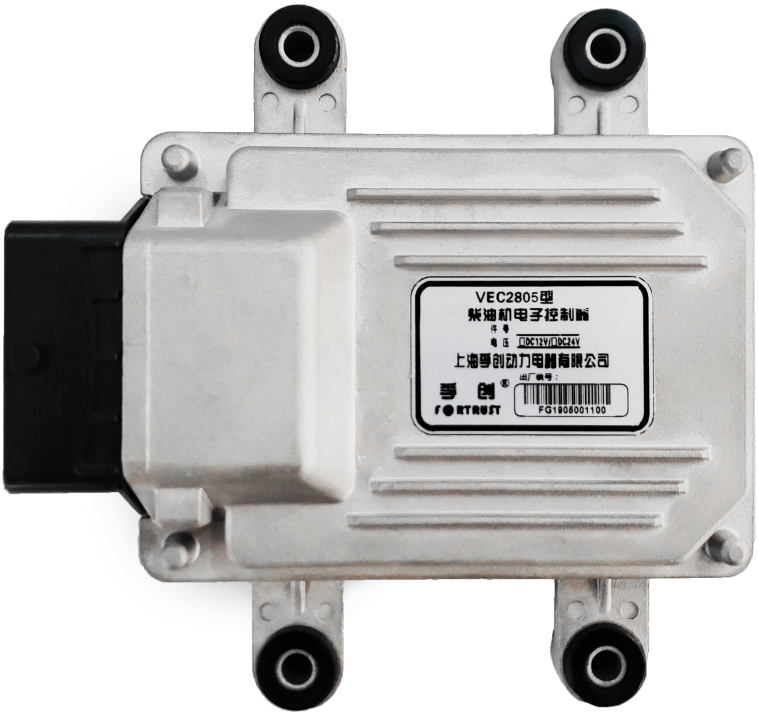
VEC2805 USER MANUAL



In order to provide you with products with the best quality and comprehensive functions, we reserve the right to modify the product specification and design at any time. Please download the latest version of this manual at the following website: http://www.fortrust.cn

Foreword

This manual mainly introduces the working principle, composition, adjustment, operation, maintenance and simple troubleshooting of VEC2805. It is suitable for staff who have a certain understanding of the engine and electronic speed regulation system and carry out daily installation, wiring, use and maintenance. It is recommended to place this manual in the workplace of the product and strictly follow the methods provided here.

CAUTION

Before installing this product, please note:

◆Power off the device.
◆Observe all safety warnings of the equipment manufacturer.
◆Ensure that the equipment does not work during installation.
◆If there are problems during installation, please consult the service department of Fortrust.
◆The speed sensor used in this electronic speed regulation system shall not be shared with other systems to prevent interference.
◆Before starting the engine, confirm that the fuel supply rod of the fuel injection pump is in the fuel cut-off position.

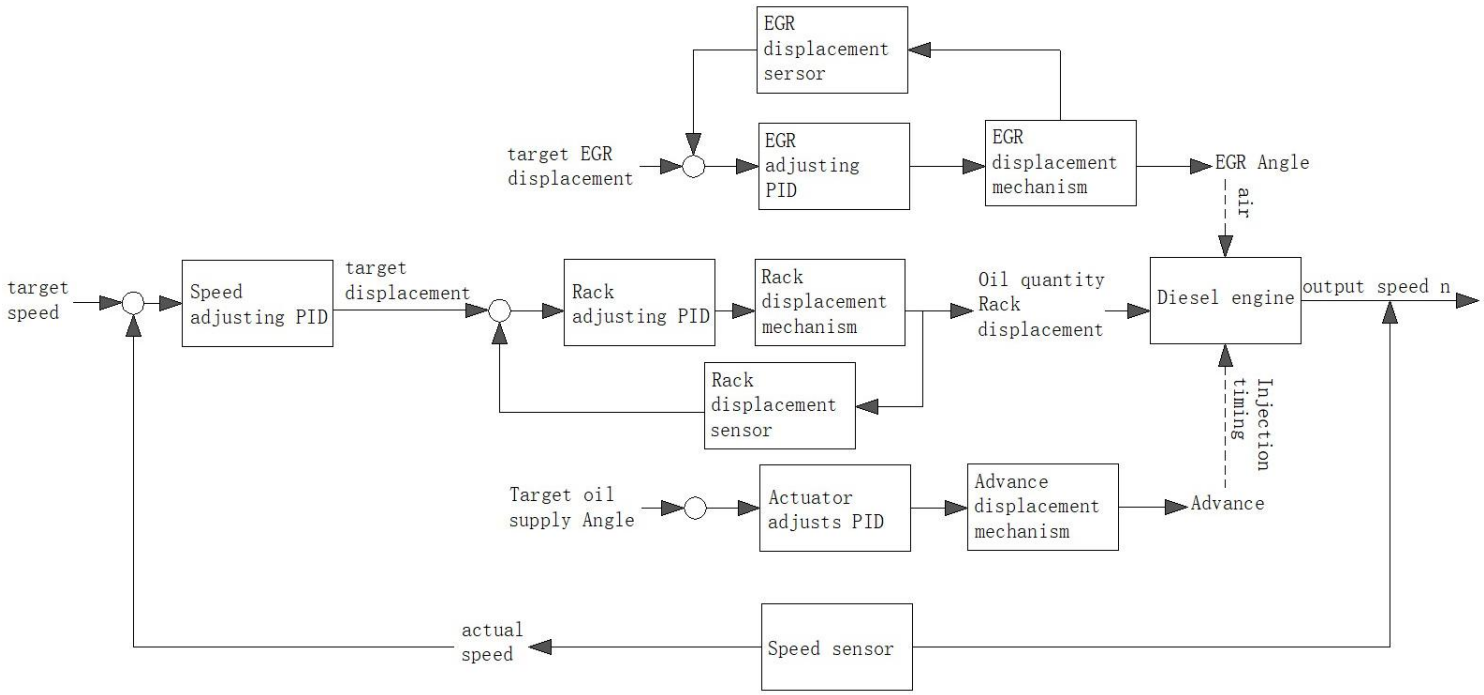
Contents

I. SYSTEM SUMMARY

VEC2805 is a single closed-loop controller in VEC2800 series, which is used to match the engine system with single closed-loop demand.

VEC2805 electric control system improves the performance of the engine without any major transformation of the traditional engine.

The control system consists of controller (ECU), actuator, related sensors and connecting wiring harness.As the core of the whole control system, ECU contains complex control circuit, whose core component is a fast and efficient 32-bit microprocessor. Compared with the mechanical speed control system, the system can improve the engine performance indicators, and its response time is less than 35ms; Compared with analog electronic speed control, the system can realize flexible control strategies, such as: four protection, intake preheating, oil pre-supply, full-range speed control, dual-frequency switch, OBD alarm, self-defined intelligent mode.The controller can communicate with the external monitoring system through its own CAN bus or LIN bus interface. Through the connection with the monitoring system, a new monitoring system can be created to make the whole control system more perfect.



ECU Control Schematic Diagram

II. SYSTEM COMPOSITION AND CONECTION

2.1 System Composition

Part Name	Quantity	Model	Specification	Configuration
ECU	1	VEC2805		Mandatory
Actuator	1	AO7A-WL-BQ-00R	Match according to oil pump model	Mandatory
Speed Sensor	2	TM18*1.5-70A	Magneto-electric (one spare)	Mandatory
Electronic Throttle	1	As the customer required	4.7K potentiometer	Mandatory
Wire Harness Parts	1	As the customer required	Adjust wire harness length according to engine	Mandatory
Acceleration/Deceleration Switch	1	As the customer required	Speed self-reset switch	Optional
High/low Speed Switch	1	As the customer required	High/low speed switch set.	Optional
Multi-speed Switch	1	As the customer required	Multi-speed switch can be set.	Optional
Special Display Module for Electric Control	1	VEC1000	Display various parameters and alarm values of ECU	Optional
Ambient Temperature Sensor	1	As the customer required	NTC	Optional
Coolant Water Temperature Sensor	1	As the customer required	NTC	Optional
Intake Temperature and Pressure Sensor	1	As the customer required	Temperature and pressure integration	Optional
Oil Temperature Pressure Sensor	1	As the customer required	Temperature and pressure integration	Optional
Fault Indicator	2	As the customer	One yellow and one red	Optional

		required		
Intake Heating Relay	1	As the customer required	Used for cold start preheating	Optional
Oil Pre-supply Relay	1	As the customer required		Optional

2.2 ECU Terminal Definition Diagram

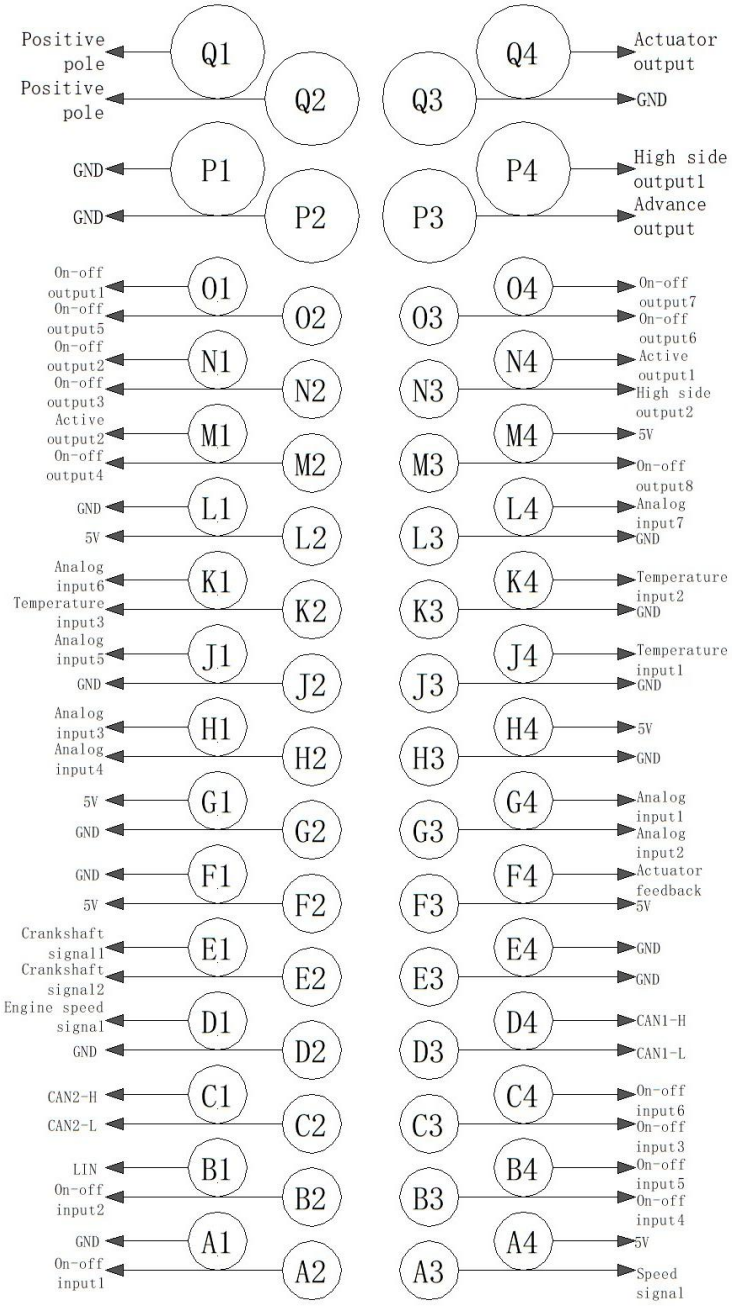


Chart 2-1 28 Pin Definition

III. ECU INTRODUCTION

3.1 Operating Environment

Power Voltage：12V/24V

Atmospheric Pressure：60 ～120kPa

Ambient Temperature：-40 ～ +105℃

Protection grade：IP65

Operating Humidity：＜95%

Electromagnetic Environment：IEC61000

Vibration grade: frequency 100-150Hz/150-400Hz.

Amplitude: 1.2mm/0.2mm.

Acceleration: 8g/ 4g.

3.2 Input and Output

Input and Output	Quantity	Specification
Speed signal input	3	2 circuits are magneto-electric and 1 circuit is Hall type，25～8000Hz，voltage is 2～20V
Car speed signal input	1	magneto-electric，25～8000Hz，voltage is 2～20V
Temperature signal input	3	resistance-type，pull-up resistance of 750Ω built in ECU
Voltage signal input	9	Voltage signal: 0～5V
On-off input	6	3 circuits are active-low and active-high
On-off output	8	High-side drive, current ≤ 3A, with short circuit, over-current and overheating protection
PWM output	4	High-side drive, current ≤ 3A, can be configured as switching value or frequency output
Actuator output	1	Current ≤ 5A, position feedback closed-loop control
Lead time output	1	Current ≤ 5A, position feedback closed-loop control

3.3 Communication Interface

2 circuits CAN bus, supporting SAEJ1939 communication protocol；

1 circuit LIN bus, baud rate 9600, currently used as debugging interface.

3.4 Function Introduction

- **Full-range/bipolar speed control：** Support full-rang and bipolar speed control；
- **External characteristic curve：** Three external characteristic curves can be set to switch through multi-file switch.
- **Speed droop：** Three speed droops can be set by switching. Support MAP speed setting to meet the requirements of various speed regulation characteristics.
- **Dual potentiometer throttle：** Support dual potentiometer throttle, and automatically switch and alarm in case of main potentiometer failure；
- **Remote accelerator：S**upport remote accelerator control；
- **PTO/remote PTO：S**upport PTO（power output）and remote PTO；
- **Advance device control：** Support electric advance device control；
- **EGR control：S**upport EGR control；
- **Intake preheating：S**upport intake preheating control；
- **Fan control：** Support cooling fan control；
- **Smoking restrictions：** Support smoke restrictions function；
- **Oil pressure monitoring：** Support oil pressure monitoring, alarm and emergency shutdown；
- **Idle trim：** Support idle trim function；
- **Fast idle warm-up：** Support fast idle warm-up function；
- **Battery voltage management：** Support battery voltage management function；
- **Workload cycle statistics：** Support workload cycle statistics function；
- **Engine protection：** Supports power reduction function when the coolant temperature is too high；
- **OBD** function：Support online fault diagnosis, alarm and recording；
- **GPS location and car lock：** Support GPS location and car lock function；
- **Else：** Other special functions can be customized.

3.5 Manually adjust the method of content setting

A、Over-speed alarm shutdown with independent dual frequency

According to the dual frequency rated speed value set in 3.5, when the actual speed of the diesel engine exceeds 115% of the rated speed of this frequency, the electromagnetic actuator will quickly turn off the output, the diesel unit will shut down, the OBD self diagnostic flash code will alarm with the fault code 234. After the power is cut off and the fault cause is solved, the diesel will restart without alarm and the diesel engine returns to normal.

B、Full-range speed regulation setting

An external potentiometer (or 0-5V voltage or 4-20mA current) is connected to the analog input interface of the wire harness, and the software is calibrated as follows

First, open the debugging software FECU_SG 1.41

Set the corresponding speed of voltage 0-5V, as shown in the figure, and the full-range speed regulation setting can be realized.

C、Full-range speed regulation over-speed alarm shutdown function

When the external potentiometer is in full-range speed, if it exceeds 115% of the corresponding frequency value under the rated speed condition automatically set by the ECU controller, the electromagnetic actuator shall quickly turn off the output, the diesel unit shall be shut down, the OBD self diagnostic flash code alarm with the fault code 234. After the power is cut off and the fault cause is solved, restart, the alarm is eliminated, and the diesel engine returns to normal.

3.6 OBD actuator disconnection alarm shutdown protection function

When the diesel engine works normally, any wire of the actuator is disconnected, the output rod of the actuator shall quickly return to zero oil level, the diesel unit will be shut down, OBD self diagnostic flash code alarm with the fault code 824. After the power is cut off and the fault cause is solved, restart, the

alarm is eliminated, and the diesel engine returns to normal.

3.7 OBD speed sensor disconnection shutdown protection function

When the diesel engine works normally, any wire of the speed sensor is disconnected, the output rod of the actuator shall quickly return to zero oil level, and the diesel unit will be shut down.

3.8 AUX modulation interface

Aux terminal (receiving 0-5V voltage) has a reference voltage of 2.5V DC, and the base point is adjusted from 2.5V to 3.5V (or 2.5V to 1.5V). At this time, the speed of the diesel engine increases. When the base point is adjusted from 2.5V to 1.5V, the speed of the diesel engine decreases. It can also achieve voltage rise, speed drop, voltage drop and speed rise.

3.9 Debugging tools

The commissioning of VEC2805 system must use the special software and supporting communication line of Shanghai Fortrust Power Electric Co., Ltd. At the same time, the version of commissioning software shall be consistent with that of ECU software.

Part	Quantity	Model	Specification
Computer	1		With USB port 2.0 or above
Debugging software	1	FECU_SG140	VEC2800 special debugging software
Special communication line	1	LIN-TO-USB	Connect computer USB port and controller debugging port

IV. SYSTEM INSTALLATION

4.1 Speed Controller Installation

The controller shall be installed in the cab as far as possible. During installation and disassembly, the cleanliness of the connector shall be maintained as much as possible, the tightening force of the four mounting bolts shall be uniform, and the electronic control unit shall not be collided and dropped during assembly. Install shock absorbers on the front and back of the four mounting bolts.

ECU installation plug-in interface faces down.

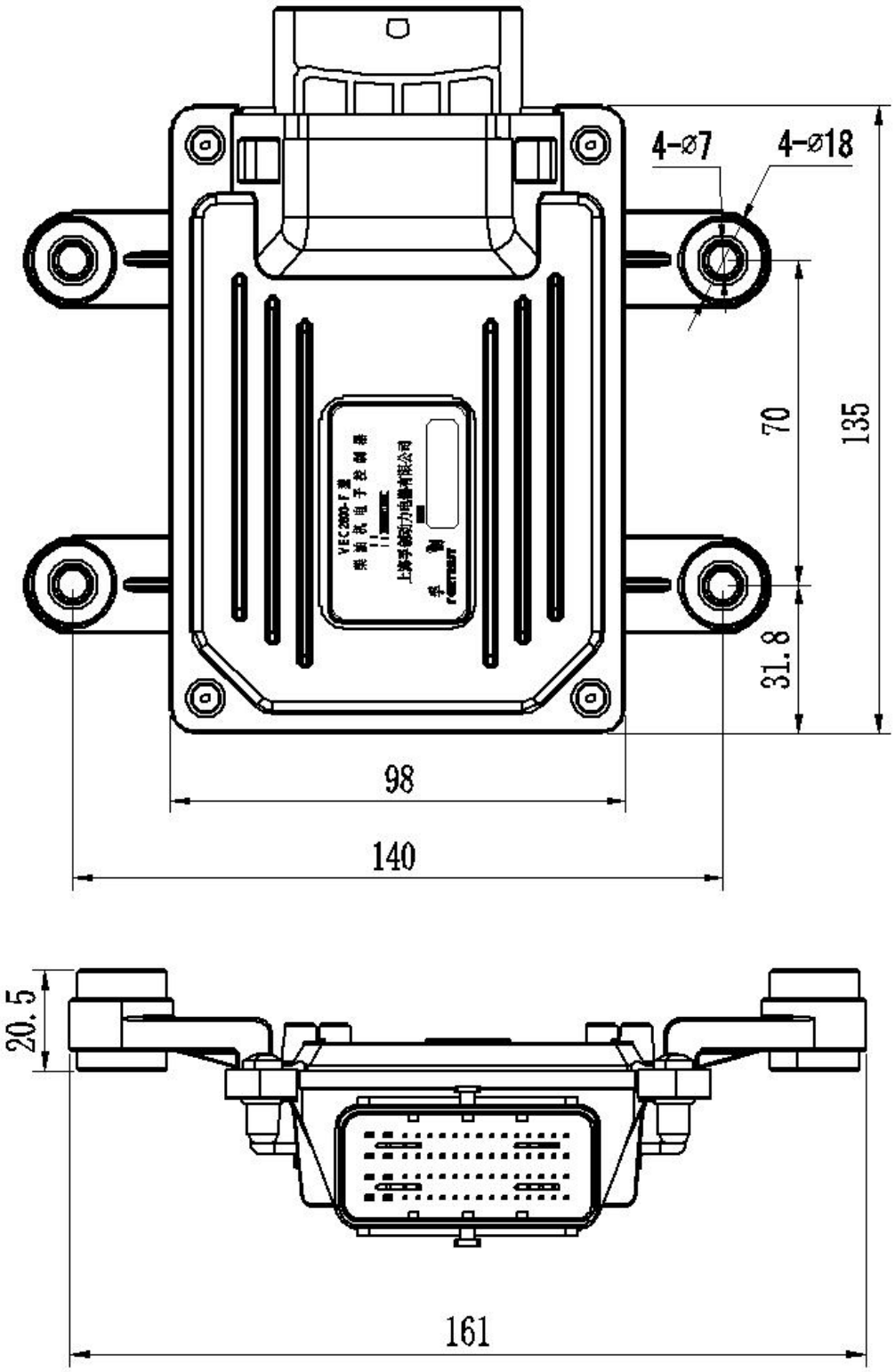


Chart 4-2 VEC2805 Controller

4.2 Speed Sensor Installation

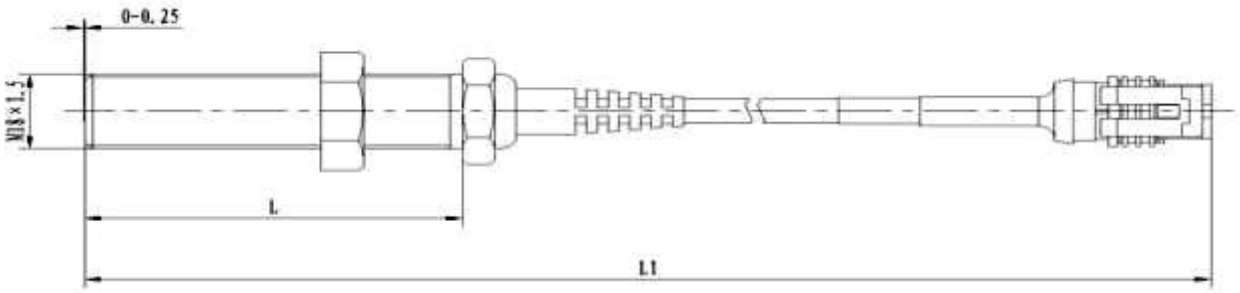


Chart 4-3 Speed Sensor

The speed sensor adopts passive magnetoelectric speed sensor. The installation of the sensor shall exit 1 / 2 ~ 3 / 4 circle after contacting the tooth top of the gear (the distance from the sensor top to the flywheel tooth top is about 0.4mm ~ 0.8mm), which is an ideal gap.

Fortrust company can provide a variety of installation sizes, which can be selected according to users' actual needs.

4.3 System Debugging

4.3.1 System diagnosis

Check whether the wiring harness is intact, whether there is broken wire, bad contact phenomenon. Check whether the sensor is properly installed and whether there is dust or iron filings on the top of the sensor. Check whether the actuator is installed normally and there is no jam. Check whether the power wiring harness is connected directly to the battery. Check whether the starter motor is in good condition.

4.3.2 Data calibration

FECU_SG 1.41 software is used to calibrate the electronic control system of the loader. The calibration software mainly consists of four parts: parameter (P), function (F), measurement (M) and chart (G). The corresponding calibration data has been input when the product leaves the factory, which basically meets the requirements of engine control functions. However, according to different engine conditions, the data need to be adjusted as shown below：

4.3.2.1 Basic parameters

No.	Parameter	Specification
3	Crank Teeth 2	Provided by the customer
8	Idle Speed 1	Idle in engine nameplate
11	Rated Speed 1	Rated in engine nameplate
17	Over-Speed	120% of the rated speed
32	Gain	As 4.5.2.2
33	Stability	As 4.5.2.2
34	Derivative	As 4.5.2.2
73	Start Fuel 1	Generally set as 1100
74	Start Fuel 2	Generally set as 1300

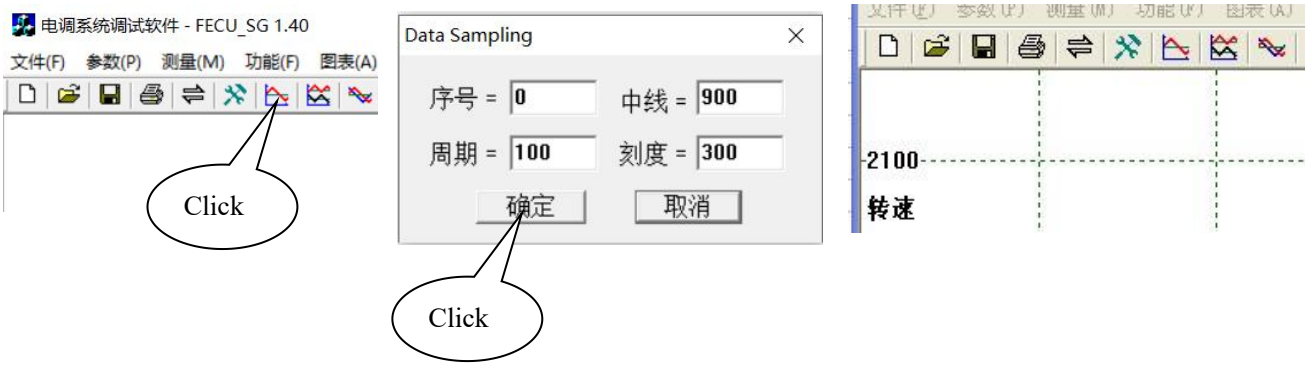
4.3.2.2 PID Adjustment（Special Attention）

PID adjustment：It consists of proportional unit P, integral unit I and differential unit D, and is set by the parameters in the calibration software. It is used to optimize the working process and meet the requirements of customer operation indicators. The specific steps are as follows:

Step 1: Open the software

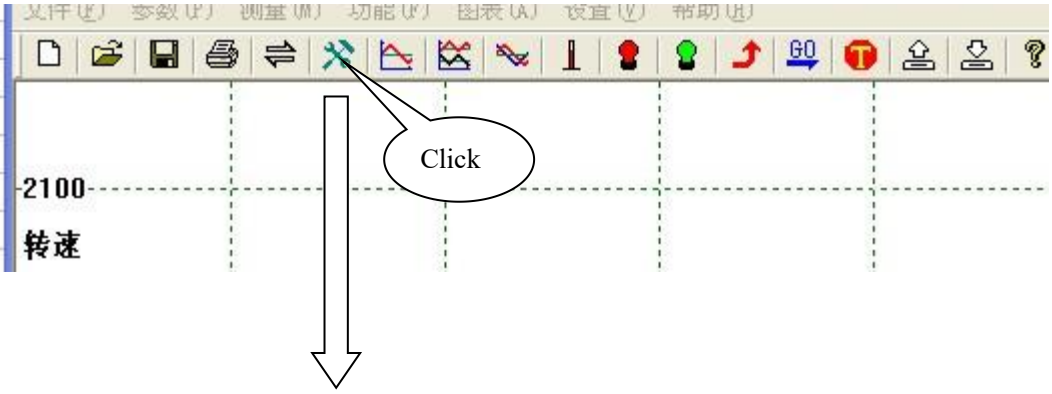
Step 2: Enter the speed monitoring interface

A.Initial state B.Set N0.0 as speed monitoring C.Enter the speed monitoring interface



Step 3: Debugging parameters

A.Debugging basic initial state (speed monitoring)



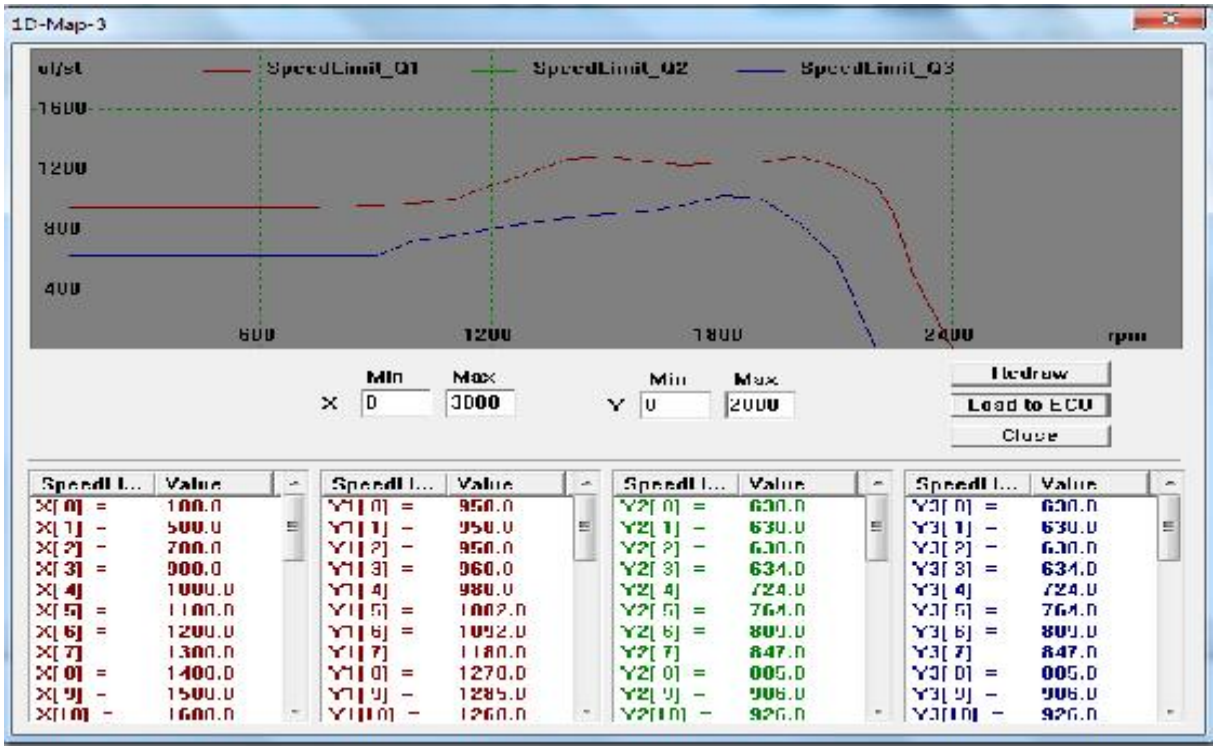
B.PID Debugging

Reference value			
Name	No.	Step size	Value range
P	24	20	180-700
I	25	50	1800-3500
D	26	10	10-200

Step 4: External characteristic power calibration

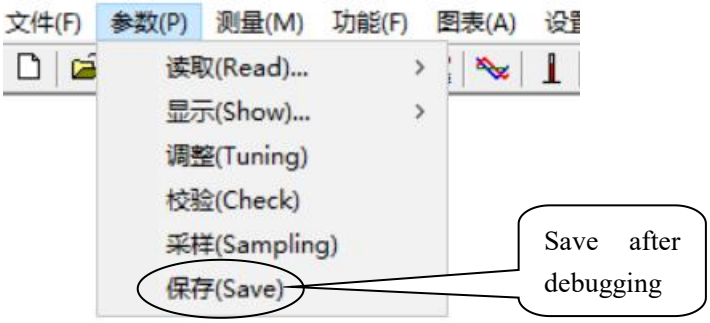
According to the power value under various working conditions required by the customer, calibrate the external characteristic oil quantity on the bench test-bed, and limit the maximum power output of the engine by setting the maximum oil quantity.

Click the chart → read → No.4 fuel limit (speed) → adjust the external characteristic map



For the engine external characteristic diagram, three external characteristics can be set for different working conditions

Step 5: Save the parameters after adjusting



V. VEC2805 GENSET ECLECTRIC CONTROL SYSTEM（Take YD485 diesel and BQ pump as an example）

5.1 Summary

VEC2805 series electronic control system is a customized intelligent control system.

5.2 System diagram

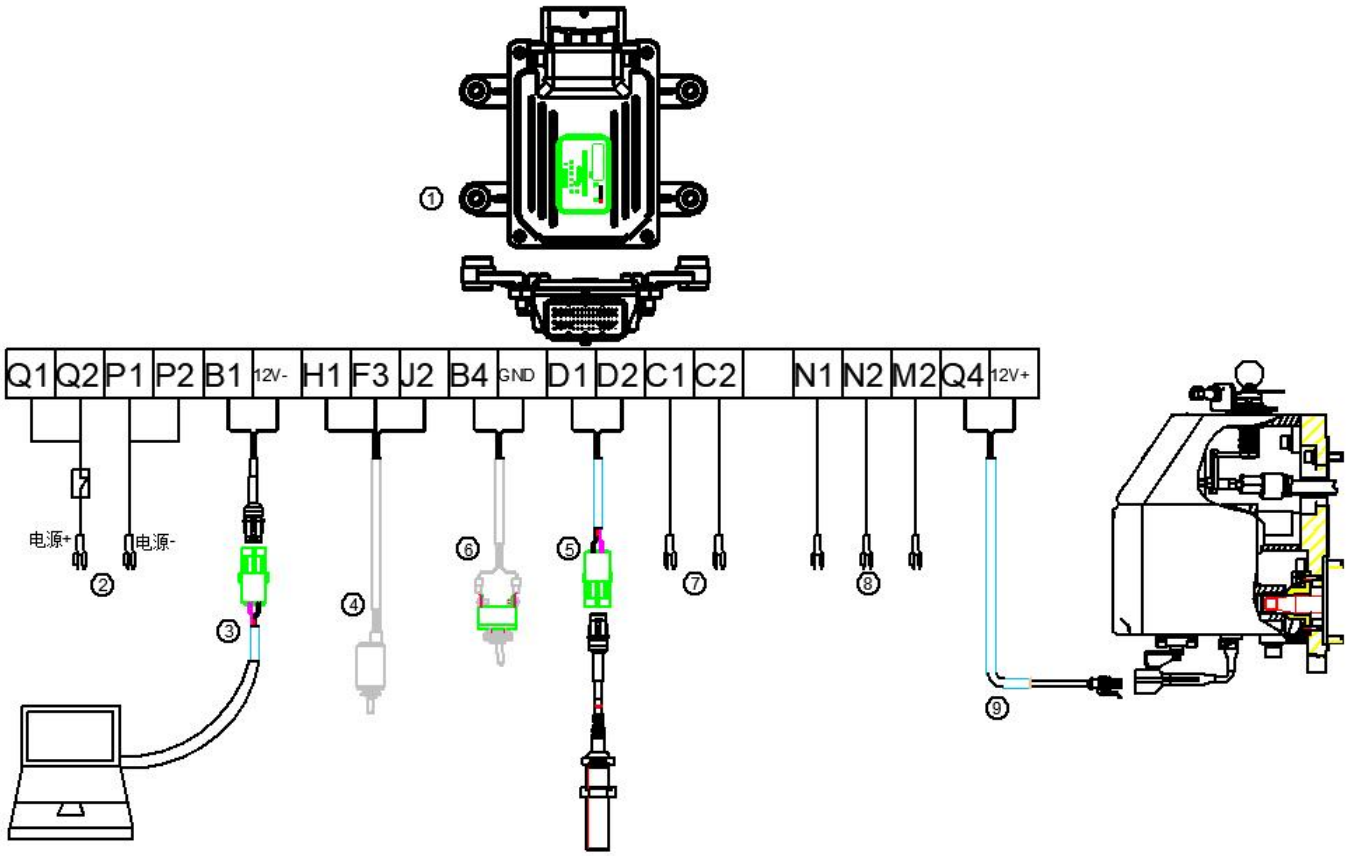


Chart 5-2 System diagram

5.3 Detailed description of each component in system diagram

Label 1：VEC2805 controller.

Label 2： The power supply is connected to DC 24 / 12V power supply. The engine control battery, starting battery or other regulated and non regulated power supply can be used for power supply, but the peak power consumption and voltage fluctuation range of the system shall be guaranteed. When the starting battery is used for power supply, a charging device must be set to ensure sufficient battery power. When the engine is started, the output voltage drop of the battery for a short time will not affect the normal operation. The positive power supply terminal (+) of the speed controller is directly connected to the positive pole of the battery through the power switch (or shutdown switch) and fuse if necessary, that is, it is directly powered from the positive pole of the battery. The negative power supply terminal (-) of the speed controller must be led directly from the negative pole of the battery. If the negative pole of the power supply needs to be grounded, the negative pole of the power supply shall be grounded at the negative terminal of the battery, not from the negative (-) terminal of the controller. If the length of the power line is less than 10m, the selected power line shall be greater than or equal to 0.75mm2; If it is more than ten meters, the power cord needs to be thickened accordingly.

Label 3： VEC2805 system communication wiring harness connector and port are mainly used for system parameters calibration of upper computers.

Label 4：Full-range speed potentiometer.

Label 5：Speed sensor interface.

Label 6：Idle / rated speed switch.

Label 7：CAN communication wiring harness.

Label 8：Fault indicator and OBD alarm output.

Label 9：Electromagnetic actuator interface.

VI. FAULT DIAGNOSIS AND TREATMENT

The electronic control system is mainly composed of four parts: controller, actuator, sensor and wiring harness. In case of failure, check whether the wiring harness is normal, whether the sensor is installed normally and whether the actuator works normally. If the above are normal, it is recommended to replace the controller. Specific fault phenomena and treatment measures are as follows：

Fault	Diagnosis	Treatment
Failed to start	1、There is no speed signal, and the speed signal monitored by the commissioning software is 0 RPM.	1、Check the clearance between the speed sensor probe and the speed measuring gear to ensure that it is within 0.4-0.8mm； 2、If the wiring harness of speed sensor is broken, the DC resistance shall be 400-900 Ω。
	2、The actuator displacement is small and no action	1、Check the battery voltage for power loss； 2、If the starting oil is too small, increase the starting oil; 3、The forced oil limit value is too small, and the forced oil value is increased； 4、Check the internal and external wiring of the actuator, measure the internal resistance of the actuator coil, and the resistance value is between 2 ~ 5 ohms.
	3、There are bubbles in the oil pump and the fuel injector does not inject fuel	1、Loosen the joint between the high-pressure oil pipe and the oil outlet valve of the oil pump, turn the engine until the oil is discharged from the oil outlet valve, and re-tighten the high-pressure oil pipe.
Black smoke from starting	Excessive starting oil	Decrease the starting oil
Hunting	1、Improper speed PID value； 2、Incorrect use of power supply； 3、The slope of external characteristic oil volume curve is too large； 4、Actuator or oil pump rack stuck.	1、Adjust the speed PID value； 2、Replace the battery or regulated power supply； 3、Check rack flexibility. If it is determined that the actuator is stuck, replace the actuator; If the oil pump rack is stuck, replace the oil pump.

VII. PRECAUTION

7.1 Routine Maintenance

1) Check whether the wiring harness is damaged and deal with it in time. Wiring harness shall be bundled and fastened along the layout route to avoid wiring harness shaking and body wear; The wiring harness shall be arranged so as to avoid being close to high-temperature parts (such as supercharger and exhaust pipe)；

2) Check whether the mounting fasteners of the actuator are loose, and handle them in time；

3) Check whether the connectors and wiring harness fastening screws of actuators, ECU and sensors are greasy or loose, and deal with them accordingly；

4) Check whether the battery is sufficient and whether the charging device works normally；

5) Observe whether there is oil leakage in the actuator. If there is oil leakage, deal with it in time；

6) Scale may be formed at the probe of speed sensor, which should be checked regularly；

7)Open the intermediate observation hole cover plate, check whether the fasteners and pins connecting the actuator and the oil pump rack are loose, and handle them.

7.2 Special Precautions

1) The speed sensor is only for the exclusive use of Fortrust electric control system and cannot be shared with other speed measuring devices；

2) If the ECU is damaged or cannot be used normally, contact the after-sales department of Fortrust in time, and do not open the ECU without authorization；

3) ECU has been calibrated when leaving the factory and non-professional personnel are not allowed to adjust；

4) ECU should be installed in the cab avoiding high temperature, oil pollution and rain, and can not be washed directly.

7.3 Precautions for Electric Welding

1) When using welding machines such as electric welding and gas welding, disconnect all wiring harness connection terminals on the ECU or remove the ECU to prevent damage to the ECU and sensors；

2) When connecting to an external power supply, disconnect the connection terminals on the ECU to prevent excessive current from damaging the ECU and sensors.

7.4 Precautions for Power Connection

The operating voltage of the system is DC24/12V, which can not get power from the starter motor. It must be powered by battery, and ensure sufficient battery power.

The VEC2805 power supply needs to be connected to the positive electrode of the battery directly after being connected to the 10A fuse.

The length of the power wiring harness should be less than 10 meters, and the diameter should be at least 0.75 square mm.

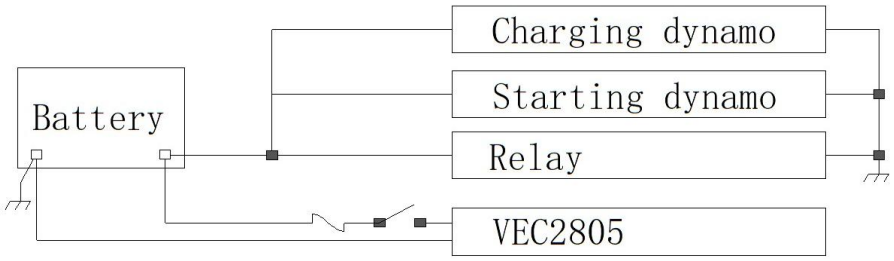


Chart 7 Correct power wiring harness

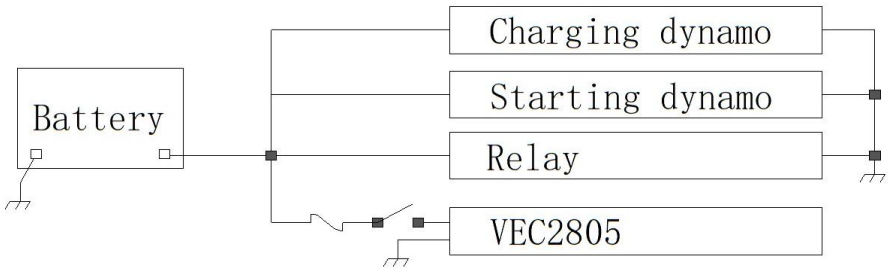


Chart 8 Incorrect power wiring harness

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