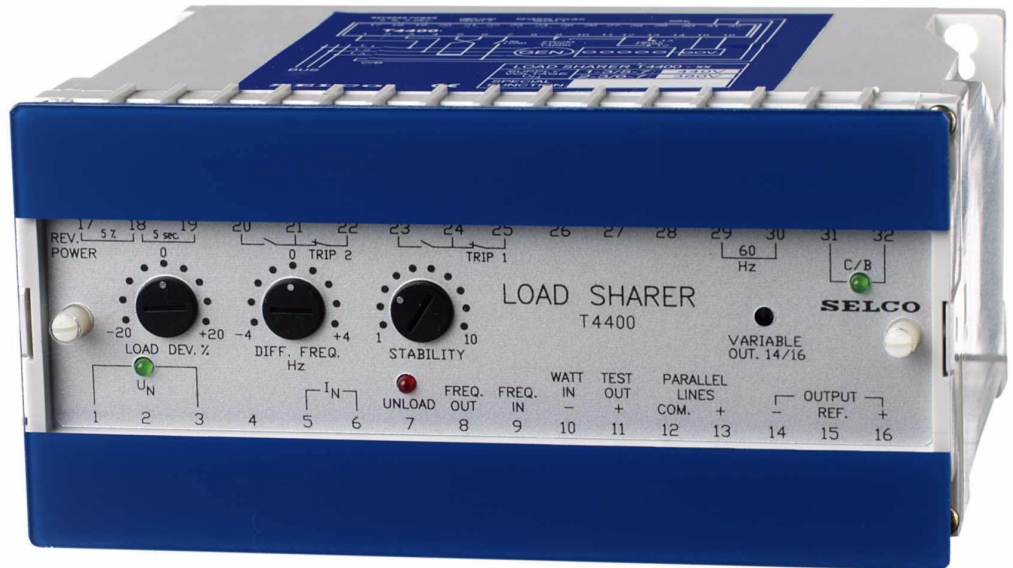


Reliable Supervision and Control

- Cost effective and highly reliable compact design
- Adaptable to most speed controllers
- Is available for all system voltages up to 660V
- 2-wire communication with other T4400 Load Sharers
- Built-in frequency control
- Load / unload facility with ramp function
- Reverse power and unloaded trip
- 50 hours burn-in before final test
- Visual indication of voltage and generator C/B state
- Operates in ambient temperatures -20°C to +70°C (-4°F to 158°F)
- Flame retardant enclosure
- DIN rail mounting



Application

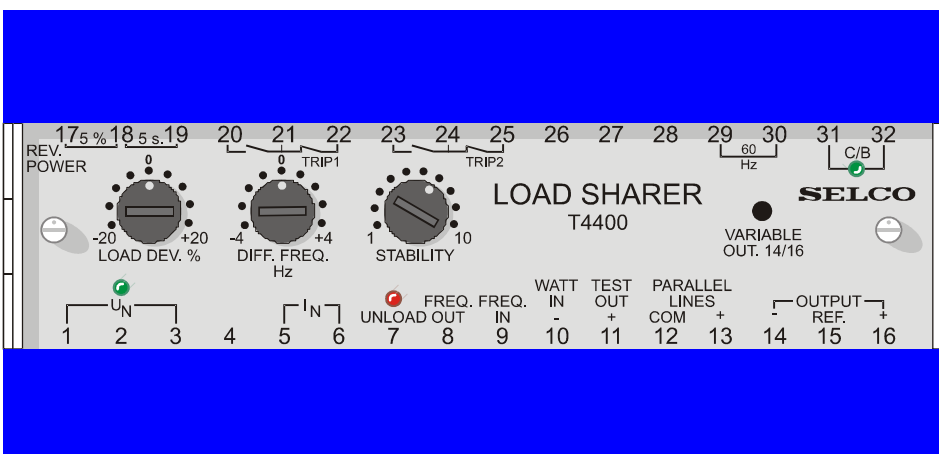
The T4400 provides automatic load sharing and frequency control for parallel running generators. The T4400 works in connection with most electronic speed controllers. The active load (kW) on each generator is compared with the active load on the other generators and corrected until balance is obtained. Load sharing is necessary after synchronization in order to re-establish load balance and to obtain long term stability of load and system frequency. When applied with the B9300 Power Reference Unit, one or several generators can be operated in parallel with the grid.

Function

The input to the unit is the voltage and current, from which the active load and frequency are determined. The basis of the measurement is a measurement of $I \times \cos \phi$. The load on each generator is compared with the load on the other generators and calculated into a control signal that is connected to the electronic speed controller for regulating the load with optimal speed and stability. The T4400 includes a built-in frequency control and an integration function. These two features provide a very high overall stability and compensate for any drift within the speed controller. A soft load / unload function is also provided. When activated, the T4400 will slowly increase or decrease speed to transfer load to or from the generator. A built-in relay can automatically trip the circuit breaker when the unload procedure is completed. The T4400 has a built-in reverse power protection with selectable current limit and time delay.

Supply voltage / current

The supply voltage from L1 and L2 is connected to terminals 1 and 3 or 2 and 3, depending on the system voltage. The measuring current from L3 is



connected to terminals 5 and 6 with 5 referring to the generator (see the application diagram on page 3). The current measurement must be taken from the same phase on all generators. The current is measured in the phase that is not supplying the unit. It is important to ensure that the phase sequence is correct. This relation between the connections of voltage and current must be correct in order to achieve a correct load measurement. It can be checked on terminal 11 (TEST OUT) where an input of nominal current (1A or 5A) and power factor 1.0 gives +6V for correct connection.

Ramp function

The T4400 includes a ramp function. With this function activated, the unit will smoothly take over the load up to load balance. In order to activate this function, terminals 7 (UNLOAD) and 32 should initially be bridged and so should terminals 31 (C/B) and 32 (for example with an aux. contact of the circuit breaker). Now the ramp function can be activated by opening the connection between terminals 7 (UNLOAD) and 32.

Common reference

Terminal 12 (COM.) is the common reference for terminals 8 to 13.

Unload facility

The unload facility will smoothly unload the generator. This facility works like an inverted ramp function. If activated, the load on the generator will be reduced and *maintained* at a low level. In order to activate, terminals 31 (C/B) and 32 should initially be bridged. The unload function is then activated by connecting terminal 7 (UNLOAD) to 32.

Unload trip

When the load passes below 5% load, a trip signal is provided as a normally open (NO) contact on terminal 20-21 and a normally closed (NC) contact on 21-22. This trip signal can be used to trip the circuit breaker.

Reverse power trip

The reverse power trip operates at 10% with a delay of 10 sec., but it can be reduced to 5% by bridging terminals 17 and 18, and to 5 sec. delay by bridging 18 and 19. A resistor of 510 Ω between 17 and 18 gives 7.5%, a resistor of 2.7M Ω between 18 and 19 gives 7.5 sec. delay. The reverse power trip is provided as a normally open (NO) contact on 23-24 and a normally closed (NC) contact on 24-25.

Frequency control

The electronic speed controller will control the frequency of the generator. However, the frequency control of some speed controllers will drift with time. In order to compensate for this, the T4400 includes frequency control. The system frequency can be set to 60Hz with terminals 29 and 30 bridged or 50Hz with these terminals open. Further adjustment of the frequency is possible using the potentiometer DIFF. FREQ. on the front panel. Connecting 8 (FREQ. OUT) to 12 will disable the frequency control. This is used when running parallel with the grid, where the frequency is already determined.

Input from synchronizer

Between terminals 9 (FREQ. IN) and 12 the SELCO T4400 Auto Synchronizer or most other synchronizer makes can be connected. The synchronizer will then give the

synchronizing output through the T4400. This signal is not affected by the output adjustments on the T4400.

External power measurement

On terminal 10 (WATT IN) a negative voltage (0 to -1V DC from a watt converter) can be connected to substitute the internal load measuring circuit. In this case no input on terminals 5 and 6 is needed.

Most standard measuring signals can be adapted with external resistors.

0-10V : series resistor 510k
0-5mA : parallel resistor 200

Communication between load sharers

For communication between the load sharers all terminals 12 (COM.) as well as terminals 13 (+) are interconnected.

Output to the speed controller

Output to the electronic speed controller is taken from terminals 15 (REF.) and 16 (+) with terminal 15 as reference. If an inverse signal is needed, use terminals 15 (REF.) and 14 (-) rather than changing wires to 15 and 16. The output signal is an integrated signal. This means, the output signal will change as long as there is a load deviation. When load balance is obtained the output signal will stay at its current level.

Adjustments

LOAD DEV. can be used for fine adjustments of the load balance. LOAD DEV. should also be used for adapting input signals from generators of different size and with different type of current transducers (CT's). For generators of same size and with same type of CT the setting 0 should be used on all load sharers.

DIFF. FREQ. is used for adjustment of system frequency as described on page 2 in the section about frequency control. If the system frequency should be exactly 50 Hz or 60 Hz the setting 0 should be used. STABILITY is used for adjusting the regulation time. A high setting of STABILITY will give a slow regulation and few load fluctuations. A low setting will give a fast regulation with more load fluctuations. Use a setting as low as possible, but not so low that the system becomes instable. VARIABLE OUT is intended for adjusting the size of the output signal to the speed controller. The output increases with higher setting on the potentiometer. Too much output can result in instability. If this is the case, turn the potentiometer anti clockwise until stability is restored.

Interfacing

A detailed note on interfacing the T4000 and the T4400 to a wide number of different electronic speed controllers is available from SELCO. This note can also be downloaded from our web-site.

Trouble Shooting

If load balance is not obtainable

If load balance is not obtainable and the power goes to maximum or reverse power, one of the signals is inverted due to wrong polarity or interchanged wires. If this is the case, the following should be checked:

The polarity of the power measuring signals on terminal 11 (TEST OUT) must be positive with the generator on load. If the polarity is negative, change the voltage connections 1 and 3 or 2 and 3 or the current connections 5 and 6.

Output from 15 (REF.) and 16 (+) must be connected to the speed controller input. Terminal 16 is going positive for increased load. If a negative voltage for increased load is needed, then terminal 14 (-) s should be used rather than terminal 16 (+).

The parallel lines connected to 12 (COM.) and 13 (+) between load sharers must not be interchanged.

If the load balance is incorrect

If there is a balance point, but the load balance is incorrect, the following should be checked:

1. Load deviation shall be set to 0 for same size of generators and same type of current transducers (CT's).
2. The frequency of the generators before paralleling should be the same.
3. The output adjustment must have the same setting on all load sharers.
4. If the deviation from other generators is approximately two times, it is likely that the current on 5 and 6 is measured in one of the phases supplying the T4400. The current must be measured in the phase that is *not* supplying the unit (see the application diagram on page 3). Check the voltage on 11 (TEST OUT) to be +6V DC for nominal current input (IN=1A or IN=5A) and power factor = 1.0. A current measurement in a wrong phase will give +3V DC.

Example:

If the current in terminals 5 and 6 is 2.0A, the nominal current IN is 5A, and the power factor is 0.8, then the voltage for correct connection is: $6 \times (2 / 5) \times 0.8 = +1.9V$

SPECIFICATIONS

Voltage

Max. 660V

Range: 70-110%

Consumption: 4VA at U_N

Frequency

35-70Hz

Current

Continuously: $2 \times I_N$

Consumption: 0,4VA at I_N

Operating temperature

-20°C + 70°C / -4°F to 158°F

Contact rating

AC = 380V, 2A, 250VA

DC = 110V, 2A, 100W

Output voltage

Max. $\pm 6V$

Enclosure material

Polycarbonate, flame retardant

Weight

0,7kg / 1.54Lb

Dimensions (H x W x D)

70 x 150 x 115mm

2.76 x 5.91 x 4.53"

EMC

CE according to EN50081-1, EN50082-1,

EN50081-2,

EN50082-2, EN61000-6-2:1999

Burn-in

50 hours before final test

Installation

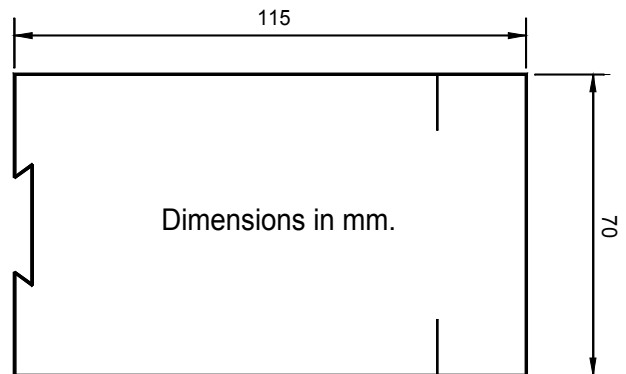
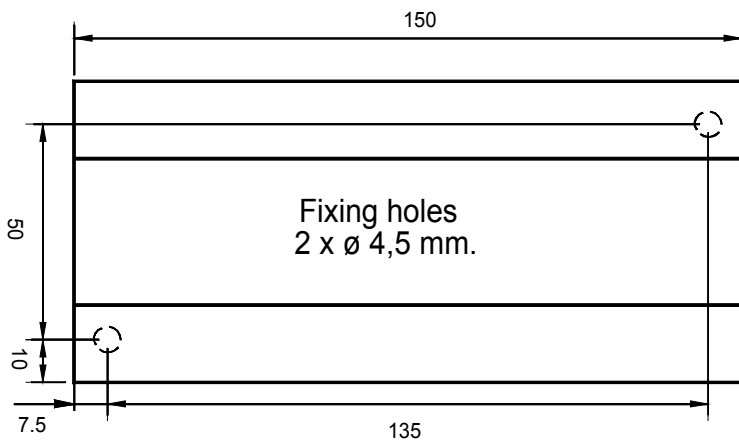
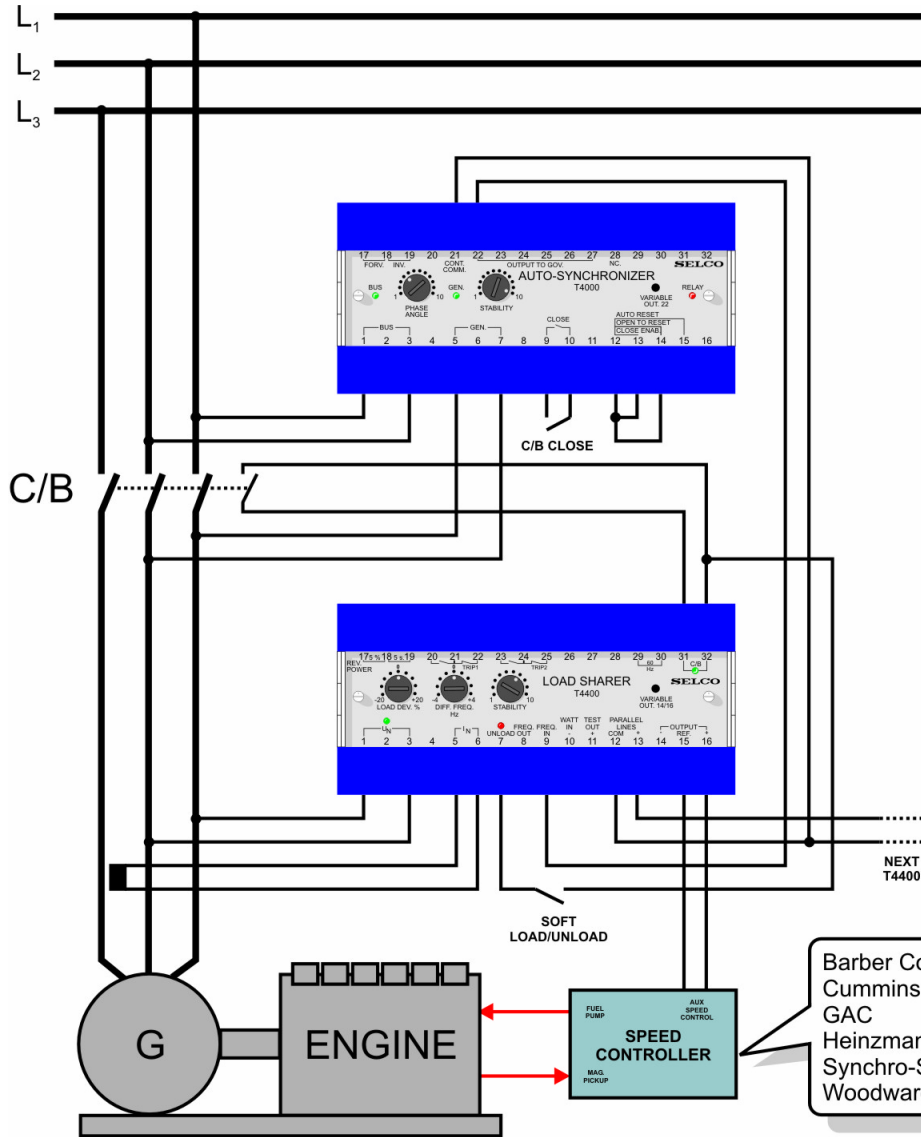
35 DIN rail or two 4mm (3/16") screws

The specifications are subject to change without notice

Type Description

Type	Terminals		I_N
	1-3	2-3	
T4400-31	440V	380V	5A
T4400-33	240V	220V	5A
T4400-35	480V	415V	5A
T4400-41	110V	100V	1A
T4400-42	440V	380V	1A
T4400-45	127V	120V	5A
T4400-46	110V	100V	5A

Other supply voltages, nominal currents, and combinations are available on request.



95-61

Dimensions are in millimeter