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Metrology**

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OD2 USER LEAFLET



 **Solartron
Metrology**
AMETEK®
ULTRA PRECISION TECHNOLOGIES

OD2 

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SAFETY SUMMARY

S1. Safety Characteristics

This apparatus has been tested and supplied in a safe condition. This manual contains some information and warnings which must be followed by the user to ensure safe operation and to retain the apparatus in a safe condition.

S1.1 Terms in This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

S1.2 Symbols in This Manual



This symbol indicates where applicable cautionary or other information is to be found.

S2. Safety Instructions

Upon delivery from the factory the instrument complies with the required safety regulations, see para. S1. To maintain this condition and to ensure safe operation, the instructions below must be carefully followed.

S2.1 Power Source

This product is intended to operate from a power source that will not apply more than 48 volts DC between the supply conductors.

S2.2 Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

S2.3 Grounding the Product

This product is grounded through the grounding conductor of the power supply.

S2.4 Do Not Remove Covers or Panels

To avoid personal injury, do not remove the lid. Do not operate the product without the lid properly fitted.

CAUTION: Electrical Safety

Under normal circumstances, you are unlikely to suffer any real harm from the low voltages and currents used in the OD2 Transmitter. However, the electrical connections should be made with the power off.

SERVICE SAFETY SUMMARY FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators' Safety Summary

This product contains no user serviceable parts

Adjustments may be made to the internal gain settings by qualified personnel, Chapter 5 refers.

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Return Of Goods

Solartron Sales Offices

1. GENERAL

1.1 INTRODUCTION

The Model OD2 Transmitter is designed for use with ac inductive type LVDT displacement transducers. It has a dual function: (1) its onboard oscillator derives power from the supply and produces a sine wave carrier to drive the transducer primary winding; (2) its amplifier, demodulator and filter circuit conditions the transducer output and a voltage-to-current converter produces this as a dc milliamp drive. The transmitter is especially suitable where a readout is required at a substantial distance from the transducer and for interfacing with a controller, or computer in automated manufacturing processes.

1.2 SPECIFICATIONS

Instrument specifications are listed in Table B1.1. These specifications are the performance standards or limits against which the instrument is tested.

1.3 SAFETY CONSIDERATIONS

Before operation, the instrument and manual, including the safety page, should be reviewed for safety markings and instructions. These must then be followed to ensure safe operation and to maintain the instrument in a safe condition.

1.4 INSTRUMENTS COVERED BY MANUAL

Attached to the top of this instrument is a name plate (Fig. 1.1), this manual only refers to instruments listed in Table B1.2.

1.5 MAINTENANCE AND REPAIR

If the instrument is suspected of being unsafe, take it out of operation permanently. This is the case when the instrument:

- shows physical damage;
- does not function anymore;
- is stressed beyond the tolerable limits (eg. during storage and transportation).

1.6 DISMANTLING THE INSTRUMENT

Before opening the instrument, disconnect it from all power sources. Refer to the Service Safety Summary. Calibration, maintenance or repair must be performed only by trained personnel being aware of the risks.

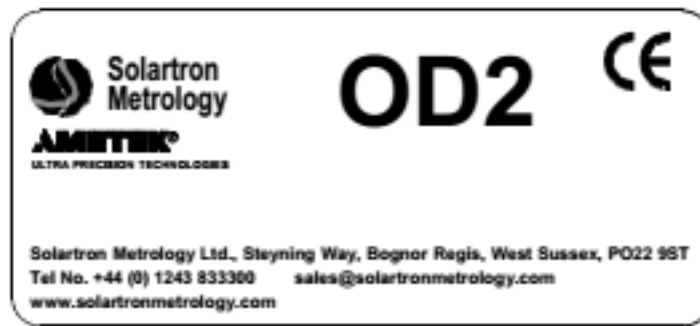


Fig. 1.1 - Instrument Identification

2. INSTALLATION

2.1 INTRODUCTION

This section provides installation instructions for the instrument. It also includes information about initial inspection and damage claims, preparation for use and packaging, storage and shipment.

2.2 INITIAL INSPECTION

Inspect the shipping container for damage. If the container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. If the contents are incomplete, or if there is a mechanical damage or defect, or if the instrument does not pass the operator's checks, notify the nearest Solartron Metrology office. Keep the shipping materials for carrier's inspection.

2.3 PREPARATION FOR USE

CAUTION:

Do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure.

It is recommended that all installation instructions are read fully prior to installation of the instrument.

2.4 POWER REQUIREMENTS

A dc power supply of 13V to 48V and up to 30mA is required. Because the transmitter is frequently installed at a considerable distance from the indicator/control point, there is a possibility that the supply cable connections will be reversed. The transmitter is protected by an internal diode against possible damage caused by reversed polarity.

For correct operation 13V must be achieved at the transmitter at 20mA full scale, the total resistance of the installed indicator and cable must not be too large. As a general guide do not exceed the value of R calculated using the following formula:

$$R \leq \frac{V_s - 13}{0.02} \text{ ohms}$$

Where V_s = actual power supply voltage

For example, if $V_s = 24V$, $R \leq 550$ ohms.

2.5 WORKING ENVIRONMENT

Model OD2 Transmitters will operate in environmental temperatures from 0 to 60°C (32 to 140°F).

Provided the lid and cable entry seals have been properly applied, the enclosure will withstand low pressure water hosing to IP65 specification requirements. This version is therefore ideally suited for installation in dirty or damp industrial environments or in the open where it may be exposed to rain.

2.6 PHYSICAL DESCRIPTION

The OD2 Transmitter can be supplied enclosed in a grey ABS plastic box measuring 120mm x 80mm x 55mm (4.75in x 3.15in x 2.16in) deep with sealed cover and cable entries, one for the transducer wire and the other for the supply cable.

Alternatively, it is available simply as a basic printed circuit card measuring 94mm x 72mm (2.7in x 2.83in) for mounting into the customer's own enclosure. Cable glands accept wires from 1mm to 5mm (0.04in to 0.02in) diameter.

2.7 MOUNTING

The instrument has four (4) 4.2mm (0.165in) diameter mounting holes on 108mm x 50mm (4.25in x 1.97in) centres. These mounting holes are segregated from the electronics by partitioning in the box moulding which may thus be secured to any surface using only two screws without affecting the sealing.

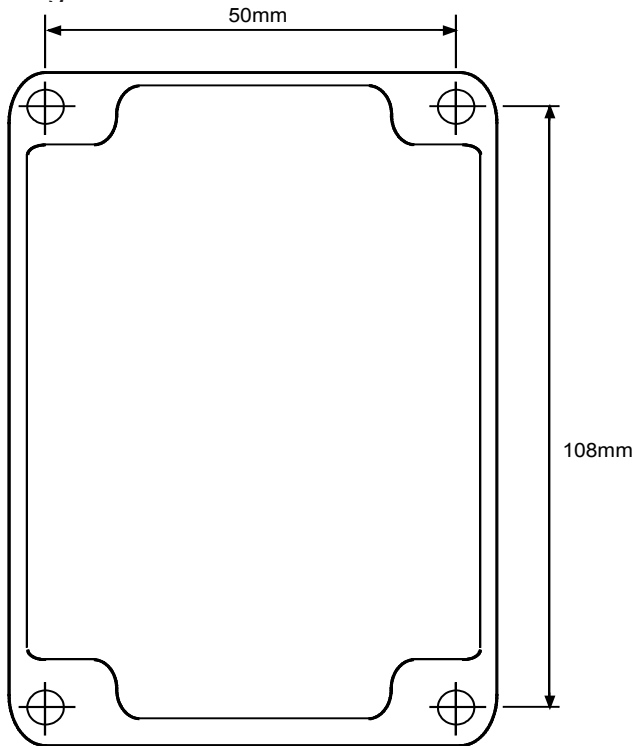


Fig. 2.1 Mounting Holes

Note: Two securing screws and two nuts for alternative fixing to a DIN46277-1 rail are supplied loose with the transmitter.

2.8 ELECTRICAL AND EMC CONSIDERATIONS

The OD2 meets the following requirements

Emissions

EN61000-6-3, specifically EN 55022 Conducted Emissions Class B and EN55022 Radiated Emissions Class B.

Susceptibility

EN610004-3 Radiated Immunity 1.4GHz to 2.7GHz 3V/m

EN610004-3 Radiated Immunity 80MHz to 1GHz 10V/m

ESD

EN610004-4-: ± 4 kV contact and ± 8 kV air

Installation Guidance

The type of cabling used to connect the OD2 depends on the electrical environment. In a clean environment unscreened twisted pairs provide a low cost suitable connection, in an environment where electrical noise is higher, such as installation inside a machine or on the factory floor it is advised to use screened cables.

Do not route power cables close to the OD2 or any interconnecting cables as these may cause a disturbance in the performance. Avoid as much as possible mounting the OD2 close to any kind of switch gear or other equipments that can produce high intensity electrical or magnetic fields.

Wherever possible keep cables below 3m in length.

3. OPTIONS

3.1 INTRODUCTION

OD2 Transmitter will operate with most Solartron transducers having strokes up to $\pm 100\text{mm}$ ($\pm 4\text{in}$), in particular with the SM, AC, AX, AT and some of the MACH 1's. Switches on the printed circuit card are used to set up the transmitter for a specific transducer type and onboard Span/Zero controls are provided for calibration purposes.

3.2 4-20mA OR 0-20mA OPERATION

The OD2 will operate equally well as either a 4-20mA two wire transmitter or a 0-20mA three wire transmitter.

3.3 4-20mA OPERATION

As a 4-20mA transmitter, only two wires are used to connect to the power supply and indicator:

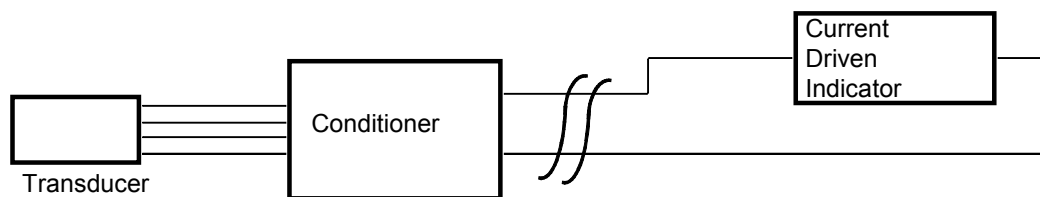


Fig. 3.1 - 4-20mA Option

The transmitter draws 4mA to operate the electronics and the position of the transducer controls a 0-16mA current sink wired in parallel. Therefore the position of the transducer is indicated by the current consumption and a broken cable by zero current. Due to its inherent fault indication, the need for only two wires and its low susceptibility to electrical noise/cable resistance, it is ideal for industrial environments.

3.4 0-20mA OPERATION

The 0-20mA transmitter works on the same principle, but has three wires.

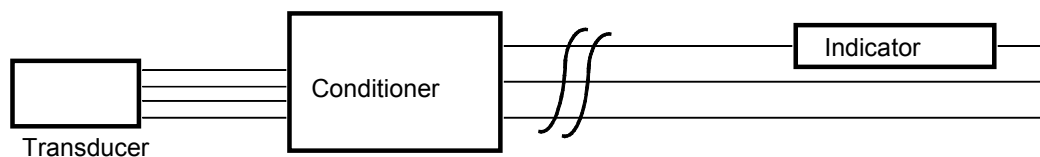


Fig. 3.2 - 0-20mA Option

This has the extra complication of the third wire, but a simpler indicator can be used.

3.5 FREQUENCY SELECTION

Switch S1, S2, S3 and S4 select the excitation frequency with reference to Table 3.2. The optimum frequency for the transducer in use should be selected (see Table 3.1).

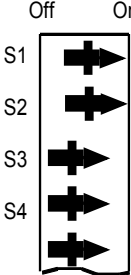
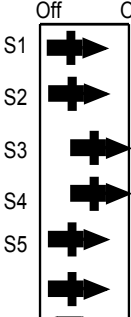
	Frequency Selection Switch 1, 2, 3 and 4
13kHz	<div style="text-align: center;"> Off On  </div>
5kHz	<div style="text-align: center;"> Off On  </div>

Table 3.1 - Frequency Selection

3.6 TUNING CAPACITOR SETTING

Switch S5, S6 and S7 introduce tuning capacitors in parallel with the transducer primary coil with reference to Table 3.3 set S5 to S7 to the optimum capacitance for the transducer in use.

Transducer	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
SM/1	On	On	Off	Off	On	On	Off	On
SM/3	On	On	Off	Off	Off	On	Off	Off
AC/15 & 100	Off	Off	On	On	Off	Off	On	Off
AC/25 & 50	Off	Off	On	On	Off	On	Off	Off
AC/250	Off	Off	On	On	Off	Off	On	On
AX1 to 5	Off	Off	On	On	On	On	On	Off
MACH 1 Series (5kHz)								
BS/1.5 & BS/15	Off	Off	On	On	On	On	On	Off
BS/2.5 & BS/7.5	Off	Off	On	On	On	On	Off	Off
BS/5 & BS/10	Off	Off	On	On	Off	Off	On	Off
BS/25	Off	Off	On	On	On	On	On	Off

Table 3.2 - Switch Settings

Note: Refer to BS settings for BT transducers

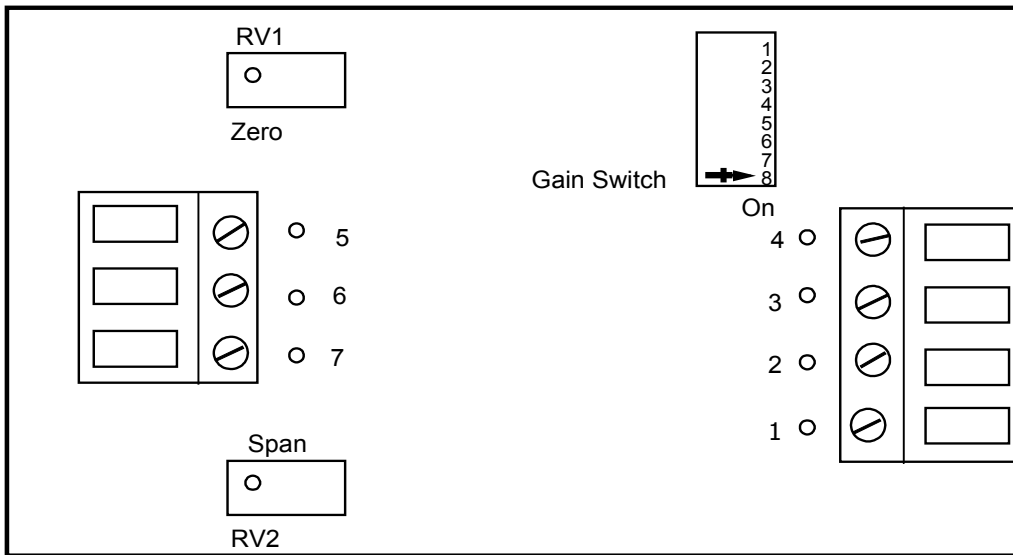


Fig. 3.3 - Gain Selection Switch 8

3.7 GAIN SELECTION

Switch 8 allows selection of Hi and Lo gain. In the Hi position (normal for gauging transducer) the span pot RV2 will allow a gain adjustment of 5 and has an input range of 0 to 320mV for a 4-20mA output. In the Lo position (normal for displacement transducers) the span pot RV2 will allow a gain adjustment of 5 and an input range of 0 to 150mV for a 4-20mA output (ref. Table 5.1).




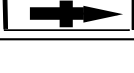
	Gain Selection Switch 8	
Lo		7
		8
Hi		7
		8

Table 3.3 - Gain Selection Switch 8

4. ELECTRICAL CONNECTIONS

4.1 TERMINAL DESIGNATION

Connections should be made to the appropriate terminals detailed in Table 4.1 and 4.2. Refer to Section 2 prior to making any connections.

Transducer Connections	
Terminal Number	Designation
1	Excitation (+)
2	Excitation (-)
3	Input (+)
4	Input (-)

Table 4.1 - Connector 1

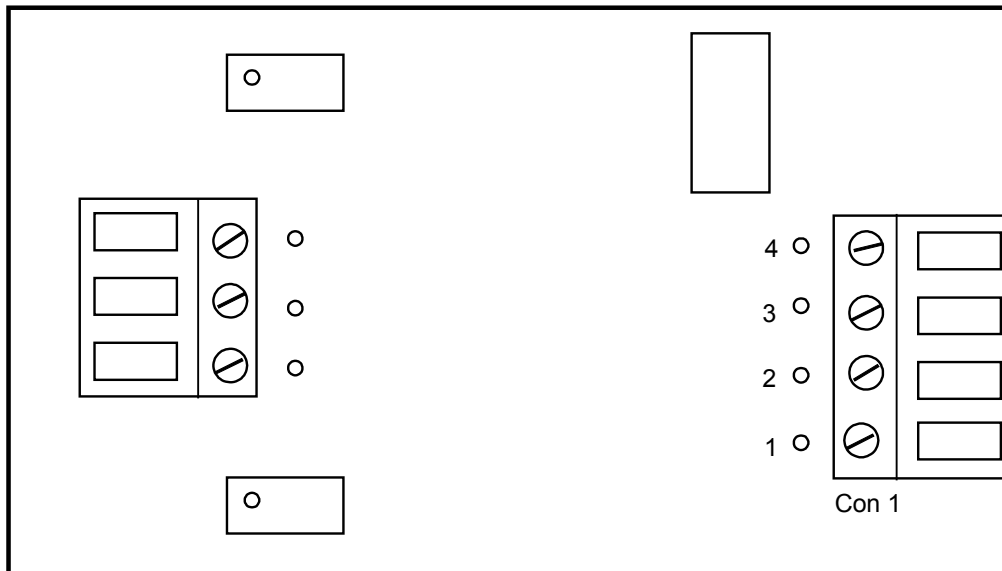


Fig. 4.1 - Connector 1

4.2 TRANSDUCER CONNECTIONS

LVDT Connections - The following connections for standard Solartron transducers should be made:

AX/AC/SM/AE Series and MACH 1 (5kHz)	Pin Number	Function
Red	1	Excitation (+)
Blue	2	Excitation (-)
White	3	Demodulator Input (+)
Green	4	Demodulator Input (-)
Yellow to White or Green via resistor provided		

Table 4.2 - LVDT Connections

4.3 NON-STANDARD CONNECTIONS

For non-standard transducer connections please contact your nearest Solartron Metrology office.
Note: To reverse the transducer output, ie. change for + for inward movement from null to - for inwards movement from null, reverse connections for the green and white wires (AX/AC series) or the black and red wires (MACH 1 series).

4.4 CONNECTING INSTRUMENTATION

Connections should be made with no power applied to the OD2. Once connections have been made pass the wire through the grommet in the case. If required provide some cable retention to prevent unwanted disconnection from the terminal block. Do not operate the OD2 unit without the top cover securely fastened.

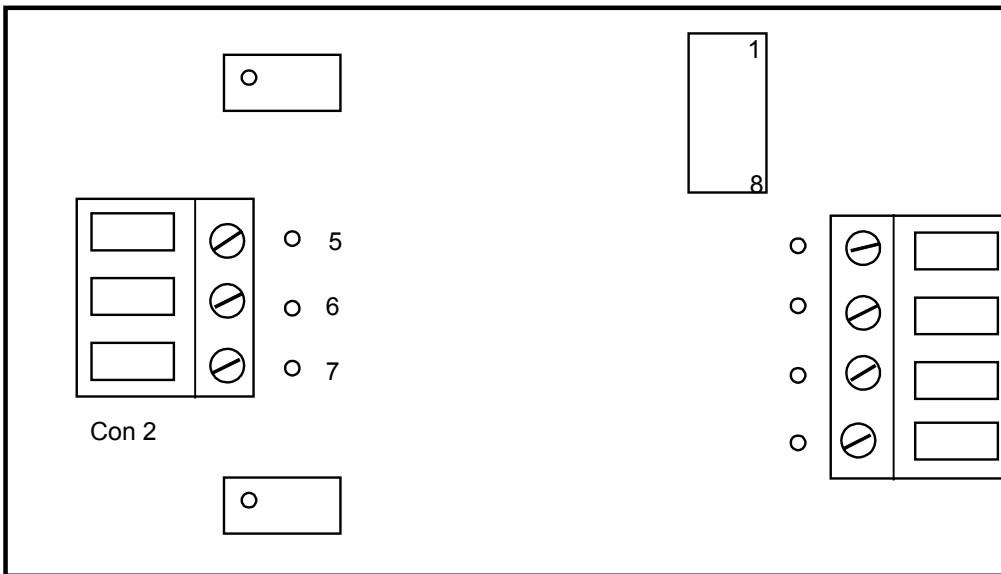


Fig. 4.2 - Connector 2

A 4-20mA Transmitter is suited to current-driven indicators and provides a directly compatible interface with computerised data acquisition and control systems. The Transmitter (Figure 4.3) draws 4mA to operate the electronics while the position of the transducer controls a 0-16mA current sink wired in parallel. Thus, the position of the transducer is indicated by the current consumption and a broken cable is identified by zero current. This inherent ability for fault indication, together with its low susceptibility to electrical noise and cable resistance, and the need for only two wires make the 4-20mA Transmitter ideal for use in industrial environments.

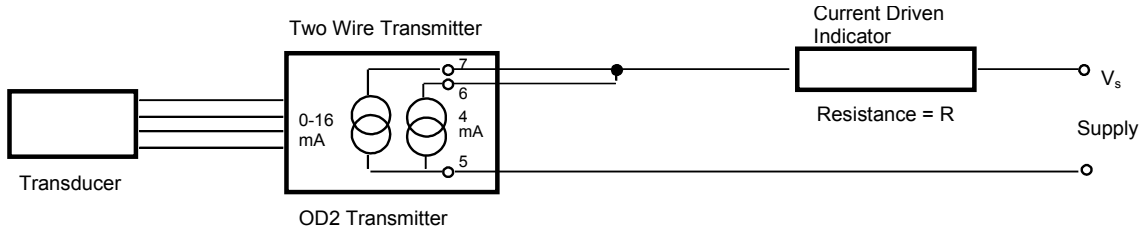


Fig. 4.3 - 4-20mA Transmitter Connections

A 0-20mA Transmitter (Figure 4.4) works on the same principle, but without linking the two current drives. It can therefore be used with a simpler indicator although it needs a third wire.

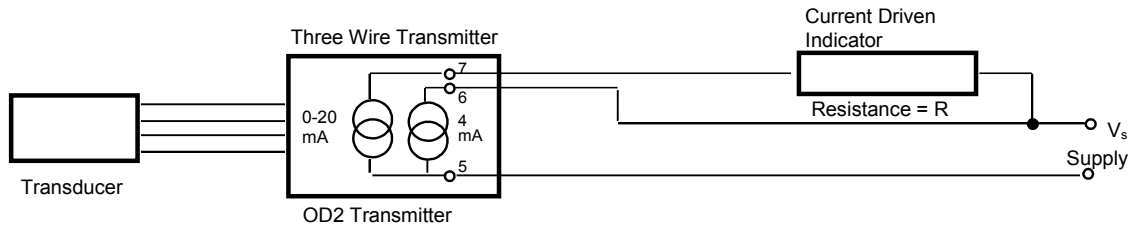


Fig. 4.4 - 0-20mA Transmitter Connections

5. SETTING UP

5.1 GAIN SELECTION

The coarse gain should be selected using Table 5.1 RV2 (span) may then be used for fine adjustment.

Transducer	Range Useable (mm)			
	4-20mA		0-20mA	
	Low Gain	High Gain	Low Gain	High Gain
SM/1	0.7 to 3.6	0.2 to 1.0	0.9 to 4.5	0.3 to 1.3
SM/3	0.8 to 4.1	0.2 to 1.1	1.0 to 5.1	0.3 to 1.5
AC/15	3.1 to 15.6	0.9 to 4.4	3.9 to 19.5	1.1 to 5.5
AC/25	5.3 to 26.5	1.5 to 7.5	6.7 to 33.2	1.9 to 9.4
AC/50	11.4 to 57.0	3.2 to 16.1	14.3 to 71.3	4.1 to 20.2
AC/100	21.2 to 106.0	6.0 to 30.0	26.6 to 132.6	7.6 to 37.6
AC/250	14.2 to 71.4	50.5 to 252.4	18.0 to 90.0	63.0 to 316.0
AX/1	0.5 to 2.5	0.14 to 0.7	0.6 to 3.2	0.2 to 0.9
AX/1.5 & AX/2.5	0.7 to 3.5	0.2 to 1.0	0.9 to 4.4	0.3 to 1.3
AX/5	1.0 to 5.0	0.3 to 1.4	1.3 to 6.3	0.4 to 1.8
MACH 1 Series (5kHz only)				
BS/1.5	0.4 to 2.0	0.1 to 0.6	0.5 to 2.5	0.1 to 0.7
B S/2.5	0.5 to 2.5	0.1 to 0.7	0.6 to 3.2	0.2 to 0.9
BS/5	1.0 to 5.2	0.3 to 1.5	1.3 to 6.5	0.4 to 1.8
BS/7.5	2.1 to 10.4	0.6 to 2.9	2.6 to 13.0	0.7 to 3.7
BS/10	3.9 to 19.3	1.1 to 5.5	4.8 to 24.1	1.4 to 6.8
BS/15	3.7 to 18.6	1.1 to .3	4.7 to 23.3	1.3 to 6.6
BS/25	6.8 to 34.0	1.9 to 9.6	8.5 to 42.5	2.4 to 12.0

Table 5.1 - Gain Selection

Note: The upper gain limit will be set by the transducer. For example, although the 4-20mA electronics with low gain will allow an AX transducer to be used over the stroke range $\pm 2.5\text{mm}$ (0.31in), it is only a 1mm (0.24in) transducer, so $\pm 1\text{mm}$ ($\pm 0.24\text{in}$) is the practical limit.

5.2 ZERO ADJUSTMENT

The Zero (RV1) control allows the zero voltage output position to be adjusted within the normal stroke of the transducer. Sufficient zero adjustment is provided so that the minimum stroke range can be used anywhere within the maximum range. For example, with the SM3 transducer and the 4-20mA transmitter operating with switch 8 OFF (low gain), the Span range is approximately for $\pm 0.8\text{mm}$ ($\pm 0.03\text{in}$) up to $\pm 4.1\text{mm}$ ($\pm 0.17\text{in}$) ($\pm 3\text{mm}$ in practice). Adjustment of the Zero control can place the $\pm 0.8\text{mm}$ ($\pm 0.03\text{in}$) anywhere in the length of the transducer from -3.0 to -1.4mm (-0.12 to -0.057in) and from +1.4 to +3.0mm (+0.057 to +0.12in). Less Zero adjustment is available with a wider span, but does not apply in this case since it would involve moving outside the transducer's range.

5.3 OTHER SWITCH SETTINGS

Referring to Chapter 3, Table 3.2, set the other switch settings S1 to S7 to a suitable position.

6. CALIBRATION

6.1 CALIBRATION WITH STANDARD SOLARTRON TRANSDUCERS

6.1.1 4-20mA Transmitter

Move the transducer to the 4mA end of its required travel and adjust the Zero control to give 4mA. If 4mA cannot be obtained, rotate the Span control clockwise until it can.

Move the transducer to the 20mA end of its required travel and adjust the Span control to give 20mA. If the output stays at 4mA or falls, again the transducer white and green connections are probably reversed. It will prove necessary to adjust the Zero and Span controls more than once to achieve a satisfactory stroke range.

6.1.2 0-20mA Transmitter

Move the transducer to the 0mA end of its required travel and adjust the Zero control to give 0mA on an indicator. The control should be set for just 0mA since the current cannot go negative and a wide range of Zero control may produce 0mA. It may be necessary to slightly adjust the Span control clockwise, in association with Zero control, in order to achieve 0mA if the transducer is being operated over a small range at one end of its travel.

Move the transducer to the 20mA end of its required travel and adjust the Span control to give 20mA. If the current stays at 0mA, try reversing the white and green transducer connections. It may prove necessary to adjust the Zero and Span controls more than once to achieve a satisfactory stroke range.

APPENDIX A

GENERAL TRANSDUCER CONNECTIONS: AX, AC, MD, SA, SM Series, & MACH 1

Connections to connector 2 should be made as indicated:

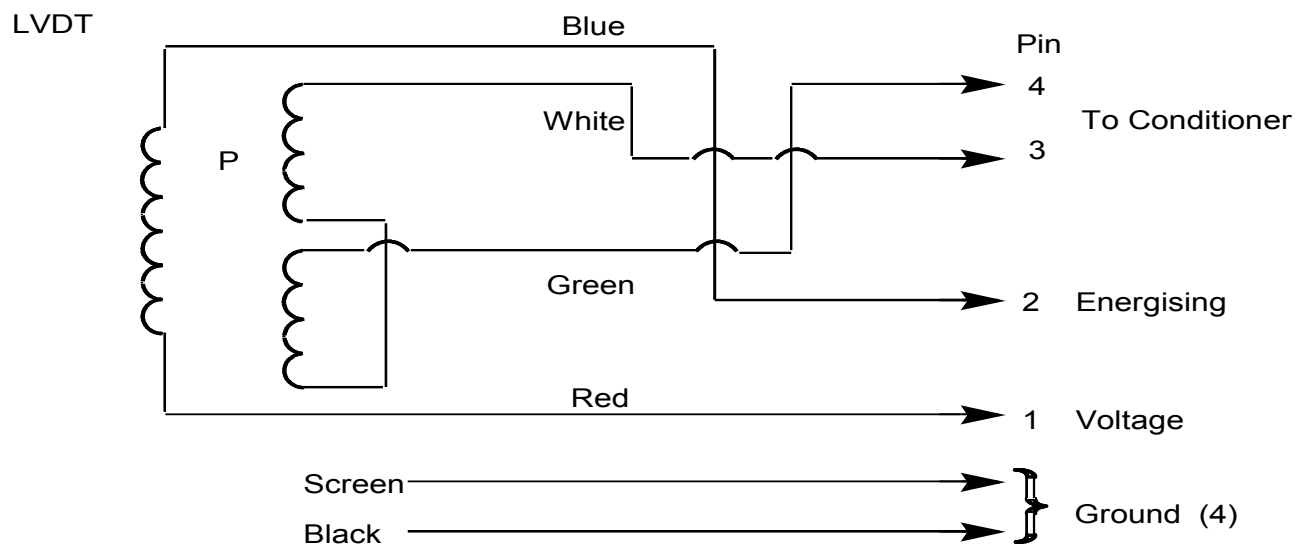
Yellow wire on LVDT's:

- a) Normally left unconnected and insulated.
- b) On some transducers a resistor must be connected from yellow to green or white as instructed on transducer calibration sheet.
- c) Do not extend beyond standard cable length fitted to transducer.

Where screen is used, connect to case of plug. Ensure that elsewhere the screen is isolated electrically.

Cable colours are as fitted to Solartron transducers.

Increase of element impedance marked P gives a positive going voltage output.



Note: The black lead should only be connected if the transducer case is to be grounded.

APPENDIX B

Common Specifications			
<u>Power Supply</u>		<u>Oscillator/Demodulator</u>	
Power Supply	13 - 42V dc	Oscillator frequency	5kHz or 13kHz switchable
		Oscillator output voltage	0.9V rms
		Oscillator max. current	16mA
Loading	Up to 30mA	Input sensitivity for rated output	30 to 530mV/V in 2 coarse gain positions
Supply Protection	Protected internally against reversed connections	Range of gain control	3.5:1 switched 5:1 adjustable
<u>Mechanical</u>		Output	
		Non-Linearity	Better than 0.02%
		Output zero Offset	Up to 100% on maximum gain
Case Size	120mm x 80mm x 54.5mm	Output protection	Output open/short circuit protected
Weight	400g	Output ripple @ 5kHz	0.1% rms maximum
Mounting	Four (4) Fixing Holes	Output filter	25Hz cut off, critically damped
Termination	Connector Screw Terminals	Effect of Supply Change	Negligible
Cable Gland	Accept wire 1 to 5mm dia.	Effect of Temperature Change	Zero 0.01% per °C typical 0-60°C Span 0.01% per °C typical
Case Material	Light grey ABS plastic		Zero 0.02% per year typical Span 0.03% per year typical
Environment	Sealed to IP65	Oscillator protection	Open and short circuit protected

Table B1.1

Instruments Referred to by this Manual	
Part Number	Description
910764	OD2 Displacement Transmitter

Table B1.2