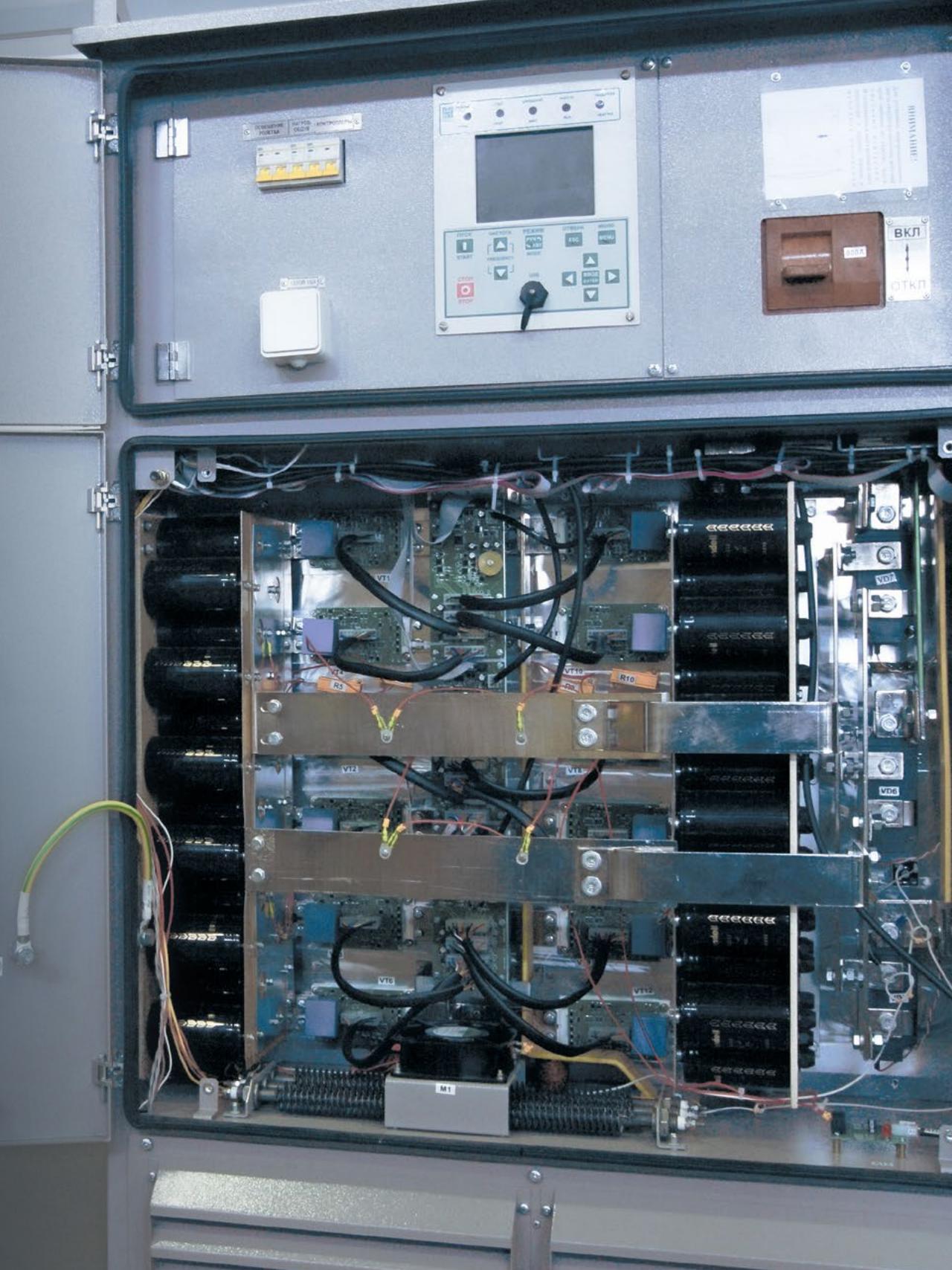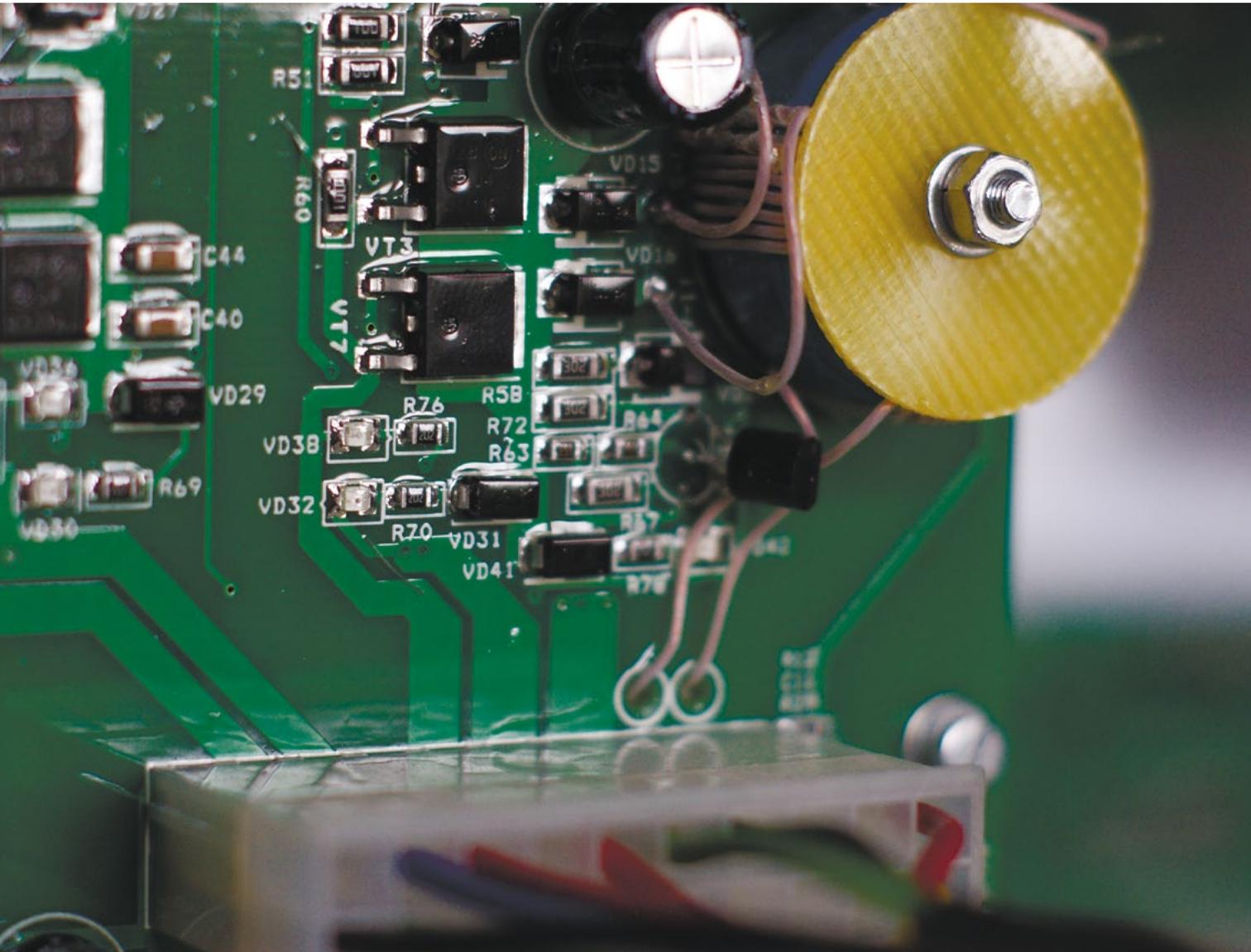# VARIABLE SPEED DRIVE

**RIMERA**

# VARIABLE SPEED DRIVE (VSD)

Our VSD-A supplied with a highly reliable station controller enables monitoring and protecting a submersible pump equipped with an induction or PM motor with a voltage of up to 5000V.

# BENEFITS



## CONTROL

a large graphic LCD and keyboard make it easier to receive information or configure the VSD

## SERVICING

a modular design makes it possible to service and repair the VSD at the place of operation

## DME AND ENERGY METERING

support downhole monitoring equipment and energy meters of various manufacturers.

## EASY-TO-READ DATA

· by using the remote control and monitoring systems, including LTE;
· log reading using a USB flash drive

## UPDATE

the possibility of expanding the scope of functional parameters by updating the VSD controller in the field

# A THREE-SIDE SERVICE METAL CABINET WITH MAXIMUM SERVICEABILITY:

**1.** Power cabinet and control panel are on the front side of the VSD;

**2.** Input and Output voltage electrical boxes are on the backside. Input voltage box has connection pins for the VSD power supply. Output voltage box has the pins to connect the VSD to a step-up transformer and the plug for the ground cable;

**3.** Surface board and power meter compartments are on the side;

**4.** Lifting lugs are on the roof for VSD handling.

All VSD doors have special key locks and a tight seal. When the cabinet door is open, energized elements are covered with insulating safety shields and alarm-activating features.

**The VSD is manufactured with a built-in frequency converter and an output filter (at the request of the customer, the filter may be omitted):**

· The frequency converter is designed to convert the input three-phase voltage to the output three-phase voltage with an adjustable frequency and the effective voltage value; the frequency converter is resistant to emergency and abnormal conditions;

· The VSD output filter is designed to prevent higher harmonic components in the frequency converter output voltage.

**The VSD provides for archive generation, saving operation parameters and an log storage:**

· Memory capacity of at least 50,000 records;
· Event log volume is at least 2,000 events;
· Log is written on a USB flash drive.



control compartment
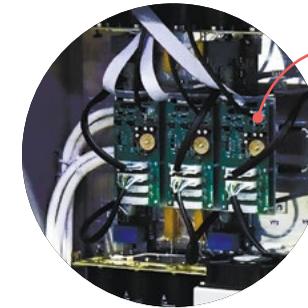


power compartment



input terminals for connecting cables to the power supply



output terminals for connecting transformer and a terminal for combining a cable measuring motor+power cable insulation resistance



lifting lugs for loading and unloading the VSD



compartment for surface block and a compartment for an electric energy meter

## CONTROL FUNCTIONS

- **VSD control mode:**
  - manual;
  - automatic;
  - programmable (Set up of operating time and idle time, work in a cyclic mode).

- **Remote control of VSD operation parameters through modem;**

- **Adjusting motor speed to a programmed frequency;**

- **The built-in PID controller maintains the process parameters of the pump unit;**

- **Consumed active & reactive electricity measurement with or without energy meters:**
  - automatic optimization of the U/F characteristics when changing the Motor load;
  - the PWM modulation change mode ensures reduced power losses in the frequency converter in the loaded state, while lowering the level of harmonics at the output of the control VSD.

- **Direct or remote control of the submersible motor:**
  - smooth acceleration and braking;
  - jogging start-up mode;
  - shaking mode start-up;
  - motor speed control;
  - changing the motor starting torque;
  - changing the direction of rotation;
  - delayed motor restart when protections are triggered;
  - start blocking after exceeding the number of restarts.

- **Smart back spin lock and rotation revers mode;**

- **Smart pump unit wedging mode;**

- **Smart mode for pumping and removing gas lock;**

- **Shaking mode with a set shaking period and frequency (prevention of scaling on the pump impellers);**

- **VSD output voltage automatic optimization mode;**

- **VSD output current limiting mode.**

## FEATURES

- **ESP operation parameters measurement:**
  - active power consumption: from 0 to 1,342 hp (0 to 1,000 kW);
  - load power factor (cos): from 0 to 1.0;
  - insulation resistance in the motor power supply circuit for high voltage: from 0 to 10 M$\Omega$;
  - direction and frequency of Back spin: from 1 to 40 Hz.

- **Consumed active & reactive energy measurement:**
  - measurement error without an electric energy meter is no more than 2.5%;
  - measurement error with an electric energy meter is no more than 0.5%.

- **VSD with bypass contactors (option):**
  - direct Motor start-up with the possibility of reverse motor operation;
  - transition from the frequency control mode to the Motor power supply from network.

- **VSD with a contactor switching off output filter capacitors (option):**
  - induction motor control;
  - PMM control.

- **Built-in frequency converter and output filter;**

- **Displaying the values of all set points, current parameters and operating modes of the station, submersible equipment, wells;**

- **Automatic maintenance of esp operation process parameters;**

- **Flexible settings for each protection;**

- **Displaying symbolic and graphic information of the graphic in lcd;**

- **The vsd generates, saves and displays up to ten start-up graphs:**
  - Three phases motor current;
  - Three phase motor voltage.

- **Modern hardware components, a large set of software management and protection functions;**

- **USB software update;**

- **Replacement of the KSU-6 controller with the running or shut down motor;**

- **Two levels of protection against unauthorized access to changing the parameters and operating mode of the vsd;**

- **Forced air cooling or heating of power elements by a fan and heating coils integrated in the vsd.**

## THE VSD MONITORS THE WORK PARAMETERS OF THE FOLLOWING COMPONENTS:

- **Power supply:**
  - input voltage;
  - input voltage imbalance;
  - phase sequence;
  - output voltage;
  - output voltage imbalance;
  - output frequency.

- **VSD control:**
  - scanning of all VSD units during activation;
  - full and active power output;
  - monitoring the VSD status.

- **Downhole equipment:**
  - power-cable-motor insulation resistance;
  - motor operation parameters:
    - a. motor load;
    - b. power factor (cos);
    - c. voltage;
    - d. motor current;
    - e. current imbalance;
    - f. motor oil pressure (if DME is available);
    - g. motor winding temperature (if DME is available);
    - h. vibration along three axes (if DME is available).

- **ESP & Well parameters:**
  - pump intake pressure
  - pump intake temperature
  - pump discharge pressure
  - pump discharge temperature
  - flowrate at pump discharge (if flowrate meter available)
  - casing pressure (if gauges available)

## VSD SPECIFICATIONS

| | VSD-A 250A | VSD-A 400A | VSD-A 630A | VSD-A 800A |
|---|---|---|---|---|
| Current rating | 250 A | 400 A | 630 A | 800 A |
| Total power output:<br>- at 380B<br>- at 480B | 150 kVA<br>200 kVA | 240 kVA<br>320 kVA | 380 kVA<br>500 kVA | 480 kVA<br>650 kVA |
| Speed control range:<br>- PMM<br>- induction motor | 1 - 250 Hz with 0.1 Hz increments<br>1 - 70 Hz with 0.1 Hz increments | | | |
| Supply voltage | ~ 380 V at 50 Hz, 480V at 60 Hz | | | |
| Supply voltage frequency | 50 ± 2 Hz, 60 ± 2 Hz | | | |
| Voltage deviation range, from rated value | -50 … +25% | | | |
| Output voltage generation method | 3 … 6 kHz PWM, U/F characteristics. 5 points | | | |
| Measuring input and output voltage in three phases | 0 – 500 V | | | |
| Current measurement in output power circuit | 0 – 3,200 A | | 0 – 6,400 A | |
| Active power consumption measurement | 0 – 1,342 hp (0 – 1,000 kW) | | | |
| Output filter | built-in output sine wave filter | | | |
| Operating system | OC Linux (over 15 years of service) | | | |
| Memory capacity | 528 MHz, 128 MB DDR-3 RAM, 128 MB NAND-FLASH (additional memory expansion possible) | | | |
| Efficiency of the VSD at nominal operation mode, not less than with an integrated output filter | 95% | | | |
| Overload current, from rated value (within 300 seconds) | 125% | | | |
| Total harmonic distortion of output current and voltage, no more than with an integrated output filter | 5% | | | |
| VSD degree of environmental protection | NEMA3, NEMA4, IP 43, IP54 | | | |
| Ambient temperature | -76…122°F | | | |
| Air relative humidity | up to 100% at a temperature of +77°F (+25°C) | | | |
| Interfaces | RS-232 (1 pcs.). USB. RS-485 (2 pcs.). Ethernet. CAN (system) | | | |
| Protocols | GPRS. ModbusRTU (Region 2000, Region 3.0, Telescope memory cards) | | | |
| Overall dimensions:<br>[height x width x depth] | 6.349 x 3.314 x 3.560 feet<br>(1,935 x 1,010 x 1,085 mm) | | 6.283 x 3.215 x 3.609 feet<br>(1,915 x 980 x 1,100 mm) | |
| Weight | 970 lbs<br>(440 kg) | 1,125 lbs<br>(510 kg) | 1,499 lbs<br>(680 kg) | 1,610 lbs<br>(730 kg) |

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