



PLC/Plant Connection To Rotech Motion sensors and Encoders

Direct to A – PLC

An alternative to connecting a Rotech motion sensor/encoder to a speed relay or similar monitoring relay is to connect it directly to a PLC.

A small monitoring program can then be written into the PLC which carries out the function of the speed relay.

Motion sensors/encoders with the DC type electrical output can normally be connected direct to a PLC 12/24VDC digital input card.

Motion sensors/encoders with the AC type W electrical output can normally be connected direct to a PLC 110V AC digital input card.

Care must be taken to ensure that the rate of the input pulses can be accepted by the PLC.

PLC's scan their inputs several times a second, on large PLC's the scan time can be quite slow.

If the rate / speed at which the input pulses are arriving from the motion sensor is high, a slow scanning PLC might miss some of them. The solution in this situation is to use a motion sensor with only a small number of pulses per rev (PPR), i.e. 4 PPR, 2 PPR or 1 PPR.

An alternative solution is on the PLC to use a high speed counter card, but these are usually expensive.

Connection of Rotech Motion Sensors to a PLC Input

In order to connect the sensor to the PLC input it is important to ensure the frequency of the signal being received by the PLC is within the scan time of the PLC input.

To check this the following information is required:

- 1) Belt Speed/Linear travel to metres per second
- 2) Know diameter of wheel, roller, drum etc to which Rotech Motion Sensor/Encoder is fitted.
- 3) Pulses per revolution (PPR) of Rotech Motion Sensor/Encoder fitted to item in 2 above.

To calculate the Rotech output signal frequency the following formula can be used-

All units used should be in millimetres & seconds:

Belt speed divided by wheel, roller, drum, circumference = revolutions per second (RPS)

Then RPS multiplied by PPR = frequency in Hertz (pulses per second)

Working example:

Belt speed = 4 metres per second or 4000mm per second

Wheel diameter = 200mm

Circumference is diameter multiplied by Pi: $200 \times 3.142 = 628.4\text{mm}$

(sometimes written pi) Is a mathematical constant whose value is the ratio of any circles circumference to its diameter. It is approximately equal to 3.142.

Rotech encoder fitted to wheel has a PPR = 4

By substitution using the above:

$4000 \text{ divided by } 628.4 = 6.36 \text{ multiplied by } 4 = 25.4 \text{ Hz or } 1 \text{ pulse every } 0.04 \text{ seconds (40 milli seconds)}$

Allowing for a complete signal pulse being received by the PLC the pulse interval scan would be 80ms

PLC Program

The easiest option for writing the program to monitor the Rotech motion sensor/encoder is to set up an internal timer in the PLC with its time set to 110% of the time interval between the incoming pulses.

For example, at normal running speed if the incoming pulses are being received at approximately a rate of 1 per second, then the timer is set to 1.1 seconds.

The incoming pulses being received at approximately 1 per second constantly reset the timer, never allowing it to reach its set time of 1.1 seconds.

If a problem occurs and the drive slows down the incoming pulses arrive more slowly, when the time between incoming pulses exceeds 1.1 seconds the internal timer will time out and operate an internal relay which signals an alarm. (PLC programmers only: - to operate correctly a strobe pulse needs to be generated from the rising or falling edges of the motion sensor input pulse).

Variable Speed Drives

For accurate monitoring of variable speed drives the recommended solution is to obtain an analogue signal (0 to 10VDC, 4 – 20mA, or similar) from the variable speed controller and input this into an analogue input on the PLC.

Within the PLC a sub-routine can be written so that the analogue input changes the time set in the timer.

Rotech systems can supply frequency to analogue converter modules as required.



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CONVERSION FROM METRES PER SECOND TO RPM

In order to calculate the RPM the following information is required:

1. Belt speed linear travel in Metres Per Second
2. Known diameter of Drum, wheel etc to which ROTECH motion sensor/Encoder is fitted.
3. Circumference of Drum, Wheel etc

The formula required is:

**Belt Speed divided by Drum, Wheel, circumference = RPS (Revolutions per Second)
x 60 = RPM (in millimetres)**

Working Example:

Belt Speed = 8 metres per second (8000 mm per second)

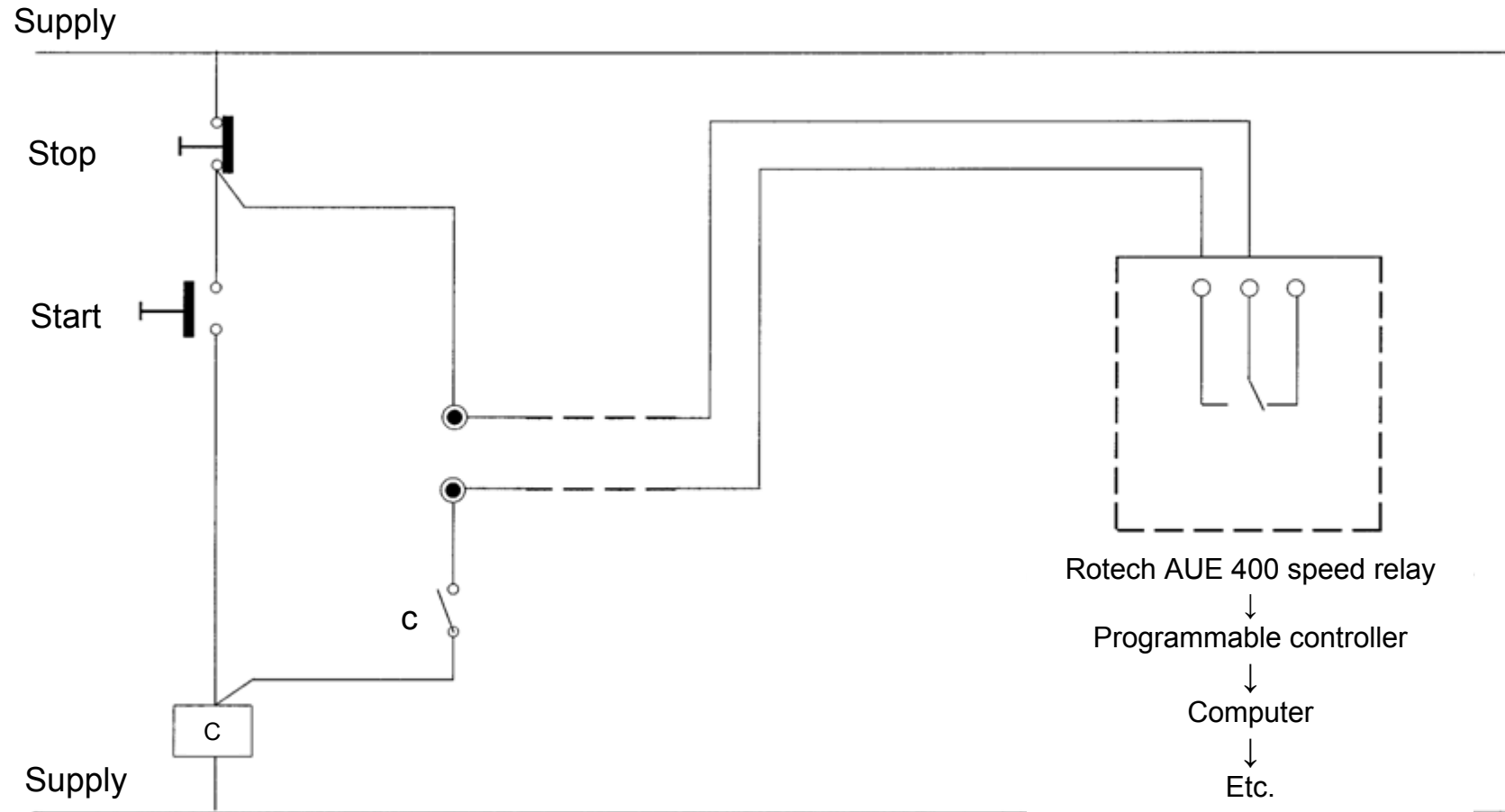
Drum, Roller, Wheel diameter = 200mm

Therefore it's circumference is $200 \times 3.142 (\pi) = 628\text{mm}$

Using the formula above & substitution:-

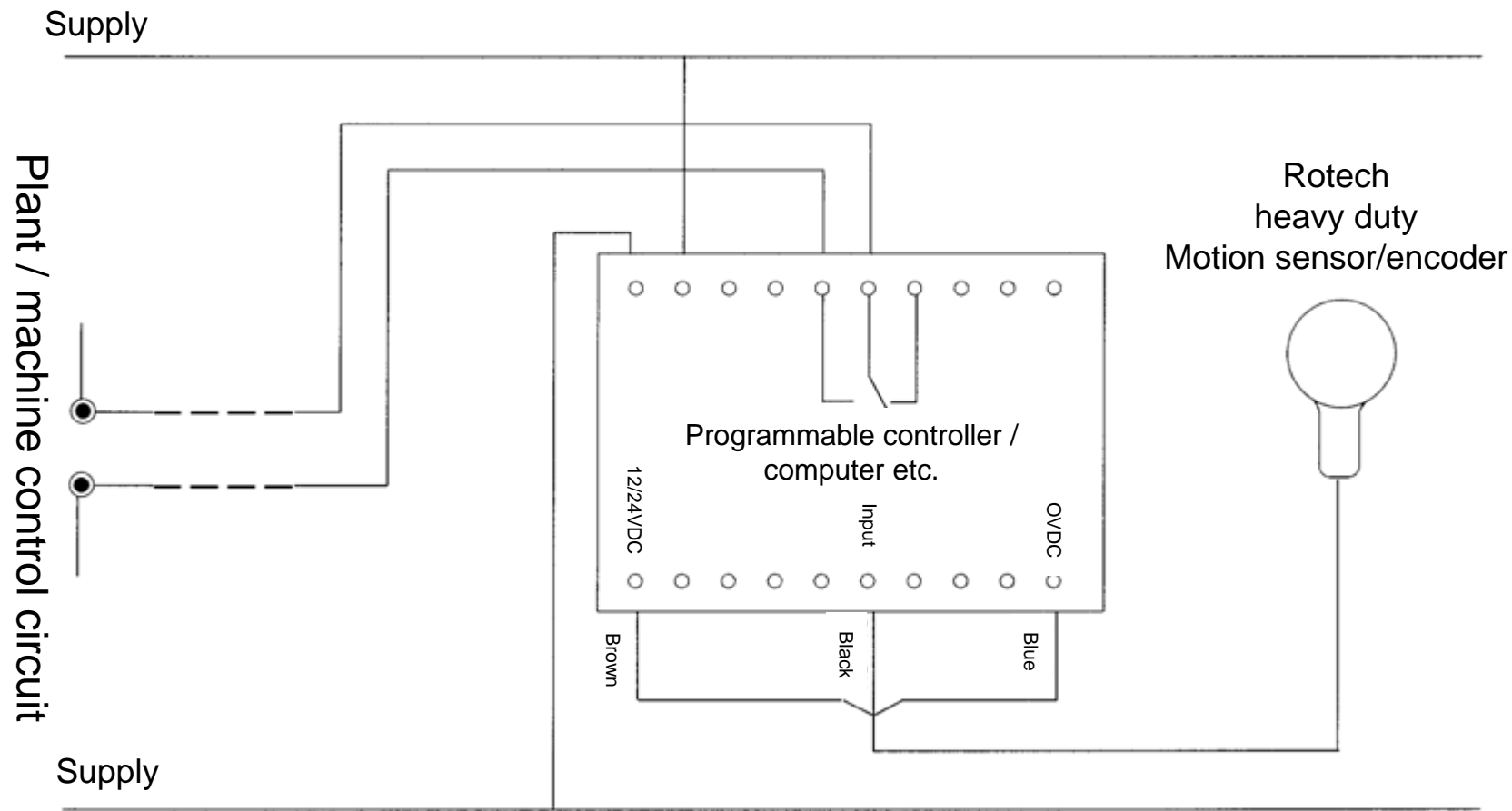
$8000\text{mm divided by } 628 = 12.73 (\text{RPS}) \times 60 = 763 \text{ RPM}$

Connection to plant, electrical control system



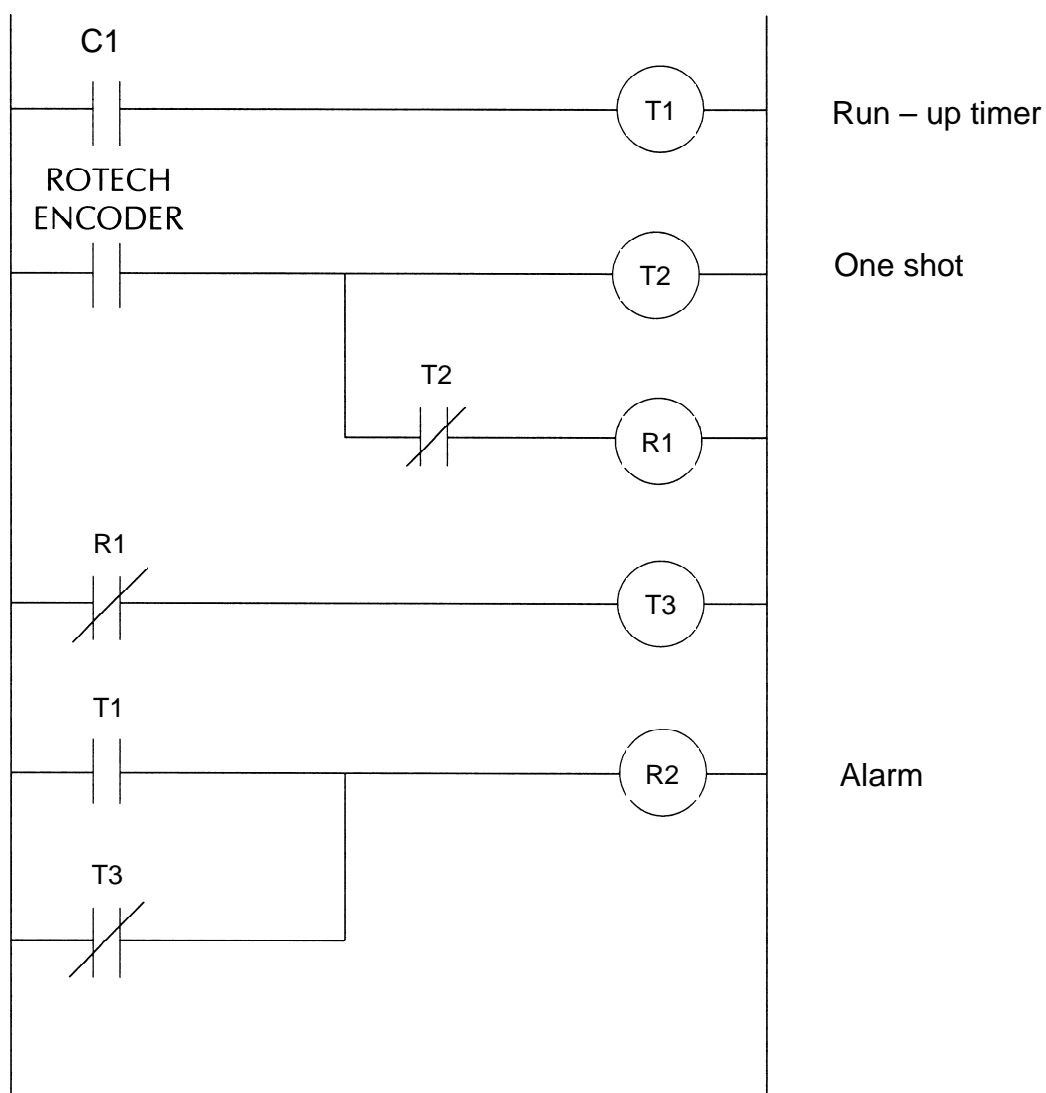
Typical motor
Control circuit

Connection to programmable controller / computer etc.



Typical program

Programmable controller / computer



Notes

1 T1 typical - 10 seconds

2 T2 typical - 5 milliseconds

3 T3 typical - 2 x encoder pulse interval