

Variable Speed Drives Product Catalog






Purpose and Features

MAJU MANDIRI UTAMA - HI-RUN Variable Speed Drive (VSD) with 6-pulse input, filtered PWM output, NEMA3R /4 enclosure is designed for controlling and protecting of electric submersible pumping units for crude oil production equipped with electric submersible inductive motors (ESM), 2017 Product permanent magnet motors (PMM) or equivalent, offers enhanced motors performance, reliability and system integration options for electric submersible pumps (ESP's).

The VSD design provides possibility for replacement of all basic modules, functional units and circuit boards in the field. All couplings and connections between units and circuit boards are detachable and demountable; there is no need to perform soldering when replacing any failed unit inside the VSD.

- Completely sealed enclosure compatible for desert and tropical environments, also available in stainless steel for offshore applications;
- Smooth Electric Submersible Pump (ESP) start, full control and protection during operation;
- Real-time process monitoring, analysis and control;
- «Flying start» mode allows starting the ESP while it is back spinning decreasing downtime;
- Various «Rocking start» modes unlock the ESP in case of mechanical jam saving time and money on round trip operations;
- Maintaining process parameters (pressure, level, pump, vibration), output current and motor speed;
- «Soft Start with Synchronization» algorithm holding output frequency for a present time upon the start prior to its further increase;
- Motor current optimization through automatic adjustment of output voltage to frequency ratio at any given frequency;
- Periodic operation between two preset frequencies, maintains oil level needed for the ESP to keep running, while keeping the oil flowing compared to on-off periodic modes where the oil could drain back if the check valve fails.

Special features

- Operability at high ambient temperatures and direct sunlight.
 - Protection from sand and dust storms, fog, pollutants in the air. For offshore installations, protection from accumulation of wetted salt and saltspray.
 - Protection from wind.
 - Resistant to corrosive environments.
 - Protected to prevent corrosion due to galvanic action.
 - Communication protocol serial Modbus RTU or optional Modbus TCP/IP.
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- Provide the following additional information: cabinet temperature, cabinet high temperature shutdown, frequency signal (analog output), output voltage.
- Continuous operation at 100% of nameplate power rating, and 120% nameplate power rating for 1 minute.
- Continuous operation at nameplate power rating: Voltage level: -5% or +15%.
- Continuous operation but at reduced output power/torque: Voltage level: -5% to -10%.
- Continuous operation for up to 200 ms, at reduced power/torque: Voltage level: -10% to -55%.
- Adhesives not used to control, restrict or prevent movement and not used to maintain a seal.
- Space heater installed within the enclosure for the purposes of eliminating condensation within the controller.
- Provide mechanical interlocks to prevent: the compartment door housing the disconnecter from being opened if the operating handle of the isolation device is in the closed position, the operating handle from being closed if the compartment door is in the open position.
- Barriers to separating personnel from energized components.
- For opening and closure of door used a 3-point latching mechanism operated by a handle.

VSD Functionality

Variable speed drive allows the following:

- Motor switching on/off;
- Electric motor operation in the following modes: manual (without any capability of the ESM/PMM automatic reclosing after protection acting); automatic with a capability of the ESM/PMM automatic reclosing (AR) and automatic reclosing by a preset time program;
- Current optimization mode when a preset rpm is reached;
- Operation by a preset time program with ESM/PMM ON/OFF periods programmed separately;
- Motor speed manual control using UMKA-03 controller and remote control using a supervisory control console;
- Automatic change of the output frequency by a preset time program;
- ESM smooth acceleration and braking with assigned rate;
- Motor reversal;



- Motor automatic switching on with a controlled time delay when supply voltage is applied;
- Automatic keeping a setpoint for some process parameter (pressure, current or else).
- Electric motor starting modes: swinging, impact start (may be used for unjamming submersible unit), soft start with synchronization. Unjamming features the maximum motor torque at low speed;
- Monitoring of the “cable—ESM/PMM” system isolation resistance with ESM switching-off if the resistance is decreased below the admissible level;
- Operation when the “cable—ESM/PMM” system isolation resistance is decreased with the fast shutdown in case of overload;
- Measurement of the actual parameters of the submersible pumping unit and VSD and their representation on the HMI display;
- Motor remote control, monitoring of motor parameters, reading and changing of protection setpoints through a telemetering system using RS-485 interface; control through **SCADA** system using modem or direct connection (external connections compartment);
- Recording of causes of ESM/PMM switching-on/off and recording the actual parameters into the integrated non-volatile memory during operation;
- Recording of modified setpoints into the event log with date and time of the setpoint change.
- Outdoor light alarm system indicating the pumping unit state (run, wait, stop);
- Control of the motor from a submersible device (transducer);
- Overload/underload protections, current imbalance protections, protection against unacceptable supply voltage and DC-link high voltage, against continuous low-frequency operation of VSD, against overheating of power switch cooler, and against operation with telemetering parameters beyond the preset limits, all protections may be adjusted in the field;
- Information of the VSD door opening may be transferred to dispatching station through the TMS;
- Measurement of electric energy consumption;
- Monitoring for availability of three phases of the power supply. ESM/PMM is tripped or its start is disabled if a phase is unavailable.



VSD Technical Characteristics

Parameter	Unit	Value				
		HI-RUN06-MM-105	HI-RUN06-MM-130	HI-RUN06-MM-250	HI-RUN 06-MM-400	HI-RUN 06-MM-500
Nominal output current	A	183	223	330	460	855
Rated full power for 480	kVA	170	200	270	350	525
Rated full power for 380	kVA	130	166	242	329	500
Nominal output voltage	V	3 x 380/480 - 25%, + 10%				
Output frequency	Hz	1.5 ... 80 ± 0.1% - asynchronous motor				
Overcurrent		up to 120 % of rated value during 60 sec				
Nominal supply voltage	V	3 x 480 - 5%, + 10%				
		3 x 380 - 5%, + 10%				
Continuous operation but at reduce output power	V	3 x 480 - 10%, - 5%				
		3 x 380 - 10%, - 5%				
Continuous operation, for up to 200 ms, at reduced power	V	3 x 480 - 55%, - 10%				
		3 x 380 - 55%, - 10%				
Nominal supply frequency	Hz	50/60 ± 2%				
Output section		Integrated output filter				
Efficiency, not less than	%	97				
Power factor	%	98				
Controller		UMKA03 Controller				
Interfaces		2 analog inputs; 0...10 V DC, 0... 5mA, 0...24mA				
		2 digital inputs; 24 VDC				
		2 digital output; NC/NO relay; 5A, 250 VAC or 24 VDC				
Additional blocks (option)		8 differential analog inputs: ±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V, ±20 mA				
		4 digital inputs: 1...10~30 VDC				
		4 analog outputs (±10 VDC; 0~20 mA; 4~20 mA)				
		I Drive GPS Router				
Serial ports		2 x RS485 ; 1 x RS232 ; 1 x USB, Ethernet (optional)				
Exchange protocol		Modbus RTU				
Log memory size, not less		1 month				
Operation mode		Continuous				
Cooling		Forced air				
Position		Vertical (on the ground)				
Protection level		NEMA4				
Ambient temperature	°C	Storage	Transport		Operation	
		-20 ... +70	-20 ... +70		-20 ... +50	
Relative humidity		100%				
Altitude above Sea level	m	1000				
Vibration load	m/c ²	5				
Impact load	m/c ²	30				
*The manufacturer has the right to change these parameters in agreement with the client						



Name description HI-

HI-RUN-MM-XXX-110231-

Field	Description
HI-RUN	Variable speed drive for ESP applications
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MM	Multipurpose motor
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XXX	Output drive current 183 Amps 223 Amps 270 Amps 460 Amps 855 Amps
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1	Input section 1 – 6-pulse input
1	Built-in output filter
0	Without drive bypass
2	Special climate rating upon the requirements of the customer -20...+50 °C
3	With UMKA-03 controller
1	English language user interface and documentation
-	Special enclosure rating upon the requirements of the customer – 1 – NEMA3R
380 / 480	Supply voltage – 380/480 V

VSD Protections

HI-RUN variable speed drive provides for the following types of protections and interlocks:

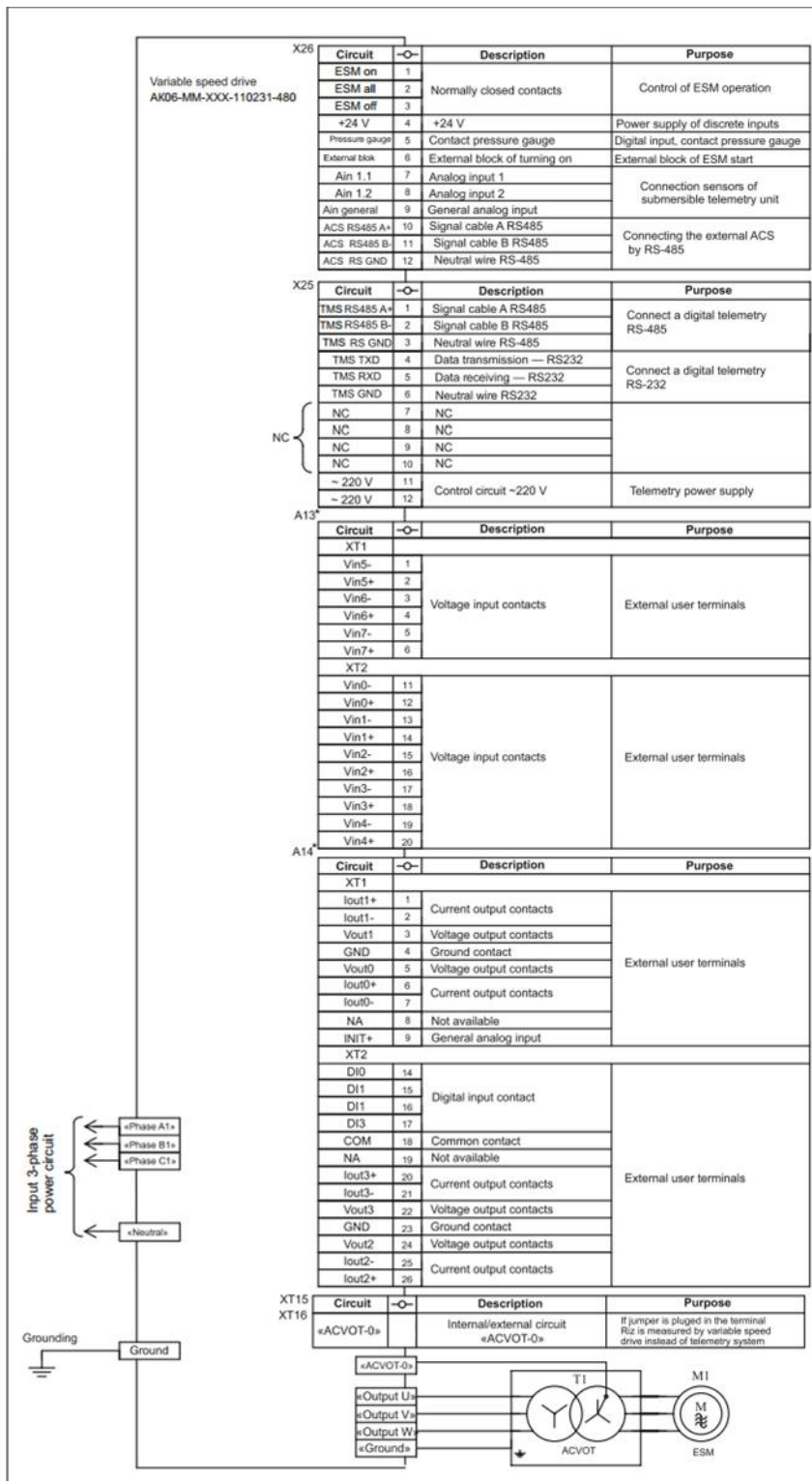
- ESM tripping when supply-line voltage is changed provided that such a deviation results in inadmissible current overload with the possibility of AR after voltage recovery;
- ESM tripping under condition of underload (Trip on underload);
- ESM tripping under overload according to programmable time-current characteristic;
- ESM tripping caused by overcurrent protection (OCP);
- ESM tripping if «cable—ESM»—system» isolation resistance is decreased down to inadmissible level;
- ESM tripping caused by frequency converter (FC) inadmissibly low output frequency;
- ESM tripping as a response of FC power switch protection;
- ESM tripping if power modules are overheated;
- ESM tripping if telemetry system parameters exceeds preset values;
- ESM tripping if the pipeline pressure is inadmissible (by signals of contact pressure gage);
- ESM tripping if the power section door is opened.
- Output built-in sine filter used to form a sinusoidal voltage waveform with minimum harmonic distortion when the VSD is in PWM mode.
- The sine filter provides the following:
 - Limited voltage surges (dU/dt) on long cables;
 - Reduced losses and insulation damage of the motor;
 - Reduced electromagnetic radiation;
 - Low level of harmonic distortion in the output voltage;
 - Protects the step up transformer from overheating;



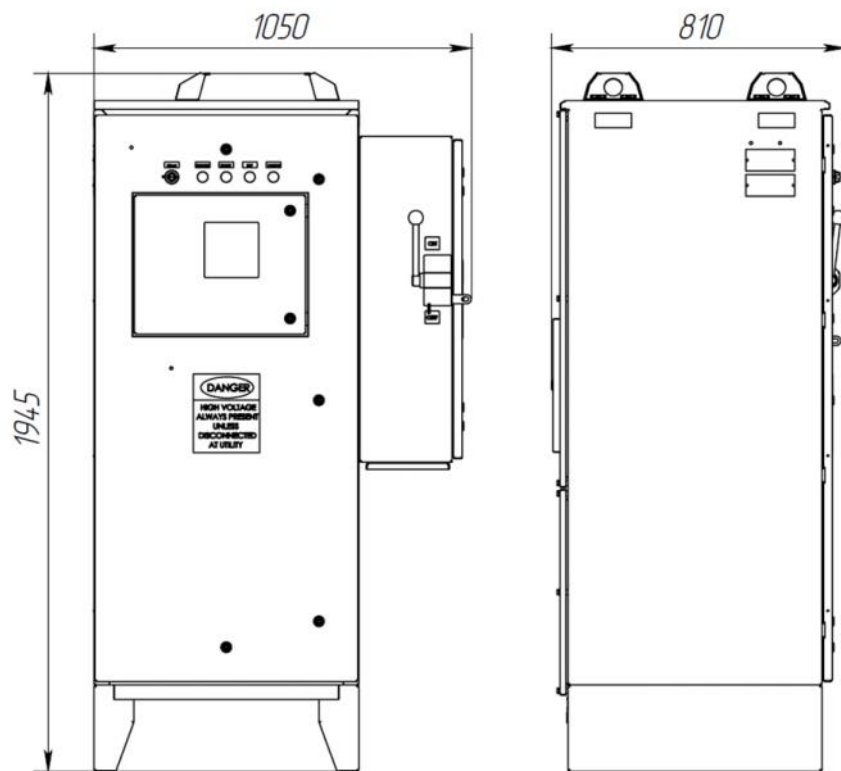
Arrangement of elements on the control section front panel

Controller UMKA-03 configuration

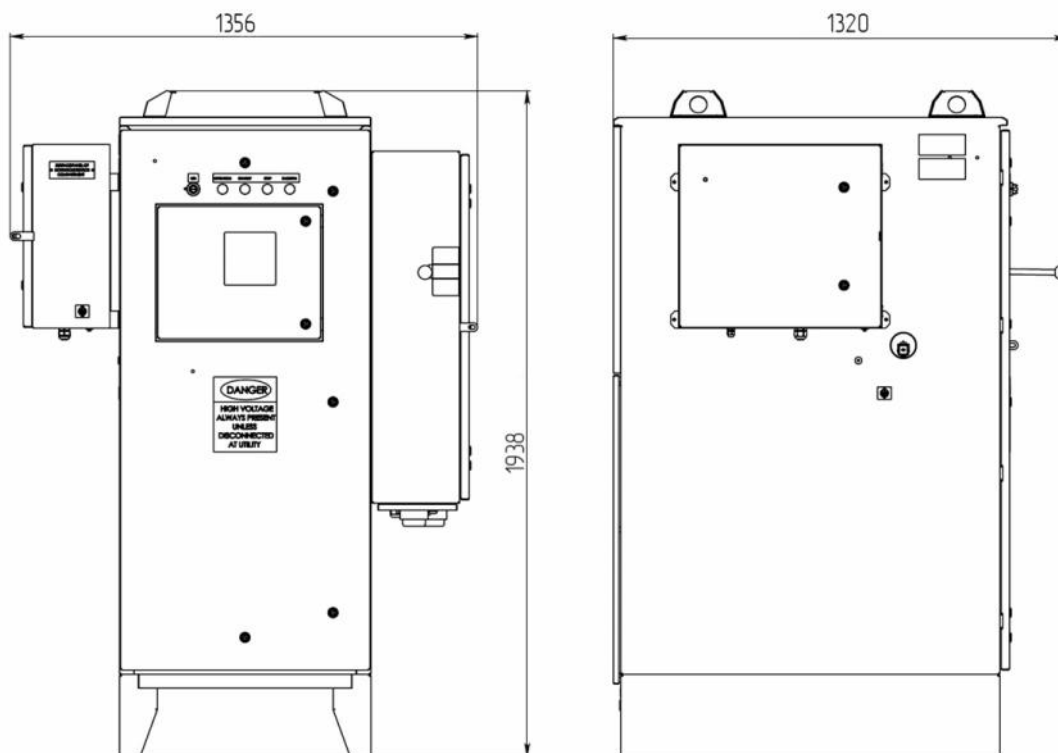
Scheme of external VSD connections



Overall dimensions of HI RUN 06- -100 VSDs



Overall dimensions of HI RUN 06- -160, HI-RUN-MM-250 VSDs





Overall dimensions of HI RUN 06- -400 VSDs

