

## Guidelines for installation of shaft encoders

### Introduction

This paper gives some advice on good installation practice. Should you have further questions, please contact Eltomatic and we will be happy to assist you.

### Important

Before commencing installation of an “Ex” shaft encoder, it is necessary to read and understand the installation instructions applicable for the specific type-approval of the product.

### Liquids

Even though the shaft encoder can withstand short-time exposure to liquids, we recommend some precautions to protect the shaft encoder from dripping or splashing liquids that can cause the following problems:

- Some liquids can wash out the bearing lubricants
- Some parts can rust
- Through time, a liquid can soak into the shaft encoder and cause an electronic malfunction

If there is any risk of splashing or dripping liquids, we recommend that you mount a shield or cover around the shaft encoder. Even though there is no apparent risk of liquids, there may be from time to time, condensation present. Another pitfall is a liquid being lead to the shaft encoder via the electric cable. This can be avoided by providing the cable with a loop at a lower level than the shaft encoder.

The shaft encoder bearings are pre-lubricated and do not need extra lubrication if the shaft encoder is handled correctly. If you decide, however, to oil the bearings, only a small drop must be applied or there will be a risk of oil being lead into the encoder via the bearings resulting in possible electronic malfunction.

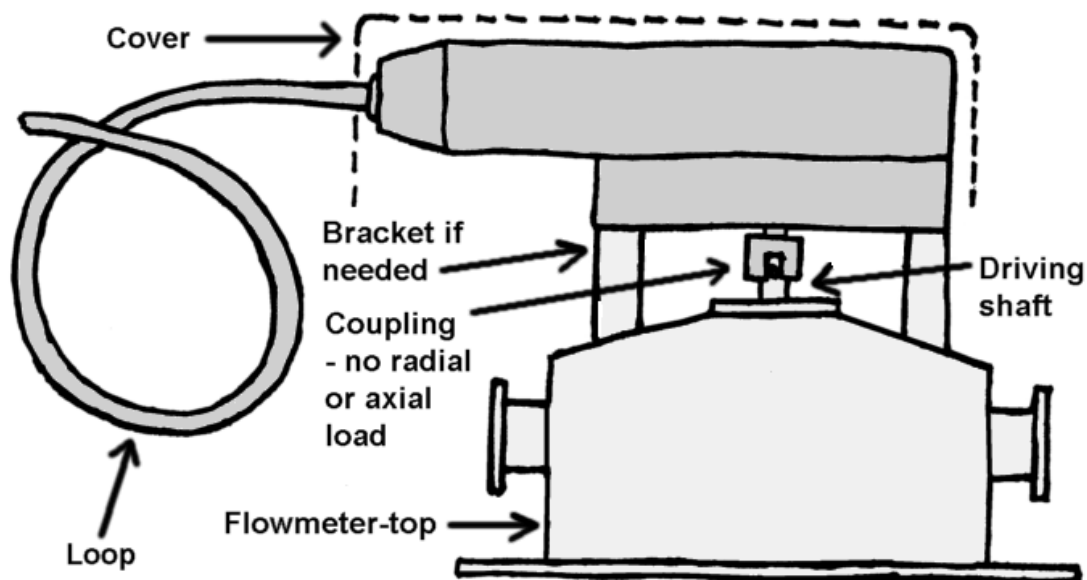


Figure 1

### Coupling and mounting

The shaft encoder shaft must not be submitted to axial or radial load. This can be achieved by choosing the correct coupling. Some examples are shown.

For other problems that can occur between a flow meter and a shaft encoder, such as 'jitter' and unwanted backwards turning, we can recommend various solutions:

- The shaft encoder coupling can have some degree of angle of backlash to its counterpart (e.g. 2b, 2c and 2d)
- The shaft encoder coupling can be supplied with a 15° To 30° backlash coupling (e.g. 2a)
- The shaft encoder can be supplied with a free wheel clutch, which will allow the shaft encoder to be turned in one direction only
- The shaft encoder can be fitted with a microprocessor-controller, which can electronically simulate a mechanical backlash coupling

The coupling on the left (2a) has a backlash built into the coupling. The next three (2b, 2c and 2d) couplings have a backlash function contained in the mechanical interface with their counterparts. The coupling to the right (2e) has no backlash but is supplied with a worm gear wheel to drive a gearbox or an integrated mechanical totalizer. The coupling "2e" is connected to a driving shaft and fixed with two screws - great care must be taken during installation to avoid axial and radial load being applied to the shaft encoder coupling/shaft.

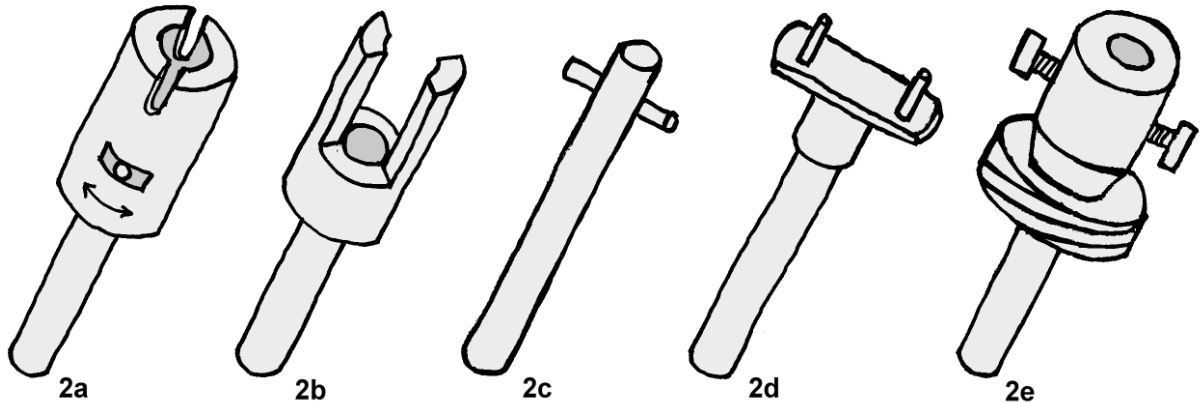


Figure 2

#### Power supply

The power supply must be a stable voltage without transient spikes. Do not use the same power supply or supply lines (Both supply "+" and "0") for the shaft encoder that you use for neon tubes, solenoids or motors. We recommend the power supply to be fused with maximum 100 mA.

#### EMC (Electro Magnetic Compatibility)

Standard shaft encoders have very minimal emission so EMC focus can normally be limited to immunity issues. However, shaft encoders with built-in microprocessors can emit noise generated by the clock oscillator and EMC emission might need to be addressed.

The cable shield should normally be connected in both ends to achieve optimal immunity and emission characteristics. If the shield is connected in one end only, then the immunity against RF fields and magnetic near fields is poor.

The shaft encoder must not be exposed to unwanted DC or low frequency signals (often caused by leakage current). It is important that all metal parts in your installation are potentially balanced.

#### Cabling

To avoid common mode noise in the shaft encoder installation, the shaft encoder cable should not be placed alongside other cables carrying heavy current.

#### Cable shield

The cable shield is normally connected internally to the encoder housing and, when installing the shaft encoder in a dispenser, it is important that the cable shield is connected to the calculator shield reference in order to achieve full EMC immunity against any ambient electromagnetic influence. There are three connecting possibilities:

A) Cable shield connected directly to the calculator shield reference.

There must not be any illegal current present in the cable shield (no potential voltage differences in the petrol pump installation). Where the cable end is separated into different

wires, the shield (pigtail) must be kept as short as possible. If this method of installation is employed, there will most likely be no EMC problems with the shaft encoder.

B) Cable shield connected to the calculator shield reference via a capacitor.

It is an EMC requirement that no low frequency current is present in the cable shield due to potential differences. However, if there are potential differences in the petrol pump installation, an EMC acceptable solution could be a 10 - 50 nF/500 V Y capacitor coupled in series with the cable shield and the calculator ground reference.

C) Cable shield not connected to the calculator shield reference.

Because of possible potential differences (low frequency signals e.g. 50 Hz) in the installation, it may be decided not to connect the cable shield to the calculator shield reference. In this situation, the shield offers the shaft encoder no protection against RF interference, e.g. 'Burst' impulses from switches.

### Shaft encoder signal coupled to the calculator

To achieve good noise immunity, the calculator-input circuit must have a hysteresis. For the shaft encoder output transistor, the maximum current is 30 mA and maximum supply voltage is 24 V. An output current between 5 and 10 mA can be recommended when the cable between the shaft encoder and the calculator is in the range of 1 to 10 meters. The input circuit can be designed in many ways - some examples are given.

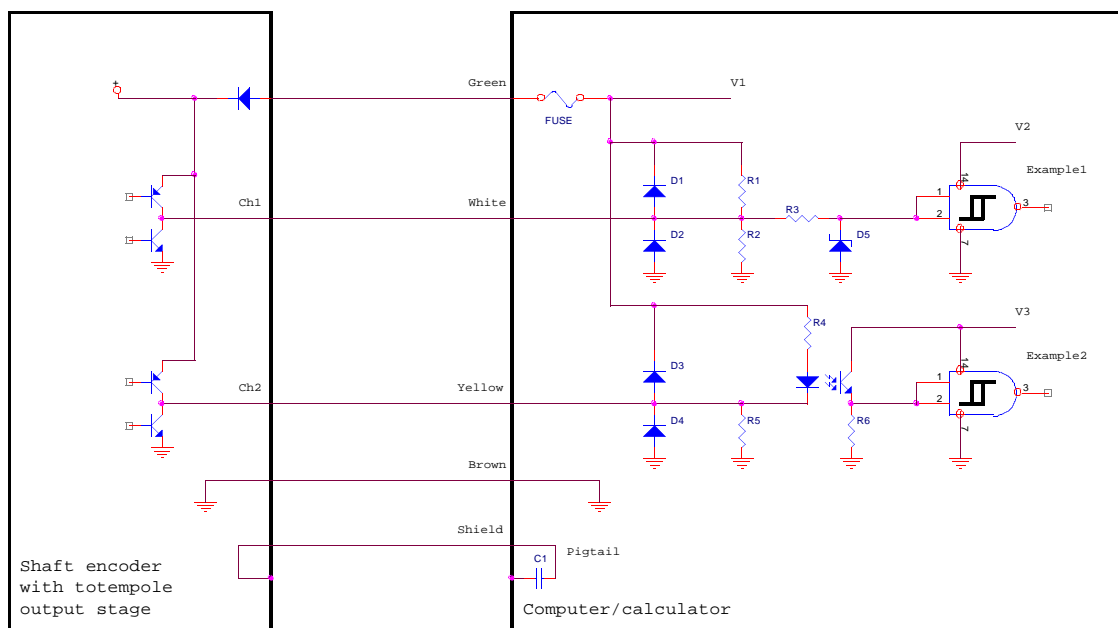


Figure 3

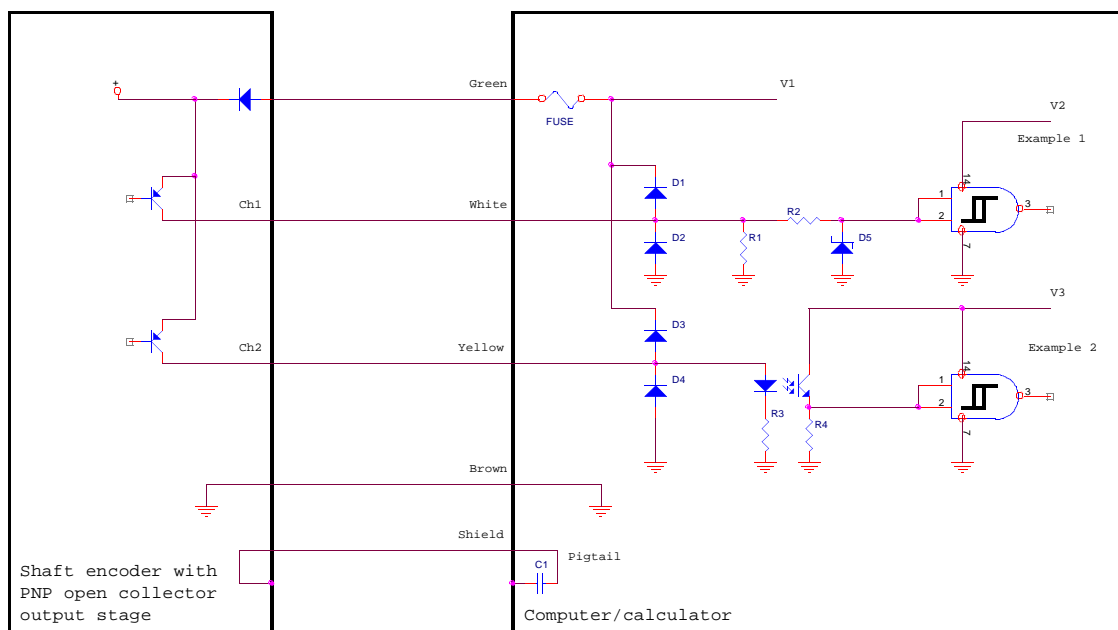


Figure 4

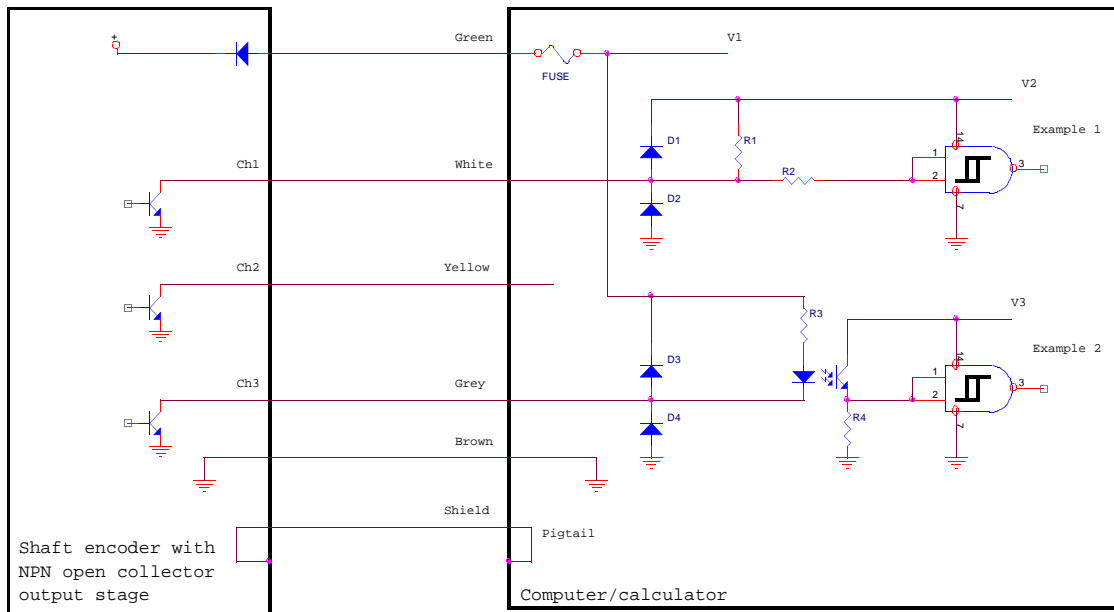


Figure 5

### Interfacing to electronic counter

During “power on” initialisation of the electronic counter, care must be taken, that the shaft encoders are not short circuited or are driven outside of specification.

SW for monitoring of the shaft encoder signals must be robust to avoid timing tolerance problems and must be able to suppress jitter.

### Caution: Do Not

- Apply higher or lower voltage supply than specified
- Use a power supply or supply lines which are shared with “noisy” equipment
- Place the shaft encoder cable alongside cables carrying heavy current
- Apply higher load to the output than specified
- Disconnect or connect any wires with power present
- Short circuit the output signal or short the outputs together
- Cut the cable - because of the potting, the cable cannot be replaced
- Apply axial or radial load to the coupling
- Attempt to change the coupling
- Lubricate the shaft (if necessary, only a small drop of oil must be applied)
- Expose the shaft encoder to liquids
- Expose the shaft encoder to leakage current

**If you make one fault, and you don't admit it to yourself, then you have made two faults!**