1.1 General arrangement

Thank you for purchasing a Dualpulse Flowmeter. It is important that you read this manual to gain a full understanding of the capability and operational aspects of the equipment you are about to install.

This information is provided only to assist in the installation of the product and does not diminish your obligation to read the manual.

1. Select a location that meets the requirements as illustrated on the guideline sheet (yellow pages located in the center of this manual). An ideal installation would provide for 25 diameters of straight pipe upstream from the meter and 10 diameters downstream.

You will also need to know the pipe internal diameter (NB) and pipe wall thickness for calculation of the insertion depth. (refer page 5.) Non ideal installations may require in-situ calibration (refer to the factory for details).

2. After screwing the Dualpulse in place ensure the flow alignment mark located on the top positioning collar of the meter aligns with the flow in the pipe (refer page 5). This ensures the paddle is correctly aligned to the flow. Note, the meter is bi-directional so a flow direction arrow is not provided.

3. Calculate and adjust the height of the Dualpulse (refer page 5).

4. Electrical Installation depends on the model you have purchased. If the dualpulse is fitted or supplied with a receiving instrument such as a totaliser or rate totaliser please refer to the appropriate manual and Page 10 of this manual. For pulse output meters, select the appropriate output and wire to your receiving device. (refer pages 7 to 9).

5. Calculate the Dualpulse K (scale) factor to suit the installation. For ideal installations refer to page 11 or 12 or 13 of the Dualpulse Manual. For non ideal installations the K-factor may be calculated by performing an in-situ calibration. Enter the appropriate K-factor into your receiving instrument.
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1.2 Overview

Dualpulse insertion flow transducers provide a cost effective and simple means of measuring the flow of a wide range of low viscosity liquids. Installation is quick and inexpensive for pipe diameters ranging from 40mm to 900mm (1.5-36") and up to 2500mm (100") nominal bore for the Hot tap capable model DP525.

Dualpulse has a linear measuring range of 0.3~10.0 metres/sec. (1~33 ft/sec.). Minimum detectable flow velocity is 0.15 m/sec. (0.5 ft/sec.). When used in conjunction with the RT12 flow rate totaliser NLC feature the linear flow range is extended down to 0.15 m/sec. (0.5 ft/sec.) with an improved linearity.

The Dualpulse is constructed from 316 L (1.4404) stainless steel enabling use in many applications for metering water and low viscosity chemicals.

Two independent pulse outputs are standard & can directly input to a wide range of ancillary instruments, PLC's and computers. Both pulse outputs have a high level of immunity to electrical interference. Options include a reed switch.

1.3 Operating principle

Flow passes through a pipe causing the rotor to spin. Magnets installed in the rotor pass by pulse sensors within the transducer body & inturn this produces frequency outputs proportional to flow rate.

1.4 Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>490</th>
<th>525</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suits pipe sizes</td>
<td>40mm - 900mm</td>
<td>50mm - 2500mm</td>
</tr>
<tr>
<td>Flow range</td>
<td>0.25 - 6300 litres/sec.</td>
<td>0.4 - 49000 litres/sec.</td>
</tr>
<tr>
<td>Process connections</td>
<td>1.5&quot; or 2&quot; NPT or BSPT</td>
<td>2&quot; NPT or BSPT</td>
</tr>
<tr>
<td>Velocity range</td>
<td>0.3 - 10 metres/sec.</td>
<td>(1 - 3 feet/sec.)</td>
</tr>
<tr>
<td>Linearity</td>
<td>typically ± 1.5%</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>typically ± 0.5%</td>
<td></td>
</tr>
<tr>
<td>Pressure (max)</td>
<td>80 Bar (1200PSI)</td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40°C to 100°C (-40°F to 212°F) – refer options</td>
<td></td>
</tr>
<tr>
<td>Body material</td>
<td>316L stainless steel (1.4404)</td>
<td></td>
</tr>
<tr>
<td>Rotor materials</td>
<td>PEEK rotor w ith graphite-PTFE impregnated PEEK bearing</td>
<td></td>
</tr>
<tr>
<td>O-Ring material</td>
<td>VITON- options available</td>
<td></td>
</tr>
<tr>
<td>(a) Voltage output (to 125°C)</td>
<td>1.5volt x 100v/sec pulsewidth, self-generated (2wire)</td>
<td></td>
</tr>
<tr>
<td>(b) Square wave (Hall Effect)</td>
<td>5-24vdc, 3wire NPC open collector (20mA max. current sink)</td>
<td></td>
</tr>
<tr>
<td>(c) Reed Switch (to 100°C)</td>
<td>30vdc max. x 20mA max. (output freq. is 1/3 std. K-factor)</td>
<td></td>
</tr>
<tr>
<td>Output freq. @ max. velocity</td>
<td>(a &amp; b) outputs 220-240 Hz</td>
<td>(c) output 73-80 Hz</td>
</tr>
<tr>
<td>Output options</td>
<td>Ultra high temp. coil 204°C (400°F) or non magnetic</td>
<td></td>
</tr>
<tr>
<td>Transmission distance</td>
<td>1000 metres (3300 feet) max</td>
<td></td>
</tr>
<tr>
<td>Wiring (standard)</td>
<td>5 core, screened cable, length 3 metres (10feet)</td>
<td></td>
</tr>
<tr>
<td>Protection class</td>
<td>IP65 submersible (Nema 6X)</td>
<td></td>
</tr>
<tr>
<td>Conduit entry (terminal box)</td>
<td>3/8&quot; NPT or PG9</td>
<td></td>
</tr>
<tr>
<td>Shipping Weight</td>
<td>1.2 kg (2.7 lbs)</td>
<td>1.5 kg (3.3 lbs)</td>
</tr>
</tbody>
</table>
2.1 Meter location
Choose an appropriate section of horizontal or vertical pipe as per the guidelines below. With vertical pipe installations the media should be pumped up through the pipe past the flow sensor so that any entrained air will pass freely.

The DP flow sensor requires a fully developed turbulent flow profile to ensure maximum measurement accuracy and repeatability. This can be achieved by installing the DP in a straight run of pipe. We recommend at least 10 but ideally 25 straight pipe diameters upstream & at least 5 but ideally 10 pipe diameters downstream of the Dualpulse. Major obstructions such as pumps, valves or strainers will require longer straight runs before and after the Dualpulse.

2.2 Meter installation & orientation
Cut a 40mm diameter hole (1.6") on either the 2, 10 or 12 o’clock positions of the pipe. If there is any likelihood of air entrainment in a horizontal pipe do not locate the flow transducer in the 12 o’clock position.

Install a female threaded weld on fitting (threadolet) or service saddle. Wrap the threads of the Dualpulse with Teflon tape or sealing compound & screw the unit into the installed fitting.

2.3 Height adjustment calculation
Calculate the adjustment height A for DP490 (or AA for the DP525) as follows:

\[
A \quad (\text{for DP490}) \quad = 175\text{mm (6.9") - (B + C + D)} \\
AA \quad (\text{for DP525}) \quad = 420\text{mm (16.5") - (B + C + D)}
\]

Where:
B = Distance between the top of the pipe & the top of the hex adaptor.
C = Pipe wall thickness
D = Insertion depth (pipe ID ÷ 8)

Examples of insertion depth D:
For 40mm pipe ID (D= 5.0 mm)
For 50mm pipe ID (D= 6.25 mm)
For 100mm pipe ID (D= 12.5 mm)
For 400mm pipe ID (D= 50.0 mm)

Turn the height adjustment nuts (1) as required so that the distance between the top of the hex adaptor (2) and the top of the positioning collar (3) equals your calculated distance A (for DP490) or AA for model DPS25. Retighten the height adjustment nuts (1).

2.4 Flow direction orientation
The unit is bi-directional however the paddle must be aligned with the direction of flow.

Using a 2mm hex key (Allen key), unlock the locking screw located on the positioning collar (3) then insert the hex key (as a lever) in the body rotating hole located above the collar, turn the body until the alignment slot is parallel with the direction of pipe. Retighten the locking screw.


2.5 Hot tap installation

Clean & lubricate screw threads before withdrawing the transducer body in order to avoid nut seizure.

CAUTION: Hot tap installation should only be performed by qualified personnel. Installation procedures should be in accordance with the safety rules, regulations and requirements applying to the territory in which the flow transducer is being installed.

IMPORTANT

Before removing the DP525 from the installation first withdraw the transducer body to the maximum distance allowed by the three height adjusting threaded rods. This will enable the isolating valve to be fully closed without damaging the paddle.

If necessary extend valve port using a 2” nipple & socket combination to ensure the paddle is clear of the ball valve.

2” Weld-O-let (threadolet)

2” Nipple

2” ball or gate isolation valve. (Allow min. 40mm I.D. to clear metering head)

2.5 Hot tap installation

(model DP525)

Hot tap clearance hole in pipe wall to be a minimum of 40mm diameter (1.6”).

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(model DP525)

Hot tap clearance hole in pipe wall to be a minimum of 40mm diameter (1.6”).

3.0 ELECTRICAL CONNECTIONS

(see page 9 for QP outputs)

3.1 Standard outputs

Conductor color coding also applies to the non-magnetic sensor and high temperature output options.

Pull up resistor required, they are generally incorporated in most receiving instruments.

SQUARE WAVE PULSE OUTPUT

Red (VDC supply)

White (+ Sig. output)

Black (-0v ground)

VOLTAGE PULSE OUTPUT

Yellow (+)

Green (-)

Yellow (+)

Green (-)

3.2 Optional Reed switch output

HAZARDOUS AREAS

The REED SWITCH output is classed as a “simple apparatus” as defined in the CENELEC standard EN50020 & recognized IEC & ATEX directive. It can be connected to an approved I.S. secondary instrument with both being located in the hazardous area. The Reed Switch may also be connected through an approved I.S. barrier.

Note: The Reed switch produces 1/3rd the normal pulse output value (eg. 1/3 the standard K-factor).

Conductor color coding also applies to the non-magnetic sensor and high temperature output options.
3.3 Instrument cable installation requirements
Use twisted multi-core low capacitance shielded instrument cable (22 AWG ~ 7x 0.3 stranded) for electrical connection between the flow meter and the remote instrumentation. The screen should be earthed at the readout instrument end only to protect the transmitted signal from mutual inductive interference.

The cable should **not** be run in a common conduit or parallel with power and high inductive load carrying cables as power surges may induce erroneous noise transients onto the transmitted pulse signal. Run the cable in separate conduit or with other low energy instrument cables.

3.4 Pulse output selection (standard outputs)
The standard flowmeter has two independent pulse output signals that are linearly proportional to volumetric flow rate. Pulse transmission can be up to 1000 metres (3300 ft). An optional I.S. Reed Switch output is available (see page 7).

Voltage pulse (pulse wire) output & Optional Reed Switch
A self generating pulse output which produces a strong 1.5 volt voltage spike of approximately 10 microsecond duration with no dependence on rotor speed.

Square Wave Pulse (Hall sensor) (also applies to non-magnetic & QP Hall outputs)
An NPN open collector transistor pulse output produced by a solid state Hall Effect device. This three wire device requires 5-24vdc and produces an NPN square wave output (20mA max. sink), pulse width is 2-75 mSec. The Hall output requires a pull up resistor, these are generally incorporated in most receiving instruments. For (QP) Quadrature pulse output refer details page 9.

3.5 Quadrature outputs
DP series flowmeters supplied with the QP option produce two NPN open collector pulse outputs from two Hall Effect sensors. The outputs are "phase offset" in their timing so that external electronics are able to differentiate. These outputs may be used to assure output signal integrity or to measure bi-directional flow.

3.6 Bi-directional flow
The DP flow transducer is capable of accurately measuring flow in both directions without modification. Meters fitted with the QP output option (quadrature pulse output) may be interfaced with the Pulse Discriminator Module (PD1). The PD1 accepts the Quadrature pulse inputs & from these will discriminate between forward & reverse flow. Two individual & proportional pulse outputs can then be sent to appropriate totalising registers or an add and subtract flow rate totaliser.

It is **important to note** that the Quadrature Pulse option has the same pulse resolution (pulses/unit volume) as a standard Dualpulse for both forward & reverse outputs.
3.7 Voltage Pulse Connection to family instruments

**Note:** For other output styles see receiving instrument manual

Flow instruments or a terminal box can be directly mounted to the Dualpulse using ST4 (for DP490) or ST5 (DP525) mounting stem kits

4.0 K – FACTORS (calibration factors for meter)

The K-factor (pulses / litre, gallon etc.) will vary in relation to the bore size of the pipe in which the Dualpulse is installed.

The K-factors and formula shown are a result of factory testing using smooth bore piping under ideal conditions. Variations to the given K-factors may occur when using rough bore piping or inadequate flow conditioning on either side of the flow transducer (refer clause 2.1). In these instances on site calibration may be used to determine the K-factor.

4.1 Flow transducer K-factors for common pipe sizes

<table>
<thead>
<tr>
<th>Pipe detail</th>
<th>K-factors (standard K-factors for voltage &amp; square wave outputs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NB ID (#40)</td>
<td>Schedule 40 pipe - (#40)</td>
</tr>
<tr>
<td>inches mm p/litre p/m³ p/USgal p/litre p/m³ p/USgal</td>
<td></td>
</tr>
<tr>
<td>1.5&quot; 40.9</td>
<td>18.678</td>
</tr>
<tr>
<td>2&quot; 52.6</td>
<td>11.238</td>
</tr>
<tr>
<td>2.5&quot; 62.7</td>
<td>7.880</td>
</tr>
<tr>
<td>3&quot; 78.0</td>
<td>5.062</td>
</tr>
<tr>
<td>3.5&quot; 90.2</td>
<td>3.768</td>
</tr>
<tr>
<td>4&quot; 102</td>
<td>2.912</td>
</tr>
<tr>
<td>5&quot; 128</td>
<td>1.839</td>
</tr>
<tr>
<td>6&quot; 154</td>
<td>1.268</td>
</tr>
<tr>
<td>8&quot; 203</td>
<td>0.719</td>
</tr>
<tr>
<td>10&quot; 255</td>
<td>0.450</td>
</tr>
<tr>
<td>12&quot; 303</td>
<td>0.316</td>
</tr>
<tr>
<td>14&quot; 333</td>
<td>0.281</td>
</tr>
<tr>
<td>16&quot; 381</td>
<td>0.198</td>
</tr>
<tr>
<td>18&quot; 429</td>
<td>0.156</td>
</tr>
<tr>
<td>20&quot; 478</td>
<td>0.125</td>
</tr>
<tr>
<td>24&quot; 575</td>
<td>0.087</td>
</tr>
</tbody>
</table>

For other pipe sizes below 610mm (24") not listed above, use the graphs and apply the formula on the following pages (12 & 13).

4.2 K-factors for large pipes 460mm ID (18") and above use:

- **Pulses per litre** = \( \frac{28647}{\pi \times \text{ID}^2} \) (mm)
- **Pulses per M³** = \( \frac{28647000}{\pi \times \text{ID}^2} \) (mm)
- **Pulses per US gallon** = \( \frac{168.14}{\pi \times \text{ID}^2} \) (inches)
- **Pulses per Imp. gallon** = \( \frac{201.94}{\pi \times \text{ID}^2} \) (inches)

**NOTE:** K-factors for Reed Switch output option are 1/3 the standard factors of voltage pulse output.
4.3 Calculating K-factors (litres or m³)

Calculate K-factor (pulses / litre) using the above graph and the metric constant of 1273.2 as follows:

\[
Pulses/\text{litre} = \frac{1273.2 \times (A)}{\text{pipe ID}^2 (\text{mm})}
\]

**Example 'a':**
K-factor for 100mm pipe: 1) from graph 100mm ID \((A) = 24.0\)

2) pulses/litre. \[
\frac{1273.2 \times 24.0}{10000} = 3.056 \text{ p/litre}
\]

**K-factor for m³:** multiply by 1000 eg. \(K = 3056 \text{ p/m}^3\)

**K-factor for megalitres:** multiply by 1000000 eg. \(K = 3056000 \text{ pmegalitre}\)

**NOTE:** K-factors for Reed Switch output option are 1/3 the standard factors of voltage pulse output.

4.4 Calculating K-factors (US gallons)

Calculate K-factor (pulses / gallon) using the above graph and the volumetric constant of 24.51 as follows:

\[
Pulses/\text{US gal.} = \frac{24.51 \times (A)}{\text{pipe ID}^2 \text{ (inches)}}
\]

**Example 'b':**
K-factor for 10" pipe: 1) from graph 10" ID \((A) = 7.01\)

2) pulses/gal. \[
\frac{24.51 \times 7.01}{100} = 1.718 \text{ p/gal}
\]

**NOTE:** K-factors for Reed Switch output option are 1/3 the standard factors of voltage pulse output.