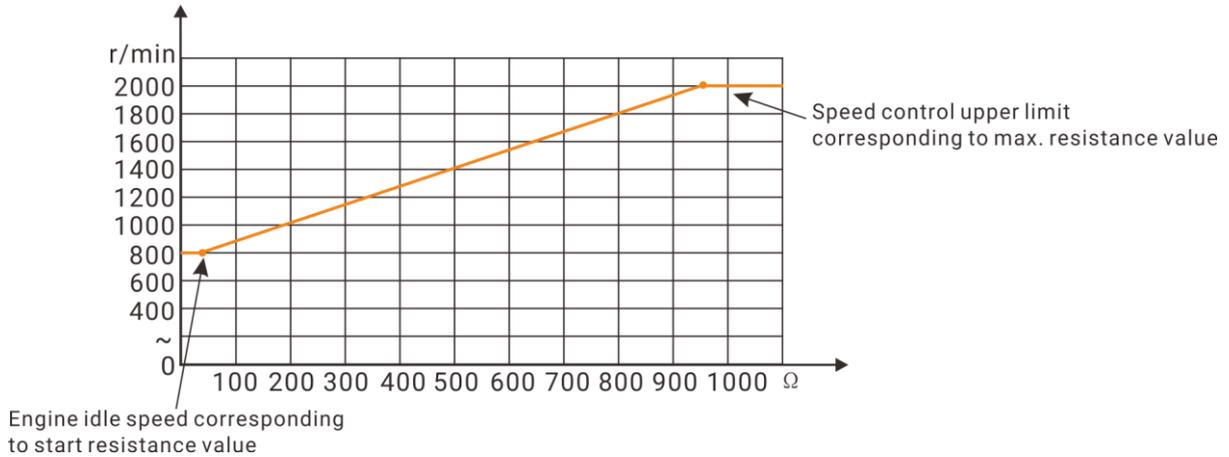


**Fig.9 Resistance and Speed Relationship**

NOTE: Once any sensor channel is configured as a throttle control input and the corresponding throttle mode is activated, its programmable sensor function will be disabled.

## 8.3 PRIORITY DESCRIPTION FOR GEAR INPUT PORT

**Table 13 Description of Gear Input Port Priority**

| 1st Gear Active | 2nd Gear Active | 3rd Gear Active | Real Active Gear RPM |
|---|---|---|---|
| 0 | 0 | 0 | None |
| 1 | 0 or 1 | 0 or 1 | 1 |
| 0 | 1 | 0 or 1 | 2 |
| 0 | 0 | 1 | 3 |

NOTE: The priority of gear input port is higher than the throttle speed control and key/input port speed control.

## 9 LOCAL REMOTE MODE

Connect the two controllers via the 485 interface. Set one to local mode and the other to remote mode. Once communication is successfully connected, the remote mode controller will read data from the local mode controller.

## 10 CUSTOM SPN FAULT CODES

Users can configure custom alarm names for SPN fault codes into the controller via PC. A total of 50 custom SPN fault codes are supported, with Chinese/English display.

**Fig.10 SPN Code Page of PC Software**

## 11   SENSOR CURVE SETTING

— When external sensor is required, sensor type needs to be set, default sensor to "Not Used".

— When there is difference between standard sensor curves and used sensor curves, users can select "Custom Sensor", and input sensor curve.

— When the sensor curve is inputted, x value must be inputted from small to large, otherwise, mistake occurs.

— If sensor type is selected as "Not Used", sensor curve is not working.

— The headmost or backmost values in the vertical coordinates can be set as the same as below.
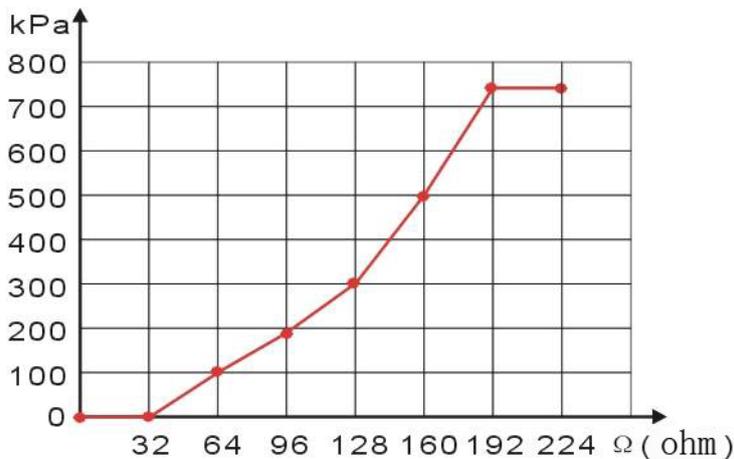


**Fig.11 Curve Setting**

**Table 14 Sensor Selection**

| No. | Sensor | Curve Type | Remark |
|-----|--------|-----------|--------|
| 1 | Temperature Sensor | 0 Not Used<br>1 Custom Resist. Curve<br>2 Custom (4-20)mA Curve<br>3 Custom Volt Curve<br>4 VDO<br>5 CURTIS<br>6 VOLVO-EC<br>7 DATCON<br>8 SGX<br>9 SGD<br>10 SGH<br>11 PT100<br>12 PT1000<br>13 Cu50<br>14 -15 Reserved | Custom resistance type input range is (0~1)kΩ. |
| 2 | Pressure Sensor | 0 Not Used<br>1 Custom Resist. Curve<br>2 Custom (4-20)mA Curve<br>3 Custom Volt Curve<br>4 VDO 10bar<br>5 CURTIS<br>6 VOLVO-EC<br>7 DATCON 10bar<br>8 SGX<br>9 SGD<br>10 SGH<br>11-15 Reserved | Custom resistance type input range is (0~1)kΩ. |
| 3 | Level Sensor | 0 Not Used<br>1 Custom Resist. Curve<br>2 Custom (4-20)mA Curve<br>3 Custom Volt Curve<br>4 Reserved<br>5 Reserved<br>6 4-126Ω<br>7 0-190Ω<br>8 190-0Ω<br>9 240-33Ω<br>10 33-240Ω<br>11-15 Reserved | Custom resistance type input range is (0~1)kΩ. |

## SmartGen

**12 ALARMS**

When controller detects alarm signal, it displays the alarm content. When alarm is removed, alarm is cleared automatically.

**Table 15 Warning Alarms**

| No. | Warning | Description |
|-----|---------|-------------|
| 1 | Over Speed | When controller detects engine speed |
| 2 | DPF Regeneration | When controller receives DPF regeneration warning signal of engine via J1939, it issues warning signal. |
| 3 | NCD Error | When controller receives NCD error warning signal via J1939, it issues warning signal. |
| 4 | Charge Alt Failure | Act when charging failure warning alarms. |
| 5 | Battery Overvoltage | When controller detects engine battery voltage is higher than pre-set threshold, it issues warning alarm signal. |
| 6 | Battery Undervoltage | When controller detects engine battery voltage is lower than pre-set threshold, it issues warning alarm signal. |
| 7 | ECU Warning | When controller receives warning signal of engine via J1939, it issues warning signal. |
| 8 | Sensor 1~6 Open | When controller detects sensor is open and action type is "Warning", it issues warning signal. |
| 9 | Sensor 1~6 High | When controller detects sensor value is above pre-set upper limit of warning values, it issues warning signal. |
| 10 | Sensor 1~6 Low | When controller detects sensor value is below pre-set lower limit of warning values, it issues warning signal. |
| 11 | Sensor 3~6 Error | When sensor parameter configuration is wrong, it issues warning signal. |
| 12 | Coolant Temperature (ECU) High | When controller detects coolant temperature is higher than pre-set high warning value, it issues warning signal. |
| 13 | Coolant Temperature (ECU) Low | When controller detects temperature is lower than pre-set low warning value, it issues warning signal. |
| 14 | Oil Pressure (ECU) High | When controller detects oil pressure value is above pre-set high warning value, it issues warning signal. |
| 15 | Oil Pressure (ECU) Low | When engine is running, controller detects oil pressure value is below pre-set low warning value, it issues warning signal. |
| 16 | Maintenance 1~10 | When maintenance countdown is 0, and time due action is "Warning", it issues warning signal. |
| 17 | Input Port 1~3 | When digital input port is configured as "Warning" and it is active, controller issues a corresponding warning signal. |

# SmartGen

## 13 WIRE CONNECTION

The back panel of HED400 is below:



1.SENSOR 1
2.SENSOR 2
3.MP1
4.MP2
5.D+
6.SENSOR 3
7.CAN H
8.CAN L
9.SENSOR 4
10.VOUT(+5V)
11.SENSOR 5
12.SENSOR 6
13.GND
14.485 B
15.485 A
16.AUX.INPUT 1
17.AUX.INPUT 2
18.AUX.INPUT 3
19.AUX.OUTPUT 1
20.AUX.OUTPUT 2
21.AUX.OUTPUT 3
22.B+
23.GND

**Fig.12 Controller Back Panel**

**Table 16 Connection Terminal Description**

| No. | Function | Cable Size | Remark |
|---|---|---|---|
| 1 | Flex. Sensor 1 | 0.5mm$^2$ | Connect with temperature, pressure or level sensor. Setting items see *Table of Sensor Selection*. Only resistance sensor is available. |
| 2 | Flex. Sensor 2 | | |
| 3 | Speed Sensor Input MP1 | 0.5mm$^2$ | Speed Sensor Input |
| 4 | Speed Sensor Input MP2 | | Speed sensor input, controller inside has been connected to negative post of battery. |
| 5 | Charger D+ Input | 1.0mm$^2$ | Connect with charger D+ (WL) terminal. If this terminal doesn't exist, hang it in the air. |
| 6 | Flex. Sensor 3 | 0.5mm$^2$ | Connect with temperature, pressure or level sensor. Setting items see *Table of Sensor Selection*. Voltage sensor, current sensor and resistance sensor are available. |
| 7 | ECU CAN H | 0.5mm$^2$ | Impedance-120Ω shielding wire is recommended, and the single-end shall be earth connected. The "Matched Resistance Enable" is configured to determine if a 120Ω matched resistance should be connected to CANBUS automatically. |
| 8 | ECU CAN L | 0.5mm$^2$ | |
| 9 | Flex. Sensor 4 | 0.5mm$^2$ | Connect with temperature, pressure or level sensor. Setting items see *Table of Sensor Selection*. Voltage sensor, current sensor and resistance sensor are |

# SmartGen

| No. | Function | Cable Size | Remark |
|-----|----------|------------|--------|
|  |  |  | available. |
| 10 | VOUT (+5V) | 0.5mm$^2$ | Output DC+5V, Max. current is 30mA. |
| 11 | Flex. Sensor 5 | 0.5mm$^2$ | Connect with temperature, pressure or level sensor. Setting items see *Table of Sensor Selection*. Voltage sensor, current sensor and resistance sensor are available. |
| 12 | Flex. Sensor 6 |  | Connect with temperature, pressure or level sensor. Setting items see *Table of Sensor Selection*. Voltage sensor, current sensor and resistance sensor are available. |
| 13 | GND | 1.0mm$^2$ | Sensor Common. |
| 14 | RS485 B(-) | 0.5mm$^2$ | Impedance-120Ω shielding wire is recommended, and the single-end shall be earth connected. No external 120Ω resistance is required, the "Matched Resistance Enable" is configured to determine if an internal resistance should be used automatically. |
| 15 | RS485 A(+) | 0.5mm$^2$ |  |
| 16 | AUX. Input 1 | 0.5mm$^2$ | Ground connected is active (B-). |
| 17 | AUX. Input 2 | 0.5mm$^2$ | Ground connected is active (B-). |
| 18 | AUX. Input 3 | 0.5mm$^2$ | Ground connected is active (B-). |
| 19 | AUX. Output 1 | 1.0mm$^2$ | B+ is supplied by 22 points, rated 5A. |
| 20 | AUX. Output 2 | 1.0mm$^2$ | B+ is supplied by 22 points, rated 5A. |
| 21 | AUX. Output 3 | 1.0mm$^2$ | B+ is supplied by 22 points, rated 5A. |
| 22 | DC Power B+ | 1.5mm$^2$ | Connect with positive post of starting battery. |
| 23 | GND | 1.5mm$^2$ | Connect with negative post of starting battery. |

**NOTE1: The USB interface on back panel is a parameter programming interface, and you can use a PC to program the controller.**
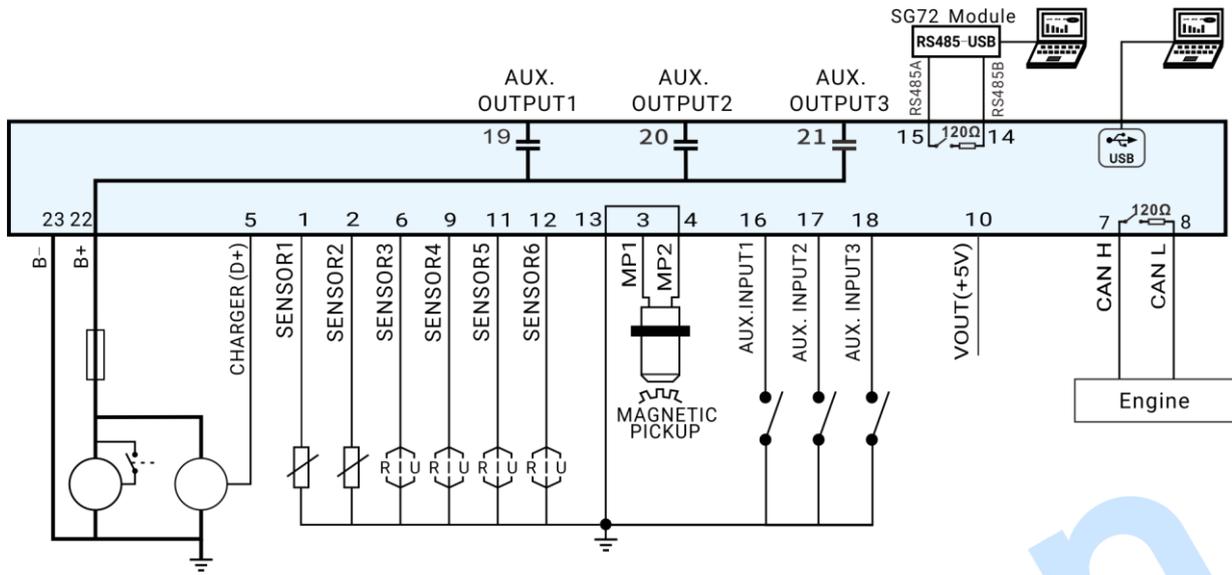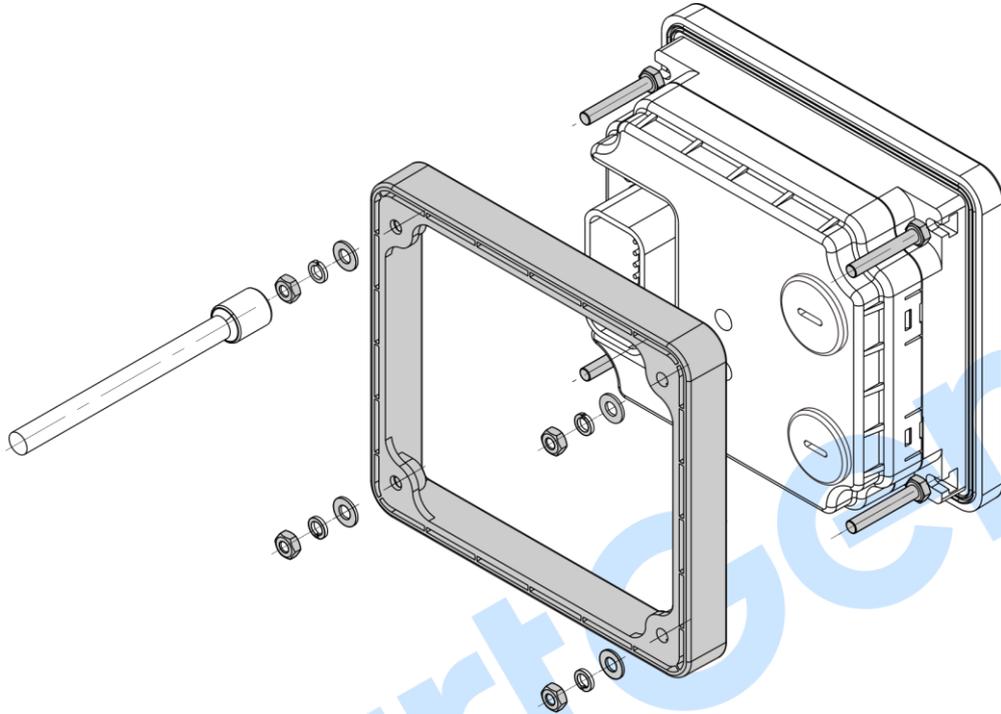
## 14 TYPICAL APPLICATION



**Fig.13 HED400 Typical Application Diagram**

## 15    INSTALLATION

### 15.1    FIXING CLIPS

Unit:  mm



**Fig.14 HED400 Fixing Clips Installation**

—    This controller is panel built-in design and is fixed by pressure frame when installation;
—    Remove the pressure from the controller;
—    Remove the four M4 bolts and place them in the corresponding slots of the front shell;
—    Place the controller in the opening position of the control cabinet, place the pressure frame behind the controller by aligning the four bolts;
—    Install and tighten the flat washers, spring washers and hexagonal nuts respectively.

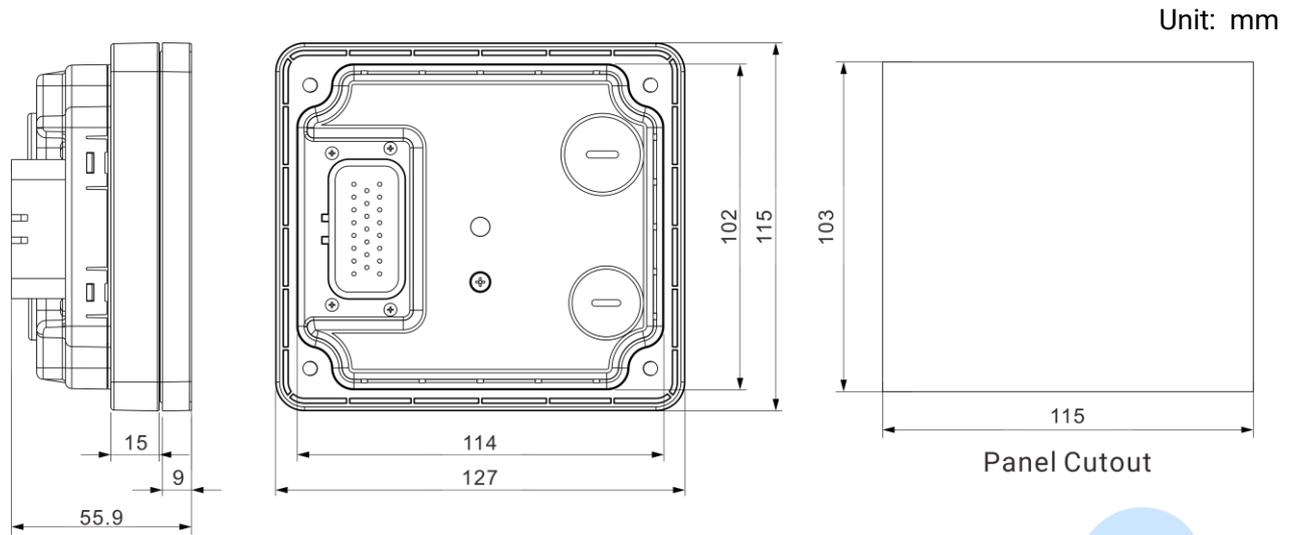## 15.2 OVERALL DIMENSIONS AND PANEL CUTOUT

Unit: mm



**Fig.15 Overall Dimensions and Panel Cutout**

# 16 CONNECTIONS OF CONTROLLER WITH J1939 ENGINE

## 16.1 CUMMINS ISB/ISBE

**Table 17 9-pin Connector**

| Terminals of controller | 9 pins connector | Remark |
|---|---|---|
| CAN(H) | SAE J1939 signal-C | Using impedance 120Ω connecting line. |
| CAN(L) | SAE J1939 return-D | Using impedance 120Ω connecting line. |

## 16.2 VOLVO

Suitable engine type is TD520，TAD520(optional), TD720, TAD720(optional), TAD721, TAD722, TAD732.

**Table 18 Connector**

| Terminals of controller | Connector | Remark |
|---|---|---|
| - | 1 | Connected to negative of battery. |
| CAN(H) | 12 | Using impedance 120Ω connecting line. |
| CAN(L) | 13 | Using impedance 120Ω connecting line. |

## 16.3 YUCHAI

Suitable for Yuchai electronic-controlled engine.

**Table 19 Engine 42-pin Port**

| Terminals of controller | Engine 42 pins port | Remark |
|---|---|---|
| CAN_SCR | - | CAN communication shielding line. |
| CAN(H) | 1.35 | Using impedance 120Ω connecting line. |
| CAN(L) | 1.34 | Using impedance 120Ω connecting line. |

**Table 20 Engine 2-pin Port**

| Battery | Engine 2 pins port | Remark |
|---|---|---|
| Battery negative | 1 | Wire diameter 2.5mm$^2$. |
| Battery positive | 2 | Wire diameter 2.5mm$^2$. |

**16.4   WEICHAI**

Suitable for Weichai electronic-controlled engine.

**Table 21 Engine Port**

| Terminals of controller | Engine port | Remark |
|---|---|---|
| CAN_SCR | - | CAN communication shielding line. |
| CAN(H) | 1.35 | Using impedance 120Ω connecting line. |
| CAN(L) | 1.34 | Using impedance 120Ω connecting line. |

⚠**NOTE:** If there is any question of connection between controller and ECU communication, please feel free to contact SmartGen's service.

# SmartGen

## 17  TROUBLE SHOOTING

**Table 22 Troubleshooting**

| Symptoms | Possible Solutions |
|---|---|
| Controller no response with power | Check starting battery;<br>Check controller wirings;<br>Check DC fuse. |
| Oil pressure low alarm after crank disconnection | Check oil pressure sensor and its wirings. |
| Water temp. high alarm after crank disconnection | Check water temperature sensor and its wirings. |
| Alarm in running | Check related switch and wirings according to LCD display information. |
| RS485 communication abnormal | Check wirings;<br>Check COM port settings are correct or not;<br>Check RS485 A and B line are connected reversely or not;<br>Check PC communication port is damaged or not;<br>Recommend to enable 120Ω resistor between A and B of RS485. |
| Control displays ECU alarm | Troubleshoot by translating the SPN fault code according the alarm display;<br>Refer to the fault manual;<br>Consult the engine manufacturer. |
| ECU comm. Failure or incorrect data | Check its wirings;<br>Check if CAN BUS H and L are connected reversely or not;<br>Check if ECU is damaged or not;<br>Check if the correct engine type is selected;<br>Check if 120Ω resistor between CAN BUS H and L is enabled; |
| Low backlight brightness | Check battery voltage;<br>Check backlight brightness setting. |

_____