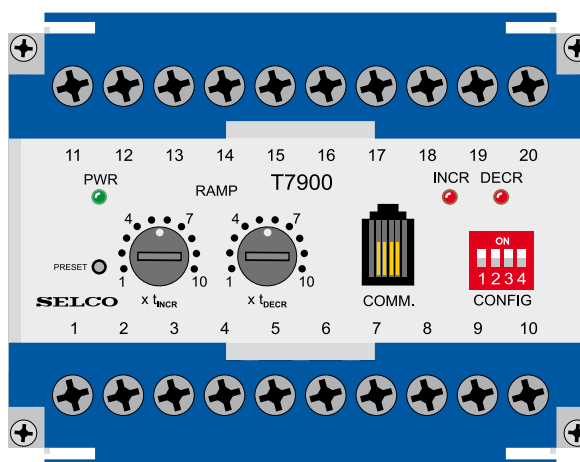# T7900 Electronic Potentiometer

- Electronic Potentiometer with voltage, current or PWM output
- Wide selection of output ranges
- Isolated outputs
- Adjustable ramping times
- 2 LEDs indicating "increase" and "decrease"
- Preset push button defines the output reference
- Programmable power reference unit for operation of generators in parallel with the grid
- 50 hour burn-in before test
- Operating temperature range: -20ºC to +70ºC
- Flame retardant enclosure
- DIN rail or screw mounting

Application

The T7900 Electronic Potentiometer is typically used as an interface between increase and decrease contacts and a device requiring control / adjustment by a voltage or current signal, such as an electronic speed controller.
In such applications, the T7900 acts in a very similar manner to a motorized potentiometer, except that the outputs are a voltage, a current or a pulse width modulated signal (PWM), while the motorized potentiometer has a variable resistor output.

In generator control applications, the T7900 can be used together with e.g. the SELCO T4500 Auto Synchronizer and the T4800 Load Sharer.
The T7900 converts the increase and decrease pulses (from e.g. the T4500 and T4800) into a suitable analog voltage or current signal. This analog output signal can be used as a control input to an electronic speed controller.

The analogue outputs from T7900 are isolated. The rise and fall time of the output signal can be individually adjusted to match the response time of a specific speed governor or voltage regulator. The slope of the output signal is not limited by mechanical aspects, unlike a conventional motorized potentiometer, which is limited by the RPM of the internal motor.
A wide number of output ranges can be selected via dipswitches in order to match almost any type of speed controller. Additional ranges can be defined via the optional advanced PC

configuration of the T7900, using a standard ANSI terminal such as the Windows HyperTerminal.

The unit can also be used as a programmable power reference unit

for setting the capacity to be provided by engine driven generators, when the generators are operated in parallel with the grid (utility) or a shaft generator. This function is described on the following pages.

| Terminals 1, 2 & 3:	Optional AC supply for the AC versions of T7900 (an alternative to the 24V DC / AC supply).
Terminal 4:	+ 10V output
Terminal 5:	+ Reference of voltage signal for PWM output
Terminal 6:	Output voltage of 0 − 10V DC for connection of a meter instrument.
Terminals 7, 14 & 19:	Common reference for inputs and outputs.
Terminals 8, 9 & 10:	Output control signals as voltage, current or PWM.
Terminal 11 & 12:	24V DC supply.
Terminal 13:	RESET for reset of output signal back to the reference level.
Terminals 15, 16 & 17:	IN1, IN2 & IN3 are control inputs for setting various output levels when the T7900 is used as a power reference unit.
Terminals 18, 19 & 20:	INCR, REF & DECR are control inputs for the T7900 with increase and decrease pulses.
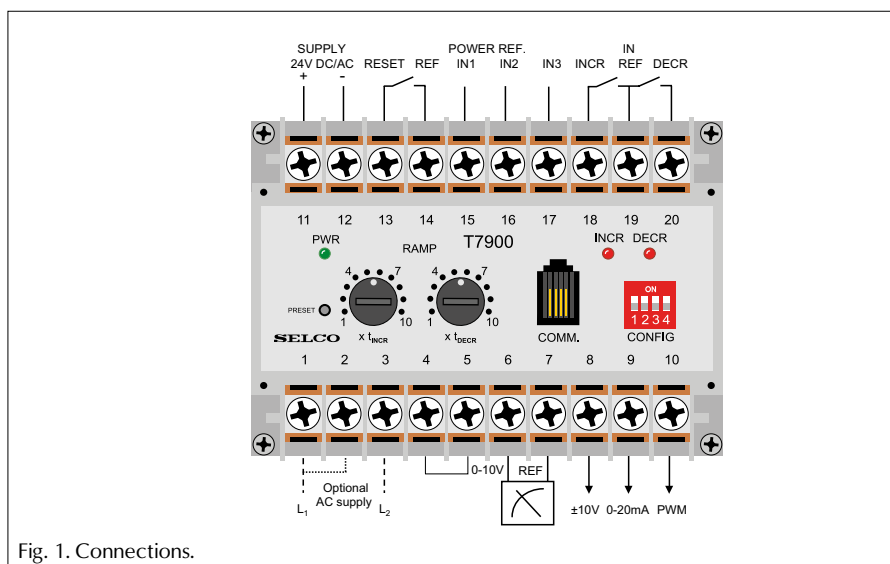
Fig. 1. Connections.

Electronic Potentiometer Function

When the CONFIG dipswitch no. 1 on the front is OFF, the T7900 will act as an electronic potentiometer. The output is a variable voltage, current or pulse width modulated signal (PWM).

The type and range of output can be selected via dipswitches on the back of the unit. This selection should be made in order to match the input type and range of the unit to control e.g. an electronic speed controller. The following can be selected on the dipswitches:

SW1 1	SW2 2	SW3 4	SW4 8	Output	Ref.
OFF	OFF	OFF	OFF	-10V – +10V	0V
OFF	OFF	OFF	ON	0V – +10V	+5V
OFF	OFF	ON	OFF	-5V – +5V	0V
OFF	OFF	ON	ON	-10V – 0V	-5V
OFF	ON	OFF	OFF	-1V – 0V	0V
OFF	ON	OFF	ON	0V – +1V	0V
OFF	ON	ON	OFF	0V – +3V	0V
OFF	ON	ON	ON	0V – +5V	0V
ON	OFF	OFF	OFF	0V – +6V	0V
ON	OFF	OFF	ON	-1V – +1V	0V
ON	OFF	ON	OFF	-3V -- +3V	0V
ON	OFF	ON	ON		
ON	ON	OFF	OFF	10-90% 2.94KHz	50%
ON	ON	OFF	ON	4mA – 20mA	12mA
ON	ON	ON	OFF	10-90% 500Hz	50% PWM
ON	ON	ON	ON	PRG. MODE	

Setting all dipswitches to ON will put the unit in programming mode. In programming mode the unit can be configured from a PC using a standard ANSI terminal such as the Windows HyperTerminal. In this case additional output ranges, reference levels and other parameters can be specified from the PC. An optional programming kit G0100 is available for this purpose.

The control inputs are the increase / decrease contact inputs on terminals 18 and 20. As long as no increase / decrease inputs have been received, the output signal will stay at the reference level.
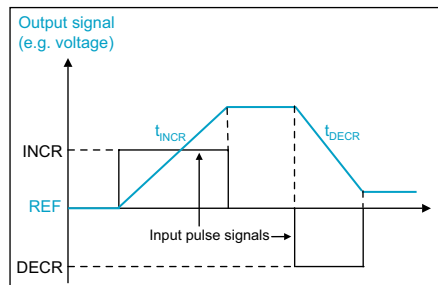

Fig. 2. Normal output characteristic.

Fig. 2 illustrates the normal output characteristic. When an increase signal is applied to the T7900, the output signal will increase until the increase signal is interrupted. The ramping of the increase is determined by the setting of t_{INCR} in such a way that lower settings will cause faster ramps.

When a decrease signal is applied to the T7900, the output signal will decrease until the decrease signal is interrupted. The ramping of the decrease is determined by the setting of t_{DECR}.

When using a PC for configuration, it is also possible to select a different type of output characteristic, a so called "rubber band" output characteristic where the output automatically goes back to the reference level when the increase or decrease signal is interrupted.

In this case, the ramping of the increase and decrease is a little different. They are both the same, determined by the setting of t_{INCR}, whe reas the ramping of going back to the reference level is now determined by the setting of t_{DECR}. This is illustrated in figure 3.
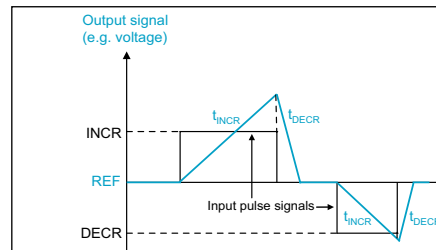

Fig. 3. "Rubber band" output characteristic.

The ramping times t_{INCR} and t_{DECR} can be set on the two dials on the front panel. The ramping times have the following ranges:

$$0.25 \text{ s} / \text{V} – 2.5 \text{ s} / \text{V}$$
$$0.25 \text{ s} / \text{mA} – 2.5 \text{ s} / \text{mA}$$
$$0.04 \text{ s} / \% – 0.4 \text{s} / \%$$

The ramping time t_{INCR} can be multiplied by 10 by setting the CONFIG dipswitch 3 to on and the ramping time t_{DECR} can be multiplied by 10 by setting the CONFIG dipswitch 4 to ON.

$$2.5 \text{ s} / \text{V} – 25 \text{ s} / \text{V}$$
$$2.5 \text{ s} / \text{mA} – 25 \text{ s} / \text{mA}$$
$$0.4 \text{ s} / \% – 4\text{s} / \%$$

The function of the CONFIG dipswitches on the front is as follows:

SW1 ON:	POWER REF
SW2 ON:	INVERT
SW3 ON:	INCR ramp*10
SW4 ON	DECR ramp*10

Dipswitch no. 1 should be OFF when T7900 is used as an electronic potentiometer, and on when T7900 is used as a power reference unit. Dipswitch no. 2 can be used for inverting the output, e. g. going from 10V to 0V rather than from 0V to 10V. Dipswitches nos. 3 and 4 are the dipswitches mentioned previously for multiplying the ramp times by 10.

The output reference level can be set or changed by adjusting the output signal to the desired level and then briefly activate the PRESET push button on the front of the unit.

PWM Output (terminals 10 and REF)

This type of signal is used as input in some speed controllers (e.g. Woodward & Caterpillar) because the signal is found less sensitive to noise rather than a voltage or current input.
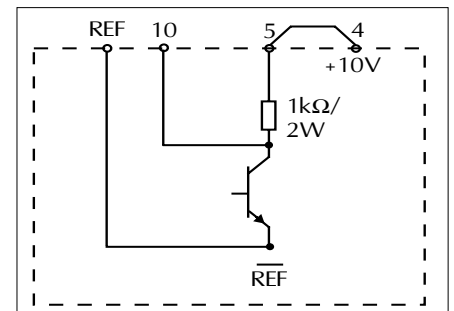

Fig. 4. T7900 PWM Output

The PWM output of T7900 is an open collector output with a 1kΩ pull up resistor as shown in figure 4. In factory default this output gives +10V when the transistor is closed and 0V (REF) when open. External voltages can be used by removing the bridge between terminals 4 and 5 and connecting and external voltage (max. 24 V DC) between terminals 5 and REF.

The frequency of the PWM siganl is 500HZ or 2,94 KHz dependending on the dip switch settings.

The range of the pulse width is 10% - 90% in default configuration. The reference point is 50%. Voltage, pulse and REF can be altered via PC configuration.
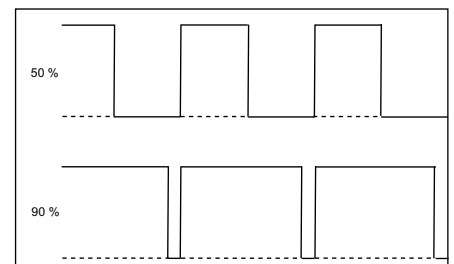

Fig. 5. Pulse width modulated signal (PWM).

Figure 5 illustrates a PWM signal of 50% and 90%. The default reference is 50%. However, this can be changed using PC configuration or by using the PRESET push button.
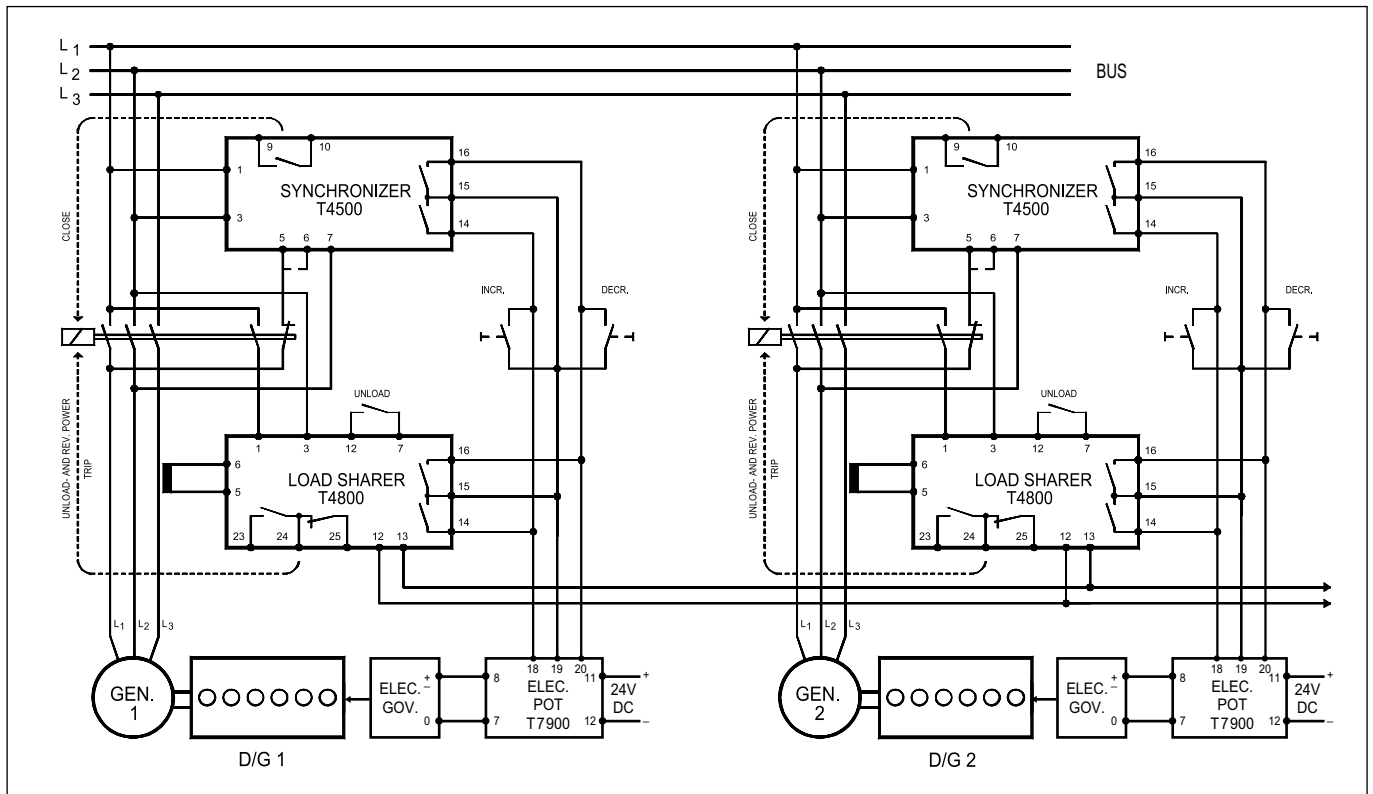
Figure 6. Application Diagram. Synchronization and load sharing with T4500, T4800 and T7900 using electronic governors.

Figure 6 shows how to synchronize and share the load using the SELCO T4500 Auto Synchronizer and the SELCO T4800 Load Sharer via the T7900.

Via the T7900 the INCR and DECR pulses will give a suitable voltage, current or PWM output signal which will control the electronic governor. Due to the wide range of setting possibilities almost any type of electronic governors can be controlled.

Power Reference Unit Function

When the CONFIG dipswitch no. 1 on the front is ON, the T7900 will act as a power reference unit for setting the capacity to be provided by engine driven generators, when the generators are operated in parallel with the grid (utility) or a shaft generator.

For such applications, the T7900 can be used with SELCO Load Sharers T4300, T4400 or T4800. The output voltage of T7900 (terminals 8 and 7) is connected to the parallel lines of the load sharers (terminals 13 and 12). The load sharer will now adjust the power of the generator according to the level of this voltage.

The output voltage can be set to different levels using three contact inputs IN1, IN2 and IN3 (terminals 15, 16 and 17) of the T7900 as described later.

The same T7900 can be connected to several load sharers where a multi engine installation is operating in parallel with a grid supply.

The voltage on the parallel lines of the T4800 Load Sharer is 0 – 1V DC, where 0V DC corresponds to no load and 1V DC corresponds to full load. Therefore, when the T7900 is used as a power reference unit with T4800 Load Sharers, the output range 0 – 1V DC should be selected on the dipswitches on the rear panel of the T7900:

SW1: OFF
SW2: ON
SW3: OFF
SW4: ON

The voltage on the parallel lines of the T4300 and T4400 Load Sharers is 0 – 3V DC. Therefore, when the T7900 is used as a power reference unit with these load sharers, the output range 0 – 3V DC should be selected on the dipswitches:

SW1: OFF
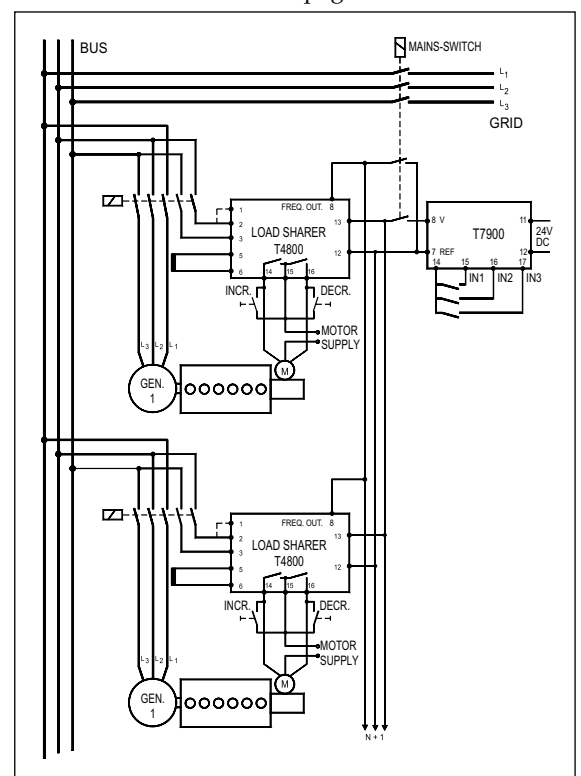SW2: ON
SW3: ON
SW4: OFF

Please see next page.

Fig. 6. Application Diagram. T7900 used as a power reference unit with T4800.

Specifications

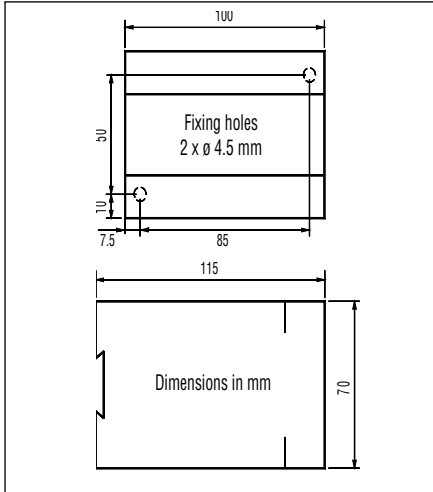## T7900 Electronic Potentiometer

Figure 8. Dimensions.

The three contact inputs IN1, IN2 and IN3 of the T7900 will by default set the following levels of the output voltage when the contacts are closed (connected to REF):

IN1: 10% of full level
IN2: 20% of full level
IN3: 40% of full level

This gives the following output possibilities:

IN3	IN2	IN1	Voltage
OFF	OFF	OFF	0%
OFF	OFF	ON	10%
OFF	ON	OFF	20%
OFF	ON	ON	30%
ON	OFF	OFF	40%
ON	OFF	ON	50%
ON	ON	OFF	60%
ON	ON	ON	70%

When using PC based configuration, the output levels corresponding to the three contact inputs IN1, IN2 and IN3 can be changed to any percentage between 0 and 100%. Please note that the level can never exceed 100%.

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Supply:	8 – 36V DC / AC		
Consumption:	Max. 120mA at 24V DC		
Output ranges:	-10V – +10V (or any part of this, e.g. 0V – +1V)		
	0 – 20mA (or any part this, e.g. 4mA – 20mA)		
	0% – 100% PWM 500Hz (or any part of this e.g. 10% - 90%)		
	0% – 100% PWM 2.94MHz(or any part of this e.g. 10% - 90%)		
PWM output signal:	Frequency: 500Hz of 2,94KHz. Level: 0 – 10V. Default reference: 50%		
Increase / decrease ramp times:	0.25 s / V – 2.5 s / V	or	2.5 s / V – 25 s / V
	0.25 s / mA – 2.5 s / mA	or	2.5 s / mA – 25 s / A
	0.04 s / % – 0.4s / %	or	0.4 s / % – 4s / %
Resolution:	12 bits or 15 bits		
Serial link:	RJ11-modular		
RS 232 parameters:	9600 bits per second		
	No parity		
	8 data bits		
	1 stop bit		
Operating temperature:	-20°C to +70°C		
EMC:	EN50263		
Burn-in:	50 hours before final test		
Enclosure material:	Polycarbonate. Flame retardant		
Weight:	0.3kg for T7900-00, 0.5kg for other types		
Dimensions:	70 x 100 x 115mm (H x W x D)		
Installation:	35mm DIN rail or 4mm (3/16") screws		

The specifications are subject to change without notice.

Type Selection Table

Type	Terminals 11-12	Terminals 1-3	Terminals 2-3
T7900.0010	24V DC / AC		
T7900.0030		250V AC	

Other supply voltages are available on request.

Accessories

G0100.0010	Optional Programming Kit for PC configuration