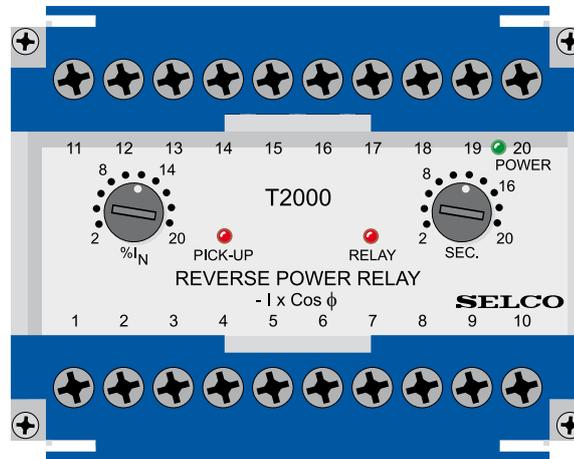


# T2000 Reverse Power Relay

- Protection of generator prime movers against reverse power
- Visual indication of power, pick-up and relay tripping
- High precision digital countdown timer for delayed output
- Direct Line-Line supply where neutral is not available
- Accepts high supply voltage variations: 50 - 110%
- Cost effective and highly reliable compact design
- 50 hours burn-in before final test
- Operating temperature range: -20°C to +70°C
- Certified by major marine classification societies
- Flame retardant enclosure
- DIN rail or screw mounting



## Application

The T2000 Reverse Power Relay will under parallel operation prevent the generator from running as a motor, thus protecting the prime mover (e.g. a diesel engine) by tripping the generator breaker, and at the same time avoiding overload on the remaining generators with a possible blackout of the system.

Together with the T2100 Excitation Loss Relay, the T2500 Overcurrent and Short Circuit Relay and the T2700 Power Relay, the T2000 provides the optimal solution for complete generator protection, both in marine and land-based applications. The T2000 is type approved by major marine classification societies.

## Function

The T2000 measures the voltage across phases L1 and L2 (or between L1 and neutral for L-N operation) and the current through a current transducer attached on phase L1.

The T2000 calculates  $I \times \cos \Phi$ , representing the active power. If the active power becomes negative and exceeds the preset level (2 - 20%), the pick-up LED will indicate and the delay timer will be started.

After the preset time (2 - 20 sec.) has expired, the output relay and LED will be activated, provided that the reverse power level was exceeded for the entire delay time.

The output relay is a latching relay. The latching can be reset or disabled by bridging terminals 13 and 14.

## Installation

Typical setting of reverse power: For diesel engines 8%, delay 10 sec. and for turbines 4%, delay 10 sec.

Example of setting:  
 Required trip level: 8%  
 Generator rating: 714A at PF = 0.8  
 $I_p \text{ max: } 714 \times 0.8 = 571A$   
 Current transformer: 800/5A  
 Setting:  $8 \times 571 / 800 = 5.7\%$

It is important that the phase where the current is measured always is connected to terminals 1 or 2. See connection diagram.

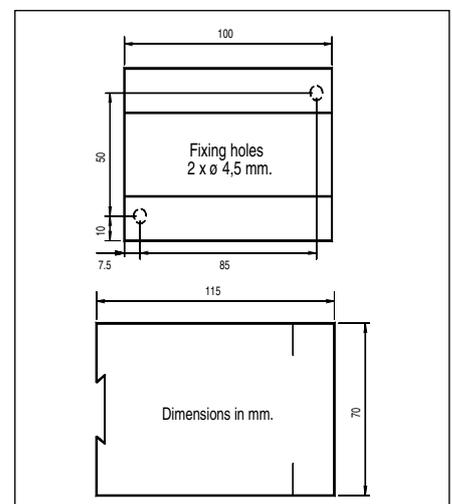
For L-L operation terminal 3 is connected to the next phase in the phase sequence. For L-N operation terminal 3 is connected to neutral.

It is important that the phase sequence is correct and the current transformer side nearest the generator side is connected to terminal 5.

The LED based pick-up indication is ideal for testing. The T2000 can be tested by reducing the speed on the generator, until the pick-up LED indicates exceeding the preset reverse power level.

## Troubleshooting

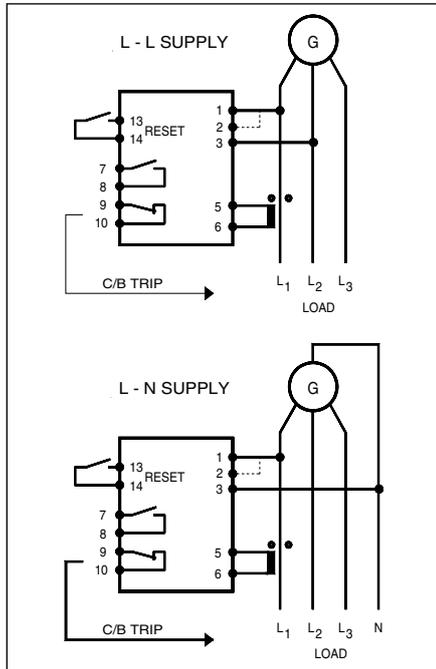
- 1) If the relay operates on forward load, the wiring to terminals 5 and 6 are interchanged.
- 2) If the relay is not operating in any power direction and there is voltage on terminals 1 and 3 or terminals 2 and 3, check that current is floating in the current circuit terminals 5 and 6.
- 3) If the relay trips at different levels when the tests are repeated, check that the voltage and current inputs have the correct phase relationship and that the phase sequence is correct.
- 4) If the relay trips in situations with high motor loads, check (as in 3) that the voltage and current inputs have the correct phase relationship and that the phase sequence is correct.



Dimensions.

# Specifications

## T2000 Reverse Power Relay



Connection diagram. Relay shown de-energized.

### Type Approvals and Certificates

The T2000 has been approved by the following marine classification societies:



- American Bureau of Shipping
- Bureau Veritas
- Croatian Register of Shipping
- Germanischer Lloyd
- Polish Register of Shipping
- Romanian Register of Shipping
- Russian Maritime Register of Shipping

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<b>Trip level</b>	2 - 20% $I_N$
<b>Delay</b>	2 - 20 sec.
<b>Max. voltage</b>	660V
<b>Voltage range</b>	50 - 110%
<b>Consumption</b>	Voltage 5VA at $U_N$ Current 0.3VA at $I_N$
<b>Continuous current</b>	$2 \times I_N$
<b>Frequency range</b>	45 - 400Hz
<b>Output relay</b>	Normally de-energized, latching, resettable
<b>Contact rating</b>	AC: 400V, 5A, 1250VA DC: 150V, 5A, 120W
<b>Overall accuracy</b>	±5%
<b>Repeatability</b>	±1%
<b>Operating temperature</b>	-20°C to +70°C
<b>Dielectric test</b>	2500V, 50Hz
<b>EMC</b>	CE according to EN50081-1, EN50082-1, EN50081-2, EN50082-2
<b>Approvals</b>	Certified by major marine classification societies
<b>Burn-in</b>	50 hours before final test
<b>Enclosure material</b>	Polycarbonate. Flame retardant
<b>Weight</b>	0.5kg
<b>Dimensions</b>	70 x 100 x 115mm (H x W x D)
<b>Installation</b>	35mm DIN rail or 4mm (3/16") screws

The specifications are subject to change without notice.

### Type Selection Table

Standard types:  $I_N = 5A$

Type	Terminals		$I_N$	Supply	Function
	1-3	2-3			
T2000.0010	230V		5A	L-N	
T2000.0020	450V	400V	5A	L-L	
T2000.0030	127V	120V	5A	L-N	
T2000.0040	110V	100V	5A	L-L	
T2000.0050	110V	100V	5A	L-L	No time delay
T2000.0060	230V		1A	L-N	
T2000.0070	660V		5A	L-L	
T2000.0080	450V	400V	5A	L-N	Delay 0.2 - 2.0 sec.
T2000.0090	127V	120V	5A	L-L	
T2000.0100	110V	100V	1A	L-L	
T2000.0110	450V	400V	5A	L-L	No time delay
T2000.0120	480V	415V	5A	L-L	
T2000.0130	230V		5A	L-N	No time delay
T2000.0140	230V		5A	L-L	
T2000.0150	480V	415V	1A	L-L	
T2000.0160	450V	400V	1A	L-L	

Other supply voltages and combinations are available on request.