

T4500 Auto Synchronizer

- Automatic synchronization with relay outputs for speed control
- Adjustable delta frequency and delta voltage
- Adjustable breaker make time
- Visual indication of bus voltage, generator voltage, closing signal, delta voltage, increase and decrease signals
- Automatic voltage matching
- Cost effective and highly reliable design
- 50 hours burn-in before final test
- Operating temperature range: -20°C to +70°C
- Vibration test up to 4g (5 - 100Hz)
- Certified by major classification societies
- Flame retardant enclosure
- DIN rail or screw mounting

Application

The T4500 Auto Synchronizer provides automatic synchronization of an incoming generator to a busbar in a minimum of time, by controlling the speed via the electric servomotor on a conventional speed governor, or by controlling an electronic speed controller via an intermediate motorized potentiometer.

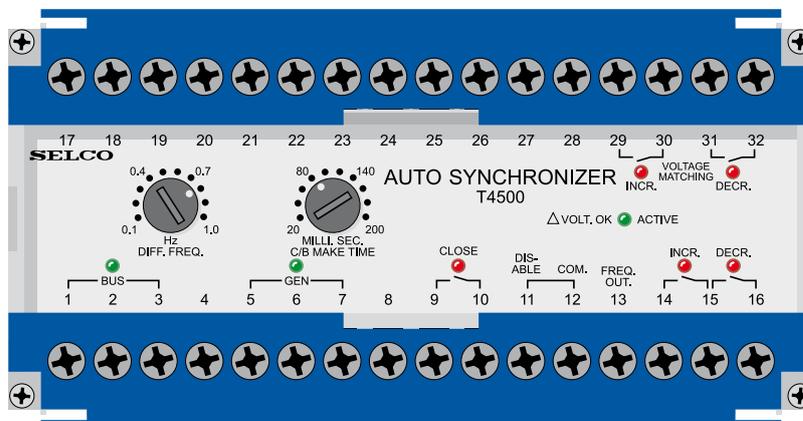
Together with the T4800 Load Sharer, the T4500 provides the optimal solution for generator control, both in marine and land-based applications. The T4500 is type approved by major marine classification societies.

Function

The T4500 measures the voltage across two phases on either side of the circuit breaker in order to obtain data on voltage, frequency and phase difference for closing the circuit breaker at exact phase accordance.

The synchronization function will become active when the difference between the bus voltage and the generator voltage is within limits, which is indicated on the ΔVOLT LED.

The voltage difference is selectable between 2% to 10% (see the resistor table on page 2 for selecting the ΔVolt window value). If the voltage difference is too high, the voltage matching



function of the unit can be used (see the separate section on voltage matching).

When the synchronization function is active, the T4500 will automatically adjust the speed of the generator through the governor in order to match the frequency to the busbar. Two built-in relays provide the increase and decrease pulses for a conventional governor. The length of the pulses is proportional to the frequency difference.

The E7800 Motorised Potentiometer can be used to adapt the contact pulses to a signal, suitable for the speed trim input of an electronic speed controller.

The T4500 will continuously adjust the generator speed until the frequency difference is within limits. The frequency difference is adjustable on the front dial DIFF. FREQ from 0.1Hz to 1.0Hz.

Before the breaker can be closed this frequency difference *must* be positive. The reason is that in order to protect the generator against reverse power, the generator should come in at a slightly higher frequency than the frequency of the busbar.

When the voltage and frequency difference are within limits, the closing signal will be activated just before the next phase accordance, anticipating the circuit breaker make time.

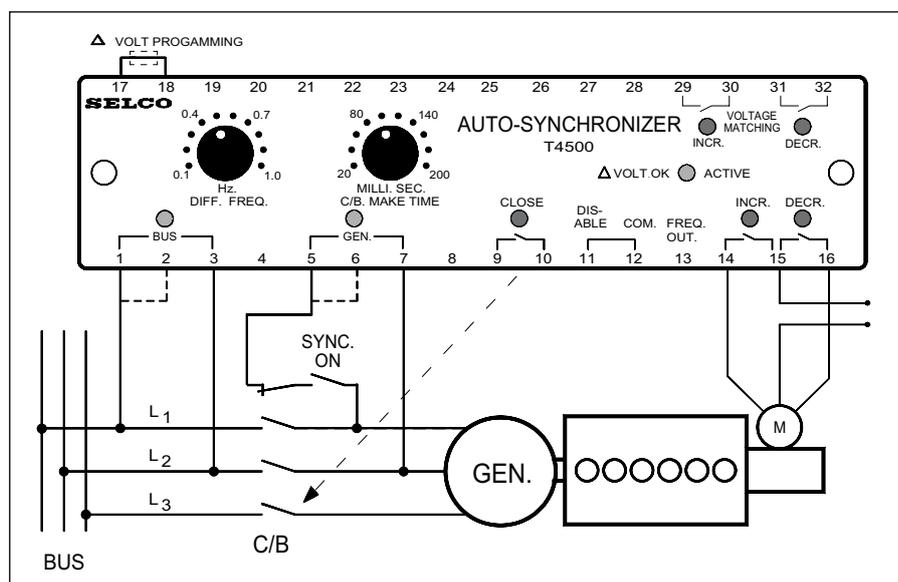


Fig. 1. Application Diagram.

The circuit breaker make time should be set on the front dial C/B MAKE TIME according to the specifications of the circuit breaker. The T4500 compensates for this make time so that the circuit breaker will close exactly at zero phase.

The circuit breaker closing signal is a pulse signal of 0.7 seconds duration at terminals 9 and 10 (CLOSE). A connection between terminals 11 and 12 (DISABLE) will disable the closing signal, but will not influence the automatic frequency alignment.

When commissioning, it is recommended to disable the closing signal with this connection. Check that the closing signal indicated on the RELAY LED is at phase accordance.

Synchronizing between busbars

A unique feature of the T4500 is the possibility of simultaneous synchronization of already parallel running generators to another busbar section, a shaft generator or the grid.

An output from terminals 12 (COM) and 13 (FREQ. OUT) connected to the terminals 12 (COM) and 29 (FREQ. IN) on all the T4800 Load Sharers, will allow the frequency to be aligned for synchronizing. See application diagram figure 5.

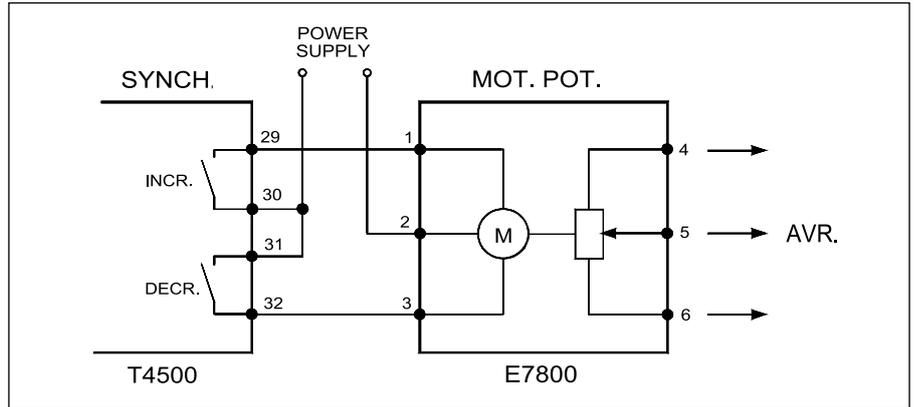


Fig. 2. Voltage matching.

Voltage matching

In situations where the voltage difference is too high for obtaining synchronization, the voltage matching function can be used.

The voltage matching works as follows: When the generator comes on voltage and the busbar voltage is present, a delay of 4 seconds allows the generator voltage to stabilize, before the voltage adjustment takes place.

If the generator voltage is outside limits, a relay for increase (terminals 29 and 30 - INCR.) and a relay for decrease (terminals 31 and 32 - DECR.) are activated until generator voltage is within limits.

The SELCO E7800 Motorized Potentiometer can be used as an intermediate unit between the T4500 and the AVR (Automatic Voltage Regulator). See figure 2.

Resistor table for selecting the ΔVolt window

Resistors to be connected between terminals 17 and 18.

10%	=	0Ω default (link)
9%	=	10kΩ
8%	=	18kΩ
7%	=	33kΩ
6%	=	82kΩ
5%	=	100kΩ
4%	=	270kΩ
3%	=	470kΩ
2%	=	no connection

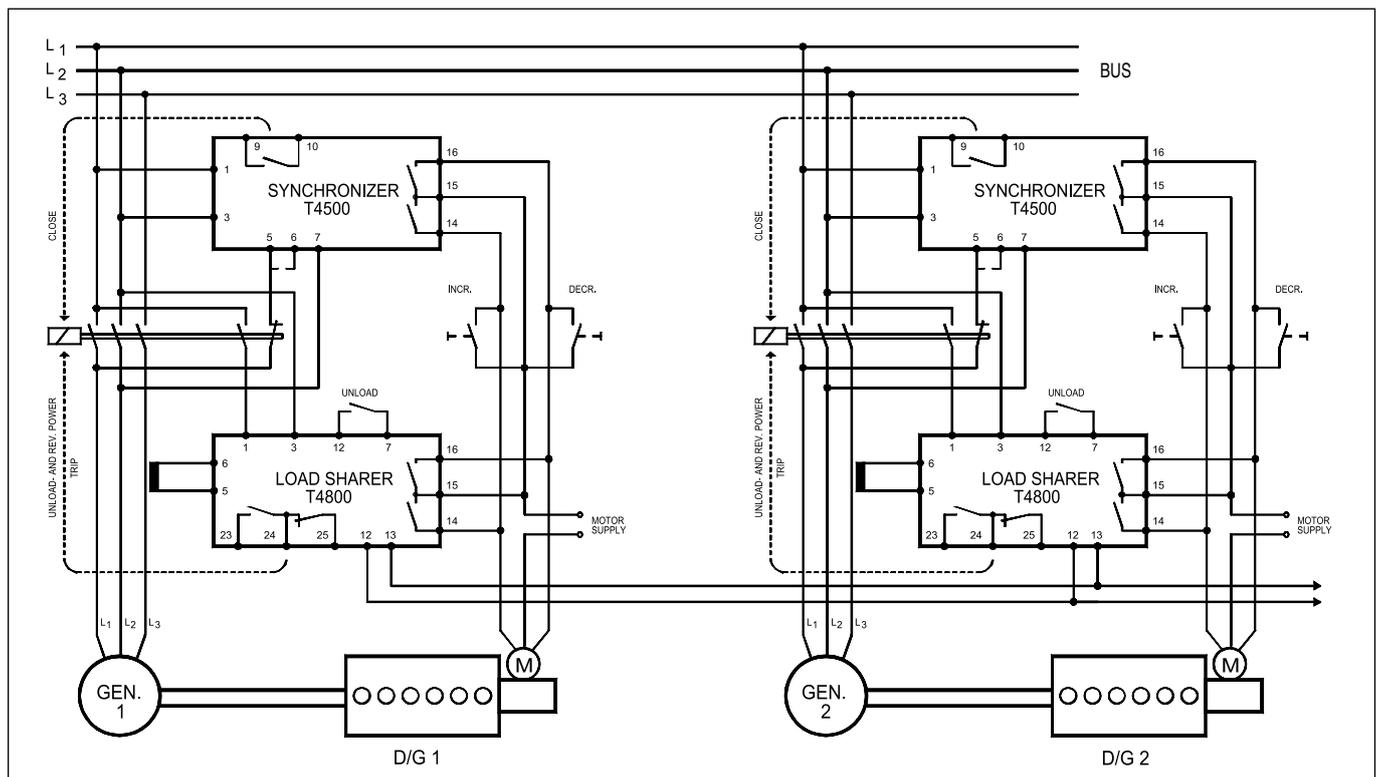


Fig. 3. Application Diagram. Synchronization and load sharing with T4500 and T4800 using conventional governors.

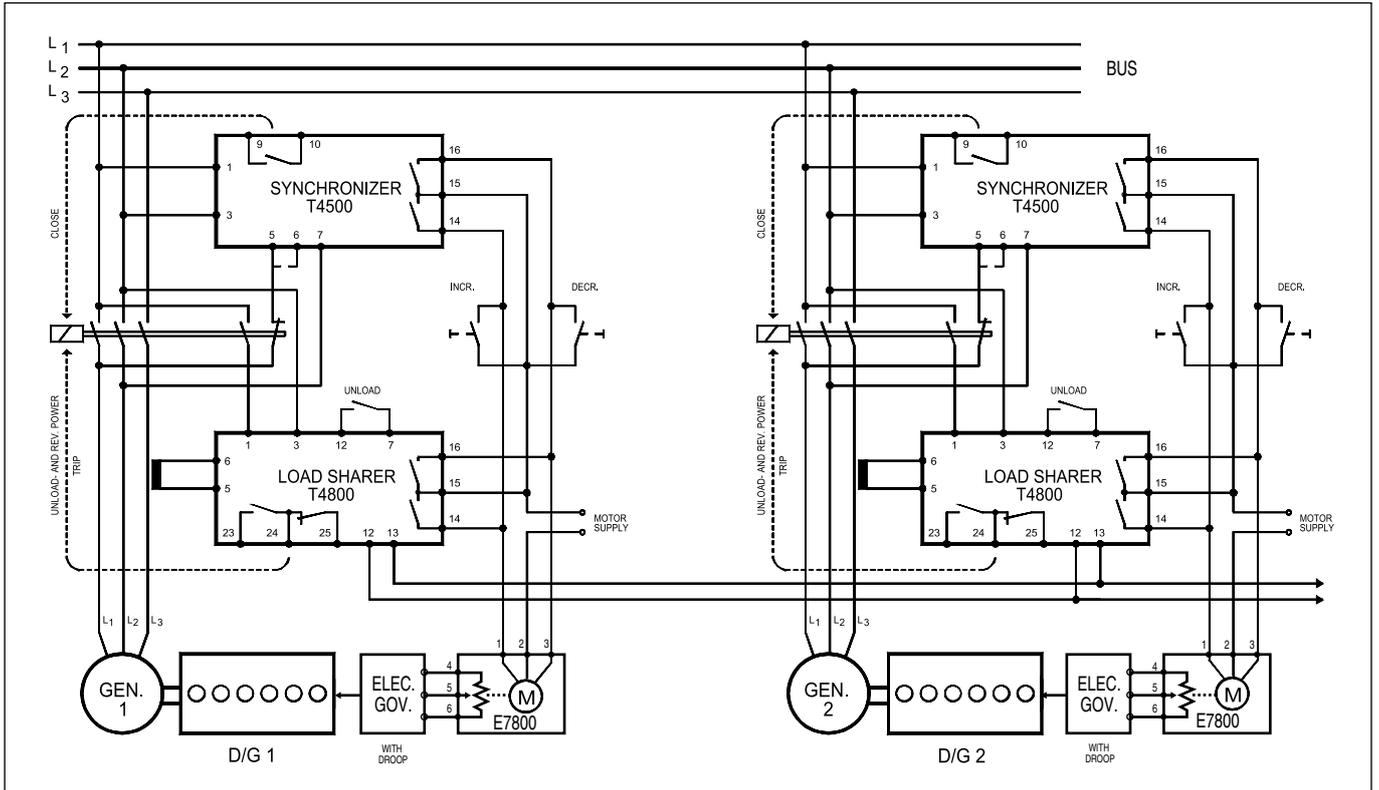


Fig. 4. Application Diagram. Synchronization and load sharing with T4500, T4800 and E7800 using electronic governors.

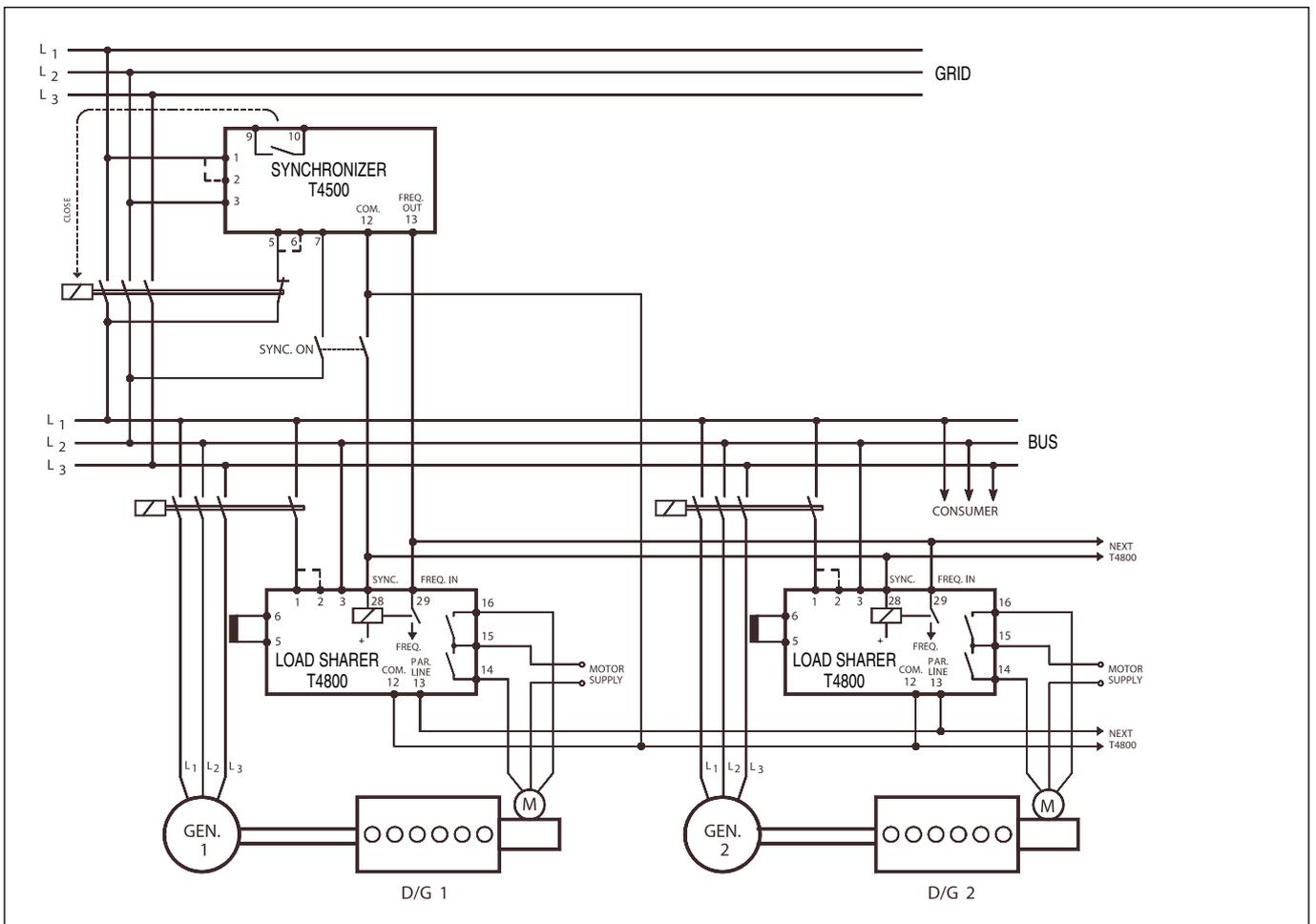


Fig. 5. Application Diagram. Synchronizing two generators on load sharing to the grid with T4500.

Specifications

T4500 Auto Synchronizer

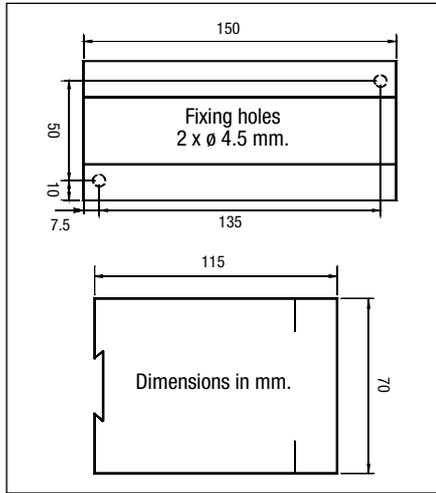


Fig. 6. Dimensions.

Type Approvals and Certificates

The T4500 has been designed and tested for use in harsh environments. The unit is based on standard components, providing long term durability.

The T4500 carries the CE label and has been approved by the following marine classification societies:



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

Max. voltage	660V
Voltage range	70 - 110%
Consumption	4VA at UN
Frequency range	35 - 70Hz
Frequency difference	0.1 - 1.0Hz
C/B make time	20 - 200ms
Voltage difference	2 - 10%
Contact rating	AC: 400V, 2A, 250VA DC: 110V, 2A, 100W
Operating temperature	-20 to +70°C
Vibration test	4g (500-100 Hz)
EMC	CE according to EN50081-1, EN50082-1, EN50081-2, EN50082-2
Approvals	Certified by major classification societies
Burn-in	50 hours before final test
Enclosure material	Polycarbonate, flame retardant
Weight	0.7kg
Dimensions	70 x 150 x 115 mm (H x W x D)
Installation	35 DIN rail or two 4mm (3/16") screws

The specifications are subject to change without notice.

Type Selection Table

Type	Terminal	
	1-3	2-3
T4500.0010	450V	400V
T4500.0020	230V	
T4500.0030	480V	415V
T4500.0040	110V	63V
T4500.0050	127V	120V
T4500.0060	110V	100V
T4500.0070	600V	

Other supply voltages and combinations are available on request.

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