MICHELL Instruments

Easidew 34
Dew-Point Transmitter
User's Manual

97317 Issue 2.2
March 2016

Please fill out the form(s) below for each instrument that has been purchased.

Use this information when contacting Michell Instruments for service purposes.

Transmitter	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Transmitter	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Transmitter	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Easidew 34 Transmitter

For Michell Instruments' contact information please go to
www.michell.com

Contents

Figures

Appendices

Safety

The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. The user must not use this equipment for any other purpose than that stated. Do not apply values greater than the maximum value stated.

This manual contains operating and safety instructions, which must be followed to ensure the safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage. Use competent personnel using good engineering practice for all procedures in this manual.

Electrical Safety

The instrument is designed to be completely safe when used with options and accessories supplied by the manufacturer for use with the instrument.

Pressure Safety

DO NOT permit pressures greater than the safe working pressure to be applied to the instrument. The specified safe working pressure is 45 MPa (450 barg / 6500 psig). Refer to the Technical Specifications in Appendix A.

Toxic Materials

The use of hazardous materials in the construction of this instrument has been minimized. During normal operation it is not possible for the user to come into contact with any hazardous substance which might be employed in the construction of the instrument. Care should, however, be exercised during maintenance and the disposal of certain parts.

Repair and Maintenance

The instrument must be maintained either by the manufacturer or an accredited service agent. Refer to www.michell.com for details of Michell Instruments' worldwide offices contact information.

Calibration

The recommended calibration interval for this instrument is 12 months unless it is to be used in a mission-critical application or in a dirty or contaminated environment in which case the calibration interval should be reduced accordingly. The instrument should be returned to the manufacturer, Michell Instruments Ltd., or one of their accredited service agents for re-calibration.

Safety Conformity

This product meets the essential protection requirements of the relevant EU and US standards and directives. Further details of applied standards may be found in the Technical Specifications in Appendix A.

Abbreviations

The following abbreviations are used in this manual:

barg	pressure unit (=100 kP or 0.987 atm)
ºC	degrees Celsius
ºF	degrees Fahrenheit
DC	direct current
ft-lbs	foot-pound force
g	grams
in	inch(es)
l/min	liters per minute
µm	micrometer
m/sec	meters per second
mA	milliampere
max	maximum
mm	millimetres
MPa	megapascal
Nl/min	normal liters per minute
Nm	Newton meter
oz	ounces
ppm_V	parts per million by volume
psig	pounds per square inch
RH	relative humidity
scfh	standard cubic feet per hour
scfs	standard cubic feet per second
T	temperature
V	Volts
Ω	Ohms
ø	diameter

Warnings

The following general warning listed below is applicable to this instrument. It is repeated in the text in the appropriate locations.

Where this hazard warning symbol appears in the following sections it is used to indicate areas where potentially hazardous operations need to be carried out.

1 INTRODUCTION

The Easidew 34 dew-point transmitter has been manufactured, tested and calibrated to the highest available standards and should be in perfect working order, ready for installation into a gas measurement application. If there are any questions about the instrument or how to install and operate it, please contact a Michell representative. Refer to www.michell.com for details of Michell Instruments' worldwide offices contact information.

1.1 Features

The Easidew 34 dew-point transmitter is a continuous on line 4-20 mA transmitter for the measurement of moisture content in air and other non-corrosive gases. The key features are:

- 3/4" UNF industry-standard process connection
- Dew-point OR parts per million (moisture content) in volume (ppm_V) measurements
- Accuracy (±2ºCdp (±3.6ºFdp))
- Repeatability (0.5ºCdp (0.9ºFdp))
- Dew-point values traceable to international standards (NIST and NPL)
- Excellent sensor protection (rugged 316 stainless steel IP66 construction)
- Interchangeability

1.2 Factory Calibration

The Easidew 34 dew-point transmitter is fully factory-tested and calibrated prior to delivery and is supplied with its own Calibration Certificate, providing direct traceability to both UK *National Physical Laboratory* (NPL) and US *National Institute of Standards and Technology* (NIST) Humidity Standards.

Michell Instruments offers a variety of re-calibration and exchange sensor schemes to suit specific needs. A Michell representative can provide detailed, custom advice (refer to www.michell.com for details of Michell Instruments' worldwide offices contact information).

2 INSTALLATION

2.1 Unpacking the Instrument

On delivery, please check that all the following standard components are in the packing box:

- Easidew 34 Transmitter
- Recessed Sensor O-Ring Seal (fitted)
- Certificate of Calibration
- Connector

Unpack the dew-point transmitter box as follows (see *Figure 1).*

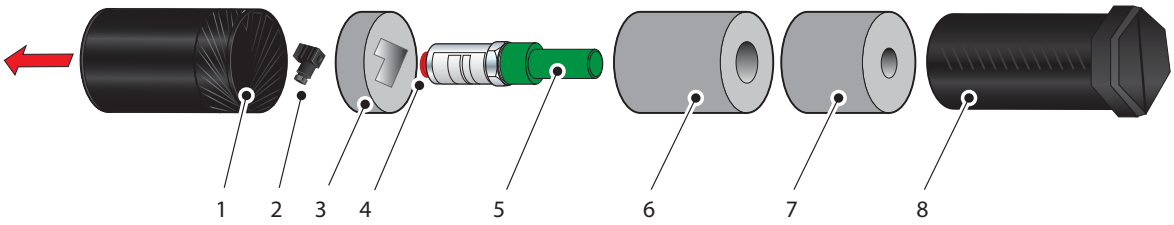


Figure 1 *Transmitter Unpacking Method*

1. Remove the cap (1) from the packing tube (8).
2. Remove the foam block (3) containing the connector (2).
3. Pull out the transmitter (5) from the tube, complete with the two foam covers (6) and (7) and the red protective cap (4).
4. Remove the foam covers from the transmitter but leave the green plastic protective cover (5) and the red cap (4) in place until ready for installation.

NOTE: The transmitter sensing element is protected while in transit by a green cover containing a small desiccant capsule. The connection pins are protected by a red plastic cap. None of these plastic items are required for the operation of the transmitter.

NOTE: Keep the connector (2) in a safe place until the transmitter is ready for wiring.

2.2 Preparation of the Sensor Cable

The sensor cable is NOT supplied as standard. A cable can be obtained by contacting your local distributor or Michell Instruments (see www.michell.com for details).

In order to achieve optimum performance of the transmitter, the sensor cable should have the specifications as shown in Appendix A.

Cable connection to the Easidew 34 transmitter is made via the removable connector. Removing the central screw enables the connector terminal block to be removed from the outer housing by using a small screwdriver to prise it clear.

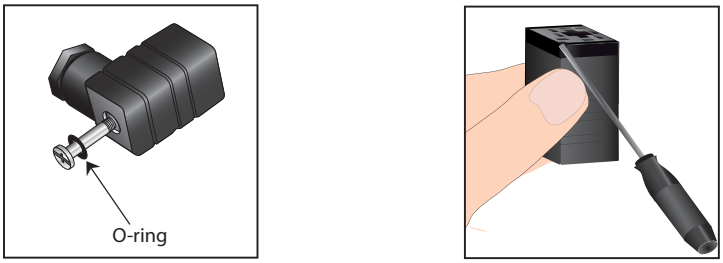


Figure 2 *Connector Terminal Block Removal*

Caution: When removing the central screw ensure that the small sealing O-ring is retained on the screw and is present during re-installation.

For the transmitter to work properly, and to achieve maximum performance, the sensor cable must be connected to the sensor connector as shown in the drawing below:

Note: The drawing below shows the identity of the connector terminals and wiring connections of the cable manufactured by Michell Instruments:

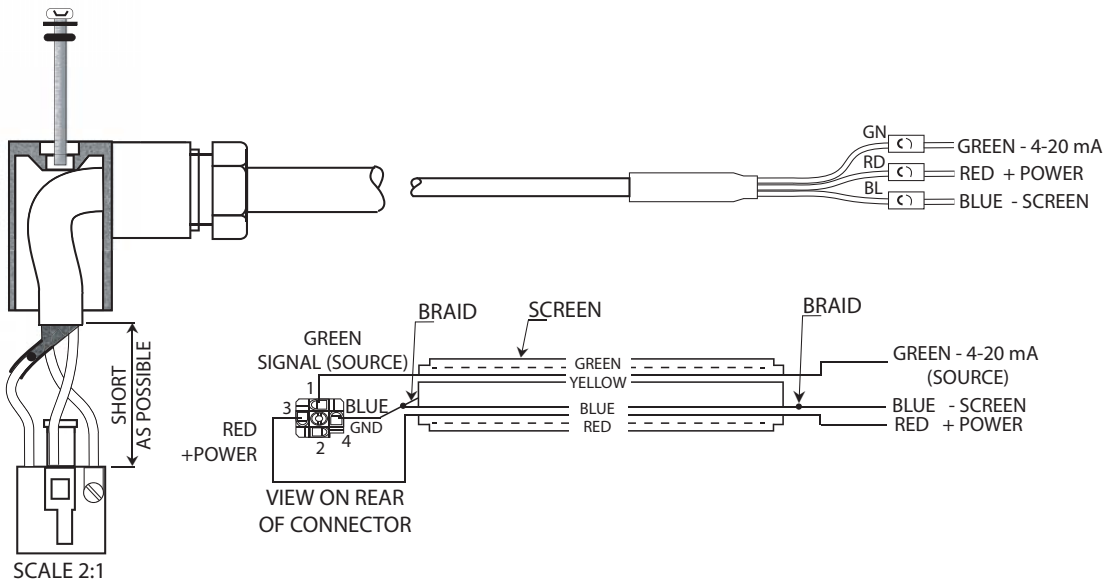


Figure 3 *Wiring Connections*

Always connect the 4-20 mA return signal to a suitable load (see *Figure 3)* before the power is applied. Without this connection, the transmitter may be damaged if allowed to operate for prolonged periods.

2.3 Cable Connection

When installing the connector, and to ensure that full ingress protection is achieved, the securing screw must be tightened to a minimum torque setting of 3.4 Nm (2.5 ft-lbs). The sensor cable used must be a minimum diameter of 4.6mm (0.2").

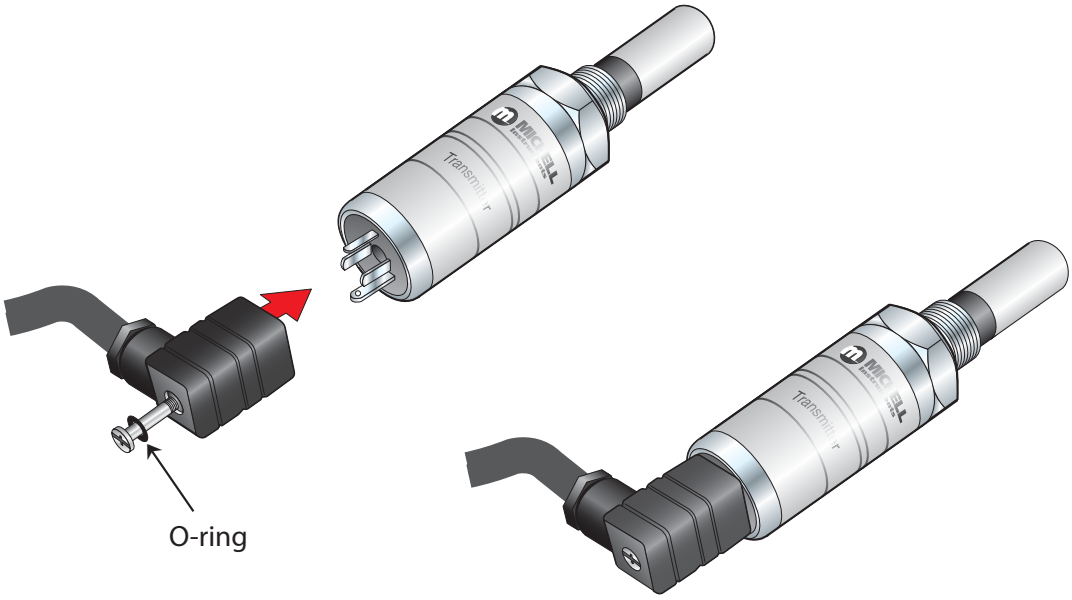


Figure 4 *Connector Installation*

2.4 Electrical Connection

NOTE: The screen/shield should be connected for maximum performance and to avoid interference.

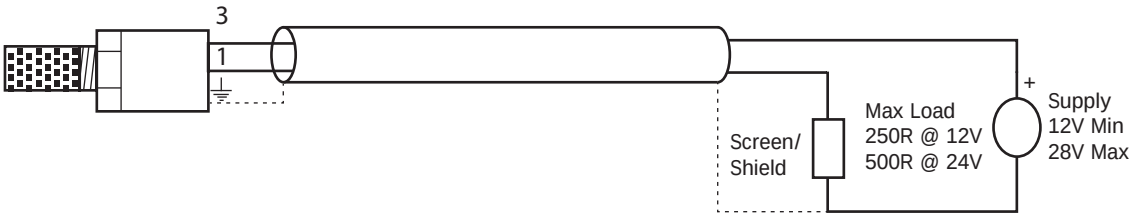


Figure 5 *2-Wire Connection Diagram*

2.5 Transmitter Mounting

Prior to installation of the transmitter, unscrew and remove the green plastic cover and retain for future use. Take care to prevent any contamination of the sensor before installation **(handle the HDPE guard by the black part only - see *Figure 9*).**

The Easidew 34 can be mounted either into a flow-through sensor sampling block (optional extra) or directly into a pipe or duct. It can be operated at pressures of up to 45 MPa (450 barg / 6500 psig) when fitted with the bonded seal or O-ring provided.

The recommended gas flow rate, when mounted in the optional sampling block, is 1 to 5 Nl/min (2.1 to 10.6 scfh). However, for direct insertion applications, gas flow can be from static to 10 m/sec (32.8 fps).

NOTE: Pass the seal over the mounting thread and assemble into the sampling location, by hand, using the wrench flats only. DO NOT grip and twist the sensor cover when installing the sensor.

When installed, fully tighten using a wrench until the seal is fully compressed and to the following setting:

- 3/4" - 16 UNF 40 Nm (29.5 ft-lbs)

2.5.1 Transmitter Mounting - Direct Pipeline Connection

The transmitter may be directly mounted into a pipe or duct as shown in *Figure 6.*

Caution: Do not mount the transmitter too close to the bottom of a bend where any condensate in the pipeline might collect and saturate the probe.

The pipe or duct will require a thread to match the transmitter body thread. Fixing dimensions are shown in *Figure 6.* For circular pipework, to ensure the integrity of a gas tight seal, a mounting flange will be required on the pipework in order to provide a flat surface to seal against.

The following procedure must be carried out by competent personnel.

1. Ensure that the protective cover (and its desiccant capsule) has been removed from the tip of the transmitter.

WARNING: Under no circumstances should the filter guard be handled with the fingers.

2. Ensure that the O-ring (2) is seated in the recess at the top of the transmitter body.
3. Cut the appropriate thread into the pipe to match the transmitter body thread. Clean out any burrs or metal shavings adhering to the inside of the pipeline.
4. After first checking that the pipeline has a wide enough bore to accept the transmitter's probe tips, screw the transmitter (3) into the pipe (1). Tighten enough to obtain a gas tight seal. **NOTE: Do not overtighten or the thread on the pipework may be stripped.**

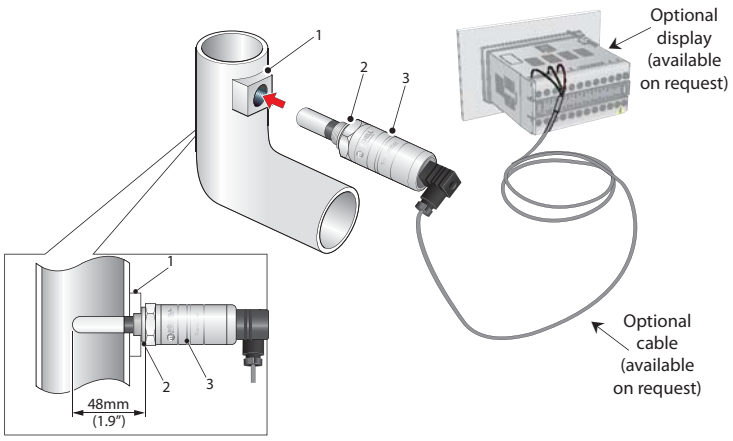


Figure 6 *Transmitter Mounting - Pipe or Duct*

3 OPERATION

Operation is very simple assuming the following installation techniques are adhered to:

Sampling Hints

Be Sure the Sample is Representative of the Gas Under Test:

The sample point should be as close to the critical measurement point as possible. Also, never sample from the bottom of a pipe as entrained liquids may be drawn into the sensing element.

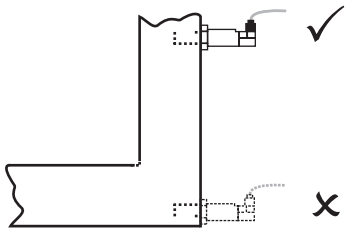


Figure 7 *Installation Location*

Minimize Dead Space in Sample Lines:

Dead space causes moisture entrapment points, increased system response times and measurement errors, as a result of the trapped moisture being released into the passing sample gas and causing an increase in partial vapor pressure.

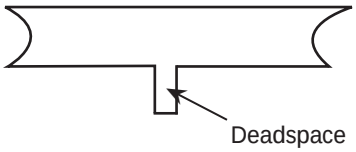


Figure 8 *Indication of Dead Space*

Remove Any Particulate Matter or Oil from the Gas Sample:

Particulate matter at high velocity can damage the sensing element and similarly, at low velocity, they may 'blind' the sensing element and reduce its response speed. If particulate, such as degraded desiccant, pipe scale or rust is present in the sample gas, use an in-line filter.

Use High Quality Sample Tube and Fittings:

Michell Instruments recommends that, wherever possible, stainless steel tubing and fittings should be used. This is particularly important at low dew points since other materials have hygroscopic characteristics and adsorb moisture on the tube walls, slowing down response and, in extreme circumstances, giving false readings. For temporary applications, or where stainless steel tubing is not practical, use high quality thick walled PTFE tubing.

4 MAINTENANCE

Calibration

Routine maintenance of the Easidew 34 is confined to regular re-calibration by exposure of the transmitter to sample gases of known moisture content to ensure that the stated accuracy is maintained. Calibration services traceable to the UK *National Physical Laboratory* (NPL) and the US *National Institute of Standards and Technology* (NIST) are provided by Michell Instruments.

HDPE Guard

The HDPE Guard provides protection to the transmitter sensing element. It is designed to show any contamination and the guard should be changed if the white surface becomes discolored.

When replacing the HDPE guard, care should be taken to handle it, using gloves, by the black part only. A pack of 10 replacement guards can be obtained by contacting Michell Instruments (www.michell.com) or your local distributor and quoting part number EA2-HDPE-PK10.

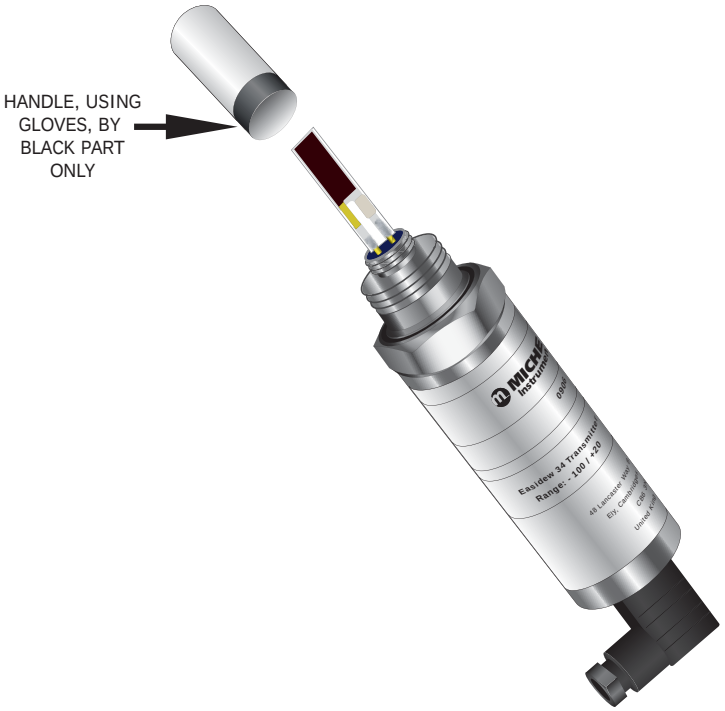


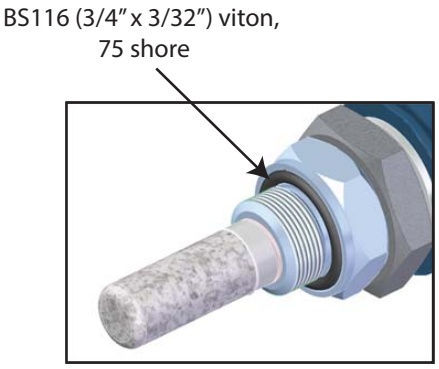
Figure 9 *Replacement of HDPE Guard*

4.1 O-Ring Replacement

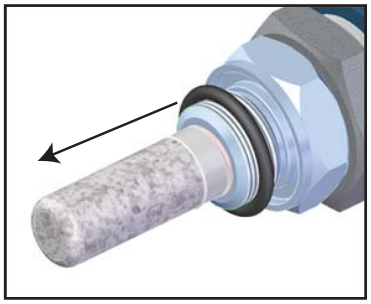
If the installed O-ring gets damaged or lost, a pack of 5 replacement O-rings can be obtained by contacting Michell Instruments, or your local distributor, and quoting part number 3/4-OR.

Do not touch the filter with bare hands

1. Identify the O-ring to be removed, as shown below.



2. Carefully slide tweezers, thin bladed screwdriver or a blunt needle under the outer edge of the O-ring. **NOTE: Take care not to scratch any of the surfaces of the surrounding metal component.**
3. Move the tool around the circumference to assist the extraction process. Slide the O-ring clear of the thread and filter.



4. Make sure the groove has no scratches and is free from grease, dirt or debris. Slide the new O-ring over the filter and thread and into the groove. **NOTE: Do not touch the filter with bare hands.**

Appendix A

Technical Specifications

Appendix A Technical Specifications

Performance		
Measurement Range (dew point)	-100 to +20ºCdp (-148 to +68ºFdp) -110 to +20ºCdp (-166 to +68ºFdp)	
Accuracy (dew point)	±2ºCdp (±3.6ºFdp)	
Response Time	5 mins to T95 (dry to wet)	
Repeatability	0.5ºCdp (0.9ºFdp)	
Calibration	Traceable 7 point calibration certificate	
Electrical Specifications		
Output Signal	4-20 mA (2-wire connection current source) User-configurable over range	
Output	Dew point, moisture content for ppm_V	
Analog Output Scaled Range	Dew point: -100 to +20ºC (-148 to +68ºF) OR Moisture content in gas: 0 - 3000 ppm_V Non-standard available upon request	
Supply Voltage	12 to 28 V DC	
Load Resistance	Max 250 Ω @ 12 V (500 Ω @ 24 V)	
Current Consumption	20 mA max	
Supply Voltage Influence	±0.0005% RH/V	
CE Marked	Certified	
Operating Specifications		
Operating Temperature	-40 to +60ºC (-40 to +140ºF)	
Operating Pressure	45 MPa (450 barg / 6500 psig) max Qualified over-pressure rating: (2 x operating pressure) 90 MPa (900 barg / 13053 psig)	
Flow Rate	1 to 5 Nl/min (2.1 to 10.6 scfh) mounted in standard sampling block 0 to 10 m/sec (0 to 32.8 fps) direct insertion	
Temperature Coefficient	Temperature compensated across operating temperature range	
Mechanical Specifications		
Ingress Protection	IP66 in accordance with standard BS EN60529:1992 NEMA 4 in protection accordance with standard NEMA 250-2003	
Housing Material	316 stainless steel	
Dimensions	Transmitter plus connector: L=132mm x ø 45mm (5.19" x ø 1.77")	
Filter (Sensor Protection)	Standard: HDPE Guard < 10µm Optional: 316 stainless steel sintered guard < 80µm	
Process Connection & Material	3/4" - 16 UNF 316 stainless steel	
Weight	150g (5.29oz)	
Interchangeability	Fully interchangeable transmitter	
Electrical Connection	Hirschmann GDS series (DIN 4350-C)	
Diagnostic Conditions (factory programmed)	**Condition** Sensor fault Under-range dew point Over-range dew point	**Output** 23 mA 4 mA 20 mA

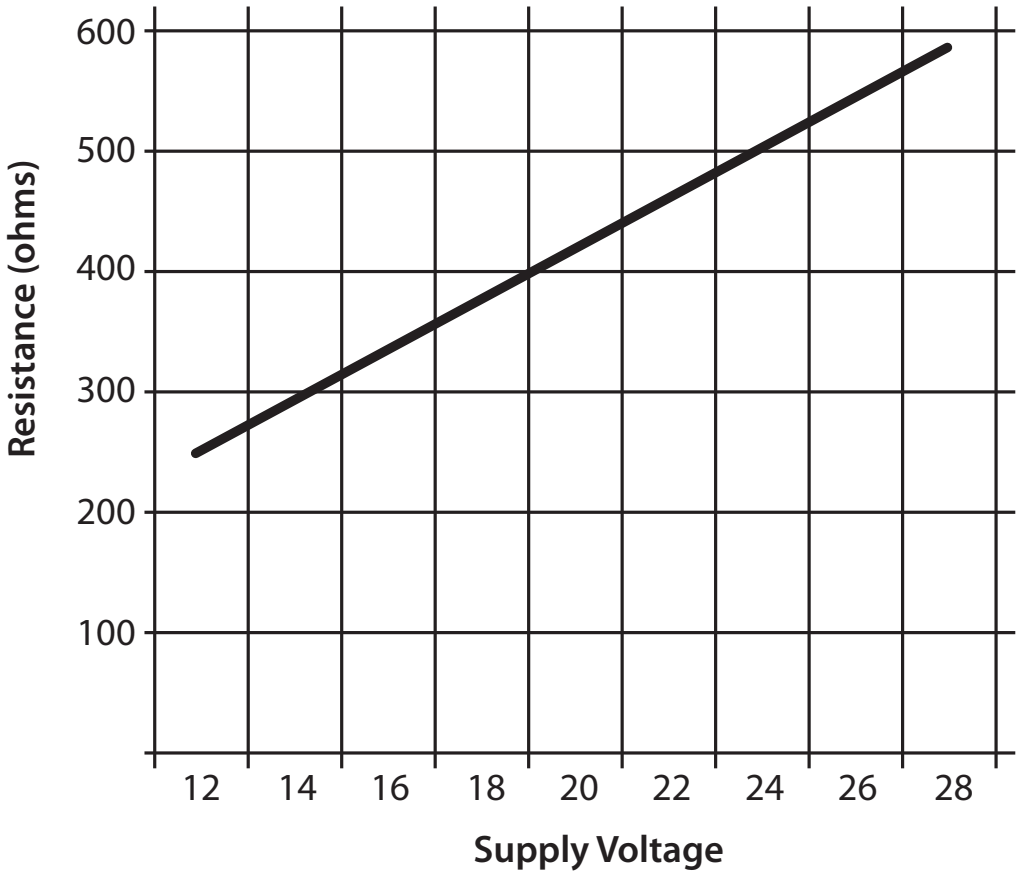


Figure 10 *Maximum Load of Easidew 34 - Including Cable Resistance*

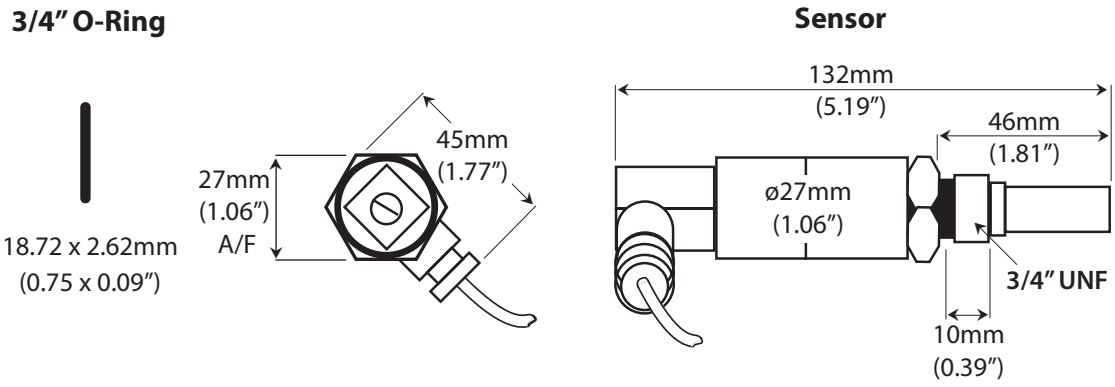


Figure 11 *Dimensions - Easidew 34*

Appendix B

EC Declaration of Conformity

Appendix B EC Declaration of Conformity

EU Declaration of Conformity

MICHELL Instruments

Manufacturer: **Michell Instruments Limited**
48 Lancaster Way Business Park
Ely, Cambridgeshire
CB6 3NW. UK.

CE

On behalf of the above named company, I declare that, on the date that the equipment accompanied by this declaration is placed on the market, the equipment conforms with all technical and regulatory requirements of the listed directives.

Easidew & Easidew 34 Dewpoint Transmitter

and complies with all the essential requirements of the EU directives listed below.

2004/108/EC EMC Directive

and (effective from 20th April 2016)
2014/30/EU EMC Directive

and (effective from 22nd July 2017)
2011/65/EU Restriction of Hazardous Substances Directive (RoHS2)
RoHS2 EU Directive 2011/65/EU (Article 3, [24]) states, *"industrial monitoring and control instruments means monitoring and control instruments designed exclusively for industrial or professional use".* (mandatory compliance effective date 22nd July 2017).

and has been designed to be in conformance with the relevant sections of the following standards or other normative documents.

EN61326-1:1997	Electrical equipment for measurement, control and laboratory use – EMC requirements –Class B (emissions) and Industrial Locations (immunity).
EN61010-1:2010	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

Andrew M.V. Stokes, Technical Director

April 2016

EUD EA & EA34 Issue 02

Appendix C

Quality, Recycling & Warranty Information

Appendix C Quality, Recycling & Warranty Information

C.1 Pressure Equipment Directive (PED) 97/23/EC

The above Directive has been implemented in United Kingdom Law by the Pressure Equipment Regulations 1999.

The Regulations require that all pressure equipment and assemblies within the scope of the Pressure Equipment Directive must be safe when placed on the market or put into service.

Michell Instruments' products have been assessed and, as referenced against the Classification Charts detailed in Annex II of the Directive, do not fall into the requirements for CE marking compliance with the Pressure Equipment Directive.

Article 3, paragraph 3 states that any product containing a pressurized fluid that does not qualify for compliance should, nevertheless, be constructed with Sound Engineering Practice (SEP).

Michell Instruments attests here that its products have been designed, manufactured & tested to assure safe operation, and in accordance with Sound Engineering Practices.

C.2 Recycling Policy

Michell Instruments is concerned with the protection of the environment. It is our commitment to reduce and eliminate from our operations, wherever possible, the use of substances which may be harmful to the environment. Similarly, we are increasingly using recyclable and/or recycled material in our business and products wherever it is practical to do so.

To protect natural resources and to promote material reuse, please separate batteries from other types of waste and recycle responsibly. If batteries are not properly disposed of, these substances can cause harm to human health and the environment.

The product that you have purchased may contain recyclable and/or recycled parts and we will be happy to provide you with information on these components if required. For further information please see the following sections.

C.3 WEEE Compliance

Directive 2012/19/EU 4 July 2012 on Waste Electronic and Electrical Equipment (WEEE)

The Waste Electronic and Electrical Equipment (WEEE) Directive places rules upon European manufacturers of electrical and electronic equipment. The directives' aim is to reduce the impact that electronic devices have on the environment.

Michell Instruments is in full compliance with the WEEE Directive and is registered with an approved recycler (Registration No. WEE/JB0235YW) and treats the requirement of the directive and the protection of the environment with the utmost importance. All Michell Instruments' products are appropriately marked indicating their requirement for recycling.

It may be required to return certain instruments for treatment at the end of their working life.

Feb 2013

C.4 RoHS2 Compliance

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011

The Restriction of Hazardous Substances (RoHS) Directive places rules upon European manufacturers of electrical and electronic equipment. The directives' aim is to reduce the impact that electronic devices have on the environment.

According to the EC Directive 2002/95/EC, Michell Instruments' products qualify as Category 9, Control and Monitoring Equipment. Under the 2002/95/EC Directive, Category 9 products are exempt from compliance with the Directive.

However, the careful design of all Michell Instruments' products takes into consideration the requirements of the Directive and, wherever possible, compliance is achieved. All future products will be developed entirely using compliant materials. Furthermore, Michell Instruments is taking active steps to remove non-compliant materials and components from existing products wherever these may occur. Presently, none of the non-compliant materials are known to occur in Michell Instruments' products.

The new Directive 2011/65/EU (RoHS2) entered into force on 21 July 2011 and required all Member States to transpose the provisions into their respective national laws by 2 January 2013.

Under the provisions of the RoHS2 EU Directive 2011/65/EU (Article 3, [24]) defines 'Control and Monitoring Equipment' specifically as 'monitoring and control instruments designed exclusively for industrial or professional use'.

RoHS2 EU Directive 2011/65/EU states the closing date for compliance of any Control and Monitoring Equipment product sold into the EU market place as 22nd July 2017.

However, the careful design policy of all Michell Instruments' products continues to attain compliance in the shortest practical timescales and strives to ensure that less than 0.1% of total mass per product, of all non-compliant materials, appear within them. Michell Instruments continues to monitor suppliers and material sources to ensure that compliance of goods provided is maintained.

January 2013

C.5 Warranty

Unless otherwise agreed, the Supplier warrants that, as from the date of delivery for a period of 12 months, the goods and all their component parts, where applicable, are free from any defects in design, workmanship, construction or materials.

The Supplier warrants that the services undertaken shall be performed using reasonable skill and care, and be of a quality conforming to generally accepted industry standards and practices.

Except as expressly stated, all warranties whether express or implied, by operation of law or otherwise, are hereby excluded in relation to the goods and services to be provided by the Supplier.

All warranty services are provided on a return to base basis. Any transportation costs for the return of a warranty claim shall reside with the Customer.

C.6 REACH Compliance

Regulation (EC) No. 1907/2006
Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

Michell Instruments is a manufacturer of moisture measurement and gas analysis instrumentation and is a 'downstream' user of chemicals, as described by the EU Council Directive 76/769/EEC. The products we supply are not raw chemical products (goods).

Under normal and reasonably foreseeable circumstances of application, the goods supplied to you shall not contain or release any prohibited chemicals. No listed SVHC (Substances of Very High Concern) appear within products manufactured by Michell Instruments. Therefore the 0.1% mass per product, or total usage of 1 tonne/year, will never be exceeded. For these reasons we are neither required by obligation for registration nor for the creation of material safety data sheets (MSDS) for our products.

Our continued review of the SVHC Candidate List and latest additions is to ensure we remain compliant.

Michell Instruments maintains a hazardous material register in which MSDS data sheets are collated, and we will check that our suppliers will comply to REACH requirements for all materials and substances we use in the processes of our manufacturing.

In the unlikely event that any chemicals of concern appear in our products in quantities greater than 0.1% of total mass per product we will immediately inform you by correspondence according to the REACH Article 33 requirements. Our current appraisal is, however, that we do not expect or foresee such an incidence.

January 2013

C.7 Calibration Facilities

Michell Instruments' calibration facilities are among the most sophisticated in the world and have been recognized for their excellence.

Traceability to the National Physical Laboratory (NPL) UK is achieved through our UKAS Accreditation (Number 0179). This covers dew point over the range -90 to +90°C (-130 to +194°F) and also Relative Humidity.

Dew-point calibrations are also traceable to the National Institute for Standards & Technology (NIST) USA over the range -75 to +20°C (-103 to +68°F).

NOTE: Standard traceable calibration certificates for instruments and sensors are not issued under our UKAS accreditation. UKAS certificates are usually to special order and are clearly identified.

C.8 Return Policy

If a Michell Instruments' product malfunctions within the warranty period, the following procedure must be completed:

1. Notify a Michell Instruments' distributor, giving full details of the problem, the model variant and the serial number of the product.
2. If the nature of the problem indicates the need for factory service then the instrument should be returned to Michell Instruments, carriage prepaid, preferably in the original packaging, with a full description of the fault and the customer contact information.
3. Upon receipt, Michell Instruments will evaluate the product to determine the cause of the malfunction. Then, one of the following courses of action will be taken:
   - If the fault is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
   - If Michell Instruments determines that the fault is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs, at standard rates, will be provided. Upon receipt of the owner's approval to proceed, the product will be repaired and returned.

C.9 Manufacturing Quality

Michell Instruments is registered with the British Standards Institute for Quality Assurance to:

BS EN ISO 9001: 2008

Rigorous procedures are performed at every stage of production to ensure that the materials of construction, manufacturing, calibration and final test procedures meet the requirements laid down by our BSI approved Quality System.

Please contact Michell Instruments (www.michell.com) if the product does not arrive in perfect working order.

Appendix D

Return Document & Decontamination Declaration

Appendix D Return Document & Decontamination Declaration

Decontamination Certificate

IMPORTANT NOTE: Please complete this form prior to this instrument, or any components, leaving your site and being returned to us, or, where applicable, prior to any work being carried out by a Michell engineer at your site.

Instrument			Serial Number	
Warranty Repair?	YES	NO	Original PO #	
Company Name			Contact Name	
Address				
Telephone #			E-mail address	
Reason for Return /Description of Fault:				

Has this equipment been exposed (internally or externally) to any of the following? Please circle (YES/NO) as applicable and provide details below		
Biohazards	YES	NO
Biological agents	YES	NO
Hazardous chemicals	YES	NO
Radioactive substances	YES	NO
Other hazards	YES	NO

Please provide details of any hazardous materials used with this equipment as indicated above (use continuation sheet if necessary)		
Your method of cleaning/decontamination		
Has the equipment been cleaned and decontaminated?	YES	NOT NECESSARY

Michell Instruments will not accept instruments that have been exposed to toxins, radio-activity or bio-hazardous materials. For most applications involving solvents, acidic, basic, flammable or toxic gases a simple purge with dry gas (dew point <-30°C) over 24 hours should be sufficient to decontaminate the unit prior to return.
Work will not be carried out on any unit that does not have a completed decontamination declaration.

Decontamination Declaration

I declare that the information above is true and complete to the best of my knowledge, and it is safe for Michell personnel to service or repair the returned instrument.

Name (Print)		Position	
Signature		Date	

MICHELL Instruments

F0121, Issue 2, December 2011

http://www.michell.com