



ELECTRUM AV

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3phCTD-6.1-DIN_Rev4

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THREE-PHASE CONTROLLED THYRISTOR DRIVER
3phCTD – 6.1-DIN
USER'S MANUAL

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Three-phase thyristor rectifier driver 3phCTD -6.1-DIN is intended for forming of control pulses by the drivers TD (manufactured by Electrum AV) composed of power bridge thyristor rectifier powered from three-phase 50 Hz.

Driver provides thyristor protection at maximum current (version CP1 and CP2). It may be also made without maximum-current protection (version CP0).

Application domain

- 1 Rectifiers for IGBT inverter power with capability of smooth charge of capacitor bank;
- 2 Rectifier for accumulator charging;
- 3 Devices' rectifiers of cathode corrosion protection;
- 4 Rectifiers for power of DC drive.

Operation

3phCTD-6.1-DIN is provided with vertical-pulse regulation method of average load voltage value when rms change is performed by duration change of thyristor open state during corresponding half-period of line voltage.

Functional circuit of 3phCTD-6.1-DIN is shown at Figure 1. Function of outputs 3phCTD-6.1-DIN is shown in Table 1.

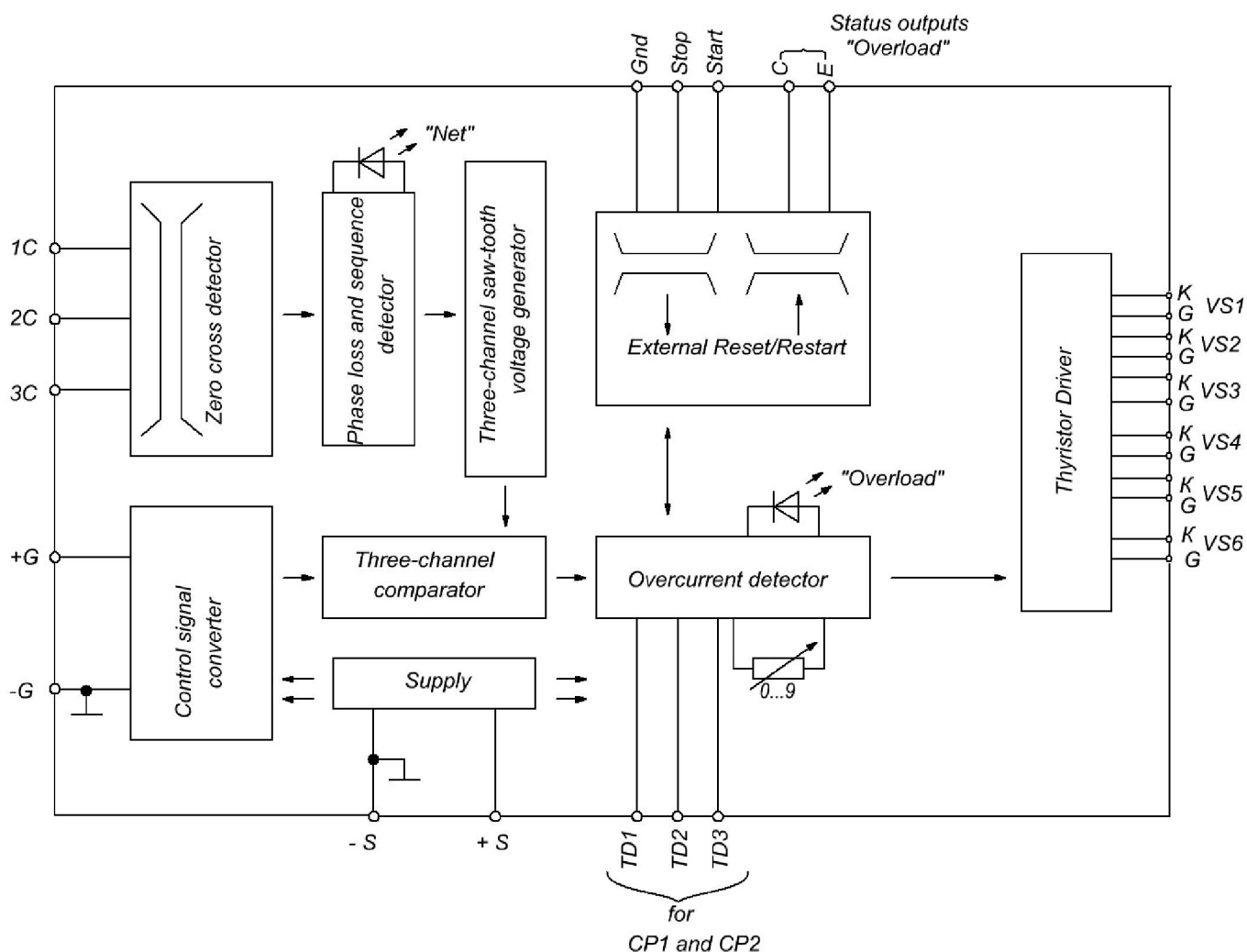


Figure 1 – Functional circuit

Table 1 – Output function of 3phCTD-6.1-DIN

Output	Symbol	Function
X1	Stop	“Stop” input (version with external rerun)
X2	Start	«Start» input (for version with external rerun)
X3	Gnd	Ground output for «Start» and «Stop» signals (for versions with external rerun)
X4	E	Emitter of status optocoupler (for versions with status optocoupler)
X5	C	Collector of status optocoupler (for versions with status optocoupler)
X6	Not involved	
X7	TD1	Current sensor input of phase 1
X8	TD2	Current sensor input of phase 2
X9	TD3	Current sensor input of phase 3
X10	- S	Supply 5 V
X11	+ S	
X12	+ G	Control
X13	- G	
X14	- VS6	- Thyristor driver VS6
X15	+ VS6	+ Thyristor driver VS6
X16	Not involved	
X17	- VS5	- Thyristor driver VS5
X18	+ VS5	+ Thyristor driver VS5
X19	- VS4	- Thyristor driver VS4
X20	+ VS4	+ Thyristor driver VS4
X21	Not involved	
X22	- VS3	- Thyristor driver VS3
X23	+ VS3	+ Thyristor driver VS3
X24	- VS2	- Thyristor driver VS2
X25	+ VS2	+ Thyristor driver VS2
X26	Not involved	
X27	- VS1	- Thyristor driver VS1
X28	+ VS1	+ Thyristor driver VS1
X29	Ph3 c	Inputs of synchronization with the network
X30	Ph2 c	
X31	Ph1 c	

Network synchronization node forms pulses at the moment of zero line voltage transient that synchronize sawtooth generator. In three-channel comparator the voltage of sawtooth generator and control signal U_{in} is compared that is delivered from converter circuit of input signal. On achievement STG voltage of value U_{cont} the turn-on pulses of thyristor driver will be generated. The change of control signal value will lead to change of equality moment of STG voltage and U_{cont} and thyristor conductance angle respectively. Thus the regulation of rms load voltage is reached.

Smooth start mode at supply turn-on is provided in 3phCTD-6.1-DIN, synchronize signals delivery and at returning from «Current overload» mode (for versions CP1 and CP2) into the operation mode, that allows decreasing inrush current of capacity filter charge of three phase controlled rectifier.

In the 3phCTD -6.1 with CP1 and CP2 performance there are current inputs to connect the current sensors, intended for power thyristors protecting against overload by currents that exceed nominal value. If load current value is higher than the normal then 3phCTD -6.1 moves in «Current overload» state, status LED is turned on (with red color) or status optocoupler transistor is opened (depending on the version), signals corresponding to closed thyristor state are formed on control outputs by thyristor drivers. Protection removes after 300 ms. The status LED is disconnected (or status optocoupler transistor will be closed), signals that perform smooth start from zero to mean load voltage value determined by control signal value are formed on control outputs by thyristor drivers.

If emergency is not eliminated then the above described process continues until the malfunction is eliminated. 3phCTD-6.1-DIN may be also made in version when return from “Current overload” mode into operating mode is performed by external signals that are delivered to input “Start”, for instance, from controller

board. There is also a capability of forced 3phCTD-6.1-DIN transfer into the mode “Overload” by means of signal delivery to input “Stop”.

There is a ten positional switcher (0 ... 9) for CP1 and CP2 version under 3phCTD -6.1-DIN hood that allows setting necessary protection operation current when entering of 3phCTD -6.1-DIN into the service. You need to take off the hood of 3phCTD -6.1-DIN and set switcher in the right position (when delivering to the consumer it is set in the «0» position). Current values for CP1 and CP2 are shown in Table 2.

Table 2 – Current value for versions CP1 and CP2

Switch position		0	1	2	3	4	5	6	7	8	9
CP1 version	Protection acting current, A	20	40	60	80	100	120	140	160	180	200
	Input current of load protection acting TD.A, TD.B, TD C, mA	14	28	42	56	70	84	98	112	126	140
CP2 version	Protection acting current, A	200	220	240	260	280	300	320	340	360	380
	Input current of load protection acting TD.A, TD.B, TD C, mA	140	154	168	182	196	210	224	238	252	266

Besides current overload protection the 3phCTD -6.1-DIN has protection that allows controlling voltage availability on all three phases connected to thyristor rectifier as well as correct phase rotation. Thus, eliminating work in open-phase mode, as well as an unresponsive state in violation of phase sequence. When there is voltage in all three phases and at correct phase rotation, the “Net” indicator has green color. In case of phase breaking as well as when trouble of their rotation order the “Net” indicator has no a color on the thyristor driver outputs and the signals corresponding to its closed state are formed.

3phCTD -6.1-DIN operates in complex with control devices (another manufacturer), that has standard analogue output DC signal.

Control signal converter turns control signal of 5 types (0...5 V; 0...10V; 0...5 mA; 0...20mA; 4...20 mA) into « U_{cont} » signal for 2 control types depending on version of 3phCTD -6.1. Dependence of conduction thyristor angle (time when thyristors conduct current) versus relative value of control signal is shown at Figure 2.

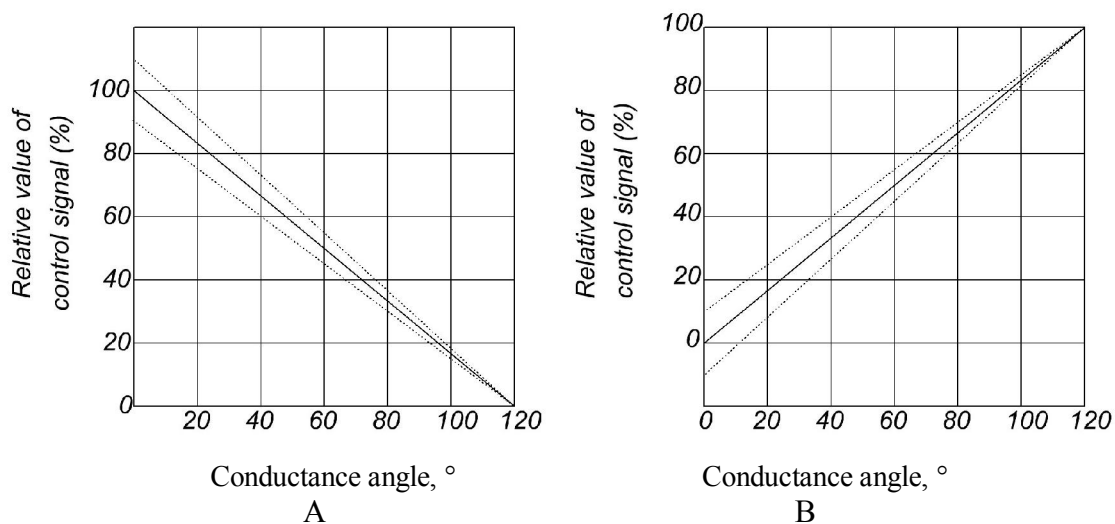


Figure 2 – Control characteristics

Basic technical characteristics of 3phCTD 6.1-DIN are shown in Table 3. Overall dimensions are given at Figures 3 and 4.

Technical characteristics

Table 3 – Basic technical characteristics

1 Supply

Parameter	Unit	Value	Note
1. Supply voltage	V	5	DC
2. Supply voltage value decline, max	%	± 10	
3. Current consumption, max	mA	150	

2 Input circuit characteristics

Parameter	Unit	Types of input circuits 3phCTD-6.1 DIN										Note
		A-1	A-2	A-3	A-4	A-5	B-1	B-2	B-3	B-4	B-5	
1 Control signal value corresponding to minimum 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	
2 Control signal value corresponding to maximum 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	
3 Input circuit resistance of control signal, R _{in} , max	kΩ	12.5	11.1	0.062	0.2	0.05	12.5	11.1	0.062	0.2	0.05	

3 Output circuit characteristic

Parameter	Unit	Value	Note
Output current	max mA	12	tp ≤ 10 ms
Output voltage	max V	5	Control circuit is open

4 Status circuit characteristic

Parameter	Unit	Value	Note
1 Collector current	max mA	50	
2 Collector-emitter voltage	max V	40	

5 Characteristics of external restart circuits («Start», «Stop»)

Parameter	Unit	Value	Note
1. Voltage of restart pulse	max V	5	
2. Time of restart pulse	min ms	10	

6 Characteristics of synchronization circuits

Parameter	Unit	Value	Note
1. Synchronization voltage	V	30 ÷ 80	
2. Current consumption of synchronization input	max mA	15	

7 Insulation characteristic

Parameter		Unit	Value	Note
1 Electrical insulation strength of power circuits, input circuits, status circuits, external restart circuits relative to input circuits	max	kV	2.5	AC 50 Hz
4 Electrical insulation resistance of power circuits, input circuits, status circuits, external restart circuits relative to input circuits when normal conditions	min	MΩ	40	DC testing voltage 1000 V

8 Weight measure

Parameter		Unit	Value	Note
1 Weight	max	kg	-	
2 Overall dimensions	max	mm	90x140	version 01
			91x160	version 02

9 Service conditions

Parameter		Unit	Value	Note
1 Operating temperature		°C	-45 ÷ + 65	
2 Relative humidity	max	%	80	

Notations

Notations: $\frac{3\text{phCTD} - 6.1 - \text{A} - 1 - \text{CP2} - \text{A} - 1 - \text{DIN}}{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8}$

- 1 Driver name;
- 2 Control characteristics:
 - 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 range
 - CP1 - 20...200 A;
 - CP2 - 200...380 A;
 - CP0 – no current protection
- 5 Restart type of current protection operate
 - A - automatic
 - E – external
- 6 Indication type when current protection operation
 - 1 – status LED
 - 2 – status optocoupler;
- 7 Fastening to DIN-rail 35 mm.
- 8 Embodiment

ATTANTION!

For drivers with performance PT0, restart view by triggering T3 (5), and the type of display when triggering T3 (6) ARE NOT INDICATED

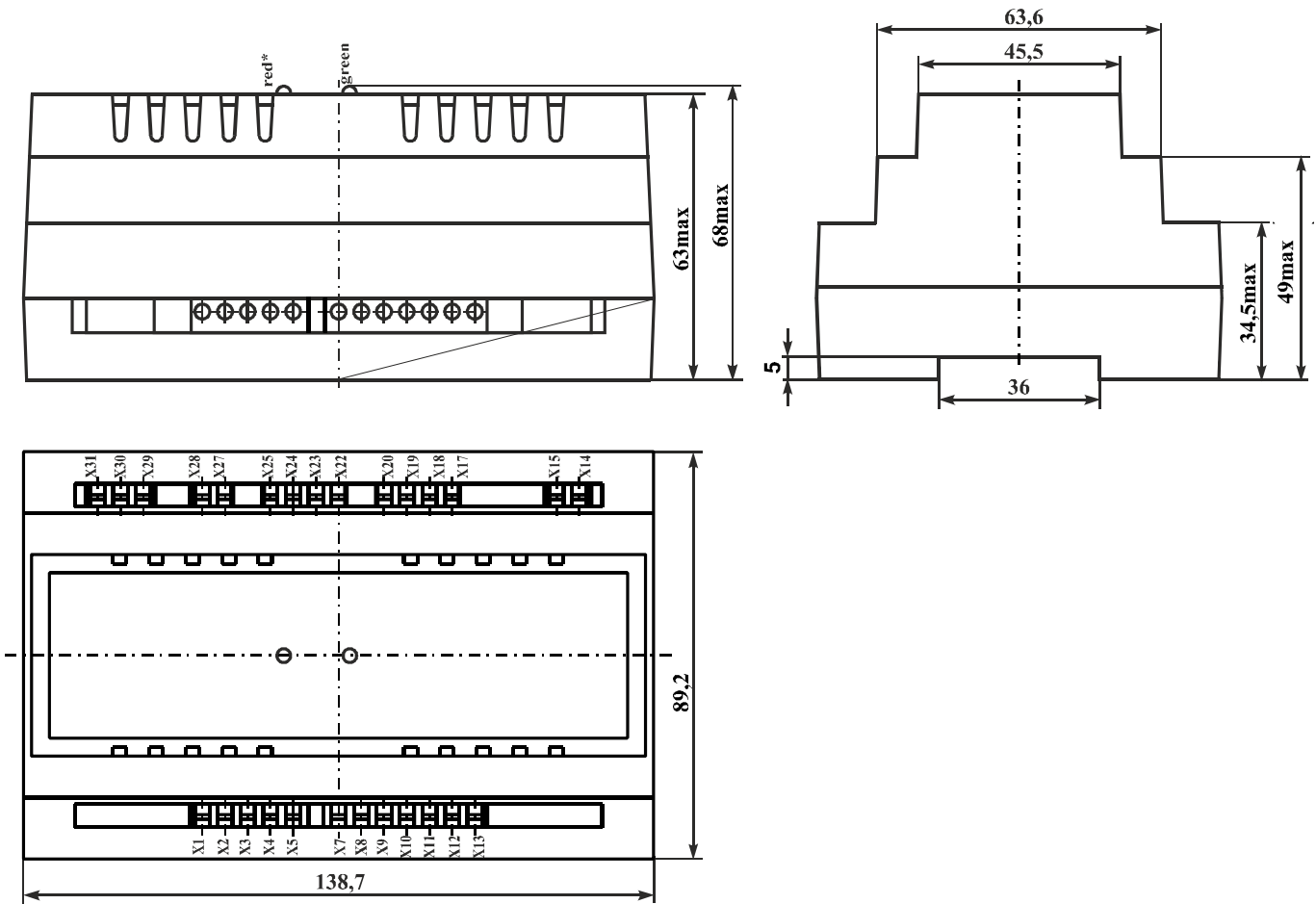


Figure 3 – Overall drawing - version 1
 *only for indication type –status LED

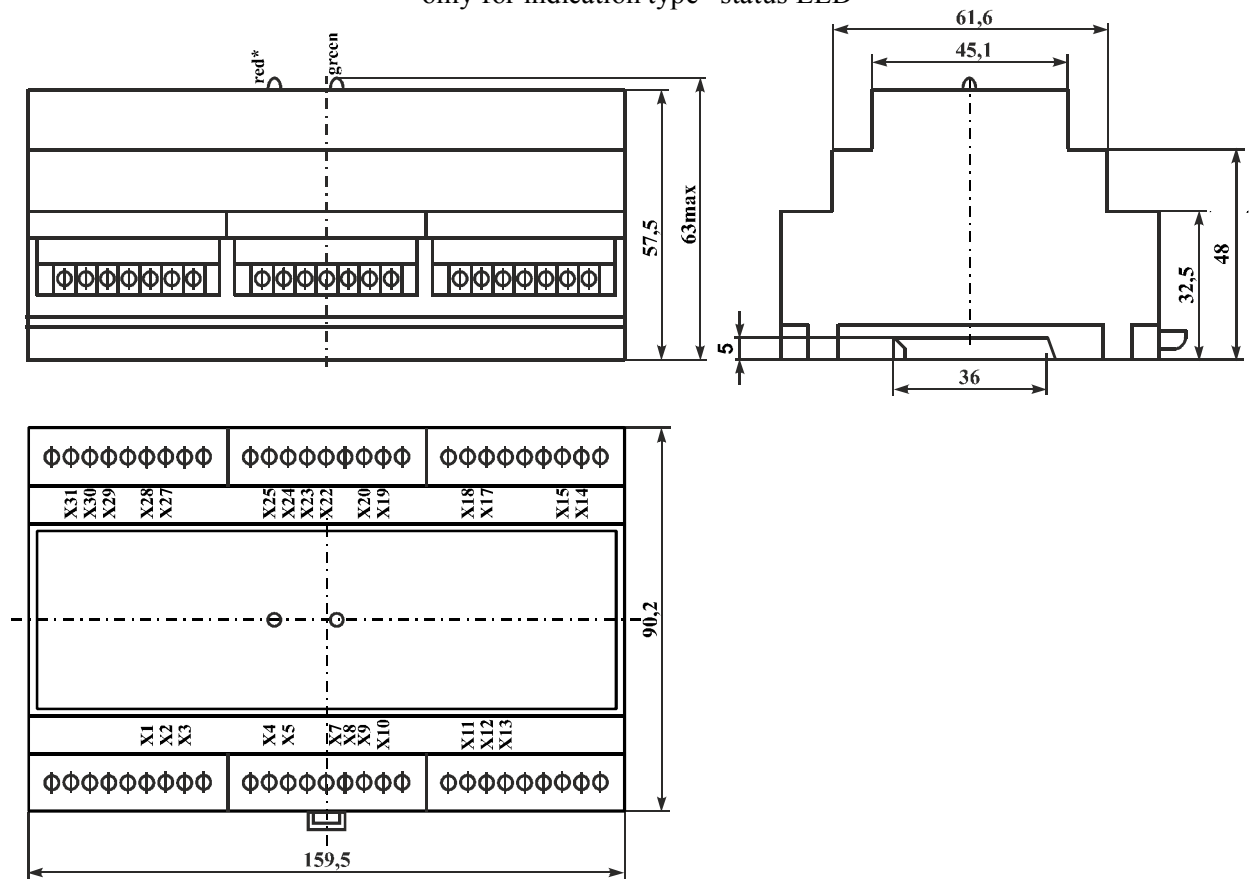


Figure 4 – Overall drawing - version 2
 *only for indication type –status LED

APPLICATION RECOMENDATIONS

It is permitted to wire field line and control circuits in one bundle or common tube (box) when mounting. Avoid loops in connecting cables of control and supply circuits. Connecting wires should be made as twisted pairs to provide noise stability.

Connection circuit of 3phCTD-6.1-DIN is shown at Figure 5

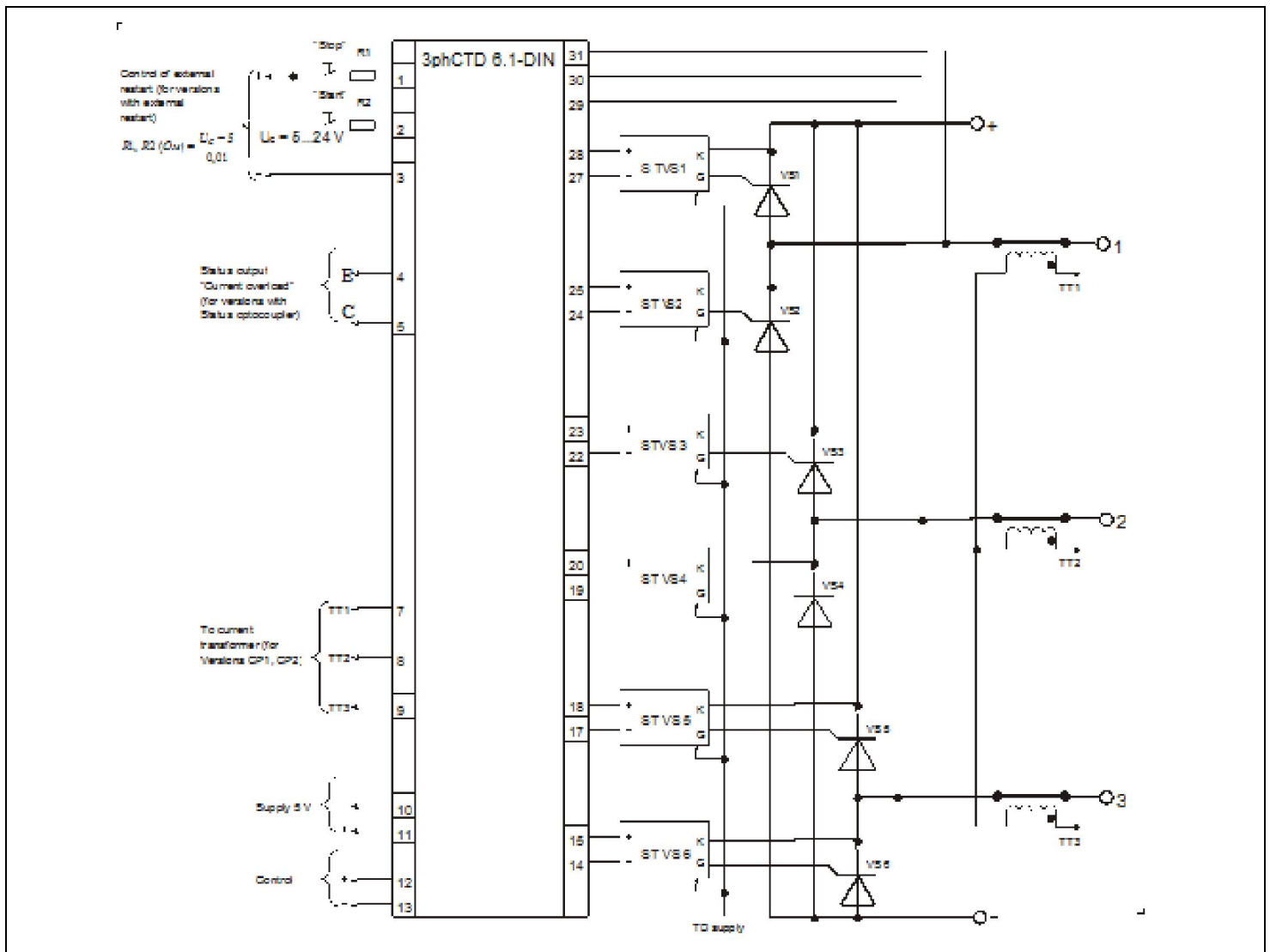


Figure 5 – Connection circuit

SUPPLY SET

- | | | |
|---|-------|-----------|
| 1. 3phCTD-6.1-DIN | _____ | _____ pcs |
| 2. Current sensor 1:2000±2% (for versions CP1, CP2) | _____ | _____ pcs |

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