

# Introduction

The measurement of Water Activity, or Equilibrium Relative Humidity, as it is sometimes known, is a key parameter in the quality control of any moisture sensitive product or material.

ROTRONIC has designed and manufactured instruments for the measurement of Water Activity for over 30 years. Our product range is based on our comprehensive application experience, which when combined with the very latest digital technology and software, offers the user the ideal combination of features, performance and competitive pricing.

## Why is water activity measured?

Water activity	Contaminant
aw = 0.91...0.95	most bacteria
aw = 0.88	most yeast
aw = 0.80	most mildew
aw = 0.75	halophile bacteria
aw = 0.70	osmiophile yeast
aw = 0.65	xerophile mildew

Water activity defines the active part of a product's moisture content, or 'free' water. It influences the microbiological, chemical and enzymatic stability of perishable products such as foods, grain and seeds. The table shows typical growth thresholds below which the specified contaminant cannot replicate, and therefore spoil the product. Control of water activity therefore has a significant impact on shelf life. For similar reasons, water activity is equally relevant in the pharmaceutical industry where it also provides useful information regarding properties such as the cohesion of tablets, agglomeration of powders, and adherence of coatings.

## Key features

- Wide operating range
- Aw Quick mode
- High measurement precision
- Long-term stability
- Interchangeable measurement stations
- Multi channel display units
- Validated PC analysis software

## Your benefits

- ▶ Suitable for any product or application
- ▶ Results in 4...6 minutes
- ▶ Reliable data every time
- ▶ Reduced maintenance and calibration
- ▶ Simple calibration and maintenance
- ▶ 2 or 4 simultaneous measurements
- ▶ Secure data acquisition and data handling

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### HygroLab Laboratory Display Units/Analysers

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- Digital technology
- Multiple probes inputs
- Networkable
- Validated, easy to use software
- Integrated AW Quick function



### HygroPalm AW Portable Analysers

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- Digital technology
- Integrated AW Quick function
- Measurement sets



### HygroClip water activity stations and probes

86-87

- Wide range of measurement options to suit any application
- Digital calibration
- 100% interchangeable without adjustment



### Accessories for Water Activity measurement

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- Sample holders
- Disposable sample containers

### Water Activity Theory and reference, Technical Data

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- What is water activity?
- Water activity or moisture content?

# Water Activity Applications



Food industry – cheese



Building materials



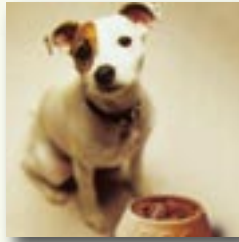
Tobacco Industry



Bakery products



Food industry – meat products



Petfoods – its important our best friends eat well!



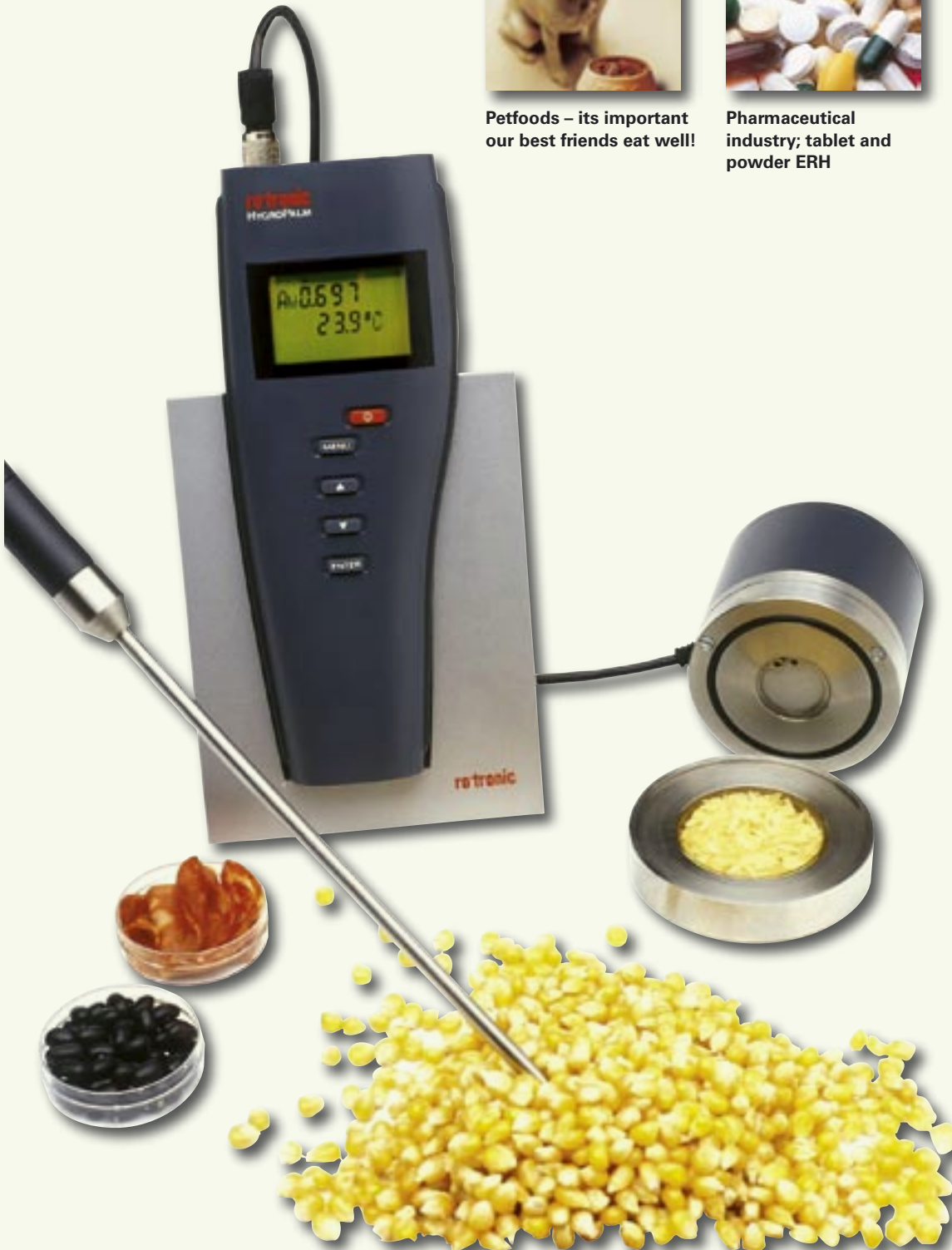
Pharmaceutical industry; tablet and powder ERH



Paper manufacturing, converting, storing and printing



Horticulture – seeds – prevention of germination during storage



## Introducing Water Activity Products

The ROTRONIC range of water activity instruments uses the latest digital technology to introduce new levels of measurement performance, application flexibility and new features. Multiple probe inputs, PC based data handling, instrument networking, software based calibration, and interchangeable measurement stations are just some of the features included in our latest range.

The humidity sensors used in our measurement probes have an enviable reputation for precision and reliability. Their performance is now augmented by software based analysis modes and new developments in mechanical probe design. These combine to achieve consistently high levels of performance with significantly reduced sampling times, and extremely cost effective pricing. Our range of water activity measurement stations and probes feature the HygroClip digital signal processing technology, including signal transmission and calibration. This produces a significant gain in accuracy, data integrity and stability, as well as convenient features such as simplified PC based configuration, data acquisition and calibration using easy-to-use Windows software.

Bench top display instrumentation is also now complemented by a handheld portable solution; using the same high precision measurement technology to ensure consistently precise results and full interchangeability between laboratory and production data.



### HygroLab

HygroLab is a range of three high quality benchtop display instruments for the laboratory environment. HygroLab 1 is a cost effective 2 channel instrument with measurements displayed in %rh and °C units. HygroLab 2 has 4 probe inputs plus the option to display measurements in aw units, and an RS232 interface for display, data acquisition or configuration.

HygroLab 3 is the flagship of our range, with all the features of the HygroLab 2, plus the addition of Aw Quick which has specialised features specific to water activity analysis including rapid equilibrium in typically 5 minutes or less, plus automatic capture of final values.



### HygroPalm AW1

In some instances, the ability to measure water activity in production or storage environments can be very useful. For example, when bulk deliveries are received, they can be checked on receipt to make sure that supply specifications are met.

The new HygroPalm AW1 has been specially configured to offer the key functions of the HygroLab 3, including Aw Quick in a portable package.

### Aw Quick

Aw Quick is advanced software for water activity analysis which is either integrated within the HygroLab 3 or HygroPalm AW1 display instruments, or can be run on a PC connected to a HygroLab. Aw Quick provides the user with final measurement results in typically five minutes or less, or can run a conventional water activity analysis with automatic detection and capture of equilibrium values.



## HygroLab Feature Overview

**LC Display:**  
Includes probe input indicator,  
three line numeric display with  
trend indicator.

**MENU:**  
Press this key to activate  
the functions menu

**Probe for paste-like  
and solid products**

Up to 32 HygroLab 2 + 3  
instruments can be networked  
together. 128 measurement  
probes controlled by one PC!

**UP/DOWN:**  
Changes displayed probe  
and navigates.

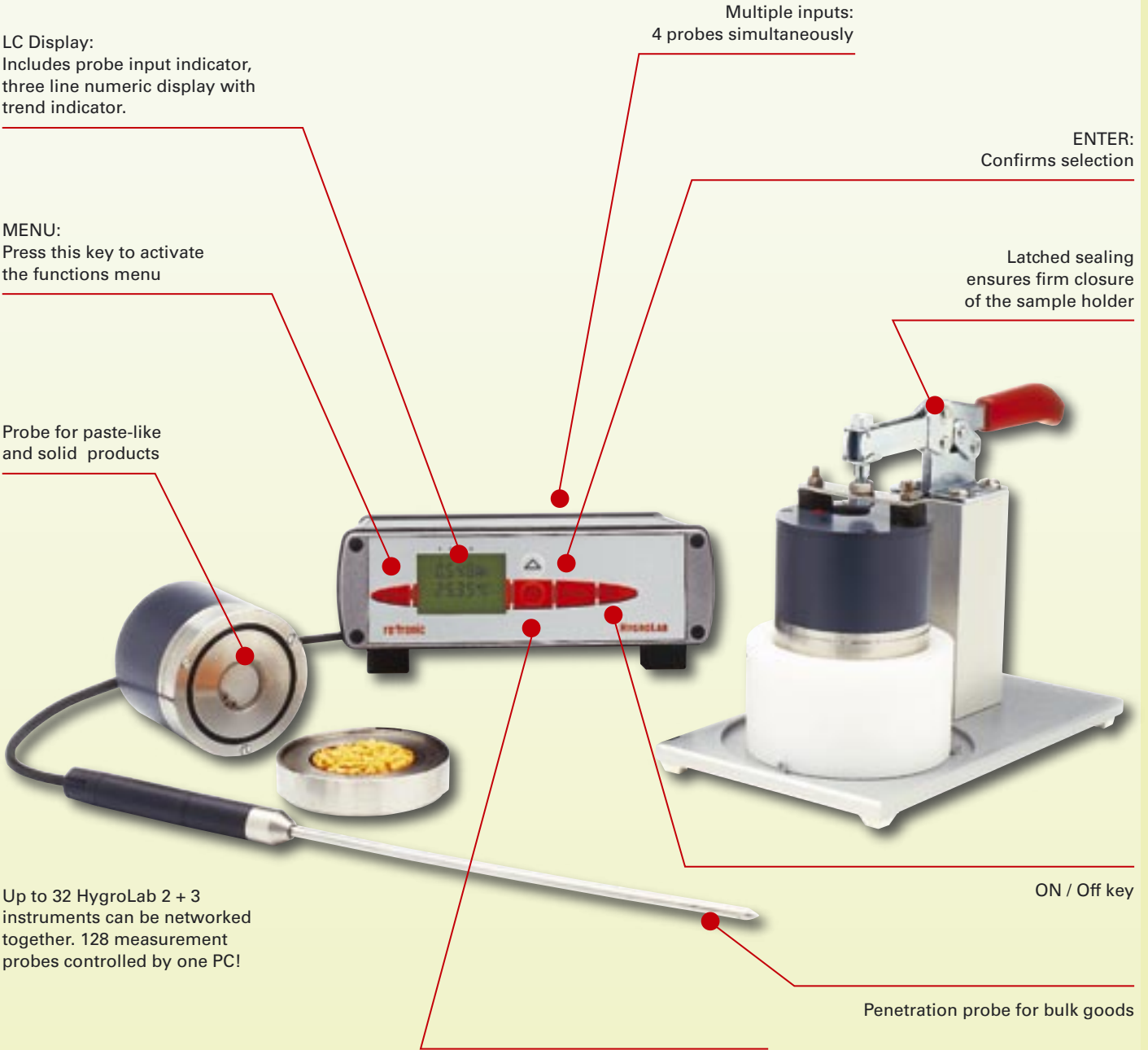
**Multiple inputs:**  
4 probes simultaneously

**ENTER:**  
Confirms selection

**Latched sealing**  
ensures firm closure  
of the sample holder

**ON / Off key**

**Penetration probe for bulk goods**



# HygroLab



## HygroLab 1:

Basic two-probe bench top indicator of %rh & °C.

### Key features:

- Accepts 2 ROTRONIC digital or analogue probes
- Display of % relative humidity and temperature
- Software-based probe calibration (1-point or multi-point)



### Order code:

HygroLab 1



## HygroLab 2:

Bench-top display instrument with four probe inputs, display in Aw units, %rh and °C. Ideally suited for climatic cabinets

### Key features:

- Accepts 4 ROTRONIC digital or analogue probes
- Full psychrometric calculations
- Software-based probe calibration (1-point or multi-point)
- Can use one of the four probes as a reference to perform a 1-point adjustment of the other probes
- RS232 interface for PC running HW3 software
- RS485 interface for networking instruments together
- Optional analogue outputs
- Optional: Accelerated water activity measurement with up to 4 probes (AwQuick mode): allows the measurement of most products in typically 5 minutes; requires HW3 software



### Order code:

HygroLab 2

HygroDATA Lab      Software HW3 and RS cable

HygroData Quick:    Aw Quick function



## HygroLab 3

Water activity analyser with four probe inputs and integrated AW Quick.

### Key features:

- Accelerated water activity measurement with up to 4 probes: (AwQuick mode): allows the measurement of most products in typically 5 minutes
- Full equilibration measurement with up to 4 probes (Standard mode) with automatic detection of equilibrium conditions
- Accepts 4 ROTRONIC digital or analogue probes
- Full psychrometric calculations
- Software-based probe calibration (single-point or multi-point)
- Can use one of the four probes as a reference to make a 1-point adjustment of the other probes
- RS232 interface for PC running HW3 software
- RS485 interface for networking instruments together
- Audible signal when measurement is terminated

### Order code:

HygroLab 3



## HW3 Software

The HW3 software package has a comprehensive range of functions which are compatible with the HygroLab.

### Order code:

HygroDATA Lab      Software HW3 and RS232 cable

See chapter HW3 Software for full information.

# HygroPalm AW1

## HygroPalm AW1

The HygroPalm AW1 is a portable instrument specifically configured for the measurement of water activity. It includes many of the advanced features of the HygroLab, including the Aw Quick mode for results in 4 – 6 minutes. This makes it perfectly suited for users who wish to perform water activity analysis in production, goods receiving or storage areas where portable instrumentation is more convenient.

### Key features:

- Accelerated water activity measurement: (AwQuick mode): allows the measurement of most products in typically 5 minutes
- Full equilibration measurement (Standard mode) with automatic detection of equilibrium conditions
- Single digital probe input
- Single or multiple point digital calibration directly with the keypad
- Aw display units
- Available as a set with carry case
- Optional docking station for battery charging or mains operation

### Order code:

HygroPalm AW1

PD 1                      Docking Station for AW1 with connector  
for AC1207 power adaptor

AC1207                  Power adaptor



## HygroPalm AW1 Sets

For on-site measurements, or for the first time user, the HygroPalm Aw1 sets are a perfect solution. The sets are supplied in a lightweight but tough ABS carry case, and include all the items required to perform measurements and maintain the instrument.

The difference between the two sets is the size of the sample holder and sample containers. AW1-Set-14 includes the WP-14/PS-14 for sample sizes such as tablets, powders, seeds, powdered spices, tea etc. AW1-Set/40 includes the WP-40/PS-40 for larger samples such as pet food, ore, nuts, beans, etc. (see also "Accessories & Consumables" for more information)



## Order Information

HygroPalm AW1-Set-14	HygroPalm AW1-Set-40	Description
HygroPalm AW1	HygroPalm AW1	Handheld display instrument
AW-DIO	AW-DIO	Measurement probe
WP-14-S	WP-40	Sample holder
PS-14	PS-40	13/6 Sample container
EA35-SCS	EA35-SCS	35 %rh Calibration standards
EA80-SCS	EA80-SCS	80 %rh Calibration standards
EA50-SCS	EA50-SCS	50 %rh Calibration standards
EA10-SCS	EA10-SCS	10 %rh Calibration standards
AC1119	AC1119	Carry case

## Water Activity Probes

Based on HygroClip digital electronics technology for high performance and convenient digital calibration, our selection of probes will suit almost any application. All water activity stations and probes incorporate temperature measurement as standard.



### AW-DIO Water Activity Station

The AW-DIO is a water activity measurement station which measures over the range 0...1 aw (0...100 %rh) and provides a digital output signal to interface with HygroLab and HygroPalm Aw1 display units. Digital calibration can be performed using the display instrument.

Minimised internal volume of the sensor chamber ensures fast equilibrium with all products, and an all metal construction ensures good temperature stability during measurements, with stainless steel used on all critical surfaces. Sample holders, sample containers and a sealing mechanism are detailed in accessories.

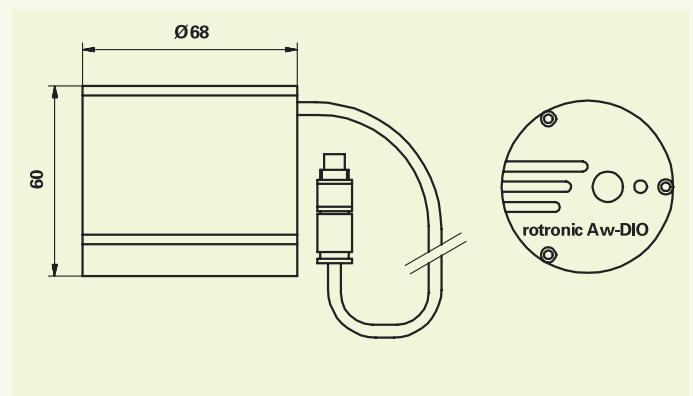
AW-DIO is now the single option for water activity measurements in a sample chamber. It replaces previous products such as the WA-14, WA40, AS-ST, and WAO. It also has superseded the AWVC model with integrated air circulation fan. Through our continuous research and development program we have been able to match or better the equilibrium performance of the ventilated system with our new Aw specific sensor, and improved mechanical design.

Measuring range: 0...100 %rh (0...1 aw), 5...50 °C  
Signal types: ROV Analogue signal, DIO Digital signal

Order code:  
AW-DIO



### Dimensions of AW-DIO probe



### Temperature Control

Stable temperature during measurements can be very important with some products in order to obtain precise results. Our measurement probes are designed with a high thermal mass to prevent variations during measurement, but for the highest precision or where laboratory temperature changes, temperature control solutions are available.

Please contact ROTRONIC or your local distributor for more information.



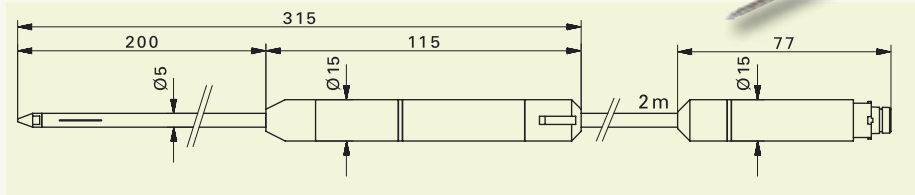
# Water Activity Probes

## HygroClip SP05 Insertion Probe

For direct measurement of water activity in bulk samples. Applications include tablets, gel capsules, grain and plastic granules. HygroClip SP05 features a precisely engineered 5 mm-diameter stainless steel probe with laser cut slots to allow the humidity measurement sensor exposure to water vapour in the air (not suitable for powders or dusty products).

Measuring range: 0...100 %rh (0...1 aw), -40...85 °C  
 Accuracy: ±1.5 %rh / 0.015 aw, ±0.3K  
 Signal types: ROV Analogue signal, DIO Digital signal

**Order code:**  
 HygroClip SP05 5 mm insertion probe  
 HygroClip SP05-B5 5 mm insertion probe, Binder 5 pin connector  
 MOK-02-B5 Cable, HygroClip SP05 to HygroLab/HygroPalm Aw1

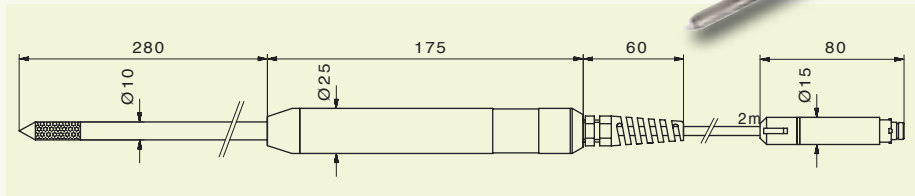


## HygroClip HP28 Insertion Probe

For direct measurement of water activity in bulk samples. Applications include powders, granules, grain and cereals. HygroClip HP28 features a robust 10 mm diameter stainless steel probe with replaceable sintered steel dust filter to allow the humidity measurement sensor exposure to water vapour in the air or product.

Measuring range: 0...100 %rh (0...1 aw), -40...85 °C  
 Accuracy: ±1.5 %rh / 0.015 aw, ±0.3K  
 Signal type: ROV Analogue signal, DIO Digital signal

**Order code:**  
 HygroClip HP28 10 mm insertion probe  
 MOK-02-B5 Cable, HygroClip SP05 to HygroLab/HygroPalm Aw1

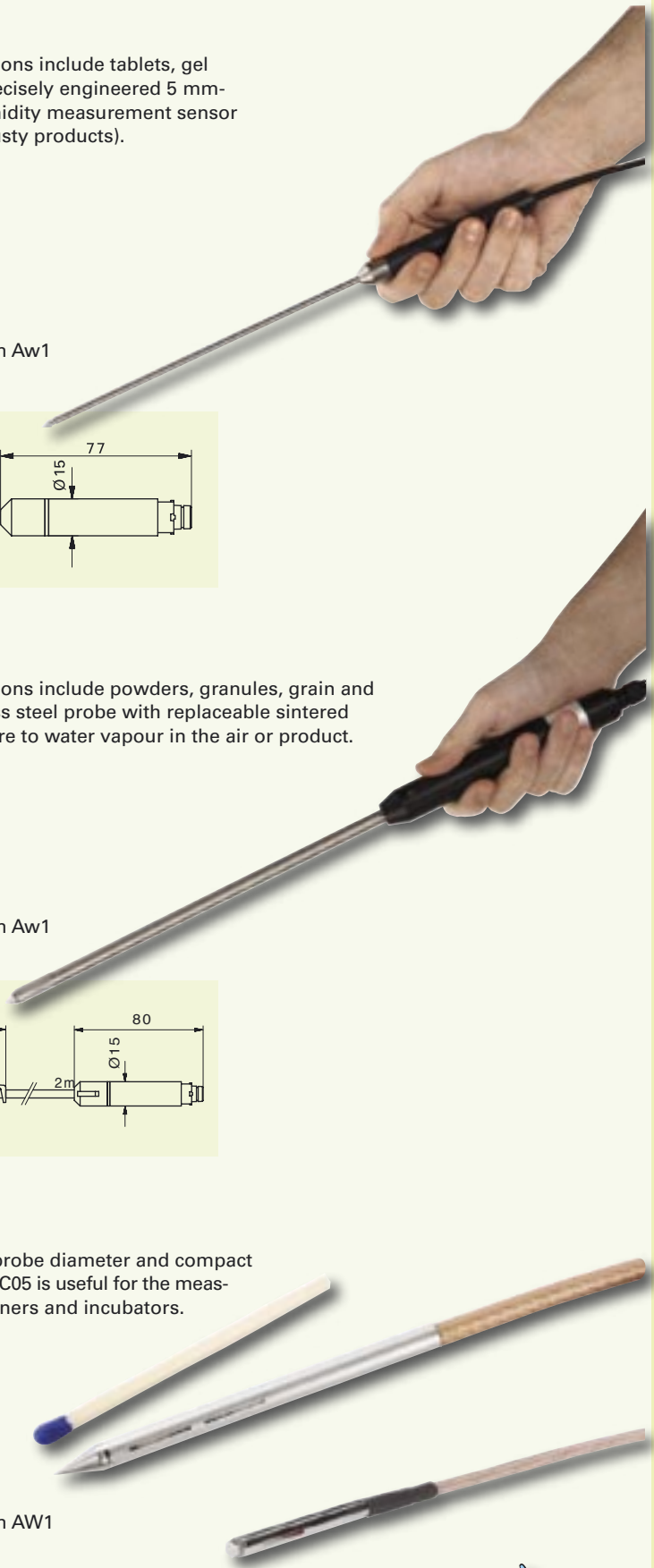
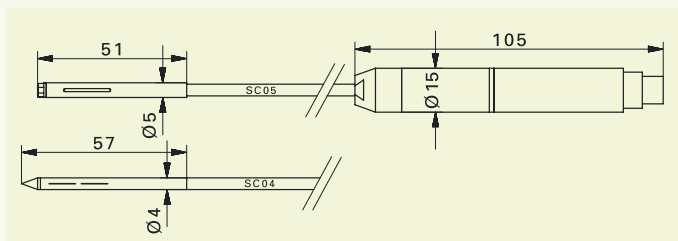


## HygroClip SC04 /SC05

Suitable for air measurement in small spaces thanks to the 5 mm probe diameter and compact dimensions. For customers measuring water activity, the HygroClip SC05 is useful for the measurement of humidity and temperature in packaging, storage containers and incubators.

Measuring range: 0...100 %rh (0...1 aw), -40...100 °C  
 Accuracy: ±1.5 %rh / 0.015 aw, ±0.3K  
 Signal types: ROV Analogue signal, DIO Digital signal

**Order code:**  
 HygroClip SC04 4 mm cable mounted probe  
 HygroClip SC05 5 mm cable mounted probe  
 MOK-02-B5 Cable, HygroClip SP05 to HygroLab/HygroPalm AW1





## Accessories and Consumables



### Sample Holders

Stainless steel sample holders that are precisely engineered to work with the AWC/VC water activity chamber. Two sizes are available, WP14-S is for small product samples (14 mm depth) and WP40 for larger materials (40 mm depth). Both products provide excellent sample containment and optimum temperature stability. WP-40TH has an integrated water jacket for temperature control. Recommended temperature control level max.  $\pm 5$  °C from ambient temperature. Material: WP14-S and WP-40: V2A Steel, WP-40-TH: Brass, nickel coated.

#### Order code:

WP-14-S	for PS14	approx. 350 g
WP-40	for PS14 and PS40	approx. 1250 g
WP-40TH	with water jacket for temperature control	approx. 1550 g

### Sample Containers

Disposable sample containers that ensure the optimum sample volume is introduced into the WP-14-S and WP-40. They help to prevent the sample holders from coming into direct contact with product being tested, and hence prevent soiling or cross contamination. The sample containers also provide a convenient means of collecting and storing samples.



#### Order code:

PS-14	Pack 100 sample containers to suit WP-14-S	approx. 880 g
PS-40	Pack 100 sample containers to suit WP-40	approx. 1250 g



### Clamp Sealing Mechanism

In some circumstances additional mechanical sealing of the AW measurement station and sample holder is required to prevent external conditions influencing the sample. The AW-KHS provides a strong mechanical seal, and is compatible with all available sample holders. (Only in combination with WP-40 and WP-40TH)

#### Order code:

AW-KHS		approx. 1100 g
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### Humidity Standards

The ROTRONIC SCS certified humidity standards provide a reference value against which instruments can be calibrated. They are supplied in packs of 5, complete with certificates of calibration. They can be applied to all probe types, with Water Activity probes using sample holders and containers, for other probes (HygroClip SP05, SC04 and HP28) a calibration device is required.



#### Order code:

EA-xx-SCS	Where xx = 00, 05, 10, 11, 20, 35, 50, 65, 75,80 & 95 %rh	approx. 32 g
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### Calibration Devices

Provide a sealed environment around probes where ROTRONIC humidity standards can be applied.

#### Order code:

ER-05	for 5 mm diameter probes (HygroClip-SP05 / SC05)
ER-15	for 15 mm diameter probes (HygroClip S)
EGL	for 10 mm diameter probes (HygroClip HP28)



AW-DIO can be calibrated in combination with the sample holder and container (WP-14/PS14).

## What is Water Activity?

Water Activity ( $a_w$ ) is the relative humidity which is reached at equilibrium in a sealed container in which a hygroscopic product has been placed, but expressed on a scale of 0...1. Water Activity measurement is most commonly used in the food industry, where it is used to determine shelf life and quality.

## What is Equilibrium Relative Humidity?

Equilibrium Relative Humidity (ERH) is the value of relative humidity into which a Hygroscopic product can be placed where no net exchange of moisture between the product and the surrounding environment can take place. It is expressed on a scale of 0...100%. ERH is typically used in the paper and pharmaceutical industries, but can be applied to almost any product that is sensitive to moisture, or where the presence of moisture can effect product handling.

## Water Activity or ERH?

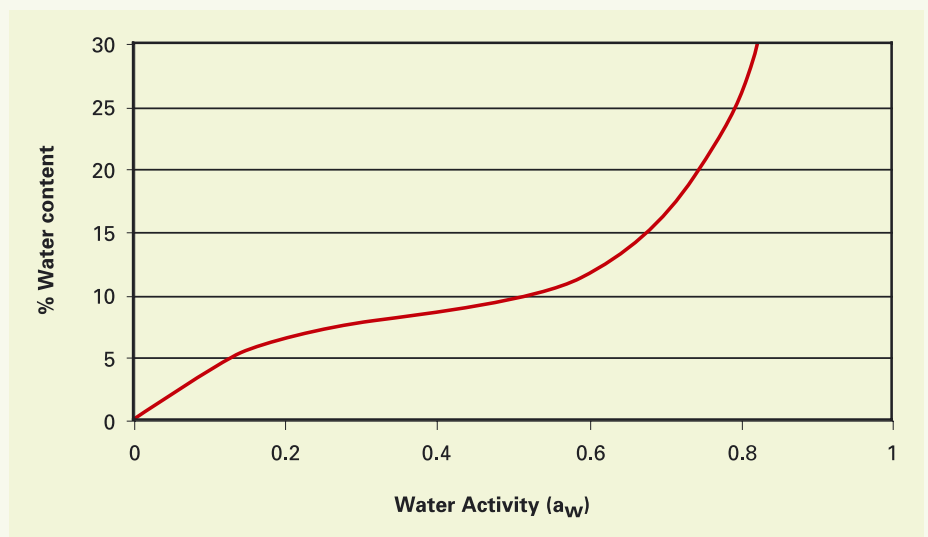
Both  $a_w$  and ERH are an expression of the amount of free water vapour present on a product, both at its surface and within its structure, and are practically the same measurement expressed in a slightly different way. Throughout this document we will refer to Water Activity, but this can be interchanged with ERH. Where specified, ROTRONIC products offer the user the possibility to select display units of  $a_w$  or %rh.

## What is Moisture Content?

Moisture content, when referring to a solid material, is an expression of the percentage of the material's weight which is water (both in liquid or gaseous phase); usually referred to as 'percent moisture content'. This term is widely used in many areas of industry.

## Correlation between Water Activity and Moisture Content

The correlation between Water Activity and Moisture Content can be related by a graph called a Sorption Isotherm (see diagram). Due to the complexity of the sorption processes, the isotherms cannot be computed but only be determined experimentally. Each Isotherm is valid for one specific product at one particular temperature only.



## Why is Water Activity measured?

Water Activity is an important parameter in the food and pharmaceutical industries. It represents the mass of free water within a product, which is of fundamental importance for many enzymatic reactions and especially for the growth of micro-organisms.

The water within a product such as food is bound by various ingredients such as proteins, salt or sugar. This chemically bound water is not available for the micro organisms, and hence they cannot replicate. The higher the amount of water-binding ingredients in a product is, the less water can evaporate. Therefore, the water vapour pressure over the product is in direct correlation to the amount of water that is available for the micro organisms.

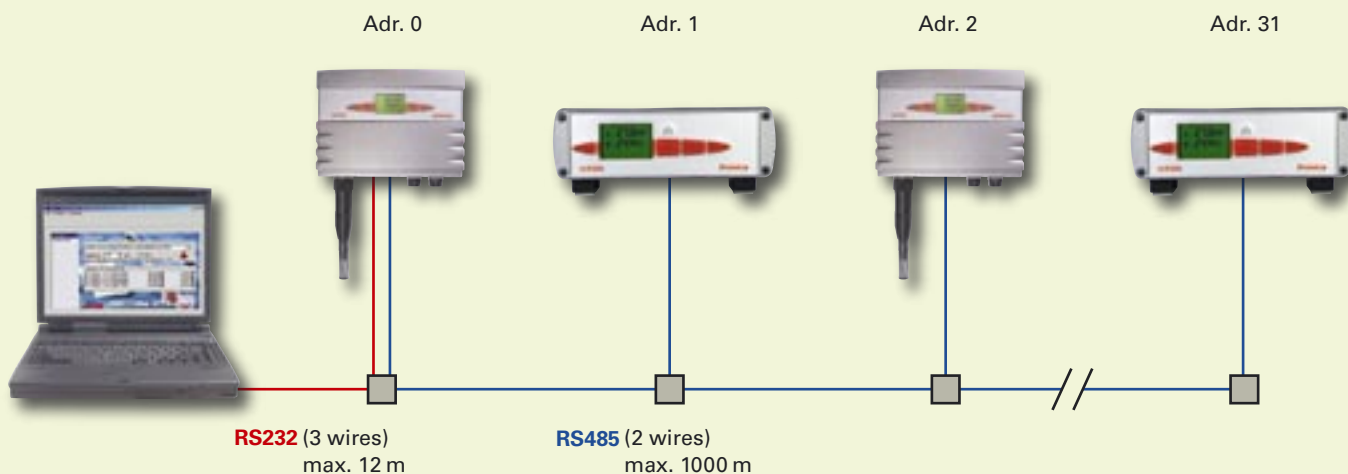
Water activity has an important influence on product stability (e.g. microbiological stability, flavour retention), handling properties such as the agglomeration of powders, chemical stability and physical properties such as dimensions of paper.

Water Activity measurement offers a non-destructive, easy-to-use measurement in a wide range of convenient configurations for both laboratory and on-site use.

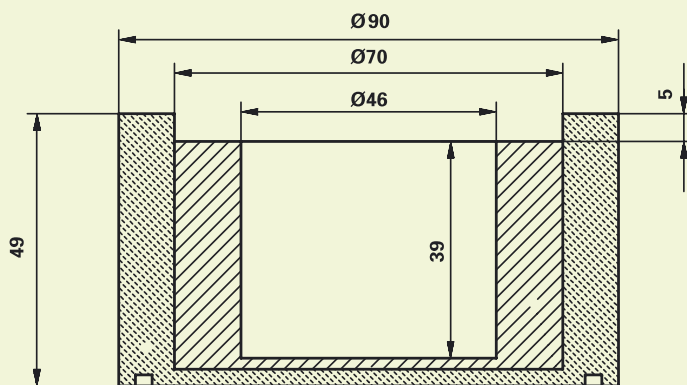
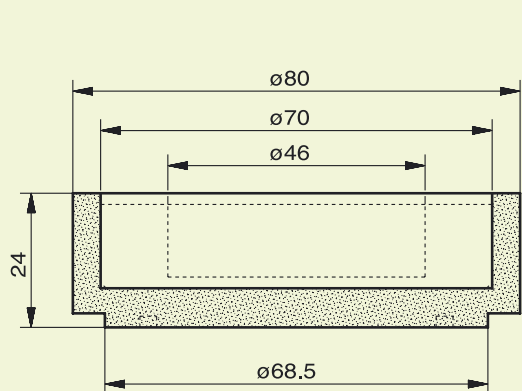
# Schematics and Diagrams

## Networking (HygroLab 2 and 3)

The optional HW3 software offers a simple means of quickly establishing a PC based network. Up to 32 HygroLab indicators and/or HygroFlex transmitters can be connected together on a network. Any instrument can be used either as a slave or a master, without special configuration. Each unit must be given a unique network address with the HW3 software (0 to 31). The master is automatically the unit that is connected to the COM port of the PC by means of the RS232 port. See Connectors – RS232 / RS485 for details.

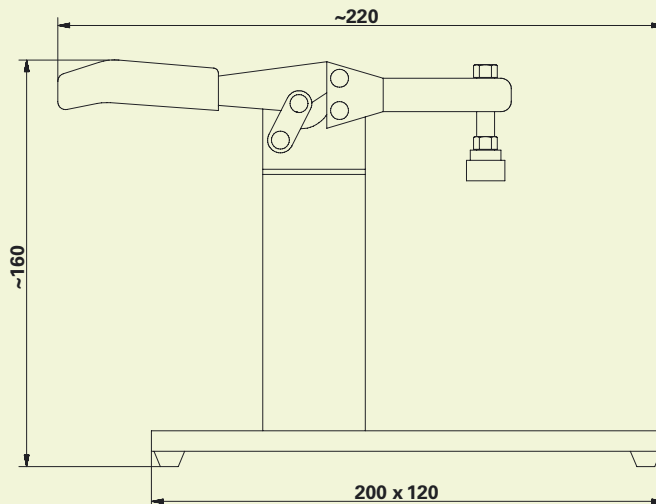
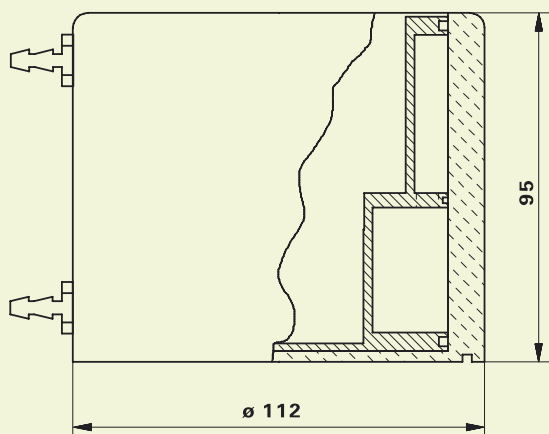


## Dimensional diagrams



WP-14-S

WP-40



WP-40TH

AW-KHS

## Technical data

### Hygrodata Quick Function

**Higher productivity in the laboratory and greater application flexibility at lower cost per measurement.**

Hygrodata Quick is a software tool developed by ROTRONIC for the fast determination of water activity. The average measurement time can be reduced to roughly four minutes when 4 probes are used simultaneously.

HygroLab 3 incorporates this feature. The function can be called directly from the keypad or be controlled from a PC. For HygroLab 2, the feature is only available as a PC-option, which can be retrofitted.

Easy and efficient operation: the functions are selectable with a mouse click. As soon as the measurement value is underlined with a green bar, the measurement is terminated.



### Technical Data HygroLab 1, 2, 3 and HygroPalm AW1

Key Features	HygroLab 1	HygroLab 2	HygroLab 3	HygroPalm AW 1
Probe connections	2	4	4	1
PC Interface	No	RS232/485	No	RS232 via PalmDock
Networking	No	Up to 32 instruments using RS485	No	No
Aw Quick mode	No	Option. Via PC with HygroData Quick Software	Integrated & with PC and HW3 Software and data cable)	Integrated
<b>Calibration functions with keypad</b>				
1 point %rh (aw),	Yes			
4 point %rh (aw), 2 point °C/F	No	Yes		
<b>Calibration functions using PC and HW3</b>				
1 point %rh (aw)	No	Yes		No
4 point %rh (aw), 2 point °C/F	No	Yes		No
Display units	%rh, °C, °F	%rh, aw, °C, °F, calculated parameters		aw, °C, °F
Calculated parameters	None	Dew-point, wet-bulb, enthalpy, mixing ratio, moisture content, partial water vapour pressure, saturation water vapour pressure		None
Audible signal at measurement end:	No	No	Yes	No
Instrument operating range	0...99 %rh, -10...60 °C (14...140 °F)			
Display Type	Liquid Crystal 3 line alphanumeric			
Trend indicator	Yes			
Display resolution	0.1 %rh/0.1 °C/F	0.1 %rh/0.1 °C/F, 0.001 aw	0.1 %rh/0.1 °C/F, 0.01 calculated value	0.1 %rh/0.1 °C/F, 0.001 aw
Housing	Aluminium, 220 x 170 x 55 mm			ABS
Power supply	9V Power adapter, +tip			PP3 battery
CE Conformity	EMV: EN50081-2 EN/EN50082-2			
Weight	1100 g			300 g

#### Note:

Many older products have been replaced by new ones, that perform better. ROTRONIC will continue to support the old products as long as possible. Our customers are used to the fact that we still maintain probes and instruments that are over 20 years old. We will continue this tradition for the benefit of our customers who will thus always get the best price/performance ratio and have their investments secured.