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.

Oil and Gas Parts & Equipment Supply

P.T. MAJUMANDIRI UTAMA

- 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 disconnector 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-	HI-RUN 06-	HI-RUN 06-MM-		
		MM- 105	MM- 130	MM-	MM-	500		
Nominal autnut auroant	٨		223	250 330	400 460	855		
Nominal output current	A	183 170	223	270	350	525		
Rated full power for 480	kVA	170	166	270	330	500		
Rated full power for 380	kVA							
Nominal output voltage	V	$3 \times 380/480 - 25\%, +10\%$						
Output frequency	Hz	$1.5 \dots 80 \pm 0.1\%$ - 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	V	3 x 480 - 10%, - 5%						
but at reduce output				3 x 380 - 10 ⁶				
power								
Continuous operation,	V		3	x 480 - 55%	6, - 10%			
for up to 200 ms, at				x 380 - 55%				
reduced power								
Nominal supply frequency	Hz			50/60 :	± 2%			
Output section			Inte	grated outpu	t filter			
Efficiency, not less than	%			97				
Power factor	%			98	}			
Controller			τ	JMKA03 Co	ontroller			
Interfaces		2 analog inputs; 010 V DC, 0 5mA, 024mA 2 digital inputs; 24 VDC 2 digital output; NC/NO relay; 5A, 250 VAC or 24 VDC						
Additional blocks (option)					nalog inputs:			
riduitional blocks (option)		+1.4			$V, \pm 5 \text{ V}, \pm 10^{\circ}$			
		4 digital inputs: 110~30 VDC 4 analog outputs (±10 VDC; 0~20 mA; 4~20 mA) I Drive GPS Router						
Serial ports		2 x RS	485;1 x F	RS232 ; 1 x U	JSB, Etherne	t (optional)		
Exchange protocol				Modbus				
Log memory size, not less				1 mo				
Operation mode				Contin				
Cooling				Force	d air			
Position		Vertical (on the ground)						
Protection level				NEM	[A4			
Ambient temperature	°C	Stora	ige	Transp	ort	Operation		
		-20	+70	-20	+70	-20 +50		
Relative humidity				100	%			
Altitude above Sea level	m			100	00			
Vibration load	m/c^2			5				
Impact load	m/c^2	30						
*The manufacturer has the	right to	o change t	hese para	meters in ag	reement wit	h the client		



Name description HI-

Field	Description
HI-RUN	Variable speed drive for ESP applications
-	
MM	Multipurpose motor
-	
XXX	Output drive current
	183 Amps
	223 Amps
	270 Amps
	460 Amps
	855 Amps
-	
1	
1	Input section
1	1 – 6-pulse input Built-in output filter
1	-
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

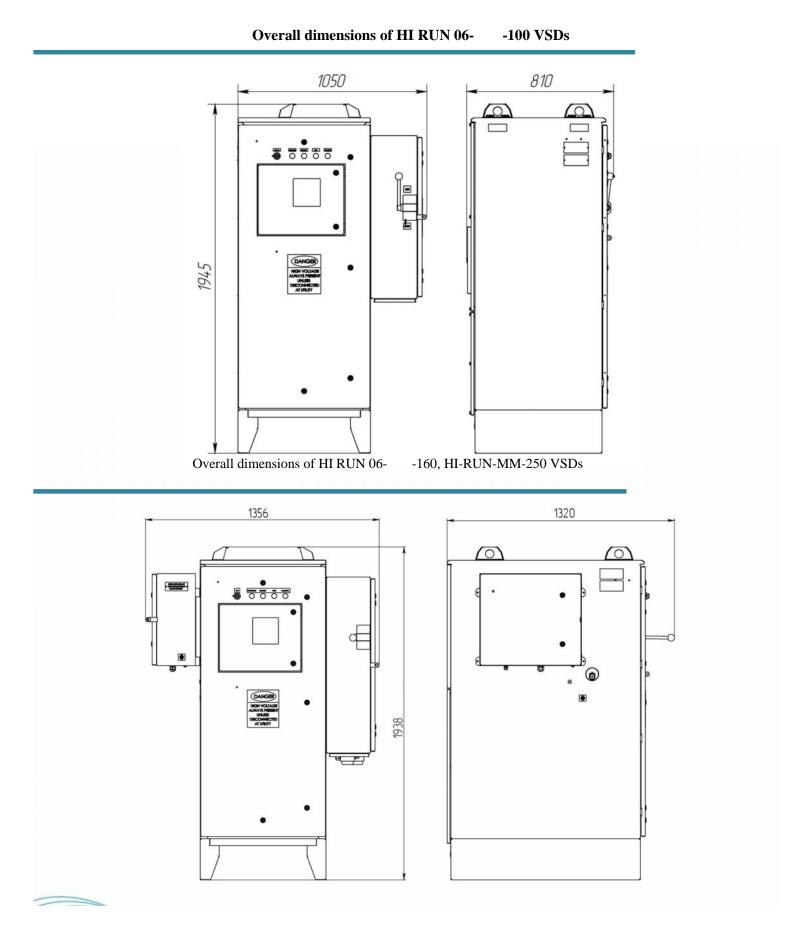




Scheme of external VSD connections

	X26	Circuit	-0-	Description	Purpose
		ESM on	1	Description	1 510050
	able speed drive 6-MM-XXX-110231-480	ESM all ESM off	2	Normally closed contacts	Control of ESM operation
		+24 V	4	+24 V	Power supply of discrete inputs
		Pressure gauge	5	Contact pressure gauge	Digital input, contact pressure gauge
		External blok	6	External block of turning on	External block of ESM start
		Ain 1.1	7	Analog input 1	and the second states
		Ain 1.2	8	Analog input 2	Connection sensors of
		Ain general	9	General analog input	submersible telemetry unit
		ACS RS485 A+	10	Signal cable A RS485	
		ACS RS485 B-	11	Signal cable B RS485	Connecting the external ACS by RS-485
		ACS RS GND	12	Neutral wire RS-485	by N3-465
	X25				
		Gircuit	-0-	Description	Purpose
		TMS RS485 A+	1	Signal cable A RS485	Connect a digital telemetry
		TMS RS485 B-	2	Signal cable B RS485	RS-485
		TMS RS GND	3	Neutral wire RS-485	
		TMS TXD TMS RXD	4	Data transmission — RS232	Connect a digital telemetry
		TMS RAD TMS GND	5	Data receiving — RS232	RS-232
	C		6	Neutral wire RS232	
		NC	7	NC	-
	NC	NC	8	NC	4
		NC NC	9 10	NC NC	4
	C		_	NC	
		~ 220 V	11	Control circuit ~220 V	Telemetry power supply
	A13*	~ 220 V	12		
	A13	Circuit	-0-	Description	Purpose
		XT1			
		Vin5-	1		
		Vin5+	2		
		Vin6-	3	Martin Constants	19
		Vin6+	4	Voltage input contacts	External user terminals
		Vin7-	5		
		Vin7+	6		
		XT2			
		Vin0-	11		
		Vin0+	12		
		Vin1-	13		
		Vin1+	14		
		Vin2-	15	Voltage input contacts	External user terminals
		Vin2+	16		
		Vin3-	17		
		Vin3+	18		
		Vin3+ Vin4-	18 19		
	A14*	Vin4- Vin4+	19 20	Description	Puroose
	A14*	Vin4- Vin4+ Circuit	19	Description	Purpose
	A14*	Vin4- Vin4+ Circuit XT1	19 20		Purpose
	A14 ⁴	Vin4+ Vin4+ Circuit XT1 Iout1+	19 20 1	Description Current output contacts	Purpose
	A14 [*]	Vin4- Vin4+ Circuit XT1	19 20 1 - - - -		Purpose
	A14 ⁴	Vin4- Vin4+ Circuit XT1 Iout1+ Iout1-	19 20 1 - 0 1 2	Current output contacts	-
	A14*	Vin4- Vin4+ Circuit XT1 lout1+ lout1- Vout1	19 20 1 - O - 1 2 3	Current output contacts Voltage output contacts	Purpose External user terminals
	A14	Vin4+ Vin4+ Circuit XT1 Iout1+ Iout1+ Iout1- Vout1 GND	19 20 - O - 1 2 3 4	Current output contacts Voltage output contacts Ground contact Voltage output contacts	-
	A14"	Vin4- Vin4+ Circuit XT1 Iout1+ Iout1- Vout1 GND Vout0	19 20 1 1 2 3 4 5	Current output contacts Voltage output contacts Ground contact	-
	A14*	Vin4- Vin4+ Circuit XT1 Iout1+ Iout1+ Vout1 GND Vout0 Iout0+	19 20 1 2 3 4 5 6	Current output contacts Voltage output contacts Ground contact Voltage output contacts	-
	A14"	Vin4- Vin4+ Circuit XT1 lout1+ lout1- Vout1 GND Vout0 lout0+ lout0-	19 20 1 2 3 4 5 6 7	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts	-
	A14"	Vin4- Vin4+ Circuit XT1 lout1+ lout1+ Vout1 GND Vout0 lout0+ lout0+ lout0- NA NIT+ XT2	19 20 1 2 3 4 5 6 7 8	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available	-
	A14*	Vin4- Vin4+ Circuit XT1 lout1+ lout1+ Vout1 GND Vout0- lout0+ lout0- NA INIT+	19 20 1 2 3 4 5 6 7 8	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available	-
	A14"	Vin4- Vin4+ Circuit XT1 Iout1+ Iout1- Vout0 Iout0+ Iout0- NA INIT+ XT2 DI0 DI1	19 20 -O- 1 2 3 4 5 6 7 8 9 14 14 15	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available General analog input	-
	A14"	Vin4- Vin4+ Circuit XT1 lout1+ lout1- Vout0 lout0+ lout0+ lout0+ NA NINIT+ XT2 DI0 DI1 DI1	19 20 1 -O- 1 2 3 4 5 6 7 8 9 9 14 15 16	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available	-
P (Physio A1		Vin4- Vin4+ Circuit XT1 Iout1+ Iout1- Vou10 Iout0- NA INIT+ XT2 DI0 DI1 DI1 DI3	19 20 1 20 1 2 3 4 5 6 7 7 8 9 9 14 15 16 17	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available General analog input Digital input contact	-
	•	Vin4- Vin4+ Circuit XT1 lout1+ lout1- Vout0 lout0+ lout0+ lout0+ NA NINIT+ XT2 DI0 DI1 DI1	19 20 1 -O- 1 2 3 4 5 6 7 8 9 9 14 15 16	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available General analog input	-
	1	Vin4- Vin4+ Vin4+ XT1 lout1+ lout1+ lout0+ lout0+ lout0+ lout0+ NA NAT2 DI0 DI1 DI1 DI3 COM NA	19 20 1 20 1 2 3 4 5 6 7 8 9 9 14 15 16 17 18 19	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available General analog input Digital input contact	External user terminals
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Phase B1	1 1 1	Vin4- Vin4+ Vin4+ Circuit XT1 lout1+ lout1+ lout1+ lout0+ lout0+ lout0+ lout0+ NA NA DI1 DI1 DI3 COM NA lout3+ lout3+ Vout3	19 20 1 2 3 4 5 5 6 7 8 9 9 14 15 15 16 17 18 19 20 21 22	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available Digital input contact Common contact Not available Current output contacts Voltage output contacts Voltage output contacts	External user terminals
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Phase B1	1 1 1	Vin4- Vin4+ Vin4+ XT1 Iout1+ Iout1- Vout0 Iout0+ Iout0- NA NA DI1 DI1 DI1 DI1 DI1 DI1 DI1 DI1 DI3 COM NA Iout3+ Iout3- Vout3 Vout3	19 20 1 2 3 4 5 6 7 8 9 9 14 15 16 17 18 19 20 21 22 23 24	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Not available Digital input contact Common contact Not available Current output contacts Voltage output contacts Voltage output contacts	External user terminals
Phase B1	1 1 1	Vin4- Vin4+ Vin4+ Circuit XT1 Iout1+ Iout1+ Iout1+ Iout0- NA Iout0- NA IOI0- NA INT+ XT2 DI0 DI1 DI1 DI1 DI1 DI1 DI1 DI1 DI1 DI1 DI1	19 20 1 2 3 4 5 6 7 7 8 9 9 14 15 16 17 18 19 20 21 22 23 24 25	Current output contacts Voltage output contacts Ground contact Voltage output contacts Current output contacts Current output contacts Digital input contact Digital input contact Common contact Not available Current output contacts Voltage output contacts Ground contact Ground contact Ground contact Ground contact	External user terminals
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Overall dimensions of HI RUN 06- -400 VSDs

