



rht+
Relative Humidity & Air Temperature Sensor



SKH 2060/70/80 series

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Skye Instruments Ltd.

Skye Instruments is based in the UK and we are very proud to be celebrating being in business since 1983. Our products are designed and built in the UK. We have a very wide product base and our sensors & systems are used for plant & crop research; micro-climate, global climate change studies; environmental monitoring and controlled environment installations.

Products include light sensors & systems, weather monitoring sensors, automatic weather stations, plant research systems, soil and water research systems.

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Please be aware that the information in this manual was correct at time of issue, and should be 100% relevant to the accompanying product. We take great pride in our ever-evolving range of products, which means that sometimes the product may change slightly due to re-design.

If you have any queries, please do not hesitate to contact our technical team by any of the methods above.

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APPENDIX 1 – TEMPERATURE CHARACTERISTICS OF 10KΩ THERMISTOR

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1. INTRODUCTION

Skye have been designing and manufacturing a range of relative humidity and air temperature sensors since 1986. The rht+ RHTplus probes are the latest addition to the range, including a new slimline housing enclosing an all new digital design.

Ease of service and maintenance is an important feature, the new design incorporates a quick release connector for fast changeover of sensors in the field, ideal for uninterrupted measurements and regular calibration routines. These probes are easy to calibrate by the user, they are not designed as 'throwaway' modules. Their 'plug and play' outputs mean that calibrated units are fully interchangeable, without the need for reconfiguring the datalogger or measuring device.

The new slimline rht+ design offers the same high quality sensor specifications as in previous models. Highest accuracy over the full meteorological 0-100 % relative humidity range is achieved using the well proven capacitive sensor technology. A choice of air temperature elements and outputs offers versatility in compatibility with datalogging and measurement devices.

Models available:

SKH 2060	rht+ probe with RH and digital temperature sensors. Output 0-IV
SKH 2065	rht+ probe with RH and PT100 temperature sensors. Output 0-IV
SKH 2070	rht+ probe with RH and thermistor temperature sensors. RH output 0-IV, temperature output 10 kohm thermistor
SKH 2080	rht+ probe with RH sensor only. Output 0-IV
SKH 2067	rht+ probe with PT100 temperature sensor only. Output 0-IV
SKH 2072	rht+ probe with thermistor temperature sensor only. Output 10 kohm thermistor

For long term, highest accuracy temperature measurements, Skye recommend the platinum resistance temperature sensor option. This sensor is a stable, fully sealed, platinum wire PT100 element. We do not use the unprotected thin film resistor type element employed by other manufacturers, which are often prone to corrosion and drift over time.

For outdoor applications the use of a radiation screen is advised to ensure the accurate measurement of shade temperature. These sensors are fully weatherproof, robust and durable. A recalibration service is offered by Skye Instruments, traceable to UKAS National Standards, which includes a 'swap' facility for non-interrupted data collection in field measurements.

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2. INSTALLATION

The rht+ RHTplus probe is suitable for installation in indoor or outdoor conditions, and in any orientation. The waterproof rating is IP65, meaning that it will withstand a jet of water but not total submergence. This rating is only valid when the 8 pin socket is fitted with its matching cable plug connector or a waterproof blanking cap.

It is recommended that the PTFE probe tip which houses the RH and / or the temperature elements is positioned to allow free air flow over and around the sensors, for maximum accuracy and fastest response time.

If to be used outdoors, in direct sunshine or where it can be influenced by other (heat) radiation sources, the use of a radiation screen is essential. A radiation screen allows accurate measurement of shade air temperature.

Skye have a range of radiation screens suitable for different accuracies and environments, please see Chapter 6 for details. Each have an easy 'push fit' insertion to accept and hold the rht+ RHTplus probe in place. Simply push the probe up inside the radiation screen as far as it will go and then bring it back down a little, enough to allow free air flow around the whole probe tip.

For meteorology applications, it is usual to install the sensor in its radiation screen at a height of 1.5m above the ground. However, this may be inconvenient in individual circumstances and the sensor should be placed appropriately for each installation site.

Please see Chapter 4 for wiring connection details. Always secure the cable to prevent damage from wind chafing, rodent nibbling etc.

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3. RHT+ RHTPLUS SENSOR ELEMENTS

3.1 RH Element

The capacitive RH element used in the rht+RHTplus probes is the same high specification, meteorological grade sensor used in all other Skye RH probes.

This RH element is specified through the entire 0-100% RH range with an accuracy better than +2% RH. No other comparable RH element boasts a better accuracy at the extreme ends of this range, especially at values above 90% RH.

The sensor response time is fast, the probe responds to 90% of a 50% RH step change in less than 2 seconds, though such changes rarely occur in natural conditions.

In high RH conditions, condensation on the sensor element may occur, but as soon as local RH reduces the element will fully recover without any effect or drift on the sensor calibration. This is contrary to lower cost RH sensors from other manufacturers which tend to drift or take a permanent calibration shift after being saturated.

Capacitive RH elements can be damaged by harsh industrial environments, especially very dusty or acidic gaseous conditions. For such installations Skye recommend the use of breathable protective covers (supplied in pairs, part number ACC/17) which allow the passage of air and water vapour but prevents contaminated moisture droplets from reaching the sensor element. These washable covers should be exchanged at regular intervals and it must be noted that the use of such covers may slow down the sensor response to RH changes.

The lifetime of a RH element is in excess of 2-3 years, but these are easily replaced and the probe recalibrated, giving an instrument lifetime of typically 5-10 years.

3.2 Digital Temperature Element

The digital temperature sensor is included in the standard SKH 2060 RH/temperature probe, and as with all 3 temperature element options is fully sealed for long life.

The rht+ RHTplus digital electronics converts this temperature sensor output to a convenient 0-IV signal suitable for most dataloggers or controllers. Accuracy of the digital temperature element over the -10 to +85°C range is typically +0.2°C, with a maximum error of +0.5°C

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3.3 PT100 Temperature Element

Skye use only a fully sealed, wound wire platinum resistance temperature elements. This highest quality sensor is hermetically sealed in glass for with a classification of 1/3rd DIN accuracy AFTER being sealed. Other accuracies, such as 1/5th or 1/10th DIN are also available on request.

The PT100 element is sealed into the rht+ RHTplus head at the glass interface, no metal contacts are exposed which may cause corrosion problems. Skye have used this same temperature element in their probes since 1986 and have long standing records for the longevity and stability of these sensors.

Probes SKH 2065 and 2067 use this PT100 element, the rht+ RHTplus electronics linearises the resistance output and converts to an easy to use 0-IV signal. Accuracy over the range -40 to +60°C is typically better than +0.2°C, with a maximum error of +0.4°C.

Skye's major competitors regularly use a PT100 element which is of the thin film capacitance type. It has been shown that this type of sensor is very prone to calibration drift over time, as the exposed thin film degrades and the connection points corrode. These problems are not seen with the Skye glass sealed PT100 element.

3.4 Thermistor Element

Skye also regularly use a 10kohm curve matched thermistor element throughout their range of temperature probes. Skye's DataHog datalogger has the calibration data for this sensor element built into its configuration for the automatic conversion of resistance to temperature.

The thermistor element is fully sealed and insulated with a PVC covering ensuring, and as with all Skye temperature sensors, it is corrosion free.

Sensors SKH 2070 and 2072 include a thermistor temperature element. The output is direct from the thermistor itself, specified as 10 kohm at 25°C (see Appendix 1 for characteristics). This output is accepted straight into a Skye DataHog logger which will automatically record measurements in Degrees Celsius. Accuracy is typically +0.2°C over the range 0-60°C.

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4. OPERATION

4.1 Power Supply

The rht+ RHTPLUS probes require a power supply between 5 and 15 VDC at a maximum of 12 mA. Voltages below 4.75V will cause measurement errors while voltages above 17.5V may cause damage to the instrument.

Some models require a 'warm up' time for excitation before a measurement is made. The following table shows the minimum recommended time that power is applied before measurement for each rht+ RHTPLUS model:

SKH 2060	rht+ probe with RH and digital temperature sensors.	750 msec
SKH 2065	rht+ probe with RH and PT100 temperature sensors.	450 msec
SKH 2070	rht+ probe with RH and thermistor temperature sensors.	450 msec
SKH 2080	rht+ probe with RH sensor only.	450 msec
SKH 2067	rht+ probe with PT100 temperature sensor only.	10 msec
SKH 2072	rht+ probe with thermistor temperature sensor only.	0 msec

4.2 Wiring Connections

4.2.1 rht+ Probe Connector

The rht+ RHTPLUS probe is fitted with an 8 pin Binder sub-miniature panel mounted plug. Pin allocations and the corresponding wire colours of the matching 8 pin in line socket are shown below:

PIN	ALLOCATION	WIRE COLOUR
Pin 1	(Data out - used with CALCOMM)	not connected
Pin 2	(Data in - used with CALCOMM)	not connected
Pin 3	Ground (power and digital)	Black
Pin 4	Positive power supply	Red
Pin 5	(Plug detect - used with CALCOMM)	not connected
Pin 6	RH% output 0-IV	Green
Pin 7	Temperature output (0-IV or thermistor)	Yellow
Pin 8	Ground (analogue)	Blue plus white
not connected	Cable screen	Grey

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4.2.2 Cable End Connector for Skye DataHog logger

NOTE: Only certain DataHog inputs are compatible with rht+probes, if you have any doubt please contact Skye with your logger serial number for advice.

A. CONNECTION OF ANY rht+MODEL TO A DATAHOG INPUTS LABELED Differential Voltage, Temperature (SKTS 200/I), SKH 2021/I or SKH 2013/I (NOT SKH 2011/I)

PIN	ALLOCATION	WIRE COLOUR
Pin 1	Positive power supply	Red
Pin 2	Temperature output (0-IV or thermistor)	Yellow
Pin 3	RH% output 0-IV	Green
Pin 4	Connected to Pin 2	
Pin 5	Grounds and cable screen	Black & Blue & White & Grey

B. CONNECTION OF rht+MODELS WITH THERMISTOR TEMPERATURE SENSOR, SKH 2070

PIN	ALLOCATION	WIRE COLOUR
Pin 1	Positive power supply	Red
Pin 2	Thermistor temperature output	Yellow
Pin 3	RH% output 0-IV	Green
Pin 4	Connected to Pin 5	
Pin 5	Grounds and cable screen	Black & Blue & White & Grey

4.2.3 Wire ended cable for user's own datalogger

The rht+ RHTPLUS probe is supplied with a cable, fitted at one end with an 8 pin Binder sub-miniature plu to connect to the probe, and wire ended at the other end for connection to the user's own datalogger or controller. Functions of each of the wire colours are shown below:

FUNCTION	WIRE COLOUR
Power supply ground	Black
Power supply positive	Red
RH% output 0-IV	Green
Temperature output (0-IV or thermistor)	Yellow
Signal ground	Blue plus white
Cable screen	Grey

It is advisable to connect the grey cable screen wire to the power supply ground.

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5. CALIBRATION

RH sensors should be calibrated at least every 12 months. Some users prefer to recalibrate every 6 months for highest accuracy measurements. When a rht+ RHTplus probe including a RH sensor is first installed in a very high humidity environment, it is advisable to make the first calibration after 6 months when the element has fully 'acclimatised', and then continue with regular calibrations every 12 months as usual.

Temperature sensors do not usually require recalibration, especially the PT100 and thermistor elements, as it is the physical property of the sensor's metal wire material which changes with temperature. However, it is advisable to periodically check the calibration of the rht+ RHTplus probe digital electronics.

Skye rht+ RHTplus probes are fully recalibrateable, they are not 'throwaway' or replacement probes. As these probes have standardised outputs and quick release connectors, they can be easily swapped over in the field in regular calibration and maintenance procedures. There is no need to reconfigure the datalogger or controller, these are truly 'plug & play' sensors. This system is ideal for long term monitoring stations and avoids any data loss between calibrations.

Simply unscrew the 8 pin connector from the + RHTplus probe leaving the cable securely installed in place. Remove the probe from the radiation screen (if appropriate) and replace with a newly recalibrated unit. Reconnect the existing 8 pin connector and cable.

The rht+ RHTplus probe removed from use can now either be returned to Skye for a recalibration, or can be easily calibrated by the user him or herself. Skye offer a RH recalibration kit for this use (part number SKH 1092) which includes apparatus and chemicals for producing both high and low humidity environments. The user will also require a CALCOMM unit to connect the rht+ RHTplus probe to a PC for the calibration process and also very importantly a stable, temperature controlled environment, such as an environmental chamber. Please contact Skye for details.

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6. RADIATION SCREENS

Skye offer 3 models of radiation screen suitable for the rht+ RHTplus probe. A radiation screen is essential for the accurate measurement of air temperature.

Skye has been designing and manufacturing naturally aspirated radiation screens alongside their RH and air temperature probes since 1986. The designs ensure that there is free air flow across the sensor tip for maximum sensor response time. Careful placement of each screening 'dish' also eliminates any stray reflected radiation from reaching the temperature sensor - you will notice you cannot see the probe tip when inside its radiation screen, showing that the sensor cannot 'see' any direct radiation which may influence its measurement.

The standard SKRS 085S radiation screen has 12 screening 'dishes' and is suitable for most installations.

SKRS 085D has an additional 3 dishes, 15 in total, and is used in high accuracy measurement systems, or in very high radiation environments.

If the installation site is very windy, such as wind farm applications, a smaller device may be necessary to reduce wind resistance. The SKRS 085C has just 9 dishes. When used in windy environments the screening accuracy is not noticeably reduced as there will be a high air flow through the radiation screen.

All radiation screens are fitted with a mounting arm suitable for attaching to a wall or mast. Fixings for a mast of maximum diameter 38 mm diameter are included.

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7. SPECIFICATIONS

General

Dimensions :	152 mm x 31 mm diameter
Cable length :	Def Std 61-12 Part 4, screened. 3m as standard, longer on request
Weight :	160g excluding cable and connector
Construction :	White painted aluminium body with PTFE grade A sensor head, fitted with 32 micron stainless steel gauze protection
Operating range :	-40 to +60°C (extended ranges available)
Power Consumption :	SKH 2060 - 7 mA (max 9 mA) SKH 2065 - 10 mA (max 12 mA) SKH 2070 - 7 mA (max 9 mA)

RH Sensor

Type :	Capacitive
Measurement Range :	0-100% RH
Accuracy :	Better than +2% RH
Resolution :	0-1V output - 0.025 % RH RS232 output - 0.012% RH
Response Time :	Typically less than 10 secs between 10 and 95% RH for 90% of the step
Recalibration :	Fully recalibratable, recalibration kit available
Output :	0-1V (options up to 0-4V available) RS232 (2 decimal places) with rht+COMM
Power Supply :	5-15 VDC
Excitation Time :	450 msec

Digital temperature sensor

Type :	Electronic temperature sensing digital device
Measurement Range :	-40 to +60°C (extended ranges available)
Accuracy :	Typically +0.2°C, maximum error +0.5°C over -10 to +60°C
Resolution :	0-1V and RS232 - 0.125°C
Output :	0-1V (options up to 0-4V available) RS232 (2 decimal places) with rht+COMM
Power Supply :	5-15 VDC
Excitation Time :	750 msec

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PT100 temperature sensor

Type :	Fully sealed, platinum wire wound PT100 (not a thin film resistor type which are prone to drift)
Measurement Range :	-40 to +60°C (extended ranges available)
Accuracy :	-39°C better than +0.4°C +20°C better than +0.2°C +60°C better than +0.35°C
Resolution :	Dependant on datalogger or controller attached
Output :	0-1V (options up to 0-4V available)
Power Supply :	5-15 VDC
Excitation Time :	10 msec

Thermistor temperature sensor

Type :	10 kohm curve matched thermistor
Measurement Range :	-40 to +60°C (extended ranges available)
Accuracy :	+0.2°C for 0-60°C
Resolution :	Dependant on datalogger or controller attached
Output :	Resistance direct from thermistor
Power Supply :	5-15 VDC
Excitation Time :	0 msec

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APPENDIX 1 - TEMPERATURE CHARACTERISTICS OF 10KOHM THERMISTOR

Thermistor Temperature 887 Deg C	Thermistor Value (kohms)	Thermistor Temperature Deg C	Thermistor Value (kohms)
-20.00	97.08	41.00	5.12
-19.00	91.62	42.00	4.92
-18.00	86.50	43.00	4.73
-17.00	81.70	44.00	4.54
-16.00	77.19	45.00	4.37
-15.00	72.96	46.00	4.20
-14.00	68.98	47.00	4.04
-13.00	65.25	48.00	3.89
-12.00	61.73	49.00	3.74
-11.00	58.43	50.00	3.60
-10.00	55.33	51.00	3.47
-9.00	52.41	52.00	3.34
-8.00	49.66	53.00	3.22
-7.00	47.07	54.00	3.10
-6.00	44.63	55.00	2.99
-5.00	42.33	56.00	2.88
-4.00	40.16	57.00	2.77
-3.00	38.12	58.00	2.68
-2.00	36.19	59.00	2.58
-1.00	34.37	60.00	2.49
0.00	32.65	61.00	2.40
1.00	31.03	62.00	2.32
2.00	29.50	63.00	2.24
3.00	28.05	64.00	2.16
4.00	26.68	65.00	2.08
5.00	25.39	66.00	2.01
6.00	24.17	67.00	1.94
7.00	23.01	68.00	1.88
8.00	21.92	69.00	1.81
9.00	20.88	70.00	1.75
10.00	19.90	71.00	1.69
11.00	18.97	72.00	1.64
12.00	18.09	73.00	1.58
13.00	17.25	74.00	1.53
14.00	16.46	75.00	1.48
15.00	15.71	76.00	1.43
16.00	15.00	77.00	1.38
17.00	14.32	78.00	1.34
18.00	13.68	79.00	1.30
19.00	13.07	80.00	1.26
20.00	12.49	81.00	1.22
21.00	11.94	82.00	1.18
22.00	11.42	83.00	1.14
23.00	10.92	84.00	1.10
24.00	10.45	85.00	1.07
25.00	10.00	86.00	1.04
26.00	9.57	87.00	1.00
27.00	9.17	88.00	0.97
28.00	8.78	89.00	0.94
29.00	8.41	90.00	0.92
30.00	8.06	91.00	0.89
31.00	7.72	92.00	0.86
32.00	7.40	93.00	0.84
33.00	7.10	94.00	0.81
34.00	6.81	95.00	0.79
35.00	6.53	96.00	0.76
36.00	6.27	97.00	0.74
37.00	6.02	98.00	0.72
38.00	5.78	99.00	0.70
39.00	5.55	100.00	0.68
40.00	5.33	101.00	0.66