

THREE-PHASE POWER REGULATOR DRIVER

**3phPRD-A1-05, 3phPRD-A2-05, 3phPRD-A3-05, 3phPRD-A4-05, 3phPRD-A5-05
3phPRD-B1-05, 3phPRD-B2-05, 3phPRD-B3-05, 3phPRD-B4-05, 3phPRD-B5-05**

TECHNICAL DESCRIPTION

Three-phase power regulator driver 3phPRD-05 (hereinafter – 3phPRD) is intended for controlling of thyristor module with three pairs of inverse-parallel thyristors connected through the TD drivers produced by JSC “Electrum AV and together with the drivers provides creation of a three-phase power regulator.

The module uses phase method of power regulation in three-phase load, so changing of alternating voltage value on load is performed by changing of on-state time of one thyristors during a half-period of main frequency. The driver is synchronized by alternating voltage 50 Hz.

The linear voltage is 200 ÷ 430 V. The operating currents range 330 ÷ 780 A.

Mode and function purpose of 3phPRD units are shown at Figure 1.

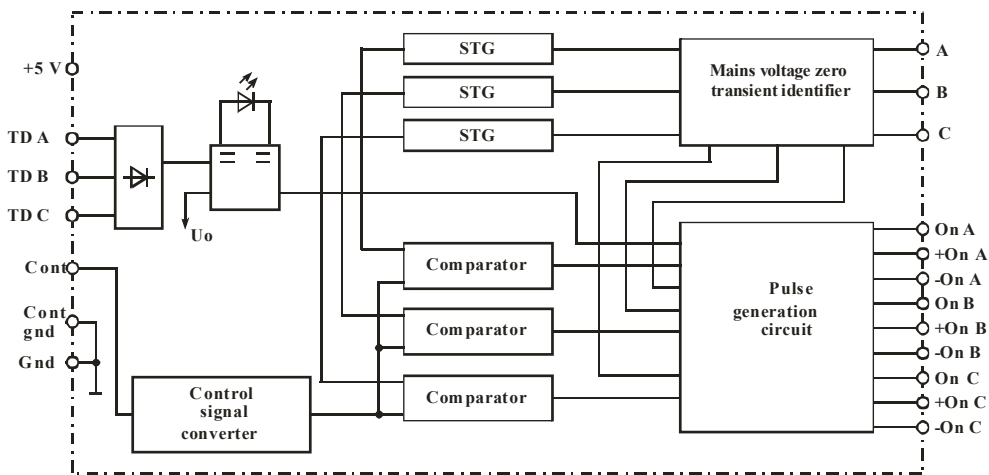


Figure 1 – 3phPRD functional circuit

Voltage zero transient identifier (VZTI) forms pulses during line voltage zero transient, which synchronize sawtooth generator (STG). In comparator (C) voltage STG and control signal voltage U_{cont} are compared, this signal is received from input signal converter circuit. When STG will reach value U_{cont} , pulse of input thyristor connection is generated. Changing the control signal value, equality of TVG and U_{cont} is varied and, accordingly, thyristor connection phase. Thereby you reach load voltage regulation.

The transformer is provided for smooth launch mode of supply turn-on and overload, which eliminates transformer big initial inrush current. The driver is provided for current inputs of current sensor connection that ensures modules’ protection opto thyristors against overload. When instantaneous value of load current is reached $I_m = 1.41 \cdot I_{com.rms}$ 3phPRD will transfer into state “Overload”, status LED changes section color from green to red, at thyristor control outputs the signals that correspond to zero load power are formed. In 300 ms protection will be removed. Section color of status LED becomes green, at thyristor control outputs the signals are formed that perform smooth launch from zero load power, which is determined by control signal value.

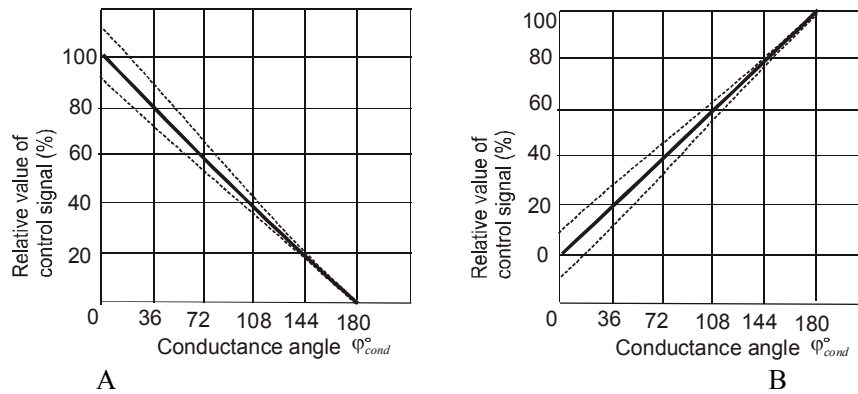
If emergency situation is not eliminated then the above described process continues until the failure is removed. There is a ten-position switch (0-9) under 3phPRD cover that allows setting necessary protection operation current when 3phPRD break-in. it is necessary to take off the 3phPRD cover and set the switch to the necessary position (when delivering to the consumer the switch is set to “0”).

Functional purpose of outputs is shown in Table 1.

Table 1 – Functional purpose of 3phPRD outputs

Connector	Outputs number	Symbol	Purpose
XS1	1	Cont.gnd	«Minus» of control signal
	2	Cont	Control signal input
	3	+5 V	Supply voltage +5 V
	4	Gnd (-5 V)	Ground «minus» of supply circuits
XS2	1	Pha	Phase inputs of AC power circuit
	2	Phb	
	3	Phc	
XS3	1	On.Pha	Connection output of phase A
	2	-On.Pha	Thyristor of negative half-wave connection input of phase A
	3	+On.Pha	Thyristor of positive half-wave connection input of phase A
	4	On.Phb	Connection output of phase B
	5	-On.Phb	Thyristor of negative half-wave connection input of phase B
XS3	6	+On.Phb	Thyristor of positive half-wave connection input of phase B
	7	On.Phc	Connection output of phase C
	8	-On.Phc	Thyristor of negative half-wave connection input of phase C
	9	+On.Phc	Thyristor of positive half-wave connection input of phase C
XS4	1	TD. Pha	Connection output of current sensor A
	2	TD. Phb	Connection output of current sensor B
	3	TD.Phc	Connection output of current sensor C

Control signal converter depending on the version of 3phPRD, transforms control signal of five types (0...5 V; 0...10 V; 0...5 mA; 0...20mA; 4...20 mA) to signal «U_{cont}» for two types of control characteristic. Thyristor conduction angle (time, during which thyristors conduct current) versus relative value of control signal is shown at Figure 2.



A – 100% control signal corresponds to zero power;
 B– 100% control signal corresponds to total power.

Figure 2 – Control characteristic types

Basic characteristic of input circuits are represented in Table 2. Basic characteristic of output circuits are represented in Table 3.

Table2 – Basic characteristic of input circuits

Characteristic name	Unit	Types of input circuits										Note	
		A-1	A-2	A-3	A-4	A-5	B-1	B-2	B-3	B-4	B-5		
Basic electric parameters													
1 Current consumption, I _s , max	mA	120										U _s = 5 V	
2 Input current «A», «B», «C» rms, I _{in.rms}	mA	7										U _{in} = ~380V	
3 Control signal value when zero power	V	5±0.5	10±1	-	-	-	0÷0.5	0÷1	-	-	-		
	mA	-	-	20±2	5±0.5	20±2	-	-	4±0.4	0÷0.5	0÷2		
4 Control signal value at total power	V	0÷0.5	0÷1	-	-	-	5±0,5	10±1	-	-	-		
	mA	-	-	4±0.4	0÷0.5	0÷2	-	-	20±2	5±0.5	20±2		
5 Input circuit resistance of control signal, R _{in}	kΩ	≥10	≥10	-	-	-	≥10	≥10	-	-	-		
Maximum permissible values of basic parameters													
1 Supply voltage, U _s	min	V	4.5										
	max	V	5.5										

2 Input voltage «Cont», U _{in}	max	V	6	12	2	2	2	6	12	2	2	2	
3 RMS value of linear voltage on inputs «Pha», «Phb», «Phc», U _{in.lin}	min	V	9										
	max		18										

Table 3 – Maximum permissible values of output circuit parameters

Parameter name		Unit	Parameter	Note
1 Output current «On.Pha», «-On.Pha», «+On.Pha», «-On.Phb», «+On.Phb», «On.Phb», «-On.Phc», «+On.Phc», «On.Phc», I _{out}	max	mA	100	
2 Operating temperature range, T _{oper}		°C	0...+80	

The 3phPRD overall drawing is shown on Figure 3.

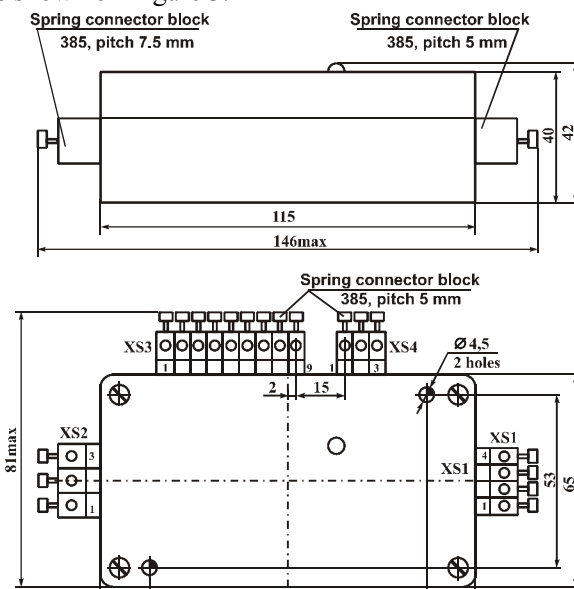


Figure3 – 3phPRD overall drawing

Precious metals are not contained.

Notation: $\frac{3phPRD - A - 1 - CP - 05}{1 \quad 2 \quad 3 \quad 4 \quad 5}$

- 1 Name of three-phase power regulator driver
- 2 Control characteristic:
A – 100% control signal corresponds to zero power;
B – 100% control signal corresponds to total power.
- 3 Control signal type:
1 - 0...5 V;
2 - 0...10 V;
3 - 4...20 mA;
4 - 0...5 mA;
5 - 0...20 mA.
- 4 Current protection:
CP – in range from 330 to 780 A.
- 5 05 – version type

Application recommendations

3phPRD connection circuit to load circuit is represented on Figure 4.

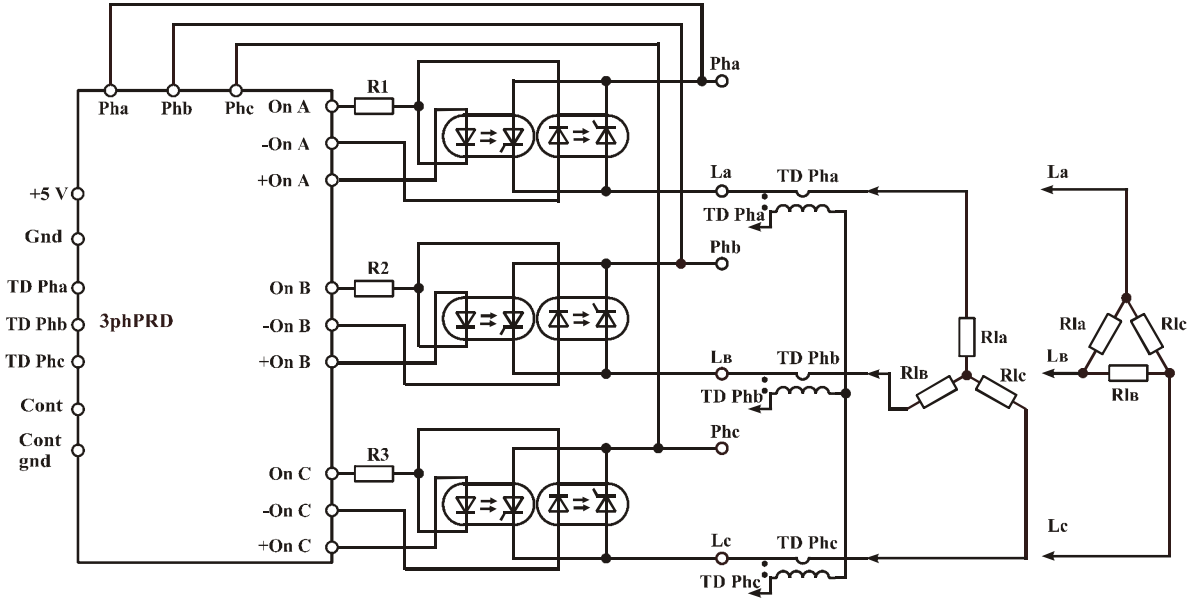
The 3phPRD should be mounted as close as possible to the controlled bridge, but not to the cooler, which it is located on. When mounting it is not permitted to lay field line wires and controlled circuits in one bundle or common tube (housing). Avoid loops in connecting wires of control and supply circuits. Connecting control wires for noise immunity support should be made by twisted pairs.

Driver is commuted by current sensors with current transmission coefficient 1:6000. If the current sensors are different from the recommended ones you should ensure input current of inputs TD.Pha, TD.Phb and TD.Phc in accordance to Table 4.

Table 4

Switch position	0	1	2	3	4	5	6	7	8	9
Load protection operation current, A	330	380	430	480	530	580	630	680	730	780
Input load protection operation current on inputs TD.Pha, TD.Phb, TD.Phc, mA	76	88	100	112	124	136	148	160	172	184

ATTENTION! For correct functioning of driver protection and current protection it is necessary to follow strictly phase connection to the driver and winding connection polarity of current transformer (TD) in accordance to Figures 4.



$R1 = R2 = R3$ and calculated by formula $R = \frac{5}{I_{\Delta}}$, where I_{Δ} - LED current of optoelectronic coupler

Figure 4 – Connection circuit to 3phPRD together with three pairs of inverse-parallel thyristors with optoisolator

MANUFACTURER GUARANTEES

Guarantee service life is 2 years from the date of acceptance, and in case of requalification – from the date of the requalification.

SUPPLY SET

- 1. 3phPRD _____ pcs
- 2. Current sensor TT80-1200A-600 (3 pcs for each 3phPRD) _____ pcs

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