

3ST

Three point speed relay



- **Three speed relays in one compact unit**
- **Operates with magnetic pickups and tachometers**
- **Engine RPM meter output**

Description

The 3ST provides three independent speed relays in one compact unit. It is designed to work with an engine mounted speed transducer, typically a magnetic pickup or tacho generator (not supplied). The 3ST measures the transducer signal frequency (which is proportional to engine speed) and compares this with three user-set trip levels. The three non-latching relays then activate or deactivate as appropriate.

Each relay circuit has a front facia LED that lights when the relay is energised. On standard units, the relay functions are designated S1 (crank), S2 (underspeed) and S3 (overspeed): all three relays are energised, and all LEDs lit, when the engine is running at normal speed - see diagram overleaf for relay/LED operation.

Nominal speed calibration and relay trip levels are set via four multi-turn potentiometers - see 'calibration' overleaf. The 3ST also features a 'meter' output, which may be used for calibration and engine speed indication.

The 3ST has a robust, polycarbonate case, designed for DIN rail or surface mounting. Electrical connection is by 12 screw terminals, suitable for stripped panel wires or narrow blade crimps.

Application

The unit is designed for use in the control and protection of engines, generators, pumps or any moving machinery where the monitoring of engine speed and controlled tripping is required.

Warranty

A two year limited warranty on materials and workmanship is given with this Murphy product. Details are available on request and are packed with each unit.

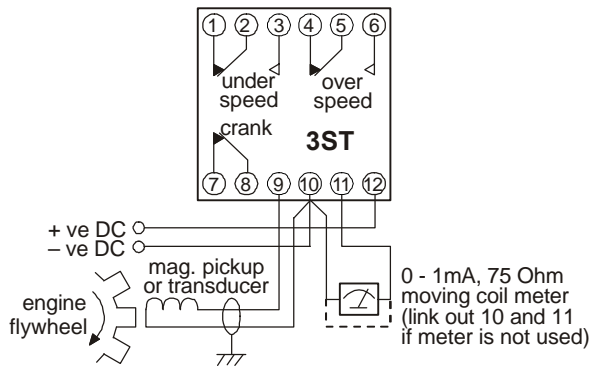
Specification

| | |
|-----------------------------|--|
| Power supply: | |
| Voltage range, 12 V units | 8 – 16 V DC |
| 24 V units | 16 – 32 V DC |
| Power consumption | 4 W typ. |
| Input: | |
| Voltage range | 0.5 – 80 V AC rms |
| Frequency range (f_0):- | |
| Standard version | 1 – 8 kHz. |
| 'M' version | 200 – 1500 Hz. |
| 'L' version | 10 – 200 Hz. |
| Trip settings: | |
| S1 (crank) range | 10 – 45 % of f_0 |
| S2 (underspeed) range | 50 – 95 % of f_0 |
| S3 (overspeed) range | 100 – 130% of f_0 |
| Trip point hysteresis | 2.5% of setting (typ.) |
| Outputs: | |
| Relays | SPNC (S1) and SPDT (S2 & S3) volt free contacts, 5A max. @ 24V DC (resistive load), 2×10^5 operations |
| Tacho/calibration | 0 – 1 mA into a 75 Ohm moving coil meter. Output at normal engine speed = 0.75 mA |
| General: | |
| Operating temperature | -10 to +55 °C |
| Dimensions (W x H x D) | 50 x 75 x 110 mm |
| Weight | approx. 190 g |

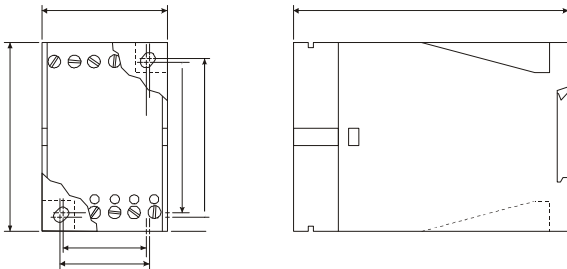
Relay Operation/LED indication

| | | | | | | |
|----|-----------|---|--------------------------------------|---------------------|-------------------------------------|---------------------------------|
| S1 | ○ | ○ | ☀ | ☀ | ☀ | CRANK |
| S2 | ○ | ○ | ○ | ☀ | ☀ | UNDERSPEED |
| S3 | ○ | ☀ | ☀ | ☀ | ○ | OVERSPEED |
| | power off | | power on, engine stationary/cranking | underspeed settings | engine running below normal running | overspeed or open circuit input |

Electrical Connection



Dimensions



How to Order

Stock Units

These are supplied with blank calibration labels and set to a nominal frequency (f_0) of 3000Hz (equivalent to 120 flywheel teeth at 1500 RPM). These units will usually therefore require customer calibration:-

Stock code Model / description

76.70.0039 3ST/1SET4 speed trip, 24V, std. settings
76.70.0068 3ST/2SET4 speed trip, 12V, std. settings

Special Calibration

We can also supply the 3ST calibrated to your requirements. Please specify:-

- Model type, e.g. 3ST/1 (24V) or 3ST/2 (12V)
- Nominal transducer frequency (f_0)
- Trip levels for S1, S2 and S3, expressed as either:
 - an absolute (transducer) trip frequency (in Hz), or
 - a percentage of f_0

Calibration

For the 3ST to correctly measure engine speed, it must be calibrated for each particular engine and transducer type.

Calibration may be carried out during engine commissioning, or 'on the bench' using a signal generator to simulate the engine speed transducer. This is a two stage process:-

a) Nominal calibration

Use the **METER ADJUST** potentiometer to calibrate the 3ST to the 'nominal' transducer frequency (or f_0 , the transducer output frequency when the engine is running at normal speed). Standard units allow adjustment of f_0 between 1 and 8 kHz. 'L' and 'M' variants allow adjustment for lower nominal frequencies (see 'specification' for details).

When calibrating with a signal generator, f_0 must be known, either a) by prior measurement of the pickup when the engine is running, or b) by calculation - e.g. for a pickup and flywheel:-

$$f_0 \text{ (Hz)} = \frac{\text{normal engine speed} \times \text{number of flywheel teeth}}{60}$$

To set the nominal calibration:-

- Connect the pickup, transducer or signal generator input: signal positive to pin 9, signal negative to pin 10
- Connect a 0 - 1mA meter (ideally with a 75 ohm moving coil action): meter positive to pin 11, meter negative to pin 10.
- Connect the DC power supply: positive DC to pin 12, negative DC to pin 10. Switch on the supply.
- Start the engine manually (not under the control of the 3ST relays) and run to normal speed, or adjust the signal generator to simulate the transducer signal.
- Turn the METER ADJUST potentiometer until the meter reads 0.75mA. Turn the pot. clockwise to increase the meter reading (i.e. to lower the nominal calibration frequency). All LEDs should now be lit.

The nominal calibration is now complete. The meter may be left connected to the 3ST or replaced with a wire link.

b) S1, S2 and S3 relay settings

Once the nominal calibration (f_0) has been set, use potentiometers S1, S2 and S3 to set the trip frequency of each relay. The adjustment range of each pot. is fixed in percentage terms to f_0 (see specification for ranges); the absolute frequency range and setting of each relay will therefore change if f_0 is changed.

For each of the 3 relay settings:-

- Adjust the engine speed to the required trip level, or adjust the signal generator to simulate the transducer frequency at the required engine speed.
- Adjust the potentiometer (S1, S2 or S3) until the relay just changes over (the LED will light then extinguish). Turn each pot clockwise to increase the trip frequency.

The 3ST is now calibrated. For full details of 3ST calibration, please see our separate installation instructions



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