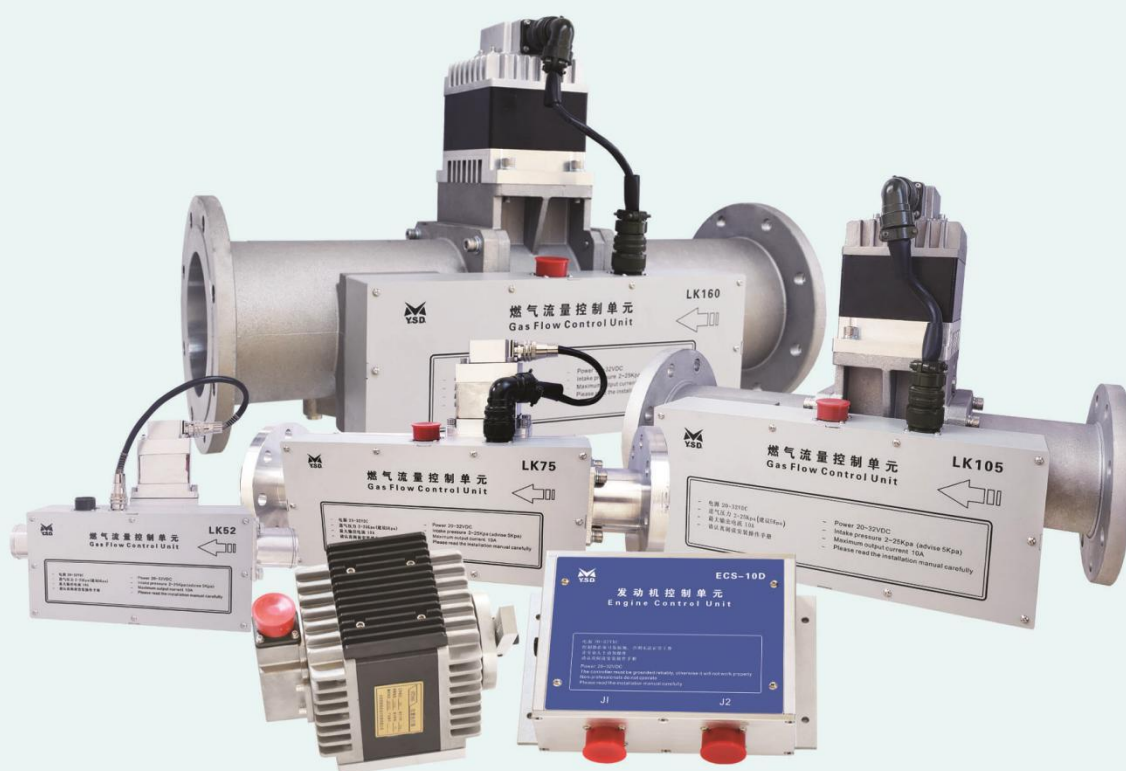# ECS-10D

燃油燃气双燃料发动机控制单元
产品使用说明书

ECS-10D

Fuel gas dual fuel engine control unit

一. Overview

The ECS-10D fuel gas dual fuel engine (power generation) control system can precisely control the ratio of engine fuel and gas, and can ensure that the engine runs at a stable speed under different working conditions.The steady-state and dynamic indicators of the system are set with conventional general parameters when leaving the factory, which can generally meet the requirements for most users or models. If instability occurs, the original speed control system can be adjusted.

The working principle of the ECS-10D system is to calculate the total flow of the mixture entering the engine based on the engine speed density method. The gas flow is calibrated by the theoretical calculation of the gas flow in the pipeline and the measured flow coefficient to obtain the actual instantaneous gas flow.Its flow accuracy error is less than 3%, which can control gas flow according to speed, pressure, differential pressure and temperature under any engine load and operating conditions.The ECS-10D controller cooperates with the LK series gas flow control unit to complete the precise control of the gas flow of different concentrations, ensuring that the engine runs at the set fuel substitution rate, so that the engine can exert the best performance. This is a dual-fuel The ideal control solution for the engine.The biggest advantage of the system is that it can adapt to a wide range of changes in gas heating value, and can achieve flexible control of engine stability, transient performance and emission performance.

The controller is suitable for a wide range of gas sources, suitable for various components of gas, and also has a wide range of intake pressure requirements, the system can adapt to various occasions of different models.

二. electrical parameters

Power supply: 20～32V DC, 10A max
Rated/idle speed regulation range: 0～9KHz
Synchronous control range: 0～5V
Output overcurrent protection: >4A 5s
Input device: 1-way speed sensor input
        1 way oxygen sensor input
        1-way manifold pressure temperature sensor input
        1-way parallel port
        1-way high and low speed switch
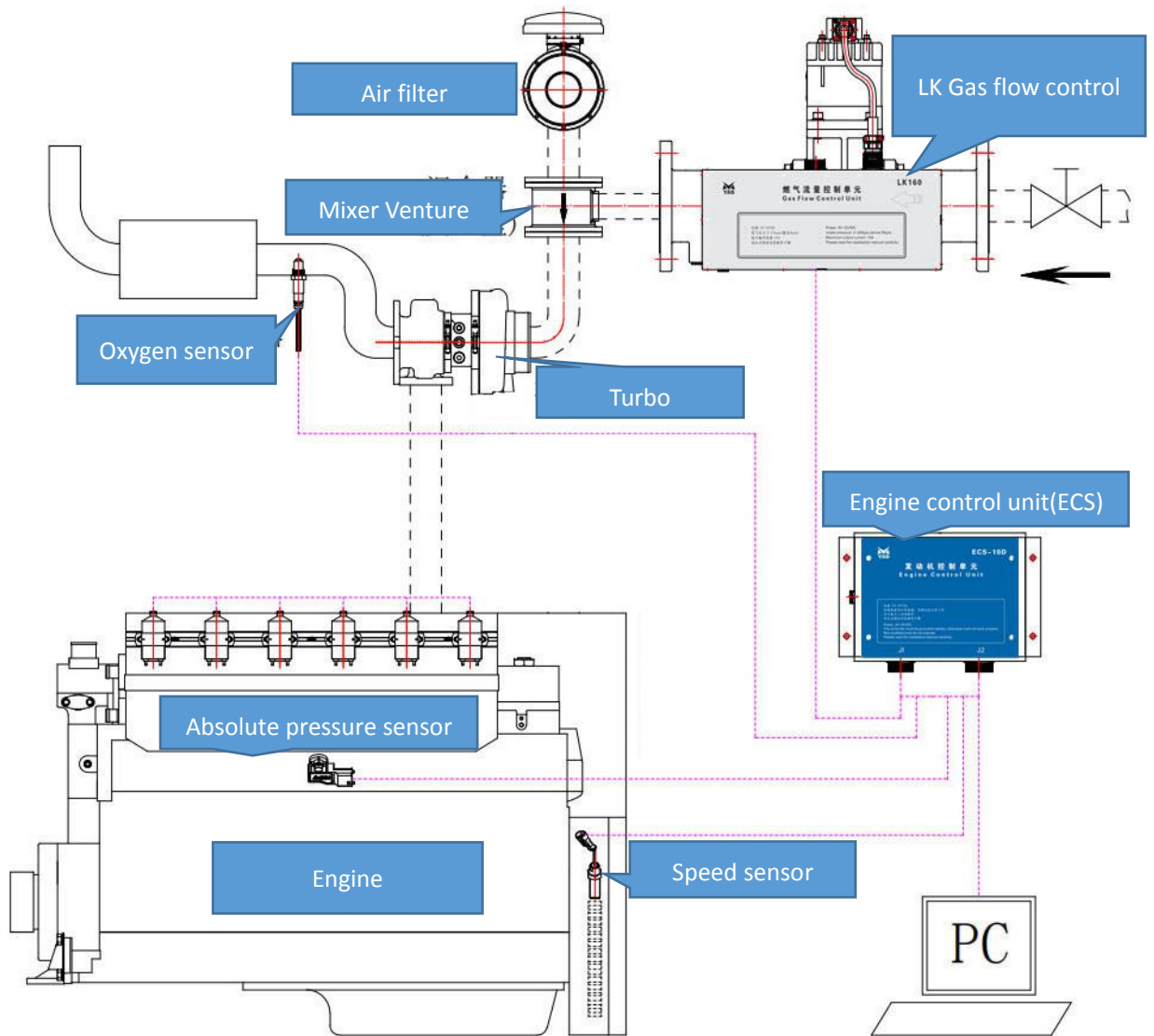Output device: 1-way actuator output
        1-way LKxxx gas flow control unit connection output
        1-way communication output
Working temperature: -20℃~+70℃
Protection class: IP56

三. System General Arrangement

四. System installation

4.1 Installation of speed sensor

The speed sensor uses a magnetoelectric sensor. The function of the speed sensor is to collect the engine speed signal and input it to the ECU to calculate the engine speed and control the electronic throttle opening to control the intake air volume, thereby controlling the engine speed.This sensor communicates with the ECU through a 2-wire connector. Installation position: installed on the flywheel housing, as shown in the figure

Speed sensor · Engine shell · Nut · Flywheel

0.4~0.8mm

发动机飞轮壳体
转速传感器
安装口
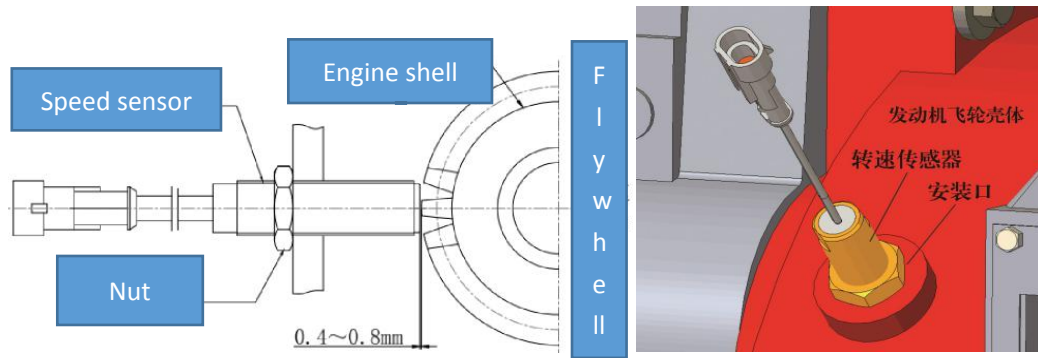
4.2 Manifold Pressure Temperature Sensor Installation

The MAP sensor is the core sensor of the system and is used to measure the absolute pressure of the intake port after the engine speed control valve. Signal type is 0-5Vdc.

The MAP sensor should be installed in a position to avoid high temperature, oil, water, and at the same time higher than the measurement sampling point.The location of the measurement sampling point should be located behind the speed control valve, in the upper part of the air inlet to prevent oil, water or foreign matter from entering the sensor.The measurement sampling point should be able to reflect the average pressure of the intake port, do not rely on the intake valve, speed control valve or the end of the intake port to avoid measurement errors caused by strong turbulence.MAP sensor cables should be kept away from high voltage lines such as ignition coils and high voltage wires.

Intercooler room

Bolts&nuts

MAP sensor
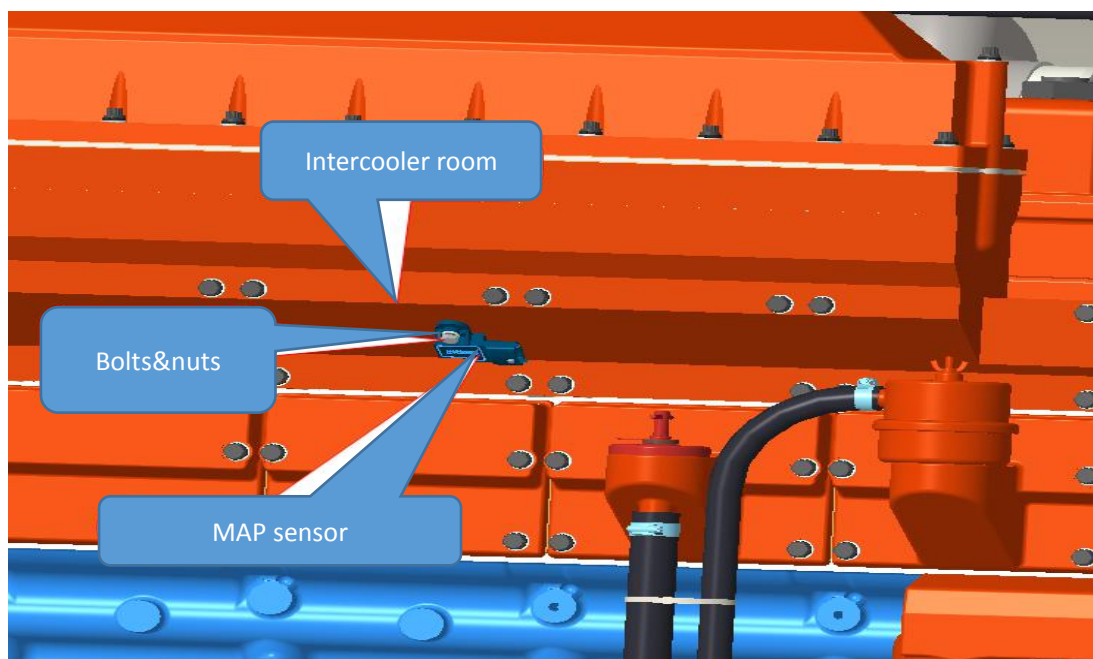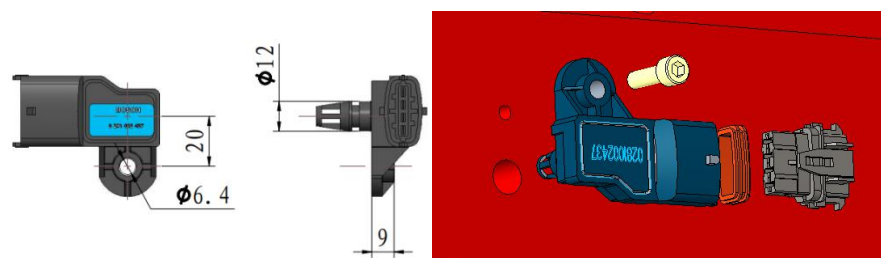
4.3 Oxygen sensor installation

Installation location: The oxygen sensor is installed on the exhaust main pipe connected to the exhaust main pipe, about 30cm away from the main pipe outlet.

Installation Specifications:

--The head of the oxygen sensor is as close as possible to the place on the engine where the exhaust gas composition is most representative (ie the mixture of exhaust gas from each cylinder measured by the sensor).

--Tilt 45° from vertical with electrical connector up

--When assembling, apply special grease to the threads. (Grease is already on the product)

--The sensor must be tightened to prevent leakage

--When tightening, do not force the fitting too hard, otherwise it will cause irreparable damage to the oxygen sensor.

Installation size:
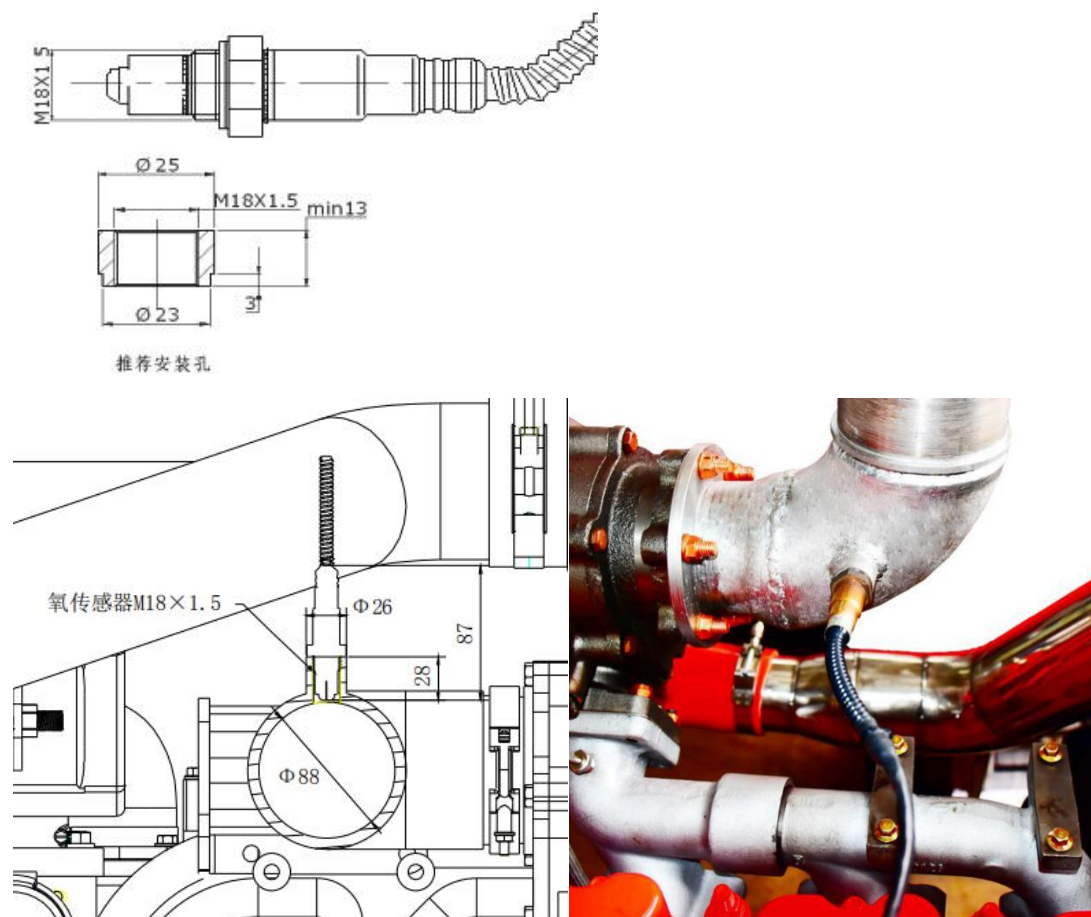
4.4 LKxxx Gas Flow Control Unit Installation

The installation requirements of the LKxxx unit are as close as possible to the engine. Pay attention to the flow direction of the gas during installation. The direction arrow of the air flow is printed on the shell panel of the control unit. Install in the direction indicated by the arrow. The flange connection is reliably sealed, and the control unit itself has been tested for air tightness.

LK52

燃气流量控制单元
Gas Flow Control Unit

Ø62
Ø62
458

301.8
Ø52
159.5

LK75

燃气流量控制单元
Gas Flow Control Unit

Ø200
Ø200
548

280
8-Ø18均布
Ø160

LK105

燃气流量控制单元
Gas Flow Control Unit

Ø222
Ø158
Ø102
Ø102
Ø158
Ø222
20
246
20
560

320
Ø180
8-Ø18均布
(两侧对称)

LK160

燃气流量控制单元
Gas Flow Control Unit

487.5
Ø280
Ø280
755

Ø160
Ø240
8-Ø18均布
322.5
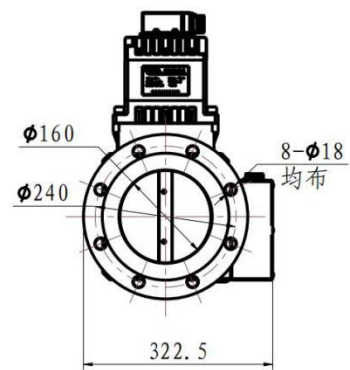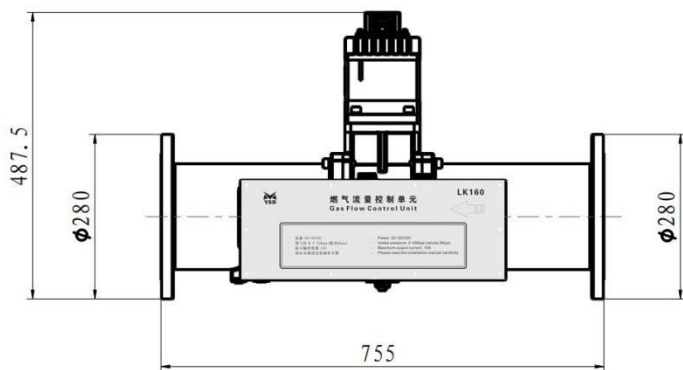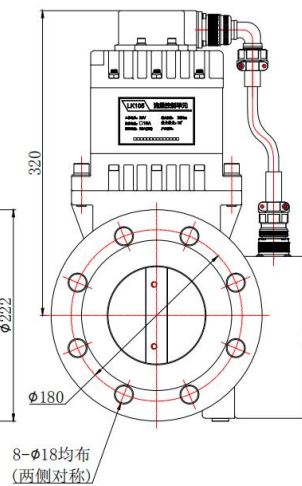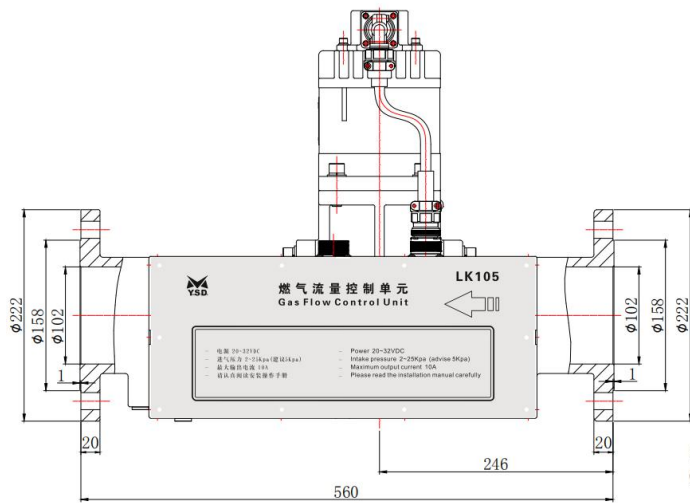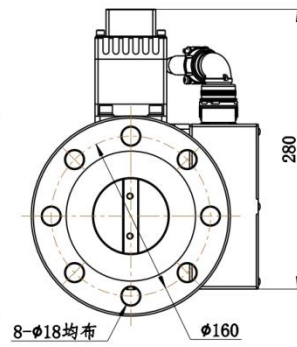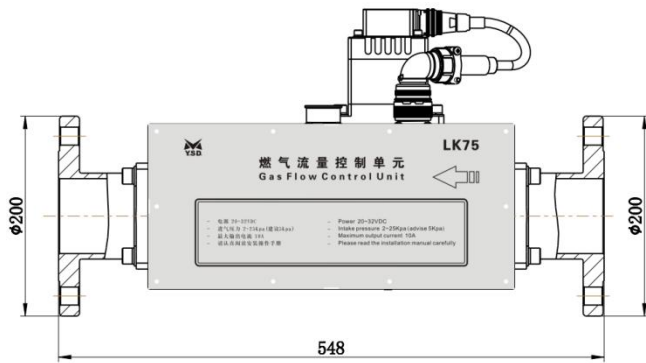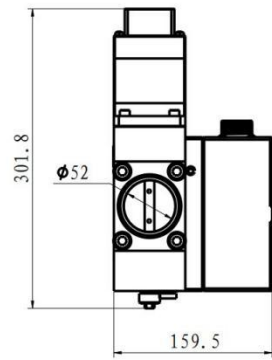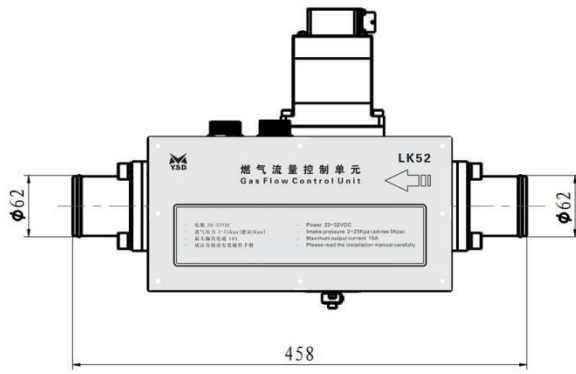
Control unit parameters:

   - Supply voltage 24V

   - Maximum current 10A

   - Pipe inner diameter　Φ52,　Φ75,　Φ105,　Φ160

   - Motor rotation angle 75°

   - Inlet pressure range 2～25KPa

4.5 ECS-10D installation

   The ECU is installed on the engine or in the control room, and the installation dimensions are as shown in the figure
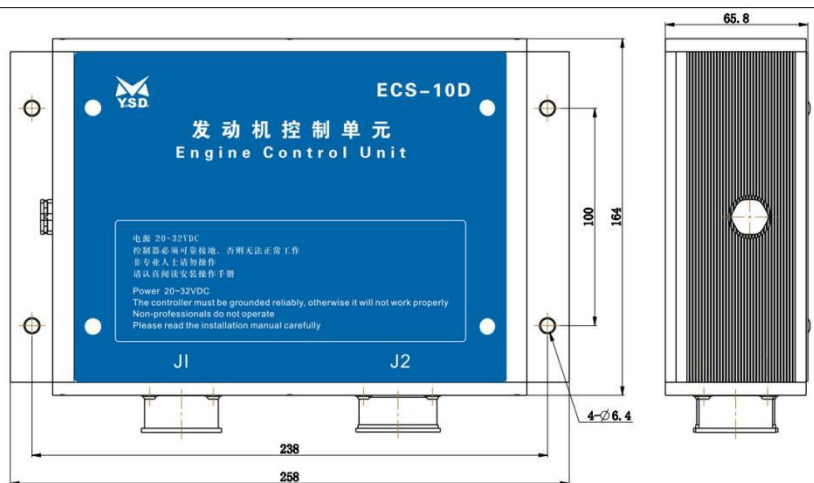
五. Instructions for use

5.1 Software installation and device connection

Double-click the installer ECS1.0.0_setup.exe Choose the installation path:

Click to install now

Wait for the software installation to complete

5.2 Engine parameter setting

Double-click the desktop program icon run the program.Select the correct COM port and click the Open button.

Select "Parameter Settings" to set engine parameters and gas parameters.

5.3 Actuator Position Calibration

Turn the actuator connecting rod to the minimum position, observe the actuator position on the "Engine Status" interface, record and input it to the "Motor Minimum Position"; then turn the actuator connecting rod to the maximum position, observe the execution on the "Engine Status" interface the position of the motor, record and enter it into "Motor Max Position".

OTX-ECS

λ-MAP表 — MAP (%)

转速	10	20	39	40	50	60	70	80	90	100	110
0	1.00	2.00	3.00	3.30	5.00	1.00	1.25	1.00	2.00	1.20	1.00
250	1.00	1.00	1.00	0.23	1.00	2.00	1.25	1.56	1.00	1.00	1.00
500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
750	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1200	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1300	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1400	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1450	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1500	1.15	1.15	1.15	1.22	1.23	1.25	1.25	1.26	1.26	1.26	1.30
1550	1.15	1.15	1.15	1.22	1.23	1.25	1.25	1.26	1.26	1.26	1.30
1600	1.20	1.20	1.20	1.23	1.25	1.25	1.25	1.26	1.26	1.26	1.30
1700	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
2500	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20

VE-MAP表 — MAP (%)

转速	15	22	30	40	50	60	70	80	90	100	110
0	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
250	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
500	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
750	0.80	0.80	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
1000	0.80	0.80	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
1100	0.80	0.80	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
1200	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
1300	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
1400	0.66	0.68	0.74	0.78	0.81	0.84	0.85	0.85	0.85	0.85	0.85
1450	0.66	0.69	0.75	0.78	0.81	0.84	0.85	0.85	0.85	0.85	0.85
1500	0.66	0.69	0.75	0.78	0.81	0.84	0.85	0.85	0.85	0.85	0.85
1550	0.66	0.69	0.75	0.78	0.81	0.84	0.85	0.85	0.85	0.85	0.85
1600	0.66	0.69	0.75	0.78	0.81	0.84	0.85	0.85	0.85	0.85	0.85
1800	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
2000	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90

实时参数：
当前转速 1500
MAP (%) 76.6
设定空燃比 1.26
当前空燃比 0.00
VE 0.85

六. Possible fault symptoms, causes and troubleshooting methods

Improper operation of the engine is usually the main cause of various engine failures. When a fault occurs, you should first confirm whether the engine itself is in a normal state. Therefore, the control system should be disconnected from the engine first, and then the cause of the failure should be determined.

If the controller has abnormal phenomena during installation, debugging and use, please refer to Table 1 to deal with it. If the fault is still not eliminated after checking and handling according to the table below, and it is confirmed that there is no problem with the engine system, please contact the manufacturer. Users who do not have maintenance conditions, please do not blindly dismantle and repair, so as not to expand the failure.

issue	Possible Causes	Solution
Engine won't start	The gas pipeline is blocked or the flow is not enough	After checking the pressure reducing valve, the KP gauge pressure should be kept greater than 2KP. If the pressure drops to 0 at startup, the intake pressure should be increased or the diameter of the intake pipe should be increased.
	Actuator stuck	Push the actuator connecting rod by hand to confirm that the actuator rotates flexibly. If stuck, it should be replaced.
	Controller has no power	Unplug the socket from the controller. Measure +24V on the +24V power and ground pins.
	The Stoping switch is not disconnected	Check the position of the toping switch to confirm that the toping switch is reliable.
	MPU installation clearance is too large	Remove the MPU and reinstall as instructed. Manually crank to check for interference.

	MPU signal connection open	Disconnect governor connector. When cranking, check that the voltage between MPU+ and MPU- should be at least 1V.
	Air fuel ratio error	Observe the air-fuel ratio, too rich or too lean to start the engine; adjust the gas parameters or the VE/λ table.
	Incorrect overspeed setpoint configuration	Check the overspeed protection point configuration settings.
Engine start overspeed	Incorrect overspeed setpoint configuration	Check the overspeed protection point configuration settings.
	Improper transient gain setting	Increase gain to reduce overshoot.
	Incorrect number of flywheel teeth	The parameters are reset by software.
	The speed control actuator is stuck	Check the actuator.
engine unstable	Inappropriate speed PID adjustment	Using the service tool, adjust the position dynamics parameters. Default in most cases.
	Inappropriate air-fuel ratio	Observe the air-fuel ratio, too rich or too lean will lead to unstable speed; adjust the gas parameters or the VE/λ table.
	Inappropriate ignition advance angle	Adjust the ignition advance angle.
	Intermittent or incorrect tach signal	Check the reliability of the speed signal shielding. Check whether the speed input line is unblocked.
	Carbon deposits on spark plugs, rust on high-voltage wires	Replace with new spark plugs and high-voltage wires.

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