Evolution Measurement
Product User Guide

EvoScann® P16-D
High Performance True Differential
Pressure Scanner

Revision History:	
Issue: 1 Revision: 0	First issued – December 2021

Doc. No: M-90227-01 Iss.1 Rev 0

EvoScann® P16-D Pressure Scanner

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1. Introduction

1.1 Scope & Definitions

This manual provides installation, operation and maintenance instructions for the EvoScann® P16-D Pressure Scanner

1.2 Description:

EvoScann® P16-D is a miniaturised pressure scanner designed specifically to meet the stringent demands of the aerodynamic testing industry where development is rapid and continuous. Utilising the latest in miniature scanner technology P16-D is at the forefront of pressure measurement in challenging aerodynamic locations. The P16-D has been designed, from the start, with physical size, weight, accuracy and functionality in-mind.

SMALL and LIGHT
Weighing-in at <45 g and with compact dimensions, the EvoScann® P16-D can be located within the tightest of spaces where any detailed pressure mapping is needed, enabling aerodynamicists and engineers to quickly gather valuable data.

PLUG and PLAY
Using latest high-speed data communications technologies, EvoScann® P16-D is a pressure measurement and engineering unit converter in one package. With no requirement for a remote converter or other hardware, the EvoScann® P16-D transmits accurate, fast data, in engineering units, directly to the test articles central processing unit over CANbus. Using industry-standard connectors, or flying leads, the EvoScann® P16-D scanner is ready to plug-and-play, producing high-speed synchronous data within seconds of connection.

ROBUST
P16-D is designed to be light, has integral impact and splash-protection and can be fitted into the smallest of installations with minimal external influences.

ACCURATE
Eight high-performance MEMS pressure sensors ensure the highest accuracy and measurement of complete aero sections in one compact device. EvoScann® P16-D scanners are supplied in True Differential mode across a selection of pressure ranges, including custom ranges. Two integrated board mounted temperature sensors provide useful data, but also apply temperature correction of pressure sensors to ensure optimal performance and minimal temperature effects. For optimal accuracy ensure that the reference tubulation is connected to a stable static source.
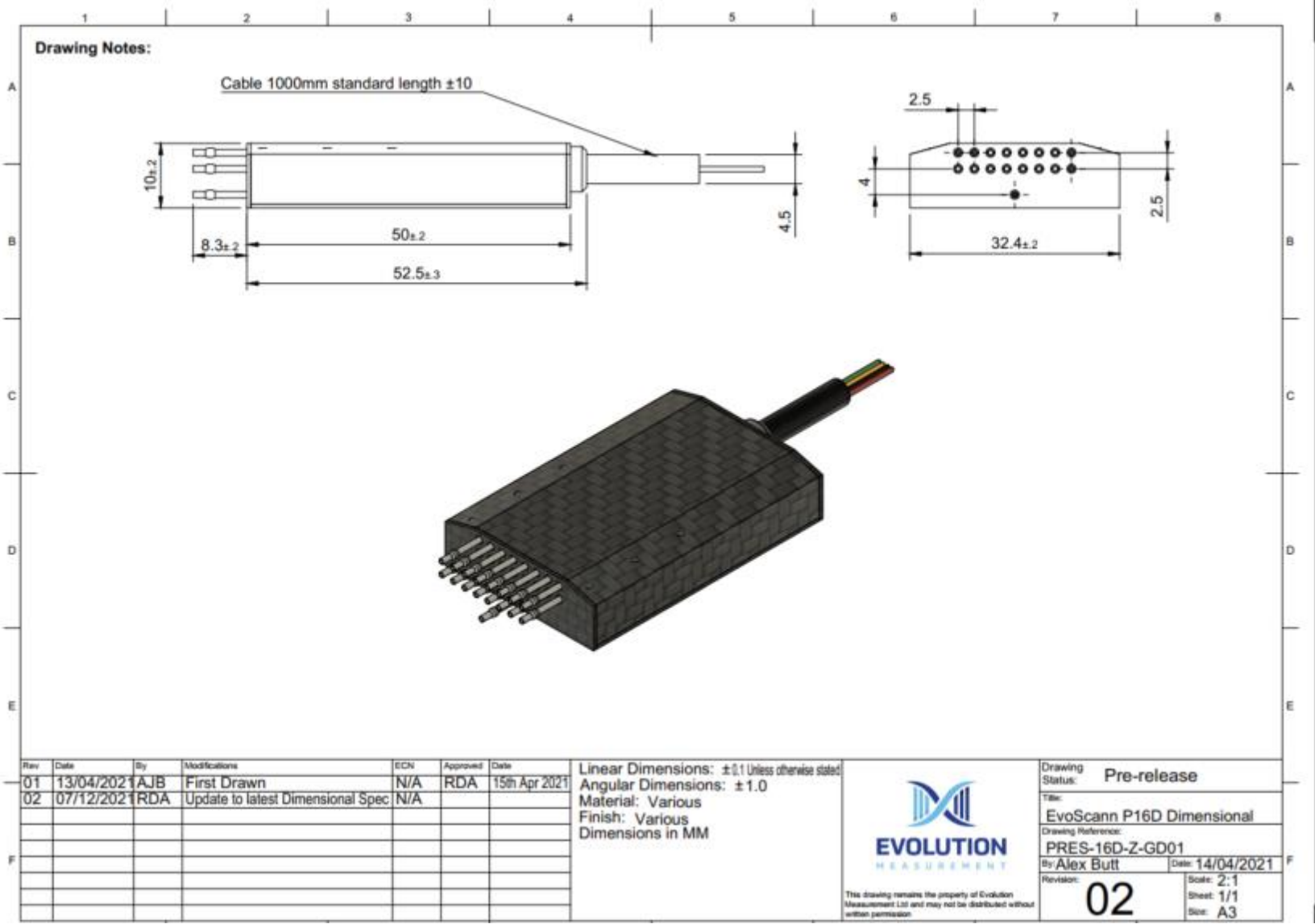
Complementing the EvoScann® P16-D is the widest range of pressure scanner accessories. Tubulations, tubing and tools help the user integrate EvoScann® P16-D quickly and effectively into the test article, enabling measurement and data acquisition to start quickly, making efficient use of expensive testing time and resources.

EvoScann® P16-D Pressure Scanner

2. EvoScann® P16-D Technical data

2.1 Performance & Specifications

Inputs (Px):	16 x 0.040" O.D.
Input (Ref):	1 x 0.040" O.D.
Full Scale Ranges:	Various
Accuracy*:	>=100 mbar +/- 0.10% FS
	<100 mbar +/-0.15% FS
	*includes effects of linearity, repeatability & hysteresis
Overpressure Capability:	5 x calibrated range
Resolution:	See Table 5a (1/Divisor)
Drift:	<0.1% FS / year

Construction materials:

Wetted parts:	Stainless Steel / Aluminium / Silicone
Outer case:	Carbon Fibre
Tubulations:	Stainless Steel

Media:	Air - Avoid liquid contaminants

Environmental Conditions:

Operating Temperature:	-20 °C to +90 °C
Vibration:	9 g / 1000 Hz (24 hr)

Communication:	Direct CANbus / CANbus FD
Optional Interface:	CANbus / CANbus FD > USB Adapter
Data Output Rate:	Variable depending on Communication Type
Power:	9-36 v DC
Current Consumption:	< 30 mA
Electrical Connector:	Flying Lead (connectors optional)
Weight:	45 g (Including 1 m Cable)
Dimensions:	50 x 32.4 x 10 mm

Drawing Notes:

Cable 1000mm standard length ±10

10±.2
8.3±.2
50±.2
52.5±.3
4.5
2.5
4
32.4±.2
2.5

Rev	Date	By	Modifications	ECN	Approved	Date
01	13/04/2021	AJB	First Drawn	N/A	RDA	15th Apr 2021
02	07/12/2021	RDA	Update to latest Dimensional Spec	N/A		

Linear Dimensions: ±0.1 Unless otherwise stated
Angular Dimensions: ±1.0
Material: Various
Finish: Various
Dimensions in MM

Drawing Status: Pre-release

Title: EvoScann P16D Dimensional

Drawing Reference: PRES-16D-Z-GD01

By: Alex Butt   Date: 14/04/2021

Revision: 02

Scale: 2:1
Sheet: 1/1
Size: A3

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3. Installation

EvoScann® P16-D is ideal for mounting as closely as possible to the point where pressure measurement is required. Consideration of mounting position will ensure optimal performance and instrument longevity. The EvoScann® P16-D is designed to be rugged but should be handled and installed with all reasonable and usual precautions necessary for a measurement instrument.

> **Important:**
>
> **Always avoid any risk of liquid contamination of the scanner. This will adversely affect performance and may result in premature failure of the scanner.**

3.1 Unpack and Inspect

Remove all packaging materials from the scanner and check for any impact damage.

If the scanner has been damaged, notify the supplier and carrier in writing within three days of delivery, stating the item number, serial number and purchase order number.

Retain all package materials for further inspection. Do not use the scanner if it has been damaged.

3.2 Physical Installation

Attach the scanner securely to a suitable surface, ensuring that access to the connectors and pressure tubulations is not impaired.

Double-sided tape, duct tape or other adhesive can be used to secure the scanner to the surface, but for permanent installations, suitable Anti-Vibration mounts are optimal.

Install in a position where tubing is kept as short as possible to minimise frequency response inaccuracies and measurement response delays.

Always handle the scanner with care, avoid dropping and unnecessary impacts to ensure measurement integrity. Ensure the scanner is securely attached to the surface to avoid excessive vibration, risk of impact or loss of the scanner. Whilst the scanner is designed to be rugged and reliable, it is a sensitive, accurate device and for continuous reliable operation secure mounting is required.

Do not use excessive force when installing pressure tubing onto the tubulations.

3.3 Table 1. Electrical Harness Identification

Cable Identification	
YELLOW	CANH
GREEN	CANL
RED	SUPPLY
BLACK	GND

3.4 CAN Message Data

Note: The Standard CANbus packets may have two possible formats: Multiplexed and non-Multiplexed.

CANbus-FD (Baud Rate 4 Mbits/s - Non-Multiplexed Output Only)

Table 2a Sensor Data – CAN-FD

Identifier	CAN ID= 0x180 (Default)		
Rate	100 Hz [Default] – Range 10..1000 Hz		
Byte	**Description**	**Format**	**Notes**
0	Pressure1 MSB	U16	Big Endian
1	Pressure1 LSB		
2	Pressure2 MSB	U16	Big Endian
3	Pressure2 LSB		
4	Pressure3 MSB	U16	Big Endian
5	Pressure3 LSB		
6	Pressure4 MSB	U16	Big Endian
7	Pressure4 LSB		
8	Pressure5 MSB	U16	Big Endian
9	Pressure5 LSB		
10	Pressure6 MSB	U16	Big Endian
11	Pressure6 LSB		
12	Pressure7 MSB	U16	Big Endian
13	Pressure7 LSB		
14	Pressure8 MSB	U16	Big Endian
15	Pressure8 LSB		
16	Pressure9 MSB	U16	Big Endian
17	Pressure9 LSB		
18	Pressure10 MSB	U16	Big Endian
19	Pressure10 LSB		
20	Pressure11 MSB	U16	Big Endian
21	Pressure11 LSB		
22	Pressure12 MSB	U16	Big Endian
23	Pressure12 LSB		
24	Pressure13 MSB	U16	Big Endian
25	Pressure13 LSB		
26	Pressure14 MSB	U16	Big Endian
27	Pressure14 LSB		
28	Pressure15 MSB	U16	Big Endian
29	Pressure15 LSB		
30	Pressure16 MSB	U16	Big Endian
31	Pressure16 LSB		

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Table 2b Sensor Data

Byte	Description	Format	Notes
Identifier	CAN ID= 0x181 (Default)		
Rate	1 Hz FIXED		
0	Temperature MSB	S16	Temperature x100. Signed Int16, Divide by 100 for ^{0}C.
1	Temperature LSB		
2	Sensor No MSB	U16	
3	Sensor No LSB		
4	Range	U8	Range – See table 5a
5	Firmware Revision	U8	Firmware Revision
6	Spare	U8	Reserved for future use
7	Spare	U8	Reserved for future use
8	Spare	U8	Reserved for future use
9	Spare	U8	Reserved for future use
10	Spare	U8	Reserved for future use
11	Spare	U8	Reserved for future use

Standard CAN Data (Baud Rate 1 Mbit/s - Non-Multiplexed Output Only)

Table 3a Sensor Data

Identifier	CAN ID= 0x180 (Default)		
Rate	100 Hz [Default] – Range: 10..1000 Hz		
Byte	Description	Format	Notes
0	Pressure1 MSB	U16	Big Endian
1	Pressure1 LSB		
2	Pressure2 MSB	U16	Big Endian
3	Pressure2 LSB		
4	Pressure3 MSB	U16	Big Endian
5	Pressure3 LSB		
6	Pressure4 MSB	U16	Big Endian
7	Pressure4 LSB		

Table 3b Sensor Data

Identifier	CAN ID= 0x181 (Default)		
Rate	100 Hz [Default]		
Byte	Description	Format	Notes
0	Pressure5 MSB	U16	Big Endian
1	Pressure5 LSB		
2	Pressure6 MSB	U16	Big Endian
3	Pressure6 LSB		
4	Pressure7 MSB	U16	Big Endian
5	Pressure7 LSB		
6	Pressure8 MSB	U16	Big Endian
7	Pressure8 LSB		

Table 3c Sensor Data

Identifier	CAN ID= 0x182 (Default)		
Rate	100 Hz [Default]		
Byte	Description	Format	Notes
0	Pressure9 MSB	U16	Big Endian
1	Pressure9 LSB		
2	Pressure10 MSB	U16	Big Endian
3	Pressure10 LSB		
4	Pressure11 MSB	U16	Big Endian
5	Pressure11 LSB		
6	Pressure12 MSB	U16	Big Endian
7	Pressure12 LSB		

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Table 3d Sensor Data

Identifier	CAN ID= 0x183 (Default)		
Rate	100 Hz [Default]		
Byte	**Description**	**Format**	**Notes**
0	Pressure13 MSB	U16	Big Endian
1	Pressure13 LSB		
2	Pressure14 MSB	U16	Big Endian
3	Pressure14 LSB		
4	Pressure15 MSB	U16	Big Endian
5	Pressure15 LSB		
6	Pressure16 MSB	U16	Big Endian
7	Pressure16 LSB		

Table 3e Sensor Data

Identifier	CAN ID= 0x184 (Default)		
Rate	1 Hz FIXED		
Byte	**Description**	**Format**	**Notes**
0	Temperature MSB	S16	Temperature x100. Signed Int16, Divide by 100 for ^{0}C.
1	Temperature LSB		
2	Sensor No MSB	U16	
3	Sensor No LSB		
4	Range	U8	Range – See table 5a
5	Firmware Revision	U8	Firmware Revision
6	Spare	U8	Reserved for future use
7	Spare	U8	Reserved for future use

Conversion to Engineering Units

Conversion of pressure data is as follows:

Range Byte	Gain	Offset	Range [mbar]	Notes
0x00	1/320	100	+/-100 mbar	mbar=(Pressure-32768)/320
0x01	1/162.5	200*	+/-200 mbar	mbar=(Pressure-32768)/162.5)
0x0A	1/327.68	50	+/-50 mV	mV=(Data-32768/327.675)

Table 5a. Calibration Info.

Range	Range Byte	Divisor	Offset	Notes
+/-10 mbar	0x30	3200	32768	
+/-20 mbar	0x31	1600	32768	
+/-50 mbar	0x32	640	32768	
+/-100 mbar	0x00	320	32768	
+/-200 mbar	0x01	162.5	32768	
+;/-350 mbar	0x02	90	32768	
+/-500 mbar	0x03	64	32768	
+/-1 Bar	0x04	32000	32768	
+/-2 Bar	0x05	16000	32768	
+/-3.5 Bar	0x06	9000	32768	
+/-7 Bar	0x07	4500	32768	
+/-10 Bar	0x08	3200	32768	
+/-20 Bar	0x09	1600	32768	
+/-1 psi	0x20	32000	32768	
+/-1.5 psi	0x21	20000	32768	
+/-2 psi	0x22	16000	32768	
+/-3 psi	0x23	10000	32768	
+/-5 psi	0x24	6400	32768	
+/-10 psi	0x25	3200	32768	
+/-15 psi	0x26	2000	32768	
+/-30 psi	0x27	1000	32768	
+/-50 psi	0x28	640	32768	
+/-100 psi	0x29	320	32768	
+/-150 psi	0x2A	200	32768	
+/-300 psi	0x2B	100	32768	

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Appendix A

System Zero
A System Zero can be performed at any time, and is saved to non-volatile memory, for subsequent Power On.

To Sensor (CAN-FD) – 12 BYTES

Identifier	0x7F2			
Rate	N/A			
Byte	**Description**	**Scaling**	**Value**	**Notes**
0	Sensor No. MSB	1	0xnn	Sensor No MSB
1	Sensor No. LSB	1	0xnn	Sensor No LSB
2	Opcode1	1	0x64	FIXED
3	Opcode2	1	0x63	FIXED
4	ZERO OPCODE	1	0x32	ZERO Message
5	N/A	1	0x00	
6	N/A	1	0x00	
7	N/A	1	0x00	
8	N/A	1	0x00	
9	N/A	1	0x00	
10	N/A	1	0x00	
11	N/A	1	0x00	

To Sensor (CAN-Std) – 8 BYTES

Identifier	0x7F2			
Rate	N/A			
Byte	**Description**	**Scaling**	**Value**	**Notes**
0	Sensor No. MSB	1	0xnn	Sensor No MSB
1	Sensor No. LSB	1	0xnn	Sensor No LSB
2	Opcode1	1	0x64	FIXED
3	Opcode2	1	0x63	FIXED
4	ZERO OPCODE	1	0x32	ZERO Message
5	N/A	1	0x00	
6	N/A	1	0x00	
7	N/A	1	0x00	

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Data Rate Change

The Speed at which the data is put onto the bus can be changed between 1 mS & 100 mS (1000 Hz to 10 Hz). This is done by setting the period of transmission in mS.

Identifier	0x7F2			
Rate	N/A			
Byte	**Description**	**Scaling**	**Value**	**Notes**
0	Sensor No. MSB	1	0xnn	Sensor No MSB
1	Sensor No. LSB	1	0xnn	Sensor No LSB
2	Opcode1	1	0x64	FIXED
3	Opcode2	1	0x63	FIXED
4	RATE OPCODE	1	0x12	RATE Message
5	Period in mS MSB	1	0xnn	Valid data range is 1 to 100
6	Period in mS LSB	1	0xnn	
7	N/A	1	0x00	
8	N/A	1	0x00	
9	N/A	1	0x00	
10	N/A	1	0x00	
11	N/A	1	0x00	

CAN ID Change

Changing the Transmitting CAN ID

Identifier	0x7F2			
Rate	N/A			
Byte	**Description**	**Scaling**	**Value**	**Notes**
0	Sensor No. MSB	1	0xnn	Sensor No MSB
1	Sensor No. LSB	1	0xnn	Sensor No LSB
2	Opcode1	1	0x64	FIXED
3	Opcode2	1	0x63	FIXED
4	CAN ID OPCODE	1	0x11	CAN ID Message
5	CAN ID MSB	1	0xnn	Transmitting CAN ID
6	CAN ID LSB	1	0xnn	
7	N/A	1	0x00	
8	N/A	1	0x00	
9	N/A	1	0x00	
10	N/A	1	0x00	
11	N/A	1	0x00	

Revision History			
Revision	Date	Notes	Author
1.0	10th Dec 2021	1st Issue	Rob A

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3.5   Installation Accessories

We highly recommend the use of Scanivalve Installation Accessories. These are listed and illustrated in a comprehensive catalogue, which is available as a printed copy on request from Evolution Measurement Ltd. It can also be viewed online at

www.evolutionmeasurement.com

These accessories are of very high quality, offer highly flexible installation and ensure many years of trouble-free service. The use of lower-cost after-market accessories may result in leakage or disconnection, compromising your measurement integrity and resulting in inconvenient and expensive downtime and lost/poor measurement data. Please call Evolution Measurement for any assistance in selecting accessories and to obtain a priced quotation.
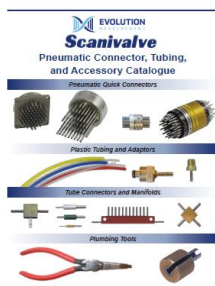
4   Operation

Operation of the EvoScann® P16-D is simple and straightforward.

Once the tubing has been connected and checked for any leakage power can be applied. Data is transferred digitally, directly over CANbus or to the Evolution Measurement EvoScann® P16-D GUI (Graphical User Interface) when used with our CANDI converter, this additional item is available from Evolution Measurement Ltd, upon request which allows for full interrogation, re-configuration and data logging via PC for a single EvoScann® P-Series Scanner. It is recommended that a Zero is regularly performed.

5   Maintenance

5.1   General Information

EvoScann® Pressure Scanners are designed to require little user intervention. Ensuring that surfaces are clean and dry, especially during tube fitment or removal is essential. This can be achieved by use of a damp cloth and mild detergent. Do not use solvents.

It is recommended that a Zero is regularly performed.

The scanner should be returned to Evolution Measurement for a full factory re-calibration, under laboratory conditions, across a wide range of pressures and temperatures. Recommend periodicity 12-months.

5.2 Safety Information

Observe all appropriate safety precautions when operating any electrical equipment. Always ensure wiring is done by competent persons in strict accordance with the electrical connection details in this manual.

Do not use abrasive or solvent substances to clean the Pressure Scanner.

Do not attempt to open the Pressure Scanner. The unit is factory sealed and opening the unit will result in its failure and voiding of the warranty

5.3 Fault Finding

Symptom:	Check likely cause:
Scanner not functioning	Ensure correct power source available Ensure correct pin out connections
Scanner reading fixed pressures	Check for any tubulation blockages Check tubing for kinks or blockages Ensure that test article tubulations are not obstructed
Scanner reading inaccurately	Check items above Perform simple zero calibration Return to factory for check/re-calibration

5.4 Repair & Recalibration

Field repair is not possible with EvoScann® P16-D. All repairs must be carried out by Evolution Measurement Ltd.

To ensure optimum service and performance, return to Evolution Measurement for Calibration, periodically, using the following form, available from our website at www.evolutionmeasurement.com

6 Storage and Disposal

6.1 Storage

EvoScann® P16-D pressure scanner is a rugged, but sensitive, measurement device that will provide years of useful service if protected and stored correctly.

When not in use, place a protective cover, if available, over the open tubulations to avoid ingress of dirt or moisture. If no cover is available, careful application of adhesive tape should suffice.

EvoScann® P16-D is delivered in robust protective packaging. Retain this for future use. Always store the EvoScann® scanner in its packaging when not in use and store in a clean, dry, dust and moisture-free area, avoiding temperature extremes. Avoid the risk of droppage, vibration or other unnecessary impact.

6.2 Disposal

At end of life, dispose of EvoScann® P16-D pressure scanner in full accordance with all local procedures and practices, or return the unit to Evolution Measurement Ltd for disposal. Do not incinerate as the product may emit noxious fumes.

Contact us:

Evolution Measurement Ltd
7 Regents Court, South Way,
Walworth Business Park,
Andover, Hampshire
SP10 5NX, UK
Telephone: +44 (0) 1264 316470
Email: enquiries@evolutionmeasurement.com
www.evolutionmeasurement.com

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