



# SF52

## Dew-Point Transmitter

### User's Manual



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## SF52

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## **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 up to 20 bar (290 psi) maximum.

### **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 Appendix C 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 Benelux BV, for re-calibration.

### **Safety Conformity**

This product meets the essential protection requirements of the relevant EU directives. Further details of applied standards may be found in the product specification.

## Abbreviations

The following abbreviations are used in this manual:

bar	pressure unit (=100 kP or 0.987 atm)
°C	degrees Celsius
°F	degrees Fahrenheit
DC	direct current
Dp	Dew point
g	grams
g/m <sup>3</sup>	grams per cubic meter
gr/ft <sup>3</sup>	grains per cubic foot
m	meter(s)
mA	milliampere
mm	millimetres
psi	pounds per square inch
%	percentage
oz	ounces
RH	relative humidity
V	Volts
+ve	positive
"	inches
'	feet

## 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.

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.

## WEEE And RoHS Compliance

The Waste Electronic and Electrical Equipment (WEEE) Directive, and the Restriction of Hazardous Substances (RoHS) Directive place 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 products are currently exempt from the RoHS directive, however all future products will be developed entirely using compliant materials. Furthermore, Michell is taking active steps to remove non-compliant materials and components from existing products wherever possible.

Michell is in full compliance with the WEEE Directive (Registration No. WEE/JB0235YW). Customers may be required to return certain instruments for treatment at the end of their working life.

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## 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 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.

## Return Policy

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

Notify a Michell Instruments' representative, giving full details of the problem, the model variant and the serial number of the product.

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.**

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.

## **1 Introduction**

The SF52 dew-point transmitter from Michell Instruments can provide 4-20mA or voltage signal for either dew point or absolute humidity with excellent accuracy and linearity.

The robust housing, together with an operating pressure of up to 20 bar (290 psi), makes the SF52 ideal for many dew-point and moisture measurement applications.

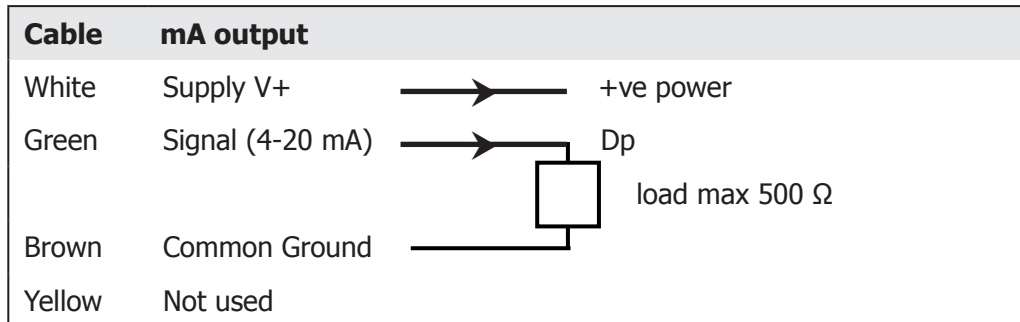
### **1.1 Features**

- Dew-point or absolute humidity outputs
- Current or voltage output signals
- Excellent linearity and temperature compensation
- IP65
- Excellent sensor protection
- Fast response
- Small size
- Digital recalibration (ask local distributor for more details)



## 2 Preparation for use

### 2.1 Electrical Connections



Cable	Voltage output
White	→ +ve power
Green	→ Signal (Voltage) Dp
Brown	→ Common Ground
Yellow	→ Not used

**Figure 2.1** Electrical Connections

### 2.2 Installation

Prior to installation of the sensor, ensure that hands are clean in order to prevent contamination

**NOTE: DO NOT TOUCH THE FILTER DISC**

The SF52 can be mounted into either a flow-through sensor sampling block (optional extra) or directly inserted into a pipe or duct and can be operated at pressures of up to 2 MPa (20 bar / 290 psi) when fitted with the bonded seal provided.

The recommended gas flow rate, when mounted in the optional sampling block, is 1 to 5 l/min (2.1 to 10.6 scfh). However, for direct insertion applications, gas flow can be from static to 10 m/sec (353 scfs).

**Tighten the sensor finger-tight, ensuring the cable does not snag. Then, using a 24mm A/F spanner/wrench, tighten to fully compress bonded seal (~ 30.5 Nm [22.5 ft-lbs]).**

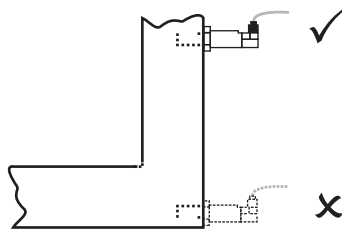
### 3 OPERATION

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:

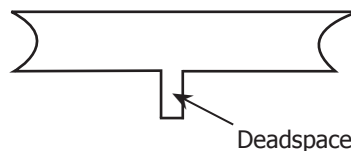
The sample point should be as close to the critical measurement point as possible. Also, never sample from the bottom of a pipe as entrained liquids may be drawn into the sensing element.



**Figure 4.1** 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 4.2** 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.

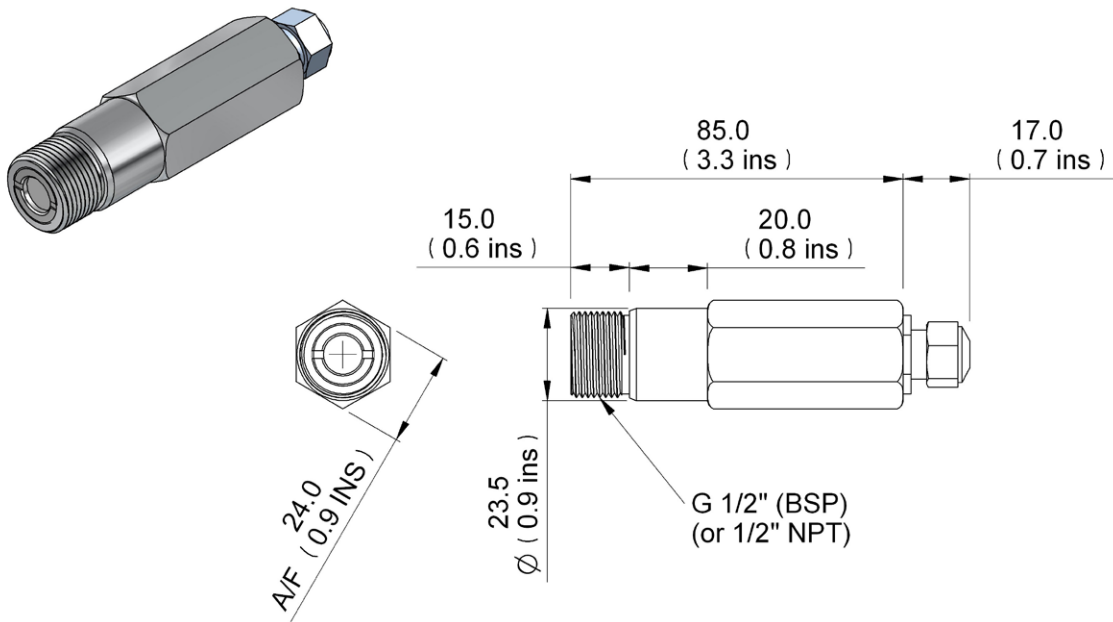
# Appendix A

## Technical Specifications

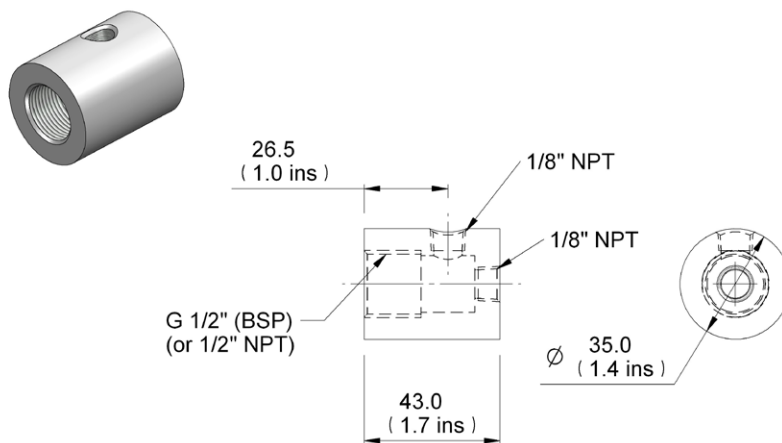
## Appendix A Technical Specifications

<b>Performance</b>	
<b>Measurement range (dew point)</b>	-40 to +60°C (-40 to +140°F), dew-point temperature
<b>Measurement range (absolute humidity)</b>	0 to 200 g/m <sup>3</sup> (0 to 87.4 gr/ft <sup>3</sup> )
<b>Accuracy (dew point)</b>	±2°C (±3.6°F) dew point
<b>Accuracy (absolute humidity)</b>	0.4 to 3 g/m <sup>3</sup> (0.175 to 1.311 gr/ft <sup>3</sup> ) on value of absolute humidity
<b>Stability</b>	<1°C / year (<1.8°F / year)
<b>Response time</b>	<10 sec typical (for 90% of the step change)
<b>Electrical output/input</b>	
<b>Output signal</b>	0–1, 0–5, 0–10 V or 4–20 mA
<b>Supply voltage</b>	14–30 V DC (for 0–10 V output) 8–30 V DC (for 0–1 / 0–5 V / 4–20 mA output)
<b>Current consumption</b>	9 mA + load current
<b>Supply voltage influence</b>	±0.005% RH/V
<b>Operating conditions</b>	
<b>Operating temperature</b> Probe, Housing Storage	-30 to +85°C (-22 to +185°F) -40 to +85°C (-40 to +185°F)
<b>Operating pressure</b>	20 bar (290 psi) maximum
<b>Temperature coefficient</b>	Temperature compensated across operating temperature range
<b>Mechanical specification</b>	
<b>Ingress protection</b>	IP65
<b>Housing material</b>	Nickel-coated brass
<b>Dimensions</b>	L=85mm, ø24mm (L=3.34", ø0.94") (max)
<b>Filter</b>	HDPE front filter
<b>Weight</b>	320g (11.29oz)
<b>Mechanical connections</b>	G ½" BSP (DIN ISO 228) or ½" NPT
<b>Cable</b>	2m (6.5')

**A1**                      **Dimensions**



**Figure A1**    *Dimensions of the SF52*



**Figure A2**    *Dimensions of the Sample Block*

# Appendix B

## Recommended Practices in Humidity Measurements

## Appendix B Recommended Practices in Humidity Measurements

The following text is reproduced with kind permission from the National Physical Laboratory. It is originally published in the booklet, *A Guide to the Measurement of Humidity*.

### Definition of Relative Humidity

**Relative Humidity** – The ratio of the actual vapor pressure to the saturation vapor pressure over a plane liquid water surface at the same temperature, expressed as a percentage. This is commonly understood when the term 'X percent relative humidity' is used.

For actual vapor pressure,  $e$ , and saturation vapor pressure,  $e_s$

$$\text{relative humidity (in \%)} = \frac{e}{e_s} \times 100$$

**USAGE:** The phrase 'relative humidity' is commonly abbreviated RH although this is not a recognized abbreviation. Values of relative humidity are commonly expressed in units of percent relative humidity (% RH).

### Recommended practices in humidity measurements

#### General practical recommendations

- Where relative humidity is of interest, a direct measurement of relative humidity is usually best. Where an absolute measure of humidity is needed, choose dew point, vapor pressure or similar measurements.
- Establish the measurement requirements at the purchasing stage in order to have the right instrument for the job.
- Allow hygrometers to equilibrate in any new environment. This is particularly necessary after changes in temperature due to transportation or storage. Depending on the instrument and on how great the change in conditions, this may require from only a few minutes to many hours.
- Follow Michell Instruments' care instructions for the instrument. Some instruments need routine cleaning or other maintenance. Before using any solvent cleaner, check with Michell Instruments that this will not harm the sensor or other materials of construction.
- Wherever possible, ensure that hygrometers are calibrated under the conditions of use, i.e. at similar values of humidity and temperature, and (if relevant) in similar conditions of pressure, airflow, etc.
- Keep a record of calibrations and any adjustments to the hygrometer. This will show the long-term stability of the instrument and allow the associated uncertainty to be assessed.
- Check instruments, if possible, at intervals between calibrations, by comparison with another (stable) instrument, to monitor for long-term drift. Routine checks are also useful before and after subjecting an instrument to transportation or other stress, which might lead to a shift in its performance. Where the check is against two (or more) instruments this is even better: not only does this add confidence, but in the event of one instrument drifting among a set of three, it can be seen which reading is most suspect.
- Cleanliness of the environment will affect different hygrometers in different ways. Dust and airborne droplets should be avoided or filtered out if possible. Contaminants can come from the most surprising sources, ordinary urban pollution, for example.

- The readings given by some types of hygrometer are sensitive to gas type. For any Instrument which reads in terms of mass per unit volume, e.g. in grams per cubic metre, it must be confirmed whether the calibration is valid for the gas in use.
- Avoid using instruments in direct sunlight or near any other source of heat, unless they are suitably shielded to prevent measurement errors.

### Sampling in general

- Relative humidity measurements should be carried out at a representative temperature. Failure to allow temperature equilibration will lead to a false indication of the relative humidity.
- Variations in vapor pressure from place to place can occur where an environment is subject to any addition or removal of water. If so, care must be taken over where to make a measurement in order to obtain a representative result.
- Sources and sinks of water vapor should be avoided in any sampling system. Invasion of stray water can be minimised by attention to leaks, hygroscopic materials, droplets and condensation. The lower the humidity, the more critical these precautions are.
- Hygroscopic materials should be avoided. Many materials contain moisture as part of their structure, particularly organic materials (whether natural or synthetic), salts (or anything which contains them), and anything which has small pores. Temperature changes can increase the tendency of these materials to affect the humidity of the surrounding air.
- Condensation in a sampling process can invalidate humidity measurements by reducing the water content of the gas being measured. What is more, condensed liquid may alter the humidity elsewhere by dripping or running to other locations and evaporating there. In these circumstances, measurement results may be misleading if hygrometer location is not considered carefully.
- Water droplets or mist must be avoided. These can result in overestimates of the humidity of the air between the droplets. Such results may exceed 100% RH, or may be impossible to interpret meaningfully. Droplets of liquid also damage some electrical types of humidity sensor. Filtering the air sample can eliminate droplets.
- If pumps are used for sampling gas, these should be located after the hygrometer, to avoid contaminating the measurement environment. Where possible, oil free pumps should be used, or filters employed. Oscillations in pressure due to pumping can sometimes be reduced or buffered using a needle valve or a reservoir of large volume.
- Special treatments such as filtration can change the amount of moisture in a gas. Some drying agents take out other gases, too
- When sealing any sensor or probe into a port or manifold in a duct or chamber, leaks through the probe or electrical cable should be considered. These are not always sealed against passage of ambient air.
- Where sampling involves a step change in temperature, pressure or gas flow rate, relative to the process being sampled, results may need to be converted or interpreted. For example 'pressure dew point' will differ from the value found after expanding the gas sample to atmospheric pressure. Care should be taken to distinguish between 'gauge' and absolute values of pressure.

### Dew point in general

- The measuring environment and all parts of the sampling pathway must be kept above the dew point if condensation is to be avoided. Electrical trace heating or other heating methods should be used if necessary. An excess temperature of 10°C above the dew point is usually a safe margin.
- For measurements in the region below 0°C it must be clear whether the condensate is dew or frost. Failure to distinguish between these can result in errors of about 1°C for every 10°C below zero.



### Relative humidity in general

- Due care must be taken of temperature. The effect of temperature on humidity is highly significant. Failure to take this into account can sometimes lead to errors so large that the measurement is meaningless. In many situations, the largest single source of uncertainty in a humidity measurement is the effect of temperature differences from place to place in the process, room or chamber. The importance of considering the temperature effects carefully cannot be overstated when relative humidity is the parameter of interest.
- Care must be taken when expressing uncertainties, changes or fractional differences in relative humidity. For example, the difference between 50% RH and 52% RH is 2% RH. This can also be expressed as a difference of 4% of value. It is important to distinguish clearly between these two kinds of statement.

### Recommendations specific to ranges of measurements

- Ambient humidity - Avoid using hygrometers near the body, which is a source of heat and moisture. Do not breathe close to the measurement.
- High humidity, above the ambient range - Ample lines should be maintained above the dew point of the gas being measured, to avoid condensation. Electrical trace heating is often the most practical method.
- Low humidity, and very dry gases - If possible, prepare for measurements by flushing sample lines and hygrometers with dry gas, or by evacuating to low pressure. Drive off stray residual water by baking assemblies if possible (but not instruments – unless designed for this!). The lower the moisture content to be measured, the more dramatically the required drying time multiplies.
- Avoid hygroscopic materials. At low humidity (anything much below a dew point of 0°C) the amounts of water given off by organic and porous materials can dramatically affect the value of humidity. The lower the level of moisture, the more significant the effects.
- Choose impermeable materials, to avoid inward diffusion of moisture through sampling tubes and enclosures. Steel and other metals are practically impermeable. PTFE ('Teflon') is only slightly permeable and will usually be satisfactory for dew points above -20°C, and sometimes below this level. Materials such as PVC and rubber are relatively permeable and so totally unsuitable at low humidity, and not really satisfactory in any humidity range.
- Surface finish of pipework is important for very dry gases. Even the tiny quantities of water adsorbed on the surfaces of non-hygroscopic materials can have significant effect. Polished or electropolished steel is recommended for the best results.
- Clean environments are always best for humidity measurements, but this is especially critical at very low humidity. Even fingerprints harbour water. High purity cleaning agents are recommended: Analytical Reagent (AR) quality solvents for oil-based contaminants, and purified water (distilled or de-ionised) for salts. Cleaning should be followed by thorough drying by a clean method.
- Sample tubing should be as short in length as possible. The surface area should be minimised by using the narrowest tubing that the flow conditions will permit.
- Avoid leaks. Minimising the number of connections (elbows, tees, valves, etc.) helps with this.
- Adequate flow of the gas sample should be ensured, to minimise the influence of sources of stray water in the flow path.
- 'Dead ends' should be avoided, as they cannot easily be flushed.
- Back-diffusion of moisture should be minimised, e.g. by fast flow rates of gas, long exhaust tubes after the sensor, or by valves which isolate the low-humidity region from ambient air.

## Practical recommendations for specific types of hygrometer

### Relative humidity capacitive sensor

- Care should be taken to avoid mechanical shock (impact) or thermal shock (sudden temperature changes). Sensors should be protected from steam or water sprays, and from direct sunlight.
- Where a sensor is at risk of exposure to dust, droplets, or the occasional knock during handling, the appropriate guard or filters for the sensor head should be used.
- Any temptation to breathe on the sensor, or to wave it over cups of tea, etc. should be resisted. Filters and saturation guarding may protect the sensor, but these actions carry a risk of damage by condensation or other contamination.
- Protective filters can slow the response time of sensors. This can be avoided by removing any filter, but the benefit must be weighed against the risk of damage to the sensor.
- Sensors should not normally be submerged in liquids. In the case of a resistive (electrolytic) sensor, water or other liquids would certainly damage the sensor beyond repair.
- Salt solutions are especially commonly used for calibration of electrical sensors, and should be provided with traceability directly or via a calibrated hygrometer. Protection of sensors from direct contact with salt or solution is most important as contamination would destroy or seriously impair the sensing element.

# Appendix C

## List of Worldwide Michell Instruments' Offices

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